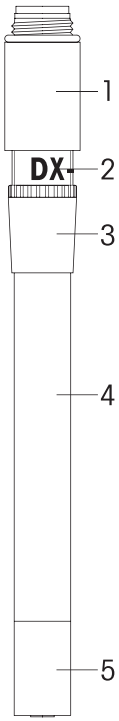
Operating Instructions

Ion selective electrode

DX series



1 S7 Screw cap
2 ID Ring
3 Adapter sleeve
4 Electrode shaft
5 Membrane module

METTLER TOLEDO

General information

General information on ISE measurements can be found in the "Guideline to ION selective measurement" (51300075) or in the "Application brochure" (51724646).

Intended use

METTLER TOLEDO DX-electrodes are intended for precise ion measurement in the laboratory at atmospheric pressure, along with a separate reference electrode.

Specifications

For detailed information on your specific electrode see **Specification tables**.

General safety information

When working with chemicals, all relevant safety regulations provided by the manufacturer and the laboratory must be observed.

Product specific safety information

The electrode is only intended for the purpose specified above. The manufacturer does not assume liability for any damage that results from use outside of the intended purpose.

The electrode is made partly of glass; there is therefore a risk of injury in the event of breakage. Failure to observe the handling instructions below may result in distorted results and electrode damage.

Precision

In the absence of interfering substances, a precision of better than ±0.5 mV corresponding to ±2% of the measured ion concentration can be achieved.

Response times

When changing from lower to higher concentrations below 10^{-4} mol/L, responding takes ap prox. 30 seconds, above 10^{-4} mol/L less than 30 seconds; when changing from higher to lower concentrations several minutes.

Materials

The electrode body is made of POM copolymer, the seals are silicon. For the material of the membrane module see **Specification tables**.

Maintenance and service

Deposits on the surface of the membrane can be removed by placing the electrode in deionized water for a few minutes. Careful use of dilute acids or bases (<0.001 mol/L) can improve the cleaning effect. After rinsing with deionized water, conditioning in the appropriate conditioning solution is required before the next calibration.

Storage

For long term storage the membrane modules are preferably separated from the electrodes and stored dry. Alternatively and for short term storage the electrodes can be stored in deionized water.

Changing the membrane module

Changing the membrane module Membrane modules with a damaged membrane (excessive response times or unstable potentials) which can no longer be regenerated must be changed.

Procedure for changing a membrane module:

1 Place electrode upside down and unscrew old membrane module from the electrode body.

2 Fill electrode body with internal solution up to the edge ensuring absence of bubbles.

3 Also fill the new membrane module with internal solution up to the sealing ring.

4 Screw the membrane module on tightly.

5 Give the electrode a single powerful shake towards the electrode head (like a clinical thermometer).

6 Rinse the entire electrode thoroughly with deionized water. Then condition as recommended.

Accessories

Reference electrode titrators	DX200	51089935
Reference electrode ion meters	InLab® Reference Plus	51343191
Cable InLab® Reference Plus to ion meter	InLab® cable S7-2mm 1.2m	30281923
Cable ISE to titrator	ISE Sensor Cable	51089954
Cable ISE to ion meter	InLab® cable S7-BNC 1.2m	30281915

