

- **Compact simple design**
  - ensures ease of operation and maximizes on-line availability
- **Full microprocessor control**
  - safeguards instrument integrity
- **Fully automatic two-point calibration**
  - monitors instrument performance
- **Minimal maintenance requirements at extended periods**
  - guarantees low cost of ownership
- **Large fluorescent display for maximum impact with 20-character dot matrix display for additional data**
  - ease of customer programming
- **Fully comprehensive alarm and remote interrogation facility**
  - improves data management



## Introduction

ABB has forty years of continuous experience and innovation in the design and successful application of on-line chemical analyzers. This has been combined with the latest electronics and production technologies to produce the 8230 Series of monitors for Ammonia, Nitrate, Fluoride and Chloride.

They are based on ion-selective and gas-sensing probe techniques and a carefully designed liquid handling section to reduce the routine maintenance to a minimum. Utilizing microprocessor-based electronics, advanced features, such as automatic two-point calibration, assessment of the sensor performance and the option of a serial interface are made available.

## Applications

The demand for a cleaner environment is increasing daily in almost every part of the world. Sewage treatment, river quality, potable water purity and industrial waste water are at the centre of this concern.

To overcome these problems, effective and reliable monitoring or control of fluoride, ammonia, chloride and nitrate is essential. Typical monitoring points are as follows:

### 1 Sewage Treatment

- Raw sewage – ammonia monitoring gives an indication of the loading on the plant.
- Activated sludge stage – ammonia monitoring provides information on the efficiency of the aeration.
- Denitrification stage – nitrate monitors can be used to control the nitrate removal.
- Final treated outfall – ammonia and nitrate monitoring ensures adequate treatment and ensures that discharge consent limits are being met.
- Waste water – monitoring of chloride for enhanced environmental control.
- Potable water – fluoride and chloride monitoring.

### 2 River Quality

Both ammonia and nitrate monitoring are indicators of the general health of the river. Monitoring is carried out downstream of known discharges, in areas where fish need to be protected and adjacent to water abstraction.

### 3 Potable Water Treatment

- River intake protection – fluoride, ammonia and nitrate monitoring are used to ensure levels are within consent limits.
- Borehole abstraction – nitrate monitoring may be required to confirm acceptable levels are not being exceeded.
- Final water quality – fluoride is frequently added to potable water to reduce decay in childrens' teeth. Since fluoride solutions are toxic in high concentrations, careful monitoring is essential to maintain the concentration within safe limits.
- Denitrification/nitrate reduction – high levels of nitrate may be reduced by blending or carrying out nitrate removal using a biological or ion-exchange process. Nitrate monitoring is essential to control the process and to meet consent limits of the final water quality.
- Ammonia is occasionally added to the water as part of the disinfection process: an ammonia monitor ensures that residual levels do not exceed consent limits.

### 4 Power Industry

Ammonia is used to control the pH of the boiler feedwater in order to reduce the effects of acid corrosion. An on-line monitor provides an indication of the actual concentration on a continuous basis.

### 5 Industrial Waste Water

Ammonia is increasingly being monitored to ensure compliance with the discharge consent limits. Chloride is becoming of greater importance in many regions as the drive to improve river water quality continues.



Main Components

## Liquid Handling Section

### Model 8231 Fluoride Monitor

The monitor uses a fluoride ion-selective and reference electrode pair, both manufactured by ABB, mounted in a temperature controlled flowcell.

Pre-treatment of the sample with a reagent solution is carried out to adjust the pH, decomplex the fluoride ions in solution and remove the effects of changes in ionic strength in the sample.

Range of measurement can be set to any two consecutive decades of concentration between 0.1 and 1000mg<sup>-1</sup>.

