Instructions-Installation

E-Flo® DC Motor

3A2526U

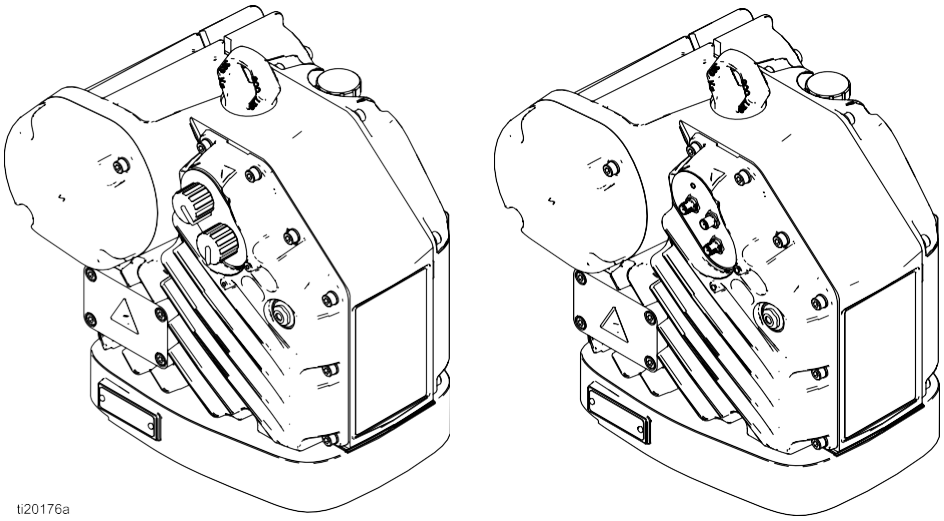
EN

Electric drive for low to medium volume paint circulation pumps.
For professional use only.

Important Safety Instructions

Read all warnings and instructions in this manual. Save these instructions.

See page 3 for model part numbers and approvals information.



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Related Manuals

Manual No.	Description
3A4801	E-Flo DC Repair–Parts
3A2527	Advanced Control Module Instructions–Parts

Models

Basic Models

Motor Part No.	Series	Horsepower	Maximum Force, lbf (N)
EM0011	C	1	1400 (6227)
EM0021	C	2	2800 (12455)

CE 2575

Ex II 2 G
Ex db IIA T6 Gb 0°C≤Ta≤40°C
CML 25ATEX1352X
IECEx CML 25.0076X

FM C US APPROVED For Class I, Div. 1, Group D T6.
Class 1, Zone 1, AEx db IIA T6 0°C≤Ta≤40°C
Ex d IIA T6 Gb 0°C≤Ta≤40°C

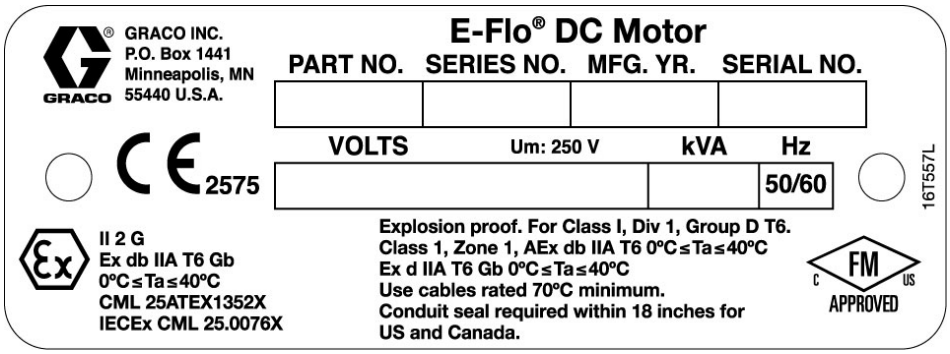


Figure 1 Basic Motor Identification Label

List of Standards

- IEC 60079–0: 2017 (Ed. 7)
- IEC 60079–1: 2014 (Ed. 7)
- EN IEC 60079–0: 2018
- EN 60079–1: 2014 (Ed. 7)
- ANSI/ISA 60079–0: 2013
- ANSI/ISA 60079–1: 2015
- FM 3615:2018
- CSA C22.2 No. 0.4:2017
- CSA C22.2 No. 0.5:2016
- CSA C22.2 No. 30:R2016
- CSA-C22.2 No. 60079–0:2015
- CSA-C22.2 No. 60079–1:2016
- CAN/CSA C22.2 No. 61010.1:R2017

Specific Conditions of Use:

1. Consult the manufacturer if dimensional information on the flameproof joint is necessary.
2. Consult the manufacturer for genuine replacement fasteners. M8 x 30 socket-head cap screws of Class 12.9 steel or better with a minimum yield strength of 1100 MPa (160,000 psi) are acceptable alternatives.

Basic Models with Region-Specific Approvals

Motor Part No.	Series	Horsepower	Maximum Force, lbf (N)
EM0013	C	1	1400 (6227)
EM0023	C	2	2800 (12455)

CE 2575

Ex II 2 G
Ex d IIA T6 Gb 0°C≤Ta≤40°C
CML 25ATEX1352X
IECEx CML 25.0076X

KTL 13-KB4BO-0368

(ITRI)2022 07-00021X

All Models

Model EM0013

Model EM0023

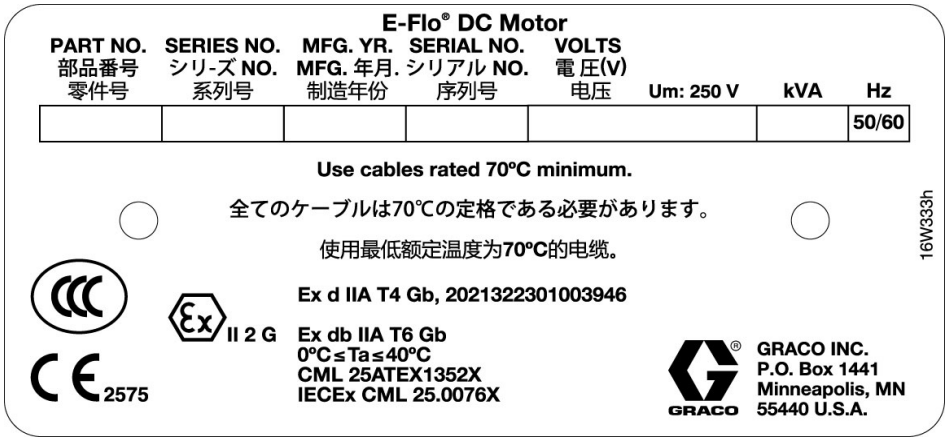


Figure 2 Basic Motor with Region-Specific Approvals Identification Label

List of Standards

- IEC 60079–0: 2017 (Ed. 7)
- IEC 60079–1: 2014 (Ed. 7)
- EN IEC 60079–0: 2018
- EN 60079–1: 2014 (Ed. 7)

Specific Conditions of Use:

1. Consult the manufacturer if dimensional information on the flameproof joint is necessary.
2. Consult the manufacturer for genuine replacement fasteners. M8 x 30 socket-head cap screws of Class 12.9 steel or better with a minimum yield strength of 1100 MPa (160,000 psi) are acceptable alternatives.

