ELEVATOR CONTROLS CORPORATION

6150 Warehouse Way, Sacramento, CA 95826
(916) 428-1708 * FAX (916) 428-1728
e-mail – tech.support@elevatorcontrols.com

MODEL V800 TYPE VVVF
with
YASKAWA - F7, VECTOR CONTROL DRIVE

Manual for Start Up and Final Adjustment
of the Elevator Controls V800- VVVF Control Unit
Used in Conjunction with
YASKAWA – F7 VECTOR CONTROL
Digital Drive

Rev. 05/12/2005

TABLE OF CONTENTS

Introduction

WARNINGS:

Throughout this manual, icons will be used to accentuate certain areas of text. These icons represent safety warnings, cautions, and interest areas. These icons are explained below:

☠ 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 and informative procedures.

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

NOTE: It is also assumed that the elevator counterweight balance has been properly checked and corrected as necessary; Speed governor device is installed and calibrated; Safety Clamp is properly tested; and all switches for slowdown, stop, and over travel limits at both terminal landings are checked for proper type, placement, and operation.

CAUTION: The 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. The field personnel must be familiar with all codes and regulations pertaining to the safe installation and running of elevators.

> Installation and wiring must be in accordance with the national electrical code and consistent with all local codes, and elevator codes and regulations. The 3 phase AC. power supply to this equipment must come from a proper fused disconnect or circuit breaker. Improper protection may create a hazardous condition.
>
> Wiring to controller terminals must be done in a careful, neat manner. Stranded wire conductors must be twisted together to avoid strands from being left out of terminal and create potential shorts. All terminals and cable connectors must be checked to be sure they are seated properly. When connecting flat cable connectors be certain to match pin #1 marks (arrow symbol on connectors, red stripe on cable).

CAUTION: Please restrict access to elevator control equipment and apparatus to qualified personnel only.

Section I

INSTRUCTIONS FOR INSTALLING AND ADJUSTING ELEVATOR

I.1. Protect printed circuit boards, and drive unit, from dust & foreign materials, remove fusing.

I.1.1 Complete controller mounting installation and wiring, observe controller field terminals location in relation to wiring ducts to determine where to cut holes for field wiring ducts. For closed-loop jobs, install encoder unit to end of motor shaft, mounting coupling must allow for motor shaft axial play, but set screw must be tight to accurately track motor rotation without any slippage. For encoder (referred to as Pulse Generator - PG in the drive manual) wiring refer to PG-X2 card instruction manual (section 2-37). Use multi-shielded-pair cable only, ground shield at controller end only as indicated. Improper mounting/wiring will create problems. Use separate metal, grounded conduit for encoder cable.

CAUTION: Encoder mounting is very critical for closed loop systems. The encoder must track motor rotation accurately without slippage, bumping or vibration. On geared elevators, mounting to the back of the motor shaft is recommended. Refer to job prints for encoder wiring. Use multi-shielded-pair cable only, ground shield at controller end only as indicated. Improper mounting or wiring will create problems. Use separate metal, grounded conduit for encoder cable.

WARNING: MISWIRING MAY DAMAGE ENCODER and void its warranty

NOTE: Check job prints for any requirements for mounting of speed monitoring tachometer or magnetic speed pick-up unit. . Magnetic pick-up sensor is mounted using uni-strut to detect magnets glued on to motor shaft. In any case, you must use shielded cable to wire unit to controller.

I.1.2 Refer to any Supplemental Adjusting instructions.

I.2. Procedure for startup of Elevator Controls Microprocessor Control System Model V800

These are not final adjusting instructions.

In the following instructions it is assumed that all hatch doors are closed but not necessarily locked, all hoistway and machine room wiring is complete. The car safety must be adjusted to the manufacturers specifications and the governor installed and roped. Test the safety by hand to insure it will hold the car. Correct any malfunction before proceeding further.

These instructions also assume a minimum of electrical trouble-shooting experience and no attempt is made here to out-guess all the possibilities that may occur. Follow the procedure carefully and if the elevator does not respond correctly, check the circuits according to your ability. If you can't locate the problem in a reasonable time, call for an adjuster or serviceman experienced in trouble-shooting. proceed cautiously. You will find the multiple L.E.D. indicators on boards and computer diagnostics a very useful tool that will save you installation/troubleshooting time.

Read these instructions all the way through before starting to work to familiarize yourself with the procedure.

I.2.1 Test all terminals for grounds. Also, test for shorts on terminals 4, 4A, 6, 50 to each of the terminals on I/O board. If any are located, remedy the problem before proceeding or I/O boards may be damaged.

I.2.2 Make sure Supervisory control system cards supply fuses are removed. At this point, flip controller insp and test switches to inspection and test position respectively (on).

I.2.3 Remove fuses F4, F50, F7, F8, to disable primary controller relay voltage, and the door operator.

✍ NOTE: Always check prints to double check fuse designation and correct amperage.

I.2.4. Check the line side of the disconnect and check that all three legs are at the correct voltage. Now turn on the disconnect and check the voltages at L1, L2, and L3 on controller. Check prints for detail on how input power connects to the drive and controller.

I.2.5. Turn power off and replace fuse F4, and computer power supply.

I.3. Start-up for F7 Vector Drive Supplemental Instructions

I.3.1. Familiarize yourself with the Yaskawa F7 Drive User Manual -herein referred to as "drive manual", pay particular attention to all safety precautions. Study the interface to the drive on page 4 of the job prints and note that the basic inputs to the drive are:

i. Direction inputs (up, dn contacts)
ii. Speed signal inputs (H, HL, L, etc.)
iii. Power inputs to terminals L1, L2, and L3

The basic outputs are:

i. 3-Phase output to motor through contactor
ii. Fault output, drops DSAF relay if fault.
iii. Drive Run output.

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

I.3.2. The motor drive has the responsibility to produce the speed pattern and control the actual speed and ride of the elevator. Familiarize yourself with the use of the drive's Digital Operator in chapter 3, Basic Programming in chapter 5 and Parameters in Appendix A of the drive manual to preset or change parameters using the Digital Operator keypad as necessary.

NOTE: The drive can be set for “DRIVE”, operation only; “Quick” or “Advanced” level of programming. Please note that all of the drive programming parameters are accessible from the Advanced level only. The “Quick” menu allows programming of a select list of parameters as listed in chapter 3-11 of the drive manual. The drive has been set for programming from the advanced level. Parameter access level can be set as in the drive manual's Initialization section, parameter # A1-01. Parameters listed with the access level as “Q” can be programmed thru the “Quick” or “Advanced” menus. Parameters listed with the access level as “A” can be programmed only thru the “Advanced” menu.