The current outputs can be used to view any window within the range to which the instrument is set, e.g. in control of fluoridation where a window of 0.1 to 1.5mg<sup>-1</sup> provides optimum discrimination at the control point, i.e. 1mg<sup>-1</sup>, along with maximum visibility of alarm conditions. Alarm contacts are provided which can be set to suitable values, e.g. 1.2mg<sup>-1</sup> to initiate a shutdown of the dosing system if this value is exceeded. Programmable delay and hysteresis functions avoid spurious alarms which can cause problems with the control plant.

Under such typical circumstances, with appropriate standard solutions and calibration frequencies, accuracies better than ±5% of reading or ±0.1mg<sup>-1</sup>, whichever is the greater, can be achieved.

### Model 8232 Ammonia Monitor

The monitor employs a development of an ammonia gas sensing probe which was first commercially produced by ABB in 1970 for routine ammonia measurement.

In this monitor the sample is pre-treated with two separate reagent solutions before being presented to the sensor. The first reagent contains a complexing agent to prevent hardness precipitation forming in the monitor tubing when the pH is raised with the second solution, an alkali, to convert the ammonium ions in solution to dissolved ammonia gas.

Optimum response time has been achieved by the presentation of the sample to the sensor membrane area by a flowing film technique, which further avoids blockage and build-up of solids at this critical point.

Range of measurement can be set to any two consecutive decades of concentration between 0.05 and 1000mg<sup>-1</sup> as N, NH<sub>3</sub> or NH<sub>4</sub><sup>+</sup>. The range of 0.05 to 5mg<sup>-1</sup> makes the monitor ideally suited to river monitoring and potable water intake protection applications, whilst 1 to 100mg<sup>-1</sup> is more suitable for normal sewage outfall applications.

Under such operating conditions with appropriate standard solution and calibration frequencies, accuracies better than ±5% of reading of ±0.1mg<sup>-1</sup>, whichever is the greater, can be achieved.

### Model 8235 Chloride Monitor

The monitor utilizes the well-proven 8004 ABB ion-selective chloride electrode, together with a silver chloride double-junction reference electrode.

Automatic sample conditioning ensures optimum sample conditions and automatic two-point calibration maintains performance without the need for frequent manual intervention. A second chloride electrode is provided, as standard, to enable refurbishment of the in-use sensor without downtime. The monitor is programmable over the range 2 to 5000mg<sup>-1</sup> enabling the user to select the most appropriate operating range for individual applications.

### Model 8236 Nitrate Monitor

This monitor employs the ABB long life, reservoir fed, ion-exchange nitrate ion-selective electrode, in conjunction with a reference electrode in a temperature controlled flowcell.

The sample is pre-treated with a single reagent to remove the effect of changes in ionic strength of the sample and also to maintain the sample within defined pH limits.

In typical river monitoring applications, nitrate concentrations are often expressed either as N or as NO<sub>3</sub><sup>-</sup>. The range setting in the 8236 accommodates both these requirements by allowing any two consecutive decades of concentration between 0.2 and 1000mg<sup>-1</sup> as N or 1.0 and 5000mg<sup>-1</sup> as NO<sub>3</sub><sup>-</sup> to be displayed.

Borehole and river water abstraction and sewage treatment applications are catered for by setting the monitor to the lowest range of 1 to 100mg<sup>-1</sup> as NO<sub>3</sub><sup>-</sup>.

Under such operating conditions with appropriate standard solutions and calibration frequencies, accuracies better than ±5% of reading or ±0.1mg<sup>-1</sup> as N or 0.5mg<sup>-1</sup> as NO<sub>3</sub><sup>-</sup>, whichever is the greater, can be achieved.

In other applications, where high levels of chloride might also be present in the sample, special formulations of calibration solutions may be necessary to optimize performance.

## Operation

On entering the monitor the sample is first presented to the constant head unit. From here the sample passes through two solenoid valves, used for calibration, and one channel of the peristaltic pump. The reagents are added to the sample via further channels of the peristaltic pump. The resulting solution is then presented to the sensor flowcell under constant flowing conditions. The temperature of the measurement is controlled by the electronics section to remove the effects of sample and ambient temperature variations. Calibrations are carried out automatically under the control of the microprocessor using two standard solutions of a known value introduced via the solenoid valves in a specific sequence, allowing drift in zero and slope to be corrected, thus maintaining the accuracy of the measurement.

