Infinitum

Aircore EC+ Fan

Installation, Operation, and Maintenance Manual

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1. Safety

a. Warnings, Cautions and Notes

Warnings, cautions, and notes are throughout the manual to alert the technician of potential hazard or process information.

Below is an explanation of the use.

⚠ *Warnings: are safety related. Serious injury, death and equipment damage can result if the instructions in the warning are not followed.*

Cautions: apply to conditions that can cause equipment damage. If instructions in the Caution are not followed, motor and associated equipment damage may occur.

b. Rotating Parts and Electrical Shock Hazard

Fans should be installed and serviced by qualified personnel only. Improper installation can result in electric shock, possible injury due to coming into contact with moving parts, as well as other potential hazards.

Follow all local electrical and safety codes, as well as National Electrical Code (NEC) and the National Fire Protection Association (NFPA), where applicable.

Disconnect electric power before working on unit (prior to removal of guards or entry into access doors).

Follow proper lockout/tag out procedures to ensure the unit cannot be energized while being installed or serviced.

Ensure the power cable does not kink or come into contact with oil, grease, hot surfaces or chemicals. Ensure the power source is compatible with the equipment.

2. EC Fan Technology

a. EC Fan Wheel and Supporting Structure

The Infinitum EC Fan wheel is an aluminum backwards inclined centrifugal design or an aluminum wheel with an airfoil blade. For correct performance, Infinitum motors are programmed to run in a counterclockwise direction when viewed into the inlet or shaft end. This wheel is optimized for use with the Infinitum Aircore EC+ motors.

The supporting structure is galvanized steel. The EC Fan is assembled with Whizlock™ and HuckBolts™, reducing the need for on-going tightening after installation.

b. Balancing

All wheels are statically and dynamically balanced at the factory. Wheel alignment is checked prior to shipping.

c. Motor Overview

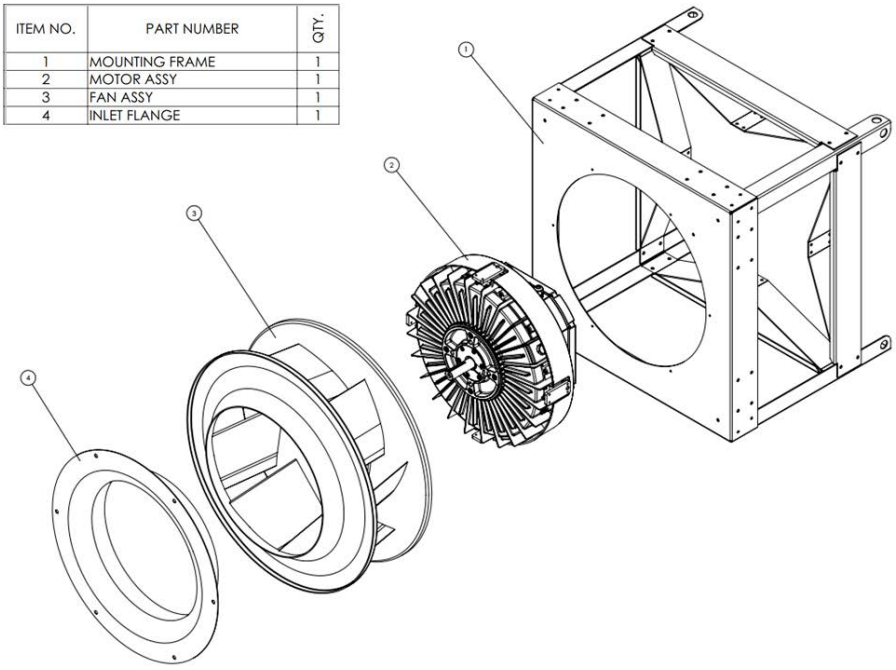
Infinitum has developed a new generation of electric motors with unparalleled efficiency and durability. Infinitum has reinvented axial flux motors with an air-core architecture using lightweight materials and a modular design that generates the same power with less weight than a legacy motor. These motors include an optimized VFD (Variable Frequency Drive) for maximum performance and efficiency at a wide operating range as well as a PCB stator. These motors are manufactured at a fraction of the carbon footprint created by conventional motors. It is designed with future generations in mind taking the entire lifecycle into account creating a huge leap in sustainability.

d. EC Fan Components

Key EC Fan components are identified by the drawing in Figure 1 below.

Figure 1: EC Fan Components

ITEM NO.	PART NUMBER	QTY.
1	MOUNTING FRAME	1
2	MOTOR ASSY	1
3	FAN ASSY	1
4	INLET FLANGE	1



e. EC Fan Maximum RPM

EC Fan units have a maximum RPM depending on fan size. See below for details.

EC Fan	Fan Size	Assembly Max RPM
EFxxxx01	710	1475
	630	1550
	560	1850
	500	2100
	450	2350
EFxxxx02	710	1525
	630	1930
	560	2200
	500	2850
	450	3350
EFxxxx03	710	1400
	630	1970
	560	2200
	500	2800
	450	2200

3. Receiving Inspection and Storage

Immediately upon receipt of a shipment, carefully inspect for damage and shortage. Turn impeller by hand to see that it turns freely and does not bind. If any damage and/or shortage is detected or suspected, the carrier must be asked to conduct an inspection. The consignee's representative should not accept shipment without a notation on the delivery receipt indicating item discrepancy or apparent extent of damage.

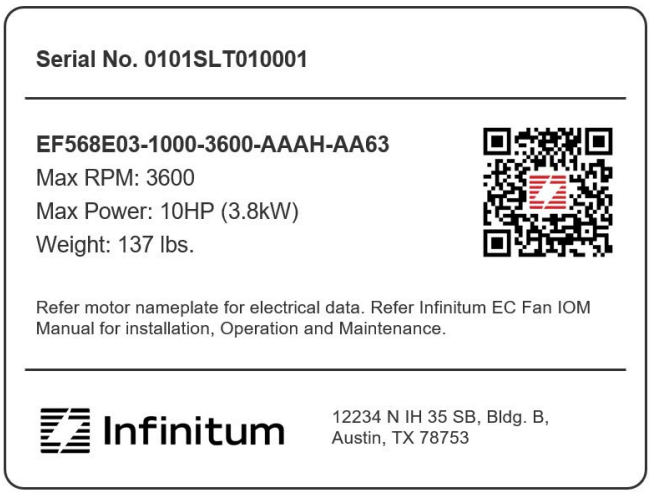
When a shipment is opened and damage is found which was not evident externally (concealed damage), it is mandatory that the consignee request an immediate inspection by the carrier. Report damage to the carrier within 15 days. Failure to report damage within the above time limit will cause rejection of a claim.

