Stand-Alone Bubble Detection System

1. Introduction

The Bubble Detection system is designed to detect air-bubble induced gaps in a bead of material as it is being dispensed. When a bubble is detected, the fault light on the panel comes on. The use of a relay is optional as either a switch to the PLC or to the robot.

See Figure 1. The Stand-Alone Bubble Detection system can be used with either 500 psig or 1000 psig pressure transducers. The primary components of the system are the bubble detect printed circuit board (PCB) (5), thumbwheel switch (1), pressure transducer, cables, and connectors. The thumbwheel switch increases or decreases system sensitivity. The pressure transducer is located directly on the gun.

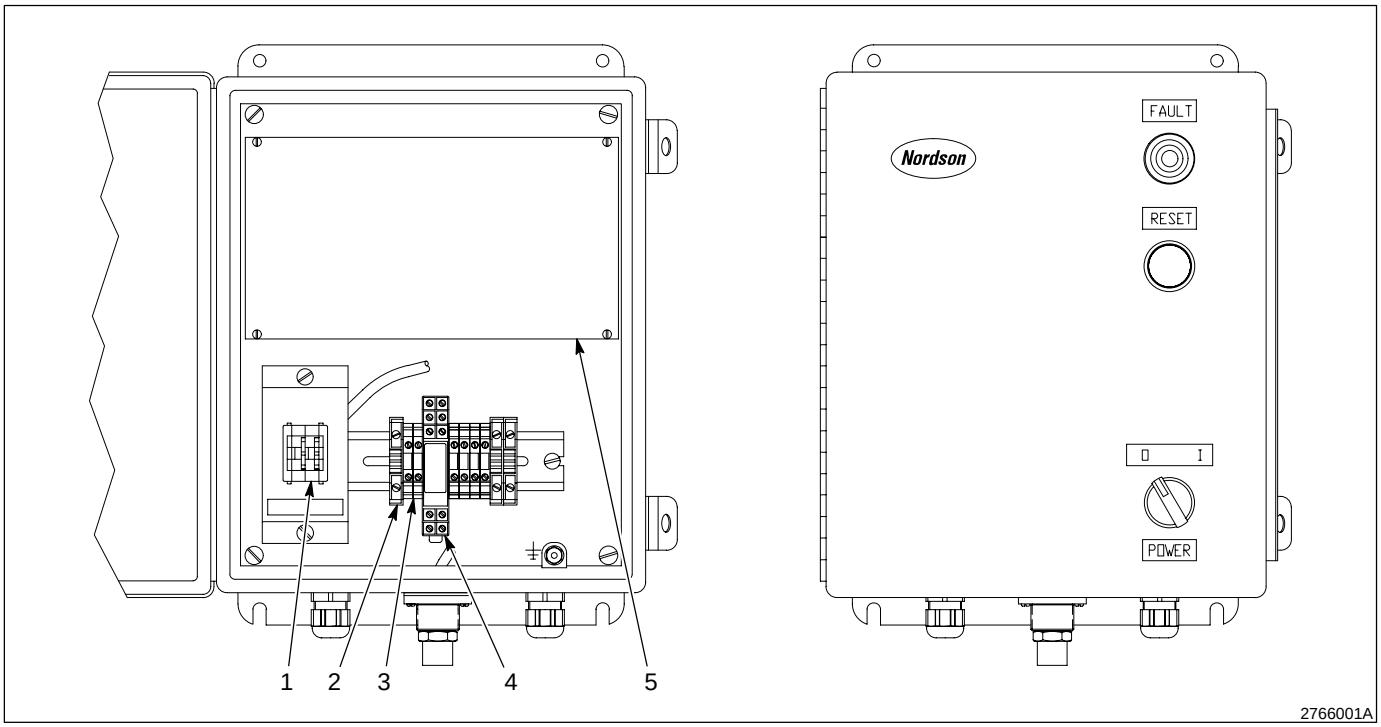

Fig. 1 System diagram

1. Thumbwheel switch
2. Gun signal terminal blocks
3. Fused terminal blocks
4. Relay socket
5. Bubble detect PCB

2. Installation

WARNING: Allow only qualified personnel to perform the following tasks. Observe and follow the safety instructions in this document and all other related documentation.

Setup

See Figure 1.

