

# Ecogate® Power MASTER™

Documentation Version 7, March 2022

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**Warning:** Automatic Equipment – the complete dust collecting system (the main fan and dust collector including transport fans and conveyors) can start automatically at any time without warning!

**Warning:** Risk of electric shock; the Power MASTER has two separate power supply sources, both of them must be disconnected before servicing.

**Do not use the Ecogate system until you have thoroughly read and understand the safety instructions completely (including the separate safety instructions for dust collector, fan, transport, gates, greenBOX and all other parts of the ventilation system). Failure to comply can result in an accident or personal injury.**

ECOGATE, Inc. does not assume any liability regarding the interpretation of the information in this document. The information contained in this document a recommended method for installing and operating a dust collection system and is offered as a guide only. You are individually responsible for the safety and design of your particular dust collection system. Your particular system must adhere to all rules and regulations set by federal, state or local governing codes and requirements where applicable. This document does not attempt to describe every aspect of safety, implementation, and operation of any particular dust collection system. Industrial applications also involve many more variables and trade-off decisions as well as strict compliance with OSHA and other regulatory agencies.

Copyright Ecogate Inc 2012 -2023, All rights reserved. The product specifications and physical appearance are subject to change without notice.US Pat. No. 6,012,199; 7,146,677; ECOde® greenBOX®, ECOGATE® and ECOGATE logo are registered trademarks of ECOGATE, Inc.

Updated: March 6, 2023



# 2. Power MASTER User Guide

**1.** The Fan and the Dust Collector\* will START automatically even if the system is NOT ENABLED, and it will stop if ENABLE SIGNAL from dust collector is not provided within 15 seconds after start (this time is user programmable\*\*).

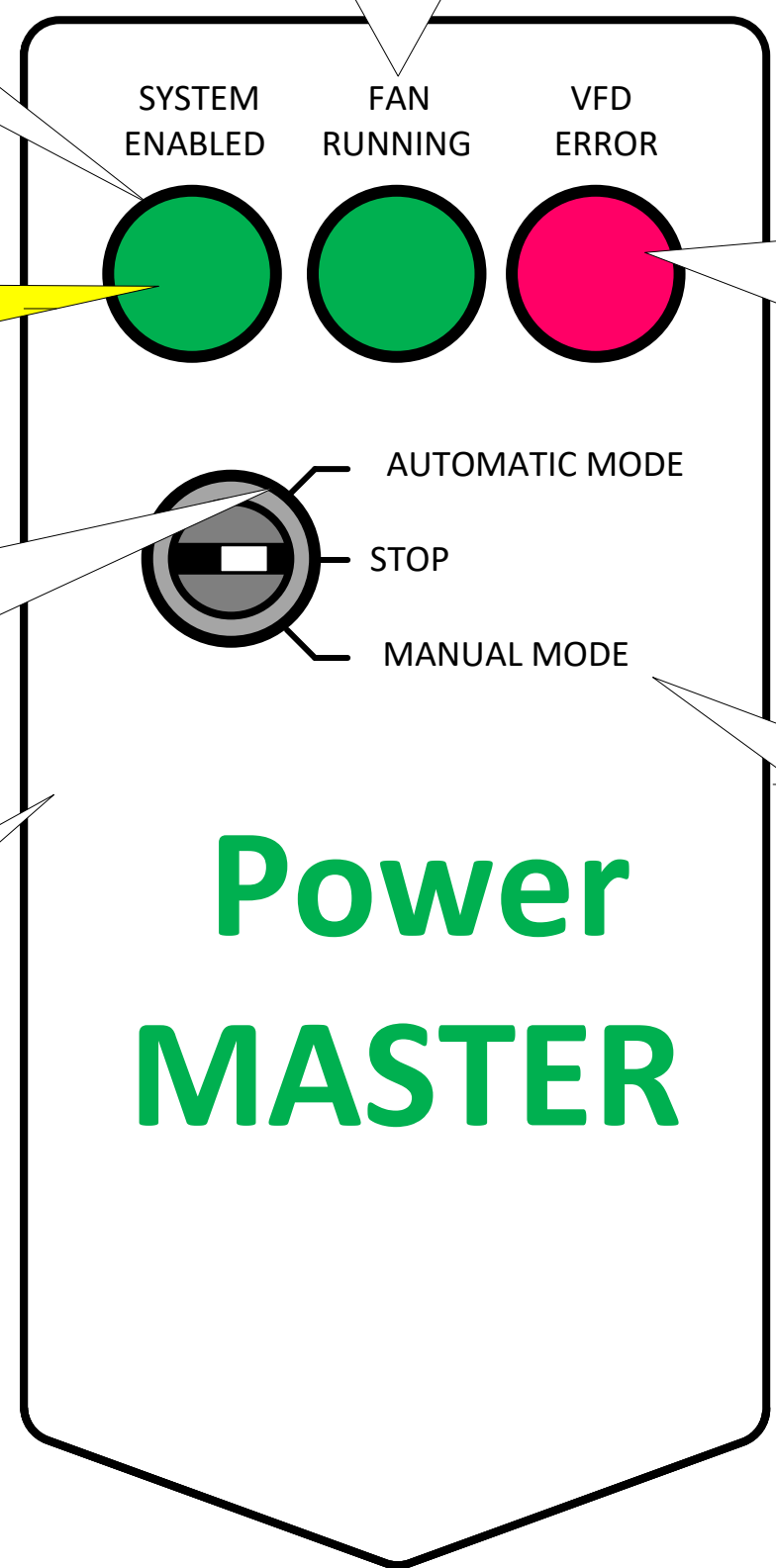
**4.** If the ENABLE SIGNAL from your dust collector disappears during normal operation (indicator is OFF) the main fan will STOP, if the ENABLE signal will re-appear the fan will restart automatically

**5.** Select AUTOMATIC MODE if the dust collecting system will be automatically operated by the greenBOX control unit. The fan will start automatically on-demand – only if any sensor connected to the gates will be active- greenBOX MASTER will start the fan and the dust collector\*. The dust collecting system will stop automatically if all the sensors are inactive.

**7.** Select STOP to stop the fan and dust collector.

\* if the dust collector is connected via START and STOP signals  
 \*\* If you don't like that the fan will start without the Enable signal, simply set the parameter 47.01 to 0 seconds.

**2.** If the main fan is running, the FAN RUNNING indicator is ON.



**3.** If the VFD ERROR indicator is on, there is a problem with the VFD – check the text on the LCD screen above these indicators. Use the VFD User guide to find the meaning of the text/error code and recommended correction action.

The correct way to reset the error is to press soft RESET button under the LCD screen) or press RESET ERROR button on the greenBOX main screen or cycle the Power MASTER main and optional power – switch the power off, wait until the LCD screen turns off, then switch the power back on again. If the fan does not start, check the greenBOX MASTER control unit main screen, press RESET ERROR button on the screen (bottom right of the screen – active only at error).

**6.** Select MANUAL MODE to operate the system manually (for example if greenBOX control unit is not yet connected, if greenBOX unit does not work, or in case of an error). The dust collector will also be started in MANUAL MODE\*. The fan speed in the Manual Mode can be set by the parameter 47.07.

**NOTE:** If Power MASTER stops because the IMMEDIATE STOP input was missing: first check and reset the equipment that caused immediate stop (for example fire alarm) if it is safe to run system again. The input Immediate Stop DI5 must be closed, and then use soft RESET button under VFD screen; the fan will start automatically.

**WARNING: Automatic Equipment – the complete dust collecting system (the main fan and dust collector including transport fans and conveyors) can start automatically at any time without warning!**

#	Problem	Indicators/ LCD Screen	Why this is happening	How to Resolve
1	Fan is not running	Enable Indicator is OFF	The Enable signal is connected from your dust collector; if contact is closed (ENABLE light is ON) the fan can be operated, <b>if Enable contact is open, fan cannot be operated</b> (note: fan can start without Enable signal present, but contact must be closed within 30 seconds of start).	Check your dust collector control panel for any error; if error is present, resolve it, and reset the error.
2	Fan is not running	Error Indicator is ON	The VFD Fault; most common faults: Immediate Stop input is open (typically it means customer safety equipment is connected to Immediate Stop input, it could be fire detection etc.), VFD over current, VFD overloaded, VFD overheated.	Most faults are explained in plain english on the LCD screen; if only error code is present you need to check ACS880 User Guide for details; resolve the issue, reset the Error by pressing RESET "soft" button.
3	Fan is running at constant speed	No error or fault indication	Is Power MASTER switched over to MANUAL MODE?, then move front panel selector to AUTOMATIC MODE; if the fan is running at constant speed at AUTOMATIC mode it can be because the VFD is not in REMOTE control.	The VFD must be set to "REMOTE" (displayed in Top Left corner of the LCD); if "LOCAL" is displayed press "Loc/Rem" button to switch the VFD to Remote Mode. The front panel selector must be in position AUTOMATIC.
4	Fan pressure too high, fan is not running	LCD screen: High Pressure	The fan pressure is monitored via Analog Input 2, and Supervision function 1 is used to Fault the VFD if pressure will reach 23" w.c.	Check if gates are open, the pressure limit is set from a factory to 23" w.c. (error is delayed 10 seconds), see VFD parameter details in table on right.
5	Overcurrent during fan start	Overcurrent, A2B1	To speed-up high inertia fan requires higher power, higher current; proper acceleration time is calculated by Ecogate Assistant during setup, but sometimes the acceleration time must be increased	Increase value (in seconds) in the Parameter 28.72 Frequency Acceleration time 1, and Parameter 28.73 Frequency Deceleration time 1 (+20%)
6	DC overvoltage during fan stop	DC Link Overvoltage	Proper deceleration time is calculated by Ecogate Assistant during setup, but sometimes the deceleration time must be increased	Increase value (in seconds) in the Parameter 28.73 Frequency Deceleration time 1
7	Overheating	IGBT Overtemperature	Inssufficient heatsink cooling (IGBT is type of high voltage tranzistor used in invertor)	Clean the door filters; clean heatsink in back of the cabinet by compressed air. Check if cooling fan(s) are running.
8	Input Phase Loss	Input Phase Loss	3-phase power supply used for the VFD was missing for short ammount of time; it serves as a warning for user	Check with your electrician or power company why this is happening; if you see this error to often you can disable this warning by using the Parameter 31.21
9	EFB Communication Loss	EFB comm loss	Lost communcation with greenBOX control unit via Modbus (EFB = Embbeded FieldBus)	Check if greenBOX is working correctly, check terminals, check Modbus cable for continuity and shorts
10	Output current oscillating during fan stop	The VFD is tripping on overccurent.	We are not sure, but ABB support recommended us how to resolve it.	Requires drive firmware version 2.90 or later; Enter 170708 to parameter 96.02 (pass code), and then Enter 1.5 to the parameter 227.44.
11	Emergency Stop Off 1, Off 2, Off 3 warnings	AFE1, AFE2 warnings	We are not sure, but ABB support recommended us how to resolve it.	Use Parameter 31.40 Safety Warnings and disable [5] = Off 2 and [6] Off 1 and Off 3

See additional troubleshooting on page 22

### 3. Power MASTER Troubleshooting

**Using VFD Control Panel to monitor faults:** check list of "inhibitors" (what is causing that the VFD cannot run) - see **Active Warnings**, and **Active Faults** list (available from OPTIONS menu of the Power MASTER LCD screen). See ACS880 software Manual **page 489: Warning Tracing**, and **page 507 Fault Tracing**.

**Using greenBOX MASTER to monitor faults** (locally or remotely):

- Go to Setup tree, VFD page, select **Monitoring TAB**.
- Select **Parameter P401 = TRIPPING FAULT**, read blue Hexadecimal Format number – for example 0x9081.
- Go to the ACS880 Firmware Manual, search for 9081 (it is chapter FAULT TRACING, page 507).
- Read Fault description, use blue shortcuts for detailed explanation.

#### Ecogate Specific Warning/Fault Texts on Power MASTER LCD Screen

1. IMMEDIATE STOP (DI5, External Fault 1), Fault 9081  
If "Immediate Stop" input DI5 is active = Fault, Immediate system Stop

**Explanation: "Equipment connected to Immediate Stop (DI5) stopped system; reset equipment, and then reset Error on control panel and/or on greenBOX."**

2. SUPERVISION 1 (PRESSURE TOO HIGH), Fault 80B0  
If "Signal Supervision 1" that is monitoring the FAN PRESSURE via Analog Input 2 active = Error, Immediate system Stop; The fan pressure is monitored via Analog Input #2. If sensor current is over 19mA (we are using the sensor range 25" w.c., 19 mA is corresponding approx. to 23" w.c.) the VFD will fault. This level can be adjusted in parameter 32.10, or disabled in parameter 32.5 if necessary. See details at "Optional Programming" page 13.

**Explanation: "Fan pressure reached limit set in parameter 32.10 to protect duct system. Check if gates are open, and then reset Error."**

3. DUST COLLECTOR ENABLE MISSING, Warning AFEB  
If "Enable" signal that confirms that the dust collector is running OK is missing (connected to the DI6) is missing = system must stop (when enable will re-appear system will continue to run)

**Explanation: "ENABLE signal(s) from DUST COLLECTOR is missing, reset dust collector Enable signal(s), system will restart automatically."**



## Power MASTER Maintenance

The lifespan of the Power MASTER VFD depends on its total run time, ambient temperature, and dust concentration. The VFD will last longer if the cooling system works properly because high temperatures shorten the life of the output transistors, capacitors, cooling fans, and other electronic components. Follow all the safety procedures while doing maintenance.

For details of recommended maintenance see ACS880 hardware manual (supplied with the Power MASTER on a USB flash drive (it looks like a thick business card). This is a brief summary.

### Maintenance Monitoring

The greenBOX MASTER displays the maintenance values as reported by the VFD in the VFD Monitoring tab of the "Input/Output Monitoring" window. The greenBOX NXT displays them on the VFD page:

- Heatsink temperature (% of max.)
- Life of main cooling fan (% of life)
- Life of aux cooling fan (% of life)
- Run Time (days)

These values are also accessible from the VFD control panel via Diagnostic parameters (05.01...05.121).

### 1. Keep VFD Clean

The cleaning period is determined by the dust concentration in the air. After the Power MASTER is installed do a monthly inspection (and cleaning if necessary) to determine how often cleaning is actually required in your specific environment.

### 2. Annual Inspection

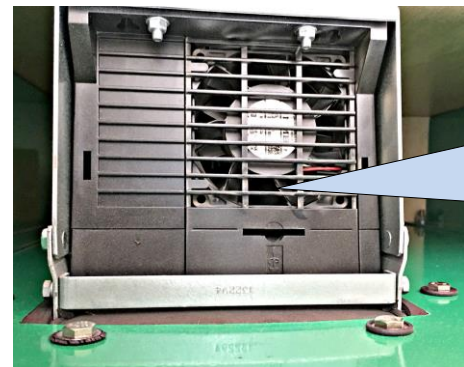
- Clean the VFD and heatsink using the ABB recommend procedure (see the hardware manual). Check and replace all the air filters as necessary
- Check cleanliness and tightness of the power terminals (a thermal imaging camera is ideal) to detect and rectify overheating terminals

### 3. Recommended Part Replacements

- Cooling fans: every 6-9 years
- VFD ZCU control board and Control panel real time/date battery: every 6-9 years

### 4. Safe Torque Off

If you are using the Safe Torque Off (STO) function as E-stop after the circuit is validated during startup, the STO function must be maintained by periodic proof testing. For details see the ACS880 hardware manual, chapter Safe Torque Off.