Review all appropriate sections prior to EC Fan installation. The EC Fan is shipped in crates. The crated fan assembly can be moved by using a dolly, pallet jack or fork truck.

a. Product Labeling

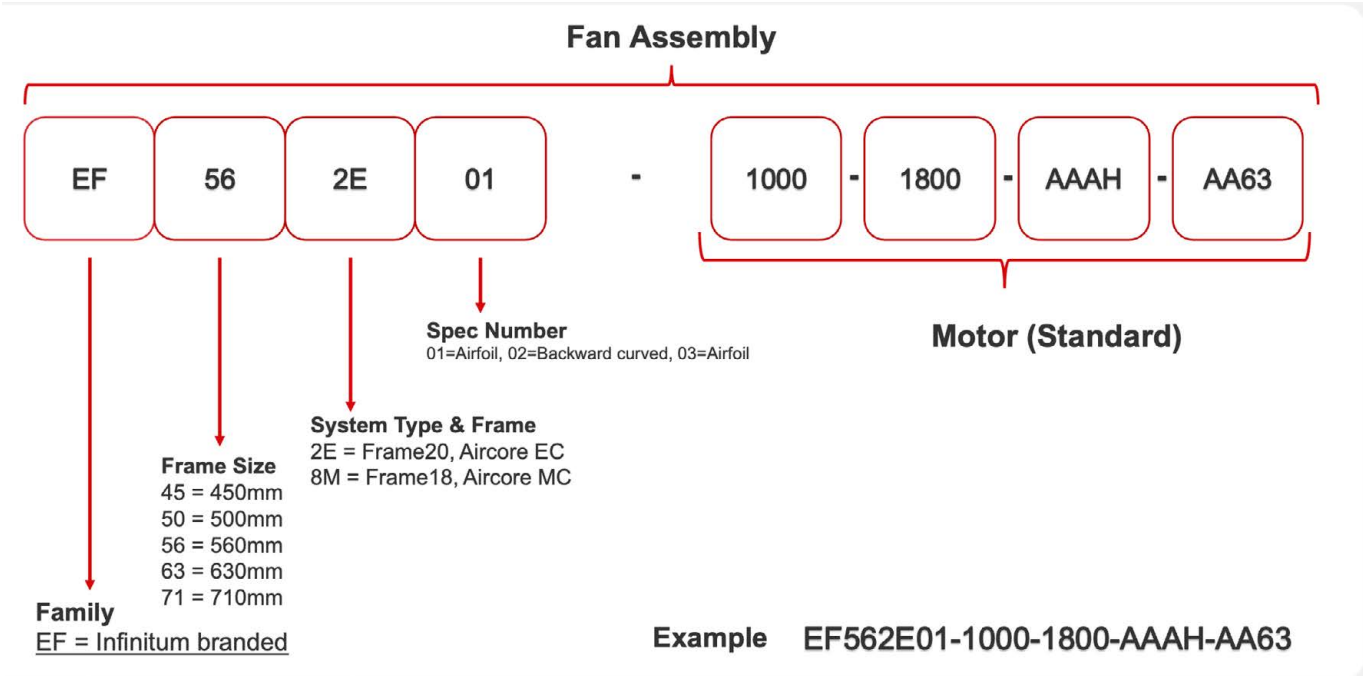
- Compare data on (updated) nameplate (Figure 02 below) with purchase order to verify receipt of proper EC Fan. Labels are on the motor shroud.
- Compare data on nameplate for desired power supply and control equipment requirements.

Figure 2: Nameplate



b. Catalog Number Decoder

Figure 3: Aircore EC+ Fan catalog decoder



Note: This is not an exhaustive list. Refer to motor datasheet for motor decoder.

c. Shipping Crates

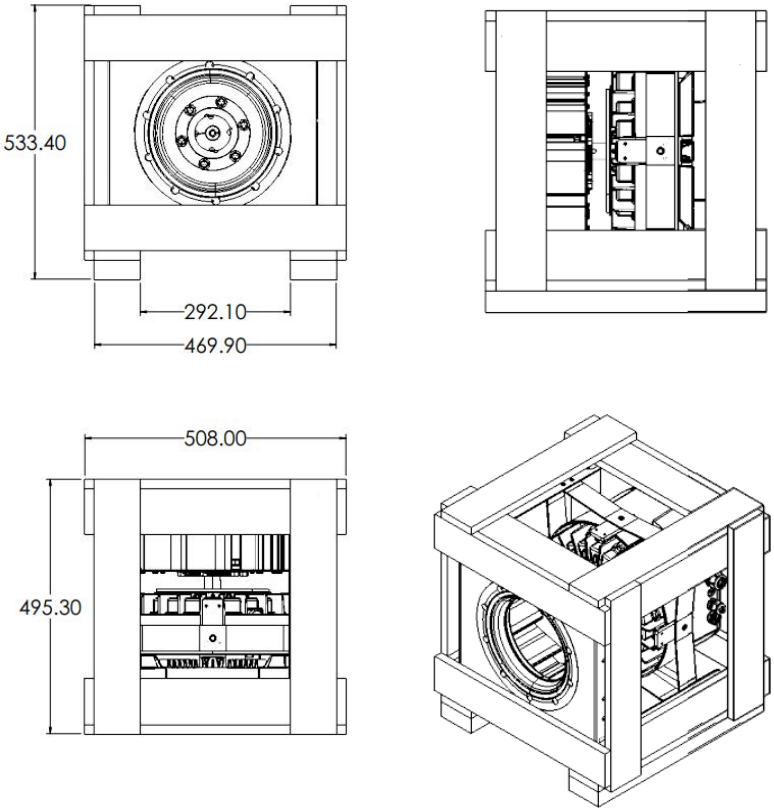
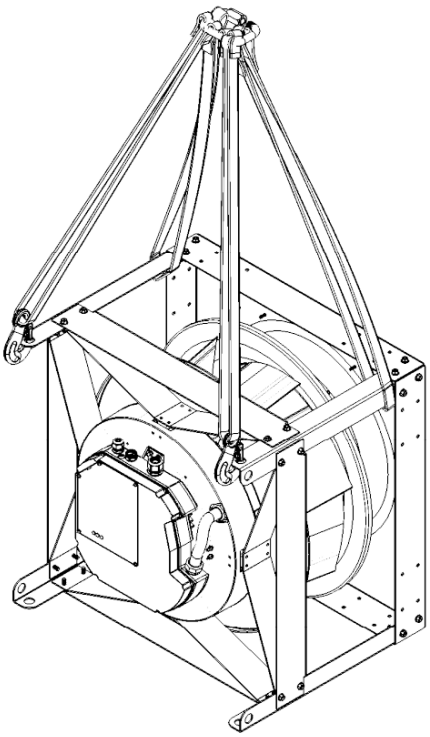


Figure 4: Lifting details

d. Removing EC Fan From Crate

⚠ *Warning: To reduce the possibility of personal injury and equipment damage, only use a lifting device and straps that are rated for the EC Fan weight. Do not lift the assembly without mechanical assistance. Always inspect straps for damages and weight certification prior to use. Straps should be attached to the EC Fan at points identified on the frame.*



e. EC Fan Weights

Lifting equipment should be capable of supporting the fan assembly.

Fan Weights

EC Fan	Fan Size	Full assembly weight (lbs)
EFxxxx01	710	261
	630	225
	560	210
	500	147
	450	143
EFxxxx02	710	289
	630	254
	560	234
	500	208
	450	202
EFxxxx03	710	244
	630	227
	560	209
	500	204
	450	151

f. Wheel Alignment

Efficient fan performance can be maintained by ensuring the correct radial gap and axial overlap between the impeller and inlet cone; these values shall be verified before initial start-up, after the first 24 hours of operation, and following any service. Refer to the table below for the required overlap (u) and radial gap values applicable to your fan wheel type and size.