CAUTION: Speeds, accel/decel rates, s-curve, and gain parameter initial values below will need to be fine-tuned during final adjustment procedure. Parameters not listed may not be used, or used programmed per factory default value, please verify factory defaults per drive manual. For open loop and open loop vector, please refer to next section in this manual.

I.3.3. Turn off power (check all terminals first for voltages that shouldn't be there). Remove all grounding fuses in system (consult prints). Check for grounds on Rx1 resistance setting on all terminals and correct if necessary.

CAUTION: Power capacitors in drive remain charged for some time after power is removed, be very careful!

I.3.4. Turn power on, check main safety circuit to see that SAF relay in controller is picked.

I.4. Adjustment Procedure for VVVF Vector-Drive and Elevator Controller V800

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 F7 Programming List supplied with this elevator controller.

Parameters listed below have been changed from the factory defaults by Elevator Controls Corp. and except as noted (*) must remain as changed for proper operation:

1.4.1. Programming for Flux Vector mode with Encoder Feedback

I.4.1.a. Analog inputs and outputs

Parameter #	E.C.C. Setting	Terminal #	Access Level	Comments
H3-05	1F	A1	A	Not Used
H4-01	5	FM	A	Motor speed output for monitoring
H4-07	1		A	Set motor speed output to +10 to –10 vdc

I.4.1.b. Digital inputs and outputs

Parameter #	E.C.C. Setting	Terminal #	Access Level	Comments
H1-01	24	S3	A	External Fault, N/O
H1-02	8	S4	A	External Baseblock, N/O
H1-03	3	S5	A	Multi-Step Frequency Reference 1
H1-04	4	S6	A	Multi-Step Frequency Reference 2
H1-05	5	S7	A	Multi-Step Frequency Reference 3
H1-06	15	S8	A	Fast Stop – Decelerates using C1-09
H4-01	5	21	B	Analog speed output for scope monitoring

I.4.1.c. Digital outputs

Parameter #	E.C.C. 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

I.4.1.d. System Constants

Parameter #	E.C.C. Setting	Access Level	Comments
A1-02	3	Q	Flux Vector Mode. Requires encoder.
B1-03	0	Q	Ramp to Stop.
C6-01	1	A	Normal duty
C6-02	3(*)	Q	Carrier Frequency – adjust for motor noise
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

I.4.1.e. V/F Pattern and Motor Setup.

Parameter #	E.C.C. 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	0.5 Hz(*)	A	Minimum frequency
E2-01	Motor Amps	Q	Motor full load amps on nameplate
E2-02	Motor Slip	A	If unknown = 60-(F.L.rpm X # of poles/120)
E2-03	No Load Amps	A	If unknown = 35% of E2-01 value
E2-04	# of Motor Poles	A	60 Hz - 900 rpm = 8, 1200 rpm = 6, 1800 rpm = 4

I.4.1.f. Encoder Setup

Parameter #	E.C.C. Setting	Access Level	Comments
F1-01	1024	A	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

I.4.1.g. Speed parameters, Acceleration /Deceleration rates, and Gain parameter pre-setting.

Parameter #	E.C.C. Setting	Access Level	Comments
C1-01	3.5 sec(*)	Q	Acceleration time 1
C1-02	2.0 sec(*)	Q	Deceleration time 1
C1-03	0.0 sec	A	Acceleration time 2
C1-04	0.1 sec(*)	A	Deceleration time 2
C1-09	0.0 sec(*)	A	Fast stop time
C2-01	0.20 sec(*)	A	S-curve at acceleration start
C2-02	0.20 sec(*)	A	S-curve at acceleration end
C2-03	0.20 sec(*)	A	S-curve at deceleration start
C2-04	0.20 sec(*)	A	S-curve at deceleration end
C3-01	1.0(*)	A	Slip Compensation gain
C5-01	20.00(*)	A	Automatic speed regulation gain
C5-02	0.500 sec	A	Automatic speed regulation "dampening" time
D1-02	(*) Hz	Q	(L)Freq equal to leveling speed
D1-03	(*) Hz	Q	(L2)Freq equal to re-leveling speed
D1-04	(*) Hz	Q	Freq equal to Earthquake speed
D1-05	(*) Hz	A	(HL)Freq equal to high leveling / Inspection speed
D1-06	(*) Hz	A	(HI)Freq equal to Intermediate speed, if used
D1-07	(*) Hz	A	(H)Freq equal to Rated speed
D1-08	(*) Hz	A	(HIL)Freq equal to High Intermediate speed, if used

✍ NOTE: Settings for parameters D1-02 to D1-08 will be equal to

Speed (fpm) * 60 Hz / Contract speed (fpm) or
Meters per sec (mps) for (fpm) or
Speed (fpm) * 50 Hz / Contract speed (fpm) for 50 Hz motors

1.4.2. Programming for Flux Vector mode without Encoder Feedback

(Please skip to step I.4.4. for Flux Vector Closed loop application utilizing encoder feedback)

For Open loop Vector applications without Encoder, proceed to program all parameters as indicated in the prior section "PROGRAMMING FOR FLUX VECTOR..." mode, with the following exceptions:

✍ NOTE: OPEN LOOP VECTOR MODE may not yield best results with motors whose very high slip and properties are substantially different from standard NEMA B designs. For these applications, the control mode A1-02 will have to be set to A1-02 = 0, for V/F mode. The other parameters in the table below apply to V/F and open loop vector modes, both.

Parameter #	E.C.C. Setting	Access Level	Comments
A1-02	2	Q	Open loop Vector Mode.
B1-03	2	Q	D.C. Braking to Stop.
B2-01	0	A	D.C. Injection time at start = 0 sec (used if rollback)
B2-02	50	A	D.C. Injection current. Increase as needed for stop.
B2-04	0.2	A	D.C. Injection time at stop.
C5-xx	-	-	C5 parameters not accessible in this mode.
C3-01	1	A	Slip Compensation gain. Increase for large up vs. dn speed spread.
C4-01	1	A	Torque gain. Set to 1. Adj up to 2 as needed for torque at slow speeds without excess current. Else, set E1-08 and E1-10 min and Mid output voltages for High Starting Torque 1 or 2 per manual. Be on the alert for excess current saturation.
C4-02	20	A	Torque gain time constant.
E2-04	-	-	Not accessible in this mode.
F1-xx	-	-	F1 parameters not accessible in this mode.

I.4.3. Place controller on inspection (by setting controller run/insp. switch to inspection). Try to run by using up/dn sw on controller (jump door locks, if necessary. Car top insp switch needs to be off for controller up/dn switch to work). If car runs backwards, reverse any two of the field wires from motor to contactor.