Heatsink & Aux Cooling Fan of the wall mounted Power MASTER units (up to 200 HP) is located in open back compartment; this is a view from top

## 4. Power MASTER Maintenance

greenBOX | Analog Inputs / Digital Inputs | VFD Monitoring | Other Modbus Devices

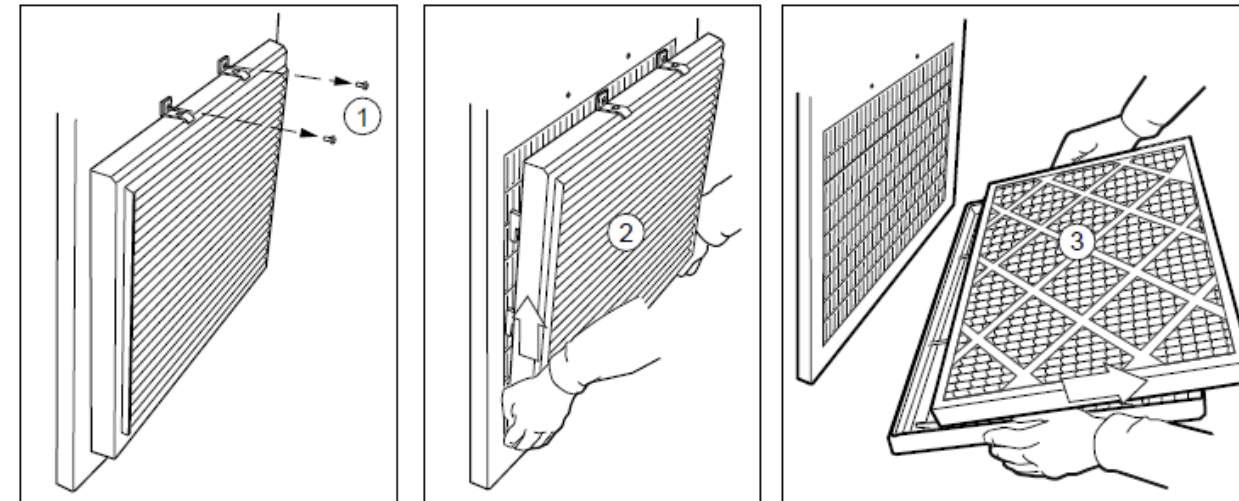
VFD TYPE: ABB ACS880 EG

Input Terminals Status

- S1 - MANUAL MODE
- S2 - AUTOMATIC MODE
- S3 - GB12 RUN
- S4 - Dust Collector OK #1
- S5 - Dust Collector OK #2
- S6 - Dust Collector OK #3
- SAFETY STOP
- S8 - SYSTEM ENABLE

Analog Input FAN [-, mA]	896	17.92	(A2)
Analog Input FILTER [-, mA]	256	5.12	(A1)
Heatsink Temperature	42%		
Frequency Ref. in Register	20000 = 60.00 Hz		
Maintenance [%]	Dust Collector Control, Fan Pressure		
Main cooling fan	1	SV1 - Fan Pressure Above Limit	
Aux cooling fan	1	RD1 - Dust Collector Start	
Running [days]	22	RD2 - Dust Collector Stop	
		RD3 - Dust Collector OK	

## Standalone Power MASTER (250 HP & larger) Inlet (Door) & Outlet (Roof) Filter Cleaning/Replacement



### Inlet (door) filters

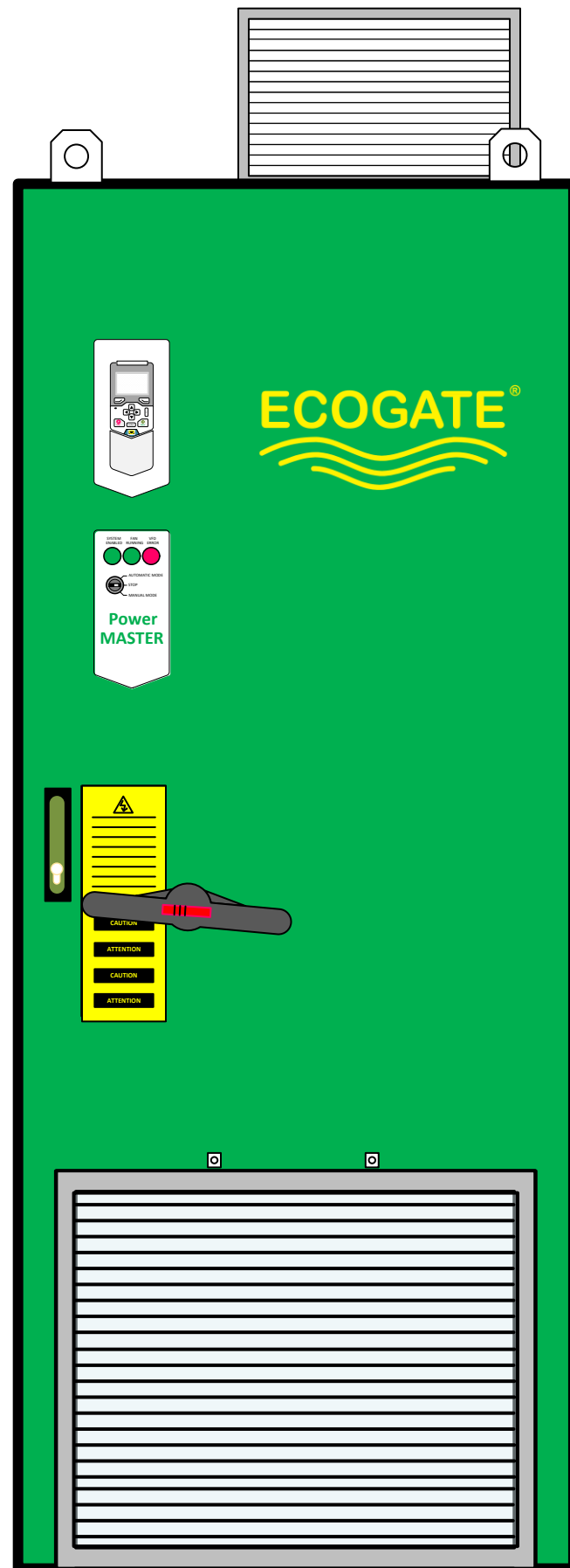
1. Remove the fasteners at the top of the grating.
2. Lift the grating upwards and pull it away from the door.
3. Remove the air filter mat.
4. Clean or replace the filter then reinstall it in the grating with the metal wire side facing the door.
5. Reinstall the grating in reverse order.

### Outlet (roof) filters

1. Remove the front and back gratings of the fan cubicle by lifting them upwards
2. Remove the air filter mat.
3. Clean or replace the filter mat in the grating.
4. Reinstall the grating in reverse order.



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## 5. Ecogate Power MASTER Installation Overview

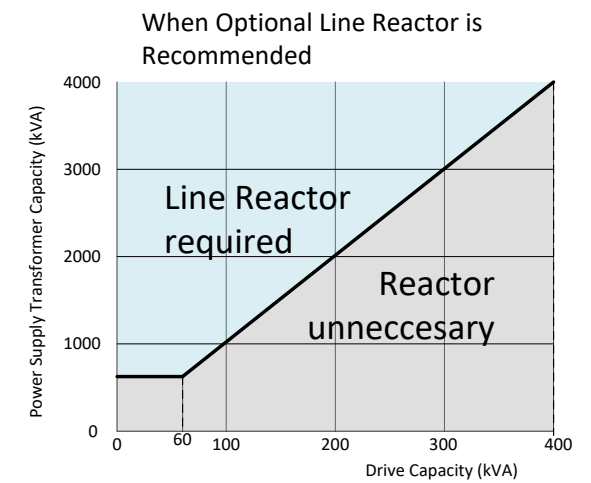
Installation of the Power MASTER VFD consist these steps:

1. **Mechanical installation** of the enclosure in proper place, securing it to floor or wall
2. **3-phase connection**: 3-phase VFD input in separate metal conduit, 3-phase VFD output in separate continuous metal conduit (if cable is not in separate continuous metal conduit use the VFD rated "symmetrical shielded VFD motor cable"), grounding of enclosure, conduits at both ends, and motor – **see best wiring practice on page 7.**
3. **Setup of the VFD by using Ecogate Setup Assistant** (on the VFD's LCD screen, you do not need computer), testing with the fan
4. **Connection between the dust collector and Power MASTER** (minimum: ENABLE free contact that is closed if main fan can be safely operated and open if there is any dust collector error – for example if air lock is not working; optimally: remote start, and remote stop of the dust collector)
4. **Connect 3/8" hoses between FAN Inlet & Outlet and Power MASTER** FAN pressure sensor (this sensor is used to protect the duct system against implosion), connect FILTER inlet & outlet hoses to FILTER pressure sensor (Note: if you expect temperatures -10F or below, it is recommended to use tubing of double internal diameter to reduce problems with condensation freezing inside the tubes)
6. **Connection to control unit greenBOX**: one Ecogate MASTER cable (four wires & shielding)
7. **If E-stop function is required use ACS880 Safe Torque Off function**: XSTO terminals, see Safe Torque Off function chapter in ACS880 Hardware manual
7. **Testing whole system**, fine tuning if necessary

## 6. Ecogate Power MASTER Installation Procedure & Checklist

- A. [Mechanical installation](#) (selecting proper place, ensure distances for proper cooling, fastening cabinet to floor or wall)
- B. Before connecting VFD output to the motor [check the fan motor by megger](#) (high voltage insulation test)
- C. [Connect 3-phase Power Cables](#) (per NEC), grounding ( VFD input and VFD output cables must be in separate conduits)

- **Connect Ground wire to enclosure and to the motor, use same wire size like for phase wire;** note: on freestanding enclosure power input and output are connected on top of cabinet via metal plate that has rubber seal – you need to connect grounding to the end of conduits
- **3-phase power supply** (check size of the site transformer if optional line reactors should be used see chart – contact Ecogate)
- **Output to the fan motor** (shorter cable is better, long cable can create voltage spikes, limit is 100 feet for small motors, 1,000 ft for large motors, for long cables inverter output rating must be de-rated); **Important: if the cable between VFD output and motor are not in continuous metal conduit the VFD rated "symmetrical shielded VFD motor cable" must be used.**
- Note about control cables: if you need to operate the fan without the greenBOX control unit, you do not need to connect control cables; however it is necessary to install the Enable contact from the duct collector (if free Enable contact from your dust collector PLC is closed it means that main fan can be operated); the jumpers are installed at all enable inputs from factory; remove the jumpers as necessary to connect enable outputs from dust collector, from spark detection etc.).



Follow startup checklist:

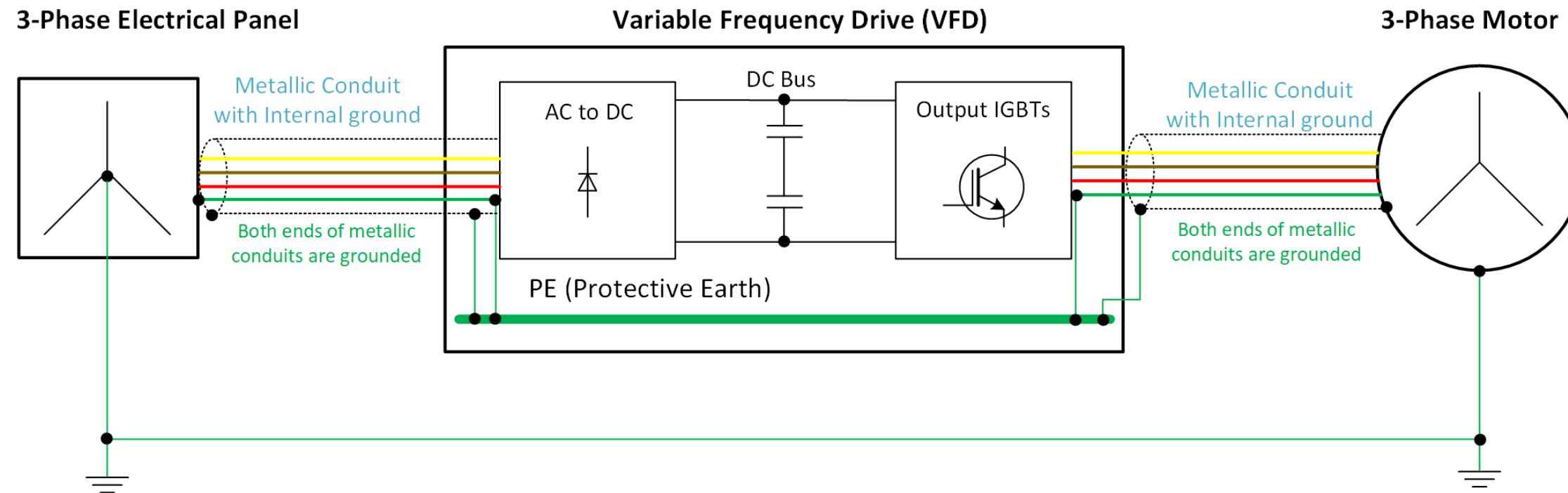
#1	Will be ambient temperature where drive will be installed within 5...104 F and humidity max. 95%:		Motor	
#2	Is drive cooling ensured by min. distances from ceiling, floor (see drawings):		Manufacturer:	
#3	Is mechanical Installation finished, cabinet secured to floor or wall:		Motor Model:	
#4	Is 3-phase power supply to VFD installed in separate conduit:		Motor HP:	
#5	While VFD is disconnected from motor measure the motor insulation by Megger; is insulation OK?		Voltage (V):	
#6	Is 3-phase power from VFD to fan motor installed in separate conduit:		Current (A):	
#7	Is proper enclosure and motor grounding installed (same wire size like phase wire):		RPM:	
#8	Control cables installed (20" distance from output power cables, 8" from input):		Power Factor:	
#9	Hoses from fan and filter installed to pressure transmitters:		Installation date:	
#10	Check Input fuses (must be Fast Acting type, proper current and voltage rating):			
#11	Is Motor cable length under 100 ft small motors and under 1000 ft for large motors:			
#12	Is an Motor is disengaged, it is safe to operate the fan:			
#13	Measure 3-phase Input Voltage L1-L2:            V, L2-L3:            V, L3-L1:            V			
#14	Measure L1 to ground:            V, L2 to ground:            V, L3 to ground:            V			
#15	Fill ABB Warranty Registration Form, submit it:			

- D. [Set front panel selector to STOP, Switch Power On, and use Ecogate Setup Assistant \(detailed description is on next page\)](#)
- E. [Start the fan in Manual Mode](#) (use selector on Power MASTER front panel – move it from STOP to MANUAL MODE)
- F. [Connection between the dust collector and Power MASTER, and to greenBOX](#) (Ecogate MASTER cable)

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## 7. Best Practice of the VFD Wiring to Limit Common Mode Voltage and EMI Interferences



### Can a Variable Frequency Drive Cause a Motor Bearing Failure?

Even though avoidable and not common, unchecked bearing currents can cause motor failure, but most commonly problems with bearing are caused by improper bearing lubrication, improper alignment (between motor & fan shafts), or by unbalanced fan. If a Variable Frequency Drive (VFD) is installed by carefully following the manufacturer's best wiring practice, it's not necessary to install shaft grounding devices and bearing insulation.

### Best Practice Wiring Practice

- The cable between the VFD output and motor should be short (install the VFD close to the motor)
- The cable between VFD output and motor should be a four wire cable in metallic conduit grounded at both ends (dedicated ground cable is always required) or a symmetrical shielded motor cable (especially if the cable is long)
- Couple separate parts of a conduit together. Also bond the conduits to the drive PE (Protective Earth) and motor frame. Use separate conduits for input power, and for the motor.
- Control cable should be Ecogate MASTER cable - the Modbus pair is properly twisted and shielded, and shielding must be connected at one point only (as it is described in our installation guide).

### What are the options if you see high Common Mode Voltage at a particular installation?

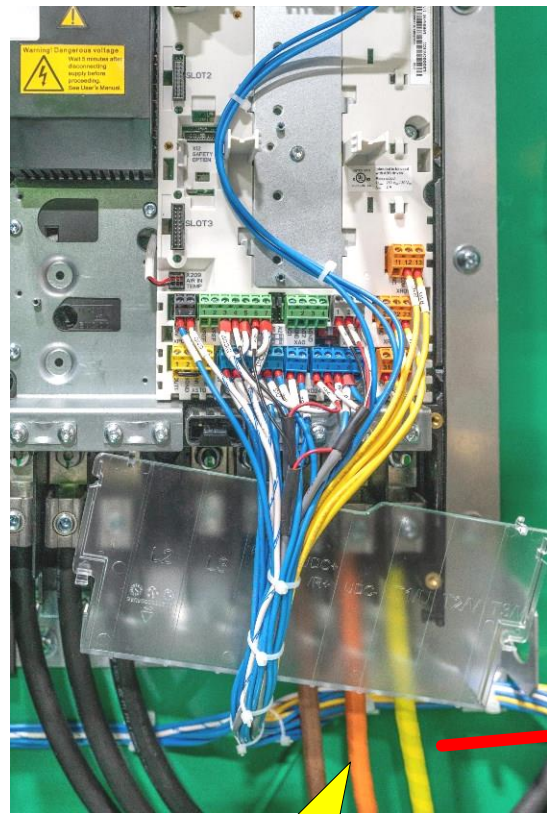
If you think you might have a problem, bearing currents are easy to check for and straightforward to solve. In most cases your first indication of a bearing current issue is an increase in noise and vibration. Sometimes problems with bearing are caused by improper bearing lubrication. The lubrication is the owner's responsibility, the schedule is in the motor's user manual. Another possible issue is are improper alignment between motor & fan shafts, or by an unbalanced fan.

To eliminate bearing current you can install insulated bearings and shaft grounding devices, for example Baldor Shaft Grounding Brush Assembly, or Aegis bearing protection ring, or Inpro Seal Current Diverter Ring & Motor Grounding Seal.

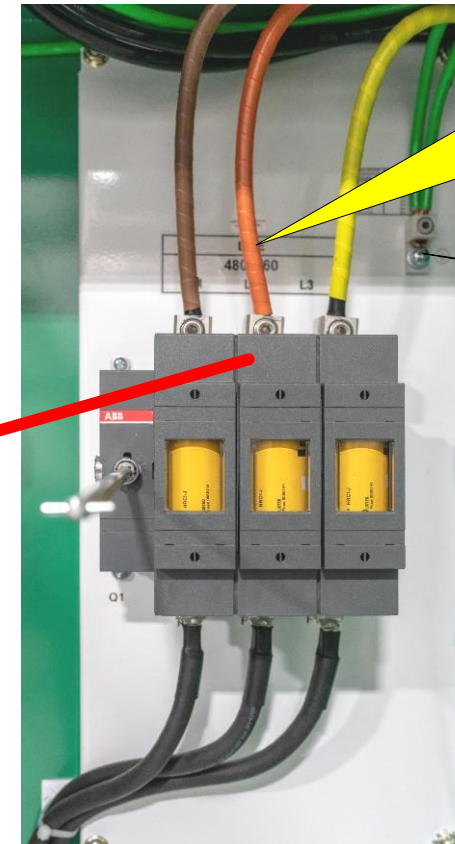
# 8. Ecogate Wall Mounted Power MASTER Units Installation (up to 200 HP)

The output, input, and control cable conduits

Please follow ABB Hardware installation guide, intention of this page is to show the location where the cables should be connected.



