Fisher Controls

Maintenance Manual

Maintaining the Type DM6001 Multiplexer Control Unit

FISHER®

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Maintaining the Type DM6001 Multiplexer Control Unit

July 1990

MM4.11:DM6001 Rev A

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Section 1
Introduction

1.1 Scope of Manual

This manual describes maintenance of the Type DM6001 Multiplexer Control Unit. The discussion includes a description of the unit, theory of operation, preventive maintenance, fault isolation and corrective maintenance, and removal and installation procedures. Table 1-1 lists related documents.

Table 1-1 Related Documents

PN4:002	Planning the Installation
PN4:003	AC and DC Power and Ground Wiring
PN4:004	Signal Wiring and Data Highway Guidelines
PN4:006	Environmental Conditions for Instrumentation Systems

1.2 Product Description

The Type DM6001 Multiplexer Control Unit (MCU) provides an interface between the data highway and analog and discrete input and output units by performing three major functions:

- o **Data Highway Interface** - Accepts commands from and passes information to the data highway.
- o **Input Signal Interface** - Accepts and processes signals from field devices received through multiplexer input units.
- o **Output Signal Interface** - Converts data highway output commands to electrical signals transmitted through multiplexer output units to field devices.

Figure 1-1 shows a general overview of an instrumentation system with a multiplexer control unit and multiplexer I/O units.

1.3 Detailed Product Descriptions

The Type DM6001 Multiplexer Control Unit consists of the following:

- o Card file
- o Card set

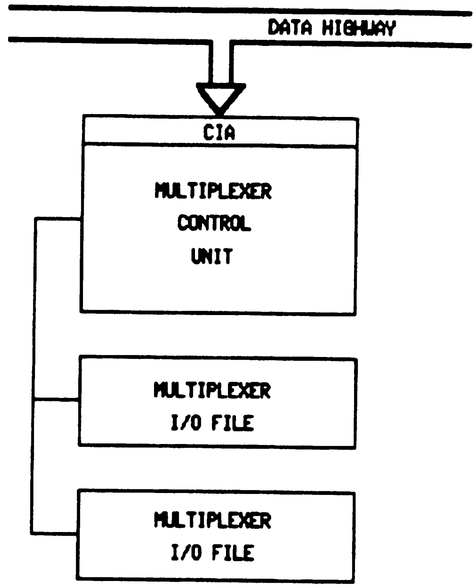

Figure 1-1. System Overview

The card set includes the following circuit cards:

- o Microprocessor Unit/Read-Only-Memory (MPU/ROM) card
- o Additional ROM card (older units only)
- o Random Access Memory (RAM) card or cards
- o Type DH7001 Communications Interface Assembly (CIA) card
- o Power converter card
- o Parallel I/O interface card

In addition to the basic card set, the following cards may be added:

- o One additional CIA card (for redundant communications)
- o Type DM7052 Memory Assembly (nonvolatile)

Figure 1-2 shows the MCU card file layout.

1.3.1 Multiplexer Control Unit Card File

The card file mounts on standard 19-inch (483 mm) EIA rails in a system cabinet. A backplane mounted in the rear of the card file provides the required connections and wiring for the card set.

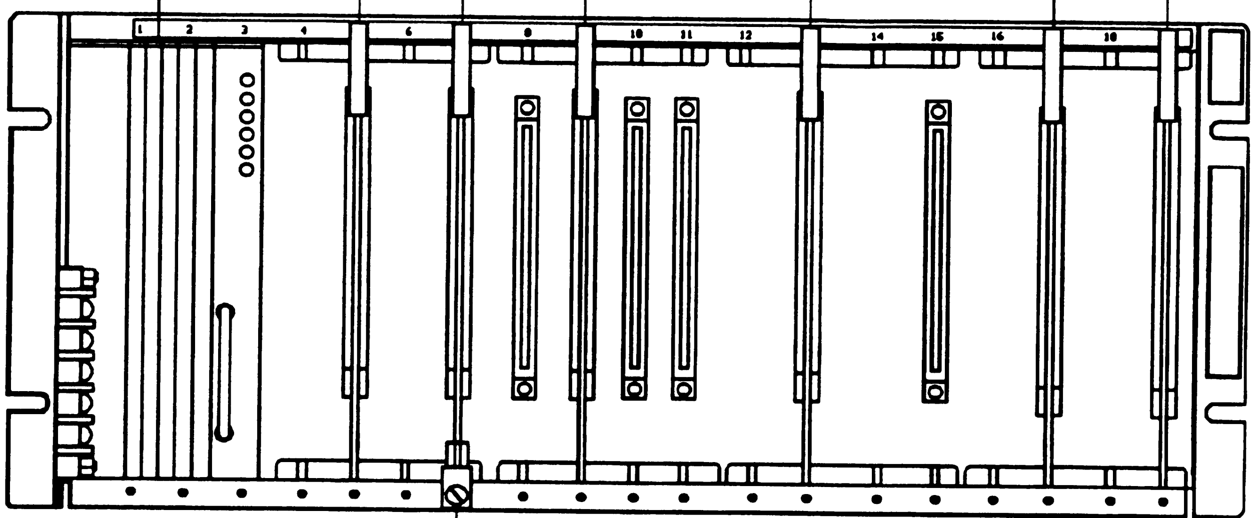

Figure 1-2. MCU Card File Layout

1.3.2 MPU/ROM Card

The MPU/ROM card contains read-only memory, random access memory (RAM), and processes message information for communication between I/O units and the data highway. The card also provides a watchdog timer to monitor communications activity, reset circuitry, interrupt processing, and two status LED's.

1.3.3 Additional ROM Card

Older units have an additional ROM card to provide expanded memory capability for the unit. More recent variations of the MPU/ROM cards have additional memory that eliminate the card.

1.3.4 Random Access Memory (RAM) Card

Older units have one to three Type DM7051 Memory Assemblies (random access). The Type DM7051 assembly provides 8K bytes (K = 1024) of random access memory. More recent variations provide a single DH7201 Random Access Memory card with 24K bytes of memory.

1.3.5 Type DH7001 Communications Interface Assembly (CIA) Card

The communications interface assembly connects the multiplexer control unit to the primary data highway. For systems using redundant communications, a second CIA connects to the secondary highway.

1.3.6 Power Converter Card

The power converter card converts 24 volt dc system power to the voltages required by the circuit cards.

1.3.7 Parallel I/O Interface Card

The parallel I/O interface card links the MCU to the multiplexer I/O files. An arithmetic processor unit (APU) on the card converts between multiplexer data values and engineering unit values reported on the data highway.

1.3.8 Type DM7052 Memory Assembly (nonvolatile)

When used, the optional nonvolatile memory assembly protects multiplexer point configuration for I/O channels during power outages.

Table 1-2. Specifications

TOTAL I/O CAPACITY	Maximum combined total of 288 analog and discrete input and output points (four discrete input channels = one discrete point), subject to constraints of scan loading
POINT CONFIGURATION PROTECTION	With the Type DM7052 Memory Assembly installed, no less than 24 hour retention of point configuration during power outage
SCANNING TIMES	0.25, 0.5, 1, 5, 10, 15, 30, or 60 seconds, selected for each point
PERIODIC AND PERIODIC-EXCEPTION REPORTING	**Periodic Reporting Interval:** 0.25, 0.5, 1, 5, 10, 15, 30, or 60 seconds

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Table 1-2. Specifications (continued)

	Periodic-Exception Deadbands: 0.03125, 0.0625, 0.125, 0.25, 0.5, 1, 2, or 4% of span.(1) Reports addressable to a maximum of eight highway devices in older MCU's or a maximum of 24 highway devices in MCU's with extended reporting capability. A single point may have different reporting intervals to different devices. Deadband for a single point is the same for all devices.
FAILSAFE TIMEOUT INTERVALS	0.25, 0.5, 1, 5, 10, 15, 30, or 60 seconds, selected for each output point
CONTROL UNIT SWITCHES AND INDICATORS	**Microprocessor Unit and Read-Only Memory (MPU/ROM) Card:** Pause switch disengages communications. Switch manually resets microprocessor. Red LED indicates communications interface assembly (CIA) reset. Green LED indicates watchdog timer (WDT) armed **Communications Interface Assembly:** Green LED indicates WDT armed. Switch sets highway and device address **Power Converter Card:** Green LED indicates normal operation
POWER REQUIRED	21 to 28 volts dc at nominal 1.2 amperes for base unit. Add 0.4 ampere for nonvolatile memory and 0.5 ampere for second CIA.
ELECTRICAL CLASSIFICATION	Refer to Nonhazardous Area Classification Bulletin, PS4.7:001(A1)
MOUNTING	File mounts on standard 19-inch (483 mm) EIA rails. Each file requires 7 inches (178 mm) of vertical rail space
WEIGHT	**Base Unit:** 19.06 pounds (8.7 kg) **Nonvolatile Memory Assembly:** 9 ounces (0.25 kg) **Communications Interface Assembly:** 11 ounces (0.30 kg)

Table 1-2. Specifications (continued)

OPERATING CONDITIONS

Conditions	Reference Limits[1]	Normal Limits[1]	Operative Limits[1]	Transport & Storage Limits[1]
Ambient Temperature[1]	73 to 81°F (23 to 27°C)	41 to 122°F (5 to 50°C)	32 to 131°F (0 to 55°C)	-40 to 149°F (-40 to 65°C)
Maximum Temperature Variation	3.5°F/h (2°C/h)	36°F/h (20°C/h)	9°F/min (5°C/min)	18°F/min (10°C/min)
Ambient Relative Humidity w/o Condensation	35 to 45%	10 to 90%	5 to 95%	5 to 95%
Electro-magnetic Field[2]	100 mV/m 20 to 1000 MHz	10 V/m 20 to 1000 MHz	30 V/m 20 to 1000 MHz	

Notes:
1. ISA Standard S71.04-1985.
2. SAMA Standard PM33.1-1978 explains these conditions, which apply only when all cabinet doors are closed.

Section 2
Theory of Operation

2.1 Scope

This section describes theory of operation and functions of the components that make up the Multiplexer Control Unit (MCU).