O CAUTION**:** Make sure motor rotation is correct and that it does not produce unusual noise or vibration, refer to drive manual for Faults indication details. If pulse generator encoder is used, and it is incorrect, drive will probably trip off or car will move very slow, irrespective of speed setting. If so, change encoder direction parameter F1-05 from 0 to 1, or vise-versa. If still a problem, check wiring of encoder signals. Verify proper operation.

In the following procedure, "inspect down (up)" means to run car on inspection down (up).

I.4.4. While attempting to run, adjust brake volts to desired value (refer to original data for the job). See prints for any brake voltage adjustment resistors.

I.4.5. Gradually vary parameter D1-05 (HL-speed) setting on drive to observe performance (do not exceed 100 FPM). This is the inspection and high leveling speed, setting of 20 to 50 FPM is desirable during installation phase. For jobs using encoder, if motor vibrates, try reducing proportional gain C5-01, if no effect, return it to previous value and advance C5-06 slightly. For jobs without encoder, start with C4-01 torque gain set to 1. At this point, check some of the monitoring parameters "Un" as listed on drive manual such as output current U1-03, and speed deviation U1-23.

I.4.6. Prove that the brake will properly hold at least an empty car. Perform any necessary adjustments to get proper brake operation.

I.4.7. Remove any jumpers in safety string, and check primary safety circuit (all items) and repair as necessary. Check cartop stop switch and up and down buttons. Inspect full length of hoistway for free running clearances. Check all door locks.

I.4.8. Check access operation (if provided) including proper door lock bypassing.

I.4.9. Set leveling switches on cartop to give proper dead zone (+/- 1/4") If DUPAR mag switches are used, both LU and LD switches are in at dead zone. Adjust D1-02 Low speed parameter setting on drive to move car when leveling.

I.4.10. Be sure TM switches or slowdown limits, stop limits, and overtravel limits are all properly set according to hoistway print.

✍ NOTE: Approaching terminal landings the mechanical slowdown contact must open <u>after</u> the stepping sensor leaves the stepping vane or control difficulties will result.

The elevator should now be completed, vanes installed, etc. For installing vanes it is desirable to open the car door about a foot to check sill heights. Tape closed the car gate contact or jumper 12 to 13. (12 to 11 if no hoistway access provided, check prints).

Test all terminals for grounds. If any are located, remedy the problem before proceeding.

I.4.11. Verify all cards connectors to be fully snapped-into card slots, turn on AC power. Change from inspection operation to normal. The car should travel to the bottom terminal landing. If this does not happen jumper 4 to 45 (door close button), as the car is placed on Independent Service with the control Test switch on test position. Refer to the "Elevator Controls' Guide to Error Condition Codes" sheet which will aid the adjuster in determining why the elevator is not responding. Pay particular attention to the multiple L.E.D. indicators on the I/O board. If car is leveling, the LVL indicator will be off, and car cannot respond until leveling process is complete, if any of the door opening devices or call input is active the corresponding indicator will be lit, if the SD (or SU for up) indicator is on and Down relay is not picked, check normal limit switch, also check DSD2 and USD2 LED's, They must not be both off or reversed, these are the terminal floors slowdown switches that open when car is at the corresponding terminal landing. Observe the liquid crystal display LCD, if provided.

Be sure duplexing cables are installed along with any #18 wire cross-connects (If more than one car) according to the hoistway print.

CAUTION**:** BE SURE CARD CONNECTORS ARE SNAPPED ALL THE WAY IN.

Install computer power supply fuses.

I.4.12. Turn "test-normal" switch on main relay board to the "test" position. This disables the opening of the doors, puts car on independent service, and allows door closing power.

I.5. Final Adjustment (Read thoroughly before continuing)

I.5.1. Using the drive manual complemented with these instructions as a guide, adjust the elevator for proper 3 or more floor runs first, then one floor runs, then 2 floor runs (if applicable). A great deal of adjustment time should be spent here to get proper operation.

I.5.2. The door operator must be operating properly on the car with all door equipment clutches, rollers, etc., properly adjusted with correct running clearances. Check controller prints to be sure any instructions have been followed regarding the installation of diodes on the door operator on the car. (Especially for G.A.L. door operators).

I.5.3. Make sure all hoistway and car doors in building are closed and locked. Run car on inspection through hoistway to be sure hoistway is completely clear. Check to be sure vanes are installed as per installation instructions to +/- 1/2" tolerance.

I.5.4. Turn test switch on relay printed circuit board in the power control cabinet to the "test" position.

I.5.5. Run the car with one-floor runs to make sure the HI-speed drops at about the mid-point of the run (if provided, H-speed otherwise). Notice that when the test switch on the HLS or relay printed circuit board is in the "TEST" position, the doors will not open when the car arrives at a floor. The car must wait for a full door time before the car may leave the landing again (removing field wire from terminal 36, DOL, will cancel wait time). Since the car is also on independent service while on "TEST", a constant input on the car call terminal is necessary to get the car to leave the landing. For a series of runs for a particular direction, the car calls may be registered, then the last call in the group may be clip-leaded in to get the car to accomplish the series of runs. Check the operation of the speed relays to be sure the proper sequence occurs for slowdown, From a 2-or more floor run, the sequence is H-HIL-HL-L2-L, and for a 1-floor run, it is H-HI-HL-L2-L, but if no HI relay provided, it will be H-HL-L2-L in both cases. HIL is normally set equal to or less than HI value, as needed. HIL timer is set to about 2 seconds to cause HIL speed selection instead of HI during 2- or more- floor runs.

Check to be sure the stepping vanes are all present by putting in a car call for one floor below the top terminal landing and verifying that the car arrived there. Do the same for one landing up from the bottom. Correct any problems with missing vanes before proceeding further.

I.5.6. The first runs to be adjusted will be high speed runs of 3 or more floors only. Adjust ACC TIME (C1-01) for a comfortable value. Begin increasing H speed setting (D1-07) up to the desired RPM setting that yields contract speed as measured by a hand held tachometer in 10-50 fpm increments, and also adjust DEC TIME (C1-02) so that the drop from high speed is not quite so abrupt. Make sure the ACC TIME is up high enough so that there is no overshoot on the car speed. Too much ACC setting causes the car to take too long to reach contract speed. You may adjust C2-01 to C2-04 between 0.2 to 0.7 seconds of S-curve control at this point, for best results, if high values required you may reduce C1-01 or C1-02 ACCEL/DECEL to compensate. If an oscilloscope is available (needle movement meter is also useful), analog output on pins 21 & 22 of drive is programmed to provide car speed indication. Next, if HI speed relay is provided, begin advancing speed parameter D1-06, while making one floor runs to produce same slowdown into floor as that obtained on a two or more floor run. Increase HIL, D1-08, to HI value. While making two floor runs, if car now overshoots or charges floor, decrease HIL gradually, as needed, for best results. Adjusting the leveling speeds D1-02 (L1) and D1-03 (L2) close to same value, also reduces leveling bumps, but leveling time may be increased.

