Series 9

PowderVision Guide

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Issue B

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Series 9 PowderVision Guide

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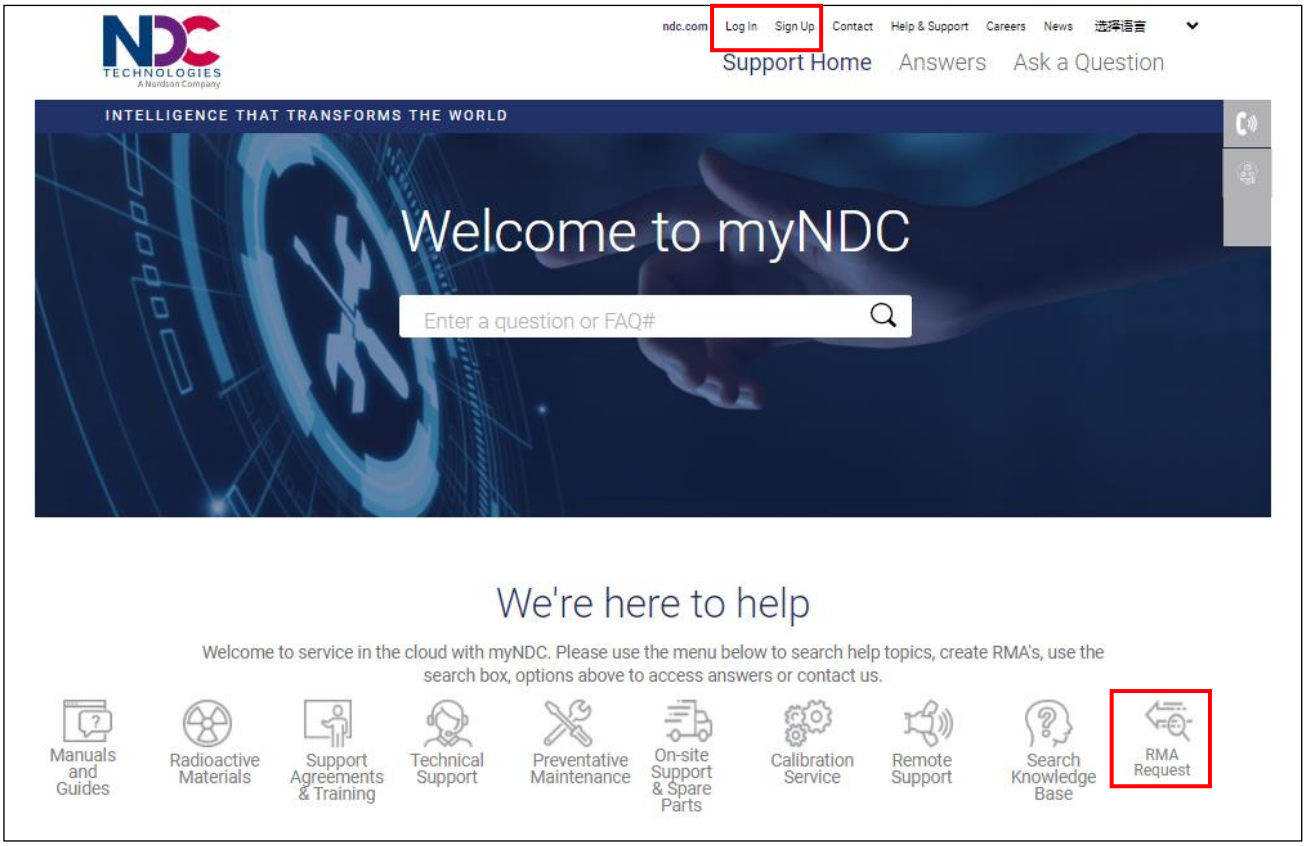

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WARNING! THIS SAMPLER MUST NOT BE USED ON A POSITIVELY PRESSURIZED PROCESS AS IT WILL RESULT IN A SAFETY HAZARD.

DNK

ADVARSEL! DENNE PRØVETAGNINGSENHED MÅ IKKE BRUGES I EN OVERTRYKSPROCES, DA DETTE VIL MEDFØRE EN SIKKERHEDSRISIKO.

DEU

ACHTUNG! DIESER PROBENNEHMER DARF NICHT IN EINEM PROZESS MIT ÜBERDRUCK VERWENDET WERDEN, DA DIES EIN SICHERHEITSRISIKO DARSTELLT.

NLD

WAARSCHUWING! IN VERBAND MET VEILIGHEIDSRISICO'S MAG DIT BEMONSTERINGSAPPARAAT NIET GEBRUIKT WORDEN BIJ PROCESSEN ONDER DRUK.

FRA

ATTENTION! CET ÉCHANTILLONNEUR NE DOIT PAS ÊTRE UTILISÉ DANS UN PROCÉDÉ DE SURPRESSION ÉTANT DONNÉ QU'IL PRÉSENTERAIT UN DANGER POUR LA SÉCURITÉ.

ITA

ATTENZIONE! QUESTO CAMPIONATORE NON DEVE ESSERE USATO ALL'INTERNO DI PROCESSI A PRESSIONE POSITIVA, ALTRIMENTI METTERÀ A RISCHIO LA SICUREZZA.

ESP

¡ATENCIÓN! ESTE MUESTREADOR NO DEBE UTILIZARSE EN UN PROCESO CON PRESIÓN POSITIVA, PUES PODRÍA SUPONER UN PELIGRO PARA LA SEGURIDAD.

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CHAPTER 1

1 Introduction

1.1 General

Powders, granules and flakes are often conveyed in pneumatic or gravity fed ducts which prevents the conventional approach of measuring over a band or vibro conveying system.

PowderVision enables measurements to be made on such materials in enclosed ducting or pneumatic conveying systems by collecting quantities of the powders, granules or flakes in the duct and presenting these to a backscatter infrared gauge. This then enables accurate measurement of constituents in the product, such as moisture, fat, protein and sugars.

It allows near continuous sampling of the process stream, which provides a representative view of the product stream.

1.2 Applications

PowderVision has been designed to suit many applications, and works best with dry fluid powder/granular/flake type product. It is suitable for installation in the following industries:

- Food
- Chemical / Pharmaceutical
- Mineral Processing
- Wood Processing
- Animal Feed

Some typical products for the standard Powder Sampler are:

- Milk powder
- Sawdust
- Coffee powder
- Gluten
- Starch
- Fibre and feeds
- PVC
- Animal feed meals
- Casein
- Plastic granule

1.3 Location in the Plant

Typical locations in a plant for the installation of PowderVision are illustrated in Figure 1-1. In Installation 1, the product is being measured just after a grinding stage, and in Installation 2, the product is being measured immediately after a conical drying chamber.