The electronics are mounted on the monitor back plate with the displays and key pad accessible from the front of the monitor. Easy access and indication of all parameters is provided by two blue-filtered vacuum fluorescent displays. The upper one is a 5-digit display indicating the measured value. The lower one is a 20-character dot matrix display which provides user information during setting-up and also on demand. Units and range of measurement, alarm values and standard solution values are examples of the many programmable functions.

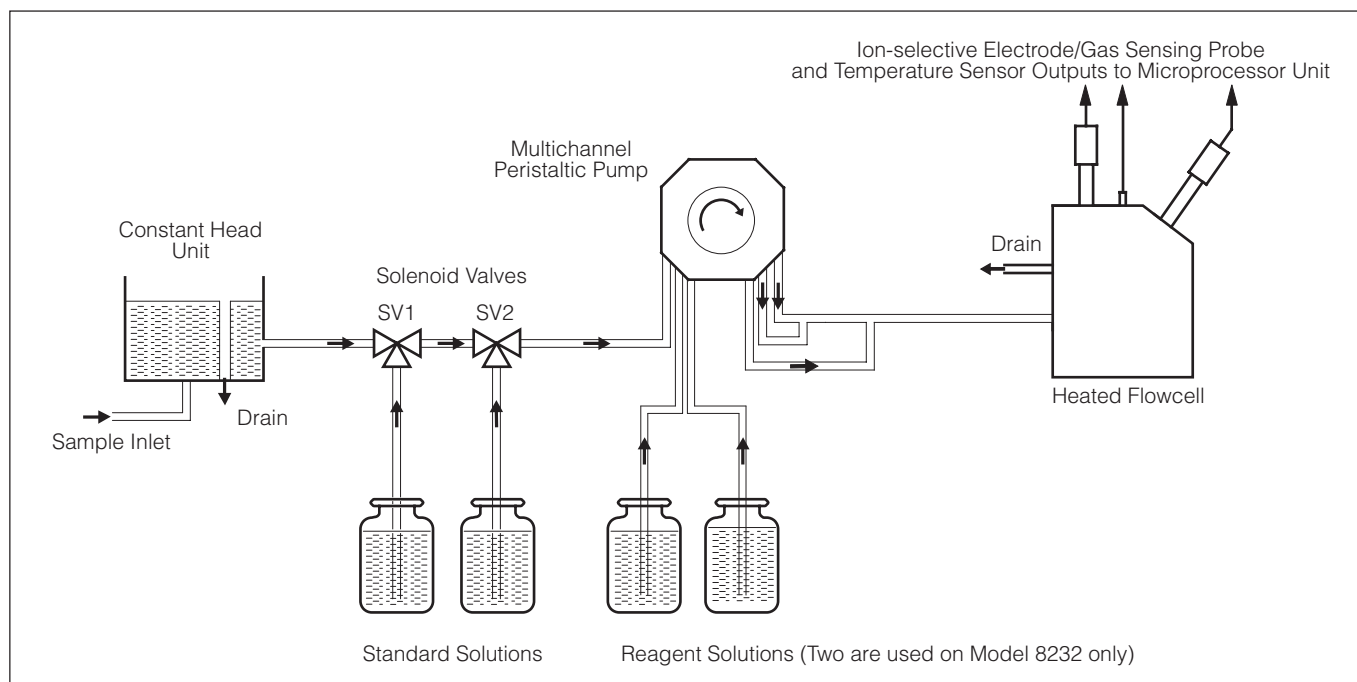
Eight fingertip-operated tactile membrane switches are used to obtain useful information on the current status of the monitor and for data entry during programming. Two dedicated switches are used to manually initiate a calibration and to set the monitor to 'HOLD'. This latter switch is used when carrying out maintenance to hold the concentration alarms and inhibit automatic calibration.