Specification tables

Designation	DX262-NO3	DX287-BF4	DX219-F	DX235-Cl	DX280-Br
Assembled ISE order number	51340800	51107676	51340500	51340400	51340300
Membrane kit order number	51340011	51107690	51340008	51340007	51340006
Electrolyte order number	51340034	51107890	51340031	51340030	51340029
Specifications as on quality certificate[1]					
Slope (at 25°C)	< –57 mV	< –57 mV	< –57 mV	< –57 mV	< –57 mV
Detection limit	< 0.03 mM	< 0.003 mM	< 0.001 mM	< 0.04 mM	< 0.003 mM
ISA	25 mM MgSO4	25 mM MgSO4	10 vol% TISAB I	100 mM KNO3	100 mM KNO3
Membrane resistance	< 1 MΩ	< 2 MΩ	< 2 MΩ	< 1 MΩ	< 1 MΩ
Response time t(98%)	< 20 sec	< 20 sec	< 20 sec	< 20 sec	< 20 sec
Materials					
Type of membrane	Polymer	Polymer	Single crystal	Heterogeneous pellet	Heterogeneous pellet
Material of membrane module	PVC	PVC	POM	POM	POM
Selectivity coefficient according to IUPAC, log K(pot)					
fluoride	–3.6	–4.6	0.0	–2.7	–5.1
chloride	–2.2	–3.9	–5.5	0.0	–2.8
bromide	–0.5	–2.5	–5.0	2.3	0.0
iodide	1.4	–0.5	–4.2	5.0	3.4
formate	–3.0	–4.8	–4.1	–2.7	–5.2
acetate	–3.4	–4.9	–3.7	–2.7	–5.1
dihydrogenphosphate	–3.8	–5.0	–4.9	–2.6	–4.6
bicarbonte	–3.1	–4.3	–2.3	–2.1	–3.4
hydroxide	–3.4	–4.2	–1.0	–2.3	–3.9
nitrate	0.0	–2.1	–5.1	–2.4	–4.6
benzoate	–1.0	–2.8	–4.0	–2.4	–4.8
salicylate	1.4	–0.4	–4.8	–2.4	–4.4
perchlorate	3.2	1.1	–5.4	–2.6	–4.6
tetrafluoroborate	1.9	0.0	–2.0	–2.8	–4.9
thiocyanate	2.0	–0.1	–4.4	1.0	–1.1
cyanide	–1.7	–3.1	–2.4	1.1	0.8
sulphate	–3.5	–5.1	–5.5	–3.0	–5.1
hydrogenphosphate	–3.7	–4.8	–3.4	–2.7	–4.7
carbonate	–3.6	–4.7	–2.6	–3.1	–5.2
sulphide	–2.1	–3.2	–1.0	4.7	4.3
citrate	–3.4	–5.0	–4.2	–2.8	–4.7
Reference system					
Reference element (recommended)	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl
Bridge electrolyte (recommended)	2 M MgSO4	2 M MgSO4	3 M KCl	1 M KNO3	1 M KNO3
Typical measuring specifications[2]					
Dynamic response time (Time to reach 98% of jump in mV from 0.1 mM to 10 mM)	< 2 sec	< 2 sec	< 2 sec	< 2 sec	< 2 sec
Membrane resistance	0.1 MΩ	1.2 MΩ	1.3 MΩ	0.2 MΩ	0.05 MΩ
Offset potential (±25 mV)	140 mV	25 mV	–30 mV	145 mV	10 mV
Detection limit in ISA (log c, [M])	–4.5	–6.5	–6.3	–4.8	–6.1
Operational pH range	2...12	2...12	4...10	2...13	2...13
Short term storage	deionized water	deionized water	dry	dry	dry
Long term storage	disassembled dry	disassembled dry	dry	dry	dry
Conditioning after storage (30 min)	10 mM NaNO3	10 mM NaBF4	deionized water	deionized water	deionized water
Shelf life (dry at 20°C)	> 12 months	> 12 months	> 24 months	> 24 months	> 24 months

1) These values can be achieved depending on application, storage conditions, maintenance, usage and age of membrane module
2) Electrode/module is individually factory tested after production to meet these criterias

Designation	DX327-I	DX226-CN	DX258-SCN	DX232-S
Assembled ISE order number	51107680	51107681	51107870	51107675
Membrane kit order number	51107694	51107695	51107871	51107689
Electrolyte order number	51107898	51107893	51107872	51107894

Specifications as on quality certificate[1]

Slope (at 25°C)	< –57 mV	< –57 mV	< –57 mV	< –28 mV
Detection limit	< 0.001 mM	< 0.01 mM	< 0.03 mM	< 0.001 mM
ISA	100 mM KNO3	100 mM NaOH	100 mM KNO3	100 mM NaOH
Membrane resistance	< 1 MΩ	< 1 MΩ	< 1 MΩ	< 1 MΩ
Response time t(98%)	< 20 sec	< 20 sec	< 20 sec	< 20 sec

Materials

Type of membrane	Heterogeneous pellet	Heterogeneous pellet	Heterogeneous pellet	Heterogeneous pellet
Material of membrane module	POM	POM	POM	POM