Connect the cables to the fan motor to the VFD outputs under plastic cover (Red arrow shows approx. location inside the enclosure)



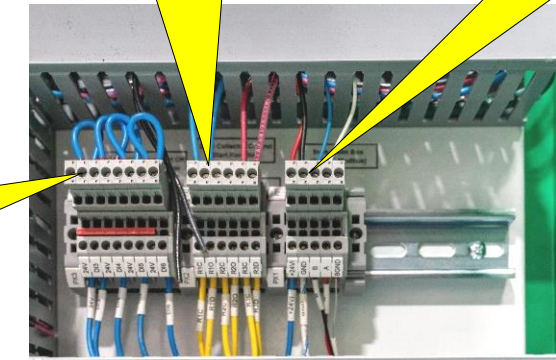
Connect the VFD supply cables to the input of the fused disconnect, connect ground to the grounding lug. (Red arrow shows approx. location inside the enclosure)

The ground terminal (ABB requires same wire size for ground wire as used for phase wires)

Connect the Dust Collector remote START & STOP

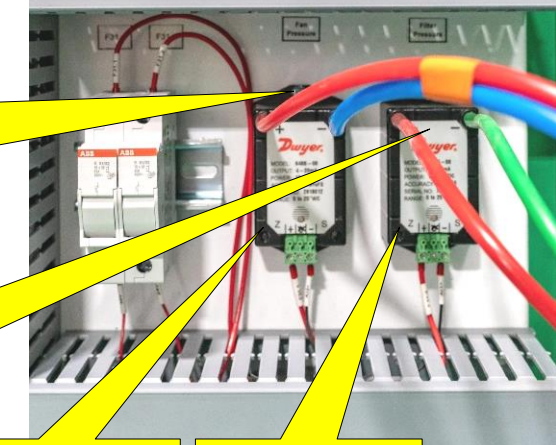
Connect the Ecogate MASTER cable from greenBOX (+, -, A, B)

Connect the ENABLE signal(s) from the dust collector, immediate stop



Connect 3/8" hoses from the FAN OUTLET (RED) & the FAN INLET (BLUE)

Connect 3/8" hoses from the FILTER OUTLET (RED) & FILTER INLET (GREEN)



Note: if you expecting temperatures -10F or below, it is recommended to use tubing of double internal diameter to reduce problems with condensation freezing inside the tubes)

Install the 3-phase VFD input in a separate metal conduit, the 3-phase VFD output in a separate continuous metal conduit (if the cable is not in a separate continuous metal conduit use VFD rated "symmetrical shielded motor cable"). Ground the enclosure, all the conduits at both ends, and motor ground.

After installation while hoses to fan inlet and outlet are not yet connected, with VFD powered, and sensor powered press SET ZERO button on the Dwyer sensor (bottom left). Note: some Power MASTER units are equipped by Ashcroft pressure transmitter where ZERO should be set by potentiometer on left side of the sensor.

SET ZERO BUTTON SET ZERO BUTTON



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# 9. Ecogate Standalone Power MASTER Unit Installation (250 HP and up)

Install the 3-phase VFD input in a separate metal conduit, the 3-phase VFD output in a separate continuous metal conduit (if the cable is not in a separate continuous metal conduit use VFD rated "symmetrical shielded motor cable"). Ground the enclosure, all the conduits at both ends, and motor ground.

**Ground terminals** (ABB requires the same wire size for ground as for the phase wires)

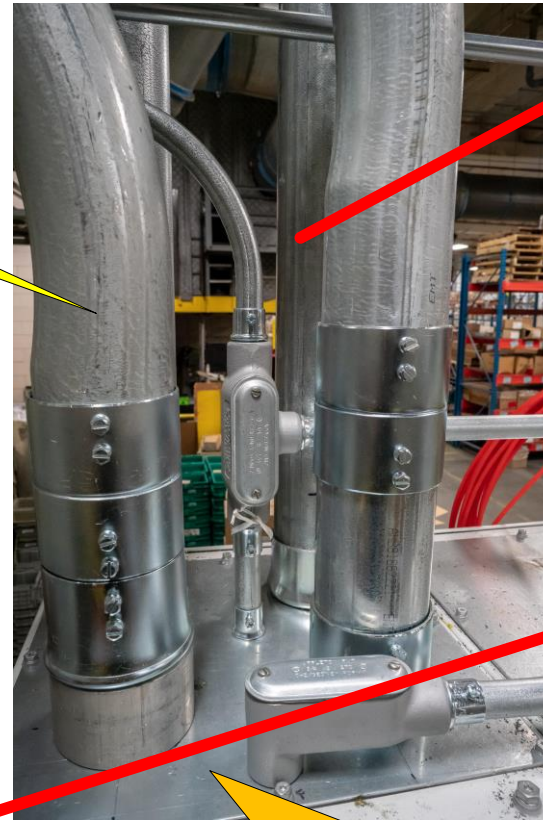
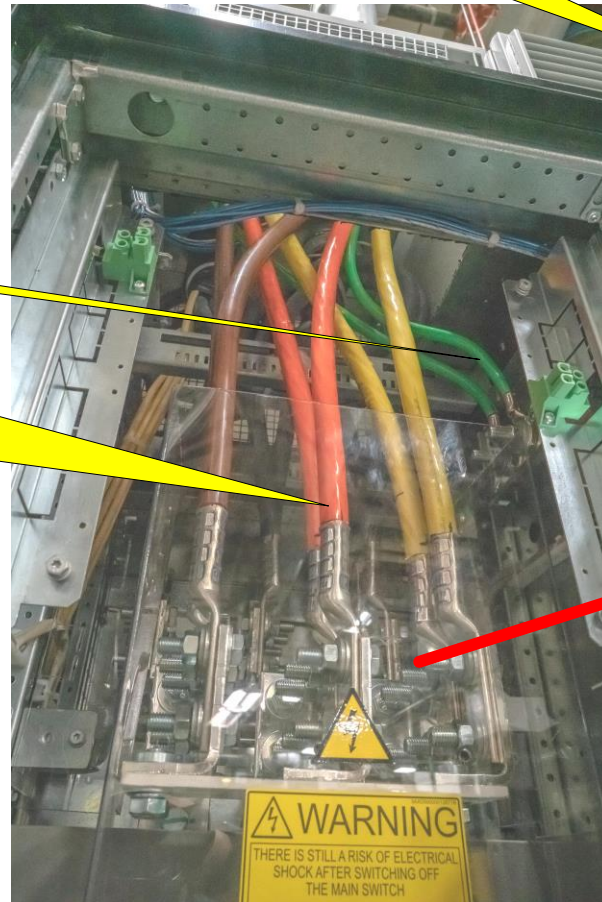
Connect the **VFD supply cables, output to fan motor** (red arrow shows approx. location inside enclosure), metal screen and plastic cover must be removed for access

Connect the **Dust Collector remote START & STOP**

Connect the **ENABLE signal(s)** from the dust collector

Connect **Ecogate MASTER cable** from greenBOX (+, -, A, B)

The output, input, and control cable conduits



**Important Note:** Connect a ground wire to the top metal square in order to ground the metal conduits (power input, output to fan motor, control wires conduit), the plate is isolated from the rest of the enclosure by a rubber seal.

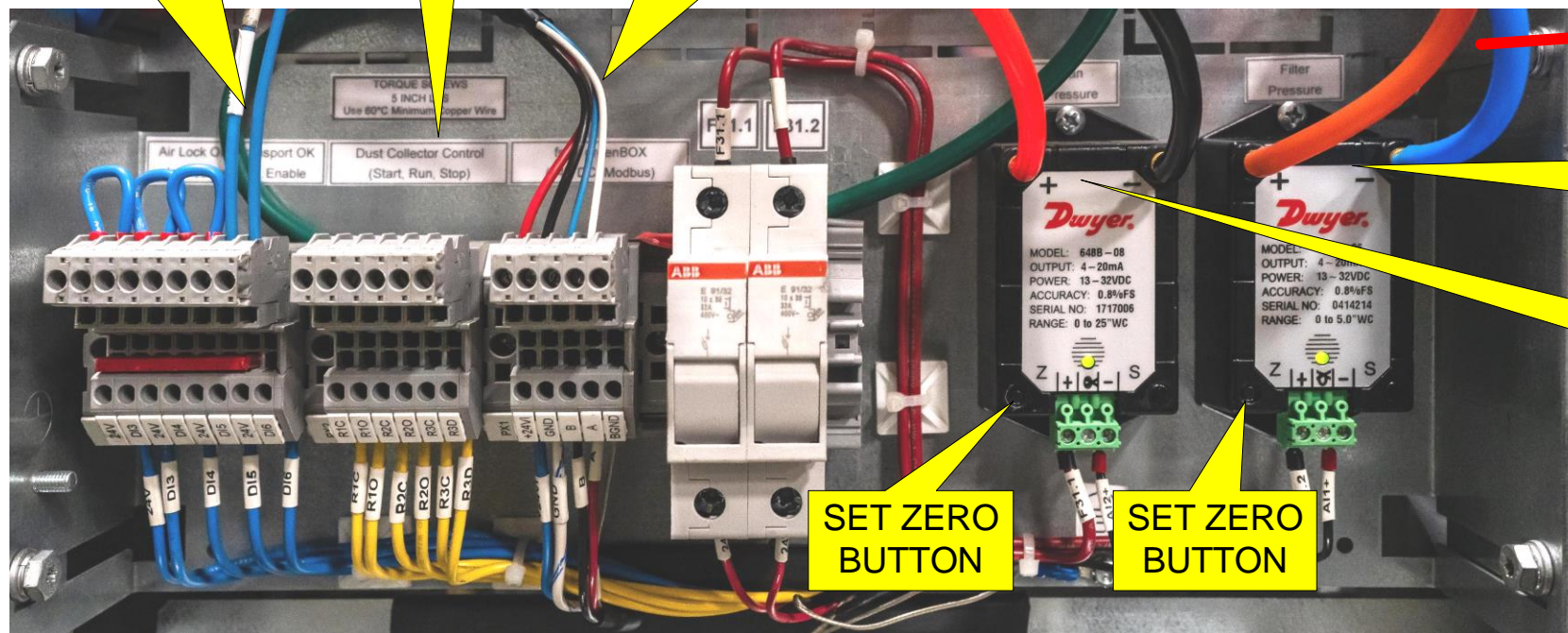
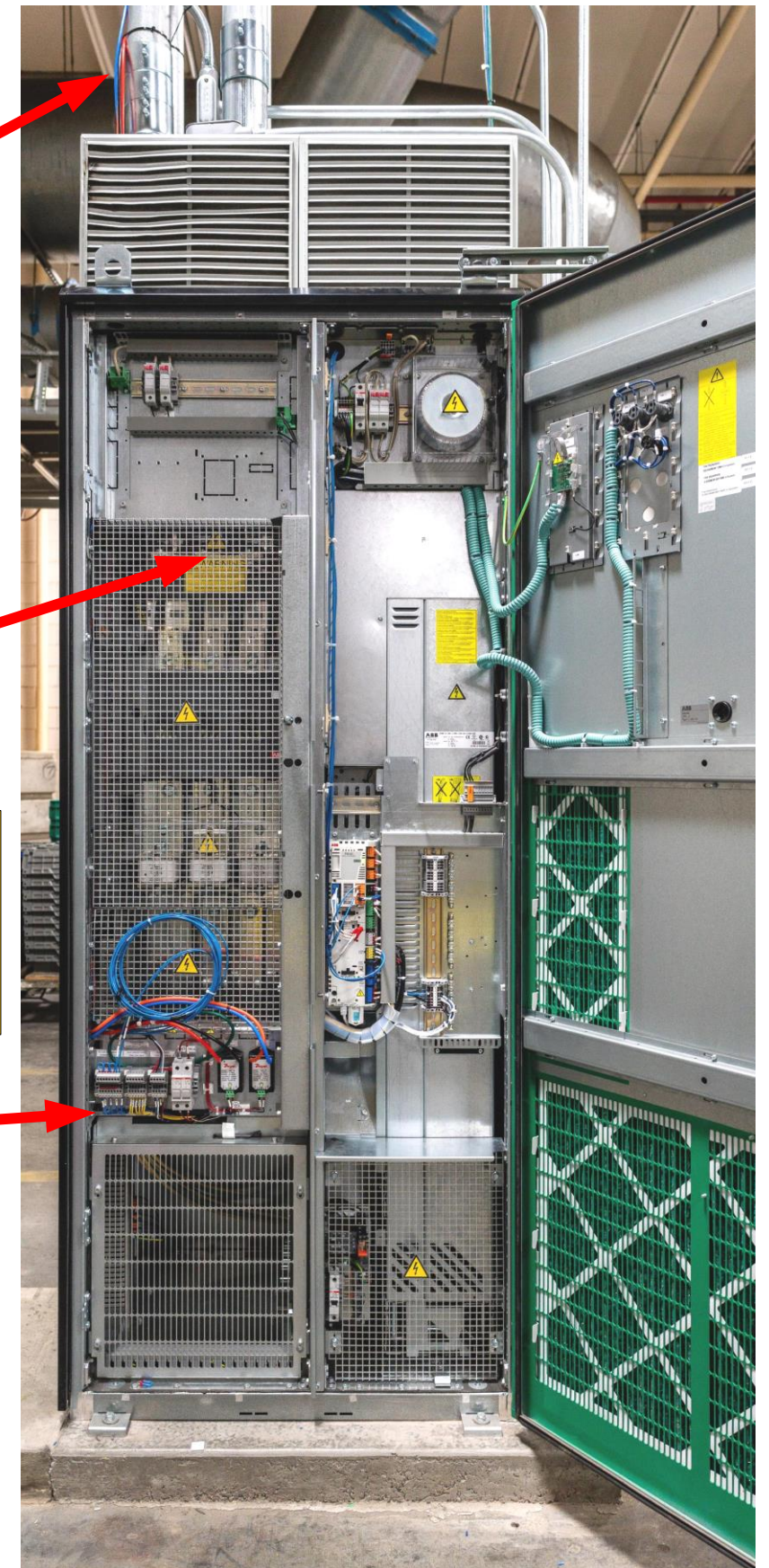
After installation while hoses to fan inlet and outlet are not yet connected, with VFD powered and sensor powered, press SET ZERO button on the Dwyer sensor (bottom left). Note: some Power MASTER units are equipped by Ashcroft pressure transmitter where ZERO should be set by potentiometer on left side of the sensor.

Connect 3/8" hoses from the **FILTER OUTLET (RED) & FILTER INLET (GREEN)**

Connect 3/8" hoses from the **FAN OUTLET (RED) & the FAN INLET (BLACK)**

Note: if you expecting temperatures -10F or below, it is recommended to use tubing of double internal diameter to reduce problems with condensation freezing inside the hoses.

Please follow the ABB Hardware installation guide, the intention of this page is to show the locations where cables should be connected.

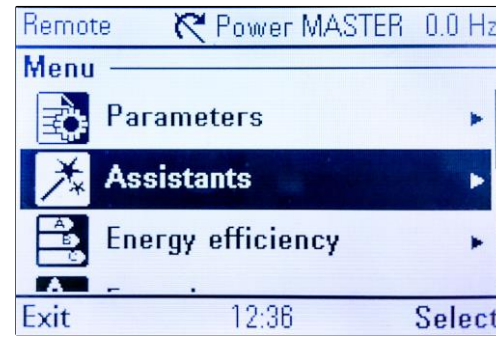


SET ZERO BUTTON

SET ZERO BUTTON

# 10. Ecogate Setup Assistant

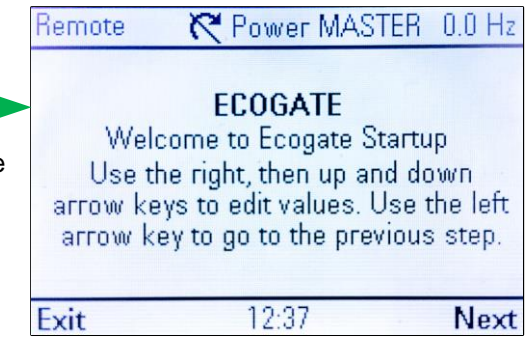
Ecogate Setup Assistant will help you to set the Power MASTER VFD based on selection of greenBOX control unit and fan motor nameplate values. To access Ecogate assistant press **MENU** button on right side under the screen, select **Assistants**, **Ecogate setup assistant**.



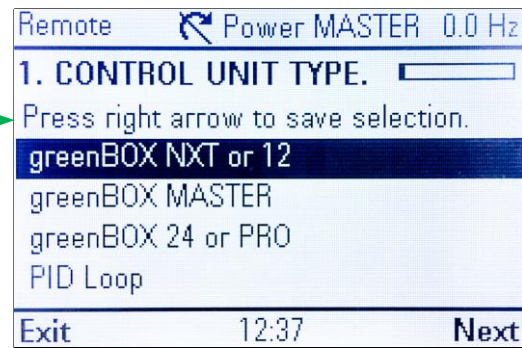
Highlight "Assistants" by using arrow keys, and press **Select**



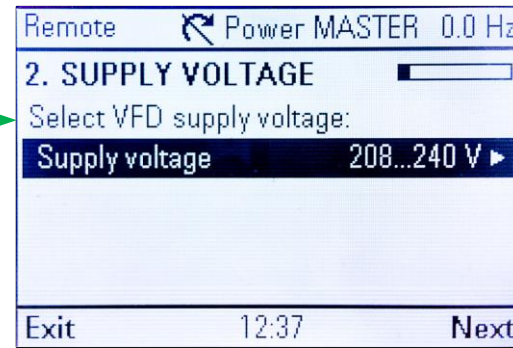
Highlight "Ecogate setup Assistant" and press **Select**



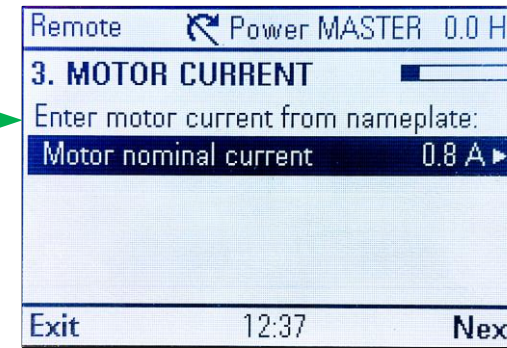
Read instructions, and Press **Next**



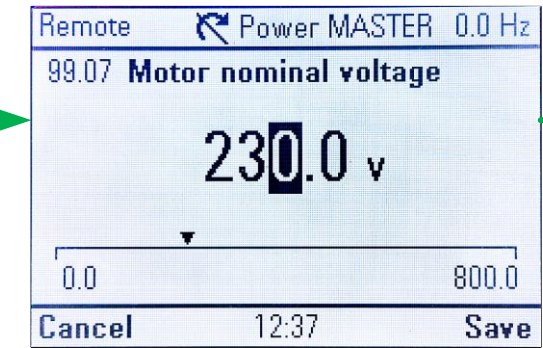
Select greenBOX model you are installing, and Press **NEXT**



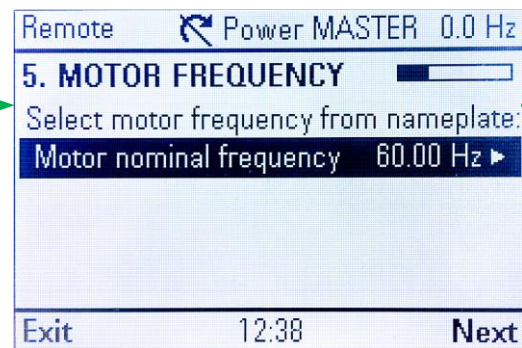
Only supply voltages available to particular VFD hardware will be shown.



