user manual
Last changed on: 19.01.2018

SHR series

Switchable high end high precision AC/DC desktop HV supply

- 2 / 4 channel, 2 kV / 6kV versions
- electronically switchable polarity
- versatile 6kV-channel with switchable HV-generation modes: up to 6kV/2mA, 4kV/3mA or 2kV/4mA
- high precision / ultra low ripple and noise
- Ethernet / USB interfaces, integrated iCS2 on ARM Linux server hardware
- 4.3" TFT capacitive touch display
- comprehensive features including logging, diagrammatic display and script control

- preliminary -

Document history

Version	Date	Major changes
1.0	19.01.2018	Initial version

Disclaimer / Copyright

The information in this manual is subject to change without notice. We take no responsibility for any mistake in the document. We reserve the right to make changes in the product design without reservation and without notification to the users. We decline all responsibility for damages and injuries caused by an improper use of the device.

Important security information

It is strongly recommended to read the operator´s manual before operation. To avoid injury of users it is not allowed to open the unit. There are no parts which can be maintained by users inside of the unit. Opening the unit will void the warranty.

We decline all responsibility for damages and injuries caused by an improper use of the module. It is strongly recommended to read the operators manual before operation.

WARNING!
 WARNING! The non-observance of the advices marked as “Warning!” could lead to possible injury or death.

ATTENTION!
 ATTENTION! Advices marked as “Attention!” describe actions to avoid possible damages to property.

INFORMATION
 INFORMATION Advices marked as “Information” give important information.

Safety notes

CAUTION!

CAUTION

To avoid injury of users it is not allowed to open the unit. Before any operations on the HV output or the application, the unit has to be switched off and discharge of residual voltage has to be finished. Depending on application residiual voltages can be present for long time periods. These residiual voltages can lead to severe injuries.

Table of Contents

1 General description

WARNING!

WARNING!

The devices induce output voltages and currents which conformable to **EN61010-1** are not dangerous to life. But it is possible that they effect health damages to sensitive persons.

The iseg SHR modules are standalone High Precision HV laboratory SMU – Source Measuring Unit – equipped with the finest iseg HV generation technology and iCS control system.

The SHR provides up to 4 channels, each with an independent voltage and current control and electronically reversible polarity. The 6kV channel provides a maximum versatility: with three electronically switchable HV-output modes it can supply 4mA up to voltages of 2kV, 3mA up to 4kV and 2mA up to 6kV. Alternatively the SHR can be equipped with cost efficient 2kV/6mA channels.

A high quality 4.3" TFT display shows detailed information and can be controlled by capacitive touch. All comprehensive features like logging, graphical display and customer specific plugins are also available by the precise jog-wheel and buttons.

2 Technical Data

SPECIFICATIONS	SHR Standard	SHR High Precision
Polarity	Electronically switchable	
Ripple and noise (f > 10 Hz)	< 10 mV_{p-p}	< 2-3 mV_{p-p}
Ripple and noise (f > 1 kHz)	< 3 mV_{p-p}	< 2 mV_{p-p}
Ripple and noise (10 Hz – 0.1Hz)		< 5-10 mV_{p-p}
Stability [ΔVout / ΔVin]	$2 \cdot 10^{-4} \cdot V_{mode}$	$1 \cdot 10^{-4} \cdot V_{mode}$
Stability - [ΔVout / ΔRload]	$2 \cdot 10^{-4} \cdot V_{mode}$	$1 \cdot 10^{-4} \cdot V_{mode}$
Temperature coefficient	50 ppm/K	30 ppm/K | 10 ppm/K (option TC)
Resolution voltage setting	$2 \cdot 10^{-6} \cdot V_{nom}$	
Resolution current setting	$2 \cdot 10^{-6} \cdot I_{nom}$	
Resolution voltage measurement	$2 \cdot 10^{-6} \cdot V_{nom}$	$1 \cdot 10^{-6} \cdot V_{nom}$
Resolution current measurement - full range	$2 \cdot 10^{-6} \cdot I_{nom}$	$1 \cdot 10^{-6} \cdot I_{nom}$
Resolution current measurement - 2nd range	n/a	50 pA [I_{out} < 20 µA]
Accuracy voltage measurement	± (0.01 % • V_{out} +0.02 % • V_{nom})	± (0.01 % • V_{out} +0.01 % • V_{nom})
Accuracy current measurement - full range	± (0.01 % • I_{out} +0.02 % • I_{nom})	± (0.01 % • I_{out} +0.01 % • I_{nom})
Accuracy current measurement - 2nd range	n/a	± (0.01 % • I_{out} + 4 nA)
Measurement accuracy - The measurement accuracy is guaranteed in the range 1% • V_{mode} < V_{out} < V_{mode} and for 1 year		
Sample rates (SPS)	5, 10, 25, 50, 60, 100, 500	
Digital filter averages	1, 16, 64, 256, 512, 1024	
Hardware limits	Potentiometer per module [V_{max} / I_{max}]; relative to V_{nom} / I_{nom}	
Voltage ramp	$1*10^{-6}$ • V_{mode}/s up to 0.2 • V_{mode} / s	