One current output is provided as standard with the option of a second current output or a serial interface.

Two concentration alarms are provided with the addition of two further relays to indicate remotely when the monitor is carrying out a calibration and when the monitor is 'OUT OF SERVICE'. This latter relay, normally energised, indicates mains failure, calibration failure or when the monitor is in 'HOLD'.

An optional out of sample sensor can be fitted, providing a further relay output that can be used for remote indication.

Calibrations are carried out automatically at programmable preset intervals of 6 or 12 hours, or 1,2,3,4,5,6 or 7 days, timed to take place at specified times of the day. Manual initiation of the calibration sequence can be carried out any time via the front panel switch or the serial interface if fitted.

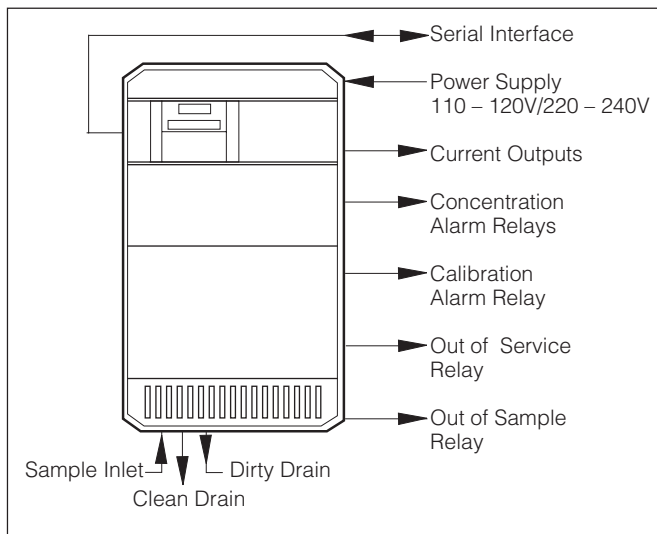


Schematic Flow Diagram

**Filtration**

It is frequently necessary to monitor in dirty water applications, such as certain river and sewage samples, where a very high level of solids can be present. ABB can supply filtration systems which are particularly suited to these applications. The heart of these systems is a filter based on the principle of ultrafiltration which removes sample particles down to 0.02µm. This unique filter has been used on the most demanding and arduous applications with great success. These include raw and activated sewage sludge.

ABB can design the filtration system for particular applications to optimize the performance of the filter, with minimum maintenance in an area of the monitoring system which has traditionally been very maintenance intensive.



Input and Output Connections



Close-up of Microprocessor Unit

**Monitoring Systems**

Within the hydrological cycle – abstraction, treatment, distribution and final effluent treatment – an enormous range of analytical products supplied by ABB are deployed to ensure that the highest standards of quality and efficiency are maintained. These can be custom designed into permanent or mobile, local or remote, stations, many of which are unmanned.

From initial discussions with the potential user or contractor, through the comprehensive engineering design and draughting stages to the final building of a system or laboratory, our engineers have the experience and expertise necessary to customize each to suit the end user's particular requirements.



Multi-channel Peristaltic Pump and Sensor Flow Cell

## Specification

### Range

<b>Fluoride</b>	Any two consecutive decades of concentration between 0.1 and 1000mg <sup>l</sup> <sup>-1</sup>
<b>Ammonia</b>	Any two consecutive decades of concentration between 0.05 and 1000mg <sup>l</sup> <sup>-1</sup> as N, NH <sub>3</sub> or NH <sub>4</sub> <sup>+</sup>
<b>Nitrate</b>	Any two consecutive decades of concentration between 0.2 and 1000mg <sup>l</sup> <sup>-1</sup> as N, or 1.0 and 5000mg <sup>l</sup> <sup>-1</sup> as NO <sub>3</sub> <sup>-</sup>
<b>Chloride</b>	Any two consecutive decades of concentration between 2 and 5000mg <sup>l</sup> <sup>-1</sup> chloride

