User's Guide

Control Systems for
VFD-Based Fume and Dust Collection Systems

Rev. 08 2018-08-01

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List of Illustrations

Reference Documents

SOURCE	TITLE	DOWNLOAD REF
ABB	ABB ACS250 Users' Guide	https://library.e.abb.com/public/e26638e1f3cd410e85257db00052f1a2/3AUA0000137830_REVB.pdf
ABB	ABB ACS250 Users' Guide – 600V variants	https://library.e.abb.com/public/0f8c901fd61bbb9c85257dbd005028b7/3AUA0000138354_REVB.pdf
ABB	ABB ACS550 User's Guide	https://library.e.abb.com/public/313b6ebaf237059fc1257d0a0048fd68/EN_ACS550_01_UM_H_A4.pdf
Belimo	FSLF Actuators	https://www.belimo.us/belimo/media/Technical_Documents/Fire_and_Smoke_Actuators/FSLF_Actuators.pdf
Danfoss	MG11AK22 Danfoss FC102 Instruction Manual	http://drives.danfoss.com/downloads/documents/#/
Danfoss	MG11CD22 Danfoss Programming Guide	http://drives.danfoss.com/downloads/documents/#/
Dwyer	616KD Series	http://www.dwyer-inst.com/PDF_files/PDS/DS_616KD.PDF http://www.dwyer-inst.com/PDF_files/616KD_new.pdf
Eaton	Eaton DA1 VFD Installation Manual MN0402005Z_EN	ftp://ftp.moeller.net/DOCUMENTATION/AWB_MANUALS/MN04020005Z_EN.pdf
Eaton	Eaton DA1 VFD Parameter Manual MN0402006Z_EN	ftp://ftp.moeller.net/DOCUMENTATION/AWB_MANUALS/MN04020006Z_EN.pdf
Eaton	Eaton DC1 VFD Installation Manual MN04020003Z_EN	ftp://ftp.moeller.net/DOCUMENTATION/AWB_MANUALS/MN04020003Z_EN.pdf
Eaton	Eaton DC1 VFD Parameter Manual MN04020003Z_EN	ftp://ftp.moeller.net/DOCUMENTATION/AWB_MANUALS/MN04020004Z_EN.pdf
Invertek	Optidrive Eco User Guide Rev 3.0	http://www.invertekdrives.com/client-uploads/download-manager/user-guides/82-HEMAN-IN_V3.00%20Optidrive%20Eco%20User%20Guide.pdf
Lev-co	Users' Guide - Model 13-16 Enhanced Control System for Wet Collectors	Request from Lev-co
Lev-co	Manual Supplement – ABB ACS250 and Eaton DC1 VFDs	Request from Lev-co
Lev-co	Manual Supplement – ABB ACS550 VFD	Request from Lev-co
Lev-co	Manual Supplement – Invertek Optidrive and Eaton DA1 VFDs	Request from Lev-co
Norgren	V61R517AA213JB	http://cdn.norgren.com/pdf/V60-V62%20Series%20Valves.pdf
Sensocon	A1/A2 Installation & Operation Manual	http://www.sensocon.com/files/PDFs/IOM_A1-A2.pdf

Revision Record

DATE	Rev No.	Description
2015-11-19	01	First Release
2015-11-20	02	Updated Spare Parts Numbers
2016-04-29	03	Complete update
2016-06-27	04	Drawing updates; text revisions; addition of sections 7 & 8
2016-08-30	05	Revised Figs 5 & 7, all section 9. Changed title. Text updates.
2016-12-13	06	Revised to included multiple VFD types; extended to include new models
2017-04-24	06.1	Minor updates to troubleshooting sections
2018-03-01	07	Rewritten to include Eaton drives and manual supplements
2018-08-01	08	Minor textual revisions to remove bias to Optidrive VFD; clarifications

Warranty

This product is guaranteed to be free of defects in materials or workmanship for a period of one (1) year from date of delivery. Lev-co undertakes to repair and/or replace any such defect within the warranty period at no cost to the client. Any action by the client involving attempted repair and/or replacement either by himself or a third party voids this and all warranties.

If such exists, Lev-co extends the warranty of the manufacturer(s) for components used in this product under the terms stipulated in said warranty(ies). No other warranty is either express or implied.

1 Introduction

1.1 Scope

This User's Guide is intended to describe the control systems used in Lev-co fume and dust extraction systems employing Variable Frequency Drives (VFDs). It does not cover the installation of the ducting, arms or hose reels, dampers or blast gates, motors, fans, filters or other equipment directly related to the extraction process. It is limited to the control system only.

Lev-co uses VFDs from various vendors in its systems, dependent on commercial and/or technical factors or in some cases user preference (familiarity with a given vendor's product, for example). In essence, all systems function identically, with differences in Control panel to VFD wiring and VFD programming. The reader is directed to the appropriate **Manual Supplement** for further information. The Supplement also provides detailed schematic, wiring and programming information for each unique model and VFD type.

Items which are critical for safety, performance, or compliance with legal requirements are highlighted in RED and marked with this symbol. 

1.2 System Architectures

Lev-co manufactures and distributes local exhaust fume and dust extraction systems. Apart from effective contaminant removal, one of our major objectives is the minimization of energy consumption, for both economic and environmental reasons. One of the key methods by which this objective is achieved is by the use of Variable Frequency Drives to control the operation of fan motors.

The fan motor is invariably a three-phase AC induction motor, which may in some cases be supplied by single-phase mains power (converted to three-phase by the VFD). Such a motor may be operated in a variable-speed/constant-torque manner by driving it with a source of variable frequency and voltage. These two parameters bear a fixed relationship for any given motor; for example, a motor rated for operation at 575 volts and 60Hz has a V/Hz characteristic of 575/60 = 9.583V/Hz. If it is a two-pole motor, it also has a full rated speed of 3600RPM. Thus, it can be driven at any selected speed by applying a voltage and frequency along the 9.583V/Hz curve, with the resultant speed being 60RPM/Hz. Thus, half-speed (for example) is achieved at a voltage of 287.5V and 30Hz, and 90% speed at 517.5V and 54Hz. (Motor slip is ignored.)

A typical VFD has four main components:

a) A single- or three-phase controlled bridge rectifier which converts the primary AC input voltage into a semi-regulated internal DC voltage.
b) A DC link which smooths the rectified output, usually by means of a large capacitor, and provides the control feedback to the primary voltage regulator.
c) A DC-to-AC inverter which converts the internal DC bus to the variable-frequency/variable voltage output power, usually by means of a high-frequency PWM (pulse-width-modulated) oscillator. The AC output is in fact a sinusoid synthesized from high-frequency pulses of variable width and amplitude.
d) A controller which manages the output frequency and voltage as well as many other ancillary functions.

Lev-co uses VFDs in one of three system architectures:

- Type 1 – manually variable duct pressure with optional automatic start/stop
- Type 2 – controlled duct pressure with optional automatic start/stop
- Type 3 – controlled duct pressure and automatic start/stop with system-powered electrical dampers.

