# VLBA ACQUISITION MEMO #366

## National Radio Astronomy Observatory

New Mexico
August 17, 1993

To: VLBA Data Acquisition Group

From: Bryan Martin
Summer Student
NRAO, NM

Subject: Methods of remotely monitoring power supply voltages in VLBA equipment racks

**Introduction:**

It is desirable to remotely monitor the power supply voltages in the recorders, D racks, and C racks at the VLBA sites. This would aid in diagnosing problems with these components. Currently, this monitoring is not being done. I was assigned the task of investigating methods of remotely monitoring the power supply voltages.

There are 12 power supply voltages to monitor in each recorder. The analog power supply puts out five: +15V, -15V, +12V, -12V, and variable write. The digital power supply puts out two: +5V and -5.2V. The Honeywell unregulated power supply puts out two: +33V and -33V. The Honeywell regulated power supply puts out three: +12V, -12V, and +5V. The D rack is powered by five power supplies: two 15 volt supplies and three 5 volt supplies. The C rack is powered by three power supplies: +15V, -15V, and +5V. This gives a total of 32 power supply voltages to monitor at each VLBA site building.

**Discussion:**

Power Monitoring can be easily provided in the C rack. Two modules in this rack use VLBA standard interface boards to communicate with the MCB bus: the round-trip phase monitor and the maser interface. The maser interface has four open analog channels and the round-trip phase monitor has seven. Both modules have plenty of room to add the necessary circuitry to monitor the power supplies.

Unfortunately, the recorders and all of the modules in the D racks use a modified version of the standard interface; the modification consists of incorporating the interface into another board and eliminating the analog monitoring capabilities entirely. Because of this design decision, some other method of monitoring the power supply voltages must be found.

I considered five methods of monitoring the power supply voltages in the recorders and D racks. These are: using the R122 analog I/O board, using an alternative analog VME interface board, adding the analog circuitry to the existing MCB interface, using a new module designed around a VLBA standard interface board, and monitoring the D rack via a module in the C rack.

Analog I/O board R122:

The recorder has an analog board in it; a Xycom XVME-540. This analog I/O board provides some analog monitoring capability. The analog I/O board does not interface directly with the MCB bus; It interfaces with the VME bus in the recorder rack. The analog I/O board has both A/D and D/A capabilities. The A/D section is configured for 16 differential inputs. The input voltage to each channel is limited to + or - 10 volts. Five of the 16 channels are currently in use, leaving only 11 for expansion; at least 12 channels are required.

Since there are not enough open channels left for monitoring the power supplies, either the present boards would have to be modified or a second board would have to be acquired for each recorder. I believe the first option, modifying the boards, is impractical. The boards are already very densely packed with components; there is no room for expansion. The second option, acquiring additional boards, would be very expensive; the list price of these modules from Xycom is $1700 each.

The D racks have no analog monitoring capability built into them at all. The same analog board used in the recorder could be added to the formatter chassis in the D rack to add analog monitoring capability. But again, the cost would be high.

Many of the voltages in the recorders and D racks are out of the maximum input voltage range of the R122 boards. Because of this, an additional module would have to be added to each rack to convert the voltages to a form usable by the R122 boards. These new modules might add up to $300 per rack to the cost. The recorder rack uses NIM type modules while the D rack uses NRAO type modules. This means that different converter modules must be used for the recorders and D racks. The R134 analog conditioner module might be modified do this job in the recorder but a new module must be built for the D rack.

This plan calls for adding one or two new modules in each rack and possibly modifying another module. There are enough empty slots in both the recorder and the D racks to implement this solution. Using the R122 boards for monitoring the power supplies would also require modifications to the VME controller firmware. A change which may have adverse implications for non-NRAO users of the recorders and formatters. The per-station cost of this plan would be about $6000 ($1700 X 3 + $300 X 3).

Alternative analog VME interface board:

An alternative to acquiring more R122 boards would be to obtain or build a much simpler analog board for the recorders and D racks to interface with the VME bus. The R122 board contains 16 A/D inputs and four D/A outputs. This complexity is not necessary for monitoring the power supplies.

The Xycom XVME-500/1 is one VME bus board that would work for this application. This board can be configured for 16 single ended analog inputs and lists for $725. This board has the same input voltage limitations as the R122 board so separate voltage conversion modules (at $300 each) would also be required with this board.

This plan would cost about $1000 per rack or $3000 per station; which is much less expensive than obtaining more R122 boards. However, it would still require modifying the firmware in the VME controllers.

<u>Adding the analog circuit to existing MCB interface:</u>

The MCB interface for the recorder is built into the recorder transport module. There is not enough room on this board to install the Burr-Brown SDM854 data acquisition circuit used in the standard MCB interface; this circuit (see Figure 1) is way too large. However, the SDM854 is an old design; newer designs are available which are much smaller. The Burr-Brown SDM862 (see Figure 2) has capabilities and specifications very similar to the SDM854 but is less than one-fourth the size. An SDM862 installed in an adapter socket (see Figures 3,4,and 5) would just fit on the transport module circuit board (Figure 6) and would provide 16 single-ended input channels. Wiring would have to be added to the recorder to route the 12 power supply voltages to the transport module for monitoring.

The SDM862 requires a + and -15 volt power supply. This supply is not available on the transport module but is available in the recorder rack. The SDM862 could be supplied with + and -15 volts either by tapping off the power supply in the recorder rack or by installing a DC/DC converter, such as the TW1.8-12-15 from Polytron Devices (Figure 7), on the transport module.

SDM862s cost $104 each. The DC/DC converter lists for $34 each. The total cost for materials to implement this modification should be less than $300 per recorder. This plan requires no firmware changes. MCB address space is available for this expansion; for instance addresses 20-2F are not currently in use.

