



# SM15K - Interfaces

- INT MOD CON
- INT MOD SER
- INT MOD DIG
- INT MOD SIM-2
- INT MOD M/S-2
- INT MOD ANA

## Firmware Update

It is strongly recommended, first to perform a firmware update before further operation.

Download the SM15K Quick Start Manual for instructions.

## PRODUCT MANUAL

### Firmware version P0103

Contents:

- 1 - Datasheet
- 2 - Safety Instructions
- 3 - Isolated Contacts
- 4 - Serial Interface
- 5 - Digital (User) I/O

## 2 SAFETY INSTRUCTIONS - SM15K-series

### 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 Elektronika shall not be liable for user's failure to comply with these requirements.

### 2 Installation Category

The Delta Elektronika power supplies have been evaluated to installation category II (Over voltage category II).

### 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.

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.

### 4 Grounding of DC Power Terminals

If the DC power terminal of a unit is specified to sink or source to a maximum of 60VDC, and either the negative or positive DC power terminal is grounded, the voltage on the DC power terminals and sense connections can be considered safe.

#### Warning:

When the positive DC power terminal can exceed 60VDC in respect to the negative DC power terminal, additional external measures must be taken to ensure safety isolation of the DC power terminals and sense connections.

#### Warning:

When the negative power output of the unit can exceed 60VDC / 42.4Vpk 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 negative DC power terminal of the unit does not exceed 1000VDC / 707Vpk in respect to ground.

**Caution 1:** If a low voltage unit has both DC power terminals floating, or if the DC terminals are in series with an external high AC or DC voltage, the lower 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 60VDC, 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 and schematics regards Grounding and Safety, see the special application note "*Safe operation of a power supply*" on the Delta Elektronika website.

### 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. See next paragraph "Connection to the mains supply".

### 6 Connection to mains supply

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

### 7 Fuses

Fuses must be changed by authorized Delta Elektronika service personnel only, for continued protection against risk of fire.

### 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 Elektronika power supply series are stated in the accompanying datasheet.

### 9 Live Circuits

Operating personnel should not remove the unit covers. No internal adjustment or component replacement is allowed by non Delta Elektronika 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.

### 10 Parts Substitutions & Modifications

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

## 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.
- Disconnect the unit from the mains supply or power outlet.
- Wait for 5 minutes to allow internal capacitors to discharge.
- Unscrew the screws and remove the cover(s).
- Always place the cover(s) back before connecting the unit to the mains supply again.

## 12 Environmental Conditions

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

- Indoor use
- Ambient temperature : -20 to 50 °C
- Maximum relative humidity : 95%, non condensing, up to 40 °C  
: 75%, non condensing, up to 50 °C
- Altitude : up to 2000 m
- Pollution degree : 2



*Caution risk of electrical Shock*



*Instruction manual symbol. The unit will be marked with this symbol when it is necessary for the user to refer to the instruction manual*



*Protective ground conductor terminal*



*Off (supply)*



*On (supply)*

## WEEE (Waste Electrical & Electronic Equipment)

### 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 wastes 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 ISOLATED CONTACTS

**Warning!** carefully read the chapter "Safety Instructions" in this manual before connecting or operating the unit!

#### 1 CONDENSATION

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

#### 2 TEMPERATURE & COOLING

- The storage temperature range is  $-40$  to  $+85$  °C.
- The operating temperature range is  $-20$  to  $+50$  °C. But this temperature range only holds when the air-intake and air-outlet of the power supply 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-outlet entering the air-intake again.
- Please note: a lower temperature extends the lifetime of the interface.

#### 3 FIRMWARE

- Before hardware installation of the interface, check the firmware package is P0103 or higher. In the front menu, go to: SYSTEM INFO -> UNIT-> VERSION.
- If an update is required, refer to the SM15K unit manual how to do this.

#### 4 HARDWARE INSTALLATION

**Warning!** Never make connections to the Power Input, the Power Output or the Sense Connector when the SM15K unit is connected to the mains supply!

Safety covers are used to cover these in- and outputs.

##### INSERT INTERFACE IN THE UNIT

- Switch off the unit.
- Disconnect the unit from the mains supply.
- Wait for 5 minutes to allow internal capacitors to discharge.
- Select a none used slot at the rear side.  
The Interface can be inserted in any free slot 1...4.  
See figure 3 - 1.
- Unscrew the 2 torx T10 screws and remove the slot cover.
- Insert the interface and place the 2 screws back to secure the interface.

