HPV 900 AC Vector Elevator Drive Technical Manual

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HPV 900 DRIVE RATINGS

Rated Input Voltage	Rated Horsepower	Rated kW	Continuous Output Current General Purpose Rating	Continuous Output Current Elevator Duty Cycle Rating	Maximum Output Current for 5 Sec
230V	10	7.5	27	31	68
	15	11.2	41	47.1	102
	20	14.9	52	59.8	130
	25	18.7	68	78.2	170
	30	22.4	80	92	200
	40	29.8	104	119	260
460V	5	3.7	8	9.2	20
	10	7.5	16	18.4	40
	15	11.2	21	24.1	53
	20	14.9	27	31	68
	25	18.7	34	39.1	85
	30	22.4	41	47.1	102
	40	29.8	52	59.8	130
	50	37.3	65	74.7	162
	60	44.8	77	88.5	192
	75	56.0	96	110	240

Table 1 - HPV 900 Drive Ratings

NOTE: all ratings at 60/50Hz and 10 kHz carrier frequency

For more information on the Elevator Duty Cycle Rating, see section (5.7).

Section 1
INTRODUCTION to the HPV 900 Elevator Drive

1.1 DRIVE DESCRIPTION

1.1.1 Dedicated to Elevator Industry

The HPV 900 is a dedicated digital AC vector drive tailored to the elevator industry. It encompasses high overload capacity, coupled with advanced closed loop vector control techniques for superior motor control. The HPV 900 was designed to easily fit into any AC elevator application.

The HPV 900 is guaranteed to run continuously at 150% of continuous rating for 60 seconds and 250% of continuous rating for 5 seconds.

The HPV 900 includes four programmable S-curves. Each S-curve is programmed with the following: acceleration rate; deceleration rate; jerk rate for accel/decel; and leveling jerk rate.

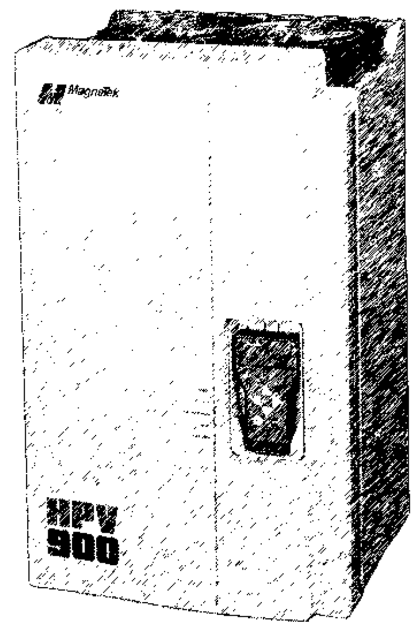


Figure 1. 1 - HPV 900

1.1.2 Torque Control

The HPV 900 excellent torque control is specifically designed for use with elevators.

➡ **Handling Unbalanced Loads**
The HPV 900 provides a Pre-torque value, which is the value of torque that the controller would need to produce as soon as the speed command is released to help to smoothly handle unbalanced elevator loads.

➡ **Helping Eliminate Car Roll-back**
The priming of the speed regulator with a pre-torque value can help to eliminate car roll back.

➡ **Controlling Brake Slippage**
A function unique to elevators involves the interaction between the torque control and the mechanical brake that holds the elevator. Under full load conditions, if the brake is set and the motor torque is removed immediately at the end of a run, some brake slippage can occur. Therefore, the HPV 900 provides an option of gradually removing the motor torque thus controlling mechanical brake slippage

1.1.3 Speed Control

The HPV 900 advanced speed control adapts the drive to rigorous performance requirements and helps to ensure ride quality even in existing hoistways.

➡ **Helping Prevent Floor Over-shoot**
Elevators coming into the floor will be able to utilize the HPV 900's speed regulation to help prevent overshooting the floor.

➡ **Helping Prevent Car Creeping**
The HPV 900 has excellent zero speed control, which keeps the elevator from creeping the moment the brake is released.

➡ **Reducing Effects of Ropes**
The HPV 900's speed response can help to reduce resonant characteristics created by the spring action of the elevator ropes, which can cause car vibration in high performance elevator systems. In addition, a tach rate gain function is available for systems that exhibit additional problems with rope resonance.

➡ **Controlling Leveling Ride Quality**
The S-curves adjustable Leveling Jerk Rate can be programmed to control ride quality during leveling.

➡ **Controlling Reference Overshoot**
The use of the HPV 900's Elevator Speed Regulator (Ereg) prevents speed reference overshoot at the end of an accel or decel.

➡ **Sources of Speed Command**
The three possible sources for the speed command are: serial channel; analog channel (±10V); and multi-step command (16 discrete speed commands).

➡ **Providing for Overspeed Tests**
In order to allow overspeed tests during elevator inspections, the HPV 900 provides a means to multiply the speed command by a user-defined factor.

1.1.4 Installation Versatility

The HPV 900 has been designed to fit both new installations and modernization elevator applications. The power and flexibility of the HPV 900 can be utilized for a new elevator installations, or, installed when modernizing an existing system to experience better control and accuracy than when it was new.

1.1.5 Fast Startup

The advanced elevator software and control algorithms have been specifically designed for ease of installation for elevator applications.

➡ **Drive / Motor Compatibility**
Since the specific MagneTek motor characteristics are already contained in the software, by using a MagneTek motor all the motor parameters are automatically adjusted to the optimum values, once the proper Motor ID is selected.

➡ **Advanced Set-up**
The parameter values contained in the drive software are entered using engineering units (e.g. contract speed in ft/min or m/s)

The Configure Parameters can be preloaded with the configuration for each car controller. The Configure Parameters include the following: user switches; logic inputs; logic outputs; and analog outputs

The Adjust Parameters can also be preloaded. The Adjust Parameters include the following: S-curve data (accel, decel, & jerk rates) and speed command values.

1.1.6 Operation

The HPV 900 elevator software allows for ease in tuning for specific elevator applications.

➡ **Adaptive Tune**
The slip frequency of the motor is automatically calculated by the HPV 900 software. The software calculates the percentage no load current and the estimated rated rpm. Since the Slip frequency can change with temperature, this is an important feature to obtain the maximum performance from the motor.

➡ **Estimating Inertia**
The HPV 900 software can also be used to calculate the inertia of the entire elevator, which is used for accurate tuning of the speed regulator.

➡ **Reduced Harmonic Distortion**

The HPV 900 can be configured with the following two items to help reduce harmonic distortion: allows for input from a 12-pulse transformer and allows for connection of external DC bus choke.

➡ **Quiet Motor Operation**
The HPV 900 provides for an adjustable carrier frequency. The carrier frequency can range from 2.5 kHz to 16 kHz. The HPV 900 can use a 10 kHz carrier frequency without drive derating.

➡ **User-Friendly Digital Operator**

The Digital Operator for the HPV 900 is a removable push button fully programmable operator with LCD two-line sixteen-character display. The operator shows parameter definition, units and parameter values. In order to cut down on the number of keystrokes necessary to navigate among the parameters, the HPV 900 software allows for more the in-depth parameters to be hidden.

1.2 DRIVE SPECIFICATIONS

1.2.1 Ratings

- Horse Power ratings at 230 Volt AC input: 10, 15, 20, 25, 30, and 40 HP
- Horse Power ratings at 460 Volt AC input: 5, 10, 15, 20,25, 30, 40, 50, 60, and 75 HP
- 150% of continuous current rating (general purpose rating) for 60 seconds
- 250% of continuous current rating (general purpose rating) for 5 seconds

1.2.2 Performance Features

- Control Method:
  Digital flux vector, Space Vector PWM (1/3 less switching loss then Sine coded)
- Speed Command Sources:
  Serial channel; Analog channel; and Multi-step command
- Speed Control:
  Range: 0 to rated speed
  Accuracy: ±0.02%
- Speed Reference Resolution
  Multi-step reference:0.1 ft/min/0.001 m/s
  Analog reference: 0.05%
- Speed Reference Signal: -10V to +10V
- Four distinctive programmable S-curves with: adjustable accel / decel rates and adjustable jerk rates (accel/decel & leveling)
- Torque Limit: Setting range: 0 to 250% motoring/regeneration set independently
- Selectable Functions: Multi-step speed operation (16 steps max.) and S-curves accel / decel
- Adaptive Tune: Adjusts motor parameters automatically by: calculating the percentage no load current and estimating the rated rpm
- Estimates Inertia: Calculates the inertia of the entire elevator for easy tuning of the speed regulator
- Functions Available: Configuration and tuning of the speed regulator; Specifying the input line and motor parameters; Monitoring various internal signals; Fault annunciation & Fault log viewing.
- Programmable auto restart on a resettable fault

1.2.3 Input Power

- Voltage: 200 - 240 VAC, 3-phase, ± 10%
  380 - 480 VAC, 3-phase, ± 10%
- Frequency: 48 - 63 Hz
- Line Impedance: 3% without choke
  1% with choke
- Nominal Voltage Levels:
  230 & 460 VAC, 3-phase, 60/50 Hz

1.2.4 Output Power

- Voltage: 0 - Input Voltage
- Frequency: 0 - 120 Hz
- Carrier Frequency: 2.5 kHz - 16 kHz

1.2.5 Digital Inputs

Nine (9) programmable opto-isolated logic inputs.

- Voltage: 24VDC pull-up (internal or external)
- Sinking Current: inputs 1&2 = 18mA
  inputs 3-10 = 9 mA
- Update Rate: 2 msec.

1.2.6 Digital Outputs

Two (2) programmable Form-C relays.

- Relay 1: 5A at 30VDC / 250VAC
  100,000 operations
- Relay 2: 10A at 24VDC / 220VAC
  10,000,000 operations
- Update Rate: 2 msec.

Four (4) programmable opto-isolated open collectors.

- Voltage: 50 Volts DC (max.)
- Capacity: ≤ 150 mA
- Update Rate: 2 msec.

1.2.7 Analog Inputs

Two (2) differential inputs.

- Voltage: ± 10 Volts DC
- Channel 1: Speed Command
- Channel 2: Pre Torque Command
- Resolution: 12 Bit
- Software gain and offset available
- Update Rate: 2 msec.

1.2.8 Analog Outputs

Two (2) programmable differential outputs.

- Voltage: ± 10 Volts DC
- Capacity: 10 mA
- Resolution: 12 Bit
- Update Rate: 2 msec.

1.2.9 Encoder Feedback

- Supply Voltage: 12VDC or 5VDC
- Capacity: 200mA or 150mA
- PPR: 600 - 10,000
- Maximum Frequency: 300 kHz
- Input: 2 channel quadrature
  5 or 12 volts dc differential
  (A, $\overline{A}$, B, $\overline{B}$)

1.2.10 Design Features

- DC Bus Choke: Connections for optional external DC Bus Choke
- Internal Dynamic Brake IGBT: Connections for external Dynamic Brake Resistor
- Serial Channel: Optically isolated RS422 port

1.2.11 Protective Features

- Internal motor overload protection per UL/CSA
- Overspeed Fault
- Drive Overload Fault
- DC Bus Overvoltage and Undervoltage Faults
- Overcurrent Fault
- Phase Overcurrent Fault
- Open Phase Fault
- Overtemperature Fault
- Encode Malfunction Fault

1.2.12 Environmental

- Operating temperature range -10°C (14°F) to 50°C (120°F)
- Altitude 3300 Ft. without derating
- Relative humidity 95% (non-condensing)

1.2.13 Standards and Reliability

- UL and CSA listed
- Surface mount devices

1.3 DRIVE IDENTIFICATION

The HPV 900 nameplate contains a fifteen digit part number, which provides complete identification of the drive. The following figure (Figure 1.2). details the part number.

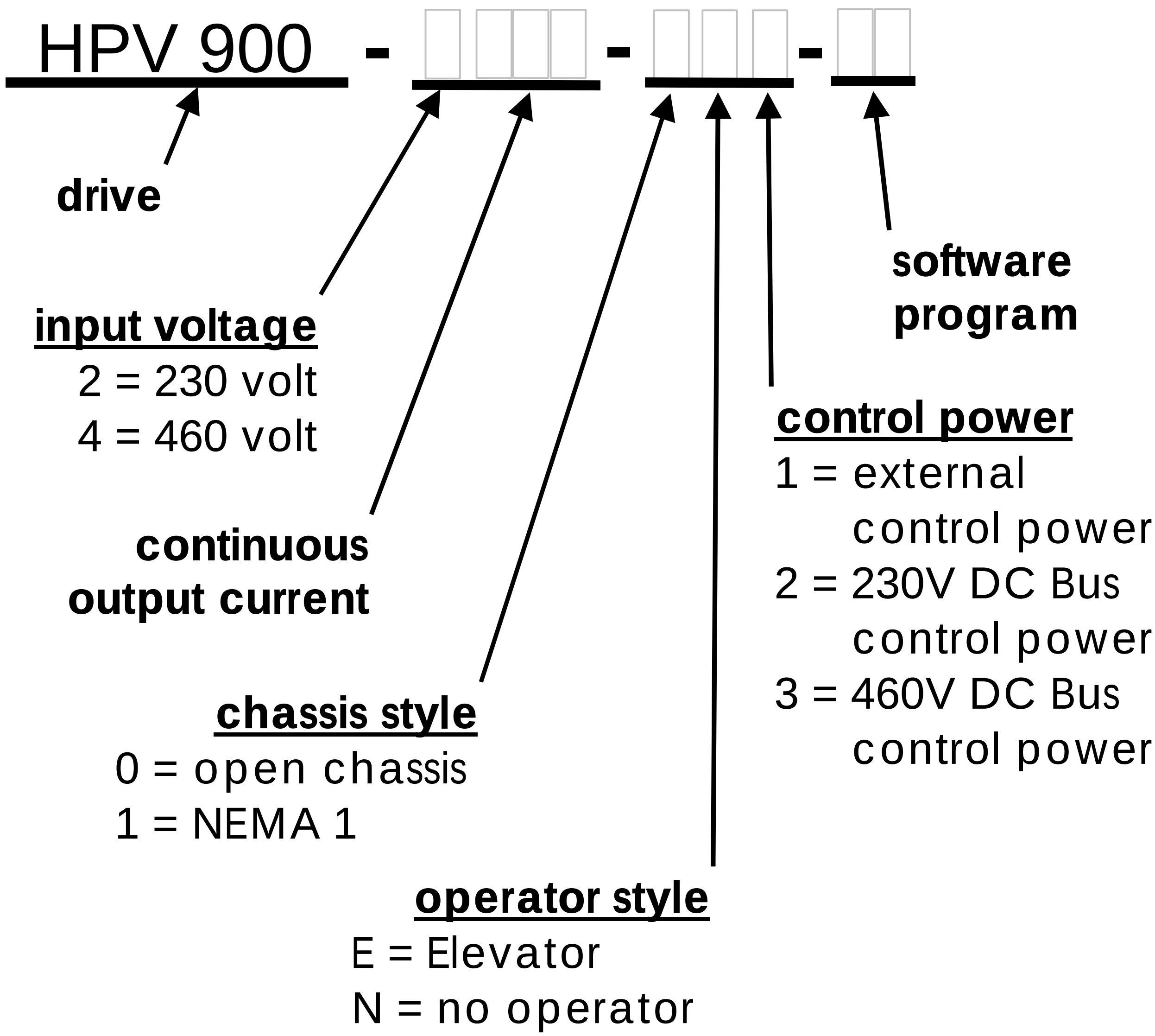


Figure 1. 2 - HPV 900 Part Number

1.4 FUNCTIONAL DESCRIPTION

The HPV 900 consists of a heatsink mounted power bridge circuit and printed circuit board control circuits.

1.4.1 Drive Control Board

This board is located directly behind the front cover and bolted to the frame. This board provides the digital signal processor, memory, and support circuits needed to control drive operation. The control circuitry can be considered to be made up of two functional areas. The first section is called the Power Conversion Unit PCU). The PCU circuit controls the power section of the drive. The second section is called the Drive Control Unit or DCU. This is where the elevator specific control algorithms exist. The DCU handles all necessary functions providing motor control and all other functions relating to the elevator function. These function include: parameters, inputs and outputs, fault indications and diagnostics, speed and torque control.

- I/O Interfaces - off/on board connections to the HPV 900 are described in detail in:
  Figure 2.5 – Interconnection Diagram
  Section 3.5.2 LOGIC INPUTS C2.
  Section 3.5.3 LOGIC OUTPUTS C3.
  Section 3.5.4 ANALOG OUTPUTS C4.

- Serial Port - The serial port uses RS422 full duplex serial communications. The physical connector is a DB9 (9-pin serial connection).

- Digital Operator Port - The digital operator port uses standard RS232 standard for full duplex serial communications with handshaking.

- User Terminal Blocks

  TB1 contains locations for the analog and digital user inputs, and digital encoder inputs as well. There are nine logic inputs referenced to an isolated 24V common and two bi-polar ± 10V analog inputs. Outputs include four optically isolated logic outputs and two ±10V straight binary analog outputs.

  TB2 provides 6 terminals for connections of output signals from two form C relays.

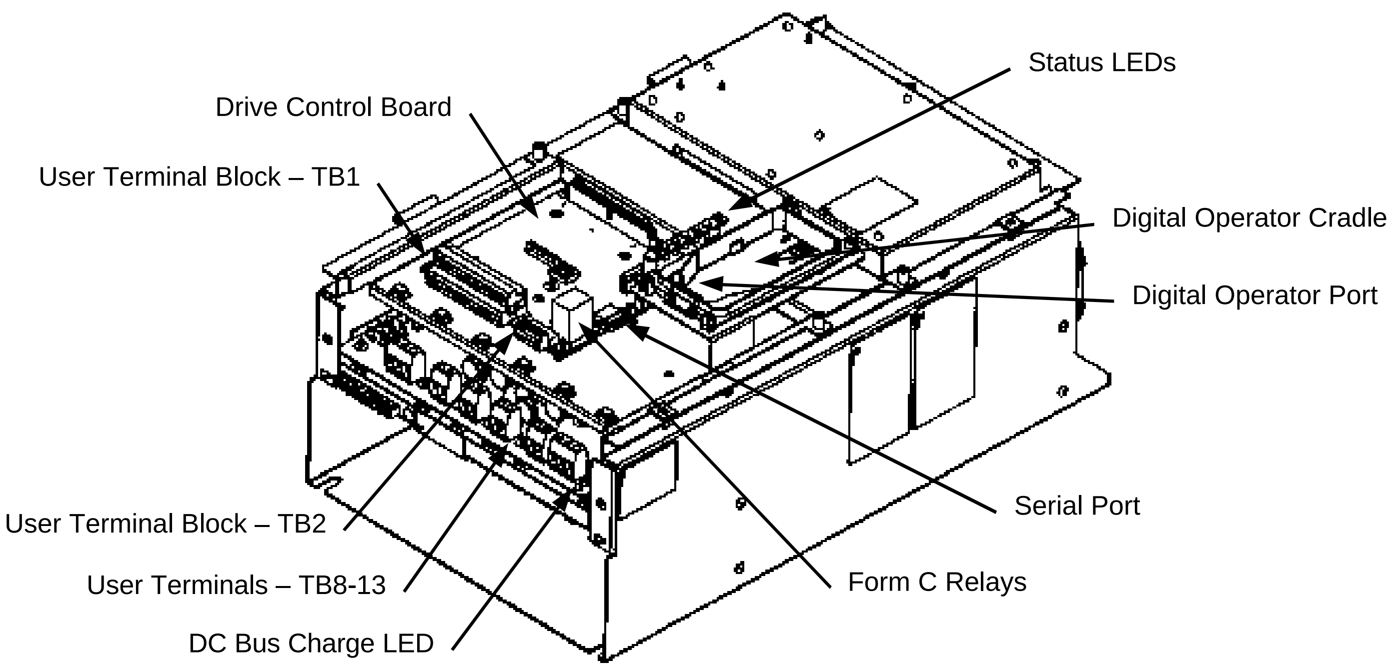


Figure 1. 3 - Drive Internals (20 to 40 HP – 460V and 10 to 20 HP – 230V)

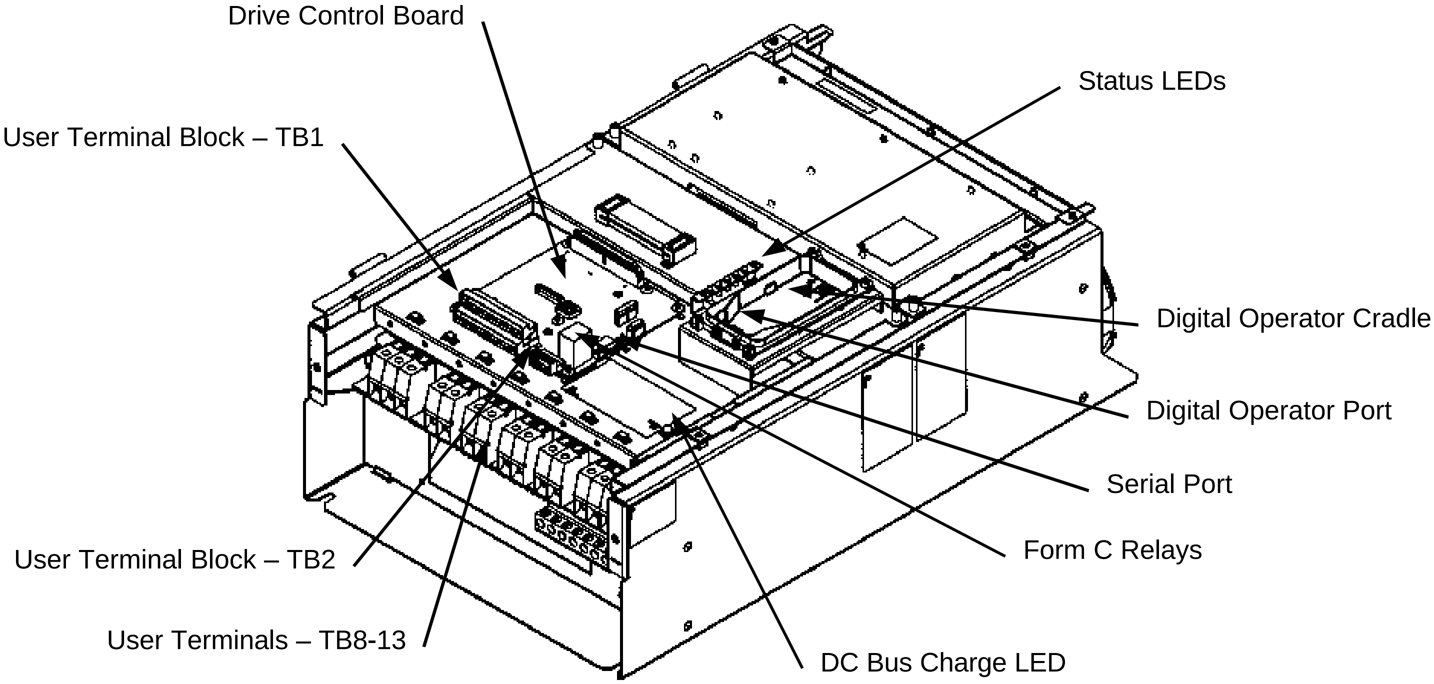


Figure 1. 4 - Drive Internals (50 to 75 HP – 460V and 25 to 40 HP – 230V)

1.4.2 Power Bridge Circuit

The power conversation circuit of the HPV 900 consists of an input diode rectifier circuit, a DC Bus circuit, and an output inverter circuit. Insulated gate bipolar transistor (IGBT) modules are used in the inverter circuit to ensure low audible motor noise and extended motor life.

A dynamic braking IGBT is also included to shunt current from the DC Bus to an external braking resistor.

1.4.3 Power Board

This board provides the following functions:

- DC Bus Fuses - Provides for both the power supply DC bus fuse and the inverter DC bus fuse.
- Devices - Contains both the current sensors and the pre-charge relay.
- Terminals - Provides for the terminals for connecting the input voltage, motor leads, dynamic braking resistor, and optional DC choke.

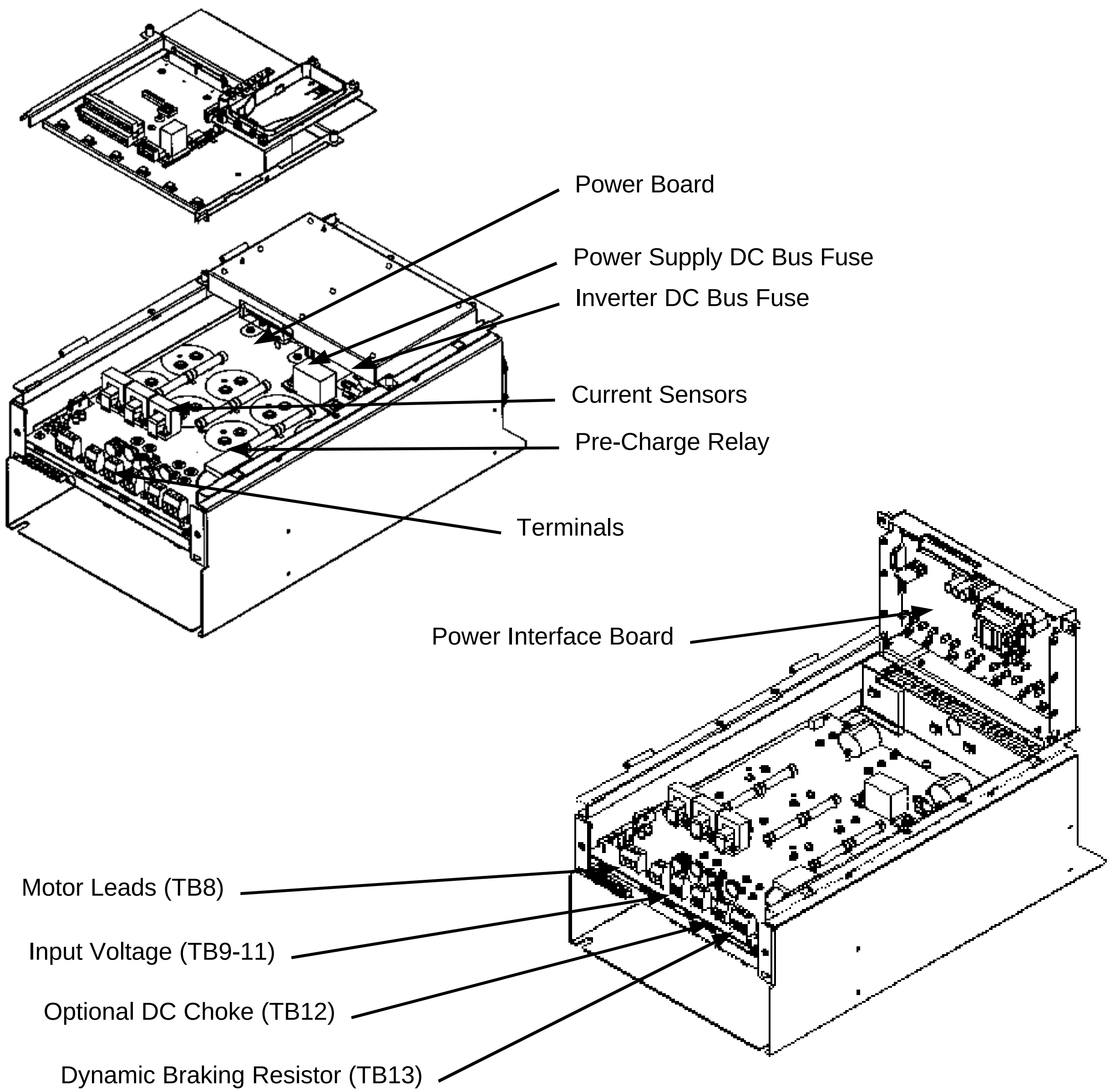


Figure 1. 5 - Drive Internals (20 to 40 HP – 460V and 10 to 20 HP – 230V)

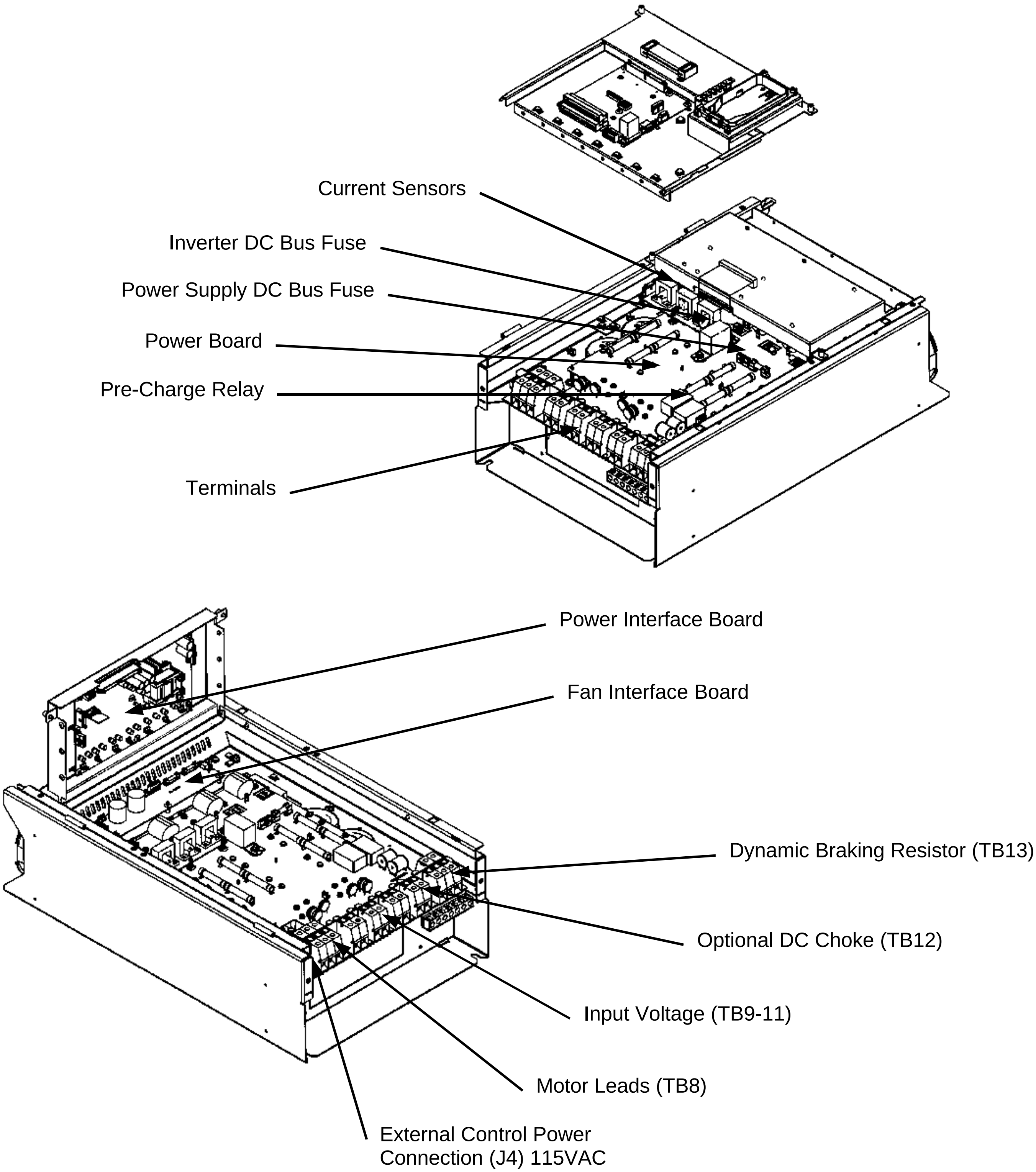


Figure 1. 6 - Drive Internals (50 to 75 HP – 460V and 25 to 40 HP – 230V)

1.4.4 Power Interface Board

This board provides the following functions:

- DC Voltage Sensor - Senses the DC bus voltage.
- Output Current Sensor - Provides control power to the current sensors.
- Thermal Sensor - Used to interface a heatsink mounted thermistor.
- Charge Control - Used to supply +24V to the coil of the pre-charge relay.

.

- Brake Gate Control - Controls the brake emitter circuit of the brake IGBT.
- Drive Control Board Interfacing - Provides the control power to the Drive Control Board (+5V, ±15V, +24V).
- Additional Interfacing - The inverter and brake gating circuits are driven by the +5V.

1.4.5 Fan Interface Board

This board provides the following functions:

- Provides connection for the external 115VAC control power (J4 connector)
- Fan Fuse - Provides fuse protection to the fan power.
- Power Supply Fuse - Provides fuse protection to the power supply on the Power Interface Board.

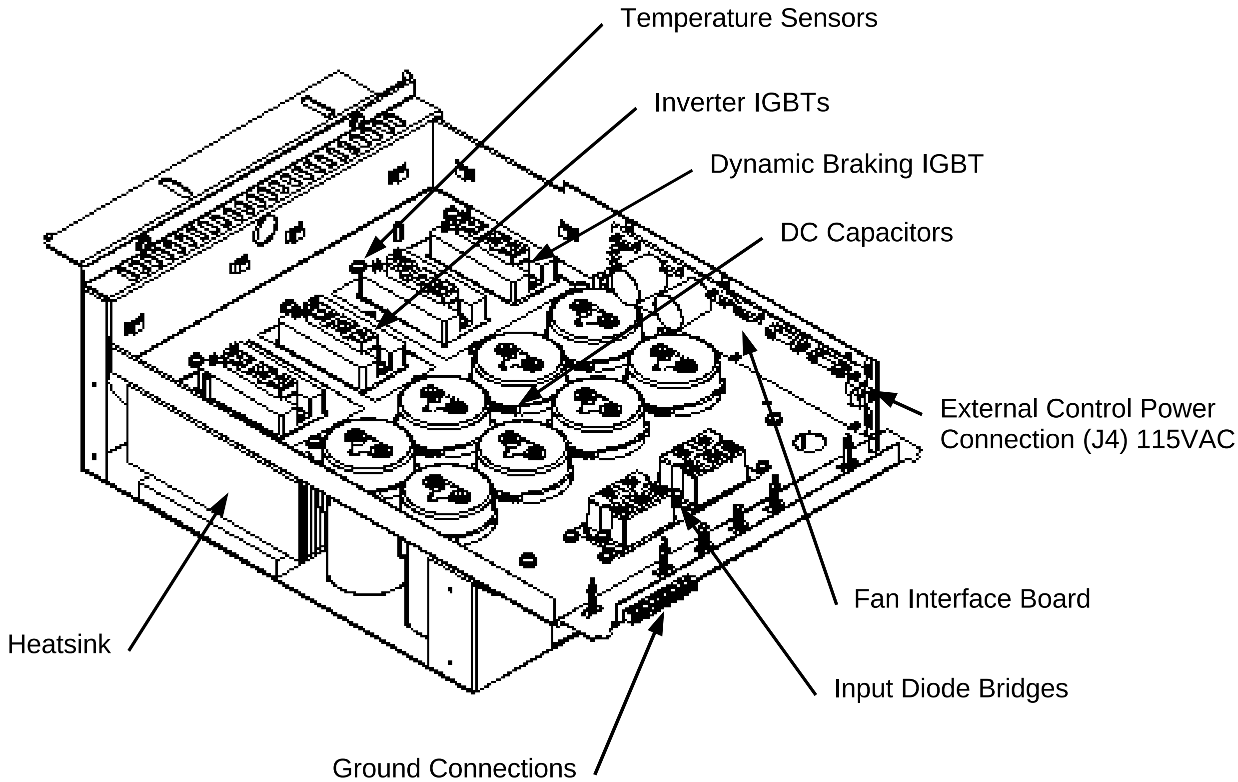


Figure 1. 7 - Drive Internals (20 to 40 HP – 460V and 10 to 20 HP – 230V)

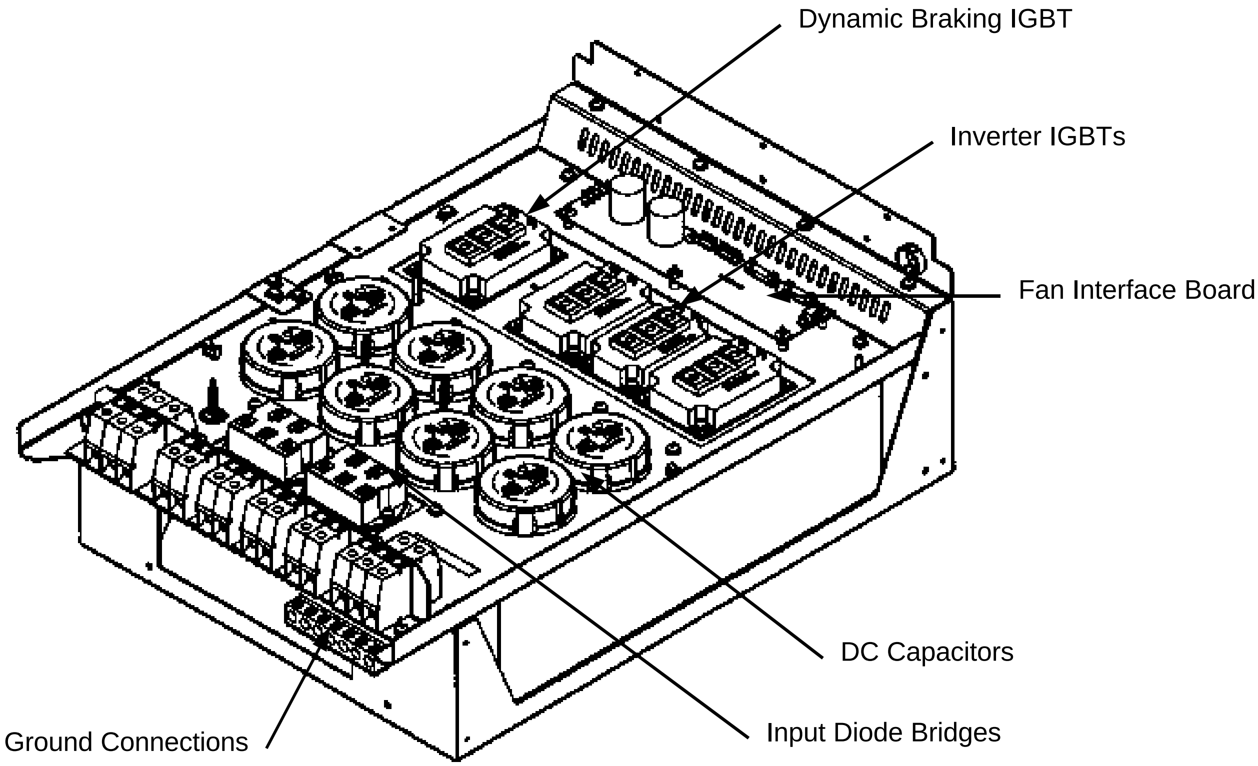


Figure 1. 8 - Drive Internals (50 to 75 HP – 460V and 25 to 40 HP – 230V)

1.5 THE HPV 900 DIGITAL OPERATOR

The Digital Operator for the HPV 900 is a hand-held push button operator with LCD display, which connects to the drive via a 9-pin DB9 cable. The Digital Operator receives power from the drive, and uses the cable for communication with the drive.

A single Digital Operator can easily be removed and transferred to another drive, *see Figure 1. 9.*

For details on the operation of the Digital Operator, see MENUS section (3.2).

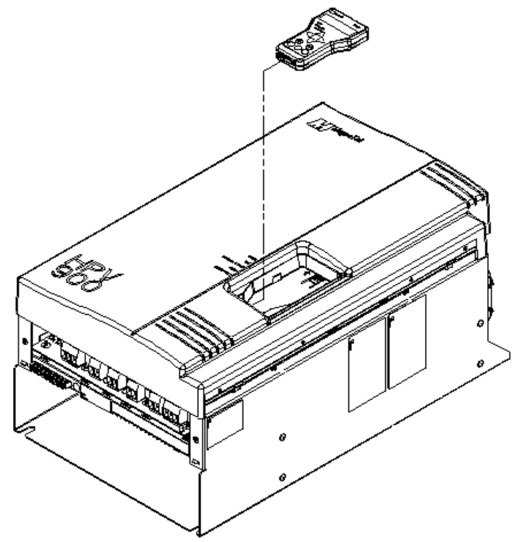


Figure 1. 9 - Digital Operator Insertion

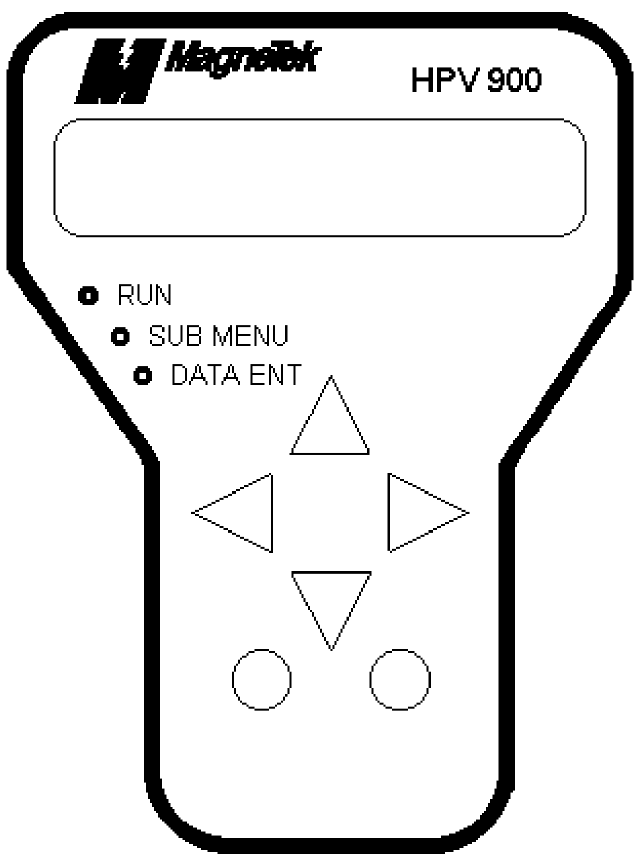


Figure 1. 10 - Digital Operator

Section 2
INSTALLATION AND INITIAL START UP

2.1 RECEIVING

The HPV 900 is thoroughly tested at the factory. After unpacking, verify the part number with the purchase order (invoice). Any damages or shortages evident when the equipment is received must be reported to the commercial carrier that transported the equipment. Assistance, if required, is available from your sales representative.

2.2 PHYSICAL INSTALLATION

NOTE: See Appendix 1 for drive dimensions

Location of the HPV 900 is important for proper operation of the drive and normal life expectancy. The installation should comply with the following:

- DO NOT mount in direct sunlight, rain or extreme (condensing) humidity.
- DO NOT mount where corrosive gases or liquids are present.
- AVOID exposure to vibration, airborne dust or metallic particles.
- DO NOT allow the ambient temperature around the control to exceed the ambient temperature listed in the specification.
- Mount control vertically using mounting holes provided and wiring knockouts provided by MagneTek.
- Allow at least 15 cm (6 in) clearance above and below the unit.
- Allow 7 cm (2.75 in) clearance to either side of the control.
- Separate grounded metal conduit is required for input, output and control wiring.

2.2.1 Drive Cooling

The unit should be installed in an open ventilated area where free air can be circulated around the control. The installation should comply with the following:

- When necessary, the cooling should be provided by using filtered air.
- If the cooling coming inside the control cabinet contains airborne dust, filter the incoming air as required and clean the cooling surface of the HPV 900 regularly using compressed air and a brush. An uncleaned heatsink operates at an efficiency less than that of cooling design specifications. Therefore, drive may fault on thermal protection if heatsink is not cleaned periodically.
- Allow at least 15 cm (6 in) clearance above and below the unit.
- Allow at least 7 cm (2.75 in) clearance on either side of the unit.

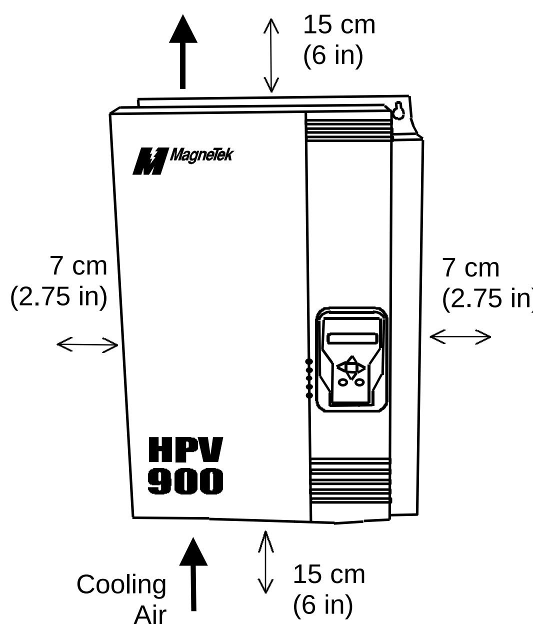


Figure 2. 1 - Mounting Distances

2.2.2 Altitude Derating

Control ratings apply to 3300 feet altitude without derating. For installations at higher altitudes, derate both the continuous and peak current levels 5% for each 300 m (1000 ft)above 1000 m (3300 ft).

2.2.3 Temperature Derating

Control ratings apply for 55 °C (130 °F) inside the customer's control cabinet. Derate both the continuous and peak current levels by 5 % for temperatures above 55 °C (130 °F) up to a maximum of 60 °C (140 °F).

2.2.4 Derating for Carrier Frequency

Control ratings apply for carrier frequencies up to and including 10 kHz. Above that linearly derate both the continuous and peak current levels by 5% for each 1kHz to a maximum derating of 25% above 15kHz.

2.3 SELECTING AND MOUNTING OF DIGITAL ENCODER

2.3.1 Encoder Selection

MagneTek offers a +5V industrial duty encoder as standard on all MagneTek elevator motors. If another encoder is used, a +12V hollow shaft encoder with the maximum speed of each channel to be at least 50 kHz.

2.3.2 Mounting

Proper mounting and alignment of the digital encoder used for speed feedback is very critical for smooth operation of the HPV 900 drive. Even the slightest wobble of the encoder shaft due to misalignment can cause one-per-revolution torque pulsations that have the potential of exciting natural rope resonance frequencies.

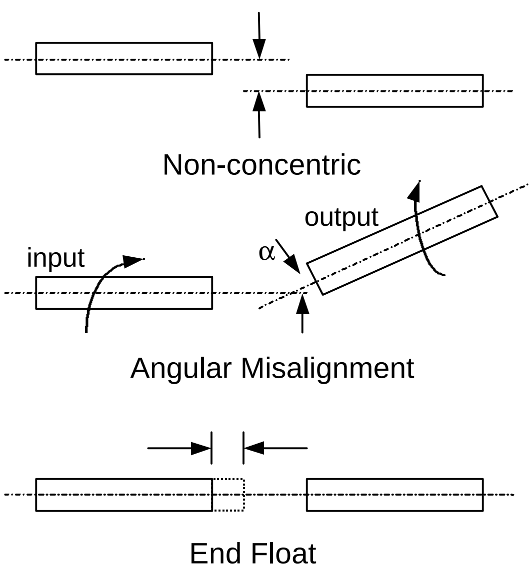


Figure 2. 2 - Common Problems in Shaft Encoder Mounting

Our recommendation for mounting the encoder for motor speed feedback is to directly connect it to the motor shaft, usually to the end opposite the drive end. Normally, a stub shaft is mounted in the end of the motor shaft. The stub shaft must be absolutely concentric (share the same center) with the motor shaft, and have no angular misalignment. The encoder is normally face mounted to a bracket, which is mounted on the motor. A standard NEMA 56 "C" face tach generator adapter bracket may be used, or a special fabricated bracket may be designed and used. The encoder should be mounted on the bracket and positioned so that the encoder shaft and stub shaft are concentric and have no angular misalignment.

An alternate method of mounting, which has been used in the elevator industry, is to drive the encoder with a rubber wheel that runs on the brake surface of the sheave. This approach may be satisfactory for many applications, but it can introduce problems under certain circumstances:

1) Excessive bearing wear can occur in the encoder due to the method of mounting and holding the rubber wheel against the sheave.
2) Lack of concentricity of the measuring wheel.
3) The rubber wheel can develop a flat spot when it sits idle for an extended time. This goes away after a short time of operation, but it can affect performance while it exists.

2.3.3 Coupling

Regardless of the care used in mounting the encoder, there is likely to be some small amount of misalignment. A good quality coupling between the encoder shaft and the motor stub shaft can help avoid the remaining problems due to shaft runout.

A good coupling will also offer some protection for the encoder against end float, a condition which exists in gearing on direction changes, and which can be transmitted through the motor.

2.4 ELECTRICAL INSTALLATION

NOTE: See General Safety Precautions in section 2.6.2 (CSA Warnings)

The HPV 900 drives are rated for 200/208/230V and 380/400/460V three phase system. The necessary protection and equipment includes the three power leads and a grounding lead. The input & output conductors and the branch circuit protection must be sized to meet the local electrical code requirements

See Figure 2. 5 - Interconnection Diagram.

2.4.1 Main Circuit Input/Output

Observe the following precautions:

- Use 600V vinyl sheathed wire or equivalent. Wire size should be determined considering voltage drop of leads.
- Never connect main AC power to the TB8 output terminals: U, V, and W.
- Never allow wire leads to contact metal surfaces. Short circuit may result.
- SIZE OF WIRE MUST BE SUITABLE FOR CLASS I CIRCUITS.
- Motor lead length should not exceed 150 feet and motor wiring should be run in a separate conduit from the power wiring. If lead length must exceed this distance, contact MagneTek for proper installation procedures.
- Use UL/CSA certified connectors sized for the selected wire gauge. Install connectors using the specified crimping tools specified by the connector manufacturer.

Refer to Figure 2. 5 for completing the connections.

2.4.1.1 Input Power Connections

Terminals: R & R1, S & S1, and T & T1 provide connections for AC input power. Two position removable links are provided for the following pairs of terminals: R:R1, S:S1, T:T1. With the links in place power can be supplied as a three phase source.

IMPORTANT

Input Fusing is required for the following ratings: 5 to 15 HP at 460V. *For more information, see Appendix 5.*

2.4.1.2 Motor Lead Connections

TB8 terminals: U, V, & W provide connection points for the motor leads.

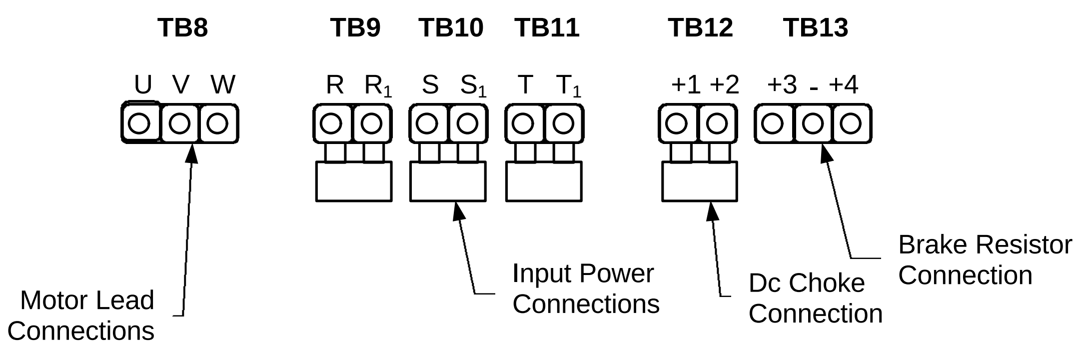


Figure 2. 3 - Terminal Layout

2.4.1.3 DC Choke Connections

Terminals +1 and +2 provide connection points for a user supplied DC choke. A two position removable link is provided to the pair of terminals. With this link, the drive can be operated without the use of a DC choke.

