

# DVR1

Precision Temperature-Regulated DC Voltage Reference



## Triple Reference Output

10V (3 outputs) or tripple voltages 10V, 1V and 0,1V

The DVR1 is a very cost efficient, yet precision voltage reference assembly, capable of generating three precise and low-drift, buffered reference voltages of 10V (single voltage version) or 10V, 1V and 0,1V (triple voltage version). It incorporates a temperature-controlled oven to stabilize the output voltages, thus limiting the impact of ambient temperature fluctuations and is intended as an OEM product to be incorporated in equipment where precise reference voltages are needed, such as e.g. in electronic labs or physics applications or for calibration purposes.

## Temperature Stabilized

Includes internal oven for low temperature drift

## Cost Efficient Design

The use of burried zener diodes in hermetic package (LT1021) in combination with other low drift components and a precision temperature control circuitry is the prerequisite of a precision voltage standards. The design, which does not require continuous operation to achieve stable output voltages, results in a very attractive price/performance ratio. Other cost efficient, yet temperature compensated standards often use thermistors to compensate thermal drifts and non-hermetic chip versions, resulting in sub-optimal temperature compensation and higher aging related drifts. This, amongst other reasons, is because exact trimming of the thermistor to each specific reference temperature gradient is essentially impossible for production units. Non-hermetic reference chips show higher aging drift rates due to environmental impacts. Therefore this reference assembly uses an internal precision heater working on component level and a hermetic voltage reference chip. A PT100 temperature sensor enables monitoring of the internal reference device temperature.

## High Precision

Calibrated against low tolerance standards

## Low Drift

Based on low drift burried zener diodes

## Temperature Sensor

Integral PT100 sensor for temperature surveillance

## Options

Versions e.g. with binding posts on request

## Input Power Conditioning

Power input with reverse polarity protection, voltage regulation and EMI filtering

## Output Protection

Short circuit proof output Output EMI filtering

Every product is factory calibrated, traceable to national standards after a minimum of 500 hours of pre-aging for the references and an additional 100 hours for the complete unit. The calibration includes the adjustment of the 10V output and the precision measurement of the 1V and 0.1V output (for the tripple voltage version). The single output version supports 3 outputs with 10V each. The first output is adjusted to exactly 10V by use of a trimmer, the remaining two are calibrated (measured). The trimmer is accessible by the user from outside to support readjustment. The unit is accompanied by a factory calibration report including specification of the tolerances of standards used to enable a total error budget calculation for the user.

Versions can be made available, e.g. with 10V, 2V and 0.2V output voltages or with binding posts as output terminals, please contact us.

For further details see also [www.ab-precision.com](http://www.ab-precision.com).

DVR1 Datasheet V7; (c) 1/2018 by ab-precision

# DVR1

## Datasheet

**IMPORTANT NOTE: Power GND and Output GND are NOT on same potential, do NOT connect together**

All values are typical specifications at 23°C, K=2, unless otherwise specified:

Parameter	Condition	Specification
Ambient Conditions	Operation, per specification Operation, no damage Storage, transport	18 - 28°C 10 - 35°C 5 - 45°C
Output 1 Voltage 10V	Absolute calibration uncertainty 30 day drift *)6 1 year drift *)6	< 2 ppm max. *)1 < 2 ppm < 10 ppm
Output 2 Voltage 1V *)2	Absolute calibration uncertainty 30 day drift *)6	< 8 ppm max. *)1 < 25 ppm
Output 3 Voltage 0.1V *)2	Absolute calibration uncertainty 30 day drift *)6	< 15 ppm max. *)1 < 0.05 %
Thermal Drift	10V output, T=18 - 28 °C *)6	0.1 ppm/K typ. *)4 < 0.25 ppm/K max. *)4
Output Noise Voltage	10V output, 0.1-10Hz	< 1 ppm peak-peak
PT100 temperature tolerance	4 wire measurement	< 0.5K
Warmup Time	10V output	30 min. to $\partial U < 1$ ppm of nominal
Output Impedance	10V output	< 2 Ohms
DC Supply Voltage *)5	Specification / no damage Peak startup current Average current (heated up)	17.5-18.5V / 17.0-24.0V < 150mA *)7 < 50mA
Output Current	Short circuit, any output Recommended output current	Indefinite *)3 <1 $\mu$ A
I/O Connectors	All standard versions (mating Connector supplied)	15 pin D-Sub female; 4mm optionally
Weight	All standard versions	Appr. 150g

