

DR/4000 UV-VIS Spectrophotometer



The totally integrated, **complete** laboratory testing solution
that makes analysis easy, **accurate** and more
convenient than ever before.

DR/4000 UV-VIS Spectrophotometer



The DR/4000 Spectrophotometer is a powerful scanning spectrophotometer that gives you advanced capabilities and performance over any other instrument in its class.

- Expand your laboratory's testing abilities using the ultraviolet (UV) testing capabilities for applications and measurements requiring wavelengths not available on visible-light-only spectrophotometers.
- Speed analysis of a wide range of samples and enable your analysts to carry out unique experiments using preprogrammed procedures and storage capacity for custom calibrations.
- Study kinetics using time-course measurement or complete other research projects using its ability to automatically complete multiple scans.

The DR/4000 is ideal for analyzing compounds that require multiple wavelengths, longer path lengths or time course operations. It is available in two models:

- DR/4000 U has ultraviolet and visible spectrum analysis capabilities with a range of 190 to 1100 nm.
- DR/4000 V has visible spectrum capabilities with a range of 320 to 1100 nm.

Expand Your Capabilities

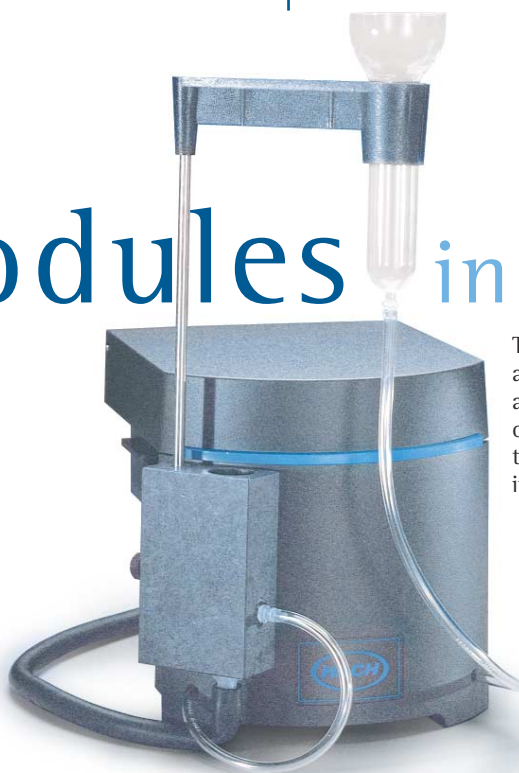
The DR/4000 is ideally suited for applications in diverse fields such as **water and wastewater treatment, industrial processes, quality control, food and beverage processing, pharmaceutical production and chemical synthesis.** And because the DR/4000 Spectrophotometer is part of a complete solution that supplies everything you need to run even the most complicated tests, you can expand your testing capabilities. You get:

- An intuitive user interface to simplify the most complex methods.
- 130 Preprogrammed Hach methods, which are proven procedures based on EPA accepted standard methods.
- Illustrated manuals – one for operating the instrument plus another for running the tests.
- The best personal service and technical support right from Hach, as close as your telephone.

While other spectrophotometers may claim they are easy to use, none can offer the total integration of reagents, methods, reference manuals and service that distinguishes a Hach system from the others.



Switch Modules in Seconds



The patented modular sample compartment accommodates a variety of innovative accessories. Modules and cell holders swap out in seconds without having to turn off the DR/4000. See page 12 for more information about module configurations.

The DR/4000 Surpasses Comparable Spectrophotometers

Designed to increase productivity and efficiency without sacrificing accuracy, the DR/4000 outperforms any other spectrophotometer in its class. Take a closer look at its advanced features – all included with the instrument unless otherwise noted.

Resolution and Accuracy

The DR/4000 gives you industry-leading accuracy and outstanding precision for the most reliable test results. You can set the wavelength step size as small as 0.1 nm, and the sample blank correction feature permits automated measurements with precision and stability. And when you power up the DR/4000, it automatically aligns the lamp, performs a wavelength calibration and an offset correction; and performs memory, voltage and system tests.

Scanning Measurements

The DR/4000 U can scan across the range of 190 to 1100 nm, while the DR/4000 V scans from 320 to 1100 nm. With the scan overlay, scan add and scan subtract features, you can easily analyze and compare sample results. The DR/4000 U automatically performs lamp changeover when it moves from visible to UV wavelengths.

Ergonomic Graphic Display

The large, liquid crystal display is backlit to reduce eyestrain and fatigue, and brightness and viewing angle can be adjusted according to your preferences. During instrument operation, the display shows you a graphical representation of the calibration curve and data points along with quantitative data generated during the actual analysis.



Flexible Sample Handling

The innovative, patented modular sample compartment can accommodate multi- or single-cell holders. In addition to handling one-inch, one-centimeter, five-centimeter and 10-centimeter sample cells, the DR/4000 also accommodates:

- four-, five- and six-position carousels
- microcell adapters
- 16-millimeter (COD, Test 'N Tube™, and UniCell™) vial adapters
- AccuVac® Ampul adapters
- Temperature control module

Sipper Modules and Flow-Cell Modules can also be used for increasing sample throughput.

Data Storage and Recall

Store, recall or print data with the push of a button. Store and recall up to 200 data points, 10 spectral scans and 10 time course scans automatically or manually. Print data or send it to a computer at the time of measurement or upon recall by simply pressing the print key.

Exceptional Stability and a Space-Saving Design

The DR/4000 Spectrophotometer's optical design provides an exceptionally stable analysis system in a small, efficient package. The DR/4000 goes through an internal, self-test procedure upon power-up with visual feedback on the display.

Computer Interface

Because results documentation is an integral component of the analysis process, the DR/4000 is equipped to download data to a printer, PC or LIMS. Data can be output as a text file for spreadsheet or word processing software applications.

