# Installation, Operation & Maintenance **Instructions**

## 9700 SERIES

Hydrostatic Level transmitter

## SAFETY INSTRUCTIONS

**Information** ...points out useful tips, recommendations and information for efficient and trouble-free operation.

**CAUTION!** ...indicates a potentially dangerous situation that can result in light injuries or damage to equipment or the environment, if not avoided.

**WARNING!** ...indicates a potentially dangerous situation that can result in serious injury or death, if not avoided.

**WARNING!** ...identifies hazards caused by electric power. Should the safety instructions not be observed, there is a risk of serious or fatal injury.

**WARNING!** ...indicates a potentially dangerous situation that can result in burns, caused by hot surfaces or liquids, if not avoided.

**WARNING!** ...indicates a potentially dangerous situation in the hazardous area that can result in serious injury or death, if not avoided.

**Ex applications**…special instructions for Ex applications.

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## Foreword

### Product overview

The 9700 Series range of tank level transmitters from Delta-Mobrey, is a loop powered level transmitter. It provide an accurate level measurement solution where in-tank problems such as foaming, vapor layers, and temperature gradients makes difficult the use of other instrumentation.

The series comprises 3 different model for measurement inside the tank and one for measurement outside the tank with different connections available, to meet the requirements of the installation:

**Models :**

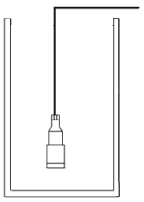
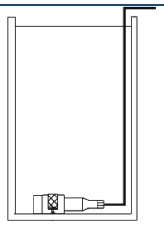
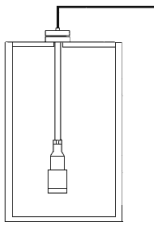
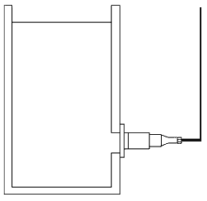
**9710, 9720, 9780** for installation INSIDE the tank

**Models:**

**9790** for installation OUTSIDE the tank

The transmitter is designed to withstand the harshest of environments.

Its rugged, flush ceramic sensor is inherently capable of withstanding attack from most chemicals.

| | | |
|---|---|---|
| **Inside the tank** | **9710** |  |
| | **9720** |  |
| | **9780** |  |
| **Outside the tank** | **9790** |  |

**Warning:** Units must be selected and installed by suitably trained and qualified personnel in accordance with appropriate codes of practice so that the possibility of failure resulting in injury or damage caused by misuse or misapplication is avoided.

**Warning:** Before installation **check** that the **characteristics** of the chemical seal comply with process and plant requirements

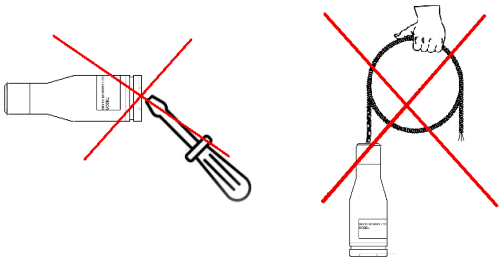
**Warning:** The user should ensure the equipment is suitable for use in the application with aggressive substances.

**Warning:** The users attention is drawn to the fact that, when the unit is 'live' with respect to electrical or pressure supplies, a hazard may exist if the unit is opened or dismantled.

**Warning:** Do not try to disassemble the cable nor the pole from the transmitter

**Warning:** Use appropriate tools for the installation or the device.

**Warning: Do not hang the instrument from the cable!**



## OPERATING PRINCIPLE

The instrument detects the pressure of the water column in contact with the sensor, corresponding to the level of the liquid.
The sensor is a Capacitive Sensor (CCS) that provides a "flush" diaphragm, avoiding the risks of sensor clogging. The sensor works like a capacitor with electrode surfaces on the inside comprising one measuring and one reference capacitor. A compensating tube provides the equilibrium with the atmospheric pressure.
The surfaces of the capacitors are gold-plated and linked to ASIC electronics. These electronics generate a signal proportional to the applied pressure, which is sent to the 4–20 mA signal conditioner .

