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Model 7053 High Current Scanner Card

Instruction Manual

Contains Operating and Servicing Information

KEITHLEY

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During the warranty period, we will, at our option, either repair or replace any product that proves to be defective.

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Keithley Instruments, Inc. • 28775 Aurora Road • Cleveland, OH 44139 • 216-248-0400 • Fax: 216-248-6168 • http://www.keithley.com

CHINA:	Keithley Instruments China • Yuan Chen Xin Building, Room 705 • 12 Yumin Road, Dewai, Madian • Beijing 100029 • 8610-62022886 • Fax: 8610-62022892
FRANCE:	Keithley Instruments SARL • BP 60 • 3 Allée des Garays • 91122 Palaiseau Cédex • 33-1-60-11-51-55 • Fax: 33-1-60-11-77-26
GERMANY:	Keithley Instruments GmbH • Landsberger Strasse 65 • D-82110 Germering, Munich • 49-89 8493070 • Fax: 49-89-84930787
GREAT BRITAIN:	Keithley Instruments, Ltd. • The Minster • 58 Portman Road • Reading, Berkshire RG30 1EA • 44-118-9575666 • Fax: 44-118-9596469
ITALY:	Keithley Instruments SRL • Viale S. Gimignano 38 • 20146 Milano • 39-2 48303008 • Fax: 39-2-48302274
NETHERLANDS:	Keithley Instruments BV • Avelingen West 49 • 4202 MS Gorinchem • 31-(0)183-635333 • Fax: 31-(0)183-630821
SWITZERLAND:	Keithley Instruments SA • Kriesbachstrasse 4 • 8600 Dübendorf • 41-1-8219444 • Fax: 41-1-8203081
TAIWAN:	Keithley Instruments Taiwan • 1FL., 1, Min Yu First Street • Hsinchu, Taiwan, R.O.C. • 886-35-778462 • Fax: 886-35-778455

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Model 7053 High Current Card
Instruction Manual

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SPECIFICATIONS

MODEL 7053 HIGH CURRENT SCANNER CARD

CHANNELS PER CARD: 10

CONTACT CONFIGURATION: 2-pole Form A with common Guard. Unselected inputs are shorted (HI to LO) via user removable jumpers.

CONNECTOR TYPE: Quick disconnect screw terminal, No. 18 AWG maximum wire size.

RELAY DRIVE CURRENT: 80mA (per relay) typical.

MAXIMUM SIGNAL LEVEL: 300V, 5A, 100VA peak (resistive load).

CONTACT LIFE: 10^7 closures (cold switching); 10^5 closures (at maximum signal level)

CONTACT RESISTANCE: 0.15Ω maximum.

CONTACT POTENTIAL: 1mV maximum.

ACTUATION TIME: <15ms exclusive of mainframe.

CHANNEL ISOLATION: $>10^9\Omega$ and <50pF.

INPUT ISOLATION,

Differential: $>10^7\Omega$ and <150pF.

Common Mode: $>10^7\Omega$ and <150pF.

COMMON MODE VOLTAGE: 300V peak.

ENVIRONMENT,

Operating: 0° to 50°C, up to 35°C at 70% R.H.

Storage: −25°C to +65°C.

DIMENSIONS, WEIGHT: 32mm high × 114mm wide × 272mm long (1¼" × 4½" × 10¾"). Net weight 0.37kg (13oz.).

Specifications subject to change without notice.

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SECTION 1
GENERAL INFORMATION

1.1 INTRODUCTION

The Model 7053 is a high current scanner card with the maximum capabilities of 300V, 5A or 100V•A switching (resistive load only). Signal levels of this magnitude may be found in applications such as power semiconductor testing. The Model 7053 can also be used in monitoring currents from DC power supplies in general purpose ATE bench or laboratory applications. For easy input and output wiring the Model 7053 is designed with quick disconnect screw terminals. Each channel has a HI and LO connection with a common guard. Each of the 10 channels consist of a single 2-pole Form C relay.

