

This Sheet Has Been Replaced



PCT/US 93/06908
R O / U S 10 NOV 1993

1

REPLACED SHEETS	SO
✓ Description : paged 1 to paged	89
✓ (s) : paged 10 to paged	97
✓ (ing(s) : paged 100 to paged	100
✓ (ect : paged 100 to paged	100
DATE OF RECEIPT	

TITLE OF THE INVENTION

APPARATUS FOR CONNECTING COMPUTER DEVICES

COPYRIGHT NOTICE

A portion of the disclosure of this patent document
5 contains material which is subject to copyright protection. The
copyright owner has no objection to the facsimile reproduction
by anyone of the patent document or the patent, disclosure, as
it appears in the Patent and Trademark Office patent file or
records, but otherwise reserves all copyright rights
10 whatsoever.

BACKGROUND OF THE INVENTION

1. Field of the Invention.

This invention relates to an apparatus for connecting
computer devices and, more specifically, where the apparatus
15 comprises a first connector, a cable assembly, a converter
adapter and a second connector.

2. Description of Related Art.

Figure 1 is a schematic illustration of a host or
local mainframe computer or mainframe 2 connected to a first
20 remote peripheral device or peripheral 4 which in turn is
connected to a second remote peripheral device or peripheral 6
in a typical conventional manner. A pair of conventional bus
and tag electrical assemblies 8 and 10, respectively,
interconnect one channel between the mainframe 2 and the first
25 peripheral 4. Similarly, a pair of conventional bus and tag
electrical assemblies 8 and 10, respectively, interconnect one
channel between the first peripheral 4 and the second
peripheral 6. The bus and tag electrical assemblies 8 and 10

SUBSTITUTE SHEET (RULE 26)

PCT/US 93/06908
R O / U S | 0 NOV 1993

- 2 -

include a plurality of bus and tag lines. The bus lines are used to transmit information including data, I/O-device address, commands, and control information. The tag lines are used for interlocking and controlling information on the bus lines and for special sequences. For a more detailed description of the bus and tag lines and their uses see Publication GA22-6974-09 entitled International Business Machines (IBM) System/360 and System/370 I/O Interface Channel to Control Unit Original Equipment Manufacturers' Information. Additional peripherals can be connected in series to the second peripheral 6 in a similar manner.

The mainframe 2 represents an IBM 360, 370, 43XX, 30XX, or ES/9000 mainframe computer, or a plug compatible mainframe. The peripherals 4,6 are plug compatible with the mainframe 2 and can be disk drives, tape drives, servers, printers or the like. The mainframe 2 and peripherals 4,6 have internal bus and tag serpent connectors 12-19, respectively, which mate with corresponding bus and tag serpent connectors 22-29, respectively, on ends of the electrical assemblies 8,10. The internal bus and tag serpent connectors 12-19 may be adapters which convert a first or external wiring/terminal connection scheme, grid or geometry to a second or internal wiring/terminal scheme, grid or geometry. For instance, the adapters 12-19 may convert from a spacing of 0.250 inches between centers of adjacent ones of a first or external plurality of rows and columns of terminals to a spacing of 0.125 inches between centers of adjacent ones of a second or internal plurality of rows and columns of terminals. The first or external terminals have serpent contacts for mating with serpent contacts in the bus and tag serpent connectors 22-29 on the electrical assemblies 8,10. The serpent contacts are hermaphroditic or gender neutral as defined in Federal Information Processing standards (FIPS) publication 60-2 published July 29, 1983 entitled I/O Channel Interface. The serpent adapters are also defined in IBM Publication GA22-6974-09 previously mentioned. The adapters 12-19 may be as disclosed in U.S. Patent 4,585,284.

PCT/US 93/06908
R O / U S 10 NOV 1993

- 3 -

Conventional bus and tag serpent connectors 22-29 on the electrical assemblies 8,10 do not convert the wiring/terminal connection scheme, grid or geometry. Conventional bus and tag serpent connectors 22-29 comprise a plurality of rows and columns of terminals. One end of the terminals have serpent contacts spaced 0.250 inches apart center to center for mating with the serpent contacts in the bus and tag serpent adapters 12-19 on the mainframe 2 or peripheral 4,6. The other end of the terminals in the conventional bus and tag serpent connectors 22-29 are also spaced 0.250 inches apart center to center and are soldered to ends of wires terminating from an "elephant" cable 20 having about a 0.8-1 inch diameter and containing a plurality of about 20 coaxial cables. One such elephant cable 20 is needed to transmit data between the mainframe 2 and peripheral 4, or one peripheral 4 and another peripheral 6, and is included in the bus cable assembly 8. Another such elephant cable 20 is needed to transmit control signals instructing how to handle the data and is included in the tag cable assembly 10. The elephant cables 20 are very heavy, bulky and limited in permissible length. Conventional bus and tag cable assemblies 8,10 allow only an attachment cable distance of up to 400 feet from the mainframe 2 to the last peripheral on the channel.

To accommodate the heavy and bulky elephant cables 20, computer rooms are specifically built with raised computer room flooring to run and store the cables 20 beneath the raised flooring. This hides the cables, but makes relocating the computers 2 and peripherals 4,6 very difficult without cutting and abandoning the initial cables 20.

30

SUMMARY OF THE INVENTION

The present invention is related to an apparatus for use in connecting a first computer device and a second computer device through a dual line cable assembly, the first and second computer devices having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:



- 4 -

a first bus and tag sub-assembly including:

a first connector for mating with the first interface in the first device,

5 a first multi-line cable assembly having a first end and a second end, the first end connected to the first connector assembly,

a first converter adapter connected to the multi-line cable assembly second end,

10 a second connector connected to the converter adapter, the second connector assembly for mating with the second interface in the first device, and

the first converter adapter including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and
15 second interfaces in the first device and sending such multiplexed serial information over a first line of the dual line cable assembly to the second computer device and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line
20 cable assembly and sending such parallel and demultiplexed information to the first and second interfaces of the first device.

The invention is further directed to an apparatus for use in connecting a first computer device and a second computer
25 device through a dual line cable assembly, the first and second computer devices having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:

a first connector for connecting to the second
30 interface in the first device;

a converter adapter adjacent and connected to the first connector, the converter adapter comprising:

a printed circuit board with conductive paths;
one or more second connector connected to some
35 of the conductive paths and for receiving signals from the first interface in the first device;



PCT/US 93/06908
R O / U S 10 NOV 1993

- 5 -

one or more third connector connecting the first connector and some of the conductive paths;

one or more fourth connector for connecting some of the conductive paths to one or more power sources;

5 a receiver connector connected to some of the conductive paths and for connecting to a connector on one end of the dual line cable assembly to receive signals over one of the lines in the dual line cable assembly; and

a transmitter connector connected to some of the
10 conductive paths and for connecting to the connector on the end of the cable assembly to send signals over the other one of the lines in the dual line cable assembly;

terminator networks connected by some of the paths to the second and third connectors;

15 line drivers/receivers connected by some of the paths to the terminator networks;

integrated circuit means connected to the line drivers/ receivers and for (1) multiplexing and then serializing parallel bus and tag information received from the
20 first and second interfaces in the first device and sending such multiplexed serial information over a first line of the dual line cable assembly and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly from the second
25 computer device and sending such parallel and demultiplexed information to the first and second interfaces of the first device, wherein the integrated circuit means comprises:

an erasable programmable logic device, a nonerasable programmable logic device, or a custom design
30 programmable logic device, the device connected by some of the paths to the line drivers/receivers;

a transmitter section including;

a serializer for receiving a plurality of parallel multiplexed signals from the programmable device
35 over conductive paths, encoding the signals, serializing the signals, converting the signals to emitter coupled logic (ECL)

- 6. -

levels and shifting the converted signals out on a conductive path; and

an ECL to current translator connected by paths to the serializer and the transmitter connector; and

5 a receiver section including a deserializer for receiving serialized signals and continuously deserializing, decoding and latching parallel data through parallel conductive paths to the programmable device.

BRIEF DESCRIPTION OF THE DRAWINGS

10 The invention can be more fully understood from the following detailed description thereof in connection with accompanying drawings described as follows.

Figure 1 is a schematic illustration of a mainframe and a pair of peripherals interconnected by conventional
15 electrical assemblies.

Figure 2 is a block diagram illustrating a first embodiment of an apparatus for connecting one computer device to another computer device in accordance with the present invention.

20 Figure 3 a perspective view of a bus and tag subassembly including a first connector, a cable assembly, a converter assembly and a second connector in accordance with the present invention.

Figure 4 is a perspective view of the first connector
25 in accordance with the present invention with parts exploded from one another.

Figure 5 is a perspective view of the second connector in accordance with the present invention with parts exploded from one another.

30 Figure 6 is a perspective view of a housing for the converter adapter in accordance with the present invention.

Figure 7 is a perspective view of a first side of the converter adapter with its housing removed in accordance with the present invention with parts exploded from one another.

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)



Figure 8 is a perspective view of a second side of the converter adapter with its housing removed in accordance with the present invention with parts exploded from one another.

Figure 9 is a block diagram of a converter circuit in the converter adapter in accordance with the present invention.

Figures 10-12 are block diagrams illustrating second, third and fourth embodiments of apparatus for connecting one computer device to another computer device in accordance with the present invention.

10 DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Throughout the following detailed description, similar reference characters refer to similar elements in all figures of the drawings.

Referring to Figure 2, there is depicted a block
15 diagram illustrating an apparatus 100 for connecting computer devices 2,4 in accordance with the present invention. Either one of the computer devices can be a mainframe, a peripheral, a disk drive, a tape drive, a server, a printer, a channel switch, a fiber optic or electrical cable channel extender, or
20 the like. The apparatus 100 comprises a first, host or local bus and tag sub-assembly 102 and a second or remote bus and tag subassembly 104 joined by a dual line cable assembly 106. The bus and tag sub-assemblies 102,104 can be electro-optic or just electronic. If the bus and tag sub-assemblies 102,104 are
25 electro-optic, the cable assembly 106 is a fiber optic cable including two fiber optic lines, such as a duplex fiber optic cable assembly. If the bus and tag subassemblies 102,104 are just electronic, the cable assembly 106 is an electrical cable assembly including two lines, such as an electrical coaxial
30 cable or twisted wire pair assembly. Power sources 108 connect with, in order to provide power to, the sub-assemblies 102 and 104.

Referring to Figures 2 and 3, each one of the bus and tag sub-assemblies 102,104 comprises a first connector 110,111,
35 a multi-line electrical cable assembly 112 connected at a first end to the first connector 110,111, a converter adapter 114,115



- 8 -

connected to a second end of the cable assembly 112 and a second connector 116,117 connected to the converter adapter 114,115. The first and second connectors 110,116 in the first or host bus and tag sub-assembly 102 are adapted to connect to the connectors or adapters 12 and 14 in the first computer device or mainframe 2. The first and second connectors 111,117 in the second or remote bus and tag sub-assembly 104 connect to the connectors or adapters 12 and 14 in the second computer device or peripheral 4. The converter adapters 114,115 are adapted to connect to power sources 108. More specifically, power for active electronics in the converter adapters 114,115 can be supplied externally through power connectors on the converter adapters 114,115 to external power supplies 108 or through unused terminals within the one of the connectors 110,111 or 116,117 to power supplies within the computer device 2,4.

Referring to Figure 4, each one of the first connectors 110,111 is preferably an adapter which converts a first or external wiring/terminal connection scheme, grid or geometry to a second or internal wiring/terminal scheme, grid or geometry. Each adapter 110,111 preferably has a first plurality of terminals 120 having first serpent contacts or end portions 122 and second solder tail or press fit shaped contacts or end portions 124. The first terminals 120 are preferably arranged in a first grid pattern comprising two groups, each with two rows and twelve columns. Each input/output connector assembly 110,111 preferably further comprises a second plurality of pin shaped terminals 126 having first contacts or end portions and second contacts or end portions. The second terminals 126 are preferably arranged in a second grid pattern comprising one group of two rows and twenty-five columns. Two of the second terminals 126 can be connected to ground. The first terminals 120 are preferably spaced 0.125 inches apart from center to center of adjacent terminals in the columns and 0.250 inches apart from center to center of terminals in different rows. The second terminals 126 are preferably spaced 0.100 inches apart from center to

SUBSTITUTE SHEET (RULE 26)

PCT/US 93/06908
R O / U S 10 NOV 1993

- 9 -

center of adjacent terminals in the columns and 0.100 inches apart from center to center of terminals in 0.100 inches apart from center to center of terminals in different rows. The input/output adapter assembly 100,111 preferably further comprises means 128 for electrically interconnecting the second contacts of the first and second terminals 120,126. Preferably, the interconnecting means 128 is a printed circuit board or the like. The interconnecting means 128 can be different for each one of the adapters 110 and 111.

10 Preferably, they are different in that the conductive paths in the circuit boards are arranged to interconnect the first and second terminals 120,126 in the adapters 110 and 111 as required in IBM Publication GA22-6974-09. Each adapter 110,111 preferably further includes an insulative shroud or header 130

15 for receiving the second plurality of terminals 126 and mating with the cable assembly 112. The header 130 can be a quick eject header commercially available under part no. 65863 from E. I. du Pont de Nemours and Company, hereafter "Du Pont", with offices at Wilmington, Delaware. Each adapter 110,111 further

20 includes an insulative housing 132. Preferably, the housing 132 includes a first housing part 134 with passages 136 for receiving the first plurality of terminals 120 for mating with the connector 12,14 in the first computer device 2 or the second computer device 4, respectively. Preferably, the

25 housing 132 includes a second housing part 138 attached to the printed circuit board 128 and the first housing part 134 with fasteners 140, such as screws. The second housing part 138 has a slot 142 through which the shroud 130 extends for mating with a connector 144 terminating one end of the cable assembly 112.

30 A jack screw assembly 146 can extend through the adapter 110,111 for use in securing the adapter 110,111 to the mainframe 2 or peripheral 4. Preferred adapters for use as the adapters 110 and 111 in the present invention are described in U.S. Patent 4,585,284 and are commercially available under part

35 nos. 69477-006 and 69477-005 from Du Pont.

Referring to Figures 3 and 7, preferably, the multiline cable assembly 112 comprises a generally flat and

SUBSTITUTE SHEET (RULE 26)

PCT/US 93/06908
R O / U S 10 NOV 1993

- 10 -

flexible- electrical transmission line cable 148 with a plurality of insulated conductors terminated by connectors 144 on each end of the cable 148. The connectors 144 are preferably receptacles. A suitable cable assembly that can be
5 used as the cable assembly 112 is commercially available under part no. 92642-001 from Du Pont.

Referring to Figure 5, each one of the first connectors 116,117 is also preferably an adapter which converts an external wiring/terminal connection scheme, grid or geometry
10 to an internal wiring/terminal scheme, grid or geometry. Each adapter 116,117 preferably has a first plurality of terminals 150 having first serpent contacts or end portions 152 and second solder tail or press fit shaped contacts or end portions 154. The first terminals 150 are preferably arranged in a grid
15 pattern comprising two groups, each with two rows and twelve columns. Each input/output connector assembly 116,117 preferably further comprises a second plurality of pin shaped terminals 156 having first contacts or end portions and second contacts or end portions. The second terminals 156 are
20 preferably arranged in a second grid pattern comprising two groups of two rows and thirteen columns. Each of the two group of the second terminals 156 preferably are stacked in an insulative support 157. The first terminals 150 are preferably spaced 0.125 inches apart from center to center of adjacent
25 terminals in the columns and 0.250 inches apart from center to center of terminals in different rows. The second terminals 156 are preferably spaced 0.100 inches apart from center to center of adjacent terminals in the columns and 0.100 inches apart from center to center of terminals in different rows.
30 The input/output adapter assembly 116,116 preferably further comprises means 158 for electrically interconnecting the second contacts of the first and second terminals 150,156. Preferably, the interconnecting means 158 is a printed circuit board or the like. The interconnecting means 158 can be different for each
35 one of the adapters 116 and 117. Preferably, they are different in that the conductive paths in the circuit boards are arranged to interconnect the first and second terminals 150,156 in the

SUBSTITUTE SHEET (RULE 26)



- 11 -

adapters 116 and 117 as required in IBM Publication GA22-6974-09. Each adapter 116,117 further includes an insulative housing 162. The housing 162 includes passages 166 for receiving the first plurality of terminals 150 for mating with the connector 12,14 in the first device 2 or second device 4, respectively. Preferred adapters for use as the adapters 116 and 117 in the present invention are described in U.S. Patent 4,585,284. Preferred adapters 116 and 117 are parts of assemblies commercially available under part nos. 92643-001 (dark) and 92644-001 (light) from Du Pont.

Figure 6 is a perspective view of a housing 500 for the converter adapter 114,115. The housing 500 has a main rectangularly shaped frame 502 with a first top wall 504, a second bottom wall 506, a third side wall 508, a fourth side wall 510 and a fifth end wall 512. The side walls are parallel and spaced from one another and have internal longitudinal rails or ridges 514 defining grooves 516 between a pair of the rails or ridges 514. Edges of circuit board 190 slide in the grooves 516 such that the adjacent rails or ridges 514 hold the circuit board 190 in place in the housing 500. The housing 500 includes a cover 518 with ribs 520 that slide in grooves 516 defined by a pair of the rails or ridges 514. The cover 518 also has projections 522 that snap over an edge of the end side 512 of the frame 502 to secure the cover 518 on the frame 502. The housing 500 can be made of a conductive material (e.g., aluminum) or an insulative material (e.g., plastic). If the housing is made of plastic, it can be coated with a metallized or conductive layer. Alternatively, a conductive or metallized sheet can be slid in grooves 515 adjacent the top wall 504 and/or the bottom wall 506 to enhance electrical performance. After the printed circuit board 190 is inserted in the housing 500, the housing 500 is secured to the second connector printed circuit board 158 and the second connector housing 162, such as, by screws 524. A jack screw assembly 526 (such as the assembly commercially available from Du Pont under part number 92645-001) can extend through the housing 500 and the adapter 116,117 for use in securing the converter adapter 114 combined



- 12 -

with the adapter 116,117 to the mainframe 2 or peripheral 4. The connector 116,117 connected to the converter adapter 114,115 can be contained within a box approximately 1 inch (2.54 centimeters) by 4 inches (10.16 centimeters) by 4.5 5 inches (11.43 centimeters).

Figure 7 is a perspective view of a first side of the converter adapter 114,115 with the housing 500 removed with parts exploded from one another. Figure 8 is a perspective view of a second side of the converter adapter 114,115 with the 10 housing 500 removed with parts exploded from one another. The converter adapter 114,115 comprises a circuit board 190 with conductive traces, paths or lines, a plurality of connectors 216, 222, 238, 240, 300, 302, and 304 electrically interconnecting the traces with parts off the board 190, and 15 other components electrically connected to the traces. The connector 304 is for mating with the connector 144 on one end of the cable assembly 112. The connector 304 can be a right angle sea horse or quick eject header, such as commercially available under part number 78278 from Du Pont. The pair of 20 connectors 300 and 302 are for receiving the two groups of the second terminals 156. The connectors 300 and 302 can be surface mount horizontal card connectors, such as commercially available under part number 67848-013 from Du Pont. One or more connector 238,240 is for connection to one or redundant 25 power sources 108. The connectors 238 and 240 can be 1 by 3 right angle friction latch headers, such as commercially available under part number 78208-013 from Du Pont. The receiver connector 222 is for connecting to a connector on one end of the cable assembly 106 to receive signals over one of 30 the fiber optic or electrical lines in the cable assembly 106. The transmitter connector 216 is for connecting to the connector on the end of the cable assembly 106 to send signals over the other one of the fiber optic or electrical lines in the cable assembly 106. If the converter adapter 114,115 is an 35 electro-optic adapter, then the transmitter connector 216 can be a light emitting diode (LED) device commercially available under part number HFBR 1414T and the receiver connector 222 can

PCT/US 93/06908
R O / U S 10 NOV 1993

- 13--

be a positive intrinsic negative (PIN) photodetector and amplifier assembly under part number HFBR 2416TC, both from Hewlett Packard with offices in San Jose, California.

Figure 9 is an architectural or structural block diagram of the converter adapter 114,115 schematically showing the connectors 216, 222, 238, 240, 300, 302, and 304, and other components in the converter adapter 114,115. Bus IN lines and Bus OUT lines pass through the connector 304 and board conductive traces to terminator networks 200 comprising resistor circuits which terminate the lines to their characteristic impedance. Similarly, tag IN lines and tag OUT lines pass through the connectors 300,302 and board traces to terminator networks 204 comprising resistor circuits which similarly terminate the lines. Resistor circuits commercially available under part no. 628A470G from Beckman Co. with offices in Fullerton, California, can be used for the terminator networks 200,204.

The terminator networks 200,204 are connected by board traces to line drivers/receivers 202,206 which receive and convert (1) IBM Original Equipment Manufacturers-Information (OEMI) compatible voltage levels to transistor to transistor levels (TTL) compatible voltage levels from left to right in Figure 9 or (2) from TTL compatible voltage levels to IBM OEMI compatible voltage levels from right to left in Figure 9. Suitable drivers/receivers that can be used for drivers/receivers 202,206 are commercially available under part no. SN751730D from Texas Instruments with office in Dallas, Texas.

A relay 208 is provided to terminate or propagate a SELECT-OUT transmission tag line in the converter adapter 114. If the converter adapter 114 is powered up by a power source 108 and connected to the adapter 115 through the cable assembly 106, the relay 208 terminates the SELECT-OUT transmission tag line. If the converter adapter 114 is not powered up by power source 108 and/or if connection is not established with the adapter 115, the relay 208 propagates the SELECT-OUT transmission tag line to the SELECT-IN transmission tag line.

SUBSTITUTE SHEET (RULE 26)



- 14 -

The converter adapter 115 does not contain a corresponding relay 208.

The drivers/receivers 202,206 are connected by board traces to means 210 for multiplexing signals received from the
5 receivers 202,206 and demultiplexing signals sent to the drivers 202,206. The multiplexing and demultiplexing means 210 combines Bus signals and Tag signals onto a bus 231 having a plurality of lines (e.g., 10). The multiplexing and demultiplexing means 210 also separates Bus signals and Tag
10 signals from a bus 219 having a plurality of lines (e.g., 10). This multiplexing synchronizes the Bus and Tag signals through a master clock generated by an onboard oscillator. Strobe and acknowledge signalling provides this synchronization by registering the 10 bit bus into an input latch. The data in
15 the input latch is then passed over bus 211.

The multiplexing and demultiplexing means 210 further includes means for emulating TAG signals to reduce system and cable induced delays. The multiplexing and demultiplexing means 210 can be a programmed erasable programmable logic
20 device (EPLD), such as the EPLD commercially available under part no. EPM5130-WC-1 from Altera Corp. with offices in San Jose, California. The EPLD can be programmed accordingly to follow the protocols defined by IBM Publication GA22-6974-09 with the following exceptions. The converter adapter 114 does
25 not propagate reserved lines or special-use lines, except the J09 signal line, to the converter adapter 115. When the channel raises 'service out' ('data out') during dc-interlocked data transfer, the adapter 114 drops 'service in' ('data in'). This may occur before the control unit has recognized the rise
30 of 'service out' ('data out'). After the control unit recognizes the rise of 'service out' ('data out'), it drops 'service in' ('data in') and the adapter 115 drops 'service out' ('data out'). This may occur before the channel has recognized the fall of 'service in' ('data in'). When the
35 adapter 115 recognizes the rise of 'operational in' during initial selection for DASH, it drops 'address out'. When the adapter 115 recognizes the fall of 'status in' during initial



- 15 -

selection for DASH and the current command is being chained from a previous command, it drops 'service out'. This may occur before the channel has recognized the fall of 'status in.

5 Two report files generated by a Max+Plus II Compiler for an EPM5130WC-1 chip from Altera Corp. are included in Appendices A and B to this specification and appear immediately before the claims. The report files in Appendices A and B show how embodiments of the EPLD 210 in each one of the adapters 114
10 and 115, respectively, can be implemented. These report files are sufficient information for one of ordinary skill in the art to reproduce the designs of these embodiments.

Alternatively, the multiplexing and demultiplexing means 210 can include a nonerasable programmable logic device
15 (PLD) or a custom design programmable logic device, such as an application specific Integrated circuit (ASIC). If an ASIC is used, it can be designed to perform other functions than those included in the EPLD. For instance, such other functions can include the functions performed by any or all other components
20 on the print circuit board 190. Such alternatives are equivalent to the embodiments disclosed in more detail using the EPLD. The structure for performing the functions performed by any or all components on the print circuit board 190 can be referred to as integrated circuit means.

25 The integrated circuit means can include a transmitter section 213 and a receiver section 217.

The bus 211 of parallel traces connects the programmed EPLD 210 to a serializer 212 within the transmitter section 213. The serializer 212 converts parallel data to serial data.
30 More specifically, the serializer 212 receives a plurality of parallel multiplexed signals from the 10-bit bus 211 and sends it to an encoder latch to convert the 10-bit bus to a 12-bit encoded word. this encoding is used to maximize bit boundary transitions to help balance the data pattern and aid in the
35 timing recovery on the receiving side. The 12-bit word is then fed to a shift register where the contents are serially shifted out in a single stream on one line. The serializer 212 can be



PCT/US 93/06908
R O / U S 10 NOV 1993

- 16--

a transparent synchronous transmitter-receiver interface (TAXI) commercially available under part no. AM-7968 from Advanced Micro Devices with offices in Sunnyvale, California. A quartz crystal oscillator and clock generator 236 can provide a fixed
5 clock frequency to the serializer 212. In summary, the serializer 212 encodes the data, serializes it, converts the data to emitter coupled logic (ECL) levels (which are voltage signals), and shifts the data out over balanced lines. This data is fed to an ECL to current translator 214 which feeds
10 current pulses to the transmitter connector 216 which can contain a light emitting diode device. The transmitter connector 216 connects to the connector on the end of the cable assembly 106 to send optical data pulses over one 107 of the fiber optic lines in the cable assembly 106. Alternatively,
15 current data pulses from the ECL to current translator 214 are fed through an electrical transmitter connector and an electrical line of the electrical cable assembly 106.

Signals or data pulses are transmitted over line 109 of the cable assembly 106 and received by the receiver section
20 217. If the cable assembly 106 is fiber optic, the receiver section 217 includes the receiver connector 222 which can be a photodiode and preamplifier which converts groups of photons or optical light pulses to an analog voltage output. The photodiode and preamplifier 222 can be a positive intrinsic
25 negative (PIN) photodiode and preamplifier, such as, commercially available under part no. HFBR2614TC from Hewlett Packard. The output from the photodiode and preamplifier 222 is fed into a data quantizer 220 which amplifies and converts the voltage signals to a constant level output that is ECL
30 compatible. The data quantizer 220 also provides a status indication or a loss of signal to the EPLD 210 indicating whether there is a connection at the distal end of the cable assembly 106. The data quantizer 220 can be part no. NE5224 commercially available from Signetics with offices in
35 Sunnyvale, California. The output of the data quantizer 220 is fed into a deserializer 218 which receives and the serialized ECL levels and continuously deserializes, decodes and latches



- 17 -

parallel data through the 10 bit parallel bus 219 to the EPLD 210. The deserializer 218 can be part no. AM7969 commercially available from Advanced Micro Devices.

One or more voltage regulator 224, 226, 228, 230, 232 can be connected to provide a constant voltage supply to the line drivers/receivers 202, 206, the EPLD 210, the serializer 212 and the deserializer 218. The voltage regulators can be connected to a power input circuit 234 which can be "OR" connected to redundant power supplies 108. Thus, if the primary power supply 108 fails, power is automatically supplied from a second power supply 108.

Thus, data inputted to the bus and tag sub-assembly 102 from the bus and tag interfaces 12 and 13 is transmitted over the dual line cable assembly 106 and the bus and tag sub-assembly 104 and appears at the receiving device interfaces 12 and 14 exactly duplicated, only delayed in the time domain by the serialization and deserialization function and the propagation delay of the pulses in the lines which is length dependent (approximately 5 microseconds for each kilometer of optical fiber).

Figures 10-12 are block diagrams illustrating second, third and fourth embodiments of apparatus 100A, 100B and 100C for connecting one computer device 2 to another computer device 4 in accordance with the present invention. Figure 10 illustrates the apparatus 100A similar to the apparatus 100 illustrated in Figure 2, except the converter adapters 114A, 115A are connected directly to the connectors 110A, 111A connected to bus interfaces 12, rather than to the connectors 116A, 117A connected to the tag interfaces 14.

Figure 11 illustrates an apparatus 100B similar to the apparatus 100 illustrated in Figure 2, except the functions performed by the converter adapters 114 and 115 in Figure 2 are now performed by converter adapters 114B, 114B', 115B and 115B' which are connected directly to the connectors 110B, 116B, 111B and 117B, respectively. One of the cable assemblies 112 interconnects adapters 114B and 114B'. Another one of the cable assemblies 112 interconnects adapters 115B and 115B'. Each



pair of the converter adapters 114B,114B' and 115B,115B' include integrated circuit means similar to the one previously described in detail in relation to the embodiment illustrated in Figure 9, but with parts located in two housings rather than one. In the embodiment depicted in Figure 11, the integrated circuit means in converter adapters 114B,114B' is for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces 12,14 in the first device 2 and sending such multiplexed serial information over a first line of the dual line cable assembly 106 to the second computer device 4 and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly 106 and sending such parallel and demultiplexed information to the first and second interfaces 12,14 of the first device 2. In other words, the result achieved by converter adapter 114 in Figure 2 is achieved by converter adapters 114B and 114B' in Figure 11. Similarly, the result achieved by converter adapter 115 in Figure 2 is achieved by converter adapters 115B and 115B' in Figure 11.

Figure 12 illustrates the apparatus 100C similar to the apparatus 100 illustrated in Figure 2, except a converter adapter 114C,114C',115C,115C' is attached to each of the four connectors 110C,114C,111C,117C connected to the interfaces 12,14 of the devices 2,4. This is like the apparatus 100B in Figure 11 in that each pair of the converter adapters 114C,114C' and 115C,115C' include integrated circuit means similar to the one previously described in detail in relation to the embodiment illustrated in Figure 9, but with parts located in two housings rather than one. Further, a dual line cable assembly 106 interconnects both bus converter adapters 114C,115C and a dual line cable assembly 106 interconnects both tag converter adapters 114C',115C'. In the embodiment depicted in Figure 12, the integrated circuit means in converter adapters 114C,114C' is for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces 12,14 in the first device 2 and



PCT/US 93/06908

R O / U S | 0 NOV 1993

- 19 -

5 sending such multiplexed serial information over lines of the
dual line cable assemblies 106 to the second computer device 4
and (2) deserializing and then demultiplexing serial bus and
tag information received through other lines of the dual line
cable assemblies 106 and sending such parallel and
demultiplexed information to the first and second interfaces
12,14 of the first device 2. In other words, the result
achieved by converter adapter 114 in Figure 2 is achieved by
converter adapters 114C and 114C' in Figure 12. Similarly, the
10 result achieved by converter adapter 115 in Figure 2 is
achieved by converter adapters 115C and 115C' in Figure 12.

Each one of apparatuses 100A, 100B and 100C are
defined as equivalent in function and structure to, and obtain
the same result as, the apparatus 100.

15 The apparatus 100,100A,100B,100C of the present
invention can also interconnect daisy-chained peripheral
control units on one mainframe multiplexer channel.

The apparatus of the present invention provides up to
4.5 million bytes per second of data throughput between the
20 mainframe and peripherals. It also allows distances up to
2,000 meters (6600 feet) between devices - mainframe to
peripheral, and/or peripheral to peripheral.

These features allow a user to replace bulky, limited
distance bus and tag cables with dual line fiber optic or
25 electrical cables in a structured wiring scheme. Data
transmission via fiber optic cables provides significant
advantages over data transmission via conventional copper
conductor (bus and tag) cables. There is less bulk and weight.
They eliminate the need for raised computer room flooring,
30 except potentially for cooling purposes. There is no
electromagnetic or radio frequency interference with signals
transmitted through fiber optic cables. There is greater data
integrity and security since fiber optic cables are not easily
tapped or monitored. Finally, the transmission distance is
35 greater - up to 6600 feet versus 400 feet for conventional bus
and tag cables. Those skilled in the art, having the benefit of
the teachings of the present invention as hereinabove set

- 20 -

forth, can effect numerous modifications thereto. These modifications are to be construed as being encompassed within the scope of the present invention as set forth in the appended claims.

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

Project Information f:\max2work\mini\mini_loc\mini_loc.rpt
MAX+plus II Compiler Report File
Version 2.11 04/06/92

***** Project compiled without errors

Title: LOCAL MINI-EXTENDER
Company: FiberCom, Inc.
Designer: Richard LaBarbera
Rev: A
Date: 3:35p 5-28-1992

** DEVICE SUMMARY **

Chip/ POF	Device	Input Pins	Output Pins	Bidir Pins	Shareable MCs	EXPs	% Utilized
MINI	EPM5130WC-1	36	35	0	122	45	95 %

** PIN/MC/CHIP ASSIGNMENTS **

User Assignments	Actual Assignments (if different)	Node Name
MINI@85		ACKNLGE
MINI@99		ACTIVITY
MINI@7		ADR_IN
MINI@21		ADR_OUT
MINI@40		BUS_INP
MINI@50		BUS_IN0
MINI@49		BUS_IN1
MINI@48		BUS_IN2
MINI@47		BUS_IN3
MINI@46		BUS_IN4
MINI@45		BUS_IN5
MINI@42		BUS_IN6
MINI@41		BUS_IN7
MINI@29		BUS_OUTP
MINI@39		BUS_OUT0
MINI@36		BUS_OUT1
MINI@35		BUS_OUT2
MINI@34		BUS_OUT3
MINI@33		BUS_OUT4
MINI@32		BUS_OUT5
MINI@31		BUS_OUT6
MINI@30		BUS_OUT7
MINI@51		CLOCK
MINI@15		CMD_OUT
MINI@84		CO0
MINI@83		CO1
MINI@3		DATA_IN
MINI@11		DATA_OUT
MINI@1		DISC_IN
MINI@97		DIV_A_B
MINI@73		DIO
MINI@74		DI1

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

MINI@75
MINI@76
MINI@77
MINI@78
MINI@79
MINI@80
MINI@81
MINI@82
MINI@54
MINI@55
MINI@56
MINI@57
MINI@58
MINI@59
MINI@60
MINI@61
MINI@64
MINI@65
MINI@28
MINI@70
MINI@100
MINI@10
MINI@52
MINI@98
MINI@23
MINI@22
MINI@8
MINI@9
MINI@2
MINI@27
MINI@6
MINI@17
MINI@4
MINI@14
MINI@5
MINI@86
MINI@20
MINI@72
MINI@96

DI2
DI3
DI4
DI5
DI6
DI7
DI8
DI9
DO0
DO1
DO2
DO3
DO4
DO5
DO6
DO7
DO8
DO9
DRV_OE
DSTRB
FAULT
HOLD_OUT
LOS
MR
MRK0_IN
MRK0_OUT
OP_IN
OP_OUT
REQ_IN
RLY_DRV
SEL_IN
SEL_OUT
SER_IN
SER_OUT
STAT_IN
STROBE
SUPR_OUT
VLTN
WD_EN

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

FILE HIERARCHY **

```

rx_cir_1:80
rx_cir_1:80 ds_det_1:47
rx_cir_1:80 sl_dmx_1:93
rx_cir_1:80 ds_dmx_1:77
rx_cir_1:80 ds_dmx_1:78
rx_cir_1:80 bt_dmx_1:80
rx_cir_1:80 bt_dmx_1:82
rx_cir_1:80 bt_dmx_1:76
rx_cir_1:80 bt_dmx_1:75
rx_cir_1:80 bt_dmx_1:74
rx_cir_1:80 bt_dmx_1:73
tx_cir_1:131
tx_cir_1:131 bt_mx_1:59
tx_cir_1:131 bt_mx_1:59 fclatch:51
tx_cir_1:131 sup_mx_1:100
tx_cir_1:131 sup_mx_1:100 fclatch:51
tx_cir_1:131 c_mx_1:94
tx_cir_1:131 c_mx_1:94 fclatch:96
tx_cir_1:131 ds_mx_1:89
tx_cir_1:131 s_mx_1:88
tx_cir_1:131 s_mx_1:88 fclatch:92
tx_cir_1:131 d_mx_1:85
tx_cir_1:131 d_mx_1:85 fclatch:93
tx_cir_1:131 as_syn_1:95
tx_cir_1:131 bt_mx_1:61
tx_cir_1:131 bt_mx_1:61 fclatch:51
tx_cir_1:131 bt_mx_1:62
tx_cir_1:131 bt_mx_1:62 fclatch:51
tx_cir_1:131 bt_mx_1:65
tx_cir_1:131 bt_mx_1:65 fclatch:51
tx_cir_1:131 bt_mx_1:66
tx_cir_1:131 bt_mx_1:66 fclatch:51
ala_drv:102
ala_drv:102 wd_cntr:123

```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

device: EPHS130WC-1
security: OFF

[illegible]

	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81		
DISC_IN	1																				80	DI7
REQ_IN	2																				79	DI6
DATA_IN	3																				78	DI5
SER_IN	4																				77	DI4
STAT_IN	5																				76	DI3
SEL_IN	6																				75	DI2
ADR_IN	7																				74	DI1
OP_IN	8																				73	DI0
OP_OUT	9																				72	VLTN
HOLD_OUT	10																				71	GND
DATA_OUT	11																				70	DSTRB
GND	12																				69	VCC
GND	13																				68	VCC
SER_OUT	14																				67	GND
CHD_OUT	15																				66	GND
GND	16																				65	DO9
SEL_OUT	17																				64	DO8
VCC	18																				63	GND
VCC	19																				62	GND
SUPR_OUT	20																				61	DO7
ADR_OUT	21																				60	DO6
MRK0_OUT	22																				59	DO5
MRK0_IN	23																				58	DO4
RESERVED	24																				57	DO3
RESERVED	25																				56	DO2
RESERVED	26																				55	DO1
RLY_DRV	27																				54	DO0
DRV_OE	28																				53	RESERVED
BUS_OUTP	29																				52	LOS
BUS_OUT7	30																					

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

** RESOURCE USAGE **

Logic Array Block	Macrocells	I/O Pins	Shareable Expanders	External Interconnect
A: MC1 - MC16	12/16(75%)	8/8(100%)	8/32(25%)	14/24(58%)
B: MC17 - MC32	14/16(87%)	5/8(62%)	2/32(6%)	9/24(37%)
C: MC33 - MC48	16/16(100%)	8/8(100%)	29/32(90%)	18/24(75%)
D: MC49 - MC64	16/16(100%)	8/8(100%)	0/32(0%)	7/24(29%)
E: MC65 - MC80	16/16(100%)	7/8(87%)	1/32(3%)	8/24(33%)
F: MC81 - MC96	16/16(100%)	8/8(100%)	0/32(0%)	14/24(58%)
G: MC97 - MC112	16/16(100%)	6/8(75%)	3/32(9%)	17/24(70%)
H: MC113 - MC128	16/16(100%)	5/8(62%)	2/32(6%)	10/24(41%)

Total dedicated input pins used:	16/ 20 (80%)
Total I/O pins used:	55/ 64 (85%)
Total macrocells used:	122/128 (95%)
Total shareable expanders used:	45/256 (17%)

Total input pins required:	36
Total output pins required:	35
Total bidirectional pins required:	0
Total macrocells required:	122
Total shareable expanders in database:	45

Synthesized macrocells:	0/128 (0%)
-------------------------	-------------

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

PCT/US 93/06908
R O / U S 10 NOV 1993

** INPUTS **

Pin	MCell	LAB	Primitive	Shareable Expanders		Fan-In		Name
				Total	Shared	INP	FBK	
85	(101)	(G)	INPUT	0	0	0	0	ACKNL DGE
21	-	-	INPUT	0	0	0	0	ADR_OUT
29	(23)	(B)	INPUT	0	0	0	0	BUS_OUTP
39	(39)	(C)	INPUT	0	0	0	0	BUS_OUT0
36	(38)	(C)	INPUT	0	0	0	0	BUS_OUT1
35	(37)	(C)	INPUT	0	0	0	0	BUS_OUT2
34	(36)	(C)	INPUT	0	0	0	0	BUS_OUT3
33	(35)	(C)	INPUT	0	0	0	0	BUS_OUT4
32	(34)	(C)	INPUT	0	0	0	0	BUS_OUT5
31	(33)	(C)	INPUT	0	0	0	0	BUS_OUT6
30	(24)	(B)	INPUT	0	0	0	0	BUS_OUT7
51	(65)	(E)	INPUT	0	0	0	0	CLOCK
15	-	-	INPUT	0	0	0	0	CMD_OUT
11	-	-	INPUT	0	0	0	0	DATA_OUT
97	(117)	(H)	INPUT	0	0	0	0	DIV_A_B
54	(68)	(E)	INPUT	0	0	0	0	DO0
55	(69)	(E)	INPUT	0	0	0	0	DO1
56	(70)	(E)	INPUT	0	0	0	0	DO2
57	(71)	(E)	INPUT	0	0	0	0	DO3
58	(72)	(E)	INPUT	0	0	0	0	DO4
59	-	-	INPUT	0	0	0	0	DO5
60	-	-	INPUT	0	0	0	0	DO6
61	-	-	INPUT	0	0	0	0	DO7
64	-	-	INPUT	0	0	0	0	DO8
65	-	-	INPUT	0	0	0	0	DO9
70	-	-	INPUT	0	0	0	0	DSTRB
10	-	-	INPUT	0	0	0	0	HOLD_OUT
52	(66)	(E)	INPUT	0	0	0	0	LOS
98	(118)	(H)	INPUT	0	0	0	0	MR
22	-	-	INPUT	0	0	0	0	MRK0_OUT
9	-	-	INPUT	0	0	0	0	OP_OUT
17	-	-	INPUT	0	0	0	0	SEL_OUT
14	-	-	INPUT	0	0	0	0	SER_OUT
20	-	-	INPUT	0	0	0	0	SUPR_OUT
72	-	-	INPUT	0	0	0	0	VLTN
96	(116)	(H)	INPUT	0	0	0	0	WD_EN

This Sheet Has Been Replaced



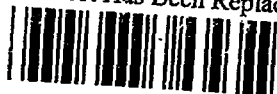
SUBSTITUTE SHEET (RULE 26)