## Specification

### Functional data

| 9710, 9720, 9780—Inside the tank | |
|---|---|
| **Output signal:** | Two-wire, 4-20mA |
| **Power supply:** | 10-30V d.c. |
| **Load resistance:** | R = 50 x (supply voltage -10V) Ω |
| **Measuring ranges & Overrange** | See table |
| **Process temp. limits:** | -20 to + 60°C / -4 to +140°F |
| **Ambient temp. limits:** | -20 to + 60°C |
| **Humidity limits:** | 0 to 100% RH |
| **Hazardous area use:** | CSA (Canada & USA) |
| **Cable specification:** | Capacitance 500 pF/meter<br>Refer to section 4 |

### Performance

| 9790—External to tank | |
|---|---|
| **Output signal:** | Two-wire, 4-20mA |
| **Power supply:** | 10-30V d.c. |
| **Load resistance:** | R = 50 x (supply voltage -10V) Ω |
| **Measuring ranges & Overrange** | See table |
| **Overrange limit:** | -20 to + 90°C (80 °C Ex ia) |
| **Process temp. limits:** | -20 to + 60°C |
| **Ambient temp. limits:** | 0 to 100% RH |
| **Humidity limits:** | CSA (Canada & USA) |
| **Hazardous area use:** | Capacitance 500 pF/meter |
| **Cable specification:** | Refer to section 4 |

* URL = Upper range limit
** BSL = Best straight line, includes effects of linearity, hysteresis & repeatability

| 9710, 9720, 9780, 9790 —Inside & outside tank | |
|---|---|
| **Accuracy:** | +/- 0.1% (BSL)** of calibrated span |
| **Stability:** | +/- 0.1% URL* per 6 months |
| **Temperature effect:** | +/- 0.015% URL per °C |
| **Response time:** | See Section 5.5 |

| Range & Overrange Limits | Code | Pmax in psi (*ft H20 / mH20*) |
|---|---|---|
| 0 to 6.5 ft. (0 to 2 m) H20 depth | **A** | **14.2** (*32 / 10*) |
| 0 to 16.4 ft. (0 to 5 m) H20 depth | **B** | **35.6** (*82 / 25*) |
| 0 to 32.8 ft. (0 to 10 m) H20 depth | **C** | **71.1** (*164 / 50*) |
| 0 to 65.6 ft. (0 to 20 m) H20 depth | **D** | **142.3** (*328 / 100*) |
| 0 to 164 ft. (0 to 50 m) H20 depth | **E** | **142.3** (*328 / 100*) |
| 0 to 328 ft. (0 to 100 m) H20 depth | **F** | **142.3** (*328 / 100*) |
| 0 to 3.3 ft. (0 to 1 m) H20 depth | **G** | **7.1** (*16.4 / 5*) |
| 0 to 11.5 ft. (0 to 3.5 m) H20 depth | **H** | **24.9** (*57.4 / 17.5*) |

### Mechanical

| 9710, 9720, 9780—Inside the tank | |
|---|---|
| **Process connection:** | Submersible |
| **Wetted Parts:** | |
| **- Sensor:** | Ceramic |
| **- Sensor Housing:** | 316 St. Steel or Aluminium Bronze |
| **- Sensor 'O' Rings:** | Fluorocarbon (FPM/FKM) Nitrile |
| **Body 'O' Rings** | Fluorocarbon (FPM/FKM) or Nitrile |
| **Cable Seals** | Fluorocarbon (FPM/FKM) or Nitrile |
| **Cable:** | Polyurethane or FEP coated |
| **Pole:** | 316 Stainless steel pole supplied with 316 Stainless steel housing option. Copper Nickel pole supplied Aluminium Bronze Housing option |
| **Remote enclosure** | Polyester IP67 Grey (RAL 7001) |
| **Ingress Protection:** | IP68 / NEMA 6P<br>(200m / 656ft H20) |
| **Approximate weight:** | 0.7Kg / 1.54lbs (sensor only)<br>1.2kg (remote enclosure) |

| 9790—External to tank | |
|---|---|
| **Process connection:** | Submersible |
| **Wetted Parts:** | |
| **- Sensor:** | Ceramic |
| **- Sensor Housing:** | 316 St. Steel or Aluminium Bronze |
| **- Sensor 'O' Rings:** | Fluorocarbon (FPM/FKM) Nitrile |
| **Body 'O' Rings** | Fluorocarbon (FPM/FKM) or Nitrile |
| **Cable Seals** | Fluorocarbon (FPM/FKM) or Nitrile |
| **Cable:** | Polyurethane or FEP coated |
| **Remote enclosure** | Polyester IP67 Grey (RAL 7001) |
| **Ingress Protection:** | IP68 / NEMA 6P<br>(200m / 656ft H20) |
| **Approximate weight:** | 0.7Kg / 1.54lbs (sensor only)<br>1.2kg (remote enclosure) |

