



Analytical Innovations of the DPST BEHNERT GMBH

Standard Offer of DPST Electrochemical Electrodes and Accessories

2008



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DPST BEHNERT GMBH
DIREKT POTENTIOMETRISCHE SENSOR TECHNIK

DPST Electrochemical Electrodes and Accessories

An excellent quality standard, carefully manufacturing and more than 30 years of experience in electrochemical analysis distinguish the products of the DPST BEHNERT GMBH, Bremerhaven, FRG.

We like to present you the comprehensive standard offer of DPST electrochemical electrodes and accessories. As well as in research, education or process control: With the choice of DPST products you will participate from their outstanding benefits.

With DPST electrochemical electrodes and accessories we focus on functionality: DPST electrochemical electrodes and accessories will convince you by reliable and precise measurements, easy handling, robustness and a reasonable, friendly price.

The DPST electrochemical electrodes and accessories program includes all you need for your electrochemical analysis:

DPST Electrochemical Electrodes

- DPST Ion Selective Electrodes
- DPST Silver Metal Electrodes
- DPST Glass pH Electrodes
- DPST Reference Electrodes
- DPST Polarographic Electrodes
- DPST Conductivity Cells
- DPST Redox Electrodes
- DPST Dissolved Oxygen Electrodes

DPST Accessories and Auxiliary

- DPST Reference and Salt Bridge Solutions
- DPST Ion Standards
- DPST Ionic Strength Adjustors, pH Adjustors, TISAB
- DPST Buffer Solutions
- DPST Heavy Metal Standards
- DPST Conductivity Standards
- DPST Redox Standards
- DPST Storage and Cleaning Solutions
- DPST Connecting Cables

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Directory

General Information	4
DPST Electrochemical Electrodes	7
DPST Ion Selective Electrodes, ISE	6
DPST Silver Metal Electrodes	9
DPST Glass pH Electrodes	10
DPST Reference Electrodes	13
DPST Polarographic Electrodes	15
DPST Platinum Electrodes	17
DPST Conductivity Cells	18
DPST Redox Electrodes	20
DPST Dissolved Oxygen Electrodes	22
DPST Temperature Sensors	22
DPST Accessories and Auxiliary	23
DPST Reference and Salt Bridge Solutions	23
DPST Ion Standards	24
DPST Ionic Strength Adjustors, pH Adjustors, TISAB	25
DPST Buffer Solutions	26
DPST Heavy Metal Standards	26
DPST Conductivity Standards	27
DPST Redox Standards	27
DPST Storage and Cleaning Solutions	28
DPST Connecting Cables	28
Contact and Ordering Information	29

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DIREKT POTENTIOMETRISCHE SENSOR TECHNIK

General Information

Compatibility

We offer our standard DPST electrode program with BNC, DIN, cinch or banana connector or without connector for clamping. On request: any other common connector is available for a low additional charge (SN6 and S7 head connector and SMS connector as well) to fit our broad offer of electrodes and measuring cells to any common apparatus and instrumentation. For available connectors see paragraph "DPST Connecting Cables" and "DPST Type Numbers", page 6 and page 28.

Special Electrodes

For some very special applications you may require a special electrode construction. For these applications we offer atypical electrodes, custom made, upon request with description and/or technical drawing.

DPST Ion Selective Electrodes (ISE)

ISEs are analytical tools widely used for potentiometric determination of a large scale of ionic analytes, using various procedures of measurement and evaluation. These sensors are especially suitable for routine analysis being done in agriculture and food process, soil analysis, environmental samples, water quality control, tribo technical analysis, explosives and pyrotechnical mixtures analysis, biochemical and chemical process control and many other applications in research, education and process. DPST Ion selective electrodes fit to all commonly used meters.

The work with ion selective electrodes saves time and chemicals and is a friendly priced measuring equipment.

DPST Silver Metal Electrodes

Silver metal electrodes are sensors for argentometric, coulometric or potentiometric titrations of chloride, bromide, iodide, cyanide, cyanate, sulfocyanide and other ions with slightly soluble silver salts. Our DPST silver metal electrodes are applicable to all commonly used pH-meters, titrators, coulometers and other analytical instruments for argentometric titrations.

DPST Glass pH Electrodes

Since a very long period of time, nearly one century, pH glass electrodes are successfully used as sensors for the potentiometric determination of H^+ , respective H_3O^+ activity, what is expressed in the well known pH units. pH measurements are essential for all fields of research, development, process and many other human activities.

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DPST Reference Electrodes

Reference electrodes are commonly used as a stable electric potential source for various electrochemical applications. DPST reference electrodes are applicable to all commonly used electrochemical apparatus.

DPST Polarographic Electrodes

Polarography is an important electrochemical method for many analytical tasks in industrial processes and laboratory research and many other applications. We offer DPST polarographic electrodes as carbon, gold, silver and platinum working electrodes, argentchloride, calomel and mercurousulphate reference electrodes, platinum auxiliary electrodes and a scale of combined electrodes. They are new fashioned, small size compact embodied and very sensitive sensors, widely applied for voltametric analysis of electroactive matters like heavy metals, organic compounds, ions and more. The DPST polarographic electrodes are especially constructed for extremely small or even no mercury consumption. Mercury or more electropositive analytes can be deposited on a pure carbon or gold surface. The DPST polarographic electrodes are designed for application in Metrohm, PolaroSensors, Gamma Analysen Technik, PAR and Ekom PA stands or any instrumentation with a suitable measuring cell.

