

SF₆ Analyzer 973



Operation Manual Version 973-ABB V1.1

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General

This manual explains the function of the SF₆ Analyzers 973, Version 973-ABB. In this manual the instrument will be called 973.

Vol SF6 %

All descriptions in **bold** and *italic* are related to the text on the front panel, the display and the back panel of the 973.

If you wish to use the instrument as quickly as possible, we recommend reading the chapters **Commissioning** (page 13) and **Measurement** (page 17). Standard use of the instrument is explained in these two chapters.

Short Description

Reliable SF₆ Measurement

The 973 was specifically designed for measurement of Humidity and SF₆ Purity in gas insulated switchgear systems. Humidity Measurement data is displayed in ppm_v, ppm_w and Dew/Frost Point. Purity Measurement is displayed directly in % Volume SF₆. Both the Humidity and Purity measurements utilize accurate and reliable condensation techniques

Gas Recovery and Pressure Measurement

The 973 is equipped with a gas recovery system that stores the sampled gas during the measurement process in its internal storage tank. After completion of the measurement, the stored gas is automatically pumped back into the original compartment or into another vessel. The compartment pressure is also measured.

Easy, Automated Measurement

The 973 is equipped with a user configurable full color active matrix LCD with integrated touch screen. The 973 may be configured for measurement of Humidity and % Volume SF₆ with either automatic or manually initiated Pump Back. In addition the 973 measures the pressure of the connected gas compartment. Using the bi-directional RS-232 communications port, all measurement data may be easily transferred into a computer.

Calibration

Easily check the calibration at any time using the built-in Ice Test function, providing instant proof of system accuracy and integrity.

Connect and Go

The system is supplied ready for immediate use.

973-ABB with Standard Accessories

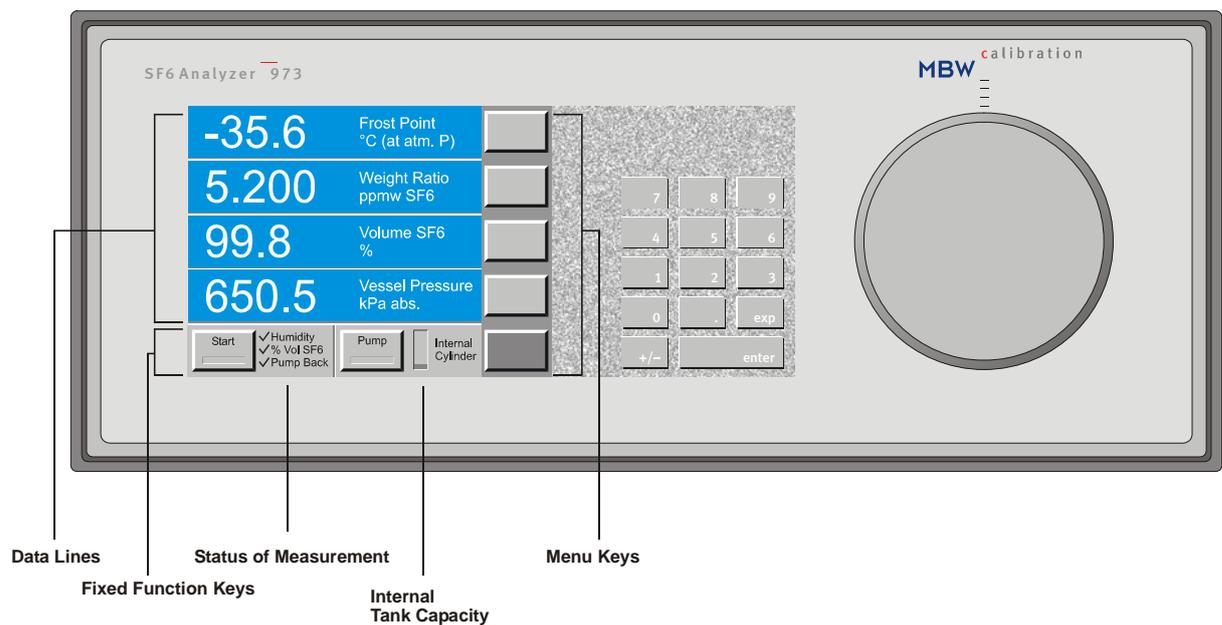
Transport Case
10m Stainless Steel armored PTFE tubing
DIL0 coupling DN20 and DN8
Spanner 17/22 mm and 22/24 mm
3m RS 232 cable incl. USB adapter with USB cable
3m power cable
Manual
CD-ROM

Specifications

Model:	973-SF₆	
Measuring range:		
Frost/Dew Point	-55...+20°C	
Humidity content by volume	20...20'000 ppm _v	
Humidity content by weight	2.5...2500 ppm _w	
% Volume SF ₆	80...100%	
Pressure	110...3000 kPa abs.	
Accuracy:		
Frost/Dew Point	±0.4°C	
ppm _v /ppm _w	±5% of reading	
% Volume SF ₆	±0.5%	
Pressure	±2 kPa	
Reproducibility:		
Frost/Dew Point	± 0.2°C	
% Volume SF ₆	± 0.3%	
Pressure	±1 kPa	
Thermoelectric Mirror cooling:	3-stage	
Cooling:	Air	
Display:	Active Matrix Color Graphic LCD	
Digital I/O:	RS-232	
Gas couplings:	Quick connect fitting	
Mirror temperature sensor:	PRT-100	
Sample gas pressure:	100...3000 kPa	
Sample gas flow rate:	0.5...1 l/min	
Operation temperature:	-10...+45°C	
Storage temperature:	-10...+50°C	
Ambient humidity:	98% RH max., non condensing in operation	
Voltage:	100...240 VAC, 50/60 Hz	
Power consumption:	200 Watt	
	Instrument	with Transport Case and Accessories
Width:	420 mm	624 mm
Height:	155 mm	305 mm
Depth:	390 mm	495 mm
Weight:	16.5 kg	32 kg

