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# MODEL H800
## CONTROLLER MANUAL

MICROCOMPUTER CONTROLLED
HYDRAULIC ELEVATOR


Rev. 01/14//02

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# 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 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 elevator.

NOTE: Installation and wiring must be in accordance with the National Electrical Code and consistent with all local codes, and elevator codes and regulations. The AC. power supply to this equipment must come from 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 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).

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

# Section I

## INSTRUCTIONS FOR INSTALLING AND ADJUSTING ELEVATOR

### I.A. Begin

I.1. Protect printed circuit boards 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.

CAUTION: Be careful not to allow metal debris to fall on circuit boards.

I.1.2 Refer to any supplemental adjusting instructions.

### I.B. Startup of Elevator Controls Microprocessor Control System Model H800.

NOTE: 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. 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.B.1. Test all terminals for continuity to ground. If continuity is located, remedy the problem before proceeding.

I.B.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.B.3. Remove fuses F4, 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.B.4. Check the line side of the disconnect to see that you have all three legs at the correct voltage.

I.B.5. Turn on the disconnect and check the voltages at L1, L2, and L3, on starter(s). REMOVE BOARDS PROTECTIVE COVERING BEFORE APPLYING POWER.

I.B.6. Check the rotation of pump motor by momentarily pushing in the starter (use the Y Contactor for Y-Delta starters) switch. (Do not hold in more than one second). If the rotation is incorrect, interchange two of the leads at the disconnect or top of the starter (power lines only-not motor leads).

I.B.7. Observe the RP (Reverse Phase) relay. If it is picked-up, proceed to the next step. If RP is not picked-up, check fuses F1, F2, and F3, and make sure that if an adjustable sensor is provided, that the setting is correct. Next, turn off the power and reverse two of the three wires (probably #14-#18 gauge) that feed 3 phase AC power form the starter to the rest of the controller. These wires will typically be at the top of the starter. Turn on power again and the RP relay should pick. If not, replace the RP plug-in sensor or the RP relay and repeat this step.

I.B.8. Make sure power is turned off and replace F4 to restore relay voltage to normal, Leave door fuses out.

I.B.9. Check the car and cartop stop switches and any other safety switches to see that they are on. Put the inspection switch on inspect.

I.B.10. If the car is on the top final limit jumper 24 to 23A, but remove this jumper as soon as it is possible to do so. Turn the insp HI/LO switch on controller to "LO" to adjust low speed valves. Use the UP/DN rocker switch on controller to run car. The pump motor should start when running car up, and for WYE-DELTA starters, the proper transition time from Wye to Delta should be checked. If no relays are picked, check fuse F4 and check to see that 110 VDC is between terminals 3 and 4A. If AA is in and BB contact does not close, the time on the BB plug-in timer may be set for too long, but it must eventually pull in BB. If it does not, replace the BB timer. If SAF is not in, briefly jumper 4A to 24. If SAF pulls in with the jumper, the trouble is in the safety contact string and will have to be fixed. Remember, the car may be resting on an overtravel limit switch or buffer switch.

I.B.11. Use controller UP/DN switch to run the car ( Note controller INS switch must be on inspection position and cartop inspection switch on normal for up/dn switch to operate).

NOTE: To speed-up installation, H800 controllers for cars with speeds below 150 FPM are equipped with an inspection HI-LO switch, you may wish to flip this switch to HI position during installation phase.

I.B.12. 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).

I.B.13. Test all terminals for grounds. If any are located, remedy the problem before proceeding.

# SECTION II

## FINAL ADJUSTMENT OF THE ELEVATOR CONTROLS
## H800 CONTROLLER

II.A. The elevator should be shut down and main power shut off. Install door fuses F7 and F8. Verify that any door operator diodes are installed per instructions on Elevator Controls controller prints if G.A.L. door operators are used. Position the car in the hoistway so that the car doors can be adjusted to a preliminary setting. Open the doors by jumpering the non-banded side of the diode under the DO relay to terminal 3 on the controller, Close doors by applying a jumper between terms DCO and 4.

II.A.2. The door operator must be operating properly on the car with all door equipment clutches, rollers, etc., properly adjusted with correct running clearances. 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.

II.A.3. Turn test switch on relay printed circuit board in the power control cabinet to the "test" position.