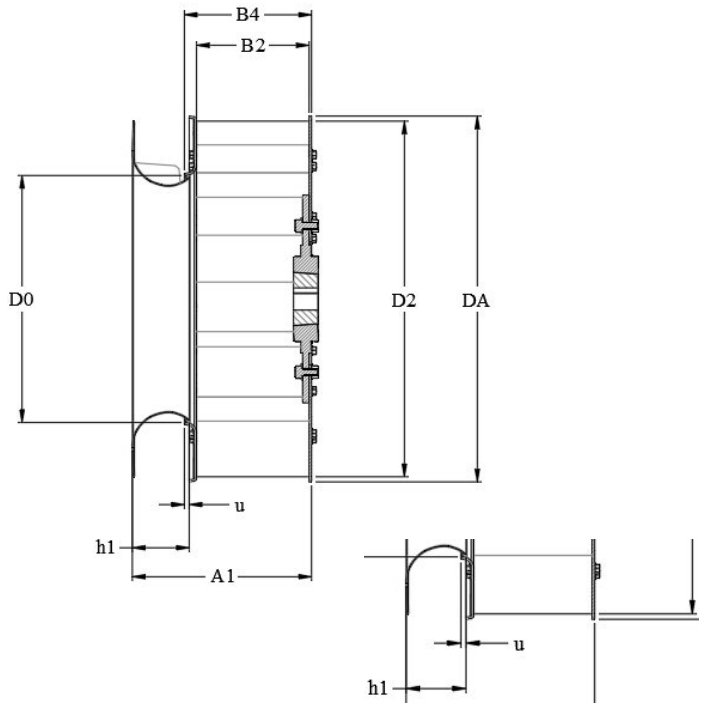
EFxxxx03 Series: Impeller and Inlet Cone Alignment Dimensions

Fan Size	u – Overlap (mm)
EF45xx03	0.25
EF50xx03	0.25
EF56xx03	0.25
EF63xx03	0.25
EF71xx03	0.25

EFxxxx01 & EFxxxx02 Series: Axial Overlap (u)

Fan Wheel Size	u – Overlap (mm)
EF45xx01, EF45xx02	4.5
EF50xx01, EF50xx02	5.1
EF56xx01, EF56xx02	5.6
EF63xx01, EF63xx02	6.3
EF71xx01, EF71xx02	7.1

Figure 5: EFxxxx03 Series Impeller and Inlet Cone Alignment Dimensions



Close-up portion of the drawing

Note: The overlap value u is derived by dividing the inlet cone size by 100 (e.g., ED71xx01 → u = 7.1 mm). The radial gap is determined by the impeller and corresponding inlet cone geometry; no separate adjustment value is specified.

g. Storage

Fans are protected against damage during shipment. If they cannot be installed and put into operation immediately upon receipt certain precautions are necessary to prevent deterioration during storage. Responsibility for integrity of fans and accessories during storage must be assumed by the consignee. The manufacturer will not be responsible for damage during storage. These suggestions are provided solely as a convenience to the user, who shall make his own decision as to whether to use any or all of them.

Indoor: The ideal storage environment for fans and accessories is indoors, above grade, in a low humidity atmosphere which is sealed to prevent the entry of blowing dust, rain, or snow. Temperatures should be maintained between 70°F and 105°F (wide temperature swings may cause condensation and "sweating" of metal parts). Windows should be covered to prevent temperature variations caused by sunlight. Provide thermometers and humidity indicators at several points and maintain the atmosphere at 40% relative humidity, or lower.

It may be necessary to use trays of renewable desiccant or a portable dehumidifier to remove moisture from the air in the storage enclosure.

Thermostatically controlled portable heaters (vented outdoors) may be required to maintain even temperatures inside the enclosure..

⚠ *CAUTION! Provide fire extinguishers or fire alarms, or emergency response communication to protect building and equipment against fire damage. Be sure that building and storage practices meet all local, state and federal fire and safety codes.*

Rotate wheels by hand to distribute bearing grease over the entire bearing surfaces.

Store at least 3 ½" off the floor on wooden blocks covered with moisture proof paper or polyethylene sheathing. Provide aisles between parts and along all walls, to permit air circulation and space for inspection.

h. Inspection and Maintenance During Storage

Inspect fans and accessories at least once per quarter, while in storage. Log results of inspection and maintenance performed. A typical log entry should include the following:

1. Date
2. Inspector's Name
3. Name of Fan
4. Location
5. Condition of Paint or Coating
6. Is moisture present?
7. Is dirt accumulated?
8. Corrective steps taken?

If moisture or dirt accumulations are found on parts, the source should be located and eliminated. Fans should be rotated at each inspection by hand ten to fifteen revolutions to redistribute the motor and bearing lubricant.

i. Scheduled Output Shaft Rotation

⚠ *Warning: The rotor in this motor incorporates a Permanent Magnet (PM) design. When the rotor is rotated a voltage is produced in the stator even when the motor is disconnected from a power source. Do not open electrical compartments or touch unprotected terminals while the rotor is turning.*

Disconnect motor supply power and allow one minute for capacitors to discharge before servicing or replacing. Failure to comply with safety procedures can cause serious injury or death and equipment damage.

It is recommended that the attached wheel be rotated five to ten times per quarter (three months). Wheels should be turned with EC Fans in their shipping crates. This distributes grease in the bearings and reduces the chance of corrosion formation on bearing rolling elements and raceways. Bearing seals can add some resistance to turning the wheel.

If paint deterioration begins, consideration should be given to touch-up or repainting. Fans with special coatings may require special techniques for touch-up or repair.

Machined parts coated with rust preventive should be restored to good condition promptly if signs of rust occur. The most critical items are shafts and bearing locking collars. At the first sign of rusting on any of the above parts, remove the original rust preventive coating with petroleum solvent and clean lint-free cloths. Polish any remaining rust from surfaces with crocus cloth or fine emery paper and oil. Do not destroy the continuity of the surfaces. Wipe clean with lint-free cloths and recoat surfaces evenly and thoroughly with a corrosion preventative.

j. Removal From Storage

As fans are removed from storage to be installed in their final location, they should be protected and maintained in similar fashion, until the fan equipment goes into operation.

Before Installing Check Fasteners.

⚠ *WARNING! Before installing and before starting, check all fasteners/set screws for tightness, particularly in the wheel hub, and fan shafts. turn the wheel by hand to make sure it rotates freely and that the wheel does not rub the inlet. Failure to do so voids the warranty as fasteners/set screws may come loose in transit.*

4. EC Fan installation

a. Preparation

Review this entire manual prior to scheduling the EC Fan installation. All equipment related to systems operation must be secured and have an active LOTO (Lock Out Tag Out) procedure in accordance with application specific safety policies. All users should be notified of equipment outage.

i. Operating ambient temperature

The ambient temperature of the air supplied to the motor cooling inlet should not exceed 40° C (104° F) or be less than -25° C (-13° F). Power can be derated at higher temperatures by 2% per degree C up to 50° C. Use the Infinitum Motor Selection Tool to confirm derating details. Consult Infinitum for ambient temperatures not within these requirements.