✍ NOTE: If accel time is too high, drive output speed display will not show car reaching HI speed setting during 1-floor runs.

⚐ CAUTION: If 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, press A+B button on scope. Use A and B probes to measure signals.

✍ NOTE As the car is adjusted to run at high speed, it may be necessary to adjust the drive Gain Control parameters C5-01, C5-02 for best response for flux vector mode. For open loop jobs, you may need to adjust C4-01 and -02 for best torque at leveling speeds. For open loop jobs with excessive UP vs DN speed spread, increasing C3-01, Slip Comp Gain and/or decreasing C3-02 time may help narrow the spread. If used, test empty car and full load for proper control and stability.

I.5.7. The car should now be running at contract speed with no overshoot on acceleration and should be undergoing a reasonable deceleration. Notice that these adjustments are best done a bit at a time with no abrupt changes made in adjustment. It will probably be necessary to go through some steps many times in order to "mold" the shape of the elevator's velocity - time curve to your liking. The idea is to get a smooth overall deceleration into the leveling zone, but to not spend much time at a steady leveling speed.

I.5.8. Since the control of the elevator is directly under control of the leveling switches from as far as 10" out, the shape of the response of the car near the floor is directly under control of the Leveling-speeds setting. If the car seems to not have a steep enough approach near the floor, HL speed setting may be advanced. Remember that if DEC time is too high the car will have a tendency to charge the leveling zone, and conversely, if it is too low, the car will drag into the floor.

⚐ CAUTION: The drive may trip on overvoltage if not enough regenerative power absorption is provided for by braking resistor(s) and braking unit, especially if deceleration is too fast. If this occurs, try to increase deceleration time, be on the alert for problems associated with brake transistor fault tripping and/or excessive regeneration resistor overheating.

I.5.9. Put car on inspection at bottom landing. Put 2/3 of contract load in the car. Now start adding weights in 50 or 100 pound increments and moving car on inspection each time UP + DN. Adjust brake tension to stop and hold 125% of contract load by tripping any stop switch open while running down on inspection. Hold the "DOWN" button in while you trip open the stop switch (preferably on the inspection station). Remove weights to leave contract load in car.

✍ NOTE : If car has difficulty lifting full load, verify proper counterweight loading. If correct, and job is setup for flux-vector mode with encoder, experiment with different values for motor slip E2-02, starting from about 0.5 up, in 0.25 increments. For open loop jobs, adjust C4-01 and if needed C4-02, if needed, to improve torque at low speed, but be on the alert not to cause excessive motor current. Set the drive to display motor amps, and verify that full load amps at high speed are not exceeded, otherwise, for open loop jobs, you may get better results with C4-01=1.2 to 1.5 and increase Min and Mid output voltage parameters E1-10 and E1-08 per "High Starting Torque " (1 or, if needed, high starting torque 2) application V/F pattern values in drive manual.

The Final stop and brake drop should now be adjusted. The idea is to apply the brake right at the instant the motor stops turning. Please check job prints for Brake picking and holding voltage adjusting resistors. The proper final stop sequence would be as follows:

A. Car travels last 3", approximately, into floor at steady leveling speed. Final leveling speed should not be too fast as to cause a hard "Electrical stop", nor too slow to cause the car to stall. The minimum leveling speed setting will be that required to bring empty car down and fully loaded car up into the floor with no signs of motor stalling. Be on the alert not to cause overcurrent tripping.

B. As the leveling relay drops (LU/LD), the drive is commanded Zero speed from leveling speed, rapidly, as adjusted by second decel parameter C1-04, increasing C1-04 produces softer electric stop but car may overshoot. Adjust as needed. For open loop jobs, D.C. injection is applied at this point to stop the motor. The brake now sets, at zero speed. The relay contact that commands zero speed and second decel time, is also used to drop brake. There's no delay in dropping this relay, but there's delay in the drop of drive output enable and contactor drop, provided by fixed capacitors on direction relays circuitry.

C. Immediately after the car stops, the brake is set, and a delay on the directional relays expires. The drive is then disabled, and contactor is dropped.

I.5.10. The adjustment should now be complete. A review of the parameter functions listings in drive manual compared to settings in drive is advised to make insure nothing was overlooked, and to make a note of settings to be used for future reference. Verify and correct proper floor leveling, and make sure door zone sensors are adjusted to prevent door pre-opening outside +/- 2" from floor.

CAUTION: IT IS RECOMMENDED TO ELIMINATE ANY PRE-OPENING AT ALL, UNLESS SPECIFICALLY SPECIFIED. THE V800 CONTROLLER HAS A JUMPER OPTION FOR JOBS REQUIRING PRE-OPENING (SEE PRINTS).

SECTION II

II.1. Low Speed Safety Adjustment

✍ NOTE: The Low Speed Safety Monitor (LSSM) contains several circuits required by code, ANSI/ ASME A17.1, and other safety circuits and therefore should be adjusted carefully, The safety monitors of the LSSM are:

1. Elevator Overspeed
2. LSSM Tachometer Monitor
3. Leveling Disable
4. Leveling and Inspection Overspeed
5. Terminal Slowdown monitor

CAUTION: The following adjustments should not be attempted until the final adjustment of the car is complete or this procedure will have to be redone.

✍ NOTE: TP-8 is ground, all measurements are to be made with the negative 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 the board will be damaged.

CAUTION: Verify: Jumpers J1 & J2 on the LSSM board are in place. Be sure to remove jumper when adjustment is complete.

II.1.1.A Set Up utilizing Pulse Input:

✍ NOTE: **Skip to II.1.1.B if Tachometer is used for speed monitor feedback.**

Jumper J3 on the LSSM board is set to "FREQ".
"TEST" switch on HLS (relay) board is on; this disables door operation.
Make a multi-floor run so that the car achieves contract speed and measure and record the **highest** voltage on TP-6 with respect to TP-8 on the LSSM board.

II.1.1. B. Set Up utilizing Tachometer Input:

✍ NOTE: **Skip to II.1.2 if Pulse Input is used for speed monitor feedback.**

Jumper J3 on the LSSM board is set to "VOLTAGE" and resistor R45 is installed.
"TEST" switch on HLS (relay) board is on; this disables door operation.
Make a multi-floor run so that the car achieves contract speed and set VR6 so that the voltage on TP-6 with respect to TP-8 on the LSSM board. is approximately 8 volts.