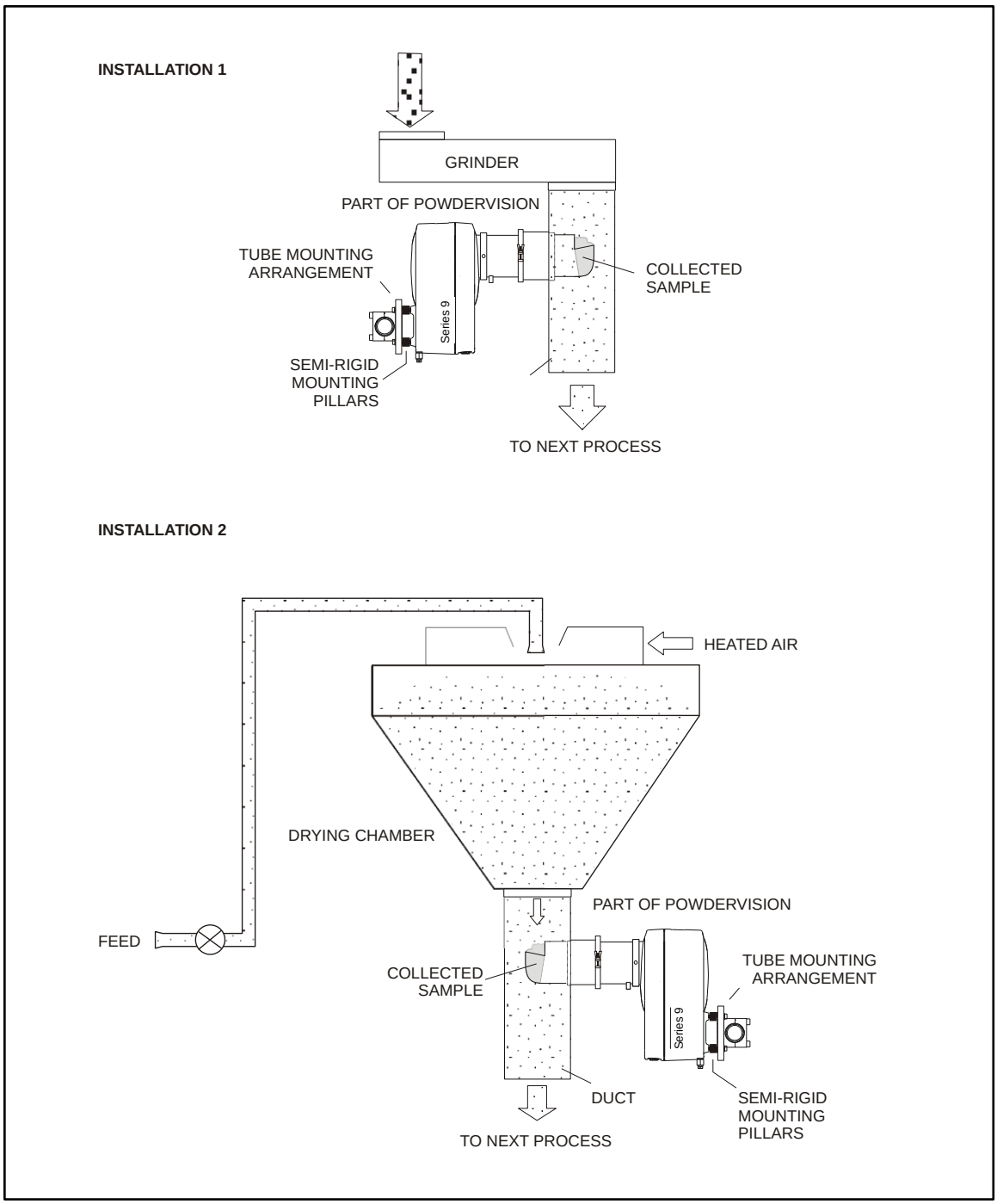

Figure 1-1 Typical installation sites for the Powder Sampler

1.4 Schematic Diagram

The schematic diagram of a typical Series 9 PowderVision system is shown in Figure 1-2.

Note: The output required to switch the solenoid valve on/off is one of the digital outputs available in the GCI.

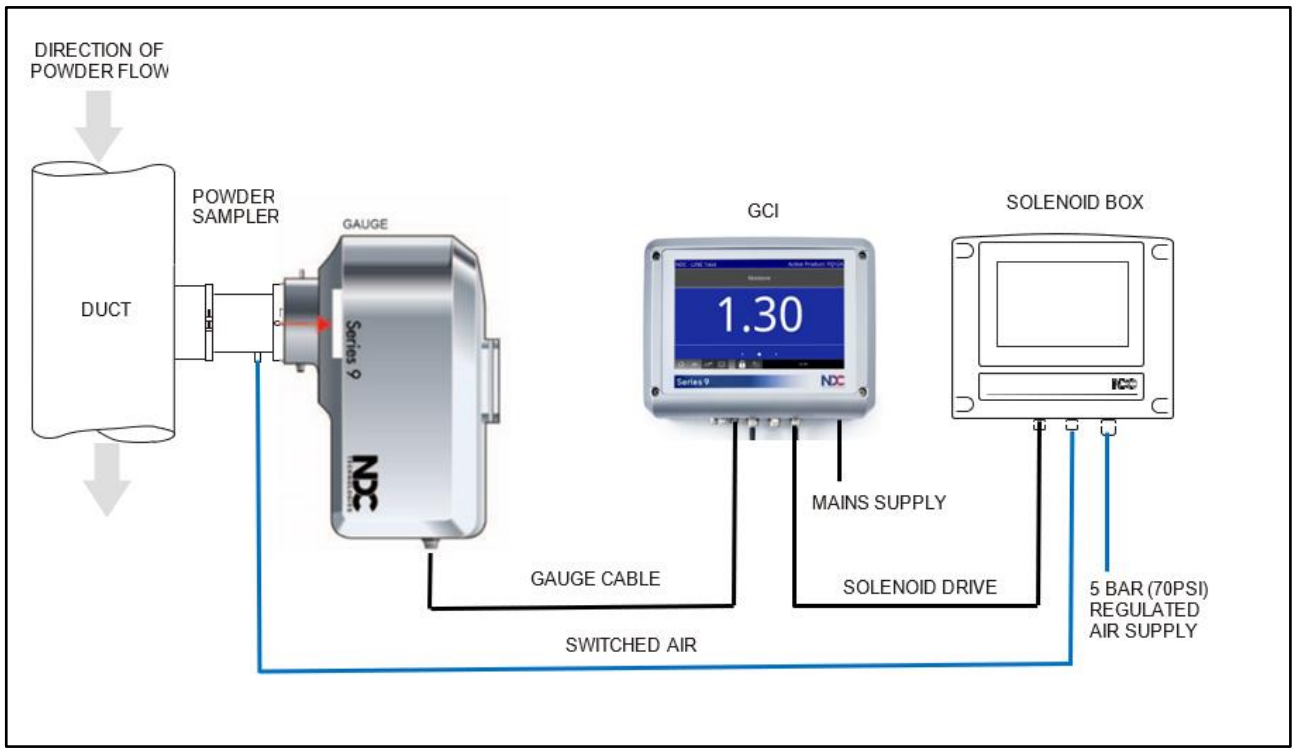

Figure 1-2 Schematic diagram for the PowderVision system

The Series 9 PowderVision typically comprises the following items:

- Powder Sampler
- Solenoid Box (contains the solenoid operated air-valve)
- Series 9 Gauge
- Series 9 GCI
- Installation kit

The installation kit contains the mounting ring, which needs to be welded to the duct, and its associated components, including a split-ring clamp for securing the powder sampler to the duct. The installation kit is usually shipped before the rest of the PowderVision system so that the duct can be prepared in advance.

1.4.1 How It Works

The operation of the Powder Sampler is controlled by the Series 9 gauge to carry out the following sequence:

1. The cup fills with the product.
2. A measurement is made on the contents of the cup.
3. The cup is emptied using a jet of air.
4. Steps 1 to 3 are repeated.

The timing of the various stages is configurable using the GCI, as will be described in Chapter 3 - Operation.

1.5 On Delivery

The equipment is supplied packaged in custom packaging. On receipt, follow the unpacking and storage recommendations given below.

1.5.1 Unpacking

1. Open the packaging carefully and remove each item.
2. Retain the packaging so that in the event that the equipment needs to be returned, it can be suitably re-packed for its safe return.
3. Check the equipment supplied against the consignment note.
4. Take the items to a clean area for inspection.
5. Check that each part is free from external damage.
6. In the event of loss and/or damage, notify the carrier, NDC Technologies or the agent of NDC Technologies as appropriate.

If the equipment is to be stored prior to installation, follow the guidelines given next.

1.5.2 Storage

Before installation, store the equipment in a dust free area within the following environmental conditions:

Temperature: 0°C - 70°C

Humidity: 5% - 95% (non-condensing)

Include desiccant if there is any possibility of condensation.

After storage, allow the equipment to reach ambient temperature before installation.

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CHAPTER 2

2 Description and Installation

Note: When the Air Heater unit is used, the solenoid and its associated components are located inside the air heater unit, and so a Solenoid Box is not required.

2.1 System Equipment

The PowderVision system comprises the items listed in the table below.

Item No.	Description	Part No.
1	Powder Sampler	116/15146-01SA
2	Solenoid Box	116/15148-01SA
3	Series 9 Gauge	Configured item
4	Series 9 GCI	Configured item
5	Series 9 Quick Guide	120/16513-01
6	Series 9 PowderVision Guide	120/16652-01
7	Cable assembly, Gauge to GCI (10m) or Cable assembly, Gauge to GCI (20m)	712085 712087
8	Cable assembly, solenoid drive	WS116/15150-00
9	Sampler installation kit	116/15147-01SA & 105/14695-04SA

2.2 Description

2.2.1 Powder Sampler

The Powder Sampler is a two-part arrangement consisting of (**1**) the main assembly and (**2**) a metal mounting ring. A restraining strap is included to prevent the main assembly from being fully ejected from the mounting, and should be fitted for safety reasons. A general view of the powder sampler is shown in Figure 2-1.

There are no moving parts in the design, which makes it a simple, maintenance-free device suitable for in-line installation.

The main assembly is cylindrical in shape and constructed from 316L polished stainless steel, open at one end. The other (closed) end is fitted with a sapphire window and a product collection cup of about 100 ml capacity. There is a nozzle in the window end which is aimed into the cup. When pressurized air is fed to the nozzle, the powder collected in the cup is blown out and the cup is emptied. When the air valve is closed, air flow is turned off and powder starts to collect in the cup again. In this way, the cup is periodically emptied at the end of a measurement period.

There is a connector fitted to the underside of the main assembly that allows a 6mm diameter air tube to be fitted to the pressurized air supply (of up to 5 bars) via the Solenoid Box.

