ISOCOMP I

GAMMA COUNTER
AND
DATA REDUCTION SYSTEM

SERVICE MANUAL

MGM INSTRUMENTS
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Note on schematics: In the Adobe Acrobat format of this manual, the schematics are scalable. If the schematics are printed on 8½ by 11" paper, they are unreadable. To print the schematics so that they are readable, select the print function in the Adobe Acrobat reader, and print only the schematic pages to a printer capable of printing on 11" by 17" paper.

If a printer capable of printing on 11" by 17" paper is not available, then by zooming in the Adobe Acrobat reader, the schematics can be viewed quite nicely.

INTRODUCTION

The ISOCOMP I Gamma Counter and Data Reduction System is the latest in a long line of compact yet powerful bench top laboratory instruments form MGM Instruments. A 1.5 inch square Sodium Iodide Crystal turns the gamma radiation emitted from a sample containing ^{125}I or ^{57}CO into an electrical pulse that is amplified and counted by the computer in the Main PCB. Menu driven instructions prompt the user to insert the correct tube and press the proper keys from calibration, to programming, to operation.

Protocols may be programmed and stored in permanent non-volatile memory. Data reduction routines are selected by the user during programming (see Operator's Manual for programming instructions and further information on the data reduction routines.) Types of test that can be performed include; RIAs, IRMAs, Uptakes, screening etc. Simultaneous ^{125}I and ^{57}CO counting is also possible for applications such as a B12/Folate assay.

Instrument calibration is performed automatically by the internal microprocessor, and results are printed by the on board thermal graphics printer. A calibration standard is required to perform instrument calibration and is available through MGM Instruments.

The ISOCOMP I is operated either via the 20 key multi-function keypad on the front panel or remotely by a computer or terminal, utilizing the RS-232 Serial Interface. Results are reported via the 20 character vacuum florescent display on the front panel, the 20 column graphics printer, or through the RS232 interface.

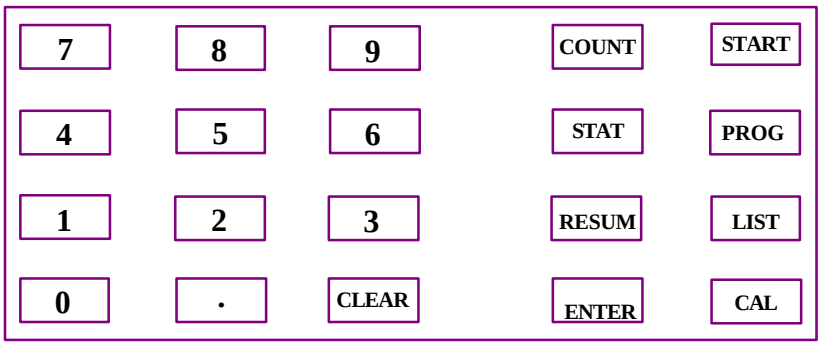
Specifications

Detector	1.5" x 1.5" NaI (thallium doped) crystal
125 I Efficiency	> 75%
Isotope Windows	^{125}I - 20 to 75 Kev ^{57}CO - 100 to 200 Kev
Crossover of 57CO into 125I window	>3% at 0.038 µCi of 57CO
Background	^{125}I - Less than 100 CPM ^{57}CO - Less than 200 CPM
Vial Size	Up to 16 mm diameter

Power Requirements	120 TO 240 VAC Selectable 50 or 60 Hz
Operating Temperature	+10 to +40 degrees C +50 to +105 degrees F
Dimensions	Height: 4” Width: 15” Depth: 11”
Weight	24 Pounds

Front Panel Controls

The ISOCOMP is controlled by function keys located to the right of the numeric keys on the Front Panel Keypad.



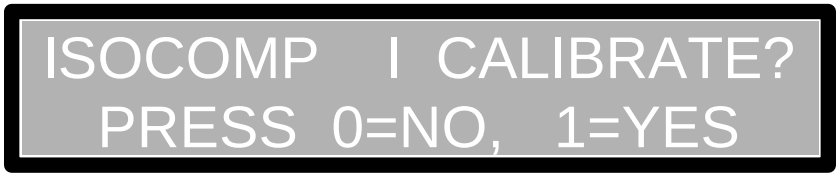
Function Keys

COUNT	INITIATES A COUNT SEQUENCE
STAT	INTERRUPTS A CURRENT PROTOCOL TO RUN A STAT ASSAY
RESUME	RESUMES INTERRUPTED PROTOCOL
ENTER	ACCEPTS DISPLAYED DATA
START	BEGINS A NEW PROTOCOL
PROG	EDITS PROTOCOL PARAMETERS
LIST	PRINTS A LIST OF PROTOCOL PARAMETERS
CAL	INITIATES A CALIBRATION ROUTINE

CALIBRATION

The Isocomp I gamma counter has the ability to self calibrate utilizing a calibration source of either ^{125}I or the long life, mock ^{125}I (^{129}I) which is recommended.
To Calibrate the instrument:
Press the CAL button on the front panel keypad. The following is displayed

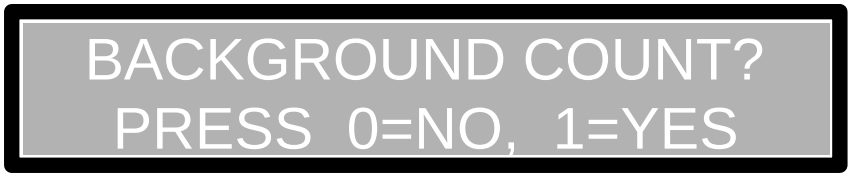
The instrument serial number will be displayed. If the serial number is correct, press ENTER. If it is not correct, enter the proper serial number and press ENTER. The following is displayed.



