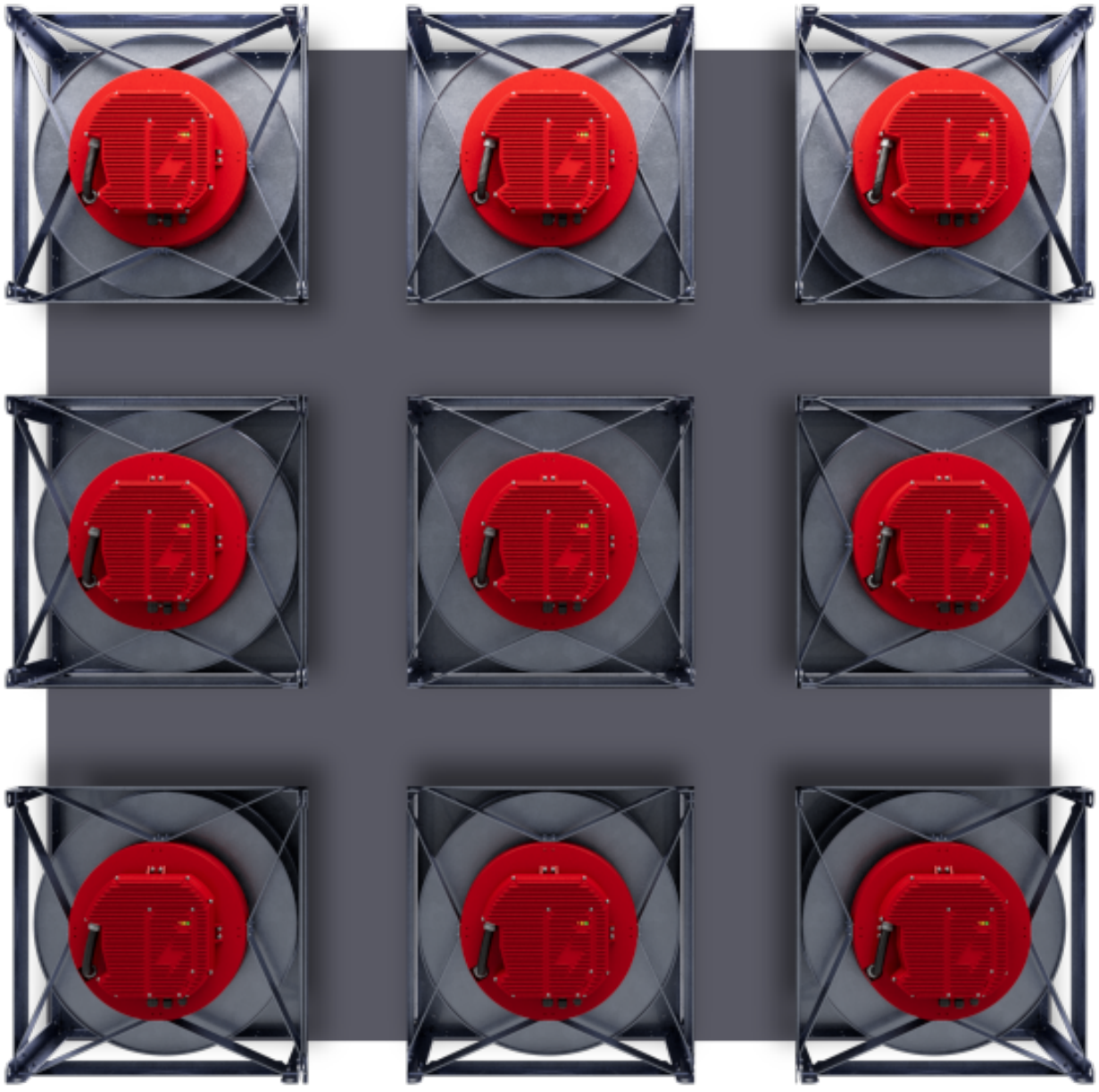
Infinitum

Aircore EC+ Fan

Installation, Operation, and Maintenance Manual

Release: 2.1

Date: November 2026



Safety information

Read all safety instructions before you work on the Aircore EC+ Fan. Ignoring these precautions risks death, serious injury, or damage to the fan and its associated components.

Only qualified personnel may install and service Aircore EC+ Fans. Improper installation can cause electric shock, contact with moving parts, and other hazards that result in injury or death.

- Follow all local electrical and safety codes, and where applicable, the National Electric Code (NEC) and the National Fire Protection Association (NFPA) standards.
- Disconnect electrical power before you work on the unit, remove any guard, or open an access door.
- Apply lockout/tagout procedures so that no one can energize the unit while you install or servie it.
- Route the power cable so that it cannot kink or contact oil, grease, hot surfaces, or chemicals.
- Confirm the power source matches the electrical requirements of the equipment.
- A turning rotor generates voltage at the motor terminals even when power is disconnected. Stop the impeller and secure it against rotation before you open any electrical compartment.

This manual uses the following safety messages.

⚠ WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE

Indicates information considered important, but hot hazard-related (e.g., messages relating to property damage).

Note: Indicates information that can aid in the completion of a process or step, or practices not related to personal injury.

Revision history

Release	Date	Changes
2.1	November 2026	Added Fault codes and Fault troubleshooting section. Updated CIM-CIO and CIM-CIO-AFE board drawings, mounting dimensions drawing and dimensions table, connector size and terminal data values.
2.0	October 2026	Added 04 fan wheel.
1.0	June 2026	Initial release 01, 02, and 03 fan wheels.

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1 Introduction

This manual covers the Infinitum Aircore EC+ Fan. Read the safety information at the front of this manual before starting any procedure.



Three hazards recur throughout and apply even when the fan is disconnected:

- Airflow through the system can turn the wheel (windmilling)
- Because the rotor uses permanent magnets, a turning wheel generates voltage at the motor terminals.
- The drive's capacitors hold a charge for one minute after power is removed.

Before any work in the fan section, secure the wheel against rotation and wait at least one minute after removing power.

1.1 Purpose and scope

This manual is intended for qualified personnel who install and service the Aircore EC+ fans. It covers safety precautions, receiving and storage, mechanical and electrical installation, operation, maintenance, Level-1 troubleshooting, and technical specifications.

Motor-level service, Modbus register detail, I-con software, and BACnet communication are outside the scope of this manual. For those topics, see the Aircore EC+ Installation, Operation, and Maintenance Manual and other documents listed in Section 8, Related documents.

1.2 Product overview

The Infinitum Aircore EC+ Fan is a centrifugal fan assembly consisting of an aluminum backward-curved fan wheel, a galvanized steel support structure, and an Aircore EC+ motor: an axial-flux motor and Variable Frequency Drive (VFD) integrated in one unit.

The motor uses an air-core design: the stator is a printed circuit board (PCB) rather than laminated iron with copper windings. This construction eliminates iron core losses and reduces motor weight compared with an equivalent iron-core induction motor, while delivering comparable power output.

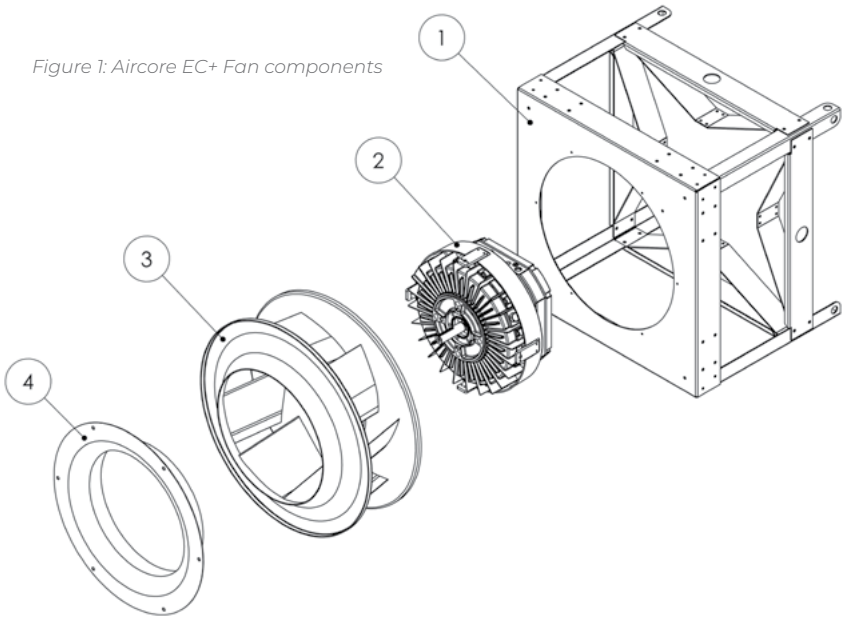
The VFD provides variable speed control and maintains high efficiency across the fan's full operating range, including at reduced speeds.

1.3 Fan components

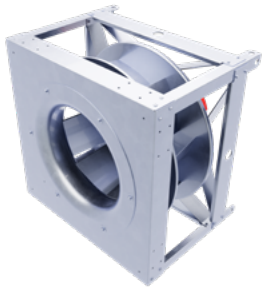
Figure 1 identifies the key Aircore EC+ Fan components.

Item No.	Part Number	Qty.
1	Mounting Frame	1
2	Motor Assembly	1
3	Fan Wheel	1
4	Inlet Flange	1

Figure 1: Aircore EC+ Fan components



1.4 Fan wheel and support structure



The Infinitum Aircore EC+ Fan wheel is an aluminum backward-curved centrifugal wheel with airfoil blades, optimized for use with Infinitum Aircore EC+ motors. Viewed from the shaft end, the motor's default rotation is counterclockwise (CCW). Infinitum programs each motor for the rotation its wheel requires: clockwise (CW) for EFxxxx01, EFxxxx02, and EFxxxx04 wheels, and counterclockwise (CCW) for EFxxxx03 wheels. The supporting structure is galvanized steel. The fan is assembled with Wiz-lock™ fasteners and Huck Magna-Lok™ for a robust, vibration-resistant design.

1.4.1 Wheel balance

Wheels dynamically balance quality grade G6.3 per AMCA/ANSI Standard 204 (Vibration and Balance Levels for Fans).

System vibration is measured in three axes (horizontal, vertical, axial) prior to shipping to ensure vibration is within the tolerances for BV-3 mounted to a rigid structure per AMCA/ANSI standard 204.

Note: BV-4 balance and vibration levels are available as a paid option.

1.5 Maximum RPM

Aircore EC+ Fan units have a maximum RPM depending on the fan size. See Table 1 for details.

Table 1: Fan maximum RPM

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
EFxxxx04	630	1970
	560	2220

Notes:

1. Assembly MAX RPM is the max RPM for the wheel and mounting assembly combination, excluding the motor.
2. Refer to the submittal generated by the Fan Selection Tool to calculate the maximum RPM of the motor and fan assembly combination.
3. Model EFxxx04 fans have limited availability. Contact your Infinitum sales representative to confirm availability for your project.

2 Receiving, handling, and storage

Inspect the shipment for damage and shortages immediately upon receipt. Record any item discrepancy or apparent damage on the delivery receipt before signing it.

Concealed damage is damage found after the shipment is opened that was not evident from an external inspection. If you find concealed damage, request an inspection by the carrier immediately. Report it to the carrier within 15 days of delivery. Claims made after 15 days are rejected.

Move the crated fan assembly with a dolly, pallet jack, or fork truck.

2.1 Nameplate

- Compare data on the fan nameplate in Figure 2 and the motor nameplate in Figure 3 with the purchase order to verify receipt of the proper Aircore EC+ Fan. Labels are on the motor shroud.
- Confirm that the nameplate ratings match the available power supply and control equipment.

