

General

The G7 AC drive is the ultimate performance solution with enhanced speed and torque control to provide servo-like performance from an induction motor. The G7 drive incorporates the world's first commercially available 480V 3-level inverter architecture that eliminates or minimizes the installation problems associated with IGBT switching and protects the entire motor-drive system.

This patented design eliminates peripheral components typically required to solve installation and reliability concerns in industrial plants. The G7 allows motor operation at any cable length, meeting NEMA MG1 Part 31, with peak voltage being 30% less than conventional drives. With motor bearing current being typically 50% less than standard drives, the G7 provides four times the motor bearing life. Common mode current is reduced by 50%. EMI/RFI radiation and audible noise are also reduced. By reducing the root cause of these motor/drive problems, expensive peripheral filters and other workaround methods are eliminated.

G7 drive performance makes it the ideal drive for high performance speed, torque, or position control applications. Open loop torque control is now possible. In closed loop vector mode, 0.01% speed regulation and 1000:1 control range can be achieved. Zero-servo capability provides position control at zero speed.

The LCD operator displays 5 lines x 16 characters, in any of 7 languages. The keypad is intuitive and includes memory for parameter settings, making it easy to transfer settings from one drive to another.

The G7 drive supports the industry's preference for open network architecture and connectivity with network choices such as EtherNet/IP, Modbus TCP/IP, DeviceNet, Profibus-DP, Modbus Plus, and others.

The G7 drive offers the ultimate performance, the best system protection, and the most flexible configurations of any drive available.

Operating Principle

Input Section – The G7 converts three phase AC line power into a fixed DC voltage, via a solid state full wave diode rectifier, with MOV (Metal Oxide Varistor) surge protection. The G7 input is phase insensitive. 12-pulse input is optional.

Intermediate Section - DC bus maintains a fixed DC voltage, with filtering and short circuit protection, as a DC supply to the VFD output section. It is interfaced with the VFD diagnostic logic circuit, to continuously monitor and protect the power components. An input power factor near 0.90 is maintained with the 3% DC bus reactor (included above 30 hp, optional below).

Output Section - Using 3-level (neutral point clamp or NPC) pulse width modulation (PWM) inverter technology, the DC voltage is processed, to produce an output waveform in a series of variable-width pulses created by Insulated Gate Bipolar Transistors (IGBTs). Unique firmware algorithms (13 patents) optimize motor magnetization through control of voltage, current, and frequency applied to generate a nearly sinusoidal output waveform.

480V 3-level Inverter Benefits

- Allows motor operation at any cable length to the motor, meeting NEMA MG1 Part 31. Reduces surge voltage by 33% with a maximum of 1300VAC.
- Reduces motor bearing current by 50%, resulting in either no bearing currents or a minimum 4 times increase in the motor bearing life.
- Reduces audible motor noise by 20% (5-10dB of noise reduction).
- Reduces common mode current (noise) by 50%.

Performance Features

- Ratings: 0.5 to 150HP, 240VAC
0.5 to 500HP, 480VAC
- Overload capacity:
 - Heavy duty
 - 150% for 60 seconds
 - 200% for 0.5 seconds
- Starting torque (150% starting at):
 - 0.5Hz and greater (open loop)
 - 0.0Hz and greater (closed loop)
- Output frequency:
 - 0.01 to 400.0Hz
- Output frequency resolution:
 - 0.001Hz
- Speed control range:
 - 200:1 (open loop)
 - 1000:1 (closed loop)
- Speed regulation:
 - 0.1% (open loop)
 - 0.01% (closed loop)
- Scan time:
 - 2.5ms
- Speed response:
 - 60Hz
- Torque response:
 - 300Hz
- Speed reference resolution:
 - 0.01Hz with digital reference
 - 0.03Hz with analog reference
 - 0.01Hz with network reference
- Speed/Torque/Position control
- Torque control without an encoder (open loop)
- Zero-servo mode for holding position
- Adjustable accel/decel:
 - 0.01 to 6000 seconds
- S-curve (soft start):
 - 0.00 to 2.50 seconds
 - Adjustable for each corner
- Displacement power factor:
 - 0.95 throughout the motor speed range
- VFD efficiency:
 - 96% at half-speed; 98% at full-speed
- Carrier frequency:
 - Adjustable without derate
 - Defaulted at highest setting
- Volts/Hertz pattern
 - Multiple preset patterns
 - Fully customizable pattern for non-standard motors