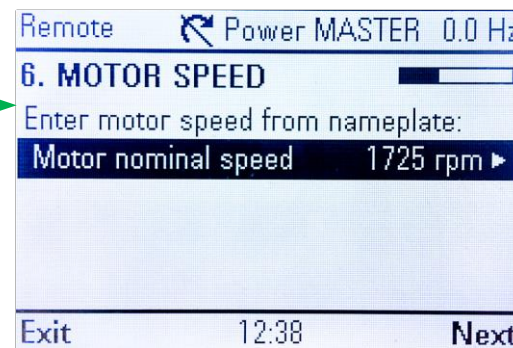
All fan motor values enter exactly as on the motor nameplate.



This is example how screen where you can enter values looks like.



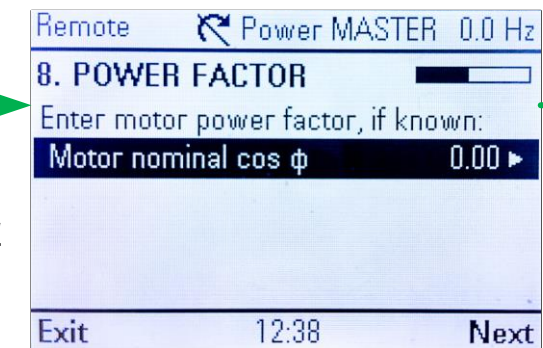
Enter fan motor nameplate frequency value



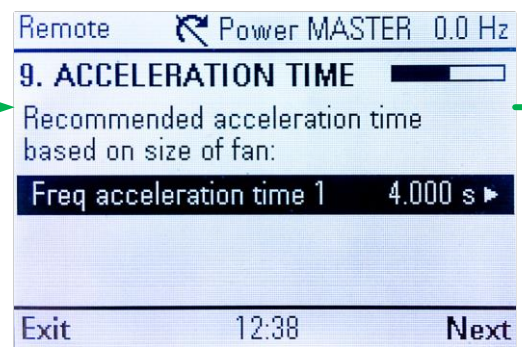
Enter fan motor nominal speed (RPM) nameplate value



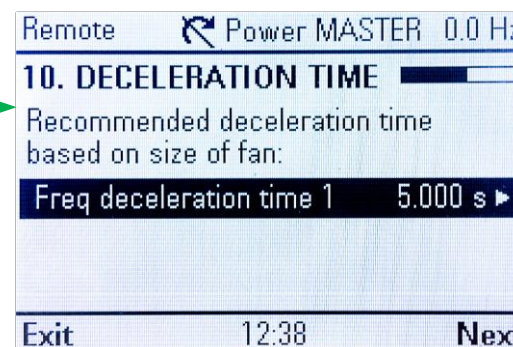
To enter motor power in HP press left **HP/kW** button.



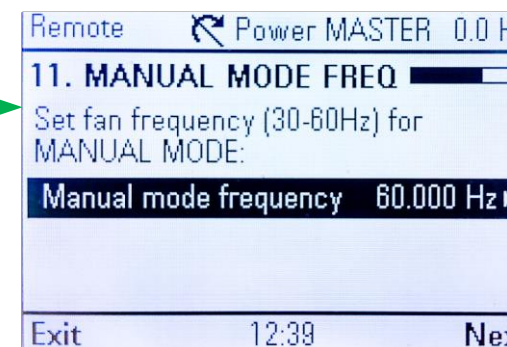
The power factor is not necessary, but it helps to the VFD to understand to the motor.



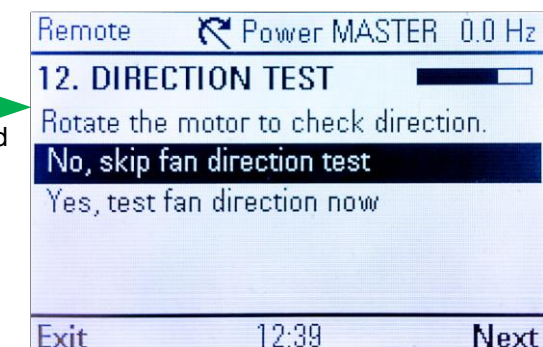
Acceleration time is calculated based on motor size in HP(kW).



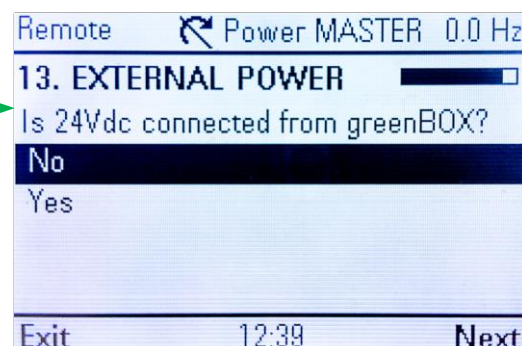
Deceleration time is calculated based on motor size in HP(kW).



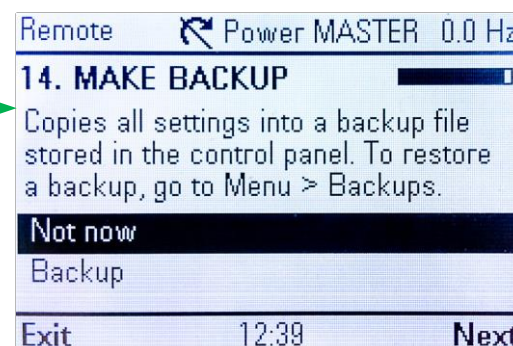
If fan is oversized for the duct system, you will need to use lower manual mode frequency.



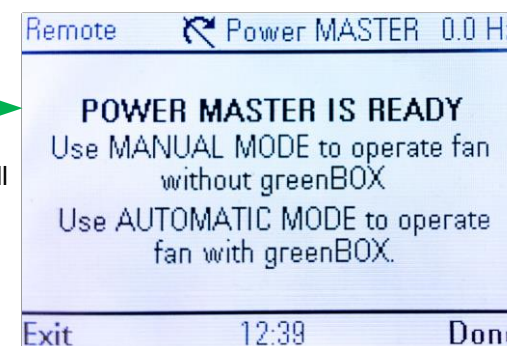
If fan rotation is not correct, Assistant will correct it by changing parameter 96.16.



It is preferable to connect greenBOX by using Ecogate MASTER cable and bring 24VDC to the VFD from greenBOX.



It is preferable to make backup of all VFD settings and store it to the Control Panel – can be used for Restore if necessary.



Press **Done** and then **Exit** several times to return to Home page.



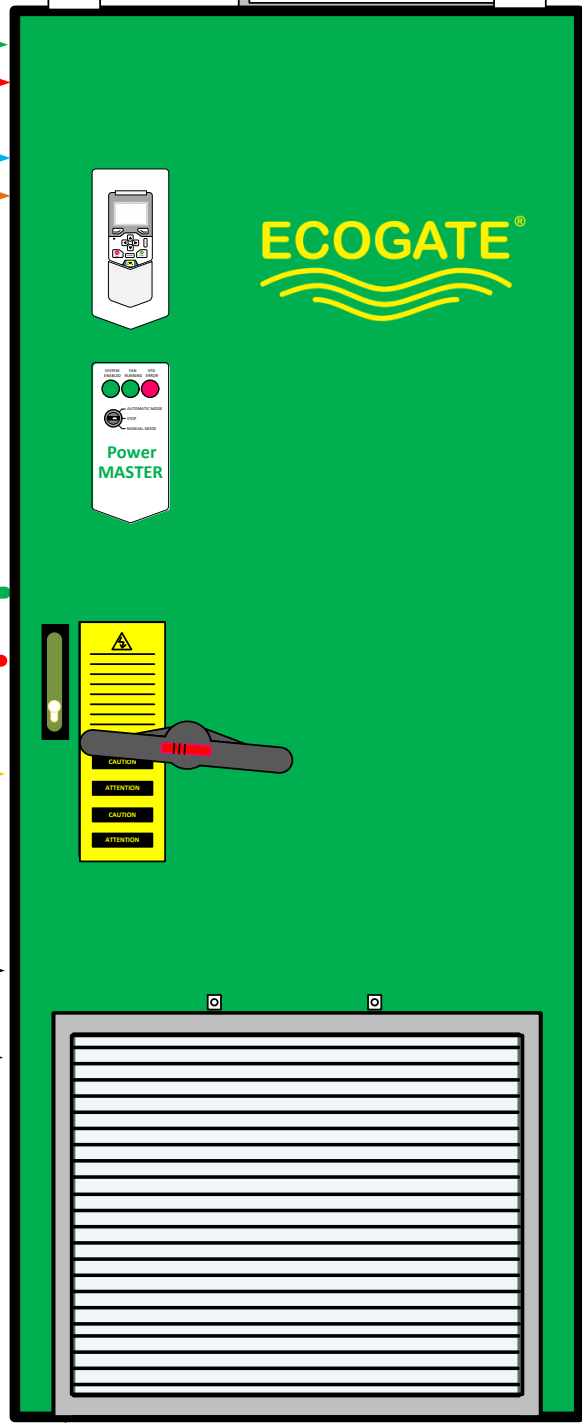
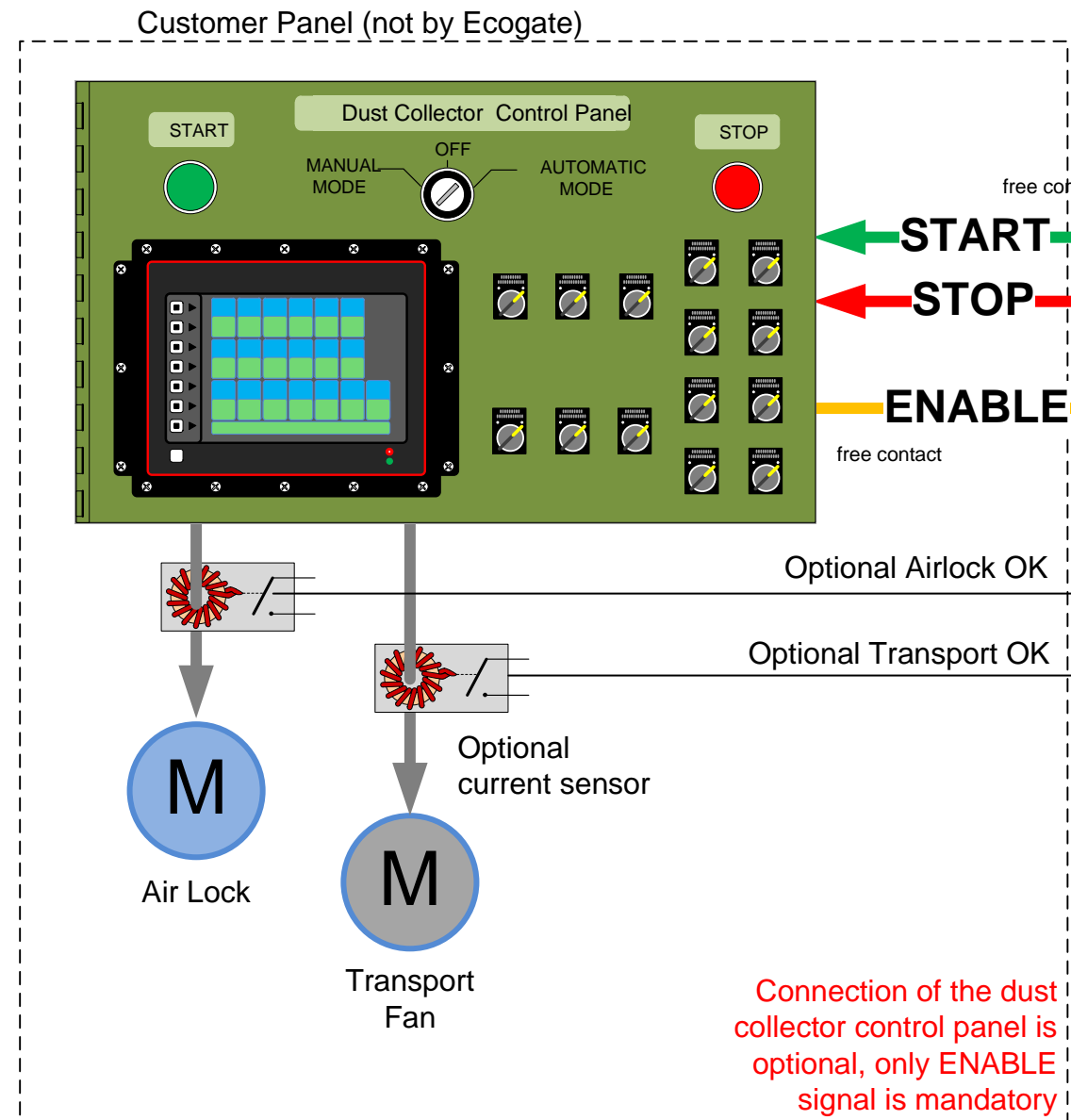
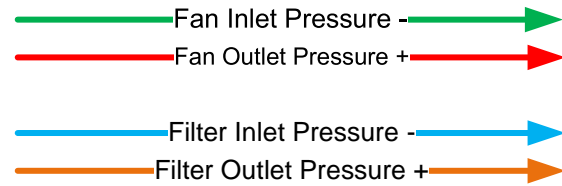
### A. Dust Collector Control Panel (existing)

### B. Power MASTER with VFD

### C. greenBOX MASTER or NXT or 12 control unit

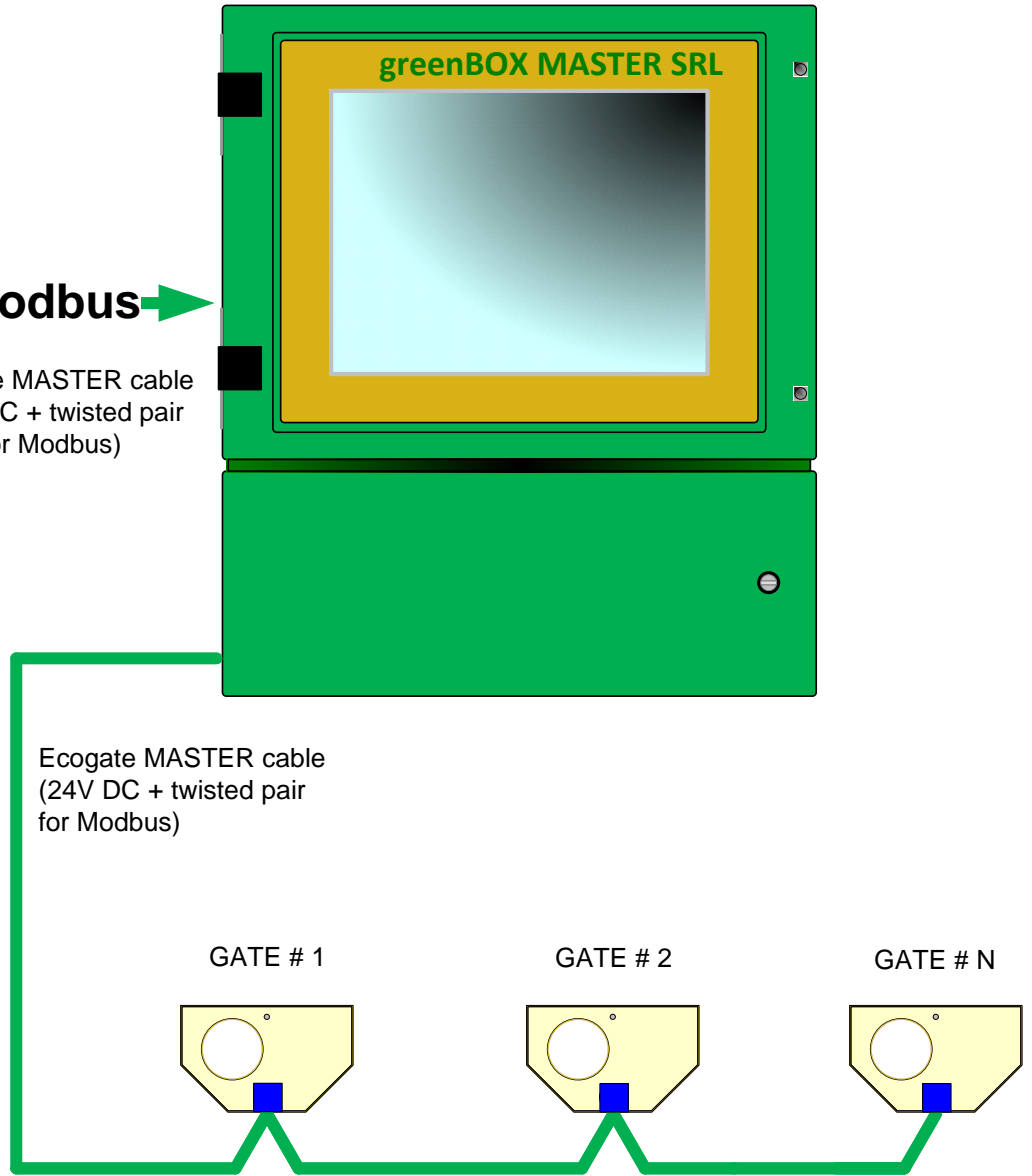
The FAN and FILTER pressure sensors are installed inside Power MASTER enclosure; connect two 3/8" hoses from fan inlet & outlet, and from filter inlet & outlet

Note: if you expecting temperatures -10F or below, it is recommended to use tubing of double internal diameter to reduce problems with condensation freezing inside the tubes).