The card is field installable in an appropriate Keithley scanner mainframe (e.g. Model 705) via the mainframe's rear panel. Channel switching is accomplished in less than 15msec (exclusive of mainframe) and the specified relay life is greater than 10^7closures (greater than 10^5 closures at maximum signal levels). With the Model 7053's high channel isolation ($>10^9\Omega$), it is well insulated from cross channel noise and interference. The Model 7053's high input isolation ($>10^6\Omega$) reduces loading to a minimum.

1.2 WARRANTY INFORMATION

Warranty information is stated on the inside front cover of this manual. If there is a need for service, contact the Keithley representative or authorized repair facility in your area. Check the back cover of this manual for addresses. The service form supplied at the end of the manual should be used to provide the repair facility with adequate information concerning any difficulty.

1.3 MANUAL ADDENDA

Improvements or changes to this manual will be explained on an addendum included with this manual.

1.4 SAFETY SYMBOLS AND TERMS

The symbol ⚠ denotes that the user should refer to the operating instructions.

The symbol ↯ denotes that a high voltage may be present on the terminal(s).

The **WARNING** used in this manual explains dangers that could result in personal injury or death.

The **CAUTION** used in this manual explains hazards that could damage the *instrument.*

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SECTION 2
OPERATION

2.1 INTRODUCTION

This section provides the necessary information to use the Model 7053 with an appropriate Keithley scanner mainframe (such as the Model 705). Once the card is installed in the scanner mainframe, refer to the scanner mainframe's instruction manual for complete operating instructions.

2.2 SAFETY PRECAUTIONS

1. Do not exceed the Model 7053's maximum allowable signal level as defined in the specifications.
2. Do not exceed the maximum common mode voltage of 300V as defined in the specifications. Exercise extreme caution when a shock hazard is present at the terminals. The American National Standard Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30V rms or 42.4V peak are present.
3. Make sure the scanner mainframe is grounded through a properly earth grounded receptacle before operation.
4. Turn off all power supplies and discharge any residual power before installing or removing the Model 7053 from the scanner mainframe or wires from the terminals of the Model 7053.
5. Use appropriately rated wire when switching high current.
6. Read this manual carefully and ahere to all the safety precautions listed before operating the instrument.
7. Inspect all test connections for wear or defects such as cracks, exposed wires, etc. Correct any defect found before operating the instrument.

2.3 WIRING

Each channel on the Model 7053 high current card consists of a single 2-pole Form C relay. The Model 7053 will switch any one of the 10 signals (inputs) to one output, or switch one signal to any one of 10 outputs.

1. Wiring is accomplised by means of quick disconnect screw terminals as shown on the component layout (Figure 6).
2. Resistance of the relay contacts (terminals) is less than 150mΩ.
3. Use wires or cables that are rated for maximum signal levels. The maximum allowable wire size is No. 18 AWG. When operating at high current levels (e.g. Amps) consider the voltage burden (I•R drop) of the wire or cable being used. For example: The approximate resistance of 18 guage copper wire is 6.3mΩ/ft. The voltage burden is approximately 6.3mV/ft/Amp. At the maximum signal current of 5 Amps the voltage burden would be 31.5mV/ft. If the wire being used is 3ft long the voltage burden of the wire is approximately 0.1V.
4. Route the wires or cables through the rubber clamps at the rear of the card.

2.4 INSTALLATION

Refer to the scanner mainframe's instruction manual for installation instructions.

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2.5 OPERATION CONSIDERATIONS

Signal Level—The maximum signal levels that the Model 7053 high current card operates at are 300V maximum, 5A or 100VA peak (resistive load only). The contact life of the relays at maximum signal levels is greater than 10^5 operations.

NOTE

Maximum signal specifications apply to scanner output as well as inputs. For example, multiple channel closures cannot put more than 5A onto the output.

WARNING

When switching signals greater than 30V rms or 42.4V rms peak take care to prevent contact with live circuits which could cause electrical shock resulting in injury or death.

Cables—Shelided cables should be used with the Model 7053 high current card and when switching above 50V or high current. The shield should be connected to circuit guard. This helps prevent excessive radiation from the cables from interfering with any equipment. The cable rating must exceed the maximum allowable signal levels as defined in the specifications.

External Considerations—The Model 7053 is specified for a resistive load, however, external circuit capacitances and inductances can cause excessive currents and voltages across the relay contacts. The currents and voltages must be limited to within the maximum allowable signal levels.

