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DESIGN AUTOMATION OF THE RACK AND PANEL FRAME

by

H. C. Anderson

ABSTRACT

DSD Design Automation has prepared computer programs to furnish automated records for the new rack and panel structure. This report illustrates the structure and also tells of certain requirements of logic layout which have to be observed for automated record processing. Some of these requirements are location designation, connector utilization, and logic systems page designation. A few advantages of this rack and panel frame are adaptability for various logic layout, low cost, and maintainability.

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INTRODUCTION

The rack and panel structure developed by the General Products Division for the IBM 1410 System has been released as a corporate standard. The corporate rack and panel module is SMS Module IV.

Data Systems Division machine development groups are using the rack and panel structure for packaging. To aid the development groups, DSD Design Automation is preparing programs which perform logic checking and record processing for the new structure.

This report describes the general layout of the new frame and also tells of certain standards which have to be observed in order for Design Automation to check and process the records for the structure.

GENERAL DESCRIPTION

The basic logic structure of the rack and panel module contains four 10 x 28 SMS socket panels. The panels are mounted two high and two wide as in a gate of the Sliding Gate Module II. Two rows of cable connectors, which are used for input-output connections, are located below the four logic panels.

Each basic structure of four panels and two I/O connector rows is designated as a module. Several basic structures or modules can be assembled together, side to side, without covers between the modules. A frame can contain one or more modules depending on the requirements of a machine. Power supplies can be housed in a complete module of a frame; or if a frame is only one module, the power supply can occupy a logic panel position. Power is distributed to modules of a frame by cabling, which is routed above the logic panels of the modules.

Figures 1 and 2 illustrate logic panels, power, and CE panels of a rack and panel frame.

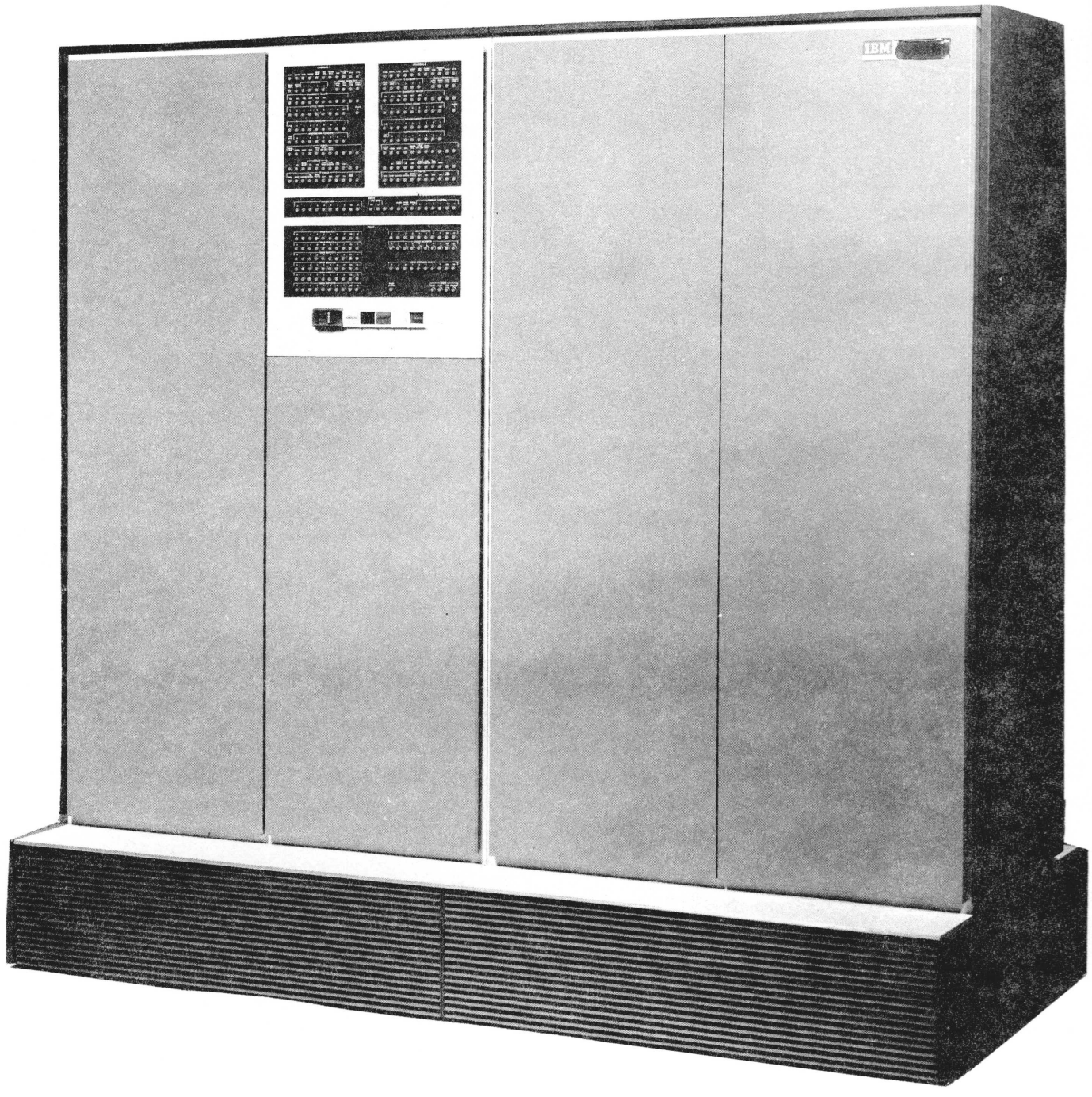


Figure 1. Rack and panel frame with covers.

