Desktop pH/ISE/ORP/mV/Conductivity/ Temp Meter
Model 460CP
Instruction Manual

istek, Inc.

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Chapter I. Introduction

istek's Desktop pH/ISE/Conductivity/TEMP Meter(model 460CP) is operated by AC/DC adaptor and is controlled by microprocessor for all measurement needs.

istek's instrument is high-performance for accurate measurement of wastewater and use at laboratory and its operation is simply designed in the position of user.

istek's Desktop pH/ISE/Conductivity/TEMP Meter(model 460CP) features a dual channel type which simultaneously measure (pH/ISE) and Conductivity with dual electrode inputs, and selectable single/divided screen display mode.

istek's Desktop pH/ISE/Conductivity/TEMP Meter(model 460CP) contains function which can know the last calibration status for pH, ISE and Conductivity, e.g. the last calibration Date/Time, Temperature and Buffer etc.

While measuring pH, if pH reading is stable, ¡Stable¡ is displayed in the lower field. Therefore can measure accurately since user can know easily a stable value.

istek's Desktop pH/ISE/Conductivity/TEMP Meter(model 460CP) features to obtain a reliable data since its program is treated in accordance with the specific character of a selected ion for a accurate measurement.

The model 460CP is capable of storing up to 100 points(totally 200 points) in memory at once for each channel and storing by control of the time interval of data-log automatically, and can be remotely controlled via RS232C interface.

It is available to simultaneously display unlimited number of each datalogging of dual channel via Excel Software with graph including GLP documentation by using DAPS .
The model 460CP displays pH, ISE(mg/L), mV, Conductivity(μS, mS), TDS(mg/L), Salinity(ppt), Resistivity (ohm, kohm, Mohm) and ATC(°C).

pH   indicates power of hydrogen(H^+).(unit pH)
       $pH = -\log_{10}[H^+]$

mV   indicates electromotive force of each ion.(unit mV)

ISE   indicates concentration of any given ion.(unit mg/L) To measure an ion must use electrodes which according to the type of ion, selectively response to only any given ion.

Conductivity   indicates conductivity of solution. (unit μS/cm and mS/cm)

TDS   indicates by converting the measured conductivity intoconcentration of the total dissolved solid present solution. (unit mg/L)

Salinity   indicates by converting the measured conductivity into salinity of solution. (unit ppt)

Resistivity   indicates resistivity of solution at a current temperature.

ATC   For automatic temperaure compensation, a temperature probe supplied by *istek* must be used.
Temperature compensation is automatically performed while measuring.

Chapter II. Instrument Setup

Real Panel

Power Source
Connect the supplied adaptor to the meter.
istek supplies AC/DC adaptor(DC 9V) adjusting to 220V.

Electrode Connection
Attach electrode by sliding the BNC connector onto the sensor input then push down and turn clockwise to lock into position. CH-1 : Conductivity, CH-2 : pH/ORP/ISE

ATC Probe Connection
Attach the ATC probe to the ATC jack by sliding the connector straight on until firmly in place.
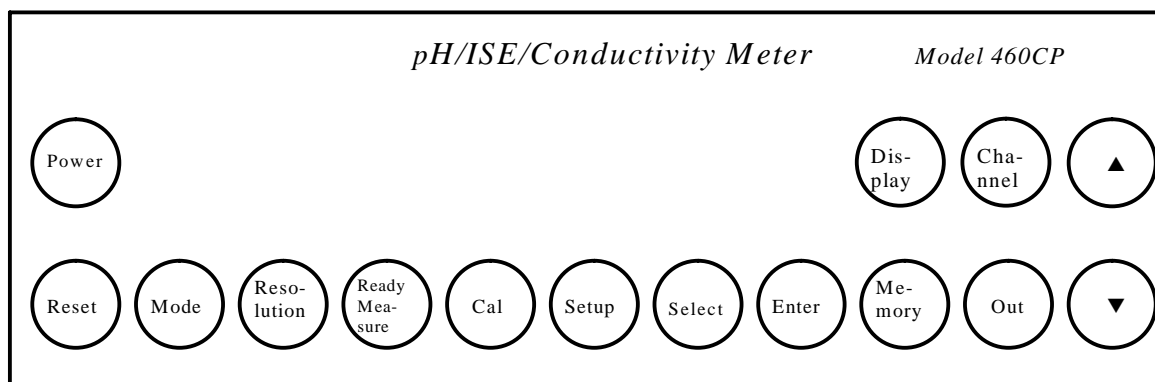
Recorder Connection
When the recorder is used, connect the recorder to the meter. Output voltage is -1999.9 ~ +1999.9 mV with impedance of 600Ω.

Printer and RS232C interface cable Connection
Insert printer and RS232C interface cable into the RS232C jack. Use interface cable supplied by *istek*.

Chapter III. General Functions

Key Function

```
pH/ISE/Conductivity Meter          Model 460CP

  (Power)                                    (Dis-play)  (Cha-nnel)  (▲)

  (Reset) (Mode) (Reso-lution) (Ready Mea-sure) (Cal) (Setup) (Select) (Enter) (Me-mory) (Out) (▼)
```

Key Name	Description
Power	used to turn ON/OFF.
Display	used to simultaneously display the measuring data(pH/ISE, DO and Conductivity) with divided screen. That is to say simultaneously display Channel [A], [B] and [C]. If pressing again, return to single screen.
Channel	Control is conversed [A]→[B]→[C] or [C]→[B]→[A].
Reset	used to initiate a system.
Mode	used to change operating modes. The operating modes are Conductivity, TDS, Salinity and Resistivity in channel [A], pH, mV and ISE in channel [B], and DO, O_2 Air and pO_2 in channel[C].
Resolution	used to change the resolution. For pH mode can choose 0.1, 0.01 or 0.001. For mV mode, used to change from a currently displayed value to zero value(relative millivolt).
Ready/measure	used to change condition of meter, i.e. measure or ready. This is used for changing from ready to measure condition or reversing.
Cal	used to start or set calibration. used to confirm the last calibration status.
Setup	used to access the setup menu. This is used for setting instrument parameters. Can set Cell Constant, Temperature Coefficient, Temperature Compensation, Date/Time and Data-Log in Channel[A]. Can set Buffer, ISE, Date/Time, Data-Log, High and Low Alarm in Channel[B].

Can set Salinity, Altitude, Date/Time, Alarm and Data-Log in Channel[C].

Chapter III   General Functions

pH/ISE/Conductivity/Temp Meter

Key Name	Description
Select	used to move position of cursor.
Enter	used to set a selected data.
Memory	used to store data in meter¡s memory while measuring. In the ready condition, used to search the memorizeded data.
Out	used to print data. used to exit in Setup mode.
up(▲)	In setup and pH calibration(manual), press to increase value. used to adjust Cell, Tref, TC, Date/Time, Data-Log and RS232C Setup in Channel [A]. used to adjust Date/Time, Alarm, Data-Log and RS232C Setup in Channel[B]. used to adjust Salinity, Altitude, Date/Time, Alarm, Data-Log and RS232C Setup in Channel[C]. while measuring mV, or displays slope after pH/Ion calibration.
down(▼)	In setup and pH calibration(manual), press to decrease value. used to adjust Cell, Tref, TC, Date/Time, Data-Log and RS232C Setup in Channel[A]. used to adjust Date/Time, Alarm, Data-Log and RS232C Setup in Channel[B]. used to adjust Salinity, Altitude, Date/Time, Alarm, Data-Log and RS232C Setup in Channel[C].

