AIM2
High-Level Analog Input Module

The AIM2 High-level Analog Input Module offers 32 channels of analog input, and is designed to accept signals ranging from -10V to +10V full scale.

Two high-speed multiplexers, controlled from software, select the channel to be measured. A multiplexer settling time of 4µsec preserves system throughput.

From the AIM2 module, signals are routed to the AMM (1A, 2, F) Analog Measurement Module in slot 1 of the 500A, 500P, 575, or 576 chassis, via a private low-noise pathway. On the AMM module, gain is applied, and the signals are converted via an analog-to-digital converter.

Optional resistor locations permit the installation of resistors to ground. All signal connections are made directly to on-card screw terminals.

The AIM2 module may be installed in slots 2-10 of a 500A or 500P chassis, or slot 3 of a 575 or 576 chassis. To install the module in a 500A or 500P, remove the top cover and insert the board in the desired slot with the components facing the power supply. To minimize the effects of heat and noise from the power supply, it is recommended that analog modules be placed as close to the AMM as possible. Generally, analog modules should be kept as far away from the power supply as possible. For installation into a 575 or 576 chassis, consult the hardware manual for that chassis.

CAUTION: Always turn off the system before installing or removing modules. Replace the top cover and secure it with the screws. To minimize the possibility of EMI radiation, never operate the system with the top cover removed.
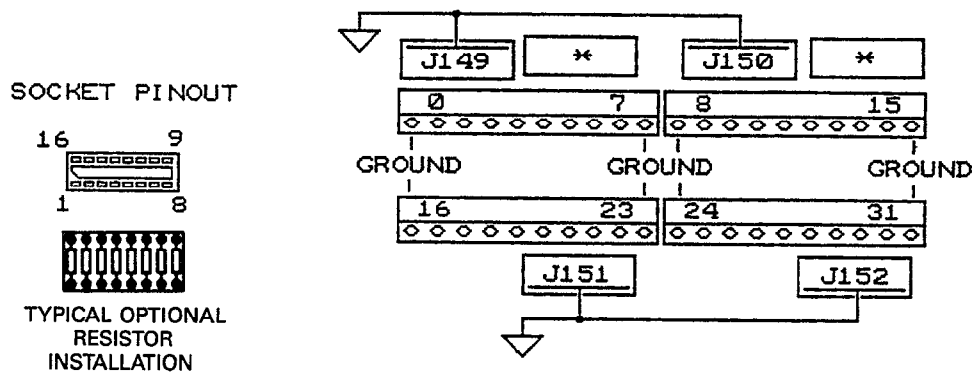
User-Configured Components

Screw terminals and optional resistors are user-configured components on the AIM2 module. Screw terminals banks J147 and J148 allow on-card signal connection for analog inputs arriving at the AIM2. 32 terminals are provided for signal line connections, and 8 terminals are provided for common ground connection. These terminals accept 16-24 gauge wire.

Optional resistor locations permit a resistor connection to ground for each channel. These locations can be used when configuring the module to accept current inputs. These components should be installed on supplied DIP headers. See Table 1 for user-configured components.

AIM2 - (SINGLE-ENDED INPUT, RESISTORS FROM INPUT TO GROUND)

Socket	Channels	Corresponds to Socket Pins
J149	0-7	1-8 (pins 9-16 are grounded)
J150	8-15	1-8 (pins 9-16 are grounded)
J151	16-23	16-9 (pins 1-8 are grounded)
J152	24-31	16-9 (pins 1-8 are grounded)