DPST Conductivity Cells and DPST Redox Electrodes

Conductivity and redox electrodes are noble metal (Gold or platinum) sensors for the measurement of conductivity and redox potential in many electrolytes and solutions. The DPST conductivity cells and redox electrodes are applicable to all commonly used electrochemical instruments.

DPST Dissolved Oxygen Electrodes

Dissolved oxygen electrodes are amperometric sensors for the determination of oxygen in aqueous samples. DPST dissolved oxygen electrodes are applicable to all commonly used oxymeters in research, education and process control.

DPST Accessories and Auxiliary

Our DPST accessories and auxiliary program covers a large choice of calibration and testing solutions, ionic strength adjustors, buffer solutions, cleaning and storage solutions, reference and salt bridge solutions and other help- and needful chemical materials for analytical electrochemistry. DPST accessories and auxiliary are carefully harmonized with DPST electrochemical electrodes to obtain a long and optimal function. Of course DPST accessories and auxiliary fits to any commonly used electrochemical analytical tool.

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DPST Connecting Cables

Our large choice of connectors and the variable cable length makes the DPST electrochemical electrodes compatible to nearly every purpose and instrumentation. For the available connectors see chapter "Type numbers". DPST standard sensors are equipped with a 1 m low-noise coaxial cable with BNC connector. The use of the special low-noise coaxial cable allows a cable length up to 10 m, what we offer on request.

DPST Temperature Sensors

Many DPST-Sensors are equipped with integrated temperature sensors. The required type of the temperature sensor depends on the used instrumentation. Our offer includes Pt 100, Pt 1000, Ni 1 k Ω , Ni 2 k Ω and thermistor NR 3 k Ω temperature sensors according to your demand.

DPST-ELMETRON Meters

Instrumentation as pH meters, ion meters, oxymeters, conductometers and multifunction meters we offer on request. Our DPST-ELMETRON meters are the optimal complement for precise and reliable measurements with DPST electrochemical electrodes as well as for general purpose. DPST-ELMETRON meters are available for every purpose, e.g. as robust and reliable easy to handle pocket instrument or as computerized intelligent high-end laboratory equipment. DPST-ELMETRON meters will convince you by an excellent cost-performance ratio and by their optimal functionality.

DPST Type Numbers

The comprehensive offer of DPST electrochemical analytical tools is characterized by systematic alphanumeric type numbers:

The letters and the first numbers before the "-" are specific for the particular sensor.

The meaning is explained briefly in the concerning chapter.

The „+" at the end of the Type numbers is a placeholder for the connector type:

DPST Type Numbers: Connectors	
Standard Connectors	1 cable with banana plug or blank cable ends for clamping
	2 cable with BNC connector
	7 cable with DIN connector
	8 cable with cinch connector
Connectors on request	5 cable with S6 Connector
	6 electrode with S6 or SN7 head connector
	0 cable with SMS connector

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DPST Electrochemical Electrodes

DPST Ion Selective Electrodes, ISE

DPST ISEs fit to any common meter with an input resistance of more than $10^9 \Omega$ ($10^{12} \Omega$ for gas sensing electrodes).

DPST ISEs are available as half-cell (**20-**) or combined electrodes (**25-**). The combined electrodes are constructed in one body with an argentchloride reference electrode, electrolyte KCl, $c = 0,1 \text{ mol/l}$. Combined ISEs may be used if the chloride ion emission of the reference electrode does not disturb the measurement. Otherwise a DPST ISE may be combined with a suitable DPST reference electrode, e.g. a double junction one (see "DPST reference electrodes").

The third and the fourth type number represent the ions position in the periodic table of the elements as e.g.: Lithium ISE 20-**03+**.

Gas sensing NH_3 and CO_2 electrodes are constructed as combined electrodes. For the maintenance of our gas sensing electrodes we offer replacement sets (2 sensor caps and filling electrolyte solution).

The temperature range covers 0°C to 40°C except for the sodium ISE: 0°C to 80°C .

More individual specifications concerning membrane type and measuring range are listed in the electrodes' table.

Electrode dimensions for all DPST ISE are:

