



# Specifications

Hidex 300 SLL automatic TDCR liquid scintillation counter

## Specification

### Hidex 300 SL-SLL

100-240V AC and 24 V DC.

Features Model (425-020) Super Low Level (SLL) Automatic TDCR Liquid Scintillation Counter with Guard Detector and Low Level PMTs

### General Description

Hidex 300SL automatic TDCR liquid scintillation counter with guard detector and low level photomultiplier tubes for detection of low level beta and alpha radiation, suitable especially well for low level environmental radioisotope monitoring, radiocarbon dating, biofuel verification, direct DPM counting without External radioactive standard source and for extremely low levels of alpha activity when equipped with alpha/beta separation electronics.

The counter is equipped with unique 3 Low Level PMT technology to support low level TDCR counting, active guard detector for subtracting environmental background and modern MS Windows software for user-friendly operation. The design with small footprint and low weight allows integration into small laboratories and makes the system truly transportable. Instrument is delivered with dedicated laboratory table with wheels.

The instrument has min. 70 mm extended internal Pb shielding design for low background.

There is no external radioactive standard needed. Transportation and movement of standard instrument does not require licenses for handling radioactivity and decommissioning is easy and low cost.

The instrument is intended for professional laboratory research use by trained personnel

### Isotopes

Detection of beta and alpha radiation by Liquid Scintillation Counting (LSC)

- beta-emitters on LSC mode up to 2,000 keV.
- alpha-emitters on LSC mode up to 10,000 keV
- Preset protocols: H-3 (unquenched, high water load and low water load), C-14, S-35, P-33, P-32, I-125 and Free. Other nuclides and Cerenkov counting can be easily defined.
- Up to 4 energy regions (ROI) can be defined in same measurement

### Analysis of data

- Multi-Channel Analysis
- 2 x logarithmic MCA with 1024 channels each
- Beta Spectrum Analysis using Report Render analysis program
- Quench curve analysis on MikroWin 2000 data reduction software or on MS Excel macro.
- Quench correction by TDCR method, External Eu-152 standard (option), quench curve method

### Counting modes

- Beta (all coincidences), beta triple (triple coincidences), and alpha counting (a/b-separation, option)
- Direct measurement of beta efficiency by triple to double coincidence ratio
- Triple counting mode for luminescence free counting and for low level counting

### Physical Dimensions

- Table: 1000 mm (Width) x 700 mm (Depth) x 590 mm (Height)
- 300 SL: 520 mm (Width) x 630 mm (Depth) x 680 mm (Height)
- Total weight 180 kg

### Operating conditions

- +10°C - +40°C; maximum relative humidity 80% for temperatures up to 31 °C decreasing linearly to 50% relative humidity at 40°C.
- Indoor use only



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- Dust during operation: The system shall function in normal laboratory environment.
- Light during operation: The system shall function normally in normal ambient laboratory illumination

## Storage and transport conditions

- Transportation conditions -40°C to +70°C, humidity 5 - 90 %, packed in transport{ XE "Transport" } packaging
- Storage conditions -25°C to +50°C, humidity 5 - 90 %, packed in transport{ XE "Transport" } packaging

## Electrical Connections

- Voltage: 100 ~ 240 VAC
- Frequency: 50 - 60 Hz
- Normal Power Consumption: <100W
- Max. Power Consumption: 350W

## Samples

- Vials: 5 mL, 7 mL and 20 mL
- Vials require cap with flat surface to enable pneumatic gripping.
- Vial compatibility must be confirmed with Hidex.
- Vials are placed in a rack with 96 x 5 mL, 96 x 7ml vials and 40 x 20ml vials
- rack system can be integrated with liquid handlers and cell harvesters

## Counting time

- 1 second - 168 h (7 d) /sample.
- Max number of repeats in one measurement protocol is 1024 (facilitates kinetic measurements)

## Vial transport

- Robotic loading arm with pneumatic mechanism removes the need for a complex elevator mechanism.