Figure 2: Fan nameplate

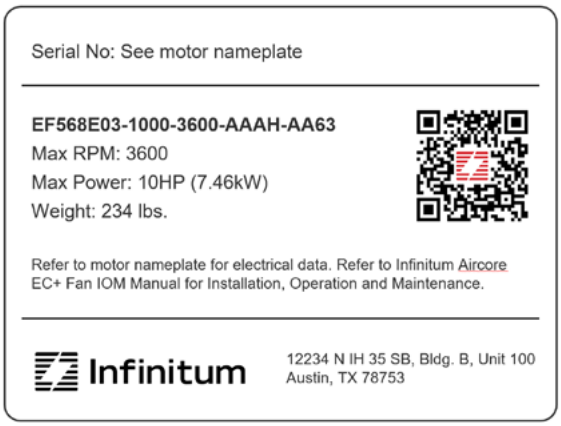
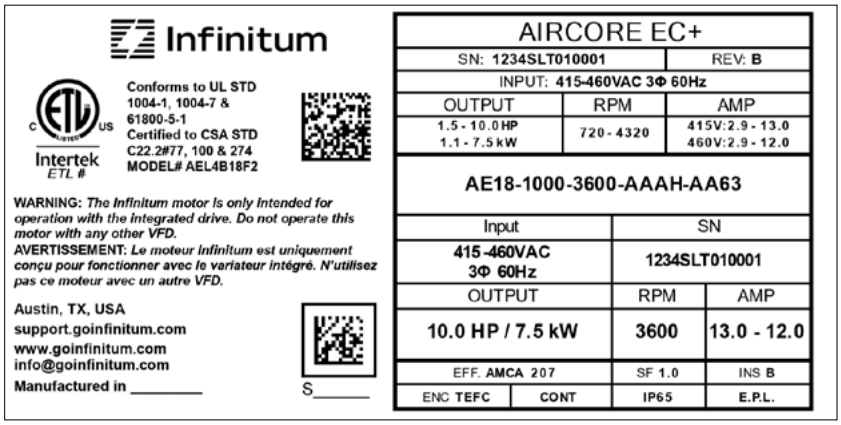


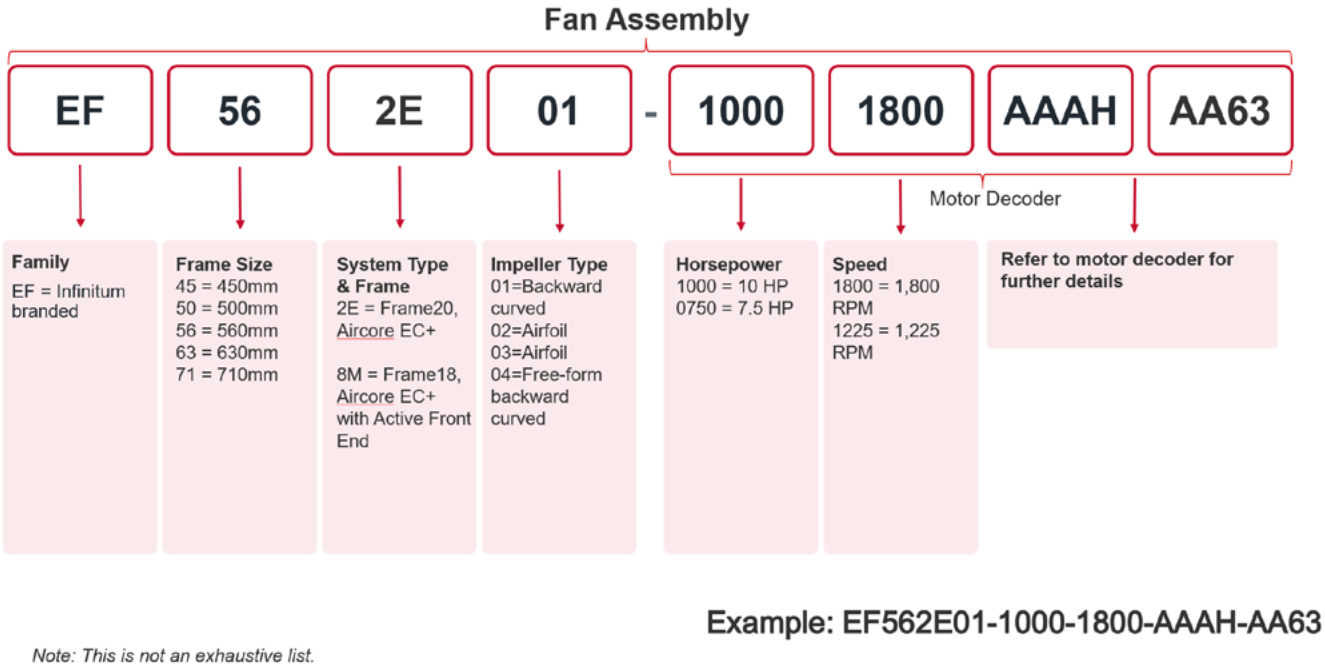
Figure 3: Motor nameplate



2.2 Catalog number decoder

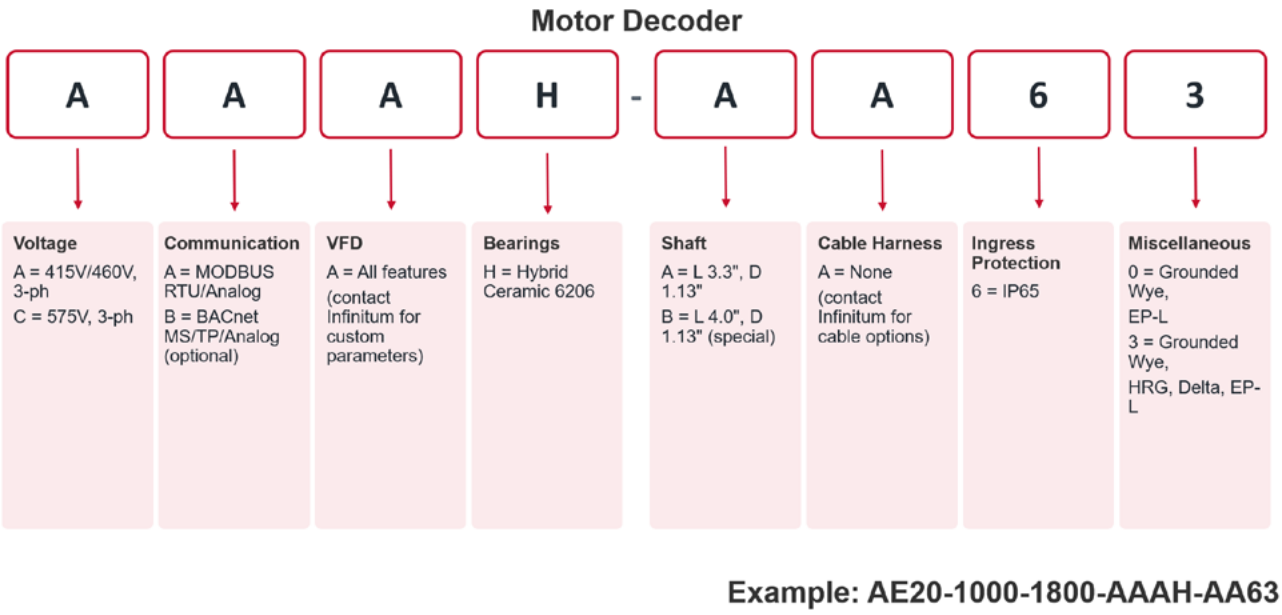
Each Infinitum Aircore EC+ Fan and motor is identified by a catalog number that encodes its configuration. Figures 4 and 5 show how the decoder works.

Figure 4: Aircore EC+ Fan catalog number decoder



Note: This is not an exhaustive list.

Figure 5: Detail of motor decoder



Note: AE20: the letters indicate the motor type (AE= Aircore EC+; AM = Aircore EC+ with AFE), the number indicates the frame size.

2.3 Fan weights

Lifting equipment must support the fan assembly and account for the lift point angle. See Table 2 for fan assembly weights.

Table 2: Fan weights

EC Fan	Fan Size (mm)	Full assembly weight (lbs)
EFxxxx01	710	266
	630	230
	560	215
	500	152
	450	148
EFxxxx02	710	294
	630	259
	560	239
	500	213
	450	207
EFxxxx03	710	249
	630	232
	560	214
	500	209
	450	156
EFxxxx04	630	207
	560	176

Note: Fan weight is based on the biggest motor size. Weight is approximate.

2.4 Wheel alignment

To maintain efficient fan performance, ensure the correct axial overlap between the impeller and inlet cone. Verify these values before initial start-up, after the first 24 hours of operation, and following any service. Refer to Tables 3 and 4 for the required overlap (u). Figures 6 and 7 show the location of the overlap.

Table 3: EFxxxx03 Series: Axial overlap (u)

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

Table 4: EFxxxx01, EFxxxx02 & EFxxxx04 Series: Axial overlap (u)

Fan Wheel Size	u – Overlap (mm)
EF45xx01, EF45xx02	4.5
EF50xx01, EF50xx02	5.1
EF56xx01, EF56xx02	5.6
EF63xx01, EF63xx02, EF56xx04	6.3
EF71xx01, EF71xx02, EF63xx04	7.1

Note: For 01 and 02 series fans, u equals the inlet cone size divided by 100 (for example, EF71xxxx01 → 7.1 mm).)4 series fans use the next-larger inlet cone (EF56xxxx04 uses a 630 cone). 03 series fans use a fixed overlap of 0.25 mm.

2.5 Shipping crates

Aircore EC+ Fans are shipped individually in wooden crates.



Figure 6: Impeller and inlet cone dimensions

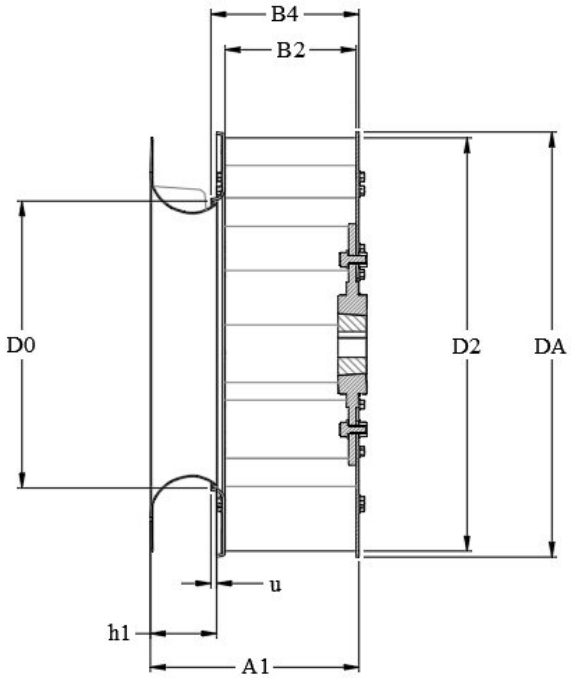


Figure 7: Detail of h1 and u dimensions

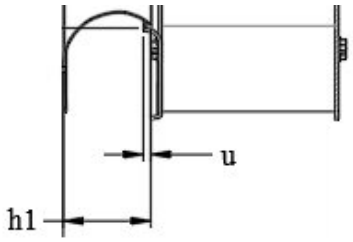
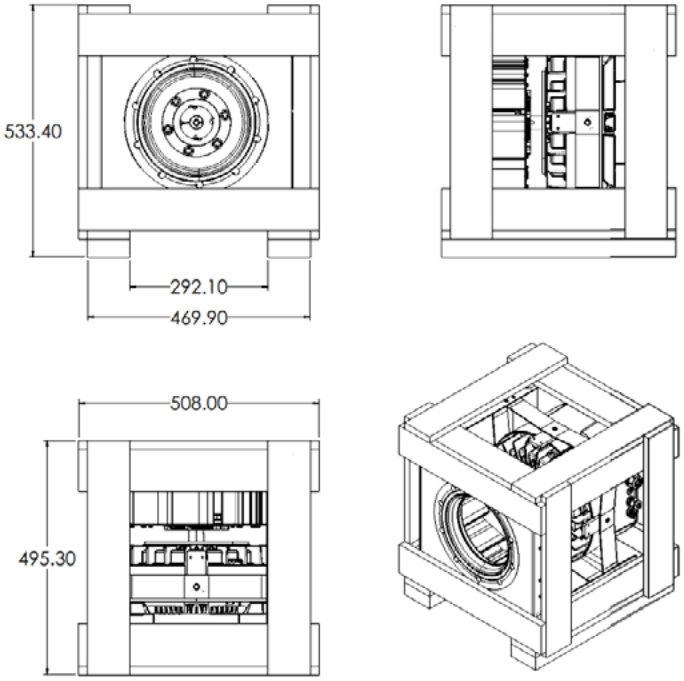


