

**Installation & Adjustment Manual**  
**MODEL V900 – PVF SERIES**  
Prodigy & Standard Models  
For Microprocessor-Based Traction  
Elevator Controls  
Utilizing AC Vector or SCR Drive Elevator Motor Control

Product Documentation that's Simple to Navigate™

**This is the Installation and Adjustment Manual** which is the guide for installation, startup and final adjustment of all Model V900 Series traction elevator controllers equipped with PVF position and velocity feedback. Other resources include:

- **Field Reprogramming Manual** for Model V900/H900 Prodigy & Standard controllers
- **PVF Position and Velocity Feedback System Manual**
- **Drive Specific Manuals**
- **Maintenance & Troubleshooting Training Manual** provided in conjunction with Factory and Customer Site technical training classes
- **Telephone Technical Support** available for Customers at no charge  
call: 916/428-1708; fax: 916/428-1728; e-mail: techsupport@elevatorcontrols.com
- **Onsite Product & Engineering Support** available worldwide by prior arrangement.

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# Introduction

## Warnings

Throughout this manual, icons will be used to call attention to certain areas of text. These icons represent safety warnings, cautions, and notes.



**WARNING:** Denotes operating procedures and practices that may result in personal injury and/or equipment damage if not correctly followed.



**CAUTION:** Denotes operating procedures and practices that may result in equipment damage if not correctly followed.



**NOTE:** Denotes useful information or procedures.

Throughout this manual it is assumed that field personnel are well qualified in the installation of elevator equipment. No attempt has been made to define terms or procedures that should be familiar to a qualified elevator mechanic.



**NOTE:** It is assumed that all switches for slowdown, stop, and over travel limits at both terminal landings have been checked for proper type, placement, and operation.



**CAUTION:** Equipment installation must be in compliance with all Local and applicable Elevator and Electrical Codes and regulations

This manual is intended only to acquaint the service technician with the information required to successfully install the microprocessor-based elevator controller. Field personnel must be familiar with all codes and regulations pertaining to the safe installation and operation of the elevator system.



**NOTE:** Installation and wiring must be in accordance with the National Electrical Code and consistent with all local codes, and National elevator codes and regulations. The AC power supply to this equipment must be provided through a proper fused disconnect or circuit breaker. Improper protection may create a hazardous condition.



**NOTE:** Wiring to controller terminals must be done in a neat and careful manner. Stranded wire conductors must be twisted together to avoid strands that would create potential shorts if left out of terminals. All controller and field terminals and cable connectors must be checked for proper seating and tightness. When connecting flat cable connectors, be certain to match pin #1 marks (arrow symbol on connectors, red stripe on cable) to prevent damage.



**CAUTION:** Restrict access to elevator control equipment and apparatus to qualified personnel only.

# Section 1 – Overview

## 1.1 Product Description

ELEVATOR CONTROLS CORPORATION model V900-PVF microcomputer based traction Controller utilizes *state-of-the-art large scale integrated circuits* built into a high performance modular circuit board design, in such a way as to optimize *reliability* and *minimize installation and maintenance costs*.

The Basic Simplex System contains a Computer Microprocessor Board, P8 for standard controller or PIO9 for Prodigy Controllers, I/O Boards, a Relay Interface Board, and a Position Velocity Feedback computer in addition to the Microprocessor Power Supply, Control Transformer, and Starter. The motor control is a DC SCR elevator drive or an AC Variable Voltage Variable Frequency elevator drive unit.

The Position Velocity Feedback computer, Smart Drive Interface (SDI), is included to provide shaft position feedback and optimized velocity speed profile pattern generation for each elevator run.

Group Controller G900-XL is available for the control of up to 16 cars.

A *simple to use, powerful diagnostic station* is built into the Computer Microprocessor Board which includes capabilities for *complete on-site re-programming* of the elevator “Personality” parameters via the LCD display.

Video Display, Modem Remote Communications, and Hardcopy Elevator performance printing are all available by means of an output connector capable of driving a standard PC and, including notebook and palm top computers.

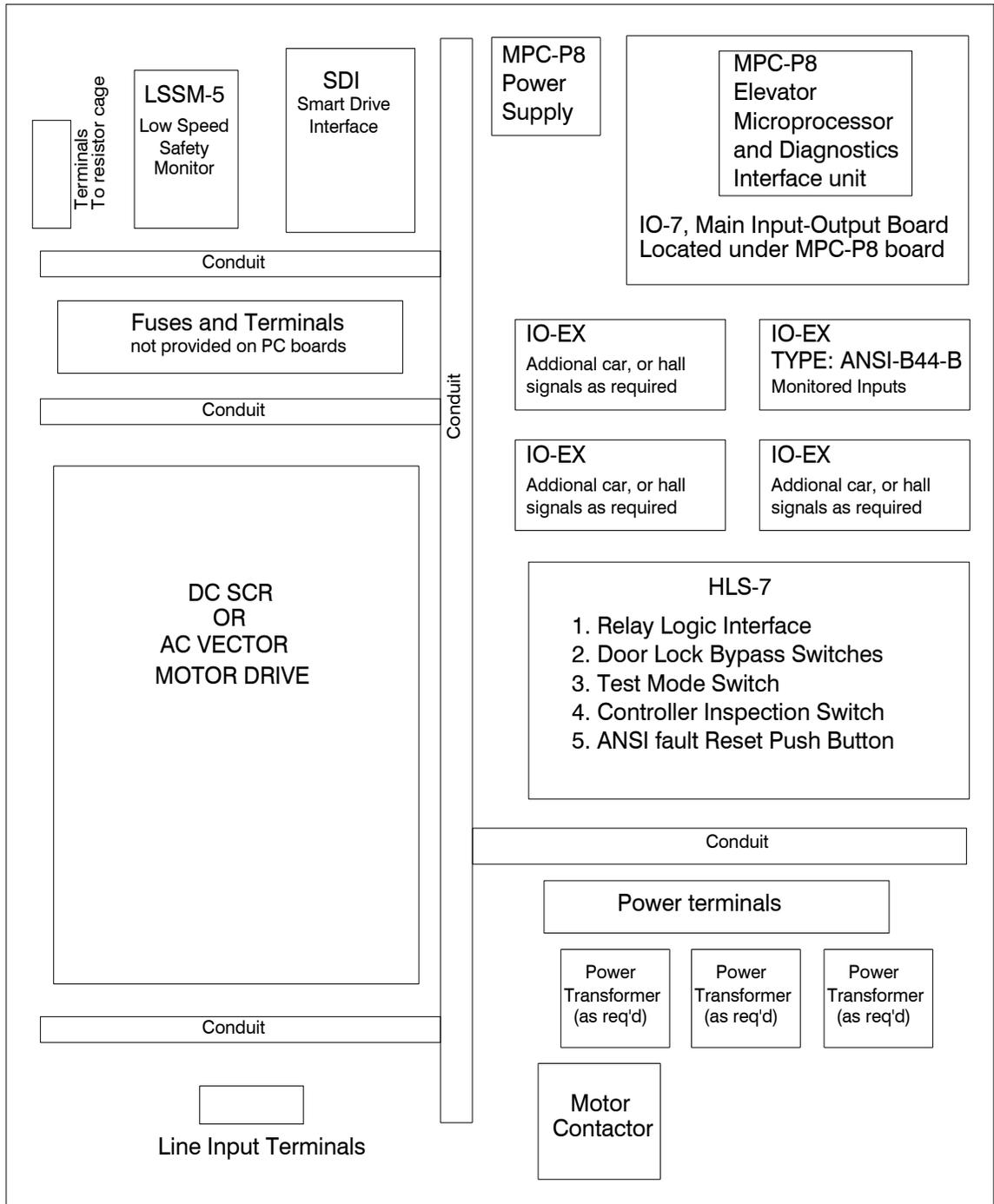
### V900-PVF Series Specifications

Number of Stops	64 stops Maximum with selective door operation (typical of EC standardized system architecture)
Number of Cars in a Group	16 cars maximum
Environment Limits	32 to 104 Degrees Fahrenheit or 0 to 40 Degrees Celsius 12,000 ft (3,658 m) altitude 95% relative humidity (non-condensing)
Motor Control Options	DC SCR Elevator Drive unit with Encoder or Tachometer feedback or AC Vector Elevator Drive unit with Encoder feedback, in addition to Position Velocity Feedback.

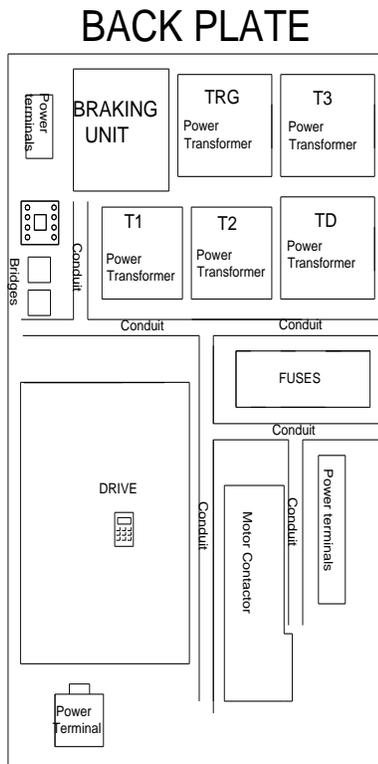
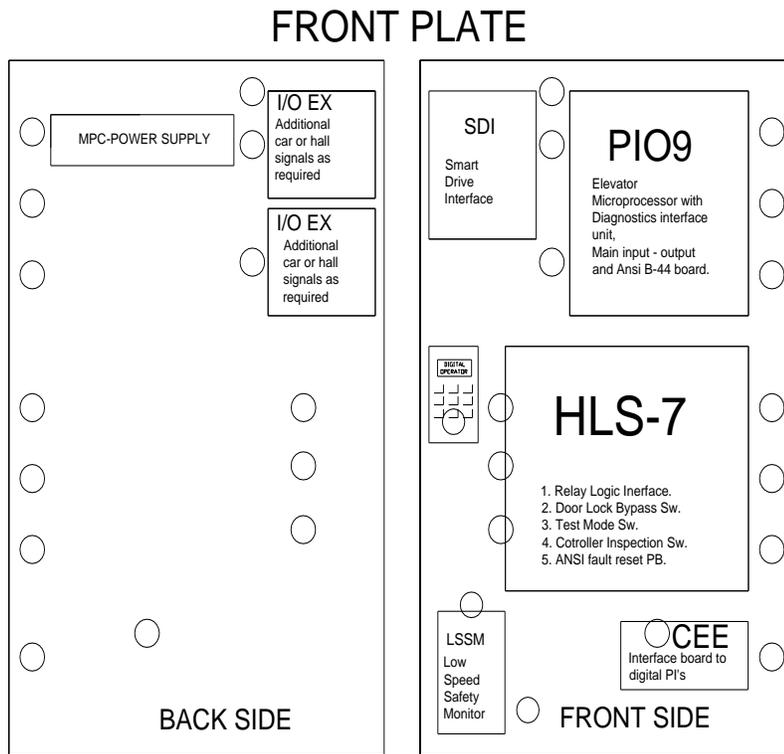
## 1.2 Typical Car Controller Physical Layout

Figure 1.2.1 and 1.2.2 show typical layouts of the V900-PVF Standard and Prodigy car controllers respectively. Following is a brief description of the various components of each controller in Section 1.3.

**Figure 1.2.1 - Typical V900-PVF Standard Controller Layout**



**Figure 1.2 - Typical V900-PVF Prodigy Controller Layout**



## 1.3 Components General Function and Description

### 1.3.1.1 P8 (V900/ H900 Standard Controller Only)

The P8 board is universal to all V900/ H900 standard series of control systems, and is used in all types of elevators from hydraulic to traction, and as a main Group dispatcher microprocessor. The P8 board utilizes high speed, microprocessor technology with a high level of system integration.

 **NOTE:** P8 microprocessor board may also be called MPC-P8 microprocessor board.

The P8 board contains an Onboard Menu Driving Diagnostics Tool coupled with a 2 x 16 alphanumeric display that allows full system reprogramming and diagnostics, four serial ports, a parallel port, an HSO high speed clocked serial port, and a real time clock. System ports are assigned as follows:

- COM1 (IBM) standard RS232 to drive IBM compatible systems
- COM2 (Duplex) duplex port for communication of duplex systems
- COM3 (PVF) communication with position velocity processor
- COM4 (Group) communication with the group G900 processor
- HSO Communication for Ez-LINK™ serial network system P8X microprocessor
- LPT1 (Dispatcher) parallel data communication with G900 processor, when P8 is used as Dispatcher processor

The P8 board is responsible for all the decision making for the elevator's automatic mode of operation, and the monitoring of inputs and outputs for ASME-17.1A-2000 code compliance.

### 1.3.1.2 PIO9 (V900/ H900 Prodigy Controller Only)

The PIO9 board is universal to all Prodigy series of control systems, and is used in all types of elevators from hydraulic to traction. The PIO9 board utilizes high speed, microprocessor technology with a high level of system integration.

The PIO9 board contains: an Onboard Menu Driving Diagnostics Tool coupled with a 2 x 16 alphanumeric display that allows full system reprogramming and diagnostics, four serial ports, an HSO high speed clocked serial port, and a real time clock. System ports are assigned as follows:

- COM1 (IBM) standard RS232 to drive IBM compatible systems
- COM2 (Duplex) duplex port for communication of duplex systems
- COM3 (PVF) communication with position velocity processor
- COM4 (Group) communication with the group G900 processor
- TOC and HALL serial ports for Ez- LINK™ serial network

The PIO9 board is responsible for all the decision making for the elevator's automatic mode of operation, and the monitoring of inputs and outputs for ASME-17.1A-2000 code compliance.

The PIO9 board absorbed several of the discrete boards used on the standard controller by utilizing surface mount technology and, by having fixture voltage fixed to 24 volts DC. The boards absorbed were P8, IO-7, IO-EX-B44, P8X, and one IO-EX board.

### **1.3.2 I/O-7 (V900/ H900 Standard Controller Only)**

The I/O-7 is the main input-output board used in all the elevator standard control systems except for the group controller. It provides all of the main inputs and outputs required to run the elevator, such as safety inputs and door control signals. Such signals are permanently labeled on the left and right sides of the board.

The connector at the right top area of the board permanently contains the first 4 position indicators, direction arrows, fire buzzer and indicator outputs which drive the actual position and fire fixtures. Different types of IO-7 boards are provided, ranging from 110AC Standard to 24DC. When replacing this board, be sure that the type and voltage match the one being replaced, and that the LED power select jumpers are placed in the same positions.

### **1.3.3 IO-EX**

The I/O-EX board provides all inputs and outputs that cannot be accommodated within the I/O-7 or PIO9 boards, including car calls, hall calls, hall gongs, position indicators, etc. Voltage and LED power select jumper positions are critical (as with the I/O-7 above) so care must be exercised when replacing this board. Note that the I/O-EX may not be present in all control panels.

### **1.3.4 IO-EX-B44-B (V900/H900 Standard Controller Only)**

The I/O-EX-B44-B board provides ASME-17.1A-2000 redundancy inputs and outputs. Voltage and LED power select jumper positions are critical (as with the I/O-7 above) so care must be exercised when replacing this board. Note that the I/O-EX-B44-B- may not be present in all standard control panels.

### **1.3.5 HLS-7**

The HLS-7 board is the main relay panel board, housing all the relay logic to interface to the elevator system door control, starters, selector, etc. It should be noted that the HLS-7 does not contain any “Smart” logic. It is a basic board that has been developed to replace point-to-point wiring with a more cost effective and reliable solution. The HLS-7 is configured per job using onboard jumper configurations and relays types loaded for ND, BH, RUN and DPX.

## **1.3.6 Position and Velocity Control**

### **1.3.6.1 PVF or Smart Drive Interface Board Version 3 (Sandwich)**

The PVF or Smart Drive Interface version 3 system is made up of two boards as follows:

- a. The SDI MPU board, based on the Intel 80-196KB motion microprocessor, calculates all motion parameters for the position velocity feedback system. The SDI communicates with the P8 or PIO9 via a dedicated serial port through a 6-pin phone cable. All motion parameters reside in the SDI, including acceleration, deceleration, jerks, etc. The system calculates the optimum speed profile for each elevator trip, on

the fly, considering parameters, elevator position, demand, and instantaneous velocity.

- b. The SDI I/O board is utilized by the SDI MPU board to support the onboard diagnostics and menu-driven reprogramming tool via a 20 x 2 LCD display unit. The SDI I/O enables the MPU to gather information from the elevator system including direction, elevator encoder count, selector, and slowdown signals.

The auxiliary safety microprocessor that monitors the elevator speed also resides on the SDI I/O board. It generates a second speed profile to prevent an overspeed condition at terminal landings or in leveling zones.

### **1.3.6.2 PVF or Smart Drive Interface Board Version 4 (Single)**

The PVF or Smart Drive Interface Version 4 system is made up of a single board as follows:

- a. The SDI MPU board, based on the Intel 80-196KB motion microprocessor, calculates all motion parameters for the position velocity feedback system. The SDI communicates with the P8 or PIO9 via a dedicated serial port through a 6-pin phone cable. All motion parameters reside in the SDI, including acceleration, deceleration, jerks, etc. The system calculates the optimum speed profile for each elevator trip, on the fly, considering parameters, elevator position, demand, and instantaneous velocity.
- b. The SDI Version 4 supports the onboard diagnostics and menu-driven reprogramming tool via a 20 x 2 LCD display unit. The SDI Version 4 also contains the required IO to allow gathering of information from the elevator system including direction, elevator encoder count, selector, and slowdown signals.

The auxiliary safety microprocessor that monitors the elevator speed also resides on the SDI Version 4 board. It generates a second speed profile to prevent an overspeed condition at terminal landings or in leveling zones.

### **1.3.7 LSSM-5**

The LSSM-5 board contains independently driven speed monitoring circuits required by elevator safety standards. These include overspeed, leveling speed monitoring, terminal slowdown speed monitoring, and inspection speed monitoring. The LSSM-5 accepts two types of feedback: (1) a DC tachometer feedback or, (2) pulses from a Hall Effect sensor working in conjunction with magnets surrounding the motor drive sheave.



**NOTE:** The COP, TOC boards are used when the elevator control system is designed with serial communications to the top of the car and the car operating panel. The Hall boards are used when the elevator control system is designed with serial communications to the hall stations. Skip 1.3.8 to 1.3.12 for standard or Prodigy non-serial elevator systems without “Ez-LINK.”

### **1.3.8 COP**

The COP microprocessor board gathers all signals from the COP buttons such as car calls, door open and door close buttons, fire service, etc. and transmits such information via RS-485 to the TOC board. It also receives all output information for car call outputs, passing chime, fire indicators, etc. from the TOC through the same RS-485 communications channel.

The COP board serves as interconnection point for signals, that can't be transmitted via serial communication, on their way to the traveling cable. Examples include emergency stop switch bypass, in car inspection, etc.

The COP board is linked to the TOC board via two twelve pin terminal connectors, housing all interconnects and shielded communication twisted pairs. When replacing the COP board, make sure that all board configuration jumpers are placed matching those on the board being replaced.

### **1.3.9 TOC**

The TOC microprocessor board gathers all signals from the top of car including the selector unit, door operator limit switches, load weighing device, car top inspection station, etc. It also receives all information from the COP board front (and rear, if elevator has rear doors) via an RS-485 channel dedicated for communications between TOC and COP boards. This information is then combined with locally gathered information, and transmitted via RS-422 to the P8X board for standard controllers or to the PIO9 for Prodigy controllers.

The TOC board receives all output and control information from the P8X or PIO9 for door control and other information on its way to the COP board through the same RS-422 communications channel.

The TOC board serves as interconnection point for signals, that can't be transmitted via serial communication, on their way to the traveling cable. Examples include emergency stop switch bypass, in car inspection, power supplies etc.

The TOC board is linked to the elevator controller via traveling cable. This cable contains three ten pin terminal connectors (which house all interconnects) and four sets of two twisted shielded pair two sets for communication and two sets for the selector DP1-DP2 signals.

When replacing the TOC board, make sure that all board configuration jumpers are placed matching those on the board being replaced.

### **1.3.10 COP-EX**

The COP-EX board is a sixteen general input/output board that is used to accommodate signals not being housed by the COP or the TOC board such as car calls, attendant service, line per floor position indicators, etc.

When replacing the COP board, make sure that all board configuration jumpers are placed matching those on the board being replaced.

### 1.3.11 HALL

The HALL board is used at each landing in a multi-drop configuration. This board gathers hall call information, per opening, and transmits this information to the P8X or PIO9 board via RS-485 communication path. It also receives information that illuminates and extinguishes hall calls indicator lights and sounds hall gongs.



**CAUTION:** The HALL board is configured for a particular floor layout through SW1, an eight-switch pack (dip switch). When replacing the HALL board, make sure the dipswitch positions match those on the board being replaced, or permanent damage to one or more boards in the hall loop may occur.

### 1.3.12 P8X (V900/ H900 Standard Controller Only)

The P8X board is attached to the back of the P8 main elevator microprocessor. It communicates with the P8 via a high-speed port, HSO. The P8X function is to gather all information from the elevator serial network, from the COP-TOC, and hall station HALL boards, which is then conveyed to the elevator microprocessor. The P8X board also receives all process commands from the P8 board and distributes commands on the network, relieving the P8 microprocessor from any communications burden.

### 1.3.13 Power Supply

The power supply has a triple linear output +5VDC, +15VDC, and -15VDC. +5VDC is used for all microprocessor logic including P8, or PIO9, IO-6, IO-EX-B44-B, IO-EX, and PVF boards +15VDC and -15VDC are used to supply the PVF analog circuits used to generate the drive pattern control signal. Typical part: Power-One HBAA-40W-A W/OVP.

### 1.3.14 Power Supply Transformers

Power supply transformers are provided as necessary, according to the power requirements of each individual job, to step down and/or provide power isolation from the main power AC line.

### 1.3.15 Door Operator Interface Logic

Logic is provided as required for control of the various door operators and configurations used in the industry.

### 1.3.16 Fuses and Terminals

Fuses, terminals, and any miscellaneous job-specific circuits not part of the standard PC board set are provided as required for each specific job.

### 1.3.17 Motor Control Units

Elevator Controls utilizes several brands of DC-SCR and AC-Vector motor drives unit. Please refer to the manufacturer's drive manual, provided with the controller information package, for details on the motor drive unit for each particular job.



**NOTE:** See 1.3.17.1 or 1.3.17.2 for the appropriate motor control information for your project.

### **1.3.17.1 SCR Motor Control & Starter Unit for DC Motors**

The DC elevator motor drive consists of three distinct control components as follows:

- a. The motor drive unit controls motor speed by applying a variable DC voltage to the motor armature and motor field. Input from a motor-shaft mounted encoder or tachometer unit provides closed loop feedback.
- b. The motor contactor isolates the motor from the motor drive unit for safety in the event of a drive malfunction.
- c. An optional drive isolation transformer and DC-choke filter. The transformer isolates the DC-SCR to prevent induced noise from affecting the building's power supply. The DC-choke filters the current supplied to the motor armature by the DC-SCR drive to prevent audible noise from being generated.

### **1.3.17.2 AC Vector Motor Control & Starter Unit for AC Motors**

The AC vector drive consists of three distinct control components as follows:

- a. Regeneration circuits dissipate motor back-EMF to the line, for line regenerative drives, or to a bank of resistors (through a braking transistor) for non- regenerative drives.
- b. The motor drive unit controls motor speed by changing the output motor voltage and frequency. Input from a motor-shaft mounted encoder unit provides closed loop feedback.
- c. The motor contactor isolates the motor from the motor drive unit for safety in the event of a drive malfunction.

# Section 2 – Preparation

## 2.1 General Information

This section contains important instructions and recommendations pertaining to the site selection environmental considerations, and wiring guidelines to ensure a successful installation.

## 2.2 Site Selection

While selecting the best location for the controller equipment take into account the following factors:

- a. Make sure the control system is placed logically, while taking into consideration the rest of the equipment location.
- b. Provide adequate working space for installation, wiring, and maintenance of the control system. Please note that rear access is not required on Elevator Controls standard control systems.
- c. Do not install equipment in a hazardous location.
- d. Do not install equipment in areas or on surfaces where it will be subject to vibration, the control systems contains parts such as relays that are placed in sockets whose functions may be affected by vibration.
- e. Provide adequate lighting and working space for comfort and efficiency; a telephone line is desirable to provide access for optional remote diagnostics, as well as more efficient access to E.C.C. factory technical support if required.

## 2.3 Environmental Considerations

For proper operation and longevity, the elevator control system should be installed according to the following requirements:

- a. The temperature inside the control system enclosure should be maintained between 32 to 104 degrees Fahrenheit (0 to 40 degrees Celsius). Higher or lower temperatures will reduce the life of the system and may prevent the system from functioning normally. Provide air-conditioning if required.
- b. The air in the machine room should be free of corrosive gases. Air should be sufficiently dry to prevent condensation from moisture. NEMA 4 or NEMA 12 enclosures with integral air-conditioning units are available for these applications.
- c. Avoid placing any control system cabinet or component near windows to prevent severe weather conditions from damaging the equipment.
- d. Extreme levels of Radio Frequency (RF) radiation should be avoided. Radio Frequency Interference (RFI) may interfere with the operation of the control system. Elevator Controls hydraulic control systems have been tested by CKC Laboratories, Inc. Report Number IM00-029 and found to be in compliance with EN61000-4-2, EN61000-4-3 and EN61000-4-4 in accordance with EN12016 regulations.

 **NOTE:** Hand-held communications devices used close to the system computers may generate disruptive RF interference.

## 2.4 Recommended Tools, Test Equipment and Manuals

The following tools are recommended for installation of V900-PVF control system:

- a. Digital multi-meter
- b. Assorted electronic tools such as pliers, cutters, flash light, Elevator Controls small screwdriver (supplied with each controller), etc
- c. Amp-Prove probe-type ammeter
- d. Telephone
- e. Test weights
- f. Control system “as built” wiring prints
- g. This manual
- h. Model V900/H900 Prodigy & Standard P8 Field Reprogramming manual
- i. Motor Drive Control Manual (SCR or AC-Vector as required)
- j. Oscilloscope and Meg-Ohm meter may be desirable for advanced troubleshooting (rarely required)
- k. Tachometer to determine the elevator’s actual car speed
- l. PVF Position and Velocity Feedback System Manual

## 2.5 Controller Installation Guidelines

 **NOTE:** It is very important to follow control system wiring guidelines to prevent problems with interference and line pollution.

 **NOTE:** Wiring to controller terminals must be done in a neat and careful manner. Stranded wire conductors must be twisted together to avoid strands that would create potential shorts if left out of terminals. All terminals and cable connectors must be checked for proper seating. When connecting flat cable connectors be certain to match pin #1 marks (arrow symbol on connectors, red stripe on cable) to prevent damage.

 **CAUTION:** Restrict access to elevator control equipment and apparatus to qualified personnel only.

There are five different entry points that should be maintained separate while wiring the control system:

- a. Power wiring: the line power coming from the elevator service disconnect with power ground.
- b. Motor wiring: power to hoist motor, brake and ground.

- c. Safety and Logic wiring: all wiring to fixtures and switches, as well as cross-connect signals from one car to another in a multi-car group system.
- d. Communications cables: communication cables run from one controller to another in a group of two or more cars.
- e. Encoder Feedback cables: cables used to deliver motor performance information from the encoder or Tachometer unit to the drive unit for speed control, and also to provide independent motor speed rotation feedback data to the Low Speed Monitor, LSSM-5, board.



**NOTE:** Both encoder feedback and LSSM-5 feedback cables can be placed together in the same metal conduit.



**WARNING:** Do not connect the building power supply directly to the motor contactor, as this will damage power transistors in the drive unit.