Advanced Models

Motor Part No.	Series	Horsepower	Maximum Force, lbf (N)
EM0012	C	1	1400 (6227)
EM0015	C	1	1400 (6227)
EM0022	C	2	2800 (12455)
EM0025	C	2	2800 (12455)

CE 2575 Ex II 2 (1) G
Ex db [ia Ga] IIA T6 Gb 0°C≤Ta≤40°C
CML 25ATEX1352X
IECEx CML 25.0076X

FM C US APPROVED For Class I, Div. 1, Group D T6.
Class 1, Zone 1, AEx db [ia] IIA T6 0°C≤Ta≤40°C
Ex db [ia] IIA T6 0°C≤Ta≤40°C

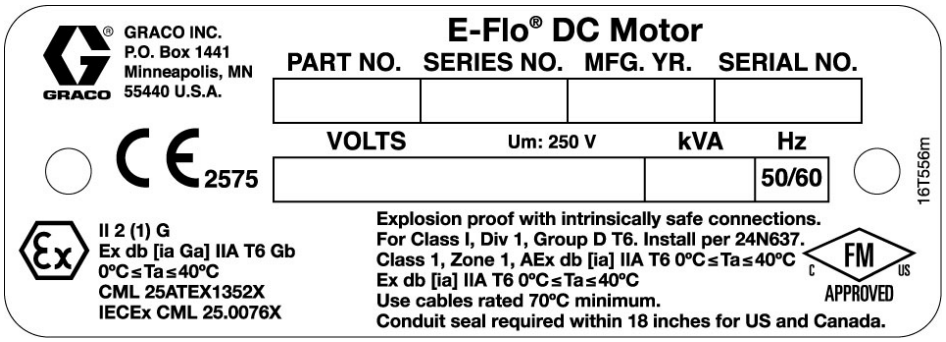


Figure 3 Advanced Motor Identification Label

List of Standards

- IEC 60079–0: 2017 (Ed. 7)
- IEC 60079–1: 2014 (Ed. 7)
- IEC 60079–11: 2011 (Ed. 6)
- EN IEC 60079–0: 2018
- EN 60079–1: 2014 (Ed. 7)
- EN 60079–11: 2012
- FM 3600:2018
- FM 3610:2018
- FM 3615:2018
- FM 3810:2018
- CSA C22.2 No. 0.4:2017
- CSA C22.2 No. 0.5:2016
- CSA C22.2 No. 30:R2016
- CSA C22.2 No. 157:R2016
- CSA-C22.2 No. 60079–0:2015
- CSA-C22.2 No. 60079–1:2016
- CAN/CSA C22.2 No. 61010–1:R2017
- CAN/CSA-E60079–11:2011
- ANSI/ISA 60079–0:2013
- ANSI/ISA 60079–1:2015
- ANSI/ISA 60079–11:2011

Specific Conditions of Use:

1. Consult the manufacturer if dimensional information on the flameproof joint is necessary.
2. Consult the manufacturer for genuine replacement fasteners. M8 x 30 socket-head cap screws of Class 12.9 steel or better with a minimum yield strength of 1100 MPa (160,000 psi) are acceptable alternatives.

Advanced Models with Region-Specific Approvals

Motor Part No.	Series	Horsepower	Maximum Force, lbf (N)
EM0014	C	1	1400 (6227)
EM0016	C	1	1400 (6227)
EM0024	C	2	2800 (12455)
EM0026	C	2	2800 (12455)

CE 2575

Ex II 2 (1) G
Ex db [ia Ga] IIA T6 Gb 0°C≤Ta≤40°C
CML 25ATEX1352X
IECEx CML 25.0076X

KTL 13-KB4BO-0607

(ITRI)2022 07-00022X

All Models

Models EM0014, EM0022, EM0024

Model EM0014

Model EM0024

Model EM0026

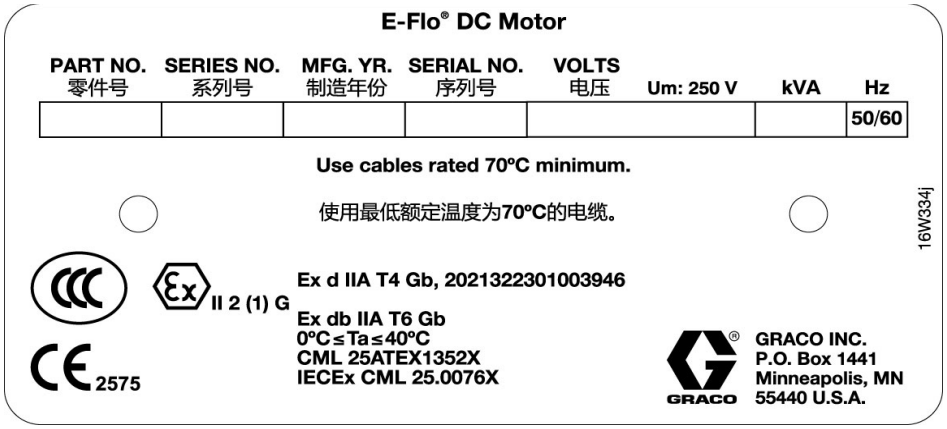


Figure 4 Advanced Motor with Region-Specific Approvals Identification Label

List of Standards

- IEC 60079–0: 2017 (Ed. 7)
- IEC 60079–1: 2014 (Ed. 7)
- IEC 60079–11: 2011 (Ed. 6)
- EN IEC 60079–0: 2018
- EN 60079–1: 2014 (Ed. 7)
- EN 60079–11: 2012

Specific Conditions of Use:

1. Consult the manufacturer if dimensional information on the flameproof joint is necessary.
2. Consult the manufacturer for genuine replacement fasteners. M8 x 30 socket-head cap screws of Class 12.9 steel or better with a minimum yield strength of 1100 MPa (160,000 psi) are acceptable alternatives.

Warnings

The following warnings are for the setup, use, grounding, maintenance, and repair of this equipment. The exclamation point symbol alerts you to a general warning and the hazard symbols refer to procedure-specific risks. When these symbols appear in the body of this manual or on warning labels, refer back to these warnings. Product-specific hazard symbols and warnings not covered in this section may appear throughout the body of this manual where applicable.

⚠ WARNING

FIRE AND EXPLOSION HAZARD

Flammable fumes, such as solvent and paint fumes, in work area can ignite or explode. To help prevent fire and explosion:

- Use equipment only in well-ventilated area.
- Eliminate all ignition sources; such as pilot lights, cigarettes, portable electric lamps, and plastic drop cloths (potential static sparking).
- Ground all equipment in the work area. See **Grounding** instructions.
- Keep work area free of debris, including solvent, rags, and gasoline.