Figure 8: Crate dimensions (mm)



2.6 Removal from crate

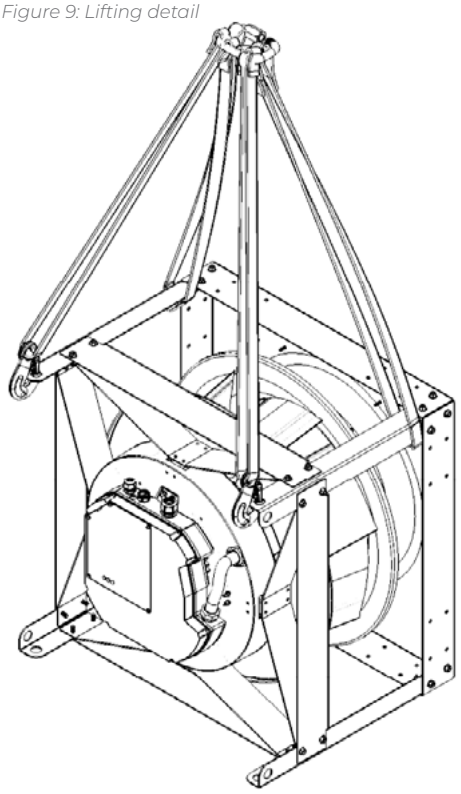
⚠ WARNING

Falling load

Improper rigging or lifting can cause the fan to fall. A dropped fan could cause death or serious injury and damage to the equipment.

- Lift the fan only with a lifting device and straps rated for the fan weight.
- Before use, inspect straps for damage and legible capacity rating.
- Attach straps only at the lifting points marked on the frame.
- Do not stand or work under a suspended fan.
- Do not lift the fan by hand.

Figure 9: Lifting detail



To remove the fan from the crate:

1. Remove the top of the crate.
2. Remove the fasteners securing the fan to the crate base.
3. Position the lifting device directly above the fan's center of gravity so the fan doesn't swing when it clears the crate base.
4. Attach the straps to the fan frame at points shown in Figure 9.
5. Lift the fan vertically until it is clear of the crate.
6. Lower the fan onto a level surface and remove the straps.
7. Turn the impeller by hand to verify that it rotates freely without binding.
8. Verify the axial overlap between the impeller and the inlet cone. See section 2.4 Wheel alignment.

2.7 Storage

⚠ WARNING

Fire

Portable heaters can ignite wooden blocks, paper, polyethylene sheathing, and packaging materials in a storage area. Fire could cause death, serious injury, or damage to the building and equipment.

- Install and vent heaters according to the manufacturer's instructions.
- Keep heaters away from fans, packaging, and othe combustable materials.
- Do not leave heaters operating in an unmonitored area unless they are approved for unattended use.
- Keep fire extinguishers and fire alarms in the storage area.
- Follow all applicable fire and safety codes.

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. The consignee is responsible for the integrity of fans and accessories during storage. Infinitum will not be responsible for damage during storage.

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. Maintain temperatures between -40 °F (-40 °C) and 185 °F (85 °C) (wide temperature swings may cause condensation and "sweating" of metal parts). Cover windows to prevent temperature variations caused by sunlight and prevent UV exposure. Provide thermometers and humidity indicators at several points and maintain the atmosphere at 95% relative humidity, or lower.

Use trays of renewable desiccant or a portable dehumidifier if needed 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.

Store at least 3.5 in (89 mm) 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.

2.7.1 Inspection and maintenance

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. Moisture present
7. Dirt accumulated
8. Corrective steps taken

If moisture or dirt accumulations are found on parts, locate and eliminate the source.

2.7.2 Rotation schedule and care

While a fan is in storage, perform the following maintenance to protect the bearings and prevent corrosion.

2.7.2.1 Wheel rotation

⚠ WARNING

Electric shock

A rotating permanent magnet rotor produces voltage at the motor terminals, even when the motor is disconnected from power. Contact with this voltage could cause death or serious injury.

- Do not open electrical compartments or touch unprotected terminals while the rotor is turning.

Rotate the wheel every three months. Rotation redistributes grease in the bearings and reduces the risk of corrosion formation on rolling elements and raceways. Turning the wheel also turns the motor's permanent magnet rotor, which generates voltage at the motor terminals.

1. Leave the fan in its shipping crate.
2. Turn the wheel by hand 10 to 15 full revolutions. Bearing seals may make the wheel slightly stiff to turn; this is normal.

2.7.2.2 Corrosion protection

During each quarterly rotation, inspect painted surfaces and machined parts for deterioration and rust.

- **Paint:** If the paint is deteriorating on the motor shroud, touch up or repaint affected areas. For fans with special coatings, contact Infinitum for repair instructions.

- **Machined parts:** If rust appears on parts coated with rust preventative, restore them promptly. Shafts and bearing collars are the most critical.

To remove rust:

1. Remove the original rust preventative coating with petroleum solvent and clean lint-free cloths.
2. Polish off any remaining rust with crocus cloth or fine emery paper and oil. Remove only the rust. Do not scratch, pit, or remove base metal.
3. Wipe the surfaces clean with lint-free cloths.
4. Recoat surfaces evenly and thoroughly with rust preventative.

2.8 Removal from storage

⚠ WARNING

Electric shock

A rotating permanent magnet rotor produces voltage at the motor terminals, even when the motor is disconnected from power. Contact with this voltage could cause death or serious injury.

- Do not open electrical compartments or touch unprotected terminals while the rotor is turning.

Flying parts

Fasteners and set screws can loosen during shipping, storage, and handling. A loose fan wheel or shaft component could come apart during operation and cause death or serious injury and damage to the fan.

- Inspect all fasteners
- Tighten threaded fasteners (Taper-Lock screws: see Table 12).
- Replace any loose lockbolt; contact Infinitum.
- Rotate the wheel by hand to confirm it turns freely and does not rub the inlet.
- Remove all tools and materials from the fan before starting it.

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 the fan for loose parts, debris, loose fasteners, or other parts that could become dangerous projectiles if not removed prior to start-up.

Notes:

1. Failure to check and tighten all fasteners and set screws before starting the fan voids the warranty.
2. Wheel alignment can shift during storage. Check the axial overlap against section 2.4 Wheel alignment, before start-up.

3 Fan installation

3.1 Preparation

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

3.1.1 Operating ambient temperature

The ambient temperature of the air supplied to the motor cooling inlet should not exceed 104 °F (40 °C) or be less than -13 °F (-25 °C). Power derates by 2% per °C above 104 °F (40 °C) up to 122 °F (50 °C). Use the Infinitum Motor Selection Tool to confirm derating details. Consult Infinitum for ambient temperatures not within these requirements.

Contact Infinitum before starting below -13 °F (-25 °C).

For continuous operation at ambient temperatures below -13 °F (-25 °C), special low temperature bearings are required. Contact Infinitum for any application below -13 °F (-25 °C) ambient.

3.1.2 Altitude

Infinitum fans are designed to operate at altitudes of 0 ft (0 m) to 2,000 ft (1,000 m). Power derates by 9% per 2,000 ft (1,000 m) when the motor operates between 2,000 ft (1,000 m) to 6,560 ft (2,000 m).

3.1.3 Ingress protection

The nameplate identifies the Infinitum motor's Ingress Protection (IP) rating. To maintain this IP rating, use cable glands or seals at all wiring ports, and keep all gaskets and covers in place.

3.2 Mechanical installation

This section covers location, installation clearance, orientation, and mounting for the Aircore EC+ Fan series.

3.2.1 Location

⚠ WARNING

Explosion

Aircore EC+ fan motors are not certified for use in hazardous locations. Operating a fan where explosive gases, vapors, or dust are or may be present could cause an explosion, resulting in death or serious injury and damage to the equipment.

- Do not install or operate these fans in hazardous locations.

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

- The Aircore EC+ Fan should be 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 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.

3.2.2 Installation clearances

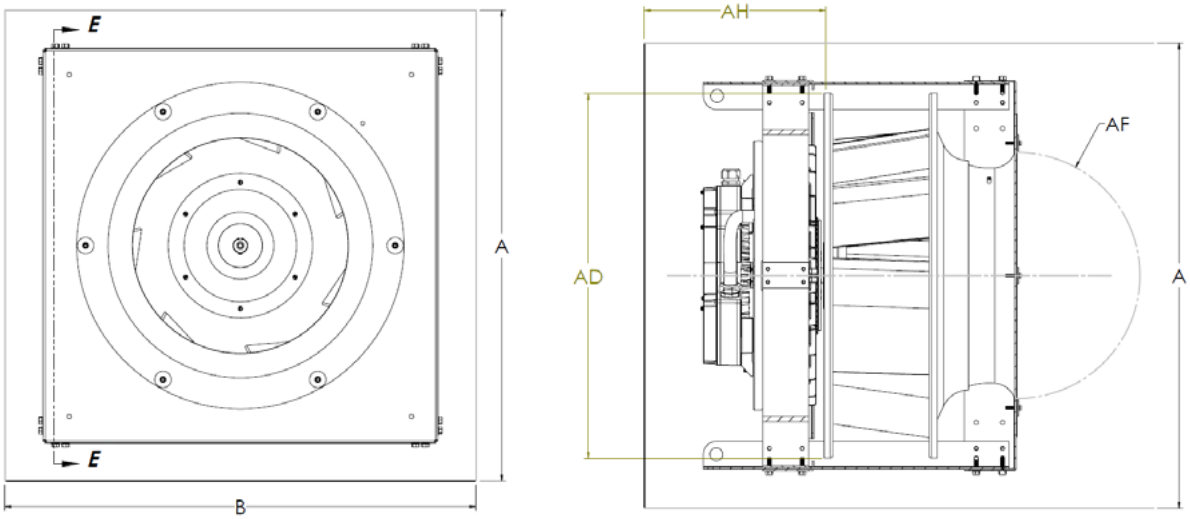
Installing the Aircore EC+ Fan too close to other components reduces air performance. Peak performance is measured in a free-blowing open configuration.

Refer to Figure 10 for fan clearance dimensions, and to the Infinitum Fan Selection Tool or other design specifications for spacing between fans.

Adhere to these dimensions to avoid losses in air performance.

Box Dimensions = A = B	**AD = Nominal Diameter Fan Wheel**
Recommended Dimensions: A ≥ 1.8 x AD **Minimum Dimensions:** A ≥ 1.5 x AD	**Distance to components suction side:** AF ≥ 0.5 x AD **Distance to components pressure side:** AH ≥ 1 x AD

Figure 10: Fan clearance dimensions



3.2.3 Orientation

Aircore EC+ Fans can be used in any orientation: horizontal, shaft up, or shaft down.