PCT/US 93/06908
R O / U S 10 NOV 1993

** OUTPUTS **

Pin	MCell	LAB	Primitive	Shareable Expanders		Fan-In		Name
				Total	Shared	INP	FBK	
99	119	H	OUTPUT	0	0	0	2	ACTIVITY
7	7	A	DFF	0	0	4	0	ADR_IN
40	40	C	DFF	0	0	1	3	BUS_INP
50	56	D	DFF	0	0	1	3	BUS_IN0
49	55	D	DFF	0	0	1	3	BUS_IN1
48	54	D	DFF	0	0	1	3	BUS_IN2
47	53	D	DFF	0	0	1	3	BUS_IN3
46	52	D	DFF	0	0	1	3	BUS_IN4
45	51	D	DFF	0	0	1	3	BUS_IN5
42	50	D	DFF	0	0	1	3	BUS_IN6
41	49	D	DFF	0	0	1	3	BUS_IN7
84	100	G	OUTPUT	0	0	1	0	CO0
83	99	G	OUTPUT	0	0	1	0	CO1
3	3	A	DFF	0	0	4	1	DATA_IN
1	1	A	DFF	0	0	4	0	DISC_IN
73	81	F	DFF	0	0	2	1	DI0
74	82	F	OUTPUT	0	0	0	3	DI1
75	83	F	OUTPUT	0	0	0	3	DI2
76	84	F	OUTPUT	0	0	0	3	DI3
77	85	F	OUTPUT	0	0	0	3	DI4
78	86	F	OUTPUT	0	0	0	3	DI5
79	87	F	OUTPUT	0	0	0	3	DI6
80	88	F	OUTPUT	0	0	0	3	DI7
81	97	G	OUTPUT	0	0	0	3	DI8
82	98	G	OUTPUT	0	0	0	3	DI9
28	22	B	OUTPUT	0	0	1	0	DRV_OE
100	120	H	OUTPUT	0	0	1	1	FAULT
23	17	B	DFF	0	0	4	0	MRKO_IN
8	8	A	DFF	0	0	4	0	OP_IN
2	2	A	DFF	0	0	4	0	REQ_IN
27	21	B	OUTPUT	0	0	1	0	RLY_DRV
6	6	A	MCELL	0	0	0	2	SEL_IN
4	4	A	DFF	0	0	4	1	SER_IN
5	5	A	DFF	0	0	4	0	STAT_IN
86	102	G	DFF	1	0	2	13	STROBE

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)



PCT/US 93/06908
R O / U S 10 NOV 1993

** BURIED LOGIC **

Pin	MCell	LAB	Primitive	Shareable		Fan-In		Name
				Total	Shared	INP	FBK	
-	128	H	DFF	0	0	2	1	ala_drv:102 wd_cntr:123 :2
-	127	H	DFF	0	0	2	2	ala_drv:102 wd_cntr:123 :4
-	80	E	DFF	0	0	2	18	ala_drv:102 wd_cntr:123 :5
-	126	H	DFF	0	0	2	3	ala_drv:102 wd_cntr:123 :6
-	79	E	DFF	0	0	2	4	ala_drv:102 wd_cntr:123 :7
-	78	E	DFF	0	0	2	5	ala_drv:102 wd_cntr:123 :8
-	77	E	DFF	0	0	2	6	ala_drv:102 wd_cntr:123 :9
-	76	E	DFF	0	0	2	7	ala_drv:102 wd_cntr:123 :10
-	75	E	DFF	0	0	2	8	ala_drv:102 wd_cntr:123 :11
-	74	E	DFF	0	0	2	9	ala_drv:102 wd_cntr:123 :12
-	73	E	DFF	0	0	2	10	ala_drv:102 wd_cntr:123 :13
(58)	72	E	DFF	0	0	2	11	ala_drv:102 wd_cntr:123 :14
(57)	71	E	DFF	0	0	2	12	ala_drv:102 wd_cntr:123 :15
(56)	70	E	DFF	0	0	2	13	ala_drv:102 wd_cntr:123 :16
(55)	69	E	DFF	0	0	2	14	ala_drv:102 wd_cntr:123 :17
(54)	68	E	DFF	0	0	2	15	ala_drv:102 wd_cntr:123 :18
(52)	66	E	DFF	0	0	2	16	ala_drv:102 wd_cntr:123 :19
(51)	65	E	DFF	0	0	2	17	ala_drv:102 wd_cntr:123 :20
(53)	67	E	DFF	1	0	4	19	ala_drv:102 WD_SEND
-	125	H	DFF	1	1	1	7	ala_drv:102 :2
-	124	H	DFF	1	1	2	5	ala_drv:102 :3
-	123	H	DFF	1	1	2	5	ala_drv:102 :96
-	48	C	DFF	0	0	3	2	rx_cir_1:80 bt_dmx_1:73 :2
-	64	D	DFF	0	0	3	2	rx_cir_1:80 bt_dmx_1:74 :2
-	63	D	DFF	0	0	3	2	rx_cir_1:80 bt_dmx_1:75 :2
-	62	D	DFF	0	0	3	2	rx_cir_1:80 bt_dmx_1:76 :2
-	61	D	DFF	0	0	3	2	rx_cir_1:80 bt_dmx_1:80 :2
-	60	D	DFF	0	0	3	2	rx_cir_1:80 bt_dmx_1:82 :2
-	32	B	DFF	1	0	1	4	rx_cir_1:80 ds_det_1:47 :2
-	31	B	DFF	0	0	1	4	rx_cir_1:80 ds_det_1:47 :3
-	59	D	DFF	0	0	3	2	rx_cir_1:80 ds_dmx_1:77 :2
-	30	B	DFF	0	0	2	2	rx_cir_1:80 ds_dmx_1:77 :26
-	58	D	DFF	0	0	3	2	rx_cir_1:80 ds_dmx_1:78 :2
-	29	B	DFF	0	0	2	2	rx_cir_1:80 ds_dmx_1:78 :26
-	57	D	DFF	0	0	3	2	rx_cir_1:80 sl_dmx_1:93 :2
-	16	A	DFF	0	0	4	0	rx_cir_1:80 sl_dmx_1:93 :3
-	15	A	DFF	0	0	2	1	rx_cir_1:80 sl_dmx_1:93 :20
-	28	B	DFF	0	0	0	2	rx_cir_1:80 :84
-	27	B	DFF	0	0	0	2	rx_cir_1:80 :85
-	26	B	DFF	0	0	1	2	rx_cir_1:80 :86
-	112	G	DFF	0	0	2	13	tx_cir_1:131 as_syn_1:95 :58
-	111	G	DFF	1	0	1	14	tx_cir_1:131 as_syn_1:95 :65
-	122	H	DFF	0	0	3	1	tx_cir_1:131 bt_mx_1:59 :4
-	121	H	DFF	0	0	1	2	tx_cir_1:131 bt_mx_1:59 :5
(98)	118	H	SOFT	0	0	0	2	tx_cir_1:131 bt_mx_1:59 :39
-	47	C	DFF	4	0	3	3	tx_cir_1:131 bt_mx_1:59 :45
-	96	F	DFF	0	0	3	1	tx_cir_1:131 bt_mx_1:61 :4
-	95	F	DFF	0	0	1	2	tx_cir_1:131 bt_mx_1:61 :5
-	94	F	SOFT	0	0	0	2	tx_cir_1:131 bt_mx_1:61 :39
-	46	C	DFF	4	0	3	3	tx_cir_1:131 bt_mx_1:61 :45
-	93	F	DFF	0	0	3	1	tx_cir_1:131 bt_mx_1:62 :4
-	45	C	DFF	0	0	1	2	tx_cir_1:131 bt_mx_1:62 :5
-	44	C	SOFT	0	0	0	2	tx_cir_1:131 bt_mx_1:62 :39

SUBSTITUTE SHEET (RULE 26)

43	C	DFF	4	0	3	3	tx_cir_1:131 bt_mx_1:62 :45
42	C	DFF	0	0	3	1	tx_cir_1:131 bt_mx_1:65 :4
110	G	DFF	0	0	1	2	tx_cir_1:131 bt_mx_1:65 :5
109	G	SOFT	0	0	0	2	tx_cir_1:131 bt_mx_1:65 :39
41	C	DFF	4	0	3	3	tx_cir_1:131 bt_mx_1:65 :45
108	G	DFF	0	0	3	1	tx_cir_1:131 bt_mx_1:66 :4
107	G	DFF	0	0	1	2	tx_cir_1:131 bt_mx_1:66 :5
106	G	SOFT	0	0	0	2	tx_cir_1:131 bt_mx_1:66 :39
(39) 39	C	DFF	4	0	3	3	tx_cir_1:131 bt_mx_1:66 :45
105	G	DFF	0	0	3	1	tx_cir_1:131 c_mx_1:94 :4
(85) 101	G	DFF	1	1	1	3	tx_cir_1:131 c_mx_1:94 :57
(90) 104	G	DFF	0	0	2	2	tx_cir_1:131 c_mx_1:94 :79
(36) 38	C	DFF	4	0	3	3	tx_cir_1:131 c_mx_1:94 :86
(89) 103	G	DFF	1	1	1	4	tx_cir_1:131 c_mx_1:94 :89
92	F	DFF	0	0	3	1	tx_cir_1:131 d_mx_1:85 RELEASE
(35) 37	C	DFF	1	0	1	3	tx_cir_1:131 d_mx_1:85 SEND
(34) 36	C	DFF	0	0	2	1	tx_cir_1:131 d_mx_1:85 :79
(33) 35	C	DFF	4	0	3	3	tx_cir_1:131 d_mx_1:85 :86
25	B	DFF	1	0	5	4	tx_cir_1:131 ds_mx_1:89 SEND
(30) 24	B	DFF	0	0	4	1	tx_cir_1:131 ds_mx_1:89 :105
(29) 23	B	DFF	0	0	4	2	tx_cir_1:131 ds_mx_1:89 :106
(32) 34	C	DFF	0	0	1	2	tx_cir_1:131 ds_mx_1:89 :116
(31) 33	C	DFF	0	0	1	2	tx_cir_1:131 ds_mx_1:89 :117
(26) 20	B	DFF	0	0	2	2	tx_cir_1:131 ds_mx_1:89 :128
(97) 117	H	DFF	0	0	3	1	tx_cir_1:131 s_mx_1:88 RELEASE
(96) 116	H	DFF	1	1	1	3	tx_cir_1:131 s_mx_1:88 :57
(95) 115	H	DFF	0	0	2	2	tx_cir_1:131 s_mx_1:88 :58
(92) 114	H	DFF	1	1	1	4	tx_cir_1:131 s_mx_1:88 :74
(91) 113	H	DFF	0	0	1	2	tx_cir_1:131 s_mx_1:88 :75
14	A	DFF	4	0	3	3	tx_cir_1:131 s_mx_1:88 :84
91	F	DFF	0	0	3	1	tx_cir_1:131 sup_mx_1:100 :4
90	F	DFF	0	0	1	2	tx_cir_1:131 sup_mx_1:100 :5
89	F	SOFT	0	0	0	4	tx_cir_1:131 sup_mx_1:100 :39
13	A	DFF	4	0	3	3	tx_cir_1:131 sup_mx_1:100 :45

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

```

M M M M M M M M M M M M M M M M
C C C C C C C C C C C C C C C C
7 3 1 8 2 1 1 6 4 5 1 1
| | | | | 6 5 | | | 4 3
MCELL | | | | | | | | | | | | | A B C D E F G H | Name
MC7 -> @ - - - - - - - - - - | @ - - - - - - - | ADR_IN
MC3 -> - @ - - - - - - - - - - | @ * - - - - - - | DATA_IN
MC1 -> - - @ - - - - - - - - - - | @ - - - - - - | DISC_IN
MC8 -> - - - @ - - - - - - - - - - | @ * - - - - - - | OP_IN
MC2 -> - - - - @ - - - - - - - - - - | @ - - - - - - | REQ_IN
MC16-> - - - - - @ @ @ - - - - | @ - - - - - - - | rx_cir_1:80|sl_dmx_1:93|:3
MC15-> - - - - - - @ - - - - - | @ - - - - - - - | @ - - - - - - - |
|rx_cir_1:80|sl_dmx_1:93|:20
MC6 -> - - - - - - - - - - - - | @ - - - - - - - | SEL_IN
MC4 -> - - - - - - @ - - - - - | @ * - - - - - - | SER_IN
MC5 -> - - - - - @ - - - - - - | @ * - - - - - * | STAT_IN
MC14-> - - - - - - - - - - - - | @ - - - - * - - | tx_cir_1:131|s_mx_1:88|:84
MC13-> - - - - - - - - - - - - | @ - - - - - * - - - |
|tx_cir_1:131|sup_mx_1:100|:45

```

[illegible]

PCT/US 93/06908
RO/US 10 NOV 1993

31

MC33 -> - - - - - * * | * - e - - - - - |
|tx_cir_1:131|ds_mx_1:89|:117

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

MMMMMMMMMMMMMM
CCCCCCCCCCCCC
2123332222222
27121098765430

[illegible][illegible]

PCT/US 93/06908
R O / U S 10 NOV 1993

33

MC5 -> - - - * * - - - * - - - - - | @ * - - - - - * | STAT_IN
MC111-> - - - - - * - - - - - | - * * - * * @ * |
|tx_cir_1:131|as_syn_1:95|:65

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

his Sheet Has Been

PCT/US 93/06908
R0/US 10 NOV 1993

Logic Array Block 'C':

SUBSTITUTE SHEET (RULE 26)

```

30  -> - - - - - * - - - - - | - - * - - - - - |
BUS_OUT7
51  -> - - * * - - * * * * - * * - - | * * * - * * * * | CLOCK
15  -> - - - - - - - - - - - - - - - | - e - - - - - e - - |
CMD_OUT
11  -> - - - - - - - - - - - - - - - | e | - e e - - e - - |
DATA_OUT
54  -> - * - - - - - - - - - - - - - | * * * * - - - - - | DO0
59  -> - - - - - - - - - - - - - - - | e - - e - - - - - | DO5
60  -> - - - - - - - - - - - - - - - | e - - e - - - - - | DO6
61  -> - - - - - - - - - - - - - - - | e - - e - - - - - | DO7
64  -> - - - - - - - - - - - - - - - | e - - e - - - - - | DO8
65  -> - e e - - - - - - - - - - - - - | - e e e - - - - - | DO9
70  -> e e - - - - - - - - - - - - - | e e e e - - - e - | DSTRB
10  -> - - - - - - - e - - - - - - - - | - - e - - - - - - |
HOLD_OUT
98  -> - - * * * - * * * * * * * - - | * * * - * * * * | MR
22  -> - - - - - - - - - - - - - - - | - - - - - - - e - |
MRK0_OUT
9   -> - - - - - - - - - - - - - - - | - - - - - - - e - |
OP_OUT
17  -> - - - - - - - - - - - - - - - | e - - - - - e - - |
SEL_OUT
14  -> - - - - - - - - - - - - - - e - | - e e - - - - e - |
SER_OUT
20  -> - - - - - - - - - - - - - - - | - - - - - e - - - |
SUPR_OUT
72  -> - - - - - - - - - - - - - - - | - - - - - e | VLTN
MC31 -> - - - - - * * - - - - - * * - - e * - - - * - |
|rx_cir_1:80|ds_det_1:47|:3
MC28 -> * * - - - - - - - - - - - - - | - e * * - - - - - |
|rx_cir_1:80|:84
MC27 -> * * - - - - - - - - - - - - - | - e * * - - - - - |
|rx_cir_1:80|:85
MC112-> - - * * - - * * * * - - * - - | * - * - - * e * |
|tx_cir_1:131|as_syn_1:95|:58
MC111-> - - - - - * - - - - - * - - - - | - * * - * * e * |
|tx_cir_1:131|as_syn_1:95|:65
MC93  -> - - - - - * * - - - - - - - - | - - * - - e - - - |
|tx_cir_1:131|bt_mx_1:62|:4
MC92  -> - - - - - - - - - - * - - - * | - - * - - e - - - |
|tx_cir_1:131|d_mx_1:85|RELEASE
MC117-> - - - - - - - - - - * - - - - - | - - * - - * - e - |
|tx_cir_1:131|s_mx_1:88|RELEASE
-----

```

**** MACROCELL INTERCONNECTIONS ****

Logic Array Block 'D':

M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	A	B	C	D	E	F	G	H	Name
C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C									
5	5	5	5	5	5	5	4	6	6	6	6	6	5	5	5									
6	5	4	3	2	1	0	9	4	3	2	1	0	9	8	7									

MC56 -> - - - - - - - - - - - - - - - | - - - e - - - - - |
BUS_IN0

This Sheet Has Been Replaced



```

Pin
21    -> - - - - - e - - -
ADR_OUT
15    -> - - - - - e - - -
CMD_OUT
11    -> - - - - - e e - - e - -
DATA_OUT
54    -> - - - - - * * * * * | * * * * - - - - DO0
55    -> - - - - -   * * * *   | * - - * - - - - DO1
56    -> - - - - -   * - - -   | * - - * - - - - DO2
57    -> - - - - -   - - - * - - | * - - * - - - - DO3
58    -> - - - - -   - - - * - - | * - - * - - - - DO4
59    -> - - - - -   - - e - - e - | e - - e - - - - DO5
60    -> - - - - -   - e - - - e - | e - - e - - - - DO6
61    -> - - - - -   e - - - - e - | e - - e - - - - DO7
64    -> - - - - - e - - - - - e - | e - - e - - - - DO8
65    -> - - - - -   - - - - - e e - | - e e - - - - - DO9
70    -> e e e e e e e e e e e e e e | e e e e - - - e DSTRB
10    -> - - - - - e - - - - -
HOLD_OUT
22    -> - - - - - e - - - - -
MRK0_OUT
9     -> - - - - - e - - - - -
OP_OUT
17    -> - - - - - e - - - - -
SEL_OUT
14    -> - - - - - e e - - - - e

```


PCT/US 93/06908

37

RO/US 10 NOV 1993

SER_OUT

20 -> - - - - - e - - - - -

SUPR_OUT

72 -> - - - - - e | VLTN

MC28 -> * * * * * - e * * - - - - -

|rx_cir_1:80|:84

MC27 -> * * * * * - e * * - - - - -

|rx_cir_1:80|:85

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

[REDACTED]

PCT/US 93/06908
RO/US 10 NOV 1993

Logic Array Block 'E':

```
Pin
21 -> - - - - - | - - - - - @ - - -
ADR_OUT
51 -> * * * * * | * * * - * * * * | CLOCK
15 -> - - - - - | - @ - - - - @ - -
CMD_OUT
11 -> - - - - - | - @ @ - - @ - -
DATA_OUT
97 -> - - - - - * | - - - - * - - -
DIV_A_B
59 -> - - - - - | @ - - @ - - - - DO5
60 -> - - - - - | @ - - @ - - - - DO6
61 -> - - - - - | @ - - @ - - - - DO7
64 -> - - - - - | @ - - @ - - - - DO8
65 -> - - - - - | - @ @ - - - - DO9
```

```

70  ->  - - - - - | e e e e - - e | DSTRB
10  ->  - - - - - | - - e - - - - -
HOLD_OUT
98  ->  * * * * * | * * * - * * * * | MR
22  ->  - - - - - | - - - - - e -
MRKO_OUT
9   ->  - - - - - | - - - - - e -
OP_OUT
17  ->  - - - - - | e - - - - e -
SEL_OUT
14  ->  - - - - - | - e e - - - e -
SER_OUT
20  ->  - - - - - | - - - - - e -
SUPR_OUT
72  ->  - - - - - | - - - - - e | VLTN
96  ->  - - - - - | - - - * - - - | WD_EN
MC128-> * * * * * | - - - - - * - - e -
| ala_drv:102|wd_cntr:123|:2
MC127-> * * * * * | - - - - - * - - e -
| ala_drv:102|wd_cntr:123|:4
MC126-> * * * * * | - - - - - * - - e -
| ala_drv:102|wd_cntr:123|:6
MC111-> * * * * * | - * * - * * e *
| tx cir 1:131|as syn 1:95|:65

```

Logic Array Block 'F':

[illegible]



PCT/US 93/06908
R O / US 10 NOV 1993

MC89 -> - - - - - e * - - - - -
|tx_cir_1:131|sup_mx_1:100|:39

Pin

21 -> - - - - - e - - - - - e - - - - -

ADR_OUT

51 -> * - - - - * - - * * * - - | * * * - * * * * | CLOCK

15 -> - - - - - e - - - - - e - - - - -

CMD_OUT

11 -> - - - - - e - - - - - e e - - - e - - - - -

DATA_OUT

59 -> - - - - - e - - - - - e - - - - - DO5

60 -> - - - - - e - - - - - e - - - - - DO6

61 -> - - - - - e - - - - - e - - - - - DO7

64 -> - - - - - e - - - - - e - - - - - DO8

65 -> - - - - - e e - - - - - e - - - - - DO9

70 -> - - - - - e e e e - - - - - e | DSTRB

10 -> - - - - - e - - - - - e - - - - -

HOLD_OUT

98 -> * - - - - * * - * * * * - | * * * - * * * * | MR

22 -> - - - - - e - - - - - e - - - - -

MRKO_OUT

9 -> - - - - - e - - - - - e - - - - -

OP_OUT

17 -> - - - - - e - - - - - e - - - - - e - - - - -

SEL_OUT

14 -> - - - - - e e - - - - - e - - - - -

SER_OUT

20 -> - - - - - e - - - - - e - - - - -

SUPR_OUT

72 -> - - - - - e - - - - - e | VLTN

MC112-> * - - - - * - - * * * - - | * - * - - * e * |

|tx_cir_1:131|as_syn_1:95|:58

MC111-> - - - - - * - - - - - * - - - - - * * e * |

|tx_cir_1:131|as_syn_1:95|:65

MC122-> - * - - - - - - - - - - - * - e |

|tx_cir_1:131|bt_mx_1:59|:4

MC47 -> - * - - - - - - - - - - - e - * - - - -

|tx_cir_1:131|bt_mx_1:59|:45

MC46 -> - - * - - - - - - - - - - - e - * - - - -

|tx_cir_1:131|bt_mx_1:61|:45

MC43 -> - - - * - - - - - - - - - - - e - * - - - -

|tx_cir_1:131|bt_mx_1:62|:45

MC105-> - - - - - * - - - - - - - - - - * e - - - -

|tx_cir_1:131|c_mx_1:94|:4

MC38 -> - - - - - * - - - - - - - - - - e - * - - - -

|tx_cir_1:131|c_mx_1:94|:86

MC35 -> - - - - - * - - - - - - - - - - e - * - - - -

|tx_cir_1:131|d_mx_1:85|:86

MC117-> - - - - - * - - - - - * - - - - - * - e - - - -

|tx_cir_1:131|s_mx_1:88|RELEASE

MC14 -> - - - - - * - - - - - - - - - - e - - - - - * - - - -

|tx_cir_1:131|s_mx_1:88|:84

MC13 -> - - - - - * - - - - - - - - - - e - - - - - * - - - -

|tx_cir_1:131|sup_mx_1:100|:45

SUBSTITUTE SHEET (RULE 26)

This Sheet Has Been Replaced

[REDACTED]

SUBSTITUTE SHEET (RULE 26)

```

MRKO_OUT
9  -> - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - e
OP_OUT
17 -> - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - e
SEL_OUT
14 -> - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - e
SER_OUT
20 -> - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - e
SUPR_OUT
72 -> - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - e | VLTN
MC67 -> - - - - - * * * - - - - - - - - - - - - - - - - - - - - e * *
|ala_drv:102|WD_SEND
MC81 -> - - - * * - - - - - - - - - - - - - - - - - - - - - - - - - - - e * - | DIO
MC31 -> - - - - - * - - - - - - - - - - - - - - - - - - - - - - - - - - - e * -
|rx_cir_1:80|ds_det_1:47|:3
MC118-> - - - - - * * * - - - - - - - - - - - - - - - - - - - - * e
|tx_cir_1:131|bt_mx_1:59|:39
MC94 -> - - - - - * * * - - - - - - - - - - - - - - - - - - - - e * -
|tx_cir_1:131|bt_mx_1:61|:39
MC44 -> - - - - - * * * - - - - - - - - - - - - - - - - - - - - e - * -
|tx_cir_1:131|bt_mx_1:62|:39
MC42 -> - - - * - - - - - * * - - - - - - - - - - - - - - - e - * -
|tx_cir_1:131|bt_mx_1:65|:4
MC41 -> - - - * - - - - - - - - - - - - - - - - - - - - - - e - * -
|tx_cir_1:131|bt_mx_1:65|:45
MC39 -> - - - - - * - - - - - - - - - - - - - - - - - - - - - - e - * -
|tx_cir_1:131|bt_mx_1:66|:45
MC37 -> - - - - - * * * - - - - - - - - - - - - - - - - - - - - e - * -
|tx_cir_1:131|d_mx_1:85|SEND
MC25 -> - - - - - * * * - - - - - - - - - - - - - - - - - - - - e - * -
|tx_cir_1:131|ds_mx_1:89|SEND
MC116-> - - - - - * * * - - - - - - - - - - - - - - - - - - - - * e
|tx_cir_1:131|s_mx_1:88|:57
MC114-> - - - - - * * * - - - - - - - - - - - - - - - - - - - - * e
|tx_cir_1:131|s_mx_1:88|:74
MC89 -> - - - - - * * * - - - - - - - - - - - - - - - - - - - - e * -
|tx_cir_1:131|sup_mx_1:100|:39

```

This Sheet Has Been Replaced



This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

```

18 -> - * * * * * - * * - * * * * * | * * * - * * * * | MR
22 -> - - - - - - - - - - - - - - - - | - - - - - - - - e - |
MRKO_OUT
9 -> - - - - - - - - - - e - - - - - - - | - - - - - - - - e - |
OP_OUT
17 -> - - - - - - - - - - - - - - - - | e - - - - - e - - |
SEL_OUT
14 -> - - - - - - - - - - - e - - - - - | - e e - - - - e - |
SER_OUT
20 -> - - - - - - - - - - - - - - - - | - - - - - e - - |
SUPR_OUT
72 -> - - - - - e - - - - - - - - - - | - - - - - e - | VLTN
MC79 -> - - - - - * * * - - - - - - - | - - - - e - - * |
|ala_drv:102|wd_cntr:123|:7
MC78 -> - - - - - * * * - - - - - - - | - - - - e - - * |
|ala_drv:102|wd_cntr:123|:8
MC67 -> - - - - - * - - - - - - - - - - | - - - - e - * * |
|ala_drv:102|WD_SEND
MC5 -> - - - - - - - - - - - - - - - * | e * - - - - - * |
STAT_IN
MC102-> - - - - - * - - - - - - - - - - | - - - - - e * |
STROBE
MC112-> - - - - - - - - - - * - - * - - - | * - * - - * e * |
|tx_cir_1:131|as_syn_1:95|:58
MC111-> - * * * - - - - - * - - * - - - | - * * - * * e * |
|tx_cir_1:131|as_syn_1:95|:65
-----

```

** EQUATIONS **

```

ACKNLGE : INPUT;
ADR_OUT : INPUT;
BUS_OUTP : INPUT;
BUS_OUT0 : INPUT;
BUS_OUT1 : INPUT;
BUS_OUT2 : INPUT;
BUS_OUT3 : INPUT;
BUS_OUT4 : INPUT;
BUS_OUT5 : INPUT;
BUS_OUT6 : INPUT;
BUS_OUT7 : INPUT;
CLOCK : INPUT;
CMD_OUT : INPUT;
DATA_OUT : INPUT;
DIV_A_B : INPUT;
DO0 : INPUT;
DO1 : INPUT;
DO2 : INPUT;
DO3 : INPUT;
DO4 : INPUT;
DO5 : INPUT;
DO6 : INPUT;
DO7 : INPUT;
DO8 : INPUT;
DO9 : INPUT;
DSTRB : INPUT;
HOLD_OUT : INPUT;

```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

OS : INPUT;
MR : INPUT;
MRKO_OUT : INPUT;
OP_OUT : INPUT;
SEL_OUT : INPUT;
SER_OUT : INPUT;
SUPR_OUT : INPUT;
VLTN : INPUT;
WD_EN : INPUT;

This Sheet Has Been Replaced



```
ACTIVITY = _MC119;
_MC119 = MCELL( _EQ001 $ VCC );
_EQ001 = !_MC124 & !_MC125;

% ADR_IN = |rx_cir_1:80|bt_dmx_1:80|TAG %
ADR_IN = _MC007;
_MC007 = DFF( _EQ002 $ GND, DSTRB, MR, VCC );
_EQ002 = DO0 & DO2
% !DO0 & _MC007;

% BUS_INP = |rx_cir_1:80|bt_dmx_1:73|:17 %
BUS_INP = _MC040;
_MC040 = DFF( _MC048 $ GND, DSTRB, _EQ003, VCC );
_EQ003 = !_MC027 & !_MC028;

% BUS_IN0 = |rx_cir_1:80|bt_dmx_1:82|:17 %
BUS_IN0 = _MC056;
_MC056 = DFF( _MC060 $ GND, DSTRB, _EQ004, VCC );
_EQ004 = !_MC027 & !_MC028;

% BUS_IN1 = |rx_cir_1:80|bt_dmx_1:80|:17 %
BUS_IN1 = _MC055;
_MC055 = DFF( _MC061 $ GND, DSTRB, _EQ005, VCC );
_EQ005 = !_MC027 & !_MC028;

% BUS_IN2 = |rx_cir_1:80|sl_dmx_1:93|:17 %
BUS_IN2 = _MC054;
_MC054 = DFF( _MC057 $ GND, DSTRB, _EQ006, VCC );
_EQ006 = !_MC027 & !_MC028;

% BUS_IN3 = |rx_cir_1:80|ds_dmx_1:78|:33 %
BUS_IN3 = _MC053;
_MC053 = DFF( _MC058 $ GND, DSTRB, _EQ007, VCC );
_EQ007 = !_MC027 & !_MC028;

% BUS_IN4 = |rx_cir_1:80|ds_dmx_1:77|:33 %
BUS_IN4 = _MC052;
_MC052 = DFF( _MC059 $ GND, DSTRB, _EQ008, VCC );
_EQ008 = !_MC027 & !_MC028;

% BUS_IN5 = |rx_cir_1:80|bt_dmx_1:76|:17 %
BUS_IN5 = _MC051;
_MC051 = DFF( _MC062 $ GND, DSTRB, _EQ009, VCC );
_EQ009 = !_MC027 & !_MC028;

% BUS_IN6 = |rx_cir_1:80|bt_dmx_1:75|:17 %
BUS_IN6 = _MC050;
_MC050 = DFF( _MC063 $ GND, DSTRB, _EQ010, VCC );
```

SUBSTITUTE SHEET (RULE 26)

```
_EQ010 = !_MC027 & !_MC028;

% BUS_IN7 = |rx_cir_1:80|bt_dmx_1:74|:17 %
BUS_IN7 = MC049;
_MC049 = DFF( MC064 $ GND, DSTRB, _EQ011, VCC );
_EQ011 = !_MC027 & !_MC028;

CO0 = MC100;
_MC100 = MCELL( !MR $ GND );

CO1 = MC099;
_MC099 = MCELL( !MR $ GND );

% DATA_IN = |rx_cir_1:80|ds_dmx_1:77|TAG %
DATA_IN = MC003;
_MC003 = DFF( _EQ012 $ GND, DSTRB, _EQ013, VCC );
_EQ012 = DO0 & DO5
# !DO0 & MC003;
_EQ013 = !_MC030 & MR;

% DISC_IN = |rx_cir_1:80|bt_dmx_1:74|TAG %
DISC_IN = MC001;
_MC001 = DFF( _EQ014 $ GND, DSTRB, MR, VCC );
_EQ014 = DO0 & DO8
# !DO0 & MC001;

% DIO = |tx_cir_1:131|as_syn_1:95|:70 %
DIO = MC081;
_MC081 = DFF( MC112 $ GND, CLOCK, MR, VCC );

DI1 = MC082;
_MC082 = MCELL( _EQ015 $ GND );
_EQ015 = MC081 & MC122
# MC047 & !_MC081;

DI2 = MC083;
_MC083 = MCELL( _EQ016 $ GND );
_EQ016 = MC081 & MC096
# MC046 & !_MC081;

DI3 = MC084;
_MC084 = MCELL( _EQ017 $ GND );
_EQ017 = MC081 & MC093
# MC043 & !_MC081;

DI4 = MC085;
_MC085 = MCELL( _EQ018 $ GND );
_EQ018 = MC081 & MC117
# MC014 & !_MC081;

DI5 = MC086;
_MC086 = MCELL( _EQ019 $ GND );
_EQ019 = MC081 & MC092
# MC035 & !_MC081;

DI6 = MC087;
_MC087 = MCELL( _EQ020 $ GND );
_EQ020 = MC081 & MC105
```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

This Sheet Has Been Replaced



```

# _MC038 & !_MC081;

DI7      = _MC088;
_MC088   = MCELL( _EQ021 $ GND );
_EQ021   = _MC081 & _MC091
# _MC013 & !_MC081;

DI8      = _MC097;
_MC097   = MCELL( _EQ022 $ GND );
_EQ022   = _MC042 & _MC081
# _MC041 & !_MC081;

DI9      = _MC098;
_MC098   = MCELL( _EQ023 $ GND );
_EQ023   = _MC081 & _MC108
# _MC039 & !_MC081;

DRV_OE   = _MC022;
_MC022   = MCELL( !LOS $ GND );

FAULT     = _MC120;
_MC120    = MCELL( _EQ024 $ _MC123 );
_EQ024    = LOS & !_MC123;

% MRK0_IN = |rx_cir_1:80|bt_dmx_1:73|TAG %
MRK0_IN   = _MC017;
_MC017    = DFF( _EQ025 $ GND, DSTRB, MR, VCC );
_EQ025    = DO0 & DO9
# !DO0 & _MC017;

% OP_IN   = |rx_cir_1:80|bt_dmx_1:82|TAG %
OP_IN     = _MC008;
_MC008    = DFF( _EQ026 $ GND, DSTRB, MR, VCC );
_EQ026    = DO0 & DO1
# !DO0 & _MC008;

% REQ_IN  = |rx_cir_1:80|bt_dmx_1:75|TAG %
REQ_IN    = _MC002;
_MC002    = DFF( _EQ027 $ GND, DSTRB, MR, VCC );
_EQ027    = DO0 & DO7
# !DO0 & _MC002;

RLY_DRV   = _MC021;
_MC021    = MCELL( !LOS $ GND );

% SEL_IN  = |rx_cir_1:80|sl_dmx_1:93|:26 %
SEL_IN    = _MC006;
_MC006    = MCELL( _EQ028 $ GND );
_EQ028    = !_MC015 & _MC016;

% SER_IN  = |rx_cir_1:80|ds_dmx_1:78|TAG %
SER_IN    = _MC004;
_MC004    = DFF( _EQ029 $ GND, DSTRB, _EQ030, VCC );
_EQ029    = DO0 & DO4
# !DO0 & _MC004;
_EQ030    = !_MC029 & MR;

% STAT_IN = |rx_cir_1:80|bt_dmx_1:76|TAG %

```

SUBSTITUTE SHEET (RULE 26)



```

STAT_IN = _MC005;
_MC005 = DFF( _EQ031 $ GND, DSTRB, MR, VCC );
_EQ031 = DO0 & DO6
# !DO0 & _MC005;

% STROBE = |tx_cir_1:131|as_syn_1:95|STRB %
STROBE = _MC102;
_MC102 = DFF( _EQ032 $ VCC, !CLOCK, _EQ033, VCC );
_EQ032 = _MC025 & _MC037 & _MC044 & _MC067 & _MC089 &
_MC094 & _MC101 & _MC103 & _MC106 & _MC109 &
_MC114 & _MC116 & _MC118;
_EQ033 = _X001;
_X001 = EXP( ACKNLGGE & _MC102 );

% |ala_drv:102|wd_cntr:123|:2 %
_MC128 = DFF( VCC $ _MC128, CLOCK, _EQ034, VCC );
_EQ034 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:4 %
_MC127 = DFF( _MC128 $ _MC127, CLOCK, _EQ035, VCC );
_EQ035 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:5 %
_MC080 = DFF( _EQ036 $ _MC080, CLOCK, _EQ037, VCC );
_EQ036 = _MC065 & _MC066 & _MC068 & _MC069 & _MC070 &
_MC071 & _MC072 & _MC073 & _MC074 & _MC075 & _MC076 &
_MC077 & _MC078 & _MC079 & _MC126 & _MC127 & _MC128;
_EQ037 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:6 %
_MC126 = DFF( _EQ038 $ _MC126, CLOCK, _EQ039, VCC );
_EQ038 = _MC127 & _MC128;
_EQ039 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:7 %
_MC079 = DFF( _EQ040 $ _MC079, CLOCK, _EQ041, VCC );
_EQ040 = _MC126 & _MC127 & _MC128;
_EQ041 = !_MC111 & MR;

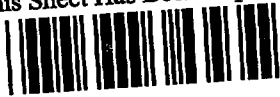
% |ala_drv:102|wd_cntr:123|:8 %
_MC078 = DFF( _EQ042 $ _MC078, CLOCK, _EQ043, VCC );
_EQ042 = _MC079 & _MC126 & _MC127 & _MC128;
_EQ043 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:9 %
_MC077 = DFF( _EQ044 $ _MC077, CLOCK, _EQ045, VCC );
_EQ044 = _MC078 & _MC079 & _MC126 & _MC127 & _MC128;
_EQ045 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:10 %
_MC076 = DFF( _EQ046 $ _MC076, CLOCK, _EQ047, VCC );
_EQ046 = _MC077 & _MC078 & _MC079 & _MC126 & _MC127 &
_MC128;
_EQ047 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:11 %

```



```

_MC075 = DFF( _EQ048 $ _MC075, CLOCK, _EQ049, VCC );
_EQ048 = _MC076 & _MC077 & _MC078 & _MC079 & _MC126 &
_MC127 &
           _MC128;
_EQ049 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:12 %
_MC074 = DFF( _EQ050 $ _MC074, CLOCK, _EQ051, VCC );
_EQ050 = _MC075 & _MC076 & _MC077 & _MC078 & _MC079 &
_MC126 &
           _MC127 & _MC128;
_EQ051 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:13 %
_MC073 = DFF( _EQ052 $ _MC073, CLOCK, _EQ053, VCC );
_EQ052 = _MC074 & _MC075 & _MC076 & _MC077 & _MC078 &
_MC079 &
           _MC126 & _MC127 & _MC128;
_EQ053 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:14 %
_MC072 = DFF( _EQ054 $ _MC072, CLOCK, _EQ055, VCC );
_EQ054 = _MC073 & _MC074 & _MC075 & _MC076 & _MC077 &
_MC078 &
           _MC079 & _MC126 & _MC127 & _MC128;
_EQ055 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:15 %
_MC071 = DFF( _EQ056 $ _MC071, CLOCK, _EQ057, VCC );
_EQ056 = _MC072 & _MC073 & _MC074 & _MC075 & _MC076 &
_MC077 &
           _MC078 & _MC079 & _MC126 & _MC127 & _MC128;
_EQ057 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:16 %
_MC070 = DFF( _EQ058 $ _MC070, CLOCK, _EQ059, VCC );
_EQ058 = _MC071 & _MC072 & _MC073 & _MC074 & _MC075 &
_MC076 &
           _MC077 & _MC078 & _MC079 & _MC126 & _MC127 &
_MC128;
_EQ059 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:17 %
_MC069 = DFF( _EQ060 $ _MC069, CLOCK, _EQ061, VCC );
_EQ060 = _MC070 & _MC071 & _MC072 & _MC073 & _MC074 &
_MC075 &
           _MC076 & _MC077 & _MC078 & _MC079 & _MC126 &
_MC127 &
           _MC128;
_EQ061 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:18 %
_MC068 = DFF( _EQ062 $ _MC068, CLOCK, _EQ063, VCC );
_EQ062 = _MC069 & _MC070 & _MC071 & _MC072 & _MC073 &
_MC074 &
           _MC075 & _MC076 & _MC077 & _MC078 & _MC079 &
_MC126 &
           _MC127 & _MC128;

```



```

_EQ063 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:19 %
_MC066 = DFF( _EQ064 $ _MC066, CLOCK, _EQ065, VCC );
_EQ064 = _MC068 & _MC069 & _MC070 & _MC071 & _MC072 &
_MC073 &
_MC074 & _MC075 & _MC076 & _MC077 & _MC078 &
_MC079 &
_MC126 & _MC127 & _MC128;
_EQ065 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:20 %
_MC065 = DFF( _EQ066 $ _MC065, CLOCK, _EQ067, VCC );
_EQ066 = _MC066 & _MC068 & _MC069 & _MC070 & _MC071 &
_MC072 &
_MC073 & _MC074 & _MC075 & _MC076 & _MC077 &
_MC078 &
_MC079 & _MC126 & _MC127 & _MC128;
_EQ067 = !_MC111 & MR;

% |ala_drv:102|WD_SEND %
_MC067 = DFF( _EQ068 $ VCC, CLOCK, MR, _EQ069 );
_EQ068 = !DIV_A_B & _MC065 & _MC066 & _MC068 & _MC069 & _MC070
&
_MC071 & _MC072 & _MC073 & _MC074 & _MC075 & _MC076
&
_MC077 & _MC078 & _MC079 & _MC080 & _MC126 & _MC127
&
_MC128 & WD_EN
% DIV_A_B & _MC073 & _MC074 & _MC075 & _MC076 & _MC077
&
_MC078 & _MC079 & _MC126 & _MC127 & _MC128 & WD_EN
% !_MC067 & WD_EN;
_EQ069 = _X002;
_X002 = EXP( !_MC067 & _MC111 );

% |ala_drv:102|:2 %
_MC125 = DFF( _MC067 $ GND, _MC102, _EQ070, VCC );
_EQ070 = MR & _X003;
_X003 = EXP( _MC078 & _MC079 & _MC126 & _MC127 & _MC128
);

% |ala_drv:102|:3 %
_MC124 = DFF( GND $ VCC, DSTRB, _EQ071, VCC );
_EQ071 = MR & _X003;

% |ala_drv:102|:96 %
_MC123 = DFF( GND $ VCC, VLTN, _EQ072, VCC );
_EQ072 = MR & _X003;

% |rx_cir_1:80|bt_dmx_1:73|:2 %
_MC048 = DFF( _EQ073 $ GND, DSTRB, _EQ074, VCC );
_EQ073 = DO0 & _MC048
% !DO0 & DO9;
_EQ074 = !_MC027 & !_MC028;

% |rx_cir_1:80|bt_dmx_1:74|:2 %
_MC064 = DFF( _EQ075 $ GND, DSTRB, _EQ076, VCC );

```



```

* |rx_cir_1:80|sl_dmx_1:93|:2 *
_MC057 = DFF( _EQ094 $ GND, DSTRB, _EQ095, VCC );
_EQ094 = DO0 & _MC057
# !DO0 & DO3;
_EQ095 = !_MC027 & !_MC028;

* |rx_cir_1:80|sl_dmx_1:93|:3 *
_MC016 = DFF( _EQ096 $ GND, DSTRB, MR, VCC );
_EQ096 = DO0 & DO3
# !DO0 & _MC016;

* |rx_cir_1:80|sl_dmx_1:93|:20 *
_MC015 = DFF( GND $ VCC, SEL_OUT, _EQ097, VCC );
_EQ097 = _MC016 & MR;

* |rx_cir_1:80|:84 *
_MC028 = DFF( GND $ VCC, !_MC008, _MC026, VCC );

* |rx_cir_1:80|:85 *
_MC027 = DFF( GND $ VCC, !_MC005, _MC026, VCC );

* |rx_cir_1:80|:86 *
_MC026 = DFF( _EQ098 $ GND, CLOCK, VCC, VCC );
_EQ098 = !_MC027 & !_MC028;

* |tx_cir_1:131|as_syn_1:95|:58 *
_MC112 = DFF( _EQ099 $ !_MC112, !CLOCK, MR, VCC );
_EQ099 = _MC025 & _MC037 & _MC044 & _MC067 & _MC089 &
_MC094 &
_MC101 & _MC103 & _MC106 & _MC109 & !_MC112 &
_MC114 &
_MC116 & _MC118;

* |tx_cir_1:131|as_syn_1:95|:65 *
_MC111 = DFF( _MC112 $ GND, !CLOCK, _EQ100, VCC );
_EQ100 = _X005;
_X005 = EXP( _MC025 & _MC037 & _MC044 & _MC067 & _MC089 &
_MC094 &
_MC101 & _MC103 & _MC106 & _MC109 & _MC114 & _MC116
&
_MC118 );

* |tx_cir_1:131|bt_mx_1:59|:4 *
_MC122 = DFF( !OP_OUT $ GND, _EQ101, MR, VCC );
_EQ101 = CLOCK & !_MC112;

* |tx_cir_1:131|bt_mx_1:59|:5 *
_MC121 = DFF( _MC122 $ GND, _MC111, MR, VCC );

* |tx_cir_1:131|bt_mx_1:59|:39 *
_MC118 = MCELL( !_MC122 $ _MC121 );

* |tx_cir_1:131|bt_mx_1:59|:45 *
_MC047 = DFF( _EQ102 $ GND, _EQ103, MR, VCC );
_EQ102 = _X006;
_X006 = EXP( _X007 & _X008 & _X009 );
_X007 = EXP( !_MC034 & _X006 );
_X008 = EXP( !BUS_OUT0 & _MC033 & _MC034 );