Operation

Front Panel

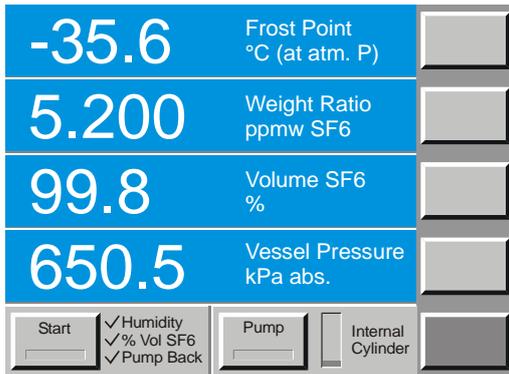


LCD Display with Touch Panel

The 973 utilizes a full color active matrix liquid crystal display with an integral touch panel. It has a high contrast ratio and a wide viewing angle for easy readability. Data is displayed in large easy to read fonts. Using the on screen function and menu keys, you can easily configure each line of the display and navigate the menus

Data Lines

The first four lines of the display are for numeric or graphic representation of the measured data. We refer to those first four lines as Data Lines. Numeric data lines contain the value to the left, with the parameter description and units to the right. The displayed parameters and units can be changed, but after a restart of the instrument the values will be reset to the stored standard configuration.



1. Data Line

This line displays the measured Dew/Frost Point. The unit is °C related to atmospheric pressure.

2. Data Line

This line displays the humidity content in ppm_w (parts per million weight). This unit is pressure independent.

3. Data Line

This line displays the SF₆ purity in % Volume.

4. Data Line

This line indicates the current pressure of the gas compartment. The unit is kilo pascal absolute pressure..

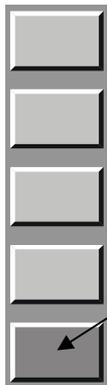
The data lines indicating the measured Humidity as well as the % Volume SF₆ will only be displayed after completion of the measurement. During the measurement only the current gas pressure of the measured compartment is indicated.

Fixed Function Keys and Status Line



The bottom line of the display contains two fixed function keys. By pressing the **Start** button the measuring process will be started. With the **Pump** button the pump back of the stored gas in the internal tank can be activated manually. These function keys are not changeable and are always available. Additionally this line contains the status indication, which indicates the current operation mode. The level indicator of the internal tank indicates the current storage capacity.

Menu Keys



Use the bottom key to change menus.

To the right side of the display is a column of menu keys. Each of these keys changes function as needed.

Notice that the bottom key in this column is different from the rest. The bottom key is used to cycle the upper keys through the various menu options. The text on the bottom key changes to indicate the currently selected menu option. The text of the upper keys change based on the functions available in the menu.

Keypad



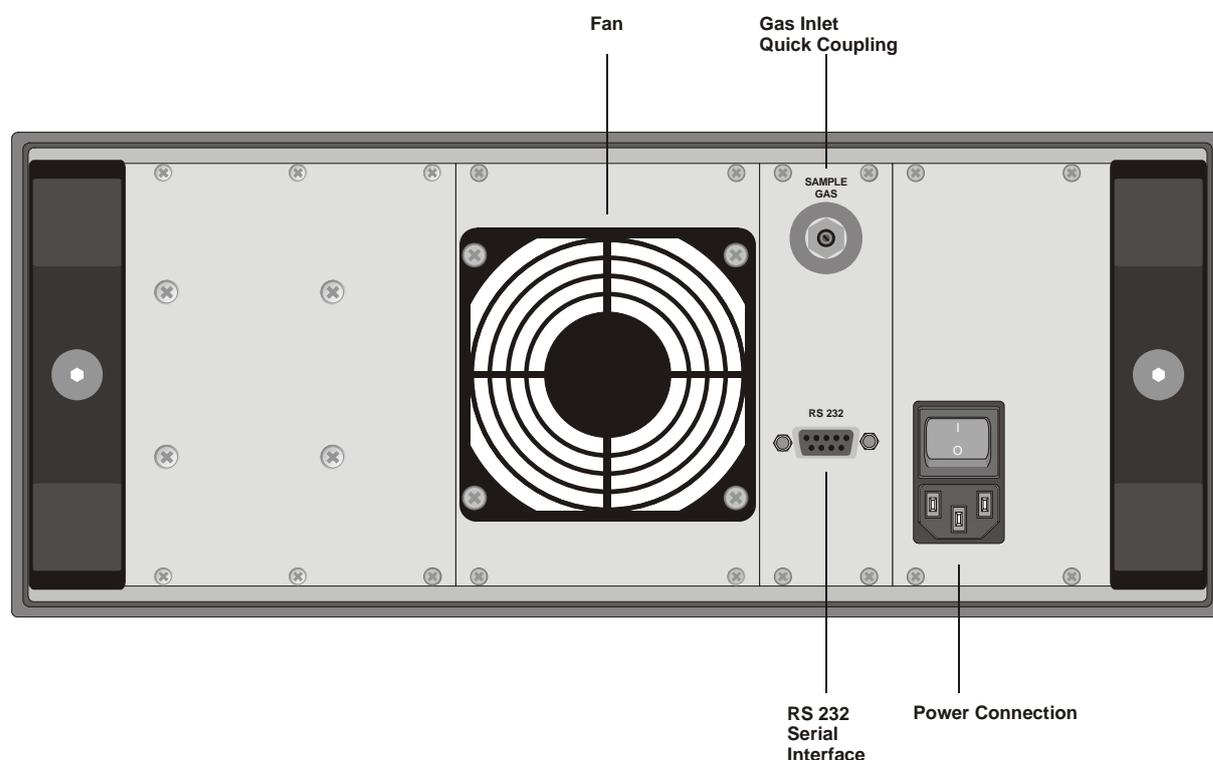
The keypad is used for entering data into the 973. For normal operation it is rarely used.

