



ZRF RITEC SIA

HIGH VOLTAGE CURRENT MEASUREMENT UNIT

Model HVCMU 3K

Operator's Manual



Attention!

Please read this Operator's Manual carefully before using the equipment. Make sure you understand all instructions and pay particular attention to items marked with this symbol.

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ILLUSTRATION

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1. INTRODUCTION

The HVCMU 3K is a portable, stand-alone instrument designed for high-resolution measurement of very small DC currents at working voltages up to ± 3 kV DC to ground. Typical applications include leakage-current measurement in high-voltage radiation detectors.

The HVCMU 3K performs high-side current measurements with very low burden voltage, providing stable operation and high measurement resolution. The instrument provides three selectable current ranges and supports both positive and negative high-voltage polarity. Data acquisition and calculations are performed internally, and the measured current is shown on a bright LED dot-matrix display.

The very low leakage current between the HV measurement path and ground allows the HVCMU 3K to be used with low-power high-voltage supplies having limited output current.

The HVCMU 3K is shown in Fig. 1.



Fig. 1. High Voltage Current Measurement Unit, model HVCMU 3K.

2. SPECIFICATIONS

Table 1 High-Resolution (HR) and Standard-Resolution (SR) product variants. Range values are shown as they appear on the display.

High-Resolution (HR)				Standard-Resolution (SR)			
Range, μA	Resolution, μA	Accuracy, nA	Measurement limit, μA	Range, μA	Resolution, μA	Accuracy, nA	Measurement limit, μA
.1000	0.0001	± 0.3	.1600	1.000	0.001	± 2	1.600
1.000	0.001	± 2	1.600	10.00	0.01	± 20	16.00
10.00	0.01	± 20	16.00	100.0	0.1	± 200	160.0

Accuracy is specified over the operating conditions stated in Table 2.

Table 2 Technical specifications.

Parameter	Value	Units
Power supply voltage	+6	V DC
Power supply current	< 200	mA
Operating temperature range	0 ... 50	$^{\circ}\text{C}$
Internal output capacitance (HV OUT terminal to ground)	~ 2.2	nF
Maximum working voltage (either HV terminal to ground)	± 3	kV DC
Leakage current from the HV measurement path to ground	< 500	pA
Additional voltage ripple at HV OUT terminal, introduced by HVCMU*	5	mVp-p
Burden voltage	< 165	mV
Maximum permissible continuous short-circuit current	80	mA
Weight	350	g
Dimensions**	$131.2 \times 87.0 \times 31.5$	mm
Input cable length	52 ± 2	cm
Input connector***	SHV cable plug	
Output connector	SHV receptacle	

* Measurement bandwidth: 20 MHz. Measured at the HV OUT terminal with the HV IN terminal connected to ground, no external HV applied, and no load connected.

** Excluding connectors, cables, and control knobs.

*** Custom cable lengths are available on request.

Table 3 Absolute maximum ratings

Parameter	Value	Units
Power supply input absolute maximum voltage	–24 to +24	V DC
Absolute maximum voltage (any HV terminal to ground)	±3.5	kV DC
Absolute maximum continuous short-circuit current	100	mA
Maximum single-pulse discharge energy*	0.92	J

* Tested with an approximately 150 nF capacitor charged to 3.5 kV.

3. DESIGN FEATURES

The HVCMU 3K is shown in Fig. 1.

The main dimensions of the HVCMU 3K are shown in Fig. 2.

