



2450

Modular
Performance
DC Drive

Overview The 2450 is an all-digital pulse-width-modulated (PWM) DC drive. Its revolutionary technology and modular design make it the optimum drive where superior performance, flexibility, and ease of operation are desired.

Motor-Independent Design

A unique design incorporating a proprietary digital current regulator and a state-of-the-art controller allows the 2450 to operate any DC motor without the current-loop setup required by conventional drives.

Application Flexibility

The 2450 can be configured for torque-, velocity-, and position-control servo applications. Depending upon application requirements, the controller can be configured to provide the appropriate analog and digital I/O, feedback, and serial communication capabilities. A programming option allows customization for unique applications using IEC 1131 open-standard ladder diagram, function block diagram, sequential function chart, structured text, and/or instruction list languages.

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 given motor and connected load. Simply enter a few values from the motor nameplate, and the advanced setup routines do the rest. The drive is completely tuned within minutes.

Modular Design

The modular bus design of the 2450 provides space, cost, and energy savings in many applications. The drive family consists of separate rectifier and amplifier units. The rectifier is comprised of a full-wave diode bridge, a bus-charging circuit, a dynamic braking circuit, and a capacitor bank. The amplifier consists of a four-IGBT, four-quadrant PWM control that operates from the DC bus of the rectifier to control armature current. A separate IGBT is used to control field current. High-power amplifiers are comprised of two separate poles.

Energy Savings

Multiple amplifier units can be operated from one rectifier unit. This allows applications that naturally share regenerative energy, such as an uncoiler and recoiler, to reuse the energy, rather than dissipate it as heat through resistors. A much smaller rectifier is therefore needed than would be required using two integrated drives. A 2400 series inverter can be used in place of the rectifier to achieve regeneration to the power line. In cyclic applications, an optional capacitor bank can be used to store regenerated energy and to return stored energy to the load.

Overview Power Quality

(continued)

The 2450 incorporates a link choke to provide near-unity power factor and low harmonic currents at all motor speeds. A 12-pulse rectifier option is available to further eliminate harmonic currents in critical applications. When a regenerative inverter is used in place of the rectifier, a unity power factor is achieved and virtually all harmonic currents are eliminated.

Application-Specific Software

The 2450 can be customized for definite-purpose applications using optional, application-specific software. Software is available for such applications as test stands, elevators, press feeders, winders, rotary cutoffs, spindles, flying cutoffs, cranes, and wire drawing, to name a few. The standard 2450 includes basic operational and auto-setup software.

Optically Isolated Digital I/O

All digital inputs and outputs are optically isolated. As many as 32 individually isolated digital I/O are locally provided, depending upon the controller, each of which can be programmed by the application to be an input or output. The voltage of each can be selected from a wide range of AC/DC values.

Transducer/Transducerless Design

The 2450 can operate with or without a feedback transducer. Typically, an incremental encoder is used for feedback, although multiturn absolute encoders and single-turn resolvers are also supported. For less demanding velocity-loop applications, the drive offers a transducerless mode of operation.

Features & Benefits

General

- All-digital control for zero drift and repeatable motor operation
- 24-bit DSP computational power for fast, dynamic response
- High-switching-frequency IGBT devices for quiet operation
- Digital current-loop regulator for fast response
- Servo loop operation for precise velocity, position, or torque control
- Full torque from zero to rated speed
- Field weakening at constant horsepower up to four times base speed

Ease of Installation, Setup, and Maintenance

- Complete, self-contained package requires few option boards
- Identical control boards across full power range reduces spare parts
- Snap-in signal connections for ease of wiring
- Automated setup feature requires no chart recorders or meters
- Software calibration and adjustment eliminates tuning components
- Software input and output scaling eliminates potentiometers
- Automated hardware configuration check

Ease of Use

- Full keypad for easy entry of application-specific setup adjustments
- Two line by 24-character-per-line descriptive, plain-English display
- Process variable display in bar graph and engineering units
- Comprehensive plain-language, self-diagnostic message display
- Real-time motion information and historical fault log
- RS-232/422/485 for communication with process controllers
- Optional software for managing the drive from a personal or handheld computer

Reliable Operation

- Tolerant of AC line fluctuations
- Extensive electronic protection circuits reduce failures
- Optically isolated signals for high noise immunity
- S-curve acceleration reduces shock and extends equipment life
- Fiber-optics for noise-free serial communication
- Designed to meet or exceed accepted international standards

Specifications **Electrical**

Input Supply

Voltage:	200 to 240 or 380 to 480 V AC, three-phase Phase sequence insensitive
Voltage tolerance:	-10% of minimum, +10% of maximum
Frequency:	47 to 63 Hz
Power factor:	Displacement: 0.99 at all loads and speeds Overall: 0.94 at rated load