Body diameter:	12 mm
Cap diameter:	16 mm
Electrode length:	145 mm



DPST SCN⁻ ISE type 20-582



DPST NH₄⁺ ISE type 20-102

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DPST Ion Selektive Electrode		Ion	Sensor	pX
Ammonium	20-10+	NH ₄ ⁺	Plastic	1 - 5
Ammonium comb.	25-10+		Plastic	1 - 5
Lithium	20-03+	Li ⁺	Plastic	1 - 5
Lithium comb.	25-03+		Plastic	1 - 5
Sodium	15-11+	Na ⁺	Glass	1 - 6
Sodium, comb.	25-11+		Glass	1 - 6
Potassium	20-19+	K ⁺	Plastic	1 - 6
Potassium comb.	25-19+		Plastic	1 - 6
Calcium	20-20+	Ca ²⁺	Plastic	1 - 6
Calcium comb.	25-20+		Plastic	1 - 6
Barium	20-56+	Ba ²⁺	Plastic	1 - 6
Barium comb.	25-56+		Plastic	1 - 6
Nitrate	20-31+	NO ₃ ⁻	Plastic	1 - 6
Nitrate comb.	25-31+		Plastic	1 - 6
Fluoroborate	20-41+	BF ₄ ⁻	Plastic	1 - 6
Fluoroborate comb.	25-41+		Plastic	1 - 6
Perchlorate	20-49+	ClO ₄ ⁻	Plastic	1 - 6
Perchlorate comb.	25-49+		Plastic	1 - 6
Fluoride	20-09+	F ⁻	Inorganic	1 - 6
Fluoride comb.	25-09+		Inorganic	1 - 6
Chloride	20-17+	Cl ⁻	Inorganic	1 - 5
Chloride comb.	25-17+		Inorganic	1 - 5
Rhodanide	20-58+	SCN ⁻	Inorganic	1 - 5
Gas sensing NH ₃	11-10+	NH ₃	Gas permeable	1 - 5
Gas sensing CO ₂	11-22+	CO ₂	Gas permeable	2 - 5

The "+" is a placeholder for the connector type (e.g. BNC, banana or DIN). For available connectors see page 6 "Compatibility" and "DPST Type Numbers".

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DPST Silver Metal Electrodes

DPST silver metal electrodes are made of 99,99 % pure silver which is coated electrochemically with silver chloride. We offer rod electrodes (active length 20mm; Ø 2 mm), foil electrodes (surface 120 mm²) or disc electrodes (disc Ø 2 mm). The DPST silver metal electrodes are optionally equipped with a 7 mm (rod and foil half cell electrodes) or 14 mm (rod and disc combined electrodes) sliding PTFE cone for optimal sample depth adjustment. The combined electrodes´ glass body (12 mm diameter) contains a mercurousulfate reference unit with filling hole for refilling the reference electrolyte (saturated potassium sulfate) or in maintenanceless version without filling hole filled with gel electrolyte, rich loaded with a sufficient amount of solid electrolyte salt.

The temperature range for combined DPST silver metal electrodes covers 0 °C to 40 °C.

DPST Silver Metal Electrode		Cone	Sensor
Silver half cell electrode	20-47+	14 mm	Ag rod
	30-47+	14 mm	Ag foil
	40-47+	7 mm	Ag rod
	50-47+	7 mm	Ag foil
	70-47+	No cone	Ag disc
Silver comb. electrode	60-47+	14 mm	Ag rod
	61-47+	No cone	Ag rod
	80-47+	14 mm	Ag disc
	81-47+	No cone	Ag disc

The "+" is a placeholder for the connector type (e.g. BNC, banana or DIN). For available connectors see page 6 "Compatibility" and "DPST Type Numbers".

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DPST Glass pH Electrodes

Due to their very common and universalized use DPST glass pH electrodes are available especially adjusted to many applications e.g. for laboratory or process use, with or without temperature sensor, with spear tip for immersion, sterilisable or with enhanced mechanical resistance or as combined or half cell electrodes.

Our DPST glass pH electrodes are applicable to all commonly used measuring apparatus with an input resistance of $10^{12} \Omega$ or more.

The electrodes with temperature compensation elements (Pt 100, Pt 1000, Ni 1 k Ω , Ni 2 k Ω or thermistor NR 3 k Ω) are equipped with an additional banana plug for the temperature sensor.

All combined electrodes are also available maintenanceless without filling hole, filled with a gel reference electrolyte. The standard reference unit is an argentchloride electrode (electrolyte: KCl, c = 3,0 mol/l, AgCl, c = sat.). If needed electrodes with a saturated calomel reference unit is available on request. Double junction combined electrodes have an argent chloride reference unit (KCl, c = 3,0 mol/l, AgCl, c = sat.) which is connected to the sample via an appropriate junction solution. In some cases (e.g. ISE measurements) the double junction design avoids pollution of the reference unit and/or the sample itself.

All process use combined electrodes are designed maintenanceless without filling hole.

Spear tip electrodes for piercing are suitable for pH measurement in paste-like materials.

Semimicro spear tip electrodes are especially suitable for small amount sample measurements as in Eppendorf sample vessels.

We offer custom made atypical electrodes on request with description.

Dimensions:

Glass body: 12 mm \varnothing

Total length 135 mm.

Laboratory electrodes: cap 16 mm \varnothing

Process electrodes: cap with 18 mm \varnothing armature fixing ring

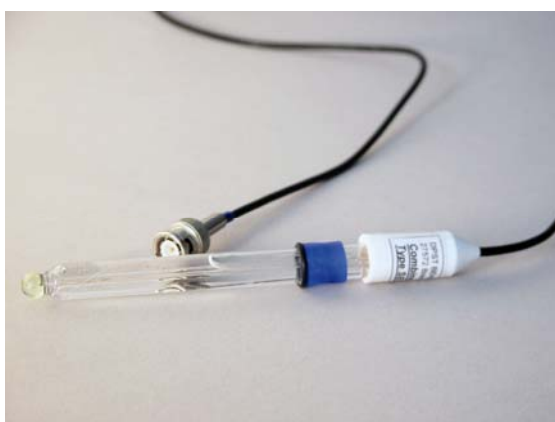
Type numbers:

