SMART

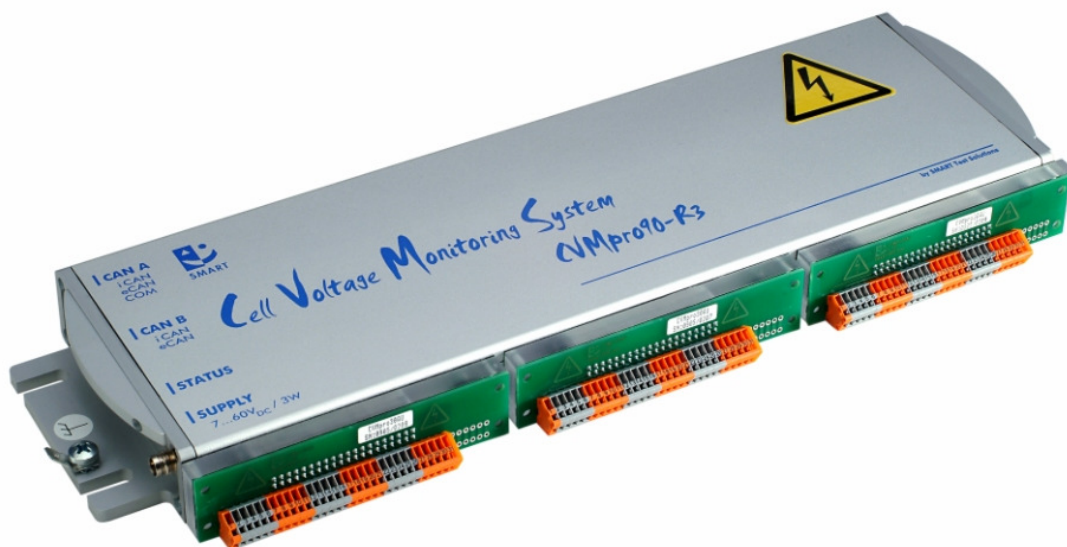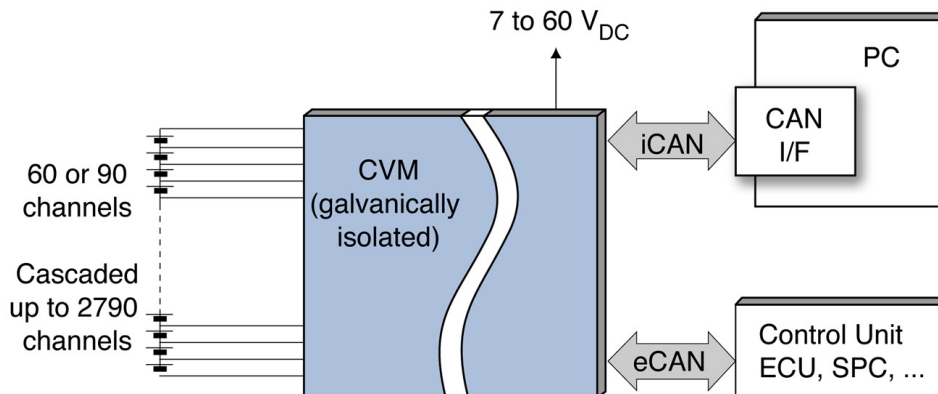# CVMpro60/90-R3

**60-channel and 90-channel Cell Voltage Monitoring unit for fuel cells, batteries and electrolyzers**

7 to 60 $V_{DC}$

PC

CAN I/F

iCAN

60 or 90 channels

Cascaded up to 2790 channels

CVM (galvanically isolated)

eCAN

Control Unit ECU, SPC, ...

# Applications

The real time cell voltage monitoring module CVMpro60/90-R3 is used for the multi-channel voltage measurement of cascaded voltage sources, such as fuel cells, electrolyzers and high-caps.

A single CVM unit can measure up to 60 single/120 double cells (CVMpro60-R3) or up to 90 single cells/180 double cells (CVMpro90-R3). For higher numbers of cells, up to 31 CVM units can be cascaded, thus providing up to 2790 channels.

The input channels are sequentially sampled, 12bit digitized and transmitted via CAN bus. There is no result memory within the unit.

The module works stand-alone. Configuration is via CAN bus, configuration data are stored non-volatile (exception: limit values).

Dedicated software packages are available for control of the CVM unit by own programs (C, C++, LabVIEW) or by means of a graphical user interface.