##### CONNECT INTERFACE

- The available connectors on this interface are push wire or so-called push in connectors.  
Relay 1 & 2 and relay 3 & 4 via a 6 pole connector.  
Interlock & Enable via a 3 pole connector, see fig. 3 -2.
- Use cables wjth an internal wiring with a diameter of  $0.3 \dots 0.5\text{mm}^2$  and with a sufficient voltage rating for the voltage of the circuit.
- With regards to safety, the connectors are at the level of Protective Earth.
- Connect the mains supply again and check all the safety covers are installed.
- Switch on the unit.  
The LED indicated in fig. 3-2 will light up.

#### 5 UNIT CONFIGURATION

- The unit will automatically detect the new inserted interface.
- The interface icon will be shown in the display, see fig 3 - 3.



fig. 3 - 1

All positions are valid for the INT MOD CON.

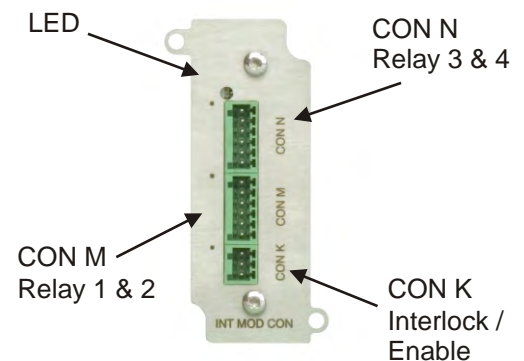


fig. 3 - 2

All four Relay and Interlock/Enable connections are made via push wire or so-called push in connectors.

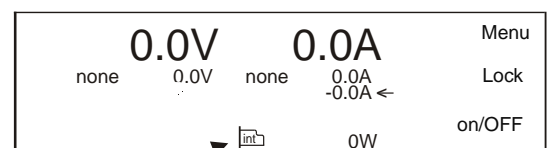


fig 3 - 3

Position of the interface icon in the unit display.

## 6 RELAY CONTACTS & INTERLOCK

- This interface provides 4 changeover relay contacts, an Interlock (additional to the standard SM15K Interlock) and an Enable input. The Relay contacts can be controlled / monitored by Ethernet commands. The Interlock and Enable input can be monitored by Ethernet commands. Refer to section 5.6 for the commands.
- Refer to the Delta Elektronika programming manual for Ethernet (section 5.6) for commands. The manual is stored inside every SM15K unit and can be downloaded via the web interface. It can also be downloaded from [www.DeltaPowerSupplies.com](http://www.DeltaPowerSupplies.com).

### RELAY CONTACTS (CON M & CON N)

- Relay contacts (see fig. 3 -4 & fig. 3 - 6) are as described below, during power off and when not set. The relay contacts can handle a maximum contact voltage of 60VDC. The maximum continuous current is 2A.

#### Pinning CON M :

- 6 = Relay 1 NC
- 5 = Relay 1 NO
- 4 = Relay 1 Common
- 3 = Relay 2 NC
- 2 = Relay 2 NO
- 1 = Relay 2 Common

#### Pinning CON N :

- 6 = Relay 3 NC
- 5 = Relay 3 NO
- 4 = Relay 3 Common
- 3 = Relay 4 NC
- 2 = Relay 4 NO
- 1 = Relay 4 Common

### INTERLOCK & ENABLE (CON K)

- The Interlock input (pin 1) is initially connected to pin 3 (common) (see fig. 3 - 5). Replace the link by two wires and a switch (for example a cabinet door switch) when its function is required.
- The Enable input (24V, pin 2) impedance is approximately 12kOhm and has a working range of 15V - 30V (see fig. 3 -7). Connect the common of the external voltage to pin 3.
- The Interlock and the Enable can not be used simultaneously (see fig. 3 - 8).
- All interlocks should be valid.

#### Pinning CON K:

- 3 = Common
- 2 = Enable
- 1 = Interlock

## 7 TROUBLE SHOOTING

### INTERLOCK SYMBOL DISPLAYED

- Check the unit's standard interlock connection
- Check Interlock / enable connection on CON K.

## 8 CALIBRATION

- Calibration of the interface is not applicable.

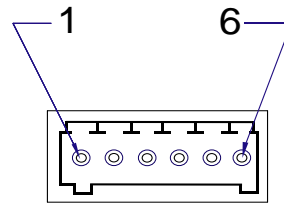


fig. 3 - 4  
Pinning of CON M and N.