Rated AC mains input	100 – 240 VAC / 1-0.5 A max / 50-60 Hz
Fuse	T 1.6A L 250V / microfuse 5mm x 20mm, 250V / 1.6AT
AC power connector	socket according IEC 60320 C13 (125V/10A or 250V/16A)
HV connector	SHV
Safety Loop connector	Lemo 2pole: FFA.0S.302.CLAC
Safety Loop socket	Lemo 2pole: ERA.0S.302.CLL
Interfaces	Ethernet, USB(A) 2.0 (Host: Wifi, Logging, Webcam), USB(B) (remote control)
Protection	INHIBIT, Safety loop, short circuit, overload, hardware V/I limits
Case	desktop case
Dimensions (L/W/H)	331/257/103 mm
Operating temperature	0 – 40 °C
Storage temperature	-20 - 60 °C
Further environmental conditions	equipment is for use in closed environment only, relative humidity 20% to 90% (no condensation), maximum Pollution degree level 2

Table 1: Technical data: Specifications

CONFIGURATIONS SHR									
Type	**Ch**	**Precision**	**V_{nom}**	**I_{nom}**	**Ripple (mV_{p-p})** >1kHz | 10Hz-1kHz		**HV output mode (V_{mode} / I_{mode})**	**Item Code**	**Options**
SHR 20 20	2	Standard	2000 V	6 mA	3	10	2 kV / 6 mA	SR020020r605	VCT,IHB,IHD
SHR 20 60	2	Standard	6000 V	4 mA	3	10	6 kV / 2mA 4kV / 3mA 2kV / 4mA	SR020060r405	VCT,IHB,IHD
SHR 40 20	4	Standard	2000 V	6 mA	3	10	2 kV / 6 mA	SR040020r605	VCT,IHB,IHD
SHR 40 60	4	Standard	6000 V	4 mA	3	10	6 kV / 2mA 4kV / 3mA 2kV / 4mA	SR040060r405	VCT,IHB,IHD
SHR 22 20	2	High	2000 V	6 mA	2	2	2 kV / 6 mA	SR022020r605	VCT,IHB,IHD,TC,L
SHR 22 60	2	High	6000 V	4 mA	2	3	6 kV / 2mA 4kV / 3mA 2kV / 4mA	SR022060r405	VCT,IHB,IHD,TC,L
SHR 42 20	4	High	2000 V	6 mA	2	2	2 kV / 6 mA	SR042020r605	VCT,IHB,IHD,TC,L
SHR 42 60	4	High	6000 V	4 mA	2	3	6 kV / 2mA 4kV / 3mA 2kV / 4mA	SR042060r405	VCT,IHB,IHD,TC,L

Table 2: Technical data: Configurations

OPTIONS / ORDER INFO	**INFO**	**EXAMPLE**	**ITEM CODE HEX CODE**
SINGLE CHANNEL INHIBIT – BNC connectors	**IHB**	SHR 4260 **IHB**	**400**
DETECTOR INHIBIT (ORTEC/CANBERRA)	**IHD**	SHR 4260 **IHD**	**800**
VOLTAGE CORRECTION by TEMPERATURE	**VCT**	SHR 4260 **VCT**	**008**
LOWER TEMPERATURE COEFFICIENT	**TC**	SHR 4260 **T10**	**004**
LOWER OUTPUT CURRENT	**L** (I_{nom} = 100 µA)	SHR 4260 **L**	**-**

Table 3: Technical data: Options and order information

3 Handling

- to be continued -

CAUTION!
 CAUTION! The device is not designed to operate as a current sink. Never apply external voltages of opposite polarity to the selected one or with values greater than the maximum value of the selected output mode. This can damage the module.

