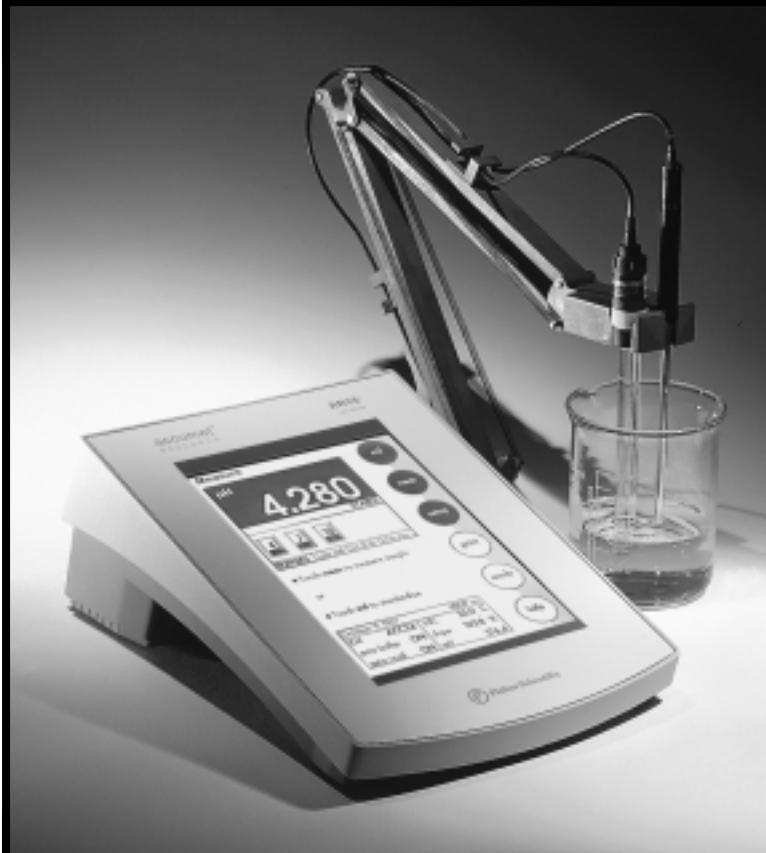


AR25



USER Manual

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Thank you for selecting a Fisher Scientific accumet pH meter. This manual describes the operation of the accumet AR25 meter. The state-of-the-art meter that you have purchased is easy to operate and will guide you through the various functions by displaying easy to understand prompts. This operating manual should answer any questions that might arise in operating your meter; however, do not hesitate to call our Fisher Lab Equipment Technical Support Hotline at 1-800/943-2006 or 412/490-6260, if you need any assistance.

This meter is designed to provide all the information necessary to guide you through the process of measuring pH, mV, or ion concentration with a series of prompts on the screen.

The accumet Research AR25 provides microprocessor precision in a compact benchtop design that is easy to use. One touch screen controls all procedures, letting you:

- Measure pH, absolute mV, relative mV, ion concentration
- Select one of three sets of standard buffer groups.
- Implement automatic buffer recognition.
- Standardize with up to five standard or custom buffers.
- Customize your display screen and operating parameters.
- Assign operator and sample identification numbers.
- Specify ion selective electrode type.
- Store 250 data points in the meter's memory or transfer data to a computer or printer.
- Access extensive online help with just a touch of a button.

It all adds up to rapid, completely automatic, intuitive operation.

The following is a listing of what you should have received with your new accumet AR25 pH/mV/Ion/meter.

Meter with kit includes

- meter
- power supply
- electrode arm support bracket
- electrode arm
- electrode (13-620-285)
- ATC probe (13-620-19)
- manual and literature

Meter only includes

- meter
- power supply
- electrode arm support bracket
- manual and literature

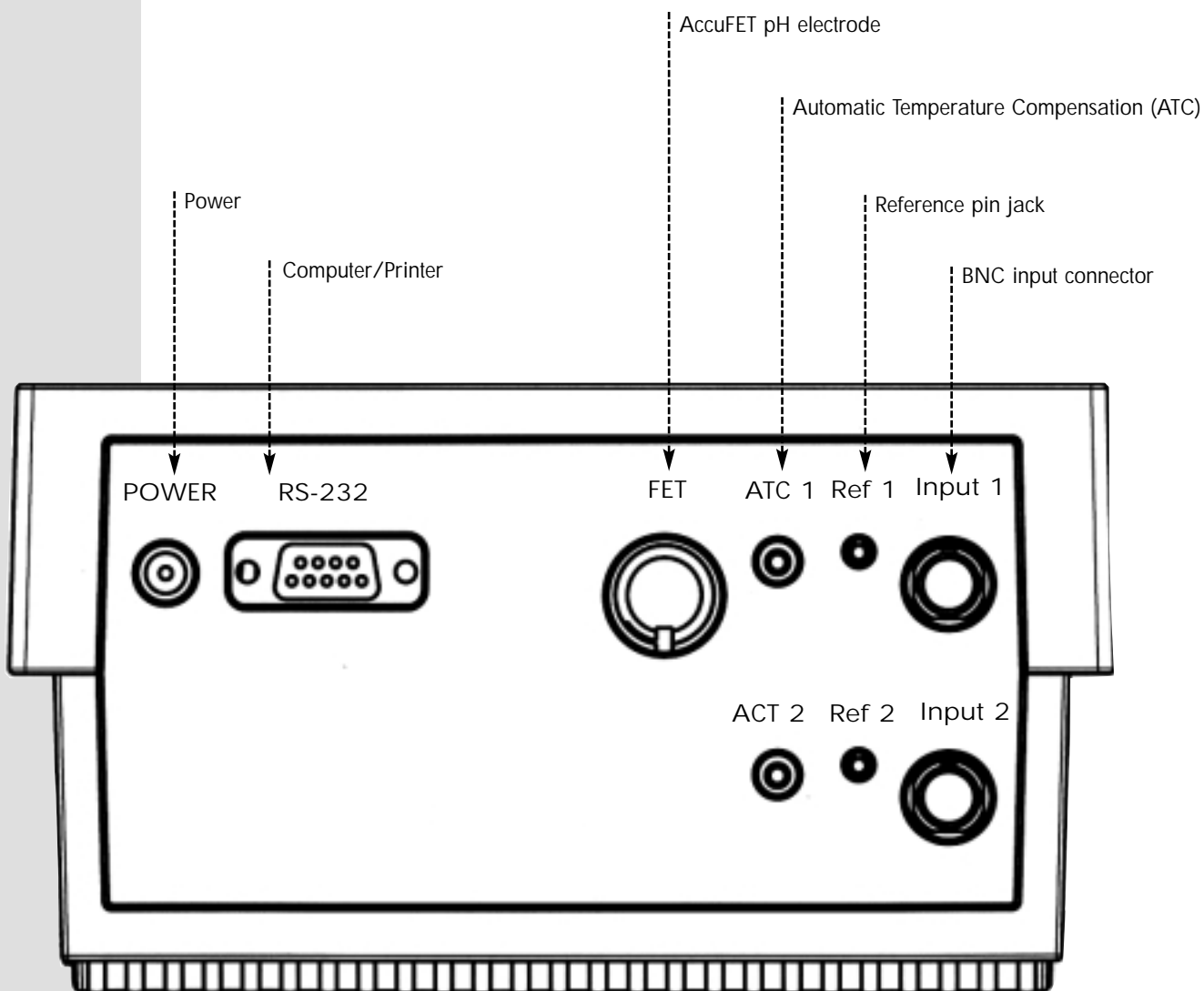
If any of these items are missing, please contact the Fisher Products Group Electrochemistry Operation by dialing 412/490-6267.

Ion Selective Electrodes are available and can be ordered by calling Fisher Customer Service at 800/766-7000.

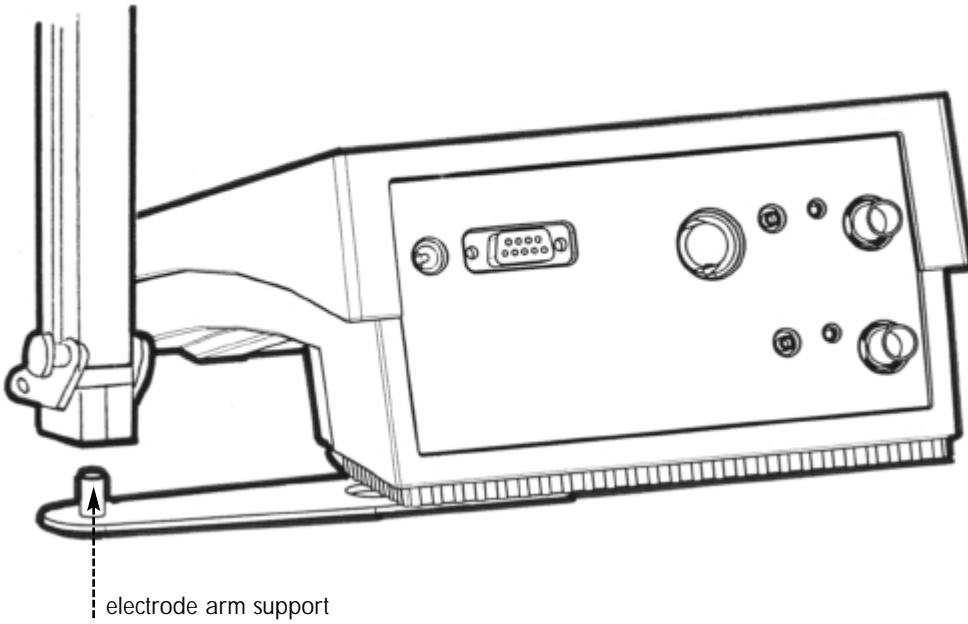
Display		640x480 digit LCD
	screen size	4 1/2" x 6"
	measurement display height	3/4"
	temp/etc. display height	1/4"
	menu options	extensive
	help screens	extensive
	configurable display	yes
	keypad controls	context specific touchscreen
Memory		250 data pts
	internal diagnostics	yes
	programmable data storage	store on stable, time, manual
	programmable data output	output on stable, time, manual
	print interval	1 to 9,999 sec
	programmable alarm	yes
pH Mode		-2.000 to 20.000
	range	
	resolution	0.1/0.01/0.001
	relative accuracy	± 0.002
	automatic buffer recognition	yes
	manual buffer recognition	yes
	calibration points	5
	auto lock	yes
FET	yes	
mV Mode		± 1800.0
	range	
	resolution	0.1
	accuracy	± 0.1
Ion Mode		1×10^{-6} to 9.99×10^{10}
	range	
	resolution	0.1/0.01/0.001
	relative accuracy	± 0.17n%
	calibration points	5
incremental methods	KA, KS, AA, AS	

Temperature Mode	range	-5.0 to +105.0 °C
	resolution	0.1 °C
	accuracy	± 0.2 °C
General	inputs/outputs	2BNC, 2Pin, 2ATC RS232, DIN (for FET)
	electrical requirements	115 V/60 Hz, 230 V/50 Hz
	output from PSU	12VDC, 500mA
	line voltage tolerance	± 10%
	input impedance	>10 ¹² ohms
	meter size	5.5" x 7.5" x 3.25"
	meter weight	1.86 lb.
Operating Conditions	operating temperature	5-45 °C
	operation humidity	5-80 % noncondensing
	maximum operating altitude	2000m
	installation category	II
	Pollution category degree	2

- 1 | Review the layout and arrangement of the rear connector panel.

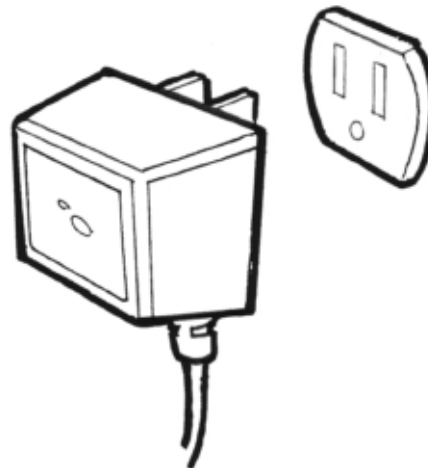


- 2** | Connect the electrode arm to the base.



- 3** | Connect the power cable to the rear connector panel power jack and to a power source.

POWER



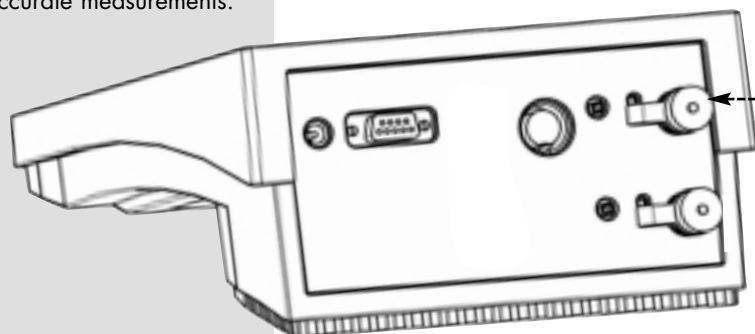
To connect RS-232, see Data Management on page 138.

This meter allows you to use two types of pH electrodes: the conventional glass pH electrode and the AccuFET field effect transistor (FET) pH electrode. If both types of pH electrodes are connected, the meter will read the AccuFET electrode. This meter also allows you to use ion specific electrodes.



If both a conventional electrode and an AccuFET electrode are connected to the meter, do not put them in a solution together because you will get inaccurate measurements.

- 1 Carefully remove the protective cover from the end of the electrode. Before first using your glass pH electrode, or whenever the electrode is dry, soak it 2-4 hours in an electrode storage solution, pH 4 Buffer, or KCl solution. Before using your ion specific electrode, consult the manufacturer's instructions for electrode preparation.



- 2 Remove the shorting cap on BNC connector. Connect the combination pH electrode by plugging it into the BNC input connector (twisting to lock in place).

If a combination electrode isn't used, connect the indicating pH electrode into the BNC input connector. Plug the reference electrode into the reference pin jack. Also, install the ATC probe into the ATC jack.

Note: Be sure to connect all probes to the appropriate channel connectors (for example: Input 1, Ref 1, and ATC 1).

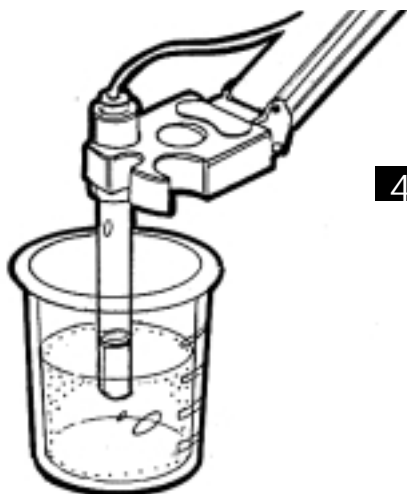
Option: Connect the optional AccuFET electrode by plugging it into the FET jack on the back meter panel. Allow the AccuFET to warm up five minutes before use.

Connect ion specific electrodes in the same manner as pH electrodes.



Do not discard the BNC shorting cap.

- 3** Rinse and blot-dry (don't wipe) electrodes between each measurement. Rinse electrodes with distilled or deionized water, or a portion of the next solution to be measured.



- 4** Between measurements, store conventional pH electrodes in electrode storage solution, pH 4 buffer, or KCl solution. Always leave the filling hole of liquid filled combination electrodes open. Refill when the level of solution gets below the manufacturer's recommended level. Store ion specific electrodes according to electrode manufacturer's recommendations.



Proper electrode care is fundamental to obtaining reliable pH measurements. Improper care of the electrode may cause the meter reading to drift, respond slowly, or produce erroneous readings. For this reason, the electrode should always be conditioned and used in accordance with manufacturer's instructions.

Standby screen

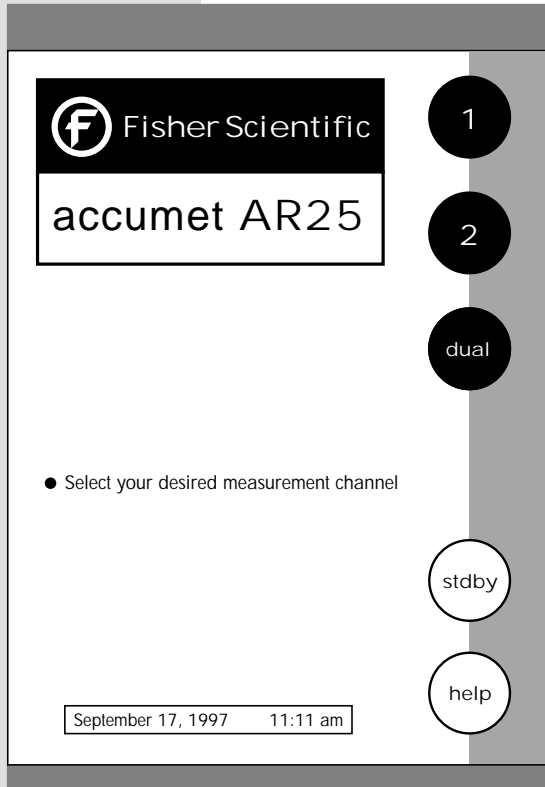


The new accumet Research benchtop pH meters operate with a state-of-the-art touch screen. The touch screen makes this the easiest meter on the market to operate and care for. When the meter is first plugged in, the STANDBY screen will appear. Touch anywhere on this screen to access the functions of the meter.

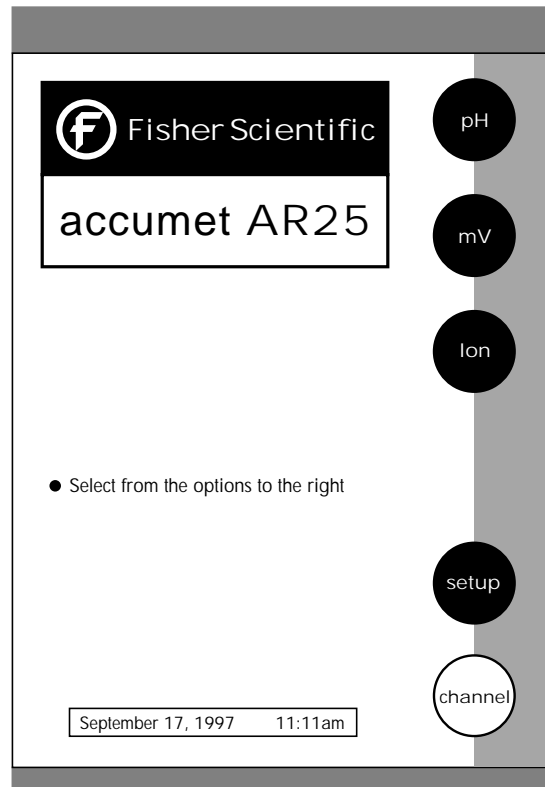
The buttons on the right side of the screen control all of the functions of the meter. A light touch on the screen is all that you need to access the various functions. Once you touch a button you will get an audible tone; the screen will not change until you lift your finger. This design prevents rapid uncontrolled scrolling through the various function screens. Function buttons and options change from screen to screen. Easy to understand prompts guide you through the operation of the meter in the selected mode. If you are ever in doubt about what to do, just touch help on the bottom right corner of the screen for detailed information about that screen.

The touch screen is made of a durable polyester material that is chemically resistant. Maintenance is simple with this meter. To clean the screen you just need to wipe it with a damp cloth and dry it with a clean dry towel. For additional information, see cleaning and troubleshooting sections of the manual (page 133).

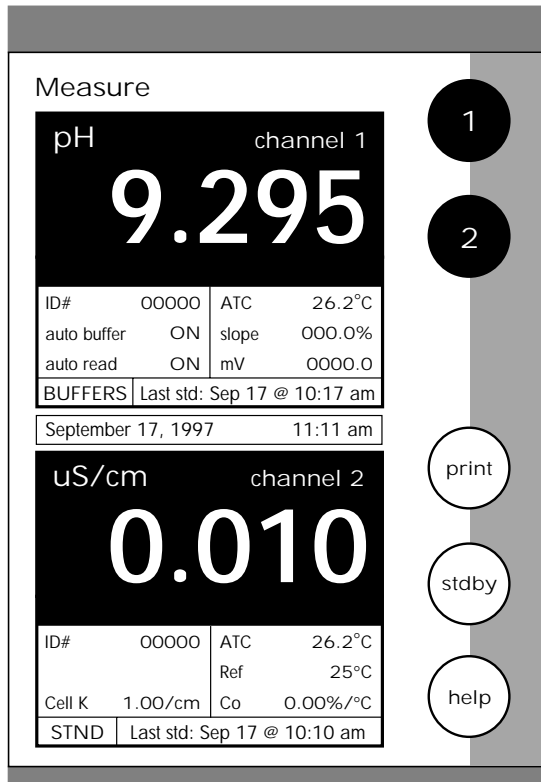
Channel screen



Main screen



Dual screen



The accumet Research AR25 is a Multi-channel pH meter. With this meter you can switch from channel 1 to channel 2. You can also view both channels at the same time by accessing the dual channel mode. If you set the meter to view both channels, you cannot change the parameters without choosing the screen that you want to modify. The setup parameters for each screen are setup independently of one another.

Choosing a Channel

- 1** Touch anywhere on the Standby screen.
OR
Touch channel on the main screen.
THEN
- 2** Touch 1, 2 or dual to access the channel that you want to view.

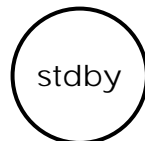
To access System Setup from the Standby screen

- 1** Touch anywhere on the Standby screen.
- 2** Touch 1 or 2 on the channel screen to access either channel.
- 3** Touch setup.
- 4** Touch system on the Setup screen.

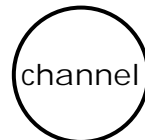


If you are in any measure mode, touch mode until you access the main screen.

The touch screen of your accumet Research pH meter has “buttons” along the right side of the screen that are common to many of the screens. The following indicates the function of these common buttons.



This is the standby button and it allows you to access the standby mode. When in standby, the meter will not take measurements. It is in a state of rest. When you touch standby the meter will return to the standby screen which says “Fisher Scientific” and displays the time.



This button allows you to access the channel screen to choose what channel you want to view. This button appears only on multichannel meters such as the accumet AR25 and AR50. This button also allows you to move from the main mode screen to the channel screen to access the standby mode.



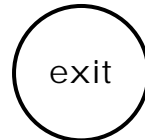
The mode button allows you to switch between the various operations of the meter. These operations, depending upon which meter you have, include four measuring modes (pH, mV, ion, conductivity) as well as a setup mode.



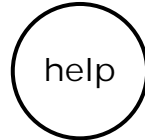
The enter button allows you to accept any changes that you have made on setup screens or accept values that you have input with keypads. When touched, enter will save the changes and return you to the previous screen.



The save button allows you to save multiple changes you have made on one screen as a group. It functions like the enter button does for individual changes.



The exit button allows you to leave the screen you are currently viewing and return to the previous screen without making any changes.



The help button allows you to access helpful information on any screen. When you touch the help button, information about the current screen appears. This information will include step-by-step instructions for operating the meter from the current screen and possible applications information for that screen.



The close key appears on the bottom of all help screens and allows you to exit the help screen and return to the previous screen.



The more button appears on the help screens and allows you to advance to the next help screen for additional information.




The back button appears on the help screens and allows you to move back to a previous help screen.

- std**

This button accesses the standardization screen from the various measure modes and initiates standardization of the meter once the standardization screen is accessed.
- meas**

This button is the measure button and directs the meter to measure your sample when in the Auto Read function of the pH or Ion modes.
- setup**

This button will access the setup screens for the measuring mode that you are currently using. It can also be used to access the system setup screen that allows you to set parameters that are not related to measurements such as the time and the date.
- print**

The print button will send information to the output device that you have connected to your accumet meter. The output device can be a printer, data logger or a computer. In addition to this, touching the print button will also send data to the data storage center of the meter if a sample ID# has been assigned to your sample.
- 

The arrow keys on the screen move the cursor up and down in order to highlight parameters that you would like to review or edit.
- edit**

The edit button appears on the setup screens. After you have highlighted a parameter that you would like to change, the edit button allows you to access the available options for that parameter.
- clear**

The clear button allows you to remove a setup parameter or standard buffer value from the meter's memory that may have been entered at a previous time or by a previous user that is no longer of value to you. Touching the clear button erases the value so you may enter a new one. It can also erase a parameter that you may have entered erroneously.
- BS**

The BS button is a backspace button. It appears on keypad screens and it allows you to back up and delete a character entered in error.
- delete**

The delete button appears on the "View Stored Data" screens. This button allows you to erase the data from the memory of the meter.
- prev**

The prev button appears on the Data Screens when the data stored in the meter's memory has been accessed. It allows you to scroll through data points sorted and stored prior to the current data point displayed.
- next**

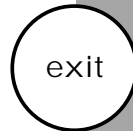
The next button appears on the Data Screens when the data stored in the meter's memory has been accessed. It allows you to scroll through data points sorted and stored after the current data point displayed.


accumet®
RESEARCH

System Setup

SYSTEM SETUP OPTIONS

- Select Language
- Set Date
- Set Time
- Set Beeper Status
- Select Procedural Level
- Set Print Configuration
- Set Operator
- Set Display Contrast
- Display Meter Information
- Reset to Factory Defaults



 Fisher Scientific

Access SYSTEM SETUP	20
Select LANGUAGE	22
Set DATE	24
Set TIME	26
Set BEEPER STATUS	28
Select PROCEDURAL LEVEL	30
Set PRINT CONFIGURATION	32
Set BAUD RATE	34
Set NUMBER OF BITS	35
Set STOP BITS	36
Set PARITY	37
Set OPERATOR	38
Set DISPLAY CONTRAST	40
Display METER INFORMATION	42
Reset to FACTORY DEFAULTS	43

Fisher Scientific
accumet AR25

1
2
dual
stdby
help

● Select your desired measurement channel

September 17, 1997 11:11 am

Fisher Scientific
accumet AR25

pH
mV
Ion
setup
channel

● Select from the options to the right

September 17, 1997 11:11 am

Setup

pH
mV
Ion
system
exit

● Select from the setup options to the right

System Setup

SYSTEM SETUP OPTIONS

- Select Language
- Set Date
- Set Time
- Set Beeper Status
- Select Procedural Level
- Set Print Configuration
- Set Operator
- Set Display Contrast
- Display Meter Information
- Reset to Factory Defaults

▲
▼
edit
exit
help

The system setup function allows you to customize the meter display options to meet your personal preference. Once set, these will rarely need to be changed.