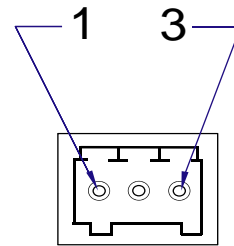


fig. 3 - 5  
Pinning of CON K.

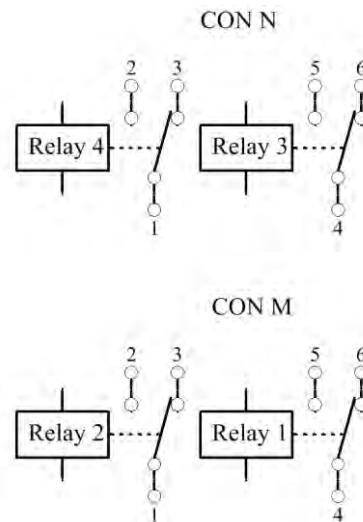


fig. 3 - 6  
Pinning of CON M and N.

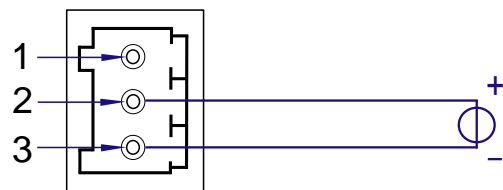


fig. 3 - 7  
15 - 30 V Enable

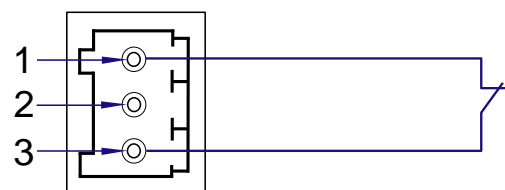


fig. 3 - 8  
Interlock contact (door switch)

## 4 SERIAL INTERFACE

**Warning!** carefully read the chapter "Safety Instructions" in this manual before connecting or operating the unit!

### 1 CONDENSATION

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

### 2 TEMPERATURE & COOLING

- The storage temperature range is  $-40$  to  $+85$  °C.
- The operating temperature range is  $-20$  to  $+50$  °C. But this temperature range only holds when the air-intake and air-outlet of the power supply 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-outlet entering the air-intake again.
- Please note: a lower temperature extends the lifetime of the interface.

### 3 FIRMWARE

- Before hardware installation of the interface, check the firmware package is P0103 or higher. In the front menu, go to: SYSTEM INFO -> UNIT-> VERSION.
- If an update is required, refer to the SM15K unit manual how to do this.

### 4 HARDWARE INSTALLATION

**Warning!** Never make connections to the Power Input, the Power Output or the Sense Connector when the SM15K unit is connected to the mains supply!

Safety covers are used to cover these in- and outputs.

#### INSERT INTERFACE IN THE UNIT

- Switch off the unit.
- Disconnect the unit from the mains supply.
- Wait for 5 minutes to allow internal capacitors to discharge.
- Select a none used slot at the rear side.  
The Interface can be inserted in any free slot 1...4.  
See figure 4 - 1.
- Unscrew the 2 torx T10 screws and remove the slot cover.
- Insert the interface and place the 2 screws back to secure the interface.

#### CONNECT INTERFACE

- The available connectors on the serial interface are (see fig. 4 - 2 & fig. 4 - 3):
  - female 9 pole D-connector for RS232n ( For connection with a PC use a 1:1 cable ( supplied with interface )
  - B-type socket for USB ( cable for connection with PC supplied with interface )
  - push wire or so-called push in connector for RS485 or RS422
- Use cables with an internal wiring with a diameter of  $0.3 \dots 0.5 \text{mm}^2$  and with a sufficient voltage rating for the voltage of the circuit.
- With regards to safety, the serial programming connectors are at the level of Protective Earth.
- Connect the cable to the programming source.
- Connect the mains supply again and check all the safety covers are installed.
- Switch on the unit.
- The LED should light up.



fig. 4 - 1

All positions are valid for the INT MOD SER.