Any of these basic architectures may be supplemented by options including fire detection and automatic filter cleaning. These are described below.

1.3 List of Standard Models

Standard available models comprise the following:

- Model 13-12 – Type 1 – VFD as a Contactor Replacement
- Model 13-13 – Type 2 – VFD System with Constant Duct Pressure
- Model 13-14 – Type 3 – Type 2 System with Controlled Electrical Dampers
- Model 13-15 – Type 3 VFD System with Blast Gates
- Model 13-16 – Enhanced Control System for Wet Collectors[1]
- Model 13-74 – Type 2 System with Vibra-Pulse Cleaning
- Model 13-75 – Type 2 System with Shaker Motor Cleaning
- Model 13-76 – Type 2 System with DC Sequenced Solenoids Cleaning
- Model 13-77 – Type 2 System with AC Sequenced Solenoids Cleaning

[1] This model is not described in this Manual. It has its own User Guide, noted in the Reference Documents table.

1.3.1 Model 13-12 – Type 1 – VFD as a Contactor Replacement

In this architecture, the VFD operates simply as an enhanced-performance contactor replacement. The benefits are the ability to gently ramp motor speed up and down at start and stop, thereby minimizing motor stresses and extending motor life, as well as eliminating heavy startup surge currents and their attendant wasteful energy costs. Motor speed may also be adjusted via a supplied speed adjustment potentiometer to obtain desired extraction performance, reduce noise, or to deliberately reduce energy consumption during periods when peak demand charges are in effect.

External start/stop interlocking is provided to permit control by one or more external contacts, such as damper limit switches, foot switches, hood switches, or current-sensing switches. AMU (air make-up unit) interlocking is also available via this function.

An indicator is provided to show when the motor is running. Options include fused disconnect and duct pressure indicator.

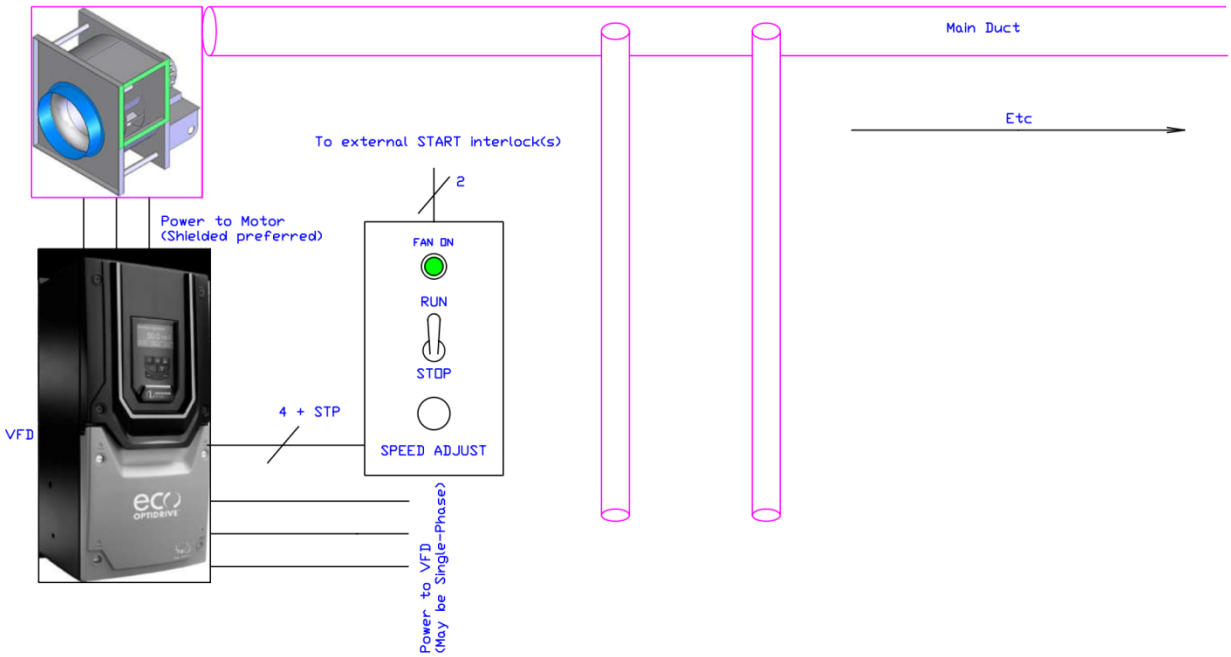

Figure 1 – Type 1 Architecture

1.3.2 Model 13-13 – Type 2 – VFD System with Constant Duct Pressure

In this approach, the Type 1 system is extended to include a pressure sensor in the main duct downstream of the fan, which allows the VFD to actively control motor speed as a function of duct (negative) pressure. This permits constant, effective exhaust at a target duct pressure no matter how many dampers are open or (within limits) the state of the filters. The benefits of the Type 1 architecture also apply.

A MANUAL/OFF/AUTO switch (sometimes HAND/OFF/AUTO) permits the user to override pressure sensing and run the system at maximum speed. The same interlocks, indicators and options are available as for Type 1.