To access System Setup

- 1** Touch anywhere on the Standby screen.
- 2** Touch 1 or 2 on the Channel screen to access either channel.
- 3** Touch setup on the Main screen.
- 4** Touch system on the Setup screen.

The System setup options are now displayed on the screen.

To access a System Setup option

- 1** Use the arrow keys to scroll through the setup options and highlight the option to be reviewed.
- 2** Touch edit to view the current status of the selected option.

The following is a detailed description of the System setup option screens.



Remember, HELP is always just a touch of the button away.

Select Language

Current LANGUAGE	English
English	
French	

- Use arrow keys to highlight desired language and then touch enter to accept

Navigation buttons: Up arrow, Down arrow, enter, exit, help

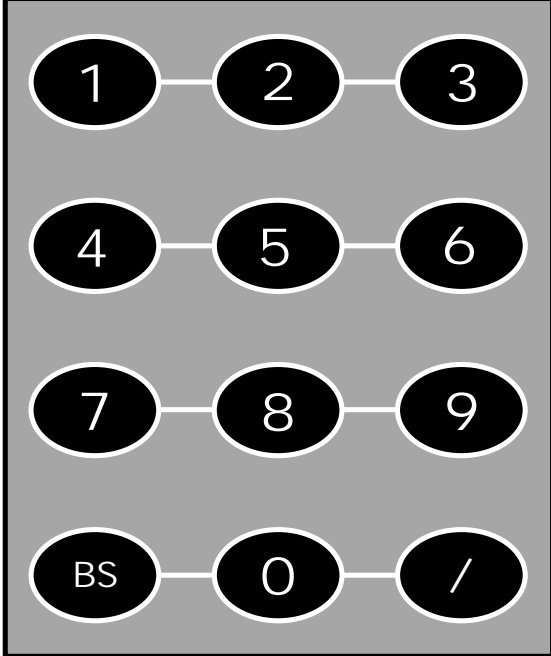
This option allows you to choose the language in which all prompts and directions will appear on the touch screen.

To Select Language

- 1** Access the Select Language screen from the System Setup screen. The current language is displayed on the screen.
 - 2** Use the arrow keys to highlight the desired language.
 - 3** Touch enter to accept the language and return to the System Setup screen.
- OR
- Touch exit to return to the System Setup screen, without making any changes.

Set Date

Current MM/DD/YY	11/11/97
------------------	----------



● Touch clear to delete current date

● Use numeric touchpad to input the new date and then touch enter to accept

enter

D/M/Y

clear

exit

help

This screen can be used to set the present date which will be displayed on the measure screens. This date will also be printed on demand and stored in the data storage center of the meter when data is saved. There are two format options for the date: month/day/year (M/D/Y) or the European format of day/month/year (D/M/Y).

To Set Date

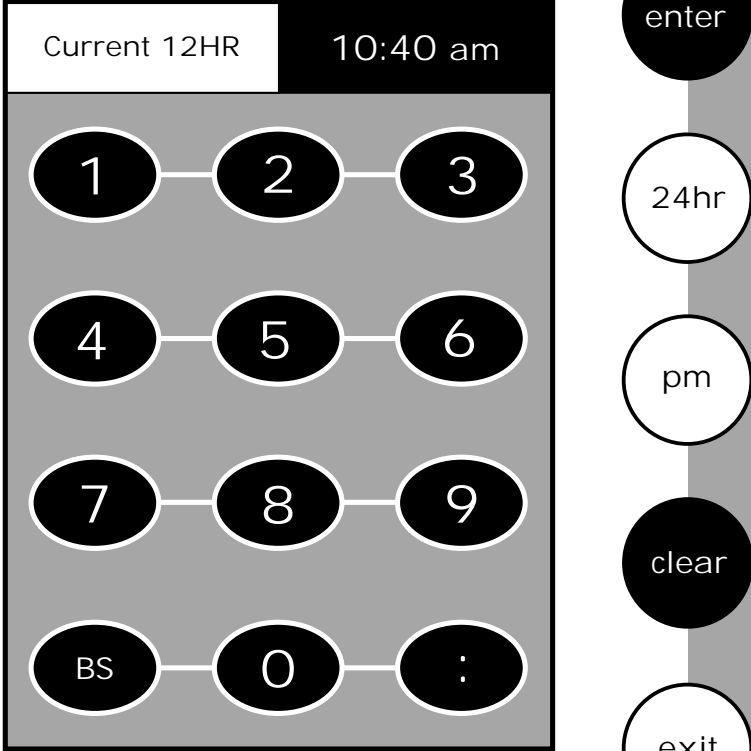
- 1** Access the Set Date screen from the System Setup screen. The current date and numeric keypad are displayed on the screen.
 - 2** Touch clear to delete the current entry.
 - 3** Touch D/M/Y or M/D/Y to set the date format.
 - 4** Use the numeric touch pad to enter the desired date, separating the day, the month and the year by touching the / key on the keypad.
 - 5** Touch enter to accept the date in the current format.
- OR
- Touch exit to return to the System Setup screen, without making any changes.



If you do not use the /, the meter will not accept the date.

Set Time

Current 12HR	10:40 am
--------------	----------

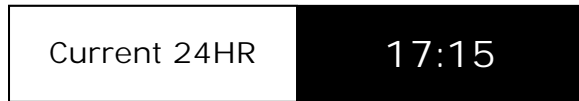


- Touch clear to delete current time setting
- Use numeric touchpad to input the new time and then touch enter to accept

This screen can be used to set the present time which will be displayed on the measure screens. This time will also be printed on demand and stored in the data storage center of the meter when data is saved. There are two format options for the time. The clock can be set as either a 12 hour clock or a 24 hour clock.

To Set Time

- 1** Access the Set Time screen from the System Setup screen. The current time and numeric keypad are displayed on the screen.
- 2** Touch clear to delete the current entry.
- 3** Touch the 24hr or 12hr button to format the clock as either a 12 hour or a 24 hour clock.



- 4** Touch am or pm to set the appropriate time.
- 5** Use the numeric touch pad to enter the desired time, separating the hour and the minutes by touching the : key on the keypad.
- 6** Touch enter to accept the time in the current format.

OR

Touch exit to return to the System Setup screen, without making any changes.



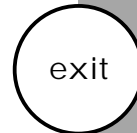
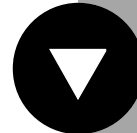
If you do not use the :, the meter will not accept the time.



Remember, HELP is always just a touch of the button away.

Set Beeper Status

Current BEEPER STATUS	
After STABLE Reading	ON
After KEY Touch	OFF
On LIMIT Exceeded	ON



- Use arrow keys to highlight beeper option and then touch ON/OFF to change
- Touch save to accept changes

This screen allows you to turn on or turn off the beeper. You may choose to have an audible signal when the meter recognizes that the current measurement is stable, each time a function button is touched and/or when the set limits of a measurement mode have been exceeded.

After STABLE Reading

When active, the meter delivers an audible tone each time the meter recognizes the current measurement as stable. If deactivated, you will not hear an audible tone at a stable measurement. You will still see the STABLE indicator even if there is no audible tone.

After KEY Activation

When active, the meter delivers an audible tone each time you touch a function button or a key on an alphanumeric keypad. If deactivated, you will not hear a tone after a key touch. The changes will only be visible on the screen.

On LIMIT Exceeded

When active, the meter delivers an audible tone each time the set limits in a measurement mode have been exceeded. If deactivated, you will not hear an alarm tone when the limits in the measurement modes have been exceeded. You will see the LIMIT indicator on the measurement screen. For additional information on the Alarm Limits of the meter, see the setup sections of this manual for each of the measurement modes.

To Set Beeper Status

- 1** Access the Set Beeper Status screen from the System Setup screen. The current beeper status is displayed on the screen.
 - 2** Use the arrow keys to highlight the beeper status option that you would like to modify.
 - 3** Touch ON or OFF until the desired status is visible in the current beeper status box.
 - 4** Touch save to accept the changes and return to the System Setup screen.
- OR
- Touch exit to return to the System Setup screen, without making any changes.

Select Procedural Level

Current LEVEL **1**

LEVEL 1 - Basic Level

LEVEL 2 - Advanced Level

enter

1

2

Procedural Level 1

September 17, 1997	11:11 am
Temperature	25.0 °C
Electrode Performance	100%

Procedural Level 2

September 17, 1997	11:11 am
ID# 00000	ATC 25.0 °C
auto buffer ON	slope 100%
auto read ON	mV 0000.0

This Selection screen allows you to choose the amount of information that you want to have displayed on the screen. There are two levels to choose from. Both of the levels provide identical results. The amount of information appearing on the measure screens and the number of setup parameters you can manipulate will vary from Basic to Advanced procedural levels.

LEVEL 1 - Basic Level

This level option offers a full set of prompts to guide you through the basic operation of the meter. The information provided on the screen is minimal to reduce clutter. It includes the measurement and the last standardization time and buffer values. The data box at the bottom of the measure screen includes the current date, time, sample temperature and the electrode performance. In addition to the limited information appearing on the measure screen, there are also fewer options available to you in the setup screens of the various measurement modes.

LEVEL 2 - Advanced Level

This option allows you access to all of the features available on the meter. A full set of prompts is available on virtually every screen to lead you through the operation of the meter. You are also given access to all setup parameters for the various measurement modes. Any parameter not appearing on the Basic Level Setup screens will maintain the value previously set in the Advanced Level Setup screens. They will not automatically default to factory default settings. This is ideal if you want to "lock" in a parameter in the Advanced Level and switch to the Basic Level so others cannot accidentally modify the parameter.

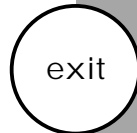
To Select Procedural Level

- 1** Access the Select Procedural Level screen from the System Setup screen. The current procedural level is displayed on the screen.
 - 2** Use the numbered buttons on the right of the screen to select the desired procedural level.
 - 3** Touch enter to accept the procedural level and return to the System Setup screen.
- OR
- Touch exit to return to the System Setup screen, without making any changes.

Set Print Configuration

Current PRINT CONFIGURATION	
- Baud Rate	19200
- # of Bits	8
- # of Stop	1
- # Parity	NONE

- Use arrow keys to highlight desired print setting and then touch edit to change
- Touch save to save the print settings



You can adjust the print configuration of the meter from this screen. The configuration of the following screens must match the configuration of the printer or computer to which the data will be sent.

To Set Print Configuration

- 1** Access the Print Configuration screen from the System Setup screen. The current Print Configuration is displayed on the screen.
 - 2** Use the arrow keys to highlight the configuration option to be modified.
 - 3** Touch edit to access the parameters for the highlighted option.
- OR
- Touch exit to return to the System Setup screen, without making any changes.

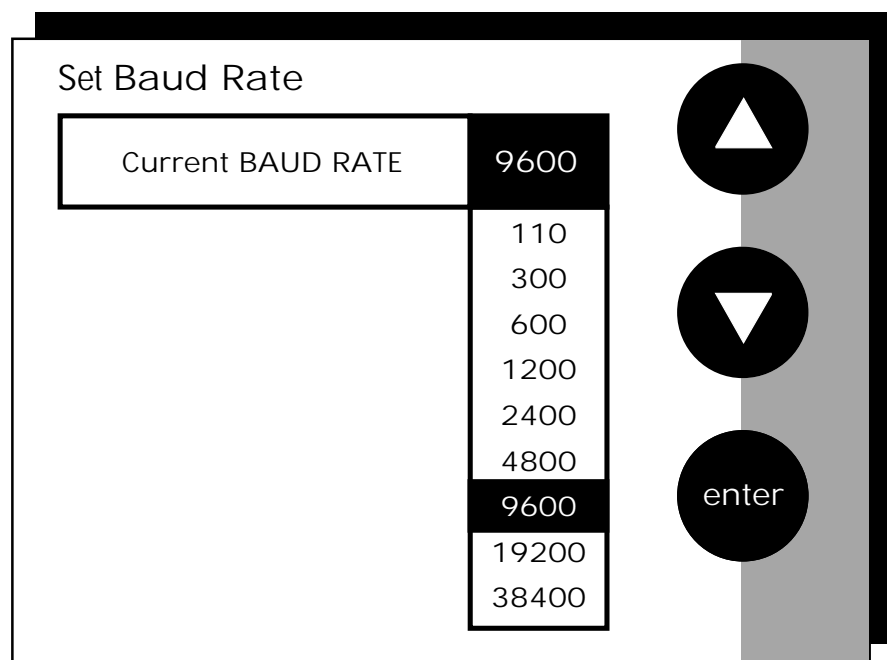
This configuration option will control the speed at which the data will be transmitted to the printer. This parameter needs to match the baud rate designated by the printer or computer.

To Set Baud Rate

- 1** Access the Set Baud Rate screen from the Set Print Configuration screen. The current baud rate is displayed on the screen.
- 2** Use the arrow keys to highlight the baud rate option that matches the baud rate of your printer or computer.
- 3** Touch enter to accept the baud rate and return to the Set Print Configuration screen.

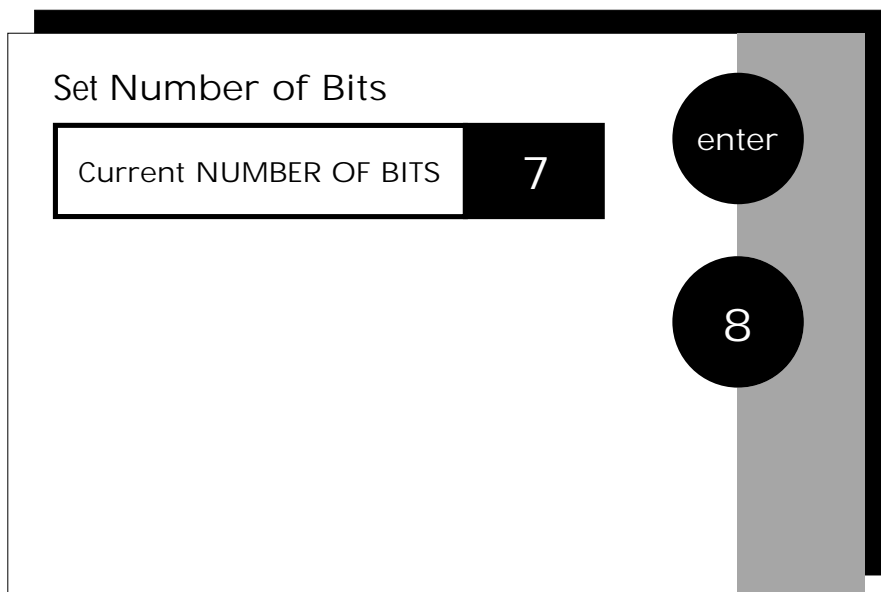
OR

Touch exit to return to the Set Print Configuration screen, without making any changes.



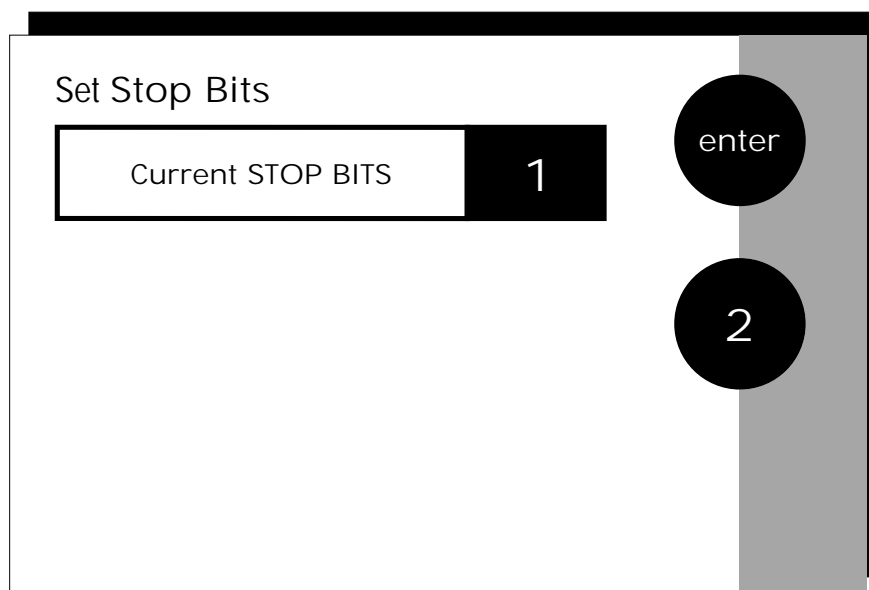
To Set Number of Bits

- 1** Access the Set Number of Bits screen from the Set Print Configuration screen. The current number of bits is displayed on the screen.
 - 2** Touch 7 or 8 to select the number of bits.
 - 3** Touch enter to accept the bit value and return to the Set Print Configuration screen.
- OR
- Touch exit to return to the Set Print Configuration screen, without making any changes.



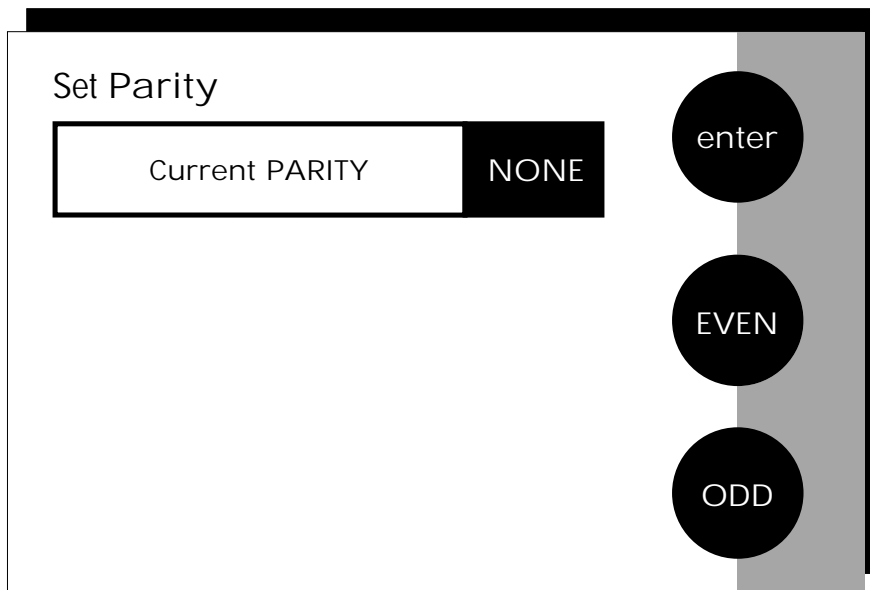
To Set Stop Bits

- 1** Access the Set Stop Bits screen from the Set Print Configuration screen. The current number of bits is displayed on the screen.
 - 2** Touch 1 or 2 to set the desired number of stop bits.
 - 3** Touch enter to accept the stop bit value and return to the Set Print Configuration screen.
- OR
- Touch exit to return to the Set Print Configuration screen, without making any changes.



To Set Parity

- 1** Access the Set Parity screen from the Set Print Configuration screen. The current Parity is displayed on the screen.
 - 2** Touch ODD or EVEN or NONE to set the desired parity.
 - 3** Touch enter to accept the parity setting and return to the Set Print Configuration screen.
- OR
- Touch exit to return to the Set Print Configuration screen, without making any changes.



Set Operator

Current Operator

A	B	C	1
D	E	F	2
G	H	I	3
J	K	L	4
M	N	O	5
P	Q	R	6
S	T	U	7
V	W	X	8
Y	Z	-	9
BS	/	.	0

enter

clear

exit


help

This option allows you to identify the user of the meter. This information can be saved in the meter's memory. It can also be printed out with measurement data on demand. The operator identification can be up to 9 characters in length.

To Set Operator

- 1** Access the Set Operator screen from the System Setup screen. The current operator identification is displayed on the screen.
 - 2** Touch `clear` to remove the current operator identification.
 - 3** Use the alphanumeric keys on the touch screen to enter the desired operator identification. The BS button will allow you to backspace to remove a character that was incorrectly entered. The operator identification code can be a maximum of 9 characters in length.
 - 4** Touch `enter` to accept the new operator identification.
- OR
- To deactivate the operator identification:
1. Touch `clear` to erase the current user identification.
 2. Touch `enter` to return to the System Setup screen.
- OR
- Touch `exit` to return to the System Setup screen, without making any changes.

Set Display Contrast



17

lighter

darker

save

- Touch lighter or darker to adjust contrast and then touch save to accept
- The value displayed ranges from 0 (darkest) to 25 (lightest)

exit

help

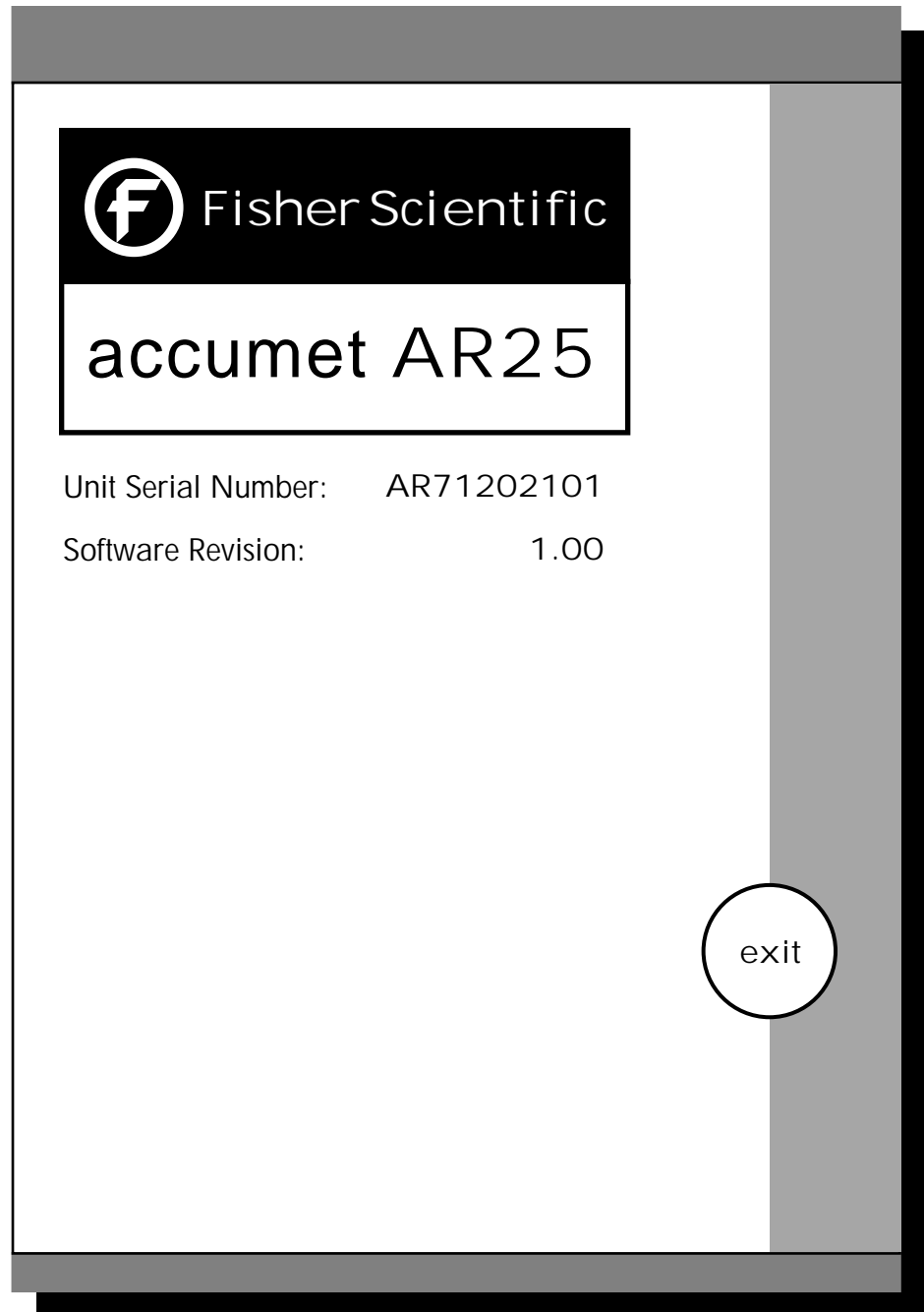
This option allows you to change the contrast on the screen to improve the readability of the information presented on the screen. The numbering system that appears on the screen is from 0 to 25. The darkest setting is 0 and the lightest setting is 25.

To Set Display Contrast

- 1** Access the Set Display Contrast screen from the System Setup screen. The current display contrast value is displayed on the screen.
 - 2** Use the lighter or darker button to adjust the contrast of the screen to the desired level.
 - 3** Touch save to accept the contrast setting and return to the System Setup screen.
- OR
- Touch exit to return to the System Setup screen, without making any changes.

