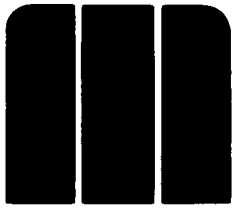

MIPROM I

Troubleshooting Guide

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TABLE OF CONTENTS

Page

MIPROM I OVERVIEW 1

POWER SUPPLIES AND PSC CARD 4

POWER SUPPLY CHECKS 8

PSC CARD LED 1
AND LED 2 OPERATION 10

CPU CARD 11

PROM CARD 15

I/O INTERFACE 17

CARDRACKS 22

INPUT CARD 29

OUTPUT CARD 34

TIMER CARD 41

SUPERVISORY INPUTS 44

SUPERVISORY OUTPUTS 51

SUPERVISORY TIMERS 59

COMMON INPUTS 63

COMMON OUTPUTS 64

COMMON TIMERS 66

POWER AND TIE POINTS 66

REFERENCE PHOTOS 68

MIPROM 1 DEBUG TESTS 84

MIPROM I OVERVIEW

Computers play an important part of our lives in just about everything we do. They are used to do bookkeeping, keep data files, play games, and process just about any kind of information you can think of. Computers are widely used to perform tasks which humans could perform but find to be very tedious or time consuming. They are also used to perform tasks which require a constant observation for gathering and processing data because they never sleep and never need to take a break.

The MONTGOMERY ELEVATOR COMPANY MIPROM I elevator logic controller is a special application of a computer as a data gathering device and data processor. The data the MIPROM I is processing is all of the information necessary to provide the customer with elevator service which is reliable and will provide the building tenants with fast efficient service.

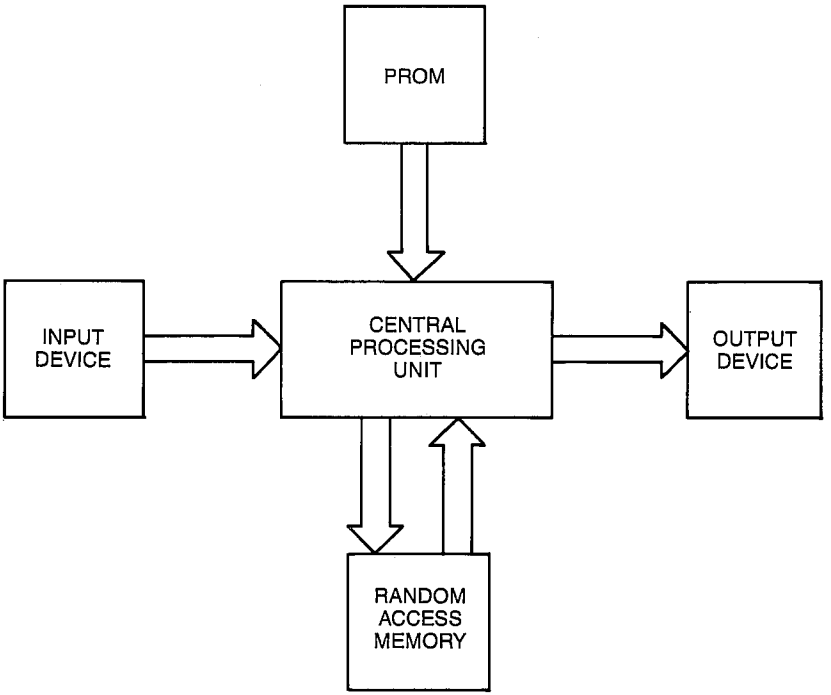
REFER TO FIGURE 1.1

Although not all computers are built following the same architecture they are all built according to the same basic block diagram. All computers have a CENTRAL PROCESSING UNIT (CPU) which is the processor of the data gathered by the computer, a written set of instructions for the CPU to carry out, some method of getting information to the CPU for processing, and a method of getting the processed data out of the computer so that it can be put to use.

The CPU which is used in the MIPROM I controller is a device called a MICROPROCESSOR. A microprocessor is an integrated circuit which is capable of performing arithmetic functions, making logical decisions, counting, "reading" data, "writing" data, and other tasks at very fast speeds.

For all of the things that a microprocessor is capable of doing it is of little use by itself. The microprocessor can be a great tool, but it must first know what it is suppose to be doing. A microprocessor must be given a set of instructions to follow before it can perform even the simplest task. This set of instructions is called the PROGRAM and is stored in another Integrated Circuit (IC) called a PROM. PROM is an acronym for Programmable Read Only Memory. As the name implies, the microprocessor can only read information from this type of memory. The microprocessor is capable of performing only one instruction of the program at a time, but since it can operate at very fast speeds it becomes a very valuable tool in the area of information processing and logic control.

While the CPU is processing information necessary for it to operate the elevator system it keeps track of the current status of the system in another type of memory called RAM. RAM is an acronym which stands for Random Access Memory. RAM is sometimes referred to as READ/WRITE MEMORY because the CPU can write data to RAM, read



BLOCK DIAGRAM OF A TYPICAL COMPUTER

Figure 1.1

data from RAM, and re-write new data over previously stored information. The MIPROM I uses RAM in much the same way as you would use a scratch pad to keep notes.

Once the CPU is given a program to follow it must be able to gather information for it to process according to the program instructions. Some computers use a keyboard, joysticks, touch screen monitors, or some other sensing device to input information to the computer. The MIPROM I controller uses the INPUT CARD to take information from such devices as push buttons and switches and make this information available for the CPU to process.

Even though the CPU has received information and processed it according to the program instructions it has been given, it is of little value unless the results of processing are in some way made available for use. This is usually made available by the computer making an output to some external device. Some computers will output the data to a monitor, a printer, or a tape or disk drive. The MIPROM I controller makes its processed data available for use through the OUTPUT CARD. The OUTPUT CARD allows the MIPROM I to control external devices such as lights, buzzers, door operations, and the elevator motion controller.

A typical MIPROM I controller will consist of at least one CARDRACK, a POWER SUPPLY CONNECT CARD, a CPU CARD, a PROM CARD, a TIMER CARD, an I/O INTERFACE CARD, INPUT CARDs, and OUTPUT CARDs. The number of INPUT CARDs and OUTPUT CARDs used in the controller will depend upon the size of the system and the number of cardracks will depend upon the number of cards in the system. Each of these parts and its function in the system will be explained in its own section of this book.

POWER SUPPLIES AND POWER SUPPLY CONNECT CARD

REFER TO FIGURE 2.1

The MIPROM I controller contains many different power supplies. These include 120 VAC, 24 VDC, 14 VDC, 11 VDC, 5 VDC, and on some early models a 45 VDC power supply. The use of the 45 VDC power supply has been discontinued. The incoming 120 VAC power to the MIPROM I system is an isolated supply which should measure 110 to 125 VAC at terminals L2AX and L1A with L1A being the neutral side of the line. This supplies the DC power supplies with the 120 VAC necessary to generate the appropriate DC power and supplies power to hoistway devices and relay circuits. The devices such as switches and pushbuttons and relay circuits are supplied the 120 VAC power through a switch which ties L2AX to terminal SS.

Another switch is used to connect the 120 VAC power to the DC power supplies in the system. There are two power supplies which use 120 VAC to generate their DC voltages. One is a 24 VDC supply which is generally located in the upper left hand corner of the MIPROM I cabinet and on the bottom of the TMS cabinet, the other is the 11 VDC supply which is located on the POWER SUPPLY CONNECT (PSC) CARD. This card is the first card (far left) in the first cardrack. Both of these power supplies are unregulated.

The 24 VDC power supply is used to generate the input voltage to a voltage regulator which then generates a 14 VDC supply. There is one 14 VDC regulator in each cardrack in the system. This 14 VDC supply is used by the cardrack, INPUT CARDs, OUTPUT CARDs, TIMER CARD, and I/O INTERFACE CARD.

The 11 VDC signal is used to supply the input voltage to a 5 VDC regulator. This 11 VDC supply is located on the PSC CARD. There is only one 5 VDC regulator in each common controller and each car controller in the system and it is located in the first cardrack only. This 5 VDC signal is used by the CPU CARD, PROM CARD, and I/O INTERFACE CARD.

The hoistway devices and the relay circuits are supplied with 120 VAC through switch S2, the bottom switch on the PSC CARD. This switch simply ties L2AX to terminal SS.

Switch S1 is the top switch mounted on the PSC CARD and it is used to supply 120 VAC to the DC power supplies in the system. The 11 VDC power supply which is located on the PSC CARD and can be measured across the 4000 microfarad capacitor on this card. The output terminals of this power supply are called V11 (+) and VG (–). This is an unregulated supply so the actual voltage may vary. The 11 VDC output of this supply serves as the input voltage of the systems 5 VDC regulator. This regulator is mounted on the right hand side of the first cardrack and is bolted to the aluminum side

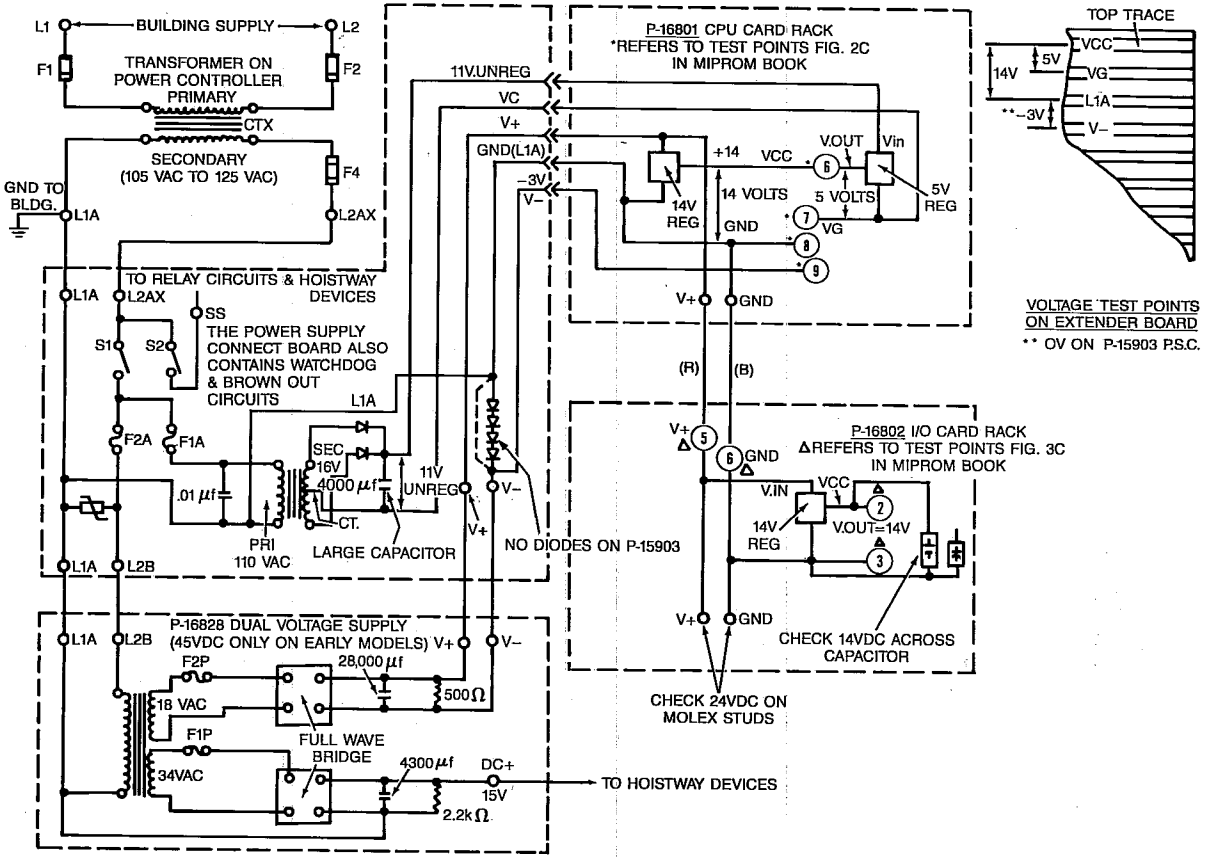

L1
BUILDING SUPPLY
L2
F1
TRANSFORMER ON POWER CONTROLLER PRIMARY
F2
CTX
SECONDARY (105 VAC TO 125 VAC)
F4
GND TO BLDG.
L1A
L2AX
TO RELAY CIRCUITS & HOISTWAY DEVICES
SS
THE POWER SUPPLY CONNECT BOARD ALSO CONTAINS WATCHDOG & BROWN OUT CIRCUITS
S1
S2
F2A
F1A
.01 μf
SEC
16V
4000 μf
CT.
PRI
110 VAC
11V UNREG
LARGE CAPACITOR
NO DIODES ON P-15903
L2B
P-16828 DUAL VOLTAGE SUPPLY (45VDC ONLY ON EARLY MODELS)
F2P
18 VAC
28,000 μf
500Ω
F1P
34VAC
FULL WAVE BRIDGE
4300 μf
DC+
15V
2.2kΩ
TO HOISTWAY DEVICES
11V.UNREG
VC
V+
GND(L1A)
–3V
V–
P-16801 CPU CARD RACK
*REFERS TO TEST POINTS FIG. 2C IN MIPROM BOOK
+14
VCC
V.OUT
Vin
14V REG
14 VOLTS
5 VOLTS
5V REG
GND
VG
(R)
(B)
P-16802 I/O CARD RACK
ΔREFERS TO TEST POINTS FIG. 3C IN MIPROM BOOK
V.IN
V.OUT=14V
CHECK 14VDC ACROSS CAPACITOR
CHECK 24VDC ON MOLEX STUDS
TOP TRACE
5V
14V
**–3V
VOLTAGE TEST POINTS ON EXTENDER BOARD
** OV ON P-15903 P.S.C.

Figure 2.1

panel of the cardrack so that it may dissipate the heat generated by the regulator. The output of this regulator is VCC (+) and VG (–). Refer to POWER SUPPLY CHECKS, Step 5f for measuring this voltage.

REMEMBER there is only one 5 VDC regulator in each CAR CONTROLLER and each COMMON CONTROLLER and is located in the CARDRACK containing the CPU CARD.

The output of the 24 VDC unregulated supply is used as the input of the 14 VDC regulators in the controller. Each cardrack including the first cardrack will have its own 14 VDC regulator. The output of this power supply is V+ (+) and V– (–) and may vary from 24 VDC because it is unregulated. The output of the 14 VDC regulator is tied to VCC (+) and L1A (–). This regulator is bolted to the aluminum side panel of the cardrack and uses it as a heatsink. Refer to POWER SUPPLY CHECKS Step 5d for measuring this voltage.

The 45 VDC power supply shown on the schematic was used to power hoistway devices but it is not used on the later model MIPROM I controllers. The output of the 45 VDC power supply is between terminals DC+ (+) and L1A (–) and being an unregulated supply the actual voltage measured may vary. This power supply and the 24 VDC power supply used in the early MIPROM I systems were contained on one assembly.

There are two types of voltage regulators used in the MIPROM I controller. One type of regulator has four pins, the other has only three pins on its base. These regulators must be mounted with the original hardware in order to keep them isolated from the cardrack. There is also a small pad between each regulator and side panel to help isolate, yet it also helps to dissipate the heat generated by the regulators. Although these regulators may be physically different the function remains the same.

In early models of the MIPROM I controller, the voltage regulators plugged into a socket which was soldered to the BACKPLANE of the cardrack. In time these plug-in regulators became the cause of intermittent problems when the connection between the socket and the regulator pins lost continuity. Later models use a regulator which has a ribbon cable soldered to the regulator pins with the other end of the ribbon cable being soldered to the BACKPLANE of the cardrack.

The POWER SUPPLY CONNECT card also contains circuitry which monitors the incoming power and the operation of the CPU. A BROWN OUT CIRCUIT monitors the incoming 120 VAC power and will let the MIPROM I controller operate only if it is within certain tolerances. If the circuit detects that a BROWN OUT does occur, it will force the controller into a RESET state, causing the CPU card to clear all outputs and timers and hold the microprocessor disabled so that it cannot perform the program instructions, and hold it there until power returns to an acceptable level. A WATCHDOG CIRCUIT on the PSC CARD expects to see a signal from the CPU at a preset interval to protect

against the failure of the execution of the control program. If the WATCHDOG CIRCUIT detects a failure of the CPU to execute the program, it will also generate a RESET signal. The operation of the RESET signal will be explained in more detail in the section on the CPU card.

When grounding the MIPROM I controller system, or any other controller, it is good practice to utilize a single point grounding method, that is all ground leads in the controller should be tied to a single grounding point. This practice will minimize the possibility of any ground loops which could occur.

L1A is required to be common between all MIPROM units within a group. This should be done with a #14 wire, DO NOT rely upon conduit, flexible conduit, or duct to provide this connection or for grounding purposes.

Step 5 in the POWER SUPPLY CHECKS list on the next page calls for removing all cards from the rack when checking the power supplies. This is done due to the fact that a bad card could cause the output of one of the systems voltage regulators to appear to be bad, when all that is really wrong is that the output of the regulator is being shorted to ground through the bad card. To isolate this as being the problem pull all of the cards in the rack out so that they are not plugged in to the BACKPLANE. Check the voltage. If the voltage is there, then insert one card at a time to see if one or more of the cards will cause the voltage to drop when inserted.

PART NUMBER	CAN REPLACE	NOTES
P-16835	P-16787	JUMPERS J1 AND J2 MUST BE IN THE PROPER POSITION ON THE CARDRACK.
P-16787	P-16835	JUMPERS J1 AND J2 MUST BE IN THE PROPER POSITION ON THE CARD-RACK. P-16787 HAS NO BROWN OUT PROTECTION.

POWER SUPPLY CONNECT CARD REPLACEMENT
CHART 2.1

POWER SUPPLY CHECKS

IMPORTANT: Never insert or remove cards with power on!

1) "S1" and "S2" switches on the POWER SUPPLY CONNECT (PSC) CARD to be in the off position.

2) Pull all cards except the PSC CARD out of their sockets.

3) Apply mainline power. Voltage between terminals "L2AX" and "L1A" must be 110 VAC to 125 VAC.

4) Turn on switch "S1" at the PSC CARD. LED 2 should be flashing.

5) With all cards removed from sockets check the following voltages.

a) Terminal: "L2B" to "L1A"
Voltage: 110 VAC to 125 VAC
Description: DC supply input voltage supply. Measure at PSC CARD terminals.

b) Terminal: "V+" (+) to "V–" (–)
Voltage: 20 VDC to 27 VDC unregulated
Description: 24 VDC power supply output voltage. Measure at PSC CARD terminals.

c) Terminal: "V+" (+) to "L1A" (–)
Voltage: 17 VDC to 27 VDC unregulated
Description: 14 volt regulator input voltage. Check at 4 wire cable molex connector on each cardrack.

d) Terminal: "VCC" (+) to "L1A" (–)
Voltage: 13 VDC to 14 VDC
Description: 14 volt regulator output voltage.

On first cardrack use EXTENDER CARD in MINI MONITOR slot. Measure between top trace, VCC (+), and the third trace from the top, L1A (–).

On additional cardracks check across the larger of the two capacitors on righthand side of BACKPLANE. Top of capacitor VCC (+) to L1A (–).

e) Terminal: "V11" (+) to "VG" (–)
Voltage: Approximately 11 VDC
Description: 5 VDC regulator input <u>on first cardrack only.</u> Check across 4000 MFD capacitor on PSC CARD.

f) Terminal: "VCC" (+) to "VG" (–)
Voltage: 4.75 VDC to 5.25 VDC
Description: 5 volt regulator output voltage. On first cardrack only. Use EXTENDER CARD in MINI MONITOR slot. Measure between top trace, VCC (+), and the second trace from the top, VG (–).

g) Terminal: "V–" (+) to L1A (–)
Voltage: –2.4 VDC to –3.0 VDC
NOTE: ZERO VDC with P-15903 PSC CARD. Use EXTENDER CARD in MINI MONITOR SLOT. Measure between the third trace from the top, L1A (–) and the fourth trace from the top, V– (+)

h) Terminal: "DC+" (+) to "L1A" (–)
Voltage: 35 VDC to 55 VDC unregulated
NOTE: If used. Measure at PSC CARD terminals.

6) Turn on switch "S2" on the PSC CARD. "SS" to "L1A" should measure 110 VAC to 125 VAC.

7) When all power checks out "OK" turn off switches "S1" and "S2" and insert all cards into their sockets.

8) To insure voltage regulators are stable under load conditions re-check regulator output voltages with cards in place.

9) Turn on switch "S1" on the PSC CARD. With all cards in place LED 2 should not be flashing.

PSC CARD LED 1 AND LED 2 OPERATION

1) * POWER ON *

   Reset causes CPU CARD to clear ram, all timers and all outputs; and causes microprocessor to begin executing the program from the beginning. LED 2 on momentarily.

2) * PSC BOARD MISSES THREE CONSECUTIVE AC CYCLES *

   LED 2 on momentarily causing same as above to occur.

3) * CONTROL PROGRAM NOT BEING EXECUTED *

   PSC CARD expects to see a pulse (WATCHDOG) from the CPU at least once every second. If this pulse is not received from the CPU then the PSC CARD will generate a reset signal and LED 2 will be on momentarily, causing the same effect as in step 1 above.

4) * LOW VOLTAGE IN 120VAC SUPPLY *

   LED 1 will come on and stay on to indicate that a brown out situtation did occur. LED 2 will come on and stay on until power returns to an acceptable level, holding the MIPROM in a reset state. After power has returned to an acceptable level LED 1 can be cleared by turning off switches S1 and S2 for 2 to 3 seconds.

CPU CARD

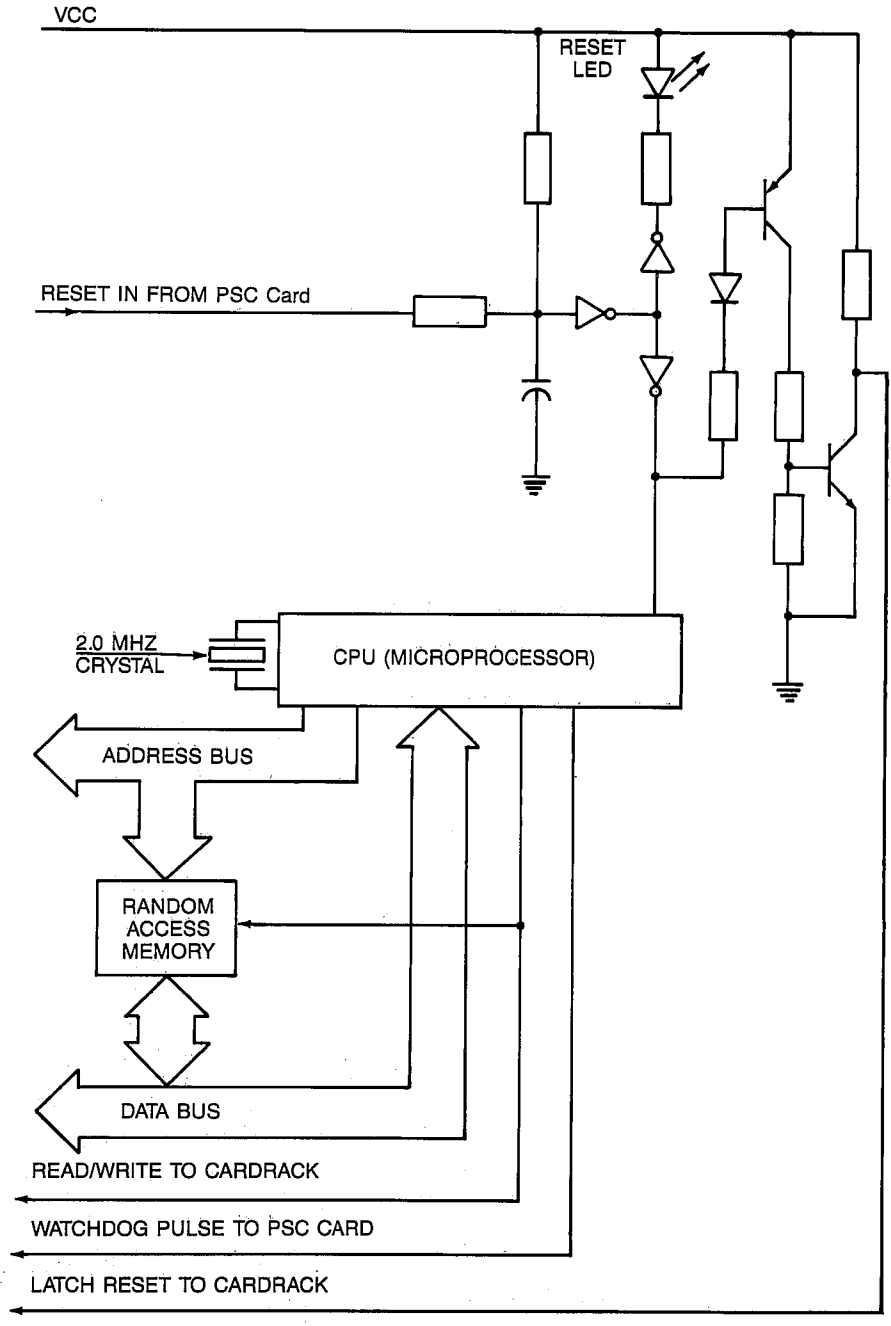
The microprocessor works with DIGITAL LOGIC. That is it can only recognize that a signal is either ON or OFF. A very simple example of a digital device is a switch. The switch can only be open or closed. If the switch were wired to supply power to a light bulb then the light could only be ON or OFF. There is no "in between" state. In digital logic ON equals supply voltage and OFF equals ground potential.

In the MIPROM I system as in most electronic systems the supply voltage is referred to as VCC and, of course, VCC is in reference to a system ground. Since the microprocessor only recognizes VCC and ground potential other terminology has been applied to represent these two voltage levels. If a given input or output signal is at VCC potential it is said to be HI or it is a 1. If the signal is at ground potential it is said to be LO or it is a O (ZERO). In reality there are certain tolerances as to what any given digital device will recognize as a HI or LO signal, but for all practical purposes and for the purpose of this text, it is assumed that they will represent VCC and GROUND. This will stand true throughout this entire text, not just in this section. These terms refer to the low voltage DC circuits on the printed circuit boards not the high voltage AC on the input and output terminals.

A point to remember here is that there are two DC grounds in the MIPROM I system. One is the ground for the 14 VDC regulators which is L1A. The other is the ground for the 5 VDC regulator which is VG. Both L1A and VG will be referred to as LO so please try to keep in mind which supply is being used.

A computer system is constructed with several different devices which the CPU can communicate with. These devices can be looked at a lot like houses on a street with each house having a different ADDRESS. When the CPU wants to communicate with any given device in the system it must first send out the proper address of the device before the device can become available. The MIPROM I controller's CPU must do this before it can communicate to any INPUT CARD, OUTPUT CARD, timer on the TIMER CARD, or memory location in the system.

The MIPROM I controller has 16 lines which are outputs from the CPU CARD called an ADDRESS BUS. Each of these lines can only be HI or LO when the CPU sends out an address on the ADDRESS BUS. This address that the CPU sends out along the bus can be looked at as the combination of a lock. When an address goes out along the bus it is received by every device in the system, but it is the proper combination which will allow the CPU to access only one device. Each device will have support circuitry of some kind which will decode the address on the bus as the address which will allow the CPU to gain access to it. Again, this device may be any one of the cards which is a part of the MIPROM I controller.



BLOCK DIAGRAM OF CPU CARD

Figure 3.1

When the CPU sends out an address it intends to communicate with a device. Once the CPU gains access to the device the CPU can communicate with it in one of two ways; it can send data to the device or it can receive data from the device. If the device is an INPUT CARD it will receive data. This is referred to as the CPU "reading" data from an INPUT CARD. If the device is an OUTPUT CARD the CPU is said to be "writing" data to the OUTPUT CARD. "Reading" and "writing" are terms used throughout the computer industry to refer to any CPU input or output of data.

The CPU used in the MIPROM I controller also has a DATA BUS which is used to either send or receive data. This bus is referred to as a BI-DIRECTIONAL bus because the CPU can send data out to a device and receive data from a device along the same lines. Although the CPU can both send and receive data along these same 8 lines, it is important to understand that the bus can only be used to send data or it can be used to receive data at any given instant. This bus cannot be used to send and receive data at the same time. This bus has 8 lines so the CPU can either send out 8 bits or receive 8 bits of information at any time. The 8 lines together represent what is called a BYTE and each individual line in the byte is referred to as a BIT. The combination of bits will depend upon the status of the INPUT CARD being "read" or the data being "written" to the OUTPUT CARD.

The CPU CARD also contains the Random Access Memory (RAM) which is used in the MIPROM I controller. This is the temporary memory which the CPU uses to keep track of the current status of the elevator system. For example when a call is registered, the CPU will store this information in the RAM. When the call is answered the CPU will erase this information from the RAM. The CPU uses the RAM in much the same way as you would use a scratch pad to keep notes.

Also mounted on the CPU CARD is the driver circuitry of the RESET LINE. The PSC CARD contains circuitry which will send a signal to the CPU CARD which will then generate the actual RESET signal. When the CPU generates a RESET the line called LATCH RESET is taken LO. This LATCH RESET line is tied to the OUTPUT CARDs, and TIMER CARD. The RESET signal from the PSC CARD is used to signal the CPU CARD to clear the RAM and the OUTPUT CARDs and TIMER CARD and prevent the CPU from carrying out the program instructions. To indicate that the PSC CARD is calling for a reset an LED mounted on the CPU CARD will be illuminated. This LED is labeled RESET and should be lit only when the RESET circuitry on the PSC CARD tells the CPU CARD to take the LATCH RESET line LO. Refer to the page in the POWER SUPPLY CONNECT CARD section of this text which covers the operation of the RESET circuit and the system monitors which will cause the CPU to reset the controller.

PART NUMBER	CAN REPLACE	NOTES
P-15783	P-16782	
P-16782	P-15783	IF USED WITH PROM CARDS P-16774 OR P-16992 ONLY. CHECK JUMPERS J1 AND J2 ON CARDRACK.