## Performance

- Measurement of single cells ($\pm 1{,}2V$) or double cells ($\pm 2{,}4V$), typically for fuel cells
- Measurement of single battery cells with voltages up to $\pm 4{,}8V$
- Calculation of total stack voltage and total system voltage
- Comparison against 2 thresholds and generation of alarms in realtime
- Masking of individual cells (e.g. for removal of known defect cells)

- Detection of contact interruption
- Sampling time for one measurement point < 1ms, cycle time typ. 100ms
- Transmission of detailed results via iCAN ('internal CAN')
- Transmission of condensed results via eCAN ('external CAN')
- Wide supply voltage 7-60$V_{DC}$
- All inputs electrically isolated, isolation voltage 1kV
- Embedded reprogrammable controller
- Compact aluminium housing with protection class IP54
- Temperature range: -25 ℃ to +80 ℃
- Dimensions: 334 x 29 x 105 (90 channels), 276 x 29 x 105 (60 channels)

## Accessories

- CAN-PC interfaces
  PC interface cards for PCI bus and PCMCIA slot with external trigger outputs Software
- CVMLIB!pro-V2
  Windows library for configuration and communication for C, C++
- CVMView!pro-V2
  Graphical user interface for configuration and visualisation

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# Technical data (60channels/90channels)

| Parameter | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|
| Supply voltage | 7 | - | 60 | $V_{DC}$ |
| Power consumption | - | - | 6 | W |
| Number of measuring units per system | 1 | - | 31 | - |
| Number of channels per measuring unit | - | - | 60 / 90 | - |
| Input signal range, fuel cell version, single-cell mode | -1,20 | - | +1,20 | V |
| Input signal range, fuel cell version, double-cell mode (factory settable) | -2,40 | - | +2,40 | V |
| Input signal range, battery version (5V version) | -4,80 | - | +4,80 | V |
| Resolution (fuel cell version / battery version) | - | 1 / 4 | - | mV |
| Measuring uncertainty | - | - | ±0,4%±0,2%FSR | |
| Resistance between cells and measurement inputs | | | 10 | Ω |
| Scan time per measuring channel | | 1 | | ms |
| Cycle time per measurement unit for all channels | | | 80/110 | ms |
| Isolation voltage of last channel to ground supply | - | - | 1000 | V |
| Maximum voltage across CVM (from first to last channel), fuel cell version | | | 216 | $V_{DC}$ |
| Maximum voltage across CVM (from first to last channel), battery version | | | 432 | $V_{DC}$ |

| Parameter | Values |
|---|---|
| Protection class | IP54 in accordance with EN60529 |
| Operating / Storage temperature range | -25℃ to +80℃ |
| Humidity during operation / storage&transportation | 20% to 65% r.H. / 0% to 85% r.H. |
| Size | 276 x 29 x 105 mm (60channels) or 334 x 29 x 105 mm (90channels) plus 2 x 24 mm for mounting flange |
| Weight | 1,02 kg (60channels) or 1,23 kg (90channels) |
| Installation height / position | max. 2000m above NN / any |
| CAN compatibility | ISO11898, CAN 2.0B |
| CAN transfer rate | 500 kBd (can also be parameterised for other baudrates) |
| Safety | Safety class II |
| Measurement category | Complies with measurement category I for max. voltages of 216V or 432V. Not suited for measurement circuits of categories II, III or IV. |

| Firmware Function | Description |
|---|---|
| Bus Scan | Detection of connected CVM modules |
| System Config. | Read and set system configuration (number of cells, stacks, serial numbers) |
| Statistics | Total voltage, cells with highest or lowest voltages |
| Thresholds | Read and set 2 voltage limits |
| Alarms | Alarming if voltage limits are exceeded |
| Masking | Masking of channels |
| Single cell values | Start and stop transmission of single cell values |
| Contact interruption | Detection of contact breaks |
| Signal polarity | Measuring channel normal or inverted |
| Single/double cell | Measuring of single cells or double cells |

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# Interface description

## Power supply
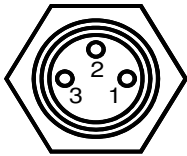
| Pin | I / O | Name | Function |
|-----|-------|------|----------|
| 1 | SUP | UBAT | Power supply plus |
| 2 | SUP | GND | Power supply minus (ground) |
| 3 | - | - | n.c. |

## CAN and RS232 (COM)
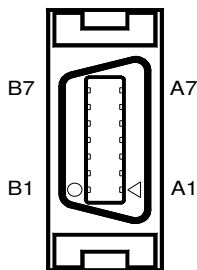
| Pin | I | / | O | Name | Function |
|-----|---|---|---|------|----------|
| A1 | | | x | TXD | Transmit Data RS232C |
| A2 | x | | x | ICAN_HIGH | CAN intern High |
| A3 | x | | x | ICAN_LOW | CAN intern Low |
| A4 | SUP | | | GND | Ground |
| B1 | x | | | RXD | Receive Data RS232 |
| B2 | x | | x | ECAN_HIGH | CAN extern High |
| B3 | x | | x | ECAN_LOW | CAN extern Low |
| B4 | SUB | | | GND | Ground |

