

Aircore EC

Installation, Operation & Maintenance Manual




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1. About the manual

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.

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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.

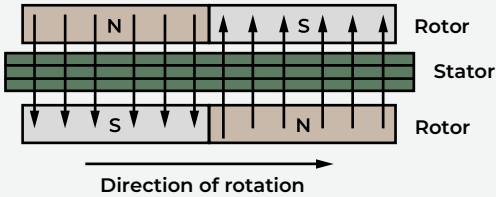
Notes: The text of the note is italicized. Notes add information that can aid in the completion of a process or step.

2. Motor technology

a. Motor overview

Infinitum has developed a new generation of electric motors with unparalleled efficiency and durability. We've reinvented axial air-core motors using lightweight materials and a modular design that generates the same power with less weight than a legacy motor. These motors include on optimized VFD (Variable Frequency Drive) for maximum performance and efficiency at a wide operating range. Infinitum has an established ecosystem of configuration software as well as optional IoT connectivity for real-time monitoring and analytics. 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.

Figure 1: Aircore EC stator



i. Aircore EC motor technology

The introduction of the Aircore EC motor surpasses motors utilizing standard technology and construction. Like all motors, Infinitum machines have a stator, the stationary part and a rotor. The rotating component Aircore EC motors have two rotors. In traditional motors the stator is located in the body of the motor and is usually made of iron cores with copper windings. This iron and copper adds to the overall weight of the motor. Additionally, the insulation on these coil windings degrades with heat and time requiring maintenance or eventual replacement of the motor.

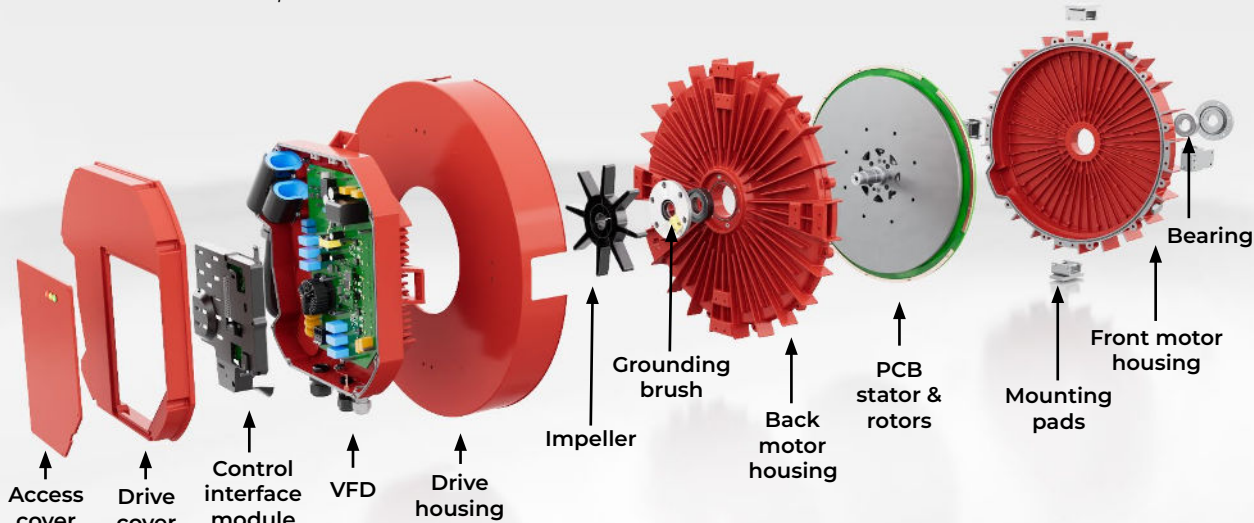
ii. Infinitum Aircore EC stator

The Aircore EC stator is a Printed Circuit Board (PCB) rather than utilizing a heavy iron core and with copper windings. The Infinitum motor is designed utilizing a PCB stator sandwiched between two rotors (Figure 1). Permanent magnets are attached to the surface of the two rotors. Since there is no iron in the magnetic path, the motors can be classified as an air-core design.

iii. Aircore EC motor components

The PCB stator design allows for a smaller motor that weighs significantly less than a conventional motor. Key components are identified by the drawing in Figure 2.