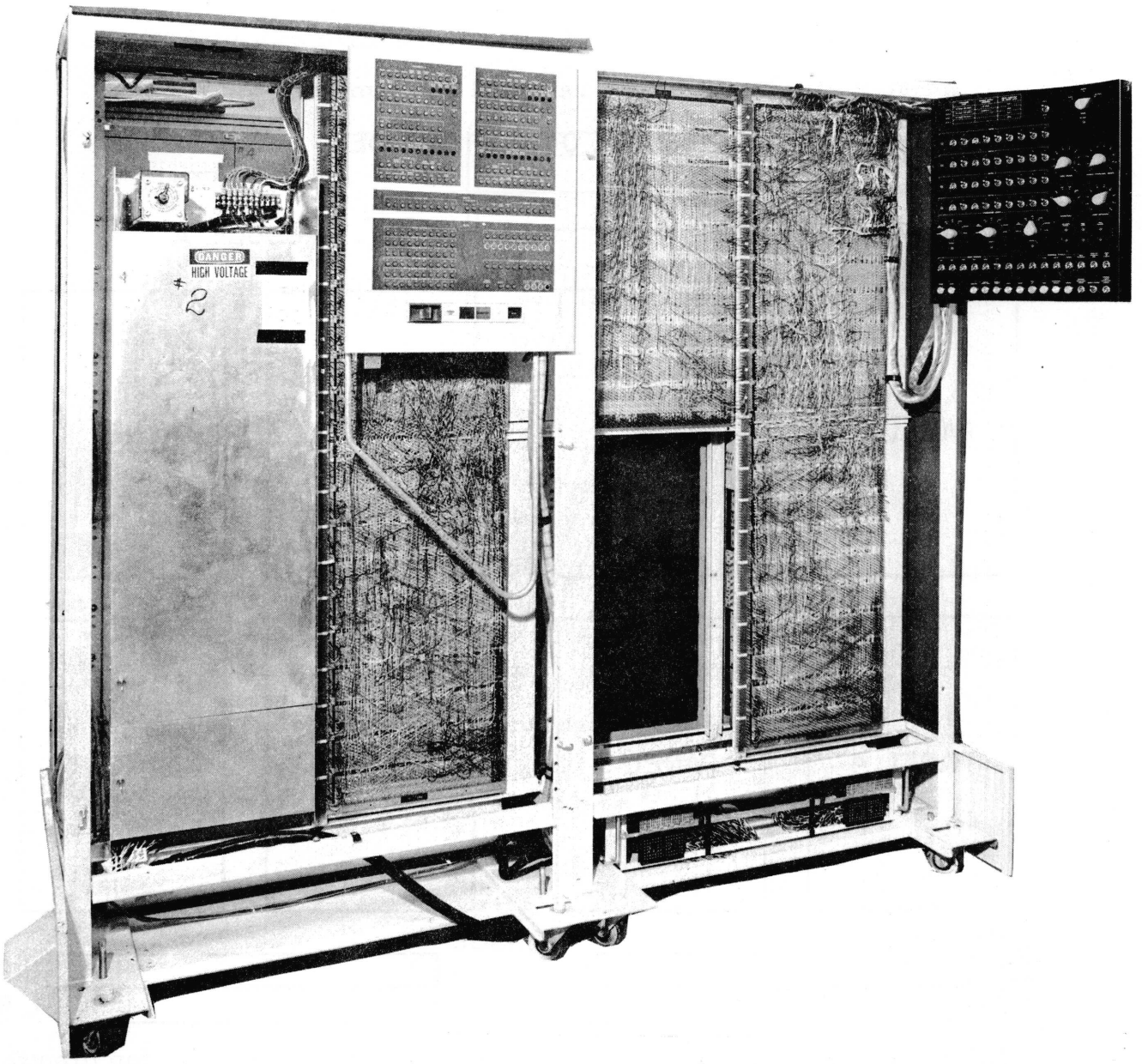
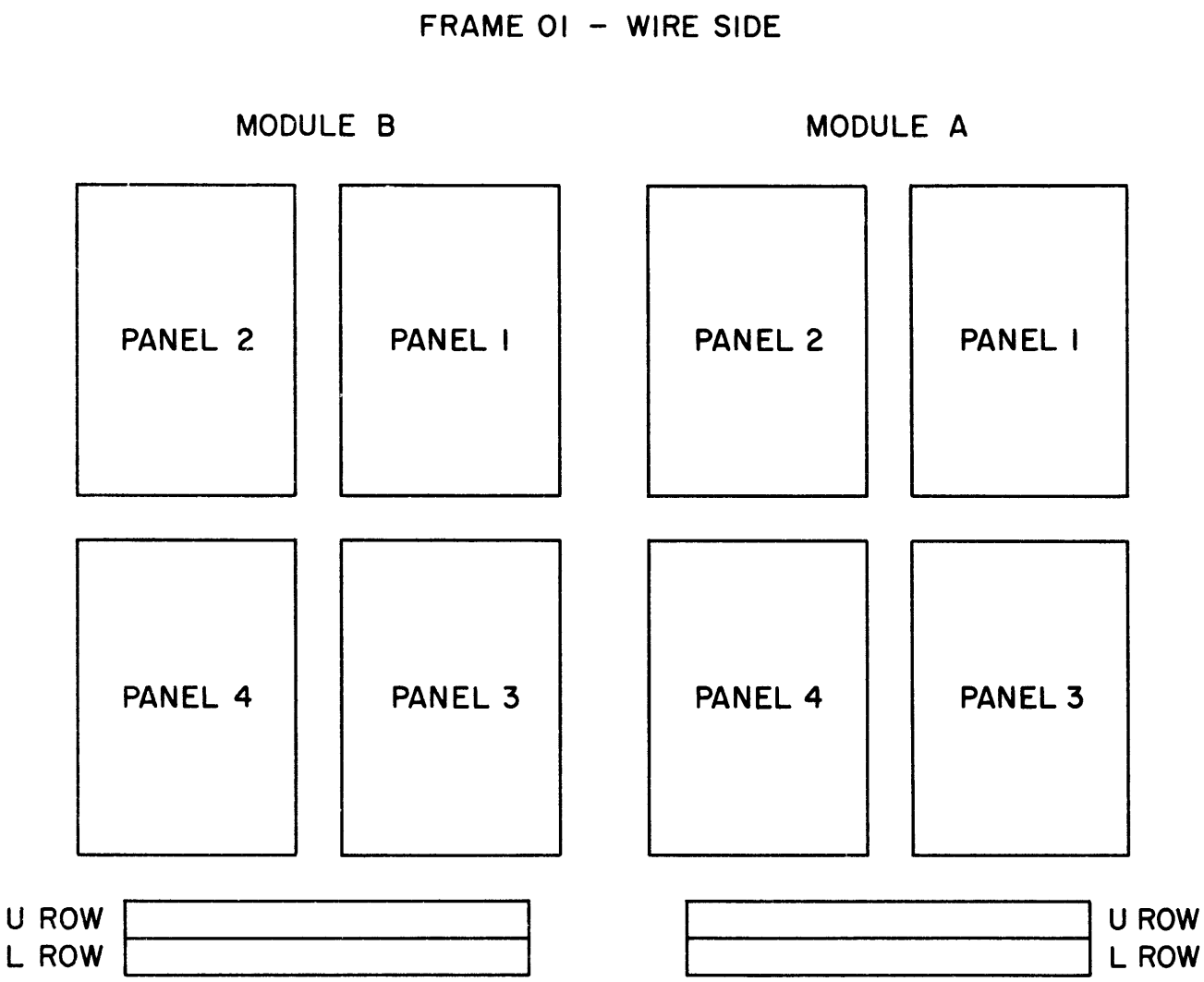


Figure 2. Rack and panel frame without covers.

