

Installation Guide



Control Panels for VFD-Based Fume and Dust Extraction Systems

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Reference Documents

SOURCE	TITLE	DOWNLOAD REF
ABB	ABB ACS250 Users' Guide	https://library.e.abb.com/pub-lic/e26638e1f3cd410e85257db00052f1a2/3AUA0000137830_REV.B.pdf
ABB	ABB ACS250 Users' Guide – 600V variants	https://library.e.abb.com/pub-lic/0f8c901fd61bbb9c85257dbd005028b7/3AUA0000138354_REV.B.pdf
ABB	ABB ACS550 User's Guide	https://library.e.abb.com/pub-lic/313b6ebaf237059fc1257d0a0048fd68/EN_ACS550_01_UM_H_A4.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	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
Lev-co	Users' Guide - Control Systems for VFD-Based Fume and Dust Collection Systems	Request from Lev-co
Sensocon	A1/A2 Installation & Operation Manual	http://www.sensocon.com/files/PDFs/IOM_A1-A2.pdf

Revision Record

DATE	Rev No.	Description
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1 Introduction

This manual provides a step-by-step guide to the electrical installation of Lev-co Control Panels for use with Variable Frequency Drive (VFD) - based fume and dust extraction systems. For information on mechanical installation, power wiring and VFD programming, the user is directed to the Users' Guide and Manual Supplements as referenced in the Reference Documents table.

2 Overview

Lev-co manufactures several different standard models of VFD-based fume and dust extraction systems. The most common of these are:

- 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 13-74 – Type 2 System with Vibra-Pulse Cleaning
- Model 13-75 – Type 2 System with Shaker Motor Cleaning
- Models 13-76 and 13-77 – Type 2 System with Sequenced Solenoids Cleaning

In all cases, there is low-voltage control wiring between the Lev-co panel and the VFD. Since this wiring is frequently installed by non-electricians, this manual undertakes to simplify and explain this installation to the greatest degree possible in view of this target audience.

The User is encouraged to start with a detailed reading of the appropriate VFD Owners' Manual to gain an understanding of installation, wiring and setup issues. This should be followed by a study of the Lev-co Users' Guide and the appropriate Manual Supplement. This last document provides all the information covered in this Guide, but in a higher-level form.

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



3 Installation Kits

Lev-co provides installation kits for each installation type. These comprise 10 feet of cable of the types required to connect the Control Panel and the VFD and, if required, 50 feet (more on special order) of pressure-sensing hose, fittings and tools for installing the duct pressure sensor and indicator. Details of these kits are shown below.

Lev-co Installation Kits			
Type 1			
Item	Qty	UM	Description
1	10	ft	Cable, #18AWG STR, 4-conductor
2	10	ft	Cable, #18AWG, STP with drain wire
Type 2,3,74,75,76,77			
Item	Qty	UM	Description
1	10	ft	Cable, #18AWG STR, 4-conductor
2	10	ft	Cable, #18AWG, STP with drain wire
3	1	ea	Pipe Tap, 1/8-27 NPT
4	1	ea	Hose Barb, 3/16", 1/8 MNPT, Brass
5	1	ea	Barbed Tee, HDPE, 3/16" Barb Size, Natural
6	50	ft	PVC tubing, 3/16" ID

Figure 1 - Installation Kits

4 Step-by-Step Guide – Model 13-12

4.1 ABB ACS-250 and Eaton DC1 Drives <400V

Once mechanical installation and power wiring are complete, proceed as follows.



1. If the drive is an Eaton DC1 IP66 type (Model number ends with “A6SN”), **REMOVE the internal wiring** from VFD terminals 1,2,3,5,6,7.



2. Connect the drive and the Control Panel using the supplied wiring kit as per the Run List below.
3. Ensure **jumpers on the VFD are installed** as shown on the Run List.

CABLE	COLOUR	FROM	TO
4-conductor	GREEN	Control Panel 1	VFD 1
4-conductor	RED	Control Panel 2	VFD 2
4-conductor	BLACK	Control Panel 5	VFD 5
4-conductor	WHITE	Control Panel 11	VFD 11
STP	RED	Control Panel 6	VFD 6
STP	BLACK	Control Panel 7	VFD 7
STP	SHIELD	No Connection	VFD FRAME
JUMPER	Any	VFD 9	VFD 10

Figure 2 - Run List Model 13-12 - ABB ACS-250 and Eaton DC1 Drives <400V

4.2 ABB ACS-250 Drives – 600V Types

Once mechanical installation and power wiring are complete, proceed as follows.