This plan would not work for the D rack. None of the modules in The D rack that interface with the MCB bus have room for the necessary circuitry. Figure 8 shows the layout of the Formatter timing and control module, which contains the MCB interface. The other modules in the D rack have even less room for expansion.

VLBA Standard Interface Board:

I next considered using a system designed around the VLBA standard interface board. This board has an A/D circuit with eight differential analog inputs built into the board and can easily be expanded to include up to 64 analog channels. The standard interface board and voltage conversion circuitry could be built into an NRAO type module and installed in an open slot in the D rack.

The conversion circuitry is required to convert the power supply voltages down to the + or - 10 volt range required by the A/D converter. This would provide eight analog input channels. A similar plan could be used in the recorder but would require different packaging unless the interface for both the recorder and D rack were built to fit in a 2/3 height VME bus slot.

One slot in the D rack (Bin C, Slots 11-12) is already wired for an interface module; all of the power supply voltages and the MCB lines are routed to the rear connector in this slot. The installation would consist of removing a blank plate, sliding the module into the empty slot, and installing some new software on the station computer. No firmware changes are required.

The standard interface boards cost about $400; the additional circuitry and hardware might add $300 more to the cost for a total of $700 per rack, or $2100 per station if used in both recorders and the D rack.

Monitoring the D rack via the C rack:

The C rack and D rack are adjacent to each other at the VLBA sites. The C rack has enough open analog channels available to monitor the power supplies in both racks. The three voltages in the C rack could be monitored in the maser interface module where there are four open channels, and the five voltages from the D rack could be monitored in the round-trip phase monitor module where there are seven open channels. It would be easy to route a cable from the power supply terminals in the D rack to the round-trip phase monitor module in the C rack. Some additional circuitry would be required in these modules but there is plenty of room available. This plan would involve very little additional cost, probably about $100.

Conclusion:

Adding remote monitoring of the C rack can be done easily and with very little cost because of the open channels on the standard interface boards already in this rack. The D rack can also be monitored from the C rack for an additional cost of about $100. A cleaner, although more expensive solution for the D rack would be to add an MCB interface module, at a cost of $700. The recorder has some analog capability, but not enough. The best solution for the recorder is to add the analog monitoring capability to the MCB interface on the transport module at a cost of $300 per recorder.

The material cost of adding remote monitoring of the power supplies in the C and D racks and two recorders would thus range from about $700 on up.

BURR-BROWN®

# SDM854

FOR A COMPLETE DATA SHEET, SEE PDS-423D

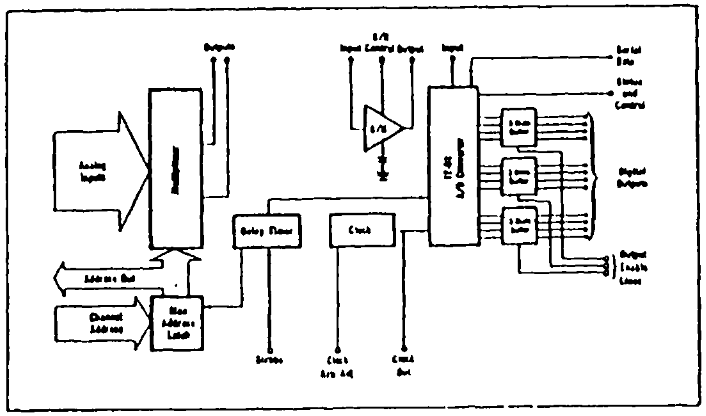
## HYBRID DATA ACQUISITION SYSTEM

## FEATURES

- 12 BIT, ±0.012% LINEARITY ERROR
- INPUTS UP TO ±10 VOLTS
- WIDE TEMPERATURE RANGE
- SELECTABLE 16 SINGLE, 8 DIFFERENTIAL INPUTS
- THREE-STATE OUTPUT BUFFERS

## DESCRIPTION

The SDM854 is a complete data acquisition system contained in a miniature 2.2" x 1.7" x 0.22" (55.9mm x 43.2mm x 5.6mm) ceramic package. This system offers all the functions available in large modular data acquisition systems. Inputs up to ±10V can be accepted and low-level inputs can be accommodated by connecting an external instrumentation amplifier to the output of the multiplexer and to the input of the sample/hold amplifier. Digital resolution is 12 bits with accuracy of ±0.024% at a throughput rate of 27kHz.





## SYSTEM DESCRIPTION

The SDM854 contains all components necessary to multiplex and convert analog signals up to ±10V into equivalent digital outputs. Throughput sampling rates are from 27kHz (12-bit resolution) to 70kHz (8-bit resolution) in the overlap mode of operation. The SDM854 can be configured to accept either 8-channel differential or 16-channel single-ended signals and can be expanded almost without limit with external multiplexers. Three-state outputs are provided for easy interface to microprocessor and other bus-structure systems. The system components are illustrated in Figure 1 and described in the following paragraphs.

### ANALOG MULTIPLEXER

The analog multiplexer consists of two CMOS integrated circuits. Pin interconnects are used to select 16-channel single-ended or 8-channel differential operation. In single-ended operation the multiplexer can be used in a pseudo-differential mode by connecting an external amplifier's inverting input to common remote signal ground. Channel selection is made by an internally latched 3- or 4-bit binary word, for differential or single-ended operation respectively.

### SAMPLE/HOLD

A complete stand-alone circuit, the sample/hold amplifier features buffered output, 10μsec acquisition time, and 100nsec aperture time.

Input, output, and mode control lines are brought out to separate pins. This allows maximum system flexibility for performing functions, such as automatic gain ranging, with no loss of aperture time.

### ANALOG-TO-DIGITAL CONVERTER

The ADC is a 12-bit, 25μsec converter with 0.012% linearity error. Its features include positive and negative reference voltage outputs, external gain and offset adjustments, straight binary or two's complement output, serial data and clock outputs, status output, a short cycle feature, and a clock rate control for higher throughput rates at lower resolution or accuracy.