Carrying Handle



To adjust the position of the carrying handles press the buttons on both sides to unlock the handle. Release the buttons when the desired position is found.

Back Panel



Power Connection

The mains power cord is connected to the power plug on the instrument back panel. The power socket also includes the power switch. The power supply voltage is 100 to 240 VAC at 50 to 60Hz. The power supply is internally fused and will automatically be switched off in case of an overload. To restart the power supply the instrument main switch must be switched to **0** and **I** again.

Gas Inlet Quick Coupling

The sampling line is connected to the sample gas inlet. If the instrument is not in use the inlet should be protected with the blue cover.

RS 232 Serial Interface Connector

The RS 232 connector is used when connecting the 973 to a computer. Use a 9 pin 1:1 cable to connect the 973 to a desktop or laptop computer. This cable has a male connector on one end and a female connector on the other end. It is most often referred to as a serial extension cable.

Fan

When the 973 is switched on the cooling fan is always running independent of the ambient and the instrument temperature.

Commissioning

Preparation

The 973 needs a source of normal AC power. The label on the back panel indicates the mains voltage. The instrument has been designed to work with a power range between 100V to 240V and with 50Hz or 60Hz. This normally covers all usual mains voltages

Electrical Connection



The power socket and the 973 main power switch are on the back panel of the instrument. Use the provided power cable to connect the instrument to the mains power.

By pressing the power switch the instrument is started. The display of the 973 comes up immediately following the processor's boot phase. The boot phase may take several seconds to complete.

Connection of the Serial Interface



If you intend to transfer the measured data via the serial interface to a computer, the provided serial cable must be connected to the RS 232 port on the 973 and to the serial interface of the computer.



If your computer is equipped with a USB interface, you must use the provided RS 232/USB converter. You will find the drivers on the CD. The installation will be explained in the following chapter.

RS 232 – USB Converter / MSCOMM32 Driver Installation



KeyspanUSA19hsWinV34.exe

On the CD-ROM 973-ABB you will find the drivers for the Keyspan RS 232 / USB Adapter. Double click on

KeyspanUSA19hsWinV34.exe

and follow the installations instructions.



K19hasst.exe

After the installation you will find in the folder **C:\Programme\Keyspan\USB Serial Adapter** the assistant for the Keyspan RS 232 / USB Adapter.

Double click on

K19hasst.exe



In the **Adapter Status tab**, the assistant will show you which COM Port the USB Adapter will use. You will need this COM Port number later since it will need to be entered into the ABB Excel Protocol in the cell **Read Data From COM**.



KeyspanUSA19HforWindowsv34.pdf

For further information regarding use of the Keyspan RS 232 / USB Adapter please refer to the PDF manual in the folder:

C:\Programme\Keyspan\USB Serial Adapter\docs



Install.bat

On the CD-ROM 973-ABB in the folder **973ABBINSTAL** you will find the driver **MSCOMM32**

Install the MSCOMM32 driver by double clicking on

Install.bat

and following the installation instructions. The driver will be installed and registered.

SF₆ Gas Connection



The quick coupling on the instrument side of the sampling tube must be connected to the **SAMPLE GAS** inlet.

Note:

To prevent contamination the blue cover caps of the instrument and sampling tube should always be installed when the instrument is not in use.



The standard accessories of the 973 include a DN8 and a DN20 DILO coupling.

The sampling tube must always be stored with an installed DILO coupling in order to avoid exposure to air. Also protect the coupling from dust with the yellow screw cover.



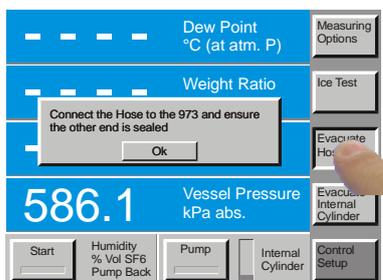
For a possible change of the DILO coupling use the supplied spanner 17/22 mm and 22/24 mm.

To disconnect the DILO coupling from the sampling tube, unscrew the stainless steel nut with the 24mm spanner.

After changing the DILO coupling the sampling tube must be evacuated.

Evacuate the Sampling Tube

The sampling tube must be evacuated before the first initial measurement is started. Once initially evacuated, there is no need to re-evacuate the hose, even when moving the connection from compartment to compartment, unless the DILO coupling is changed or air has otherwise been allowed to enter the tube.



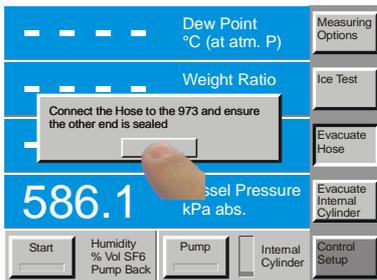
Press the lower right key in order to select the **Control Setup** menu. **Control Setup** appears on the key, while on the upper keys the available menu options are indicated.

Press the key **Evacuate Hose**.