Figure 2: Aircore EC motor components



3. Receiving inspection

Review and complete all appropriate sections prior to motor installation. The motor is shipped in a robust container. The container and motor can be moved by using a dolly, pallet jack or fork truck (Figure 3).

a. Packing inspection

Inspect the motor packing for damages during shipping. If the package is damaged, remove the packing and inspect the motor for damage. Motor damage from shipping must be reported to shipper.

b. Remove motor from container

Warning: The motor is provided with threaded holes for a lifting lug. Lifting lugs may or may not be shipped with the motor. (Figure 4). The lugs are intended to lift the motor assembly only. Attaching the component it drives will exceed the design weight limits. To reduce the possibility of personal injury or death and equipment lift the motor only, make sure the lugs are completely threaded into the motor, and ensure they do not rotate out during lifting. Lifting eye-bolts are M10x1.5t thread, 20mm shank or 1/2"-13 thread, 1 1/2" shank length, depending on motor. Consult the appropriate drawing for that motor to be sure.

Warning: To reduce the possibility of personal injury and equipment damage, only use a lifting device and straps that are rated for the motor weight. Do not lift the motor without mechanical assistance. Always inspect straps for damages and weight certification prior to use.

Remove top of the packing crate and install the supplied lifting lugs (Figure 3). Make sure the lugs are threaded completely into the motor housing. Use an approved lifting device and sling to remove the motor from the packing crate.

Figure 3: Typical pallet

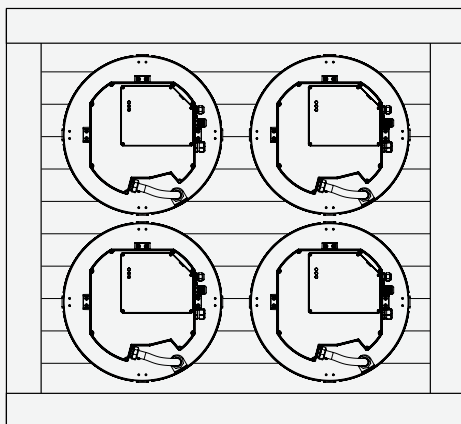
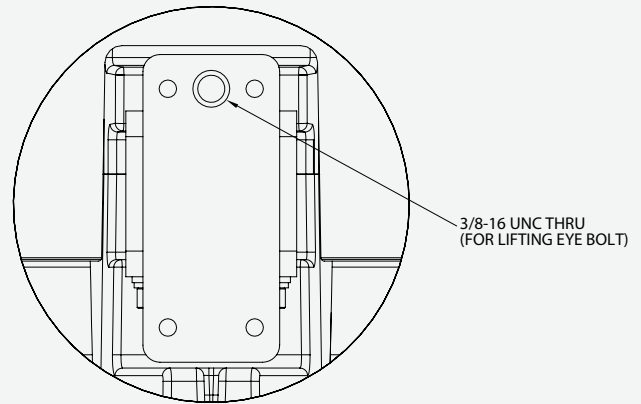


Figure 4: Lifting lugs



c. Compare nameplate data

- Compare data on nameplate with purchase order to verify receipt of proper motor.
- Compare data on nameplate for desired power supply and control equipment requirements.

d. Rotate motor output shaft

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 rotor safety procedures can cause serious injury or death and equipment damage.

Make sure all motor wire connections are properly terminated and insulated. Turn motor rotor (output shaft) by hand. It should turn freely with some drag from the bearing seals.

e. Ready spare storage


Motors purchased for ready spares are not placed into service immediately. These motors should be stored in a clean, dry space. Avoid spaces with large temperature swings to reduce condensation. Storage temperature is -40 to 185 °F (-40 to 85 °C).

Cover motors to prevent airborne dust and dirt particles. If storage area location is prone to vibration, place vibration dampers under motor base to prevent premature wear and damage to bearings.

i. Motor bearings

The bearings (Figure 5) used in this motor are lubricated and sealed at the factory. The motor does not require bearing lubrication in the field or during storage.

ii. 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 rotor safety procedures can cause serious injury or death and equipment damage.*

It is recommended the rotor (output shaft) be rotated five to ten times per every quarter (three months). 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 rotor.

Figure 5: Bearings



4. Motor installation

a. Preparation

Review this entire manual prior to scheduling the motor 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 of 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. Consult Infinitum for ambient temperatures not within these requirements.

