



PRODUCT MANUAL

SM15K-Series Power Supplies

SM70-CP-450
SM210-CP-150
SM500-CP-90
SM1000-CP-45
SM1500-CP-30

Version 202606-8
Firmware P0250

Important Information

Firmware Update

Before commissioning the power supply, check whether a newer firmware package is available.

Firmware updates may include functional improvements, corrections and compatibility updates. Read the applicable release notes before updating the unit.

Firmware packages and release notes are available from:

[PRODUCTS > SM15K > DOWNLOADS](#)

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1 About this Document

1.1 Scope and Validity

This document is valid for SM15K-series models as stated on the cover and with firmware version as stated on the cover page or higher.

1.2 Intended Audience

This equipment must be operated only by qualified personnel who understand the instructions and safety instructions provided with the equipment. If the equipment must be operated by unqualified personnel, then they must be supervised by qualified personnel.

1.3 Content and Structure

This manual begins with safety instructions in English, German and French. Read the applicable safety instructions before connecting, installing or operating the power supply.

The Quick Start section provides the essential information required to identify the connections, connect the unit and perform basic local operation. The remainder of this manual provides detailed information about product characteristics, installation, output configuration, local operation, protection functions, Function Blocks, firmware updates and remote programming. It also includes troubleshooting guidance, maintenance information and the EU Declaration of Conformity.

1.4 Related Documentation and Software

Additional product-related documentation is available on our website, as listed in the table below. Please visit our website to access the latest versions and related downloads.

SM15K series downloads: [Products > SM15K > Downloads](#)

Document name	Type
Data sheet SM15K-series	Data sheet
Data sheet Interfaces SM15K-series	Data sheet
Quick Start Guide SM15K-series	Manual
Product Manual SM15K-series	Manual
Manual Interfaces SM15K-series	Manual
Programming Guide Ethernet and Sequencer SM15K-series	Manual
Application note Simulation software SM15K-series	Application note
Application note Safe operation	Application note
Application note Battery charging	Application note
Application note Master/Slave series operation SM500-CP-90	Application note
Application note Master/Slave parallel operation SM70-CP-450	Application note
Application note Master/Slave parallel operation SM210-CP-150	Application note
Application note Master/Slave parallel operation SM500-CP-90, SM1000-CP-45 and SM1500-CP-30	Application note
DE Applications bundle description	Software
DE Applications	Software
Example Code and Software	Example code
Firmware Release Notes SM15K series	Firmware
Firmware update SM15K series	Firmware
3D drawings SM15K series	Drawings
REACH compliance certificate	Certificate
ROHS compliance certificate	Certificate

1.5 Contact and Service

For additional guidance, questions, or feedback, please use the contact form on our website. A structured technical contact form is available for submitting detailed descriptions and uploading files.

In case of malfunction or breakdown, please use the RMA form to arrange service for your product.

Technical inquiries: [Contact & Support > Contact form](#)

Service & repairs: [Contact & Support > Repair service > RMA form](#)

2 Safety Instructions

2.1 Caution

The following safety precautions must be observed during all phases of operation, service and repair of this equipment. Failure to comply with the safety precautions or warnings in this document violates safety standards of design, manufacture and intended use of this equipment and may impair the built-in protections. Delta Elektronik shall not be liable for the user's failure to comply with these requirements.

2.2 Installation Category

The Delta Elektronik power supplies have been evaluated to installation category II (Overvoltage Category II).

2.3 Grounding of Mains Terminals (AC Power Terminals)

This product is a safety Class 1 unit. To minimize shock hazard, the unit must be connected to the AC Power Supply mains through a four-conductor power cable, with the ground wire firmly connected to an electrical ground (safety ground) at the power outlet.

Warning! When the 'plus' DC power terminal can exceed $60 V_{DC}$ in respect to the 'minus' DC power terminal, additional external measures must be taken to ensure safety isolation of the DC power terminals and sense connections.

Warning! When the 'minus' DC power terminal of the unit can exceed $60 V_{DC} / 42.4 V_{pk}$ in respect to ground, additional external measures must be taken to ensure safety isolation of the DC power terminals and sense connections.

The standard LAN, USB and Interlock connectors and optional interfaces are at ground level and can be considered safe if the 'minus' DC power terminal of the unit does not exceed $1000 V_{DC} / 707 V_{pk}$ in respect to ground for SM70-CP-450, SM210-CP-150, SM500-CP-90 and SM1000-CP-45, or does not exceed $1500 V_{DC} / 1060 V_{pk}$ in respect to ground for SM1500-CP-30.

For units designed to be hard-wired to the mains supply, the protective earth terminal must be connected to the safety electrical ground before another connection is made. Any interruption of the protective ground conductor, or disconnection of the protective earth terminal will cause a potential shock hazard that might cause personal injury.

2.4 Grounding DC Power Terminals

If the DC power terminal of a unit is specified to sink or source to a maximum of $60 V_{DC}$, and either the 'minus' or 'plus' DC power terminal is grounded, the voltage on the DC power terminals and sense connections can be considered safe.

Caution 1: If a low voltage unit has both DC power terminals floating, or if the terminals are in series with an external high AC or DC voltage, the 'minus' DC power terminal can exceed the safe value in respect to ground as specified in the above warning!

Caution 2: Although a high voltage unit is set to a safe voltage below $60 V_{DC}$, for safety it must always be considered as a high voltage unit! Wrong operation, a programming error or an external defect can result in an unsafe high DC output voltage.

For more information regarding Grounding & Safety, see the online application note *"Safe operation of a power supply"*.

2.5 Danger of Electrical Shock

Touching the contacts of the mains plug or wires directly after disconnecting from the mains, can cause an electrical shock. And there can still be a dangerous voltage between one of the DC power terminals and the PE because of charged X-capacitors. This can also happen when the DC power output is switched off, but the unit is still switched on! Therefore, never touch PE and one of the DC power terminals at the same time.

2.6 Connection to Mains Supply

Either connect to the mains supply permanently or via an industrial type of plug, complying with IEC 60309. "Permanently connected equipment" or "Pluggable equipment type B".

2.7 Fuses

Fuses may be replaced only by authorized Delta Elektronik service personnel, for continued protection against risk of fire.

2.8 AC Input Ratings

Do not use an AC Supply which exceeds the AC input voltage and frequency rating of this unit. The AC input voltage and frequency rating of the Delta Elektronik power supply series are stated in the accompanying datasheet.

2.9 Live Circuits

Operating personnel should not remove the unit covers. No internal adjustment or component replacement is allowed by non-Delta Elektronik qualified personnel. Never replace components with the power cable connected. To avoid injuries, always disconnect power, remove external voltage sources and discharge circuits before touching components.

2.10 Parts Substitutions & Modifications

Parts substitutions and modifications are allowed by authorized Delta Elektronik service personnel only. For repairs or modifications, the unit must be returned to a Delta Elektronik service facility.

2.11 Removal of (Safety) Covers

Safety cover(s) are used to cover potentially hazardous voltages.

Observe the following when removing safety cover(s):

- Switch off the unit and disconnect the unit from the AC mains supply and from the DC power application.

- Wait for 5 minutes to allow internal capacitors to discharge, then unscrew and remove the cover(s).
- Always place the cover(s) back before connecting the unit to the mains supply again.

2.12 Handling and Mounting

Warning! Unit weight is 27 kg! Take care when unpacking or moving unit: lift with 2 persons or use a lift tool.

- Risk of crushing or clamping of limbs!
- Risk of cutting: unit has sharp edges and corners!

Warning! No wall mounting or ceiling mounting allowed! Risk of crushing under unit.
Only mount unit horizontally, place on a stable surface or use rack mounting.

2.13 Rotating Fan, Thermal Burn

Proper air flow is required for cooling of the unit. This enables operation at full power and a longer life time.
If the unit gets over heated, the power will shut down until unit has cooled down again.

Warning! Top cover and fan exhausts can get hot. Avoid touching these while operating the unit at high power!

Warning! Do not block fan openings, or air exhausts. Do not try to enter fan openings by any object to obstruct fan. Long hair can get stuck in fan, wear a hairnet if you have long hair.

Warning! Do not (dis)connect cables to the DC power terminals while the unit is on. Sudden making or breaking of high DC currents can cause large sparks, even at low voltages. Risk of thermal burn and fire!

2.14 Electro Medical Devices

Warning! High currents can run through the DC power terminals. These currents cause strong magnetic fields. Do not come near if you have an electro medical device such as a pacemaker.

2.15 Environmental Conditions

The Delta Elektronika power supplies safety approval applies to the following operating conditions:

Usage:	Indoor use only. Warning! Not intended to be used in the presence of children or animals!
Ambient temperature:	-20 to 50 °C.
Maximum relative humidity:	95%, non-condensing, up to 40 °C, 75 %, non-condensing, up to 50 °C.
Altitude:	Do not use above 2000 m sea level. Warning! Electrical Creepage & Clearance not valid for higher altitudes!
Pollution degree:	2

2.16 Symbols & Markings



Caution risk of electrical Shock.



Instruction manual symbol. The instrument will be marked.



Protective earth conductor terminal.



Off (supply)



On (supply)

2.17 Waste Electrical & Electronic Equipment (WEEE)

2.17.1 Correct Disposal of this Product

Applicable in the European Union.



This marking shown on the product, its packing or its literature indicates that it should not be disposed with other waste at the end of its working life but should be collected separately to recycle it responsibly to promote the sustainable reuse of material resources.

3 Sicherheitshinweise

3.1 Vorsicht

Die folgenden Sicherheitsvorkehrungen müssen in allen Betriebs-, Service- und Reparaturphasen dieses Geräts befolgt werden. Die Nichteinhaltung der Sicherheitsvorkehrungen oder Warnungen in diesem Dokument verstößt gegen die Sicherheitsstandards im Hinblick auf Bauart, Produktion und vorgesehene Nutzung dieses Geräts und kann die eingebauten Schutzvorrichtungen beschädigen. Delta Elektronik haftet nicht dafür, wenn der Nutzer diesen Anforderungen nicht nachkommt.

3.2 Installationskategorie

Die Stromversorgungen von Delta Elektronik wurden der Installationskategorie II (Überspannungskategorie II) zugeordnet.

3.3 Erdung der Netzanschlussklemmen (AC-Einspeiseklemmen)

Dieses Produkt ist ein Gerät der Sicherheitsklasse 1. Um die Gefahr eines elektrischen Schlags zu minimieren, muss das Gerät mit einem Vierleiter-Stromkabel mit dem AC-Stromversorgungsnetz verbunden werden. Hierbei muss der Schutzleiter fest mit einem elektrischen Erdungsanschluss (Schutzleiter) an der Stromquelle verbunden sein. Bei Geräten, die fest mit dem Versorgungsnetz verdrahtet werden, muss die Schutzerdungsklemme mit dem Sicherheitserdungsanschluss verbunden werden, bevor eine andere Verbindung hergestellt wird. Eine Unterbrechung des Schutzleiters oder eine Trennung der Schutzerdungsklemme kann zu einem elektrischen Schlag führen, der zur Verletzung von Personen führen kann.

3.4 Erdung der DC-Anschlussklemmen

Wenn die DC-Anschlussklemme eines Geräts dafür ausgelegt ist, maximal 60 V_{DC} zu empfangen oder zu beziehen und entweder die 'minus' oder 'plus' DC-Anschlussklemme geerdet ist, kann die Spannung auf den DC-Anschlussklemmen und Sense-Verbindungen als sicher angesehen werden.

Warnung! Wenn die 'plus' DC-Anschlussklemme im Verhältnis zur 'minus' DC-Anschlussklemme 60 V_{DC} überschreiten kann, müssen zusätzliche externe Maßnahmen ergriffen werden, um die Sicherheitsisolation der DC-Anschlussklemmen und Sense-Verbindungen sicherzustellen.

Warnung! Wenn die 'minus' DC-Anschlussklemme im Verhältnis zur Erdung 60 V_{DC} / 42,4 V_{pk} überschreiten kann, müssen zusätzliche externe Maßnahmen ergriffen werden, um die Sicherheitsisolation der DC-Anschlussklemmen und Sense-Verbindungen sicherzustellen.

Die standardmäßigen LAN-, USB- und Interlock-Verbinder sowie optionale Schnittstellen sind auf Erdpotential und können als sicher angesehen werden, wenn die 'minus' DC-Anschlussklemme des Geräts im Verhältnis zur Erdung 1000 V_{DC} / 707 V_{pk} nicht überschreitet für SM70-CP-450, SM210-CP-150, SM500-CP-90 und SM1000-CP-45, oder 1500V_{DC} / 1060V_{pk} im Verhältnis zur PE für SM1500-CP-30.

Vorsicht 1: Falls beide DC-Anschlussklemmen eines Niederspannungsgerätes potentialfrei sind oder falls die DC-Klemmen in Reihe mit einer externen AC- oder DC-Hochspannung geschaltet sind, kann die 'minus' DC-DC-Anschlussklemme den sicheren Wert in Bezug auf die Erdung wie in der Warnung oben spezifiziert überschreiten.

Vorsicht 2: Obwohl ein Hochspannungsgerät mit einer sicheren Spannung unter 60 V_{DC} betrieben wird, muss es zur Sicherheit immer als Hochspannungsgerät angesehen werden! Falsche Bedienung, ein Programmierfehler oder ein externer Fehler können zu einer unsicheren, hohen DC-Ausgangsspannung führen. Für weitere Informationen und Schaltpläne hinsichtlich Erdung und Sicherheit, siehe den online Applikationshinweis 'Safe operation of a power supply'.

3.5 Gefahr eines elektrischen Schlags

Das Berühren der Kontakte des Netzsteckers oder der Kabel direkt nach der Trennung vom Netz kann zu einem elektrischen Schlag führen. Und aufgrund von geladenen X-Kondensatoren, kann gefährliches Potential zwischen 'plus' oder 'minus' DC-Anschlussklemme und PE bestehen oder entstehen. Auch wenn die DC-Anschlussklemmen ausgeschaltet sind, aber das Gerät noch eingeschaltet ist. Daher niemals gleichzeitig PE und einen der DC-Anschlussklemmen berühren mit bloßen Händen.

3.6 Verbindung mit dem Versorgungsnetz

Entweder permanent mit dem Versorgungsnetz verbinden oder via einer Industriesteckverbindung entsprechend IEC 60309. „Permanent verbundene Ausrüstung“ oder „Steckbare Ausrüstung Typ B“.

3.7 Sicherungen

Sicherungen dürfen ausschließlich von autorisiertem Delta Elektronik-Service-Personal ausgetauscht werden, um Brandgefahr dauerhaft auszuschließen.

3.8 AC-Eingangsleistung

Verwenden Sie keine AC-Versorgung, welche die AC-Eingangsspannung und Frequenzleistung dieses Geräts überschreiten. Die AC-Eingangsspannung und Frequenzleistung der Delta Elektronik-Stromversorgungsserie sind im beiliegenden Datenblatt angegeben.

3.9 Spannungsführenden Stromkreise

Bedienungspersonal darf die Geräteabdeckungen nicht entfernen. Interne Einstellungen oder Bauteilaustausche sind ausschließlich qualifiziertem Personal von Delta Elektronik gestattet. Bauteile nie bei eingestecktem Stromkabel austauschen. Um Verletzungen zu vermeiden, vor dem Berühren von Bauteilen immer den Strom trennen, externe Spannungsquellen entfernen und Stromkreise entladen.

3.10 Teileaustausch & Modifikationen

Teileaustausch und Modifikationen sind ausschließlich autorisiertem Delta Elektronik-Service-Personal gestattet. Reparaturen am Gerät dürfen nur durch eine Delta Elektronik-Serviceeinrichtung durchgeführt werden.

3.11 Entfernung von (Sicherheits-) Abdeckungen

Sicherheitsabdeckung(en) werden verwendet, um potenziell gefährliche Spannungen abzudecken. Beachten Sie Folgendes, wenn Sie die Sicherheitsabdeckung(en) entfernen:

- Gerät ausschalten, Gerät von dem AC-Versorgungsnetz und DC-Anwendung trennen.
- Warten Sie 5 Minuten, um interne Kondensatoren zu entladen. Abschrauben und entfernen von Abdeckung(en).
- Bevor Sie das Gerät wieder mit dem Versorgungsnetz verbinden, montieren Sie vorher jedes Mal die Abdeckung(en).

3.12 Handhabung und Montage

Warnung! Einheit Gewicht ist 27kg! Beim Auspacken oder Umziehen vorsichtshalber: Heben Sie mit 2 Personen an oder benutzen Sie ein Liftwerkzeug. Gefahr der Zerkleinerung der Gliedmaßen unter Einheit.

Risiko des Schneidens: Einheit hat scharfe Kanten und Ecken!

Warnung! Keine Wandmontage oder Deckenmontage erlaubt! Gefahr der Zerkleinerung unter Einheit. Nur Einheit horizontal montieren, auf eine stabile Oberfläche stellen oder Rack-Montage verwenden.