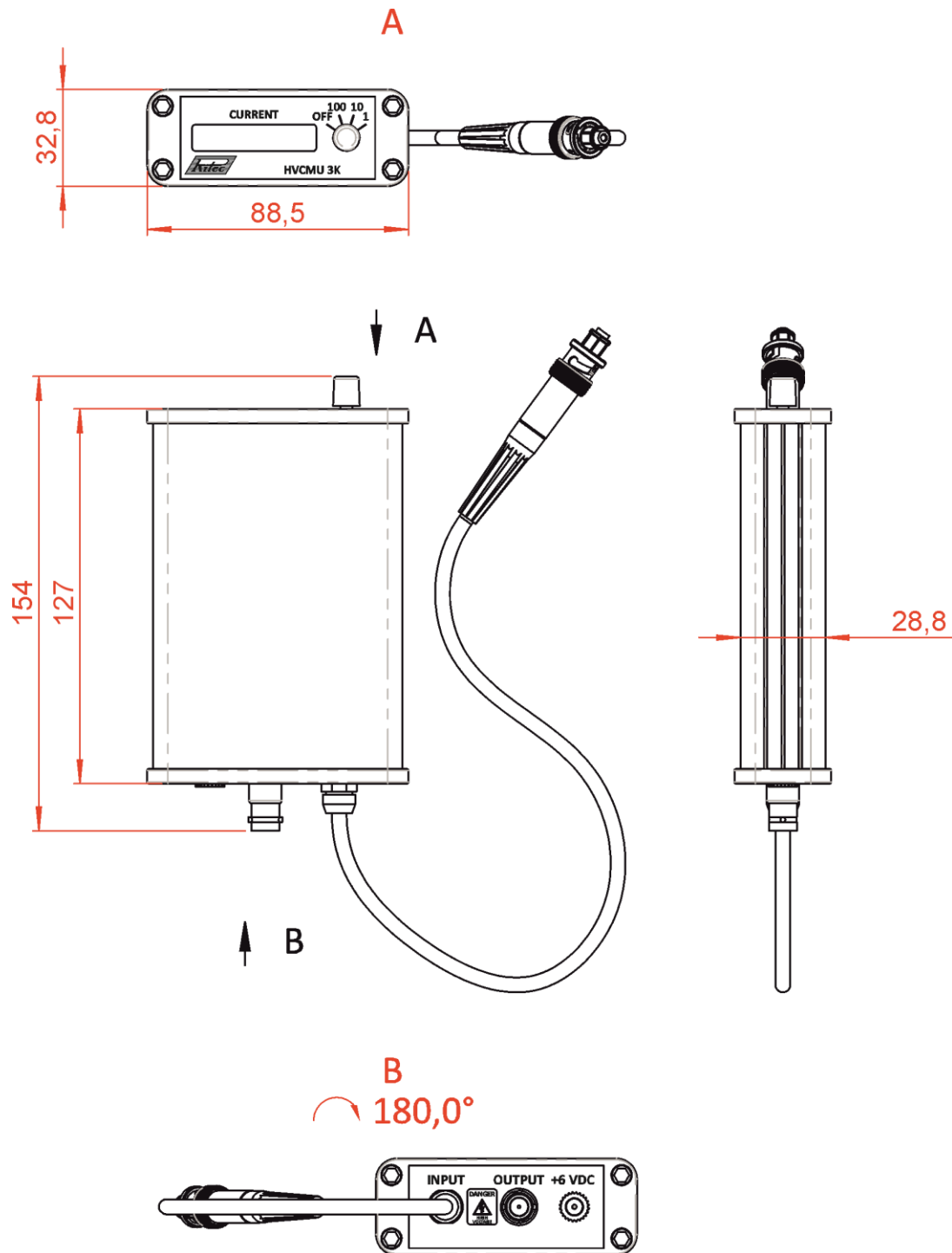


Fig. 2. Main dimensions of HVCMU 3K.

The block diagram of the HVCMU 3K is shown in Fig. 3.