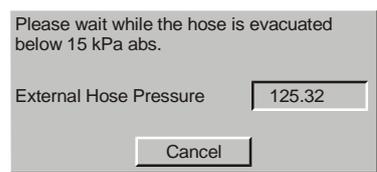


Make sure that a DILLO coupling DN8 or DN20 is properly installed on the sampling tube, but do not connect the DILLO coupling to anything else at this time. Since the DILLO couplings are self-sealing, the sampling tube is sealed.

Ensure that the other end of the sampling tube is properly connected to the 973.



With the sampling tube correctly connected, press the **Ok** key in order to start the evacuation process.



After the evacuation has started the next window indicates the decreasing pressure of the sampling gas tube while evacuating.

After reaching the set residual pressure of 15 kPa the evacuation process is stopped automatically and the window is closed. The instrument and the sampling tube are now ready for the measurement

By pressing the **Cancel** key during evacuation the process can be manually stopped.

SF₆ Gas Connection to the Compartment

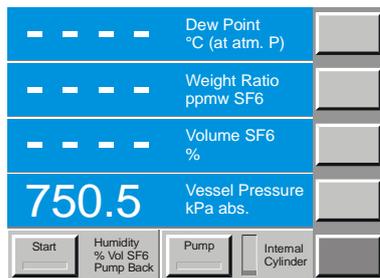


If the sampling tube was properly evacuated before the first measurement, it is now ready to connect to the gas compartment. When moving the connection from compartment to compartment, there is no need to re-evacuate.

Measurement

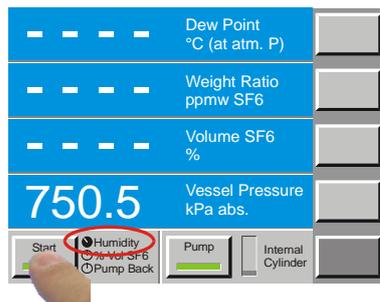
Measurement Start

If all preparations are done in accordance with the previous section, the 973 is ready for use.

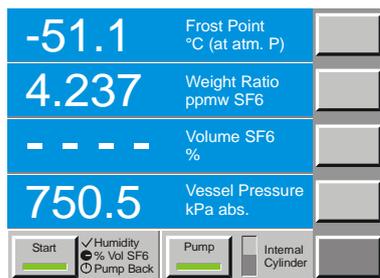


As soon as the 973 is connected to the gas compartment the current vessel pressure is indicated. The ABB standard configuration for the pressure unit is kPa absolute. The input pressure range is 100 - 3000 kPa.

When the instrument is switched on the standard ABB measuring mode with Humidity Measurement, % Volume SF₆ Measurement and Pump Back After Measurement is activated.



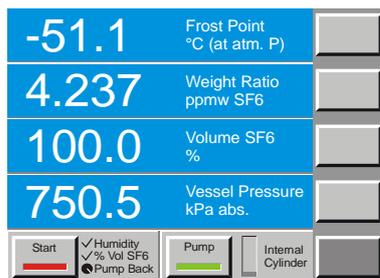
Press the **Start** button. The **Start** button and the **Pump** button turn green. The pump starts and the humidity clock, located next to the **Start** button, begins to spin. During the measurement, SF₆ gas flows from the gas compartment, through the hose, through the measuring head, and into the internal storage tank.



After the completion of the Humidity measurement the spinning clock stops and the measured Dew/Frostpoint as well as the calculated humidity content in ppm_w is displayed.

Now the % Volume SF₆ measurement starts and the corresponding clock begins to spin.

The internal cylinder level indicator shows the rising pressure in the internal storage tank.



After the completion of the % volume SF₆ measurement the spinning clock stops and the measured % volume SF₆ is displayed.

Now the pump back starts and the corresponding clock begins to spin. The level indicator shows the decreasing pressure in the internal storage cylinder. At the same time the mirror is heated. This is indicated by the red **Start** key. During the heating phase the **Start** key is locked.

-51.1	Frost Point °C (at atm. P)	
4.237	Weight Ratio ppmw SF6	
100.0	Volume SF6 %	
750.5	Vessel Pressure kPa abs.	
Start	<input checked="" type="checkbox"/> Humidity <input checked="" type="checkbox"/> % Vol SF6 <input checked="" type="checkbox"/> Pump Back	Pump Internal Cylinder

After the completion of the pump back into the gas compartment, the measuring head pressure is released to 1 bar abs. The measurement results are now available on the display. The measurement data for humidity and % volume SF6 remain stored and displayed until the next measurement is started by pressing the **Start** button. The vessel pressure measurement always indicates the current pressure at the 973 sample gas input. After completion of the measurement the gas compartment pressure remains indicated as long as the sampling tube is connected to the gas compartment. The stored data is also available on the serial interface for transfer into the Protocol.

After connection of the sampling tube to the next gas compartment, the next measurement can be started by pressing the **Start** button.

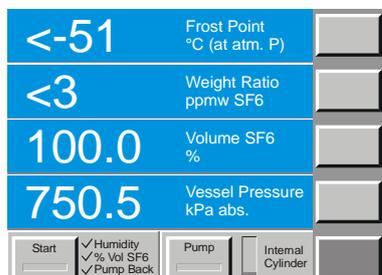
Termination of Measurement

After completion of the measurements, disconnect the DILO coupling from the gas compartment and close it with the yellow screw cover. Then disconnect the quick coupling from the 973 and cover the gas inlet as well as the coupling of the tube with the blue caps. The least measured SF₆ remains in the sampling tube. A correctly closed sampling tube is protected from dust and ambient air.

If the measurement was stopped with a normal pump back sequence, 2 bar pressure (1bar gauge) will remain in the internal storage cylinder. The instrument can now be correctly transported.