Design Features

- One control board for all horsepower ratings
- LCD programming keypad:
 - 5 lines x 16 characters, backlit
 - 7 languages
 - Copy function
 - Removable (remote mounting capable)
 - Provides readout functions that include: output frequency, output voltage, output current, output power, output torque, DC bus voltage, input and output terminal status, PID status, fault status, and others. Output frequency and speed display can be programmed for other speed-related and control indications, including: RPM, Hz, % of maximum RPM, or custom units.*
- Customizable monitor display
- Simple programming:
 - Quick start
 - Modified parameter groups
- Parameter initialization:
 - Resettable to factory or user-definable presets
- Microprocessor logic:
 - 32-bit
- Memory type:
 - Flash memory for easy upgrades
 - CASE custom software applications
 - Non-volatile program retention
- Control logic:
 - 24VDC (sinking or sourcing)
 - Internal or external power supply
- Terminal strip:
 - Quick disconnect
- Front cover:
 - Split for easy wiring
- Heat sink fans:
 - Quick disconnect
 - On-off control
- Motor auto-tuning:
 - Static
 - Rotational
 - Resistance only
- Speed search:
 - Bi-directional into rotating motor
- Process control:
 - PID, Reference with PID trim
- Motor parameters:
 - 2 sets
- Stopping methods:
 - Ramp stop
 - Coast stop
 - High Slip Braking
- DC injection braking:
 - Adjustable level and time
- Speed reference presets:
 - 17 available
- Timer function:
 - Programmable on / off delay
- Digital M.O.P.:
 - Up / down / hold / reset reference
- Bias and gain:

All analog and pulse train I/O

Design Features (continued)

- Automatic energy saving, reduced voltage operation
- Elapsed timer
 - Hours of power up or run time
- Enclosure ratings:
 - NEMA 1 (IP20):
 - 240V, 0.5HP - 30HP (optional end caps to 100HP)
 - 480V, 0.75HP - 75HP (optional end caps to 250HP)
 - Open Chassis (IP00):
 - 240V, 40HP - 150HP
 - 480V, 100HP - 500HP
- DC input power supply capability:
 - All models
- Dynamic braking transistor:
 - 240VAC: 20HP and below
 - 480VAC: 25HP and below
- DC bus choke:
 - 240VAC: 25HP and above
 - 480VAC: 30HP and above
- 12-pulse capability:
 - 240VAC: 25HP and above
 - 480VAC: 30HP and above

Service Conditions

- Ambient service temperature:
 - NEMA 1 (IP20): -10°C to 40°C (14°F to 104°F)
 - Chassis (IP00): -10°C to 45°C (14°F to 113°F)
- Ambient storage temperature:
 - 20°C to 60°C (-4°F to 140°F)
- Input Voltage:
 - 200 - 240VAC, 380 - 480VAC, +10% / -15%
 - 3 phase (Single phase with derate)
 - Phase insensitive
- Input frequency:
 - 50 / 60Hz, +/- 5%
- Humidity:
 - Non-condensing, 95% maximum
- Altitude:
 - 3300 feet (1000 meters) without derate
- Vibration:
 - 240VAC: 60HP and below, 480VAC: 75HP and below
 - 1.0G (9.8m/s²), 10 - 20Hz
 - 0.6G (5.9m/s²), 20 - 55Hz
 - 240VAC: 60HP and above, 480VAC: 100 HP and above
 - 1.0G (9.8m/s²), 10 - 20Hz
 - 0.2G (2.0m/s²), 20 - 55Hz