## INSTALLATION

### Safety notice

**Warning**: installation should be carried out by qualified personnel in safe condition.

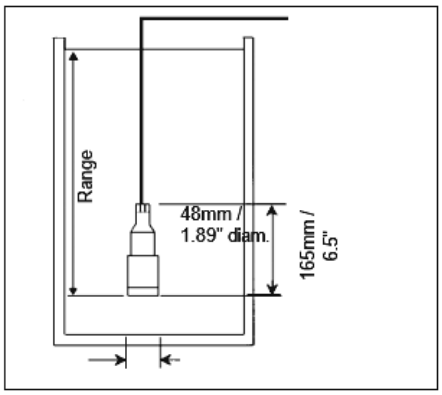
**Warning:** The protection of the diaphragm used for flush diaphragm type seals, should not be removed until the instrument is going to be installed.

**Warning:** The instrument must not be subjected to any external loading (e.g. uses a climbing aid, depositing of objects, reaction forces through pipelines (torsion and bending).

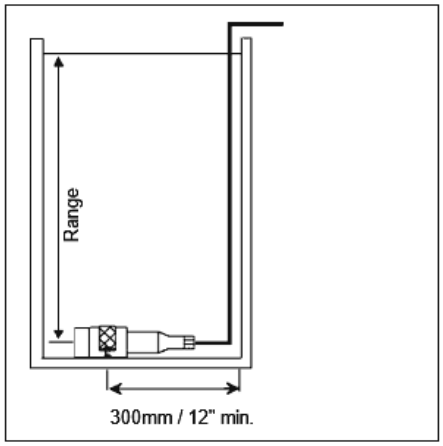
The 9700 is available in both submersible versions and externally mounted (floodable) versions.
The housing contains the capacitive ceramic sensor and the electronics circuit board, all the components needed to produce an accurate and reliable measurement of the process. The glanding system used with the submersible versions ensures absolute integrity of the IP68
/ NEMA 6P rating. IP68 / NEMA 6P units are generally factory fitted with the required length of vented cable fitted

Before planning the installation, the below dimensions must be considered for each model:

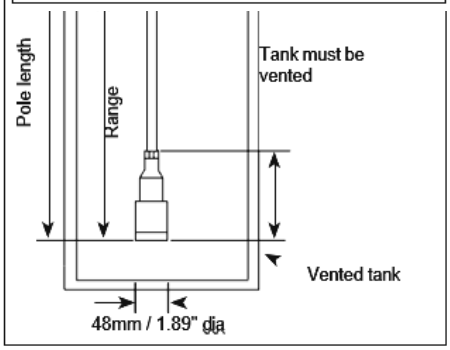
**9710**



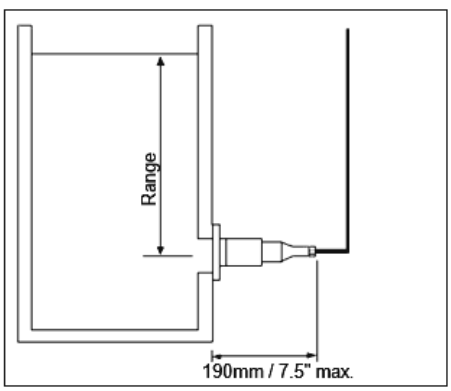

**9720**




**9780**

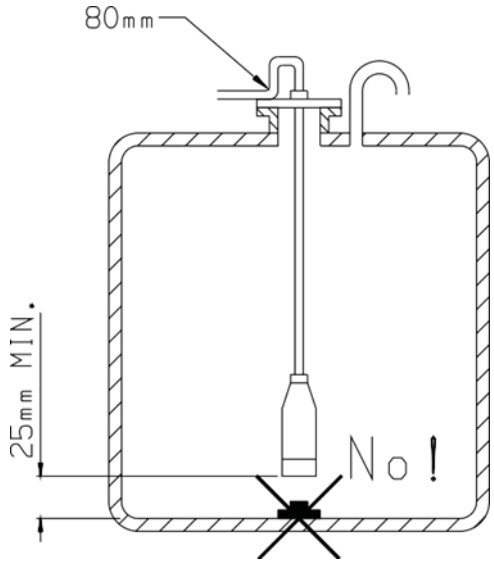



**9790**




**Warning:** When installed in an explosive atmosphere refer to the CSA control drawing 71907/1167 as shown in successive page.