### THREE-STATE OUTPUT BUFFERS

Digital outputs of the ADC are internally buffered by LSTTL three-state buffers. Three separate enable lines are brought out for easy interfacing to 4-, 8- or 16-bit data buses. $\overline{MSB}$ and BUSY are also buffered by separate three-state devices, each with its own enable line.

### ADDRESS LATCH

Outputs of the 4-bit LSTTL register latch are connected to the address inputs of the multiplexer. This latch serves as an address storage register for the selected analog input. It may be loaded through 4 address inputs. Other inputs are LOAD and CLEAR. The 3 least significant bits are used for 8-channel differential mode addressing.

### DELAY TIMER

A delay timer allows settling time for the multiplexer and sample/hold circuits before conversion begins. The delay is adjustable over a wide range by use of an external resistor or capacitor. This allows for longer settling time if an external instrumentation amplifier is used and is operating at high gains, or shorter settling time for lower resolution operation.

### CHANNEL EXPANSION

The number of analog input channels of the SDM854 can be easily increased by using Burr-Brown's MPC8D (8-channel differential) and MPC16S (16-channel single-ended) multiplexers. These are latch-free devices which contain internal binary decoding at TTL or MOS levels and may be integrated into a system with minimal external logic.

### SYSTEM PERFORMANCE

The SDM854 is configured for random channel selection. With the addition of an external counter they can be configured to continuously sequence through all analog channels or sequence through all analog channels on command from an external trigger.



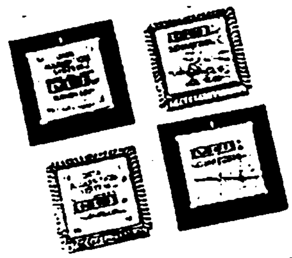
Figure 1

Refer to the
: in boldface
rr-Brown IC

| | | | |
|---|---|---|---|
| nd, Mil | LCC, PGA | | |
| nd, Mil | LCC, PGA | | |
| nd, Mil | LCC, PGA | | |
| nd, Mil | LCC, PGA | | |

(2) Temperature Range: ...
square Leadless Chip ...

BURR-BROWN®



# SDM862 SDM863 SDM872 SDM873

## 16 Single Ended/8 Differential Input 12-BIT DATA ACQUISITION SYSTEMS

### FEATURES

- COMPLETE 12-BIT DATA ACQUISITION SYSTEM IN A MINIATURE PACKAGE
- INPUT RANGES SELECTABLE FOR UNIPOLAR OR BIPOLAR OPERATION
- THROUGHPUT RATES:

| | 862/3 | 872/3 |
|---|---|---|
| 8-BIT ACCURACY: | 45kHz | 67kHz |
| 12-BIT ACCURACY: | 33kHz | 50kHz |

- SELECTABLE GAINS OF 1, 10, AND 100
- FULL MICROPROCESSOR COMPATIBLE INTERFACE
- GUARANTEED NO MISSING CODES OVER TEMPERATURE
- SURFACE-MOUNT OR PIN GRID ARRAY PACKAGE OPTIONS
- FULL SPECIFICATION OVER THREE TEMPERATURE RANGES:
  0 TO +70°C
  −25 TO +85°C
  −55 TO +125°C

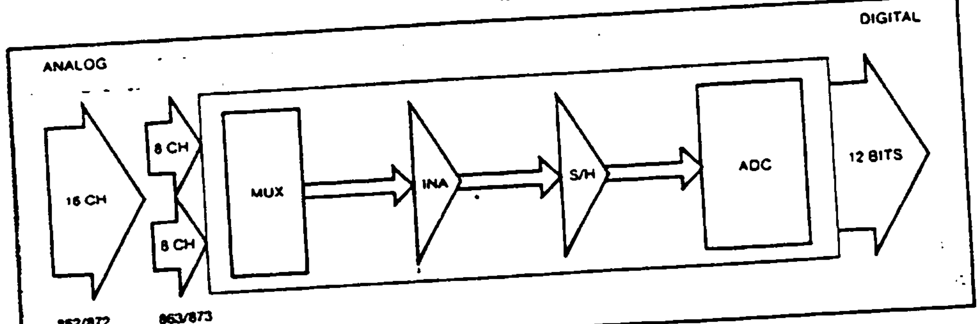
### DESCRIPTION

| | | |
|---|---|---|
| 16 Single-Ended Inputs: | SDM862 | SDM872 |
| 8 Differential Inputs: | SDM863 | SDM873 |
| 33kHz Throughput Rate: | SDM862 | SDM863 |
| 50kHz Throughput Rate: | SDM872 | SDM873 |

The SDM components are complete, pin-compatible, data acquisition systems housed in a hermetically sealed 1"-square leadless chip carrier or a 1.1"-square pin grid array. The small package outlines and low power consumption provide an ideal data acquisition solution when space is at a premium.

The devices comprise of an input multiplexer, instrumentation amplifier with selectable gains, sample/hold amplifier and A/D converter with microprocessor interface and three-state buffers.

The SDM family will accept unipolar or bipolar voltage inputs in the range 0 to +10V, ±5V and ±10V. For low-level signals, jumper-selectable gains of 10 or 100 can be applied. The number of input channels can be expanded by the addition of multiplexers. System integration is simplified by the microprocessor interface and the facility of the sample/hold amplifier being controlled directly by the A/D converter.