Protective Features

- Diagnostic fault indications with descriptive text
- Fault display and last 4 faults storage
 - Torque limit (four quadrant individually)
- Thermal motor overload protection (UL 508C approved)
- Over-torque / Under-torque detection
- Phase-to-phase short circuit protection
- Ground fault short circuit protection
- Over-current protection
- Over-voltage protection
- Over-temperature protection
- Input / Output phase loss protection
- Optically-isolated control logic
- DC bus charge indicator
- Motor thermistor input
- Output current overload rating:
 - 150% of drive's current rating for 60 seconds
- Stall prevention (overload trip prevention):
 - Acceleration
 - Deceleration
 - Running
- Hunting prevention
- Current limiting DC bus fuse
- Cooling fan operating hours recorded
- Reverse prohibit selectability
- Short circuit withstand rating: 100kA RMS
- Power loss ride-thru:
 - Auto-restart or inertia ride-thru
 - 2 seconds or length of CPU power up
- Run permissive input
- Programmable security (lockout) code
- Programmable external fault input
- Network communication loss:
 - Detection and selectable response
- Critical frequency rejection capability:
 - 3 selectable, adjustable bandwidths
- Speed reference signal loss detection
- PID feedback signal loss detection
- Auto restart capability:
 - 0 - 10 attempts

Inputs and Outputs

- Analog inputs:
 - 3 total (2 programmable)
 - 10 to +10VDC (20kΩ) or 4 to 20mA (250Ω)
 - 11 bit + sign
- Analog outputs:
 - 2 total (2 programmable)
 - 10 to +10VDC or 4-20mA
 - 9 bit + sign
- Digital inputs:
 - 12 total (10 programmable)
 - Sinking or sourcing
 - Internal or external power supply
- Digital outputs:
 - 6 total
 - 1 fixed
 - 1 form C (fault with CPU watchdog circuit)
 - 5 programmable
 - 3 form A
 - 2 open collector
- Pulse train input:
 - 1 total (1 programmable)
 - 32 kHz maximum frequency
- Pulse train output:
 - 1 total (1 programmable)
 - 32 kHz maximum Frequency
- RS-422/485:
 - Modbus RTU protocol
 - 19.2kbps
 - Built-in terminating resistor

Options

- DriveWorksEZ™ programming tool
- DriveWizard™ management software
- CASE custom drive software
- Network communication kits for EtherNet/IP, Modbus TCP/IP, DeviceNet, Profibus-DP, Modbus Plus, LonWorks, and others
- Remote display / keypad kits
- High resolution I/O kits
- 120VAC interface kits
- NEMA 12 enclosures
- Input breaker, disconnect, fuses
- Input / output reactors
- EMC-compliant filters
- Dynamic braking transistor (if not standard)
- DC bus choke (if not standard)

Standards & Reliability

- Mean Time Between Failure (MTBF):
 - Exceeds 28 years
- UL, cUL, and CE listed
 - UL 508C (Power Conversion)
 - CSA 22.2 No. 14-95 (Industrial Control Equipment)
 - EN 50178 (LVD)
 - EN 61800-3
 - IEC 529
 - FCC CFR 47 Part 15 Subpart B
- In circuit testing of all printed circuit boards is conducted, to insure proper manufacturing
- Final printed circuit board assemblies are functionally tested, via computerized test equipment and burned in for 96 hours at 85°C
- Fully assembled drives are burned in for 4 hours, at 60°C
- All fully assembled controls are computer tested with induction motor loads to assure unit specifications are met
- Non-Volatile memory (NVRAM) for program retention at power loss
- 3 current transformers detect the output current for motor control and protective functions
- Surface mount technology with conformal coating
- Digital operator keypad and display, with copy function, provides local control, fault reset, monitoring, and easy drive change out capability
- User definable parameter initialization
- Easy to remove heat sink cooling fans with programmable on/off control.
- Line regeneration (RC5 or DC5)