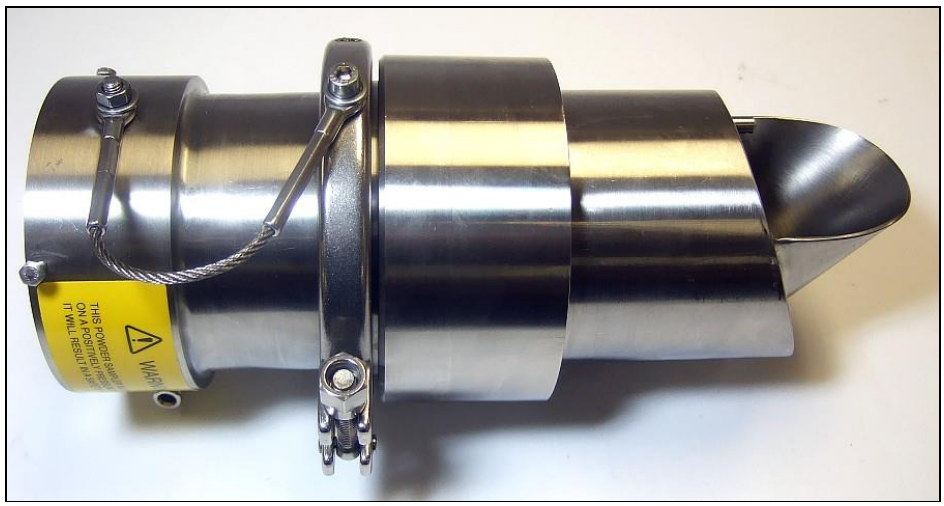


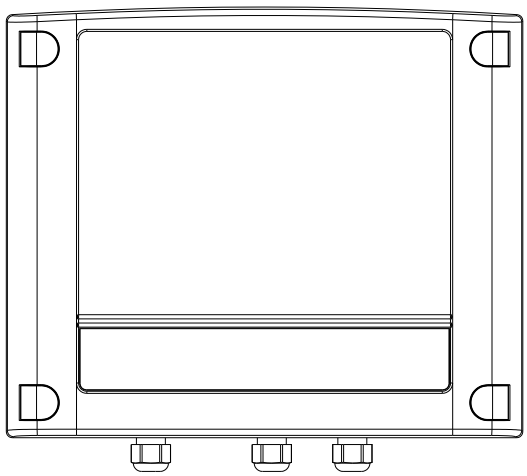
Figure 2-1 General view of the Powder Sampler

2.2.2 Solenoid Box

A general view of the Solenoid Box is shown in Figure 2-2. It contains a solenoid operated air-valve.

The valve receives air at a pressure of 5 bar via a 6 mm diameter tube, and a solenoid drive signal (+24 volt d.c.) from the GCI. When commanded by the Series 9 gauge, +24 volt d.c. signal is applied to the solenoid, and air is routed to the powder sampler via a 6mm diameter tube. Note that a flyback diode is fitted across the solenoid terminals in reverse polarity to protect the drive circuitry in the GCI, and should always be fitted.

The valve body contains a manual override switch that can mechanically open the valve. This may be used when a continuous air flow is required during specialized cleaning operations. The lid must be removed to access the valve.



Valve manual override shown here
in the off position

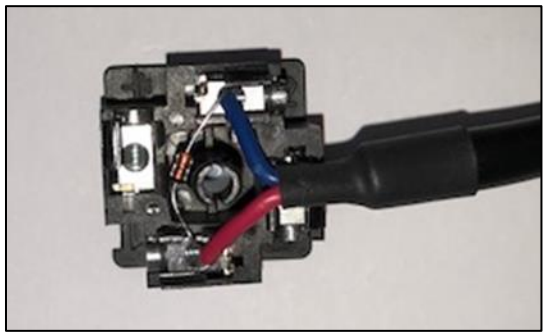


Figure 2-2 Solenoid Box: general view and solenoid valve

2.2.3 Installation Kit

The installation kit contains the mounting ring and various other components required during the assembly of the powder sampler in the duct, and includes a split-ring locking clamp for securing the powder sampler to the mounting ring. These components and how they are used are shown in Figure 2-3 and Figure 2-4.

2.3 Installation Location

The PowderVision should be located at the main point of interest for monitoring and control, typically close to the exit of a drying process. However, the following aspects should also be considered when selecting the location:

- Where all products are routed, for all product types and process conditions.
- Where there is a good flow of product, enough to fill the Powder Sampler cup.
- Where product is relatively dry and cool, less likely to stick to the sampler window.
- Accessible for setup and servicing, ideally at a safe working height.

2.4 Installation Procedure

2.4.1 Mounting Ring

The mounting ring is contained in the installation kit, as shown in Figure 2-3. The kit is normally supplied first so that the mounting ring can be installed ready for when the powder sampler is received. The ring is to be welded to the duct, as shown in Figure 2-4, to provide a sleeve in which the powder sampler can be positioned and secured with a clamp. The gauge will then be located so that the gauge window aligns with the open end of the powder sampler.

The gasket and blanking plate are supplied to seal the opening made in the duct until the powder sampler is fitted, or at any time the sampler is removed.

The mounting ring is fitted as follows:

1. Cut a 125 mm diameter hole in the side of the vertical duct where the measurement is to be taken, see Figure 2-4.
2. Position the mounting ring in the hole and tack weld the ring in place as shown, ensuring good squareness in all planes.
3. Fully weld the inside and outside of the ring to the duct, avoiding any distortion to its internal diameter and concentricity.
4. If the powder sampler unit is not to be inserted at this time, place the rubber gasket between the blanking plate and the end of the fitted mounting ring. Secure the gasket and blanking plate to the mounting ring using the split ring clamp. Fully tighten the nut on the clamp to a torque of **15Nm**.

Figure 2-3 Installation kit

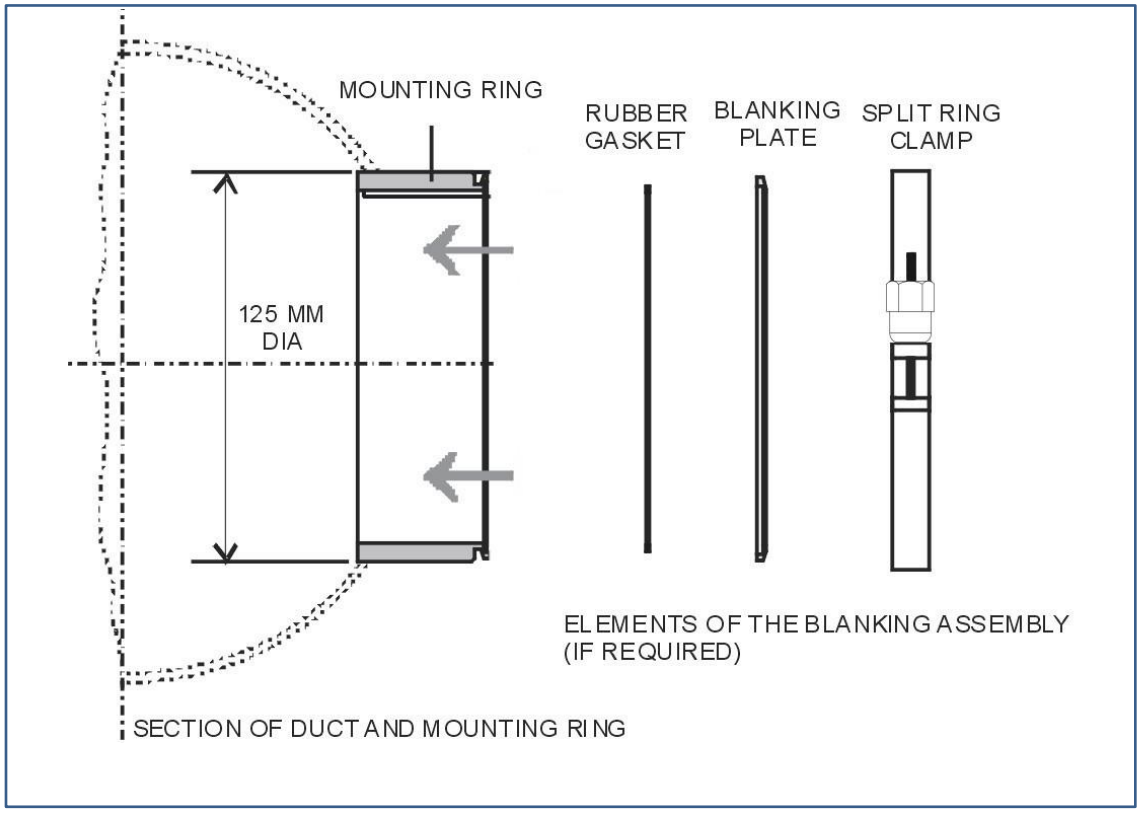


Figure 2-4 Mounting ring: outline drawing and details of fixing to the duct

2.4.2 Powder Sampler

Caution:	**Before mounting, check that the window of the powder sampler is clean on both sides, in particular, no fingerprints or dust deposits and if necessary, clean with a tissue.**

The powder sampler is of rugged construction and is sealed to IP65 standard. It can be used in most production line environments. The powder sampler should be fitted in a horizontal position in the duct, with the collecting cup pointing up against the flow of the powder in the duct. The cup is at the correct orientation when the air inlet connector on the body of the sampler is pointing down.