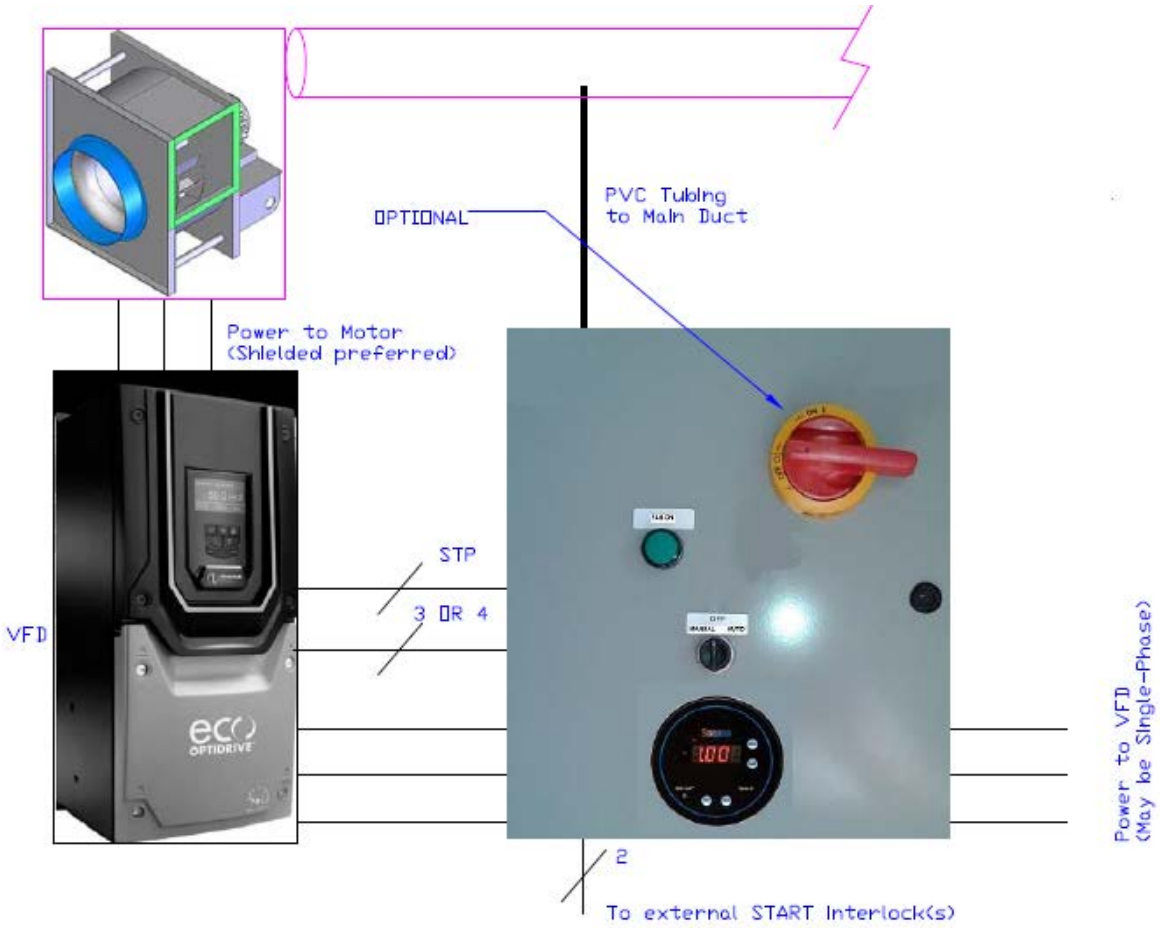

Figure 2 – Type 2 Architecture

1.3.3 Model 13-14 – Type 3 – Type 2 System with Controlled Electrical Dampers

This system takes the Type 2 approach a step further, making the start/stop damper interlock an inherent feature and providing power to electrically-operated/spring-return dampers. The first damper to open causes the fan to start; the last one to close causes it to stop. AMU or other start interlocks are also provided.

Up to six dampers may be accommodated with a standard system – more are available on special order.

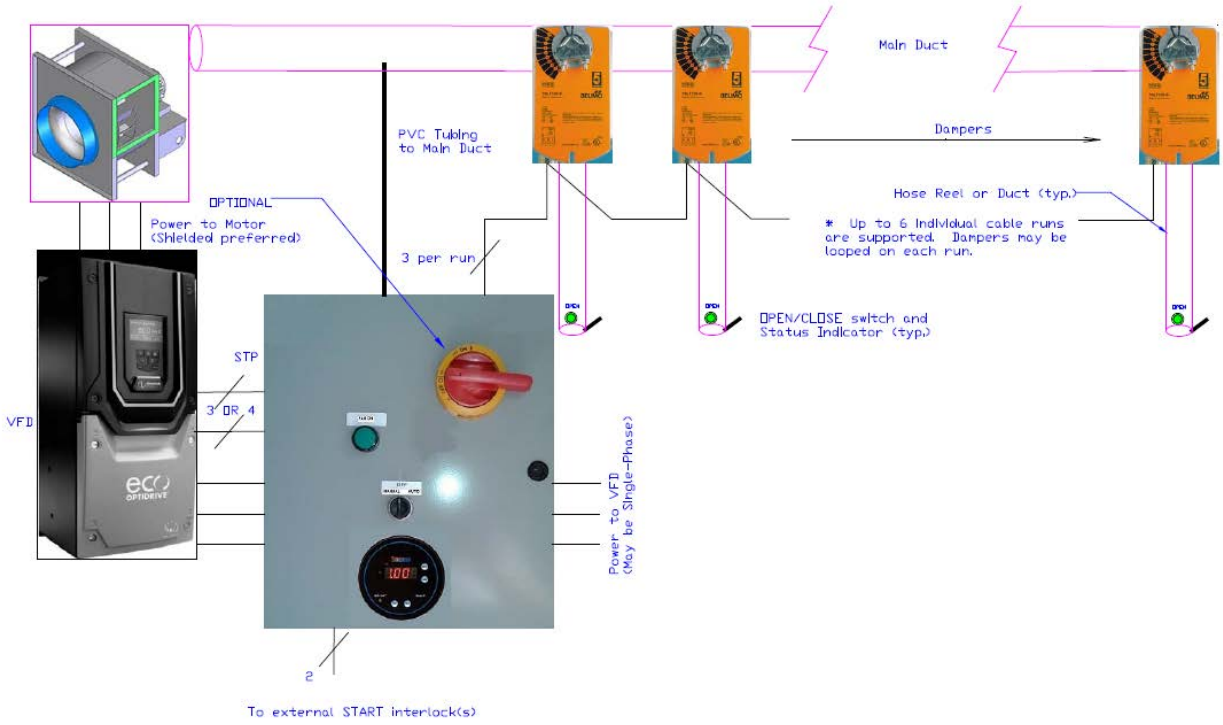

Figure 3 – Type 3 Architecture

1.3.4 Model 13-15 – Type 3 VFD System with Blast Gates

Blast gates may be used as an alternative to electrical dampers in some installations. The functionality is essentially identical to a standard Type 3 system except for extraction adjustability (HI/LO) at the (up to 8) workstations. However, due to the use of a cyclonic filter these systems always run at full speed and the pressure transducer is used for indication only.