Note: The display contrast of the screen is affected by the internal temperature of the meter. The meter will warm up after being plugged in. During this period (approximately 20 minutes), the display contrast of the screen will get lighter. You may need to adjust the contrast during this period to meet your specifications.

This screen displays the model number, serial number and current software revision of your meter.



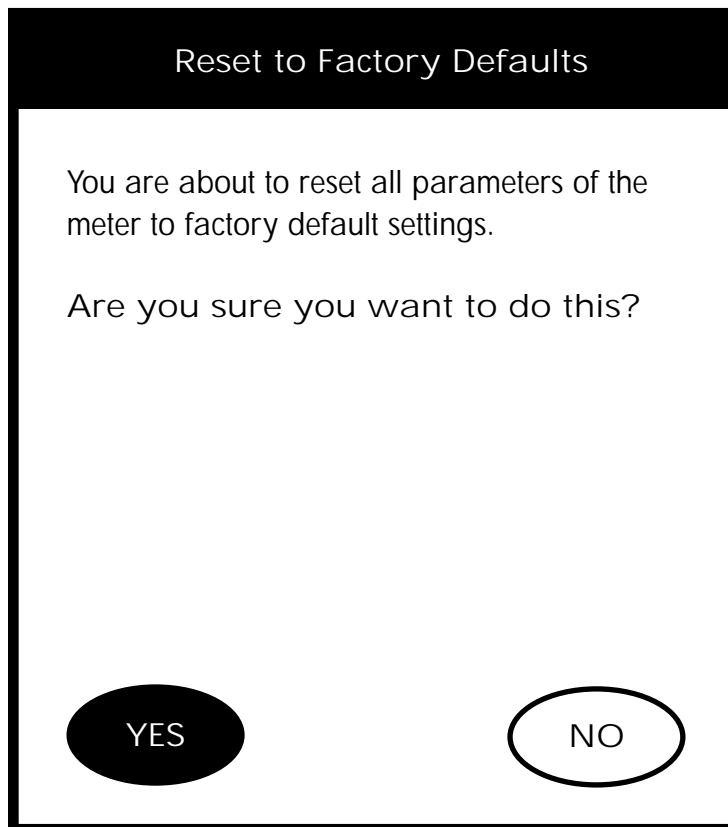
This screen allows you to reset all functions and setup parameters of the meter to the settings originally programmed at the factory.

To Reset to Factory Defaults

- 1** Access the Reset to Factory Defaults screen from the System Setup screen.
- 2** Touch YES to reset all parameters to the original factory default settings.

OR

Touch NO to return to the System Setup screen, without making any changes.

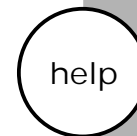
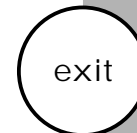


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pH Setup

pH SETUP OPTIONS

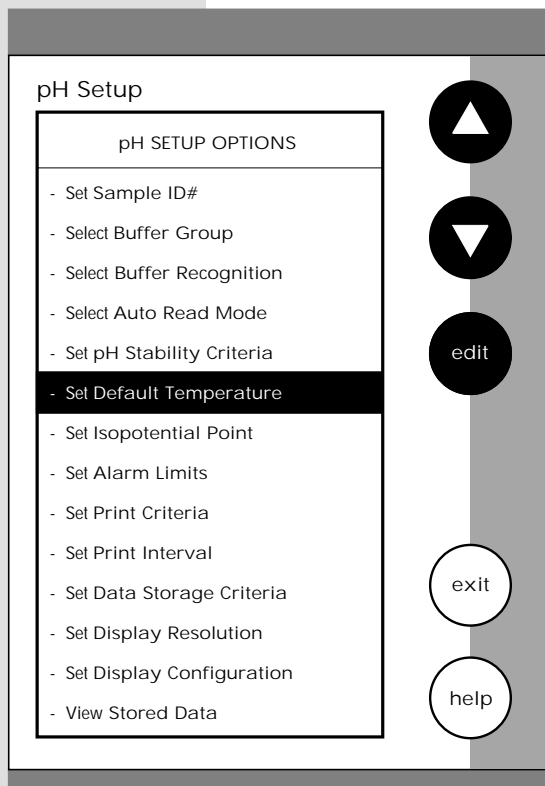
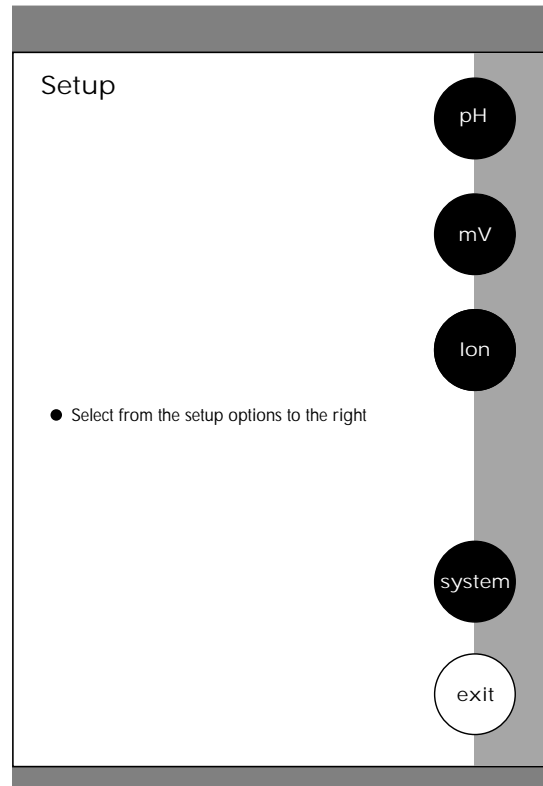
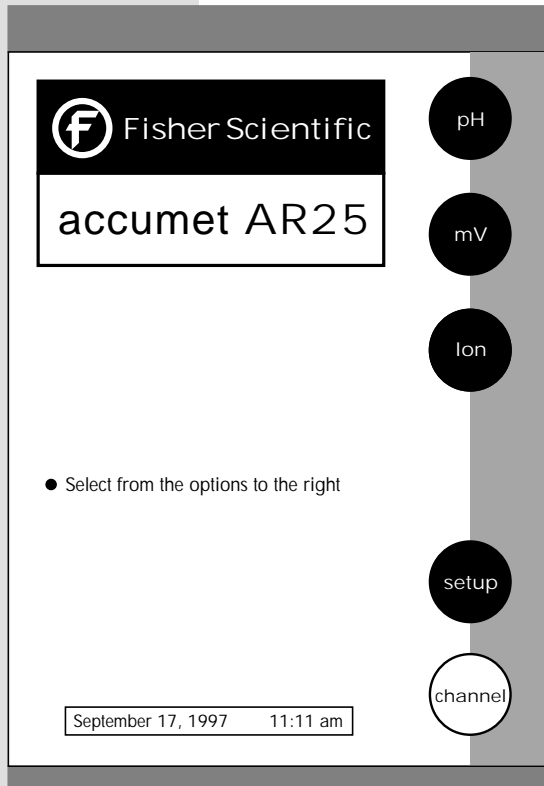
- Set Sample ID#
- Select Buffer Group
- Select Buffer Recognition
- Select Auto Read Mode
- Set pH Stability Criteria
- Set Default Temperature
- Set Isopotential Point
- Set Alarm Limits
- Set Print Criteria
- Set Print Interval
- Set Data Storage Criteria
- Set Display Resolution
- Set Display Configuration
- View Stored Data



Fisher Scientific

The operating parameters of the pH mode can be set and controlled from the pH Setup screen. The following sections will guide you through the various options available for the pH setup mode.

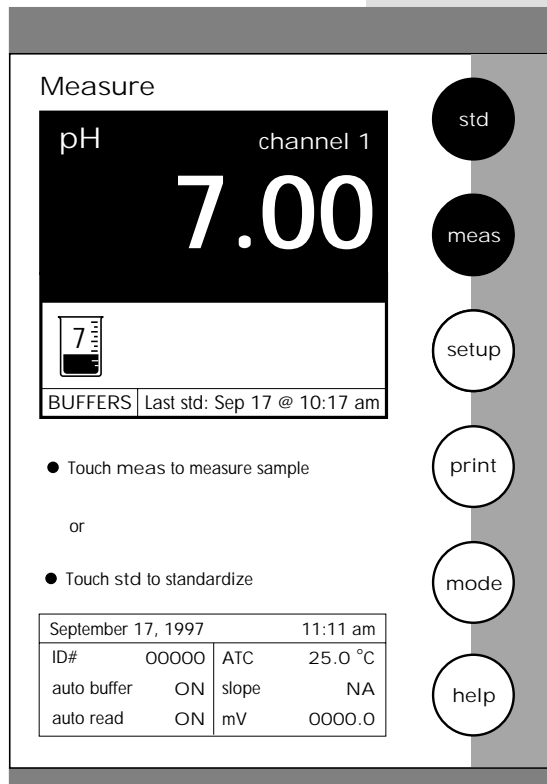
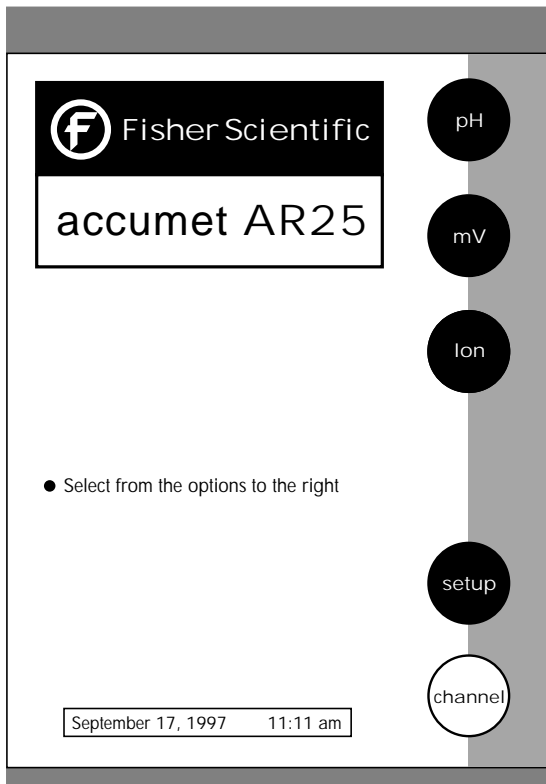
Access pH SETUP	46
Set SAMPLE ID#	48
Select BUFFER GROUP	50
Set pH CUSTOM BUFFER GROUP	54
Select BUFFER RECOGNITION	56
Select AUTO READ MODE	57
Set pH STABILITY CRITERIA	58
Set DEFAULT TEMPERATURE	60
Set ISOPOTENTIAL POINT	62
Set ALARM LIMITS	64
Set PRINT CRITERIA	66
Set PRINT INTERVAL	68
Set DATA STORAGE CRITERIA	70
Set DISPLAY RESOLUTION	72
Set DISPLAY CONFIGURATION	74
View STORED DATA	76



There are two ways to access the pH Setup screen.

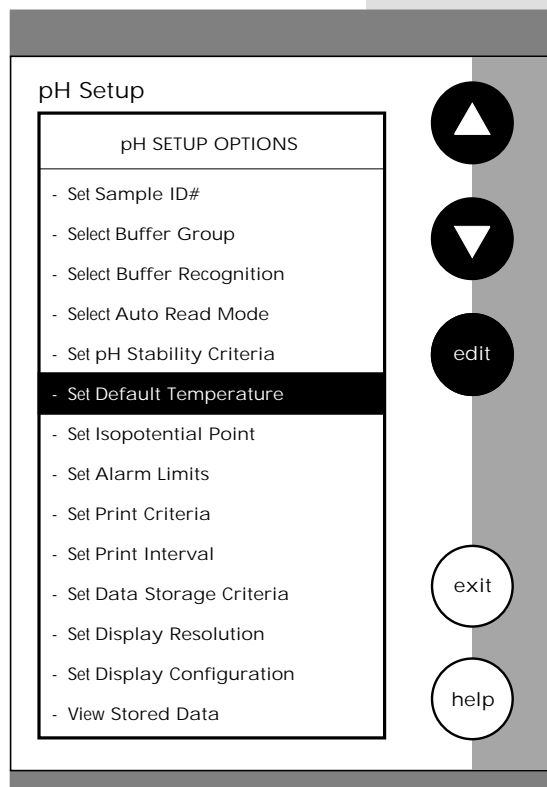
From the Setup screen

- 1** Touch setup on the main screen. Touch pH to access the pH Setup screen.
- 2** Use the arrow keys to highlight the setup option that you would like to review.
- 3** Touch edit to access the screen for the selected option.



From the pH Measure screen

- 1 Touch pH on the main screen to access the pH mode. Touch setup on the pH Measure screen. The pH Setup screen is now displayed.
- 2 Use the arrow keys to highlight the setup option that you would like to review.
- 3 Touch edit to access the screen for the selected option.



Set pH Sample ID#

Manual ID#			
A	B	C	1
D	E	F	2
G	H	I	3
J	K	L	4
M	N	O	5
P	Q	R	6
S	T	U	7
V	W	X	8
Y	Z	-	9
BS	/	.	0

enter

seq

clear

exit

help

When this option is active, each time you touch print on the Measure screen the pH value along with the date/time/channel and the sample ID# will be sent to data storage. (See Data Storage Criteria page 99 for additional information on saved parameters.) You can manually enter an alphanumeric identification number of up to 10 characters for any sample or you can have the meter sequentially number your samples beginning at the number of your choice. You may also choose to deactivate the sample ID#.

To Set Sample ID#

Manual ID# Assignment

- 1** Access the Set Sample ID# screen from the pH (mV, Ion) Setup screen.
- 2** Touch man for manual ID# entry. The current ID# is displayed on the screen.
- 3** Touch clear to delete the current ID#.
- 4** Use the alphanumeric keypad on the screen to enter the desired Sample ID#. The BS key will allow you to backspace to remove a character that was incorrectly entered.
- 5** Touch enter to accept the current ID# and return to the pH (mV, Ion) Setup screen.

Set pH Sample ID#

Sequential ID#

1	2	3
4	5	6
7	8	9
BS	0	.

enter

man

clear

exit

help

- Touch clear to delete current ID
- Use numeric touchpad to input the new starting ID and then touch enter to accept

Sequential ID# Assignment

- 1** Access the Set Sample ID# screen from the pH (mV, Ion) Setup screen.
- 2** Touch seq for sequential ID# assignment. The current ID# is displayed on the screen.
- 3** Touch clear to delete the current ID#.
- 4** Use the alphanumeric keypad on the screen to enter the number that you would like your sequential ID# assignment to begin with. Every time you touch print on the Measure screen, the ID# will increase by 1. The BS key will allow you to backspace to remove a character that was incorrectly entered.
- 5** Touch enter to accept the first sequential ID# and return to the pH (mV, Ion) Setup screen.

OR

To Deactivate the Sample ID# Assignment

- 1** Access the Set Sample ID# screen from the pH (mV, Ion) Setup screen.
- 2** Touch man for manual ID# entry. The current ID# is displayed on the screen.
- 3** Touch clear to delete the current ID#.
- 4** Touch enter. The ID# assignment is now deactivated. No number will be assigned to your samples. The meter will return to the pH (mV, Ion) Setup screen.

OR

Touch exit to return to the pH (mV, Ion) Setup screen without making any changes.



Remember, HELP is always just a touch of the button away.

Select pH Buffer Group

Current BUFFER GROUP

USA

2	4	7	10	12
---	---	---	----	----

- Use keys to display desired buffer group and then touch enter to accept

enter

EURO

NIST

custom

exit

help

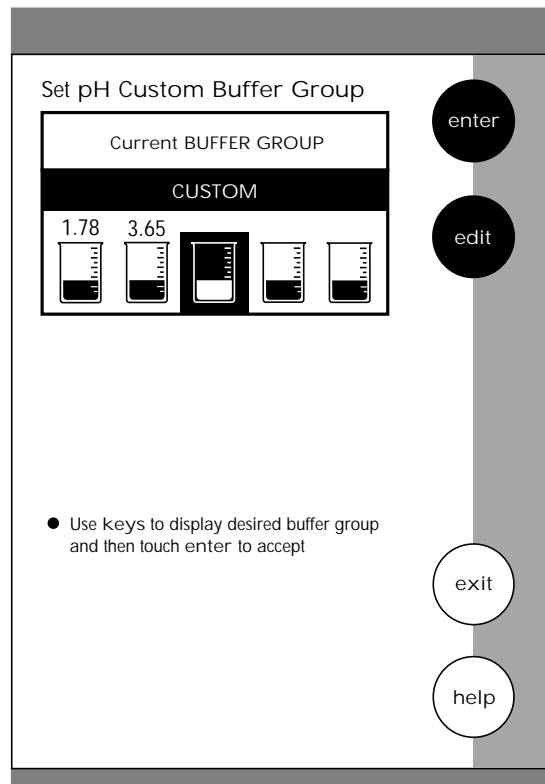
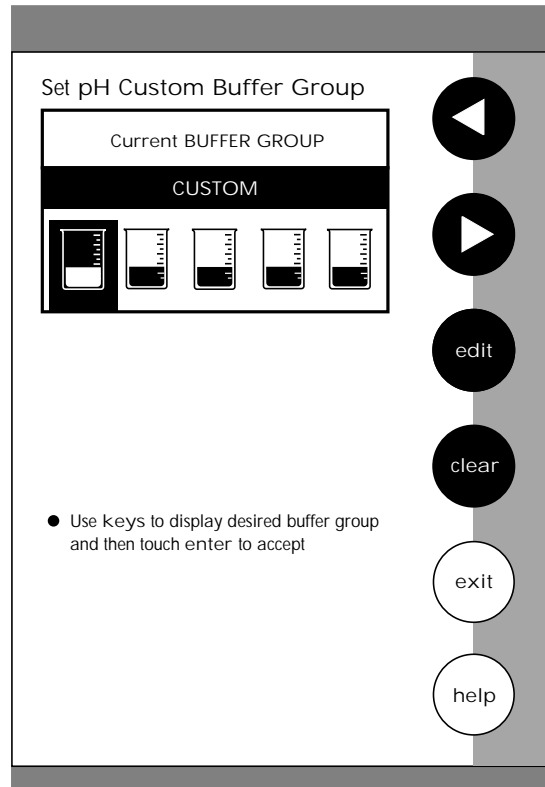
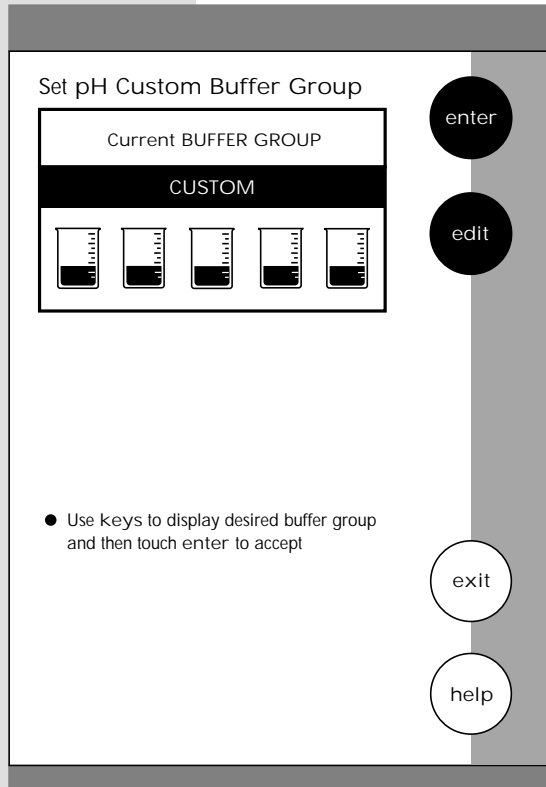
This setup option allows you to select from 3 different buffer groups, each containing 5 buffers, for auto buffer recognition. Or you can create a custom group of buffers for auto buffer recognition by touching custom.

The 3 existing buffer groups are:

USA buffers:	2, 4, 7, 10, and 12
European buffers:	1, 3, 6, 8, and 10
NIST buffers:	1.68, 4.01, 6.86, 9.18, and 12.45

To Select Buffer Group

- 1** Access the Select pH Buffer Group screen from the pH Setup screen. The current buffer group is displayed on the screen.
 - 2** Touch USA or NIST or EURO or custom on the right of the screen to select a buffer group.
 - 3** Touch enter to accept the buffer group to be used for auto recognition.
- OR
- Touch exit to return to pH Setup Screen, without making any changes.



To Set pH Custom Buffer Group

This option allows you to create a custom buffer group of up to 5 buffers to be used for auto buffer recognition. To obtain optimal results, it is important to maintain at least 2 pH units between selected buffers in the custom group.

- 1** Touch custom on the Set pH Buffer Group screen. The current buffer box will show the current custom buffer group.
- 2** Touch edit to alter the present group or create a new custom buffer group. The newly displayed Set pH Custom Buffer Group screen has 5 beakers in the current buffer group box.
- 3** Use the arrow keys to highlight the beaker icon with the pH value you want to change. If there are no buffers in the group then proceed to the next step.
- 4** Touch edit to add a buffer or make changes to the current buffer group OR touch clear to delete the highlighted buffer value.
- 5** Use the numeric keypad that is now displayed to enter the pH buffer value that you want in your custom buffer set.
- 6** Touch enter to accept the value. If you have entered an erroneous value, use the BS key on the keypad to erase the last digit entered and correct the mistake. If you decide not to change the buffer value on the highlighted beaker icon, touch exit on the numeric keypad to return to the Set pH Custom Buffer Group screen.
- 7** Repeat steps 3 through 6 to add up to 5 buffers to your custom buffer group.
- 8** Touch exit to return to the Set pH Custom Buffer Group screen to view the current Custom Buffer Group.
- 9** Touch enter to accept the group and return to the pH Setup screen, OR touch edit to modify the group and repeat steps 3 through 6.

OR

Touch exit to return to the Set pH Buffer Group screen, without making any changes to the custom buffer group.



If you use the custom buffer group for auto buffer recognition, when you access the Set pH Buffer Group from the pH Setup screen, the current buffer group that appears on the screen is the custom buffer group. In order to access the edit option for the custom buffer group, you need to touch any of the other buffer group buttons and then touch custom to access the edit screen.



Regardless of which Buffer Recognition Mode you select, STABLE will appear on the Measure screen when the meter recognizes the value as stable.

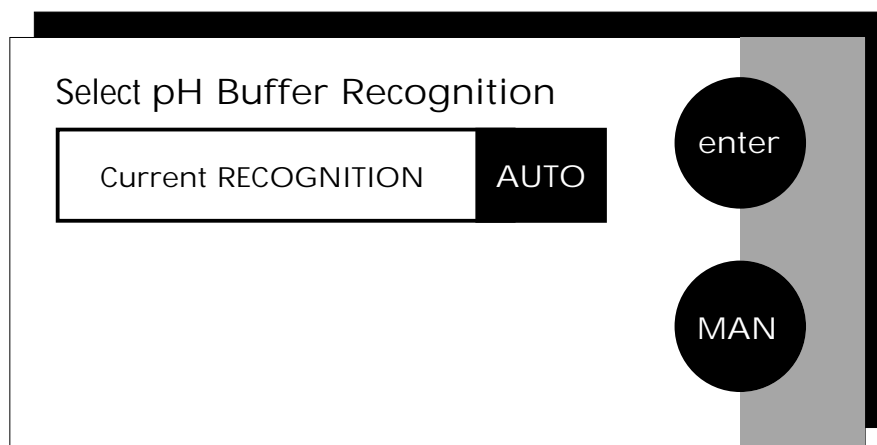
This option allows you to select Automatic buffer recognition or manual buffer recognition when standardizing. With the Automatic buffer recognition activated, the meter will automatically recognize the buffers from the chosen buffer group and accept them when the meter recognizes the reading as stable. When in the Manual buffer recognition mode, you must enter the buffer value during the standardization procedure. The meter will accept the manually entered buffer when it recognizes that the measurement is stable. During the standardization procedure, you may accept the buffer value before the meter recognizes it as stable by touching std.

To Select Buffer Recognition

- 1** Access the Select Buffer Recognition screen from the pH Setup screen. The current method of recognition is displayed on the screen.
- 2** Touch MAN or AUTO to choose the method of buffer selection.
- 3** Touch enter to accept the method of buffer recognition and return to the pH Setup screen.

OR

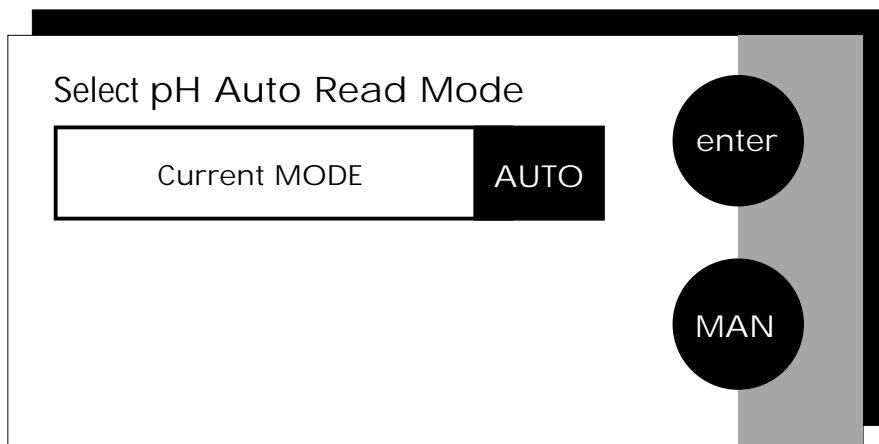
Touch exit to return to the pH Setup screen, without making any changes.