Output Rating

Voltage:	Zero to $\pm 135\%$ of input supply voltage, DC
Switching frequency:	Programmable from 1 to 16 kHz
Overload current:	<i>Torque Overload (1 min) Maximum</i> Constant 150% of rated 200% of rated Variable 120% of rated 140% to 160% of rated

Conversion

Rectifier unit:	Less than 150 hp (CT): six-pulse 150 hp (CT) or more: six- or 12-pulse
Amplifier unit:	Four-IGBT, four-quadrant, PWM
Regeneration:	Dynamic braking transistor with resistors, capacitor bank energy storage, or regenerative inverter

Environmental

Operating temperature:	32° to 104° F (0° to 40° C)
Storage temperature:	-40° to 158° F (-40° to 70° C)
Relative humidity:	95% maximum, noncondensing
Altitude:	To 3,300 ft. (1,000 m) without derating

Performance

Position Control

Bandwidth:	50 Hz
Settle time:	10 ms

Velocity Control

Bandwidth:	100 Hz with transducer 10 Hz without transducer
Regulation:	$\pm 0.001\%$ of base speed with transducer $\pm 0.50\%$ of base speed without transducer

Current Control

Bandwidth:	300 Hz
Regulation:	$\pm 1.0\%$ of maximum current

Control Modules

Common Features:

- Three ± 10 V DC or 0 to 20 mA 12-bit analog inputs
- Two ± 10 V DC 12-bit analog outputs
- Two programmable contact outputs
- Fiber-optic high-speed synchronous/asynchronous serial port with clock synchronization up to 1 Mbaud
- Fiber-optic synchronous serial port with clock synchronization at 2 Mbaud
- One optional communication interface provision

Standard Control Module:

- Eight optional configurable I/O points
- One optional feedback interface provision
- One RS-422/485 asynchronous serial port up to 115.2 kbaud

Expandable Control Module:

- Two programmable isolated inputs
- 16 or 32 optional configurable I/O points
- One incremental encoder interface
- Two optional feedback interface provisions
- Two RS-422/485 asynchronous serial ports up to 115.2 kbaud

Specifications

(continued)

Communication Modules

Serial Communications:

- Two isolated RS-232/422/485 synchronous/asynchronous serial ports up to 1 Mbaud

Fiber-Optic Communications:

- One isolated fiber-optic synchronous/asynchronous serial port up to 1 Mbaud
- One RS-232/422/485 synchronous/asynchronous serial port up to 1 Mbaud

Profinet Communications:

- Profinet interface

EtherCAT Communications:

- EtherCAT interface

ControlNet Communications:

- ControlNet interface

Profibus Communications:

- Profibus DP interface

Ethernet Communications:

- Ethernet/IP interface

Transducer Options

A variety of motor-mounted transducers are available to provide feedback of motor position, velocity, and acceleration.

Incremental Encoder:

Two quadrature channels with marker pulse operating up to a maximum frequency of 300 kHz per channel

Single-Turn Resolver:

Up to 14-bit resolution

Multiturn Absolute Encoder:

24-bit resolution with RS-422/485 synchronous serial communication

Inputs and Outputs

Input Converters:

2.5 to 28 V DC @ 30 mA, 90 to 140 V AC @ 11 mA, or 180 to 280 V AC @ 5 mA

Output Converters:

5 to 60 V DC @ 3 A, 12 to 140 V AC @ 3 A, or 24 to 280 V AC @ 3 A

Relay Converters:

250 V AC @ 8 A, normally open or normally closed

Control Module Relay Contacts:

Form A 250 V AC @ 5 A

Optional Analog Interface Module:

Two ±10 V DC inputs and two ±10 V DC outputs

Protection

- Ground fault
- Drive thermal overload
- Software circuit breaker
- DC bus overvoltage
- DC bus undervoltage
- DC bus fuse and blown fuse
- Instantaneous overcurrent
- Motor thermal overload
- Braking unit overcurrent
- Heat sink overtemperature
- Phase loss
- Power transistor fault
- Control undervoltage
- Excessive position error
- Uncommanded motion
- Motor overspeed
- Feedback transducer failure
- Memory malfunction
- Processor not running fault
- Serial communication error

Power Range

Input Voltage	Constant-Torque Applications	Variable-Torque Applications
230 V AC	1 1/2-150 hp (1.1-110 kW)	2-200 hp (1.5-150 kW)
460 V AC	1 1/2-800 hp (1.1-600 kW)	2-900 hp (1.5-675 kW)

Consult factory for other powers. Other voltages require appropriate derating or adjustment of the switching frequency.

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