1. Connect the gun signal wires to TB3 and TB4.

NOTE: Relay K1 and the PLC or robot have no cabling requirements.

2. Install the pressure transducer onto the dispensing gun.
3. Connect the transducer cable between the transducer and the 7-pin transducer connector.
4. Attach the user interface signals to the appropriate terminals on the relay socket (4).
5. Connect 120 V power to the two fused terminal blocks (3).
6. Set the bubble detect PCB (5) switches to:
   a. SW1 = ON (unless the application requires that bubble detect fault be reset at Gun Off)
   b. SW3 = 5
   c. SW4 = 0
7. Verify that SW2 = 115 (preset at the factory).
8. Set the skip sensitivity thumbwheel to 50. This is an initial setting that can be modified later.

Sensitivity Setup

Follow these procedures for sensitivity setup.

1. Turn on power to the controller.
2. Disconnect the fittings at the gun inlet or the gear pump outlet and scoop out some material.
3. Determine the smallest size bubble to be detected and introduce just enough air into the material line to create this bubble. This may have to be repeated several times to get the required bubble size.

Sensitivity Setup (contd.)

4. Run a dispense cycle such that the dispensed bead has the smallest size skip that needs to be detected.

5. Adjust the skip sensitivity thumbwheel to obtain the correct sensitivity:

   a. If the bubble detect indicator on the control front panel is off and LED1 on the bubble detect PCB is off, decrease the skip sensitivity thumbwheel switch value.

      or

   b. If the bubble detect indicator on the control front panel is on and LED1 on the bubble detect PCB is on, increase the skip sensitivity thumbwheel switch value.

NOTE: If bubbles are no longer detected, return the thumbwheel to the previous value and regard this value as the correct skip sensitivity setting.

6. Repeat this procedure until the correct sensitivity has been obtained.

NOTE: The correct skip sensitivity is obtained when the smallest size bubble to be detected causes the bubble detected indicator to turn on and the next higher skip sensitivity value causes the bubble detected indicator to turn off.

Delay Setup

Follow these procedures for delay setup.

1. Adjust the Detect on Delay using SW3 and SW4 on the bubble detect PCB to the shortest duration without generating a false bubble detect output. The range of Detect on Delay is 0–2 seconds with a recommended setting of 0.2 seconds.

2. If desired, ensure that the robot/PLC is set to read the bubble detect fault relay output and abort the part with the skip.

3. Use Table 1 to record the settings:

Table 1 Settings

Switch	Setting
SW3	
SW4	
Skip Sensitivity	
SW1 (Skip Reset)	
TP7	

3. Operation

Perform the *Operation* sections in the gun and controller manuals.

NOTE: The *Operation* sections will explain startup and shutdown procedures.

Adjustments

Perform the adjustments in Table 2 as necessary.

Table 2 Adjustments

Item	Description
Detect on Delay	Adjust the Detect on Delay using SW3 and SW4 on the bubble detect PCB to the shortest duration without generating a false bubble detect output. Range: 0–2 sec (recommended 0.2 sec)
Skip Sensitivity	Increase the thumbwheel value in order to detect only larger bubbles (less sensitive). Decrease the thumbwheel in order to detect smaller as well as larger bubbles (more sensitive). Range: 0 to 990 mV Increment: 10 mV/step Average: 50 (corresponds to approx. 0.5 V at TP7)
Fault Reset Mode	Set SW1 to either Gun On or Gun Off per application requirement. The recommended mode is Gun On. If the user decides to configure this device to keep the gun on after a fault, the Stand-Alone Bubble Detection system can be reset manually by pushing in the manual reset button on the enclosure cover. This will shut-off the panel light, de-energize the relay (K1), and re-enable the bubble detection circuitry.

4. Troubleshooting

Troubleshooting consists of making adjustments and observing indicator lights.

The *Fault Indicator* section provides problems that may occur with the fault indicator during normal operation. Tables 3 through 5 list additional information. If the problem is not listed or the corrective action does not work, contact your Nordson Corporation representative.

