CONSORT

MANUAL

HANDLEIDING

MODE D'EMPLOI

ANLEITUNG

P901
P902
P903

August 2002

QUALITYMASTERS

CERTIFICATE OF REGISTRATION

CERTIFICATE OF REGISTRATION

This is to certify that:

Consort NV
Parklaan 36
B-2300 Turnhout

Has been assessed by QualityMasters in respect of its Quality Management System and found to comply with:

NEN-EN-ISO 9001 : 2000

Approval is hereby granted for registration providing the rules and conditions relating to certification are observed at all times.

Scope: Het vervaardigen van hoogwaardige meettoestellen voor elektrochemie en elektroforese.

Orginal Approval:	24 Oktober 2000
Current Certificate:	15 Augustus 2001
Certificate Expiry:	24 Oktober 2005
Certificate Number:	BE 4007

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CERTIFICATE OF REGISTRATION

Authorized signatory

QualityMasters B.V.

This certificate remains the property of QualityMasters B.V.

SRTCI
ACCREDITED
EU9706010F

Lack of fulfillment of conditions as set forth in the certification regulations may render this certificate invalid. The use of the accreditation mark indicates accreditation in respect to the activities covered by the accreditation number EU9706010F.

Instruments manufactured by CONSORT

Electrophoresis power supplies
•
Ion analysers
•
pH meters
•
Conductometers
•
Dissolved oxygen meters
•
Thermometers
•
Industrial controllers

CONSORT nv
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CE

DECLARATION OF CONFORMITY

We declare under our sole responsibility that the product

Multi-channel analysers

content of the type numbers

P901, P902, P903

to which this declaration relates is in conformity

with the following standards

EN61010

LOW VOLTAGE DIRECTIVE 73/23/EEG

EN50081-1

EN50082-1

EN60555-2

EMC DIRECTIVE 89/336/EEG

Turnhout, January 8, 1998

on behalf of **CONSORT nv**

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Forms

This instrument is manufactured with the latest technology and needs no particular maintenance. **CONSORT** certifies that this instrument was thoroughly inspected and tested at the factory prior to shipment and found to meet all requirements defined by contract under which it is furnished. However, dimensions and other physical characteristics may differ.

The normal operating temperature should be between 4° and 40°C. Never store the instrument in a room with high humidity or at very low temperatures (condensation water!).

Manufacturer

CONSORT nv

Parklaan 36 — Tel (+32)(14)41 12 79

B2300 Turnhout — Fax (+32)(14)42 91 79

Belgium — E-mail: info@consort.be

Warranty

This instrument (excluding all accessories) is warranted against defective material and workmanship for a period of thirty-six (36) months from the date of shipment ex factory. **CONSORT** will repair all defective equipment returned to it during the warranty period without charge, provided the equipment has been used under normal laboratory conditions and in accordance with the operating limitations and maintenance procedures in this instruction manual and when not having been subject to accident, alteration, misuse or abuse. A return authorisation must be obtained from **CONSORT** before returning any product for warranty repair on a freight prepaid basis!

CONSORT is not liable for consequential damages arising out of the use or handling of its products.

Servicing

In the event of this instrument being returned for servicing, the owner is requested to remove the power supply lead and **NOT** to send the following items unless they are suspect:

Manual

Cables

Accessories

If serious malfunctioning occurs, stop using the unit immediately and consult your local **CONSORT** dealer.

Ranges	**pH**	-2...+16 pH
	mV	±2000 mV
	Ion	10^{-11} to 10^{+1}, any unit *(P903)*
	°C	-30...+130°C
Resolution		0.1/0.01/0.001 pH, 1/0.1 mV, 0.1°C, 1% Ion
Inputs		BNC input for pH/mV/Ion electrodes BANANA input for a Pt1000/Pt100 temperature probe
Temp. Comp.		automatic with Pt1000/Pt100 or manual
Digital output		programmable RS232, 300...9600 b/s, for bi-directional communication with a computer or printer
Analogue output		0...2 V, ca 8 kΩ, 8 bit D/A
Display		LCD display, 128 x 64 pixels
Keys		8 tactile keys
Ambient temp.		4...40°C
Rel. Humidity		0...90 % (non-condensing!)
Power supply		210-250 V~ (105-125 V~), 50/60 Hz, max. 2 VA and 4 NiMH batteries, size AA
Cabinet		IP65 cabinet
Dimensions		252 x 121 x 50 mm
Weight		600 g