## Static electricity

- By deionizer prior the movement of the vial to detector.
- Deionization time can be defined by user at 1 second intervals

## Quench correction by

The instrument has automatic color, chemical and luminescence (quenching) detection and correction. Quench correction can be done using:

### 1. TDCR method

- Allows automatic direct DPM counting of single beta emitters without the use of External standard source or quench curve method
- Allows automatic direct DPM counting of samples labeled with dual beta emitters, and with constant quench, without the use of external radioactive standard source or quench curve method
- Deviation from true DPM is +/- 10 % (+/- 5 % typical) depending on the isotope and on the degree of quenching
- Accuracy of TDCR method can be increase down to +/- 2 % by combining with quench curve method

### 2. External Eu-152 standard (option)

- suggested only for double and triple labeled samples with variable quench
- requires fitting of the results on standard curve

### 3. Quench curve method

- set of quench standards required for each isotope measured
- can be used to improve the accuracy of TDCR method

### 4. Instant DPM

- by TDCR method

## Instrument operation and software

Counter can be operated using:

- MS Windows based, CFR 21 part 11 compliant MikroWin 2000 user interface software



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- Hidex Control Software

Data reduction by:

- MS Windows based, CFR 21 part 11 compliant MikroWin 2000 software
- Excel based Report Render spectral analysis software
- By user definable export format (txt, xls, csv, etc.) to any other data reduction software or data base.

MikroWin 2000 parameter-files for measurement for most typical isotopes and applications are available at parameter library included in all instrument deliveries.

The parameter files include predefined settings for running the assay and calculation formulas for printing out desired data. MikroWin 2000 software includes capabilities for biological assays, immunoassays, screening type assays, data validation and control history.

Analysis of data includes features such as automatic calculation of activity, normalization of results, background subtraction, precision, error of measurement, minimum detectable activity, analysis of kinetic data, analysis of dual- and triple label data, half-life correction, etc. Also sample identification with sample number, position in the rack and with user definable ID is facilitated.

Report Render spectral analysis software enables convenient and easy-to-use tools for optimizing FOM, analysis of spectra and background spectral subtraction. It also incorporates useful two-dimensional alpha-beta separation graph for validating alpha-beta separation performance.

MikroWin 2000 software is compatible with Windows 98, 2000, XP, Vista and Windows 7

Results are saved permanently in the data-file in computer memory after counting of each sample.

### Communication connections

- Output port using the industry-standard RS-232 serial interface allows communication with PC.
- USB optional

### Detectors

Three low background PMTs provide optimum measurement geometry and facilitate TDCR counting

- 3 x 1.5 inch Low Level Single Photon Counting Photo Multiplier Tube (PMT)
- Spectral range from 300 nm to 630 nm
- PMTs 120 degrees apart from each other

### Detector Shielding

- Optimal Pb shield design with an extended 4-pi 70 mm shielding of PMTs in all directions provides low background and minimizes instrument weight.
- Lead shutter provides optimum shielding from cosmic radiation
- Copper shielding around the measurement chamber eliminates x-rays from Pb shield.
- Active guard detector for subtracting environmental background
- Measurement chamber with high reflective opaque paint maximizes light collection.

### Performance Specifications

All the measurements are performed at temperature of  $22\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  and at normal humidity conditions of Hidex laboratory, Turku, Finland (relative humidity not measured). Background may vary locally depending on natural environmental radiation.

Counting efficiency:

- Counting efficiency typical  $> 70\%$  for H-3 and typical  $> 96\%$  for C-14 with unquenched samples.
- $> 35\%$  for H-3 quenched (8 mL water sample + 12 mL AquaLight cocktail)
- $\alpha$ 's (Po-210, U-234/238, Am-241, Rn-222, Ra-226)  $> 95\%$

Typical background:

- 3.5 CPM with 8 mL water + 12 mL AquaLight Low Level cocktail.

\*Background value measured using window with 25 % counting efficiency.