3.13 Rotierender Lüfter, thermischer Verbrennung

Für die Kühlung des Geräts ist ein richtiger Luftstrom erforderlich. Dies ermöglicht den Betrieb bei voller Leistung und einer längeren Lebensdauer. Wenn das Gerät überhitzt wird, schaltet sich die Stromversorgung herunter, bis das Gerät wieder abgekühlt ist.

Warnung! Top-Abdeckung und Lüfter Auspuffs können heiß werden. Vermeiden Sie diese zu berühren, während Sie das Gerät mit hoher Leistung bedienen!

Warnung! Blockieren Sie keine Lüfter Öffnungen oder Luftabsaugungen. Versuchen Sie nicht, Lüfter Öffnungen durch ein Objekt zu betreten, um Lüfter zu behindern. Lange Haare können in Ventilator stecken bleiben, tragen Sie ein Haarnetz, wenn Sie lange Haare haben.

Warnung! Schließen Sie keine Kabel an die DC-Anschlussklemmen an, während das Gerät eingeschaltet ist. Plötzliches Machen oder Brechen von hohem Gleichstrom kann große Funken verursachen, auch bei niedriger Spannung. Gefahr von thermischer Verbrennung und Feuer!

3.14 Elektromedizinische Geräte

Warnung! Hohe Ströme können durch die DC-Anschlussklemmen laufen. Diese Ströme verursachen starke Magnetfelder. Kommen Sie nicht in die Nähe, wenn Sie ein elektromedizinisches Gerät wie einen Herzschrittmacher haben.

3.15 Umgebungsbedingungen

Die Stromversorgungssicherheitszulassung von Delta Elektronik gilt für die folgenden Betriebsbedingungen:

Gebrauch: Nur Innengebrauch.

Warnung! Nicht für die Verwendung in Gegenwart von Kindern oder Tieren vorgesehen!

Umgebungstemperatur: -20 bis 50 °C.

Maximale relative Luftfeuchtigkeit: 95 %, nicht kondensierend, bis zu 40 °C, 75 %, nicht kondensierend, bis zu 50 °C

Höhe: Nicht über 2000 m Meeresspiegel verwenden.

Warnung! Elektrische Creepage & Clearance nicht gültig für größere Höhen!

Verschmutzungsgrad: 2

3.16 Symbole und Markierungen



Vorsichtsfahr bei elektrischem Schlag.



PE-Leiterklemme



Bedienungsanleitung Symbol. Das Gerät wird mit diesem Symbol gekennzeichnet, wenn der Benutzer auf die Bedienungsanleitung verweisen muss.



Aus (Versorgungsnetz)



Ein (Versorgungsnetz)

3.17 Waste Electrical & Electronic Equipment (WEEE)

3.17.1 Korrekte Entsorgung dieses Produkts

Anwendbar in der Europäischen Union.



Diese Kennzeichnung auf dem Produkt, seiner Verpackung oder seiner Literatur weist darauf hin, dass es am Ende seiner Lebensdauer nicht mit anderen Abfällen entsorgt, sondern separat gesammelt werden sollte, um es verantwortungsvoll zu recyceln, um die nachhaltige Wiederverwendung von Material zu fördern.

4 Consignes de sécurité

4.1 Mise en garde

Les précautions de sécurité suivantes doivent être suivies dans toutes les phases de fonctionnement, d'entretien et de réparation de cet appareil. Le non-respect des précautions de sécurité ou des avertissements contenus dans le présent document enfreint les normes de sécurité concernant la conception, la production et l'utilisation prévue de cet appareil et peut endommager les dispositifs de protection intégrés. Delta Elektronika n'est pas responsable si l'utilisateur ne se conforme pas à ces exigences.

4.2 Catégorie d'installation

Les alimentations de Delta Elektronika ont été affectées à la catégorie d'installation II (catégorie de surtension II).

4.3 Mise à la terre des bornes de raccordement secteur (bornes d'alimentation CA)

Ce produit est un appareil de classe 1. Pour minimiser le risque de choc électrique, l'appareil doit être connecté au réseau d'alimentation CA à l'aide d'un câble d'alimentation à quatre fils. Dans ce cas, le conducteur de protection doit être fermement connecté à une connexion de mise à la terre électrique (conducteur de protection) à la source d'alimentation. Pour les appareils câblés au réseau d'alimentation, la borne de mise à la terre de protection doit être connectée au connecteur de mise à la terre de sécurité avant d'effectuer une autre connexion. Une interruption du conducteur de protection ou une séparation de la pince de mise à la terre de protection peut entraîner un choc électrique pouvant blesser les personnes.

4.4 Mise à la terre des bornes CC

Si la borne CC d'un appareil est conçue pour recevoir ou obtenir un maximum de 60 V_{DC} et que la borne CC 'moins' ou 'plus' est mise à la terre, la tension sur les bornes CC et les connexions de circuit de lecture (marque 'Sense') peuvent être considérées comme sûres.

Attention! Si le bornier CC 'plus' peut dépasser 60 V_{DC} par rapport au bornier CC 'moins', des mesures externes supplémentaires doivent être prises pour assurer l'isolation de sécurité des bornes CC et des connexions de circuit de lecture (marque 'Sense').

Attention! Si le bornier CC 'moins' peut dépasser 60 V_{DC} / 42,4 V_{pk} par rapport à la mise à la terre, des mesures externes supplémentaires doivent être prises pour assurer l'isolation de sécurité des bornes CC et des connexions de circuit de lecture (marque 'Sense').

Les connecteurs LAN, USB et de verrouillage standard ainsi que les interfaces optionnelles sont à leur potentiel de mise à la terre et peuvent être considérés comme sûrs si le terminal CC 'moins' de l'appareil par rapport à la mise à la terre ne dépasse pas 1000 V_{DC} / 707 V_{pk} pour SM70-CP-450, SM210-CP-150, SM500-CP-90 et SM1000-CP-45, ou 1500V_{DC} / 1060V_{pk} par rapport à PE pour SM1500-CP-30.

Attention 1 : Si les deux bornes CC d'un dispositif basse tension sont sans potentiel ou si les bornes CC sont connectées en série avec une haute tension EXTERNE CA ou CC, le bornier CC-CC 'moins' peut dépasser la valeur de sécurité en termes de mise à la terre comme spécifié dans l'avertissement ci-dessus.

Attention 2: Bien qu'un appareil haute tension fonctionne à une tension de sécurité inférieure à 60 V_{DC}, il doit toujours être considéré comme un appareil haute tension pour la sécurité! Un fonctionnement incorrect, une erreur de programmation ou une erreur externe peut entraîner une tension de sortie CC incertaine et élevée. Pour plus d'informations et des schémas de circuit concernant la mise à la terre et la sécurité, voir la note d'application en ligne '*Fonctionnement sûr d'une alimentation électrique*'.

4.5 Risque de choc électrique

Toucher les contacts de la fiche d'alimentation ou des câbles immédiatement après la déconnexion du secteur peut entraîner un choc électrique. Et en raison des condensateurs X chargés, un potentiel dangereux entre le terminal CC 'plus' ou 'moins' et le PE peut exister ou survenir. Même si les bornes CC sont éteintes, mais que l'appareil est toujours allumé. Par conséquent, ne touchez jamais PE et l'un des terminaux DC à mains nues en même temps.

4.6 Connexion au réseau d'alimentation

Connectez-vous en permanence au réseau d'alimentation ou via une connexion de prise industrielle conformément à la norme CEI 60309. 'Équipement connecté en permanence' ou 'Équipement enfichable de type B'.

4.7 Fusibles

Les fusibles ne peuvent être remplacés que par le personnel de service autorisé de Delta Elektronika afin d'éliminer définitivement le risque d'incendie.

4.8 Alimentation d'entrée CA

N'utilisez pas une alimentation CA qui dépasse la tension d'entrée CA et la puissance de fréquence de cet appareil. La tension d'entrée CA et la puissance de fréquence de la série d'alimentations Delta Elektronika sont spécifiées dans la fiche technique ci-jointe.

4.9 Circuits en direct

Les opérateurs ne doivent pas retirer les couvercles de l'appareil. Les réglages internes ou les remplacements de composants ne sont autorisés qu'au personnel qualifié de Delta Elektronika. Ne remplacez jamais les composants par le câble d'alimentation branché. Pour éviter les blessures, débranchez toujours le courant avant de toucher les composants, retirez les sources de tension externes et les circuits de décharge.

4.10 Remplacement et modifications des pièces

Le remplacement et les modifications des pièces ne sont autorisés qu'au personnel de service autorisé de Delta Elektronika. Les réparations de l'appareil ne peuvent être effectuées que par un centre de service Delta Elektronika.

4.11 Retrait des couvercles (de sécurité)

Les couvercles de sécurité sont utilisés pour couvrir les tensions potentiellement dangereuses. Gardez les points suivants à l'esprit lorsque vous retirez le(s) couvercle(s) de sécurité :

- Éteignez l'appareil, déconnectez-le du réseau d'alimentation CA et de l'application CC.
- Attendez 5 minutes pour décharger les condensateurs internes. Dévissez et retirez-le(s) couvercle(s).
- Avant de reconnecter l'appareil au réseau d'alimentation, installez-le(s) couvercle(s) à chaque fois.

4.12 Manipulation et assemblage

Attention! Le poids unitaire est de 27 kg! Lors du déballage ou du changement par précaution: Soulevez avec 2 personnes ou utilisez un outil de levage. Danger d'écraser les membres sous l'unité. Risque de coupe: L'unité a des arêtes vives et des coins!

Attention! Aucun montage mural ou au plafond n'est autorisé! Danger d'écrasement sous l'unité. Montez uniquement l'unité horizontalement, placez-la sur une surface stable ou utilisez un support en rack.

4.13 Ventilateur rotatif, combustion thermique

Un flux d'air approprié est nécessaire pour refroidir l'appareil. Cela permet un fonctionnement à pleine puissance et une durée de vie plus longue. Si l'appareil surchauffe, l'alimentation s'éteindra jusqu'à ce que l'appareil ait refroidi à nouveau.

Attention! Le couvercle supérieur et les échappements du ventilateur peuvent devenir chauds. Évitez de les toucher lorsque vous utilisez l'appareil avec une puissance élevée!

Attention! Ne bloquez pas les ouvertures des ventilateurs ou les bouches d'aération. N'essayez pas d'entrer dans les ouvertures des ventilateurs à travers un objet pour obstruer les ventilateurs. Les cheveux longs peuvent rester coincés dans un ventilateur, portez un filet à cheveux si vous avez les cheveux longs.

Attention! Ne connectez pas de câbles aux bornes CC lorsque l'appareil est allumé.

Soudain, faire ou casser un courant continu élevé peut provoquer de grandes étincelles, même à basse tension. Danger de combustion thermique et d'incendie!

4.14 Équipement électromédical

Attention! Des courants élevés peuvent traverser les bornes CC. Ces courants provoquent de forts champs magnétiques. Ne vous approchez pas si vous avez un appareil électromédical comme un stimulateur cardiaque.

4.15 Conditions ambiantes

L'approbation de sécurité de l'alimentation de Delta Elektronika s'applique aux conditions de fonctionnement suivantes:

Utilisation:	Utilisation à l'intérieur seulement. Attention! Non destiné à être utilisé en présence d'enfants ou d'animaux!
Température ambiante:	-20 à 50 °C.
Humidité relative max:	95 %, sans condensation, jusqu'à 40 °C, 75 %, sans condensation, jusqu'à 50 °C
Altitude:	Ne pas utiliser au-dessus de 2000 m niveau de la mer. Attention! Creepage & Clearance électrique non valable pour les altitudes plus élevées!
Degré de contamination:	2

4.16 Symboles et marqueurs



Risque de prudence en cas de choc électrique.



Terminal conducteur de terre de protection.



Icône du manuel d'instructions. L'appareil est marqué de cette icône lorsque l'utilisateur doit se référer au manuel d'instructions.



Désactivé (réseau d'approvisionnement).



A (réseau d'approvisionnement).

4.17 Déchets D'équipements Electriques et Electroniques (DEEE)

4.17.1 Élimination correcte de ce produit

Applicable dans l'Union européenne:



Cet étiquetage sur le produit, son emballage ou sa documentation indique qu'il ne doit pas être éliminé avec d'autres déchets en fin de vie, mais doit être collecté séparément afin de le recycler de manière responsable afin de promouvoir la réutilisation durable des matériaux.

5 Quick Start

5.1 Introduction

This chapter introduces the main controls, connections and basic operation of the SM15K series. Read the safety instructions before connecting, installing or operating the unit. After becoming familiar with the front and rear connections, connect the unit as described below. The final section explains basic local operation from the front-panel user interface.

Warning! Never make connections to the power inputs, power outputs or sense connector while the unit is connected to the mains supply or power outlet. Safety covers are used to cover these inputs and outputs.

Carefully read the chapter Safety Instructions in this manual before connecting or operating the unit.

Warning! Some components inside the power supply are connected to AC voltage even when the ON/OFF switch is in the OFF position. Therefore, a readily accessible, appropriately rated external disconnection device shall be incorporated. The power supply shall be connected to the mains supply via a protection device with a maximum rating of 32 A, such as a circuit breaker or fuses.

5.2 Controls and Connections

The front side of the unit, with its user interface and the rear side, with the connections, are shown in Figure 5.1 and Figure 5.2.



Figure 5.1: Controls on front side



Figure 5.2: Connections on rear side

5.3 Connecting the unit

5.3.1 AC Mains Connection

- The AC input connector is located at the rear side and is marked as connector A, CON A.
- Use a cable with a cross-section of 4 mm² for each conductor and a sufficient voltage rating for the AC input voltage of the unit.
- Use the included 4-pole plug with the markings L1, L2, L3, PE to connect the cable to the unit at CON A.
- The mounting torque for the header terminals is 0.6 Nm.
- Always connect the Protective Earth (PE) terminal.
- No neutral connection is required.
- The unit can operate only on a 3-phase grid with a rated voltage of 380...480 VAC. See the data sheet for all specifications.
- After installation, mount the cable to the pull relief at the right side of CON A. Mount the supplied plastic safety cover over the AC terminals. Mount the supplied plastic safety cover over the AC terminals.

5.3.2 DC Output Connection

- The DC output terminals are located at the rear side and are marked as CON B1 (PLUS) and CON B2 (MINUS), see Figure 5.2.
- For recommended DC conductor cross-sections and mounting torque, see Table 5.1. Use cables with a sufficient voltage rating for the maximum DC output voltage of the unit.

Unit	Output conductor cross-section [mm ²]	Bolt size	Torque [Nm]
SM70-CP-450	150	M12	80
SM210-CP-150	50	M8	20
SM500-CP-90	35	M8	20
SM1000-CP-45	12	M8	20
SM1500-CP-30	5	M8	20

Table 5.1: Recommended conductor cross-sections and mounting torque.

- With high output current, use low-resistance connections between the power supply and the load:
 - Mount the cable lugs directly on the DC output strips using the supplied bolt. Then assemble in the washers and nuts in following order: washer, split washer and the nut. Always in this order.
 - Never place washers between the lugs and the strips because this adds resistance and can result in excessive heat and may damage the unit and cable.
 - Only use nuts and washers supplied with the unit.
- The DC power terminals are floating relative to Protective Earth.
- After installation, mount the supplied safety cover over the DC power terminals.

5.3.3 LAN Connection

- Insert a standard RJ45 network cable to the LAN-connector at the rear side, see Figure 5.2. Make a connection to a Local Area Network (LAN) to perform a firmware update and to use the units' web interface, see Section 5.4.1.
- The LAN-connector is at Protective Earth level.

5.3.4 Additional Connections and Functions

- The SM15K-series power supplies support many additional functions, such as load sensing, interlock, plug-and-play interface modules, parallel or series operation in Master/Slave configuration, and more.

5.4 Basic Operation

5.4.1 Firmware Update

- Switch the unit on by rotating the mains switch on the front panel clockwise.
- In the unit menu, check the firmware revision via Menu -> System info -> Unit -> Version. Use the V- and A-knob to navigate through the menu.
- Visit our website and check if a newer firmware version is available.
- Firmware files: [products > SM15K > downloads](#)
- Download the firmware package to a computer and connect it to the same LAN as the power supply unit.
- In the unit menu, check the IP-address via Menu -> Interfaces -> LAN -> Address.
- On the computer, open the SM15K web interface using an internet browser by entering the IP-address of the unit in the address bar of the browser. Note that when DHCP is enabled, the IP-address can change, for example after a power cycle.
- In the web interface, go to Administration -> Firmware.

- Select "Choose File" and browse to the downloaded package, enter password and "Start Update".
- The password is by default "depower".

5.4.2 First Operation

- This section explains how to operate the unit from the front panel UI.
- The first line in the display indicates the measured output voltage and current at the DC output terminals. The second line shows the programmed Constant Voltage (CV) and Constant Current (CC) values, see Figure 5.3 for an example.