Three letters	half cell without reference electrode
Four letters	combined electrodes
First digit 1	process use, maintenanceless
First digit 2	laboratory use, reference unit with filling hole
First digit 6	plastic body, maintenanceless
Second digit 1	electrode without temperature sensor
Second digit 2 – 6	see table
Second digit 9	electrode with temperature sensor
Third digit +	connector, see page 6, "Compatibility" and "DPST Type Numbers"

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DPST Glass pH Electrode		Temp. / °C	pH
Half cell electrode, enhanced mechanical resistance			
Laboratory use	SEO 21+	5-105	0-13
Process use	SEO 11+	5-105	0-13
PG 13,5 adapter	SEO 51+	5-105	0-13
Half cell electrode, low temperature range			
Laboratory use	SEN 21+	-5-50	0-11
Process use	SEN 11+	-5-50	0-11
Half cell electrode, general purpose			
Laboratory use	SEU 21+	10-105	0-14
Process use	SEU 11+	10-105	0-14
Combined pH-electrode, enhanced mechanical resistance			
Laboratory use	SEOJ 21+	5-105	0-13
Process use	SEOJ 11+	5-105	0-13
PG 13,5 adapter	SEOJ 51+	5-105	0-13
plastic body, maintenanceless	SEOJ 61+	5-60	0-13
Combined pH-electrode, low temperature range			
Laboratory use	SENJ 21+	-5-50	0-11
Process use	SENJ 11+	-5-50	0-11
Combined pH-electrode, general purpose			
Laboratory use	SEUJ 21+	10-105	0-14
Process use	SEUJ 11+	10-105	0-14



DPST pH-electrode type SEOJ 212

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DPST Glass pH Electrode		Temp. / °C	pH
Combined pH-electrode, spear tip for piercing:			
Laboratory use	SEOJ 22+	5-90	0-13
Combined pH-electrode, enhanced pressure, max 800 kPa			
Process use	SEOJ 13+	5-105	0-13
Combined pH-electrode, sterilisable at 300 kPa, 135 °C			
	SEOJ 31+	5-105	0-13
Combined, semimicro, general purpose, sensor Ø 6,5 mm, 70 mm length			
	SEOJ 25+	5-90	0-13
Combined, semimicro, spear tip, sensor Ø 6,5 mm, 70 mm length			
	SEOJ 24+	5-90	0-13
Combined pH-electrode, double junction combined electrode			
	SEOJ 26+	5-90	0-13
Combined, enhanced mechanical resistance, temperature compensation			
Laboratory use	SEOJ 29+	5-105	0-13
Process use	SEOJ 19+	5-105	0-13

The "+" is a placeholder for the connector type (e.g. BNC, banana or DIN). For available connectors see page 6 "Compatibility" and "DPST Type Numbers".

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DPST Reference Electrodes

DPST reference electrodes are applicable to any common electrochemical instruments. DPST reference electrodes for polarography are designed especially for the application in Metrohm, GAT, PolaroSensors and Ekom PA voltametric analyzers.

Standard DPST reference electrodes have a glass or plastic body. They are available maintenanceless without filling hole and filled with an electrolyte gel saturated with an excess of reference salt for a stable lifetime function or with a filling hole for the maintenance with reference electrolyte.

Argentchloride (Ag/AgCl, KCl, c = as required, saturated by AgCl), calomel (Hg/Hg₂Cl₂, KCl, c = as required, saturated by calomel) and mercurousulphate (Hg/Hg₂SO₄, K₂SO₄, c = as required, sat. by Mercurousulphate) reference electrodes are available.

If it is not allowed to use KCl diaphragm solution, for example if precipitation occurs, the argentchloride as well as the calomel electrodes are available in double junction design. The junction may be filled with any suitable electrolyte.

Special reference electrodes for the application in polarography are described later.

We offer atypical custom made electrodes on request with description.

Dimensions: Body Ø: 12 mm, cap Ø: 16 mm, total length: 145 mm.

The temperature range depends on the electrode type: 0 °C to 80 °C (argent chloride), 0 °C to 70 °C (calomel) and 0 °C to 40 °C (mercurousulphate).

The DPST reference electrodes are classified by following type numbers:

First digit 4	14 mm glass cone (NS 14)
First digit 5	PG 13,5 thread adapter
First digit 6	plastic body, maintenanceless
First digit 7	glass body, maintenanceless
Fifth digit 0	standard
Fifth digit 5	double junction



DPST reference electrode type 10-201

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DPST Reference Electrode		Type
Argentchloride, various KCl concentrations, saturated with AgCl	No cone	10-20+
	14 mm glass cone (NS 14)	410-20+
	PG 13,5 thread adapter	510-20+
	Plastic body, maintenanceless	610-20+
	Glass body, maintenanceless	710-20+
	Double junction	10-25+
	Double junction, 14 mm glass cone	410-25+
	Double junction, PG 13,5 thread adapter	510-25+
Calomel, various KCl concentrations, saturated with calomel	No cone	10-10+
	14 mm glass cone (NS 14)	410-10+
	PG 13,5 thread adapter	510-10+
	Plastic body, maintenanceless	610-10+
	Glass body, maintenanceless	710-10+
	Double junction	10-15+
	Double junction, 14 mm glass cone	410-15+
	Double junction, PG 13,5 thread adapter	510-15+
Mercurosulphate, various K_2SO_4 concentrations, saturated with mercurosulphate	No cone	10-20+
	14 mm glass cone (NS 14)	410-30+
	PG 13,5 thread adapter	510-30+
	Plastic body, maintenanceless	610-30+
	Glass body, maintenanceless	710-30+

The "+" is a placeholder for the connector type. For available connectors see page 6.