Modbus

Ecogate MASTER cable (24V DC + twisted pair for Modbus)



Immediate Stop

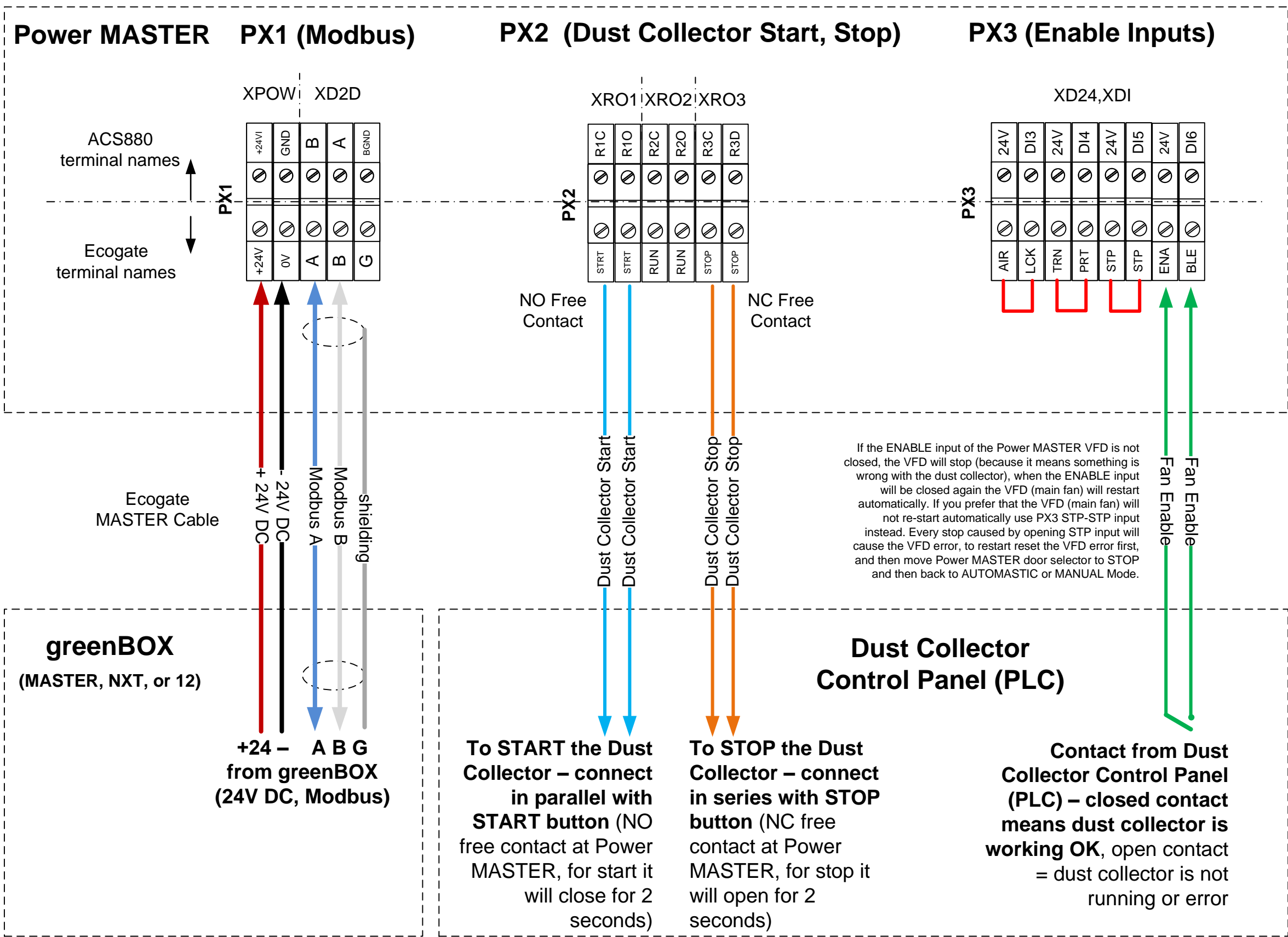
free contact (Or Safe Torque Off Inputs)

STOP

Power supply is not shown, only control wiring.

See following pages for schematic diagrams, and terminal wiring.

# 12. Power MASTER Control Terminals



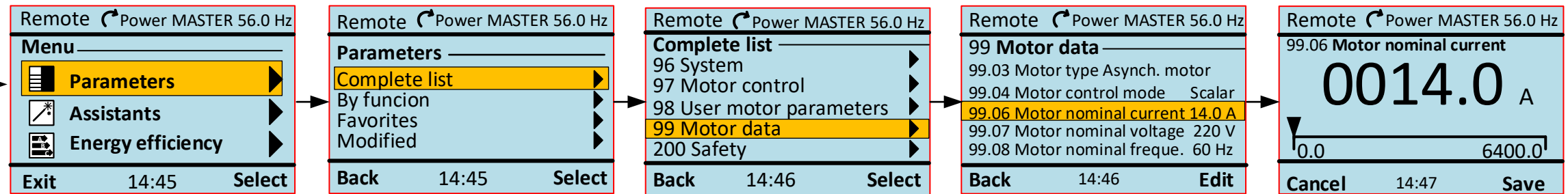
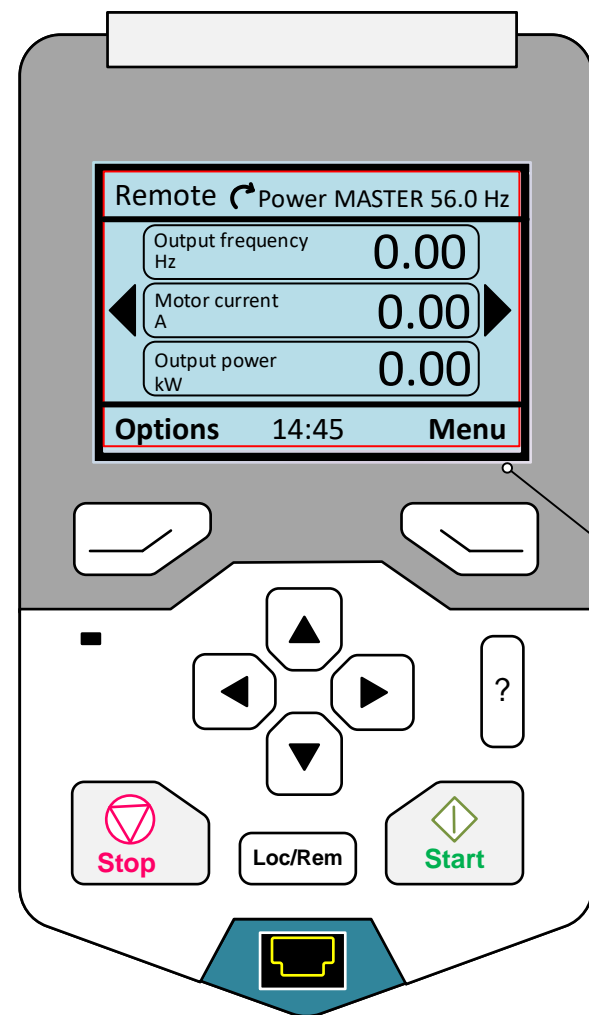
## Power MASTER Control Wiring

**Keep control wires 20" away from power cables, if crossing is necessary do it in 90 degree**

1. Use Ecogate MASTER Cable (green) to connect Modbus A, B (twisted – shielded pair, shielding is connected only at greenBOX) to the PX1 terminal.
2. Connect the Enable free contact from Dust collector control Panel to the Power MASTER PX3 ENA-BLE terminals.
3. Preferable connect remote start of the dust collector (i.e. the Power MASTER will Start/Stop the Dust Collector) – START (NO) and STOP (NC) to PX2 STRT- STRT terminals.
4. Optionally you can install current sensors on the Transport Fan motor and Air Lock Motor and connect them to Transport Fan OK and Air Lock OK Power MASTER inputs PX3 AIR-LCK and TRN-PRT.
5. The customer safety can be connected to the IMMEDIATE STOP input terminals PX3 STP-STP.
6. The PX2 terminals RUN-RUN is free contact that is closed if the main fan is running (i.e. Power MASTER VFD is running – outputting frequency).



# 13. How to Set VFD Parameters by using Power MASTER Control Panel



- #1. Press **Menu**
- #2. Select **Parameters**, press →
- #3. Select **Complete List**, press →
- #4. Select **Motor data**, press →
- #5. Select **Motor nominal current**, press →
- #6. Use arrows to select digit and adjust value by ↑ or ↓, press **Save**

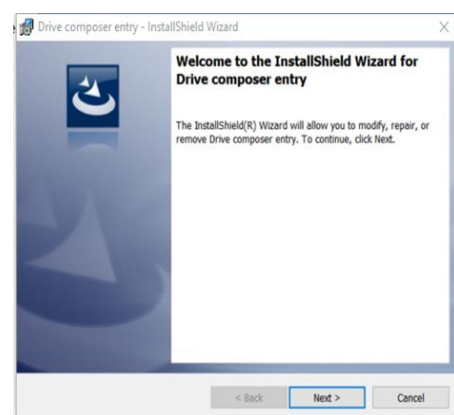
Use the control panel installed on Power MASTER door: press “soft” buttons under LCD display to select the functions; use arrow buttons to select menu items and to set a numerical values.

**This example shows how to change the Parameter 99.06 Motor nominal current.**

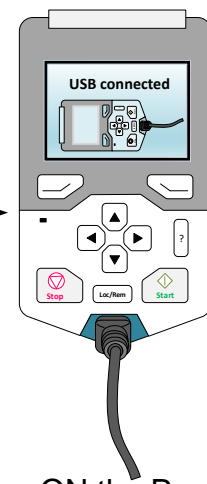
Repeat the steps #4...#6 to change other parameters per list in the page “Starting Procedure”.

## Alternatively: Set VFD Parameters by using Drive Composer software

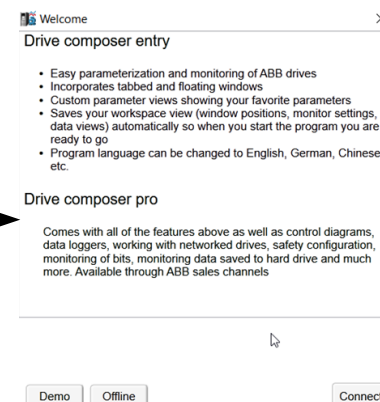
You can use Drive Composer Entry software from ABB to setup the VFD parameters: you need Windows PC, and USB Mini cable. This software is available as a free download from ABB. Google search: Drive Composer Entry Download (it is as Feb 2017 at “<http://new.abb.com/drives/software-tools/drive-composer>”, but location might change. You will need to fill a registration with ABB (name, email, company, country) to be able to download the software. After download, follow the installation wizard.



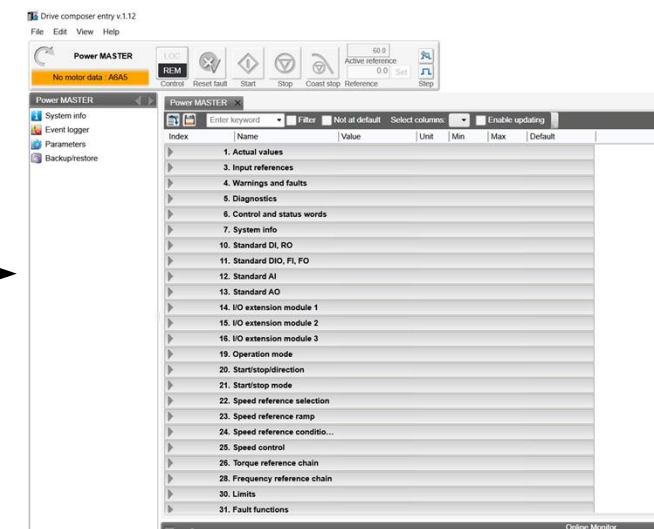
1. Install the downloaded software, follow the instructions.



2. Power ON the Power MASTER, connect USB mini cable between control panel and Windows PC.



3. Start the Drive Composer, it will select automatically COM port where the VFD is connected, and press “Connect” button.



4. Set checkbox “Enable updating”, scroll down to select “99. Motor data”, select the parameter, edit the value.

5. As you change the parameters they are automatically updated in the VFD (Enable updating must be checked). Change all parameters as described in “Starting Procedure” on previous page.

By using the Save function you can also save copy of all parameters to your Windows PC.

You can download Drive composer manual - google: “EN\_Drive composer PC tool User's manual pdf”.



## 14. HOW TO PRESET POWER MASTER TO WORK WITH ANALOG CONTROL (greenBOX 24, greenBOX PRO, with PID LOOP) & ADVANCED PROGRAMMING

A. The greenBOX is set from the factory to use Modbus control with greenBOX 12, greenBOX NXT, and greenBOX MASTER (if you need to re-load this settings: use Ecogate Assistant from Power MASTER Control Panel: MENU → ASSISTANT, select Ecogate Assistant, run it, follow instructions on screen).

B. **If you need to control Power MASTER by greenBOX 24 (two greenBOX 12 units) or by legacy greenBOX PRO:** we prepared necessary Power MASTER parameter settings, simply use Ecogate Assistant available from Power MASTER Control Panel: MENU - ASSISTANT. There is separate document available that is describing the wires connection.

C. **If you need to control Power MASTER by the PID loop:** we prepared necessary Power MASTER parameter settings simply use Ecogate Assistant available from Power MASTER Control Panel: MENU - ASSISTANT. There is separate document available that is describing the wires connection.

D. **If you need to adjust dust collector control (START, STOP, ENABLE) or FAN SPEED in the MANUAL MODE:**

47. Data Storage		Value as displayed on Control Panel	Units	Description
38	47.01	ENABLE SIGNAL GRACE PERIOD 15	sec	The Grace Period - the time the system will run without the Enable Signal at the start. If you prefer that system will not start without Enable signal, change it to 0 sec. If your dust collector need longer time before providing the Enable signal because
39	47.02	HOW LONG GLITCH IN ENABLE SIGNALS IS IGNORED 3	sec	This time will define how long temporary missing Enable signals (at terminal PX3: AIR-LOCK, TRN -PRT, ENA-BLE inputs) are tolerated (i.e. the fan will not stop is the Enable signals will be missing for up to 3 seconds, for example if you cahnge this time
40	47.03	LENGH OF THE DUST COLLECTOR START PULSE 2	sec	How long is the Start Pulse at PX2 STRT-STRT terminal (simulating pressing START button on dust collector control panel), change as necessary.
41	47.04	LENGH OF THE DUST COLLECTOR STOP PULSE 2	sec	How long is the Stop Pulse at PX2 STP-STP terminal (simulating pressing Stop button on the dust collector control panel), change as necessary.
42	47.05	DUST COLLECTOR STOP PULSE OFF DELAY 3	sec	Delay Off Time for the Dust Collector PX2 STP-STP terminal - you can st the delay - how long after the fan will stop the STOP puls for your dust collector control panel is provided; Use this value if for example cleaning must be done before the dust colle
43	47.07	MANUAL MODE FREQUENCY (FAN SPEED) 60	Hz	This value in Hz sets the speed of the fan motor when the MANUAL MODE is selected on the Power MASTER front panel. If the fan should run at full speed use 60 Hz, if you need to decrease the fan speed enter lower value. Do not run the fan under 30 Hz - it

Before start changing the drive parameters make a BACKUP of the parameters from the VFD to the Control Panel; you can later restore these parameters from the BACKUP copy (stored at the control panel) to the VFD. The Backup function is available from MENU. Also make a Backup when you finish all changes.

### MAXIMUM FAN PRESSURE MONITORING TO PROTECT DUCT SYSTEM

The Power MASTER is using ACS880 SUPERVISION function #1 (parameters 32.05...32.10) to monitor maximum allowable pressure to protect the duct system against implosion - same function is built-in greenBOX, but Supervision function also works without greenBOX (if not installed yet, not powered, or failed) and also in MANUAL MODE (as selected at Power MASTER front door switch); the factory settings is that the fan will stop if pressure reaches 23.75" wc, it can be changed by user to any preferable pressure value in parameter 32.10. Note: hoses from fan inlet & outlet must be connected to the FAN pressure transmitter mounted inside the Power MASTER enclosure to support this function.