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. Motor location

 *Warning: This motor 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.*

Electric motors have guidelines for the location and operating environment. These guidelines are listed below:

- The motor 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 gasses.
- The area should be free from dust and metallic particles.
- The motor should be easily accessed for cleaning and maintenance.
- The motors are intended for indoor applications.

c. Motor Orientation

Gen4 Aircore EC motors can be used in any orientation, horizontal, shaft up or shaft down.

d. Motor mounting and alignment

The Aircore EC motor system is supplied with an integrated VFD. The motor and drive are the major components of the assembly. Refer to motor [datasheets](#) for detailed dimension drawings.

i. Mounting options

Driven equipment (for example, a fan wheel) should be mounted to the shaft using as much of the available shaft length as possible. A shaft key-way and shaft key are provided for secure coupling of hubs to the shaft.

There are two mounting options for the motor, peripheral mounting or C-face mounting.

ii. Peripheral mounting block

There are four mounting blocks on the surface of the motor, spaced at 90° intervals. Each block has provisions for a lifting lug that can be used to lift the motor, and mounting holes at the drive end (DE) face and transverse surface.

The transverse face of the mounting block has threaded holes for four mounting bolts. All four mounting bolts should be installed for secure motor mounting. See the respective motor diagram for a its mounting hole pattern in Figure 6.

iii. C-face mounting

Infinitum Aircore EC motors are not a NEMA standard frame size but utilize a NEMA 182TC faceplate mounting configuration.

The DE face of the mounting block has threaded holes for four bolts (M8X1.25). All bolt holes should be used for secure mounting of the motor to equipment (Figure 7).

⚠ Caution: Use care when installing the driven equipment onto the rotor shaft. Do not force the hub or coupling onto the shaft since this may damage the motor bearings. If the hub or coupling does not slide without resistance, check alignment of the equipment with the rotor shaft.

Maintain adequate clearance between the front of the motor body and the equipment to prevent mechanical obstruction that may cause damage or injury.

The motor and stator assembly must be mounted on a structure that will support the operational weight of the motor. Use vibration dampers at motor assembly mounts to reduce motor vibration. Align the stator output shaft centerline with the driven component and install mounting hardware but do not tighten. This is completed with the alignment process.

Figure 6: Circumference mounting pads and shaft keyway

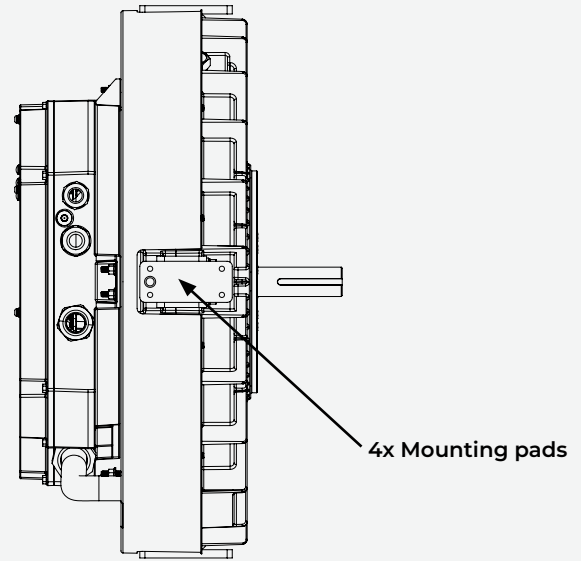
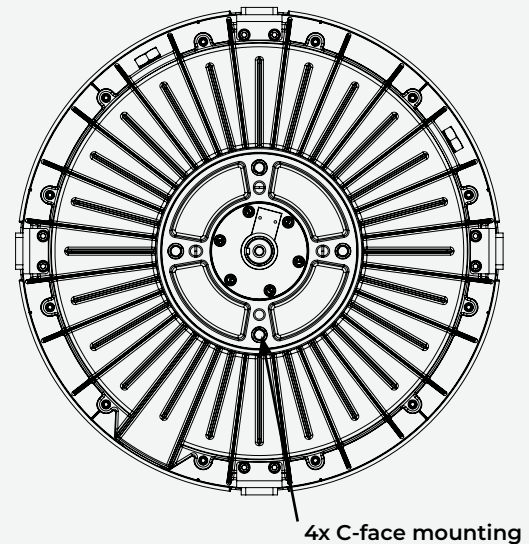


Figure 7: DE face



e. Mounting and aligning motor

The motor may be directly mounted to equipment such as fan wheels or may be connected through a belt or pulley system. It may also be attached through a shaft coupling, e.g., to an independently mounted pump, or to a torque meter in a laboratory setting. Ensure proper alignment is maintained in all arrangements.