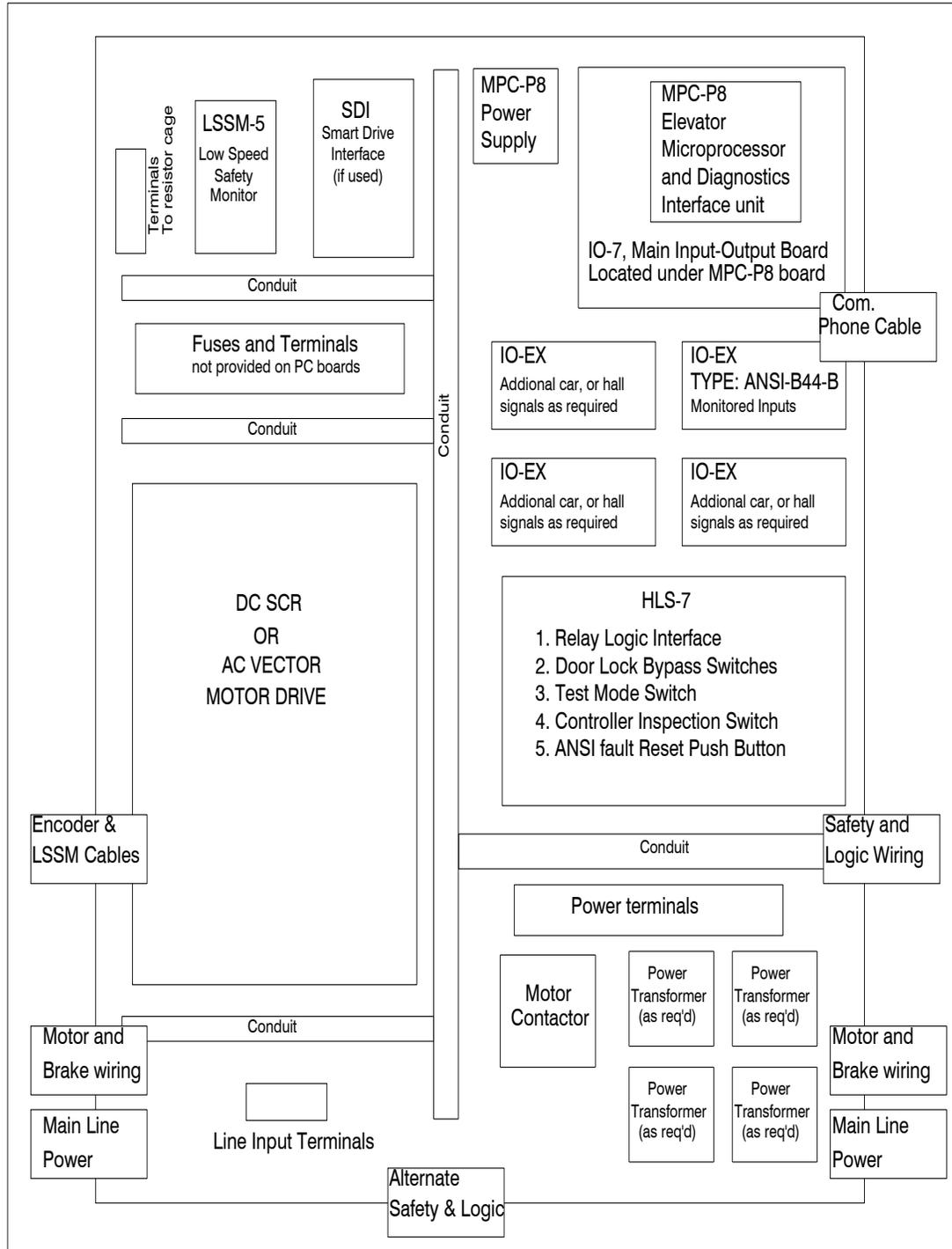
**NOTE:** Study your control system layout to achieve the best arrangement, keeping the five entry points separated and positioned logically to suit the particular control system you will be installing. Following are the proposed layout for wiring a standard and Prodigy controller.



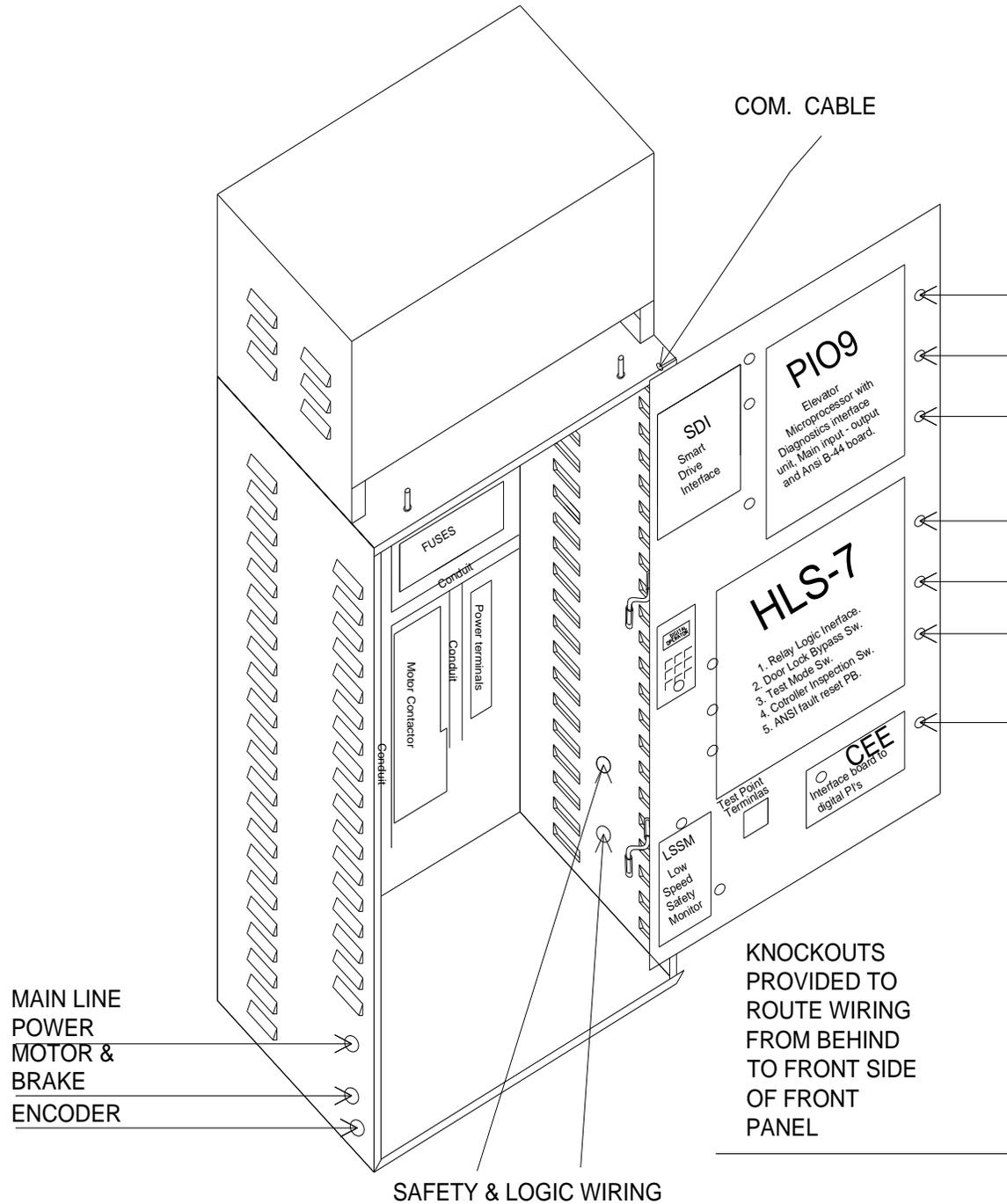
**NOTE:** The standard NEMA-1 enclosure provided for V900-PVF Standard & Prodigy controllers with factory knockouts, which suggest locations for wiring entry points. These knockouts are located as follows: one on the top right side of the enclosure for the communication cable; and three on each side of the lower portion of the enclosure for other required wiring.

Space intentionally left blank

**Figure 2.1 – Typical V900 PVF Standard Controller Wiring Layout**



**Figure 2.2 – Typical V900 PVF Prodigy Controller Wiring Layout**



# Section 3 – Startup

## 3.1 General Information

Protect printed circuit boards from dust and foreign materials. Remove main fuses. Complete elevator controller mounting installation and wiring. Observe controller field terminal locations in relation to wiring ducts in order to determine optimum locations for wiring to enter the control equipment enclosure.



**NOTE:** The standard V900-PVF controller enclosure has several  $\frac{3}{4}$ " knockouts marked for wiring ducts which can be used as guides for location of knockouts required for each particular job.



**CAUTION:** Use care to protect circuit boards from metal debris when cutting.



**CAUTION:** Do not connect the building power supply to the motor contactor.



**CAUTION:** Power capacitors in the drive remain charged for some time after power is removed. Use caution to prevent shock injury.

## 3.2 Startup of V900 – PVF Microprocessor Control System



**NOTE:** These are not instructions for final adjustment.

In the following instructions it is assumed that all hatch doors are closed but not necessarily locked and all hoistway and machine room wiring is complete.

These instructions assume that the installer has a working knowledge of electrical troubleshooting. Follow prescribed procedures carefully.

If the elevator does not respond as expected, check the circuits according to your ability. If you can't locate the problem in a reasonable time, call in an adjuster or serviceman with advanced troubleshooting experience. Proceed with caution.



**NOTE:** You will find multiple LED indicators on PC boards and onboard computer diagnostics very useful tools that will save installation and troubleshooting time.

Read these instructions all the way through before starting work to become familiar with the entire procedure.

### 3.2.1 Test Ground Continuity

Test all terminals for continuity to ground. If continuity is identified, remedy the problem before proceeding.



**NOTE:** Terminal 3 is connected to ground and is used as system common.

### 3.2.2 Remove Group System Fuses (if applicable)

Make sure supervisory control system supply fuses are removed.

### 3.2.3 Remove Primary Controller Fuses

Remove fuses F4, F7, F8, FB1, and FB2 to disable primary controller relay voltage, brake control circuits, and the door operator. Place controller INSP and TEST switches in inspection and test positions, respectively (on).



**NOTE:** Always review prints to double check fuse designations and correct amperages, as well as to become familiar with job specific circuit requirements.

### 3.2.4 Check Disconnect Switch

Check the line side of the disconnect switch and verify all three legs are at the correct voltage.



**CAUTION:** Remove protective covering on PC boards and components before applying power.



**WARNING:** Make sure power is within 10% of specified control voltage or permanent damage could occur to both the motor drive unit and elevator control logic. Turn off the main line disconnect and correct any voltage problem before proceeding with installation.

### 3.2.5 SH6 “Serial Safety” Jumper for Serial Link to Top of Car



**NOTE:** If serial link to Top of Car is not used, skip to next step, 3.2.6.

Place the SH6 jumper on the HLS-7 board (which is located in front of the JDRK2 harness connector) to allow the safety string to be made without the TOC and COP boards being wired to the elevator system. This will permit car movement on Inspection mode; Refer to page 3 area 3 of job prints for reference on jumper function, which is to bypass the circuit that confirms that TOC and COP boards are in place.

### 3.2.6 Turn on Main Line Disconnect

Turn on the disconnect switch. For DC-SCR, check voltages at L1, L2, and L3 terminals located towards the top of the DC-SCR drive unit. For AC-Vector, check voltages at the Marathon terminal block or on the EMI-RFI filter input terminals, if job has been provided with such filters.



**NOTE:** For Prodigy controllers the drive unit and power terminals are located behind the front the panel, on the back panel.

### 3.2.7 PVF System Setup

#### 3.2.7.1 Verify PVF Parameters

Read through the PVF manual and become familiar with the use of the PVF onboard diagnostics and reprogramming tool. Follow procedures described in 3.2.7 section to verify PVF parameter settings. Keep the PVF manual handy for reference start up, final adjust, and troubleshooting.

### 3.2.7.2 Initial Speed Parameter Guidelines

Familiarize yourself with the PVF Position and Velocity Feedback System Manual. The PVF computer system generates the speed pattern that is fed to the motor drive for speed control. The PVF system initial setup is done at the factory.

Verify initial parameter settings before attempting to run the car. See the PVF Manual Section 3, Program Variables, for a detailed explanation and description of the function of each parameter.

As a good rule of thumb, use speed divided by three to program all Jerks, Acceleration, and Deceleration parameters for jobs up to 300 feet per minute (i.e.: if the job is 300 feet per minute, program parameters to 100). For car speeds above 300 feet per minute, start with all parameters at 100 and tune as required for optimum performance during final adjustment of the elevator system. Also, confirm that inspection speed is set to a reasonable working speed (i.e. 20 to 50 feet per minute).



**NOTE:** DO NOT USE the "Quick Installation Reference Guide" in the PVF manual unless you're familiar with the Elevator Controls system or otherwise directed herein to do so. The guide in the PVF manual is intended for general reference purposes only, and as a quick reference when replacing PVF boards only, where no drive or controller parameter readjustment is required.

The following PVF parameters must be set correctly:

- a. Contract Speed (See PVF System Manual Section 3-3)
- b. Number of Floors (See PVF System Manual Section 3-4)
- c. Tach Polarity (See PVF System Manual Section 3-15)
- d. Tach Gain (See PVF System Manual Section 3-16). Final setting of this parameter requires the car to be running at contract speed.
- e. Tach Zero (See PVF System Manual Section 3-17)

### 3.2.7.3 Set Speed Pattern Clamps

The PVF pattern clamps must be set correctly. This is not a final adjustment. The speed clamp initial setup is done at the factory according to the values in the table below. Verify these preset values by accessing the PVF diagnostics submenu 2.5 "Set Speed Clamps". Some clamps may not be used on your job; if your contract speed is less than the value shown below, that clamp parameter will not be used. Turn potentiometers for unused clamps fully counter-clockwise 20 turns. See PVF System Manual Section 3.6 for more details.

<b>Initial Clamp Settings Before Final Adjustment</b>			
Terminal & Resistor No	Pattern Clamp	Terminal & Resistor No	Pattern Clamp
U/D T1, R55	P = 20 FPM	U/D T8, R60	P = 700 FPM
U/D T2, R54	P = 100 FPM	U/D T10, R61	P = 800 FPM
U/D T5, R53	P = 250 FPM	U/D T12, R50	P = 1000 FPM
U/D T6, R58	P = 400 FPM	U/D T14, R57	P = 1200 FPM
U/D T7, R59	P = 600 FPM		

### 3.2.8 Index to Motor Drive Parameters Appendix

This section directs you to the appropriate appendix section of this manual for the various drive units utilized with the V900-PVF control system. Refer to the appendix section as it applies to your specific motor control unit as follows:

For example, if working with a Magnetek SCR drive system and a reference such as “Adjust the drive gain, refer to Section 3.2.8 entry x.1 of this manual to hold car...” is made in reference to Appendix B1 Section B1.1. If same reference is made for a Yaskawa F7 drive unit, it is referring to Appendix A1 section A1.1

#### 3.2.8.1 Appendix A – AC Vector Motor Control Drives

- A1 Yaskawa F7 drive unit
- A2 Magnetek HPV-900 drive unit
- A3 Magnetek HPV-600 drive Unit
- A4 KEB Combivert F5 drive Unit

#### 3.2.8.2 Appendix B – SCR Motor Control Drives

- B1 Magnetek DSD-412 drive unit
- B2 Control Techniques Mentor II drive unit



**NOTE:** Read through the Drive Manual section, “**Drive Parameters Overview**” pertaining to the appendix corresponding to the drive unit used in your particular installation before proceeding to Section 3.2.9.

Skip to Section 3.2.9 if not a KEB Combivert F5 Drive unit with Permanent Magnet Gearless motor elevator system application.



**NOTE:** KEB Combivert F5 Drive when used to drive Permanent Magnet Gearless motor elevator systems, the drive unit will have to learn the position of the encoder vs. motor every time the encoder is replaced, repositioned, or during start up to be able to generate proper motor torque control.



**WARNING:** Do not attempt to move the car before making sure all variables are set per actual motor requirements and section A4.2.2 of Appendix A4 has been successfully performed.



**NOTE:** Do not proceed further until step A4.2.2 of Appendix A4 has been successfully performed.

### 3.2.9 Verify Safety Switches

Verify that car, car-top stop and any other safety switches are set and operating properly. In order for the elevator monitoring system to permit movement of the elevator, the following conditions must be met:

- a. Governor switch, governor contact must be wired between Terminals 4A and GOV.
- b. The emergency stop switch must be wired between Terminals 4A and 17, and 17A to 17B for emergency stop switch monitor input, and the safety switches between Terminals 17 and 23. Refer to job prints page 3.
- c. The PVF STO output will energize the SSAF relay if the PVF unit is in a normal mode of operation, no faults being detected.
- d. The Motor Drive unit Drive On relay output should be on, completing the controller main safety string if the Motor Drive unit is in a normal mode of operation, no faults being detected.
- e. The UP (Terminals 28 and 30) and DOWN (Terminals 29 and 33) normal limits must be made.
- f. The car gate (Terminals 4 and CG) must be made, as well as the hoistway door safety string, bottom, Top, and Intermediate door locks between Terminals 4S and THD, refer to job prints to verify door lock wiring.
- g. The Door Open Limit (Terminals 4 and DOLF) must be closed and the Door Close Limit (Terminals 4 and DCLF) must be opened. If equipped with selective rear doors, the rear Car Gate and Door Open and Close limits must follow the same status as the front limits.
- h. The Emergency Brake “Rope Gripper” contacts, between Terminals BC1 and BC2, must be made to allow power to flow in the directional circuits (refer to job print areas 4 and 5).
- i. Remove the SH2 jumper from the LSSM-5 board in order to bypass trip latching of the ST relay on the LSSM-5 speed monitor board during job installation.
- j. If the controller is equipped with the Ez-LINK serial communication option, install the SH6 “SERIAL LINK” jumper on HLS-7 to enable safeties to set without the COP and TOC boards being installed.

 **NOTE:** Circuits above will allow the car to move on Car Top Inspection mode of operation.

 **NOTE:** In order to allow the car to be run on Controller Inspection, car top inspection, in-car inspection, and Access mode switches must be in the off position. Car Top Inspection (4 to ICTO), In Car Inspection (ICTO to ICIO), Access (INAC to INAO), and Hall & Car Door Bypass switches in controller must be on normal position.

 **NOTE:** If elevator installation does not require In Car Inspection or In Car Access, jumper the respective terminals above to permanently disable these functions.

### 3.2.10 Temporary Final Limit Jumper

If the car is at the top, or at the bottom of the hoistway, jumper the final limit terminals 17 and 23 to allow the car to move. **REMOVE THIS JUMPER AS SOON AS IT IS POSSIBLE TO DO SO.** Use the UP/DN rocker switch to control car movement.

 **NOTE:** Local elevator safety code may not allow the use of a controller Inspection switch. In this case, the car top inspection station should be used to run the car.

If no relays are picked, check fuse F4 and verify that 110 VDC is present between Terminals 3 and 4A, and also between Terminal 4 and 3. If voltage is present on Terminal 4A but not on Terminal 4, turn to page 3 area 3 of the prints and verify the Emergency Stop and Elevator Safeties field wiring.

### 3.2.11 Running the Car on Inspection

#### 3.2.11.1 Signals Required for PVF to Generate a Pattern

The PVF computer receives commands from the elevator computer P8 or PIO9 board along with relay contact inputs to Terminals UP, DN, and enable on Terminal EX along with the inspection input INS.

 **NOTE:** These inputs, connected via relay logic, are the minimum signals the PVF system needs to generate a pattern. These signals can be viewed at menus 3.4 and 3.6 on the PVF as shown:

#### 3.4 CONTROL SIGNALS

UP = 0	LU=0	DZ=1	INS=1
DN=0	LD=0	DPS=01	EQ=0

#### 3.6 EDGE I/O

EQS=0	PEN=0
MFW=0	ST=1

0= NOT ACTIVE    UP= UP DIRECTION  
1= ACTIVE        DN= DOWN DIRECTION

INS= INSPECTION INPUT  
EQ & EQS= EARTHQUAKE INPUT

LU= LEVELING UP                      PEN= PATTERN ENABLE ( EX Terminal)  
LD= LEVELING DOWN                  MFW= MOTOR FIELD WEAKENING  
DZ= DOOR ZONE                        ST= PVF READY WITH NO FAULTS  
DPS= DIGITAL PULSES, DP1 & DP2 INPUTS

 **NOTE:** ST indicates that PVF is ready and drives the SSAF relay in the safety circuit. The PVF system will not output a signal voltage until PEN (Pattern enable) is active at Terminal EX on the SDI top board. MFW (motor field weakening) is not used with AC Vector or SCR drives control systems.

If the ST, UP or DN, INS and PEN inputs are not active as you try to run the car in 3.2.11.3 below, then you will need to determine the cause. Problems most typically result from an open safety string, an open limit switch, or the drive unit not ready to run the hoist motor.

### 3.2.11.2 Verify Safeties

Verify that the main safety circuit SAF input LED is lit. This LED is located on the right side of the IO-7 board or PIO9. The IO7 board is located below the P8 microprocessor board for standard controllers. If the SAF LED is not on when the car is on inspection, trace the safety circuit, referring to job prints Page 3 area 3, to locate the problem.

 **NOTE:** When no faults exist, the drive will normally pick the DSAF relay, and the PVF system will pick the SSAF relay.

### 3.2.11.3 Car Direction

 **NOTE:** For KEB Combivert F5 Drive when used to drive Permanent Magnet Gearless motor elevator systems, Skip to section 3.2.11.4 below (3.2.11.3 has been verified as part of section 4.2.2 of Appendix 4).

Place the controller on inspection by placing the controller inspection switch in the inspection position. Run the car using the UP/DN switch on the controller. Car Top inspection, In Car Inspection and Access switches will need to be off in order for the controller UP/DN switch to work. If the car runs backwards, for AC-Vector control systems interchange two of the three motor leads from the bottom of the Delta contactor for SCR control systems interchange the two armature wires at the top of the Delta DC Contactor.

 **NOTE:** Use care not to interchange the input power leads.

 **NOTE:** If motor rotation is correct, verify that the motor does not produce unusual noise or vibration. Refer to the drive manual for details on Faults indications. If the pulse generating encoder direction is incorrect, the drive will typically trip, or the car will move very slowly or erratically, irrespective of the speed setting. Reverse the encoder direction by reversing encoder leads A and A/. If this doesn't resolve the problem, check the encoder signal wiring.

 **NOTE:** For Mentor II DC Drive if analog tachometer is use, feed back reversal fault will be generated as the car may momentarily try to run away before drive trip out occurs, reverse tachometer field wires to resolve problem.

### 3.2.11.4 Brake Adjustment

While attempting to run the car, adjust brake voltage to the desired value. Verify the actual brake data versus the controller data, referring to job prints page 4, area D3. If settings differ from actual measured values, call Elevator Controls for assistance in recalibrating brake circuits. Once settings and measured values agree, adjust brake picking and holding voltages to values required follow instructions found on prints Page 4, area D3.

 **NOTE:** Brake power resistors are located inside the resistor cage on top of the controller.

### 3.2.11.5 Set Inspection Speed

Set inspection speed to zero using PVF parameter 1.12. Adjust the drive gain, referring to Section 3.2.8 entry x.1 of this manual, to hold the car at or near zero speed. Gradually

increase inspection speed, using PVF program variable 1.12, to observe performance (do not exceed 100 FPM). A setting between 20 to 50 FPM is desirable during the installation phase. Verify that the drive can follow the pattern signal as speed is increased, adjusting drive gain as needed. Refer to Section 3.2.8 entry x.1 of this manual.

 **NOTE:** The higher the number entered as a response parameter, the more responsive the drive will be.

### **3.2.11.6 Brake Mechanical Operation**

Prove that the brake will properly hold at least an empty car. Perform any necessary mechanical adjustments to obtain proper brake operation.

### **3.2.11.7 Car Speed Calibration**

Run the car on inspection in the up direction. Measure car speed on the governor rope using a hand held tachometer.

Measured car speed should agree with the speed value setting. Adjust the motor speed, referring to Section 3.2.8 entry x.1 of this manual. This setting will be finalized when the car is run at full speed. Refer to the PVF System Manual Section 5, select display 3.1, Tracking Performance.

The Tach value displayed must match car speed. Adjust Tach Gain parameter 1.14 under PVF Program Variables menu. Refer to the PVF System Manual Section 3.16 for a more detailed discussion of the Tach Gain parameter.

 **NOTE:** The higher the number entered as a Tach Gain parameter, the smaller the speed value displayed.

### **3.2.11.8 Verify Hoistway Clearances**

Verify safety circuits between Terminals 4A and 23 and make any necessary corrections. Refer to page 3, area 3 of the job prints. Check the car top stop switch to enable/disable inspection up and down buttons. Inspect the full length of the hoistway to ensure the availability of required free running clearances. Check all door locks to ensure proper clearances have been maintained.

### **3.2.11.9 Verify Limit and Slowdown Switches**

Check inspection access operation, (if provided); including proper operation of door lock bypass detection.

 **NOTE:** The elevator safety code does not allow operation of the elevator on inspection access operation if the door locks are bypassed.

Be sure TM switches or slowdown limits, stop limits, and overtravel limits are all properly set according to the hoistway print.

### **3.2.11.10 Controller Connectors Seating**

Verify that all connectors in the system are correctly seated. Ribbon and plug-in field wire connectors can wiggle loose when the system is being worked on. Press firmly on all

connectors to seat them. Be sure duplex cables are installed along with any #18 wire cross connections (if more than one car) according to the hoistway print. Install F50 fuse if used on this controller.



**CAUTION:** Proper seating and secure latching of all connectors is critical to reliable system operation.

### 3.2.12 Complete Installation

At this point the system startup is complete: the elevator car should run correctly on inspection. If you are still having problems, review the steps above and repeat as necessary. The elevator system installation should now be completed, including installation of the selector, etc.

Before running the system on automatic, follow steps 3.2.12.1 through 3.2.12.4, and complete steps described in Section 4 of this manual.

#### 3.2.12.1 Set Dead Zone

Verify and adjust (as required) the leveling switches on the car top for proper Door Zone dead zone, +/- 1/4". Correct vane lengths and switch arrangements are specified on job prints and selector reference materials.



**NOTE:** LU and LD, at Terminals 25 and 26 to Terminal 3 respectively, need to be off (0 VDC) when the car is at floor level.

Make sure all hoistway doors and car doors are closed and locked. Run the car on inspection mode through the entire hatch, making sure it is clear of obstructions.

#### 3.2.12.2 Position Feedback DP1 and DP2 Wiring

Use two twisted shielded pairs for the digital pulse output from the selector. Connect DP1 and DPC each to one wire in the first shielded pair. Connect DP2 and DPC each to one wire in the second shielded pair.

DP1 and DP2 are labeled the same on both the PVF-SDI board and the selector. DPC is labeled as DPC on the PVF-SDI board and DPC or MINUS (-) terminal on the selector side. See your drive PVF prints for a correct wiring schematic.

Be sure shields are connected at all intermediate junction terminal strips for continuity from the selector box to the PVF-SDI board EGND terminal. Be sure optical sensors on the selector are kept clean.



**NOTE:** Direct sunlight exposure (i.e.: in glass hoistway and other such applications) interferes with normal operation of the standard selector sensor head. Under these conditions, the optical sensor area must be shrouded in order to work correctly. Contact Elevator Controls technical support for guidance.