CPU REPLACEMENT CHART
CHART 3.1

There are two Berg jumpers mounted on the COMBINATION CPU-I/O CARDRACK BACKPLANE which must be in the proper position in order to allow certain PSC CARDs, PROM CARDs, and CPU CARDs to work together. Jumper J1 is located between card slot EC4 and EC5 toward the bottom of the CARDRACK. When PSC CARDs P-16835 or P-15903 are used, the jumper belongs on the two left most pins. When PSC CARD P-16787 is used the jumper belongs on the two right most pins.

Jumper J2 is located between the CPU CARD slot and the slot for the MINI-MONITOR. When PROM CARD P-16774 or CPU CARD P-16782 is used, the jumper belongs on the two left most pins. For PROM CARD P-16992 and CPU CARD P-15783, the jumper can be in either the left or right position. For CPU CARD P-15783 and other PROM CARDs, the jumper belongs on the two right most pins.

PROM CARD

The systems Programmable Read Only Memory (PROM) integrated circuits (IC's) which are mounted on this card contain the PROGRAM which the CPU is to follow in order to control the elevator. The program is the set of instructions which tells the CPU how to read inputs, write to outputs, and how it is to process the data it receives. The CPU carries out the program instructions one at a time. After one instruction is carried out the CPU advances to the next program instruction and carries out that instruction and so on. The program contained in the PROMs is loaded into these ICs at the factory and is not reprogrammable in the field.

Since not every elevator system has the same characteristics the program contained in the PROMs may vary from one system to the next, the program stored in the PROMs is encoded in a digital format called the BINARY system. Remember from previous text that digital signals can be looked at as a 1 or 0, this is the meaning of binary. Each digit in a binary number can only be either a 1 or a 0. If the instructions stored in the PROMs are looked at as representing binary numbers, then these numbers can be added together or summed. The sum of these numbers is what is referred to as the CHECK SUM of a program. Since not every MIPROM I control program is the same, then not every program will have the same check sum number. This number is written on the card for use with the systems debugging equipment. If a program failure is suspected, then the check sum of the PROMs can be checked against the check sum taken in the factory. If the two numbers are not the same, then the chances are that the program or PROM CARD has in some way been altered.

When a controller is set up to operate a specific elevator, a map of the terminals, timers and dipswitches is created which defines the function of the individual input terminals, output terminals and timers. This map is used within the program to allow the CPU to recognize which terminal represents "DG", "STP", "_U" 's and so on for input information; which terminal represents "DO10",, "CSV1", or "_DJ" 's and so on for output information; which timer represents "DOT", "MST", or "DPT" and so on; and which dipswitch represent any of the functions they can be set for. If a program failure is suspected then a PROM CARD from another controller having the exact same terminal map may be substituted temporarily to determine this. Keep in mind that it is important to keep the status of the dipswitches set the same as the original program when switching these PROM CARDs out in this manner. A dipswitch set in a different position may cause it to appear as though another problem is present even though the car is now running. The factory should be consulted whenever a PROM CARD needs to be replaced.

Since the program contained in the PROMs cannot be changed in the field, this locks a system into the set of instructions loaded at the factory. In order to add some flexibility to the program, a set of DIP SWITCHES has been added to some PROM CARDs which

will allow field personnel to select certain options of the program. The switches will allow the selection of the "main fire return floor", "advance door opening", "lobby preference", and other options which may or may not need to be altered from the factory loaded program instructions. Some installations use an INPUT CARD to perform the functions of the dipswitches. The options are then selected or not selected by jumping the appropriate terminal to SS or by leaving the terminal disconnected.

I/O INTERFACE CARD

As stated in the section on the POWER SUPPLIES AND PSC BOARD there are two different DC supplies used by the various cards in the MIPROM I controller. The 5 VDC supply is used by the PROM and the CPU CARDS while the TIMER, INPUT, and OUTPUT CARDs work off of the 14 VDC supply. The CPU used in the MIPROM I controller uses 5 VDC signals when it communicates with any of the other cards in the system. This makes it incompatible to communicate directly with the 14 VDC cards in the controller so in order to make the two signal levels compatible an INTERFACE must be inserted between them. An interface is any device which will allow one voltage level to work with another voltage level. A simple example of an interface is a transformer; it can be used to either step up or step down an incoming voltage so that it may be used by a device which is not directly compatible with the incoming voltage source.

The MIPROM I uses the I/O INTERFACE CARD to make the 14 VDC circuits compatible with the 5 VDC CPU. The ADDRESS BUS spoken of in the section on the CPU BOARD uses the I/O INTERFACE CARD to step the 5 VDC signal from the CPU up to the 14 VDC signal necessary to address the TIMER, INPUT, and OUTPUT CARDs in the system. It also converts the 5 VDC data signals from the CPU to the 14 VDC data signal necessary for the OUTPUT or TIMER CARDS on the DATA BUS whenever the CPU is "writing" data. When the CPU is "reading" data from one of the 14 VDC INPUT or TIMER CARDs in the system, the signals on the DATA BUS are converted from 14 VDC to the necessary 5 VDC signal for the CPU.

REFER TO FIGURE 5.1

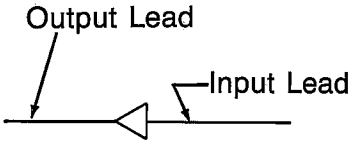
Although the CPU has the capability of using 16 lines to address any given device in the system, it uses only 6 of these lines to address any TIMER, INPUT, or OUTPUT CARD. These 6 lines will allow for the CPU to access up to 8 cardracks and up to 8 cards in each of the cardracks in the controller. The cardracks contain the circuitry used to decode which of the cardracks and which INPUT or OUTPUT CARD in that rack is being addressed, but each TIMER BOARD has its own decoder circuit mounted on the TIMER BOARD. These 6 address lines are sent out from the CPU as 5 VDC signals and are changed to the necessary 14 VDC signals by the interface circuitry which is represented here by the blocks with the triangles in them.

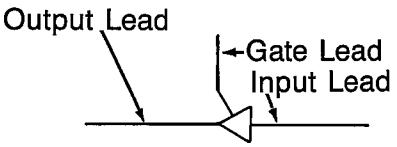
The triangles within the blocks represent the digital amplifiers which are contained on the I/O INTERFACE CARD. There are two types of amplifiers shown here, one is just the triangle which is simply a BUFFER AMPLIFIER. Whenever a digital signal is received on the input of a buffer amplifier, it simply passes the signal on the input of the amplifier to the output of the amplifier.

The other is a triangle with a lead going into one of the sides of the triangle. This type of amplifier differs from the buffer amplifier in a unique way. Although both of these

amps achieve the same end result, which is pass the signal on the input of the amp on to the output of the amp, the CPU can control when the signal is passed on to the amp's output by using the third lead. Each of the amps has an input lead and an output lead, but the third lead of this amplifier is a GATE LEAD. This gate lead works just like a gate in a fence. If the gate is open, then the data or address on the input of the amp can be passed to the output of the amp. If the gate is closed, then the signal on the input of the amp cannot be passed to the amplifiers output. The amplifiers output is in effect electrically disconnected from the bus it is wired to.

A regular digital buffer amplifier can only have two possible states on the output, HI or LO, depending on the signal on the input of the amp. When a signal is received on the input of the amp it is immediately passed on to the output of the amp. The digital buffer amplifier with the gate lead can have three possible states on its output. The output can be either HI or LO, depending upon the status of the input lead, but it can also be electrically disconnected from the line; this is referred to as the output being in a high impedance or HI Z state or simply OFF. When the amplifier output is OFF, it is neither HI or LO. This type of amplifier then can have three possible states and is appropriately called a TRI-STATE BUFFER. See the truth table below.





Input	Output
LO	LO
HI	HI

BUFFER AMPLIFIER

Gate	Input	Output
Disable	LO	OFF (HI Z)
Disable	HI	OFF (HI Z)
Enable	LO	LO
Enable	HI	HI

TRI-STATE BUFFER

TRUTH TABLE 1

When the CPU wants to read data from a card or write data to a card, it must put the proper address out on the ADDRESS BUS. The ADDRESS BUS is only enabled when the address is decoded as being a valid address for either the TIMER CARD, an INPUT CARD, or an OUTPUT CARD. When the gate is enabled, the address is passed on through the I/O INTERFACE CARD.

The ADDRESS BUS is like a one-way street, that is an address can only be generated by the CPU so the address only travels in one direction, from the CPU to the device. Since the CPU must be able to read and write information along the DATA BUS, it must act like a two-way street and allow data to travel to and from the CPU. The data written

by the CPU to a device must be converted from a 5 VDC signal to a 14 VDC signal, but the data being read by the CPU from a device must be converted from a 14 VDC signal to a 5 VDC signal. To accomplish this data being written by the CPU travels through one set of amplifiers and data being read by the CPU travels through a different set of amplifiers on the I/O INTERFACE CARD. A TRI-STATE BUFFER is inserted in both the input portion of the bus and the output portion of the bus on this card. The output side of the bus is enabled only when the data is intended to be sent out to a device. The input side of the bus is enabled only when the data is intended to be read from a device.

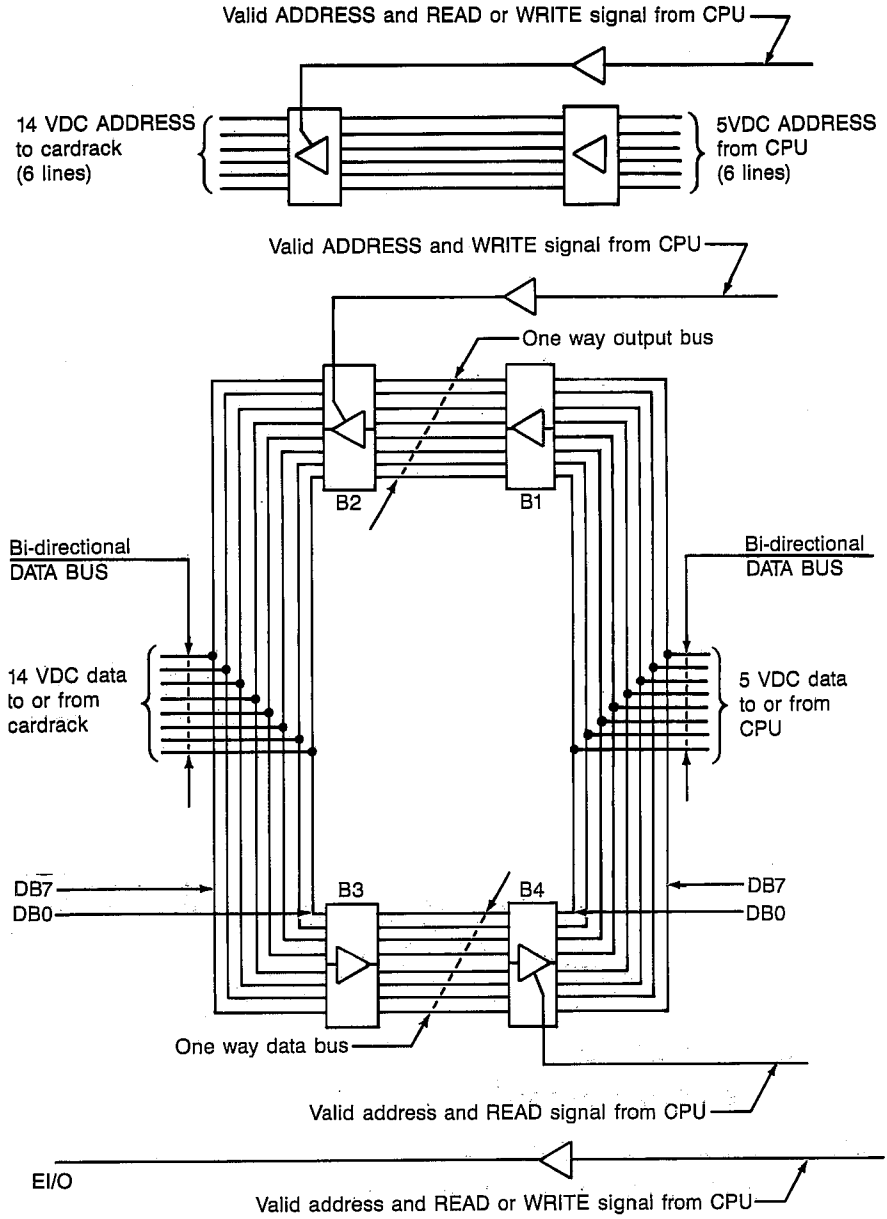
The portion of the bus which reads data from a device is enabled only when the address is a valid address for an INPUT or TIMER CARD and the CPU generates a READ signal. When this combination occurs then the gate on the TRI-STATE BUFFER in that circuit is enabled. The portion of the bus which writes data to a device is enabled only when the address is a valid address for an OUTPUT or TIMER CARD and the CPU generates a WRITE signal. When this combination occurs, then the gate on the TRI-STATE BUFFER in that circuit is enabled.

An important point to remember here is that although the DATA BUS uses the same 8 lines coming into this card and the same 8 lines going out of this card, the input data and the output data on this card travels through two completely different circuits. If there is a problem on this card in only one side of the DATA BUS then the CPU may be able to read data from an input properly but it may not be able to properly write data to an output, and vice versa.

To help clarify the above paragraph, let's trace an output signal and an input signal through the I/O INTERFACE CARD along only one of the DATA BUS lines. When the data signal sent out by the CPU along the bus line labeled DBO reaches the input of the I/O INTERFACE DATA BUS, the 5 VDC signal is passed directly through amplifier B1 to the input of amplifier B2. Only when amplifier B2 is enabled will the data be passed out along the 14 VDC DATA BUS line which is also line DBO. Amplifier B4 is disabled so it is, in effect, disconnected from the bus because the CPU did not send out a READ signal.

When the data signal coming into the CPU along the bus line labeled DBO reaches the input of the I/O INTERFACE DATA BUS, the 14 VDC signal is passed directly through amplifier B3 to the input of amplifier B4. Only when amplifier B4 is enabled will the data be passed out along the 5 VDC DATA BUS line DBO to the CPU. Amplifier B2 is disabled so it is, in effect, disconnected from the bus because the CPU did not send out a WRITE signal.

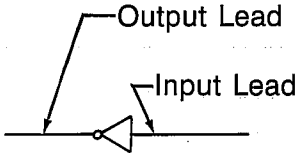
If amplifier B1 or B2 is bad, then the CPU cannot WRITE the correct information to an output device, but it may still be able to READ the correct data of an input to the CPU through amplifiers B3 and B4. The opposite holds true if amplifier B3 or B4 is bad yet amplifiers B1 and B2 are working properly.

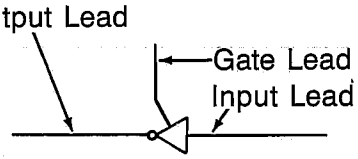


BLOCK DIAGRAM OF I/O INTERFACE BOARD
Figure 5.1

One other signal which is generated on the I/O INTERFACE BOARD is called EI/O, which is an acronym for Enable Input/Output. This signal is generated when the CPU sends out a valid address for an INPUT CARD, OUTPUT CARD or TIMER CARD and a READ or WRITE signal. The purpose of the EI/O signal will be discussed in the section concerning the COMBINATION CPU - I/O CARDRACK and the I/O CARDRACK.

Some of the digital amplifiers used in the MIPROM I controller are INVERTING AMPLIFIERS. If a standard amplifier receives a HI signal on its input then the output is HI, if the signal is LO the output is LO. On the INVERTING AMPLIFIER if the input signal is HI then the output signal is LO, and if the input signal is LO then the output signal is HI. In other words the signal is inverted. Some of the circuits we will be tracing will be using this type of amplifier which is shown schematically similar to the NON-INVERTING AMPLIFIER except that the output terminal has a small circle on it. See the schematic symbol and truth table for the INVERTING AMPLIFIER below.





Input	Output
LO	HI
HI	LO

INVERTING
BUFFER AMPLIFIER

Gate	Input	Output
Disable	LO	OFF (HI Z)
Disable	HI	OFF (HI Z)
Enable	LO	HI
Enable	HI	LO

INVERTING
TRI-STATE BUFFER

TRUTH TABLE 2

The only I/O INTERFACE CARD in production at this time for the MIPROM I controller is P-16783.

CPU - I/O CARDRACK
AND
I/O CARDRACK

There are three different types of cardracks used in the MIPROM I controller. The early models of the controller have a cardrack which has slots for the PSC, TIMER, I/O INTERFACE, PROM, and CPU CARDs, and the MINI MONITOR. This CARDRACK is called the CPU CARDRACK. They also use a separate cardrack for the INPUT and OUTPUT CARDs called the I/O CARDRACK. The newer models still use the I/O CARDRACK for the INPUT and OUTPUT CARDs, but they also use a cardrack which combines the first two cardracks into one. This third cardrack is called the COMBINATION CPU - I/O CARDRACK. The use of the CPU CARDRACK has been discontinued. This text will concern itself only with the COMBINATION CPU - I/O CARDRACK and the I/O CARDRACK. The operation of the CPU CARDRACK is identical to the operation of the COMBINATION CPU - I/O CARDRACK as far as the ADDRESS BUS and the DATA BUS are concerned. The only real difference is that the CPU CARDRACK has no slots for INPUT CARDs or OUTPUT CARDs to be inserted.

As covered in the POWER SUPPLIES AND PSC CARD section of this text the cardracks contain the voltage regulators used to generate the 5 VDC and the 14 VDC power which is used by the cards in the cardracks. Please refer to the POWER SUPPLIES AND PSC CARD section for information on this subject.

The cardrack itself is made of several different parts of hardware which include the side panels, card slots and the PRINTED CIRCUIT BOARD mounted on the rear of the rack. This printed circuit board is called the BACKPLANE of the cardrack. In manufacturing, a printed circuit board is covered with a metal foil which is then etched to leave the desired pattern for the circuit. The thin pathways of foil left after the etching process are called TRACES. The BACKPLANE is mainly just a network of traces which are extension of the ADDRESS BUS and DATA BUS used by the CPU and other traces for the power to be distributed to each of the voltage regulators and cards in the cardrack and to other cardracks.

There are also sockets for cables to be plugged into so that the ADDRESS BUS, DATA BUS and power supplies may be extended on to any additional cardrack which may be in the controller. The ADDRESS BUS and DATA BUS lines are connected through a MULTI-COLORED RIBBON CABLE which is plugged into a Dual-In-line Package (DIP) socket. The other end of the cable then plugs into an identical socket on the next cardrack. This cardrack may then connect to another in the same manner and so on, depending upon the number of cardracks in the controller.

The 24 VDC power supply, V+ and L1A, is connected from the first cardrack to the next through a MOLEX connector 4 wire cable. This power supply may then be connected

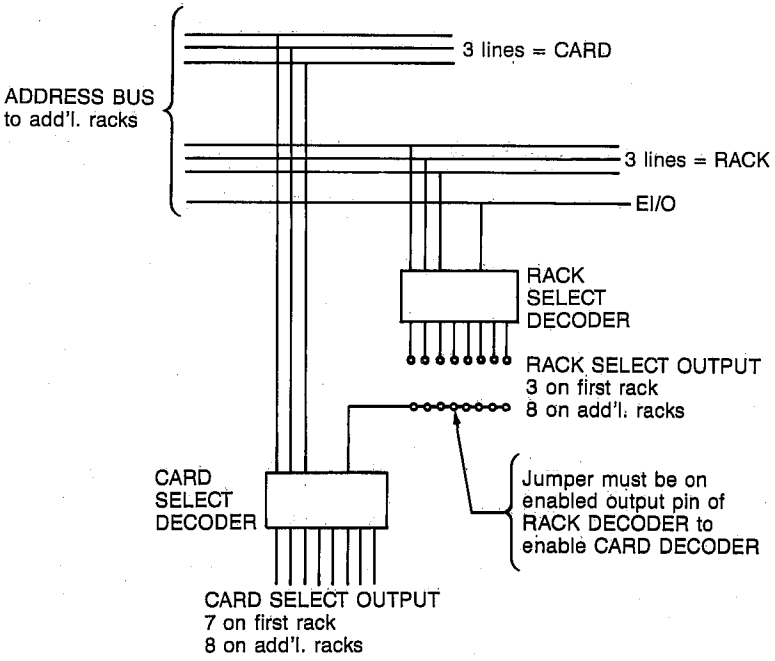
from one cardrack to the next, in the same manner as described above, so that each cardrack in the system is supplied with 24 VDC power. Remember from the POWER SUPPLIES AND PSC BOARD section that each cardrack has its own 14 VDC regulator which must be supplied with a 24 VDC input voltage. Mounted on the BACKPLANE of each cardrack are two IC's which are called the CARDRACK SELECT DECODER and the CARD SELECT DECODER. These IC's are used to decode the address on the bus and allow the CPU to communicate with only one card at a time on the ADDRESS BUS which connects to every CARDRACK SELECT DECODER and every CARD SELECT DECODER in the controller. When the CPU sends out an address, it is in a binary format. The decoder used in the MIPROM I controller must decode the binary address from the CPU and enable only one card to be accessed.

REFER TO FIGURE 6.1

Here is how the decoders work. On the BACKPLANE are the 6 address lines which pass through the I/O INTERFACE CARD. On the input of the CARDRACK SELECT DECODER are 3 of the 6 address lines. These 3 address lines represent which rack is being addressed and can represent a binary value of 0 through 7, considering the first rack in the controller to be number 0, this allows for 8 racks. Also on the input of this decoder is the EI/O signal generated on the I/O INTERFACE CARD, this signal serves as an enable input for the decoder. There are 8 outputs on this decoder which are numbered 0 through 7 and each output corresponds to the value of the binary number on the input of the decoder. Only one of the outputs of the decoder can be enabled at any instant and each output is enabled only when the corresponding binary number is on the input to the decoder and the decoder is enabled by the EI/O signal generated on the I/O INTERFACE CARD.

Immediately below the CARDRACK SELECT DECODER on the BACKPLANE is a blue BERG JUMPER which can be connected to any one of the 8 outputs of the CARDRACK SELECT DECODER. This jumper is used to select which rack is to be represented by this decoder. The jumper should be in the first or far left position of the first rack, the second position to represent the second rack in the system and so on through 8 racks if necessary. The COMBINATION CPU - I/O CARDRACK has only 3 positions for the jumper. The common side of the jumper serves as the enable input to the CARD SELECT DECODER.

The CARD SELECT DECODER works exactly like the first decoder except that the enable input comes from the output of the CARDRACK SELECT DECODER instead of the EI/O signal. This decoder has the 3 other lines of the ADDRESS BUS on the BACKPLANE tied to its inputs. These 3 address lines represent which card is being addressed and can also represent a binary value of 0 through 7, considering the first card in the rack to be number 0 this allows for 8 cards. The card decoder also has 8 outputs which correspond to the binary value of the 3 address lines on the decoder's input. Only one output of the CARD SELECT DECODER will be enabled at any instant and only when the corresponding binary number is on the input and the decoder is enabled through



CARDRACK SELECT AND CARD SELECT DECODERS

Figure 6.1

the RACK SELECT DECODER and the BERG JUMPER. The outputs of this decoder are tied to the enable lead of the INPUT and OUTPUT CARDs in the cardrack. Note that the COMBINATION CPU - I/O CARDRACK has only 7 card slots.

When an address intended for a card and rack is sent out along the ADDRESS BUS on the BACKPLANE every CARDRACK SELECT DECODER and every CARD SELECT DECODER in the controller receives the address. Every rack decoder decodes which rack is being addressed, but if the blue jumper is not on the corresponding output of the decoder, there is no physical connection to the CARD SELECT DECODER in that rack and, therefore, it cannot be enabled. Since it is not enabled it cannot decode the address which represents which card is being addressed. This enables only one CARD SELECT DECODER to enable only one card onto the DATA BUS.

Figures 6.2 and 6.3 are schematic diagrams of the COMBINATION CPU - I/O CARDRACK and the I/O CARDRACK. As you can see the data lines on these drawings (B0 through B7) are connected to each and every card slot in the system, this is the reason for allowing only one card to be on the bus at any time. If the blue jumper is in the wrong position then there will be more than one rack being enabled at a time which will allow more than one card on the DATA BUS at a time. Or if one of the decoders on the backplane is bad then one of the outputs of the decoder may be allowing a card to be on the DATA BUS continuously. Either of these two conditions will cause the data on the bus to be erroneous due to one or more lines which should be HI being held at ground potential by a LO signal from the card which is not suppose to be on the bus.

One other problem which can occur is caused by the capacitors on the LATCH RESET line. Sometimes these capacitors can become leaky and cause the LATCH RESET line to be taken to ground through the capacitor. When this line is taken to ground then all of the OUTPUT CARDS and TIMER CARD are held inoperative. This appears as all of the INPUT CARDS are still functioning properly but all of the OUTPUT CARD LED's will be out. At times it will begin as an intermittent problem causing the controller to shut down and then come back into operation after a short period of time.

There are two other Berg jumpers mounted on the CARDRACK BACKPLANE which must be in the proper position in order to allow certain PSC CARDs, PROM CARDs, and CPU CARDs to work together. Jumper J1 is located between card slot EC4 and EC5 toward the bottom of the CARDRACK. When PSC CARDs P-16835 or p-15903 are used, the jumper belongs on the two left most pins. When PSC CARD p-16787 is used the jumper belongs on the two right most pins.

Jumper J2 is located between the CPU CARD slot and the slot for the MINI-MONITOR. When PROM CARD P-16774 or CPU CARD P-16782 is used, the jumper belongs on the two left most pins. For PROM CARD P-16992 and CPU CARD P-15783, the jumper can be in either the left or right position. For CPU CARD P-15783 and other PROM CARDs, the jumper belongs on the two right most pins.

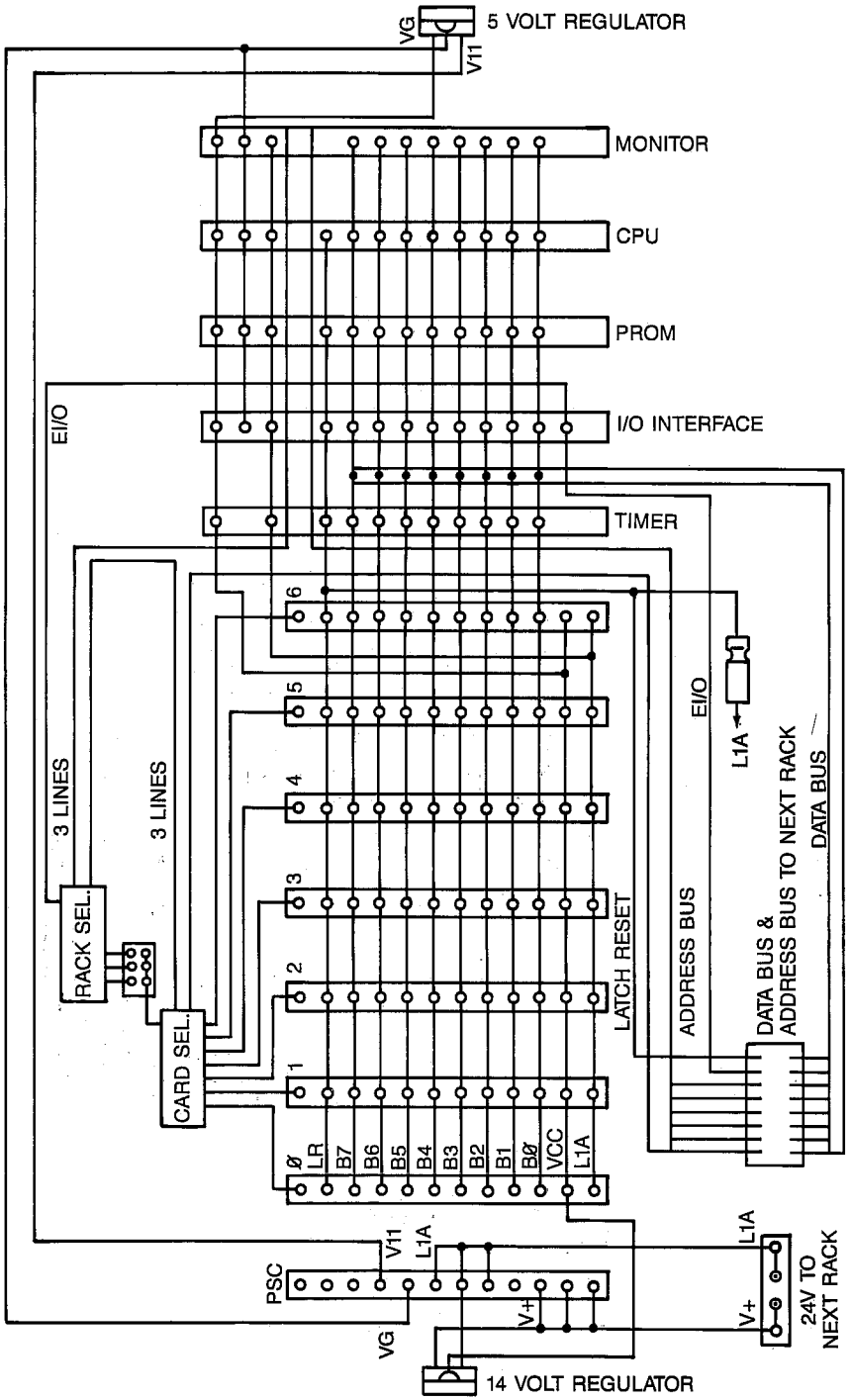

5 VOLT REGULATOR
VG
V11
MONITOR
CPU
PROM
I/O INTERFACE
TIMER
EI/O
3 LINES
3 LINES
RACK SEL.
CARD SEL.
6
5
4
3
2
1
Ø LR B7 B6 B5 B4 B3 B2 B1 BØ VCC L1A
LATCH RESET
ADDRESS BUS
DATA BUS & ADDRESS BUS TO NEXT RACK
DATA BUS
EI/O
L1A
PSC
V11
L1A
V+
VG
L1A
V+
24V TO NEXT RACK
14 VOLT REGULATOR