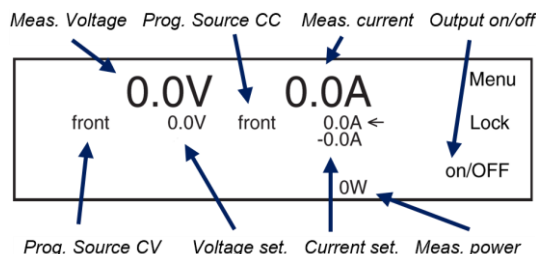


Figure 5.3: Measured values and settings

- Check whether the text front is indicated twice as the programming source. The left indication shows that the CV value is programmed by the front-panel user interface. The right indication shows that the CC setting is programmed by the front-panel user interface. This means the unit is in local operation and can be controlled by the V-knob and A-knob on the front panel. The V-knob sets the CV value and the A-knob sets the CC value.
- Switch the output on by pressing the button next to the on/OFF text in the bottom-right corner of the display.
- To program the CV and CC values, turn the V-knob and A-knob half a turn clockwise. Depending on the load, a voltage should now be present at the output and a current will flow through the load. Observe how the settings are reflected in the second line of the display.
- Depending on the load and programmed values, the unit will operate in Constant Voltage (CV), Constant Current (CC) or Constant Power (CP) mode. See Figure 5.4 for the indicator locations.

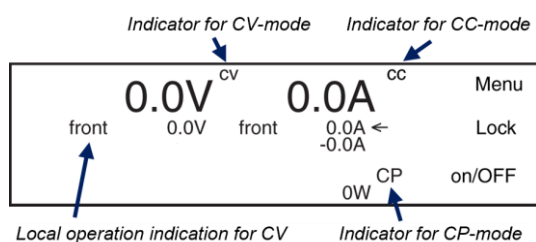


Figure 5.4: Operation mode

- The CV indication appears on the first line next to the measured voltage value. The CC indication appears next to the measured current value, and the CP indication appears next to the measured power value.
- See Figure 5.5 for a practical example. The output is ON. The unit is in CV mode, and 9.2 V, 2.1 A and 19 W are measured at the DC output. The CV setting is 9.2 V, the positive current setting is 10 A and the negative current setting is -10 A.

5.4.3 Source and Sink Current Settings

- The unit is bidirectional. It can supply current and sink current.
- By default, the A-knob on the front panel sets the source current CC+.

- The arrow next to the CC+ and CC- settings indicates which setting is currently changed by turning the A-knob.
- Press Lock and Menu simultaneously to toggle the A-knob between the source current setting CC+ and the sink current setting CC-.

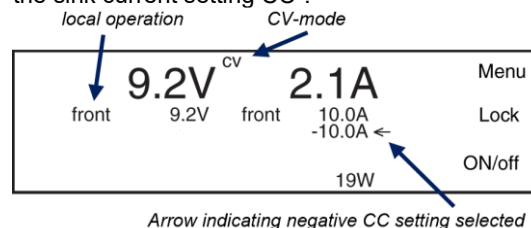


Figure 5.5: Positive and negative CC settings

- In the display the arrow behind the value for the current changes position. Observe the difference in arrow position between Figure 5.4 and Figure 5.5.

5.4.4 Source and Sink Power Settings

- Set the maximum power via Menu -> Configuration -> Prg Setting -> Psettings.
- Here rotate the V-knob to set the source power from 0 to 15 kW. This is the power the unit can deliver to the DC power terminals.
- Rotate the A-knob to set the sink power from 0 to -15 kW. This is the power the unit can absorb from the DC power terminals and feed back into the grid.

5.4.5 Output Limits

- By default, the settings for CV, CC and CP Limit are set to the maximum.
- Change the limit settings via Menu -> Protection -> Limits.

5.4.6 Remote Programming

- As mentioned previously, the unit is in local operation by default, see Figure 5.4.
- In remote operation different programming source options are available such as 'eth', 'web', 'seq', 'slot1', etc. See a screenshot of the remote display on in the web interface in Figure 5.6.



Figure 5.6: Remote display on web interface

- Via the front menu, the programming source can be set to the required programming input via:
- Menu -> Configuration -> Source
- When connected to LAN, enter the unit's IP address in a web browser to open the web interface.
- With the web interface, all parameters described above, plus additional parameters, can be programmed or monitored.
- For detailed remote-programming information, see Chapter 9 of the product manual.

5.5 Further Information

- This Quick Start covers basic connection, local operation and initial remote-programming setup. Detailed information about product characteristics, installation, operating functions, remote programming, troubleshooting and maintenance.
- The full product manual is available on our website.
- Manual: [Products > SM15K > Downloads](#)

6 Product Overview

6.1 Introduction

- The SM15K-series consists of the SM70-CP-450, SM210-CP-150, SM500-CP-90, SM1000-CP-45 and SM1500-CP-30 models.
- The power supplies can be used as a DC source or as a load, with independently adjustable source and sink current and power.
- This chapter provides an overview of the DC output, AC input, power-up behavior, performance, EMC, thermal characteristics and available functionality of the SM15K-series.
- Detailed instructions for installation, operation and remote programming are provided in the following chapters.

6.2 DC Output Characteristics

6.2.1 DC Output

- The SM15K series power supplies can either be used as a constant voltage sink and source with current or power limit, or as a constant current sink and source with voltage or power limit.
- The change of mode occurs at the crossing of the voltage, current and power settings. Figure 6.1 shows the output ranges of different models.

6.2.2 Bidirectional Operation

- The unit operates in source or sink mode and changes over between modes depending on the settings and the load conditions at the DC power terminals.
- Warning! When using the unit as a load, the user needs to take care the voltage of the source connected to the DC power terminals does not exceed the maximum allowed voltage, too high voltage or overshoot can damage the unit.
- Note that the inductance (like cable inductance) in series with a voltage source can cause a voltage overshoot at the DC power terminals, when switching the output from "ON" to "OFF" or switching off the mains.
- Via the user menu the amounts of sink power and source power can be set between 15 kW and almost zero independently from each other.
- A minimum sink current is programmed to enhance the source behavior at low output voltages. See the data sheet for the specifications of each individual model.

6.2.3 Constant Power Mode

- Both in Source and in Sink mode, the unit can operate in Constant Power mode, depending on the DC load and mains supply.
- The user can select any value between zero and maximum power for source and sink mode individually.

6.2.4 Ripple and Noise

- The DC output ripple is very low with almost no spikes. At low ambient temperatures like -20 °C, the ripple increases. By using high quality electrolytic capacitors, the increase is kept to a minimum.

6.3 AC Input Characteristics

6.3.1 AC Input Voltage

- The power supply works on three phase AC mains voltage and has a wide input voltage range.
- No neutral connection is required.
- In case of low AC voltage or missing phase, the AC-Fail (ACF) status will be indicated.

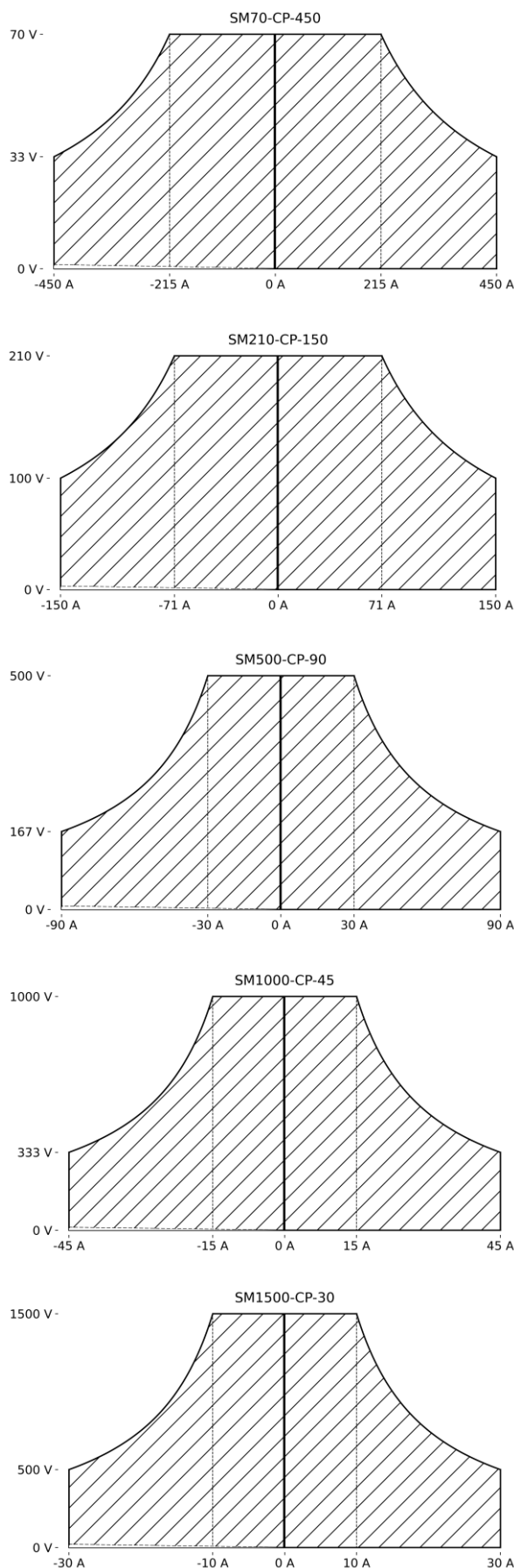


Figure 6.1: Output ranges of different models

6.3.2 AC Input Current

- The unit has active Power Factor Correction (PFC). The AC input current is nearly sinusoidal. This means that the RMS value and the harmonic distortion of the AC input current will be relatively low.

6.3.3 AC Input Power with DC Output Off

- The unit consumes little standby power when the DC output is switched off. This makes it possible to leave the AC input powered on when the DC output is disabled by the Output On/Off function.
- See the specifications in the data sheet.
- The DC output can be switched on or off via a push button on the front panel or by remote programming.

6.3.4 Inrush Current

- The AC inrush current is electronically limited. Repeatedly switching on and off does not change the maximum peak current.
- Switching on and off at a fast rate can overheat the inrush current limiter with the result that the unit may not start until it has cooled down. After cooling down (mains switched off) the unit will start up again.

6.4 Power-up and Mains Interruption

6.4.1 Turn On Delay

- The DC output voltage is available quickly after mains switch on.
- The turn on delay specifications can be found in the datasheet.

6.4.2 Hold-Up Time

- The holdup time specifies how long the unit can operate when the AC input is interrupted.
- The holdup time is specified in the data sheet.
- The hold-up time depends on the DC load and the DC output voltage. A lighter load or a lower output voltage result in a longer hold-up time, see Figure 6.2.

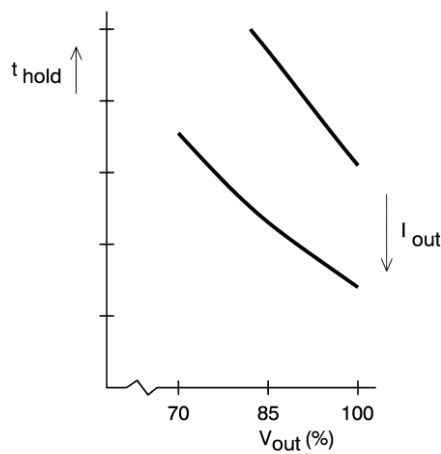


Figure 6.2: Hold-up time vs. V_{out} , for different I_{out}

6.5 Performance Characteristics

6.5.1 Efficiency

- The efficiency is very high and constant over a wide DC sink and source range. High efficiency means low power losses and little heat generation.

6.5.2 Programming Speed

- The programming speed is the time needed for the output to respond to a change in programmed value.
- The programming speed is specified in the data sheet.
- The rise and fall times listed in the data sheet are measured with a step waveform using the internal sequencer.
- Up and down programming is nearly load independent.

6.6 EMC Characteristics

6.6.1 RFI Suppression

- Both the input and output have RFI filters, resulting in very low conducted RFI to the line and load. Due to the output filter the output voltage is very clean, having almost no spikes.

6.7 Electrical Isolation

- The insulation between AC input and DC output is verified during manufacturing by testing the separating components at 3750 V_{RMS} (5300 V_{DC}) for one minute. See Figure 6.3 for a schematic.

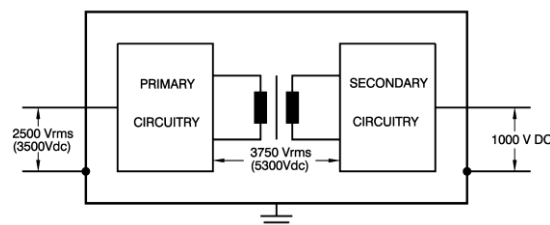


Figure 6.3: Insulation test voltages, depending on model.

- The insulation between the AC input terminals and Protective Earth is tested at 3500 V_{DC}.
- The insulation between the DC output terminals and Protective Earth is tested at 1000 V_{DC} or 1500 V_{DC}, depending on the unit model.
- The input-to-output insulation test cannot be repeated on the assembled unit.
- These are factory test voltages. Refer to the data sheet for the applicable insulation rating of each model.

6.8 Thermal Characteristics

6.8.1 Cooling System

- Three low noise fans cool the unit. The speed of the fans depends on the temperature of the internal heatsinks, see Figure 6.4. Normally, at 50 °C ambient temperature and full load the fans are designed such that they will not turn at full speed.

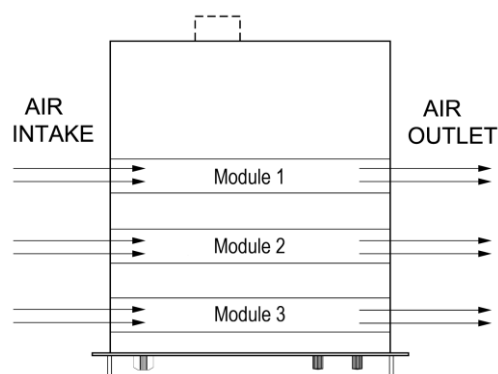


Figure 6.4: The fans are located at the left side and blow through the unit.

- Due to the air that enters on the left and exits on the right, it is possible to stack the power supplies. No vertical distance between the units is required.

6.8.2 Operating Temperature

- At full power, the operating temperature range is -20 to +50 °C ambient. Above this temperature, the output current is derated linearly.
- For example from 50 to 60 °C the output current (either positive or negative) is derated to 75% at 60 °C, see Figure 6.5. These temperatures hold for normal operation, i.e. the air intakes & air outlets on the left and right side must be free.

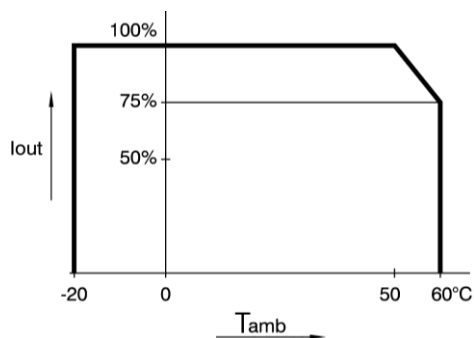


Figure 6.5: Operating temperature ranges. Note the current derating is the same for either sink or source mode.

6.9 Functions and Interfaces

6.9.1 Remote Sensing

- The DC voltage at the load can be kept constant by remote sensing. Remote sense moves the voltage sense points towards the load.
- This feature should only be used when the load voltage is not allowed to vary a few millivolts.
- To compensate for the voltage-drop across the load leads, the unit will have to supply a higher voltage at the output to provide the desired voltage at the load, see Figure 6.6.

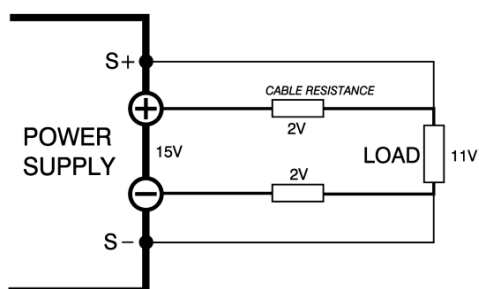


Figure 6.6: Remote sensing, voltage drop in load leads subtracts from maximum DC output.

- The sense leads are protected against accidental interruption.

6.9.2 Series Operation

- Only the SM500-CP-90 of the SM15K series may be connected in series without additional precautions. For the maximum permitted series voltage, refer to the data sheet.
- **Warning!** An internal anti-parallel diode is connected across the DC power terminals to protect the unit against reverse polarity. When the output is switched OFF or the mains supply is disconnected, reverse current from another source may flow through this diode and cause it to overheat.
- This can occur in series-connected systems when one unit is inactive while current is forced through it by the other units. To prevent overheating, keep the output switched ON and set a sufficient negative current limit to allow the unit to sink the current.
- For easier and coordinated control of series-connected units, the optional Master/Slave interface module is recommended. The series connected units will behave as a single system, see Figure 6.7 for an overview schematic.

