



**EQ**SERIES  
EQ7

**A high-performance full-featured drive that has a wide horsepower range and is easy to configure**



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08-12



# EQ 7 Overview

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- **230VAC, 3 $\Phi$ , 1-125HP(CT)  
1-150HP(VT)**
- **460VAC, 3 $\Phi$ , 1-900HP(CT)  
1-1000HP(VT)**
- **4 Drives in one! Operates in V/Hz as standard with multiple control selections available:**
  - Dynamic torque Control
  - PG Closed loop Vector Control
  - Sensorless Vector
- **Operators Keypad is full featured**
  - LED and LCD features in one unit!
  - Quick Start menu and Copycat capabilities
  - Remote/Local control selection with bumpless transfer is standard on keypad



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# EQ 7 Overview

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- **Software Parameters Organized by Functions**
  - Basic parameters
  - I/O assignment parameters
  - Motor parameters
  - Application related parameters
  - RS485 Communications parameters
  - Higher performance parameters
- **Drive Programming very Similar to EQ5**
  - Terminals common to EQ7 and EQ5 have same tags
  - Software parameters common EQ7 and EQ5 generally have same parameter numbers
- **Conformal Coating on PC boards**
  - Nickel and tin plated bus bars
  - Greater corrosion resistance than standard PC Boards



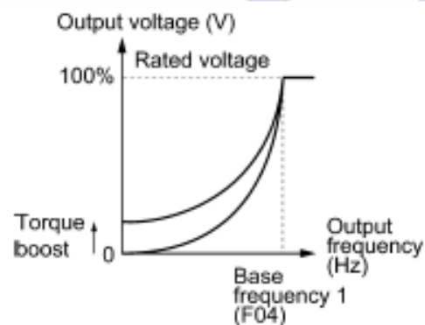
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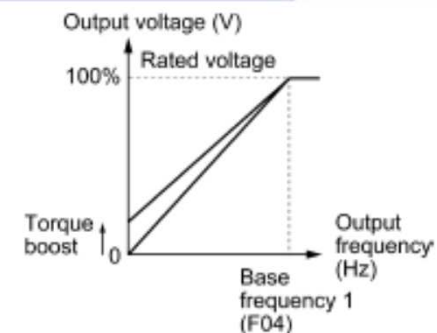


# EQ7 Control Features

- **V/F Selection: Constant (Linear) or Variable Torque**
  - Most common form of VFD control
  - Default is constant torque (F37 = 1)
  - Torque boost via F09 adjustment



Variable torque V/f pattern (F37 = 0)



Linear V/f pattern (F37 = 1)



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# EQ7 Control Features

- **Dynamic Torque Control**
  - Maximizes torque output available to a motor
  - Calculates the motor torque, then optimizes voltage and current output based on result
  - Automatically applies torque boost and slip compensation to eliminate possible speed droop
  - Auto-tune procedure will optimize settings
- **Sensorless Vector and PG Closed Loop Flux Vector Available**
  - More commonly used in non-pumping applications



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# EQ7 Performance Features

- **Fully Programmable Digital Inputs**
  - Forward and Reverse plus 7 programmable inputs
  - Dedicated safety (interlock) input
- **3 Analog Inputs**
  - Qty 2 +/- 10Volts and (1) 4 to 20Ma input
- **6 Fully Digital Programmable Outputs**
  - 2 contacts, 4 transistor type
  - Convert all transistor types to relays (option)
- **2 Programmable Analog Outputs**
  - 0-10V or 4-20ma via switch settings
  - RS485 output : Modbus standard, plus optional protocols such as Ethernet, Devicenet, Profibus plus more.



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# EQ7 Performance Features

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- **DC Link Choke (DC Reactor) at 75HP CT(100HP VT) and Above is Included**
  - Supplied as standard with drive for separate installation
  - Optional external DC link chokes at lower ratings.
  - Can help mitigate line harmonics
  - Enhances bus voltage stability to improve performance