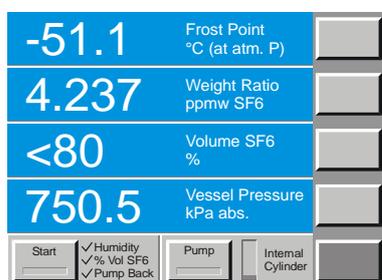
Measuring Range Limitations

The lower measuring limits of the 973 are 2,5 – 3 ppm_w for humidity and 80% for volume SF₆ measurement. If the measured value for humidity or % volume SF₆ is below this measuring limit the instrument indicates this condition as follows:



If the measured value of the Humidity is below the measuring limit of the 973, the display shows 'smaller than' < and the value in °C Frost Point and ppmw.

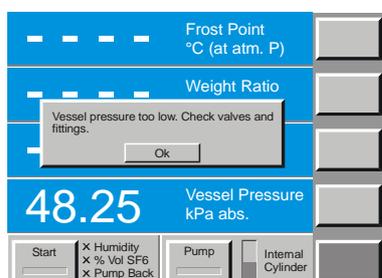
This indicates that the actual humidity is below the displayed value.



If the measured value of the % Volume SF₆ measurement is below the measuring limit of the 973, the display shows 'smaller than' < 80%.

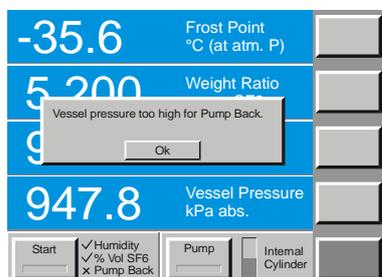
This indicates that the actual % Volume SF₆ value is below 80%.

Alarm Messages



If the gas compartment pressure is too low or if the DILO coupling is not correctly connected to the gas compartment an underpressure occurs in the sampling tube and the 973 turns off automatically. The 973 displays that the pressure is too low.

Make sure the sampling tube is correctly connected on both sides and the minimal gas pressure of 100kPa is available.



If the gas compartment pressure is too high to allow the pump back, the 973 turns the pump off automatically and indicates that the compartment pressure is too high.

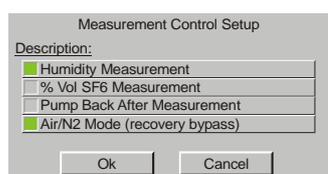
Connect the 973 to a gas compartment with a lower pressure to pump back the stored SF₆.

Measurement Aborted

If the measurement is aborted due to low or high pressure conditions, the 973 will heat up the mirror and release the measuring head pressure to 1 bar abs. Pump back of the stored gas in the internal tank can be started by pressing the **pump** key.

Measurement of nitrogen (N₂)

The 973 is equipped with a measuring mode for nitrogen. The measured nitrogen is not stored in the internal tank and will be pumped to atmosphere.



Select **Measuring Options** in the **Control Setup** menu.

For this example, select **Humidity Measurement** and **Air/N₂ Mode**.

Press the **OK** key.

In this measuring mode, only the humidity measurement is performed. %Vol SF6 measurement is not performed. The nitrogen gas is released to the atmosphere during the measurement and is not stored in the internal cylinder.

Prior to resuming SF6 measurements, the hose should once again be evacuated.

Data Collection over RS 232 with ABB Protocol

When the 973 is connected to a computer via the RS 232 connection, the measuring results may be transferred directly into the ABB Excel Protocol program. The required data will always be transferred into the Excel Protocol in the default ABB units, regardless of the current 973 configuration.

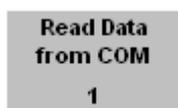


973-ABB Protocol V1.2

On the CD-ROM 973-ABB you will find the 973-ABB protocol.

Double click on

973-ABB Protocol V1.2



Change the value in the **Read Data from COM** field to match the comm. Port used on the computer. If using the Keyspan USB/232 converter, the comm port number may be found in the Keyspan Serial Assistant program.

Feeder / Bay	Gas Compartment	Phase
B1	Q0	R
B1	Q0	S
B1	Q0	T

Enter the gas compartment identification in the appropriate fields.

-51.1	Frost Point °C (at atm. P)	<input type="text"/>
4.237	Weight Ratio ppmw SF6	<input type="text"/>
100.0	Volume SF6 %	<input type="text"/>
750.5	Vessel Pressure kPa abs.	<input type="text"/>
Start	<input checked="" type="checkbox"/> Humidity <input checked="" type="checkbox"/> % Vol SF6 <input checked="" type="checkbox"/> Pump Back	<input type="text"/> Pump <input type="text"/> Internal Cylinder

After completion of the measurement the stored measuring results for humidity and % SF6 are available on the display and on the serial port. The pressure value on the display indicates the current gas compartment pressure as long as the sampling tube is connected to the corresponding gas compartment.

Dew/Frost Point [°C at atm P]	Moisture Content [ppmw]	SF6 Vol [%]	Pressure [kPa abs]	Read Data from COM 1
-51.1	4.2	100.0	750.5	Read
				Read
				Read

By clicking the **Read** button the measured values for **Dew/Frost Point [°C at atm P]**, **Moisture Content [ppmw]**, **SF6 Vol [%]** and **Pressure [kPa abs]** are transferred in to the corresponding line.

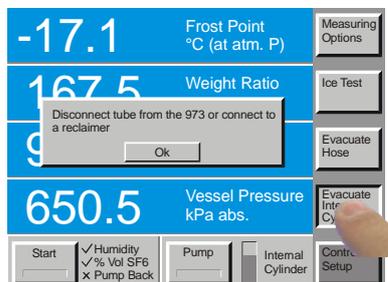
The value for the pressure measurement corresponds with the measured value at the moment when the **Read** button is pressed. The stored data for **Dew/Frost Point**, **Moisture Content** and **SF6 Vol** remained fixed in the 973 until the next measurement is started.