Before the sampler can be inserted in the duct, the PowderVision mounting ring must first be securely fitted as per Section 2.4.1 - Mounting Ring.

Refer to Figure 2-5 and Figure 2-6. The powder sampler is mounted as follows:

1. If the blanking plate assembly is fitted, remove these items.

2. Slide the clamping flange with the chamfered side towards the gauge-end of the sampler.

3. Next, slide the rubber O-ring onto the body of the sampler.

4. Carefully feed the cup end of the sampler into the mounting ring on the duct to the required depth.

5. Carefully slide the O-ring and the clamping flange up to the face of the mounting ring. Correctly seat the O-ring and push the clamping ring up to the mounting ring and secure by starting to tighten the nut on the split ring clamp, but do not fully tighten.

6. Fit the restraining strap as shown in Figure 2-6 and fully tighten the two nuts.

7. Set the sampler at the required position and orientation. The correct orientation is when the air inlet connector on the body of the sampler is pointing down. Fully tighten the nut on the clamp to a torque of **15Nm**. Check that the arrangement is secure.

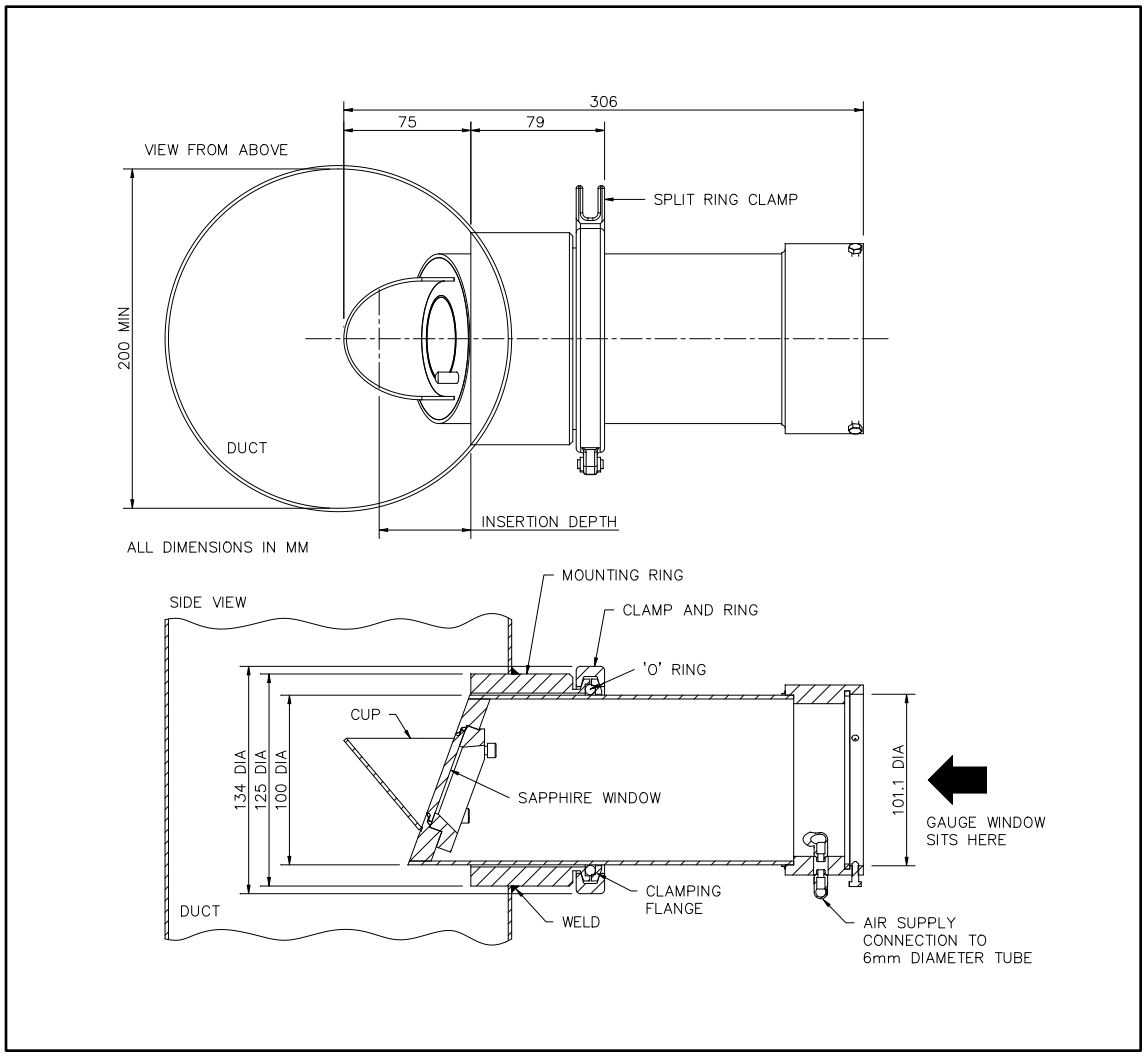


Figure 2-5 Powder Sampler: outline drawing

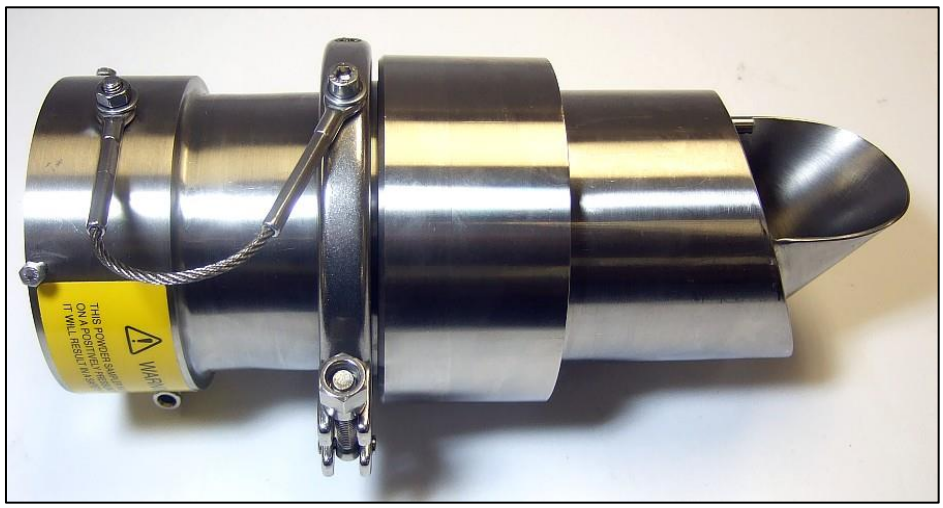


Figure 2-6 Powder Sampler: Restraining strap

2.4.2.1 Setting the Duct Penetration Depth

To set the collecting cup at the correct position in the duct, carry out the following:

1. Connect a suitable air supply to the system.
2. Loosen the locking ring.
3. Shine a torch down the sampler from where the gauge window will connect to view the collecting cup.
4. Position the cup at the depth that collects the powder within the required collection time. Discharge the contents of the cup by manually operating the valve for a short time.
5. Repeat the previous for all products and flow rates to ensure the good operation for all process variants. If the flow rate is too great for the cup to empty reliably, try rotating the sampler to restrict the cup opening.
6. Fully tighten the nut on the clamp to a torque of **15Nm**. Check that the arrangement is secure.
7. Mark the position of the sampler barrel against the mounting ring with a permanent marker, so that the position can be re-established if the sampler is removed for servicing.

2.4.3 Gauge

WARNING:	**The gauge is not designed to be supported on its window flange and must always be supported on its backside using the four M8 mounting points. Otherwise, there is a danger that the window flange will shear from the gauge enclosure.**

IMPORTANT:	**The gauge mounting should have good lateral adjustment to allow the Powder Sampler to be slid in and out of its mount to find the optimum position in the process, as well as allowing clearance for its removal when servicing.**

Before the gauge is connected to the sampler, the gauge must be accurately aligned and fully supported at the sampler open end.

It is recommended that flexible mounts are used to secure the gauge to its mounting plate. Four semi-rigid 25 mm long mounting pillars with washers are provided for this purpose, as shown in Figure 2-7. These components couple the gauge case to the rear mounting plate, allowing a small degree of error in the mounting.