1. **Capacitance**—Charged capacitances in the circuit can cause excessive currents (surge currents) to flow through the relay contacts if the source is shorted out or the output is switched to capacitive loads. This excessive current can weld the relay contacts together. Therefore, use series resistors, where needed, to limit the maximum current that can flow to within contact ratings. The maximum signal levels are stated in the specifications.
2. **Inductance**—The inductance of cables can produce high voltage and arcing across relay contacts when switching. The peak transients must be limited to within the maximum signal levels as defined in the specifications.

2.6 MODEL 7053 MODIFICATION

Unselected inputs on the Model 7053 high current scanner card, are shorted (HI to LO) via installed jumpers (W101-W110). If isolation is required between channel LO and channel HI, the Model 7053 can be modified to disconnect channel LO from channel HI when a relay is off (open). The modification involves removing a jumper wire for the channel that is to be modified. For example, remove jumper W101 to disconnect channel 1's HI terminal from channel 1's LO terminal. Refer to the component layout (Figure 6) for jumper location.

It is recommended to remove the jumpers by cutting them with a pair of wire cutters.

2.7 SWITCH TERMINOLOGY

Throughout this manual the terminology Form C is used. The term Form C is used in switch terminology and is described as follows:

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1. Form A is simply a single pole normally open (SPNO) switch (refer to Figure 1).. A 2-pole switch normally open is classified as a 2 Form A.
2. Form B is similar to Form A except that its contacts are normally closed (refer to Figure 1). A 2-pole switch normally closed is classified as a 2 Form B.
3. Form C is shown in Figure 1 as a single pole double throw switch. It could also be a multiple switch such as a 2-pole which would be classified as a 2 Form C.

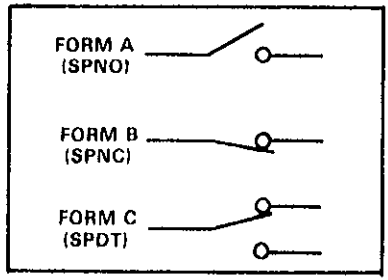


Figure 1. Switch Terminology

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SECTION 3
SERVICING INFORMATION

3.1 INTRODUCTION

This section contains a performance verification procedure. Since there are no calibration adjustments, no recalibration is necessary. Recommended maintenance would include inspection of the scanner plug-in board and card edge connector to ensure good electrical contact. The verification procedure should be performed upon receiving the Model 7053 or at the time maintenance is performed on the mainframe.

3.2 REQUIRED TEST EQUIPMENT

Recommended test equipment for performance verification is given in Table 1. Test equipment other than the recommended equipment in Table 1 may be substituted if specifications equal or exceed the stated characteristics.

Table 1. Recommended Test Equipment

Item	Description	Specifications	Mfr.	Model
A	Scanner Mainframe	—	Keithley	705
B	Voltage Source	100V DC	Keithley	230
C	Ohmeter (DMM)	$< 0.1\Omega$ sensitivity	Keithley	195
D	Electrometer	Sensitivity to 10^{-7}A	Keithley	614

3.3 PERFORMANCE VERIFICATION

This section contains procedures needed to verify that the operation of the Model 7053 is within specifications.

1. Channel Isolation
   A. This test measures the electrical isolation between channels on the Model 7053. Set up the circuit shown in Figure 2.
   B. Short the HI and LO connections of each channel on the Model 7053.
   C. Set the scanner mainframe to the channel mode, channel 1 and the step mode. Set the electrometer to AMPS and zero check. Program the Model 230 to output 100V and take the electrometer out of zero check. Program channel 1 open and the other channels are closed.
   D. The reading on the electrometer should be less than 10^{-7}A (100nA). Using Ohm's law calculate channel isolation. For example; $R = E/I = 100V/10^{-7}A = 10^{9}\Omega$. Due to the capacitance of the circuit the offset current may be high until the capacitance of the circuit is charged up. Wait until the readings settle out.
   E. Repeat steps C and D for the remaining channels on the card.