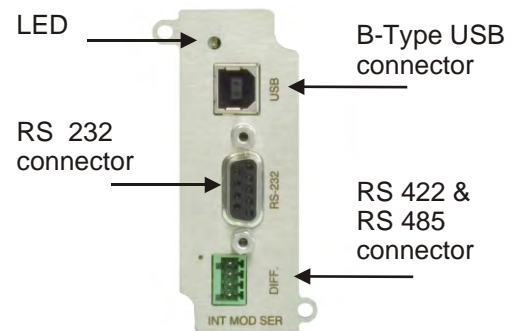
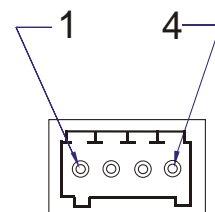


fig. 4 - 2

The available connectors on the INT MOD SER.



1 = Ground  
2 = Positive  
3 = Negative  
4 = x

fig. 4 - 3

Pin connections of the RS422 / RS485 connector.

### 5 UNIT CONFIGURATION

- The unit will automatically detect the new inserted interface.
- The interface icon will be shown in the display, see fig 4 - 4.
- For programming the voltage, current and/or power via the interface, set the correct source for CV, CC and CP respectively, see below example:

For example the interface is mounted in slot2.  
 To program the CV-settings via this interface, via the front menu go to CONFIGURATION -> PRG SOURCE -> Vsettings and set it to Slot2.

To program the CC-settings via this interface, go to CONFIGURATION -> PRG SOURCE -> Isettings and also set it to Slot2.

To program the CP-settings via this interface, go to CONFIGURATION -> PRG SOURCE -> Psettings and also set it to Slot2.

Instead of doing this via the Front Menu, the source can also be set via the web interface or via Ethernet commands if the unit is connected to the network via LAN.

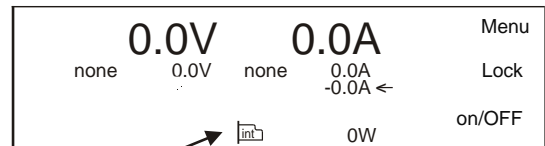


fig 4 -4  
 Position of the interface icon in the unit display.

### 6 SERIAL PROGRAMMING

- The unit can be programmed by using the serial programming commands. See table 4.1 for an overview of the available commands.
- To start, first the command "CH n" must be executed to activate the interface by setting its channel number (address). The variable n is a number between 1...32. For example "CH 1".
- The command "CH?" queries the channel of the active serial interface.
- For more details about the commands in table 4.1, refer to chapter 5 of the programming manual for Ethernet & Sequencer. The manual is stored inside every SM15K unit and can be downloaded via the web interface. It can also be downloaded from www.DeltaPowerSupplies.com.

### 7 PROGRAMMING SPEED

- Programming from a low to a high output voltage is nearly load independent.
- With optional high speed programming, the rise and fall time is 5 to 25 times faster. Note that with this option, the output ripple is higher.

### 8 MONITORING VIA SERIAL INTERFACE

- Via the programming command "MEASURE:" the voltage, current or power can be monitored. See the manual 'Ethernet & Sequencer Programming SM15K' for details.

### 9 TROUBLE SHOOTING

- Check the programming source is set to the correct slot.
- Check the output is switched ON, the Interlock is connected and Remote ShutDown is low.
- The first programming command must be "CH n" otherwise the interface will not be activated.
- Check that the communication is working; "\*"IDN?" must return a value. Ensure to end the query with the termination character LF. (LF = 0x0Ah in ASCII)
- Note: the serial interface uses the '.' (dot) as the decimal symbol and not the ',' (comma). Check if your program is using the settings in Microsoft Windows® regional settings.
- Either change your program to specifically use the '.' or else change the decimal symbol to '.' in your regional settings (from the control panel).
- Check that the power supply's output is not limited. Consult the SM15K manual about adjusting the limit settings.
- Check that ALL values for CV, CC and CP are not zero. For example it is not possible to program a voltage when the current and power control is set to zero.