3.2.4 Mounting

⚠ WARNING

Falling load

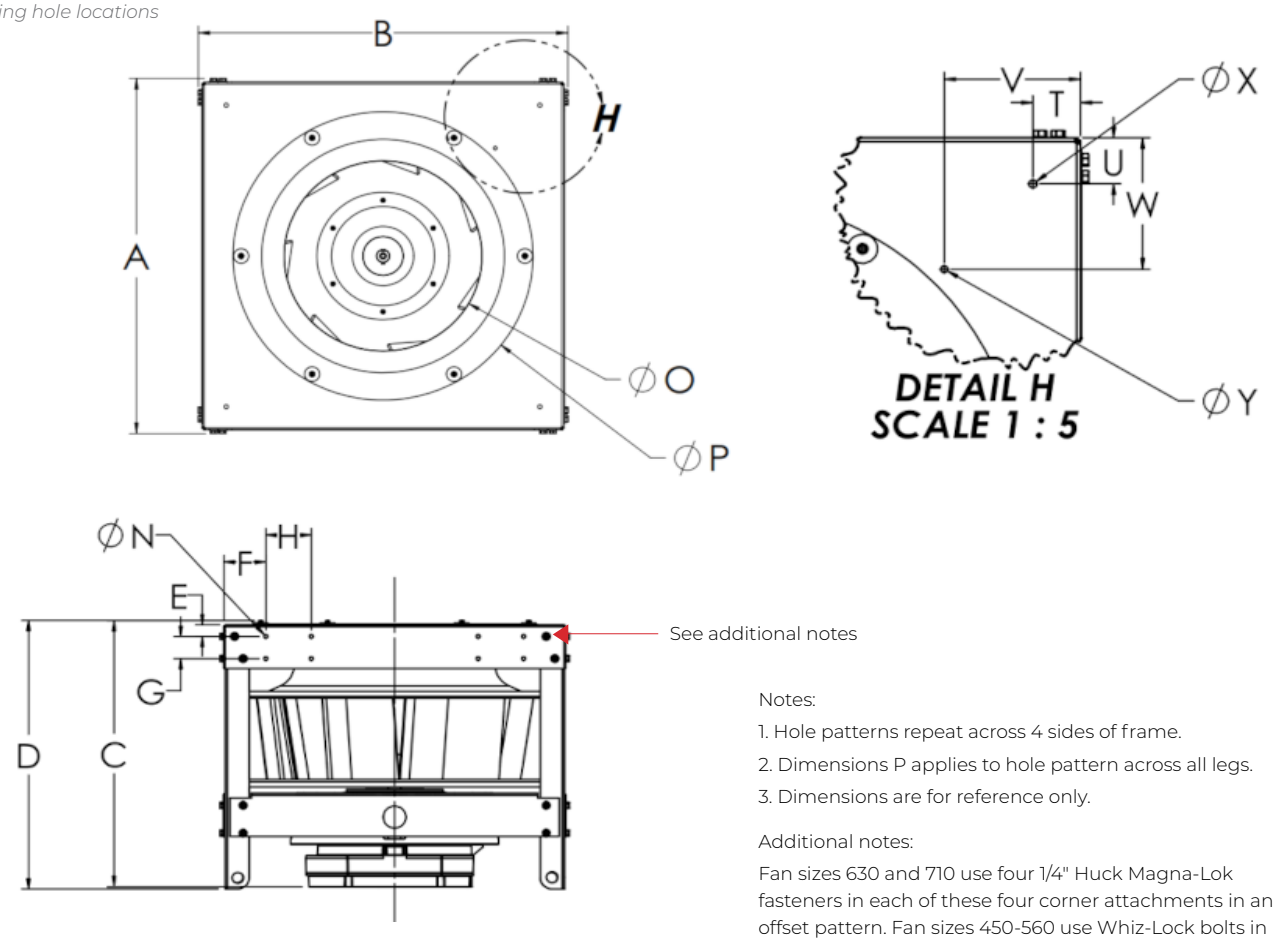
A dropped fan could cause death or serious injury and damage to the equipment.

- Lift the fan only with a lifting device and straps rated for the fan weight.
- Before use, inspect straps for damage and legible capacity rating.
- Attach straps only at the lifting points marked on the frame.
- Make sure the fan is securely attached to the mounting surface before removing the lifting straps.
- Do not lift the fan by hand.

Aircore EC+ Fans come with mounting holes in the side of the frame and the front faceplate (Figure 11). This facilitates mounting the fan assembly to a fan wall, fan array, or plenum using flanges, brackets or other attachment techniques. Infinitum does not recommend face mounting without using additional mounting points due to the increased potential for system level structural resonance. The customer must ensure the mounting structure is adequate to support the fans. Infinitum is not responsible for injury, damaged equipment, or poor fan performance caused by improper mounting/fan support.

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

Figure 11: Mounting hole locations



Notes:

1. Hole patterns repeat across 4 sides of frame.
2. Dimensions P applies to hole pattern across all legs.
3. Dimensions are for reference only.

Additional notes:

Fan sizes 630 and 710 use four 1/4" Huck Magna-Lok fasteners in each of these four corner attachments in an offset pattern. Fan sizes 450-560 use Whiz-Lock bolts in a straight pattern.

Table 5: Mounting dimensions

		Measurement ID																
	Fan Size	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**N**	**O**	**P**	**T**	**U**	**V**	**W**	**X**	**Y**
EFxxx01	**450**	660.4	660.4	543.2	489.2	25.7	94.1	-	50.8	8.6	298.7	464.1	50.8	50.8	154.5	154.5	8.7	7.5
	500	660.4	660.4	544.8	519.9	25.7	94.1	-	50.8	8.6	332	514.1	50.8	50.8	136.9	136.9	8.7	7.5
	560	660.4	660.4	578.1	570.5	25.7	94.1	-	50.8	8.6	371.1	563.9	50.8	50.8	119.2	119.2	8.7	7.5
	630	764.8	764.8	609.9	614.2	26.7	94.1	51.6	101.6	8.6	418.6	634	50.8	50.8	145.2	145.2	8.7	7.5
	710	863.6	863.6	658.9	641.4	26.7	94.1	51.6	101.6	8.6	471.2	704.1	50.8	50.8	171.3	171.3	8.7	7.5
EFxxx02	**450**	660.4	660.4	529.3	489.2	25.7	94.1	-	50.8	8.6	298.7	464.1	50.8	50.8	154.5	154.5	8.7	7.5
	500	660.4	660.4	554.2	518.2	25.7	94.1	-	50.8	8.6	332	514.1	50.8	50.8	136.9	136.9	8.7	7.5
	560	660.4	660.4	578.1	570.5	25.7	94.1	-	50.8	8.6	371.1	563.9	50.8	50.8	119.2	119.2	8.7	7.5
	630	764.8	764.8	609.9	614.2	26.7	94.1	51.6	101.6	8.6	418.6	634	50.8	50.8	145.2	145.2	8.7	7.5
	710	863.6	863.6	658.9	641.4	26.7	94.1	51.6	101.6	8.6	471.2	704.1	50.8	50.8	171.3	171.3	8.7	7.5
EFxxx03	**450**	482.6	482.6	489.2	491.7	25.7	94.1	-	50.8	8.6	292.9	462.8	50.8	50.8	68.7	68.7	8.7	7.5
	500	660.4	660.4	533.6	516.9	25.7	94.1	-	50.8	8.6	320.5	495.8	50.8	50.8	143.3	143.3	8.7	7.5
	560	660.4	660.4	527.8	503.2	25.7	94.1	-	50.8	8.6	355.9	550.2	50.8	50.8	124	124	8.7	7.5
	630	660.4	660.4	558	561.3	26.6	94.1	51.6	101.6	8.6	392.7	607.3	50.8	50.8	101.3	101.3	8.7	7.5
	710	764.5	764.5	589.8	594.4	26.6	94.1	51.6	101.6	8.6	432.8	669.3	50.8	50.8	132.4	132.4	8.7	7.5
EFxxx04	**560**	660.3	660.3	595.9	578.1	26.0	94.1	-	50.8	8.7	418.6	634	50.8	50.8	94.5	94.5	8.7	7.5
	630	764.8	764.8	632.8	614.1	26.7	94.1	51.6	101.6	8.7	471.0	704	50.8	50.8	122.3	122.3	8.7	7.5

Note: Values above are in millimeters (mm) and subject to change. Refer to CAD models for the latest designs.

3.3 Electrical installation

⚠ WARNING

Electric shock

Supply power, stored charge in capacitors, and a rotating permanent magnet rotor can each produce hazardous voltage at motor terminals. The rotor produces voltage even when the motor is disconnected from power, and airflow through the fan can turn it. Contact with this voltage could cause death or serious injury and damage to the equipment.

- Before installing, troubleshooting, or repairing the motor, disconnect and lock out motor supply power and follow all site-specific safety procedures.
- Stop the impeller and secure it against rotation.
- Wait at least one minute for capacitors to discharge.
- Verify voltage at the motor terminals with a properly tested voltage meter.
- Do not open electrical compartments or touch unprotected terminals when the rotor is turning.

This section covers connection requirements, grounding, wiring guidelines, and control options for the Aircore EC+ Fan.

Sections 3.3.1 to 3.3.7 apply to both motor variants: Aircore EC+ and the Aircore EC+ with AFE. The control connections differ between variants and are covered in sections 3.3.8 and 3.3.9. If the motor catalog number starts with AE, go to section 3.3.8. If it starts with AM, go to section 3.3.9.

3.3.1 Connection requirements

⚠ WARNING

Electric shock and fire

Loose connections, wires on the wrong terminal, or exposed conductor strands could cause electric shock or fire, resulting in death or serious injury and damage to the equipment.

- Use the wire gauge specified in Table 6.
- Use terminating ferrules on all supply wires, with no strands outside the ferrule.
- Connect each wire to its correct terminal as shown in Figures 13 and 14.
- Make sure each wire is fully inserted and clamped in its spring terminal.
- Tighten the grounding lug screw to 2 N·m (see Table 6)

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.

To install ferrules:

1. Disconnect and lock out motor supply power.
2. Stop the impeller and secure it against rotation.
3. Wait at least one minute for capacitors to discharge.
4. Verify voltage at the motor terminals with a properly tested voltage meter.
5. 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.

Follow NFPA 70 (NEC) and NEMA MG 2 for motor power wiring.

3.3.2 Control methods

Infinitum provides its own configuration software, called I-con motor control software (I-con), for configuring and controlling motors.

Infinitum Aircore EC+ motors support the following standard industry control methods:

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

Note: Refer to I-con for additional information on register configuration for the different modes.

3.3.2.1 Analog/Digital connection

Enable this mode by configuring, at a minimum, the registers for control mode, speed input source, and start/stop input source. Control speed with an analog signal (0-10 V, 4-20 mA) or with a combination of digital inputs. Contact Infinitum if Analog/Digital mode is required as a default. Note that, even when the control mode is set for Analog/Digital, the motor communicates over Modbus for all functions except for speed control. The Aircore EC+ motor requires a Modbus RTU server address, but the EIA-RS485 wiring to a Modbus RTU master is optional.

Refer to the Modbus Parameters Manual for additional details.

3.3.2.1.1 GUI override (I-con)

The user activates GUI override mode manually in I-con. It is not intended to be activated externally, for example from a controller. This mode enables I-con to temporarily override Analog/Digital speed control when the motor is configured for Analog/Digital control mode.

3.3.2.2 Modbus connection

Enable this mode by configuring, at a minimum, the registers for control mode, speed input source, and start/stop input source. Infinitum ships Aircore EC+ motors configured for Modbus by default. The Aircore EC+ motor requires a Modbus RTU server address and hardwired EIA-RS485 wiring to a Modbus RTU master.

Refer to the Modbus Parameters Manual for more details.

If BACnet MS/TP communication is utilized, the Aircore EC+ motor is configured for Modbus. The BACnet MS/TP module converts the Modbus RTU protocol to BACnet MS/TP. The Aircore EC+ motor, configured for BACnet MS/TP communication, requires a Modbus RTU server address.

Refer to the BACnet User Manual for more details.