Occasional start-up at temperature below -25C is permitted under certain conditions. For continuous operation at ambient temperatures below -25°C, special low-temperature bearings are required. Contact Infinitum for any application below -25C ambient.

ii. Ingress protection

Infinitum motor Ingress Protection (IP) ratings are identified by their respective nameplates. To maintain this IP rating, cable glands or seals must be used at all wiring ports and all gaskets in place with covers.

b. EC Fan Location

⚠ *Warning: This motor in EC Fans is not certified to operate in any hazardous environments. Operating a motor in areas contaminated with explosive gases can cause explosions resulting in serious injury or death and equipment damage.*

EC Fans have guidelines for the location and operating environment. These guidelines are listed below:

- The EC Fan should be located in a ventilated enclosure and should be in an area that allows air circulation.
- Air cooling inlets and outlets must not be obstructed.
- The enclosure cannot be located in an area with harmful or explosive gases.
- The area should be free from dust and metallic particles.
- The motor should be easily accessed for cleaning and maintenance.

c. EC Fan Installation Clearances

Installing the EC Fan too close to other components may result in reduced air performance compared to the best achievable performance, which is determined at free-blowing open configurations.

Please follow these installation instructions to avoid air losses in air performance.

Box Dimensions = A = B

Recommended Dimensions:
A ≥ 1.8 x AD

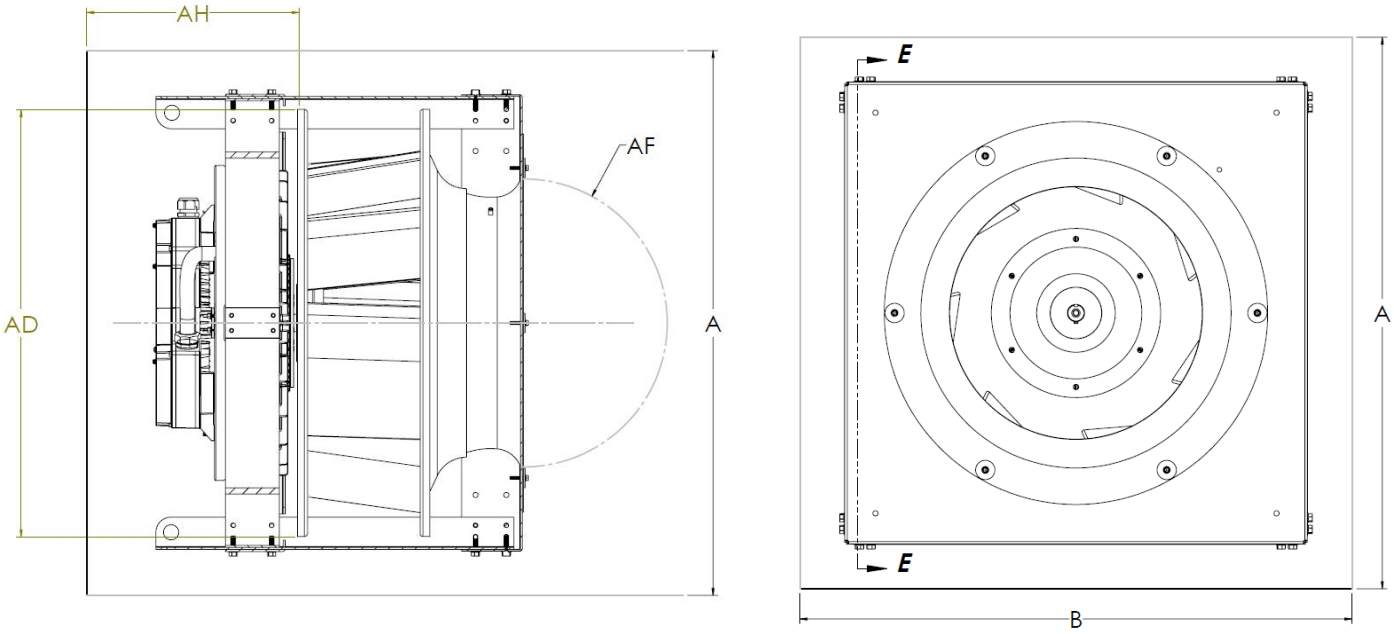
Minimum Dimensions:
A ≥ 1.5 x AD

AD = Nominal Diameter Fan Wheel

Distance to components on suction side:
AF ≥ 0.5 x AD

Distance to components pressure side:
AH ≥ 1 x AD

Figure 6: Fan clearance dimensions



Refer to the Infinitum “Fan Selection Tool” or other design specifications for spacing between fans.

d. EC Fan Orientation

EC Fans can be used in any orientation.