2.2 Functional Description

The MCU is a microprocessor-based, communicating device that connects multiplexer I/O units with local and network PROVOX• Instrumentation System Data Highways. When configured, the MCU routinely samples selected inputs for reporting to the highway and generates selected outputs for the process being controlled. The MCU also responds to highway-transmitted requests for these signals and values.

The MCU performs continuous self-tests and checks the interface between the unit and I/O card files. Self-test errors and interface errors are reported to the system data highway and indicated on instrumentation system console displays and LED indicators on the front of MCU cards.

The overall operation of the MCU is controlled by the firmware in the MPU/ROM card. It regulates traffic flow between the CIA shared memory and RAM. The CIA provides direct interface with the data highway. The Parallel I/O Interface card provides a buffer between I/O units and RAM. Figure 2-1 illustrates a functional block diagram of the MCU.

A reset switch on the MPU/ROM card initiates a reset of the MCU including the communications interface assemblies and the MPU/ROM card. The RUN/PAUSE switch on the MPU/ROM card causes the MPU to stop processing when in the PAUSE position. When the RUN/PAUSE switch is returned to RUN, it initiates a general reset of the MCU.

The following paragraphs describe the detailed functions of the following files and cards:

- o Card file
- o Power converter card
- o MPU/ROM card
- o Random Access Memory (RAM) card
- o Communication Interface Assembly (CIA)
- o Parallel I/O Interface card
- o Nonvolatile Memory Assembly

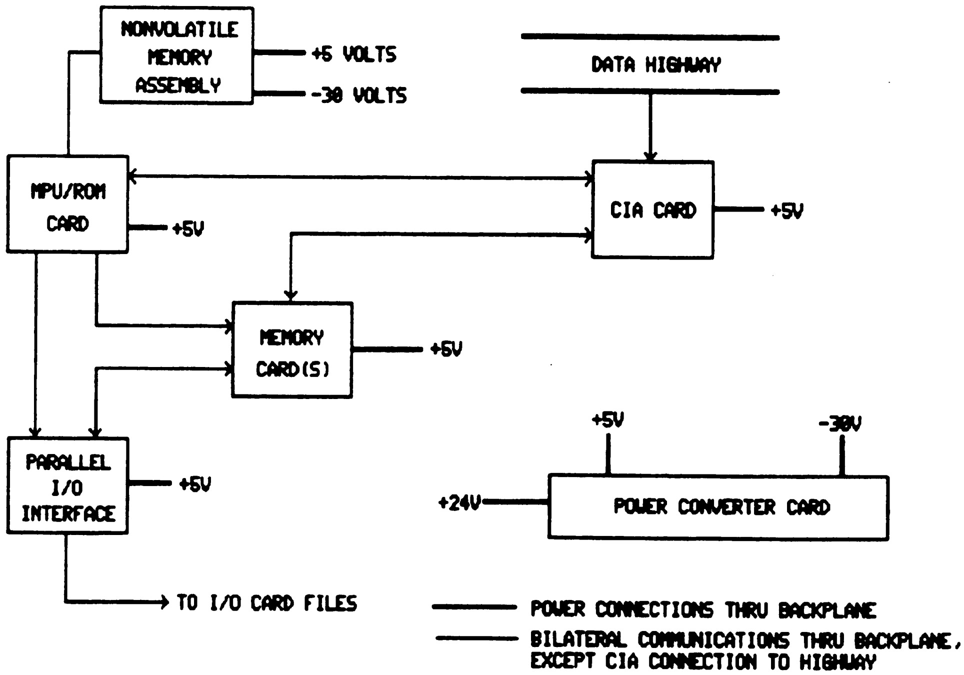

Figure 2-1. Multiplexer Control Unit Block Diagram

2.3 Card File

The card file houses the components of the highway MCU. It is a single 7 inch (177.8 mm) high, 19 inch (483 mm) deep, rack-mounting card file, powered by a nominal 24 volt dc cabinet bus. The card file backplane provides plug-in connections for the component circuit cards, and distributes regulated dc voltages, provided by the power converter card, to the other cards in the file. Figure 1-2 shows the card layout in a MCU.

2.4 Power Converter Card

The power converter card converts 24 volt dc power from the power supply assembly to the voltage levels required by the cards in the MCU. Figure 2-2 shows a functional block diagram of the power converter card. The power converter card consists of the following:

- o Printed circuit board with front bezel
- o Input circuit
- o Output circuits
- o Logic reset circuit
- o Supervisory circuit

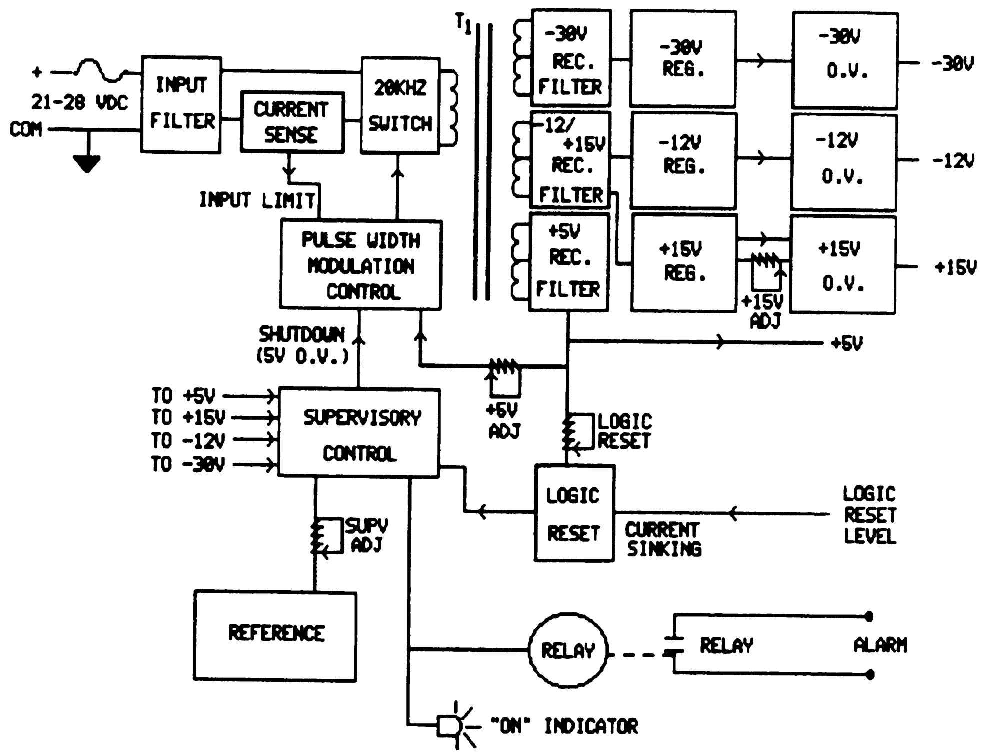

Figure 2-2. Power Converter Card Block Diagram (PN46A4233)

2.4.1 Printed Circuit Board with Front Bezel

Circuit components mount on a 6.125 inch (155.6 mm) high, by 11.26 inch (286.1 mm) long, by 0.0625 inch (1.6 mm) thick circuit board.

Attached to the front of the circuit board, the high-finned bezel is 2.1875 inches (55.6 mm) by 6.266 inches (159.1 mm). The bezel provides a green LED indicator, which lights when the card is functioning properly, and five test jacks (the four output voltages plus common) to measure the output voltages. The bezel also acts as a heat sink for converter card components.

2.4.2 Input Circuit

The input circuit uses a nominal 24 volt dc input. The acceptable range is 21 to 29 volts dc with a maximum 2% ripple. Normal input current is less than 3 amperes with all outputs at full load simultaneously, and less than 0.5 ampere with no loads. The maximum peak input surge current is 75 amperes for less than 300 microseconds. A 3 ampere slow-blow fuse and a 5 ampere current limiter provide input protection for the circuit.

2.4.3 Output Circuits

The output circuits provide four voltage levels as follows:

- **+5 Volts** - The circuit is rated at 6 amperes. The voltage is factory adjusted. Overvoltage protection is electronically controlled starting at 5.5 volts ± 0.2 volts.
- **+15 Volts** - The circuit is rated at 200 milliamperes. The voltage is factory calibrated. Overvoltage protection is crowbar type at 16.5 to 17.5 volts dc.
- **-12 Volts** - The circuit is rated at 200 milliamperes. The voltage is fixed within ± 3.2%. Overvoltage protection is crowbar type at 13.3 to 14.1 volts dc.
- **-30 Volts** - The circuit is rated at 75 milliamperes. The voltage is fixed within ± 3.2%. Overvoltage protection is crowbar type at 32.4 to 35.0 volts dc.

2.4.4 Logic Reset Circuit

The logic reset circuit provides a high logic level signal to the backplane when a normal 5 volt output is being provided. If the voltage drops, a voltage detector sets the logic signal to a low level at the backplane. When the voltage level is restored, the logic signal returns to a high level. This circuit provides the signal for the 5 volt dc low-voltage alarm. The low level detector is factory calibrated for 4.84 to 4.86 volts dc. The detection time is typically 10 to 30 microseconds, and the restoration time (back to a high logic level) is typically 20 to 40 microseconds.

2.4.5 Supervisory Circuit

The supervisory circuit monitors all outputs for low voltages, and overvoltage for the 5 volt output. The supervisory circuit performs the following functions:

- **+5 Volt Overvoltage Protection** - Starts electronic shutdown at 5.5 volts dc, ± 0.2 volt dc
- **Low Voltage Alarm** - Opens the alarm contacts and turns off the green LED if the +15 volt, -12 volt, or -30 volt output drops below 5% of the nominal value, or if the +5 volt logic-reset signal goes to a low state.

2.5 MPU/ROM Card

The MPU/ROM card houses the microprocessor used for processing communications between the data highway and the MCU. It stores and implements reporting schedules, maintains the MCU functions, processes system interrupts, and provides watchdog timer and reset circuits. Figure 2-3 shows a simplified functional block diagram of the MPU/ROM card.