- Do not plug or unplug power cords, or turn power or light switches on or off when flammable fumes are present.
- Use only grounded hoses.
- Hold gun firmly to side of grounded pail when triggering into pail. Do not use pail liners unless they are antistatic or conductive.

- **Stop operation immediately** if static sparking occurs or you feel a shock. Do not use equipment until you identify and correct the problem.
- Keep a working fire extinguisher in the work area.

Static charge may build up on plastic parts during cleaning and could discharge and ignite flammable vapors. To help prevent fire and explosion:

- Clean plastic parts only in well-ventilated area.
- Do not clean with a dry cloth.
- Do not operate electrostatic guns in equipment work area.

SPECIAL CONDITIONS FOR SAFE USE

- Consult the manufacturer if dimensional information on the flameproof joints is necessary.
- Consult the manufacturer for genuine replacement terminal compartment/wiring entry and enclosure fasteners. M8x30 socket headed cap screws of Class 12.9 steel or better with a minimum yield strength of 1100 MPa (160,000 psi) are acceptable alternatives.

WARNING

ELECTRIC SHOCK HAZARD

This equipment must be grounded. Improper grounding, setup, or usage of the system can cause electric shock.

- Turn off and disconnect power at main switch before disconnecting any cables and before servicing or installing equipment.
- Connect only to grounded power source.
- All electrical wiring must be done by a qualified electrician and comply with all local codes and regulations.

INTRINSIC SAFETY

Intrinsically safe equipment that is installed improperly or connected to non-intrinsically safe equipment will create a hazardous condition and can cause fire, explosion, or electric shock. Follow local regulations and the following safety requirements.

- Be sure your installation complies with national, state, and local codes for the installation of electrical apparatus in a Class I, Group D, Division 1 Hazardous Location, including all of the local safety fire codes, NFPA 33, NEC 500 and 516, and OSHA 1910.107.
- Equipment that comes in contact with the equipment's intrinsically safe terminals must meet the entity parameter requirements specified in Control Drawing 24N637. See Intrinsically Safe Installation Requirements for Advanced Motors, page 12. This includes safety barriers, DC voltage meters, ohmmeters, cables, and connections. Remove the unit from the hazardous area when troubleshooting.
- Do not install any equipment approved only for a non-hazardous location in a hazardous area, as defined in Article 500 of the National Electrical Code (USA) or your local electrical code. See the ID label for the intrinsic safety rating for your equipment.
- Ground the motor. Use a 12 gauge minimum ground wire, connected to a true earth ground. See Grounding, page 12.
- Do not operate the motor with any cover removed.
- Do not substitute system components, as this may impair intrinsic safety.

BURN HAZARD

Equipment surfaces and fluid that is heated can become very hot during operation. To avoid severe burns:

- Do not touch hot fluid or equipment.

MOVING PARTS HAZARD

Moving parts can pinch, cut, or amputate fingers and other body parts.

- Keep clear of moving parts.
- Do not operate equipment with protective guards or covers removed.
- Pressurized equipment can start without warning. Before checking, moving, or servicing equipment, follow the **Pressure Relief Procedure** and disconnect all power sources.

WARNING

PRESSURIZED EQUIPMENT HAZARD

Fluid from the equipment, leaks, or ruptured components can splash in the eyes or on skin and cause serious injury.

- Follow the **Pressure Relief Procedure** when you stop spraying/dispensing and before cleaning, checking, or servicing equipment.
- Tighten all fluid connections before operating the equipment.
- Check hoses, tubes, and couplings daily. Replace worn or damaged parts immediately.

TOXIC FLUID OR FUMES HAZARD

Toxic fluids or fumes can cause serious injury or death if splashed in the eyes or on skin, inhaled, or swallowed.

- Read Safety Data Sheets (SDSs) to know the specific hazards of the fluids you are using.
- Store hazardous fluid in approved containers, and dispose of it according to applicable guidelines.

PERSONAL PROTECTIVE EQUIPMENT

Wear appropriate protective equipment when in the work area to help prevent serious injury, including eye injury, hearing loss, inhalation of toxic fumes, and burns. Protective equipment includes but is not limited to:

- Protective eyewear, and hearing protection.
- Respirators, protective clothing, and gloves as recommended by the fluid and solvent manufacturer.

EQUIPMENT MISUSE HAZARD

Misuse can cause death or serious injury.

- Do not operate the unit when fatigued or under the influence of drugs or alcohol.
- Do not exceed the maximum working pressure or temperature rating of the lowest rated system component. See **Technical Data** in all equipment manuals.
- Use fluids and solvents that are compatible with equipment wetted parts. See **Technical Data** in all equipment manuals. Read fluid and solvent manufacturer's warnings. For complete information about your material, request Safety Data Sheets (SDSs) from distributor or retailer.
- Do not leave the work area while equipment is energized or under pressure.
- Turn off all equipment and follow the **Pressure Relief Procedure** when equipment is not in use.
- Check equipment daily. Repair or replace worn or damaged parts immediately with genuine manufacturer's replacement parts only.
- Do not alter or modify equipment. Alterations or modifications may void agency approvals and create safety hazards.
- Make sure all equipment is rated and approved for the environment in which you are using it.
- Use equipment only for its intended purpose. Call your distributor for information.
- Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.
- Do not kink or over bend hoses or use hoses to pull equipment.
- Keep children and animals away from work area.
- Comply with all applicable safety regulations.

Installation

Installation of this equipment involves potentially hazardous procedures. Only trained and qualified personnel who have read and who understand the information in this manual should install this equipment.

NOTE: To install an advanced motor, also see Intrinsically Safe Installation Requirements for Advanced Motors, page 12.

Check the Oil Level Before Using the Equipment

The motor is pre-filled with oil. Before using the equipment, replace the shipping plug with the vented fill cap (P) that is included with the motor.

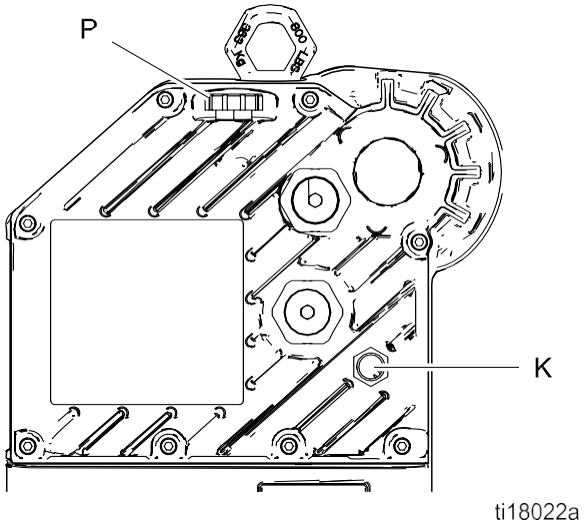


Figure 5 Sightglass and Oil Fill Cap

Power Supply Requirements

Improper wiring may cause electric shock or other serious injury if work is not performed properly. Have a qualified electrician perform any electrical work. Be sure your installation complies with all National, State and Local safety and fire codes.