II.1.2. OVERSPEED potentiometer setting: with the car running at contract speed, turn the "OVERSPEED" trimpot CCW until the board does an Overspeed trip. The "OVERSPEED" LED and the "SAFETY TRIPPED" neon should be lit. This verifies that the Overspeed circuit is working. Now multiply the tach voltage recorded from II.1.1 above by 1.15. Set the "OVERSPEED" trimpot to give that voltage at TP-3. This sets the Overspeed trip point to 115% of maximum normal speed.

II.1.3. TACH LOSS potentiometer setting: The SCR Drive is set to activate the output tied to the LSSM board's "AS" input at 5% of contract speed (parameter 3.23). While making one floor runs, slowly turn the "TACH LOSS" trimpot CW until the board does a tach loss trip. This verifies that the LSSM tach loss circuit is working. The motor drive has it's own "Tach Loss" monitor. Multiply the voltage recorded from II.1.1 above by 0.03. Set the "TACH LOSS" trimpot to give that voltage at TP-1. Put the car on test and make several runs to verify that there is no tach loss tripping.

II.1.4. LEVEL DISABLE potentiometer setting: Put the car on inspection and position it on a leveling vane. Ground TP-5. This should make the "LEV DISABLE" LED light. Remove jumper J2 from the LSSM board. Put the car back on test. The car should not move. Remove the ground jumper from TP-5. The car should now level into the floor. This verifies that the leveling disable circuit is working. If the contract speed is below 500 fpm, multiply the voltage recorded from II.1.1 above by 0.3. If the contract speed is 500 fpm or more, multiply the voltage by 0.2. Set the "LEV DISABLE" trimpot to give that voltage at TP-5. This sets the leveling disable threshold to 30% or 20% of maximum normal speed, depending on the contract speed.

II.1.5. LEVELING and INSPECTION OVERSPEED potentiometer setting: Put the car on inspection. While running the car, turn the "LEV/INSP" trimpot CCW until the board trips. The "LEV/INSP" LED and the "BOARD TRIPPED" neon should be lit. This verifies that the leveling and inspection Overspeed circuit is working. Leave the board in the tripped state. With the car stopped, remove the jumper from J1. The SAF relay should drop. Replace the jumper. Put the car on test. Make a multi-floor run and measure the voltage at TP-6 when the car speed has stabilized after any initial speed overshoot. This is the tach voltage when the car is running exactly at contract speed. Multiply that voltage by 140. Divide the number you get by the contract speed of the elevator. This is the tach voltage at 140 fpm. Set the "LEV/INSP" trimpot to give this voltage at TP-4. 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 X 140 = 700; 700 / 400 = 1.75 (the answer)

Set TP-4 to 1.75 V.

II.1.6. TERMINAL SLOWDOWN potentiometer setting: Check the controller prints to see if the "SLDN" terminal on the LSSM board is tied to 4A bus. If it is, skip this adjustment.

While making multi-floor runs into either of the terminal landings, turn the "SLOWDOWN" trimpot CCW until the board trips as the car slows down on approach to the terminal. Now turn the trimpot back about a half a turn at a time until the board doesn't trip on terminal slowdown. Measure the voltage at TP-2 and turn the "SLOWDOWN" trimpot 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. Now make multi-floor runs into both terminal landings and see that the board does not do a slowdown trip. If the board does trip, increase the voltage at TP-2 in .1 V steps until it does not trip. Finally, check to see that the voltage setting on TP-2 is less than or equal to the voltage recorded from II.1.1 above.

II.1.7. Remove jumpers J1 & J2 from the LSSM board. The adjustment is complete.

✍ NOTE: The LSSM board has two fault indications. If a fault occurs momentarily, the associated LED will illuminate and stay lit as a warning, the safety circuit will not open until the fault is maintained for at least 0.4 seconds. This is indicated by the neon lamp.

II.2. Motor Limit Timer Control

If car is running and fails to reach its call within a pre-determined time interval, the controller will automatically stop the motor, further operation of the elevator is prevented until the trouble has been corrected by cycling the inspection switch or power disconnect. The computer error code LED indicators and LCD (if provided) will display the corresponding error status. This timer is factory preset for 120 seconds, refer to Field Re-programming Manual for instructions on adjusting this timer on-site.

II.3. Multiple Door Open Times

The V800 controller is equipped with selective door timing for car, hall, and short door open times. The factory pre-set values are field-adjustable through the use of the ON-BOARD diagnostics unit. Refer to Field Re-Programming Manual for complete detail. Check door open times for proper operation and in conformance with Handicapped and applicable codes.

II.4. GUIDE FOR PERFORMING ELEVATOR SAFETY TESTS AND INSPECTION

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

⚐ CAUTION: Safety tests should be accomplished by qualified adjuster or serviceman. A helper should always be present and prepared to turn-off main line disconnect to remove power from elevator when needed that car is run with safety switches bypassed. Proceed with caution.

✍ NOTE: For the following safety tests, II.4.1 thru II.4.5, remove the wire from terminal Rd when Absolute Floor Encoding is used. Reconnect the wire to terminal Rd when safety tests are completed.

II.4.1. FULL -LOAD CAR BUFFER TEST.

II.4.1.1 Put full load in car, then place controller test switch to test position.

II.4.1.2. Call elevator to a floor several floors up from bottom.

II.4.1.3. Jumper terminal 4A to all down slowdown switches terminals (DSD1, DSD2).

II.4.1.4. Identify and remove signal STD from controller terminal.

II.4.1.5. Place jumper from controller terminals 17 to 23. This bypasses safety switches. Also, jumper terminals 29 to 33, to bypass down normal limit.

II.4.1.6 Place a car call to bottom floor to run car into buffer. After car strikes buffer and drive sheave slips under cables, quickly flip controller inspection switch to inspection to stop car. Run car up to bottom floor level and remove all jumpers above.

II.4.2. EMPTY CAR COUNTERWEIGHT BUFFER TEST

II.4.2.1. Place controller test switch to test position.

II.4.2.2. Call elevator to a floor several floors below top.

II.4.2.3. Jumper terminal 4A to all up slowdown switches terminals (USD1, USD2).

II.4.2.4. Identify and remove signal STU from controller terminal.

II.4.2.5. Place jumper from controller terminals 17 to 23. This bypasses safety switches. Also, jumper terminals 28 to 30, to bypass up normal limit.

II.4.2.7 Place a car call to top floor to run counterweight into buffer. After counterweight strikes buffer and drive sheave slips under cables, quickly flip controller inspection switch to inspection to stop car. Run car down to top floor level and remove all jumpers above.