Instrument ID: 973-ABB **Instrument S/N:** 05-0714

The instrument type and serial number are automatically stored in the last line at the bottom of the page.

Evacuation of the Internal Storage Tank

If a gas compartment with bad SF₆ quality was measured and the stored gas should not be pumped back, the internal storage cylinder can be evacuated.

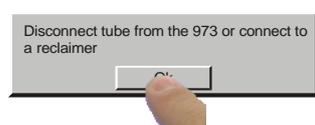


Press the **Evacuate Internal Cylinder** key in the **Control Setup** menu.

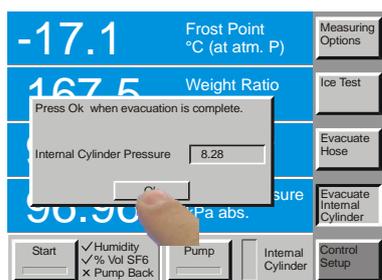
The dialogue box requests you to remove the sampling gas tube (to exhaust the internal cylinder to the atmosphere) or connect a reclaimer to the 973.



Disconnect the quick coupling from the **SAMPLE GAS** inlet or connect the instrument to a SF₆ reclaimer.



Press the **Ok** button to start the internal tank evacuation.



The dialogue box indicates the current storage tank pressure during evacuation. After evacuating below 15kPa residual pressure the internal pump automatically stops. The evacuation process can be stopped by pressing the **Ok** button.

If the 973 is connected to a reclaimer, the evacuation can be continued with the external reclaimer, until the desired residual pressure is reached. By pressing the **Ok** button the evacuation can be stopped.

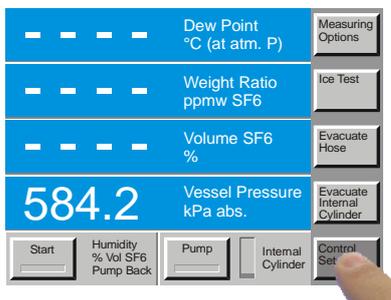
Measurement Options

Navigating the Menus

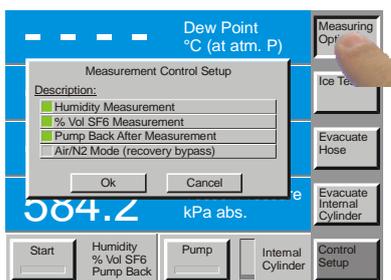
The various menus of the right column of keys are navigated by using the key in the lower right corner of the touch screen. Each time you press the lower right key, a new menu appears on the keys directly above it. The menu is circular, meaning that once you go past the last menu, the first one appears again and the process starts over. You can use the +/- key on the keypad to move backward through the menus. Use the **Enter** key to clear the menu.

Selecting the Measurement Options

With the measuring options you can select the Humidity measurement, % Volume SF₆ measurement only, or both. In addition you can select Automatic Pump Back of the stored gas after termination of each measurement. With the standard 973 ABB configuration Humidity measurement and % Volume SF₆ measurement with Automatic Pump Back are selected. This configuration can be changed, however, after restarting the instrument it will be set back to the standard configuration.

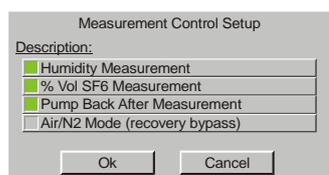


Press the lower right menu key once to select the **Control Setup** menu. **Control Setup** appears on the key while the keys above change to available menu options. Notice that the top key indicates **Measuring Options**.



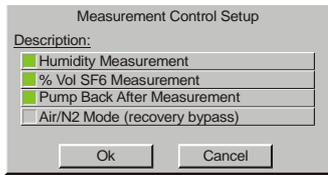
Press the **Measuring Options** menu key at the top right corner of the screen. The **Measurement Control Setup** window appears.

Humidity Measurement, % Volume SF₆ Measurement, and Pump Back After Measurement are selected. This is the standard ABB configuration

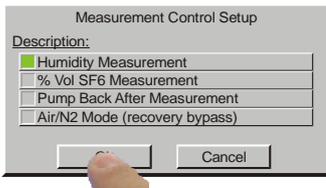


With the buttons **Humidity Measurement, % Vol SF₆ Measurement, Pump Back After Measurement** and **Air/N₂ Mode** the desired measuring mode can be activated. The small green indicator to the left of the buttons indicates that this mode is activated. Pressing the button toggles the activation mode on and off.

Measuring Mode examples



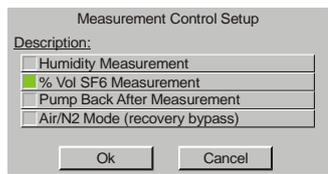
Several buttons appear in the dialog box to allow selection of **Humidity Measurement**, **% Volume SF₆ Measurement** and **Pump Back after Measurement**. A small green box on the left of each option indicates that the option is currently enabled. If the box is not green, this option is currently disabled. To enable or disable an option, just press the button. Each time you press the button, the green square toggles on or off.



For purposes of this example, select only **Humidity Measurement**, and disable the other two.

Now press the **Ok** button or the **Enter** key.

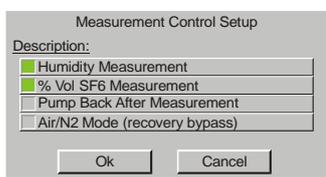
With this configuration only **Humidity Measurement** is selected.



For purposes of this example, select only the **% Volume SF₆ Measurement**, and disable the other two.