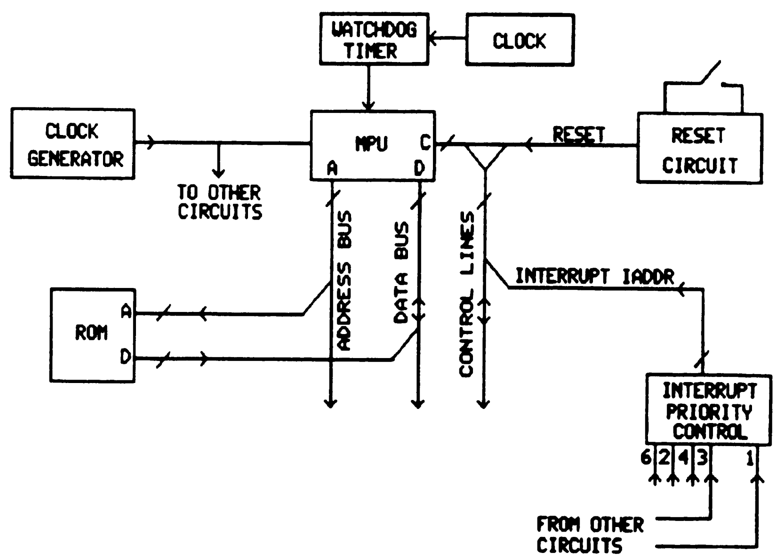

Figure 2-3. MPU/ROM Card Block Diagram

The MPU/ROM card is 6.125 inches (155.6 mm), by 11.25 inches (285.8 mm), by 0.50 inch (12.7 mm), with a 72 position (36 per side on 0.1 centers) card edge connector. The card requires +5, ± 0.25 volts dc input that is provided by the power converter card. The MPU/ROM card has two indicators, as follows:

- o **Green LED** - ON during normal operation; OFF during any reset
- o **Red LED** - ON whenever all CIA's are reset

The card also has two switches located on the front edge of the card. The momentary switch resets the MPU/ROM card. This also resets the CIA's, causing the red LED on the MPU/ROM card to light. The second switch is a pause switch that halts microprocessing functions so that a CIA can be removed and replaced.

The MPU/ROM card provides the following functions:

- o Watchdog timer
- o Reset processing

- o Interrupt processing
- o MPU pause
- o CIA interfacing
- o Pseudo-direct memory accessing (DMA)

Older MCU's required an additional ROM card for required firmware. Currently, all firmware for the MCU MPU/ROM card resides on the single MPU/ROM card.

2.5.1 Watchdog Timer

The watchdog timer performs a monitoring function for the microprocessor unit on the MPU/ROM card. The timer has a timeout range of 2.5 seconds, and if it is not rearmed, it initiates a system reset signal. A rearm signal is generated by doing a write within the normal functional memory range.

2.5.2 Reset Processing

A system reset may be generated by one of the three following sources:

- o **Active Power Fail** - Sent by the power converter card at startup or when in a high or low voltage alarm state

- o **Manual Reset** - Generated by depressing the manual reset momentary switch

- o **Auto Reset** - Generated by the watchdog timer if it has not received a rearm signal

2.5.3 Interrupt Processing

The MPU/ROM card processes interrupts using a Priority Interrupt Controller (PIC) circuit. The PIC generates an Interrupt Request (IRQ) signal for the microprocessor and defines an address in ROM based on the interrupt priority. There are eight interrupt levels. Each priority level has a separate subroutine stored in ROM. The address identifies the location of the subroutine program that handles the defined priority level. If several interrupts are processed together, the assigned priority level is the highest level of any interrupt in the group.

2.5.4 MPU Pause

The pause switch is used to hold data in the microprocessor and prevent a system reset from being generated by the watchdog timer. If the switch is in the pause position, it generates a logical 1. This status value causes the firmware to enter a loop and continuously rearm the watchdog timer.

When the switch is in the run position, it generates a logical 0 that allows the unit to function normally. When the switch is moved from pause to run, the status signal changes from 1 to 0, the microprocessor exits the process loop, goes through the reset routine, and restarts normal processing.

2.5.5 CIA Interfacing

The microprocessor can interface to either CIA-shared RAM by either of the following two methods:

- o Pseudo DMA
- o Standard memory R/W instructions

Pseudo DMA is discussed in the following paragraph. In the second method, separate address ranges are defined for each CIA used with the unit. Through these addresses, the microprocessor can access each CIA independently.

2.5.6 Pseudo DMA

The MPU/ROM can use a pseudo, direct-memory-access (DMA) method to transfer data between RAM (a specific address range only) and the shared RAM of each CIA, without transferring the data through the MPU/ROM card.

2.6 Random Access Memory Card

The MCU currently uses a single memory card with no switches and 24K 8-bit bytes. Older MCU's may have up to three memory cards, each with 8K 8-bit bytes of memory with no switches. The microprocessor on the MPU/ROM card controls the read/write access to the RAM, and data transfer to the highway through the CIA's. Figure 2-4 shows a functional block diagram of the memory card.

The memory card is 6.50 inches (165.1 mm) by 11.25 inches (285.8 mm) and requires a 0.75 inch (19.1 mm) clearance on the component side. A 72 pin (36 per side) card edge connector provides the card-to-backplane connection. The card uses +5.00 volts ± 0.25 volts dc input power, with the following current requirements:

- o 8K byte board - Typically uses 353 milliamperes; maximum current is 597 milliamperes
- o 24K bytes board - Typically uses 693 milliamperes; maximum current is 693 milliamperes

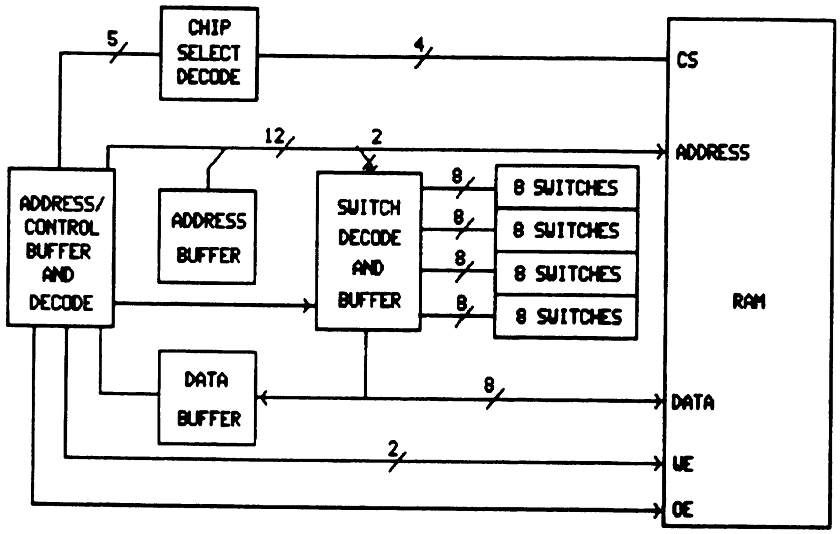

Figure 2-4. Memory Card Block Diagram

2.7 Communication Interface Assembly

The Communications Interface Assembly (CIA) interfaces the data highway and the MCU. The CIA performs the standard data highway communication functions. A second CIA provides communications capability for systems with redundant data highway systems. Figures 2-5 and 2-6 show functional block diagrams of the CIA card and its data transmission functions.

The CIA card is 6.50 inches (165.1 mm) by 11.25 inches (285.8 mm) and requires 0.75 inch (19.1 mm) clearance on the component side. A 72 pin (36 per side) card edge connector provides the card to backplane connection. The card requires +5 ± 0.25 volts dc input power and uses maximum current of 2.2 amperes.

The card contains two independent memories: a transmit memory and a receive memory. It also contains the control circuitry needed to interface the memories to the data highway.