**Function description:** if output current from FAN filter pressure is higher than 19 mA (equals 23.4"wc if transmitter has 25 "wc range) for time longer than 10 seconds, the VFD will stop on failure. Parameters:

- 32.05...Super vision 1 **function** (should be 2 = high)
- 32.06...Super vision 1 **action** (should be 2 = fault)
- 32.07...Super vision 1 **signal** (should be 10 = AI2 = Analog Input 2 = Fan Pressure)
- 32.08...Super vision 1 **time** (should be 10000 = 10 seconds = action delay)
- 32.09...Super vision 1 **low** (should be 0)
- 32.10...Super vision 1 **high** (should be 19 mA, change this value for different protection pressure)

For Dwyer pressure transmitter 4...20 mA with range 0...25" wc 19 mA equals 23.4" wc

#### Example of calculations:

- a. 20 mA minus 4 mA = 16 mA range from 0 "wc to 25 "wc
- b. 1 mA = 25/16 = 1.563 "wc
- c. At 19 mA output current = 19-4= 15 mA difference \* 1.563= 23.44 "wc

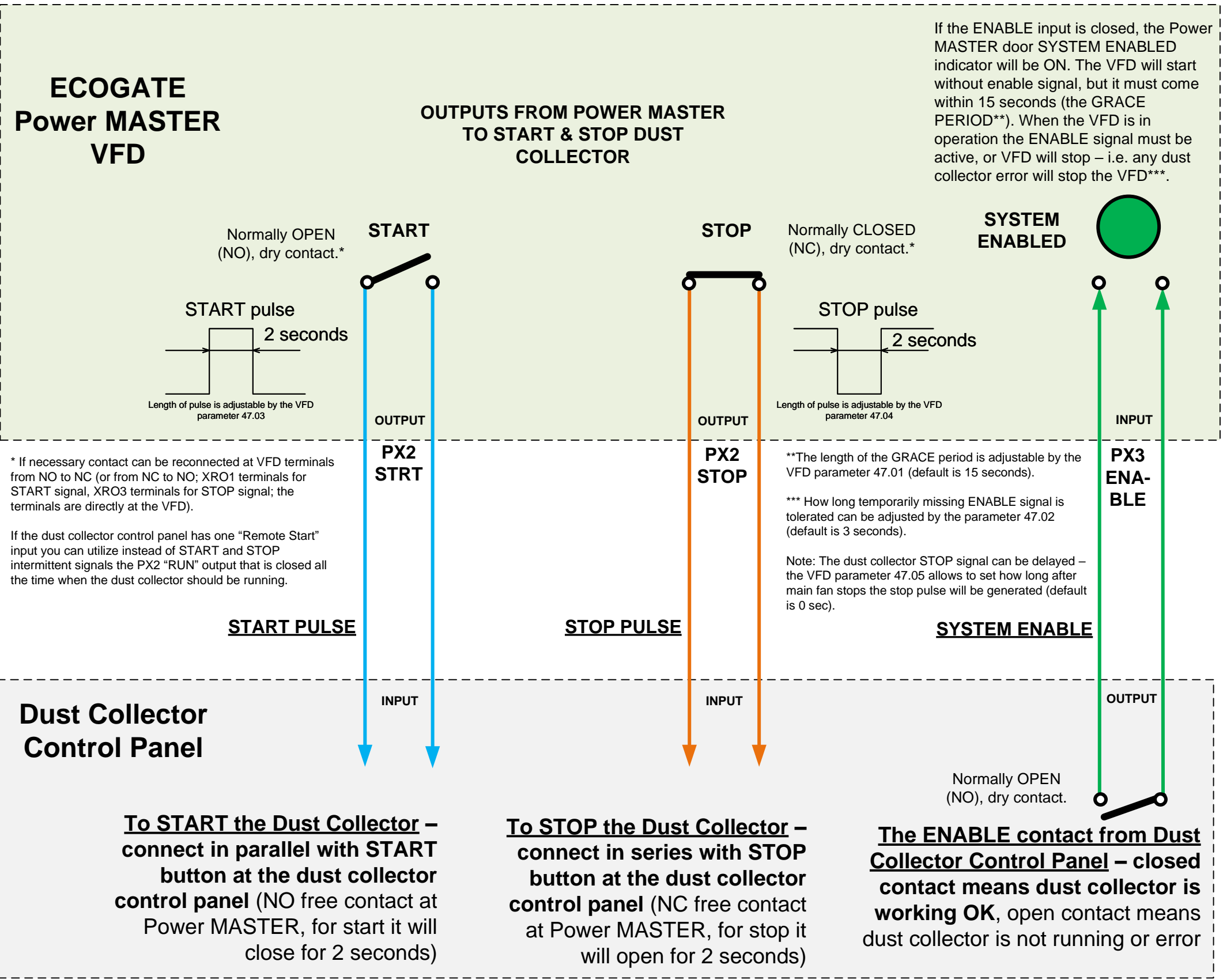
### After external 24V DC Power Supply from greenBOX is connected set parameter 94.04 to External power

After connecting the 24V DC power supply from greenBOX (serves as backup power for VFD processor change VFD to use External 24 VDC (set parameter 95.04 to 1 = External power supply);



Updated: March 6, 2023

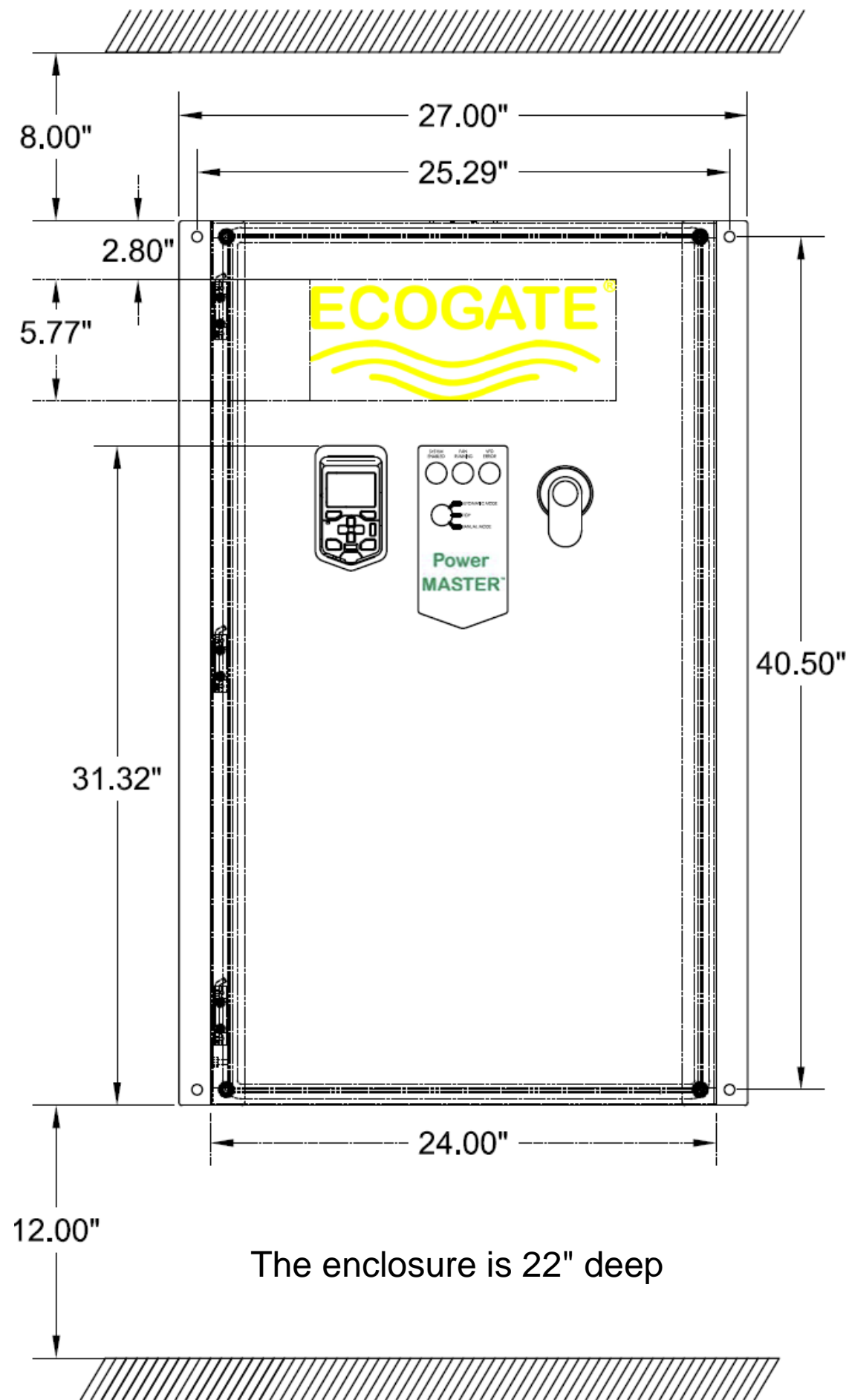
# 15. Troubleshooting the Dust Collector Connection– Start/Stop/Enable



## STARTUP & TEST PROCEDURE

- Test functionality of the dust collector remote start and remote stop (follow all safety codes: the wires can contain 115 – 460 VAC voltage):
  - put the dust collector control panel to normal operating mode
  - Connect together the wires connected in series to the STOP button at the dust collector control panel (to simulate STOP contact).
  - Connect together the wires connected in parallel to the START button at the dust collector control panel (to simulate START contact), the dust collector should start (whole start cycle takes the 5 – 60 seconds).
  - Open for one second wires connected to the STOP button to simulate the STOP; the dust collector should stop (whole start cycle takes the 5 – 60 seconds).
  - By using the ohmmeter check if the ENABLE output contact from the dust collector control panel is closed when the duct collector is running. Simulate the dust collector error and check that the ENABLE contact will open to indicate the ERROR (this will be used to stop the main fan).
  - Measure how long it takes after dust collector start that the ENABLE signal will close. If this time is longer than 15 seconds the GRACE period must be adjusted by the VFD parameter 47.01\*\*.
- The Power MASTER VFD generates the START pulse every time when the VFD starts (fan starts rotating), and the STOP pulse is every time when the fan stops rotating; test this by using the ohmmeter:
  - Connect the ohmmeter to the Power MASTER PX2 terminals STRT-STRT, move from page selector from STOP to MANUAL, when the RUN indicator will be on, the start contact will close for 2 seconds.
  - Connect the ohmmeter to the Power MASTER PX2 terminals STOP-STOP, move front door selector from MANUAL to STOP, when the RUN indicator will go off, the stop contact will open for 2 seconds.
- If all above is OK, connect the wires between the dust collector control panel and the Power MASTER VFD per this sheet. Test the dust collector start procedure:
  - move Power MASTER front door selector from the STOP to MANUAL – the dust collector should start; move the front door selector to STOP, the dust collector should stop.
  - When dust collector is running simulate the dust collector ERROR, the Power MASTER ENABLE signal must disappear and main fan must stop.





16. Power MASTER Enclosure #1: up to **40 HP (460V)**  
**27" wide, 42" high, 22" deep**

wall mounted

Available for US at 460V as 10, 15, 20, 25, 30, 40 HP

Available for EU at 380-415 V as 5.5, 7.5, 11, 15, 18.5, 22 kW

HP	Volts	Power MASTER (lbs)	Shipping (lbs)
10	230	213	268
15	230	236	291
20	230	236	291
25	230	276	345
30	230	276	345
50	230	324	393
10	460	206	261
15	460	209	264
20	460	213	268
25	460	213	268
30	460	232	287
40	460	236	291

HP	Volts	Power MASTER (lbs)	Shipping (lbs)
10	575	264	333
15	575	264	333
20	575	267	336
25	575	267	336
30	575	267	336
40	575	267	336

Note: all weights are approximate.

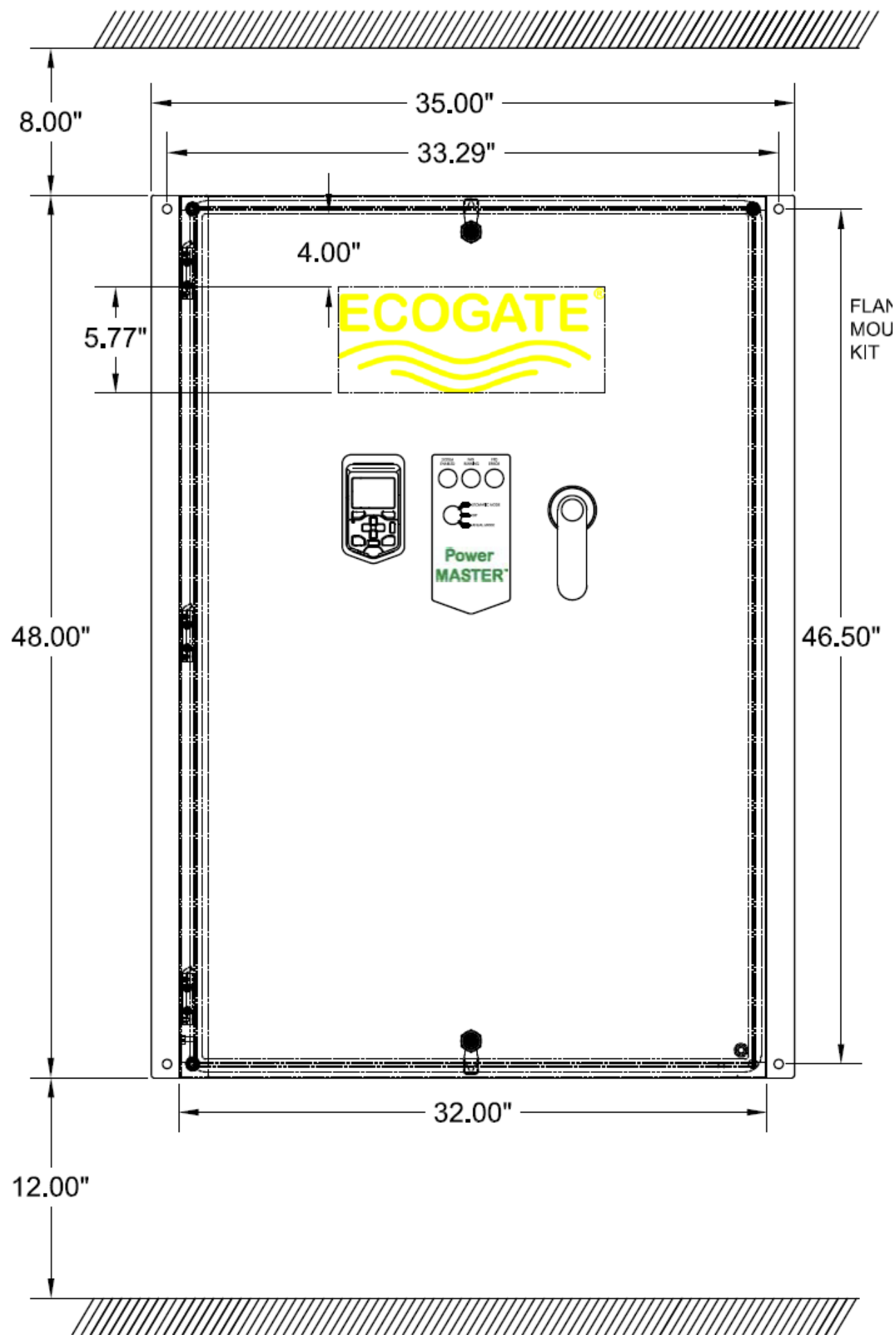
**Installed Ashcroft CXLdp pressure transmitters:**

- The FILTER pressure transmitter range is 10" w.c., it is connected to the ASC880 analog input 1 (AI1)
- The FAN pressure transmitter range is 25" w.c., it is connected to the ASC880 analog input 2 (AI2)



Updated: March 6, 2023





17. Power MASTER Enclosure #2: up to **50 – 200 HP (460V)**  
**35" wide, 48" high, 22" deep**  
 wall mounted

Available for US at 460V as 50, 60, 75, 100, 125, 150, 200 HP  
 Available for EU at 380-415V as 30, 37, 45, 55, 75, 90, 110 kW  
 Available for Canada 575V as 10, 15, 20, 25, 30, 40, 50, 60, 75, 100, 125, 150 HP

HP	Volts	Power MASTER (lbs)	Shipping (lbs)
50	460	271	340
60	460	276	345
75	460	324	393
100	460	324	393
125	460	359	428
150	460	359	428
200	460	392	461
50	575	271	340
60	575	324	393
75	575	324	393
100	575	346	415
125	575	346	415
150	575	392	461

HP	Volts	Power MASTER (lbs)	Shipping (lbs)
50	575	271	340
60	575	324	393
75	575	324	393
100	575	346	415
125	575	346	415
150	575	392	461

Note: all weights are approximate.

