SERVOMEX

AquaXact 1688 Dew Point Transmitter

Operator Manual

IMPORTANT INFORMATION

Continued safe and reliable operation of this equipment is conditional on all installation, operation and maintenance procedures being carried out in accordance with the appropriate manuals, by personnel having appropriate qualifications, experience and training. Failure to observe the requirements of the manual may result in the user being held responsible for the consequences and may invalidate any warranty. Servomex accepts no liability for unauthorised modifications to Servomex supplied equipment.

Servomex has paid particular attention to Health and Safety throughout this manual. Where special precautions need to be taken due to the nature of the equipment or product, an appropriate safety icon and warning message is shown. Special attention should be made to section 3 – Safety, where all such messages are summarized.

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The customer agrees that in accepting and using this instrument Servomex's liability arising from or in any way connected with this instrument shall be limited exclusively to performing a new calibration or replacement or repair of the instrument or sensor, at Servomex's sole option, as covered by Servomex's warranty. In no event shall Servomex be liable for any incidental, consequential or special damages of any kind or nature whatsoever, including but not limited to lost profits arising from or in any way connected with this instrument or items hereunder, whether alleged to arise from breach of contract, express or implied warranty, or in tort, including without limitation, negligence, failure to warn or strict liability.

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Contents

1 Introduction

1.1 About this manual

1.1.1 Scope of the manual

This manual covers the installation, operation and routine maintenance of the AquaXact 1688 Dew Point Transmitter. It is intended for those already familiar with the installation, use and maintenance of analytical or process instrumentation.

1.1.2 Safety information

Read this manual and make sure you fully understand its contents before you attempt to install, use or maintain the device.

The following icons are used throughout this manual to identify any potential hazards that could cause serious injury to people. Always follow the safety instructions and be aware of the hazard.

This symbol warns of specific hazards which, if not taken into account, may result in personal injury or death.

This symbol warns of specific hazards due to high voltages which, if not taken into account, may result in personal injury or death.

This symbol warns of specific hazards due to high temperatures which, if not taken into account, may result in personal injury or death.

This symbol warns of specific hazards due to hazardous substances which, if not taken into account, may result in personal injury or death.

This symbol warns of specific hazards due to caustic or corrosive substances which, if not taken into account, may result in personal injury or death.

This symbol highlights where you must take special care to ensure the equipment or property is not damaged.

1.1.3 Other information provided by the manual

Note: Notes give extra information about the equipment.

> ***Hint:*** *Hints give helpful tips and highlights information which is useful for you to be aware of, for example, specific operating conditions.*

1.2 Product overview

The basic AquaXact 1688 dew point transmitter is a microprocessor based 4-20 mA loop-powered hygrometer designed to measure moisture content in gases in a wide range from -100 °C to +20 °C dew point in gases.

The measurement is transmitted by varying the current drawn (4-20 mA) from the power supply, where the current varies in a proportional manner to the selected measurement units.

In addition to the 4-20mA transmission a digital output can be used in conjunction with a Servomex 1688 controller or MonoExact DF310E analyzer. Thus the AquaXact 1688 is capable of communicating with properly equipped external computers or DCS systems as well as the proprietary Servomex controllers. The AquaXact controller also allows field span measurements and supports the field based sensor tip replacement process (Appendix E). The AquaXact 1688's advanced design allows it to be housed in a small stainless steel enclosure behind the sensor probe making the transmitter and sensor a single integrated unit.

The AquaXact 1688 uses the Servomex thin film Al_2O_3 technology sensor which is encapsulated in sintered stainless steel making it compatible with a wide variety of environments.

The sensor is a sensitive device and it should be handled accordingly.

1.3 Product identification

Figure 1-1: The AquaXact 1688 Dew Point Transmitter

1.4 Ordering options

For the latest ordering options please contact your local Servomex agent or visit www.servomex.com.

2 Unpacking

Read this manual carefully BEFORE you remove the AquaXact 1688 Dew Point Transmitter from its box, or you attempt to install, commission or use the equipment.

1. Examine the AquaXact package for damage or mishandling. If any damage is evident notify the carrier and request an inspection.
2. Unpack the box. It should contain:
   - Transmitter and sensor in desiccant container. The transmitter should be stored in the desiccant container when not in use.
   - Mating connector.
3. A USB memory stick with calibration files and an Adobe Acrobat file of this manual. Check that you have received all of the items that you ordered. If any item is missing, contact Servomex or your local Servomex agent immediately.
4. Inspect the items supplied, and check that they are not damaged. If any item is damaged, contact Servomex or your local Servomex agent immediately.
5. Read section 3 – Safety before proceeding further.

> ***Hint:*** *Keep the shipping documentation and packaging for future use, for example when moving the equipment, or returning it for service or repair.*

3 Safety

The Servomex thin film Al_2O_3 sensor is designed and field proven to be highly reliable, rugged and maintenance free. However the user should be aware of the following precautions:

3.1 Installation

To avoid prolonged dry-down (when expecting to measure dew points drier than -65 ºC), do not expose the sensor to room air longer than 1 - 2 minutes.

Do not open the desiccated sensor container before you are ready to install the sensor.

The sensor container has desiccant to keep the sensor dry during shipping and to avoid damage due to condensation. Close the container using the attached red plug immediately after removing the sensor to avoid degradation of the desiccant.

Do not throw away the sensor container. You may use it again to transport the sensor between locations, to store it between uses or to ship it back to the factory for certification. The container can be attached to the loop cable, by trapping the cable with the lid strap.

Do not expose the sensor to corrosive gases or liquids such as ones containing Chlorine, Ammonia or HCl. Cyanide, Br2, I2, NH3 and HNO3 may harm the gold layer of the sensor and limit the sensor life.

Do not expose the sensor to liquid water, as it may get damaged.

Do not breathe directly onto the sensor, as condensation may form which could damage the sensor element.

Do not install the sensor near high heat sources such as radiators or air ducts.

Do not install the sensor in places subject to extreme mechanical vibration or shock.

Do not disassemble the porous metal filter encapsulation. This will damage the sensor and void your factory warranty.

Before you install the probe, make sure that no contaminants are present in the system (e.g. oil, liquid water).

3.2 Operation

The AquaXact 1688 uses state-of-the-art microelectronics to provide a miniature full functioning transmitter. The user should consider the following precautions when using any sensitive electronic device:

Do not install the unit near heat sources such as radiators or air ducts.

Do not install the unit in places subject to extreme mechanical vibration or shock.

Observe the appropriate electrical safety codes and regulations.

3.3 Electromagnetic compatibility considerations

The AquaXact 1688 has been designed and verified by testing to meet the requirements of the EU EMC Directive 2014/30/EU, for Industrial, Scientific & Medical equipment. The sensor and the 4-20 mA loop are electrically connected, however they are isolated from the AquaXact 1688 housing and sample cell fitting threads. Please consider the following electromagnetic interference issues during installation:

- In order to provide an acceptable noise environment for the AquaXact 1688 or any other digital equipment in the proximity of switching inductive loads, it is recommended that there be varistors placed across the inductors to keep down the high voltage spikes during transitions.
- AC power wiring should be routed as far away from the AquaXact 1688 and its wiring as practical.

4 Installation

Do not attempt to install, commission, maintain or use the AquaXact 1688 Dew Point Transmitter unless you are trained and know what you are doing.

Follow the instructions in this section to safely install the AquaXact 1688 Dew Point Transmitter.

Do not install the unit in places subject to extreme mechanical vibration or shock. If you do, sample measurements may not be accurate and the transmitter may be damaged.

4.1 Sensor installation

The moisture content at the sensor is not only due to the moisture of the gas being measured, but is also due to desorption of water from tubing, trapped moisture (at the interconnection points, valves, filters and other hygroscopic materials in the system), leaks in the system and others. As a result the measurement may vary from what is expected and care should be taken in choosing the sampling approach utilized in the measurement. Factors such as gas pressure, flow rate, materials of construction, length and diameter of tubing, number of interconnecting fittings, dead space in tubing and manifolds will influence the observed measurement value and response time.