```



```

_EQ075 = DO0 & _MC064
      # !DO0 & DO8;
_EQ076 = !_MC027 & !_MC028;

% |rx_cir_1:80|bt_dmx_1:75|:2 %
_MC063 = DFF( _EQ077 $ GND, DSTRB, _EQ078, VCC );
_EQ077 = DO0 & _MC063
      # !DO0 & DO7;
_EQ078 = !_MC027 & !_MC028;

% |rx_cir_1:80|bt_dmx_1:76|:2 %
_MC062 = DFF( _EQ079 $ GND, DSTRB, _EQ080, VCC );
_EQ079 = DO0 & _MC062
      # !DO0 & DO6;
_EQ080 = !_MC027 & !_MC028;

% |rx_cir_1:80|bt_dmx_1:80|:2 %
_MC061 = DFF( _EQ081 $ GND, DSTRB, _EQ082, VCC );
_EQ081 = DO0 & _MC061
      # !DO0 & DO2;
_EQ082 = !_MC027 & !_MC028;

% |rx_cir_1:80|bt_dmx_1:82|:2 %
_MC060 = DFF( _EQ083 $ GND, DSTRB, _EQ084, VCC );
_EQ083 = DO0 & _MC060
      # !DO0 & DO1;
_EQ084 = !_MC027 & !_MC028;

% |rx_cir_1:80|ds_det_1:47|:2 %
_MC032 = DFF( GND $ VCC, _EQ085, _EQ086, VCC );
_EQ085 = X004;
_X004 = EXP( !_MC003 & !_MC004 & !_MC032 );
_EQ086 = !_MC005 & _MC008 & MR;

% |rx_cir_1:80|ds_det_1:47|:3 %
_MC031 = DFF( _MC003 $ GND, _MC032, _EQ087, VCC );
_EQ087 = !_MC005 & _MC008 & MR;

% |rx_cir_1:80|ds_dmx_1:77|:2 %
_MC059 = DFF( _EQ088 $ GND, DSTRB, _EQ089, VCC );
_EQ088 = DO0 & _MC059
      # !DO0 & DO5;
_EQ089 = !_MC027 & !_MC028;

% |rx_cir_1:80|ds_dmx_1:77|:26 %
_MC030 = DFF( !_MC031 $ GND, !DATA_OUT, _EQ090, VCC );
_EQ090 = _MC003 & MR;

% |rx_cir_1:80|ds_dmx_1:78|:2 %
_MC058 = DFF( _EQ091 $ GND, DSTRB, _EQ092, VCC );
_EQ091 = DO0 & _MC058
      # !DO0 & DO4;
_EQ092 = !_MC027 & !_MC028;

% |rx_cir_1:80|ds_dmx_1:78|:26 %
_MC029 = DFF( !_MC031 $ GND, !SER_OUT, _EQ093, VCC );
_EQ093 = _MC004 & MR;

```

SUBSTITUTE SHEET (RULE 26)



```

_X009 = EXP( !_MC033 & _X006 );
_EQ103 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:61|:4 %
_MC096 = DFF( |ADR_OUT $ GND, _EQ104, MR, VCC );
_EQ104 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:61|:5 %
_MC095 = DFF( _MC096 $ GND, _MC111, MR, VCC );

% |tx_cir_1:131|bt_mx_1:61|:39 %
_MC094 = MCELL( !_MC096 $ _MC095 );

% |tx_cir_1:131|bt_mx_1:61|:45 %
_MC046 = DFF( _EQ105 $ GND, _EQ106, MR, VCC );
_EQ105 = _X010;
_X010 = EXP( _X011 & _X012 & _X013 );
_X011 = EXP( !_MC034 & _X010 );
_X012 = EXP( |BUS_OUT1 & _MC033 & _MC034 );
_X013 = EXP( !_MC033 & _X010 );
_EQ106 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:62|:4 %
_MC093 = DFF( |SEL_OUT $ GND, _EQ107, MR, VCC );
_EQ107 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:62|:5 %
_MC045 = DFF( _MC093 $ GND, _MC111, MR, VCC );

% |tx_cir_1:131|bt_mx_1:62|:39 %
_MC044 = MCELL( !_MC093 $ _MC045 );

% |tx_cir_1:131|bt_mx_1:62|:45 %
_MC043 = DFF( _EQ108 $ GND, _EQ109, MR, VCC );
_EQ108 = _X014;
_X014 = EXP( _X015 & _X016 & _X017 );
_X015 = EXP( !_MC034 & _X014 );
_X016 = EXP( |BUS_OUT2 & _MC033 & _MC034 );
_X017 = EXP( !_MC033 & _X014 );
_EQ109 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:65|:4 %
_MC042 = DFF( |HOLD_OUT $ GND, _EQ110, MR, VCC );
_EQ110 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:65|:5 %
_MC110 = DFF( _MC042 $ GND, _MC111, MR, VCC );

% |tx_cir_1:131|bt_mx_1:65|:39 %
_MC109 = MCELL( !_MC042 $ _MC110 );

% |tx_cir_1:131|bt_mx_1:65|:45 %
_MC041 = DFF( _EQ111 $ GND, _EQ112, MR, VCC );
_EQ111 = _X018;
_X018 = EXP( _X019 & _X020 & _X021 );
_X019 = EXP( !_MC034 & _X018 );
_X020 = EXP( |BUS_OUT7 & _MC033 & _MC034 );
_X021 = EXP( !_MC033 & _X018 );

```

SUBSTITUTE SHEET (RULE 26)



```

      _EQ112 = CLOCK & !_MC112;

      * |tx_cir_1:131|bt_mx_1:66|:4 *
      _MC108 = DFF( !MRK0_OUT $ GND, _EQ113, MR, VCC );
      _EQ113 = CLOCK & !_MC112;

      * |tx_cir_1:131|bt_mx_1:66|:5 *
      _MC107 = DFF( _MC108 $ GND, _MC111, MR, VCC );

      * |tx_cir_1:131|bt_mx_1:66|:39 *
      _MC106 = MCELL( !_MC108 $ _MC107 );

      * |tx_cir_1:131|bt_mx_1:66|:45 *
      _MC039 = DFF( _EQ114 $ GND, _EQ115, MR, VCC );
      _EQ114 = _X022;
      _X022 = EXP( _X023 & _X024 & _X025 );
      _X023 = EXP( !_MC034 & _X022 );
      _X024 = EXP( !BUS_OUTP & _MC033 & _MC034 );
      _X025 = EXP( !_MC033 & _X022 );
      _EQ115 = CLOCK & !_MC112;

      * |tx_cir_1:131|c_mx_1:94|:4 *
      _MC105 = DFF( !CMD_OUT $ GND, _EQ116, MR, VCC );
      _EQ116 = CLOCK & !_MC112;

      * |tx_cir_1:131|c_mx_1:94|:57 *
      _MC101 = DFF( GND $ GND, _MC105, MR, _EQ117 );
      _EQ117 = _X026;
      _X026 = EXP( _MC104 & _MC111 );

      * |tx_cir_1:131|c_mx_1:94|:79 *
      _MC104 = DFF( _EQ118 $ VCC, CLOCK, MR, VCC );
      _EQ118 = _MC101 & _MC103;

      * |tx_cir_1:131|c_mx_1:94|:86 *
      _MC038 = DFF( _EQ119 $ GND, _EQ120, MR, VCC );
      _EQ119 = _X027;
      _X027 = EXP( _X028 & _X029 & _X030 );
      _X028 = EXP( !_MC034 & _X027 );
      _X029 = EXP( !BUS_OUT5 & _MC033 & _MC034 );
      _X030 = EXP( !_MC033 & _X027 );
      _EQ120 = CLOCK & !_MC112;

      * |tx_cir_1:131|c_mx_1:94|:89 *
      _MC103 = DFF( _MC031 $ GND, !_MC105, MR, _EQ121 );
      _EQ121 = _X026;

      * |tx_cir_1:131|d_mx_1:85|RELEASE *
      _MC092 = DFF( !DATA_OUT $ GND, _EQ122, MR, VCC );
      _EQ122 = CLOCK & !_MC112;

      * |tx_cir_1:131|d_mx_1:85|SEND *
      _MC037 = DFF( GND $ GND, _MC092, MR, _EQ123 );
      _EQ123 = _X031;
      _X031 = EXP( _MC036 & _MC111 );

      * |tx_cir_1:131|d_mx_1:85|:79 *
      _MC036 = DFF( !_MC037 $ GND, CLOCK, MR, VCC );

```

SUBSTITUTE SHEET (RULE 26)

```
* |tx_cir_1:131|d_mx_1:85|:86 *
_MC035 = DFF( _EQ124 $ GND, _EQ125, MR, VCC );
_EQ124 = _X032;
_X032 = EXP( _X033 & _X034 & _X035 );
_X033 = EXP( !_MC034 & _X032 );
_X034 = EXP( !BUS_OUT4 & _MC033 & _MC034 );
_X035 = EXP( !_MC033 & _X032 );
_EQ125 = CLOCK & !_MC112;

* |tx_cir_1:131|ds_mx_1:89|SEND *
_MC025 = DFF( _EQ126 $ _MC025, CLOCK, MR, _EQ127 );
_EQ126 = CMD_OUT & DATA_OUT & _MC020 & _MC023 & _MC024 & _MC025
&
SER_OUT;
_EQ127 = _X036;
_X036 = EXP( !_MC025 & _MC111 );

* |tx_cir_1:131|ds_mx_1:89|:105 *
_MC024 = DFF( _EQ128 $ GND, CLOCK, _EQ129, VCC );
_EQ128 = CMD_OUT & DATA_OUT & _MC020 & SER_OUT;
_EQ129 = CMD_OUT & DATA_OUT & _MC020 & SER_OUT;

* |tx_cir_1:131|ds_mx_1:89|:106 *
_MC023 = DFF( _MC024 $ GND, CLOCK, _EQ130, VCC );
_EQ130 = CMD_OUT & DATA_OUT & _MC020 & SER_OUT;

* |tx_cir_1:131|ds_mx_1:89|:116 *
_MC034 = DFF( GND $ GND, !SER_OUT, VCC, _EQ131 );
_EQ131 = _MC031 & !_MC117;

* |tx_cir_1:131|ds_mx_1:89|:117 *
_MC033 = DFF( GND $ GND, !DATA_OUT, VCC, _EQ132 );
_EQ132 = _MC031 & !_MC092;

* |tx_cir_1:131|ds_mx_1:89|:128 *
_MC020 = DFF( _EQ133 $ VCC, CLOCK, _EQ134, VCC );
_EQ133 = !_MC020 & !_MC031;
_EQ134 = _MC025 & MR;

* |tx_cir_1:131|s_mx_1:88|RELEASE *
_MC117 = DFF( !SER_OUT $ GND, _EQ135, MR, VCC );
_EQ135 = CLOCK & !_MC112;

* |tx_cir_1:131|s_mx_1:88|:57 *
_MC116 = DFF( GND $ GND, _MC117, MR, _EQ136 );
_EQ136 = _X037;
_X037 = EXP( _MC111 & _MC115 );

* |tx_cir_1:131|s_mx_1:88|:58 *
_MC115 = DFF( _EQ137 $ VCC, CLOCK, MR, VCC );
_EQ137 = _MC114 & _MC116;

* |tx_cir_1:131|s_mx_1:88|:74 *
_MC114 = DFF( !_MC113 $ GND, !_MC117, MR, _EQ138 );
_EQ138 = _X037;

* |tx_cir_1:131|s_mx_1:88|:75 *
_MC113 = DFF( _MC005 $ GND, _MC117, MR, VCC );
```

SUBSTITUTE SHEET (RULE 26)

This Sheet Has Been Repl



```
* |tx_cir_1:131|s_mx_1:88|:84 *
_MC014 = DFF( _EQ139 $ GND, _EQ140, MR, VCC );
_EQ139 = _X038;
_X038 = EXP( _X039 & _X040 & _X041 );
_X039 = EXP( !_MC034 & _X038 );
_X040 = EXP( !BUS_OUT3 & _MC033 & _MC034 );
_X041 = EXP( !_MC033 & _X038 );
_EQ140 = CLOCK & !_MC112;

* |tx_cir_1:131|sup_mx_1:100|:4 *
_MC091 = DFF( !SUPR_OUT $ GND, _EQ141, MR, VCC );
_EQ141 = CLOCK & !_MC112;

* |tx_cir_1:131|sup_mx_1:100|:5 *
_MC090 = DFF( _MC091 $ GND, _MC111, MR, VCC );

* |tx_cir_1:131|sup_mx_1:100|:39 *
_MC089 = MCELL( _EQ142 $ VCC );
_EQ142 = !_MC090 & _MC091 & !_MC092 & !_MC117
# _MC090 & !_MC091 & !_MC092 & !_MC117;

* |tx_cir_1:131|sup_mx_1:100|:45 *
_MC013 = DFF( _EQ143 $ GND, _EQ144, MR, VCC );
_EQ143 = _X042;
_X042 = EXP( _X043 & _X044 & _X045 );
_X043 = EXP( !_MC034 & _X042 );
_X044 = EXP( !BUS_OUT6 & _MC033 & _MC034 );
_X045 = EXP( !_MC033 & _X042 );
_EQ144 = CLOCK & !_MC112;
```

*
Shareable Expanders that are Duplicated in Multiple LABs:
(none)
* Copyrighted April 6, 1992 by FiberCom, Inc.

This Sheet Has Been Replaced.



SUBSTITUTE SHEET (RULE 26)

APPENDIX B

Project Information f:\max2work\mini\mini_rem\mini_rem.rpt
MAX+plus II Compiler Report File
Version 2.11 04/06/92

***** Project compiled without errors

Title: REMOTE MINI-EXTENDER
Company: FiberCom, Inc.
Designer: Richard LaBarbera
Rev: A
Date: 4:24p 5-29-1992

** DEVICE SUMMARY **

Chip/ POF	Device	Input Pins	Output Pins	Bidir Pins	MCs	Shareable EXPs	% Utilized
MINI	EPM5130WC-1	39	35	0	118	44	92 %

** PIN/MC/CHIP ASSIGNMENTS **

User Assignments	Actual Assignments (if different)	Node Name
MINI@85		ACKNLGE
MINI@99		ACTIVITY
MINI@20		ADR_IN
MINI@8		ADR_OUT
MINI@29		BUS_INP
MINI@39		BUS_IN0
MINI@36		BUS_IN1
MINI@35		BUS_IN2
MINI@34		BUS_IN3
MINI@33		BUS_IN4
MINI@32		BUS_IN5
MINI@31		BUS_IN6
MINI@30		BUS_IN7
MINI@40		BUS_OUTP
MINI@50		BUS_OUT0
MINI@49		BUS_OUT1
MINI@48		BUS_OUT2
MINI@47		BUS_OUT3
MINI@46		BUS_OUT4
MINI@45		BUS_OUT5
MINI@42		BUS_OUT6
MINI@41		BUS_OUT7
MINI@51		CLOCK
MINI@5		CMD_OUT
MINI@84		CO0
MINI@83		CO1
MINI@95		DASD
MINI@11		DATA_IN
MINI@3		DATA_OUT

SUBSTITUTE SHEET (RULE 26)

This Sheet Has Been Replaced



-58-

MINI@97
MINI@73
MINI@74
MINI@75
MINI@76
MINI@77
MINI@78
MINI@79
MINI@80
MINI@81
MINI@82
MINI@54
MINI@55
MINI@56
MINI@57
MINI@58
MINI@59
MINI@60
MINI@61
MINI@64
MINI@65
MINI@28
MINI@70
MINI@100
MINI@2
MINI@52
MINI@98
MINI@22
MINI@23
MINI@21
MINI@1
MINI@10
MINI@27
MINI@17
MINI@6
MINI@14
MINI@25
MINI@4
MINI@15
MINI@86
MINI@7
MINI@72
MINI@96

DAT_IN_D
DISC_IN
DIV_A_B
DIO
DI1
DI2
DI3
DI4
DI5
DI6
DI7
DI8
DI9
DO0
DO1
DO2
DO3
DO4
DO5
DO6
DO7
DO8
DO9
DRV_OE
DSTRB
FAULT
HOLD_OUT
LOS
MR
MRK0_IN
MRK0_OUT
OP_IN
OP_OUT
REQ_IN
RLY_DRV
SEL_IN
SEL_OUT
SER_IN
SER_IN_D
SER_OUT
STAT_IN
STROBE
SUPR_OUT
VLTN
WD_EN

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

FILE HIERARCHY **

```
rx_cir_r:82|
rx_cir_r:82 ds_det_r:60|
rx_cir_r:82 d_dmx_r:102|
rx_cir_r:82 s_dmx_r:101|
rx_cir_r:82 ad_dmx_r:99|
rx_cir_r:82 c_dmx_r:96|
rx_cir_r:82 op_dmx_r:83|
rx_cir_r:82 bt_dmx_r:90|
rx_cir_r:82 bt_dmx_r:89|
rx_cir_r:82 bt_dmx_r:91|
rx_cir_r:82 bt_dmx_r:85|
tx_cir_r:109|
tx_cir_r:109 as_syn_r:93|
tx_cir_r:109 bus_in_0:100|
tx_cir_r:109 req_mx_r:99|
tx_cir_r:109 req_mx_r:99 fclatch:43|
tx_cir_r:109 ds_dn_r:91|
tx_cir_r:109 ds_mx_r:97|
tx_cir_r:109 ds_mx_r:97 fclatch:86|
tx_cir_r:109 ds_mx_r:98 fclatch:86|
tx_cir_r:109 ds_mx_r:98 fclatch:86|
tx_cir_r:109 bt_mx_r:81 fclatch:43|
tx_cir_r:109 bt_mx_r:81 fclatch:43|
tx_cir_r:109 bt_mx_r:80 fclatch:43|
tx_cir_r:109 bt_mx_r:80 fclatch:43|
tx_cir_r:109 bt_mx_r:78 fclatch:43|
tx_cir_r:109 bt_mx_r:78 fclatch:43|
tx_cir_r:109 bt_mx_r:77 fclatch:43|
tx_cir_r:109 bt_mx_r:77 fclatch:43|
tx_cir_r:109 bt_mx_r:76 fclatch:43|
tx_cir_r:109 bt_mx_r:76 fclatch:43|
tx_cir_r:109 bt_mx_r:75 fclatch:43|
tx_cir_r:109 bt_mx_r:75 fclatch:43|
ala_drv:83|
ala_drv:83 wd_cntr:123|
```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

**** RESOURCE USAGE ****

Logic Array Block	Macrocells	I/O Pins	Shareable Expanders	External Interconnect
A: MC1 - MC16	16/16(100%)	8/8(100%)	1/32(3%)	10/24(41%)
B: MC17 - MC32	16/16(100%)	7/8(87%)	2/32(6%)	12/24(50%)
C: MC33 - MC48	16/16(100%)	8/8(100%)	1/32(3%)	11/24(45%)
D: MC49 - MC64	16/16(100%)	8/8(100%)	8/32(25%)	13/24(54%)
E: MC65 - MC80	6/16(37%)	7/8(87%)	0/32(0%)	6/24(25%)
F: MC81 - MC96	16/16(100%)	8/8(100%)	28/32(87%)	23/24(95%)
G: MC97 - MC112	16/16(100%)	6/8(75%)	3/32(9%)	19/24(79%)
H: MC113 - MC128	16/16(100%)	6/8(75%)	1/32(3%)	8/24(33%)

Total dedicated input pins used: 16/ 20 (80%)
Total I/O pins used: 58/ 64 (90%)
Total macrocells used: 118/128 (92%)
Total shareable expanders used: 44/256 (17%)

Total input pins required: 39
Total output pins required: 35
Total bidirectional pins required: 0
Total macrocells required: 118
Total shareable expanders in database: 44

Synthesized macrocells: 0/128 (0%)

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

** INPUTS **

Pin	MCell	LAB	Primitive	Shareable Expanders		Fan-In		Name
				Total	Shared	INP	FBK	
85	(101)	(G)	INPUT	0	0	0	0	ACKNLDGE
20	-	-	INPUT	0	0	0	0	ADR_IN
29	(23)	(B)	INPUT	0	0	0	0	BUS_INP
39	(39)	(C)	INPUT	0	0	0	0	BUS_IN0
36	(38)	(C)	INPUT	0	0	0	0	BUS_IN1
35	(37)	(C)	INPUT	0	0	0	0	BUS_IN2
34	(36)	(C)	INPUT	0	0	0	0	BUS_IN3
33	(35)	(C)	INPUT	0	0	0	0	BUS_IN4
32	(34)	(C)	INPUT	0	0	0	0	BUS_IN5
31	(33)	(C)	INPUT	0	0	0	0	BUS_IN6
30	(24)	(B)	INPUT	0	0	0	0	BUS_IN7
51	(65)	(E)	INPUT	0	0	0	0	CLOCK
95	(115)	(H)	INPUT	0	0	0	0	DASD
11	-	-	INPUT	0	0	0	0	DATA_IN
24	(18)	(B)	INPUT	0	0	0	0	DAT_IN_D
9	-	-	INPUT	0	0	0	0	DISC_IN
97	(117)	(H)	INPUT	0	0	0	0	DIV_A_B
54	(68)	(E)	INPUT	0	0	0	0	DO0
55	(69)	(E)	INPUT	0	0	0	0	DO1
56	(70)	(E)	INPUT	0	0	0	0	DO2
57	(71)	(E)	INPUT	0	0	0	0	DO3
58	(72)	(E)	INPUT	0	0	0	0	DO4
59	-	-	INPUT	0	0	0	0	DO5
60	-	-	INPUT	0	0	0	0	DO6
61	-	-	INPUT	0	0	0	0	DO7
64	-	-	INPUT	0	0	0	0	DO8
65	-	-	INPUT	0	0	0	0	DO9
70	-	-	INPUT	0	0	0	0	DSTRB
52	(66)	(E)	INPUT	0	0	0	0	LOS
98	(118)	(H)	INPUT	0	0	0	0	MR
22	-	-	INPUT	0	0	0	0	MRKO_IN
21	-	-	INPUT	0	0	0	0	OP_IN
10	-	-	INPUT	0	0	0	0	REQ_IN
17	-	-	INPUT	0	0	0	0	SEL_IN
14	-	-	INPUT	0	0	0	0	SER_IN
25	(19)	(B)	INPUT	0	0	0	0	SER_IN_D
15	-	-	INPUT	0	0	0	0	STAT_IN
72	-	-	INPUT	0	0	0	0	VLTN
96	(116)	(H)	INPUT	0	0	0	0	WD_EN

This Sheet Has Been Replaced



** OUTPUTS **

Pin	MCell	LAB	Primitive	Shareable Expanders		Fan-In		Name
				Total	Shared	INP	FBK	
99	119	H	OUTPUT	0	0	0	2	ACTIVITY
8	8	A	DFF	0	0	4	2	ADR_OUT
40	40	C	DFF	0	0	4	1	BUS_OUTP
50	56	D	DFF	0	0	4	1	BUS_OUT0
49	55	D	DFF	0	0	4	1	BUS_OUT1
48	54	D	DFF	0	0	4	1	BUS_OUT2
47	53	D	DFF	0	0	4	1	BUS_OUT3
46	52	D	DFF	0	0	4	1	BUS_OUT4
45	51	D	DFF	0	0	4	1	BUS_OUT5
42	50	D	DFF	0	0	4	1	BUS_OUT6
41	49	D	DFF	0	0	4	1	BUS_OUT7
5	5	A	DFF	0	0	4	1	CMD_OUT
84	100	G	OUTPUT	0	0	1	0	CO0
83	99	G	OUTPUT	0	0	1	0	CO1
3	3	A	DFF	0	0	4	2	DATA_OUT
73	81	F	DFF	0	0	2	1	DIO
74	82	F	OUTPUT	0	0	0	3	DI1
75	83	F	OUTPUT	0	0	0	3	DI2
76	84	F	OUTPUT	0	0	0	3	DI3
77	85	F	OUTPUT	0	0	0	3	DI4
78	86	F	OUTPUT	0	0	0	3	DI5
79	87	F	OUTPUT	0	0	0	3	DI6
80	88	F	OUTPUT	0	0	0	3	DI7
81	97	G	OUTPUT	0	0	0	3	DI8
82	98	G	OUTPUT	0	0	0	3	DI9
28	22	B	OUTPUT	0	0	1	0	DRV_OE
100	120	H	OUTPUT	0	0	1	1	FAULT
2	2	A	DFF	0	0	4	1	HOLD_OUT
23	17	B	DFF	0	0	4	1	MRK0_OUT
1	1	A	DFF	0	0	4	0	OP_OUT
27	21	B	OUTPUT	0	0	1	0	RLY_DRV
6	6	A	DFF	0	0	4	1	SEL_OUT
4	4	A	DFF	0	0	4	3	SER_OUT
86	102	G	DFF	1	0	2	13	STROBE
7	7	A	DFF	0	0	4	1	SUPR_OUT

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

** BURIED LOGIC **

Pin	MCell	LAB	Primitive	Shareable		Fan-In		Name
				Total	Shared	INP	FBK	
-	128	H	DFF	0	0	2	1	ala_drv:83 wd_cntr:123 :2
-	127	H	DFF	0	0	2	2	ala_drv:83 wd_cntr:123 :4
-	48	C	DFF	0	0	2	18	ala_drv:83 wd_cntr:123 :5
-	126	H	DFF	0	0	2	3	ala_drv:83 wd_cntr:123 :6
-	125	H	DFF	0	0	2	4	ala_drv:83 wd_cntr:123 :7
-	47	C	DFF	0	0	2	5	ala_drv:83 wd_cntr:123 :8
-	46	C	DFF	0	0	2	6	ala_drv:83 wd_cntr:123 :9
-	45	C	DFF	0	0	2	7	ala_drv:83 wd_cntr:123 :10
-	44	C	DFF	0	0	2	8	ala_drv:83 wd_cntr:123 :11
-	43	C	DFF	0	0	2	9	ala_drv:83 wd_cntr:123 :12
-	42	C	DFF	0	0	2	10	ala_drv:83 wd_cntr:123 :13
-	41	C	DFF	0	0	2	11	ala_drv:83 wd_cntr:123 :14
(39)	39	C	DFF	0	0	2	12	ala_drv:83 wd_cntr:123 :15
(36)	38	C	DFF	0	0	2	13	ala_drv:83 wd_cntr:123 :16
(35)	37	C	DFF	0	0	2	14	ala_drv:83 wd_cntr:123 :17
(34)	36	C	DFF	0	0	2	15	ala_drv:83 wd_cntr:123 :18
(33)	35	C	DFF	0	0	2	16	ala_drv:83 wd_cntr:123 :19
(32)	34	C	DFF	0	0	2	17	ala_drv:83 wd_cntr:123 :20
(31)	33	C	DFF	1	0	4	19	ala_drv:83 WD_SEND
-	124	H	DFF	1	1	1	7	ala_drv:83 :2
-	123	H	DFF	1	1	2	5	ala_drv:83 :3
-	122	H	DFF	1	1	2	5	ala_drv:83 :96
-	16	A	DFF	0	0	2	1	rx_cir_r:82 ad_dmx_r:99 :19
-	15	A	DFF	0	0	2	3	rx_cir_r:82 d_dmx_r:102 :26
-	14	A	DFF	1	0	5	1	rx_cir_r:82 ds_det_r:60 :2
-	13	A	DFF	0	0	4	2	rx_cir_r:82 ds_det_r:60 :3
-	12	A	DFF	0	0	2	3	rx_cir_r:82 s_dmx_r:101 :26
-	11	A	DFF	0	0	3	2	rx_cir_r:82 s_dmx_r:101 :41
-	96	F	DFF	0	0	11	2	rx_cir_r:82 s_dmx_r:101 :42
-	10	A	DFF	0	0	2	2	rx_cir_r:82 s_dmx_r:101 :43
-	112	G	DFF	0	0	2	13	tx_cir_r:109 as_syn_r:93 :58
-	111	G	DFF	1	0	2	14	tx_cir_r:109 as_syn_r:93 :65
-	121	H	DFF	0	0	2	2	tx_cir_r:109 bt_mx_r:75 :4
(98)	118	H	DFF	0	0	1	2	tx_cir_r:109 bt_mx_r:75 :5
-	9	A	MCELL	0	0	0	2	tx_cir_r:109 bt_mx_r:75 :33
-	95	F	DFF	4	0	3	3	tx_cir_r:109 bt_mx_r:75 :36
(97)	117	H	DFF	0	0	3	0	tx_cir_r:109 bt_mx_r:75 :41
(96)	116	H	DFF	0	0	2	2	tx_cir_r:109 bt_mx_r:76 :4
(95)	115	H	DFF	0	0	1	2	tx_cir_r:109 bt_mx_r:76 :5
(92)	114	H	MCELL	0	0	0	2	tx_cir_r:109 bt_mx_r:76 :33
-	94	F	DFF	4	0	3	3	tx_cir_r:109 bt_mx_r:76 :36
(91)	113	H	DFF	0	0	3	0	tx_cir_r:109 bt_mx_r:76 :41
-	64	D	DFF	0	0	2	2	tx_cir_r:109 bt_mx_r:77 :4
-	80	E	DFF	0	0	1	2	tx_cir_r:109 bt_mx_r:77 :5
-	79	E	MCELL	0	0	0	2	tx_cir_r:109 bt_mx_r:77 :33
-	93	F	DFF	4	0	3	3	tx_cir_r:109 bt_mx_r:77 :36
-	63	D	DFF	0	0	3	0	tx_cir_r:109 bt_mx_r:77 :41
-	62	D	DFF	0	0	2	2	tx_cir_r:109 bt_mx_r:78 :4
-	78	E	DFF	0	0	1	2	tx_cir_r:109 bt_mx_r:78 :5

This Sheet Has Been Replaced

SUBSTITUTE SHEET (RULE 26)



-	77	E	MCELL	0	0	0	2	tx_cir_r:109 bt_mx_r:78 :33
-	92	F	DFF	4	0	3	3	tx_cir_r:109 bt_mx_r:78 :36
-	61	D	DFF	0	0	3	0	tx_cir_r:109 bt_mx_r:78 :41
-	60	D	DFF	0	0	2	2	tx_cir_r:109 bt_mx_r:80 :4
-	110	G	DFF	0	0	1	2	tx_cir_r:109 bt_mx_r:80 :5
-	109	G	MCELL	0	0	0	2	tx_cir_r:109 bt_mx_r:80 :33
-	59	D	DFF	4	0	3	3	tx_cir_r:109 bt_mx_r:80 :36
-	58	D	DFF	0	0	3	0	tx_cir_r:109 bt_mx_r:80 :41
-	108	G	DFF	0	0	2	2	tx_cir_r:109 bt_mx_r:81 :4
-	107	G	DFF	0	0	1	2	tx_cir_r:109 bt_mx_r:81 :5
-	106	G	MCELL	0	0	0	2	tx_cir_r:109 bt_mx_r:81 :33
-	57	D	DFF	4	0	3	3	tx_cir_r:109 bt_mx_r:81 :36
-	105	G	DFF	0	0	3	0	tx_cir_r:109 bt_mx_r:81 :41
-	32	B	DFF	1	0	6	4	tx_cir_r:109 ds_dn_r:91 SEND
-	31	B	DFF	0	0	2	2	tx_cir_r:109 ds_dn_r:91 :81
-	30	B	DFF	0	0	1	2	tx_cir_r:109 ds_dn_r:91 :104
-	29	B	DFF	0	0	1	2	tx_cir_r:109 ds_dn_r:91 :106
-	28	B	DFF	0	0	5	2	tx_cir_r:109 ds_dn_r:91 :136
-	27	B	DFF	0	0	5	1	tx_cir_r:109 ds_dn_r:91 :137
-	26	B	DFF	0	0	3	1	tx_cir_r:109 ds_mx_r:97 RELEASE
(85)	101	G	DFF	1	1	1	3	tx_cir_r:109 ds_mx_r:97 :57
(90)	104	G	DFF	0	0	2	2	tx_cir_r:109 ds_mx_r:97 :58
-	91	F	DFF	4	0	3	3	tx_cir_r:109 ds_mx_r:97 :72
(89)	103	G	DFF	1	1	1	5	tx_cir_r:109 ds_mx_r:97 :76
-	25	B	DFF	0	0	3	1	tx_cir_r:109 ds_mx_r:98 RELEASE
(30)	24	B	DFF	1	1	1	3	tx_cir_r:109 ds_mx_r:98 :57
(29)	23	B	DFF	0	0	2	2	tx_cir_r:109 ds_mx_r:98 :58
-	90	F	DFF	4	0	3	3	tx_cir_r:109 ds_mx_r:98 :72
(25)	19	B	DFF	1	1	1	5	tx_cir_r:109 ds_mx_r:98 :76
-	76	E	DFF	0	0	2	2	tx_cir_r:109 req_mx_r:99 :4
(24)	18	B	DFF	0	0	1	2	tx_cir_r:109 req_mx_r:99 :5
(26)	20	B	MCELL	0	0	0	4	tx_cir_r:109 req_mx_r:99 :33
-	89	F	DFF	4	0	3	3	tx_cir_r:109 req_mx_r:99 :36
-	75	E	DFF	0	0	3	0	tx_cir_r:109 req_mx_r:99 :41

This Sheet Has Been Replaced



Logic Array Block 'A':

[illegible][illegible]

This Sheet Has Been Replaced

SUBSTITUTE SHEET (RULE 26)



**** MACROCELL INTERCONNECTIONS ****

[illegible]

[REDACTED]

R O / U S 1 0 NOV 1993

Pin	Signal	Value	Signal	Value	Signal	Value
20	ADR_IN	- - - - -	e			
51	CLOCK	- - - * * - - * * * * - *	- * * * * * *			
11	DATA_IN	- - - e - - - e e - - - - -	e e - - - - -			
24		- - - * - * - * * * - - -	- * - - - - -			
DAT_IN_D						
9	DISC_IN	- - - - -	- e - - - - -			
54	DO0	- - - * - - - - -	* * * * - - -			
59	DO5	- - - - -	e - - e - - -			
60	DO6	- - - - -	e - - e - - -			
61	DO7	- - - - -	e - - e - - -			
64	DO8	- - - - -	e - - e - - -			
65	DO9	- - - e - - - - -	- e e - - - -			
70	DSTRB	- - - e - - - - -	e e e e - - -			
52	LOS	- - - * - * - - - - -	- * - - - - *			
98	MR	- - - * - * * - - * * * * *	* * * * * *			
22	MRK0_IN	- - - - -	- - - - e - -			
21	OP_IN	- - - - -	e - - - - e			
10	REQ_IN	- - - - -	- - - e - - -			
17	SEL_IN	- - - - -	- - - e - - -			
14	SER_IN	- - - e - - - e e - - - -	e e - - - - -			
25		- - - * - - * * * - * - -	- - - * - - -			
SER_IN_D						
15	STAT_IN	- - - - -	e - - e - e - -			
72	VLTN	- - - - -	- - - - - e			
MC5	CMD_OUT	- - - - - * - - -	e * - - - * -			
MC1	OP_OUT	- - - * - - - - -	e * * * - - -			
MC13		- - - * * * - - - *	- e * - - - -			
rx_cir_r:82 ds_det_r:60 :3						
MC112		- - - * * - - - -	- * - * * e *			
tx_cir_r:109 as_syn_r:93 :58						
MC111		- - - * - - * * -	- * * - * - e *			
tx_cir_r:109 as_syn_r:93 :65						
MC76		- - - - - * * -	- * - - e * -			
tx_cir_r:109 req_mx_r:99 :4						

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

** MACROCELL INTERCONNECTIONS **

Logic Array Block 'C':

M M M M M M M M M M M M M M M M																									
C C C C C C C C C C C C C C C C																									
4 4 4 4 4 4 4 4 3 3 3 3 3 3 3 4																									
8 7 6 5 4 3 2 1 9 8 7 6 5 4 3 0																									
MCELL																A	B	C	D	E	F	G	H	Name	
MC48	->	@	-	-	-	-	-	-	-	-	-	-	-	-	-	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :5																							
MC47	->	@	@	@	@	@	@	@	@	@	@	@	@	@	@	@	-	-	-	@	-	-	-	-	*
		ala_drv:83 wd_cntr:123 :8																							
MC46	->	@	-	@	@	@	@	@	@	@	@	@	@	@	@	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :9																							
MC45	->	@	-	-	@	@	@	@	@	@	@	@	@	@	@	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :10																							
MC44	->	@	-	-	-	@	@	@	@	@	@	@	@	@	@	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :11																							
MC43	->	@	-	-	-	-	@	@	@	@	@	@	@	@	@	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :12																							
MC42	->	@	-	-	-	-	-	@	@	@	@	@	@	@	@	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :13																							
MC41	->	@	-	-	-	-	-	-	@	@	@	@	@	@	@	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :14																							
MC39	->	@	-	-	-	-	-	-	-	@	@	@	@	@	@	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :15																							
MC38	->	@	-	-	-	-	-	-	-	-	@	@	@	@	@	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :16																							
MC37	->	@	-	-	-	-	-	-	-	-	-	@	@	@	@	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :17																							
MC36	->	@	-	-	-	-	-	-	-	-	-	-	@	@	@	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :18																							
MC35	->	@	-	-	-	-	-	-	-	-	-	-	-	@	@	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :19																							
MC34	->	@	-	-	-	-	-	-	-	-	-	-	-	-	@	@	-	-	-	@	-	-	-	-	
		ala_drv:83 wd_cntr:123 :20																							
MC33	->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	@	-	-	-	@	-	-	-	*	*
		ala_drv:83 WD_SEND																							
MC40	->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	@	-	-	-	@	-	-	-	-	
BUS_OUTP																									

Pin																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
-----	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

This Sheet Has Been Replaced

SUBSTITUTE SHEET (RULE 26)



```

70  -> - - - - - - - - - - - - - - e | e e e e - - - e | DSTRB
98  -> * * * * * * * * * * * * * * * | * * * * * * * * | MR
22  -> - - - - - - - - - - - - - - - | - - - - - - e - | MRKO_IN
21  -> - - - - - - - - - - - - - - - | e - - - - - e - | OP_IN
10  -> - - - - - - - - - - - - - - - | - - - - e - - - | REQ_IN
17  -> - - - - - - - - - - - - - - - | - - - e - - - - | SEL_IN
14  -> - - - - - - - - - - - - - - - | e e - - - - - - | SER_IN
15  -> - - - - - - - - - - - - - - - | e - - e - e - - | STAT_IN
72  -> - - - - - - - - - - - - - - - | - - * - - - - - | VLTN
96  -> - - - - - - - - - - - - - - - | - - * - - - - - | WD_EN
MC128-> * * * * * * * * * * * * * * * | - - - * - - - - | e
|ala_drv:83|wd_cntr:123|:2
MC127-> * * * * * * * * * * * * * * * | - - - * - - - - | e
|ala_drv:83|wd_cntr:123|:4
MC126-> * * * * * * * * * * * * * * * | - - - * - - - - | e
|ala_drv:83|wd_cntr:123|:6
MC125-> * * * * * * * * * * * * * * * | - - - * - - - - | e
|ala_drv:83|wd_cntr:123|:7
MC1  -> - - - - - - - - - - - - - - * | e * * * - - - - | OP_OUT
MC111-> * * * * * * * * * * * * * * * | - - * * - * - e * |
|tx_cir_r:109|as_syn_r:93|:65

```

*** MACROCELL INTERCONNECTIONS ***

Logic Array Block 'D':

```

          M M M M M M M M M M M M M M M M
          C C C C C C C C C C C C C C C C
          5 5 5 5 5 5 5 4 6 6 6 6 6 5 5 5
          6 5 4 3 2 1 0 9 4 3 2 1 0 9 8 7
MCELL   | | | | | | | | | | | | | | | | A B C D E F G H | Name
MC56 -> | e - - - - - - - - - - - - - - | - - - - e - - - - |
BUS_OUT0
MC55 -> | - e - - - - - - - - - - - - - - | - - - - e - - - - |
BUS_OUT1
MC54 -> | - - e - - - - - - - - - - - - - - | - - - - e - - - - |
BUS_OUT2
MC53 -> | - - - e - - - - - - - - - - - - - - | - - - - e - - - - |
BUS_OUT3
MC52 -> | - - - - e - - - - - - - - - - - - - - | - - - - e - - - - |
BUS_OUT4
MC51 -> | - - - - - e - - - - - - - - - - - - - - | - - - - e - - - - |
BUS_OUT5
MC50 -> | - - - - - - e - - - - - - - - - - - - - - | - - - - e - - - - |
BUS_OUT6
MC49 -> | - - - - - - - e - - - - - - - - - - - - - - | - - - - e - - - - |
BUS_OUT7
MC64 -> | - - - - - - - - - - - - - - - - - - - - | - - - - e * * - - |
|tx_cir_r:109|bt_mx_r:77|:4
MC63 -> | - - - - - - - - e - - - - - - - - - - | - - - - e - - - - |
|tx_cir_r:109|bt_mx_r:77|:41

```



```
MC62 -> - - - - - | - - - @ * * - - |  
|tx_cir_r:109|bt_mx_r:78|:4  
MC61 -> - - - - - | - - - e - - - - - |  
|tx_cir_r:109|bt_mx_r:78|:41  
MC60 -> - - - - - | - - - e - - * - - |  
|tx_cir_r:109|bt_mx_r:80|:4  
MC59 -> - - - - - | - - - e - - * - - |  
|tx_cir_r:109|bt_mx_r:80|:36  
MC58 -> - - - - - | - - - e - - - - - |  
|tx_cir_r:109|bt_mx_r:80|:41  
MC57 -> - - - - - | - - - e - - * - - |  
|tx_cir_r:109|bt_mx_r:81|:36
```

Pin	Signal	Direction	Notes
20	ADR_IN	Input	
29	BUS_INP	Input	
30	BUS_IN7	Input	
51	CLOCK	Input	
11	DATA_IN	Input	
9	DISC_IN	Input	
54	DO0	Output	
55	DO1	Output	
56	DO2	Output	
57	DO3	Output	
58	DO4	Output	
59	DO5	Output	
60	DO6	Output	
61	DO7	Output	
64	DO8	Output	
65	DO9	Output	
70	DSTRB	Output	
98	MR	Input	
22	MRK0_IN	Input	
21	OP_IN	Input	
10	REQ_IN	Input	
17	SEL_IN	Input	
14	SER_IN	Input	
15	STAT_IN	Input	
72	VLTN	Input	
MC1	OP_OUT	Output	
MC112			
MC30			
MC29			

**** MACROCELL INTERCONNECTIONS ****

Logic Array Block 'E':