### Repeatability

±2% of reading

### Reproducibility

±3% of reading

### Response time

Less than 5 minutes for 90% step change

### Millivolt range

-400mV to +400mV

### Millivolt resolution

±0.1mV

### Control temperature range

30 to 45°C (86 to 113°F)

### Temperature resolution

±0.1°C (±0.2°F)

### Displays

<b>Concentration</b>	5-digit blue fluorescent
<b>Information</b>	20-character dot matrix blue fluorescent

### Status indication

- Two flashing LED's in alarm state
- Single LED lit when 'HOLD' switch operated
- Single LED lit when calibration is in progress
- Single LED lit when the monitor is 'Out of Service'

### Current outputs

As standard one isolated current output 0 to 1, 0 to 10, 0 to 20 or 4 to 20mA selectable via plug-in links  
 Optional 2<sup>nd</sup> current output  
 Maximum voltage load 15V

### Current output span

Any 1 to 2 decades of display range, logarithmic or linear

### Computer interface

Modbus via RS433/RS423 serial interface

### Alarms

- Two high or low concentration alarms
- Remote calibration mode indication
- Remote monitor 'Out of Service' indication, includes:
  - Loss of Mains Supply
  - Loss of Sample
  - Calibration Failed
  - Electronic Failure
- All voltage-free 250V 5A non-inductive changeover relay contacts

### Concentration alarm adjustment

Programmable over assigned range

### Concentration alarm differential

Programmable 0 to 5%

### Concentration alarm delay

Programmable 0 to 60 minutes

### Calibration

Fully automatic two-point, plus manual initiation on demand

### Routine maintenance

- Four-weekly: replenish reagents, clean flow system
- Twelve-monthly: replace plumbing, pump tubing and pump capstans

### Power supply

110 to 120V or 220 to 240V 50/60Hz 100VA

### Power supply tolerance

+6% to -10%

### Isolation voltage

Input, output and power supply 1.5kV

### Weight

Approximately 35kg (77lb)

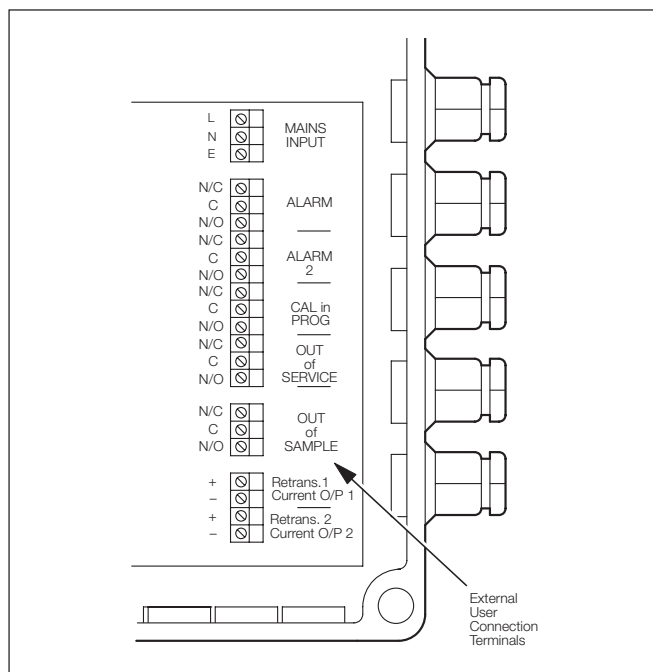
### Dimensions

Height	893mm (35.2 in.)
Width	541mm (21.3 in.)
Depth	207mm (8.2 in.)