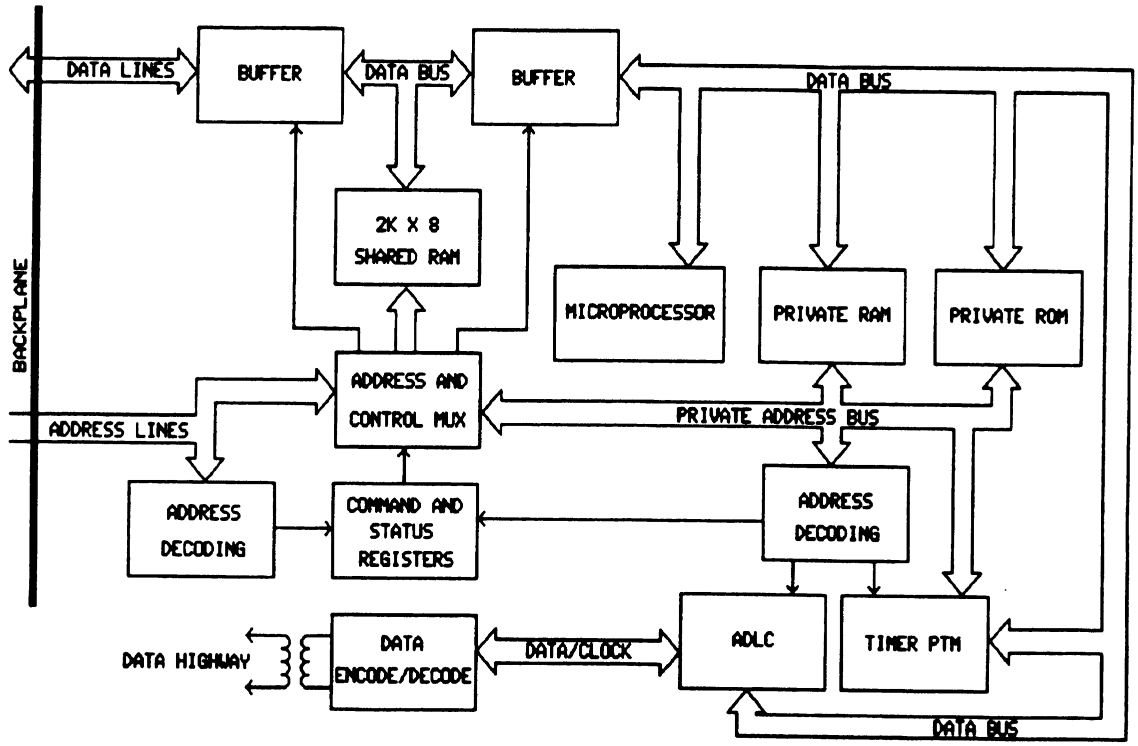

Figure 2-5. CIA Card Block Diagram

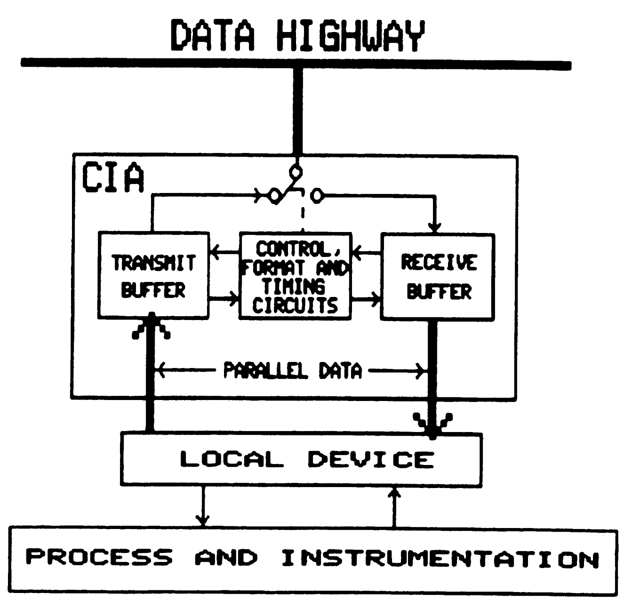

Figure 2-6. CIA Data Transmission Block Diagram

Each CIA has one, 8-position, dual-in-line-package (DIP) switch that sets the device address for the MCU on the data highway. The CIA also has one green LED on the front edge of the card to indicate normal operation. The LED goes out if power fails, if the card is not functioning properly, or if the MPU/ROM card is holding the CIA in reset. A BNC connector at the front edge of each card provides highway connection capability.

2.7.1 CIA Card Functions

The CIA provides the following functions:

- Address decoding
- Data circuitry
- Control circuitry
- Interrupt generator
- Self-test

When data is sent on the highway to an addressed device, the control circuitry receives the data, uses the address decoding function to verify that the device is addressed, checks for transmission errors, and loads the data into the receive memory using the data circuitry. The interrupt generator notifies the microprocessor that data is received, and the device then retrieves the data from memory for use as needed.

The interrupt generator also notifies the microprocessor if a data request is received or if the self-test circuit detects an error. The self-test circuit performs startup and periodic checks on the data and on the other circuits in the CIA. Test failures send an interrupt to the microprocessor and also stop CIA processing, indicated by extinguishing the green LED on the front of the card.

2.7.2 CIA Operations

The CIA has five operational states, as follows:

- **Power Up** - Card is held in reset until the power stabilizes and the reset is released

- **Reset** - A system reset causes the card to reset

- **Normal Operation** - When the reset clears, the CIA enters normal operation. Initially, the CIA runs a startup self-test and when completed successfully, the green LED lights and the CIA grants control of the transmit and receive buffers to the microprocessor on the MPU/ROM card. CIA status registers generate interrupts to process data.

- **Shut Down** - The CIA shuts down and the green LED goes out with loss of power
- **Self-Test** - Upon entry into normal operation and periodically during normal operation, the CIA performs system self-tests. If the tests detect an error, the CIA generates an error status and turns off the green LED on the CIA.

2.8 Parallel I/O Interface Card

The Parallel I/O Interface card provides a data buffer between the MCU and I/O card files. The MPU provides addressing signals used by the interface card to enable specified I/O point addresses for sampling input values or generating output signals.

The interface card uses an Arithmetic Processor Unit (APU) to convert between the parallel discrete values received from or sent to I/O files and the engineering unit values received from or sent to the data highway. A Valid Memory Address (VMA) circuit provides an interface between the backplane and the APU.

The interface card uses two Peripheral Interface Adapter (PIA) circuits. The first PIA provides two data ports called port A and port B. Port A is an output only port. Port B is an input only port. Direction of the interface is controlled by the MPU controlled read/write (R/W) signal on the backplane.

The second PIA provides two 8-bit output ports used for control and address lines for the I/O file. The signals from this PIA select the correct card file (by comparing the file address switches on the I/O buffer card), the specific card being addressed, and the channel on the card.

2.9 Nonvolatile Memory Assembly

The Type DM7052 Memory Assembly (nonvolatile) provides 8K bytes of Electrically Alterable Read-Only Memory (EAROM) to store multiplexer configuration information in case of power outage. The memory on the card is buffered by two PIA's to provide bus isolation.

One PIA provides a read/write interface for the memory. The other PIA provides address and control lines. Both PIA's use +5 volts dc for data levels. The address/control PIA enables the -30 volt dc power used to write to or erase the memory.

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Section 3
Preventive Maintenance

3.1 Scope

This section describes preventive maintenance procedures for the Type DM6001 Multiplexer Control Unit (MCU). The tables in this section explain, for each procedure, the recommended frequency, the purpose, actions to be performed, and observations to verify satisfactory completion. Only Fisher trained and qualified maintenance technicians are authorized to perform the preventive maintenance procedures.

Note

> Ideally, preventive maintenance procedures should be performed as recommended. Realistically, this schedule will be dictated by the user's process, availability of backup systems, and other variables.

Preventive maintenance schedules require an environment maintained in accordance with guidelines given in PN4:002, Planning the Installation and PN4:006, Environmental Conditions for Instrumentation Systems. If the operational environment does not meet these standards, preventive maintenance procedures should be performed more frequently.

3.2 Circuit Card Cleaning

Table 3-1 contains specific procedures, the recommended frequency, and instructions for cleaning circuit cards.

3.3 Device Self-Test

As described in Section 2, the MPU/ROM card microprocessors continually run memory self-tests. In addition, the communication interface assemblies and the power converter card also perform self-test functions. Self-test failures can produce alarm signals and can initiate an MCU shutdown.

The operator initiates such tests by pushing the system reset button on the MPU/ROM card. This action causes the system to go through several diagnostic tests routinely as the system is brought up after the reset is released.

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3.4 System Trouble Log Reports

Section 4 describes the development of a systematic recording of failures for a system. This recommended trouble log provides a basis for evaluating overall system performance, areas with high failure rate, and the types of spares that should be maintained. When the system has been maintained for at least six months, the trouble log can suggest where repeating system problems might exist. Depending on the location and type of problem, adequate preventive maintenance may be able to reduce the incidence of these failures.

3.5 Tools and Supplies Required

In addition to the standard tools available to the technician, the following items are recommended.

Ionizing air gun
Freon™ solvent (Miller Stevenson MS-80)
Residue cleaner (Tech Spray Instant FD Zero)
Digital Voltmeter - Range 0.5 to 35 volts dc
Accuracy 0.1% or better

Freon is a trademark of E.I. DuPont DeNemours Co.

3.6 Preventive Maintenance

Table 3-1. Circuit Card Cleaning

Recommended Frequency: Quarterly

CAUTION

Handling circuit cards without adequate grounding precautions can result in static discharge damage to the card. Use a wrist grounding strap and a grounded work surface when removing, cleaning, and installing cards.

Use the following steps to insure card protection:

1. **Lay out the grounded work surface.**
2. **Connect the grounding cable from the work surface to the grounding stud on the system cabinet.**
3. **Remove power to the system cabinet.**

Step	Action
1	Check circuit cards for dust or oil.

Table 3-1. Circuit Card Cleaning (continued)

Step	Action
2	Remove and label all dirty cards.
	FOR DUST BUILDUP:
3	Neutralize circuit card with ionizing air gun.
4	Remove dust with compressed air.
5	Return circuit card to its assigned slot.
6	Repeat as necessary for other cards with dust buildup.
	FOR OIL BUILDUP:
7	Spray circuit card with aerosol solvent until oil buildup dissolves.
8	Place card on work surface and allow solvent to dry.
9	Wipe off remaining residue and oil with a clean dry cloth.
10	Return circuit cards to their assigned slots.
11	Disconnect grounded work surface from grounding stud on system cabinet.
12	Restore power to system cabinet.

Table 3-2 contains a listing of system components and their preventive maintenance requirements. All cards require cleaning every three months.

Table 3-2. Preventive Maintenance Requirements

Device	Requirements
Card File	Clean only
Power Converter	Clean, Calibrate as required
MPU/ROM Card	Clean only
RAM Card	Clean only
ROM Card	Clean only

Table 3-2. Preventive Maintenance Requirements (continued)

Device	Requirements
CIA Card	Clean only
Parallel I/O Interface Card	Clean only
Memory Assembly Card	Clean only

Table 3-3. Power Converter Card Check

Recommended Frequency: Annually

Purpose: The purpose of this procedure is to check the output voltages supplied by the power converter card to the other cards and assemblies. This procedure can be accomplished while the cards are in service.

Step	Action
1	Check the wiring between the cabinet bus bar and the MCU alarm and power terminal block.
2	Replace any damaged, frayed, or worn cables.
3	Set the voltmeter to measure at least 35 Vdc full scale.
4	Connect the voltmeter between the power supply common (PSC) terminal on the bus bar and the 24 Vdc terminal on the power terminal strip.
5	The voltmeter should read between 23 and 25 Vdc. If not, and input power is verified, replace the power supply.
6	Ensure that the power converter card is firmly seated in the backplane connector.
7	The LED on the front of the power converter card should be ON.
8	Set the voltmeter to measure at least 7 Vdc full scale.
9	Connect the voltmeter between the COM and the +5 Vdc test jacks on the front of the card.