Display Description

The following display is specially specified.
Even some messages are not shown in the below display, describe together below.

[A] **Ready**	96 / 11 / 12 11:15
0.00 uS/cm	**Tr. 25.0** **2.1 %/°C**
Conductivity	25.0 °C

[B] **Ready**	96 / 11 / 12 11:15
7.00_{pH} ATC 25.0 °C	
Stable	

▣A▣ **Ready**	**[B]** **Ready**
0.00 uS/cm	7.00
DO 25.0 °C	pH 25.0 °C

Display	**Function**
[A]	indicates Channel[A]. In divided screen, **A** indicates that Channel[A] is controlled.
[B]	indicates Channel[B]. In divided screen, **B** indicates that Channel[B] is controlled.
Channel[A]	
Conductivity	indicates conductivity with range of 0 ~199,999 µS/cm.
TDS	indicates the amount of total dissolved solids presents in solution (unit mg/L).
Salinity	indicates salinity presents in solution at a current temperature. (unit ppt)
Resistivity	indicates resistivity of solution at a current temperature.

Temp(°C)   displays when a temperature probe is attached, and indicates automatic temperature compensation.

Display	Function
Ready	indicates that meter is in ready condition.
Measure	indicates that meter is in measure condition.
96/11/12 11:15	indicates a current date and time.
Tr. 25.0	indicates that compensation of temperature is performed at 25.0 °C.
Tr. 20.0	indicates that compensation of temperature is performed at 20.0 °C.
-------	indicates no temperature compensation.
2.10 % / ℃	indicates to compensate temperature with the temperature coefficient, 2.10 % /°C.
Error	displays when it is not available to correctly measure because something is wrong in the meter or buffer while calibrating or measuring.

Channel[B]

pH	displays power of hydrogen ion in range of ?2.000 to 19.999pH.
mV	indicates electromotive force of each ion.
ISE	displays concentration of current ion in range of 0 to 99,999 mg/L.
ATC(°C)	displays when a temperature probe is attached, and indicates automatic temperature compensation.
Stable	when pH reading is stable, ¡Stable¡ is displayed in the lower field.
Measure	indicates that meter is in measure condition.
Ready	indicates that meter is in ready condition.
Cal	indicates that meter is in calibration condition.
Cal-OK	indicates whenever finish each calibration.
96/11/12 11:15	indicates a current date and time.
Slope	indicates slope value.
Select Ion Please...	message to select ion. When measuring without selection of ion.
Select Buffer Please...	message to select buffer(standard solution) while calibrating ion.

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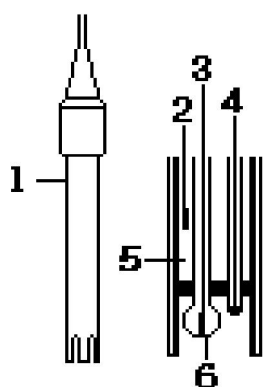| Error | displays when it is not available to correctly measure because something is wrong in the meter or buffer while calibrating or measuring. |

Electrode Structure

General pH Combination Electrode

1. Reference Filling Hole ; injection hole of the filling solution
2. Ag/AgCl or calomel ; Reference Electrode
3. pH mono electrode ; indicator electrode
4. Temperature sensor
5. Reference Filling Solution ; Saturated KCl Solution
6. Glass Membrane ;
   membrane selectively responding hydrogen ion

Electrode Storage & Maintenance

pH Electrode Storage
Electrodes are stored in the cap storage solution supplied by *istek*.
Membrane must be kept wet. If there is no storage solution, pH 4 buffer is best for the single glass electrode and saturated KCl is preferred for a calomel and Ag/AgCl reference electrode. Saturated KCl is the preferred solution for a combination electrode. Electrodes are sometimes stored in distilled water, but this method causes electrode life to decrease.

pH Electrode Maintenance (Electrode Cleaning)
If it takes long time to response or a stable data isn't obtained, can be often restored to normal performance by one of the following procedures;
Glass electrodes fail because of scratches, deterioration or accumulation of debris on the glass surface.

| - Salt deposits | Recover electrode by alternately immersing it three times each in 0.1N HCl and 0.1N NaOH for approx. five minutes. If this fails, immerse tip in KCl solution for 30s. After recovery, soak in pH 7.00 buffer overnight. Rinse and soak in pH 7.00 buffer. Rinse again with distilled water before use. |
| - Oil/Grease films | Remove oil/Grease films with detergent, and |

then rinse electrode with distilled water.

- Clogged Reference Junction   Heat a diluted KCl solution to about 60~80°C.
The electrode must be stored in this solution
for approx. ten minutes, then cool electrode in not
heated KCl solution.

- Protein removal   Protain coatings can be removed by soaking
glass electrode in a 10% pepsin solution adjusted
to pH 1 to 2.

* In case of Ion Selective Electrode, refer to ISE manual.

Conductivity Cell Storage

A dirty cell will contaminate the solution and cause conductivity to change. It is best to store cells that are immersed in deionized water. Provided the cell has been stored in condition of drying, should be soaked in distilled water for five to ten minutes before using to keep electrode wet.

Conductivity Cell Maintenance (Cell Cleaning)

Glease, oil, fingerprints, and other contaminants on the sensing elements can cause erroneous measurements and sporadic responses.
If it takes long time to response or a stable data isn't obtained, can be often restored to normal performance by using the following procedures;
Clean cells with detergent and/or dilute nitric acid(1%) by dipping or filling the cell with cleaning solution and agitating for two or three minutes. Other diluted acids(e.g. sulfuric, hydrochloric, chromic) may be used for cleaning except for aqua regia. When a stronger cleaning solution is required, try concentrated hydrochloric acid mixed into 50% isopropanol.

Chapter IV. Setup Functions

The setup menu is used to identify and change instrument parameters.

Conductivity, Channel[A]

Temperature Setting

If temperature on display differs from a real temperature, set a real temperature according to the following procedure.

Press **Setup** and then the display is shown as follows.

```
[A]          <<   COND SETUP   >>
    1.Cell/Tref/TC
    2.Date/Time
    3.Data-Log
    4.Exit
```

Press **Mode** key.

```
[A]          << TEMP SETUP   >>


                 21.3 ℃

```

Set temperature by using ▲ or ▼ key and exit by pressing **Out** key.