Press 1 to initiate a calibrate sequence. The following is displayed:

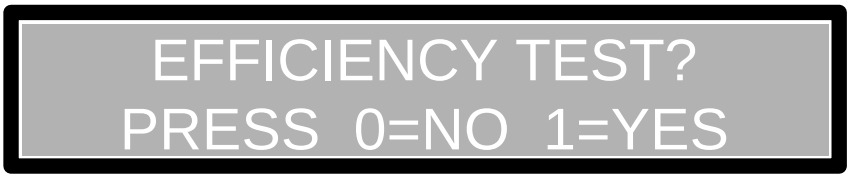
The instrument prompts the user to insert a source. Insert the calibration source and press ENTER.

The instrument will take approximately 1 minute to complete its calibration. At the conclusion of a successful calibration, a calibration number will be printed, and the following will be displayed:

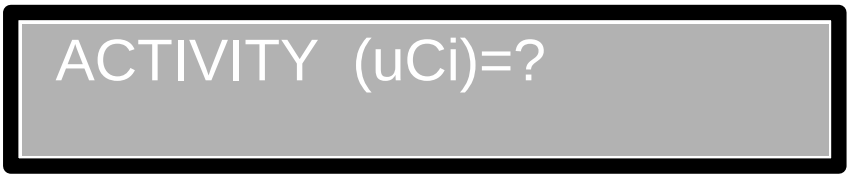


Press 1 to perform a background check. The Isocomp will take 10-1 minute counts and store the average of the backgrounds for ^{125}I and ^{57}CO in memory for use (if desired) during an assay utilizing the background subtract parameter.

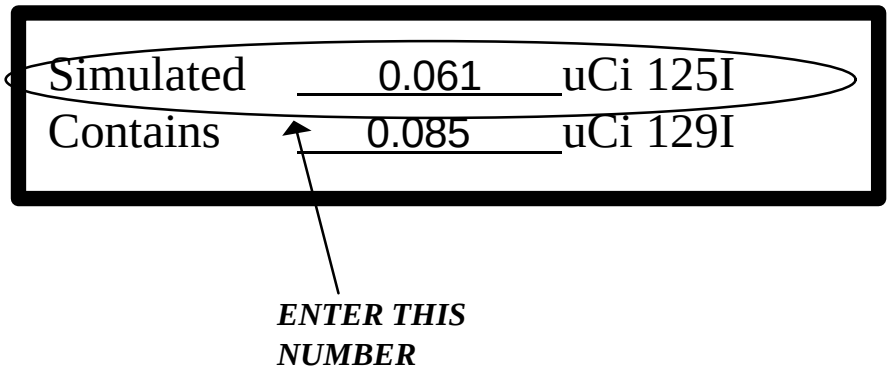
Consult operator's manual for more information. After the background count is complete, the following will be displayed.



Press 0 to skip the efficiency test. Press 1 to perform the efficiency test. If 1 is pressed, the following is displayed:



Enter the activity of the calibration source. If the source was purchased from MGM, there will be two numbers printed on the label on the tube. Enter the SIMULATED activity as is printed on the label.



The following will be displayed:

The instrument will perform 10-1 minute counts of the calibration source. After the last tube has been counted, the printer will report the average counts, efficiency, chi2 and report that efficiency is complete. The display will return to the main menu and the instrument is ready to be operated.

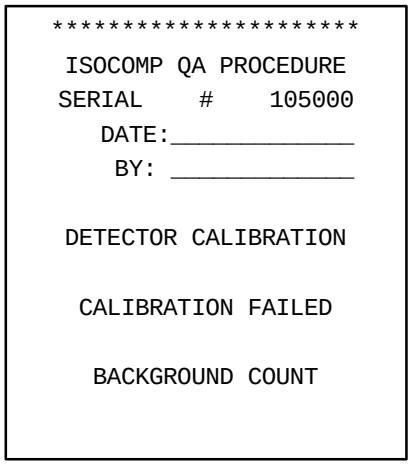
NOTE: It is recommended that calibration be performed weekly and the printouts saved to be able to track the performance of the instrument.

```
**********************
 ISOCOMP QA PROCEDURE
SERIAL    #    105000
   DATE:_____________
    BY: _____________

 DETECTOR CALIBRATION
 CAL. NUMBER:    107

  BACKGROUND COUNT
       I125    CO57
          49     73
          39     65
          41     62
          51     63
          51     78
          43     65
          48     69
          47     75
          26     65
          53     76
--------------------
          45     69

 BACKGROUND COMPLETE

   EFFICIENCY TEST

           I129
          62313
          62748
          62242
          62985
          62589
          62441
          62782
          62847
          62731
          63003
--------------------
          62668
EFFICIENCY =    80.7%
 CHI 2  =        10.1

 EFFICIENCY COMPLETE

  QA  TEST  COMPLETE
**************************
```

SAMPLE PRINTOUT

OF CALIBRATION

Should calibration fail the printout will alert the user that the calibration has failed. See below.