Table 3-3. Power Converter Card Check (continued)

Step	Action
10	The voltmeter should read between 5.06 and 5.08 Vdc. If not refer to calibration procedures in Section 5.
11	Set the voltmeter to measure at least 20 Vdc full scale.
12	Connect the voltmeter between COM and +15 volt test jacks on the front of the card.
13	The voltmeter should read between 15.5 and 15.6 Vdc. If not, refer to calibration procedures in Section 5.
14	Set the voltmeter to measure at least -15 Vdc full scale.
15	Connect the voltmeter between COM and -12 volt test jacks on the front of the card.
16	The voltmeter should read between -11.6 and -12.4 Vdc. If not, refer to fault isolation and corrective maintenance in Section 4.
17	Set the voltmeter to measure at least -35 Vdc full scale.
18	Connect the voltmeter between COM and the -30 volt test jacks on the front of the card.
19	The voltmeter should read between -28.9 and -31.0 Vdc. If not, refer to fault isolation and corrective maintenance in Section 4.

Section 4
Fault Isolation and Corrective Maintenance

4.1 Scope

This section describes fault isolation and corrective maintenance procedures for the Type DM6001 Multiplexer Control Unit. Fault isolation uses the following aids:

- The configuration console or configuration interface diagnostic program
- Local indications

These aids can help to identify that a problem exists, isolate an area where the fault has occurred, and in some cases, identify the faulty board. Using diagnostic program displays and local indications reduces maintenance time. This section also includes detailed corrective maintenance procedures.

From the system level, device failures appear in the following ways:

- The diagnostic program receives a failure message from the failed device
- The failed device does not respond to system prompts
- An alarm appears in a system display
- An alarm appears in the communications status message

When the system detects a device failure, the diagnostic program can help isolate the problem to a local level.

4.2 Diagnostic Program

The diagnostic program is a series of routines used by the operator during the system operations:

- Startup
- Configuration
- Preventive maintenance
- Corrective maintenance

The diagnostic program displays provide indications to:

- Verify primary and secondary highway communications o Troubleshoot field devices down to the replaceable assembly

Operation of the diagnostic program requires one of the following:

- o DC6300 Series configuration console with flexible disk unit
- o DC6500 Series configuration console with hard disk unit
- o DC6800 Series computer with configuration and hard disk unit
- o Type DC5502 Large Database Console
- o Type DH6221 Configuration Interface
- o Type DH6231 Engineering Workstation

The following functions are the most useful for fault isolation:

- o Network communications integrity
- o Detailed internal integrity

To access the displays, use the following procedures:

o **Type DC5500/DC6500 Configuration Console**

1. Turn the CONSOLE KEYLOCK SWITCH to the CONFIG position and press START.

   CONFIGURATION MODE
   SELECT OPTION:

CONFIG	UTILI TIES	DIAG NOSTICS

2. Press the DIAGNOSTICS key.

   SELECT FUNCTION:

   1. NTD TRAFFIC STAT
   2. LTD TRAFFIC STAT
   3. COMM INTEG
   4. DET INTL INTEG
   5. DET DEVC STAT
   6. DEVICE TYPES
   7. CRD/CTLR TYPES
   8. IAC/COMP TRACE

3. Press softkey 4 (DET INTL INTEG) and then indicate the MCU.

4. See Figure 4-3 for the correct display. If the display indicates a bad status, refer to the fault isolation procedures in this section.

- PROFLEX Configuration Device

1. System ON and configuration software loaded. Press MAIN SCREEN key to call the MAIN MENU.

   FISHER CONFIGURATION INTERFACE
   CHIP (PRO) EXECUTIVE
   DISK/DISKETTE SERVICES
   FILE SERVICES
   PRINT SERVICES
   ADDITIONAL APPLICATIONS
   VIEW MESSAGE/STATUS

2. Position the cursor at FISHER CONFIGURATION INTERFACE and press DO key.

   FISHER CONFIGURATION INTERFACE EXECUTIVE

   CONFIGURATION
   DIAGNOSTICS
   TRACE/TUNE

3. Position the cursor at DIAGNOSTICS and press DO key.

   DIAGNOSTICS EXECUTIVE

   COMMUNICATION STATUS
   DETAILED INTERNAL INTEGRITY
   DETAILED DEVICE STATUS
   CONTROLLER TYPES
   CARD TYPES
   TRAFFIC STATISTICS

4. Position the cursor at DETAILED INTERNAL INTEGRITY and press DO key.

   ENTER HIGHWAY #: (0-6 network, 1-8 local)

5. Enter MCU highway number.

   ENTER DEVICE #: (0-6 network, 0-30 local)

6. Enter MCU device number.

   ENTER 1 or 2 (1 for Device Status or 2 for I/O Status)

7. Enter 1 or 2 for display.

8. See Figure 4-3 for display. If the display indicates a bad status refer to fault isolation procedures in this section.

The prompt **ENTER KEYWORD** is displayed on the various screens. These keywords and their effect are as follows:

- **LOG** - Entering LOG at the keyword prompt will cause a message to be printed when any of the fields on the screen change their state.
- **SWITCH** - Entering SWITCH at the keyword prompt causes the cards to switch to their opposite state (active to standby, standby to active). It is only effective when a redundant card or controller is configured.
- **ENABLE** - Entering ENABLE allows the cards to automatically switchover when they detect an error. Once they switch over, they must be enabled again before they will activate automatically.
- **DISABLE** - Entering DISABLE prevents the cards from switching except when activated manually at the card, or the operator enters the SWITCH command.
- **NEXT/PREV** - When more than one screen is available, entering NEXT/PREV will display the next screen or previous screen.

4.2.1 Network Communications Integrity

This function monitors the status of communications for all devices. The local traffic directors monitor the local device communications and the network traffic director monitors network and device communications. The network communications integrity function is the logical starting point for system fault isolation because the display, shown in Figure 4-1, indicates which highway devices have a fault indication. This helps to identify whether the problem is isolated to a single device or perhaps to one area. If a local area is identified use the communications status display shown in Figure 4-2 to identify individual device faults.

NETWORK COMMUNICATIONS STATUS LOG: OFF 23 MAY 88 16:05:20
HWY #: 0

LOCAL AREAS

AREA	COMPOSITE INTEGRITY	PRI COMM	RED COMM
1			
2			
3			
4			
5			
6			
7			
8			
NET			

NETWORK DEVICES

DEV #	TYPE	INTEG	ACT PRI COMM	ACT RED COMM	STB PRI COMM	STB RED COMM
1						
2						
3						
4						
5						
6						

ENTER KEYWORD:

Figure 4-1. Network Communications Status Display

COMMUNICATIONS STATUS LOG: OFF 23 MAY 88 16:05:51
HWY #: 1

DEV #	TYPE	INTEG	ACT PRI COMM	ACT RED COMM	STB PRI COMM	STB RED COMM
1	OPCON	GOOD	GOOD			
2	DCU	GOOD	GOOD			
3						
4						
5	MCU	GOOD	GOOD			
6						
7	UOC	GOOD	GOOD			
8	SIU	GOOD	GOOD			
9						
10						
11						
12						
13						
14						
15						
	LTD	GOOD	GOOD			

DEV #	TYPE	INTEG	ACT PRI COMM	ACT RED COMM	STB PRI COMM	STB RED COMM
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

ENTER KEYWORD:

Figure 4-2. Communications Status Display

4.2.2 Detailed Internal Integrity

The detailed internal integrity Figure 4-3, evaluates the communications status of the MCU for which the display is requested. If the error is caused by an individual input or output unit, the detailed internal integrity may help to identify the faulty card immediately. To access the displays, use the procedures in 4.2 above.

```
MCU INTEGRITY
HWY#: 1  DEV#: 5                          LOG: OFF  23 MAY 86  16:13:20
                                      POLLING HWY 1 DEV 5

                 PRIMARY CIA: GOOD    REDUNDANT CIA: GOOD
CONFIGURATION: GOOD APU ERR: NO I/O SCAN OVERLOAD: NO NVM ERR: NO
          CARD 1     CARD 2     CARD 3     CARD 4     CARD 5     CARD 6
         CFG STAT   CFG STAT   CFG STAT   CFG STAT   CFG STAT   CFG STAT
FILE#1    NO         NO         YES GOOD   NO         NO         NO
FILE#2    NO         NO         NO         NO         NO         NO
FILE#3    NO         NO         NO         NO         NO         NO
FILE#4    NO         NO         NO         NO         NO         NO
FILE#5    NO         NO         NO         NO         NO         NO
FILE#6    NO         NO         NO         NO         NO         NO
FILE#7    NO         NO         NO         NO         NO         NO
FILE#8    NO         NO         NO         NO         NO         NO
FILE#9    NO         NO         NO         NO         NO         NO
FILE#10   NO         NO         NO         NO         NO         NO
FILE#11   NO         NO         NO         NO         NO         NO
FILE#12   NO         NO         NO         NO         NO         NO
FILE#13   NO         NO         NO         NO         NO         NO
FILE#14   NO         NO         NO         NO         NO         NO
FILE#15   NO         NO         NO         NO         NO         NO
FILE#16   NO         NO         NO         NO         NO         NO

ENTER KEYWORD:
```

Figure 4-3. Multiplexer Detailed Internal Integrity Display

The following is a brief description of the terms used in the MUX Detailed Internal Integrity Display:

- HWY# - Indicates the data highway connected to the monitored device.

- DEV# - Indicates the data highway address of the monitored device.

- o PRIMARY CIA - Indicates whether or not the primary CIA is performing properly.
- o REDUNDANT CIA - Indicates whether or not the redundant CIA is performing properly.
- o CONFIGURATION - Indicates condition of multiplexer configuration, GOOD/BAD.
- o APU ERROR - Indicates APU has successfully completed a known calculation, YES/NO.
- o I/O SCAN OVERLOAD - Indicates the integrity of configured scan times, YES/NO.
- o NVM ERR - Indicates the integrity of the nonvolatile memory (NVM) to communicate and store data properly, YES/NO.
- o CARD 1 - CARD 6 - Indicates cards in the I/O file by file position number.
- o CFG - Indicates that the card type information matches the card in the specific slot, YES/NO.
- o STAT - Indicates the integrity of the card in that position, GOOD/BAD
- o FILE# - Indicates the I/O file units connected to the MCU.

4.3 Local Indications

The MCU provides several status LED's to assist in providing local indications of a unit fault. At the local level, fault isolation consists of evaluating LED indications.