FRAME DESIGNATION LAYOUT

Here is a list of standards for the rack and panel module:



Rack and panel frame location designations run right to left, top to bottom, when facing the wiring side of the frame.

Frames are designated with two numeric digits, 01 - 99.

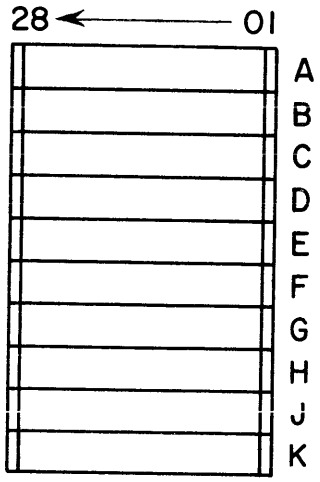
Modules of a frame are designated consecutively A through Z excluding I and O.

The 10 x 28 panels of a module are designated 1 through 4, right to left, top to bottom. When using 6 x 26 panels they are designated 1 through 6, right to left, top to bottom.

I/O connector rows for a module are designated row U and row L, top to bottom.

LOGIC PANEL LAYOUT (10x28)

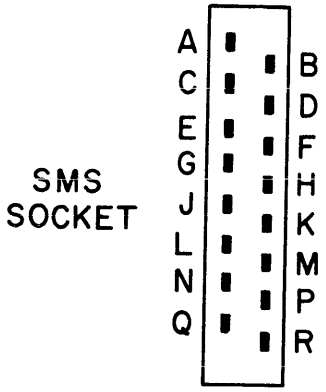
A standard 10 x 28 logic panel contains 280 SMS sockets. The SMS sockets form a matrix 28 columns wide by 10 rows long.



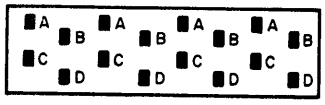
The columns are designated 01 through 28, right to left.

The rows are designated A through K, top to bottom.

Each SMS socket has 16 pins, A through R (excluding I and O).



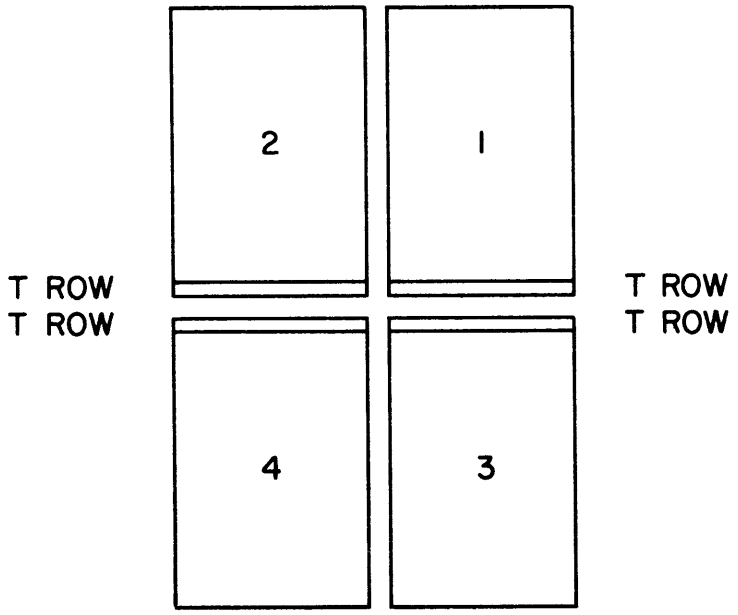
The panels of a module may have T row connector blocks mounted on them. The T row connector blocks have 4 pins per column, designated A, B, C, and D.



T ROW
CONNECTOR BLOCK

The T rows for panels 1 and 2 of a module are mounted below the SMS socket K row of the panels.

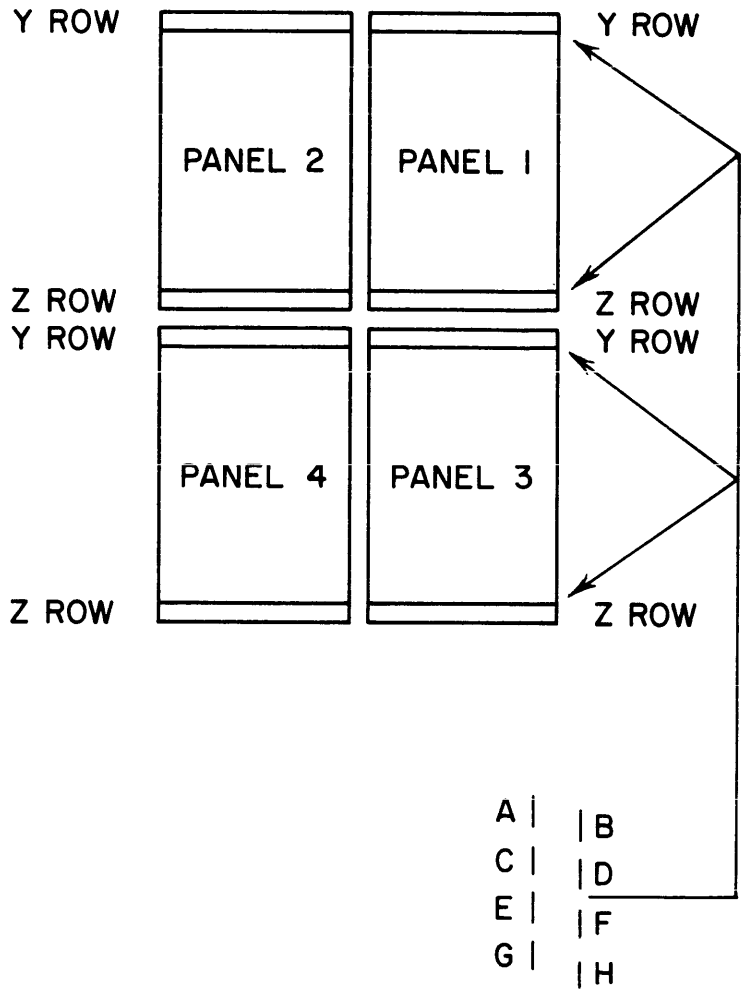
The T rows for panels 3 and 4 of a module are mounted above the A row of the panels.