II.A.4. With power off, install fuses F5 & 6 feeding power to computer circuit boards, and make sure the necessary ribbon cables and other interconnecting wires are installed and plugged into the card connectors for Car 2 of a Duplex or Multi-car group. Refer to hoistway prints for interconnects. Check terminals 443 and 444 (fire service) on the controller for this car and if it does not read 24 to 120V, jumper 50 to 443 & 444 on this controller as a temporary measure (Check prints for proper voltage and terminal confirmation).

NOTE: For duplex systems, computer power supply comes from separate fused disconnect.

II.A.5. 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.

II.A.6. Run the car with one-floor runs. Notice that when the test switch on the HLS (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. Since the car is also on independent service while on "TEST", a constant input on the car call terminal (or door close button) 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 leveling, if car is traveling in the up direction and fails to reach its call within a pre-determined time interval, the controller will automatically stop the pump and motor and return the car to the lowest landing. The doors will open, but further operation of the elevator is prevented until the trouble has been corrected.

II.A.7. Verify proper placement and operation of vanes and switches for proper stepping. Adjust valves for proper operation, check relay board for "soft stop jumper" SSJ, computer controlled timer is factory set for 1-2 seconds, see section II.2 below. Remove jumper if not required. Verify operation of all call buttons, and all functions such as fire service main , alternate, and phase 2, independent, access, operation of Car and door devices and switches, terminal slowdown, normal, and limit switches, as well as all safety switches, etc. Verify and correct proper floor leveling, and make sure door zone sensors are adjusted to prevent door pre-opening outside +/- 2" from floor level (it is recommended to eliminate any pre-opening at all, unless specifically specified).

**II.B. Soft Stop Timer Control**

Control of the pump motor for the up direction is controlled by the pilot relay AA (check prints). If this relay is energized, and car is in the door zone area, while completing an up run, the computer will hold the MGR output, as indicated by the LED indicator on the I/O board, for a predetermined field adjustable time. If it becomes necessary to adjust this timer, please refer to FIELD RE-PROGRAMMING AND USE OF ON-BOARD DIAGNOSTICS MANUAL FOR COMPLETE DETAILS. This manual also includes instructions for the "wealth" of information available through the use of the ON-BOARD diagnostics.

NOTE: In the Field Re-programming Manual, you will note that, due to wide range in timer adjustability, the timers are indicated to have two "Addresses" to be modified. It is important to note that you may only need to update one of these addresses since changing the contents of the high address value by one will produce variations in timer values of just over 1 minute, while changing the contents of the Low address value by one will result in timer variations of 1/4 of a second.

**II.C. Motor Limit Timer Control**

If car is traveling in the up direction and fails to reach its call within a pre-determined time interval, the controller will automatically stop the pump and motor and return the car to the lowest landing. The doors will open, 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.D. Multiple Door Open Times

The H800 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.

# Section III

## TROUBLESHOOTING GUIDE

### III.A. 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 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 H800 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 RP (Reverse Phase) Relay must be pulled in.

If it is not:

(1) check the three fuses supplying the RP Module;
(2) replace the RP Relay with type specified.

After verifying the operation of the RP Relay, the local controller power supplies should be verified. First, Terminal 4A should measure +110 VDC. The voltage at Terminal 50 with reference to ground and the voltage between Terminal Strip terminal 1 & 2 should be measured and verified to be in accordance with the voltages as shown on the Power Dispatch, page 1 of the job drawings.. If any of the above power supply voltages are improper, check the appropriate fuses.

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 24-110 V). 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.B.1. Malfunctions in an Operating System

### III.B.1.1. 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 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.B.1.2. 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. |
| 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 jumpered to terminal 3, the corresponding LED lites 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. |

### III.B.1.3. Position Indicator Malfunctions

| 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. |

✍ NOTE: 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.

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.B.1.4. Valve problems

Refer to manual supplied by manufacturer.

## III.C. 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.

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 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.C.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 in 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.

#### III.C.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.C.1.2. Door open function rear output -DOFR:

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

#### III.C.1.3. Computer up output -SU:

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

#### III.C.1.4. 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).

**III.C.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.C.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

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.

**III.C.2. Hardware Logic:**

**III.C.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, 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.C.2.2. Microprocessor Board.**

WARNING: Do **NOT** depress the microprocessor reset button while car(s) is running as it will cause the car(s) to immediately stop. Use extreme care.

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 page 4 in the Field Re-programming manual for an error code listing, ). 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.C.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

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 firemans 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 stepup and STD for stepdown) 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

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

**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