2.4.1.4 Brake Resistor Connections

Terminals +3, -, and +4 provide connection points for an external user supplied braking resistor. Connect the external brake resistor between terminals +3 and +4. Terminals: +3 and - are the positive and negative rails of the DC bus. (see Figure 2. 4)

2.4.1.5 Equipment Grounding

A terminal block is provided for the required user supplied equipment grounding.

2.4.2 Control Circuit

Observe the following precautions:

Use twisted shielded or twisted-pair shielded wire for control and signal circuit leads. The shield sheath MUST be connected at the HPV 900 ONLY. The other end should be dressed neatly and left unconnected (floating). Wire size should be determined considering the voltage drops of the leads. Lead length should not exceed 150 feet. Signal leads and feedback leads should be run in separate conduits from power and motor wiring.

Use UL / CSA certified connectors sized for the selected wire gauge. Install connectors using the crimping tools specified by the connector manufacturer.

Refer to Figure 2. 5 for completing encoder connections; analog inputs; logic inputs; and logic outputs at the Drive Control Board.

IMPORTANT

Parameter adjustments will have to be made for the specific analog input, logic inputs, and logic outputs to be used for the installation.

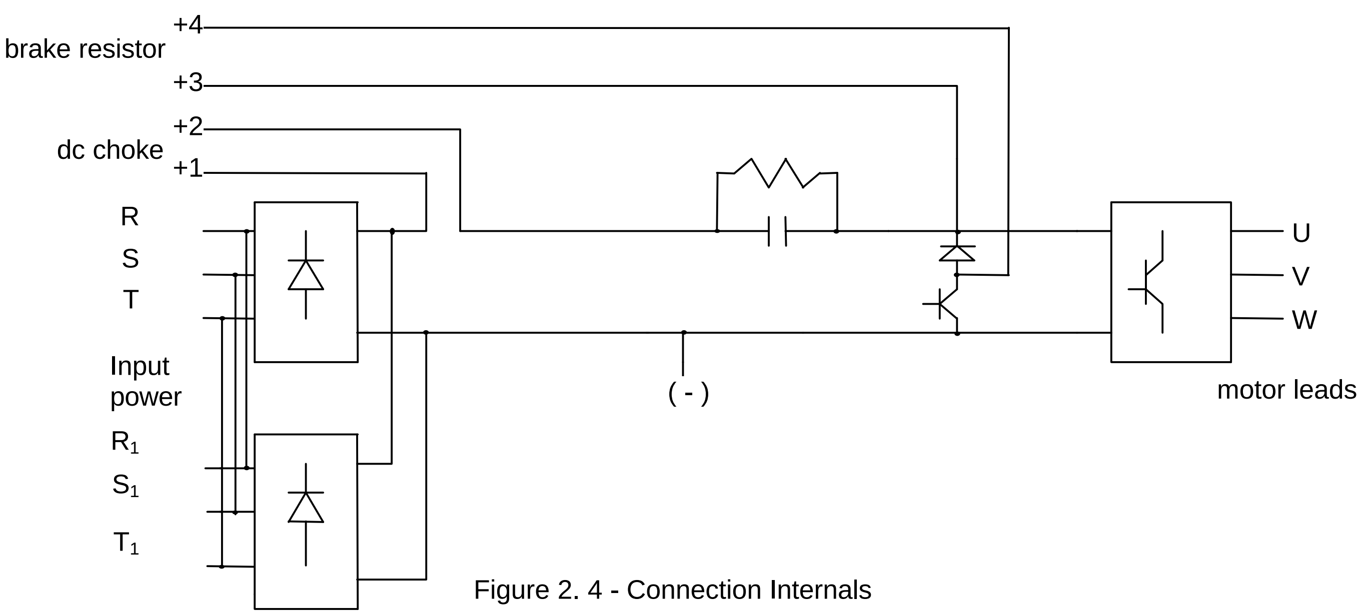


Figure 2. 4 - Connection Internals

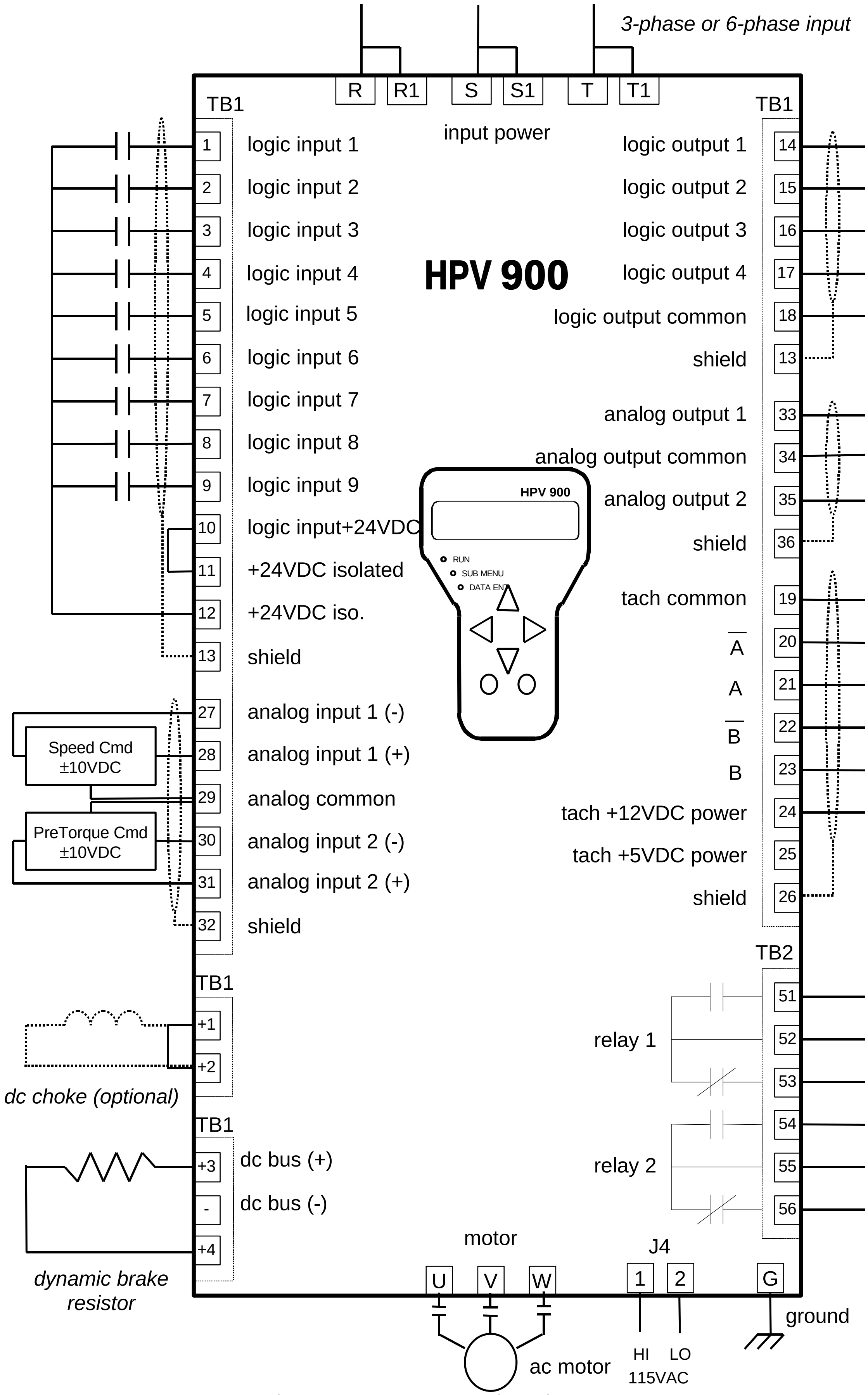


Figure 2. 5 - Interconnection Diagram

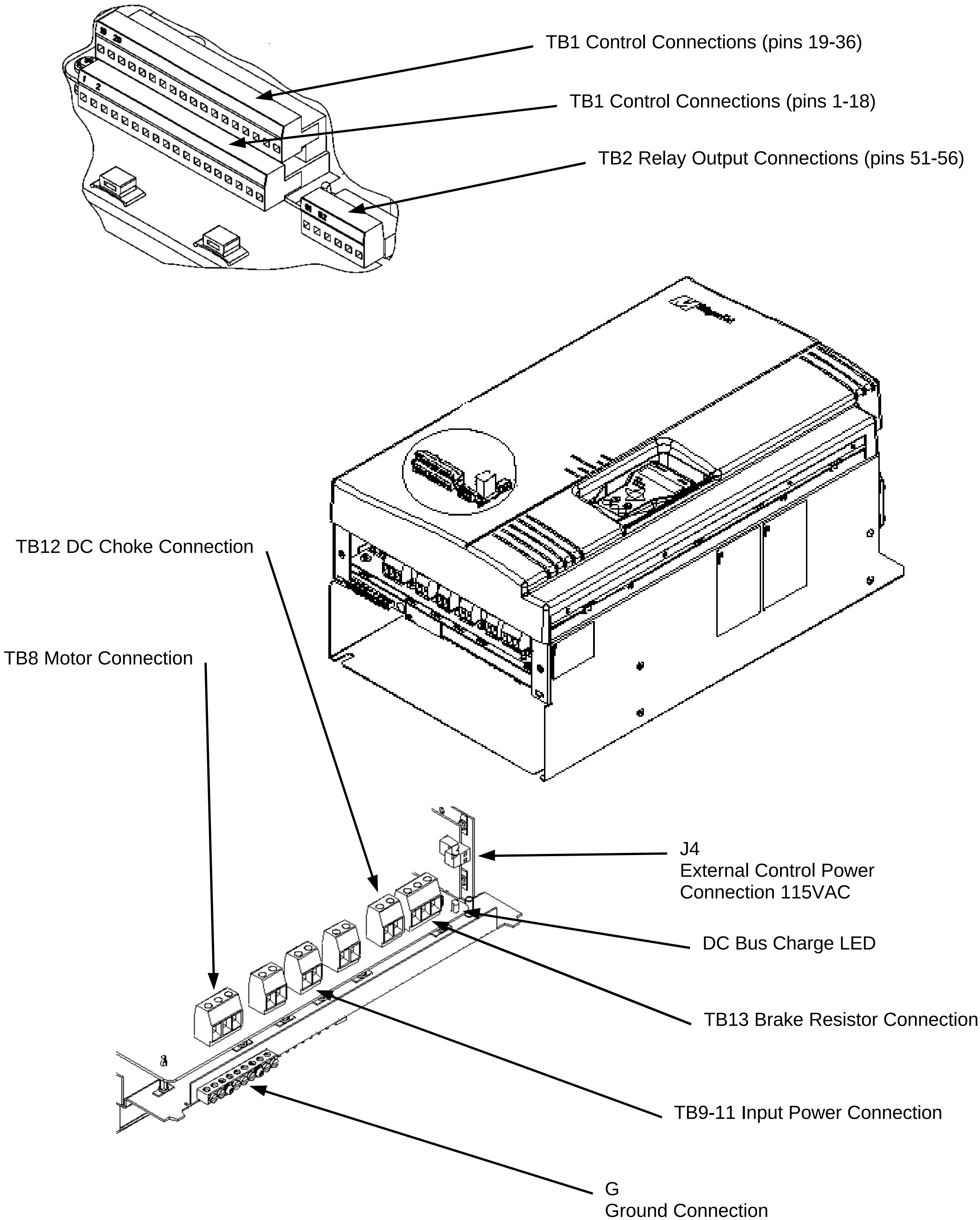


Figure 2. 6 - Terminal Connections (20 to 40 HP – 460V and 10 to 20 HP – 230V)

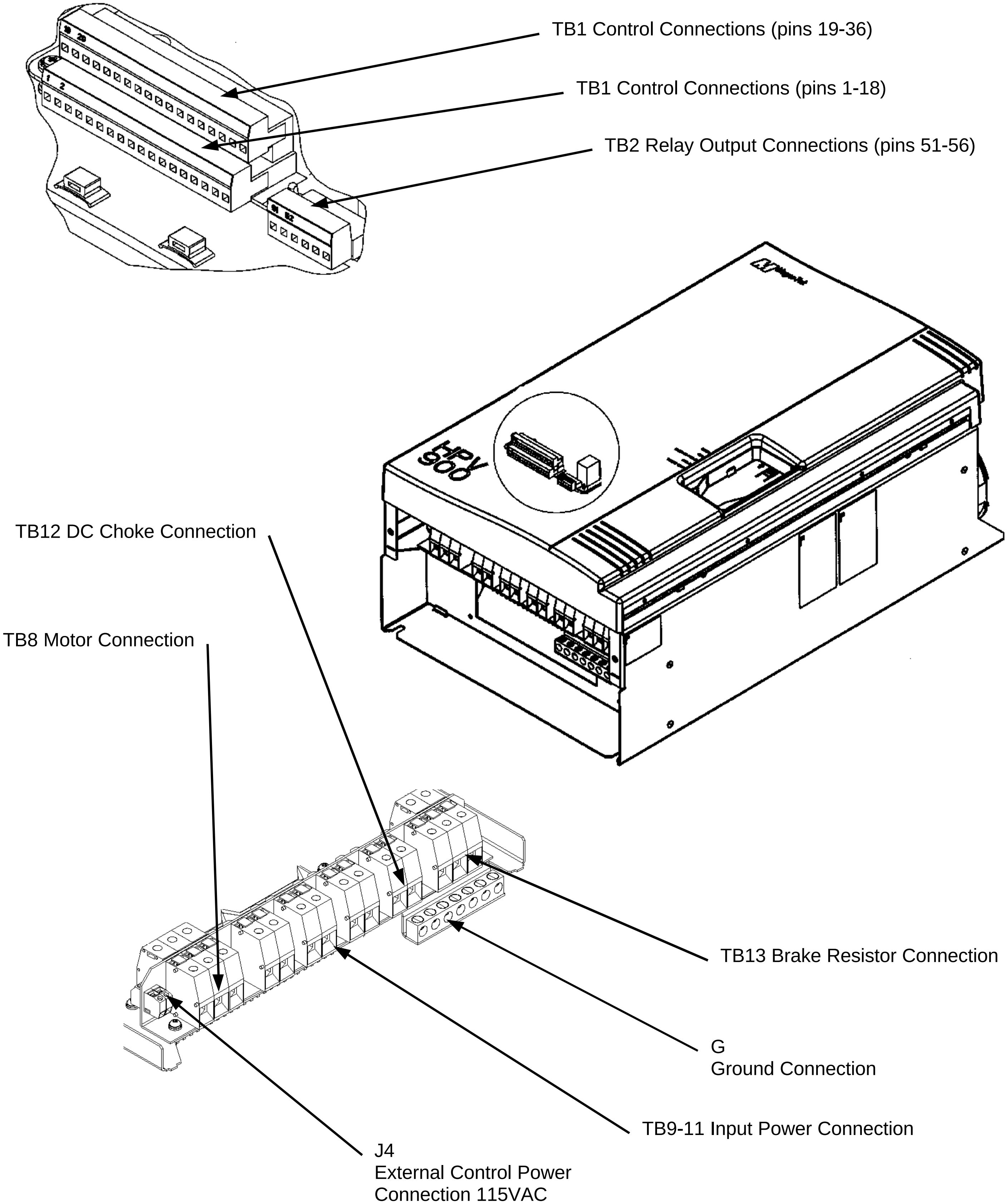


Figure 2. 7 - Terminal Connections (50 to 75 HP – 460V and 25 to 40 HP – 230V)

2.5 HPV 900 INTERCONNECTIONS

The HPV 900 Interconnection is detailed in Figure 2. 8.

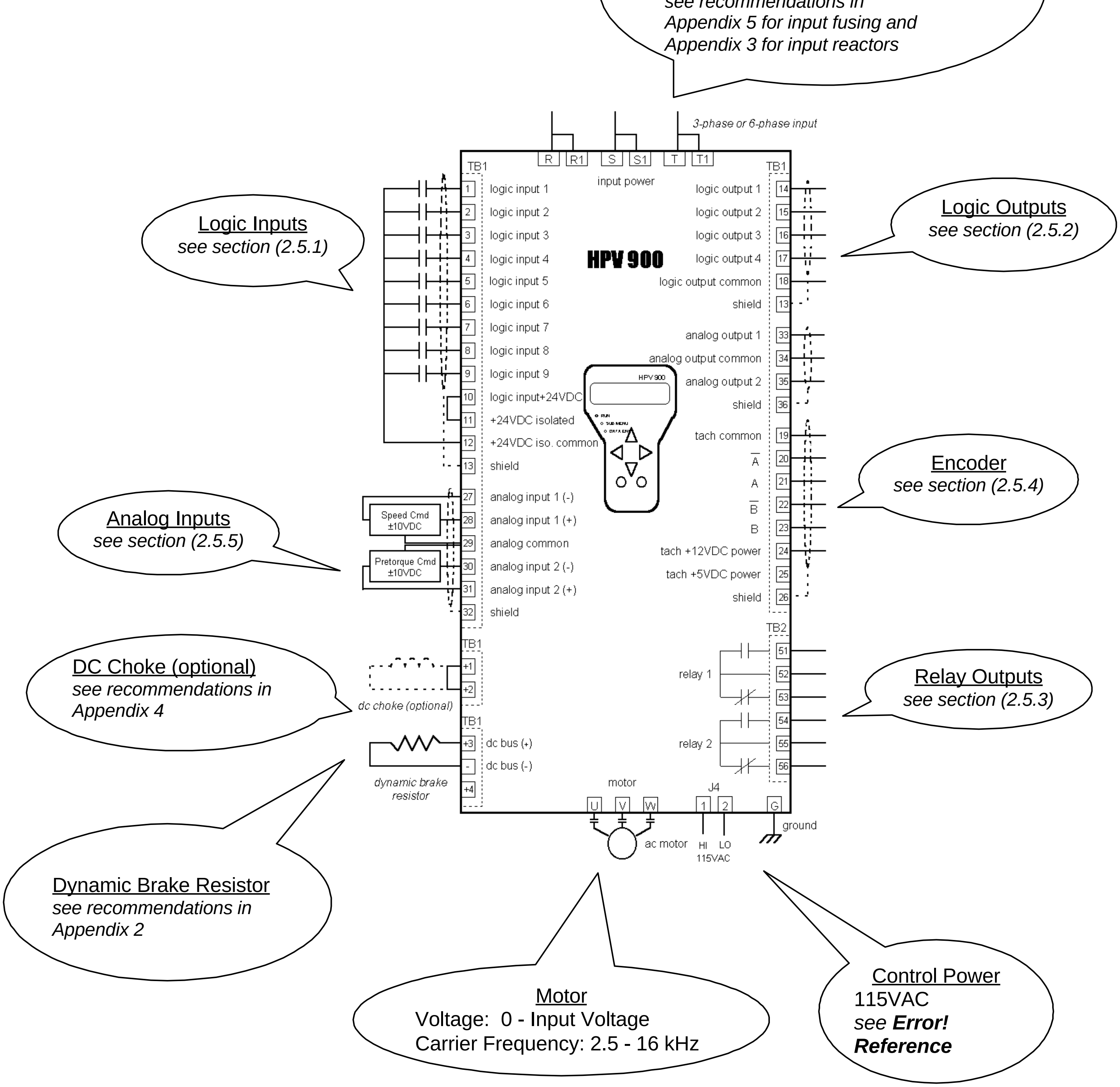


Figure 2. 8 - Interconnection Diagram Reference

2.5.1 Logic Inputs

The HPV 900's nine programmable logic inputs are opto-isolated. The inputs become "true" by closing contacts or switches between the logic input terminal and voltage source common. The voltage supply for the logic inputs is 24VDC.

The choices for the voltage source common depend on if the user is using an external voltage supply or using the internal voltage supply.

In Figure 2. 9, shows the connection for using the internal voltage supply. And in this case the voltage source common is TB-12 (+24VDC iso. common).

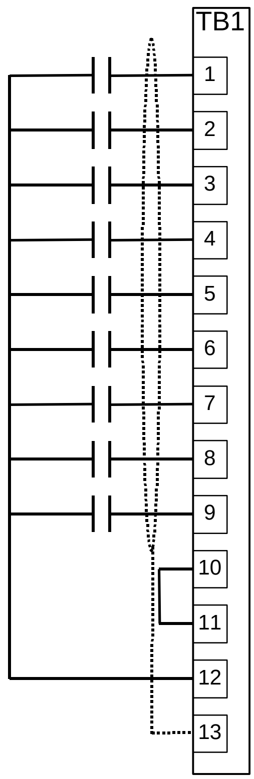


Figure 2. 9 - Logic Inputs (Internal Supply)

In Figure 2. 10, shows the connection for using the external voltage supply. And in this case the voltage source common is negative side of the external voltage supply.

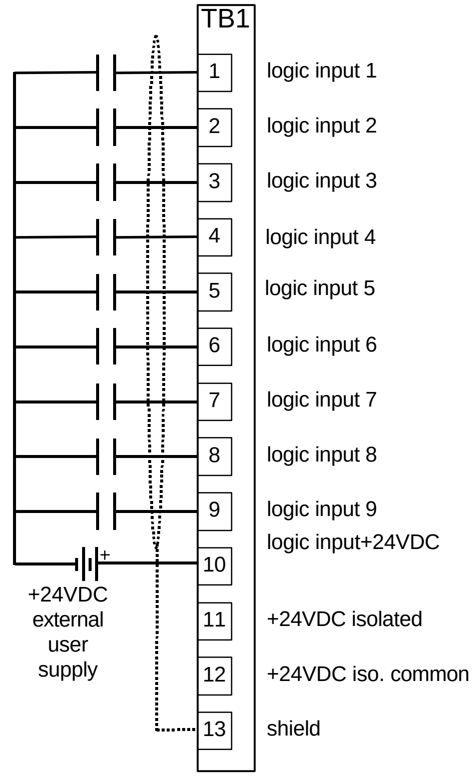


Figure 2. 10 - Logic Inputs (External Supply)

The logic inputs have two different sinking current ratings.

- logic inputs 1 and 2 sink 18mA.
- logic inputs 3, 4, 5, 6, 7, 8, and sink 9mA.

The switches or contacts used to operate the logic inputs may be replaced by logic outputs from a PLC or car controller, if the outputs are open collector and the ground is connected to the proper voltage source common.

For more information on the programming the logic inputs, see section (3.5.2).

2.5.2 Logic Outputs

The HPV 900's four programmable logic outputs are opto-isolated open collectors. The outputs are normally open and can withstand an applied maximum voltage of 50VDC. When the outputs become "true", the output closes and are capable of sinking up to 150mA between the logic output terminal and the logic output common (TB1-13). In Figure 2. 11, shows the logic output terminals.

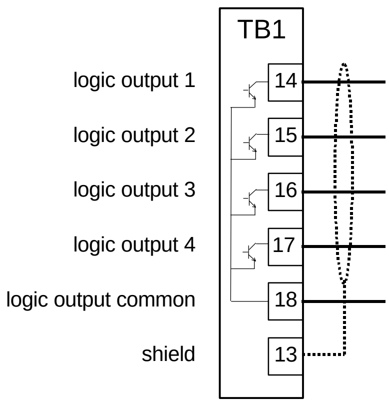


Figure 2. 11 - Logic Outputs

For more information on the programming the logic outputs, see section (3.5.3).

2.5.3 Relay Outputs

The HPV 900's two programmable relay logic outputs are Form-C relays. The have both normally open and normally closed contacts. Relay 2 is designed for more operations and is recommended for use with in controlling the motor contactor. Relay 1 is recommended for use with the fault circuitry.

The specifications for each relay are as follows:
Relay 1

- Current capacity: 5A
- Maximum voltage: 30VDC or 250VAC
- Maximum number of operations: 100,000

Relay 2

- Current capacity: 10A
- Maximum voltage: 24VDC or 220VAC
- Maximum number of operations: 10,000,000

In Figure 2. 12. shows the logic output terminals.

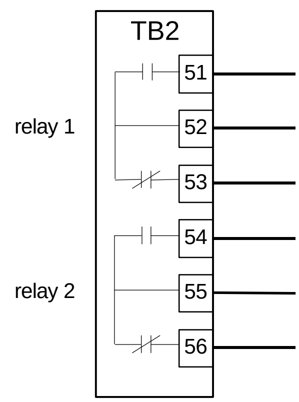


Figure 2. 12 - Relay Outputs

For more information on the programming the relay outputs, see section (3.5.3).

2.5.4 Encoder

The HPV 900 has connections for an incremental two-channel quadrature encoder. The drive's encoder circuitry also incorporates resolution multiplication and complimentary outputs.

2.5.4.1 Encoder Theory

An incremental encoder, often referred to as a tachometer, is normally used for position and velocity information. Velocity data is generated by looking at the number of pulses within a given time period.

Quadrature encoders have dual channels, A and B, which are phased 90°, electrically apart. An important benefit of having two output signals is that the direction of rotation can be determined by monitoring the phase relationship between these two channels.

Another important benefit of quadrature encoders is the capability of providing very high resolutions by multiplying the number of output pulses. In a dual channel encoder, a four times multiplication of the output count or resolution can be achieved by externally counting the rising and falling edges of each channel (A and B). A 1,024 pulses per revolution quadrature encoder, for example, can generate 4,096 pulses per revolution by employing this technique.

In addition to the need to count pulses accurately, correct position feedback depends on eliminating any false signals resulting from electrical noise. Incremental encoders are susceptible to noise, especially when the encoder cable is in the proximity of large electrical motors or switching gear. Noise problems can be eliminated or greatly reduced by using an encoder that providing complementary outputs. As shown in Figure 2. 14, a correct signal will generate two simultaneous outputs. As channel A goes high, channel A goes low. If this doesn't occur, the signal is assumed to be the result of electrical noise and is ignored.

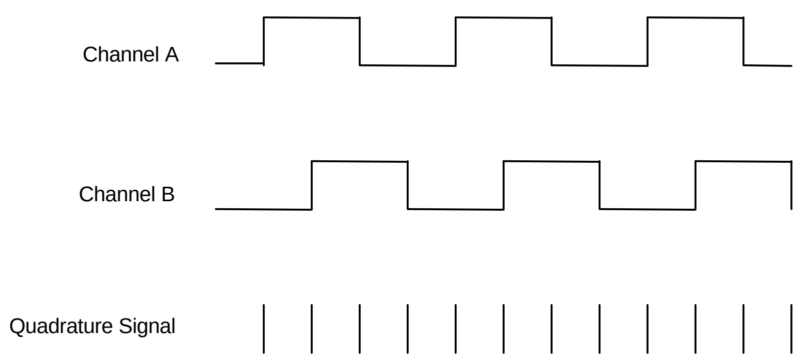


Figure 2. 13 - Dual Channel - Quadrature Encoder Signals

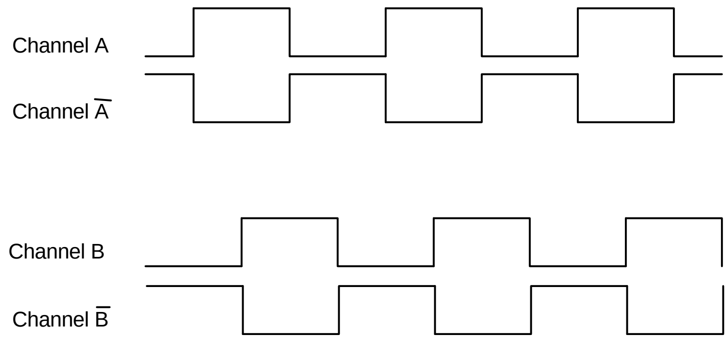


Figure 2. 14 - Complementary Encoder Outputs

2.5.4.2 HPV 900 Encoder Specifications

The HPV 900 requires the use of an encoder coupled to the motor shaft. The encoder power can be either a 5VDC or 12VDC supply. The capacity of each power supply is the following:

- supply voltage: 12VDC 200mA capacity
- supply voltage: 5VDC 150mA capacity

The HPV 900 can accept encoder pulses of:

- 600 to 10,000 pulses per revolution (ppr)
- a maximum frequency of 300kHz

IMPORTANT

Motor phasing should match the encoder feedback phasing. If the phasing is not correct, the motor will not accelerate up to speed. It will typically oscillate back and forth at zero speed, and the current will be at the torque limit. Switching two motor phases should correct this situation.

The encoder pulses per revolution must by entered in the Encoder Pulses parameter, *see section (3.4.1)*.

The encoder connection terminals are shown in Figure 2. 15.

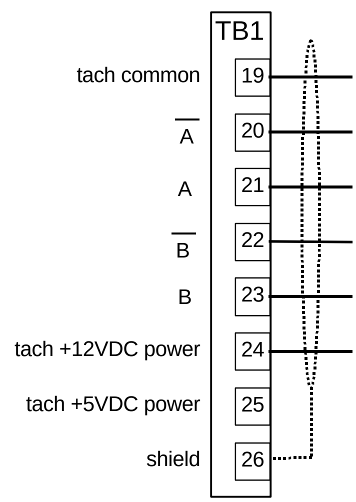


Figure 2. 15 - Encoder Connections

2.5.5 Analog Inputs

The HPV 900 has two non-programmable differential analog input channels.

- Analog input channel 1 is reserved for the speed command (if used).
- Analog input channel 2 is reserved for the pre-torque command (if used).

The analog input channels are bipolar and have a voltage range of ±10VDC.

Available with the analog channels is multiplier gain parameters (SPD COMMAND MULT and PRE TORQUE MULT) and bias parameters (SPD COMMAND BIAS and PRE TORQUE BIAS). These parameters are used to scale the user's analog command to the proper range for the drive software. The formula below shows the scaling effects of these two parameters.

$$\left(\begin{matrix} \text{analog} \\ \text{channel} \\ \text{input} \\ \text{voltage} \end{matrix} - BIAS \right) \times MULT = \begin{matrix} \text{signal} \\ \text{drive} \\ \text{software} \\ \text{uses} \end{matrix}$$

For more on the multiplier gain or bias parameters, see sections (3.4.1),(5.1.1.2), and (5.1.4.7.2).

The scaling of the analog input signals follows:

- Speed Command
  +10VDC = positive contract speed
  -10VDC = negative contract speed
- Pre Torque Command
  +10VDC = positive rated torque of motor
  -10VDC = negative rated torque of motor

The HPV 900 provides common mode noise rejection with the differential analog inputs. The connection of these two inputs is shown in Figure 2. 16.

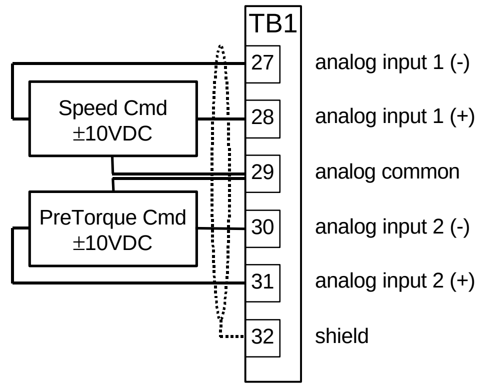


Figure 2. 16 - Analog Inputs (Differential)

In Figure 2. 17, shows the connection for the analog inputs, if they are configured to be single ended. In this configuration, the HPV 900 noise immunity circuitry is not in effect.

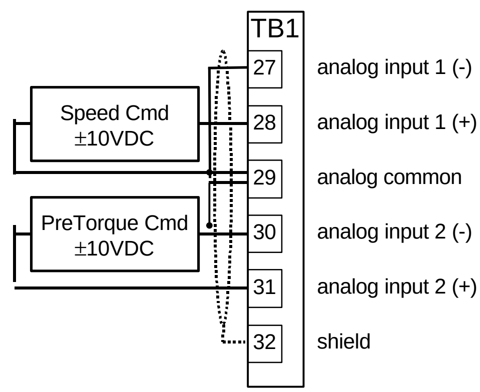


Figure 2. 17 - Analog Inputs (Single Ended)

2.5.6 Analog Outputs

The HPV 900 has two programmable differential analog output channels. The two analog output channels were designed for diagnostic help. *For more information on programming the analog output channels, see section (3.5.4).*

The analog output channels are bipolar and have a voltage range of ±10VDC.

Available with the analog channels is multiplier gain parameters (ANA 1 OUT GAIN and ANA 2 OUT GAIN) and a bias or offset parameters (ANA 1 OUT OFFSET and ANA 2 OUT OFFSET). These parameters are used to scale the user's analog outputs to the proper range for the drive software. The formula below shows the scaling effects of these two parameters.

$$\left(\begin{matrix} signal \\ drive \\ software \\ creates \end{matrix} - BIAS \right) \times MULT = \begin{matrix} analog \\ channel \\ output \\ voltage \end{matrix}$$

For more on the gain or offset parameters, see section (3.4.1).

The scaling of the analog output signals is detailed in *section (3.5.4).*

The HPV 900 provides common mode noise rejection with the differential analog inputs. The connection of these two inputs is shown in Figure 2. 18.

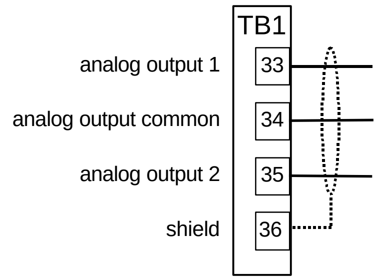


Figure 2. 18 - Analog Outputs

2.6 INITIAL START-UP

2.6.1 Pre-Power Check

CAUTION

TO PREVENT DAMAGE TO THE DRIVE. THE FOLLOWING CHECKS MUST BE PERFORMED BEFORE APPLYING THE INPUT POWER.

A. Inspect all equipment for signs of damage, loose connections, or other defects.

B. Ensure the three phase line voltage is within +10%/-20% of the nominal input voltage. Also verify the frequency (50 or 60 Hz) is correct for the elevator control system.

C. Remove all shipping devices. Manually operate all contactors and relays to ensure they move freely.

D. Ensure all electrical connections are secure.

E. Ensure that all transformers are connected for proper voltage.

2.6.2 CSA Warnings

The following are written warnings located on the drive chassis. They appear in both English and French. In this section, these warnings appear in English only.

A. Marking of the field wiring terminals 75c Cu or Al wire 6 AWG Max.

B. Warning: Capacitive voltages above 50V may remain for 5 minutes after power is disconnected.

C. Warning: More than 1 live circuit.

D. Warning: Twist wires together before inserting in terminal.

E. Warning: Manufacturers' instructions for selecting current elements and setting the interrupters must be followed.

2.6.3 Start-up Procedure

In order to compete the HPV 900 set-up a few drive parameters will need to be adjusted.

2.6.3.1 Controller Specific Parameters

The following groups of parameters would POSSIBLY NEED TO BE CHANGED ONLY ONCE for each specific type of elevator car controller. Most of the parameter default values will be suitable for most applications.

These elevator car controller specific parameters are the following:

- CONFIGURE C0 menu - contains the configurations necessary to operate the drive.
  - USER SWITCHES C1 sub menu - contains the operation configurations for the drive.
  - LOGIC INPUTS C2 sub menu - contains parameters for defining the functions of the logic inputs to be connected to TB1 terminals 1-9.
  - LOGIC OUTPUTS C3 sub menu - contains parameters which define the logic outputs at TB1 terminals 14-17 and two relays at TB2 terminals 51-53 & 54-56.
- ADJUST A0 menu - provides selections and settings, which are used to configure the drive to the specific motor and elevator application.
  - DRIVE A1 sub menu - contains parameters, which configure the drive for the specific installation.
  - S-CURVES A2 sub menu - contains parameters that define the drive's s-curves.
  - MULTISTEP REF A3 sub menu - contains parameters that define the multi-step speed references.
  - POWER CONVERT A4 sub menu - contains parameters related to the voltage levels and carrier frequency.
  - MOTOR A5 sub menu - contains parameters, which are programmed for each specific motor being controlled by the drive.
    (defined by motor id)

2.6.3.2 Site Specific Parameters

The following parameters would possibly need to be changed for each specific site.

These site specific parameters are the following:

- DRIVE A1 sub menu
  CONTRACT CAR SPD - parameter programs the elevator contract speed in ft/min or m/s.
  CONTRACT MTR SPD - parameter programs the motor speed at elevator contract speed in RPM.
  INERTIA - sets the elevator system inertia in terms of the time it takes the elevator to accelerate to top speed at rated torque to motor base speed. The drive software can be used to estimate the elevator system inertia *(see Section 5.6)*
  ENCODER PULSES - sets the pulses per revolution the drive will see from the encoder.

- POWER CONVERT A4 sub menu
  INPUT L-L VOLTS - set to the input AC line to line voltage.

- MOTOR A5 sub menu
  MOTOR ID - set to MagneTek EMI number. If unknown or non-MagneTek motor is being used, *see section (5.5).*

2.6.3.3 Operation Tools

The following parameters can be useful when setting up and operating the HPV 900.

- DISPLAY 1 & 2 D0 menu - two identical menus that allow the user to monitor the drive's running parameter. This menu is divided into two sub menus ELEVATOR DATA D1 and POWER DATA D2.

- FAULTS F0 menu - provides a means of examining the drive's active faults and the fault history. The menu also allows for clearing of faults to get the drive ready to return to operation after a fault shutdown.

- UTILITY U0 menu - Provides many useful functions including the following:
  HIDDEN ITEMS U2 - allows the user to enable and disable the hidden parameters. When the hidden parameters are disabled, the number of keystrokes necessary to navigate the standard parameters is reduced.
  UNITS U3 - the user can choose either Metric units or standard English measurements units for certain monitor parameters displays and for parameters in the sub menus of the Adjust A0 menu.
  RESTORE DFLTS U5 - allows the to reset all the parameters to there default values.

- CONFIGURE C0 menu
  USER SWITCHES C1 sub menu - provides the following:
  MOTOR ROTATION - allows the user to determine how the HPV 900 interprets the incoming pulses from the encoder. It can be used to change the direction of the motor without having to change encoder wiring. As an example, if the car controller is commanding the up direction and the car is actually going in a down direction, this parameter can be changed to allow the motor rotation to match the car controller command.

Section 3
PARAMETER ADJUSTMENTS

3.1 PARAMETER INTRODUCTION

This section presents the sequence in which parameters in the HPV 900 are accessed by means of the Digital Operator, and describes what each parameter is used for and what setting choices the user has.

Parameters are grouped under six major menus:

- **ADJUST A0** **section 3.4**
- **CONFIGURE C0** **section 3.5**
- **UTILITY U0** **section 3.6**
- **FAULTS F0** **section 3.7**
- **DISPLAY 1 D0** **section 3.3**
- **DISPLAY 2 D0** **section 3.3**

The currently selected menu is shown on the top line of the Digital Operator display when the SUB-MENU LED is *not* lit. The specific menu trees are shown below in Figure 3. 1.

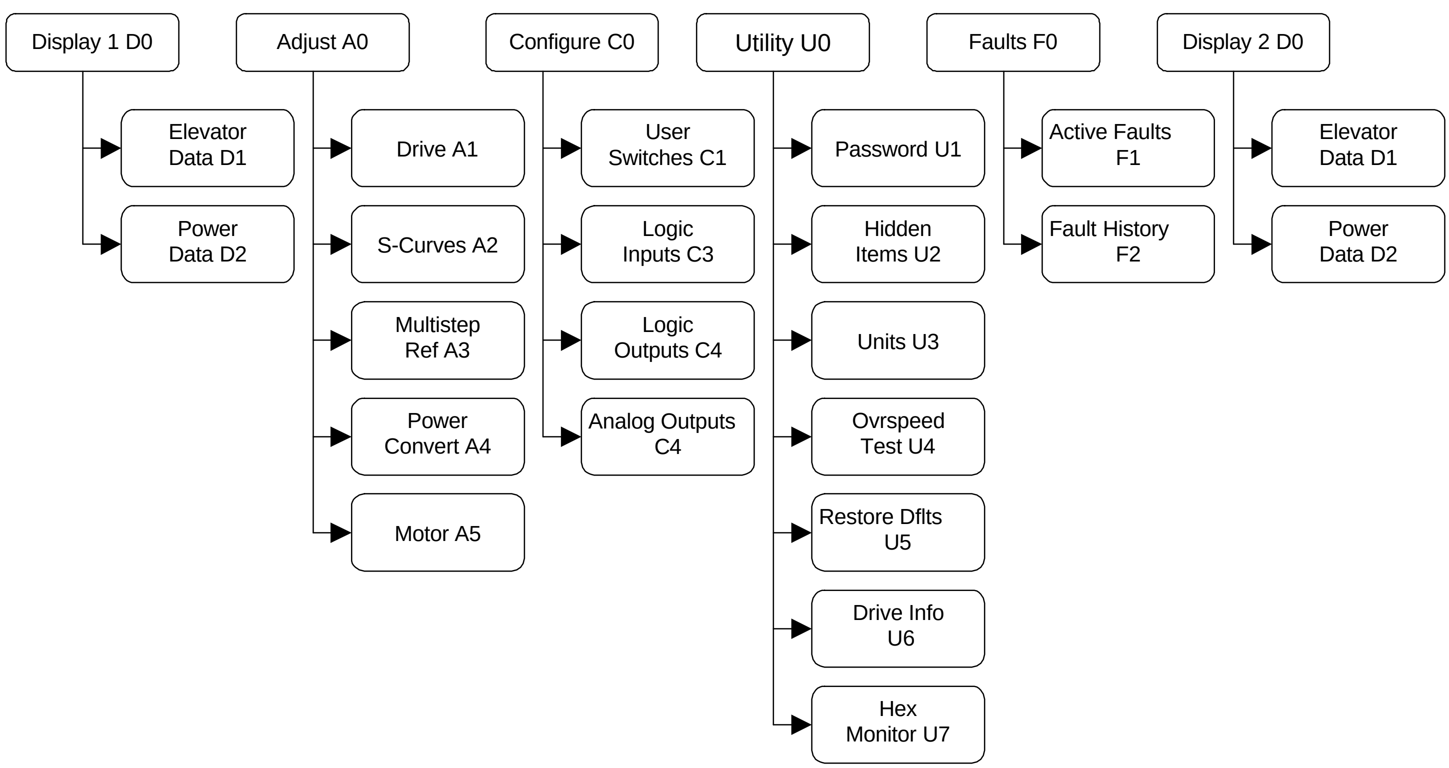


Figure 3. 1 - Menu Trees

3.1.1 Hidden Parameters

There are two types of parameters: standard and hidden. Standard parameters are available at all times. Hidden parameters are for more advanced functions and are available only if activated. Activation of the hidden parameters is accomplished by setting of a utility parameter, HIDDEN ITEMS U2. *See details in section 3.6.2.*

Table 3. 1 shows the standard and hidden parameters, while Table 3. 2 shows only the standard parameters.

CONFIGURE C0	ADJUST A0			DISPLAY 1 & 2 D0
User Switches C1	Drive A1	S-Curves A2	Power Convert A4	Elevator Data D1
Spd Command Src	Contract Car Spd	Accel Rate 0	Id Reg Diff Gain	Speed Command
Run Command Src	Contract Mtr Spd	Decel Rate 0	Id Reg Prop Gain	Speed Reference
Hi/Lo Gain Src	Response	Jerk Rate 0	Iq Reg Diff Gain	Speed Feedback
Speed Reg Type	Inertia	Lev Jerk Rate 0	Iq Reg Prop Gain	Speed Error
Motor Rotation	Inner Loop Xover	Accel Rate 1	PWM Frequency	Pre-Torque Ref
Spd Ref Release	Gain Reduce Mult	Decel Rate 1	UV Alarm Level	Spd Reg Torq Cmd
Cont Confirm Src	Gain Chng Level	Jerk Rate 1	UV Fault Level	Tach Rate Cmd
PreTorque Source	Tach Rate Gain	Lev Jerk Rate 1	Extern Reactance	Aux Torque Cmd
PreTorque Latch	Spd Phase Margin	Accel Rate 2	Input L-L Volts	Est Inertia
PTorq Latch Clck	Ramped Stop Time	Decel Rate 2	Motor A5	Power Data D2
Fault Reset Src	Contact Flt Time	Jerk Rate 2	Motor Id	Torque Reference
Overspd Test Src	Brake Pick Time	Lev Jerk Rate 2	Rated Mtr Pwr	Motor Current
Brake Pick Src	Brake Hold Time	Accel Rate 3	Rated Mtr Volts	% Motor Current
Brake Pick Cnfm	Overspeed Level	Decel Rate 3	Rated Excit Freq	Motor Voltage
Brake Hold Src	Overspeed Time	Jerk Rate 3	Rated Motor Curr	Motor Frequency
Ramped Stop Sel	Overspeed Mult	Lev Jerk Rate 3	Motor Poles	Motor Torque
Ramp Down En Src	Encoder Pulses	Multistep Ref A3	Rated Mtr Speed	Power Output
Brk Pick Flt Ena	Spd Dev Lo Level	Speed Command 1	% No Load Curr	DC Bus Voltage
Brk Hold Flt Ena	Spd Dev Time	Speed Command 2	Stator Leakage X	Flux Reference
Logic Inputs C2	Spd Dev Hi Level	Speed Command 3	Rotor Leakage X	Flux Output
Log In 1 tb1-1	Spd Command Bias	Speed Command 4	Stator Resist	Slip Frequency
Log In 2 tb1-2	Spd Command Mult	Speed Command 5	Motor Iron Loss	Motor Overload
Log In 3 tb1-3	Pre Torque Bias	Speed Command 6	Motor Mech Loss	Drive Overload
Log In 4 tb1-4	Pre Torque Mult	Speed Command 7	Ovld Start Level	Flux Current
Log In 5 tb1-5	Zero Speed Level	Speed Command 8	Ovld Time Out	Torque Current
Log In 6 tb1-6	Zero Speed Time	Speed Command 9	Flux Sat Break	Flux Voltage
Log In 7 tb1-7	Up/Dwn Threshold	Speed Command 10	Flux Sat Slope 1	Torque Voltage
Log In 8 tb1-8	Mtr Torque Limit	Speed Command 11	Flux Sat Slope 2	Base Impedance
Log In 9 tb1-9	Regen Torq Limit	Speed Command 12		Est No Load Curr
Logic Outputs C3	Flux Wkn Factor	Speed Command 13		Est Rated RPM
Log Out 1 tb1-14	Ana Out 1 Offset	Speed Command 14		
Log Out 2 tb1-15	Ana Out 2 Offset	Speed Command 15		
Log Out 3 tb1-16	Ana Out 1 Gain			
Log Out 4 tb1-17	Ana Out 2 Gain	FAULTS F0	UTILITY U0	
Relay Coil 1	Flt Reset Delay	Active Faults F1	Password U1	Restore Dflts U5
Relay Coil 2	Flt Resets/Hour	Fault History F2	Hidden Items U2	Drive Info U6
Analog Outputs C4			Units U3	Hex Monitor U7
Ana Out 1 tb1-33			Ovrspeed Test U4	
Ana Out 2 tb1-35				

Table 3. 1 - All HPV 900 Parameters (hidden and standard)

ADJUST A0			DISPLAY 1 & 2 D0	
Drive A1	Multistep Ref A3	Power Convert A4	Elevator Data D1	Power Data D2
Contract Car Spd	Speed Command 1	PWM Frequency	Speed Command	Torque Reference
Contract Mtr Spd	Speed Command 2	Input L-L Volts	Speed Reference	Motor Current
Response	Speed Command 3	Motor A5	Speed Feedback	% Motor Current
Inertia	Speed Command 4	Motor Id	Speed Error	Motor Voltage
Inner Loop Xover	Speed Command 5	Rated Mtr Pwr	Pre-Torque Ref	Motor Frequency
Encoder Pulses	Speed Command 6	Rated Mtr Volts	Est Inertia	Motor Torque
Mtr Torque Limit	Speed Command 7	Rated Excit Freq		Power Output
Regen Torq Limit	Speed Command 8	Rated Motor Curr		DC Bus Voltage
S-Curves A2	Speed Command 9	Motor Poles		Est No Load Curr
Accel Rate 0	Speed Command 10	Rated Mtr Speed		Est Rated RPM
Decel Rate 0	Speed Command 11	% No Load Curr		
Jerk Rate 0	Speed Command 12			
Lev Jerk Rate 0	Speed Command 13	FAULTS F0		
Accel Rate 1	Speed Command 14	Active Faults F1		
Decel Rate 1	Speed Command 15	Fault History F2		UTILITY U0
Jerk Rate 1				Hidden Items U2
Lev Jerk Rate 1				

Table 3. 2 - Standard Parameters (Hidden Parameters disabled)

3.2 MENUS

Each main menu may have a number of sub-menus, see Figure 3. 1. Following is a listing of the top level menus:

- **ADJUST A0**
- **CONFIGURE C0**
- **UTILITY U0**
- **FAULTS F0**
- **DISPLAY 1 D0**
- **DISPLAY 2 D0**

3.2.1 Menu Navigation

The digital operator keys operate on three levels, the menu level, the sub-menu level and the entry level. At the menu level, they function to navigate between menus or sub-menus. At the sub-menu level they navigate between menu items. At the entry level, they are used to adjust values or select options. Six (6) keys are used for this navigation, they are:

1) The up arrow key.
2) The down arrow key.
3) The left arrow key.
4) The right arrow key.
5) The “ENTER” key.
6) The “ESCAPE” key.