1. Connect the drive and the Control Panel using the supplied wiring kit as per the Run List below.
2. Ensure **jumpers on the VFD are installed** as shown on the Run List.

CABLE	COLOUR	FROM	TO
4-conductor	GREEN	Control Panel 1	VFD 1
4-conductor	RED	Control Panel 2	VFD 2
4-conductor	BLACK	Control Panel 5	VFD 5
4-conductor	WHITE	Control Panel 11	VFD 15
STP	RED	Control Panel 6	VFD 6
STP	BLACK	Control Panel 7	VFD 7
STP	SHIELD	N/C	VFD FRAME
JUMPER	Any	VFD 1	VFD 12
JUMPER	Any	VFD 7	VFD 13
JUMPER	Any	VFD 9	VFD 14

Figure 3 - Run List Model 13-12 - ABB ACS-250 Drives 600V Variants

4.3 ABB ACS-550 Drives

Once mechanical installation and power wiring are complete, proceed as follows.



1. Connect the drive and the Control Panel using the supplied wiring kit as per the Run List below.
2. Ensure **jumpers on the VFD are installed** as shown on the Run List.

CABLE	COLOUR	FROM	TO
4-conductor	GREEN	Control Panel 4	VFD 4
4-conductor	RED	Control Panel 10	VFD 10
4-conductor	BLACK	Control Panel 13	VFD 13
4-conductor	WHITE	Control Panel 24	VFD 24
STP	RED	Control Panel 2	VFD 2
STP	BLACK	Control Panel 3	VFD 3
STP	SHIELD	No Connection	VFD 1
JUMPER	Any	VFD 11	VFD 12
JUMPER	Any	VFD 12	VFD 22

Figure 4 - Run List Model 13-12 - ABB ACS-550 Drives

4.4 Invertek Optidrive and Eaton DA1 Drives

Once mechanical installation and power wiring are complete, proceed as follows.



1. Connect the drive and the Control Panel using the supplied wiring kit as per the Run List below.
2. Ensure **jumpers on the VFD are installed** as shown on the Run List.

CABLE	COLOUR	FROM	TO
4-conductor	GREEN	Control Panel 1	VFD 1
4-conductor	RED	Control Panel 2	VFD 2
4-conductor	BLACK	Control Panel 5	VFD 5
4-conductor	WHITE	Control Panel 17	VFD 17
STP	RED	Control Panel 6	VFD 6
STP	BLACK	Control Panel 7	VFD 7
STP	SHIELD	No Connection	VFD Frame
JUMPER	ANY	VFD 1	VFD 12
JUMPER	ANY	VFD 7	VFD 13
JUMPER	ANY	VFD 13	VFD 18

Figure 5 - Run List Model 13-12 - Invertek Optidrive and Eaton DA1

4.5 First Run

1. Program the drive as per the programming information in the Supplement. Note down all values.
2. Set the speed potentiometer approximately in the middle of its travel.
3. Switch ON. The drive should ramp up to about half speed.
4. SLOWLY move the potentiometer. Drive speed should track potentiometer setting.
5. Switch off. The drive should ramp down to a stop.

4.6 Troubleshooting

1. Any drive fault will be displayed by the drive and should be trouble-shot using the drive's procedures as documented in the drive manual.
2. For any other fault, re-check the wiring. Ensure all connections are correct and tight. Pay particular attention to jumpers.

5 Step-by-Step Guide – Model 13-13

5.1 ABB ACS-250 Drives <400V

Once mechanical installation and power wiring are complete, proceed as follows.



1. Connect the drive and the Control Panel using the supplied wiring kit as per the Run List below.
2. Ensure **jumpers on the VFD are installed** as shown on the Run List.
3. Drill 1/8 in the duct just upstream (low-pressure side) of the fan. Tap using the tap supplied in the Installation Kit. Install the hose barb and run the hose to the Control Panel, using the parts supplied in the Installation Kit.
4. Use the supplied Tee adapter to split the hose to the two pneumatic devices (pressure sensor and indicator). Connect to the “LOW” or “-” inputs as appropriate.

CABLE	COLOUR	FROM	TO
4-conductor	GREEN	Control Panel 1	VFD 1
4-conductor	RED	Control Panel 2	VFD 2
4-conductor	WHITE	Control Panel 3	VFD 3
4-conductor	BLACK	Control Panel 11	VFD 11
STP	RED	Control Panel 4	VFD 6
STP	BLACK	Control Panel 9	VFD 9
STP	SHIELD	No Connection	VFD frame
JUMPER	ANY	VFD 7	VFD 10

Figure 6 - Run List Model 13-13 - ABB ACS-250 Drives <400V

5.2 Eaton DC1 Drives

Once mechanical installation and power wiring are complete, proceed as follows.