Clear data(Memory)

If clearing the stored data in Channel[A], press **Mode** key to enter Salinity mode and press **Setup** key. The display is shown as follows. And then press **Enter** to clear. Therefore all data, which set at setup, are changed to a basic value.

```
              <<   CLEAR   >>


              Memory Clear ?
              (Yes = Enter) (No = Out)

```

(1) Conductivity Mode

In the conductivity ready condition press **Setup** key to enter setup and then the message is shown as follows.

```
[A]           <<   COND SETUP   >>
      1.Cell/Tref/TC
      2.Date/Time
      3.Data-Log
      4.Exit
```

The selected menu shows an emphasized black color in turn with pressing **Select** key and the condition of each item is set with pressing **Enter** key.
After finishing setup, press **Out** key or select a displayed **Exit** to exit.

Cell/Tref/TC

In the initial display of Conductivity Setup, after selecting **1.Cell/Tref/TC** by using **Select** key, press **Enter** key and then the display is shown as follows.

```
[A]           <<   Cell/Tref/TC   >>
      1. Cell              1.0
      2. Tref             25.0
      3. TC               2.10
      4. Exit
```

1) Cell
1. Cell has function to set cell constant.
For conductivity measurement of a solution, can accurately measure by adjusting cell constant.
Cell constants consist of 0.01, 0.1, 1.0, 10 and 100, and set by using ▲ or ▼ key.

2) Tref
2. Tref has function to set compensation temperature(25.0 °C or 20.0 °C).

```
[A]           <<   Cell/Tref/TC   >>
      1. Cell              1.0
      2. Tref             25.0
      3. TC               2.10
      4. Exit
```

Press ▲ or ▼ key to change 25.0 or 20.0.
The conductivity of a solution exhibits at 25.0°C or 20.0 °C.

3) TC
3. TC is used to set temperature coefficient. The conductivity of solution with a specific electrolyte concentration will change in accordance with the change of temperature. Each conductive ion has a different temperature coefficient.
All *istek*'s meters allow adjusting coefficient for the advanced performance.

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```
[A]              <<    Cell/Tref/TC    >>
     1. Cell                        1.0
     2. Tref                       25.0
     3. TC                          2.10
     4. Exit
```

Press ▲ or ▼ key until the desired value is displayed.

The following table is a typical temperature coefficients(percentage of change of conductivity per °C).

Solution	% / °C
Ultrapure Water	4.55
Salt(NaCl)	2.12
5% NaOH	1.72
Dilute Ammonia	1.88
10% HCl	1.32
5% Sulfuric Acid	0.96
98% Sulfuric Acid	2.84

4) Exit
If finishing setup or exiting setup in the middle of setting, select **Exit** and press **Enter** key. **Out** key has the same function.

Date/Time
In the initial display of pH setup, after selecting **3.Date/Time** by using **Select** key, press **Enter** key and then the display is shown as follows. Select data(year, month, day and time etc.) by using **Select** key and set data by using ▲ or ▼ key.

```
[A]              <<    DATE/TIME SET    >>


          <   Current    Time   >
          96 / 11 / 26    13 : 36 : 36      [Exit]

```

If finishing setup, press **Out** key or select a displayed **Exit** to exit Date/Time setup.

Data-Log
In the initial display of setup, After selecting **3. Data-Log** by using **Select** key, press **Enter** key. And then the display is shown as follows. Select data by using **Select** key.

```
[A]              <<    DATA LOGGING    >>
```

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```
┌─────────────────────────────────────────────┐
│  1. Destination :          Memory           │
│  2. Time Interval :        0 min            │
│  3. Exit                                    │
└─────────────────────────────────────────────┘
```

1) **1.Destination** is a place to store memory type, such as memory, printer or Excel etc., by using ▲ or ▼ key.
If pressing **Enter** key in **1.Destination**, display is shown as follows.

```
┌─────────────────────────────────────────────┐
│ [A]      <<   RS232C SETUP   >>             │
│                                             │
│    Baud       Data      Stop     Parity     │
│    9600        8         1       No         │
│                                  [Exit]     │
└─────────────────────────────────────────────┘
```

Select communication data by using **select** key, and set Baudrate, Data Bit, Stop Bit and Parity Bit by using ▲ or ▼ key.
· Baud : adjust communication rate between computer and meter by using ▲ or ▼ key.
· Data : adjust Data Bit between computer and meter by using ▲ or ▼ key.
· Stop : adjust Stop Bit between computer and meter by using ▲ or ▼ key.
· Parity : adjust Parity Bit between computer and meter by using ▲ or ▼ key.
If finishing setup press **Out** key or a displayed **Exit** to exit RS232C setup.

2) Time Interval
In order to store data to any Destination with certain, select a desired time interval(minutes or seconds) by using ▲ or ▼ key.

```
┌─────────────────────────────────────────────┐
│ [A]      <<   DATA LOGGING   >>             │
│                                             │
│    1. Destination :        Memory           │
│    2. Time Interval :      0 min            │
│    3. Exit                                  │
└─────────────────────────────────────────────┘
```

Unit of time interval, such as minutes and seconds, is changed by pressing **Enter** key.
Adjust time interval by using ▲ or ▼ key.

```
┌─────────────────────────────────────────────┐
│ [A]      <<   DATA LOGGING   >>             │
│                                             │
│    1. Destination :        Memory           │
│    2. Time Interval :      0 sec            │
│    3. Exit                                  │
└─────────────────────────────────────────────┘
```

Time interval ranges from 1 second to 23 hours 59 minutes 59 seconds.

3) Exit
If finishing setup, press either **Out** key or a displayed **Exit** key to exit Data-Log setup.

Exit

If finishing setup or exiting setup in the middle of setting, select a displayed **Exit** and press **Enter** key. **Out** key has the same function as **Exit** key.

(2) TDS Mode

In the TDS ready condition if pressing **Setup** key, the display is shown as follows. TDS factor adjusts by using ▲ or ▼ key and is basically adjusted to 0.7.

```
[A]          << TDS FACTOR INPUT >>


                   0.70


```

If finishing setup, press either **Out** key to exit setup.

pH/ISE, Channel[B]

Temperature Setting

If temperature on display differs from a real temperature, set a real temperature according to the following procedure.

Press **Setup** and then the display is shown as follows.

```
[B]              <<   pH SETUP   >>
    1.Cal/Auto              2.Buffer
    3.Date/Time             4.Alarm
    5.Data-Log             6.Exit
```

Press **Mode** key.

```
[B]              << TEMP SETUP   >>


                 21.3℃

```

Set temperature by using ▲ or ▼ key and exit by pressing **Out** key.

Clear data(memory)

If clearing all the stored data in Channel[B], press **Mode** key to enter mV mode, and press **Setup** key. The displays will show the messages, "Memory Clear?" And then press **Enter** key to clear. Therefore all data, which set at setup, are changed to a basic value.

```
              <<   CLEAR   >>
```

```
┌─────────────────────────────────────────┐
│          Memory Clear?                   │
│        (Yes=Enter) (No=Out)              │
│                                          │
└─────────────────────────────────────────┘
```

(1) pH Mode

In pH ready condition if pressing **Setup** key to enter the setup, the display is shown as follows. The selected menu shows an emphasized black color in turn by pressing **Select** key and the condition of each item is set by pressing **Enter** key.

```
┌───────────────────────────────────────────┐
│  [B]           <<   pH SETUP   >>         │
│                                           │
│   1.Cal/Auto            2.Buffer          │
│                                           │
│   3.Date/Time           4.Alarm           │
│                                           │
│   5.Data-Log            6.Exit            │
└───────────────────────────────────────────┘
```

After finishing setup, press **Out** key or select a displayed **Exit** key to exit setup.