2. Open and Close Test
   A. This test verifies that the Model 7053 opens and closes the channels on the card on command from the scanner mainframe. Set up the test circuit shown in Figure 3.
   B. Set the scanner mainframe to the channel mode, channel 1 and the step mode. Set the Model 195 to OHMS and auto range. Using the scanner mainframe front panel controls close channel 1.

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C. The reading on the Model 195 should indicate a short circuit (less than 0.15Ω). The far right corner of the scanner mainframe's front panel display should indicate a C.
D. Using the scanner mainframe's front panel controls open channel 1. The reading on the Model 195 should indicate an open circuit. The far right corner of the scanner mainframe's front panel display should indicate an O.
E. Connect the test leads to the channel under test's LO terminal and the output LO terminal. Repeat steps B through D for the LO connections.
F. Repeat steps A, B, C , D and E for the remaining channels on the card.

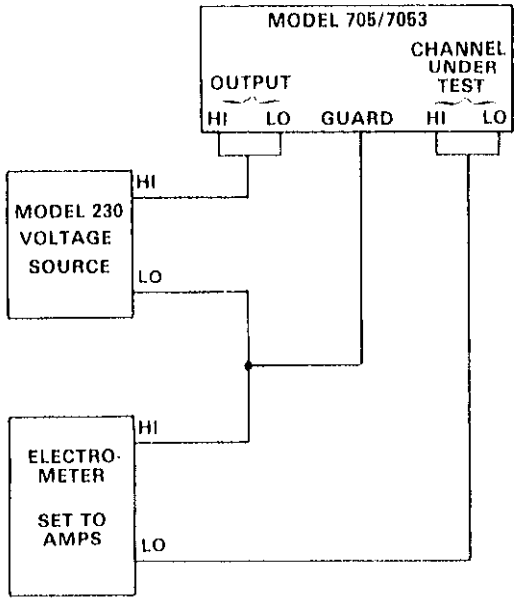


Figure 2. Model 7053 Channel Isolation Test Circuit

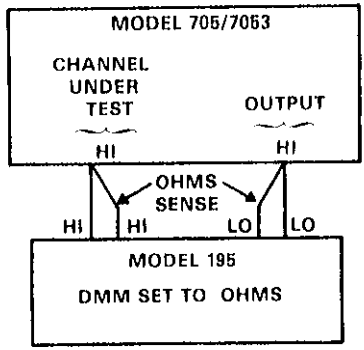


Figure 3. Model 7053 Open and Close Test Circuit

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3. Input Isolation
   A. This test measures the differential input isolation, which is the leakage resistance between a guarded channel's HI and LO connections. Set up the test circuit shown in Figure 4.
   B. Set the scanner mainframe to the channel mode, channel 1 and the step mode. Set the electrometer to AMPS and place it in zero check. Program the Model 230 to output 100V and take the electrometer out of zero check.
   C. The reading on the electrometer should be less than 10^{-5}A (10μA). Using Ohm's law calculate the input isolation. For example: $R = E/I = 100V/10^{-5}A = 10^{7}\mu$. Due to the capacitance of the circuit the offset current may be high until the capacitance of the circuit is charged up. Wait until the readings settle out.
   D. Repeat steps B and C for the remaining channels on the card.
   E. For Input Isolation (common mode) repeat steps B through D using the setup shown in Figure 5.