Test the DP1 and DP2 inputs to the PVF. Use Submenu 3.8 Target and Position. Run the car up on inspection; verify that the DP (digital pulse) value goes up and that it is positive. Run

the car down on inspection; verify that the DP value goes down. If the DP value increments in the wrong direction, or increases negatively when going up, reverse the DP1 in DP2 wire connections at the PVF-SDI top board.

### 3.2.12.3 PVF Learn Hoistway

The PVF system needs to learn the hoistway. Be sure normal stop switches do not open before car is fully level at terminal floors, and allow for approximately two (2) inches of overshoot in either direction.

This procedure is fully detailed in the PVF System Manual, Section 4.2 Set Up Mode. Note terminal post SH5, PVF LEARN JUMPER, has been provided on the HLS-7 relay board. Place this jumper to perform the set up procedure described below:

#### *Set Up Mode:*

1. Select menu 2, Hoistway, from the PVF diagnostics menu.
2. Select Entry 2.1 Set Up Mode.
3. Move the car down on Inspection Mode until it stops on the down normal limit switch, approximately 2 inches below the bottom landing.
4. Run the car up nonstop the full length of the hoistway, until it stops on the up normal limit switch, approximately 2 inches above the top landing.
5. Review the checklist below and Section 3.2.12.4 before removing the car from Inspection mode of operation.

Next, verify that the floor position table is correct. Use PVF System Submenu 2.2 Floor Position Table. Press the UP button on this menu, observing the recorded position for each floor. The floor positions are shown in two ways: feet (FT) and pulses (P). Each pulse represents about 3/16 inch. Floor position values should appear reasonable and correspond to what you would expect the floor heights to be. Any of the following indicate a problem.

- a. *Floor positions are not as expected.* Floor heights are measured relative to the bottom limit and should increase. If not as expected, check field wiring, especially DP1, DP2, DPC, EGND and door level switches. Be sure DP1 and DP2 shields are connected properly.
- b. *Floor positions decrease or are negative Pulse counts are less than 1000P.* Floor distance should start at 0 ft or 1000 pulses at the bottom limit and increase from there. If the count is negative, reverse DP1 and DP2 field wires, then go back to step 3.2.12.2.
- c. *Verify that the terminal slowdown position table is correct.* Use PVF System Submenu 2.3 Terminal Position Table. Press the UP button on this menu, observing the recorded positions for each terminal. Like the floor position table, these values should appear reasonable and correspond to what you would expect the terminal positions to be.

If you do experience a problem, check field wiring. Verify that the slowdowns are set in the correct positions, and that the car is allowed to overshoot the top and bottom floors by approximately two inches in each direction of travel.

### 3.2.12.4 Verify PVF Learn Procedure

To verify that the PVF learn procedure was successful, use following steps:

- a. Using the PVF Menu 2 “HOISTWAY” Submenu 2.2 “Floor Position Table” verify proper floor heights. Refer to the PVF System Manual section 4.3.
- b. Using the PVF Menu 2 “HOISTWAY” Submenu 2.3 “Terminal Position Table” verify learned positions for the terminal slowdown switches. Refer to the PVF System Manual section 4.4.
- c. If proper floor heights and terminal slowdown switch positions appear reasonable, proceed to place the TEST switch to the ON position. This will put the system on Test mode when the INSP switch is turned OFF. TEST disables door opening (TEST mode does NOT disable door closing).
- d. Remove the car from inspection, this will allow the car to re-level into the top floor if the learn hoistway procedure was successful. If the hoistway learn procedure was not successful, a “Hoistway Not Learned” error will be displayed on the PVF-SDI board LCD.
- e. If a “Hoistway Not Learned” error message is generated, verify PVF parameters for contract speed 1.1, and number of floors 1.2, under Program Variables menu, verify selector and slowdown switch positions, then repeat step 3.2.12.3 until a successful hoistway learn is achieved.
- f. **REMOVE THE PVF SH5 SDI LEARN JUMPER.**
- g. On inspection mode, move the car below the floor onto the leveling vane, using the inspection UP/DN switch. Then place the INSP switch in the OFF position. The car should re-level up into the floor. Verify that the relays sequence properly for re-leveling. Adjust re-level speed, as required for accuracy and comfort, using PVF Program Variable 1.11. Repeat this step as required until re-leveling up is satisfactory.
- h. Repeat step “g” above, this time starting with the car above the floor to verify and adjust re-level down.



**CAUTION:** If you have not already done so, **REMOVE THE PVF SH5 SDI LEARN JUMPER** when you have completed this section.

# Section 4 – Final Adjustment

## 4.1 Door Adjustment

The elevator should be shut down and main power shut off.

- a. Install door fuses F7 and F8.
- b. Position the car in the hoistway so that car doors can be adjusted to a preliminary setting.
- c. Open the doors by placing a jumper from the non-banded side of diode D73 (under the DO relay) to Terminal 3 on the controller and close doors by placing a jumper from the non-banded side of diode D65 under the DC relay to Terminal 3. Alternatively, place the car on inspection and follow door operation adjustment procedure described by the door operator manufacturer

 **NOTE:** Make sure jumpers on item c above are removed after door adjustment procedure is complete.

 **NOTE:** Most new solid-state door control systems offer adjustment procedures that require no interaction with the elevator controller.

## 4.2 Check Hoistway Clearances

The door operator must be operating properly with all door equipment clutches, rollers, etc., adjusted to correct running clearances. Make sure all hoistway and car doors in the building are closed and locked.

Run the car on inspection the entire length of the hoistway to be sure that the hoistway is completely clear of obstructions. Check to be sure that all selector vanes and the tape selector unit are properly installed per manufacturer's instructions.

## 4.3 Use of Test Switch

Turn the TEST switch to "Test" position, (the TEST switch is located on the HLS-7 board). Placing this switch in the test position prevents the controller from opening the doors (both front and rear if the car has rear doors) while car behaves as on Independent Service mode of operation.

Verify that all ribbon cable connectors, harness connectors, and relays are seated properly. Turn on AC power. Switch from inspection to normal operation. The car should travel to the bottom terminal landing, or re-position itself to the correct landing.

 **NOTE:** If this does not happen, jumper terminal 4 to DC (door close button), place the control test switch in the "TEST" position. Observe the LCD liquid crystal display for Error Condition to determine why the elevator is not responding. Pay particular attention to the multiple LED indicators on the I/O-7 or PIO9 board.

If the car is leveling, the LVL indicator will be off, and the car will not be able to respond until the leveling process is complete. If any of the door opening devices or any call input is

active, the corresponding indicator will be lit. If the SD (or SU for up) indicator is on and the Down relay is not picked, check the normal limit switch. Also, check the DSD2 and USD2 LED's. They must not both be off, or reversed, as these are the corresponding terminal landing slowdown switches that open when the car is at each respective terminal landing.

Refer to Troubleshooting Section 7 of this manual for guidance.

## 4.4 Ez-LINK Serial Communication System Verification



**CAUTION:** Make sure the Serial Safety jumper has been removed from SH6 post terminals on HLS-7 board, if job is equipped with Ez-Link to top of car.



**NOTE:** For non Ez-LINK systems, skip to Section 4.5.

### 4.4.1 Verify Communication to TOC Board

To verify communication to the top of the car, LED's DIAG1 and DIAG2 on the TOC board should be blinking (approximately 4 times a second). DIAG1 indicates communication with the P8X or PIO9 board in the controller, and DIAG2 indicates communication with the COP board (or boards if rear doors are present).

If the two diagnostic LED's are not blinking 4 times a second, verify wiring, and shielded communications wiring connections. Also, make sure all shields are correctly jumpered on all hoistway junction terminal strips.

### 4.4.2 Verify Communication to COP Board

To verify communication to the COP board, LED's DIAG1 and DIAG2 on the COP board should be blinking (approximately 4 times a second). DIAG1 and DIAG2 indicate communication with the TOC board on top of the elevator cab.

If the two diagnostic LED's are not blinking 4 times a second, verify wiring. Perform this same check for the rear COP board, if present.

### 4.4.3 Verify Communication from COP to TOC Boards

Verify all signals coming from the COP and TOC boards to the P8 or PIO9 elevator microprocessor board. Refer to the Field Reprogramming Manual "Direct Access" menu.

To view the following table, have someone go inside the elevator cab and press each car call and activate each button, while a second person selects and verifies proper activation response in the P8 or PIO9 memory map below:



**NOTE:** Verify that all job-required signals activate the proper input memory location in the P8 or PIO9 computer, per the table below, before removing the car from Inspection operation. Table Fig 4.1 lists all possible signals. You need only verify signals pertaining to your specific system.

To verify communications to the top of the car, LED's DIAG1 and DIAG2, on the TOC board should be blinking approximately 4 times a second. DIAG1 indicates communication

with the P8X or PIO9 board in the controller, and DIAG2 indicates communication with COP board (or boards if front and rear doors are present).

If either of the two diagnostics LED's are not blinking approximately 4 times a second, verify wiring and communication shield connections. Also, make sure all shields are correctly jumpered on all hoistway junction terminal strips.

**Figure 4.4 – Ez-LINK Memory Input Map**

Address	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
F900	U8R	U7R	U6R	U5R	U4R	U3R	U2R	U1R	UCIR: Up call input rear
F901	U16R	U15R	U14R	U13R	U12R	U11R	U10R	U9R	
F902	U24R	U23R	U22R	U21R	U20R	U19R	U18R	U17R	
F903	U32R	U31R	U30R	U29R	U28R	U27R	U26R	U25R	
F904	U40R	U39R	U38R	U37R	U36R	U35R	U34R	U33R	
F905	U48R	U47R	U46R	U45R	U44R	U43R	U42R	U41R	
F906	U56R	U55R	U54R	U53R	U52R	U51R	U50R	U49R	
F907	U64R	U63R	U62R	U61R	U60R	U59R	U58R	U57R	
F908	D8R	D7R	D6R	D5R	D4R	D3R	D2R	D1R	DCIR: Down call input rear
F909	D16R	D15R	D14R	D13R	D12R	D11R	D10R	D9R	
F90A	D24R	D23R	D22R	D21R	D20R	D19R	D18R	D17R	
F90B	D32R	D31R	D30R	D29R	D28R	D27R	D26R	D25R	
F90C	D40R	D39R	D38R	D37R	D36R	D35R	D34R	D33R	
F90D	D48R	D47R	D46R	D45R	D44R	D43R	D42R	D41R	
F90E	D56R	D55R	D54R	D53R	D52R	D51R	D50R	D49R	
F90F	D64R	D63R	D62R	D61R	D60R	D59R	D58R	D57R	
F910	U8F	U7F	U6F	U5F	U4F	U3F	U2F	U1F	UCIF: Up call input front
F911	U16F	U15F	U14F	U13F	U12F	U11F	U10F	U9F	
F912	U24F	U23F	U22F	U21F	U20F	U19F	U18	U17F	
F913	U32F	U31F	U30F	U29F	U28F	U27F	U26F	U25F	
F914	U40F	U39F	U38F	U37F	U36F	U35F	U34F	U33F	
F915	U48F	U47F	U46F	U45F	U44F	U43F	U42F	U41F	
F916	U56F	U55F	U54F	U53F	U52F	U51F	U50F	U49F	
F917	U64F	U63F	U62F	U61F	U60F	U59F	U58F	U57F	
F918	D8F	D7F	D6F	D5F	D4F	D3F	D2F	D1F	DCIF: Down call input front
F919	D16F	D15F	D14F	D13F	D12F	D11F	D10F	D9F	
F91A	D24F	D23F	D22F	D21F	D20F	D19F	D18F	D17F	
F91B	D32F	D31F	D30F	D29F	D28F	D27F	D26F	D25F	
F91C	D40F	D39F	D38F	D37F	D36F	D35F	D34F	D33F	
F91D	D48F	D47F	D46F	D45F	D44F	D43F	D42F	D41F	
F91E	D56F	D55F	D54F	D53F	D52F	D51F	D50F	D49F	
F91F	D64F	D63F	D62F	D61F	D60F	D59F	D58F	D57F	
F920	DOLF	DBCf	DOBF	LLI	SEF	PHEF	DHLDF	DCLF	Front door inputs
F921	DOLR	DBCR	DOBR	DHLDR	HLI	SER	PHER	DCLR	Rear Door Inputs
F922	FCS	CLLI	IND	PGI	CCCI	copRc	copFc	tocC	Fire and Misc. inputs
F923	RD	PR	R32	R16	R8	R4	R2	R1	Absolute floor position
F924	Analog load weigher 16 bit value (future)								Used if analog load weighing device is used
F925									
F926	CF8	CF7	CF6	CF5	CF4	CF3	CF2	CF1	Car calls front floors 1 to 8
F927	CR8	CR7	CR6	CR5	CR4	CR3	CR2	CR1	Car calls rear floors 1 to 8
F928	FREE	FREE	FREE	p8xC	hallC	auxlr	auxlf	emtP2in	
F929	C16F	C15F	C14F	C13F	C12F	C11F	C10F	C9F	ACCIF: Front car call input

<b>Ez-LINK Memory Input Map Continues</b>								
<b>F92A</b>	C24F	C23F	C22F	C21F	C20F	C19F	C18F	C17F
<b>F92B</b>	C32F	C31F	C30F	C29F	C28F	C27F	C26F	C25F
<b>F92C</b>	C40F	C39F	C38F	C37F	C36F	C35F	C34F	C33F
<b>F92D</b>	C48F	C47F	C46F	C45F	C44F	C43F	C42F	C41F
<b>F92E</b>	C56F	C55F	C54F	C53F	C52F	C51F	C50F	C49F
<b>F92F</b>	C64F	C63F	C62F	C61F	C60F	C59F	C58F	C57F
<b>F930</b>	C16R	C15R	C14R	C13R	C12R	C11R	C10R	C9R
<b>F931</b>	C24R	C23R	C22R	C21R	C20R	C19R	C18R	C17R
<b>F932</b>	C32R	C31R	C30R	C29R	C28R	C27R	C26R	C25R
<b>F933</b>	C40R	C39R	C38R	C37R	C36R	C35R	C34R	C33R
<b>F934</b>	C48R	C47R	C46R	C45R	C44R	C43R	C42R	C41R
<b>F935</b>	C56R	C55R	C54R	C53R	C52R	C51R	C50R	C49R
<b>F936</b>	C64R	C63R	C62R	C61R	C60R	C59R	C58R	C57R
<b>F937</b>	FREE	FREE	FREE	FREE	FREE	ATT	UP	DN

ACCIR: Rear car call input

Attendant inputs

### 4.5 Running the Car on Test Mode



**NOTE:** When the test switch on the HLS board (located on the relay printed circuit board) is in the "TEST" position, the doors will not open when the car arrives at a floor.



**NOTE:** To place car calls from the machine room for a standard non Ez-LINK systems, jumper from the IO-7 Call GND post, located on the top right corner of the board, to the car call field terminals on the IO-7 or IO-EX boards for standard controllers or from Terminal 3 to the car call field terminals on the PIO9 or IO-EX boards for Prodigy controllers.



P8 or PIO9 with car program version V5.50 or latter, use the Reprogramming Manual to locate the car call entry menu by raising all four menu switches and pressing the **UP** or **DN** (down) buttons to display **System Control**. Lower the Menu / Sub switch to enter the System Control menu and press the **UP** button until **EZ Link Advance** is displayed. Lower the View / Edit switch to enter direction and floor data.

#### Procedure

- Place the car on test mode.
- Set the left LCD character to 1 to move the car up or 0 to move the car down by pressing the **UP** or **DN** buttons.
- Press the shift button **SHIFT** to move between characters.
- Set the right LCD character to the number of floors from the current position to move the car by pressing the **UP** or **DN** buttons. A valid floor offset entry is 1 to 9 where 1 will command a 1 floor run, and 3 will command a 3 floor run, etc.
- Press the write button **WR** to start. Keep pressing the write button each time the car arrives at a floor to continue moving the car up or down by the same number of floors.

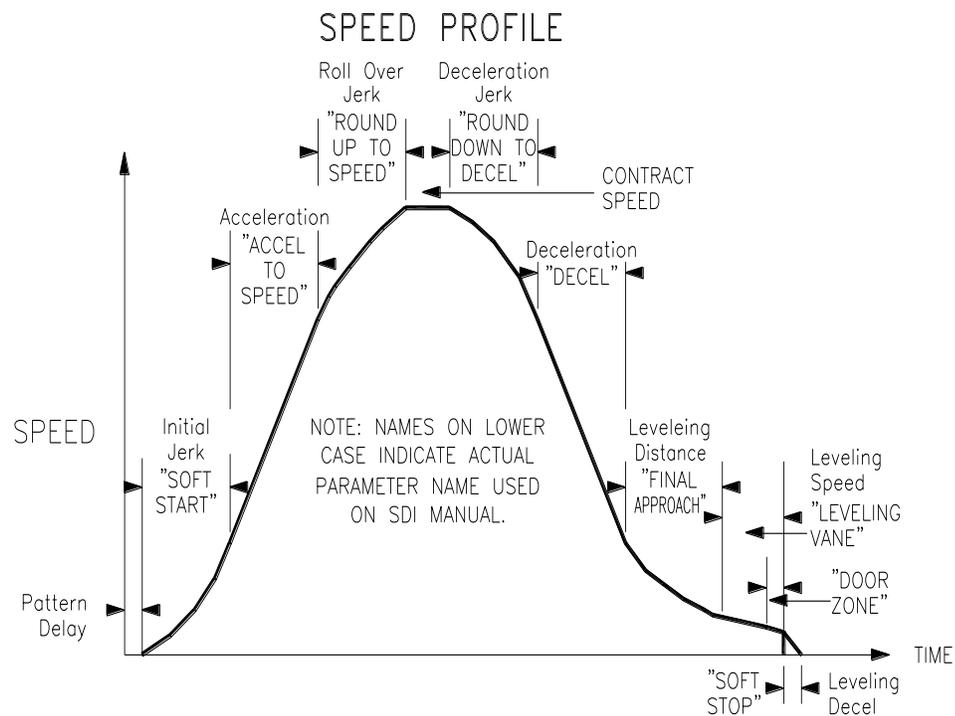
If a car traveling in either direction fails to reach the call within a pre-determined interval, the controller will identify this occurrence as a fault condition and automatically stop the car.

Further operation of the elevator will be prevented until the fault condition has been cleared. To reset this fault, momentarily place the car on Inspection mode.

## 4.6 Speed Profile Adjustment

The speed profile reference drawing, Figure 4.6 below illustrates the parameters available for adjusting the elevator ride.

**Figure 4.6 – Speed Profile**



 **NOTE:** Observing the pattern output and the tach signal from the drive can save a lot of time and hassle. The best way to accomplish this is with a dual-trace storage oscilloscope.

Connect one probe to the signal input terminals on the Motor Drive. This is the pattern signal, with a normal value range from 0 to +10 volts, with +10 volts being contract speed. Direction is determined by the UP or DN signal input.

Connect the second probe to the ABS Speed output. This is the Encoder feedback signal with a normal +10 to –10volt signal output. Refer to page 4 of the prints for drive terminal designations.

 **CAUTION:** If the grounding pin on your oscilloscope plug is electrically connected to the negative probe lead, then you **MUST NOT** attempt to connect the negative lead to the equipment or damage will occur. In this case, if your scope has 2-channels with channel B invert feature active, remove negative leads from probes, then press the A+B button on the scope. Use A and B probes to measure signals.

 **NOTE:** After the speed pattern is adjusted as well as possible from the machine room, the adjuster should ride the car. A pair of hand-held radios and a helper can simplify this process, enabling the helper to adjust the system per the adjuster's instructions from inside the car. There is simply no substitute for adjusting while riding the car.

With the car on Inspection, bring the car to the bottom floor. Remove the car from Inspection, leaving it on Test mode of operation. Place a car call for one floor above. The car should make a one floor run up from the first level and slowdown into the second floor. Observe how the system responds, especially the brake, motor and sheave. Make any necessary adjustments to the mechanical portion of the system. Problems with the brake or door clutch clearances will become apparent here. Correct any problems as they occur before continuing with this adjustment.

With the car on Test mode, make single and multiple floor runs, adjusting speed profile parameters as necessary to "mold" the speed curve. You will need to make a sufficient number of runs to be sure that the system responds as desired. Take your time; adjustment procedures are not inherently quick.

It is recommended that a series of test runs starting with one floor runs and then advancing to multiple floors runs up and down. If car vibration is detected, first check the encoder mounting and wiring. If mounting is solid and wiring is correct, adjust the drive response parameters as required, referring to Section 3.2.8 entry x.1 of this manual.

 **CAUTION:** Higher drive gain numbers may cause oscillation, while lower numbers may cause sluggish response. Adjust these settings for optimal ride quality.

If the car will not move, refer to Section 7 of this manual for troubleshooting guidance. Note any error messages on the system LCD display. Look up these messages on Tables 7.2, 7.3 and/or 7.4, which describe problems and possible solution/s.

Pay particular attention to the multiple LED indicators on the I/O-7 or PIO9 board. If car is leveling, the LVL indicator will be off, and the car will not respond until the leveling process is complete. If none of the door opening devices or calls inputs is active, the corresponding indicator will be lit. If the SD (or SU for up) indicator is on and the Down relay is not picked, check the corresponding normal limit switch.

Also, check the DSD2 and USD2 LED's. They must not both be off, or reversed, as these are the corresponding terminal landing slowdown switches that open when the car is at each respective terminal landing. Note any messages on the on the elevator computer board LCD display.

## **4.7 Final Ride Adjustment** (Read thoroughly before continuing)

### **4.7.1 Brake Tension and Drive Response Setup**

With the car at the bottom landing, put the car on inspection and test weights equal to two-thirds of contract capacity in the car.

Next, start adding weights in 50 or 100 pounds increments, moving car on inspection UP and DN after each increase. Continue until the car is loaded to 125% of contract capacity.

Test brake tension to stop and hold 125% of a contract load by tripping any stop switch except car stop switch open while the car is running down on inspection. Hold the "DOWN" button in while you trip open the stop switch (preferably on the inspection station). The brake should stop the car.

Next, with the car still loaded at 125% of contract load, set Inspection speed = Leveling speed (approximately 4 FPM) and verify that the car lifts and lowers (moves both up and down the hoistway with this load) at approximately the same speed. If the car does not move in the up direction, increase the drive gain as needed, referring to Section 3.2.8 entry x.1 of this manual.

Finally, return inspection speed to the desired value once the procedure in this section is completed.

### **4.7.2 Contact Speed Vs. Pattern Adjustment**

While making a long multi-floor run, verify that the car runs at contract speed when maximum (approximately 10) volts is applied to Motor Drive Pattern signal input terminals.

If not, adjust motor speed as needed, referring to Section 3.2.8 entry x.1 of this manual. Refer to the PVF System Manual Section 5, select display 3.1, Tracking Performance. The Tach display value must agree with car's speed. Adjust Tach Gain parameter 1.14 found in the PVF Program Variables menu; Refer to the PVF Manual Section 3.16 for a discussion of Tach Gain parameter adjustment.



**NOTE:** The higher the number entered in parameter 1.14 Tach Gain, the smaller the speed value displayed.

The car should now be running at contract speed with no overshoot on acceleration and deceleration into the floor. The idea is to get a smooth overall deceleration into the leveling zone, while minimizing time spent at a steady leveling speed.

### **4.7.3 Adjusting Speed Pattern and Performance**

Adjusting the speed pattern can be more of an art than a science. You have two goals: ride comfort and brake-to-brake time. You will have to decide which to work on at any one time. The two goals are not exclusive; both can be achieved. The sections below provide the adjuster with information and hints to help fine-tune the elevator for best performance and comfort. Please read thoroughly, making adjustments as needed.

As you adjust the parameters described below, refer to the relevant sections in the PVF System Manual and/or the Drive Manual.

#### 4.7.4 Decreasing Brake-to-Brake Time

- a. Increase Acceleration “Acceleration to speed”.

 **NOTE:** When you do this, you will probably have to increase Initial Jerk “Soft Start” and Roll Over Jerk “Round up to speed.” The jerk values should be larger than or equal to the Acceleration value. Example: if Acceleration is set to 100 FPM/s, Initial Jerk and Roll Over Jerk should be set between 100 FPM/s/s and 200 FPM/s/s.

- b. Increase Initial Jerk “Soft Start” and Roll Over Jerk “Round up to speed”.

 **NOTE:** Both of these parameters should be changed whenever “Acceleration to speed” is changed significantly. For quick brake-to-brake times, use 1.4 to 2 times the Acceleration value. Higher jerk values cause the pattern to reach contract speed faster.

- c. Increase Decel “Deceleration”.

 **NOTE:** Deceleration value is typically set from 25 to 50 FPM/s less than the Acceleration value. This improves passenger comfort and also makes final approach into the floor more accurate.

- d. Decrease Leveling Distance “Final approach”.

 **NOTE:** Within the PVF system, leveling distance is used in place of a final jerk rate. An oscilloscope can be very useful for viewing the shape of the final curve.

 **NOTE:** Leveling distance is measured in pulses generated by the landing system tape, 3/16 of an inch per pulse. Changes of at least six to ten pulses are required in order to see any change in performance. Leveling distance must always be greater than 16 pulses, which is only 3" of controlled floor targeting. Leveling distance should normally be greater than 32 pulses. A good working range is 38(P) to 62(P).

#### 4.7.5 Improving Passenger Comfort

- a. Increase “Pattern Delay”. Refer to Section 3.8 in the PVF System Manual.

 **NOTE:** Increasing this setting is only useful if the car is pulling through the brake when the pattern starts. Increasing pattern delay produces a wait for a fixed user defined amount of time, allowing the brake to pick.

- b. Decrease “Leveling Speed”.

 **NOTE:** Leveling speed is typically set high at the factory, so the car will not stall coming into a floor. In most applications, leveling speed will need to be decreased, to about 4 to 6 FPM, in order to eliminate any bump felt when stopping.

- c. Decrease Initial Jerk “Soft Start”.

 **NOTE:** Excessively high jerk values can cause passenger discomfort.

 **NOTE:** Some motors cannot follow high jerk values. The resulting overshoot can cause bumps during the ride. A dual trace storage oscilloscope can be used to determine whether the motor is the limiting factor. Connect the probe to the “Analog output 1” from the drive, then decrease the initial jerk setting until a smooth start can be seen when looking at the tachometer from the drive.

- d. Decrease Roll Over Jerk “Round down to decel”. See part “c” above for hints on how to accomplish this by replacing Initial jerk with increased Roll over jerk.

- e. Decrease Deceleration “Decel”.

 **NOTE:** Excessively “Deceleration” values can cause passenger discomfort and can also cause the car to overshoot the floor.

Adjustment should now be completed. Verify and correct proper floor leveling, and make sure door zone sensors are adjusted to prevent door pre-opening beyond +/- 2" from floor level.

 **NOTE:** If you change any door zone or floor sensor, the PVF system will need to relearn the hoistway.

 **CAUTION:** Verify that all connectors in the system are correctly seated, if you have not done so before. Ribbon and pluggable field wire connector can wiggle loose while the system is being worked on. Press firmly on all connectors to ensure that they are seated securely.

## 4.7.6 Speed Clamps Final Adjustment

After all ride adjustments described above are complete, the pattern clamps must be adjusted.

While still on TEST mode, run the car to the bottom floor. Then make one complete run of the hoistway up to the top terminal landing. Next, run down to the bottom terminal in one run.

Access the PVF System Submenu 2.5 Set Speed Clamps. The system will display proper values for final speed clamp and potentiometer settings.

 **NOTE:** These values will now be different than the initial values. Use the displayed value for T1 through T14. Press the UP button on the PVF system and repeat for the next clamp. Continue until all clamps are adjusted.