Keyboard

MODE	=	Selects all modes or escapes from error traps, calibration procedures, etc..by returning to the original mode.
⮝/⮟/⮜/⮞	=	Button for entering a value or for selecting a function.
CAL	=	Starts or proceeds a calibration or a function.
PRINT	=	Displayed value is printed through the RS232 output.
HELP	=	Built-in manual.
HOLD	=	Holds display when measuring.
ON/OFF	=	Switches the instrument on or off.

Batteries

The batteries can be replaced by opening the bottom compartment of the cabinet. Only use NiMH batteries!

AC adaptor

Remove the protective silicone stopper from the DC socket and connect the jack of a suitable AC adaptor (model **A4070** for 230 V~ or model **A4071** for 115 V~) to the DC socket for recharging the NiMH batteries. **Avoid to use an AC adaptor without NiMH batteries being inserted in the instrument!** For field work, remove the adaptor and re-insert the protective silicone stopper into the DC socket. Do not hold the adapter by wet hand!

Inputs

The measuring electrode should be connected to the coaxial INPUT connector. If separate electrodes are used, connect the reference electrode to the REF. terminal. Automatic temperature compensation and temperature measurements are possible by plugging a Pt1000 temperature probe into the °C terminals. You can also use a combination pH electrode with built-in Pt1000. Its banana plugs should be inserted in the °C terminals. Without Pt1000, the manual temperature compensation is automatically switched on.

Recorder output

A recorder can be connected to the red (+) and black (-) terminals. Use only laboratory recorders with a high input impedance!

Digital output

A standard RS232 output terminal (DP9) is provided for interfacing the instrument with a printer or computer. Data is sent in the ASCII code at a BAUD rate of 150...4800 bps (8 bit, no parity, 1 stopbit).

Serial port pinout specifications:
pin 1 : connected to pin 4 and pin 6
pin 2 : TxD, transmit data
pin 3 : RxD, receive data
pin 4 : connected to pin 1 and pin 6
pin 5 : Gnd, signal ground
pin 6 : connected to pin 1 and pin 4
pin 7 : connected to pin 8
pin 8 : connected to pin 7
pin 9 : not connected

System

1. Select [MAIN MENU] by pressing **MODE**.
2. Select [SET-UP], [SYSTEM] and press **CAL**.
3. Follow the instructions on the screen to adjust language, contrast and automatic power-off timer.

Date and Time

1. Select [MAIN MENU] by pressing **MODE**.
2. Select [SET-UP], [DATE/TIME] and press **CAL**.
3. Adjust the date (respectively year, month and day) by pressing **CAL** each time.
4. Adjust the time (respectively hour, minutes and seconds) by pressing **CAL** each time.

Recorder

1. Select [MAIN MENU] by pressing **MODE**.
2. Select [SET-UP], [RECORDER] and press **CAL**.
3. Select the desired range and press **CAL**.
4. Select the desired minimum level corresponding to a 0 V recorder output and press **CAL**.
5. Select the desired maximum level corresponding to a 2 V recorder output and press **CAL**.

Password *(P902, P903)*

1. Select [MAIN MENU] by pressing **MODE**.
2. Select [SET-UP], [PASSWORD] and press **CAL**.
3. A private code can be programmed to avoid undesired access to the instrument. Enter your secret sequence of 5 keys and press **CAL**.

1. Select [MAIN MENU], [pH] by pressing **MODE**. The display will immediately show the measured value according to the previous calibration. Should you want to recalibrate, press **CAL**.
2. The display shows up to five of the 9 buffers in memory, e.g. [7.00] and [4.00]. Select the proper buffers or enter manually a special value and press **CAL**. The unused buffers should be switched off.
3. Rinse the electrodes with distilled water and immerse them in the first buffer solution. Select [CALIBRATE], press **CAL** and follow the instructions on the screen until the calibration is finished.
4. After rinsing the electrodes with distilled water, immerse them in the samples and read the display.
5. Rinse the electrodes always with distilled water after use and store them in a 3...4 M KCl solution.