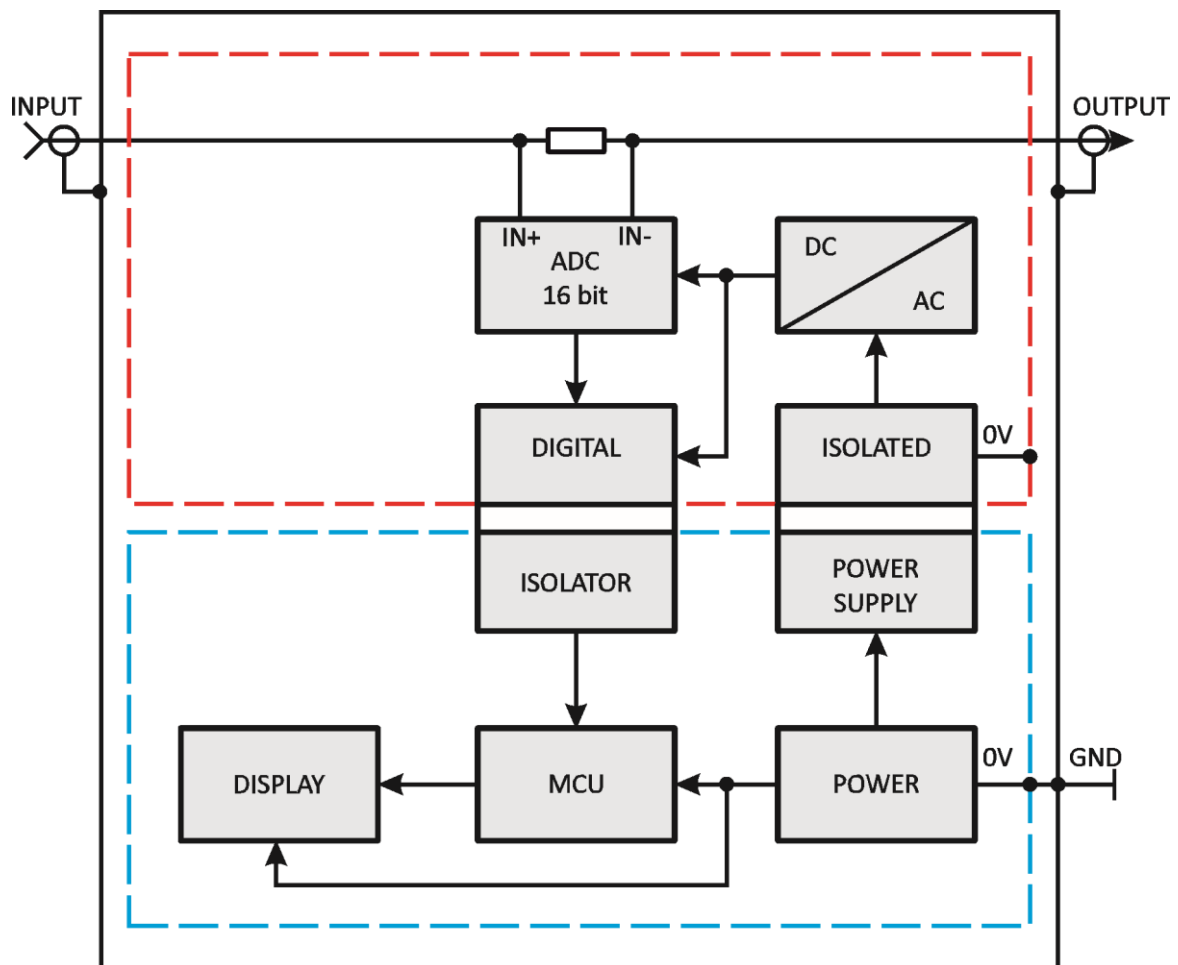


Fig. 3. Block diagram of the HVCMU 3K.

The HVCMU 3K consists of two main sections: a high-voltage (HV) section and a low-voltage (LV) section, which are galvanically isolated. Current through the shunt resistor in the HV section produces a voltage drop measured by a 16-bit analog-to-digital converter (ADC). The microcontroller unit (MCU) in the LV section processes the ADC data and displays the measured value. A digital isolator transfers data between the HV and LV sections, while an isolated power supply powers the HV section. The AC/DC block contains rectifiers and voltage regulators. The digital isolator and isolated power supply provide the required galvanic isolation. The POWER block in the LV section supplies the MCU, display, and pulse-transformer driver of the isolated power supply.