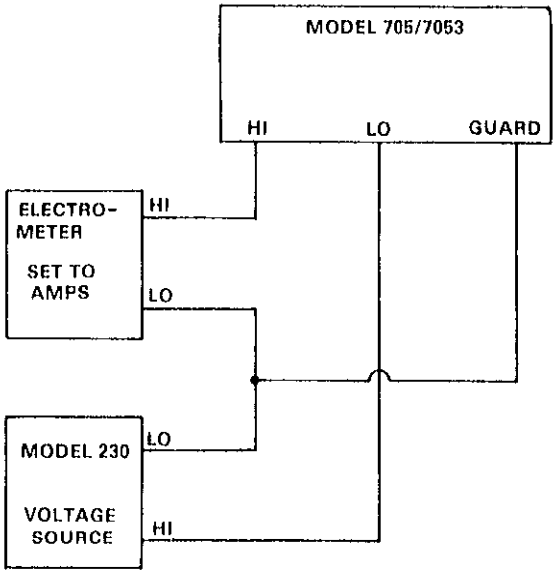


Figure 4. Model 7053 Input Isolation (Differential) Test Circuit

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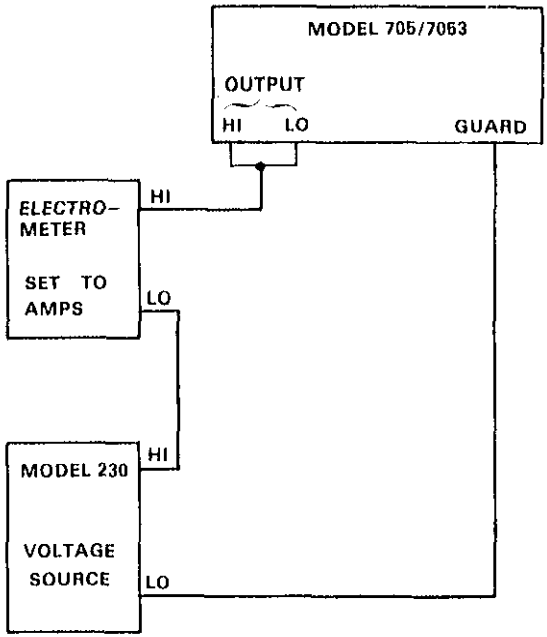


Figure 5. Model 7053 Input Isolation (Common Mode) Test Circuit

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SECTION 4
REPLACEABLE PARTS

4.1 INTRODUCTION

This section contains replacement parts information, a schematic diagram and a component layout for the Model 7053.

4.2 REPLACEABLE PARTS

Parts are listed alpha-numerically in order of their circuit designation. Table 2 contains the electrical replaceable parts. Table 3 contains the mechanical parts.

4.3 ORDERING INFORMATION

To place an order, or to obtain information concerning replacement parts, contact your Keithley representative or the factory. See the back cover for addresses. When ordering include the following information:

1. Instrument Model Number
2. Instrument Serial Number
3. Part Description
4. Circuit Description (if applicable)
5. Keithley Part Number

4.4 FACTORY SERVICE

If the instrument is to be returned to the factory for service, please photo copy the service form which follows this section, fill it out and return with the instrument.

4.5 COMPONENT LAYOUT AND SCHEMATIC DIAGRAM

Figure 6 contains a component layout for the Model 7053. Figure 7 contains the schematic diagram of the Model 7053.

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Table 2. Model 7053 Electrical Replaceable Parts

Circuit Desig.	Description	Keithley Part No.
C101	Capacitor, 10μF, 25V, Aluminum Electrolytic	C-314-10
J1001	3 pin terminal strip	CS-457-1
J1002	3 pin terminal strip	CS-457-1
J1003	3 pin terminal strip	CS-457-1
J1004	3 pin terminal strip	CS-457-1
J1005	3 pin terminal strip	CS-457-1
J1006	10 pin terminal strip	CS-457-2
J1007	10 pin terminal strip	CS-457-2
K101	Relay, 2 Form C	RL-80
K102	Relay, 2 Form C	RL-80
K103	Relay, 2 Form C	RL-80
K104	Relay, 2 Form C	RL-80
K105	Relay, 2 form C	RL-80
K106	Relay, 2 Form C	RL-80
K107	Relay, 2 Form C	RL-80
K108	Relay, 2 Form C	RL-80
K109	Relay, 2 Form C	RL-80
K110	Relay, 2 Form C	RL-80
W101	Jumper	J-3
W102	Jumper	J-3
W103	Jumper	J-3
W104	Jumper	J-3
W105	Jumper	J-3
W106	Jumper	J-3
W107	Jumper	J-3
W108	Jumper	J-3
W109	Jumper	J-3
W110	Jumper	J-3

Table 3. Model 7053 Mechanical Replaceable Parts

Description	Keithley Part No.
Handle (2 required)	FA-119
Rivet (2 required)	FA-121
Clamp, assembly, upper	7055-303-07
a. Clamp, upper	7055-305-
b. Strip, rubber	26621
Clamp, assembly, lower	26740
a. Clamp, cable, lower	26620
b. Strip, rubber	26621
No. 6-32 × 5/16 Phillips Pan Head Screw	
No. 6-32 × 1 inch Phillips Pan Head Screw	