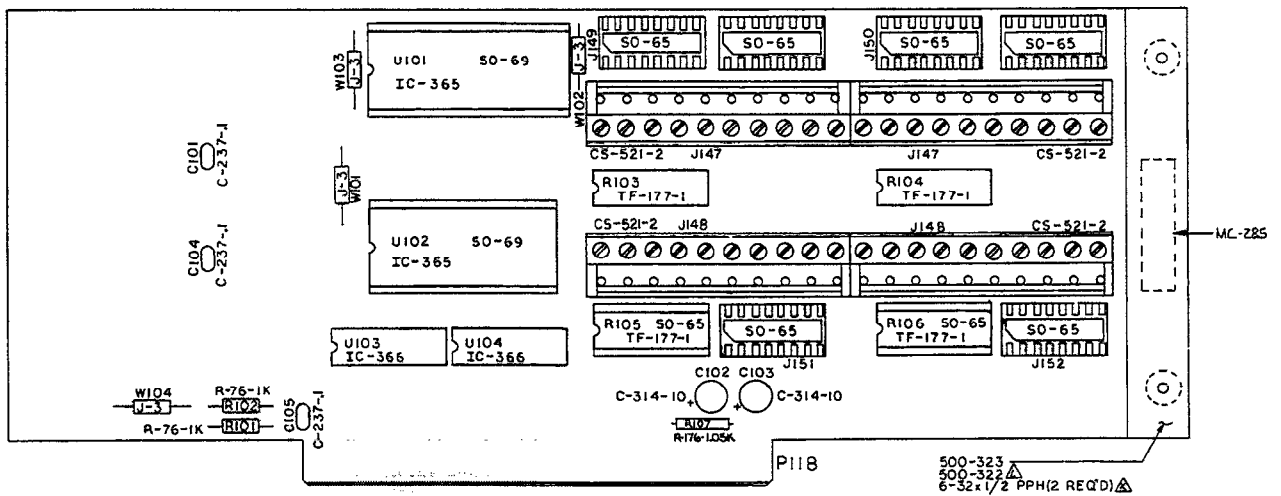Install resistors from pin 1 to pin 16, pin 2 to pin 15, pin 3 to pin 14, etc.

SOCKET PINOUT

TYPICAL OPTIONAL
RESISTOR
INSTALLATION

* = not used (may not be present)

Figure 1. AIM2 Module Configuration

Table 1. User-Configured Components on the AIM2

Name	Designation	Function
DIP header	J149, J150, J151, J152	Optional per channel connection to ground
Screw terminals	J147	Input connection for channels 0-15
Screw terminals	J148	Input connection for channels 16-31

Connections

The positive input for each channel should be connected to the terminal of J147, J148 corresponding to that channel, while the negative input should be connected to a ground terminal of J147 or J148. See Figure 2 for a typical connecting scheme. Refer to the top of Figure 1 for channel configuration of J147 and J148.

CAUTION: To minimize the possibility of EMI radiation, the use of shielded cable is recommended. One end of the shield should be connected to the AIM2 ground terminal and the other end should be left disconnected. Do not use the shield as a signal lead.

CAUTION: The maximum safe input voltage is ±30V (power on), ±10V (power off). If the input voltage on any channel exceeds ±10V, no channel will operate.
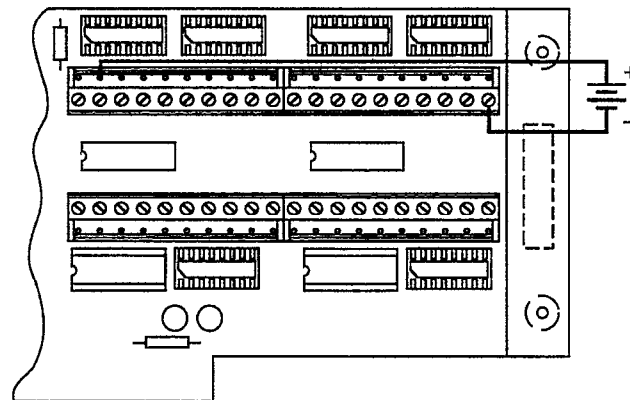

Figure 2. Typical AIM2 Connections (Channel 0 shown)

Current-to-voltage Conversion

When connecting transducers and instrumentation with current outputs rather than voltage outputs, resistors can be installed to convert the current range to an equivalent voltage range. Resistor locations on J149 and J150 are provided for channels 0-15, and J151 and J152 for channels 16-31, respectively. These resistors should be installed on the supplied DIP headers. The value of the resistor can be determined by applying Ohm's law, which describes the relationship of current and resistance to voltage:

E=I*R
Voltage = Amps * Resistance

E should be set equal to the upper limit of the voltage range for the A/D converter, and I to the upper limit of the current range for the signal being measured. R will equal the value (in ohms) of the resistor to be installed on that channel.