II.4.3. GOVERNOR TEST

II.4.3.1 ELECTRICAL OVERSPEED TEST: Manually trip governor overspeed switch open to verify that safety circuit drops out. Now, with governor cable lifted off the governor, spin governor while measuring speed to verify electrical and mechanical tripping speeds. A variable speed drill motor is very handy for spinning governor. Place governor cable and contact back to normal. Repeat procedure for counterweight governor, if any.

II.4.4. FULL LOAD CAR SAFETY OVERSPEED TEST

II.4.4.1. Put full load in car, then place controller test switch to test position.

II.4.4.2. Call elevator to Top floor.

II.4.4.3. Place jumper from controller terminals 17 to 23. This bypasses safety switches.

II.4.4.4. Read and record Max Output Speed parameter E1-04 ,and H-speed parameter d1-07, on drive, normally 60hz, or 50hz for some countries, then program these to a value 1.4 times higher. Set drive display to view speed feedback display to note % speed at which safety activates .

II.4.4.5. Place a car call to bottom floor. Car will accelerate to overspeed until safety sets firmly. Flip controller inspection switch to inspection to stop car. Restore car safety and contact to normal, as well as governor contact.

II.4.4.6. Restore parameters E1-04, and d1-07 on drive to previously recorded value. Remove all jumpers above to place car back to normal operation. Repeat procedure similarly for counterweight safety, if any, speeding empty car from bottom floor up instead.

II.4.5. EMERGENCY TERMINAL STOPPING AND SPEED LIMITING DEVICES TEST

II.4.5.1. SPEED LIMITING DEVICE TEST

II.4.5.1.1. Place test switch on controller to test position.

The speed limiting circuits work independently of the computer and work by directly dropping the speed relays that command speed inputs from drive to cause the elevator to slowdown to the corresponding lower set speed, as the slowdown switches at the terminal floors, operate in sequence. Please note that the number of slowdown switches used increases with elevator contract speed.

For cars with speeds 500fpm and over, or when provided, the SLD trimpot on the Speed safety board needs to be adjusted , as instructed below.

II.4.5.2. EMERGENCY SLOWDOWN SPEED SAFETY SHUT-DOWN TEST FOR CARS WITH SPEEDS 500FPM AND OVER.

II.4.5.2.1. Locate Low Speed Safety Board on controller and jumper safety output contact at J1 plug connector (refer to job print).

II.4.5.2.2. While making long floor runs (2 or more floors) into terminal landings, adjust the SLD trimpot on Speed Safety board clockwise until trip point is determined, as indicated by safety trip indicator on board. Remove safety output contact jumper from step II.4.7.1 and verify that safety string drops out, and SAF relay drops, then replace jumper.

II.4.5.2.3. While making long floor runs into terminal landings, adjust the SLD trimpot counter-clockwise until safety trip just stops tripping. Turn SLD 2 more full turns counter-clockwise, and verify that SLD and safety trip indicators do not come on while running into terminal landing. Remove J1 jumper above.

CAUTION: After completing safety tests, be sure to remove all jumpers above.

NOTE: Reconnect the wire to terminal Rd if Absolute Floor Encoding is used.

Section III

TROUBLESHOOTING GUIDE

III.1. System Not Functional In General (car won't run)

The solid state portion of the Elevator Controls' Microprocessor Controller is the most reliable part of the entire elevator plant. While it is possible that a problem may occur, one should first look to the power controller and "outside world" for malfunctions. It should also be noted that the same program loop is used for both cars of a duplex installation, and that if one car is running, the computer is working properly, even if the other car is inoperative.

IMPORTANT

For your convenience, and in order to save troubleshooting time and money, the V800 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 board, every action the computer wants to take is indicated (DOF for example means door open function, the computer wants to open doors), and every action the "outside" controller wants the computer to perform is also indicated (DOB for example means the door open button is active). Note that a Bar on top of signal name indicates that signal is in the active mode when the LED is off, FRS and FRA are a good example, when off they indicate car is on Main or alternate fire mode. The computer error code LED display will flash a particular status/error code as detected by computer, a list of these codes is pasted on the controller door, if not, procure a copy from the Field-reprogramming manual. The computer error/status codes are also displayed in English format on the LCD display, if provided. Finally, if available, an IBM PC compatible may optionally be used for powerful trouble-shooting, diagnostics, monitoring purposes.

If a particular car is not running, first make sure that it is not on Fire Emergency Service. Normal operation of the Fire Emergency circuitry is to have 24-110V on Terminal 443 with respect to Terminal 3.* If the elevator is not operating under 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. Next, verify that each Power Control stepdown Transformer has the correct secondary voltage. (Refer to Controller Schematic, Page 1, for terminal and fuse numbers.) Replace fuses as necessary.

The local controller power supplies should be verified. First, Terminal 4A should measure +110 VDC. Terminal 50 should measure +110 VDC. 208-240 VAC should be present between Terminal Strip terminal 1 & 2. If any of the above power supply voltages are improper, check the appropriate fuses. (Again, refer to the Power Control system Schematic Diagram).

✍ NOTE: System common is the 3 buss, and unless otherwise noted all DC voltage measurements are with respect to Terminal 3.

In the upper left portion of the Power Controller System Schematic Diagram can be seen a string of normally closed safety contacts and switches connecting Terminal 4A to Terminal 24. In order for the car to run, all of these contacts must be closed, applying +110 VDC to Terminal 24 and pulling in the SAF Relay. With SAF picked, Terminal 4 will also be at a +110 VDC level.

Assuming Terminal 4 is operating properly at +110 VDC, check the operation of the computer system by observing the MPR output indicator on I/O board. This indicator should be lit, signifying that the computer system has control of the car. If the MPR LED is not lit, go to the section on Microprocessor Troubleshooting.

After verifying that the MPR indicator is on, check for proper HLS Module relay operation (The HLS module is the relay control board in controller). In order for the car to leave a landing in response to system demand, the following relays must be picked: INS, DOL, U (or D depending on desired direction), P, and SAF. H relay will also pick if slowdown for the direction of travel is made up.

Note that direction (SU/SD), and speed signals (HR/HIR) enter the HLS Module from the computer drivers on the I/O board, via the connecting ribbon cable, (pin numbers are indicated on prints, pin one is indicated by red conductor in 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 FWI -fire warning indicator- is off (Terminal 443&444 At 24-110V). If all the above functions are normal, registering a call must establish a direction arrow. If there is still no arrow refer to the section on Microprocessor Trouble-shooting.