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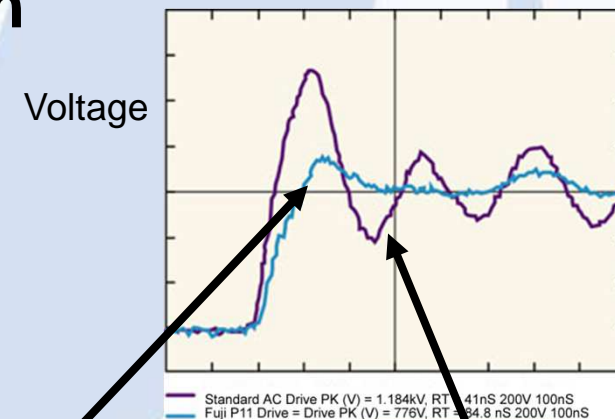
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# EQ7 Performance Features

- **Soft Switching Technology**
  - Reduces motor heating
  - Reduced motor insulation stress
  - Longer cable lengths

## IGBT pulse



Soft Switching

Standard PWM



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# EQ7 Performance Features

- **Soft Switching Technology Eliminates the Need for Output Reactors in Many Installations.**

Inverters 7.5HP/CT, 10HP/VT and Higher			
Motor Insulation Rating	1000V	1300V	1600V
460 VAC Input Voltage	66 ft (20 m)	328 ft (100 m)	1312 ft (400 m) *
230 VAC Input Voltage	1312 ft (400 m) *	1312 ft (400 m) *	1312 ft (400 m) *
Inverters 5HP/CT/VT and Smaller			
Motor Insulation Rating	1000V	1300V	1600V
460 VAC Input Voltage	66 ft (20 m)	165 ft (50 m) *	165 ft (50 m) *
230 VAC Input Voltage	328 ft (100 m) *	328 ft (100 m) *	328 ft (100 m) *
* In this case the cable length is determined by secondary effects and not voltage spiking.			

**Note:** For Vector Control 328 ft is the maximum distance



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# EQ7 Software Features

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- **Wide Variety of Frequency Source Selections**
  - 0-10V
  - 4-20ma (reversible: 20-4ma)
  - 4-20ma + 0-10V (additive)
  - $\pm 10V$  from Either Analog Voltage Input
  - MOP (2 Modes)
  - RS-485
  - Keypad
  - Pulse Train



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# EQ7 Software Features

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- **Wide Variety of Digital Input Configurations**
- **All Digital Inputs Can be Configured for Normally Open or Closed Field Signals**
- **Dedicated FWD and REV Inputs PLUS 7 Configurable Inputs**
  - 15 multi-step selections
  - Accel / decel
  - Forced stop with alternate decel setting
  - Pulse Train Input
  - Switch between motor 1 and motor 2 operation
  - Configuration lock-out
  - Motor Preheat Enable
  - Independent Digital Input (with RS-485 operation)
  - DC Injection braking
  - MOP inputs



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# EQ7 Software Features

- **Can Switch Between 2 motors**
  - Via digital input/ digital output to eternally supplied contactors
  - Ability to retain separate motor data and auto tuning results for each motor
- **Separate Overload Settings for Motor 1, Motor 2, and Braking Transistors**
  - Torque limiting settings for all these as well
- **Carrier Frequency: See Table Below**
  - Motor sound (tone) adjust at lower carrier frequencies
  - Can automatically reduce set carrier frequency in response to high VFD Temperatures

<b>Maximum carrier Frequency (kHz)</b>	<b>16</b>	<b>10</b>	<b>6</b>	<b>4</b>
<b>Maximum HP (VT Mode)</b>	<b>Up to 30</b>	<b>50-100</b>	<b>125-900</b>	<b>1000</b>
<b>Maximum HP (CT Mode)</b>	<b>Up to 100</b>	<b>125-900</b>	<b>1000</b>	<b>---</b>



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# EQ7 Software Features

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- **4 Separate Acceleration / Deceleration Rates**
  - Linear, adjustable s-curve, and non-linear ramp selections
- **PID Control**
  - Process control of VFD
  - Low-demand (sleep) mode
  - Dancer control
- **Energy Savings Mode and Drive Cooling Fan Control**
- **Auto Reset on Selected faults**
  - Avoid Nuisance Trips
- **6 Language Settings on LCD Including Spanish**
- **Torque Limit Control**
  - Decrease speed in motoring situations
  - Increase speed when in regenerative mode



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# EQ7 LED/LCD Keypad

- **Unique LED and LCD**
  - LED = 5-Digit Display
  - LCD = 5 Line, 13 Character
- **LCD Backlight Feature (shown)**
- **Built-in Remote / Local Select**
  - Bumpless mode transfer
- **10 Function Modes:**
  - Quick Set – Data Set – Data Check
  - Monitor – I/O Check – Maintenance
  - Alarm Info – Alarm Cause – Data Copy
  - Load FCTR
- **Data Copy Function**
  - Transfer parameters to any other EQ7 with the same rating