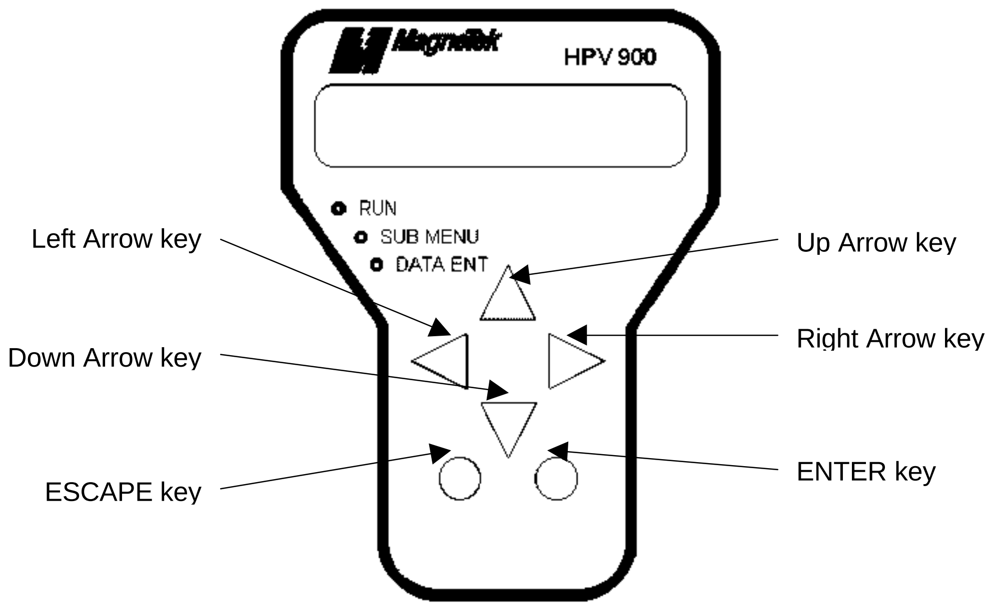


Figure 3. 2 - Digital Operator Keys

How these keys operate is dependent on the "level" (i.e. main menu, sub-menu or entry level.) In general, the "ENTER" and "ESCAPE" keys control the level. That is the ENTER key used to move to a lower level and the ESCAPE key is used to move to a higher level. The arrow keys control movement. With the up and down arrow keys controlling vertical position. And the left and right arrow keys controlling horizontal position.

3.2.2 Navigation at main menu level.

At the main menu level, the up and down arrow keys cause the display to show the sub-menus. The side arrow keys cause the display to select which main menu is active. When the end is reached (either up, down, left or right), pressing the same key will cause a wrap around. See Figure 3. 3

Each main menu will remember the last accessed sub-menu. The left and right arrow keys will navigate between these last active sub-menus. This remembrance of last active sub-menu is volatile and will be lost at power down.

When any sub-menu is displayed, pressing the "ENTER" key will place the operator in the sub-menu level.

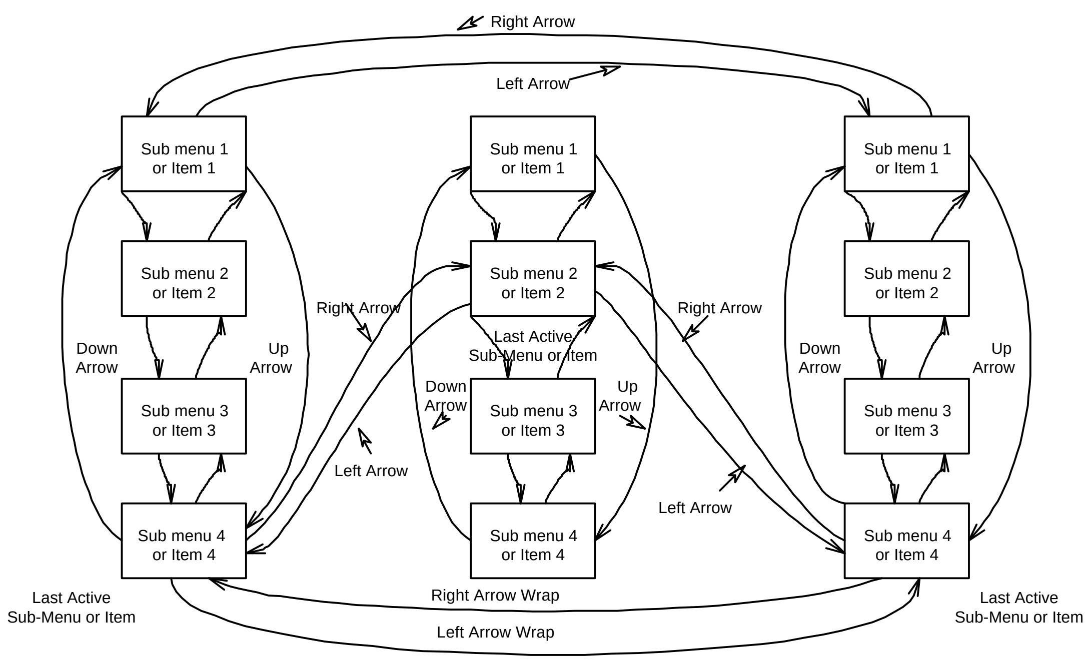


Figure 3. 3 - Menu Navigation

3.2.3 Navigation at sub-menu level.

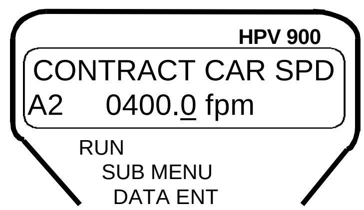
When at sub-menu level, the positioning keys work slightly different than they did at the main menu level. The up and down arrow keys for example now select separate items in the sub-menu.

At any time pressing the "ESCAPE" key will return control to the Main Menu level. Upon exiting a sub-menu via the "ESCAPE" key, the last item number is "remembered". The next time this sub-menu is entered, it is entered at the "remembered" item number.

This feature can be used to obtain quick access to two monitor values. Two main menus one labeled Display 1 D0 (see section 3.3) and one labeled Display 2 D0 (see section 3.3) have the same display items. One item can be selected one under the Display 1 menu and another under the Display 2 menu. The left and right arrow keys can then be used to move back and forth between these two display items. Remember, that the "remembering" of sub-menus and sub-menu items is volatile and is lost at power-down.

3.2.4 Navigation at the Entry level.

At the entry level, the function of keys is redefined. The "ESCAPE" key remains as the key used to move back to the higher level (in this case to the sub menu level). The left and right arrow keys are used as cursor positioning keys and the up and down arrow keys are used as increment and decrement keys. Depending on the display selected the cursor position may be indicated by an underline or reverse video or blinking character.



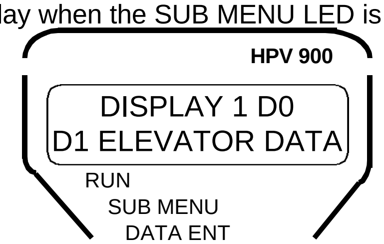
3.3 DISPLAY 1 & 2 D0 MENU

These two identical menus allow the user to monitor running parameters. These displays vary as operating conditions change; no user setting is possible.

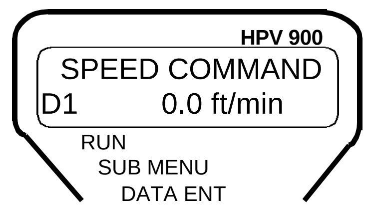
NOTE: The units in which the running parameter values are displayed are determined by the UNITS SELECTION setting *(see section 3.6.3)*.

NOTE: When the word ***Hidden*** appears above a parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details in section 3.6.2.*

The sub-menu is identified by its full name on the bottom line of the Digital Operator display when the SUB MENU LED is *not* lit.



When the SUB MENU LED is ON, the two letter code for the sub-menu appears at the far left of the bottom line of the display.



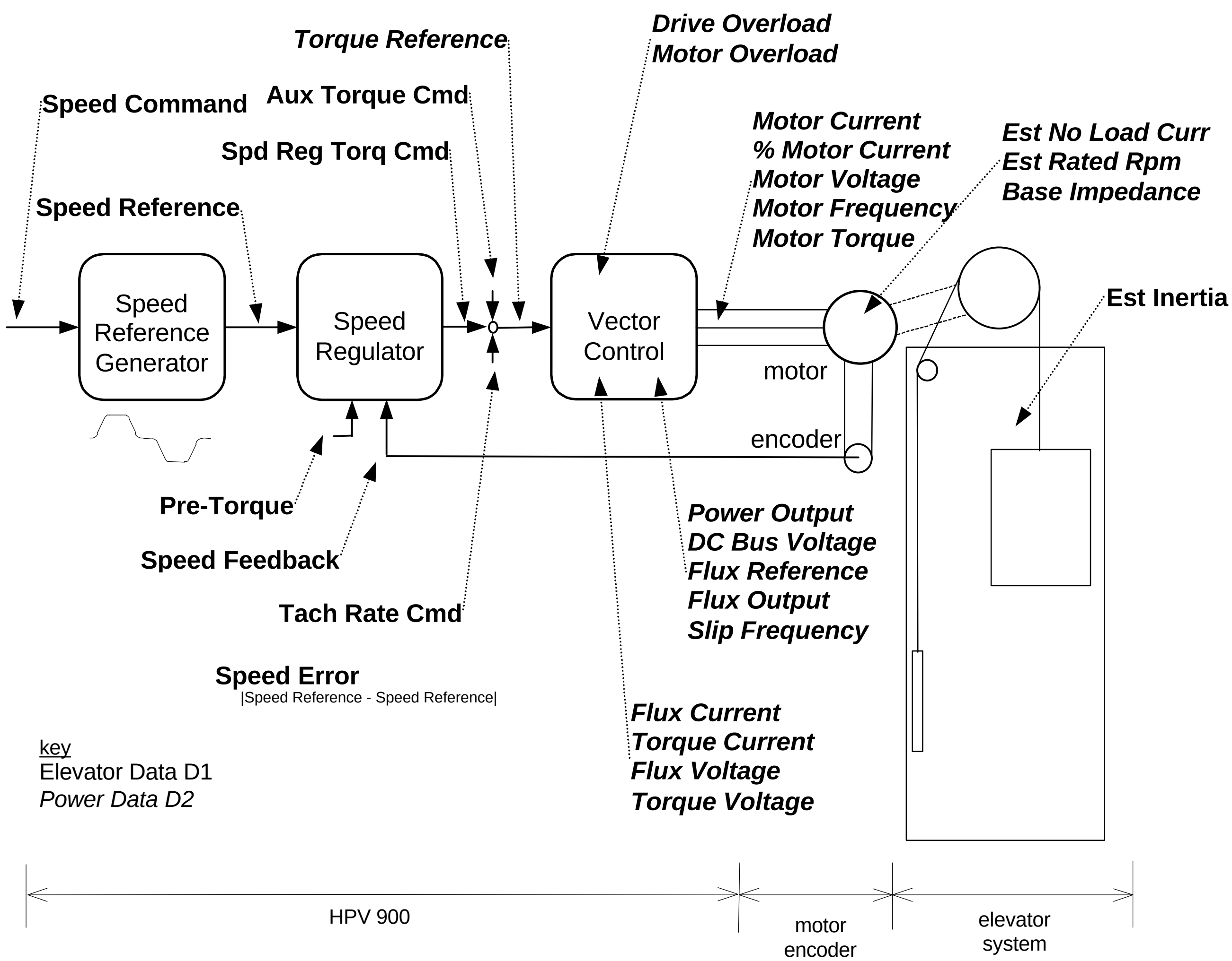


Figure 3. 4 - Available Display Values

These two display menus each have two sub menus:

- **ELEVATOR DATA D1 3.3.1**
- **POWER DATA D2 3.3.2**

A summary of the Elevator Data is shown in Table 3. 3. A summary of the Power Data is shown in Table 3. 4.

Name	Description	Units	Hidden
Speed Command	Speed command before speed reference generator	ft/min or m/s	N
Speed Reference	Speed reference after speed reference generator	ft/min or m/s	N
Speed Feedback	Encoder feedback used by speed regulator	ft/min or m/s	N
Speed Error	Speed reference minus speed feedback	ft/min or m/s	N
Pre-Torque Ref	Pre-torque reference	% rated torque	N
Spd Reg Torq Cmd	Torque command from speed regulator	% rated torque	Y
Tach Rate Cmd	Torque command after tach rate gain function	% rated torque	Y
Aux Torque Cmd	Feedforward torque command from auxiliary source	% rated torque	Y
Est Inertia	Estimated elevator system inertia	seconds	N

Table 3. 3 - Elevator Data

Name	Description	Units	Hidden
Torque Reference	Torque reference used by vector control	% rated torque	N
Motor Current	RMS motor current	Amps	N
% Motor Current	Percent motor current	%rated current	N
Motor Voltage	RMS motor terminal voltage	Volts	N
Motor Frequency	Electrical frequency output	Hz	N
Motor Torque	Calculated motor torque output	% rated torque	N
Power Output	Calculated drive power output	KW	N
DC Bus Voltage	Measured DC bus voltage	Volts	N
Flux Reference	Flux reference used by vector control	% rated flux	Y
Flux Output	Measured flux output	% rated flux	Y
Slip Frequency	Commanded slip frequency	Hz	Y
Motor Overload	Percent of motor overload trip level reached	%	Y
Drive Overload	Percent of drive overload trip level reached	%	Y
Flux Current	Measured flux producing current	%rated current	Y
Torque Current	Measured torque producing current	%rated current	Y
Flux Voltage	Flux voltage reference	% rated volts	Y
Torque Voltage	Torque voltage reference	% rated volts	Y
Base Impedance	Drive calculated base impedance	Ohms	Y
Est No Load Curr	Estimated no load current	%rated current	N
Est Rated RPM	Estimated rated RPM	RPM	N

Table 3. 4 - Power Data

3.3.1 ELEVATOR DATA D1 Sub Menu

SPEED COMMAND

(Speed Command)

Monitors the speed command before the speed reference generator (input to the S-Curve). This command comes from either multi-step references, speed command from analog channel #1, or the serial channel.

	English	Metric
Units:	ft/min	m/sec
Decimal:	+XXXX.X	+XX.XXX

SPEED REFERENCE

(Speed Reference)

Monitors the speed reference being used by the drive. This is the speed command after passing through the speed reference generator (which uses a S-Curve).

	English	Metric
Units:	ft/min	m/sec
Decimal:	+XXXX.X	+XX.XXX

SPEED FEEDBACK

(Speed Feedback)

Monitors the speed feedback coming from the encoder. It is based on contact speed, motor rpm and encoder pulses per revolution. The drive converts from motor RPM to linear speed using the relationship between the CONTRACT CAR SPD and CONTRACT MTR SPD parameters.

	English	Metric
Units:	ft/min	m/sec
Decimal:	+XXXX.X	+XX.XXX

SPEED ERROR

(Speed Error)

Monitors the speed error between the speed reference and the speed feedback. It is equal to the following equation:

$$\left| \begin{pmatrix} speed \\ reference \end{pmatrix} - \begin{pmatrix} speed \\ feedback \end{pmatrix} \right| = \begin{matrix} speed \\ error \end{matrix}$$

	English	Metric
Units:	ft/min	m/sec
Decimal:	+XXXX.X	+XX.XXX

PRE-TORQUE REF

(Pre-Torque Reference)

Monitors the pre torque reference, coming from either analog channel #2 or the serial channel

Units:	% rated torque
Decimal:	+XXX

SPD REG TORQ CMD ***Hidden***

(Speed Regulator Torque Command)

Monitors the speed regulator's torque command. This is the torque command before it passes through the tach rate gain function or the auxiliary torque command. It is the torque required for the motor to follow the speed reference.

Units:	% rated torque
Decimal:	+XXX

TACH RATE CMD ***Hidden***

(Tachometer Rate Command)

Monitors the torque command from the tach rate gain function, (if used), *see section (5.1.4.5).*

Units:	% rated torque
Decimal:	+XXX

AUX TORQUE CMD ***Hidden***

(Auxiliary Torque Command)

Monitors the feedforward torque command from auxiliary source, when used. This command can only come from the serial channel.

Units:	% rated torque
Decimal:	+XXX

EST INERTIA

(Estimated Inertia)

Estimated elevator system inertia. *For more details on estimating the elevator system inertia see section 5.6.*

Units:	% rated torque
Decimal:	+XXX.XX

3.3.2 POWER DATA D2 Sub Menu

TORQUE REFERENCE

(Torque Reference)

Monitors the torque reference used by the HPV 900 for vector control. This value is calculated by:

$$\begin{pmatrix} speed \quad reg \\ torque \\ cmd \end{pmatrix} + \begin{pmatrix} aux \\ torque \\ cmd \end{pmatrix} + \begin{pmatrix} tach \\ rate \\ cmd \end{pmatrix} = \begin{matrix} torque \\ reference \end{matrix}$$

Units: % rated torque
Decimal: +XXX

MOTOR CURRENT

(RMS Motor Current Output)

Monitors the RMS motor output current.
Units: A (Amps)
Decimal: XXX.XX

% MOTOR CURRENT

(Percent Motor Current)

Monitors the motor current as a percent of rated motor current.
Units: % motor rated current
Decimal: XXX

MOTOR VOLTAGE

(Motor Voltage Output)

Monitors the RMS motor terminal line-line voltage.
Units: V (Volts)
Decimal: XXX

MOTOR FREQUENCY

(Motor Frequency Output)

Monitors the electrical frequency of the motor output.
Units: Hz
Decimal: XXX.X

MOTOR TORQUE

(Motor Torque Output)

Calculated motor output torque in terms of percent rated torque.
Units: % rated torque
Decimal: +XXX

POWER OUTPUT

(Power Output)

Calculated drive power output.
Units: kW
Decimal: +XXX.XX

DC BUS VOLTAGE

(DC Bus Voltage)

Measured voltage of the DC bus.
Units: V (Volts)
Decimal: XXX

FLUX REFERENCE

(Flux Reference)

Flux reference used by the vector control of the drive.
Units: % rated flux
Decimal: XXX

FLUX OUTPUT ***Hidden***

(Flux Output)

Measured value of the flux output.
Units: % rated flux
Decimal: XXX

SLIP FREQUENCY ***Hidden***

(Slip Frequency)

Displays the commanded slip frequency of the motor.
Units: Hz
Decimal: +XXX.XX

MOTOR OVERLOAD ***Hidden***

(Motor Overload)

Displays the percentage of motor overload trip level reached. Once this value reaches 100% the motor has exceeded its user defined overload curve and a motor overload alarm is declared by the drive. For more information on the motor overload curve, *see section (5.3.2)*.
Units: % rated current of motor
Decimal: XXX

DRIVE OVERLOAD ***Hidden***

(Drive Overload)

Displays the percentage of drive overload trip level reached. Once this value reaches 100% the drive has exceeded its overload curve and a drive overload fault is declared. For more information on the drive overload curve, *see section (5.3.1)*.
Units: % rated current of drive
Decimal: XXX

FLUX CURRENT ***Hidden***
(Flux Current)
Displays the flux producing current of the motor.
Units: % rated current
Decimal: +XXX

TORQUE CURRENT ***Hidden***
(Torque Current)
Displays the torque producing current of the motor.
Units: % rated current
Decimal: +XXX

FLUX VOLTAGE ***Hidden***
(Flux Voltage)
Displays the flux voltage reference.
Units: % rated volts
Decimal: +XXX

TORQUE VOLTAGE ***Hidden***
(Torque Voltage)
Displays the torque voltage reference.
Units: % rated volts
Decimal: +XXX

BASE IMPEDANCE ***Hidden***
(Base Impedance)
Displays the drive calculated base impedance, which is based on the RATED MTR PWR and the RATED MTR VOLTS parameters (*see section 3.4.6*). This value is used to calculate the Per Unit values of the system impedances (i.e. EXTERN REACTANCE and STATOR RESIST).
Units: Ohms
Decimal: XXX.XXX

EST NO LOAD CURR
(Estimated No Load Current)
Estimated no load current of the motor calculated by the HPV 900's adaptive tune.
Units: %
Decimal: XXX.X

EST RATED RPM
(Estimated Rated RPM)
Estimated rated rpm of the motor calculated by the HPV 900's adaptive tune.
Units: RPM
Decimal: XXXX.X

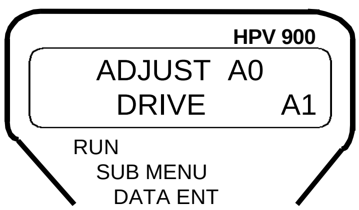
3.4 ADJUST A0 Menu

The ADJUST A0 menu provides selections and settings which are used to configure the drive to the specific motor and elevator application.

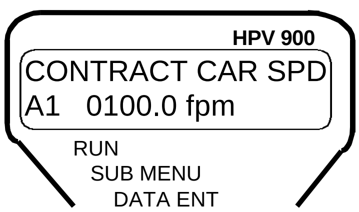
This menu has seven sub menus:

- **DRIVE A1** **3.4.1**
- **S-CURVES A2** **3.4.2**
- **MULTISTEP REF A3** **3.4.3**
- **POWER CONVERT A4** **3.4.4**
- **MOTOR A5** **3.4.5**

The sub-menu is identified by its full name on the bottom line of the Digital Operator display when the SUB MENU LED is *not* lit.



When the SUB MENU LED is ON, the two letter code for the sub-menu appears at the far left of the bottom line of the display.



3.4.1 DRIVE A1 Sub Menu

This sub menu contains drive software parameters, which are used to configure the drive for specific installations. This section gives parameters, ranges, units, run lock-out status, and brief descriptions.

NOTE: When the word ***Hidden*** appears with the parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details in section 3.6.2*

NOTE: When the word ***Lockout*** appears with the parameter description, the parameter cannot be changed when the drive is in the RUN mode.

.

Table 3. 5 summarizes the available Drive parameters.

Name	Description	Units	Hidden	Lockout
Contract Car Spd	Elevator contract speed	m/s or ft/min	N	Y
Contract Mtr Spd	Motor speed at elevator contract speed	RPM	N	Y
Response	Sensitivity of the speed regulator	rad/sec	N	N
Inertia	System inertia	sec	N	N
Inner Loop Xover	Inner speed loop crossover frequency (only with Ereg speed regulator)	rad/sec	N	N
Gain Reduce Mult	Percentage of response of the speed regulator using when in the low gain mode	%	Y	N
Gain Chng Level	Speed level to change to low gain mode (only with internal gain switch)	% rated speed	Y	N
Tach Rate Gain	Helps with the effects of rope resonance	%	Y	N
Spd Phase Margin	Sets phase margin of speed regulator (only with PI speed regulator)	degrees	Y	N
Ramped Stop Time	Time to ramp torque from rated torque to zero (only with torque ramp down stop function)	seconds	Y	N
Contact Flt Time	Time before a contactor fault is declared	seconds	Y	N
Brake Pick Time	Time before a brake pick fault is declared	seconds	Y	N
Brake Hold Time	Time before a brake hold fault is declared	seconds	Y	N
Overspeed Level	Threshold for detection of overspeed fault	% contract spd	Y	N
Overspeed Time	Time before a overspeed fault is declared	seconds	Y	N
Overspeed Mult	Multiplier for overspeed test	%	Y	N
Encoder Pulses	Encoder counts per revolution	none	N	Y
Spd Dev Lo Level	Range around the speed reference for speed deviation low logic output	% contract spd	Y	N
Spd Dev Time	Time before speed deviation low logic output is true	seconds	Y	N
Spd Dev Hi Level	Level for declaring speed deviation alarm	% contract spd	Y	N
Spd Command Bias	Subtracts an effective voltage to actual speed command voltage	volts	Y	Y
Spd Command Mult	Scales analog speed command	none	Y	Y
Pre Torque Bias	Subtracts an effective voltage to actual pre torque command voltage	volts	Y	Y
Pre Torque Mult	Scales pre-torque command	none	Y	Y
Zero Speed Level	Threshold for zero speed logic output	% contract spd	Y	Y
Zero Speed Time	Time before zero speed logic output is declared true.	seconds	Y	Y
Up/Dwn Threshold	Threshold for detection of up or down direction	% contract spd	Y	Y
Mtr Torque Limit	Motoring torque limit	% rated torque	N	N
Regen Torq Limit	Regenerating torque limit	% rated torque	N	N
Flux Wkn Factor	Defines the torque limit at higher speeds	% torque	Y	N
Ana Out 1 Offset	Subtracts an effective voltage to actual analog output 1	%	Y	N
Ana Out 2 Offset	Subtracts an effective voltage to actual analog output 1	%	Y	N
Ana Out 1 Gain	Scaling factor for analog output 1	none	Y	N
Ana Out 2 Gain	Scaling factor for analog output 2	none	Y	N
Flt Reset Delay	Time before a fault is automatically reset	seconds	Y	N
Flt Resets / Hour	Number of faults that is allowed to be automatically reset per hour	faults	Y	N

Table 3. 5 - DRIVE A1 Parameters

CONTRACT CAR SPD
Lockout (Contract Car Speed)
This parameter programs the elevator contract speed in fpm (feet per minute) or m/s (meters per second).
Default: 400.0 fpm / 2.000 m/s
Min: 0.0 / 0.00 Max:3000.0 / 16.00
Units: fpm or m/s

CONTRACT MTR SPD
Lockout (Contract Motor Speed)
This parameter programs the motor speed at elevator contract speed in rpm (revolutions per minute).
Default: 1130.0 rpm
Min: 3000.0 Max: 50 .0
Units: rpm (revolutions per minute)

RESPONSE
(Response)
This parameter sets the sensitivity of the drive's speed regulator in terms of the speed regulator bandwidth in radians. The responsiveness of the drive as it follows the speed reference will increase as this number increases. If the number is too large, the motor current and speed will become jittery. If this number is too small, the motor will become sluggish.
Default:10.0 rad/sec
Min: 1.0 Max: 20 .0

Units: rad/sec (radians per second)

INERTIA
(System Inertia)
This parameter sets the equivalent of the system inertia in terms of the time it takes the elevator to accelerate to motor base speed at rated torque. *For more details on estimating the elevator system inertia see section 5.6.*
Default: 2.00 sec
Min: 0.25 Max: 50 .00

Units: sec (seconds)

INNER LOOP XOVER
(Inner Loop Cross Over)
This parameter sets the inner speed loop cross over frequency. This parameter is only used by the Elevator Speed Regulator (Ereg).
Default: 2.0 rad/sec
Min: 0.1 Max: 20 .0
Units: rad/sec (radians per second)

GAIN REDUCE MULT ***Hidden***
(Gain Reduce Multiplier)
This parameter is the percent of 'response' the speed regulator should use in the 'low gain' mode. This value reduces the RESPONSE value when the drive is in 'low gain' mode. (i.e. setting this parameter to 100% equals no reduction in gain in the 'low gain' mode)
Default: 100 %
Min: 10 Max: 100
Units: %

GAIN CHNG LEVEL ***Hidden***
(Gain Change Level)
When the gain control is set to internal, the drive will control the high/low gain switch. This parameter sets the speed reference level, when the drive is in 'low gain' mode. *For further information, see section (5.1.4.1) or HI/LO GAIN SRC parameter in section (3.5.1).*
Default: 000.0%
Min: 000.0 Max: 100.0
Units: % rated speed

TACH RATE GAIN ***Hidden***
(Tach Rate Gain)
This parameter can be used to help to reduce the effects of rope resonance. It should be adjusted only *after* the INERTIA, and RESPONSE has been set correctly. *For further information, see section (5.1.4.5).*
Default: 00.0%
Min: 00.0 Max: 30.0
Units: none

SPD PHASE MARGIN ***Hidden***
(Speed Phase Margin)
This parameter sets the phase margin of the speed regulator assuming a pure inertial load. This parameter is only used by the PI speed regulator.
Default: 80 degrees
Min: 45 Max: 90
Units: degrees

RAMPED STOP TIME ***Hidden***

(Ramped Stop Time)

This parameter is only used by the torque ramp down stop function and sets the time to ramp torque from rated torque to zero. After the elevator lands and the brake is applied, the torque ramp down function allows the torque to ramp down at an even level. This helps eliminate the 'bump' felt upon landing caused by the torque being immediately dropped to zero. *For further information, see RAMPED STOP SEL and RAMP DOWN EN SRC parameters in section (3.5.1).*

Default: 0.20 seconds
Min: 0.00 Max: 2.50
Units: seconds

CONTACT FLT TIME ***Hidden***

(Contact Fault Time)

When external logic inputs are used to confirm the closing of the motor contactor, this parameter sets the amount of time allowed for the contactor's auxiliary contacts to reach the user commanded state before a CONTACTOR FLT occurs.

Default: 0.50 seconds
Min: 0.10 Max: 5.00
Units: seconds

BRAKE PICK TIME ***Hidden***

(Brake Pick Time)

If the brake pick fault is enabled, this parameter sets the time allowed for the brake pick feedback not to match the brake pick command before a BRK PICK FLT occurs. *For further information, see BRK PICK FLT ENA parameter in section (3.5.1).*

Default: 1.00 seconds
Min: 0.00 Max: 5.00
Units: seconds

BRAKE HOLD TIME ***Hidden***

(Brake Hold Time)

If the brake hold fault is enabled, this parameter sets the time allowed for the brake hold feedback not match the brake hold command before a BRK HOLD FLT occurs. *For further information, see BRK HOLD FLT ENA parameter in section (3.5.1).*

Default: 0.20 seconds
Min: 0.00 Max: 5.00
Units: seconds

OVERSPEED LEVEL ***Hidden***

(Overspeed Level)

This parameter sets the percentage of rated speed the drive uses (in conjunction with OVERSPEED TIME, below) to determine when an OVERSPEED fault occurs.

Default: 115.0 %
Min: 100.0 Max: 150.0
Units: % rated speed

OVERSPEED TIME ***Hidden***

(Overspeed Time)

This parameter sets the time that the drive can be at or above the OVERSPEED LEVEL, before the drive declares an OVERSPEED FLT.

Default: 1.00 seconds
Min: 0.00 Max: 9.99
Units: seconds

OVERSPEED MULT ***Hidden***

(Over Speed Multiplier)

This parameter sets the percentage of rated speed for the OVERSPEED TEST. *See section 3.4.2 for the procedure on running an overspeed test.*

Default: 125 %
Min: 100 Max: 150
Units: % contract speed

ENCODER PULSES
Lockout (Encoder Pulses)

This parameter sets the pulses per revolution (before the x4 logic) the drive receives from the encoder.

Default: 1024
Min: 00600 Max: 10000
Units: pls/rev (pulses per revolution)

SPD DEV LO LEVEL ***Hidden***

(Speed Deviation Low Level)

This parameter defines a range around the speed reference. When the speed feedback is within this range (in conjunction with SPD DEV TIME) the drive will set the SPEED DEV LO logic output. *For more information see section (5.1.4.9).*

Default: 10.0 %
Min: 00.1 Max: 10.0
Units: % contract speed

SPD DEV TIME ***Hidden***
(Speed Deviation Time)
This parameter defines the time the speed feedback needs to be in the range around the speed reference defined by SPD DEV LO LEVEL before the Speed Deviation Low logic output is true. *For more information see section (5.1.4.9).*
Default: 0.50 seconds
Min:0.00 Max: 9.99
Units: seconds

SPD DEV HI LEVEL ***Hidden***
(Speed Deviation High Level)
This parameter defines a threshold around the speed reference. If the speed feedback is outside of this threshold the drive will declare a Speed Deviation Alarm. *For more information see section (5.1.4.9).*
Default: 10.0%
Min: 00.0 Max: 99.9
Units: % contract speed

SPD COMMAND BIAS ***Hidden***
Lockout (Speed Command Bias)
This parameter subtracts an effective voltage to the actual analog speed command (channel 1) voltage signal. *For more information, see section (5.1.1.2).*

$$\left(\begin{matrix}\text{analog}\\\text{channel\#1}\\\text{input}\\\text{voltage}\end{matrix} - \begin{matrix}\text{SPD}\\\text{COMMAND}\\\text{BIAS}\end{matrix}\right) \times \begin{matrix}\text{SPD}\\\text{COMMAND}\\\text{MULT}\end{matrix} = \begin{matrix}\text{signal}\\\text{drive}\\\text{software}\\\text{uses}\end{matrix}$$

Default: 0.00 V
Min: 0.00 Max: 6.00
Units: Volts (V)

SPD COMMAND MULT ***Hidden***
Lockout (Speed Command Multiplier)
This parameter scales the analog speed command (channel 1). *For more information, see section (5.1.1.2).*

$$\left(\begin{matrix}\text{analog}\\\text{channel\#1}\\\text{input}\\\text{voltage}\end{matrix} - \begin{matrix}\text{SPD}\\\text{COMMAND}\\\text{BIAS}\end{matrix}\right) \times \begin{matrix}\text{SPD}\\\text{COMMAND}\\\text{MULT}\end{matrix} = \begin{matrix}\text{signal}\\\text{drive}\\\text{software}\\\text{uses}\end{matrix}$$

Default: 1.00
Min: 0.90 Max: 3.00
Units: none

PRE TORQUE BIAS ***Hidden***
Lockout (Pre-Torque Bias)
This parameter subtracts an effective voltage to the actual analog pre torque command (channel 2) voltage signal. *For more information, see section (5.1.4.7.3).*

$$\left(\begin{matrix}\text{analog}\\\text{channel\#2}\\\text{input}\\\text{voltage}\end{matrix} - \begin{matrix}\text{PRE}\\\text{TORQUE}\\\text{BIAS}\end{matrix}\right) \times \begin{matrix}\text{PRE}\\\text{TORQUE}\\\text{MULT}\end{matrix} = \begin{matrix}\text{signal}\\\text{drive}\\\text{software}\\\text{uses}\end{matrix}$$

Default: 0.00 V
Min: 0.00 Max: 6.00
Units: volts

PRE TORQUE MULT ***Hidden***
Lockout (Pre-Torque Multiplier)
This parameter scales the analog pretorque command (channel 2). *For more information, see section (5.1.4.7.3).*

$$\left(\begin{matrix}\text{analog}\\\text{channel\#2}\\\text{input}\\\text{voltage}\end{matrix} - \begin{matrix}\text{PRE}\\\text{TORQUE}\\\text{BIAS}\end{matrix}\right) \times \begin{matrix}\text{PRE}\\\text{TORQUE}\\\text{MULT}\end{matrix} = \begin{matrix}\text{signal}\\\text{drive}\\\text{software}\\\text{uses}\end{matrix}$$

Default: 1.00
Min: -10.00 Max: 10.00
Units: none

ZERO SPEED LEVEL ***Hidden***
Lockout (Zero Speed Level)
This parameter sets the threshold for zero speed detection. This is only used to generate the ZERO SPEED logic output.
Default: 1.00 %
Min: 0.00 Max: 9.99
Units: % contract speed

ZERO SPEED TIME ***Hidden***
Lockout (Zero Speed Time)
This parameter sets the time at which the drive is at the ZERO SPEED LEVEL before zero speed logic output is true.
Default: 0.10 seconds
Min: 0.00 Max: 9.99
Units: seconds

UP/DWN THRESHOLD ***Hidden***

Lockout (Up/Down Directional Threshold)

This parameter sets the threshold for the direction sense logic outputs. If speed feedback does not reach this level, the drive will not detect a directional change. This is only used to generate the direction sense logic outputs (CAR GOING UP and CAR GOING DOWN).

Default: 1.00 %

Min: 0.00 Max: 9.99

Units: % contract speed

MTR TORQUE LIMIT

(Motor Torque Limit)

This parameter sets the maximum torque allowed at when in the motoring mode. This parameter may need adjustment to reduce the effects of field weakening. *For further information, see section (5.1.5.1).*

Default: 200.0 %

Min: 000.0 Max: 250.0

Units; % rated torque

REGEN TORQ LIMIT

(Regenerative Mode Torque Limit)

This parameter sets the maximum amount of regenerative torque the drive will see during regeneration. This parameter may need adjustment to reduce the effects of field weakening. *For further information, see section (5.1.5.1).*

Default: 200.0 %

Min:000.0 Max: 250.0

Units: % rated torque

FLUX WKN FACTOR ***Hidden***

(Flux Weakening Factor)

This parameter limits the maximum amount of torque available at higher speeds. When the drive is commanding higher speeds, this parameter defines a percentage of the defined torque limits (MTR TORQUE LIMIT and REGEN TORQ LIMIT). This parameter is used to reduce the effects of field weakening and reduce the amount of motor current produced at higher speeds. *For further information, see section (5.1.5.1).*

Default: 100.0 %

Min:060.0 Max: 100.0

Units: % of defined torque limits

ANA 1 OUT OFFSET ***Hidden***

(Digital to Analog #1 Output Offset)

Offset for scaling Analog Output Channel #1.

$$\left(\begin{matrix}signal\\drive\\software\\creates\end{matrix} - \begin{matrix}ANA\\OUT\\OFFSET\end{matrix}\right) \times \begin{matrix}ANA\\OUT\\GAIN\end{matrix} = \begin{matrix}analog\\channel\\output\\voltage\end{matrix}$$

Default: 0.00 %

Min: -99.9 Max: 99.9

Units: %

ANA 2 OUT OFFSET ***Hidden***

(Digital to Analog #2 Output Offset)

Offset for scaling Analog Output Channel #2.

$$\left(\begin{matrix}signal\\drive\\software\\creates\end{matrix} - \begin{matrix}ANA\\OUT\\OFFSET\end{matrix}\right) \times \begin{matrix}ANA\\OUT\\GAIN\end{matrix} = \begin{matrix}analog\\channel\\output\\voltage\end{matrix}$$

Default: 0.00 %

Min: -99.9 Max: 99.9

Units: %

ANA 1 OUT GAIN ***Hidden***

(Digital to Analog #1 Output Gain)

Adjusts the scaling for the Analog Output Channel #1.

$$\left(\begin{matrix}signal\\drive\\software\\creates\end{matrix} - \begin{matrix}ANA\\OUT\\OFFSET\end{matrix}\right) \times \begin{matrix}ANA\\OUT\\GAIN\end{matrix} = \begin{matrix}analog\\channel\\output\\voltage\end{matrix}$$

Default: 01.0

Min: 00.0 Max: 10.0

Units: none

ANA 2 OUT GAIN ***Hidden***

(Digital to Analog #2 Output Gain)

Adjusts the scaling

$$\left(\begin{matrix}signal\\drive\\software\\creates\end{matrix} - \begin{matrix}ANA\\OUT\\OFFSET\end{matrix}\right) \times \begin{matrix}ANA\\OUT\\GAIN\end{matrix} = \begin{matrix}analog\\channel\\output\\voltage\end{matrix}$$

Default: 01.0

Min: 00.0 Max: 10.0

Units: none

FLT RESET DELAY ***Hidden***

(Fault Reset Delay)

When the drive is set for automatic fault reset, this is the time before a fault is automatically reset. *For further information, see RESET SRC and parameters in section (3.5.1).*

Default: 5

Min: 0 Max: 120

Units: seconds

FLT RESETS/HOUR ***Hidden***

(Fault Resets per Hour)

When the drive is set for automatic fault reset, this is the number of faults that is allowed to be automatically reset per hour. *For further information, see RESET SRC and parameters in section (3.5.1).*

Default: 3

Min: 0 Max: 10

Units: faults

3.4.2 S-CURVES A2 Sub Menu

An important feature of the HPV 900 is the internal S-curve function. The S-curves are specified by four parameters: acceleration rate (ft/s^2 or m/s^2), deceleration rate (ft/s^2 or m/s^2), leveling jerk rate (ft/s^3 or m/s^3), and jerk rate (ft/s^3 or m/s^3).

Since an adjustable jerk rate is helpful for smooth landings, the jerk rates were split for ease in elevator fine tuning. The jerk rate parameter specifies: acceleration from the floor (jerk in), jerk out acceleration , jerk in deceleration. And the leveling jerk parameter specifies the deceleration jerk out.

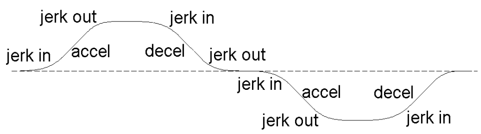


Figure 3. 5 - S-Curve

There are four S-curve patterns available in the HPV 900 and each S-curve is customized by four parameters:

Parameters for S-curve-0 (SC0):
- ACCEL RATE 0
- DECEL RATE 0
- JERK RATE 0
- LEV JERK 0

Parameters for S-curve-1 (SC1):
- ACCEL RATE 1
- DECEL RATE 1
- JERK RATE 1
- LEV JERK 1

Parameters for S-curve-2 (SC2):
- ACCEL RATE 2
- DECEL RATE 2
- JERK RATE 2
- LEV JERK 2

Parameters for S-curve-3 (SC3):
- ACCEL RATE 3
- DECEL RATE 3
- JERK RATE 3
- LEV JERK 3

A summary of S-Curve parameters is shown in Table 3. 6.

NOTE: When the word ***Hidden*** appears above a parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details in section 3.6.2.*

NOTE: When the word ***Lockout*** appears above a parameter description, it parameter cannot be changed when the drive is in the RUN mode.

For more detailed information on the S-curve settings see the HPV 900 Application section (5.4).

Name	Description	Units	Hidden	Lockout
Accel Rate 0	Acceleration rate #0	ft/s^2 or m/s^2	N	Y
Decel Rate 0	Deceleration rate #0	ft/s^2 or m/s^2	N	Y
Jerk Rate 0	Accel jerk in, accel jerk out, decel jerk in #0	ft/s^3 or m/s^3	N	Y
Lev Jerk Rate 0	Leveling jerk rate (decel jerk out) #0	ft/s^3 or m/s^3	N	Y
Accel Rate 1	Acceleration rate #1	ft/s^2 or m/s^2	N	Y
Decel Rate 1	Deceleration rate #1	ft/s^2 or m/s^2	N	Y
Jerk Rate 1	Accel jerk in, accel jerk out, decel jerk in #1	ft/s^3 or m/s^3	N	Y
Lev Jerk Rate 1	Leveling jerk rate (decel jerk out) #1	ft/s^3 or m/s^3	N	Y
Accel Rate 2	Acceleration rate #2	ft/s^2 or m/s^2	Y	Y
Decel Rate 2	Deceleration rate #2	ft/s^2 or m/s^2	Y	Y
Jerk Rate 2	Accel jerk in, accel jerk out, decel jerk in #2	ft/s^3 or m/s^3	Y	Y
Lev Jerk Rate 2	Leveling jerk rate (decel jerk out) #2	ft/s^3 or m/s^3	Y	Y
Accel Rate 3	Acceleration rate #3	ft/s^2 or m/s^2	Y	Y
Decel Rate 3	Deceleration rate #3	ft/s^2 or m/s^2	Y	Y
Jerk Rate 3	Accel jerk in, accel jerk out, decel jerk in #3	ft/s^3 or m/s^3	Y	Y
Lev Jerk Rate 3	Leveling jerk rate (decel jerk out) #3	ft/s^3 or m/s^3	Y	Y

Table 3. 6 - S-CURVES A2 Parameters

ACCEL RATE 0
Lockout (S-curve-0 Acceleration Rate)
Default: 3.00 ft/s/s or 0.900 m/s/s
Min: 0.00 / 0.000 Max: 7.99 / 3.999
Units: ft/s^2 or m/s^2

DECEL RATE 0
Lockout (S-curve-0 Deceleration Rate)
Default: 3.00 ft/s/s or 0.900 m/s/s
Min: 0.00 / 0.000 Max: 7.99 / 3.999
Units: ft/s^2 or m/s^2

JERK RATE 0
Lockout (S-curve-0 Jerk Rate)
Accel jerk in, accel jerk out, & decel jerk in.
Default: 8.0 f/s/s/s or 2.400 m/s/s/s
Min: 0.00 / 0.000 Max: 29.9 / 9.999
Units: f/s^3 or m/s^3

LEV JERK RATE 0
Lockout (S-curve-0 Leveling Jerk Rate)
Leveling jerk rate (decel jerk out)
Default: 8.0 f/s/s/s or 2.400 m/s/s/s
Min: 0.00 / 0.000 Max: 29.9 / 9.999
Units: f/s^3 or m/s^3

ACCEL RATE 1
Lockout (S-curve-1 Acceleration Rate)
Default: 3.00 ft/s/s or 0.900 m/s/s
Min: 0.00 / 0.000 Max: 7.99 / 3.999
Units: ft/s^2 or m/s^2

DECEL RATE 1
Lockout (S-curve-0 Deceleration Rate)
Default: 3.00 ft/s/s or 0.900 m/s/s
Min: 0.00 / 0.000 Max: 7.99 / 3.999
Units: ft/s^2 or m/s^2

JERK RATE 1
Lockout (S-curve-1 Jerk Rate)
Accel jerk in, accel jerk out, & decel jerk in.
Default: 8.0 f/s/s/s or 2.400 m/s/s/s
Min: 0.00 / 0.000 Max: 29.9 / 9.999
Units: f/s^3 or m/s^3

LEV JERK RATE 1
Lockout (S-curve-1 Leveling Jerk Rate)
Leveling jerk rate (decel jerk out)
Default: 8.0 f/s/s/s or 2.400 m/s/s/s
Min: 0.00 / 0.000 Max: 29.9 / 9.999
Units: f/s^3 or m/s^3

ACCEL RATE 2 ***Hidden***
Lockout (S-curve-2 Acceleration Rate)
Default: 3.00 ft/s/s or 0.900 m/s/s
Min: 0.00 / 0.000 Max: 7.99 / 3.999
Units: ft/s^2 or m/s^2

DECEL RATE 2 ***Hidden***
Lockout (S-curve-2 Deceleration Rate)
Default: 3.00 ft/s/s or 0.900 m/s/s
Min: 0.00 / 0.000 Max: 7.99 / 3.999
Units: ft/s^2 or m/s^2

JERK RATE 2 ***Hidden***
Lockout (S-curve-2 Jerk Rate)
Accel jerk in, accel jerk out, & decel jerk in.
Default: 8.0 f/s/s/s or 2.400 m/s/s/s
Min: 0.00 / 0.000 Max: 29.9 / 9.999
Units: f/s^3 or m/s^3

LEV JERK RATE 2 ***Hidden***
Lockout (S-curve-2 Leveling Jerk Rate)
Leveling jerk rate (decel jerk out)
Default: 8.0 f/s/s/s or 2.400 m/s/s/s
Min: 0.00 / 0.000 Max: 29.9 / 9.999
Units: f/s^3 or m/s^3

ACCEL RATE 3 ***Hidden***
Lockout (S-curve-3 Acceleration Rate)
Default: 3.00 ft/s/s or 0.900 m/s/s
Min: 0.00 / 0.000 Max: 7.99 / 3.999
Units: ft/s^2 or m/s^2

DECEL RATE 3 ***Hidden***
Lockout (S-curve-3 Deceleration Rate)
Default: 3.00 ft/s/s or 0.900 m/s/s
Min: 0.00 / 0.000 Max: 7.99 / 3.999
Units: ft/s^2 or m/s^2

JERK RATE 3 ***Hidden***
Lockout (S-curve-3 Jerk Rate)
Accel jerk in, accel jerk out, & decel jerk in.
Default: 8.0 f/s/s/s or 2.400 m/s/s/s
Min: 0.00 / 0.000 Max: 29.9 / 9.999
Units: f/s^3 or m/s^3

LEV JERK RATE 3 ***Hidden***
Lockout (S-curve-3 Leveling Jerk Rate)
Leveling jerk rate (decel jerk out)
Default: 8.0 f/s/s/s or 2.400 m/s/s/s
Min: 0.00 / 0.000 Max: 29.9 / 9.999
Units: f/s^3 or m/s^3

3.4.2.1 S-Curve Pattern Selection

The default S-curve pattern is S-curve-0 (SC0). To make the other patterns available, the user must assign S-CURVE SEL 0 and/or S-CURVE SEL 1 as logic input(s) (*see section 3.3.2*). The logic input(s) can then be used to select one of the S-curve patterns, as follows:

Logic Inputs Assigned	S-curves Available
None	SC0 only
SEL 0 only	SC0 or SC1
SEL 1 only	SC0 or SC2
SEL 0 & SEL 1	SC0, SC1, SC2 or SC3

Table 3. 7 - S-curve Availability

logic input S-CURVE SEL 1	SEL 0	S-curve selected
0	0	SCO
0	1	SC1
1	0	SC2
1	1	SC3

Table 3. 8 - Selecting S-curves

3.4.3 MULTISTEP REF A3 Sub Menu

The multi-step speed reference function is possible way for the drive to accept speed command. To use this function, the user can enter up to fifteen speed commands (CMD1 – CMD15) and assign four logic inputs as speed command selections.

Note: CMD0 is reserved for zero speed, therefore is not accessible to the user for programming.

During operation, the user will encode a binary signal on the four logic inputs (see Table 3. 9) that determines which speed command the software should use. The user need not use all four speed command selection bits; if no logic input is specified for one of the selection bits, that bit is always zero. For instance, if no logic input is specified for the most significant bit (B3), that bit will be zero and the user can select from CMD0 - CMD7.

NOTE: Since these speed commands are selected with external contacts, a new command selection must be present for 50ms before it is recognized.

logic input STEP REF				multi-step speed
B3	B2	B1	B0	command
0	0	0	0	CMD0
0	0	0	1	CMD1
0	0	1	0	CMD2
0	0	1	1	CMD3
0	1	0	0	CMD4
0	1	0	1	CMD5
0	1	1	0	CMD6
0	1	1	1	CMD7
1	0	0	0	CMD8
1	0	0	1	CMD9
1	0	1	0	CMD10
1	0	1	1	CMD11
1	1	0	0	CMD12
1	1	0	1	CMD13
1	1	1	0	CMD14
1	1	1	1	CMD15

Table 3. 9 - Multi-step Selection

An example of the use of the multi-step command is as follows:

- All speed commands are positive.
- CMD0 specifies zero speed.
- CMD1 specifies leveling speed.
- CMD2 specifies inspection speed.
- CMD3 specifies an overspeed limit.
- CMD4 – CMD15 specify different top speeds depending on number of floors in the run.

For typical use, the user will have all speed commands to be positive, in which case a logic input (UP/DWN) must also be specified to determine UP or DOWN direction. It is possible for the user to specify both positive and negative values for CMD1 - CMD15, in which case the UP / DOWN logic input bit is not needed.

NOTE: When the word ***Hidden*** appears above a parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details in section 3.6.2.*

NOTE: When the word ***Lockout*** appears above a parameter description, it parameter cannot be changed when the drive is in the RUN mode.

For all speed command have the following parameter ranges and units apply:

SPEED COMMAND
Lockout (Speed Command)
Multi-step speed command
Default: 0.0 ft/min or 00.000 m/sec
Min: -3000.0 / -16.0 Max: 3000.0 / 16.0
Units: ft/min or m/sec

A summary of the Speed Command parameters is shown in Table 3. 9.

Name	Description	Units	Hidden	Lockout
Speed Command 1	Multi-step speed command #1	ft/min or m/sec	N	Y
Speed Command 2	Multi-step speed command #2	ft/min or m/sec	N	Y
Speed Command 3	Multi-step speed command #3	ft/min or m/sec	N	Y
Speed Command 4	Multi-step speed command #4	ft/min or m/sec	N	Y
Speed Command 5	Multi-step speed command #5	ft/min or m/sec	N	Y
Speed Command 6	Multi-step speed command #6	ft/min or m/sec	N	Y
Speed Command 7	Multi-step speed command #7	ft/min or m/sec	N	Y
Speed Command 8	Multi-step speed command #8	ft/min or m/sec	N	Y
Speed Command 9	Multi-step speed command #9	ft/min or m/sec	N	Y
Speed Command 10	Multi-step speed command #10	ft/min or m/sec	N	Y
Speed Command 11	Multi-step speed command #11	ft/min or m/sec	N	Y
Speed Command 12	Multi-step speed command #12	ft/min or m/sec	N	Y
Speed Command 13	Multi-step speed command #13	ft/min or m/sec	N	Y
Speed Command 14	Multi-step speed command #14	ft/min or m/sec	N	Y
Speed Command 15	Multi-step speed command #15	ft/min or m/sec	N	Y

Table 3. 10 - MULTISTEP REF A3 Parameters

3.4.5 POWER CONVERT A4 Sub Menu

This drive software power related parameters.

