# BIC700-0.65

***Open Chassis Microprocessor-based Variable Frequency AC Drive***

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## Specifications

| Model | Line Voltage (VAC) | Motor Voltage (VAC) | Continuous Motor Current (Amps) | Motor Horsepower Range |
|---|---|---|---|---|
| BIC700-0.65 | 115<br>230 | 230 | 0.65 | 1/50 - 1/6 |

**AC Line Voltage**.....115/230 VAC ± 10%, 50/60 Hz, single phase
**AC Line Current** *with 115 VAC line voltage with a 230V motor*.....approx. 4x motor current
*with 230 VAC line voltage with a 230V motor*.....approx. 2x motor current
**AC Motor Voltage**.....230 VAC, 50/60 Hz, three phase
**Overload Capability**.....200% (2x) for 1 minute
**Standard Carrier Frequency**.....2 or 12 kHz
**Output Frequency Range**.....0 - 120 Hz
**Adjustable Maximum Output Frequency Range**.....30 - 120 Hz
**Adjustable Minimum Output Frequency Range**.....0 - 30 Hz
**DC Injection Voltage**.....0 - 30 VDC
**Acceleration Time Range**.....1 - 10 seconds
**Deceleration Time Range**.....1 - 10 seconds
**Analog Input Voltage Range** (Signal must be isolated).....0 - 3.3 VDC
**Input Impedance (S1 to S2)**.....>100K ohms
**Vibration** *(0 - 50 Hz)*.....0.5G maximum
*(>50 Hz)*.....0.1G maximum
**Temperature Range**.....0°C - 40°C
**Maximum Surrounding Air Temperature**.....40°C
**Weight**.....0.25 lbs / 113 grams
**Safety Certifications**.....UL/cUL Recognized Component, file # E132235

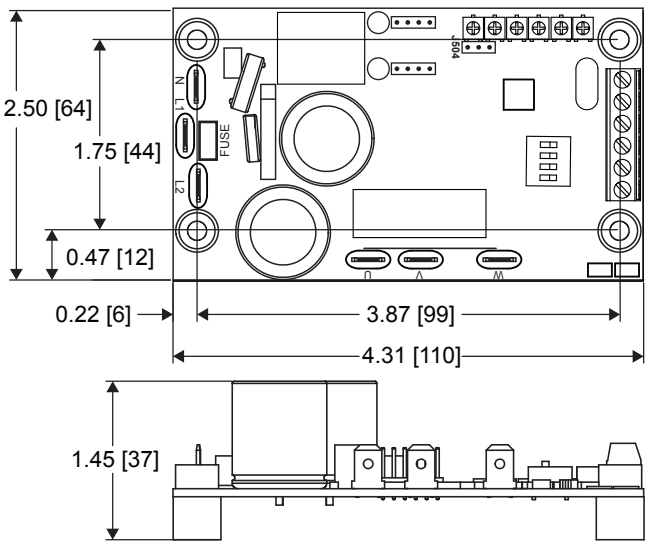
**Warning:** The circuits connected to terminal block TB501 labeled EN, COM, S1, S2, S3, and DIR are not isolated from the power circuits by Protective Separation in accordance with UL 61800-5-1. Protective separation to protect these circuits against direct contact is to be supplied by the end user. Model BIC704-0.65 comes preinstalled with an adder board that provides this isolation and is a UL Listed device.

## Safety Warnings

***READ ALL SAFETY WARNINGS BEFORE INSTALLING THIS EQUIPMENT***

- **DO NOT INSTALL, REMOVE, OR REWIRE THIS EQUIPMENT WITH POWER APPLIED.** Have a qualified electrical technician install, adjust and service this equipment. Follow the National Electrical Code and all other applicable electrical and safety codes, including the provisions of the Occupational Safety and Health Act (OSHA), when installing equipment.
- **Circuit potentials are at 115 or 230 VAC above earth ground**. Avoid direct contact with the printed circuit board or with circuit elements to prevent the risk of serious injury or fatality. Use a non-metallic screwdriver for adjusting the calibration trim pots. Use approved personal protection equipment and insulated tools if working on this drive with power applied.
- Reduce the chance of an electrical fire, shock, or explosion by proper grounding, over-current protection, thermal protection, and enclosure. Follow sound maintenance procedures.
- **It is strongly recommended to install a master power switch in the line voltage input.** The switch contacts should be rated for 250 VAC and 200% of motor nameplate current.
- **Removing AC line power is the only acceptable method for emergency stopping.** Do not use DC injection braking, decelerating to minimum speed, or coasting to a stop for emergency stopping. They may not stop a drive that is malfunctioning. Removing AC line power is the only acceptable method for emergency stopping.
- Line starting and stopping (applying and removing AC line voltage) is recommended for infrequent starting and stopping of a drive only. DC injection braking, decelerating to minimum speed, or coasting to a stop is recommended for frequent starts and stops. Frequent starting and stopping can produce high torque. This may cause damage to motors.
- **Do not disconnect any of the motor leads from the drive** unless power is removed or the drive is disabled. Opening any one lead while the drive is running may destroy the drive.
- Under no circumstances should power and logic level wires be bundled together.
- Be sure potentiometer tabs do no make contact with the potentiometer enclosure. Grounding the input will cause damage to the drive.
- Caution should be taken when operating fan-cooled motors at low speeds because their fans may may not move sufficient air to properly cool the motor. It is recommended to use "inverter-duty" motors when the speed range is beyond 10:1.
- This product does not contain speed-sensitive overload protection, thermal memory retention, or provisions to receive and act upon signals from remote devices for over temperature protection. If motor protection is needed in the end-use product, it needs to be provided by additional equipment in accordance with NEC standards.