1. If the drive is an Eaton DC1 IP66 type (Model number ends with “A6SN”), **REMOVE the internal wiring** from VFD terminals 1,2,3,5,6,7.



2. Connect the drive and the Control Panel using the supplied wiring kit as per the Run List below.
3. Ensure **jumpers on the VFD are installed** as shown on the Run List.
4. Drill 1/8 in the duct just upstream (low-pressure side) of the fan. Tap using the tap supplied in the Installation Kit. Install the hose barb and run the hose to the Control Panel, using the parts supplied in the Installation Kit.
5. Use the supplied Tee adapter to split the hose to the two pneumatic devices (pressure sensor and indicator). Connect to the “LOW” or “-” inputs as appropriate.

CABLE	COLOUR	FROM	TO
4-conductor	GREEN	Control Panel 1	VFD 1
4-conductor	RED	Control Panel 2	VFD 2
4-conductor	WHITE	Control Panel 3	VFD 3
4-conductor	BLACK	Control Panel 11	VFD 11
Shielded Twisted Pair	RED	Control Panel 4	VFD 6
Shielded Twisted Pair	BLACK	Control Panel 9	VFD 9
Shielded Twisted Pair	SHIELD	No Connection	VFD frame
JUMPER	ANY	VFD 1	VFD 4
JUMPER	ANY	VFD 7	VFD 10

Figure 7 - Run List Model 13-13 – Eaton DC1 Drives

5.3 ABB ACS-250 Drives – 600V Types

Once mechanical installation and power wiring are complete, proceed as follows.



1. Connect the drive and the Control Panel using the supplied wiring kit as per the Run List below.
2. Ensure **jumpers on the VFD are installed** as shown on the Run List.
3. Drill 1/8 in the duct just upstream (low-pressure side) of the fan. Tap using the tap supplied in the Installation Kit. Install the hose barb and run the hose to the Control Panel, using the parts supplied in the Installation Kit.
4. Use the supplied Tee adapter to split the hose to the two pneumatic devices (pressure sensor and indicator). Connect to the “LOW” or “-” inputs as appropriate.

CABLE	COLOUR	FROM	TO
4-conductor	GREEN	Control Panel 1	VFD 1
4-conductor	RED	Control Panel 2	VFD 2
4-conductor	WHITE	Control Panel 3	VFD 4
4-conductor	BLACK	Control Panel 11	VFD 15
STP	RED	Control Panel 4	VFD 6
STP	BLACK	Control Panel 9	VFD 7
STP	SHIELD	No Connection	VFD frame
JUMPER	ANY	VFD 1	VFD 12
JUMPER	ANY	VFD 7	VFD 13
JUMPER	ANY	VFD 9	VFD 14

Figure 8 - Run List Model 13-13 - ABB ACS-250 Drives 600V Variants

5.4 ABB ACS-550 Drives

Once mechanical installation and power wiring are complete, proceed as follows.



1. Connect the drive and the Control Panel using the supplied wiring kit as per the Run List below.
2. Ensure **jumpers on the VFD are installed** as shown on the Run List.
3. Drill 1/8 in the duct just upstream (low-pressure side) of the fan. Tap using the tap supplied in the Installation Kit. Install the hose barb and run the hose to the Control Panel, using the parts supplied in the Installation Kit.
4. Use the supplied Tee adapter to split the hose to the two pneumatic devices (pressure sensor and indicator). Connect to the “LOW” or “-” inputs as appropriate.

CABLE	COLOUR	FROM	TO
4-conductor	GREEN	Control Panel 10	VFD 10
4-conductor	RED	Control Panel 13	VFD 13
4-conductor	BLACK	Control Panel 14	VFD 14
4-conductor	WHITE	Control Panel 24	VFD 24
STP	RED	Control Panel 5	VFD 5
STP	BLACK	Control Panel 6	VFD 6
STP	SHIELD	No Connection	VFD 1
JUMPER	Any	VFD 6	VFD 11
JUMPER	Any	VFD 11	VFD 12
JUMPER	Any	VFD 12	VFD 22
JUMPER	Any	VFD 13	VFD 15
JUMPER	Any	VFD 14	VFD 18

Figure 9 - Run List Model 13-13 - ABB ACS-550 Drives

5.5 Invertek Optidrive and Eaton DA1 Drives

Once mechanical installation and power wiring are complete, proceed as follows.