You can use this meter when the Auto Read function is active or when it is inactive. When the Auto Read function is active, the meter will lock onto a reading when the meter recognizes it as stable. The meter will not deviate from this reading until meas is touched. If the Auto Read function is inactive, then the meter will continuously monitor the pH of the sample and the Measure screen display will indicate any fluctuation in the sample pH.

To Select Auto Read Mode

- 1** Access the Select Auto Read Mode screen from the pH (Ion) Setup screen. The current Read Mode is displayed on the screen.
 - 2** Touch AUTO or MAN to choose the desired read mode.
 - 3** Touch enter to accept the read mode and return to the pH (Ion) Setup screen.
- OR
- Touch exit to return to the pH (Ion) Setup Screen, without making any changes.



Set pH Stability Criteria

Current CRITERIA	Medium
Fast	
Medium	
Slow	

- Use arrow keys to highlight stability criteria and then touch enter to accept

Navigation buttons: Up arrow, Down arrow, enter, exit, help

This setup screen allows you to determine how quickly the meter will respond to electrode drift. There are 3 speed settings: fast, medium and slow.

To Set pH Stability Criteria

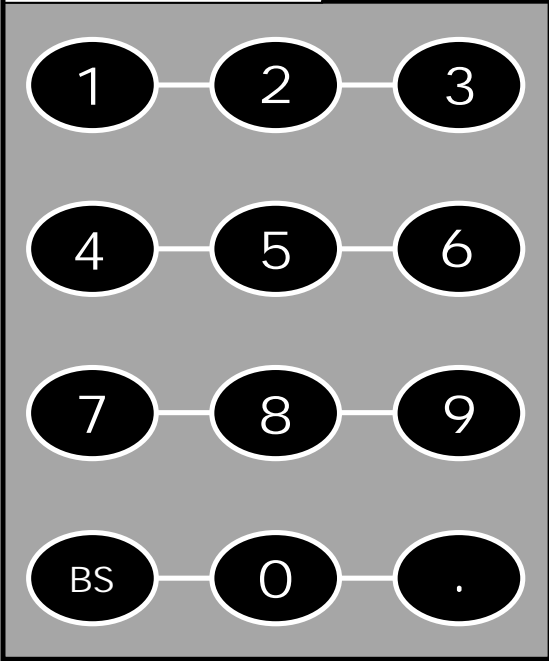
- 1** Access the Set pH Stability Criteria screen from the pH (Ion) Setup screen. The current stability criteria are displayed on the screen.
 - 2** Use the arrow keys to highlight the desired stability criteria.
 - 3** Touch enter to accept the stability criteria and return to the pH (Ion) Setup screen.
- OR
- Touch exit to return to the pH (Ion) Setup screen, without making any changes.



Stability criteria are more stringent at the slower setting. Therefore, if the highest precision is required, then a slow setting would be desired. The default setting is the medium speed and this should be adequate for the majority of applications.

Set pH Default Temperature

Current DEFAULT	25.0 °C
-----------------	---------



- Touch clear to delete current default temp
- Use numeric touchpad to input the new temperature and then touch enter to accept

enter

F

K

clear

exit

help

It is a well known fact that pH is a temperature dependent measurement. The factory default setting is 25°C. If you are taking the pH of a solution that is not 25°C and you are not using an Automatic Temperature Compensation (ATC) Probe, then you should enter the temperature value of that solution in order to get the correct pH value. The current default temperature setting will be displayed when the Set Default Temperature screen is displayed.

To Set Default Temperature

- 1** Access the Set Default Temperature screen from the pH (Ion) Setup screen. The current default temperature is displayed on the screen.
 - 2** Touch clear to erase the current temperature value.
 - 3** Select the temperature units by touching the appropriate unit key C (Celsius), F (Fahrenheit), or K (Kelvin).
 - 4** Use the numeric keypad to enter the desired default temperature.
 - 5** Touch enter to accept the temperature setting and return to the pH (Ion) Setup screen.
- OR
- Touch exit to return to the pH (Ion) Setup screen, without making any changes.



The use of an ATC probe provides a measured temperature value to the meter and will override any value entered in the default temperature screen. This measured value will be used by the meter to make pH (Ion) calculations.

Set pH Isopotential Point

Current ISO POINT	0.0 mV	
1	2	3
4	5	6
7	8	9
BS	0	.

enter

clear

exit

help

- Touch clear to delete current Iso Point
- Use numeric touchpad to input the new Iso Point and then touch enter to accept

The Isopotential Point is the millivolt reading for an electrode at which temperature has no effect on the measurement. pH electrodes are constructed so that the isopotential point is theoretically zero millivolts. This is very close to a pH of 7. Most pH electrodes do not achieve this value precisely. However, they are close enough so that it is not usually necessary to use an isopotential point other than zero. The true isopotential point of any given electrode must be determined experimentally. (See Appendix: Determining Isopotential Points Experimentally, page 137)

To Set Isopotential Point

- 1** Access the Set Isopotential Point screen from the pH (Ion) Setup screen. The current isopotential point is displayed on the screen.
 - 2** Touch **clear** to remove the current mV value.
 - 3** Use the numeric keypad to enter the desired mV setting for the new isopotential point.
 - 4** Touch **enter** to accept this value and return to the pH (Ion) Setup screen.
- OR
- Touch **exit** to return to the pH (Ion) Setup screen, without making any changes.

Set pH Limits

Current LIMITS	
pH Alarm	OFF
pH Minimum	0.00
pH Maximum	14.00

▲

▼

edit

Set mV Limits

Current LIMITS	
- mV Alarm	OFF
- mV Minimum	-1800.0
- mV Maximum	1800.0

Set Ion Limits

Current LIMITS	
- Ion Alarm	OFF
- Ion Minimum	0.00
- Ion Maximum	1.00E6

This option allows you to set alarm limits for the pH measuring mode. If the pH value of the measurement is outside of the boundaries set by the minimum and maximum limits, an audible alarm and/or a visual warning will appear to let you know that your sample measurement was outside of the set limits.

To Set Alarm Limits

- 1** Access the Set Alarm Limits screen from the pH (mV, Ion) Setup screen. The current alarm limits are displayed on the screen.
 - 2** Use the arrow keys to highlight the pH (mV, Ion) Alarm option you want to modify.
 - 3** Touch ON or OFF to set the status of the alarm for the pH (mV, Ion) mode.
 - 4** Use the arrow keys to highlight the desired pH (mV, Ion) alarm limit.
 - 5** Touch edit to change the value.
 - 6** Use the keypad to enter the new limit value.
 - 7** Touch enter on the keypad to accept this limit and return to the Set pH (mV, Ion) Limits screen. If you do not want to change the limit value, you can touch exit on the keypad and return to the Set pH (mV, Ion) Limits screen.
 - 8** Repeat steps 4 through 7 to set the other pH (mV, Ion) Alarm limit.
- OR
- Touch exit to return to the pH (mV, Ion) Setup screen, without making any changes.

Set pH Print Criteria

Current PRINT CRITERIA	
- Date/Time/Channel	ON
- Sample ID#	ON
- pH measurement	ON
- Temperature - ATC	ON
- Last Standardization	OFF
- Current Buffers	OFF
- Slope	ON
- mV measurement	ON
- Meter model #/serial #	ON
- Operator	ON

Set mV Print Criteria

Current PRINT CRITERIA	
- Date/Time/Channel	ON
- Sample ID#	ON
- mV measurement	ON
- Temperature - ATC	ON
- Meter model #/serial #	ON
- Operator	ON

Set Ion Print Criteria

Current PRINT CRITERIA	
- Date/Time/Channel	ON
- Sample ID#	ON
- Ion measurement	ON
- Temperature - ATC	ON
- Last Standardization	OFF
- Current Standards	OFF
- Slope	ON
- mV measurement	ON
- Meter model #/serial #	ON
- Operator	ON
- electrode/method	ON

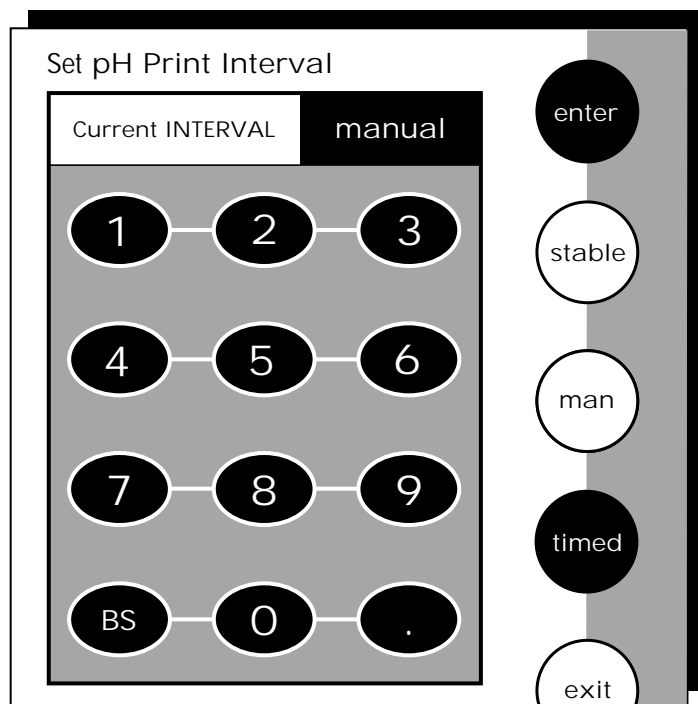
This screen allows you to select which criteria are printed with the measurement when you print the data or send it to a computer. The status of the current print criteria is displayed on the screen. The criteria option is active if "ON" appears to the right of the option. It is inactive if "OFF" appears to the right of the option. Any active criteria will be printed on demand.

To Set Print Criteria

- 1** Access the Set Print Criteria screen from the pH (mV, Ion) Setup screen. The current print criteria are displayed on the screen.
 - 2** Use the arrow keys to highlight the print criteria option you want to modify.
 - 3** Touch ON or OFF change the status of the criteria.
 - 4** Repeat steps 2 and 3 with the remaining criteria.
 - 5** Touch save to save the entire group of print criteria and return to the pH (mV, Ion) Setup screen.
- OR
- Touch exit to return to the pH (mV, Ion) Setup screen, without making any changes.



The Date/Time/Channel option and the Measurement option are always active and cannot be deactivated. These criteria will always be printed. Because they can not be changed, they will not be highlighted when using the arrow keys.



You have three options for setting the print interval: manual printing, stable reading printing, and timed interval printing.

For manual printing of data

In this mode, data is printed only when you touch print on the pH (mV, Ion) Measure screen.

- 1** Access the Set Print Interval screen from the pH (mV, Ion) Setup screen. The current print interval is displayed on the screen.
- 2** Touch MAN to set the meter for manual printing.
- 3** Touch enter to accept the print interval mode and return to the pH (mV, Ion) Setup screen.

Printing is now done manually by touching print on the Measure screen.

OR

Touch exit to return to the pH (mV, Ion) Setup screen, without making any changes.

For stable reading printing

In this mode, data is printed every time the meter recognizes the current pH (mV, Ion) measurement as stable.

1 Access the Set Print Interval screen from the pH (mV, Ion) Setup screen. The current print interval is displayed on the screen.

2 Touch stable to set the meter for stable reading printing.

3 Touch enter to accept the print interval mode and return to the pH (mV, Ion) Setup screen.

Printing is now done when the meter recognizes the present reading as stable.

OR

Touch exit to return to the pH (mV, Ion) Setup screen, without making any changes.

For timed interval printing

In this mode, data is printed at the timed interval that you select.

1 Access the Set Print Interval screen from the pH (mV, Ion) Setup screen. The current print interval is displayed on the screen.

2 Touch timed to access the timed interval mode and delete the current print interval time.

3 Use the keypad to enter the desired time for the print interval.

4 Touch enter to accept the new time interval for printing and return to the pH (mV, Ion) Setup screen.

Printing is now done at the set timed interval.

OR

Touch exit to return to the pH (mV, Ion) Setup screen, without making any changes.

Set pH Data Storage Criteria

Current DATA STORAGE CRITERIA	
- Date/Time/Channel	ON
- Sample ID#	ON
- pH measurement	ON
- Temperature - ATC	ON
- Last Standardization	OFF
- Current Buffers	OFF
- Slope	ON
- mV measurement	ON
- Meter model #/serial #	ON
- Operator	ON

Set mV Data Storage Criteria

Current DATA STORAGE CRITERIA	
- Date/Time/Channel	ON
- Sample ID#	ON
- mV measurement	ON
- Temperature - ATC	ON
- Meter model #/serial #	ON
- Operator	ON

Set Ion Data Storage Criteria

Current DATA STORAGE CRITERIA	
- Date/Time/Channel	ON
- Sample ID#	ON
- Ion measurement	ON
- Temperature - ATC	ON
- Last Standardization	OFF
- Current Standards	OFF
- Slope	ON
- mV measurement	ON
- Meter model #/serial #	ON
- Operator	ON
- electrode/method	ON

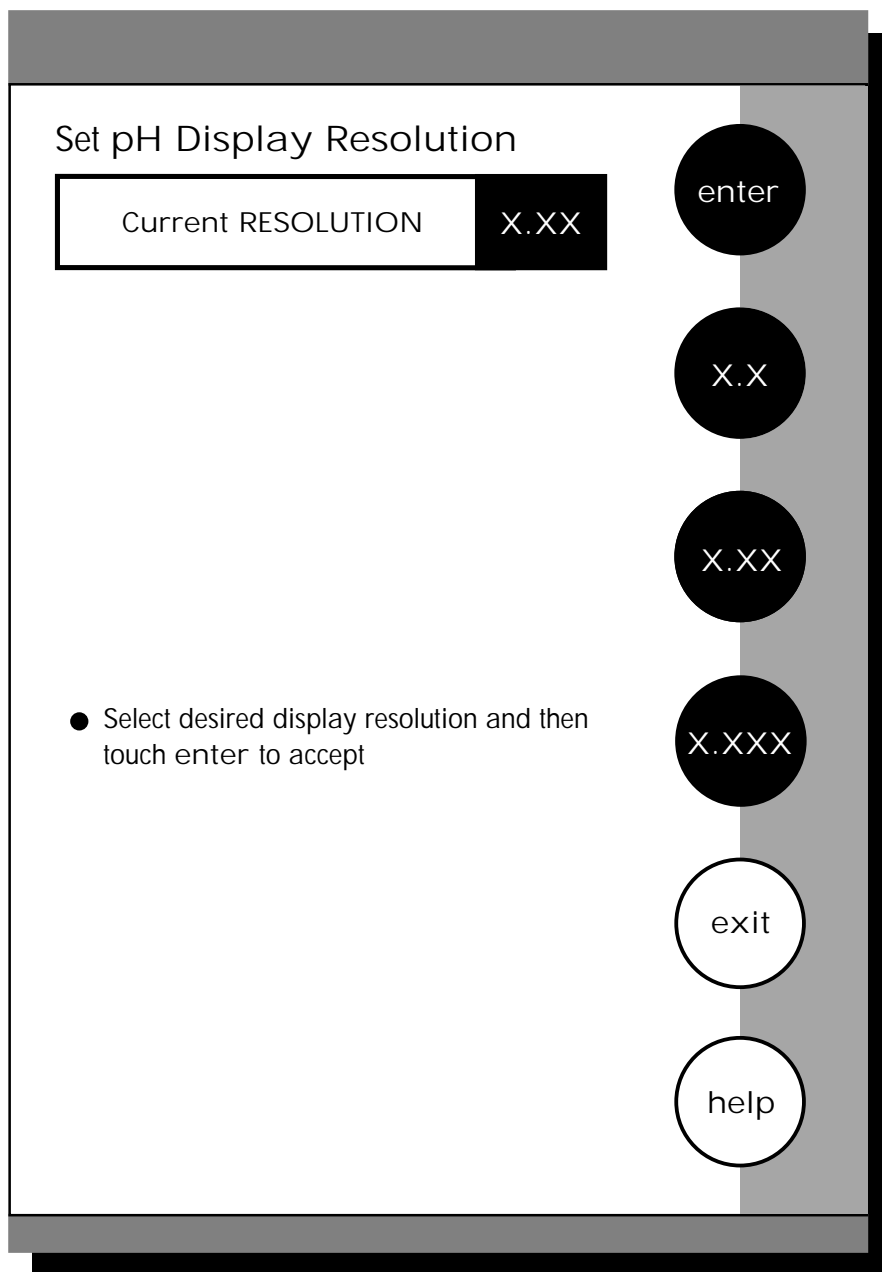
This screen allows you to select what criteria are stored in the meter's memory with the measurement when you save the data. Data is stored only if a Sample ID# has been assigned. The status of the current data storage criteria is displayed on the screen. The criteria option is active if "ON" appears to the right of the option. It is inactive if "OFF" appears to the right of the option. All storage criteria will be stored in the meter's memory with the measurement. However, only active items will appear on the View Stored Data screens. Changing the status of the storage criteria to active from inactive will allow the criteria to be displayed with the previously stored data.

To Set Data Storage Criteria

- 1** Access the Set Data Storage Criteria screen from the pH (mV, Ion) Setup screen. The current Data Storage Criteria are displayed on the screen.
 - 2** Use the arrow keys to highlight the data storage criteria you want to modify.
 - 3** Touch ON or OFF to change the status of the criteria.
 - 4** Repeat steps 2 and 3 with the remaining criteria.
 - 5** Touch save to save the entire group of data storage criteria and return to the pH (mV, Ion) Setup screen.
- OR
- Touch exit to return to the pH (mV, Ion) Setup screen, without making any changes.



The Date/Time/Channel criteria and the Measurement criteria are always active and cannot be deactivated. These criteria will always be stored with the measurement value. Because they can not be changed, they will not be highlighted when using the arrow keys.



This mode allows you to set the display resolution that you desire on the screen. You have the choice of one, two or three decimal places.

To Set Display Resolution

- 1** Access the Set Display Resolution screen from the pH Setup screen. The current Display Resolution is displayed on the screen.
 - 2** Touch X.X, X.XX or X.XXX to select the desired resolution of the display. This will be the format in which your measurement will be displayed.
 - 3** Touch enter to accept the resolution and return to the pH Setup screen.
- OR
- Touch exit to return to the pH Setup screen, without making any changes.



Remember, HELP is always just a touch of the button away.

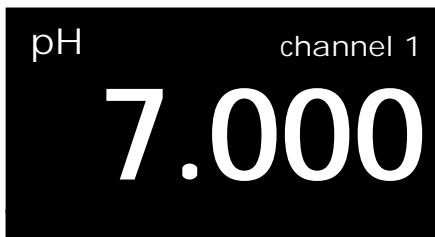
Example of X.X resolution



Example of X.XX resolution



Example of X.XXX resolution



Set pH Display Configuration

Current DISPLAY CONFIGURATION	
- Last Standardization	ON
- Date	ON
- Time	ON
- measurement channel	ON
- sample ID#	ON
- auto buffer status	ON
- auto read status	ON
- temperature	ON
- slope	ON
- mV Display	ON

Set mV Display Configuration

Current DISPLAY CONFIGURATION	
- Date	ON
- Time	ON
- measurement channel	ON
- sample ID#	ON
- temperature	ON

Set Ion Display Configuration

Current DISPLAY CONFIGURATION	
- Last Standardization	ON
- Date	ON
- Time	ON
- measurement channel	ON
- sample ID#	ON
- auto read status	ON
- temperature	ON
- slope	ON
- mV Display	ON
- electrode/method	ON

This function will allow you to choose what information you would like to be displayed on the pH Measure screen, particularly the information contained in the data box at the bottom of that screen.

To Set Display Configuration

- 1** Access the Set Display Configuration screen from the pH (mV, Ion) Setup screen. The current Display Configuration is displayed on the screen.
- 2** Use the arrow keys to highlight the Display Configuration criteria you want to modify.
- 3** Touch ON or OFF to change the status of the criteria.
- 4** Repeat steps 2 and 3 with the remaining criteria.
- 5** Touch save to save the entire group of Display Configuration criteria and return to the pH (mV, Ion) Setup screen.

OR

Touch exit to return to the pH (mV, Ion) Setup screen, without making any changes.

pH Display Configuration

September 17, 1997		11:11 am	
ID#	00000	ATC	25.0 °C
auto buffer	ON	slope	100%
auto read	ON	mV	0000.0

View Stored Data

Data POINTS	17
Sample ID	
Date	
Operator	

● Use arrow keys to highlight desired sort option and then touch enter to accept

↑

↓

enter

exit

help

This pH meter has memory capacity of up to 250 data points. The View Stored Data screen allows you to sort and look at specific data points. The stored data can be sorted by sample identification number, date or operator identification number.

To View Stored Data

- 1** Access the View Stored Data screen from the pH (mV, Ion) Setup screen. The number of data points in the memory and the sorting options are now displayed on the screen.
- 2** Use the arrow keys to highlight the desired data sort option.
- 3** Touch enter to access the sort option screen.

To sort by Sample ID#

- 1** Access the Sample ID sort option from the View Stored Data screen.
- 2** Use the keypad to enter the sample ID# of the data point(s) that you want to view.
- 3** Touch clear to delete a Sample ID# entered in error and reenter the ID#.
- 4** Touch enter. All data will be sorted by the meter and the first data point displayed on the screen will be the most recent data point saved under the selected Sample ID#.
- 5** Touch next or prev to scroll through additional data points saved in the memory of the meter.
- 6** Touch print to send the data to a printer or computer, OR touch delete to erase the data point from the meter's memory, OR touch exit to return to the pH (mV, Ion) Setup screen.

If a sample ID# is entered and no data points are stored with that sample ID#, you will see a message indicating the sample ID# was not found. Touch OK to return to the sample ID# keypad and enter a new sample ID#.

To sort by Date

- 1** Access the Date sort option from the View Stored Data screen.
- 2** Touch clear to delete the current date.
- 3** Use the numeric keypad to enter the date on which the data points you want to view were saved. Be sure to use / to separate the month, the day and the year.
- 4** Touch enter. All data will be sorted by the meter and the first data point displayed on the screen will be the most recent data point saved under the selected Date.
- 5** Touch next or prev to scroll through additional data points saved in the memory of the meter.
- 6** Touch print to send the data to a printer, OR touch delete to erase the data point from the meter's memory, OR touch exit to return to the pH (mV, Ion) Setup screen.

If a date is entered and no data points are stored with that date, you will see a message indicating the date was not found. Touch OK to return to the operator ID keypad and enter a new date.

To sort by Operator

- 1** Access the Operator sort option from the View Stored Data screen.
- 2** Use the keypad to enter the Operator ID of the data point(s) that you want to view.
- 3** Touch clear to delete an Operator ID entered in error and reenter an ID#.
- 4** Touch enter. All data will be sorted by the meter and the first data point displayed on the screen will be the most recent data point saved under the selected Operator ID.
- 5** Touch next or prev to scroll through additional data points saved in the memory of the meter.
- 6** Touch print to send the data to a printer, OR touch delete to erase the data point from the meter's memory, OR touch exit to return to the pH (mV, Ion) Setup screen.

If an operator ID is entered and no data points are stored with that operator ID, you will see a message indicating the operator ID was not found. Touch OK to return to the operator ID keypad and enter a new operator ID.

NOTE:

Even if you do not know the appropriate information to access a specific data point, you can access the stored data through any of the sort options. Highlight the sort option of interest and touch enter to access the sort screen. Touch enter again and the meter will place you at a data point.

- * The sample ID# sort option will place you at the first data point in numeric order by sample ID#.
- * The Operator sort option will place you at the data point of the first operator ID in alphabetic order.
- * The Date sort option will place you at the most recent point on the last date that data was stored.

Once you access the data storage center, you can touch prev and next to scroll through the additional data points stored in memory.

View Stored Data

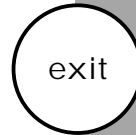
Current STORED DATA	
September 17, 1997	
11:11 am	
Channel:	1
sample ID#:	110
Ion value:	1.0
Ion method:	Known Addition
Ion electrode:	AMMONIA
Temperature:	25.0°C
Last Std:	Sep.17 @11:11am
Current Stds:	10.0 100
Slope:	102.2%
mV value:	0.6
model#/serial#:	AR25/alpha 0001
Operator:	Tom D.