Table 4-1 gives a summary of the LED indications available in all MCU's. Use the table to isolate the faulty card.

Table 4-1. MCU Local Indications

Assembly	Indication	Description
MPU/ROM	Green LED ON	Watchdog timer armed and enabled No on-board faults detected.
	Green LED OFF	Watchdog has timed out and/or on-board faults detected.
	Red LED ON, Green OFF	Pause switch depressed
	Red LED OFF, Green ON	Card operational

Table 4-1. MCU Local Indications (continued)

Assembly	Indication	Description
CIA (Primary/ Redundant)	Green LED ON Green LED OFF	Card in self-test or operation Bad communications interface card
Power Converter	Green LED ON Green LED OFF	Card operational Power or card failure
Parallel Buffer (I/O File Unit)	Top Green LED ON Top Green LED OFF Middle Green LED ON Middle Green LED OFF Bottom Green LED ON Bottom Green LED OFF	+15 Vdc power present Power failure +5 Vdc power present Power failure File selected File not selected

4.4 Corrective Maintenance

Once the fault is isolated to a card or cable level, it must be corrected. Faults may fall into several categories, including:

- o Switch setting errors
- o Improper or faulty cabling or connections
- o Power fault
- o Other card and card file faults

Consult Section 5 of this document to determine correct switch settings, and identify proper cable connections. Visually inspect cables for damage and loose connections. Replace damaged cables and connectors and reseat any loose connectors.

4.5 System Trouble Log

Development of a system trouble log provides a basis for monitoring normal system operation and failure, and for documenting intermittent problems. Intermittent or unreproducible errors are major problems in maintaining any electronic system. Because they are intermittent or unusual, they cannot easily be identified and corrected. Therefore, they are responsible for increased downtime and loss of equipment when they occur.

The trouble log should include a date, reported symptoms including equipment affected and action taken (including "none" because the problem resolved or went away). It should be maintained at the console by the operator so that new symptoms can be recorded immediately, if they occur. It should also be kept uniformly, so that all operators are recording the information in the same form.

Section 5
Removal and Installation Procedures

5.1 Scope

This section provides removal and installation procedures for the Multiplexer Control Unit and its components.

WARNING

Do not remove or install circuit cards with power applied.

CAUTION

Failure to use proper protective procedures can result in static discharge damage to static sensitive circuit card components. To prevent such damage, always use a grounded wrist strap when handling circuit cards or cables connected to circuit cards.

5.2 Power Converter Card Removal

1. Ensure that power to the MCU is OFF.
2. Grasp the handle of the power converter card and pull it straight out of the file.

5.3 Power Converter Card Installation

1. Ensure that power to the MCU is OFF.
2. Position the power converter card with the component side on the left and the edges of the card aligned with the card slot.
3. Slide the card into the card file until it is firmly seated in the backplane.

5.4 Card Removal

1. Ensure that power to the MCU is OFF.

2. Tag and disconnect cables connected to the card.
3. Remove the retainer at the bottom of the circuit card.
4. Pull outward on the tab at the top of the circuit card.
5. Pull on the extended tab and remove the circuit card from the card file.

5.5 Card Installation

1. Ensure that power to the MCU is OFF.
2. Extend the tab on the top of the circuit card.
3. Insert the card into the proper slot and ensure that it is firmly seated in the backplane.
4. Push on the tab and lock the circuit card in position.
5. Position the retainer and tighten to secure card.
6. Connect cables as required.

5.6 MCU Card File Removal

1. Ensure that all power to the MCU is OFF.
2. Remove the power converter card using the procedures above.
3. Tag and disconnect all cables from circuit cards in the card file.
4. Following the card removal procedures, tag and remove all cards from the card file.
5. Tag and disconnect power and alarm wiring from the power terminal block on the left side of the card file.
6. Support the card file, remove the retaining screws securing it to the mounting rails and remove the card file from the cabinet.

5.7 MCU Card File Installation

1. Place the card file in position on the mounting rails and secure with retaining screws.

2. Connect the power and alarm wiring to the terminal block on the left side of the card file.

3. Following the card installation procedures above, install the cards in their proper slots.

4. Connect all cables as required.

5. Following the power converter installation procedures above, install the power converter card.

6. Restore power to the cabinet, including battery backup, if so equipped.

5.8 MCU Power Connections

DC power connections on the alarm and power terminal block are shown in Figure 5-1. For typical cabinet dc power wiring information refer to the PN4:003, AC and DC Power and Ground Wiring.

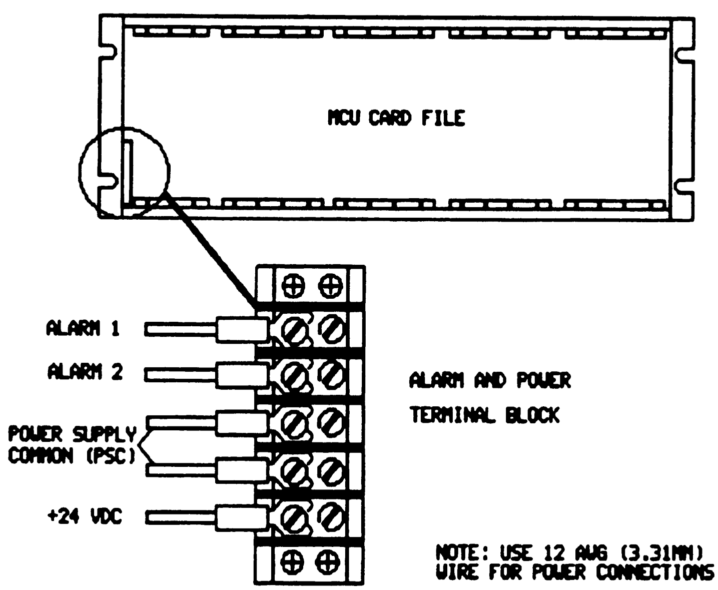

Figure 5-1. Alarm and Power Terminal Block

5.9 Data Highway Connections

Data highway cables connect the CIA's in the highway devices together, either within the same cabinet or between cabinet groupings. Inside the system cabinets, the cables route through either the left or right vertical cable tray, but with redundant highway systems, the two cables should not route through the same cable tray. The primary data highway cable connects to the primary CIA card in slot 17 of each MCU. If used, the secondary data highway cable connects to the secondary CIA card in slot 19 of each MCU.

5.10 Alarm Wiring

Alarm wiring connects to the alarm and power terminal block on the left side of the MCU card file as shown in Figure 5-1. Alarm wiring should route through the left vertical cable tray of the cabinet. The following paragraphs explain the basic alarm wiring connections.

The two alarm terminals available at the alarm and power block indicate the loss of output from the power converter card in the interface unit card set. These terminals connect to power converter card relay contacts rated for 0.8 amperes at 29 volts dc. The relay contacts remain closed during normal operation and open upon loss of output (that is, zero volts, a low voltage, or in general, the detection of a failed condition) from the power converter card.

The alarm wiring connects to the terminals on the alarm and power terminal block, as shown in Figure 5-1. The alarm wiring can be connected directly to the appropriate terminals of an annunciator or alarm device. The alarm wiring can also be joined with alarm wiring from other units in the cabinet and routed to the power distribution panel in the cabinet. For direct monitoring by a system console, the output can also be routed to a Type DM6362 Discrete Input Unit (dry contacts) in a multiplexer.

5.11 Switch Settings

The following MCU cards contain switches:

- o MPU/ROM card
- o Communication interface assembly

5.11.1 MPU/ROM Card Switches

The MPU/ROM card uses two switches, as follows:

- o Reset - A momentary switch (S2) which initiates a microprocessor reset for the MCU.

- o Pause/Run - The pause/run switch (S1) is a two position switch. In the RUN position (UP), the microprocessor runs normally. In the PAUSE position (DOWN), the microprocessor holds in a process loop and continually rearms the watchdog timer to prevent a reset.

5.11.2 Communication Interface Assembly Switches

The communication interface assembly (CIA) switches allow the MCU to communicate with the data highway and the rest of the instrumentation system. They establish the address of the MCU on the data highway. This address must also be enabled in the local or network traffic director.

Figure 5-2 shows the 8-position, dual in-line package (DIP) switch. The left example shows the settings for a device on a local highway, and the right example shows the settings for a device on a network highway.

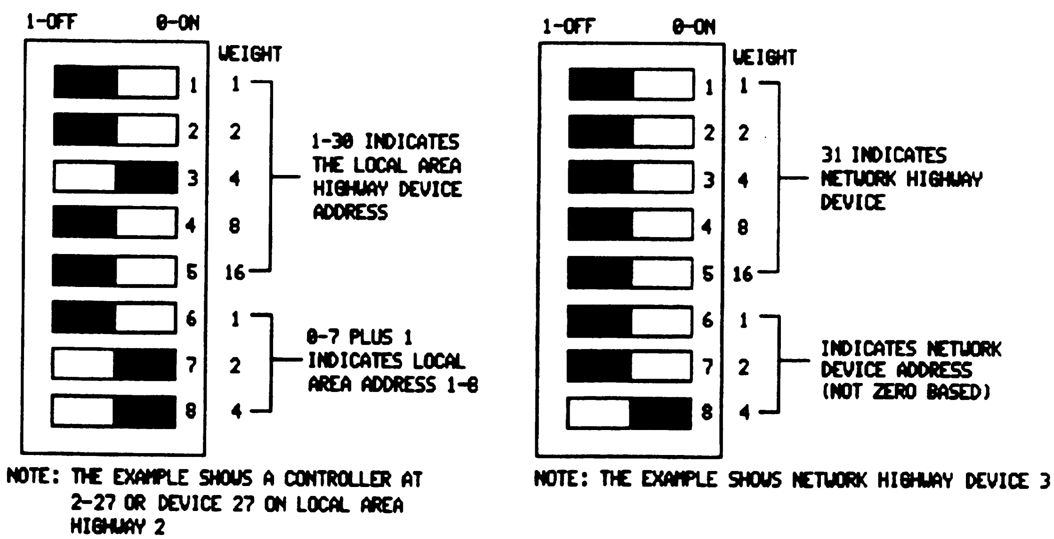

Figure 5-2. CIA Device Address Switch

The example local address in Figure 5-2 is highway 2, device 27. Switch positions 6, 7, and 8 identify the highway. The highway number is equal to the value of the switch settings, read as a binary number with position 6 as the least significant bit, plus one. The device number is equal to the value of switch positions 1 through 5, read as a binary number with position 1 being the least significant bit.