DPST reference electrode and DPST ISE

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DPST Polarographic Electrodes

Solid state disc surface DPST **working electrodes** are designed for general application in all commonly used polarographic apparatus and especially adjusted for the optimal application in PolaroSensors, Ekom (active length 80 mm) PA, GAT, PAR, Metrohm (active length 50 mm) and other instrumentation with suitable measuring cells. The compact electrode body is made of PTFE and it is equipped with a 14 mm cone for fitting the electrode into the adapter of the measuring cell. The standard electrical connection is a 0,6 m cable with banana or micro banana plugs. The disk shaped sensors are carefully made of high quality materials as special carbon or pure gold, platinum or silver.

Carbon and gold working electrodes can be used pure or as a flat surface mercury film carrier. The mercury is deposited on an electrochemical "non destructing" way from a diluted mercury salt solution. So the electrodes have a very small or even no mercury consumption. The temperature range covers 0 °C to 40 °C.

For our working electrodes we offer a polishing set containing a polishing pad, special polyurethane fixed fibres, polishing powder (Al_2O_3 , 0,5 μm particle size) and polishing suspension (Al_2O_3 , 1,1 μm particle size).

DPST Polarographic Electrode	Active length	Type
Working carbon electrode 3 mm disk sensor	50 mm*	SESV 12
	80 mm**	SESV 11
Working gold electrode 0,5 mm disk sensor	50 mm*	SESV 21
	80 mm**	SESV 20
Working platinum electrode 0,5 mm disk sensor	50 mm*	SESV 28
	80 mm**	SESV 27
Working silver electrode 2 mm disk sensor	50 mm*	SESV 30
	80 mm**	SESV 29

DPST **reference electrodes** represent commonly used reference electrodes in polarography. They are designed according to the working electrodes.

DPST Polarographic Electrode	Active length	Type
Argentchloride reference electrode	50 mm*	SESV 18
	80 mm**	SESV 17
Calomel reference electrode	50 mm*	SESV 24
	80 mm**	SESV 23
Mercurousulphate reference electrode	50 mm*	SESV 26
	80 mm**	SESV 25

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DPST **auxiliary electrodes** (counter electrodes) are needed for all polarographic applications with three electrodes. As well as the described working and reference electrodes they are designed as compact PTFE embodied sensors with a pure platinum wire as noble metal auxiliary or counter electrode.

DPST Polarographic Electrode	Active length	Type
Platinum auxiliary electrode	50 mm*	SESV 16
	80 mm**	SESV 15

DPST **combined electrodes** are designed as combination of two (working and reference electrode) or three electrodes (working, reference and auxiliary electrode) in one compact PTFE body, equipped with 14 mm cone for fitting it safely in the measuring cell. The main advantages of combined electrodes are their compact small size and the stable sensors position during calibration and measurement, what leads to a high reproducibility and the comfortable handling with only one electrode. Standard electrical connection is a 0,6 m cable with banana or micro banana (red: WE, blue: RE and green AE).

The temperature range reaches from 0 °C to 40 °C.

DPST Polarographic Electrode	Active length	Type
Combined argent chloride RE & platinum AE	50 mm*	SESV 14
	80 mm**	SESV 13
Combined argent chloride RE & platinum AE & carbon WE	50 mm*	SESV 03
	80 mm**	SESV 02

Other combinations of electrodes are available upon request.

* Active length 80 mm: Polaro Sensors, GAT or Ekom stands

** Active length 50 mm: Metrohm or PAR stands

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DPST Platinum Electrodes

Platinum electrodes are used in electrochemistry for many applications, e.g. as counter electrodes in polarography or as working electrodes in potentiometry. DPST platinum electrodes may be used in combination with all types of commonly used pH meters, mV meters and other analytical electrochemical instrumentation

Dimensions:

Glass body: Ø 12 mm

Total length 145 mm

Laboratory electrodes: cap Ø 16 mm

Process electrodes: cap with 18 mm Ø armature fixing ring

DPST platinum electrodes are classified by following type numbers

First digit 4	14 mm glass cone
First digit 5	PG 13,5 thread adapter
First digit 2	laboratory use
First Digit 1	process use
Second digit 1	platinum foil sensor 0,5 cm ²
Second digit 2	platinum wire sensor 0,2 cm ²
Third digit +	connector

DPST Platinum Electrode	Type
Platinum foil sensor, surface area 0,5 cm ²	
Laboratory use	PtE 21+
Process use	PtE 11+
14 mm glass cone	PtE 41+
13,5 PG thread adapter	PtE 51+
Platinum wire sensor, surface area 0,2 cm ²	
Laboratory use	PtE 22+
Process use	PtE 12+
14 mm glass cone	PtE 42+
13,5 PG thread adapter	PtE 52+

The "+" is a placeholder for the connector type (e.g. BNC, banana or DIN). For available connectors see page 6 "Compatibility" and "DPST Type Numbers".

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DPST Conductivity Cells

DPST conductivity cells are designed for all types of commonly used electrochemical conductivity meters as two- or four-electrode cells. The mode of operation is the measurement of the AC impedance at 3 kHz.