The high-capacitance thin-film sensor can be installed either directly in the line to be sampled (in-situ), or in a slip stream of a sample system (extractive). To assure a long and accurate performance of the sensor, it should be protected from contaminants such as liquids (water, oil etc.), and particulates. The sintered stainless steel sensor encapsulation protects from particulates larger than 100 microns, finer particulates (e.g. from degraded desiccant or rust) should be filtered with a particulate filter with suitable capability, do not use hygroscopic filter materials.

4.1.1 In-situ installation

In-situ installation is recommended only for measurements where the gas pressure is expected to be constant, the gas is expected to be free of contaminants, the gas temperature is within the operating specifications of the sensor and there is no chance of liquids coalescing. Examples of applications suited for in-situ installations are pure gases or output of desiccant dryers (for instrument air), glove boxes, etc. For most other applications in-situ installation should be avoided for the following reasons:

- Sample conditioning is almost always necessary to avoid exposure of the sensor to liquid water and other contaminants, such as hydrocarbons, which may damage the sensor or affect accuracy over time.
- If the gas line is under pressure, it is more likely that water condensation occurs which may damage the sensor.

- Under a pressurized system removal of the sensor without the installation of isolation valves can be dangerous. If in-situ installation is required, bypass mounting is preferable. If in-line installation is required, make sure to install the sensor at the upper surface of the gas line to minimize its exposure to liquid water should condensation occur. Also consider the need to isolate (depressurize) before installing or removing the sensor.
- Variations in line pressure affect the reading of the sensor because dew point varies with pressure.

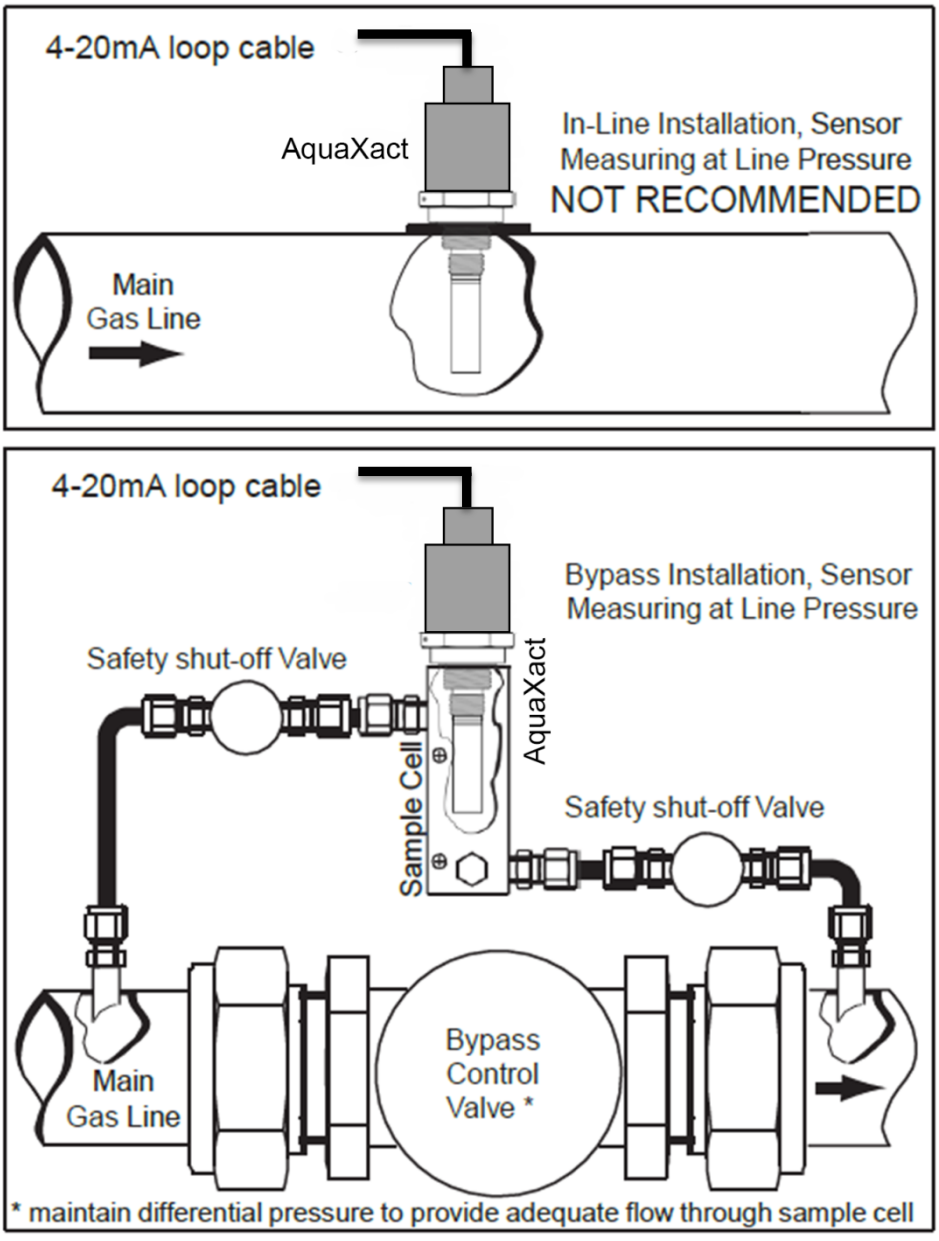


Figure 4-1: In-situ installation

4.1.2 Extractive installation

For extractive installations we recommend our sample handling systems, which may be equipped with a variety of features, such as isolation valve, particulate filter, pressure regulator, calibration sample injection or extraction port, pressure gauge, flow meter. Contact your local Servomex sales office for more information on sampling system options

It is generally recommended to measure at ambient pressure for the following reasons:

- The readings will not be affected by variations in line pressure.
- The risk of exposing the sensor to liquid water is significantly reduced.

If the resources to make your own sample system are available Figure 4-2 can be used as a guideline to configure a sampling system.

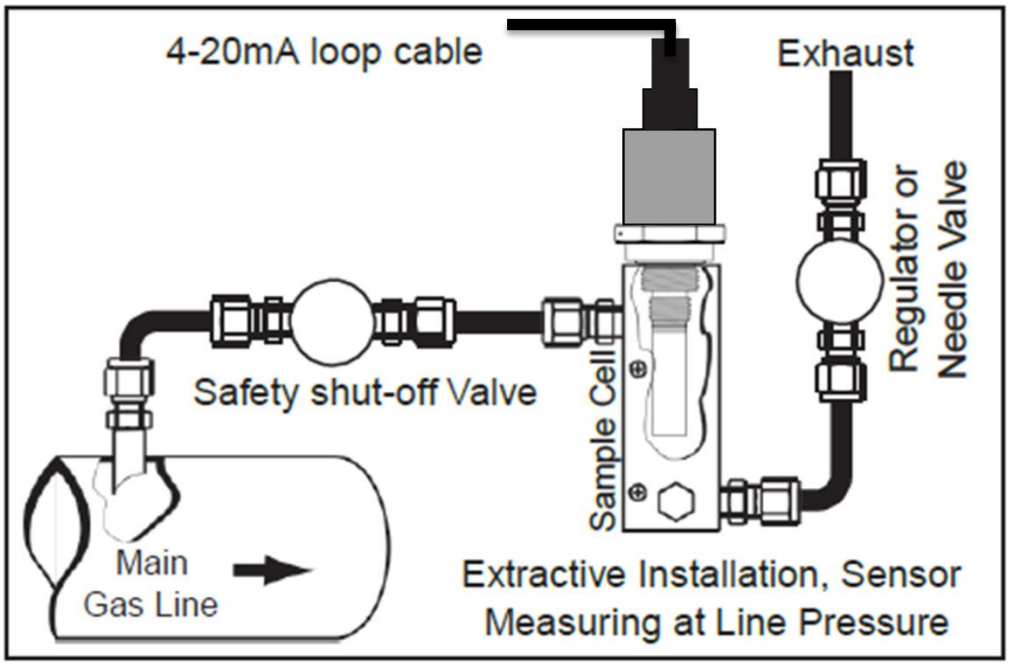


Figure 4-2: Extractive installation

The transmitter is programmed to send ppm readings (if that engineering unit is specified via purchase order or set through the digital controller) that are computed for a pressure of one atmosphere (1 bar); and have to be corrected using a pressure compensation calculation if the sensor is measuring at different pressures. The programmed process pressure can adjusted using the digital controller if equipped.