This would indicate a possible problem with the instrument. Another possibility is that the calibration was performed without a source in the well. It is recommended that the rest of the calibration routine be aborted, and a new calibration routine initiated.

SAMPLE PRINTOUT

The following protocol can be programmed to provide a sample printout to check the operation of the microprocessor and printer in the ISOCOMP I.
Press the PROG key, and asign a number to the sample protocol. For this example we use Protocol 1.
From the Main Menu, press 1, ENTER
The following menu appears:

Press 5, ENTER. The following Menu appears:

Press 1, Enter. The following Menu appears:

Press 1, ENTER. The following Menu appears:

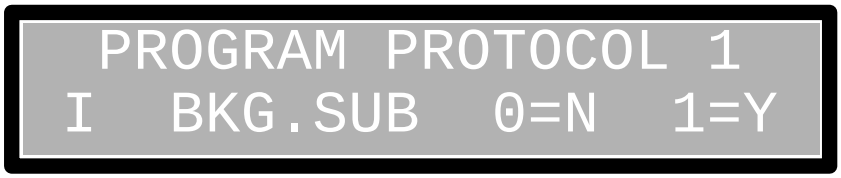
Press 1, Enter. The following Menu appears:

Press 1, ENTER. The following Menu appears:

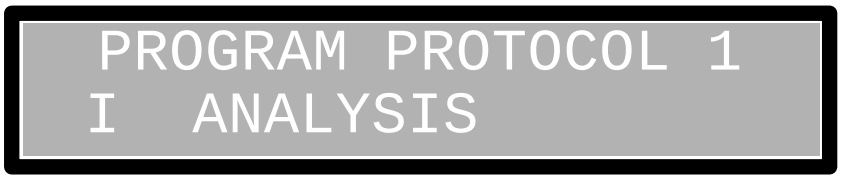
Press 1, ENTER. the following Menu appears:

Press 1, ENTER. The following Menu is displayed:

Press 1, ENTER. The following Menu is displayed:



Press ENTER. The following Menu is displayed:



Press 3, ENTER. The following is displayed:

Press 3, ENTER. The following is displayed:

Press 11, ENTER. The following is displayed:

Press ENTER. The following is displayed:

Press 2.5, ENTER. The following is displayed:

Press 5, ENTER. The following is displayed:

Press 10, ENTER. The following is displayed:

Press 15, ENTER. The following is displayed:

Press 30, ENTER. The Main Menu is displayed.

Press the START key and select PROTOCOL 1, ENTER. The following is displayed:

Select 2, Enter and enter the following values as prompted;

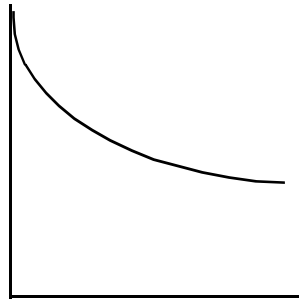
PROMPT	ENTER
TOTAL REP 1	80619
NSB REP 1	6464
B0 REP 1	58009
STD 1 REP 1	50660
STD 2 REP 1	43799
STD 3 REP 1	34669
STD 4 REP 1	28032
STD 5 REP 1	18873

The printout for this protocol can be found on the following page.

TEST PROTOCOL PRINTOUT

```
****************************

       DATE: _____________
         BY: _____________

TOTAL
  1     80619
AVG     80619   0

NSB
  2     6464
AVG     6464    0

B0
  3     58009
AVG     58009   0

STANDARD 1              2.5
   4    50660           2.50
AVG     50660   0       2.50

STANDARD 2               5
  5     43799           5.04
AVG     43799   0       5.04

STANDARD 3              10
  6     34669           9.72
AVG     34669   0       9.72

STANDARD 4              15
  7     28032           15.1
AVG     28032   0       15.1

STANDARD  5             30
  8     18873           30.1
AVG     18873   0       30.1
----------------------------
```

```
%BOUND  NSB             8.02
%BOUND B0               72.0
CURVE TEST

  STD  CONC             DIFF
  2.5   2.50            .058
    5   5.04            .791
   10   9.72           -2.79
   15   15.1            .485
   30   30.1            .480
%SCATTER                .237
ED  50%                  11
SLOPE                  -1.18
INTERCEPT               4.15
----------------------------

CNT/  58009

.9
.8
.7
.6
.5
.4
.3
.2
.1
      5          15      30
-----------------------------------
```



TROUBLESHOOTING

The following chart is intended to assist technical personnel in the troubleshooting and repair of the ISOCOMP I Gamma Counter and Data Reduction System.

CAUTION!
Hazardous voltages exist inside the instrument. Turn the power off and remove the power cord from the wall outlet prior to servicing. Covers are to be removed by qualified personnel only!!