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

M M M M M M																					
C C C C C C																					
8 7 7 7 7 7																					
0 9 8 7 6 5																					
										A	B	C	D	E	F	G	H	Name			
MCELL																					
MC80 ->										-	@	-	-	-	-	-	-	tx_cir_r:109	bt_mx_r:77	:5	
MC79 ->										-	-	-	-	-	-	-	-	-	@	*	
tx_cir_r:109										bt_mx_r:77:33											
MC78 ->										-	-	-	@	-	-	-	@	tx_cir_r:109	bt_mx_r:78	:5	
MC77 ->										-	-	-	-	-	-	-	-	-	@	*	
tx_cir_r:109										bt_mx_r:78:33											
MC76 ->										-	-	-	-	-	-	-	-	*	-	@	*
tx_cir_r:109										req_mx_r:99:4											
MC75 ->										-	-	-	-	@	-	-	-	-	-	@	-
tx_cir_r:109										req_mx_r:99:41											

[illegible]

**** MACROCELL INTERCONNECTIONS ****

Logic Array Block 'F':

MCELL	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	A	B	C	D	E	F	G	H	Name
MC81 ->	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	-	-	-	-	-	@	*	-	DIO
	8	8	8	8	8	8	8	9	9	9	9	9	9	9	8									
	1	2	3	4	5	6	7	8	6	5	4	3	2	1	0									

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

[illegible][illegible]

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

```

MC4  -> - - - - - * - - - - - | e - - - - * - - | SER_OUT
MC112-> * - - - - - * * * * * | - * - * * * e * |
|tx_cir_r:109|as_syn_r:93|:58
MC121-> - * - - - - - - - - - - | * - - - - * - e |
|tx_cir_r:109|bt_mx_r:75|:4
MC116-> - - * - - - - - - - - - | - - - - - * - e |
|tx_cir_r:109|bt_mx_r:76|:4
MC64  -> - - - - * - - - - - - - | - - - e * * - - |
|tx_cir_r:109|bt_mx_r:77|:4
MC62  -> - - - - * - - - - - - - | - - - e * * - - |
|tx_cir_r:109|bt_mx_r:78|:4
MC30  -> - - - - - * * * * * * * | - e - * - * - - |
|tx_cir_r:109|ds_dn_r:91|:104
MC29  -> - - - - - * * * * * * * | - e - * - * - - |
|tx_cir_r:109|ds_dn_r:91|:106
MC26  -> - - - - * - - - - - - - | - e - - - * * - |
|tx_cir_r:109|ds_mx_r:97|RELEASE
MC25  -> - - - - * - - - - - - - | - e - - - * - - |
|tx_cir_r:109|ds_mx_r:98|RELEASE
MC76  -> - - - - * - - - - - - - | - * - - e * - - |
|tx_cir_r:109|req_mx_r:99|:4
-----

```

**** MACROCELL INTERCONNECTIONS ****

Logic Array Block 'G':

	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	A	B	C	D	E	F	G	H	Name
	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C									
	1	9	9	9	1	1	1	1	1	1	1	1	1	1	1									
	0	9	7	8	0	1	1	1	0	0	0	0	0	0	0									
MCELL	0				2	2	1	0	9	8	7	6	5	1	4	A	B	C	D	E	F	G	H	
MC100->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	CO0
MC99 ->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	CO1
MC97 ->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	DI8
MC98 ->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	DI9
MC102->	-	-	-	-	e	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	*	STROBE
MC112->	-	-	-	-	-	e	e	-	-	e	-	-	-	-	-	-	-	*	-	*	*	*	e	*
tx_cir_r:109 as_syn_r:93 :58																								
MC111->	-	-	-	-	-	e	-	-	e	-	-	e	-	e	-	-	*	*	-	*	-	e	*	
tx_cir_r:109 as_syn_r:93 :65																								
MC110->	-	-	-	-	-	e	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	
tx_cir_r:109 bt_mx_r:80 :5																								
MC109->	-	-	-	-	-	e	e	e	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	
tx_cir_r:109 bt_mx_r:80 :33																								
MC108->	-	-	-	-	e	-	-	-	e	e	-	-	-	-	-	-	-	-	-	-	-	e	-	
tx_cir_r:109 bt_mx_r:81 :4																								
MC107->	-	-	-	-	-	-	-	-	e	-	-	-	-	-	-	-	-	-	-	-	-	e	-	
tx_cir_r:109 bt_mx_r:81 :5																								
MC106->	-	-	-	-	-	e	e	e	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	
tx_cir_r:109 bt_mx_r:81 :33																								
MC105->	-	-	-	-	-	-	-	-	e	-	-	-	-	-	-	-	-	-	-	-	-	e	-	
tx_cir_r:109 bt_mx_r:81 :41																								



MC101-> - - - - e e e - - - - - e - | - - - - - e - |
|tx_cir_r:109|ds_mx_r:97|:57
MC104-> - - - - e e - - - - - e - | - - - - - e - |
|tx_cir_r:109|ds_mx_r:97|:58
MC103-> - - - - e e e - - - - - e - | - - - - - e - |
|tx_cir_r:109|ds_mx_r:97|:76

Pin
85 -> - - - - * - - - - - - - - - - - * - |
ACKNL DGE
20 -> - - - - - - - - - - - - - - - - - e | ADR_IN
51 -> - - - - * * * - - * - - * - * - | - * * * * * * * * | CLOCK
11 -> - - - - - - - - - - - - - - - - - e e | DATA_IN
9 -> - - - - - - - - - - - - - - - - - e - | DISC_IN
59 -> - - - - - - - - - - - - - - - - - e - - - - - | DO5
60 -> - - - - - - - - - - - - - - - - - e - - - - - | DO6
61 -> - - - - - - - - - - - - - - - - - e - - - - - | DO7
64 -> - - - - - - - - - - - - - - - - - e - - - - - | DO8
65 -> - - - - - - - - - - - - - - - - - e e e - - - - | DO9
70 -> - - - - - - - - - - - - - - - - - e e e e - - - e | DSTRB
98 -> * * - - - * * * - * * - * * * * | * * * * * * * * | MR
22 -> - - - - - - - - - - - - - - - - - e - - - - - | MRK0_IN
21 -> - - - - - - - - - - - - - - - - - e - - - - - | OP_IN
10 -> - - - - - - - - - - - - - - - - - e - - - - - | REQ_IN
17 -> - - - - - - - - - - - - - - - - - e - - - - - | SEL_IN
14 -> - - - - - - - - - - - - - - - - - e e - - - - | SER_IN
15 -> - - - - - - - - - - - - - - - - - e - - - - - | STAT_IN
72 -> - - - - - - - - - - - - - - - - - e - - - - - | VLTN
MC33 -> - - - - - * * * - - - - - - - - e - - - - * * |
|ala_drv:83|WD_SEND
MC5 -> - - - - - - - - - - - - - - - - - e * - - - * - | CMD_OUT
MC81 -> - - - * * - - - - - - - - - - - e * - - - | DIO
MC13 -> - - - - - - - - - - - - - - - - - * - e * - - - * - |
|rx_cir_r:82|ds_det_r:60|:3
MC9 -> - - - - - * * * - - - - - - - - e - - - - * - |
|tx_cir_r:109|bt_mx_r:75|:33
MC114-> - - - - - * * * - - - - - - - - - - - * e |
|tx_cir_r:109|bt_mx_r:76|:33
MC79 -> - - - - - * * * - - - - - - - - - - - e - * - |
|tx_cir_r:109|bt_mx_r:77|:33
MC77 -> - - - - - * * * - - - - - - - - - - - e - * - |
|tx_cir_r:109|bt_mx_r:78|:33
MC60 -> - - - * - - - - - * - - - - - - - - - e - * - |
|tx_cir_r:109|bt_mx_r:80|:4
MC59 -> - - - * - - - - - - - - - - - - - - - e - * - |
|tx_cir_r:109|bt_mx_r:80|:36
MC57 -> - - - * - - - - - - - - - - - - - - - e - * - |
|tx_cir_r:109|bt_mx_r:81|:36
MC32 -> - - - - - * * * - - - - - - - - - e - - - * - |
|tx_cir_r:109|ds_dn_r:91|SEND
MC26 -> - - - - - - - - - - - * - * - - - - e - - * * - |
|tx_cir_r:109|ds_mx_r:97|RELEASE
MC24 -> - - - - - * * * - - - - - - - - - e - - - * - |
|tx_cir_r:109|ds_mx_r:98|:57

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

R O / U S 10 NOV 1993

```

MC19 -> - - - - * * * - - - - - | - e - - - - * - |
|tx_cir_r:109|ds_mx_r:98|:76
MC20 -> - - - - * * * - - - - - | - e - - - - * - |
|tx_cir_r:109|req_mx_r:99|:33
-----

```

** MACROCELL INTERCONNECTIONS **
 Logic Array Block 'H':

```

      M M M M M M M M M M M M M M M M
      C C C C C C C C C C C C C C C C
      1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
      1 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1
MCELL 9 8 7 6 5 4 3 2 0 1 8 7 6 5 4 3 | A B C D E F G H | Name
MC119-> - - - - - - - - - - - - - - | - - - - - - - @ | ACTIVITY
MC128-> - @ @ @ @ @ @ @ - - - - - | - - - - - * - - @ |
|ala_drv:83|wd_cntr:123|:2
MC127-> - - @ @ @ @ @ @ - - - - - | - - - - - * - - @ |
|ala_drv:83|wd_cntr:123|:4
MC126-> - - - @ @ @ @ @ - - - - - | - - - - - * - - @ |
|ala_drv:83|wd_cntr:123|:6
MC125-> - - - - @ @ @ @ - - - - - | - - - - - * - - @ |
|ala_drv:83|wd_cntr:123|:7
MC124-> @ - - - - - - - - - - - - | - - - - - @ | |ala_drv:83|:2
MC123-> @ - - - - - - - - - - - - | - - - - - @ | |ala_drv:83|:3
MC122-> - - - - - @ - - - - - - - | - - - - - @ | |ala_drv:83|:96
MC120-> - - - - - - - - - - - - | - - - - - @ | FAULT
MC121-> - - - - - - - - - - @ - - - - | * - - - - * - @ |
|tx_cir_r:109|bt_mx_r:75|:4
MC118-> - - - - - - - - - - - - | - - - - - * - - - @ |
|tx_cir_r:109|bt_mx_r:75|:5
MC117-> - - - - - @ - - - - - - - | - - - - - - - @ |
|tx_cir_r:109|bt_mx_r:75|:41
MC116-> - - - - - @ @ - - - - - - | - - - - - * - @ |
|tx_cir_r:109|bt_mx_r:76|:4
MC115-> - - - - - @ - - - - - - - | - - - - - - - @ |
|tx_cir_r:109|bt_mx_r:76|:5
MC114-> - - - - - - - - - - - - | - - - - - * @ |
|tx_cir_r:109|bt_mx_r:76|:33
MC113-> - - - - - @ - - - - - - - | - - - - - - - @ |
|tx_cir_r:109|bt_mx_r:76|:41

```

```

Pin
20 -> - - - - - - - - - - - - - @ | - - - - - - - @ | ADR_IN
51 -> - * * * * - - - - - * * * - - * | - * * * * * * * * | CLOCK
11 -> - - - - - - - - - - - - - | e e - - - - - | DATA_IN
9 -> - - - - - - - - - - - - - | - - e - - - - | DISC_IN
59 -> - - - - - - - - - - - - - | e - - - e - - - | DO5
60 -> - - - - - - - - - - - - - | e - - - e - - - | DO6
61 -> - - - - - - - - - - - - - | e - - - e - - - | DO7
64 -> - - - - - - - - - - - - - | e - - - e - - - | DO8
65 -> - - - - - - - - - - - - - | e e e e - - - - | DO9
70 -> - - - - - - - e - - - - - - - | e e e e - - - e | DSTRB

```

This Sheet Has Been Replaced

SUBSTITUTE SHEET (RULE 26)




```

52  -> - - - - - * - - - - - | - * - - - - - * | LOS
98  -> - * * * * * * * - * * * * * | * * * * * * * * | MR
22  -> - - - - - - - - - - - | - - - - - e - - - | MRKO_IN
21  -> - - - - - - - - - - - | e - - - - - e - - - | OP_IN
10  -> - - - - - - - - - - - | - - - e - - - - - | REQ_IN
17  -> - - - - - - - - - - - | - - - e - - - - - | SEL_IN
14  -> - - - - - - - - - - - | e e - - - - - - - | SER_IN
15  -> - - - - - - - - - - - | e - - e - e - - - | STAT_IN
72  -> - - - - - e - - - - - | - - - - - e - - - | VLTN
MC47 -> - - - - - * * * - - - - - | - - - e - - - - - * |
|ala_drv:83|wd_cntr:123|:8
MC33 -> - - - - - * - - - - - | - - - e - - - - - * * |
|ala_drv:83|WD_SEND
MC102-> - - - - - * - - - - - | - - - - - e * - - | STROBE
MC112-> - - - - - * - - - - - | - * - * * * e * |
|tx_cir_r:109|as_syn_r:93|:58
MC111-> - * * * * - - - - - * - - - * - | - * * - * - e * |
|tx_cir_r:109|as_syn_r:93|:65
-----

```

**** EQUATIONS ****

```

ACKNL DGE : INPUT;
ADR_IN    : INPUT;
BUS_INP   : INPUT;
BUS_IN0   : INPUT;
BUS_IN1   : INPUT;
BUS_IN2   : INPUT;
BUS_IN3   : INPUT;
BUS_IN4   : INPUT;
BUS_IN5   : INPUT;
BUS_IN6   : INPUT;
BUS_IN7   : INPUT;
CLOCK     : INPUT;
DASD      : INPUT;
DATA_IN   : INPUT;
DAT_IN_D  : INPUT;
DISC_IN   : INPUT;
DIV_A_B   : INPUT;
DO0       : INPUT;
DO1       : INPUT;
DO2       : INPUT;
DO3       : INPUT;
DO4       : INPUT;
DO5       : INPUT;
DO6       : INPUT;
DO7       : INPUT;
DO8       : INPUT;
DO9       : INPUT;
DSTRB     : INPUT;
LOS       : INPUT;
MR        : INPUT;
MRKO_IN   : INPUT;
OP_IN     : INPUT;

```

This Sheet Has Been Replaced



```

REQ_IN   : INPUT;
SEL_IN   : INPUT;
SER_IN   : INPUT;
SER_IN_D : INPUT;
STAT_IN  : INPUT;
VLTN     : INPUT;
WD_EN    : INPUT;

```

```

ACTIVITY = _MC119;
_MC119 = MCELL( _EQ001 $ VCC );
_EQ001 = !_MC123 & !_MC124;

```

```

% ADR_OUT = |rx_cir_r:82|ad_dmx_r:99|TAG %
ADR_OUT = _MC008;
_MC008 = DFF( _EQ002 $ GND, DSTRB, _EQ003, VCC );
_EQ002 = DO0 & DO2
# !DO0 & _MC008;
_EQ003 = _MC001 & !_MC016 & MR;

```

```

% BUS_OUTP = |rx_cir_r:82|bt_dmx_r:91|BUS %
BUS_OUTP = _MC040;
_MC040 = DFF( _EQ004 $ GND, DSTRB, _EQ005, VCC );
_EQ004 = DO0 & _MC040
# !DO0 & DO9;
_EQ005 = _MC001 & MR;

```

```

% BUS_OUT0 = |rx_cir_r:82|op_dmx_r:83|BUS %
BUS_OUT0 = _MC056;
_MC056 = DFF( _EQ006 $ GND, DSTRB, _EQ007, VCC );
_EQ006 = DO0 & _MC056
# !DO0 & DO1;
_EQ007 = _MC001 & MR;

```

```

% BUS_OUT1 = |rx_cir_r:82|ad_dmx_r:99|BUS %
BUS_OUT1 = _MC055;
_MC055 = DFF( _EQ008 $ GND, DSTRB, _EQ009, VCC );
_EQ008 = DO0 & _MC055
# !DO0 & DO2;
_EQ009 = _MC001 & MR;

```

```

% BUS_OUT2 = |rx_cir_r:82|bt_dmx_r:85|BUS %
BUS_OUT2 = _MC054;
_MC054 = DFF( _EQ010 $ GND, DSTRB, _EQ011, VCC );
_EQ010 = DO0 & _MC054
# !DO0 & DO3;
_EQ011 = _MC001 & MR;

```

```

% BUS_OUT3 = |rx_cir_r:82|s_dmx_r:101|BUS %
BUS_OUT3 = _MC053;
_MC053 = DFF( _EQ012 $ GND, DSTRB, _EQ013, VCC );
_EQ012 = DO0 & _MC053
# !DO0 & DO4;
_EQ013 = _MC001 & MR;

```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

```

% BUS_OUT4 = |rx_cir_r:82|d_dmx_r:102|BUS %
BUS_OUT4 = _MC052;
_MC052 = DFF( _EQ014 $ GND, DSTRB, _EQ015, VCC );
_EQ014 = DO0 & _MC052
# !DO0 & DO5;
_EQ015 = _MC001 & MR;

% BUS_OUT5 = |rx_cir_r:82|c_dmx_r:96|BUS %
BUS_OUT5 = _MC051;
_MC051 = DFF( _EQ016 $ GND, DSTRB, _EQ017, VCC );
_EQ016 = DO0 & _MC051
# !DO0 & DO6;
_EQ017 = _MC001 & MR;

% BUS_OUT6 = |rx_cir_r:82|bt_dmx_r:89|BUS %
BUS_OUT6 = _MC050;
_MC050 = DFF( _EQ018 $ GND, DSTRB, _EQ019, VCC );
_EQ018 = DO0 & _MC050
# !DO0 & DO7;
_EQ019 = _MC001 & MR;

% BUS_OUT7 = |rx_cir_r:82|bt_dmx_r:90|BUS %
BUS_OUT7 = _MC049;
_MC049 = DFF( _EQ020 $ GND, DSTRB, _EQ021, VCC );
_EQ020 = DO0 & _MC049
# !DO0 & DO8;
_EQ021 = _MC001 & MR;

% CMD_OUT = |rx_cir_r:82|c_dmx_r:96|TAG %
CMD_OUT = _MC005;
_MC005 = DFF( _EQ022 $ GND, DSTRB, _EQ023, VCC );
_EQ022 = DO0 & DO6
# !DO0 & _MC005;
_EQ023 = _MC001 & MR;

CO0 = _MC100;
_MC100 = MCELL( !MR $ GND );

CO1 = _MC099;
_MC099 = MCELL( !MR $ GND );

% DATA_OUT = |rx_cir_r:82|d_dmx_r:102|TAG %
DATA_OUT = _MC003;
_MC003 = DFF( _EQ024 $ GND, DSTRB, _EQ025, VCC );
_EQ024 = DO0 & DO5
# !DO0 & _MC003;
_EQ025 = _MC001 & !_MC015 & MR;

% DIO = |tx_cir_r:109|as_syn_r:93|:70 %
DIO = _MC081;
_MC081 = DFF( _MC112 $ GND, CLOCK, MR, VCC );

DI1 = _MC082;
_MC082 = MCELL( _EQ026 $ GND );

```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

```

_EQ026 = _MC081 & _MC121
        # !_MC081 & _MC095;

DI2      = _MC083;
_MC083   = MCELL( _EQ027 $ GND );
_EQ027   = _MC081 & _MC116
        # !_MC081 & _MC094;

DI3      = _MC084;
_MC084   = MCELL( _EQ028 $ GND );
_EQ028   = _MC064 & _MC081
        # !_MC081 & _MC093;

DI4      = _MC085;
_MC085   = MCELL( _EQ029 $ GND );
_EQ029   = _MC025 & _MC081
        # !_MC081 & _MC090;

DI5      = _MC086;
_MC086   = MCELL( _EQ030 $ GND );
_EQ030   = _MC026 & _MC081
        # !_MC081 & _MC091;

DI6      = _MC087;
_MC087   = MCELL( _EQ031 $ GND );
_EQ031   = _MC062 & _MC081
        # !_MC081 & _MC092;

DI7      = _MC088;
_MC088   = MCELL( _EQ032 $ GND );
_EQ032   = _MC076 & _MC081
        # !_MC081 & _MC089;

DI8      = _MC097;
_MC097   = MCELL( _EQ033 $ GND );
_EQ033   = _MC060 & _MC081
        # _MC059 & !_MC081;

DI9      = _MC098;
_MC098   = MCELL( _EQ034 $ GND );
_EQ034   = _MC081 & _MC108
        # _MC057 & !_MC081;

DRV_OE   = _MC022;
_MC022   = MCELL( !LOS $ GND );

FAULT    = _MC120;
_MC120   = MCELL( _EQ035 $ _MC122 );
_EQ035   = LOS & !_MC122;

% HOLD_OUT = |rx_cir_r:82|bt_dmx_r:90|TAG %
HOLD_OUT = _MC002;
_MC002   = DFF( _EQ036 $ GND, DSTRB, _EQ037, VCC );
_EQ036   = DO0 & DO8

```



PCT/US 93/06908
RO/US 10 NOV 1993

```

      # !DO0 & _MC002;
_EQ037 = _MC001 & MR;

% MRK0_OUT = |rx_cir_r:82|bt_dmx_r:91|TAG %
MRK0_OUT = _MC017;
_MC017 = DFF( _EQ038 $ GND, DSTRB, _EQ039, VCC );
_EQ038 = DO0 & DO9
      # !DO0 & _MC017;
_EQ039 = _MC001 & MR;

% OP_OUT = |rx_cir_r:82|op_dmx_r:83|TAG %
OP_OUT = _MC001;
_MC001 = DFF( _EQ040 $ GND, DSTRB, MR, VCC );
_EQ040 = DO0 & DO1
      # !DO0 & _MC001;

RLY_DRV = _MC021;
_MC021 = MCELL( !LOS $ GND );

% SEL_OUT = |rx_cir_r:82|bt_dmx_r:85|TAG %
SEL_OUT = _MC006;
_MC006 = DFF( _EQ041 $ GND, DSTRB, _EQ042, VCC );
_EQ041 = DO0 & DO3
      # !DO0 & _MC006;
_EQ042 = _MC001 & MR;

% SER_OUT = |rx_cir_r:82|s_dmx_r:101|TAG %
SER_OUT = _MC004;
_MC004 = DFF( _EQ043 $ GND, DSTRB, _EQ044, VCC );
_EQ043 = DO0 & DO4
      # !DO0 & _MC004;
_EQ044 = _MC001 & !_MC011 & !_MC012 & MR;

% STROBE = |tx_cir_r:109|as_syn_r:93|STRB %
STROBE = _MC102;
_MC102 = DFF( _EQ045 $ VCC, !CLOCK, _EQ046, VCC );
_EQ045 = _MC009 & _MC019 & _MC020 & _MC024 & _MC032 & _MC033 &
      _MC077 & _MC079 & _MC101 & _MC103 & _MC106 & _MC109 &
      _MC114;
_EQ046 = _X001;
_X001 = EXP( ACKNL DGE & _MC102 );

% SUPR_OUT = |rx_cir_r:82|bt_dmx_r:89|TAG %
SUPR_OUT = _MC007;
_MC007 = DFF( _EQ047 $ GND, DSTRB, _EQ048, VCC );
_EQ047 = DO0 & DO7
      # !DO0 & _MC007;
_EQ048 = _MC001 & MR;

% |ala_drv:83|wd_cntr:123|:2 %
_MC128 = DFF( VCC $ _MC128, CLOCK, _EQ049, VCC );
_EQ049 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:4 %

```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

```

_MC127 = DFF( _MC128 $ _MC127, CLOCK, _EQ050, VCC );
_EQ050 = !_MC111 & MR;

* |ala_drv:83|wd_cntr:123|:5 *
_MC048 = DFF( _EQ051 $ _MC048, CLOCK, _EQ052, VCC );
_EQ051 = _MC034 & _MC035 & _MC036 & _MC037 & _MC038 & _MC039 &
        _MC041 & _MC042 & _MC043 & _MC044 & _MC045 & _MC046 &
        _MC047 & _MC125 & _MC126 & _MC127 & _MC128;
_EQ052 = !_MC111 & MR;

* |ala_drv:83|wd_cntr:123|:6 *
_MC126 = DFF( _EQ053 $ _MC126, CLOCK, _EQ054, VCC );
_EQ053 = _MC127 & _MC128;
_EQ054 = !_MC111 & MR;

* |ala_drv:83|wd_cntr:123|:7 *
_MC125 = DFF( _EQ055 $ _MC125, CLOCK, _EQ056, VCC );
_EQ055 = _MC126 & _MC127 & _MC128;
_EQ056 = !_MC111 & MR;

* |ala_drv:83|wd_cntr:123|:8 *
_MC047 = DFF( _EQ057 $ _MC047, CLOCK, _EQ058, VCC );
_EQ057 = _MC125 & _MC126 & _MC127 & _MC128;
_EQ058 = !_MC111 & MR;

* |ala_drv:83|wd_cntr:123|:9 *
_MC046 = DFF( _EQ059 $ _MC046, CLOCK, _EQ060, VCC );
_EQ059 = _MC047 & _MC125 & _MC126 & _MC127 & _MC128;
_EQ060 = !_MC111 & MR;

* |ala_drv:83|wd_cntr:123|:10 *
_MC045 = DFF( _EQ061 $ _MC045, CLOCK, _EQ062, VCC );
_EQ061 = _MC046 & _MC047 & _MC125 & _MC126 & _MC127 &
        _MC128;
_EQ062 = !_MC111 & MR;

* |ala_drv:83|wd_cntr:123|:11 *
_MC044 = DFF( _EQ063 $ _MC044, CLOCK, _EQ064, VCC );
_EQ063 = _MC045 & _MC046 & _MC047 & _MC125 & _MC126 & _MC127 &
        _MC128;
_EQ064 = !_MC111 & MR;

* |ala_drv:83|wd_cntr:123|:12 *
_MC043 = DFF( _EQ065 $ _MC043, CLOCK, _EQ066, VCC );
_EQ065 = _MC044 & _MC045 & _MC046 & _MC047 & _MC125 & _MC126 &
        _MC127 & _MC128;
_EQ066 = !_MC111 & MR;

* |ala_drv:83|wd_cntr:123|:13 *
_MC042 = DFF( _EQ067 $ _MC042, CLOCK, _EQ068, VCC );
_EQ067 = _MC043 & _MC044 & _MC045 & _MC046 & _MC047 & _MC125 &
        _MC126 & _MC127 & _MC128;
_EQ068 = !_MC111 & MR;

```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

```
% |ala_drv:83|wd_cntr:123|:14 %
_MC041 = DFF( _EQ069 $ _MC041, CLOCK, _EQ070, VCC );
_EQ069 = _MC042 & _MC043 & _MC044 & _MC045 & _MC046 & _MC047 &
_MC125 & _MC126 & _MC127 & _MC128;
_EQ070 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:15 %
_MC039 = DFF( _EQ071 $ _MC039, CLOCK, _EQ072, VCC );
_EQ071 = _MC041 & _MC042 & _MC043 & _MC044 & _MC045 & _MC046 &
_MC047 & _MC125 & _MC126 & _MC127 & _MC128;
_EQ072 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:16 %
_MC038 = DFF( _EQ073 $ _MC038, CLOCK, _EQ074, VCC );
_EQ073 = _MC039 & _MC041 & _MC042 & _MC043 & _MC044 & _MC045 &
_MC046 & _MC047 & _MC125 & _MC126 & _MC127 & _MC128;
_EQ074 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:17 %
_MC037 = DFF( _EQ075 $ _MC037, CLOCK, _EQ076, VCC );
_EQ075 = _MC038 & _MC039 & _MC041 & _MC042 & _MC043 & _MC044 &
_MC045 & _MC046 & _MC047 & _MC125 & _MC126 & _MC127 &
_MC128;
_EQ076 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:18 %
_MC036 = DFF( _EQ077 $ _MC036, CLOCK, _EQ078, VCC );
_EQ077 = _MC037 & _MC038 & _MC039 & _MC041 & _MC042 & _MC043 &
_MC044 & _MC045 & _MC046 & _MC047 & _MC125 & _MC126 &
_MC127 & _MC128;
_EQ078 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:19 %
_MC035 = DFF( _EQ079 $ _MC035, CLOCK, _EQ080, VCC );
_EQ079 = _MC036 & _MC037 & _MC038 & _MC039 & _MC041 & _MC042 &
_MC043 & _MC044 & _MC045 & _MC046 & _MC047 & _MC125 &
_MC126 & _MC127 & _MC128;
_EQ080 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:20 %
_MC034 = DFF( _EQ081 $ _MC034, CLOCK, _EQ082, VCC );
_EQ081 = _MC035 & _MC036 & _MC037 & _MC038 & _MC039 & _MC041 &
_MC042 & _MC043 & _MC044 & _MC045 & _MC046 & _MC047 &
_MC125 & _MC126 & _MC127 & _MC128;
_EQ082 = !_MC111 & MR;
```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

```

% |ala_drv:83|WD_SEND %
_MC033 = DFF( _EQ083 $ VCC, CLOCK, MR, _EQ084 );
_EQ083 = !DIV_A_B & _MC034 & _MC035 & _MC036 & _MC037 & _MC038 &
        _MC039 & _MC041 & _MC042 & _MC043 & _MC044 & _MC045 &
        _MC046 & _MC047 & _MC048 & _MC125 & _MC126 & _MC127 &
        _MC128 & WD_EN
        # DIV_A_B & _MC042 & _MC043 & _MC044 & _MC045 & _MC046 &
        _MC047 & _MC125 & _MC126 & _MC127 & _MC128 & WD_EN
        # !_MC033 & WD_EN;
_EQ084 = _X002;
_X002 = EXP( !_MC033 & _MC111 );

% |ala_drv:83|:2 %
_MC124 = DFF( _MC033 $ GND, _MC102, _EQ085, VCC );
_EQ085 = MR & _X003;
_X003 = EXP( _MC047 & _MC125 & _MC126 & _MC127 & _MC128 );

% |ala_drv:83|:3 %
_MC123 = DFF( GND $ VCC, DSTRB, _EQ086, VCC );
_EQ086 = MR & _X003;

% |ala_drv:83|:96 %
_MC122 = DFF( GND $ VCC, VLTN, _EQ087, VCC );
_EQ087 = MR & _X003;

% |rx_cir_r:82|ad_dmx_r:99|:19 %
_MC016 = DFF( DASD $ GND, !OP_IN, _MC008, VCC );

% |rx_cir_r:82|d_dmx_r:102|:26 %
_MC015 = DFF( !_MC013 $ GND, DATA_IN, _EQ088, VCC );
_EQ088 = _MC001 & _MC003 & MR;

% |rx_cir_r:82|ds_det_r:60|:2 %
_MC014 = DFF( GND $ VCC, _EQ089, _EQ090, VCC );
_EQ089 = _X004;
_X004 = EXP( DATA_IN & !_MC014 & SER_IN );
_EQ090 = _MC001 & MR & !OP_IN & STAT_IN;

% |rx_cir_r:82|ds_det_r:60|:3 %
_MC013 = DFF( !DATA_IN $ GND, _MC014, _EQ091, VCC );
_EQ091 = _MC001 & MR & !OP_IN & STAT_IN;

% |rx_cir_r:82|s_dmx_r:101|:26 %
_MC012 = DFF( !_MC013 $ GND, SER_IN, _EQ092, VCC );
_EQ092 = _MC001 & _MC004 & MR;

% |rx_cir_r:82|s_dmx_r:101|:41 %
_MC011 = DFF( _EQ093 $ GND, STAT_IN, _EQ094, VCC );
_EQ093 = DASD & _MC096;
_EQ094 = _MC004 & MR;

```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)


```
% |rx_cir_r:82|s_dmx_r:101|:42 %
_MC096 = DFF( _EQ095 $ GND, _MC004, MR, VCC );
_EQ095 = !BUS_INP & BUS_IN0 & BUS_IN1 & BUS_IN2 & BUS_IN3 &
        BUS_IN4 & BUS_IN5 & BUS_IN6 & BUS_IN7 & _MC010 &
        !STAT_IN;

% |rx_cir_r:82|s_dmx_r:101|:43 %
_MC010 = DFF( _EQ096 $ GND, _MC004, MR, VCC );
_EQ096 = _MC007 & !STAT_IN;

% |tx_cir_r:109|as_syn_r:93|:58 %
_MC112 = DFF( _EQ097 $ !_MC112, !CLOCK, MR, VCC );
_EQ097 = _MC009 & _MC019 & _MC020 & _MC024 & _MC032 & _MC033 &
        _MC077 & _MC079 & _MC101 & _MC103 & _MC106 & _MC109 &
        !_MC112 & _MC114;

% |tx_cir_r:109|as_syn_r:93|:65 %
_MC111 = DFF( _MC112 $ GND, !CLOCK, _EQ098, VCC );
_EQ098 = MR & _X005;
_X005 = EXP( _MC009 & _MC019 & _MC020 & _MC024 & _MC032 &
        _MC033 & _MC077 & _MC079 & _MC101 & _MC103 & _MC106 &
        _MC109 & _MC114 );

% |tx_cir_r:109|bt_mx_r:75|:4 %
_MC121 = DFF( _MC117 $ GND, _EQ099, MR, VCC );
_EQ099 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:75|:5 %
_MC118 = DFF( _MC121 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|bt_mx_r:75|:33 %
_MC009 = MCELL( !_MC121 $ _MC118 );

% |tx_cir_r:109|bt_mx_r:75|:36 %
_MC095 = DFF( _EQ100 $ GND, _EQ101, MR, VCC );
_EQ100 = _X006;
_X006 = EXP( _X007 & _X008 & _X009 );
_X007 = EXP( !_MC029 & _X006 );
_X008 = EXP( !BUS_IN0 & _MC029 & _MC030 );
_X009 = EXP( !_MC030 & _X006 );
_EQ101 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:75|:41 %
_MC117 = DFF( !OP_IN $ GND, CLOCK, MR, VCC );

% |tx_cir_r:109|bt_mx_r:76|:4 %
_MC116 = DFF( _MC113 $ GND, _EQ102, MR, VCC );
_EQ102 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:76|:5 %
_MC115 = DFF( _MC116 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|bt_mx_r:76|:33 %
_MC114 = MCELL( !_MC116 $ _MC115 );
```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

```
% |tx_cir_r:109|bt_mx_r:76|:36 %
_MC094 = DFF( _EQ103 $ GND, _EQ104, MR, VCC );
_EQ103 = _X010;
_X010 = EXP( _X011 & _X012 & _X013 );
_X011 = EXP( !_MC029 & _X010 );
_X012 = EXP( !BUS_IN1 & _MC029 & _MC030 );
_X013 = EXP( !_MC030 & _X010 );
_EQ104 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:76|:41 %
_MC113 = DFF( !ADR_IN $ GND, CLOCK, MR, VCC );

% |tx_cir_r:109|bt_mx_r:77|:4 %
_MC064 = DFF( _MC063 $ GND, _EQ105, MR, VCC );
_EQ105 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:77|:5 %
_MC080 = DFF( _MC064 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|bt_mx_r:77|:33 %
_MC079 = MCELL( !_MC064 $ _MC080 );

% |tx_cir_r:109|bt_mx_r:77|:36 %
_MC093 = DFF( _EQ106 $ GND, _EQ107, MR, VCC );
_EQ106 = _X014;
_X014 = EXP( _X015 & _X016 & _X017 );
_X015 = EXP( !_MC029 & _X014 );
_X016 = EXP( !BUS_IN2 & _MC029 & _MC030 );
_X017 = EXP( !_MC030 & _X014 );
_EQ107 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:77|:41 %
_MC063 = DFF( !SEL_IN $ GND, CLOCK, MR, VCC );

% |tx_cir_r:109|bt_mx_r:78|:4 %
_MC062 = DFF( _MC061 $ GND, _EQ108, MR, VCC );
_EQ108 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:78|:5 %
_MC078 = DFF( _MC062 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|bt_mx_r:78|:33 %
_MC077 = MCELL( !_MC062 $ _MC078 );

% |tx_cir_r:109|bt_mx_r:78|:36 %
_MC092 = DFF( _EQ109 $ GND, _EQ110, MR, VCC );
_EQ109 = _X018;
_X018 = EXP( _X019 & _X020 & _X021 );
_X019 = EXP( !_MC029 & _X018 );
_X020 = EXP( !BUS_IN5 & _MC029 & _MC030 );
_X021 = EXP( !_MC030 & _X018 );
_EQ110 = CLOCK & !_MC112;
```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

```
% |tx_cir_r:109|bt_mx_r:78|:41 %
_MC061 = DFF( |STAT_IN $ GND, CLOCK, MR, VCC );

% |tx_cir_r:109|bt_mx_r:80|:4 %
_MC060 = DFF( _MC058 $ GND, _EQ111, MR, VCC );
_EQ111 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:80|:5 %
_MC110 = DFF( _MC060 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|bt_mx_r:80|:33 %
_MC109 = MCELL( !_MC060 $ _MC110 );

% |tx_cir_r:109|bt_mx_r:80|:36 %
_MC059 = DFF( _EQ112 $ GND, _EQ113, MR, VCC );
_EQ112 = _X022;
_X022 = EXP( _X023 & _X024 & _X025 );
_X023 = EXP( !_MC029 & _X022 );
_X024 = EXP( !BUS_IN7 & _MC029 & _MC030 );
_X025 = EXP( !_MC030 & _X022 );
_EQ113 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:80|:41 %
_MC058 = DFF( |DISC_IN $ GND, CLOCK, MR, VCC );

% |tx_cir_r:109|bt_mx_r:81|:4 %
_MC108 = DFF( _MC105 $ GND, _EQ114, MR, VCC );
_EQ114 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:81|:5 %
_MC107 = DFF( _MC108 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|bt_mx_r:81|:33 %
_MC106 = MCELL( !_MC108 $ _MC107 );

% |tx_cir_r:109|bt_mx_r:81|:36 %
_MC057 = DFF( _EQ115 $ GND, _EQ116, MR, VCC );
_EQ115 = _X026;
_X026 = EXP( _X027 & _X028 & _X029 );
_X027 = EXP( !_MC029 & _X026 );
_X028 = EXP( !BUS_INP & _MC029 & _MC030 );
_X029 = EXP( !_MC030 & _X026 );
_EQ116 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:81|:41 %
_MC105 = DFF( |MRK0_IN $ GND, CLOCK, MR, VCC );

% |tx_cir_r:109|ds_dn_r:91|SEND %
_MC032 = DFF( _EQ117 $ _MC032, CLOCK, MR, _EQ118 );
_EQ117 = DATA_IN & DAT_IN_D & _MC027 & _MC028 & _MC031 &
_MC032 & SER_IN & SER_IN_D;
_EQ118 = _X030;
_X030 = EXP( !_MC032 & _MC111 );
```

This Sheet Has Been Replaced



```

% |tx_cir_r:109|ds_dn_r:91|:81 %
_MC031 = DFF( _EQ119 $ VCC, CLOCK, _EQ120, VCC );
_EQ119 = !_MC013 & !_MC031;
_EQ120 = _MC032 & MR;

% |tx_cir_r:109|ds_dn_r:91|:104 %
_MC030 = DFF( GND $ GND, !DAT_IN_D, VCC, _EQ121 );
_EQ121 = _MC013 & !_MC026;

% |tx_cir_r:109|ds_dn_r:91|:106 %
_MC029 = DFF( GND $ GND, !SER_IN_D, VCC, _EQ122 );
_EQ122 = _MC013 & !_MC025;

% |tx_cir_r:109|ds_dn_r:91|:136 %
_MC028 = DFF( _MC027 $ GND, CLOCK, _EQ123, VCC );
_EQ123 = DATA_IN & DAT_IN_D & _MC031 & SER_IN & SER_IN_D;

% |tx_cir_r:109|ds_dn_r:91|:137 %
_MC027 = DFF( _EQ124 $ GND, CLOCK, _EQ125, VCC );
_EQ124 = DATA_IN & DAT_IN_D & _MC031 & SER_IN & SER_IN_D;
_EQ125 = DATA_IN & DAT_IN_D & _MC031 & SER_IN & SER_IN_D;

% |tx_cir_r:109|ds_mx_r:97|RELEASE %
_MC026 = DFF( !DAT_IN_D $ GND, _EQ126, MR, VCC );
_EQ126 = CLOCK & !_MC112;

% |tx_cir_r:109|ds_mx_r:97|:57 %
_MC101 = DFF( GND $ GND, _MC026, MR, _EQ127 );
_EQ127 = _X031;
_X031 = EXP( _MC104 & _MC111 );

% |tx_cir_r:109|ds_mx_r:97|:58 %
_MC104 = DFF( _EQ128 $ VCC, CLOCK, MR, VCC );
_EQ128 = _MC101 & _MC103;

% |tx_cir_r:109|ds_mx_r:97|:72 %
_MC091 = DFF( _EQ129 $ GND, _EQ130, MR, VCC );
_EQ129 = _X032;
_X032 = EXP( _X033 & _X034 & _X035 );
_X033 = EXP( !_MC029 & _X032 );
_X034 = EXP( !BUS_IN4 & _MC029 & _MC030 );
_X035 = EXP( !_MC030 & _X032 );
_EQ130 = CLOCK & !_MC112;

% |tx_cir_r:109|ds_mx_r:97|:76 %
_MC103 = DFF( _EQ131 $ VCC, !_MC026, MR, _EQ132 );
_EQ131 = _MC005 & !_MC013;
_EQ132 = _X031;

% |tx_cir_r:109|ds_mx_r:98|RELEASE %
_MC025 = DFF( !SER_IN_D $ GND, _EQ133, MR, VCC );
_EQ133 = CLOCK & !_MC112;

```

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

```
% |tx_cir_r:109|ds_mx_r:98|:57 %
_MC024 = DFF( GND $ GND, _MC025, MR, _EQ134 );
_EQ134 = _X036;
_X036 = EXP( _MC023 & _MC111 );

% |tx_cir_r:109|ds_mx_r:98|:58 %
_MC023 = DFF( _EQ135 $ VCC, CLOCK, MR, VCC );
_EQ135 = _MC019 & _MC024;

% |tx_cir_r:109|ds_mx_r:98|:72 %
_MC090 = DFF( _EQ136 $ GND, _EQ137, MR, VCC );
_EQ136 = _X037;
_X037 = EXP( _X038 & _X039 & _X040 );
_X038 = EXP( !_MC029 & _X037 );
_X039 = EXP( !BUS_IN3 & _MC029 & _MC030 );
_X040 = EXP( !_MC030 & _X037 );
_EQ137 = CLOCK & !_MC112;

% |tx_cir_r:109|ds_mx_r:98|:76 %
_MC019 = DFF( _EQ138 $ VCC, !_MC025, MR, _EQ139 );
_EQ138 = _MC005 & !_MC013;
_EQ139 = _X036;

% |tx_cir_r:109|req_mx_r:99|:4 %
_MC076 = DFF( _MC075 $ GND, _EQ140, MR, VCC );
_EQ140 = CLOCK & !_MC112;

% |tx_cir_r:109|req_mx_r:99|:5 %
_MC018 = DFF( _MC076 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|req_mx_r:99|:33 %
_MC020 = MCELL( _EQ141 $ VCC );
_EQ141 = !_MC018 & !_MC025 & !_MC026 & _MC076
# _MC018 & !_MC025 & !_MC026 & !_MC076;

% |tx_cir_r:109|req_mx_r:99|:36 %
_MC089 = DFF( _EQ142 $ GND, _EQ143, MR, VCC );
_EQ142 = _X041;
_X041 = EXP( _X042 & _X043 & _X044 );
_X042 = EXP( !_MC029 & _X041 );
_X043 = EXP( !BUS_IN6 & _MC029 & _MC030 );
_X044 = EXP( !_MC030 & _X041 );
_EQ143 = CLOCK & !_MC112;

% |tx_cir_r:109|req_mx_r:99|:41 %
_MC075 = DFF( !REQ_IN $ GND, CLOCK, MR, VCC );
```

```
%
Shareable Expanders that are Duplicated in Multiple LABs:
(none)
```

```
%
- Copyrighted April 6, 1992 by FiberCom, Inc.
```





CLAIMS

What is claimed is:

1. An apparatus for use in connecting a first computer device and a second computer device through a dual line cable assembly, the first and second computer devices having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:
 - a first bus and tag sub-assembly including:
 - a first connector for mating with the first interface in the first device,
 - a first multi-line cable assembly having a first end and a second end, the first end connected to the first connector assembly,
 - a first converter adapter connected to the multi-line cable assembly second end,
 - a second connector connected to the converter adapter, the second connector assembly for mating with the second interface in the first device, and
 - the first converter adapter including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in the first device and sending such multiplexed serial information over a first line of the dual line cable assembly to the second computer device and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly and sending such parallel and demultiplexed information to the first and second interfaces of the first device.
2. The apparatus of Claim 1, further comprising:
 - a dual line cable assembly having a first line and a second line, a first end of the dual line cable assembly connected to the first converter adapter; and

This Sheet Has Been Replaced





PCT/US 93/06908

-91-

RO/US 10 NOV 1993

a second bus and tag sub-assembly including:

a third connector for mating with the first interface in the second device,

a second multi-line cable assembly having a first
5 end and a second end, the first end connected to the third connector,

a second converter adapter connected to the second cable assembly second end and a second end of the dual line cable assembly,

10 a fourth connector connected to the second converter adapter, the fourth connector for mating with the second interface in the second device, and

the second converter adapter including integrated circuit means for (1) multiplexing and then serializing
15 parallel bus and tag information received from the first and second interfaces in the second device and sending such multiplexed serial information over the second line of the dual line cable assembly and (2) deserializing and then demultiplexing serial bus and tag information received through
20 the second line of the dual line cable assembly and sending such parallel and demultiplexed information to the first and second interfaces of the second device.