Make sure that:

- The sample is taken from the upper surface of the main gas line. This avoids problems with contamination. The sample should be taken away from pipe line walls where flow rates may be low, and dew point changes may lag.
- For dew points dryer than -40 °C , use stainless steel tubing only. Copper tubing is acceptable for dew points wetter than -40 °C. Never use plastic, rubber tubing under

any circumstances, as measurements would be incorrect and/or response time slow due to water retention inside these materials.

- Try to run pipes to the sensor upwards, so that contaminants tend to fall back into the main line.
- Keep the length of the sample line to the sensor as short as possible.
- Use small diameter pipes (1/4” or 1/8” OD).
- Use sufficient flow rates (e.g. 2-15 liter/min with 6 feet of 1/8” piping is recommended). The flow rate will influence the systems response time.
- Do not install any devices upstream of the sensor, such as other measuring systems, flow meters etc., which are not absolutely necessary as these are potential leak sources.
- Install a coalescing and / or particulate filter ahead of the sensor to prevent any liquid or particulate contamination of the sensor.
- If filters are used upstream of the sensor, make sure these only contain non-hygroscopic filter materials.
- If pressure regulators, shut-off valves etc. are used upstream of the sensor, make sure they do not contain rubber or other hygroscopic materials.

4.2 Mechanical installation

Various adapters are available for direct connection into existing dew point transmitter openings. Ask your representative for a sample block cell, if you do not have the ability to provide an appropriate sample cavity mounting. If the 14 mm x 1.25 mm thread is used then the AquaXact will seal against the wall of the sample cell with the provided Viton A O-ring. The AquaXact is light enough such that the standard thread will mechanically support the whole transmitter. To prevent any leaks, tighten the transmitter into the sample cavity, with a 1½ “wrench, 1/8 turn past finger-tight to assure metal-to-metal contact, do not exceed 15 foot-pounds.

The sensor tip can be removed from the transmitter by unscrewing it (Figure 4-3). Make sure that the sensor is securely fastened to the transmitter (the tension washer should be compressed), so that it does not come loose during use, do not over-tighten because the sintered material will break.

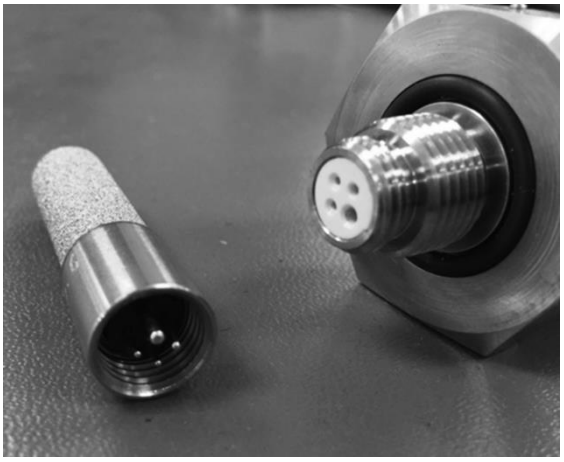


Figure 4-3: Mechanical installation – remove sensor tip

4.3 Electrical installation

The AquaXact 1688 will operate properly with 13 Vdc minimum to 33 Vdc maximum at its input, if this voltage is exceeded the internal fuse may open, this fuse will self-reset after a cool down time. When selecting the power supply voltage do not neglect the voltage drop across any current measurement resistor and wiring in the loop. The keyed connector is an industrial standard 9.4 mm, 7-pin connector, IP65 NEMA 4X (Figure 4-4). Do not force the connector. When the connector engages, secure it with the retention screw.

The AquaXact 1688 will draw 4 mA to 20 mA from the power supply depending on the dew point being measured. The dew points corresponding to 4 mA and 20 mA are the full -100 °C to 20 °C range. The range is user selectable via the Servomex digital controller. In between 4 mA and 20 mA, the current varies linearly with dew point. There are two custom ppm ranges that can be ordered namely 0-100 ppm and 0-1,000 ppm.

Please observe good electrical safety and grounding practices when connecting any electrical equipment; connecting one end (e.g. negative) of the power supply to earth ground is advisable.

VIEW FROM CONNECTOR REAR
(SOLDER CUPS)

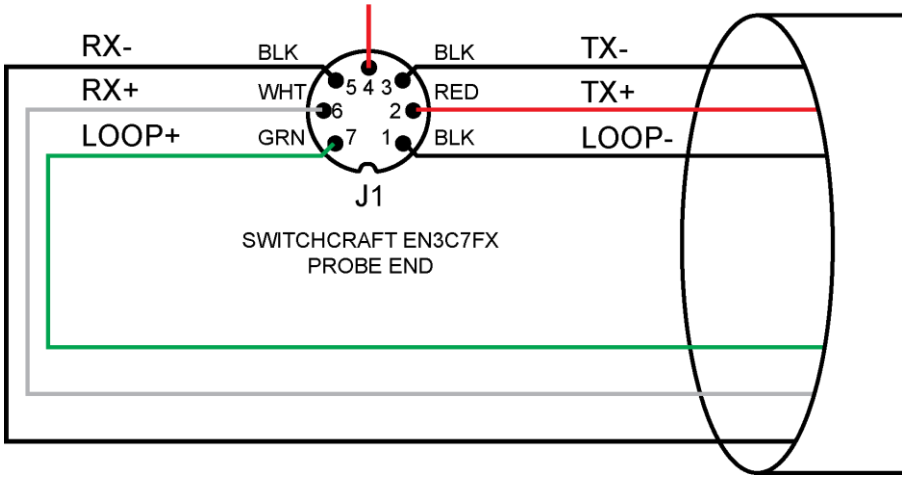


Figure 4-4: Electrical installation – connector and connections

5 Operation

5.1 Starting up

It is advisable to carry out an initial purge of the sample loop before installing the transmitter in order to eliminate the possibility of damage on startup.

Before the transmitter is installed into the sample block open the inlet isolation valve slowly until a small flow of process gas flows though the transmitter block and exhausts through the transmitter block outlet transmitter opening.

Allow the purge to continue for about 20 minutes to remove residual moisture from the sampling pipework. Close the inlet isolation valve and install the transmitter into the sampling block. Connect the cable and secure it using the retaining ring.

Note: The plugs and sockets only locate in one position because the pins are of different sizes in the tip, and the main connector is keyed.

Open the inlet slowly and allow a low pressure purge through the whole system. Set the required pressure flow within the sample loop.

The instrument is ready for use as soon as the power cable is installed. When power is applied the instrument will initialize its program.

Once completed and powered, the device is on line but gas sample lines could take several hours to clean up and reach equilibrium.

6 Technical specification

The protection, accuracy, operation and condition of the equipment may be impaired if the device is not installed in accordance with the requirements of this and other sections of the manual.

6.1 Instrument

Dimensions:	*Includes sensor and connector* *Diameter x length* 31.5 x 136 mm 1.24 x 5.36 inches
Mass:	175 grams
Enclosure:	Stainless steel
Operating temperature:	-22 to +158 °F (-30 to +70 °C)
Mechanical connections:	5/8”-18 threads. Adapters for other threads are available.
Electrical connections:	Industrial Standard 9.4mm 7-pin connector IP65
Cable:	The digital seven conductor cable or the two conductor 4-20mA cable must be shielded to meet CE requirements; for ambient temperatures above 60 °C make sure that wiring temperature rating exceeds the maximum expected ambient temperature.
Maximum digital cable length:	200 metres.
Power requirements:	13 Vdc (min) to 33 Vdc (max), the instrument draws 4 - 20mA depending on measured dew point
Input resolution:	0.1 ºC dew point
Engineering units:	Factory programmed: • °C dew point • °F dew point • ppmV
Controls:	Digital RS485 with AquaXact Controller
Outputs:	Analog and digital outputs are available: • 4-20 mA drawn by the instrument from the

power supply. The 4-20 mA is linear to the engineering units, the range is programmable. Output resolution is 0.1 °C dew point or ~0.25 µA whichever is greater.