Now press the **Ok** button or the **Enter** key.

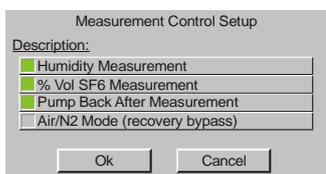
With this configuration only the **% Volume SF₆ Measurement** is selected.



For purposes of this example, select only the **Humidity and % Volume SF₆ Measurement**, and disable the **Pump Back**.

Now press the **Ok** button or the **Enter** key.

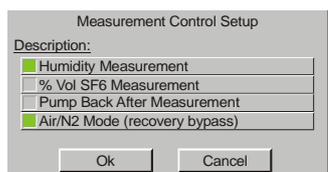
With this configuration both measurements will be selected, without **Automatic Pump Back**.



For purposes of this example, select the **Humidity and % Volume SF₆ Measurement** with **Automatic Pump Back**.

Now press the **Ok** button or the **Enter** key.

With this configuration both measurements will be selected, with **Automatic Pump Back** (ABB standard).



For purposes of this example, select the **Humidity Measurement** and **Air/N₂ Mode**.

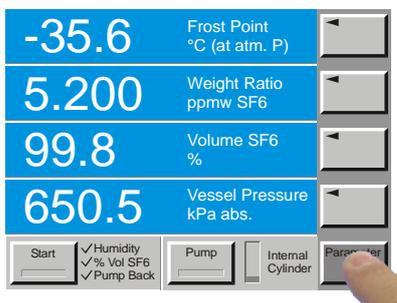
Now press the **Ok** button or the **Enter** key.

With this configuration only the **Humidity Measurement** is selected, without storage in the internal cylinder. The measured gas will be pumped to atmosphere. This mode is only used for the measurement for air or nitrogen (N₂).

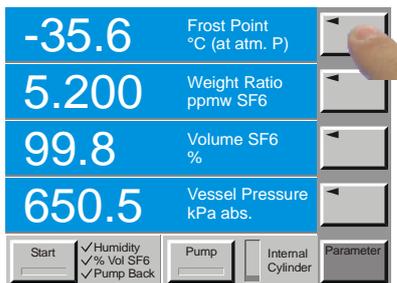
Additional Functions

Selection of the Indicated Parameters

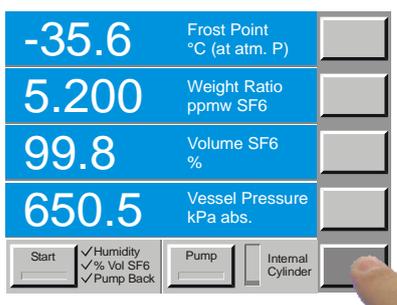
Selecting which parameter to display on the four data lines is easy. It is done with the **Parameter** menu.



Use the lower right menu key a couple of times to select the **Parameter** menu. The arrow indicates that each key corresponds to its adjacent data line.



Press the arrow key corresponding to the data line you wish to change. Notice that each time you press the arrow key, the parameter of the data line changes. The parameter selection is circular, meaning that once you reach beyond the last available parameter, the first one is again displayed and the cycle starts over. Change the parameters on any of the other three data lines with the same method.

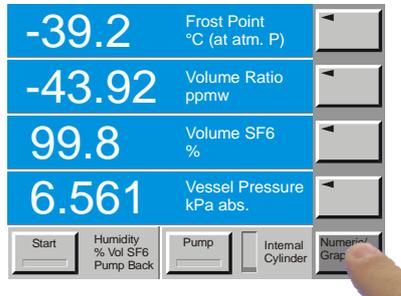


If you like, you may clear the menu keys when finished by cycling through all the menus using the lower right key on the touch screen, or by pressing the **Enter** key once. Note that this is not required and nothing is wrong with leaving the **Parameter** menu (or any other menu) on the screen.

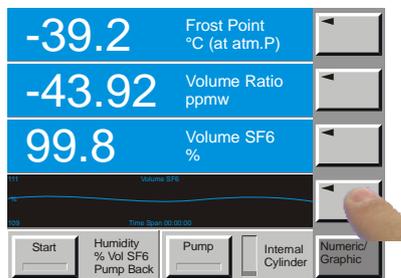
The changed selection of the **Parameter** menu remains displayed as long as the 973 is in operation. After restart of the 973 the display is set back to the standard configuration.

Selecting Numeric Data or Graph

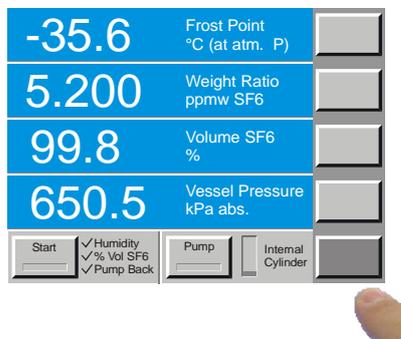
Any data line may be viewed either as numeric or as a graph of the data during a certain period. The **Numeric/Graphic** menu is used to toggle any data line between numeric and graph mode.



Use the lower right menu key to select the **Nu-meric/Graphic** menu. **Numeric/Graphic** appears on the key. The arrow indicates that each key corresponds to its data line.



Press the key according to the data line you wish to change. Notice that the data line toggles between numeric or graph mode each time you press the key.