Multi-Language Capability

Display messages guide you through proper key sequences for each testing and programming procedure. The system comes pre-installed with six languages: English, French, Spanish, German, Portuguese and Japanese.



HachLink™ Software* Ensures Data Integrity

Using the intuitive HachLink Software will help your program meet GLP requirements for data collection. This Microsoft® Windows®-compatible software program, available as an option, enables your personal computer to capture fresh or stored data from the DR/4000 and transfer it to text files or to Microsoft® Excel. The software automatically records instrument, test and sample data at the push of a button.

HachLink system requirements:

- IBM PC/AT or compatible with a 486/100 mHz or higher processor
- 3MB of RAM
- Hard-disk drive with at least 20MB of free space
- 3.5" 1.44 MB floppy disk drive or CD-ROM drive
- VGA graphics with 640 x 480 or higher resolution, 256 colors
- Mouse or other pointing device
- 9-pin serial port or 25-pin serial port with 9 pin adapter
- Windows® 95/98/2000 or NT 4.0
- Computer interface cable

**Not included*

Advanced Software Guides You Through Each Test

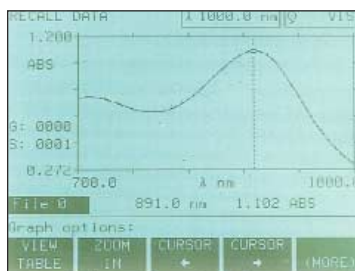
Conduct Sophisticated Experiments

The DR/4000's advanced software enables you to conduct experiments on challenging samples. Most operations can be accomplished with just a few keystrokes, and intuitive messages guide you from one screen to the next.

Here's an illustration of how to study a new analyte using a phosphorus test as an example.

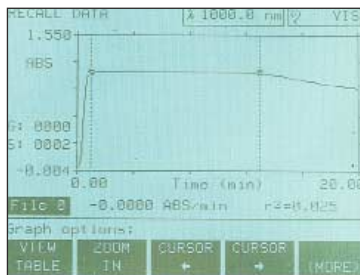
Scanning Function

First, identify the optimum wavelength at which the study should be conducted by scanning across the wavelength range. Just select the wavelength scan range, key in the rate at which the data will be collected, and select either %T or ABS. You will then be prompted by the instrument to take a baseline and start the data collection. The data is available either tabulated or displayed in a graphical form, with peaks and valleys located automatically. Zoom in or out to view a selected range of data. Automatically or manually store the scan for future recall. Scans may be overlayed, and then added or subtracted.



Time-Course Function

In the next phase of the experiment, you may wish to ascertain the length of time required for maximum color development in the test sample. With a DR/4000, you can monitor changes in %T or ABS at a single wavelength over a defined period of time. Just select the wavelength, key in the time period (hours, minutes or seconds) and select either %T or ABS. The instrument will store the data, which can be recalled onto the screen in graphical or tabular form for further study.



User Calibration

In the final phase of the study, you must generate a calibration curve. After selecting the option for user-entered calibrations, you are prompted to enter the appropriate information into a table. As the measurements are made, the DR/4000 prompts you for each standard sample. Once the data collection is completed, the DR/4000 prompts you to select linear, quadratic, cubic or piece-wise linear formulas. The calibration curve is displayed in graphical or tabular format for review. If desired, you can add more points or delete outliers. You can also identify alternative chemical species (P instead of PO_4^{3-} for example) at this time, if desired.

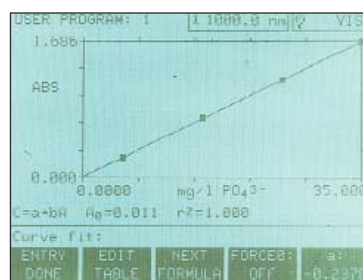
Custom Calibrations

Store up to 200 of your own calibrations in its memory. Each calibration curve can contain up to 16 data points. A simple programming procedure makes it easy to key in your data to adapt the instrument to your laboratory's protocols or special testing requirements. The DR/4000 accommodates any test within its analysis range. Just establish a calibration curve using the appropriate data or standards, and store.

Preprogrammed Calibrations

More than 130 preprogrammed Hach methods are permanently stored in the instrument's non-volatile memory. You can call up wavelength measurements with just a few keystrokes, and a user-oriented interface guides you through each procedure.

As new methods become available, they are packaged into software upgrades you can purchase to update your DR/4000.



Program	Parameter	Limit
1	Phosphate	35.000 mg/l
2	(unnamed)	(none)
1050	Arsenic As	0.201 mg/l
1690	Copper, Autocatal.	3.30 g/l
2850	Palladium Pd	275 mg/l
3100	Potassium K	7.7 mg/l

Program to run? 1

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Program	Parameter	Limit
2500	N, Total, TH1, TNT	25.0 mg/l
2600	Nitrite, HR	250 mg/l
2610	Nitrite, LR	0.3000 mg/l
2620	Nitrite, LR AV	0.3000 mg/l
2630	Nitrite, TNT	0.5000 mg/l
2650	O, Dissol. LR HV	1000 ug/l

Program to run? 2630

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Standard Additions

To ensure confidence in your results, the DR/4000 includes a standard additions option. Just key in the appropriate information, add an aliquot of standard to your sample and the DR/4000 calculates the percent recovery. Used with Hach calibrations or user-entered methods, standard additions can identify interferences, bad reagents or faulty procedures.