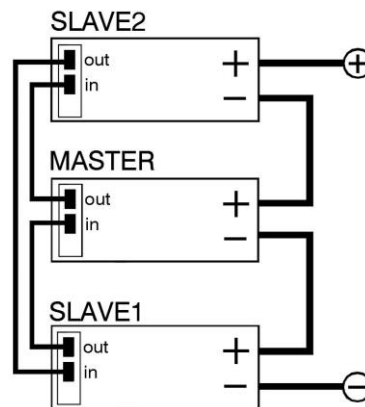


Figure 6.7: Optional Master/ Slave series-connected operation

6.9.3 Parallel Operation

- Without Master/Slave interface, only one unit can operate in the bidirectional mode, all others can only be used as power source.
- With the optional Master/Slave interface the power supplies can be connected in parallel without limitations and with full functionality.
- It is recommended to use the Master/Slave interface to operate multiple units in parallel. See Figure 6.8 for an overview schematic.

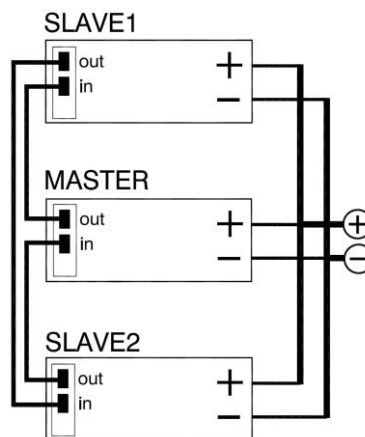


Figure 6.8: Optional Master/slave parallel-connected operation

6.9.4 Interlock

- The interlock functionality disables the DC output when the loop at the interlock connector on the rear panel is interrupted. When the two pins on the interlock connector are connected again, the DC output is turned on again.
- It can be used for example in combination with a cabinet door contact. Once the interlock pins are connected again, the DC power output will be turned on again.
- **Warning!** Before closing the interlock again, which will turn the output on again, ensure that the connected load and system can be energized safely.
- The Interlock is at PE level and is a software disable. A floating interlock is available through the contacts interface module.

6.9.5 Web Interface

- The web interface and Ethernet are standard available on all units via the LAN connector at the rear side.
- The web interface can be used to view and change the settings for CV, CC+, CC-, Power+, Power-, Output On/Off, optional interfaces, sequencer, function blocks, to upload new firmware and to configure the unit similar as with the front display menu.

6.9.6 Ethernet Programming

- With the built-in Ethernet interface, program and monitor values using SCPI commands.
- The SCPI commands are listed in the Ethernet programming guide.

6.9.7 USB Programming

- A USB connector is standardly available on the front and rear side of the unit. However, USB programming through these ports is still under development for an upcoming firmware version.
- The unit can be programmed and monitored alternatively using the serial interface module.
- Sequences can be uploaded using the web interface.

6.9.8 Sequencer Programming

- It is possible to use the unit in stand-alone automation or use as an arbitrary waveform generator and create loops, ramps etc.
- The sequencer can be controlled via the web interface and via Ethernet programming.

6.9.9 Function Blocks

- Integrated Function Blocks are functional integrated software blocks with predefined behavior that can be put in between a program source and the unit's output controllers, see Figure 6.9.

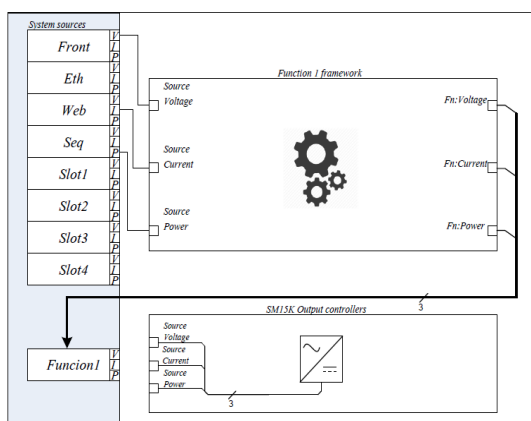


Figure 6.9: Functions Blocks can be put in between a program source and the units output controllers

- By using these Integrated Function Blocks the user can manipulate the unit's Programming sources or can set up specific simulations.
- The available function blocks are leadless sensing, internal resistance and photovoltaic simulation.
- Configuration instructions are provided in Section 8.6.

6.9.10 Optional Interfaces

- Up to 4 interfaces can be plugged in the slots at the rear side of the unit, see Figure 6.10 for an overview of the available modules.



Figure 6.10: Overview of the pluggable modules.

- All interface modules can easily be plugged in afterwards at the customer site.
- The following modules are available:
 - Master/Slave controller (INT-MOD-M/S-2).
 - Serial, USB and differential programming (INT-MOD-SER).
 - Digital User I/O for programming (INT-MOD-DIG).
 - Floating Contacts, floating Interlock and floating Enable (INT-MOD-CON).

- Isolated analog programming & monitoring, logic status outputs. (INT-MOD-ANA)
- A carrier for Industrial automation protocol plugins such as CANopen, EtherCAT, Ethernet/IP, Modbus-TCP, PROFIBUS, PROFINET. (INT-MOD-ANY)

6.10 Firmware Update

- The firmware is continuously updated to improve functionality, enhance reliability, and resolve known issues.
- It is recommended to regularly check for firmware updates on our website and update the power supply. Release note and firmware update can be found at: [Products > SM15K > Downloads](#)
- Section 8.7 explains the firmware update process.

7 Installation

7.1 Introduction

- This chapter describes how to install the power supply in its operating environment, make the required electrical connections and configure the output for the intended system.
- It includes environmental and mechanical requirements, AC and DC connections, sensing, interlock, system configurations and considerations for specific load types.
- **Warning!** Carefully read the chapter Safety Instructions in Chapter 2 before connecting or operating the unit.

7.2 Environment and Mounting

7.2.1 Humidity and Condensation

- During normal operation, humidity will not harm the power supply, provided the air is not aggressive. The heat normally produced in the power supply will keep it dry.
- Avoid condensation inside the power supply, to prevent breakdown. Condensation can occur during a period when the power supply has been switched off (or operating at no load) and the ambient temperature is increasing. Always make sure the power supply is dry inside before switching it on again.

7.2.2 Temperature and Cooling

- The storage temperature range is -40 to $+70$ °C.
- The operating temperature range at full load is -20 to $+50$ °C.
- This temperature range only holds when the air-intakes and air-outlets are unobstructed, and the temperature of the air-intake is not higher than $+50$ °C.
- When the power supply is mounted in a cabinet, please note that the temperature of the air-intake should be kept low and avoid a short circuit in the airflow i.e., the hot air leaving the air-outlets entering the air-intakes again.
- Please note: a lower and constant ambient temperature extends the lifetime of the power supply.

7.2.3 19-Inch Rack Mounting

- On both sides in the rack, mount a proper support slide that can hold the weight of the unit. It is advised to use a separate slide for each unit.
- After placing the unit on the slide, secure the front panel using all four mounting screws. Use proper screws intended for keeping equipment of this weight in position.
- Assuming the rack is deliberately designed for the weight, stacking of the units is allowed without limitations. See Section 7.2.2 for cooling instructions.

7.2.4 Contaminated Environments

- The power supply is designed for pollution degree 2.
- When the installation environment contains dust, conductive particles, salt, acid vapor or other contaminants, take appropriate measures to protect the power supply.
- Install the power supply in a clean, non-condensing environment or in a suitable enclosure supplied with clean cooling air.
- Depending on the application, suitable measures may include pre-filtering of the cooling air, an overpressure cabinet or a cabinet with a heat exchanger.
- Ensure that any filters or cooling-air systems are maintained so that sufficient airflow through the power supply is retained.

- Galvanic and plating installations are examples of environments that may require these measures to prevent breakdown.

7.3 Electrical Connections

- **Warning!** Never make connections to the Power Inputs and Outputs or the Sense Connector when the unit is connected to the mains supply or power outlet!
- Safety covers are used to cover AC input DC outputs and sense connectors.
- Before removing the safety covers:
 - Switch off the unit.
 - Disconnect the unit from the mains supply.
 - Wait for 5 minutes to allow internal capacitors to discharge.
 - Unscrew the screws and remove the safety cover.
 - Place the safety cover back on the unit before connecting it to the mains supply again.
- **Warning!** Some components inside the power supply are at AC voltage even when the ON/OFF switch is in the OFF position. Therefore a readily accessible, appropriately rated, disconnect device shall be incorporated externally to the equipment.
- The power supply shall be connected to the mains supply via a protection device with a rating of maximum 32 A. For example, a circuit breaker or fuses.

7.3.1 AC Mains Connection

- The unit can operate only on a 3-phase grid. Refer to the data sheet for the input specifications.
- The AC input connector is located at the rear side, marked as CON A.
- Use a cable with a diameter of 4 mm² for each wire and use a cable with a sufficient voltage rating for the AC input voltage of the unit.
- Use the included 4-pole header with the markings L1, L2, L3 and PE for connecting the cable to the unit, see Figure 7.1. The mounting torque for the header terminals is 0.6 Nm.

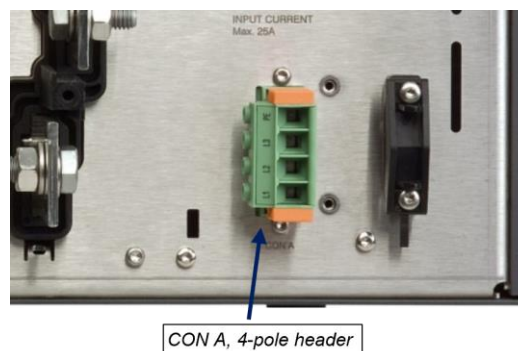


Figure 7.1: Insert the included 4-pole header in CON A for the connection of the AC power / Mains.

- Always connect the PE terminal to Protective Earth.
- See Figure 7.2 for the connection schematic.

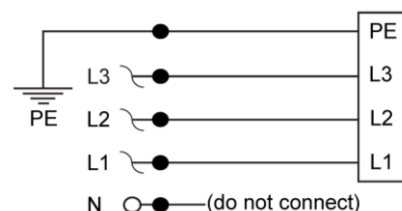


Figure 7.2: The 3 phase connections for AC Mains.

- No neutral connection is required.

- After installing the cable to CON A, fixate the cable by connecting the cable pull relief. The pull relief is located to the right of CON A. The last step is to add the safety cover over the AC terminals.

7.3.2 DC Output Connection

- These terminals are located at the rear side, marked as CON B1 (PLUS) and CON B2 (MINUS), see Figure 7.3.

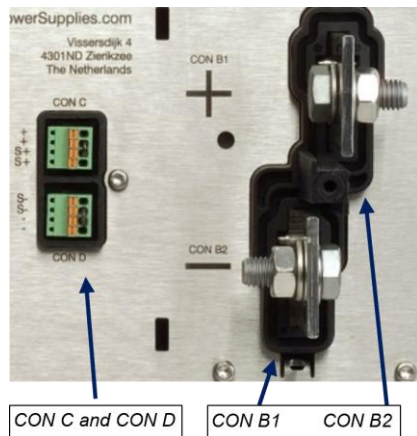


Figure 7.3: The two DC power terminals CON B1 and B2. CON C and D are the sensing connectors.

- For conductor cross-section recommendations and mounting torque recommendations, see Table 7.1.

Unit	Output conductor cross-section [mm ²]	Bolt size	Torque [Nm]
SM70-CP-450	150	M12	80
SM210-CP-150	50	M8	20
SM500-CP-90	35	M8	20
SM1000-CP-45	12	M8	20
SM1500-CP-30	5	M8	20

Table 7.1: Recommended conductor cross-section and mounting torque.

- Use cables with a sufficient voltage rating for the output voltage of the unit.
- With high output current, make sure to use low resistive connections between the power supply and the load:
 - Mount the cable lugs directly on the DC power strips followed by a washer, a split washer and a nut. Always in this order!
 - Never place washers between the lugs and the strips because this can result in excessive heat due to the added contact resistance.
 - Only use nuts and washers supplied with the unit.
- Minimize loop inductance by keeping the positive and negative DC conductors close together over their full length. For flexible cable connections, twist the positive and negative conductors together where practical, or use a suitable two-core cable.
- For high-current connections, use short, closely spaced positive and negative busbars where practical. When cables are used, route them tightly side-by-side and secure them together.
- The DC power terminals are floating relative to Protective Earth.
- After installation, mount the safety cover over the DC power terminals.

7.3.3 Remote Sensing Connection

- The remote sensing connectors are located at the rear side, marked as CON C and CON D, see Figure 7.3.

- Use the included 4-pole headers for connecting the sense wires to the unit. By pressing the orange clips with a small screwdriver, the wires can be inserted or released.
- For local/ internal sensing (sensing at power terminals of the unit), check whether there is a link between + and S+ and between – and S– on the sense header (default), see Figure 7.4.

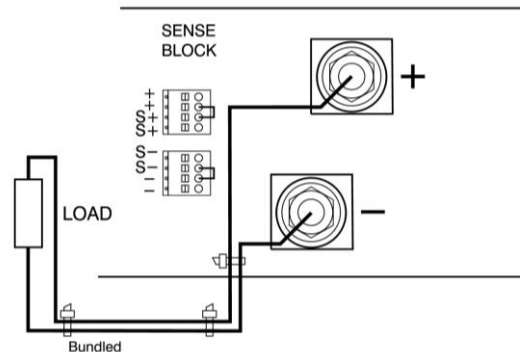


Figure 7.4: Local sensing with the power cables bundled close together to minimize inductance.

- For remote sensing, see Section 7.5.1.
- To use remote sensing, remove the links between + and S+ and – and S– and connect sense leads to the inputs for S+ and S–.
- The connectors enable the use of two sets of sense wires, but one set is sufficient.
- Use cables with a diameter of 0.3 to 0.5mm² and with a sufficient voltage rating for the DC output voltage of the unit.
- To prevent interference must always be shielded and the sense wires in the cable should be twisted. See Figure 7.5 for an overview.

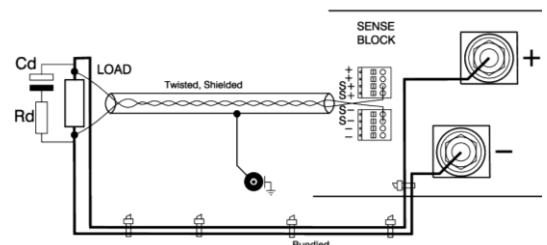


Figure 7.5: Remote sensing with shielded twisted wires and the power cables bundled close together to minimize inductance.

- With regards to safety, the sense terminals are at the level of the DC power terminals.
- After installation, mount the safety cover over the sense terminals.

7.3.4 LAN Connection

- This connector is located at the rear side, marked as LAN see Figure 7.6.

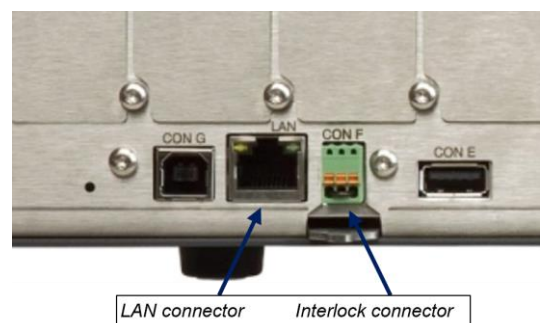


Figure 7.6: The location of the LAN-connector (left) and the Interlock connector (right) at the rear panel

- For Ethernet programming or Web Interface control, insert a standard RJ45 cable in the LAN connector at the rear side.
- With regards to safety, the LAN connector is at the level of Protective Earth.

7.3.5 Interlock Connections

- This connector is located at the rear side, marked as CON F, see Figure 7.6.
- Use the included 3-pole header for connecting the interlock wires to the unit. By pressing the orange clips with a small screwdriver, the wires can be inserted or released.
- For more details and specifications about Interlock, please read Section 7.5.2
- When the Interlock function is not used, connect a link between terminal 1 and 3 of the Interlock header, this is the factory default.
- Use cables with a cross-section of 0.3 to 0.5mm² and with a sufficient voltage rating for the voltage of the circuit.
- With regards to safety, the Interlock connector is at the level of Protective Earth. For a floating Interlock contact, use the optional interface INT-MOD-CON.

7.3.6 USB Connections

- The USB inputs are currently disabled in software and will be enabled with a future firmware update. To program the power supply through USB, alternatively use the optional pluggable Serial programming module. Sequencer files can be uploaded through the web interface.
- With regards to safety, all USB connectors are at the level of Protective Earth.
- The type-A (Host) connectors are located at the front panel near the display, and one at the rear panel (CON E), see Figure 7.6 and Figure 7.7.