Figure 6.2

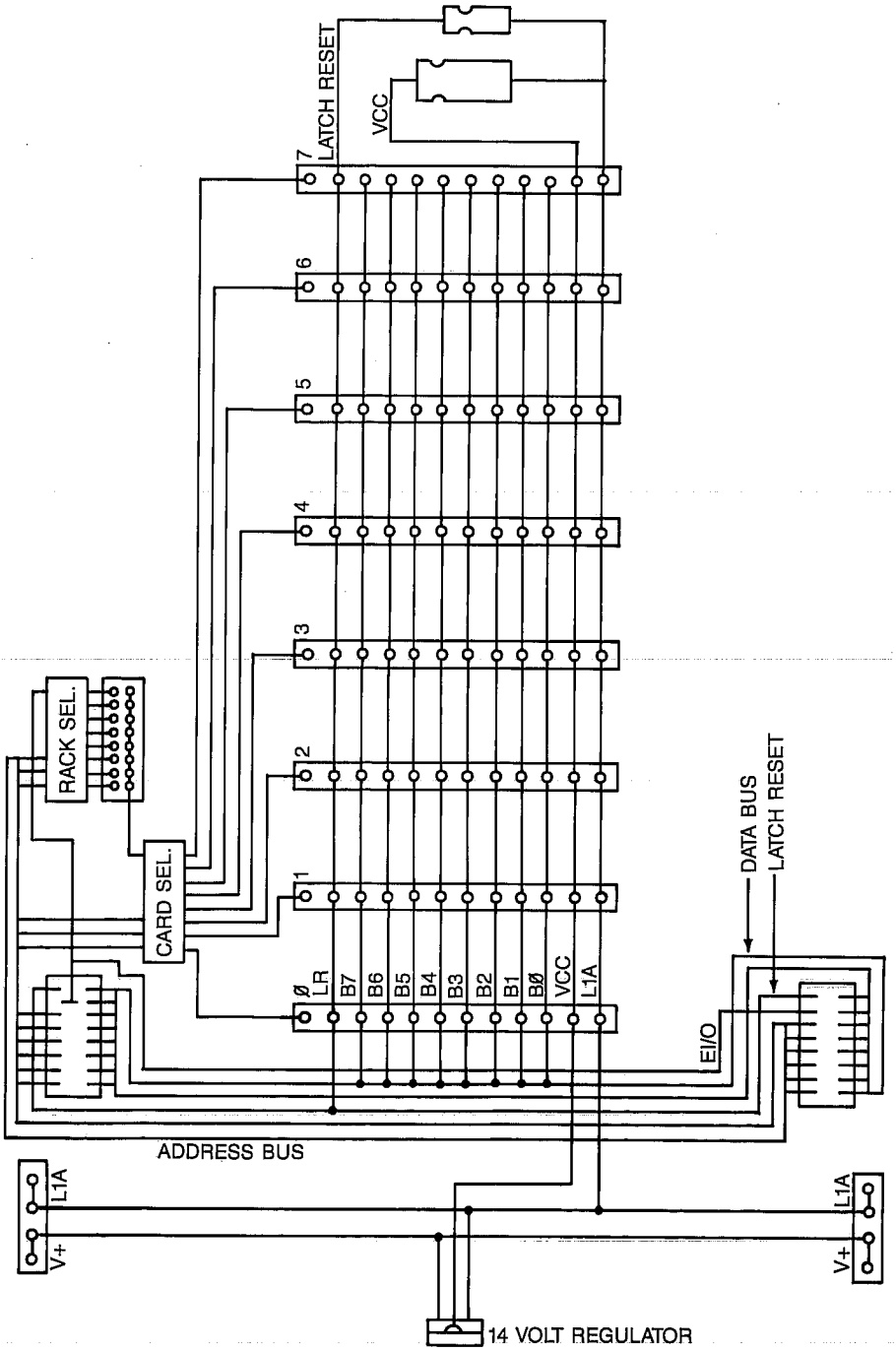

LATCH RESET
VCC
7
6
5
4
3
2
1
RACK SEL.
CARD SEL.
Ø
LR
B7
B6
B5
B4
B3
B2
B1
BØ
VCC
L1A
DATA BUS
LATCH RESET
EI/O
ADDRESS BUS
L1A
V+
L1A
V+
14 VOLT REGULATOR

Figure 6.3

PART NUMBER	CAN REPLACE	NOTES
P-16801	P-15785	IF PROM CARD IS NOT P-16774 OR P-16992 THEN P-16801 MUST BE REV. 2
P-15785	P-16801	
P-15771	P-16802	
P-16802	P-15771	

CARDRACKS REPLACEMENT
CHART 6.1

INPUT CARD

The CPU in the MIPROM I uses 5 VDC signals to communicate, but the switches, pushbuttons and relay contacts within the overall system use 120 VAC signals. Since the CPU cannot use the 120 VAC signals, there must be a method of changing these high voltage signals to a suitable DC voltage. The INPUT CARD converts the 120 VAC signal coming to a terminal on the INPUT CARD to a 14 VDC signal which is then changed to a 5 VDC signal on the I/O INTERFACE CARD before reaching the CPU. Each INPUT CARD actually has eight such input channels. Each input terminal circuit requires approximately 25 - 30 volts to activate the circuit. Old boards had a much lower threshold and were subject to stray pickup causing intermittent problems, especially on long wire runs.

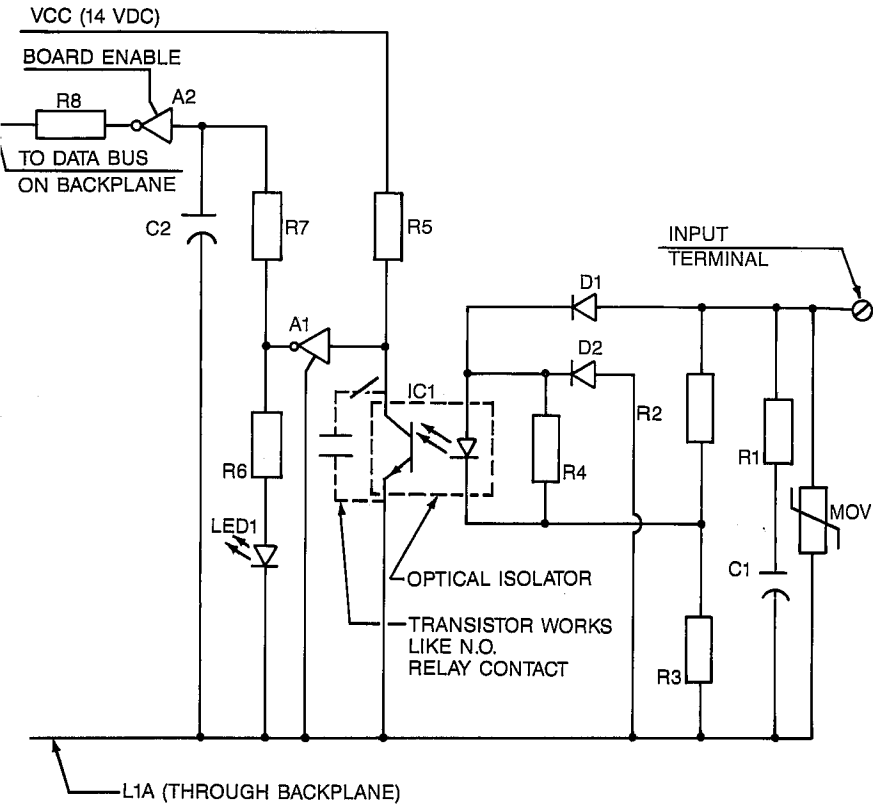
Refer to Figure 7.1 which shows the schematic diagram of a typical input channel. The device labeled IC1 is called an opto-isolator, this one having a transistor output. The input side of the opto-isolator is an LED which shines a beam of light onto the base of the transistor to turn it on. The transistor works like the normally open contact which is shown simply for purposes of understanding the operation of the circuit.

The MOV is a Metal Oxide Varistor; this along with R1 and C1 protect the input channel from any irregularities in the incoming signal.

The circuit is divided into two distinct parts; the circuitry to the right of IC1 is a high voltage full wave rectifier, the circuitry to the left of IC1 operates on 14 VDC and is used to condition the signal before it reaches the DATA BUS on the BACKPLANE.

If a 120 VAC signal is connected to the input terminal, the current of the positive side of the sine wave will travel the following path. Diode D1 is forward biased so current flows through it to the junction of D2, R4, and the LED of IC1. D2 is reverse biased so the current is divided among R4 and IC1. The LED in IC1 glows to turn on the transistor in IC1 whenever current flows through that LED. Current then flows through resistor R3 to L1A which is connected to the INPUT CARD through the BACKPLANE. When the transistor in IC1 is on it is virtually the same as having a closed relay contact in the circuit in its place.

The current of the negative half of the sine wave will flow through D2 to the junction of D1, R4 and the LED of IC1. This time D1 is reverse biased, and current flows through the LED of IC1 in the same direction as did the first half of the sine wave. The current is again divided between IC1 and R4. On this half of the signal current flows through R2 to the other side of the line.



SCHEMATIC DIAGRAM OF TYPICAL UNIVERSAL INPUT CHANNEL

Figure 7.1

As you can see, current flows through the LED in IC1 in the same direction on each half of the sine wave. Thus, this is simply a full wave rectifier.

If the input signal is a +DC source, the current will follow the same path as the positive half of the sine wave signal.

When there is a signal present at the input terminal, then the LED in IC1 is shining light onto the base of the transistor of IC1 and is, therefore, on, or acting like a closed contact. This makes the input of amplifier A1 LO which makes the output of A1 HI. When the output of A1 is HI, then LED1 is on. LED1 is the actual indicator LED which is mounted on the front of the INPUT CARD. The output of A1 is also the input of A2, which is again an inverting amplifier, so the output of A2 is LO when it is gated on.

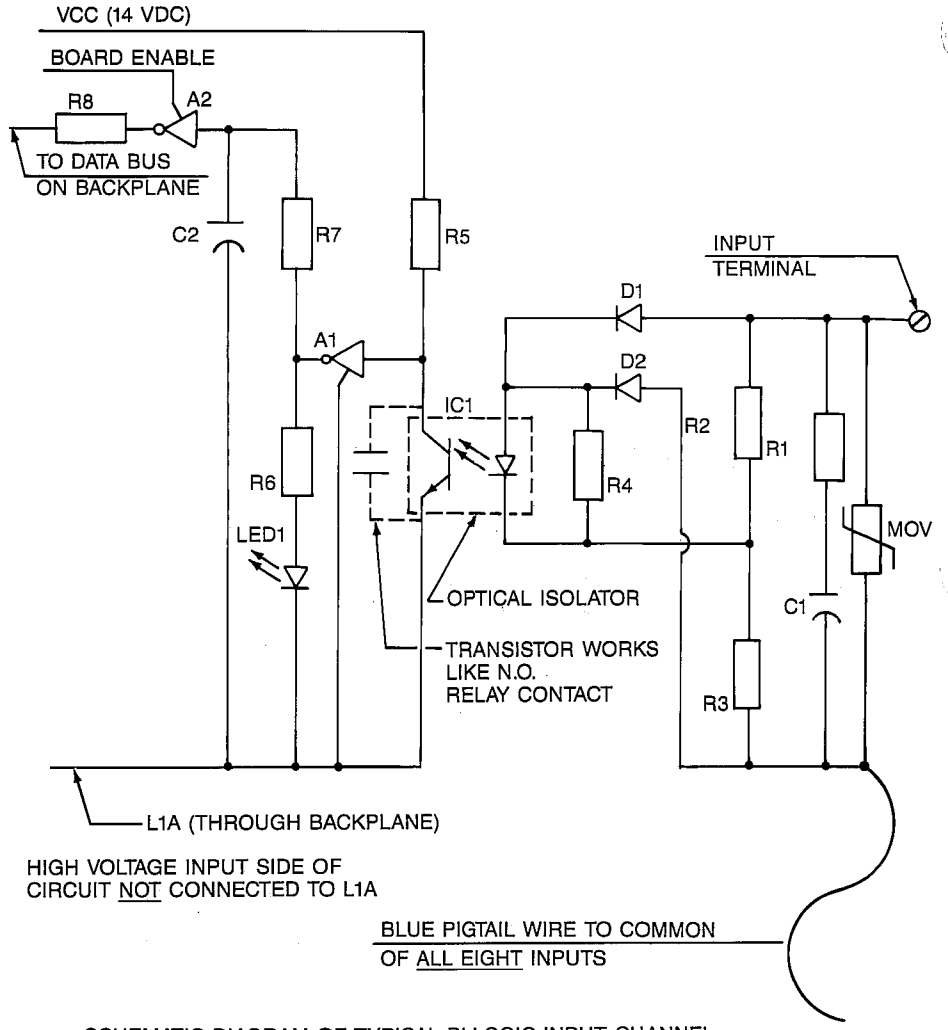
Amplifier A2 is a tristate buffer which allows the data to pass to the DATA BUS on the BACKPLANE only when the CPU signals the gate of this amplifier to open by addressing this particular card. The card enable lead is tied to one of the outputs of the CARD SELECT DECODER. Refer to the section on the I/O INTERFACE CARD for the operation of a tristate buffer and buffer amplifier.

When there is no signal present at the input terminal, then the LED in IC1 is not shining light onto the base of the transistor of IC1 and is, therefore, off, or acting like an open contact. This makes the input of amplifier A1 HI through the pull-up resistor R5 which makes the output of A1 LO. When the output of A1 is LO, then LED1 is off. The output of A1 is again the input of A2, which is an inverting amplifier, so the output of A2 is HI when it is gated on.

The schematic of the BI-LOGIC Input CARD in figure 7.2 is nearly identical to the standard Input channel. The difference being that the high voltage and the low voltage sides of the input channel no longer need to have the same common. Note that L1A is no longer tied to the high voltage side of the input channel. The common of the high voltage side is connected to a blue pigtail wire which can be tied to the common of any source. This allows the INPUT CARD to accept signals from any source and remain totally isolated from the grounding system of the MIPROM I controller if necessary.

This type of INPUT CARD is widely used on the TMS OVERLAY SYSTEM, which allows the MIPROM I to accept signals from other equipment without having a common grounding system.

The operation of this input channel is identical to the input channel previously described, except that the high voltage signal will use the common connected to the pigtail wire instead of L1A through the BACKPLANE. The opto-isolator allows for the isolation of the high and low voltage sides of the card because the only thing connecting the two is a beam of light.



SCHEMATIC DIAGRAM OF TYPICAL BI-LOGIC INPUT CHANNEL

Figure 7.2

If necessary the BI-LOGIC INPUT CARD can be used in place of the standard INPUT CARD. This is done by simply tieing the blue pigtail wire to L1A. This then makes the common for the high voltage side of the card common to L1A just as the low voltage side is. The reverse is not necessarily true however, care must be exercised when considering using a standard INPUT CARD to replace a BI-LOGIC INPUT CARD. IF THE BI-LOGIC INPUT CARD PIGTAIL WIRE IS NOT TIED TO L1A THEN IT MUST BE REPLACED WITH A BI-LOGIC CARD.

PART NUMBER	CAN REPLACE	NOTES
P-15730	P-16785	USE P-15730 WITH LONG WIRE RUNS
P-15731	P-16786	USE P-15731 WITH LONG WIRE RUNS
P-15761	P-16785	
P-15762	P-16786	
P-15761	P-15730	LONG WIRE RUNS COULD CAUSE FALSE OPERATION OF P-15761
P-15762	P-15731	
P-15730	P-15761	
P-16785	P-15761	ONLY IN EMERGENCY CASES!!
P-15731	P-15762	
P-16786	P-15762	ONLY IN EMERGENCY CASES!!
P-24151	P-15730	TIE PIGTAIL WIRE TO L1A. SEE ABOVE PARAGRAPH.
P-25766	NONE	CAUTION! LOW VOLTAGE INPUT CHANNEL

INPUT CARD REPLACEMENT CHART
CHART 7.1

P-15730 and P-15731 contain a snubber network which is represented by R1 and C1 in figure 7.1. These cards should be used with long wire lengths of 12 floors rise or more, or equivalent wire lengths. Each terminal requires approximately 25 - 30 volts to activate the input circuitry. Older boards had a much lower threshold and were subject to stray pickup causing intermittent problems.

P-24151 and P-25766 have no direct replacements at this time.

OUTPUT CARD

There are three types of OUTPUT CARDs used in the MIPROM I system. Two of these cards are completely solid state and the third uses relays as the output devices. The two solid state boards are capable of switching 120VAC and the relay can be used to switch either AC or DC current. The device used to control the current on the solid state cards is a TRIAC. The triac used on the MIPROM I OUTPUT CARD is a solid state device which is capable of switching 120VAC current and can be turned on by applying current to the gate of the triac. The triac turns off when the gate current ceases to flow and the current flowing through the triac goes to zero.

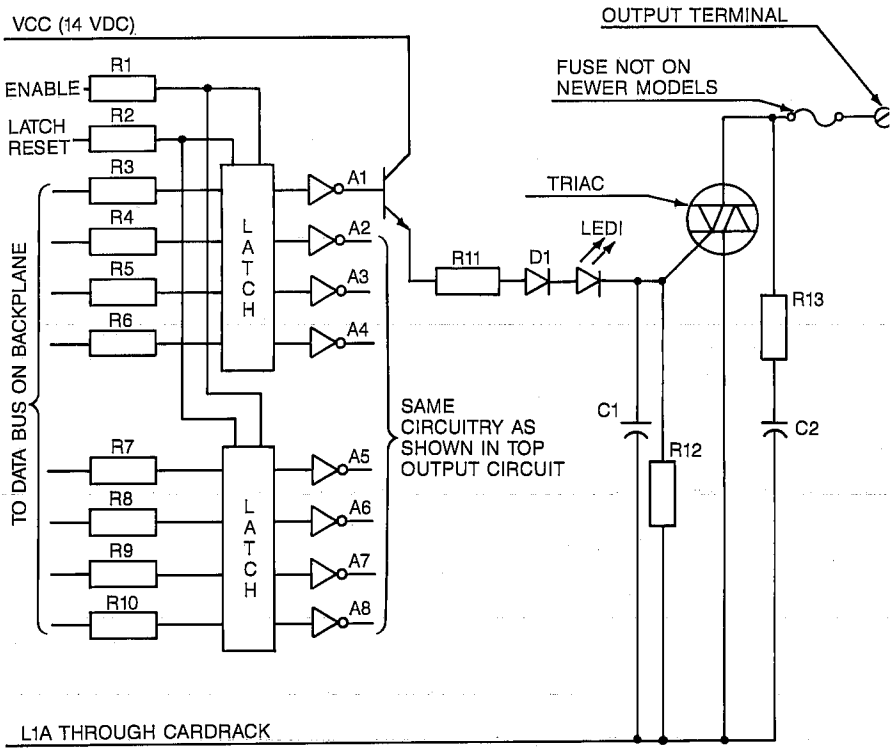
REFER TO FIGURE 8.1

The device labeled LATCH is capable of latching up its output after just momentarily reading the data on the input of the latch. The CPU will put the data for the card to read on the bus and then enable the card by putting the proper address on the ADDRESS BUS. The OUTPUT CARD will only be allowed a very short amount of time to read the data on the bus before the CPU disables it by taking the address for that particular card off of the ADDRESS BUS. The latch will then hold its output in the proper state until the CPU gives it new data to output. The enable lead is tied to the output of the CARD SELECT DECODER just the same as the INPUT CARD is.

The actual operation of the circuit works like this. If the output of the latch is low then the output of amplifier A1 is high, A1 being an inverting amplifier. This then turns on the transistor which will supply current through R11, D1, and LED1. LED1 is the actual green indicating LED mounted on the front of the card. Current is then supplied to the gate of the triac which turns it on and allows current to flow through the device it is controlling. The device may be a light, buzzer, or any other 120VAC device. This particular schematic shows a fuse on the output terminal, this fuse has been eliminated on later style boards. The other components in the circuit are signal conditioners much like those on the INPUT CARD.

If the output of the latch is high then the output of A1 is LO and so the transistor is off so no current flows through R11, D1, or LED1 and the triac is off. No current then will flow through the device being controlled by the output and it will be off also.

The device being controlled by the output will be tied to the output terminal on one side and the other side will be tied to a 120VAC supply such as SS. The purpose of the output triac is simply to supply a connection to L1A which will then complete the circuit and allow current flow. When the output LED is on then the terminal should read the same potential as L1A.



SCHEMATIC DIAGRAM OF TYPICAL OUTPUT BOARD

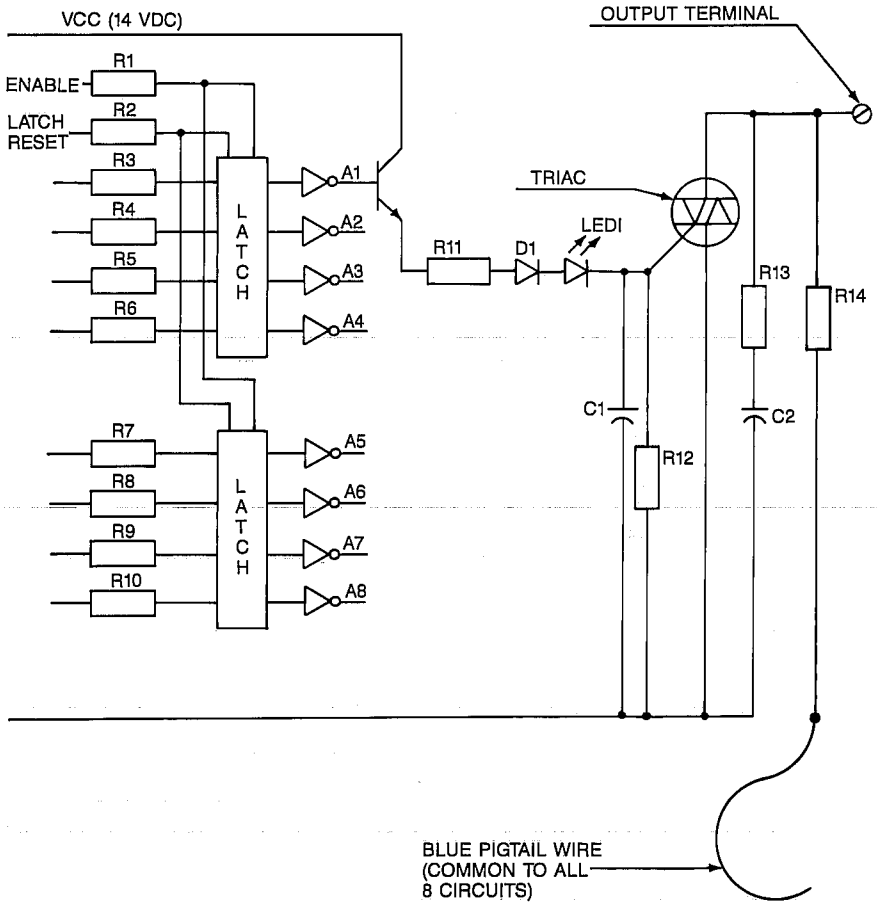
Figure 8.1

As stated in an earlier section of this text, some of the early models of the MIPROM I controller used 45VDC to control hoistway devices, because of this there were DC OUTPUT CARDs. The operation of the DC OUTPUT CARD is identical to that of the solid state AC OUTPUT CARD except that in the schematic the output triac would be replaced with a transistor, and the indicating LED would glow red instead of green.

The BI-LOGIC OUTPUT CARD shown in figure 8.2 works in the exact same manner as the standard OUTPUT CARD except that there is a resistor tied to the output terminal which can then be tied to a 120VAC supply which has L1A as the neutral side of the line. This card has a blue pigtail wire just like the BI-LOGIC INPUT CARD which is the common to all eight of the output pull-up resistors. When the output triac is on then the output terminal will be tied to L1A. When the output triac is off then the output terminal will be at the potential of the source tied to the blue pigtail wire. It is important that you keep in mind that the common supply to any BI-LOGIC OUTPUT CARD must be using L1A as the neutral side of the line.

To give an example of a use for the BI-LOGIC OUTPUT CARD let's say that the output terminal of a bi-logic card, on a car controller, which is using CSS as the common supply to the eight pull-up resistors, is tied to an input of the common controller. When the output terminal is off, then the terminal has the potential of CSS. This then will make current flow through the 5K ohm pull-up resistor to the input terminal it is tied to. Since the input terminal now has current flowing to it through the pull-up resistor the red indicating LED should be on to show that the input terminal is active due to current flow through that channel. If the output terminal is on then both terminals would be at the potential of L1A so the input LED should be off because there is no current flow through the input channel. This method of tieing the two terminals together allow the car and the common controllers to communicate. Bi-logic cards work identical to the output in combination with the external pull up resistor on the RESISTOR BOARD which was used to accomplish this in early models.

Since the 120VAC supply must flow through the 5K resistor and the 10K impedance of the input channel the actual voltage is divided between the two resistances. The actual voltage measured at the input terminal should be approximately 80VAC if only one input terminal is tied to the output terminal. If more input terminals are tied to any one output terminal then the effective impedance is reduced and so is the voltage which will be measured at either of the input terminals. This is due to the fact that a single fixed 5K resistor, on the output channel, is in series with the input resistors which are all in parallel. Since the two input channels are in parallel then the effective resistance is 5K ohms. The voltage is now split equally between the 5K ohm output resistor and the two input resistors which means that the input terminals will now measure 60VAC. As you can see if we were to add more input channels tied to the single output terminal



SCHEMATIC DIAGRAM OF TYPICAL BI-LOGIC OUTPUT BOARD

Figure 8.2

the voltage measured at the input terminal will drop.

As the voltage at the input terminal drops so does the current which is flowing through the input opto-isolator. If the current flowing through the input channel drops too low then the input channel can no longer recognize that the terminal is active. Remember that each input channel requires 25 - 30 volts in order to activate the input circuitry. To remedy this problem another 5K ohm resistor of comparable wattage must be placed in parallel with the one on the channel of the output board which is feeding the input channels. This need not be done on the OUTPUT CARD itself. If the pigtail wire is tied to CSS and the output terminal is ESHP then the 5K ohm resistor can be added between these two terminals on the terminal strip in the controller. See chart 8.1.

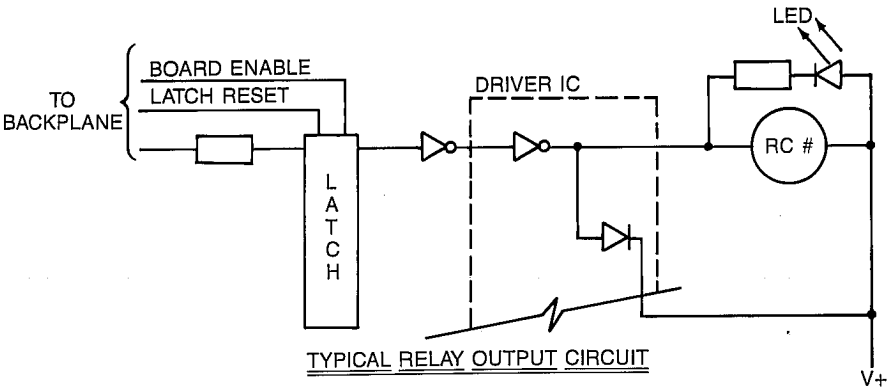
		WITHOUT ADD'L. PULL UP RESISTOR		WITH ADD'L. PULL UP RESISTOR	
NUMBER OF INPUTS	TOTAL INPUT OHMS	OUTPUT VOLT DROP	INPUT VOLT DROP	OUTPUT VOLT DROP	INPUT VOLT DROP
1	10K	40V	80V	24V	96V
2	5K	60V	60V	40V	80V
3	3.3K	72V	48V	51V	69V
4	2.5K	80V	40V	60V	60V

VOLTAGE DROP COMPARISON CHART FOR BI-LOGIC OUTPUT TO INPUT

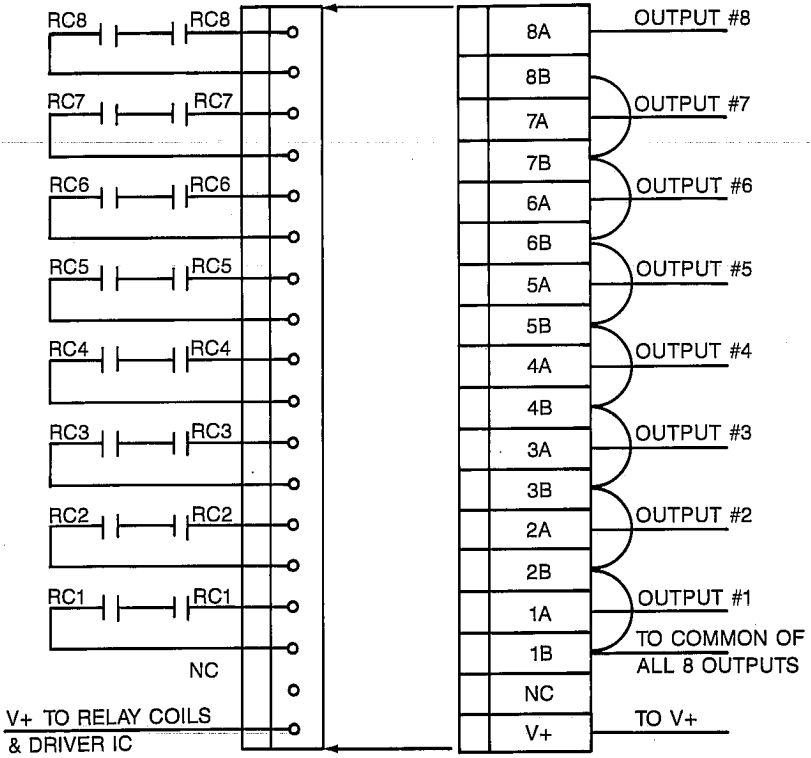
CHART 8.1

The two solid state OUTPUT CARDs must have L1A as the neutral side of the line for the devices they are controlling. The RELAY OUTPUT CARD allows for the MIPROM I controller to control devices which are on a totally separate power supply system. Refer to FIGURE 8.3 for the schematic of the RELAY OUTPUT CARD. The latch shown in the schematic works the same as the latch on the two solid state cards. The two amplifiers shown are inverting amplifiers. The second amplifier is in a special driver IC for operating the relay. When the output of the driver amp is LO then the relay is picked. Each relay is used to pilot its output terminal through a set of two contacts in series. The indicating LED is around the relay so it is on whenever the driver amp is trying to pick the relay.

The terminal connections on this card are made through a molex connector. The bottom wire on the connector is always tied to V+ (24VDC) to power the relays and the driver IC. The relay contacts can all be supplied with one common supply, or they can each be isolated from the rest by cutting the common feed wire to that particular set of



RC # = RC1-RC8



MOLEX CONNECTOR LAYOUT AND CONTACT
CONFIGURATION FOR RELAY OUTPUT BOARD

Figure 8.3

contacts and supplying a separate common. The commons are all tied together on the molex connector so care must be taken not to get power supplies crossed if this is ever done.