Symptom	Possible Cause	Action
No response at power up	Power cord not plugged in	Check both ends of power cord
	Blown fuse	Replace fuses
	Incorrect line voltage setting	Check line voltage setting
	Missing +5V	Check TP2 on Main PCB
Power up OK, No response from the keypad	Keypad ribbon cable loose	Check both ends of ribbon cable
	Bad ribbon cable	Replace ribbon cable
	Bad keypad	Replace keypad
High background counts	Contaminated well liner	Remove, and decontaminate well liner
	Contaminated well	Decontaminate well
	Contaminated workbench	Clean work bench
	Reagents stored too close	Move reagents or instrument
	Bad detector	Replace detector
Low Efficiency	Incorrect source activity entered during calibration	Enter the Simulated activity written on the tube
	Bad detector	Replace detector
No response from printer	Loose printer harness	Check connections
	Bad printer power supply	Replace printer power supply
	Bad printer	Replace printer
Printer feeds blank paper	Paper installed incorrectly	Turn paper over (treated on one side)
	Bail bar pulled back	Push bail bar toward rear of Isocomp
	Bad printhead	Replace printer
Invalid Protocol displayed	Incorrect protocol number entered	Restart protocol
	Memory erased	Re-enter protocol, restart
Zero counts	Incorrect count time	Reprogram
	High background value	Disable background subtract
	Incorrect isotope selected	Reprogram to use proper isotope

TEST POINTS

Test points are located in the middle of the main board just forward of the heat sink. There are 6 test points for the voltages which run the instrument. They are as follows:

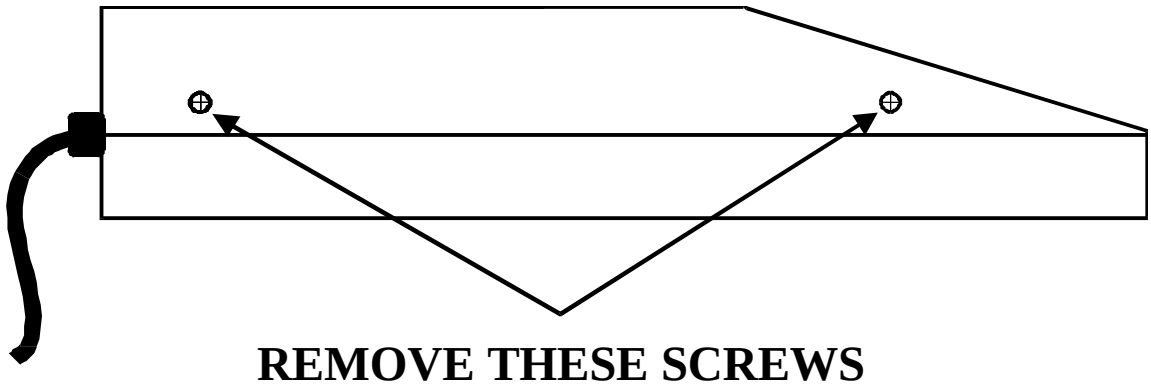
TEST POINT	FUNCTION
TP-1	GROUND
TP-2	+5VDC
TP-3	+12VDC
TP-4	-12VDC
TP-5	+8VDC (DAC REF.)
TP-6	HIGH VOLTAGE

When checking the high voltage use caution! Voltage is typically at or above 600VDC. It is recommended that the voltmeter be set to the proper range, and connected to TP1 prior to applying power to the instrument. If the voltmeter is connected with power applied, arcing may occur, which will cause the ISOCOMP to "lock up" and require the operator to turn the power off to clear this condition.

COVER REMOVAL

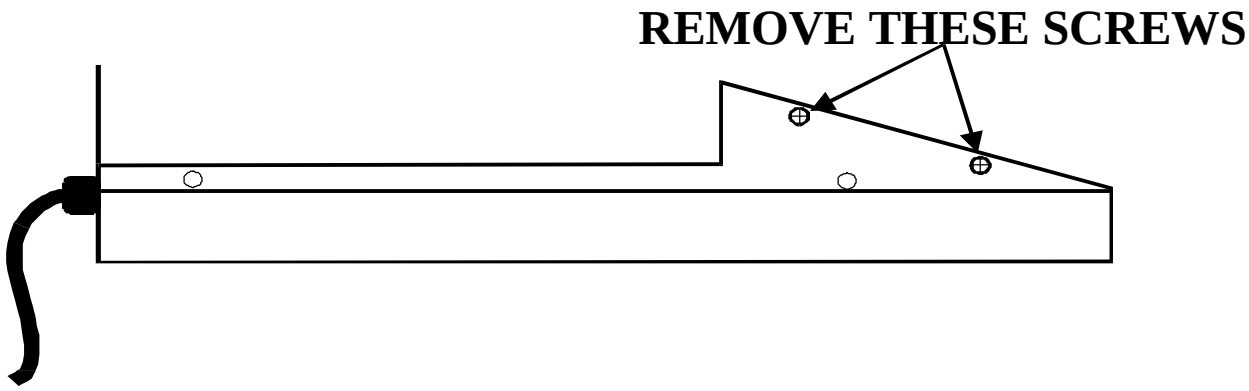
Tools required; #1 point Philips screwdriver
Turn the instrument off and remove the power cord from the wall receptacle.
Using the screwdriver, remove the four screws, located two on either side of the instrument.

ISOCOMP I SIDE VIEW



REMOVE THESE SCREWS

Lift the rear portion of the cover, and slide the cover toward the rear of the instrument.
Note: The printer harness will not permit total removal of the cover. There is however, enough slack in the harness to permit access to the inside with out complete removal
Locate the four flat head screws (two on either side) which secure the front panel to the base. Remove the four screws.