The ceramic capacitive sensor is extremely rugged, however, care should be taken to avoid physical impact of solid objects onto the sensor face. Care should be taken, particularly in the case of series 9710, 9720 and 9780 submersible transmitters when lowering them into a tank, that solid objects resting on the bottom of the vessel are not in direct contact with sensor face, as this will cause large errors




The use of Aluminium Bronze sensors is strongly recommended for application on any tanks that may contain seawater or brine to avoid the corrosive effects that may be caused by stray currents. Always check that the sensor being fitted is of the correct material for the application.
All 9700 units should be installed well away from tank inlets, pumps and areas of turbulence or pressure surges, as these can cause errors or even damage the sensor.

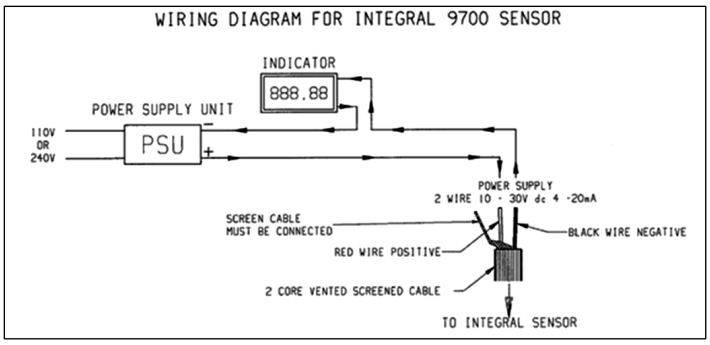
9710 units may be suspended from the cable provided. However, in moving tanks, such as found in Marine applications, the sensor should be clamped or fixed such that damage from impacts or shock are avoided.

9790 flanged units: Ensure flange bolts are tightened evenly and that mA o/p is stable and correct prior to use.

## Wiring

Submersible 9700 units are supplied fitted with a specified length of vented cable to be terminated in a vented box.
For connection diagrams see below :

- **Black** wire = negative
- **Red** wire = positive
- **Screen** cable must be connected



For applications where a long cable run is required when using integral transmitters, the use of a vented terminal box to be mounted in the nearest clean and dry area to the tank, and standard 2 core screened cable from the terminal box can often reduce cabling costs.
Terminate the cable screen to an appropriate earth point. This connection should be inspected periodically to ensure an effective contact.
In excessively humid environments and all shipboard applications, the cable must be terminated in the control room, or other clean and dry area, to minimise risk of moisture entering vent tube and ultimately the sensor.
Alternatively the cable should be terminated into the bellows box option which provides a sealed venting system.
Ensure all cable glands are tight before use