Relative pH measurements (P902, P903):

1. While in the pH range, press ⩓. At that moment the instrument stores the actual value and automatically subtracts it from all next measurements. You can repeat this as many times as required. [REL] in the display appears.
2. To cancel relative pH readings, press **MODE** and you will be in the normal measuring mode again.

Using pH electrodes with an abnormal zero point (P902, P903):

1. Select [E0 = x mV] and press **CAL**.
2. Enter the zero point (Eo) of the electrode and press **CAL**.

- *A blinking decimal point warns you for unstable measurements. Wait to read the display!*
- *Stirring the solution during the measurements promotes the homogeneity and is therefore always recommended.*
- *Press ⩔ to change the resolution from 0.1 to 0.001 pH.*

mV measurement

1. Select [MAIN MENU], [mV] by pressing **MODE**. The display will immediately show the measured value according to the previous calibration. Should you want to recalibrate, press **CAL**.
2. Immerse the electrodes in a standard solution of known potential, adjust to the proper value and press **CAL**.

Relative mV measurements (P902, P903):

1. While in the mV range, press ⩓. At that moment the instrument stores the actual value and automatically subtracts it from all next measurements. You can repeat this as many times as required. [REL] in the display appears.
2. To cancel relative mV readings, press **MODE** and you will be in the normal measuring mode again.

- *A blinking decimal point warns you for unstable measurements. Wait to read the display!*
- *Stirring the solution during the measurements promotes the homogeneity and is therefore always recommended.*
- *Press ⩔ to change the resolution from 1 to 0.1 mV (P903).*

The pH of each solution varies with the temperature. Therefore it is impossible to accurately compare pH readings unless they are corrected to a reference temperature. This model features a unique microprocessor controlled system, which helps you completely to overcome the problem of non linear temperature correction curves for the species to be measured. There is no need to keep sample temperatures close to each other, since a special temperature curve for any type of sample can be plotted in the non-volatile memory. Temperature corrected pH readings should not be confused with **the normal temperature compensation!**

1. Select [MAIN MENU] by pressing **MODE**.
2. Select [SET-UP], [pH/°C CORRECTION] and press **CAL**.
3. Select whether or not temperature corrected pH readings should be displayed and press **CAL**.
4. Select [REFERENCE] and press **CAL**.
5. Select the temperature to which all future measurements will be referred to and press **CAL**.
6. Select [RECORD CURVE] and press **CAL**.
7. Prepare the sample solution to be measured in a thermostatic bath with magnetic stirrer and immerse the electrodes in it. Its temperature should be about 5°C lower than the lowest value you may possibly need during future measurements. The display shows °C and pH of the sample. Wait a while to enable the electrodes to adapt themselves to the new temperature. Press **HOLD**, when readings are stable, to store the values in memory. Increase the temperature with at least 5°C and repeat the same procedure for as many temperatures as necessary. When the temperature has reached about 5°C more than the highest value you need for future measurements, press **CAL** to stop the temperature tracing.
8. To view the recorded curve on the display, select [SHOW CURVE] and press **CAL**. Press **PRINT** to print the curve in table format.

Temperature measurement

1. Select [MAIN MENU], [°C] by pressing **MODE**. Without Pt1000, adjust the manual temperature compensation and proceed by pressing **MODE**. Should you want to recalibrate, press **CAL**.
2. Immerse the Pt1000 in a standard solution of known temperature. Calibrate to the proper value and press **CAL**.

A pH electrode is active and stable only after wetting! For this purpose it must be immersed for **at least ten hours** in a 3...4 M KCl solution. During short interruptions (e.g. storage) the electrode should be immersed in a 3...4 M KCl solution. In doing this it is always kept ready for use. When the interruption is longer than a month, refill the closing cap with 3...4 M KCl and plug it on the electrode tip in order to protect the glass bulb. Before use, ensure that the reference part of the electrode is topped up with a 3...4 M KCl solution.

Avoid a low pressure inside the electrode! Therefore always remove the closure from the refilling aperture during the measurements as well as during the calibration. This allows the saltbridge solution to flow through the ceramic liquid junction and prevents contamination of the electrolyte. For the same reason, the inside level should always be higher than the outside level of the measuring solution. Close the refilling aperture again when storing the electrode.