 **NOTE:** If you change any velocity pattern variables in the PVF, the speed clamps may need to be readjusted. Repeat speed clamp adjustment any time you adjust Initial Jerk, Acceleration, Roll-Over Jerk, Deceleration Jerk, Deceleration or Leveling Distance.

#### **4.7.7 Landing System Vanes**

Verify placement and operation of vanes and switches for proper position indicator stepping. Verify operation of all call buttons, and all functions including fire service main, alternate and phase 2, independent and access operation of the car, door devices and switches, terminal slowdowns, normal and limit switches, as well as all safety switches, etc. Verify and correct floor leveling as required.

#### **4.8 Motor Limit Timer Control**

If the car is traveling in either direction and fails to reach the call within a pre-determined time interval, the controller will identify this occurrence as a fault condition and automatically stop the car. To reset a motor limit timer fault, cycle the inspection switch or power disconnect.

LED indicators will show the computer error code while the LCD display will indicate the corresponding error status. The motor limit timer is factory preset for 180 seconds. Refer to the Model V900/H900 Field Reprogramming Manual for timer adjustment instructions.

#### **4.9 Multiple Door Open Times**

The V900 PVF controller is equipped with selective door timing for car, hall, and short door open times. The factory-preset values are field adjustable using the onboard diagnostics unit. Refer to the Field Reprogramming Manual for complete details. Check door open times for proper operation conforming to ADA and other applicable codes.

 **NOTE:** The hall door timer starts as soon as the car engages DZ, even if it is still leveling. If the pre-opening option is not set, doors may not finish opening before the hall door timer expires. If this happens, because the car takes too long to finish leveling into the floor, extend the hall door timer value to allow for the extra leveling time required.

# Section 5 – LSSM-5 Adjustment

## 5.1 LSSM-5 Functional Description

The LSSM-5 or Low Speed Safety Monitor board is an independent means for monitoring elevator safeties and performance. In case of an elevator speed malfunction, the LSSM-5 will latch, preventing movement of the elevator until board latching circuits are reset by pressing the RESET button on the board.

Movement of the elevator is prevented by removing power from the ST relay coil, which in turn prevents the AA relay from closing which prevents the Delta starter from energizing.

The ST relay is also monitored to confirm proper operation before car motion is enabled.

 **NOTE:** The Low Speed Safety Monitor (LSSM-5) contains several circuits required by ASME-17.1A/ASME A17.1 code, as well as other safety circuits. Therefore, it should be adjusted with care to ensure the integrity of the safety monitoring system.

The LSSM-5 system monitors:

- a. Elevator overspeed
- b. LSSM tachometer monitor
- c. Leveling and inspection overspeed
- d. Terminal slowdown monitor
- e. Runaway elevator condition.

 **CAUTION:** The following adjustments should not be attempted until final adjustment of the car is complete. If these adjustments are made prematurely, this procedure will have to be repeated after final adjustment.

 **CAUTION:** TP-8 is ground. All measurements are to be made with the negative meter lead attached to TP-8. Do not use any other ground point for this purpose. If an oscilloscope is used, be certain that the ground lead is isolated from the line or board damage will result.

 **CAUTION:** Verify that jumper SH2 on the LSSM-5 board has been removed. Be sure to **REPLACE THE SH2 JUMPER** once adjustment is completed. The SH1 jumper enables an external reset input to the LSSM-5 board. If this option is not currently being used, be sure the SH1 is not loaded.

 **NOTE:** Section 5.2 is for Pulse Input feedback and Section 5.3 is for Tachometer feedback. Proceed to the appropriate section.

## 5.2 Setup Utilizing Pulse Input

Place the SH3 jumper on the LSSM board in the “FREQ” position. Place the “TEST” switch on the HLS (relay) board in the TEST position these will disable door open operation and hall calls. Make a multi-floor run so that the car achieves contract speed. Measure and record the **highest** voltage on test post TP-6 with respect to test post TP-8 on the LSSM-5 board.

 **NOTE:** Skip to Section 5.4 to continue LSSM-5 adjustment.

## 5.3 Setup Utilizing Tachometer Input

Place the SH3 jumper on the LSSM-5 board in the “VOLTAGE” position and confirm that resistor R45 is installed. Place the “TEST” switch on the HLS (relay) board in the TEST position these will disable door open operation and hall Calls. Make a multi-floor run so that the car achieves contract speed while adjusting Tach Gain potentiometer so that the voltage on terminal TP-6 with respect to terminal TP-8 on the LSSM-5 board is 8 volts.

## 5.4 LSSM-5 Adjustment Procedures

### 5.4.1 Overspeed

Set the overspeed potentiometer by running the car at contract speed and turning the "OVERSPEED" potentiometer counter-clockwise until the board indicates an overspeed trip. The "OVERSPEED" and the "SAFETY TRIPPED" LED's should be lit. This procedure verifies that the overspeed circuit is working.

Multiply the tach voltage, recorded from Section 5.2, or the 8 volts setting from Section 5.3 above, by 1.15. Set the "OVERSPEED" potentiometer so that this voltage is read between TP-3 and TP-8. This procedure sets the overspeed trip point to 115% of maximum normal speed.

#### 5.4.2.1 Tach Loss

Set the Motor Drive unit to activate the output tied to the LSSM board's "ABS" input at 10% of contract speed, refer to section 3.2.8 section x.2 Digital Outputs for parameter setting.

While making one floor runs, slowly turn the "TACH LOSS" potentiometer clockwise until the board indicates a tach loss trip. This verifies that the LSSM tach loss circuit is working.

Multiply the voltage recorded from 5.2, or the 8 volts setting from Section 5.3 above by 0.03. Set the "TACH LOSS" potentiometer so that this voltage is read between TP-1 and TP-8. Make several runs to verify that no tach loss tripping occurs. If it does occur turn "TACH LOSS" potentiometer counter clockwise by one eighth of a turn at a time while incrementing the motor drive unit “AS” output setting by 5% at the time, refer to Section 3.8 of this manual for “AS” parameter number direction. Call elevator Controls if condition persists after four increment steps.

#### 5.4.2.2 Leveling & Inspection Overspeed

Set the leveling and inspection potentiometer with the car on inspection. While running the car, turn the "LEV/INSP" potentiometer counter-clockwise until the board indicates leveling and inspection trips. The "LEV/INSP" and the "SAFETY TRIPPED" LED's should be lit. This verifies that the leveling and inspection overspeed circuit is working.

Multiply the voltage from 5.2 or the 8 volts setting from Section 5.3 above by 140 then divide this number by the contract speed of the elevator in feet per minute. This is the recommended tach voltage at 140 fpm. Set the "LEV/INSP" potentiometer so that this voltage is read between TP-4 and TP-8. This sets the leveling and inspection speed trip point to 140 fpm.

**EXAMPLE:**

Contract speed = 400 fpm

Tach Voltage @ contract speed = 5.00 V

$5.00 \times 140 = 700$ ;  $700 / 400 = 1.75$  (the answer)

Set the voltage between terminals TP-4 and TP-8 to 1.75 V

### 5.4.2.3 Terminal Slowdown

Verify from controller prints if the "SLDN" terminal on the LSSM board is tied to the 4A bus. If it is, skip this adjustment.

Otherwise, while making multi-floor runs into either of the terminal landings, turn the "SLOWDOWN" potentiometer counter-clockwise until the board indicates a slowdown trip as the car slows down approaching the terminal. Now turn the potentiometer clockwise, a half turn at a time, until no trip is indicated on terminal slowdown.

Measure the voltage between terminals TP-2 and TP-8. Turn the "SLOWDOWN" potentiometer until it rises 0.1 V.

**EXAMPLE:**

If the 'non-tripping' voltage at TP-2 is 6.50 V, set it to 6.60 V. Then make multi-floor runs into both terminal landings to confirm that the board does not indicate a slowdown trip. If a trip is detected, increase the voltage at between terminals TP-2 and TP-8 in 0.1 V steps until no trip is indicated. Finally, check to see that the voltage setting between terminals TP-2 and TP-8 is less than or equal to the voltage recorded from 5.2 or the 8 volts setting from Section 5.3 above.

### 5.4.3 Runaway

This function is not presently being used. Verify the potentiometer setting to 20 turns clockwise, producing 11 volts between terminals TP-9 and TP-8.



**NOTE:** Reinstall jumper SH2 on the LSSM-5 board. Adjustment in this section is now complete.



**NOTE:** The LSSM-5 board has two fault indications. If a momentary fault occurs the associated LED will illuminate and stay lit as a warning. The safety circuit will not open unless a fault is maintained for at least 0.4 seconds, which will be indicated by illumination of the Safety Trip LED.

# Section 6 – Elevator Safety Tests & Inspection

## 6.1 Performing Elevator Safety Tests & Inspections



**NOTE:** The following procedure is intended as a guide while performing periodic inspection and safety tests of the elevator system. Please refer to the Safety Code for Elevators and all applicable local codes for specific requirements.



**WARNING:** Safety tests should be performed by a qualified adjuster or service personnel. A helper should always be present and prepared to turn off the main line disconnect to remove power from the elevator if needed **when the car is run with safety switches bypassed**. Proceed with caution.



**NOTE:** For the following safety tests, 6.2 thru 6.5, remove the wire from terminal RD, if absolute floor position is provided on the elevator controller, or program FC86 bit 1 to 0 (if the controller is equipped with Ez-LINK serial communication). Refer to the Model V900/H900 V5.x Field Reprogramming Manual, “Direct Access” operation, to disable the Absolute Floor Encoding option if it is being used.

**RECONNECT THE WIRE REMOVED FROM TERMINAL RD OR PROGRAM FC86 BIT 1 TO 1 WHEN SAFETY TESTS ARE COMPLETED.**

## 6.2 Car Buffer Test – Fully Loaded Car



**NOTE:** For two stops elevators refer to Appendix B3 of this manual to perform test.

- a. Place a full load in the car; place the controller test switch in the test position.
- b. Enter a call to a floor several floors up from the bottom landing (but not to the top floor).
- c. Jumper terminal 4A to all down slowdown switches terminals (DSD1, DSD2, and DT6 thru DT14 to bypass all present down slowdown switches as required.
- d. Identify and remove signal wires DP1 and DP2 from SDI top board DP1 and DP2 terminals.
- e. Place the controller inspection switch in the inspection position, and run the car one or more floors down to a lower floor level. Be sure the DZ relay is picked. Reconnect the DP1 and DP2 wires and place the controller inspection switch in the normal position.
- f. Place a jumper from controller terminals 17 to 23 to bypass safety switches. Place a jumper from controller terminals 29 to 33 to bypass the down normal limit switch.
- g. Enter a car call to the bottom floor to run car into the buffer. After the car strikes the buffer, and drive sheave slips under the cables, quickly flip the controller inspection switch to the inspection position to stop the car. Run the car up to the bottom landing door zone area and **REMOVE ALL JUMPERS PLACED IN THE PROCEDURE DESCRIBED ABOVE.**

 **NOTE:** The SDI microprocessor board will open the safety string after detecting the pulse count failure caused by the buffer test. Reset the SDI after the buffer test is completed and the car is stopped to restore safety circuits to normal operation.

### 6.3 Counterweight Buffer Test – Empty Car

-  **NOTE:** For two stops elevators refer to Appendix B3 of this manual to perform test.
- a. Place the controller test switch in the test position.
  - b. Enter a call to a floor several floors below the top landing (but not to the bottom floor).
  - c. Jumper terminal 4A to all up slowdown switches terminals (USD1, USD2, and UT6 thru UT14 to bypass all present up slowdown switches as required.
  - d. Identify and remove signal wires DP1 and DP2 from SDI top board DP1 and DP2 terminals.
  - e. Place the controller inspection switch in the inspection position, and run the car one or more floors up to a higher floor level. Be sure the DZ relay is picked. Reconnect the DP1 and DP2 wires and place the controller inspection switch in the normal position.
  - f. Place a jumper from controller terminals 17 to 23 to bypass safety switches. Place a jumper from controller terminals 28 to 30 to bypass the up normal limit.
  - g. Enter a car call to the top landing to run the counterweight into the buffer. After the counterweight strikes the buffer, and drive the sheave slips under the cables, quickly flip the controller inspection switch to the inspection position to stop the car. Run car down to the top landing door zone area and **REMOVE ALL JUMPERS PLACED IN THE PROCEDURE DESCRIBED ABOVE.**

 **NOTE:** The SDI microprocessor board will open the safety string after detecting the pulse count failure caused by the buffer test. Reset the SDI after the buffer test is completed and the car is stopped to restore safety circuits to normal operation.

### 6.4 Governor & Rope Brake Test (ASME A17.1-2000 Section 2.19.1)

- a. Place a jumper from controller terminals 17 to 23 to bypass safety switches.
- b. Manually trip the governor overspeed switch and verify that the following events occur: GTS and GTSX relays drop out; the Emergency Brake or “Rope Gripper” sets; the GTSM LED monitor is illuminated; and the P8 or PIO9 board LCD displays a Governor Contact Fault.
- c. Lift the governor cable off the governor, and then spin the governor while measuring its speed to verify electrical and mechanical tripping speeds. A variable speed drill motor is a good method for spinning the governor.
- d. Replace the governor cable and return the governor overspeed switch to the normal position.

- e. Repeat procedure 6.4.c for a counterweight governor, if any.
- f. **REMOVE JUMPER** between terminals 17 and 23, and verify that the SAF input LED on IO-7 or PIO9 is not lit.
- g. Press the “ANSI-RST” button on HLS-7 board. The Rope Brake and the GTS and GTSX relays should pick, the GTSM LED monitor should be off, and the SAF LED should be on.

## 6.5 Safety Overspeed Test – Fully Loaded Car

- a. Put a full load in the car then place the controller test switch in the test position.
- b. Enter a call to the top floor.
- c. Place a jumper from controller terminals 17 to 23 to bypass safety switches. Place a jumper between terminals 4A and GOV to bypass the governor.
- d. Set the required parameters to run the motor at 1.4 times the contract speed (refer to Section 3.2.8 entry x.3 of this manual). Return the car to the top landing door zone area and return the inspection switch to the normal position.
- e. Enter a car call to the bottom landing after preparing to measure car speed at the trip point. The car will accelerate to overspeed at which time the safeties will set firmly. Immediately flip the controller inspection switch to the inspection position to stop the car. Restore the car safety contacts to normal and the governor contact to normal. Return the parameter for motor speed to its original value. **REMOVE JUMPER** between terminals 4A and GOV.
- f. Repeat the procedure described in this section for a counterweight safety test, if required causing an empty car to overspeed from the bottom landing up.
- h. **REMOVE JUMPER** from terminals 17 to 23.



**NOTE:** The SDI microprocessor board, LSSM-5 board and/or the motor drive may open the safety string after detecting the failure caused by the overspeed test above. Reset the SDI, LSSM-5 or Drive unit after the overspeed test is completed and the car is stopped to restore safety circuits to normal operation.

## 6.6 Terminal Stopping Devices

### 6.6.1 Terminal Stopping Devices Test (ASME A17.1-2000, Section 2.25)

#### Down Direction:

- a. Place the car on inspection, as the stopping devices function identically in both inspection and automatic operation.
- b. Place a jumper from controller terminals 17 to 23 to bypass the safety switches.
- c. Run the car down past the bottom landing. The car should stop when the down Normal Stopping Device (NTSD) contact is opened.
- d. Run the car up. The car should move up, allowing the NTSD contact to close.

**Up Direction:**

- e. Run the car up past the top landing. The car should stop when the up Normal Stopping Device (NTSD) contact is opened.
- f. Run the car down. The car should move down, allowing the NTSD contact to close.
- g. **REMOVE JUMPER** from terminals 17 to 23.

**6.6.2 Final Terminal Stopping Device Test (ASME A17.1-2000, Section 2.25.3)****Down Direction:**

- a. Remove the jumper between controller terminals 17 and 23. Place a jumper from terminals 29 to 33 to bypass the down NTSD.
- b. Run the car down, past the bottom landing. The car should stop when the Final Stopping device (FTSD) contact is opened.
- c. Attempt to run the car. It should not move in either direction. Verify that the safety string is open by confirming 0 volts from terminal 23 to terminal 3.
- d. Place a jumper between controller terminals 17 and 23.
- e. Remove jumper from terminals 29 to 33. Verify that the NTSD is still open by confirming 0 volts from terminal 33 to terminal 3, and that the car will not move in the down direction.
- f. Replace the jumper from controller terminals 29 to 33. Run the car down until the buffer is fully compressed. Verify that the FTSD remains actuated by removing the jumper from terminals 17 to 23 and confirming 0 volts on terminal 23 to terminal 3.
- g. **REPLACE JUMPER** between terminals 17 and 23, and **REMOVE JUMPER** between terminals 29 and 33.
- h. Move the car up to the bottom landing door zone area, then **REMOVE JUMPER** between terminals 29 and 33.

**Up Direction:**

- a. Run the car to top landing.
- b. Remove the jumper between controller terminals 17 and 23. Place a jumper from terminals 28 to 30 to bypass the down NTSD.
- c. Run the car up, past the top landing. The car should stop when the Final Stopping device (FTSD) contact is opened.
- d. Attempt to run the car. It should not move in either direction. Verify that the safety string is open by confirming 0 volts from terminal 23 to terminal 3.
- e. Place a jumper between controller terminals 17 and 23.
- f. Remove jumper from terminals 28 to 30. Verify that the NTSD is still open by confirming 0 volts from terminal 30 to terminal 3, and that the car will not move in the up direction.

- g. Replace the jumper from controller terminals 28 to 30. Run the car up until the buffer is fully compressed. Verify that the FTSD remains actuated by removing the jumper from terminals 17 to 23 and confirming 0 volts from terminal 23 to terminal 3.
- h. **REPLACE JUMPER** between terminals 17 and 23, then **REMOVE JUMPER** between terminals 28 and 30.
- i. Move the car down to top landing door zone area and **REMOVE JUMPER** between terminals 17 to 23.

### 6.6.3 Emergency Terminal Stopping Test



**NOTE:** This test procedure requires that the LSSM-5 monitor board has been adjusted per section 5 of this manual.



**NOTE:** The LSSM-5 Slowdown input “SLDN” has been provided Plug in jumper labeled D55 on the HLS-7 board to be used while performing this procedure, located towards the left center top of the HLS-7 board below the JLS harness connector.

To verify operation of the Terminal stopping perform following steps:

- a. Place the car on Test mode of operation.
- b. Place a car call to execute a multi floor run.
- c. When the car reaches contract speed unplug the “D55” Plug in jumper, to simulate the opening of the NTSD device, The LSSM-5 board will trip with a Slowdown trip LED indication.
- d. The car should come to a stop and no further car movement will be allowed.
- e. Plug back in the “D55” Plug in jumper and verify the car will not be allowed to move.
- f. Reset the LSSM-5 board to restore elevator service, repeat test for opposite direction.

## 6.7 Emergency Terminal Speed Limiting Device Test (ASME A17.1-2000, Section 2.25.4.1)

### Down Direction:

- a. Enter a call to a floor several floors above the bottom landing (but not to the top floor). Place a jumper from controller terminals 28 to 30 and 29 to 33 to disable the NTSD. Remove the SH2 jumper from the LSSM-5 board.
- b. Identify and remove signal wires DP1 and DP2 from SDI top board DP1 and DP2 terminals.
- c. Place the controller inspection switch in the inspection position, and run the car one or more floors down to a lower floor level. Be sure DZ relay is picked. Reconnect the DP1 and DP2 wires, and place the controller inspection switch in the normal position.
- e. Enter a car call to the bottom floor. As the car approaches the bottom landing, the SDI microprocessor should initiate an emergency slowdown upon detection of the opening of the down slowdown switches after detecting interruption of normal floor

counts as caused by steps “a” and “c” above. Verify that the car has stopped and that motor and brake contactors are not energized.

- f. Verify that the car safeties have not been applied.



**CAUTION:** After completing safety tests, be sure to **REMOVE JUMPERS** above, and **REPLACE** the SH2 jumper on the LSSM-5 board.

#### **Up Direction:**

- a. Enter a call to a floor several floors below the top landing (but not to the bottom floor). Place a jumper from controller terminals 28 to 30 and 29 to 33 to disable the NTSD. Remove the SH2 jumper from the LSSM-5 board.
- b. Identify and remove signal wires DP1 and DP2 from SDI top board DP1 and DP2 terminals.
- c. Place the controller inspection switch in the inspection position, and run the car one or more floors up to an upper floor level. Be sure DZ relay is picked. Reconnect the DP1 and DP2 wires, and place the controller inspection switch in the normal position.
- d. Enter a car call to the top floor. As the car approaches the top landing, the SDI microprocessor should initiate an emergency slowdown upon detection of the opening of the up slowdown switches after detecting interruption of normal floor counts as caused by steps “a” and “c” above. Verify that the car has stopped and that motor and brake contactors are not energized.
- e. Verify that the car safeties have not been applied.



**CAUTION:** After completing safety tests, be sure to **REMOVE JUMPERS** above, and **REPLACE** the SH2 jumper on the LSSM-5 board.



**NOTE:** An Emergency Terminal Speed Limiting Device Test (ASME A17.1-2000, Section 2.25.4.2) is not required on elevators that have an emergency terminal speed limiting device that complies with ASME A17.1-2000 Section 2.25.4.1



**NOTE: RECONNECT THE WIRE REMOVED FROM TERMINAL RD OR PROGRAM FC86 BIT 1 TO 1 WHEN SAFETY TESTS ARE COMPLETED,** if Absolute Floor Encoding is used.

## **6.8 Test Procedures for Compliance: Monitoring Critical Circuits** (ASME 17.1-2000 Sections 2.26.9.3 and 2.26.9.4)

### **6.8.1 This Section Describes Test Procedures that Confirm Compliance with Part B, Redundancy & Monitoring in Critical Circuits** (ASME A17.1-2000, Sections 2.29.9.3 and 2.26.9.4)



**NOTE:** All relays used as critical components are **Safety Relay SR6**, such relays are known as forced guided relays with the characteristics which allow the monitoring of one contact to be used to determine the state of the remaining relay contacts.

 **NOTE:** LCD refers to the P8 or PIO9 display unit for all tests below, unless otherwise specified

 **NOTE:** Make sure elevator is placed on TEST mode of operation and elevator cab has been evacuated before proceeding with testing procedure below.

### 6.8.1.1 **Microprocessor Monitoring**

**Critical Component:** P8 or PIO9 Microprocessor

**Redundant Component:** P8 or PIO9 and GTS watch dog timers

**Monitored Component:** Memory Checksum, I/O Integrity check

The P8 or PIO9 microprocessor board incorporates a watch dog timer which needs to be refreshed by the program loop every 0.25seconds, a second watch dog timer is used to time out the P8 main safety output for the GTS relays, therefore in the event that the computer were to malfunction the watch dog timer will perform a computer reset and in the event that the computer is not able to reset, the GTS watch dog timer will reset the GTS output, to disable the GTS relays and removing power to Starter coils.

#### **GTS Watch dog timer test:**

Press the reset button on the P8 or PIO9 and hold it down to prevent the computer from functioning. This will also prevent the onboard microprocessor timeout from updating the GTS output. As a result, GTS relay should drop; resetting the GTS relay outputs opens the power circuit to the Starter coils.

Print reference to GTS and GTSX contacts 4 is page 1 area 1 of the prints.

To restore, release pressure on the reset button.

#### **P8 or PIO9 Watch dog timer test:**

Turn power off and remove program chip labeled L.Hex, turn power back on and observe the Power on LED on the P8 board blink at the rate of 0.25 seconds demonstrating the effect of the P8 or PIO9 watch dog timer, turn power off to restore program chip.

 **NOTE:** The P8 or PIO9 also performs a memory integrity check for by writing a pattern to the Ram memory and by performing check sums to the program portion of the software and comparing them to default stored values, if the program gets corrupted the computer will display a “Memory Corruption Error” and will disable all outputs.

#### **P8 I/O Integrity Check (Standard controller only)**

Turn power off and remove the ribbon cable that connects the P8 to the Monitor board, this should signal the computer that the computer I/O string to the monitor board has failed. The computer display should show, “Safety String Open,” preventing the computer from executing any motion commands.

Restore the ribbon cable into its socket. Make sure socket latching hooks are latched.

 **NOTE:** The IO-EX-B44 circuits are part of the PIO9 board.

### **6.8.1.2 GTS & GTSX Relay Operation and Monitoring**

**Critical Component:** GTS and GTSX Relays

**Redundant Component:** GTSM Computer Monitoring Input

**Monitored Component:** GTS and GTSX Relays contacts

Apply 110 VDC using a jumper from terminal 4A to R13 resistor, located above the HDR relay label, on HLS-7 board. The LCD should show, “GTS Relay Fault”. GTS and GTSX relays should drop, Confirm that the car will not respond to hall or car calls. The latching fault should not clear until the ANSI-RST button is pressed.

### **6.8.1.3 Stop Relay Proper Operation and Monitoring**

**Critical Component:** STOP Relay

**Redundant Component:** STOPM Computer Monitoring Input

**Monitored Component:** STOP Relay Contacts

Apply 110 VDC using a jumper from terminal 4A to harness connector JSDI-6, STOPM monitor input, located on the top left corner of the HLS-7 board. The LCD should show, “Stop Relay Fault.” Confirm that the car will not respond to hall or car calls. **REMOVE JUMPER.** Car shall return to normal operation once jumper has been removed.

### **6.8.1.4 DZ Relay Proper Operation and Monitoring**

**Critical Component:** DZ Relay

**Redundant Component:** DZM Computer Monitoring Input

**Monitored Component:** DZ Relay Contacts

On inspection move the car outside door zone area, remove field wire from terminal DZM on HLS-7 board, remove car from inspection. The LCD should show, “Door zone relay fault.” Confirm that the car will not respond to hall or car calls. **Replace wire into DZM terminal** to return Car to normal operation.

### **6.8.1.5 Leveling Relay Operation and Monitoring**

**Critical Component:** LVL Relay

**Redundant Component:** LVLM Computer Monitoring Input

**Monitored Component:** LVL Relay Contacts

Position the car below or above floor level using Controller Inspection mode, Short resistor R4 to terminal 4A, R4 is located on HLS-7 board below JUP ribbon cable connector. Turn Controller Inspection switch off. The LCD Display should show, “Level Relay Fault.” Confirm that the car will not respond to hall or car calls. **REMOVE JUMPER.** Car shall return to normal operation once jumper has been removed and ANSI-Reset push button is pressed.

### **6.8.1.6 Car Gate Relay Operation and Monitoring**

**Critical Component:** CG Relay

**Redundant Component:** DLM Computer Monitoring Input

**Monitored Component:** CG Relay contact.

With the car doors fully closed, DLK LED indicator on IO-7 or PIO9, DCLF LED indicator OFF, apply 110 VDC with a jumper from terminal 4A to terminal SH47 jumper, located above HDR relay label, on HLS-7 board. The LCD should show, “Door Lock Relays Fault.” Confirm that the car will not respond to hall or car calls. **REMOVE JUMPER** car shall return to normal operation once jumper has been removed.

#### **6.8.1.7 Car Stop Bypass Relay Operation and Monitoring**

**Critical Component:** CSB Relay

**Redundant Component:** CSBM Computer Monitoring Input

**Monitored Component:** CSB Relay contact.

With the car level at a floor, remove field wire from terminal 17B on the HLS-7 board, to remove power to CSBM computer input. The LCD should show, “Car stop bypass relay Fault” Confirm that the car will not respond to hall or car calls. Replace wire to terminal 17B to return car to normal operation.