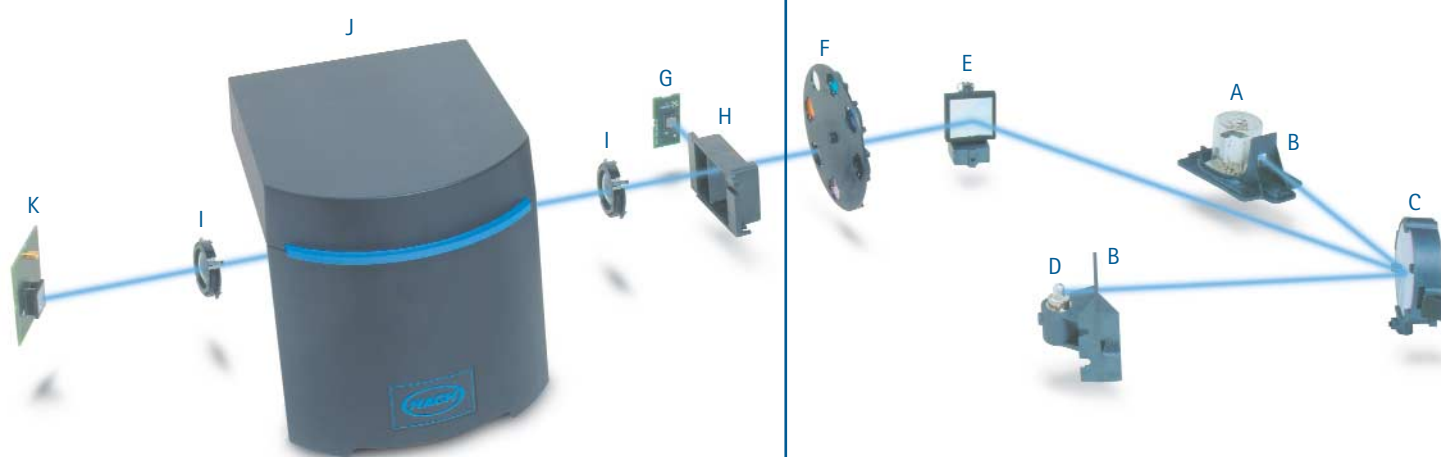
Multiwavelength Analysis

With the DR/4000, you can measure a sample at up to four different wavelengths, in rapid succession, in one operation.

Sophisticated Optics

The DR/4000's optical system consists of a Seya-Namioka split-beam diffraction grating monochromator, a light source and silicon photodiode detectors. Innovative reference beam technology ensures stable, accurate readings. A halogen gas-filled tungsten lamp is the light source for visible spectrum analysis, while a deuterium lamp provides the light source for UV analysis. When you power up the DR/4000, a self-test procedure checks offset correction, wavelength calibration, lamp alignment, memory system and voltages.

When the light source is activated, the optics system separates the light into a monochromatic beam, which passes through the sample cell to the photodetector. The photodetector responds to the light's intensity and relays that information to the microprocessor. Readout displays in concentration, ABS or %T.



- Deuterium Lamp A
- Aperture Stop B
- Rotating Concave Spherical Mirror C
- Tungsten Halogen Lamp D
- Rotating Concave Holographic Grating E
- Order Sorting Filter F
- Reference Detector G
- Fused Silica Beam Splitter H
- Convex Fused Silica Lens I
- Sample Cell J
- Measurement Detector K

Sample Specification for DR/4000 UV-VIS



The spectrophotometer is a scanning, laboratory instrument capable of analysis in the near infrared, visible and ultraviolet spectrum. It has an intuitive user interface to simplify complex methods; proven, preprogrammed procedures based on accepted standard methods; illustrated manuals for both operating the instrument and running the tests; and technical support available by telephone and/or web site.

A backlit, liquid crystal display screen is provided for the graphical display of spectral scans, calibration curves and data points along with quantitative data generated during the analysis. Display contrast and viewing angle is adjustable. Operator-selectable readout modes is available for concentration, ABS and %T. Alpha-numeric prompting messages and menus is provided on the display in multiple languages including English, French, Spanish, German, Portuguese and Japanese.

The spectrophotometer is capable of automated scanning, multiple wavelength and time course operations and accommodates a variety of sample cells including 1-inch, 1-cm, 5-cm, 10-cm, 16-mm and microcells. A standard additions option is available to identify interferences, bad reagents or faulty procedures. The instrument has the ability to measure a sample at up to four different wavelengths in rapid succession in one operation. Scan overlay, scan add and scan subtract features are available to enable users to easily analyze and compare sample results.

The spectrophotometer has a patented quick change, plug-in modular sample compartment that accommodates Single Cell Modules, Carousel Modules, Sipper Modules, Flow-Cell Modules and Temperature Control Modules. Modules and cell holders swap out easily without having to power down the unit.

The optical system is composed of a Seya-Namioka split-beam monochromator, tungsten halogen (visible spectrum) and deuterium (UV spectrum) light sources, and silicon photodiode detectors. The monochromator provides a full 190 to 1100-nm wave-length range with a nominal spectral bandwidth of 4 nm. Wavelength step size has the ability to be set as small as 0.1 nm. A sample blank correction feature permits precise and stable automated measurements. The spectrophotometer provides automated changeover between visible and ultraviolet source lamps. Wavelength accuracy is ± 1 nm. The spectrophotometer carries out an automated self-test at power-up, including wavelength calibration, automatic lamp alignment, offset correction, and memory, voltage and system tests.

A read-only memory (ROM) is provided with preprogrammed calibration data for more than 130 colorimetric test procedures to provide direct readout in concentration mode without the need for calculations or calibration curves. The instrument provides storage of up to 200 user-generated calibrations with linear, cubic, quadratic and piecewise curve-fitting capability. It has the capacity to store up to 200 data points, 10 spectral scans, and 10 time course scans, and is able to store, recall or print data with the push of a button. Users have the ability to download data to a printer, PC or LIMS, and, using Microsoft® Windows®-compatible software, output it as a text file or spreadsheet.