4 Options

4.1 VCT – voltage correction by temperature

This option allows a temperature dependent correction of the output voltage. The temperatures are measured with a distinct sensor for each channel. The temperature sensors are connected via BNC connectors on the backplane of the module. An user-adjustable VCT-coefficient allows to specify a linear relationship between the measured temperature and the output voltage. As an option one sensor per module can be orded.

4.1.1 Technical data

Sensor type	EPCOS B57867S0502F140
Temperature range	-40 ... 80°C
Accuracy of temperature measurement	±0.5 K (0 ... 60°C)
Resolution of temperature measurement	1 mK (0 ... 60°C)
Temperature update rate	15 updates/min

Table 5: Technical data VCT sensor

4.1.2 Operation

The connector of the temperature sensor must be plugged in the slot of the corresponding channel on the VCT-connector at the rear panel of the HV-module.

A programmable VCT-coefficient for each channel defines the rate and the direction of the voltage correction. The temperatures, measured at the sensors can be read out from the module.

At the time a HV-channel is switched on or the output voltage is set by the user, the module registers the temperature of the corresponding sensor and the set voltage as reference values.

If the temperature at the sensor changes, the output voltage is automatically adjusted according to the formula:

$$V = V_{ref} + a*(T-T_{ref}) \qquad \textbf{(a...VCT-coefficient)}$$

Example: A channel is set to 60V. At the time it is switched on a temperature of 25°C is measured. The VCT-coefficient is set to +1V/K. If the temperature now increases to 26°C the output voltage will increase to 61V. (For channels with a negative output voltage the voltage changes from –60V to –61V).

A VCT-coefficient of -1V/K would decrease the voltage to 59V.

Notes:

- During operation the values for V_{set} are adjusted. If a channel is switched off the adjusted set value will be kept, not the original value set by the user.
- If the VCT-coefficient if modified during operation, V_{ref} and T_{ref} are reset to the present values to prevent a sudden voltage change.
- If the temperature sensor is dis- and reconnected during operation, V_{ref} and T_{ref} are reset to the present values to prevent a sudden voltage change.
- The temperature dependent voltage correction can be deactivated by setting the VCT-coefficient to 0 or by disconnecting the temperature sensor. If this is done during operation, the channel will keep the actual voltage set.
- If the temperature sensor is disconnected a temperature of -273.15°C is shown for that channel.

- The VCT data points are described in the manual "**iseg Hardware Abstraction Layer**" ***(see appendix)*.**

4.2 Single Channel Inhibit

INFORMATION
 INFORMATION INHIBIT is an external signal, that switches off the high voltage for the device or a specific channel

If none of the options **IHB**, **IHD** or **VCT** is ordered, modules are equipped with an *INHIBIT* for each channel via a Sub-D connector on the backplane of the module. Channel 0 to 3 corresponds to Pin 1 to 4 at the Sub-D connector, Pins 5-9 are connected to GND.

With option **IHB** the module is equipped with BNC connectors for the *INHIBIT* of each channel instead.