P-16777 and P-15774 are slightly different from the other solid state OUTPUT CARDs, these cards have the lower two output circuits modified from the standard circuits. These two circuits have been made with an 8 amp triac instead of the normal 4 amp triac. This was done in order to allow the output card to control the FVC and SVC coils on the Montgomery hydraulic units. A standard output in this circuit will experience a short lifetime and begin to effect the way the car levels into the floor.

PART NUMBER	CAN REPLACE	NOTES
P-15779	P-16775	AC/DC WITH TERMINAL STRIP
P-15775	P-16776	AC WITH TERMINAL STRIP
P-15774	P-16777	AC WITH MOLEX FOR HYDRO USE
P-15778	P-16778	DC WITH TERMINAL STRIP
P-16777	P-15774	AC WITH MOLEX FOR HYDRO USE
P-16776	P-15775	AC WITH TERMINAL STRIP
P-16778	P-15778	DC WITH TERMINAL STRIP
P-16775	P-15779	AC/DC WITH TERMINAL STRIP

OUTPUT CARD REPLACEMENT
CHART 8.2

BILOGIC OUTPUT CARD P-24147 and RELAY OUTPUT CARD P-24100 have no replacements at this time.

TIMER CARD

Certain operations in the elevator system require that they are allowed to happen for only a given amount of time, a maximum amount of time, or for a minimum amount of time. The purpose of the TIMER CARD is to allow the MIPROM I controller the ability to time certain functions it is performing. The TIMER CARD is actually like an INPUT CARD and OUTPUT CARD in one unit. The CPU must be able to tell the timer to start timing, and it must also be able to see if the timer has timed out. To accomplish this the CPU must be able to write information to the TIMER CARD in order to start the timer, and the CPU must also be able to read the status of the timers in order to tell if the timer is done timing.

The TIMER CARD has its own set of decoders similar to the ones on the CARDRACK BACKPLANE. These decoders are used by the CPU to gain access to the individual timers on the card as is necessary; according to the instructions in the program, similar to the way it access the INPUT CARDs and the OUTPUT CARDs in the CARDRACKs. Each card contains several individual timers so the decoders read the address which is on the ADDRESS BUS at the same time the decoders on the backplane do. The decoders will allow the CPU to have access to the TIMER CARD on the DATA BUS, which in this case can be used to either start a timer, or read the status of a timer.

The timers on the TIMER CARD can all be set to the time required per the job specifications through the use of the DEBUG CARD and MINI MONITOR. Each timer has a potentiometer which is used to adjust the length of time each is set for. Turning the potentiometer clockwise will increase the time that the timer will time for. Typically the timers will range from .05 seconds to 45 seconds. The DEBUG CARD allows the length of time to be displayed in numerical form on the MINI MONITOR. Some functions need to be timed for a length of time which is longer than the actual maximum time that the timer can be set for, in this case the PROM would be programmed to time it several times instead of just once.

Timers come in various models, 4X, 8X, 9X, and 14X, where the number designates the number of timers on the card. Care must be taken when replacing TIMER CARDs because not all cards are able to replace another. For example a 14X timer cannot replace a 9X timer card. See the chart below for compatibility.

If a 9X TIMER CARD is needing to be replaced with an 8X TIMER CARD due to the 9X card not being available, then a program change is also required from the factory.

The timer is timing whenever the LED on the card in front of that timer is lit. On the 9X TIMER CARD only one timer can be on at a time in T5 thru T9. If any of these timers are on then the LED just below timer T5 will be illuminated.

PART NUMBER	CAN REPLACE	NOTES
P-16779	P15758	4X TIMER
P-16780	P-15759 P-16779	9X TIMER. REQUIRES PROGRAM CHANGE TO REPLACE P-15759.
P-15758	P-16779	4X TIMER
P-15759	P-15758 P-16779 P-16780	8X TIMER. REQUIRES PROGRAM CHANGE TO REPLACE P-16780
P-15760	P-15758 P-15759 P-16779 P-16780	14X TIMER. REQUIRES PROGRAM CHANGE TO REPLACE P-16780

TIMER CARD REPLACEMENT
CHART 9.1

P-15760, 14X TIMER, has no replacement.

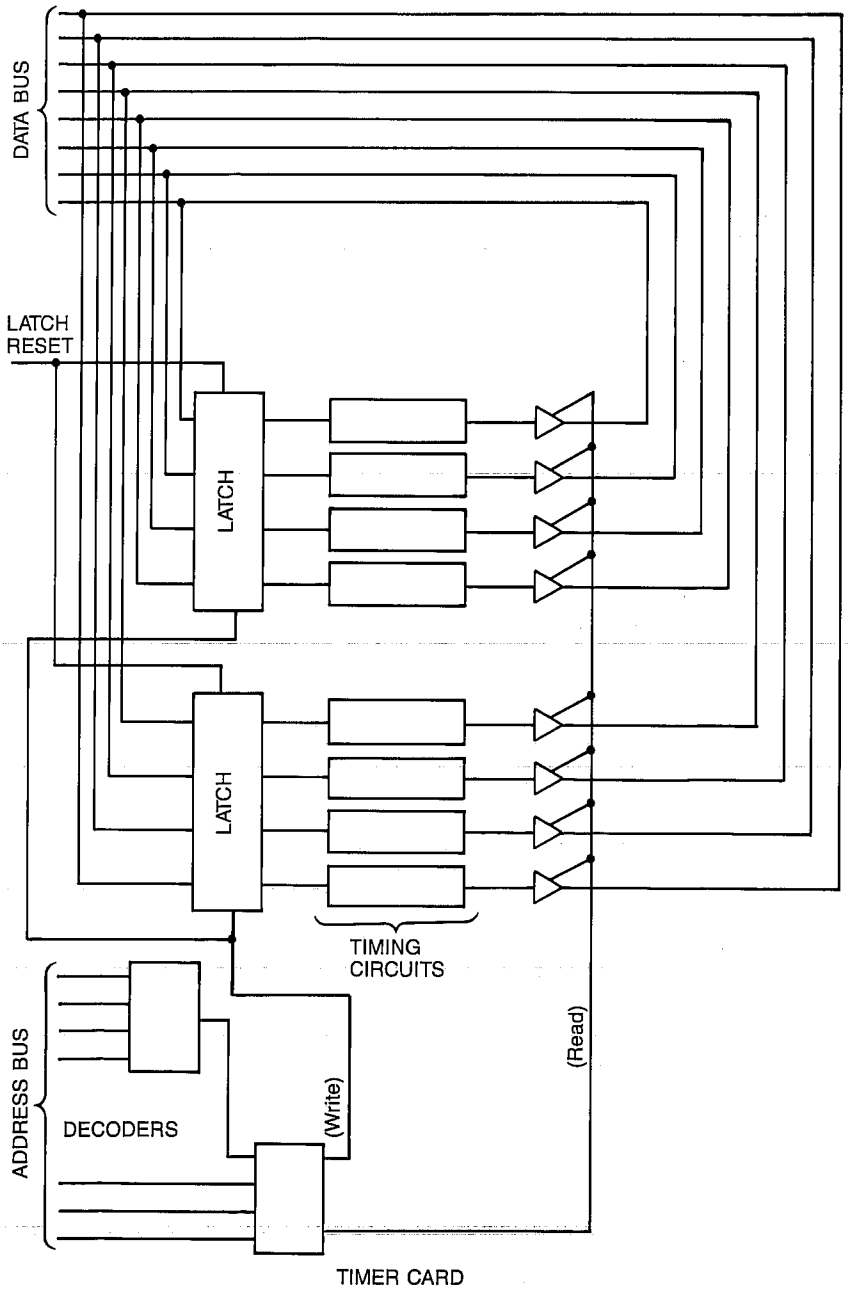

DATA BUS
LATCH
RESET
LATCH
LATCH
TIMING
CIRCUITS
ADDRESS BUS
DECODERS
(Write)
(Read)
TIMER CARD

Figure 9.1

Supervisory Inputs

HI = Input Energized
LO = Input De-Energized

BI1, BI2	Binary Floor Position (HI indicates which floor car is stopped at, in binary form; LO indicates car is between floors. Inputs controlled by absolute position floor readers mounted on car.)
1HDS	First Floor Front Hall Door Close P.B.
2HDS	Second Floor Front Hall Door Close P.B.
A	Alarm Bell P.B.
ABR	Alarm Bell Reset P.B.
ADO	Advanced Door Opening Cancel (Jumper to "SS" if advanced door opening is not desired)
AESH - AESHP	Alternate Floor Fire Recall (AESH - HI when switch at Alt.Flr. is in "ON" Position; LO for normal service) (AESHP - HI for normal service; LO causes recall to Alt.Flr.)
AESS	Alternate Fire Sensor Signal (HI for normal service; LO when main floor sensor has tripped)
AF	At Floor Leveling Signal (Controlled by contact of "MAS" relay through at Flr. Leveling unit)
AFR	At Floor
APIB	Audible Position Indicator Pushbutton
AT	Attendent Operation Key Switch (HI when attendant key switch is in "ON" position; LO for normal service)
ATD	Attendent Down P.B. Note: Only effective if "AT" input is HI. (Input must remain HI until doors close and car starts to run down)
AT	At Floor Pilot (HI when car is within at Floor Zone)
ATU	Attendent Up P.B. Note: Only effective if "AT" input is HI. (Input must remain HI until doors close and car starts to run up)
BP	Non-Stop (Bypass) Pushbutton for Attendant Operation
BRS	Distress Buzzer Reset P.B.
BS1	Down Sense
BTI	Warning Buzzer Time
CDS (R)	Hatch Door Closing Slowdown (Rear) (HI when hatch door close slowdown limit is closed; LO when hatch door is open)
CG	Car Gate (HI when car door is closed; LO when car door is open or when "P" contactor drops on 2SL, VVL or SSC-6010 Power Controller)
CGS (R)	Car Gate Closing Slowdown (Rear) (HI when car gate close slowdown limit is closed; LO when car gate is open)
CL (R)	Door Close Slowdown (Rear) (Goes LO when slowdown limit is reached during closing sequence; HI when doors are open)
CLD (R)	Limit SW. for Activation of Car Lantern (Jumper to "DO17 (RO17) if SW. is not supplied on door operator)
CLU	Common Leveling Unit (HI for normal service; LO when car top or in car inspection switch is in "Inspect" position)
CNPB	Call Cancel P.B.
CPO	Constant Pressure Override (Jumper to "SS" if constant pressure door closing is not req'd. while on in car fire service)

CSV — Common Supply Voltage
With seperate common controller: Controlled by 110V. supply of Common Controller (HI for normal service; LO sends car to predetermined floors)
With Master/Slave Controller: Controlled by 110V. supply of "Master" Cotroller (HI for normal duplex service; LO causes "Slave" to respond to hall call demand from its own hall call inputs rather than from communication pilots from "Master")

CSV1 - CSV2 — Common Service Toggle
Inputs toggle on and off for normal service, indicating that common controller is functioning properly. If inputs remain HI or LO car will disregard communication pilots from common, causing cars to respond to predetermined floors, when seperate common is supplied, or causing "Slave" to serve its own hall call inputs, on "Master/Slave" systems.

CWS — Counterweight Derailment Sensor
(HI for normal service through contact of "CWS" relay; LO if "CWS" relay drops due to activation of counterweight sensing wires)

DCL (R) — Door Close Slowdown (Rear)
(HI when hatch door is open; LO when door closing slowdown is reached)

DDS — Down Drive Start Pilot From Common
Provides drive start signal for Hall Call or Homing Call below car.
(HI when no demand exists or is no longer below car's advanced position; LO when car has been assigned hall call or homing call below its position)

DGPB — Door Gate Pilot from Car "B"
(HI when car "B" doors are open; LO when car "B" doors are closed)

DG — Door Gate
(HI when car and hatch doors are closed; LO when any door is open or when "P" contactor drops on 2SL, VVL or SSC-6010 Controller)

DHO (R) — Door Hold Open P.B. (Rear)

DIS — Distress Signal

DLR — Down Leveling

DM — Derailment Sense
(HI for normal service through contact of "DM" latch relay; LO if "DM" relay unlatches due to activation of seismic device)

DN (R) — At Floor Down Hall Call Pilot From Common
Provides door open pilot for down hall calls
(HI when at floor down hall call has been answered; LO when down hall call exists at car's advanced position.)

DO3 — Front Door Open Limit
(HI when front door open limit is closed; LO when front door open limit is reached, signalling doors are fully open)

DO17 — Front Door Close Limit
(HI when front door close limit is closed; LO when front door close limit is reached, signalling doors are fully closed)

DOF (R) — Door Open Limit - Peele (Rear)

DOL (R) — Door Open Slowdown
(HI when hatch door is closed; LO when door open slowdown is reached)

DOX — Front Door Open Button
(Front Safety Edge may also be connected to this input)

DPK — Down Peak Signal
Controlled by contact of Down Peak Time Clock
(HI for Down Peak Operation, contact closed; LO for normal service, contact open)

DRSB — Down Hall Call Annunciator Reset Button

DRSW — Derailment Run Switch
Note: Only effective if "DM" input is LO and "CWS" input is HI.
(HI allows car to be run at reduced speed; LO prevents car from running)

DSC — Door Short
(Used to shorten door time when a car call is registered. Option "Hand 1" overrides this feature for compliance with local codes. Also used for constant pressure close from a car call button on independent service. The second pole of all car call buttons are connected to this input.)

DSF — Front Door Close Button

DSR — Rear Door Close Button

DX T — Down Auxiliary

DZS — Derailment Zone MFS Switch (Located at Midpoint of Travel)
Note: Only effective if "DM" input is LO.
(HI when car is in upper part of building, signalling car to run up in event derailment occurs; LO when car is in lower part of building signalling car to run down in event derailment ocurs)

EPC — Emergency Power Contact
(HI when on emergency power; LO for normal service) (Connect to "RSQ2" terminal on M.E.CO. Rescue Pack, when furnished)

EPRA — Manual Emergency Power Switch - Car "A"
(HI when car is selected; LO when car is unselected)

EPRB — Manual Emergency Power Switch - Car "B"
(HI when car is selected; LO when car is unselected)

EPRX — Emergency Power Return - Second Chance

EPS — Emergency Power Select Pilot from Common
Note: Only effective if "EPC" input is HI.
(HI on unselected cars; LO on car selected to run on emerg. power) (On Simplex Controls not tied into other group controls, "EPS" is HI when key switch is on to select car to run; LO when unselected)

EPX — Emergency Power Pending

ESB — Emergency Service Sensor Bypass
(HI when fire recall switch is in "Bypass" position allowing normal service of car, indepedent of fire sensor inputs "ESS" and "AESS". LO during normal service)

ESC — Emergency Service Car
(HI when in car fire SW. is in "ON" position; LO for normal service)

ESCH — Emergency Service Car Hold
(HI when the in car fire service switch is in the hold position. To prevent the car from responding to any car calls or door close button.)

ESCN — Emergency Service Car Cancel
(HI when the cancel push button, inside the car, is pushed. Used to cancel any car calls registered in error, when on in car fire service)

ESCP — Another Car On In Car Fire Service Pilot
Note: Only effective if "EPC" input is HI.
(HI for normal service during emerg. power; LO if any car is on in car fire service. When input goes LO, if car is selected to run but is not on in car fire service, it will be returned to the Main Flr.)

ESCX — Emergency Service Car (Latch Relay Memory)
(HI when Latch Relay is in the latched position. Used to maintain Phase 2 fire service when there is a power failure.)

ESDO — Emergency Service Door Open P.B.
(Separate door open P.B. in life safety panel. Only effective when car is at the return floor on phase one fire service and not on phase two fire service)

ESH - ESHP — Main Floor Fire Recall
(ESH - HI when switch at Main Flr. is in "ON" position; LO for normal service)
(ESHP - HI for normal service; LO causes recall to Main Floor)

ESS	Fire Sensor Signal (HI for normal service; LO when sensor signal, other than at main floor has tripped)
FPC	Fire Pump Contact
FS	Freight Service Key SW. (HI when switch is in "ON" position causing car to be removed from normal service and allowing it to be controlled by seperate hall button riser; LO for normal service)
FSO	Freight Service Override Switch
FSP	Final Slowdown Pilot (Controlled by contact of "FSP" relay through magnetic slowdown units "MUS-MDS"
GCL (R)	Gate Close Slowdown (Rear) (HI when car gate is open; LO when gate closing slowdown is reached)
GOF (R)	Gate Open Limit (Rear) - Peele Doors (HI when gate open limit is closed; LO when gate open limit is reached, indicating car gate is fully open)
GOL (R)	Gate Open Slowdown (Rear) (HI when car gate is closed; LO when gate opening slowdown is reached)
HAS	Hospital Service Call Switch
HCNB-(HCRB)	Hall Call Cancel Pilot (Rear) From Car "B" (HI when car "B" is running but not in slowdown, or stopped with no further demand; LO when car "B" is in slowdown or stopped for demand)
HDOX	Front Hall Door Open Button
HDSF	Front Hall Door Close Button
HDSR	Rear Hall Door Close Button
HEP	Hospital Emergency Service Pilot from Common (HI for normal service; LO when car has been assigned hospital call)
HESB	Hospital Emergency Service Pilot from Car "B" (HI when car "B" is in normal service; LO when car has received "HEPB" signal and is responding to hospital service demand)
HESC	In Car "Commandeering" Switch (HI with switch in "ON" position; LO for normal service)
HFL	Hospital Service Key Switch in Hall (At Single Floor) (HI with switch in "ON" position to provide priority call; LO for normal Service)
HIND	In Car Hospital Service (Independent) Key Switch (HI with switch in "ON" position; LO for normal service)
HLX	Homing Override Key Switch (HI for normal service; LO causes automatic homing of car after all demand has been satisfied)
HR	Parking Switch Input (HI when switch is in "ON" position causing car to return to lobby; LO for normal service)
HR1	Parking Switch Input at First Floor
HR2	Parking Switch Input at Second Floor
HROX	Rear Hall Door Open Button
HOP	Homing Door Signal (Jumper to "SS" if car is to park with doors open after homing)
HSP	High Speed Slowdown Pilot (Controlled by contact of "HSP" relay through magnetic slowdown units "1MUS-1MDS")
HWSW	High Water Level Switch Input
IA	Hatch Access (HI when in car inspect SW. is in "Access" or "Inspect" position LO for normal service)
IND	Independent Service (HI with SW. in "ON" position; LO for normal service)
INS	In Service or Controller Switch in Lobby (HI for normal service; LO shuts down car)

IR	Inspection
IRUD	Inspection Run (Must be energized through doors and car top insp. direction SW. before retiring cam is picked on inspection operation; LO for normal service)
LC	Leveling
LLO	Lower Low Oil Device
LOB	Lobby Preference Switch (HI causes car to stop at lobby when going to or coming from basement floors.)
LR	Final Leveling (Controlled by contact of "LR" relay through middle leveling unit(s) "MLU")
LRD	Leveling Down (Controlled by contact of "LRD" relay through down leveling unit "DLU")
LRS	Disdress Light Reset P.B.
LRU	Up Leveling (Controlled by contact of "LRU" relay through up leveling unit "ULU")
LRUD	Leveling Up or Down (Controlled by contacts of "LRU" or "LRD" relays when on up or down leveling units "ULU-DLU")
LSPB	Load Weigh Pilot from Car "B" (HI for normal service; LO when "LWS" input is HI on car "B" indicating that it is 60% filled)
LTP	Lamp Test Pushbutton (Lights "NPL", "EPL", "EPLA" and "EPLB" outputs when HI)
LWB	Load Weigh Bypass (HI when load weigh device has been activated, causing all hall calls to be bypassed; LO for normal service)
LWC	Anti-Nuisance Load Weigh (HI when load in car is less than 300 lbs. allowing registration of only 3 car calls; de-energized when load exceeds 300 lbs. allowing registration of any number of car calls)
LWS	Load Weigh Dispatch (HI when load weigh device has been activated, causing early dispatch of car from lobby, and preventing re-opening of closing doors for all at floor hall calls; LO for normal service)
MAS1	At Floor
MDS	Down Slowdown (HI when "MDS" slowdown unit is on vane)
MGS	Controller Shutdown Switch in Car (HI for normal service; LO shuts down car and parks doors open)
MSC	Master Security Control Signal (HI for normal service; LO provides after hours security operation)
MSPK	Master Security After Hours Parking Note: Only effective if "MSC" input is LO. (Jumper to "SS" if car is to park at lobby during after hours)
MSTI	"MST" Control Initializing (HI for normal operation; LO indicates "MST" controller is not in functional operational mode and car will be prevented from running, unless in search mode.)
MUS	Up Slowdown (HI when "MUS" slowdown unit is on vane)
MZ	Immediate Lobby Dispatch (Jumper to "SS" if 1st zone car is to be forced into upper zone when free car enters 1st zone)
N/A	Terminal Connection Not Applicable (Indicates connection of terminal or wire is not required)

ESS	Fire Sensor Signal (HI for normal service; LO when sensor signal, other than at main floor has tripped)
FPC	Fire Pump Contact
FS	Freight Service Key SW. (HI when switch is in "ON" position causing car to be removed from normal service and allowing it to be controlled by seperate hall button riser; LO for normal service)
FSO	Freight Service Override Switch
FSP	Final Slowdown Pilot (Controlled by contact of "FSP" relay through magnetic slowdown units "MUS-MDS"
GCL (R)	Gate Close Slowdown (Rear) (HI when car gate is open; LO when gate closing slowdown is reached)
GOF (R)	Gate Open Limit (Rear) - Peele Doors (HI when gate open limit is closed; LO when gate open limit is reached, indicating car gate is fully open)
GOL (R)	Gate Open Slowdown (Rear) (HI when car gate is closed; LO when gate opening slowdown is reached)
HAS	Hospital Service Call Switch
HCNB-(HCRB)	Hall Call Cancel Pilot (Rear) From Car "B" (HI when car "B" is running but not in slowdown, or stopped with no further demand; LO when car "B" is in slowdown or stopped for demand)
HDOX	Front Hall Door Open Button
HDSF	Front Hall Door Close Button
HDSR	Rear Hall Door Close Button
HEP	Hospital Emergency Service Pilot from Common (HI for normal service; LO when car has been assigned hospital call)
HESB	Hospital Emergency Service Pilot from Car "B" (HI when car "B" is in normal service; LO when car has received "HEPB" signal and is responding to hospital service demand)
HESC	In Car "Commandeering" Switch (HI with switch in "ON" position; LO for normal service)
HFL	Hospital Service Key Switch in Hall (At Single Floor) (HI with switch in "ON" position to provide priority call; LO for normal Service)
HIND	In Car Hospital Service (Independent) Key Switch (HI with switch in "ON" position; LO for normal service)
HLX	Homing Override Key Switch (HI for normal service; LO causes automatic homing of car after all demand has been satisfied)
HR	Parking Switch Input (HI when switch is in "ON" position causing car to return to lobby; LO for normal service)
HR1	Parking Switch Input at First Floor
HR2	Parking Switch Input at Second Floor
HROX	Rear Hall Door Open Button
HOP	Homing Door Signal (Jumper to "SS" if car is to park with doors open after homing)
HSP	High Speed Slowdown Pilot (Controlled by contact of "HSP" relay through magnetic slowdown units "1MUS-1MDS")
HWSW	High Water Level Switch Input
IA	Hatch Access (HI when in car inspect SW. is in "Access" or "Inspect" position LO for normal service)
IND	Independent Service (HI with SW. in "ON" position; LO for normal service)
INS	In Service or Controller Switch in Lobby (HI for normal service; LO shuts down car)

IR	Inspection
IRUD	Inspection Run (Must be energized through doors and car top insp. direction SW. before retiring cam is picked on inspection operation; LO for normal service)
LC	Leveling
LLO	Lower Low Oil Device
LOB	Lobby Preference Switch (HI causes car to stop at lobby when going to or coming from basement floors.)
LR	Final Leveling (Controlled by contact of "LR" relay through middle leveling unit(s) "MLU")
LRD	Leveling Down (Controlled by contact of "LRD" relay through down leveling unit "DLU")
LRS	Disdress Light Reset P.B.
LRU	Up Leveling (Controlled by contact of "LRU" relay through up leveling unit "ULU")
LRUD	Leveling Up or Down (Controlled by contacts of "LRU" or "LRD" relays when on up or down leveling units "ULU-DLU")
LSPB	Load Weigh Pilot from Car "B" (HI for normal service; LO when "LWS" input is HI on car "B" indicating that it is 60% filled)
LTP	Lamp Test Pushbutton (Lights "NPL", "EPL", "EPLA" and "EPLB" outputs when HI)
LWB	Load Weigh Bypass (HI when load weigh device has been activated, causing all hall calls to be bypassed; LO for normal service)
LWC	Anti-Nuisance Load Weigh (HI when load in car is less than 300 lbs. allowing registration of only 3 car calls; de-energized when load exceeds 300 lbs. allowing registration of any number of car calls)
LWS	Load Weigh Dispatch (HI when load weigh device has been activated, causing early dispatch of car from lobby, and preventing re-opening of closing doors for all at floor hall calls; LO for normal service)
MAS1	At Floor
MDS	Down Slowdown (HI when "MDS" slowdown unit is on vane)
MGS	Controller Shutdown Switch in Car (HI for normal service; LO shuts down car and parks doors open)
MSC	Master Security Control Signal (HI for normal service; LO provides after hours security operation)
MSPK	Master Security After Hours Parking Note: Only effective if "MSC" input is LO. (Jumper to "SS" if car is to park at lobby during after hours)
MSTI	"MST" Control Initializing (HI for normal operation; LO indicates "MST" controller is not in functional operational mode and car will be prevented from running, unless in search mode.)
MUS	Up Slowdown (HI when "MUS" slowdown unit is on vane)
MZ	Immediate Lobby Dispatch (Jumper to "SS" if 1st zone car is to be forced into upper zone when free car enters 1st zone)
N/A	Terminal Connection Not Applicable (Indicates connection of terminal or wire is not required)

NC	Near Capacity Load Weigh Switch (HI when load weigh device has been activated, causing light to be illuminated; LO for normal service)
NIS	Not in Normal Service (HI causes car to operate on independent service; LO for normal service)
NPP	Normal Power Pending Input Note: Only effective if "EPC" input is HI. (HI upon receipt of normal power pending signal, causing car to be returned to main floor before transfer of power from emergency back to normal; de-energized for normal service while on emergency power)
ODS (R)	Hatch Door Opening Slowdown (Rear) (HI when hatch door open slowdown limit is closed; LO when hatch door is closed)
OGS (R)	Car Gate Opening Slowdown (Rear) (HI when car gate open slowdown limit is closed; LO when car gate is closed)
OL (R)	Door Open Slowdown (Rear) (Goes LO when slowdown limit is reached during opening sequence; HI when doors are closed)
OV	Overload Load Weigh Switch (HI when load in car exceeds 125% of rated capacity, causing car to be shut down; LO for normal service)
PB1B, PB2B, etc	Binary Position Pilots from Car "B" (Inputs that are LO show car "B" position in binary form. Refer to "PB1, PB2", etc. output function for more detail)
PC (R)	Photocell (Rear) (HI when photocell beam is obstructed)
PCX	Photocell Shut-Off Key Switch in Car
PI	M.E.C.O. Digital Position Indicator Common Note: Connected to "SS"; if traction then connect to "SS" thru "PA" relay contact. (HI when "PA" relay is energized and "SW2" on miprom controller is in "ON" position; LO causes position indicator to be blank) (Jumper to "SS" if position indicator is to remain illuminated when power controller shuts down)
PTP	Power Transfer Pending (HI to cancel all calls and stop the car at the next floor when transferring from emergency power to normal power and vice versa, LO for normal service)
PX	Power Controller Aux.
RB	Annunciator Reset P.B.
RDG	Cam Interlocks (Used with Retiring or Solid Cam) (HI when car and hatch doors are closed and cam locks are made up; LO when cam drops and allows doors to be opened)
RO3	Rear Door Open Limit (HI when rear door open limit is closed; LO when rear door open limit is reached)
RO17	Rear Door Close Limit (HI when rear door close limit is closed; LO when rear door close limit is reached)
ROX	Rear Door Open Button (Rear safety edge may also be connected to this input)
RPBX	Alarm Signal Reset P.B. in "PBX" Station
RRIS	Rear Hall Pushbutton Riser Select Switch
RSAB	Alarm Bell Light Reset Button (In Control Room Panel)
RSB (R)	Door Reset Button (Rear) Note: Button is only effective if "DT" or "RT" time expires during opening or closing sequence.

RSBZ — Buzzer Reset Button (In Control Room Panel)

RSPL — Malfunction Light Reset Button (In Control Room Panel)

RST — Warning Buzzer Reset Button (In Monitor Panel)

RSTP — Stop Switch Light Reset Button (In Control Room Panel)

RSUB — Up Direction Pilot from Car "B"
(HI when car "B" has no preference or down preference; LO when car "B" establishes up preference)

RTL — Lower Low Oil Reset P.B.

RTU — Upper Low Oil Reset P.B.

SBP — Brake Energized
(HI when brake is energized, signalling car is running; LO when brake is set, signalling car is stopped)
Note: Used to reset cam protection timer "PRT". On tractions with "FAPB" operation, car will slowdown at "MFS" if "SBP" is LO.