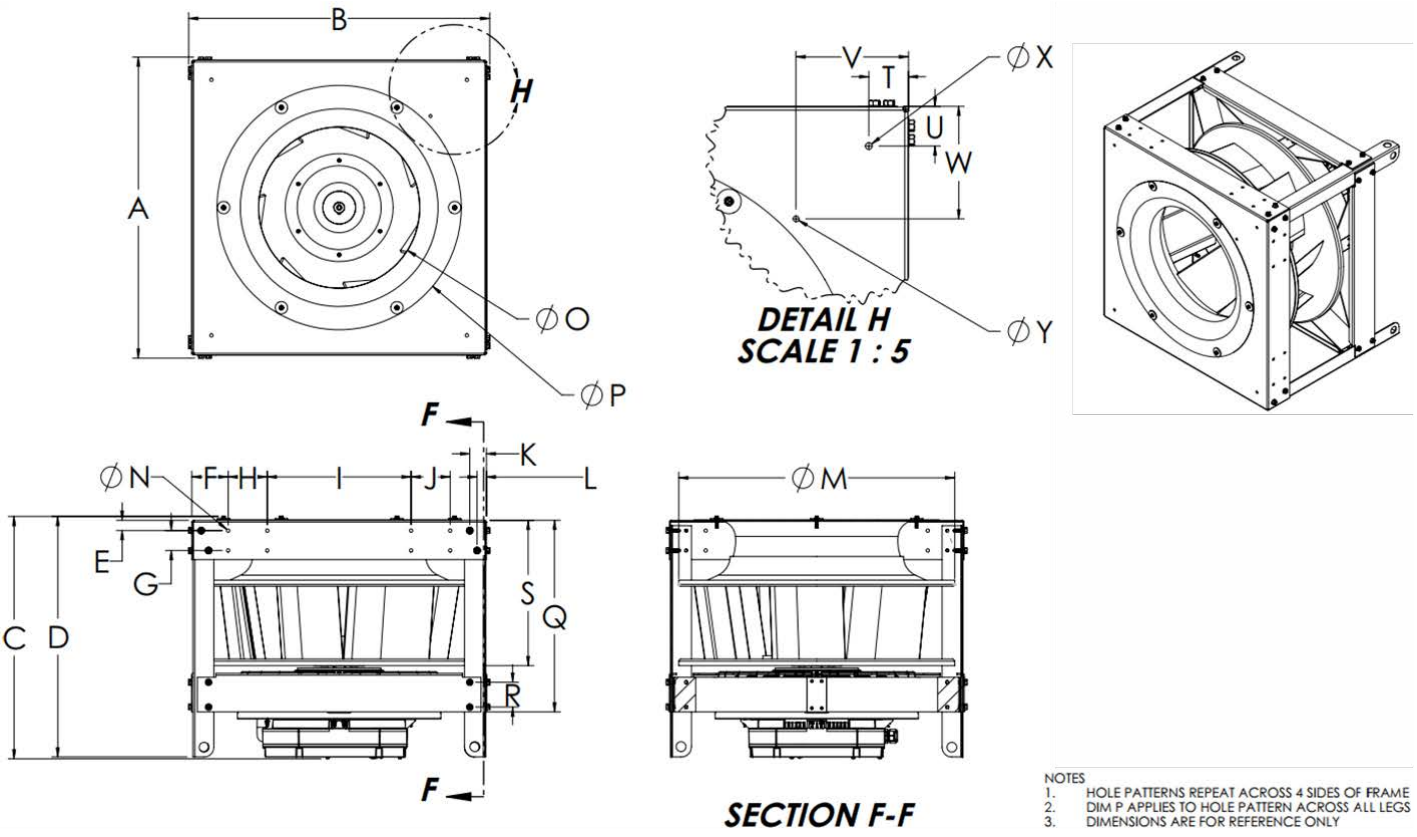
e. EC Fan Mounting

EC Fans come with mounting holes in the sides of the frame. (see Figure xxx below). This facilitates mounting the fan assembly to a fan wall, fan array or plenum using flanges, L-brackets or other attachment techniques.

Note: Mounting dimensions will change. Coordinate with Infinitum prior to design.

⚠ *Warning: To reduce the possibility of personal injury and equipment damage, use a lifting device and straps that are rated for the EC Fan weight. Do not lift the assembly without mechanical assistance. Always inspect straps for damages and weight certification prior to use. Straps should be attached to the EC Fan at points identified on the frame. Confirm the assembly is securely attached to the mounting surface before removing lifting straps.*

Figure 7: Mounting hole locations



Measurement ID

	Fan Size	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
	450	482.6	482.6	489.2	491.7	28.2	43.4	-	50.8	192.3	50.8	43.52	-	475.5	8.6	292.9	462.8	352.6	64.8	362.7	50.8	50.8	68.7	68.7	8.7	7.5
	500	660.4	660.4	533.6	516.9	26.7	43.4	-	50.8	370.6	50.8	43.27	-	502.9	8.6	320.5	495.8	374.7	64.8	386.3	50.8	50.8	143.3	143.3	8.7	7.5
EFxxx03	560	660.4	660.4	527.8	503.2	26.9	43.4	-	50.8	370.6	50.8	43.27	-	572.8	8.6	355.9	550.2	397.3	64.8	408.9	50.8	50.8	124	124	8.7	7.5
	630	660.4	660.4	558	561.3	27.9	43.4	51.6	101.6	269.5	101.6	43.31	24.2	632.2	8.6	392.7	607.3	427.7	64.8	439.1	50.8	50.8	101.3	101.3	8.7	7.5
	710	764.5	764.5	589.8	594.4	27.9	43.4	51.6	101.6	373.1	101.6	43.31	24.2	698	8.6	432.8	669.3	459.5	64.8	470.8	50.8	50.8	132.4	132.4	8.7	7.5
	450	660.4	660.4	529.3	489.2	27.9	43.4	-	50.8	370.6	50.8	43.31	-	505	8.6	298.7	464.1	379	64.8	391.3	50.8	50.8	154.5	154.5	8.7	7.5
	500	660.4	660.4	554.2	518.2	27.9	43.4	-	50.8	370.6	50.8	43.31	-	565.9	8.6	332	514.1	407.9	64.8	420.7	50.8	50.8	136.9	136.9	8.7	7.5
EFxxx02	560	660.4	660.4	578.1	570.5	25.7	94	-	50.8	370.6	50.8	43.27	-	636	8.6	371.1	563.9	440.2	64.5	452.8	50.8	50.8	119.2	119.2	8.7	7.5
	630	764.8	764.8	609.9	614.2	26.7	94.2	51.6	101.6	373.4	101.6	43.31	24.2	706.9	8.6	418.6	634	479.6	64.5	492.2	50.8	50.8	145.2	145.2	8.7	7.5
	710	863.6	863.6	658.9	641.4	26.7	94.2	51.6	101.6	472.2	101.6	43.31	-	805.9	8.6	471.2	704.1	528.6	64.5	541.2	50.8	50.8	171.3	171.3	8.7	7.5
	450	660.4	660.4	543.2	489.2	27.9	43.4	-	50.8	370.6	50.8	43.31	-	505	8.6	298.7	464.1	379	64.8	391.3	50.8	50.8	154.5	154.5	8.7	7.5
	500	660.4	660.4	544.8	519.9	27.9	43.4	-	50.8	370.6	50.8	43.31	-	565.9	8.6	332	514.1	408.4	64.8	419.4	50.8	50.8	136.9	136.9	8.7	7.5
EFxxx01	560	660.4	660.4	578.1	570.5	25.7	94	-	50.8	370.6	50.8	43.27	-	636	8.6	371.1	563.9	440.2	64.5	452.8	50.8	50.8	119.2	119.2	8.7	7.5
	630	764.8	764.8	609.9	614.2	26.7	94.2	51.6	101.6	373.4	101.6	43.31	24.2	706.9	8.6	418.6	634	479.6	64.5	492.2	50.8	50.8	145.2	145.2	8.7	7.5
	710	863.6	863.6	658.9	641.4	26.7	94.2	51.6	101.6	472.2	101.6	43.31	-	805.9	8.6	471.2	704.1	528.6	64.5	541.2	50.8	50.8	171.3	171.3	8.7	7.5

Note: Values above are in millimeters (mm)

f. Minimum EC Fan Electrical Connection Requirements

> ⚠ *Warning: Always disconnect power to the motor and practice all application specific safety procedures when installing, troubleshooting, or repairing a motor. Always verify power is secured with a multimeter prior to work. Failure to disconnect power from motors can result in serious personal injury or death and equipment damage.*
>
> *Warning: The rotor in this motor incorporates a Permanent Magnet (PM) design. When the rotor is rotated in a disconnected motor voltage is produced. Do not touch unprotected terminals while the rotor is turning. Disconnect motor supply power and allow one minute for capacitors to discharge before servicing or replacing. Failure to comply with rotor safety procedures can cause serious injury or death and equipment damage.*
>
> *Warning: To reduce the possibility of personal injury or death and equipment damage, always make sure wire connections are secure and wires are in the correct location.*
>
> *Caution: To prevent the possibility of motor damage, always use terminating ferrules for all supply wires. Terminating ferrules create a single connection point that is more secure than stranded wire.*

Wire tensile forces can affect the point of termination during installation and motor operation. Terminal blocks with the correct wiring installed ensure safe motor operation. Using the correct wire gauge and amount of exposed conductor length with ferrules installed on each wire satisfies the requirements.

Make sure the source of power to the motor has been disconnected.

Strip wires and crimp on wire ferrules. Install each wire into the appropriate terminal block as provided in the wiring instructions. Verify all connections are tight and installed to specifications.