NOTE: When the word ***Hidden*** appears above a parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details in section 3.6.2.*

NOTE: When the word ***Lockout*** appears above a parameter description, it parameter cannot be changed when the drive is in the RUN mode.

A summary is shown in Table 3. 11.

Name	**Description**	**Units**	**Hidden**	**Lockout**
Id Reg Diff Gain	Flux current regulator differential gain	none	Y	N
Id Reg Prop Gain	Flux current regulator proportional gain	none	Y	N
Iq Reg Diff Gain	Torque current regulator differential gain	none	Y	N
Iq Reg Prop Gain	Torque current regulator proportional gain	none	Y	N
PWM Frequency	Carrier frequency	kHz	N	N
UV Alarm Level	Voltage level for undervoltage alarm	%nominal bus	Y	N
UV Fault Level	Voltage level for undervoltage fault	%nominal bus	Y	N
Extern Reactance	External choke reactance	% base Z	Y	Y
Input L-L Volts	Nominal line-line AC input Voltage, RMS	Volts	N	N

Table 3. 11 - POWER CONVERT A4 Parameters

Id REG DIFF GAIN ***Hidden***

(Current Regulator Differential Gain for Flux Generation)

The differential gain for the current regulator flux generation. This parameter is meant for advanced operation, therefore, the parameter will rarely need to be changed from the default value.

Default: 1.00
Min: 0.80 Max: 1.20
Units: none

Id REG PROP GAIN ***Hidden***

(Current Regulator Proportional Gain for Flux Generation)

The proportional gain for the current regulator flux generation**.** This parameter is meant for advanced operation, therefore, the parameter will rarely need to be changed from the default value.

Default: 0.30
Min: 0.20 Max: 0.40
Units: none

Iq REG DIFF GAIN ***Hidden***

(Current Regulator Differential Gain for Torque Generation)

The differential gain for the current regulation of motor torque. This parameter is meant for advanced operation, therefore, the parameter will rarely need to be changed from the default value.

Default: 1.00
Min: 0.80 Max: 1.20
Units: none

Iq REG PROP GAIN ***Hidden***

(Current Regulator Proportional Gain for Torque Generation)

The proportional gain for the current regulator torque generation. This parameter is meant for advanced operation, therefore, the parameter will rarely need to be changed from the default value.

Default: 0.30
Min: 0.20 Max: 0.40
Units: none

PWM FREQUENCY

(PWM Frequency)

This parameter sets the PWM or 'carrier' frequency of the drive. The carrier is defaulted at 10.0 kHz, which is well out of audible range. The drive does not derate when the PWM frequency is set to 10kHz or below. *For more information on derating see section (2.2.4)*

Default: 10.0 kHz
Min: 2.5 Max: 16.0
Units: kHz

UV ALARM LEVEL ***Hidden***

(Undervoltage Alarm Level)

This parameter sets the level (as a percentage of the INPUT L-L VOLTS) at which an under voltage alarm will be declared.

Default: 90%
Min: 80 Max: 99
Units: % of nominal bus

UV FAULT LEVEL ***Hidden***

(Undervoltage Fault Level)

This parameter sets the level (as a percentage of the INPUT L-L VOLTS) at which an under voltage fault will occur.

Default: 80%
Min: 50 Max: 99
Units: % of nominal bus

EXTERN REACTANCE ***Hidden***
Lockout (External Reactance)

This parameter sets the externally connected reactance (as a percentage of base impedance) between the drive and the motor.

Default: 00.0 %
Min: 0.0 Max: 10
Units: % reactance

INPUT L-L VOLTS

(Input Line to Line Voltage - Input Voltage)

This parameter sets the input voltage or AC line input voltage to the drive.

Default: 460 Vrms
Min: 110 Max: 480
Units: volts (V) rms

3.4.6 MOTOR A5 Sub Menu

This sub menu contains parameters, which are programmed with information about the motor being controlled by the drive.

NOTE: When the word ***Hidden*** appears above a parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details in section 3.6.2.*

NOTE: When the word ***Lockout*** appears above a parameter description, it parameter cannot be changed when the drive is in the RUN mode.

A summary of the motor parameters is shown Table 3. 12.

Name	**Description**	**Units**	**Hidden**	**Lockout**
Motor ID	Motor Identification	none	N	Y
Rated Mtr Power	Rated motor output power	HP / KW	N	Y
Rated Mtr Volts	Rated motor terminal RMS voltage	Volts	N	Y
Rated Excit Freq	Rated excitation frequency	Hz	N	Y
Rated Motor Curr	Rated motor current	Amps	N	Y
Motor Poles	Motor poles	none	N	N
Rated Mtr Speed	Rated motor speed at full load	RPM	N	Y
% No Load Curr	Percent no load current	%rated current	N	N
Stator Leakage X	Stator leakage reactance	% base Z	Y	N
Rotor Leakage X	Rotor leakage reactance	% base Z	Y	N
Stator Resist	Stator resistance	% base Z	Y	N
Motor Iron Loss	Iron loss at rated frequency	% rated power	Y	N
Motor Mech Loss	Mechanical loss at rated frequency	% rated power	Y	N
Ovld Start Level	Maximum continuous motor current	% rated current	Y	Y
Ovld Time Out	Time that defines motor overload curve	seconds	Y	Y
Flux Sat Break	Flux saturation curve slope change point.	% flux	Y	Y
Flux Sat Slope 1	Flux saturation curve slope for low fluxes	PU slope	Y	Y
Flux Sat Slope 2	Flux saturation curve slope for high fluxes	PU slope	Y	Y

Table 3. 12 - MOTOR A5 Parameters

MOTOR ID

Lockout (Motor Identification)

This parameter allows for the selection of specific sets of motor parameters. A listing of each Motor ID with its corresponding set of motor parameters is shown in Table 3. 13 and Table 3. 14.

NOTE: The default motor selection needs to have the motor nameplate information entered in the appropriate motor parameters. The other motor parameters are already set to nominal values. And the Adaptive Tune can be used to obtain maximum performance from the motor. *See section (5.5.1.)*

Motor ID	Rated Mtr Power	Rated Mtr Volts	Rated Excit Freq	Rated Motor Curr	Motor Poles	Rated Mtr Speed	% No Load Curr
default motor	0.0 HP	0.0 V	0.0 Hz	0.0 A	00	0.0 rpm	35.0 %

Table 3. 13 - Motor ID Parameters

Motor ID	Stator Leakage X	Rotor Leakage X	Stator Resist	Motor Iron Loss	Motor Mech Loss	Flux Sat Break	Flux Sat Slope 1	Flux Sat Slope 2
default motor	9.0 %	9.0 %	1.,5 %	0.5 %	1.0 %	75 %	0 %	50 %

Table 3. 14 - Motor ID Parameters (continued)

RATED MTR PWR
Lockout (Rated Motor Power)
This parameter sets the rated power in horsepower (HP) or kilowatts (kW) of the motor
Default: per MOTOR ID
Min: 1.0 Max: 500.0
Units: HP/kW

RATED MTR VOLTS
Lockout (Rated Motor Voltage)
This parameter sets the rated motor voltage.
Default: per MOTOR ID
Min: 190.0 Max: 575.0
Units: Volts (V)

RATED EXCIT FREQ
Lockout (Rated Motor Excitation Freq.)
This parameter sets the excitation frequency of the motor.
Default: per MOTOR ID
Min 5.0 Max: 400.0
Units: Hz

RATED MOTOR CURR
Lockout (Rated Motor Amps)
This parameter sets the rated motor current.
Default: per MOTOR ID
Min: 1.00 Max: 800.00
Units: Amps (A)

MOTOR POLES
Lockout (Motor Poles)
This parameter sets the number of poles in the motor.
NOTE: This must be an even number or a Setup Fault #3 will occur.
Default: per MOTOR ID
Min: 2 Max: 32
Units: none

RATED MTR SPEED
(Rated Motor Speed)
This parameter sets the rated rpm of the motor (nameplate speed).
NOTE: This is a function of the motor only and does not need to be the same as the CONTRACT MTR SPD parameter setting (*see section 3.4.1*).
Default: per MOTOR ID
Min: 50.0 Max: 3000.0
Units: rpm

% NO LOAD CURR
(Percent No Load Current)
This parameter sets the percent no load current of the motor. This parameter can be adjusted by the HPV 900's Adaptive Tune. *See section (5.5.1).*
Default: per MOTOR ID
Min: 10.0 Max: 60.0
Units: % Current

STATOR LEAKAGE X ***Hidden***
(Stator Leakage Reactance)
This parameter sets the stator reactance leakage, as a percent of the BASE IMPEDANCE, which appears in the Power Data display (*See section 3.3.2*).
NOTE: The base impedance is based on the RATED MTR PWR and RATED MTR VOLTS parameters.
Default: per MOTOR ID
Min: 0.00 Max: 20.0
Units: % reactance of base impedance

ROTOR LEAKAGE X ***Hidden***
(Rotor Leakage Reactance)
This parameter sets the rotor reactance leakage, as a percent of the BASE IMPEDANCE, which appears in the Power Data display (*See section 3.3.2*).
NOTE: The base impedance is based on the RATED MTR PWR and RATED MTR VOLTS parameters.
Default: per MOTOR ID
Min: 0.00 Max: 20.0
Units: % reactance of base impedance

STATOR RESIST ***Hidden***
(Stator Resistance)
This parameter sets the amount of resistance in the motor stator, as a percent of the BASE IMPEDANCE, which appears in the Power Data display (*See section 3.3.2*).
NOTE: The base impedance is based on the RATED MTR PWR and RATED MTR VOLTS parameters.
Default: per MOTOR ID
Min: 0.0 Max: 20.0
Units: % resistance of base impedance

MOTOR IRON LOSS ***Hidden***

(Motor Iron Loss)

This parameter sets the motor iron loss at rated frequency.

Default: per MOTOR ID

Min: 0.0 Max: 15.0

Units: % of rated power

MOTOR MECH LOSS ***Hidden***

(Motor Mechanical Losses)

This parameter sets the motor mechanical losses at rated frequency.

Default: per MOTOR ID

Min: 0.0 Max: 15.0

Units: % of rated power

OVLD START LEVEL ***Hidden***

Lockout (Motor Overload Start Level)

This parameter defines maximum current at which motor can run continuously. This parameter is also one of the two parameters that define the motor overload curve. *For more information on the motor overload curve, see section (5.3.2).*

Default: 110 %

Min: 100 Max: 150

Units: % rated current

OVLD TIME OUT ***Hidden***

Lockout (Motor Overload Time Out)

This parameter defines the amount of time before a motor overload alarm occurs when the motor is running at the current level defined below:

$$\begin{pmatrix} OVLD \\ START \\ LEVEL: \end{pmatrix} + \begin{pmatrix} 40\% \\ rated \\ motor \\ current \end{pmatrix}$$

This is the other parameter used to define the overload curve. *For more information on the motor overload curve, see (5.3.2) Motor Overload*.

Default: 60.0 sec

Min: 5.0 Max: 120.0

Units: Seconds (sec)

FLUX SAT BREAK ***Hidden***

Lockout (Flux Saturation Break Point)

This parameter sets the flux saturation curve slope change point.

Default: per MOTOR ID

Min: 0 Max: 100

Units: % Flux

FLUX SAT SLOPE 1 ***Hidden***

Lockout (Flux Saturation Slope #1)

This parameter sets the flux saturation curve slope for low fluxes.

Default: per MOTOR ID

Min: 0.00 Max: 200.0

Units: PU slope 100%

FLUX SAT SLOPE 2 ***Hidden***

Lockout (Flux Saturation Slope #2)

This parameter sets the flux saturation curve slope for high fluxes.

Default: per MOTOR ID

Min: 0.00 Max: 200.0

Units: PU slope 100%

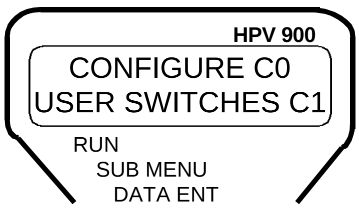
3.5 CONFIGURE C0 MENU

The CONFIGURE C0 menu contains the configuration parameters for the drive.

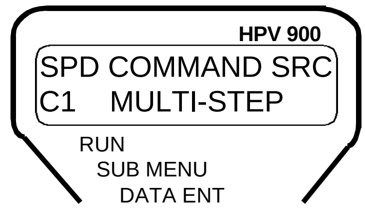
This menu has four sub-menus:

- **USER SWITCHES C1 3.5.1**
- **LOGIC INPUTS C2 3.5.2**
- **LOGIC OUTPUTS C3 3.5.3**
- **ANALOG OUTPUTS C4 3.5.4**

The sub-menu is identified by its full name on the bottom line of the Digital Operator display when the SUB MENU LED is *not* lit.



When the SUB MENU LED is ON, the two letter code for the sub-menu appears at the far left of the bottom line of the display.



3.5.1 USER SWITCHES C1 Sub Menu

This sub-menu contains the operation configurations for the drive.

NOTE: When the word ***Hidden*** appears with the parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details in section 3.6.2.*

NOTE: When the word ***Lockout*** appears with the parameter description, the parameter cannot be changed when the drive is in the RUN mode.

A summary of the user switches parameters is shown in Table 3. 15.

User Switches	Description	Hidden	Lockout
Spd Command Src	Speed Command Source	Y	Y
Run Command Src	Run Command Source	Y	Y
Hi/Lo Gain Src	High / low gain change switch source	Y	Y
Speed Reg Type	Chooses speed regulator: Ereg or PI regulator	Y	Y
Motor Rotation	Allows user to reverse direction of motor rotation.	Y	Y
Spd Ref Release	Determines when speed reference release is asserted.	Y	Y
Cont Confirm Src	Determines if an external logic input is used for contactor confirm.	Y	Y
PreTorque Source	Determines if a pre torque command is used and if used, it determines the source of the pre torque command.	Y	Y
PreTorque Latch	Chooses if analog pre-torque command is latched	Y	Y
PTorq Latch Clck	Determines source of pre torque latch control (if used)	Y	Y
Fault Reset Src	Fault reset source	Y	Y
Overspd Test Src	Determines external logic source to trigger overspeed test	Y	Y
Brake Pick Src	If drive controls the mechanical brake, this determines the source of the brake pick command	Y	Y
Brake Pick Cnfm	Determines if a logic input is used for brake pick confirm	Y	Y
Brake Hold Src	If drive controls the mechanical brake, this determines the source of the brake hold command.	Y	Y
Ramped Stop Sel	Chooses between normal stop and torque ramp down stop	Y	Y
Ramp Down En Src	Determines the source that signals the torque ramp down stop (if used)	Y	Y
Brk Pick Flt Ena	Brake pick fault enable	Y	Y
Brk Hold Flt Ena	Brake hold fault enable	Y	Y

Table 3. 15 - USER SWITCHES C1

SPD COMMAND SRC ***Hidden***
Lockout (Speed Command Source)
Default: MULTI-STEP
Choices: analog input
multi-step
serial

This parameter designates the source of the drive's speed command. The choices are the multi-step logic inputs, the analog input channel #1, and the serial channel. *For more information, see section (5.1.1).*

RUN COMMAND SRC ***Hidden***
Lockout (Run Command Source)
Default: EXTERNAL TB1
Choices: external tb1
serial

This parameter allows the user to choose either an external run signal or a run signal transferred across a serial channel. If set to EXTERNAL TB1, the Run signal on TB1 must be selected (*see section 3.5.2*)

HI/LO GAIN SRC ***Hidden***
Lockout (Hi/Lo Gain Source)
Default: INTERNAL
Choices: external tb1
serial
internal

This parameter determines the source of the high / low gain switch. *For more information, see section (5.1.4.1).*

SPEED REG TYPE ***Hidden***
Lockout (Speed Regulator Type)
Default: ELEV SPD REG
Choices: elev spd reg
pi speed reg

This switch toggles between the Elevator Speed Regulator (Ereg)and the PI Speed Rregulator. MagneTek recommends the use of the Elevator Speed Regulator for better elevator performance. *For more information, see section (5.1.4.2).*

MOTOR ROTATION ***Hidden***
Lockout (Motor Rotation)
Default: FORWARD
Choices: forward
reverse

This parameter allows the user to change the direction of the motor rotation. As an example, if the car controller is commanding the up direction and the car is actually going in a down direction, this parameter can be changed to allow the motor rotation to match the car controller command.

SPD REF RELEASE ***Hidden***
Lockout (Speed Reference Release)
Default: REG RELEASE
Choices: reg release
brake picked

The user can select when the Speed Reference Release signal is asserted:

1) If the user does not want the drive to wait for the mechanical brake to be picked then SPD REF RELEASE can be made equal to REG RELEASE;
2) If the user does want the drive to wait for the brake to be picked then SPD REF RELEASE is not asserted until BRAKE PICKED becomes true.

CONT CONFIRM SRC ***Hidden***
Lockout (Contactor Confirm Source)
Default: NONE
Choices: none
external tb1

This switch selects if hardware confirmation of motor contactor closure is necessary before drive attempts to pass current through motor. If hardware confirmation is available set to EXTERNAL TB1 and select the Contact Cnfirm signal on a logic input terminal (*see section 3.5.2*).

PreTorque SOURCE ***Hidden***
Lockout (Pre-Torque Source)
Default: NONE
Choices: none
analog input
serial

This switch determines if a pre torque command is used and if used the source. *For more information see section (5.1.4.7).*

Pre-Torque LATCH ***Hidden Lockout*** (Pre-Torque Latch)

Default: NOT LATCHED

Choices: not latched
latched

This parameter determines if the pre-torque signal is latched. *For more information, see section (5.1.4.7.3).*

NOTE: If PreTorque Source has been set to NONE, the setting does not have any effect on the operation of the drive.

PTorq LATCH CLCK ***Hidden Lockout*** (Pre-Torque Latch Clock)

Default: EXTERNAL TB1

Choices: external tb1
serial

If the PRE-TORQUE LATCH has been set to LATCHED, then this parameter chooses the source for latch control. If set to EXTERNAL TB1, the Pre-Trq Latch signal on TB1 must be selected (see section 3.5.2). *For more information see section (5.1.4.7.3).*

FAULT RESET SRC ***Hidden Lockout*** (Fault Reset Source)

Default: EXTERNAL TB1

Choices: external tb1
serial
automatic

This parameter determines the source of the drive's external fault reset. If the fault reset source is set to automatic, the faults will be reset according to the setting of the FLT RESET DELAY and FLT RESETS/HOUR parameters *(see section (3.4.1)).* The user also has the option to reset faults directly through the operator. *See section 3.5.2.2, Resetting Active Faults*.

CAUTION

If the run signal is asserted at the time of a fault reset, the drive will immediately go into a run state.

OVERSPEED TEST SRC ***Hidden Lockout*** (Overspeed Test Source)

Default: EXTERNAL TB1

Choices: external tb1
serial

This switch determines the source of the overspeed test. Operation of the overspeed test function is specified by the OVRSPEED MULT parameter *(see section (3.4.1)).* Regardless of the setting of this parameter, the user can call for the overspeed test via the Digital Operator, *(see Section 3.4.4). For more information, see section (5.1.2).*

BRAKE PICK SRC ***Hidden Lockout*** (Brake Pick Source)

Default: INTERNAL

Choices: internal
serial

If the BRAKE PICK SRC is set to INTERNAL, the HPV 900 will attempt to pick (lift) the brake when magnetizing current has been developed in the motor.

BRAKE PICK CNFM ***Hidden Lockout*** (Brake Pick Confirm)

Default: NONE

Choices: none
external tb1

If this switch is set to EXTERNAL TB1, the HPV 900 will wait for brake pick confirmation before releasing the speed reference. When set to EXTERNAL TB1, the MECH BRK PICK signal on TB1 must also be selected (*see section 3.5.2*)

BRAKE HOLD SRC ***Hidden Lockout*** (Brake Hold Source)

Default: INTERNAL

Choices: internal
serial

If set to internal, the drive will command the mechanical brake to hold mode until confirmation of brake picked exists.

RAMPED STOP SEL ***Hidden Lockout*** (Ramp Stop Select)

Default: NONE

Choices: none
ramp on stop

This parameter allows the selection of the Torque Ramp Down Stop function. This function is used to gradually remove the torque command after the elevator has stopped and the mechanical brake has been set. This prevents a shock and possible 'bump' felt in the elevator from the torque signal going to zero too quickly. *For more information, see section (5.1.4.8).*

RAMP DOWN EN SRC ***Hidden Lockout*** (Ramp Down Enable Source)

Default: EXTERNAL TB1

Choices: external tb1
run logic
serial

If RUN LOGIC is selected, the user can remove the run command and the drive will delay in dropping the run command until torque ramp down stop function is complete. If EXTERNAL TB1 or SERIAL is selected, the user must keep the run command while allowing the Torque Ramp Down Stop function to be completed.

BRK PICK FLT ENA ***Hidden Lockout*** (Brake Pick Fault Enable)

Default: DISABLE

Choices: disable
enable

When this parameter is set to ENABLE, the brake pick command and confirmation must match within the specified time in BRK PICK TIME parameter *(see section (3.4.1))* or a brake pick fault is declared.

BRK HOLD FLT ENA ***Hidden Lockout*** (Brake Hold Fault Enable)

Default: DISABLE

Choices: disable
enable

When this parameter is set to ENABLE, the brake hold command and confirmation must match within the specified time in BRK HOLD TIME parameter *(see section (3.4.1))* or a brake hold fault is declared.

3.5.2 LOGIC INPUTS C2 Sub Menu

This sub-menu contains the parameters that define the logic inputs on TB1 terminals 1-9 (*see Figure 3. 6).*

LOG IN 1 TB1-1
Lockout ***Hidden***
Default: DRIVE ENABLE
Choices *See section 3.5.2.1.*

LOG IN 2 TB1-2
Lockout ***Hidden***
Default: RUN
Choices *See section 3.5.2.1.*

LOG IN 3 TB1-3
Lockout ***Hidden***
Default: FAULT RESET
Choices *See section 3.5.2.1.*

LOG IN 4 TB1-4
Lockout ***Hidden***
Default: UP/DWN
Choices *See section 3.5.2.1.*

LOG IN 5 TB1-5
Lockout ***Hidden***
Default: S-CURVE SEL 0
Choices *See section 3.5.2.1.*

LOG IN 6 TB1-6
Lockout ***Hidden***
Default: STEP REF B0
Choices *See section 3.5.2.1.*

LOG IN 7 TB1-7
Lockout ***Hidden***
Default: STEP REF B1
Choices *See section 3.5.2.1.*

LOG IN 8 TB1-8
Lockout ***Hidden***
Default: STEP REF B2
Choices *See section 3.5.2.1.*

LOG IN 9 TB1-9
Lockout ***Hidden***
Default: EXTRN FAULT 1
Choices *See section 3.5.2.1.*

NOTE: The user can assign particular functions to each input terminal. Only one function per terminal is allowed and multiple terminals cannot have the same function. When a function is assigned to an input terminal, it is removed from the list of possible selections for subsequent terminals.

NOTE: When the word ***Hidden*** appears with the parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details in section 3.6.2.*

NOTE: When the word ***Lockout*** appears with the parameter description, the parameter cannot be changed when the drive is in the RUN mode.

NOTE: The *current* setting of each parameter is displayed in all caps; all other choices in the list are displayed in lower case.

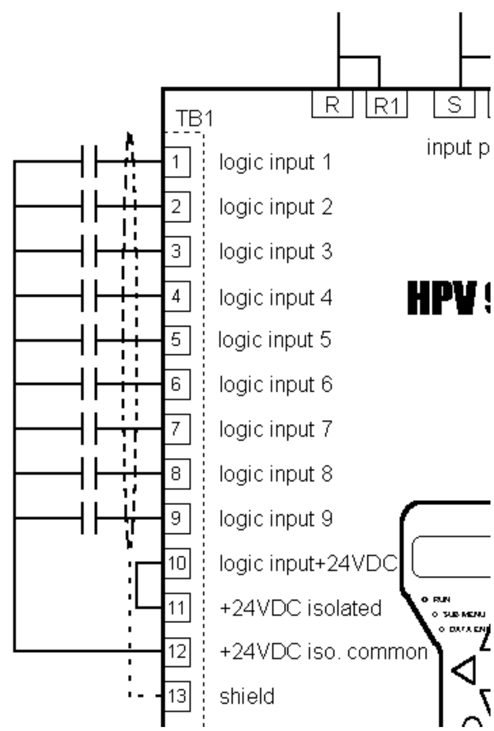


Figure 3. 6 - Logic Input Connections

A summary of all the available input logic functions is shown in Table 3. 16.

Logic Functions	Description
Contact Cfirm	Auxiliary contacts from motor contactor.
Drive Enable	Must be asserted to permit drive to run. This does not initiate run, just permits initiation.
Extrn Fault 1	User input fault #1
Extrn Fault 2	User input fault #2
Extrn Fault 3	User input fault #3
Fault Reset	Asserting this input attempts to reset faults.
Low Gain Sel	Low gain for the speed regulator is chosen when this input is asserted.
Mech Brake Hold	Auxiliary contacts from mechanical brake. Asserted when brake is in hold mode.
Mech Brake Pick	Auxiliary contacts from mechanical brake. Asserted when brake is picked (lifted).
No Function	Input not assigned
Ospd Test Src	Asserting input, applies the overspeed multiplier to the speed command for the next run.
Pre-Trq Latch	Transition from false to true latches pre torque command.
Run	If drive is enabled through the DRIVE ENABLE logic input, this function will start drive operation.
S-Curve Sel 0	Bit 0 of S-curve selection
S-Curve Sel 1	Bit 1 of S-curve selection
Step Ref B0	Bit 0 of multi-step speed command selection
Step Ref B1	Bit 1 of multi-step speed command selection
Step Ref B2	Bit 2 of multi-step speed command selection
Step Ref B3	Bit 3 of multi-step speed command selection
Trq ramp down	Asserting this ramps torque output to zero at “Ramped Stop Time parameter” rate.
Up/Dwn	This logic can be used to change the sign of the speed command. false = no inversion, true = inverted.

Table 3. 16 - Input Logic Functions

3.5.2.1 Choices for LOGIC INPUTS

The following is a list of the available choices for each of the logic input terminals.

contact cfirm

(Contact Confirm Signal)

Closure of the auxiliary contacts confirming closure of the motor contactor. *For more information, see section (5.2.4).*

drive enable

(Drive Enable)

Enables drive to run. This signal must be asserted to permit drive to run. This does not initiate run, just permits initiation. *For more information, see section (5.2.1).*

.

extrn fault 1 (External Fault 1)

extrn fault 2 (External Fault 2)

extrn fault 3 (External Fault 3)

Closure of this contact will cause the drive to declare a fault and perform a fault shutdown.

fault reset

(Fault Reset)

If the FAULT RESET SRC switch is set to EXTERNAL TB1, the drive's fault circuit will be reset when this signal is true.
NOTE: This input is edge sensitive and the fault is reset on the transition from false to true.

low gain sel

(Low Gain Select Signal)

If the HI/LO GAIN SRC switch is set to EXTERNAL TB1, the low gain mode is chosen for the speed regulator when this signal is true.

mech brk hold

(Mechanical Brake Hold Signal)

Auxiliary contact closures confirming when the mechanical brake is in the hold mode (engaged). *For more information, see section (5.2.5).*

mech brk pick

(Mechanical Brake Pick Signal)

Closure of auxiliary contacts confirming the mechanical brake has been picked (lifted). *For more information, see section (5.2.5).*

no function

(No Function)

When this setting is selected for one of the TB1 input terminals, any logic input connected to that terminal will have no effect on drive operation.

ospd test src

(Overspeed Test Source)

This function works only if the OVRSPEED TEST SRC switch is set to EXTERNAL TB1. A true signal on this input applies the OVERSPEED MULT to the speed command for the next run. After the run command has dropped, the drive returns to 'normal' mode and must be re-configured to perform the overspeed function again. The OVERSPEED FLT level is also increased by the OVERSPEED MULT, allowing the elevator to overspeed without tripping out on an overspeed fault.
NOTE: This input must be taken false then true each time that an overspeed test is run. If the input is left in the true, it is ignored after the first overspeed test.

pre-trq latch

(Pre-Torque Latch)

Closing a contact between this input and ground latches the pre torque command present on the analog channel #2. *For more information, see section (5.1.4.7.3).*

run

(Run)

If drive is enabled through the DRIVE ENABLE logic input, this function will start drive operation. *For more information, see section (5.2.1).*

s-curve sel 0

(S-Curve Select bit-0)

s-curve sel 1

(S-Curve Select bit-1)

These two bits are used to select one of four s-curve selections. *For more information, see section (5.1.3.2).*

step ref b0
(Step Reference Speed Selection bit-0)

step ref b1
(Step Reference Speed Selection bit-1)

step ref b2
(Step Reference Speed Selection bit-2)

step ref b3
(Step Reference Speed Selection bit-3)

Four inputs, which must be used together as a 4-bit command for multi-step speed selection. *For more information, see section (5.1.1.3).*

trq ramp down
(Torque Ramp Down Signal)
This function works only if the RAMP STOP SEL switch is set to RAMP TO STOP and RAMP DOWN EN SRC is set to EXTERNAL TB1. This will enable the torque ramp down stop function. *For more information, see section (5.1.4.8).*

up/dwn
(Up/Down Signal)
This signal is used to change the sign of the speed command. Default is FALSE; therefore, positive commands are for the up direction and negative speed command are for the down direction. Making this input true reverses the car's direction.

3.5.3 LOGIC OUTPUTS C3 Sub Menu

This sub menu contains the parameters that define the logic outputs on TB1 terminals 14-17 and two relays on TB2 terminals 51-53 & 54-56 (see *Figure 3. 7 and Figure 3. 8).*

LOG OUT 1 TB1-14
Lockout ***Hidden***
Default: READY TO RUN
Choices: *See section 3.5.3.1*

LOG OUT 2 TB1-15
Lockout ***Hidden***
Default: RUN COMMANDED
Choices: *See section 3.5.3.1*

LOG OUT 3 TB1-16
Lockout ***Hidden***
Default: MTR OVERLOAD
Choices: *See section 3.5.3.1*

LOG OUT 4 TB1-17
Lockout ***Hidden***
Default: ENCODER FLT
Choices: *See section 3.5.3.1*

RELAY COIL 1
Lockout ***Hidden***
Default: FAULT
Choices: *See section 3.5.3.1*

RELAY COIL 2
Lockout ***Hidden***
Default: SPEED REG RLS
Choices: *See section 3.5.3.1*

NOTE: When the word ***Hidden*** appears with the parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details in section 3.6.2.*

NOTE: When the word ***Lockout*** appears with the parameter description, the parameter cannot be changed when the drive is in the RUN mode.

NOTE: The *current* setting of each parameter is displayed in all caps; all other choices in the list are displayed in lower case.

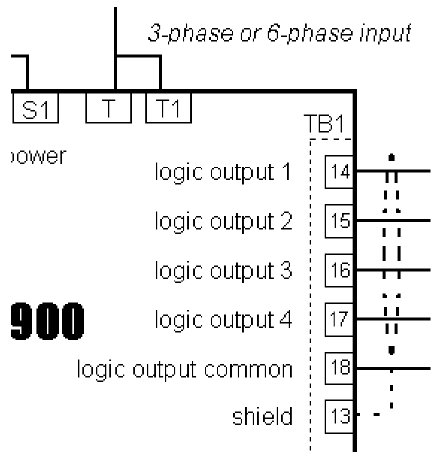


Figure 3. 7 - Logic Output Connections

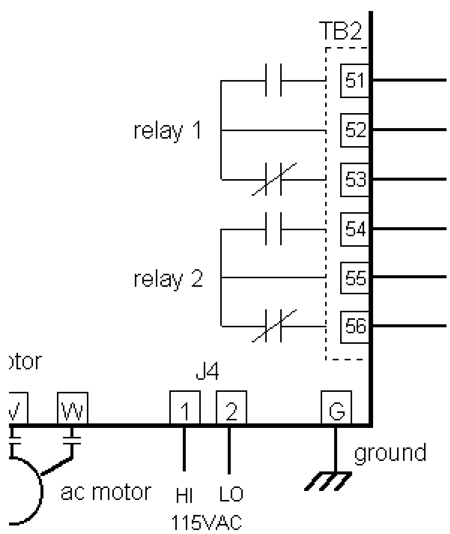


Figure 3. 8 - Relay Output Connections

A summary of what would cause each logic output choice to be true is shown in Table 3. 17.

Output Function	Description
Alarm	An alarm declared by the drive
Alarm+Flt	A fault or alarm is declared by the drive
Brake Alarm	A brake fault is declared while the drive is running
Brake Hold	The brake pick confirmation is received
Brake Pick	The speed regulator is released
Brk Hold Flt	Brake hold state has not matched the commanded state
Brk IGBT Flt	Brake IGBT has reached overcurrent
Brk Pick Flt	Brake pick state has not matched the commanded state
Car Going Dwn	The motor is moving in negative direction faster than user specified speed
Car Going Up	The motor is moving in positive direction faster than user specified speed
Charge Fault	DC bus has not charged
Close Contact	The drive has been enabled & commanded to run and no faults are present
Contactor Flt	Contactor state has not matched the commanded state
Curr Reg Flt	The actual current measurement does not match commanded current
Drv Overload	The drive has exceeded the drive overload curve
Encoder Flt	Encoder is disconnected or not functioning, while attempting to run
Fan Alarm	Cooling fan failure
Fault	A fault declared by the drive
Flux Confirm	The drive’s estimate of flux has reached 90% of reference.
Fuse Fault	DC bus fuse is open
Ground Fault	Sum of all phase currents exceeds 50% of rated current
In Low Gain	Low gain or response is now being used by the speed regulator
Motor Trq Lim	The drive has exceeded the motoring torque limit
Mtr Overload	The motor has exceeded the motor overload curve
No Function	Output not assigned
Over Curr Flt	Phase current exceeded 300%
Overspeed Flt	The drive has exceeded the overspeed level
Overtemp Flt	Heatsink temperature exceeded 105°C (221°F)
Overvolt Flt	DC bus voltage exceeded 850VDC for 460V drive or 425 VDC for 230V drive
Ovrtemp Alarm	Heatsink temperature exceeded 90°C (194°F)
Phase Fault	Open motor phase
Ramp Down Ena	Indicates the torque is being ramped to zero
Ready To Run	The drive’s software has initialized and no faults are present
Regen Trq Lim	The drive has exceeded the regenerating torque limit
Run Commanded	The drive is being commanded to run
Run Confirm	The drive has been enabled & commanded to run; no faults are present; the contactor has closed; and the IGBTs are firing
Speed Dev	The speed feedback is failing to properly track the speed reference
Speed Dev Low	The speed feedback is properly tracking the speed reference
Speed Ref Rls	Flux is confirmed and brake is picked (if used)
Speed Reg Rls	Flux is confirmed and brake is commanded to be picked (if used)
Undervolt Flt	DC bus voltage has dropped below a specified percent
UV Alarm	DC bus voltage has dropped below a specified percent
Zero Speed	The motor speed is below a user defined level

Table 3. 17 - Output Logic Functions

3.5.3.1 Choices for LOGIC OUTPUTS

The following is a list of the available choices for each of the logic output terminals.

alarm

(Alarm)

The output is true when an alarm is declared by the drive.

alarm+flt

(Alarm and/or Fault)

The output is true when a fault and/or an alarm is declared by the drive.

brake alarm

(Brake Alarm)

The output is true when the dynamic brake resistor is in an overcurrent condition and the drive is in a run condition.

brake hold

(Brake Hold)

The output is true when the brake pick confirmation is received. It is used to show the mechanical brake is remaining open. *For more information, see section (5.2.5).*

brake pick

(Brake Pick)

The output is true when the speed regulator is released and is used to open the mechanical brake. *For more information, see section (5.2.5).*

brk hold flt

(Brake Hold Fault)

The output is true when the brake hold command and the brake feedback do not match for the user specified time.

brk IGBT flt

(Brake Fault)

The output is true when the dynamic brake resistor is in a overcurrent condition and the drive is not in a run condition.

brk pick flt

(Brake Pick Fault)

The output is true when the brake pick command and the brake feedback do not match for the user specified time.

car going dwn

(Car Going Down)

The output is true when the motor moves in negative direction faster than the user specified speed. *For more information, see section (3.4.1).*

car going up

(Car Going Up)

The output is true when motor moves in positive direction faster than user specified speed. *For more information, see section (3.4.1).*

charge fault

(Charging Fault)

The output is true when the DC bus voltage has not stabilized above the voltage fault level or the charge contactor has not closed after charging.

close contact

(Close Motor Contactor)

The output is true when the run command is given, the drive is enabled, the software has initialized, and no faults are present. *For more information, see section (5.2.4).*

contactor flt

(Contactor Fault)

The output is true when the command to close the contactor and the contactor feedback do not match before the user specified time.

curr reg flt

(Current Regulator Fault)

The output is true when the actual current measurement does not match commanded current.

drv overload

(Drive Overload)

The output is true when the drive has exceeded the drive overload curve. *For more information, see section (5.3.1).*

encoder flt

(Encoder Fault)

The output is true when the drive is in a run condition and the encoder is:

- not functioning
  or
- not connected.

fan alarm

(Fan Alarm)

The output is true when the fan on the drive is not functioning.

fault

(Fault)

The output is true when a fault is declared by the drive.

flux confirm

(Motor Flux Confirmation)

The output is true when the drive has confirmed there is enough flux to issue a speed regulator release (the drive's estimate of flux must reach 90% of reference).

fuse fault

(Fuse Fault)

The output is true when the DC bus fuse on has blown.

ground fault

(Ground Fault)

The output is true when the sum of all phase current exceeds 50% of rated current of the drive.

in low gain

(In Low Gain)

The output is true when the speed regulator is in "low gain" mode. *For more information, see section (5.1.4.1).*

motor trq lim

(Motor Torque Limit)

The output is true when the torque limit has been reached while the drive is in the motoring mode. The motoring mode is defined as the drive delivering energy to the motor. *For more information, see section (3.4.1).*

mtr overload

(Motor Overload)

The output is true when the motor has exceeded the user defined motor overload curve. *For more information, see section (5.3.2).*

no function

(No Function)

This setting indicates that the terminal or relay will not change state for any operating condition; i.e. the output signal will be constantly false.

over curr flt

(Motor overload current fault)

The output is true when the phase current has exceeded 300% of rated current.

overspeed flt

(Overspeed Fault)

The output is true when the motor has gone beyond the user defined percentage contract speed for a specified amount of time.

overtemp flt

(Heatsink Over Temperature Fault)

The output is true when the drive's heatsink has exceeded 105° C (221°F).

overvolt flt

(Over Voltage Fault)

The output is true when the DC bus voltage exceeds 850VDC for a 460V class drive or 425VDC for a 230V class drive.

ovrtemp alarm

(Drive Over Temperature Alarm)

The output is true when the drive's heatsink temperature has exceeded 90°C (194°F).

phase fault

(Phase Loss)

The output is true when the drive senses an open motor phase.

ramp down ena

(Ramp Down Enable)

The output is true after a torque ramp down stop has been initiated by either a logic input, the serial channel, or internally by the drive. When this output is true the torque is being ramped to zero. *For more information, see section (5.1.4.8).*

ready to run

(Ready to Run)

The output is true when the drive's software has been initialized and no faults are present. *For more information, see section (5.2.1).*

.

regen trq lim

(Regeneration Torque Limit)

The output is true when the torque limit has been reached while the drive is in the regenerative mode. The regenerative mode is defined as when the motor is returning energy to the drive. When the drive is in regenerative mode, the energy is dissipated via the dynamic brake circuitry (internal brake IGBT and external brake resistor). *For more information, see section (3.4.1).*

run commanded

(Run Commanded)

The output is true when the drive is being commanded to run. *For more information, see section (5.2.1).*

run confirm

(Run Command Confirm)

The output is true after the software has initialized, no faults are present, the drive has been commanded to run, the contactor has closed and the IGBTs are firing.

speed dev

(Speed Deviation)

The output is true when the speed feedback is failing to properly track the speed reference. The speed deviation needs to be above a user defined level.
(Speed Dev. = reference - feedback)
For more information, see section (5.1.4.9).

speed dev low

(Speed Deviation Low Level)

The output is true when the speed feedback is properly tracking the speed reference. The speed deviation needs to be within a user defined range for a user defined period of time. (Speed Dev. = reference - feedback)
For more information, see section (5.1.4.9).

speed ref rls

(Speed Reference Release)

The output is true when the speed regulator is released. When this output is true, the speed reference is allowed to change from zero. *For more information, see section (5.2.1).*

speed reg rls

(Speed Regulator Release)

The output is true when the speed regulator is released. *For more information, see section (5.2.1).*

undervolt flt

(Low Voltage Fault)

The output is true when the DC bus voltage drops below the user specified percent of the input line-to-line voltage. *For more information, see section (3.4.5).*

uv alarm

(Low Voltage Alarm)

The output is true when the DC bus voltage drops below the user specified percent of the input line-to-line voltage. *For more information, see section (3.4.5).*

zero speed

(Zero Speed)

The output is true when the motor speed is below the user specified speed for the user specified time. *For more information, see section (3.4.1).*

3.5.4 ANALOG OUTPUTS C4 Sub Menu

This sub menu contains the parameters that define the two D/A analog outputs on TB1 terminals 33 and 35. *See Figure 3. 9.*

ANA OUT 1 TB1-33

Hidden

Default: TORQUE REF
Choices: See section 3.5.4.1.

ANA OUT 2 TB1-35

Hidden

Default: SPEED FEEDBK
Choices: See section 3.5.4.1.

A summary of the analog output functions is shown in Table 3. 18.

NOTE: When the word ***Hidden*** appears with the parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details in section 3.6.2.*

NOTE: The *current* setting of each parameter is displayed in all caps; all other choices in the list are displayed in lower case.

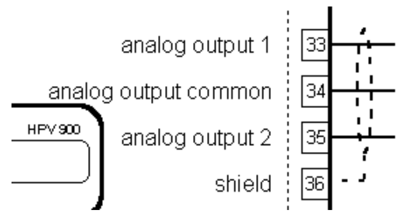


Figure 3. 9 - Analog Output Connections

Output Function	Description
Aux Torq Cmd	Additional torque command from auxiliary source
Bus Voltage	Measured DC bus voltage
Current Out	Percent motor current
Drv Overload	Percent of drive overload trip level reached
Flux Current	Measured flux producing current
Flux Output	Measured flux output
Flux Ref	Flux reference used by vector control
Flux Voltage	Flux producing voltage
Frequency Out	Electrical frequency
Mtr Overload	Percent of motor overload trip level reached
Power Output	Calculated power output
PreTorque Ref	Pre-torque reference
Slip Freq	Commanded slip frequency
Spd Rg Tq Cmd	Torque command from speed regulator
Speed Command	Speed command before S-Curve
Speed Error	Speed reference minus speed feedback
Speed Feedbk	Speed feedback used by speed regulator
Speed Ref	Speed reference after S-Curve
Tach Rate Cmd	Torque command from tach rate gain function
Torq Current	Measured torque producing current
Torq Voltage	Torque producing voltage
Torque Output	Calculated torque output
Torque Ref	Torque reference used by vector control
Voltage Out	RMS motor terminal voltage

Table 3. 18 - Analog Output Functions

3.5.4.1 Choices for ANALOG OUTPUTS

The following is a list of the available choices for each of the analog output terminals.

aux torq cmd
(Auxiliary Torque Command)
Additional torque command from auxiliary source.
D/A Units: % rated torque

bus voltage
(DC Bus Voltage Output)
Measured DC bus voltage.
D/A Units: % of peak in

current out
(Current Output)
Percent motor current.
D/A Units: % rated current

drv overload
(Drive Overload)
Percent of drive overload trip level reached.
D/A Units: % of trip point

flux current
(Flux Producing Current)
Measured flux producing current.
D/A Units: % rated current

flux output
(Flux Output)
Measured flux output.
D/A Units: % rated flux

flux ref
(Flux Reference)
Flux reference used by vector control.
D/A Units: % rated flux

flux voltage
(Flux Producing Voltage)
Flux producing voltage reference.
D/A Units: % rated volts

frequency out
(Frequency Output)
Electrical frequency.
D/A Units: % rated freq

mtr overload
(Motor Overload)
Percent of motor overload trip level reached.
D/A Units: % of trip point

power output
(Power Output)
Calculated power output.
D/A Units: % rated power

pretorque ref
(PreTorque Reference)
Pre-torque reference.
D/A Units: % base torque

slip freq
(Motor Slip Frequency)
Commanded slip frequency.
D/A Units: % rated freq

spd rg tq cmd
(Speed Regulator Torque Command)
Torque command from speed regulator.
D/A Units: % base torque

speed command
(Speed Command)
Speed command before S-Curve
D/A Units: % rated speed

speed error
(Speed Error)
Speed reference minus speed feedback.
D/A Units: % rated speed

speed feedbk
(Speed Feedback)
Speed feedback used by speed regulator.
D/A Units: % rated speed

speed ref
(Speed Reference)
Speed reference after S-Curve
D/A Units: % rated speed

tach rate cmd
(Tachometer Rate Command)
Torque command from tach rate gain function.
D/A Units: % base torque

torq current

(Torque Producing Current)

Measured torque producing current.
D/A Units: % rated current

torq voltage

(Torque Producing Voltage)

Torque producing voltage reference.
D/A Units: % rated volts

torque output

(Torque Output)

Calculated torque output.
D/A Units: % rated torque

torque ref

(Torque Reference)

Torque reference used by vector control.

D/A Units: % base torque

voltage out

(Voltage Output)

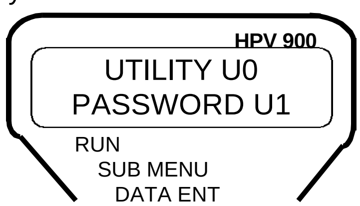
RMS motor terminal voltage.
D/A Units: % rated volts

3.6 UTILITY U0 MENU

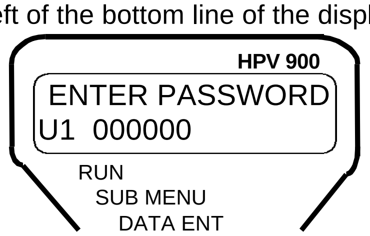
This menu has five sub menus:

- **PASSWORD U1** **3.6.1**
- **HIDDEN ITEMS U2** **3.6.2**
- **UNITS U3** **3.6.3**
- **OVRSPEED TEST U4** **3.6.4**
- **RESTORE DFLTS U5** **3.6.5**
- **DRIVE INFO U6** **3.6.6**
- **HEX MONITOR U7** **3.6.7**

The sub-menu is identified by its full name on the bottom line of the Digital Operator display when the SUB MENU LED is *not* lit.



When the SUB MENU LED is ON, the two letter code for the sub-menu appears at the far left of the bottom line of the display.



NOTE: When the word ***Hidden*** appears with the parameter description, it indicates that its appearance in the list is controlled by the HIDDEN ITEMS setting. *See details in section 3.6.2.*

NOTE: When the word ***Lockout*** appears with the parameter description, the parameter cannot be changed when the drive is in the RUN mode.

3.6.1 PASSWORD U1 Sub Menu

The following three different screens are used by the password function:

- ENTER PASSWORD
- NEW PASSWORD
- PASSWORD LOCKOUT

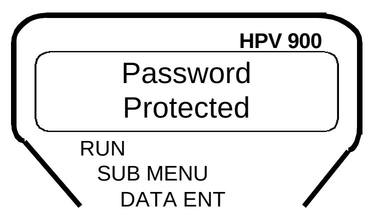
3.6.1.1 Password Function

The password function allows the user to select a six-digit number for a password. The password function allows the user to lockout changes to the parameters until a valid password is entered.

And with the password lockout enabled, all parameters and display values will be able to be viewed but, no changes to the parameters will be allowed until a correct password is entered.

3.6.1.2 Parameter Protection

If the password lockout is enabled, the following message will appear on the display when attempting to change a parameter.



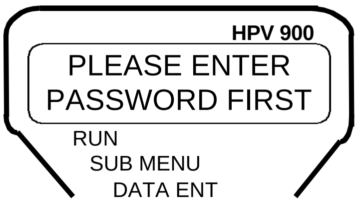
In order to change a parameter after password lockout has been enabled, the following two steps must be followed in the PASSWORD sub menu:

1) A valid password must be entered in the ENTER PASSWORD screen.
2) The password lockout must be DISABLED in the PASSWORD LOCKOUT screen.

3.6.1.3 PASSWORD Sub Menu Protection

The following message will appear when in the PASSWORD sub menu, if you are trying to:

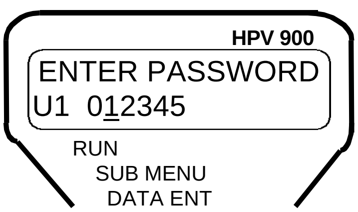
- Enable or disable the password lockout without a valid password being entered.
- Enter a new password without a valid password being entered.



3.6.1.4 ENTER PASSWORD Screen

This screen allows the user to enter in a password. A valid password must be entered before enabling or disabling the password lockout or changing to a new password.

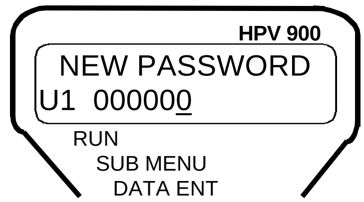
The factory default password is shown below.



3.6.1.5 NEW PASSWORD Screen

This screen is used to change the established password.

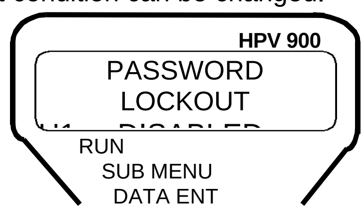
NOTE: Remember that a valid password must be entered at the ENTER PASSWORD screen before the established password can be changed.



3.6.1.6 PASSWORD LOCKOUT Screen

This screen is used to enable and disable password lockout. The factory default for password lockout is DISABLED.

NOTE: Remember that a valid password must be entered at the ENTER PASSWORD screen before the password lockout condition can be changed.



Legend	Type	Max/Min	Default	Hidden	Lockout
ENTER PASSWORD	Numeric	999999/0	012345	N	N
NEW PASSWORD	Numeric	999999/0	none	N	N
PASSWORD ENABLE	LOGIC	NA	DISABLED	N	N

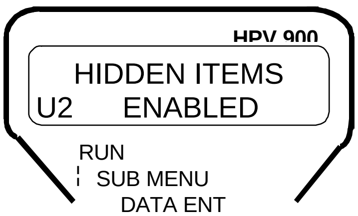
Table 3. 19 - Password Function

3.6.2. HIDDEN ITEMS U2 Sub Menu

The HIDDEN ITEMS sub menu allows the user to select whether or not “hidden” parameters will be displayed on the Digital Operator.