#### **6.8.1.8 Entry purposely left blank**

#### **6.8.1.9 Entry purposely left blank**

#### **6.8.1.10 Delta and BK2 Contactors, Motor and Brake Contactor Monitoring**

**Critical Component:** AA Relay, Delta and BK2 contactors

**Redundant Component:** STPM Computer Monitoring Input

**Monitored Component:** AA relay, Delta and BK2 Auxiliary contacts.

With the car level at a floor, remove AA relay from its socket on the HLS-7 board, to remove power to STPM computer input. The LCD should show, “Contactor Drop relay Fault” Confirm that the car will not respond to hall or car calls. Replace AA relay Car shall return to normal operation once relay has been replaced. Repeat for Delta and BK2 contactors by manually pressing contactor instead of removing wiring from auxiliary contacts.

#### **6.8.1.11 Entry purposely left blank**

#### **6.8.1.12 LVLO Relay output Operation and Monitoring**

**Critical Component:** LU and LD Selector signals

**Redundant Component:** LVLO Computer output & LVL relay.

**Monitored Component:** LU & LD, LVLM input.

Place car on test mode of operation and make several one and multi floor runs, observe that the LVLO output LED on IO-7 or PIO9 board and that the LVL Relay energizes only when the car comes into leveling zone of target floor independently of the LU and LD inputs. Please refer to test 4 above for LVL Relay test for LVL relay test.

### 6.8.1.13 DZ1 and DZ2 Selector signals Operation and Monitoring

**Critical Component:** DZ1 and DZ2 Selector signals

**Redundant Component:** DZI, DZM Computer inputs and DZ relay.

**Monitored Component:** DZ relay and DZI, DZM computer inputs.

Place car on test mode of operation and make several one and multi floor runs, observe that the DZ input LED on IO-7 or PIO9 board come on and the DZM input goes off as the car passes over the trucking zone but the car continues to move in high speed only allowing leveling and door operation at the target floor. Refer to test 3 above for DZ relay test and unintended movement test below for further monitoring of the DZ1 and DZ2 inputs.

### 6.8.1.14 Hall & Car Door Bypass Switch Operation and Monitoring

**Critical Component:** Hall and Car Door Bypass Switches

**Redundant Component:** HDBM Computer Monitoring Input

**Monitored Component:** Hall and Car Door Bypass Switches Contacts

Jump R15 resistor top to ground, R15 is located above the STOP relay on HLS board. The LCD should show, “Door Bypass System Fault.” Confirm that the car will not respond to hall or car calls. **REMOVE JUMPER.** Car shall return to normal operation once jumper has been removed

Place the car on Automatic Operation and open the hall and/or car doors, the DLK LED should be off. Turn on Car Door Bypass and/or Hall Door Bypass switch(s) as necessary. Verify that the controller mode of operation changes to Inspection.

On the controller relay board, flip the Inspection Switch to “INSP.” Flip the run switch “Up” and then “Down” and confirm that the car will not run on inspection. Turn on Car Door Bypass and/or Hall Door Bypass switch(s) off, to return car to normal operation, and press the ANSI-Reset push button to return car to normal operation.



**NOTE:** If the hoistway door or car door is bypassed, the elevator controller will prevent the car from being run using the machine room inspection circuit or on access inspection mode, the car will only be allowed to move on Car Top Inspection mode of operation.

### 6.8.1.15 Detection of Jumpers on Door Safety String

**Critical Component:** Car Gate and Hoistway Door Locks

**Redundant Component:** CG Relay

**Monitored Component:** CG, THD, DLK and DCL Computer Monitoring Input

With the car on automatic operation, place a jumper from terminal 4 to CG on the HLS-7 board. Press the Door Open button and allow doors to fully open. The LCD should show, “Door lock system fault.” Confirm that the car will not respond to hall or car calls.

**REMOVE JUMPER.** Car shall return to normal operation once jumper has been removed.

With the car on Automatic Operation, place a jumper from terminal 4 to THD on the HLS-7 board. Press the Door Open button and allow doors to fully open. The LCD should show,

“Door Lock System Fault.” Confirm that the car will not respond to hall or car calls.

**REMOVE JUMPER.** Car shall return to normal operation once jumper has been removed. Place the car on Inspection Mode and verify that the car will not respond to hall or car calls.

#### **6.8.1.16 Door Open and Closed Simultaneously**

**Critical Component:** Door Opened & Door Closed Limits

**Redundant Component:** DOL and DCL Computer Monitoring Inputs

**Monitored Component:** Door Opened & Door Closed Limits

Place a jumper from the Terminal DOB to terminal 4 on the IO-7 or PIO9 board and allow the doors to open fully. Confirm that the DOLF LED indicator on the IO-7 or PIO9 board is off, and remove the DCLF input wire from IO-7 or PIO9. The LCD should show, “Front Door Limit Switches Fault.” Confirm that the car will not respond to hall or car calls.

**REMOVE JUMPER** and reattach DCLF input wire to return car to normal operation.

#### **6.8.1.17 Revert to Automatic Operation (ASME 2.26.9.3.d)**

**Critical Component:** IN Computer Input, SU or SD Computer Outputs

**Redundant Component:** IN, and STOP relays

**Monitored Component:** INM, and STOPM Computer Monitoring Inputs

With the car on Inspection operation, place a jumper from D20 or D26 diode anodes on the HLS-7 board to terminal 3 “ground.” These diodes are in series with the computer SU and SD direction relay outputs. Confirm that the car will not move and will not respond to any car or hall call demand.

**REMOVE JUMPER.** Return the car to Normal mode of operation.

#### **6.8.1.18 Unintended Movement (ASME 2.19.2)**

**Critical Component:** DZ, and LVL Relays

**Redundant Component:** DZ, and LVL Contacts

**Monitored Component:** DZM, LVLM, CG, and THD Computer Monitoring Inputs

Place a jumper from the Terminal DOBF to terminal 4 on the IO-7 or PIO9 board and allow the doors to open fully. Confirm that the DOLF LED indicator on the IO-7 or PIO9 board is off. Turn power off, remove wires from 27 and DZM terminals located on HLS-7 board. Restore power.

The LCD should show, “Unintended Movement System Fault.” Relays GTS and GTSX should drop, setting the emergency brake and opening the directional circuits. Turn power off and rewire terminals 27 and DZM. Confirm that the error does not reset by cycling power. The latching fault should not clear until the ANSI-RST button is pressed.

### **6.8.1.19 Single Ground**

**Critical Component:** N/A

**Redundant Component:** N/A

**Monitored Component:** N/A

Short terminal 4 located on the controller power terminal strip, (not on the any of the PC boards) to ground. Fuse F4 should blow removing power to all elevator control relay logic disabling all controller functions. Turn power off, and replace fuse.

### **6.8.1.20 Permit Car Speeds Over 150 fpm (ASME 2.26.9.3.c except 2.26.1.5.10(b))**

**Critical Component:** LVL, STOP Relay, Motor Drive

**Redundant Component:** LSSM-5 Board, ST Relay

**Monitored Component:** LVL, STOP Relay Contacts

Place the car on Inspection operation. View the PVF parameters menu and select the inspection speed parameter. Write down the current inspection speed (so it can be restored later). Then increase inspection speed to 150 fpm. Run the car on Inspection and verify that the LSSM-5 board trips on Leveling/ Inspection. It should produce a LEV/INSP fault. This prevents the ST relay from picking which in turn should prevent the AA relay from picking and the motor contactor from operating. Refer to Section 5, LSSM-5 in this manual for LSSM-5 adjustment.

Reset the LSSM-5 board and restore the inspection speed to the original setting.

# Section 7 – Troubleshooting

## 7.1 System Not Functional in General (Car Won't Run)



**NOTE:** The Solid State portion of the Elevator Controls Microprocessor Controller is the most reliable part of the entire elevator system. While it is possible that a problem may occur, one should first look to the power controller and "outside world" for the malfunctions that most frequently take elevators out of service.



**NOTE:** Earthquake faults can only be cleared by pressing the EQS-RST button or by placing car on controller Inspection operation, once earthquake switches and sensors have been reset, then returning the car to normal operation,

### 7.1.2 General Troubleshooting Tips.

For your convenience, and in order to save troubleshooting time, the V900-PVF controller is equipped with multiple indicators that are designed to help you troubleshoot at a glance.

You are strongly advised to pay particular attention to the indicators on the I/O or PIO9 board. Every action instructed by the computer is indicated (DOF for example means door open function, the computer wants to open doors), and every action the human interface wants the computer to perform is also indicated (DOB for example means the door open button is active).



**NOTE:** Signal names written with bar on top of the signal name, indicates the signal is in active mode when the LED is off ( $\overline{\text{FRS}}$  and  $\overline{\text{FRA}}$  are a good examples – when the LED is off they indicate the car is on main or alternate fire mode respectively).

The computer error code LED display will flash a particular status/error code as detected by the P8 or PIO9 computer; a list of these codes can be found permanently applied to the inside of the controller door. Extra or replacement copies can be made from the list found in the Field Reprogramming Manual.

Computer error/status codes are also displayed in English format on the LCD display. Finally, an optional PC may be used for powerful troubleshooting, diagnostics, and for monitoring purposes.

### 7.1.3 Car Not Running General Check List

- a. Make sure that the car is not on Fire Emergency Service; The P8 or PIO9 will display the fire operation active if any. During normal operation of fire emergency circuits, 24-110V should be present on each fire recall terminal with respect to terminal 3, (refer to prints page 5 for fire interface circuits).
- b. If all terminals for Fire Emergency Service are properly set, refer to Section 7.2.1 for directions to reset the different modes of Fire Emergency Service.

- c. If the elevator is not set to Fire Emergency Service, all power supplies should then be checked. The natural starting point is the three-phase input. There must be 208-480 VAC (as specified) present between all combinations of phases.
- d. Verify that each power control step-down transformer has the correct secondary voltage (refer to Controller Schematic page 1 for terminal and fuse numbers). Replace fuses as necessary.
- e. Terminal 4A should measure approximately +110 VDC. The voltage at Terminal 50, (hall lamp supply) with reference to ground and the voltage between Terminal Strip terminals 1 and 2 should be measured and verified to be in accordance with the voltages shown on page 1 of the job prints. If any of the above power supply voltages are not within range, check the appropriate fuses.



**NOTE:** System common is the 3 buss, (normally terminal 3 is connected to chassis ground) unless otherwise noted all DC voltage measurements are with respect to Terminal 3 or chassis ground.

- f. Verify the Safety String (schematic for it is located on the upper portion of page 3 of the job prints). The Safety String is made up of normally closed safety contacts and switches connecting Terminal 4A to Terminal 23. In order for the car to run, all of these contacts must be closed, which will cause +110 VDC to be applied to Terminal 23 signaling the computer input that the safety string is closed (SAF input is active, verify LED on IO-7 or PIO9).
- g. Assuming Terminal 4 is operating properly at +110 VDC; verify that the computer display does not show Safety String Open. If this message is displayed, check to be sure that the termination jumper plug has been correctly placed on the last IO or IO-EX board; inside the Out ribbon cable connector.
- h. Verifying that the GTS indicator located on the IO-7 or PIO9 is on, the following relays should also be on: GTS, GTSX, and STOP (STOP will be on for Automatic mode of operation and off for Inspection/ Access operation) CG, and once demand is establish, U or D (depending on intended direction). AA should be on, H relay will also pick if the slowdown for that direction of travel is closed and automatic mode of operation is selected.



**NOTE:** All relays mentioned below on item “i” are located on the HLS-7 board.

- i. Direction (SU/SD) and speed signal HR both enter the HLS-7 board from the computer relay driver outputs on the IO-7 or PIO9 board via the connecting ribbon cable. Pin numbers are indicated on prints (pin one is indicated by a red conductor in the ribbon cable). If a high speed run toward a call is required, register a call and check the appropriate up or down arrow (SUA/SDA) LED. If neither arrow is on, make sure no special function has control of the car (INS in, INA out), and that the fire warning indicator (FWI) is off. If all the above functions are normal, call registration should establish a direction of travel as indicated by an arrow, which can be observed on the IO-7 top right corner or towards bottom left corner on the PIO9 LED indicator. If no arrow is displayed, refer to the Microprocessor Troubleshooting Section 7.6 following below.

- j. Some of the relay coils referenced above are hardware interlocked through the door safety circuit. In order for the car to move away from a landing, all doors must be closed and locked. A locked condition is indicated by a lit DLK indicator on the I/O or PIO9 board (+110 VDC on Terminal 11). An unlocked condition leaves the DLK indicator unlit (with 0 VDC on Terminal 11). Also the door closed limit switch should be open and the door open limit should be made, (verify 0 volts on terminal DCL and +110 VDC on terminal DOL). If the door string indicates an unlocked condition, examine and repair door locks as required.
- k. Should the U or D relays remain unlatched with a properly locked door circuit, check the UP STOP LIMIT switch located between terminals 28 to 30, similarly terminals 29 to 33 for down. These switches are feeding power to the directional circuits. If switches are not made, the direction relays can not be energized by the microprocessor outputs. See page 3, area 4 of prints for stop limit switches and directional circuit functions.

## 7.2 Microprocessor Error Reporting and Correction

### 7.2.1 Elevator Normal Operation Fault Monitoring and Display

The table below shows the different faults that can be generated from the normal monitoring portion of the system as follows:

**Scrolling Message:** Indicates the display shown on the LCD display for each fault.

**Description and Possible Solution:** Explains how the fault was generated and possible

-  **NOTE:** Faults listed in Figure 7.2 below will not prevent the car from starting or executing the function fault such as Fire Service, Independent Service, Etc. Faults listed in Figure 7.2 will prevent the car from running.
-  **NOTE:** A group of special conditions are recognized by the microprocessor. If one of these "errors" occurs, a code will be displayed corresponding to that condition. The microprocessor will scroll up to 6 errors at a time on the LCD display. The eight LED array will display the error that needs too be corrected first, that is, the one with the highest priority.
-  **NOTE:** The field technician should look first to the LED array to identify the error that needs to be corrected first. Error codes can be found in this Section (below) and on the inside of the control equipment enclosure door.

**Figure 7.2 – Fault Conditions that will Not Prevent the Car from Running**

Scrolling Message	Description and Possible Solution
Main Fire Service Phase 1	Main floor smoke detectors or HF1 smoke detectors activated. Reset smoke detectors. <b>Return car to the fire floor and turn fire service switch to reset to clear fire service condition.</b>
Alternate Fire Service Phase 1	Alternate floor smoke detectors or HF2 smoke detectors activated. <b>Reset smoke detectors. Return car to the fire floor and turn fire service switch to reset to clear fire service condition.</b>
Fire Service Phase 2	Fire Service Phase II switch is on or was on before power down. <b>Return car to the fire floor and turn Fire Service Phase II switch to off position and open the doors to break door open limit to clear fire service condition.</b>
Front Doors Not Fully Closed	Front door closed limit not open, even do door lock is made.
Rear Doors Not Fully Closed	Rear door closed limit not open, even do door lock is made.
Leveling Down	Level Down input on
Leveling Up	Level Up input on
In leveling Zone Without Direction	Either level Up or Down input is active but direction of movement can't be achieved. <b>Verify Up and Down terminal switches probably one or both are open.</b>
Re-Leveling Down	Re-Leveling Down on after being level
Re-Leveling Up	Re-Leveling Up on after being level
Trying to Re-Level Without Direction, or Both Directions On	Either level Up or Down input become active after being level, but direction of movement can't be achieved. <b>Verify Up and Down terminal switches probably one or both are open.</b>
Doors Unlocked	Car at landing with the doors not locked, DLK input off.
Security mode in operation	BSI input is active, placing car in COP security operation, where the COP car call buttons are used to input access codes to place car calls.
Independent Service	IND input is active, placing car in independent mode of operation.

Fault Conditions that will Not Prevent the Car from Running (continued)	
Hospital Service	Car is responding to a hospital emergency request.
Independent and security mode	BSI and IND inputs are active simultaneously. <b>Remove one of the inputs; these two modes of operation contradict each other.</b>
Emergency power operation	Car is executing an emergency power return or operating under emergency power.
EMT phase 1 operation	EMT-1 input became active to request Massachusetts's Medical emergency recall.
EMT phase 2 operation	EMT-2 input became active to place the car on Mass. Medical emergency mode of operation.
Earthquake: Normal condition	EQI input become active and then went back to normal allowing the car to run on earthquake normal mode at 150ft/min maximum speed.
Earthquake: Abnormal condition	EQI and CWI inputs became active and stayed active, counter-weight derailed grounding both inputs, or CWI input is active only indicating that the string running in the hoistway tear down.
Heavy Load in Car	HLI input became active, placing car under heavy load operation thus bypassing hall calls until doors open and HLI input becomes in-active.
Controller Inspection	Car is under controller inspection mode of operation.
Access Inspection	Car is under access inspection mode of operation.
In-car inspection	Car is under in car inspection mode of operation.
Ca top inspection	Car is under car top inspection mode of operation.
Viscosity Control	The microprocessor is running the pump motor while the VSI input is on to keep the motor oil viscosity under control. The pump will run for three minutes on and stop for nine minutes, and will continue this cycle until VSI input becomes inactive.
Car on wild operation	Group - loss of communication or WILD operation is active. Function can be used for Sabbath operation.

Fault Conditions that will Not Prevent the Car from Running (continued)	
Car door bounced during takeoff	The car took off on high speed run and the doors relaxed, opening the door lock safety string to terminal 11. <b>Make sure door close power while running shunt jumper Sh21 on HLS board has been installed, where applicable, verify page 3 of prints and your door operator manufacturer for proper guidance.</b>
Door lock clipped open at high speed	The car was running on high speed while the door lock broke open. <b>Check door lock clearance.</b>
Hall or car lamp fuse blown	The computer is detecting all car or all hall call buttons active at the same time, which happens when the common to the lamps is not present. <b>Check fuses FLS or 50H, 50. Refer to page 1 of prints.</b>
Absolute PI correction	The computer internal selector track did not match the absolute floor encoding in the hoistway for the floor the car just arrived. <b>Remove RD signal and run the car with the internal selector tracking only, if car does not stop at the wrong landing verify the position feedback portion of the selector. If the car stops at the wrong floor verify the stepping portion of the selector.</b>
Door zone count error	Error display will occur when stepper tracking option is set to on, and is used to determine which selector signal may be missing in the hoistway causing the car to stop at the wrong floors. <b>Call Elevator Controls for more information about using this option for diagnostics.</b>
Door Zone Input Error	The car got the door zone input before engaging leveling, i.e. crash into a floor. Once error occurs it latches until microprocessor is reset or the car is momentarily placed on inspection to clear fault message. <b>Verify LU and LD work properly at each floor.</b>
Car out of Step	Missed door zone input or mechanical speed limit actuated before selector stepping input. This error is only detected while the car approaches a terminal landing. Once it occurs, it latches until the microprocessor is reset or the car is momentarily placed on inspection to clear fault message. <b>Correct position of Up and Down slowdown switches, need to activate 1 to 2 inches after STU or STD drop off. Verify and replace any DZ target on the selector if needed.</b>
Test mode	Test switch on, car will behave as in independent service but will inhibit door opening operation.

Fault Conditions that will Not Prevent the Car from Running (continued)	
Unknown Error	The computer detected an error that was not able to identify. <b>Place car on inspection, and reset the microprocessor. Call Elevator Controls if error persists.</b>
Password access active	Current password has been entered and system access granted.

Figure 7.3 – Fault Conditions that Will Prevent the Car from Running	
Scrolling Message	Description and Possible Solution
Safety String Open	Voltage is not getting to the microprocessor SAF input. <b>Check voltage on terminal 4A (110 VDC), and follow the safety string path to terminal 24. Refer to page 3 of job prints.</b>
USD2 & DSD2 on simultaneously	Both Up and Down Slowdown speed limits switches are open at same time. <b>One of the two or both limit switches failed repair or replace.</b>
Check channel A cable / termination	A cable on Channel A chain is not properly seated or the last board on the chain does not have the terminator jumper installed. <b>Re-seat cables, or add terminator to last IO board.</b>
Check channel B cable / termination	A cable on Channel B chain is not properly seated or the last board on the chain does not have the terminator jumper installed. <b>Re-seat cables, or add terminator to last IO board, only for P8 driven controllers.</b>
EEPROM write failure	The computer was not able to write to the electrically erasable EEPROM. <b>Replace EEPROM U-18. U-18 contains the personality portion of this elevator, replacing this chip will mean that all field modified parameters will need to be re-entered, or notify Elevator Controls so that they can be incorporated with new chip.</b>
Door open limit & door lock on simultaneously	Door lock input is active and, door open limit (DOL or DOLR) is open. One of the two inputs is incorrect if the doors are fully closed the DOL limit is bad, and if fully open the door lock is bad. <b>Correct either door open limit or door lock switches.</b>
Starter stuck in Wye or bad starter output	No DEL input or feedback is being received and the Delta output has been activated. <b>Bad delta contactor or auxiliary contact, or bad IO-7 or PIO9 output or input.</b>

Fault Conditions that Will Prevent the Car from Running (continued)	
Door reopen input active	The door open button or safety edge is still active and the doors are already fully open.
DCL: Doors not closed	Door lock is made but door closed limit still closed. <b>Re-position DCL switch as to open while the doors lock.</b>
Motor run stall protection timer expired	The car did not reach destination during the time allowed to be with the pump motor on. This problem occurs if car can not level into a floor due to malfunction of valves, or the Motor limit timer is too short for the distance required to travel. <b>Verify Motor stall protection Timer, refer to the Field Reprogramming Manual, and make sure car is capable leveling at every landing especially terminal landings without opening the normal terminal switches.</b>

### 7.2.2 ASME-17.1A fault Monitoring

The table below shows the different faults that can be generated from the ASME-17.1A monitoring portion of the system as follows:

- a. Message: Indicates the display shown on the LCD display for each fault.
- b. Output: The response of the system by dropping Stop relay only, or Stop and GTS-GTSX combination depending on the severity of the fault.
- c. Reset Required Yes: Indicates that in order for the car to return to normal the fault generating problem has to be resolved and the ANSI-Reset push button has to be pressed to clear the fault. Reset Required No: will allow the car to return to normal operation as soon as the problem causing is resolved.
- d. Conditions Producing Monitor Fault: Indicate the input and output flags that are involved to generate such faults.
- e. Description and Possible Solution: Explains how the fault was generated and what may be a corrective action to resolve fault.
- f. Address of Bit in Memory: Indicates where in memory the computer stores the state of the monitored points, please refer to the Field Reprogramming Manual to see how to access these memory locations.

**Fig 7.4 ASME-17.1A Monitor Errors**

Message	Output	Reset Required	Conditions Producing Fault	Description and Possible Solution	Bit Memory Address
Governor contact fault.	Reset gtsOut	Yes	GOV = 0	Governor auxiliary monitored contact opened. <b>Verify Governor mechanical operation, reset Governor.</b>	F1C2 bit 1
Contact drop system fault <b>Note: Fault active also on Non- ANSI-2000 Controllers</b>	Won't run until fault clears	No	MGR = 1 STPM = 1	Contact relay output is on and monitoring input is on. <b>Bad contact on AA, BK, H, or contactor auxiliary, see page 3 of job prints for reference.</b>	F007 bit 7 F1C2 bit 5
GTS relay fault	Reset inStop and gtsOut	Yes	GtsOut = 1 GTSM = 1	GTS relay output and GTSM monitoring contact is active. <b>GTS or GTSX or both relays are bad.</b>	F1CE bit 0 F1C2 bit 0
Stop relay fault	Reset inStop	No	HDBM = 1 INS-STOP= 1 STOPM = 1	Door lock bypass is off, INS-STOP output is on and STOPM monitoring contact is active. <b>Bad STOP relay.</b>	F1C2 bit 6 F1CE bit 5 F1C2 bit 3
Front door limit system fault	Won't run until fault clears.	No	DCLF = 0 DOLF = 0	Door open limit front and door closed limit front are both open. <b>Bad IO or PIO9 board or field problem.</b>	F006 bit 0 F000 bit 7
Rear door limit system fault	Won't run until fault clears.	No	DCLR = 0 DOLR = 0	Door open limit rear and door closed limit rear are both open. <b>Bad IO or PIO9 board or field problem.</b>	F006 bit 1 F005 bit 7
Door zone relay fault	Won't run until fault clears.	No	DZORDZ = 0 DZM = 0	Door zone input is not active and DZM relay monitoring contact is also not active. <b>Bad DZ relay.</b>	F01A bit 0 F37F bit 2
Door zone relay fault	Won't run until fault clears.	No	DZORDZ = 1 DZM = 1	Door zone input is active and DZM relay monitoring contact is also active. <b>Bad DZ relay.</b>	F01A bit 0 F1C2 bit 2
Door lock relays fault	Won't run until fault clears.	No	CGF = 1 DLM=1 Or CGR=1 DLM=1	Car gate CG Front or CG Rear, and Hoistway door locks are open but monitoring input DLM is not active. <b>Bad CG relay.</b>	F1C2 bit 7 F1C3 bit 0  F1C3 bit 5 F1C3 bit 0
Door lock relay fault	Won't run until fault clears.	No	CGF = 0 CGR = 0 HDR=0 DLM=0	Car gates inputs are active and CG monitoring contact is also active. <b>Bad CG relay or HDR relay, or both relays are bad.</b>	F1C2 bit 7 F1C3 bit 5 F1C3 bit 4 F1C3 bit 0

<b>ASME-17.1A Monitor Errors (continued)</b>					
Level relay fault	Won't run until fault clears.	No	lvlOut = 1 LU = 1 LVLM = 1	Car is allowed to level into a floor LU input is active and LVLM monitoring input is active. <b>Bad LVL relay.</b>	F1CD bit 0 F01C bit 7 F001 bit 1
Level relay fault	Won't run until fault clears.	No	lvlOut = 1 LD = 1 LVLM = 1	Car is allowed to level into a floor LD input is active and LVLM monitoring input is active. <b>Bad LVL relay.</b>	F1CD bit 0 F01C bit 6 F001 bit 1
Bypass system fault	Won't run until fault clears.	No	INS = 1 HDBM = 1	Inspection input not active inside memory, LED indicator on IO-7 or PIO9 On, and HDBM Switch monitoring input still active. <b>Bad IO-7, or PIO9 or bad HLS-7 bypass Switches.</b>	F001 bit 7 F1C2 bit 6
Door lock system fault	Won't run until fault clears.	No	IN = 0 CGF = 1 DOLF=0 DCLF=1 THD=0	Car not on inspection, front doors fully open, and car gate is closed. <b>Bad IO-7 or PIO9, or bad Door open limit front Switch.</b>	F001 bit 7 F1C2 bit 7 F000 bit 7 F006 bit 0 F1C3 bit 1
Door lock system fault	Won't run until fault clears.	No	IN = 0 CGF= 0 DOLF=0 DCLF=1 THD=1	Car not on inspection, front doors fully open, and hoistway doors still closed. <b>Bad IO-7 or PIO9, or bad hoistway door lock Switch.</b>	F001 bit 7 F1C2 bit 7 F000 bit 7 F006 bit 0 F1C3 bit 1
Door lock system fault	Won't run until fault clears.	No	IN = 0 CGR= 1 DOLR=0 DCLR=1 HDR=0	Car not on inspection, rear doors fully open, and car gate is closed. <b>Bad IO-7 or PIO9, or bad Door open limit rear Switch.</b>	F000 bit 7 F1C2 bit 7 F005 bit 7 F006 bit 1 F1C3 bit 1
Car stop bypass relay fault	Won't run until fault clears.	No	IN = 0 CGR= 0 DOLR=0 DCLR=1 HDR=1	Car not on inspection, front doors fully open, and hoistway doors still closed. <b>Bad IO-7 or PIO9, or bad Door open limit Switch.</b>	F000 bit 7 F1C2 bit 7 F005 bit 7 F006 bit 1 F1C3 bit 1
Car stop bypass relay fault	Won't run until fault clears.	No	CSB = 0 CSBM = 0	CSB relay output is off, and CSB monitoring contact input is also off. <b>Bad CSB relay.</b>	F007 bit 6 F1C2 bit 4
Car stop bypass relay fault	Won't run until fault clears.	No	CSB = 1 CSBM = 1	CSB relay output is on, and CSB monitoring contact input is also on. <b>Bad CSB relay.</b>	F007 bit 6 F1C2 bit 4