Pins of the T row connector blocks are for vertical interpanel connections between panels 1 and 3 and panels 2 and 4. Connections between T rows are assumed to be a one to one relationship as follows:

FROM				TO			
Panel	Row	Col.	Pin	Panel	Row	Col.	Pin
1	T	01	A	3	T	01	A
1	T	01	B	3	T	01	B
1	T	01	C	3	T	01	C
1	T	01	D	3	T	01	D
	THROUGH				THROUGH		
1	T	28	A	3	T	28	A
1	T	28	B	3	T	28	B
1	T	28	C	3	T	28	C
1	T	28	D	3	T	28	D
2	T	01	A	4	T	01	A
2	T	01	B	4	T	01	B
2	T	01	C	4	T	01	C
2	T	01	D	4	T	01	D
	THROUGH				THROUGH		
2	T	28	A	4	T	28	A
2	T	28	B	4	T	28	B
2	T	28	C	4	T	28	C
2	T	28	D	4	T	28	D

Instead of the four-pin T row connector blocks, the panels of a rack and panel module can have Y and Z row connector blocks mounted on them. The Y and Z row connector blocks have eight pins per column, A through H.

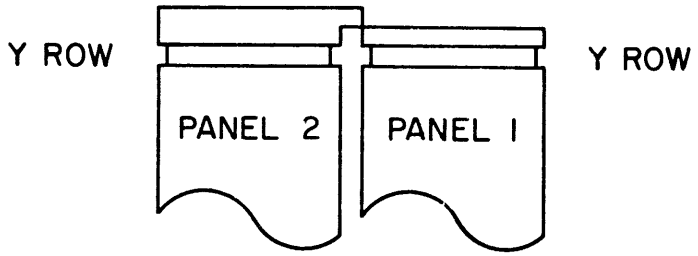


Any or all panels of a module can have a Y connector block row above the A row of the panels.

Any or all panels of a module can have a Z connector block row below the K row of the panels.

The Z rows below panels 1 and 2 should connect to the Y rows above panels 3 and 4. As with the smaller T row blocks, the connections should have a one to one relationship.

The Y rows above panels 1 and 2 can be used for horizontal interpanel connections. One method of connecting panel 1, Y row, with panel 2, Y row, is with a laced cable using slip-on connectors on the pins. The relationship of connection between the two rows must be one of the two described below for connector sequence checking by Design Automation.

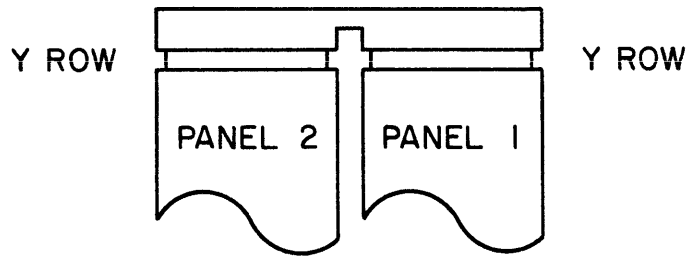


The row, column, and pin of the From and To locations MATCH.

FROM				TO			
Panel	Row	Col.	Pin	Panel	Row	Col.	Pin
1	Y	01	A	2	Y	01	A
1	Y	01	B	2	Y	01	B
	THROUGH				THROUGH		
1	Y	28	G	2	Y	28	G
1	Y	28	H	2	Y	28	H

The wires in a cable for this type of connection would all be the same length.

The row and pin of the From and To locations match and the column numbers SUM to one more than the maximum column number.

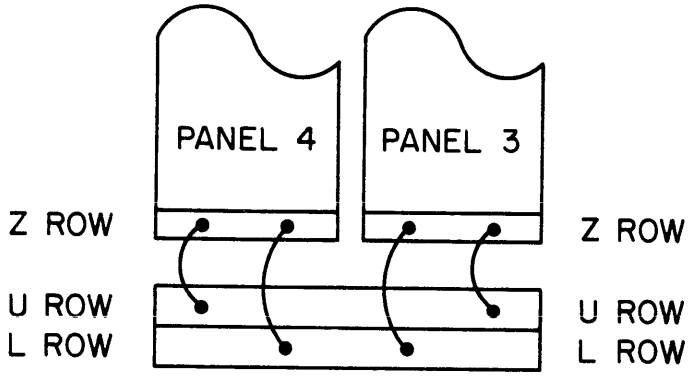


Example: Column 28 to Column 1 = 29
Column 27 to Column 2 = 29

FROM				TO			
Panel	Row	Col.	Pin	Panel	Row	Col.	Pin
1	Y	28	H	2	Y	01	H
1	Y	28	G	2	Y	01	G
	THROUGH				THROUGH		
1	Y	01	B	2	Y	28	B
1	Y	01	A	2	Y	28	A

The wires in a cable for this type of connection would be different in length.

The Z rows below panels 3 and 4 are primarily for connections going to the I/O connector rows. There is no fixed method of connection between the Z rows below panels 3 and 4 and the I/O connector rows.



The Z rows below panels 3 and 4 can be used for horizontal interpanel connections between panels 3 and 4 if they are not used for I/O connections. When used for interpanel connections the Z rows must have the same relationship as the Y rows above panels 1 and 2.

Figures 3 and 4 illustrate the use of Y and Z row connector blocks.

Blocks containing two pins per SMS socket can be installed between the SMS socket rows. The two pins are designated as the 9 and 0 (zero) pins of the SMS socket below the pins. Thus, SMS socket rows B through K can have 9 and 0 pins in them.