## Dimensions




ALL DIMENSIONS IN INCHES [MILLIMETERS]

## Installation

**Mounting**

- Drive components are sensitive to electrostatic discharge. Avoid direct contact with the circuit board. Hold the drive by the chassis only.
- Protect the drive from dirt, moisture, and accidental contact.
- Provide sufficient room for access to the terminal block and calibration trim pots.
- Mount the drive away from heat sources. Operate the drive within the specified operating temperature range.
- Prevent loose connections by avoiding excessive vibration of the drive.
- Mount the drive with its board in either a horizontal or vertical plane. Four plastic standoffs accept #8 pan head screws.

**Wiring**

Use 18 - 24 AWG wire for logic wiring (COM, DIR, EN, S1, S2, S3). Use 16 - 22 AWG wire for AC line (L1, L2, N) and motor (U, V, W) wiring. Follow NEC standards for wiring.

**Short Circuit Current Rating (SCCR):** This drive is suitable for use on a circuit capable of delivering not more than 5,000 rms Symmetrical Amperes, 115/230 voltage.

**Shielding Guidelines**

As a general rule, it is recommended to shield all conductors. If it is not practical to shield power conductors, it is recommended to shield all logic-level leads. If shielding of logic-level leads is not practical, the user should twist all logic leads with themselves to minimize induced noise.

**Install the drive in Pollution Degree 2 environment only.**

## Connections

**POWER**

**Line Input**

Connect the AC line power leads to terminals L1 and N if using 115 VAC line power or to L1 and L2 if using 230 VAC line power. It is recommended to use a single-throw, double-pole master power switch. The switch should be rated at a minimum of 250 VAC and 200% of motor current.

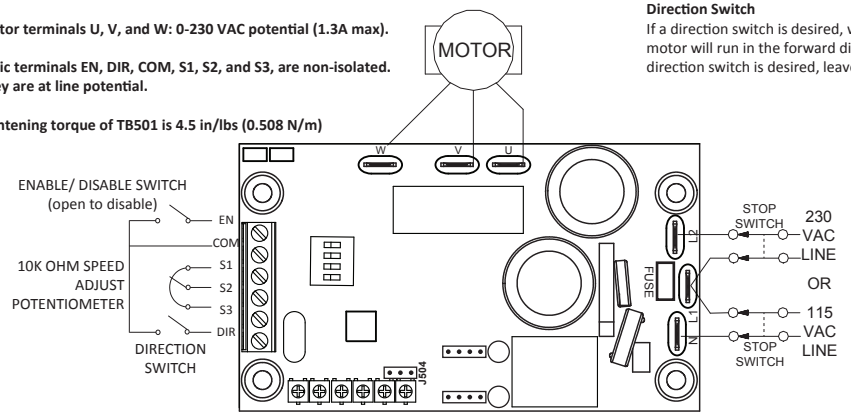
**Motor**

If using a three phase motor, connect the AC motor leads to terminals U, V, and W. If the motor does not spin in the desired direction, power down the drive and swap any two of these connections.

**Motor terminals U, V, and W: 0-230 VAC potential (1.3A max).**

**Logic terminals EN, DIR, COM, S1, S2, and S3, are non-isolated. They are at line potential.**

**Tightening torque of TB501 is 4.5 in/lbs (0.508 N/m)**




**LOGIC**

**Speed Potentiometer**

Use a 5K - 20K ohm, 1/4 W potentiometer for speed control. Connect the counter-clockwise end of the potentiometer to S1, the wiper to S2, and the clockwise end to S3. If the potentiometer works inversely of desired functionality, (i.e. to increase motor speed, you must turn the potentiometer counterclockwise), power off the drive and swap the S1 and S3 connections.