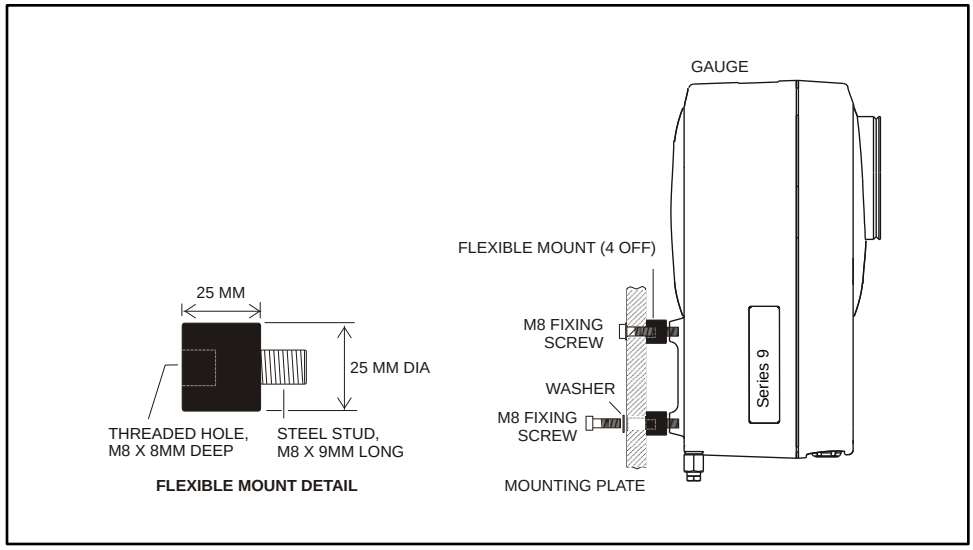


Figure 2-7 Flexible gauge mounts

Loosely attach the gauge mounting plate:

1. Align the gauge with the open end of the sampler barrel that is inserted in the duct at the correct depth.

2. Ensure that the three screws around the gauge window bezel are fully opened.

3. Slide the gauge window flange into the sampler open end. Whilst applying pressure by hand, check that the flange is fully inserted and square, then, evenly tighten the three screws on the bezel to a torque of **4Nm**.

4. Tighten the mounting plate fixings.

2.4.4 GCI

To mount the GCI, refer to the Series 9 Guides.

2.4.5 Solenoid Box

IMPORTANT:	**The air supply must be regulated to 5 Bar (70 psi) and be instrument quality, i.e. clean and dry, with good quality oil and water removal filters. (NDC uses a 40μm element filter followed by a 0.01μm coalescing filter to achieve this standard.) Otherwise, the window will get contaminated and the measurement will fail. Note that the air consumption at this pressure is approximately 10.9 standard litres per minute.**

The Solenoid Box is formed from an ABS enclosure like the GCI. It has a removable lid to access the wall mounting holes and the solenoid valve to make connections. The drive for the solenoid is an insulated cable that enters the enclosure through a sealed gland (rated IP65). There are two air tubes that connect to the valve, AIR IN and AIR OUT. These are push fit types which enter the box through glands.

Ideally, the box should be mounted close to the powder sampler to limit the length of air tube between the two units to **3 meters**. The enclosure should be sited where it is isolated from continuous mechanical vibration, with adequate clearance below the unit for insertion and removal of tubes and cables. The cables to the unit should be placed away from heavy-duty power cables and cables carrying high frequencies to other equipment.

The outline drawing of the Solenoid Box is shown in Figure 2-8.

To mount the Solenoid Box:

1. Carefully remove the four screw covers **(1)** from the corners of the lid using a thin flat-bladed screwdriver. Unscrew the exposed screws with an Allen Key and remove the lid.

2. Fix the unit to a suitable flat surface using the mounting holes **(2)**.

3. Complete all the tube and electrical connections to the unit.

4. Fit and secure the lid. Insert the screw covers.

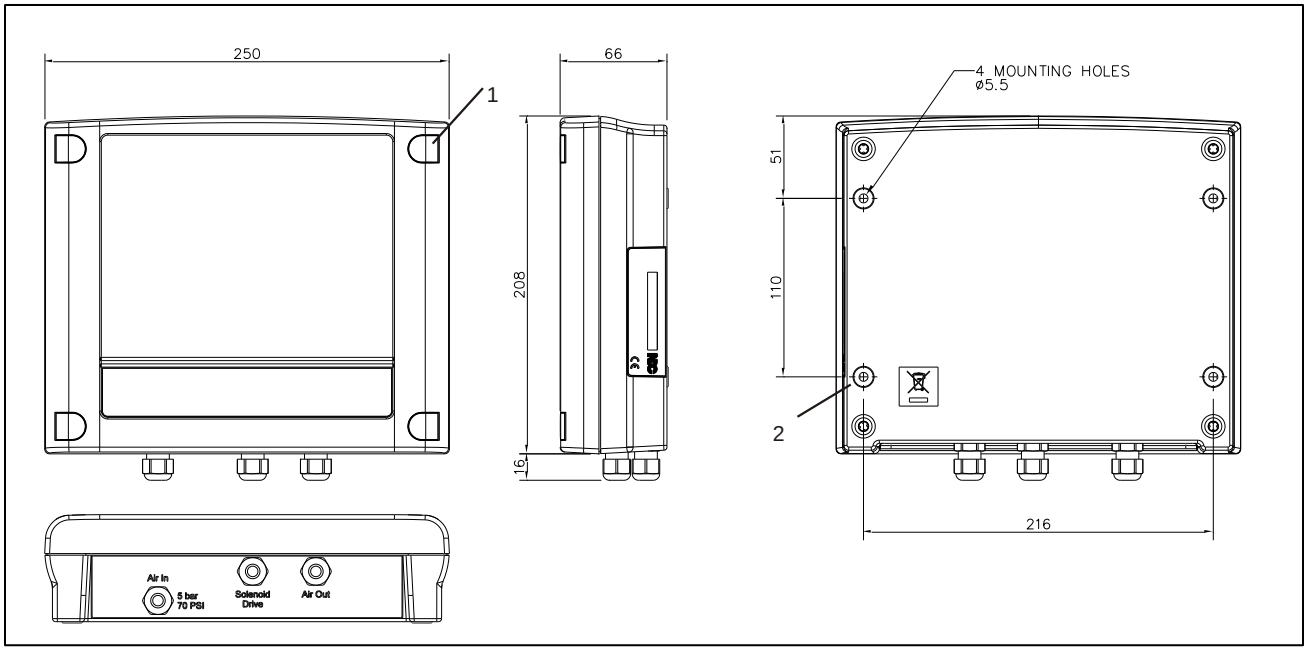


Figure 2-8 Solenoid Box: outline drawing

2.4.6 PowderVision ATEX Solenoid Wiring

For the ATEX solenoid version with encapsulated cable, connect the cable wires into the GCI/GCP, as per Figure 2-9, with the fly-back diode across the digital output terminal, as circled in red, with the cathode bar on the left side.

The polarity of the two black wires can be ignored, and the yellow/green wire should be connected to an earth point in the GCI/GCP.

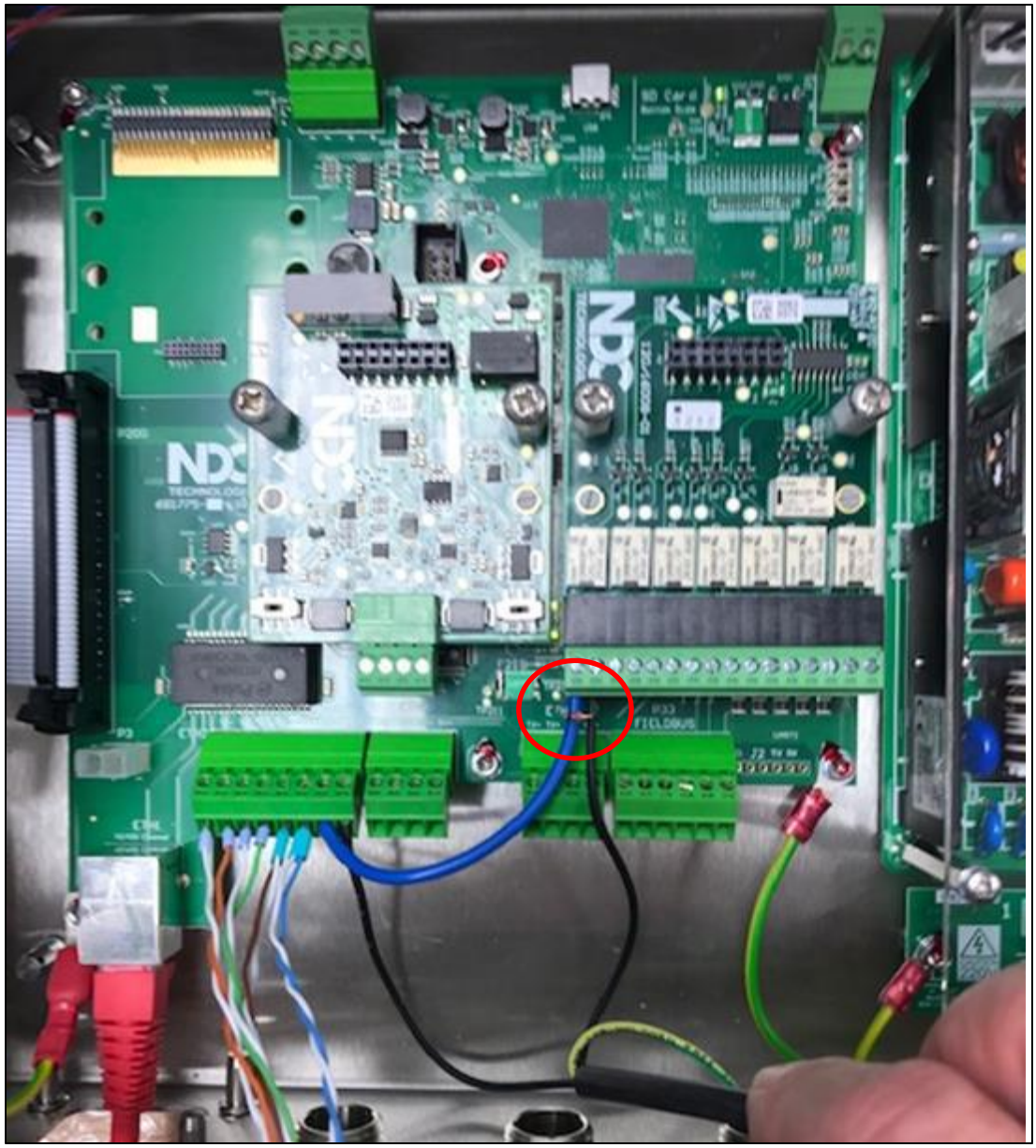


Figure 2-9 Connect cable wires into GCI/GCP

2.4.7 PowderVision Earthing

It is important that the PowderVision body is connected to an earth potential to prevent possible static build up caused by the powder flow.