International Airport Industrial Park • P.O. Box 11400 • Tucson, Arizona 85734 • Tel.: (602) 746-1111 • Twx: 910-952-1111 • Cable: BBRCORP • Telex: 66-6491

PDS-686B

DATA ACQUISITION COMPONENTS

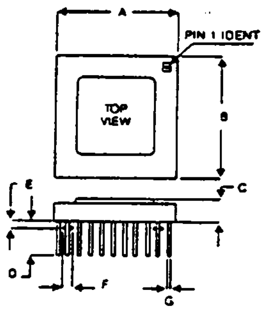
11

SDM862/863/872/873



Figure 2

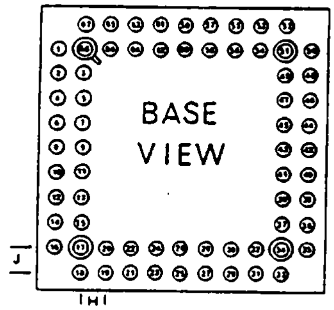
## P.G.A. MECHANICAL OUTLINE



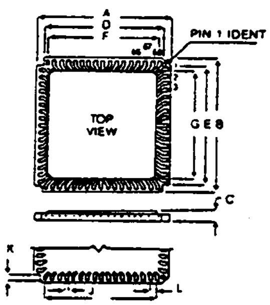

H PACKAGE

Terminations: Gold plated KOVAR.
Case: Black ceramic with gold plated nickel lid.
Hermeticity: Gross leak test.
Weight: 9 grms (0.32oz)

| DIM | INCHES MIN | INCHES MAX | MILLIMETRES MIN | MILLIMETRES MAX |
|---|---|---|---|---|
| A | 1 087 | 1 109 | 27 610 | 28.169 |
| B | 1 087 | 1 109 | 27 610 | 28.169 |
| C | 095 | 120 | 2 413 | 3 048 |
| D | 162 | 198 | 4 115 | 5.029 |
| E | 045 | 055 | 1 143 | 1 397 |
| F | 045 | 055 | 1 143 | 1 397 |
| G | 016 | 020 | 406 | 508 |
| H | 100 BASIC | | 2 540 BASIC | |
| J | 100 BASIC | | 2 540 BASIC | |




## L.C.C. MECHANICAL OUTLINE




Terminations: Gold plated nickel on refractory metallization.
Case: Ceramic with gold plated nickel lid.
Hermeticity: Gross leak test.
Weight: 4.2 grams (0.15oz)

| DIM | INCHES MIN | INCHES MAX | MILLIMETRES MIN | MILLIMETRES MAX |
|---|---|---|---|---|
| A | 945 | 965 | 24 003 | 24 511 |
| B | 945 | 965 | 24 003 | 24 511 |
| C | 076 | 094 | 1 934 | 2 388 |
| D | 841 | 859 | 21 361 | 21 819 |
| E | 841 | 859 | 21 361 | 21 819 |
| F | 755 | 785 | 19 177 | 19 939 |
| G | 755 | 785 | 19 177 | 19 939 |
| H | 800 BASIC | | 20 320 BASIC | |
| J | 027 | 033 | 686 | 838 |
| K | 045 BASIC | | 1 143 BASIC | |
| L | 050 BASIC | | 1 270 BASIC | |

## P.C.B. COMPONENTS PARTS LIST

| | | | | | |
|---|---|---|---|---|---|
| R1 | 100kΩ For 0–10 Volts setting | C26 | 10nF Ceramic | P3 | 100kΩ 0–10 volts range only |
| R2 | 100Ω | C27, C29, C35, C32, C38, C39 | 10µF Tantalum (Decoupling) | L1 . . . L3 | 100µH (Decoupling) |
| R3 . . . R18 | 10kΩ 1% | C28, C30, C31, C36, C37, C40 | 100nF Ceramic (Decoupling) | D1 . . . D32 | 1N4148 (Input Protection Diodes) |
| C1 . . . C16 | 0.47µF—Single ended input mode<br>10nF 1%—Differential input mode | C33, C34 | 0.33µF Tantalum | D33, D34 | 1N4007 |
| C17 . . . C24 | 0.47µF—Differential input mode | P1 | 100Ω | 78 | MC78M15CG |
| C25 | 4700pF (Polypropylene, Polystyrene or Teflon™) | P2 | 100Ω ±5 volts, ±10 volts range only | 79 | MC79L15CG |
| | | | | 74175 | 74LS175 |
| | | | | LCC Socket | MC0068 |

UNLESS OTHERWISE MARKED—RESISTORS ARE 1/4W, 5%, CAPACITORS ARE 10%

## ORDERING INFORMATION(1)

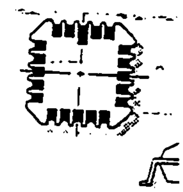
| Model | Input | LCC, PGA Pkg. | Accuracy (% FSR) | Throughput | Temp. Range (°C) | Model | Input | LCC, PGA Pkg. | Accuracy (% FSR) | Throughput | Temp. Range (°C) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SDM862J(2) | 16SE | L, H | ±0.024 | 33kHz | 0 to +70 | SDM863J | 8DIF | L, H | ±0.024 | 33kHz | 0 to +[illegible] |
| SDM862K | 16SE | L, H | ±0.012 | 33kHz | 0 to +70 | SDM863K | 8DIF | L, H | ±0.012 | 33kHz | 0 to +[illegible] |
| SDM862A | 16SE | L, H | ±0.024 | 33kHz | −25 to +85 | SDM863A | 8DIF | L, H | ±0.024 | 33kHz | −25 to +[illegible] |
| SDM862B | 16SE | L, H | ±0.012 | 33kHz | −25 to +85 | SDM863B | 8DIF | L, H | ±0.012 | 33kHz | −25 to +[illegible] |
| SDM862R | 16SE | L, H | ±0.024 | 33kHz | −55 to +125 | SDM863R | 8DIF | L, H | ±0.024 | 33kHz | −55 to +[illegible] |
| SDM862S | 16SE | L, H | ±0.012 | 33kHz | −55 to +125 | SDM863S | 8DIF | L, H | ±0.012 | 33kHz | −55 to +[illegible] |
| SDM872J | 16SE | L, H | ±0.024 | 50kHz | 0 to +70 | SDM873J | 8DIF | L, H | ±0.024 | 50kHz | 0 to +[illegible] |
| SDM872K | 16SE | L, H | ±0.012 | 50kHz | 0 to +70 | SDM873K | 8DIF | L, H | ±0.012 | 50kHz | 0 to +[illegible] |
| SDM872A | 16SE | L, H | ±0.024 | 50kHz | −25 to +85 | SDM873A | 8DIF | L, H | ±0.024 | 50kHz | −25 to +[illegible] |
| SDM872B | 16SE | L, H | ±0.012 | 50kHz | −25 to +85 | SDM873B | 8DIF | L, H | ±0.012 | 50kHz | −25 to +[illegible] |
| SDM872R | 16SE | L, H | ±0.024 | 50kHz | −55 to +125 | SDM873R | 8DIF | L, H | ±0.024 | 50kHz | −55 to +[illegible] |
| SDM872S | 16SE | L, H | ±0.012 | 50kHz | −55 to +125 | SDM873S | 8DIF | L, H | ±0.012 | 50kHz | −55 to +[illegible] |