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mV Setup (channel 1)

mV SETUP OPTIONS

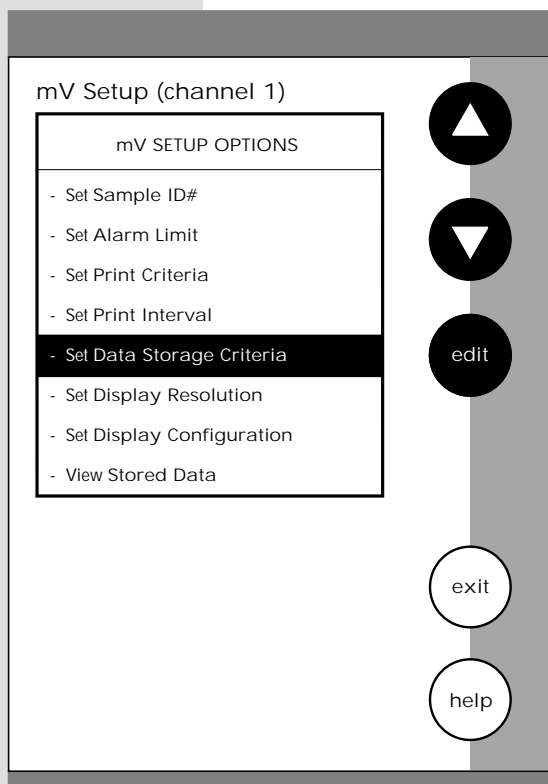
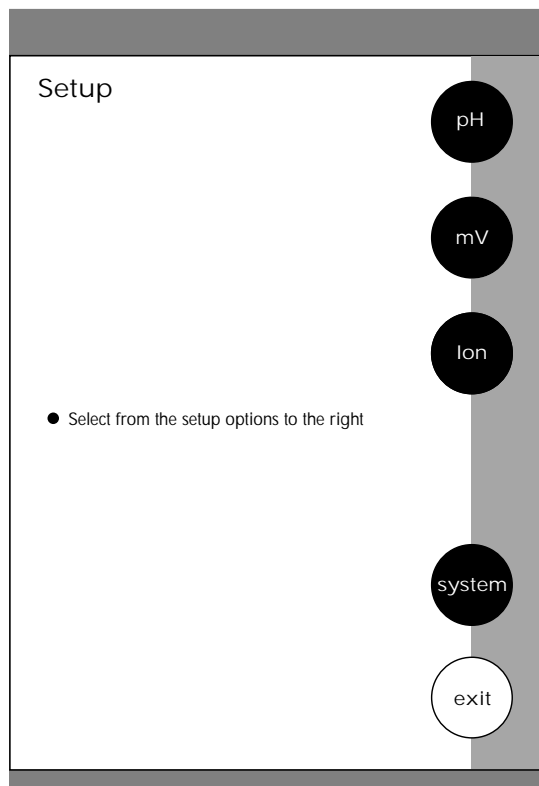
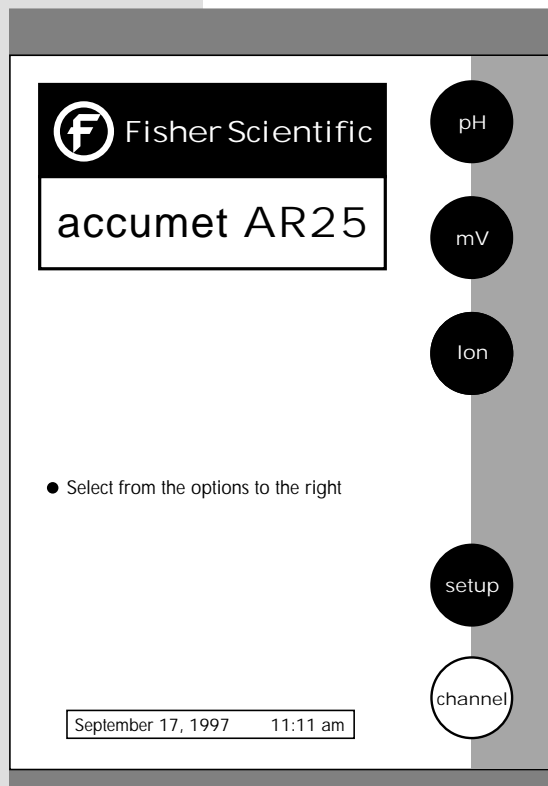
- Set Sample ID#
- Set Alarm Limit
- Set Print Criteria
- Set Print Interval
- Set Data Storage Criteria
- Set Display Resolution
- Set Display Configuration
- View Stored Data



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The operating parameters of the mV mode can be set and controlled from the mV Setup screen. The following sections will guide you through the various options available for the mV setup mode.

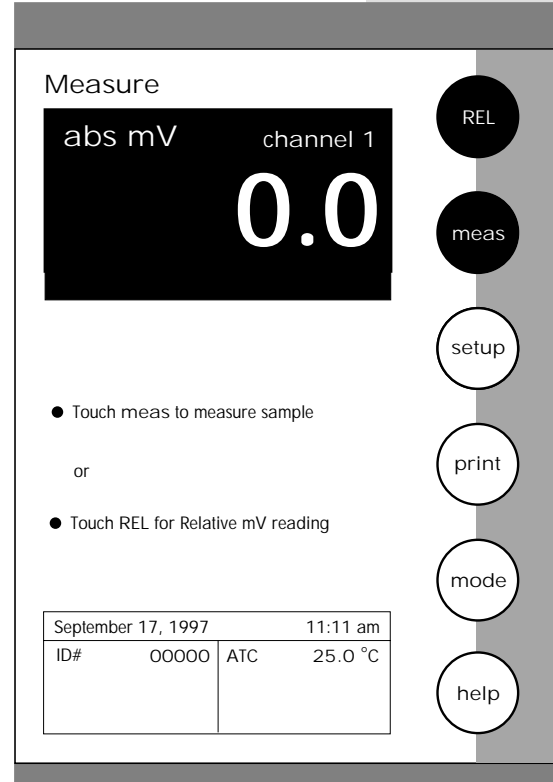
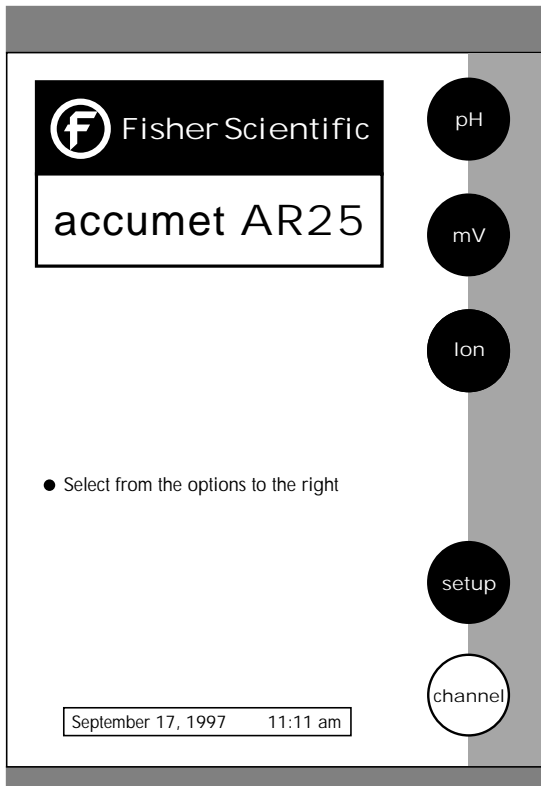
Access mV SETUP	82
Set SAMPLE ID#	84
Set ALARM LIMIT	84
Set PRINT CRITERIA	84
Set PRINT INTERVAL	85
Set DATA STORAGE CRITERIA	85
Set DISPLAY RESOLUTION	86
Set DISPLAY CONFIGURATION	85
View STORED DATA	85



There are two ways to access the mV Setup screen.

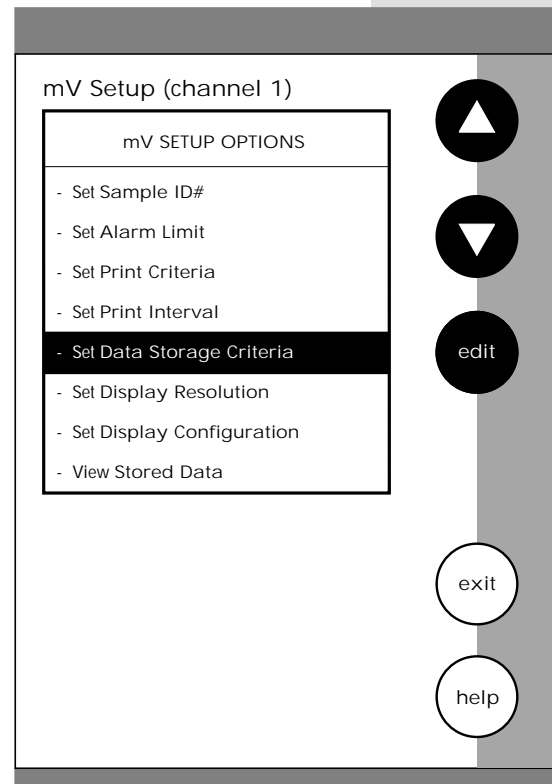
From the Setup screen

- 1** Touch setup on the main screen. Touch mV to access the mV Setup screen.
- 2** Use the arrow keys to highlight the setup option that you would like to review.
- 3** Touch edit to access the screen for the selected option.



From the mV Measure screen

- 1** Touch mV on the main screen to access the millivolt mode. Touch setup on the mV Measure screen. The mV Setup screen is now displayed.
- 2** Use the arrow keys to highlight the setup option that you would like to review.
- 3** Touch edit to access the screen for the selected option.



To Set Sample ID#

When this option is active, each time you touch print on the Measure screen the mV value along with the date/time/channel and the sample ID# will be sent to data storage. You can manually enter an alphanumeric identification number of up to 10 characters for any sample, or you can have the meter sequentially number your samples beginning at the number of your choice. You may also choose to deactivate the sample ID#.

The mV Sample ID# is set the same way as previously described in pH Setup. See page 48 for instructions.

To Set Alarm Limit

This option allows you to set alarm limits for the mV measuring mode. If the mV value of the measurement is outside of the boundaries set by the upper and lower limits, an audible alarm and/or a visual warning will appear to let you know that your sample measurement was outside of the set limits.

The mV Alarm Limits are set the same way as previously described in pH Setup. See page 64 for instructions.

To Set Print Criteria

This screen allows you to select which criteria are printed with the measurement when you print the data or send it to a computer. The status of the current print criteria is displayed on the screen. The criteria option is active if "ON" appears to the right of the option. It is inactive if "OFF" appears to the right of the option. Any active criteria will be printed on demand.

The mV Print Criteria are set the same way as previously described in pH Setup. See page 66 for instructions.



Remember, HELP is always just a touch of the button away.

To Set Print Interval

You have three options for setting the print interval: manual printing, stable reading printing, and timed interval printing.

The mV Print Interval is set the same way as previously described in pH Setup. See page 68 for instructions.

To Set Data Storage Criteria

This screen allows you to select what criteria are stored in the meter's memory with the measurement when you save the data. The status of the current data storage criteria is displayed on the screen. The criteria option is active if "ON" appears to the right of the option. It is inactive if "OFF" appears to the right of the option. All storage criteria will be stored in the meter's memory with the measurement. However, only active items will appear on the View Stored Data screens. Changing the status of the storage criteria to active from inactive will allow the criteria to be displayed with the previously stored data.

The mV Data Storage Criteria are set the same way as previously described in pH Setup. See page 70 for instructions.

To Set Display Configuration

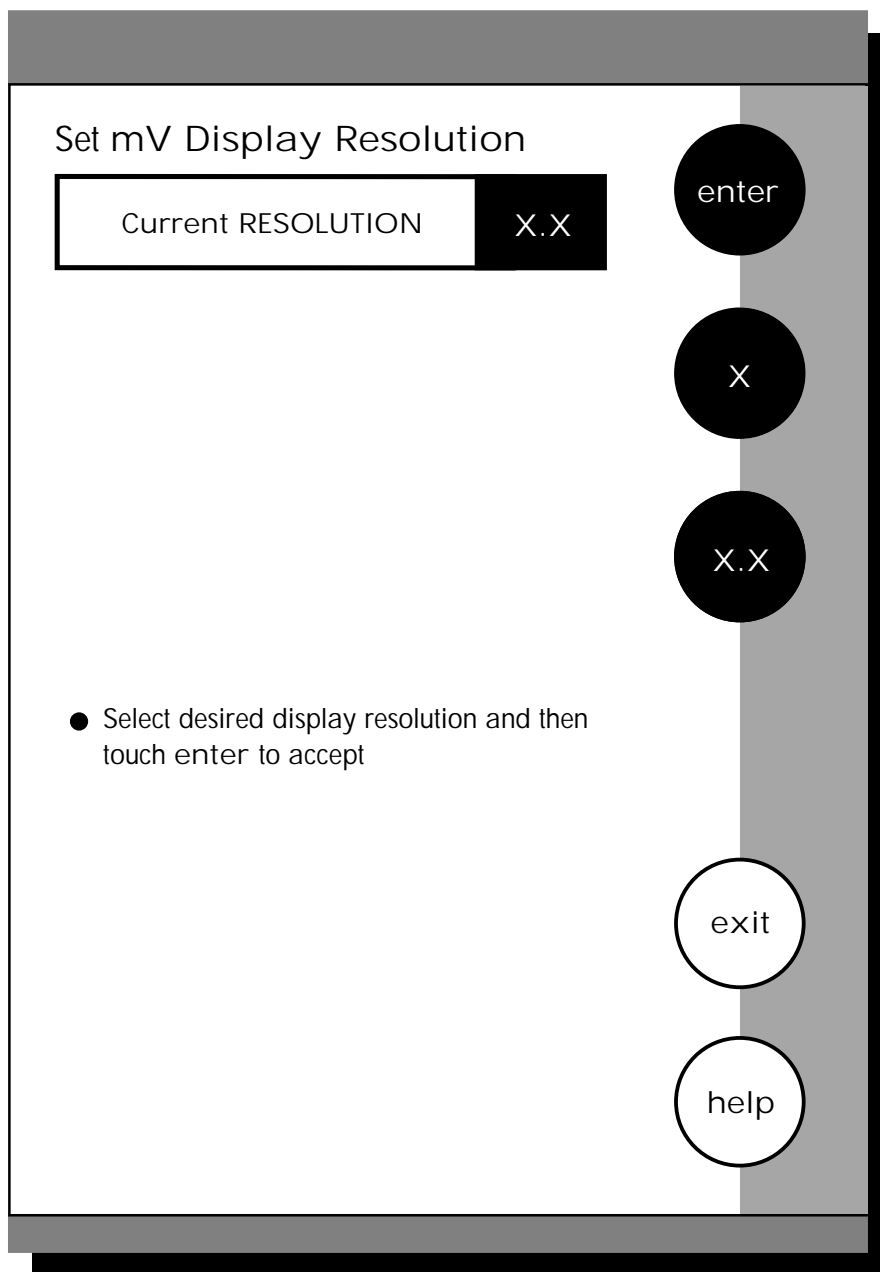
This function will allow you to choose what information you would like to be displayed on the mV Measure screen, particularly the information contained in the data box at the bottom of that screen.

The mV Display Configuration is set the same way as previously described in pH Setup. See page 74 for instructions.

To View Stored Data

This meter has memory capacity for up to 250 data points. The View Stored Data screen allows you to sort and look at specific data points. The stored data can be sorted by sample identification number, date or operator identification number.

The mV Stored Data is viewed the same way as previously described in pH Setup. See page 76 for instructions.



To Set Display Resolution

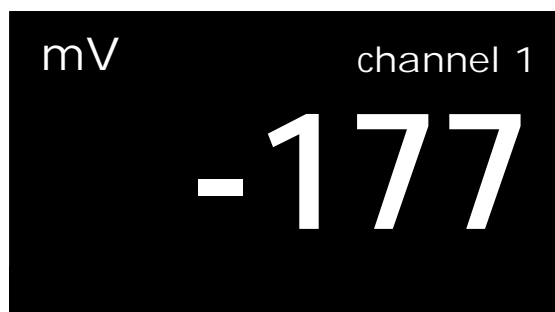
This mode allows you to set the display resolution that you desire on the screen. You have the choice of zero or one decimal place.

- 1** Access the Set Display Resolution screen from the mV Setup screen. The current Display Resolution is displayed on the screen.
- 2** Touch X or X.X to select the resolution of the display that you desire. This will be the format in which your measurement will be displayed.
- 3** Touch enter to accept the resolution and return to the mV setup screen.

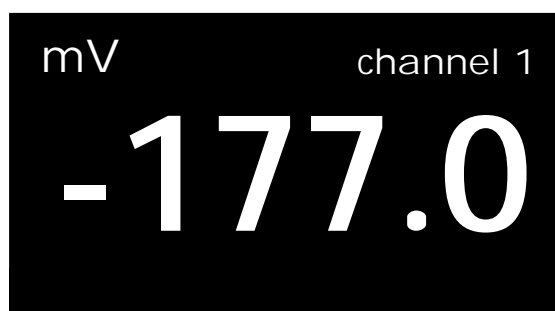
OR

Touch exit to return to the mV Setup Screen, without making any changes.

Example of X resolution



Example of X.X resolution

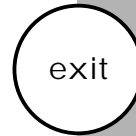
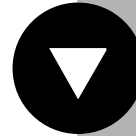



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Ion Setup (channel 1)

ION SETUP OPTIONS

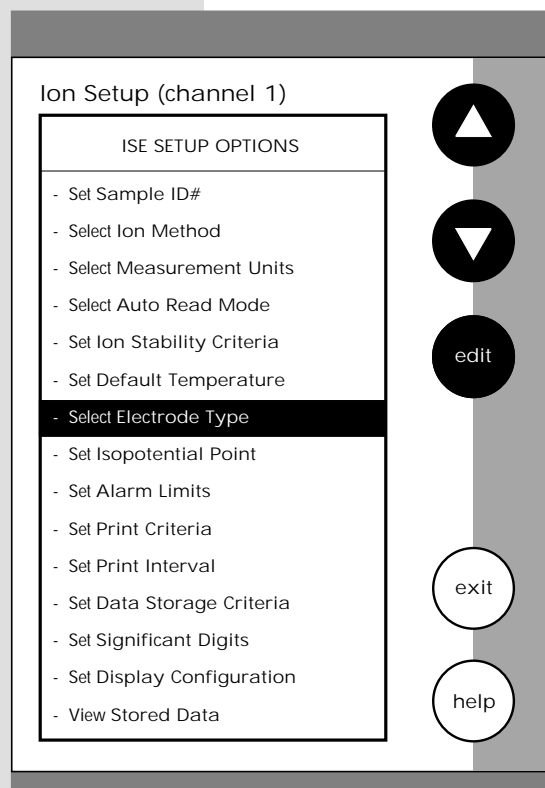
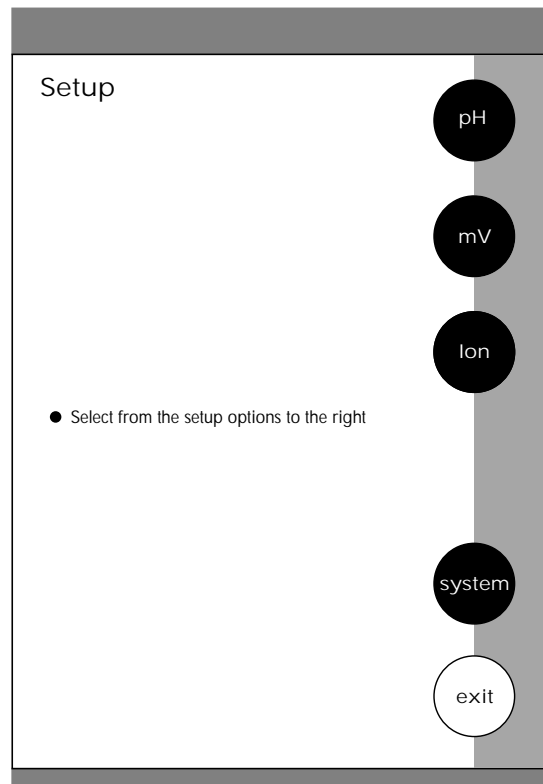
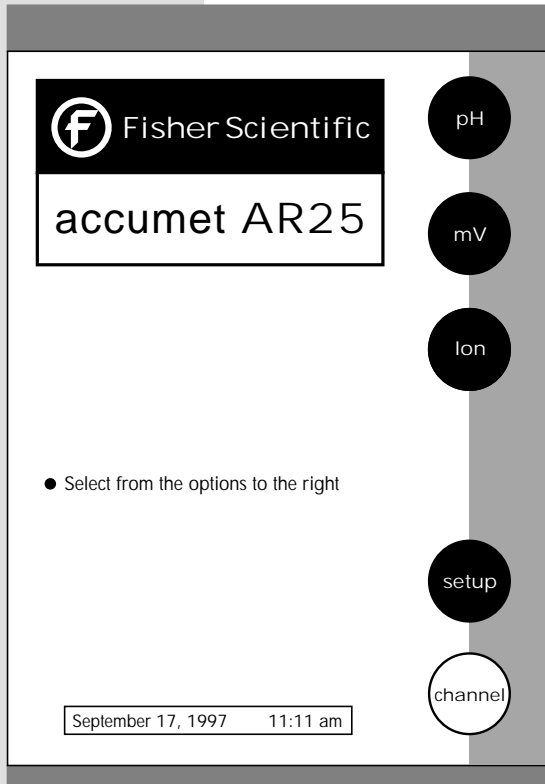
- Set Sample ID#
- Select Ion Method
- Select Measurement Units
- Select Auto Read Mode
- Set Ion Stability Criteria
- Set Default Temperature
- **Select Electrode Type**
- Set Isopotential Point
- Set Alarm Limits
- Set Print Criteria
- Set Print Interval
- Set Data Storage Criteria
- Set Significant Digits
- Set Display Configuration
- View Stored Data



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The operating parameters of the ion mode can be set and controlled from the Ion Setup screen. The following sections will guide you through the various options available for the ion setup mode.

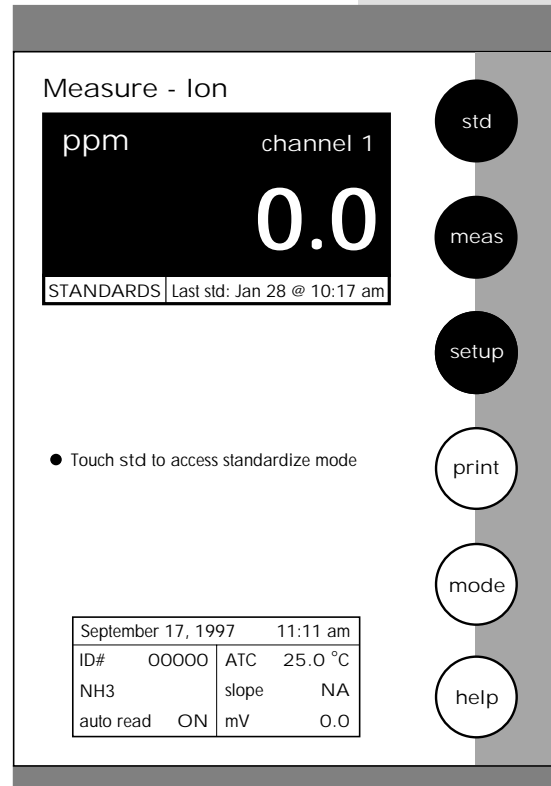
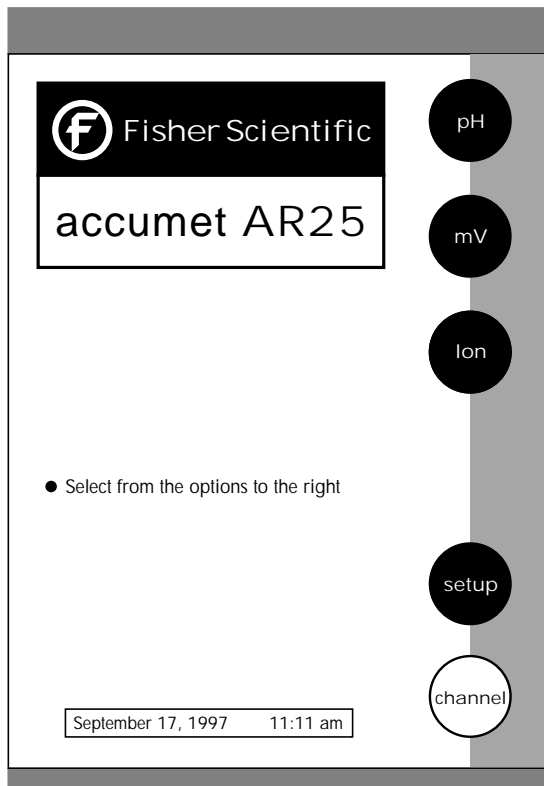
Access ION SETUP	90
Set SAMPLE ID#	92
Select ION METHOD	92
Select MEASUREMENT UNITS	94
Select AUTO READ MODE	95
Set ION STABILITY CRITERIA	95
Set DEFAULT TEMPERATURE	95
Select ELECTRODE TYPE	96
Set ISOPOTENTIAL POINT	98
Set ALARM LIMITS	98
Set PRINT CRITERIA	98
Set PRINT INTERVAL	99
Set DATA STORAGE CRITERIA	99
Set SIGNIFICANT DIGITS	100
Set DISPLAY CONFIGURATION	101
View STORED DATA	101



There are two ways to access the Ion Setup screen.

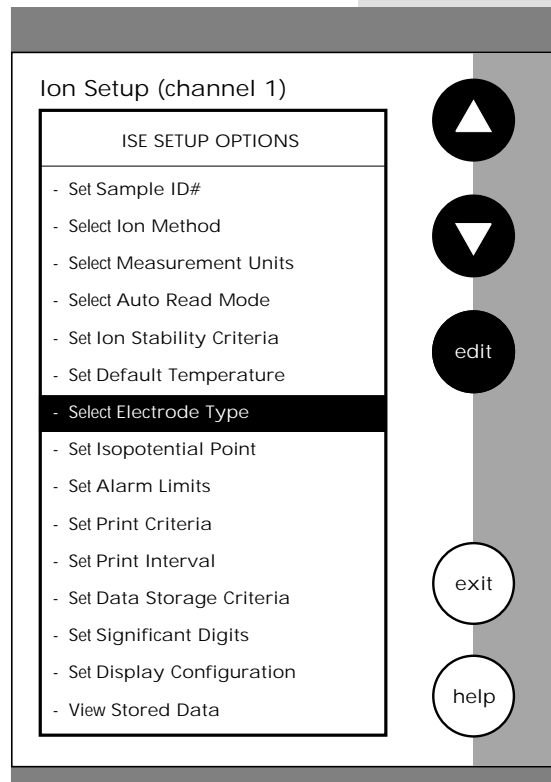
From the Setup screen

- 1** Touch setup on the main screen. Then touch Ion to access the Ion Setup screen.
- 2** Use the arrow keys to highlight the setup option that you would like to review.
- 3** Touch edit to access the selected option screen.