It is now possible to lift the Front Panel off of the base and gain access to the Main PCB and other components inside the instrument. It is necessary to disconnect the cables from the keypad and display in order to completely remove the panel.

COMPONENT REPLACEMENT

Replacement of internal components involves opening the instrument and exposing a possible shock hazard. Please exercise extreme caution when working on the inside of the instrument, Voltages inside can exceed 600VDC.

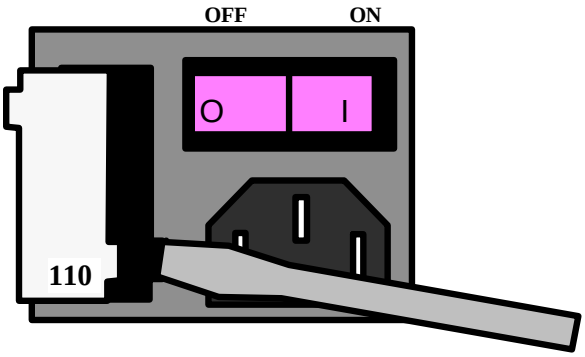
CAUTION!

INTERNAL VOLTAGES CAN EXCEED 600VDC.
REMOVE POWER BEFORE REMOVING COVERS.
SERVICE BY QUALIFIED PERSONNEL ONLY

FUSE REPLACEMENT

To replace the fuse(s) on the ISOCOMP, it is first necessary to remove the power cord from the power entry module located at the left rear of the instrument.

1. Turn the power to the instrument off with the power switch located near the power cord.
2. Remove the power cord from the wall receptacle.
3. Remove the power cord from the power entry module
4. Using a small flat blade screwdriver, or something equivalent, remove the fuse block from the power entry module.



5. Remove the bad fuse(s) and replace with a 1/4 amp Slo-Blo fuse.
6. Install the fuse block into the power entry module. NOTE: Observe the voltage setting on the outside of the fuse block. The proper voltage setting should be facing the bottom side of the Power Entry Module as shown.

KEYBOARD REPLACEMENT

1. Turn power off and remove the power cord from the wall outlet
2. Remove the Top Cover.
3. Remove Front Panel.
4. Remove six screws securing the Keypad to the Front Panel.
5. Remove keypad.
5. Install replacement keypad
6. Replace six screws to secure the new Keypad.
7. Replace Front Panel.
8. Replace Top Cover.

DISPLAY REPLACEMENT

Turn power off to the instrument and remove the power cord from the wall receptacle.
Remove the Top Cover and Front Panel as described on page #2-3
Disconnect the two wires from the Display.
Remove the four screws securing the Display.
Remove the Display. If there is a blue filter on the original display, it may be necessary to transfer it to the new display. A piece of tape can be used to hold the filter in place while the display is being secured.
Install the new display. If the original Display was manufactured by Futaba (recognizable by a 40 conductor ribbon cable connection to the main board), J-3 on the main board should be open. If the Display was manufactured by Noritake (discreet wire harness connection to the main PCB) J-3 on the main pcb must be shorted.

PRINTER REPLACEMENT

Turn the Instrument off and remove the power cord from the wall receptacle.
Remove the Top Cover as described above.
Remove the Printer Harness from the printer by gently pulling the connector away from the printer.
Remove the four Philips head screws from the base of the Printer PCB.
Check the DIP switch setting on the original printer, make sure that the replacement printer is set the same way. (SEE BELOW)

It may be necessary to retain the paper tear bar from the original printer. Compare the new printer with the original printer. The paper tear bar is a stainless steel strap that runs across the top of the printer mechanism and snaps into the frame. To remove it, simply lift it off of the frame and transfer it to the new printer. Note: It may be necessary to pry the frame gently to be able to snap the bar into the frame.

Next, pull the bail bar forward and insert the bar into the slot in the cover. The four mounting holes in the Printer PCB should line up with the standoffs.
Install the four mounting screws. NOTE: The ground lug from the Printer PCB must be installed on one of the mounting screws.
Connect the printer to the printer harness. NOTE: The printer PCB has contacts on only one side, check to insure that the contacts line up with the wires of the printer harness.

MAIN PCB REMOVAL/REPLACEMENT

Turn the Isocomp off and remove the power cord from the wall receptacle.
Remove the Top Cover and Front Panel as described on Page#2-3
Disconnect all harnesses from the Main PCB connectors.
Remove 7 Screws from the MAIN PCB, and 5 from the heatsink.
The MAIN PCB can now be removed.
If you are replacing the Main PCB, compare the replacement PCB to the original PCB to make sure that all of the IC's are present
Install the Replacement PCB
Replace the 7 screws into the clearance holes in the Main PCB
Replace the 5 screws into the heatsink.

Connect all harnesses to the Main PCB as listed below.

J-1	RS-232
J-2	Printer
J-3	Keyboard Ribbon
J-4	Preamp Signal/Power
J-6	Preamp High Voltage
J-7	AC In
J-8	Display Data
J-9	Display Power (+5V and Ground)

Reassemble the Front Panel and Top Cover without screwing the covers down.
Plug the instrument in and apply power to it to make sure that the replacement PCB is functioning properly.
When it has been determined that the PCB is functional, remove the top cover and secure the Front Panel with the four flat head screws.
Replace the Top Cover and secure it using the four Philips head screws.