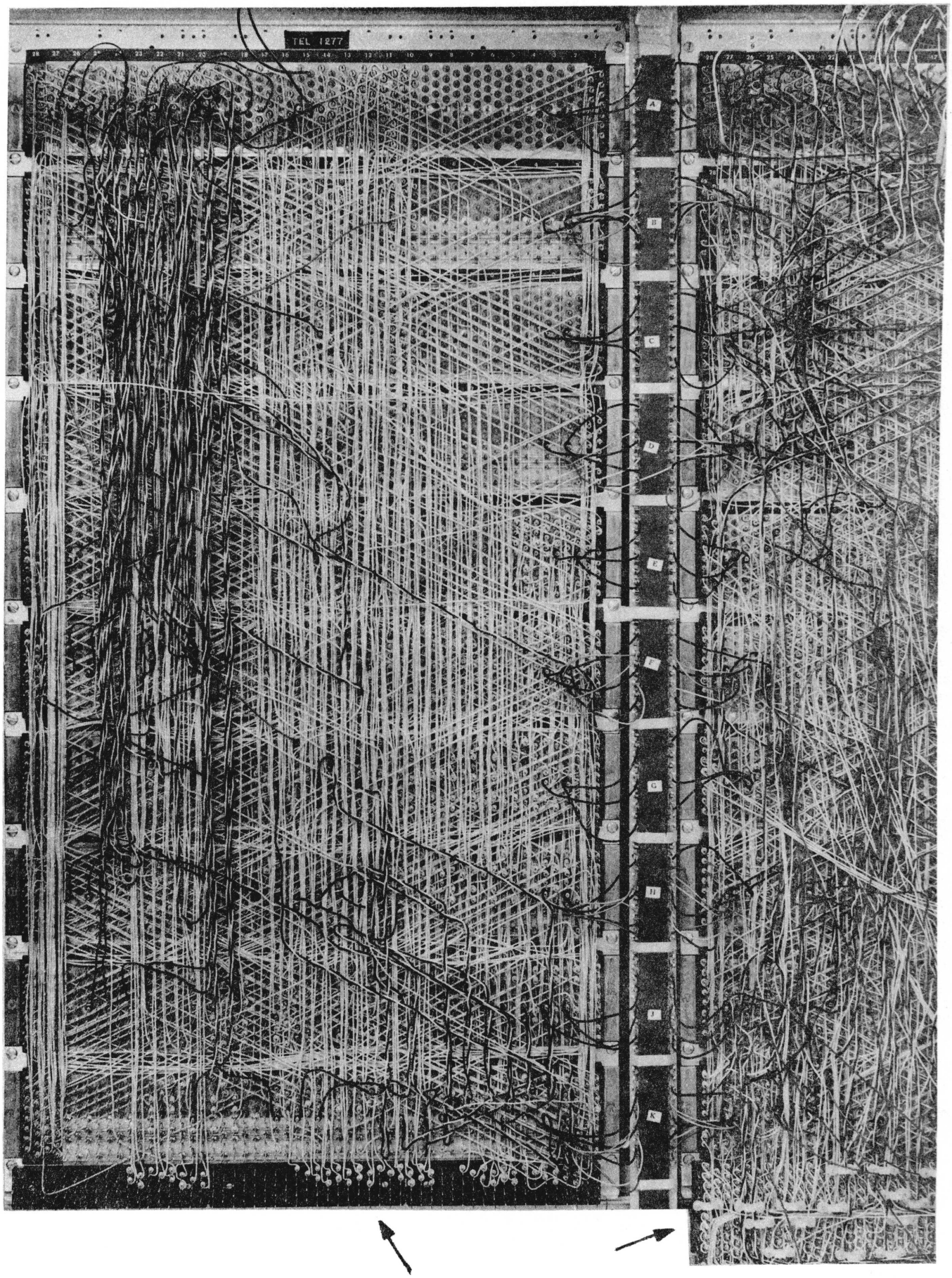


Figure 3. 10 x 28 panels with large connector blocks.

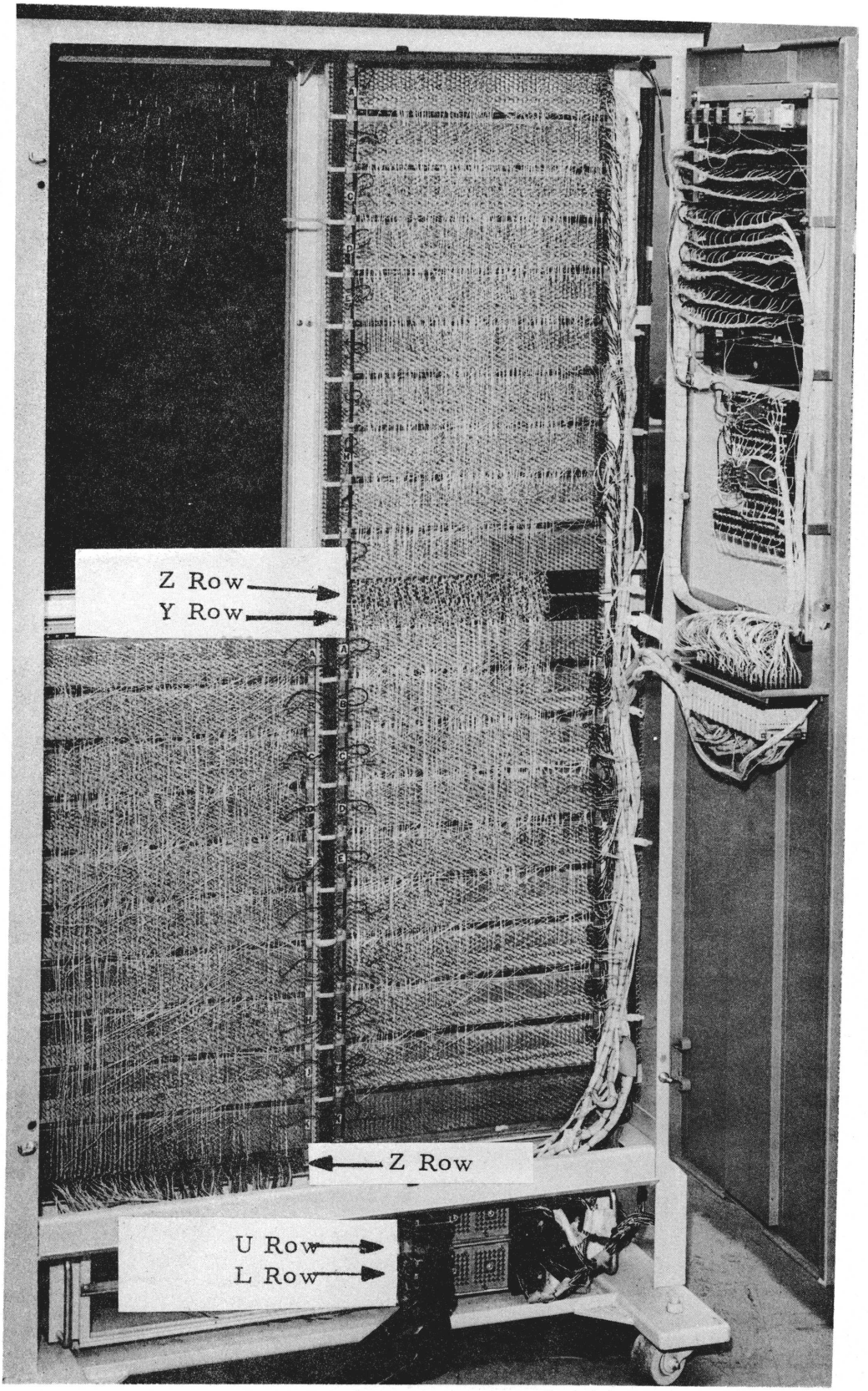
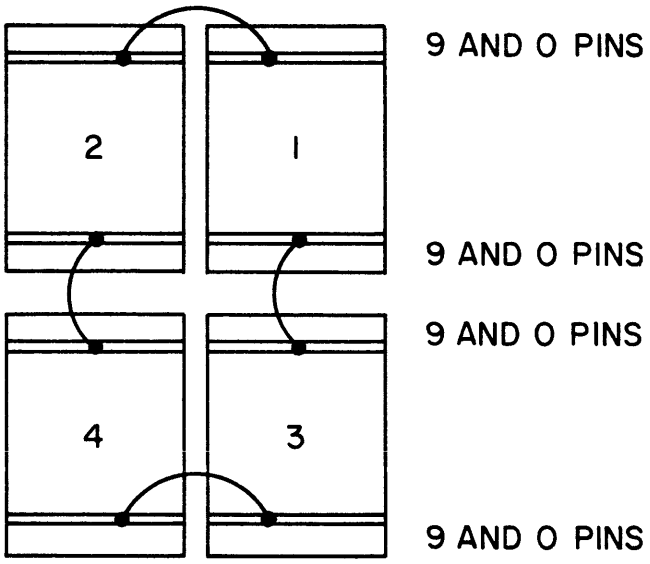