Selectivity coefficient according to IUPAC, log K(pot)

fluoride	–6.6	–4.9	–4.5	< –14
chloride	–5.5	–4.1	–2.3	< –14
bromide	–3.4	–2.3	0.3	< –14
iodide	0.0	1.4	3.5	< –14
formate	–5.6	–3.7	–3.4	< –14
acetate	–6.0	–4.2	–4.4	< –14
dihydrogenphosphate	–6.7	–4.9	–4.5	< –14
bicarbonte	–4.8	–3.5	–4.3	< –14
hydroxide	–4.5	–3.0	–3.7	< –14
nitrate	–6.2	–4.4	–0.8	< –14
benzoate	–5.9	–4.3	–4.3	< –14
salicylate	–6.2	–4.6	–4.4	< –14
perchlorate	–6.4	–4.8	–4.5	< –14
tetrafluoroborate	–6.6	–6.0	–4.5	< –14
thiocyanate	–3.4	–2.1	0.0	< –14
cyanide	–1.4	0.0	0.9	–8.6
sulphate	–6.6	–5.1	–4.8	< –15
hydrogenphosphate	–6.1	–4.7	–4.7	< –15
carbonate	–6.2	–4.7	–4.5	< –15
sulphide	1.5	2.5		0.0
citrate	–6.3	–4.9		

Reference system

Reference element (recommended)	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl
Bridge electrolyte (recommended)	1 M KNO3	1 M KNO3	1 M KNO3	1 M KNO3

Typical measuring specifications[2]

Dynamic response time (Time to reach 98% of jump in mV from 0.1 mM to 10 mM)	< 2 sec	< 10 sec	< 2 sec	< 2 sec
Membrane resistance	0.1 MΩ	0.2 MΩ	0.1 MΩ	0.05 MΩ
Offset potential (±25 mV)	225 mV	–220 mV	15 mV	–750 mV
Detection limit in ISA (log c, [M])	–8.0	–5.7	–5.2	–8.0
Operational pH range	1...13	4...13	2...10	4...13
Short term storage	dry	dry	dry	dry
Long term storage	dry	dry	dry	dry
Conditioning after storage (30 min)	deionized water	deionized water	10 mM NaSCN	deionized water
Shelf life (dry at 20°C)	> 24 months	> 24 months	> 24 months	> 24 months

1) These values can be achieved depending on application, storage conditions, maintenance, usage and age of membrane module
2) Electrode/module is individually factory tested after production to meet these criterias

Designation	DX407-Pb	DX312-Cd	DX264-Cu	DX207-Li	DX218-NH4
Assembled ISE order number	51107873	51107672	51107678	51107673	51340900
Membrane kit order number	51107874	51107686	51107692	51107687	51340012
Electrolyte order number	51107875	51107891	51107889	51107881	51340035
Specifications as on quality certificate[1]					
Slope (at 25°C)	> 25 mV	> 25 mV	> 28 mV	> 57 mV	> 57 mV
Detection limit	< 0.01 mM	< 0.01 mM	< 0.01 mM	< 0.01 mM	< 0.01 mM
ISA	100 mM KNO3	100 mM KNO3	100 mM KNO3	25 mM MgSO4	25 mM MgSO4
Membrane resistance	< 10 MΩ	< 10 MΩ	< 1 MΩ	< 10 MΩ	< 10 MΩ
Response time t(98%)	< 20 sec	< 20 sec	< 20 sec	< 20 sec	< 20 sec
Materials					
Type of membrane	Polymer	Polymer	Heterogeneous pellet	Polymer	Polymer
Material of membrane module	PVC	PVC	POM	PVC	PVC
Selectivity coefficient according to IUPAC, log K(pot)					
Lithium	–1.6	–2.3	–3.2	0.0	–4.0
Sodium	–1.3	–2.3	–3.3	–2.8	–2.8
Potassium	–1.6	–2.3	–2.9	–2.8	–0.8
Ammonium	–1.7	–2.4	–2.9	–3.5	0.0
Tris(hydroxymethyl)aminomethan	–1.9	–2.9	–3.0	–4.6	–3.0
Tetraethylammonium				–1.8	
Hydrogenion	–0.8	–0.9	–0.4	–2.8	–4.1
Magnesium	–4.1	–5.0	–4.6	–6.4	–5.4
Calcium	–3.8	–4.2	–4.9	–5.7	–5.4
Barium				–5.6	–5.4
Zinc(II)	–3.4	0.7	–4.7	–4.7	–2.7
Cadmium(II)	–3.8	0.0	–4.2		
Copper(II)	–2.5	0.3	0.0		
Lead(II)	0.0	–2.9	–3.0		
Nickel(II)	–3.9	–3.8	–4.4		
Cobalt(II)	–4.1	–3.8	–4.9		
Mangan(II)	–4.0	–3.8	–4.6		
Silver(I)	4.9	8.4	9.0		
Reference system					
Reference element (recommended)	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl
Bridge electrolyte (recommended)	1 M KNO3	1 M KNO3	1 M KNO3	3 M KCl	2 M MgSO4
Typical measuring specifications[2]					
Dynamic response time (Time to reach 98% of jump in mV from 0.1 mM to 10 mM)	< 6 sec	< 2 sec	< 2 sec	< 2 sec	< 2 sec
Membrane resistance	1.0 MΩ	5.0 MΩ	0.05 MΩ	3.0 MΩ	6.0 MΩ
Offset potential (±25 mV)	170 mV	130 mV	150 mV	30 mV	45 mV
Detection limit in ISA (log c, [M])	–4.5	–6.1	–6.3	–4.8	–6.1
Operational pH range	2...8	2...8	2...8	2...12	2...9
Short term storage	deionized Water	deionized Water	dry	deionized Water	deionized Water
Long term storage	disassembled dry	disassembled dry	dry	disassembled dry	disassembled dry
Conditioning after storage (30 min)	10 mM Pb(NO3)2	10 mM Cd(NO3)2	deionized water	10 mM LiCl	10 mM NH4Cl
Shelf life (dry at 20°C)	> 12 months	> 12 months	> 24 months	> 12 months	> 6 months