3.3.3 Ground circuit verification

⚠ WARNING

Electric shock

An ungrounded motor frame can become energized during an electrical fault. Contact with an energized frame could cause death or serious injury.

- Verify ground continuity between motor frame and the equipment grounding conductor before energizing the motor.

Take resistance readings with a multimeter on the ground motor circuit to verify continuity of the equipment grounding conductor back to the service ground. Per NEC 250.4(A)(5), the path must be low-impedance and capable of carrying fault current. Readings should be near zero (typically less than 1 Ω, or as your site standard requires). All electrical equipment must be grounded and bonded to the facility ground system with minimal resistance.

Never apply power to a motor that does not have a complete ground circuit.

3.3.4 Grounding configurations

Infinitum Aircore EC+ motors can be installed in one of the following:

1. Grounded Wye
2. Grounded Wye in combination with either Delta or High Resistance Ground (HRG) topology.

The catalog ordering number identifies the grounding topology.

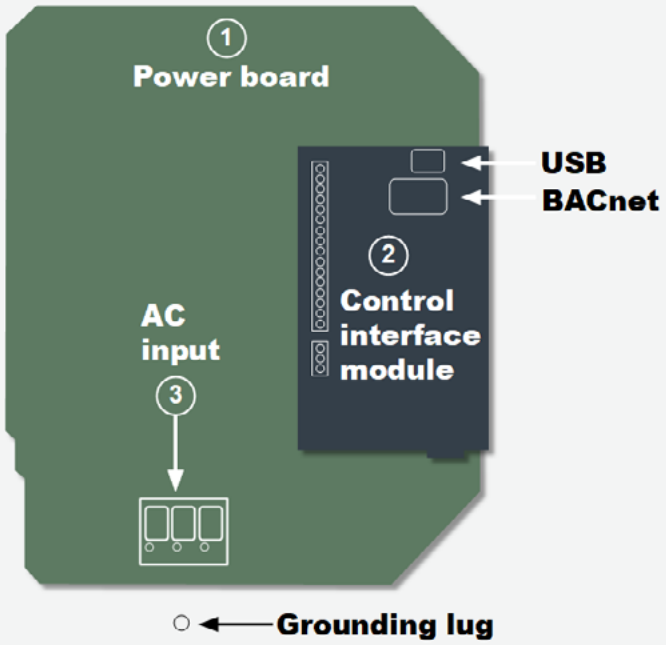
3.3.5 Connection locations

Each of the circuit boards and housing components has a separate design function. Only the Control Interface Module (CIM) and AC Input have user inputs.

Figure 12 highlights the main circuit boards and connection points.

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: Grounding lug is in the chassis.

Figure 12: Main motor board



Note: Safety cover removed for illustration purposes.

3.3.6 Conductor size and terminal data

Table 6 lists the maximum conductor size, exposed conductor length, and terminal type for each board and terminal.

Table 6: Conductor size

Board/Terminal	Terminals	Maximum conductor size mm^2	Maximum conductor size AWG	Exposed conductor length	Terminal type
CIM-CIO (16-terminal)	Control terminals	0.2-1.3	24-16	9 mm	Spring terminal
CIM-CIO / CIM-CIO-AFE (18-terminal)	Control terminals	0.2-0.5	24-20	9 mm	Spring terminal. One conductor per position, no solder-tinned wire.
Power board	AC Mains-U, V & W	0.2-8.4	24-8	11-13 mm	Spring terminal
Screw terminal	Earth ground	0.8-8.4	18-8	NA	Lug and screw
Fault Relay (3-terminal)	Fault terminals	0.2-1.3	24-16	9 mm	Spring terminal

Note: The maximum torque on the earth grounding lug and screw is 2 N·m. The grounding location post size is M5.

3.3.7 Circuit breaker and wire sizing



Provide short-circuit protection for the input power conductors. Use UL- and/or CSA-approved Class CC or Class J fuses, or UL 489 circuit breakers, sized per applicable regulations or Table 7.

Size the supply conductors to the motor's current requirements. Table 8 lists the connector minimum and maximum wire sizes.

Overload protection is not required for Infinitum motors marked as Electronically Protected L or E.P.L. Use and set approved motor overload protectors as local regulations require (UL and/or CSA). 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 5 kA.

Note: Confirm latest rated current values using the Motor Selection Tool.

Table 7: Breakers and fuses (three-phase)

Voltage VAC (+/- 10%)	Power (HP)	Rated current (A)	Listed/Certified fuses or breakers	Minimum suggested wire size (AWG)
415/460	5	6.0	10	16
	7.5	9.0	15	14
	10	12.0	15	14
	15	17.0	20	12
575	5	4.8	10	16
	7.5	7.2	15	14
	10	9.6	15	14
	15	15	20	12

Table 8: CIM terminal connection data

Conductor type	min.	max.
Rigid cable cross-section	0.2 mm²	6 mm²
Flexible cable cross-section	0.2 mm²	6 mm²
Cross section AWG	24	10
Wire-end ferrules (w/insulating collar)	0.2 mm²	4 mm²

3.3.8 Aircore EC+ motor connections

This section covers the control and power wiring for the Aircore EC+ motor. Before removing the VFD cover, disconnect and lock out power to all relay circuits; see warning in section 3.3.8.1. Remove the VFD cover for access to Analog/Digital, Modbus, and (optional) BACnet connections.

3.3.8.1 Control wiring requirements

⚠ WARNING

Electric shock

The relay output terminals (KCOM, NO, NC) can carry up to 125 VAC from an external power source. Locking out the motor supply power does not de-energize relay circuits. Wire larger than 20 AWG cannot be securely clamped in the control terminals and could loosen. Contact with a live wire could cause death or serious injury.

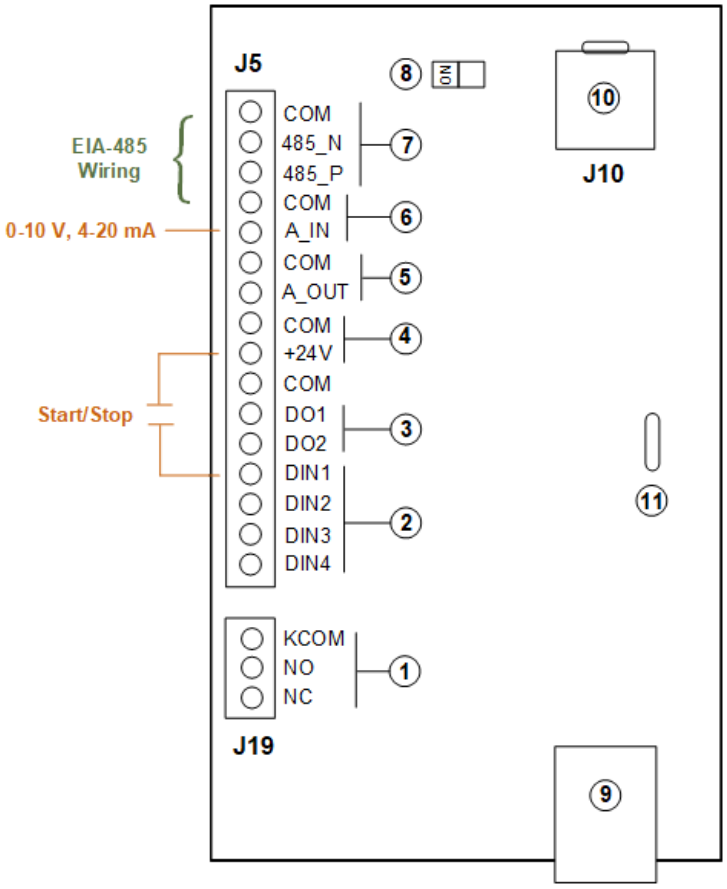
- Disconnect and lock out power to all relay circuits before wiring the control terminals.
- Do not insert external wiring larger than 20 AWG into the control terminals.
- Keep relay wiring separated from low-voltage control wiring.

- Join shield wires with a wire nut. **Do not connect shields to COM**.
- Control terminals use push-button spring clips.
- The relay output indicates internal faults only; it cannot be configured.

1. Relay (1) – NO / NC (KCOM must be used)
   - Max voltage: 125 VAC / 30 VDC
   - Max current: NO-5 A VAC, 5 A VDC
   - Max current: NC-3 A VAC or VDC
2. Digital input accepts 24 VDC (4x) – DIN1, DIN2, DIN3, DIN4
3. Digital output (2x) – DO1 & DO2
   - Open drain output
   - Max switching voltage: 40 VDC
   - Max switching current: 350 mA

   NOTICE: Permanent damage to DO1 and DO2 can result from exceeding 40 VDC or 350 mA.
4. Auxiliary voltage (1) – +24V (COM must be used), 250 mA max
5. Analog output (1) – A_OUT (COM must be used) 10 V, 10 mA max
6. Analog input (1) – A_IN (COM must be used)
7. EIA-485 interface (1) – 485_P & 485_N (Modbus RTU or BACnet MS/TP)
8. EIA-485 termination switch. (Default is Off)
9. RJ45 (Ethernet) for I-con connection
10. Optional BACnet module
11. USB-C for I-con connection

Figure 13: 16-terminal CIM-CIO board



Note: Earlier versions of the CIM-CIO board use a USB-micro as a serial port to connect to I-con. The CIM-CIO board also supports a TCP port where an RJ45 cable can be used to connect to I-con.

3.3.8.2 Analog control wiring guidelines

NOTICE
Exceeding the input ratings will permanently damage the communications board. Apply no more than 24 VDC to digital inputs DIN1-DIN4 and keep analog input A_IN within (0-10 V, 4-20 mA). Do not exceed the maximum output ratings for DO1, DO2,+24 V, and A_OUT.

To control the unit using Analog control, use the wiring guidelines on the CIM-CIO board (Figures 13 and 13a). Note that a 24 VDC external voltage source can be used for the IO, but it must have a common DC reference.

Refer to Analog / Digital Control Configuration and Wiring for additional details.

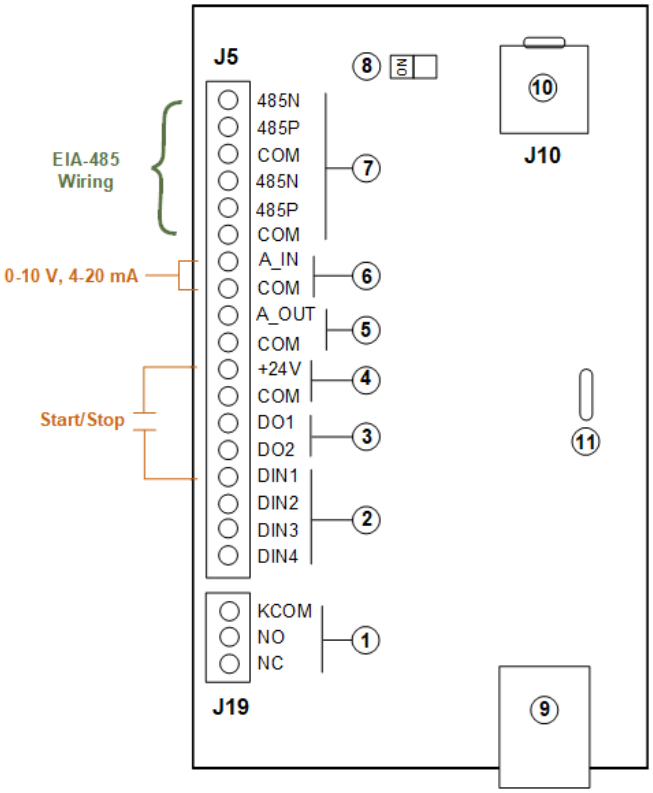
3.3.8.3 Modbus RTU or BACnet MS/TP wiring guidelines

NOTICE
Connecting the shield to COM or the motor assembly can create ground loops that damage the communication board and cause communication errors. Connect the shield to ground at the controller only.