Consider the following example: The A/D range is 0 to +10V, and the anticipated current input range is 4 to 20mA. E should be set to 10, and I to .02 (20/1000A). R equals 10/.02, or 500Ω. Thus, a 500Ω resistor should be installed in the appropriate location. Note: The KDAC500 software package requires that a 250Ω resistor be used with 4-20mA inputs. See the KDAC500 manual for details. Precision 250Ω resistors are available from Dale Resistors, P.N. RN55E2500B or from Keithley as P.N. 500-RES-250 (for eight resistors).

Commands

AIM2 module commands are listed in Table 2. Table 3 summarizes the locations of slot-dependent commands.

Table 2. Commands Used with the AIM2 Module

Command	Location
SELECT CHANNEL	CMDA (Slot-dependent location)

Table 3. Locations for Slot-dependent CMDA (500A, 500P, 575)

Slot	Location *
Slot 2	CFF82
Slot 3	CFF84
Slot 4	CFF86
Slot 5	CFF88
Slot 6	CFF8A
Slot 7	CFF8C
Slot 8	CFF8E
Slot 9	CFF90
Slot 10	CFF92

*Assumes IBIN address set to hex
CFF80 (the factory default).

SELECT CHANNEL

Location: Slot-dependent CMDA

The SELECT CHANNEL command is used to select which of 32 channels on the AIM2 is directed to the AMM. This command is also used with the AMM and other input modules.

In all cases, the number of the channel being measured is the value to write to the SELECT CHANNEL location. If channel 0 is selected, the SELECT CHANNEL location should be loaded with the number 0; if channel 25 is selected, SELECT CHANNEL is loaded with 25, and so on (see Table 4).

The SELECT CHANNEL command is always followed by the SELECT SLOT command, which loads the number of the slot in which the module is installed (see AMM reference section). If successive readings are taken from various channels located on the same module, the SELECT SLOT command need not be reissued for each reading. Similarly, for successive readings of a single channel, SELECT CHANNEL need only be issued once.

SELECT CHANNEL and SELECT SLOT must be issued at least once before starting an A/D conversion.

Table 4. Values Written to SELECT CHANNEL

Function	Binary	Hex	Decimal
Channel 0	00000	H0	0
Channel 1	00001	H1	1
Channel 2	00010	H2	2
Channel 3	00011	H3	3
Channel 4	00100	H4	4
Channel 5	00101	H5	5
Channel 6	00110	H6	6
Channel 7	00111	H7	7
Channel 8	01000	H8	8
Channel 9	01001	H9	9
Channel 10	01010	HA	10
Channel 11	01011	HB	11
Channel 12	01100	HC	12
Channel 13	01101	HD	13
Channel 14	01110	HE	14
Channel 15	01111	HF	15
Channel 16	10000	H10	16
Channel 17	10001	H11	17
Channel 18	10010	H12	18
Channel 19	10011	H13	19
Channel 20	10100	H14	20
Channel 21	10101	H15	21
Channel 22	10110	H16	22
Channel 23	10111	H17	23
Channel 24	11000	H18	24

Table 4. Values Written to SELECT CHANNEL (continued)

Function	Binary	Hex	Decimal
Channel 25	11001	H19	25
Channel 26	11010	H1A	26
Channel 27	11011	H1B	27
Channel 28	11100	H1C	28
Channel 29	11101	H1D	29
Channel 30	11110	H1E	30
Channel 31	11111	H1F	31

Theory of Operation

Refer to schematic number 500-146 for the following discussion.