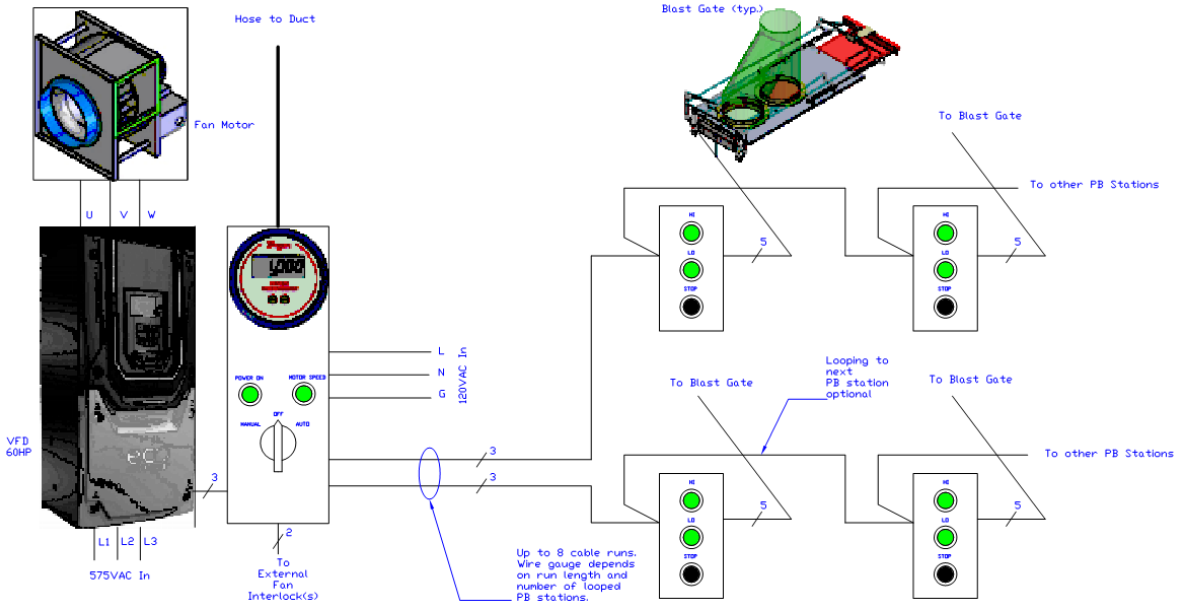

Figure 4 – Blast Gate System Architecture

1.3.5 Model 13-16 – Enhanced Control System for Wet Collectors

This model is covered in its own User Guide. For reference, its architecture is shown below. Note that the VFD is not shown as it is usually contained within the main control panel rather than being separately-mounted as in most other control systems.

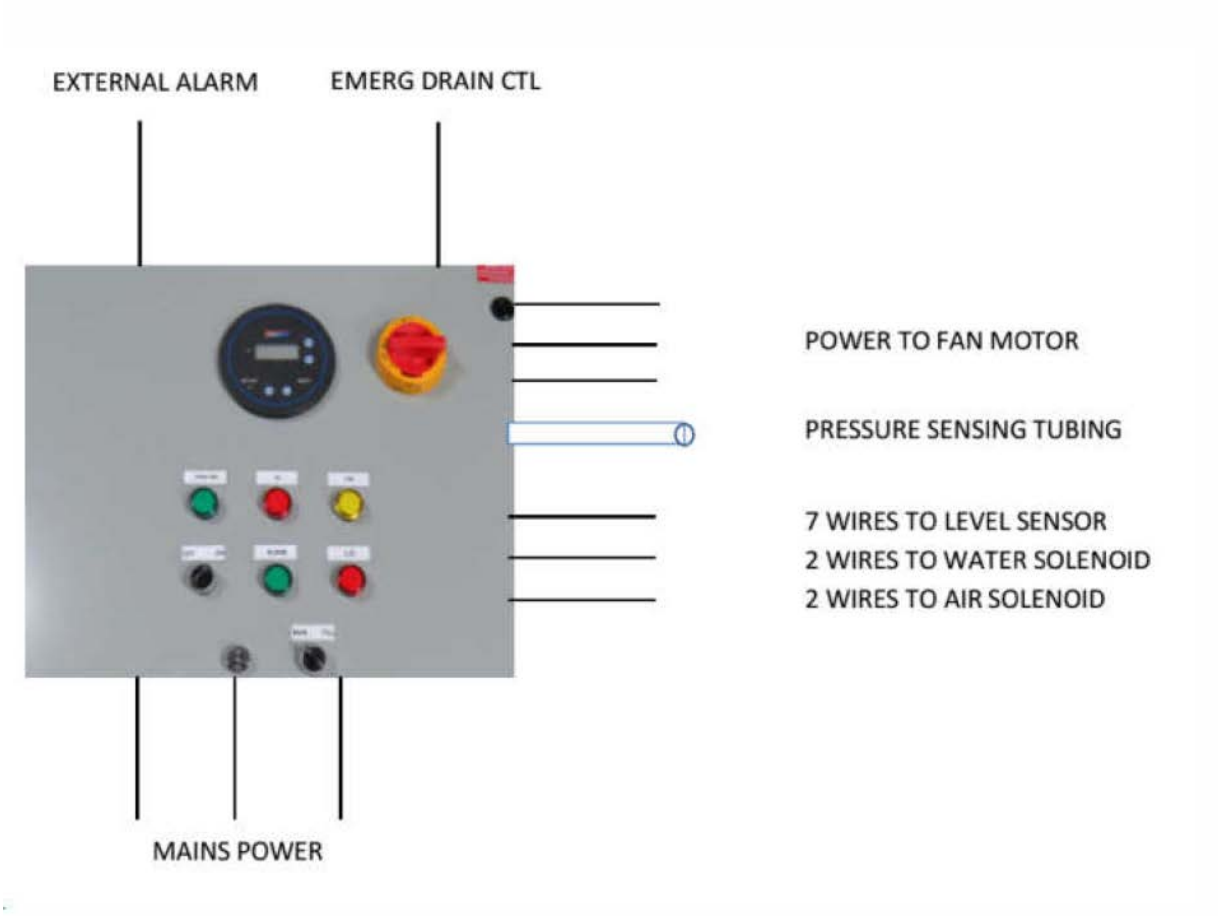

Figure 5 – Enhanced Control System for Wet Collectors - System Architecture

1.3.6 Model 13-74 – Type 2 System with Vibra-Pulse Cleaning

This system combines the basic Type 2 model with an additional filter cleaning facility comprising drives for two air-blast solenoids as used in the Vibra-Pulse cleaning system.