**Warning:** DO NOT drag the sensor over sharp edges.

**Warning:** DO NOT swing the sensor by the cable.

**Warning:** DO NOT bend the cable to a radius of less than 80mm radius.

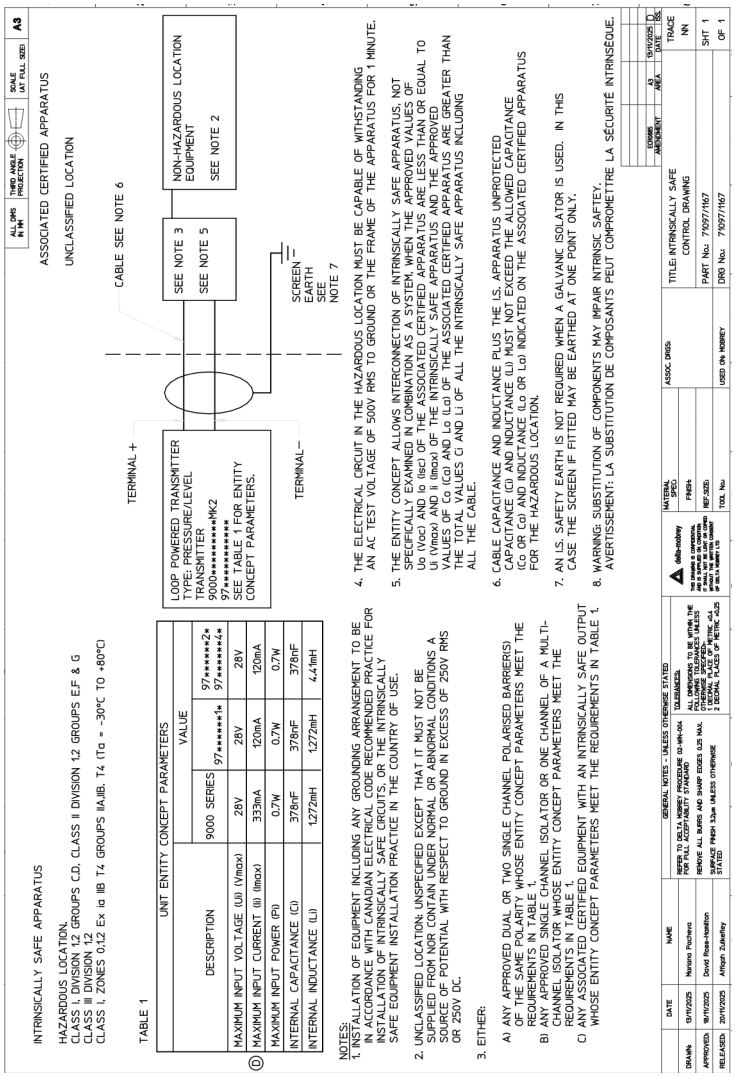
**Warning:** DO check cable sheathing for signs of damage (cuts, weld spatter, burns etc.) particularly inside the tank area. Damage to the sheathing will allow process fluid to leak inside the transmitter.

## Replacement parts & Maintenance

Other than periodic inspection to ensure satisfactory operation & sealing, no routine maintenance is necessary.
All transmitters are factory calibrated over the range stated on the label on the transmitter.
Re-ranging of the transmitter is not possible and will require breaking of the factory seals.
If re-ranging is required, would be better it is carried out elsewhere, in the 4 - 20mA loop (e.g. the indicator, PLC or controller
For Series 9710, 9720, 9780, 9790 repairs are only possible by returning to the factory.

## CSA control drawing

**Warning:** When installed in an explosive atmosphere refer to the CSA control drawing 71097/1167 in Section 7.




## Fault finding

For Series 9710, 9720, 9780, 9790 repairs are only possible by returning to the factory.

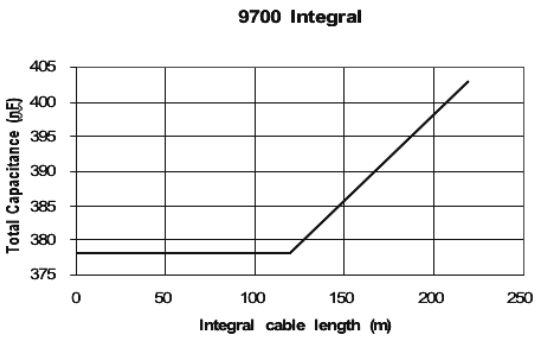
| FAULT | CAUSE | REMEDY |
|---|---|---|
| High mA output<br>No Change in out-put with pressure change | **Lightning**  | Return to factory to fit new main circuit board and recalibration |
| Fluctuating output<br>Steady output signal approx. 4mA and no change in output with pressure change | **Moisture Condensation**  | Remove the trans-mitter to a dry area and allow it to fully dry out |
| High mA output (Voltage output sensor) approx. >10mA<br>No Change in out-put with pressure change | **Damaged Sensor**  | Return to factory. Replace sensor |

## Integral Cable length for I.S. circuits

In calculating the permissible capacitance for an intrinsically safe system, the cable supplied with the equipment must be taken into consideration

Integral electronics:
For L ≤ 120m, C = 378nF
For L > 120m, C = 378 + 0.25(L - 120) nF
(L = length of integral cable in meters)

The value of Ci (378nF) must be increased by 0.25nF for each meter of integral cable fitted above 120m



## Storage

If the devices are not required for immediate use then they should be stored in their original packaging and end protectors should not be removed. Storage should be off the ground in a clean, dry, indoor area. If storage period exceed 12 months then items should be accurately inspected prior to installation.