Figure 4. Rack and panel frame with Y and Z rows.

SMS Sockets
in rows
B through K.

```
 ----
9|
    |0
 ----
A|  |B
C|  |D
E|  |F
G|  |H
J|  |K
L|  |M
N|  |P
Q|  |R
 ----
```

Design Automation will process the 9 and 0 (zero) pins the following optional ways.



The 9 and 0 pins can be used for horizontal interpanel connections. The horizontal connections between panels using the 9 and 0 pins must be the MATCH or SUM methods as described for the Y row of panels 1 and 2.

The 9 and 0 pins can also accomplish vertical interpanel connections. If used vertically, a 9 or 0 pin must connect to the same column and pin designation in the panel above or below it. The 9 and 0 pin rows of the upper and lower panel should have the following relationship:

Upper Panel Row to Lower Panel Row

K	B
J	C
H	D
G	E
F	F
E	G
D	H
C	J
B	K

Example: 01A1K019-01A3B019
01A1K010-01A3B010
01A1K029-01A3B029
01A1K020-01A3B020

01A1K279-01A3B279
01A1K270-01A3B270
01A1K289-01A3B289
01A1K280-01A3B280

The 9 and 0 pins are usable for additional ground pins.

If 9 and 0 pins are not specified to be on a panel, Design Automation will assume the area occupied by the two pins to be available for routing and via point assignment for other wiring of the panel.

Here is a list of Design Automation standard designations for 10 x 28 logic panels on system pages:

Two Digit Frame	One Digit Module	One Digit Panel	One Digit Row	Two Digit Column	One Digit Pin
01-99	A - Z (excluding I and O)	1 - 4	A - K (excluding I) T, Y, and Z for connector block rows.	01 - 28	A - Z (excluding I and O) 1 - 8, 9 and 0 for connector block pins.

Here is an example of the designations for eight digits total:

Socket Pins

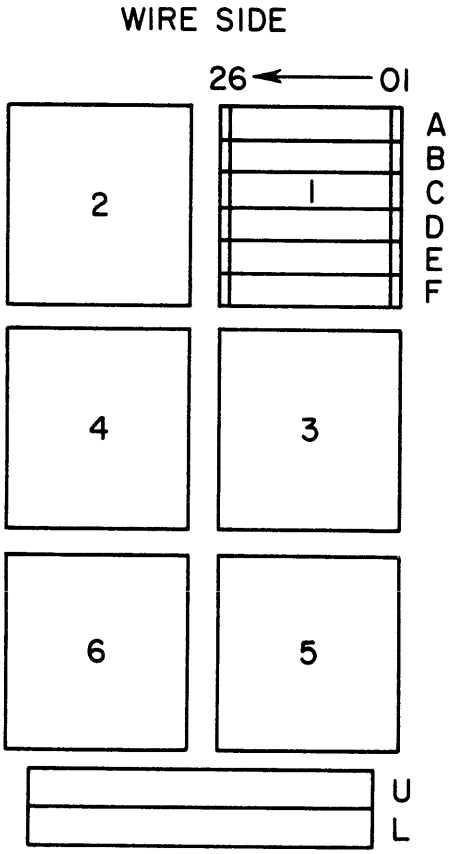
01A1A01A
01Z4K28R

Connector Pins

01A1T01A
01B4Y01A
01B4Z01A
01B4B019

LOGIC PANEL LAYOUT (6 x 26)

A standard 6 x 26 logic panel contains 156 SMS sockets. The SMS sockets form a matrix 26 columns wide by 6 rows long.



The columns are designated 01 through 26, right to left.

The rows are designated A through F, top to bottom.

Six of the 6 x 26 logic panels can be installed in a rack and panel module. The panels are designated 1 through 6, right to left, top to bottom.

Use of the 6 x 26 panels instead of the 10 x 28 panels in a module represents a loss in SMS sockets. Design Automation, however, will provide for 6 x 26 panels the same services (checking, wiring, etc.) that are provided for 10 x 28 panels.

Here is a list of Design Automation standard designations for 6 x 26 panels on system pages.

Frame	Module	Panel	Row	Column	Pin
01 - 99	A - Z (excluding I and O)	1-6	A - F, Y, and Z (connector block rows)	01 - 26	A - Z (excluding I and O) 1 - 8, 9, and 0 for connector block pins.

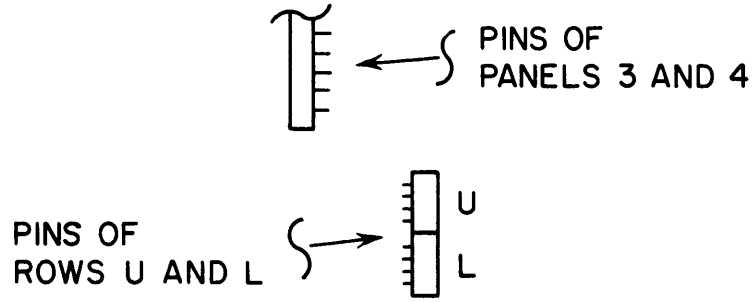
INPUT/OUTPUT CONNECTOR ROWS

The I/O connector rows for a module are located below the logic panels of the module.

The two rows are designated row U and row L, top to bottom.