To control the motor with Modbus RTU or BACnet MS/TP, use the wiring guidelines to connect to the Communication I/O.

- On the last unit on a daisy-chain Modbus RTU or BACnet MS/TP configuration, set the EIA-485 termination DIP switch to “ON”. The termination resistance is 120 Ω.
- On all other units set the DIP switch to “OFF”.
- For Modbus RTU operation, change the server address in the motor configuration parameters. Refer to the Modbus Parameters Manual for required changes.
- For BACnet MS/TP operation, change the Device Instance field to give each motor a unique BACnet identifier. Refer to the BACnet User Manual.
- To connect multiple motors, see section 3.3.10, Daisy-chain wiring.

Figure 13a: 18-terminal CIM-CIO board



3.3.8.4 AC main input connections

The AC main inputs are on the power board (Figure 14).

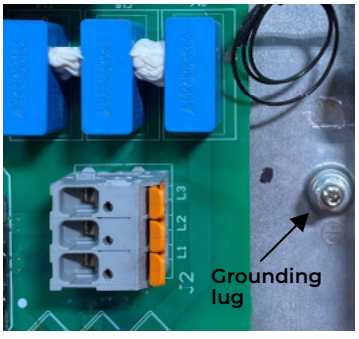
The AC input terminals feature spring clips. Lower the orange tab, insert the wire, then close the tab to secure it (Aircore EC+ variant only). The grounding lug is located off the power board on the chassis itself.

Provide 415 V/460 V/575 VAC, three-phase, 60 Hz power to the unit at the AC main input connection points at the AC main input terminals. Make sure to install the ground connection.

The supply voltage connections are:

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

Figure 14: AC input terminals



3.3.9 Aircore EC+ (AFE) motor connections

This section covers the control wiring for the Aircore EC+ with AFE motor. Only the control wiring requirements differ from the Aircore EC+. For analog control wiring, Modbus RTU or BACnet MS/TP wiring, and AC main input connections see sections 3.3.8.2, 3.3.8.3, and 3.3.8.4.

Before removing the VFD cover, disconnect and lock out power to all relay circuits; see warning in section 3.3.8.1. Remove the VFD cover for access to Analog/Digital, Modbus, and (optional) BACnet connections.

3.3.9.1 Control wiring requirements

⚠ WARNING

Electric shock

The relay output terminals (KCOM, NO, NC) can carry up to 125 V from an external power source. Locking out the motor supply power does not de-energize relay circuits. Wire larger than 20 AWG cannot be securely clamped in the control terminals and could loosen. Contact with a live wire could cause death or serious injury.

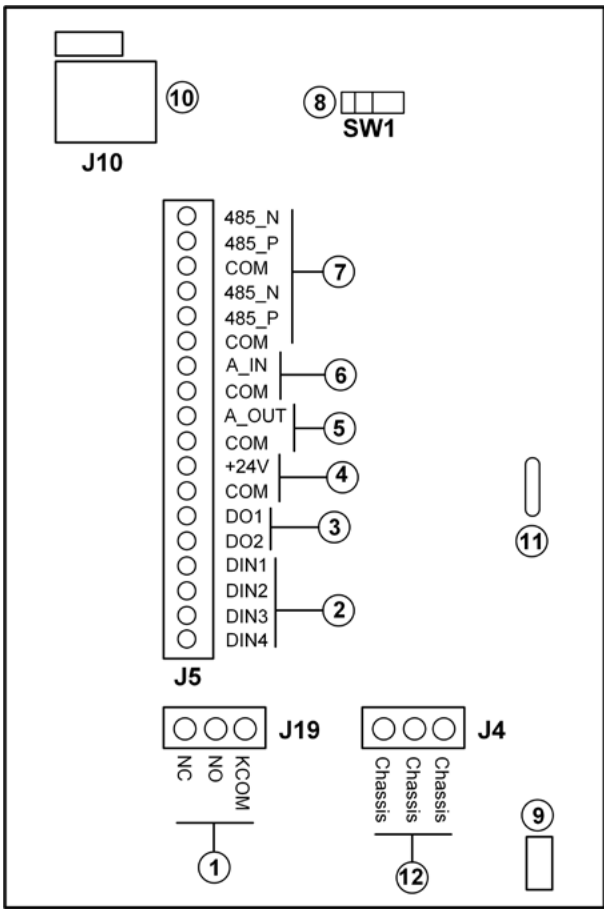
- Disconnect and lock out power to all relay circuits before wiring the control terminals.
- Do not insert external wiring larger than 20 AWG into the control terminals.
- Keep relay wiring separated from low-voltage control wiring.

The relay output signals internal fault only and is not configurable.

1. Relay (1) – NO / NC (KCOM must be used)
   - Max voltage: 125 VAC / 30 VDC
   - Max current: NO-5 A VAC, 5 A VDC
   - Max current: NC-3 A VAC or VDC
2. Digital input accepts 24 VDC (4x) – DIN1, DIN2, DIN3, DIN4
3. Digital output (2x) – DO1 & DO2
   - Open drain output
   - Max switching voltage: 40 VDC
   - Max switching current: 350 mA

   NOTICE: Permanent damage to DO1 and DO2 can result from exceeding 40 VDC or 350 mA.
4. Auxiliary voltage (1) – +24V (COM must be used), 250 mA max
5. Analog output (1) – A_OUT (COM must be used) 10 V, 10 mA max
6. Analog input (1) – A_IN (COM must be used)
7. EIA-485 interface (1) – (Modbus RTU or BACnet MS/TP)
8. EIA-485 termination switch. (Default is Off)
9. USB for BACnet module programming
10. Header for optional BACnet module
11. USB-C for I-con connection
12. Chassis terminal block

Figure 15: 18-terminal CIM-CIO-AFE board



Note: The CIM-CIO-AFE board has only one USB-C and does not support a TCP/IP port.

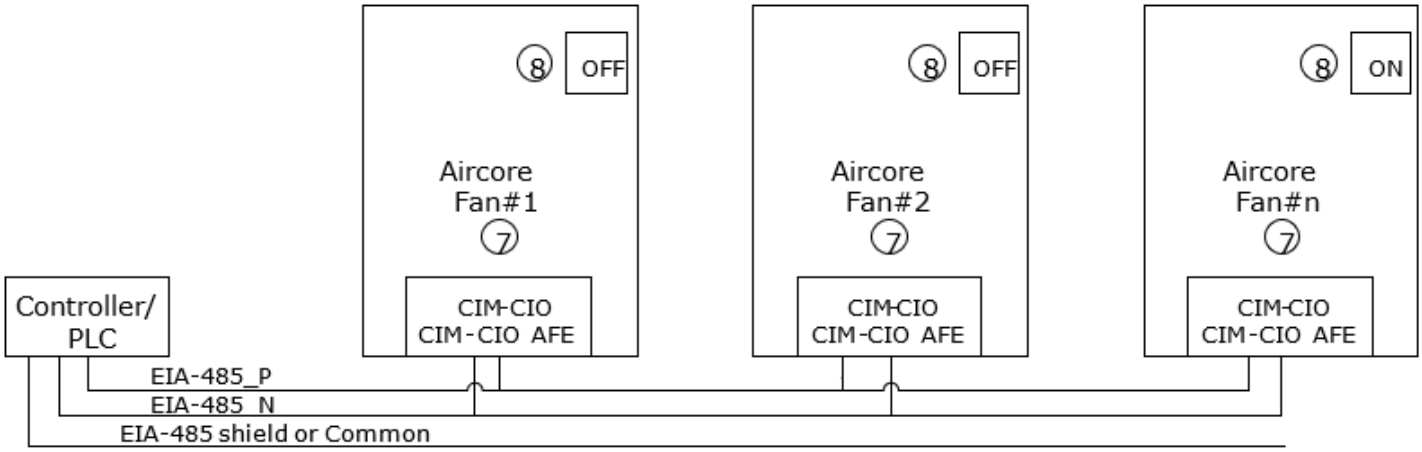
3.3.10 Daisy-chain wiring

NOTICE
If you use shielded cable, connecting the shield to COM or the motor assembly, or grounding it at more than one point, can create ground loops that damage the communication board and cause communication errors. At each motor, connect the IN and OUT shield wires together inside the VFD and insulate the splice. Do not connect the shield to COM or the motor assembly. Connect the shield to ground at the controller only.

You can daisy-chain multiple Aircore EC+ Fans, as shown in Figure 16.

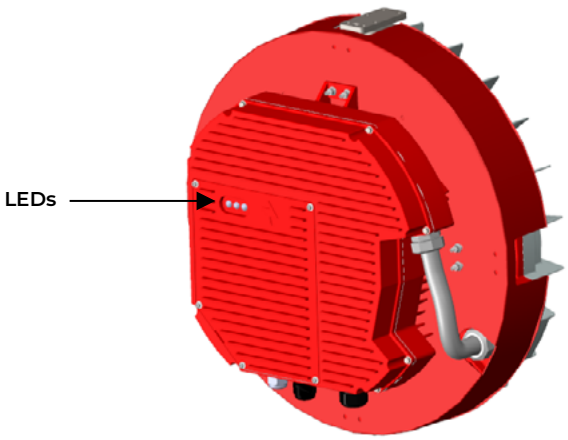
Refer to PN# 23-05 | September 6, 2023 for more details.

Figure 16: Multiple Aircore EC+ fans



3.3.11 LED operation

Figure 17: Operational status LEDs



All Infinitum motors in Aircore EC+ Fans have three LEDs viewable on the outside of the VFD that indicate operational status (Figure 17):

Green: Normal operation; mains AC input is active

Yellow: Blinking “heartbeat”; inverter is operational

Red: Fault or important user notification

3.4 Fan motor rotation

This section covers testing the fan motor's rotation and system operation when the motor is under load.

If the motor has been tested, and the technician has verified motor rotation prior to installation, the facility can elect to skip this test.

Prerequisites:

- The motor is installed, aligned, and electrically connected

When looking at the shaft end of Infinitum motors, the standard rotation is counterclockwise (CCW).

To check the motor rotation:

1. Review all installation instructions and all warnings before 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 to the intended direction, switch the direction command using I-con.
4. Disconnect AC power.

3.5 Software control

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

Refer to section 3 of I-con for information on firmware updates.

4 Piezometric airflow measurement

Infinitum Aircore EC+ Fans include two pre-installed rivet nuts (Figure 18). For users requiring airflow measurements these rivet nuts can be used with "push-to-fit" tube attachment devices.

Figure 18: Rivet nuts



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, use a pressure transducer to measure 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 Aircore EC+ Fans can be calculated with the following formula and data from Infinitum: $Q = K \sqrt{\Delta P}$ where K comes from Table 9 and ΔP is the differential static pressure from the two taps installed in the Aircore EC+ Fan. Q is in CFM; ΔP in inches of water.

Table 9: K values by 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
EFxxxx04	630	3836
	560	3031

5 Maintenance

⚠ WARNING

Electric shock and rotating parts

Live electrical parts, stored capacitor charge, and a turning permanent magnet rotor can cause electric shock. Unexpected start-up or a wheel turned by airflow can cause contact with rotating parts. These hazards could cause death or serious injury.

- Disconnect and lock out electrical power.
- Make sure the wheel has stopped, then block or secure it so it cannot rotate.
- Wait at least one minute for capacitors to discharge.
- Verify zero volatage at the motor terminals before starting work.

No spare parts should be required during the first year of normal operation.

Regular servicing and visual examinations, performed at the suggested intervals, will help maintain the fan's performance and prevent potential issues.

5.1 Windmilling during servicing

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, secure the impeller to restrict rotational movement in a powered-down condition.

5.2 Fan inspection and cleaning

NOTICE

Striking or pressing on the fan wheel can distort it, which could cause severe vibration and damage to the fan. When cleaning debris from the wheel, do not strike the wheel or apply pressure that could bend it.