There are two types of parameters, standard and hidden. Standard parameters are available at all times. Hidden parameters are available only if activated.

The default for this function is ENABLED (meaning the hidden parameters are visible). To disable the HIDDEN ITEMS option, go to this screen displayed below.



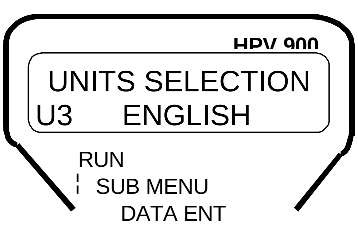
All parameters in the HPV 900 that are designated as “hidden” have the word ***Hidden*** included before their function description throughout this manual. Also, a comparison table listing the hidden and standard parameters is shown in Table 3. 1 and Table 3. 2.

Legend	Default	Hidden	Lockout
HIDDEN ITEMS	ENABLED	N	N

Table 3. 20 - Hidden Items Function

3.6.3 UNITS U3 Sub Menu

When the UNITS SELECTION sub menu is displayed, the user can choose either Metric units or standard English measurements units for use by the drive’s parameters.



IMPORTANT

The units selection must be made before entering any setting values into the parameters. The user can not toggle between units after drive has been programmed.

Legend	Default	Hidden	Lockout
UNITS	ENGLISH	N	Y

Table 3. 21 - Units Function

3.6.4 OVERSPEED TEST U4 Sub Menu

The speed command is normally limited by Overspeed Level parameter (OVERSPEED LEVEL), which is set as a percentage of the contract speed (100% to 150%). But in order to allow overspeed tests during elevator inspections, a means is provided to multiply the speed command by the Overspeed Multiplier parameter (OVERSPEED MULT). *For more information, see section (3.4.1).*

An overspeed test can be initiated by:

- an external logic input
- the serial channel
- directly from the digital operator.

3.6.4.1 Overspeed Test via Logic Input

The external logic input can be used by:

- Setting the Overspeed Test Source parameter to external tb1. *(see section (3.5.1))*
- Defining an logic input terminal to ospd test src. *(see section (3.5.2))*

NOTE: This logic input requires a transition from false to true to be recognized - this prevents the overspeed function from being permanently enabled if left in the true state.

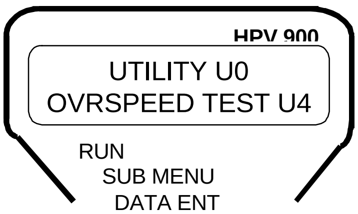
3.6.4.2 Overspeed Test via Serial Channel

The serial channel can be used by setting Overspeed Test Source parameter to serial. *(see section (3.5.1))*

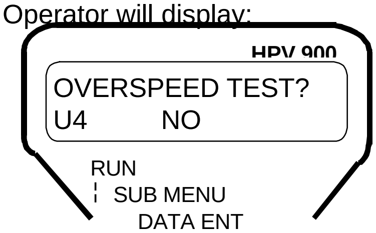
3.6.4.3 Overspeed Test via Operator

The Digital Operator can also initiate the overspeed test by performing the following:

- While the Digital Operator display shows

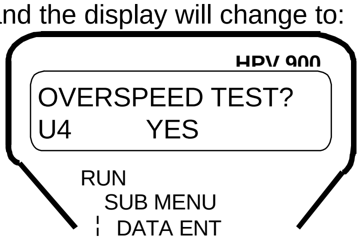


Press the ENTER key. The sub menu LED will turn on, and the Digital Operator will display:



- Press the ENTER key again. The sun menu LED will go out and data ent LED will turn on.

- Press the up arrow or down arrow key and the display will change to:



- Press the ENTER key to begin the overspeed test.

The value in the Overspeed Mult parameter is applied to the speed reference and the overspeed level, so that the elevator can be operated at greater than contract speed and not trip on an Overspeed Fault.

When the Run command is remove after the overspeed test, overspeed test reverts back to its default of NO. In order to run another overspeed test via the Digital Operator, the above steps must be repeated again.

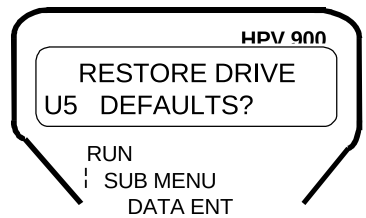
3.6.5 RESTORE DFLTS U5 Sub Menu

Two different functions are included in this sub menu.

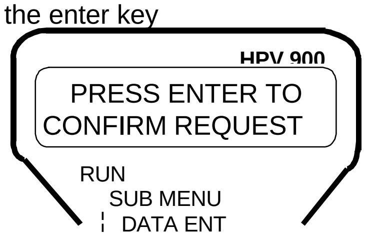
3.6.5.1 RESTORE DRIVE DEFAULTS

This function resets all parameters to there default values except the parameters in the MOTOR A5 sub menu.

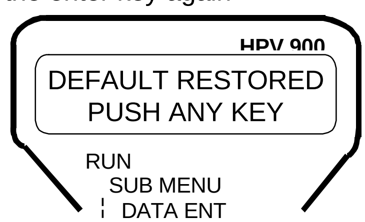
The following shows how to restore the drive defaults:



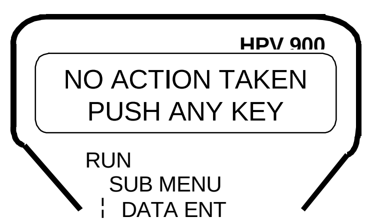
Press the enter key



Press the enter key again

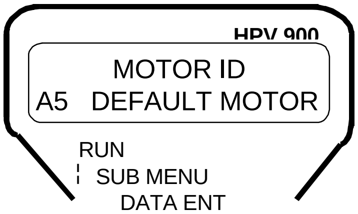


If the esc key is pressed, instead the reset action will be aborted

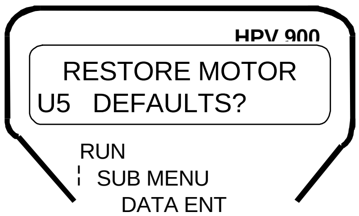


3.6.5.2 RESTORE MOTOR DEFAULTS

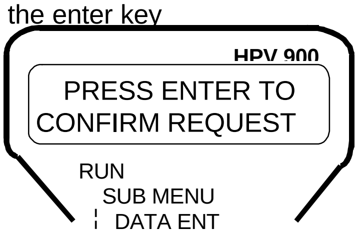
This function resets the parameters in the MOTOR A5 sub menu to the defaults defined by the MOTOR ID parameter in that sub menu.



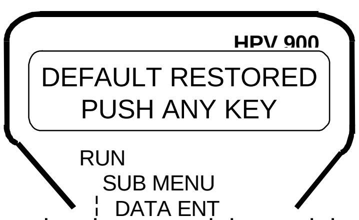
The following shows how to restore the motor defaults for the defined motor ID:



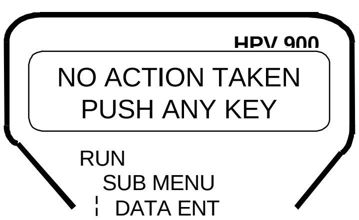
Press the enter key



Press the enter key again



If the esc key is pressed, instead the reset action will be aborted

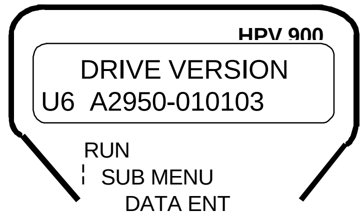


3.6.6 DRIVE INFO U6 Sub Menu

Three different screens are included in this sub menu, each display an identification number.

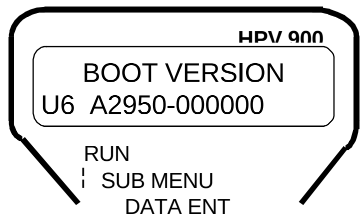
3.6.6.1 DRIVE VERSION Screen

Shows the software version of the drive software.



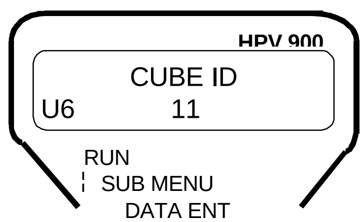
3.6.6.2 BOOT VERSION Screen

Shows the lower level software version of the drive.



3.6.6.3 CUBE ID Screen

Displays the cube identification number of the drive. See Table 3. 22



460 V		230 V	
ID #	HP	ID #	HP
5	5	32	10
7	10	34	15
8	15	35	20
9	20	36	25
10	25	37	30
11	30	38	40
12	40		
13	50		
14	60		
15	75		

Table 3. 22 - Cube ID Numbers

3.6.7 HEX MONITOR U7 Sub Menu

The hex monitor was designed for fault and parameter diagnostics. It is intended for use by MagneTek service personnel.

3.7 FAULTS F0 MENU

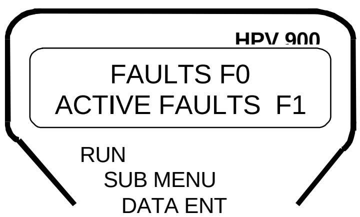
The FAULTS F0 menu does not access settable parameters; instead, it provides a means of examining the drive's active faults and the fault history.

This menu also allows for clearing of active faults in order to get the drive ready to return to operation after a fault shutdown.

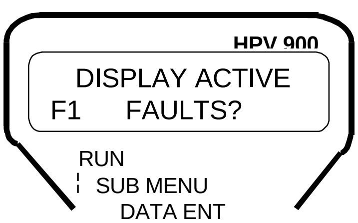
This menu is divided into two sub menus:

- **ACTIVE FAULTS F1 3.7.2**
- **FAULT HISTORY F2 3.7.3**

The sub-menu is identified by its full name on the bottom line of the Digital Operator display when the SUB MENU LED is *not* lit.



When the SUB MENU LED is ON, the two letter code for the sub-menu appears at the far left of the bottom line of the display.



3.7.1 Faults and Alarms

Two classes of warnings are reported by the HPV 900; these are identified as Faults and Alarms.

3.7.1.1 Faults and Fault Annunciation

A fault a severe failure that will stop a drive if it has been running and prevent the drive from starting as long as it is present. All faults require some type of action by the user to clear.

There are five means of fault annunciation.

- The Fault LED on the front panel of the HPV 900 will illuminate.

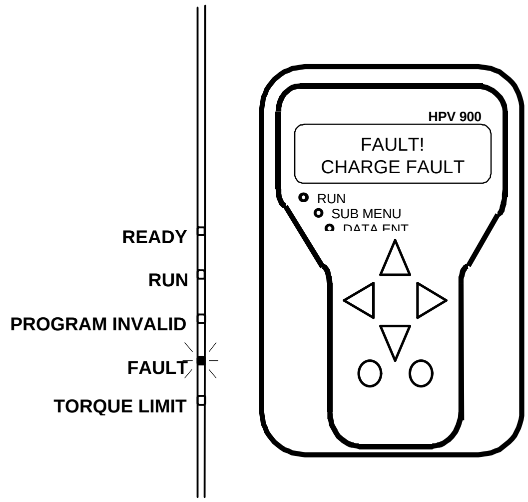
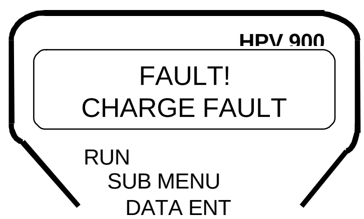


Figure 3. 10 - Fault LED

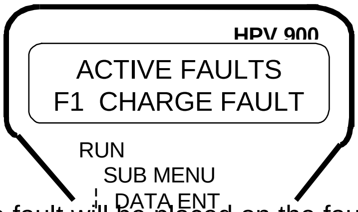
- A priority message will be seen on the Digital Operator:



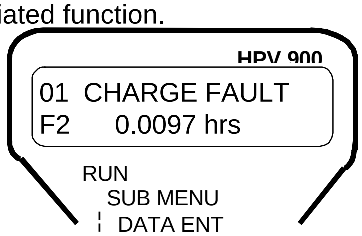
A priority message will overwrite what ever is currently displayed. The user can clear this message by pressing any key on the Digital Operator keypad. If another fault is present, the next fault will appear as a priority message.

NOTE: Clearing the fault priority message from the display DOES NOT clear the fault from the active fault list. The faults must be cleared by a fault reset before the drive will run.

- The fault will be placed on the active fault list. The active fault list will display and record currently active faults. The faults will remain on the fault list until an active fault reset is initiated.



- The fault will be placed on the fault history. The fault history displays the last 16 faults and a time stamp indicating when each happened. The fault history IS NOT affected by an active fault reset or a power loss. The fault history can be cleared via a user initiated function.



- The user can assign a fault to an external logic output. *(see section (3.5.3))*

3.7.1.2 Fault Clearing

Most faults can be cleared by performing a fault reset. The fault reset can be initiated by:

- an external logic input
- the serial channel
- automatically by the drive

For more information, see section (3.5.1)

CAUTION

If the run signal is asserted at the time of a fault reset, the drive will immediately go into a run state.

A fault reset can also be done via the Digital Operator. *(see section (3.7.2))*

3.7.1.3 Fault Displays

A summary of the HPV 900 faults is shown in Table 3. 23.

Fault Name	Description	Fault Clear	Logic Out?
AtoD Fault	AtoD on control board is not responding	power on reset	No
Brk Hold Flt	Brake hold state has not matched the commanded state	fault reset	Yes
Brk IGBT Flt	Brake IGBT has reached overcurrent.	fault reset	Yes
Brk Pick Flt	Brake pick state has not matched the commanded state	fault reset	Yes
Charge Fault	DC bus has not charged.	fault reset	Yes
Contactor Flt	Contactor state has not matched the commanded state	fault reset	Yes
Cube data Flt	Cube parameters checksum is invalid	power on reset	No
Cube ID Fault	Cube identification is bad	fault reset	No
Curr Reg Flt	Current regulator fault.	fault reset	Yes
DCU data Flt	DCU parameters checksum is invalid	power on reset	No
Drive Ovrload	The drive has exceeded the drive overload curve	fault reset	Yes
Encoder Flt	Encoder is disconnected or not functioning, while attempting to run	fault reset	Yes
Extrn Fault 1	User defined external logic fault input #1	fault reset	No
Extrn Fault 2	User defined external logic fault input #2	fault reset	No
Extrn Fault 3	User defined external logic fault input #3	fault reset	No
Fuse Fault	DC bus fuse is open	fault reset	Yes
Ground Fault	Sum of all phase currents exceeds 50% of rated current	fault reset	Yes
Motor ID Flt	Motor identification is bad	fault reset	No
Mtr data Flt	Motor parameters checksum is invalid	power on reset	No
Over Curr Flt	Phase current exceeded 300%	fault reset	Yes
Overspeed Flt	The drive has exceeded the overspeed level	fault reset	Yes
Overtemp Flt	Heatsink temperature exceeded 105°C (221°F)	fault reset	Yes
Overvolt Flt	DC bus voltage exceeded: 850VDC for 460V drive or 425 VDC for 230V drive	fault reset	Yes
PCU data Flt	PCU parameters checksum is invalid	power on reset	No
Phase Flt	Open motor phase	fault reset	Yes
Setup Fault 1	The rated motor speed and excitation frequency, must satisfy formula	fault reset	No
Setup Fault 2	Number of poles and encoder pulses, must satisfy formula	fault reset	No
Setup Fault 3	Number of motor poles must be even	fault reset	No
Setup Fault 4	Contract motor speed and encoder pulses, must satisfy formula	fault reset	No
Setup Fault 5	Rated motor power and voltage, must satisfy formula	fault reset	No
Undervolt Flt	DC bus voltage has dropped below a specified percent	fault reset	Yes

Table 3. 23 - Faults

The following is a list of the HPV 900 faults, with a description of what each fault indicates.

AtoD FAULT

(Analog to Digital Fault)

The Analog to Digital conversion on the drive's control board is not working properly.

BRK HOLD FLT

(Brake Hold Fault)

The brake hold command and the brake feedback did not match for the time specified by the Brake Hold Time parameter, *see section (3.4.1)*. This fault can be disabled by Brake Hold Fault Enable parameter, *see section (3.5.1).*

BRK IGBT FLT

(Brake Transistor IGBT Fault)

Dynamic brake resistor overcurrent. This fault is latched by the software, but does not declare a fault until after the run command is dropped. This is done in order for the elevator to safely reach a floor and unload the passengers before a fault is declared.

BRK PICK FLT

(Brake Pick Fault)

The brake pick command and the brake feedback did not match for the time specified with Brake Pick Time parameter, *see section (3.4.1)*. This fault can be disabled by Brake Pick Fault Enable parameter, *see section (3.5.1).*

CHARGE FLT

(Charge Fault)

The DC bus voltage has not stabilized above the voltage fault level within 2 seconds or the charge contactor has not closed after charging.

CONTACTOR FLT

(Contactor Fault)

The command to close the contactor and the contactor feedback do not match before the time specified by the Contact Flt Time parameter, *see section (3.4.1).* This fault can be disabled by Contactor Confirm Source parameter to none, *see section (3.5.1).*

CUBE DATA FLT

(Cube Data Fault)

The cube (drive) parameters checksum is invalid.

CUBE ID FLT

(Drive Identification Fault)

The identification for the drive is bad. This will normally happen only at the initial power up of the drive.

CURR REG FLT

(Current Regulator Fault)

Actual current measurement does not match commanded current.

DCU DATA FLT

(Drive Control Unit Data Fault)

The DCU parameters checksum is invalid.

DRV OVRLOAD

(Drive Current Overload)

The drive has exceeded the drive overload curve.
Once the DRIVE OVERLOAD display value *(see section (3.3.2))* reaches 100%, the drive has exceeded its overload curve and a drive overload fault is declared by the drive. *For more information, see section (5.3.1).*

ENCODER FLT

(Encoder Fault)

The drive is in a run condition and the encoder is:

- not functioning
  or
- not connected.

EXTRN FAULT 1

(External Fault #1)

User defined external logic fault input #1. *(see section (3.5.2.1))*

EXTRN FAULT 2

(External Fault #2)

User defined external logic fault input #2. *(see section (3.5.2.1))*

EXTRN FAULT 3

(External Fault #3)

User defined external logic fault input #3. *(see section (3.5.2.1))*

FUSE FAULT

(Fuse Fault)

The DC bus fuse on the drive is open.

GROUND FLT

(Ground Fault)

The sum of all phase current exceeds 50% of rated current of the drive.

MOTOR ID FLT

(Motor Identification Fault)

The identification for the motor is bad. This will normally happen only at the initial power up of the drive.

MTR DATA FLT

(Motor Data Fault)

Motor Parameters checksum is invalid.

OVERCURR FLT

(Overcurrent Fault)

The phase current exceeded 300% of rated current.

OVERSPEED FLT

(Overspeed Fault)

Generated when the motor has gone beyond the user defined percentage contract speed for a specified amount of time. This is defined by Overspeed Level parameter and Overspeed Time parameter. *(see section (3.4.1))*

OVERTEMP FLT

(Drive Over Temperature Fault)

The heatsink on the drive has exceeded 105°C (221°F).

OVERVOLT FLT

(Over Voltage Fault)

The DC bus voltage of the drive exceeded:

- 850 Volts for a 460V class drive
- 425 Volts for a 230V class drive.

PCU DATA FLT

(Power Conversion Unit Data Fault)

The PCU parameters checksum is invalid.

PHASE FLT

(Motor Phase Fault)

The drive senses an open motor phase.

SETUP FLT #1

(Setup Fault #1)

This fault is declared if the rated motor speed and excitation frequency do not satisfy:

$$9.6 < \left[120\begin{pmatrix}rated\\excitation\\frequency\end{pmatrix}\right] - \left[\begin{pmatrix}\#\\poles\end{pmatrix}\begin{pmatrix}rated\\motor\\speed\end{pmatrix}\right] < 1222.3$$

SETUP FLT #2

(Setup Fault #2)

This fault is declared if the number of poles and encoder pulses per revolution do not satisfy:

$$\frac{\begin{pmatrix}encoder\\pulses\end{pmatrix}}{\begin{pmatrix}\#\\poles\end{pmatrix}} > 64$$

SETUP FLT #3

(Setup Fault #3)

This fault is declared if the number of poles is not an even number.

SETUP FLT #4

(Setup Fault #4)

This fault is declared if the contract motor speed (in rpm) and encoder pulses/revolution do not satisfy:

$$300{,}000 < \begin{pmatrix}contract\\motor\\speed\end{pmatrix}\begin{pmatrix}encoder\\pulses\end{pmatrix} < 18{,}000{,}000$$

SETUP FLT #5

(Setup Fault #5)

This fault is declared if the rated motor power (in watts) and rated motor voltage do not satisfy:

$$(0.07184)\left[\frac{\begin{pmatrix}rated\\motor\\power\end{pmatrix}}{\begin{pmatrix}rated\\motor\\voltage\end{pmatrix}}\right] < \begin{matrix}general\\purpose\\current\\rating\\of\\drive\end{matrix}$$

UNDERVOLT FLT

(Low Voltage Fault)

Generated during a run condition when the DC bus voltage drops below the user specified percent of the input line-to-line voltage. The input line-to-line voltage is specified by the Input L-L Volts parameter and the fault level is specified by the Undervoltage Fault Level parameter. *For more information, see section (3.4.5).*

3.7.1.4 Alarm Annunciation

An alarm is only meant for annunciation. It will not stop the operation of the drive or prevent the drive from operating.

When the alarm annunciation is cleared, the alarm is no longer displayed and is not stored.

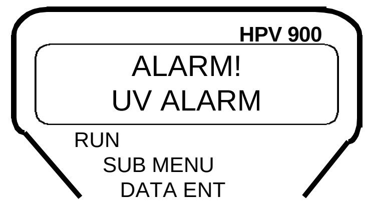
Since an alarm does not stop the operation of the drive, the HPV 900 has some control as to how frequently an alarm will be displayed. For example, after an alarm has been cleared once while the drive is operating, it will not be displayed again until after another run command is given to the drive.

Alarms will not keep the drive from running but an alarm condition can signify the start of a fault condition.

A summary of the HPV 900's alarms is shown in Table 3. 24.

There are two means of alarm annunciation.

- A priority message will be sent to Digital Operator:



  A priority message will replace whatever is currently being displayed on the screen. The user can clear the alarm notice by touching any key on the Digital Operator keypad. If another alarm exists after the original alarm is cleared, it will appear as another priority message.

- The alarms can be assigned to an external logic output. (*see section (3.5.3)*)

ALARM NAME	DESCRIPTION
Brake Alarm	A brake fault is declared while the drive is running
Fan Alarm	Cooling fan failure
Mtr Overload	The motor has exceeded the motor overload curve
Ovrtemp Alarm	Heatsink temperature exceeded 90°C (194°F)
Speed Dev	The speed feedback is failing to properly track the speed reference
UV Alarm	DC bus voltage has dropped below a specified percent

Table 3. 24 - Alarms

3.7.1.5 Alarm Descriptions

BRAKE ALARM

(Brake Alarm)

Dynamic brake resistor overcurrent . This is initially treated as an alarm so the elevator can safely reach a floor and unload the passengers before the alarm becomes a fault. After the run command has been dropped, this alarm becomes a Brake IGBT fault.

FAN ALARM

(Fan Alarm)

The heatsink cooling fan on the drive is not functioning. Check wiring or fan for malfunctions.

MTR OVERLOAD

(Motor Overload)

The motor had exceeded the user defined motor overload curve. Once the MOTOR OVERLOAD display value *(see section (3.3.2))* reaches 100% the motor has exceeded its defined overload curve and a motor overload alarm is declared by the drive. *For more information, see section (5.3.2).*

NOTE: The motor overload can not exceed the drive overload capability, otherwise a drive overload fault will occur.

OVRTEMP ALARM

(Drive Over Temperature Alarm)

The heatsink on the drive has exceeded 90°C (194°F).

SPEED DEV

(Speed Deviation)

An alarm is declared when the speed feedback is failing to properly track the speed reference. The speed deviation needs to be above a user defined level specified by the Speed Deviation High Level parameter, *see section (3.4.1).*
(Speed Dev. = reference - feedback)
For more information, see section (5.1.4.9).

UV ALARM

(Under Voltage Alarm)

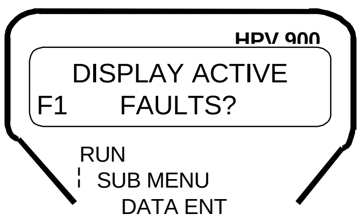
Generated during a run condition when the DC bus voltage drops below the user specified percent of the input line-to-line voltage. The input line-to-line voltage is specified by the Input L-L Volts parameter and the fault level is specified by the Undervoltage Alarm Level parameter. *For more information, see section (3.4.5).*

3.7.2 ACTIVE FAULTS F1 Sub Menu

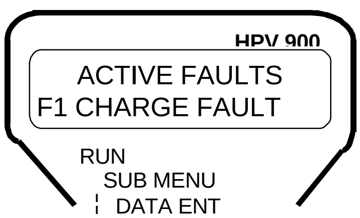
This sub menu contains a list of the active faults. This sub menu also allows the user to reset the active faults.

3.7.2.1 Active Faults List

The active fault list displays and records the active faults. The faults will remain on the fault list until a fault reset is initiated.



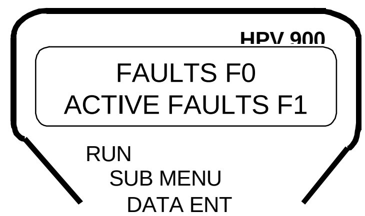
Press the enter key to enter the active fault list. Use the up and down arrow keys to scroll through the active faults.



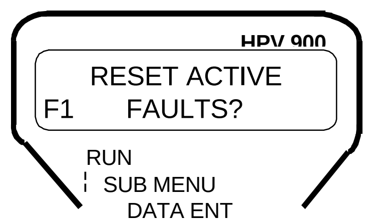
3.7.2.2 Resetting Active Faults

The Reset Active Faults function allows the user to initiate a fault reset via the digital operator, regardless of the setting of the Fault Reset Source parameter. *(see section (3.5.1))*

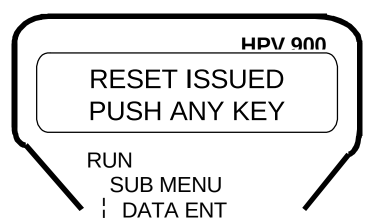
- While the Digital Operator display shows:



Press the ENTER key. The sub menu LED will turn ON, and the Digital Operator will display:



- Press the ENTER key again to begin the fault reset procedure. The sub menu LED will go out and the data ent LED will turn on.



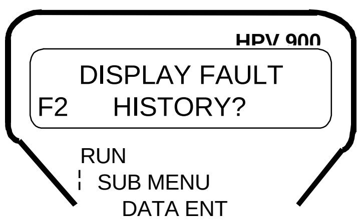
3.7.3 FAULT HISTORY F2 Sub Menu

This sub menu contains a list of up to the last sixteen faults.

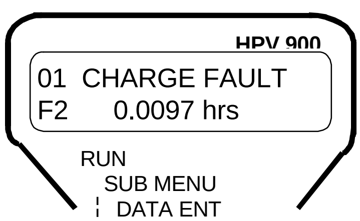
NOTE: The fault history is not affected by the fault reset or a power loss. The fault history can only be cleared by a function in this sub-menu.

3.7.3.1 Fault History

All faults will placed on the fault history. The fault history displays the last 16 faults that have occurred and a time stamp indicating when each happened.



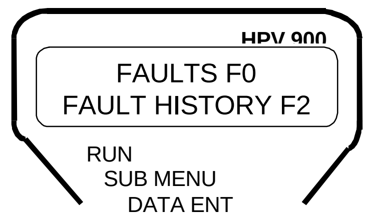
Press the enter key to enter the fault history. Use the up and down arrow keys to scroll through the faults.



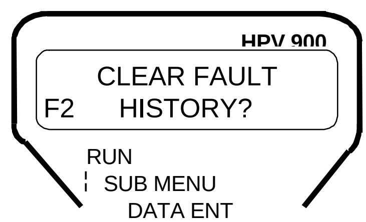
3.7.3.2 Clearing Fault History

The fault history is not affected by the fault reset or a power loss. The fault history can only be cleared via the user function described below.

- While the Digital Operator display shows:

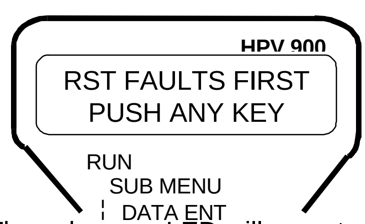


Press the ENTER key. The sub menu LED will turn ON, and the Digital Operator will display:

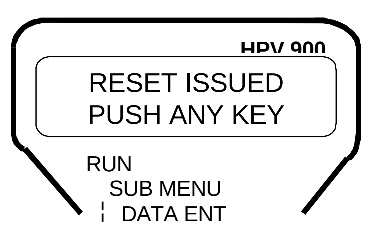


- Press the ENTER key again to begin the fault reset procedure.

  The active faults must be cleared in order to clear the fault history. If not the following message will appear when trying to clear the fault history.



The sub menu LED will go out and the data ent LED will turn on.



Section 4
MAINTENANCE

4.1 MAINTENANCE OVERVIEW

Preventive maintenance is primarily a matter of routine inspection and cleaning. The most important maintenance factors are the following:

- Is their sufficient air flow to cool the drive?
- Has vibration loosened any connections?

The HPV 900 needs to have sufficient air flow for long, reliable operation. Accumulated dust and dirt accumulation can reduce air flow and cause the heat sinks to overheat. The heat sinks can be kept clean by brushing, while using a vacuum cleaner.

Periodically, check air filters on enclosure doors, clean if dirty and replace as necessary.

Periodically, clean the cooling fans to prevent dirt buildup. At the same time, check that the impellers are free and not binding in the housing.

Periodically, check all mounting and electrical connections. Any loose hardware should be tightened.

WARNING

Hazardous voltages may exist in the drive circuits even with drive circuit breaker in off position. NEVER attempt preventive maintenance unless incoming power and control power is disconnected and locked out. Also insure the DC Bus charge light is out.

4.2 LIFETIME MAINTENANCE

The HPV 900 is a AC digital drive. It is intended to last for twenty years in the field assuming the drive is installed and run according to MagneTek specifications and recommendations. The following recommendations for part replacement to ensure twenty-year life is as follows:

- Fans
  - Heavy Usage* = 3 years
  - Average Usage** = 8 years

- Bus Capacitors
  - Heavy Usage* = 8 years
  - Average Usage** = 15 years

* Heavy Usage can be defined as beyond what MagneTek specifies as average usage. All recommendations for environmental conditions specified in Section 2, *Installation and Start-up*.

** Average Usage can be defined as following MagneTek's guidelines for average usage. All recommendations for environmental conditions specified in Section 2, *Installation and Start-up*.

4.3 REFORMING BUS CAPACITORS

The following is a procedure for reforming the electrolytic bus capacitors. If the drive has been stored for more than 9-months, it is recommended that the bus capacitors be reformed. After 18 months of storage it is ***mandatory*** that the bus capacitors are reformed.

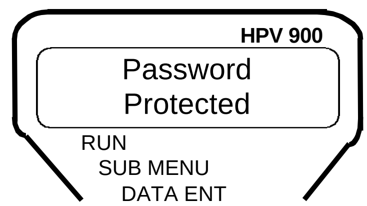
The bus capacitors in the HPV 900 can be reformed *without removing them from the drive.* To reform the capacitors, voltage must be gradually increased as follows: increase the AC input voltage from zero at a very slow rate, approximately 7 VAC per minute, reaching full rated voltage after about an hour. This will reform the capacitors.

4.4 PARAMETERS LOCKED OUT

The following three conditions would cause parameter changes to be locked out.

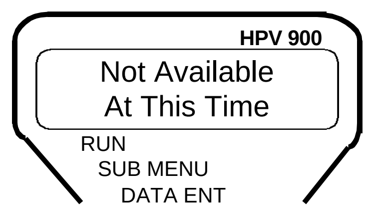
- The password protection is enabled.
- The drive is running and the parameter being changed is protected by Run Lockout.
- The hidden items are disabled and the parameter to be change is a hidden parameter.

When the password protection is enabled and a parameter is trying to be changed, the digital operator will display the following:



For more information, see section (3.6.1).

When the drive is in a Run condition and a parameter is trying to be changed, the digital operator will display the following:



This means the parameter cannot be changed, when the drive is running. The parameter can be changed once the drive's run command is removed.

When the hidden items function is disabled and a parameter is cannot be found in the menus. The hidden items will need to be enabled. *For more information, see section (3.6.2).*

4.5 TROUBLESHOOTING GUIDE

Table 4. 1 list the HPV 900's status LEDs (see Figure 4. 1) along with a description.

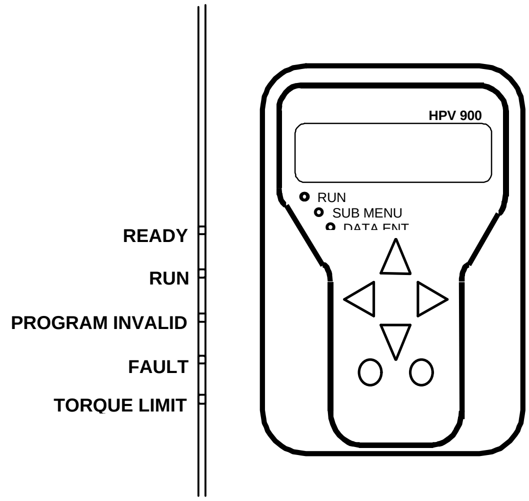


Figure 4. 1 – Status LEDs

Status LED	Description	Possible Causes & Corrective Action
READY (green)	The drive is ready to run meaning: • The software is up and ready. • No faults are present.	N/A
RUN (green)	The drive is in operation. • RUN & DRIVE ENABLE logic inputs true • Current being sent to the motor	N/A
PROGRAM INVALID (red)	The HPV 900 is not sensing any valid software in the drive's control board.	**Drive is Not Sensing Software** ➲ consult factory
FAULT (red)	The drive has declared a fault.	**Fault Present in the Drive** ➲ Use digital operator to check the fault and consult Table 4. 2.
TORQUE LIMIT (amber)	The drive has reached its torque limit.	**Incorrect Wiring** ➲ Motor phasing should match the encoder feedback phasing. If the phasing is not correct, the motor will not accelerate up to speed. It will typically oscillate back and forth at zero speed, and the current will be at the torque limit. ➲ Switching two motor phases should correct this situation. **Drive and/or Motor is Undersized** ➲ Verify drive and/or motor sizing. May need a larger capacity HPV 900 and or motor. **Check Parameter Settings** ➲ Check the torque limit parameters MTR TORQUE LIMIT and REGEN TORQ LIMIT (A5) – maximum 250% ➲ Check speed regulator parameters RESPONSE and INERTIA (A1)

Table 4. 1 - Status LED Troubleshooting Guide

Table 4. 2 list the HPV 900's faults along with possible causes and corrective actions.

Fault Name	Description	Possible Causes & Corrective Action
AtoD Fault	The Analog to Digital conversion on the drive's control board is not working properly.	**Drive Control PCB Failure** ➲ Replace Drive Control board
Brk Hold Flt	The brake hold command and the brake feedback did not match for the time specified with Brake Hold Time parameter.	**Check Parameter Settings** ➲ Check BRAKE HOLD SRC (C1) parameter for the correct source of brake hold feedback ➲ Check BRAKE HOLD TIME (A1) parameter for the correct brake hold time. If nuisance fault, the fault can be disabled by BRK HOLD FLT ENA (C1) parameter.
Brk IGBT Flt	Dynamic brake resistor overcurrent.	**Brake Resistor problem** ➲ Braking Resistor is shorted. When this fault occurs while the elevator is in motion, it will be declared as a brake fault alarm until the run condition is removed. If the drive is in regeneration an Overvolt Fault may occur instead.
Brk Pick Flt	The brake pick command and the brake feedback did not match for the time specified with Brake Pick Time parameter.	**Check Parameter Settings and Mechanical Brake Pick Signal Wiring** ➲ Check the correct logic input is configured for the correct TB1 terminal and set to MECH BRK PICK (C2) ➲ Check wiring between the mechanical brake and the terminal on TB1. ➲ Check BRAKE PICK SRC (C1) parameter for the correct source of brake pick feedback ➲ Check BRAKE PICK TIME (A1) parameter for the correct brake hold time. If nuisance fault, the fault can be disabled by BRK PICK FLT ENA (C1) parameter.
Charge Fault	The DC bus voltage has not stabilized above the voltage fault level within 2 seconds or the charge contactor has not closed after charging.	**DC Bus Low Voltage** ➲ Increase input AC voltage with the proper range ➲ Check wiring and fusing between main AC contactor and the drive ➲ Drive may need to be replaced

Table 4. 2 – Fault Troubleshooting Guide

Fault Name	Description	Possible Causes & Corrective Action
Contactor Flt	The command to close the contactor and the contactor feedback do not match before the time specified by the Contact Flt Time parameter. This fault can be disabled by Contactor Confirm Source parameter to none.	**Check Parameter Settings and Contactor** ➲ Check CONTACTR FLT TIME (A1) parameter for the correct contactor fault time**.** ➲ Contactor hardware problem If nuisance fault, the fault can be disabled by CONT CONFIRM SRC (C1) parameter (set to none).
Cube data Flt	The cube (drive) parameters checksum is invalid.	**Parameters Corrupted** ➲ Re-enter parameters and reset ➲ If re-occurs, replace Drive Control board
Cube ID Fault	The identification number for the drive is bad.	**Hardware Problem** ➲ Power cycle the drive. ➲ If re-occurs, the drive needs to be replaced
Curr Reg Flt	Actual current does not match the command current.	**Current Regulation problem** ➲ Check for a possible motor open phase ➲ Check if contactor is closing. ➲ Otherwise, replace the drive
DCU data Flt	The DCU parameters checksum is invalid.	**Parameters Corrupted** ➲ Check & re-enter parameters and power cycle the drive ➲ If re-occurs, replace Drive Control board
Drive Ovrload	The drive has exceeded the drive overload curve.	**Excessive Current Draw** ➲ Decrease decel rate ➲ Is elevator car being held in position? (i.e. mechanical brake not releasing) ➲ Mechanical brake may not have properly released **Encoder Problem** ➲ Check encoder coupling: align or replace ➲ Encoder failure (replace encoder) ➲ Check encoder count parameter ENCODER PULSES (A1) **Motor Problem** ➲ Check for motor failure **Drive Sizing** ➲ Verify drive sizing. May need a larger capacity HPV 900

Table 4. 2 – Fault Troubleshooting Guide (continued)

Fault Name	Description	Possible Causes & Corrective Action
Encoder Flt	The drive is in a run condition and the encoder is: • not functioning or • not connected.	**Encoder Power Supply Loss** ➲ Check 12 or 5 volt supply on terminal strip **Encoder Coupling Slopped or Broken** ➲ Check encoder to motor coupling **Excessive Noise on Encoder Lines** ➲ Check encoder connections. Separate encoder leads from power wiring (cross power lead at 90°) **Another Condition Causing Fault** ➲ Check encoder count parameter ENCODER PULSES (A1) ➲ Possible motor phase loss ➲ Possible bad Brake IGBT
Extrn Fault 1	User defined external logic fault input	**Check Parameter Settings and External Fault Signal Wiring** ➲ Check the correct logic input is configured for the correct TB1 terminal and set to EXTRN FAULT 1 (C2) ➲ Check external fault is on the correct terminal on TB1.
Extrn Fault 2	User defined external logic fault input	**Check Parameter Settings and External Fault Signal Wiring** ➲ Check the correct logic input is configured for the correct TB1 terminal and set to EXTRN FAULT 2 (C2) ➲ Check external fault is on the correct terminal on TB1.
Extrn Fault 3	User defined external logic fault input	**Check Parameter Settings and External Fault Signal Wiring** ➲ Check the correct logic input is configured for the correct TB1 terminal and set to EXTRN FAULT 3 (C2) ➲ Check external fault is on the correct terminal on TB1.
Fuse Fault	The DC bus fuse on the drive is open.	**Hardware Problem** ➲ Check if motor is faulty ➲ Check if any output phases shorted to ground. ➲ The drive may need to be replaced.

Table 4. 2 – Fault Troubleshooting Guide (continued)

Fault Name	Description	Possible Causes & Corrective Action
Ground Fault	The sum of all phase currents has exceeded 50% of the rated amps of the drive.	**Improper Wiring** ➲ Disconnect wiring between control and motor. Retry. If cleared, reconnect motor and control. If problem continues possible short between the motor windings and chassis ➲ If problem continues, check system grounding
Mtr data Flt	Motor parameters checksum is invalid.	**Parameters Corrupted** ➲ Check parameters and reset ➲ If re-occurs, replace Drive Control board
Overcurr Flt	The phase current exceeded 300% of rated current.	**Encoder Problem** ➲ Check encoder coupling: align or replace ➲ Encoder failure (replace encoder) **Motor Problem** ➲ Possible motor lead short ➲ Check for motor failure **Excessive Load** ➲ Verify motor and drive sizing. May need a larger capacity HPV 900
Overspeed Flt	Generated when the motor has gone beyond the user defined percentage contract speed for a specified amount of time. This is defined by Overspeed Level parameter and Overspeed Time parameter.	**Check Parameter Settings** ➲ Check OVERSPEED LEVEL (A1) parameter for the correct level. ➲ Check OVERSPEED TIME (A1) parameter for the correct time.
Overtemp Flt	The heatsink on the drive has exceeded 105°C (221°F).	**Excessive Heat** ➲ Reduce Ambient Temperature ➲ Clean heat sink ➲ Check for cooling fan failure
Overvolt Flt	The DC bus voltage of the drive exceeded: • 850 Volts for a 460V class drive • 425 Volts for a 230V class drive.	**Too High of Braking Resistor Value** ➲ Check for no braking resistor ➲ Possible Brake IGBT Failure ➲ Possible brake resistor is open **Dynamic Braking Wiring Problem** ➲ check dynamic brake hardware wiring **High Input Voltage** ➲ Decrease input AC voltage with the proper range ➲ Use liner reactor to minimize voltage spikes
PCU data Flt	PCU parameters checksum is invalid.	**Parameters Corrupted** ➲ Check parameters and reset ➲ If re-occurs, replace Drive Control board

Table 4. 2 – Fault Troubleshooting Guide (continued)

Fault Name	Description	Possible Causes & Corrective Action
Phase Flt	The drive senses an open motor phase.	**Motor Problem** ➲ Check motor wiring ➲ Check for motor failure ➲ Check for bad contactor
Setup Fault 1	This fault is declared if the rated motor speed and excitation frequency do not satisfy: $9.6 < \left[120\begin{pmatrix} rated \\ excitation \\ frequency \end{pmatrix}\right] - \left[\begin{pmatrix} \# \\ poles \end{pmatrix}\begin{pmatrix} rated \\ motor \\ speed \end{pmatrix}\right] < 1222.3$	**Check Parameters Settings:** ➲ Check RATED EXCIT FREQ (A5) parameter for correct setting ➲ Check RATED MTR SPEED (A5) parameter for correct setting ➲ Check MOTOR POLES (A4) parameter for correct setting
Setup Fault 2	This fault is declared if the number of poles and encoder pulses per revolution do not satisfy: $\dfrac{\begin{pmatrix} encoder \\ pulses \end{pmatrix}}{\begin{pmatrix} \# \\ poles \end{pmatrix}} > 64$	**Check Parameters Settings:** ➲ Check ENCODER PULSES (A1) parameter for correct setting ➲ Check MOTOR POLES (A4) parameter for correct setting
Setup Fault 3	This fault is declared if the number of poles is not an even number.	**Check Parameters Settings:** ➲ Check MOTOR POLES (A4) parameter for correct setting
Setup Fault 4	This fault is declared if the contract motor speed (in rpm) and encoder pulses/revolution do not satisfy: $300,000 < \begin{pmatrix} contract \\ motor \\ speed \end{pmatrix}\begin{pmatrix} encoder \\ pulses \end{pmatrix} < 18,000,000$	**Check Parameters Settings:** ➲ Check ENCODER PULSES (A1) parameter for correct setting ➲ Check CONTRACT MTR SPD (A1) parameter for correct setting
Setup Fault 5	This fault is declared if the rated motor power (in watts) and rated motor voltage do not satisfy: $(0.07184)\left[\dfrac{\begin{pmatrix} rated \\ motor \\ power \end{pmatrix}}{\begin{pmatrix} rated \\ motor \\ voltage \end{pmatrix}}\right] < \begin{matrix} general \\ purpose \\ current \\ rating \\ of \\ drive \end{matrix}$	**Check Parameters Settings:** ➲ Check RATED MOTOR PWR (A4) parameter for correct setting ➲ Check RATED MTR VOLTS (A4) parameter for correct setting
Undervolt Flt	Generated during a run condition when the DC bus voltage drops below the user specified percent of the input line-to-line voltage. The input line-to-line voltage is specified by the Input L-L Volts parameter and the fault level is specified by the Undervoltage Fault Level parameter.	**Low Input Voltage** ➲ Check INPUT L-L VOLTS (A4) parameter ➲ Disconnect Dynamic Braking hardware and re-try. ➲ Verify proper input voltage and increase, if necessary, the input AC voltage within the proper range ➲ Check power line disturbances due to starting of other equipment

Table 4. 2 – Fault Troubleshooting Guide (continued)

Section 5
HPV 900 APPLICATION

5.1 DRIVE SOFTWARE

The HPV 900 is a dedicated fully, digital AC vector drive tailored to the elevator industry. Following is a description of the drive software.

A block diagram of the software is shown in Figure 5. 1.

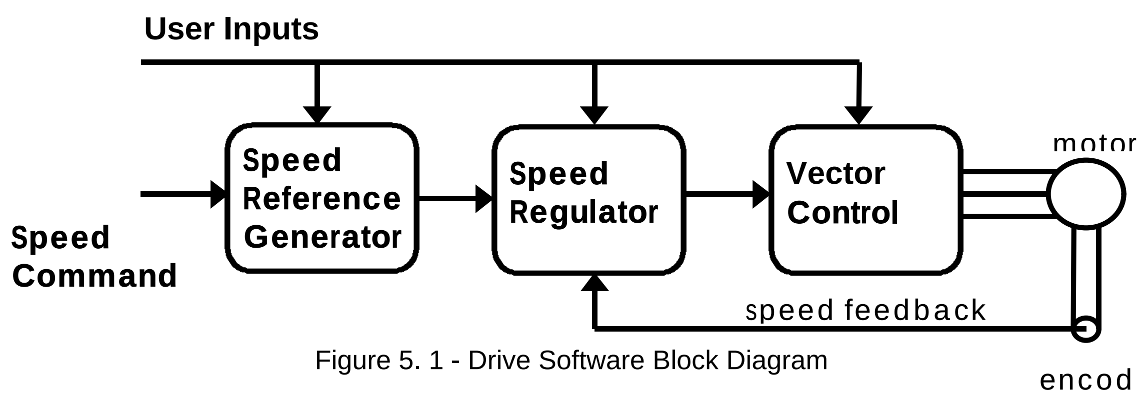


Figure 5. 1 - Drive Software Block Diagram

The drive software consists of the following:

- Speed Command – *see section (5.1.1)*.
- Speed Reference Generator – *see section (5.1.3)*.
- Speed Regulator – *see section (5.1.4).*
- Vector Control – *see section (5.1.5).*

5.1.1 Speed Command Generation

The three possible sources for the speed command are following:

- serial channel
- analog channel
- multi-step command

5.1.1.1 Serial Channel

The serial channel is a RS-422 serial port located on the drive control board. The serial protocol used to control the HPV 900 is agreed upon by MagneTek and the user.

5.1.1.2 Analog Channel

The analog channel is bipolar (±10V). The speed command channel is predetermined as analog channel #1. Available with the analog channel is a Speed Command Multiplier (SPD COMMAND MULT) and Speed Command Bias (SPD COMMAND BIAS). These parameters are used to scale the user's analog speed command to the proper range for use by the drive software. The formula below shows the scaling effects of these two parameters.

$$\left(\begin{matrix}\textit{analog}\\ \textit{channel\#1}\\ \textit{input}\\ \textit{voltage}\end{matrix} - \begin{matrix}\textit{SPD}\\ \textit{COMMAND}\\ \textit{BIAS}\end{matrix}\right) \times \begin{matrix}\textit{SPD}\\ \textit{COMMAND}\\ \textit{MULT}\end{matrix} = \begin{matrix}\textit{signal}\\ \textit{drive}\\ \textit{software}\\ \textit{uses}\end{matrix}$$

In the following example, the user is supplying the drive a 0 to +10V signal on analog channel #1 and the user wants to control the speed from positive contract speed to negative contract speed. Therefore, the signal on analog channel #1 will need to be scaled before it is used by the drive software by configuring the parameters as shown in Figure 5. 2.

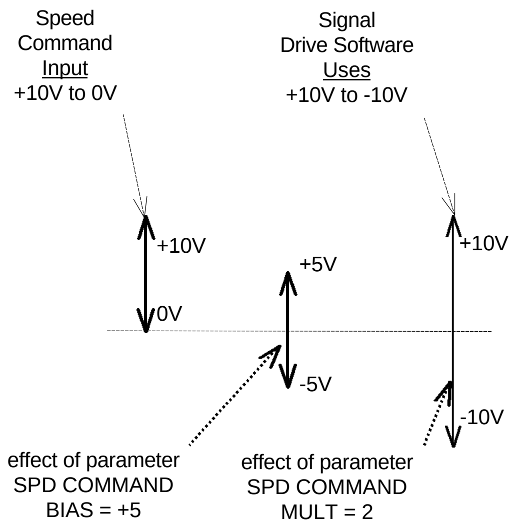


Figure 5. 2 - Example Analog Gain & Bias

The sign of the analog speed command can be changed via up/down logic input (UP/DWN). When the logic input is false there is no inversion, but when the logic input is true the speed command is inverted. Normally, positive commands are for the up direction and negative speed commands are for the down direction. Thus, making the up/down input true reverses the car's direction.

As an example, the user is supplying the drive a 0 to +10V signal on analog channel #1 and the user wants to control the speed from positive contract speed to negative contract speed. Since to user is already supplies a signal for zero to positive contract speed, the user can use the up/down logic input to reverse the sign of the speed command.

5.1.1.3 Multi-Step Commands

The multi-step command. To use this source, the user can enter fifteen discrete speed commands (CMD1 - CMD15) and assign four logic inputs as speed command selections; CMD0 is reserved for zero speed. But, the user can specify CMD1 - CMD15 to be any speed command either positive or negative.

For typical use, the user will have all speed commands to be positive, in which case a logic input (UP/DWN) must also be specified to determine UP or DOWN direction. It is possible for the user to specify both positive and negative values for CMD1 - CMD15, in which case the UP / DOWN logic input bit is not needed.