From the Ion Measure screen

- 1 Touch ION on the main screen to access the Ion mode. Touch setup on the Ion Measure screen. The Ion Setup screen is now displayed.
- 2 Use the arrow keys to highlight the setup option that you would like to review.
- 3 Touch edit to access the selected option screen.



To Set Sample ID#

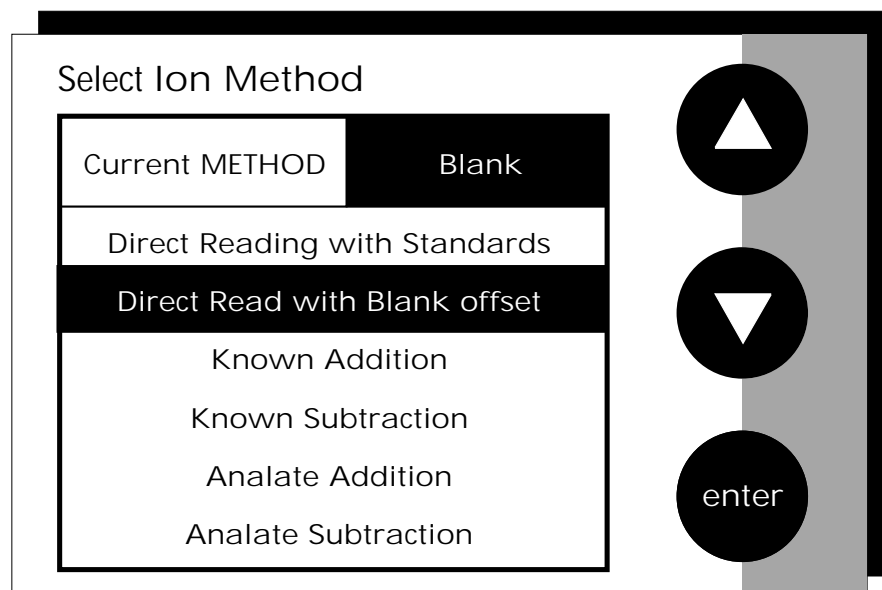
When this option is active, each time you touch print on the Measure screen the ion concentration value along with the date/time/channel and the sample ID# will be sent to data storage. You can manually enter an alphanumeric identification number of up to 10 characters for any sample or you can have the meter sequentially number your samples beginning at the number of your choice. You may also choose to deactivate the sample ID#.

The Ion Sample ID# is set the same way as previously described in pH Setup. See page 48 for instructions.

To Select Ion Method

Remember, HELP is always just a touch of the button away.

- 1** Use the arrow keys to highlight the method you want to use.
 - 2** Touch enter to accept the method and return to the Ion Setup screen.
- OR
- Touch exit to return to the Ion Setup screen, without making any changes.



Direct Reading with Standards

The direct reading method is the most common method of ion measurement. When using this method, you will use standards of known values to standardize the meter in the ion mode. An ionic strength adjuster (ISA) is added to both the standards and the sample. Then 2 to 5 standards are used to standardize the meter. The standards should bracket the expected value of the sample. The ion specific electrode is immersed in a stirring sample and the ion concentration is read directly from the meter.

Direct Reading with Blank offset

The blank method is a method commonly used for determination of ion concentration in a sample with a very low level of ions present. Because of background interference at low concentration levels, a blank is used and the value of the ion concentration in the blank is subtracted from the value of the measured sample.

Known Addition

The known addition method is an incremental method used for samples with a complex matrix. A standard with a known concentration of the ion species of interest is added to the sample. The difference in mV potential is then used to calculate the concentration of the ion of interest.

Known Subtraction

The known subtraction method is also an incremental method. The ion of interest in the sample is not identical to the ion in the standard solution. The standard of known ion concentration that is added to the sample quantitatively reacts in the sample with the ion of interest. This reaction removes a fixed amount of the ion of interest from the sample solution. The ion concentration is then calculated based upon the difference in the mV potential.

Analate Addition

The analate addition method is a modification of the known addition method. In the Analate Addition method, the initial mV measurement is recorded in a standard solution. The ion in the standard solution is the ion of interest and is detected by the ion selective electrode in use. A sample containing the ion of interest is then added to the standard solution. The difference in the mV potential is then used in the calculation of the concentration of the ion of interest. This method is useful if the sample temperature is significantly different than that of the standard. When the small volume of hot sample is added to the larger volume, the temperature impact becomes negligible.

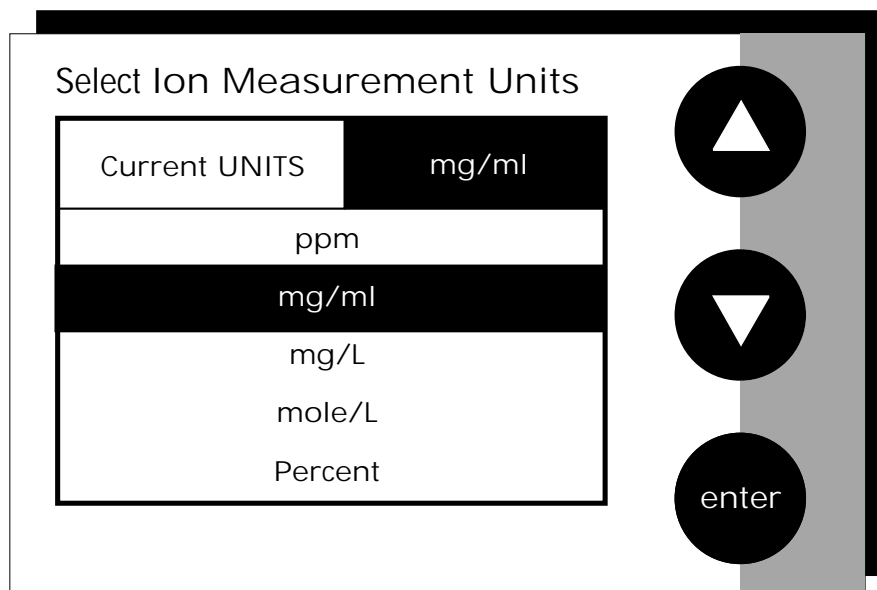
Analate Subtraction

The Analate Subtraction method is particularly useful in the event that there is no ion specific electrode available to directly measure the concentration of the ion of interest. This particular method employs the addition of a sample of the ion of interest to a standard containing a different ion of known concentration. The ion of interest will quantitatively react with the ion in the standard, creating a complex and removing the ion from the standard solution. The ion specific electrode is specific for the ion in the standard and not for the ion of interest. The difference in mV potential is used to calculate the concentration of the ion of interest based upon this quantitative reaction.

This screen allows you to select the units in which the meter will report the concentration of the ion of interest. The current units are displayed on the screen.

To Select Measurement Units

- 1** Access the Select Measurement Units screen from the Ion Setup screen. The current units are displayed on the screen.
 - 2** Use the arrow keys to highlight the desired units.
 - 3** Touch enter to accept these units and return to the Ion Setup screen.
- OR
- Touch exit to return to the Ion Setup screen, without making any changes.



To Select Auto Read Mode

You can use this meter when the Auto Read function is active or when it is inactive. When the Auto Read function is active, the meter will lock onto a reading when the meter recognizes it as stable. The meter will not deviate from this reading until meas is touched. If the Auto Read function is inactive, then the meter will continuously monitor the concentration of the ion of interest. The display on the measure screen will indicate any fluctuation in the ion concentration.

The Ion Auto Read Mode is set the same way as previously described in pH Setup. See page 57 for instructions.

To Set Ion Stability Criteria

This setup screen allows you to determine how quickly the meter will respond to electrode drift. There are 3 speed settings.

The Ion Stability Criteria is set the same way as previously described in pH Setup. See page 68 for instructions.

To Set Default Temperature

Ion concentration is a temperature dependent measurement. The default temperature option allows you to select the temperature that will be used by the meter to calculate the correct ion concentration. The factory default setting is 25°C. You should enter the temperature value of that solution as the default temperature in order to get the correct concentration value. The current default temperature setting will be displayed when the Set Default Temperature screen is displayed.

The Ion Default Temperature is set the same way as previously described in pH Setup. See page 60 for instructions.



Regardless of the status of the Auto Read Mode, STABLE will be displayed as the meter recognizes the measurement as stable.



Stability criteria are more stringent at the slower setting. Therefore, if the highest precision is required, then a slow setting would be desired. The medium or slow setting is recommended for Ion work.








Best results are obtained when the standards and the samples are at the same temperature.



Remember, HELP is always just a touch of the button away.

Select Ion Electrode Type

Current	CHLORIDE
	AMMONIA
	BROMIDE
	CALCIUM
	CARBON DIOXIDE
	CHLORIDE
	CYANIDE
	FLUORIDE
	NITRATE
	POTASSIUM
	SODIUM
	MONOVALENT CATION
	MONOVALENT ANION
	DIVALENT CATION
	DIVALENT ANION

- Use arrow keys to highlight desired electrode type and then touch enter to accept

This screen allows you to select the type of electrode that is specific for your ion of interest. Your choice of electrode informs the meter which default slope to use in the calculations made for electrode efficiency and sample concentration. Once you have selected an electrode, you will not be required to enter the default slope numerically.

Note: The default slope value specific for the electrode that you choose is a theoretical slope value that is used in the calculations to determine the efficiency of your electrode. This slope value is not the slope value that is displayed in the data box of the measurement screen. You will still need to standardize the meter using ion standards to determine the actual efficiency of your electrode.

To Select Electrode Type

- 1** Access the Select Electrode Type screen from the Ion Setup screen. The current electrode type is displayed on the screen.
 - 2** Use the arrow keys to highlight the electrode type specific for the Ion of interest.
 - 3** Touch enter to accept the electrode type and return to the Ion Setup screen.
- OR
- Touch exit to return to the Ion Setup screen, without making any changes.

To Set Isopotential Point

The Isopotential Point is the millivolt reading for an electrode at which temperature has no effect on the measurement. Ion selective electrodes, unlike pH electrodes, are not designed to achieve any particular isopotential point. If samples and standards are at different temperatures when performing ISE experiments, it will be necessary to experimentally determine the isopotential point of your Ion Specific Electrode. (see Appendix: Determining Isopotential Point Experimentally page 137.)

The Ion Isopotential Point is set the same way as previously described in pH Setup. See page 62 for instructions.

To Set Alarm Limits

This option allows you to set alarm limits for the Ion measuring mode. If the ion concentration measurement is outside of the boundaries set by the upper and lower limits, an audible alarm and/or a visual warning will appear to let you know that your sample measurement was outside of the set limits.

The Ion Alarm Limits are set the same way as previously described in pH Setup. See page 64 for instructions.

To Set Print Criteria

This screen allows you to select what criteria are printed with the measurement when you print the data or send it to a computer. The status of the current print criteria is displayed on the screen. The criteria option is active if "ON" appears to the right of the option. It is inactive if "OFF" appears to the right of the option. Any active criteria will be printed on demand.

The Ion Print Criteria are set the same way as previously described in pH Setup. See page 66 for instructions.

To Set Print Interval

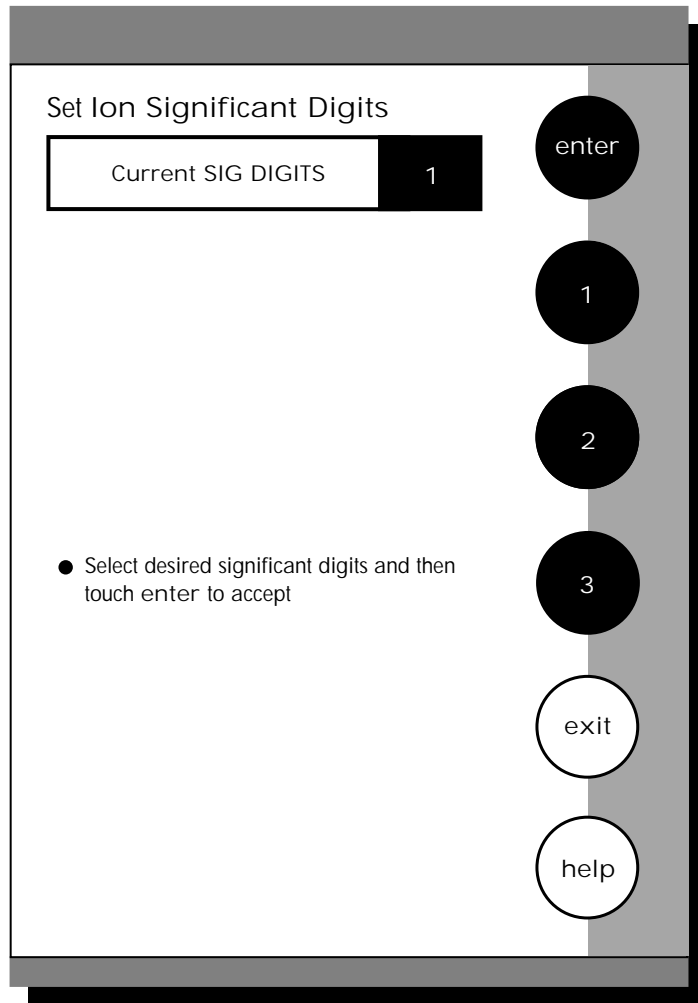
You have three options for setting the print interval: manual printing, stable reading printing, and timed interval printing.

The Ion Print Interval is set the same way as previously described in pH Setup. See page 68 for instructions.

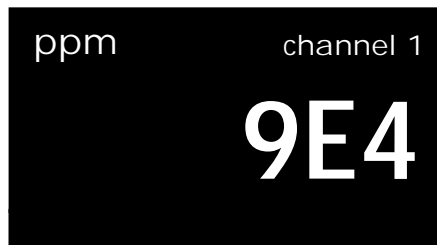
To Set Data Storage Criteria

This screen allows you to select what criteria are stored in the meter's memory with the measurement when you save the data. The status of the current data storage criteria is displayed on the screen. The criteria option is active if "ON" appears to the right of the option. It is inactive if "OFF" appears to the right of the option. Any active criteria will be stored with the measurement. All storage criteria will be stored in the meter's memory with the measurement. However, only active items will appear on the View Stored Data screens. Changing the status of the storage criteria to active from inactive will allow the criteria to be displayed with the previously stored data.

The Ion Data Storage Criteria are set the same way as previously described in pH Setup. See page 70 for instructions.



Example of 1 significant digit



Example of 2 significant digits



Example of 3 significant digits



This option allows you to select the number of significant figures that will be used when reporting your ion measurement. You have the choice of one, two or three significant digits.

To Set significant digits

- 1** Access the Set Significant Digits screen from the Ion Setup screen. The current Significant digits are displayed on the screen.
 - 2** Touch 1, 2, or 3 to select the desired significant digits.
 - 3** Touch enter to accept the number of significant digits and return to the Ion Setup screen.
- OR
- Touch exit to return to the Ion Setup screen, without making any changes.

To Set Display Configuration

This function will allow you to choose what information you would like to be displayed on the Ion Measure screen, particularly the information contained in the data box at the bottom of that screen.

The Ion Display Configuration is set the same way as previously described in pH Setup. See page 74 for instructions.




To View Stored Data

This meter has memory capacity for up to 250 data points. The View Stored Data screen allows you to sort and look at specific data points. The stored data can be sorted by sample identification number, date or operator identification number.

The Ion Stored Data is viewed the same way as previously described in pH Setup. See page 76 for instructions.

Measure

pH channel 1
7.00

BUFFERS | Last std: Sep 17 @ 10:17 am

- Touch meas to measure sample

or

- Touch std to standardize

September 17, 1997		11:11 am	
ID#	00000	ATC	25.0 °C
auto buffer	ON	slope	100%
auto read	ON	mV	0000.0

std

meas

setup

print

mode

help

In this mode, you will be able to measure the pH of a wide variety of samples. Before measuring pH, you will need to standardize the meter using buffers with known pH values. It is good practice to standardize the meter frequently using a minimum of two buffers. Using two buffers allows the meter to calculate and display an actual slope for the electrode, and therefore produce more accurate measurements. If there is no standardization in the memory of the meter or if only one buffer has been used to standardize the meter, the slope value will appear as "NA".

You can standardize your meter using automatic or manual buffer recognition. With the Automatic buffer recognition activated, the meter will automatically recognize the buffers from the chosen buffer group and accept them when the meter recognizes the reading as stable. When in the Manual buffer recognition mode, you must enter the buffer value during the standardization procedure. The meter will accept the manually entered buffer when it recognizes that the measurement is stable. During the standardization procedure, you may accept the buffer value before the meter recognizes it as stable by touching std. See page 56 to select desired buffer recognition.

At the Basic Procedural level the only setup options that you can access are the Buffer Groups, the Print Interval and the Display Resolution. If you need to change any other parameter such as Buffer Recognition or Auto Read mode you will need to set the Procedural Level to Advanced in the System Setup screen. Any values previously saved in the pH Setup screen at the Advanced Procedural Level will become the default values for the Basic Procedural Level.

Remember to setup your pH measuring mode parameters. Refer to pages 44-79 for pH setup instructions.

Connect the electrodes you will be using to the meter. See page 10 for details.



Remember, HELP is always just a touch of the button away.

Measure

pH channel 1

7.00

STABLE

4 7

BUFFERS Last std: Sep 17 @ 10:17 am

- Touch meas to measure sample

or

- Touch std to standardize

September 17, 1997		11:11 am	
ID#	00000	ATC	25.0 °C
auto buffer	ON	slope	100%
auto read	ON	mV	0000.0

std

meas

setup

print

mode

help

Standardize

pH channel 1

7.00

4 7 10

BUFFERS Last std: Sep 17 @ 10:17 am

Current BUFFER GROUP USA

- Touch clear to delete previous buffers

Insert electrode into buffer and stir

- Touch std to standardize new buffer

September 17, 1997		11:11 am	
ID#	00000	ATC	25.0 °C
auto buffer	ON	slope	100%
auto read	ON	mV	0000.0

std

meas

setup

clear

mode

help

To Standardize the meter with Auto Buffer Recognition

- 1** Touch STD on the pH measure screen to access the standardize screen.
- 2** Touch clear to delete a previous standardization. All pH standardization values will be cleared. The meter will remain on the Standardization screen at this point.

OR
If the screen says "Not Standardized" proceed to step 3.
- 3** Immerse your rinsed electrode(s) in a buffer solution from the selected buffer group that you chose during the setup process (see pages 54) and stir gently.
- 4** Touch std again to standardize the meter using this buffer. The word MEASURING will flash until the signal is stable. The meter will accept the value once it recognizes that the reading is stable. At that time, STABLE will appear on the screen. A beaker icon and the entered pH value will also appear on the screen at this time. The meter will then return to the measure screen.
- 5** Touch std on the pH measure screen to access the standardization screen and repeat steps 3 through 5 to standardize with up to 5 buffers.



For optimal results, the meter should be standardized at a minimum of every 8 hours. For more accurate measurements, the meter should be standardized more frequently.

Updating a standardization with Auto Buffer Recognition:

You can update a standardization at anytime. To update a standardization, place your electrode in any of the buffers originally used to standardize the meter and touch std on the touch screen twice. The value for that buffer will be updated and stored in the meter's memory. The time of standardization will also be updated on the pH measurement screen.

The efficiency of the electrode is reported as the slope. When doing a multi-point standardization, the slopes of the individual segments are calculated by the meter. The slope that appears on the screen is the slope that is the least perfect, or the farthest from 100%.

Standardize

pH channel 1

7.00

BUFFERS	Last std: Sep 17 @ 10:17 am		
Current BUFFER GROUP	USA		

- Touch clear to delete previous buffers
- Insert electrode into buffer and stir
- Touch std to standardize new buffer

September 17, 1997		11:11 am	
ID#	00000	ATC	25.0 °C
auto buffer	ON	slope	100%
auto read	ON	mV	0000.0

std

meas

setup

clear

mode

help

Standardize

pH channel 1

Enter pH

1	2	3
4	5	6
7	8	9
-	0	.
BS	exit	enter

ID#	00000	ATC	25.0 °C
auto buffer	ON	slope	NA
auto read	ON	mV	0000.0

std

meas

setup

clear

mode

help

To standardize the meter with manual buffer recognition

- 1** Touch std on the pH measure screen to access the standardize screen.
- 2** Touch clear to delete a previous standardization. All pH standardization values will be cleared. The meter will remain on the Standardization screen at this point.

OR
If the screen says "Not Standardized" proceed to step 3.
- 3** Immerse your rinsed electrode(s) in a buffer solution and stir gently.
- 4** Touch std again to standardize the meter using this buffer.
- 5** Using the displayed keypad, input the value of the buffer that you are using to standardize the meter and then touch enter. The meter will accept the value once it recognizes that the reading is stable. At that time, STABLE will appear on the screen. A beaker icon and the entered pH value will also appear on the screen at this time. The meter will return to the pH measure screen.
- 6** Touch std on the pH measure screen to access the standardization screen and repeat steps 3 through 5 to standardize with up to 5 buffers.

Updating a standardization with Manual Buffer Recognition:

You can update a standardization at any time. To update a standardization with manual buffer recognition, place your electrode in any of the buffers originally used to standardize the meter and touch the std key on the touch screen twice. Then using the keypad displayed on the screen enter the value of the buffer and touch enter. The value for that buffer will be updated and stored in the meter's memory. The time of standardization will also be updated on the pH measure screen.



Remember, HELP is always just a touch of the button away.

Measure

pH channel 1

7.00

std

meas

setup

print

mode

help

4

7

10

BUFFERS Last std: Sep 17 @ 10:17 am

- Touch meas to measure sample

or

- Touch std to standardize

September 17, 1997		11:11 am	
ID#	00000	ATC	25.0 °C
auto buffer	ON	slope	100%
auto read	ON	mV	0000.0

The measure screen provides a readout of the current sample measurement. You can use this meter when the Auto Read function is active or when it is inactive. When the Auto Read function is active, the meter will lock onto a reading when the meter recognizes it as stable. The meter will not deviate from this reading until meas is touched. If the Auto Read mode is inactive, then the meter will continuously monitor the pH of the sample and the measure display screen will indicate any fluctuation in the sample pH. Regardless of the status of the Auto Read mode, STABLE will flash as the meter recognizes the measurement as stable.

Once the meter is standardized, you are ready to take pH measurements of your sample.

To measure pH of a sample with Auto Read ON

- 1** Immerse the rinsed electrode(s) in the stirring sample.
- 2** Touch meas to begin measuring your sample. The meter will accept the reading and display STABLE when the measurement meets the selected stability criteria.

OR

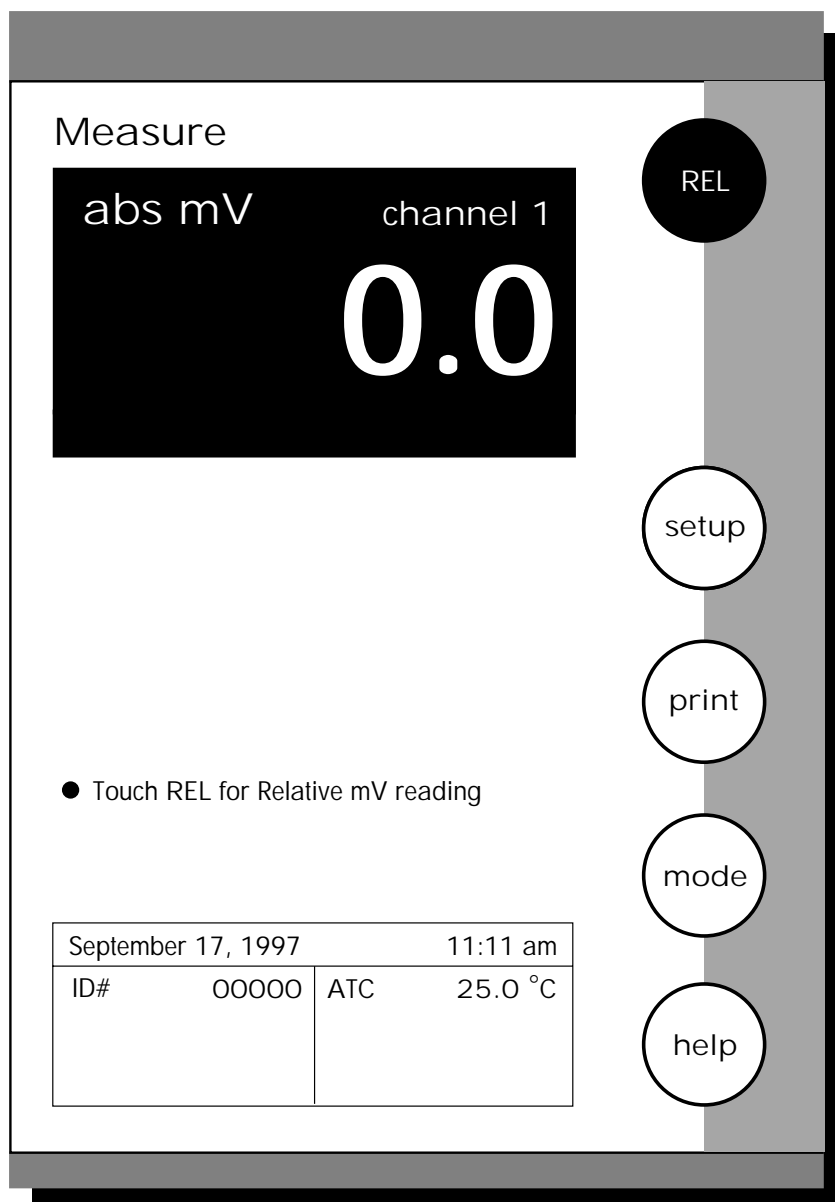
To measure pH of a sample with Auto Read OFF

- 1** Immerse the rinsed electrode(s) in the stirring sample.
- 2** Record the reading once the measurement has become stable. STABLE will appear once the meter recognizes that the measurement is stable.