- In the digital mode the AquaXact 1688 can be remotely operated, the dew point & temperature can be read.

Alarms: The 4-20 mA signal or the digital output may be used by an external device to operate relays.

Isolation: The sensor is connected to the current loop but, isolated from the AquaXact 1688 housing and installation

6.2 Sensor

Type: Thin film high capacitance Al_2O_3

Dew point range: -100 °C to +20 °C

Accuracy: ± 3 °C

Repeatability: ± 0.5 °C

Typical Response time: See the graph in Appendix E

Temperature range: -10 °C to +70 °C

Sample pressure range: 0 to 100 psig

Sample flow range: 2 to 15 l/min

Storage temperature: -40 °C to +80 °C

Mechanical: Encapsulated in 100µ sintered stainless steel

Calibration method: NIST/NPL traceable multi-point factory calibration

6.3 Approvals / classifications

CE: CE for electromagnetic compatibility, accredited laboratory tested and certified.

7 Routine maintenance

The AquaXact 1688 Dew Point Transmitter does not contain any user serviceable parts.

Do not attempt to maintain or service the AquaXact 1688 Dew Point Transmitter unless you are trained and know what you are doing. The transmitter must be maintained by a factory-trained field service engineer.

Sample and calibration gases may be toxic or asphyxiant.

Never inspect the inlet filter(s), or service or repair the transmitter while such gases are still connected to it.

If the transmitter is to be serviced or repaired it is important that all pipework is flushed with an inert gas and the transmitter is allowed to freely vent to local atmosphere.

Do not store replacement tips for more than 12 months before use to assure the calibration is still valid.

7.1 Preventative maintenance

To minimize unscheduled instrument downtime, ensure the proper operation of the AquaXact and to comply with the guidelines of applicable regulatory bodies, we recommend that you utilize an annual preventative maintenance program for your transmitter.

The preventative maintenance program consists of an annual inspection of the AquaXact, and repair of any faults. To ensure that the AquaXact meets its original factory specification we recommend that the sensor tip be replaced every year. This can be accomplished by the user if equipped with a digital controller.

Contact Servomex or your local Servomex agent to arrange for a preventative maintenance contract.

8 Troubleshooting

8.1 Instrument

This instrument performs diagnostic tests on power up as well as once every three seconds. The following table lists possible error/unexpected indications that may occur.

Symptom (more than 25 seconds after power up)		Possible cause	Remedy
Current loop	**Pin 3**		
Fixed at 21 mA		1. Failed Device 2. Open sensor 3. Shorted sensor	Check sensor & cycle power, if problem persists return instrument
4 to 20 mA		Normal operation	
0 mA	High impedance	1. Cable open 2. Fuse open due to excessive voltage	1. Check cables 2. Check power 13 to 33 Vdc Check source polarity pin 7 +; Pin 1 – 3. Cycle power

8.2 Sensor

To troubleshoot unexpected readings from the sensor, identify the unexpected reading category in the following table, and consider the possible causes and appropriate diagnostic action and remedy.

Symptom	Possible cause
Reading is not changing	Condensation in sample system
Slow response	1. Water vapor in the system
	2. Flow rate too low
	3. Sample pipe too large and/or too long
	4. Unsuitable sample pipe material
	5. Leaks
	6. Hygroscopic materials in sample system
Dry reading	Faulty sensor
Wet reading	Leak in system or use of unsuitable pipe.
	Comparison of readings with manual cooled-mirror instrument.
Current loop outside of 4-20mA range	1. Prolonged exposure to wet gas
	2. Instrument failure
	3. Short circuited sensor
	4. Open circuit on sensor
	5. Instrument failure
Reading is not changing	Condensation will occur if the temperature of the sample system, at any point is below (colder) the dew point temperature of the sample gas. Once having formed, the sample reaching the sensor will have a dew point equal to the temperature of the condensation, regardless of the dew point of the sample at the sample point.
Slow Response	It is usually more satisfactory to bleed a sample gas at atmospheric pressure through the sensor sampling chamber, and to use 1/8” (3 mm) o.d. sample pipe.

Dry Reading	Return sensor for full calibration to your representative.
Wet Reading	Cure the leak, or replace unsuitable pipe with copper or stainless steel. Flexible connections should be made with PTFE pipe. NEVER use rubber or plastic pipe.
	Dry the sensor, install sensor in either a known dry gas stream i.e. instrument quality air or dry nitrogen, or place sensor in a dry can or bottle of desiccant and seal the container from outside air (the shipping container is designed for this purpose).
	Remove (unscrew) sensor, if the current does not change even momentarily, then the problem is with the instrument, otherwise the problem may be with the sensor.
	Check sensor connection or replace sensor.

9 Storage and disposal

9.1 Storage

All Servomex AquaXact 1688 Al_2O_3 sensors and replacement tips are shipped in glass storage bottles in order to maintain sensor integrity. The storage bottle is partially filled with a desiccant to keep the sensor dry and ready for use.

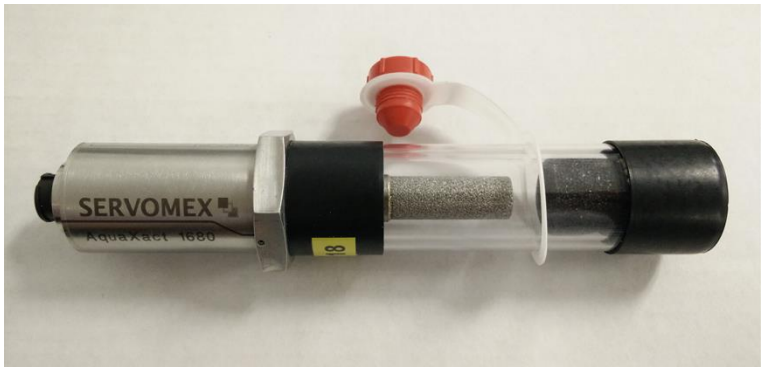


Figure 9-1: AquaXact 1688 Al_2O_3 sensor glass storage bottle

The storage bottle can be used for long term storage provided the correct procedures are followed.

The AquaXact ultra-thin film sensor technology is based on the ability of the sensor to react to changes in the partial water-vapor pressure in the surrounding gas stream. In a constant moisture level environment, the rate of absorption and desorption of water molecules reaches equilibrium with the surrounding gas stream based on the partial water vapor pressure in the gas environment. Once equilibrium is achieved, the change in the dielectric strength of the aluminum oxide layer based on the amount of water present in the layer is accurately sensed as a change in capacitance of the sensor. The ability to absorb and desorb water molecules in the aluminum oxide layer is based on a certain level of water molecules being present in different chemical structures within the aluminum oxide which act as receptor sites.

Because the desiccant in the storage bottle continues to absorb moisture as long as the sensor remains sealed in the bottle the sensor can dry down to extremely low levels. Holding the sensor at extremely low moisture levels for long periods of time (more than 3 months) can cause the sensor response to be sluggish when first put into service.

The slow response phenomenon after a long storage period is driven by the fact that the desiccant continues to absorb water molecules. As a result after a long storage period in this environment the majority of the water molecules in the chemical structures of the aluminum oxide layer have been removed, reducing the ability of the senor to absorb water. When the sensor is then exposed to a gas stream with a partial water vapor pressure within its normal detection range, the sensor first has to ‘rehydrate’ before it can start to respond normally.

Therefore for long term storage, it is recommended that the sensor be removed from the storage bottle every 30 days to sustain the moisture level in the sensor. The sensor should be exposed to ambient conditions for approximately 2 minutes then returned to the storage bottle. Note that the ambient conditions should be between 15 °C to 25 °C with a relative humidity between 35% and 90%. This will allow the sensor to absorb enough moisture to remain properly hydrated.