This earth should be made through a dedicated wire (18 awg minimum), with ring crimp connected to the M6 threaded stud located at the base of the PowderVision body (doubles as the anchor point for the lanyard), and then connected to a nearby earth point for the plant ducting. See Figure 2-10.

Figure 2-10 M6 earth point

2.5 Interconnections

In a single gauge system, where the GCI can be located close to the gauge, then only a GCI will be required since it has suitable I/O for the powder sampler, can display its measurements, and has system setup functionality. This is the system described here. A typical interconnection diagram is shown in Figure 2-11.

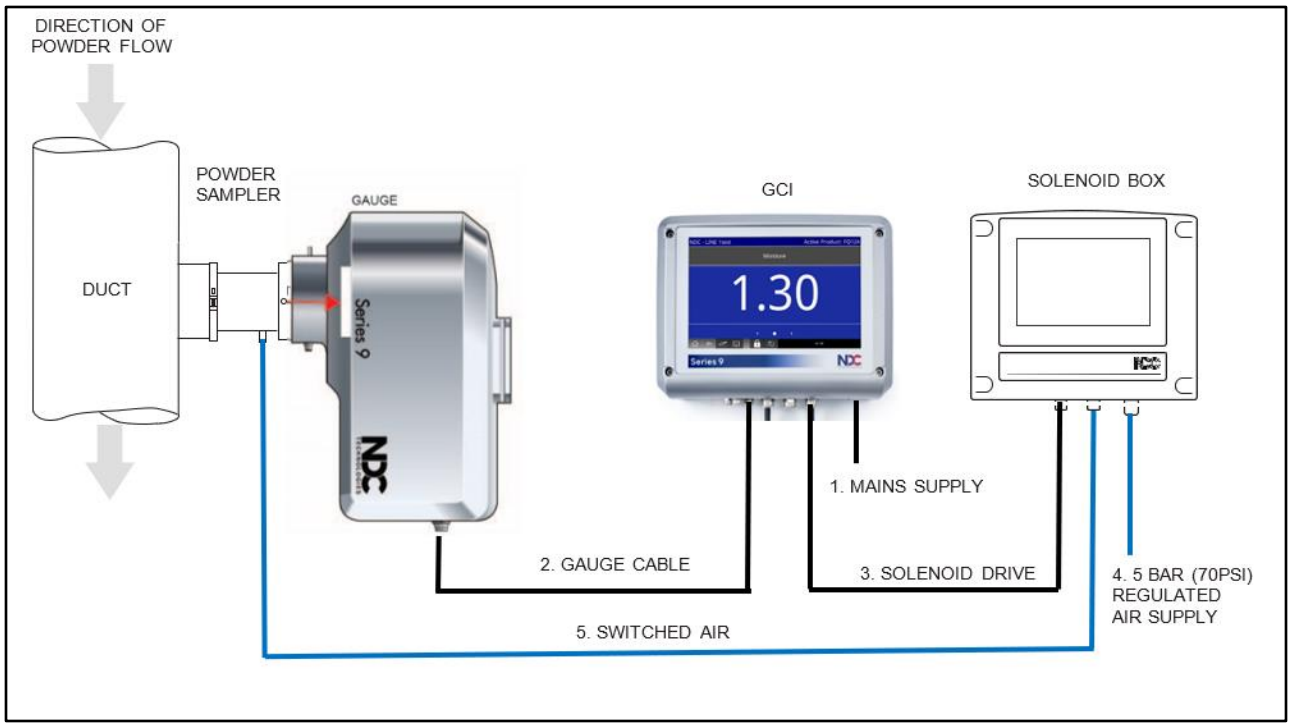


Figure 2-11 A typical interconnection diagram

In Figure 2-11, for reference purposes, the interconnection cables and air tubes are numbered 1 to 5 and described in the table below.

Ref. No.	Description	Cable Ref. No	Remarks
1	Mains supply to system power supply unit	Single phase, 3-core, 5A min., 4mm - 7mm diameter. To be supplied by the customer.	Refer to the Series 9 Guide
2	Ethernet and power from Gauge to the GCI	712085 (10m) or 712087 (20m)	Refer to the Series 9 Guide
3	+24V d.c. and solenoid drive	116/15150-00	See Figure 2-11
4	Solenoid operated valve air outlet tube, 6mm OD	--	See Figure 2-12
5	Solenoid operated valve air inlet tube, 6mm OD	--	See Figure 2-12

To interconnect the elements in your system, carry out the wiring instructions in the table above and the following procedure for connecting the Solenoid Box.

Figure 2-12 shows the interior of the Solenoid Box with the lid removed.

1. Remove the lid from the Solenoid Box.
2. Pass the air input tube through the allocated gland to align with the push fit connector **(1)**. Push the tube fully into the connector.
3. Finger-tighten the case wall gland so that it securely grips the tube without deforming it.
4. Pass the air-to-sampler tube through the allocated gland to align with the push fit connector **(2)**. Push the tube fully into the connector.

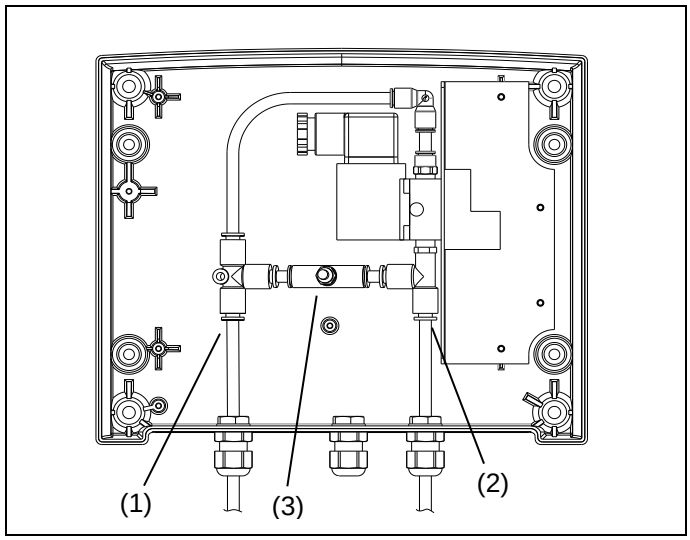


Figure 2-12 Solenoid Box: connecting the air tubes

5. Finger-tighten the case wall gland so that it securely grips the tube without deforming it.

6. Connect the other end of the tube from the output port to the Powder air input connector. This is a push fit connector.

7. The installation of the air tubes is complete.

8. At this stage, the bypass valve **(3)** can be adjusted to ensure a small air flow through the PowderVision air jet to keep it from being blocked when the system is not running. To close the bypass valve, screw fully clockwise, then crank anti-clockwise slightly to achieve a minimal flow. This may require further tuning when running on-line.

9. Also ensure at this stage that the solenoid valve manual override is in the off position (fully clockwise position).

10. The Solenoid drive connections are shown in Figure 2-13 as follows:

Valve Connection	GCI Connection	Signal Name	Remarks
Positive (terminal 1)	ETH2 – terminal 7 labelled FUSED +	+24V d.c.	Red
Negative (terminal 2)	Digital output board – terminal 1	Digital output, Ch1	Blue

A link wire will need to be fitted between ETH2 – terminal 7 labelled FUSED + and Digital output board – terminal 2.