SBXB — Run Pilot From Car "B"
(HI when car "B" is stopped; LO when car "B" is running)

SCB — Security Call Push Button

SCX — Security Active Signal
(HIGH for normal service; LO indicates security is in effect)

SD H — Down Direction Sense
P-15828 Relay Interface Board:
(HI when inspect switches are in run position and bottom terminal slowdown switch is closed, allowing car to run down; LO when bottom terminal slowdown switch is open, preventing car from running down)

SD T — Down Direction Sense
Controlled by contact of "D" contactor on power controller.
(HI when car is running down; LO when car is stopped, if input goes LO before normal slowdown occurs miprom senses abnormal stopping of car and will shut off "DA" output)

SEC (R) — Safety Edge (Rear)
(HI when safety edge is activated)

SHU — Shuttle Service Key Switch

SHUT — Shuttle Service Key Switch

SRB — Security Reset Push Button

ST — Safety String Pilot
(HI for normal service; LO keeps car from seeing hall demand)

STP — Stop Switch in Car
(HI when in car stop SW. is in "ON" position; LO causes doors to remain open if car is at floor with switch in "Stop" position)

SU H — Up Direction Sense
P-15828 Relay Interface Board:
(HI when inspect switches are in run position and top terminal slowdown switch(es) are closed, allowing car to run up; LO when top terminal slowdown switch(es) are open, preventing car from running up)

SU T — Up Direction Sense
Controlled by contact of "U" contactor on power controller.
(HI when car is running up LO when car is stopped, if input goes LO before normal slowdown occurs miprom senses abnormal stopping of car and will shut off "UA" output)

TCLK — Car Cycle - Time Clock Input

TUS — Hot Oil Protection
(HI for normal service; LO when overload contact opens, signalling hot oil condition and causing car to return to bottom floor under "PT" operation)

UDS — Up Drive Start Pilot from Common
Provides drive start signal for hall call or homing call above car.
(HI when no demand exists or is no longer above car's advanced position; LO when car has been assigned hall call or homing call above its position)

ULO	Upper Low Oil Device
ULR	Up Leveling
UP (R)	At Floor Up Hall Call Pilot from Common Provides door open pilot for up hall calls (HI when at floor up hall call has been answered; LO when up hall call exists at car's advanced position)
UPK	Up Peak Clock Controlled by contact of up peak time clock (HI for up peak operation, contact closed; LO for normal service, contact open)
USRB	Up Hall Call Annunciator Reset Button
US1 - US2	Up Stop Monitor (Both inputs must show same state to allow normal operation. In event one input is HI and other is LO miprom senses Up Stop Switch is open and will not allow car to run up)
UX T	Up Auxiliary
VFIX	Vector Fixture Option (LO for normal dual stroke lantern drive; HI disables dual stroke)
XOL (R)	Aux. Door Open Limit (Rear) (HI when hatch door limit switch is made up due to doors creeping closed without power on them)
C (R)	Car Call (Rear)
CA	Card Reader Contact (HI allows normal registration of call)
CX	Car Call Cut-Out Key Switch(es) (HI for normal reigstration of calls; LO prevents registration of car call for particular floor or cancels call if already in.)
CS (R)	Hall Car Send P.B. (Rear)
D (R)	Down Hall Call (Rear)
DF	Down Hall Call (Freight Service Riser)
DO (R)	Hall Door Open P.B. (Rear)
DS (R)	Hall Door Close P.B. (Rear)
F	Hall Call (F.A.P.B.)
HS	Hospital Service Call
L	Car at Landing (HI when car is within position of particular floor)
S	MFS Switch (Located ½ Way Between Floors) (HI when switch is closed; LO when switch is open)
2SP, 3SP, 4SP, etc.	Two, Three, Four Floor Run Slowdown Pilot (Controlled by contact of "2SP", "3SP", "4SP" relays, thru magnetic slowdown units "2MUS-2MDS", "3MUS-3MDS", "4MUS-4MDS", etc.)
U (R)	Up Hall Call (Rear)
UF	Up Hall Call (Freight Service Riser)

Supervisory Outputs
HI = Output Energized
LO = Output De-Energized

1FR - 2FR - 3FR etc.	One, Two, Three Flr. Run Pilot Etc. (HI when doors close and car is req'd. to make flr. run due to bldg. flr. height condition. Maintained until car stops running)
1SD	Initiate Slowdown Pilot (Goes HI when slowdown pilot input "FSP", "2SP", "3SP" etc. or "HSP" is HI and car is to slowdown for corresponding floor. Output is maintained until car stops at floor and direction sense input "UA" or "DA" goes LO. Ouput is LO when car is stopped or running High Speed)

AB — Alarm Bell

ABL — Alarm Bell Light

ABZL — Alarm Signal Light and Buzzer (In "PBX" Station)

ADL — Demand Below Car Operating on Attendant
Note: Only effective if "AT" input is HI.
(HI when demand exists below car's position)

AESHP — Alt. Flr. Fire Service Pilot Light
(Goes HI when Alt. Flr. fire recall is in effect)

AESP — Main Flr. Fire Sensor Power Supply Pilot
(HI for normal service; goes LO if "AESS" input is LO)

AL — Alarm Bell Light

ALEV — Alternate Leveling Rack Transfer
(Goes HI when rear leveling rack is made effective on jobs requiring selective leveling; LO when front leveling rack is effective)

ANP — Anti-Nuisance Pilot
(Energized momentarily in order to drop existing car call relays under the following conditions:
1) In the event the car makes 3 consecutive stops and the photocell beam is not broken.
2) When car stops for call on independent or in car fire service, and doors are open.
3) When anti-nuisance load weigh switch is activated and car calls registered are not proportionate to load in car.
4) When reverse cancel option is provided and car reverses direction.

API — Audible Position Indicator
(Goes HI momentarily with each change in MFS status)
Note: Only effective after activation of special pushbutton in car or when car call has been registered if special button is not furnished.
(Also provides pulse signal to EPCO readout P.I. length of pulse is dependent upon "APT" time setting)

ARG — Main Floor Arrival Gong
(Goes HI when car is at main floor and "CG" input is LO)
(Also provides reset signal to "EPCO" readout P.I.)

AUL — Demand Above Car Operating on Attendant
Note: Only effective if "AT" input is HI.
(HI when hall demand exists above car's position)

BPL — Bypass Light
(HI when car is not in normal service or when "LWB" input is HI indicating hall calls are being bypassed)

BUZ (R) — Warning Buzzer
(HI when power freight doors are being automatically closed or when special operation is in effect)

BZZR — Warning Buzzer in Monitor Panel

C (R) — Close Pilot (Rear)
(HI when gate and hatch doors are in closing sequence; goes LO approx. 1-½ sec. after hatch door dynamic braking is completed)

CC1, CC2, etc. — Car Call Pilots
When used with "Count1" Option:
(Outputs that are HI show ½ the number of car calls that are registered in the going direction)
When used with "TMS1" option:
(Outputs that are energized indicate which zones car has registered in line car calls for)

CCP — Car Call Pilot & Light
(Goes HI when any car call is registered)

CD (R) — Hatch Door Close Pilot (Rear)
(HI when hatch doors are closing or closed)

CDL (R) Down Car Riding Lantern (Rear)
Note: Only effective "CLD(R)" input is HI.
(Goes HI when doors are open and car has down direction preference; LO when doors are closed or car looses down preference)

CGP (R) Car Gate Close Pilot (Rear)
(HI when car gate is closing or closed)

CHSK Car Call Handshake
(Blinks on and off when car calls are regd. This is used to synchronize the timing between the car control and the Miprom II Common, when sending over the car calls using the "CC1-CC2 etc" outputs.)

CLOL Door Close Button Glow Light

CRG Gong Output for Car Riding Lanterns

CUL (R) Up Car Riding Lantern (Rear)
Note: Only effective if "CLD(R)" input is HI.
(Goes HI when doors are open and car has up direction preference; LO when doors are closed or car looses up preference)

DA Down Direction Pilot
(HI when all doors are closed, "MST" time has expired and car is set to run down; goes LO when on inspection or when final slowdown input "FSP" goes HI at floor where leveling is to be made effective. Also goes LO if down direction input "SD" goes LO before final slowdown is reached.)

DDSB Down Drive Start Pilot to Car "B"
Provides drive start signal for hall call or homing call below car.
(HI when car "B" has been assigned call below its position; goes LO when demand no longer exists below car's advanced position)

DGP Door Status and Advanced Slowdown Pilot
Note: Output signals door status when car is stopped or in slowdown and provides advanced slowdown pilot while running high speed.
Door Status:
(When "PA" output is HI "DGP" will be HI when "CG" input is HI and LO when "CG" input is LO; when "PA" output is LO "DGP" will be HI when "DO17" input is LO and LO when "DO17" input is HI.)
Advanced Slowdown Pilot:
(When car is running but has not reached slowdown "DGP" will go LO as soon as no further demand exists beyond the car's advanced position or as soon as the At Floor Hall Call input "UP" or "DN" goes LO. Once slowdown has been initiated for a floor the "DGP" output will signal the door status.)

DH (R) High Speed Door Pilot (Rear)
(HI when hatch door is to open or close at full speed; goes LO when door slowdown has been reached or "DT" ("RT") time has expired)

DHOL Door Hold Button Pilot Light
(Goes HI when button is activated; remains HI until "DHT" times out)

DIB Distress Buzzer

DIL Distress Light

DL (R) Reduced Speed Door Pilot (Rear)
(HI whenever doors are opening or closing; goes LO when door slowdown has been reached. After dynamic braking time expires output again goes HI until doors reach fully open or closed position)

DN (R)B At Floor Down Hall Call Pilot to Car "B"
(HI when down hall call exists at car's advanced position. Remains HI to provide door open pilot, until car stops and doors open)

DNL Down Direction Arrow
(HI when car is running down or is set to run down; LO when car has no direction preference or reverses direction)

DO4 Front Reduced Speed Closing Pilot
Note: Effective only after "OBT" time has expired.
(Remains HI as long as "PC" input is HI and doors are closing)

DO7	Front Door Close Pilot (HI when front doors are closed or closing; LO on inspection)
DO10	Front Door Open Pilot (HI when front doors are open or opening; LO on inspection)
DO18	Front Door Locking Pilot (HI when car is running to prevent doors from being manually opened; LO when car is stopped)
DO19	Aux. Speed Control Pilot to PM-SSC Door Operator (HI when car is at a floor that requires aux. speed control due to abnormal door size or weight; LO when car is away from these special floors)
DOB	Door Open Bell (HI when doors are open and hall button is pressed; LO when doors are closed or pressure is released from hall button)
DOXL	Door Open Button Glow Light
DPA	Annunciator Down Direction Light
DPKL	Down Peak Light (HI when down peak operation is in effect)
DRL	Derailment Pilot Light (HI when "DM" input is LO, indicating seismic device has tripped; LO during normal service)
DRLP	Derailment Leveling Pilot (HI during derailment operation to make leveling hot; LO during normal service or during derailment operation after car has stopped at a floor and is selected to run at reduced speed by means of in car "DRSW" switch or fire service)
DRNC	Door Fail To Close Light (In Monitor Panel)
DRNO	Door Fail To Open Light (In Monitor Panel)
DX	Down Direction Pilot
EPL	Emergency Power Light (HI when on emergency power; LO on normal service)
EPLA	Emergency Power Light for Car "A" (HI when selected to run; LO when unselected. Note that this output is not used for communication)
EPLB	Emergency Power Light for Car "B" (HI when selected to run; LO when unselected. Note that this output is not used for communication)
EPP	Emergency Power Park Pilot (HI for normal service; goes LO as soon as car has returned to main floor during emergency power recall or has timed out of service after being selected to run on emergency power)
EPSA	Car "A" Selected On Emergency Power (HI when car is selected; LO when unselected)
EPSB	Car "B" Selected On Emergency Power (HI when car is selected; LO when unselected)
ESCL	In Car Fire Service Light (HI when car is operating on in car fire service; LO when car is in normal service)
ESF - ESFX	Flashing Emergency Sign (Flashes during Phase I or II fire service)
ESHP	Fire Service Hall Pilot Light (HI when main flr. fire recall is in effect; LO for normal service)
ESL	Fire Emergency Service Warning Light (HI when car is operating on Phase I or II fire service; LO when car is in normal service)
ESP	Fire Sensor Power Supply Pilot (For All Flrs. Except Main) (HI for normal service; goes LO if "ESS" input is LO)
ESW	Emergency Service Warning Buzzer (HI when car is being recalled to fire floor; LO when car arrives at fire floor and doors open, or car is in normal service)

ESX	Emergency Service Aux. (HI when fire recall is in effect, renders stop switch in car inoperative; LO when car is removed from Phase I fire service)
FVC	Fast Valve Coil (HI when car is set to run high speed, provided doors are closed and "SU" or "SD" input is HI; goes LO when slowdown occurs or when car is on inspection)
GH (R)	High Speed Car Gate Pilot (Rear) (HI when car gate is to open or close at full speed; goes LO when gate slowdown has been reached or "DT" ("RT") time has expired)
GL (R)	Reduced Speed Car Gate Pilot (Rear) (HI whenever gate is opening or closing; goes LO when gate slowdown has been reached. After dynamic breaking time expires output again goes HI until gate reaches fully open or closed position)
HASL	Hospital Service Pilot Light
HCN - HCR	Hall Call Cancel Pilot (Rear) (HI whenever "ICPT" monitor light is on, indicating car is in slowdown, or car has door open signal, if stopped)
HDL (R)	Down Hall Lantern (Rear)
HEPB	Hospital Emergency Service Pilot to Car "B" (HI when car "B" is selected to respond to hospital recall demand; LO when no hospital demand exists or car is unable to respond)
HES	Hospital Emergency Service Pilot to Common (HI when car has received "HEP" input and is responding to hospital emergency demand; LO when car is in normal service)
HESF	Flashing "Emergency" Light
HESL	Hospital Emergency Service Light (HI when car is operating on hospital emergency service)
HUL (R)	Up Hall Lantern (Rear)
IUL	In Use Lights (HI when car is on inspection or has already been assigned to a demand for service; output LO, indicates car is able to respond to any demand for service. Used primarily with "FAPB" operation)
LEV	Leveling Pilot (HI when leveling units are made effective at floor; goes LO when car is set to run or goes on inspection)
LSP	Load Weigh Pilot (HI when car is 60% filled and "LWS" input is HI)
M	Miprom Control in Effect (HI when in normal service and operating on miprom control; LO when "NIS" input goes HI.)
MSCL	Master Security Control Light (HI when after hours security operation is in effect; LO during normal operation hours)
NCL	Near Capacity Light (HI when car is 85% filled and "NC" input is HI)
NIS	Not in Service Light
NPL	Normal Power Light (HI when in normal service; LO on emergency power)
NPTP	Normal Power Pending - Car Parked (Output to transfer switch, indicating car is parked and ready to transfer to normal power)
NRML	Car In Normal Service Light (Hi as long as car is in normal service; goes LO whenever car is not in normal service or if safety string opens)
NRS	Not In Service (HI when car is not in normal service)
NS	Normal Service Light

O (R) Open Pilot (Rear)
(HI when gate and hatch doors are in opening sequence; goes LO approx. 1-½ sec. after car gate dynamic braking is completed)

OBZ (R) Door Obstruction Buzzer (Rear)
Note: Only effective after "OBT" ("OBRT") time expires
(HI when doors are open; LO when doors are closed)

OD (R) Open Hatch Door (Rear)
(HI when hatch doors are opening or open)

ODH (R) Open Hatch Door Hold (Rear)
(HI when hatch door and gate are fully open; goes LO when close signal is received)

OG (R) Open Car Gate (Rear)
(HI when car gate is opening or open)

OSL Car Out of Normal Service Light
(LO as long as car is in normal service; goes HI whenever car is not in normal service or if safety string opens)

OVL Overloaded Car Light
(HI when load in car exceeds 125% of capacity and "OV" input is HI)

PA Power Controller Activated
(HI when car is running, has demand to run or is on inspection; goes LO when "PST" time expires or will stay LO until "SST" time expires upon power up condition) Note: "SST" timer is optional.

PAX Aux. Pa Pilot for Auto Fan & Light Protection
(Output shows same state as "PA" output with exception that "PAX" will remain HI when "PST" times out if car is on emergency power or safety string is open)

PAXL Power Controller Malfunction Light (In Control Room Panel)
(HI if safety string is broken or car is on emergency power otherwise it is the same state as "PA" output)

PB1, PB2, etc Binary Position Pilots
(Outputs that are HI show car's position in binary form. When car is stopped, "MFS" position is shown. When car is running, advanced position is shown. If all outputs are LO car is not in normal group operation.)
Note: In order to determine car's position add up binary total (PB1=1, PB2=2, PB3=4, PB4=8, PB5=16) of outputs that are HI. Example: If car is at 13th floor PB1, PB3, and PB4 will be HI.

PH2U PH2L Latch and Unlatch Pilots
(Used for Phase 2 fire service latch relay)

PI1, PI2, PI3 Data, Clock, Pulse Pilots to M.E.CO. Digital Pos. Ind.
(Outputs provide serial pilots required to drive M.E.CO. P.I.)

PTI Low Oil Indicator
(HI when "PT" time has expired, indicating low oil condition. Remains HI until car is placed on inspection or main line power is cycled)

RCR Retiring Cam Pilot
(HI when doors are closed and car is set to run or running; LO when car stops, doors are open or "PRT" time has expired due to car failing to run)

RO4 Rear Reduced Speed Closing Pilot
Note: Effective only after "OBRT" time has expired.
(Remains HI as long as "PCR" input is HI and doors are closing)

RO7 Rear Door Close Pilot
(HI when rear doors are closed or closing; LO on inspection)

RO10 Rear Door Open Pilot
(HI when rear doors are open or opening; LO on inspection)

ROR Rear Door Transfer Pilot
Note: Only furnished with non-opposed front and rear openings.
(HI when car is at landing with reverse opening. Used to switch from front to rear cam and gate motor controls.)

RS (R) Door Reset Pilot (Rear)
(Must be HI in order to run doors or gate; if "DT" ("RT") time expires output will go LO and will only go HI after reset button has been activated, ("RSB" input goes HI).

RSQ Battery Power Rescue Activated
(HI when "EPC" input is HI and car is returning to bottom floor on battery power; goes LO when car arrives at bottom floor and doors have closed after cycling open once)

RSU Up Direction Preference Pilot
(HI whenever "UDA" monitor light is on, indicating car has an up direction preference; LO when car has no preference or is set to run down)

RUN Car Running Pilot to "MST" Control
(Goes HI when car starts to run for demand and remains HI while car is running; goes LO when car stops. Remains LO during relevel motion)

S Position Search
(HI when miprom is powered up and does not receive any "L" input; goes LO when position has been read and car stops running)

SBX Car Running Pilot
(HI when doors are closed and car is running; LO when car is stopped)

SBXL Car Running Pilot
(HI when doors are closed and car is running; LO when car is stopped)

SD O Start Down Pilot to Power Controller

SDB Attendant Service Demand Buzzer
Note: Only effective if "AT" input is HI.
(HI when doors are open and hall button is pressed; goes LO as soon as doors are closed or pressure on button is released)

SDP (R) Slow Speed Pilot for Hatch Doors (Rear)
(HI after door slowdown has been reached and dynamic braking time has expired; goes LO if "DT" ("RT") time expires or doors reach fully open or closed position)

SEQL Security Sequence in Progress

SFR Short Floor Run
Note: Only furnished when selective leveling is required due to abnormally short floors.
(HI when doors close and car is req'd. to make floor run. Maintained until car stops at next floor)

SG (R) Slow Speed Pilot for Car Gate (Rear)
(HI after gate slowdown has been reached and dynamic braking time has expired; goes LO if "DT" ("RT") time expires or gate reaches fully open or closed position)

SGA Rear Door Transfer Pilot
Note: Only furnished with non-opposed front and rear openings.
(HI when car is at landing with reverse opening. Used to switch from front to rear cam and gate motor controls.)

SHUL Shuttle Service Activated Light

SOL Stop Switch Activated Light (In Control Room Panel)

SRCH Position Search Mode
(HI when miprom is powered up and does not read a valid position on its position inputs. Car is then ran at slow speed in order to find a position and output goes LO when position is found and car stops running.)

STOP Stop Switch Activated Light (In Monitor Panel)

STRT Controller Start Pilot
(HI when there is a demand and the doors are closing; goes LO when "SBP" input goes HI)

SU O Start Up Pilot To Power Controller

SVC	Slow Valve Coil (HI when car is on inspection. During normal service output goes HI when car is running or leveling; goes LO when car stops)
TCD	This Car Down Sign (HI when car is at main floor with doors open and has "Next Down" status; goes LO when doors close)
TCU	This Car Up Sign (HI when car is at main floor with doors open and has "Next Up" status; goes LO when doors close)
TN1, TN2, etc.	Tens Display of I.E.E. Digital P.I. (Left Hand Unit) (HI when digit is to be displayed)
TOS	Out of Service Timer Pilot (HI when car is in normal service; goes LO if "OST" time expires before car runs for demand)
TXR (R)	Final Door Braking (Rear) (HI when hatch door or car gate starts to open; goes LO approx. 1-½ sec. after "O(R)" and "GL(R)" outputs have gone LO.)
UA H	Up Direction Pilot Normal Service: (HI when doors are closed and car is running or set to run up; LO when car stops and "UST" time expires. Will also go LO if car is running up and "US1" and "US2" inputs show opposite states, indicating up stop switch has opened) Inspection Service: (HI when "US1" and "US2" inputs are HI by placing inspection direction switch in up position; LO when "US1" and "US2" are LO or are opposite states.)
UA T	Up Direction Pilot (HI when all doors are closed, "MST" time has expired and car is set to run up; goes LO when on inspection or when final slowdown input "FSP" goes HI at floor where leveling is to be made effective. Also goes LO if up direction input "SU" goes LO before final slowdown is reached.)
UDSB	Up Drive Start Pilot to Car "B" Provides drive start signal for hall call or homing call above car. (HI when car "B" has been assigned call above its position; goes LO when demand no longer exists above car's advanced position)
UN0, UN1, UN2, etc.	Units Display of I.E.E. Digital P.I. (Right Hand Unit) (HI when digit is to be displayed)
UP (R)B	At Floor (Rear) Up Hall Call Pilot To Car "B" (HI when up hall call exists at car's advanced position. Remains HI to provide door open pilot, until car stops and doors open)
UPA	Up Direction Light In Annunciator
UPKL	Up Peak Light (HI when up peak operation is in effect)
UPL	Up Direction Arrow (HI when car is running up or is set to run up; LO when car has no direction preference or reverses direction)
USR	Up Stop Relay (HI when "LRU" input goes HI after slowdown; LO when car is level at floor and "UST" time has expired)
UX	Up Direction Pilot
YTR	Y-Delta Transfer Pilot (HI when car is set to run up and "YDT" time expires; goes LO when car stops and "UST" time expires)
AL	Car Arrival Lantern Note: Only furnished with "FAPB" operation. (HI with car stopped at floor; goes LO as soon as car starts to run)
BZ (R)	Car Arrival Buzzer (Rear)

CJ (R)	Car Call Registered Glow Lights (Rear)
DJ (R)	Down Hall Call Registered Glow Lights (Rear) Note: If outputs only remain HI as long as "D(R)" input is HI, car is not in normal service. Check special service inputs.
DFJ	Down Hall Call Registered (Freight Service Riser)
DL(R)	Down Hall Lantern (Rear) (Car running, output goes HI when final slowdown occurs and car has down preference. Car stopped, output goes HI as soon as "ICPT" is set for at floor down hall call or car call; goes LO when car reverses direction or door close limit "DO17" ("RO17") input goes LO)
DY	Down Hall Call Annunciator Lights
FJ (R)	"FAPB" Call Registered Lights (Rear)
HJ	Hospital Serv. Hall Call Registered
LG	Gong Output For Hall Lanterns
P	Position Indicator Outputs
PD	Advanced Position Pilots (Output shows cars advanced position status when stopped or in slowdown)
SJ (R)	Hall Car Send Glow Lights (Rear)
UJ (R)	Up Hall Call Registered Glow Lights (Rear) Note: If outputs only remain HI as long as "U(R)" input is HI, car is not in normal service. Check special service inputs.
UFJ	Up Hall Call Registered (Freight Service Riser)
UL (R)	Up Hall Lantern (Rear) (Car running, output goes HI when final slowdown occurs and car has up preference. Car stopped, output goes HI as soon as "ICPT" is set for at floor up hall call or car call; goes LO when car reverses direction or door close limit "DO17" ("RO17") input goes LO)
UY	Up Hall Call Annunciator Lights

Supervisory Timers		**Approx. Setting**
APT	Audible P.I. Pulse (Set with each change in "MFS" position. Used to determine length of time "API" output stays HI, when used with "EPCO" readouts)	⅓ To ½ Sec.
BZT	Front Door Close Warning Buzzer (Set after full door open time expires. Maintains "BUZ" output to provide warning signal before auto closing of power freight doors)	5 Sec.
BZRT	Rear Door Close Warning Buzzer (Set after full door open time expires. Maintains "BUZ" output to provide warning signal before auto closing of power freight doors)	5 Sec.
CGT	Front Car Direction Sign Gong (Provides delay between first and second strokes of dual stroke car direction sign)	½ Sec.
CGRT	Rear Car Direction Sign Gong (Provides delay between first and second strokes of dual stroke car direction sign)	½ Sec.
CYCT	Car Cycle Time (Timer times out 100 times for setting)	6 Sec. To 1 Hr.
DBT	Front Door Dynamic Braking (Set after door and gate opening and closing slowdowns have been reached. Keeps all power off of doors and gate)	½ Sec.
DCT	Front Door Closing (Times out (5) five times for setting set any time doors receive close signal and "DO3" input is HI. If doors fail to close during this time they will reopen and receive close signal again)	10 To 20 Sec.

DCRT	Rear Door Closing (Times out (5) five times for setting set any time doors receive close signal and "RO3" input is HI. If doors fail to close during this time they will reopen and receive close signal again)	10 To 20 Sec.
DHT	Front Door Hold Open (Set when "DHO" input goes HI. Provides extended door open time.)	7 To 15 Sec.
DHRT	Rear Door Hold Open (Set when "DHOR" input goes HI. Provides extended door open time.)	7 To 15 Sec.
DLT	Front Door Limit	1 To 2 Sec.
DNT	Front Door Nudging	2 Sec.
DOT	Front Door Open (Set when doors receive open signal to provide hooked interlock time, until "CG" input goes LO. Timer is then reset and provides full door open time once "DO3" input drops. When multiple door time option "M5DT1" is furnished, "DOT" provides long lobby time on "Next Up" Car.)	3 To 5 Sec.
DPT	Down Peak (Maintains down peak operation when initiated from fully loaded car traveling down)	30 To 45 Sec.
DT	Front Door Opening or Closing (Set when power doors are opening or closing. Provides stall open or close time for hatch door and car gate. If doors fail to reach full open or closed position during this time, all power is removed)	6 To 10 Sec.
EPT	Emergency Power (Set when "EPC" input first goes HI. Used to provide delay between normal and emergency power transfer)	5 Sec.
FPT	Fire Pump Start Delay	8 Sec.
GDT	Gong Delay	1 Sec.
GOT	Gong Initiate	1 Sec.
HGT	Front Hall Gong (Provides delay between first and second strokes of dual stroke hall lanterns)	½ Sec.
HGRT	Rear Hall Gong (Provides delay between first and second strokes of dual stroke hall lanterns)	½ Sec.
HNT	Position Hunting Timer (Set on power up condition when hot within a floor position on the selector. Provides time for miprom to receive a running signal from the power controller when searching for position. If no running signal is received during this time the miprom will drop the direction pilot output and energize the opposite direction pilot)	5 Sec.
HOT	Homing (Set when car has no demand for service. If "HOT" times out 15 consecutive times car is returned to designated landing)	Field To Suit
HST	Hospital Service (Set when car has been recalled to floor and is parked with doors open. If car is not placed on hospital independent service within this time, it will be returned to normal operation.)	10 Sec.

INDT	Independent Service Override (Set when car is on independent service and fire service is activated. After the timer times out, the car will close the doors and return to the fire return floor.)	15 To 40 Sec.
LCT	Front Long Time Car Call (Set when car has stopped in response to car call. Transfers to "SCT" when photocell beam is broken)	2 To 3 Sec.
LCRT	Rear Long Time Car Call (Set when car has stopped in response to car call. Transfers to "SCRT" when photocell beam is broken)	2 To 3 Sec.
LHT	Front Long Time Hall Call (Set when car has stopped in response to hall call. Transfers to "SHT" when photocell beam as broken)	3 To 5 Sec.
LLT	Lont Lobby Time	5 To 7 Sec.
MST	Minimum Stop (Set whenever car stops. Keeps "UA" - "DA" off to prevent abrupt hoist motor direction reversals whenever car makes a stop without opening doors)	3 To 4 Sec.
NIT	Non Interference (Prevents registration of hall calls to allow passenger entering car to close doors and register car call when "FAPB" operation is furnished)	5 To 10 Sec.
OBT	Front Door Obstruction (Set whenever "PC" input is HI. Disables "PC" input if photocell remains interrupted for this time)	15 To 20 Sec.
OBRT	Rear Door Obstruction (Set whenever "PCR" input is HI. Disables "PCR" input if photocell remains interrupted during this time)	15 To 20 Sec.
OLT	Door Open Limit (Set whenever front doors receive open signal. Provides hooked interlock time from open signal to "DO3" dropping.)	5 To 10 Sec.
OLRT	Rear Door Open Limit (Set whenever rear doors receive open signal. Provides hooked interlock time from open signal to "RO3" dropping.)	5 To 10 Sec.
OST	Out of Service (Set when drive output "UA" or "DA" is set or car has demand to run. If car fails to run during this time it will be removed from group service)	20 To 30 Sec.
PT	Low Oil (Set whenever "UA" output is HI. If "PT" times out "X" times before "UA" goes LO and car stops running, car will be returned to bottom landing. "X" = Number of Floors + 1)	Total Travel Time Plus 10 Sec.
PRT	Retiring Cam Protection (Set whever car has demand to run and "RCR" out is HI. If car fails to run during this time drive will be aborted and all calls canceled)	15 To 20 Sec.
PST	Power Controller Shutdown (Times out 4 times for setting. Maintains "PA" output HI when car is stopped with no demand)	Field To Suit
RBT	Rear Door Dynamic Braking (Set after door and gate opening and closing slowdowns have been reached. Keeps all power off of doors and gate)	½ Sec.