Cal/Auto & Cal/Manual

In the initial display of pH setup, after selecting **1.Cal/Auto** by using **Select** key, press **Enter** key. The message, such as Cal/Auto(auto calibration) or Cal/Manual(manual calibration), is alternately shown so it is available to select either auto or manual calibration.

Buffer

In the initial display of pH setup, after selecting **2.Buffer** by using **Select** key, press **Enter** key to enter the buffer option mode but the buffer shall be selected only in case of Cal/Auto. Press **Select** key to move into a desired buffer, and then press **Enter** key to select a buffer. The buffer shall be selected up to 5 points, and while calibrating the selected buffers are displayed in the right field. If finishing setup, choose **Exit** or press **Out** key to exit buffer setup.

```
┌───────────────────────────────────────────┐
│  [B]         <<   pH BUFFER SET   >>      │
│   Cal/Auto   Buffer   Selection           │
│   2.00     4.00    7.00    10.00   12.00  │
│   Selected Value                 [Exit]   │
│   4.00                                    │
└───────────────────────────────────────────┘
```

When Cal/Manual is selected, calibrate with a desired buffer pressing . Refer to manual calibration.

Date/Time

In the initial display of pH setup, after selecting **3.Date/Time** by using **Select** key, press **Enter** key and then the display is shown as follows. Select data(year, month, day and time etc.) by using **Select** key and set data by using σ or τ key.

```
┌───────────────────────────────────────────┐
│  [B]          <<   DATE/TIME SET   >>     │
│                                           │
```

```
            <   Current    Time   >
            96 / 11 / 26   13 : 36 : 36      [Exit]
```

After finishing setup, press **Out** key or select a displayed **Exit** to exit Date/Time setup.

Alarm

In the initial display of pH setup, after selecting **4.Alarm** by using **Select** key, the display is shown as follows. Select high and low values respectively by using **Select** key and set data by using σ or τ key.

```
[B]           <<   pH ALARM SET >>

      1. High              :     20.00
      2. Low              :      0.00
      3. [Exit]
```

If the measured pH value is not within this range, the alarm rings. After finishing setup, press **Out** key or select a displayed **Exit** to exit Alarm setup.

Data-Log

In the initial display of pH setup, after selecting **5.Data-Log** by using **Select** key, press **Enter** key. And then the display is shown as follows. Select data by using **Select** key.

```
[B]           <<    DATA LOGGING   >>

      1. Destination :            Memory

      2. Time Interval :          0 min

      3. Exit
```

1) Destination
   1.Destination is a place to store memory type, such as memory, printer or Excel etc., by using ▲ or ▼ key. Refer to Data-Log.
   If pressing **Enter** key in **1.Destination**, the display is shown as follows.

```
[B]           <<    RS232C SETUP    >>

      Baud        Data        Stop        Parity
      9600        8           1           No
                                          [Exit]
```

Select communication data by using **Select** key, and set Baudrate, Data Bit, Stop Bit and Parity Bit by using ▲ or ▼ key.
· Baud : adjust communication rate between computer and meter by using ▲ or ▼ key.
· Data : adjust Data Bit between computer and meter by using ▲ or ▼ key.

· Stop : adjust Stop Bit between computer and meter by using ▲ or ▼ key.

· Parity : adjust Parity Bit between computer and meter by using ▲ or ▼ key.

If finishing setup press **Out** key or select a displayed **Exit** to exit RS232C setup.

2) Time Interval

In order to store data to any Destination with certain, select a desired time interval(minutes or seconds) by using ▲ or ▼ key.

```
[B]          <<   DATA LOGGING   >>

     1. Destination :              Memory
     2. Time Interval :            0 min
     3. Exit
```

Unit of time interval, such as minutes and seconds, is changed by pressing **Enter** key.

Adjust time interval by using ▲ or ▼ key.

```
[B]          <<   DATA LOGGING   >>

     1. Destination :              Memory
     2. Time Interval :            0 sec
     3. Exit
```

Time interval ranges from 1 second to 23 hours 59 minutes 59 seconds.

3) Exit

If finishing the setting of Destination and Time Interval, press **Out** key or select a displayed **Exit** key to exit Data Logging setup.

Exit

After finishing setup or exiting setup mode in the middle of setting, select a displayed **Exit** and press **Enter** key.

The **Out** key has the same function as **Exit** key.

(2) ISE Mode

Press **Mode** key to enter ISE mode and then ISE mode indicator is displayed in the lower field.

In ISE ready condition if pressing **Setup** key, the display is shown as follows.

```
[B]              << ION SETUP>>

       1. Select Ion
       2. Buffer
       3. Exit
```

The selected Menu shows an emphasized black color in turn by pressing **Select** key, and the condition of each item is set by pressing **Enter** key. After finishing setup, press either a displayed **Exit** key or **Out** key to exit setup.

Select Ion

In the initial display of ISE setup, after selecting **1. Select Ion** by using **Select** key, press **Enter** key. And then the display is shown as follows.

NH_3	NH_4^+	Br^-	Cd^{+2}	Ca^{+2}	CO_2	K^+
Cl^-	Cu^{+2}	CN^-	F^-	BF_4^-	Ag^+/S^{-2}	
I^-	Pb^{+2}	Li^+	NO_3^-	NO_X	ClO_4^-	
Na^+	Ca^{+2}/Mg^{+2}	Others			[Exit]	

Select ion by using **Select** key and set the selected ion by pressing **Enter** key. If it is not necessary to select ion, press **Out** key or select a displayed **Exit** to return to the initial mode.

Buffer
In the initial display of ISE setup, after selecting **2. Buffer** by using **Select** key, press **Enter** key to enter buffer option mode and then the display is shown as follows.

```
[B]            << ION BUFFER SET>>

 0.01    0.1    1    10    100       1000
 Selected Value[mg/L]              [Exit]
  100
```

The buffer shall be selected up to 5 points and the selected buffers are displayed in the lower field. While calibrating the selected buffers are displayed in the right field. If finishing setup, press **Out** key or select a displayed **Exit** to exit Ion Buffer setup.

Exit
If finishing setup or exiting setup in the middle of setting, select a displayed **Exit** and press **Enter** key. **Out** key has the same function as **Exit** key.

Chapter V. Calibration and Measurement

Caution : **Don¡t use only one solution for simultaneous measuring of pH, DO and conductivity.**
Please note that when simultaneously measuring, each electrode of pH, DO and conductivity must be put into three solutions respectively.

Conductivity, Channel [A]

The basic condition is as follows.