A polluted electrode may be cleaned with a soft detergent or 0.1 M HCl. Greasy substances may be removed with acetone or alcohol **(never do this with plastic electrodes!)**.

If the electrode is polluted by proteinaceous materials (such as blood), it should stand in a cleaning solution overnight and then be cleaned with distilled water before use. The pH electrode wears away by being used. If the electrode tends to respond slower and calibration becomes difficult, even after cleaning, it should be replaced by a new one.

Metal electrodes (Pt, Ag, Au): Metal electrodes are always ready for use. During short interruptions they are immersed in distilled water. **They should be cleaned regularly:**

- Silver electrodes are immersed in a concentrated ammonia solution during one hour.
- Platinum or gold electrodes are immersed in concentrated nitric acid during one hour.

1. Select [MAIN MENU], [ION] by pressing **MODE**. The display will immediately show the measured value according to the previous calibration. Should you want to recalibrate, press **CAL**.
2. Select [CURVE x] and press **CAL**.
3. Select the desired curve (x) and press **CAL**.
4. Select [ION y] and press **CAL**.
5. Select the desired ion (y) from the list and press **CAL** (Ion1 = random ion) (---- = no indication).

Calibration:
Always calibrate the electrode in the same conditions as future determinations will require and make sure temperature remains constant. The instrument only accepts the following standard values, in scientific notation: 1.10^{-9}/ 3.10^{-9}/ 1.10^{-8}/ 3.10^{-8}/ 1.10^{-7}/ 3.10^{-7}/ 1.10^{-6}/ 3.10^{-6}/ 1.10^{-5}/ 3.10^{-5}/ 1.10^{-4}/ 3.10^{-4}/ 1.10^{-3}/ 3.10^{-3}/ 1.10^{-2}/ 3.10^{-2}/ 1.10^{-1}/ 3.10^{-1}/ 1.10^{0}, any unit. Therefore, e.g. 1 mg/l is shown on the display as [1.-3] (= 1.10^{-3}).

1. Prepare 2 or more (up to 19) standards, covering your future measuring range. Each of them should be 3 to 10 times stronger than the previous one.
2. Select [CALIBRATE] and press **CAL**.
3. After rinsing the electrodes with distilled water, immerse them in the first standard solution. Select the first calibration value and press **CAL** when readings are stable. Go on in the same way with all the next standard solutions. After the last one has been entered, press **MODE** to stop the calibration procedure.
4. Decide whether a blank correction should be carried out or not. Follow the instructions on the screen. After rinsing the electrodes with distilled water, immerse them in a blank solution. When readings are stable press **CAL**.
5. Rinse the electrodes with distilled water, immerse them in the samples, and read the concentration on the display.

Standard addition:
The standard addition method is used when the samples can be kept at the same temperature and a standard of 5 to 100 times the expected sample concentration is available. The most suitable increment can be found from: increment percentage > 100 x expected sample value / standard value.

1. Select [STANDARD ADDITION] and press **CAL**.
2. Select the desired increment and press **CAL**.
3. Select the desired standard and press **CAL**.
4. Select [DETERMINATION] and press **CAL**.
5. After rinsing the electrodes with distilled water, immerse them in e.g. 100 ml sample solution. The display will show the electrode potential. When readings are stable press **CAL**. Add a small increment of standard corresponding to the chosen mode (e.g. 5 ml). The display will show the difference in electrode potential. When readings are stable press **CAL**. The instrument calculates the result and shows the concentration of the sample.

Standard subtraction:
The standard subtraction method is used to measure species for which stable standards or ion selective electrodes do not exist. The procedure is similar to the standard addition method. The most suitable increment can be found from: increment percentage > 100 x expected sample value / standard value.

1. Select [STANDARD SUBTRACTION] and press **CAL**.
2. Select the desired increment and press **CAL**.
3. Select the desired standard and press **CAL**.
4. Calculation of the stoichiometric ratio (n) of the reaction: xS + yR > SxRy n=x/y (S = sample, R = reagent). Select the first coefficient and press **CAL**. Go on in the same way with all the next coefficients.
5. Select [DETERMINATION] and press **CAL**.
6. After rinsing the electrodes with distilled water, immerse them in e.g. 100 ml sample solution. The display will show the electrode potential. When readings are stable press **CAL**. Add a small increment of standard corresponding to the chosen mode (e.g. 5 ml). The display will show the difference in electrode potential. When readings are stable press **CAL**. The instrument calculates the result and shows the concentration of the sample.