RDGT	Cam Interlock Delay	½ To 1 Sec.
RLT	Rear Door Limit	1 To 2 Sec.
RNT	Rear Door Nudging	2 Sec.
ROT	Rear Door Open (Set when doors receive open signal to provide hooked interlock time, until "CG" input goes LO. Timer is then reset and provides full door open time once "RO3" input drops. When multiple door time option "M5DT2" is furnished, "ROT" provides long hall time.)	3 To 5 Sec.
RT	Rear Door Opening or Closing (Set when power doors are opening or closing. Provides stall open or close time for hatch door and car gate. If doors fail to reach full open or closed position during this time, all power is removed)	6 To 10 Sec.
SCT	Front Short Time Car Call (Set when car has stopped for car call and photocell beam has been interrupted)	1 To 2 Sec.
SCRT	Rear Short Time Car Call (Set when car has stopped for car call and photocell beam has been interrupted)	1 To 2 Sec.
SDT	Short Front Door (Set when closing doors are reopened or photocell beam has been interrupted. Provides shorter time interval than "DOT")	2 To 3 Sec.
SECT	Security Code Entry (Set while code is being entered for secured floor, during after hours. If code is not entered during this interval call will not be accepted)	5 Sec.
SHT	Front Short Time Hall Call (Set when car has stopped for hall call and photocell beam has been interrupted)	2 To 3 Sec.
SHRT	Rear Short Time Hall Call (Set when car has stopped for hall call and photocell beam has been interrupted)	2 To 3 Sec.
SRT	Short Rear Door (Set when closing doors are reopened or photocell beam has been interrupted. Provides shorter time interval than "ROT")	2 To 3 Sec.
SST	Sequence Start (Set when initial power on occurs. Prevents "PA" output from going HI simultaneously on all cars in a group when transfer of power occurs. Note: Set each car in group differently)	Field To Suit
UPT	Up Peak (Maintains up peak operation when initiated from fully loaded car traveling up)	30 To 45 Sec.
UST	Up Stop (Set whenever "LRU" input goes LO and "LR" input is HI. Provides soft stop feature by maintaining "UA" and "YTR", direction contactors, until valve coils have de-energized)	2 Sec.
YDT	Y-Delta (Set whenever car is set to run up. Prevents "YTR" output from going HI immediately, to allow transfer of "WYE" to "Delta" monitor windings)	2 Sec.

Common Inputs
Hi = Input Energized
Lo = Input De-Energized

("@" - Indicates Suffix "A" for Car "A" Connections,
Suffix "B" for Car "B" Connections, etc.)

AESH — Alternate Floor Fire Recall Switch
(HI when switch at alt. flr. is in "ON" position; LO for normal service)

AESS — Alternate Floor Fire Sensor Signal
(HI for normal service; LO when main floor sensor has tripped)

CC1@, CC2@, etc. — Car Call Pilots from Car "@"
When used with supervisory control option "Count 1";
(Shows, in binary form, half the # of registered in line car calls)
Used along with registered hall calls for call counting on "MZ5'S"
When used with supervisory control option "TMS1";
(Shows which zones car has registered in line car calls for)

CCP@ — Car Call Pilot from Car "@"
(HI = No Car calls registered; LO = Car calls registered)
Common will not assign homing call for unoccupied zones to cars that have registered for car calls.

DGP@ — Door Gate Pilot from Car "@"
Note: Provides door status when car is stopped ("SBX@" is HI) or when running and in slowdown ("SBX@" and "HCN@" or "HCR@" are LO). Provides advanced slowdown status when car is running ("SBX@" is LO). But car is not in slowdown ("HCN@" or "HCR@" is HI).
Door Status: (HI when doors are open; LO when doors are closed)
Adv. Slowdown: (Goes HI as soon as car has no further demand beyond its advanced position, stays HI until slowdown)

DPK — Down Peak Clock
Controlled by contact of down peak time clock
(HI for down peak operation, contact closed; LO for normal service, contact open)

EPC — Emergency Power Contact
(HI when on emergency power; LO for normal service)

EPP@ — Car Parked on Emergency Power
(HI when selected car returns to main flr. or times out of service; must be LO if car is to be selected to run)

EPR@ — Manual Emergency Power Switch - Car "@"
(HI when car is selected; LO when car is unselected)

ESB — Emergency Service Sensor Bypass
(HI when fire recall switch is in "Bypass" position allowing normal service of car, independent of fire sensor inputs "ESS" and "AESS"; LO during normal service)

ESCL@ — Car Running On In Car Fire Service During Emergency Power
(HI when car is in normal service; LO when car is running on in car fire service)

ESH — Main Floor Fire Recall Switch
(HI when switch at main floor is in "ON" position; LO for normal service)

ESS — Fire Sensor Signal
(HI for normal service; LO when sensor signal, other than at main floor, has tripped)

HCN@ - (HCR@) — Hall Call Cancel Pilot (Rear) from Car "@"
(HI when car is running but not in slowdown, or stopped with no further demand. LO when car is in slowdown or stopped for demand) Used by common along with car's position ("PB1@, PB2@", etc.) and preference ("RSU@") in order to cancel appropriate hall call.
Note: Actual calls are cancelled as soon as "HCN@" - "HCR@" goes LO, but glow light outputs will remain HI until car stops running at floor ("SBX@" goes HI).

HCV — Hall Call Supply Voltage
(HI when external relay control hall call button supply voltage is present; LO causes CSV1 and CSV2 toggle to be disabled)

HES@ — Hospital Emergency Service Pilot from Car "@"
(HI for normal service; goes LO when car has received "HEP@" signal and is responding to hospital service demand)

LTP — Lamp Test Pushbutton
(Lights "NPL", "EPL" and "EPL@" outputs when HI)

LSP@ — Load Weigh Pilot from Car "@"
(HI for normal service; LO when "LWS" input is HI on car, indicating car is 60% loaded)
Used by common along with car's preference ("RSU@") to initiate up or down peak operation.

MP1@ MP8@ — Monitor Pilots from Car "@"
(To be used for "CRT" display describing specific reasons car is not in normal group service)

NPP — Normal Power Pending Input
Note: Only effective if "EPC" input is HI.
(HI upon receipt of normal power pending signal; LO for normal service while on emergency power)

PB1@, PB2@, etc. — Binary Position Pilots from Car "@"
(Inputs that are LO show car's position in binary form. When car is stopped, MFS position is received. When car is running, advanced position is received)
Note: If all inputs are HI, common will consider car as being out of service. To determine car's position: Add up binary total, (PB1=1, PB2=2, PB3=4, PB4=8, PB5=16), of inputs that are LO.

RB — Annunciator Reset P.B.

RSU@ — Up Direction Preference Pilot from Car "@"
(HI when car has no preference or down preference; LO when car establishes up preference)

SBX@ — Running Pilot from Car "@"
(HI when car is stopped; LO when car is running)

TOS@ — Out of Service Timer Pilot from Car "@"
(Goes HI when car has timed out of service; must be LO to indicate car is in normal service)

UPK — Up Peak Clock
Controlled by contact of up peak time clock
(HI for up peak operation, contact closed; LO for normal service, contact open)

D (R) — Down Hall Call (Rear)

DF — Down Hall Call (Freight Service Riser)

HS — Hospital Service Call

U (R) — Up Hall Call (Rear)

UF — Up Hall Call (Freight Service Riser)

Common Outputs
Hi = Output Energized
Lo = Output De-Energized

Note: ("@" - Indicates Suffix "A" for Car "A" Connections, Suffix "B" for Car "B" Connections, etc.)

AESHP — Alt. Flr. Fire Service Pilot to All Cars
(Goes HI when alt. flr. fire recall is necessary due to "AESS" input going LO or "AESH" input going HI; LO during normal service)

AESP	Main Flr. Fire Sensor Power Supply Pilot (HI for normal service; goes LO if "AESS" input is LO)
BAPL	Balance Program M.R.I.P. Light (HI when normal zoning operation is in effect; LO if system is operating on up or down peak operation)
CSV1 - CSV2	Common Service Toggle (Outputs toggle on and off for normal service, indicating that common controller is functioning properly. If outputs remain HI or LO car controllers will ignore any signals received from the common.)
DDS@	Down Drive Start Pilot to Car "@" Provides drive start signal for hall call or homing call below car. (HI when car has been assigned call below its advanced position; goes LO when demand no longer exists below car's advanced position)
DN (R)@	At Floor Down Hall Call Pilot to Car "@" (HI when down hall call exists at car's advanced position. Remains HI, to provide door open pilot, until car stops and doors open)
DPKL	Down Peak Light (HI when system is on down peak operation from time clock, load-weighers or call counting)
EPL	Emergency Power Light (HI when on emergency power; LO on normal service)
EPL@	Emergency Power Light for Car "@" (HI when selected to run; LO when unselected. Note that this output is not used for communication)
EPS@	Emergency Power Select Pilot to Car "@" (HI on car selected to run, maintained until car is removed from service or returns to main floor. LO on unselected cars)
ESCP	Car Operating On In Car Fire Service Pilot to All Cars (HI when any car is operating on in car fire service during emergency power; LO during normal power)
ESF	Flashing Emergency Sign (Flashes any time fire recall is in effect)
ESHP	Main Floor Fire Recall Pilot to All Cars (Goes HI when main flr. fire recall is necessary due to "ESS" input going LO or "ESH" input going HI; LO during normal service)
ESP	Fire Sensor Power Supply Pilot (For All Flrs. Except Main) (HI for normal service; goes LO if "ESS" input is LO)
HEP@	Hospital Emergency Service Pilot to Car "@" (HI when car is selected to respond to hospital recall demand; LO when no demand exists or car is unable to respond to such demand)
MPA	Miprom Control Activated (Energized on initial power up of miprom control)
NPL	Normal Power Light (HI when system is on normal power; LO when on emergency power)
NU @	Next Up Light Car "@" (HI when car is selected as next up)
UDS@	Up Drive Start Pilot to Car "@" Provides drive start signal for hall call or homing call above car. (HI when car has been assigned call above its advanced position; goes LO when demand no longer exists above car's advanced position)
UP (R) @	At Floor Up Hall Call Pilot to Car "@" (HI when up hall call exists at car's advanced position. Remains HI, to provide door open pilot, until car stops and doors open. Also goes HI when car is selected as "Next Up".)
UPKL	Up Peak Light (HI when system is on up peak operation from time clock, load-weighers or call counting)

ZO @	Zone Car Light Car "@" (HI when car occupies and is in control of 2nd, 3rd, 4th zone, etc.)
DJ (R)	Down Hall Car Registered Glow Lights (Rear) Note: If outputs only remain HI as long as "D(R)" input is HI, common senses all cars as being out of service)
DFJ	Down Hall Call Registered (Freight Service Riser)
HJ	Hospital Serv. Hall Call Registered
UJ (R)	Up Hall Call Registered Glow Lights (Rear) Note: If outputs only remain HI as long as "U(R)" inputs are HI, common senses all cars as being out of service.
UFJ	Up Hall Call Registered (Freight Service Riser)

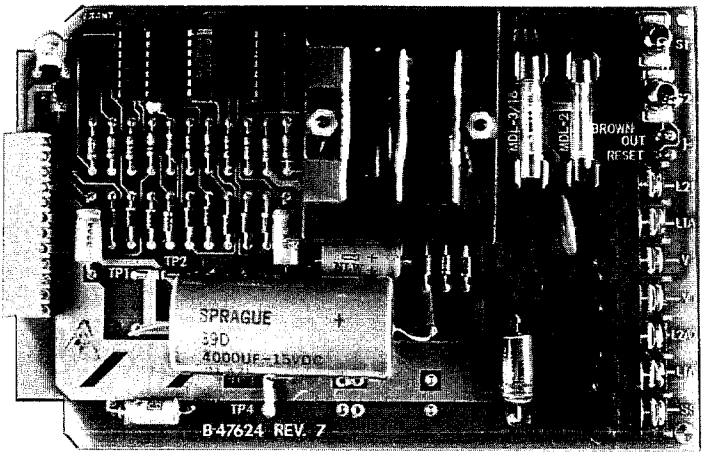
Common Timers		**Approx. Setting**
DPT	Down Peak Timer Used to initiate and maintain down peak operation from loadweigh pilots or call counting. Loadweighing: (Timer is set if car has down preference and "LSP@" goes LO. In event "LSP@" goes LO on another car with down preference, during "DPT" interval, timer is reset and down peak operation goes into effect for "DPT" time) Call Counting ("MZ5'S" Only): (Timer is set as soon as number of down calls exceeds count difference. If calls remain predominantly down when "DPT" time expires, timer is reset and system will go into down peak operation until "DPT" times out)	30 To 45 Sec.
EPT	Emergency Power Delay (Set when "EPC" input first goes HI. Used to provide delay between normal and emergency power transfer)	5 Sec.
UPT	Up Peak Timer Used to initiate and maintain up peak operation from loadweigh pilots or call counting. Loadweighing: (Timer is set if car has up preference and "LSP@" goes LO. In event "LSP@" goes LO on another car with up preference, during "UPT" interval, timer is reset and up peak operation goes into effect, for "UPT" time) Call Counting ("MZ5'S" Only): (Timer is set as soon as number of up calls exceeds count difference. If calls remain predominantly up when "UPT" time expires, timer is reset and system will go into up peak operation until "UPT" times out)	30 To 45 Sec.

POWER AND TIE POINTS

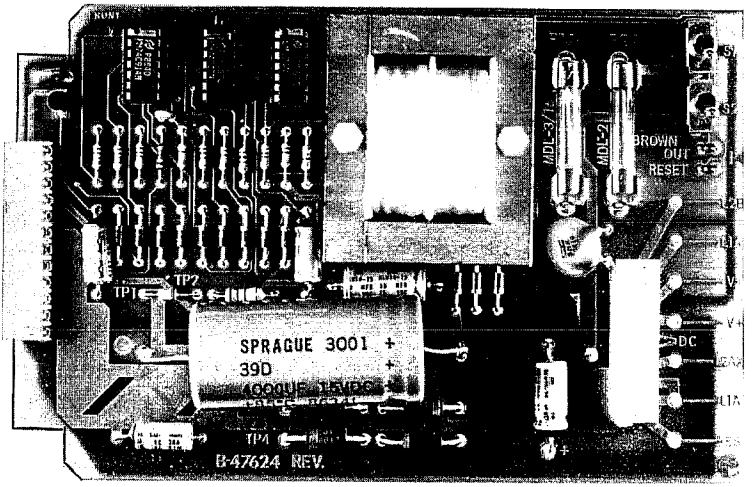
CL1	Common Supply - Neutral Line
CL2	Common Supply - Power Line (Incoming)
CL3	Common Supply - Fused Power Line (Outgoing to CCX Trans.)
CSS	Miprom Supply - S2 Switch Controlled Power Line (Outgoing) (Common connection for most I/O devices)
CSV	Common/Supervisory Communication Common (Connected to CSS thru jumper)

HCB	Hall Call Buttons and Call Registered Lights Common (Connected to CSS thru jumper or cut-out switch if used)
L1A	Miprom Supply - Neutral Line
L2AX	Miprom Supply - Power Line (Incoming) (Connected to 110V, 115V, or 120V thru jumper)
110V	110 Volt L2AX Supply
115V	115 Volt L2AX Supply
120V	120 Volt L2AX Supply

P-15903
POWER SUPPLY CARD
REPLACES P-16787



P-16835
POWER SUPPLY CARD
REPLACES P-16787



P-16787
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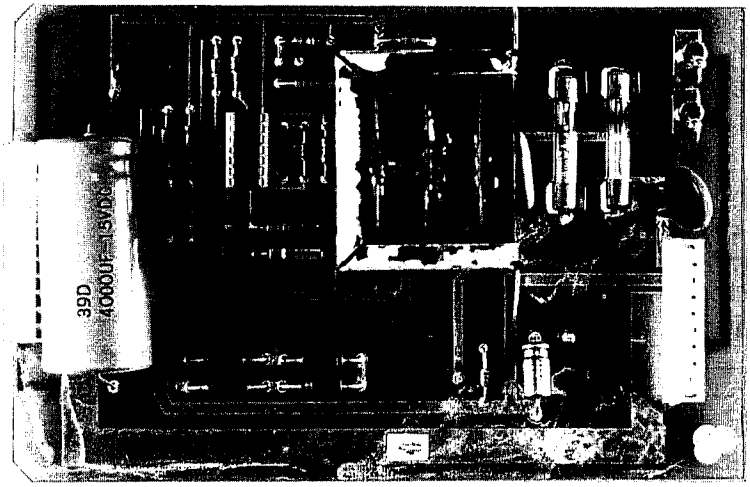

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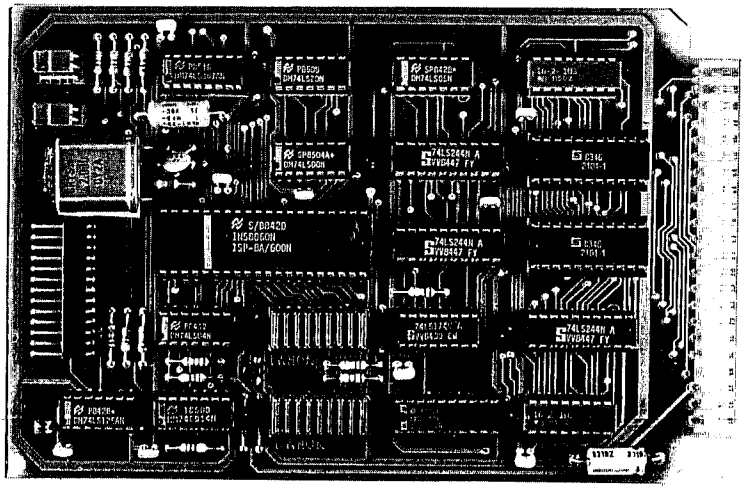
CPU CARD



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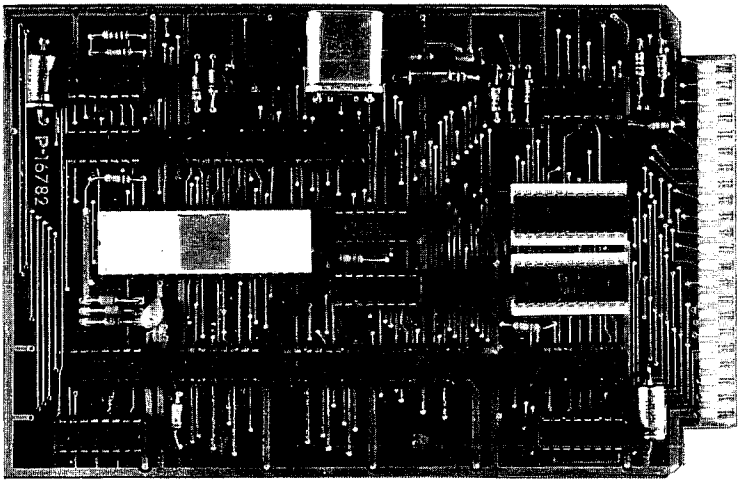

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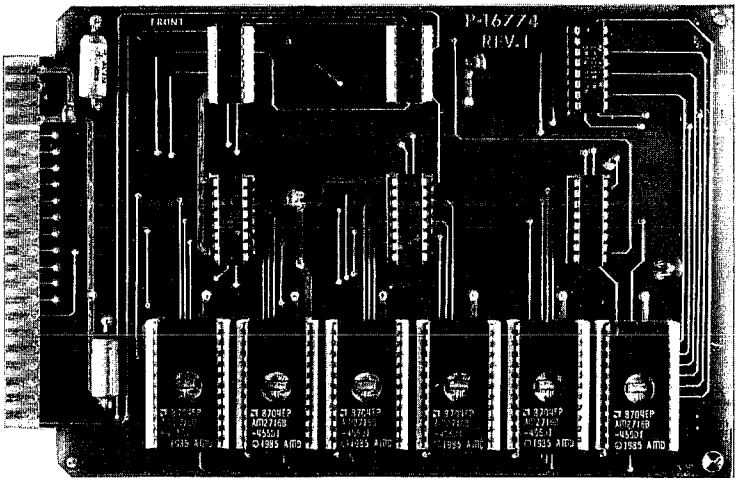

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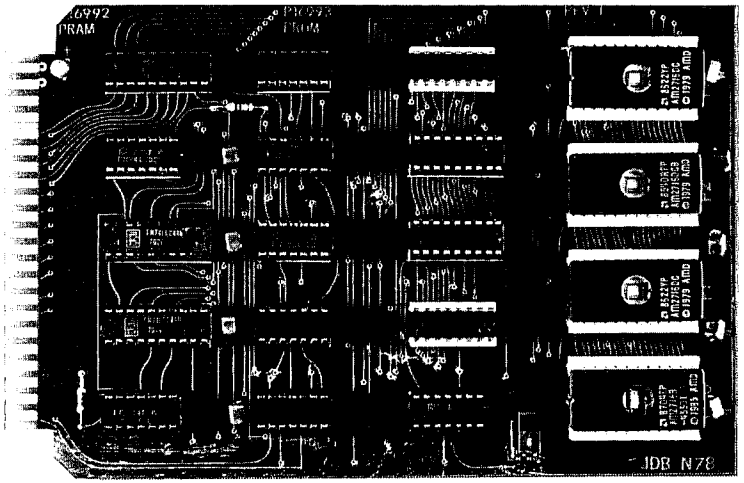

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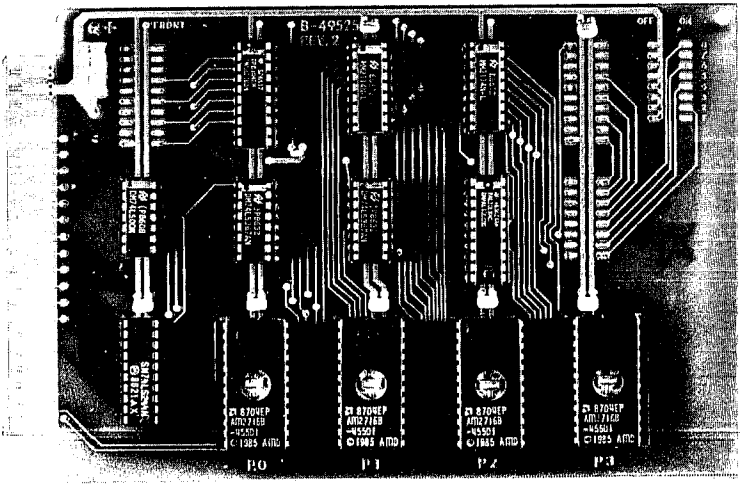

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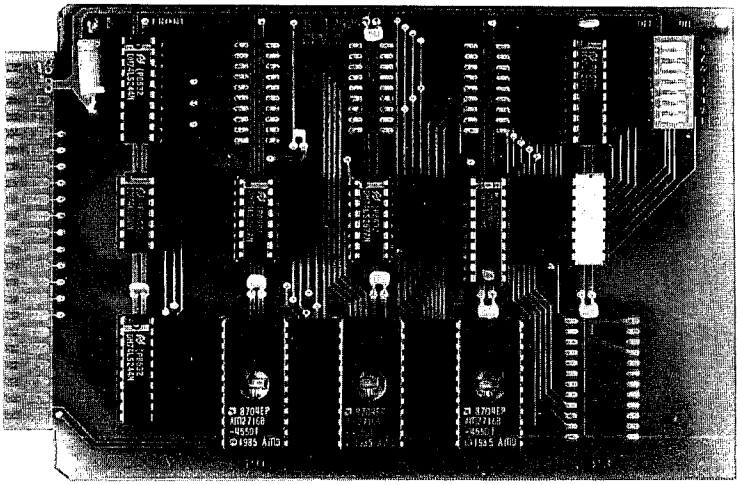

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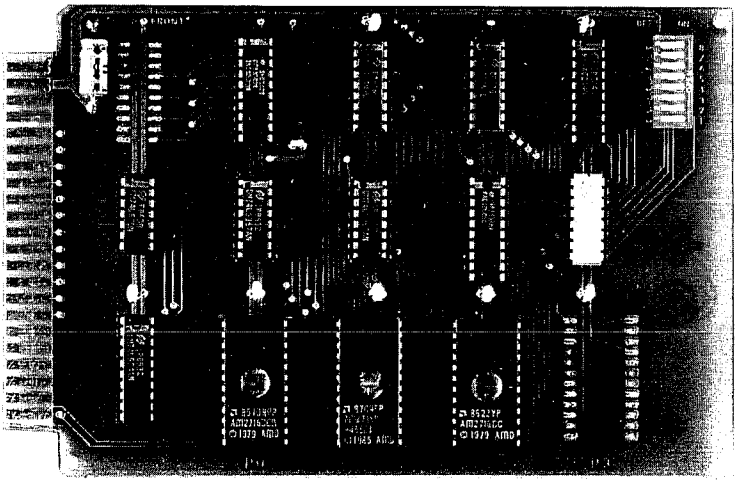
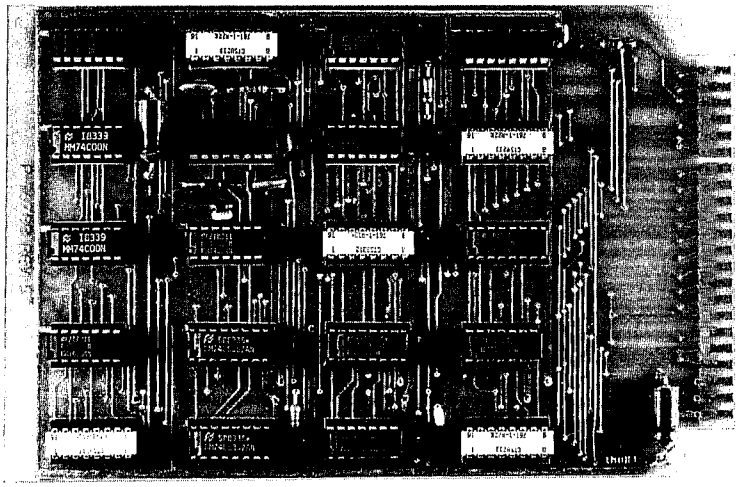
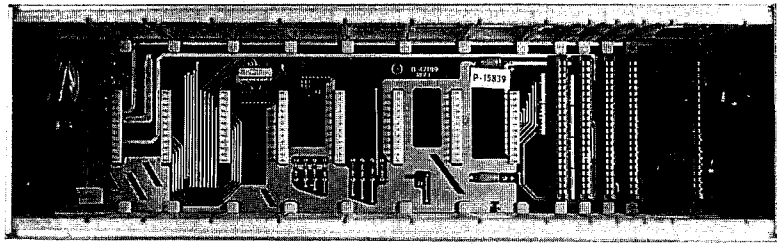


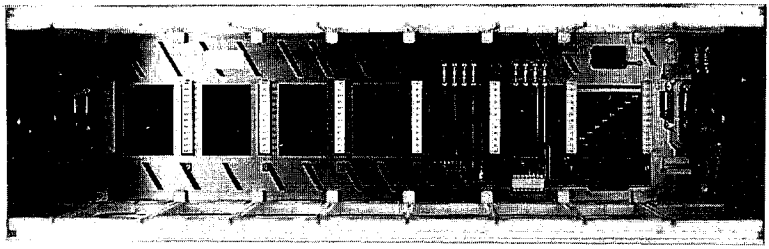
P-16783
INTERFACE CARD



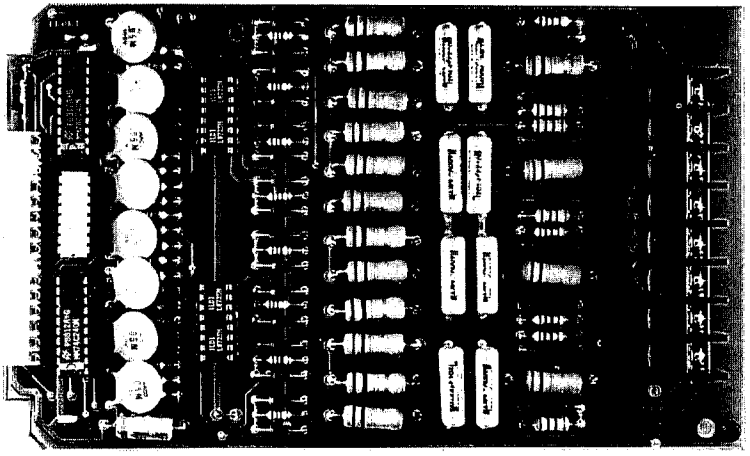
P-16801
CPU CARD RACK
*NOT SHOWN, *HAS NO
REPLACEMENT EXCEPT
ANOTHER P-16801