## Meaning of LED

| LED | Indicates |
|-----|-----------|
| 🟢 Green ("POWER") | on: supply voltage OK<br>off: no supply voltage |
| 🟠 Orange ("STATUS") | on: measurement running, CAN messages transmitted<br>blinking: measurement running, CAN communication error<br>off: measurement not running (e.g. during configuration via internal CAN bus) |

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## Signal connector clamp units

The signal wires are connected to clamping units (Wago 233) and are detachable. The maximum conductor cross-section is $0.5mm^2$. Please use the proper WAGO tool for locking and unlocking of the tension springs. This tool is included in the delivery.
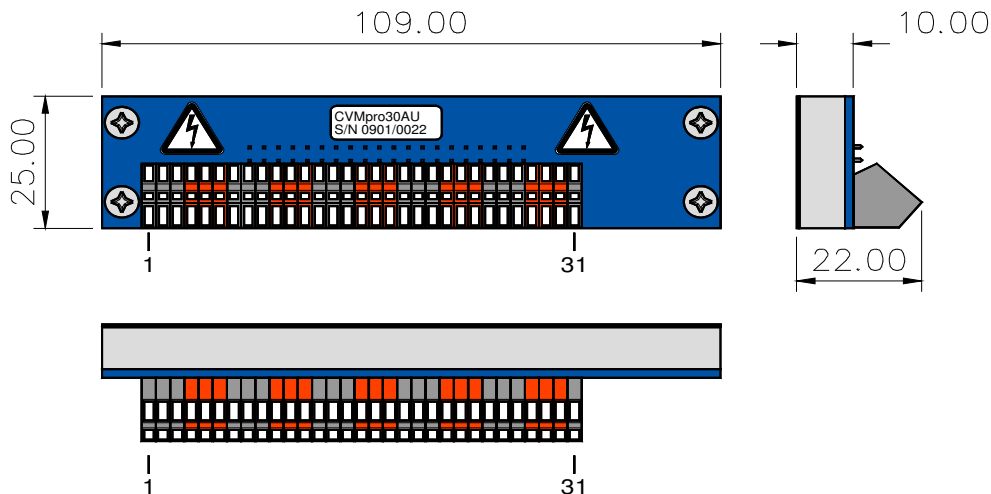


| Clamp No. | CON 1 Cell-No. / Polarity | CON 2 Cell-No. / Polarity | CON 3 Cell-No. / Polarity |
|---|---|---|---|
| 1 | 1- | 30+ / 31- | 60+ / 61- |
| 2 | 1+ / 2- | 31+ / 32- | 61+ / 62- |
| 3 | 2+ / 3- | 32+ / 33- | 62+ / 63- |
| 4 | 3+ / 4- | 33+ / 34- | 63+ / 64- |
| ... | ... | ... | ... |
| 28 | 27+ / 28- | 57+ / 58- | 87+ / 88- |
| 29 | 28+ / 29- | 58+ / 59- | 88+ / 89- |
| 30 | 29+ / 30- | 59+ / 60- | 89+ / 90- |
| 31 | 30+ | 60+/61- | 90+/91- |
| | CVMpro60-R3 | | |
| | CVMpro90-R3 | | |