CH
CH?
*CLS
*IDN?
*RST
*SAV
CALI:VOLT:MEAS:OFFSET
CALI:VOLT:MEAS:OFFSET?
CALI:VOLT:MEAS:GAIN
CALI:VOLT:MEAS:GAIN?
CALI:CURR:MEAS:OFFSET
CALI:CURR:MEAS:OFFSET?
CALI:CURR:MEAS:GAIN
CALI:CURR:MEAS:GAIN?
MEASURE:VOLTAGE?
MEASURE:CURRENT?
MEASURE:POWER?
OUTPUT?
OUTPUT
SOURCE:VOLTAGE
SOURCE:VOLTAGE?
SOURCE:VOLTAGE:MAX?
SOURCE:CURRENT
SOURCE:CURRENT?
SOURCE:CURRENT:MAX?
SOURCE:CURRENT:NEGATIVE
SOURCE:CURRENT:NEGATIVE?
SOURCE:CURRENT:NEGATIVE:MAX?
SOURCE:POWER
SOURCE:POWER?
SOURCE:POWER:MAX?
SOURCE:POWER:NEGATIVE
SOURCE:POWER:NEGATIVE?
SOURCE:POWER:NEGATIVE:MAX?
SYSTEM:ERROR?
SYSTEM:FRONTPANEL:STATUS
SYSTEM:FRONTPANEL:STATUS?
SYSTEM:FRONTPANEL:CONTROL
SYSTEM:FRONTPANEL:CONTROL?
SYSTEM:PASSWORD:STATUS?
SYSTEM:REMOTE:CV:STATUS
SYSTEM:REMOTE:CV:STATUS?
SYSTEM:REMOTE:CC:STATUS
SYSTEM:REMOTE:CC:STATUS?
SYSTEM:REMOTE:CP:STATUS
SYSTEM:REMOTE:CP:STATUS?
SYSTEM:RSD
SYSTEM:RSD:STATUS?
SYSTEM:PASSWORD
STATUS:REGISTER:A?
STATUS:REGISTER:B?

\* =Clear Error Queue

Table 4.1  
 Available serial programming commands

- Check that the power supply is in the required mode (CV or CC or CP). When programming a voltage, the unit must be in CV-mode, when programming a current, the unit must be in CC-mode and when programming a power, the unit must be in CP-mode.

## 10 CALIBRATION

- Calibration of the interface is not applicable.

## 11 Settings

- **Settings via the web page.**

Bustype : USBcom  
Device channel nr : ch 1  
Baudrate : bps 9600  
Data bits : 8  
Stop bits : 1  
Flowcontrol: None  
Parity bits : None  
Slestrate : Disabled  
Termination : Disabled  
Differential communication : Half-duplex

- **Port settings on the PC.**

Baudrate : bps 9600  
Data bits : 8  
Parity bits : None  
Stop bits : 1  
Flow control : None



## 5 DIGITAL (USER) I/O

**Warning!** carefully read the chapter "Safety Instructions" in this manual before connecting or operating the unit!

### 1 CONDENSATION

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

### 2 TEMPERATURE & COOLING

- The storage temperature range is -40 to +85 °C.
- The operating temperature range is -20 to +50 °C. But this temperature range only holds when the air-intake and air-outlet of the power supply 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-outlet entering the air-intake again.
- Please note: a lower temperature extends the lifetime of the interface.

### 3 FIRMWARE

- Before hardware installation of the interface, check the firmware package is P0103 or higher. In the front menu, go to: SYSTEM INFO -> UNIT-> VERSION.
- If an update is required, refer to the SM15K unit manual how to do this.

### 4 HARDWARE INSTALLATION

**Warning!** Never make connections to the Power Input, the Power Output or the Sense Connector when the SM15K unit is connected to the mains supply!  
Safety covers are used to cover these in- and outputs.

#### INSERT INTERFACE IN THE UNIT

- Switch off the unit.
- Disconnect the unit from the mains supply.
- Wait for 5 minutes to allow internal capacitors to discharge.
- Select a none used slot at the rear side.  
The Interface can be inserted in any free slot 1...4.  
See figure 5-1.
- Unscrew the 2 torx T10 screws and remove the slot cover.
- Insert the interface and place the 2 screws back to secure the interface.

#### CONNECT INTERFACE

- The available connectors on the digital user I/O interface are high density 15pole D-connectors, female, see fig. 5-2.
- Use cables with an internal wiring with a diameter of 0.3 ... 0.5mm<sup>2</sup> and with a sufficient voltage rating for the voltage of the circuit.
- With regards to safety, the user I/O connectors are at the level of Protective Earth.
- Connect the cable to the programming source.
- Connect the mains supply again and check all the safety covers are installed.
- Switch on the unit.
- The LED indicated in fig. 5-2 will light up.

### 5 UNIT CONFIGURATION

- The unit will automatically detect the new inserted interface.
- The interface icon will be shown in the display, see fig 5-3.