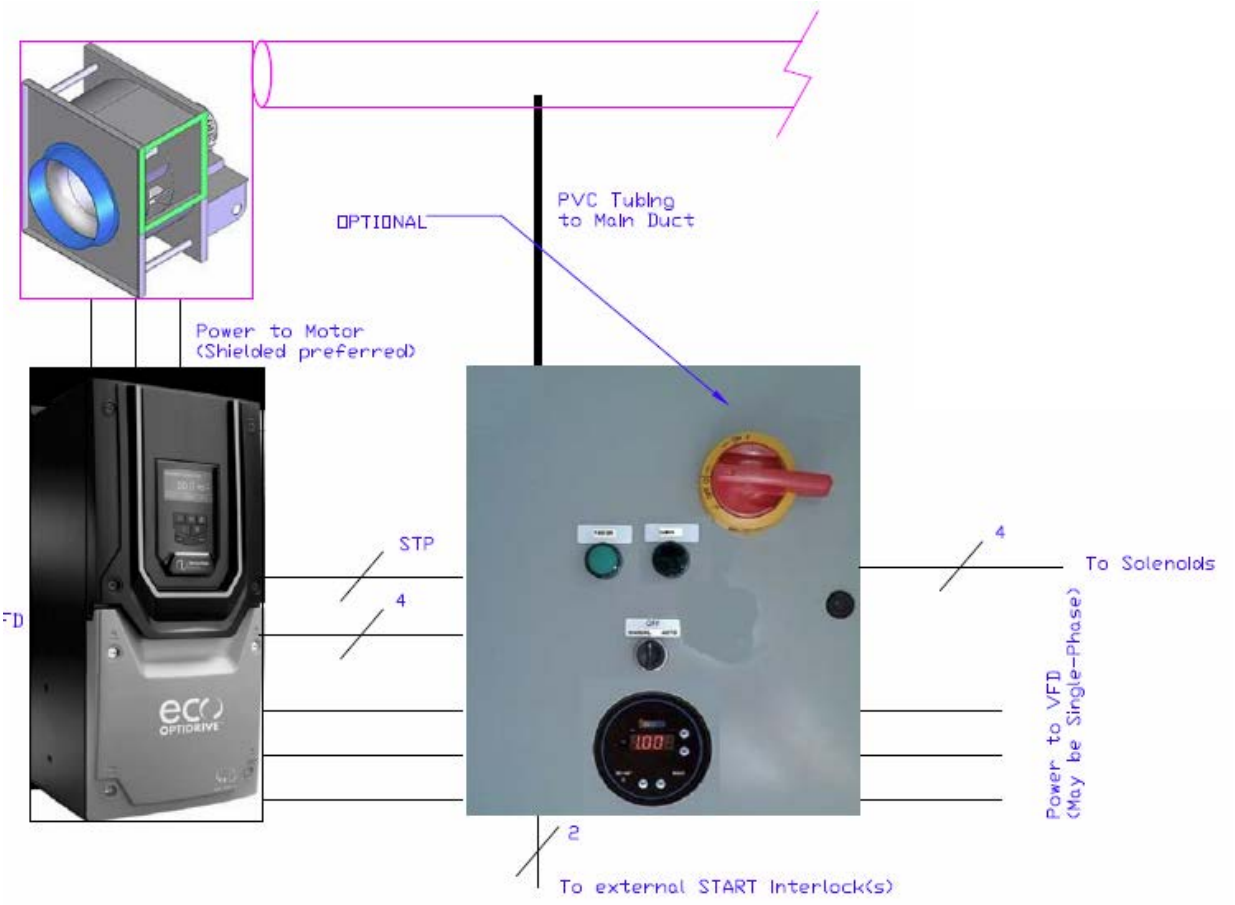

Figure 6 – Type 2 System with Vibra-Pulse Cleaning System Architecture

1.3.7 Model 13-75 – Type 2 System with Shaker Motor Cleaning

This system is similar to the Vibra-Pulse system except that a shaker motor rather than air-blast solenoids is used for filter cleaning.

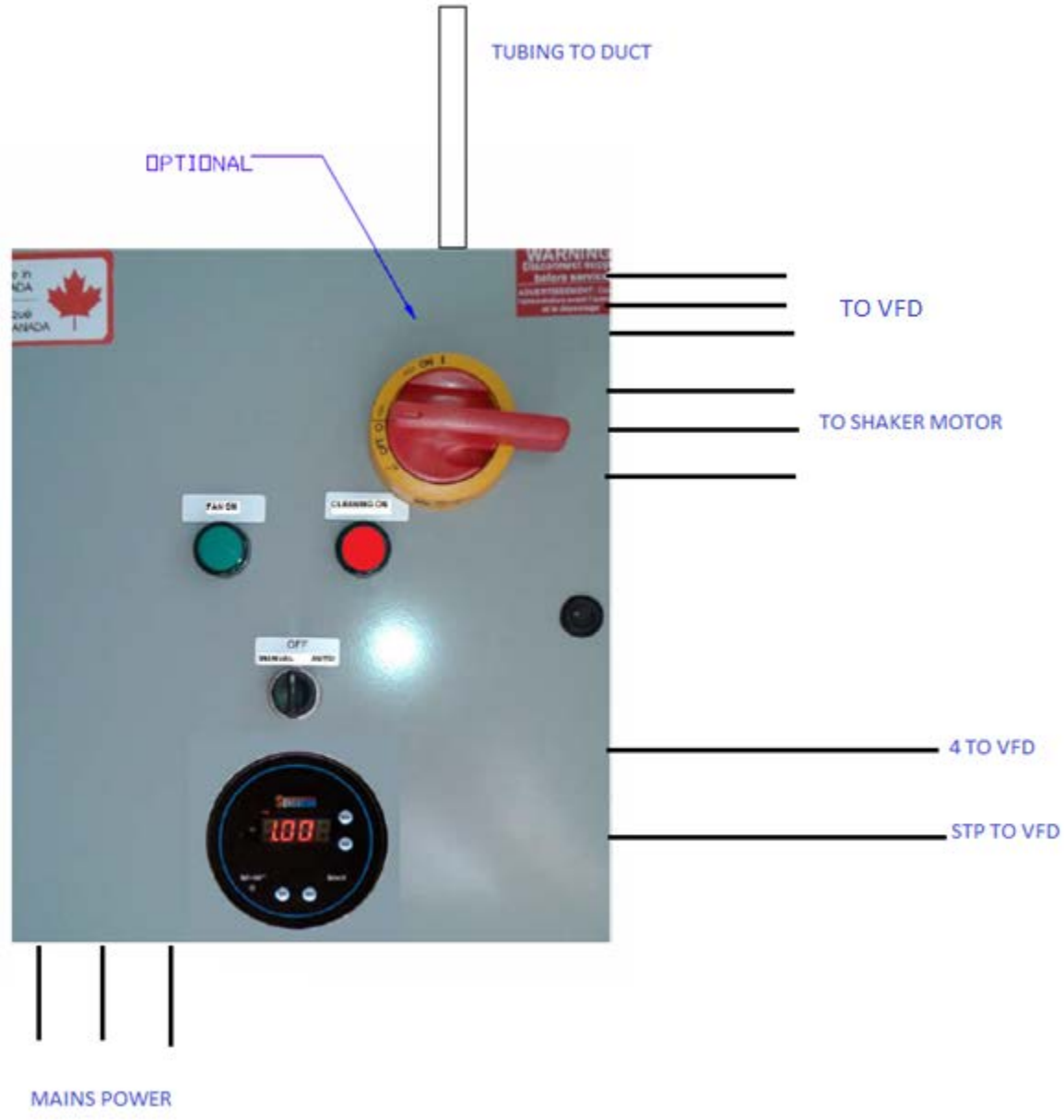

Figure 7 – Type 2 System with Shaker Motor Cleaning System Architecture

1.3.8 Models 13-76 and 13-77 – Type 2 System with Sequenced Solenoids Cleaning

These systems are essentially identical except for the type of control board and solenoids supported – AC in one case and DC in the other. They provide similar functionality to the two previous systems except for the use of a series of air solenoids which are triggered in rapid-fire sequence to provide the cleaning function.