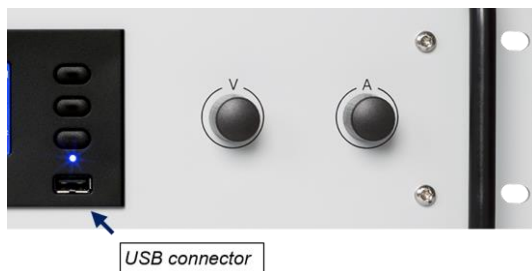


Figure 7.7: The location of the front USB-connector.

- The type-B (Device) is located at the rear panel (CON G), see Figure 7.6.
- Type-A connectors are meant for direct connection of flash drives for data exchange.
- The type-B connector is meant for controlling the unit. Use a cable which is maximum 3 m in length.

7.3.7 Optional Interfaces

- For programming via an optional interface, refer to the interface manual for installation and cable connections.

7.4 System Earthing and Insulation Testing

- The DC output terminals are floating in relation to Protective Earth.
- The DC output is galvanically isolated from the AC input.
- The sensing terminals are at the level of the DC output terminals.
- The LAN connector, USB connectors and standard Interlock connector are at Protective Earth potential.
- Take these potential relationships into account when integrating the power supply into a grounded system.
- Observe the grounding and safety requirements in Section 2.3.

- For series operation, observe the maximum permitted voltage between each DC output terminal and Protective Earth. See Section 7.5.4 and the data sheet.
- Do not perform an insulation test between the AC input terminals and DC output terminals on an assembled unit.
- When insulation testing between the AC input terminals and Protective Earth, or between the DC output terminals and Protective Earth, is required by the installation procedure, apply and remove the test voltage gradually, for example over one second.
- Gradual charging and discharging limits peak current through the internal Y-capacitors.
- Ensure that the Y-capacitors are fully discharged before reconnecting or operating the unit.

7.5 Output and System Configuration

7.5.1 Remote Sensing

- **Warning!** This feature is not recommended for normal use, because damping is critical and wrong connection or routing can lead to instabilities.
- With remote sensing, the voltage at the load can be kept constant. The voltage drop in the load leads will be compensated.
- For best dynamic performance, keep the DC load connection as short as possible and minimize loop inductance as described in Section 7.3.2.
- By default, maximum 1 V per load lead can be compensated.
- Via the web interface this can be set to a maximum of 10 V. See Chapter 9, Remote Programming.
- Note that the voltage drop in the leads decreases the maximum DC output voltage of the unit: $U_{out\ DC} = U_{leads} + U_{load}$.
- For example, shown in Figure 7.8, on a 15 V power supply only 11 V will be available at the load when 2 x 2 V compensation is used.

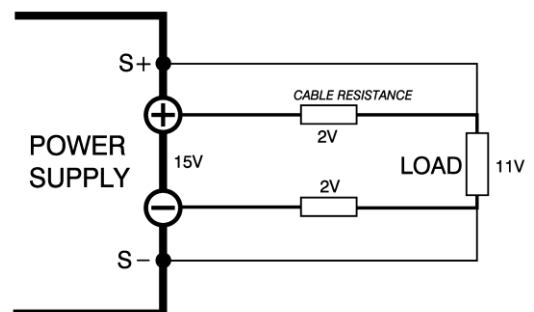


Figure 7.8: Remote sensing: voltage drop in DC load leads subtracts from the maximum DC output voltage.

- To minimize the inductance in the DC load leads, keep them close to each other. The inductance of these leads could give a problem with pulsating or dynamic loads.
In this case a large electrolytic capacitor (Cd) in series with a damping resistor (Rd) both in parallel with the load will help, see Figure 7.9. Check that the capacitor Cd in combination with the load leads and resistor Rd forms a well damped circuit.

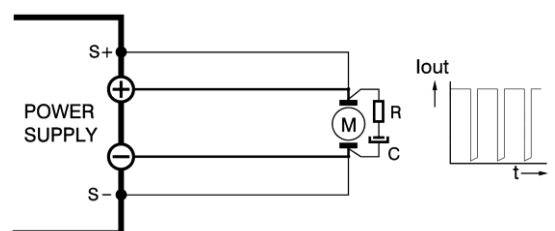


Figure 7.9: Remote sensing on a pulsating load.

- Since the voltmeter is internally connected to the sensing terminals, it will automatically display the remote voltage at the load. Note that the voltage measured at the load will be lower than on the DC power terminals of the power supply.
- The voltage limit setting of the unit should be increased by the total voltage drop in the load leads.
- For sensing on a pulsating load, see Section 7.6.1.

7.5.2 Interlock Function

- The interlock connector CON F has one output (pin1) and one input (pin3). Pin2 is not used. As soon as the link between pin 1 and 3 is interrupted, the DC power output of the unit will shut down.
- If the link is open, the interlock symbol is flashing on the display, see Figure 7.10 and the interlock status will be active.



Figure 7.10: The Interlock symbol will be visible in the display when the link is interrupted.

- Connecting the terminals will switch the DC power terminals on again.
- **Warning!** The terminals can only be connected to a floating contact, for example a switch or a relay. Internally the terminals are connected to a logic circuit which cannot be charged or loaded.
- The current through a closed contact is less than 1 mA.
- The voltage over the open contact is 3.3 V (typical).
- The maximum Interlock wiring length is 3 meters.
- It is not possible to connect the interlock of multiple SM15K units in parallel.
- With regards to safety, the Interlock connector is at the level of Protective Earth. On the optional interface Isolated contacts, a floating interlock connector is available, See Section 9.6.3.

7.5.3 Bidirectional Operation

- **Warning!** When using the unit as a load, the user needs to take care the voltage of the source connected to the DC power terminals is not exceeding the maximum allowed voltage, too high voltage or overshoot can damage the unit. Refer to the data sheet for allowed maximum voltage.
- Note that the inductance like cable inductance in series with a voltage source can cause a voltage overshoot at the DC output terminals, when switching the output from "ON" to "OFF" or switching off the mains.
- No additional hardware is needed to enable the sink current to be delivered back into the grid.
- Via the software menu the values for maximum sink current "CC-" and sink power "Power-" can be set.
- See Sections 7.5.4 and 7.5.5 on how to set up the unit for bidirectional operation in combination with Series or Parallel operation.

7.5.4 Series Operation

- Only the SM500-CP-90 can be connected in series without special precautions, see Figure 7.11. The SM70-CP-450, SM210-CP-150, SM1000-CP-45 and SM1500-CP-30 cannot be connected in series.

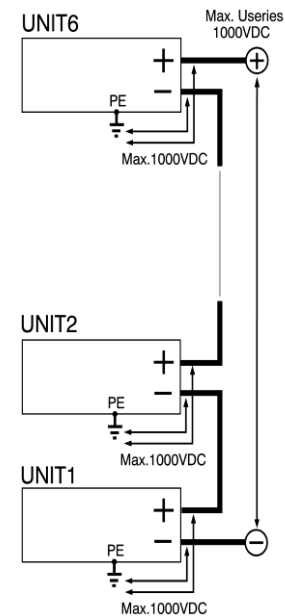


Figure 7.11: Series operation

- For series operation of the SM500-CP-90, the maximum series voltage is 1000 V_{DC}. Take care the DC Power Terminals are floating and the functional insulation between DC terminals and PE is 1000 V_{DC}. This applies for both plus and minus terminals, and for all units connected in series.
- The functional insulation of SM500-CP-90 allows a total series voltage of 1000 V for units delivered Q4 / 2018 or newer. Older units allow a total series operation voltage of max. 750 V. Contact factory for upgrading older units to enable 1000 V.
- **Warning!** Internally there is an anti-parallel diode connected to the DC power terminals. This protects the output in case of a reverse polarity connection. However, in series operation it can get overheated when current flows through the output with the output switched to "OFF", or the mains switched off.
- To avoid overheating of the diode, take care the output is switched to "ON" and the sink current setting CC- is sufficient to hold the current.
- For easier and coordinated control of series-connected units, the optional Master/Slave interface module is recommended. The series connected units will behave as a single system.

7.5.5 Parallel Operation

- For parallel operation without the optional M/S interface, only one of the units can operate in bidirectional mode. Make sure the CV setting of this unit is always 0.5 % higher than the others.
- For all other units disable the bidirectional operation by setting the values for CC- and Power- to zero.
- Use the cable configuration recommendations from Section 7.3.2.
- Additionally for parallel connections use a symmetrical connection layout with equal-length, low-resistance connections from each unit to the common positive and negative busbars.
- For high-current parallel systems, use short, closely spaced positive and negative copper busbars where practical. Busbars are offered for the SM15K series.

7.5.6 Optional Master / Slave Control

- For easy series or parallel operation, the Master / Slave interface is strongly advised.
- See Section 9.6.4 for more information about the M/S interface.
- Consider all recommendations for the installation mentioned in 7.3.2, 7.5.4, and 7.5.5.

7.6 Load-Related Considerations

7.6.1 Pulsating Load

- To avoid overheating the output capacitors, the AC component of the DC load current should be limited, see Figure 7.12.

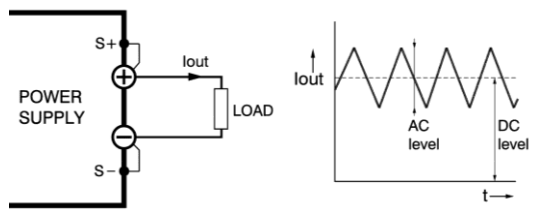


Figure 7.12: Pulsating load current.

- One method of reducing the AC current through the output capacitor is by using a large external electrolytic capacitor in parallel with the load. Care must be taken so that the capacitor in combination with the lead inductance will not form a series resonant circuit.
- When using remote sensing on a pulsating load (for instance a DC motor), use a capacitor in series with a resistor over the load see Figure 7.9. With this the AC component caused by the pulsing of the load is filtered out.

7.6.2 Battery Charging

- The SM15K can be used in battery-charging systems when the required, voltage limit, current limit, protection and monitoring have been defined for the battery type and application.
- See the Battery Charging application note before use.
- Use a Circuit Breaker in series to protect the power supply from accidental reverse connection, see Figure 7.13. However in the case polarity reversal when connection a battery, this protection measure may become overloaded.

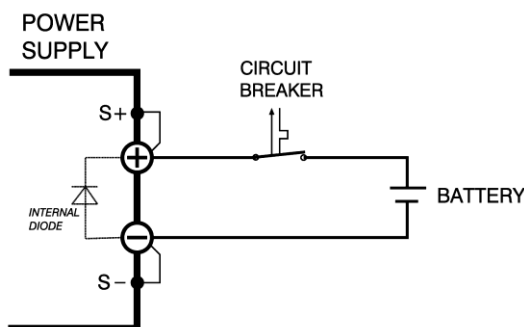


Figure 7.13: Charging battery with a circuit breaker in series to protect the internal diode.

- Warning!** The unit has a reverse diode in parallel with the output, this diode and the wiring cannot withstand the enormous current supplied by a wrongly connected battery.
- Contact our support for information on which type of circuit breaker to use.

7.6.3 Large Capacitive Load

- With a large capacitive load connected to the output, the CV-control might get unstable. This is particularly the case for units of higher voltages, like 500 V, 1000 V and 1500 V.
- In practice, inverter or converter circuits often have a large input capacitance.
- Reducing the CV-control speed normally stabilizes the control response.

- Use the web interface to adjust the CV-control speed. Go to Configuration -> Regulation -> V_Control, reduce the setting from the default 100 % to a lower value and press the apply settings button, see Figure 7.14.



Figure 7.14: Reducing CV-control speed

- Reduce the setting until a stable response is observed.

7.6.4 Large Inductive Load

- When connecting a very large inductive load to the output, like magnets, the CC-control might cause high overshoots in current and even instability. A special coil with very low series resistance could easily result in a series resonance circuit with the output capacitor of the power supply, this would need extra damping from the power supply CC-control. This is particularly the case for units of higher currents, like the SM70-CP-450 and Master/Slave parallel systems.
- Adjusting the CC-control normally solves the instability problem. The CC-control can be adjusted by tuning the positive current control parameters in I_Control_Pos and/or by tuning the negative current control parameters in I_Control_Neg.
- Use the web interface to adjust the I_Control_Pos and/or I_Control_Neg. Go to Configuration -> Regulation -> I_Control_Pos and/or I_Control_Neg.
- See Figure 7.15 for an illustration of the available settings.

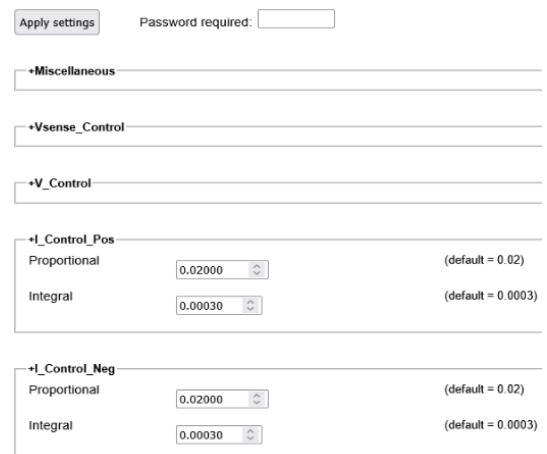


Figure 7.15: CC-control adjusting

- When connecting a very large inductive load, note that adjusting I_Control_Neg is rarely needed, only when you have a voltage source in series with the inductor and the power supply acts like a load.
- To get sufficient damping it is recommended to increase the Proportional value from 0.05 to a large value like 3.5 and maybe decrease the Integral value slightly.
- Adjust the setting of Proportional and Integral until a good result is achieved.

8 Operating the Unit

8.1 Introduction

- This chapter describes how to operate the power supply locally by using the front panel display menu, display buttons and the rotary encoders. It includes basic operation, output settings, limits and protection functions, menu settings, function blocks and firmware updating.

8.2 Basic Operation

8.2.1 First Operation

- Switch the unit ON by rotating the mains switch on the front panel clockwise.
- The first line in the front display indicates the measured values for the DC output voltage and current. See Figure 8.1.

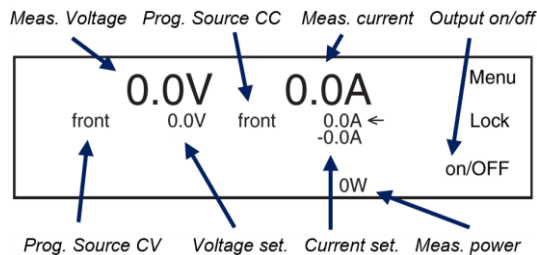


Figure 8.1: The first line in the display shows the actual output value for voltage and current

- The second line shows the settings of the controls for the voltage and current. If the unit is in local operation, the text 'front' is indicated before the voltage and current settings values. If the unit is set to remote programming, for example Ethernet programming, the text 'eth' is indicated instead of 'front'. See Figure 9.1.
- The right side of the display shows the texts 'Menu', 'Lock' and 'on/OFF'. Press the push buttons right from these texts to operate the following item:
 - Menu: This button will enter the main menu of the unit. See Section 8.5 for the different choices and settings.
 - Lock: Pressing this button for about 5 seconds will lock the rotary encoders and/or the display menu. Pressing it again for about 5 seconds, will unlock the encoders and/or the display menu. This function can be useful to protect the output from accidental shutdown.
 - On/Off: This button will switch the power output on or off.
- Check if the unit is in local operation: the text before the set values on the 2nd line must be 'front'. See Figure 8.2.

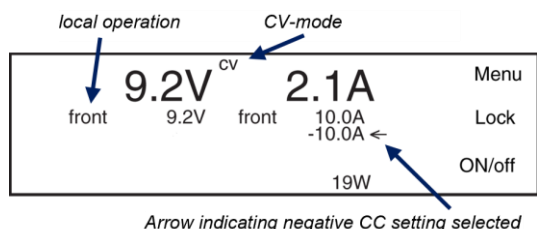


Figure 8.2: The second line shows the set value for voltage and for source current and sink current (with a minus sign).

- Switch on the output by pressing the on/OFF button, it should now change to ON/off.

8.2.2 CV, CC and CP Control

- Turn both the V- and A-knob a few turns clockwise.
- A voltage should now be present on the output.

- Under the values for the actual output voltage and current, the display always shows the settings for the CV-control and for the CC-control. See Figure 8.1.
- Depending on the load and the settings, the unit will be either in CV, CC or in CP mode. See Figure 8.3.

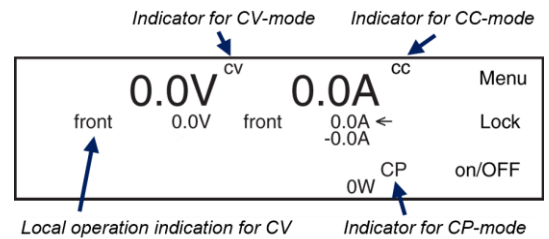


Figure 8.3: A unit is either in CV, CC or CP mode, indicated next to the measured values of respectively the output voltage, output current or the output power.