4. INSTALLATION

Connect the equipment in the following order:

HV power supply → HVCMU HV IN → HVCMU HV OUT → Load

Connection and operation procedure

1. Make sure the HV power supply is OFF and its output voltage is below 20 V.
2. Connect the HVCMU HV IN terminal to the HV power supply and the HV OUT terminal to the load.
3. Switch on the HVCMU and all associated equipment.
4. Switch the HV power supply ON and wait until the current reading stabilizes.
5. Select the most sensitive measurement range that does not produce an OVERLOAD indication.
6. After completing the measurement, switch the HV power supply OFF and wait until the voltage falls below 20 V.
7. Switch off the remaining equipment before disconnecting the measurement circuit.

The HVCMU is intended for measurement of slowly varying currents. The display update rate is approximately 3.8 readings per second.

When the HVCMU is powered off, the measurement circuit remains connected in the most sensitive-range configuration. Applying HV in this condition will not damage the instrument. However, if the current exceeds the measurement limit of the most sensitive range, the burden voltage may exceed its specified value.

Current polarity indication

For positive HV polarity:

“+” indicates normal current flow from source to load.

“–” indicates reverse current flow, for example during discharge of external capacitance after the HV supply is switched off.

For negative HV polarity, the indications are reversed.

5. APPLICATION EXAMPLE

One practical application of the HVCMU 3K is monitoring leakage current in semiconductor radiation detectors, as shown in Fig. 4.