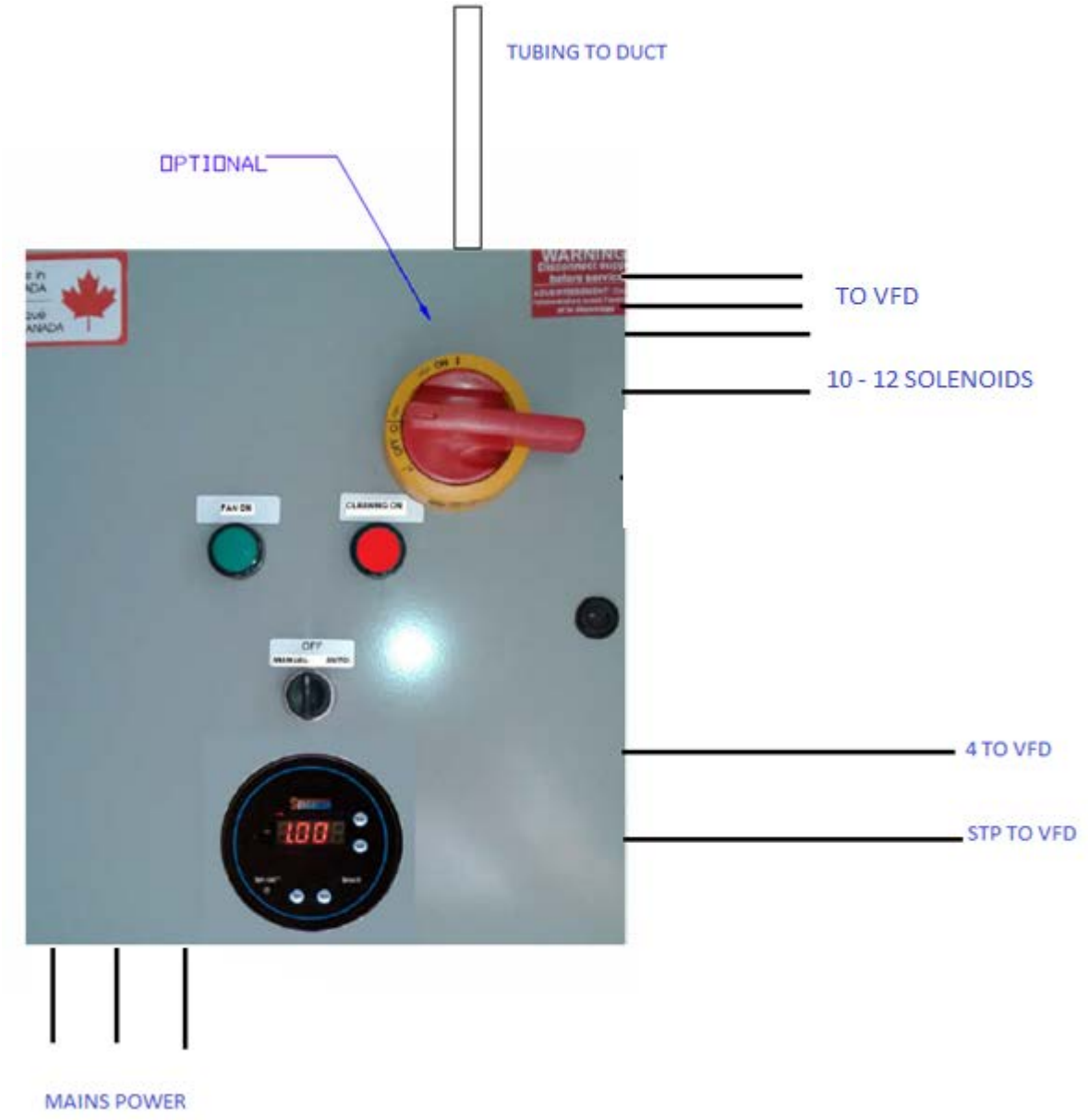

Figure 8 – Type 2 System with Sequenced Solenoids Cleaning System Architecture

2 VFD Specifications

Lev-co uses VFDs from Invertek, ABB (three types), Eaton (two types) and in some cases Danfoss. Devices available provide the following range of capabilities:

IP RATING	INPUT VOLTAGE	MOTOR POWER
IP20/55/66	120/1/60 to 575/3/60	0.5 to 60HP

Consult the appropriate Owner's Manual (see Refence Documents table) and Lev-Co Manual Supplement for the drive type supplied.

3 Type 1

3.1 Mechanical Installation

A type 1 control package comprises two units: a control panel with switch, potentiometer and indicator (and optional fused disconnect and pressure gauge) and a VFD. These may be mounted as desired, although care must be observed in selecting the location of the VFD.

The VFD must be located within a 50m cable run from the motor for best performance and motor life.

See the appropriate section of the VFD User Guide for detailed installation information. Note that the VFD keypad is used for setup and should thus be easily operator-accessible, preferably within a few feet of the Lev-co Control Panel.

3.2 Electrical Installation

Power wiring must observe the requirements of the Canadian Electrical Code CSA C22.1-15. Additionally, screened wiring is recommended for the connection from the VFD to the motor. See the appropriate section of the VFD User Guide for detailed installation information.

See the appropriate Manual Supplement for the system schematic and wiring. Recommended cable types are shown on the schematic. **Note the jumpers on the VFD and ensure they are in place.**

3.3 VFD Setup

Consult the Commissioning section of the VFD User's Guide before proceeding. For some types, a separate Programming Guide is provided.

Standard VFD setup is shown on the schematic attached to the Manual Supplement. When performing this setup, a comprehensive list of all parameter settings should be created for future reference.

Once set up, control is implemented with the control panel RUN/STOP and SPEED ADJUST controls.

3.4 Operation

The VFD is controlled by the control panel RUN/STOP and SPEED ADJUST controls. The FAN ON indicator shows the motor status – in case of a fault it will turn off.

To avoid overheating the motor due to lack of airflow, the fan should never be operated unless at least one damper is open.

3.5 Troubleshooting

The latest generation of VFDs is remarkably robust and reliable. In addition, they have extensive self-protection and self-diagnostic capabilities. In case of drive failure, error code(s) are displayed which point towards fault correction procedures. See the appropriate section of the VFD User Guide for detailed information.

Due to the simplicity of the Type 1 architecture, there is not much else that can go wrong except for loose connections, improper wiring, wiring which may be pinched, cut or shorted in conduit or junction boxes, or a defective or scratchy potentiometer. Any improper function which does not involve the VFD may invariably be traced to one of the above.

4 Type 2

4.1 Mechanical Installation

A type 2 control package comprises two units: a control cabinet that also includes a MANUAL (or HAND) / OFF / AUTO switch, a FAN ON indicator, a pressure gauge and transmitter, and a separate VFD. The control panel may include a fused disconnect or this may be supplied externally by others. The elements may be mounted as desired, although care must be observed in selecting the location of the VFD.

The VFD must be located within a 50m cable run from the motor for best performance and motor life.

See the appropriate section of the VFD User Guide for detailed installation information. Note that the VFD keypad is used for setup and should thus be easily operator-accessible, preferably within a few feet of the Lev-co Control Panel. Note also that it is also required to have the control cabinet and the VFD in reasonably close proximity to minimize noise pickup on the shielded wiring carrying the 4-20mA control signal. A limit of ten feet is recommended.