During operation, the user will encode a binary signal on the four logic inputs (see Table 5. 1) that determines which speed command the software should use. The user need not use all four speed command selection bits; if no logic input is specified for one of the selection bits, that bit is always zero. For instance, if no logic input is specified for the most significant bit (B3), that bit will be zero and the user can select from CMD0 - CMD7.

logic input STEP REF				multi-step speed
B3	B2	B1	B0	command
0	0	0	0	CMD0
0	0	0	1	CMD1
0	0	1	0	CMD2
0	0	1	1	CMD3
0	1	0	0	CMD4
0	1	0	1	CMD5
0	1	1	0	CMD6
0	1	1	1	CMD7
1	0	0	0	CMD8
1	0	0	1	CMD9
1	0	1	0	CMD10
1	0	1	1	CMD11
1	1	0	0	CMD12
1	1	0	1	CMD13
1	1	1	0	CMD14
1	1	1	1	CMD15

Table 5. 1 - Multi-Step Selection

An example of the use of the multi-step command is as follows:

- All speed commands are positive.
- CMD0 specifies zero speed.
- CMD1 specifies leveling speed.
- CMD2 specifies inspection speed.
- CMD3 specifies an overspeed limit.
- CMD4 – CMD15 specify different top speeds depending on number of floors in the run.

Since these speed commands are selected with external contacts, a new command selection must be present for 50ms before it is recognized. This eliminates the situation where a zero speed command may erroneously be specified while transitioning between two non-zero states (i.e. while transitioning, all contacts may be open briefly).

5.1.2 Overspeed Test

In order to allow overspeed tests during elevator inspections, a means is provided to multiply the speed command the Overspeed Multiplier parameter (OVERSPEED MULT). The result of this multiplication is not subject to the overspeed level limit. *For more information, see section (3.4.1).*

To initiate an overspeed test, the user can select from:

- an external logic input (OSPD TEST SRC), *see section (3.5.2)*
- the serial channel
- directly from the operator, *see section (3.6.4)*

To use an external logic input or the serial channel to initiate an overspeed test, the Overspeed Test Source parameter (OVERSPEED TEST SRC) must be set-up properly. *For more information, see section (3.5.1).*

Once an overspeed test is initiated, it is applied to the next run. The overspeed test logic requires a transition from FALSE to TRUE to be recognized. This prevents the overspeed function from being permanently enabled if left in the TRUE state.

5.1.3 Speed Reference Generation

A block diagram of the speed reference generator is shown in Figure 5. 3.

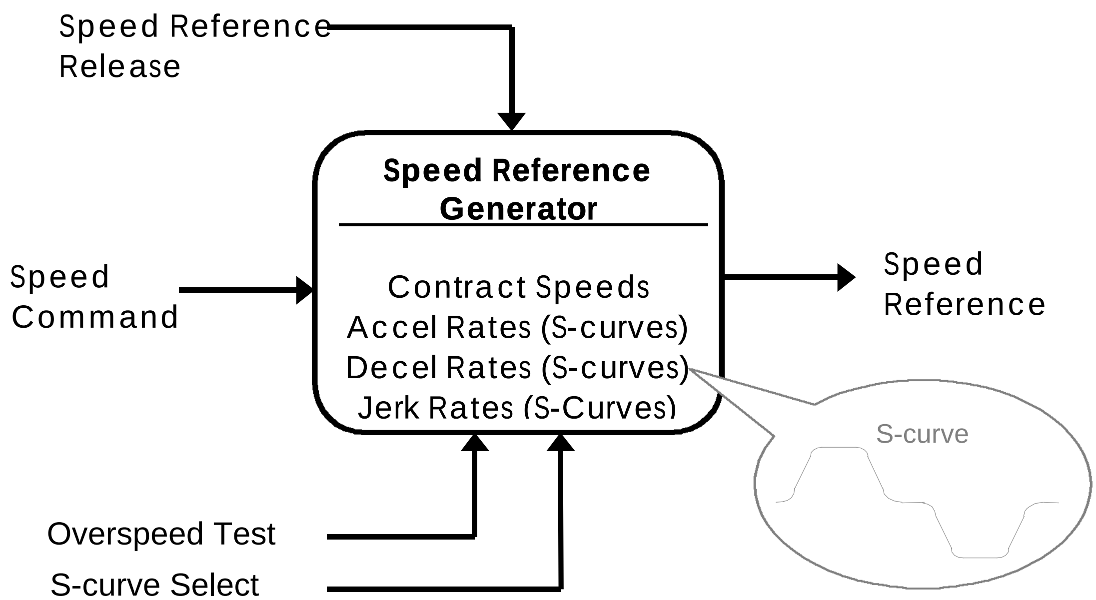


Figure 5. 3 - Speed Reference Generator Block Diagram

The inputs to the speed reference generator are the following:

- Speed Command – the HPV 900 commanded speed and is described above in *section (5.1.1*).
- Overspeed Test – used to initiate an overspeed test, *see section (5.1.2).*
- S-curve Select – used to select one of four available of the drive's available S-curves, *see section (5.1.3.2).*
- Speed Reference Release – an internal signal to the drive and is described in detail in the drive sequencing section, *see section (5.2).*

The output of the speed reference generator is a speed reference.

5.1.3.1 Contract Speeds

The two contract speeds are the contract car speed and the contract motor speed. The interaction between these two parameters allow engineering units to be used throughout the HPV 900 software.

The contract car speed is defined as the elevator contract speed in fpm (feet per minute) or m/s (meters per second).

The contract motor speed is defined as the motor speed at elevator contract speed in rpm (revolutions per minute).

For more information on the Contract Speed parameters see section (3.4.1).

In the speed reference generator, the speed command is passed through an S-curve block in order to produce a speed reference. The S-curve definitions are shown in Figure 5. 4.

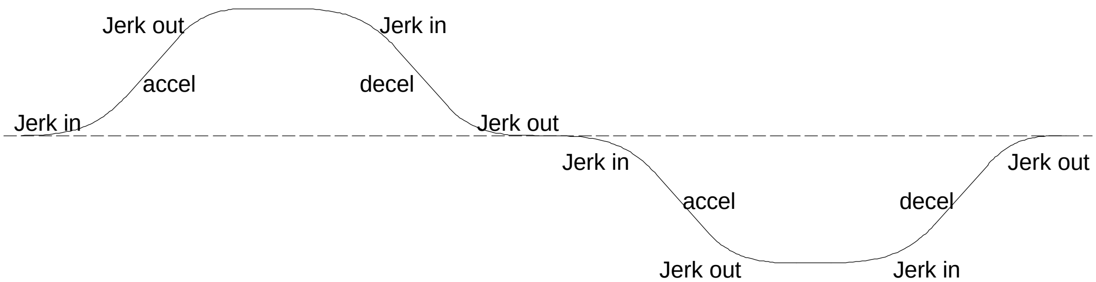


Figure 5. 4 - S Curve Definitions

5.1.3.2 HPV 900 S-curve Definition

To simplify the S-curve definitions the HPV 900 defines:

- the jerk rate as: the jerk when going into an acceleration; the jerk when going out of an acceleration; and the jerk when going into a deceleration.
- the leveling jerk rate as the jerk when going out of a deceleration.

Therefore, the HPV 900 defines a S-curve by four parameters:

- accel rate (ft/s^2 or m/s^2)
- decel rate (ft/s^2 or m/s^2)
- jerk rate (ft/s^3 or m/s^3)
- leveling jerk rate (ft/s^3 or m/s^3)

For more detailed information on the S-curve see section (5.4).

The HPV 900 provides the user with the ability to specify up to four sets of S-curve data (SC0 - SC3). Also, the user has the ability to assign up to two logic inputs (SC select 0 and SC select 1) for use in selecting the various S-curves.

During operation, the user will encode a binary signal on the two logic inputs (see Table 5. 3) that determine which S-curve the software will use. The user need not use the two S-curve selection bits; if no logic input is specified for one of the selection bits, that bit is always zero. For instance, if no logic input is specified for SC select 1, that bit will be zero and the user can select from SC0 and SC1 (see Table 5. 2).

For more detailed information on the S-curve parameters see section (3.4.2).

Logic Inputs Assigned	S-Curves Available
none	SC0
SC select 0 assigned SC select 1 not assigned	SC0 or SC1
SC select 0 not assigned SC select 1 assigned	SC0 or SC2
SC select 0 assigned SC select 1 assigned	SC0, SC1, SC2 or SC3

Table 5. 2 - Possible S-curve Selection Assignments

logic input S-CURVE SEL 1	S-CURVE SEL 0	S-curve selected
0	0	SCO
0	1	SC1
1	0	SC2
1	1	SC3

Table 5. 3 - S-curve Selection Table

5.1.3.3 Disabling Parts of the S-curve

The jerk rates can be turned off by setting the jerk rates to zero.

The accel / decel rates can also be turned off by setting them to zero. But, setting the accel / decel rates to zero is not recommended.

5.1.3.4 S-curve with Analog / Serial

When using speed commands given via the analog or serial channel, it is recommended that the accel and decel rates are used as a slew limit and the jerk rates turned off.

This is accomplished by setting the accel / decel rates to be greater then used by the car controller and setting the jerk rates to zero.

5.1.4 Speed Regulator

The speed regulator for the HPV 900 can be is a closed loop regulator with a torque limit. Also available with the speed regulator is a pre-torque command and a Torque Ramp Down function. The block diagram of the speed regulator is shown in Figure 5. 5.

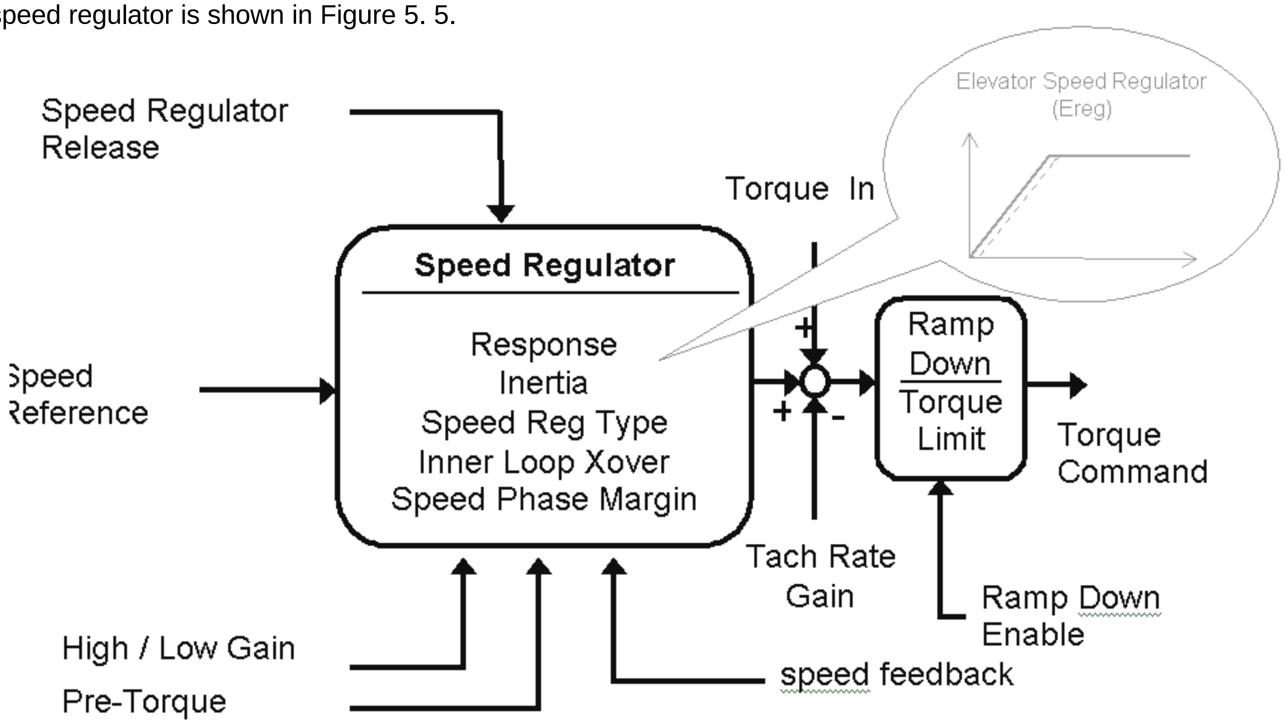


Figure 5. 5 - Speed Regulator Block Diagram

The inputs to the speed regulator are the following:

- Speed Reference – the output of the speed reference generator and is described in *section (5.1.3*).
- High / Low Gain – used to select, usually at higher speeds, a lower gain (response) in the speed regulator, *see section (5.1.4.1).*
- Pre-Torque – used to primes the speed regulator with an initial torque command, *see section (5.1.4.7).*
- Torque In – allows for additional torque reference to be added into the torque command via the serial channel.
- Tach Rate Gain – used for the tach rate function, which is used help dampen the rope resonance, *see section (5.1.4.5).*
- Ramp Down Enable – used to initiate the torque ramp down function, *see section (5.1.4.8).*
- Speed Regulator Release – an internal signal to the drive and is described in detail in the drive sequencing section, *see section (5.2).*

Internal to the speed regulator are the following:

- Response – sets the response (or gain) of the drive's speed regulator, see *section (5.1.4.3*).
- Inertia – is defined as the elevator system inertia and the value is used by the speed regulator, *see section (5.1.4.4).*
- Speed Reg Type – used to select the type speed regulator. The recommended choice is the Elevator Speed Regulator (Ereg), *see section (5.1.4.2.1).* The other speed regulator option is the PI Speed Regulator, *see section (5.1.4.2.2).*

- Inner Loop Xover – used by Elevator Speed Regulator (Ereg), *see section (5.1.4.2.1).*
- Speed Phase Margin – used by the PI Speed Regulator, *see section (5.1.4.2.2).*
- Ramp Down – the torque ramp down function, *see section (5.1.4.8).*
- Torque Limit – the speed regulator's torque limits, *see section (5.1.4.6).*

The output of the speed regulator is a torque command.

5.1.4.1 High / Low Gain

The speed regulator high / low gain function was developed in response to high performance elevator requirements where the resonant nature of the elevator system interferes with the speed response of the drive.

When the speed response (gain) is set to high levels, the resonant characteristics created by the spring action of the elevator ropes can cause car vibration. To solve this problem, the speed regulator is set to a low enough response (gain) so that the resonant characteristics of the ropes are not excited.

This is accomplished by controlling the sensitivity or response of the speed regulator via the high / low gain switch and gain reduce multiplier.

By using the gain reduce multiplier, the user can specify a lower response (gain) for the speed regulator when the drive is at higher speeds. The gain reduce multiplier (GAIN REDUCE MULT) tells the software how much lower, as a percentage, the speed regulator response (gain) should be. *For more information, see section (3.4.1).*

The high / low gain switch determines when the HPV 900 is in 'low gain' mode. In the 'low gain' mode, the gain reduce multiplier has an effect on the speed regulator's response (gain).

The drive allows for the high / low gain switch to be controlled either externally or internally. The high / low gain source parameter (HI/LO GAIN SRC) allows for this external or internal selection, *see section (3.5.1)*.

The high / low gain switch can be controlled externally by either:

- a logic input *(see section (3.5.2))*
- the serial channel.

The high / low gain switch can also be controlled internal by:

- the gain change level parameter (GAIN CHNG LEVEL), which defines a percentage of contract speed *(see section (3.4.1)).*

With the drive set to internal control, the speed regulator will go into 'low gain' mode when the drive senses the motor is above a defined speed level. The defined speed level is determined by the gain change level parameter. An example of internal high / low gain control is shown in Figure 5. 6

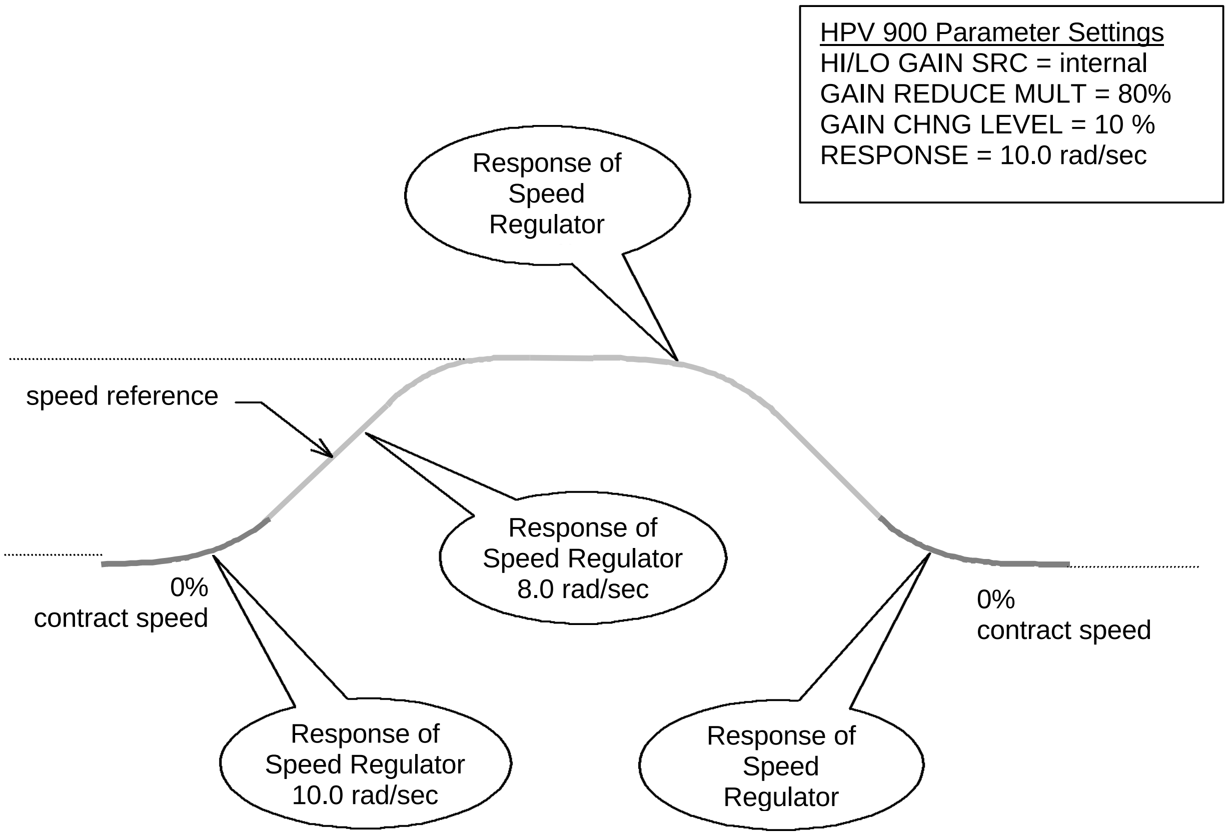


Figure 5. 6 - High / Low Gain Example

5.1.4.2 Speed Regulator Types

The HPV 900 has the following two closed loop speed regulation options:

- Elevator Speed Regulator (Ereg)
- PI Speed Regulator

The Elevator Speed Regulator is recommended for use with elevator applications but is not required. The regulator type can be changed by using the speed regulator type parameter (SPEED REG TYPE), *see section (3.5.1).*

5.1.4.2.1 Elevator Speed Regulator (Ereg)

The use of the Elevator Speed Regulator allows the overall closed loop response between speed reference and speed to be ideal for elevator applications. The desirable features of the Elevator Speed Regulator are:

- no overshoot at the end of accel period
- no overshoot at the end of decel period

One characteristic of the Elevator Speed Regulator is that during the accel / decel period the speed feedback does not match the speed reference creating a speed error or tracking delay. As an example, the Elevator Speed Regulator's speed response is shown for a ramped speed reference in Figure 5. 7.

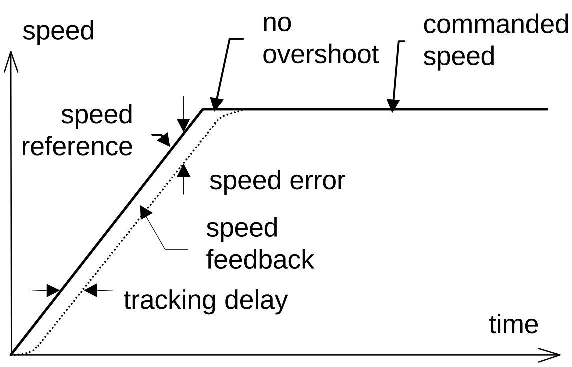


Figure 5. 7 – Ereg Example

The Elevator Speed Regulator is tuned by:

- System Inertia parameter (INERTIA), which is easy to obtain by using the drive software to estimate the system inertia, *see section (5.6); section (3.4.1); and section (5.1.4.4).*
- Response parameter (RESPONSE), which is the overall regulator bandwidth in radians per sec, *see section (3.4.1) and section (5.1.4.3).* This parameter defines the responsiveness of the speed regulator.

The tracking delay shown in Figure 5. 7 is defined as (1/RESPONSE) seconds. The tracking delay is not effected by the gain reduce multiplier.

The inner loop crossover parameter (INNER LOOP XOVER) should not need to be changed, *see section (3.4.1).* But if the number is changed, it must satisfy the following formula:

$$\begin{matrix}\textit{inner}\\ \textit{loop}\\ \textit{crossover}\end{matrix} < \textit{response} \times \begin{matrix}\textit{gain}\\ \textit{reduce}\\ \textit{multiplier}\end{matrix}$$

5.1.4.2.2 PI Speed Regulator

When the Proportional plus Integral (PI) speed regulator is used, the response to a speed reference is different. As an example, the PI Speed Regulator's speed response is shown for a ramped speed reference in Figure 5. 8. With the PI speed regulator, the end of each accel and decel period, there will be an overshoot. The amount of overshoot will be a function of the defined phase margin and response parameters.

Because of this overshoot, the PI regulator is not recommended for elevator control

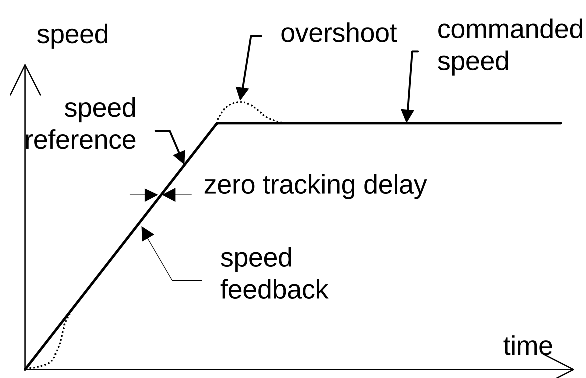


Figure 5. 8 - PI Speed Regulator Example

The PI Speed Regulator is tuned by:

- System Inertia parameter (INERTIA), which is easy to obtain by using the drive software to estimate the system inertia, *see section (5.6); section (3.4.1); and section (5.1.4.4).*
- Response parameter (RESPONSE), which is the overall regulator bandwidth in radians per sec, *see section (3.4.1) and section (5.1.4.3).* This parameter defines the responsiveness of the speed regulator.
- Speed Phase Margin parameter (SPD PHASE MARGIN) is used only by the PI Speed Regulator to define the phase margin of the speed regulator, *see section (3.4.1).*

5.1.4.3 Speed Regulator Response

This parameter sets the response of the regulator in terms of the speed regulator bandwidth in rad/sec. This parameter defines the responsiveness of the drive as it follows the speed reference, *see section (3.4.1).*

If the response is set to a large number, the speed error and tracking delay will be small. But, the speed regulator will be less stable.

If the response is set to a small number, the speed regulator will be more stable. But, the speed error and tracking delay will be large.

A lower gain (response) can be specified for the speed regulator at higher speeds by using the high / low gain switch *(see section (5.1.4.1))*.

5.1.4.4 Inertia

This parameter sets the elevator system inertia in seconds and is used to accurately tune the speed regulator, *see section (3.4.1)*.

The system inertia is the time in seconds it takes the elevator system to accelerate from zero to rated speed, while the motor is producing the rated torque.

The HPV 900 software can be used to calculate the inertia of the elevator system, see section (5.6).

5.1.4.5 Tach Rate Gain

The tach rate function is available for high performance systems that exhibit problems with rope resonance characteristics.

This function subtracts a portion of the speed feedback derivative from the output of the speed regulator. The Tach Rate Gain parameter (TACH RATE GAIN) selects a unitless gain factor that determines how much of the derivative is subtracted, *see section (3.4.1).*

5.1.4.6 Torque Limit

The following two parameters adjust these maximum torque limits:

- Motor Torque Limit parameter (MTR TORQUE LIMIT) – sets the maximum torque allowed when the drive is in motoring mode *(see section 3.4.1).*
- Regenerative Mode Torque Limit parameter (REGEN TORQ LIMIT) - sets the maximum amount of regenerative torque the drive will allow during regeneration *(see section 3.4.1).*

Both these torque limits can have an effect on field weakening, *see section (5.1.5.1).*

5.1.4.7 Pre-Torque

Pre-torque is the value of torque that the drive should produce as soon as the speed regulator is released to prevent rollback due to unbalanced elevator loads.

This ‘priming’ of the speed regulator is done with the pre-torque command, which is used when the speed regulator release is asserted. The speed regulator release is an internal signal to the drive and is described in detail in the drive sequencing section, *see section (5.2).*

The two possible sources for the pre-torque command are following:

- serial channel
- analog channel

For more information on the Pre-Torque Source parameter, see section (3.5.1).

5.1.4.7.1 Pre-Torque Via Serial Channel

The serial channel is a RS-422 serial port located on the drive control board. The serial protocol used to control the HPV 900 is agreed upon by MagneTek and the user.

5.1.4.7.2 Pre-Torque Via Analog Channel

The pre-torque channel is bipolar (±10V). The speed command channel is predetermined as analog channel #2. Available with the analog channel is a Pre-Torque Command Multiplier (PRE TORQUE MULT) and Pre-Torque Bias (PRE TORQUE BIAS). These parameters are used to scale the user’s analog pre-torque command to the proper range for use by the drive software. The formula below shows the scaling effects of these two parameters.

$$\left(\begin{array}{c} \textit{analog} \\ \textit{channel\#2} \\ \textit{input} \\ \textit{voltage} \end{array} - \begin{array}{c} \textit{PRE} \\ \textit{TORQUE} \\ \textit{BIAS} \end{array} \right) \times \begin{array}{c} \textit{PRE} \\ \textit{TORQUE} \\ \textit{MULT} \end{array} = \begin{array}{c} \textit{signal} \\ \textit{drive} \\ \textit{software} \\ \textit{uses} \end{array}$$

In the following example, the user is supplying the drive a 0 to +10V signal on analog channel #2 and the user wants to supply a pre-torque command from positive 100% of the motor’s rated torque to negative 100% of the motor’s rated torque. Therefore, the signal on analog channel #1 will need to be scaled before it is used by the drive software by configuring the parameters as shown in Figure 5. 9.

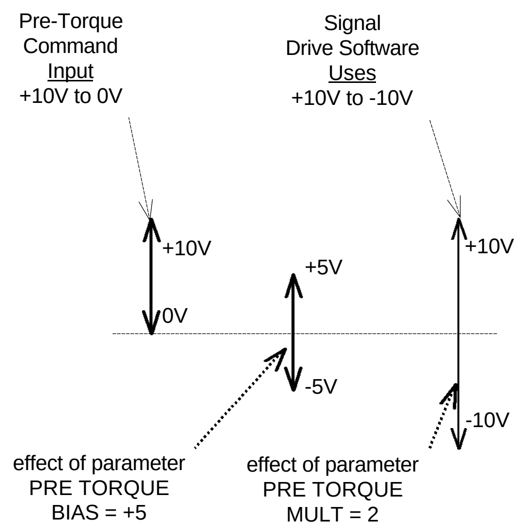


Figure 5. 9 - Example Analog Gain & Bias

5.1.4.7.3 Using Pre-Torque Latch

Some car controllers send the pre-torque and speed command on the same analog channel (see Figure 5. 10). To facilitate this, the HPV 900 has the option of latching the pre-torque command.

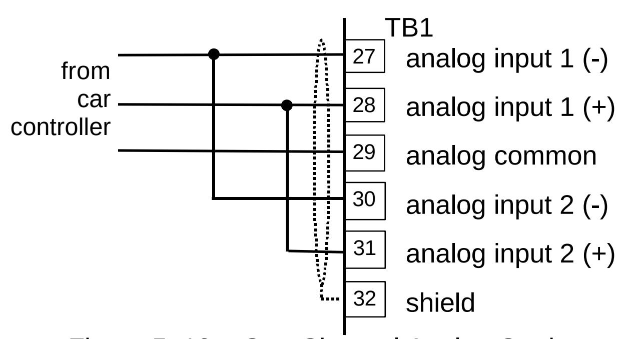


Figure 5. 10 – One Channel Analog Cmds

If pre-torque latching is selected using the Pre-Torque Latch parameter *(see section (3.5.1))*, a FALSE to TRUE transition on the pre-torque latch clock latches the value on the pre-torque channel (analog input channel 2) into the drive. This channel is allowed to change any time except during this transition without affecting the value of the latched pre-torque command.

The Pre-Torque Latch Clock controls when the pre-torque command is latched. The Pre-Torque Latch clock parameter (PTorq LATCH CLCK) determines the source of this latch control. The two choices for latch control are the serial channel or a logic input (EXTERNAL TB1). *For more information see section (3.5.1).*

The latched pre-torque command is used by the speed regulator when the internal Speed Regulator Release signal is asserted. Once the pre-torque command is used the latch and the pre-torque command is cleared. *For more information on the Speed Regulator Release signal, see section (5.2).*

5.1.4.8 Torque Ramp Down

A function unique to elevators involves the interaction between the motor torque and the mechanical brake that holds the elevator. Under full load conditions at the end of a run, if the brake is set and the motor torque is removed quickly, some brake slippage may occur. Therefore, the option of gradually reducing the motor torque is provided by the Torque Ramp Down Stop function.

Upon being enabled by the Ramped Stop Select Parameter (RAMPED STOP SEL), *see section 3.5.1*, the torque command is linearly ramped to zero from the value that was present when the 'Ramp Down Enable' was selected.

The Ramp Down Enable has the following three possible sources:

- An input logic bit (EXTERNAL TB1)
- The run logic – initiated by the removal of the run command
- The serial channel

The Ramp Down Enable Source parameter (RAMP DOWN EN SRC) is used to select one of the above options, *see section (3.5.1).*

A method of providing the Ramp Down Enable would be with a logic signal (EXTERNAL TB1) that is dedicated to that function. The Ramp Down Enable would be asserted while the Run command is still present and remain there until the ramp is completed, after which the Run command would be removed.

The RUN LOGIC option to trigger the Ramp Down Enable from the Run command is provided. In this case, removal of the Run command enables the Ramp Down Stop Function.

The time it takes for the HPV 900 to perform its ramped stop is determined by the Ramped Stop Time Parameter, *see section (3.4.1).* The Ramped Stop Time parameter (RAMPED STOP TIME) selects the amount of time it would take for the drive to ramp from the rated torque to zero torque.

5.1.4.9 Speed Deviation

The following two functions are available to indicate how the speed feedback is tracking the speed reference.

- Speed Deviation Low – indicates that the speed feedback is tracking the speed reference within a defined range.
- Speed Deviation High – indicates that the speed feedback is failing to properly track the speed reference.

The Speed Deviation Low function has the ability to set a configurable logic output*, see section (3.5.2).* The logic output will be true, when the speed feedback is tracking the speed reference within a defined range around the speed reference for a defined period of time (see Figure 5. 11). The defined range is determined by the Speed Deviation Low Level parameter (SPD DEV LO LEVEL) and the defined time is determined by the Speed Deviation Time parameter (SPD DEV TIME), *see section (3.4.1).*

The Speed Deviation High function annunciates a Speed Deviation Alarm*, see section (3.7.1.4)*, and has the ability to set a configurable logic output*, see section (3.5.2).* The alarm will be annunciated and the logic output will be true, when the speed feedback is not properly tracking the speed reference and is outside a defined range around the speed reference (see Figure 5. 11). The defined range is determined by the Speed Deviation High Level parameter (SPD DEV HI LEVEL), *see section (3.4.1).*

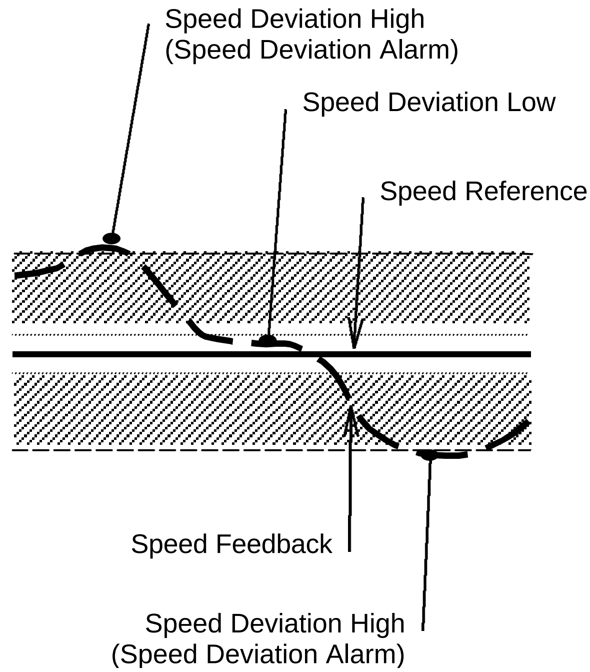


Figure 5. 11 - Speed Deviation Example

5.1.5 Vector Control

The torque control of the HPV uses digital flux vector control technology. The block diagram of the vector control is shown in Figure 5. 12

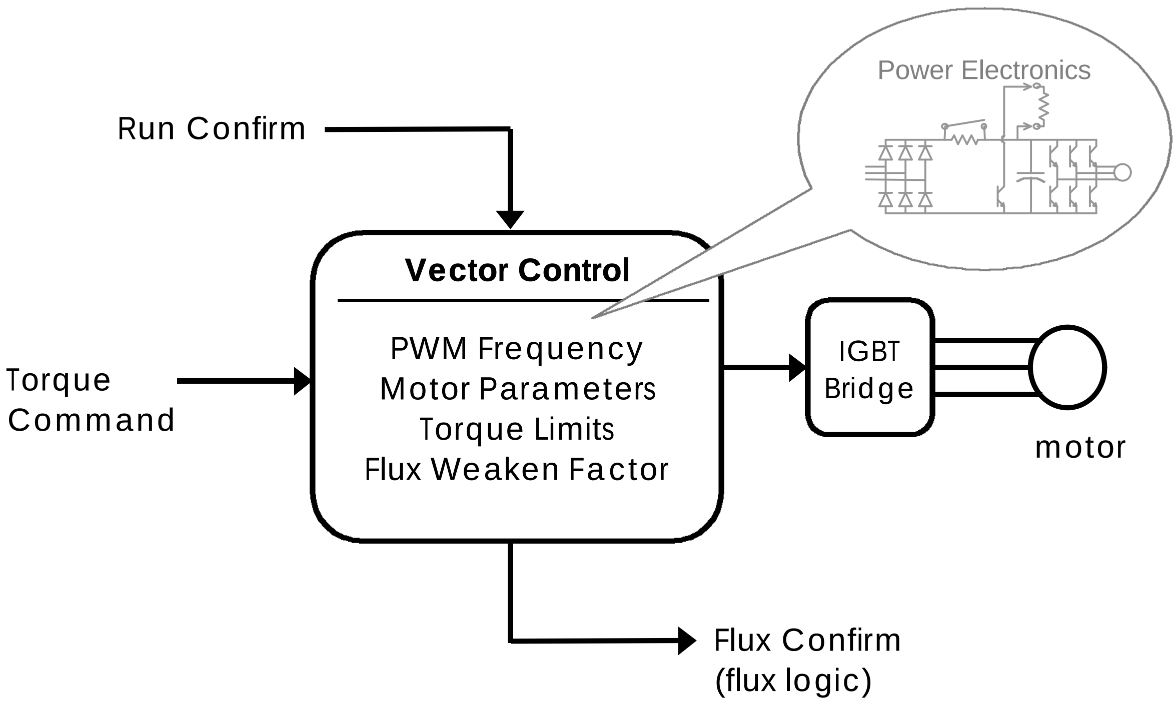


Figure 5. 12 - Vector Control Block Diagram

The inputs to the vector control are the following:

- Torque Command– the output of the speed regulator and is described above in *section (5.1.4*).
- Run Confirm – an internal signal to the drive and is described in detail in the drive sequencing section, *see section (5.2).*

Internal to the vector control are the following:

- PWM Frequency – sets the pulse width modulation frequency or 'carrier' frequency of the drive, see *section (3.4.6).*
- Motor Parameters – used to defined the characteristics of the motor connected to the drive, *see section (3.4.6).*
- Torque Limits – the HPV 900 defined torque limits, *see section (5.1.4.6).* The setting of these parameters have an effect on when the HPV 900 goes into field weakening, *see section (5.1.5.1).*
- Flux Weaken Factor – is defined, *see section (5.1.5.1).*

The output of the vector control goes through the power electronics to the motor.

- Flux Confirm – an internal signal generated by the drive, when the drive's estimated flux level reaches 90% of the flux reference. This signal is the "flux logic" input shown in the drive sequencing section, *see section (5.2).*

5.1.5.1 Field Weakening

The HPV 900 will calculate the rated flux level by using the following motor parameters:

- rated motor voltage
- rated motor current
- rated excitation frequency
- stator resistance
- stator and rotor leakage reactances.

As motor speed increases, the drive will calculate the maximum available flux and decrease the flux automatically. This 'field weakening' will cause less torque to be available during this time.

5.1.5.1.1 Traditional Flux Weakening

Traditionally, AC drives set the flux level to 100% up to rated speed, then reduce it above rated speed.

The product of flux and speed produces a CEMF. The drive's output voltage must overcome the CEMF and voltage drop across the leakage inductance to produce current.

With traditional flux control, the drive cannot supply more than 100% current and therefore 100% torque, at the motor's rated speed.

The speed-torque curve of a traditional AC drive is shown in Figure 5. 13.

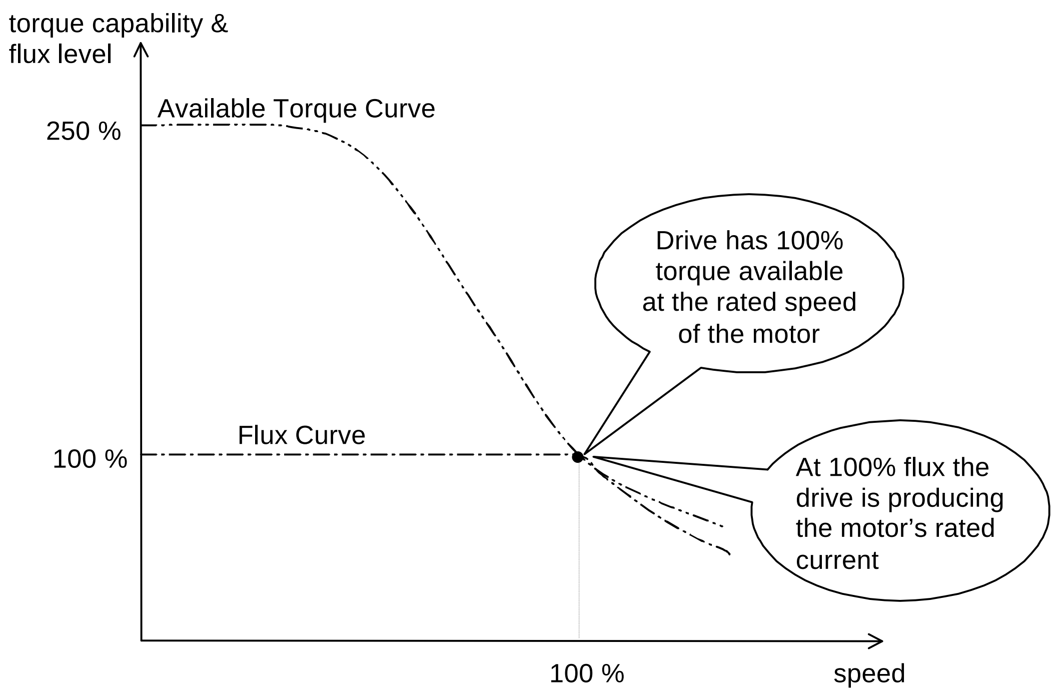


Figure 5. 13 - Speed-Torque Curve (Traditional Flux Weakening)

5.1.5.1.2 HPV 900 Flux Weakening

In the HPV 900, flux weakening begins before the motor reaches rated speed.

The drive can supply more than 100% current, since the CEMF is lower. Therefore, the drive can produce more than 100% of the motor's rated torque at the rated speed.

Figure 5. 14 shows the speed-torque curve of a drive system operating at 250% current. Note that the "earlier" flux weakening allows the drive to supply more than 100% torque at rated speed.

However, this increased torque capability requires more than 100% motor current to produce 100% torque at rated speed.

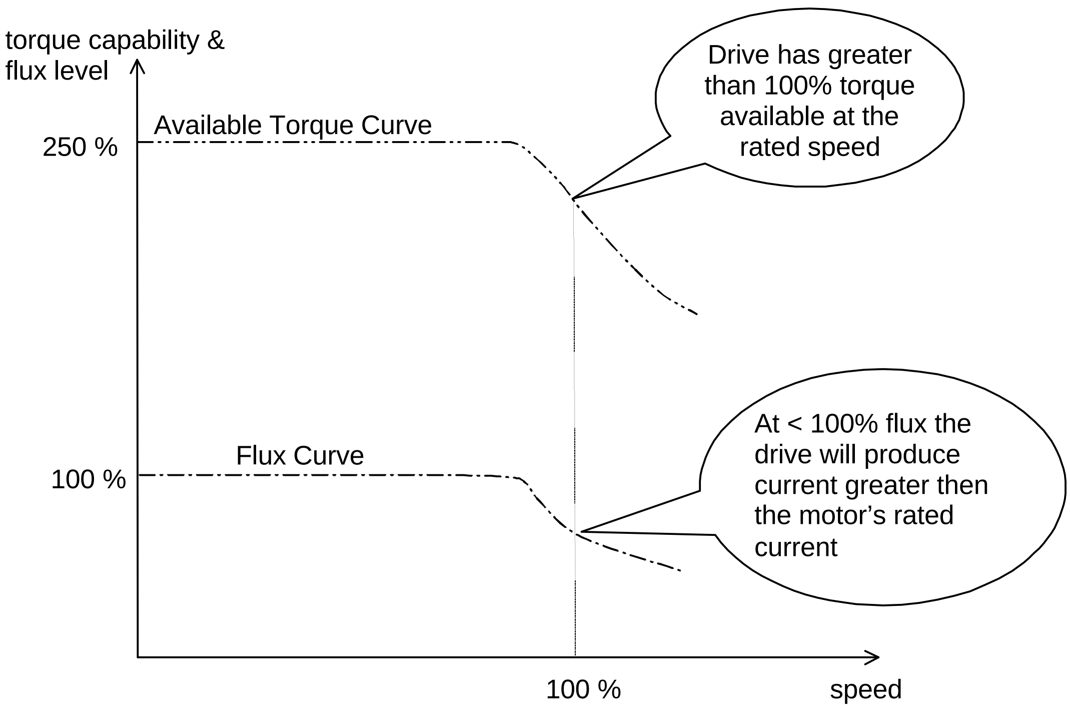


Figure 5. 14 - Speed-Torque Curve (HPV 900 Flux Weakening)

5.1.5.1.3 Flux Weakening Parameters

The following three HPV 900 parameters effect both the available torque curve and flux level curve:

- Motor Torque Limit
  (MTR TORQUE LIMIT)
- Regenerative Mode Torque Limit
  (REGEN TORQ LIMIT)
- Flux Weakening Factor
  (FLUX WKN FACTOR)

The highest of the two torque limits is used as the torque limit that defines the two curves.

An example of the effects of the torque limit on the amount of flux weakening needed and the amount of torque available through the entire speed range is shown in Figure 5. 15.

By lowering the torque limit you can effectively reduce the amount of field weakening needed and reduce the amount of current needed by the motor at motor's rated speed. The trade-off is you have lower over-all torque available.

In order to have more torque available at the lower speeds, the HPV 900 has the Flux Weakening Factor parameter, which effectively reduces the amount of torque available only at the higher speeds. This will allow the HPV 900 to have a higher flux level at the motor's rated speed and require less current to produce rated torque.

An example of the effects of the flux weakening factor on the amount of flux weakening needed and the amount of torque available through the entire speed range is also shown in Figure 5. 15.

The maximum amount of torque available can be defined as the following:

- At low speeds…
  the torque limit parameters
- At high speeds…
  function of the torque limit parameters and the flux weakening factor

For more information on the torque limit parameters or the flux weakening factor, see section (3.4.1).

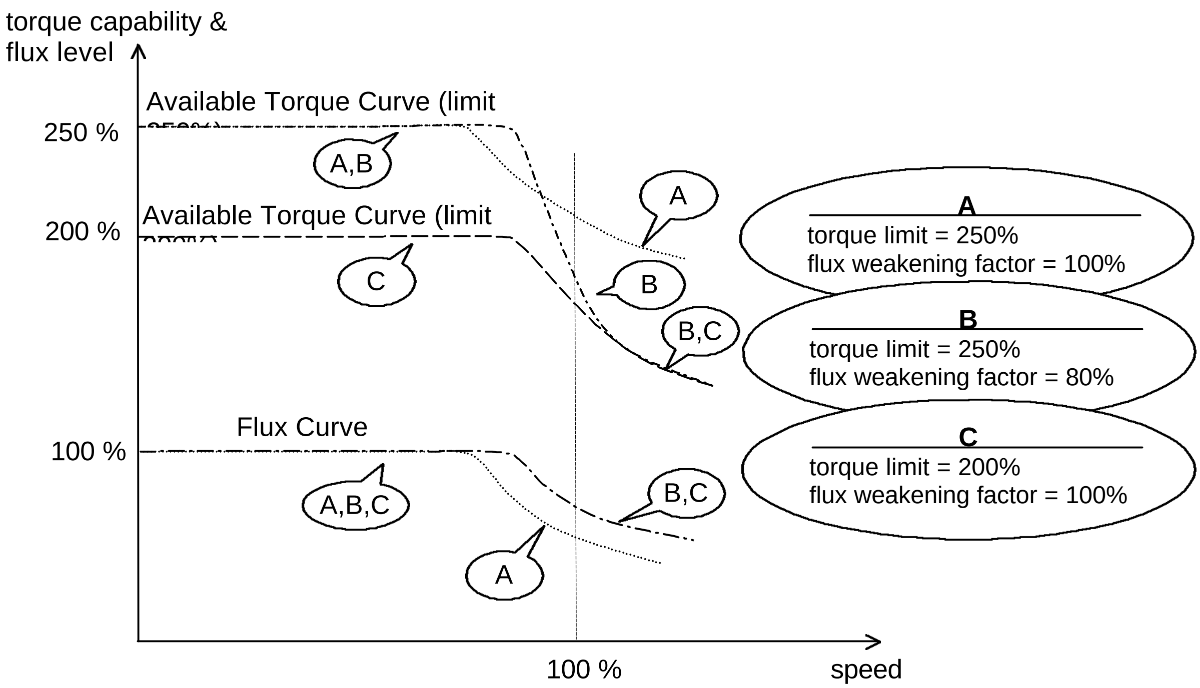


Figure 5. 15 - Speed-Torque Curves (Examples)

5.2 DRIVE SEQUENCING

In general, the sequence of events that must transpire for the elevator to run are described here. Not all functions are necessarily selected by the user but they are available if desired.

5.2.1 Standard I/O Sequence

Figure 5. 16 detail the HPV 900's standard input/output sequence.

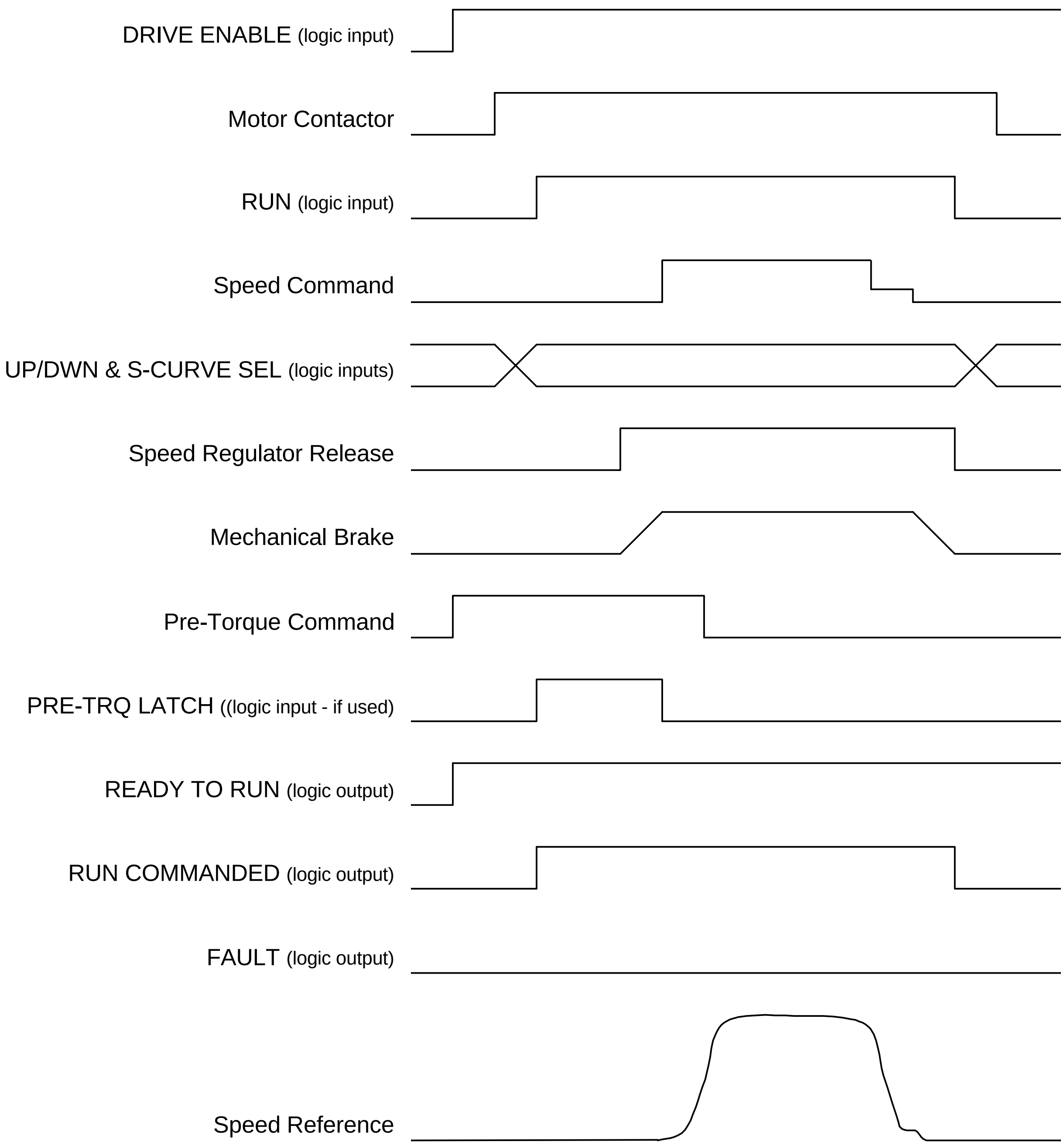


Figure 5. 16 – HPV 900 Standard I/O Sequence

The following describes each of labels of the I/O Sequences shown in Figure 5. 16, Figure 5. 17, Figure 5. 18, and Figure 5. 19.