- Respectively the indication 'CV' will appear on the first line, next to the measured voltage value. The indication 'CC' will appear next to the measured current value or 'CP' will appear next to the measured power value.

8.2.3 Source and Sink Current Settings

- By default, the A-knob at the front can be used to set the positive/source current setting CC+.
- Set the function of the A-knob via Menu -> Front Settings -> Knobs: here select 'Iset-' or 'Iset+'. In the display the arrow behind the value for the current changes position. See Figure 8.4.

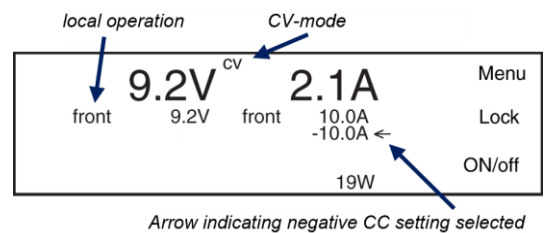


Figure 8.4: When the arrow appears behind the negative current settings, the sink current can be adjusted with the A-knob at the front panel.

- Select the options to enable sinking under special conditions via Menu -> Powersink -> Curr-Permissions.
- Here it can be set to sink under different conditions such as during Remote Shut-Down RSD, Interlock and Output Off.
- By pressing both the button 'Lock' followed by 'Menu' at the same time, the function of the A-knob toggles between sink current setting 'CC-' and source current setting 'CC+'.

8.2.4 Source and Sink Power Settings

- Set the values for maximum sink and source power via Menu -> Configuration -> Prg Setting -> P-Settings and here rotate the V-knob to set the source power, and the A-knob to set the sink power.

8.2.5 Rotary Encoders

- Digital encoders for CV (V-knob) and CC (A-knob) setting have a very long lifetime and enable functions such as keylock and automatic coarse and fine adjustment. The CP setting is changed using these encoders, via the menu.
- The encoders are also used for scrolling through the menu, see Figure 8.5.

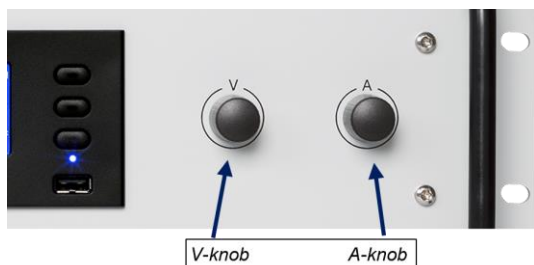


Figure 8.5: Encoders for voltage and current settings

8.2.6 Display Icons

- An overview of all icons that can appear on the display are given in Table 8.1, the location of each icon is shown in Figure 8.6.

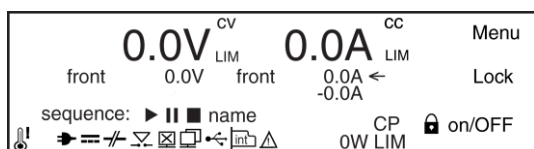


Figure 8.6: Location of icons on the front display.

AC Fail

- This indicator is active if the AC input voltage is too low / too high, or if a phase is missing.

DC Fail

- This indicator is active if the DC power terminals are 5% below or above the set value for the voltage.

Over Voltage

- This indicator is active if the voltage on the DC power terminals is 102.5 % or more than allowed. The output will remain ON.

Self-Protect

- This indicator is active if the voltage on the DC power terminals is 105 % or more. The output will switch to OFF.
- Reset by pressing the output ON/OFF button.

Over Temperature

- Over Temperature This indicator is active if the temperature measured by one of the sensors is higher than 90°C. The output will shut down until the temperature has dropped below 80°C.

Limiter

- This indicator is active if one of the settings for CV, CC or CP is limited.

LAN

- This indicator is active if the unit is connected to a LAN.

Interlock

- This indicator is active if the terminals of the interlock connector have been interrupted.

Communication Watchdog

- This indicator is active if the communication watchdog timer has expired.

Remote Shutdown

- This indicator is active if the DC terminals of the unit are shut down via the ETH connection, or via an optional interface.

USB

- USB functionality is not available.

S_{min} / S_{plus} Break

- This functionality is currently not available.

CV- CC OR CP-Mode

- This indicator will indicate if a unit is operating in CV, CC or CP mode.

Controls Locked

- This indicator is active if the rotary encoders on the front panel are locked.

	AC Fail (ACF)
	DC Fail (DCF)
OL	Over Voltage (OL)
PROT	Self-Protect (PROT)
	Over Temp (OT)
LIM	Limiter (LIM)
	LAN
	Interlock
	Communication Watchdog
	Remote Shutdown (RSD)
	USB
	S _{min} / S _{plus} Break
CV CC CP	CV-, CC- OR CP-Mode
	Controls Locked
	Internal Error
	Interfaces
	Master or Slave
	Sequencer Running/Pause/Stop

Table 8.1: Display icons

Internal Error

- This indicator is active if there is an internal error in the unit, or when an interface is not correctly configured. Verify the "System information" page of the web interface. Or contact support.

Interfaces

- This indicator is active if there is an interface mounted inside one of the slots at the rear side.

Master or Slave

- The standard interface icon is replaced by a Master or a Slave icon if the optional Master Slave interface is configured as a Master or a Slave.

Sequencer Running or Pause or Stop

- These indicators show the status of the Sequencer.
- Note: If both the interlock and watchdog indicator conditions are true, the symbols will be displayed in an alternating way.

8.3 Protection Functions and Limits

8.3.1 Overload Protection

- **Warning!** The output can be damaged by voltage overload.
- The power supply is fully protected against all overload conditions, except connecting a voltage source, exceeding the maximum allowed voltage, to the DC power terminals.
- The display indicates OL in case of a voltage overload of 102.5 % or more.
- The DC power terminals automatically disable at a voltage overload of 105 % or more, the display indicates PROT.

8.3.2 Limit For Voltage, Current and Power

- The Voltage Limit will protect your circuit from unwanted high voltages. A high DC output voltage could be caused by accidental interruption of leads, accidentally turning up the voltage setting, a programming error or a defect in the system.
- The Current+ and Current- Limits protect your circuit from unwanted high DC source and sink currents.
- The Power+ and Power- Limits protect your circuit from unwanted high sink or source power.
- The Limits maintain the output to a safe preset value. They do not trip, so no resetting is needed after a fault.

8.3.3 CV, CC & CP Limit

- In the default configuration, the settings for CV, CC and CP Limit are set to the maximum values.
- Set the limits via Menu -> Protection -> Limits.

8.3.4 Thermal Protection

- A thermal protection circuit shuts down the output in case of insufficient cooling. The display will show a thermometer symbol, and the OT-status will be active. After cooling down, the unit will start working again.

8.4 Front Panel Menu Operation

8.4.1 Accessing the Main Menu

- After switching on the unit, the right side of the display shows the texts 'Menu', 'Lock' and 'on/OFF', see Figure 8.7: At the right side of the display, the 3 main menu items can be chosen. Press the upper push button right from the text 'Menu' to enter the menu of the unit.

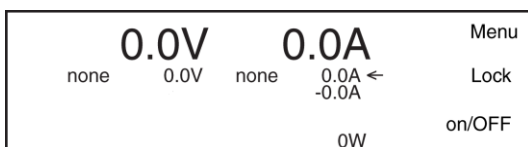


Figure 8.7: At the right side of the display, the 3 main menu items can be chosen.

- Operate the left rotary encoder marked 'V' to choose one of the sub menus.
- To change a final setting, operate the right encoder marked 'A'.
- By using the upper or middle push buttons, one can respectively go back to the previous menu level (Back) or go deeper in the menu (Select).
- In every menu level, it is possible to switch the DC power output on or off, using the lower push button.

8.4.2 Menu Map

- The overview in Figure 8.8 shows the tree structure of the main menu. Not all items are already implemented in the present firmware package. Regularly check the Delta Elektronika website for new releases. The unit can be updated with the latest package via the web interface.

SYSTEM INFO

UNIT

VERSION
SERIALNR
PUD

STATUS

TEMPERATURE
INPUT
SUPERVISOR

CONFIGURATION

FRONT SETTINGS

LCD SETTINGS
INDICATORS
SOUNDS
LANGUAGE
KNOBS

POWER-ON STATE

VOLTAGE
CURRENT+
CURRENT-
POWER+
POWER-
OUTPUT

PRG SOURCE

V-SETTINGS
I-SETTINGS
P-SETTINGS

PRG SETTING

P-SETTINGS

POWER SINK

CURR- PREMISSION

MASTER SLAVE

STATUS
SETTINGS

SETUP

RECALL SETUP
SAVE SETUP

PROTECTION

ACCESS SECURITY

CHANGE KEY
LOCK OPTIONS
UNLOCK OPTIONS

LIMITS

VOLTAGE LIMIT
CURRENT+ LIMIT
CURRENT- LIMIT
POWER+ LIMIT
POWER- LIMIT

INTERFACES

LAN

ADDRESS
SUBNETMASK
GATEWAY
DHCP
IP-VERSION

MAC-ADDRESS

SLOTS

OVERVIEW

Figure 8.8: Menu tree structure.

8.5 Menu Settings

8.5.1 System Info

UNIT

VERSION

- Displays the version of the firmware package.

SERIALNR

- Displays serial number
- PUD**
- Displays 'Protected User Data'

STATUS**TEMPERATURE**

- Displays the highest temperature inside the power supply.

INPUT

- Displays mains Vac and Iac

SUPERVISOR

- In case of an error, more information about the location inside the unit is shown here.
- When there is no error, it shows 'system is okay'.

8.5.2 Configuration**FRONT SETTINGS****LCD SETTINGS****LIGHT ON**

- Select the setting of the display back light level during operation of the rotary encoders or the push buttons.
- A range of 20 - 100% is available.
- The default setting is 50%.

LIGHT DIM

- Select the setting of the normal display back light level.
- A range of 0 - 100% is available.
- The default setting is 20%.

DIM DELAY

- Select the time after which the display switches back from a high-level during encoder or button operation, and the normal back light level.
- A range of 0 - 200 seconds is available (0 = do not dim).
- The default setting is 5 seconds.

CONTRAST

- Select the setting of the display contrast.
- A range of 0 - 100% is available.
- The default setting is 60%.

INDICATORS

- There are 13 different indicators available: OT, ACF, DCF, P-limit, Interlock, RSD, Internal error, LAN, V-limit, I-limit, USB, Sequencer and Interfaces.
- Select the setting for each indicator separately.
- Possible settings are NONE, VISUAL, AUDIO and VISUAL&AUDIO.

SOUNDS

- Select the sound for each indicator separately.
- Possible settings are 1xCHANGE, 3xCHANGE, DOWNWARDS and CONTINUOUS BEEP.

LANGUAGE

- The language available is 'ENGLISH'.

KNOBS

- Select the function of the A-knob at the front panel, to either set the positive or negative current control.
- Possible settings are Iset+ or Iset-.
- Default setting is Iset+.

POWER-ON STATE**VOLTAGE**

- Select CV setting of the unit after mains switch on.
- Possible settings are ZERO, FIXED VALUE and RESTORE VALUE.
- Default setting is ZERO.

CURRENT+

- Select CC+ setting of the unit after mains switch on.
- Possible settings are ZERO, FIXED VALUE and RESTORE VALUE.
- Default setting is ZERO.

CURRENT-

- Select CC- setting of the unit after mains switch on.
- Possible settings are ZERO, FIXED VALUE and RESTORE VALUE.
- Default setting is ZERO.

POWER+

- Select CP+ setting of the unit after mains switch on.
- Possible settings are ZERO, FIXED VALUE and RESTORE VALUE.
- Default setting is ZERO.

POWER-

- Select CP- setting of the unit after mains switch on.
- Possible settings are ZERO, FIXED VALUE and RESTORE VALUE.
- Default setting is ZERO.

OUTPUT

- Select OUTPUT ON / OFF-setting of the unit after mains switch on.
- Possible settings are DISABLED, ENABLED and RESTORE VALUE.
- Default setting is DISABLED.

PRG SOURCE**V-SETTINGS**

- Select programming source for the CV-setting.
- Possible settings are NONE, FRONT, ETH, WEB, SEQ and SLOT1...4.
- Default setting is FRONT.

I-SETTINGS

- Select programming source for the CC-setting.
- Possible settings are NONE, FRONT, ETH, WEB, SEQ and SLOT1...4.
- Default setting is FRONT.

P-SETTINGS

- Select programming source for the CP-setting.
- Possible settings are NONE, FRONT, ETH, WEB, SEQ and SLOT1...4.
- Default setting is FRONT.

PRG SETTING**P-SETTINGS**

- Change the settings for the CP-control.
- Use the V-knob to set the source power and use the A-knob to set the sink power.

POWERSINK**CURR- PERMISSION**

- Select when a negative current (sink current) into the output is permitted.
- This can be set for RSD, INTERLOCK and Output OFF.
- For all options, the default setting is N.

MASTER SLAVE**STATUS**

- Displays id number, configuration status and number of units
- (if device is master).

SETTINGS

- Select and view the setting for the master/slave interface.
- Selection can be done via front, via the web interface or via eth commands.
- Possible settings are master, slave or off.
- Select nr of units in parallel or in series.

SETUP

RECALL SETUP

- Recall an earlier saved setup of the menu settings, voltage and current settings and limits, network settings.
- Choose Setup1, Setup2 or Setup3.

SAVE SETUP

- Save the present settings.

8.5.3 Protection**ACCESS SECURITY****CHANGE KEY**

- Select the 4-digit access key.
- Default setting is '0000'.
- In case of a forgotten access key see troubleshooting (Section 10.12)

LOCK OPTIONS

- Select which functions are blocked with the 'LOCK' function.
- Possible settings are 'Menu' and 'Menu & Controls'.
- Default setting is 'Menu & Controls'.

UNLOCK OPTIONS

- Select how to unlock the unit. To select, first the 4-digit access key must be entered.
- Possible settings are 'With Key' and 'Without Key'.
- Default setting is 'Without Key'.

LIMITS**VOLTAGE LIMIT**

- Select the setting for the Voltage limit.
- Possible settings are 'DISABLED' and 'FIXED VALUE'.
- Default setting is 'DISABLED'.

CURRENT+ LIMIT

- Select the setting for the Current+ limit.
- Possible settings are 'DISABLED' and 'FIXED VALUE'.
- Default setting is 'DISABLED'.

CURRENT- LIMIT

- Select the setting for the Current- limit.
- Possible settings are 'DISABLED' and 'FIXED VALUE'.
- Default setting is 'DISABLED'.

POWER+ LIMIT

- Select the setting for the Power+ limit.
- Possible settings are 'DISABLED' and 'FIXED VALUE'.
- Default setting is 'DISABLED'.

POWER- LIMIT

- Select the setting for the Power- limit.
- Possible settings are 'DISABLED' and 'FIXED VALUE'.
- Default setting is 'DISABLED'.

8.5.4 Interfaces**LAN****ADDRESS**

- Select / View the present IP-address.
- The default setting is 169.254.0.2.

SUBNETMASK

- Select / View the present Subnet-mask.
- The default setting is 255.255.0.0.

GATEWAY

- Select / View the present Gateway-address.
- The default setting is 169.254.0.1.

DHCP

- Select the setting for DHCP.
- Possible settings are 'Enabled' and 'Disabled'.
- The default settings is 'Enabled'.

IP-VERSION

- View the IP-version.
- Currently the version is IPv4.

MAC ADDRESS

- View the unique MAC-address.
- The address is in the range of F4:E1:42:xx:xx:xx.

SLOTS**OVERVIEW**

- Shows the optional installed interfaces in Slot1, 2, 3 and 4.

8.6 Function Blocks

- Integrated Function Blocks are functional integrated software blocks with predefined behavior that can be put in between a program source and the unit's output controllers. See Figure 8.9 for a diagram of the function block structure.
- By using Integrated Function Blocks, the user can manipulate the unit's program sources or set up specific simulations.

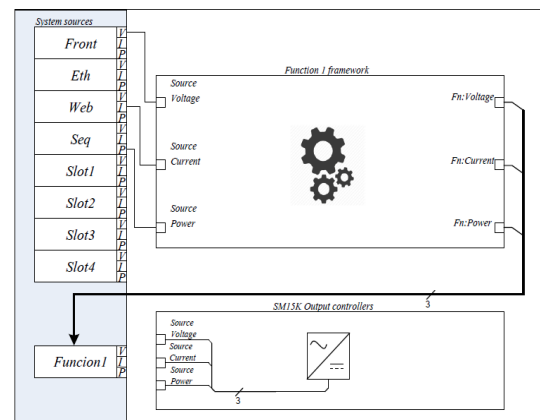


Figure 8.9: Function block diagram

- The program sources for the Function Blocks are freely selectable.
- The output of an active Function Block is made available in its output register.
- The Function Block output register can be selected as a program source for the output control.