### Degree of protection

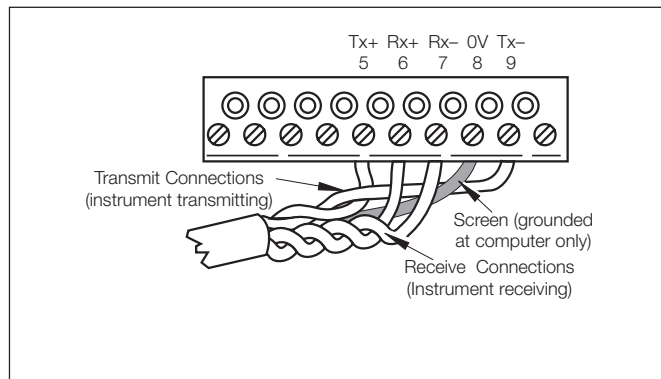
Electronics section	IP65
Liquid handling	Case IP31
	Critical internal components IP65

## Electrical Connections

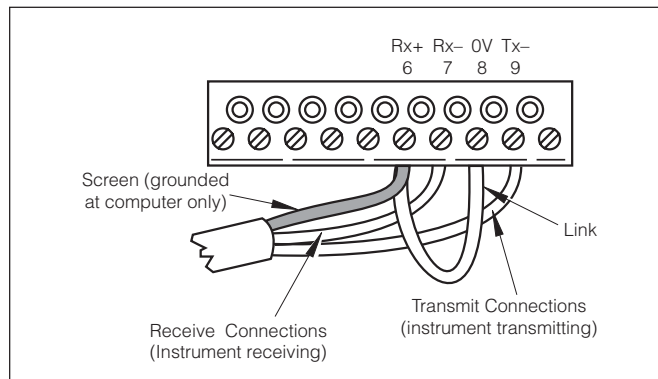


Standard Connections

**...Electrical Connections**



RS422 Connections within Microprocessor Unit



RS423 Connections within Microprocessor Unit

**Ordering Information**

<b>Series 8230 Monitors</b>	<b>823</b>	<b>X/</b>	<b>X</b>	<b>X</b>	<b>X</b>	<b>X</b>
<b>Parameter</b>						
Fluoride	1					
Ammonia	2					
Chloride*	5					
Nitrate	6					
<b>Outputs</b>						
4 to 20mA				0		
0 to 1mA				1		
0 to 10mA				2		
0 to 20mA				3		
<b>Supply Voltage</b>						
230V 50Hz					0	
230V 60Hz					1	
110V 50Hz					2	
110V 60Hz					3	
<b>No. of Outputs</b>						
One Current						1
Two Current						2
One Current + Serial communication						3
<b>Manual</b>						
English						0
German						1
French						2
Spanish						3
Special						9

\*English language only.

Supplied with Monitor:

- a) Instruction manual
- b) Consumable spares kit
- c) Reagent and calibration containers.

Each monitor as supplied is set up to suit the most frequently encountered requirement. This can be very simply reconfigured, if required, at commissioning.

Additional options (please specify):

- a) Second current output
- b) Serial interface.

**Note.** Only one of the above outputs can be fitted, not both.

**Installation Information**

The monitor must be installed where the following conditions can be maintained:

- Sample flow 5 to 1250mlmin<sup>-1</sup>
- Suspended solids <10mg<sup>-1</sup>, <5 microns
- Ambient temperature Normally within the range 5 to 40°C (14 to 109°F)
- Sample temperature Within 20°C (40°F) of the ambient temperature

**Reagent Solutions**

Consumption of each reagent is 10 litres (2 gallons) per month. General recommendations are as follows, though other reagents may be formulated to suit particular applications:

**8231 Fluoride Monitor**

- a) Sodium hexametaphosphate, sodium chloride and di-sodium EDTA

**8232 Ammonia Monitor**

- a) Sodium hydroxide
- b) Di-sodium EDTA

**8235 Chloride Monitor**

- a) Ammonium acetate +0.5mg<sup>-1</sup> acetic acid

**8236 Nitrate Monitor**

- a) Potassium di-hydrogen phosphate and di-sodium EDTA

**Calibration Solutions**

Two solutions, each of one litre (1.75 pints), are required of concentrations and formulations suitable for the particular range and application. Consumption of each solution is between 50 and 80ml per calibration cycle.