The spectrophotometer is constructed of impact-resistant structural plastic and carries either the ETL certification mark for UL and CSA safety standards (AC line power is auto selectable for 95 to 240 Vac, 50/60Hz) or the European Union (CE) certification mark (European model).



Parameters, Methods,

The table below lists test ranges, methods of analysis and corresponding reagent sets for the DR/4000 Spectrophotometer. The complete procedure for each test is included in the manual supplied with the instrument. The ranges are given for the precalibrated instrument readout; higher ranges can be analyzed by sample dilution.

Test	Method	DR/4000 Range	EDL***	Cat. No.
Aluminum	Aluminon	0-0.800 mg/L	0.005	22420-00
Aluminum	Eriochrome Cyanine R	0-0.250 mg/L	0.002	26037-00
Aluminum, <i>UniCell</i> ™	Chromazurol S	0.02 - 0.50	0.02	HCT 150+++
Ammonia, Free (Monochloramine and Nitrogen)	Indophenol	0.02-0.50 mg/L	--	28797-04
Ammonium, <i>UniCell</i> ™	Indophenol	0.05-1.50 mg/L	0.05	HTC 100
Ammonium, <i>UniCell</i> ™	Indophenol	1.50-45.0 mg/L	1.5	HTC 102
Arsenic (USEPA)	Silver Diethyldithiocarbamate	0-0.200 mg/L	NA	--
Barium	Turbidimetric	0-100 mg/L	NA	12064-66
Barium (AccuVac®)	Turbidimetric	0-100 mg/L	NA	25130-25
Benzotriazole	UV Photolysis	0-16.0 mg/L	0.3	21412-99
Boron	Carmine	0-14.0 mg/L	0.4	14170-99
Boron, LR	Azomethine-H	0-1.50 mg/L	0.02	26669-00
Bromine	DPD	0-4.50 mg/L	0.03	21056-69
Bromine (AccuVac®)	DPD	0-4.50 mg/L	0.02	25030-25
Cadmium	Dithizone	0-80 µg/L	1.3 µg/L	22422-00
Cadmium, <i>UniCell</i> ™	Cadion/CN-	0.02 - 0.30	0.02	HCT 154+++
Chloramine, mono, LR	Indophenol	0-4.50 mg/L	0.09	28022-46
Chloramine, mono, HR	Indophenol	0-10.0 mg/L	0.1	28051-45
Chloride	Mercuric Thiocyanate	0-25.00 mg/L	0.24	23198-00
Chlorine, free (USEPA)	DPD	0-2.00 mg/L	0.01	21055-69
Chlorine, free (AccuVac®) (USEPA)	DPD	0-2.00 mg/L	0.01	25020-25
Chlorine, free, Test 'N Tube™	DPD	0-5.00 mg/L	0.04	21055-45
Chlorine, free, HR	DPD	0-5.00 mg/L	0.02	14070-99
Chlorine, total (USEPA)	DPD	0-2.00 mg/L	0.01	21056-69
Chlorine, total (AccuVac®) (USEPA)	DPD	0-2.00 mg/L	0.01	25030-25
Chlorine, total, Test 'N Tube™	DPD	0-5.00mg/L	0.04	21056-45
Chlorine, total, ULR (USEPA)	DPD	0-500 µg/L	3 µg/L	25630-00
Chlorine, total, HR	DPD	0-5.00 mg/L	0.02	14064-99
Chlorine dioxide	DPD	0-5.00 mg/L	0.04	27709-00
Chlorine dioxide (AccuVac®)	DPD	0-5.00 mg/L	0.04	27710-00
Chlorine dioxide, LR	Chlorophenol Red	0-1.00 mg/L	0.02	22423-00
Chlorine dioxide, MR	Direct Reading	0-50 mg/L	0.6	--
Chlorine dioxide, HR	Direct Reading	0-1000 mg/L	2	--
Chlorophyll-a	Acetone Extraction	--	--	27480-00
Chromium, hexavalent (USEPA)	1,5-Diphenylcarbohydrazide	0-0.700 mg/L	0.006	12710-99
Chromium, hexavalent (AccuVac®) (USEPA)	1,5-Diphenylcarbohydrazide	0-0.700 mg/L	0.005	25050-25
Chromium, hexavalent (for soil)	1,5-Diphenylcarbohydrazide	0-0.700 mg/L	0.006	12710-99
Chromium, total	Alkaline Hypobromite Oxidation	0-0.700 mg/L	0.003	22425-00
Chromium, <i>UniCell</i> ™	H ₃ PO ₄ , Peroxodisulfate, Diphenylcarbazide	0.03 - 1.00	0.3	HCT 156+++
Chromium, trivalent	Colorimetric	0-20.0 g/L	0.1 g/L	--
Cobalt	PAN	0-2.00 mg/L	0.01	26516-00
Color	ADMI	0-250 units Pt-Co	3 ADMI	--
Color, Gardner	ASTM D 6166-97	1-18 units	--	--
Color, True and Apparent	Platinum-Cobalt	0-500 units	2 units Pt-Co	--
Color, Tristimulus and Chromaticity	ASTM E 308-95	--	--	--
Color, Yellowness Index	ASTM E 313-96	--	--	--
Copper (USEPA)	Bicinchoninate	0-5.000 mg/L	0.021	21058-69+
Copper (AccuVac®) (USEPA)	Bicinchoninate	0-5.000 mg/L	0.020	25040-25+
Copper	Porphyrin	0-210.0 µg/L	1.4 µg/L	26033-00
Copper, autocatalytic	Colorimetric	0-3.00 g/L	--	1042-66
Copper, <i>UniCell</i> ™	Bathocuproin	0.1 - 6.00	0.1	HCT 163+++
Cyanide	Pyridine-Pyrazalone	0-0.240 mg/L	0.0003	24302-00
Detergents, anionic	Crystal Violet	0-0.275 mg/L	0.005	24468-00
Fluoride (Reagent Solution) (USEPA)	SPADNS	0-2.00 mg/L	0.02	444-49++
Fluoride (AccuVac®) (USEPA)	SPADNS	0-2.00 mg/L	0.04	25060-25++
Fluoride, <i>UniCell</i> ™	SPADNS	0.1 - 1.5	0.1	HCT 132
Formaldehyde	MBTH	0-500 µg/L	6 µg/L	22577-00
Hardness, total, ULR	Chlorophosphonazo	0-1000 µg/L	4 µg/L	26031-00
Hardness, calcium and magnesium as CaCO ₃	Calmagite Colorimetric	0-4.00 mg/L	0.03	23199-00
Hydrazine	p-Dimethylaminobenzaldehyde	0-600 µg/L	2.4 µg/L	1790-32
Hydrazine (AccuVac®)	p-Dimethylaminobenzaldehyde	0-600 µg/L	4.3 µg/L	25240-25
Iodine	DPD	0-7.00 mg/L	0.04	21056-69
Iodine (AccuVac®)	DPD	0-7.00 mg/L	0.04	25030-25
Iron	FerroZine®	0-1.400 mg/L	0.004	2301-66
Iron, ferrous	1,10-Phenanthroline	0-3.000mg/L	0.008	1037-69
Iron, ferrous (AccuVac®)	1,10-Phenanthroline	0-3.000 mg/L	0.007	25140-25
Iron, total (USEPA)	FerroVer®	0-3.000 mg/L	0.008	21057-69+
Iron, total (AccuVac®) (USEPA)	FerroVer®	0-3.000 mg/L	0.007	25070-25+
Iron, total	FerroMo™	0-1.800 mg/L	0.025	25448-00
Iron, total	TPTZ	0-1.800 mg/L	0.022	26087-99
Iron, total (AccuVac®)	TPTZ	0-1.800 mg/L	0.008	25100-25
Iron, <i>UniCell</i> ™	Phenanthroline	0.1 - 5.00	0.1	HCT 159+++
Lead (USEPA)	Dithizone	0-300 µg/L	3 µg/L	22431-00+
Lead (LeadTrak™)	Fast Column Extraction	0-150 µg/L	2 µg/L	23750-00
Lead, <i>UniCell</i> ™	PAR/CN-	0.1 - 2.00	0.1	HCT 152+++
Manganese, LR	PAN Method	0-0.700 mg/L	0.005	26517-00
Manganese, HR (USEPA)	Periodate Oxidation	0-20.0 mg/L	0.1	24300-00+
Mercury	Cold Vapor	0.1-2.5 µg/L	0.1 µg/L	26583-00
Metals Prep Set, <i>UniCell</i> ™	--	--	--	HCT 200+++
Molybdenum, Molybdate, LR	Ternary Complex	0-3.00 mg/L	0.03	24494-00
Molybdenum, Molybdate, HR	Mercurioacetic Acid	0-50.0 mg/L	0.1	26041-00
Molybdenum, Molybdate, HR (AccuVac®)	Mercurioacetic Acid	0-50.0 mg/L	0.1	25220-25
Monochloramine	Salicylate	0-0.50 mg/L	0.003	26184-00
Monochloramine (AccuVac®)	Salicylate	0-0.50 mg/L	0.003	25210-98
Monochloramine (Free Ammonia and Nitrogen)	Indophenol	0.02-0.50 mg/L	--	28797-04
Nickel (USEPA)	Heptoxime	0-1.80 mg/L	0.01	22435-00+