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# EQ7 LED/LCD Keypad

- **LED Display can be Changed in Run Mode to View:**
  - Output Frequency (with or without slip compensation)
  - Frequency Reference
  - Output Current
  - Output Voltage
  - Motor Speed RPM, Set Motor Speed, Load Shaft Speed
  - Line Speed m/Min
  - Machine Speed RPM
  - PID Parameters
  - Input Power
  - Motor Output Power
- **Pressing the  Key will Scroll Through each Display**
- **The LCD Shows which Variable is Being Monitored on the LED Display**



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# EQ7 LED/LCD Keypad

Can Display Parameters Numerically or Graphically



Standard Mode



Graphics Mode

← LCD Contrast is adjustable. →

Bar graph displays frequency, amps, and % torque




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# EQ7 LED/LCD Keypad

- By Depressing the  Key, 10 Different Menus may be Selected
  - Quick Set (Quick Start)
  - Data Set
  - Data Check
  - Opr Mntr
  - I.O. Check
  - Maintenance
  - Alarm Info
  - Alarm Cause
  - Data Copy
  - Load FCTR



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# EQ7 Quick Set Feature

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- Selection from Program Menu that Provides a Concise List of Parameters Relevant to all Applications
- Allows Users to Set These Parameters Quickly for Basic Drive Installations
- Quick Set Parameters Include:
  - Start/Stop and Frequency command source
  - Maximum and Base Speed settings
  - Acceleration / Deceleration Times
  - Motor Parameters and Auto Tuning selections
  - Torque Boost and Overload settings
  - Carrier Frequency Adjustment



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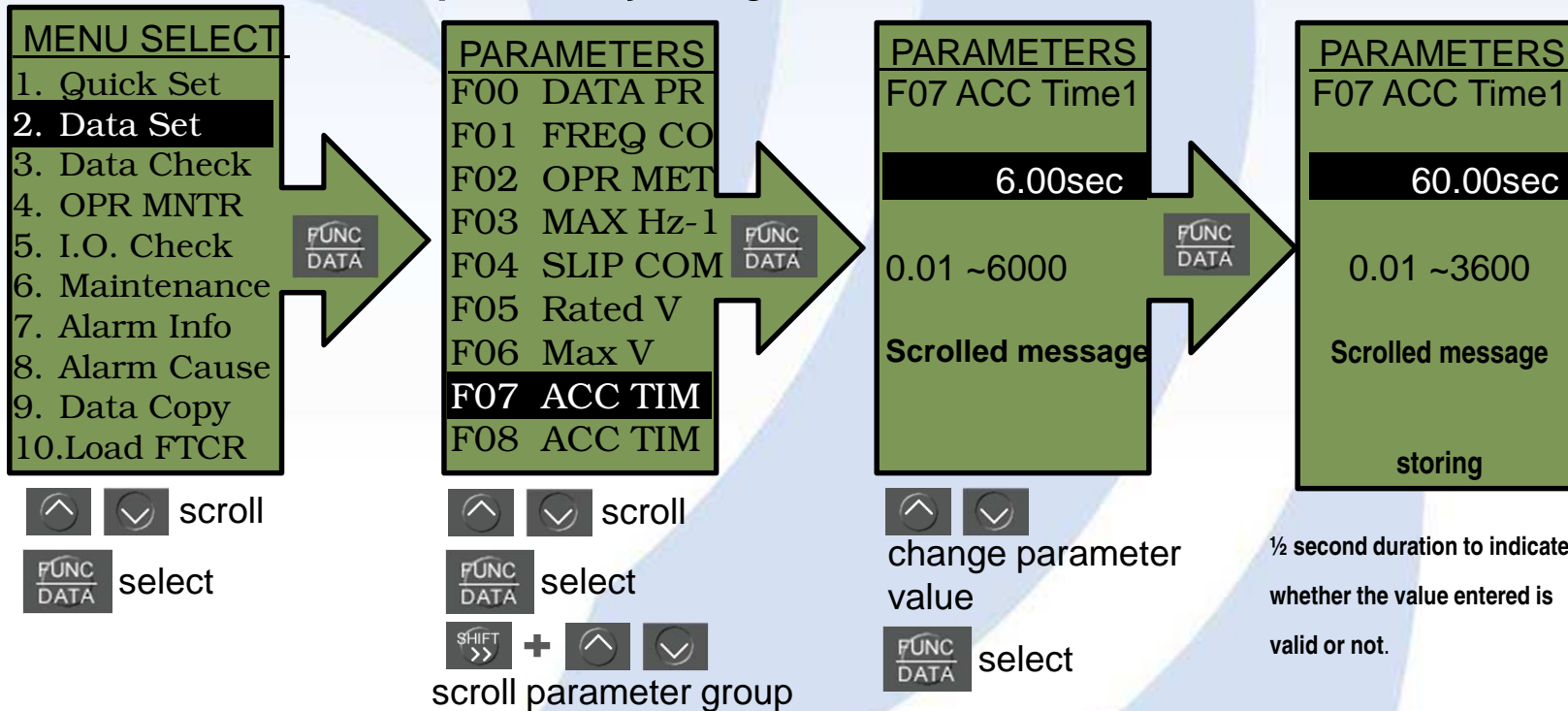
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# EQ7 LCD Data Set Function