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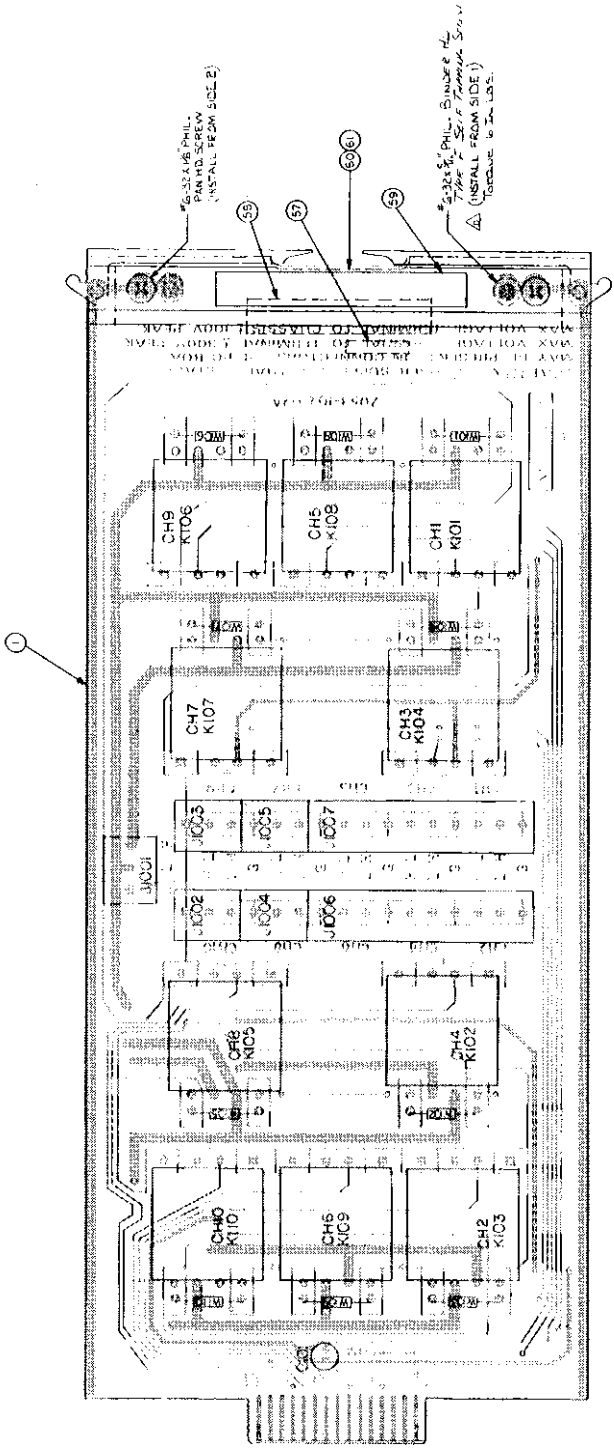