3. The apparatus of Claim 1, wherein the bus and tag subassembly is electro-optic.

25 4. The apparatus of Claim 2, wherein the bus and tag subassemblies are electro-optic and the dual line cable assembly is a fiber optic cable assembly.

5. The apparatus of Claim 2, wherein the dual line cable assembly is an electrical cable assembly.

30 6. The apparatus of Claim 1, wherein the first and/or the second connector is a bus or tag adapter which converts a first or external wiring/terminal connection scheme, grid or geometry

SUBSTITUTE SHEET (RULE 26)

This Sheet Has Been Replaced





to a second or internal wiring/terminal scheme, grid or geometry.

7. The apparatus of Claim 2, wherein the first, the second, the third and/or the fourth connectors are bus or tag adapters
5 which convert a first or external wiring/terminal connection scheme, grid or geometry to a second or internal wiring/terminal scheme, grid or geometry.

8. The apparatus of Claim 1, wherein the second connector
10 connected to the first converter adapter can be contained within a box approximately 1 inch (2.54 centimeters) by 4 inches (10.16 centimeters) by 4.5 inches (11.43 centimeters).

9. The apparatus of Claim 1, wherein the integrated circuit means further emulates TAG signals to reduce apparatus including cable induced delays.

15 10. The apparatus of Claim 1, wherein the integrated circuit means comprises:

an erasable programmable logic device, a nonerasable programmable logic device, or a custom design programmable logic device;

20 a transmitter section including a serializer for receiving a plurality of parallel multiplexed signals from the programmable device over conductive paths, encoding the signals, serializing the signals, converting the signals to emitter coupled logic (ECL) levels and shifting the converted
25 signals out on a conductive path; and

a receiver section including a deserializer for receiving serialized signals and continuously deserializing, decoding and latching parallel data through parallel conductive paths to the programmable device.

30 11. The apparatus of Claim 10, wherein the converter adapter further comprises:





PCT/US 93/06908
RO/US 10 NOV 1993

a printed circuit board with conductive paths;
one or more fifth connector connecting the second end
of the first multi-line cable assembly and some of the
conductive paths;

5 one or more sixth connector connecting the second
connector and some of the conductive paths;

one or more seventh connector for connecting some of
the conductive paths to one or more power sources;

a receiver connector connected to some of the
10 conductive paths and for connecting to a connector on one end
of the dual line cable assembly to receive signals over one of
the lines in the dual line cable assembly; and

a transmitter connector connected to some of the
conductive paths and for connecting to the connector on the end
15 of the cable assembly to send signals over the other one of the
lines in the dual line cable assembly.

12. The apparatus of Claim 11, wherein the converter adapter
further comprises:

terminator networks connected by some of the paths to
20 the fifth and sixth connectors; and

line drivers/receivers connected by some of the paths
to the terminator networks and to programmable device.

13. The apparatus of Claim 12, wherein the transmitter section
further comprises:

25 an ECL to current translator connected by paths to the
serializer and the transmitter connector.

14. The apparatus of Claim 13, wherein the receiver section
further comprises:

a photodiode and preamplifier for converting optical
30 light pulses received from the dual line cable assembly to an
analog voltage output; and

a data quantizer connected by paths to the photodiode
and preamplifier and the deserializer, the data quantizer

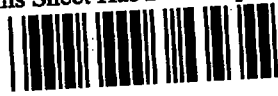




amplifies and converts the analog voltage signals to a constant level output that is ECL compatible.

15. An apparatus for use in connecting a first computer device and a second computer device through a dual line cable assembly, the first and second computer devices having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:
- a first connector for connecting to the second interface in the first device;
 - 10 a converter adapter adjacent and connected to the first connector, the converter adapter comprising:
 - a printed circuit board with conductive paths;
 - one or more second connector connected to some of the conductive paths and for receiving signals from the
 - 15 first interface in the first device;
 - one or more third connector connecting the first connector and some of the conductive paths;
 - one or more fourth connector for connecting some of the conductive paths to one or more power sources;
 - 20 a receiver connector connected to some of the conductive paths and for connecting to a connector on one end of the dual line cable assembly to receive signals over one of the lines in the dual line cable assembly; and
 - a transmitter connector connected to some of the
 - 25 conductive paths and for connecting to the connector on the end of the cable assembly to send signals over the other one of the lines in the dual line cable assembly;
 - terminator networks connected by some of the paths to the second and third connectors;
 - 30 line drivers/receivers connected by some of the paths to the terminator networks;
 - integrated circuit means connected to the line drivers/receivers and for (1) multiplexing and then serializing parallel bus and tag information received from the first and
 - 35 second interfaces in the first device and sending such multiplexed serial information over a first line of the dual





PCT/US 93/06908
R O / U S 10 NOV 1993

-95-

line cable assembly and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly from the second computer device and sending such parallel and demultiplexed
5 information to the first and second interfaces of the first device, wherein the integrated circuit means comprises:

an erasable programmable logic device, a nonerasable programmable logic device, or a custom design programmable logic device, the device connected by some of the
10 paths to the line drivers/receivers;

a transmitter section including;

a serializer for receiving a plurality of parallel multiplexed signals from the programmable device over conductive paths, encoding the signals, serializing the
15 signals, converting the signals to emitter coupled logic (ECL) levels and shifting the converted signals out on a conductive path; and

an ECL to current translator connected by paths to the serializer and the transmitter connector; and

20 a receiver section including a deserializer for receiving serialized signals and continuously deserializing, decoding and latching parallel data through parallel conductive paths to the programmable device.

16. An apparatus for use in connecting a first computer device
25 and a second computer device through a dual line cable assembly, the first and second computer devices having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:

a first bus and tag sub-assembly including:

30 a first connector for mating with the first interface in the first device,

a first converter adapter connected to the first connector,

a first multi-line cable assembly having a first
35 end and a second end, the first end connected to the first converter adapter,

SUBSTITUTE SHEET (RULE 26)





- a second converter adapter connected to the multi-line cable assembly second end, a second connector connected to the second converter adapter, the second connector assembly for mating with the second interface in the first device, and
- 5 the first and second converter adapter including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in the first device and sending such multiplexed serial information over a first line of the
- 10 dual line cable assembly to the second computer device and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly and sending such parallel and demultiplexed information to the first and second interfaces of the first
- 15 device.
17. An apparatus for use in connecting a first computer device and a second computer device through a pair of dual line cable assemblies, the first and second computer devices having first and second electrical interfaces having a plurality of rows and
- 20 columns of bus and tag inputs and outputs, comprising:
- a first connector for mating with the first interface in the first device;
 - a first converter adapter connected to the first connector;
 - 25 a second connector for mating with the first interface in the second device;
 - a second converter adapter connected to the second connector;
 - a first dual line cable assembly having a first line
 - 30 and a second line, a first end of the first dual line cable assembly connected to the first converter adapter and a second end of the first dual line cable assembly connected to the second converter adapter;
 - a third connector for mating with the second interface
 - 35 in the first device;



a third converter adapter connected to the third connector;

a fourth connector for mating with the second interface in the second device;

5 a fourth converter adapter connected to the fourth connector;

a second dual line cable assembly having a first line and a second line, a first end of the second dual line cable assembly connected to the third converter adapter and a second
10 end of the second dual line cable assembly connected to the fourth converter adapter; and

the converter adapters including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and second
15 interfaces in either the first device or the second device and sending such multiplexed serial information over the dual line cable assemblies and (2) deserializing and then demultiplexing serial bus and tag information received through the dual line cable assemblies and sending such parallel and demultiplexed
20 information to the first and second interfaces of the either the first device or the second device.

This Sheet Has Been Replaced



* C L N S *

SUBSTITUTE SHEET (RULE 26)

TITLE OF THE INVENTION

ELECTRO-OPTIC APPARATUS FOR CONNECTING COMPUTER DEVICES

ABSTRACT OF THE DISCLOSURE

The present invention relates to an apparatus for
5 connecting computer devices and, more specifically, where the
apparatus comprises a first connector, a cable assembly, a
converter adapter and a second connector.

This Sheet Has Been Replaced



SUBSTITUTE SHEET (RULE 26)

1/10

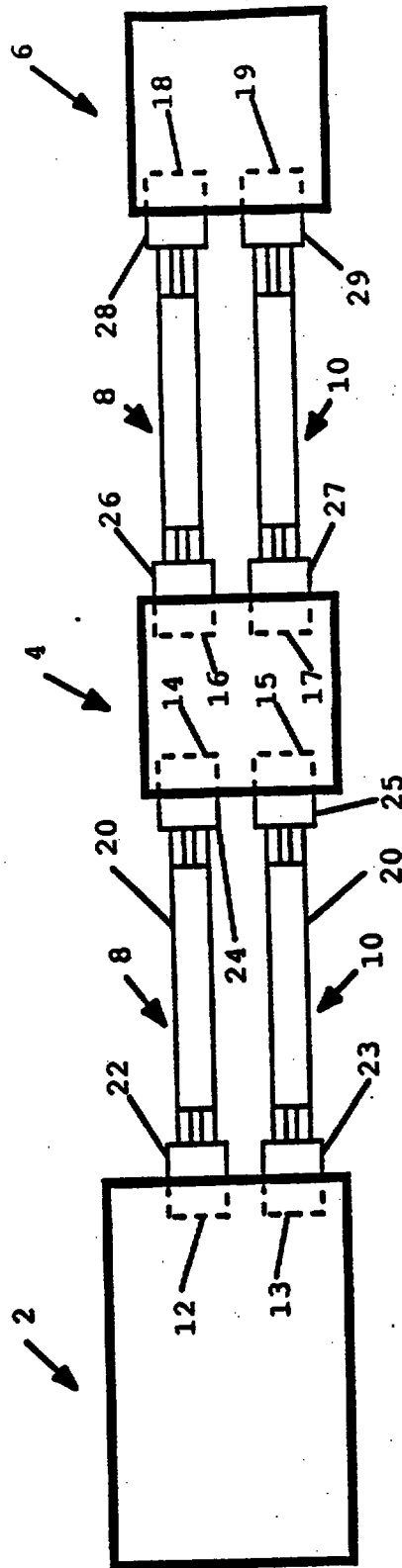


Fig. 1

This Sheet Has Been Replaced



2/10

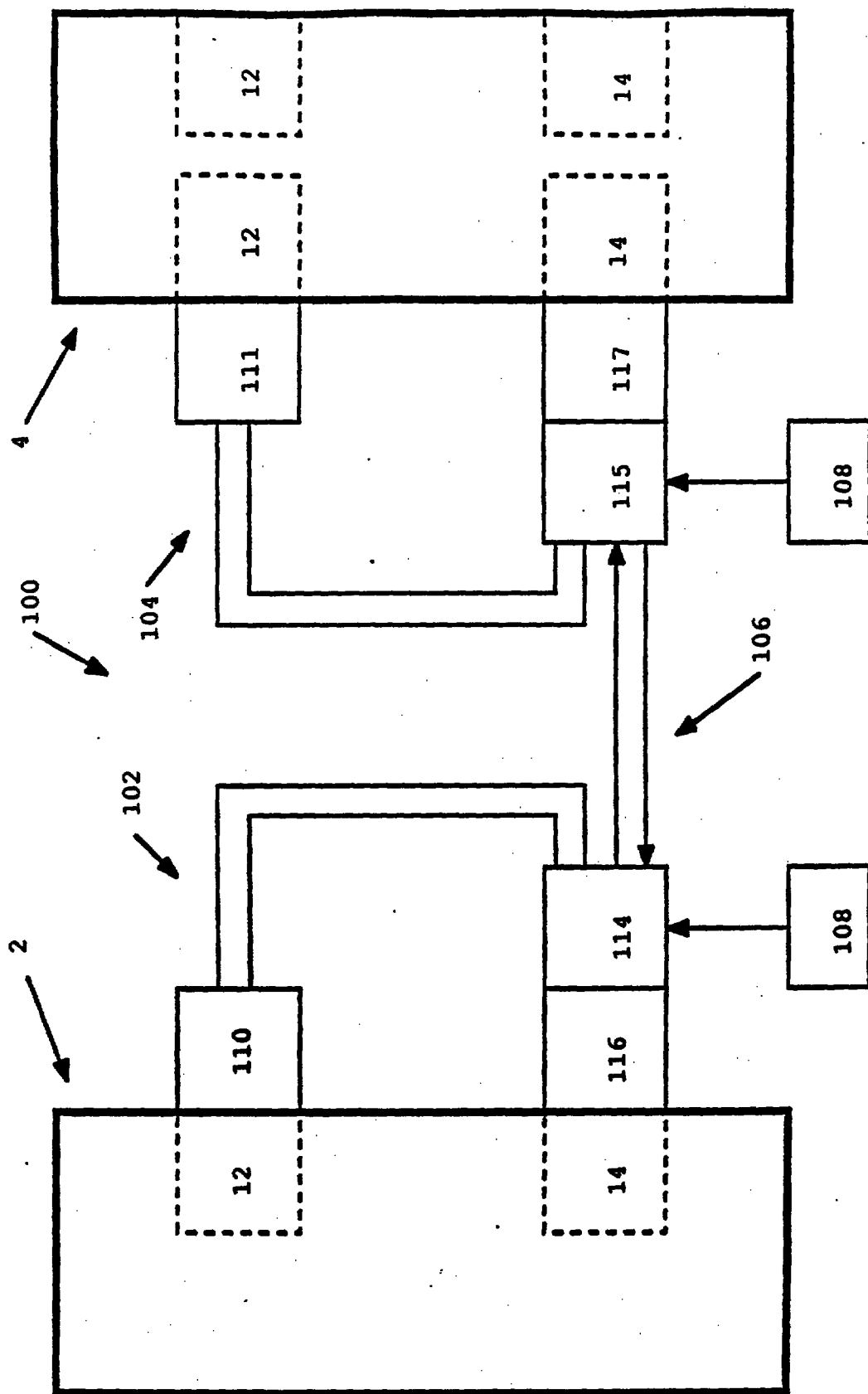
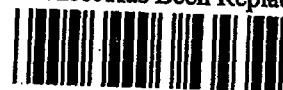


Fig. 2



3/10

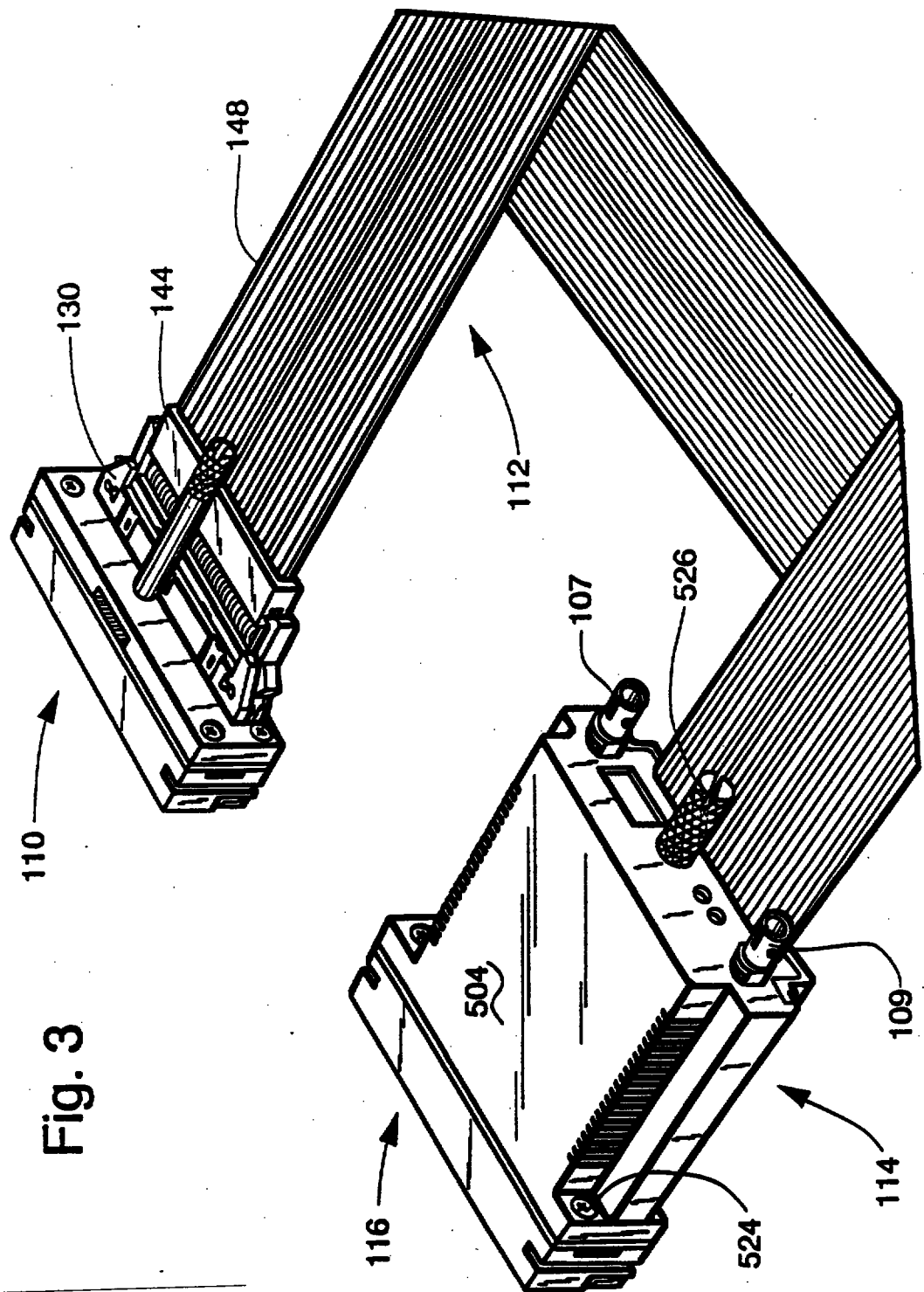


Fig. 3

This Sheet Has Been Replaced



4/10

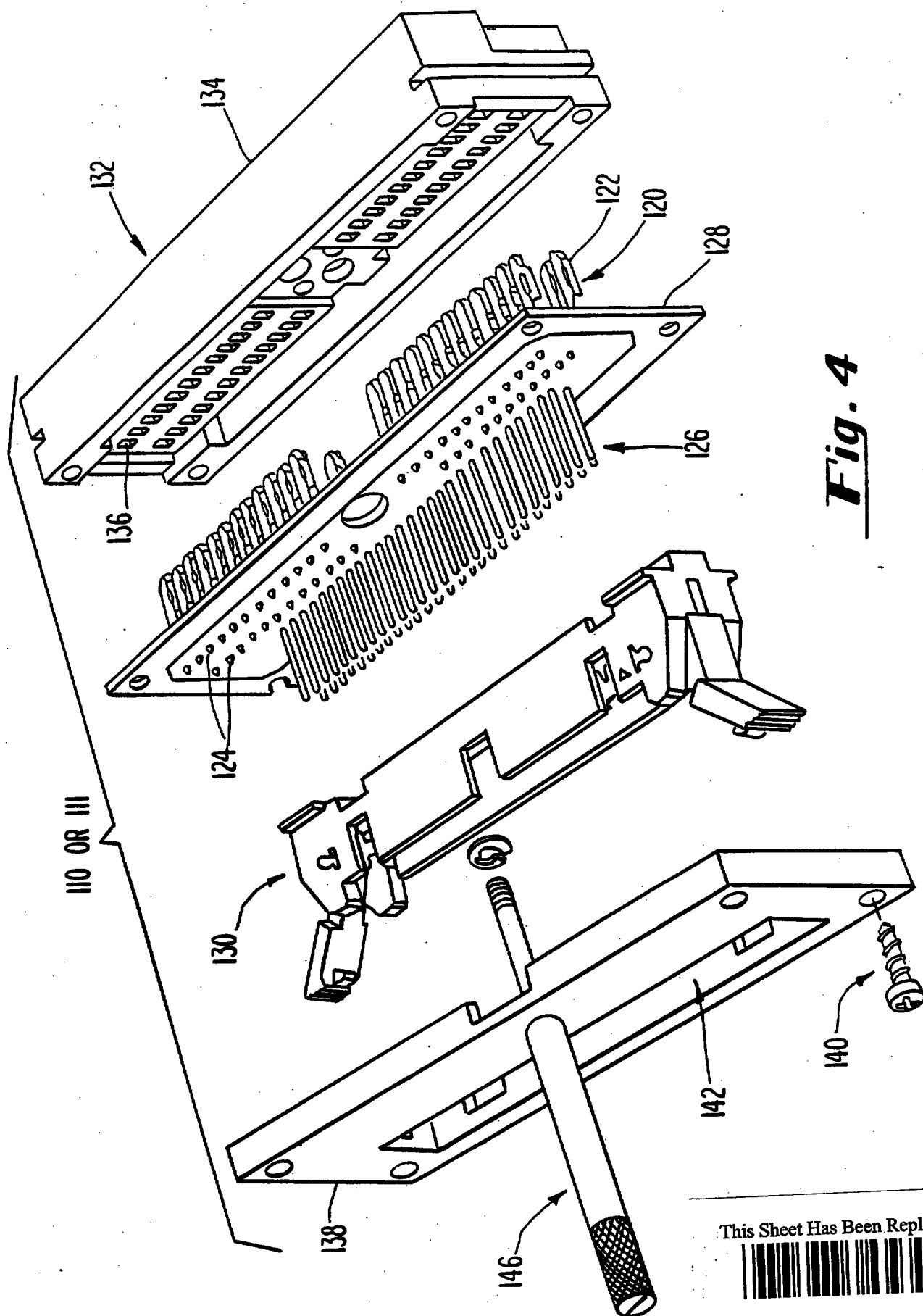


Fig. 4

This Sheet Has Been Replaced



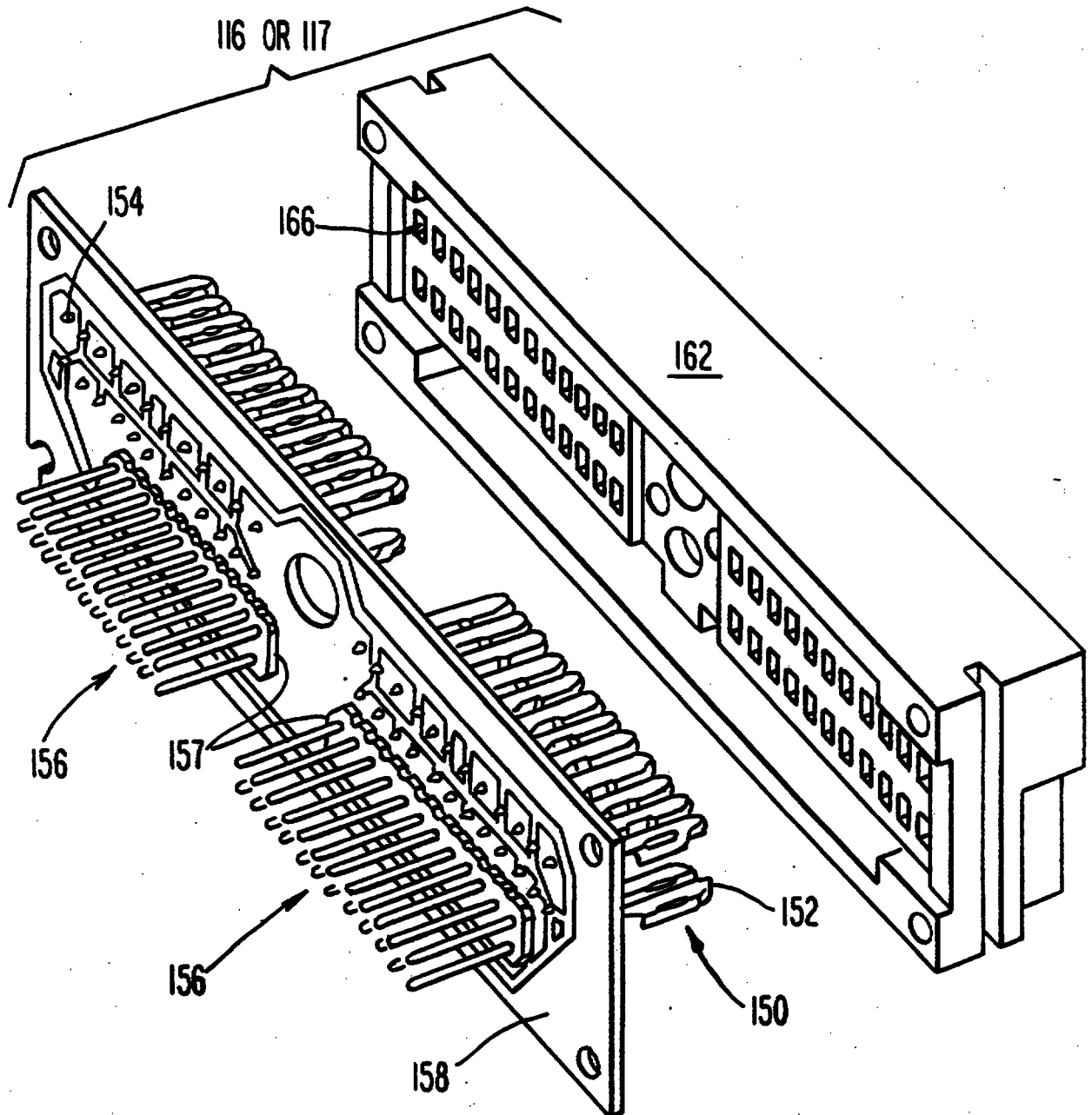
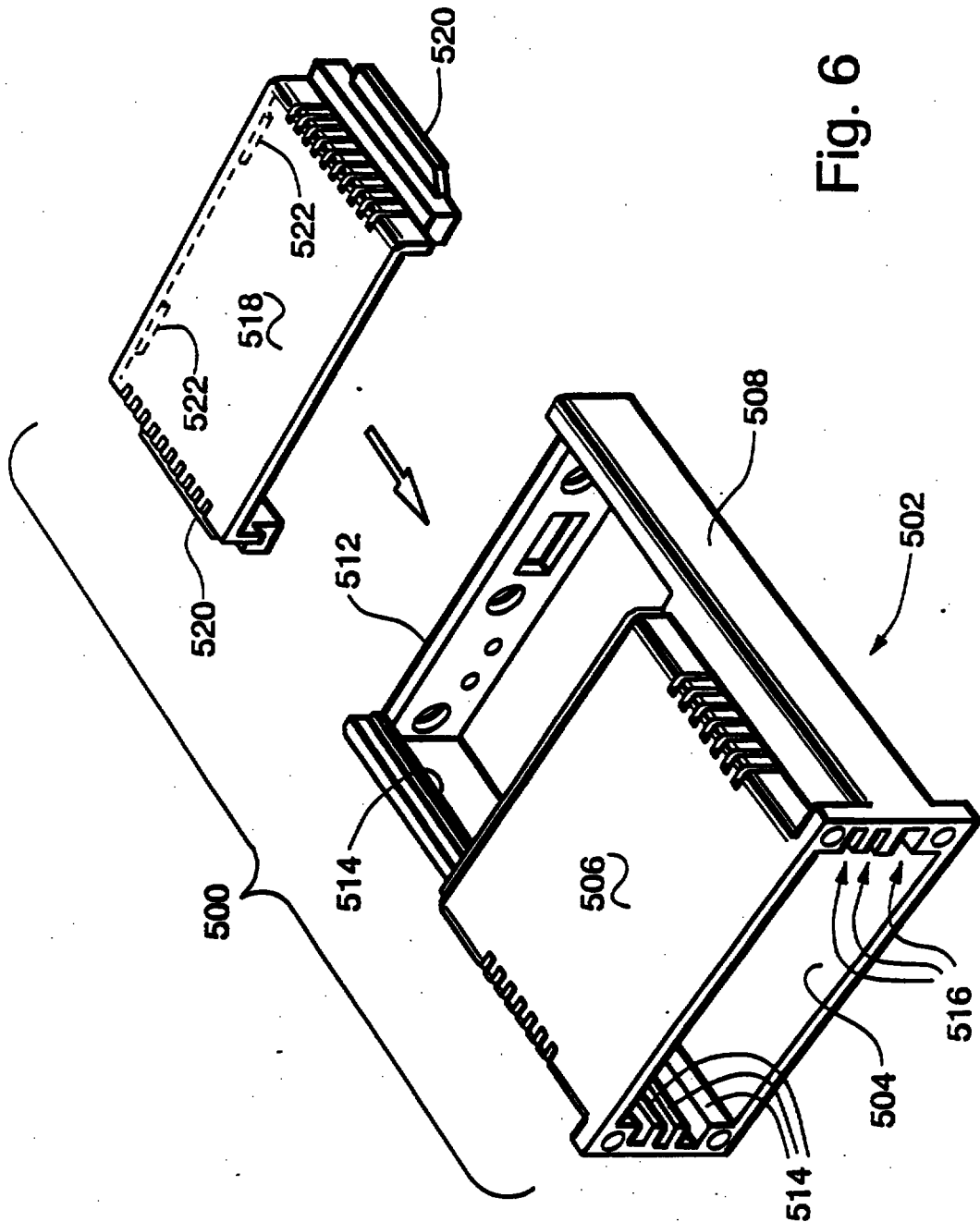


Fig. 5

This Sheet Has Been Replaced



6



This Sheet Has Been Replaced





7/10

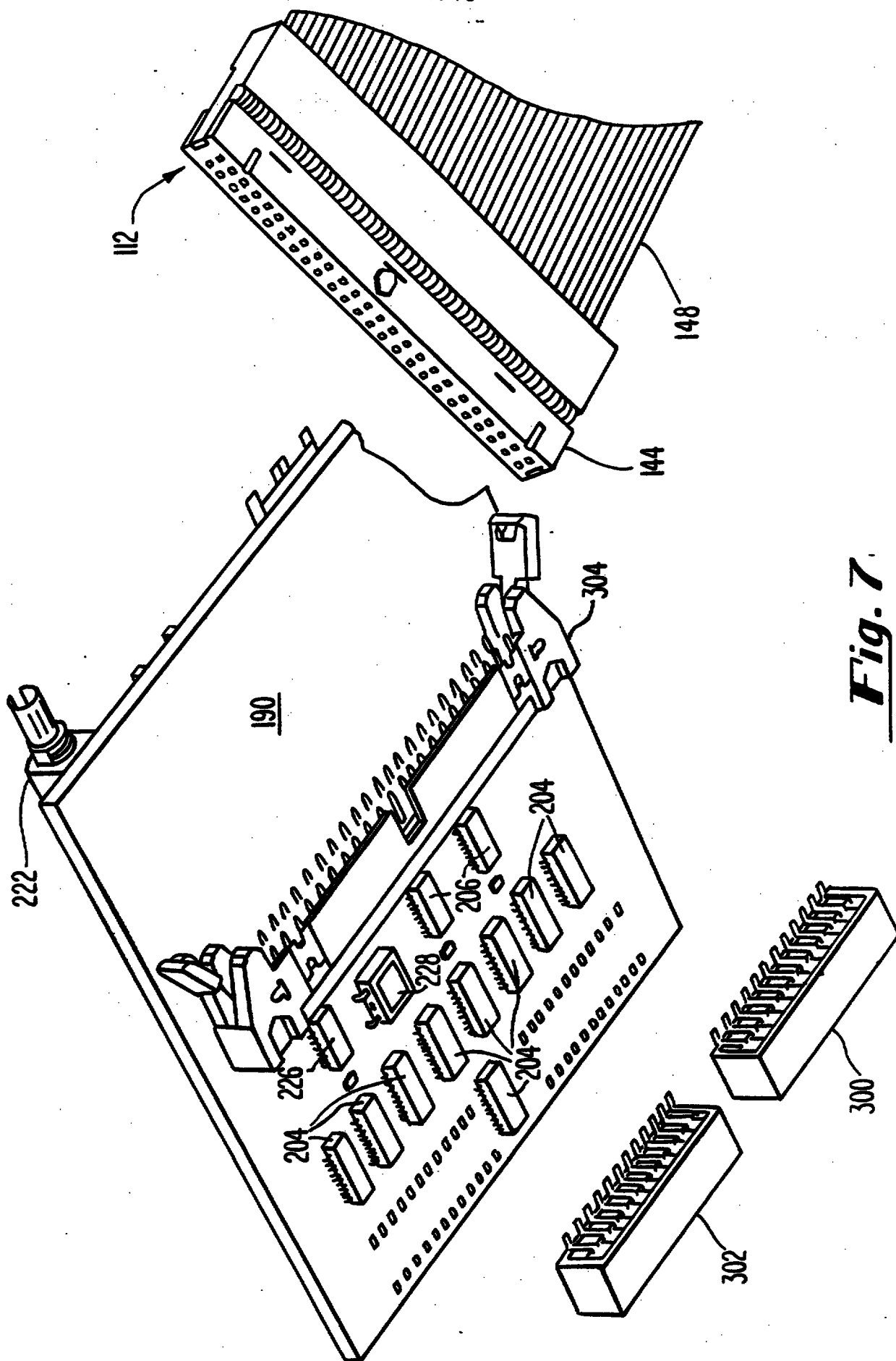


Fig. 7

This Sheet Has Been Replaced

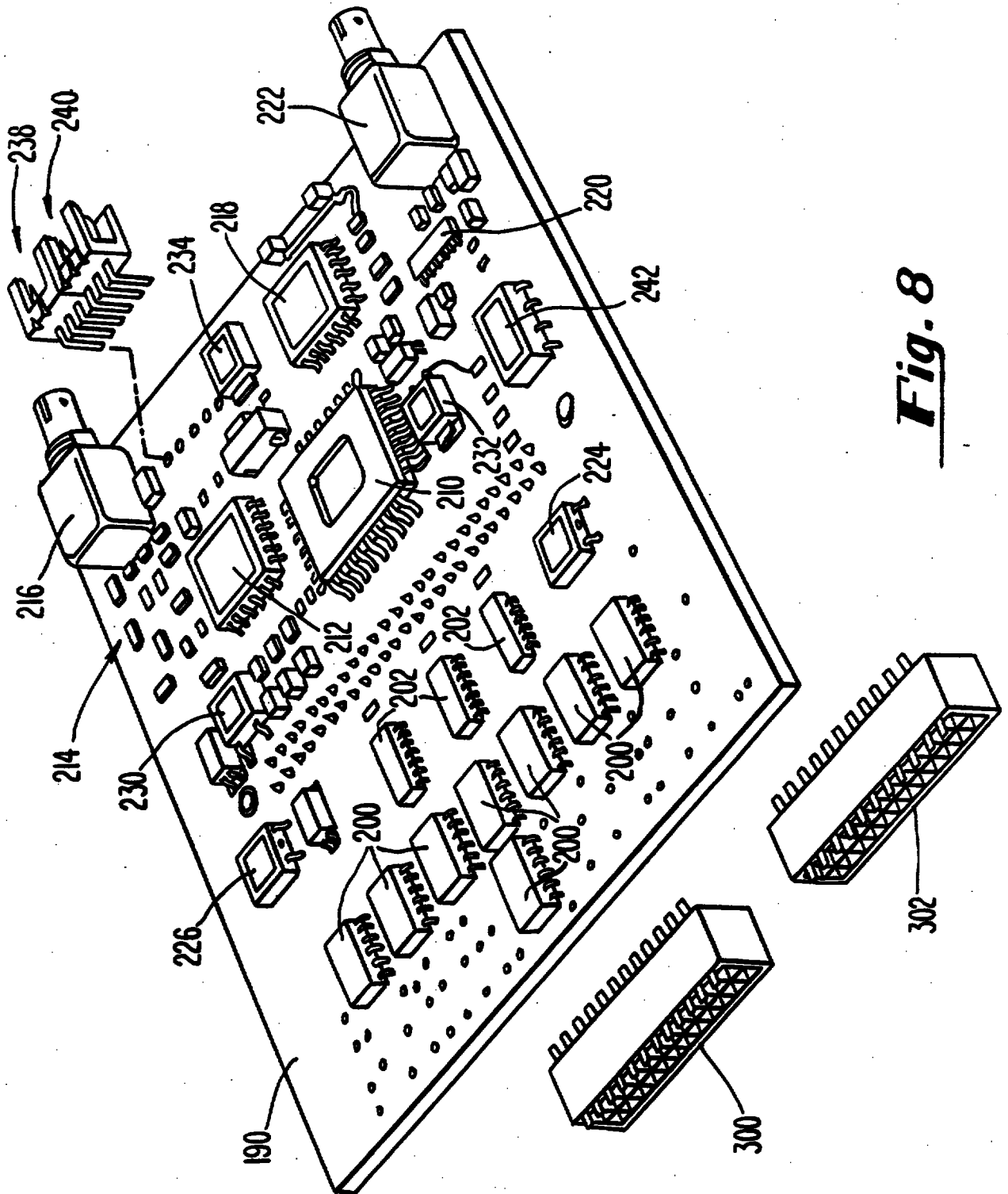
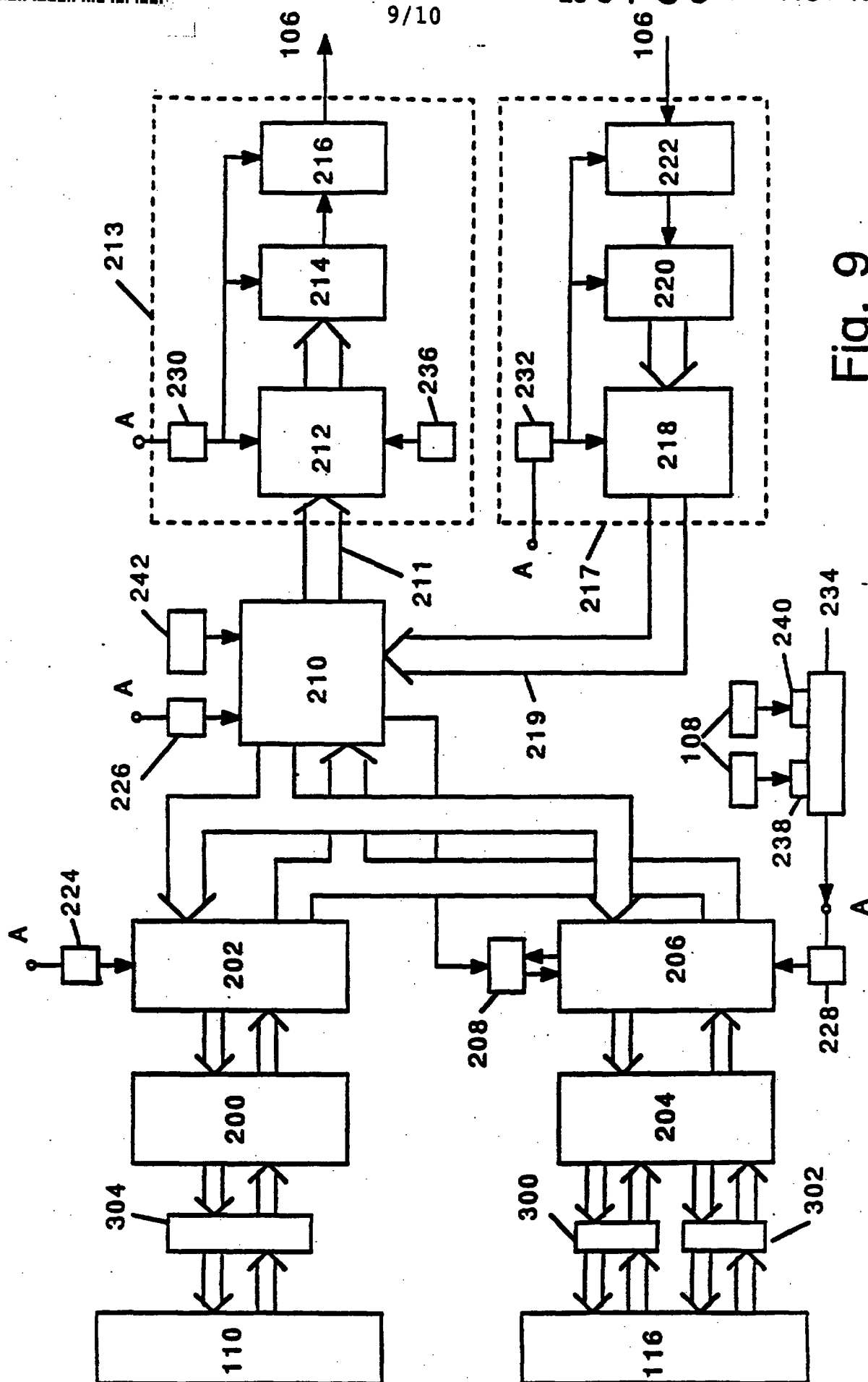


Fig. 8





10/10

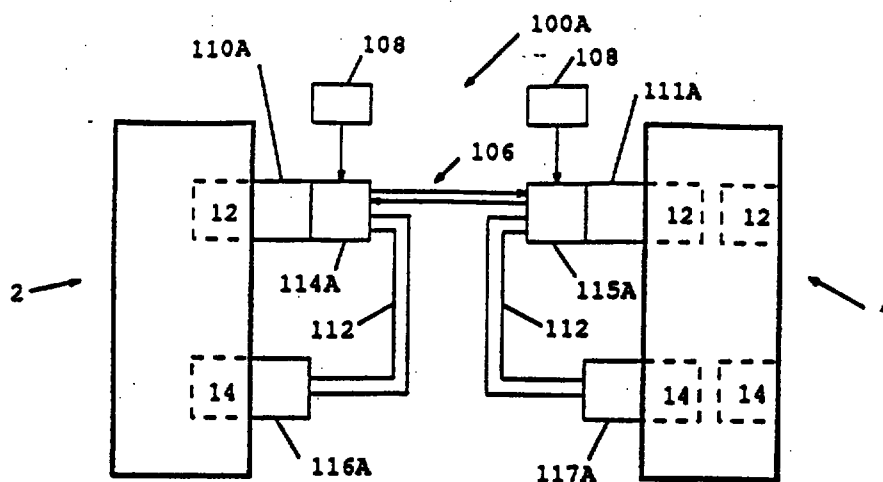


Fig. 10

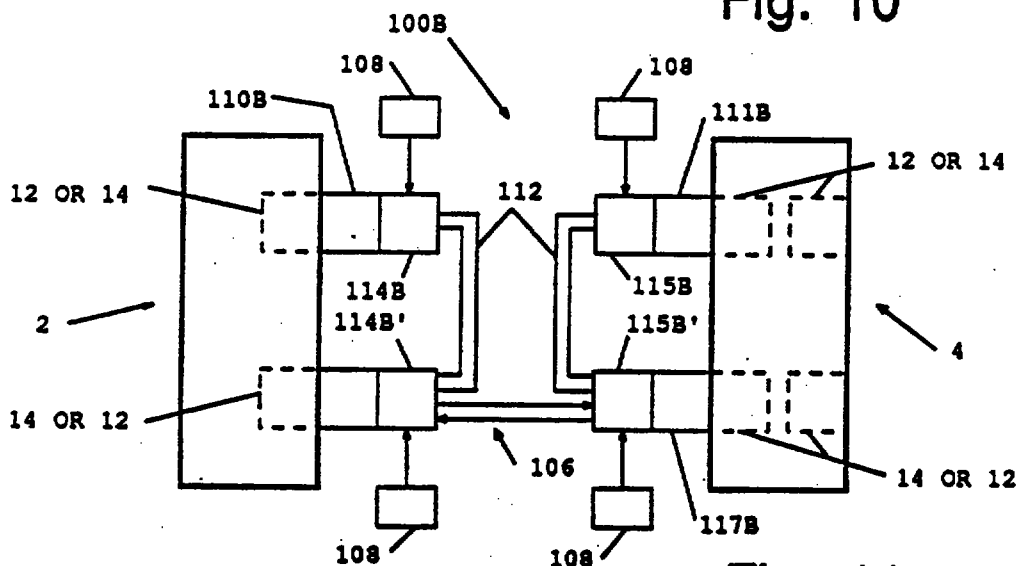


Fig. 11

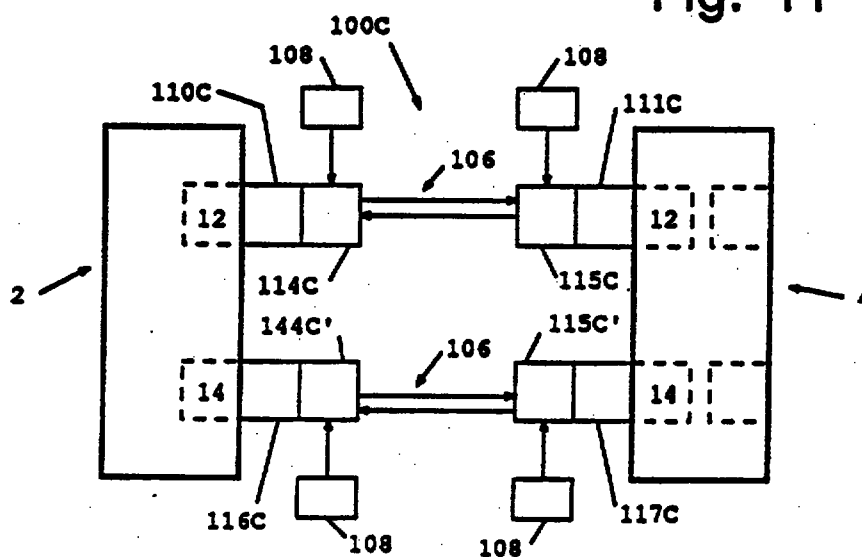


Fig. 12

REPLACED SHEETS		SG
☒	Description : paged 216-7-9, 11-18	to paged -
☒	Claim(s) : paged 20	to paged 27
☒	Drawing(s) : paged 40	to paged 69
☒	Abstract : paged 18	to paged -
DATE OF RECEIPT		

- 1 -

REPLACEMENT SHEETS		SG
☒	Description : paged 1..	to paged 22.
☒	Claim(s) : paged 20..	to paged 27..
☒	Drawing(s) : paged 40..	to paged 69..
☒	Abstract : paged 18..	to paged
DATE OF RECEIPT 26/7/96		

TITLE OF THE INVENTION

APPARATUS FOR CONNECTING COMPUTER DEVICES

COPYRIGHT NOTICE

A portion of the disclosure of this patent document contains material which is subject to copyright protection. The copyright owner has no objection to the facsimile reproduction by anyone of the patent document or the patent, disclosure, as it appears in the Patent and Trademark Office patent file or records, but otherwise reserves all copyright rights whatsoever.