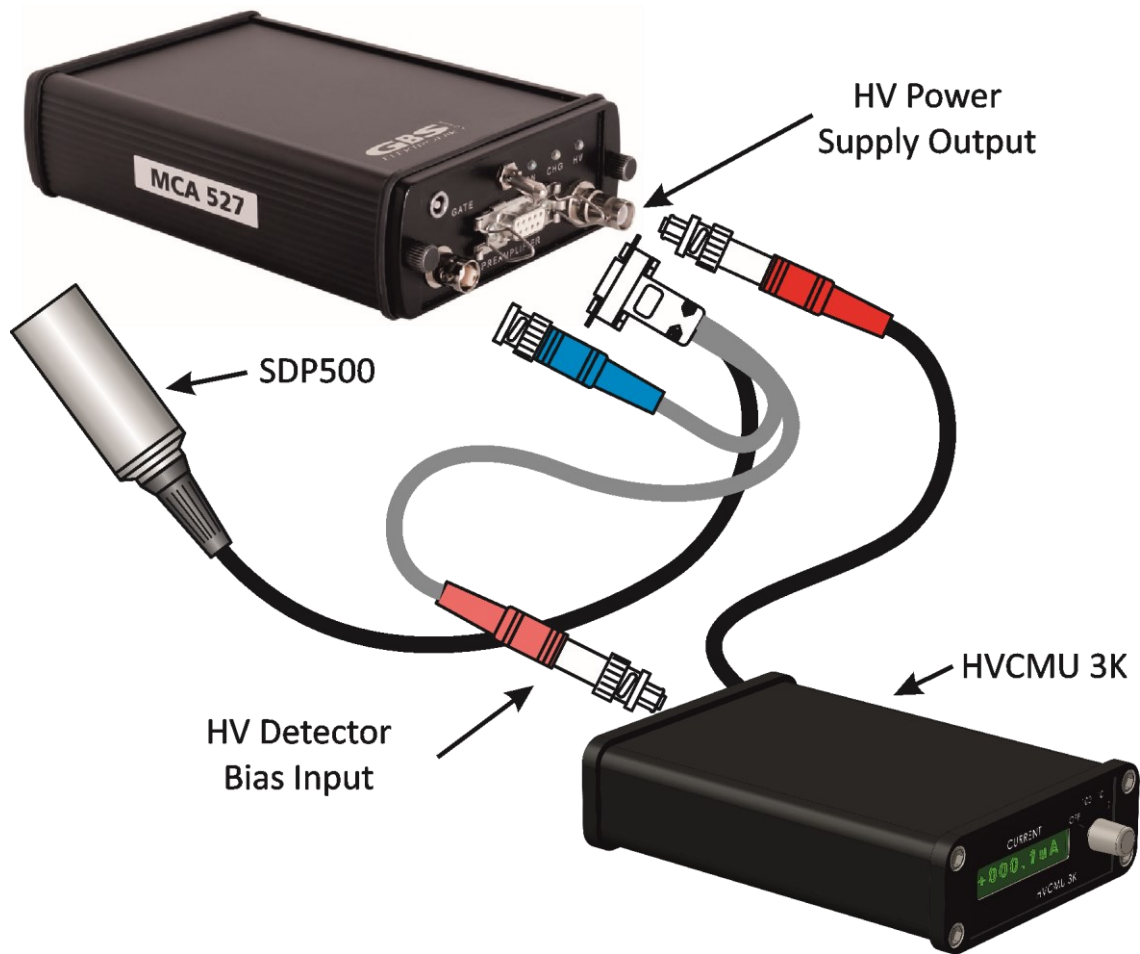


Fig. 4. Connection diagram of the HVCMU 3K.

Such detectors typically operate at voltages ranging from a few hundred volts to several kilovolts. The HVCMU 3K may be used where the detector bias voltage does not exceed its specified maximum working voltage. Leakage currents typically ranging from 0.1 nA to 100 nA depending on detector size, material properties, and operating temperature. Accurate leakage-current monitoring is important during both manufacturing and normal operation. The measuring instrument should not introduce interference that could affect detector performance.

Fig. 4 shows the HVCMU 3K connected to an MCA527 multichannel analyzer with a high-voltage power supply for measuring the leakage current of an SDP500 CZT detector.

6. SAFETY AND PRECAUTIONS



Warning!

Exceeding any absolute maximum rating may cause permanent damage or permanently affect measurement accuracy.

The HVCMU 3K is designed for current measurement only. It does not provide load protection or current limiting.

- Do not connect or disconnect the HVCMU 3K from the equipment when a high-voltage supply is turned on. This can cause damage to the device.

Cleaning and decontamination:

- Switch off the high-voltage power supply and all connected equipment before cleaning. Ensure that the voltage at the HV terminals has decreased to a safe level and disconnect the HVCMU 3K from the measurement circuit.
- Clean the external surfaces with a soft cloth slightly moistened with water or 70% ethyl alcohol. Do not pour or spray liquids directly onto the instrument or allow liquid to enter the enclosure or connectors. Allow the instrument to dry completely before reconnecting or applying power.



Warning!

Electric shock safety:

- Make sure all devices are properly grounded. Measure the resistance between each metal chassis and a suitable ground point using a multimeter. The resistance must be less than 1 Ω .
- Do not touch connector interiors or cable ends until the voltage falls to a safe level (<20 V).

WARRANTY

Equipment manufactured by ZRF RITEC SIA is warranted against defects in materials and workmanship for one year from the date of shipment. This warranty does not cover damage caused by improper use of the equipment.

If a defect is discovered within 30 days after receipt of the equipment, ZRF RITEC SIA will pay transportation costs in both directions. After the first 30 days, transportation costs are the customer's responsibility.

Inspect the shipment carefully upon receipt for evidence of transit damage. If damage is found, notify ZRF RITEC SIA immediately. ZRF RITEC SIA is not responsible for damage sustained in transit.

Equipment no longer covered by warranty may be returned to ZRF RITEC SIA, freight prepaid, for repair. After repair, the equipment will undergo a pre-shipment inspection.

Before returning equipment for repair, contact ZRF RITEC SIA in writing by e-mail or fax for instructions.

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