Fault Indicator

Problem	Possible Cause	Corrective Action
1. Fault indicator does not light	SW 2 set wrong	Verify that SW2 is correctly set to 115 to match the AC voltage level connected to Connector 6.
	Power not on	Verify that the green power LED is on when AC power is applied to Connector 6.
	Connections incorrect	Verify that all connections from Connector 3 to the nozzle pressure transducer are correct and connected.
2. Fault indicator turns on and off incorrectly	Sensitivity too low	Verify that sensitivity adjustment (thumbwheels) are not set too low. The lower the number, the more sensitive the system becomes to small bubbles.
	Bubble Fault Time Delay too low	Verify that the Bubble Fault Time Delay (mask time) is high enough. The time-delay on the bubble board must be great enough to mask any pressure disturbances occurring when the gun physically activates and dispensing of material starts. When the gun shuts off, the resulting pressure spikes require no masking. Pressure spikes occur after the bubble board is disabled due to the gun-on input turning off.

Bubble Detection Board Specifics

Use Tables 3 to 5 for additional information.

Table 3 Bubble Detection Board Specifics

Item	Setting
Thumbwheel Switch	Two digit (00 to 99) switch which sets the skip sensitivity reference voltage against which TP6 voltage is compared. Increment: 10 mV/step Range: 0 to 990 mV
TP1	Ground
TP2	5 Vdc (excitation voltage required for pressure transducer)
TP3	Nozzle pressure signal: 0–5 Volts Nozzle pressure (PSI): $^1/_5$ x (Volts at TP3) x (transducer full scale psi)
TP4	Not used
TP5	Not used
TP6	Fast changing pressure fluctuations extracted from the composite pressure waveform at TP3 of the gun board. Positive pulses indicate bubbles.
TP7	Skip sensitivity reference voltage adjustable via thumbwheel. TP6 is compared to TP7 for bubble detection. Range: 0 mV–990 mV (approximately)
TP8	Bubble detection circuit output; connected to the comparator (TP6 vs. TP7). TP8 = 0 Volt when TP6 > TP7 (bubble present) TP8 = 5 Volt when TP6 < TP7
TP9	Gun On signal. This signal represents the actual time during which the gun dispenses material.
TP10	Bubble detection activated after the delay.

Table 4 Connectors with Descriptions

Connector	Description
1	Spare pressure input—no bubble detection on this channel
2	Upstream pressure input—no bubble detection on this channel
3	Nozzle pressure input—tied to bubble detection circuit
4	Input/output
5	Analog pressure output
6	Power input
7	Thumbwheel cable—9-pin shielded cable connector from the thumbwheel switch

Bubble Detection Board Specifics *(contd.)*

Table 5 Connectors with Signal Names

Pin	Connector and Signal Name					
	1	**2**	**3**	**4**	**5**	**6**
1	+5 Vdc excitation	+5 Vdc excitation	+5 Vdc excitation	Gun On Sig +	Spare pressure output +	AC power L1
2	Sig +	Sig +	Sig +	Gun On Sig –	Spare pressure output –	Not used – N/C
3	Sig –	Sig –	Sig –	Bubble Detected N.O. contact	Upstream pressure output +	AC power GND
4	Com excitation	Com excitation	Com excitation	Bubble Detected N.O. contact	Upstream pressure output -	Not used – N/C
5	Shield	Shield	Shield	N/A	Nozzle pressure output +	AC power L2
6	N/A	N/A	N/A	N/A	Nozzle pressure output –	N/A
7	N/A	N/A	N/A	N/A	N/A	N/A
8	N/A	N/A	N/A	N/A	N/A	N/A
9	N/A	N/A	N/A	N/A	N/A	N/A

5. Maintenance

No maintenance is required for the bubble detection system. Refer to the applicable manual for the correct gun maintenance.

6. Parts

To order parts, call the Nordson Customer Service Center or your local Nordson representative.

Bubble Detect

See Figure 2.

Item	Part	Description	Quantity	Note
—	306 311	Enclosure, stand alone bubble detect, assembly	1	
—	238 280	Kit, bubble detect, CE	1	
1	185 648	• PCA, enhanced bubble detector	1	
2	933 343	• • Connector, plug, 5 position	4	A
3	933 344	• • Connector, plug, 6 position	1	A
4	933 342	• • Connector, plug, 4 position	1	A
5	185 660	• Harness, enhanced skip detection	1	B

NOTE A: Terminating port shown in Figure 2.
B: See Figure 3 for location.