Sensors left in storage bottles for more than three months without a wet up cycle being performed need to be exposed to 3 - 5 wet/dry cycles with a dew point high and low between -70 °C and + 20 °C before being put into service.

Note: The impact of long term storage is just a temporary slowing of the response to dew point changes and does not impact the overall life span of the sensor.

Do not store replacement tips for more than 12 months before use to assure the calibration is still valid.

Refit the protective plastic sensor enclosure (section 2) and place the transmitter in its original packaging before storage. Alternatively, seal it inside a waterproof plastic bag, sack, or storage box.

Store the equipment in a clean, dry area. Do not subject it to excessively hot, cold, or humid conditions (section 6).

9.2 Disposal

Dispose of the transmitter safely, and in accordance with all of your local and national safety and environmental requirements.

Hint: *If you send the equipment to Servomex or your local Servomex agent for disposal, it must be accompanied by a correctly completed decontamination certificate and a Return Authorization Number (RAN) (section 11.2).*

10 Spares

Do not use spares other than those specified below, and do not attempt to carry out any maintenance procedures other than those specified in this manual. If you do, you can damage the transmitter and invalidate any warranty.

The standard spares available for the AquaXact are shown below. You can order these spares from Servomex or your Servomex agent.

Part number	Description
220533	AquaXact 1688 Sensor - Tip

11 Warranty

Servomex instruments are warranted to be free from defects in workmanship and materials. Liability under this warranty is limited to servicing, calibrating, and replacing any defective parts of the instrument returned to the factory for that purpose.

This warranty is effective from the date of delivery to the original purchaser. The equipment must be determined by Servomex to have been defective for the warranty to be valid.

This warranty applies as follows:

- one year for electronics
- one year for mechanical failures to the sensor

If damage is determined to have been caused by misuse or abnormal conditions of operation, the owner will be notified and repairs will be billed at standard rates after approval.

Servomex Group Limited warrants each instrument manufactured by them to be free from defects in material and workmanship at the F.O.B. point specified in the order, its liability under this warranty being limited to repairing or replacing, at the Seller's option, items which are returned to it prepaid within one year from delivery to the carrier and found, to the Seller's satisfaction, to have been so defective.

In no event shall the Seller be liable for consequential damages. NO PRODUCT IS WARRANTED AS BEING FIT FOR A PARTICULAR PURPOSE AND THERE IS NO WARRANTY OF MERCHANTABILITY.

Additionally, this warranty applies only if: (i) the items are used solely under the operating conditions and in the manner recommended in the Seller's instruction manual, specifications, or other literature; (ii) the items have not been misused or abused in any manner or repairs attempted thereon; (iii) written notice of the failure within the warranty period is forwarded to the Seller and the directions received for properly identifying items returned under warranty are followed; and (iv) with return, notice authorizes the Seller to examine and disassemble returned products to the extent the Seller deems necessary to ascertain the cause of failure. The warranties stated herein are exclusive. THERE ARE NO OTHER WARRANTIES, EITHER EXPRESSED OR IMPLIED, BEYOND THOSE SET FORTH HEREIN, and the Seller does not assume any other obligation or liability in connection with the sale or use of said products.

11.1 Maintenance policy

In cases when equipment fault is suspected, please notify your representative of the problem and provide them with model and serial numbers.

If the problem cannot be resolved, then ask for a Return Authorization Number (RAN) and shipping instructions. The issue of an RAN does not automatically imply that the equipment is covered by our warranty - that will be determined after we receive the equipment.

Pack the equipment in a suitable box with sufficient padding, include the RAN number on your paperwork, and send the equipment, prepaid, to the designated address. Servomex will not accept equipment returned without a RAN, or with reversed shipping or import/export charges.

If the warranty has expired, or the damage is due to improper use or exposure of the equipment, Servomex will provide an estimate and wait for approval before commencing repairs.

For your convenience a Return Authorization Request Form is provided in section 11.2. Fill out the form and sent it back to Servomex to obtain a RAN.

11.2 Return Authorization Request

Servomex must approve and sign a Return Authorization Number (RAN) to any device being returned. The RAN must appear on all paperwork and packaging.

The issuance of a RAN does not automatically imply that the instrument is covered by our warranty.

In order to serve you better and to protect our employees from any potentially hazardous contaminants, Servomex must return, unopened and at the sender’s expense, all items that do not have a RAN.

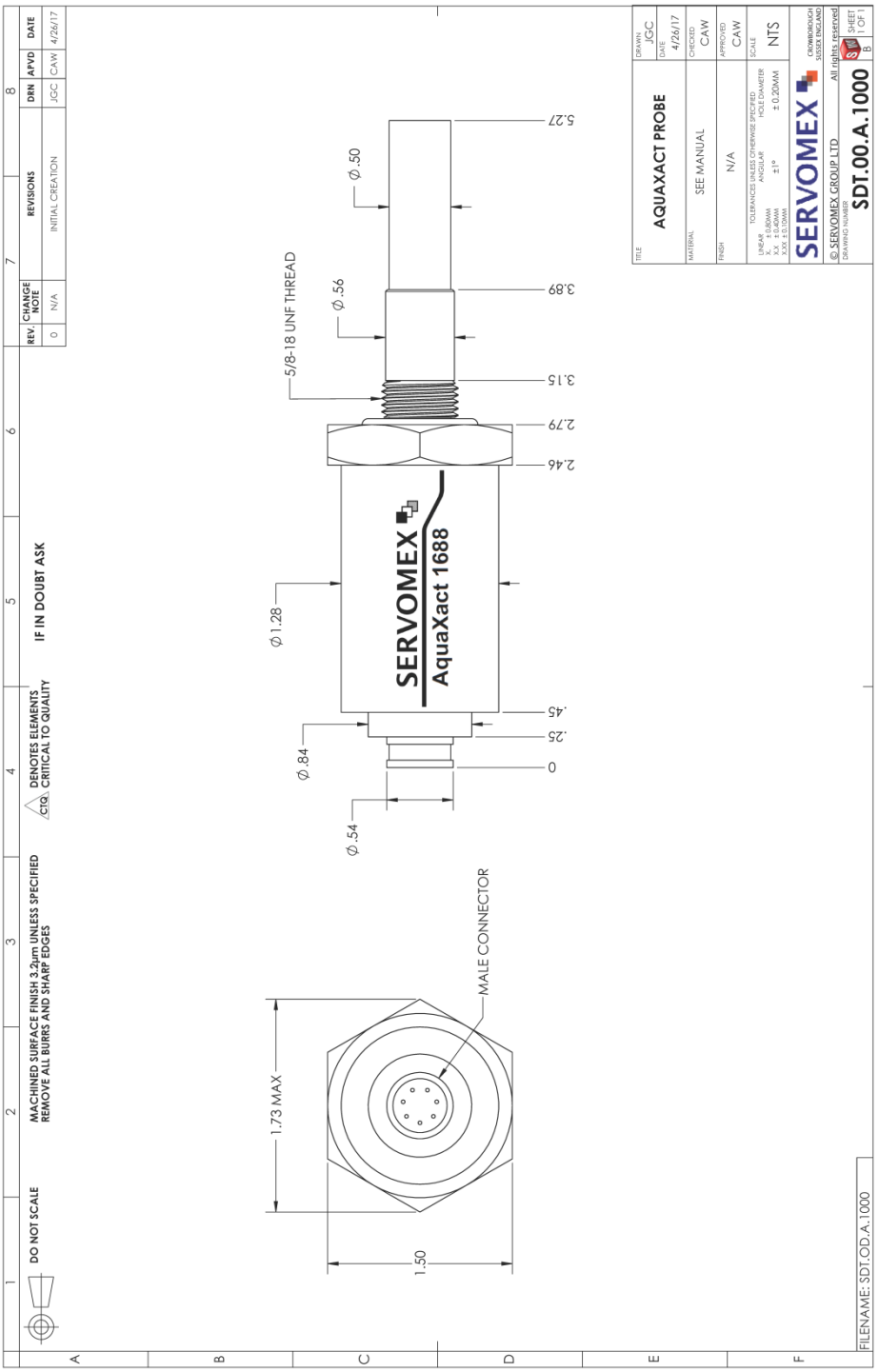
OSHA Hazard Communication Standard 29CFR 1920.1200 mandated that we take specific steps to protect our employees from exposure to potential hazards. Therefore, a letter certifying that the equipment has been decontaminated must accompany all equipment exposed to hazardous contamination.