Reagent Sets and Ranges

Parameters marked (USEPA) are USEPA-approved or accepted for reporting purposes; sample pretreatment may be required on some procedures. If no reagent set is listed for a parameter, order needed reagents and supplies separately.

Test	Method	DR/4000 Range	EDL ***	Cat. No.
Nickel	PAN	0-1.000 mg/L	0.005	22426-00
Nickel, autocatalytic	Photometric	0-8.00 g/L	0.05 g/L	14321-98
Nickel, <i>UniCell</i> ™	Dimethylglyoxime	0.1 - 6.00	0.1	HCT 167†††
Nitrate, <i>UniCell</i> ™	Dimethylphenol	1.0-60.0 mg/L	1.0	HCT 106
Nitrogen, ammonia (USEPA)	Nessler	0-2.500 mg/L	0.017	24582-00††
Nitrogen, ammonia	Salicylate	0-0.80 mg/L	0.09	22437-00
Nitrogen, ammonia LR Test 'N Tube™	Salicylate	0-2.500 mg/L	0.031	26045-45
Nitrogen, ammonia HR Test 'N Tube™	Salicylate	0-50.0 mg/L	0.6	26069-45
Nitrogen, Monochloramine and Free Ammonia	Indophenol	0.02-0.50 mg/L	--	28797-04
Nitrogen, Nitrate	UV Direct Reading	0-10.2 mg/L	0.2	23213-53
Nitrogen, Nitrate, LR	Cadmium Reduction	0-0.50 mg/L	0.01	24298-00
Nitrogen, Nitrate, MR	Cadmium Reduction	0-5.0 mg/L	0.1	21061-69
Nitrogen, Nitrate, MR (AccuVac®)	Cadmium Reduction	0-5.0 mg/L	0.1	25110-25
Nitrogen, Nitrate, HR	Cadmium Reduction	0-30.0 mg/L	0.5	21061-69
Nitrogen, Nitrate, HR (AccuVac®)	Cadmium Reduction	0-30.0 mg/L	0.3	25110-25
Nitrogen, Nitrate HR Test 'N Tube™	Chromotropic Acid	0-30.0 mg/L	0.2	26053-45
Nitrogen, Nitrite, LR (USEPA)	Diazotization	0-0.3000 mg/L	0.0008	21071-69
Nitrogen, LR (AccuVac®) (USEPA)	Diazotization	0-0.3000 mg/L	0.004	25120-25
Nitrogen, Nitrite, LR Test 'N Tube™	Diazotization	0-0.5000 mg/L	0.0013	26083-45
Nitrogen, Nitrite, HR	Ferrous Sulfate	0-25.0 mg/L	1	21075-69
Nitrogen, total, <i>UniCell</i> ™	Alkaline Digest/Dimethylphenol	5.0-40.0 mg/L	5	HCT 111*
Nitrogen, total Inorganic Test 'N Tube™	Titanium Trichloride Reduction	0-25.0 mg/L	0.3	26049-45 26045-45
Nitrogen, total Test 'N Tube™	Persulfate Digestion	0-25 mg/L	2	26722-45*
Nitrogen, total, HR Test 'N Tube™	Persulfate Digestion	10-150 mg/L	7	27141-00*
Nitrogen, total Kjeldahl	Nessler	0-150 mg/L	1.2	24953-00†
Organics Constituents, UV Absorbing	Direct	--	--	26415-53
Oxygen demand, chemical, ULR	Reactor Digestion	0-40 mg/L	0.2	24158-25*
Oxygen demand, chemical (USEPA)	Reactor Digestion	0-150 mg/L	1.1	21258-25*
Oxygen demand, chemical, HR (USEPA)	Reactor Digestion	0-1500 mg/L	3	21259-25*
Oxygen demand, chemical, HR Plus	Reactor Digestion	0-15,000 mg/L	30	24159-25*
Oxygen demand, chemical	Manganese III Digestion	20-1000 mg/L	4	26234-25*
Oxygen, dissolved, LR (AccuVac®)	Indigo Carmine	0-1000 µg/L	10 µg/L	25010-25
Oxygen, dissolved, HR (AccuVac®)	HRDO	0-15.0 mg/L	0.1	25150-25
Oxygen, dissolved, Super HR (AccuVac®)	SHRDO	0-40.0 mg/L	0.2	25150-25
Oxygen Scavengers (DEHA)	Iron Reduction	0-500 µg/L	5 µg/L	24466-00
Ozone, LR (AccuVac®)	Indigo	0-0.25 mg/L	0.01	25160-25
Ozone, MR (AccuVac®)	Indigo	0-0.75 mg/L	0.01	25170-25
Ozone, HR (AccuVac®)	Indigo	0-1.50 mg/L	0.008	25180-25