<b>ASME-17.1A Monitor Errors (continued)</b>					
Inspection switch fault	Won't run until fault clears.	No	InsACC = 1 or InsCT = 1 or	Main inspection input is off, and one of the inspection mode inputs is on. <b>Bad IO-7 or PIO9, or bad Inspection, car top or in-car, or Access switches bad.</b>	F01C bit 2 F01C bit 4
Inspection switch fault	Won't run until fault clears.	No	insINC = 1 INS = 0 insACC = 1 insCT = 1	Main inspection input is on, and access input and car top input on. <b>Bad Access switch.</b>	F01C bit 3 F001 bit 7 F01C bit 2 F01C bit 4
Inspection switch fault	Won't run until fault clears.	No	INS= 0 insACC = 1 insINC = 1	Main inspection input is on, and access input and in car input on. <b>Bad Access switch.</b>	F001 bit 7 F01C bit 2 F01C bit 3
Inspection switch fault	Won't run until fault clears.	No	IN = 1 insCT = 1	Main inspection input is on, and in car and car top input on. <b>Bad in car inspection switch.</b>	F001 bit 7 F01C bit 4
Drive Relay fault	Won't run until fault clears.	No	Hydro = 0 SAF =1 SSM =1 DSAF=1	Drive Unit safety relay has Normally open and closed contacts active. <b>Bad DSAF relay, relay is located in the drive unit.</b>	FF03 bit 0 F005 bit 5 F01F bit 2 F1C3 bit 2
LSSM Relay fault	reset inStop and gtsOut	Yes	Hydro = 0 UPS/DNS = 1 SSM =1 LSSM=1 SU/ SD =1	LSSM tripped or bad LSSM relay. <b>Bad LSSM relay or tripped LSSM board relay is located on LSSM board.</b>	FC92 bit 0 FF01 bit 3/2 F005 bit 5 F01F bit 0 F07 bit 2/1
Unintended movement system fault <b>Car will stop immediately. Manual reset is required.</b>	reset inStop and gtsOut	Yes	INS = 1 DZORDZ = 0 THD = 0 CG=0	Car is not within door zone area, not on inspection mode, and the car gate and hoistway door lock string are open. <b>Correct door lock string, and car gate lock switches. Note: While releasing car from car top inspection there is a time-out period to allow the technician to close doors and release car before tripping occurs.</b>	F01C bit 3 F01A bit 0 F1C3 bit 1 F1C2 bit 7
SDI Relay fault <b>PVF JOBS only</b>	Won't run until fault clears.	No	SDI Opt.= 1 Hydro = 0 SAF =1 SSM =1 SSAFM=1	SDI board safety relay has Normally open and closed contacts active. <b>Bad SSAF relay, relay is located on HLS-7 board.</b>	FC92 bit 0 FF03 bit 0 F005 bit 5 F01F bit 2 F01F bit 1

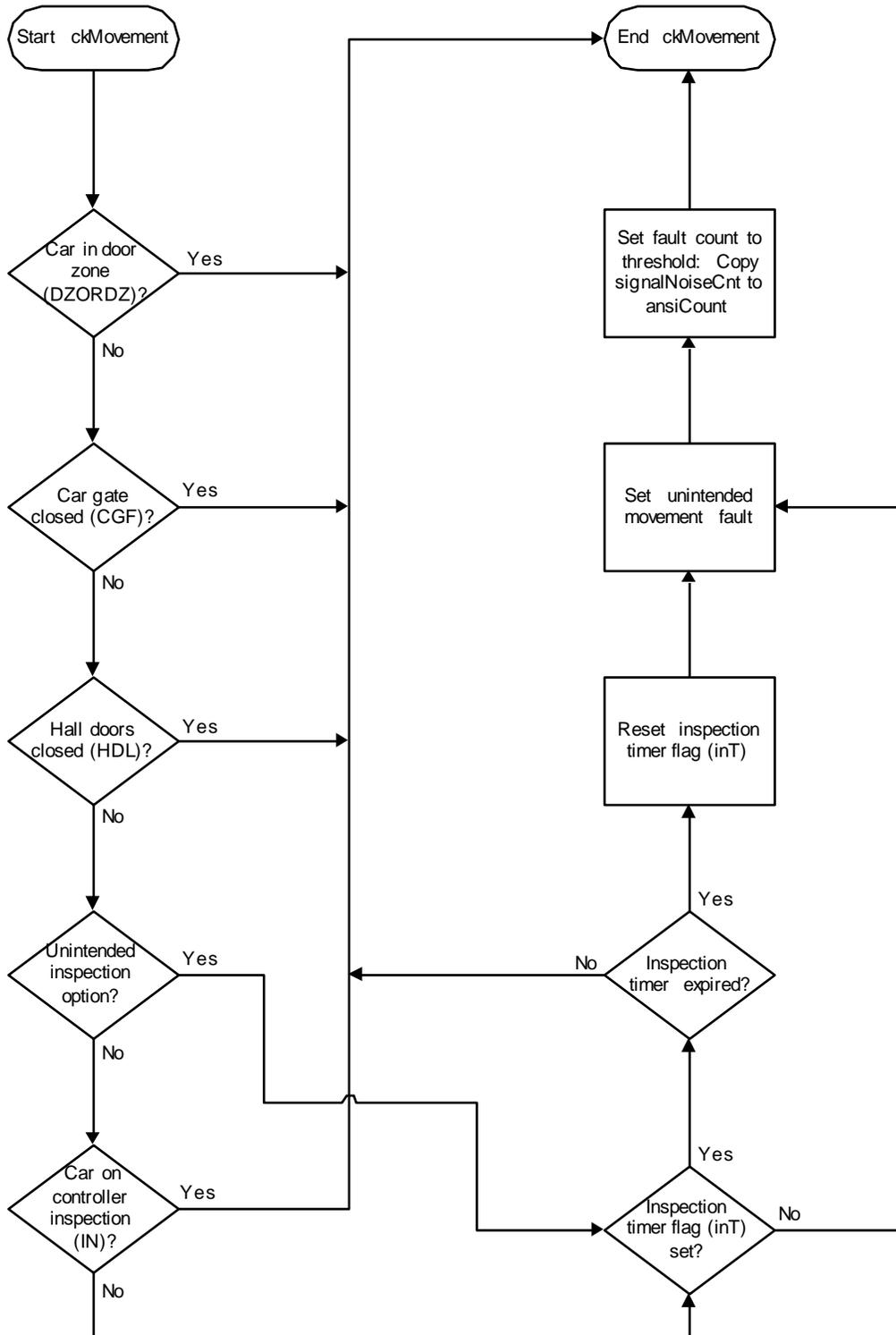
### **7.2.3 ASME-17.1A Fault Monitoring Flow Charts**

The following section contains a series of flow charts showing the different scenarios that create an ASME-17.1A monitoring fault. Flow chart analysis may aid understanding of system processes In order to resolve problems that may occur with the elevator control system.

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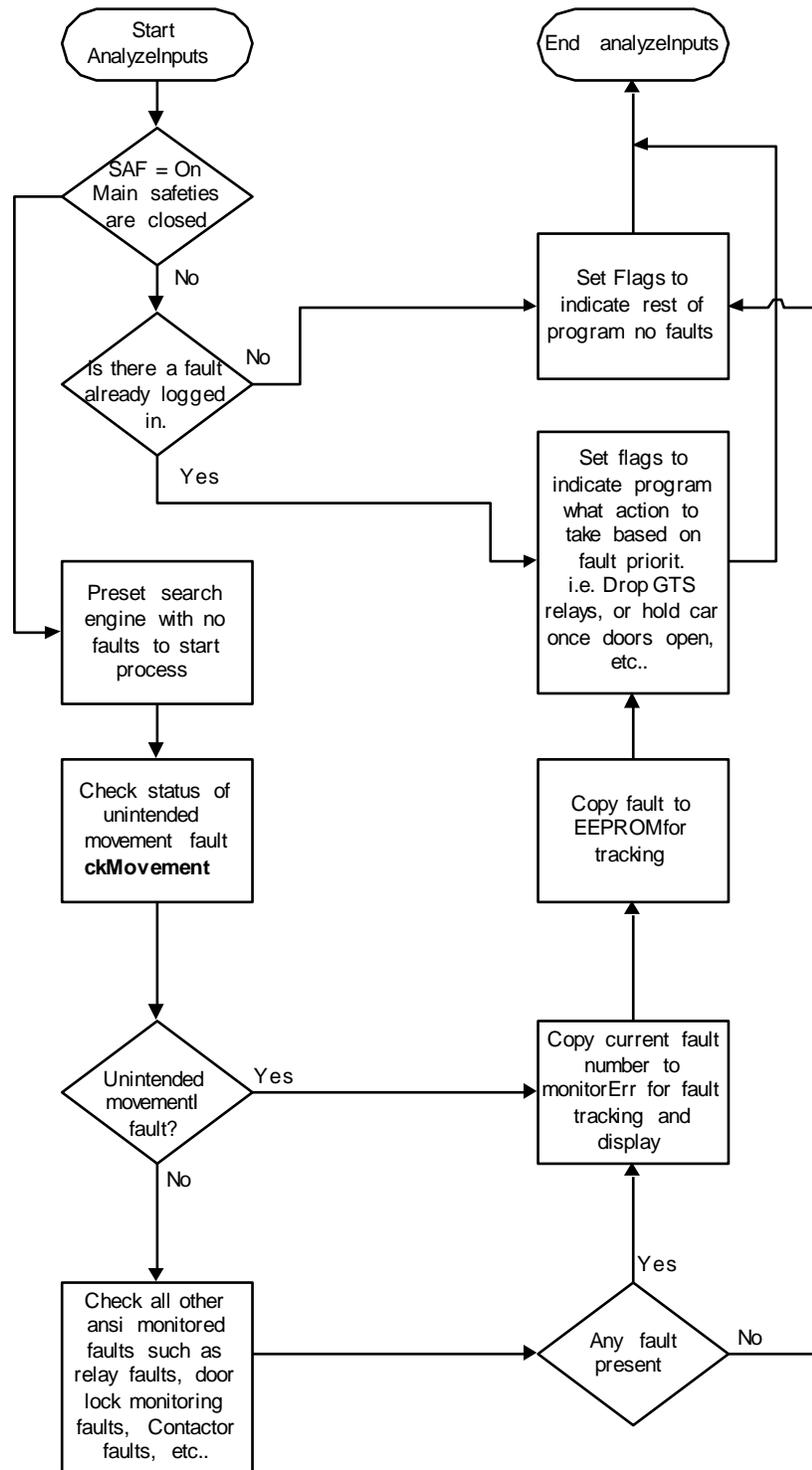
### 7.2.3.1 Unintended Movement Flow Chart

The following flow chart shows the status and events that result in Unintended Movement Fault.



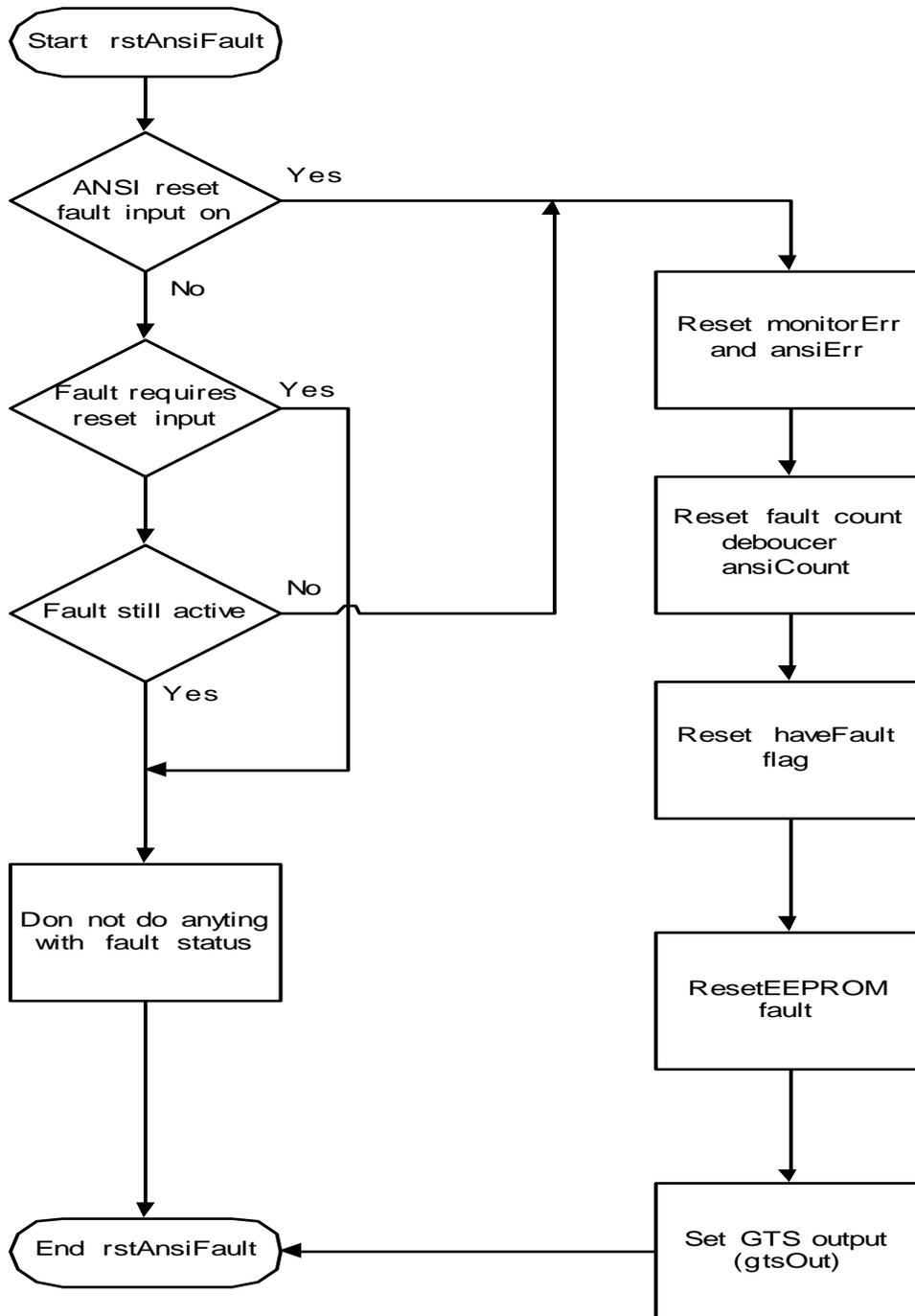
### 7.2.3.2 ASME-17.1A Monitoring Analysis Input Fault Flow Chart

The following flow chart shows the fault-scan process for logging and responding when an ASME-17.1A monitoring fault is detected.



### 7.2.3.3 ASME-17.1A Fault Reset Process Flow Chart

The following flow chart shows the fault reset process required by the monitoring programs for both latching faults (faults requiring the reset fault input) and not-latching faults (faults which the program will auto reset once the fault condition clears).



## 7.3 Malfunctions in the Operating System

### 7.3.1 Doors Operating Improperly or Not at All

Problem	Solution
Blows fused F8 and/or F7 and/or Resistor (RD1) Overheats (25ohms 225W).	Test For: (1) Damage to relays O, C, or CX. (2) Mechanical trouble on door operator on car.
No operation of doors, DO and DC relays operate OK, fuses F7 and F8 are OK.	Check: (1) All components in the O, C, and CX relay circuits, and (2) Mechanical trouble on door operator on car.
Doors operate one direction only and correct DO and DC relays are operating.	Test for contact closure across proper relay--DC for close, DO for open.
Doors operate one direction only. Only one DO or DC relay will operate.	Check DOF/DCF indicator on I/O7 or PIO9 driver board. (Refer to Microprocessor Troubleshooting Guide). Turn "NORMAL-TEST" switch on HLS-7 board to NORMAL."
Door speed incorrect at either end of travel. Doors slam or drag.	Check: (1) Slowdown cams that operate slowdown resistors on door operator on car top. Readjust if necessary; and (2) Spring operated door closer on hoistway door.
Doors open a few inches or less at one particular landing and appear to be mechanically stuck but re-close so car can leave.	Readjust upper and lower link connections on lift rod for door lock so that lock properly clears lip of enclosure.
Other mechanical problems with doors.	Refer to drawings relating to mechanical portions of door operator.

### 7.3.2 Call Button Problems

Problem	Solution
Car responds to call button but call registration lamp will not light.	After verifying that the bulb is not burned out, check to see if the problem is internal to the controller or in the external wiring. This is most easily observed by noting if associated LED is lit. If it won't show call registration, check for voltage on call common supply. Should the common voltage be correct, replace the associated input/output driver board.
Car will not respond to a specific call.	<p data-bbox="678 495 1435 594">If the system does not register a call (or a group of calls) but the car functions normally otherwise, the call information is not reaching the computer data storage memory.</p> <p data-bbox="678 632 1435 905">First make sure that the car and hall call common (terminal 6 for car calls or terminal 50 for hall calls) have proper fixture voltage with respect to 3 buss. Next, check the terminals on the controller. One easy method of determining whether the problem is internal to the controller or in the external field wiring is to momentarily jumper 3 to the call terminal number in question. If the car responds to the call, the problem is external.</p> <p data-bbox="678 942 1435 1134">If not: (1) Check that when call terminal is jumpered to terminal 3, the corresponding LED lights up, then refer to microprocessor troubleshooting section to check the computer CCD (HCDX) - Car (Hall) Call Disconnect - function inside computer indicating computer not accepting calls. (2) Replace the associated input/output board.</p>

### 7.3.3 Position Indicator Malfunctions

Problem	Solution
Position indicator is out of step with the elevator car physical position	<p data-bbox="678 1287 1435 1419">The computer system contains automatic synchronizing logic to place the position indicator in step with the car whenever it reaches a terminal landing. Therefore placing a call for a terminal landing should resynchronize the position indicator.</p> <p data-bbox="678 1457 1435 1730">Should the car get out of step repeatedly, or the position indicator jumps from terminal to terminal, a stepping problem is indicated. Verify proper operation of the DZ, STU, STD (and ISTU and ISTD, if provided) inputs, making sure that the proper signal LED operates when magnetic switch is on a vane (note that STU/STD, ISTU/ISTD indicators go off when input is active), and signal reaches the appropriate controller input terminal.</p> <p data-bbox="678 1768 1435 1856">Also check for missing or damaged hoistway vanes, and make sure that activation of STU or STD does not overlap with activation of DZ or LU/LD.</p>

## **7.4 Proper Stepping Sequence**

This section is intended to describe the state of the stepping signals required to execute an automatic run, and to illustrate how the elevator computer, P8 or PIO9, keeps track of the car movements as it travels from floor to floor.

### **7.4.1 Initial Selector Status**

While the Car is at a landing floor level

1. The DZ indicator LED will be lit, indicating car is at floor level.
2. STU/STD signals (at P8 or PIO9 board memory location F000) from the PVF system are lit inside computer memory; Refer to the Field Reprogramming Manual "Memory Flags List" menu.
3. Indicating that stepping inputs from SDI are not active, i.e. they are active low.

### **7.4.2 Re-Arming the Selector**

1. As car travels out of the door zone area, the DZ indicator should turn off.
2. The STU (or STD for down) indicator will turn off as the SDI sends stepping signals to the P8 or PIO9 microprocessor Position indicator output will reflect the new floor position.
3. Further activation of STU/STD will be ignored until after ISTU/ISTD is cycled (on/off), "re-arming" the electronic selector for stepping at the next floor.

### **7.4.3 Car Approaching a Stop at Floor**

1. Once the PVF system determines that the travel distance to the target floor has been met, it sends the last STU/STD signal to the P8 or PIO9 board, causing the elevator microprocessor to update position to match the target position.
2. After the last STU/STD signal, the P8 or PIO9 drops the H relay output.
3. The PVF will hold the last ISTU/ISTD until the car passes the position half way in between floor preceding the target and the target.
4. After the last ISTU/ISTD signal, the P8 or PIO9 drops the HI flag and turns on LVLO output to enable the leveling sequence.
5. As the car travels into the Door Zone area, it is driven into final stopping position by the LU and/or LD leveling sensors.

## **7.5 Microprocessor Troubleshooting**

This section is intended to help determine if the Computer Logic Check indicates a faulty board, and if so, which if any of the microprocessor system logic boards is bad so that a good board can be substituted. No attempt has been made to diagnose specific problems that might occur on any particular board, since doing so requires specialized test equipment, which is not generally available to elevator service mechanics in the field.

Assume it has been determined that an output signal is not being sent by the computer system when conditions indicate that a signal should be present. The next step is to determine whether the computer is attempting to turn on the output or not, and if not, what might be preventing it from doing so.

To find out what the computer is trying to do or "thinking", look into the computer memory itself using the onboard diagnostics described in the Field Reprogramming Manual.

### 7.5.1 Troubleshooting Example

For example, let's say you note that the door open output fails to operate door open relay DO in response to a door opening input signal. You observe that the DOF (door open function) output LED indicator does not turn on. Set the diagnostics switches as described in the Field Reprogramming Manual. Locate the DOF function on the Memory Flags Listing page, which indicates an address of F007 for DOF. Check the LED indicator corresponding to address location F007 and observe that the LED is off.

This tells us the computer is not turning on the Door Open output. This must mean that either the open signal input (say door open button DOBF address F001 is not coming in, or the computer incorrectly thinks doors are already fully open (DOLF - door open limit front input is zero, address F000). Alternatively, the computer may have determined it unsafe to open doors (DZ=0 or HIR=1). Inspection of these flags will show that either (1) an input was not supplied to the system properly, or (2) that the computer cannot see it. In the later case, it is suspected that the I/O7 or PIO9 board (especially if DOBF and DOLF do not track input signals) or ribbon cable connecting the I/O board to the computer board is faulty for standard controllers.

Based on the methods used in this example, any other input/output can be traced to the computer memory to help identify the cause of the fault. The section following illustrates the computer logic used to process the indicated outputs and signals.

## 7.6 Operational Logic Description

The following description of computer logic control is described in a synthesized format (Boolean logic flow equations). They are very simple to read and understand if the following guidelines are understood:

- a. The logic equations below use signal abbreviations, as listed in the Field Reprogramming Manual, which are referenced in the job prints describing input/output signals. Straightforward signal abbreviations aid understanding (e.g., DOB=door open button, DC=Down Call cancel, etc.).
- b. The small zero superscript used on a signal name indicates that the signal is active when off, or it is otherwise required that the signal go off in order for something else to happen. Thus, DOLF<sup>0</sup> is a signal that, when on, indicates that doors are not fully open. When off, DOLF<sup>0</sup> indicates that doors are fully open.
- c. The plus symbol + is used to indicate an OR function. Thus, the equation: DOB+SE reads, "either door open button input OR safety edge input". Likewise, the & symbol is used to indicate an AND function. Thus the equation DOI & DOLF<sup>0</sup>=DOF reads, "door open intent on AND door open

limit off will generate a door open function output". Please note that the words AND and OR are used instead of & and + symbols when combining two smaller equations.

### 7.6.1 Door Open Function Output - DOF

(Demand) CCF+UC+DC OR (Input) DOB+SE+PHE+DHLD AND DZ = DOI  
DOI & DOLF<sup>0</sup> = DOF

### 7.6.2 Door Open Function Rear Output - DOFR

SAME AS ABOVE, FLAGS ARE SUFFIXED WITH LETTER R: CCFR, UCR, ETC.

### 7.6.3 Computer Up Output - SU

Start: DZ & DLK<sup>0</sup> & HIR & DMU & DCL<sup>0</sup> = SU  
Hold: HIR+DZ<sup>0</sup> AND SU & DLK<sup>0</sup> = SU

### 7.6.4 Computer Down Output - SD

Same as SU above, replace DMU/SU with DMD/SD.

 **NOTE:** DMU/DMD are the demand flags, they are set any time the computer is requested to move the car in response to a call (SUA+SDA = 1), car lost (BFD+TFD =1), parking demand (UPF+LPF = 1), fire or emergency recall (FRM+EPR).

### 7.6.5 High Speed Output - HR

Start: DLK<sup>0</sup> & EQA<sup>0</sup> & (DMU & USD1 + DMD & DSD1) & LVL & DOI<sup>0</sup> = HR  
Drop: CCT+HCT+CCF+CCR = HR<sup>0</sup> . Call answered.  
OR DMU<sup>0</sup> & DMD<sup>0</sup> & (SU & STU + SD & STD) = HR<sup>0</sup> . Lost demand.  
OR DLK+EQA+(DNS & DSD1<sup>0</sup>)+(UPS & USD1<sup>0</sup>) = HR<sup>0</sup> . Not save for HR.

### 7.6.6 Call Disconnect and Reject - CCD, HCDX, HCR

A. CCD - CAR CALL DISCONNECT (CAR CALLS WON'T LATCH):  
IN+EPI+FRM+EPS+EQA+MLT+INC+ISR<sup>0</sup>+TFD+BFD+CCDFU+CCDFD = CCD

B. HCDX - HALL CALL DISCONNECT (HALL CALLS WON'T LATCH):  
FRS<sup>0</sup>+FRA<sup>0</sup>+EQA<sup>0</sup> = HCDX. If duplex both cars' flags are considered.

C. HCR - HALL CALL REJECT (CALLS LATCH BUT CAR WON'T RESPOND):

INC+FRM+EQA+TOS+ISR<sup>0</sup>+HLW+SAF<sup>0</sup>+IN+EPS = HCR

 **NOTE:** Even if HCR=0 (CCD=0), Hall (car) calls will be ignored by computer (even when latched-in if car stopping table indicates car should not respond to such call. See Car Stopping table in field re-programming manual.

## 7.7 PVF troubleshooting.

Refer to the PVF System Manual, Sections 7 and 8, for troubleshooting this microprocessor. It will helpful to read through the PVF manual to become aware of the application of this microprocessor and to learn how to use the onboard diagnostics tool provided as an integral part of this board.



**WARNING:** Do **NOT** depress the PVF microprocessor reset button while car is running, as it will cause an emergency stop. Use extreme care.

## 7.8 Hardware Logic

### 7.8.1 Computer Power Supply

The proper voltage to the computer board is +5VDC +/-5%; this voltage should be checked at the power supply +OUT to -OUT terminals. Adjust with caution, as a trip will result if voltage is adjusted too high. To reset a trip, reduce the voltage adjustment, then cycle power. Also verify Analog Inputs for + and - 15VDC supply in the PVF menu 3.5.



**CAUTION:** Adjusting output too high will cause the unit to trip.

### 7.8.2 Microprocessor Board

On the microprocessor board there are nine LED's (light emitting diodes), five pushbuttons, and four switches. The On LED for the P8 or the Status LED for PIO9 microprocessor being on indicates that the board is running but not necessarily functioning normally. The eight remaining LED's (in a row) display error/status codes (the LCD display will display this information in English format when provided). In general, the car A/B switch toggles the function of the eight LED's as indicators for CAR A (if the switch is UP) or CAR B (if switch is DOWN). Note that CAR A/B switch is not used for V900 control systems. Refer to the Field Reprogramming Manual for more details on the use of microprocessor PC board switches.



**WARNING:** Do **NOT** depress the microprocessor-reset button while any car is running, as it will cause an emergency stop. Use extreme care.