8.6.1 Function Block Configuration

- The configuration of a Function Block can be done through the unit's web interface via Configuration -> Functions and through the Ethernet interface using SCPI commands.
- To enable and configure a Function Block:
 - Select a Function type, for example "Internal Resistance".
 - Configure the Function Block parameters and select its program sources for Voltage, Current and Power.
 - Configure the power supply program sources to use the Function Block as program source for its output controllers.

8.6.2 Leadless Sensing

- The Integrated Function Block "Leadless sensing" is a functional integrated software block with predefined behavior that can be put in between a program source and the unit's output controllers.
- By using this Integrated Function Block, the user can compensate for a voltage drop over long or high-resistance load cables.

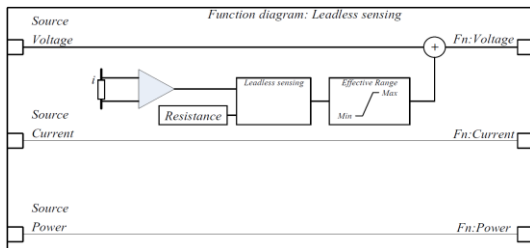


Figure 8.10: Leadless sensing block

- The Voltage program source for this Function Block is freely selectable.
- The Power and Current sources are fixed to "None" (zero).
- The compensated sources of the active Function Block are always written in program source "Function 1", where they are again available as a regular program source.
- To configure Leadless sensing:
 - Select through the web interface via Configuration -> Functions the Function type "Leadless sensing".
 - Apply the Function type.
 - Configure the cable resistance, for example 2 Ω .
 - Configure the compensation limits, for example +100 V and -100 V.
 - Select the required Voltage program source, for example "Front".
 - Select through the web interface via Configuration -> General the Voltage controller source "Function 1".
 - Configure the Power and Current controller sources properly
- The resulting behavior is shown in Figure 8.11.

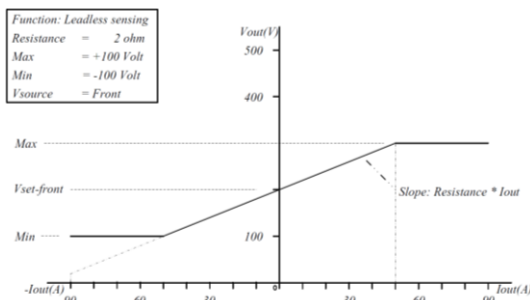


Figure 8.11: Leadless sensing example

8.6.3 Internal Resistance Simulation

- The Integrated Function Block "Internal Resistance" is a functional integrated software block with predefined behavior that can be put in between a program source and the unit's output controllers.
- By using this Integrated Function Block, the user can simulate a voltage drop over a virtual internal resistance.

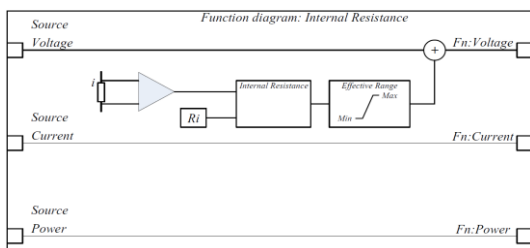


Figure 8.12: Internal resistance block

- The Voltage program source for this Function Block is freely selectable.
- The Power and Current sources are fixed to "None" (zero).

- The compensated sources of the active Function Block are always written in program source "Function 1", where they are again available as a regular program source.
- To configure Internal Resistance:
 - Select through the web interface via Configuration -> Functions the Function type "Internal resistance".
 - Apply the Function type.
 - Configure the virtual resistance, for example 2 Ω .
 - Configure the compensation limits, for example +100 V and -100 V.
 - Select the required Voltage program source, for example "Front".
 - Select through the web interface via Configuration -> General the Voltage controller source "Function 1".
 - Configure the Power and Current controller sources properly.
- The resulting behavior is shown in

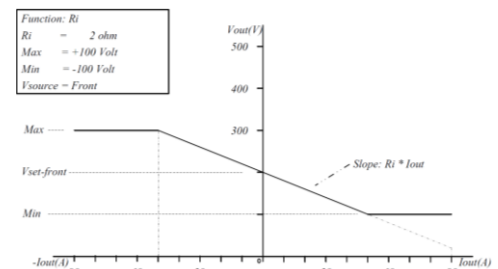


Figure 8.13: Internal resistance example

- Resistance ranges:
 - SM70-CP-450: 0.001 ... 0.33 Ω .
 - SM210-CP-150: 0.001 ... 1.0 Ω .
 - SM500-CP-90: 0.001 ... 10 Ω .
 - SM1500-CP-30: 0.001 ... 10 Ω .
- The smallest step size is 1 m Ω .

8.6.4 Photovoltaic Simulation

- The Integrated Function Block "Photovoltaic" or "PV" is a functional integrated software block that can be configured to program the unit's output controllers.
- By using the "Photovoltaic" Function Block, users can simulate a full-scale solar plant.

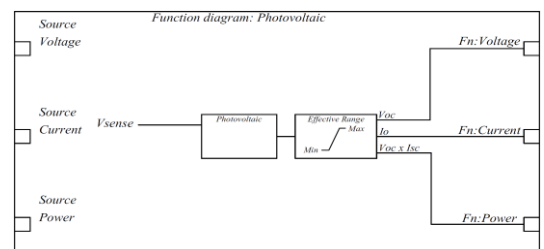


Figure 8.14: PV simulation block

- Panel specifications, temperature and irradiance can be configured statically through the web interface.
- When used in automated processes, these values can be updated dynamically through the SCPI interface.
- There are no programmable sources for this Function Block.
- The outputs of the active Function Block are always written in program source "Function 1", where they are again available as a regular program source.
- To configure Photovoltaic Simulation:
 - Select through the web interface via Configuration -> Functions the Function type "Photovoltaic Simulation".
 - Apply the Function type.
 - Configure the Photovoltaic plant specifications.
 - Select through the web interface via Configuration -> General all controller sources to "Function 1".

- Verify the PV curve through the web interface simulation console via Console -> Simulation.
- Changes through SCPI are directly updated in the simulation console.
- Changes in Photovoltaic configuration force the output to OFF, unless "Direct mode" is enabled.

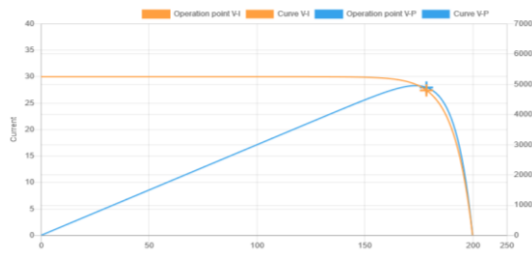


Figure 8.15: PV simulation example

8.7 Firmware Update

- Check the version of the firmware in the unit via Menu -> System Info -> Unit -> Version.
- Go to and check if there is new firmware available via Products -> SM15K -> Downloads.
- Download the new firmware package to the computer.
- Connect the unit to the above computer via LAN and open the SM15K web interface using an internet browser.
- The web interface is found by entering the IP-address of the unit in the address bar of the browser. The IP-address is found via Menu -> Interfaces -> LAN -> Address.
- Note: when DHCP is enabled the IP-address can change, for example after a power cycle. In the web interface, go to Administration -> Firmware.
- Select "Choose File" and browse to the downloaded package, enter password and "Start Update". See Figure 8.16 for a screen shot of the web interface.

Update firmware

Choose File

No file chosen

Firmware:

Maximum filesize: 20MB.

Start update

The unit's output will be switched off during the update process

The update process will be shown in a new window. The unit re

At the end of the update, the browser will show the update resu

Compatible browsers are: Mozilla Firefox, Google Chrome and

Notes:

Please the keep unit powered during the update process.

[\[View last log\]](#)

System information

Unit type

SM500-CP-90

Serial number

000010206017

Manufacturer

Delta Electronics B.V.

Figure 8.16: Via the web interface the downloaded firmware package can be uploaded to the unit

- Do not disconnect the mains supply, network connection or power supply while the firmware update is in progress.
- Keep the unit powered on until the update has completed and the unit has restarted.

9 Remote Programming

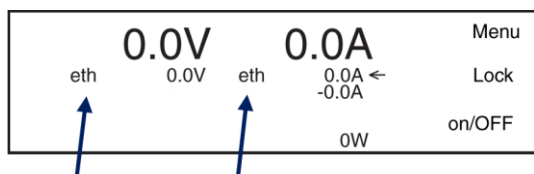
9.1 Introduction

- This chapter describes how to control and configure the power supply from an external system.
- The available programming methods include the web interface, Ethernet, sequencer and optional interface modules.
- Before using remote programming, configure the required programming source for voltage, current and power.

9.2 Program Source Selection

9.2.1 Source Settings

- Via the front menu, the source can be set to the required programming input via: Menu -> Configuration -> Source.
- The possible settings for V-settings, I-settings and P-settings are front encoders, ethernet, web interface, sequencer or an optional interface in rear slot1, 2, 3 or 4.
- It is possible to have different sources for the settings, for example V- and I-settings via 'web' and P-settings via 'front'.
- The programming source selection is shown in the display, Figure 9.1. The programming source names are abbreviated for example as: 'eth', 'web', 'seq', 'slot1' etc. See Section 8.5.2 for more details about the configuration of the programming sources through the menu.



Voltage and current setting set to Ethernet as setting source

Figure 9.1: The programming source indication.

9.3 Web Interface

- It is advised to use the web browsers Mozilla Firefox, Google Chrome or MS Edge.
- The web interface is available 15 seconds after startup of the unit.
- Set the programming source for voltage, current and/or power to 'web' via the front menu.
- The menu items below are available in the web interface:

9.3.1 Console

- The console layout is designed to closely match the appearance of the front panel display for maximum familiarity. It is divided into two sections: the upper section for monitoring unit status and the lower section for programming and controlling the power supply.
- An example of the console layout closely resembling the front panel display is shown in Figure 9.3.

FRONTPANEL

- Possible settings via the console:
 - voltage, current and power
 - output ON/OFF
- Possible monitoring via the console:
 - actual and set values of voltage, current and power
 - output setting (on/off)
 - status icons, for example DC-fail
 - type of unit and serial number
 - on time of the unit
 - system temperature and fan speed
 - input voltage
- See Figure 9.2 for the console layout.



Figure 9.2: Front console for setting of the output and monitoring various parameters.

SEQUENCER

- Possible to select sequences from the unit memory.
- Running, Pausing and Stopping of sequences.
- Trigger sequence
- Running in Single Step mode.
- Monitor sequencer variables and timers via the "advanced" button.
- See Figure 9.3 for the console layout.



Figure 9.3: Sequencer console for selecting and controlling sequences.

MASTER / SLAVE

- Only available on the Master unit.
- Overview of the entire system.
- Shows the most important icons.
- Links to the front panels of Slave units when the Slave(s) are connected to the same LAN. (Click ID#)
- See Figure 9.4 for the console layout.



Figure 9.4: Console for Master / Slave monitoring.

9.3.2 Configuration

GENERAL

FRONTPANEL

- Front user interface language.
- Front unlock key protected (Enabling will lock Front panel).
- Backlight intensity when active.
- Backlight intensity when no user interaction.
- Timeout for backlight dimmer.
- LCD contrast.

DEFAULTS

- Default voltage setting and value after power cycle.
- Default current+ and current- setting after power cycle.
- Default power+ and power- setting after power cycle.
- Default output state after power cycle.

LIMITS

- Switch Voltage Limit ON or OFF and set value.
- Switch Current Limits ON or OFF and set values.
- Switch Power Limits ON or OFF and set values.

SOURCES

- Set the program source for voltage control.
- Set the program source for current control.
- Set the program source for power control.

POWER SINK

- Sink current when Remote Shutdown is activated.
- Sink current when Interlock link is open.
- Sink current when the Output is Off.

NETWORK

- DHCP enabled / disabled.
- IP Version.
- Network IP address.
- Network Subnet mask.
- Network Gateway address.
- Network interface MAC address.

INTERFACES (Slot1, 2, 3 and 4)

ISOLATED ANALOG

- Voltage levels on analog programming and monitoring for output voltage and current.
- Level of Status signals ACF, DCF, LIMIT, RSD, OT, CC.

SERIAL & USB

- Select BUS-type: USB, Differential, RS232.
- Device channel nr.
- Baud rate, Data-bits, Stop-bits, Parity bits.
- Slew rate, Termination, Simplex/Duplex.

DIGITAL I/O

- Level of digital inputs A...H (High / Low).
- Level of digital outputs A...H (High / Low).

ISOLATED CONTACTS

- Status of the relay contact 1...4 (On / Off).
- Level of the Interlock input (High / Low).
- Level of the Enable input (High / Low).

MASTER / SLAVE

- Enable or disable master / slave mode.
- Select Master or Slave.
- Number of units in parallel or series.

SEQUENCES

- Upload sequences into the unit's volatile memory.
- Synchronize memory to copy sequences from the volatile to the non-volatile memory.
- After switching off the unit, the sequences remain on the power supply.
- Monitor and make settings.
- System information
 - Unit.
 - Serial number.
 - Manufacturer.
 - Software version.
 - Internal error.
- Highlight button
 - Display on front will blink for about 2 seconds.
 - Buzzer on front is on for about 2 seconds.

LOGGING

- Ethernet communication
 - Download log file.
 - Log settings displayed.

PASSWORD

- Change the password to block the unit.
- The default password is "depower".
- Passwords are not case sensitive.
- In case of a forgotten password, see Section 10.12.

9.3.3 Documentation

- Unit documentation in PDF-format available:
 - Safety instructions.
 - Unit operation and installation manual.
 - Interfaces operation and installation manual.
 - Ethernet & Sequencer programming manual.

- Please note that documents are updated more frequently than the firmware packages in which they may be included. For the latest version, always download the manuals from our website.

9.4 Ethernet Programming

- The ETH interface is available 15s after the startup of the unit.
- Connect the unit to the network via the LAN-connector at the rear side, see Figure 7.6.
- Download the programming manual for Ethernet & Sequencer from our website.

9.5 Sequencer Programming

- Set the programming source for voltage, current and/or power to 'seq' via the front menu or the web interface.
- Download the programming manual for Ethernet & Sequencer via from our website.
- Create or edit the sequence in a plain-text editor, such as Notepad, and save the file with the .seq extension. An example is shown in Figure 9.5 and Figure 9.6.

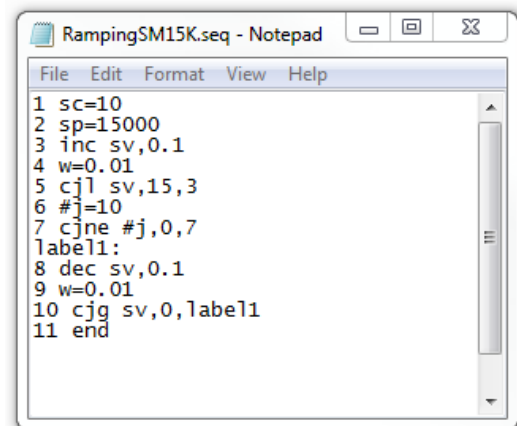


Figure 9.5: Example of a small sequence to ramp up the output to 15 V and then back to 0 V.

- Upload the sequence to the unit via the web interface or Ethernet commands.
- Set the programming source for voltage, current and/or power to 'seq' via the front menu, web interface or Ethernet commands.
- Start or stop the sequence via the web interface, Ethernet commands or a hardware trigger through the Digital I/O interface.
- By default, uploaded sequences are stored in volatile memory and are lost when the unit is switched off. Copy the sequences to non-volatile memory before switching off the unit.

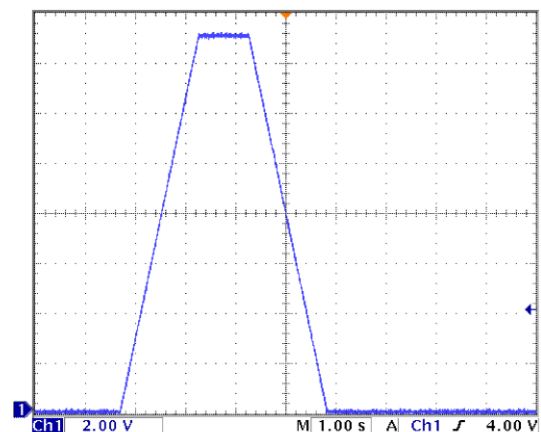


Figure 9.6: Output voltage as result of the above example.

9.6 Optional Interfaces

- Optional interface modules can be installed in the rear slots of the unit to extend the available programming options. Depending on the installed module, the unit can be controlled via serial communication, digital I/O, analog signals, relay contacts or industrial fieldbus protocols.
- The specifications of the available interface modules are described in the Interfaces data sheet. Installation, configuration and operating instructions are described in the Interfaces manual.
- To use the interface modules to program the unit, set the programming source for voltage and/or current to 'slot1...4' via the front menu, the web interface or Ethernet commands.
- The unit contains four interface module slots at the rear panel.
- The following interfaces can be plugged in the slots at the rear panel of the unit, see Figure 9.7 to Figure 9.9.