Some of the above mentioned relay coils 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 DLK indicator on I/O board lit (+12O VDC on Terminal 11, while an unlocked condition places 0 VDC on Terminal 11). If the door string indicates an unlocked condition, examine and repair the door locks as required. Should the U or D Relays remain out with a properly locked door circuit, check the operation of the relays by briefly jumping Terminals 4 to 30. U should pick. If it does, but jumping 4 to 28 does not, check and repair the UP STOP LIMIT switch. (Similarly try 4-29 and 4-33 for down.) If the U or D Relays pick on these tests (and the P Relay picks with either U or D) but do not with the registration of a call, with SU/SD indicator on I/O board lit, turn controller off and replace the ribbon cable connecting the HLS Module to the I/O. If SU/SD indicator does not lite-up, check that call registered LED indicated call latched, if you cannot get calls to latch-in, refer to the section on microprocessor Troubleshooting.

III.2. Malfunctions in an Operating System

III.2.1. 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.
Problem	**Solution**
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.
Problem	**Solution**
Doors operate one direction only and correct DO and DC relays are operating.	Test for contact closure across the proper relay- DC for close, DO for open.
Problem	**Solution**
Doors operate one direction only. Only one DO or DC relay will operate.	Check DOF/DCF indicator on I/O driver board. (Refer to Microprocessor Troubleshooting Guide). Turn "NORMAL-TEST" switch on HLS Module to NORMAL."
Problem	**Solution**
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.
Problem	**Solution**
Doors open a few inches or less at one particular landing and appear to be mechanically stuck but reclose so car can leave.	Readjust upper and lower link connections on lift rod for door lock so that lock properly clears lip of enclosure.
Problem	**Solution**
Other mechanical problems with doors.	Refer to drawings relating to mechanical portions of door operator.

III.2.2. Drive problems

Refer to manual supplied by manufacturer.

III.2.3. Call Button Problems

Problem	Solution
Car will not respond to a specific call.	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. First make sure that the call common (terminal 4 for car calls or terminal 50 for hall calls) is live with +110 VDC with respect to 3 buss. Then 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. If not: (1) Check that when call terminal is jumped 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 which comes on to indicate computer not accepting calls. (2) Replace the associated input/output board.
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.

III.2.4. Position Indicator Malfunctions

The position indicator is strictly under software control and will not respond if the car is moved manually by using the car top inspection station.

Problem	Solution
Position indicator out of step with elevator car.	The computer system contains automatic synchronizing logic to place the position indicator in step with the car whenever either reaches a terminal landing. Therefore, entering a call for a terminal landing should resynchronize the position indicator. Should the car get out of step repeatedly, or the position indicator jump from terminal to terminal, a stepping problem in 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. 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.

PROPER STEPPING SEQUENCE:

1. Car is at floor, DZ indicator LED is on AND STU/STD are also lit, indicating door zone is active and stepping inputs are not.

2. DZ indicator goes off, now STU (STD for down) indicator will go off as car engages stepping vane, and position indicator output reflects new floor position. Further activation of STU/STD will be ignored until after DZ is cycled on/off "re-arming" electronic selector for next floor stepping.

III.3. MICROPROCESSOR TROUBLESHOOTING

The basic idea of this section is to determine if the Computer Logic Check-out indicates a faulty board, and if so which, if any, of the microprocessor system logic boards is faulty, so that a good board may be substituted. No attempt has been made to diagnose specific problems that might be on any particular board, since to do so requires specialized test equipment not generally available to elevator service mechanics.

Let us assume that you have come to the conclusion that an output is not coming out of the computer system when conditions appear such that it should. At this point it becomes necessary to determine if the computer is trying to turn on the output or not, and if not, what is preventing it from doing so.

To find out what the computer is "thinking" or trying to do, we need to look into its memory itself. This is done by using the ON-BOARD diagnostics unit in the manner described in the Field Re-programming manual. You may now review the re-programming manual. Refer particularly to the "Memory Flags" table listing for viewing inputs and outputs.

As an example, let us say that it is observed that the door open function output fails to operate the door open relay DO in response to a door opening input signal. It is observed that the DOF door open function output LED indicator does not turn-on. We now set the diagnostics switches as described, and locate the DOF function near the bottom of the Memory Flags Listing page which indicates an address of 9B for DOF. We then set the MSA, LSA switches to this 9B respectively and observe that, indeed, the LED indicator corresponding to the DOF position 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 DOB address=81) is not coming in, or computer thinks doors are already fully open (DOLF -door open limit front input is zero, address 80), or it is otherwise unsafe to open doors (DZ=0 or HIR=1). Inspection of these flags will indicated either that an input was not supplied to the system properly, or that the computer can not see it. In the later case we suspect that the I/O board (specially if DOB and DOLF do not track input signals), or ribbon cable connecting it to computer board is faulty.

In a manner similar to the example above, any other output/input can be traced to the computer memory in search for the faulty section. The section below illustrates the logic involved in the computer to process the indicated outputs and signals.

III.3.1. 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 names as listed in the Field Re-programming manual; they are used on the job prints for the input/output signals. These abbreviations are easily learned since they clearly represent the signal name (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 required for signal to go off for something to happen. Thus, $DOLF^0$ is a signal that when on, indicates doors are not fully open, when off indicates that doors are fully open.

c. The plus symbol + is used to indicates 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 & $DOLF^0$=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.

LOGIC FLOW EQUATIONS

III.3.1.1 Door Open Function Output -DOF:

(Demand) CCF+UC+DC OR (Input) DOB+SE+PHE+DHLD AND DZ = DOI
DOI & $DOLF^0$ = DOF.

III.3.1.2 Door Open Function Rear Output -DOFR:

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

III.3.1.3 Computer Up Output -SU:

Start: DZ & DLK^0 & HIR & DMU = SU
Hold: HIR+DZ^0 AND SU & DLK^0 = SU

III.3.1.4 Computer Down Output -SD:

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

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).

III.3.1.5 High Speed Output -HR:

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

III.3.1.6 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^0+TFD+BFD+CCDFU+CCDFD = CCD

b. HCDX - Hall Call Disconnect (hall calls won't latch):

FRS^0+FRA^0+EQA^0 = HCDX. If duplex both car's flags are considered.

c. HCR - Hall Call Reject (calls latch but car won't respond):

INC+FRM+EQA+TOS+ISR^0+HLW+SAF^0+IN+EPS = HCR

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.

III.3.2. HARDWARE LOGIC:

III.3.2.1. 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. If you need to adjust, be very cautious, turning adjustment for too high an output will cause the unit to trip out. If this happens, lower adjustment back, then cycle power off.

III.3.2.2. Microprocessor Board.