NOTES: (1) LCC Evaluation Board Part Number: PC862/863-1. PGA Evaluation Board Part Number: PC862/863-2. (2) 16 single-ended inputs, LCC package, with accuracy of 0.024% FSR, Temp Range of 0°C to 70°C and throughput of 33kHz = SDM862JL.

Teflon™ E.I. du Pont de Nemours & Co.

Figure 3





SURF

Burr-Brown offe
mount packages.
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concentrates prim
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SOIC

Plastic small-outli
example, the SOIC

LCC

Ceramic leadless c
ample, the LCC-20

STAY UP TO I

Burr-Brown is conti
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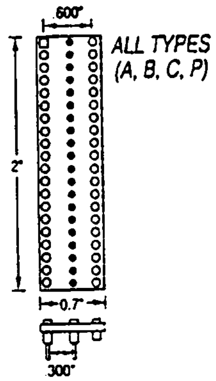
Emulation Technologies



# PROTOTYPING ADAPTERS

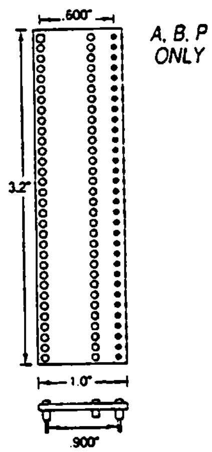
## DIP (.100' Spacing)

### 40 Pin



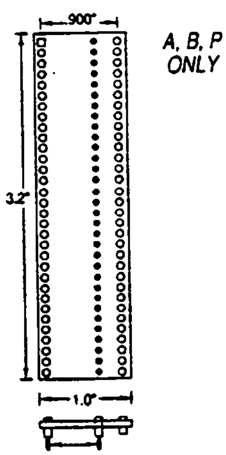

AB-40-600FEM-300MALE-M
AB-40-600FEM-300MALE-W

### 64 Pin




→ AB-64-600FEM-900MALE-M
→ AB-64-600FEM-900MALE-W

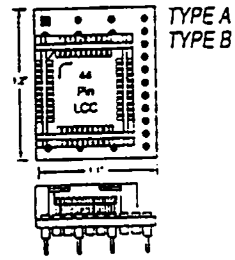
### 64 Pin




AB-64-900FEM-600MALE-M
AB-64-900FEM-600MALE-W

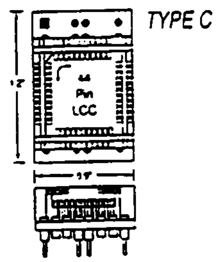
## LCC

### 44 Pin



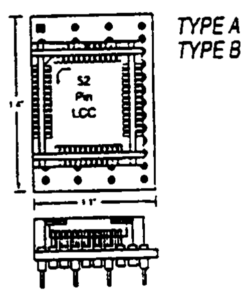

AB-44-LCC3-A/B-M
AB-44-LCC3-A/B-W

### 44 Pin



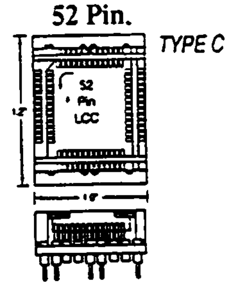

AB-44-LCC3-C-M
AB-44-LCC3-C-W

### 52 Pin




AB-52-LCC4-A/B-M
AB-52-LCC4-A/B-W

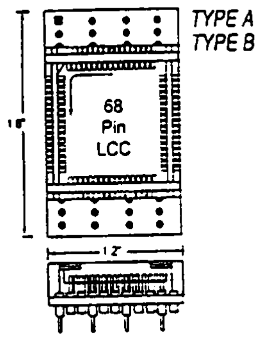
### 52 Pin.




AB-52-LCC4-C-M
AB-52-LCC4-C-W

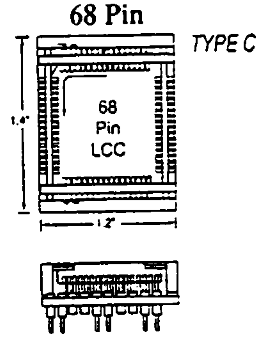
## LCC

### 68 Pin



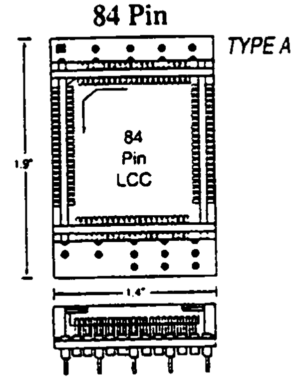

AB-68-LCC2-A/B-M
AB-68-LCC2-A/B-W

### 68 Pin




AB-68-LCC2-C-M
AB-68-LCC2-C-W

### 84 Pin




AB-84-LCC5-A-M
AB-84-LCC5-A-W

See page 9 for Fast Delivery.
Prices from $14.00 to $290.00.