This Menu is Where to Change Parameters

Example for adjusting acceleration time



1/2 second duration to indicate whether the value entered is valid or not.

RESET Key returns to previous menu



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# EQ7 LCD Data Set Function

- Data Set Menu Mode
- Parameters Organized in the Following Categories.

FUNCTION CODE	FUNCTION TYPE
F00-F80	Fundamental Functions
E00-E99	Terminal Functions
C01-C53	Frequency/Scaling Functions
P01-P99	Motor Parameters
H03-H90	High Performance Parameters
J1-J99	Application (PID) Parameters
Y01-Y99	Link (RS-485) Parameters



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# Fundamental (F) Functions

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- Frequency and Run Command Sources
- Acceleration / Deceleration Settings
- Maximum / Minimum
- Torque Boost and Variable/Constant Torque Selection
- Control Mode
  - V/Hz, Sensorless Vector, Dynamic Torque Vector, or PG Closed Loop Vector
- DC Braking
- Carrier Frequency
- Current and Torque Limits



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# Terminal (E) Functions

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- **Input Terminal Assignments**
  - Separate selections for normally-closed state for field signals
  - Can configure the FWD or REV inputs to other input settings when controlling the VFD locally.
- **Output relay and Digital Output Settings**
  - Separate selections for normally-closed state activation
- **Analog Inputs Configuration**
- **PID Display Scaling**
- **Pulse Output**
- **Overload and Other Threshold Settings**
- **Display Settings (LCD or Graphics)**
- **Alternate Acceleration / Deceleration settings (4 total sets available in EQ7)**



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# Frequency / Scaling (C) Functions

- Preset Frequency Assignments
- Gain / Bias Adjustment on Analog Signals
- Normal or Inverse Analog Reference Selection

## Main Motor (P) and Alternative (A) Functions

- Slip Adjustment Settings
- Motor Amps, Poles, Motor KW
- Auto Tuning



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# High Performance (H) Functions

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- Auto Reset
- Factory Initialize
- Auto Re-start on Fault
- Auto Re-start after Power Failure
- Cooling Fan Operation Selection
- Acceleration /Deceleration Patterns
- RS485 run / Frequency Source Selection
- PTC Input Setting
- Energy Savings



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# Application (J) Functions

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- **PID Adjustment and Control**
  - Sleep mode select
  - Hi – Lo Alarms for PID Feedback
  - Hi – Lo Limits on PID Output
- **DC Injection Braking**
- **Servo Lock (Hold motor shaft in place after stopping for specified time interval)**
  - PG Closed-Loop Vector Feature
  - Corrects for shaft overtravel to lock into a fixed position



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# EQ7 Data Check

- **Similar to Data Set Menu**
  - Actual values displayed as shown at right
  - Can change parameters in this menu
  - Values different from default will have a \* preceding them
    - Can be a useful de-bugging tool

PARAMETERS	
F00	0
F01	0
F02	*1
F03	*1
F04	60Hz
F05	60Hz
F06	0
F07	*6.00 sec
F08	*0



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# EQ7 Monitor Items

- View Live Operating Parameters
- Examples of More Significant Monitor Screens
  - The output frequency, current, voltage (As shown below)
  - Torque, speed reference, and running status
  - PID Setpoint, feedback, and PID output
  - Torque Limit, PG (encoder) data