BACKGROUND OF THE INVENTION

1. Field of the Invention.

This invention relates to an apparatus for connecting computer devices and, more specifically, where the apparatus comprises a first connector, a cable assembly, a converter adapter and a second connector.

2. Description of Related Art.

Figure 1 is a schematic illustration of a host or local mainframe computer or mainframe 2 connected to a first remote peripheral device or peripheral 4 which in turn is connected to a second remote peripheral device or peripheral 6 in a typical conventional manner. A pair of conventional bus and tag electrical assemblies 8 and 10, respectively, interconnect one channel between the mainframe 2 and the first peripheral 4. Similarly, a pair of conventional bus and tag electrical assemblies 8 and 10, respectively, interconnect one channel between the first peripheral 4 and the second peripheral 6. The bus and tag electrical assemblies 8 and 10

REPLACEMENT SHEET
25 JUL 1996

include a plurality of bus and tag lines. The bus lines are used to transmit information including data, I/O-device address, commands, and control information. The tag lines are used for interlocking and controlling information on the bus lines and for special sequences. For a more detailed description of the bus and tag lines and their uses see Publication GA22-6974-09 entitled International Business Machines (IBM) System/360 and System/370 I/O Interface Channel to Control Unit Original Equipment Manufacturers' Information. Additional peripherals can be connected in series to the second peripheral 6 in a similar manner.

The mainframe 2 represents an IBM 360, 370, 43XX, 30XX, or ES/9000 mainframe computer, or a plug compatible mainframe. The peripherals 4,6 are plug compatible with the mainframe 2 and can be disk drives, tape drives, servers, printers or the like. The mainframe 2 and peripherals 4,6 have internal bus and tag serpent connectors 12-19, respectively, which mate with corresponding bus and tag serpent connectors 22-29, respectively, on ends of the electrical assemblies 8,10. The internal bus and tag serpent connectors 12-19 may be adapters which convert a first or external wiring/terminal connection scheme, grid or geometry to a second or internal wiring/terminal scheme, grid or geometry. For instance, the adapters 12-19 may convert from a spacing of 0.250 inches between centers of adjacent ones of a first or external plurality of rows and columns of terminals to a spacing of 0.125 inches between centers of adjacent ones of a second or internal plurality of rows and columns of terminals. The first or external terminals have serpent contacts for mating with serpent contacts in the bus and tag serpent connectors 22-29 on the electrical assemblies 8,10. The serpent contacts are hermaphroditic or gender neutral as defined in Federal Information Processing standards (FIPS) publication 60-2 published July 29, 1983 entitled I/O Channel Interface. The serpent adapters are also defined in IBM Publication GA22-6974-09 previously mentioned. The adapters 12-19 may be as disclosed in U.S. Patent 4,585,284.

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1996

Conventional bus and tag serpent connectors 22-29 on the electrical assemblies 8,10 do not convert the wiring/terminal connection scheme, grid or geometry. Conventional bus and tag serpent connectors 22-29 comprise a plurality of rows and columns of terminals. One end of the terminals have serpent contacts spaced 0.250 inches apart center to center for mating with the serpent contacts in the bus and tag serpent adapters 12-19 on the mainframe 2 or peripheral 4,6. The other end of the terminals in the conventional bus and tag serpent connectors 22-29 are also spaced 0.250 inches apart center to center and are soldered to ends of wires terminating from an "elephant" cable 20 having about a 0.8-1 inch diameter and containing a plurality of about 20 coaxial cables. One such elephant cable 20 is needed to transmit data between the mainframe 2 and peripheral 4, or one peripheral 4 and another peripheral 6, and is included in the bus cable assembly 8. Another such elephant cable 20 is needed to transmit control signals instructing how to handle the data and is included in the tag cable assembly 10. The elephant cables 20 are very heavy, bulky and limited in permissible length. Conventional bus and tag cable assemblies 8,10 allow only an attachment cable distance of up to 400 feet from the mainframe 2 to the last peripheral on the channel.

To accommodate the heavy and bulky elephant cables 20, computer rooms are specifically built with raised computer room flooring to run and store the cables 20 beneath the raised flooring. This hides the cables, but makes relocating the computers 2 and peripherals 4,6 very difficult without cutting and abandoning the initial cables 20.

SUMMARY OF THE INVENTION

The present invention is related to an apparatus for use in connecting a first computer device and a second computer device through a dual line cable assembly, the first and second computer devices having first and second electrical interfaces
35 having a plurality of rows and columns of bus and tag inputs and outputs, comprising:

REPLACEMENT SHEET

26 JUL 1996

a first bus and tag sub-assembly including:

a first connector for mating with the first interface in the first device,

a first multi-line cable assembly having a first end and a second end, the first end connected to the first connector assembly,

a first converter adapter connected to the multi-line cable assembly second end,

a second connector connected to the converter adapter, the second connector assembly for mating with the second interface in the first device, and

the first converter adapter including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in the first device and sending such multiplexed serial information over a first line of the dual line cable assembly to the second computer device and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly and sending such parallel and demultiplexed information to the first and second interfaces of the first device.

The invention is further directed to an apparatus for use in connecting a first computer device and a second computer device through a dual line cable assembly, the first and second computer devices having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:

a first connector for connecting to the second interface in the first device;

a converter adapter adjacent and connected to the first connector, the converter adapter comprising:

a printed circuit board with conductive paths;

one or more second connector connected to some of the conductive paths and for receiving signals from the first interface in the first device;

REPLACEMENT SHEET

26 JUL 1996

one or more third connector connecting the first connector and some of the conductive paths;

one or more fourth connector for connecting some of the conductive paths to one or more power sources;

a receiver connector connected to some of the conductive paths and for connecting to a connector on one end of the dual line cable assembly to receive signals over one of the lines in the dual line cable assembly; and

a transmitter connector connected to some of the conductive paths and for connecting to the connector on the end of the cable assembly to send signals over the other one of the lines in the dual line cable assembly;

terminator networks connected by some of the paths to the second and third connectors;

line drivers/receivers connected by some of the paths to the terminator networks;

integrated circuit means connected to the line drivers/ receivers and for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in the first device and sending such multiplexed serial information over a first line of the dual line cable assembly and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly from the second computer device and sending such parallel and demultiplexed information to the first and second interfaces of the first device, wherein the integrated circuit means comprises:

an erasable programmable logic device, a nonerasable programmable logic device, or a custom design programmable logic device, the device connected by some of the paths to the line drivers/receivers;

a transmitter section including;

a serializer for receiving a plurality of parallel multiplexed signals from the programmable device over conductive paths, encoding the signals, serializing the signals, converting the signals to emitter coupled logic (ECL)

REPLACEMENT SHEET

26 JUL 1996

levels and shifting the converted signals out on a conductive path; and

an ECL to current translator connected by paths to the serializer and the transmitter connector; and

a receiver section including a deserializer for receiving serialized signals and continuously deserializing, decoding and latching parallel data through parallel conductive paths to the programmable device.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be more fully understood from the following detailed description thereof in connection with accompanying drawings described as follows.

Figure 1 is a schematic illustration of a mainframe and a pair of peripherals interconnected by conventional electrical assemblies.

Figure 2 is a block diagram illustrating a first embodiment of an apparatus for connecting one computer device to another computer device in accordance with the present invention.

Figure 3 a perspective view of a bus and tag subassembly including a first connector, a cable assembly, a converter assembly and a second connector in accordance with the present invention.

Figure 4 is a perspective view of the first connector in accordance with the present invention with parts exploded from one another.

Figure 5 is a perspective view of the second connector in accordance with the present invention with parts exploded from one another.

Figure 6 is a perspective view of a housing for the converter adapter in accordance with the present invention.

Figure 7 is a perspective view of a first side of the converter adapter with its housing removed in accordance with the present invention with parts exploded from one another.

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1996

Figure 8 is a perspective view of a second side of the converter adapter with its housing removed in accordance with the present invention with parts exploded from one another.

Figure 9 is a block diagram of a converter circuit in the converter adapter in accordance with the present invention.

Figures 10-12 are block diagrams illustrating second, third and fourth embodiments of apparatus for connecting one computer device to another computer device in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Throughout the following detailed description, similar reference characters refer to similar elements in all figures of the drawings.

Referring to Figure 2, there is depicted a block diagram illustrating an apparatus 100 for connecting computer devices 2,4 in accordance with the present invention. Either one of the computer devices can be a mainframe, a peripheral, a disk drive, a tape drive, a server, a printer, a channel switch, a fiber optic or electrical cable channel extender, or the like. The apparatus 100 comprises a first, host or local bus and tag sub-assembly 102 and a second or remote bus and tag subassembly 104 joined by a dual line cable assembly 106. The bus and tag sub-assemblies 102,104 can be electro-optic or just electronic. If the bus and tag sub-assemblies 102,104 are electro-optic, the cable assembly 106 is a fiber optic cable including two fiber optic lines, such as a duplex fiber optic cable assembly. If the bus and tag subassemblies 102,104 are just electronic, the cable assembly 106 is an electrical cable assembly including two lines, such as an electrical coaxial cable or twisted wire pair assembly. Power sources 108 connect with, in order to provide power to, the sub-assemblies 102 and 104.

Referring to Figures 2 and 3, each one of the bus and tag sub-assemblies 102,104 comprises a first connector 110,111, a multi-line electrical cable assembly 112 connected at a first end to the first connector 110,111, a converter adapter 114,115

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1996

connected to a second end of the cable assembly 112 and a second connector 116,117 connected to the converter adapter 114,115. The first and second connectors 110,116 in the first or host bus and tag sub-assembly 102 are adapted to connect to the connectors or adapters 12 and 14 in the first computer device or mainframe 2. The first and second connectors 111,117 in the second or remote bus and tag sub-assembly 104 connect to the connectors or adapters 12 and 14 in the second computer device or peripheral 4. The converter adapters 114,115 are adapted to connect to power sources 108. More specifically, power for active electronics in the converter adapters 114,115 can be supplied externally through power connectors on the converter adapters 114,115 to external power supplies 108 or through unused terminals within the one of the connectors 110,111 or 116,117 to power supplies within the computer device 2,4.

Referring to Figure 4, each one of the first connectors 110,111 is preferably an adapter which converts a first or external wiring/terminal connection scheme, grid or geometry to a second or internal wiring/terminal scheme, grid or geometry. Each adapter 110,111 preferably has a first plurality of terminals 120 having first serpent contacts or end portions 122 and second solder tail or press fit shaped contacts or end portions 124. The first terminals 120 are preferably arranged in a first grid pattern comprising two groups, each with two rows and twelve columns. Each input/output connector assembly 110,111 preferably further comprises a second plurality of pin shaped terminals 126 having first contacts or end portions and second contacts or end portions. The second terminals 126 are preferably arranged in a second grid pattern comprising one group of two rows and twenty-five columns. Two of the second terminals 126 can be connected to ground. The first terminals 120 are preferably spaced 0.125 inches apart from center to center of adjacent terminals in the columns and 0.250 inches apart from center to center of terminals in different rows. The second terminals 126 are preferably spaced 0.100 inches apart from center to

REPLACEMENT SHEET

26 JUL 1996

center of adjacent terminals in the columns and 0.100 inches apart from center to center of terminals in 0.100 inches apart from center to center of terminals in different rows. The input/output adapter assembly 100,111 preferably further comprises means 128 for electrically interconnecting the second contacts of the first and second terminals 120,126. Preferably, the interconnecting means 128 is a printed circuit board or the like. The interconnecting means 128 can be different for each one of the adapters 110 and 111. Preferably, they are different in that the conductive paths in the circuit boards are arranged to interconnect the first and second terminals 120,126 in the adapters 110 and 111 as required in IBM Publication GA22-6974-09. Each adapter 110,111 preferably further includes an insulative shroud or header 130 for receiving the second plurality of terminals 126 and mating with the cable assembly 112. The header 130 can be a quick eject header commercially available under part no. 65863 from E. I. du Pont de Nemours and Company, hereafter "Du Pont", with offices at Wilmington, Delaware. Each adapter 110,111 further includes an insulative housing 132. Preferably, the housing 132 includes a first housing part 134 with passages 136 for receiving the first plurality of terminals 120 for mating with the connector 12,14 in the first computer device 2 or the second computer device 4, respectively. Preferably, the housing 132 includes a second housing part 138 attached to the printed circuit board 128 and the first housing part 134 with fasteners 140, such as screws. The second housing part 138 has a slot 142 through which the shroud 130 extends for mating with a connector 144 terminating one end of the cable assembly 112. A jack screw assembly 146 can extend through the adapter 110,111 for use in securing the adapter 110,111 to the mainframe 2 or peripheral 4. Preferred adapters for use as the adapters 110 and 111 in the present invention are described in U.S. Patent 4,585,284 and are commercially available under part nos. 69477-006 and 69477-005 from Du Pont.

Referring to Figures 3 and 7, preferably, the multiline cable assembly 112 comprises a generally flat and

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1996

flexible electrical transmission line cable 148 with a plurality of insulated conductors terminated by connectors 144 on each end of the cable 148. The connectors 144 are preferably receptacles. A suitable cable assembly that can be used as the cable assembly 112 is commercially available under part no. 92642-001 from Du Pont.

Referring to Figure 5, each one of the first connectors 116,117 is also preferably an adapter which converts an external wiring/terminal connection scheme, grid or geometry to an internal wiring/terminal scheme, grid or geometry. Each adapter 116,117 preferably has a first plurality of terminals 150 having first serpent contacts or end portions 152 and second solder tail or press fit shaped contacts or end portions 154. The first terminals 150 are preferably arranged in a grid pattern comprising two groups, each with two rows and twelve columns. Each input/output connector assembly 116,117 preferably further comprises a second plurality of pin shaped terminals 156 having first contacts or end portions and second contacts or end portions. The second terminals 156 are preferably arranged in a second grid pattern comprising two groups of two rows and thirteen columns. Each of the two group of the second terminals 156 preferably are stacked in an insulative support 157. The first terminals 150 are preferably spaced 0.125 inches apart from center to center of adjacent terminals in the columns and 0.250 inches apart from center to center of terminals in different rows. The second terminals 156 are preferably spaced 0.100 inches apart from center to center of adjacent terminals in the columns and 0.100 inches apart from center to center of terminals in different rows. The input/output adapter assembly 116,116 preferably further comprises means 158 for electrically interconnecting the second contacts of the first and second terminals 150,156. Preferably, the interconnecting means 158 is a printed circuit board or the like. The interconnecting means 158 can be different for each one of the adapters 116 and 117. Preferably, they are different in that the conductive paths in the circuit boards are arranged to interconnect the first and second terminals 150,156 in the

REPLACEMENT SHEET

26 JUL 1996

adapters 116 and 117 as required in IBM Publication GA22-6974-09. Each adapter 116,117 further includes an insulative housing 162. The housing 162 includes passages 166 for receiving the first plurality of terminals 150 for mating with the connector 12,14 in the first device 2 or second device 4, respectively. Preferred adapters for use as the adapters 116 and 117 in the present invention are described in U.S. Patent 4,585,284. Preferred adapters 116 and 117 are parts of assemblies commercially available under part nos. 92643-001 (dark) and 92644-001 (light) from Du Pont.

Figure 6 is a perspective view of a housing 500 for the converter adapter 114,115. The housing 500 has a main rectangularly shaped frame 502 with a first top wall 504, a second bottom wall 506, a third side wall 508, a fourth side wall 510 and a fifth end wall 512. The side walls are parallel and spaced from one another and have internal longitudinal rails or ridges 514 defining grooves 516 between a pair of the rails or ridges 514. Edges of circuit board 190 slide in the grooves 516 such that the adjacent rails or ridges 514 hold the circuit board 190 in place in the housing 500. The housing 500 includes a cover 518 with ribs 520 that slide in grooves 516 defined by a pair of the rails or ridges 514. The cover 518 also has projections 522 that snap over an edge of the end side 512 of the frame 502 to secure the cover 518 on the frame 502. The housing 500 can be made of a conductive material (e.g., aluminum) or an insulative material (e.g., plastic). If the housing is made of plastic, it can be coated with a metallized or conductive layer. Alternatively, a conductive or metallized sheet can be slid in grooves 515 adjacent the top wall 504 and/or the bottom wall 506 to enhance electrical performance. After the printed circuit board 190 is inserted in the housing 500, the housing 500 is secured to the second connector printed circuit board 158 and the second connector housing 162, such as, by screws 524. A jack screw assembly 526 (such as the assembly commercially available from Du Pont under part number 92645-001) can extend through the housing 500 and the adapter 116,117 for use in securing the converter adapter 114 combined

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1996

with the adapter 116,117 to the mainframe 2 or peripheral 4. The connector 116,117 connected to the converter adapter 114,115 can be contained within a box approximately 1 inch (2.54 centimeters) by 4 inches (10.16 centimeters) by 4.5 inches (11.43 centimeters).

Figure 7 is a perspective view of a first side of the converter adapter 114,115 with the housing 500 removed with parts exploded from one another. Figure 8 is a perspective view of a second side of the converter adapter 114,115 with the housing 500 removed with parts exploded from one another. The converter adapter 114,115 comprises a circuit board 190 with conductive traces, paths or lines, a plurality of connectors 216, 222, 238, 240, 300, 302, and 304 electrically interconnecting the traces with parts off the board 190, and other components electrically connected to the traces. The connector 304 is for mating with the connector 144 on one end of the cable assembly 112. The connector 304 can be a right angle sea horse or quick eject header, such as commercially available under part number 78278 from Du Pont. The pair of connectors 300 and 302 are for receiving the two groups of the second terminals 156. The connectors 300 and 302 can be surface mount horizontal card connectors, such as commercially available under part number 67848-013 from Du Pont. One or more connector 238,240 is for connection to one or redundant power sources 108. The connectors 238 and 240 can be 1 by 3 right angle friction latch headers, such as commercially available under part number 78208-013 from Du Pont. The receiver connector 222 is for connecting to a connector on one end of the cable assembly 106 to receive signals over one of the fiber optic or electrical lines in the cable assembly 106. The transmitter connector 216 is for connecting to the connector on the end of the cable assembly 106 to send signals over the other one of the fiber optic or electrical lines in the cable assembly 106. If the converter adapter 114,115 is an electro-optic adapter, then the transmitter connector 216 can be a light emitting diode (LED) device commercially available under part number HFBR 1414T and the receiver connector 222 can

REPLACEMENT SHEET

26 JUL 1996

be a positive intrinsic negative (PIN) photodetector and amplifier assembly under part number HFBR 2416TC, both from Hewlett Packard with offices in San Jose, California.

Figure 9 is an architectural or structural block diagram of the converter adapter 114,115 schematically showing the connectors 216, 222, 238, 240, 300, 302, and 304, and other components in the converter adapter 114,115. Bus IN lines and Bus OUT lines pass through the connector 304 and board conductive traces to terminator networks 200 comprising resistor circuits which terminate the lines to their characteristic impedance. Similarly, tag IN lines and tag OUT lines pass through the connectors 300,302 and board traces to terminator networks 204 comprising resistor circuits which similarly terminate the lines. Resistor circuits commercially available under part no. 628A470G from Beckman Co. with offices in Fullerton, California; can be used for the terminator networks 200,204.

The terminator networks 200,204 are connected by board traces to line drivers/receivers 202,206 which receive and convert (1) IBM Original Equipment Manufacturers-Information (OEMI) compatible voltage levels to transistor to transistor levels (TTL) compatible voltage levels from left to right in Figure 9 or (2) from TTL compatible voltage levels to IBM OEMI compatible voltage levels from right to left in Figure 9. Suitable drivers/receivers that can be used for drivers/receivers 202,206 are commercially available under part no. SN751730D from Texas Instruments with office in Dallas, Texas.

A relay 208 is provided to terminate or propagate a SELECT-OUT transmission tag line in the converter adapter 114. If the converter adapter 114 is powered up by a power source 108 and connected to the adapter 115 through the cable assembly 106, the relay 208 terminates the SELECT-OUT transmission tag line. If the converter adapter 114 is not powered up by power source 108 and/or if connection is not established with the adapter 115, the relay 208 propagates the SELECT-OUT transmission tag line to the SELECT-IN transmission tag line.

REPLACEMENT SHEET

26 JUL 1996

The converter adapter 115 does not contain a corresponding relay 208.

The drivers/receivers 202,206 are connected by board traces to means 210 for multiplexing signals received from the receivers 202,206 and demultiplexing signals sent to the drivers 202,206. The multiplexing and demultiplexing means 210 combines Bus signals and Tag signals onto a bus 231 having a plurality of lines (e.g., 10). The multiplexing and demultiplexing means 210 also separates Bus signals and Tag signals from a bus 219 having a plurality of lines (e.g., 10). This multiplexing synchronizes the Bus and Tag signals through a master clock generated by an onboard oscillator. Strobe and acknowledge signalling provides this synchronization by registering the 10 bit bus into an input latch. The data in the input latch is then passed over bus 211.

The multiplexing and demultiplexing means 210 further includes means for emulating TAG signals to reduce system and cable induced delays. The multiplexing and demultiplexing means 210 can be a programmed erasable programmable logic device (EPLD), such as the EPLD commercially available under part no. EPM5130-WC-1 from Altera Corp. with offices in San Jose, California. The EPLD can be programmed accordingly to follow the protocols defined by IBM Publication GA22-6974-09 with the following exceptions. The converter adapter 114 does not propagate reserved lines or special-use lines, except the J09 signal line, to the converter adapter 115. When the channel raises 'service out' ('data out') during dc-interlocked data transfer, the adapter 114 drops 'service in' ('data in'). This may occur before the control unit has recognized the rise of 'service out' ('data out'). After the control unit recognizes the rise of 'service out' ('data out'), it drops 'service in' ('data in') and the adapter 115 drops 'service out' ('data out'). This may occur before the channel has recognized the fall of 'service in' ('data in'). When the adapter 115 recognizes the rise of 'operational in' during initial selection for DASH, it drops 'address out'. When the adapter 115 recognizes the fall of 'status in' during initial

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1993

selection for DASH and the current command is being chained from a previous command, it drops 'service out'. This may occur before the channel has recognized the fall of 'status in.

Two report files generated by a Max+Plus II Compiler for an EPM5130WC-1 chip from Altera Corp. are included in Appendices A and B to this specification and appear immediately before the claims. The report files in Appendices A and B show how embodiments of the EPLD 210 in each one of the adapters 114 and 115, respectively, can be implemented. These report files are sufficient information for one of ordinary skill in the art to reproduce the designs of these embodiments.

Alternatively, the multiplexing and demultiplexing means 210 can include a nonerasable programmable logic device (PLD) or a custom design programmable logic device, such as an application specific Integrated circuit (ASIC). If an ASIC is used, it can be designed to perform other functions than those included in the EPLD. For instance, such other functions can include the functions performed by any or all other components on the print circuit board 190. Such alternatives are equivalent to the embodiments disclosed in more detail using the EPLD. The structure for performing the functions performed by any or all components on the print circuit board 190 can be referred to as integrated circuit means.

The integrated circuit means can include a transmitter section 213 and a receiver section 217.

The bus 211 of parallel traces connects the programmed EPLD 210 to a serializer 212 within the transmitter section 213. The serializer 212 converts parallel data to serial data. More specifically, the serializer 212 receives a plurality of parallel multiplexed signals from the 10-bit bus 211 and sends it to an encoder latch to convert the 10-bit bus to a 12-bit encoded word. this encoding is used to maximize bit boundary transitions to help balance the data pattern and aid in the timing recovery on the receiving side. The 12-bit word is then fed to a shift register where the contents are serially shifted out in a single stream on one line. The serializer 212 can be

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1996

a transparent synchronous transmitter-receiver interface (TAXI) commercially available under part no. AM-7968 from Advanced Micro Devices with offices in Sunnyvale, California. A quartz crystal oscillator and clock generator 236 can provide a fixed clock frequency to the serializer 212. In summary, the serializer 212 encodes the data, serializes it, converts the data to emitter coupled logic (ECL) levels (which are voltage signals), and shifts the data out over balanced lines. This data is fed to an ECL to current translator 214 which feeds current pulses to the transmitter connector 216 which can contain a light emitting diode device. The transmitter connector 216 connects to the connector on the end of the cable assembly 106 to send optical data pulses over one 107 of the fiber optic lines in the cable assembly 106. Alternatively, current data pulses from the ECL to current translator 214 are fed through an electrical transmitter connector and an electrical line of the electrical cable assembly 106.

Signals or data pulses are transmitted over line 109 of the cable assembly 106 and received by the receiver section 217. If the cable assembly 106 is fiber optic, the receiver section 217 includes the receiver connector 222 which can be a photodiode and preamplifier which converts groups of photons or optical light pulses to an analog voltage output. The photodiode and preamplifier 222 can be a positive intrinsic negative (PIN) photodiode and preamplifier, such as, commercially available under part no. HFBR2614TC from Hewlett Packard. The output from the photodiode and preamplifier 222 is fed into a data quantizer 220 which amplifies and converts the voltage signals to a constant level output that is ECL compatible. The data quantizer 220 also provides a status indication or a loss of signal to the EPLD 210 indicating whether there is a connection at the distal end of the cable assembly 106. The data quantizer 220 can be part no. NE5224 commercially available from Signetics with offices in Sunnyvale, California. The output of the data quantizer 220 is fed into a deserializer 218 which receives and the serialized ECL levels and continuously deserializes, decodes and latches

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1996

parallel data through the 10 bit parallel bus 219 to the EPLD 210. The deserializer 218 can be part no. AM7969 commercially available from Advanced Micro Devices.

One or more voltage regulator 224, 226, 228, 230, 232 can be connected to provide a constant voltage supply to the line drivers/receivers 202, 206, the EPLD 210, the serializer 212 and the deserializer 218. The voltage regulators can be connected to a power input circuit 234 which can be "OR" connected to redundant power supplies 108. Thus, if the primary power supply 108 fails, power is automatically supplied from a second power supply 108.

Thus, data inputted to the bus and tag sub-assembly 102 from the bus and tag interfaces 12 and 13 is transmitted over the dual line cable assembly 106 and the bus and tag sub-assembly 104 and appears at the receiving device interfaces 12 and 14 exactly duplicated, only delayed in the time domain by the serialization and deserialization function and the propagation delay of the pulses in the lines which is length dependent (approximately 5 microseconds for each kilometer of optical fiber).

Figures 10-12 are block diagrams illustrating second, third and fourth embodiments of apparatus 100A, 100B and 100C for connecting one computer device 2 to another computer device 4 in accordance with the present invention. Figure 10 illustrates the apparatus 100A similar to the apparatus 100 illustrated in Figure 2, except the converter adapters 114A, 115A are connected directly to the connectors 110A, 111A connected to bus interfaces 12, rather than to the connectors 116A, 117A connected to the tag interfaces 14.

Figure 11 illustrates an apparatus 100B similar to the apparatus 100 illustrated in Figure 2, except the functions performed by the converter adapters 114 and 115 in Figure 2 are now performed by converter adapters 114B, 114B', 115B and 115B' which are connected directly to the connectors 110B, 116B, 111B and 117B, respectively. One of the cable assemblies 112 interconnects adapters 114B and 114B'. Another one of the cable assemblies 112 interconnects adapters 115B and 115B'. Each

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1996

pair of the converter adapters 114B,114B' and 115B,115B' include integrated circuit means similar to the one previously described in detail in relation to the embodiment illustrated in Figure 9, but with parts located in two housings rather than one. In the embodiment depicted in Figure 11, the integrated circuit means in converter adapters 114B,114B' is for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces 12,14 in the first device 2 and sending such multiplexed serial information over a first line of the dual line cable assembly 106 to the second computer device 4 and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly 106 and sending such parallel and demultiplexed information to the first and second interfaces 12,14 of the first device 2. In other words, the result achieved by converter adapter 114 in Figure 2 is achieved by converter adapters 114B and 114B' in Figure 11. Similarly, the result achieved by converter adapter 115 in Figure 2 is achieved by converter adapters 115B and 115B' in Figure 11.

Figure 12 illustrates the apparatus 100C similar to the apparatus 100 illustrated in Figure 2, except a converter adapter 114C,114C',115C,115C' is attached to each of the four connectors 110C,114C,111C,117C connected to the interfaces 12,14 of the devices 2,4. This is like the apparatus 100B in Figure 11 in that each pair of the converter adapters 114C,114C' and 115C,115C' include integrated circuit means similar to the one previously described in detail in relation to the embodiment illustrated in Figure 9, but with parts located in two housings rather than one. Further, a dual line cable assembly 106 interconnects both bus converter adapters 114C,115C and a dual line cable assembly 106 interconnects both tag converter adapters 114C',115C'. In the embodiment depicted in Figure 12, the integrated circuit means in converter adapters 114C,114C' is for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces 12,14 in the first device 2 and

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1996

sending such multiplexed serial information over lines of the dual line cable assemblies 106 to the second computer device 4 and (2) deserializing and then demultiplexing serial bus and tag information received through other lines of the dual line cable assemblies 106 and sending such parallel and demultiplexed information to the first and second interfaces 12,14 of the first device 2. In other words, the result achieved by converter adapter 114 in Figure 2 is achieved by converter adapters 114C and 114C' in Figure 12. Similarly, the result achieved by converter adapter 115 in Figure 2 is achieved by converter adapters 115C and 115C' in Figure 12.

Each one of apparatuses 100A, 100B and 100C are defined as equivalent in function and structure to, and obtain the same result as, the apparatus 100.

The apparatus 100,100A,100B,100C of the present invention can also interconnect daisy-chained peripheral control units on one mainframe multiplexer channel.

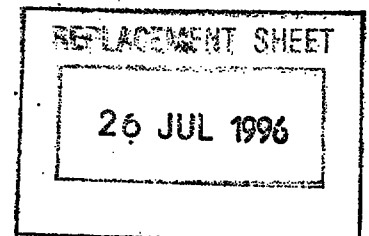
The apparatus of the present invention provides up to 4.5 million bytes per second of data throughput between the mainframe and peripherals. It also allows distances up to 2,000 meters (6600 feet) between devices - mainframe to peripheral, and/or peripheral to peripheral.

These features allow a user to replace bulky, limited distance bus and tag cables with dual line fiber optic or electrical cables in a structured wiring scheme. Data transmission via fiber optic cables provides significant advantages over data transmission via conventional copper conductor (bus and tag) cables. There is less bulk and weight. They eliminate the need for raised computer room flooring, except potentially for cooling purposes. There is no electromagnetic or radio frequency interference with signals transmitted through fiber optic cables. There is greater data integrity and security since fiber optic cables are not easily tapped or monitored. Finally, the transmission distance is greater - up to 6600 feet versus 400 feet for conventional bus and tag cables. Those skilled in the art, having the benefit of the teachings of the present invention as hereinabove set

REPLACEMENT SHEET

26 JUL 1996

forth, can effect numerous modifications thereto. These modifications are to be construed as being encompassed within the scope of the present invention as set forth in the appended claims.



APPENDIX A

Project Information f:\max2work\mini\mini_loc\mini_loc.rpt
MAX+plus II Compiler Report File
Version 2.11 04/06/92

***** Project compiled without errors

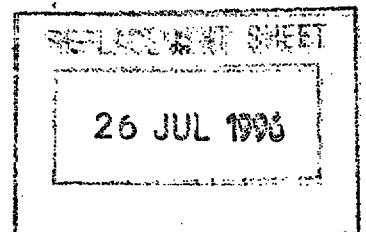
Title: LOCAL MINI-EXTENDER
Company: FiberCom, Inc.
Designer: Richard LaBarbera
Rev: A
Date: 3:35p 5-28-1992

** DEVICE SUMMARY **

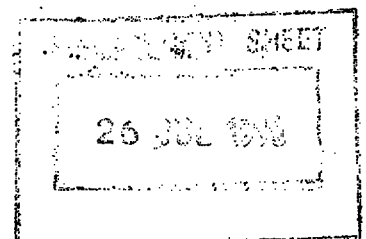
Chip/ POF	Device	Input Pins	Output Pins	Bidir Pins	Shareable MCs	EXPs	% Utilized
MINI	EPM5130WC-1	36	35	0	122	45	95 %

** PIN/MC/CHIP ASSIGNMENTS **

User Assignments	Actual Assignments (if different)	Node Name
MINI@85		ACKNL DGE
MINI@99		ACTIVITY
MINI@7		ADR_IN
MINI@21		ADR_OUT
MINI@40		BUS_INP
MINI@50		BUS_IN0
MINI@49		BUS_IN1
MINI@48		BUS_IN2
MINI@47		BUS_IN3
MINI@46		BUS_IN4
MINI@45		BUS_IN5
MINI@42		BUS_IN6
MINI@41		BUS_IN7
MINI@29		BUS_OUTP
MINI@39		BUS_OUT0
MINI@36		BUS_OUT1
MINI@35		BUS_OUT2
MINI@34		BUS_OUT3
MINI@33		BUS_OUT4
MINI@32		BUS_OUT5
MINI@31		BUS_OUT6
MINI@30		BUS_OUT7
MINI@51		CLOCK
MINI@15		CMD_OUT
MINI@84		CO0
MINI@83		CO1
MINI@3		DATA_IN
MINI@11		DATA_OUT
MINI@1		DISC_IN
MINI@97		DIV_A_B
MINI@73		DIO
MINI@74		DI1



MINI@75	DI2
MINI@76	DI3
MINI@77	DI4
MINI@78	DI5
MINI@79	DI6
MINI@80	DI7
MINI@81	DI8
MINI@82	DI9
MINI@54	DO0
MINI@55	DO1
MINI@56	DO2
MINI@57	DO3
MINI@58	DO4
MINI@59	DO5
MINI@60	DO6
MINI@61	DO7
MINI@64	DO8
MINI@65	DO9
MINI@28	DRV_OE
MINI@70	DSTRB
MINI@100	FAULT
MINI@10	HOLD_OUT
MINI@52	LOS
MINI@98	MR
MINI@23	MRK0_IN
MINI@22	MRK0_OUT
MINI@8	OP_IN
MINI@9	OP_OUT
MINI@2	REQ_IN
MINI@27	RLY_DRV
MINI@6	SEL_IN
MINI@17	SEL_OUT
MINI@4	SER_IN
MINI@14	SER_OUT
MINI@5	STAT_IN
MINI@86	STROBE
MINI@20	SUPR_OUT
MINI@72	VLTN
MINI@96	WD_EN



** FILE HIERARCHY **

```
rx_cir_1:80|
rx_cir_1:80| ds_det_1:47|
rx_cir_1:80| sl_dmx_1:93|
rx_cir_1:80| ds_dmx_1:77|
rx_cir_1:80| ds_dmx_1:78|
rx_cir_1:80| bt_dmx_1:80|
rx_cir_1:80| bt_dmx_1:82|
rx_cir_1:80| bt_dmx_1:76|
rx_cir_1:80| bt_dmx_1:75|
rx_cir_1:80| bt_dmx_1:74|
rx_cir_1:80| bt_dmx_1:73|
tx_cir_1:131|
tx_cir_1:131| bt_mx_1:59|
tx_cir_1:131| bt_mx_1:59| fclatch:51|
tx_cir_1:131| sup_mx_1:100|
tx_cir_1:131| sup_mx_1:100| fclatch:51|
tx_cir_1:131| c_mx_1:94|
tx_cir_1:131| c_mx_1:94| fclatch:96|
tx_cir_1:131| ds_mx_1:89|
tx_cir_1:131| s_mx_1:88|
tx_cir_1:131| s_mx_1:88| fclatch:92|
tx_cir_1:131| d_mx_1:85|
tx_cir_1:131| d_mx_1:85| fclatch:93|
tx_cir_1:131| as_syn_1:95|
tx_cir_1:131| bt_mx_1:61|
tx_cir_1:131| bt_mx_1:61| fclatch:51|
tx_cir_1:131| bt_mx_1:62|
tx_cir_1:131| bt_mx_1:62| fclatch:51|
tx_cir_1:131| bt_mx_1:65|
tx_cir_1:131| bt_mx_1:65| fclatch:51|
tx_cir_1:131| bt_mx_1:66|
tx_cir_1:131| bt_mx_1:66| fclatch:51|
ala_drv:102|
ala_drv:102| wd_cntr:123|
```

REPLACEMENT SHEET

26 JUL 1996

***** Logic for device 'MINI' compiled without errors

Device: EPM5130WC-1

Security: OFF

```

      A      D      R      R R R R      A
      C      I      S      S S S S      C
      T      V      E      S S S S      K
      F I      W E      E E E E      T N
      A V      D R      R R R R      R L
      U I      A V V V V V V V G G O D C C D D
      L T M      E E C C E E E E N N B G O O I I
      T Y R      B N D C C D D D D D D D D E E O 1 9 8
  
```

		100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81		
DISC_IN	1																				80	DI7	
REQ_IN	2																				79	DI6	
DATA_IN	3																				78	DI5	
SER_IN	4																				77	DI4	
STAT_IN	5																				76	DI3	
SEL_IN	6																				75	DI2	
ADR_IN	7																				74	DI1	
OP_IN	8																				73	DI0	
OP_OUT	9																				72	VLTH	
HOLD_OUT	10																				71	GND	
DATA_OUT	11																				70	DSTRB	
GND	12																				69	VCC	
GND	13																				68	VCC	
SER_OUT	14																				67	GND	
CHD_OUT	15																				66	GND	
GND	16																				65	DO9	
SEL_OUT	17																				64	DO8	
VCC	18																				63	GND	
VCC	19																				62	GND	
SUPR_OUT	20																				61	DO7	
ADR_OUT	21																				60	DO6	
MRK0_OUT	22																				59	DO5	
MRK0_IN	23																				58	DO4	
RESERVED	24																				57	DO3	
RESERVED	25																				56	DO2	
RESERVED	26																				55	DO1	
RLY_DRV	27																				54	DO0	
DRV_OE	28																				53	RESERVED	
BUS_OUTP	29																				52	LOS	
BUS_OUT7	30																				51	CLOCK	

EPM5130WC-1

	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	B	B	B	B	B	B	G	G	B	B	B	B	V	V	B	B	B	B	B	B
	U	U	U	U	U	U	N	N	U	U	U	U	C	C	U	U	U	U	U	U
	S	S	S	S	S	S	D	D	S	S	S	S	C	C	S	S	S	S	S	S
	O	O	O	O	O	O			O	I	I	I			I	I	I	I	I	I
	U	U	U	U	U	U			U	N	N	N			N	N	N	N	N	N
	T	T	T	T	T	T			T	P	7	6			S	4	3	2	1	0
	6	5	4	3	2	1			0											