9.6.1 Serial and USB Programming

- The protocols RS232, RS422, RS485 and USB (Virtual COM) are supported by this interface.
- With this interface it is possible to program the CV- and CC-settings, to read the CV- and CC-monitor values and the internal status signals.
- See datasheet and manual of the INT-MOD-SER for more information.
- Of this type of interface module, a maximum of four interface modules per unit is allowed.



Figure 9.7: Left: Serial programming, Right: Digital I/O

9.6.2 Digital I/O

- This interface provides 8 opto-isolated logic inputs and 8 opto-isolated logic open drain outputs.
- All in- and outputs have a common zero.
- Also see the data sheet and manual of the INT-MOD-DIG.
- Of this type of interface module, a maximum of four interface modules per unit is allowed.

9.6.3 Isolated Contacts

- On this interface, there are 4 floating relay contacts available that can be controlled by Ethernet commands.
- This can be used to trigger an external safety alarm or to interact in automated processes.
- Floating Interlock connector (standard Interlock is at the level of Safety Earth).
- Floating Enable input to switch the output On/Off (24 V_{DC}).
- See the data sheet and manual of the INT-MOD-CON for more information.
- Note: the floating relay contacts cannot be controlled by the sequencer.
- Of this type of interface module, a maximum of four interface modules per unit is allowed.



Figure 9.8: Left: Isolated contacts, Right: Master/Slave

9.6.4 Master / Slave Control

- The resulting combination behaves like one power supply and can be manually controlled or programmed on the master.
- Mixed parallel and series operation is not possible.
- Note that the M/S-2 interface (2nd. generation) is for SM15K-units only, the M/S interface (1st generation) is for SM3300 series units only.
- Also see the data sheet and manual of the INT-MOD-M/S-2.
- Of this type of interface module, a maximum of one interface module per unit is allowed.

9.6.5 Isolated Analog Programming

- With this interface it is possible to program the CV- and CC-settings using a 0 – 5 V or 0 – 10 V voltage source.
- The CV- and CC-monitor signals can be measured with a voltmeter (0 – 5 V or 0 – 10 V). Also available are the 5V logic status signals, Remote Shutdown (RSD = 5V), an auxiliary voltage (+12 V) and a reference of 5.1 V.
- Because the interface is isolated from the power output, earth loops between the programming source and the power supply are prevented.
- The connector of the analog module is pin compatible with the analog programming connector of all Delta Elektronika power supplies.
- Also see the data sheet and manual of the INT-MOD-ANA.
- Of this type of interface module, a maximum of one interface module per unit is allowed.



Figure 9.9: Left: Isolated analog programming, Right: Anybus carrier.

9.6.6 Anybus Carrier

- This interface is a carrier module for Anybus Compactcom 40 modules from HMS Networks AB. A picture of the carrier module with an EtherCAT Anybus module is shown in Figure 9.9.
- Each individual module enables a different communication protocol. A limited set of Compactcom 40 modules is compatible at this moment. These are: CANopen, EtherCAT, EtherNet/IP, Modbus-TCP, PROFIBUS and PROFINET.
- An implementation guide for the anybus carrier interface can be found on our website. The implementation guide lists the available commands.
- Of this type of interface module, a maximum of one interface module per unit is allowed.

9.7 Auto-Synchronization

- During power-up, the power supply will check for interface modules. Once found, the firmware version is checked to verify if it is compatible with the unit. If so, nothing is noticed of this process.
- But if there is a mismatch, the interface module and the unit will not function properly together.
- Therefore, the user is prompted in three different ways: via the front panel, via Ethernet commands and via the web interface.

9.7.1 Via Front Panel

- The front display will show a warning “Interface firmware incompatible with unit. Auto-synchronize?”.
- There are two options: “cancel” and “OK”.
- “Cancel” allows proceeding to the normal operation, but with the possibility that the unit and interface module don’t work properly. The message “Update required” will be shown.
- Selecting “OK” will activate an update mechanism, and the firmware of the interface module is updated to a matching version. No network connection is required, and no update file has to be applied since the power supply itself contains the matching firmware version of each type of interface module.

9.7.2 Via Ethernet Command

- To query the need of auto-synchronization, the “SYSTEM:WARNING?” command can be sent.
- See the manual “Ethernet + Sequencer”.
- Via Ethernet commands there is no possibility to start the auto-synchronization.

9.7.3 Via Web Interface

- Go to “Administration, Info”. A warning is shown in case of a firmware version mismatch.
- The mismatching interface module can be auto synchronized by going to the related slot in “Configuration, Interfaces”. Select “Auto synchronize” and “Apply settings” and the update mechanism will be activated.

9.8 Driver & Example Software

- Driver and example software are available on our website.
- Software: [Products > SM15K > Downloads](#)

10 Troubleshooting

10.1 Introduction

- This chapter helps to identify and resolve common operating faults, warnings and unexpected behavior.
- It includes checks for missing DC output, programming problems, parallel-operation problems, status indicators and forgotten access or network settings.
- If the problem is not described in this chapter, contact Delta Elektronika support. Do not attempt to repair the unit yourself.

10.2 General

- For questions about the unit, please contact our support department via the contact form on our website.
- Support: [Contact & Support > Contact Form](#)
- If the unit is defective, first complete the RMA form on our website before returning the unit. Include a detailed fault description to support fast service. Do not attempt to repair the unit yourself.
- RMA form: [Contact & Support > Repair > RMA form](#)

10.3 No DC Output

- If 'OL' or 'PROT' is displayed, see Section 10.10.
- **Warning!** Risk of damage caused by over voltage.
- Check the output is switched ON: the text 'ON/off' must be visible on the right side of the display.
- If the text is 'on/OFF', press the button next to this text to switch it ON if needed.
- Check the unit is not in LOCK mode: the text 'Lock' must be visible on the right side of the display.
- If the text is 'Unlock', press the button next to this text for a few seconds to unlock the unit, see Figure 10.1.

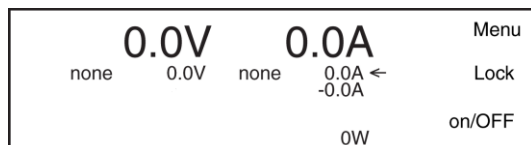


Figure 10.1: At the right side, the texts must be 'Lock' and 'ON/off'.

- First set the unit in local operation (or so-called manual operation): press and hold the ON/off button for 4 seconds.
- On the second line of the display, before both the set values the text 'front' will be seen, now press the button next to the text on/OFF to switch on the output.
- Check connections on the SENSE BLOCK (at rear panel).
- For local sensing, there should be a link between + and S+ and between - and S-, see Figure 10.2.

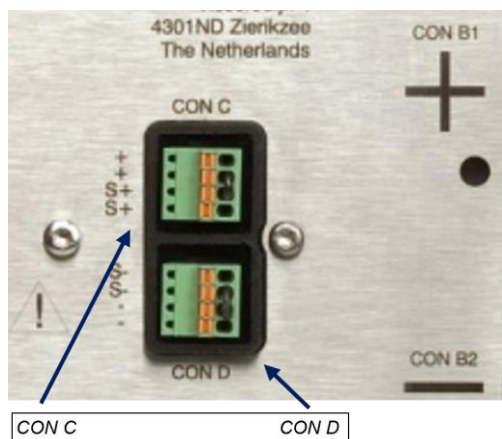
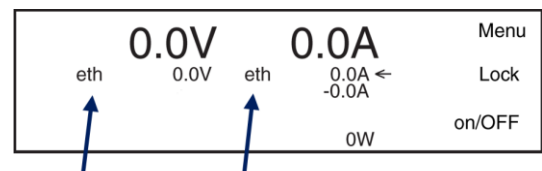


Figure 10.2: For normal operation links should be connected between S+ and +, and between S- and -.

- Note that there is room for two links in each sense block but it is sufficient if one is connected.
- For remote sensing, the wires from S+ and S- should be connected to respectively the + and - terminals on the load.
- Check there is a link between pin 1 and pin 3 of the Interlock connector.
- Check the settings for CV- CC- and CP-limit are set to a value greater than 0.
- Go to Menu -> Protection -> Limits.
- Here set Voltage, Current and Power limits.
- Turn both the CV and CC encoders a few turns clockwise, and via Menu -> Configuration -> Prg Setting -> P-Settings set a value suitable to the required power.
- Now a voltage should be present on the output.

10.4 Remote Programming Problems

- First make sure the unit works in local mode, see Section 10.3.
- If this is okay, check the unit is in Remote mode.
- Go to Menu -> Configuration -> PrgSource.
- Here set the Vsettings, Isettings and Psettings to the required programming source, either 'eth', 'web', 'seq', 'slot1', 'slot2', 'slot3' or 'slot4'.
- For example, when programming via Ethernet, on the second line of the display, before both the set values the text 'eth' must be seen, see Figure 10.3.



Voltage and current setting set to Ethernet as setting source

Figure 10.3: For Ethernet programming, the text 'eth' must be seen before the setting(s) that is/are in 'remote mode'.

- It is also possible to only have one of the settings in remote mode and have the other setting in local mode.
- Enter a command to program the Vsettings, Isettings and Psettings to a value greater than 0.
- Now a voltage should be present on the DC output.
- Note: when changing programming source, the output switches to OFF (to avoid accidental damage to a load).
- If the text is 'on/OFF', press the button next to this text to switch it ON if needed.

10.5 Parallel Operation Problems

- Check the voltage drop of the DC wiring between the master and the slaves is < 10 mV.
- Check the wiring has a low inductance.
- Without an M/S-interface, check that one of the units operates in Bi-Directional mode. And check the CV setting of this unit is always 0.5% higher than on the slaves.
- For all other units check the CC- and POWER- is set to 0.

10.6 DC Output Voltage Higher Than Set Value

- Check connections on SENSE BLOCK (on rear panel), For normal operation there should be a link between + and S+ and between - and S-, see Figure 10.2.
- When remote sensing is used, check the wires of the sensing.
- Check that if the connected load does deliver power back into the unit, the power supply is set in Bi-Directional mode. See also Section 7.5.3.

10.7 OT Indicator Active

- An Over Temperature (OT) warning is active and a protection mechanism is enabled.
- The temperature of one of the internal heat sinks or modules is too high, the output has been shutdown to avoid overheating, see Figure 10.4.



Figure 10.4: If the OT-icon is shown on the display, the unit has run hot and the DC power terminals are shut down.

- Check if the cooling fans are running.
- Check if the air temperature of the air inlets (at the left side) is below 50 °C and the airflow is not obstructed.

10.8 ACF Indicator Active

- An AC-Failure (ACF) warning is active.
- The AC mains voltage is too low or too high or was intermittent because of a bad connection. Disconnect the mains, wait a few minutes and try again, see Figure 10.5.



Figure 10.5: If the ACF-icon is shown on the display, the unit has not enough AC input power and the DC power terminals are shut down.

- There is a phase missing from the mains supply.
- If the AC mains voltage is within the specified range, there must be an internal error. Send the unit for repair, see Section 10.2.

10.9 DCF Indicator Active

- A DC-Failure (DCF) warning is active.
- The DC output voltage is 5 % below or above the set voltage.



Figure 10.6: If the DCF-icon is shown on the display, the voltage at the DC power terminals is 5% below/above the set voltage.

- This automatically happens when the unit is in CC-mode and can happen when the unit is in CP-mode, see Figure 10.6.
- If the DC output voltage is within 5 % of the set value and DCF is still active, there must be an internal error. Send the unit for repair, see Section 10.2.

10.10 OL or PROT Indicator Active

- An Voltage Over-Load (OL) or Self-Protection (PROT) warning is active.
- If the text OL or PROT appears in the display, the output voltage on the DC power terminals is respectively 2.5 % or 5 % above the nominal voltage. E.g. for an SM500-CP-90, the nominal voltage is 500 V.
- The OL-indicator is a warning for voltage Overload.
- The PROT indicator will also switch off the DC output terminals (Self-Protection mode).
- **Warning!** Risk of damage caused by over voltage. First remove the high external voltage from the DC terminals, before resetting the output.
- Reset by pressing the OUTPUT ON/OFF button.

10.11 Internal Error Indicator Active

- This indicator is active if there is an internal error in the unit, or when an interface is not correctly configured. Verify the "System information" page of the web interface or front menu, see Figure 10.7.
- Either the unit or one of the interfaces must be sent for repair.



Figure 10.7: If the Internal Error-icon is shown on the display, the DC-power output of the unit will shut down.

10.12 Forgotten Password, Access Key or Network Settings

- The default password for the web interface is "depower".
- The default security key is "0000".
- To restore the password and network settings, use the Reset button located on the rear panel of the unit (while the unit is powered on), see Figure 10.8. A bent paperclip or similar pointed tool can be used to press the internal micro push button.



Figure 10.8: Location of the reset button.

- When the Reset button is pressed, a light tactile click will be felt, and the Error LED will start blinking to indicate that the button press has been detected. No reset action is performed at this first stage.
- If the button is held for more than 3 seconds, the blinking stops, the password is reset to its default value, and the network configuration toggles between DHCP and Fixed IP modes.
- At this second stage, the Error LED indicates the active network mode:
LED off: DHCP active
LED on: Fixed IP active
The network mode toggles at 3-second intervals while the button remains pressed.

10.13 Restoring the Ethernet Connection

- The Ethernet connection was active but could not be restored after it was interrupted.
- If the Ethernet connection cannot be restored after disconnecting the cable or switching off the network switch, proceed as follows.
 - Close the Ethernet connection in the software.
 - Reconnect the Ethernet cable or switch the network switch on again.
 - Wait up to one minute for the power supply to become available again.
 - If the connection is still not restored, switch the power supply off and on again.

10.14 Other Faults

- If the problem is not listed in the previous sections, please see Section 10.2 on how to contact our support department or send the unit for repair.

11 Maintenance & Calibration

11.1 Introduction

- The SM15K-series power supplies normally do not require maintenance or calibration.
- To maintain reliable operation, keep the cooling air paths unobstructed and take appropriate precautions when the unit is used in an aggressive environment.
- Calibration is normally only required after repair or in other special situations.

11.2 Cooling Fan

- The heatsinks in the power supply are cooled by forced air.
- The airflow direction is from left to right, see Figure 11.1.

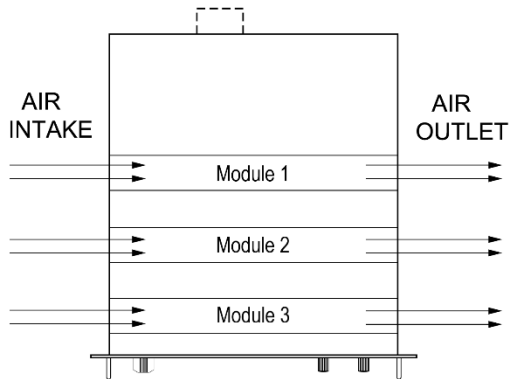


Figure 11.1: The fans are located at the left side and blow through the unit.

- The power supply is designed for pollution degree 2. If the environment is worse, pre-filtering of the cooling air is required.
- Thermal protection shuts down the output in case of overheating to prevent permanent damage.

11.3 Calibration

- The power supplies are factory calibrated and normally need no further calibration.
- After installation of a new or different interface, no calibration is needed.
- Only in special situations, for example after repairing a unit, calibration can be necessary. Do not attempt to repair a unit yourself.
- The SM15K units can only be calibrated by software.
- Inside the unit, there are no positions with calibration components such as trimmers or CR-resistors.
- The software calibration is performed by connecting the unit to a TCP/IP network using the LAN connector at the rear panel.
- Download the programming manual for Ethernet & Sequencer from our website.
- Manual: [Products > SM15K > Downloads](#)



12 EU Declaration of Conformity



We

Delta Elektronika
Visserdijk 4
4301 ND Zierikzee
The Netherlands

Declare under sole responsibility that the following Power Supplies:

SM70-CP-450

SM210-CP-150

SM500-CP-90

SM1000-CP-45

SM1500-CP-30

Meet the intent of Directives:

2014/30/EU Electromagnetic Compatibility (EMC)

2014/35/EU Low Voltage Directive (LVD)

2011/65/EU Reduction of Hazardous Substances (RoHS2)

Compliance was demonstrated to the following specification as listed in the official Journal of the European Union:

EN 61326-1:2013

**EMC requirements for electrical equipment for
measurement, control and laboratory use**

EN 61010-1:2010/A1:2019/AC:2019-04

**Safety requirements for electrical equipment for
measurement, control and laboratory use**

EN IEC 63000:2018

**Assessment of electrical and electronic products with
respect to RoHS**

J. Koopman
Managing director,
Zierikzee, June 2026