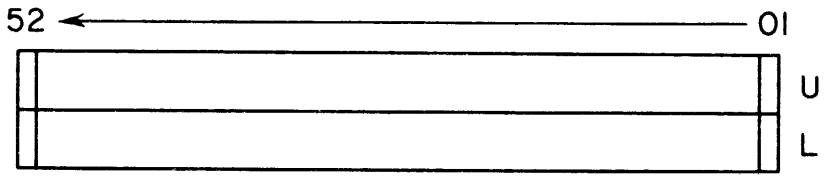
Note: A panel designation or number is not used for rows U and L. The reason a panel designation is not used is that when using 40 position connectors in rows U and L, the pins require two positions of the standard eight position location designation instead of the one position normally required.

The I/O connector rows are viewed from the socket or cable side when facing the wiring side of the panels.

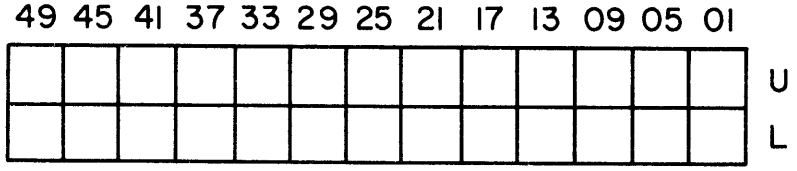


Different types of connectors can be in the I/O connector rows:

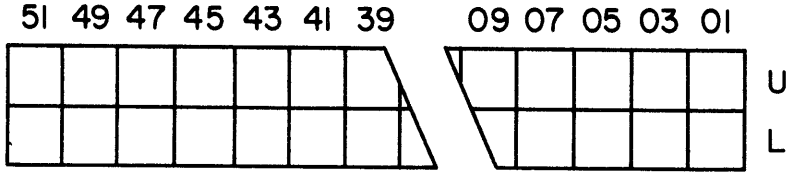
SMS card sockets, 52 per row, are designated 01 through 52, right to left, when facing the wiring side of the logic panels.



Forty-position connectors, 13 per row, are designated 01, 05, 09, 13, etc.



Sixteen-position connectors, 26 per row, are designated 01, 02, 05, etc.



I/O connector system page designations are as follows:

Frame	Module	Row	Column	Pin
01-99	A - Z, (excluding I and O)	U or L	01 - 52	-A through -R (excluding - I) 01 through 40

Examples:

01AU52-A	SMS socket
02AU1301	Forty position
03AU2601	Sixteen position

METHODS OF INTERPANEL CONNECTION

Interpanel communication depends on the type of connector blocks on the panels of a frame. The minimum and maximum use of connector blocks for interpanel and intermodule connections are illustrated in the following layouts.

Frame Layout 1 (Figure 5)

The two module frame of layout 1 has only T row connector blocks (four pins per column) on the panels. The T rows provide for vertical connections between the panels.

Horizontal connections between panels are made using "paddle card" jumpers. The SMS sockets of columns 27 and 28 in panels 1 and 3 connect to the SMS sockets of columns 01 and 02 in panels 2 and 4.

Paddle card jumpers connect the panels using the SUM method (the row and pin designations for the From and To panels are the same and the column designations sum to 29 -- 28 to 01 and 27 to 02).

Intermodule connections are the same as interpanel connections except that the module designations change for the From and To locations. Intermodule connections can also be accomplished through the U and L rows of the modules. A cable from a logic panel could go to the I/O connector rows for the module, then to the I/O connector rows of the other module, and finally to the desired panel.

Interframe connections use the I/O connector rows of the modules. Wires are routed to the correct cable connector by panel connections and/or I/O connector row connections.

Frame Layout 2 (Figure 6)

The two module frame of layout 2 has Y and Z row connector blocks (eight pins per column) on the panels. The two pins per column blocks (9 and 0) are also between the SMS socket rows of the panels.

Vertical connection between panels 1 to 3 and 2 to 4 is done using the Z rows below panels 1 and 2 to the Y rows above panels 3 and 4.

Horizontal connections between the panels use the 9 and 0 pins. Nine rows of the 9 and 0 pin blocks are available on each panel. On panel 1, module A, four 9 and 0 pin rows are used to connect with panel 2 of module A. The remaining five rows of 9 and 0 pins in panel 2 connect with panel 1 of module B. Four rows of 9 and 0 pins are left to connect panels 1 and 2 of module B. The horizontal connection of panels 3 and 4 is done in the same fashion.