A tubing connection is required between the control panel and the main duct for pressure sensing. This connection is made with clear PVC tubing of 3/16" ID, supplied in the installation kit. Drill an 11/32" diameter hole in the main duct downstream from the fan but ahead of the first damper. Tap with a 1/8-27NPT tap such as Acklands-Grainger part number WSWPT18. Screw in a 3/16" hose barb as supplied by Lev-co in the installation kit – ensure it is tight. Run the tubing back to the control cabinet, through the strain relief grommet in the base, and up to the tee connector which splits the sense line to the pressure sensor and the indicator. **Connect to the minus or low inputs of the pressure sensor (IMPORTANT!) and the indicator.**

Figure 9 - Pressure Sensor

4.2 Electrical Installation

Power wiring must observe the requirements of the Canadian Electrical Code CSA C22.1-15. Additionally, screened wiring is recommended for the connection from the VFD to the motor. See the appropriate section of the VFD User Guide for detailed installation information.

See the appropriate Manual Supplement for the system schematic and wiring. There are two terminals available for wiring to optional external start/stop interlocks. If unused, these terminals must be left shorted with the wire that comes pre-installed from the factory. Recommended cable types are shown on the schematic. **Note the jumpers on the VFD and ensure they are in place.**

4.3 Pressure Sensor Setup

A single push button is provided to zero the transmitter. Allow transmitter to warm up for 20 minutes. The zero calibration can be set by applying zero pressure to both the pressure ports (block them off) and pressing the zero button for 2 seconds. Span is factory calibrated to the range specified on the label. There is no user span adjustment necessary.

4.4 VFD Setup

Consult the Commissioning section of the VFD User's Guide before proceeding.

Standard VFD setup is shown on the schematic attached to the Manual Supplement. For detailed information see the appropriate section(s) of the VFD User Guide. When performing this setup, a comprehensive list of all parameter settings should be created for future reference.

To set the motor speed to achieve target negative pressure, follow the instructions in the VFD setup table on the schematic. If, after performing this setup, the drive is unstable or "hunting", PID integration time may be too short – try increasing it gradually until stability is restored. Note that this will slow down the response of the system to step changes such as opening or closing a damper.

4.5 Operation

The MANUAL/OFF/AUTO switch on the control panel will turn on the fan motor in either of the MANUAL or AUTO positions. The FAN ON light will illuminate once the motor has started.

Note that the motor ramps to start and ramps to stop at the specified rate (generally set to 30 seconds to or from full speed as default) and should be allowed sufficient time to achieve its final state before any other action is taken (such as a restart).

In MANUAL mode, the fan motor will start immediately and ramp up to full speed. If external interlocks are installed, the motor will not start in AUTO mode until the external condition is satisfied. Multiple damper contacts wired in parallel will give a first-on/last-off functionality, and the target duct pressure will be maintained regardless of how many dampers are open.

To avoid overheating the motor due to lack of airflow, the fan should never be operated unless at least one damper is open.

4.6 Troubleshooting

The latest generation of VFDs is remarkably robust and reliable. In addition, they have extensive self-protection and self-diagnostic capabilities. In case of drive failure, error code(s) are displayed which point towards fault correction procedures. See the appropriate section of the VFD User Guide for detailed information.

Other areas to verify are loose connections, improper wiring, or wiring which may be pinched, cut or shorted in conduit or junction boxes; the status of fuses and/or circuit breakers; and the integrity of the pressure sensing tubing and its connections. All VFD parameters should also be validated against the initial setup list to eliminate any uncalled-for changes as a cause of malfunction. The zeroing of the pressure sensor may also be re-verified. Its output may be viewed on the VFD (see the VFD manual for how to do this) and its function verified by attaching a length of tubing to the “HI” or “+” input and blowing into it.

5 Type 3

5.1 Mechanical Installation

This is identical to the Type 2 installation – see section 4.1, with the exception that a Sensocon integrated pressure gauge/transmitter is usually installed rather than a separate gauge and transmitter as in a Type 2. This is a minor difference and has no impact on functionality. **It is again important that the tubing connects to the LOW input of the device.**

See section 7.1 for further details of this installation

5.2 Electrical Installation

Power wiring must observe the requirements of the Canadian Electrical Code CSA C22.1-15. Additionally, screened wiring is recommended for the connection from the VFD to the motor. See the appropriate section of the VFD User Guide for detailed installation information.

See the appropriate Manual Supplement for the system schematic and wiring. There are two terminals available for wiring to optional external start/stop interlocks. If unused, these terminals must be left shorted with the wire that comes pre-installed from the factory. Recommended cable types are shown on the schematic. **Note the jumpers on the VFD and ensure they are in place.**

Three conductors are also required to be routed to each damper. Each terminal on the control panel may accommodate up to two wires. Thus, up to six dampers may be accommodated with a standard system – more are available on special order. Wiring may be a combination of direct runs and loops among dampers. See the schematic for recommended cable type. See also the Type 3 System Field Wiring Diagram in the Manual Supplement.

5.3 Pressure Sensor Setup

Pressure sensor setup is identical to a Type 2 system – see section 4.3. In the case where a Sensocon gauge/transmitter is employed, see section 7.3 for further details.

5.4 VFD Setup

VFD setup is identical to a Type 2 system – see section 4.4.

5.5 Operation

Operation is essentially identical to a Type 2 system (see section 4.5), except that in AUTO mode the start/stop interlocks are now integral to the system and not optional. Note that ramp-up and ramp-down times remain.

To avoid overheating the motor due to lack of airflow, the fan should never be operated in MANUAL mode unless at least one damper is open.

5.6 Troubleshooting

Troubleshooting is essentially identical to a Type 2 system (see section 4.6), with the addition of possible problems with damper wiring or a damper switch. These may be checked separately by disconnecting the damper control panel connections and verifying that the switch contact closure is sensed properly. The damper light should also illuminate.

One additional problem which may arise is due to the fact that in this configuration, one side of the internal power supply is now chassis-grounded. Any shorts to ground anywhere else in the system can cause unpredictable behavior, including tripping of breakers and/or blowing of fuses. If this is observed, the chassis ground connection on the secondary side of the control transformer should be removed to determine of this is the cause and if so, a careful check of all wiring for ground faults must be conducted.

6 Type 3 with Blast Gates

This type is functionally similar to Type 3 except for the use of blast gates as opposed to electrically-operated / spring-return dampers. As in a Type 3, in AUTO mode the fan starts when the first gate is opened and stops when the last one is closed. (In MANUAL mode the fan runs immediately.) However, blast gates are often used in conjunction with a cyclone-type filtration system which requires continuous high-speed air flow in order to function. As such, there is no active control of fan speed – the fan runs at full speed all the time. Blast gates are designed to divert flow as follows:

- OFF – all flow sourced from outside air
- LOW – ½ flow from exhaust, ½ from outside
- HIGH – all flow from exhaust

All installation, setup and troubleshooting is identical to a Type 3 with the exception of the wiring and fan speed setup (not required – the pressure indicator is just that, an indicator, and has no control function). Instead of a single 3-conductor cable to each damper, each blast gate includes a pushbutton station with HIGH, LOW and OFF buttons and pilot lights to indicate status. Each pushbutton station connects to its associated blast gate with a 5-conductor cable (recommended Alpha Cable type 1175C). The pushbutton stations are connected with 3-conductor cable and may be wired in individual runs from the master control panel or looped from one to the next, or combinations thereof. The wire gauge to be used is dependent on run length and the number of stations looped on each run, but for the majority of cases the type recommended on the System Wiring Diagram is adequate. Contact Lev-co if there are any questions regarding this cabling.