A group of special conditions are recognized by the microprocessor. If one of these "errors" occurs, a code will be displayed corresponding to that condition. The microprocessor will scroll up to six errors at a time, which show on the LCD display. The eight LED array will display the error that needs to be corrected first, that is, the one with the highest priority. The field technician should look first to the LED array to identify the error that needs to be corrected first. Error codes can be found in Section 5 of this manual and on the inside of the control equipment enclosure door.

Not all system errors are detected and displayed by the P8 or PIO9; however, the most frequent errors have been programmed to be recognized. Even the fact that the door lock string is open, as it sometimes is during normal operation, is defined with an "error" code, which is frequently displayed during normal operation.

### **7.8.3 I/O-7 or PIO9 IO section, board (I/O-EX board)**

The I/O board performs the task of buffering or protects the five volt computer logic environment from the electrically noisy 110 volt outside world. For this reason, most microprocessor system problems occur on the I/O boards.

The input buffer section of the I/O accepts high-level inputs from the HLS-7 board or car signals, and converts them to five volts computer signals. The I/O board also provides low-pass filtering to reduce noise susceptibility and Schmitt triggers to increase noise margin. The relay and signal driver sections of the I/O board provide high voltage switching outputs that actuate relays on the HLS-7 module and general elevator signals.

The output portion of the IO-7 or PIO9 or IO-EX is field replaceable. The replaceable components consist of an output Triac and a Zener diode, which can be identified by the corresponding LED number (i.e. LED 77 corresponds to Triac 77 and Zener diode Z77).

To determine if the Triac is bad, note that normal behavior of the output will be to turn on such signal as soon as power is applied to the controller. If the Zener diode is shorted, the output will not come on until the controller turns it on, and once turned on it will not be able to be turned off.

A Zener diode has the same characteristics as a standard diode. Using a standard multi-meter on diode check mode, the diode shall conduct in one direction only, when the positive meter lead is placed on the anode side (non-belted side of the diode) and the negative lead on the cathode side of the diode, and shall not conduct if meter leads are reversed. If a diode conducts in both directions, it is shorted and needs to be replaced.

If a Zener diode requires replacement, remove it using a pair of pliers. Trim leads on the replacement diode to the proper length, and then carefully insert the new diode into position.

# Section 8 – Group System

## 8.1 Detailed Explanation of Group Dispatching Subsystem

Since an elevator is a continuous, real-time machine, the supervisory control subsystem microcomputer (or microprocessor) is designed to operate in a loop, performing a predetermined pattern of instructions many times each second. Its speed is such that each elevator control function appears to be continuously monitored. The basic control loop and the functions performed by the computer during each portion of that loop are described below.

## 8.2 Data Acquisition

Before any logic decisions can be made data must be acquired during the first portion of the control loop called "contact scan." The microprocessor interrogates each input (hall calls, car calls, and power subsystem inputs) and saves the data in storage memory. This data is used during the rest of the control loop. In effect, the controller takes a "snapshot" of the entire elevator system, and then it makes decisions based on that information. Snapshots are made many times each second providing functionally continuous system monitoring.

## 8.3 Fireman's Service

After data has been acquired, proper outputs are computed for fireman's service.

## 8.4 Stepping

The next major block in the control loop deals with stepping. The system has no mechanical floor selector so, when power is first applied, the Supervisory Control system checks to see if the car is at the top landing (on the up slowdown limit) or at the bottom landing (on the down slowdown limit). If the car is at either of these locations the internal electronic "selector" is set to the proper value.

If the car happens to be somewhere mid-hoistway when power is first applied, the system will create a phantom call, and run the car until it reaches a terminal landing, whereupon it will become synchronized. After initial synchronization, magnetic vanes placed in the hoistway inform the Supervisory Control System when the car passes each floor. The internal electronic "selector" updates accordingly.

The stepping point is actually one slowdown distance ahead of each floor. When the car steps into any given floor, the control system determines if there are any calls registered for that floor, and if so, initiates a slowdown and cancels the calls. This method requires no mechanical attachments to the car, such as chains, wires, or tapes.

After the controller processes data pertaining to a moving car it scans all calls present and selects a direction preference for the car (if it is not already answering a call).

## **8.5 Door Operation**

The next block in the control loop is concerned with door operation. While the car is running, this portion is bypassed, but when the car enters a door zone this block becomes active. Functions performed by the door-processing block include door holding times (hall call time, car call time, and shortened door time), door opening and closing, and permission to proceed at high speed. The car actually moves in response to signals generated during door control loop processing, since all interlocks and timers (as well as car panel button inputs) must be correct before car movement is allowed.

## **8.6 Indicator Lamps**

The final block of the control loop uses data generated by all previous calculations and calls stored in memory to light the appropriate car panel and hall indicator lamps. Once this has been accomplished, the loop is completed and the processor starts the next contact scan.

The entire loop process is repeated many times each second for a smooth and, to all outward appearances, continuous operation.

It should be noted that the power-up logic, in addition to correctly presetting the floor selector memory location, clears all memory locations and output buffers prior to applying any signals to the power control subsystem, ensuring safe, stable operation.

# Section 9 – Maintenance

## 9.1 Maintenance

The Elevator Controls Microprocessor Elevator Controller has been designed to require as little routine maintenance as possible. In fact, the mechanical interconnections are the least reliable portion of the solid-state system, and the less they are disturbed, the more likely the system is to continue to function properly.

The elevator itself, however, is a complex mechanical apparatus, and therefore requires periodic routine preventive maintenance. In addition to lubrication of the various moving parts, the door lock contacts should be cleaned and inspected regularly since the exposed contacts are susceptible to dirt and corrosion. The doors also receive the most wear, often making two or even three cycles at a floor.

The various rotating machinery belts and couplings should be routinely inspected for wear. Wear could cause loss of control of the elevator car.

If the elevator system develops problems or becomes inoperative refer to the Troubleshooting guide Section 7 of this manual.

## 9.2 Replacement Parts List

### 9.2.1 Elevator Controls PC Boards

- 1) P8 Main microprocessor board (Standard controllers only).
- 2) IO7-Vxx Main input-output board (Standard controllers only).
- 3) IOEX-B44 ASME-17.1A-2000 monitoring board (Standard controllers only).
- 4) IOEX-Vxx Input-output expander board.
- 5) PVF Pattern generator microprocessor board set Version 3, IO and Microprocessor boards or SDI Version 4 Board.
- 6) LSSM-5 Speed monitor board.
- 7) PIO9 Main microprocessor board (Prodigy controllers only).

#### **For EZ-Link systems only**

- 1) P8X Controller to serial link microprocessor board (Standard controllers only).
- 2) TOC Car top microprocessor board.
- 3) COP Car panel microprocessor board.
- 4) Hall Microprocessor for hall stations.
- 5) COP/TOC-EX Car top or COP extender board.



**NOTE:** xx is the fixture voltage

### **9.2.2. Relays**

4 pole ice-cube 120 VAC  
P&B KHAU-17A12N-120  
Omron MY4AC110/120S  
Idec RU4S-D12

4 pole ice-cube 110 VDC  
P&B KHAU-17D12N-110  
Omron MY4-DC12S  
Idec RU4S-A12

3 pole ice-cube 110 VDC  
P&B KUP-14D35-110  
Omron RR3B-ULDC110V

Power 2 poles 30-amp 110VDC relay with DC Blow-outs  
P&B PRD11DH0-110VDC

Force guided relay  
Shrack SHRACK V23050-A1110-A533, 110 VDC

### **9.2.3 Fuses**

AGC ¼, 1, 2, 3, 5, 6,10, 15 AMP 250VOLT  
MDA TYPE 3, 5, 10 & 15 AMP 250 VOLT  
FRN-R 10, 20, 30, 60 AMP 250 VOLT (208 to 240 VAC power supply)  
FNQ 5, 10, 15A 500 VOLT (440 to 480 VAC power supply)

### **9.2.4 Power Supply**

Power One HBAA-40W-AW/OVP 3-AMPS@ 5VDC,+/- 15 VDC @ 1Amp

### **9.2.5 Semiconductors**

Motorola HEP-RO170  
Motorola 1N5347B – 10V, 5 Watt, Zener Diode  
Motorola 1N5333B – 3.3V, 5 Watt, Zener Diode  
Tecor L4004F31 – 4 AMP, 400 VOLT, Sensitive Gate Triac

# Appendix A1

## Yaskawa F7 AC Vector Drive Unit

### A1 Motor Drive Parameters

#### A1.1 Drive Parameters Overview

Review and become familiar with the YASKAWA F7 Drive User Manual. For simplified reference we will refer to it as the Drive Manual.

Pay particular attention to all safety precautions. Study the job prints, noting that the interface to the drive consists of basic drive inputs including:

- a. Direction / run inputs
- b. Speed signal input from PVF terminals PUP and GND
- c. Power inputs to terminals R/L1, S/L2 and T/L3
- d. Encoder inputs

The basic outputs are:

- a. 3-Phase output to motor through contactor
- b. Fault output (drops DSAF relay if a fault condition is detected)
- c. Drive run output
- d. ABS speed output



**CAUTION:** Do not connect the building power supply directly to the motor contactor.



**WARNING:** Power capacitors in the drive remain charged for some time after power is removed. Use care to prevent injury.

Familiarize yourself with the use of the drive's Digital Operator in the Drive Manual Chapter 3, including use of the keypad as described below.

Parameters may be accessed using the Quick Setting Menu (-QUICK-) which is used to set/read the most commonly used parameters or the Programming Menu (-ADV-) that is used to set/read every available drive parameter. The letters Q and A have been used, respectively, to indicate which mode is required to access each parameter.



**NOTE:** The Auto Tuning Menu (-A.TUNE-) can be used to auto-tune the motor drive. This function will calculate the required motor parameter settings for optimized motor performance. Auto-tuning is ideally performed with the motor disconnected from the load. When this cannot be accomplished, static or terminal resistance tuning can be done.

 **NOTE:** Do not change any parameters except those found in the following tables. Other parameters are either not used in this particular application or are pre-programmed to EC default settings.

Verify that the parameters are as listed on the job-programming list supplied with the Elevator Controls job prints. Parameters listed below have been changed from the drive manufacturer defaults by Elevator Controls. Parameters noted (\*) may need to be fine tuned during adjustment.

 **NOTE:** Throughout the following procedures it will be necessary to match the actual car speed to the commanded car speed by adjusting the “motor speed” parameter.

The “Motor Speed” is adjusted, when required, by changing parameter H3-02 in the drive submenu Analog Inputs.

“Drive Gain” adjusts the sensitivity with which the drive follows the input signal without undesirable vibration or discomfort. “Drive Gain” is adjusted, when required, by changing the parameter C5-01 and C5-02 in the drive submenu ASR Tuning. EC ships the drive with drive gain preset to drive manufacturer defaults.

## A1.2 Drive Adjustments

### System Constants

These drive parameters configure the drive for elevator control’s PVF operation behavior.

Parameter #	EC Setting		Access Level	Comments
A1-02	3		Q	Flux Vector Mode
B1-03	0		Q	Ramp to Stop (0) / DC Injection (2)
B1-05	3		A	Zero Speed Operation
C1-01	1.0		Q	Acceleration Time 1
C1-02	0		Q	Deceleration Time 1
C1-03	0		A	Acceleration Time 2
C1-04	0		A	Deceleration Time 2
C1-10	0		A	Acc/Dec time units resolution 0.01 sec.
C2-01	0		A	S curve time at start of acceleration
C2-03	0		A	S curve time at end of acceleration
C2-03	0		A	S curve time at start of deceleration
C6-01	0		A	Heavy duty drive operation
C6-02	F		Q	Carrier Frequency – Determined by C6-03 thru C6-05
C6-03	8		A	Maximum Carrier frequency
C6-04	8		A	Minimum Carrier Frequency
L3-01	0		A	Acceleration Stall disable
L3-04	0		Q	Deceleration Stall disable
L5-01	2 (*)		A	Auto resets. Set to 2 or desired # of auto-resets
L5-02	1		A	Fault Relay Active during auto-reset

L6-01	2		A	Alarm @ Run on over-torque detection
L6-02	250 % (*)		A	Torque detection level
L8-07	0		A	Output phase loss disabled
L8-15	0		A	OL2 at low speeds disabled

## Digital Inputs

These drive parameters configure the drive digital inputs to receive elevator control's PVF controller digital commands.

Parameter #	EC Setting	Terminal #	Access Level	Comments
H1-01	24	S3	A	External fault, N/O
H1-02	8	S4	A	External base-block N/O
H1-03	F	S5	A	Terminal not used
H1-04	F	S6	A	Terminal not used
H1-05	F	S7	A	Terminal not used
H1-06	7	S8	A	Fast Stop – decelerates using C1-08

## Digital Outputs

These drive parameters configure the drive digital outputs to signal elevator control's PVF controller of drive operational mode.

Parameter #	EC Setting	Terminal #	Access Level	Comments
H2-01	0	M1 – M2	A	Drive on - closed during run
H2-02	5	M3 – M4	A	Output to turn on LSSM speed monitor
L4-01	10 Hz (*)		A	Freq to LSSM –Low speed safety monitor

## Analog Inputs

These drive parameters configure the drive analog inputs to receive elevator control's PVF controller S-Curve input.

Parameter #	EC Setting	Terminal #	Access Level	Comments
H3-01	0	A1	A	Speed reference input to term A1
H3-02	95 % (*)		A	Adjust to obtain rated speed
H3-09	1F	A2	A	Terminal A2 not used
H3-11	0.1		A	Terminal A2 Bias.

Adjust H3-02 to obtain rated car speed with rated speed input from the PVF as measured with a tachometer.

## Analog Outputs

These drive parameters configure the drive analog outputs to generate an actual car speed curve profile from encoder speed feedback for speed monitoring purpose.

Parameter #	EC Setting	Terminal #	Access Level	Comments
H4-01	5	FM	A	Motor speed output (TAC input to <b>PVF</b> )
H4-07	1		A	Set terminal FM output to +10 to –10 VDC

## V/F Pattern

These drive parameters configure the drive for main line power input and motor power output voltage and frequency.

Parameter #	EC Setting		Access Level	Comments
E1-01	Line Voltage (*)		Q	Set to proper line Voltage
E1-04	60		Q	Maximum Frequency = 50 for some Countries.
E1-05	Motor Voltage (*)		Q	Set to Motor Nameplate voltage
E1-06	60		Q	Base Frequency = 50 for some Countries.
E1-09	0.0		A/A/Q	Minimum frequency- Hz

## Motor Setup

These drive parameters configure the drive for the hoist motor.

Parameter #	EC Setting		Access Level	Comments
E2-01	Motor Amps (*)		Q	Motor full load amps on nameplate
E2-02	Motor Slip (*)		A	If unknown = $60 - (\text{F.L.rpm} \times \# \text{ of poles} / 120)$
E2-03	No Load Amps (*)		A	If unknown = 35% of E2-01 value
E2-04	# of Motor Poles (*)		Q	60 Hz - 900 rpm = 8, 1200 rpm = 6, 1800 rpm = 4

## PG Option Setup

These drive parameters configure the drive for the encoder feedback unit attached to the hoist motor, F1-01 must match encoder unit Pulses per Revolution data.

Parameter #	EC Setting		Access Level	Comments
F1-01	1024 (*)		Q	Encoder Pulses per Rev
F1-02	0		A	Ramp to stop with PG Fdbk loss
F1-03	0		A	Ramp to stop with PG overspeed
F1-04	0		A	Ramp to stop with PG speed deviation
F1-05	0 (*)		A	PG rotation; 0: up = CCW, 1: up = CW

### A1.3 Overspeed Using the Drive to Drive the Hoist Motor

These drive unit can be configured to run the hoist motor at a frequency larger than the hoist motor base input frequency to create an overspeed condition by manipulating parameters E1-04, Maximum Output Frequency.

- To overspeed the car to 125% of contract speed perform following steps:
- Place the car on Test Mode of operation.
- Take the car to bottom landing.
- Multiply the value in E-04 by 1.25 and program the result into E1-04.
- Call the car via a car call to and intermediate landing, not the top landing.

- f. Car will over speed to 125% of contact speed.
- g. For down direction take the car to the top landing and call it to and intermediate landing, but not the bottom landing.



**WARNING:** When performing an overspeed test. Make sure all parameters are **RESET TO THE ORIGINAL VALUE** when testing is completed.

# Appendix A2

## Magnetek HPV-900 AC Vector Drive Unit

### A2 Motor Drive Parameters

#### A2.1 Drive Parameters Overview

Review and become familiar with the MAGNETEK HPV-900 Drive User Manual. For simplified reference we will refer to it as the Drive Manual.

Pay particular attention to all safety precautions. Study the job prints, noting that the interface to the drive consists of basic drive inputs including:

- a. Direction / run inputs
- b. Speed signal input from PVF terminals PUP and GND
- c. Power inputs to terminals R/R1, S/S1 and T/T1
- d. Encoder inputs

The basic outputs are:

- a. 3-Phase output to motor through contactor
- b. Fault output (drops DSAF relay if a fault condition is detected)
- c. Drive run output
- d. ABS speed output



**CAUTION:** Do not connect the building power supply directly to the motor contactor.



**WARNING:** Power capacitors in the drive remain charged for some time after power is removed. Use care to prevent injury

Familiarize yourself with the use of the drive's Digital Operator in the Drive Manual Parameters Section 3, starting on page 28, including use of the keypad as described below.



**NOTE:** The Adaptive Tune procedure can be used to auto-tune the motor drive. This function will calculate the required motor parameter settings for optimized motor performance. This procedure is explained in Section 5.7 of the HPV-900 Drive Manual.

There are two types of parameters, standard and hidden. Parameter access levels are set in the drive's Utility UO menu, parameter U2 – Hidden Items. Note that the hidden parameters are only accessible when U2 – Hidden Items is “enabled”.

Refer to Section 3.6 Utility U0 Menu in the Drive Manual for use of the utility functions.

 **NOTE:** Do not change any parameters except those found in the following tables. Other parameters are either not used in this particular application or are pre-programmed to EC default settings.

Verify that the parameters are as listed on the job-programming list supplied with the Elevator Controls job prints. Parameters listed below have been changed from the drive manufacturer defaults by Elevator Controls. Parameters noted (\*) may need to be fine tuned during adjustment.

 **NOTE:** Throughout the following procedures it will be necessary to match the actual car speed to the commanded car speed by adjusting the “motor speed” parameter.

The “Motor Speed” is adjusted, when required, by changing parameter “SPD COMMAND MULT” in the drive submenu A1.

“Drive Gain” adjusts the sensitivity with which the drive follows the input signal without undesirable vibration or discomfort. “Drive Gain” is adjusted, when required, by changing the parameter “RESPONSE” in the drive submenu A1. EC ships the drive with drive gain preset to drive manufacturer defaults.

## A2.2 Drive Adjustments

### Adjust AO Menu – Drive A1 Submenu

Parameter	EC Setting	Hidden Item
CONTRACT CAR SPEED - fpm	(*)	Y
CONTRACT MOTOR SPEED - rpm	(*)	Y
OVERSPEED MULT	140 (*)	N
ENCODER PULSES	(*)	N
SPD COMMAND MULT	0.95 (*)	Y
FLT RESET DELAY	0 seconds	Y
FLT RESETS / HOUR	3	Y

(§) Adjust SPD COMMAND MULT to obtain rated car speed with rated speed input from the PVF as measured with a tachometer.

 **NOTE:** When performing an overspeed test, note that an “OVERSPEED MULT” is included in the A1 submenu for simulating an overspeed condition. It is initiated through the Utility UO Menu. See Section 3.6.4.3 of the Drive Manual. Overspeed is automatically reset after each run.

 **NOTE:** S-Curves, A2 submenu, Acceleration and Deceleration Rates are used as Slew rate limit make sure to set all to 7.99 Ft/ Sec X Sec, and all Jerk Rates to 00. Multi Step Ref A3 submenu settings are not used with the V900-VF-PVF system, set them all to 00.

### Power Convert – A4 Submenu

Parameter	EC Setting	Hidden Item
PWM FREQUENCY – carrier frequency, adjust for noise	10.0 kHz (*)	N
EXTERN REACTANCE - % of base impedance	(*) if supplied	Y
INPUT L-L VOLTS – AC line input voltage	(*) VAC	N

### Motor – A5 Submenu

Parameter	EC Setting	Hidden Item
MOTOR ID – Motor Identification	(*)	N
RATED MTR POWER - HP	(*)	N
RATED MOTOR VOLTS – RMS voltage	(*)	N
RATED EXCIT FREQ - Hz	(*)	N
RATED MOTOR CURRENT - Amps	(*)	N
MOTOR POLES	(*)	N
RATED MTR SPEED - RPM	(*)	N
%NO LOAD CURR - % of rated current	10.0 (*)	N

## A2.3 Configure CO Menu

### User Switches – C1 Submenu

Parameter	Terminal TB1-	EC Setting	Hidden Item
		PVF	
SPD COMMAND SRC (0 to +10vdc)	28 - 29	analog input	Y
RUN COMMAND SRC		external tb1	Y
MOTOR ROTATION		forward (*)	Y
FAULT RESET SRC		automatic	Y

### Inputs – C2 Submenu

Parameter	Terminal TB1-	EC Setting	Hidden Item
LOGIC INPUT 1	1	drive enable	Y
LOGIC INPUT 2	2	run	Y
LOGIC INPUT 3	3	Not used	Y
LOGIC INPUT 4	4	extrn fault 1	Y
LOGIC INPUT 5 to 9	5 - 9	Not used	Y

### Digital Outputs (Logic Outputs) – C3 Submenu

Parameter	Terminal TB1-	EC Setting	Hidden Item
LOGIC OUTPUT 1, LSSM-5 ABS Output	14	up to speed	Y
UP TO SPD LEVEL – Output to turn on LSSM, logic output 1		25.00 % (*)	Y
LOGIC OUTPUT 2	15	not used	Y
LOGIC OUTPUT 3	16	not used	Y
LOGIC OUTPUT 4	17	not used	Y
RELAY COIL 1 ( Safety circuit)	52 - 53	fault	Y
RELAY COIL2 (Run output)	54 - 55	speed reg	Y

## Analog Outputs – C4 Submenu

Parameter	Terminal	EC Setting	Hidden Item
ANALOG OUTPUT 1 (Output to <b>PVF</b> )	33 - 34	speed feedback	N
ANALOG OUTPUT 2	35 - 34	not used	N

### A2.3 Overspeed Using the Drive to Drive the Hoist Motor

The drive unit can be configured to run the hoist motor at a frequency larger than the hoist motor base input frequency to create an overspeed condition as follows:

1. Place the car on Test mode.
2. Take the car to terminal Landing.
3. Program parameter A1-16, Overspeed Multiplier to 125%, to allow the car to run at 125% of contract speed.
4. Under drive menu U0 select submenu OVR SPEED TEST U4, refer to section 3.6.4.3 of drive manual, Overspeed Test Via Operator, for detailed overspeed test description.
5. Place a Car Call several floors above/ below floor to allow car to attain overspeed.
6. The drive will reset to non-overspeed mode when every time the run command is removed at the end of each run, repeat step 4 above for every test run required.



**WARNING:** When performing an overspeed test. Make sure all parameters are **RESET TO THE ORIGINAL VALUE** when testing is completed.



**NOTE:** When performing an overspeed test, note that an “OVERSPEED MULT” is included in the A1 submenu for simulating an overspeed condition. It is initiated through the Utility UO Menu. See Section 3.6.4.3 of the Drive Manual. Overspeed is automatically reset after each run.

# Appendix A3

## Magnetek HPV-600 AC Vector Drive Unit

### A3 Motor Drive Parameters

#### A3.1 Drive Parameters Overview

Review and become familiar with the MAGNETEK HPV-600 AC Vector Elevator Drive, Technical Manual. For simplified reference we will refer to it as the Drive Manual.

Pay particular attention to all safety precautions. Study the job prints, noting that the interface to the drive consists of basic drive inputs including:

- a. Direction / run inputs
- b. Speed signal input from PVF terminals PUP and GND
- c. Power inputs to terminals R, S and T
- d. Encoder inputs

The basic outputs are:

- a. 3-Phase output to motor through contactor
- b. Fault output (drops DSAF relay if a fault condition is detected)
- c. Drive run output
- d. ABS speed output



**CAUTION:** Do not connect the building power supply directly to the motor contactor.



**WARNING:** Power capacitors in the drive remain charged for some time after power is removed. Use care to prevent injury



**NOTE:** The HPV-600 motor drive Adaptive Tune procedure can be used to auto-tune the motor drive. This function will calculate the required motor parameter settings for optimized motor performance. This procedure is explained in the ADAPTIVE TUNE section of the HPV-600 Drive Manual, pages 20-23.



**NOTE:** Adaptive tuning cannot be accomplished until adjustment per Section 3 of this manual has been completed.

Familiarize yourself with the use of the drive's Digital Operator in the Drive Manual Parameters Section, starting on page 37, including use of the keypad as described below.

There are two types of parameters, standard and hidden. Parameter access levels are set in the drive's Utility UO menu, parameter U2 – Hidden Items. Note that the hidden parameters are only accessible when U2 – Hidden Items is “enabled”.

Refer to the Utility Section U0 menu, page 127 in the Drive Manual for use of the utility functions.

 **NOTE:** Do not change any parameters except those found in the following tables. Other parameters are either not used in this particular application or are pre-programmed to EC default settings.

Verify that the parameters are as listed on the job-programming list supplied with the Elevator Controls job prints. Parameters listed below have been changed from the drive manufacturer defaults by Elevator Controls. Parameters noted (\*) may need to be fine tuned during adjustment.

 **NOTE:** Throughout the following procedures it will be necessary to match the actual car speed to the commanded car speed by adjusting the “motor speed” parameter.

The “Motor Speed” is adjusted, when required, by changing parameter “SPD COMMAND MULT” in the drive submenu A1.

“Drive Gain” adjusts the sensitivity with which the drive follows the input signal without undesirable vibration or discomfort. “Drive Gain” is adjusted, when required, by changing the parameter “RESPONSE” in the drive submenu A1. EC ships the drive with drive gain preset to drive manufacturer defaults.

### A3.2 Drive Adjustments

#### Adjust AO Menu – Drive A1 Submenu

Parameter	EC Setting	Hidden Item
CONTRACT CAR SPEED - fpm	(*)	Y
CONTRACT MOTOR SPEED - rpm	(*)	Y
OVERSPEED MULT	140 (*)	N
ENCODER PULSES	(*)	Y
SPD COMMAND MULT	0.95 (§)	Y
FLT RESET DELAY	0 seconds	Y
FLT RESETS / HOUR	3	Y

 **NOTE:** Adjust SPD COMMAND MULT to obtain rated car speed with rated speed input from the PVF as measured with a tachometer.

 **NOTE:** When performing an overspeed test, note that an “OVERSPEED MULT” is included in the A1 submenu for simulating an overspeed condition. It is initiated through the Utility UO Menu. See Drive Manual page 109. Overspeed is automatically reset after each run.



**NOTE:** S-Curves, A2 submenu, Acceleration and Deceleration Rates are used as Slew rate limit make sure to set all to 7.99 Ft/ Sec X Sec, and all Jerk Rates to 00. Multi Step Ref A3 submenu settings are not used with the V900-VF-PVF system, set them all to 00.