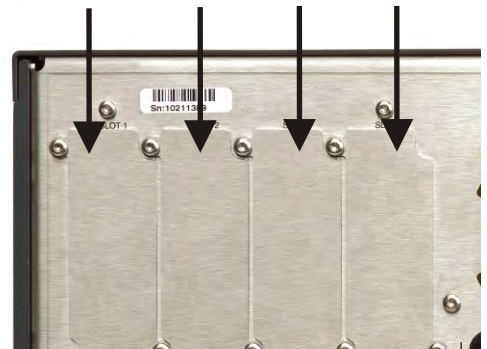


fig. 5 - 1

All positions are valid for the INT MOD DIG.

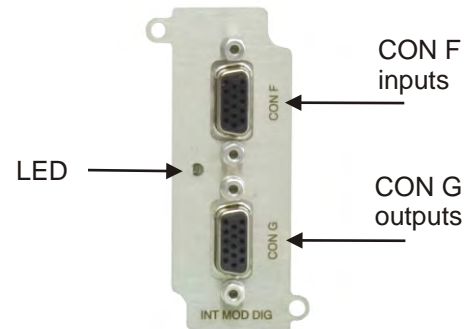


fig. 5 - 2

User Outputs via a 15 pole D-connector .  
User Inputs via 15 pole D-connector .  
Both connectors are High Density female.

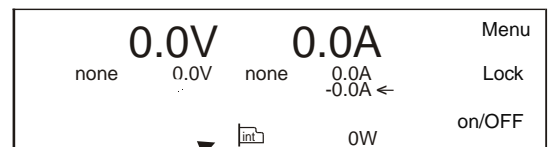


fig 5 - 3

Position of the interface icon in the unit display.

## 6 INPUTS AND OUTPUTS

- This interface provides 8 user inputs and 8 user outputs. These can be controlled / monitored by Ethernet commands or can be used to interact with the Sequencer to make the power supply act like a Power PLC.
- Refer to the Delta Elektronika programming manual for Ethernet (section 5.5) & Sequencer (section 6) for commands. The manual is stored inside every SM15K unit and can be downloaded via the web interface. It can also be downloaded from [www.DeltaPowerSupplies.com](http://www.DeltaPowerSupplies.com).

### USER INPUTS (CONNECTOR CON F):

- Unconnected inputs are LOW. To make an input HIGH, apply the +5V of pin 9 or pin 14. Also an external voltage can be used to control the inputs. Make sure the common of the external source is connected to pin 10 or pin 15. The user inputs have a working range of 2V - 30V, use a common zero and have an impedance of approximately 22kOhms. The maximum load of the +5V is 100mA.
- See figure 5-4 and table 5-1 for the pinning of CON F.

### USER OUTPUTS (CONNECTOR CON G):

- The 8 user outputs are Open Drain with common zero. When an output is TRUE, it is pulled down to 0V. Otherwise the output is open. The output impedance is 7 Ohm, maximum rating is 30V / 200mA.
- See figure 5-4 and table 5-2 for the pinning of CON G.

## 7 CALIBRATION

- Calibration of the interface is not applicable.

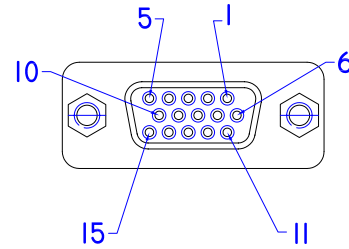


fig. 5 - 4

Pinning of connector CON F and G

- |    |                |
|----|----------------|
| 1  | = user input A |
| 2  | = user input B |
| 3  | = user input C |
| 4  | = user input D |
| 5  | = user input E |
| 6  | = user input F |
| 7  | = user input G |
| 8  | = user input H |
| 9  | = +5V          |
| 10 | = 0V           |
| 11 | = n.c.         |
| 12 | = n.c.         |
| 13 | = n.c.         |
| 14 | = +5V          |
| 15 | = 0V           |

table 5 - 1

Pinning of connector CON F.

- |    |                 |
|----|-----------------|
| 1  | = user output A |
| 2  | = user output B |
| 3  | = user output C |
| 4  | = user output D |
| 5  | = user output E |
| 6  | = user output F |
| 7  | = user output G |
| 8  | = user output H |
| 9  | = +5V           |
| 10 | = 0V            |
| 11 | = n.c.          |
| 12 | = n.c.          |
| 13 | = n.c.          |
| 14 | = +5V           |
| 15 | = 0V            |

table 5 - 2

Pinning of connector CON G.