→ We ship this item overnight.

Figure 4

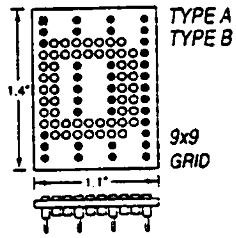
Emulation Technologies



# PROTOTYPING ADAPTERS

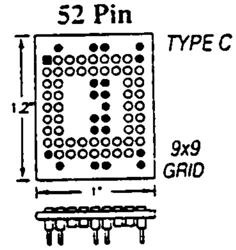
## PGA

### 52 Pin



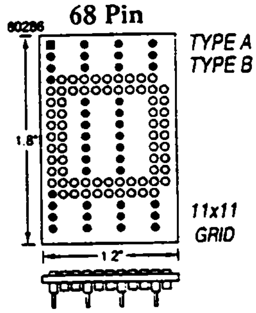

AB-52-PGA6-A/B-M
AB-52-PGA6-A/B-W

### 52 Pin



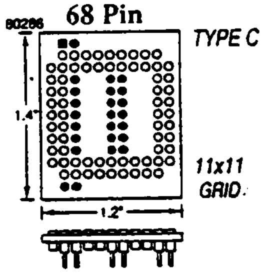

AB-52-PGA6-C-M
AB-52-PGA6-C-W

### 68 Pin




→AB-68-PGA1-A/B-M
→AB-68-PGA1-A/B-W

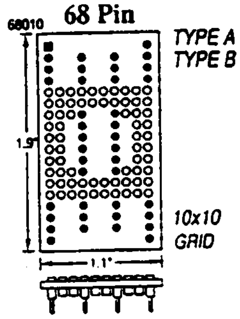
### 68 Pin




AB-68-PGA1-C-M
AB-68-PGA1-C-W

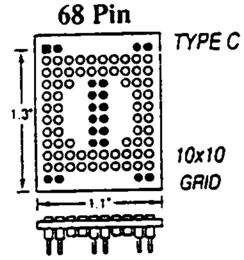
## PGA

### 68 Pin



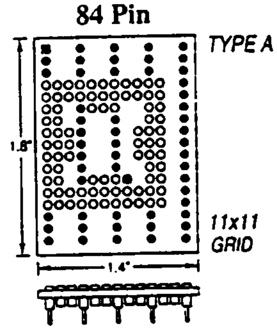

AB-68-PGA2-A/B-M
AB-68-PGA2-A/B-W

### 68 Pin



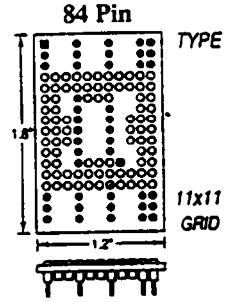

AB-68-PGA2-C-M
AB-68-PGA2-C-W

### 84 Pin




→AB-84-PGA1-A-M
→AB-84-PGA1-A-W

### 84 Pin



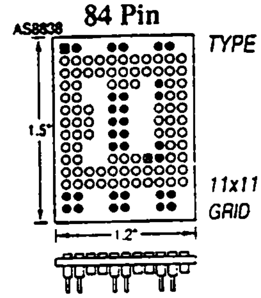

AB-84-PGA1-B-M
AB-84-PGA1-B-W

*NOTE: The part numbers below are for the previous version and are still available in cases where it is already in use.*

AB-84-PGA1-BG-M
AB-84-PGA1-BG-W

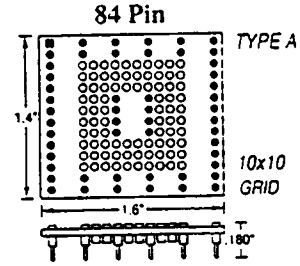
## PGA

### 84 Pin



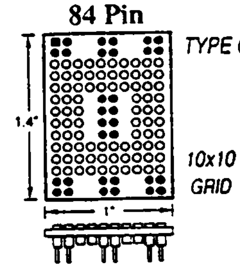

AB-84-PGA1-C-M
AB-84-PGA1-C-W

### 84 Pin




AB-84-PGA2-A-M
AB-84-PGA2-A-W

### 84 Pin




AB-84-PGA2-C-M
AB-84-PGA2-C-W

See page 9 for Fast Delivery.
Prices from $14.00 to $290.00.

→ We ship this item overnight.