To obtain a RAN, fill out a copy of this form and contact your regional Servomex service group.

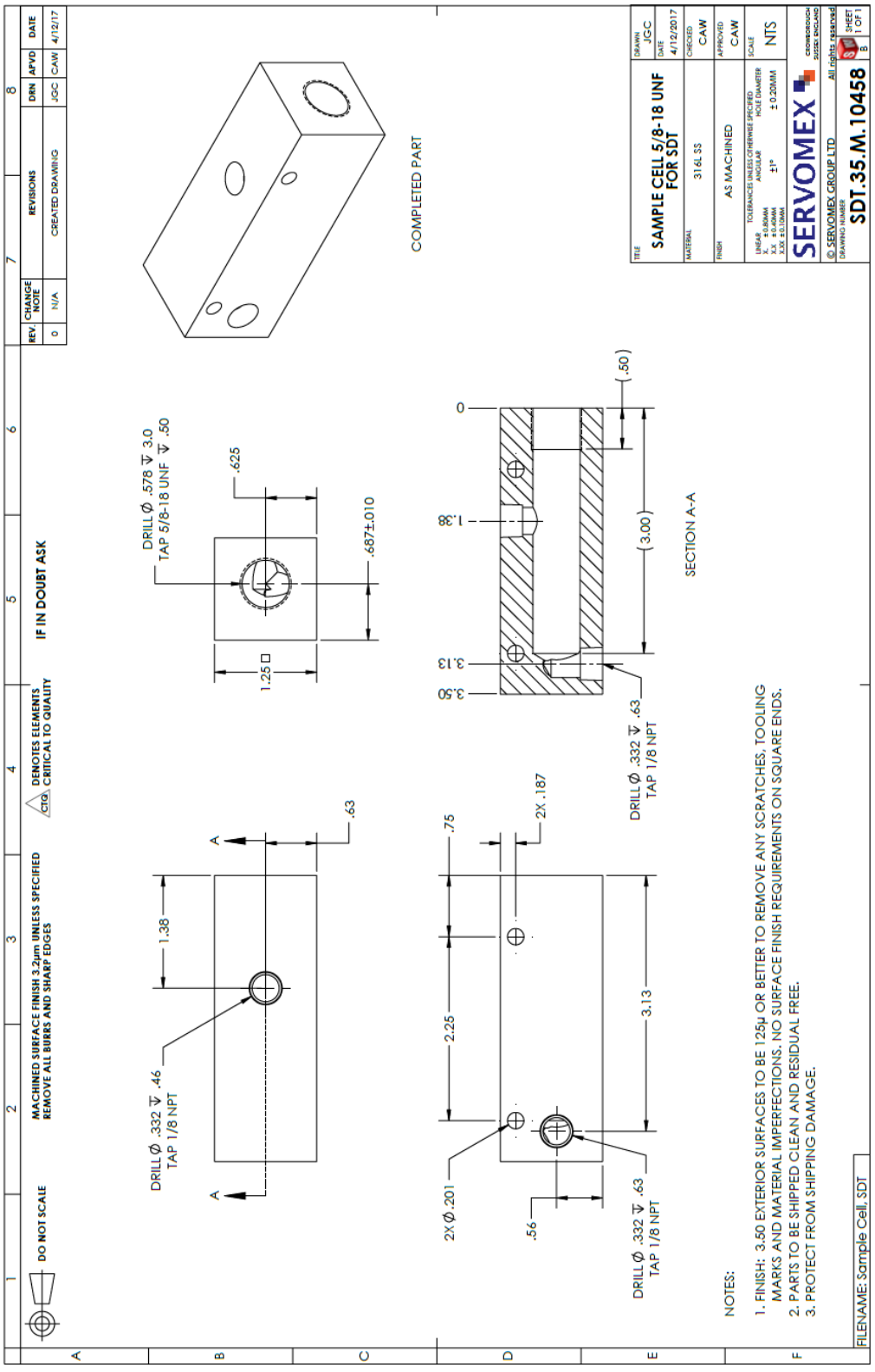
Customer information:	
Company name:	
Address:	
Contact name:	
Phone:	
Fax:	
Equipment information:	
Part or model number:	AquaXact 1688
Serial number:	
Original purchase date:	
PO number:	
Reason for return: **(Failure and hookup description if applicable)**	
Process material(s) and/or environments (including radiation) to which the equipment has been exposed:	
Has the equipment been decontaminated?	
Does a letter stating that the equipment has been decontaminated accompany the equipment?	

Appendix A Mechanical Drawings

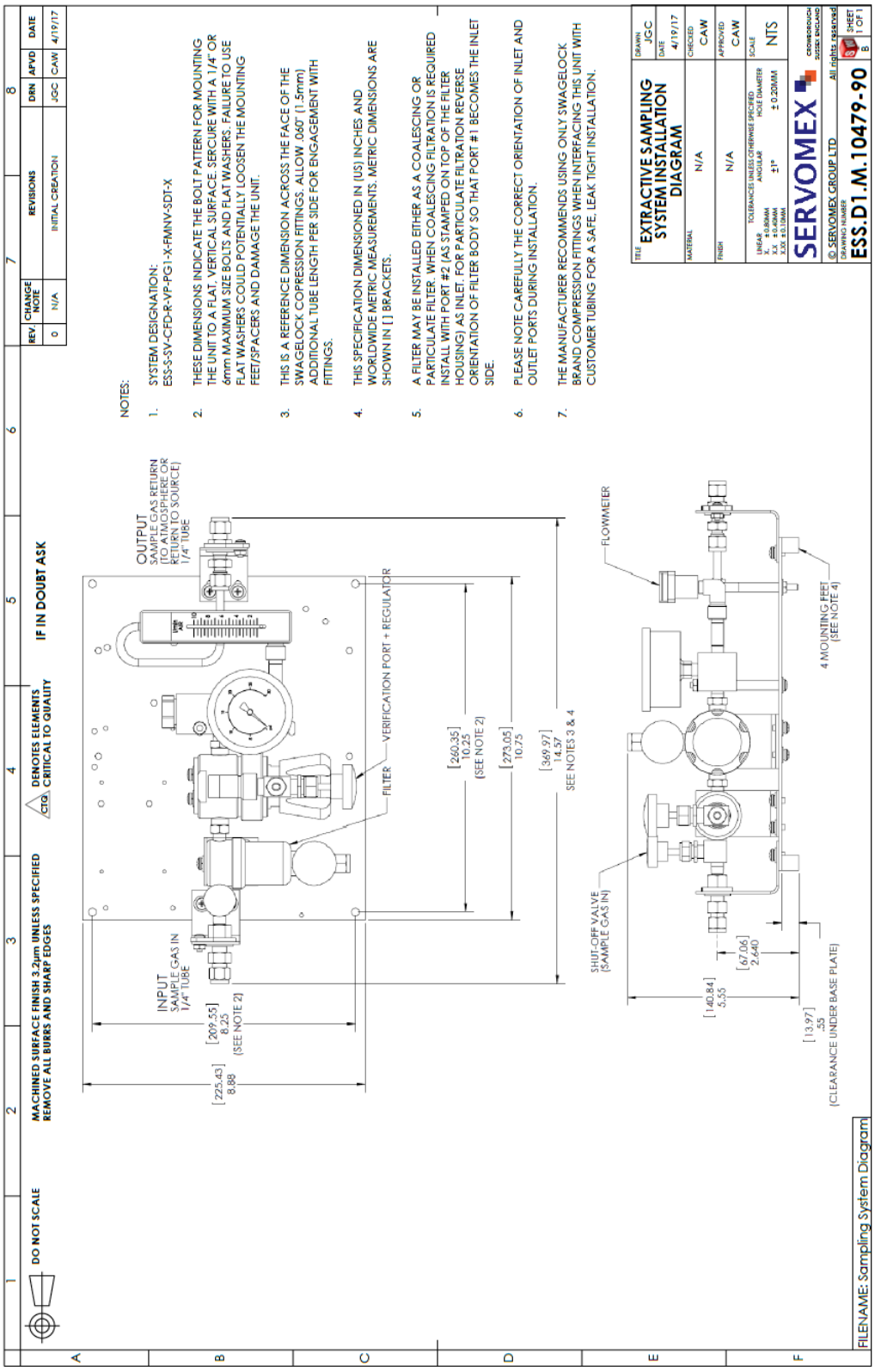
A.1 Dew point transmitter



A.2 Sample block



A.3 Sampling panel



Appendix B Current vs. dew point

The current being drawn by the AquaXact 1688 varies with the dew point being measured.