**Installed Ashcroft CXLdp pressure transmitters:**

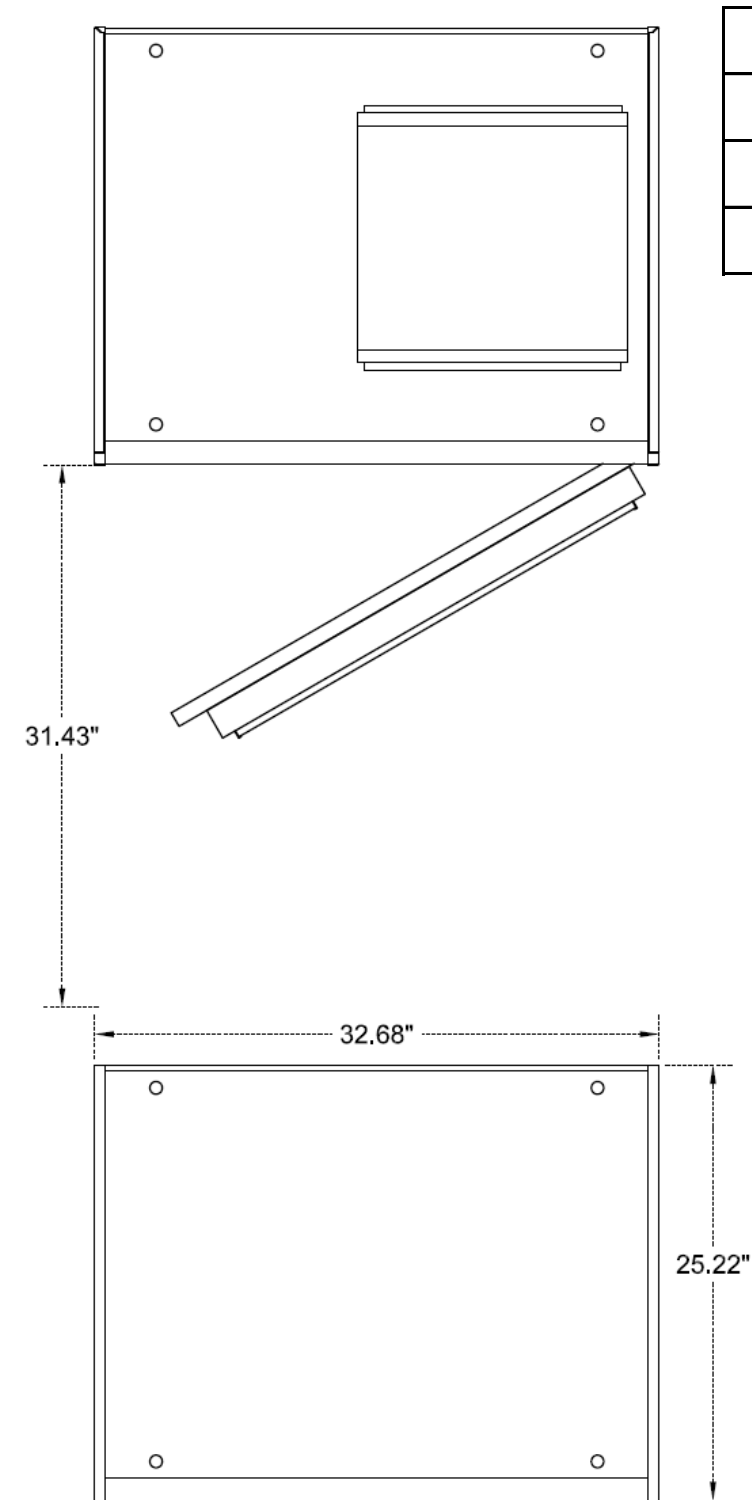
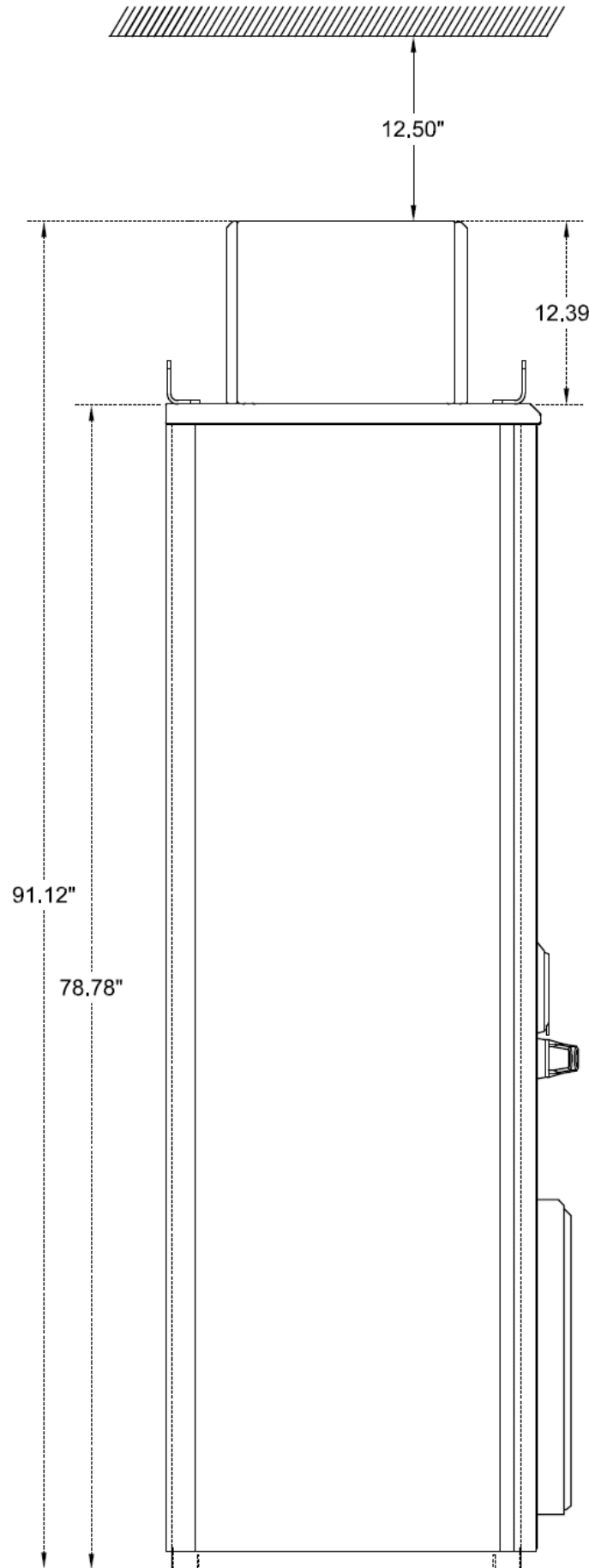
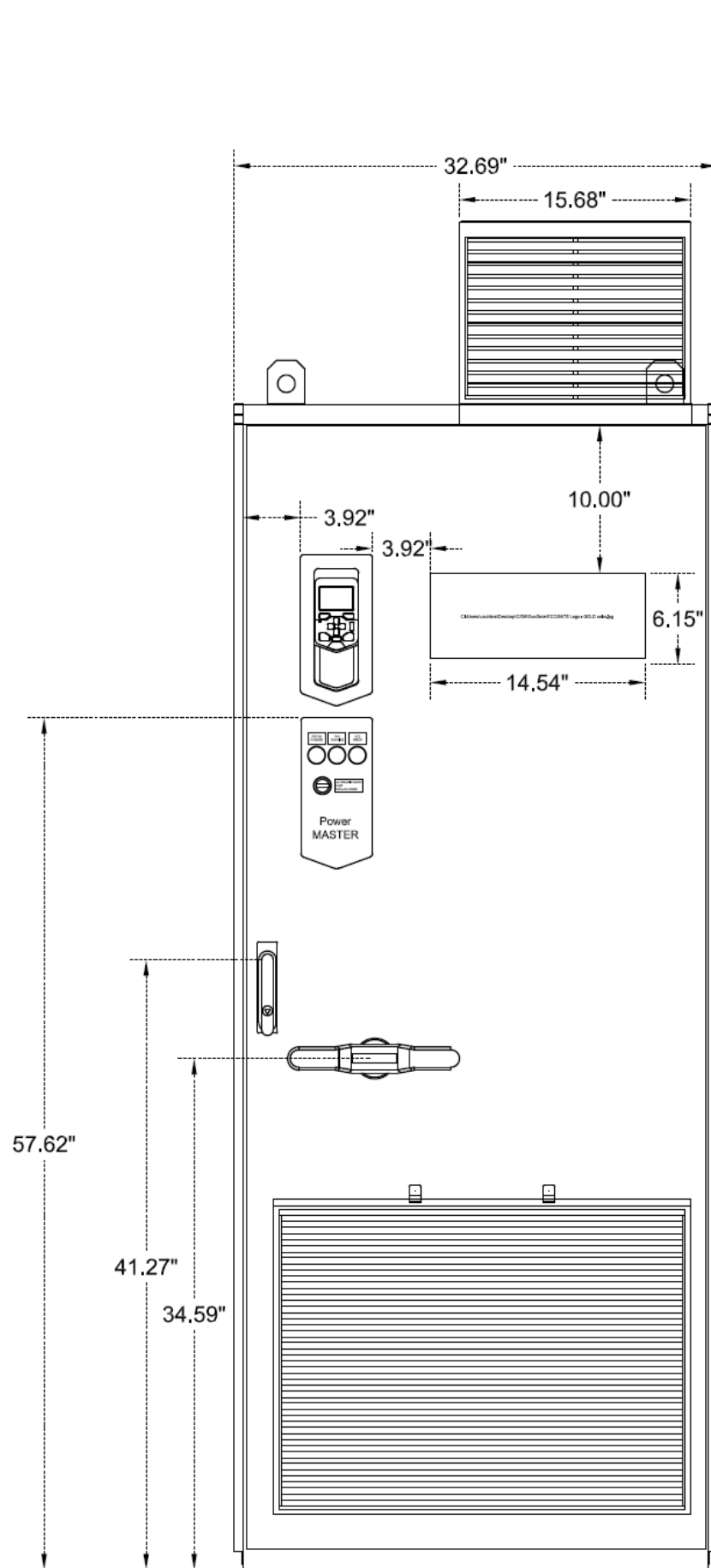
- The FILTER pressure transmitter range is 10" w.c., it is connected to the ASC880 analog input 1 (AI1)
- The FAN pressure transmitter range is 25" w.c., it is connected to the ASC880 analog input 2 (AI2)



Updated: March 6, 2023

18. Power MASTER Enclosure #3: up to **250 – 350 HP (460V)**  
**32.7" wide, 91.2" high, 25.3" deep**  
 free standing

Available for US at 460V as 250, 300, 350 HP  
 Available for EU at 380-415 V as 132, 160, 200 kW



HP	Volts	Shipping (lbs)
250	460	938
300	460	960
350	460	1,117

Note: all weights are approximate.

**Installed Ashcroft CXLdp pressure transmitters:**

- The FILTER pressure transmitter range is 10" w.c., it is connected to the ASC880 analog input 1 (AI1)
- The FAN pressure transmitter range is 50" w.c., it is connected to the ASC880 analog input 2 (AI2)



Updated: March 6, 2023

**19. Power MASTER Enclosure #4: 400 HP (460V)**  
**32.7" wide, 91.1" high, 25.3" deep**

free standing

**Available for US at 460V as 400 HP**

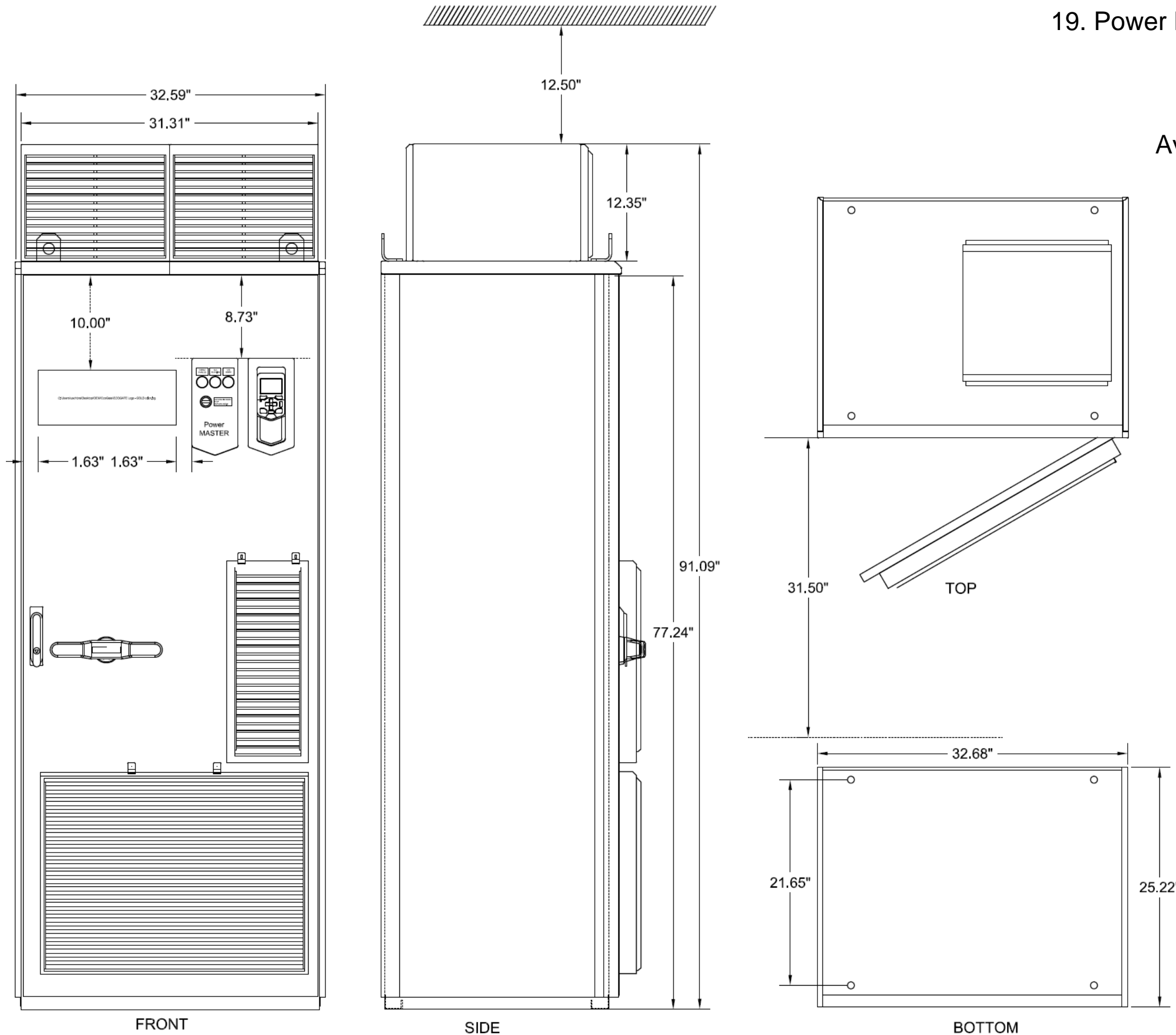
**Available for EU at 380-415 V as 250 kW**

HP	Volts	Shipping (lbs)
400	460	1,274

Note: all weights are approximate.

**Installed Ashcroft CXLdp pressure transmitters:**

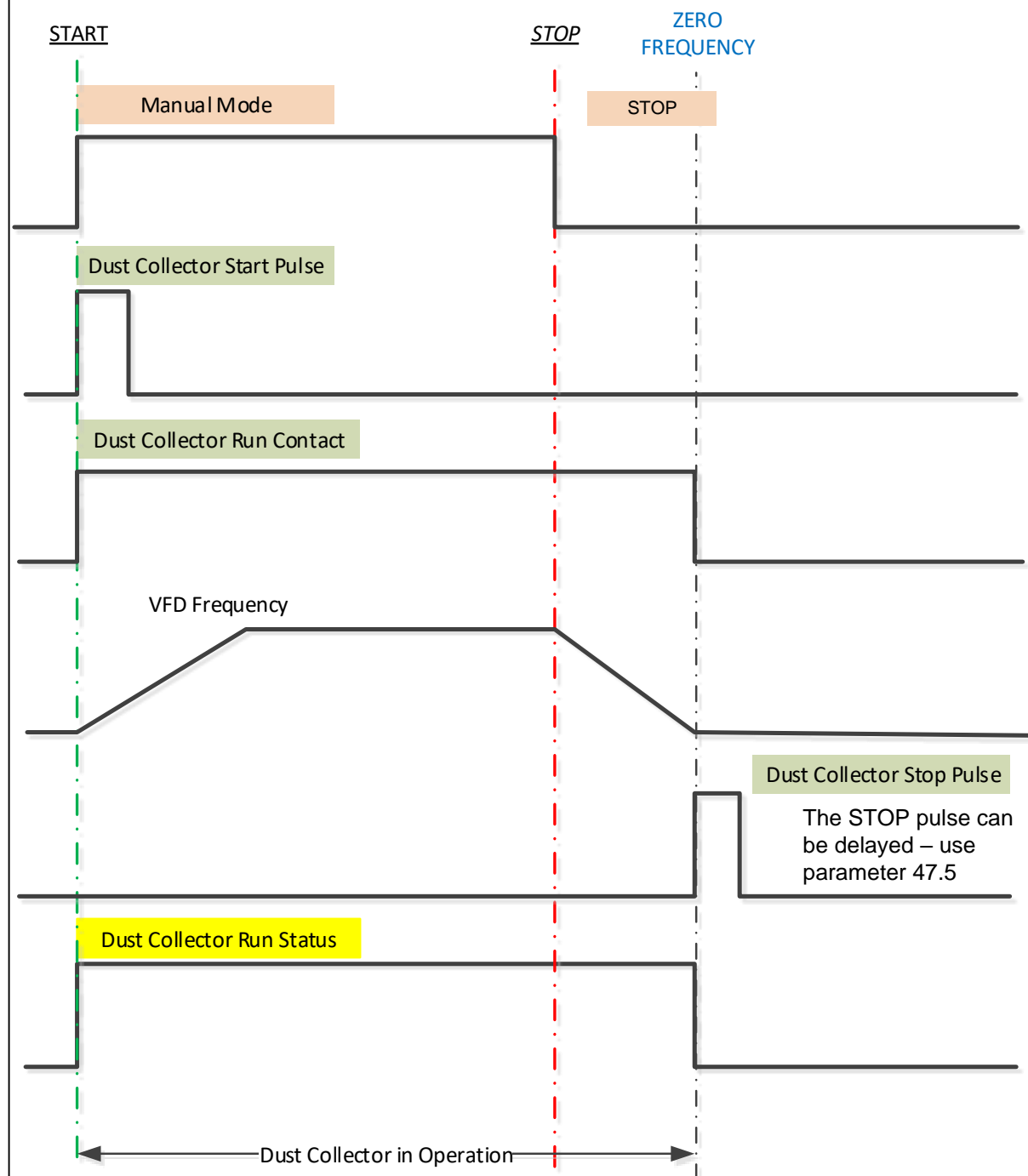
- The FILTER pressure transmitter range is 10" w.c., it is connected to the ASC880 analog input 1 (AI1)
- The FAN pressure transmitter range is 50" w.c., it is connected to the ASC880 analog input 2 (AI2)



Updated: March 6, 2023

# 20. Power MASTER Function Description

## Dust Collector Control Signals Logic



- Legend:
- User Input
  - Contacts to Control Dust Collector, terminal #3
  - Dust Collector Status Signal, terminal #5

The Power MASTER is operating the (main) dust collecting fan. The Power MASTER can also start/stop and can monitor air lock and transport fan of the dust collector (dust collector is usually controlled by its own PLC) – the advantage of controlling the dust collector with the Power MASTER is that the dust collector starts and stops on demand (typically one to two hours of the dust collector operation per day can be saved). This saves electricity and reduces dust collector wear & tear. Another advantage is that the function of the dust collector can be monitored remotely via a greenBOX unit (for example we can see if the air lock, and transport fan are working OK via Remote access).

The dust collector typically starts operation before the main fan is in operation and stop with a delay after the main fan stops. It takes about 10-60 seconds to start all the dust collector motors in sequence (the transport fan, air lock, and the cleaning). It takes about the same amount of time to start the main fan due to the acceleration ramp which is typically 60 seconds. The Power MASTER will the start dust collector and start accelerating the main fan at the same time. If your particular dust collector needs a longer time to start, do not use the automatic start on the Power MASTER.

The dust collector should stop after a certain delay after the main fan stops to avoid jams during next start. This function is typically built into dust collector control panel – therefore if the Power MASTER simulates the stop button, the dust collector control panel will start the appropriate shut-down sequence.