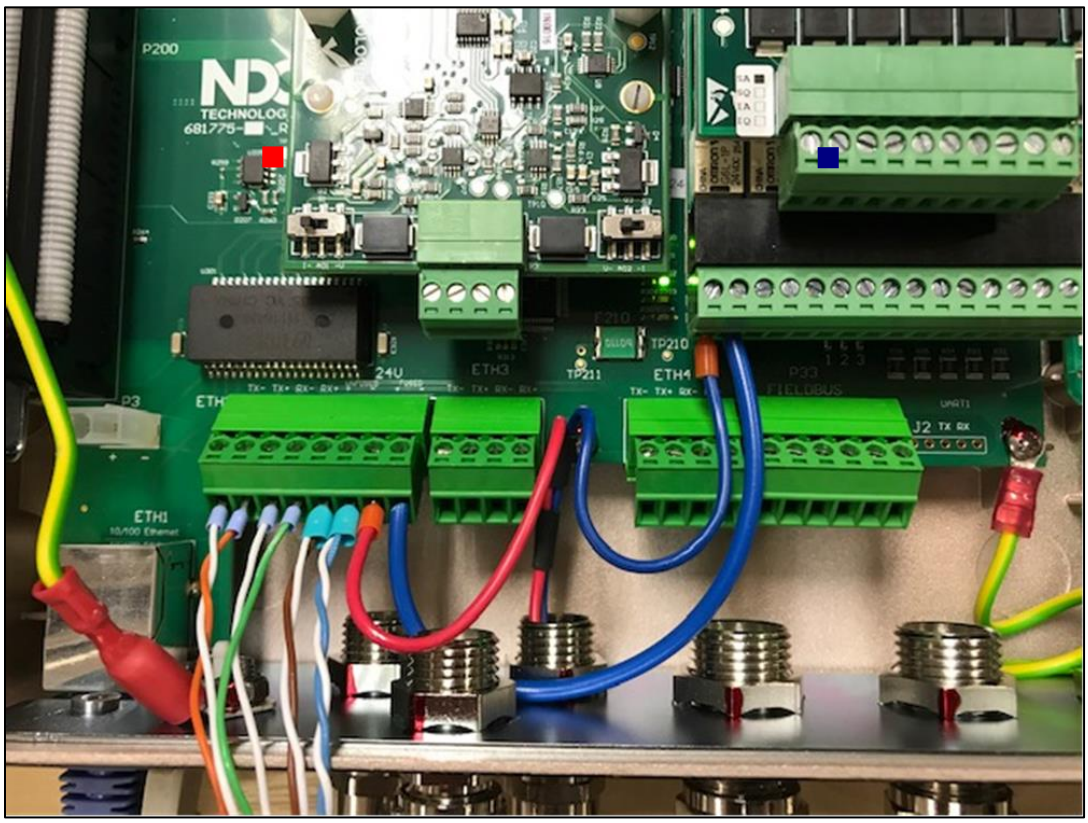


Figure 2-13 Solenoid drive connections

11. The interconnections are complete.

12. Replace the lid on the Solenoid Box.

2.6 GCI Settings for PowderVision

1. Power up the system, and from the GCI with Supervisor/Engineer security level, go to the **Settings Page**, select **Gauge Settings** and then **PowderVision** to display the following PowderVision Settings page (Figure 2-14).

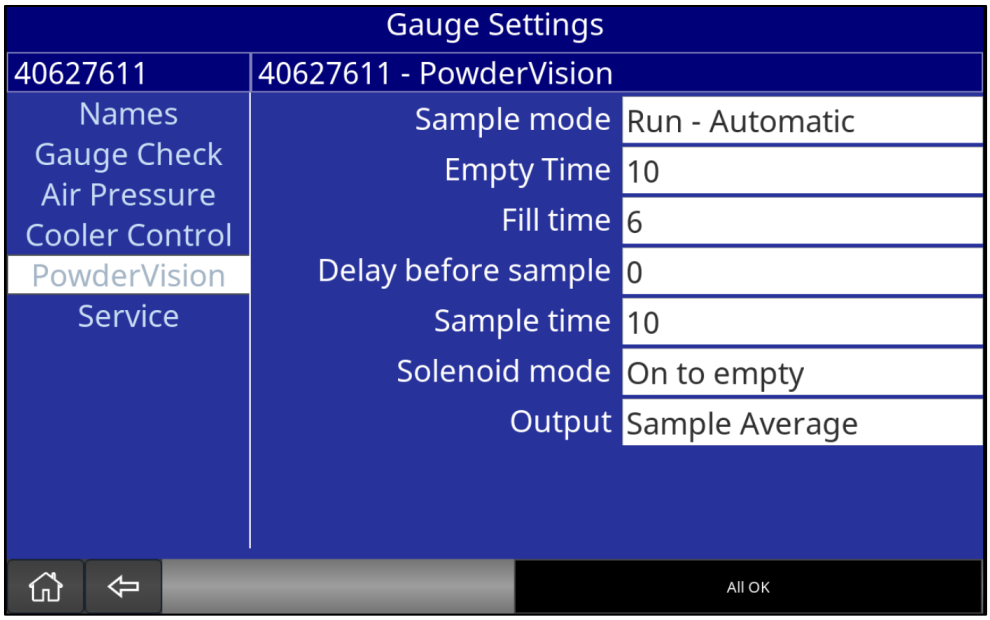


Figure 2-14 PowderVision Settings page

2. The settings are described below. The timings shown are in seconds.

   - **Sample mode** – 3 options are available:
     1. **Run - Automatic** (default cycling)
     2. **Stopped - Meas Active** (measurement is being continually updated)
     3. **Stopped - Meas Inactive** (measurement is frozen at last value)

   - **Empty Time** – Time to empty the cup (air jet on).

   - **Fill time** – Time to fill the cup (air jet off).

   - **Delay before sample** – Time delay before the measurement starts to update (air jet off).

   - **Sample time** – Time that the measurement is averaged or updated – see **Output** (air jet off).

   - **Solenoid mode** – 2 options are available, depending on the solenoid active state:
     1. **On to empty** (default)
     2. **Off to empty**

- **Output** – 2 options are available:
    1. **Measurement** (Sample measurement is updated continuously, with the response time applied during the sample period)
    2. **Sample Average** (Sample measurement is updated as an average of the sample period using the raw measurement, without the response time applied)

The settings shown in Figure 2-14 can be used initially, and should be adjusted, depending on the line conditions, to ensure optimal performance.

3. Go to the Digital Outputs screen (refer to the Series 9 Guide) and ensure that output 1 is set as shown in Figure 2-15.

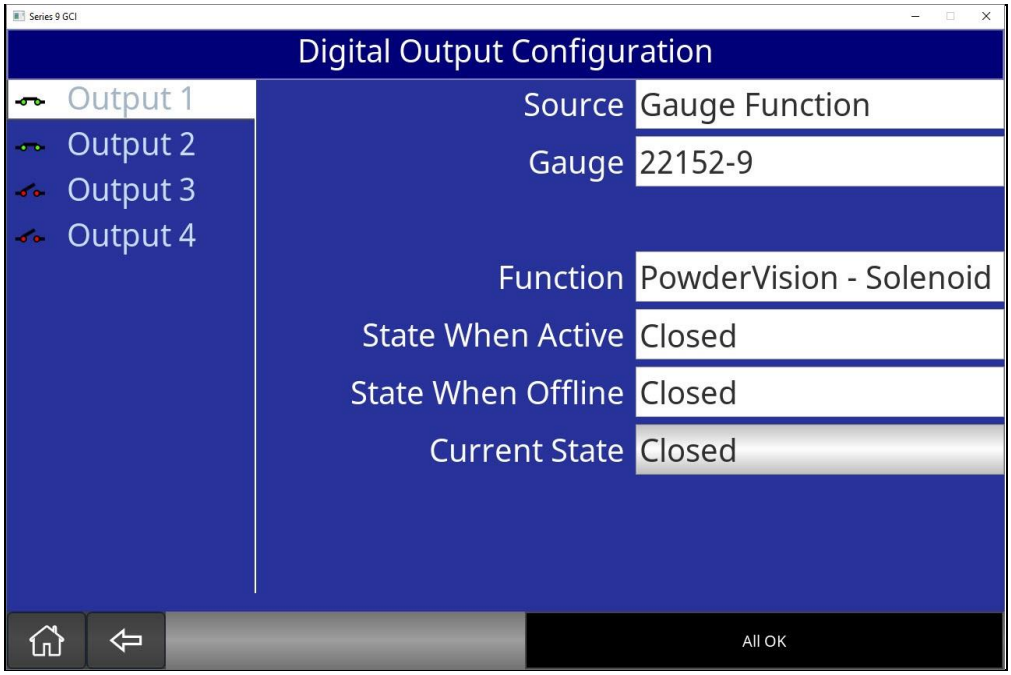


Figure 2-15 PowderVision Digital Output Setup

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CHAPTER 3

3 Operation

3.1 Home Page

The Series 9 PowderVision is supplied already set up for the application advised to NDC, and will automatically start the sampling sequence as explained in Section 2.6 - GCI Settings for PowderVision on power up.

The Operation through the GCI is fully covered in the Series 9 Guide, and remains largely unchanged due to the PowderVision function. However, the measurement values will only update after each sampling period, and the Home screen includes a banner showing the progress of the PowderVision sampling (Figure 3-1).