Inspection frequency depends on 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 be as 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.

5.3 Bearing lubrication

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

5.4 Taper-Lock bushing

⚠ WARNING

Flying parts

Worn hex keys can strip Taper-Lock screws or prevent full tightening. A loose wheel hub could come apart during operation and cause death or serious injury and damage to the equipment.

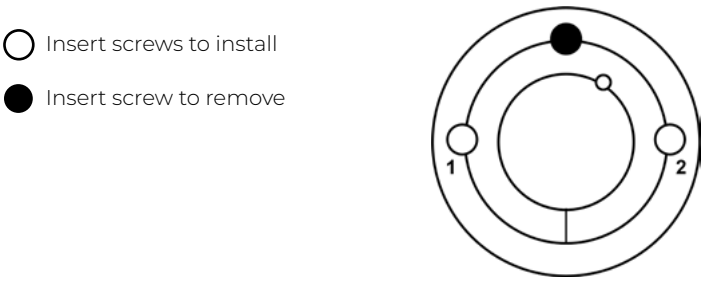
- Use only hex keys in good condition and use only genuine Taper-Lock screws.

The fan wheel is mounted on the shaft with a Taper-Lock bushing. If the bushing loosens during operation, tighten it as described in section 5.4.1. If the fan wheel needs to be repositioned or realigned on the shaft, release the bushing as described in section 5.4.2, then tighten it as described in section 5.4.1.

Table 10: Taper-Lock bushing clamp bolts – torque

Bushing No.	ft·lbs	N·m
1610	12.5	17
2012	19.2	26
2517	30.3	41
3020	56.8	77

Figure 19: Taper-Lock bushing



5.4.1 Tightening

To tighten the bushing:

1. Stop the fan and lock out all power. Block the wheel so it cannot rotate. Airflow through the fan can turn the wheel even when the motor is locked out.
2. Open the access door to get access to the bushing.
3. Remove the grease from the forcing bore (black circle in Figure 19). Clean dirt and debris from the bushing face and screw heads.
4. Check the shaft, key and bushing for damage, such as scoring, fretting or a worn keyway. If you find damage do not retighten. Contact Infinitum support.
5. Check that the wheel is in the correct position, with the inlet cone overlap as shown in Figure 6 and the wheel centered in the inlet cone. If it is not, loosen and reposition the wheel as described in 5.4.2.
6. Tighten screws 1 and 2 alternately and evenly to the torque given in Table 10.
7. Place a drift or sleeve against the bushing face and tap lightly with a hammer. Do not strike the bushing directly.
8. Retighten screws 1 and 2 to the specified torque.
9. Repeat steps 7 and 8 until the specified torque no longer turns the screws after hammering.
10. Fill the forcing bore with grease to keep dirt out.
11. Remove the blocking and turn the wheel by hand. Check that it does not rub on the inlet cone or housing.
12. Close the access door and remove the lockout.
13. Lock out power, block the wheel, and check that screws 1 and 2 are still at the Table 10 torque (steps 1-2 and 6) Restore the fan to service (steps 11-12).

5.4.2 Loosening and realigning

To loosen and realign the bushing:

1. Stop the fan and lock out all power. Block the wheel so it cannot rotate. Airflow through the fan can turn the wheel even when the motor is locked out.
2. Open the access door to get access to the bushing.
3. Remove the grease from the forcing bore (black circle in Figure 19). Clean dirt and debris from the bushing face and screw heads.
4. Support the wheel so it cannot drop or slide when the bushing releases.
5. Remove screws 1 and 2. Replace any screw with damaged threads or head.

6. Oil the threads of one screw and insert it into the forcing bore.
7. Tighten the screw until the bushing releases from the hub.
8. Remove the screw from the forcing bore.
9. Move the wheel to the correct position on the shaft, with the inlet cone overlap as shown in Figures 6 and 7 and the wheel centered in the inlet cone.
10. Make sure the tapered surfaces are clean. Do not lubricate them.
11. Oil the threads and points of screws 1 and 2. Insert them into holes 1 and 2, but do not tighten them yet.
12. Tighten the bushing as described in 5.4.1, starting at step 6.

6 Fan operations

6.1 Windmilling during operation

Infinitum Aircore 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 is above 200 RPM, alternative solutions are required such as anti-windmilling devices like brakes, clutches, or louvers.

7 Related documents

The Aircore EC+ product family is supported by the following documentation.

	Aircore EC+ Installation, Operation, and Maintenance Manual	**Modbus Parameters**	**Aircore EC+ I-con Software Manual**	**Aircore EC+ BACnet User Manual**	**Aircore EC+ Fan Installation, Operation, and Maintenance Manual**
Key Topics Addressed	Receiving, installing, operating, maintaining the motor; Level-1 motor troubleshooting; field wiring diagrams and specifications.	Table of supported Modbus registers with descriptions, default values, compatible firmware versions, and fault codes for advanced troubleshooting.	Installing, connecting to, and navigating the I-con software; detailed description of software features and how they interact with the hardware and Modbus registers.	Supplemental for installations using the optional BACnet module; BACnet-to-Modbus mapping; BACnet Protocol Implementation Conformance Statement (PICS).	Receiving, installing, operating, and maintaining the fan; Level-1 fan troubleshooting; field wiring diagrams and specifications.
	Aircore EC+ Installation, Operation, and Maintenance	Modbus Parameters	Aircore EC+ I-con Software Manual	Aircore EC+ BACnet User Manual	(This document)

The following resources help with fan selection and setup:

Infinitum Fan Selection Tool
Motor Selection Tool
Wiring Quick Start Guide

8 Troubleshooting guide

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

Only qualified personnel with the proper tools and equipment should troubleshoot or service the motor. Follow LOTO procedures per company guidelines.

“Motor” refers to the motor system consisting of the motor and VFD.

When contacting Infinitum Support, have the Save State and Statistics file available for further diagnostics. Use I-con to save the Save State and Statistics files (Refer to the I-con Software Manual).

See Appendix A: Faults and error codes in the Modbus Parameters Manual for a list of fault codes. See also Fault codes and Fault code troubleshooting below.

8.1 Motor troubleshooting

Issue	Observations	Probable Cause	Mitigation
Motor unresponsive/ fails to start	No LED status lights Nearby motors also inoperable	No supply voltage (see nameplate)	• Check incoming voltage. • If no incoming voltage, contact the 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 AC 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, initiate an RMA for the motor (Gen 2/3 only). • Close cover and try power again if no open fuses (Gen 2/3 only). • If no LEDs are lit, contact Infinitum support to request a return merchandise authorization (RMA).
	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 volt-age or incorrect I/O terminal connection	• The +24 V terminal on the I/O board is OUTPUT in DC voltage only. • The digital input 1 (DIN1) needs to receive 24 VDC 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 (0-10 V, 4-20 mA) for 0-100% speed.
	Red LED Fault LED illuminated	Internal electrical issue	• Use I-con to determine fault, and Serial # for motor. • See Fault code troubleshooting for the cause and mitigation of each fault. • Photograph motor label and reach out to Infinitum Support for assistance.

Issue	Observations	Probable Cause	Mitigation
Non AFE motor only. No connection to Motor Control Software via TCP (Ethernet)	LEDs (green on, yellow flashing), No red LED	Incorrect motor operating mode	• Change I-con 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 (subnet 255.255. 0.0) Set your computer to a static IP address on the same subnet.
I-con connects to motor, but motor won't start	Fault observed in upper right corner of I-con	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. If a Motor Parameters fault is reported, see Motor Parameters. • Record the state of the motor and the order of the faults as they are listed. • Refer to the Modbus Parameters Manual. • Refer to Fault Page on the Infinitum Support page for information. • Refer to Fault code toubleshooting for the cause and mitigation of each fault. • Clear Faults with I-con 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 it runs normally, run the motor at mid speed and then full speed, for 10 mins each. • If the motor runs for both with no issue, then remove the laptop and return motor to service.
I-con connects to motor, but motor has Modbus or Serial communication issues	I-conconnects 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 deter-mine if anything looks burnt, unplugged, or out of place. • Contact Infinitum Support with any concerns. Pictures will help. • Confirm power is removed and LOTO is applied. Then spin the motor by hand to check that it turns freely. • If there is resistance, record it with a video and send to Infinitum Support. • If motor spins freely then remove the EIA-485 communication 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 EIA-485 DIP switch installed per specs and only at the end of line. • Confirm all motors that are not end of line motors have the EIA-485 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 link. • Install wires from USB to RS485 adapter in the comm ports. • See if the motor will run using only I-con and attached wires.

Issue	Observations	Probable Cause	Mitigation
			• If YES then there is a field wire issue. • If NO then contact Infinitum Support for a new CIO board.
I-con control software connects to motor but not delivering 100% power	Motor is running, LEDs are normal (green ON, yellow flashing)	Power wiring, or Board issue	• Perform LOTO. • Remove VFD access cover on Gen2 or entire drive cover on Gen3 VFD. • Confirm connections for power connections, measure the mains AC line-in wiring for all three phases. • The motor will run even if one phase is lost. • A missing phase lowers the DC bus voltage; if it drops far enough, the motor stops with an Under-voltage fault (see Under-voltage).

Note: Gen x refers to the motor generation.

8.2 Fan troubleshooting

Issue	Observations	Probable Cause	Mitigation
Excessive noise	Metallic scrape or squeal. Scoring on the inlet cone or wheel.	Wheel rubbing inlet	• Adjust the wheel and/or inlet cone. • Check wheel hub fasteners for proper torque and tighten if necessary.
	Growl or chirp at the bearing housing. Housing running hot.	Bearings	• See Motor Installation, Operation, and Maintenance Manual. Contact Infinitum Support.
	Hum or thump that rises with fan speed.	Wheel imbalance	• Clean any dirt or debris off the wheel. • Check wheel balance and trim balance if necessary.
	Rattle or drumming; loudest at the support structure.	Improper installation	• Ensure installation is robust enough to support the fan system.
Low CFM	Airflow and RPM below design spec.	Fan	• Check fan wheel for correct rotation. • Check fan speed. • *Increase fan speed.
	Static pressure above design spec. Dirty filters, closed dampers, or crushed duct.	Duct system	• Check duct installation to ensure alignment with engineering drawings and ensure ther are no poor inlet or discharge conditions.
High CFM	Airflow and RPM below design spec.	Fan	• Decrease fan speed.
	Static pressure below design spec. Filters missing or dampers wide open.	Duct system	• Check duct installation to ensure alignment with engineering drawings. • Check system pressure during testing and balance.
High power	Amps above rating. Overloads tripping. RPM above design spec.	Fan	• Check fan wheel rotation. • Check system pressure during testing and balance. • Reduce fan speed.
	Static pressure below design spec. with airflow above design spec.	Duct system	• Check duct installation to ensure alignment with engineering drawings. • Check system pressure during testing and balance.

Issue	Observations	Probable Cause	Mitigation
Excessive vibration	Vibration rises with speed. Debris on wheel or bushing seated at an angle.	System imbalance	• Check for any dirt or debris on rotation components. • Check that the bushing is installed correctly on the motor shaft and not on an angle. • Trim balance wheel if necessary.
	Bolts or screws backed out.	Loose fasteners	• Check all fasteners for tightness, particularly the bushing bolts and set screws.
	Vibration worse at the structure. Isolators bottomed out or uneven.	Improper installation	• Ensure installation is robust enough to support the fan system.

* Always check motor amps and compare to nameplate rating. Excessive fan speed may overload the motor and result in motor failure. Do not exceed the maximum fan RPM as provided in this manual.

8.3 Fault codes

I-con displays the Fault Words (Modbus registers 4011, 4012, 4013, and 4014) and the CIM Status register (4015) as decimal values. Convert a value to binary to read which bits are set, as shown in the tables below.