See Table 1 for power supply requirements. The system requires a dedicated circuit protected with a circuit breaker.

Table 1 . Power Supply Specifications

Model*	Voltage	Phase	Hz	kVA
EM001x	100–130 /200–240 Vac	1	50/60	1.5
EM002x	200–240 Vac	1	50/60	2.9

* The last digit of the Model No. varies. See the **Models** tables on pages 3–6.

Hazardous Area Cabling and Conduit Requirements

Explosion Proof

All electrical wiring in the hazardous area must be encased in Class I, Division I, Group D approved explosion-proof conduit. Follow all National, State, and Local electric codes.

A conduit seal (D) is required within 18 in. (457 mm) of the motor for the US and Canada.

All cables must be rated at 70°C.

Flame Proof (ATEX and UKEX)

Use appropriate conduit, connectors, and cable glands rated for ATEX II 2 G. Follow all National, State, and Local electric codes.

All cable glands and cables must be rated at 70°C.

Connect the Power Supply

Improper wiring may cause electric shock or other serious injury if work is not performed properly. Have a qualified electrician perform any electrical work. Be sure your installation complies with all National, State and Local safety and fire codes.

1. Ensure that the fused safety switch (B) is shut off and locked out.

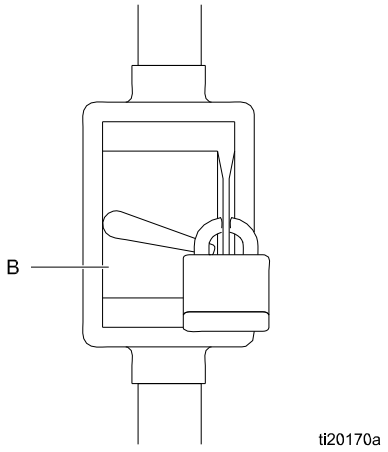


Figure 6 Locked Out Fused Safety Switch

2. Install a start/stop control (C) in the electrical supply line (A), within easy reach of the equipment. The start/stop control must be approved for use in hazardous locations.
3. Open the electrical compartment (S) on the motor.
4. Bring the power wires into the electrical compartment through the 3/4–14 npt(f) inlet port. Connect the wires to the terminals, as shown. Torque the terminal nuts to 15 in-lb (2 N•m) maximum. **Do not over-torque.**
5. Close the electrical compartment. Torque the cover screws (J) to 15 ft-lb (20 N•m).

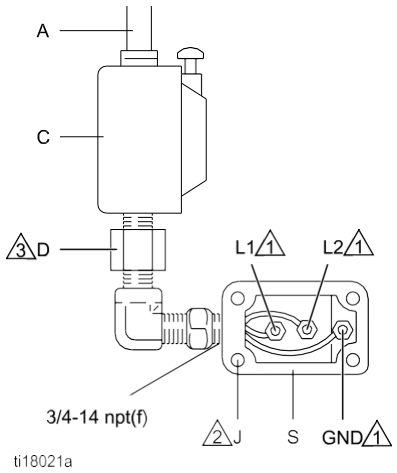
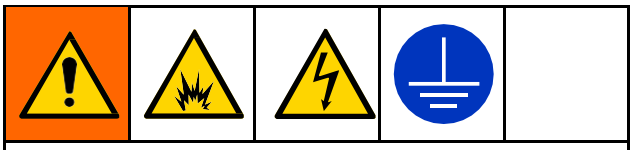


Figure 7 Connect the Power Wires

Notes for Fig. 7	
1	Tighten all terminal nuts to 15 in-lb (2 N•m) maximum. **Do not over-torque.**
2	Tighten cover screws to 15 ft-lb (20 N•m).
3	A conduit seal (D) is required within 18 in. (457 mm) of the motor for the US and Canada.

Grounding



This equipment must be grounded to reduce the risk of static sparking and electric shock. Electric or static sparking can cause fumes to ignite or explode. Improper grounding can cause electric shock. Grounding provides an escape wire for the electric current.

Loosen the ground screw and attach a ground wire (Y). Tighten the ground screw securely. Connect the other end of the ground wire to a true earth ground.

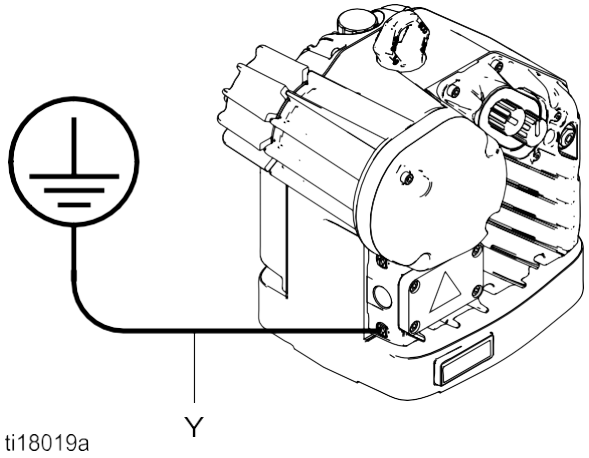
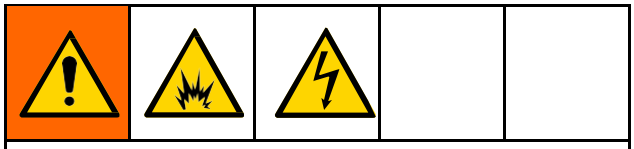


Figure 8 Ground Wire

Intrinsically Safe Installation Requirements for Advanced Motors



Do not substitute or modify system components as this may impair intrinsic safety. For installation, maintenance, or operation instructions, read instruction manuals. Do not install equipment approved only for non-hazardous location in a hazardous location. See the identification label for the intrinsic safety rating for your model.

See Appendix A - System Control Drawing 24N637, page 19, for installation requirements and entity parameters. Follow all installation instructions in your system manual.

NOTE: For multiple advanced motors (EM00X2, EM00X4, EM00X5, and EM00X6) using a single advance control module, all motors must be bonded to the same high integrity equipotential system.

Operation

Startup

1. Unlock the fused safety switch (B) and turn it on. See Connect the Power Supply, page 11.
2. Press the start pushbutton (C).
3. Check that the power indicator (L) is lit (steady on).
4. See Advanced Motor Operation, page 13 or Basic Motor Operation, page 14 for further instructions.

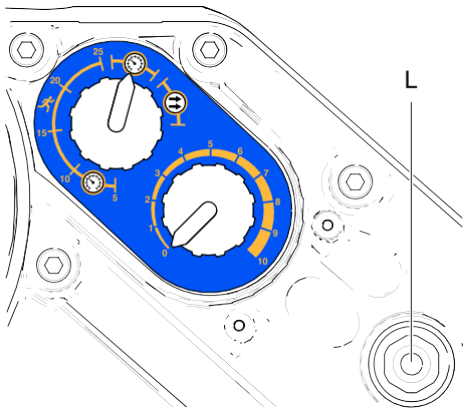
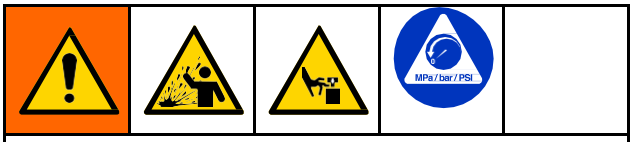


Figure 9 Power Indicator

Shutdown

Follow the Pressure Relief Procedure, page 13.