¡ Cell Constant (Cell) : 1.0

¡ Compensation Temperature (Tref) : 25.0

¡ Temperature Coefficient(TC) : 2.10 % /°C

¡ Data-Log : memory

This meter contains function to confirm the last calibration status of conductivity.

(1) Conductivity Calibration Status

In conductivity ready condition press **Setup** key and **Cal** key or in measurement condition press **Cal** key to enter ¡Cond Calibration Status¡.

<< **Cond Calibration Status**>>
1. Date/Time : 98/03/26 17:30
2. Temp : 18.0
3. Tref : 25.0
4. Standard : 146.9 uS/cm

Confirm Date/Time, temperature(Temp) and compensation temperature(Tref) and standard solution used for the last calibration. If pressing **Out** key, return to an initial display.
If clearing data, can¡t confirm the last Calibration Status, and the display is shown as follows.

<< **Cond Calibration Status**>>
1. Date/Time : 00/00/00 00:00
2. Temp : 0.0
3. Tref : 0.0
4. Standard :
No Data

(2) Preparation
Connect meter with cell and ATC jack.
Prepare a required buffer for measurement and magnetic stirrer.
Clearly rinse cell with the distilled water and blot dry.

(3) Calibration
In conductivity ready condition, press **Cal** key to enter calibration mode.
The display is shown as follows, and select standard solution by using **Select** key.

[Cal] Ready	146.9 uS
	1413 uS
0.00 uS/cm	6.67 mS
	12.89 mS
TEMP : 18.0 Tr : 25.0	111.9 mS

Put cell into the selected standard solution and press **Measure** key.
Put cell into standard solution and press **Measure** key.

[Cal] Measure	146.9 uS
	1413 uS
143.6 uS/cm	6.67 mS
	12.89 mS
TEMP : 18.0 Tr : 25.0	111.9 mS

After the reading is stable, press **Cal** key and then Cal-OK message is displayed and returns to an initial mode.

[Cal] Cal-OK	146.9 uS
	1413 uS
146.9 uS/cm	6.67 mS
	12.89 mS
TEMP : 18.0 Tr : 25.0	111.9 mS

If using standard solution that not showing on screen, adjust conductivity by using ▲ or ▼ key .

[Cal] Ready	158.7 uS
	1413 uS
0.00 uS/cm	6.67 mS
	12.89 mS
TEMP:18.0 Tr:25.0	111.9 mS

The following table is shown correlation conductivity with concentration of KCl solution.

KCl solution(M)	Conductivity
0.001	146.9 µS/cm
0.01	1413.0 µS/cm
0.05	6.67 mS/cm
0.1	12.89 mS/cm
1	111.9 mS/cm

(4) Measurement

1) Conductivity Measurement
In the calibration, TC(i.e. Temperature Compensation Coefficient) is automatically

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selected by standard solutions and measuring temperature. KCl solution have a lower temperature coefficient (app. 1.9%/°C) of conductivity than typical potable water. Sodium chloride(NaCl) has a temperature coefficient (2.12%/°C) that closely approximates that found in most waters from wells and surface sources.

Press **Measure** key to measure the conductivity of solution. The display is shown as follows.

[A] Measure	96 / 11 / 12 11:15	
1413 uS/cm	**Tr. 25.0** **2.10 %/°C** ℃	
Conductivity	18.0 °C	

After the reading is stable, store or record it. If measuring conductivity without compensation of temperature, press **Select** key to measure conductivity at measuring temperature without compensation of temperature.

[A] Measure	96 / 11 / 12 11:15
1215 uS/cm	----------
Conductivity	18.0 °C

2) TDS Measurement

The preparation for TDS is the same as for conductivity.
Press **Mode** key to enter TDS mode.
Press **Measure** key to measure TDS of solution.

[A] Measure	96 / 11 / 12 11:15
798.4 mg/L	**Tr. 25.0** **2.10 %/°C**
TDS	18.0 °C

While measuring conductivity, can measure TDS by pressing **Mode** key.

Chapter V   Calibration & Measurement
pH/ISE/Conductivity/Temp Meter

3) Salinity Measurement

The preparation for salinity is the same as for conductivity.
Press **Mode** key to change salinity mode.
Press **Measure** key to measure salinity of solution.

[A] Measure	96 / 11 / 12 11:15
0.7 ppt	
Salinity	18.0 °C

While measuring conductivity or TDS, can measure salinity by pressing **Mode** key

4) Resistivity Measurement

The preparation for resistivity is the same as for conductivity.
Press **Mode** key to change resistivity mode.
Press **Measure** key to measure resistivity of solution.

[A]　　　Measure　　　　　96 / 11 / 12　　11:15
12.5 kohm
Resistivity　　　　　　　　　　　　18.0 °C

While measuring conductivity, TDS or salinity, can measure resistivity by pressing **Mode** key

pH/ISE, Channel[B]

The basic condition is as follows.

¡　pH Calibration Method : Auto Calibration (buffer : 4.00, 7.00, 10.00)

¡　Alarm ? high : 20.00

　　　　　low : 0.00

¡　Data-Log : memory

This meter contains function that can confirm the last calibration status of pH and ISE.

pH Calibration Status

In pH ready condition press **Setup** key and **Cal** key or in pH measure condition press **Cal** key to enter pH Calibration Status.

```
<< pH Calibration Status>>
1.Date/Time : 98/03/26 17:30
2.Temp : 25.0
3.Buffer :
   2.00    4.00    7.00    10.00
```

Through pH Calibration Status, can confirm Date/Time, Temp and Buffer solution for the last calibration.
If pressing **Out** key, return to an initial display.
If clearing data, can¡t confirm the last Calibration Status, and the display is shown as follows.

```
<< pH Calibration Status>>
1. Date/Time : 00/00/00 00:00
2. Temp : 0.0
3. Buffer :
     No Data
```

Ion Calibration Status

In ISE ready condition press **Setup** key and **Cal** key or in ISE measure condition press **Cal** key to enter Ion Calibration Status.

```
<< Ion Calibration Status>>
1.Date/Time : 98/03/26 17:30
2.Temp : 25.0
3.Buffer : Ammonia(mg/L)
   0.01    0.1    1    10
```

Through Ion Calibration Status, can confirm Date/Time, Temp and Buffer solution for the last calibration. If pressing **Out** key return to an initial mode.
If clearing data, can¡t confirm the last Calibration Status, and the display is the same pH.

pH Calibration and Measurement

(1) Preparation

Connect meter with electrode and ATC.
Prepare a calibration buffer and magnetic stirrer.
Confirm all parameters(calibration method, buffer and other selection) are properly set as desired.

Perform calibration every two hours to compensation for electrode drift. There are two ways of calibrations; auto calibration or manual calibration.
If calibrating by selecting buffer of pH 2.00, 4.00, 7.00, 10.00, 12.00, select buffer in Setup.

In case of manual calibration, refer to Setup Functions.
Please note that it is not available to calibrate just only 1 point. If try to exit after calibrating only 1 point, error message is displayed. In this case, press **Reset** key or continue calibration.