To use the current to calculate the value of the dew point measurement, one must know the settings of the low and high ends of the analog output range, then:

$$D = \frac{(I - 4) \times (H - L)}{16} + L$$

where:

I = current drawn by AquaXact 1688 loop in mA

H = value of High end of Analog Output range converted to selected engineering units

L = value of Low end of Analog Output range converted to selected engineering units

D = dew point measured by instrument in selected engineering units

An AquaXact Digital Controller is required to check and set the analog output low and high ranges as well as the engineering units and the process pressure. The factory default settings are -100 °C and +20 °C respectively, dew point °C and ambient pressure. For example a unit with factory default settings, drawing 12 mA is computed to be measuring a dew point of -40 °C.

$$\frac{(12 - 4) \times (20 - (-100))}{16} + (-100) = -40\ °C$$

Note that the computation is such that the current is linear to the selected engineering units. Hence, ordering an AquaXact 1688 with the units set to ppm will cause the analog output to be linearly proportional to those units (approximately logarithmically proportional to dew point), refer to the graph in Appendix C. Naturally selecting °C or °F will cause the analog output to be linearly proportional to dew point.

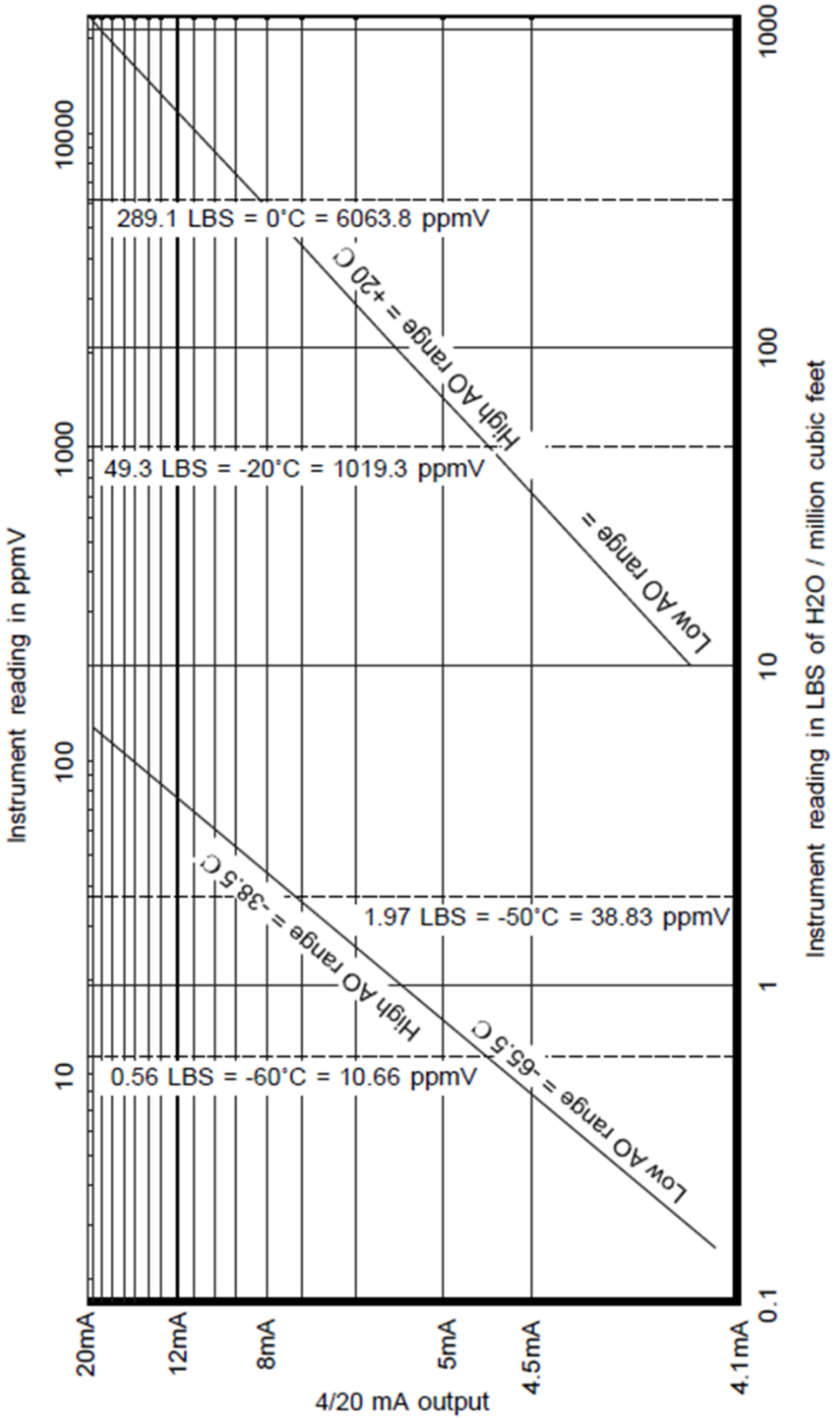
Note: The analog output range can only be set by the factory or using the AquaXact Digital Controller.

When monitoring in ppmV, the analog output low and high ranges may have to be adjusted via the digital controller or as a factory supplied option to provide a useful output. Consider an example where the area of interest to be monitored is 10 to 100 ppmV, and the analog output is set up with the factory defaults of -100°C to +20°C (which is 0.014 to 23612 ppmV); then the current loop output will vary only from ~4.1 to ~4.2 mA in the area of interest (see the graph in Appendix C). In most instances this would be an unacceptable output for proper monitoring of the measurement. In this example the user should adjust the analog output low & high ranges such that the output range is better suited to the measurement of 10 to 100 ppmV. It may be useful to select the low and high ranges to be 5 and 150 ppmV respectively, thus out of range conditions will be detected properly. Then the low range will be set to 5 ppmV which is -65.5 °C dew point, and the high range will be