Figure 5

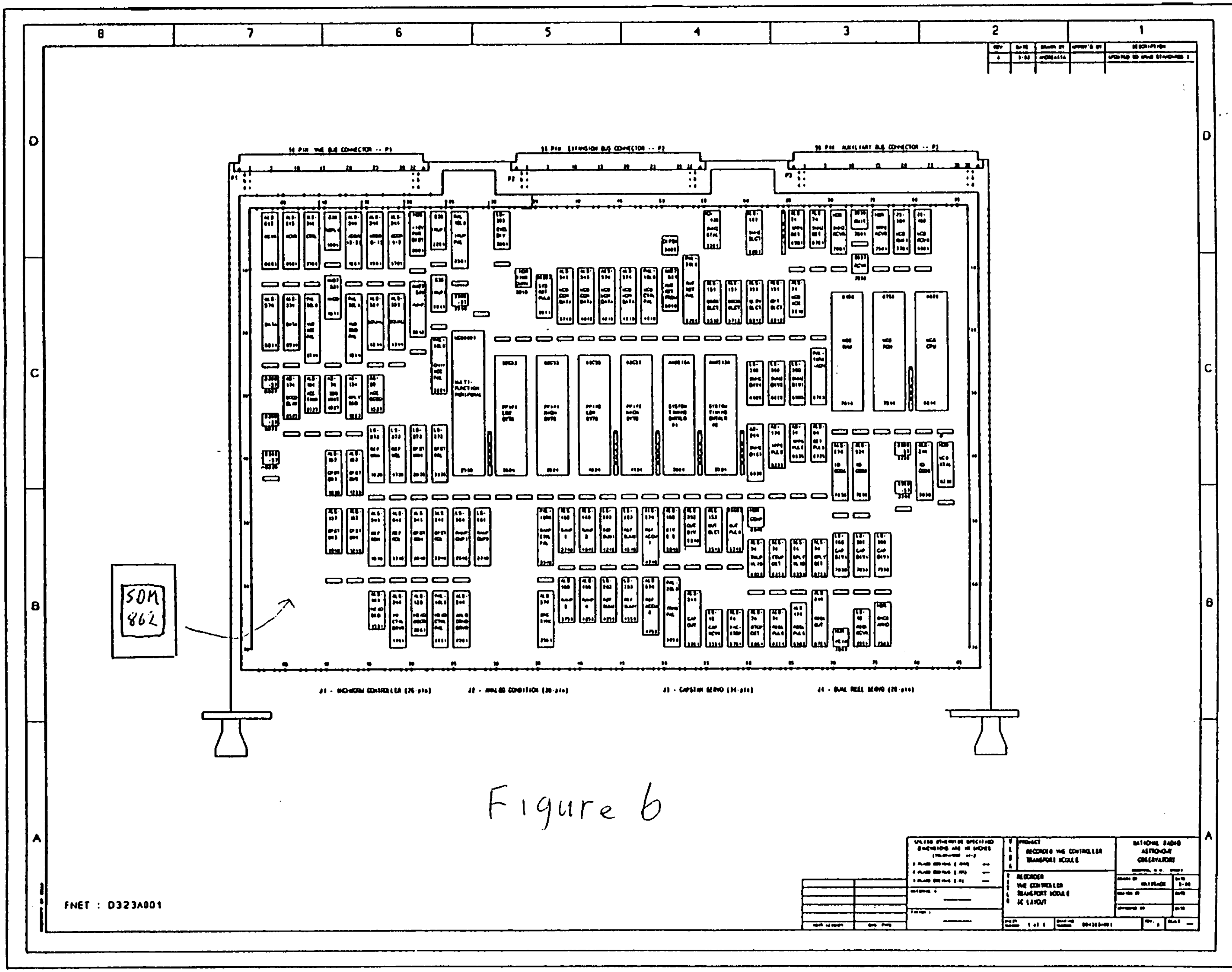
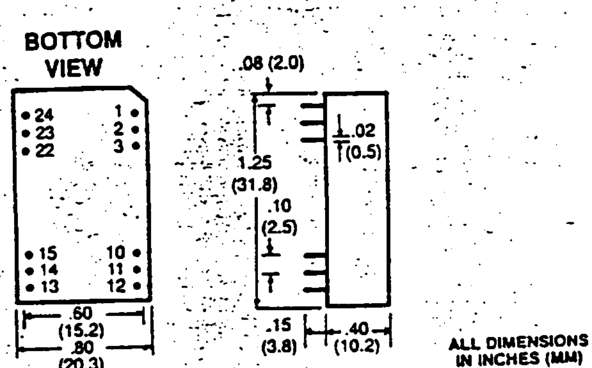

50M
862
PROJECT
RECORDER VME CONTROLLER
TRANSPORT MODULE
RECORDER
VME CONTROLLER
TRANSPORT MODULE
IC LAYOUT
NATIONAL RADIO
ASTRONOMY
OBSERVATORY
FNET : D323A001

Figure 6

# 24-PIN DIP DC/DC CONVERTERS (continued)

**DUAL VOLTAGE UNITS**

| INPUT VOLTAGE (VDC) | OUTPUT VOLTAGE (VDC) | OUTPUT CURRENT (mA) | MODEL NUMBER | PRICE 1-9 QTY |
|---|---|---|---|---|
| 5 (4.75-5.25) | ±5 | ±180 | TW1.8-5-5 | 29.00 |
| | ±5 | ±300 | TW3-5-5 | 34.00 |
| | ±9 | ±100 | TW1.8-5-9 | 29.00 |
| | ±9 | ±167 | TW3-5-9 | 34.00 |
| | ±12 | ±75 | TW1.8-5-12 | 29.00 |
| | ±12 | ±125 | TW3-5-12 | 34.00 |
| | ±15 | ±60 | TW1.8-5-15 | 29.00 |
| | ±15 | ±100 | TW3-5-15 | 34.00 |
| 12 (11.40-12.60) | ±5 | ±180 | TW1.8-12-5 | 29.00 |
| | ±5 | ±300 | TW3-12-5 | 34.00 |
| | ±12 | ±75 | TW1.8-12-12 | 29.00 |
| | ±12 | ±125 | TW3-12-12 | 34.00 |
| | ±15 | ±60 | TW1.8-12-15 | 29.00 |
| | ±15 | ±100 | TW3-12-15 | 34.00 |
| 24 (22.80-25.20) | ±5 | ±180 | TW1.8-24-5 | 29.00 |
| | ±5 | ±300 | TW3-24-5 | 34.00 |
| | ±12 | ±75 | TW1.8-24-12 | 29.00 |
| | ±12 | ±125 | TW3-24-12 | 34.00 |
| | ±15 | ±60 | TW1.8-24-15 | 29.00 |
| | ±15 | ±100 | TW3-24-15 | 34.00 |
| 28 (26.60-29.40) | ±5 | ±180 | TW1.8-28-5 | 29.00 |
| | ±5 | ±300 | TW3-28-5 | 34.00 |
| | ±12 | ±75 | TW1.8-28-12 | 29.00 |
| | ±12 | ±125 | TW3-28-12 | 34.00 |
| | ±15 | ±60 | TW1.8-28-15 | 29.00 |
| | ±15 | ±100 | TW3-28-15 | 34.00 |
| 48 (45.60-50.40) | ±5 | ±180 | TW1.8-48-5 | 29.00 |
| | ±5 | ±300 | TW3-48-5 | 34.00 |
| | ±12 | ±75 | TW1.8-48-12 | 29.00 |
| | ±12 | ±125 | TW3-48-12 | 34.00 |
| | ±15 | ±60 | TW1.8-48-15 | 29.00 |
| | ±15 | ±100 | TW3-48-15 | 34.00 |