(2) Calibration

Auto Calibration

1) Calibration of CAL1(Buffer 1)
In the pH ready condition, press **Cal** key and then the selected buffer solution are displayed as follows. In case of selecting buffer of pH 2.00 and pH 12.00, refer to Setup.

[B]	Ready		CAL 1 :	4.00
			CAL 2 :	7.00
	7.00 pH		CAL 3 :	10.00
			CAL 4 :	0.00
ATC	25.0 °C		CAL 5 :	0.00

Before use, remove electrode from storage solution, rinse with distilled water, blot dry and put into the first buffer. With constant, but not violent, stirring for an accurate measurement, press **Measure** key.

[B]	Measure		CAL 1 :	4.00
			CAL 2 :	7.00
	4.04 pH		CAL 3 :	10.00
			CAL 4 :	0.00
ATC	25.0 °C		CAL 5 :	0.00

If pH reading is stable, ¡Stable¡ is displayed in the lower field.

[B]	Measure		CAL 1 :	4.00
			CAL 2 :	7.00
	4.04 pH		CAL 3 :	10.00
			CAL 4 :	0.00
Stable	25.0 °C		CAL 5 :	0.00

Press **Cal** key and then Cal-OK message is displayed in the upper field.

[B]	Cal-OK		CAL 1 :	4.00
	4.04		CAL 2 :	7.00

	CAL 3 : 10.00
	CAL 4 : 0.00
ATC 25.0 °C	CAL 5 : 0.00

This indicates the end of CAL1 calibration.

2) Calibration CAL2 to CAL5(Buffer2 to Buffer5)

[B] Ready	CAL 1 : 4.00
	CAL 2 : 7.00
4.00 pH	CAL 3 : 10.00
	CAL 4 : 0.00
ATC 25.0 °C	CAL 5 : 0.00

Clearly rinse electrode with distilled water, blot dry and put into the second buffer. The calibration method of CAL2~CAL5 is the same as done in CAL1. It is available to calibrate up to the number of buffer which is set at Setup (Max.5 points), if finishing calibration completely, changed to the initial display automatically.
If pressing **Cal** key after calibrating 2, 3 or 4 points, change to initial mode.

Manual Calibration
1) Calibration of CAL1(Buffer 1)
Clearly rinse electrode with distilled water, blot dry and put into the first buffer. With constant stirring the solution by using magnetic stirrer, press the **Measure** key.

[B] Measure	CAL 1 : 0.00
	CAL 2 : 0.00
4.04 pH	CAL 3 : 0.00
	CAL 4 : 0.00
ATC 25.0 °C	CAL 5 : 0.00

If pH reading is stable, ¡Stable¡ is displayed in the lower field. Adjust value to the measuring buffer by pressing the ▲ or ▼ key. Press **Cal** key to set pH value, and then Cal-OK message is displayed in the upper field.

[B] Cal-OK	CAL 1 : 3.98
	CAL 2 : 0.00
3.98 pH	CAL 3 : 0.00
	CAL 4 : 0.00
ATC 25.0°C	CAL 5 : 0.00

2) Calibration CAL2 to CAL5

Rinse electrode, blot dry and put into the second buffer. The calibration method of CAL2~CAL5 is the same as done in CAL1. It is available to calibrate up to 5 points, if calibrating up to 5 points, changed to the initial mode automatically.

If pressing **Cal** key after calibrating 2, 3 or 4 points, change to initial mode.

If finishing calibration completely, put electrode into sample and press **Measure** key.

[B]	Measure	96 / 11 / 12 11:15	
	6.58 pH	ATC 25.0 °C	
Stable			

While measuring pH can also measure mV by pressing **Mode** key

[B]	**Measure**	96 / 11 / 12 11:15	
	25.2 mV	ATC 25.0 °C	

ISE Calibration and Measurement

(1) Preparation

Connect meter with electrode and ATC.

Prepare solution for measurement and magnetic stirrer.

Set a kind of the measuring ion in Setup.

Set standard solution(buffer) in Setup.

Calibration should be done in order from the lower concentrated solution to the more concentrated solution.

Preparation of Ion electrode refer to electrode manual.

1) Calibration of CAL1

In the ISE ready condition, press **Cal** key and then the selected standard solutions(buffers) are displayed as follows.

[B] Ready	CAL 1 : 10
0.00 mg/L	CAL 2 : 100
	CAL 3 : 1000
	CAL 4 : 0.00
NH_3 25.0 °C	CAL 5 : 0.00

Rinse electrode with distilled water, blot dry and put electrodes into the first standard solution(buffer) with stirring solution by using magnetic stirrer and press **Measure** key. And then ion concentration of the selected standard solution is displayed in right field.

If the reading is stable, press the **Cal** key. Then automatically set and Cal-OK message is displayed in the upper field.

[B] Cal-OK	**CAL** 1 : 10
$\times 10^1$	CAL 2 : 100
1.00 mg/L	CAL 3 : 1000
	CAL 4 : 0.00
NH_3 25.0 °C	CAL 5 : 0.00

2) Calibration of CAL2 to CAL5

Clearly rinse electrode with distilled water, blot dry and put into the second standard solution(buffer). The calibration method of CAL2~CAL5 is the same as done in CAL1. It is available to calibrate up to the number of buffer which is set at Setup(Max. 5 points), if finishing calibration completely, changed to the initial display automatically.

If pressing **Cal** key after calibrating 2, 3 or 4 points, change to initial display.

If finishing calibration, rinse electrode with distilled water, blot dry and put electrode into sample with stirring solution by using magnetic stirrer and press **Measure** key.

[B]   Measure   96 / 11 / 12   11:15
$\times 10^1$
5.25 mg/L   ATC 25.0 °C
NH_3

While measuring Ion, can also measure mV by pressing **Mode** key

[B]   Measure   96 / 11 / 12   11:15

```
┌─────────────────────────────────────────────┐
│                                             │
│     125.2 mV      ATC 25.0 °C               │
│                                             │
├─────────────────────────────────────────────┤
│  NH₃                                        │
└─────────────────────────────────────────────┘
```

Slope Feature & Functions

```
┌─────────────────────────────────────────────┐
│  [B]      Ready        96 / 11 / 12   11:15  │
│                                             │
│        7.00 pH        ATC 25.0 °C           │
│                                             │
├─────────────────────────────────────────────┤
│                                 Slope 100   │
└─────────────────────────────────────────────┘
```

Press ▲ key to confirm electrode slope after pH and Ion calibration. The slope displays in the lower field and then disappeared.

It makes to estimate time of exchange of electrode since can know error(%) through slope.

For the correct operation, the range of slope must be within 80~120%. If the slope is not within this range, prefer newly calibrating in order to prevent the higher error.

If the slope is not within 80-120% for pH or Ion measurement, must newly calibrate.

Millivolt / Relative Millivolt Measurement

Meter can measure absolute or relative millivolt. The millivolt modes are useful when performing potentiometric titration or preparing calibration curves.