### Notes:

- \*)1: Relative to National Standards (PTB) at time of calibration; Output 1 is adjusted to nominal 10V by trimmer on item top side (see marking) and is user-adjustable; calibration is lost on all channels if trimmer is adjusted by user. Use non-conductive screw driver only!
  - \*)2: Only tripple voltage versions support this output voltage
  - \*)3: One 10V output ONLY at a time, for 2 or 3 damage will occur. After removal of short circuit, allow 30 min temperature stabilisation.
  - \*)4: Averaged over 10K, total <2.5ppm over a 10K temperature range
  - \*)5: We recommend to use a linear regulated, low noise supply. Avoid switchmode regulators to minimize noise.
  - \*)6: To calculate total output uncertainties, add calibration uncertainty, aging drift and temperature drift
  - \*)7: Although an internal fuse is installed, use external fuse 500mA slow blow to limit supply current
- Please note that all specifications are typical values only and related to 23°C, unless explicitly otherwise specified.  
- For specified values, ambient temperature gradient shall be < 1K/h and item shall be operated in horizontal position  
- 'K' denotes temperature changes, relative to absolute values indicated in °C. A 1K increase equates a delta from x °C to x + 1 °C

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### Circuit Description:

The DRV1 consists of the following functional blocks to achieve the performance specified:

- Input reverse voltage protection and power filtering, ESD protection
- Dual, separate, voltage regulator stage for reference circuitry and heater circuitry
- LT1021 buried zener voltage reference, hermetic, for low aging drift, voltage adjustable
- Precision voltage divider stages (3-voltage version only) with ultra low temp. coefficient
- Output amplifier (per output) with output protection (ESD, short circuit, EMI-filtering)
- Reference chip noise filter
- Precision PI heater control circuitry for references (and circuitry)
- PT100 temperature sensor for internal reference temperature monitoring
- Metal case for improved ESD/EMI shielding

### Operation Recommendations and Precautions:

This reference assembly is a precision device and special care should be taken when operating it to achieve optimum performance. Handle carefully and ensure a temperature stabilized environment as specified. Avoid any direct air drafts (to signal contacts and case), direct infrared radiation or other heat sources in proximity to the unit to avoid drifts. Take the standard industry precautions to minimize thermal EMF voltages when connecting cables. Avoid temperature extremes whenever possible (also storage). Do not exceed the specified operating conditions, otherwise damage may occur. Use short, twisted shielded cable to load for each output. Connect shield to GND. Avoid ground loops. Switch item off if not used to minimize aging.

**Please note:** The power input negative pin and the output GND pins are **NOT** on the same potential and **MUST NOT** be connected together. Unit generates its own output reference GND level, to be used as the output reference potential (pins 1 and 6 of output connector).

### D-Sub I/O Connector (9 pin female):

- Pin 5, 9: PT100 (use 4-wire connection at connector terminals)
- Pin 8: Positive DC supply input, 18V nominal, protect with external fuse 500mA/slow
- Pin 4: Negative DC supply input (do NOT connect to chassis or GND, Pins 1 and 6!)
- Pin 1, 6: Output GND (connected to chassis)
- Pin 3: Output 1 (10V; adjusted to nominal, see page 2)
- Pin 7: Output 2 (10V; respectively 1V with triple output version)
- Pin 2: Output 3 (10V; respectively 0.1V with triple output version)

Note: The DVR1 assembly ships with a mating D-Sub connector (with solder cups) and a shell

### Ordering Information:

Order Number	Description
DVR1-1-A-N	Precision DC Voltage Reference Assembly, 10V output (3 separate 10V outputs); NOT designed for ROHS compliance
DVR1-3-A-N	Precision DC Voltage Reference Assembly, three output voltages, 10V, 1V, 0,1V output; ; NOT designed for ROHS compliance

# DVR1 (PRELIMINARY)

## Datasheet

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