Switch settings for the network highway address are completely different. The address in the example is the network highway (31), device 3. For the network highway address, switches 1 through 5 are off. The device number is the value of switch positions 6, 7, and 8, read as a binary number with position 6 as the least significant bit.

5.12 Traffic Director Address Switches

In addition to the switches on cards in the MCU, there are two address switch groups in the traffic directors. The first group, on the CIA's in the traffic director, identifies the traffic director as a device on the highway. The second group, located on the traffic director memory card, enables the device addresses on the highway controlled by the traffic director. Figure 5-3 shows examples of both types of switches. For the MCU to communicate on the highway, the traffic director must indicate the correct highway number on its CIA, and the device address designated on the MCU CIA must be enabled by the correct switch on the memory card in the traffic director.

5.13 Traffic Director CIA Switch Settings

The CIA switch is an 8-position DIP switch like that used to define local and network highway addresses in other highway devices. In a local traffic director, the highway portion of the address (positions 6 through 8) identifies the local highway over which the local traffic director exercises control. The device address for the local traffic director itself is always 0 (00000), which means that switches 1 through 5 are all in the closed (0) position. To use the local highway example given in Figure 5-3, that is to enable highway address 2-27, examine the CIA card for the highway 2 local traffic director. Set the device address switch on that CIA card for highway 2, device 0.

The network traffic director uses the same 8-position DIP switch, but all switches for the device portion (positions 1 to 5) are set to open (1) and all switches for the highway portion (positions 6 to 8) are set to closed (0). This identifies the unit as a network traffic director.

5.14 Traffic Director Memory Card Switch Settings

To enable local highway addresses, the local traffic director has four, 8-position DIP switches on the front edge of its memory card. This makes a total of 32 switch positions numbered 0 through 31, on the board, as shown in Figure 5-3.

For this purpose, disregard the 1 thru 8 position numbers of the individual switches. Switch positions 0 and 31 are not used. For example, if the multiplexer control unit is device 11 on the highway, enable switch position 11, by moving it to the open (1) position.

To enable network highway addresses, the network traffic director uses two, 8-position DIP switches, as shown in Figure 5-3. The 16 switch positions are numbered 0 thru 15 on the board. For this purpose, disregard the 1 thru 8 position numbers of the two switches. Switch positions 0 and 15 are not used. Switch positions 1 through 8 enable local highways 1 through 8 for the instrumentation system. Switches 9 through 14 enable network device addresses 0-1 through 0-6. For example, to enable the device address 0-3, set switch position 11 to open (1).

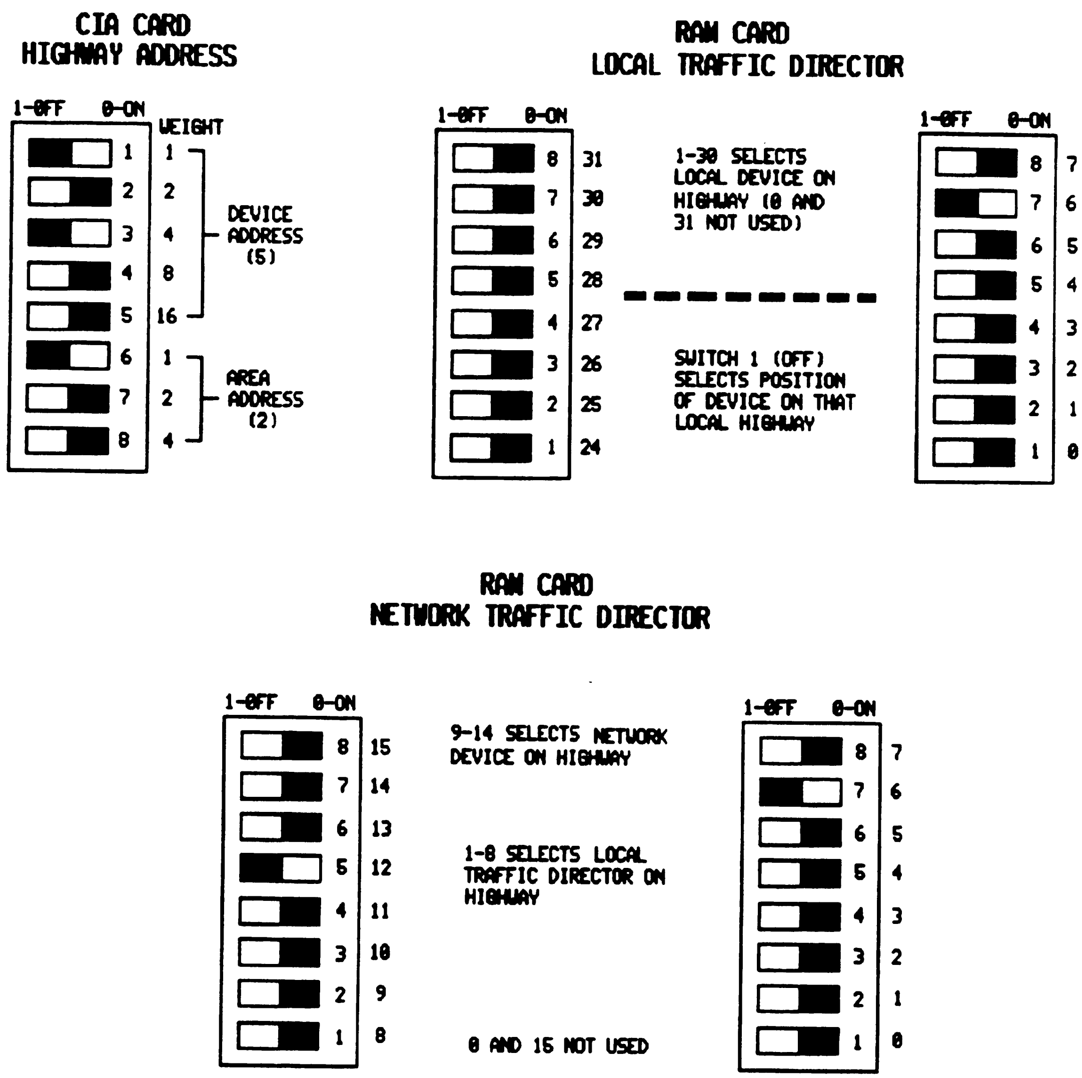

Figure 5-3. Device Addressing

5.15 Power Converter Card (for Highway Devices)(PN46A4233) Calibration

The calibration procedure for the power converter card allows the user to calibrate the +5 and +15 volt output levels and check the -12 and -30 volt output levels.

Equipment Required:

Type CS6003 Calibrator
Voltmeter

1. Verify that the calibrator ON/OFF switch is OFF.

2. Insert the power converter card shown in Figure 5-4 in the test slot labeled MUX POWER CARD.

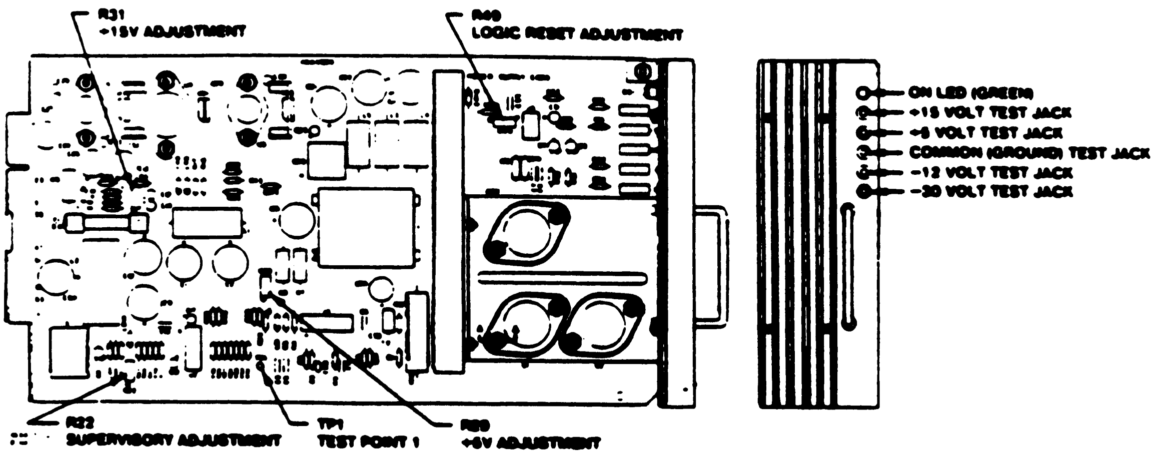

Figure 5-4. Power Converter Card (for Highway Devices) PN46A4233

3. Connect a jumper between test point TP1 and the common (COM) test jack on the front of the power converter card.

4. Set the calibrator ON/OFF switch to ON.

5. Disconnect the jumper and wait five minutes for the card outputs to stabilize.

6. Connect a voltmeter between test point TP1 and the common (COM) test jack on the front of the power converter card. The volt meter should read 3.69 ± 0.015 volts dc. If not, adjust the SUPV (R22) potentiometer to obtain the proper reading.

7. Connect the voltmeter between the +5V and COM test jacks on the front of the power converter card. The voltmeter should read 4.855 ± 0.002 volts dc. If not, adjust the +5 VOLT (R29)

potentiometer to obtain the proper reading. If unable to adjust R29 for the proper reading, proceed to Step 17.

8. Adjust the LOGIC RESET (R49) potentiometer on the power converter card until the ON indicator on the power converter card and the RESET TEST and RELAY TEST indicators of the calibrator just go out.

9. Adjust the +5 VOLT (R29) potentiometer on the power converter card until the voltmeter reads at least 4.91 volts dc and the ON indicator on the power converter card and RELAY TEST and RESET TEST indicators on the calibrator light.