Palladium	N,N'-Dimethyldithiooxamide	0-250 mg/L	--	23123-00
PCB (in soil)	Immunoassay	--	--	25859-00**
Phenols (USEPA)	4-Aminoantipyrine	0-0.200 mg/L	0.001	22439-00††
Phosphate, <i>UniCell</i> ™	Digestion - Molybdate/Ascorbic Acid	1.5-15.0 mg/L	1.5	HCT121*
Phosphate, <i>UniCell</i> ™	Digestion - Molybdate/Ascorbic Acid	6.0-60.0 mg/L	6	HCT122*
Phosphonates	Persulfate/UV Oxidation	0-2.50 to 0-125 mg/L	0.045 -2.25	24297-00
Phosphorus, acid hydrolyzable, Test 'N Tube™	Ascorbic Acid with Acid Hydrolysis	0-5.00 mg/L	0.17	27427-00*
Phosphorus, reactive	Molybdovanadate	0-45.0 mg/L	0.09	20760-32
Phosphorus, reactive (AccuVac®)	Molybdovanadate	0-45.0 mg/L	0.24	25250-25
Phosphorus, reactive, LR Test 'N Tube™ (USEPA)	Ascorbic Acid	0-5.00 mg/L	0.02	27425-45
Phosphorus, reactive (USEPA)	Ascorbic Acid	0-2.500 mg/L	0.045	21060-69
Phosphorus, reactive (AccuVac®) (USEPA)	Ascorbic Acid	0-2.500 mg/L	0.031	25080-25
Phosphorus, reactive	Amino Acid	0-30.00 mg/L	0.04	22441-00
Phosphorus, reactive, HR Test 'N Tube™	Molybdovanadate	0-100.0 mg/L	5.0	27673-45
Phosphorus, total, digestion (USEPA)	Acid Persulfate Digestion	--	--	2451-99
Phosphorus, total, LR Test 'N Tube™ (USEPA)	Ascorbic Acid with Acid Persulfate Digestion	0-3.50 mg/L	0.06	27426-45*
Phosphorus, total, HR Test 'N Tube™	Molybdovanadate with Acid Persulfate Digestion	0-100.0 mg/L	5.0	27672-45*
Platinum	N,N'-Dimethyldithiooxamide	0-10 g/L	--	24596-00
Polyacrylic Acid	Absorption - Colorimetric	0-20.0 mg/L	0.2 - 0.3	22252-00
Potassium	Tetraphenylborate	0-7.0 mg/L	--	24591-00
Quaternary Ammonium Compounds	Direct Binary Complex	0-5.00 mg/L	0.11	24592-00
Selenium	Diaminobenzidine	0-1.000 mg/L	0.003	22442-00
Silica, HR	Silicomolybdate	0-100.0 mg/L	0.3	24296-00
Silica, LR	Heteropoly Blue	0-1.600 mg/L	0.01	24593-00
Silica, ULR	Heteropoly Blue	0-1000.0 µg/L	1.0 µg/L	25535-00
Silver	Colorimetric	0-0.700 mg/L	0.006	22966-00
Sulfate (USEPA)	SulfaVer® 4	0-70.0 mg/L	--	12065-99
Sulfate (AccuVac®) (USEPA)	SulfaVer® 4	0-70.0 mg/L	--	25090-25
Sulfate, <i>UniCell</i> ™	Barium Sulfate Turbidity	40-150 mg/L	40	HTC 125
Sulfate, <i>UniCell</i> ™	Barium Sulfate Turbidity	150-900 mg/L	150	HTC 126
Sulfide (USEPA)	Methylene Blue	0-800 µg/L	2.4 µg/L	22445-00
Surfactants, Anionic - see Detergents				
Tannin and Lignin	Tyrosine	0-9.00 mg/L	0.09	22446-00
Tolyltriazole	UV Photolysis	0-16.0 mg/L	0.4	21412-99
Total Organic Carbon, HR	Direct	100-700 mg/L	4	27604-45*
Total Organic Carbon, MR	Direct	15-150 mg/L	--	28159-45*
Total Organic Carbon, LR	Direct	0-20.0 mg/L	0.4	27603-45*
Trihalomethanes	THM Plus	6-200 ppb	6 ppb	27908-00
Toxicity	ToxTrak™	0-100% I	--	25972-00
TPH (in soil)	Immunoassay	10 and 100 ppm TPH	--	26026-00**
TPH (in water)	Immunoassay	-	--	26237-00**
Turbidity	Radiation Attenuation	0-5000 FAU	14 FAU	-
Volatile Acid	Esterification	0-2800 mg/L	12	22447-00
Zinc (USEPA)	Zincon	0-3.000 mg/L	0.009	24293-00†
Metals Prep Set	--	--	--	HTC 200