NOTES: You can access other functions of the meter with the remaining buttons on the measure screen.

- Touching print will send the data to the meter's memory if the sample ID# is activated and to a printer or computer if it is attached to the meter. The saved data can be accessed through the View Stored Data screen in the pH Setup mode.
- Touching setup will access the pH Setup screen. For detailed information regarding pH Setup see pages 44-79.
- Touching meas will initiate a new measurement of a sample.
- At anytime, you can touch mode to access another mode of operation including: mV, rel mV, Ion or the setup mode or place the meter in the standby mode.

This mode is used to measure oxidation/reduction potential (ORP/redox), perform titration and to verify the function of the meter. The mV measure function allows you to continuously monitor the mV potential of the electrodes in use. This can be done in either absolute or relative mV. In the millivolt mode, the current millivolt output from the electrodes being used is monitored and displayed on the screen. The meter will continually monitor the millivolt reading in this mode and will not lock onto a single reading. However, once the reading has become stable, a stable message will be displayed. Remember to setup your mV measuring mode parameters. Refer to pages 80-87 for mV setup instructions.



In the mV mode, you will be able to make measurements in either absolute or relative millivolts, access the mV Setup screens and print your results to a printer or a computer.

Connect the electrodes you will be using to the meter. See page 10 for details.

Absolute mV measurements

- 1** Access the mV Measure screen from the main screen.
- 2** Touch ABS to access the Absolute mV screen.
- 3** Immerse your rinsed electrode(s) in the sample and stir gently.
- 4** Record the measurement when STABLE is displayed.
- 5** Touch print to store a measurement with an assigned ID# in the data storage center of the meter or print the data to a printer or computer.

Relative mV measurements

In this mode, the first mV reading is set to zero and all subsequent readings are relative to this initial mV measurement.

- 1** Access the mV Measure screen from the main screen.
- 2** Touch REL to access the Relative mV screen.
- 3** Immerse your rinsed electrode(s) in the stirring sample.
- 4** Record the measurement when STABLE is displayed.
- 5** Touch print to store a measurement with an assigned ID# in the data storage center of the meter or print the data on a printer or computer.




Rinse the electrode with water and blot dry. Do not wipe the electrode. Wiping the electrode can cause a static charge on the glass bulb that will result in inaccurate readings.

Measure - Ion


ppm channel 1

17

10.0



100



STNDS
Last std: Sep 17 @ 10:17 am

- Touch meas to measure sample

or

- Touch std to access standardize mode or measure blank

September 17, 1997		11:11 am	
ID#	00000	ATC	25.0 °C
NH3		slope	102.2%
auto read	OFF	mV	0.0

std

meas

setup

print

mode

help

The accumet AR50 meter offers you unparalleled versatility with respect to ion analysis. You can choose one of 6 methods of analysis, the specific electrode you will be working with and also the units that you would like the meter to use when reporting the ion concentration. The Ion Measure screen displays the direct readout of sample concentration in the desired units, as well as the time and date of the last calibration. The standards used in the calibration and the slope of the electrode are also displayed on the screen. It is important to note that the concentration reported by the meter is actually the concentration of free uncomplexed ions in your solution.

At the Basic Procedural level the only setup options that you can access are the Electrode Type, the Print Interval and the number of Significant Digits. If you need to change any other parameter such as Ion method or measurement units you will need to set the Procedural Level to Advanced in the System Setup screen. Any values previously saved in the Ion Setup screen at the Advanced Procedural Level will become the default values for the Basic Procedural Level.

Connect the electrodes you will be using to the meter. See page 10 for details.



Remember to setup your Ion measuring mode parameters. Refer to pages 88-101 for Ion setup instructions.



Remember, HELP is always just a touch of the button away.

Standardize - Ion

ppm channel 1

STNDS	Last std: Sep 17 @ 10:17 am		
-------	-----------------------------	--	--

- Touch clear to delete previous standards

Insert electrode into standard and stir

- Touch std to standardize new standard

September 17, 1997		11:11 am	
ID#	00000	ATC	25.0 °C
NH3		slope	100.2%
auto read	OFF	mV	0.0

std
meas
setup
clear
mode
help

Standardize - Ion

ppm channel 1

STNDS	Not standardized		
-------	------------------	--	--

- Touch std to standardize new standard

September 17, 1997		11:11 am	
ID#	00000	ATC	25.0 °C
NH3		slope	NA
auto read	OFF	mV	0.0

std
meas
setup
clear
mode
help

Standardize - Ion

ppm channel 1

Concentration

STNDS			
-------	--	--	--

Insert electrode into standard and stir

- Touch std to standardize new standard

Sep			
ID#	00000	ATC	25.0 °C
NH3		slope	NA
auto read	OFF	mV	0.0

std
meas
setup
clear
mode
help

There are two direct reading methods: Direct Reading with standards and Direct Reading with Blank offset. These types of measurements allow you to directly read the concentration of your sample after standardizing the meter with ion standards of known values or blank values.

Direct Reading with Standards

This is the most common method of ion measurement. You can directly read the concentration of the sample after standardizing the meter with ion standards. An ionic strength adjuster (ISA) is added to both the standards and the sample. Two to five standards are used to standardize the meter. The standards should bracket the expected value of the sample.

To Standardize the Meter

You must use a minimum of two standards to standardize the meter.

- 1** Touch std on the Ion Measure screen to access the standardization screen.
- 2** Touch clear to remove a previous standardization.
- 3** Add ionic strength adjuster to your standard.
- 4** Immerse the ion selective electrode and the appropriate reference electrode (or combination ISE) into the standard containing the lowest concentration of the ion of interest. Stir.
- 5** Touch std again to initiate the standardization process.
- 6** Use the numeric keypad to enter the value of the standard.
- 7** Touch enter on the keypad to accept this value. If you have entered a value in error, touch BS to clear the value and key in a new value.

OR

Touch exit to return to the Ion Measure screen without entering a standard value.
- 8** Repeat steps 3-7 with up to 5 standards. A minimum of two standards is required to standardize the meter in this mode.



Generally, it is important that an ionic strength adjuster (ISA) is added to both samples and standards to obtain accurate results.

If the meter has not been standardized with at least 2 standards, a series of dashes will appear in place of a measurement value.

Measuring ion concentration in the Direct Reading
with Standards Mode

With Auto Read on

- 1** Add Ionic strength adjuster to the sample.
- 2** Immerse the ion selective electrode in the stirring sample.
- 3** Touch meas to begin measuring your sample. The meter will accept the reading and display STABLE when the measurement meets the selected stability criteria. The measure screen will fix onto this measurement and will not deviate until meas is touched.
- 4** Repeat steps 1-3 with additional samples.

With Auto Read off

- 1** Add Ionic strength adjuster to the sample.
- 2** Immerse the ion selective electrode into the stirring sample. The meter will continually monitor the ion concentration value. When the meter recognizes the reading as stable, STABLE is displayed on the measure screen. With the Auto Read function deactivated, the display on the measure screen will indicate any deviation in the concentration.
- 3** Repeat steps 1-2 with additional samples.

Standardize - Ion

ppm channel 1

STNDS | Not standardized

Insert electrode into standard and stir

- Touch std to standardize new standard or measure blank

September 17, 1997	11:11 am
ID# 00000	ATC 25.0 °C
NH3 BLK	slope NA
auto read OFF	mV 0.0

std
meas
setup
clear
mode
help

Standardize - Ion

ppm channel 1

ISE Standardize

You have selected Direct Reading with Blank offset operation.

Is this reading a STANDARD or BLANK?

STND BLANK

September 17, 1997	11:11 am
ID# 00000	ATC 25.0 °C
NH3 BLK	slope NA
auto read OFF	mV 0.0

std
meas
setup
clear
mode
help

Standardize - Ion

ppm channel 1

STNDS | Not standardized

Insert electrode into standard and stir

- Touch std to standardize new standard or measure blank

September 17, 1997	11:11 am
ID# 00000	ATC 25.0 °C
NH3 BLK	slope NA
auto read OFF	mV 0.0

std
meas
setup
clear
mode
help

Standardize - Ion

ppm channel 1

Concentration

1 2 3
4 5 6
7 8 9
- 0 .
BS exit enter

STNDS | Not standardized

Insert electrode into standard and stir

- Touch std to standardize new standard or measure blank

September 17, 1997	11:11 am
ID# 00000	ATC 25.0 °C
NH3 BLK	slope NA
auto read OFF	mV 0.0

std
meas
setup
clear
mode
help

Direct Reading with Blank Offset

This method presents you with the ability to measure samples with low level concentrations of the ion of interest. It eliminates background interference by subtracting the value of a blank concentration from the value for the sample. See ISE Theory page 146.

To Standardize the Meter

You will need to standardize the meter with one blank and a minimum of two standards.



Remember, HELP is always just a touch of the button away.

- 1** Touch STD on the Ion Measure screen to access the standardize screen.
- 2** Touch clear to delete the previous standards.
- 3** Add ionic strength adjuster to the standards and the blank.
- 4** Immerse the ion selective electrode in the standard containing the lowest concentration of the ion of interest.
- 5** Stir the standard and/or blank.
- 6** Touch STD again to initiate the standardization process. At this point, the meter will display the question "Is this a standard or a blank?"
- 7** Touch STND if the sample that the electrode is immersed in is an Ion standard solution.

OR

Touch BLANK if the sample that the electrode is immersed in is the blank solution.

If you touched STND

- 8** Use the keypad to enter the value of the standard.
- 9** Touch enter to accept the value. The meter will accept the standard value when it recognizes the reading as stable.
- 10** Repeat steps 4-7 with additional standards or steps 4-7 and 11 with a blank sample.

If you touched BLANK

- 11** The meter will return to the Ion Measure screen and a beaker icon labeled blank will be displayed.

Repeat steps 4-9 if the meter has not been standardized with at least 2 standards of known ion concentration.

Measuring Ion Concentration in the Direct Reading with Blank Mode

With Auto Read on

- 1** Add ionic strength adjuster to the samples.
- 2** Immerse the ion selective electrode in the stirring sample
- 3** Touch meas. When the meter recognizes the reading as stable, STABLE will appear on the screen. The value that appears on the screen is the value of the sample minus the value of the blank reading. The measure screen will fix on this measurement and will not deviate until meas is touched again.
- 4** Repeat steps 1-3 with additional samples. The meter will update the reading each time meas is touched.

With Auto Read off

- 1** Add ionic strength adjuster to the sample.
- 2** Immerse the ion selective electrode in the stirring sample. The meter will continually monitor the ion concentration value. When the meter recognizes the reading as stable, STABLE is displayed on the measure screen. With the Auto Read function deactivated, the display on the measure screen will indicate any deviation in the concentration reading.

Standardize - Ion

ppm channel 1

10.0 100

STNDS Last std: Sep 17 @ 10:17 am

- Touch clear to delete previous standards

Insert electrode into standard and stir

- Touch std to standardize new standard

September 17, 1997	11:11 am
ID# 00000	ATC 25.0 °C
NH3 IM	slope 100.2%
auto read OFF	mV 0.0

std
meas
setup
clear
mode
help

Standardize - Ion

ppm channel 1

10.0 100

STNDS Not standardized

Insert electrode into standard and stir

- Touch std to standardize new standard

September 17, 1997	11:11 am
ID# 00000	ATC 25.0 °C
NH3 IM	slope NA
auto read OFF	mV 0.0

std
meas
setup
clear
mode
help

Standardize - Ion

ppm channel 1

Concentration

1	2	3
4	5	6
7	8	9
-	0	.
BS	exit	enter

STNDS

Insert

- Touch

Sep	
ID# 00000	ATC 25.0 °C
NH3 IM	slope NA
auto read OFF	mV 0.0

std
meas
setup
clear
mode
help

The incremental methods which include known addition, known subtraction, analate addition and analate subtraction and are particularly useful with samples containing complex ionic backgrounds which cannot be matched in standards. They are also useful with occasional samples whose temperatures vary. More information on these methods is available in the ISE Theory Section (see page 146).

Standardizing the meter for all incremental methods

Prior to conducting an analysis using any of the incremental methods, it is necessary to standardize the meter with at least two standards. This will establish a slope value for the electrode in use. The slope value is required in the incremental method calculations which yield the ion concentration of the sample. See ISE Theory page 146.

- 1** Touch std on the Ion Measure screen to access the standardize screen.
- 2** Touch clear to remove the previous standardization from the memory of the meter.
- 3** Add ionic strength adjuster to the standards.
- 4** Immerse the ion selective electrode in the stirring standard. Always begin standardization with the least concentrated ion standard.
- 5** Touch std again to initiate standardization.
- 6** Use the keypad to enter value of the standard.
- 7** Touch enter on the keypad to accept this value. If you have entered a value in error, touch BS to clear the value and key in a new value.
- 8** Repeat steps 3-7 with additional standards.



Remember, HELP is always just a touch of the button away.

Measure - Ion

mV channel 1

0.0

1.00 10.0 100

STNDS Last std: Sep 17 @ 10:17 am

● Touch std to access standardize mode

September 17, 1997 11:11 am

ID#	00000	ATC	25.0 °C
NH3 KA		slope	102.2%
auto read	OFF	mV	0.0

std

KA

setup

print

mode

help

Measure - Ion

mV channel 1

0.0

STNDS Not Standardized

Insert electrode into standard and stir

● Touch std to standardize new standard

September 17, 1997 11:11 am

ID#	00000	ATC	25.0 °C
NH3 KA		slope	102.2%
auto read	OFF	mV	0.0

std

KA

setup

print

mode

help

Measure - Ion

mV channel 1

Sample Volume

1 2 3

4 5 6

7 8 9

- 0 .

BS exit enter

STNDS

Insert

● Touch

September 17, 1997 11:11 am

ID#	00000	ATC	25.0 °C
NH3 KA		slope	NA
auto read	OFF	mV	0.0

std

neas

setup

clear

mode

help

Measure - Ion

mV channel 1

Standard Volume

1 2 3

4 5 6

7 8 9

- 0 .

BS exit enter

STNDS

Insert

● Touch

September 17, 1997 11:11 am

ID#	00000	ATC	25.0 °C
NH3 KA		slope	NA
auto read	OFF	mV	0.0

std

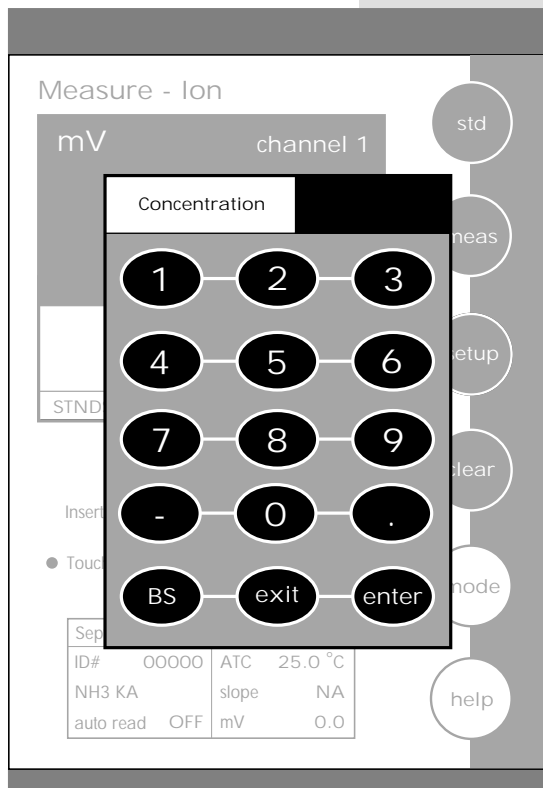
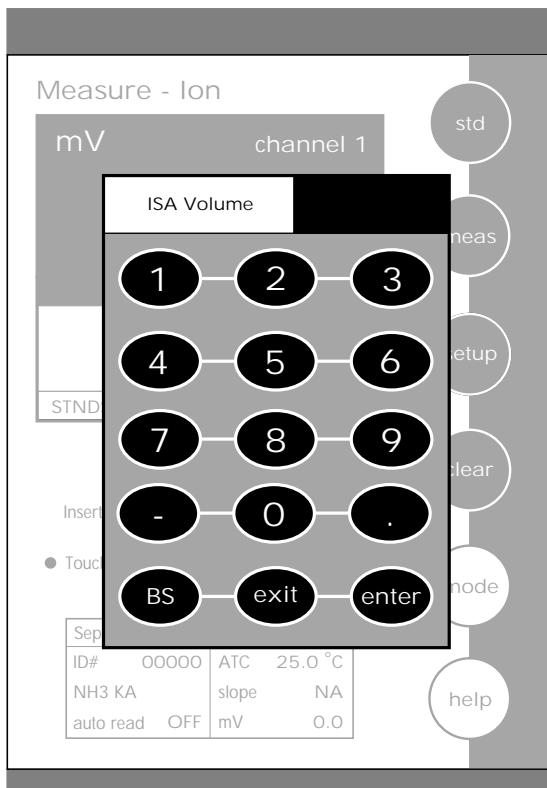
neas

setup

clear

mode

help



Known Addition Result

12.2^{ppm}

Calculated Slope:	58 mV
Reading 1:	222.7 mV
Reading 2:	200.6 mV
Sample Volume:	50
Standard Volume:	10
ISA Volume:	50
Standard Concentration:	100 ppm

OK

print

Measuring Ion Concentration in Samples Using the Incremental Methods

When performing known addition, you will add an aliquot of standard solution containing the ionic species of interest to a known volume of your sample. The mV readings of the sample are taken before and after the addition of the standard. The concentration of the sample can then be calculated based upon the difference in the mV readings. The use of the incremental methods requires that certain parameters be identified. In addition to the millivolt outputs of the electrode(s) in both the sample and the sample plus the standard, it is necessary to enter into the meter the volume of the sample, the volume of the standard, the volume of the Ionic Strength Adjuster (ISA) if used, the concentration of the standard and as previously stated the slope of the electrode in use. Your accumet research meter will prompt you through the method, permitting you to enter the appropriate parameters at the appropriate time. When the meter has all of the data needed for the calculation, it will display the ion concentration of the sample as well as the parameters entered for the calculation.

The standard concentration should be high enough to nearly double the sample ion concentration after its addition. However, the standard volume should not significantly impact the sample volume. A 1:100 ratio of standard to sample ratio is optimal. For a monovalent electrode, the standard addition should result in a 15-30 mV change. For a divalent electrode, a 7-10 mV change is adequate. If the millivolt change is too high, the addition of the standard may affect the ionic strength and therefore the activity coefficients. This could result in inaccurate measurements. If the millivolt change is too small, readability errors are enhanced. See ISE Theory page 146.

To take a measurement

- 1** Immerse the ion selective electrode in a known volume of the sample solution.
- 2** Stir the sample.
- 3** Touch KA to take the first mV reading of sample.
Wait for the reading to stabilize (STABLE will appear).

OR

Touch KA to accept the current reading.
- 4** Add a known volume of standard solution to the sample.
- 5** Touch KA to take the second mV reading of sample.
Wait for the reading to stabilize (STABLE will appear).

OR

Touch KA to accept the current reading.
- 6** Use the keypad to enter the sample volume.
- 7** Touch enter to accept the value.
- 8** Use the keypad to enter the standard volume.
- 9** Touch enter to accept the value.
- 10** Use the keypad to enter the volume of ionic strength adjuster used.
If no ISA was used, enter a value of zero.
- 11** Touch enter to accept the value.
- 12** Use the keypad to enter the concentration of the standard solution added to the sample.
- 13** Touch enter to accept the value. Your Known Addition result is now displayed.
- 14** Touch print to send the data to memory if a sample ID# has been assigned or to print the data on the screen.

OR

Touch OK to return to the Measure screen for a new measurement.

The procedure for known subtraction is very similar to that for known addition method. An aliquot of standard is added to a known volume of the sample. The difference is that the standard does not contain the same ionic species that you are trying to measure in the sample. Instead, it contains an ion that will complex or precipitate the ion of interest, removing it from the sample. Like known addition, the mV readings are taken before and after the standard is added to the sample and the difference in mV values can be used to calculate the concentration of free ions of interest in the sample. This method will also require you to enter values of certain parameters in order to obtain an ion concentration. See ISE Theory page 146.

To take a measurement



Remember, HELP is always just a touch of the button away.

- 1** Immerse the ion selective electrode in a known volume of the sample solution.
- 2** Stir the sample.
- 3** Touch KS to take the first reading.
Wait for the reading to stabilize (STABLE will appear).

OR

Touch KS to accept the current reading.
- 4** Add a known volume of standard solution to the sample.
- 5** Touch KS to take the second reading.
Wait for the reading to stabilize (STABLE will appear).

OR

Touch KS to accept the current reading.
- 6** Use the keypad to enter the sample volume.
- 7** Touch enter to accept the value.
- 8** Use the keypad to enter the standard volume.
- 9** Touch enter to accept the value

- 10** Use the keypad to enter the volume of ionic strength adjuster used.
If no ISA was used, enter a value of zero.
- 11** Touch enter to accept the value.
- 12** Use the keypad to enter the concentration of the standard solution added to the sample.
- 13** Touch enter to accept the value.
Your Known Subtraction result is now displayed.
- 14** Touch print to send the data to memory or to print the information on the screen.

OR

Touch OK to return to the Measure screen for a new measurement.

The analate addition method is useful when your sample is at an elevated temperature and you want to negate the effect that temperature will have on the concentration calculation. This method is also useful if you have only a small amount of sample available. The analate addition method differs only slightly from the known addition method. The difference being the solution that you are taking your initial mV reading in is actually the standard and not the sample of interest. The difference in mV readings of the standard before and after the sample is added is used to calculate the concentration of the ion of interest. With the analate addition method, both the sample and the standard solution contain the ionic species of interest. See ISE Theory page 146.

To take a measurement



Remember, HELP is always just a touch of the button away.

- 1** Immerse the ion selective electrode in a known volume of the standard solution.
- 2** Stir the standard.
- 3** Touch AA to take the first reading.
Wait for the reading to stabilize (STABLE will appear).

OR

Touch AA to accept the current reading.
- 4** Add a known volume of sample solution to the standard solution
- 5** Touch AA to take the second reading.
Wait for the reading to stabilize (STABLE will appear).

OR

Touch AA to accept the current reading.
- 6** Use the keypad to enter the sample volume.
- 7** Touch enter to accept the value.
- 8** Use the keypad to enter the standard volume.
- 9** Touch enter to accept the value.

- 10** Use the keypad to enter the volume of ionic strength adjuster used.
If no ISA was used, enter a value of zero.
- 11** Touch enter to accept the value.
- 12** Use the keypad to enter the concentration of the standard solution.
- 13** Touch enter to accept the value.
Your Analate Addition result is now displayed.
- 14** Touch print to send the data to memory or send the information
to a printer.

OR

Touch OK to return to the Measure screen for a new measurement.

The analate subtraction method is useful when no ion specific electrode is available to measure the ion of interest directly. Like known subtraction the sample and the standard contain different ionic species. However, the ion being measured is in the standard and not in the sample. The reduction of free ions in the standard solution is proportional to the concentration of the ion of interest in the sample. See ISE Theory page 146.

To take a measurement

- 1** Immerse the ion selective electrode in a known volume of the standard solution.
- 2** Stir the standard.
- 3** Touch AS to take the first reading.
Wait for the reading to stabilize (STABLE will appear).

OR

Touch AS to accept the current reading.
- 4** Add a known volume of sample solution to the standard.
- 5** Touch AS to take the second reading.
Wait for the reading to stabilize (STABLE will appear).

OR

Touch AS to accept the current reading.
- 6** Use the keypad to enter the sample volume.
- 7** Touch enter to accept the value.
- 8** Use the keypad to enter the standard volume.
- 9** Touch enter to accept the value.



Remember, HELP is always just a touch of the button away.

10 Use the keypad to enter the volume of ionic strength adjuster used.
If no ISA was used, enter a value of zero.

11 Touch enter to accept the value.

12 Use the keypad to enter the concentration of the standard solution.

13 Touch enter to accept the value.
Your Analate Subtraction result is now displayed.

14 Touch print to send the data to memory or send the information
to a printer or computer.

OR

Touch OK to return to the Measure screen for a new measurement.

The touch screen should be kept as clean as possible to preserve optical properties. Attempt to keep the screen free of dirt, dust fingerprints, etc. Long term contact with abrasive materials will scratch the surface, and impair image quality. To clean, use a damp nonabrasive cloth towel and any commercially available window cleaner. The cleaning solution should be applied to the towel rather than the surface of the touch screen.

The case is made out of durable ABS plastic. It can be cleaned with a damp cloth and a mild detergent. Do not use chemical solvents on the case.

Your AR meter contains many error messages to provide aid should trouble occur with a measurement or meter operation (touchpad and input errors). The messages are accompanied by a brief description of the error, and in some cases advice on how to correct it. An example of an error message is:

Bad Electrode Slope-The electrode you have standardized has a slope which is out of the normally acceptable range of 90% to 102%. You should try to restandardize, or replace your electrode if the problem persists. Note that you can continue to make measurements with this electrode; however, the readings may be inaccurate.