7 Type 2 with Sequenced Solenoid Filter Cleaning

In the most general terms, the Lev-co Type 2 VFD Exhaust System with Sequenced Solenoid Filter Cleaning is a system comprising a dust extractor as described above and a filter cleaner. The filter cleaner may be one of two types – a sequenced solenoid type or a motor-driven shaker type. This latter is described below in section 8.

Three models of sequenced solenoids are available – Vibra-Pulse, AC solenoids or DC solenoids. The Vibra-Pulse model provides for a timed delay (typically 10 minutes) after the exhaust fan stops, after which two air-blast solenoids are opened in sequence, each for a timed period which is typically 15 seconds. The AC or DC solenoid system uses up to 10 or 12 solenoids operating for approximately ½ second each with a brief interval between them. Available options include a fire detector if ignitable particulates are being exhausted. Other system options are the same as those for standard systems.

All system types are also available to be applied to Type 3 exhaust systems in an identical manner, although this is not documented herein.

7.1 Mechanical Installation

Mechanical installation for a sequenced solenoid system is similar to that of a normal type 2 or 3 system except for the pressure tubing connection. Since a 24 VAC or 120VAC source is required to drive the solenoid timers or the sequencer, this is also used to drive a Sensocon pressure transducer/gauge which combines the two functions usually performed by separate elements in a standard type 2 system. There is thus no tee adapter and only a single barbed hose connection to the LOW connector on the back of the pressure sensor. See below and the Sensocon A1/A2 Installation & Operation Manual. The HIGH connection is left unconnected to sense ambient atmospheric pressure.

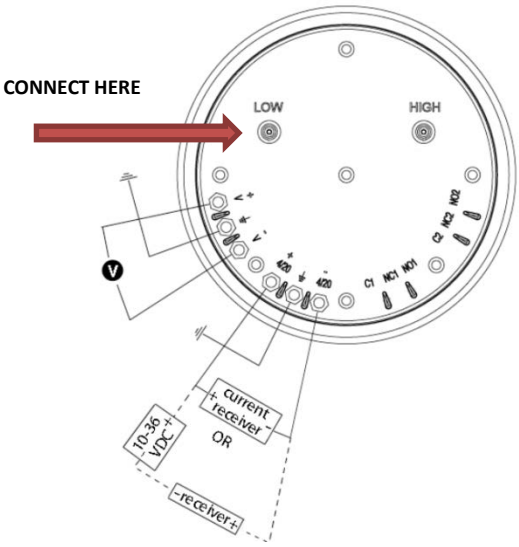

Figure 10 - Pressure Sensor Connections

7.2 Electrical Installation

This is essentially identical to the standard type 2 or 3 system described above, with the exception of the additional wiring to the solenoids. **Since this wiring must accommodate high-energy short-duration pulses, a minimum of #16AWG wire should be used for this function, and distances should be kept as short as possible.**

7.3 Pressure Sensor Setup

The A1 pressure sensor has four buttons located on the face of the gauge for set-up and calibration. These are Span, Zero, Units, and Lock. The Units button changes the unit of measure – set this for inches wc. The Lock button locks and unlocks the keypad on the gauge. Span and Zero are used for calibration (see below). Simultaneously pressing the span and zero buttons for 3 seconds switches the unit from internally sourcing the power for the current loop (factory default) to requiring an external power supply. The power source should be left in internal (factory default) mode. See below for the front panel layout.

Periodically, it may be necessary to re-zero the gauge to maintain the accuracy of the sensor. To do this, remove the pressure connection from the LOW port and hold the "zero" button for 3 seconds. Span is not normally adjusted or modified.

Figure 11 - Pressure Gauge Front Panel

7.4 VFD Setup

This is identical to a standard system – see above.

7.5 Operation

Operation is identical to a standard system, with the exception of the automatic filter cleaning function.

For the Vibra-Pulse cleaning, this takes place automatically ten minutes after the fan stops and requires thirty seconds to complete. If either of these conditions is not satisfied, cleaning either does not start or is aborted. A manual “re-clean” pushbutton is provided which causes another 30-second cleaning cycle to be initiated when the button is pressed and released, but only if the ten-minute time-out period has expired.

Multiple sequenced solenoid cleaning is similar, except that there is no delay after fan stop. A red “CLEANING ON” indicator indicates when cleaning is in operation. Additionally, a contact is brought out to be used by an air make-up system of for any other purpose as required. There is also a MANUAL CLEAN override switch which triggers cleaning regardless of any other condition. This should be used with caution.

7.6 Troubleshooting

This is again similar to a standard system, with the exception that the sequencer or timer relays may also fail. Such a failure would be immediately obvious and would require replacement of the sequencer or affected relay.

8 Type 2 or 3 with Shaker-type Auto Dust Collector

The general description and functionality of this system is similar to the Vibra-Pulse system described in section 7 above. However, instead of timed solenoids, this system operates a shaker motor for a fixed (adjustable) period. The shaker motor is contactor-driven and may run from the same primary power as the main fan motor or have its own primary power.

8.1 Mechanical Installation

Mechanical installation for a shaker-type system is similar to that described above for a solenoid-type system.

8.2 Electrical Installation

This again is as described above, with the same warnings, except for the additional power wiring to the second motor. Wire gauges, as shown on the drawings, are power- and mains-voltage dependent.

8.3 Pressure Sensor Setup

This is identical to section 7.3.

8.4 VFD Setup

This is identical to a standard system – see above.

8.5 Operation

Operation is identical to a standard system. The cleaning function takes place transparently in the back-ground with operation being indicated by a red “CLEANING ON” indicator. A MANUAL CLEAN switch is provided; this is enabled only after the fan has stopped.

8.6 Troubleshooting

This is again similar to a standard system, with the exception that the shaker motor may fail causing an overload trip. The root cause for such a failure must be determined before attempting to reset the overload.

9 Wet Cleaning – Enhanced Control System

This control system is a factory- or field-installed enhancement to a standard control system for wet collectors, the standard for which comprises a motor starter and a mechanical float for water level control. The enhanced system has two major functions:

1. Permit the establishment of a target negative pressure in the duct and maintain it regardless of changing conditions.
2. Control and monitor water level, including the management of various process triggers.

The first function is primarily implemented by the use of a VFD for fan motor control; the second by the use of an ultrasonic liquid level detector with multiple programmable sensing points.

The installation and calibration of a wet control system is lengthy and detailed. Thus, this system has its own User Guide, referenced in the Reference Documents section.