Pressure Relief Procedure



This equipment stays pressurized until pressure is manually relieved. To help prevent serious injury from splashing fluid and moving parts, follow the Pressure Relief Procedure when you stop spraying and before cleaning, checking, or servicing the equipment.

1. Disengage the start/stop control (C). See Connect the Power Supply, page 11.
2. Shut off and lock out the fused safety switch (B).
3. Relieve all fluid pressure as explained in your separate E-Flo DC pump manual.

Advanced Motor Operation

The Advanced E-Flo DC motors require installation of the 24P822 Control Module Accessory Kit to provide the interface for users to enter selections and view information related to setup and operation. See the Control Module Accessory Kit manual 3A2527 for installation and operation information.

NOTICE

To prevent damage to the softkey buttons, do not press the buttons with sharp objects such as pens, plastic cards, or fingernails.

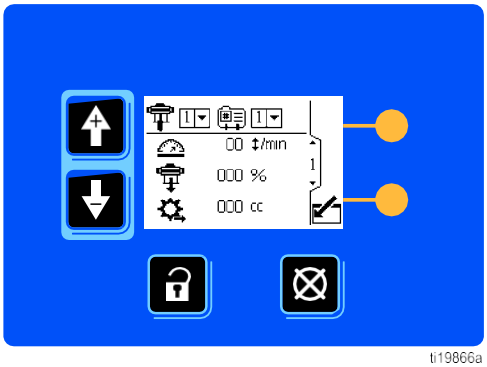


Figure 10 Control Module Accessory

Basic Motor Operation

The basic motor has three operating modes:

- Pressure Mode
- Pressure Mode with Integrated Runaway Protection
- Flow Mode

NOTE: Before changing from one mode to another, turn the Control Knob (N) fully counterclockwise to 0.

Pressure Mode

When in pressure mode, the motor will adjust the speed to maintain a constant fluid pressure.

1. Turn the Control Knob (N) fully counterclockwise to 0.
2. Pull the Mode Select switch (M) out to set. Turn the switch to Pressure. Push the switch in to lock.
3. Pull the Control Knob (N) out to set. Turn the knob clockwise to increase the pressure, or counterclockwise to decrease the pressure. Push the knob in to lock.

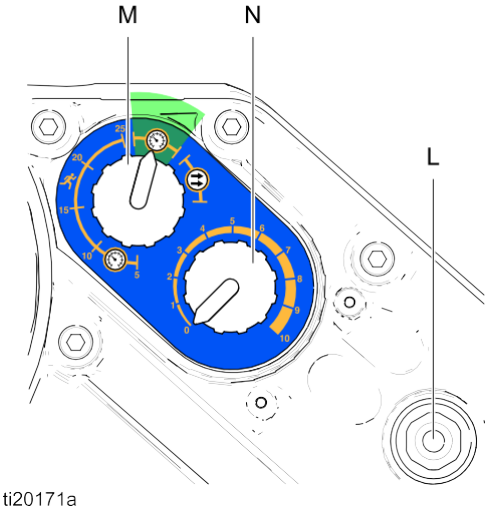


Figure 11 Pressure Mode

Pressure Mode with Integrated Runaway Protection

In pressure mode with integrated runaway protection, the motor will adjust the speed to maintain a constant fluid pressure, but will shut down if it exceeds a user-set speed.

1. Turn the Control Knob (N) fully counterclockwise to 0.
2. Pull the Mode Select switch (M) out to set. In the Runaway range, turn the switch to the desired shutdown speed in cycles per minute (5, 10, 15, 20, or 25). Push the switch in to lock.
3. Pull the Control Knob (N) out to set. Turn the knob clockwise to increase the pressure, or counterclockwise to decrease the pressure. Push the knob in to lock.

NOTE: The motor will shut down if the selected speed is exceeded for 5 cycles. To reset, turn the Control Knob (N) fully counterclockwise to 0, then turn to the desired pressure.

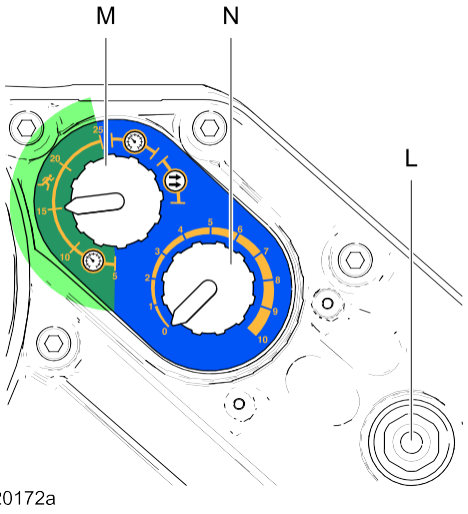


Figure 12 Pressure Mode with Integrated Runaway Protection

Flow Mode

When in flow mode, the motor will maintain a constant speed regardless of the fluid pressure, up to the pump's maximum working pressure. See Technical Data, page 25.

1. Turn the Control Knob (N) fully counterclockwise to 0.
2. Pull the Mode Select switch (M) out to set. Turn the switch to Flow . Push the switch in to lock.
3. The amount of flow is determined by the cycle rate set with the Control Knob (N). The knob's scale (0–10) corresponds to a cycle adjustment range of 0-30 cycles per minute. Turn the Control Knob (N) clockwise to increase the cycle rate (flow), or counterclockwise to decrease the cycle rate (flow).

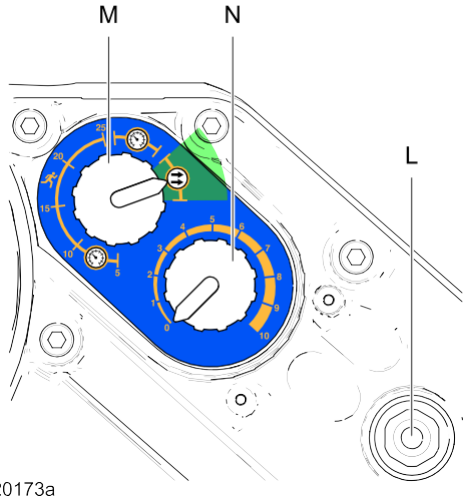


Figure 13 Flow Mode

Maintenance

Preventive Maintenance Schedule

The operating conditions of your particular system determine how often maintenance is required. Establish a preventive maintenance schedule by recording when and what kind of maintenance is needed, and then determine a regular schedule for checking your system.

Change the Oil

NOTE: Change the oil after a break-in period of 200,000–300,000 cycles. After the break-in period, change the oil once a year. Order two Part No. 16W645 ISO 220 silicone-free synthetic gear oil.