Other error messages delivered by the meter are:

- Data log full
- Data log empty
- Unrecognized date
- Unrecognized time
- Invalid pH limit
- Invalid Ion limit
- Invalid limit
- Limit exceeded
- Channel 1 limit exceeded
- Channel 2 limit exceeded
- Invalid Temperature
- Invalid Isopotential
- Invalid Print Interval
- Invalid pH value
- Sample ID not found
- Operator not found

Also, whenever possible, touch help for complete information about the meter operation in which you are currently engaged.

pH Meter and Electrode Warranty Statement

The Fisher Scientific Company ("Fisher") warrants to the direct purchaser that the accumet meters and Accumet, AccuTopH, AccuFET, AccupHast, and Microprobe electrodes will be free from defects in material or workmanship for a specified warranty period. During that period, Fisher will repair or replace the product or provide credit, at its sole option, upon prompt notification and compliance with its instructions. For accumet meters, that specified period is 24 months from delivery date. For electrodes, that specified period is 12 months - except for models 13-620-532, 13-620-533, 13-620-534, 13-620-535, 13-620-536, 13-620-537, 13-620-538 and 13-620-539 - which are warranted for six months.

Unless otherwise agreed, the warranty is limited to the country in which the product is sold.

No Fisher employee, agent or representative has the authority to bind Fisher to any oral representation or warranty concerning any product sold. Any oral representation or warranty made prior to purchase of any product and not set forth in writing and signed by a duly authorized officer of Fisher shall not be enforceable by the purchaser.

FISHER EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Fisher's sole responsibility and the purchaser's exclusive remedy for any claim arising out of the purchase of any product listed above is repair, replacement or credit as described above, where applicable. In no event:

- 1) shall the cost of the exclusive remedy exceed the purchase price;
- 2) shall Fisher be liable for any special, indirect, incidental, consequential, or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Each article that Fisher furnishes will conform to the written specifications given in this manual, or those of a further improved model. Changes are made often to the information in the manual and will be incorporated into future editions.

Notice of Compliance

WARNING: This meter generates, uses, and can radiate radio frequency energy. If not installed and used properly, that is in strict accordance with the manufacturer's instructions, it may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

This product is to be used only as described in the manual. This product is for indoor use only, and must be used in a well ventilated area.



WARNING: To meet or exceed FCC regulations and comply with CE requirements, the Fisher-supplied power supply must be used. Use of a power supply that is not approved by Fisher Scientific may cause safety hazards and/or cause unit to exceed EMC limits and/or damage unit. When using this meter with a computer or printer, a shielded RS232 cable must be used to meet or exceed FCC regulations, and comply with CE Mark requirements.

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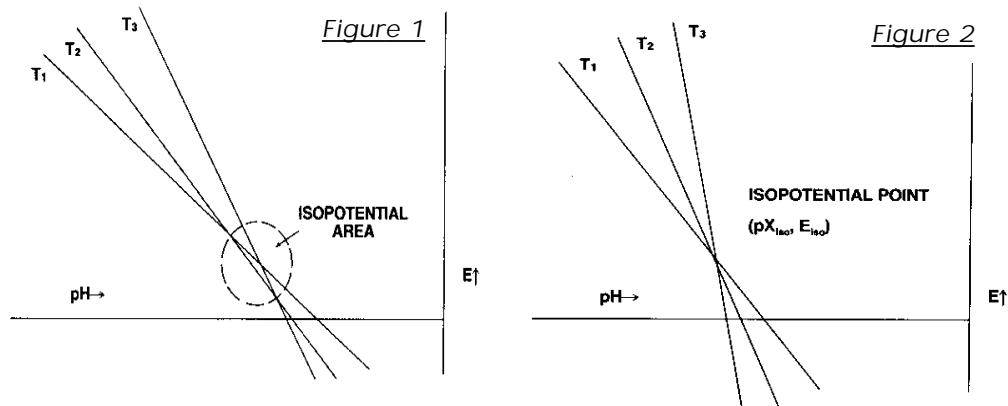
The isopotential point of an electrode system is the point at which electrode potential is unaffected by a change in temperature. The coordinates of this point would be reported as (pX_{iso}, E_{iso}) . For an ideal system, this point would be coincident with the system's Zero Potential Point (pX_{iso}, E_0).

In practical systems, however, this coincidence rarely occurs, and for some systems, there is no true Isopotential Point but a general Isopotential area. If a system exhibits an apparent Isopotential Point, or at least an Isopotential area with relatively small spread, Isopotential coordinates may be established and possibly used to some advantage.

Isopotential correction may be used only in conjunction with a One- or Two- Point Standardization; it is required only when both accuracy over a significant temperature range as well as operation with an asymmetric electrode system are contemplated. However, Isopotential correction is never necessary if all measurements will be performed on samples which are at similar temperatures. Most conventional pH electrode systems are designed and manufactured to be highly symmetrical cells. Consequently, for most pH work, unless ultimate accuracy over broad temperature ranges is required, Isopotential may be ignored. Specifically, this is accomplished by setting the Isopotential at its reset value of zero millivolts.

The following is an example for determining an Isopotential Point:

Data points are first established for three different standards at three different temperatures. The data points are then plotted and will produce three isotherms which should resemble the plot in either figure 1 or figure 2. In figure 1, the Isopotential Point is well defined as the millivolt difference between the coincidence point of the three Isotherms (pX_{iso}, E_{iso}) and the Zero Potential Point (E_0). The Isopotential Point is not so well defined in figure 2, but a value may be interpolated with some accepted error.



Your accumet pH meter is equipped with an RS-232 output port for sending measurement readings to a printer or computer. To use the meter with a printer or computer, the printer or computer must have an RS-232 port, also. It should be capable of receiving data within the following guidelines.

Baud rates	110 to 38,400 BPS
Data bits	7 or 8
Parity	even, odd, or none
Stop Bits	1 or 2

The meter and the output device must be configured to match with respect to these parameters.

A shielded RS-232 cable must be used. The RS-232 connector is on the back of the meter. (see diagram page 8) The connector is a Female DB9 style connector. If the output device has a 25-pin connector, an adapter is required. If the meter and the printer or computer are to work together, the pin configurations must match. The meter's 9-pin configuration is as follows.

<u>Pin</u>	<u>Description</u>
1	Buffers analog copy of pH input 1
2	Send data from meter
3	Receive data to meter
5	Signal Common
9	Signal Common

To initiate printing, touch print if in the manual print mod, or set the print interval for stable readings or at a prescribed timed interval. Refer to the setup sections, Set Print Interval and Set Print Criteria.

To download data stored in memory to a printer or computer, access the View Stored Data option in the setup screens. Access the desired data point by sorting the data by one of the three options. Touch print on the screen displaying the data

The following is the list of factory default settings for the accumet AR50 meter. You can reset your meter to the factory default settings by accessing the Reset to Factory Defaults screen from the System Setup screen.

Mode	Screen	Default Setting	
System Setup	Time	12 hour time mode	
	Date	month/day/year	
	Print Configuration	Baud rate	19200
		Parity	none
		Data bits	8
		Stop bits	1
	Procedural Level	Advanced	
	Operator ID	none	
Beeper Status	ON		
Display Contrast	15		
pH Setup	Display Configuration	All parameters ON	
	Print Configuration	All parameters ON	
	Data Configuration	All parameters ON	
	Buffer Group	USA	
	Sample ID#	none	
	Isopotential Point	0 mV	
	Print Interval	manual	
	Display Resolution	X.XX	
	Auto Buffer Recognition	ON	
	Auto Read Mode	OFF	
	Temperature Units	Celsius	
	Default temperature	25.0°C	
	Stability Criteria	Medium	
	Default slope	59.16 mV	
	Alarm limits	OFF	
	Alarm limit low	0.000	
Alarm limit high	14.000		
mV Setup	Display Configuration	All parameters ON	
	Print Configuration	All parameters ON	
	Data Configuration	All parameters ON	
	Sample ID#	none	
	Print Interval	manual	
	Display Resolution	X.X	
	mV readings	Absolute mV	
	Alarm limits	OFF	
	Alarm limit low	-1800.0	
	Alarm limit high	1800.0	

Mode	Screen	Default Setting
Ion	Display Configuration	All parameters ON
	Print Configuration	All parameters ON
	Data Configuration	All parameters ON
	Sample ID#	none
	Isopotential Point	0 mV
	Print Interval	manual
	Display Resolution	2 Significant digits
	Auto Read Mode	OFF
	Temperature Units	Celsius
	Default temperature	25.0°C
	Stability Criteria	medium
	Default slope	59.16 mV
	ISE method	Direct with Standards
	Units	ppm
	Electrode	Ammonia
	Alarm limits	OFF
Alarm limit low	0.00	
Alarm limit high	1.00 E ⁶	

Since its introduction by the Danish chemist Sorensen in 1909, pH measurement has become one of the most commonly used and important measurements in both laboratory and industrial settings. pH measurement and control is vital to a wide array of endeavors including municipal and industrial wastewater treatment, and textile, pharmaceutical, food, and petroleum production. Even our very existence itself is dependent upon pH. Most organisms can exist only within a narrow pH range. In humans, for example, the pH of blood must be maintained within the pH range of 7.3 to 7.4 .

In general, pH is a measure of the degree of acidity or alkalinity of a substance. It is related to the effective acid concentration ("activity") of a solution by this defining equation:

$$\text{pH} = -\log a_{\text{H}_3\text{O}^+}$$

with $a_{\text{H}_3\text{O}^+}$ representing the activity or effective concentration of the hydronium ion in solution.

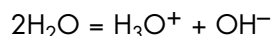
Analysts traditionally work with concentration units rather than activity. Therefore neglecting activity, pH can be defined by the following equation:

$$\text{pH} = -\log [\text{H}_3\text{O}^+]$$

with $[\text{H}_3\text{O}^+]$ representing the concentration in Moles/liter of the hydronium ion in solution.

The pH range includes values from 0 to 14. Values from 0 to 7 represent the acidic half of the scale. Values from 7 to 14 represent the alkaline or basic half of the scale. The pH value 7 is considered neutral, as it is neither acidic or alkaline.

The pH scale is based on the dissociation constant of water. Water, even in its purest state, dissociates as follows producing a positively charged hydronium ion (H_3O^+) and a negatively charged hydroxyl ion (OH^-):



At 25°C in pure water, the concentration of hydronium ions is extremely small, 1×10^{-7} Moles/liter, and balanced by an equal concentration of hydroxyl ions. The equilibrium constant, K_w of water is the product of the hydronium ion and hydroxyl ion concentrations:

$$K_w = [\text{H}_3\text{O}^+] [\text{OH}^-] = [1 \times 10^{-7}] [1 \times 10^{-7}] = 1 \times 10^{-14}$$

Since the hydronium ion concentration is 1×10^{-7} Moles/liter, the pH of pure water is 7, the neutral pH, as stated above:

$$\text{pH} = -\log [1 \times 10^{-7}] = 7$$

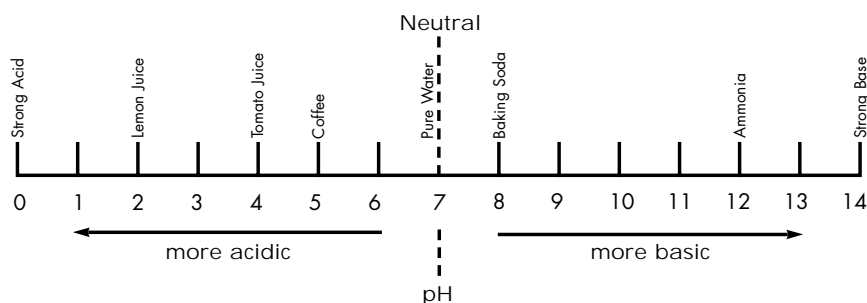
In aqueous solutions at 25°C, the product $[\text{H}_3\text{O}^+] [\text{OH}^-]$ or the K_w of water must remain constant. Therefore, an increase in concentration of either term, $[\text{H}_3\text{O}^+]$ or $[\text{OH}^-]$, will result in a decrease in the other. For example, if a strong base, sodium hydroxide (NaOH) is added to water to the extent that its final concentration is 0.01 Moles/liter, the concentration of the OH^- ion is 0.01 Moles/liter, and the concentration of the H_3O^+ must decrease according to the K_w equation as follows:

$$[\text{H}_3\text{O}^+] = K_w / [\text{OH}^-] = 1 \times 10^{-14} / 1 \times 10^{-2} = 1 \times 10^{-12}$$

The pH of this solution is:

$$\text{pH} = -\log [1 \times 10^{-12}] = 12$$

This high pH indicates that the 0.01 M NaOH solution is strongly alkaline; the concentration of hydronium ions is extremely small.



pH Measurement

The pH value of a sample can be determined in several ways. These include the use of organic dyes which change color in certain pH ranges. The dyes can be added directly to the solution or impregnated onto paper which may be dipped into the solution. At best, these "colorimetric" methods yield approximate pH values, often with an accuracy of plus or minus 0.5 pH units.

The preferred and most accurate way to measure a pH value is the potentiometric measurement, using a pH electrode, a reference electrode, and a pH meter. This method is based on the fact that certain electrodes, immersed in solution, produce a millivolt potential (i.e. voltage) that is related to the hydronium ion concentration or pH of a solution in a precise way.

The relationship between the electrode's voltage and the solution pH is defined by the Nernst equation:

$$E_{\text{meas}} = E^* - \left(\frac{2.3RT}{nF} \right) (\text{pH})$$

In this equation, E_{meas} is the voltage output of the electrodes, E^* is the total of all other voltages in the system including the reference voltage, R is the Gas Law constant, T is the temperature in °Kelvin, n is the charge on the hydronium ion (+1), and F is the Faraday constant.

pH Meter

The pH meter is a sensitive voltmeter capable of accurately measuring small voltage differences between the pH electrode and the reference electrode. This voltage difference is amplified, and shown as a pH reading. Almost all modern meters are microprocessor controlled, and programmed to use electrode voltages, efficiency, and temperature to calculate an accurate pH for the sample. Since the voltage output from different electrodes will vary, it is essential to calibrate a pH meter. The ability to calibrate or to standardize a pH meter permits the meter to match the pH reading on the meter with the known pH value of a buffer solution. For best accuracy, it is recommended that at least two buffer solutions be used to calibrate a pH meter. Buffer solutions are available as ready-to-use solutions, concentrated solutions, capsules, or prepackaged salts. The following table lists three of the most widely used NIST buffers along with their pH values at different temperatures.

<u>Temperature</u>	<u>4.01</u>	<u>6.86</u>	<u>9.18</u>
0	4.003	6.984	9.464
10	3.998	6.923	9.332
20	4.002	6.881	9.225
25	4.008	6.865	9.180
30	4.015	6.853	9.139
40	4.035	6.838	9.068
50	4.060	6.833	9.011

pH Electrodes

The electrode system consists of two half cells: a pH indicating electrode, which is primarily responsive to the acidity (the hydronium ion concentration) of a solution, and a reference electrode, which provides a constant voltage and completes the electrical circuit.

Traditional pH indicating electrodes use a tip made of pH sensitive glass. Inside this electrode is a buffer solution with a fixed pH and ionic strength. A silver wire coated with silver chloride is immersed inside this internal solution, and establishes electrical contact between the solution and the meter. The voltage associated with this wire and the voltage associated with the pH of the internal solution and the inside wall of the pH sensitive glass tip remain constant. Therefore, changes in voltage from this electrode result from the voltage developed between the solution and the outside of the glass tip.

If the pH sensitive glass tip or membrane is to function properly, it must be hydrated. A dry or dehydrated electrode membrane will not respond properly to changes in acidity. pH electrodes are also effected by changes in temperature, and the presence of other ions. Temperature effects can be countered by temperature compensation functions on the pH meter. While temperature compensation will not allow you to predict what the pH of the sample is at another temperature, it will permit you to accurately assess the pH at whatever temperature you are presently working. pH sensitive membranes are also sensitive, though to a lesser extent, to other ions than the hydronium ion. For example, most pH glasses are somewhat sensitive to sodium ion as well. For some pH glasses, this means an error as high as 0.5 pH units in highly alkaline, high-sodium solutions. The special FS-5 glass used in Fisher's pH electrodes exhibits much less sodium error in these solutions, <.05 pH units.

Reference electrodes typically consist of three elements: an internal reference electrode, a filling solution, and a reference junction through which the filling solution can "flow", and provide electrical contact with the sample and the internal reference electrode. The most convenient internal reference electrodes are made from a metal (such as silver or mercury) and its sparingly soluble salt (silver chloride or mercurous chloride). The filling solution is most often a concentrated solution of potassium chloride. Most problems with reference electrodes are associated with the interruption or blockage of flow of the potassium chloride fill solution through the reference junction.

The classic electrode pair, separate pH indicating and reference half cells, offer you unmatched versatility to match the needs of your sample. This approach makes for the highest accuracy, as well as low replacement costs, since usually only one of the pair is broken or malfunctioning.

However, the pH indicating half-cell and the reference half-cell can be merged into one electrode - a combination electrode. Combination electrodes are quite popular for they offer distinct advantages in convenience and compactness. Some combination electrodes also incorporate an ATC probe into their body also, providing temperature readout and compensation with meters equipped with these features. Newer combination electrodes are available in which the glass pH membrane sensor has been replaced with a field effect transistor or FET. All of Fisher Scientific's AB and AR meters are capable of using this type of electrode by direct connection (except AB30).

Ion selective electrodes (ISE) respond to ionic activity or concentration in a liquid because of the characteristics of the electrode's sensing membrane. Ideally, the ISE develops an electrical potential which is proportional to the activity or concentration of the ion for which the membrane is selective. For example, the fluoride electrode can be used to directly sense fluoride ion in drinking water. Analyses utilizing ion selective electrodes offer the advantages of speed, ease-of-operation, low cost, and versatility over other analytical techniques. The ISE can measure the ion concentration of samples at very high levels (> 1000ppm) to very low levels (< 1ppm).

When an ISE, the indicator electrode, and a reference electrode are placed in a solution, and connected to a pH/mV/ion meter, they form a potentiometric cell. At equilibrium, the meter measures the potential difference between the ISE and the reference electrode. This millivolt potential is proportional to the activity of the ion of interest, and the relationship is defined by the Nernst equation:

$$E = E^* \pm 2.3 \frac{RT}{nF} (\log a) \quad \text{where}$$

E is the measured potential

E* is the sum of the standard potential and all other constant potentials of the system

R is the gas constant

T is the temperature in °K

F is Faraday's constant

n is the valence of the ion being measured

Activity, *a*, is not the same as concentration. It is a thermodynamic function whose value is influenced by the ionic environment in which the ion exists. Activity and concentration are the same in very dilute, ideal solutions. In non-ideal solutions, activity and concentration are related by an "activity coefficient".

ISEs sense the activity of free, uncomplexed ions rather than concentration. However, by calibrating the meter with standards with a similar ionic background as the sample, the difference between activity and concentration becomes negligible. Most often this is achieved by adding an ionic strength adjustor to both samples and standards. The Nernst equation becomes:

$$E = E^* \pm 2.3 \frac{RT}{nF} (\log c) \quad \text{where}$$

c is the concentration of the ion of interest.

This form of the Nernst equation states that the electrode potential varies directly with the log of the concentration in straight line manner, and results are then expressed in the preferred concentration units. The slope of the line is equal to the value of :

$$\text{Slope} = S = 2.3RT/nF$$

The table below gives theoretical slope values at 25°C.

Species	Slope (mV/decade)	Species	Slope (mV/decade)
Monovalent cation	+59.16	Divalent cation	+29.58
Monovalent anion	-59.16	Divalent anion	-29.58

The Nernst equation thus reduces to:

$$E = E^* + S [\log c]$$

Ion-selective Analysis Methods

Direct Analysis

In this method, a sample concentration is determined by measuring the electrode potential and comparing to those obtained in standard solutions. Normally, an ionic strength adjustor and/or pH adjustor must be added to both the samples and the standards. This helps in that the closer the standard solution matrix is to the sample matrix, the more valid is the analysis. A number of standard solutions are used to standardize a pH/mV/ion meter, or to construct a calibration curve (by plotting the electrode's output in mV versus the log of the concentration). The sample concentration is then read from the meter or the calibration curve.

The advantages of the direct method of analysis are:

1. Many samples (particularly those with relatively simple ionic backgrounds) can be quickly measured after a single calibration procedure.
2. The technique is valid over a wide range of concentrations.
3. Sample volume values are not required, and may also vary over a wide range.

Incremental Methods

These procedures can reduce errors caused by temperature variations, complex matrices, and complexation. They are also useful for applications where only occasional samples are analyzed. Incremental methods include: Known Addition, Known Subtraction, Analyte Addition, and Analyte Subtraction.

Known Addition and Known Subtraction

With the Known Addition and Known Subtraction methods, the initial millivolt output of the electrode in the sample solution is measured. Then an aliquot of standard solution is added, and a final millivolt potential is measured. The concentration of the sample can then be computed from the observed change in the millivolt readings before and after the addition. The techniques differ in that with Known Addition the standard added is the same ionic species as that being measured. With Known Subtraction, the measured ion is not the same as the one being added via the standard. For example, a chloride ISE can be immersed in sample for a chloride measurement. If a silver standard is added to the sample, AgCl precipitates, effectively removing or subtracting chloride ion from the sample.

Equations for known addition and known subtraction calculations are as follow:

Known Addition

$$C_S = \frac{C_{std} V_{std}}{(V_S + V_{std})10^{\Delta E/S} - V_S}$$

Known Subtraction

$$C_S = \frac{C_{std} V_{std}}{V_S - (V_S + V_{std})10^{\Delta E/S}} \quad \text{where}$$

C_S is the concentration of the sample; C_{std} is the concentration of the standard; V_S is the sample volume; V_{std} is the standard volume; ΔE is the difference in millivolt readings from the electrode; and S is the slope of the electrode determined in a previous standardization.

Whereas the direct method is suitable for samples with fairly uncomplicated ionic matrices, the addition methods are advantageous with samples that have complex matrices, samples in which no ISA is added, samples in which excess complexing species are present, and samples whose concentration is in the non-linear region on the electrode response curve.

Analyte Addition and Analyte Subtraction

In the Analyte methods, the initial millivolt reading is taken with the electrode immersed in the standard; then an aliquot of sample is added, and the final millivolt reading is taken. Sample concentration is calculated from the change in the millivolt readings.

Analyte Addition

$$C_s = C_{std} \left[\left(\frac{V_s + V_{std}}{V_s} \right) 10^{\Delta E/S} - \left(\frac{V_{std}}{V_s} \right) \right]$$

Analyte Subtraction

$$C_s = C_{std} \left[\left(\frac{V_{std}}{V_s} \right) - \left(\frac{V_s + V_{std}}{V_s} \right) 10^{\Delta E/S} \right]$$

As with known addition, with analyte addition the sample and the standard solution contain the same ion being measured. With analyte subtraction, the ion being measured is in the standard solution, and not in the sample solution. For example, a fluoride standard and a fluoride ISE might be used to measure to aluminum concentration of a sample. When the sample containing aluminum is added to the standard it reduces the measured fluoride content of the standard. The amount of reduction is proportional to the aluminum in the sample.

The analyte methods offer the same advantages as do the addition methods in that they effectively deal with complex samples. A distinct advantage of the analyte subtraction method is that it can be used in cases where an ISE does not exist for a given species, such as aluminum in the example cited.

Replacement Parts

Description	Fisher Catalog Number
Accumet pH combination electrode, single junction, Ag/AgCl reference, glass body, BNC connector	13-620-285
ATC Probe	13-620-19
AccuFlex electrode support arm	13-637-671
Electrode support bracket	13-637-671A
Power Supplies: 115V, US plug	13-636-100
230V, UK plug	13-636-101
230V, Europe plug	13-636-102
Operator's Manual	13-636-AR50M
BNC Shorting cap	13-620-99

Accessories

pH Electrodes	Fisher Catalog Number
Accumet pH combination electrode, single junction, calomel reference, glass body, BNC connector.	13-620-286
Accumet 3-in-1 pH/ATC combination electrode, single junction, Ag/AgCl reference, glass body, BNC connector	13-620-530
Accumet 3-in-1 pH/ATC combination electrode, single junction, calomel reference, glass body, BNC connector.	13-620-531
AccupHast pH combination electrode, double junction, glass body, BNC connector	13-620-296
AccupHast pH combination electrode, double junction, epoxy body, BNC connector	13-620-298
AccuFET solid state pH/ATC combination electrode, Ag/AgCl gel reference	13-620-755

pH Buffers and Solutions

pH	Color	Ingredients	Size	Fisher Catalog Number
4.00	Red	Potassium Biphthalate	500 mL	SB101-500
7.00	Yellow	Potassium Phosphate Monobasic & Sodium Hydroxide	500 mL	SB107-500
10.00	Blue	Potassium Carbonate, Potassium Borate & Potassium Hydroxide	500 mL	SB115-500
Fisher Buffer-Pac		(500mL ea. of color coded pH 4, 7, and 10 buffers)	3x500 mL	SB105
4.00	Red	Individual Tear open pH Packets	20/box	SB4
7.00	Yellow	Individual Tear open pH Packets	20/box	SB7
10.00	Blue	Individual Tear open pH Packets	20/box	SB10
	Gray	Electrode Rinse Individual Tear open pH Packets	20/box	SB15
		Electrode Storage Solution	1L	SE40-1

To place an order, call 1-800/766-7000
For technical support, call 1-800/943-2006



For a complete selection of electrodes and accessories, please refer to the Fisher 1998/99 Catalog, or contact your Fisher Scientific sales representative.