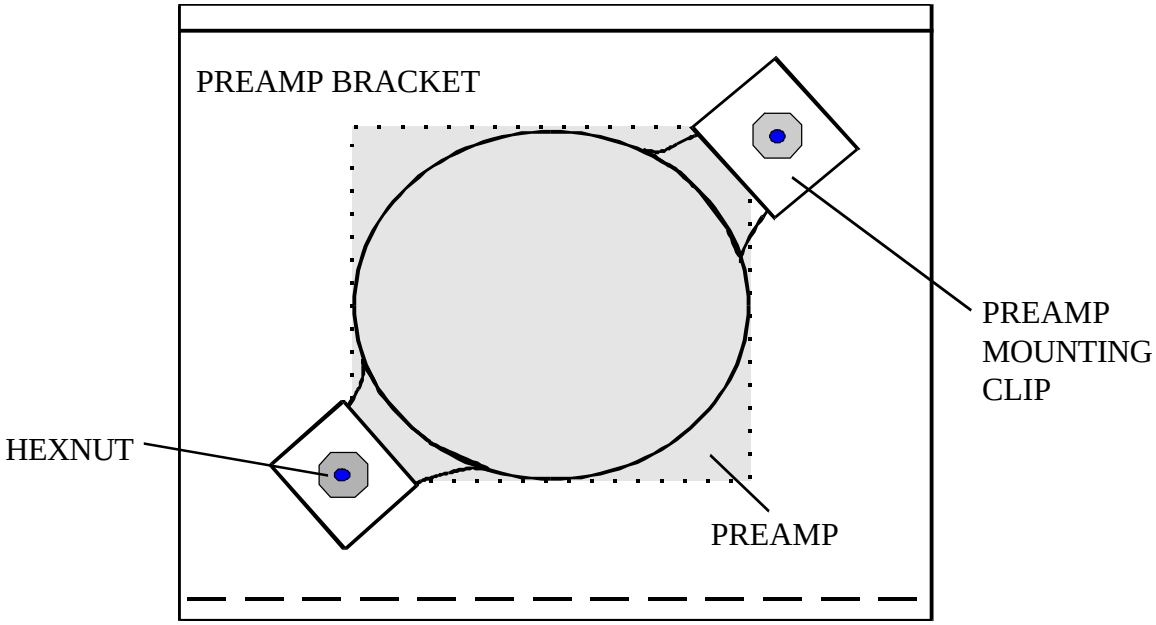
REMOVAL/REPLACEMENT OF PRINTER POWER SUPPLY

Turn the instrument off and remove the power cord from the wall receptacle.
Remove the Top Cover as described on page #2-3
Disconnect the AC Harness and the printer harness from the two connectors on the Printer Power Supply PCB.
Remove the four screws securing the Printer Power Supply PCB
Remove the Printer Power Supply PCB
Install the replacement Printer Power Supply. Position it such that the two harness connectors are facing the Main PCB.
Connect the Ac Harness and the Printer Harness to their respective headers on the Printer Power Supply PCB.

REMOVAL/REPLACEMENT OF PREAMP

Turn the power off to the instrument, and remove the power cord from the wall socket.
Remove the Top Cover as described on page #2-3
Disconnect the Preamp Power and Signal Harness and the Preamp High Voltage Harness from the Main PCB
Remove the two screws holding the Preamp Screen to the Mounting Bracket.
From the bottom of the instrument, remove the two #8 Philips head screws that secure the Preamp Bracket.

Gently wiggle the Preamp back and forth while pulling away from the lead block to remove it from the pins of the detector.
Once the Preamp is free of the detector, it can be lifted straight up and removed.
If necessary, remove the Preamp from the mounting brackets by loosening the two clips on the mounting bracket using a 5/16" wrench (preferably open end). *NOTE*: *The nuts do not have to be completely removed, if they are sufficiently loosened, the Preamp can be rotated and removed from the bracket.*