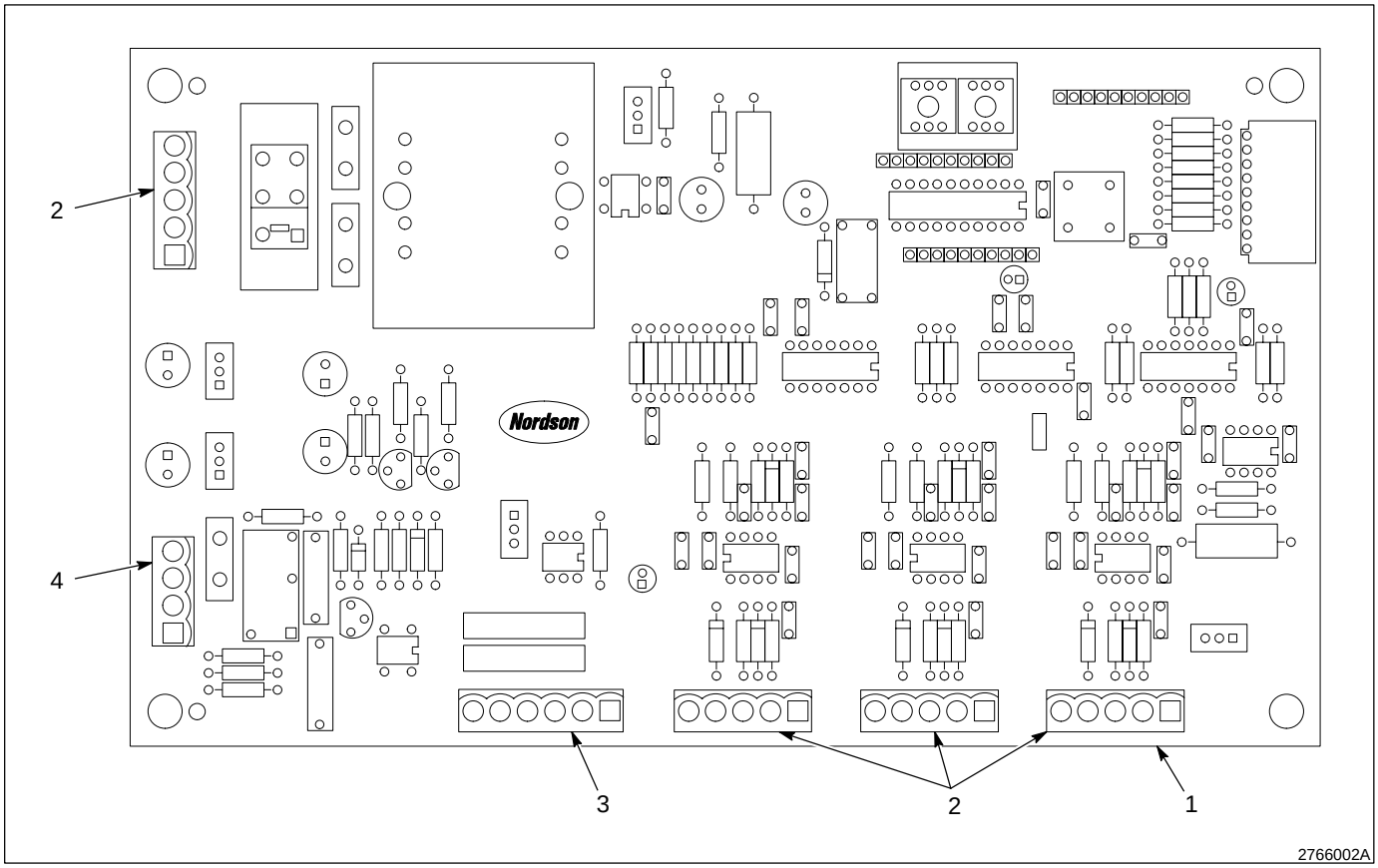

Fig. 2 Bubble detect kit

Spare Parts

See Figure 3.