The AIM2 module includes two 16-channel analog multiplexers, U101 and U102, each of which selects signals from among 32 single-ended input channels. An enable line to the two multiplexers determines which will be active, hence, which group of 16 inputs will be accessed. The multiplexers are driven by U103, a quad transparent data latch (74LS75) which latches data lines F0-F3. The enable line that holds the status of D4 is driven by U104, a second latch (74LS75). The SELECT CHANNEL command (signal line CMDA) sets up data lines F0-F5.

The outputs of U101 and U102 are connected to the AN OUT line, a private analog pathway for each slot, leading to the global multiplexer on the AMM in slot 1. Since only one of the two multiplexers is active at a given time, AN OUT is always driven by a single signal.

Resistors at J149A-J149H, J150I-J150H, J151A-J151H, and J152I-J152H are locations for the installation of resistors between signal input and signal ground.

AIM2 Specifications
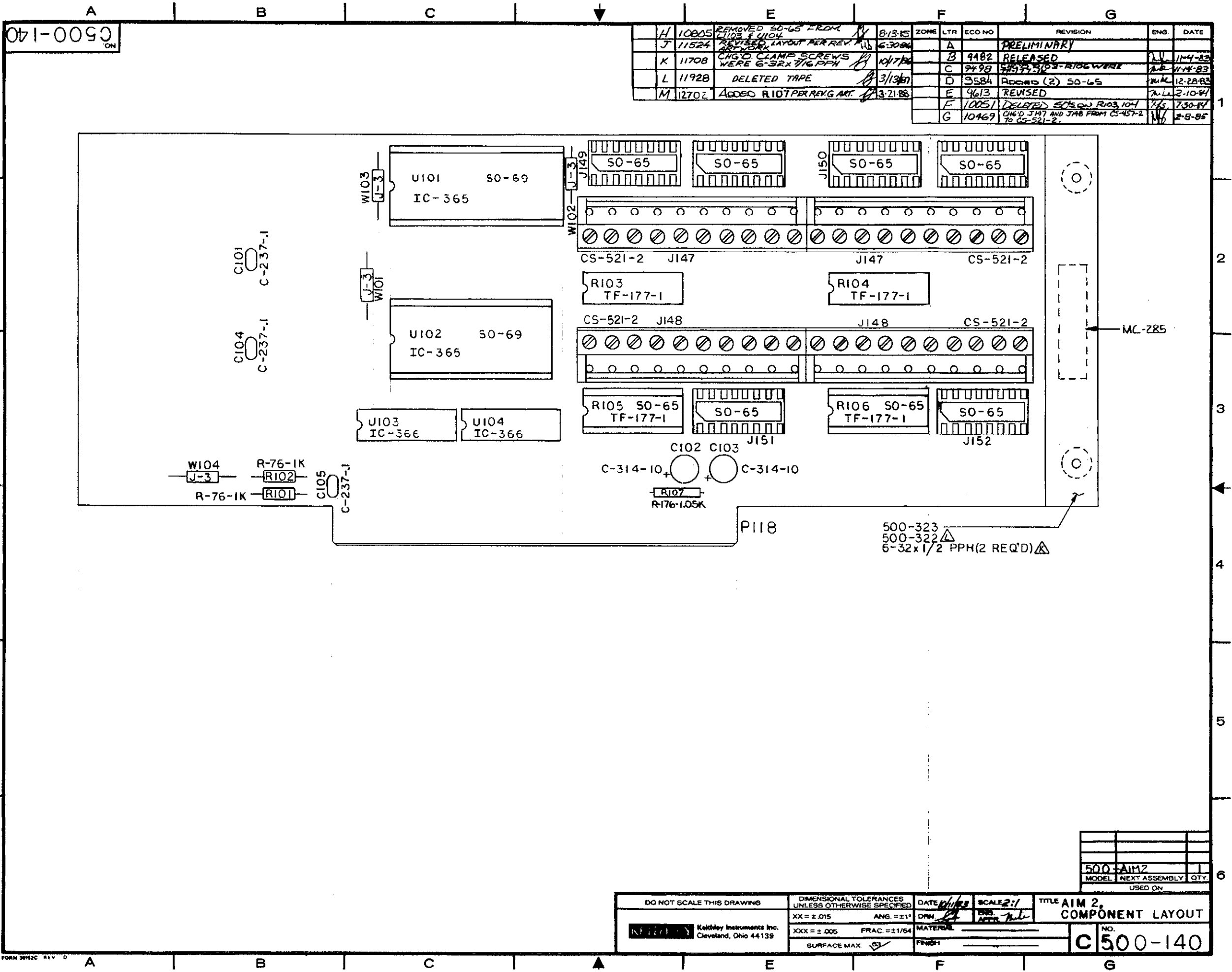
Input channels: 32 single-ended
Input characteristics:
    Input range: ±10V
    Input protection:
        ±30V max (Powered)
        ±10V (Unpowered)
    Input current: <1nA
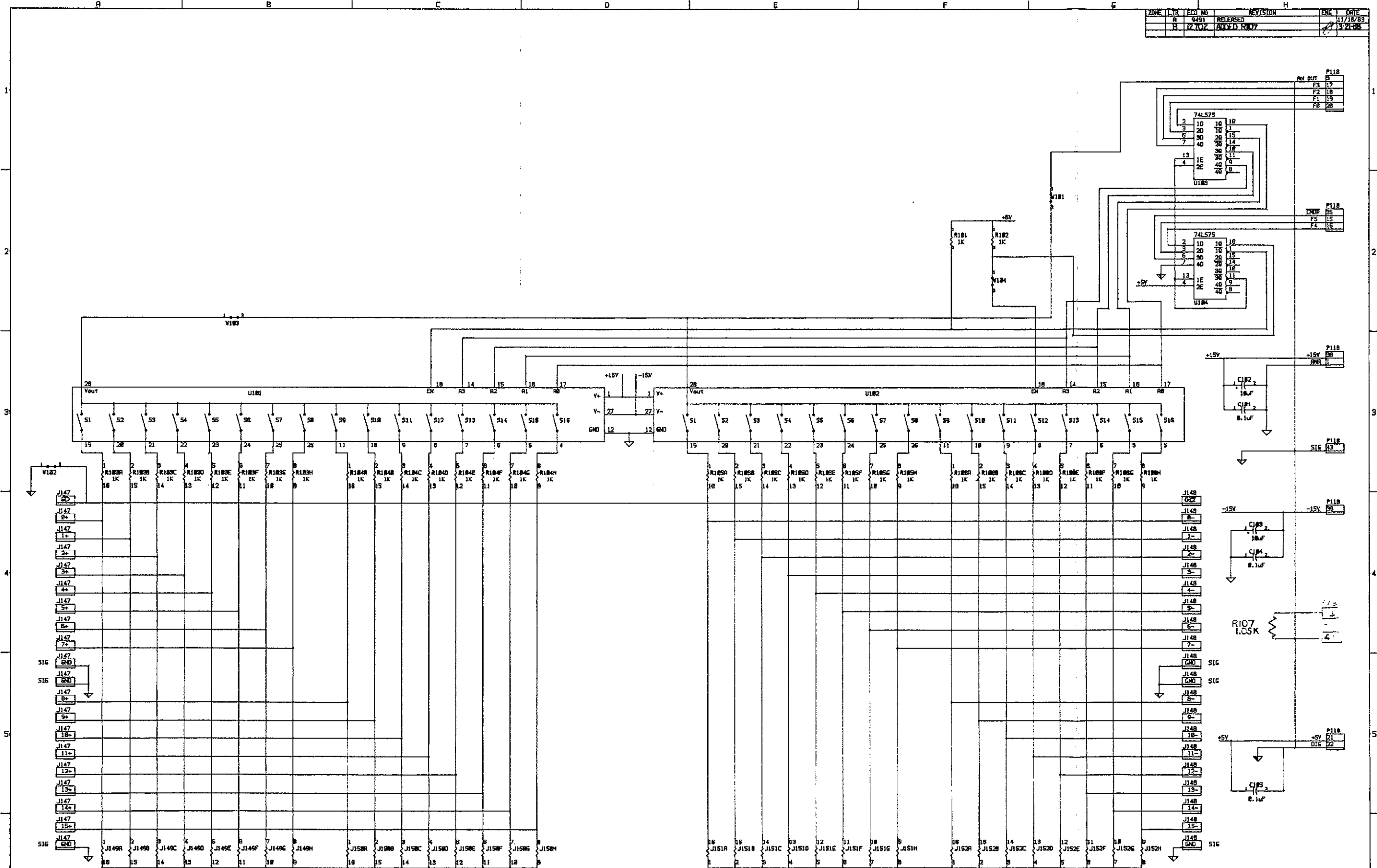
					ZONE	LTR	ECO NO	REVISION	ENG	DATE
H	10805	REMOVED SO-65 FROM U103 & U104		8-13-15		A		PRELIMINARY		
J	11524	REVISED LAYOUT PER REV. M		6-30-86		B	9482	RELEASED		11-4-83
K	11708	CHG'D CLAMP SCREWS WERE 6-32x7/16 PPH		10/17/86		C	9498	28977, 5103 - R106 WIRE		11-14-83
L	11928	DELETED TAPE		3/13/87		D	9584	ADDED (2) SO-65		12-28-83
M	12702	ADDED R107 PER REV.G ART.		3-21-88		E	9613	REVISED		2-10-84
						F	10051	DELETED 50's ON R103,104		7-30-84
						G	10469	CHG'D J147 AND J48 FROM CS-457-2 TO CS-521-2.		2-8-85