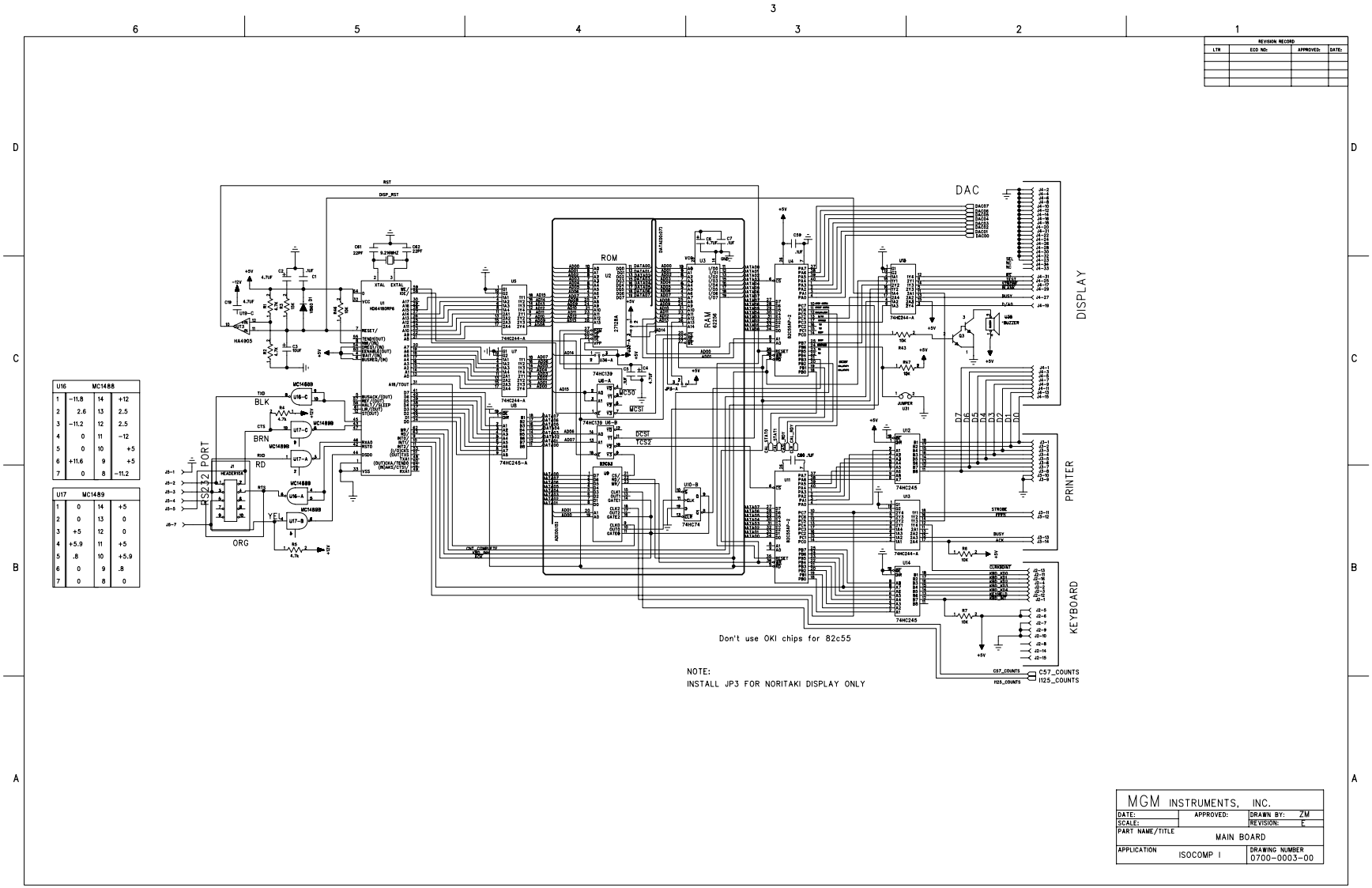


Install the replacement PREAMP onto the mounting bracket (if necessary) positioned such that the wires of the PREAMP face the Top Cover. The clips on the mounting bracket should be placed over the "tabs" of the Preamp Socket. Do not tighten the Clips at this time.
Install the replacement Preamp onto the pins of the detector. Line up the notch in the PREAMP socket with the key on the detector. Make sure that the Preamp is pushed all the way onto the pins of the detector.
Install the screws from the bottom of the instrument to anchor the PREAMP bracket.
Tighten the clips.
Replace the Preamp Screen
Connect the High Voltage Cable and the Preamp Power/Signal Cables
Replace the Top Cover assembly.
Check the operation of the replacement Preamp by running a calibration routine.