P-15839
CPU/IO CARD RACK

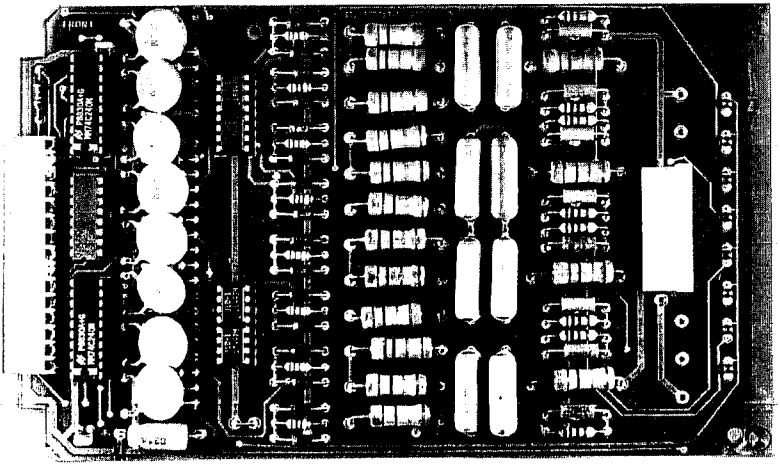




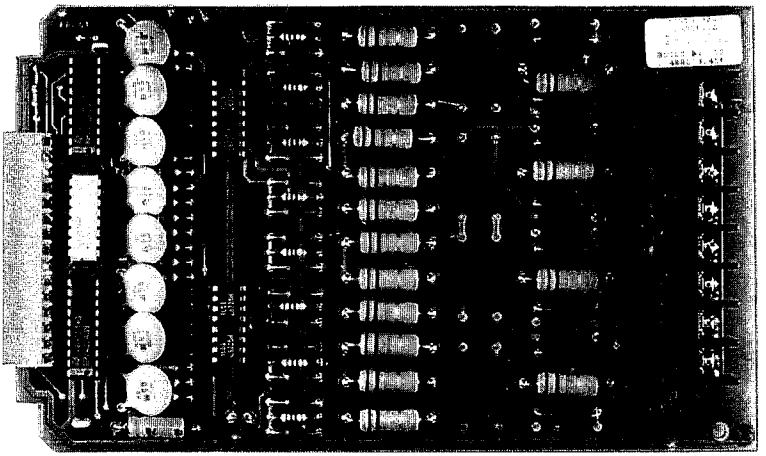
P-15730
INPUT CARD
W/SNUBBER



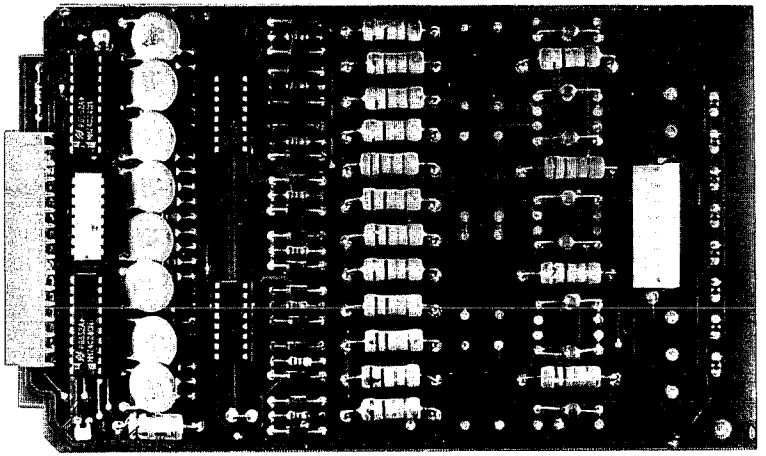
P-15731
EXPERIMENTAL ONLY



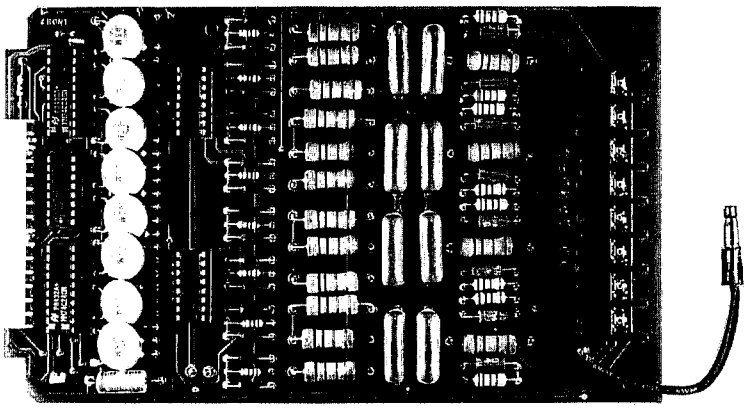
P-15761
INPUT CARD
REPLACES P-16785



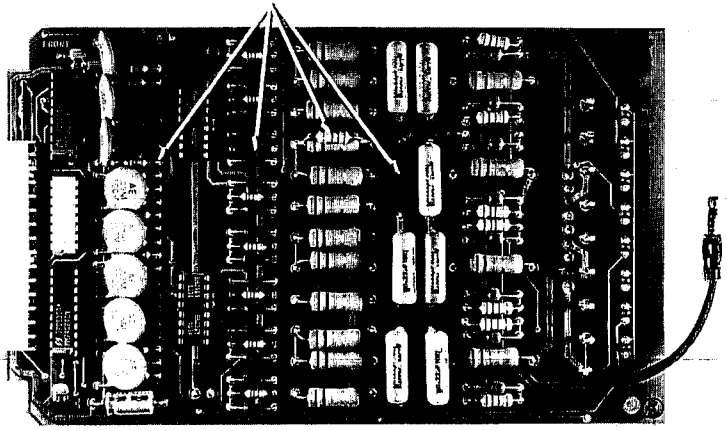
P-15762
INPUT CARD
REPLACES P-16786



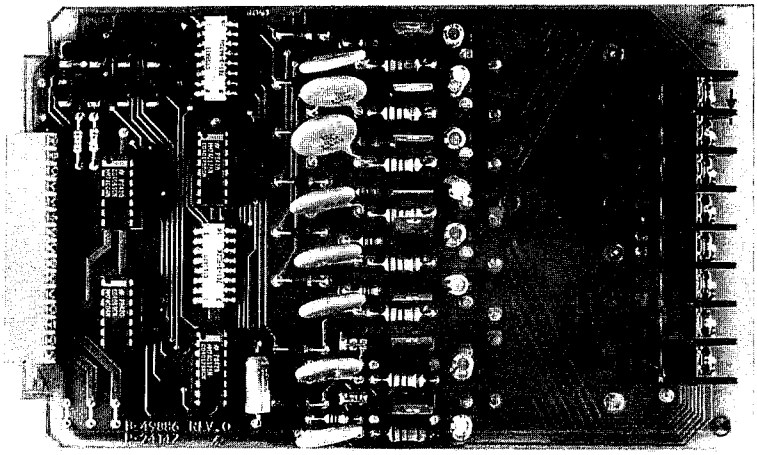
P-24151
BI-LOGIC INPUT CARD



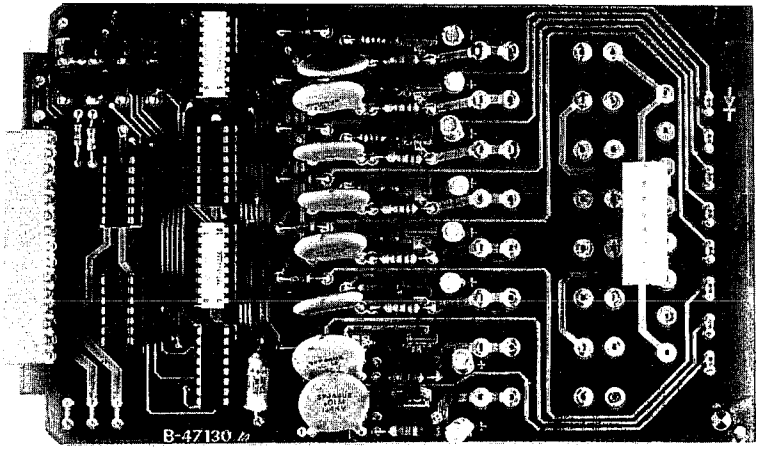
P-25766
M.S.T. INPUT CARD
3rd CHANNEL CONVERTED TO "D.C."



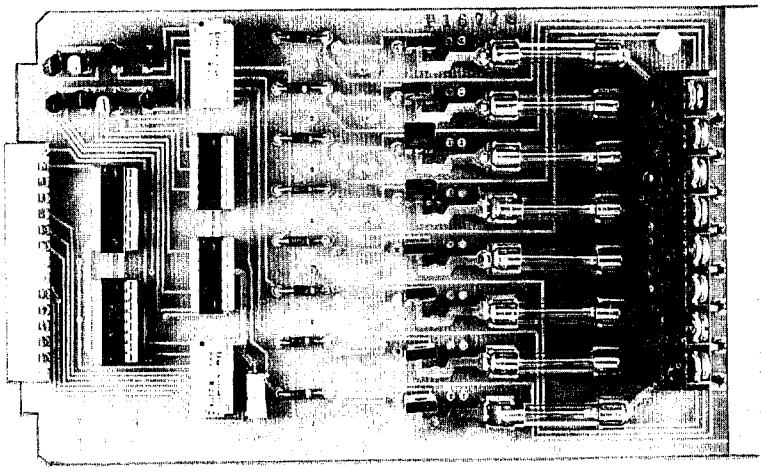
P-15775
OUTPUT CARD
W/TERMINAL STRIP



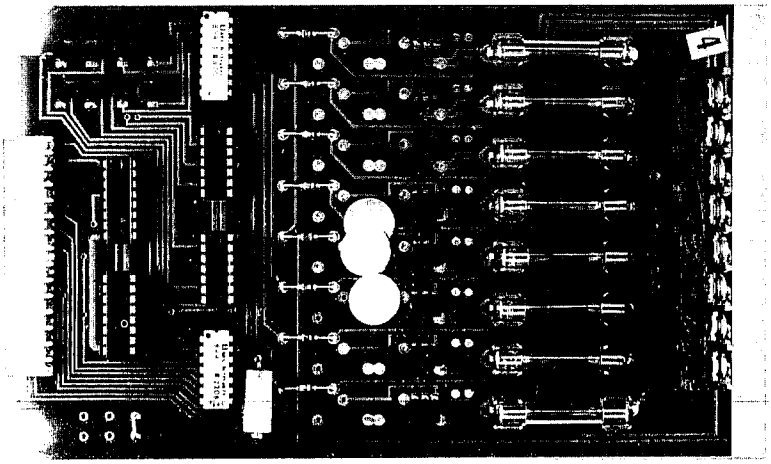
P-15774
OUTPUT CARD
W/MOLEX CONNECTOR



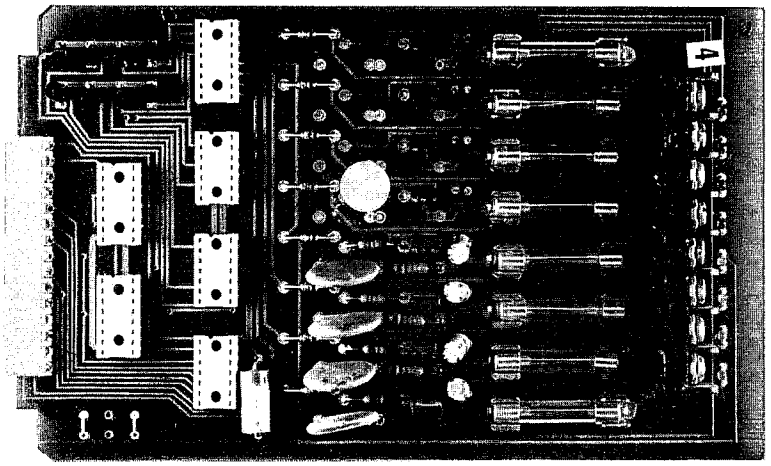
P-15778
AC OUTPUT CARD
EXPERIMENTAL ONLY



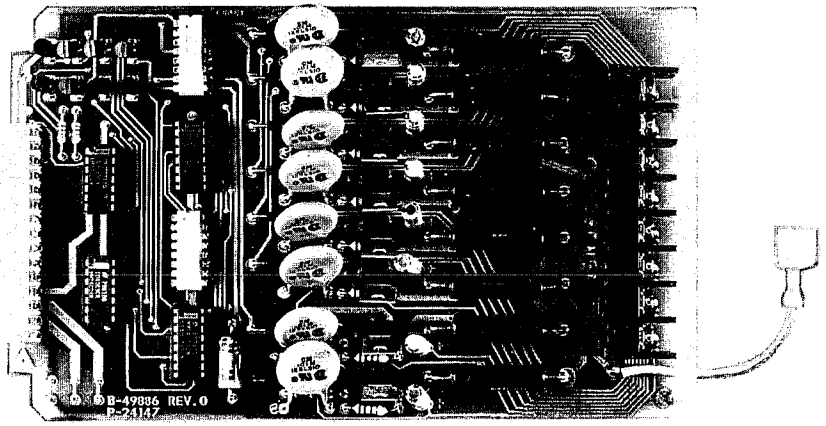
P-16778
DC OUTPUT CARD



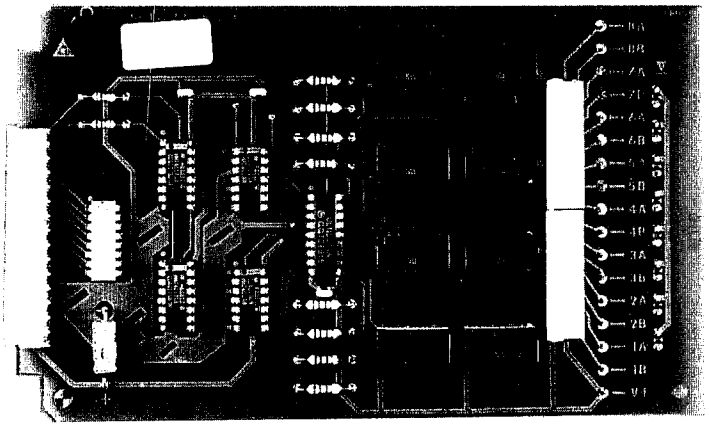
P-16775
AC/DC OUTPUT CARD
REPLACES P-15779



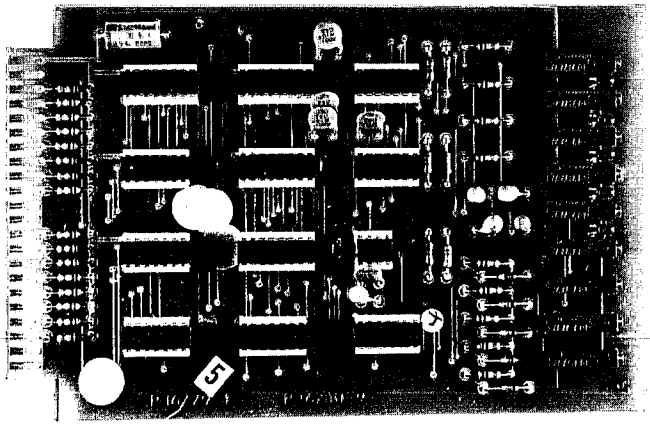
P-24147
BI-LOGIC OUTPUT CARD



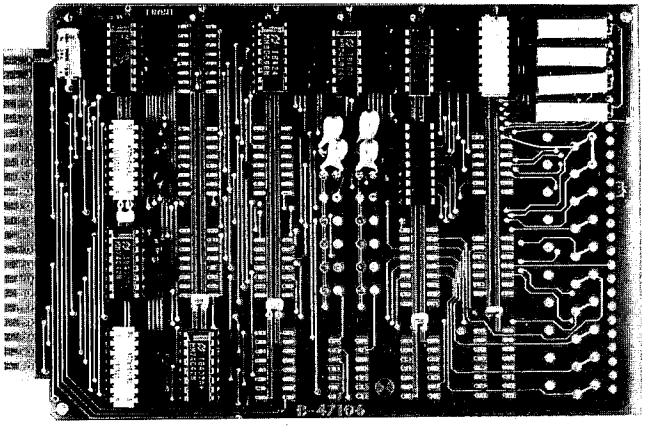
P-24100
RELAY OUTPUT CARD



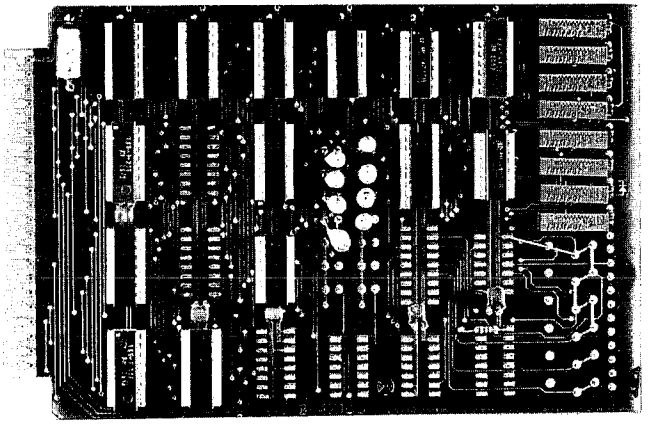
P-16780
9X TIMER CARD



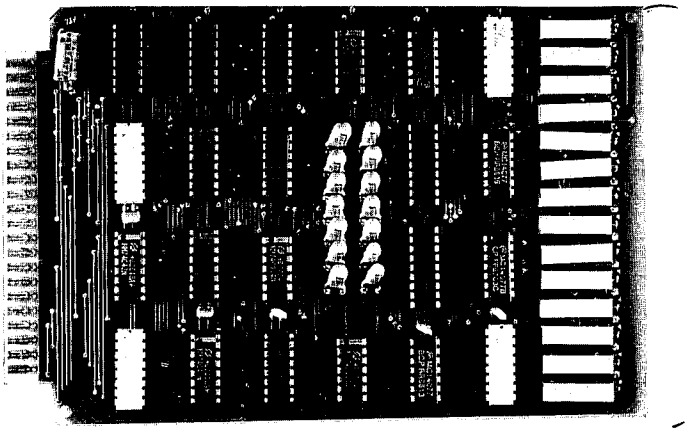
P-15758
4X TIMER CARD
REPLACES P-16779

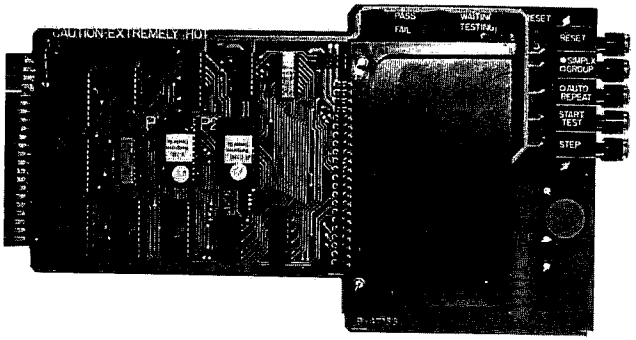


P-15759
8X TIMER CARD

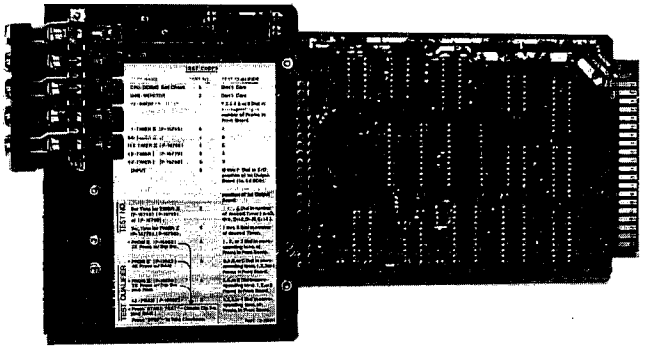


P-15760
14X TIMER CARD





FRONT SIDE



TEST NUMBER SWITCH

TEST QUALIFIER SWITCH

BACK SIDE

P-15824 UNIVERSAL DEBUG BOARD
Used as an Aid in Troubleshooting

MIPROM I DEBUG TESTS

The MIPROM MINI MONITOR (P-16989) and UNIVERSAL DEBUG BOARD (P-15824) are used together to test the individual INPUT BOARDS, OUTPUT BOARDS, TIMER BOARD, PROM BOARD, and CPU BOARD in a MIPROM I CONTROLLER. They can also be used together to adjust the timers on the various timer boards.

The tests on the following pages assume that all D.C. and A.C. voltages are correct. Any variation of voltage levels from the specified tolerances may affect the test.

SOME DO'S AND DON'TS OF THE MIPROM I CONTROLLER, UNIVERSAL DEBUG BOARD, AND MIPROM MINI MONITOR:

1) Always turn power to the MIPROM I CONTROLLER off before inserting or removing circuit boards.

2) Before servicing the MIPROM I, or any electronic equipment, remove static electricity charges from your body by first touching a good earth ground. Static discharge to a circuit board can destroy a board or wound a board so that it will need to be replaced sooner than it should.

   Do not touch the edge connectors, traces or components on the circuit boards. The best way to handle a circuit board is by holding the edges of the boards without touching the traces or components.

3) Do not force the boards into the card rack slots! Always check the edge connectors for keyed slots. Some boards or connectors will warp which will require careful alignment of the board and card rack connector before insertion.

4) When storing circuit boards always store them in static resistant bags like the ones they were shipped in. The bag, with the board inside it, should then be placed in the protective shipping box. Always store circuit boards away from dust, dirt and moisture.

5) Do not drop circuit boards! Small components on the board may become dislodged or broken.

BEFORE YOU START...

... Most often the problem will not be in the MIPROM I CONTROLLER. Note or write down the status of the MIPROM I INPUTS and OUTPUTS, including the MINI MONITOR LED'S if it is plugged in. This information may lead you to a faulty device on the CAR, in the HOISTWAY, or on the RELAY INTERFACE PANEL. The information you note will be very helpful if you should require assistance from someone not on site.

Note: Refer to Sequence of Operation listings for assistance in determining proper input, output, timer and relay status.

...Check all voltages in the MIPROM I CONTROLLER. If any differ from the specified tolerances correct the problem and see if the MIPROM will then operate properly before proceeding.

UNIVERSAL DEBUG BOARD:

The UNIVERSAL DEBUG BOARD (P-15824) is inserted into the CARD RACK in place of the existing PROM BOARD. The DEBUG BOARD must be used with the MINI MONITOR to perform tests on the INPUT BOARDS, OUTPUT BOARDS, TIMER BOARD, I/O INTERFACE BOARD, PROM BOARD, and CPU BOARD.

THE DEBUG BOARD CONTAINS 2 ROTARY THUMB WHEEL SWITCHES WHICH ARE USED TO SELECT WHICH TEST IS TO BE PERFORMED:

TEST NUMBER (Top Switch) — Used to select the type of test to be performed. EXAMPLE: TIMER TEST, INPUT TEST, etc.

TEST QUALIFIER (Bottom Switch) — Used to select a particular type of board to be tested or board position. Using the TIMER TEST as an example you would use this switch to select whether you are testing a 4X, 8X, or 14X TIMER.

THE DEBUG BOARD CONTAINS THESE 5 PUSH-PUSH SWITCHES THAT ARE USED IN THE VARIOUS TESTS:

RESET (Orange) — A momentary switch which will reset the CPU, clear all OUTPUTS, and clear the TIMERS. This may need to be pressed if the operator enters unintelligible instructions which would cause the DEBUG BOARD to lock up.

SIMPLEX / GROUP (Blue When Pushed In) — Not used. Should be in out position.

AUTO REPEAT (Yellow When Pushed In) — Allows some tests to be repeated automatically. This feature will allow you to check for an intermittent board problem.

START (Green) — A momentary switch which when pushed starts the test that the DEBUG BOARD is currently set up for.

STEP (White) — A momentary switch which when pushed during the INPUT and OUTPUT tests will advance to the next INPUT BOARD or OUTPUT BOARD. Also used during some PROM BOARD tests.

THE UNIVERSAL DEBUG BOARD CONTAINS 5 LED'S WHICH WILL BE USED DURING THE TESTING PROCEDURE:

RESET — Indicates a system reset when lit. A system reset will reset the CPU, TIMER, and OUTPUTS.

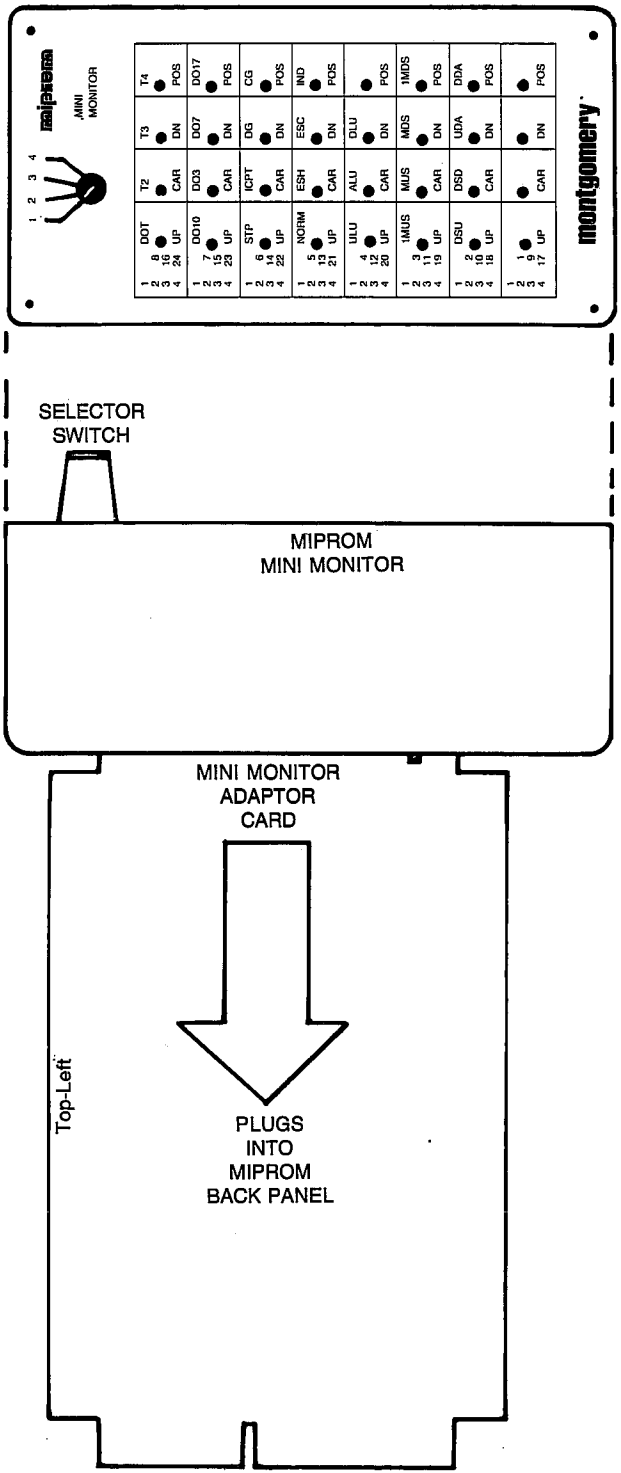
WAITING — Indicates that the DEBUG BOARD is ready and is waiting for the operator to begin a test or press the reset button.

TESTING — Indicates that the DEBUG BOARD is currently running a test. If this LED stops flashing for more than a few seconds there is a major problem in the system. Proceed to the section on Troubleshooting.

PASS — The CPU/DEBUG, TIMER, and SET TIME tests can determine a pass or fail situation. This LED will light if the test passes.

FAIL — The CPU/DEBUG, TIMER and SET TIME tests can determine a pass or fail situation. This LED will light if the test fails.

CAUTION!!!
THE UNIVERSAL DEBUG BOARD CONTAINS A POWER RESISTER WHICH WILL GET EXTREMELY HOT DURING NORMAL OPERATION. THIS IS WELL MARKED ON THE BOARD. CAUTION SHOULD BE TAKEN WHEN HANDLING THE BOARD.


miprom
MINI MONITOR
montgomery
SELECTOR SWITCH
MIPROM MINI MONITOR
MINI MONITOR ADAPTOR CARD
Top-Left
PLUGS INTO MIPROM BACK PANEL

MINI MONITOR:

The MINI MONITOR is used as a visual display either with the UNIVERSAL DEBUG BOARD during testing, or during normal operation of the elevator. The information displayed on the MINI MONITOR is input information that is received by the MIPROM CPU, and output information as the MIPROM CPU intends for it to be. Any variation from this indicates a problem in the system.

For example if an input is on but does not show up on the MINI MONITOR then the signal did not get through to the CPU. A faulty output circuit may be displayed on the MINI MONITOR by the CPU but might not show up at the output terminal.

During normal elevator operation the MINI MONITOR is capable of displaying information regarding some inputs, some outputs, mode of operation, some timers, hall calls, car calls, and car position.

A four position switch is used to determine which information is displayed at any time. Refer to the MINI MONITOR diagram for the following. Each LED has four functions which correspond to the position of the switch. The numbers in the far left column of the MONITOR indicate which function corresponds to each of the four positions.

Example: The top left box can represent the following:

POSITION	FUNCTION
1	DOT
2	8TH FLOOR UP HALL CALL
3	16TH FLOOR UP HALL CALL
4	24TH FLOOR UP HALL CALL

During the DEBUG TEST PROCEDURE the LED's assume totally different functions. The MONITOR can display a flashing "X" which, along with the "Fail" LED, indicates test failure. It can also display a "?", which indicates that the DEBUG BOARD was set up to perform a test that does not exist. The MONITOR can also display the characters "0" through "9", and the letters "A" through "F". Which characters should be displayed will be explained in the individual tests.

CAUTION!!!

THE UNIVERSAL DEBUG BOARD CONTAINS A POWER RESISTER WHICH WILL GET EXTREMELY HOT DURING NORMAL OPERATION. THIS IS WELL MARKED ON THE BOARD. CAUTION SHOULD BE TAKEN WHEN HANDLING THE BOARD.

1) Remove power to the MIPROM by turning switches SW1 and SW2 on the POWER SUPPLY CONNECT BOARD to the "off" (Down) position.

2) Remove the PROM BOARD and set it aside temporarily. Use static discharge prevention when handling all MIPROM BOARDS. See "DO'S AND DON'TS" on previous pages.

3) Insert DEBUG BOARD in the slot that the PROM BOARD was removed from. Component side facing left.

4) Insert the EXTENDER BOARD into the far right card slot. The EXTENDER BOARD is marked "Top Left" on one side. This must be inserted to the top and left for proper operation.

5) Attach MINI MONITOR to the EXTENDER BOARD.

6) Turn switch SW1 to the "On" position. The "Reset" LED's on the DEBUG BOARD, CPU BOARD and POWER SUPPLY CONNECT BOARD should flash momentarily one time.

7) Proper operation up to this point should be verified by the "Waiting" LED on the DEBUG BOARD flashing. All other DEBUG BOARD LED's, OUTPUT BOARD LED'S, TIMER LED's, and all MINI MONITOR LED's should be off.

8) If anything other than the above description occurs press the "Reset" button on the DEBUG BOARD. If the problem continues then turn off power and go to the "DEBUG HINTS" section.

Note: Refer to "TROUBLESHOOTING HINTS" section for additional information.

TEST NAME:
CPU/DEBUG SELF TEST

TEST PURPOSE:
Test the DEBUG BOARD and the CPU BOARD for proper operation.

BOARDS REQUIRED:
CPU BOARD
DEBUG BOARD
MINI MONITOR not required
All others may be removed if desired

TEST NUMBER SWITCH POSITION:
1

TEST QUALIFIER SWITCH POSITION:
Any position will work

TEST DESCRIPTION:
Press "Start" button. If the MINI MONITOR is installed several of it's LED'S should flash on and off. When the test is complete the "Pass" or "Fail" LED will flash to indicate the outcome of the test.

The AUTO REPEAT BUTTON will allow the test to be repeated automatically. This can be helpful in detecting a board with an intermittent problem failure.

TEST FAILURE:
If the test fails then the CPU BOARD or DEBUG BOARD may be at fault.

TEST NAME:

MINI MONITOR TEST

TEST PURPOSE:

Test the MINI MONITOR for proper operation

BOARDS REQUIRED:

CPU BOARD
DEBUG BOARD
MINI MONITOR

TEST NUMBER SWITCH:

2

TEST QUALIFIER SWITCH:

Any position will work

TEST DESCRIPTION:

Place MINI MONITOR ROTARY SWITCH in "1" position. Press "Start" button. MINI MONITOR LED'S in left hand column will light one at a time. Each should light 4 times. When a column is done then some of the LED'S in the next column will flash at the same time. Turn ROTARY SWITCH to next position and same action takes place. Proceed through each column by placing the switch in the appropriate position and then observe the LED'S.