Figure 6. Model 7053 Component Layout

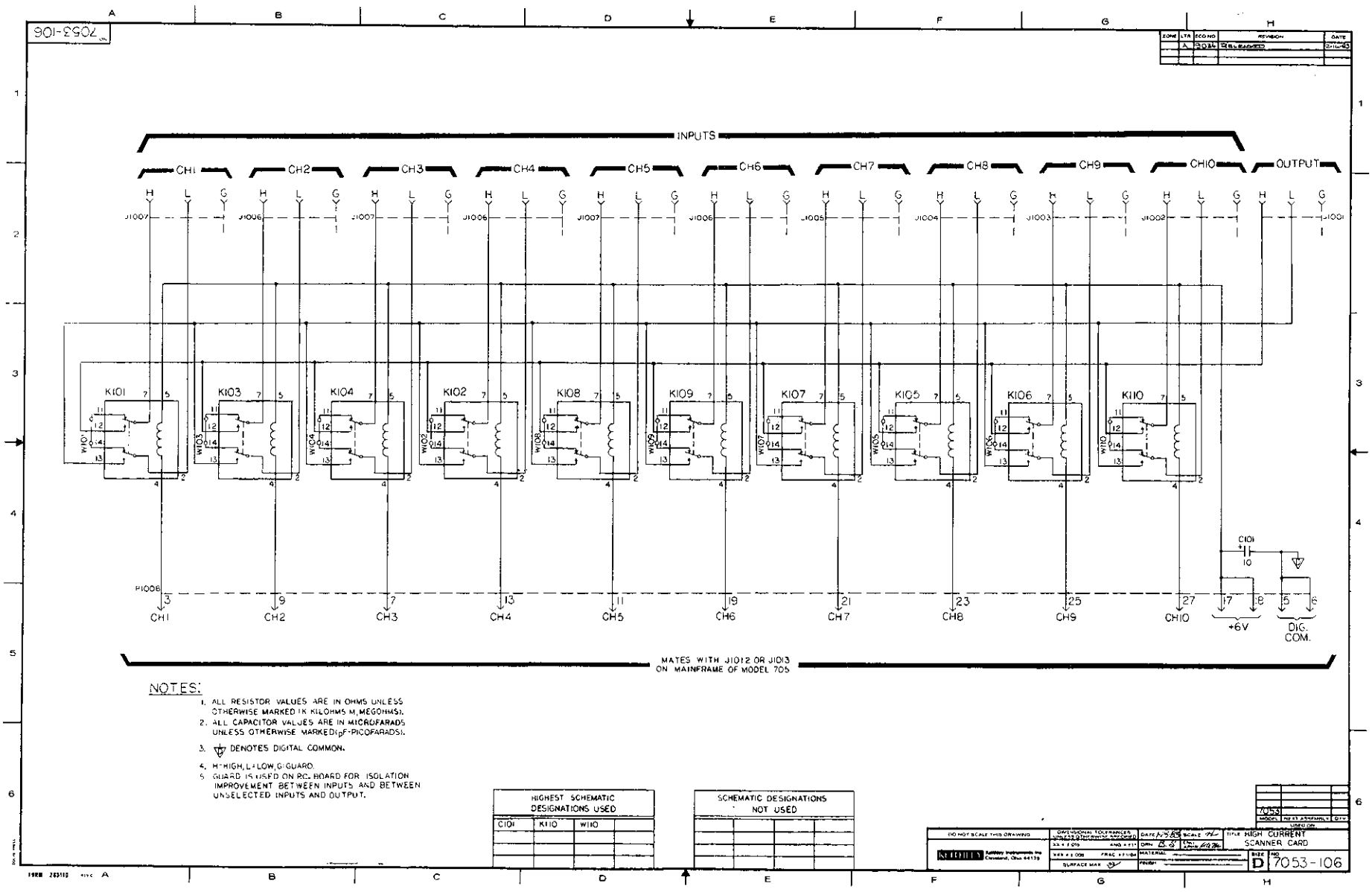


Figure 7. Model 7053 Schematic Diagram

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Service Form

Model No. _____ **Serial No.** _____ **Date** _____

Name and Telephone No. _____

Company _____

List all control settings, describe problem and check boxes that apply to problem.

_____

_____

- ❑ Intermittent
- ❑ IEEE failure
- ❑ All ranges or functions are bad
- ❑ Particular range or function bad; specify

_____

- ❑ Front panel operational
- ❑ Analog output follows display
- ❑ Obvious problem on power-up
- ❑ Batteries and fuses are OK
- ❑ Checked all cables

Display or output (check one)

- ❑ Drifts
- ❑ Unstable
- ❑ Overload
- ❑ Unable to zero
- ❑ Will not read applied input

- ❑ Calibration only
- ❑ Data required

(attach any additional sheets as necessary)

- ❑ Certificate of calibration required

Show a block diagram of your measurement system including all instruments connected (whether power is turned on or not). Also, describe signal source.

Where is the measurement being performed? (factory, controlled laboratory, out-of-doors, etc.)

_____

_____

What power line voltage is used? _____ Ambient temperature? _____ °F

Relative humidity? _____ Other? _____

Any additional information. (If special modifications have been made by the user, please describe.) _____

_____

_____

Be sure to include your name and phone number on this service form.

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