Sample addition:
The analate addition method is used when the samples vary widely in temperature or have a 5 to 100 times higher concentration than the available standard. The most suitable increment can be found from: increment percentage < 100 x standard value / expected sample value.

1. Select [SAMPLE ADDITION] and press **CAL**.
2. Select the desired increment and press **CAL**.
3. Select the desired standard and press **CAL**.
4. Select [DETERMINATION] and press **CAL**.
5. After rinsing the electrodes with distilled water, immerse them in e.g. 100 ml standard solution. The display will show the electrode potential. When readings are stable press **CAL**. Add a small increment of sample corresponding to the chosen mode (e.g. 5 ml). The display will show the difference in electrode potential. When readings are stable press **CAL**. The instrument calculates the result and shows the concentration of the sample.

Sample subtraction:
The analate subtraction method is used to measure species for which stable standards or ion selective electrodes do not exist. The procedure is similar to the analate addition method. The most suitable increment can be found from: increment percentage < 100 x standard value / expected sample value.

1. Select [SAMPLE SUBTRACTION] and press **CAL**.
2. Select the desired increment and press **CAL**.
3. Select the desired standard and press **CAL**.
4. Calculation of the stoichiometric ratio (n) of the reaction: xS + yR > SxRy n=x/y (S = sample, R = reagent). Select the first coefficient and press **CAL**. Go on in the same way with all the next coefficients.
5. Select [DETERMINATION] and press **CAL**.
6. After rinsing the electrodes with distilled water, immerse them in e.g. 100 ml standard solution. The display will show the electrode potential. When readings are stable press **CAL**. Add a small increment of sample corresponding to the chosen mode (e.g. 5 ml). The display will show the difference in electrode potential. When readings are stable press **CAL**. The instrument calculates the result and shows the concentration of the sample.

1. Select [MAIN MENU] by pressing **MODE**.
2. Select [SET-UP], [GLP] and press **CAL**.
3. Select [SHOW REPORT] and press **CAL**. Browse with ⮝, ⮟, ⮜ or ⮞ to show a complete calibration report. Press **PRINT** to print the report.

```
pH/mV/Ion/°C-meter P903
-----------------------
Date                      : 15/12/1997
Time                      : 11:32:04
Version                   : 1.0

SETTINGS
--------
Identification No         : 003
Password                  : OFF
pH/°C correction          : OFF
Temp. probe               : ---
Manual temp.        (°C)  : 22.6

pH CALIBRATION
--------------
Date                      : 15/12/1997
Time                      : 11:20:06
Eo                  (mV)  : 0

Buffer 4.008/6.865
Slope                (%)  : 98.4
Zero point          (pH)  : 6.871

Buffer 6.865/9.180
Slope                (%)  : 98.2
Zero point          (pH)  : 6.879

AVERAGE VALUES
--------------
Slope                (%)  : 98.3
Zero point          (pH)  : 6.875
Response time        (s)  : 11
Temperature         (°C)  : 22.6

STATISTICS
----------
Slope                (%)  : +0.4
Zero point          (pH)  : +0.002
Response time        (s)  : -1
```

Calibration reminder:

1. Select [INTERVAL] and press **CAL**.
2. Select the desired time interval between each automatic warning for a new calibration of the electrodes and press **CAL**.

1. Select [MAIN MENU] by pressing **MODE**.
2. Select [SET-UP], [DATALOGGER] and press **CAL**.

Start the data-logging:

1. Select [STORE] and press **CAL**.
2. Select [RANGE] and press **CAL**.
3. Select the desired range and press **CAL**.
4. Select [RESOLUTION] and press **CAL**.
5. Select the desired resolution and press **CAL** (high = 16 bit, low = 8 bit).
6. Select [INTERVAL] and press **CAL**.
7. Select the desired time interval between the data-logging and press **CAL**.
8. Select [NUMBER] and press **CAL**.
9. Select the desired number of values to be data-logged and press **CAL**.
10. Select [START DATA-LOGGING] and press **CAL**.
11. Starts the data-logging according to the previous settings while a blinking [LOG] appears. When manual data-logging has been selected, press **PRINT** to put a next measurement into memory. In the meantime the display shows the logging-number e.g. [#0027].