**Analog Input Signal**

The drive may also follow a 0-3.3 VDC analog signal that is isolated from earth ground. Connect the signal common to terminal S1 and the signal input to terminal S2.

**Direction Switch**

If a direction switch is desired, wire a switch to terminals COM and DIR. When the connection is open, the motor will run in the forward direction. When the connection is closed, the motor will run in reverse. If no direction switch is desired, leave this connection open.

**Enable**

Open the terminals COM and EN to coast the motor to minimum speed. Close terminals COM and EN to accelerate the motor to set speed. If no enable switch is desired, jumper terminals COM and EN. **Do not use the enable for emergency stopping.**

**Fusing**

The drive has an onboard auxillary fuse for protection. Use quick acting 6.3A, 350Vac BEL micro fuse, part number 0698Q6300-02 for replacement.

**WARNING:** Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.

# Startup

**SELECT SWITCHES**

**DIP Switch (SW501)**

Switch 1: ON - Manual Start/Restart: Enable must be open at power-up, if closed the drive will fault. To reset a fault condition, the Enable or AC power must be cycled.
OFF - Auto Start/Restart: The drive may start with the enable closed. An undervoltage or overvoltage fault condition will automatically reset when the condition disappears. Other faults must still be reset with an Enable or AC power cycle.

Switch 2: ON - 50 Hz base frequency at output voltage determined by jumper J504.
OFF - 60 Hz base frequency at output voltage determined by jumper J504.

Switch 3: ON - DC Injection Braking. The drive will apply 30 VDC for 2 seconds following DISABLE command to quickly decelerate the motor.
OFF - Coast to Stop. The motor will decelerate in a natural coast to stop.

Switch 4: ON - 2 kHz Carrier Frequency
OFF - 12 kHz Carrier Frequency

**VAC Output Jumper (J504)**

ON - Place a jumper on pins 1 and 2.
Pin 1 is towards the center of the board.

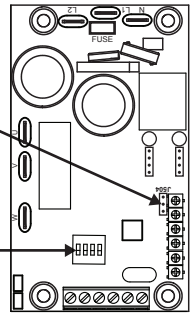
115 VAC Output


Output Jumper (J504)

OFF - Place a jumper on pins 2 and 3.
Pin 3 is towards the outside of the board.

230 VAC Output


DIP Switch (SW501)




**STARTUP**

- Verify that no foreign conductive material is present on the printed circuit board.
- Ensure that all dip switches and jumpers are properly set.

1. Turn the speed adjust potentiometer full counterclockwise (CCW).
2. Apply AC line voltage.
3. Enable the drive.
4. Slowly advance the speed adjust potentiometer clockwise (CW). The motor slowly accelerates as the potentiometer is turned CW. Continue until the desired speed is reached.
5. Remove AC line voltage from the drive to coast the motor to a stop.

# LEDs

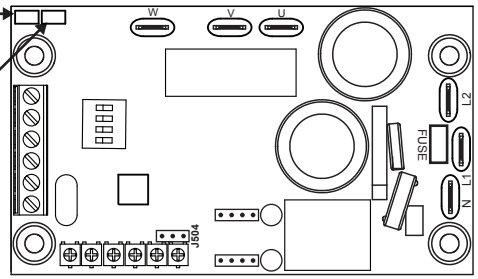
**Power (PWR):** Green LED lights whenever AC line voltage is applied to the drive.
Solid: Power is applied and the output is disabled.
Flashing Slow: Power is applied and the output is enabled and motor torque is less than setpoint.
Fashing Fast: Power is applied and the output is enabled, but the motor torque is more than setpoint.

**Status (ST):** Red LED lights whenever a fault condition occurs.
Solid: Torque Limit - The motor is asking for more torque than the drive is set to allow for.
2: Undervoltage - Internal DC BUS voltage dropped too low.
3: Overvoltage - Internal DC BUS voltage rose too high.
4: Short Circuit - Short circuit between any two phases on output.
5: Overtemperature Warning - Drive's temperature is approaching critical temperature.
6: Overtemperature Shut Down - Drive's temperature has reached critical temperature.
7: Overload Protection Trip - The drive was in an overload condition for too long.
8: Manual Start Fault - The Enable was closed at power up. See SW501, Switch 1.

If the drive has tripped from a fault condition, cycle the Enable switch or AC line power to reset the drive.

Power LED

Status LED






# Operation

**WARNING:** When using a brake equipped motor, be sure to bypass the BIC700-0.65 and power the brake rectifier directly from the AC line. Using the BIC700-0.65 to power the brake rectifier will result damage the motor, brake, and/or BIC700-0.65. See the gearmotor instruction manual for more wiring information.