1. Millivolt
Absolute millivolt is displayed to 0.1mV resolution in the range of -1999.9 to +1999.9 mV.

Access the absolute millivolt mode by pressing **Mode** key and then **Measure** key.

While measuring, the display is shown as follows.

```
Measure          96 / 11 / 12   11:15

25.2 mV      ATC 25.0 °C
```

While measuring pH or Ion, measure each millivolt by pressing **Mode** key.

2. Relative Millivolt

Relative millivolt is used to measure ORP(oxidation-reduction potentials) or relative millivolt. Relative millivolt is displayed to 0.1mV resolution in the range of -1999.9 to +1999.9 mV.

In the condition of measuring mV, current displayed value automatically changes into zero(0) value by pressing **Resolution** key and then relative millivolt is displayed.

```
Measure          96 / 11 / 12   11:15

0.0 mV      ATC 25.0 °C

ORP
```

In ORP mode, if measuring absolute millivolt, press **Mode** key.

Dual and Simultaneous Display

In Conductivity ready or measure condition press **Display** key and then the divided screen appears as follows.

```
[A]    Ready        [B]       Ready

0.00 uS/cm            7.00
```

COND	25.0 °C	pH	25.0 °C

All functions are operated the same as that in single screen except Setup functions.
Can measure simultaneously in channel[A] and [B].
If entering the divided screen in ready condition of channel[A], the display is shown as upper figure. Conductivity is measured by pressing **Measure** key, and then if pressing **Channel** key channel is converted as follows.

[A] **Measure**	**B** **Ready**
1215 uS/cm	7.00
COND 25.0 °C	pH 25.0 °C

Setup

In the ready condition, press **Setup** key and then the display appears as follows.

```
<<   DATA LOGGING   >>

1. Destination :          Excel
2. Time Interval :        0 min
3. Exit
```

There are two ways for datalogging, for example Memory or Excel. The set of time interval refer to Setup Functions.

Chapter VI. Data -Log

Model 460CP can transmit information to printer or computer via RS232 interface. Data-Log consists of memory, excel and printer etc.

(1) Memory Data - Log

The basic condition of Data-Log is set as follows.

```
[B]          <<   DATA LOGGING   >>

      1. Destination :         Memory
      2. Time Interval :        0 min
      3. Exit
```

The measured data is stored in meter by pressing **Memory** key manually.
If the condition of Data-Log is set as follows(refer to Setup), the measured data is automatically stored with time interval of one minute in meter.

```
[B]          <<   DATA LOGGING   >>

      1. Destination :         Memory
      2. Time Interval :        1 min
      3. Exit
```

Unit of time interval, such as minutes and seconds, is changed by pressing **Enter** key.

```
[B]          <<   DATA LOGGING   >>

      1. Destination :         Memory
      2. Time Interval :        0 sec
      3. Exit
```

Up to 100 points are stored in memory at once for each channel.

```
[B]          [    DATA    MODE     ]
No.   3        96 / 11 / 26   11 : 15
      pH         :      7.023
      ATC        :      25.0
```

If setting Destination as ¡None¡, ata isn't stored. If needing to print the data stored in meter, it is available to output by using printer supplied by *istek*. In ready or measure condition, enter Data(Memory) Mode by **Memory** key, search data stored in meter by using ▲ or ▼ key, and press **Memory** key to exit or press **Out** key to print data.

The following figure is an example to print.

```
[DATA MODE ? B]
Number : 3
Date & Time [ 96/11/26 11:15 ]
pH              : 7.0.23
ATC             : 25.0 °C
```

(2) Printer Data-Log

Connect meter to printer via RS232C interface cable supplied by *istek*.
If condition of Data-Log is set as follows, the measured data is automatically printed every one minute.

```
[B]            <<   DATA LOGGING   >>


    1. Destination :              Printer
    2. Time Interval :            1 min
    3. Exit
```

In case of the direct output by printer, must use printer supplied by *istek*.
If printing data while measuring, can print by pressing **Memory** key regardless of time.
The following figure is an example to print.

```
[DATA MODE-B]    Number : 3
Date & Time [ 96/11/26 11:15 ]
pH       : 7.023
ATC    : 25.0°C
```

(3) Excel Data-Log

Connect meter to PC via RS232C interface cable supplied by *istek*.
It is available to store data in PC while measuring by pressing **Memory** key regardless of time. If the condition of Data-Log is set as follows, the measured data is automatically stored in PC with excel form every one minute.

```
[B]            <<   DATA LOGGING   >>


    1. Destination :              Excel
    2. Time Interval :            1 min
```

Chapter VII.   Remote Control

The meter can be remotely controlled by PC.

After connecting your meter to PC by RS232C interface cable and performing communication program of computer, if pressing **Enter** key of keyboard, remotely controlled and key button of meter doesn't work.

```
[B]        Ready              96 / 11 / 12   11:15


       7.00 pH      ATC 25.0 °C

Remote Control
```

If inputting help while performing communication program, the remote control commands are displayed on the monitor of computer.

ISTEK-cond>help ⏎

The following messages are the remote control commands.

```
: ----------- Command List -------------:
1. exit       : Exit Remote Control
2. cond       : Read Conductivity
3. tds        : Read TDS
4. sal        : Read Salinity
5. temp       : Read Reference Temperature
6. data       : Read the data stored in meter
7. a,b        : Select Channel
8. help       : Command Help Message
```

ISTEK-pH>help⏎
The following messages are the remote control commands.

```
:------ Command   List ---------:
1.exit        : Exit Remote Control
2.ph: Read pH
3.mv          : Read mV
4.ion         : Read Concentration of Ion
5.temp        : Read Temperature
6.all: Read pH, mV and Temperature
7.data        : Read the data stored in meter
8.a,b         : Select Channel
9.help        : Display Command Help Message
```

Chapter VII   Remote Control
pH/ISE/Conductivity/Temp Meter

The following figure is an example of the remote control using communication program.

```
ISTEK-pH>Remote Control Mode
ISTEK-pH>data
Data Reading No:
```

In case of reading the data stored in meter if inputting data, message "Data Reading No :" is displayed and if inputting Data Number the data stored in meter is displayed as follows. This is also used by storing in "screen capture" or recording.

```
[DATA MODE-B]    Number : 3
Date & Time :      [ 96/11/26 11:15 ]
pH            :     7.023
ATC                :     25.0 'C
```

The following message is to read a measuring pH.

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ISTEK-pH>pH
7.203

Chapter VIII.
Troubleshooting & Error Description

MALFUNCTION	POSSIBLE CAUSE	REMEDY
No display	No power to meter	Press Power key.
		Check that the adaptor is correctly plugged.

Channel[A] Conductivity Drift (reading slowly changing in one direction), Noisy or Unstable Readings (readings continuously or randomly changing		Check that meter is correctly connected with cell and ATC probe. Clearly rinse sensor of cell to remove interference.
Channel[B] pH/ISE Error occurred in Cal mode ? Reading Out of Range	Electrode failure Out of Range for Buffer	Check that meter is correctly connected with electrode and ATC probe.
	When trying to exit after calibrating only 1 point, error message (Err) appears.	Press **Reset** key or continue calibration.
Error occurred in measure mode	Out of measuring range of pH	Check that meter is correctly connected with electrode and ATC probe. Check Calibration Slope

If the cause can¡t know, clear memory(data) to eliminate all data.
Refer to Clear Memory(data) of Setup Functions.