W103 J-3
U101 SO-69
IC-365
J149 J-3
SO-65 SO-65 J150 SO-65 SO-65
W102

C101 C-237-1

CS-521-2 J147 J147 CS-521-2

R103 TF-177-1 R104 TF-177-1

J-3 W101

C104 C-237-1

CS-521-2 J148 J148 CS-521-2

U102 SO-69
IC-365

MC-285

U103 IC-366 U104 IC-366

R105 SO-65 TF-177-1 SO-65 R106 SO-65 TF-177-1 SO-65
J151 J152

W104 J-3 R-76-1K R102
R-76-1K R101 C105 C-237-1

C102 C103
C-314-10 + + C-314-10

RIO7
R-176-1.05K

P118

500-323
500-322
6-32x1/2 PPH(2 REQ'D)

500	AIM2		1	
MODEL	NEXT ASSEMBLY	QTY		
	USED ON			

DO NOT SCALE THIS DRAWING

DIMENSIONAL TOLERANCES UNLESS OTHERWISE SPECIFIED
XX = ±.015   ANG. = ±1°
XXX = ±.005   FRAC. = ±1/64
SURFACE MAX. .63

DATE 10/14/83   SCALE 2:1
DRN.
ENG. APPR.
MATERIAL
FINISH

TITLE AIM 2,
COMPONENT LAYOUT

Keithley Instruments Inc.
Cleveland, Ohio 44139

C 500-140

FORM 30152C REV D

KEITHLEY INSTRUMENTS INC.

TITLE: AIM2

NOTES:
1. ALL RESISTOR VALUES ARE IN OHMS UNLESS MARKED OTHERWISE.(K=KILOHMS,M=MEGOHMS)
2. ALL CAPACITOR VALUES ARE IN MICROFARADS UNLESS MARKED OTHERWISE. (pF=PICOFARADS)
3. ▽ DENOTES ANALOG GROUND.
4. ▽ DENOTES SIGNAL GROUND.
5. ▽ DENOTES DIGITAL GROUND.

SIZE D | DRN PWB | NUMBER S00-148 | APP

DATE NOV. 18,1983 | SHEET 1 OF 1