REPLACEMENT SHEET

26 JUL 1996

** RESOURCE USAGE **

Logic Array Block	Macrocells	I/O Pins	Shareable Expanders	External Interconnect
A: MC1 - MC16	12/16(75%)	8/8(100%)	8/32(25%)	14/24(58%)
B: MC17 - MC32	14/16(87%)	5/8(62%)	2/32(6%)	9/24(37%)
C: MC33 - MC48	16/16(100%)	8/8(100%)	29/32(90%)	18/24(75%)
D: MC49 - MC64	16/16(100%)	8/8(100%)	0/32(0%)	7/24(29%)
E: MC65 - MC80	16/16(100%)	7/8(87%)	1/32(3%)	8/24(33%)
F: MC81 - MC96	16/16(100%)	8/8(100%)	0/32(0%)	14/24(58%)
G: MC97 - MC112	16/16(100%)	6/8(75%)	3/32(9%)	17/24(70%)
H: MC113 - MC128	16/16(100%)	5/8(62%)	2/32(6%)	10/24(41%)

Total dedicated input pins used:	16/ 20 (80%)
Total I/O pins used:	55/ 64 (85%)
Total macrocells used:	122/128 (95%)
Total shareable expanders used:	45/256 (17%)

Total input pins required:	36
Total output pins required:	35
Total bidirectional pins required:	0
Total macrocells required:	122
Total shareable expanders in database:	45

Synthesized macrocells:	0/128 (0%)
-------------------------	-------------

REF ID: A67157

26 JUL 1996

** INPUTS **

Pin	MCell	LAB	Primitive	Shareable Expanders		Fan-In		Name
				Total	Shared	INP	FBK	
85	(101)	(G)	INPUT	0	0	0	0	ACKNL DGE
21	-	-	INPUT	0	0	0	0	ADR_OUT
29	(23)	(B)	INPUT	0	0	0	0	BUS_OUTP
39	(39)	(C)	INPUT	0	0	0	0	BUS_OUT0
36	(38)	(C)	INPUT	0	0	0	0	BUS_OUT1
35	(37)	(C)	INPUT	0	0	0	0	BUS_OUT2
34	(36)	(C)	INPUT	0	0	0	0	BUS_OUT3
33	(35)	(C)	INPUT	0	0	0	0	BUS_OUT4
32	(34)	(C)	INPUT	0	0	0	0	BUS_OUT5
31	(33)	(C)	INPUT	0	0	0	0	BUS_OUT6
30	(24)	(B)	INPUT	0	0	0	0	BUS_OUT7
51	(65)	(E)	INPUT	0	0	0	0	CLOCK
15	-	-	INPUT	0	0	0	0	CMD_OUT
11	-	-	INPUT	0	0	0	0	DATA_OUT
97	(117)	(H)	INPUT	0	0	0	0	DIV_A_B
54	(68)	(E)	INPUT	0	0	0	0	DO0
55	(69)	(E)	INPUT	0	0	0	0	DO1
56	(70)	(E)	INPUT	0	0	0	0	DO2
57	(71)	(E)	INPUT	0	0	0	0	DO3
58	(72)	(E)	INPUT	0	0	0	0	DO4
59	-	-	INPUT	0	0	0	0	DO5
60	-	-	INPUT	0	0	0	0	DO6
61	-	-	INPUT	0	0	0	0	DO7
64	-	-	INPUT	0	0	0	0	DO8
65	-	-	INPUT	0	0	0	0	DO9
70	-	-	INPUT	0	0	0	0	DSTRB
10	-	-	INPUT	0	0	0	0	HOLD_OUT
52	(66)	(E)	INPUT	0	0	0	0	LOS
98	(118)	(H)	INPUT	0	0	0	0	MR
22	-	-	INPUT	0	0	0	0	MRKO_OUT
9	-	-	INPUT	0	0	0	0	OP_OUT
17	-	-	INPUT	0	0	0	0	SEL_OUT
14	-	-	INPUT	0	0	0	0	SER_OUT
20	-	-	INPUT	0	0	0	0	SUPR_OUT
72	-	-	INPUT	0	0	0	0	VLTN
96	(116)	(H)	INPUT	0	0	0	0	WD_EN

SERIALIZED SHEET

26 JUL 1998

** OUTPUTS **

Pin	MCell	LAB	Primitive	Shareable Expanders		Fan-In		Name
				Total	Shared	INP	FBK	
99	119	H	OUTPUT	0	0	0	2	ACTIVITY
7	7	A	DFF	0	0	4	0	ADR_IN
40	40	C	DFF	0	0	1	3	BUS_INP
50	56	D	DFF	0	0	1	3	BUS_IN0
49	55	D	DFF	0	0	1	3	BUS_IN1
48	54	D	DFF	0	0	1	3	BUS_IN2
47	53	D	DFF	0	0	1	3	BUS_IN3
46	52	D	DFF	0	0	1	3	BUS_IN4
45	51	D	DFF	0	0	1	3	BUS_IN5
42	50	D	DFF	0	0	1	3	BUS_IN6
41	49	D	DFF	0	0	1	3	BUS_IN7
84	100	G	OUTPUT	0	0	1	0	CO0
83	99	G	OUTPUT	0	0	1	0	CO1
3	3	A	DFF	0	0	4	1	DATA_IN
1	1	A	DFF	0	0	4	0	DISC_IN
73	81	F	DFF	0	0	2	1	DIO
74	82	F	OUTPUT	0	0	0	3	DI1
75	83	F	OUTPUT	0	0	0	3	DI2
76	84	F	OUTPUT	0	0	0	3	DI3
77	85	F	OUTPUT	0	0	0	3	DI4
78	86	F	OUTPUT	0	0	0	3	DI5
79	87	F	OUTPUT	0	0	0	3	DI6
80	88	F	OUTPUT	0	0	0	3	DI7
81	97	G	OUTPUT	0	0	0	3	DI8
82	98	G	OUTPUT	0	0	0	3	DI9
28	22	B	OUTPUT	0	0	1	0	DRV_OE
100	120	H	OUTPUT	0	0	1	1	FAULT
23	17	B	DFF	0	0	4	0	MRKO_IN
8	8	A	DFF	0	0	4	0	OP_IN
2	2	A	DFF	0	0	4	0	REQ_IN
27	21	B	OUTPUT	0	0	1	0	RLY_DRV
6	6	A	MCELL	0	0	0	2	SEL_IN
4	4	A	DFF	0	0	4	1	SER_IN
5	5	A	DFF	0	0	4	0	STAT_IN
86	102	G	DFF	1	0	2	13	STROBE

REPLACEMENT SHEET

26 JUL 1996

26 JUL 1996

** BURIED LOGIC **

Pin	MCell	LAB	Primitive	Shareable Expanders		Fan-In		Name
				Total	Shared	INP	FBK	
-	128	H	DFF	0	0	2	1	ala_drv:102 wd_cntr:123 :2
-	127	H	DFF	0	0	2	2	ala_drv:102 wd_cntr:123 :4
-	80	E	DFF	0	0	2	18	ala_drv:102 wd_cntr:123 :5
-	126	H	DFF	0	0	2	3	ala_drv:102 wd_cntr:123 :6
-	79	E	DFF	0	0	2	4	ala_drv:102 wd_cntr:123 :7
-	78	E	DFF	0	0	2	5	ala_drv:102 wd_cntr:123 :8
-	77	E	DFF	0	0	2	6	ala_drv:102 wd_cntr:123 :9
-	76	E	DFF	0	0	2	7	ala_drv:102 wd_cntr:123 :10
-	75	E	DFF	0	0	2	8	ala_drv:102 wd_cntr:123 :11
-	74	E	DFF	0	0	2	9	ala_drv:102 wd_cntr:123 :12
-	73	E	DFF	0	0	2	10	ala_drv:102 wd_cntr:123 :13
(58)	72	E	DFF	0	0	2	11	ala_drv:102 wd_cntr:123 :14
(57)	71	E	DFF	0	0	2	12	ala_drv:102 wd_cntr:123 :15
(56)	70	E	DFF	0	0	2	13	ala_drv:102 wd_cntr:123 :16
(55)	69	E	DFF	0	0	2	14	ala_drv:102 wd_cntr:123 :17
(54)	68	E	DFF	0	0	2	15	ala_drv:102 wd_cntr:123 :18
(52)	66	E	DFF	0	0	2	16	ala_drv:102 wd_cntr:123 :19
(51)	65	E	DFF	0	0	2	17	ala_drv:102 wd_cntr:123 :20
(53)	67	E	DFF	1	0	4	19	ala_drv:102 WD_SEND
-	125	H	DFF	1	1	1	7	ala_drv:102 :2
-	124	H	DFF	1	1	2	5	ala_drv:102 :3
-	123	H	DFF	1	1	2	5	ala_drv:102 :96
-	48	C	DFF	0	0	3	2	rx_cir_1:80 bt_dmx_1:73 :2
-	64	D	DFF	0	0	3	2	rx_cir_1:80 bt_dmx_1:74 :2
-	63	D	DFF	0	0	3	2	rx_cir_1:80 bt_dmx_1:75 :2
-	62	D	DFF	0	0	3	2	rx_cir_1:80 bt_dmx_1:76 :2
-	61	D	DFF	0	0	3	2	rx_cir_1:80 bt_dmx_1:80 :2
-	60	D	DFF	0	0	3	2	rx_cir_1:80 bt_dmx_1:82 :2
-	32	B	DFF	1	0	1	4	rx_cir_1:80 ds_det_1:47 :2
-	31	B	DFF	0	0	1	4	rx_cir_1:80 ds_det_1:47 :3
-	59	D	DFF	0	0	3	2	rx_cir_1:80 ds_dmx_1:77 :2
-	30	B	DFF	0	0	2	2	rx_cir_1:80 ds_dmx_1:77 :26
-	58	D	DFF	0	0	3	2	rx_cir_1:80 ds_dmx_1:78 :2
-	29	B	DFF	0	0	2	2	rx_cir_1:80 ds_dmx_1:78 :26
-	57	D	DFF	0	0	3	2	rx_cir_1:80 sl_dmx_1:93 :2
-	16	A	DFF	0	0	4	0	rx_cir_1:80 sl_dmx_1:93 :3
-	15	A	DFF	0	0	2	1	rx_cir_1:80 sl_dmx_1:93 :20
-	28	B	DFF	0	0	0	2	rx_cir_1:80 :84
-	27	B	DFF	0	0	0	2	rx_cir_1:80 :85
-	26	B	DFF	0	0	1	2	rx_cir_1:80 :86
-	112	G	DFF	0	0	2	13	tx_cir_1:131 as_syn_1:95 :58
-	111	G	DFF	1	0	1	14	tx_cir_1:131 as_syn_1:95 :65
-	122	H	DFF	0	0	3	1	tx_cir_1:131 bt_mx_1:59 :4
-	121	H	DFF	0	0	1	2	tx_cir_1:131 bt_mx_1:59 :5
(98)	118	H	SOFT	0	0	0	2	tx_cir_1:131 bt_mx_1:59 :39
-	47	C	DFF	4	0	3	3	tx_cir_1:131 bt_mx_1:59 :45
-	96	F	DFF	0	0	3	1	tx_cir_1:131 bt_mx_1:61 :4
-	95	F	DFF	0	0	1	2	tx_cir_1:131 bt_mx_1:61 :5
-	94	F	SOFT	0	0	0	2	tx_cir_1:131 bt_mx_1:61 :39
-	46	C	DFF	4	0	3	3	tx_cir_1:131 bt_mx_1:61 :45
-	93	F	DFF	0	0	3	1	tx_cir_1:131 bt_mx_1:62 :4
-	45	C	DFF	0	0	1	2	tx_cir_1:131 bt_mx_1:62 :5
-	44	C	SOFT	0	0	0	2	tx_cir_1:131 bt_mx_1:62 :39

-	43	C	DFF	4	0	3	3	tx_cir_1:131 bt_mx_1:62 :45
-	42	C	DFF	0	0	3	1	tx_cir_1:131 bt_mx_1:65 :4
-	110	G	DFF	0	0	1	2	tx_cir_1:131 bt_mx_1:65 :5
-	109	G	SOFT	0	0	0	2	tx_cir_1:131 bt_mx_1:65 :39
-	41	C	DFF	4	0	3	3	tx_cir_1:131 bt_mx_1:65 :45
-	108	G	DFF	0	0	3	1	tx_cir_1:131 bt_mx_1:66 :4
-	107	G	DFF	0	0	1	2	tx_cir_1:131 bt_mx_1:66 :5
-	106	G	SOFT	0	0	0	2	tx_cir_1:131 bt_mx_1:66 :39
(39)	39	C	DFF	4	0	3	3	tx_cir_1:131 bt_mx_1:66 :45
-	105	G	DFF	0	0	3	1	tx_cir_1:131 c_mx_1:94 :4
(85)	101	G	DFF	1	1	1	3	tx_cir_1:131 c_mx_1:94 :57
(90)	104	G	DFF	0	0	2	2	tx_cir_1:131 c_mx_1:94 :79
(36)	38	C	DFF	4	0	3	3	tx_cir_1:131 c_mx_1:94 :86
(89)	103	G	DFF	1	1	1	4	tx_cir_1:131 c_mx_1:94 :89
-	92	F	DFF	0	0	3	1	tx_cir_1:131 d_mx_1:85 RELEASE
(35)	37	C	DFF	1	0	1	3	tx_cir_1:131 d_mx_1:85 SEND
(34)	36	C	DFF	0	0	2	1	tx_cir_1:131 d_mx_1:85 :79
(33)	35	C	DFF	4	0	3	3	tx_cir_1:131 d_mx_1:85 :86
-	25	B	DFF	1	0	5	4	tx_cir_1:131 ds_mx_1:89 SEND
(30)	24	B	DFF	0	0	4	1	tx_cir_1:131 ds_mx_1:89 :105
(29)	23	B	DFF	0	0	4	2	tx_cir_1:131 ds_mx_1:89 :106
(32)	34	C	DFF	0	0	1	2	tx_cir_1:131 ds_mx_1:89 :116
(31)	33	C	DFF	0	0	1	2	tx_cir_1:131 ds_mx_1:89 :117
(26)	20	B	DFF	0	0	2	2	tx_cir_1:131 ds_mx_1:89 :128
(97)	117	H	DFF	0	0	3	1	tx_cir_1:131 s_mx_1:88 RELEASE
(96)	116	H	DFF	1	1	1	3	tx_cir_1:131 s_mx_1:88 :57
(95)	115	H	DFF	0	0	2	2	tx_cir_1:131 s_mx_1:88 :58
(92)	114	H	DFF	1	1	1	4	tx_cir_1:131 s_mx_1:88 :74
(91)	113	H	DFF	0	0	1	2	tx_cir_1:131 s_mx_1:88 :75
-	14	A	DFF	4	0	3	3	tx_cir_1:131 s_mx_1:88 :84
-	91	F	DFF	0	0	3	1	tx_cir_1:131 sup_mx_1:100 :4
-	90	F	DFF	0	0	1	2	tx_cir_1:131 sup_mx_1:100 :5
-	89	F	SOFT	0	0	0	4	tx_cir_1:131 sup_mx_1:100 :39
-	13	A	DFF	4	0	3	3	tx_cir_1:131 sup_mx_1:100 :45

REPLACEMENT SHEET

26 JUL 1996

26 JUL 1996

**** MACROCELL INTERCONNECTIONS ****
Logic Array Block 'A':

```

      M M M M M M M M M M M M
      C C C C C C C C C C C C
      7 3 1 8 2 1 1 6 4 5 1 1
      | | | | | 6 5 | | | 4 3
MCELL | | | | | | | | | | | | | A B C D E F G H | Name
MC7 -> @ - - - - - - - - - - | @ - - - - - - - | ADDR_IN
MC3 -> - @ - - - - - - - - - - | @ * - - - - - - | DATA_IN
MC1 -> - - @ - - - - - - - - - - | @ - - - - - - - | DISC_IN
MC8 -> - - - @ - - - - - - - - - - | @ * - - - - - - | OP_IN
MC2 -> - - - - @ - - - - - - - - - - | @ - - - - - - - | REQ_IN
MC16-> - - - - - @ @ @ - - - - | @ - - - - - - - | rx_cir_1:80|sl_dmx_1:93|:3
MC15-> - - - - - @ - - - - - - - | @ - - - - - - - |
|rx_cir_1:80|sl_dmx_1:93|:20
MC6 -> - - - - - - - - - - | @ - - - - - - - | SEL_IN
MC4 -> - - - - - - - @ - - - - | @ * - - - - - - | SER_IN
MC5 -> - - - - - - - - @ - - - - | @ * - - - - - * | STAT_IN
MC14-> - - - - - - - - - - | @ - - - - * - - - | tx_cir_1:131|s_mx_1:88|:84
MC13-> - - - - - - - - - - | @ - - - - - * - - - |
|tx_cir_1:131|sup_mx_1:100|:45

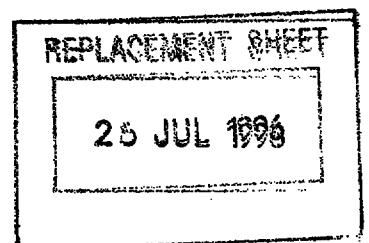
```

```

Pin
21 -> - - - - - - - - - - - - | - - - - - @ - - - | ADDR_OUT
34 -> - - - - - - - - - - * - - | * - - - - - - - - | BUS_OUT3
31 -> - - - - - - - - - - * - - | * - - - - - - - - | BUS_OUT6
51 -> - - - - - - - - - - * * - | * * * - * * * * | CLOCK
15 -> - - - - - - - - - - - @ - - - - @ - - | CMD_OUT
11 -> - - - - - - - - - - - @ @ - - - @ - - | DATA_OUT
54 -> * * * * * * - - - * * - - | * * * * - - - - | DO0
55 -> - - - * - - - - - - - - - | * - - * - - - - | DO1
56 -> * - - - - - - - - - - - - | * - - * - - - - | DO2
57 -> - - - - * - - - - - - - - - | * - - * - - - - | DO3
58 -> - - - - - - - * - - - - - - | * - - * - - - - | DO4
59 -> - @ - - - - - - - - - - - | @ - - @ - - - - | DO5
60 -> - - - - - - - @ - - - - - - | @ - - @ - - - - | DO6
61 -> - - - @ - - - - - - - - - | @ - - @ - - - - | DO7
64 -> - - @ - - - - - - - - - | @ - - @ - - - - | DO8
65 -> - - - - - - - - - - - @ @ - - - - - | DO9
70 -> @ @ @ @ @ @ - - - @ @ - - - @ - - | DSTRB
10 -> - - - - - - - - - - - @ - - - - - - | HOLD_OUT
98 -> * * * * * * * - * * * * | * * * - * * * * | MR
22 -> - - - - - - - - - - - @ - - - - - - | MRK0_OUT
9 -> - - - - - - - - - - - - @ - - - - - - | OP_OUT
17 -> - - - - - @ - - - - - - - | @ - - @ - - - - | SEL_OUT
14 -> - - - - - - - - - - - @ @ - - - @ - - | SER_OUT
20 -> - - - - - - - - - - - - @ - - - - - | SUPR_OUT
72 -> - - - - - - - - - - - - - @ - - - - - | VLTN
MC30 -> - * - - - - - - - - - - | * @ - - - - - - |
|rx_cir_1:80|ds_dmx_1:77|:26
MC29 -> - - - - - * - - - - - - | * @ - - - - - - |
|rx_cir_1:80|ds_dmx_1:78|:26
MC112-> - - - - - * * - - - * - * - - * @ * - |
|tx_cir_1:131|as_syn_1:95|:58
MC34 -> - - - - - * * - - - * - @ - - - - - |
|tx_cir_1:131|ds_mx_1:89|:116

```

MC33 -> - - - - - * * | * - @ - - - - - |
|tx_cir_1:131|ds_mx_1:89|:117



25 JUL 1996

**** MACROCELL INTERCONNECTIONS ****
Logic Array Block 'B':

M M M M M M M M M M M M M M M																														
C C C C C C C C C C C C C C C																														
2 1 2 3 3 3 2 2 2 2 2 2 2 2																														
2 7 1 2 1 0 9 8 7 6 5 4 3 0																														
MCELL														A	B	C	D	E	F	G	H	Name								
MC22->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-	-	-	-	-	-	DRV_OE							
MC17->	-	e	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-	-	-	-	-	-	MRK0_IN							
MC21->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-	-	-	-	-	-	RLY_DRV							
MC32->	-	-	-	-	e	e	-	-	-	-	-	-	-	-	-	-	e	-	-	-	-	-	-							
rx_cir_1:80 ds_det_1:47 :2																														
MC31->	-	-	-	-	-	e	e	-	-	-	-	-	-	-	e	-	e	*	-	-	-	*	-							
rx_cir_1:80 ds_det_1:47 :3																														
MC30->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	e	-	-	-	-	-	-							
rx_cir_1:80 ds_dmx_1:77 :26																														
MC29->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	e	-	-	-	-	-	-							
rx_cir_1:80 ds_dmx_1:78 :26																														
MC28->	-	-	-	-	-	-	-	-	-	-	e	-	-	-	-	-	e	*	*	-	-	-	-							
rx_cir_1:80 :84																														
MC27->	-	-	-	-	-	-	-	-	-	-	e	-	-	-	-	-	e	*	*	-	-	-	-							
rx_cir_1:80 :85																														
MC26->	-	-	-	-	-	-	-	-	e	e	-	-	-	-	-	-	e	-	-	-	-	-	-							
rx_cir_1:80 :86																														
MC25->	-	-	-	-	-	-	-	-	-	-	e	-	-	e	-	-	e	-	-	-	-	*	-							
tx_cir_1:131 ds_mx_1:89 SEND																														
MC24->	-	-	-	-	-	-	-	-	-	-	e	-	e	-	-	-	e	-	-	-	-	-	-							
tx_cir_1:131 ds_mx_1:89 :105																														
MC23->	-	-	-	-	-	-	-	-	-	-	e	-	-	-	-	-	e	-	-	-	-	-	-							
tx_cir_1:131 ds_mx_1:89 :106																														
MC20->	-	-	-	-	-	-	-	-	-	-	e	e	e	e	-	-	e	-	-	-	-	-	-							
tx_cir_1:131 ds_mx_1:89 :128																														

Pin																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
-----	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

MC5 -> - - - * * - - - * - - - - - | @ * - - - - - * | STAT_IN
 MC111-> - - - - - * - - - - - | - * * - * * @ * |
 |tx_cir_1:131|as_syn_1:95|:65

REPLACEMENT SHEET

26 JUL 1996

Logic Array Block 'C':

[illegible]

```

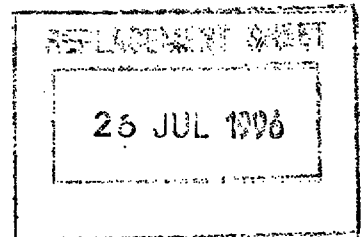
30  -> - - - - - * - - - - - | - - * - - - - |
BUS_OUT7
51  -> - - * * - - * * * * - * * - - | * * * - * * * * | CLOCK
15  -> - - - - - - - - - - - - - - - | - - e - - - - - e - - |
CMD_OUT
11  -> - - - - - - - - - - - - - - - | e | - e e - - - e - - |
DATA_OUT
54  -> - * - - - - - - - - - - - - - | * * * * - - - - - | DO0
59  -> - - - - - - - - - - - - - - - | e - - - e - - - - - | DO5
60  -> - - - - - - - - - - - - - - - | e - - - e - - - - - | DO6
61  -> - - - - - - - - - - - - - - - | e - - - e - - - - - | DO7
64  -> - - - - - - - - - - - - - - - | e - - - e - - - - - | DO8
65  -> - e - - - - - - - - - - - - - | - e e - - - - - - - | DO9
70  -> e e - - - - - - - - - - - - - | e e e e - - - - e | DSTRB
10  -> - - - - - - - - e - - - - - - | - - - e - - - - - |
HOLD_OUT
98  -> - - * * * - * * * * * * * - - | * * * - * * * * | MR
22  -> - - - - - - - - - - - - - - - | - - - - - - - - e - - |
MRK0_OUT
9   -> - - - - - - - - - - - - - - - | - - - - - - - - e - - |
OP_OUT
17  -> - - - - - - - - - - - - - - - | e - - - - e - - - - |
SEL_OUT
14  -> - - - - - - - - - - - - - - e - | - e e - - - - - e - |
SER_OUT
20  -> - - - - - - - - - - - - - - - | - - - - - e - - - - |
SUPR_OUT
72  -> - - - - - - - - - - - - - - - | - - - - - e | VLTN
MC31 -> - - - - - * * - - - - - * * | - e * - - - - * - |
|rx_cir_1:80|ds_det_1:47|:3
MC28 -> * * - - - - - - - - - - - - - | - e * * - - - - - |
|rx_cir_1:80|:84
MC27 -> * * - - - - - - - - - - - - - | - e * * - - - - - |
|rx_cir_1:80|:85
MC112-> - - * * - - * * * * * - - * - - | * - * - - * e * |
|tx_cir_1:131|as_syn_1:95|:58
MC111-> - - - * - - - - - * - - - - - | - * * - * * e * |
|tx_cir_1:131|as_syn_1:95|:65
MC93  -> - - - * * - - - - - - - - - | - - * - - e - - - |
|tx_cir_1:131|bt_mx_1:62|:4
MC92  -> - - - - - - - - - * - - - * | - - * - - e - - - |
|tx_cir_1:131|d_mx_1:85|RELEASE
MC117-> - - - - - * - - - - - * - - - | - - * - - * - e - |
|tx_cir_1:131|s_mx_1:88|RELEASE
-----

```

**** MACROCELL INTERCONNECTIONS ****

Logic Array Block 'D':

MCELL	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	A	B	C	D	E	F	G	H	Name	
MC56 ->	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C										
BUS_IN0	5	5	5	5	5	5	4	6	6	6	6	6	5	5	5										
	6	5	4	3	2	1	0	9	4	3	2	1	0	9	8	7									



```

MC55 -> - - - - - e - - - - -
BUS_IN1
MC54 -> - - - - - e - - - - -
BUS_IN2
MC53 -> - - - - - e - - - - -
BUS_IN3
MC52 -> - - - - - e - - - - -
BUS_IN4
MC51 -> - - - - - e - - - - -
BUS_IN5
MC50 -> - - - - - e - - - - -
BUS_IN6
MC49 -> - - - - - e - - - - -
BUS_IN7
MC64 -> - - - - - e e - - - - - e - - - - -
|rx_cir_1:80|bt_dmx_1:74|:2
MC63 -> - - - - - e - e - - - - - e - - - - -
|rx_cir_1:80|bt_dmx_1:75|:2
MC62 -> - - - - - e - - e - - - - e - - - - -
|rx_cir_1:80|bt_dmx_1:76|:2
MC61 -> - e - - - - - e - - - - - e - - - - -
|rx_cir_1:80|bt_dmx_1:80|:2
MC60 -> e - - - - - e - - - - - e - - - - -
|rx_cir_1:80|bt_dmx_1:82|:2
MC59 -> - - - - - e - - - - - e - - - - - e - - - - -
|rx_cir_1:80|ds_dmx_1:77|:2
MC58 -> - - - - - e - - - - - e - - - - - e - - - - -
|rx_cir_1:80|ds_dmx_1:78|:2
MC57 -> - - - - - e - - - - - e - - - - - e - - - - -
|rx_cir_1:80|sl_dmx_1:93|:2

```

```

Pin
21 -> - - - - - | - - - - e - - |
ADR_OUT
15 -> - - - - - | - e - - - e - |
CMD_OUT
11 -> - - - - - | - e e - - e - - |
DATA_OUT
54 -> - - - - - * * * * * | * * * * - - - - DO0
55 -> - - - - - * * * * * | * - - * - - - - DO1
56 -> - - - - - * * * * * | * - - * - - - - DO2
57 -> - - - - - * * * * * | * - - * - - - - DO3
58 -> - - - - - * * * * * | * - - * - - - - DO4
59 -> - - - - - * * * * * | e - - e - - - - DO5
60 -> - - - - - * * * * * | e - - e - - - - DO6
61 -> - - - - - * * * * * | e - - e - - - - DO7
64 -> - - - - - * * * * * | e - - e - - - - DO8
65 -> - - - - - * * * * * | - e e - - - - - DO9
70 -> e e e e e e e e e e e e e e e | e e e e - - - e DSTRB
10 -> - - - - - | - - - - e - - |
HOLD_OUT
22 -> - - - - - | - - - - e - - |
MRK0_OUT
9 -> - - - - - | - - - - e - - |
OP_OUT
17 -> - - - - - | e - - - e - - |
SEL_OUT
14 -> - - - - - | - e e - - - e - |

```

REPLACEMENT SHEET

26 JUL 1996

```

SER_OUT
20  -> - - - - - | - - - - - @ - - - |
SUPR_OUT
72  -> - - - - - | - - - - - @ | VLTN
MC28 -> * * * * * * * * * * * * * * * * | - @ * * - - - - |
|rx_cir_1:80|:84
MC27 -> * * * * * * * * * * * * * * * * | - @ * * - - - - |
|rx_cir_1:80|:85
-----
-----

```

REPLACEMENT SHEET

26 JUL 1996

Logic Array Block 'E':

[illegible]

REPLACEMENT SHEET

26 JUL 1996

[illegible]

```

MC89 -> - - - - - e * -
|tx_cir_1:131|sup_mx_1:100|:39

Pin
21 -> - - - - - e - - - - -
ADR_OUT
51 -> * - - - - * - - * * * - - | * * * - * * * * | CLOCK
15 -> - - - - - - - - - - - - | - e - - - - - e - -
CMD_OUT
11 -> - - - - - - - - - - - e - - - | - e e - - - e - -
DATA_OUT
59 -> - - - - - - - - - - - - | e - - e - - - - | DO5
60 -> - - - - - - - - - - - - | e - - e - - - - | DO6
61 -> - - - - - - - - - - - - | e - - e - - - - | DO7
64 -> - - - - - - - - - - - - | e - - e - - - - | DO8
65 -> - - - - - - - - - - - - | - e e - - - - - | DO9
70 -> - - - - - - - - - - - - | e e e e - - - e | DSTRB
10 -> - - - - - - - - - - - - | - - e - - - - -
HOLD_OUT
98 -> * - - - - * - - * * * * - | * * * - * * * * | MR
22 -> - - - - - - - - - - - - | - - - - - - - e - -
MRKO_OUT
9 -> - - - - - - - - - - - - | - - - - - - - e - -
OP_OUT
17 -> - - - - - - - - - - - e - - - - | e - - - - e - - -
SEL_OUT
14 -> - - - - - - - - - - - - | - e e - - - - e - -
SER_OUT
20 -> - - - - - - - - - - - e - - - - | - - - - - e - - -
SUPR_OUT
72 -> - - - - - - - - - - - - | - - - - - - e | VLTN
MC112-> * - - - - * - - * * * - - | * - * - - * e * -
|tx_cir_1:131|as_syn_1:95|:58
MC111-> - - - - - * - - - - * - - | - * * - * * e * -
|tx_cir_1:131|as_syn_1:95|:65
MC122-> - * - - - - - - - - - - | - - - - - * - e -
|tx_cir_1:131|bt_mx_1:59|:4
MC47 -> - * - - - - - - - - - - | - - e - - * - - -
|tx_cir_1:131|bt_mx_1:59|:45
MC46 -> - - - * - - - - - - - - | - - e - - * - - -
|tx_cir_1:131|bt_mx_1:61|:45
MC43 -> - - - * - - - - - - - - | - - e - - * - - -
|tx_cir_1:131|bt_mx_1:62|:45
MC105-> - - - - - * - - - - - - | - - - - - * e - -
|tx_cir_1:131|c_mx_1:94|:4
MC38 -> - - - - - * - - - - - - | - - e - - * - - -
|tx_cir_1:131|c_mx_1:94|:86
MC35 -> - - - - - * - - - - - - | - - e - - * - - -
|tx_cir_1:131|d_mx_1:85|:86
MC117-> - - - * - - - - - - - * | - - * - - * - e -
|tx_cir_1:131|s_mx_1:88|RELEASE
MC14 -> - - - - - * - - - - - - | e - - - - * - - -
|tx_cir_1:131|s_mx_1:88|:84
MC13 -> - - - - - * - - - - - - | e - - - - * - - -
|tx_cir_1:131|sup_mx_1:100|:45

```

REPLACEMENT SHEET

26 JUL 1996

Logic Array Block 'G':

[illegible]

```
MRKO_OUT
9      -> - - - - - e
OP_OUT
17     -> - - - - - e - - -
SEL_OUT
14     -> - - - - - e e - - e
SER_OUT
20     -> - - - - - e - -
SUPR_OUT
72     -> - - - - - e | VLTN
MC67   -> - - - * * * - - - e - * *
|ala_drv:102|WD_SEND
MC81   -> - - - * * - - - - - e * - DIO
MC31   -> - - - - - * - e * - * -
|rx_cir_1:80|ds_det_1:47|:3
MC118-> - - - * * * - - - - - * e
|tx_cir_1:131|bt_mx_1:59|:39
MC94   -> - - - * * * - - - - - e * -
|tx_cir_1:131|bt_mx_1:61|:39
MC44   -> - - - * * * - - - - - e - * -
|tx_cir_1:131|bt_mx_1:62|:39
MC42   -> - - - * - - - * * - - - e - * -
|tx_cir_1:131|bt_mx_1:65|:4
MC41   -> - - - * - - - - - - - e - * -
|tx_cir_1:131|bt_mx_1:65|:45
MC39   -> - - - * - - - - - - - e - * -
|tx_cir_1:131|bt_mx_1:66|:45
MC37   -> - - - * * * - - - - - e - * -
|tx_cir_1:131|d_mx_1:85|SEND
MC25   -> - - - * * * - - - - - e - * -
|tx_cir_1:131|ds_mx_1:89|SEND
MC116-> - - - * * * - - - - - - * e
|tx_cir_1:131|s_mx_1:88|:57
MC114-> - - - * * * - - - - - - * e
|tx_cir_1:131|s_mx_1:88|:74
MC89   -> - - - * * * - - - - - e * -
|tx_cir_1:131|sup_mx_1:100|:39
```

REPLACEMENT SHEET

26 JUL 1996

** MACROCELL INTERCONNECTIONS **

Logic Array Block 'H':

MCELL	9	8	7	6	5	4	3	0	2	1	8	7	6	5	4	3	A	B	C	D	E	F	G	H	Name
MC119->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e
ACTIVITY																									
MC128->	-	e	e	e	e	e	e	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	e
ala_drv:102 wd_cntr:123 :2																									
MC127->	-	-	e	e	e	e	e	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	e
ala_drv:102 wd_cntr:123 :4																									
MC126->	-	-	-	e	e	e	e	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	-	e
ala_drv:102 wd_cntr:123 :6																									
MC125->	e	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e
ala_drv:102 :2																									
MC124->	e	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e
ala_drv:102 :3																									
MC123->	-	-	-	-	-	-	-	e	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e
ala_drv:102 :96																									
MC120->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	FAULT	
MC122->	-	-	-	-	-	-	-	-	e	e	-	-	-	-	-	-	-	-	-	-	-	-	*	-	e
tx_cir_1:131 bt_mx_1:59 :4																									
MC121->	-	-	-	-	-	-	-	-	e	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e
tx_cir_1:131 bt_mx_1:59 :5																									
MC118->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*	e	
tx_cir_1:131 bt_mx_1:59 :39																									
MC117->	-	-	-	-	-	-	-	-	-	-	-	e	-	e	e	-	-	-	*	-	-	*	-	e	
tx_cir_1:131 s_mx_1:88 RELEASE																									
MC116->	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-	-	-	-	-	-	-	-	*	e	
tx_cir_1:131 s_mx_1:88 :57																									
MC115->	-	-	-	-	-	-	-	-	-	-	-	e	-	e	-	-	-	-	-	-	-	-	-	-	e
tx_cir_1:131 s_mx_1:88 :58																									
MC114->	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-	-	-	-	-	-	-	-	*	e	
tx_cir_1:131 s_mx_1:88 :74																									
MC113->	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-	-	-	-	-	-	-	-	-	e
tx_cir_1:131 s_mx_1:88 :75																									
Pin																									
21 ->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-
ADR_OUT																									
51 ->	-	*	*	*	-	-	-	-	*	-	-	*	-	*	-	-	*	*	*	-	*	*	*	*	CLOCK
15 ->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-	-	-	e	
CMD_OUT																									
11 ->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	e	-	-	e	-	
DATA_OUT																									
59 ->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-	e	-	-	-	DO5	
60 ->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-	e	-	-	-	DO6	
61 ->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-	e	-	-	-	DO7	
64 ->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-	e	-	-	-	DO8	
65 ->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	e	-	-	-	-	DO9	
70 ->	-	-	-	-	-	e	-	-	-	-	-	-	-	-	-	-	e	e	e	e	-	-	e	DSTRB	
10 ->	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	e	-	-	-	-	
HOLD_OUT																									
52 ->	-	-	-	-	-	-	-	*	-	-	-	-	-	-	-	-	-	*	-	-	-	-	*	LOS	

REPLACEMENT SHEET

26 JUL 1996

```

98  -> - * * * * * - * * - * * * * * | * * * - * * * * | MR
22  -> - - - - - - - - - - - - - - - | - - - - - - - - e - |
MRK0_OUT
9   -> - - - - - - - - - - - e - - - - - | - - - - - - - - e - |
OP_OUT
17  -> - - - - - - - - - - - - - - - | e - - - - - e - - |
SEL_OUT
14  -> - - - - - - - - - - - e - - - - - | - e e - - - - e - |
SER_OUT
20  -> - - - - - - - - - - - - - - - | - - - - - - e - - |
SUPR_OUT
72  -> - - - - - - - e - - - - - - - - | - - - - - - e - | VLTN
MC79 -> - - - - - * * * - - - - - - - - | - - - - - e - - * - |
|ala_drv:102|wd_cntr:123|:7
MC78 -> - - - - - * * * - - - - - - - - | - - - - - e - - * - |
|ala_drv:102|wd_cntr:123|:8
MC67 -> - - - - - * - - - - - - - - - - | - - - - - e - * * - |
|ala_drv:102|WD_SEND
MC5  -> - - - - - - - - - - - - - - - * | e * - - - - - * - |
STAT_IN
MC102-> - - - - - * - - - - - - - - - - | - - - - - - e * - |
STROBE
MC112-> - - - - - - - - - - * - - * - - - | * - * - - * e * - |
|tx_cir_1:131|as_syn_1:95|:58
MC111-> - * * * - - - - - * - - * - * - | - * * - * * e * - |
|tx_cir_1:131|as_syn_1:95|:65
-----

```

**** EQUATIONS ****

```

ACKNLGE : INPUT;
ADR_OUT  : INPUT;
BUS_OUTP : INPUT;
BUS_OUT0 : INPUT;
BUS_OUT1 : INPUT;
BUS_OUT2 : INPUT;
BUS_OUT3 : INPUT;
BUS_OUT4 : INPUT;
BUS_OUT5 : INPUT;
BUS_OUT6 : INPUT;
BUS_OUT7 : INPUT;
CLOCK    : INPUT;
CMD_OUT   : INPUT;
DATA_OUT  : INPUT;
DIV_A_B   : INPUT;
DO0       : INPUT;
DO1       : INPUT;
DO2       : INPUT;
DO3       : INPUT;
DO4       : INPUT;
DO5       : INPUT;
DO6       : INPUT;
DO7       : INPUT;
DO8       : INPUT;
DO9       : INPUT;
DSTRB     : INPUT;
HOLD_OUT  : INPUT;

```

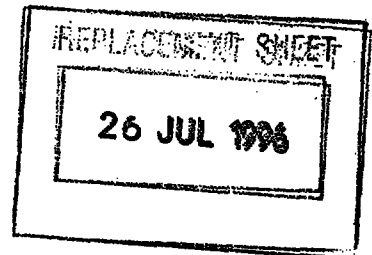
REPLACEMENT SHEET

26 JUL 1996

```

LOS      : INPUT;
MR       : INPUT;
MRK0_OUT : INPUT;
OP_OUT   : INPUT;
SEL_OUT  : INPUT;
SER_OUT  : INPUT;
SUPR_OUT : INPUT;
VLIN     : INPUT;
WD_EN    : INPUT;

```



```

ACTIVITY = _MC119;
_MC119 = MCELL( _EQ001 $ VCC );
_EQ001 = !_MC124 & !_MC125;

% ADR_IN = |rx_cir_1:80|bt_dmx_1:80|TAG %
ADR_IN = _MC007;
_MC007 = DFF( _EQ002 $ GND, DSTRB, MR, VCC );
_EQ002 = DO0 & DO2
# !DO0 & _MC007;

% BUS_INP = |rx_cir_1:80|bt_dmx_1:73|:17 %
BUS_INP = _MC040;
_MC040 = DFF( _MC048 $ GND, DSTRB, _EQ003, VCC );
_EQ003 = !_MC027 & !_MC028;

% BUS_IN0 = |rx_cir_1:80|bt_dmx_1:82|:17 %
BUS_IN0 = _MC056;
_MC056 = DFF( _MC060 $ GND, DSTRB, _EQ004, VCC );
_EQ004 = !_MC027 & !_MC028;

% BUS_IN1 = |rx_cir_1:80|bt_dmx_1:80|:17 %
BUS_IN1 = _MC055;
_MC055 = DFF( _MC061 $ GND, DSTRB, _EQ005, VCC );
_EQ005 = !_MC027 & !_MC028;

% BUS_IN2 = |rx_cir_1:80|sl_dmx_1:93|:17 %
BUS_IN2 = _MC054;
_MC054 = DFF( _MC057 $ GND, DSTRB, _EQ006, VCC );
_EQ006 = !_MC027 & !_MC028;

% BUS_IN3 = |rx_cir_1:80|ds_dmx_1:78|:33 %
BUS_IN3 = _MC053;
_MC053 = DFF( _MC058 $ GND, DSTRB, _EQ007, VCC );
_EQ007 = !_MC027 & !_MC028;

% BUS_IN4 = |rx_cir_1:80|ds_dmx_1:77|:33 %
BUS_IN4 = _MC052;
_MC052 = DFF( _MC059 $ GND, DSTRB, _EQ008, VCC );
_EQ008 = !_MC027 & !_MC028;

% BUS_IN5 = |rx_cir_1:80|bt_dmx_1:76|:17 %
BUS_IN5 = _MC051;
_MC051 = DFF( _MC062 $ GND, DSTRB, _EQ009, VCC );
_EQ009 = !_MC027 & !_MC028;

% BUS_IN6 = |rx_cir_1:80|bt_dmx_1:75|:17 %
BUS_IN6 = _MC050;
_MC050 = DFF( _MC063 $ GND, DSTRB, _EQ010, VCC );

```

```

_EQ010 = !_MC027 & !_MC028;

% BUS_IN7 = |rx_cir_1:80|bt_dmx_1:74|:17 %
BUS_IN7 = _MC049;
_MC049 = DFF( _MC064 $ GND, DSTRB, _EQ011, VCC );
_EQ011 = !_MC027 & !_MC028;

CO0 = _MC100;
_MC100 = MCELL( !MR $ GND );

CO1 = _MC099;
_MC099 = MCELL( !MR $ GND );

% DATA_IN = |rx_cir_1:80|ds_dmx_1:77|TAG %
DATA_IN = _MC003;
_MC003 = DFF( _EQ012 $ GND, DSTRB, _EQ013, VCC );
_EQ012 = DO0 & DO5
# !DO0 & _MC003;
_EQ013 = !_MC030 & MR;

% DISC_IN = |rx_cir_1:80|bt_dmx_1:74|TAG %
DISC_IN = _MC001;
_MC001 = DFF( _EQ014 $ GND, DSTRB, MR, VCC );
_EQ014 = DO0 & DO8
# !DO0 & _MC001;

% DIO = |tx_cir_1:131|as_syn_1:95|:70 %
DIO = _MC081;
_MC081 = DFF( _MC112 $ GND, CLOCK, MR, VCC );

DI1 = _MC082;
_MC082 = MCELL( _EQ015 $ GND );
_EQ015 = _MC081 & _MC122
# _MC047 & !_MC081;

DI2 = _MC083;
_MC083 = MCELL( _EQ016 $ GND );
_EQ016 = _MC081 & _MC096
# _MC046 & !_MC081;

DI3 = _MC084;
_MC084 = MCELL( _EQ017 $ GND );
_EQ017 = _MC081 & _MC093
# _MC043 & !_MC081;

DI4 = _MC085;
_MC085 = MCELL( _EQ018 $ GND );
_EQ018 = _MC081 & _MC117
# _MC014 & !_MC081;

DI5 = _MC086;
_MC086 = MCELL( _EQ019 $ GND );
_EQ019 = _MC081 & _MC092
# _MC035 & !_MC081;

DI6 = _MC087;
_MC087 = MCELL( _EQ020 $ GND );
_EQ020 = _MC081 & _MC105