Item	Part	Description	Quantity	Note
1	185 658	Bracket switch, 2 tw, 10 position	1	
2	324 224	Transducer, 500 psig	1	A
2	100 305	Transducer, 1000 psig	1	A
3	225 904	Cable, system pressure, 40 feet	1	
NS	185 648	PCA, enhanced bubble detector	1	
NS	310 904	Fuse, 1.0 Amp	2	
NS	306 319	Relay, DPDT	1	

NOTE A: Transducer is system specific. Check your system for the correct part to order.
NS: Not Shown

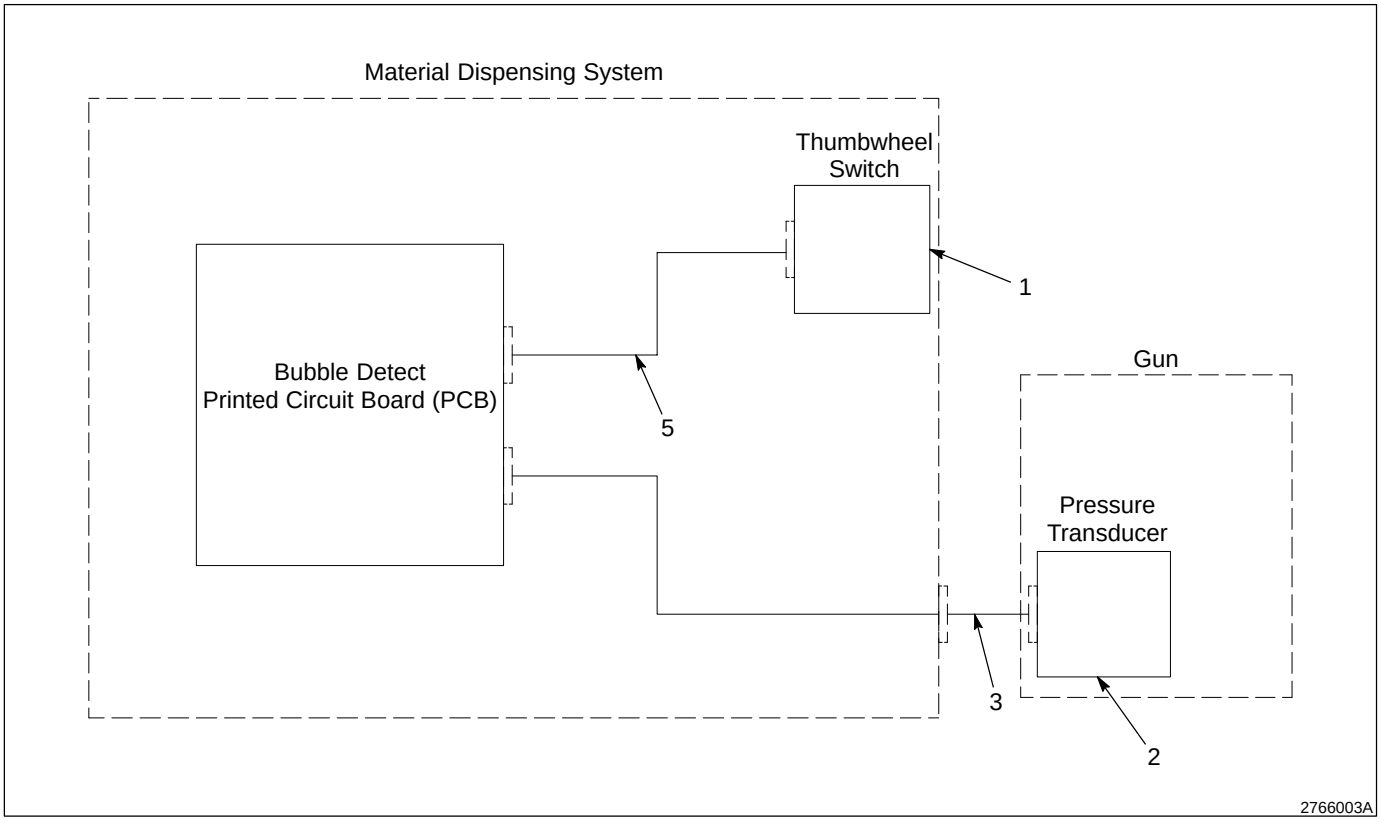

Fig. 3 Spare part locations

7. Specifications

Power rating	1 Amp @ 120 Vac
Relay contact rating	5 Amps
Gun signal	12 Vdc to 120 Vac