ULR indicates ultra-low range, LR indicates low range, MR indicates mid range, and HR indicates high range.

† Method requires digestion.

†† Method requires distillation.

††† *UniCell*™ metals tests require use of the Metals Prep Set HCT 200 and digestion with DRB 100 Reactor or COD Reactor, all ordered separately, for "total" metal reading.

*Vial test requires digestion; Order the DRB 100 Reactor or COD Reactor separately.

**Additional apparatus required: Microcell adapter, 1-cm (48588-00); immunoassay sample cell (26295-00).

***Estimated Detection Limit, mg/L, unless stated otherwise.

Customize your DR/4000 System with Accessories

The DR/4000 V includes these accessories as standard equipment:

- Single Cell Module
- Pair of 1-inch matched sample cells
- 1-cm cell adapter
- AccuVac® and 16-mm vial adapters
- 1-inch cell adapter
- Illustrated manual set on CD-ROM
- Dust cover
- Replacement tungsten lamp kit
- Power cord

The DR/4000 U includes the above, plus:

- Carousel Module with 1-inch, four-position and 1-cm, six-position carousel inserts
- Pair of 1-cm quartz sample cells

To increase speed and convenience of your analyses, optional accessories for the DR/4000 are also available:

Adapters and Sample Cells

Sipper System

COD/Test 'N Tube™/UniCell™
Carousel Adapter

Flow-Cell Module

Temperature Control Module



Adapters and Sample Cells

A wide choice of adapters and sample cells are available for the DR/4000 to increase your testing flexibility. Select from:

- Six-, five- and four-position cell adapters for multiple sample testing with the Carousel Module.
- 50-mm and 100-mm longpath cells and adapters for increased sensitivity.
- A variety of glass, quartz and plastic disposable sample cells.
- Disposable microcells and a microcell adapter for immunoassay or low volume applications.

Sipper System

The Sipper Module automatically handles small-volume sampling tasks while eliminating cell handling or breakage. In just a few seconds, the Sipper Module's peristaltic pump draws liquid into the sample cell, takes a reading, returns the liquid to the sample source or discharges it to a drain, and then begins the sequence again. This optional accessory is ideal for situations when small sample volumes are necessary, or repetitive tests are required in rapid succession. The Sipper Module options are easily programmed with the DR/4000 menu. Available with a 1-inch or a 1-cm pathlength quartz cell.

To measure smaller sample volumes for biological, pharmaceutical and other research applications, the MicroSipper Module is ideal. This optional module is plumbed at the factory with a 1-cm, 50 µL quartz flow cell. A peristaltic pump delivery system assures repeatability when you're working with batch volumes.

Flow-Cell Module

This module speeds the measurement of multiple samples; eliminates errors caused by using different, unmatched sample cells; and contributes to high sensitivity and accurate measurement of very low concentrations. The Flow-Cell Module, designed to increase precision, also prevents contamination or dilution between successive samples. Available with a 1-inch or 1-cm pathlength quartz cell.

COD/Test 'N Tube™/UniCell™ Carousel Adapter

This five-position, 16-mm sample cell adapter is designed to provide a way to group, record and quickly perform several sample measurements at a time. Configured to accept vials containing chemical oxygen demand, Test 'N Tube™ (chlorine, total nitrogen, nitrate, nitrite, ammonia, phosphorus), and UniCell™ (ammonium, nitrate, total nitrogen, phosphate, and sulfate) premeasured reagents, this carousel speeds testing with minimal human intervention. Depending on the setup menu selected by the analyst, the DR/4000 automatically rotates the sample cells and reads the concentrations in a preprogrammed sequence. An alert sounds when the readings are complete.



Temperature Control Module

This optional module is ideal for samples that need to be kept at constant temperatures or for kinetic or biological research. It uses a 1-cm quartz cell and controls the sample temperature to within $\pm 0.5^{\circ}\text{C}$ from 15 to 50°C .

Technical Support

Whether you need advice about ordering reagents, detecting interferences or entering your own calibrations, technical support staff are as close as your telephone. For intensive training on the DR/4000 and other Hach systems, contact the dealer or distributor serving your area.