Use driven equipment manufacturer's recommendations for aligning the motor with the fan drive or coupling. Tighten all bolts and nuts on the motor mount.

Motor rotation must be verified after electrical connection. Incorrect rotation can damage equipment.

f. Minimum motor 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.

g. Motor control connections

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

- Analog/Digital
- Modbus RTU
- Modbus TCP

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

h. 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.*

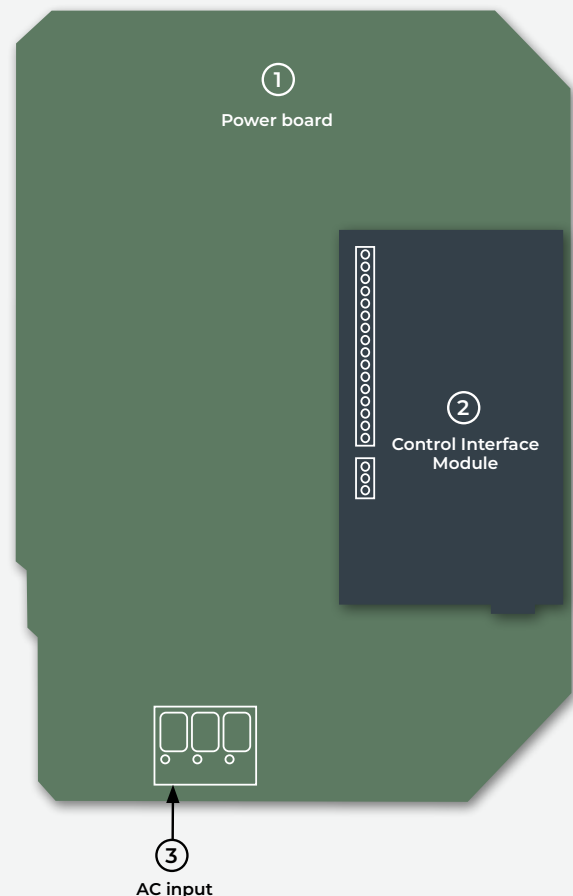
It is advised to conduct resistance readings with a multimeter on the motor ground circuit. Never apply power to a motor that does not have a complete ground circuit.

i. 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 8.

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 chassis. (Figure 10)

Figure 8: Main motor boards



Note: Safety cover removed for illustration purposes.

j. Conductor size and terminal data

Board	Terminals	Maximum conductor size		Exposed conductor length	Terminal type
		mm^2	AWG		
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

k. 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” or “EPL”. 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.



Table 1: Breakers and fuses (3-phase 480V 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	18.0	25	12

Table 2: Terminal connection data

	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

I. Control connections

Remove the VFD cover for access to Analog/Digital and Modbus 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

⚠ | *Warning: (Do not exceed +24V on this input)*

3. Digital output (2) – DO1 & DO2.

- Open drain output
- Maximum switching voltage 40 VDC
- Maximum switching current 350 mA

4. Auxiliary Voltage (1) +24v (GND must be used)

5. Analog output (1) – A_OUT (GND must be used)

6. Analog input (1) – A_IN (GND must be used)

⚠ | *Warning: (Do not exceed 0-10V @ 100 mA on this input)*

7. EIA-485 interface (1) – 485_P & 485_N

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

8. Modbus termination switch. (Default is Off)

9. RJ45 for I-con (motor control software) connection

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.

m. Analog control wire guidelines

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

⚠ | *Caution: DIN1-DIN4 are limited to +24VDC input. All is rated 0-10V @ 100mA max. Exceeding these voltages will permanently damage the communication board terminals.*