Conductivity Constant:

$$C = 1,0 \text{ cm}^{-1} \pm 20 \%$$

Temperature range:

-5 °C to 80 °C	two electrode systems
-5 °C to 100 °C	four electrode systems
0 °C to 60 °C	all plastic bodied electrodes

Dimensions:

Glass or plastic body: 12 mm Ø

Total length 145 mm

Laboratory electrodes: cap Ø 16 mm

Process electrodes: cap with 18 mm Ø armature fixing ring

Type number system:

First digit 2	laboratory use
First Digit 1	process use
Second digit 1	two electrode setup
Second digit 3	four electrode setup
Second digit 9	integrated temperature sensor
Third digit +	connector
Third digit 4	FRB Connector for four electrode setup



DPST conductivity cell type CE 212

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DPST Conductivity Cell		Type
Glass body	Laboratory use	CE 21+
	Process use	CE 11+
Glass body with temperature sensor*	Laboratory use	CE 29+
	Process use	CE 19+
Plastic body	Laboratory use	CE 21+/PV
	Process use	CE 11+/PV
Plastic body with temperature sensor*	Laboratory use	CE 29+/PV
	Process use	CE 19+/PV
Glass body, four electrodes	Laboratory use	CE 234
	Process use	CE 134

The "+" is a placeholder for the connector type (e.g. BNC, banana or DIN). For available connectors see page 6 "Compatibility" and "DPST Type Numbers".

*For the appropriate sensor see chapter „DPST Temperature Sensor“, page 22.

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DPST Redox Electrodes

DPST redox electrodes can be combined with all types of commonly used pH meters, mV meters and other similar electrochemical instruments. The metal sensors of the DPST redox electrodes are made of pure platinum or pure gold. It has an active area of 0,2 cm². The reference unit is an argent chloride reference electrode filled with KCl (c = 3,0 mol/l) electrolyte solution. Plastic bodied electrodes are maintenanceless without filling hole. They are lifetime-filled with a gel electrolyte. Maintenanceless glass bodied DPST redox electrodes are also available.

A variety of special shapes offer a comprehensive choice of applications:

DPST redox electrodes equipped with a 14 mm glass cone may be used as two electrode systems in polarography.

The electrodes for piercing or for measurements in paste-like materials are spear tip shaped.

Semimicro electrodes have reduced dimensions. They are especially suitable for small amounts of sample as in Eppendorf sample vessels.

Flat surface disc platinum or gold sensors (diameter 0,5 mm) with enhanced mechanical resistance are designed for mechanical cleaning during long time measurements.

Other constructions are available upon request.

Temperature range:

-5 °C to 90 °C

Dimensions:

Glass or plastic body: 12 mm Ø total length 145 mm

Laboratory electrodes: cap Ø 16 mm

Process electrodes: cap with 18 mm Ø armature fixing ring

Semimicro electrodes: length 70mm, Ø 6,5 mm

Type numbers:

First digit 1	process use
First digit 2	laboratory use
First digit 3	sterilisable ((300 kPa/135 °C)
First digit 4	14 mm glass cone
First digit 5	PG 13,5 thread adapter
First digit 6	plastic body
Second digit 1	standard
Second digit 2	spear tip for piercing
Second digit 3	enhanced pressure (up to 800 kPa)
Second digit 4	semimicro electrode
Second digit 5	disc, enhanced mechanical resistance
Second digit 6	maintenanceless reference unit
Third digit +	connector, see table next page.

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DPST Redox Electrode		Type
Glass body		
	Standard, laboratory use	PtEJ 21+, AuEJ 21+
	Standard, process use	PtEJ 11+, AuEJ 11+
	14 mm glass cone	PtEJ 41+, AuEJ 41+
	PG 13,5 thread	PtEJ 51+, AuEJ 51+
	Enhanced pressure, process use	PtEJ 13+, AuEJ 13+
	Sterilisable	PtEJ 32+, AuEJ 32+
	Spear tip for piercing, laboratory	PtEJ 22+, AuEJ 22+
	Semimicro, laboratory	PtEJ 24+, AuEJ 24+
	Disc, laboratory use	PtEJ 25+, AuEJ 25+
	Disc, process use	PtEJ 15+, AuEJ 15+
	Maintenanceless, laboratory use	PtEJ 26+, AuEJ 26+
	Maintenanceless, process use	PtEJ 16+, AuEJ 16+
Plastic body		
	Maintenanceless, laboratory use	PtEJ 66+, AuEJ 66+
	Maintenanceless, process use	PtEJ 76+, AuEJ 76+

The "+" is a placeholder for the connector type (e.g. BNC, banana or DIN). For available connectors see page 6 "Compatibility" and "DPST Type Numbers".



DPST redox electrode type PtEJ 212

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DPST Dissolved Oxygen Electrodes

DPST dissolved oxygen electrodes are robust (plastic bodied) and reliable tools for the determination of dissolved oxygen. The polarization voltage is about 650 +/- 10 mV, the time constant for 90 % response about 100 s, the temperature range reaches from 0 °C to 40 °C. The signal output in water equilibrated with air oxygen at 20 °C is about 25 +/- 6 nA. DPST dissolved oxygen electrodes may be used with most of the common electrochemical instrumentation. For the maintenance of the DPST dissolved oxygen electrodes we offer a replacement and maintenance set including spare membranes and filling electrolyte.