Fault Word - Main (4011)

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Startup	Motor Stopped	N/A	Motor E-Stop (a.k.a Motor Disable)	Motor Parameters	V Phase Imbalance	I Phase Imbalance	UART Comms Error	DC Bus Over-current	Gate Driver Under-voltage	Gate Driver	Over-temperature	Under-voltage	Over-voltage	Over-current	Hardware

Example: I-con reports 17, which is 00010001b. Bit 0 and Bit 4 are set to 1, so it is a hardware, over-temperature fault.

Fault Word - Gate Drive (4012)

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	UVLO	N/A	N/A	General Fault

Example: I-con reports 8, which is 00001000b. Bit 3 is set to 1, so it is a UVLO fault.

Fault Word - Over Temp (4013)

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	Board	Stator Phase	N/A	N/A	N/A	Therm4 (Stator2)	Therm3	Therm2 (Stator1)	Therm1

Example: I-con reports 8, which is 00001000b. Bit 3 is set to 1, so it is a Stator 2 over-temperature fault.

CIM Fault Word (4014)

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	CIM Board Overtemp	Failure to Write Inverter	User 24V Fault	Analog Input	Digital Input	Comms With Inverter

Example: I-con reports 8, which is 00001000b. Bit 3 is set to 1, so it is a User 24V fault.

CIM Status (4015)

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
N/A	N/A	N/A	N/A	N/A	N/A	N/A	Analog Failover	Modbus Failover	Override	Interlock	N/A	N/A	N/A	N/A	N/A

Example: I-con reports 32, which is 001000000b. Bit 5 is set to 1, so Interlock is active. These are status bits, not faults.

8.4 Fault code troubleshooting

The following is a guide to troubleshooting faults. It describes the cause(s) or each fault and potential mitigation.

Fault	Cause	Troubleshooting/Mitigation
Fault Word - Main: Hardware	Inverter hardware protection circuit has tripped. This fault is always accompanied by one of the following: • Over-temperature: Stator 1 (Therm2) or Stator 2 (Therm4) hardware temperature limit exceeded. • Over-current: hardware current limit exceeded. • Over-voltage or Under-voltage: DC bus voltage outside the hardware limits.	• Check which of Over-temperature, Over-current, Over-voltage or Under-voltage is also set, and see that fault for details. • If this fault is persistent and appears immediately upon starting the motor, the inverter board may be damaged.
Fault Word - Main: Over-current	Stator phase current exceeded the hardware trip level. Trip levels for current production motors: • 5 HP: 28 A • 7.5 HP: 50 A • 10 HP: 50 A • 15 HP: 72.7 A	• Over-current can be caused by ramping to speed too fast, decelerating too quickly, or overloading the motor, which may cause the current to spike as the motor tries to start. • Increasing acceleration or deceleration time may resolve this if it occurs whenever the motor is run. Reducing or removing the load until the motor comes up to speed may have the same effect. • If the fault persists under no load, or with acceleration/deceleration times well over 60 s, it may indicate a hardware issue within the motor.
Fault Word - Main: Over-voltage	DC bus voltage exceeded the hardware trip level: 890 V (Aircore), 1000 V (AFE).	• Over-voltage can be caused by ramping to speed too fast or decelerating too quickly. • Increasing acceleration or deceleration time may resolve this if it occurs whenever the motor is run. • If the fault persists with acceleration/deceleration times well over 60 s, it may indicate a hardware issue within the motor.
Fault Word - Main: Under-voltage	DC bus voltage dropped below the hardware trip level of 415 V.	• Under-voltage typically occurs when the VFD power line is cut while the motor is running. Back EMF carries the motor for a while; once it spins down, the voltage falls below the threshold and the fault is set. • Other cases are likely due to an insufficient power supply. Check the voltage source. • Voltage is provided by three input phases. If one phase is lost, the bus voltage can fall. Check the connections for each input wire. • This can also be caused by a failure in the relay that bypasses the inrush current limiter.
Fault Word - Main: Over-temperature	A temperature sensor exceeded its fault limit. Fault Word - Over Temp shows which sensor: • Stator 1 (Therm2) and Stator 2 (Therm4): software or hardware limit. • Heatsink (Therm3), Therm1 and inverter board: software limit. Default fault limits are 120 °C for thermistors and 100 °C for the board (registers 4032–4035 and 4040).	• If any of the temperature faults is persistent and immediate upon motor startup, either the ambient temperature is too high, or there is an issue with the temperature sensor in question (i.e. it is damaged).
Fault Word - Main: Gate Driver	Gate driver fault output is active, indicating a hardware fault such as desaturation of the output SiC FETs.	• Caused by a motor short or failed FET. A hardware change is required to resolve it.

Fault	Cause	Troubleshooting/Mitigation
Fault Word - Main: Gate Driver Under-voltage	Gate driver supply is in under-voltage lockout.	• Indicates a failure in the VFD's power supply. A hardware change is required to resolve it.
Fault Word - Main: UART Comms Error	Inverter has not received valid UART data from the CIM for 5 seconds.	• UART errors may indicate noise in the system. If the motor is being tested with probes attached, or if any connections are loose or damaged, removing the probes or repairing the connections may resolve the error. • If communication is stuck in a bad state, restarting the motor may help.
Fault Word - Main: Motor Parameters	Inverter rejected the motor parameters loaded at power-up, or the parameters are missing.	• Inspect the motor label to determine the motor type and model, and upload the appropriate FSF using I-con's firmware update feature.
Fault Word - Main: Motor E-Stop (a.k.a. Motor Disable)	Emergency Stop command is active, or the inverter E-stop input is asserted. Stops the motor immediately.	• Remove the E-stop command from the controlling system, or release the E-stop input, then clear faults.
Fault Word - Main: Startup	Motor failed to reach minimum speed during startup (locked rotor). The inverter attempts to start for about 10 seconds, holds locked-rotor current for about 10 more seconds, then sets this fault.	• The motor may fail to gain speed under an exceedingly heavy load while stationary. Repeat the test with the load uncoupled. If the fault remains, there may be a hardware issue with the rotor. If the fault clears, the load on the motor may need to be reduced.
Fault Word - Gate Drive: General Fault	Gate driver fault output is active, indicating a hardware fault such as desaturation of the output SiC FETs.	• Caused by a motor short or failed FET. Will require a hardware change to resolve.
Fault Word - Gate Drive: UVLO	Gate driver supply is in under-voltage lockout.	• Indicates a failure in the VFD's power supply. Will require a hardware change to resolve.
Fault Word - Over Temp: Therm1	Thermistor 1 temperature exceeded its fault limit (default 120 °C). Not monitored by default (enabled with register 4031).	• If the temperature seems unrealistic, manually read the temperature (or measure/estimate room temperature) to check whether the reading is accurate. If it is not, there is likely a loose or broken connector. • If any of the temperature faults is persistent and immediate upon motor startup, either the ambient temperature is too high or there is an issue with the temperature sensor in question (i.e., it is damaged).
Fault Word - Over Temp: Therm2 (Stator 1)	Thermistor 2 (Stator 1) temperature exceeded its software fault limit (default 120 °C) or hardware limit. The stator is too hot. A hardware limit trip also sets Fault Word - Main: Hardware.	• The motor may be overloaded or running in an environment that is too hot, or the stator may have a short. • If the temperature seems unrealistic, manually read the temperature (or measure/estimate room temperature) to check whether the reading is accurate. If it is not, there is likely a loose or broken connector. • If any of the temperature faults is persistent and immediate upon motor startup, either the ambient temperature is too high or there is an issue with the temperature sensor in question (i.e., it is damaged).
Fault Word - Over Temp: Therm3 (Heatsink)	Thermistor 3 temperature exceeded its fault limit (default 120 °C). The FET heatsink is too hot.	• The motor may be overloaded or running in an environment that is too hot, or the FETs may be damaged. • If the temperature seems unrealistic, manually read the temperature (or measure/estimate room temperature) to check whether the reading is accurate. If it is not, there is likely a loose or broken connector. • If any of the temperature faults is persistent and immediate upon motor startup, either the ambient temperature is too high or there is an issue with the temperature sensor in question (i.e., it is damaged).
Fault Word - Over Temp: Therm4 (Stator 2)	Thermistor 4 (Stator 2) temperature exceeded its software fault limit (default 120 °C) or hardware limit. The stator is too hot. A hardware limit trip also sets Fault Word - Main: Hardware.	• The motor may be overloaded or running in an environment that is too hot, or the stator may have a short. • If the temperature seems unrealistic, manually read the temperature (or measure/estimate room temperature) to check whether the reading is accurate. If it is not, there is likely a loose or broken connector. • If any of the temperature faults is persistent and immediate upon motor startup, either the ambient temperature is too high or there is an issue with the temperature sensor in question (i.e., it is damaged).

Fault	Cause	Troubleshooting/Mitigation
Fault Word - Over Temp: Board	Inverter board temperature exceeded its fault limit (default 100 °C).	• If any of the temperature faults is persistent and immediate upon motor startup, either the ambient temperature is too high or there is an issue with the temperature sensor in question (i.e., it is damaged).
Fault Word - Comm/IO: Comms With Inverter	The CIM board has had more than 10 consecutive receive errors from the inverter board on the internal UART that connects the two boards. The CIM then attempts to resynchronize communication with the inverter (up to 2 consecutive attempts). The fault clears automatically once communication is restored.	• If intermittent, the connection between the boards may be bad or there may be electrical interference on the UART. • If persistent, the inverter board and/or the UART may be damaged.
Fault Word - Comm/IO: User 24 V Fault	The CIM user 24 V output reports a fault (e.g. overload or short circuit). Clearing faults resets the output.	• Check the wiring and loads connected to the +24 V output for a short or overload. • Clear faults. If the fault returns immediately, disconnect the loads and clear faults again to isolate the cause.
Fault Word - Comm/IO: CIM Board Overtemp	CIM board temperature exceeded the Board Temperature Fault Limit (register 4040, default 100 °C; same limit as the inverter board). Clears automatically once the board cools.	• If the temperature seems unrealistic, manually read the temperature (or measure/estimate room temperature) to check whether the reading is accurate. If it is not, there is likely a loose or broken connector. • If any of the temperature faults is persistent and immediate upon motor startup, either the ambient temperature is too high, or there is an issue with the temperature sensor in question (i.e. it is damaged).

Appendix

Technical specifications

Fan Assembly	
Impeller Types	Backward-curved, backward inclined, and airfoil designs.
Impeller material and finish	Aluminum
Inlet cone material and finish	Galvanized steel
Frame material and finish	Galvanized steel
Fan assembly dimensions	Refer to FST submittal for project details.
Bushing	Taper-Lock
Accessories	None
Speed Control	Modbus RTU, BACnet MS/TP or Analog
Inlet Guard	None
Fasteners	Galvanized steel
Piezo Taps	Inlet cone and front plate
Performance data	Project-specific: Refer to the Fan Selection Tool (FST) submittal and the Motor Selection Tool (MST) for airflow and static pressure, max RPM, motor BHP, motor speed, static efficiency, FEI, sound and balancing.
Dimensions, weight, and rotation	Project-specific: Refer to the FST submittal. Confirm before rigging and installing.

Environmental	
Ambient Temperature	-13 °F to 104 °F (-25 °C to 40 °C)
Storage Temperature	-40 °F to 185 °F (-40 °C to 85 °C)
Altitude	0 to 2,000 ft (0 to 1,000 m) 9% Per Derate per 1,000 m up to 2,000 m
IP Rating	IP65
Relative Humidity	95% non-condensing

Motor	
Wiring Diagram	CIM Wiring Diagram
Harmonics	Refer to FST submittal for project details. Refer to MST for motor specific details.

Regulatory	
Fan	AMCA Pending
Motor	ETL Certified to UL1004, UL1007, CSA

Note: For additional details refer to the Aircore EC+ Fan Technical Brochure and the Aircore EC+ Installation, Operation, and Maintenance Manual.

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