1. Place a minimum 2 quart (1.9 liter) container under the oil drain port. Remove the oil drain plug (25). Allow all oil to drain from the motor.
2. Reinstall the oil drain plug (25). Torque to 25–30 ft-lb (34–40 N•m).
3. Open the fill cap (P) and add Graco Part No. 16W645 ISO 220 silicone-free synthetic gear oil. Check the oil level in the sight glass (K). Fill until the oil level is near the halfway point of the sight glass. The oil capacity is approximately 1.5 quarts (1.4 liters). **Do not overfill.**
4. Reinstall the fill cap.

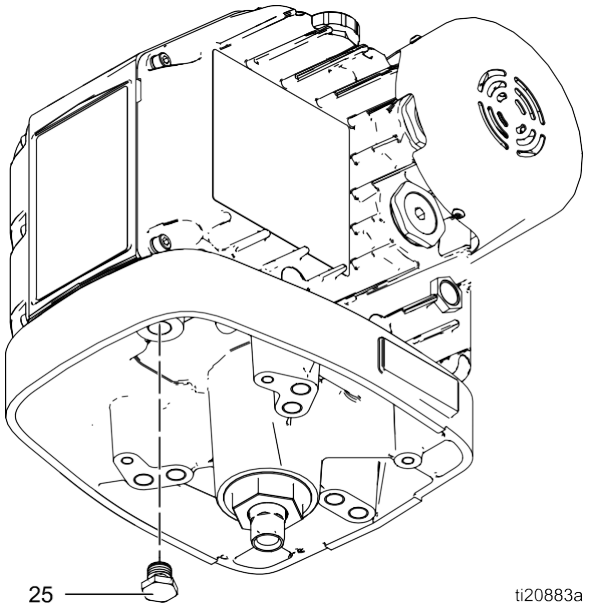


Figure 14 Oil Drain Plug

Check the Oil Level

Check the oil level in the sight glass (K). The oil level should be near the halfway point of the sight glass when the unit is not running. If low, open the fill cap (P) and add Graco Part No. 16W645 ISO 220 silicone-free synthetic gear oil as required. **Do not overfill.**

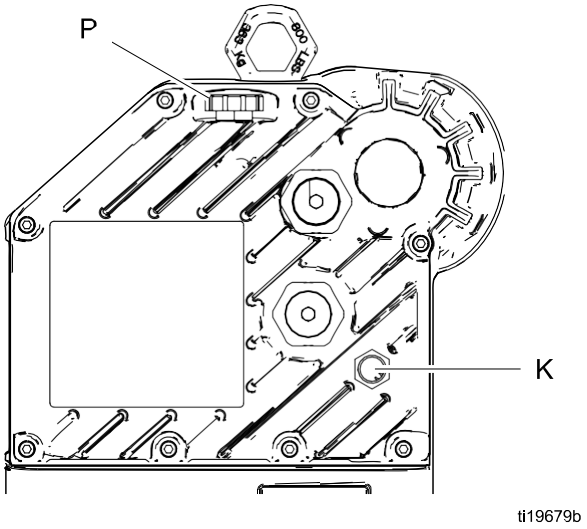


Figure 15 Sightglass and Oil Fill Cap

Error Code Troubleshooting

NOTE: The blink code is displayed using the power indicator on the motor. The blink code given below indicates the sequence. For example, blink code 2–6 indicates 2 blinks, then 6 blinks. The sequence then repeats.

Blink Code	Description
1	Flow exceeds maximum target; also indicates pump runaway condition exists.
2	Brown out; voltage supplied to motor is too low.
3	Over voltage; the motor supply voltage is too high. For DuraFlo and Xtreme lowers, cavitation at changeover can cause this alarm by turning the motor into a generator. For all lowers, if the inlet is pressurized enough, the motor can be pushed to generate enough voltage to cause this alarm.
4	An internal control board hardware failure is detected.
5	Over temperature.
6	The Mode Select knob is set between Pressure and Flow . Set the knob to the correct mode.
7	Low supply voltage detected at startup.
2–6	AC power is lost.
3–5	Internal thermistor disconnected.
3–4	Software versions do not match.
3–6	Circuit board communication failure.
4–5	Internal software error.
5–6	A calibration of the automatic encoder and stroke range is in process. (This process is initiated from the DIP switch that is internal to the motor.)

Accessories

Motor Part No.	Description	Kits	Kit Description
Models EM00X2 and EM00X5	E-Flo DC Advanced Motors	24P822	Control Module, for Advanced Motors; see manual 3A2527.
Models EM00X4 and EM00X6	E-Flo DC Advanced Motors	24X599	Control Module, for Advanced Motors; see manual 3A2527.
Models EM00X2, EM00X4, EM00X5, and EM00X6	E-Flo DC Advanced Motors	16P911	CAN Cable, 3 ft (1 m)
		16P912	CAN Cable, 25 ft (8 m)
		24P979	Pneumatic Control for Back Pressure Regulator; see manual 332142.
		24R050	Pressure Transducer Kit
		16U729	Start/Stop Switch. Allows pump to be shut off while maintaining power to the control module.
All motors in this manual	Connection kits, to mount an E-Flo DC Motor to an existing pump lower. Kits include tie rods, tie rod nuts, adapter, and coupler.	288203	For 3000 and 4000 cc 4–Ball Lowers
		288204	For Dura-Flo 1800 and 2400 Lowers
		288205	For Dura-Flo 600, 750, 900, and 1200 Lowers
		288206	For Dura-Flo 1000 Lowers
		288207	For Xtreme 145, 180, 220, 250, and 290 Lowers
		288209	For 750, 1000, 1500, and 2000 cc 4–Ball Lowers with Enclosed or Open Wet Cup
		288860	For Xtreme 85 and 115 Lowers
		17K525	For 750, 1000, 1500, and 2000 cc Sealed 4–Ball Lowers

Appendix A - System Control Drawing 24N637

NOTES FOR FIG. 16 AND 17:

1. The non-intrinsically safe terminals (power rail) must not be connected to any device which uses or generates more than Um = 250 Vrms or dc unless it has been determined that the voltage has been adequately isolated.
2. For multiple advanced motors (EM00X2, EM00X4, EM00X5, and EM00X6) using a single advance control module, all motors must be bonded to the same high integrity equipotential system.
3. Do not remove any cover until power has been removed.
4. Installation should be in accordance with ANSI/ISA RP12.06.01, installation of intrinsically safe systems for hazardous (classified) locations, and the National Electrical Code (ANSI/NFPA 70).
5. Installation in Canada should be in accordance with the Canadian Electrical Code, CSA C22.1, Part 1, Appendix F.
6. For ATEX and UKEX, install per EN 60079–14 and applicable local and national codes.
7. Between one and eight motors may be connected in series. The motors are connected with a CAN cable (16P911 or 16P912). The side of the cable with the red marking is connected to Port 1 of one motor and the unmarked side of the cable is connected to Port 2 of the next motor.
8. The first motor in the series (the one with no CAN cable on Port 2) is installed with the power jumper 24N910 connected to Port 2 and Port 3.
9. The “last” motor in the series is connected to either an IS apparatus in the hazardous location or an associated IS apparatus in the non-hazardous location. The side of the CAN cable with the red marking is connected to Port 1 of the last motor and the unmarked side of the cable is connected to the IS or associated IS apparatus.
10. The output entity parameters given for Pins 1 and 4 in each of Ports 1 and 2 are the total current and power available to both pins added together. The current on Pin 1 and Pin 4 added together will not exceed the listed Io, and the power output from Pin 1 and Pin 4 added together will not exceed the listed Po.