DPST Dissolved Oxygen Electrode		Type
Standard version	Laboratory use	KCPS 28+
	Process use	KCPS 18+
Integrated temperature sensor	Laboratory use	KCPS 29+
	Process use	KPCS 18+

The "+" is a placeholder for the connector type (e.g. BNC, banana or DIN). For available connectors see page 6 "Compatibility" and "DPST Type Numbers".

DPST Temperature Sensors

For many applications electrodes with integrated temperature sensors are available and common. In our DPST electrode program we offer electrodes as well with integrated temperature sensors as single temperature sensors. To fit our sensors to most of common equipment Pt 100, Pt 1000, Ni 1 kΩ, Ni 2 kΩ and termistore NR 3 kΩ temperature sensors are available:

DPST Temperature Sensor	Type
Temperature sensor	Pt 100
	Pt 1000
	Ni 1 kΩ
	Ni 2 kΩ
	NR 3 kΩ

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DPST Accessories and Auxiliary

Our help- and needful DPST accessories and auxiliary is carefully adjusted to the demand of the DPST electrodes and also qualified for general laboratory praxis.

DPST Reference and Salt Bridge Solutions

DPST reference and salt bridge solutions are provided in 100 ml plastic containers. They are useful for the maintenance of DPST reference electrodes, the adjustment of the concentration of the reference electrolyte and for salt bridges.

DPST Reference and Salt Bridge Solution	Compounds
Electrolyte	KCl, c = sat. (saturated)
	KCl, c = sat., AgCl, c = sat.
	KCl, c = 3,0 mol/l
	KCl, c = 3,0 mol/l, AgCl, c = sat.
	KCl, c = 1,0 mol/l
	KCl, c = 1,0 mol/l, AgCl, c = sat.
	KCl, c = 0,1 mol/l
	KCl, c = 0,1 mol/l, AgCl, c = sat.
	K_2SO_4 , c = sat.
	KNO_3 , c = sat.
	KNO_3 , c = 3,0 mol/l
	KNO_3 , c = 1,0 mol/l
	KNO_3 , c = 0,1 mol/l
	$(NH_4)_2SO_4$, c = 1,0 mol/l
	$(NH_4)_2SO_4$, c = 0,1 mol/l
	NaCl, c = 1,0 mol/l
	NaCl, c = 0,1 mol/l
	LiOAc, c = 1,0 mol/l (lithium acetate)

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DPST Ion Standards

These exactly composed electrolyte solutions are reliable standards for the calibration of DPST ISE and other electrodes. Two different concentrations (at 20 °C) are available in 500 ml and 1 l plastic bottles.

DPST Ion Standard	Molar concentration	Mass concentration
Ammonium, NH_4Cl	$c = 0,100 \text{ mol/l}$	$c = 1,00 \text{ g N/l}$
Lithium, LiCl	$c = 0,100 \text{ mol/l}$	$c = 1,00 \text{ g Li/l}$
Sodium, NaCl	$c = 0,100 \text{ mol/l}$	$c = 1,00 \text{ g Na/l}$
Potassium, KCl	$c = 0,100 \text{ mol/l}$	$c = 1,00 \text{ g K/l}$
Calcium, CaCl_2	$c = 0,100 \text{ mol/l}$	$c = 1,00 \text{ g Ca/l}$
Calcium, CaCl_2	$c = 1,00 \text{ g CaO/l}$ (100 °German hardness)	
Barium, BaCl_2	$c = 0,100 \text{ mol/l}$	$c = 1,00 \text{ g Ba/l}$
Nitrate, KNO_3	$c = 0,100 \text{ mol/l}$	$c = 1,00 \text{ g NO}_3\text{/l}$
Nitrate, KNO_3	$c = 1,00 \text{ g NO}_3\text{N/l}$ (nitrate nitrogen)	
Fluoroborate, NaBF_4	$c = 0,100 \text{ mol/l}$	$c = 1,00 \text{ g B/l}$
Perchlorate, NaClO_4	$c = 0,100 \text{ mol/l}$	$c = 1,00 \text{ g ClO}_4\text{/l}$
Fluoride, NaF	$c = 0,100 \text{ mol/l}$	$c = 1,00 \text{ g F/l}$
Ammonia, NH_4Cl	$c = 0,100 \text{ mol/l}$	$c = 1,00 \text{ g NH}_3\text{/l}$
Carbon dioxide, NaHCO_3	$c = 0,100 \text{ mol/l}$	$c = 1,00 \text{ g CO}_2\text{/l}$

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DPST Ionic Strength Adjustors, pH Adjustors, TISAB

These solutions are needed for any precise ISE measurement to adjust ionic strength and pH. They are available in 100 ml and 500 ml plastic bottles. The concentration is given at 20 °C.