<u>DRIVE ENABLE</u>
An external logic input intended to be used with the elevator control's safety chain as a permissive that provides a way for external logic to shut down the drive. The drive will not be permitted to run until this signal is true. *For more information, see section (3.5.2).*

<u>Motor Contactor</u>
The motor contactor must be closed before the run command is issued and should remain closed until the RUN COMMANDED logic output goes false.

<u>RUN</u>
An external logic input that commands the drive to run. But, before a run command can be recognized, the Ready to Run output must be true. For the Ready to Run output to be true, the following conditions must be present:

- The software must be up and ready.
- No fault can be present.

For more information, see section (3.5.2).

<u>Speed Command</u>
The commanded speed profile from the multi-step logic inputs, the analog channel, or the serial channel. *For more information, see section (5.1.1).*

<u>UP/DWN or S-CURVE SEL</u>
The following external logic outputs:

- UP/DWN logic input - used to change the sign of the speed command
- S-CURVE SEL logic inputs – used to select different s-curves

These logic inputs should be selected before the run command is initiated.
For more information, see section (3.5.2).

<u>Speed Regulator Release</u>
An internal signal to the drive used to control the HPV 900's speed regulator. For more on the logic that creates this signal, see Figure 5. 20.

<u>Mechanical Brake</u>
Shows the state of the mechanical brake. A true state is when the brake is picked (open). The mechanical brake should be picked before a non-zero speed command is given. At zero speed, the mechanical brake should be applied before the run command is removed.

<u>Pre-Torque</u>
When it is used, the HPV 900 should receive its pre-torque command via the analog channel or the serial channel. *For more information, see section (5.1.4.7).*

<u>PRE-TRQ LATCH</u>
An external logic input used to latch in the value of the pre-torque command (if used). The rising edge of the pre-torque latch should be applied on or before the run command. *For more information, see section (3.1.4.7.3).*

<u>READY TO RUN</u>
An external logic output the signals the following:

- The software must be up and ready
- No faults are present

For more information, see section (3.5.3).

<u>RUN COMMANDED</u>
An external logic output reflects the condition of the RUN logic input.
For more information, see section (3.5.3).

<u>FAULT</u>
An external logic output that becomes true when a fault is present in the drive.
For more information, see section (3.5.3).

<u>Speed Reference</u>
Shows the speed reference as it follows the HPV 900's internal S-Curve.

5.2.2 Torque Ramp Down Sequence

Figure 5. 17 details the changes in the input/output sequence when using the Torque Ramp Down function, which is triggered by the removable of the run command. *For more information, see section (5.1.4.8).*

When using the Torque Ramp Down function, the RUN COMMANDED logic output stays true until the torque output is ramped to zero, which is different then in the Standard I/O Sequence.

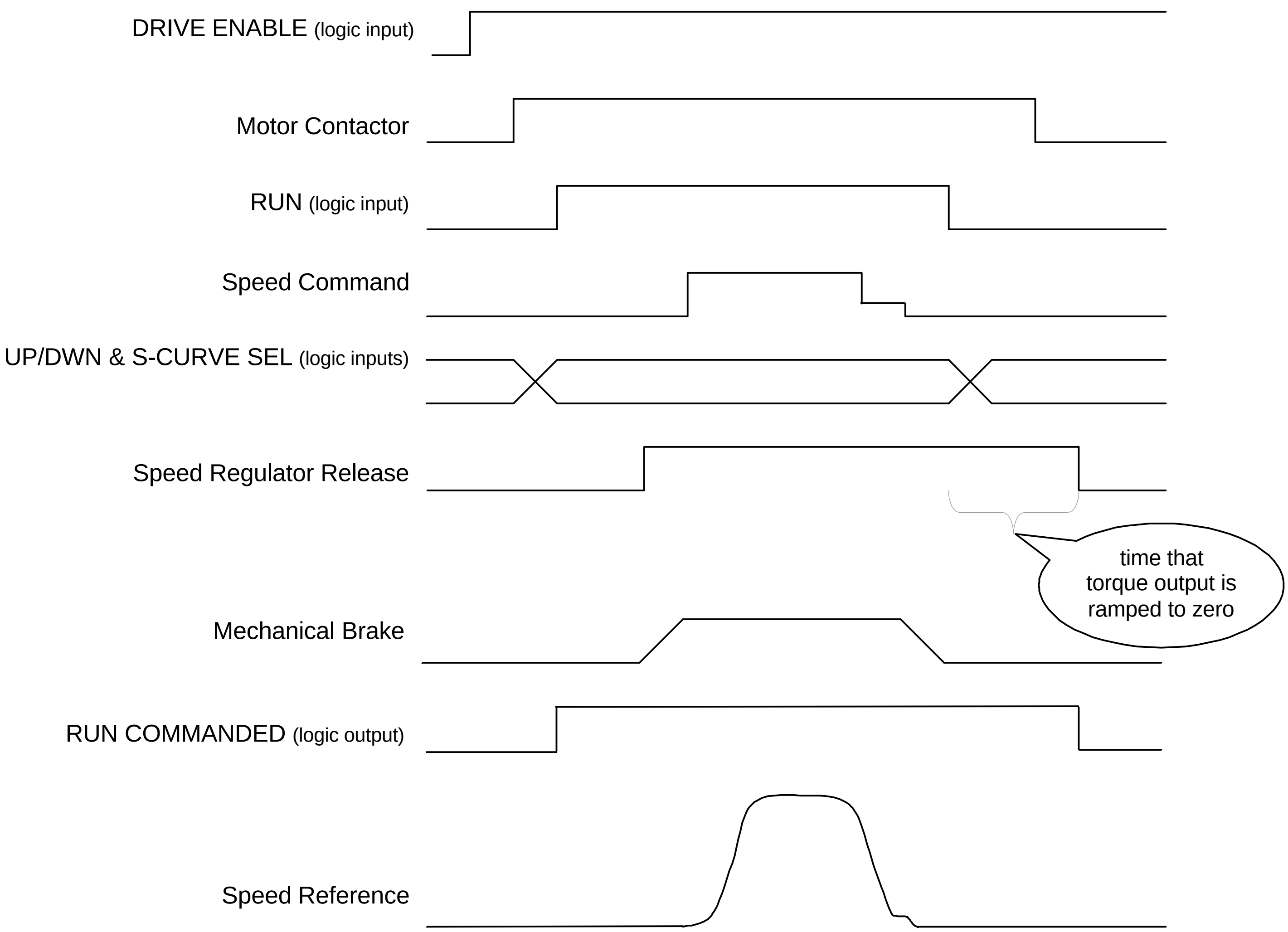


Figure 5. 17 - Changes to I/O Sequence when using Torque Ramp Down Function

5.2.4 Contactor Control Sequence

Figure 5. 18 details the changes in the input/output sequence when the HPV 900 controller the contactor.

When the RUN command is recognized, the CLOSE CONTACT logic output will become true. This in turn will close an AC contactor between the drive and the motor. The operation of the HPV 900 cannot continue until the drive has confirmation that the contactor has been closed via the CONTACT CONFIRM logic input.

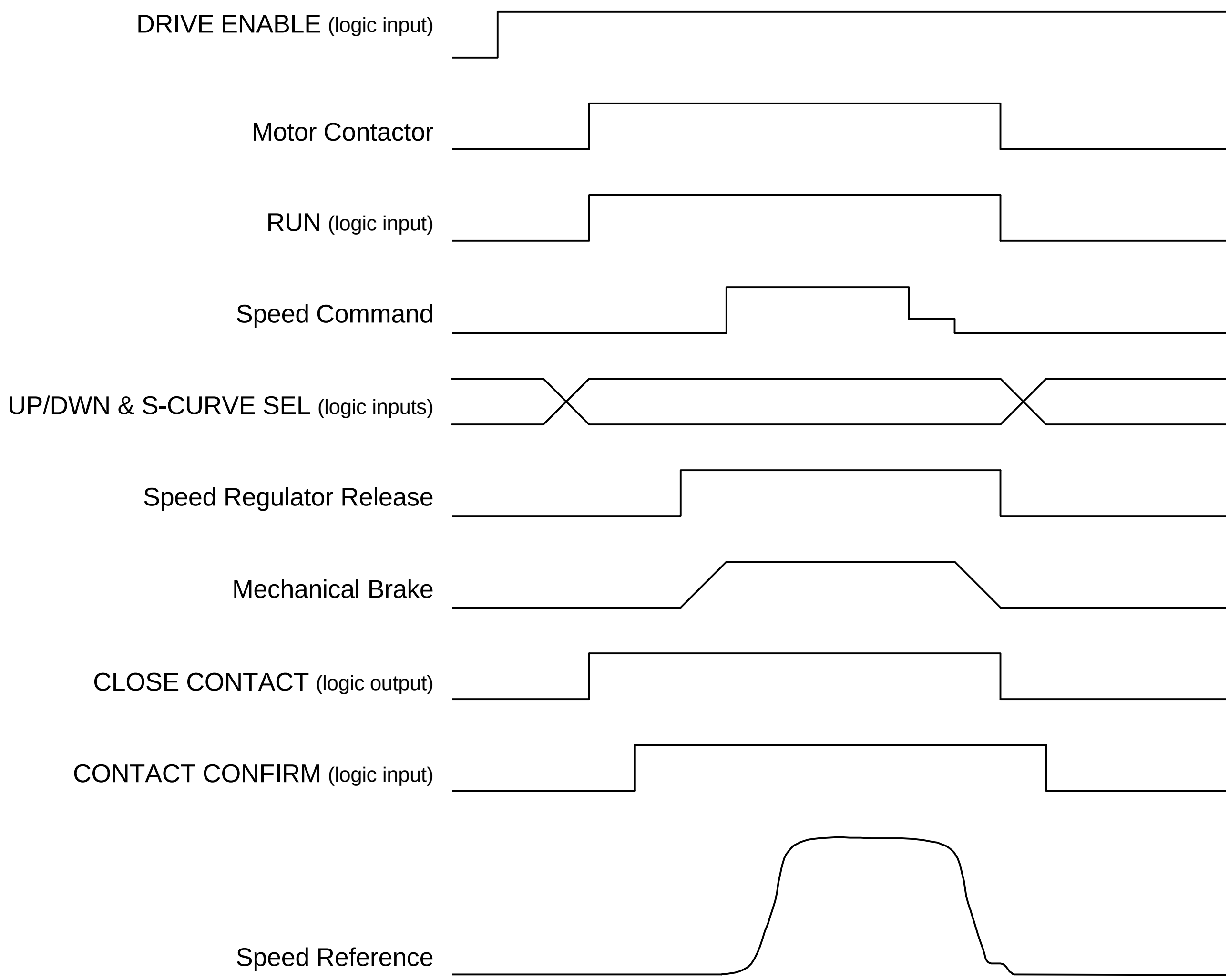


Figure 5. 18 - Changes to I/O Sequences when the HPV 900 Controls the Contactor

5.2.5 Speed Ref Release Sequence

The Speed Reference Release parameter (SPD REF RELEASE) can select when the Speed Reference Release signal is asserted. *For more information, see section (3.5.1).*

Released with Speed Regulator
If the user does not want the drive to wait for the mechanical brake to be picked then Speed Reference Release signal can be made equal to Speed Regulator Release signal by making SPD REF RELEASE = REG RELEASE. This allows the drive to receive non-zero speed commands. This may be helpful if the brake is already picked or the controller wishes to pull through the brake to prevent car rollback. The HPV 900 will follow the standard I/O sequence *(see section (5.2.1)).*

Released with Mechanical Brake
If the user does want the drive to wait for the mechanical brake to be picked then SPD REF RELEASE = BRAKE PICKED. Figure 5. 19 details the changes in the input/output sequence when the Speed Reference Release is connected with the brake logic.

The following describes each of labels of the I/O Sequence shown in Figure 5. 19.

MECH BRAKE PICK
An external logic input to signal the mechanical brake is picked “open”. *For more information, see section (3.5.2).*

MECH BRAKE HOLD
An external logic input to used open by the brake hold fault *For more information, see section (3.5.2).*

BRAKE PICK
An external logic output used to pick the mechanical brake. *For more information, see section (3.5.3).*

BRAKE HOLD
An external logic output generated once the BRAKE PICK logic input is received. *For more information, see section (3.5.3).*

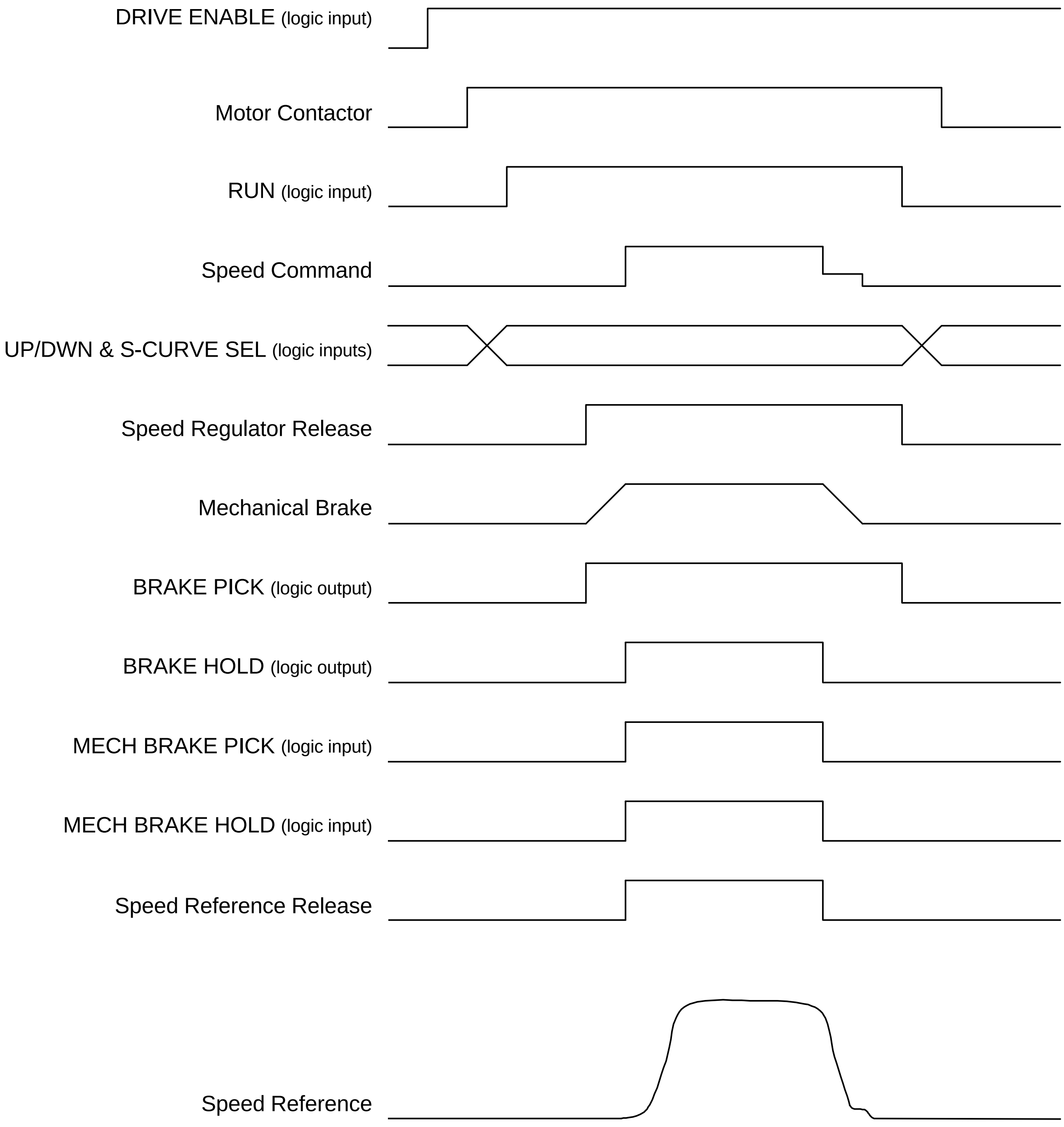


Figure 5. 19 - Changes to I/O Sequence when Using Brake Logic

5.2.6 Sequencing Logic Flow Diagram

Figure 5. 20 details the logic signals that are used to create the following three drive internal signals:

- Speed Reference Release – used by the Speed Reference Generator
- Speed Regulator Release – used by the Speed Regulator
- Run Confirm – used by the Vector Control

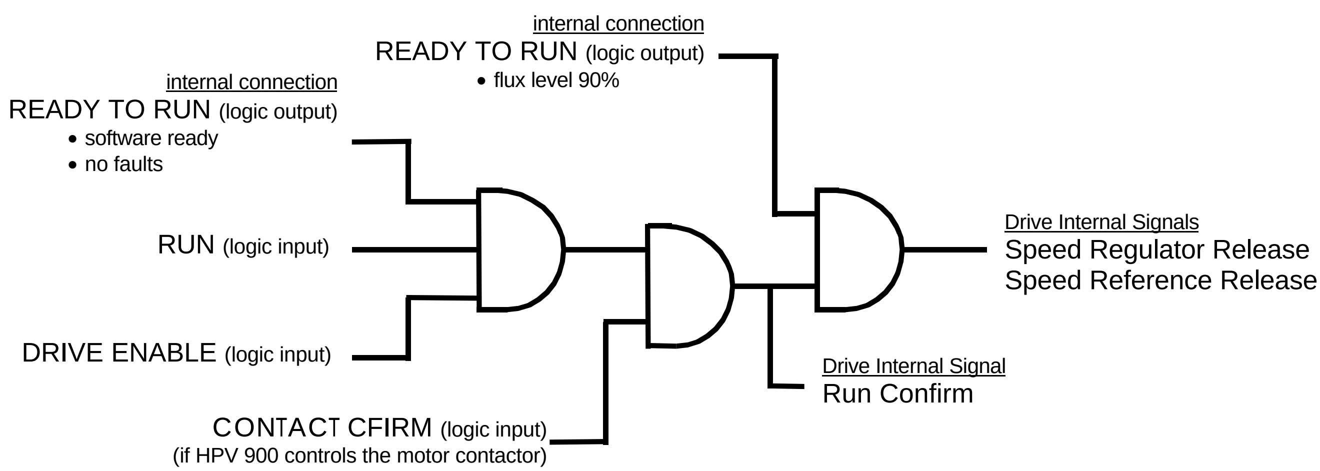


Figure 5. 20 - Drive Sequencing Logic Flow Diagram

5.2.7 LOGIC I/O RELATIONSHIP

The relationship between the drive sequencing input and output logic is detailed in Figure 5. 21.

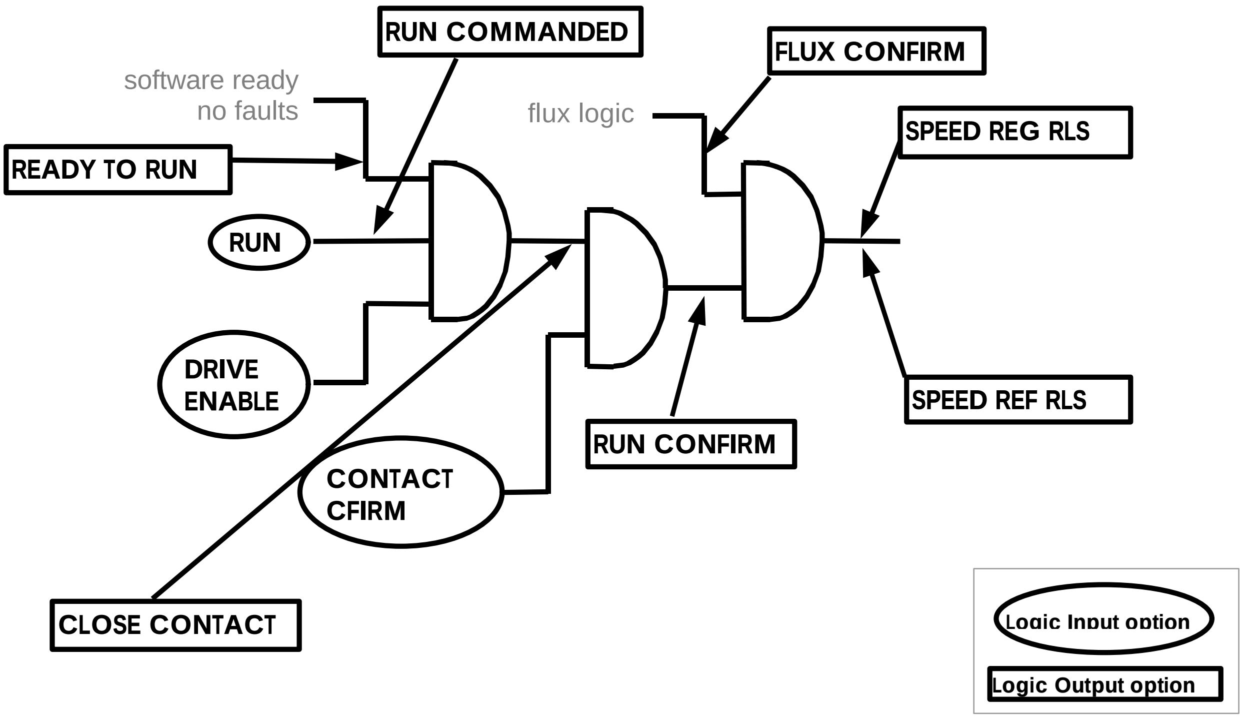


Figure 5. 21 - Drive Sequencing I/O Relationship

5.3 OVERLOAD

The elevator drive has two overload functions: a drive overload and a motor overload both calculated by the drive.

The drive overload is a fixed function that is based on the maximum current capability of the drive and generates a fault.

The motor overload is a user selectable function that is intended to protect the motor from thermal overload and generates an alarm. These overloads are independent of each other. If the motor overload is setup to allow more current than the drive can produce then the drive overload will protect the IGBTs.

5.3.1 Drive Overload

The drive provide steady state currents of 150% for 60 seconds and 250% for 5 seconds, where 100% current is the general purpose rated amps for a particular horsepower drive. The overload curve is shown in Figure 5. 22.

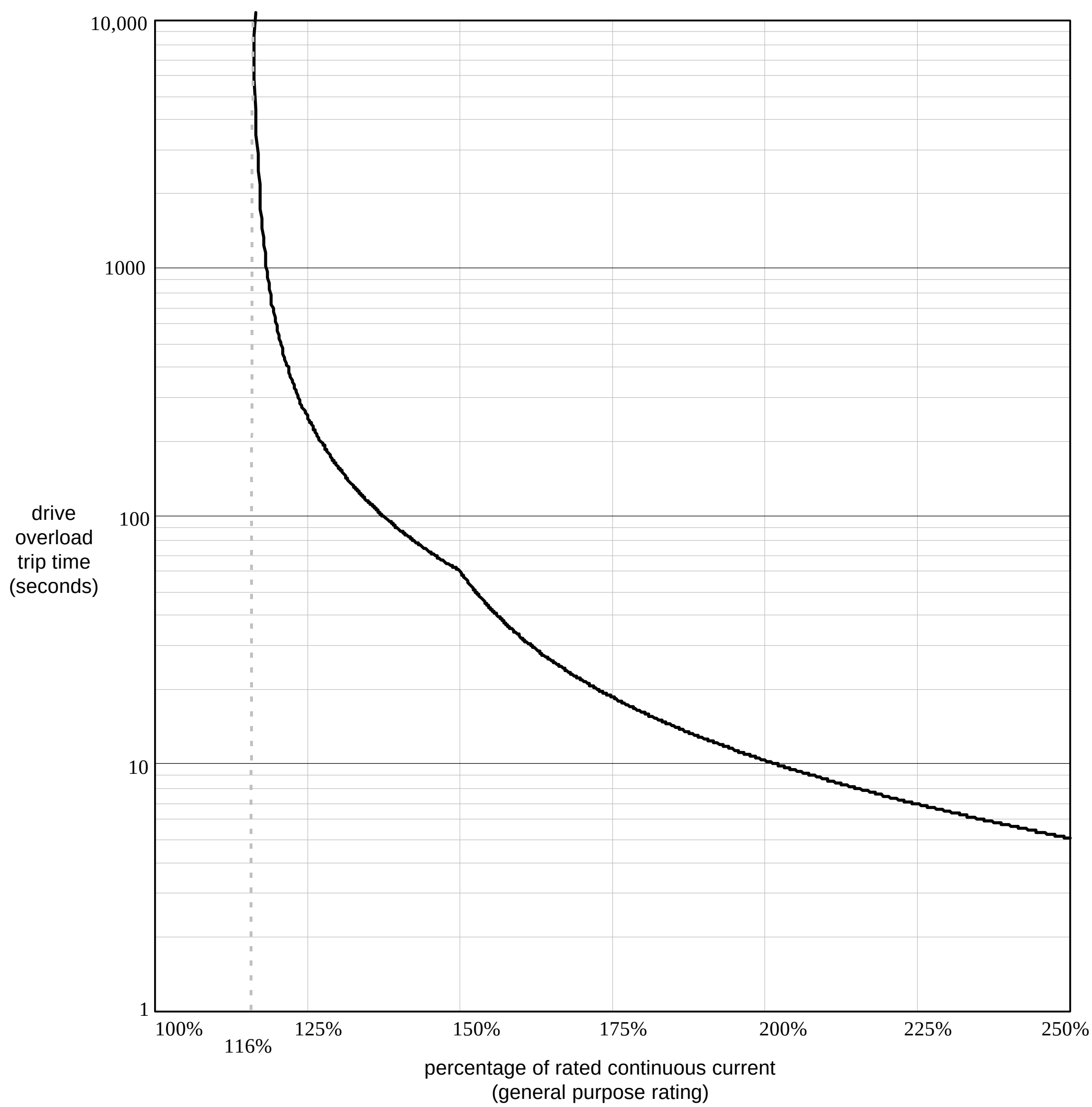
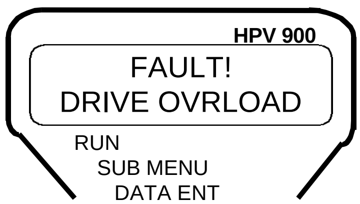


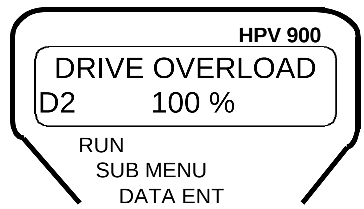
Figure 5. 22 - Drive Overload Curve

When the drive had exceeded the defined drive overload curve, the drive will declare an drive overload fault. *For more information, see section (3.7.1.3).*



The drive overload fault can also be assigned to a logic output *(see section (3.5.3)).*

Under the POWER DATA display sub menu, The DRIVE OVERLOAD value displays the percentage of motor overload trip level reached. Once this value reaches 100% the drive has exceeded its defined overload curve and a drive overload fault is declared by the drive. *For more information, see section (3.3.2).*



5.3.2 Motor Overload

Unlike the drive overload, the motor overload parameters can be adjusted by the user. The following two parameters *(see section(3.4.6))* are used to define the motor overload curve.

- The motor current overload start level (OVLD START LEVEL) parameter defines maximum current at which motor can run continuously.
- The motor current time out (OVLD TIME OUT) parameter is the other parameter used to define the overload curve. This parameter is defined as the as the amount of time before a motor overload alarm occurs when the motor is running at the current level defined below:

$$\begin{pmatrix} OVLD \\ START \\ LEVEL \end{pmatrix} + \begin{pmatrix} 40\% \\ rated \\ motor \\ current \end{pmatrix}$$

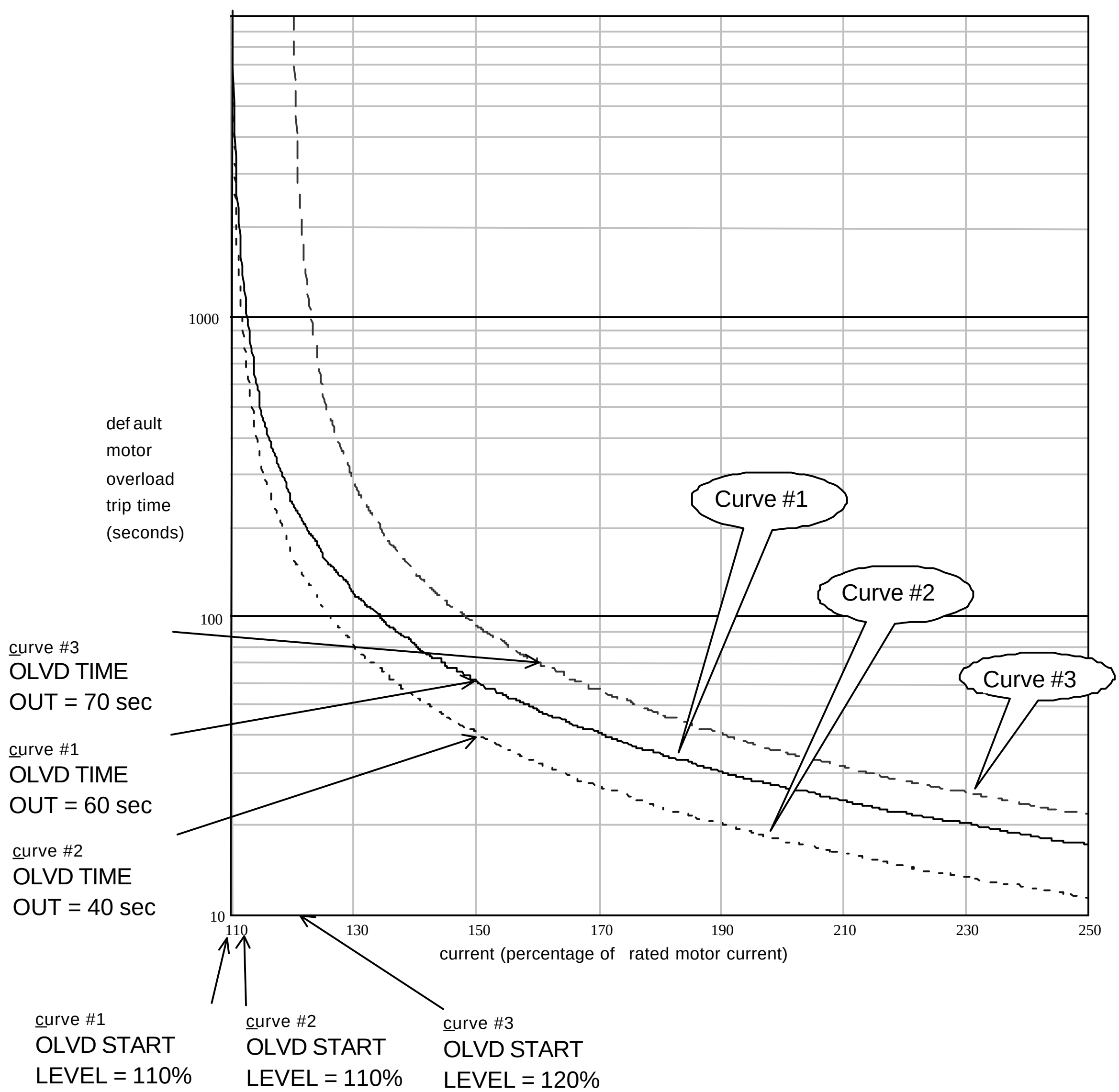


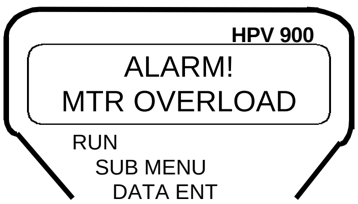
Figure 5. 23 - Motor Overload Curve

In Figure 5. 23, three overload curves are shown. Curve #1 is the default motor overload curve. The parameter settings that define the three overload curves are shown in Table 5. 4.

	OVLD START LEVEL	OVLD TIME OUT
curve #1	110%	60 sec
curve #2	110%	40 sec
curve #3	120%	70 sec

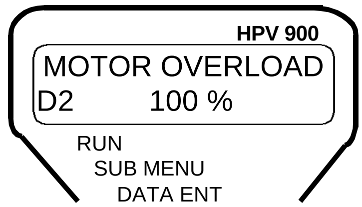
Table 5. 4 - Motor Overload Parameters

When the motor had exceeded the user defined motor overload curve, the drive will declare an motor overload alarm. *For more information, see section (3.7.1.4).*



The motor overload alarm can also be assigned to a logic output *(see section (3.5.3)).*

Under the POWER DATA display sub menu, The MOTOR OVERLOAD value displays the percentage of motor overload trip level reached. Once this value reaches 100% the motor has exceeded its user defined overload curve and a motor overload alarm is declared by the drive. *For more information, see section (3.3.2).*



The drive will only declare a motor overload and the user is responsible for action.

But, if the user wants the drive to declare a fault on a motor overload the following need to be completed:

- logic output configured to MTR OVERLOAD
- logic input configured to EXT FAULT
- wire the EXT FAULT logic input terminal to the to MTR OVERLOAD logic output terminal
- wire the logic input common terminal to the logic output common

With the above set-up, the drive will then declare an External Fault on a motor overload.

5.4 S-CURVE DETAILS

The HPV 900 speed command is passed through an internal S-curve in order to produce the speed reference. In general, the S curve function takes an arbitrary speed command and generates a speed reference subject to the conditions that the maximum accel, decel and jerk rates not be exceeded. The speed command is typically the target speed that the reference is headed to.

5.4.1 Definitions

Figure 5. 24 below shows the six parameters associated with an S-Curve data set:

- Accel - Maximum allowed acceleration rate (ft/s^2 or m/s^2)
- Decel - Maximum allowed deceleration rate (ft/s^2 or m/s^2)
- Acc Jerk In - Maximum allowed change in acceleration towards Accel (ft/s^3 or m/s^3)
- Acc Jerk Out - Maximum allowed change in acceleration from Accel (ft/s^3 or m/s^3)
- Decel Jerk In - Maximum allowed change in deceleration towards Decel (ft/s^3 or m/s^3)
- Decel Jerk Out - Maximum allowed change in deceleration from Decel (ft/s^3 or m/s^3)

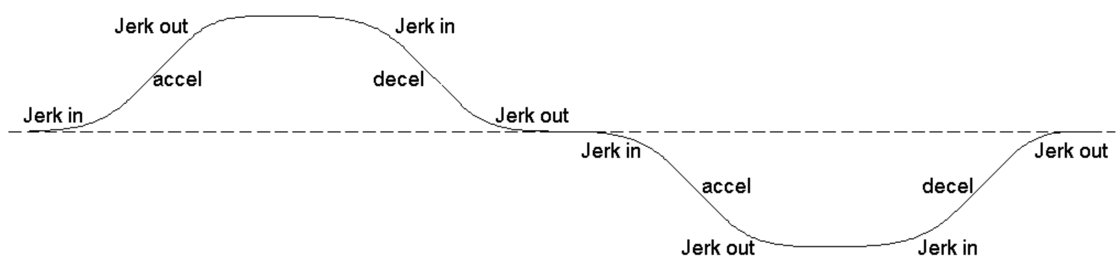


Figure 5. 24 - S-Curve Definitions

5.4.2 S-curve Parameters

A HPV 900 S-curve is specified by four parameters: acceleration (accel) rate, deceleration (decel) rate, leveling jerk (lev jerk) rate, and jerk rate. The jerk rates are split in order to facilitate elevator fine tuning.

- Accel Rate - acceleration rate
- Decel Rate - deceleration rate
- Jerk Rate - accel jerk in, accel jerk out, and decel jerk in
- Leveling Jerk Rate - decel jerk out

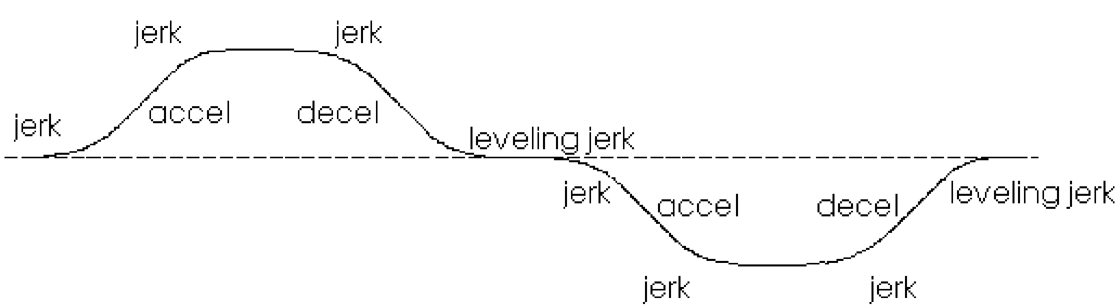


Figure 5. 25 - S-Curve Parameters

Figure 5. 26 shows an example of jerk rates, accelerations, and speed commands for a given S-curve.

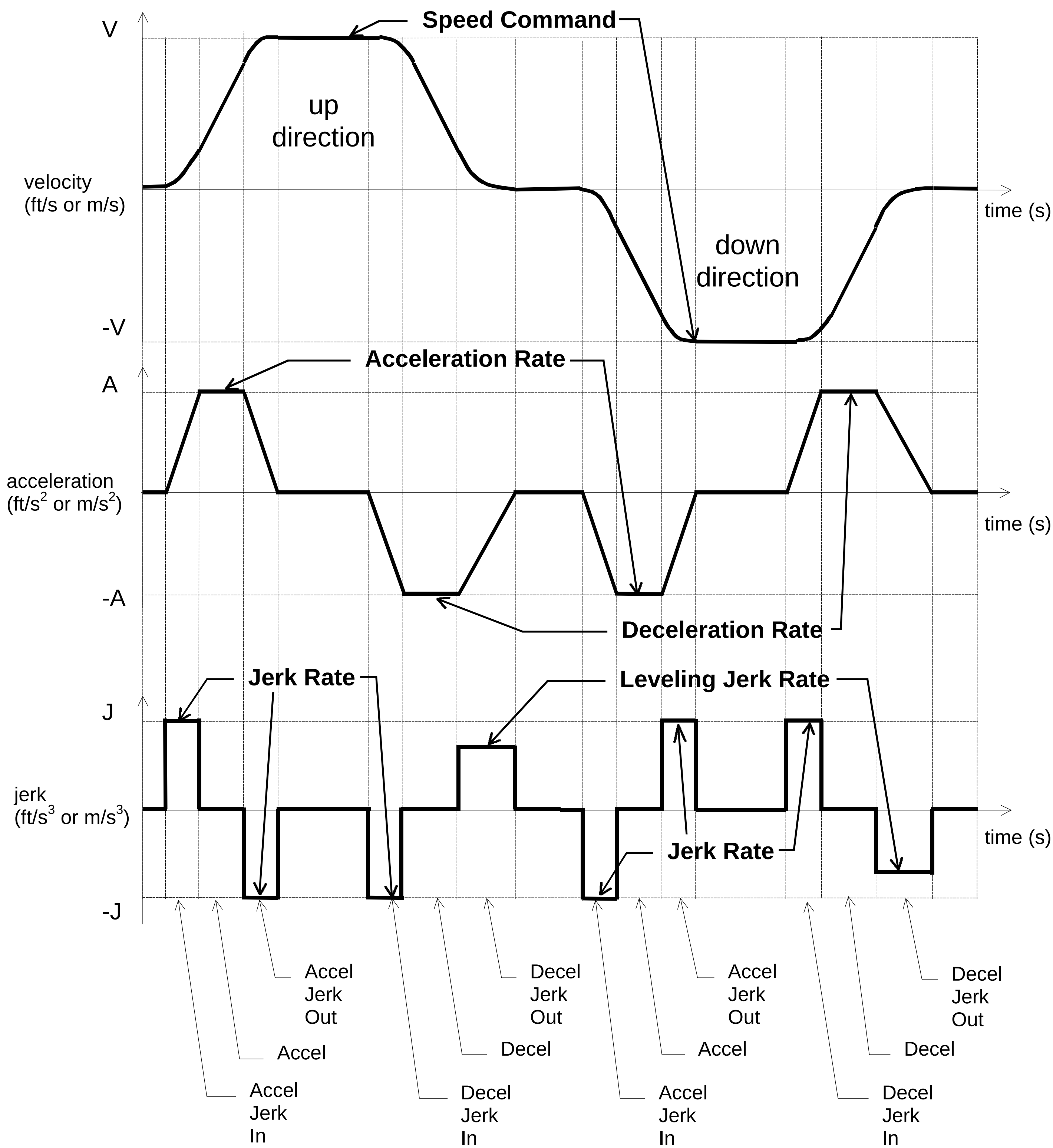


Figure 5. 26 - Example Of Jerk Rates, Accelerations, and Speed Commands

5.5 ADAPTIVE TUNE

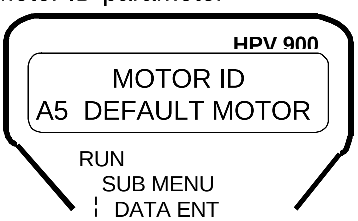
The adaptive tune is part of the HPV 900 software and is used to automatically calculate the percentage no load current and the estimated rated rpm (slip frequency). The adaptive tune constantly adjusts these two values to obtain the maximum performance from the motor.

5.5.1 Using the Adaptive Tune to Tune an Unknown Motor

The following is a step-by-step procedure for tuning an unknown motor for maximum performance with the HPV 900.

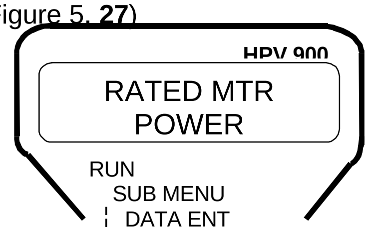
5.5.1.1 Initial Set-up

- Select the “default motor” option for the Motor ID parameter



The “default motor” selection for the motor id will place a zero values in the motor nameplate parameters (see Figure 5. **27**). This selection will also load nominal values for the other motor parameters listed in Table 5. 5.

- Now, enter the motor nameplate data into the needed motor nameplate parameters (see
- Figure 5. **27**)



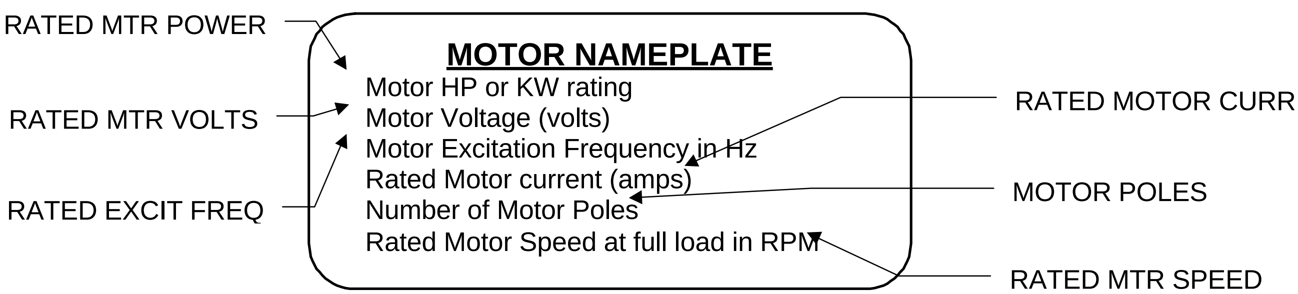


Figure 5. 27 - Motor Parameters Entered from Motor Nameplate

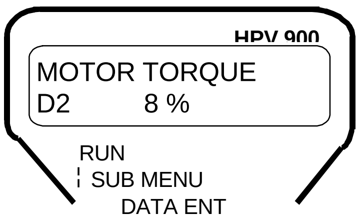
percentage no load current	% NO LOAD CURR	35.0 %
stator leakage reactance	STATOR LEAKAGE X	9.0 %
rotor leakage reactance	ROTOR LEAKAGE X	9.0 %
stator resistance	STATOR RESIST	1.5 %
motor loss - motor iron loss	MOTOR IRON LOSS	0.5 %
motor loss - motor mechanical loss	MOTOR MECH LOSS	1.0 %
flux curve - flux saturation break point	FLUX SAT BREAK	75 %
flux curve - flux saturation slope #1	FLUX SAT SLOPE 1	0 %
flux curve - flux saturation slope #2	FLUX SAT SLOPE 2	50 %

Table 5. 5 - Nominal Values for Motor Parameters

5.5.1.2 Tuning Motor No-Load Current

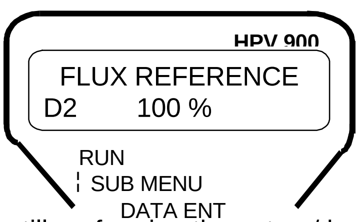
With a balanced car, run the car at 70% contract speed from top floor to the bottom floor then back to the top floor.

- During these runs verify under DISPLAY MENU - POWER DATA D2 that the MOTOR TORQUE is between ±15%. If the value is larger then ±15% the car is not balanced correctly.

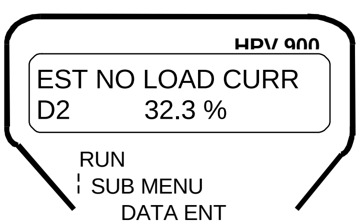


NOTE: If the elevator system has no compensation chains, achieving balanced condition may be difficult. In that case, the MOTOR TORQUE should be between ±15% for as much of the run as possible.

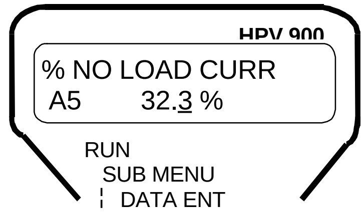
- Also, verify that the FLUX REFERENCE is 100%. If the value is not equal to 100% reduce the speed to less then 70% contract speed and check again.



- While still performing these top / bottom runs observe under DISPLAY MENU - POWER DATA D2 the EST NO LOAD CURR value.



- Enter this estimated value into the motor parameter.

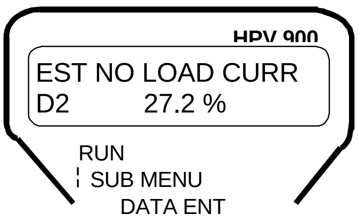


- Continue iterating the above two steps until the two values are within 2%. If the values do not converge after two iterations, verify the information entered in the initial set-up (section 5.5.1.1) is correct.
- After the values converge, again verify the MOTOR TORQUE < 15% and the FLUX REFERENCE = 100%.

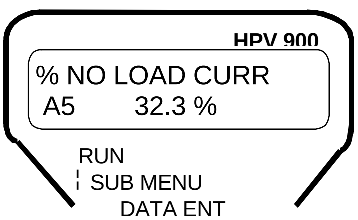
5.5.1.2 Tuning Motor's Flux Saturation Curve

With a balanced car, run the car at 100% contract speed from top floor to the bottom floor then back to the top floor.

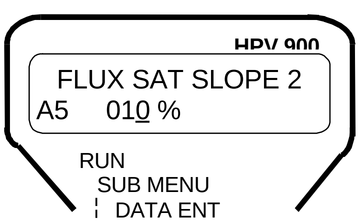
- During these top / bottom runs observe under DISPLAY MENU - POWER DATA D2 the EST NO LOAD CURR value.



- Compare the displayed value EST NO LOAD CURR with the value entered for % NO LOAD CURR under the ADJUST MENU - MOTOR A5



- If the EST NO LOAD CURR is 2% larger than the % NO LOAD CURR then, increase the FLUX SAT SLOPE 2 by 10%.
- If the EST NO LOAD CURR is 2% smaller than the % NO LOAD CURR then, decrease the FLUX SAT SLOPE 2 by 10%.



NOTE: If the EST NO LOAD CURR and % NO LOAD CURR are within 2% of each other, then continue on to Tuning the Rated Motor RPM (5.5.1.3)

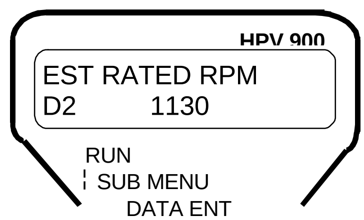
- Continue iterating FLUX SAT SLOPE 2 in 10% increments until the EST NO LOAD CURR and % NO LOAD CURR are within 2% of each other.

  NOTE: Remember change only the FLUX SAT SLOP 2 parameter DO NOT change any other parameter (these were fixed in the previous steps).

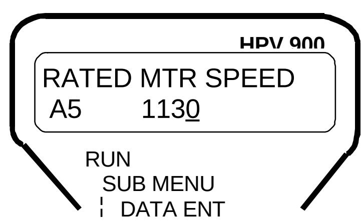
5.5.1.3 Tuning Rated Motor RPM

With a full-load car, run the car at 100% contract speed from top floor to the bottom floor then back to the top floor.

- During these top / bottom runs observe under DISPLAY MENU - POWER DATA D2 the EST RATED RPM value.



- Enter this estimated value into the motor parameter.



- Continue iterating the above to steps until the two values are within 3 RPM.

  NOTE: Remember change only the RATED MTR SPEED parameter DO NOT change any other parameter (these were fixed in the previous steps).

5.6 ESTIMATING SYSTEM INERTIA

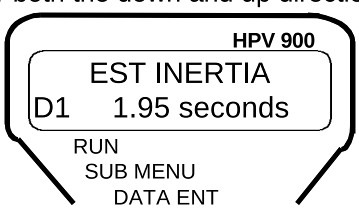
The HPV 900 software can be used to calculate the inertia of the entire elevator, which is used for accurate tuning of the speed regulator.

The following is a step-by-step procedure for using the HPV 900 to estimate the elevator system inertia.

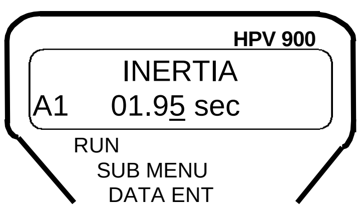
5.6.1 Using the Software to Estimate the System's Inertia

With a balanced car, run the car at 100% contract speed from top floor to the bottom floor then back to the top floor.

- Observe the EST INERTIA under DISPLAY MENU - ELEVATOR DATA D1 for both the down and up direction.



- Average the two values and enter the DRIVE A1 parameter.



5.7 ELEVATOR DUTY CYCLE

The HPV 900 Ratings Table (see Figure 5. 28) has the following two continuous current ratings:

- Continuous Output Current General Purpose Rating
- Continuous Output Current Elevator Duty Cycle Rating

The General Purpose rating defines the maximum amount of current the drive can produce if the drive was to run non-stop.