WARNING: Substitution of components may impair intrinsic safety.

ADVERTISSEMENT: La substitution de composants peut compromettre la securite intrinseque.

Table 2 . Calculation Procedures

Zones
Uo ≤ Ui
Io ≤ Ii
Po ≤ Pi
Co ≥ Ci + Ccable
Lo ≥ Li + Lcable
Lo / Ro ≥ Li / Ri

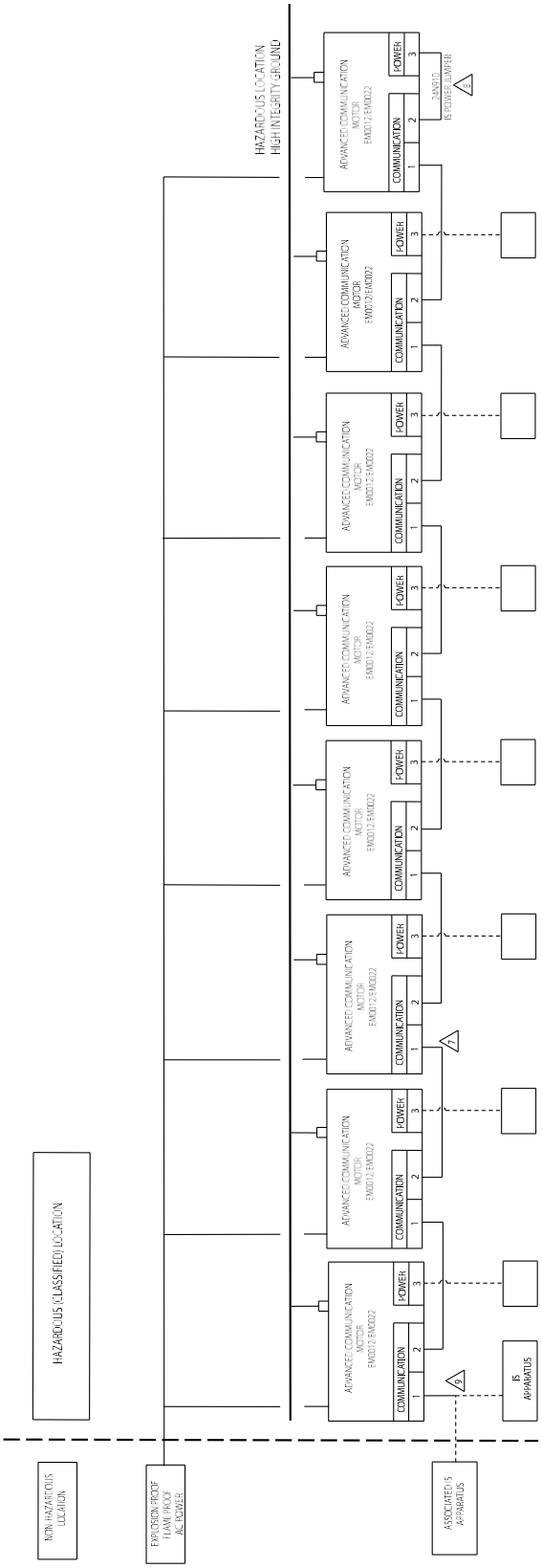


Figure 16 System Control Drawing 24N637, Sheet 1

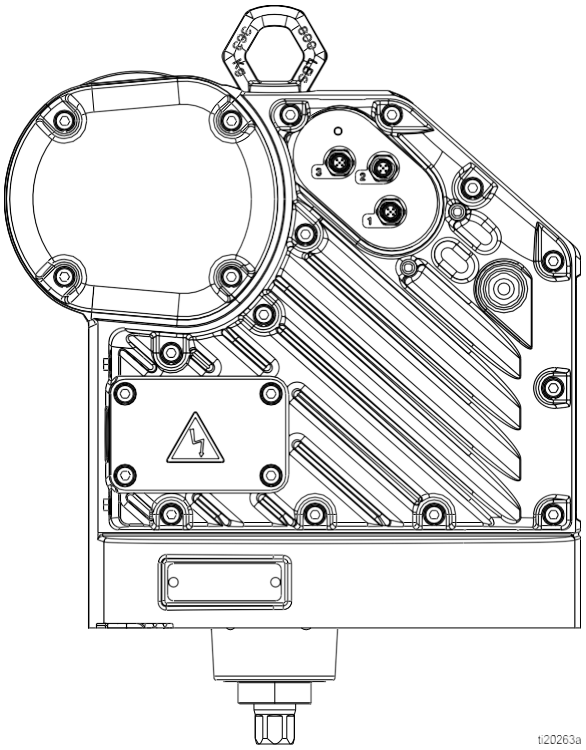


Figure 17 System Control Drawing 24N637, Sheet 2

Table 3 . Port 3: Power Barrier Output Parameters

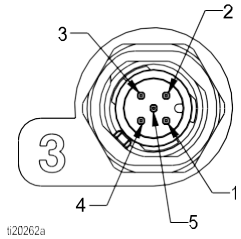
Power Barrier Output Parameters							
Port 3: Male M12 5 Pin "A" Key 	**Pin**	**Units**	**Voc**	**Isc**	**Pt**	**La**	**Ca**
			Vmax	**mA**	**mW**	**µH**	**µF**
	1	CAN Data Low	Not Connected				
	2	Power	17.9	646	2891	681	7.7
	3	IS Ground Return	—	—	—	—	—
	4	CAN Data High	Not Connected				
	5	Shield	—	—	—	—	—