DPST Ionic Strength Adjustor, pH Adjustor, TISAB	Concentration
Lithium chloride, LiCl	c = 1,0 mol/l
Lithium acetate buffer, LiOAc - HOAc	c = 1,0 mol/l
Sodium chloride, NaCl	c = 1,0 mol/l
Potassium nitrate, KNO ₃	c = 1,0 mol/l
Sodium acetate buffer, NaOAc - HOAc	c = 1,0 mol/l
TISAB, for fluoride ISE measurement	c = 1,0 mol/l
Sodium dihydrogenphosphate, NaH ₂ PO ₄	c = 1,0 mol/l
Ammonium sulphate, (NH ₄) ₂ SO ₄	c = 1,0 mol/l
Ethanolamine, EA	c = 2,0 mol/l
Ethanolamine acetate buffer, EA - HOAc	c = 2,0 mol/l
Ethanolamine hydrochloride buffer, EA - HCl,	c = 2,0 mol/l
Diethanolamine, DEA	c = 2,0 mol/l
Diethanolamine hydrochloride buffer, DEA - HCl	c = 2,0 mol/l
Triethanolamine, TEA	c = 2,0 mol/l
Triethanolamine hydrochloride buffer, TEA - HCl	c = 2,0 mol/l
Tris-buffer, (tris-hydroxymethyl)aminomethane, Tris-	c = 2,0 mol/l
Tris-hydrochloride buffer, Tris-HCl	c = 2,0 mol/l
Sodium hydroxide, NaOH	c = 10,0 mol/l
Citric acid	c = 1,0 mol/l

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DPST Buffer Solutions

DPST buffer solutions are certified according to the manufacturer Merck KgaA, 64271 Darmstadt, FRG, standardized against primary Merck standards pH 4,01 and 9,18. The DPST buffer solutions are available ready to use.

DPST buffer solutions are provided in 100 ml, 500 ml and 1 l plastic bottles, buffer sets contain 3 bottles (same volume) of different pH. The pH is given at 25 °C.

DPST Buffer Solution	Accuracy
pH 1,68	+/- 0,05
pH 3,56	+/- 0,05
pH 4,01	+/- 0,02
pH 6,00	+/- 0,05
pH 6,87	+/- 0,02
pH 7,00	+/- 0,02
pH 7,41	+/- 0,02
pH 9,18	+/- 0,02
pH 10,01	+/- 0,05
pH 10,90	+/- 0,05
pH 11,88	+/- 0,05
pH 12,83	+/- 0,05

DPST Heavy Metal Standards

For the calibration of heavy metal ions we provide standards of ions of following elements:

Ag, Al, As, Bi, Cd, Co, Cr (VI), Cu, Fe, Ga, Hg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, W, Zn.

The standard concentration is $c = 1,00 \text{ g/l} \pm 0,003$ at 20 °C. The solutions are available in 100 ml plastic bottles.

We offer other concentrations and solutions on request.

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DPST Conductivity Standards

The four DPST conductivity standard solutions cover the common range of measured conductivity. The solutions are provided in 100 ml, 500 ml and 1 l plastic bottles, sets contain three bottles of the same volume. Conductivity is given at 20 °C

DPST Conductivity Standard	Conductivity
KCl, c = 1,00 mol/l	102,1 mS/cm
KCl, c = 100 mmol/l	11,67 mS/cm
KCl, c = 10,0 mmol/l	1 278 µS/cm
KCl, c = 1,00 mmol/l	133,2 µS/cm

DPST Redox Standards

We offer two kinds of DPST redox standards in 100 ml, 500 ml and 1 l plastic bottles.

DPST Redox Standard	Redox Potential
$[\text{Fe}(\text{CN})_6]^{3-}/[\text{Fe}(\text{CN})_6]^{4-}$	U = 225 +/- 5 mV
$[\text{Fe}(\text{CN})_6]^{3-}/[\text{Fe}(\text{CN})_6]^{4-}$	U = 250 +/- 5 mV

U: Pt vs. Ag/AgCl, KCl, c = 3,0 mol/l, 20 °C

DPST Storage and Cleaning Solutions

DPST storage and cleaning solutions are carefully adjusted to DPST electrodes' demand. They are needful for a long sensor life and an optimal precise function. We offer these solutions in 100 ml and 100 ml + 1 l plastic bottles.

DPST Solution	Description
Storage solution for pH electrodes	containing Na ⁺ , K ⁺ , pH 7
Storage solution for combined pH-electrodes	KCl, c = 3,0 mol/l
Storage solution* potassium chloride	KCl, c = sat.
Storage solution* potassium sulphate	K ₂ SO ₄ , c = sat.
Cleaning solution, peptides solubilisation	pepsin - acetate buffer + HCl
Cleaning solution, lipides solubilisation	nonionogenic detergent

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DPST Connecting Cables

DPST connecting cables are useful tools for bridging longer than standard distances or for fitting together electrodes and instrumentation with different plug systems. We offer a choice of all needed combinations in requested cable lengths:

DPST Connecting Cable	
Apparatus BNC	Cable banana
Apparatus BNC	Cable BNC
Apparatus BNC	Cable SMS
Apparatus BNC	Cable SN6 (=S7)
Apparatus BNC	Cable DIN
Apparatus BNC	Cable FRB
Cable BNC	Cable BNC
Cable SN6	Cable BNC

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Contact and Ordering Information

Please feel so free to contact us if you have any question or if you need more Information.

We like to help you with more information about DPST electrochemical electrodes.

To contact us you may use the contact form on our homepage www.analysisio.com or write us an email to info@analysisio.com.

To request a quotation or to place an order you may use the order/quotation form on our homepage www.analysisio.com or write us an email to info@analysisio.com.

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