> Do not depress the microprocessor reset button while car(s) is running as it will cause car(s) to stop from whatever speed they are moving. Use extreme care.

Function of Lights and Switches.

On the processor board, there are nine light emitting diodes (LED's), Two push-buttons, and some switches. The one LED located by itself near the top of board is an indicator which, if on, says that the processor is at least functioning in a very basic way, but does not necessarily mean that the system is functioning normally. The eight remaining LED's are in a row, and are used to display the error/status codes (so will the LCD display, if provided, in English format). In general, the car A/B switch directs the eight LED's to be indicators for CAR A if the switch is UP or CAR B if the switch is DOWN. Refer to Field Re-programming manual for details on the use of switches on computer board.

There are a group of special conditions that are recognized by the processor and if one of these "errors" occurs, the processor will display the code corresponding to that condition. Then this code is looked up by the serviceman in a chart to see what the situation was that caused the processor to display the error (see Table II for an error code listing, in Field Re-programming manual). Not all errors in the system are detected and displayed by the processor; but 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 an "error" code, so this code will be frequently displayed during normal operation. The error codes are arranged in priorities so that if more than one problem is present, the most important one will be the one that is displayed (if LCD display is provided, multiply error codes are displayed in scrolling fashion) . The CAR A/B switch will select the error codes, if any, for whichever car is selected, but both cars cannot be viewed at the same time. So, if the switch is set on CAR A and a problem occurs on the other car, it will not be displayed. In a single car elevator system the CAR A -CAR B switch should be left in the CAR A position.

III.3.2.3. I/O Board (I/O-E Board)

Since the I/O board performs the task of buffering between the relatively well protected five volt computer logic environment and the 110 volt electrically noisy outside world, most microprocessor system problems occur on the I/O boards. The input buffer section of the I/O accept high-level inputs from the HLS board or car signals, and convert them to five volts signals for the computer. Also included are low-pass filtering to reduce noise susceptibility, and Schmitt triggers to increase noise margin. The relay and signal driver section of the I/O board provides high voltage switching outputs to actuate relays on HLS module and general elevator signals.

SECTION IV

DETAILED EXPLANATION OF SUPERVISORY SUBSYSTEM

IV.1. Detailed Explanation of Supervisory control Subsystem Operation

The operation of a computer is basically serial. That is, the actual logical decision-making process is concerned with one piece of data at a time. Since an elevator is a continuous, real-time machine, the supervisory control subsystem microcomputer or microprocessor is made to operate in a loop, performing a pre-determined pattern of instructions many times each second. Its speed is such that each elevator control function appears to be continuously monitored. The paragraphs that follow offer a brief explanation of the basic control loop and the functions performed by the computer during each portion of that loop.

Before any logic decisions can be made, data must be acquired, so the first portion of the control loop is called "contact scan." At this time the microprocessor interrogates each input (hall calls, car calls, and power subsystem inputs) and saves them in the data storage memory. The data from the memory is then used during the rest of the control loop. In effect, the controller takes a "snapshot" of the entire elevator system, and uses that for decision-making. These snapshots are made many times each second, so that system monitoring is essentially continuous.

After the data has been acquired, proper outputs are computed for fire service.

The next major block in the control loop deals with stepping. This system has no mechanical floor selector. When power is first applied, the Supervisory Control system checks to see if the car is at the top landing (on the up slow down limit) or at the bottom landing (on the down slow down limit). If so, the internal electronic "selector" is set to the proper value. If the car happens to be somewhere in 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 (STU for step-up and STD for step-down) placed in the hoistway inform the Supervisory Control

System when the car has passed each floor, and the internal electronic "selector" is updated accordingly. The point of this stepping is actually one slow-down 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 slow down 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.

The next block in the control loop is concerned with proper operation of the doors. While the car is running, this portion is bypassed, but when the car enters door zone the block becomes very active. Some functions performed by the door processing block are 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 the door portion, since all interlocks and timers as well as car panel button inputs must be correct in order for the car to move.

The final block of the control loop takes the data generated by all previous calculations, as well as the calls stored in memory, and lights the appropriate car panel and hall indicator lamps. The loop is now complete, and the processor starts over with contact scan. As mentioned previously, this whole loop is repeated many times each second, so that operation is smooth and, to all outward appearances, continuous.

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 to insure safe, stable operation.

Section V

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.

In addition to the door lock contacts, the various rotating machinery belts and couplings should be routinely inspected for wear. Worn belts could cause loss of control of elevator car.

If the elevator system develops problems or becomes inoperative refer to the Troubleshooting guide.

Section VI

REPLACEMENT PARTS LIST

VI.1. ELEVATOR CONTROLS PC BOARDS.

1) MPC-P8 MICRO PROCESSOR BOARD
2) MPC-IO6-INT-Vxx MAIN INPUT/OUTPUT BOARD
5) MPC-IOEX-Vxx INPUT/OUTPUT EXTENSION BOARD
6) E.C. TIMER #100D
7) MPC-SDI AND SDI I/O MICRO PROCESSOR BOARDS

Note: xx is the FIXTURE VOLTAGE

VI.2. RELAYS

1) POTTER & BRUMFIELD
   A) KHAU-17A12N-120
   B) KHAU-17D12N-110
   C) KUP-14D35-110
   D) PRD11DH0-110VDC

2) OMRON
   A) MY4AC110/120S
   B) MY4-DC12S

3) IDEC
   A) RU4S-D12
   B) RU4S-A12
   C) RR3B-ULDC110V

VI.3. FUSES

1) LITTLE FUSE
   A) 312.250 1/4 AMP 250VOLT
   B) 312-001 1 AMP 250 VOLT
   C) 312-002 2 AMP " "
   D) 312-003 3 AMP " "
   E) 314-015 15 AMP 250 VOLT
   F) MDA TYPE 3, 5, 10 & 15 AMP 250 VOLT

2) BUSSMAN
   A) FRN-R 10, 20, 30, 60 AMP 250 VOLT
   B) FNQ 5,10,15A 500 VOLT
   C) DRIVE POWER FUSES – REFER TO PAGE 4 OF DRAWINGS FOR SIZE AND RATING

VI.4. POWER SUPPLY

POWER ONE HBAA-40W-A   MICRO PROCESSOR POWER SUPPLY

VI.5. SEMI-CONDUCTORS

MOTOROLA HEP-RO170
MOTOROLA 1N5347B – 10V, 5WATT, ZENER DIODE
MOTOROLA 1N5333B – 3.3V, 5WATT, ZENER DIODE
TECOR L4004F31 – 4 AMP, 400VOLT, SENSITIVE GATE TRIAC