Figure 3-1 PowderVision Sampling Sequence

3.2 Manual Sampling

The GCI sampling feature can be used, taking a single show sample using the PowderVision time settings to empty and fill, etc., but will use the **Sample Time** in the Sample screen (Figure 3-2). This manual process will interrupt the automatic measurements during this period.

Figure 3-2 Manual sampling from Sample screen

CHAPTER
4

4 Calibration

4.1 Overview

A detailed explanation of the calibration theory and practice are given in the Calibration section of the Series 9 Guide. However, the basic steps of calibrating the PowderVision on-line are given in the following passages.

4.2 Basic Trim Calibration (Recommended)

1. Create a Product Recipe in the GCI with the correct Application code for the product being produced with a Span = 1.00 and Trim = 0.00, then select this Product Recipe.

2. Run the process at the target moisture level and start the PowderVision cycling.

3. During the filling cycle of the PowderVision, grab a physical sample from the sampling port of the process (the sampling port should be located immediately downstream of the PowderVision).
   Place the physical sample immediately in a sealed container to help retain the moisture.

4. Record the next gauge reading from the GCI (sample just taken).

5. Repeat for a further four samples at the target moisture level, so you have a total of five samples. Calculate the average moisture level from the gauge readings.

6. Next, analyze the five physical samples in the laboratory for moisture, ideally using either Oven or Karl Fischer methods. The physical samples should be split into at least two replicates each to determine the average moisture level.

7. Next, enter the average moisture level from the gauge and the laboratory into GTXL (manual Line Fit) to determine the optimum TRIM value. This is then entered into the Product recipe.

8. Repeat **1** to **7** for all Product types.

4.3 Full Calibration

Where a process is being run over a range of different moisture levels, the process described in Section 4.2 - Basic Trim Calibration (Recommended) should be repeated at high, low and medium moisture levels and GTXL manual Line Fit used to determine the optimum SPAN and TRIM values to be entered into the Product Recipe.

4.4 No Sampling Port

If there is no sampling port in the process, the PowderVision itself can be used to collect the physical sample. This involves running the PowderVision in single shot mode, where a sample is collected and measured, but not ejected. The physical sample is retrieved by carefully retracting the PowderVision and then emptying the product into a sealed container for Laboratory analysis.

CHAPTER 5

5 Servicing, Returns and Recycling

5.1 Servicing and Returning your Equipment

Your instrument was carefully inspected electrically and mechanically prior to shipment. It should be free of surface defects and scratches, and it should be in perfect working order upon receipt. If any indication of damage is found, file a claim with the carrier immediately, prior to using the instrument. If no damage is apparent, proceed by using this manual to install and setup this instrument.

Save the shipping carton and packing material for future storing or shipment of the instrument. If, at some future time, the instrument must be returned to the factory for service, include a full description of the instrument failure and the mode of operation the instrument was in at the time of failure. Also include a contact person to discuss the instrument failure.

When returning equipment for service, it is important to first obtain a Return Material Authorization (RMA) number. The RMA number is needed for proper handling of returned equipment.

- To obtain an RMA, go to https://ndc.custhelp.com/.
- To create a myNDC account, click the **Log in or Sign up** button. After creating the account, you will be immediately logged in. To log in on subsequent visits to myNDC, click the **Log in or Sign up** button, enter your username and password, and then click **Log in**.
- To submit an RMA, click on the **RMA Request** link and follow the on-screen instructions.

Ship the instrument in the original carton, or, if the original carton is unavailable, ship in a carton providing sufficient protection. Send the instrument to the Asia, Europe, or USA office, whichever is closest to you or to the office indicated by your sales engineer. Place the RMA number on the outside of the carton and include a purchase order number and any other information specific to your instrument. Field warranty service is available if the customer pays travel expenses by advance purchase order. All service operations should be performed by skilled electronics technicians, who have been trained by NDC Technologies.

5.2 Recycling, Disposal and Sustainability

NDC Technologies provides intelligent measurement and control solutions to help you focus on your unique mission in a more sustainable way. Better for your people. Better for your bottom line. Better for the planet. For this reason, NDC Technologies encourages its customers to recycle and dispose of equipment in a way which is responsible and encourages sustainability.

Please check the following before disposing of your equipment:

- Is the equipment worth repairing? If in doubt, contact NDC Service.
- If you are aware of any hazardous materials in your equipment, ensure qualified personnel take responsibility for its disposal. Some examples of hazardous substances include lead, mercury, cadmium, chromium VI, flame retardants, plasticizers, fluorescent tubes, monitors containing cathode ray tubes and products containing capacitors. NDC is compliant with the European WEEE and the most current RoHS Directive.
- Can you re-use or recycle any constituent parts? For example, if the housing/chassis is made of metal, it can be recycled by your local authority. Ensure qualified personnel take responsibility for dismantling the equipment.

If the equipment does need to be disposed of, please dispose of it in a way that does not harm the environment.

Warranty

1. All sales of NDC Technologies products are subject to the contractual terms and conditions of the Order pursuant to which they were sold to Buyer, including Warranty terms. The following terms are a general summary of the contractual Warranty terms, NOT a revision or alternative to the contractual terms, and are presented as merely a point of reference for your information. The contractual Warranty is the complete and exclusive statement of all NDC Technologies warranties to Buyer. In the event the following terms are in conflict with any of the contractual Warranty terms, the contractual Warranty terms shall be deemed to control.

   The warranty terms contained herein are expressly in lieu of any and all other warranties, expressed or implied, including any warranty of merchantability or fitness for a particular purpose. In no event shall NDC Technologies be liable for any incidental, consequential or special damages, including but not limited to, any loss of business, income or profits, expenses incurred for time when the system is not in operation, and any labor costs relating to or arising out of the performance, functioning or use of the system.

   Purchaser assumes the risk for use of this product and agrees to indemnify and hold NDC Technologies harmless for any and all damage to person or to property resulting therefrom.

   NDC Technologies grants no license under any patent rights except the right, under only such patents as may be owned or acquired by NDC Technologies, to use the product sold hereby for the purpose for which it is sold. NDC Technologies does not warrant that the product or its use does not infringe any patent owned by persons other than NDC Technologies.

2. NDC Technologies guarantees all products to be free from defects in material and workmanship for the following periods[1]:

   - Product and peripherals – 2 years from shipment
   - Source lamp – 5 years from shipment
   - Filter wheel motor – 5 years from shipment
   - Spare parts – 1 year from shipment
   - Replacement lamps and motors supplied under warranty – 1 year or up to the original 5 year warranty from shipment of the sensor, whichever is longer

   [1] Refer to the contractual terms and conditions of the Order for usage of the warranty.

   During this period, NDC Technologies will repair or at its option replace, free of all charges for parts and labor, any NDC Technologies parts determined by it to have been broken or damaged due to causes other than improper application, abuse or negligence. NDC Technologies' obligation to repair or replace shall not extend to expendable parts which are subject to normal operating wear.

   Nothing in this paragraph 2 will require NDC Technologies to make repairs or replacements where:

A. The product has been repaired, other than by an authorized NDC Technologies dealer or an NDC Technologies employee, or altered in any way without the prior written consent of NDC Technologies; or

B. The product has not been properly maintained in accordance with any operating and maintenance manual supplied therewith; or

C. The product has been damaged as a result of fire, flood, war, insurrection, civil commotion, acts of God or any other cause beyond the control of NDC Technologies or Buyer.

3. NDC Technologies' liability shall be limited to the obligations set forth in Paragraph 2. These shall be the Buyer's sole and exclusive remedies, whether in contract, tort or otherwise, provided, however, that in lieu thereof, NDC Technologies at its option may replace the entire product on an exchange basis or refund the purchase price against the return of the defective product.

4. NDC Technologies will not be responsible for failure to provide service or parts due to shortage of materials, labor or transportation strikes or delays, or any causes beyond NDC Technologies' control.

5. Unless otherwise specified by NDC Technologies, all warranty repairs will be made at NDC Technologies' facility. The customer shall be responsible for all expenses of packing, freight and insurance in connection with the shipment of products to NDC Technologies for repair. NDC Technologies will pay the cost of returning the equipment to customer.

   If it is mutually determined by the buyer and NDC Technologies that the examination, replacement or repair takes place at the buyer's facility, then the buyer will be responsible for NDC Technologies' travel and living expenses incurred in traveling to and from the buyer's facility, and during the time of the visit, as well as the cost of field labor and replacement parts unless the parts being repaired or replaced are determined to have been defective, in which event the cost of said repaired or replacement parts shall be borne by NDC Technologies. These travel and living expenses will be billed to the buyer at actual cost to NDC Technologies.

6. No person, including any NDC Technologies distributor, agent or representative, is authorized to assume any liability on behalf or in the name of NDC Technologies, and NDC Technologies shall not be bound to any understandings, representations, or agreements with respect to warranties except as set forth in this policy.

7. NDC Technologies requests immediate notification of any claims arising from damage in transit in order to determine if carrier responsibility exists. If damaged equipment arrives, save the shipping container for inspection by the carrier and telephone NDC Technologies as soon as possible.