View the stored values on the display:

1. Select [RECALL] and press **CAL**.
2. Select the desired form to display or print the stored data and press **CAL** to continue. The scales of a graph can be modified by pressing **CAL**. Follow the instructions on the screen.

Erase the stored values:

1. Select [ERASE] and press **CAL**. Follow the instructions on the screen.

RS232

1. Select [MAIN MENU] by pressing **MODE**.
2. Select [SET-UP], [RS232] and press **CAL**.
3. Select [BAUDRATE] and press **CAL**.
4. Select the desired baudrate and press **CAL**.
5. Select [INTERVAL] and press **CAL**.
6. Select the desired interval between the transmitted data and press **CAL**. Pre-set to zero if no automatic transmitting is required.

Remote control by a computer:

Send a series of characters to the instrument and it will execute the corresponding command as follows:

Command	Instruction	Answer
">1"	press **MODE**	"<1"
">2"	press ⮜	"<2"
">3"	press ⮟	"<3"
">4"	press **CAL**	"<4"
">5"	press **PRINT**	"<5"
">6"	press **HELP**	"<6"
">7"	press **HOLD**	"<7"
">?"	send displayed measurement or selection	"<?"
">+"	switch keyboard on	"<+"
">-"	switch keyboard off	"<-"
">M"	go directly to ***Set-up***	"<M"
">P"	go directly to ***pH measurement***	"<P"
">V"	go directly to ***mV measurement***	"<V"
">T"	go directly to ***°C measurement***	"<T"
">I"	go directly to ***Ion measurement***	"<I"
">Nxy"	input of value "xy" (x = low byte / y = high byte)	"<Nxy"

Follow exactly the same measuring or calibration procedures, as described in this manual, to include any desired command in your own software.

Temp.	1.68	4.01	6.87	9.18	12.45	*NIST buffers*
0°C	1.666 pH	4.003 pH	6.984 pH	9.464 pH	13.423 pH	
5°C	1.668 pH	3.999 pH	6.951 pH	9.395 pH	13.207 pH	
10°C	1.670 pH	3.998 pH	6.923 pH	9.332 pH	13.003 pH	
15°C	1.672 pH	3.999 pH	6.900 pH	9.276 pH	12.810 pH	
20°C	1.675 pH	4.002 pH	6.881 pH	9.225 pH	12.627 pH	
25°C	**1.679 pH**	**4.008 pH**	**6.865 pH**	**9.180 pH**	**12.454 pH**	
30°C	1.683 pH	4.015 pH	6.853 pH	9.139 pH	12.289 pH	
40°C	1.694 pH	4.035 pH	6.838 pH	9.068 pH	11.984 pH	
50°C	1.707 pH	4.060 pH	6.833 pH	9.011 pH	11.705 pH	
60°C	1.723 pH	4.091 pH	6.836 pH	8.962 pH	11.449 pH	
70°C	1.743 pH	4.126 pH	6.845 pH	8.921 pH		
80°C	1.766 pH	4.164 pH	6.859 pH	8.885 pH		

Temp.	4.00	7.00	9.21	10.00	*Standard buffers*
5°C	3.99 pH	7.08 pH	9.45 pH	10.24 pH	
10°C	3.99 pH	7.06 pH	9.38 pH	10.18 pH	
20°C	3.99 pH	7.02 pH	9.26 pH	10.06 pH	
25°C	**4.00 pH**	**7.00 pH**	**9.21 pH**	**10.01 pH**	
30°C	4.01 pH	6.99 pH	9.16 pH	9.87 pH	
40°C	4.03 pH	6.98 pH	9.06 pH	9.89 pH	
50°C	4.06 pH	6.97 pH	8.99 pH	9.83 pH	
60°C	4.09 pH	6.98 pH	8.93 pH	9.79 pH	

Temp.	3 M KCl	*Redox standard*
0°C	224 mV	
5°C	219 mV	
10°C	214 mV	
15°C	212 mV	
20°C	204 mV	
25°C	199 mV	
30°C	194 mV	
35°C	189 mV	
40°C	184 mV	
45°C	179 mV	
50°C	174 mV	