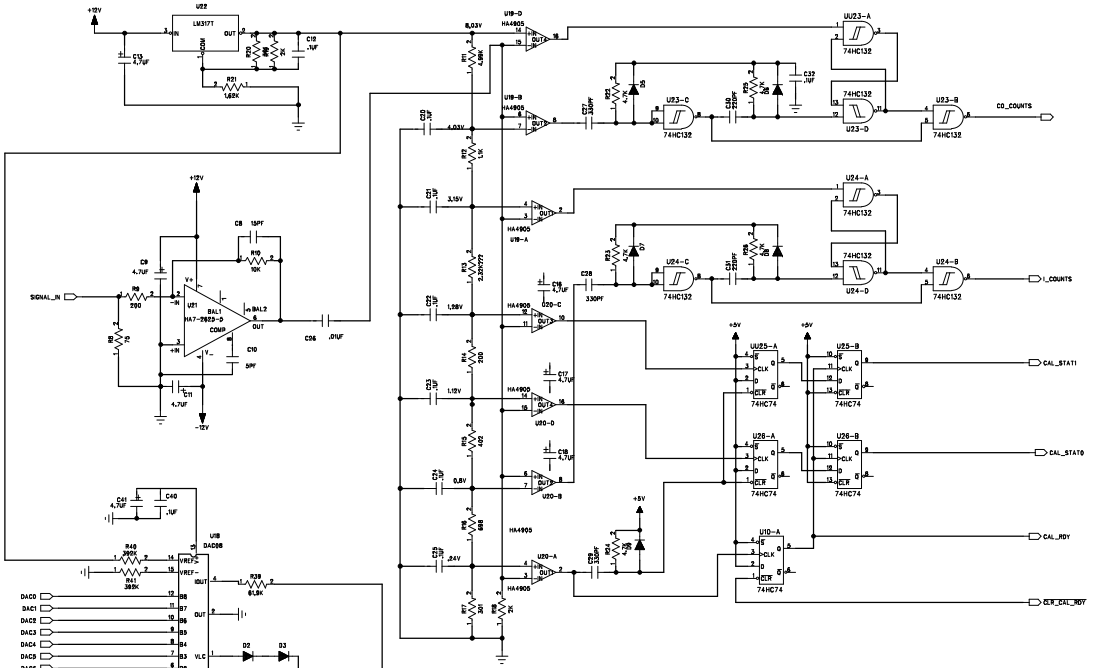
DETECTOR REPLACEMENT

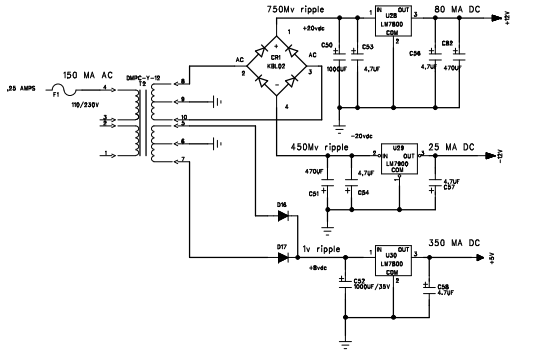
Turn the ISOCOMP off and remove the power cord from the wall socket.
Remove the Top cover assembly as described on page #2-3.
Remove the Preamp shield.
Remove Preamp Mounting Bracket
Remove well liner.

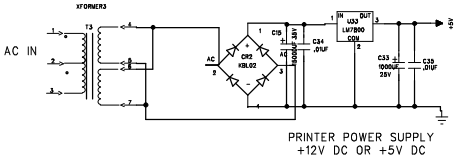
Gently pull the detector out of the Lead Block. The Lead tube will come out along with the Detector.
Place the Lead Tube on the replacement detector.
NOTE: The original detector will have a black foam packing on the outside of the large diameter end. Make sure that the replacement has some sort of packing on it to reduce the chance of the Detector being damaged during transport.
Insert the “head” of the detector into the lead block.
Insert the well liner into the top of the lead block. This will serve to line up the detector with the PREAMP.
Install the PREAMP onto the pins of the detector.
Install the screws into the PREAMP mounting bracket from the underside of the Isocomp base.
Check all connections from the PREAMP to the Main Board.
Place all the covers back onto the Isocomp.
Restore power to the Isocomp.
Run a calibration of the instrument to assure proper operation of the replacement detector.
If the instrument is operating satisfactorily, remove power once again and secure the Front Panel and Top cover.



REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



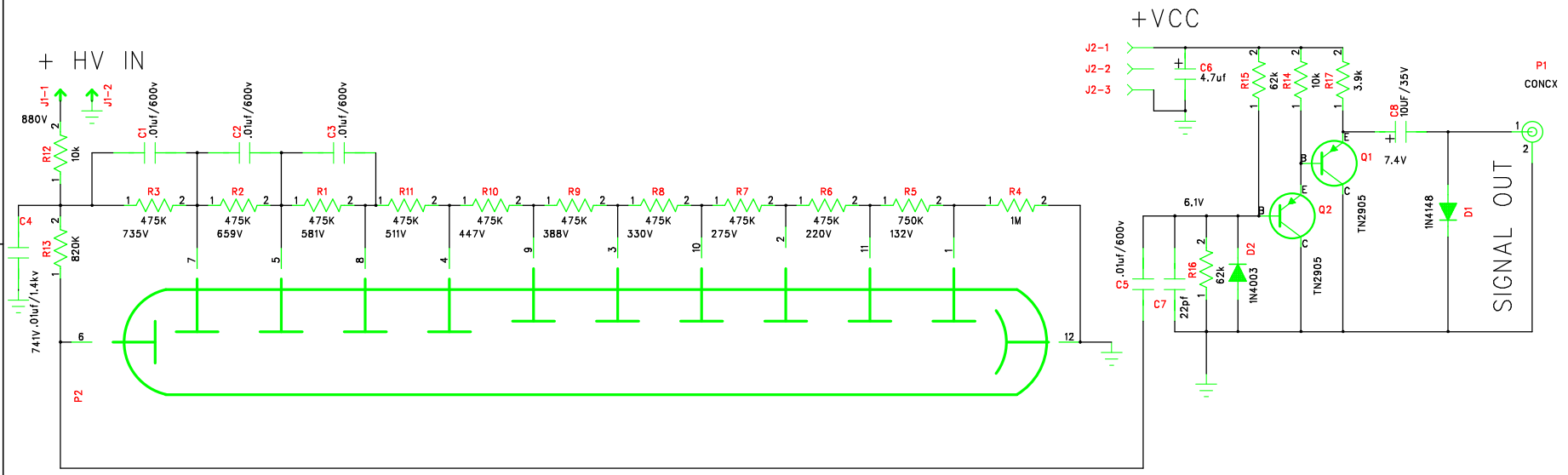




PRINTER POWER SUPPLY
+12V DC OR +5V DC

MGM INSTRUMENTS, INC.		
DATE: 9/6/96	APPROVED:	DRAWN BY: ZM
SCALE:		REVISION: F
PART NAME/TITLE: MAIN BOARD		
APPLICATION: ISOCOMP I		DRAWING NUMBER: 0700-0003-00

REVISION RECORD		
LTR	ECN NO:	DATE:



MGM INSTRUMENTS INC.		
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