### AUTOMATIC MODE = POWER MASTER IS CONTROLLED via greenBOX

If the **AUTOMATIC MODE is set** on the Power MASTER front panel the VFD will be operated via Modbus (RS485) from the greenBOX control unit.

The greenBOX is the main control unit - it detects if workstations connected to the dust collecting system require ventilation - if they do, the greenBOX sets the required main fan RPM (frequency) via Modbus, then the Power MASTER starts the DUST COLLECTOR via the “Dust collector START PULSE” (alternatively via “Dust Collector RUN CONTACT”).

At the time when the fan starts, the SYSTEM ENABLE input can be open (i.e. the Power MASTER is not enabled), but Power MASTER will monitor if the “**SYSTEM ENABLE**” signal is closed within 10-60 seconds of starting (this time is adjustable in the VFD parameter 47.1), if it is not closed within this “grace” period the Power MASTER will stop the main fan (and stop the dust collector via the STOP PULSE or via opening RUN CONTACT). In other words: the function of the SYSTEM ENABLE input is delayed – there is a “grace period” after start.

The Power MASTER can also monitor if “**AIR LOCK and TRASPORT FAN OK**” signals are present, if not it will stop the main fan after a delay. The Power MASTER will start without the “**AIR LOCK and TRASPORT FAN OK**” signals present – this function is also delayed like SYSTEM ENABLE. If the “**AIR LOCK and TRASPORT FAN OK**” inputs are not used just leave wire jumpers at these inputs.

The VFD will monitor if the “**IMMEDIATE STOP**” signal is present and if the signal is active it will stop the main fan immediately.

If the greenBOX requests the fan to stop, the main fan will stop, and the Power MASTER will stop the dust collector control panel via “**DUST COLLECTOR STOP**” NC contact (or via opening the RUN contact).

The VFD reads the fan total pressure and the filter pressure via analog inputs A2 & A1, the pressure values are transferred to the greenBOX via Modbus. The fan pressure is also used to monitor maximal fan pressure to protect the duct system: we are using SUPERVISION function #1 (parameters 32.5...32.10) to monitor maximum allowable pressure to protect the duct system against implosion - same function is built-in greenBOX, but Supervision function also works without greenBOX (if not installed, not powered, or failed); the factory settings is that the fan will stop if pressure reached 23.75" wc, but it can be changed by user to any preferable pressure value.

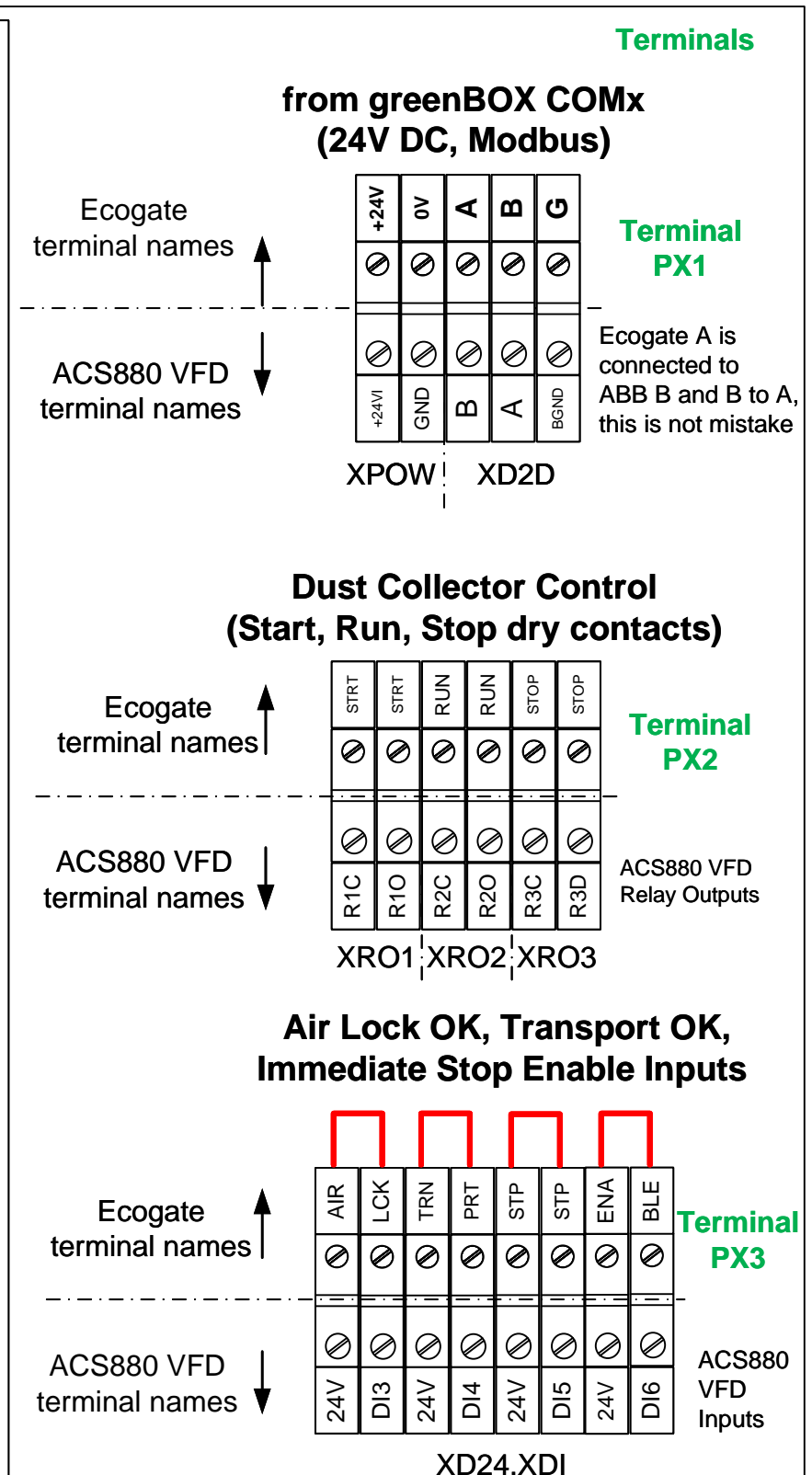
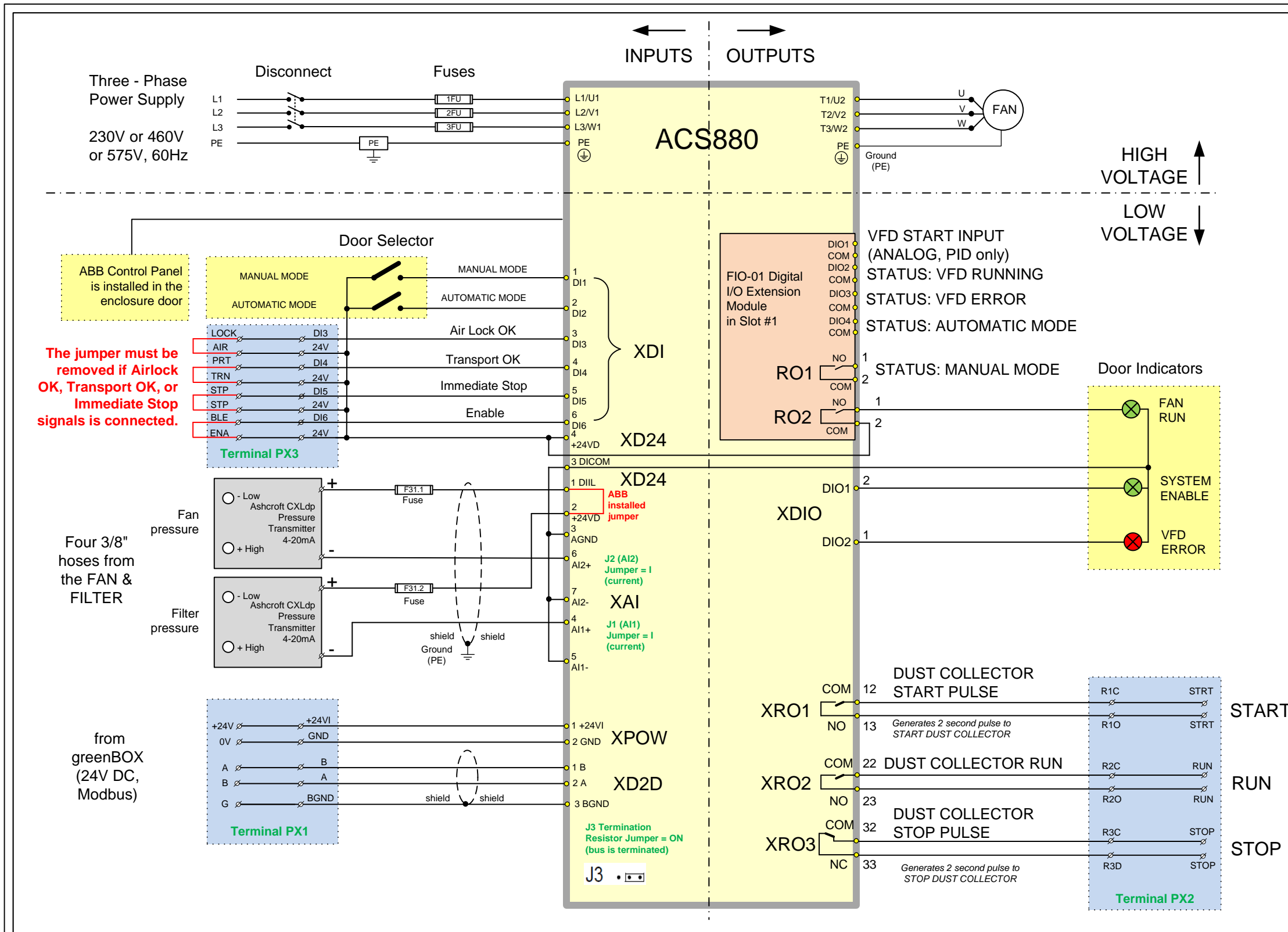
### MANUAL MODE

If at any time **MANUAL MODE is selected on the Power MASTER front panel**, the VFD will run at a preset (fixed) frequency changeable via the parameter 47.7. All above rules about starting/stopping the dust collectors are same in the MANUAL MODE. If greenBOX unit is connected then greenBOX will open all gate in the MANUAL MODE.

### STOP

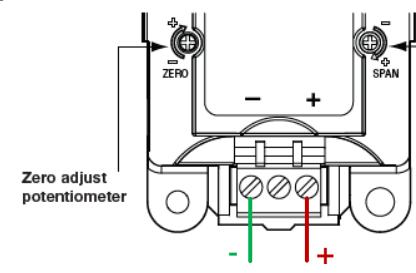
If **STOP is selected on the Power MASTER front panel**, the main fan will be turned OFF (means output frequency 0 Hz), and dust collector will stop.





**ASHCROFT CXLdp PRESSURE TRANSMITTER**

- The FILTER pressure transmitter range is 10" w.c., connected to the ACS880 analog input 1 (AI1)
- The FAN pressure transmitter range is 25" w.c. for Power MASTER units up to 200 HP, connected to the ACS880 analog input 2 (AI2), and 50" w.c. for Power MASTER units from 250 HP and up



**A. Install Wire Jumpers**

- Air lock OK (DI3)
- Transport OK (DI4)
- Immediate Stop (DI5)
- Enable (DI6)

**B. Set jumpers in production to:**

- J1 to I (current)
- J2 to I (current)
- J3 to ON (bus is terminated)

**C. Ecogate software package is installed by ABB to the ACS880**

Test the enclosure functionality per Ecogate procedure

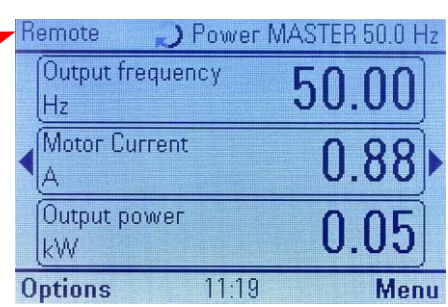
**21. Power MASTER Wiring Diagram**  
Version 1.1

Updated: March 6, 2023



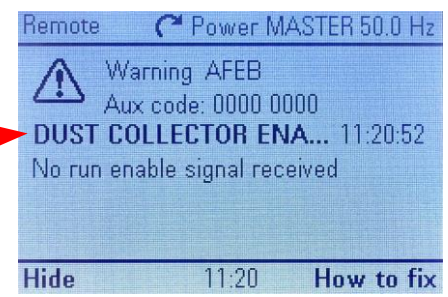
# Warning & Faults on VFD Screen

The VFD must be in REMOTE, if you see here LOCAL press "LOC/REM" button under display.



Power MASTER uses "Remote" both for AUTOMATIC mode controlled by greenBOX and for MANUAL mode set by front panel selector

The DUST COLLECTOR ENABLE IS MISSING (inputs ENABLE (DI6), AIR LOCK (DI3), TRANSFER (DI4) must be closed)



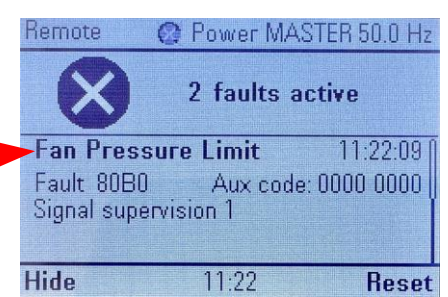
They are three Enable inputs available for customer safety; they are shipped from factory by jumpers, remove them to connect customer safeties. If any of these input will be open the VFD will stop after short delay. When all enable (OK) inputs are closed again **the VFD will restart automatically.**

The IMMEDIATE STOP IS ACTIVE (DI5 Digital Input 5 must be closed for VFD operation)



The IMMEDIATE STOP (DI5) is used for most serious customer safeties – like fire alarm; if DI5 is open the VFD will stop by FAULT, and it will not restart automatically. **After DI5 will be active again, operator must reset the Fault by pressing soft "Reset" button.**

If the FAN pressure transmitter (AI2) is outputting more than 19mA for 10 seconds or longer the VFD will stop.

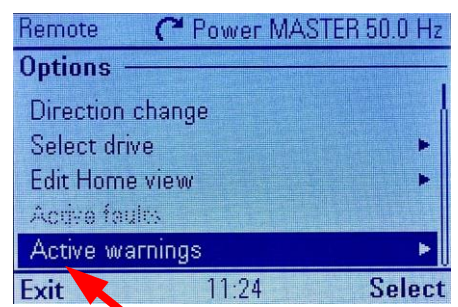


The Fan Pressure Limit is controlled by the VFD Supervision function 1 – and it is adjustable by user. It is set to 19 mA from factory = 23.4" w.c. for 25" wc sensor, and 45.9" w.c. for 50" wc sensor. You can change this value in parameter 32.10 (in mA).

There is Emergency Stop button available at greenBOX; if user will use it message "E-STOP from greenBOX" will cause the Fault, this fault can be reset remotely from greenBOX or by soft "Reset" button under VFD screen.



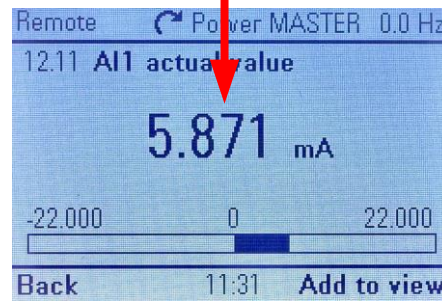
# Active Warning & Faults



To see what is causing WARNINGS or FAULT of the VFD press at the HOME page soft button OPTIONS, and select ACTIVE FAULTS or ACTIVE WARNINGS

# Analog Inputs Troubleshooting

**Parameter 12.11:** Analog Input 1 is used for **FILTER** pressure sensor; the sensor output is 4-20mA (4mA = zero pressure, 20mA = max pressure = sensor range); we are using 10"wc for the filter pressure



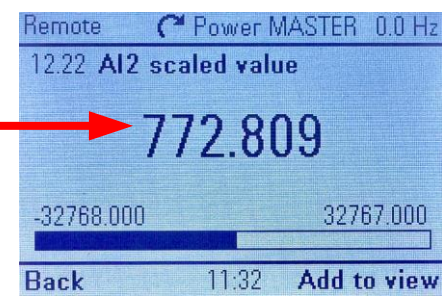
**Parameter 12.12:** Analog Input 1 is used for **FILTER** pressure sensor; the sensor current is converted to the internal value 200 at 4mA sensor output and 1000 at sensor range pressure



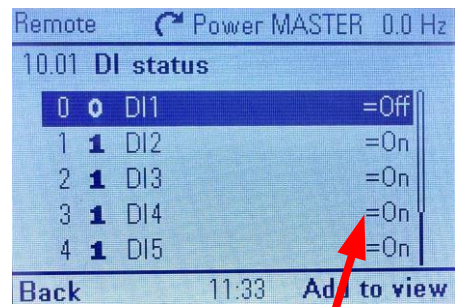
**Parameter 12.21:** Analog Input 2 is used for **FAN** pressure sensor; the sensor output is 4-20mA (4mA = zero pressure, 20mA = max pressure = sensor range)



**Parameter 12.22:** Analog Input 2 is used for **FAN** pressure sensor; the sensor current is converted to the internal value 200 at 4mA sensor output and 1000 at sensor range pressure



# Digital Inputs Troubleshooting



**Parameter 10.01:** If you are not sure if Digital Inputs are properly connected up to the VFD inputs you can use parameter 10.01 DI (Digital Inputs) status:  
 DI1 = Manual)  
 DI2 = Automatic  
 DI3 = Air Lock OK  
 DI4 = Transport OK  
 DI5 = Immediate Stop  
 DI6 = Enable

# Relay Outputs Troubleshooting

**Parameter 10.21:** If you are not sure if relay outputs are properly working you can use parameter 10.21 RO (Relay Output) status:  
 RO1 = Dust Collector **START** 2 sec pulse  
 RO2 = Dust Collector **RUN**  
 RO3 = Dust Collector **STOP** 2 sec pulse