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# Calibration

**Minimum Speed (MIN SP):** The MIN SP setting determines the motor speed when the speed adjust potentiometer is set for minimum speed. It is factory set for zero speed. To calibrate the MIN SP:
1. Set the MIN SP trim pot full CCW.
2. Set the speed adjust potentiometer for minimum speed (full CCW).
3. Adjust MIN SP trim pot until the desired minimum speed is reached.

**Maximum Speed (MAX SP):** The MAX SP setting determines the motor speed when the speed adjust potentiometer is set for maximum speed. It is factory set for 230V / 60 Hz. To calibrate the MAX SP.
1. Set the MAX SP trim pot full CCW.
2. Set the speed adjust potentiometer for maximum speed (full CW).
3. Adjust MAX SP trim pot until the desired maximum speed is reached.

**Slip Compensation (SLIPC):** The SLIPC setting determines the degree to which motor speed is held constant as the motor load changes. It is factory set for optimum motor regulation. To calibrate the SLIPC:
1. Set the SLIPC trim pot full CCW.
2. Increase the speed adjust potentiometer until the motor runs at midspeed without load. A handheld tachometer may be used to measure motor speed.
3. Load the motor to its full load current rating. The motor should slow down.
4. While keeping the load on the motor, rotate the SLIPC trim pot until the motor runs at the speed measured in step 2. If the motor oscillates (overcompensation), the SLIP trim pot may be set too high (CW). Turn the SLIP trim pot CCW to stabilize the motor.
5. Unload the motor.

**Boost (BOOST):** The BOOST setting increases the motor torque at low speeds. The minimum setting is sufficient for most applications and does not need to be adjusted. If the motor stalls or runs erratically at very low speeds (below 10 Hz), the boost trim pot may need adjustment. To calibrate the BOOST:
1. Run the motor at the lowest continuous speed/frequency required.
2. Increase the BOOST trim pot until the motor runs smoothly. **Continuous operation beyond the motor's current rating may damage the motor.**

**Acceleration/Deceleration (ACC/DEC):** The ACC/DEC setting determines the time the motor takes to ramp to a higher / lower speed. ACC/DEC is factory set for the shortest acceleration/deceleration time (full CCW). To calibrate the ACC/DEC:
1. Set the speed adjust potentiometer for minimum speed.
2. Set the speed adjust potentiometer for maximum speed. Measure the time is takes the motor to go from minimum speed to maximum speed.
3. If the time measured in step 2 is not the desired acceleration time, turn the ACC/DEC trim pot CW for a longer acceleration time, or CCW for a shorter acceleration time. Repeat steps 1 through 3 until the acceleration time is correct.

**Torque (TQ LIM):** The TQ LIM setting determines the maximum torque for accelerating and driving the motor. If torque limit adjustment is desireable, but not critical, use the chart below for approximate TQ LIM trim pot settings. Note that positions are relative to trim pot, not mounting position (ie 8:00 is full CCW on trim pot).

| 115 V | 230 V | 100% | 150% | 200% |
|---|---|---|---|---|
| 1/16 HP | 1/6 HP | 11:30 | 2:00 | 4:00 |
| 1/20 HP | 1/10 HP | 10:30 | 11:30 | 2:00 |
| 1/50 HP | 1/20 HP | 9:30 | 10:30 | 11:30 |
| 1/100 HP | 1/50 HP | 9:00 | 9:15 | 9:30 |

If torque limit adjustment is critical, determine the motor's RMS current that correlates to desired torque limit and then;
1. With power disconnected from the drive, connect a RMS ammeter in series with one of the motor leads.
2. Turn the TQ LIM trim pot to full CW. Apply power and adjust the motor speed to full rated speed.
3. Load the motor so that it draws the RMS current previously determined.
4. Slowly turn the TQ LIM trim pot CCW until the red LED starts flickering. Then turn the trim pot slightly more so that it just starts to reduce the motor amps on the RMS ammeter.

**Motor Overload Protection:**
If the drive is used as a Motor Overload Protection device, then the TQ LIM trim pot needs to be used to adjust the overload set point. To adjust it;
1. With power disconnected from the drive, connect a RMS ammeter in series with one of the motor leads.
2. Turn the TQ LIM trim pot to full CW. Apply power and adjust the motor speed to full rated speed.
3. Load the motor so that it draws rated RMS current.
4. Slowly turn the TQ LIM trim pot CCW until the green LED changes flashing from slow to fast. Then turn the trim pot slightly CW until the green LED flashing becomes slow again.

The drive uses a modified algorithm for motor overload protection. Any time the motor is overloaded, then green LED will start to flash faster and the drive starts counting time against an overload trip. The higher the overload, the sooner the drive will trip.