### Power Convert – A4 Submenu

Parameter	EC Setting	Hidden Item
PWM FREQUENCY – carrier frequency, adjust for noise	10.0 kHz (*)	N
EXTERN REACTANCE - % of base impedance	(*) if supplied	Y
INPUT L-L VOLTS – AC line input voltage	(*) VAC	N

### Motor – A5 Submenu

Parameter	EC Setting	Hidden Item
MOTOR ID – Motor Identification	(*)	N
RATED MTR POWER - HP	(*)	N
RATED MOTOR VOLTS – RMS voltage	(*)	N
RATED EXCIT FREQ - Hz	(*)	N
RATED MOTOR CURRENT - Amps	(*)	N
MOTOR POLES	(*)	N
RATED MTR SPEED - RPM	(*)	N
%NO LOAD CURR - % of rated current	10.0 (*)	N

## A3.3 Configure CO Menu

### User Switches – C1 Submenu

Parameter	Terminal TB1-	EC Setting	Hidden Item
		PVF	
SPD COMMAND SRC (0 to +10vdc)	2, 4 - 3	analog input	Y
RUN COMMAND SRC		external tb1	Y
MOTOR ROTATION		forward (*)	Y
FAULT RESET SRC		automatic	Y

### Logic Inputs – C2 Submenu

Parameter	Terminal TB1-	EC Setting	Hidden Item
LOGIC INPUT 1	16	drive enable	Y
LOGIC INPUT 2	17	run	Y
LOGIC INPUT 3	18	Not used	Y
LOGIC INPUT 4	19	extrn fault 1	Y
LOGIC INPUT 5 to 9	20-24	Not used	Y

### Digital Outputs (Logic Outputs) – C3 Submenu

Parameter	Terminal TB1-	EC Setting	Hidden Item
LOGIC OUTPUT 1, LSSM-5 ABS Output	9	up to speed	Y
UP TO SPD LEVEL – Output to turn on LSSM, logic output 1		25.00 % (*)	Y
LOGIC OUTPUT 2	10	not used	Y
LOGIC OUTPUT 3	11	not used	Y
LOGIC OUTPUT 4	12	not used	Y
RELAY COIL 1 ( Safety circuit)	52 - 53	fault	Y
RELAY COIL2 (Run output)	54 - 55	speed reg	Y

### Analog Outputs – C4 Submenu

Parameter	Terminal	EC Setting	Hidden Item
ANALOG OUTPUT 1 (Output to PVF)	A1 – A2	speed feedback	N
ANALOG OUTPUT 2	AC – A2	not used	N

### A3.3 Overspeed Using the Drive to Drive the Hoist Motor

The drive unit can be configured to run the hoist motor at a frequency larger than the hoist motor base input frequency to create an overspeed condition as follows:

1. Place the car on Test mode.
2. Take the car to terminal Landing.
3. Program parameter A1-14, Overspeed Multiplier to 125%, to allow the car to run at 125% of contract speed.
4. Under drive menu U0 select submenu OVRSPD TEST U4, refer to page 111 of drive manual, Overspeed Test, for detailed overspeed test description.
5. Place a Car Call several floors above/ below floor to allow car to attain overspeed.
6. The drive will reset to non-overspeed mode when every time the run command is removed at the end of each run, repeat step 4 above for every test run required.



**WARNING:** When performing an overspeed test. Make sure all parameters are **RESET TO THE ORIGINAL VALUE** when testing is completed.



**NOTE:** When performing an overspeed test, note that an “OVERSPEED MULT” is included in the A1 submenu for simulating an overspeed condition. It is initiated through the Utility UO Menu. See Drive Manual page 109. Overspeed is automatically reset after each run.

# Appendix A4

## KEB Combivert F5 Motor Drive Unit

### A4 Motor Drive Parameters

#### A4.1 Drive Parameters Overview

Review and become familiar with the KEB Combivert F5 Motor Drive Unit, Technical Manual. For simplified reference we will refer to it as the Drive Manual.

Pay particular attention to all safety precautions. Study the job prints, noting that the interface to the drive consists of basic drive inputs including:

- e. Direction / run input
- f. Speed signal input from PVF terminals VPAT and GND
- g. Power inputs to terminals L1, L2 and L3
- h. Encoder inputs

The basic outputs are:

- e. 3-Phase output to motor through contactor
- f. Fault output (drops DSAF relay if a fault condition is detected)
- g. Drive run output
- h. ABS speed output



**CAUTION:** Do not connect the building power supply directly to the motor contactor.



**WARNING:** Power capacitors in the drive remain charged for some time after power is removed. Use care to prevent injury.

Familiarize yourself with use of the motor drive's Digital Operator in the drive manual, Section 4 – Operation of the unit, to verify and/or set parameters.



**NOTE:** The KEB Combivert F5 Motor Drive Unit set up directions below are for Gearless Permanent Magnet AC motor applications.



**NOTE:** Do not change any parameters except those found in the following tables. Other parameters are either not used in this particular application or are pre-programmed to EC default settings.

Verify that the parameters are as listed on the job-programming list supplied with the Elevator Controls job prints. Parameters listed below have been changed from the drive manufacturer defaults by Elevator Controls. Parameters noted (\*) may need to be fine tuned during adjustment.

 **NOTE:** Throughout the following procedures it will be necessary to match the actual car speed to the commanded car speed by adjusting the LF.11 parameter “Rated Motor Speed” parameter, value entered in motor RPM.

“Drive Gain” adjusts the sensitivity with which the drive follows the input signal without undesirable vibration or discomfort. “Drive Gain” is adjusted, when required, by changing the drive gain parameters LF.31, Proportional Gain, LF.32, Integral Gain, and LF.33 Gain Offset at Low Speeds. EC ships the drive with drive gain preset to drive manufacturer defaults.

## A4.2 Drive Adjustments

### A4.2.1 Drive Parameters

#### General Drive Configuration Parameters

Parameter	EC Setting	Units
LF. 2 Operating Mode	A Spd	Analog Speed Input
LF. 3 Drive Configuration	Run	
LF. 4 Motor Selection	PgLSS	Gearless PM Motor
LF. 5 Number of Drive Auto resets	3	
L5. 8 Motor Overload Protection	On	
LF.11 Rated Motor Speed	(*)	RPM
LF.20 Contract Speed	(*)	FTM
LF.21 Traction Sheave Diameter	(*)	Inches
LF.22 Gear Reduction Ratio	1.00	See Note Below
LF.23 Roping Ratio	1	
LF.24 Load (Elevator Rated Capacity)	(*)	Lbs
LF.25 Estimated Gear Reduction	Read only parameter	See Note Below
LF.30 Control Method	2	Closed Loop
LF.41 Set Speed SL, Percentage of LF.20	10	%, Percentage

 **NOTE:** LF.25 can be used to determine the gear reduction ratio if it is not known. After correctly entering values into LF.11, LF.20, LF.21, and LF.23, read LF.25 value and enter value into LF.22. The final value for LF.22 will be set after running the car at contract speed.

 **NOTE:** LF.41 is used as a percentage of contract speed threshold output to drive the LSSM-5 Tachometer Loss input enable.

 **NOTE:** Adjust LF.11 to obtain rated car speed with rated speed input from the PVF as measured with a tachometer.

### Motor Parameters

Parameter	EC Setting	Units
LF.12 Rated Motor Current	(*)	Amps
LF.13 Rated Motor Frequency, per motor name plate	(*)	RPM
LF.14 Rated Motor Voltage	(*)	Volts

LF.17 Rated Motor Torque, per motor name plate	(*)	Lbs
LF.18 Motor Stator Resistance, per motor name plate	(*)	<b>Ohms</b>
LF.19 Motor Leakage Inductance	(*)	Mili-Henries

 **NOTE:** The inductance listed on the motor manufacturer's data sheet will have to multiply by two if it is listed per motor phase.

### Encoder Feedback Settings

Parameter	EC Setting	Units
LF.26 Encoder Feedback	HIPeR	Hiperface
LF.27 Encoder Pulse Number	2048	Pulse Per Rev
LF.28 Reverse Encoder	(*)	See note below
LF.29 Encoder Sample Time	4	Mili-seconds

 **NOTE:** LF.28 parameter is used to set up encoder direction and motor rotation, with following configurations:

- a. 0 = Nothing Reversed
- b. 1 = A and B encoder channels swapped
- c. 2 = Motor Rotation Reversed
- d. 3 = Motor Rotation Reversed, and A & B encoder channels swapped.

### Digital Inputs

Parameter	EC Setting	Units
di. 0 Input source configuration	NPn	Sinking inputs

### Digital Outputs

Parameter	EC Setting	Terminal
do.81 Output to turn on LSSM-5 ABS Output	Hsd	X2A.19
LF.41 Set to 0.5 speed output to turn on ABS output	15 Ft/Min	
do.82 Drive ready	Rdy	X2A.24 to .26
do.83 Drive On Output	Dro	X2A.27 to .29

### Analog Outputs

Description	Signal Name	Terminal
Analog Car Speed Output	ANAOU1 & COM	X2A.5 and X2A.8

### Analog Inputs

Description	Signal Name	Terminal
Analog Pattern Speed Input	AN1+ and AN1-	X2A.1 and 2
Pre-torque Input	AN2+ and AN2-	X2A.24 to .26
do.83 Speed percentage enable	Hsd	X2A.27 to .29

## A4.2.2 Drive Adjustments

The drive unit needs to measure several motor parameters for optimum performance as follows:

1. Measure the motor resistance:
  - a. Set the controller in controller inspection mode of operation.
  - b. Set LF.3 to conF, and remove the FB1 and FB2 fuses from brake circuit.
  - c. Go to LF.18 and press FUNC key on drive keypad. The display should Read Auto.
  - d. Press the UP key on drive keypad. The display should read 50.000.
  - e. Press and hold the Inspection UP controller switch, the motor contactor should pick, but the brake will not. Do not release the Inspection UP switch until procedure is completed. The Measurement will take 10 to 15 seconds and the drive will display ChEc.
  - f. When the display changes to a numerical value or E.Cdd, release the Inspection Up Switch.
  - g. If the change in display was to a numerical value the procedure was successful, skip to entry j below.
  - h. If the change was to Ec.Cdd, try repeating procedure from step b above first, if not successful verify motor connections and try again.
  - i. If unable to successfully complete procedure measure ohms from lead to lead and average results, use value to set parameter LF.18.
  - j. Set LF.3 to Run, and install FB1 and FB2 fuses.



**CAUTION:** Do not forget to set LF.3 to Run to enable drive to run.

2. Absolute Encoder Set Up, to accomplish this set up procedure refer to section 5.11, Running the Motor, in the drive manual, make sure to read complete section before starting to execute procedure

## A4.3 Overspeed Using the Drive to Drive the Hoist Motor

The drive unit can be configured to run the hoist motor at a frequency larger than the hoist motor base input frequency to create an overspeed condition as follows:

- a. Place the car on Test mode.
- b. Take the car to terminal Landing.
- c. Program parameter LF.23 to next value.
- d. Place a Car Call several floors above/ below floor to allow car to attain overspeed.



**NOTE:** Parameters LF.20 contract speed is in fpm, parameter the LF.21 sheave diameter in inches, parameter LF.22 gear ratio, and LF.23 roping ratio are used by the drive unit logic to scale the fpm contract speed value to the inverter's base unit of rpm. By increasing the roping ratio, this changes the scale to a higher rpm value for a given contract speed and also raises the inverter overspeed level, allowing an overspeed test on the elevator without tripping drive unit on overspeed fault.



**WARNING:** When performing an overspeed test. Make sure all parameters are **RESET TO THE ORIGINAL VALUE** when testing is completed.

# Appendix B1

## Magnetek DSD-412 SCR Drive Unit

### B1 Motor Drive Parameters

#### B1.1 Drive Parameters Overview

Familiarize yourself with Magnetek DSD 412 CS00407 Technical Manual. For simplified reference we will refer to it as the Drive Manual. Pay particular attention to all safety precautions. Study the interface to the drive on the job prints, and note that the basic inputs to the drive are:

- a. Direction / run inputs
- b. Speed signal input terminals from PVF terminals VPAT and GND
- c. Power inputs to terminals L1, L2, and L3
- d. Encoder input

The basic outputs are:

- a. Variable DC voltage output to motor through contactor
- b. Motor field control
- c. Fault output, drops DSAF relay if fault
- d. Drive Run output
- e. ABS Speed output



**CAUTION:** Do not connect building power supply to motor contactor.



**NOTE:** Verify that the parameters are as listed on the job-programming list supplied with the elevator controller job prints page 4 within the drive unit block diagram interface area.

Familiarize yourself with the drive's STANDARD CONTROL / DISPLAY OPERATION, pages 35 to 45 of drive manual.



**NOTE:** Parameters that are not listed in the following tables may not be used, or are used as programmed per the factory default value. Verify that the parameters are as listed on the job-programming list supplied with the elevator controller job prints.

Parameters listed below have been changed from the factory defaults by Elevator Controls. Parameters noted (\*) may need to be fine tuned during adjustment. Page 40 details the use of function #994 to save any changed value. Any changes or adjustments will be returned to previous values if power is turned OFF or the drive is reset unless saved by setting function #994 with the NVRAM switch in the proper position.



**NOTE:** Thru the following procedures it will be necessary to match the actual car speed to the commanded car speed by adjusting the “motor speed”. The performance of the drive in following the input signal, to minimize vibration or passenger discomfort, is adjusted using “drive gain”.

The “motor speed” is adjusted, when required, by changing parameter Function #11, Motor RPM. The “drive gain” is adjusted, when required, by changing Function #42, Stiffness. Drive gain factory settings have been used as initial settings.

## B1.2 Drive Adjustments

### Drive Functions

Function #	Description	EC Setting
9	AC VOLTAGE INPUT	(*)
17	RATED CAR SPEED - FPM	(*)
10	ENCODER P/R	(*)
81	OVER SPEED MULT	1.40 (*)
82	REFERENCE MULT	0.95 (1)
101	AUTO FAULT RESET ON	1 = ON (*)
102	3S LOOP FLT – Contactor Drop Time	1 = ON (*)
110	REFERENCE MODE SELECT (+/- 10 vdc input)	1

(1) Adjust Function #82, Reference Multiplier to obtain rated car speed with rated speed input from the PVF as measured with a hand held tachometer.

### Motor Armature Functions

Function #	Description	EC Setting
1	CURRENT LIMIT	(*)
3	RATED ARM AMPS	(*)
7	RATED ARM VOLTS	(*)
11	MOTOR SPEED –RPM	(*)

### Motor Field Functions

Function #	Description	EC Setting
55	FIELD CONTROL AC VOLTS	(*)
49	WEAK FIELD AMPS	(*)
50	FULL FIELD AMPS	(*)
52	RATED FIELD VOLTS	(*)
53	STANDBY FIELD AMPS	(*)

 **NOTE:** Verify that the motor field current S1 switch settings inside the drive (refer to page 4 area D1 of job prints) corresponds to the current listed on the nameplate for motor field. Also make sure the motor field is connected to the correct Terminals on section TB4 of the drive terminal strip.

 **NOTE:** S-Curves - Function #170 to #181  
These settings are not required for a V900-VFPVF system

 **NOTE:** Multi Step Ref - Functions #151 to #157  
These settings are not required for a V900-VFPVF system

### Input Functions

Function #	Description	Terminal TB1	EC Setting
115	DRIVE RUN	8 or 50	0
Drive Default	FAULT RESET	49	N/A
Drive Default	DRIVE & FIELD ENABLE	9	N/A
Drive Default	RAMP 2 SELECT	51	N/A

### Logic Output Functions

Function #	Description	Terminal TB1	EC Setting
183	K3 Relay OUT SELCT	36 - 37	3
184	K4 LGC OUT SELCT	78	not used
185	K5 LGC OUT SELCT	79	not used
186	K6 LGC OUT SELCT, LSSM-5 ABS Output	83	4
64	LOW SPEED THESHOLD - Output to LSSM-5	10% (*)	
187	K7 LGC OUT SELCT	84	not used

### Analog Output Functions

Function #	Description	Terminal TB1	EC Setting
95	OUTPUT 1 - Encoder Speed	45	3
97	ANALOG OUT 0 MULT		1.00
96	OUTPUT 2 - Command Speed	46	2

 **NOTE:** The SCR Drive “Ready” light and output is not sensitive to input power phase rotation, but they will fault if one or more phases are lost.

 **NOTE:** Motor and Brake information shown on page 4 of prints, Field Data table, was generated based on information provided to Elevator Controls and must be verified against actual Motor and Brake data tags or field measured values.



**NOTE:** It is necessary to tune the SCR Drive to the motor. Perform a drive SELF-TUNE operation, function #997, refer to page 42; The motor contactor will energize, and current will flow to the motor armature but the car will not be required to move during this procedure.

### **B1.3 Overspeed Using the Drive to Drive the Hoist Motor**

The drive unit can be configured to run the hoist motor at a frequency larger than the hoist motor base input frequency to create an overspeed condition.



**WARNING:** When performing an overspeed test. Make sure all parameters are **RESET TO THE ORIGINAL VALUE** when testing is completed.

Overspeed Test – Function #81 has been set to run the elevator at 140 % of rated speed for overspeed testing. Function #80 turns the effect of that multiplier on and off. However, be aware that the drive overspeed trip fault set by function #12 will be tested and will trip. To insure that the drive overspeed test does not interfere with the governor test, function #12 must also be increased during the governor overspeed test. After testing, be sure function #12 is returned to its original value and that function #80 is set to 0, Off.

# Appendix B2

## Control Techniques Mentor II SCR Drive Unit

### B2 Motor Drive Parameters

#### B2.1 Drive Parameters Overview

Familiarize yourself with Control Techniques Inc, Mentor II Technical Manual. For simplified reference we will refer to it as the Drive Manual. Pay particular attention to all safety precautions. Study the interface to the drive on the job prints, and note that the basic inputs to the drive are:

- a. Direction / run inputs
- b. Speed signal input from PVF terminals VPAT and GND
- c. Power inputs to terminals L1, L2, and L3
- d. Encoder or Analog Tachometer input

The basic outputs are:

- a. Variable DC voltage output to motor through contactor
- b. Motor field control
- c. Fault output, drops DSAF relay if fault
- d. Drive Run output
- e. ABS Speed output



**CAUTION:** Do not connect building power supply to motor contactor.



**NOTE:** Verify that the parameters are as listed on the job-programming list supplied with the elevator controller job prints page 4 within the drive unit block diagram interface area.



**NOTE:** Parameter 0.00 data must be set to 200, or to a specific security code, to satisfy security requirements before any changes or adjustments can be made.



**NOTE:** Through the following procedures it will be necessary to match the actual car speed to the commanded car speed by adjusting the “motor speed”. The performance of the drive in following the input signal, to minimize vibration or passenger discomfort, is adjusted using “drive gain”. Be sure that switches SW 1, B thru H are in the proper position; B to D are used for encoder, F to H for tachometer, only one at a time can be on.

The “motor speed” is adjusted, when required, by adjusting RV1 Potentiometer in Mentor II drive unit clockwise to increase elevator Speed, and counter-clockwise to reduce elevator speed for DC tachometer feedback systems, or by adjusting parameter 3.14, Encoder Feedback Scaling, for encoder feedback systems, please refer to drive

manual Menu 03 parameter 3.14 formula calculation for reference on this parameter value, increasing the parameter value will decrease car speed.

 **NOTE:** Parameters listed below have been changed from the factory defaults by Elevator Controls. Parameters noted (\*) may need to be fine tuned during adjustment.

 **NOTE:** Any change or adjustment of parameters will be returned to the previous value if power is turned off or the drive is reset unless saved by setting the parameter 00.00 data to “001” and pressing “RESET”.

 **NOTE:** It is advisable to tune the SCR Drive to the motor for optimum performance. To perform an auto-tune of the current loop, set parameter 05.27 = 1, run the elevator up and down for several seconds, set parameter 05.14 = parameter 05.13, reset parameter 05.27 = 0, record and save parameters.

“Drive Gain” adjusts the sensitivity with which the drive follows the input signal without undesirable vibration or discomfort. Drive Gain” is adjusted, when required, by changing the parameters 3.09, Speed Loop Proportional Gain, and 3.10, Speed Loop Integral Gain. Incrementing the values of these parameters will make the drive more responsive. Initially the drive gain has not been changed from the drive factory setting.

## B2.2 Adjustments

### Drive Functions

Parameter	Description	EC Setting
2.04	Minimum Forward Acceleration (.1 sec units)	Set to 0005 to prevent drive limits from interfering with s-curve input
2.05	Minimum Forward Deceleration (.1 sec units)	
2.06	Minimum Reverse Deceleration (.1 sec units)	
2.07	Minimum Reverse Acceleration (.1 sec units)	
3.12	Digital Feedback Selector (Set to “1” for encoder feedback)	(*)
3.13	Arm Voltage / Tachometer (Set to “0” for tachometer feedback)	(*)
3.14	Encoder Feedback Scaling – $750,000,000 / N \times n$ N = Encoder PPR; n = motor speed @ rated speed (rpm)	(*)
3.23	Zero Speed Threshold - % of speed to turn on Status 6 output	150 (*)
5.18	Standstill Enable - OFF	0
6.13	Enable Field Control - ON	1

### Motor Armature Functions

Parameter	Description	EC Setting
3.15	Maximum armature voltage	(*)
3.16	Maximum speed (scaling to elevator speed – fpm)	(*)
4.04	Current limit (amps)	(*)

## Motor Field Functions

Parameter	Description	EC Setting
6.11	Max field amps	(*)
6.08	% Max amps for fine setting (Field Forcing)	(*)
6.15	Enable field economy timeout	1
6.12	Time delay (seconds) before economy timeout	30
6.09	Economy - % of max field amps	500
6.07	Back EMF set point (start of field weakening)	(*)
6.10	Min value of field amps to prevent excessive weakening	500 (*)

 **NOTE:** Verify that the J1 jumper is set for the max current rating of 2A or 8A. With field currents greater than 8A, see Section 11.7 of the drive manual for setting of the FXM5 field control unit.

## Analog Output Functions

Parameter	Description	Terminal TB1-4	EC Setting
7.09	DAC 2 Source - Speed feedback to <b>PVF</b> (+/- 10 volts)	13	0302
9.19	Status 3 output - Drive On	17	0111
9.25	Status 6 output to LSSM-5 (% set by Parameter 3.23)	34	1009

 **NOTE:** The SCR Drive “Ready” light and output is not sensitive to input power phase rotation, but they will fault if one or more phases are lost.

 **NOTE:** Motor and Brake information shown on page 4 of prints, Field Data table, was generated based on information provided to Elevator Controls and must be verified against the actual Motor and Brake data tags or field measured values.

 **NOTE:** The following parameters have been set to display the data described at parameters 00.01 to 00.07 for ease of troubleshooting.

## Display Monitoring Outputs

Parameter	Data	Description	Displayed at parameter
11.01	304	Armature output voltage	00.01
11.02	502	Armature output current	00.02
11.03	303	Speed in FPM	00.03
11.04	102	Reference input (+/- 10VDC)	00.04
11.05	302	Speed feedback (+/- 10VDC)	00.05
11.06	706	Line voltage	00.06
11.07	603	Field current (% of 6.11)	00.07

### **B1.3 Overspeed Using the Drive to Drive the Hoist Motor**

The drive unit can be configured to run the hoist motor at a frequency larger than the hoist motor base input frequency to create an overspeed condition.



**WARNING:** When performing an overspeed test. Make sure all parameters are **RESET TO THE ORIGINAL VALUE** when testing is completed.

Overspeed Test –The elevator will need to be set to run at 140 % of rated speed for overspeed testing. Set Encoder feedback by setting parameter 3.14 to a value equal to rated speed divided by 1.4. Set Tachometer feedback using Potentiometer RV1, which must be increased (turn clockwise to increase) so that the car runs 1.4 x Rated Speed. The position of potentiometer RV1 can be monitored at parameter 3.26 with car running at rated speed. Record this value to allow it to be correctly reset after the Overspeed Test. After testing, be sure parameter 3.14 or potentiometer RV1 are retuned to original values.

## Appendix B3

### Two Stop Loaded Car Buffer & Counterweight Empty Car Test

#### B3.a Car Buffer Test – Fully Loaded Car

- a. Place a full load in the car; place the controller test and inspection switches in the test position.
- b. Move to the top floor, or several feet up from the bottom floor sufficient to allow reaching contract speed when running test down.
- c. Refer to SDI Manual, Program Variables Menu and record the current settings for 1.1 Contract Speed, 1.3 Initial Jerk, 1.4 Roll Over Jerk, 1.5 Deceleration Jerk, 1.7 Acceleration, 1.8 Deceleration, and 1.12 Inspection Speed. Now Temporarily program 1.1 Contract Speed and 1.12 Inspection Speed to 50 FPM, and all Jerk and Acceleration/Deceleration parameters 1.3, 1.4, 1.5, 1.7, and 1.8 to 25 FPM.

Additionally, refer to the drive parameter section and increase acceleration parameter to 3 seconds for contract speeds up to 350 FPM and 6 seconds for up to 700 FPM to soften up ramping up to speed during the test. Return this value to original setting when done with this test.

- d. Disable LSSM tripping by removing Jumper SH2 temporarily.
- e. Jumper terminal 4A to all down slowdown switches terminals (DSD1, DSD2, and DT6 thru DT14 to bypass all present down slowdown switches as required.
- f. Place a jumper from controller terminals 17 to 23 to bypass safety switches. Place a jumper from controller terminals 29 to 33 to bypass the down normal limit switch.
- g. Run car down on inspection to run it into the buffer (once you start down on inspection do not stop until car is run into buffer, as drive may fault due to abrupt stop on inspection). After the car strikes the buffer, and drive sheave slips under the cables release inspection run down activation. Restore all SDI parameters and drive's acceleration to values recorded in step c. above. Run the car up to the bottom landing door zone area and **REMOVE ALL JUMPERS PLACED IN THE PROCEDURE DESCRIBED ABOVE. Restore SH2 jumper above.**



**NOTE:** The SDI microprocessor board will open the safety string after detecting the pulse count failure caused by the buffer test. Reset the SDI after the buffer test is completed and the car is stopped to restore safety circuits to normal operation.

#### B.3.b Counterweight Buffer Test – Empty Car

- a. Place a full load in the car; place the controller test and inspection switches in the test position.
- b. Move to the bottom floor, or several feet down from the top floor sufficient to allow reaching contract speed when running test up.
- c. Refer to SDI Manual, Program Variables Menu and record the current settings for 1.1 Contract Speed, 1.3 Initial Jerk, 1.4 Roll Over Jerk, 1.5 Deceleration Jerk, 1.7 Acceleration, 1.8 Deceleration, and 1.12 Inspection Speed. Now Temporarily

program 1.1 Contract Speed and 1.12 Inspection Speed to 50 FPM, and all Jerk and Acceleration/Deceleration parameters 1.3, 1.4, 1.5, 1.7, and 1.8 to 25 FPM.

Additionally, refer to the drive parameter programming section and increase acceleration parameter to 3 seconds for contract speeds up to 350 FPM and 6 seconds for up to 700 FPM to soften up ramping up to speed during the test. Return this value to original setting when done with this test.

- d. Disable LSSM tripping by removing Jumper SH2 temporarily.
- e. Jumper terminal 4A to all up slowdown switches terminals (USD1, USD2, and UT6 thru UT14) to bypass all present down slowdown switches as required.
- f. Place a jumper from controller terminals 17 to 23 to bypass safety switches. Place a jumper from controller terminals 28 to 30 to bypass the up normal limit switch.
- g. Run car up on inspection to run counterweight into the buffer (once you start up on inspection do not stop until counterweight is run into buffer, as drive may fault due to abrupt stop on inspection). After the counterweight strikes the buffer, and drive sheave slips under the cables release inspection run up activation. Restore all SDI parameters and drive's acceleration to values recorded in step c. above. Run the car down to the top landing door zone area and **REMOVE ALL JUMPERS PLACED IN THE PROCEDURE DESCRIBED ABOVE. Restore SH2 jumper above.**



**NOTE:** The SDI microprocessor board will open the safety string after detecting the pulse count failure caused by the buffer test. Reset the SDI after the buffer test is completed and the car is stopped to restore safety circuits to normal operation.