Table 4 . Ports 1 and 2: CAN Data/Power In and Out Entity Parameters

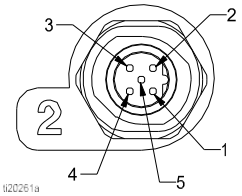
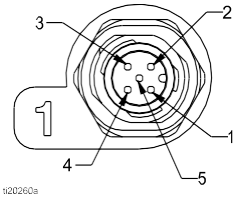
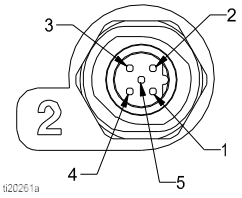
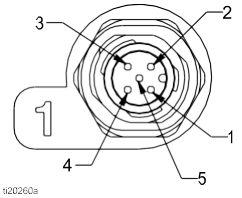
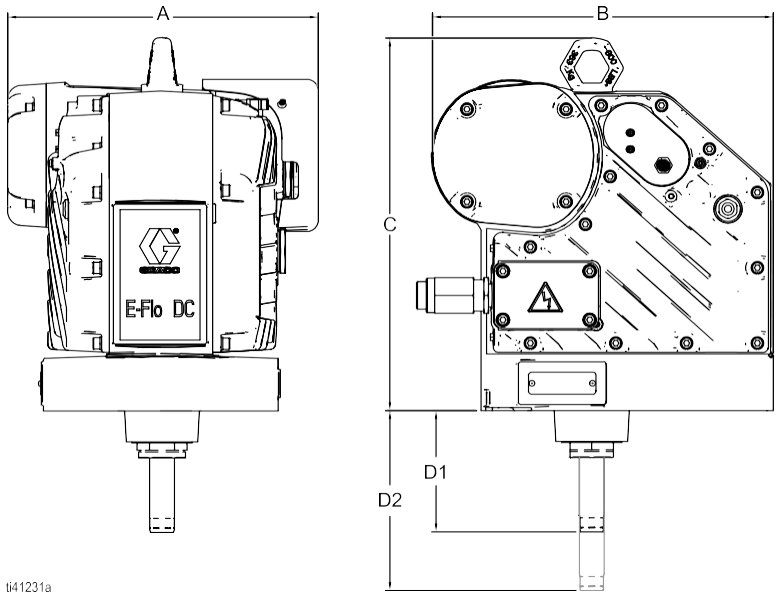
CAN Data High/Low Input Loads							
Port 2: Male M12 5 Pin "B" Key  **Port 1: Male M12 5 Pin "A" Key** 	**Pin**	**Units**	**Vmax**	**Imax**	**Pi**	**Li**	**Ci**
			Vmax	**mA**	**mW**	**µH**	**µF**
	1	CAN Data Low	See Table 5 for Data based on the Number of Motors				
	2	VIN Power	17.9	725	2900	128	0
	3	Signal Ground	—	—	—	—	—
	4	CAN Data High	See Table 5 for Data based on the Number of Motors				
	5	Shield	—	—	—	—	—
CAN Data High/Low Output Barriers							
Port 2: Male M12 5 Pin "B" Key  **Port 1: Male M12 5 Pin "A" Key** 	**Pin**	**Units**	**Voc**	**Isc**	**Pt**	**La**	**Ca**
			Vmax	**mA**	**mW**	**µH**	**µF**
	1	CAN Data Low	See Table 5 for Data based on the Number of Motors				
	2	VIN Power	17.9	646	2891	681	7.7
	3	Signal Ground	—	—	—	—	—
	4	CAN Data High	See Table 5 for Data based on the Number of Motors				
	5	Shield	—	—	—	—	—

Table 5 . Ports 1 and 2, Pins 1 and 4: CAN Data High and Low (applies to all CAN data pins shorted together or to any individual pin; see Note 10 on page 26)

CAN Data High/Low Input Loads						
Number of Motors	Units	Vmax	Imax	Pi	Li	Ci
		Vmax	mA	mW	µH	µF
1		6	700	900	67	0.2
2		6	700	900	67	0.4
3		6	700	900	67	0.6
4		6	700	900	67	0.8
5		6	700	900	67	1.0
6		6	700	900	67	1.2
7		6	700	900	67	1.4
8		6	700	900	67	1.6
CAN Data High/Low Output Barriers						
Number of Motors	Units	Voc	Isc	Pt	La	Ca
		Vmax	mA	mW	mH	µF
1		4.94	102	79	27.3	1000
2		4.94	179	158	8.88	1000
3		4.94	246	237	4.70	1000
4		4.94	305	316	3.06	1000
5		4.94	358	395	2.22	1000
6		4.94	407	474	1.72	1000
7		4.94	452	553	1.39	1000
8		4.94	494	632	1.17	1000

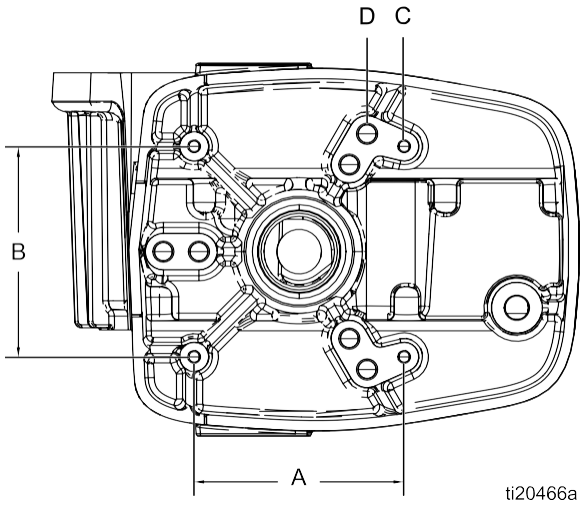
Dimensions and Mounting Holes

E-Flo DC Motor Dimensions



A	B	C	D1 (Mid Stroke)	D2
14.07 in. (35.74 cm)	15.54 in. (39.47 cm)	16.79 in. (42.65 cm)	5.5 in. (13.9 cm)	7.88 in. (20.0 cm)

Mounting Hole Pattern



A	B	C	D
6.186 in. (157 mm)	6.186 in. (157 mm)	Four 3/8–16 Mounting Holes	Six 5/8–11 Tie Rod Holes: • 8 in. (203 mm) x 120° bolt circle OR • 5.9 in. (150 mm) x 120° bolt circle

Technical Data

E-Flo DC Motors	U.S.	Metric
Input voltage/Power:		
Models EM0011, EM0012, EM0013, EM0014, EM0015, and EM0016	100–130/ 200–240 VAC single phase, 50/60 Hz, 1.5 kVA	
Models EM0021, EM0022, EM0023, EM0024, EM0025, and EM0026	200–240 VAC, single phase, 50/60 Hz, 2.9 kVA	
Maximum potential fluid pressure:		
Models EM0011, EM0012, EM0013, EM0014, EM0015, and EM0016	218000/v (volume of lower in cc) = psi	14500/v (volume of lower in cc) = bar
Models EM0021, EM0022, EM0023, EM0024, EM0025, and EM0026	436000/v (volume of lower in cc) = psi	29500/v (volume of lower in cc) = bar
Maximum continuous cycle rate	20 cpm	
Maximum force:		
Models EM0011, EM0012, EM0013, EM0014, EM0015, and EM0016	1400 lbf	6227 N
Models EM0021, EM0022, EM0023, EM0024, EM0025, and EM0026	2800 lbf	12455 N
Power inlet port size	3/4–14 npt(f)	
Ambient temperature range	32–104°F	0–40°C
Sound data	Less than 70 dB(A)	
Oil capacity	1.5 quarts	1.4 liters
Oil specification	Graco Part No. 16W645 ISO 220 silicone-free synthetic gear oil	
Weight	99 lb	45 kg

California Proposition 65

CALIFORNIA RESIDENTS

⚠ **WARNING:** Cancer and reproductive harm — www.P65warnings.ca.gov.

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