

1110

Phase-Converting AC Drive



Overview

The 1110 Phase-Converting AC Drive furnishes flexible, efficient, cost-effective solutions to a wide range of control needs. The drive provides flux vector control of three-phase AC motors, with or without encoder feedback, from a single-phase power source. It combines the latest IGBT-based PWM and digital signal processor technologies with a revolutionary, patented digital current regulator to deliver optimum motor performance, full programmability, and simplicity of operation. Compact and rugged, the drive is available in a NEMA 1 (IP2X) enclosure or as a chassis unit for mounting in any enclosure.

Performance Flexibility

The 1110 offers performance capabilities to suit a broad range of applications where variable-frequency AC or conventional DC drives are normally used. It can be configured for either variable-torque or constant-torque applications. With an optional motor-mounted incremental encoder and interface module, it provides precise velocity or torque control for demanding applications.

Motor-Independent Design

The 1110 can operate any standard, off-the-shelf or inverter-duty AC induction motor, making it a natural for retrofits as well as new applications. A unique, proprietary current regulator tunes the drive continuously in real-time, eliminating the usual current-loop tuning process required by conventional vector drives.

Auto Tuning

Once routine electrical connections have been made, the simple-to-use auto-tuning features adjust virtually all motor and inertial parameters to the motor and connected load. No motor maps are required. Simply enter the motor current, voltage, base frequency, and speed from the motor nameplate, and the advanced setup routines do the rest. The drive is completely tuned within minutes.

Digital Setup, Easy Operation

The keypad and liquid crystal display provide a simple interface for setting and viewing operating parameters and diagnostics. All controller settings are made digitally through the keypad. Readouts and fault messages are displayed in plain language. A help feature provides on-line assistance at the touch of a button.

Control Features

The 1110 provides the features needed for a variety of control applications. These include controlled acceleration and deceleration, adjustable and preset speeds, skip frequencies with adjustable windows, automatic restarting after fault trips with adjustable retries and delays, start into a spinning motor, selectable stopping methods, DC injection braking, and more.

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Overview*(continued)***Multiaxis Operation**

The 1110 includes a built-in synchronous communication port for motion control coordination of up to nine slave drives. Setup parameters allow control of the velocity ratio and position phasing between drives. Multiple motors can be operated in parallel from a single drive using optional variable-frequency software.

Power Quality

The 1110 includes a built-in link choke that provides near-unity overall power factor at all motor speeds as well as low harmonic line currents.

Protection and Advanced Diagnostics

The 1110 monitors its operating conditions and provides a comprehensive set of overload, short circuit, and other protective features. Faults are displayed in plain language along with the operating conditions at the time of occurrence. A fault log stores the last three faults.

Serial Connectivity

The 1110 features a fully-isolated EIA RS-422/485 serial interface to allow a host computer to set up, monitor, and control the drive using an ANSI standard protocol. Optional DF1 and RTU protocols allow direct connection to Allen-Bradley and Modicon programmable controllers. Fiber-optic and modem interfaces are also available.

Features & Benefits**General**

- Superior performance and value
- All-digital control for repeatable motor operation
- 24-bit digital signal processor (DSP) for fast, dynamic response
- Sine-coded PWM waveform output for improved torque performance
- High-switching-frequency IGBT devices for smooth, quiet operation
- Digital current regulator for reduced motor noise and fast response
- Internal control loop for maintaining speed with sudden load changes
- Flux vector control for full starting torque and for full torque to base speed
- Automatic field weakening for speeds up to twice base speed
- Integral DC link choke for high power factor and low total harmonic distortion
- Four stopping modes, including coast-to-stop and DC injection braking
- Optional factory-installed dynamic braking
- Seven preset speeds with separate acceleration and deceleration times
- Auto restart and start into a spinning motor for smoother, more efficient operation
- Three skip frequencies with adjustable windows for avoiding resonance
- Master-slave operation using either analog inputs or high-speed serial link
- User-programmable analog and digital inputs and outputs
- Through-hole heat sink mounting of chassis units for dissipating heat externally
- Ideal for applications requiring NEMA 1 (IP2X) enclosures

Ease of Installation, Setup, and Maintenance

- Automated setup features require no chart recorders or meters
- Software calibration and adjustment eliminates tuning components
- Digital parameter adjustment for precise and repeatable settings
- Software input and output scaling eliminates potentiometers
- Complete, self-contained package requires minimal option boards
- Identical control boards across power range reduces spare part requirements

Ease of Use

- Touch keypad for easy parameter adjustment and access to displays
- Two line by 16-character/line descriptive, plain-language display
- Information key for instant, on-line assistance
- Numerical readouts and speed bar graph display
- Comprehensive fault diagnostics displayed in plain language
- Real-time motion information and three-fault log
- Foreign language options available for export projects

Safe, Reliable Operation

- Extensive electronic protection circuits
- Tolerant of AC line voltage and frequency fluctuations
- S-curve acceleration reduces shock and extends equipment life
- Multilevel security code prevents unauthorized parameter changes
- Lockout of local operator controls for safe remote operation