NEC 70 and NEMA MG2 standards should be followed for proper motor power wiring.

5. EC Fan Motor Control Connection Overview

Infinitum Aircore EC+ motors support standard industry control methods. The following are supported:

- Analog
- Modbus RTU
- BACnet MS/TP
- Modbus TCP for I-con

Infinitum supplies proprietary configuration and control software known as I-con (motor control software).

a. Motor Ground Circuit Verification

> ⚠ *Warning: Motors must be properly grounded. Adhere to all guidelines when installing the motor ground circuit. Failure to ground a motor can cause personal injury, death, and equipment damage.*

It is advised to conduct resistance readings with a multimeter on the motor ground circuit. Never apply power to a motor that does not have a complete ground circuit.

b. Grounding

Infinitum Aircore EC+ motors can be installed in a Grounded Wye or Delta/HRG (High Resistance Ground) topology. Both are identified by their respective Catalog (ordering) number.

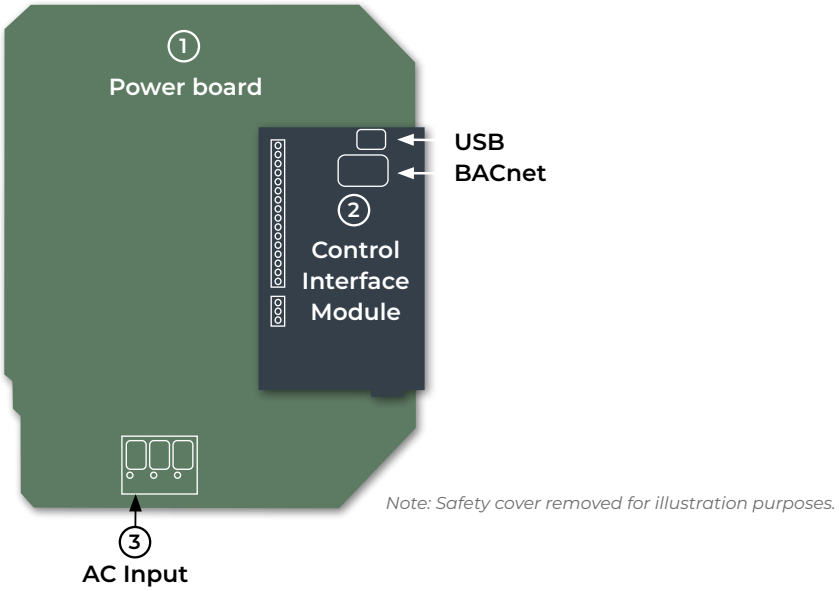
c. Connecting Motor

Each of the circuit boards and housing components has a separate design function. Only two of the circuit boards have user inputs. The main circuit boards and connection points are highlighted in Figure 10.

1. Power board: Connections for three-phase supply. Rectifiers convert AC to DC for internal use on this board.
2. Control interface module (CIM). This circuit board contains advanced controls and communications.
3. AC Input: Ground terminal is in the chassis. (Figure 8)

d. Conductor Size and Terminal Data

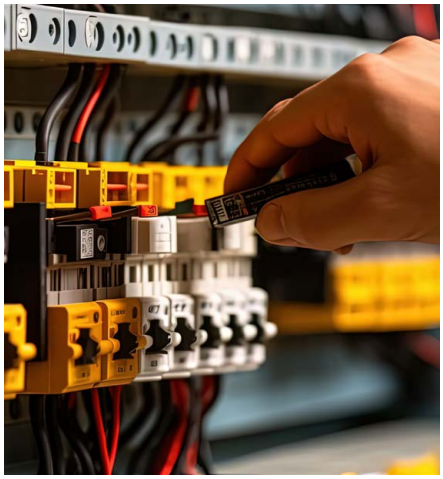
Figure 8: Main motor boards



Note: Safety cover removed for illustration purposes.

Board	Terminals	Maximum conductor size		Exposed conductor length	Terminal type
		mm^2	AWG		
EC Communication interface module	Control terminals	1.3	16	8 mm	Spring terminal
Power board	AC Mains-U, V & W	5.2 / 3.3	10 / 12	12 mm	Spring terminal
Screw terminal	Earth ground	1.6	14	12 mm	Lug and screw Max torque 2 Nm

e. Circuit Breaker and Wire Sizing



Short circuit protection should be provided to protect the input power conductors. UL and/or CSA (as required by local regulations) approved fuses (such as class CC or class J) or circuit breakers (UL 489) should be used and sized in accordance with applicable regulations or Table 1.

The supply conductors should be sized based on the current requirements of the motor. The connector minimum and maximum wire sizes are included in Table 2.

Overload protection is required for Infinitum motors marked as “Electronically Protected L.”UL and/or CSA (as required by local regulations) approved motor overload protectors should be used and set as required by local regulations. Combination motor controllers, such as UL Type E controllers, when used as intended may be used to provide disconnect, short circuit protection, and overload protection in the same device.

The maximum permissible short circuit current at the drive input power terminals is 5kA.

Note: Confirm latest Rated current values using the Motor Selection.

Table 1

Breakers and Fuses (3-phase 460V AC (+/- 10%) – 3-phase 460V output)

Power (HP)	Rated current (A)	Listed/Certified fuses or breakers	Minimum suggested wire size (AWG)
5	6.0	10	16
7.5	9.0	15	16
10	12.0	15	14
15	17.0	25	12

Table 2

Terminal Connection Data

Power (HP)	min.	max.
Rigid cable cross-section	0.2 mm^2	6 mm^2
Flexible cable cross-section	0.2 mm^2	6 mm^2
Cross section AWG	24	10
Wire-end ferrules (w/ insulating collar)	0.2 mm^2	4 mm^2

6. EC Fan Motor Control Connections

Remove the VFD cover for access to Analog/Digital, Modbus and (optional) BACnet connections.

1. Relay (1) – NO / NC (COM must be used)
   - Max voltage: 125 VAC / 30 VDC
   - Max current: NO-10A VAC, 5 A
   - VDC: NC – 3A VAC or VDC
2. Digital input (4) – DIN1, DIN2, DIN3, DIN4
3. Digital output (2) – DO1 & DO2
   - Open drain output
   - Max switching voltage: 40 VDC
   - Max switching current: 350 mA
4. Auxiliary voltage (1) – +24V (GND must be used), 250 mA max
5. Analog output (1) – A_OUT (GND must be used) 10 V, 10 mA max
6. Analog input (1) – A_IN (GND must be used)
7. EIA-485 interface (1) – 485_P & 495_N (Modbus RTU or BACnet MS/TP)

Note: Use wirenut to connect shield wires. Do not tie to GND.