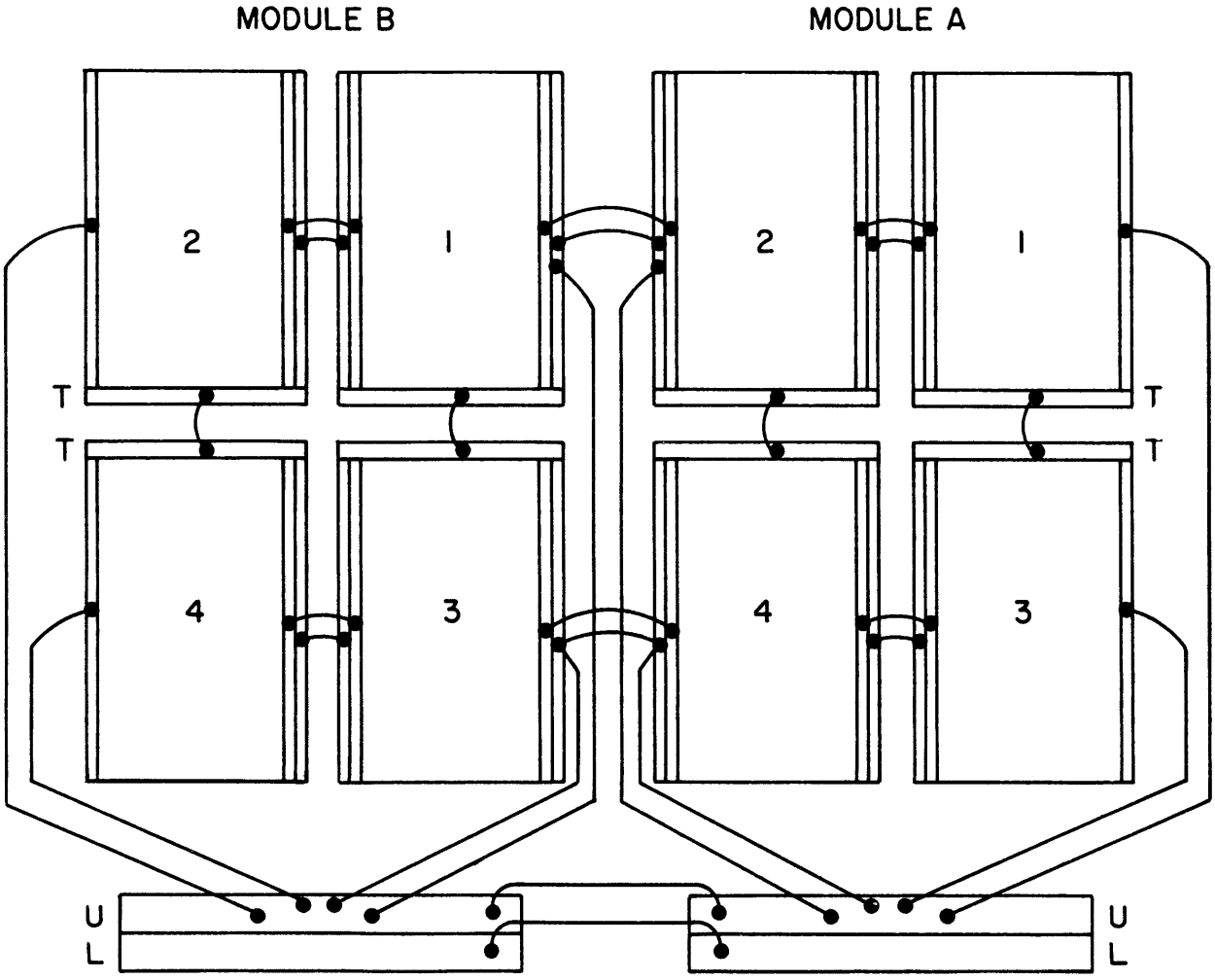


Figure 5. Frame layout 1.

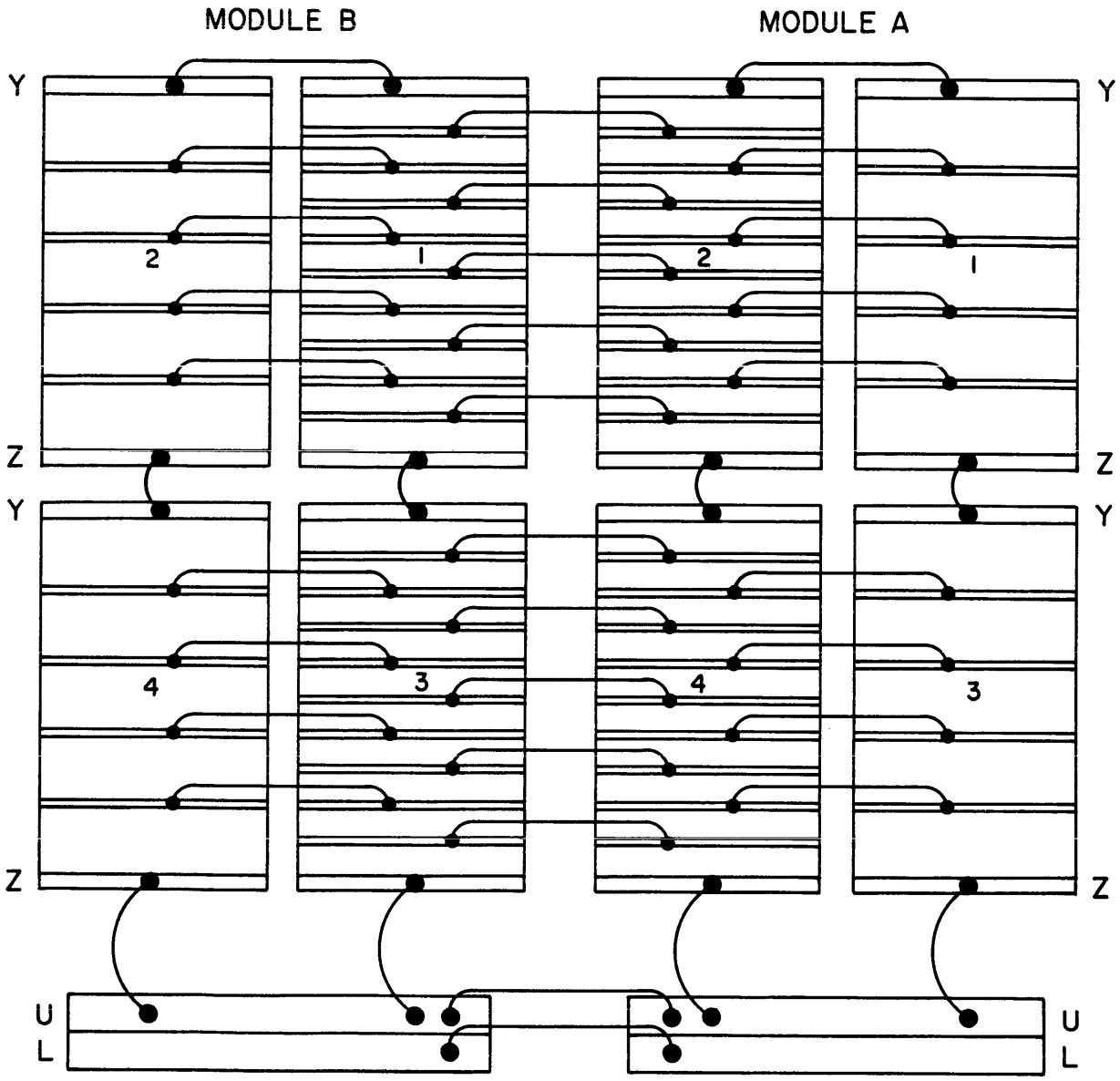


Figure 6. Frame layout 2.

The Y rows above panels 1 and 2 of both modules can also be used for horizontal connections.

I/O connections from the logic panels to the U and L rows of the modules use the Z rows below panels 3 and 4. Cables of rows U and L of a module then connect to the other module or to other frames.

Communication between panels of a module can also be by interpanel jumper. An interpanel jumper is a wire between an SMS socket pin of a panel to an SMS socket pin of another panel in the same module.

RACK AND PANEL DEFINITION

Due to the flexibility of connections possible on a rack and panel frame, it is necessary for a Development Group using this frame to provide Design Automation with a special package definition. The special package definition must define the use of SMS sockets and connector blocks of a frame. The special package definition also enables Design Automation to furnish a Development Group with logic checking and wiring lists for a rack and panel frame.

CONCLUSION

The corporate rack and panel module has many desirable features. Among these are the adaptability for different logic layouts of small and large machines, low cost achieved by the lack of moving parts and ease of assembly, and simple maintenance since all areas are readily accessible. The use of the corporate rack and panel by many machine development groups immediately justifies automated record processing by reducing the cost and gaining lead time in the release of records to manufacture a machine. DSD Design Automation will be able to give each new user of the corporate rack and panel better service by constantly improving the methods and computer programs involved in the generation of automated records.

Detailed information relating to physical size, part numbers, etc., may be obtained by referring to IBM Standard 1-2-7110-3.

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