**Remark:** just one of 2 connectors (CVMpro60-R3) or 3 connectors (CVMpro90-R3) shown for clarity

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# Mechanical specification

CVMpro60-R3:
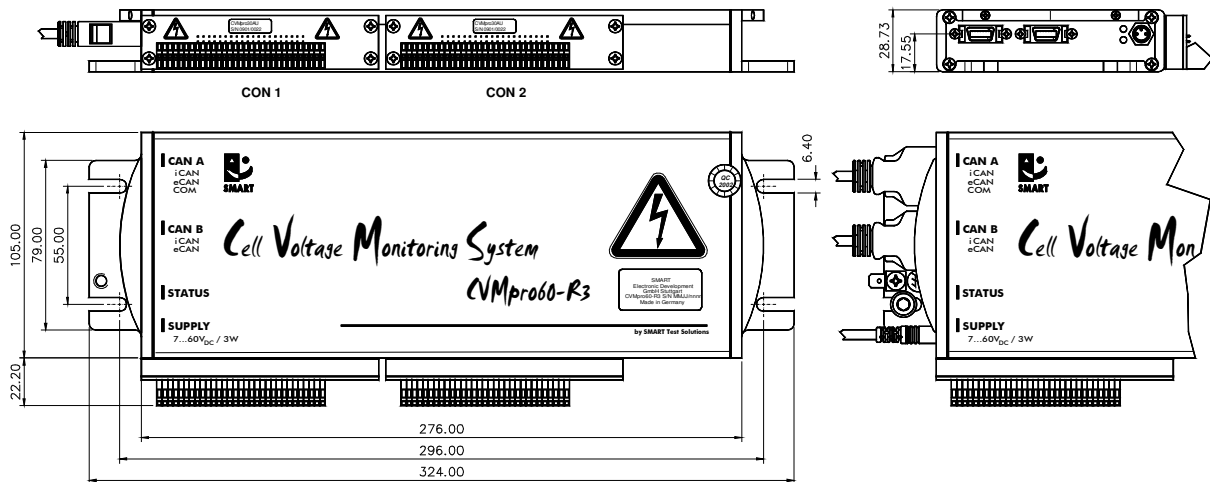


CVMpro90-R3:
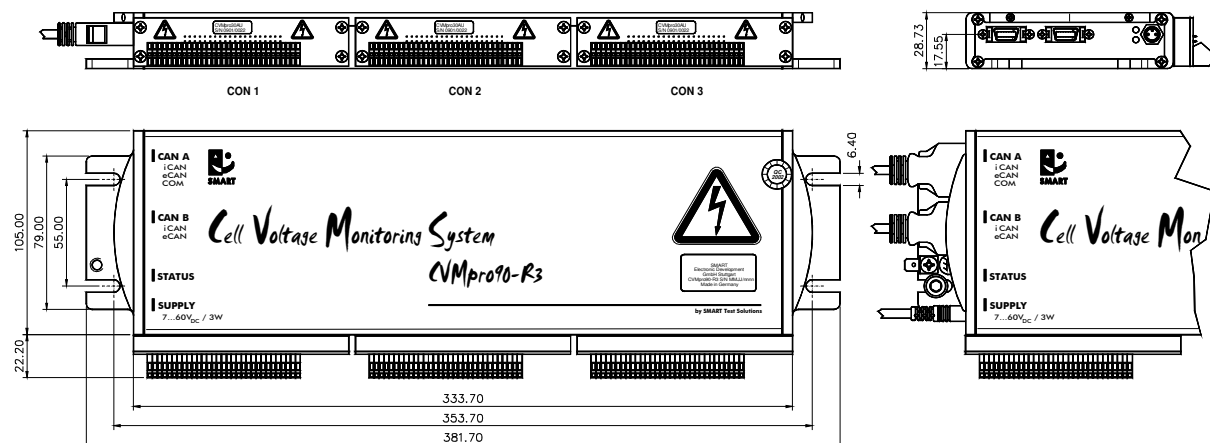
# Ordering information

| | |
|---|---|
| CVMpro60-R3 | Cell voltage monitoring unit, 60 channels, input voltage range: ±1.2V or ±2.4V |
| CVMpro90-R3 | Cell voltage monitoring unit, 90 channels; input voltage range: ±1.2V or ±2.4V |
| CVMpro60-R3-5V | Cell voltage monitoring unit, 60 channels, input voltage range: ±4.8V |
| CVMpro90-R3-5V | Cell voltage monitoring unit, 90 channels; input voltage range: ±4.8V |
| CVMLIB!pro-V2 | Dynamic link library for configuration and communication via own C/C++ programs |
| CVMView!pro-V2 | User friendly configuration and visualization software for Windows 2000/XP |
| CVMproBATL0500 | Power supply cable, 5m, 3pole, with circular mini-connector, second end open |
| CVMproCANL0050 | CAN bus cable for interconnection of 2 CVMS-units, 0,5m, 2 connectors |
| CVMproCANL1000 | CAN bus cable from CVMS-Master to visualization PC and fuel cell controller, 10m, connector at one end, second end open |
| CVMproCANTERM | Passive termination of external and internal CAN-Bus |

## Manufacturer

SMART Electronic Development GmbH
Roetestrasse 17,   D-70197 Stuttgart,   Germany
Tel        +49 (0)711 / 25521-0
Fax       +49 (0)711 / 25521-10
E-mail    smart@smart-gmbh.de
Internet  www.smart-gmbh.de

## Warranty conditions

SMART Electronic Development GmbH provides a 2-year warranty for this unit calculated from the date of sale. During this period, all faulty components will be repaired or replaced free of charge. If necessary, the unit will be replaced by an alternative equivalent unit. SMART Electronic Development GmbH shall be solely responsible for deciding how the specified operability is to be restored. The warranty covers neither damage caused by improper operation or use nor spare parts. Unauthorised intervention by the customer or by third parties shall render the warranty invalid. In the event of a repair, the product must be returned in its original packaging or in equipment packaging suitable for the specified method of transport. SMART Electronic Development GmbH cannot accept responsibility for transport damage.

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**Note:**

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