## Decommissioning

**Warning:** Do not dispose of the process fluid into the environment if this causes pollution or personal injury.

- Isolate the instrument from the process.
- Disconnect the instrument from the process connection.
- Dismount the assembly and dispose

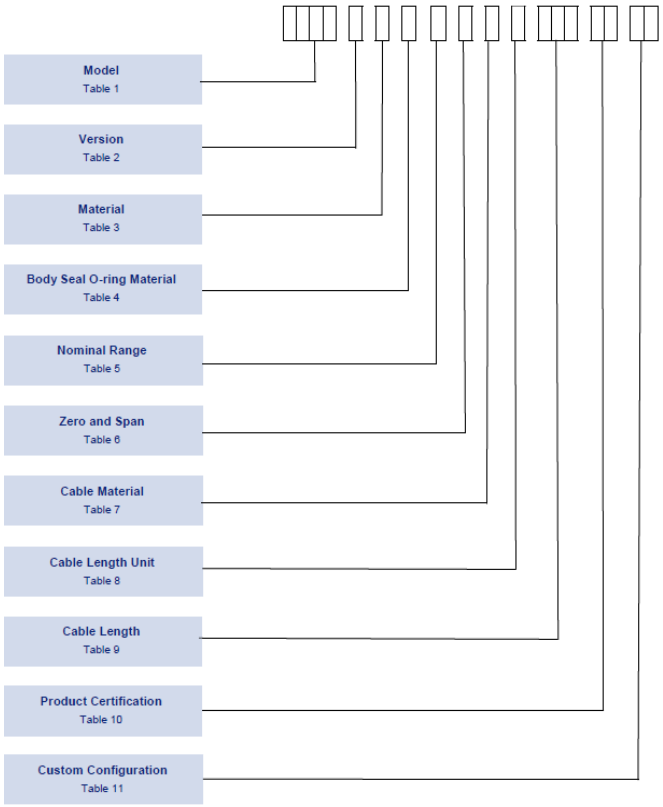
-**Warning:** The process fluid can be hot and or corrosive. Plug the process pipe.

## Disposal

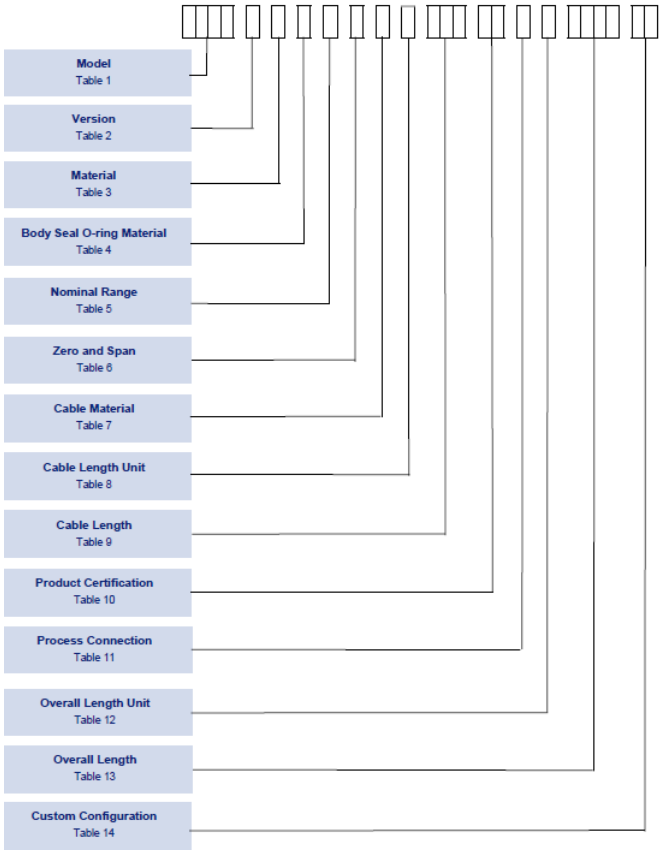
These parts are mainly made of stainless steel or other metallic material.
Clean the wetted parts before scrapping the instrument.

## Product identification

**Model 9710 / 9720**



**Model 9780**




**Model 9790**