8. EIA-485 termination switch. (Default is Off)
9. RJ45 (ethernet) for I-con (motor control software) connection
10. Optional BACnet module
11. USB

Terminals on the interface board (Figure 9) feature push-button spring clips. The push-button on each terminal must be depressed while inserting the wire. Releasing the push-button clips the wire into place.

a. Analog Control Wire Guidelines

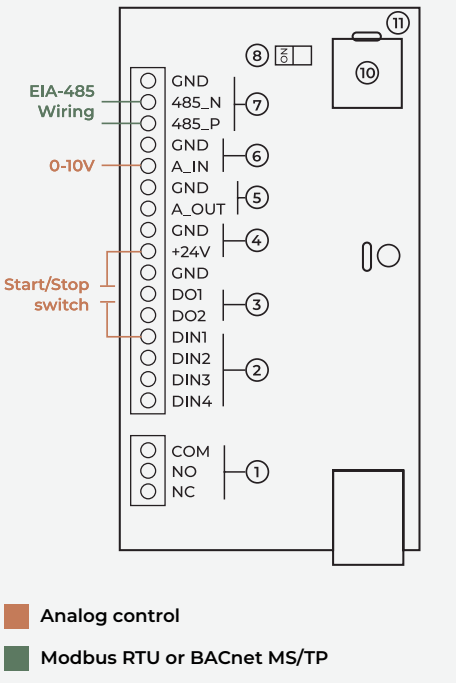
To control the unit using Analog control please utilize the wiring guidelines on the CIM board (Figure 9).

b. Modbus RTU or BACnet MS/TP Wiring Guidelines

To control the motor with Modbus RTU or BACnet MS/TP please utilize the wiring guidelines to connect to the Communication I/O (Figure 9).

- The last unit on a daisy-chain Modbus RTU or BACnet MS/TP configuration should have the EIA-485 Termination DIP switch “ON”.
- All other units must have the DIP switch in the “OFF” position.
- Modbus RTU operation requires changes to the motor parameters for slave address
- All other units must have the DIP switch in the “OFF” position.
- Modbus RTU operation requires changes to the motor configuration parameters for slave address
- BACnet MS/TP operation requires changes to the Device Instance field to establish it unique BACnet identifier.

Figure 9: CIO board



c. AC Main Input Connections

The AC main inputs (Figure 9) are on the power board.

The supply voltage connections are:

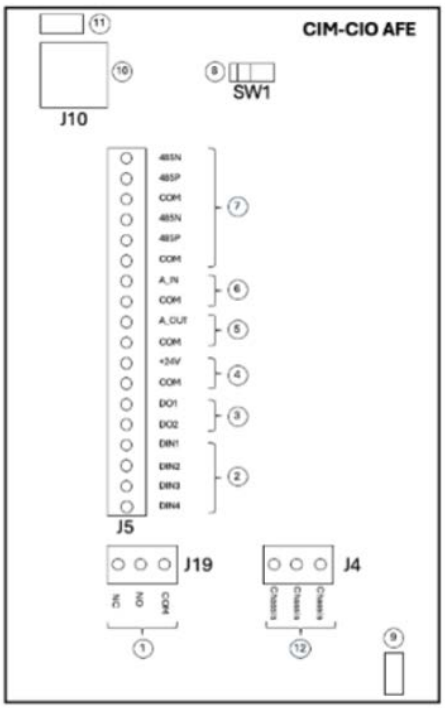
1. Supply voltage phase A
2. Supply voltage phase B
3. Supply voltage phase C

The AC input terminals feature spring clips. The orange tab must be raised to insert the wire. Closing the orange tab secures the wire into place. The grounding post is located off the power board on the chassis itself.

7. MC Fan Motor (AFE) Control Connections

Infinitum MC motors have unique CIM-CIO boards with a few differences from the EC motors.

Figure 10: Control connections



Remove the VFD cover for access to Analog/Digital, Modbus and (optional) BACnet connections. Do not insert external wiring larger than 20 AWG into control terminals

1. Relay (1) – NO / NC (COM must be used)

- Max voltage: 125 VAC / 30 VDC
- Max current: NO-10A VAC, 5 A
- VDC: NC – 3A VAC or VDC

2. Digital input (4) – DIN1, DIN2, DIN3, DIN4

3. Digital output (2) – DO1 & DO2

- Open drain output
- Max switching voltage: 40 VDC
- Max switching current: 350 mA

4. Auxiliary voltage +24V (COM must be used), 250 mA max

5. Analog output A_OUT (COM must be used) 10 V, 10 mA max

6. Analog input A_IN (GND must be used)

7. EIA-485 interface (Modbus RTU or BACnet MS/TP)

Note: Splice the shield wires and DO NOT connect to COM. Only connect the shield wires at one end of the daisy chain, preferably at the controller

8. EIA-485 termination switch. (Default is Off)

9. USB-C for I-con (motor control software) connection

10. Header for optional BACnet module

11. USB-C for BACnet module programming

12. Chassis terminal block (J4)

AC power connections are the same as for EC motors. See above.

a. LED Operation

All Infinitum motors in EC Fans have 3 LEDs viewable on the outside of the VFD that indicate operational status:

Green: Normal operation; 460V input is active

Yellow: Blinking "heartbeat" indicates Inverter is operational

Red: Fault or important user notification

b. Check EC Fan Rotation

Note: If the motor has been tested and the technician has verified motor rotation prior to installation, the facility can elect not to perform this test because of redundancy.

Prerequisites: The motor has been installed, aligned and electrically connected. The fan belt is removed, or coupling is disconnected. The motor must be briefly energized to check for proper rotation.

Steps are outlined below:

1. Review all installation instructions and all warnings prior to testing the motor.
2. Connect AC power
3. Follow all safety precautions and energize the motor briefly to determine rotation. If the motor rotates opposite of intended direction, switch the direction command utilizing I-con software tool.
4. Disconnect AC power.

c. Default and User Programmable Settings

Infinitum EC Aircore motors are shipped with factory default settings for maximum speed, control methods and other values. To change your motor's settings, download the I-con software.

8. Piezometric Airflow Measurement

Infinitum EC Fans include two pre-installed rivet nuts. See figure 11. For users requiring airflow measurements these rivet nuts can be used with "press-to-fit" tube attachment devices.

Figure 11: Example rivet nut

One rivet nut is installed in the face of the fan, the other in the throat of the inlet cone. Using these rivet nuts and requisite tubing, a pressure transducer can be utilized to determine the air pressure drop through the inlet cone. Airflow through the fan assembly can be calculated from this pressure differential.

The cubic feet per minute airflow of Infinitum EC fans can be calculated with the following formula and data from Infinitum:

$Q = K \sqrt{\Delta P}$ where K comes from the tables below and ΔP is the differential static pressure from the two taps installed in the EC Fan. Q is cfm and this assumes P in inches of water.

K Values for Each Fan Size

EC Fan	Fan Size	K Value
EFxxxx01	710	4873
	630	3836
	560	3031
	500	2417
	450	1957
EFxxxx02	710	4873
	630	3836
	560	3031
	500	2417
	450	1957
EFxxxx03	710	4156
	630	3092
	560	2649
	500	2136
	450	1688

9. EC Fan maintenance

a. Maintenance

Under normal usage, no spare parts are expected to be required for one year of operation.

⚠ *Caution: Before proceeding, make sure electrical service to fan is locked in "OFF" position.*

b. Windmilling and Bearings (unpowered)

Even when the power supply is locked out, fans may cause injury or damage if the impeller is subject to "windmilling" which is the turning of the impeller and drive components due to a draft in the system. To guard against this hazard, the impeller should be secured to physically restrict rotational movement in a powered-down condition.