10. Adjust the +5 VOLT (R29) potentiometer on the power converter card until the ON indicator on the power converter card and the RESET TEST and RELAY TEST indicators on the calibrator just go out. The voltmeter should read 4.860 ± 0.005 volts dc. If not, repeat Steps 6 thru 10 until the proper reading is obtained.

11. Adjust the +5 VOLT (R29) potentiometer until the voltmeter reads 5.07 ± 0.010 volts dc.

12. Connect the voltmeter between the +15V and COM test jacks on the front of the power converter card. The voltmeter should read between 14.05 and 14.60 volts dc and the ON indicator on the front of the power converter card and the RELAY TEST indicator go out. If not, adjust the +15 VOLT (R31) potentiometer on the power converter card to obtain the proper reading.

13. Adjust the +15 VOLT (R31) potentiometer on the power converter card until the voltmeter reads 15.550 ± 0.050 volts dc.

14. Connect the voltmeter between the -12V and COM test jacks on the front of the power converter card. The voltmeter should read -12.000 ± 0.400 volts dc. If not, the power converter card requires repair.

15. Connect the voltmeter between the -30V and COM test jacks on the front of the power converter card. The voltmeter should read between -28.900 and -30.000 volts dc. If not, the power converter card requires repair.

16. Disconnect the voltmeter.

17. Set the calibrator ON/OFF switch to OFF.

18. If a failure occurred in Step 7 continue the procedure. If not, remove the power converter card from the calibrator.

19. Using two eight inch jumpers, connect a 10 to 39K resistor across R1 on the power converter card.

20. Set the calibrator ON/OFF switch to ON.

21. Connect a voltmeter between the +5V and COM test jacks on the power converter card.

22. Adjust the +5V (R29) potentiometer on the power converter card to read 4.855 ± 0.002 volts dc.

23. Adjust the LOGIC RESET (R49) on the power converter card until the ON indicator on the power converter card and the RESET TEST and RELAY TEST indicators on the calibrator just go out.

24. Adjust the +5V (R29) on the power converter card until the voltmeter reads at least 4.910 volts dc and the ON indicator on the power converter card and the RESET TEST and RELAY TEST indicators on the calibrator light.

25. Adjust the +5V (R29) on the power converter card until the ON indicator on the power converter card and the RESET TEST and RELAY TEST indicators on the calibrator just go out. The voltmeter should read 4.855 ± 0.005 volts dc. If not, repeat Steps 22 thru 25 to obtain the proper reading.

26. Set the calibrator ON/OFF switch to OFF.

27. Remove the jumpers and resistor across R1.

28. Set the calibrator ON/OFF switch to ON.

29. Adjust the +5 VOLT (R29) potentiometer until the voltmeter reads 5.07 ± 0.010 volts dc

30. Connect the voltmeter between the +15V and COM test jacks on the front of the power converter card. The voltmeter should read between 14.05 and 14.60 volts dc and the ON indicator on the front of the power converter card and RELAY TEST indicator go out. If not, adjust the +15 VOLT (R31) potentiometer on the power converter card to obtain the proper reading.

31. Adjust the +15 VOLT (R31) potentiometer on the power converter card until the voltmeter reads 15.550 ± 0.050 volts dc.

32. Connect the voltmeter between the -12V and COM test jacks on the front of the power converter card. The voltmeter should read -12.000 ± 0.400 volts dc. If not, the power converter card requires repair.

33. Connect the voltmeter between the -30V and COM test jacks on the front of the power converter card.

34. The voltmeter should read between -28.900 and -31.000 volts dc. If not, the power converter card requires repair.

35. Disconnect the voltmeter.

36. Set the calibrator ON/OFF switch to OFF.

37. Remove the power converter card.

5.16 Power Converter Card (for Highway Devices) (PN41B0985)

The calibration procedure for the power converter card allows the used to calibrate the +5 and +15 volt output levels and check the -12 and -30 volt output levels.

Equipment Required:

Type CS6003 Calibrator
Voltmeter

1. Verify that the calibrator ON/OFF switch is OFF.

2. Insert the power converter card shown in Figure 5-5, in the test slot labeled MUX POWER CARD.

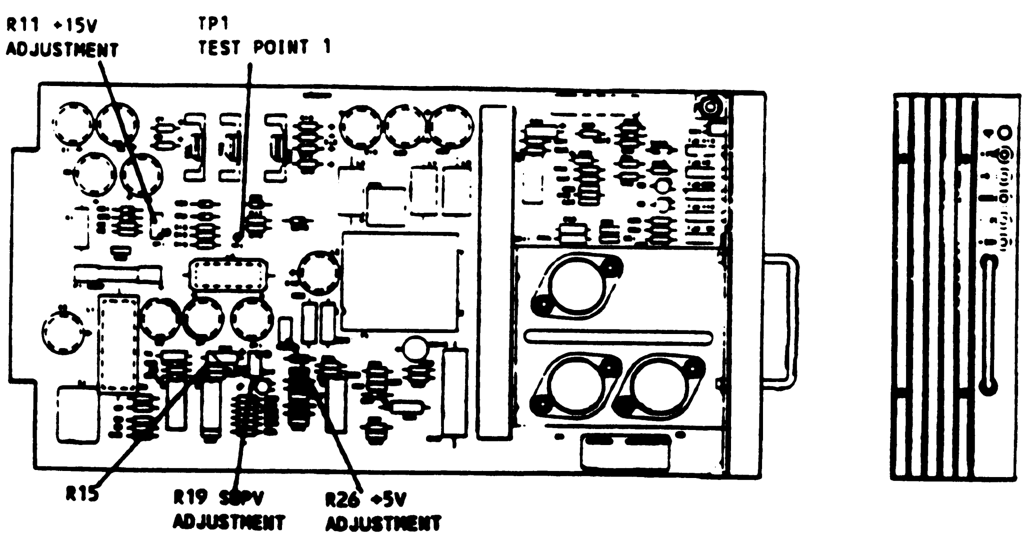

Figure 5-5. Power Converter Card (for Highway Devices) PN41B0985

3. Connect a jumper between test point TP1 and the common (COM) test jack on the front of the power converter card.

4. Set the calibrator ON/OFF switch to ON.
5. Disconnect the jumper and wait five minutes for the card outputs to stabilize.
6. Connect a voltmeter between test point TP1 and ground (GND) test jack on the power converter card. The voltmeter should read 3.690 ± 0.015 volts dc. If not, adjust the SUPV (R19) potentiometer on the power converter card to obtain the proper reading.
7. Connect a jumper between R15 (end closest to front edge) and GND test jack on the power converter card.
8. Adjust the +5 VOLT (R26) potentiometer for a reading of 4.850 volts dc on the 5 volt dc output. The calibrator RESET TEST and RELAY TEST and the ON indicator on the power converter card should go out. If not, the power converter card requires repair.
9. Adjust the +5 VOLT (R26) potentiometer on the power converter card until the voltmeter reads at least 4.910 volts dc and the ON indicator on the power converter card and RELAY TEST and RESET TEST indicators on the calibrator light.
10. Remove the jumper.
11. Adjust the +5 VOLT (R26) potentiometer on the power converter card until the voltmeter reads 5.070 ± 0.010 volts dc.
12. Connect the voltmeter between the +15V and GND test jacks on the power converter card. The voltmeter should read between 14.050 and 14.600 volts dc and the ON indicator on the power converter card and the RELAY TEST and RESET TEST indicators on the calibrator should go out. If not, adjust the +15 VOLT (R11) potentiometer on the power converter card to obtain the proper reading.
13. Adjust the +15 VOLT (R11) potentiometer on the power converter card for a reading of 15.550 ± 0.050 volts dc on the voltmeter.
14. Connect the voltmeter between the -12V and GND test jacks on the power converter card. The voltmeter should read -12.000 ± 0.400 volts dc. If not, the power converter card requires repair.
15. Connect the voltmeter between the -30V and GND test jacks on the power converter card. The voltmeter should read between -28.900 and -31.000 volts dc. If not, the power converter card requires repair.

16. Disconnect the voltmeter.
17. Set the calibrator ON/OFF switch to OFF.
18. Remove the power converter card.

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Appendix A
Glossary

The following acronyms, abbreviations and terms are used in the Multiplexer Control Unit maintenance manual.

ACK	Acknowledge To recognize and provide a response to a condition such as a process alarm.
ACT	Active
APU	Arithmetic Processor Unit A device dedicated to perform arithmetic calculation tasks using hardware rather than a series of computer instructions.
CHIP	Computer/Highway Interface Package
CIA	Communications Interface Assembly - Provides the link between PROVOX device files and the data highway system.
COM	Common
COMM	Communications
CONFIG	Configuration
CPU	Central Processing Unit
CRD	Card
CTLR	Controller
DET	Detailed
DEV	Device
DEVC	Device
DIP	Dual In-Line Package - An integrated circuit packaging method.
DMA	Direct Memory Access - The transferring of data in and out of memory without using the CPU.
EAROM	Electrically Alterable Read-Only Memory

EIA	Electronic Industries Association
EXT	External
GND	Ground
I/O	Input/Output
IAC	Interactive Controller
INAC	Inactive
INTEG	Integrity
INTL	Internal
IRQ	Interrupt Request
LED	Light Emitting Diode
LSD	Least Significant Digit
LTD	Local Traffic Director - a communications device that controls the data flow on a local highway.
MCU	Multiplexer Control Unit
MPU	Microprocessor Unit
MSD	Most Significant Digit
MUX	Multiplexer
NTD	Network Traffic Director - a communications device that controls the data flow for a network data highway.
PIA	Peripheral Interface Adapter - An integrated circuit device that provides a number of parallel discrete input and output signals that can be controlled by the address and data signals of a MPU.
PIC	Priority Interrupt Controller
PRI	Primary
PROFLEX	Process Flexible Configuration
PROVOX	Process Voice

PSC	Power Supply Common - the negative terminal of a 24 volt power supply.
RAM	Random Access Memory
ROM	Read-Only Memory
R/W	Read/Write
SEC	Secondary
STAT	Status
STB	Standby
VMA	Valid Memory Access
WDT	Watchdog Timer

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