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### FOM ( $E^2/B$ ):

- H-3 in water, optimized window > 220
- H-3 unquenched Low Level standards, optimized window > 350
- C-14 unquenched Low Level standards, optimized window > 1150

### Count Rate

- up to 3.999.999 CPM, with MCA

Resolution: 0.02 keV - 12.5 keV, unquenched conditions.

### Lowest Limit of Detection (LLoD)

- Depends on factors such as the isotope, sample matrix, counting time and sigma value
- Lowest limit of detection for H-3 in water:
  - 8.1 Bq/l, 1 h counting time, optimized window,  $\sigma = 4.65$  (5.4 Bq/L,  $\sigma = 3.0$ )
  - 5.7 Bq/l, 2 h counting time, optimized window,  $\sigma = 4.65$  (3.8 Bq/L,  $\sigma = 3.0$ )
  - 2.8 Bq/l, 6 h counting time, optimized window,  $\sigma = 4.65$  (1.9 Bq/L,  $\sigma = 3.0$ )

$$*LLoD = \sigma / (\text{Eff} * V) * \sqrt{(Bg / \text{time}) / 60}$$

### Performance Assessment

- Using standard samples
- OQ parameter file with history log
- Standards with OQ history log can be included in all measurements

### Data recovery

Automatic storing of measured data in data-file created before the start of the measurement.

The data of every sample is stored permanently in computer hard disk after completing the measurement of that particular sample.

### Vial recovery

Automatic return of sample vials after power failure.

### Power up diagnostics

- Automatic power up diagnostics of instrument settings.

### Safety Standards

- CE marked
- External power UL/CSA approved

### Warranty

- 12 months

### Maintenance

- No recommended spares during the warranty period
- Extended warranty and maintenance & service program available on request.

### 21 CFR Part11 compliance

- Included with MikroWin 2000 software delivery

### Equipment included in the delivery

- 425-201 Hidex 300 SL with dedicated table with wheels
- Owner's Handbook (on CD)
- Rack for 40 x 20 mL vials
- Rack for 96 x 7 mL vials
- Power supply 100-240V/24V
- RS-232 cable
- Hidex Control Software for service use
- Excel based Report Render spectral analysis software
- MikroWin 2000 counter control and data reduction software with parameter file library for most common



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isotopes and applications (21 CFR part11 compliant)

- Parameter library for MikroWin software
- QC report

## Optional Items

### 425-2001 Incubation specifications

- Cools down and stabilize the instrument 5°C below the ambient temperature

### 525-003 Alpha-beta separation

- High performance alpha beta separation.
- Easy to use two dimensional alpha beta separation plot for convenient separation optimization.
- No need to use pure standards to optimize separation conditions before counting
- Ultra low misclassification at 0.5 % on 100 000 CPM of activity
- Alpha background typically 0.3 CPM for Gross Alpha
- Alpha background typically < 0.1 CPM for specific energies
- Resolution 300 keV at 5 MeV using frosted or teflon coated vials

### 425-019 External Eu-152 standard

- External standard is needed with double label variable quench applications only.
- Low activity 74 kBq Eu-152. Under the IAEA free limit

### PC, keyboard and printer

- Can be obtained locally
- Requirements of the PC:
  - MikroWin Hidex 2000 runs under Microsoft Windows 98, Windows NT 4.0, Windows 2000, Windows XP, Windows Vista and Windows 7 operating systems.
  - The computer requires a minimum of 32 MB available memory (64 MB or more is preferable).
  - Super VGA or higher resolution monitor is required (XGA is recommended)
  - Depending on installation options, a MikroWin Hidex 2000 installation requires 10 to 15 MB of available hard-disk space.
  - If there is not serial port in the PC, a USB to serial adapter must be included in the delivery to facilitate communication.
  - MS Excel is suggested to facilitate installation of Report Render spectral analysis software
  - Internet connection is suggested to facilitate updates from software manufacturer and remote desktop support from Hidex.

### Manufacturer

Hidex Oy, Mustionkatu 2, FIN-20750 Turku, Finland

Data and specifications are subject to change, Hidex reserves the right to alter specifications.

No maximum is specified for background values.

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