The Elevator Duty Cycle Rating defines the maximum amount of current the drive can produce following the worst case Elevator System Load Profile. The following assumptions are made for the load profile:

- Profile is considered the worst case
- Elevator is operating at full load
- Motor/drive operating under 189 start/hr.
- Car weight to counter-weight ratio - 60:40

The details of the Elevator System Load Profile are shown in Figure 5. 29 and Table 5. 6.

Rated Full-Load Current

Rated Current From the Elevator System Load Profile

250% of Rated Full-Load Current

Rated Input Voltage	Rated Horsepower	Rated KW	Continuous Output Current General Purpose Rating	Continuous Output Current Elevator Duty Cycle Rating	Maximum Output Current for 5 Sec
	10	7.5	27	31	68
2	15	11.2	41	47.1	102
3	20	14.9	52	59.8	130
0	25	18.7	68	78.2	170
V	30	22.4	80	92	200
	40	29.8	104	119	260
	5	3.7	8	9.2	20
	10	7.5	16	18.4	40
	15	11.2	21	24.1	53
4	20	14.9	27	31	68
6	25	18.7	34	39.1	85
0	30	22.4	41	47.1	102
V	40	29.8	52	59.8	130
	50	37.3	65	74.7	162
	60	44.8	77	88.5	192
	75	56.0	96	110	240

Figure 5. 28 – Descriptions of Ratings Table Labels

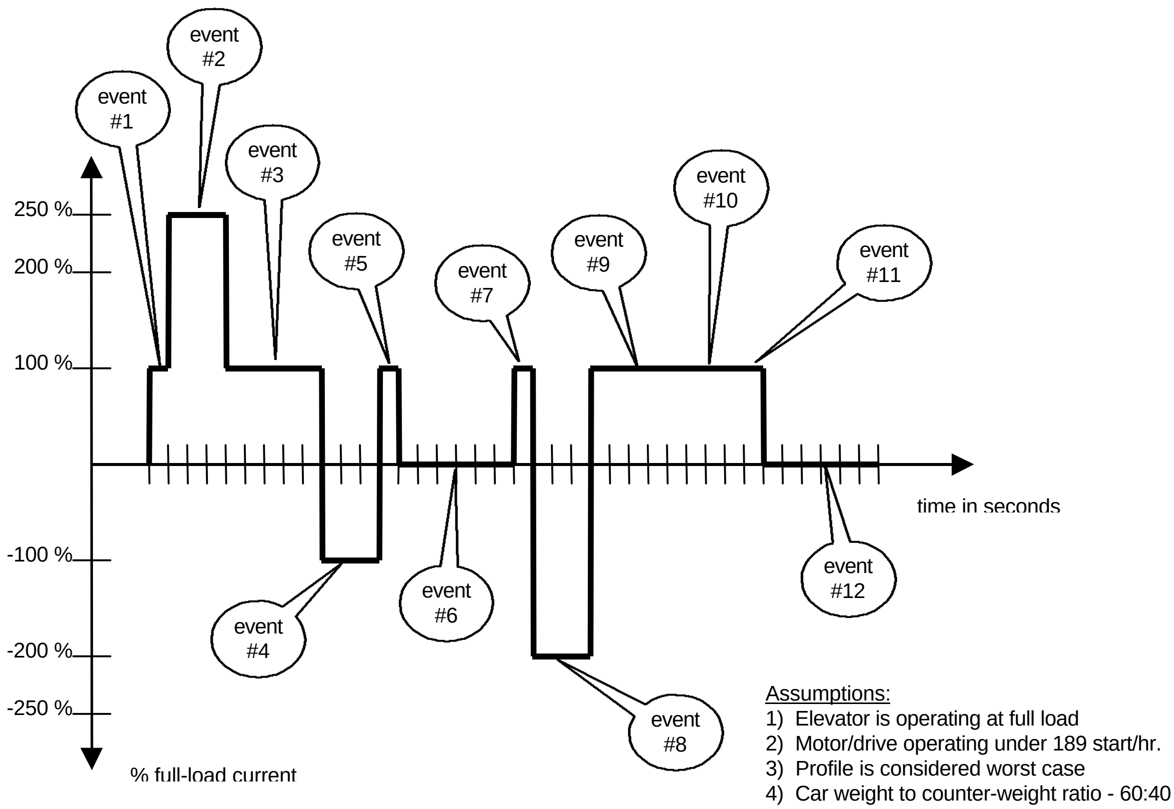


Figure 5. 29 - Elevator System Load Profile

Event		**Time (sec.)**	**Per Unit Current**	**% Full-Load Current**	**RMS Per Unit Current**
1	Pre Torque	1	1	100 %	1
2	Accel Up	3	2.5	250 %	18.75
3	Cruise	5	1	100 %	5
4	Decel Up	3	1	100 %	3
5	Post Torque	1	1	100 %	1
6	Rest	6	0	0 %	0
7	Pre Torque	1	1	100 %	1
8	Accel Down	3	2	200 %	12
9	Cruise	5	1	100 %	5
10	Decel Down	3	1	100 %	3
11	Post Torque	1	1	100 %	1
12	Rest	6	0	0 %	0
		38			50.75
				RMS Per Unit Current for Load Profile =	**1.16**
				Percentage of Full-Load Current for Load Profile =	**116 %**
				Cycles/hr =	95
				Starts/hr =	189

Table 5. 6 - Elevator System Load Profile

Appendix 1
HPV 900 DRIVE DIMENSIONS

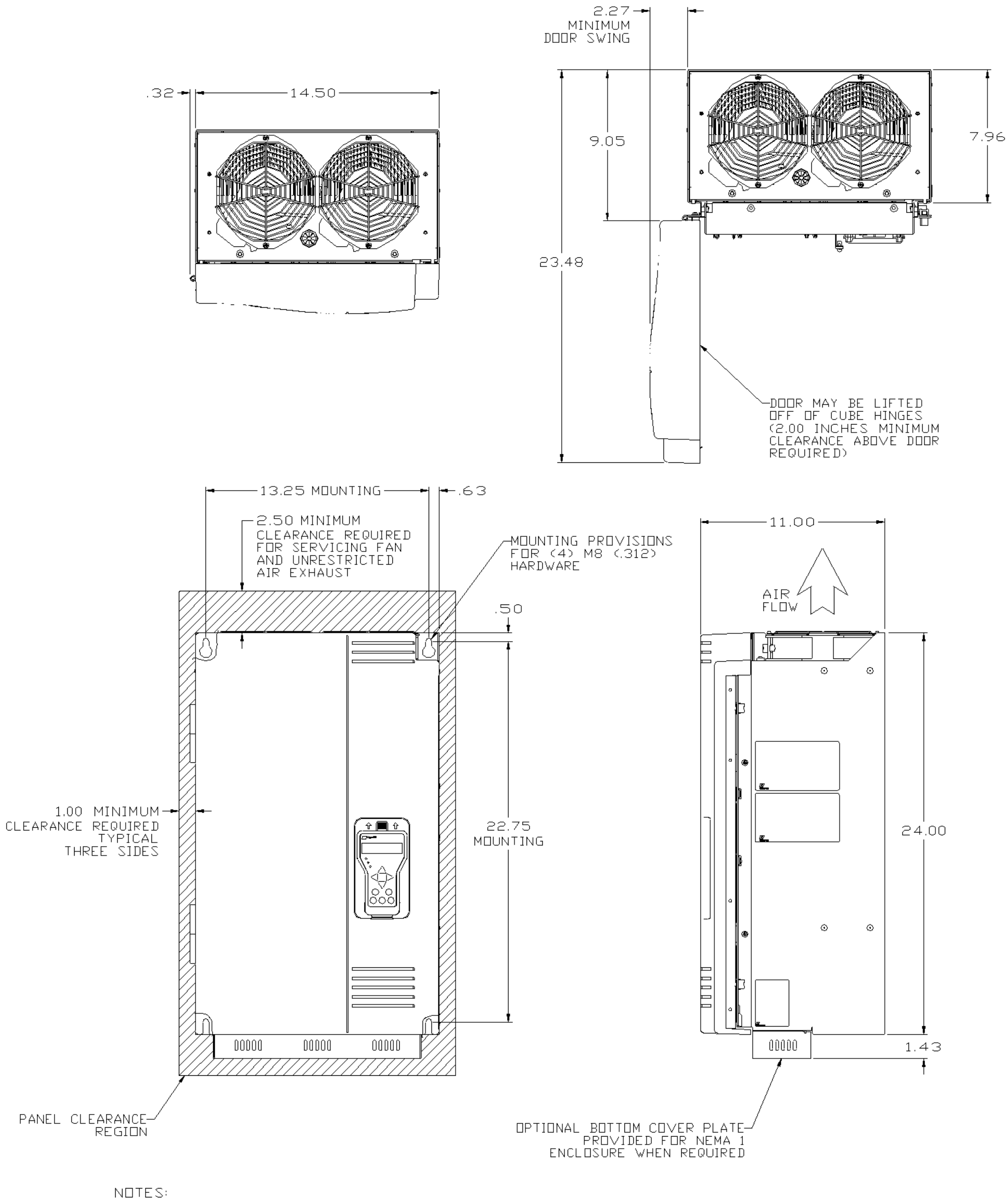


Figure A1. 1 - Dimensions and Mounting Holes (20 to 40 HP – 460V and 10 to 20 HP – 230V)

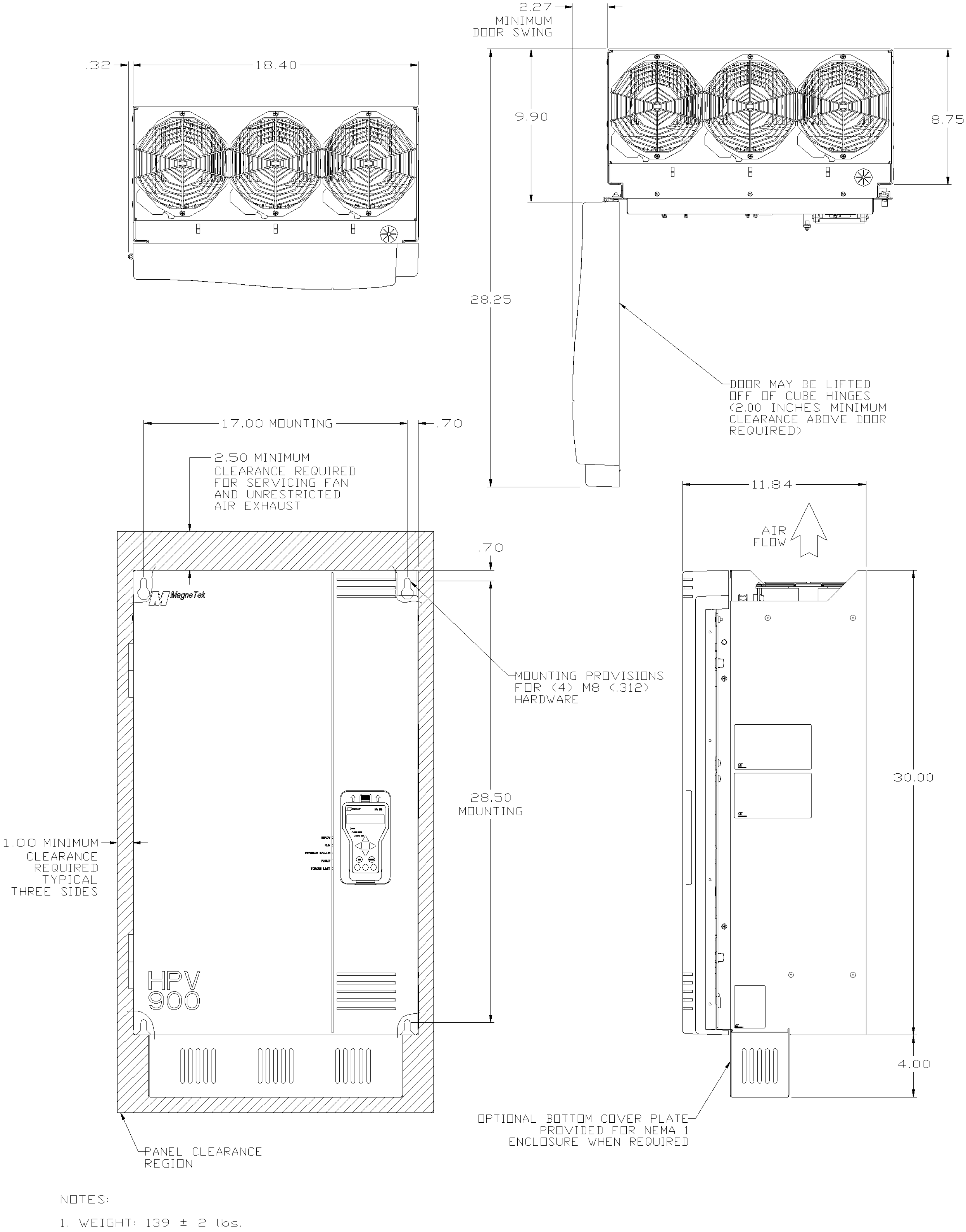


Figure A1. 2 - Dimensions and Mounting Holes (50 to 75 HP – 460V and 25 to 40 HP - 230V)

Appendix 2
DYNAMIC BRAKING RESISTOR SELECTION

Cube HP	Cube KW	% of Cube KW	Power Dissipation KW	Resistor Value Range
5	3.7	20%	0.8	80 Ω - 60 Ω
10	7.5	20%	1.5	80 Ω - 60 Ω
15	11.2	20%	2.5	60 Ω - 40 Ω
20	15	20%	3	40 Ω - 20 Ω
25	18.75	20%	3.75	30 Ω - 20 Ω
30	22.5	20%	4.5	25 Ω - 20 Ω
40	30	25%	7	15 Ω - 10 Ω
50	37.5	25%	9	12 Ω - 5 Ω
60	45	25%	11	8 Ω - 5 Ω
75	56.25	30%	16	7.5 Ω - 5 Ω

Note: 460 V, Regeneration dc bus voltage = 800V

Table A2. 1 - 460V Brake Resistor Recommendations

Cube HP	Cube KW	% of Cube KW	Power Dissipation KW	Resistor Value Range
10	7.5	20%	1.5	20 Ω - 10 Ω
15	11.25	20%	2.25	12 Ω - 10 Ω
20	15	20%	3	7.5 Ω - 5 Ω
25	18.75	20%	3.75	6 Ω - 2.5 Ω
30	22.5	20%	4.5	4 Ω - 2.5 Ω
40	30	25%	7	4 Ω - 2.5 Ω

Note: 230 V, Regeneration dc bus voltage = 400V

Table A2. 2 - 230V Brake Resistor Recommendations

Assumptions for Brake Resistor Recommendations

1) Gear box efficiencies, during regeneration, of 30% to 45% are assumed from 20 HP cube to 75 Hp cube.
2) Duty cycle of 50% is assumed i.e. elevator runs continuously up and down but regenerates 50% of the time.
3) 40% counter weight is assumed
4) Calculations are made for 125% load regenerating.
5) Motor efficiency is assumed 100%
6) The peak regeneration during deceleration is assumed to be four times the average and the resistor value range is calculated taking into account the brake IGBT size

Appendix 3
3-PHASE AC INPUT REACTOR SELECTION

Input Voltage	Cube HP	Cube KW	Inductance (mH)	Amps
460 V	5	3.7	1.4 mH	16 A
	10	7.5	0.88 mH	25 A
	15	11.2	0.63 mH	35 A
	20	15	0.63 mH	35 A
	25	18.75	0.49 mH	45 A
	30	22.5	0.28 mH	80 A
	40	30	0.28 mH	80 A
	50	37.5	0.28 mH	80 A
	60	45	0.20 mH	110 A
	75	56.25	0.20 mH	110 A

Table A3. 1 - 460V Input Reactor Recommendations

Input Voltage	Cube HP	Cube KW	Inductance (mH)	Amps
230 V	10	7.5	0.49 mH	45 A
	15	11.2	0.28 mH	80 A
	20	15	0.28 mH	80 A
	25	18.75	0.28 mH	80 A
	30	22.5	0.20 mH	110 A

Table A3. 2 - 230V Input Reactor Recommendations

Appendix 4
DC CHOKE SELECTION

Input Voltage	Cube HP	Cube KW	Inductance (mH)	DC Current Rating (A)
460 V	5	3.7	1.5 mH	18 A
	10	7.5	0.38 mH	36 A
	15	11.2	0.38 mH	36 A
	20	15	0.38 mH	36 A
	25	18.75	0.12 mH	72 A
	30	22.5	0.12 mH	72 A
	40	30	0.12 mH	72 A
	50	37.5	0.10 mH	120 A
	60	45	0.10 mH	120 A
	75	56.25	0.10 mH	120 A

Table A4. 1 - 460V DC Choke Recommendations

Input Voltage	Cube HP	Cube KW	Inductance (mH)	DC Current Rating (A)
230 V	10	7.5	0.38 mH	36 A
	15	11.2	0.12 mH	72 A
	20	15	0.12 mH	72 A
	25	18.75	0.10 mH	120 A
	30	22.5	0.10 mH	120 A

Table A4. 2 - 230V DC Choke Recommendations

NOTE

<u>MagneTek does not recommend the use of the DC Choke because:</u>
The DC choke has the disadvantage of isolating the diode bridge from the capacitor bank, making the diode bridge more susceptible to damage from transient surges.

Appendix 5
AC INPUT FUSING SELECTION

All fuses should be Class J, Low Peak Dual Element, Time delay 600VAC fuses.

Input Voltage	Cube HP	Cube KW	Fusing Required?	Fuse Size (in Amps)
460 V	5	3.7	Yes	16 to 45 A
	10	7.5	Yes	25 to 45 A
	15	11.2	Yes	35 to 45 A
	20	15	No	45 to 100 A
	25	18.75	No	50 to 100 A
	30	22.5	No	60 to 100 A
	40	30	No	80 to 100 A
	50	37.5	No	100 to 200 A
	60	45	No	125 to 200 A
	75	56.25	No	150 to 200 A

Table A5. 1 - 460V Fusing Recommendations

All fuses should be Class J, Low Peak Dual Element, Time delay 600VAC fuses.

Input Voltage	Cube HP	Cube KW	Fusing Required?	Fuse Size (in Amps)
230 V	10	7.5	No	25 to 45 A
	15	11.2	No	35 to 45 A
	20	15	No	45 to 100 A
	25	18.75	No	50 to 100 A
	30	22.5	No	60 to 100 A

Table A5. 2 - 230V Fusing Recommendations

IMPORTANT

Input Fusing is required for the following ratings:

5 to 15 HP at 460V

Parameter & Menu Index

L

M

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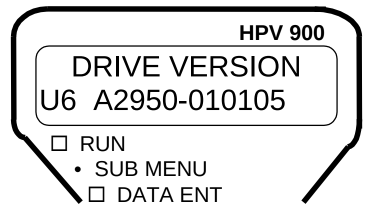
Z

Technical Manual Addendum

Software

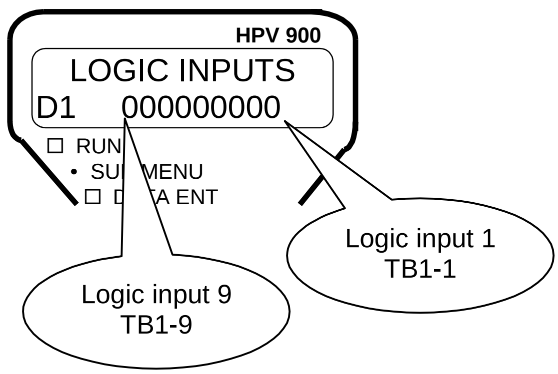
The following details the additions made to the new version of HPV 900 software.



DISPLAY - ELEVATOR DATA D1 *(page 40)*

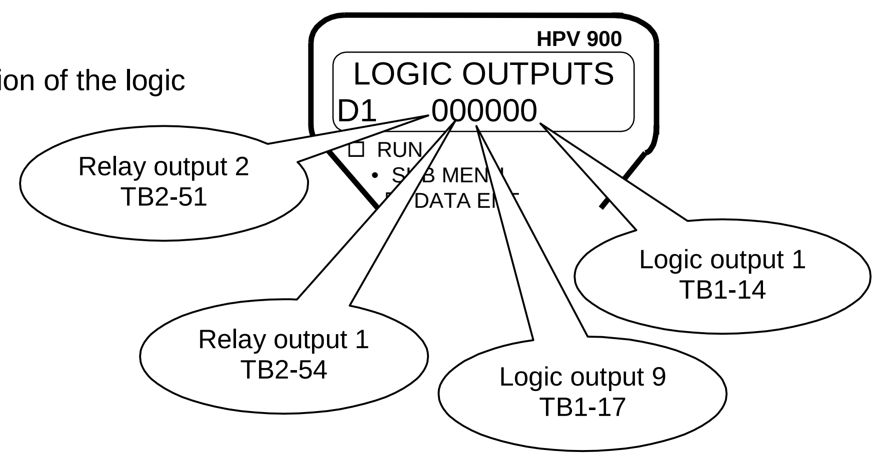
Logic Inputs

This display shows the condition of the logic inputs (1=true 0=false)



Logic Outputs

This display shows the condition of the logic outputs (1=true 0=false)



Faults *(page 83)*

Setup Fault 6

This fault is declared if the multi-step speed references have exceeded a defined limit, which is defined in terms of a percentage of contract speed (CONTRACT CAR SPD parameter).

Name	Setup Fault #6 Limit (as a % of contract speed)	Units	Hidden	Lockout
Speed Command 1	> 110%	ft/min or m/sec	N	Y
Speed Command 2	> 110%	ft/min or m/sec	N	Y
Speed Command 3	> 110%	ft/min or m/sec	N	Y
Speed Command 4	> 110%	ft/min or m/sec	N	Y
Speed Command 5	> 110%	ft/min or m/sec	N	Y
Speed Command 6	> 110%	ft/min or m/sec	N	Y
Speed Command 7	> 110%	ft/min or m/sec	N	Y
Speed Command 8	> 110%	ft/min or m/sec	N	Y
Speed Command 9	> 110%	ft/min or m/sec	N	Y
Speed Command 10	> 110%	ft/min or m/sec	N	Y
Speed Command 11	> 110%	ft/min or m/sec	N	Y
Speed Command 12	> 110%	ft/min or m/sec	N	Y
Speed Command 13	> 110%	ft/min or m/sec	N	Y
Speed Command 14	> 110%	ft/min or m/sec	N	Y
Speed Command 15	> 110%	ft/min or m/sec	N	Y

Setup Fault 7

This fault is declared if the run logic inputs are defined incorrectly. You can either choose group #1 (RUN and UP/DWN) or group #2 (RUN UP and RUN DOWN). But you cannot mix and match or this fault will be declared.

Drive A1 Sub Menu *(page 43)*

GAIN CHNG LEVEL *(page 45)*

GAIN CHNG LEVEL ***Hidden***
(Gain Change Level)
When the gain control is set to internal, the drive will control the high/low gain switch. This parameter sets the speed reference level, when the drive is in 'low gain' mode.
Default: 100.0%
Min: 000.0 Max: 100.0
Units: % rated speed

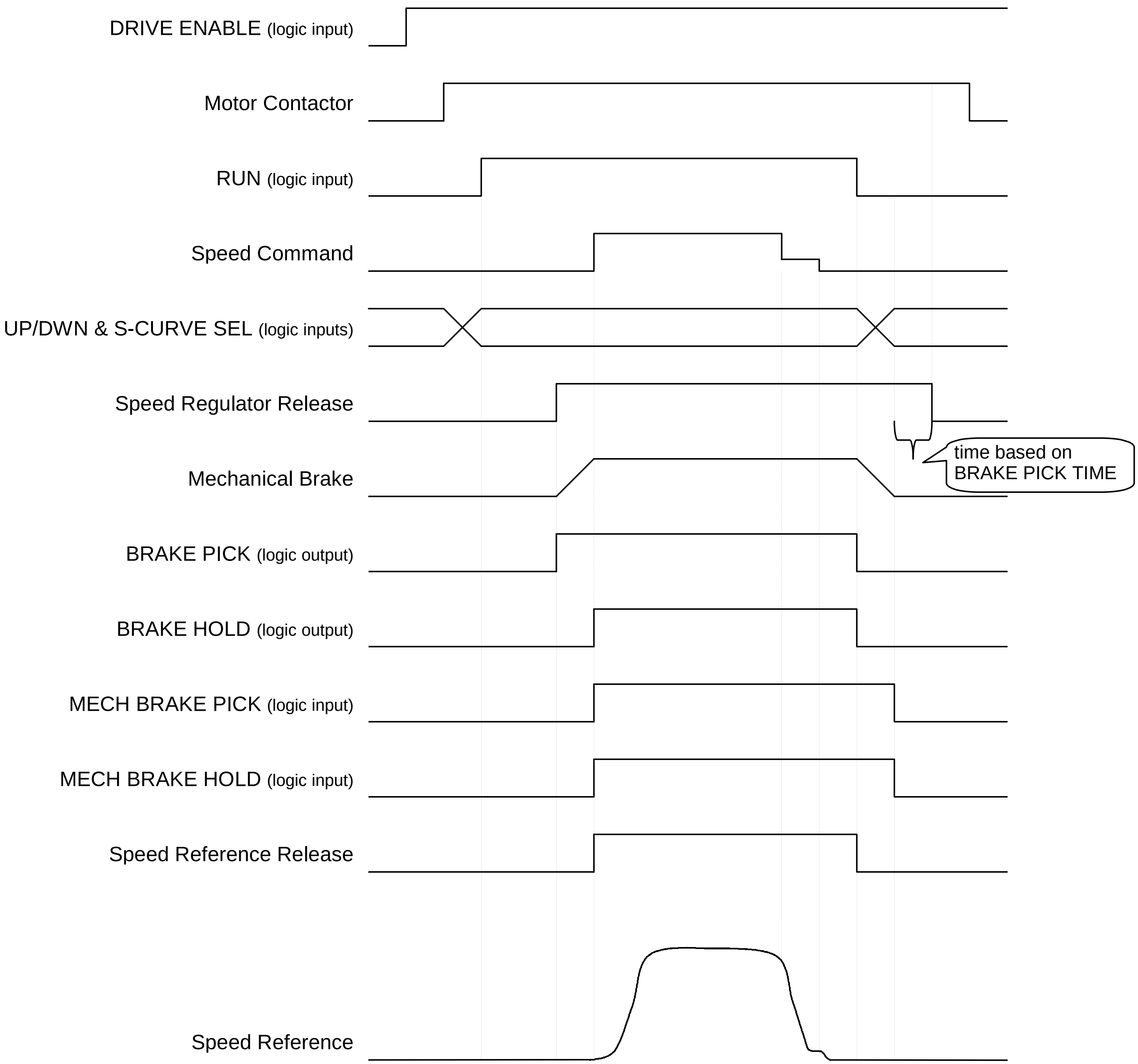
> Note: default changed to 100%

BRAKE PICK TIME *(page 46)*

BRAKE PICK TIME ***Hidden***
(Brake Pick Time)
If the brake pick fault is enabled, this parameter sets the time allowed for the brake pick feedback not to match the brake pick command before a BRK PICK FLT occurs. Also, when the user switch SPD REF RELEASE is set to BRAKE PICKED, it determines the amount of time the drive will command zero speed after the RUN command is removed (time allowed for the brake to close).
Default: 1.00 seconds
Min: 0.00 Max: 5.00
Units: seconds

> Added additional function to this parameter, which will be used when the drive controls the mechanical brake.

Note: see changes in I/O sequence diagram



Changes to I/O Sequence when Using Brake Logic ***(page 124)***

Motor A5 Sub Menu *(page 57)*

MOTOR ID *(page 58)*

Added additional motor IDs for use with 4-pole and 6-pole motors.

Motor ID	Rated Mtr Power	Rated Mtr Volts	Rated Excit Freq	Rated Motor Curr	Motor Poles	Rated Mtr Speed	% No Load Curr
4 pole dflt	0.0 HP	0.0 V	0.0 Hz	0.0 A	00	0.0 rpm	35.0 %
6 pole dflt	0.0 HP	0.0 V	0.0 Hz	0.0 A	00	0.0 rpm	45.0 %

Motor Parameters

Motor ID	Stator Leakage X	Rotor Leakage X	Stator Resist	Motor Iron Loss	Motor Mech Loss	Flux Sat Break	Flux Sat Slope 1	Flux Sat Slope 2
4 pole dflt	9.0 %	9.0 %	1.5 %	0.5 %	1.0 %	75 %	0 %	50 %
6 pole dflt	7.5 %	7.5 %	1.5 %	0.5 %	1.0 %	75 %	0 %	50 %

Motor Parameters (continued)

% NO LOAD CURR *(page 59)*

% NO LOAD CURR

(Percent No Load Current)

This parameter sets the percent no load current of the motor. This parameter can be adjusted by the HPV 900's Adaptive Tune.

Default: per MOTOR ID

Min: 10.0 Max: 80.0

Units: % Current

Note: maximum changed to 80%

Logic Inputs C2 Sub Menu *(page 65)*

RUN UP and RUN DOWN

Can be used in place the of the RUN and UP/DWN logic inputs but not in conjunction with or a SETUP FAULT #7 will occur.

Run up

(Run Up)

If drive is enabled through the DRIVE ENABLE logic input, this function will start drive operation with positive speed commands. Note: if both RUN UP and RUN DOWN are true then the run is not recognized.

Added these two options

Run down

(Run Down)

If drive is enabled through the DRIVE ENABLE logic input, this function will start drive operation with negative speed commands. Note: if both RUN UP and RUN DOWN are true then the run is not recognized.

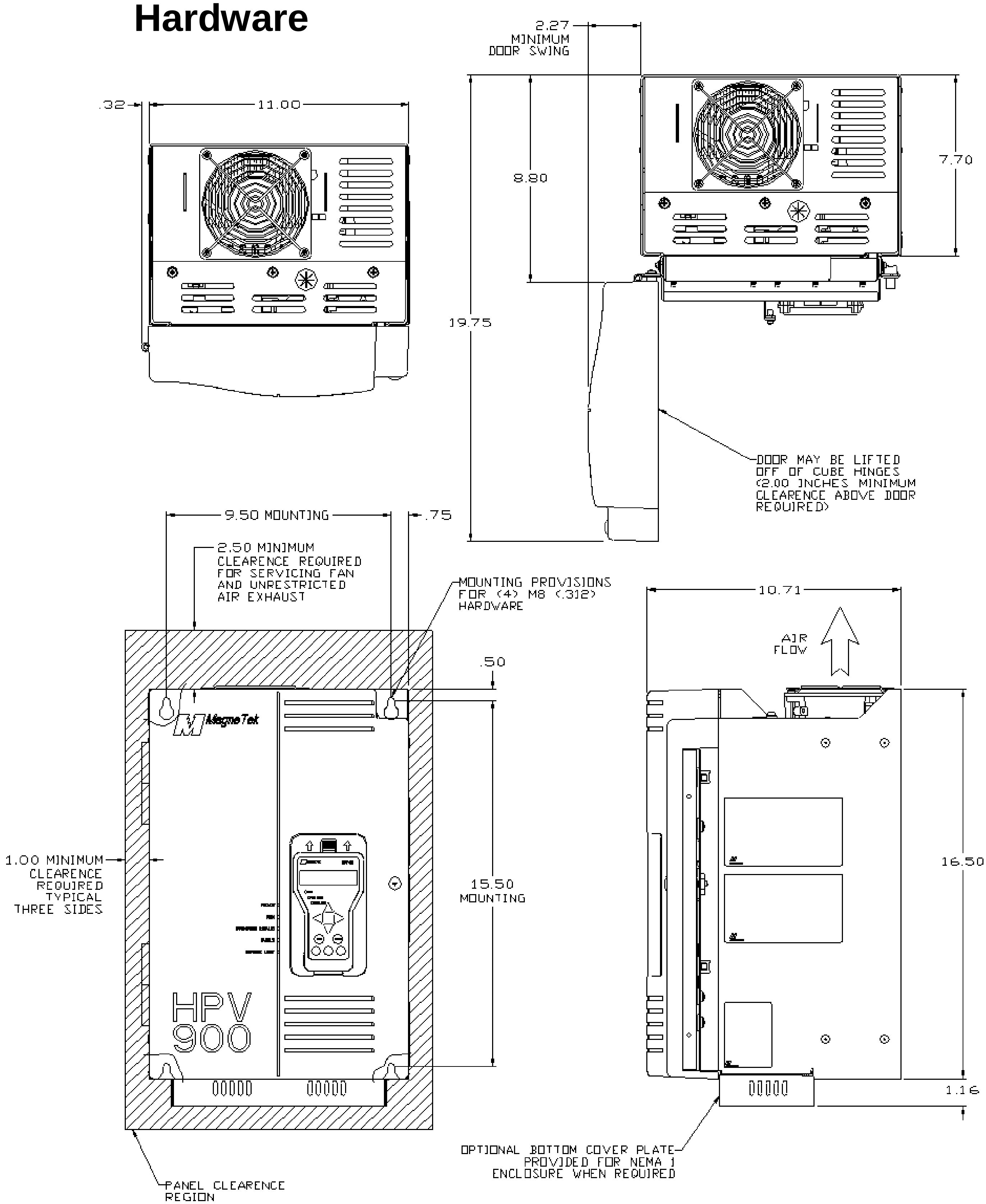
Logic Outputs C3 Sub Menu *(page 69)*

Added this option

NOT ALARM

The output is true when an alarm is NOT present.

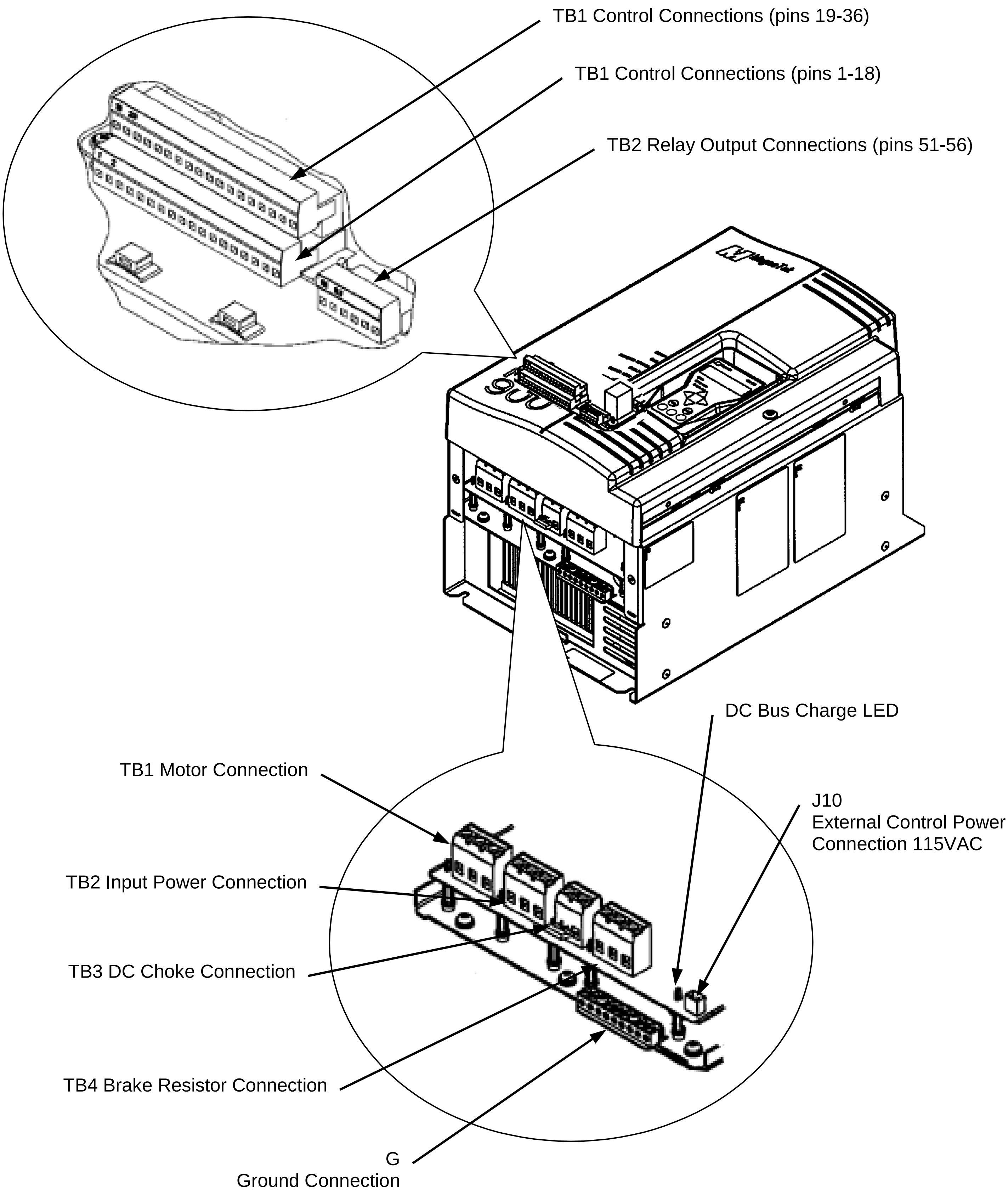
Hardware



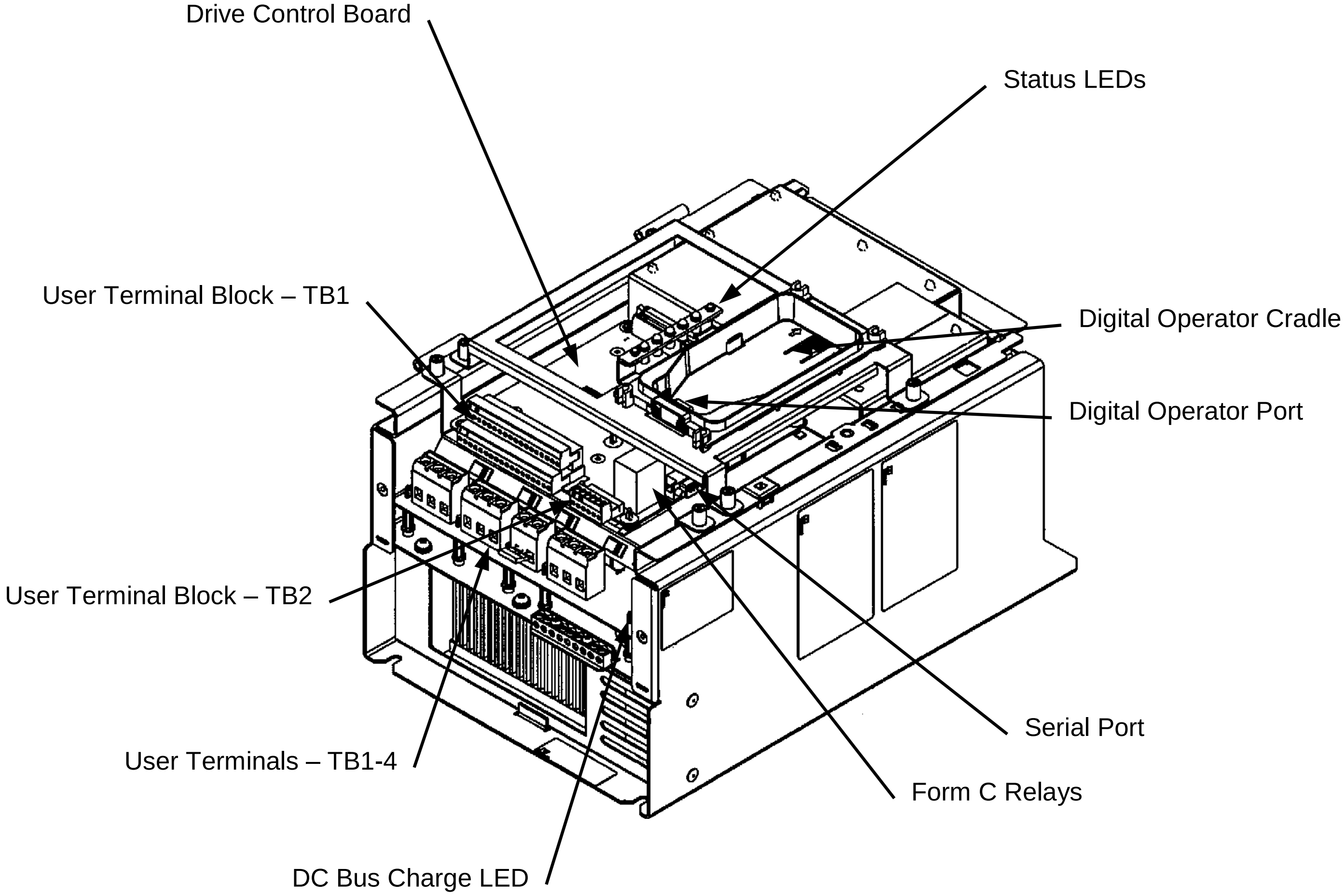
NOTES:

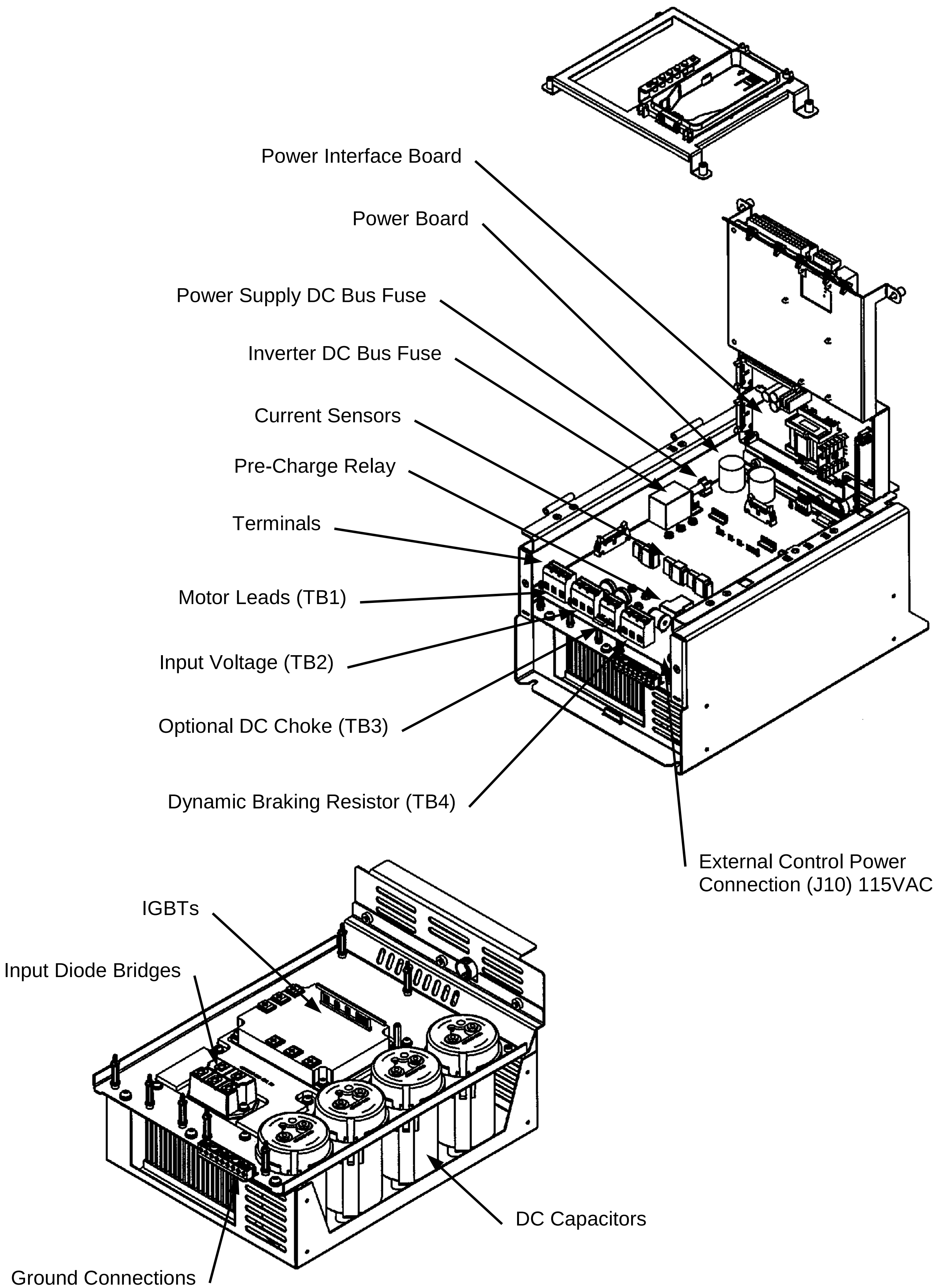
1. WEIGHT: 48 ± 2 lbs. **Dimensions and Mounting Holes (5 to 15 HP – 460V)** *(page 139)*

Terminal Connections (5 to 15 HP – 460V) *(page 21)*



Drive Internals (5 to 15 HP – 460V) *(page 7)*




Power Interface Board
Power Board
Power Supply DC Bus Fuse
Inverter DC Bus Fuse
Current Sensors
Pre-Charge Relay
Terminals
Motor Leads (TB1)
Input Voltage (TB2)
Optional DC Choke (TB3)
Dynamic Braking Resistor (TB4)
External Control Power
Connection (J10) 115VAC
IGBTs
Input Diode Bridges
DC Capacitors
Ground Connections

Configure C0

User Switches C1	= default		
Spd Command Src	☐ analog input	☒ multi-step	☐ serial
Run Command Src	☒ external tb1	☐ serial	
Hi/Lo Gain Src	☐ external tb1	☐ serial	☒ internal
Speed Reg Type	☒ elev spd reg	☐ pi speed reg	
Motor Rotation	☒ forward	☐ reverse	
Spd Ref Release	☒ reg release	☐ brake picked	
Cont Confirm Src	☒ none	☐ external tb1	
PreTorque Source	☒ none	☐ analog input	☐ serial
PreTorque Latch	☒ not latched	☐ latched	
PTorq Latch Clck	☒ external tb1	☐ serial	
Fault Reset Src	☒ external tb1	☐ serial	☐ automatic
Overspd Test Src	☒ external tb1	☐ serial	
Brake Pick Src	☒ internal	☐ serial	
Brake Pick Cnfm	☒ none	☐ external tb1	
Brake Hold Src	☒ internal	☐ serial	
Ramped Stop Sel	☒ none	☐ ramp on stop	
Ramp Down En Src	☒ external tb1	☐ run logic	☐ serial
Brk Pick Flt Ena	☒ disable	☐ enable	
Brk Hold Flt Ena	☒ disable	☐ enable	

Logic Inputs C2	default
Log In 1 tb1-1	DRIVE ENABLE
Log In 2 tb1-2	RUN
Log In 3 tb1-3	FAULT RESET
Log In 4 tb1-4	UP/DWN
Log In 5 tb1-5	S-CURVE SEL 0
Log In 6 tb1-6	STEP REF B0
Log In 7 tb1-7	STEP REF B1
Log In 8 tb1-8	STEP REF B2
Log In 9 tb1-9	EXTRN FAULT 1
Logic Outputs C3	
Log Out 1 tb1-14	READY TO RUN
Log Out 2 tb1-15	RUNCOMMANDED
Log Out 3 tb1-16	MTR OVERLOAD
Log Out 4 tb1-17	ENCODER FAULT
Relay Coil 1	FAULT
Relay Coil 2	SPEED REG RLS
Analog Outputs C4	
Ana Out 1 tb1-33	TORQUE REF
Ana Out 2 tb1-35	SPEED FEEDBK

Adjust A0

Drive A1	default	Drive A1	default	**S-Curves A2**	default
Contract Car Spd	400.0	*Spd Dev Time*	0.50	Accel Rate 0	3.00
Contract Mtr Spd	1130	*Spd Dev Hi Level*	10.0	Decel Rate 0	3.00
Response	10.0	*Spd Command Bias*	0.00	Jerk Rate 0	8.00
Inertia	2.0	*Spd Command Mult*	1.00	Lev Jerk Rate 0	8.00
Inner Loop Xover	2.0	*Pre Torque Bias*	0.00	Accel Rate 1	3.00
Gain Reduce Mult	100	*Pre Torque Mult*	1.00	Decel Rate 1	3.00
Gain Chng Level	000.0	*Zero Speed Level*	1.00	Jerk Rate 1	8.00
Tach Rate Gain	00.0	*Zero Speed Time*	0.10	Lev Jerk Rate 1	8.00
Spd Phase Margin	80	*Up/Dwn Threshold*	1.00	*Accel Rate 2*	3.00
Ramped Stop Time	0.20	Mtr Torque Limit	200.0	*Decel Rate 2*	3.00
Contact Flt Time	0.50	Regen Torq Limit	200.0	*Jerk Rate 2*	8.00
Brake Pick Time	1.00	Flux Wkn Factor	100	*Lev Jerk Rate 2*	8.00
Brake Hold Time	0.20	*Ana Out 1 Offset*	0.00	*Accel Rate 3*	3.00
Overspeed Level	115	*Ana Out 2 Offset*	0.00	*Decel Rate 3*	3.00
Overspeed Time	1.00	*Ana Out 1 Gain*	01.0	*Jerk Rate 3*	8.00
Overspeed Mult	125	*Ana Out 2 Gain*	01.0	*Lev Jerk Rate 3*	8.00
Encoder Pulses	1024	*Flt Reset Delay*	5	Utility U0 - Units U3	
Spd Dev Lo Level	10.0	*Flt Resets / Hour*	3	☐english ☐metric	

Adjust A0

Multistep Ref A3	default
Speed Command 1	0
Speed Command 2	0
Speed Command 3	0
Speed Command 4	0
Speed Command 5	0
Speed Command 6	0
Speed Command 7	0
Speed Command 8	0
Speed Command 9	0
Speed Command 10	0
Speed Command 11	0
Speed Command 12	0
Speed Command 13	0
Speed Command 14	0
Speed Command 15	0

Power Convert A4	default
Id Reg Diff Gain	1.00
Id Reg Prop Gain	0.3
Iq Reg Diff Gain	1.00
Iq Reg Prop Gain	0.3
PWM Frequency	10.0
UV Alarm Level	90
UV Fault Level	80
Extern Reactance	0.0
Input L-L Volts	460

Motor A5	default
Motor ID	DEFAULT MOTOR
Rated Mtr Pwr	id
Rated Mtr Volts	id
Rated Excit Freq	id
Rated Motor Curr	id
Motor Poles	id
Rated Mtr Speed	id
% No Load Curr	id
Stator Leakage X	id
Rotor Leakage X	id
Stator Resist	id
Motor Iron Loss	id
Motor Mech Loss	id
Ovld Start Level	110
Ovld Time Out	60.0
Flux Sat Break	id
Flux Sat Slope 1	id
Flux Sat Slope 2	id

Utility U0 - DRIVE INFO U6

Drive Version	A2950-010103	Cube ID
Boot Version	A2950-000000	

note: parameters shown in *italics* are hidden parameters