The *INHIBIT* signal are TTL-level, the signal logic and default states can be configured. The following settings are possible:

Case 1 – IU

INHIBIT signal logic:	LOW-active (LOW→ HV-generation stopped)
default state:	HIGH (internal pull-up resistor applied)
open *INHIBIT* signal input:	HV enabled

Case 2 – ID

INHIBIT signal logic:	LOW-active (LOW→ HV-generation stopped)
default state:	LOW (internal pull-down resistor applied)
open *INHIBIT* signal input:	HV disabled

Case 3 – NIU

INHIBIT signal logic:	HIGH-active (HIGH→ HV-generation stopped)
default state:	HIGH (internal pull-up resistor applied)
open *INHIBIT* signal input:	HV disabled

Case 4 – NID

INHIBIT signal logic:	HIGH-active (HIGH→ HV-generation stopped)
default state:	LOW (internal pull-down resistor applied)
open *INHIBIT* signal input:	HV enabled

The *INHIBIT* signal must be applied for at least 100 ms to guarantee a detection. When the INHIBIT is no longer active, the INHIBIT flag must be reset before the voltage can be switched ON again.

4.3 IHD - Detector INHIBIT

The option IHD is a special version of a single channel INHIBIT to be connected to the HV INHIBIT outputs of detectors/preamplifiers from Ortec and Canberra. In order to enable the HV generation either a positive voltage signal (Canberra) or a negative signal (ORTEC) must be applied. The INHIBIT signals are connected via BNC connector (one for each channel) located on the backplane of the module.

4.4 L – Lower output current (HP only)

The output current is limited to a lower value, e.g. 100 µA.

4.5 T10 – Lower temperature coefficient (HP only)

Improved temperature coefficient of 10ppm/K

5 Dimensional drawings

- to be continued -

Figure 1: Dimensional drawings

6 Connectors and PIN assignments

HV CONNECTOR ASSIGNMENTS				
Name	SHV			
Figure				

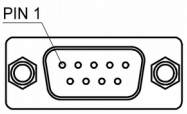
INHIBIT				
Name	INHIBIT connector- DSUB9	INHIBIT connector- DSUB9		
Figure	PIN / INHIBIT 1 1 CHANNEL 0 2 CHANNEL 1 3 CHANNEL 2 4 CHANNEL 3 5 GND 6 GND 7 GND 8 GND 9 GND			

Table 7: Connector and pin assignments

CONNECTORS PART NUMBERS (manufacturer code / iseg accessory parts item code)			
POWER SUPPLY SIDE		**CABLE SIDE**	
SHV (ROSENBERGER)			
Socket		Connector	57K101-006N3 / Z590162

Table 8: Connectors part number information

7 Order guides

CABLE ORDER GUIDE				
POWER SUPPLY SIDE CONNECTOR	**CABLE CODE**	**CABLE DESCRIPTION**	**LOAD SIDE CONNECTOR**	**ORDER CODE *LLL = length in m*** [*]
SHV	04	HV cable shielded 30kV (HTV-30S-22-2)	open	SHV_1C04-*LLL*
[*] *Length building examples: 10cm => 0.1, 2.5m => 2.5, 12m => 012 , 999m => 999*				

Table 9: Guideline for cable ordering

CONFIGURATION ORDER GUIDE (item code parts)								
SR	**04**	**0**	**020**	**r**	**605**	**000**	**02**	**00**
High Voltage, Distinct Source	Numbers of channels	Class	V_{nom}	Polarity	I_{nom} (nA)	Option (hex)	HV-Connector	Customized Version
	02 = 2ch 04 = 4ch	0 = Standard 4 = High Precision	three significante digits *100V For Examle: 020 = 2000V	r = reversible	two significante digits + number of zeros For Examle: 605 = 6mA	Sum of the hex codes (s. table 3) For Example: IU + TC = 804	02 = SHV	00 = none

Table 10: Item code parts for different configurations

8 Appendix

For more information please use the following download links:

This document
http://download.iseg-hv.com/AC_DC/SHR/iseg_manual_SHR_en_1.0.pdf
SHR SCPI Programmers-Guide
http://download.iseg-hv.com/AC_DC/SHR/iseg_SHR_SCPI_ProgrammersGuide_en.pdf

9 Warranty & Service

This device is made with high care and quality assurance methods. The factory warranty is up to 36 months, starting from date of issue (invoice). Within this period a 5 years warranty extension can be ordered at additional charge. Please contact iseg sales department.

CAUTION!

Repair and maintenance may only be performed by trained and authorized personnel.

For repair please follow the RMA instructions on our website: www.iseg-hv.com/en/support/rma

10 Manufacturer´s contact

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