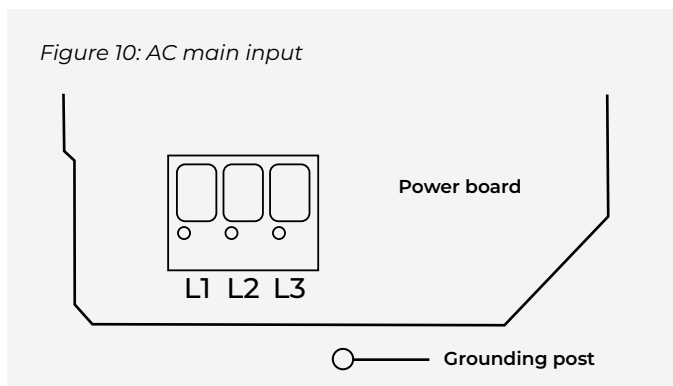
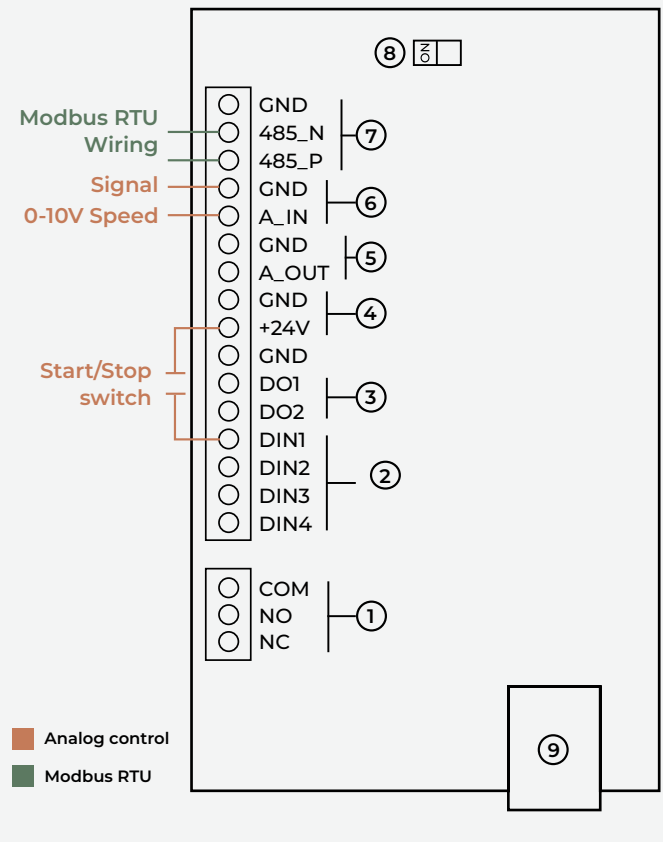


Figure 9: CIM board



n. Modbus RTU wiring guidelines

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

- The last unit on a daisy-chain configuration should have the Modbus Termination DIP switch “ON”.
- All other units must have the DIP switch in the “OFF” position.
- Modbus RTU operation requires changes to the motor configuration parameters.

o. AC main input connections

The AC main inputs (Figure 10) 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.

⚠ | *The motor is intended for connection to a solidly grounded wye supply. Connection to ungrounded, high impedance, or corner grounded systems may result in damage to the motor.*

p. Check motor 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.

q. Connect motor to driven equipment

 *Warning: Always disconnect power and practice all safety procedures when installing, troubleshooting, or repairing a motor. Always verify power is secured with a multimeter prior to work. Failure to adhere follow industry standard safety practices can result in serious personal injury or death and equipment damage.*

Prerequisite: Motor rotation has been verified. The final series of steps will place the load on the motor and test system operation.

Steps outlined below:

1. Disconnect power from the motor
2. Attach driven equipment confirming alignment
3. Install all safety covers and connect power
4. Start the system and verify the motor operates properly.

r. Default and user programmable settings

Infinity 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](#).

5. Motor maintenance

a. Maintenance tasks

This motor requires inspections and tasks be completed on a Quarterly (3 months) basis or 500 hours whichever occurs first.

Maintaining this motor requires completion of both inspection and tasks. Review above warnings. The basic tasks are outlined below:

1. Disconnect motor line power and all associated operating equipment and allow one minute for motor capacitors to discharge.
2. Examine driven equipment for looseness or damage.
3. Inspect the motor output shaft for damages. Replace damaged components and tighten any loose set screws.
4. Make sure the cooling fins and area around the motor are free from dust and debris.
5. Make sure the mounting bolts and hardware are tight and secure.
6. If used, check rubber vibration isolators for cracks and damage.
7. Make sure all wire connections are tight.
8. Inspect internal wires for signs of heat damage.

Any damages noted must be repaired before placing the motor into service.

b. Mechanical

Problems with alignment can cause bearing wear. Lack of maintenance, improper installation, and loose mounting bolts can cause premature bearing wear and motor overloads.

6. Motor drive parameters and data types

The Aircore EC motor parameters can be found [here](#).



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