ALL DIMENSIONS IN INCHES (MM)

| Pin Connections | | |
|---|---|---|
| PIN | SINGLE OUTPUT | DUAL OUTPUT |
| 1 | +V INPUT | +V INPUT |
| 2 | N.C. | −V OUTPUT |
| 3 | N.C. | COMMON |
| 10 | −V OUTPUT | COMMON |
| 11 | +V OUTPUT | +V OUTPUT |
| 12 | −V INPUT | −V INPUT |
| 13 | −V INPUT | −V INPUT |
| 14 | +V OUTPUT | +V OUTPUT |
| 15 | −V OUTPUT | COMMON |
| 22 | N.C. | COMMON |
| 23 | N.C. | −V OUTPUT |
| 24 | +V INPUT | +V INPUT |

POLYTRON DEVICES, INC.
P.O. BOX 398, PATERSON, N.J. 07544 (201) 345-5885 FAX: (201) 345-1264

| REV. | DATE | DRAWN BY | APPRV'D BY | DESCRIPTION |
|---|---|---|---|---|
| A | 4-82 | ANDREATTA | | UPDATED TO NRAO STANDARDS |

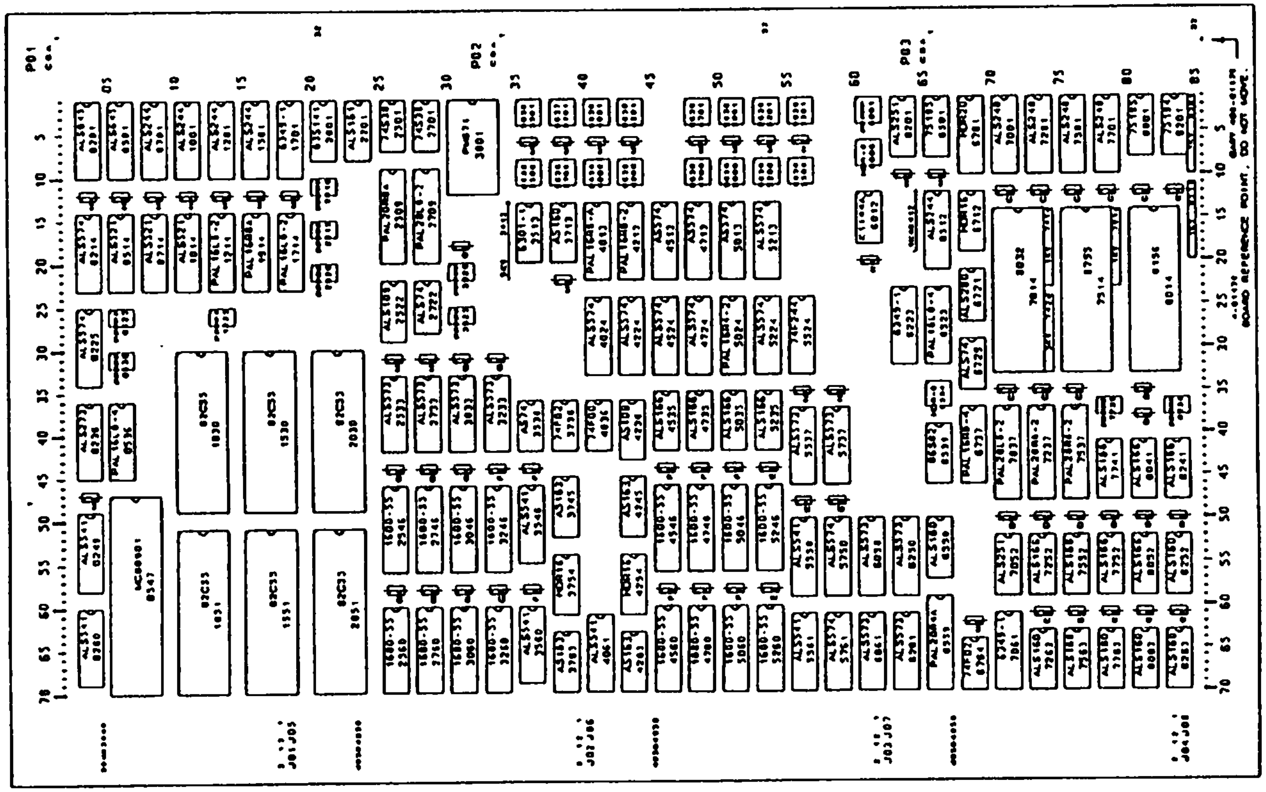


Figure 8

FNET : C4201A01

| | |
|---|---|
| UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES | |
| MATERIAL : | |
| FINISH : | |
| NEXT ASSEMBLY | DWG. TYPE |

VLBA

PROJECT FORMATTER

TITLE FORMATTER TIMING CONTROL MODULE I.C LAYOUT

NATIONAL RADIO ASTRONOMY OBSERVATORY

SOCORRO, N.M.

| DRAWN BY | HAYSTACK | DATE | 12-87 |
|---|---|---|---|
| DESIGN BY | | DATE | |
| APPROVED BY | | DATE | |

SHEET NUMBER 1 of 1 — DRAWING NUMBER C54201A001 — REV. A — SCALE —