Each LED on the MINI MONITOR should light. If any LED'S do not light or the test does not advance to the selected column then replace the MINI MONITOR. When the test is complete the "Waiting" LED on the DEBUG BOARD should flash.

The AUTO REPEAT BUTTON will allow the test to be repeated automatically. This can be helpful in detecting a board with an intermittent problem failure.

THIS IS A VISUAL TEST ONLY. THE MIPROM CAN NOT DETECT A FAULTY LED OR SWITCH.

TEST NAME:
6X PROM BOARD

TEST PURPOSE:
Verify CHECKSUM of program

BOARDS REQUIRED:
CPU BOARD
DEBUG BOARD
MINI MONITOR
6X PROM BOARD (P-16774)

TEST NUMBER SWITCH:
3

TEST QUALIFIER SWITCH:
Corresponds to the number of PROM CHIPS in the PROM BOARD.

TEST DESCRIPTION:
Remove power from MIPROM. Insert PROM BOARD into the piggy back slot on the DEBUG BOARD. Place MINI MONITOR ROTARY SWITCH in position "1". Turn on power. Press "Start" button.

When test is complete a number or letter should appear on the MINI MONITOR. This is the first digit of a four digit code. Rotate the switch through all 4 positions noting the corresponding number or letter displayed. The four digit code should match the CHECKSUM ("CHKSM") noted by the factory on the PROM BOARD. The DEBUG BOARD will not indicate "Pass" or "Fail" on this test.

EXAMPLE OF MINI MONITOR CHECKSUM READOUT

SWITCH IN POSITION "1" = FIRST DIGIT OF CHECKSUM
SWITCH IN POSITION "2" = SECOND DIGIT OF CHECKSUM
SWITCH IN POSITION "3" = THIRD DIGIT OF CHECKSUM
SWITCH IN POSITION "4" = FOURTH DIGIT OF CHECKSUM

CHECKSUM OF PROMS = E 3 7 A

EXAMPLE:
POSITION "1" DISPLAYS "E" <
POSITION "2" DISPLAYS "3" <
POSITION "3" DISPLAYS "7" <
POSITION "4" DISPLAYS "A" <

If the codes do not match then the PROM BOARD is bad. The PROM CHIPS may work in another P-16774 CIRCUIT BOARD. If not then a new set of PROM CHIPS and CIRCUIT BOARD is required from the factory.

TEST NAME:

4X PRAM TEST

TEST PURPOSE:

Test the 4X PRAM BOARD RAM and verify program CHECKSUM

BOARDS REQUIRED:

CPU BOARD
DEBUG BOARD
MINI MONITOR
4X PRAM BOARD (P-16992)

TEST NUMBER SWITCH:

B

TEST QUALIFIER SWITCH:

Corresponds to the number of PROM CHIPS in the PROM BOARD

TEST DESCRIPTION:

Remove power from MIPROM. Insert PROM BOARD into the piggy back slot on the DEBUG BOARD. Place MINI MONITOR ROTARY SWITCH in position "1". Turn on power. Press "Start" button. A memory test of the RAM on the board will be run first. If this passes the following CHECKSUM TEST will be performed.

When the CHECKSUM TEST is complete a number or letter should appear on the MINI MONITOR. This is the first digit of a four digit code. Rotate the switch through all 4 positions noting the corresponding number or letter displayed. The four digit code should match the CHECKSUM ("CHKSM") noted by the factory on the PROM BOARD.

EXAMPLE OF MINI MONITOR CHECKSUM READOUT

SWITCH IN POSITION "1" = FIRST DIGIT OF CHECKSUM
SWITCH IN POSITION "2" = SECOND DIGIT OF CHECKSUM
SWITCH IN POSITION "3" = THIRD DIGIT OF CHECKSUM
SWITCH IN POSITION "4" = FOURTH DIGIT OF CHECKSUM

CHECKSUM OF PROMS = E 3 7 A

EXAMPLE:
POSITION "1" DISPLAYS "E" <
POSITION "2" DISPLAYS "3" <
POSITION "3" DISPLAYS "7" <
POSITION "4" DISPLAYS "A" <

If the codes do not match then the PROM BOARD is bad. The PROM CHIPS may work in another P-16992 CIRCUIT BOARD. If not then a new set of PROM CHIPS and CIRCUIT BOARD is required from the factory.

The DEBUG BOARD will not indicate "Pass" or "Fail" on this test.

TEST NAME:

3X PROM WITH DIP SWITCH

TEST PURPOSE:

Verify operation of the DIP SWITCHES on the board and verify CHECKSUM of PROM CHIPS.

BOARDS REQUIRED:

CPU BOARD
DEBUG BOARD
MINI MONITOR
3X PROM BOARD with DIP SWITCH (P-15885)

TEST NUMBER SWITCH:

A

TEST QUALIFIER SWITCH:

Corresponds to the number of PROM CHIPS in the PROM BOARD

TEST DESCRIPTION:

Remove power from MIPROM. Insert PROM BOARD into the piggy back slot on the DEBUG BOARD. Place MINI MONITOR ROTARY SWITCH in position "1". Turn on power. Press "Start" button.

A test of the DIP SWITCHES on the board will be run first. Note the position of the DIP SWITCHES before changing the positions of them. Any DIP SWITCH that is placed in the "Open" position will cause a LED in the second column of the MINI MONITOR to light. The bottom switch will light the bottom LED, and the top will light the top LED. If a DIP SWITCH fails to light the corresponding LED then the board has failed the test. If the DIP SWITCH is not used during normal operation then the board may still work. When satisfied that the DIP SWITCHES are working properly press the "Step" button to make the DEBUG BOARD run the CHECKSUM TEST.

When the CHECKSUM TEST is complete a number or letter should appear on the MINI MONITOR. This is the first digit of a four digit code. Rotate the switch through all 4 positions noting the corresponding number or letter displayed. The four digit code should match the CHECKSUM ("CHKSM") noted by the factory on the PROM BOARD.

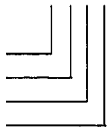
SEE NEXT PAGE FOR SAMPLE CHECKSUM READOUT CODE.

EXAMPLE OF MINI MONITOR CHECKSUM READOUT

SWITCH IN POSITION "1" = FIRST DIGIT OF CHECKSUM
SWITCH IN POSITION "2" = SECOND DIGIT OF CHECKSUM
SWITCH IN POSITION "3" = THIRD DIGIT OF CHECKSUM
SWITCH IN POSITION "4" = FOURTH DIGIT OF CHECKSUM

CHECKSUM OF PROMS = E 3 7 A

EXAMPLE: POSITION "1" DISPLAYS "E" <
POSITION "2" DISPLAYS "3" <
POSITION "3" DISPLAYS "7" <
POSITION "4" DISPLAYS "A" <



If the codes do not match then the PROM BOARD is bad. The PROM CHIPS may work in another P-15885 CIRCUIT BOARD. If not then a new set of PROM CHIPS and CIRCUIT BOARD is required from the factory.

The DEBUG BOARD will not indicate "Pass" or "Fail" on this test.

TEST NAME:

3X PROM WITH DIP SWITCH AND RAM

TEST PURPOSE:

Verify operation of the DIP SWITCHES and RAM on the board and verify CHECKSUM of PROM CHIPS.

BOARDS REQUIRED:

CPU BOARD
DEBUG BOARD
MINI MONITOR
3X PROM with DIP SWITCH and RAM (P-15889)

TEST NUMBER SWITCH:

A

TEST QUALIFIER SWITCH:

9 = 1 PROM CHIP on board
A = 2 PROM CHIPS on board
B = 3 PROM CHIPS on board

TEST DESCRIPTION:

Remove power from MIPROM. Insert PROM BOARD into the piggy back slot on the DEBUG BOARD. Place MINI MONITOR ROTARY SWITCH in position "1". Turn on power. Press "Start" button.

A memory test of the RAM on the board will be run first. If this part of the test fails then the "Waiting" LED and the "Fail" LED on the DEBUG BOARD will flash. If this part of the test passes then only the "Testing" LED will flash and the DIP SWITCH TEST will begin automatically.

Note the position of the DIP SWITCHES before changing the positions of them. Any DIP SWITCH that is placed in the "Open" position will cause a LED in the second column of the MINI MONITOR to light. The bottom switch will light the bottom LED, and the top will light the top LED. If a DIP SWITCH fails to light the corresponding LED then the board has failed the test.

When satisfied that the DIP SWITCHES are working properly press the "Step" button to make the DEBUG BOARD run the CHECKSUM TEST.

When the CHECKSUM TEST is complete a number or letter should appear on the MINI MONITOR. This is the first digit of a four digit code. Rotate the switch through all 4 positions noting the corresponding number or letter displayed. The four digit code should match the CHECKSUM ("CHKSM") noted by the factory on the PROM BOARD.

EXAMPLE OF MINI MONITOR CHECKSUM READOUT

SWITCH IN POSITION "1" = FIRST DIGIT OF CHECKSUM
SWITCH IN POSITION "2" = SECOND DIGIT OF CHECKSUM
SWITCH IN POSITION "3" = THIRD DIGIT OF CHECKSUM
SWITCH IN POSITION "4" = FOURTH DIGIT OF CHECKSUM

CHECKSUM OF PROMS = E 3 7 A

EXAMPLE:
POSITION "1" DISPLAYS "E" <
POSITION "2" DISPLAYS "3" <
POSITION "3" DISPLAYS "7" <
POSITION "4" DISPLAYS "A" <

If the codes do not match then the PROM BOARD is bad. The PROM CHIPS may work in another P-15889 CIRCUIT BOARD. If not then a new set of PROM CHIPS and CIRCUIT BOARD is required from the factory.

The DEBUG BOARD will not indicate "Pass" or "Fail" on the CHECKSUM TEST.

TEST NAME:

4X PROM WITH RAM

TEST PURPOSE:

Verify operation of the RAM on the board and verify CHECKSUM of PROM CHIPS.

BOARDS REQUIRED:

CPU BOARD
DEBUG BOARD
MINI MONITOR
4X PROM with RAM (P-15883)

TEST NUMBER SWITCH:

A

TEST QUALIFIER SWITCH:

9 = 1 PROM CHIP on board
A = 2 PROM CHIPS on board
B = 3 PROM CHIPS on board
C = 4 PROM CHIPS on board

TEST DESCRIPTION:

Remove power from MIPROM. Insert PROM BOARD into the piggy back slot on the DEBUG BOARD. Place MINI MONITOR ROTARY SWITCH in position "1". Turn on power. Press "Start" button.

A memory test of the RAM on the board will be run first. If this part of the test fails then the "Waiting" LED and the "Fail" LED on the DEBUG BOARD will flash. If this part of the test passes then only the "Testing" LED will flash. You must then press the "Step" button to proceed to the CHECKSUM portion of the test.

When the CHECKSUM TEST is complete a number or letter should appear on the MINI MONITOR. This is the first digit of a four digit code. Rotate the switch through all 4 positions noting the corresponding number or letter displayed. The four digit code should match the CHECKSUM ("CHKSM") noted by the factory on the PROM BOARD.

SEE NEXT PAGE FOR SAMPLE CHECKSUM READOUT CODE.

EXAMPLE OF MINI MONITOR CHECKSUM READOUT

SWITCH IN POSITION "1" = FIRST DIGIT OF CHECKSUM
SWITCH IN POSITION "2" = SECOND DIGIT OF CHECKSUM
SWITCH IN POSITION "3" = THIRD DIGIT OF CHECKSUM
SWITCH IN POSITION "4" = FOURTH DIGIT OF CHECKSUM

CHECKSUM OF PROMS = E 3 7 A

EXAMPLE:
POSITION "1" DISPLAYS "E" <
POSITION "2" DISPLAYS "3" <
POSITION "3" DISPLAYS "7" <
POSITION "4" DISPLAYS "A" <

If the codes do not match then the PROM BOARD is bad. The PROM CHIPS may work in another P-15883 CIRCUIT BOARD. If not then a new set of PROM CHIPS and CIRCUIT BOARD is required from the factory.

The DEBUG BOARD will not indicate "Pass" or "Fail" on this test.

TEST NAME:

INPUT BOARD TEST

TEST PURPOSE:

Verify that input information is being read by the MIPROM CPU. This will test the INPUT BOARD and I/O INTERFACE BOARD. At least one OUTPUT BOARD must be installed in the CARD RACK to test the I/O INTERFACE BOARD.

BOARDS REQUIRED:

CPU BOARD
DEBUG BOARD
MINI MONITOR
I/O INTERFACE BOARD
INPUT BOARD(S) (All P-Numbers)
OUTPUT BOARDS(S) optional

TEST LEAD WITH SERIES LIGHT BULB

TEST NUMBER SWITCH:

6

TEST QUALIFIER SWITCH:

"0" through "F" corresponding to the position of the first OUTPUT BOARD.
Example: If first OUTPUT BOARD is "EC6" then set dial on "6".

Note: If this is not set correctly then the MIPROM could be damaged.

TEST DESCRIPTION:

Remove power to the MIPROM by turning switches SW1 and SW2 on the POWER SUPPLY CONNECT BOARD to the "Off" position. Remove the wires connected to the terminals of the INPUT BOARD(S) to be tested. Remove the wires from the first OUTPUT BOARD terminals. The OUTPUTS will turn on during the test, so anything connected to them will operate if wired to the terminal (Example: doors could open, pump motor could start, bells could ring, etc...).

Connect a TEST LEAD WITH A SERIES LIGHT BULB to a suitable voltage supply which uses the same common as the INPUT BOARD being tested. Each INPUT requires at least 35 volts to turn on so too high of a resistance in the BULB/TEST LEAD could prevent the INPUT from turning on.

CAUTION!!!
BI-LOGIC INPUT BOARDS MAY NOT BE REFERENCED BACK TO "L1A". USING "SS" OR "L2A" TO TEST THE INPUT TERMINALS MAY CAUSE SERIOUS DAMAGE TO THE CONTROLLER AND/OR THE PERSON PERFORMING THE TEST.

Turn switches SW1 and SW2 to the "On" position. Press the "Start" button on the DEBUG BOARD. The third column of the MINI MONITOR should light the bottom LED. This corresponds to the first INPUT BOARD position. Using the TEST LEAD, touch EACH of the INPUT TERMINALS. The corresponding LED on the INPUT BOARD, on the first OUTPUT BOARD and in the second column of the MINI MONITOR should light. Note any of the INPUT TERMINALS that fail this test. To test the next INPUT BOARD press the "Step" button, the LED in the third column of the MINI MONITOR should advance up one LED to indicate that the SECOND INPUT BOARD will now be tested, then repeat the test procedure. As each INPUT TERMINAL is tested the LED'S on the first OUTPUT BOARD, which correspond to the INPUT TERMINAL POSITION, should also turn on.

TEST FAILURES:

If the LED on the INPUT BOARD fails to light then replace the INPUT BOARD and retest. Each INPUT requires at least 35 volts to turn on so too high of a resistance in the BULB/TEST LEAD could prevent the INPUT from turning on.

If the input LED lights, but it fails to light the corresponding LED on the MINI MONITOR then replace the INPUT BOARD and retest. If the new board displays the same failure then replace the I/O INTERFACE BOARD and retest.

If the input LED lights, and the corresponding MINI MONITOR LED lights, but the corresponding OUTPUT BOARD LED fails to light then replace the OUTPUT BOARD and retest. If the new OUTPUT BOARD displays the same failure then replace the I/O INTERFACE BOARD and retest.

If more than one LED lights on the INPUT BOARD, or more than one LED lights on the MINI MONITOR in column 2 then replace the INPUT BOARD and retest. If the new INPUT BOARD displays the same failure then replace the I/O INTERFACE BOARD and retest.

If more than one LED lights on the OUTPUT BOARD, and more than one LED lights on the MINI MONITOR in column 2 then replace the INPUT BOARD and retest. If the new board displays the same failure then replace the I/O INTERFACE BOARD and retest.

If more than one LED lights only on the OUTPUT BOARD then replace the OUTPUT BOARD and retest. If the new board displays the same failure then replace the I/O INTERFACE BOARD and retest.

If the LIGHT BULB glows brightly when connected to an INPUT TERMINAL then replace the INPUT BOARD and retest. If this happens again then verify that the voltage

supply being used is referenced to the INPUT BOARD'S COMMON (Pigtail Wire).

If test continues to fail then remove the TIMER BOARD and all INPUT BOARDS, and all but first OUTPUT BOARD and then retest the board. A bad board somewhere in the MIPROM may interfere with the test you are performing.

TEST NAME:
OUTPUT TEST

TEST PURPOSE:
To verify that each of the OUTPUT BOARDS terminals will turn on and off.

BOARDS REQUIRED:
CPU BOARD
DEBUG BOARD
MINI MONITOR
I/O INTERFACE BOARD
OUTPUT BOARD(S) (Any P-Number)

TEST NUMBER SWITCH:
7

TEST QUALIFIER SWITCH:
"0" through "F" corresponding to the position of the first OUTPUT BOARD. Example: If first OUTPUT BOARD is "EC6" then set dial on "6".

Note: If this is not set correctly then the MIPROM could be damaged.

TEST DESCRIPTION:
Remove power to the MIPROM by turning switches SW1 and SW2 on the POWER SUPPLY CONNECT BOARD to the "Off" position. Remove the wires from the terminals of the OUTPUT BOARD(S) being tested (this cannot be done on the RELAY OUTPUT BOARD). The OUTPUTS will turn on during the test, so anything connected to them will operate if wired to the terminal (Example: doors could open, pump motor could start, bells could ring, etc...).

Connect a TEST LEAD WITH A SERIES LIGHT BULB to a suitable voltage supply such as "SS" or "L2A" if it is an AC OUTPUT BOARD, or "DC+" if it is a DC OUTPUT BOARD. RELAY OUTPUT BOARDS may be either AC or DC. Use a light bulb with a suitable voltage rating. Too high of a resistance or incorrect voltage rating in the test light bulb could prevent the OUTPUT from turning it on.

CAUTION!!!
RELAY OUTPUT BOARD COMMON CAN BE A.C. OR D.C., AND CAN BE EITHER THE POWER SUPPLY OR THE GROUND OF THE POWER SUPPLY. TAKE CARE IN CONNECTING THE TEST LEAD. AN INCORRECT CONNECTION MAY CAUSE SERIOUS DAMAGE TO THE CONTROLLER AND/OR PERSON PERFORMING THE TEST.

Turn on switches SW1 and SW2. Press the start button on the DEBUG BOARD. The third column of the MINI MONITOR should light the bottom LED. This corresponds to the FIRST OUTPUT BOARD POSITION. The LED'S on the

OUTPUT BOARD will light one at a time starting at the top of the OUTPUT BOARD. The corresponding LED in the second column of the MINI MONITOR should light. Using the TEST LEAD, touch each of the output terminals and make sure that they will turn the light on and then turn it off again. The RELAY OUTPUT BOARD must have the MOLEX CONNECTOR plugged into the board to supply 24VDC to some of the circuitry. You should be able to hear the relay click on and off.

To test each set of OUTPUT RELAY CONTACTS, connect the TEST LIGHT IN PARALLEL with the OUTPUT CONTROLLED DEVICE. Connect one end of the TEST LIGHT to test points "1A" through "8A" on the RELAY OUTPUT BOARD, the other end to the OPPOSITE side of the OUTPUT CONTROLLED DEVICE. When the OUTPUT LED turns on the LIGHT BULB should GLOW. Each output terminal should be allowed to turn the TEST LIGHT ON, AND turn it OFF. Note any of the output terminals that fail this test.

To move on to the next board press the "Step" button, the LED in the third column of the MINI MONITOR should advance up one LED to indicate that the next OUTPUT BOARD will now be tested, then repeat the test procedure.

TEST FAILURES:

If the OUTPUT LED lights, but it fails to light the TEST LIGHT then replace the OUTPUT BOARD and retest. If the new board displays the same failure then check the TEST LEAD/LIGHT BULB and retest.

If the MINI MONITOR LED lights, but the corresponding OUTPUT BOARD LED fails to light then replace the OUTPUT BOARD and retest. If the NEW OUTPUT BOARD displays the same failure then replace the I/O INTERFACE BOARD and retest.

If more than one LED lights on the OUTPUT BOARD then replace the OUTPUT BOARD and retest. If the NEW OUTPUT BOARD displays the same failure then replace the I/O INTERFACE BOARD and retest.

If the LIGHT BULB glows brightly when connected to an output terminal that does NOT have it's LED on then replace the OUTPUT BOARD and retest.

If test continues to fail then remove the TIMER BOARD and all INPUT BOARDS, and OUTPUT BOARDS not needed for the test and then retest the board. A bad board somewhere in the MIPROM may interfere with the test you are performing.

TEST NAME:

TIMER TEST

TEST PURPOSE:

Verify that CPU can start the TIMERS, read the TIMERS and that the TIMERS will time out.

See "Set Timer" test to set the length of each TIMER.

BOARDS REQUIRED:

CPU BOARD
DEBUG BOARD
MINI MONITOR
I/O INTERFACE BOARD
TIMER BOARD

TEST NUMBER SWITCH:

4X TIMER P-15758 = 4
4X TIMER P-16779 = 5
8X TIMER P-15759 = 4
9X TIMER P-16780 = 5
14X TIMER P-15760 = 4

TEST QUALIFIER SWITCH:

4X TIMER P-15758 = 4
4X TIMER P-16779 = 4
8X TIMER P-15759 = 8
9X TIMER P-16780 = 9
14X TIMER P-15760 = E

TEST DESCRIPTION:

Press the "Start" button. All of the TIMERS on the board will be tested at the same time. Each of the LED'S should light. On the 9X TIMER the bottom LED will light whenever any of the bottom 5 TIMERS are timing. This is because the MIPROM CPU can use only one of the BOTTOM 5 TIMERS at any time. Next the TIMERS will be tested individually. Again each LED should light to indicate that the TIMER has begun timing.

The LED'S on the first column of the MINI MONITOR will light to show which TIMERS are being tested. The LED'S in the second column of the MINI MONITOR will light to show which TIMERS are actually timing and being read by the CPU. When the 14X TIMER is being tested the TOP 8 TIMERS will be tested first and then the BOTTOM 6 TIMERS will be tested. The bottom LED on the MINI MONITOR represents the TOP TIMER on the TIMER BOARD.

The DEBUG BOARD will light the "Pass" LED if the board passes the test.

TEST FAILURES:

If the "Fail" LED flashes then replace the TIMER BOARD and retest. If the new board fails then replace the I/O INTERFACE BOARD and retest.

If any LED on the TIMER BOARD fails to light but the corresponding LED on the MINI MONITOR lights then replace the TIMER BOARD and retest. If board displays same problem replace I/O INTERFACE BOARD and retest.

The DEBUG TEST cannot detect if a TIMER on the board will not time out. This requires visual observation by the person running the test. All TIMER LED'S and MINI MONITOR LED'S should turn OFF when the TIMERS expire.

TEST NAME:

SET TIMER

Always run the "Timer Test" before setting the TIMERS. Adjusting a BAD TIMER BOARD is just wasted time and effort!

TEST PURPOSE:

Set the length of TIMER for each TIMER

TEST NUMBER SWITCH:

4X TIMER P-15758 = 8
4X TIMER P-16779 = 9
8X TIMER P-15759 = 8
9X TIMER P-16780 = 9
14X TIMER P-15760 = 8

TEST QUALIFIER SWITCH:

Set on "1" through "E" to select each TIMER.
"1" = TIMER #1 (Top) through "9" = TIMER #9
"A" = TIMER #10
"B" = TIMER #11
"C" = TIMER #12
"D" = TIMER #13
"E" = TIMER #14

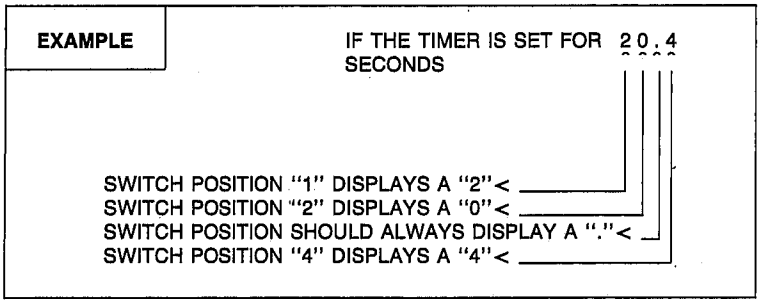
TEST DESCRIPTION:

The "Timer Test" should be run before setting the TIMERS. The "Timer Test" will determine whether the board is working properly or not.

Place the MINI MONITOR ROTARY SWITCH in position "1". Press "Start" button. The LED for the TIMER being adjusted will light on the TIMER BOARD. A LED in the first column of the MINI MONITOR will light to indicate which TIMER is being tested. A LED in the second MINI MONITOR column will light to indicate which TIMER is being read by the CPU.

When a TIMER has expired a three digit code will be displayed on the MINI MONITOR screen which will represent the length of time that the TIMER is currently adjusted for. With the ROTARY SWITCH IN POSITION "1" the TENS OF SECONDS code digit is displayed on the screen. With the ROTARY SWITCH IN POSITION "2" the SECONDS code digit is displayed on the screen. With the ROTARY SWITCH IN POSITION "3" a DECIMAL POINT is displayed on the screen. With the ROTARY SWITCH IN POSITION "4" the TENTHS OF A SECOND digit is displayed on the screen.

If the TIMER needs to be adjusted then turn the corresponding potentiometer on the TIMER BOARD CLOCKWISE TO INCREASE the time and COUNTERCLOCKWISE TO DECREASE the time.



TEST FAILURE:

If the board passes the "Timer Test" above then the board should be good. Always run the "Timer Test" first.

DEBUG TEST QUICK REFERENCE		
TEST NAME	TEST NUMBER	TEST QUALIFIER
CPU/DEBUG	1	ANY POSITION WILL WORK
MINI MONITOR	2	ANY POSITION WILL WORK
6X PROM BOARD P-16774	3	CORRESPONDS TO NUMBER OF PROM CHIPS ON BOARD
4X PRAM BOARD P-16992	B	CORRESPONDS TO NUMBER OF PROM CHIPS ON BOARD
3X PROM W/DIPS P-15885	A	CORRESPONDS TO NUMBER OF PROM CHIPS ON BOARD
3X PROM W/DIPS AND RAM P-15889	A	9 = 1 PROM CHIP INSTALLED A = 2 PROM CHIPS INSTALLED B = 3 PROM CHIPS INSTALLED
4X PROM W/RAM P-15883	A	9 = 1 PROM CHIP INSTALLED A = 2 PROM CHIPS INSTALLED B = 3 PROM CHIPS INSTALLED C = 4 PROM CHIPS INSTALLED
INPUT BOARD ALL P-NUMBERS	6	"0"THROUGH "F" CORRESPONDING TO THE POSITION OF FIRST OUTPUT BOARD.
OUTPUT TEST ALL P-NUMBERS	7	"0" THROUGH "F" CORRESPONDING TO THE POSITION OF FIRST OUTPUT BOARD.
4X TIMER TEST P-15758	4	4
4X TIMER TEST P-16779	5	4
8X TIMER TEST P-15759	4	8
9X TIMER TEST P-16780	5	9
14X TIMER TEST P-15760	4	E

SET TIMERS		
4X P-15758 4X P-16779 8X P-15759 9X P-16780 14X P-15760	8 9 8 9 8	"0" THROUGH "E" TO SELECT EACH TIMER. "1" = TIMER 1 (Top) THRU "9" = TIMER 9 "A" = TIMER 10 "D" = TIMER 13 "B" = TIMER 11 "E" = TIMER 14 "C" = TIMER 12

TROUBLESHOOTING HINTS

1) MOST OFTEN THE PROBLEM WILL NOT BE IN THE MIPROM I CONTROLLER. NOTE OR WRITE DOWN THE STATUS OF THE MIPROM I INPUTS AND OUTPUTS, INCLUDING THE MINI MONITOR LED'S IF IT IS PLUGGED IN. THIS INFORMATION MAY LEAD YOU TO A FAULTY DEVICE ON THE CAR, IN THE HOISTWAY, OR ON THE RELAY INTERFACE PANEL. THE INFORMATION YOU NOTE WILL BE VERY HELPFUL IF YOU SHOULD REQUIRE ASSISTANCE FROM SOMEONE NOT ON SITE.

   REFER TO SEQUENCE OF OPERATION LISTINGS FOR ASSISTANCE IN DETERMINING PROPER INPUT, OUTPUT, TIMER, AND RELAY STATUS.

2) ALWAYS CHECK ALL VOLTAGES ON THE MIPROM I CONTROLLER BEFORE PERFORMING ANY OF THE DEBUG TESTS. IF ANY DIFFER FROM THE SPECIFIED TOLERANCES CORRECT THE PROBLEM AND SEE IF THE MIPROM WILL THEN OPERATE PROPERLY BEFORE PROCEEDING.

3) THE CPU AND DEBUG BOARD TEST SHOULD ALWAYS BE DONE BEFORE ANY OF THE OTHER TESTS. IF THE CPU TEST PASSES BUT NO OTHER TESTS WILL OPERATE THEN REPLACE THE MINI MONITOR.

4) IF THE CPU CARD RACK (P-16801) IS NOT REVISION 2 OR NEWER THE I/O INTERFACE BOARD WILL BE REQUIRED ON ALL TESTS.

5) TRY RUNNING TEST WITH AS FEW BOARDS AS ARE REQUIRED. THEN RUN THE TEST WITH ALL OF THE BOARDS IN THE CARD RACKS. ONE BAD BOARD MAY CAUSE ANOTHER BOARD TO FAIL.

6) SEPERATE CARD RACKS BY DISCONNECTING THE INTERCONNECTING RIBBON CABLE FROM FIRST CARDRACK TO ANY ADDITIONAL CARDRACKS THEN REPEAT THE TEST. A BAD BOARD IN ANOTHER CARDRACK OR A BAD CARDRACK MAY INTERFERE WITH THE TEST YOU ARE RUNNING.

7) THE "AUTO REPEAT" BUTTON CAN BE USED TO DETECT AN INTERMITTENT BOARD FAILURE ON SOME TESTS. THE TEST WILL REPEAT UNTIL IT FAILS OR IS STOPPED BY REMOVING POWER OR PRESSING THE "RESET" BUTTON ON THE DEBUG BOARD. THE TEST WILL END IF A FAILURE IS DETECTED.