**Overall Dimensions**

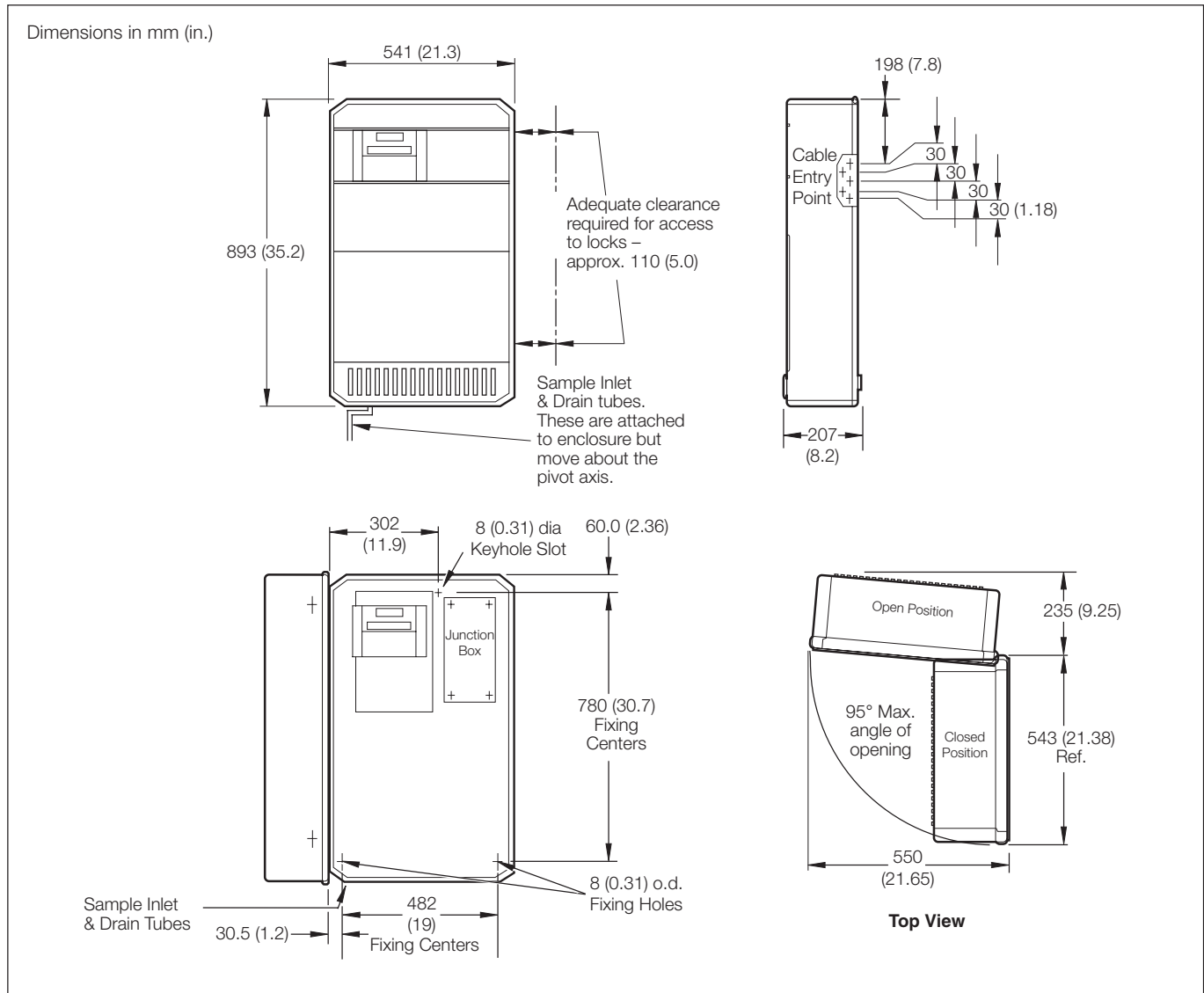


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