Technical Information TI 162C/07/en Precision Calibration Solution for Conductivity *CLY 11*



















For qualified calibration

- For calibration of reference equipment or process measurements relevant for quality
- For test equipment monitoring according to ISO 9001
- Extremely high precision: ±0.5 %
 Traceable to international standards: SRM by NIST
- With quality certificate
- Consistently high quality is guaranteed by gravimetric manufacturing process

For calibration in the field

- Practical quantity: 500 ml, enough for rinsing and calibration
- Calibration instructions and temperature table are printed on each bottle
- Seal in screw top is broken when bottle is opened
- Long storage life due to stabilisation
- Air-saturated solutions, therefore minimal CO₂ influence



Quality made by Endress+Hauser



Conductivity measuring principle

Electrical currents are transported in liquids by positively und negatively charged particles (ions). Therefore the conductivity measurement basically measures all particles in a liquid that are available for charge transport. A number of substances dissolved in water, e.g. KCl or CO₂, contribute to charge transport. Due to these relationships, conductivity calibration solutions have no buffer effect. Every ion that enters the liquid by dissolution or by introduction of air influences the conductivity.

For these reasons, conductivity calibration must be performed very carefully.



Temperature compensation

As with all electrolytes, the conductivity of the calibration solution is temperature-dependent. Therefore thermostatting of the calibration to the reference temperature $T_0 = 25.0$ °C is recommended.

If thermostatting is not feasible or practical, then the raw conductivity κ or the temperature coefficient α for any

temperature between 15 and 35 °C can be determined with the aid of the following approximation formulas. The approximation formulas render results with an accuracy greater than 0.5 %. Precisely determined values for different temperatures are listed in table 1 under »Technical data«.

Calibration solution	Raw conductivity κ
CLY 11-A	$\kappa \ [\mu S/cm] = 74.028 + 1.4504 \ (T - T_0) + 0.0030 \ (T - T_0)^2$
CLY 11-B	$\kappa \ [\mu S/cm] = 149.75 + 2.9240 \ (T - T_0) + 0.00616(T - T_0)^2$
CLY 11-C	κ [mS/cm] = 1.4072 + 0.0271 (T - T ₀) + 0.00005(T - T ₀) ²
CLY 11-D	κ [mS/cm] = 12.654 + 0.24034(T - T_0) + 0.00049(T - T_0)^2
CLY 11-E	κ [mS/cm] = 107.08 + 1.8862 (T - T ₀) + 0.00222(T - T ₀) ²

Calibration solution	Temperature coefficient α
CLY 11-A	α [%/K] = 1.96 + 0.004 (<i>T</i> - <i>T</i> ₀)
CLY 11-B	α [%/K] = 1.95 + 0.004 (<i>T</i> - <i>T</i> ₀)
CLY 11-C	α [%/K] = 1.93 + 0.004 (<i>T</i> - <i>T</i> ₀)
CLY 11-D	α [%/K] = 1.90 + 0.004 (<i>T</i> - <i>T</i> ₀)
CLY 11-E	α [%/K] = 1.76 + 0.002 (<i>T</i> - <i>T</i> ₀)

Example

What are the raw conductivity and temperature coefficient of calibration solution CLY 11-C at T = 18.3 °C?

 $\kappa_T = [1.4072 + 0.0271 (18.3 - 25.0) + 0.00005 (18.3 - 25.0)^2] \text{ mS/cm}$

= 1.23 mS/cm

 $\alpha_T = [1.93 + 0.004 (18.3 - 25.0)]$ %/K

Correct calibration

Preparation of cell for calibration

- Clean the cell
- Rinse with calibration solution
- Immerse in calibration solution

Calibration

The following table describes the calibration sequence without and with temperature compensation if thermostatting is not possible.

When thermostatted to $T_0 = 25.0$ °C, the temperature coefficient is meaningless when the measuring instrument works with the reference temperature T_0 . It is the raw conductivity of the calibration solution at T_0 that is used for calibration.

Note:

The calibration instructions and temperature table are printed on every bottle.

Calibration sequence

Without temperature compensation	With temperature compensation			
Determine temperature precisely	Determine temperature precisely			
	Correct temperature by entering the offset in the instrument if necessary			
Determine the exact conductivity (raw conductivity) of the calibration solution using the temperature formula/table	Determine the exact conductivity (raw conductivity) of the calibration solution using the temperature formula/table			
	Enter the temperature coefficient of the solution in the instrument			
Calibrate with the raw conductivity of the solution	Calibrate with the nominal conductivity (conductivity at 25 °C) of the solution			
The calibration and adjustment procedure may be different for different instruments. Observe the operating instructions supplied with the instrument!				
	Enter the temperature coefficient of the medium in the instrument			

Technical data

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Temperature coefficient α at 25 °C see table below
Storage life
CLY 11-A 1 year
CLY 11-B, C, D, E 2 years
Storage temperature
Usability after bottle is opened 2 weeks

Calibrati-	αat					ка	t				
on soluti-	25 °C [%/K]	5 °C	10 °C	15 °C	20 °C	25 °C	30 °C	35 °C	40 °C	50 °C	
CLY 11-A	1.96	46.4	52.9	59.7	66.7	74.0	81.4	88.8	96.5	112.2	μS
CLY 11-B	1.95	93.9	107.1	120.8	135.2	149.6	164.5	179.7	195.1	226.8	cm
CLY 11-C	1.93	0.8	1.010	1.136	1.270	1.406	1.542	1.683	1.824	2.114	0
CLY 11-D	1.90	8.07	9.16	10.29	11.45	12.64	13.86	15.11	16.37	18.97	cm cm
CLY 11-E	1.76	70.58	79.34	88.20	97.56	107.00	116.52	126.10	135.98	155.82	

Table 1: Measured raw conductivity for different temperatures

Subject to modifications.

How to order

Calibration solution	Conductivity at 25 °C	Order number
CLY 11-A	74.0 µS/cm	500 81902
CLY 11-B	149.6 µS/cm	500 81903
CLY 11-C	1.406 mS/cm	500 81904
CLY 11-D	12.64 mS/cm	500 81905
CLY 11-E	107.00 mS/cm	500 81906

Certificate

The analysis certificates for the particular calibration solutions are made out and provided by a special laboratory.

These certificates inform about measuring method and intended purpose of the solutions. Additionally the batch number, the decay date, the electrolytical conductivity and the reference for quality control are included

Accessories

Calibration solutions

Precision calibration solutions for conductivity, accuracy 0.5% at 25°C, referred to NIST SRM. Bottle with 500 ml.

Туре	Conductivity at 25° ¹⁾	Order number
CLY 11-A	74,0 μS/cm	50081902
CLY 11-B	149,6 µS/cm	50081903
CLY 11-C	1,406 mS/cm	50081904
CLY 11-D	12,64 mS/cm	50081905
CLY 11-E	107,00 mS/cm	50081906

¹⁾ Values may deviate due to manufacturing tolerances. The accuracy refers to the value specified on the bottle.

Pure water calibration system ConCal

Calibration solutions are not stable at low conditions. For this reason, DIN/IEC only permits solutions > 74 μ S/cm. The alternative is to use factory-calibrated ConCal comparison system. Its factory calibration is tracable to SRM by NIST.



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