Specifications Electrical

Input Supply

Voltage:	230 or 460 V AC ($\pm 10\%$), single-phase
Frequency:	47 to 63 Hz
Power factor:	Displacement: 0.89 at all loads and speeds Overall: 0.75 at rated load

Output Rating

Voltage:	Zero to 90% of input supply voltage, three-phase
Frequency:	Zero to twice base frequency
Switching frequency:	6 to 8 kHz, programmable, without derating

Service Conditions

Efficiency:	96% nominal at 6 kHz switching frequency
Overload current:	Variable torque: 120% of rated for 1 min; trip at 160% Constant torque: 150% of rated for 1 min; trip at 200%

Environmental

Operating temperature:	Control section: 32° to 131° F (0° to 55° C) Heat sink: 32° to 104° F (0° to 40° C)
Storage temperature:	5° to 158° F (-15° to 70° C)
Operating humidity:	95% maximum, noncondensing
Altitude:	To 3,300 ft (1,000 m) without derating

Performance

Velocity Control

Range:	Zero to base speed at full torque Zero to twice base speed with automatic field weakening
Regulation:	$\pm 0.01\%$ of base speed, down to zero, with encoder $\pm 0.5\%$ of base speed, 2 Hz and above, without encoder

Torque Control

Starting torque:	Variable torque: zero to 120% of rated Constant torque: zero to 150% of rated
Regulation:	$\pm 3.0\%$, with encoder

Frequency Resolution

Analog input (12-bit):	0.025%
Digital input:	0.010%

Inputs and Outputs

Analog Inputs

Three (3) 12-bit analog-to-digital inputs (with programmable scaling, offsets, and inversion):

- Speed or torque reference (software selectable) (0 to ± 10 V DC)
- Speed or torque reference (software selectable) (0 to 20 mA or 4 to 20 mA)
- Parameter adjustment (programmable to set or trim value of selected parameter) (0 to 10 V DC)

Digital Inputs

Eleven (11) digital inputs:

- Start
- Run enable
- Jog
- Reverse
- Fault reset
- Remote
- User (programmable)
- No external fault
- Preset speeds 1-7 (three binary-coded inputs)

Analog Outputs

Two (2) 12-bit digital-to-analog outputs (0 to ± 10 V DC, with programmable scaling, offsets, and inversion):

- Speed or torque (software selectable)
- Parameter value (programmable to reflect speed, torque, or other status value)

Digital Outputs

Three (3) digital outputs:

- Ready relay (Form A contacts, 250 V AC @ 5 A)
- Two (2) parameter value/drive mode (programmable to indicate selected status value or drive function) (one relay, Form C contacts, 250 V AC @ 5 A; one open collector output)

Specifications*(continued)***Serial Communications**

Asynchronous port:

EIA RS-422/485, isolated, 0.3 to 19.2 kbaud
ANSI-x3.28-2.5-A4 protocol standard; optional
Allen-Bradley DF1 and Modicon RTU protocols
EIA RS-485 for high-speed master/slave networking

Synchronous port:

Basic Parameters and Displays**Programmable Parameters**

- Setpoint
- Setpoint minimum
- Setpoint maximum
- Setpoint units label, scaling, precision
- Setpoint source
- Torque source
- Request torque
- Acceleration time
- Deceleration time
- Jog speed
- Jog acceleration time
- Jog deceleration time
- (7) preset speeds
- (7) preset speed acceleration times
- (7) preset speed deceleration times
- (3) skip frequencies
- (3) skip bandwidths
- Start mode
- Run mode
- Stop mode
- Direction mode
- Minimum/maximum motoring/braking torques
- Current limit
- Spinning restart select
- Restart retries/delay
- Analog I/O scaling/polarity
- User analog input mode
- User I/O parameter selections
- S-ramp profile smoothing
- Injection brake time/current
- Switching frequency
- Master/slave select/source
- Slave ratio/position phasing
- Display language
- Keypad enable
- Security code

Status Displays

- Set/actual speed
- Set/actual motor torque
- Speed error
- Bus voltage
- Power factor
- Motor current
- Motor frequency
- Motor voltage
- Power consumption
- Energy consumption
- Accumulated thermal load
- Accumulated time run
- Fault log and conditions
- Input status

Protection

- Ground fault
- Motor phase-to-phase short circuit
- DC bus overvoltage
- DC bus undervoltage
- Instantaneous overcurrent
- Motor overload
- Heat sink overtemperature
- Ambient overtemperature
- Power transistor fault
- Logic power undervoltage
- Remote speed command signal loss
- Motor runaway
- Dynamic brake duty cycle
- Memory malfunction
- Processor running fault
- Synchronous serial error

Options**Encoder**

A motor-mounted incremental encoder may be used for highest performance. An interface module is needed with this option.

Dynamic Braking

Dynamic braking is factory installed in the drive. Appropriately sized external braking resistors are required.

Power Range

Input Voltage	Constant-Torque Applications	Variable-Torque Applications
230 V AC	1 1/2-40 hp (1.1-30 kW)	2-50 hp (1.5-37 kW)
460 V AC	1 1/2-75 hp (1.1-56 kW)	2-100 hp (1.5-75 kW)

Consult factory for other powers. Other voltages require appropriate derating.



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Specifications subject to change without notice.

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