1. Connect the drive and the Control Panel using the supplied wiring kit as per the Run List below.
2. Ensure **jumpers on the VFD are installed** as shown on the Run List.
3. Drill 1/8 in the duct just upstream (low-pressure side) of the fan. Tap using the tap supplied in the Installation Kit. Install the hose barb and run the hose to the Control Panel, using the parts supplied in the Installation Kit.
4. Use the supplied Tee adapter to split the hose to the two pneumatic devices (pressure sensor and indicator). Connect to the “LOW” or “-” inputs as appropriate.

CABLE	COLOUR	FROM	TO
4-conductor	GREEN	Control Panel 1	VFD 1
4-conductor	RED	Control Panel 2	VFD 2
4-conductor	WHITE	Control Panel 17	VFD 17
4-conductor	BLACK	No Connection	No Connection
STP	RED	Control Panel 9	VFD 9
STP	BLACK	Control Panel 10	VFD 10
STP	SHIELD	No Connection	VFD frame
JUMPER	ANY	VFD 1	VFD 12
JUMPER	ANY	VFD 7	VFD 13
JUMPER	ANY	VFD 13	VFD 18

Figure 10 - Run List Model 13-13 - Invertek Optidrive and Eaton DA1

5.6 First Run

1. Program the drive as per the programming information in the Supplement. Note down all values.
2. Start in HAND or MANUAL mode. The drive should ramp up to the pre-programmed (usually full) speed.
3. Switch off. The drive should ramp down to a stop.
4. Start in AUTO mode. The drive should ramp up to a point where duct pressure is about 50% of maximum. (If the pressure sensor is a 10"wc type, and the drive target pressure is set at 50%, then we should see about 5"wc.) Try opening and closing one or more dampers. The drive should change motor speed to maintain constant duct pressure.
5. Switch off. The drive should ramp down to a stop.
6. Re-set the target pressure as desired. Note that this behavior may be somewhat non-linear so that some experimentation may be necessary.

5.7 Troubleshooting

1. Any drive fault will be displayed by the drive and should be trouble-shot using the drive's procedures as documented in the drive manual.
2. For any other fault, re-check the wiring. Ensure all connections are correct and tight. Pay particular attention to jumpers. Also check pressure tubing for integrity.

6 Step-by-Step Guide – Model 13-14

All type 2 and 3 systems (models 13-13 and 13-14) have identical panel-to-drive wiring, so this information is not repeated. Refer to the previous section. However, since type 3 systems provide power for electrical dampers, this power is also used for an integrated pressure sensor and display. Thus, the pressure sensor hose has only one connection within the panel and the Tee adapter is not required.

6.1 Model 13-14 Field Wiring

Type 3 systems provide power to, and sense the status of, electrical dampers. The wiring to these dampers is shown in the figure below. Recommended cable type is General Cable type E3033S.41.xx available from Digikey.

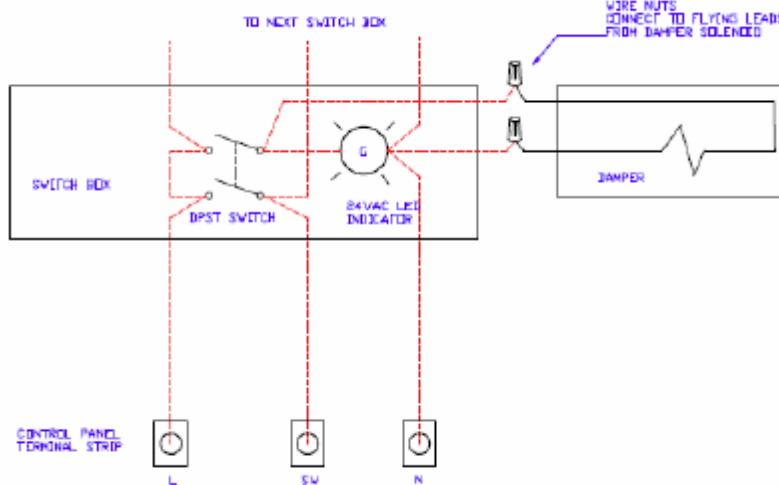


Figure 11 - Model 13-14 Field Wiring

7 Step-by-Step Guide – Models 13-74/75/76/77

These four models are based on the type 2 architecture, with filter cleaning add-ons. Thus, the panel-to-drive wiring is identical to the model 13-13 above. Additional wiring is required for the cleaning device (Vibra-pulse, shaker motor, or solenoids) and this is described on the drawings and in the Manual Supplements. Note, as mentioned in the Users' Guide, that solenoid drive pulses are short and high-energy, and



wiring to these devices should be **as short as possible and use a minimum of #16AWG wire.**