Fot1=xxxx.xHz	←	Output frequency
Fot2=xxxx.xHz	←	Output synchronous Frequency
Iout= xx.xA	←	Output current
Vout= xxxV	←	Output Voltage



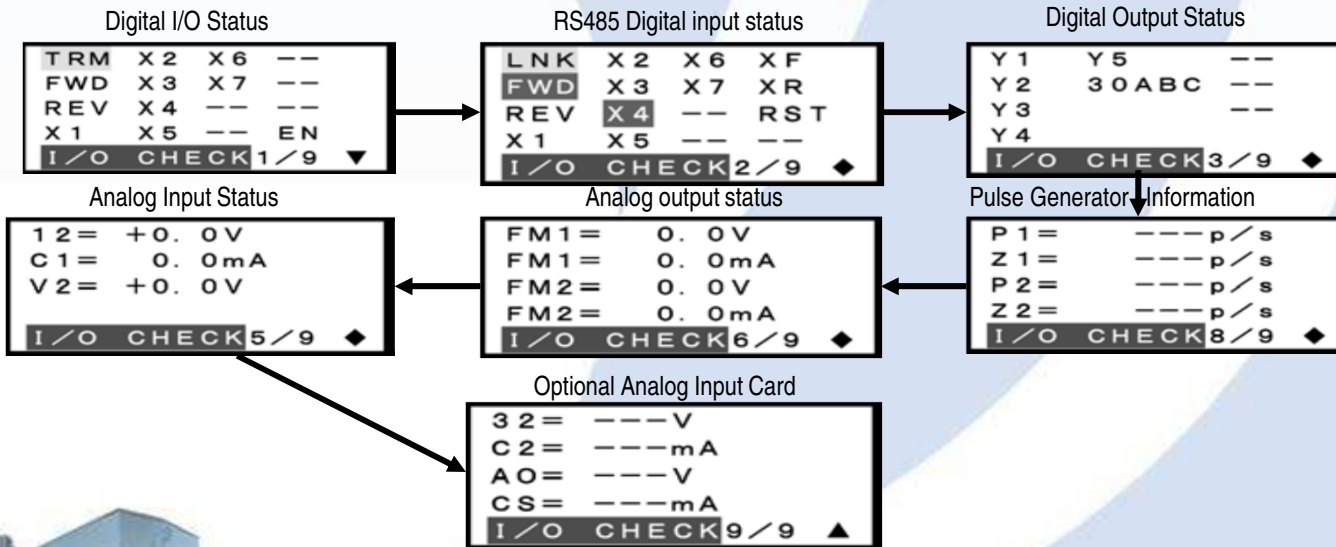
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# EQ7 Input/Output Status

- This Function Monitors State of Digital and Analog I/O
  - Step through the different screens per the example below.



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# EQ7 Maintenance Information

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- **This Function Monitors Information for Maintenance and Inspection.**
  - **Maximum drive and heat sink temperatures seen**
  - **Cumulative run times for VAD and on time for pc board capacitors, cooling fans, and DC Bus capacitors**
  - **RS-485 Communications errors for each RS485 port**



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# EQ7 Alarms

- Alarm (Fault) Condition Displays the Specific Alarm and Trips the Drive
- “Light” Alarm Condition Displays Specific Alarm and Allows Continued Operation
  - Early warning to a true alarm (User selectable)
  - Alarm message preceded by an “L” on the screen
- Auto Restart Available for Fault Recovery
- Menu Displays Relevant Drive Operating Parameters at the time of occurrence for the 4 most recent faults.
  - Output current, frequency, voltage, calculated torque, I/O signals, DC bus, plus more



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# EQ7 Alarms and Fault Data

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- **Alarms Annunciate the Following**
  - **Overcurrent (during accel, decel, and at speed)**
  - **Overvoltage (during accel, decel, and at speed)**
  - **Undervoltage**
  - **Input phase loss and ground fault**
  - **Drive Overload**
  - **Motor overload via internal calculation or PTC Input**
  - **Inverter Overtemp: at heatsink or high ambient**
  - **DB resistor overheat**
  - **Blown DC Fuse**
  - **CPU, RS485, Option Card-associated faults**
  - **PG related faults: Overspeed, loss of PG signal**
  - **User defined faults**



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