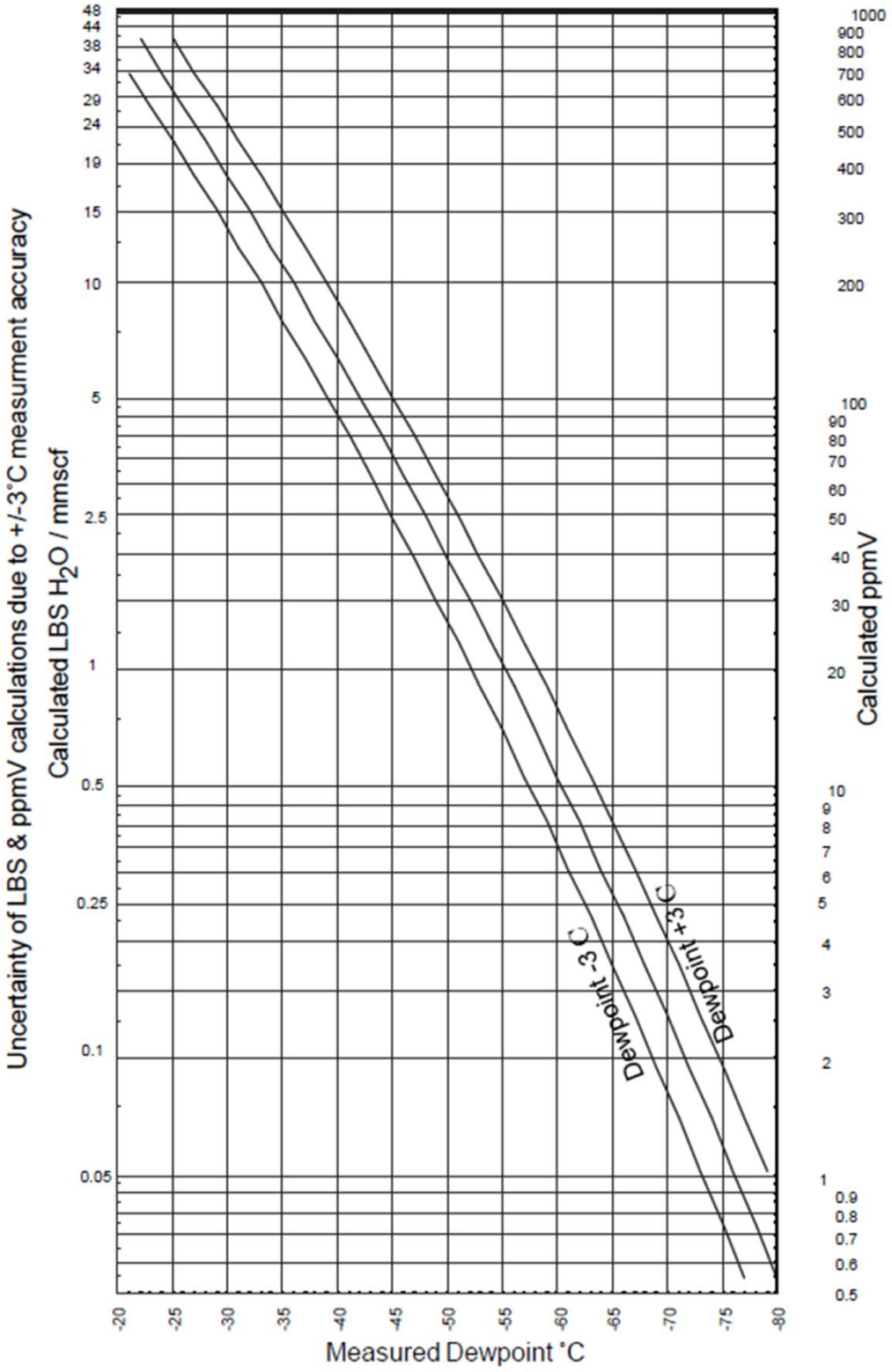
set to 150ppmV which is -38.5 °C dew point. Now the current loop output will be 4.55 to 14.48 mA in the range of 10 to 100 ppmV, the ~10mA variation is more than sufficient for a good measurement by the user's equipment.

In general, if the dew point is monitored in °C or °F, there is no need to change the factory default -100 °C to +20 °C settings, because the 4-20 mA provides sufficient resolution to measure the output better than the specified accuracy of the sensor.

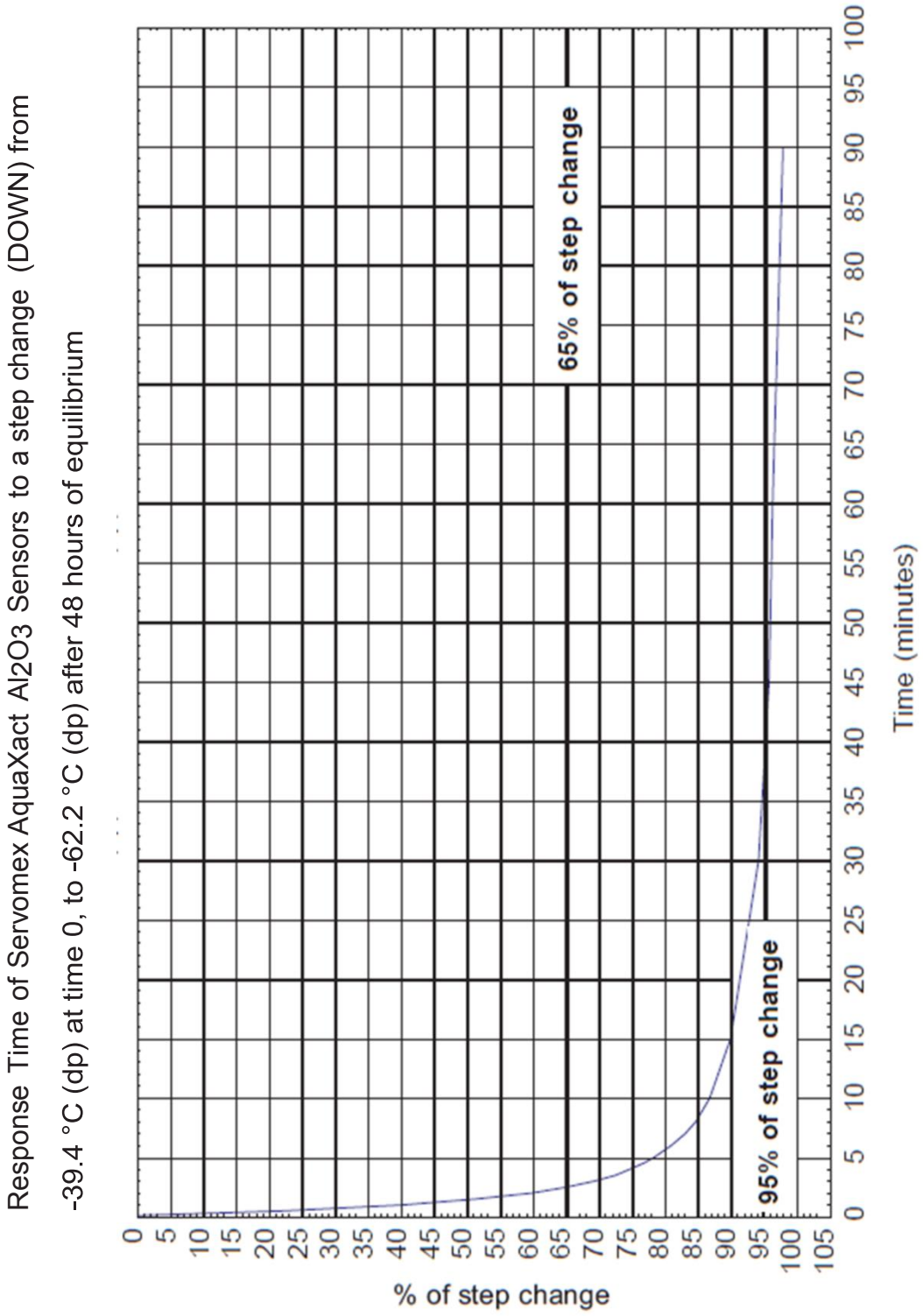
Appendix C Relationship of 4-20 mA output and instrument reading in ppmV or LBS



Appendix D Uncertainty in LBS & ppmV calculations



Appendix E Sensor response time



E.1 AquaXact 1688 Calibration Options

Do not store replacement tips for more than 12 months before use to assure the calibration is still valid.

Aluminum oxide sensors require periodic calibration. We suggest that you validate the performance of the transmitter yearly and if out of specification do one of the following.

1. If you do not have either a MonoExact DF310E or dedicated AquaXact 1688 controller you will need to return your transmitter to Servomex for recalibration or have a service engineer visit during which the sensor tip can be replaced.
2. If you have a MonoExact DF310E or dedicated AquaXact 1688 controller there are several options. These procedures are described in the digital controller manual.
    a. You can replace the sensor tip and upload the new calibration (from a USB memory stick) to the transmitter.
    b. You can run a single point span point using a calibration gas or other known moisture concentration gas.

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