* When using Ion Selective Electorde, refer to ISE manual.

If the problem persists, please contact *istek* **Product Service Department**.

Chapter IX. Specifications

Model	*460CP*
Conductivity	
Range	*0 to 199,999 µS/cm*
Resolution	*0.01/0.1*
Relative Accuracy	*±0.5%*
TDS	
Range	*0 to 1999 mg/L*
Resolution	*1 mg/L*

Relativie Accuracy	±2%
Salinity	
Range	0.0 to 70.0 ppt
Resolution	0.1
Relative Accuracy	±.0.1
Resistivity	5 ohm·cm to 100 Mohm·cm
pH	
Range	-2.000 to 19.999
Resolution	0.001/0.01/0.1
Relative Accuracy	±0.002
Auto-Buffer-Recognition	2.00, 4.00, 7.00, 10.00, 12.00
Concentration	
Range	0.00001 to 99999 mg/L
Resolution	±one least significant
Relative Accuracy	±0.25 % of reading
Millivolts	
Range	±1999.9 mV
Resolution	0.1 mV
Relative Accuracy	±0.1 mV
pH/ISE Slope	80 % to 120 %
Calibration	Auto(5points)/Manual(5 points)
Temperature Compensation	Auto
Data-Log	200 points
Print Capability	Yes
Display	Graphic LCD
Inputs	Two BNC, ATC, Power, RS232C
Outputs	Recorder, RS-232C(Computer/Printer)
Power	AC/DC Adaptor

Chapter IX   Specifications

pH/ISE/DO/Conductivity Meter

ISE Specifications

ISE Specification is simply described.
The details refer to catalog or contact *istek, Inc.*

ISE	Sensing Type	Measurement Range		Slope	pH Range	Temp (°C) Range	Resp Time	Reference Electrode & Filling Solution
		Molar(M)	ppm(mg/L)					

Ion	Type							Reference
NH_3	GS	$1.0\sim5\times10^{-7}$	17,000~0.01	56±3	above 11	0~50	20	N/A, NH_4Cl
NH_4^+	**PM**	$1.0\sim5\times10^{-6}$	18,000~0.1	56±3	4~10	0~50	30	Dbl, NaCl
Br^-	SSM	$1.0\sim5\times10^{-6}$	79,900~0.4	57±2	0~14	0~80	20	Dbl, KNO_3
Cd^{+2}	SSM	$0.1\sim1\times10^{-7}$	11,200~0.01	27±2	2~12	0~80	20	Dbl, KNO_3
Ca^{+2}	PM	$1.0\sim5\times10^{-6}$	40,000~0.2	27±2	3~10	0~50	30	Sgl, KCl
CO_2	GS	$0.01\sim1\times10^{-4}$	440~4.4	56±3	4.8~5.2	0~50	20	N/A, $NaHCO_3$
Cl^-	SSM	$1.0\sim5\times10^{-5}$	35,500~1.8	56±2	2~12	0~80	20	Dbl, KNO_3
Cu^{+2}	SSM	$0.1\sim1\times10^{-8}$	6,350~0.0006	27±2	2~12	0~80	20	Dbl, KNO_3
CN^-	SSM	$0.01\sim5\times10^{-6}$	260~0.1	57±2	11~13	0~80	20	Dbl, KNO_3
F^-	SSM	$Sat_id\sim1\times10^{-6}$	$Sat_id\sim0.02$	57±2	5~8	0~80	20	Sgl, KCl
BF_4^-	PM	$1.0\sim7\times10^{-6}$	10,800~0.1(B)	56±2	2.5~11	0~50	30	Dbl,$(NH_4)_2SO_4$
I^-	SSM	$1.0\sim5\times10^{-8}$	127,000~0.006	57±2	0~14	0~80	20	Dbl, KNO_3
Pb^{+2}	SSM	$0.1\sim1\times10^{-6}$	20,700~0.2	25±2	3~8	0~80	20	Dbl, KNO_3
Li^+	PM	$1.0\sim1\times10^{-5}$	6,900~0.7	56±2	5~10	0~50	30	Dbl,$(NH_4)_2SO_4$
NO_3^-	PM	$1.0\sim7\times10^{-6}$	62,000~0.5	56±2	2.5~11	0~50	30	Dbl,$(NH_4)_2SO_4$
NO_x	GS	$5.0\times10^{-3}\sim5\times10^{-6}$	220~0.2	56±3	1.1~1.7	0~50	30	N/A, $NaNO_2$
ClO_4^-	PM	$1.0\sim7\times10^{-6}$	98,000~0.7	56±2	2.5~11	0~50	30	Dbl,$(NH_4)_2SO_4$
K^+	PM	$1.0\sim1\times10^{-6}$	39,000~0.04	56±2	2~12	0~50	30	Dbl, NaCl
$Ag^+/$ S^{-2}	SSM	$1.0\sim1\times10^{-7}$ $1.0\sim1\times10^{-7}$	107,900~0.01 32,100~0.003	57±2 27±2	2~12 2~12	0~80 0~80	20 20	Dbl, KNO_3 Dbl, KNO_3
Na^+	PM	$1.0\sim1\times10^{-5}$	23,000~0.2	55±2	5~10	0~50	30	N/A, NH_4Cl
X^+/X^-	SSM	$5.0\times10^{-2}\sim1\times10^{-6}$	12,000~1.0	Titrat-ion	2~12	0~50	30	Sgl, KCl
$Ca^{+2}/$ Mg^{+2}	**PM**	$1.0\sim1\times10^{-6}$	40,000~0.4(Ca)	26±3	5~10	0~50	30	Sgl, KCl

* Sensing Type   ; GS(Gas Sensing), PM(Polymer Membrane),
                            SSM(Solid State Membrane)

* Resp Time   ; indicates response time.

* Reference electrode   ; N/A(No Reference Electrode),
                           Dbl(Double Junction Reference Electrode),
                           Sgl(Single Junction Reference Electrode)

Chapter IX   Specifications

Chapter X. Ordering Information

Other items contact *istek*.
For further information on other accessories, please feel free to contact *istek* at any time.

A. Standard

* Combination pH Electrode/ATC Probe

* AC/DC Adaptor

* Buffer Solutions (pH4.00, 7.00, 10.00) 125ml

* Instruction Manual

* DAPS (Data Acqustion and Processing Software)

B. Option

* Luxury Third-Arm Stand

* Conducivity Cell(K=1.0)

* pH Electrode Storage Solution

* pH Electrode Filling Solution

* Buffer Solutions (pH4.00, 7.00, 10.00) 475ml

* Conductivity Standard Solutions

* RS232C Interface Cable

Chapter X   Ordering Information