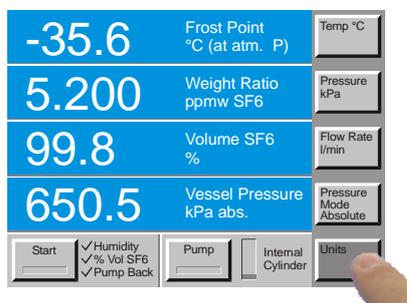


If you like, you may clear the menu keys when finished by cycling through all the menus using the lower right key on the touch screen, or by pressing the **Enter** key once. Note that this is not required and nothing is wrong with leaving the **Numeric/Graphic** menu (or any other menu) on the screen

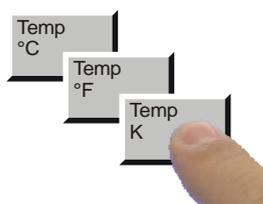
The changed selection of the **Numeric/Graphic** menu remains displayed as long as the 973 is in operation. After restart of the 973 the display is set back to the standard configuration.

Selection of Units

The data may be viewed in any of the many available units.



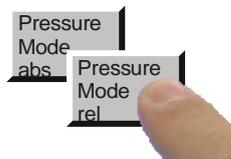
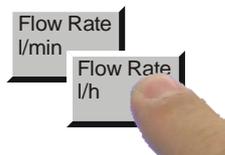
Use the lower right menu key to select the **Units** menu. **Units** appears on the key and the keys above show the various units. Notice that each of the keys shows different types of units. Unlike the **Parameter** menu, the keys do not correspond to the data lines, but rather to different unit types.



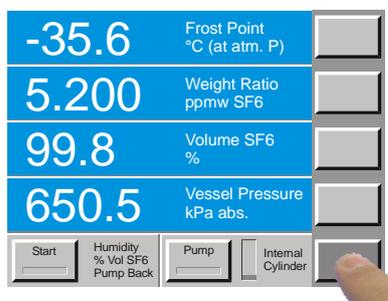
To change temperature units, press the key labeled **Temp**. Notice that the corresponding units change each time the key is pressed. Also notice that any data line that is currently indicating temperature data also changes to the new units.



Change other units (such as **Pressure**, **Flow Rate**, etc.) with the same method.



In addition to setting the **Pressure** units, the mode may be set to either absolute or relative mode. (Note: Relative mode is often referred to as 'gauge mode' or 'over-pressure').



If you like, you may clear the menu keys when finished by cycling through all the menus using the lower right key on the touch screen, or by pressing the **Enter** key once. Note that this is not required and nothing is wrong with leaving the **Units** menu (or any other menu) on the screen.

The changed units remain displayed as long as the 973 is in operation. After restart of the 973 the display is set back to the standard configuration.

Maintenance

Calibrate the Touch Screen

The 973 utilizes a touch screen for user interaction. To activate a menu option or toggle a function on or off, simply touch the screen directly over the key or object desired.

Before using the instrument for the first time, you may need to calibrate the touch screen to your finger positioning preference.



Press and hold the **Enter** key on the numeric keypad for 3 to 4 seconds. If you've done it correctly, you'll hear two short beeps and a key in the upper right corner will turn yellow. If not, release the **Enter** key and try again.



With the tip of your finger, press the center of the yellow key in the upper right corner of the touch screen. It is labeled **Touch This Key**. Once you touch it, the yellow color goes away and another key turns yellow.



Now, touch the yellow key that's in the lower left corner of the touch screen. Once you touch it, the yellow color goes away and you have successfully calibrated the touch screen.

Test your new touch screen calibration by pressing the bottom right menu selection key several times. If it seems not to work well, just repeat the calibration steps again from the beginning.

You may recalibrate the touch screen as often as needed, however, it is rarely required. If the touch screen does not seem to be working, please attempt to recalibrate it.

Mirror Cleaning

The heart of the 973 is the measuring head assembly. It is designed to be highly sensitive and accurate, yet rugged and easily accessible for periodic mirror cleaning.

Removing the Head Cover



The measuring head is located on the right side of the 973 front panel. To gain access to the mirror and opto-electronic components, you must first remove the cover screw.

The cover looks like a large tan colored knurled knob. To remove it, simply twist it counterclockwise. It requires approximately three full turns to completely unscrew, allowing you to remove it.

Removing the Optical Assembly



Once the cover screw has been removed, the black optical assembly (optical head) is now removed by pulling it straight toward you. This piece contains the light emitting and light sensing opto-electronic elements. There is an oval shaped o-ring on the face of the optical assembly that is used to seal it to the measuring head. There are also some gold contacts on the face. Avoid touching the face of the optical assembly with your fingers to prevent contamination of the contacts, the o-ring, the optical area, and the gas channel.

Inspecting / Cleaning the Mirror

The mirror requires occasional periodic cleaning to maintain high accuracy measurements. The flush mounted mirror is easily accessible by removing the cover screw and optical mirror assembly. Look at the mirror with the naked eye or with a magnifying glass. If signs of contamination are present, or suspected of being present, use the following procedure to clean the mirror.



Clean the mirror with a clean cotton swab or lint free tissue.

Although a clean mirror is important to accurate measurements and sound measurement practices, please take the following comments into consideration.

- Never attempt to polish the mirror.
- If needed, the mirror may also be cleaned with methanol or alcohol. Always follow the use of these cleaning chemicals with distilled water to ensure they are completely rinsed from the mirror surface.

Reassemble the Mirror Components

Position
bolt



Reassemble the mirror components in the reverse order of disassembly.

1. Install the optical assembly, taking note of guide pin. Ensure that the arrow is pointing toward the top of the unit.
2. Replace the cover screw. Hand tighten until snug. Do not over tighten.

Exterior Cleaning

Front Panel

The 973 front panel is completely sealed and easily cleaned with liquid glass cleaner or other mild cleaning chemicals moistened on a cloth. Clean the front panel periodically as needed.