Motor bearings are pre-lubricated. No additional lubrication is required..

c. Regular Maintenance

Determined by the condition of the air passing through the fan, regularly scheduled inspection of all fan parts establishes a good maintenance routine. When the air is clean, maintenance can beas infrequent as once a year. Regular maintenance should include inspection and cleaning of all fan parts to remove all grease and other foreign particles from the entire wheel surface including blades and front and back plates.

⚠ *WARNING! Care must be taken when cleaning the wheel to remove grease and other foreign particles. Damage to the wheel can occur if it is hit or if pressure is applied causing the wheel to be distorted. Either case can cause serious vibration and damage to the fan.*

d. Taper-Lock Bushing Clamp Bolts

To tighten or adjust Taper-Lock Clamp Bolts to realign wheel to the frame, use the information below on the Taper-Lock Bushing Clamp Bolts:

- ○ Insert Screws to Install
- ● Insert Screws to Remove

e. Tightening

Alternately torque setscrews to recommended torque setting in chart below

Torque for Taper-Lock Bushing Clamp Bolts

Bushing No.	in-lbs	Nm
2012	280	32

⚠ *CAUTION: Do not use worn hex key wrenches on the Taper-Lock screws. Doing so may result in a loose assembly or may damage screws.*

f. Loosening/Removal

Insert screws in holes indicated by ● on the above drawing. Loosen Taper-Lock bushing by alternately loosening screws. After adjusting, tighten the screws as noted in the Tightening section.

10. EC Fan Operations

a. Windmilling During Operations

Infinitum EC Fans can overcome “windmilling” (reverse rotation due to back pressure in HVAC applications) up to 200 RPM. In windmilling conditions under 200 RPM, the motor will stop the reverse rotation and resume operations in the required operational direction. If the windmilling speed exceeds 200 RPM, alternative solutions are required such as anti-windmilling devices like brakes, clutches, or louvers.

11. EC Fan Motor Drive Parameters and Data Types

The Aircore EC+ motor parameters can be found here.

12. Related Documents

Infinitum Fan Selection Tool

I-con: Infinitum motor control software manual

QSG: Quick start guide for wiring overview

MST: Rightsize motor to application with motor selection tool

BACnet user manual

13. Appendix & Troubleshooting Guide

These instructions do not cover all variations in equipment nor provide information for every possible condition in installation, operation, or maintenance. For additional information, contact Infinitum Support.

Motor troubleshooting and service must be performed by qualified personnel with proper tools and equipment. LOTO operation should be followed per company guidelines.

'Motor' refers to the motor system consisting of motor and UFD.

Issue	Observations	Probable Cause	Mitigation
Motor unresponsive/ fails to start	No LED status lights	No 460-480 voltage	· Check incoming voltage. · If no incoming voltage contact site electrician. · Retry motor once voltage has been confirmed. · If voltage is confirmed go to next troubleshooting step.
	Nearby motors also inoperable	No 460-480 voltage	· Check incoming voltage. · If no incoming voltage contact site electrician. · Retry motor once voltage has been confirmed. · If voltage is confirmed go to next troubleshooting step.
Motor fails to start with confirmed VAC	No LED status lights on motor	Internal failure	· Perform LOTO. · Remove VFD access cover on Gen2 or entire drive cover on Gen3 VFD. · Confirm connections for all internal wiring connections, particularly the main 460 VAC line-in wiring and the cable from the Inverter board to CIO board. · Using a multimeter, determine continuity of the three fuses. · If any are open, record which one, RMA motor. · Close cover and try power again if no open fuses. · If no LEDs are lighted, RMA motor
	Solid green LED, normal yellow heartbeat LED, no red LED: serial Modbus connection incomplete, grounded, or reverse polarity	Lack of external communication to the motor	· Correct the polarity. · Correct the ground/shield/drain by termination at the main RTU device with a contiguous, isolated run from end of line to end of line. · Remove any wrongful ground locations. · Verify each connection point or break for proper termination of the conductors along the daisy chain. · Verify the correct wire for the application is being used.
	Solid green LED, normal yellow heartbeat LED, no red LED: analog control unresponsive or incorrect motor speed	Incorrect signal voltage or incorrect I/O terminal connection	· The +24v terminal on the I/O board is OUTPUT in DC voltage only. · The digital input 1(DIN1) needs to receive 24v DC for the motor to start at minimum speed which can be set under Parameter Settings>Terminal Settings>AI1 Min Setting (%). · The analog input(A_IN) by default will accept 0-10v for 0-100% speed.
	Red LED Fault LED illuminated	Internal electrical issue	· Use MCS to determine fault, and Serial # for motor. · Photograph motor label and reach out to Infinitum Support for assistance.
No connection to Motor Control Software via TCP (Ethernet)	LEDs (green on, yellow flashing), No red LED	Incorrect motor operating mode	· Change MCS operating mode on upper left corner of home screen.
	LEDs (green on, yellow flashing). No red LED	Incorrect IP address	· Confirm static IP address: 172 17 20 153 / 255 255 0 0

Issue	Observations	Probable Cause	Mitigation
I-con connects to motor, but motor won't start	Fault observed in upper right corner of MCS	Internal motor fault	· Create a save state to record the data. · Confirm the motor parameters are set to what is needed for the spec of the fans. · Record the state of the motor and the order of the faults as they are listed. · Refer to Fault Page on the Infinitum Support page for information. · Clear Faults with the MCS and see if the motor will restart at the Minimum RPM. · If the motor starts, then observe its operation for 15 mins listening and looking for any defects. · If the observation is ok turn the motor to mid the full RPM for 10 mins each. · If the motor runs for both with no issues, then remove the laptop and return motor to service.
I-con connects to motor, but motor has Modbus or Serial communication issues	MCS connects to motor. No operation via Modbus or Serial	Cable, or Board issue	· LOTO the motor at the mainline disconnect and follow your company procedure to ensure no power. · Check L1, L2, L3 on the motor after LOTO to confirm no power. · Are wires stripped properly and inserted into the terminal – Remove wires and re-seat to confirm. · Review boards and wiring inside of motor access panel to determine if anything looks burnt, unplugged, or out of place. · Contact Infinitum Support with any concerns. Pictures will help. · MAKE SURE MOTOR HAS POWER REMOVED AND LOTO – Then physically spin motor to see if it spins freely. · If there is resistance record it with a video and send to Infinitum Support. · If motor spins freely then remove the CIO 24V DC Comm wires and use a meter to check them. · Check all wires in the array of fans that are for the Modbus/Coms. · Confirm shields are terminated where needed, solid connections are made, and wires are not pinched/nicked anywhere. · It may be necessary to remove all connections and reset them back in the terminals/connectors. · It is very important to have good connections on the Modbus/ Comm side. · Make sure all motors in the array have the end of line jumper or end of line resistor installed per specs and only at the end of line. · Confirm all motors that are not end of line motors have the comm dip-switch in the off position. · Remove field wires for the Modbus comms making sure the ends do not touch and are safely covered with tape or connectors. See Modbus RTU Troubleshooting PN. · Install wires from USB to RS485 adapter in the comm ports. · See if the motor will run using only the MCS and attached wires. · If YES then there is a field wire issue. · If NO then contact Infinitum Support for a new CIO board.

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