Extended Warranty and Certification

In addition to the one-year warranty offered on the DR/4000, Hach also offers an extended warranty agreement, which covers parts and service for your instrument for an additional one to three years. Performance verification services are also available to ensure that your instrument meets factory specifications.



DR/4000 UV-VIS Spectrophotometer

Specifications:

Wavelength range:	
DR/4000 U:	190 to 1100 nm
DR/4000 V:	320 to 1100 nm
Wavelength accuracy:	±1 nm
Monochromator Design:	Seya-Namioka split-beam monochromator
Wavelength calibration:	Internal, automatic at turn-on with visual feedback
Wavelength repeatability:	±0.1 nm
Wavelength resolution:	0.1 nm
Grating:	1200 lines/mm; 8 nm/mm dispersion
Wavelength slew rate:	15,000 nm/minute
Spectral bandwidth:	4 nm nominal, 5 nm maximum,
Source lamp:	Deuterium (DR/4000 U only); Gas-filled tungsten (DR/4000 U and DR/4000 V)
Source lamp change:	Automatic changeover
Display:	Backlit, graphic, liquid crystal display with adjustable viewing angle, contrast control
Photometric range:	-3.0 to 3.0 ABS
Photometric linearity:	±0.002 ABS
Stray light:	>3.3 ABS, <0.05 %T at 220 nm and 340 nm
Readout modes:	Concentration, absorbance, % transmittance
External outputs:	Parallel or RS-232 Serial
Sample compartment:	Modular, easily accessible, interchangeable for diverse testing requirements
Line power:	AC line power selectable for 95 to 240 Vac, 50/60 Hz
Dimensions:	42W x 29D x 16H cm (16.5 x 11.4 x 6.3 in)
Weight:	9 kg (20 lb.)
Compliance:	European CE mark, ETL and ETLc safety marks

Specifications are subject to change without notice.

Catalog Information:

48000-00 DR/4000 U Spectrophotometer

Visible and UV spectrum. Includes 1-inch matched sample cells; 1-cm matched quartz sample cells; Single Cell Module; AccuVac® and 16-mm vial adapters; 1-inch and 1-cm cell adapters; Carousel Module; and carousel inserts (1-inch, four-position and 1-cm, six-position); dust cover; replacement lamp kit; illustrated manual set; and power cord.

48000-02 DR/4000 U Spectrophotometer (European model)

Includes continental European power cord and fuses.

48100-00 DR/4000 V Spectrophotometer

Visible spectrum only. Includes 1-inch matched sample cells; Single Cell Module; AccuVac® and 16-mm vial adapters; 1-inch and 1-cm cell adapters; dust cover, replacement lamp kit; illustrated manual set; and power cord.

48100-02 DR/4000 V Spectrophotometer (European model)

Includes continental European power cord and fuses.

- 48090-03 Sipper Module, 1-inch quartz sample cell
- 48090-06 Sipper Module, 1-cm quartz sample cell
- 48090-07 Sipper Module, Micro 1-cm pathlength quartz cell
- 48070-05 Flow-Cell Module, 1-cm quartz cell
- 48070-04 Flow-Cell Module, 1-inch quartz cell
- 48070-08 Temperature Control Module
- 48070-02 Carousel Module Kit
- 48070-01 Single Cell Module Kit
- 48190-00 1-inch Square Cell Adapter
- 48105-00 1-inch Carousel Adapter, four position
- 48115-00 1-cm Carousel Adapter, six position
- 48186-00 5-cm Single Cell Adapter
- 48118-00 10-cm Single Cell Adapter
- 48588-00 1-cm Microcell Adapter
- 48584-00 1-cm Square Cell Adapter
- 48274-00 COD/TNT/UniCell™, 16-mm Carousel Adapter, five position
- 48189-00 COD/TNT, 16-mm Round Cell Adapter
- 48187-00 AccuVac®, 1-inch Single Round Cell Adapter
- 26126-02 1-inch Glass Sample Cell, matched pair with stoppers
- 26659-02 1-inch Precision Matched Sample Cells, matched pair
- 26659-04 1-inch Precision Matched Sample Cells, set of four
- 26659-08 1-inch Precision Matched Sample Cells, set of eight
- 24102-12 1-inch Polystyrene Sample Cell with cap, 12/pk
- 20951-00 1-cm Glass Sample Cells, matched pair, square
- 26295-00 1-cm Low Volume microcell, plastic, disposable, 100/pk (1.5mL)
- 48228-00 1-cm Quartz Sample Cell, 1 pair with caps
- 26244-50 5-cm Quartz Sample Cell with cap
- 26292-50 5-cm Optical Glass Sample Cell with cap
- 26244-01 10-cm Quartz Sample Cell with cap
- 26292-01 10-cm Glass Sample Cell with cap
- 48129-00 Computer Interface Cable, 6 ft.
- 49665-00 HachLink™ Software
- 49503-00 Printer Cable
- 49544-00 Software Upgrade Package





DR/4000 UV-VIS Spectrophotometer

An exceptional, complete
laboratory analysis
system that includes a
superior instrument,
prepared reagents, proven
methods, complete
instructions and personal
service for running
procedures for

- Water
- Wastewater
- Boiler/cooling water
- Environmental testing
- Water conditioning
- Agriculture
- Foods/beverages
- Chemicals
- Aquaculture
- Pharmaceuticals
- Paint and coatings
- Pulp and paper
- Education
- Research

The DR/4000 increases
productivity, expands testing
capabilities, and provides
accuracy and convenience
in a total solution backed
by the experience and
reputation of Hach.

For current price information,
technical support and ordering
assistance, contact the
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serving your area.

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