1) These values can be achieved depending on application, storage conditions, maintenance, usage and age of membrane module
2) Electrode/module is individually factory tested after production to meet these criterias

Designation	DX239-K	DX224-Mg	DX240-Ca	DX337-Ba
Assembled ISE order number	51340700	51107684	51340600	51107674
Membrane kit order number	51340010	51107698	51340009	51107688
Electrolyte order number	51340033	51107885	51340032	51107892

Specifications as on quality certificate[1]

Slope (at 25°C)	> 57 mV	> 23 mV	> 28 mV	> 28 mV
Detection limit	< 0.005 mM	< 0.02 mM	< 0.02 mM	< 0.02 mM
ISA	25 mM MgSO4	100 mM Tris2HCl	100 mM KCl	100 mM Tris2HCl
Membrane resistance	< 20 MΩ	< 10 MΩ	< 10 MΩ	< 10 MΩ
Response time t(98%)	< 20 sec	< 20 sec	< 20 sec	< 20 sec

Materials

Type of membrane	Polymer	Polymer	Polymer	Polymer
Material of membrane module	PVC	PVC	PVC	PVC

Selectivity coefficient according to IUPAC, log K(pot)

Lithium	–3.8	–1.9	–3.2	–1.9
Sodium	–4.5	–2.2	–4.0	–0.9
Potassium	0.0	–1.1	–4.0	–1.2
Ammonium	–1.8	–1.6	–4.2	–2.0
Tris(hydroxymethyl)aminomethan	–2.8	–2.7		–4.6
Tetraethylammonium	–3.7		–3.2	
Hydrogenion	–5.4	1.0	–3.7	–0.8
Magnesium	–4.8	0.0	–5.2	–3.5
Calcium	–5.4	–1.5	0.0	–1.7
Barium	–5.5	–1.6	–3.5	0.0
Zinc(II)	–3.4		–2.4	–3.3
Cadmium(II)				
Copper(II)				
Lead(II)				
Nickel(II)				
Cobalt(II)				
Mangan(II)				
Silver(I)				

Reference system

Reference element (recommended)	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl	Ag/AgCl/3 M KCl
Bridge electrolyte (recommended)	2 M MgSO4	3 M KCl	3 M KCl	3 M KCl

Typical measuring specifications[2]

Dynamic response time (Time to reach 98% of jump in mV from 0.1 mM to 10 mM)	< 2 sec	< 2 sec	< 2 sec	< 2 sec
Membrane resistance	8.0 MΩ	2.0 MΩ	2.5 MΩ	3.0 MΩ
Offset potential (±25 mV)	55 mV	40 mV	80 mV	70 mV
Detection limit in ISA (log c, [M])	–8.0	–6.0	–5.6	–5.7
Operational pH range	2...12	4...12	2...12	2...12
Short term storage	deionized Water	deionized Water	deionized Water	deionized Water
Long term storage	disassembled dry	disassembled dry	disassembled dry	disassembled dry
Conditioning after storage (30 min)	10 mM KCl	10 mM MgCl2	10 mM CaCl2	10 mM BaCl2
Shelf life (dry at 20°C)	> 12 months	> 6 months	> 12 months	> 12 months

1) These values can be achieved depending on application, storage conditions, maintenance, usage and age of membrane module
2) Electrode/module is individually factory tested after production to meet these criterias

To protect your product's future:
METTLER TOLEDO Service assures the quality, measuring accuracy and preservation of value of this product for years to come.

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