```

REPLACEMENT SHEET

26 JUL 1996

```

# _MC038 & !_MC081;

DI7      = _MC088;
_MC088   = MCELL( _EQ021 $ GND );
_EQ021   = _MC081 & _MC091
# _MC013 & !_MC081;

DI8      = _MC097;
_MC097   = MCELL( _EQ022 $ GND );
_EQ022   = _MC042 & _MC081
# _MC041 & !_MC081;

DI9      = _MC098;
_MC098   = MCELL( _EQ023 $ GND );
_EQ023   = _MC081 & _MC108
# _MC039 & !_MC081;

DRV_OE   = _MC022;
_MC022   = MCELL( !LOS $ GND );

FAULT    = _MC120;
_MC120   = MCELL( _EQ024 $ _MC123 );
_EQ024   = LOS & !_MC123;

% MRK0_IN = |rx_cir_1:80|bt_dmx_1:73|TAG %
MRK0_IN  = _MC017;
_MC017   = DFF( _EQ025 $ GND, DSTRB, MR, VCC );
_EQ025   = DO0 & DO9
# !DO0 & _MC017;

% OP_IN   = |rx_cir_1:80|bt_dmx_1:82|TAG %
OP_IN    = _MC008;
_MC008   = DFF( _EQ026 $ GND, DSTRB, MR, VCC );
_EQ026   = DO0 & DO1
# !DO0 & _MC008;

% REQ_IN  = |rx_cir_1:80|bt_dmx_1:75|TAG %
REQ_IN   = _MC002;
_MC002   = DFF( _EQ027 $ GND, DSTRB, MR, VCC );
_EQ027   = DO0 & DO7
# !DO0 & _MC002;

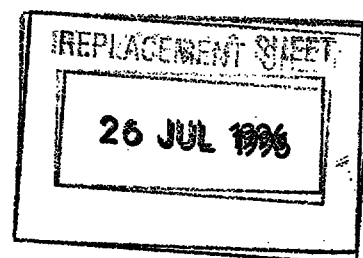
RLY_DRV  = _MC021;
_MC021   = MCELL( !LOS $ GND );

% SEL_IN  = |rx_cir_1:80|sl_dmx_1:93|:26 %
SEL_IN   = _MC006;
_MC006   = MCELL( _EQ028 $ GND );
_EQ028   = !_MC015 & _MC016;

% SER_IN  = |rx_cir_1:80|ds_dmx_1:78|TAG %
SER_IN   = _MC004;
_MC004   = DFF( _EQ029 $ GND, DSTRB, _EQ030, VCC );
_EQ029   = DO0 & DO4
# !DO0 & _MC004;
_EQ030   = !_MC029 & MR;

% STAT_IN = |rx_cir_1:80|bt_dmx_1:76|TAG %

```



26 JUL 1996

```

STAT_IN = _MC005;
_MC005 = DFF( _EQ031 $ GND, DSTRB, MR, VCC );
_EQ031 = DO0 & DO6
# !DO0 & _MC005;

% STROBE = |tx_cir_1:131|as_syn_1:95|STRB %
STROBE = _MC102;
_MC102 = DFF( _EQ032 $ VCC, !CLOCK, _EQ033, VCC );
_EQ032 = _MC025 & _MC037 & _MC044 & _MC067 & _MC089 &
_MC094 & _MC101 & _MC103 & _MC106 & _MC109 &
_MC114 & _MC116 & _MC118;
_EQ033 = _X001;
_X001 = EXP( ACKNLGGE & _MC102 );

% |ala_drv:102|wd_cntr:123|:2 %
_MC128 = DFF( VCC $ _MC128, CLOCK, _EQ034, VCC );
_EQ034 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:4 %
_MC127 = DFF( _MC128 $ _MC127, CLOCK, _EQ035, VCC );
_EQ035 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:5 %
_MC080 = DFF( _EQ036 $ _MC080, CLOCK, _EQ037, VCC );
_EQ036 = _MC065 & _MC066 & _MC068 & _MC069 & _MC070 &
_MC071 & _MC072 & _MC073 & _MC074 & _MC075 & _MC076 &
_MC077 & _MC078 & _MC079 & _MC126 & _MC127 & _MC128;
_EQ037 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:6 %
_MC126 = DFF( _EQ038 $ _MC126, CLOCK, _EQ039, VCC );
_EQ038 = _MC127 & _MC128;
_EQ039 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:7 %
_MC079 = DFF( _EQ040 $ _MC079, CLOCK, _EQ041, VCC );
_EQ040 = _MC126 & _MC127 & _MC128;
_EQ041 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:8 %
_MC078 = DFF( _EQ042 $ _MC078, CLOCK, _EQ043, VCC );
_EQ042 = _MC079 & _MC126 & _MC127 & _MC128;
_EQ043 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:9 %
_MC077 = DFF( _EQ044 $ _MC077, CLOCK, _EQ045, VCC );
_EQ044 = _MC078 & _MC079 & _MC126 & _MC127 & _MC128;
_EQ045 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:10 %
_MC076 = DFF( _EQ046 $ _MC076, CLOCK, _EQ047, VCC );
_EQ046 = _MC077 & _MC078 & _MC079 & _MC126 & _MC127 &
_MC128;
_EQ047 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:11 %

```



```

_MC075 = DFF( _EQ048 $ _MC075, CLOCK, _EQ049, VCC );
_EQ048 = _MC076 & _MC077 & _MC078 & _MC079 & _MC126 &
_MC127 &
      _MC128;
_EQ049 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:12 %
_MC074 = DFF( _EQ050 $ _MC074, CLOCK, _EQ051, VCC );
_EQ050 = _MC075 & _MC076 & _MC077 & _MC078 & _MC079 &
_MC126 &
      _MC127 & _MC128;
_EQ051 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:13 %
_MC073 = DFF( _EQ052 $ _MC073, CLOCK, _EQ053, VCC );
_EQ052 = _MC074 & _MC075 & _MC076 & _MC077 & _MC078 &
_MC079 &
      _MC126 & _MC127 & _MC128;
_EQ053 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:14 %
_MC072 = DFF( _EQ054 $ _MC072, CLOCK, _EQ055, VCC );
_EQ054 = _MC073 & _MC074 & _MC075 & _MC076 & _MC077 &
_MC078 &
      _MC079 & _MC126 & _MC127 & _MC128;
_EQ055 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:15 %
_MC071 = DFF( _EQ056 $ _MC071, CLOCK, _EQ057, VCC );
_EQ056 = _MC072 & _MC073 & _MC074 & _MC075 & _MC076 &
_MC077 &
      _MC078 & _MC079 & _MC126 & _MC127 & _MC128;
_EQ057 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:16 %
_MC070 = DFF( _EQ058 $ _MC070, CLOCK, _EQ059, VCC );
_EQ058 = _MC071 & _MC072 & _MC073 & _MC074 & _MC075 &
_MC076 &
      _MC077 & _MC078 & _MC079 & _MC126 & _MC127 &
_MC128;
_EQ059 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:17 %
_MC069 = DFF( _EQ060 $ _MC069, CLOCK, _EQ061, VCC );
_EQ060 = _MC070 & _MC071 & _MC072 & _MC073 & _MC074 &
_MC075 &
      _MC076 & _MC077 & _MC078 & _MC079 & _MC126 &
_MC127 &
      _MC128;
_EQ061 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:18 %
_MC068 = DFF( _EQ062 $ _MC068, CLOCK, _EQ063, VCC );
_EQ062 = _MC069 & _MC070 & _MC071 & _MC072 & _MC073 &
_MC074 &
      _MC075 & _MC076 & _MC077 & _MC078 & _MC079 &
_MC126 &
      _MC127 & _MC128;

```

REPLACEMENT SHEET

26 JUL 1996

26 JUL 1996

```

_EQ063 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:19 %
_MC066 = DFF( _EQ064 $ _MC066, CLOCK, _EQ065, VCC );
_EQ064 = _MC068 & _MC069 & _MC070 & _MC071 & _MC072 &
_MC073 &
      _MC074 & _MC075 & _MC076 & _MC077 & _MC078 &
_MC079 &
      _MC126 & _MC127 & _MC128;
_EQ065 = !_MC111 & MR;

% |ala_drv:102|wd_cntr:123|:20 %
_MC065 = DFF( _EQ066 $ _MC065, CLOCK, _EQ067, VCC );
_EQ066 = _MC066 & _MC068 & _MC069 & _MC070 & _MC071 &
_MC072 &
      _MC073 & _MC074 & _MC075 & _MC076 & _MC077 &
_MC078 &
      _MC079 & _MC126 & _MC127 & _MC128;
_EQ067 = !_MC111 & MR;

% |ala_drv:102|WD_SEND %
_MC067 = DFF( _EQ068 $ VCC, CLOCK, MR, _EQ069 );
_EQ068 = !DIV_A_B & _MC065 & _MC066 & _MC068 & _MC069 & _MC070
&
      _MC071 & _MC072 & _MC073 & _MC074 & _MC075 & _MC076
&
      _MC077 & _MC078 & _MC079 & _MC080 & _MC126 & _MC127
&
      _MC128 & WD_EN
# DIV_A_B & _MC073 & _MC074 & _MC075 & _MC076 & _MC077
&
      _MC078 & _MC079 & _MC126 & _MC127 & _MC128 & WD_EN
# !_MC067 & WD_EN;
_EQ069 = _X002;
_X002 = EXP( !_MC067 & _MC111 );

% |ala_drv:102|:2 %
_MC125 = DFF( _MC067 $ GND, _MC102, _EQ070, VCC );
_EQ070 = MR & _X003;
_X003 = EXP( _MC078 & _MC079 & _MC126 & _MC127 & _MC128
);

% |ala_drv:102|:3 %
_MC124 = DFF( GND $ VCC, DSTRB, _EQ071, VCC );
_EQ071 = MR & _X003;

% |ala_drv:102|:96 %
_MC123 = DFF( GND $ VCC, VLTN, _EQ072, VCC );
_EQ072 = MR & _X003;

% |rx_cir_1:80|bt_dmx_1:73|:2 %
_MC048 = DFF( _EQ073 $ GND, DSTRB, _EQ074, VCC );
_EQ073 = DO0 & _MC048
# !DO0 & DO9;
_EQ074 = !_MC027 & !_MC028;

% |rx_cir_1:80|bt_dmx_1:74|:2 %
_MC064 = DFF( _EQ075 $ GND, DSTRB, _EQ076, VCC );

```

26 JUL 1996

```

_EQ075 = DO0 & _MC064
# !DO0 & DO8;
_EQ076 = !_MC027 & !_MC028;

% |rx_cir_1:80|bt_dmx_1:75|:2 %
_MC063 = DFF( _EQ077 $ GND, DSTRB, _EQ078, VCC );
_EQ077 = DO0 & _MC063
# !DO0 & DO7;
_EQ078 = !_MC027 & !_MC028;

% |rx_cir_1:80|bt_dmx_1:76|:2 %
_MC062 = DFF( _EQ079 $ GND, DSTRB, _EQ080, VCC );
_EQ079 = DO0 & _MC062
# !DO0 & DO6;
_EQ080 = !_MC027 & !_MC028;

% |rx_cir_1:80|bt_dmx_1:80|:2 %
_MC061 = DFF( _EQ081 $ GND, DSTRB, _EQ082, VCC );
_EQ081 = DO0 & _MC061
# !DO0 & DO2;
_EQ082 = !_MC027 & !_MC028;

% |rx_cir_1:80|bt_dmx_1:82|:2 %
_MC060 = DFF( _EQ083 $ GND, DSTRB, _EQ084, VCC );
_EQ083 = DO0 & _MC060
# !DO0 & DO1;
_EQ084 = !_MC027 & !_MC028;

% |rx_cir_1:80|ds_det_1:47|:2 %
_MC032 = DFF( GND $ VCC, _EQ085, _EQ086, VCC );
_EQ085 = X004;
_X004 = EXP( !_MC003 & !_MC004 & !_MC032 );
_EQ086 = !_MC005 & _MC008 & MR;

% |rx_cir_1:80|ds_det_1:47|:3 %
_MC031 = DFF( _MC003 $ GND, _MC032, _EQ087, VCC );
_EQ087 = !_MC005 & _MC008 & MR;

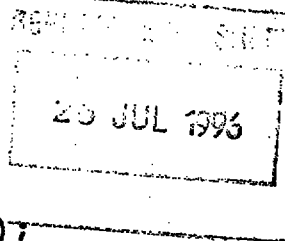
% |rx_cir_1:80|ds_dmx_1:77|:2 %
_MC059 = DFF( _EQ088 $ GND, DSTRB, _EQ089, VCC );
_EQ088 = DO0 & _MC059
# !DO0 & DO5;
_EQ089 = !_MC027 & !_MC028;

% |rx_cir_1:80|ds_dmx_1:77|:26 %
_MC030 = DFF( !_MC031 $ GND, !DATA_OUT, _EQ090, VCC );
_EQ090 = _MC003 & MR;

% |rx_cir_1:80|ds_dmx_1:78|:2 %
_MC058 = DFF( _EQ091 $ GND, DSTRB, _EQ092, VCC );
_EQ091 = DO0 & _MC058
# !DO0 & DO4;
_EQ092 = !_MC027 & !_MC028;

% |rx_cir_1:80|ds_dmx_1:78|:26 %
_MC029 = DFF( !_MC031 $ GND, !SER_OUT, _EQ093, VCC );
_EQ093 = _MC004 & MR;

```



```

% |rx_cir_1:80|sl_dmx_1:93|:2 %
_MC057 = DFF( _EQ094 $ GND, DSTRB, _EQ095, VCC );
_EQ094 = DO0 & _MC057
# !DO0 & DO3;
_EQ095 = !_MC027 & !_MC028;

% |rx_cir_1:80|sl_dmx_1:93|:3 %
_MC016 = DFF( _EQ096 $ GND, DSTRB, MR, VCC );
_EQ096 = DO0 & DO3
# !DO0 & _MC016;

% |rx_cir_1:80|sl_dmx_1:93|:20 %
_MC015 = DFF( GND $ VCC, SEL_OUT, _EQ097, VCC );
_EQ097 = _MC016 & MR;

% |rx_cir_1:80|:84 %
_MC028 = DFF( GND $ VCC, !_MC008, _MC026, VCC );

% |rx_cir_1:80|:85 %
_MC027 = DFF( GND $ VCC, !_MC005, _MC026, VCC );

% |rx_cir_1:80|:86 %
_MC026 = DFF( _EQ098 $ GND, CLOCK, VCC, VCC );
_EQ098 = !_MC027 & !_MC028;

% |tx_cir_1:131|as_syn_1:95|:58 %
_MC112 = DFF( _EQ099 $ !_MC112, !CLOCK, MR, VCC );
_EQ099 = _MC025 & _MC037 & _MC044 & _MC067 & _MC089 &
_MC094 &
_MC101 & _MC103 & _MC106 & _MC109 & !_MC112 &
_MC114 &
_MC116 & _MC118;

% |tx_cir_1:131|as_syn_1:95|:65 %
_MC111 = DFF( _MC112 $ GND, !CLOCK, _EQ100, VCC );
_EQ100 = _X005;
_X005 = EXP( _MC025 & _MC037 & _MC044 & _MC067 & _MC089 &
_MC094 &
_MC101 & _MC103 & _MC106 & _MC109 & _MC114 & _MC116
&
_MC118 );

% |tx_cir_1:131|bt_mx_1:59|:4 %
_MC122 = DFF( !OP_OUT $ GND, _EQ101, MR, VCC );
_EQ101 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:59|:5 %
_MC121 = DFF( _MC122 $ GND, _MC111, MR, VCC );

% |tx_cir_1:131|bt_mx_1:59|:39 %
_MC118 = MCELL( !_MC122 $ _MC121 );

% |tx_cir_1:131|bt_mx_1:59|:45 %
_MC047 = DFF( _EQ102 $ GND, _EQ103, MR, VCC );
_EQ102 = _X006;
_X006 = EXP( _X007 & _X008 & _X009 );
_X007 = EXP( !_MC034 & _X006 );
_X008 = EXP( !BUS_OUT0 & _MC033 & _MC034 );

```

26 JUL 1996

```

_X009 = EXP( !_MC033 & _X006 );
_EQ103 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:61|:4 %
_MC096 = DFF( !ADR_OUT $ GND, _EQ104, MR, VCC );
_EQ104 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:61|:5 %
_MC095 = DFF( _MC096 $ GND, _MC111, MR, VCC );

% |tx_cir_1:131|bt_mx_1:61|:39 %
_MC094 = MCELL( !_MC096 $ _MC095 );

% |tx_cir_1:131|bt_mx_1:61|:45 %
_MC046 = DFF( _EQ105 $ GND, _EQ106, MR, VCC );
_EQ105 = _X010;
_X010 = EXP( _X011 & _X012 & _X013 );
_X011 = EXP( !_MC034 & _X010 );
_X012 = EXP( !BUS_OUT1 & _MC033 & _MC034 );
_X013 = EXP( !_MC033 & _X010 );
_EQ106 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:62|:4 %
_MC093 = DFF( !SEL_OUT $ GND, _EQ107, MR, VCC );
_EQ107 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:62|:5 %
_MC045 = DFF( _MC093 $ GND, _MC111, MR, VCC );

% |tx_cir_1:131|bt_mx_1:62|:39 %
_MC044 = MCELL( !_MC093 $ _MC045 );

% |tx_cir_1:131|bt_mx_1:62|:45 %
_MC043 = DFF( _EQ108 $ GND, _EQ109, MR, VCC );
_EQ108 = _X014;
_X014 = EXP( _X015 & _X016 & _X017 );
_X015 = EXP( !_MC034 & _X014 );
_X016 = EXP( !BUS_OUT2 & _MC033 & _MC034 );
_X017 = EXP( !_MC033 & _X014 );
_EQ109 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:65|:4 %
_MC042 = DFF( !HOLD_OUT $ GND, _EQ110, MR, VCC );
_EQ110 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:65|:5 %
_MC110 = DFF( _MC042 $ GND, _MC111, MR, VCC );

% |tx_cir_1:131|bt_mx_1:65|:39 %
_MC109 = MCELL( !_MC042 $ _MC110 );

% |tx_cir_1:131|bt_mx_1:65|:45 %
_MC041 = DFF( _EQ111 $ GND, _EQ112, MR, VCC );
_EQ111 = _X018;
_X018 = EXP( _X019 & _X020 & _X021 );
_X019 = EXP( !_MC034 & _X018 );
_X020 = EXP( !BUS_OUT7 & _MC033 & _MC034 );
_X021 = EXP( !_MC033 & _X018 );

```

26 JUL 1986

```

_EQ112 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:66|:4 %
_MC108 = DFF( !MRK0_OUT $ GND, _EQ113, MR, VCC );
_EQ113 = CLOCK & !_MC112;

% |tx_cir_1:131|bt_mx_1:66|:5 %
_MC107 = DFF( _MC108 $ GND, _MC111, MR, VCC );

% |tx_cir_1:131|bt_mx_1:66|:39 %
_MC106 = MCELL( !_MC108 $ _MC107 );

% |tx_cir_1:131|bt_mx_1:66|:45 %
_MC039 = DFF( _EQ114 $ GND, _EQ115, MR, VCC );
_EQ114 = _X022;
_X022 = EXP( _X023 & _X024 & _X025 );
_X023 = EXP( !_MC034 & _X022 );
_X024 = EXP( !BUS_OUTP & _MC033 & _MC034 );
_X025 = EXP( !_MC033 & _X022 );
_EQ115 = CLOCK & !_MC112;

% |tx_cir_1:131|c_mx_1:94|:4 %
_MC105 = DFF( !CMD_OUT $ GND, _EQ116, MR, VCC );
_EQ116 = CLOCK & !_MC112;

% |tx_cir_1:131|c_mx_1:94|:57 %
_MC101 = DFF( GND $ GND, _MC105, MR, _EQ117 );
_EQ117 = _X026;
_X026 = EXP( _MC104 & _MC111 );

% |tx_cir_1:131|c_mx_1:94|:79 %
_MC104 = DFF( _EQ118 $ VCC, CLOCK, MR, VCC );
_EQ118 = _MC101 & _MC103;

% |tx_cir_1:131|c_mx_1:94|:86 %
_MC038 = DFF( _EQ119 $ GND, _EQ120, MR, VCC );
_EQ119 = _X027;
_X027 = EXP( _X028 & _X029 & _X030 );
_X028 = EXP( !_MC034 & _X027 );
_X029 = EXP( !BUS_OUT5 & _MC033 & _MC034 );
_X030 = EXP( !_MC033 & _X027 );
_EQ120 = CLOCK & !_MC112;

% |tx_cir_1:131|c_mx_1:94|:89 %
_MC103 = DFF( _MC031 $ GND, !_MC105, MR, _EQ121 );
_EQ121 = _X026;

% |tx_cir_1:131|d_mx_1:85|RELEASE %
_MC092 = DFF( !DATA_OUT $ GND, _EQ122, MR, VCC );
_EQ122 = CLOCK & !_MC112;

% |tx_cir_1:131|d_mx_1:85|SEND %
_MC037 = DFF( GND $ GND, _MC092, MR, _EQ123 );
_EQ123 = _X031;
_X031 = EXP( _MC036 & _MC111 );

% |tx_cir_1:131|d_mx_1:85|:79 %
_MC036 = DFF( !_MC037 $ GND, CLOCK, MR, VCC );

```

26 JUL 1996

55

```

% |tx_cir_1:131|d_mx_1:85|:86 %
_MC035 = DFF( _EQ124 $ GND, _EQ125, MR, VCC );
_EQ124 = _X032;
_X032 = EXP( _X033 & _X034 & _X035 );
_X033 = EXP( !_MC034 & _X032 );
_X034 = EXP( !BUS_OUT4 & _MC033 & _MC034 );
_X035 = EXP( !_MC033 & _X032 );
_EQ125 = CLOCK & !_MC112;

% |tx_cir_1:131|ds_mx_1:89|SEND %
_MC025 = DFF( _EQ126 $ _MC025, CLOCK, MR, _EQ127 );
_EQ126 = CMD_OUT & DATA_OUT & _MC020 & _MC023 & _MC024 & _MC025
&
SER_OUT;
_EQ127 = _X036;
_X036 = EXP( !_MC025 & _MC111 );

% |tx_cir_1:131|ds_mx_1:89|:105 %
_MC024 = DFF( _EQ128 $ GND, CLOCK, _EQ129, VCC );
_EQ128 = CMD_OUT & DATA_OUT & _MC020 & SER_OUT;
_EQ129 = CMD_OUT & DATA_OUT & _MC020 & SER_OUT;

% |tx_cir_1:131|ds_mx_1:89|:106 %
_MC023 = DFF( _MC024 $ GND, CLOCK, _EQ130, VCC );
_EQ130 = CMD_OUT & DATA_OUT & _MC020 & SER_OUT;

% |tx_cir_1:131|ds_mx_1:89|:116 %
_MC034 = DFF( GND $ GND, !SER_OUT, VCC, _EQ131 );
_EQ131 = _MC031 & !_MC117;

% |tx_cir_1:131|ds_mx_1:89|:117 %
_MC033 = DFF( GND $ GND, !DATA_OUT, VCC, _EQ132 );
_EQ132 = _MC031 & !_MC092;

% |tx_cir_1:131|ds_mx_1:89|:128 %
_MC020 = DFF( _EQ133 $ VCC, CLOCK, _EQ134, VCC );
_EQ133 = !_MC020 & !_MC031;
_EQ134 = _MC025 & MR;

% |tx_cir_1:131|s_mx_1:88|RELEASE %
_MC117 = DFF( !SER_OUT $ GND, _EQ135, MR, VCC );
_EQ135 = CLOCK & !_MC112;

% |tx_cir_1:131|s_mx_1:88|:57 %
_MC116 = DFF( GND $ GND, _MC117, MR, _EQ136 );
_EQ136 = _X037;
_X037 = EXP( _MC111 & _MC115 );

% |tx_cir_1:131|s_mx_1:88|:58 %
_MC115 = DFF( _EQ137 $ VCC, CLOCK, MR, VCC );
_EQ137 = _MC114 & _MC116;

% |tx_cir_1:131|s_mx_1:88|:74 %
_MC114 = DFF( !_MC113 $ GND, !_MC117, MR, _EQ138 );
_EQ138 = _X037;

% |tx_cir_1:131|s_mx_1:88|:75 %
_MC113 = DFF( _MC005 $ GND, _MC117, MR, VCC );

```

```

% |tx_cir_1:131|s_mx_1:88|:84 %
_MC014 = DFF( _EQ139 $ GND, _EQ140, MR, VCC );
_EQ139 = _X038;
_X038 = EXP( _X039 & _X040 & _X041 );
_X039 = EXP( !_MC034 & _X038 );
_X040 = EXP( !BUS_OUT3 & _MC033 & _MC034 );
_X041 = EXP( !_MC033 & _X038 );
_EQ140 = CLOCK & !_MC112;

% |tx_cir_1:131|sup_mx_1:100|:4 %
_MC091 = DFF( SUPR_OUT $ GND, _EQ141, MR, VCC );
_EQ141 = CLOCK & !_MC112;

% |tx_cir_1:131|sup_mx_1:100|:5 %
_MC090 = DFF( _MC091 $ GND, _MC111, MR, VCC );

% |tx_cir_1:131|sup_mx_1:100|:39 %
_MC089 = MCELL( _EQ142 $ VCC );
_EQ142 = !_MC090 & _MC091 & !_MC092 & !_MC117
# _MC090 & !_MC091 & !_MC092 & !_MC117;

% |tx_cir_1:131|sup_mx_1:100|:45 %
_MC013 = DFF( _EQ143 $ GND, _EQ144, MR, VCC );
_EQ143 = _X042;
_X042 = EXP( _X043 & _X044 & _X045 );
_X043 = EXP( !_MC034 & _X042 );
_X044 = EXP( !BUS_OUT6 & _MC033 & _MC034 );
_X045 = EXP( !_MC033 & _X042 );
_EQ144 = CLOCK & !_MC112;

%
Shareable Expanders that are Duplicated in Multiple LABs:
(none)
% Copyrighted April 6, 1992 by FiberCom, Inc.

```

REPLACEMENT SHEET

26 JUL 1993

APPENDIX B

Project Information f:\max2work\mini\mini_rem\mini_rem.rpt
MAX+plus II Compiler Report File
Version 2.11 04/06/92

***** Project compiled without errors

Title: REMOTE MINI-EXTENDER
Company: FiberCom, Inc.
Designer: Richard LaBarbera
Rev: A
Date: 4:24p 5-29-1992

** DEVICE SUMMARY **

Chip/ POF	Device	Input Pins	Output Pins	Bidir Pins	MCs	Shareable EXPs	% Utilize
MINI	EPM5130WC-1	39	35	0	118	44	92 %

** PIN/MC/CHIP ASSIGNMENTS **

User Assignments	Actual Assignments (if different)	Node Name
MINI@85		ACKNL DGE
MINI@99		ACTIVITY
MINI@20		ADR_IN
MINI@8		ADR_OUT
MINI@29		BUS_INP
MINI@39		BUS_IN0
MINI@36		BUS_IN1
MINI@35		BUS_IN2
MINI@34		BUS_IN3
MINI@33		BUS_IN4
MINI@32		BUS_IN5
MINI@31		BUS_IN6
MINI@30		BUS_IN7
MINI@40		BUS_OUTP
MINI@50		BUS_OUT0
MINI@49		BUS_OUT1
MINI@48		BUS_OUT2
MINI@47		BUS_OUT3
MINI@46		BUS_OUT4
MINI@45		BUS_OUT5
MINI@42		BUS_OUT6
MINI@41		BUS_OUT7
MINI@51		CLOCK
MINI@5		CMD_OUT
MINI@84		CO0
MINI@83		CO1
MINI@95		DASD
MINI@11		DATA_IN
MINI@3		DATA_OUT

REPLACEMENT SHEET

26 JUL 1996

-58-

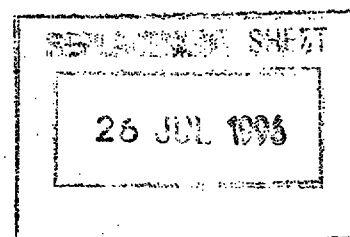
MINI@24	DAT_IN_D
MINI@9	DISC_IN
MINI@97	DIV_A_B
MINI@73	DI0
MINI@74	DI1
MINI@75	DI2
MINI@76	DI3
MINI@77	DI4
MINI@78	DI5
MINI@79	DI6
MINI@80	DI7
MINI@81	DI8
MINI@82	DI9
MINI@54	DO0
MINI@55	DO1
MINI@56	DO2
MINI@57	DO3
MINI@58	DO4
MINI@59	DO5
MINI@60	DO6
MINI@61	DO7
MINI@64	DO8
MINI@65	DO9
MINI@28	DRV_OE
MINI@70	DSTRB
MINI@100	FAULT
MINI@2	HOLD_OUT
MINI@52	LOS
MINI@98	MR
MINI@22	MRKO_IN
MINI@23	MRKO_OUT
MINI@21	OP_IN
MINI@1	OP_OUT
MINI@10	REQ_IN
MINI@27	RLY_DRV
MINI@17	SEL_IN
MINI@6	SEL_OUT
MINI@14	SER_IN
MINI@25	SER_IN_D
MINI@4	SER_OUT
MINI@15	STAT_IN
MINI@86	STROBE
MINI@7	SUPR_OUT
MINI@72	VLTN
MINI@96	WD_EN

REPLACES 31 SHEET

26 JUL 1976

** FILE HIERARCHY **

```
rx_cir_r:82|
rx_cir_r:82 ds_det_r:60|
rx_cir_r:82 d_dmx_r:102|
rx_cir_r:82 s_dmx_r:101|
rx_cir_r:82 ad_dmx_r:99|
rx_cir_r:82 c_dmx_r:96|
rx_cir_r:82 op_dmx_r:83|
rx_cir_r:82 bt_dmx_r:90|
rx_cir_r:82 bt_dmx_r:89|
rx_cir_r:82 bt_dmx_r:91|
rx_cir_r:82 bt_dmx_r:85|
tx_cir_r:109|
tx_cir_r:109 as_syn_r:93|
tx_cir_r:109 bus_in_0:100|
tx_cir_r:109 req_mx_r:99|
tx_cir_r:109 req_mx_r:99 fclatch:43|
tx_cir_r:109 ds_dn_r:91|
tx_cir_r:109 ds_mx_r:97|
tx_cir_r:109 ds_mx_r:97 fclatch:86|
tx_cir_r:109 ds_mx_r:98|
tx_cir_r:109 ds_mx_r:98 fclatch:86|
tx_cir_r:109 bt_mx_r:81|
tx_cir_r:109 bt_mx_r:81 fclatch:43|
tx_cir_r:109 bt_mx_r:80|
tx_cir_r:109 bt_mx_r:80 fclatch:43|
tx_cir_r:109 bt_mx_r:78|
tx_cir_r:109 bt_mx_r:78 fclatch:43|
tx_cir_r:109 bt_mx_r:77|
tx_cir_r:109 bt_mx_r:77 fclatch:43|
tx_cir_r:109 bt_mx_r:76|
tx_cir_r:109 bt_mx_r:76 fclatch:43|
tx_cir_r:109 bt_mx_r:75|
tx_cir_r:109 bt_mx_r:75 fclatch:43|
ala_drv:83|
ala_drv:83 wd_cntr:123|
```



***** Logic for device 'MINI' compiled without errors

Device: EPMS130WC-1

Security: OFF

[illegible]

REPLACEMENT SET

26 JUL 1996

** RESOURCE USAGE **

Logic Array Block	Macrocells	I/O Pins	Shareable Expanders	External Interconnect
A: MC1 - MC16	16/16(100%)	8/8(100%)	1/32(3%)	10/24(41%)
B: MC17 - MC32	16/16(100%)	7/8(87%)	2/32(6%)	12/24(50%)
C: MC33 - MC48	16/16(100%)	8/8(100%)	1/32(3%)	11/24(45%)
D: MC49 - MC64	16/16(100%)	8/8(100%)	8/32(25%)	13/24(54%)
E: MC65 - MC80	6/16(37%)	7/8(87%)	0/32(0%)	6/24(25%)
F: MC81 - MC96	16/16(100%)	8/8(100%)	28/32(87%)	23/24(95%)
G: MC97 - MC112	16/16(100%)	6/8(75%)	3/32(9%)	19/24(79%)
H: MC113 - MC128	16/16(100%)	6/8(75%)	1/32(3%)	8/24(33%)

Total dedicated input pins used:	16/ 20 (80%)
Total I/O pins used:	58/ 64 (90%)
Total macrocells used:	118/128 (92%)
Total shareable expanders used:	44/256 (17%)

Total input pins required:	39
Total output pins required:	35
Total bidirectional pins required:	0
Total macrocells required:	118
Total shareable expanders in database:	44

Synthesized macrocells:	0/128 (0%)
-------------------------	-------------

REPLACEMENT SHEET

26 JUL 1996

** INPUTS **

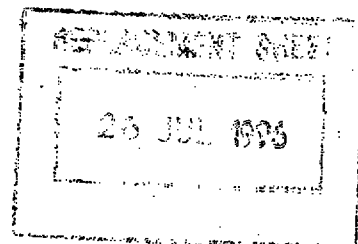
Pin	MCell	LAB	Primitive	Shareable Expanders		Fan-In		Name
				Total	Shared	INP	FBK	
85	(101)	(G)	INPUT	0	0	0	0	ACKNL DGE
20	-	-	INPUT	0	0	0	0	ADR_IN
29	(23)	(B)	INPUT	0	0	0	0	BUS_INP
39	(39)	(C)	INPUT	0	0	0	0	BUS_IN0
36	(38)	(C)	INPUT	0	0	0	0	BUS_IN1
35	(37)	(C)	INPUT	0	0	0	0	BUS_IN2
34	(36)	(C)	INPUT	0	0	0	0	BUS_IN3
33	(35)	(C)	INPUT	0	0	0	0	BUS_IN4
32	(34)	(C)	INPUT	0	0	0	0	BUS_IN5
31	(33)	(C)	INPUT	0	0	0	0	BUS_IN6
30	(24)	(B)	INPUT	0	0	0	0	BUS_IN7
51	(65)	(E)	INPUT	0	0	0	0	CLOCK
95	(115)	(H)	INPUT	0	0	0	0	DASD
11	-	-	INPUT	0	0	0	0	DATA_IN
24	(18)	(B)	INPUT	0	0	0	0	DAT_IN_D
9	-	-	INPUT	0	0	0	0	DISC_IN
97	(117)	(H)	INPUT	0	0	0	0	DIV_A_B
54	(68)	(E)	INPUT	0	0	0	0	DO0
55	(69)	(E)	INPUT	0	0	0	0	DO1
56	(70)	(E)	INPUT	0	0	0	0	DO2
57	(71)	(E)	INPUT	0	0	0	0	DO3
58	(72)	(E)	INPUT	0	0	0	0	DO4
59	-	-	INPUT	0	0	0	0	DO5
60	-	-	INPUT	0	0	0	0	DO6
61	-	-	INPUT	0	0	0	0	DO7
64	-	-	INPUT	0	0	0	0	DO8
65	-	-	INPUT	0	0	0	0	DO9
70	-	-	INPUT	0	0	0	0	DSTRB
52	(66)	(E)	INPUT	0	0	0	0	LOS
98	(118)	(H)	INPUT	0	0	0	0	MR
22	-	-	INPUT	0	0	0	0	MRK0_IN
21	-	-	INPUT	0	0	0	0	OP_IN
10	-	-	INPUT	0	0	0	0	REQ_IN
17	-	-	INPUT	0	0	0	0	SEL_IN
14	-	-	INPUT	0	0	0	0	SER_IN
25	(19)	(B)	INPUT	0	0	0	0	SER_IN_D
15	-	-	INPUT	0	0	0	0	STAT_IN
72	-	-	INPUT	0	0	0	0	VLTN
96	(116)	(H)	INPUT	0	0	0	0	WD_EN

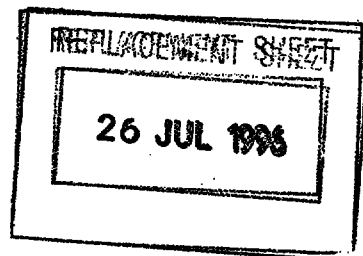
REPLACEMENT SHEET

26 JUL 1996

** OUTPUTS **

Pin	MCell	LAB	Primitive	Shareable Expanders		Fan-In		Name
				Total	Shared	INP	FBK	
99	119	H	OUTPUT	0	0	0	2	ACTIVITY
8	8	A	DFF	0	0	4	2	ADR_OUT
40	40	C	DFF	0	0	4	1	BUS_OUT1
50	56	D	DFF	0	0	4	1	BUS_OUT0
49	55	D	DFF	0	0	4	1	BUS_OUT1
48	54	D	DFF	0	0	4	1	BUS_OUT2
47	53	D	DFF	0	0	4	1	BUS_OUT3
46	52	D	DFF	0	0	4	1	BUS_OUT4
45	51	D	DFF	0	0	4	1	BUS_OUT5
42	50	D	DFF	0	0	4	1	BUS_OUT6
41	49	D	DFF	0	0	4	1	BUS_OUT7
5	5	A	DFF	0	0	4	1	CMD_OUT
84	100	G	OUTPUT	0	0	1	0	CO0
83	99	G	OUTPUT	0	0	1	0	CO1
3	3	A	DFF	0	0	4	2	DATA_OUT
73	81	F	DFF	0	0	2	1	DI0
74	82	F	OUTPUT	0	0	0	3	DI1
75	83	F	OUTPUT	0	0	0	3	DI2
76	84	F	OUTPUT	0	0	0	3	DI3
77	85	F	OUTPUT	0	0	0	3	DI4
78	86	F	OUTPUT	0	0	0	3	DI5
79	87	F	OUTPUT	0	0	0	3	DI6
80	88	F	OUTPUT	0	0	0	3	DI7
81	97	G	OUTPUT	0	0	0	3	DI8
82	98	G	OUTPUT	0	0	0	3	DI9
28	22	B	OUTPUT	0	0	1	0	DRV_OE
100	120	H	OUTPUT	0	0	1	1	FAULT
2	2	A	DFF	0	0	4	1	HOLD_OUT
23	17	B	DFF	0	0	4	1	MRKO_OUT
1	1	A	DFF	0	0	4	0	OP_OUT
27	21	B	OUTPUT	0	0	1	0	RLY_DRV
6	6	A	DFF	0	0	4	1	SEL_OUT
4	4	A	DFF	0	0	4	3	SER_OUT
86	102	G	DFF	1	0	2	13	STROBE
7	7	A	DFF	0	0	4	1	SUPR_OUT





** BURIED LOGIC **

Pin	MCell	LAB	Primitive	Shareable		Fan-In		Name
				Total	Shared	INP	FBK	
-	128	H	DFF	0	0	2	1	ala_drv:83 wd_cntr:123 :2
-	127	H	DFF	0	0	2	2	ala_drv:83 wd_cntr:123 :4
-	48	C	DFF	0	0	2	18	ala_drv:83 wd_cntr:123 :5
-	126	H	DFF	0	0	2	3	ala_drv:83 wd_cntr:123 :6
-	125	H	DFF	0	0	2	4	ala_drv:83 wd_cntr:123 :7
-	47	C	DFF	0	0	2	5	ala_drv:83 wd_cntr:123 :8
-	46	C	DFF	0	0	2	6	ala_drv:83 wd_cntr:123 :9
-	45	C	DFF	0	0	2	7	ala_drv:83 wd_cntr:123 :10
-	44	C	DFF	0	0	2	8	ala_drv:83 wd_cntr:123 :11
-	43	C	DFF	0	0	2	9	ala_drv:83 wd_cntr:123 :12
-	42	C	DFF	0	0	2	10	ala_drv:83 wd_cntr:123 :13
-	41	C	DFF	0	0	2	11	ala_drv:83 wd_cntr:123 :14
(39)	39	C	DFF	0	0	2	12	ala_drv:83 wd_cntr:123 :15
(36)	38	C	DFF	0	0	2	13	ala_drv:83 wd_cntr:123 :16
(35)	37	C	DFF	0	0	2	14	ala_drv:83 wd_cntr:123 :17
(34)	36	C	DFF	0	0	2	15	ala_drv:83 wd_cntr:123 :18
(33)	35	C	DFF	0	0	2	16	ala_drv:83 wd_cntr:123 :19
(32)	34	C	DFF	0	0	2	17	ala_drv:83 wd_cntr:123 :20
(31)	33	C	DFF	1	0	4	19	ala_drv:83 WD_SEND
-	124	H	DFF	1	1	1	7	ala_drv:83 :2
-	123	H	DFF	1	1	2	5	ala_drv:83 :3
-	122	H	DFF	1	1	2	5	ala_drv:83 :96
-	16	A	DFF	0	0	2	1	rx_cir_r:82 ad_dmx_r:99 :19
-	15	A	DFF	0	0	2	3	rx_cir_r:82 d_dmx_r:102 :26
-	14	A	DFF	1	0	5	1	rx_cir_r:82 ds_det_r:60 :2
-	13	A	DFF	0	0	4	2	rx_cir_r:82 ds_det_r:60 :3
-	12	A	DFF	0	0	2	3	rx_cir_r:82 s_dmx_r:101 :26
-	11	A	DFF	0	0	3	2	rx_cir_r:82 s_dmx_r:101 :41
-	96	F	DFF	0	0	11	2	rx_cir_r:82 s_dmx_r:101 :42
-	10	A	DFF	0	0	2	2	rx_cir_r:82 s_dmx_r:101 :43
-	112	G	DFF	0	0	2	13	tx_cir_r:109 as_syn_r:93 :58
-	111	G	DFF	1	0	2	14	tx_cir_r:109 as_syn_r:93 :65
-	121	H	DFF	0	0	2	2	tx_cir_r:109 bt_mx_r:75 :4
(98)	118	H	DFF	0	0	1	2	tx_cir_r:109 bt_mx_r:75 :5
-	9	A	MCELL	0	0	0	2	tx_cir_r:109 bt_mx_r:75 :33
-	95	F	DFF	4	0	3	3	tx_cir_r:109 bt_mx_r:75 :36
(97)	117	H	DFF	0	0	3	0	tx_cir_r:109 bt_mx_r:75 :41
(96)	116	H	DFF	0	0	2	2	tx_cir_r:109 bt_mx_r:76 :4
(95)	115	H	DFF	0	0	1	2	tx_cir_r:109 bt_mx_r:76 :5
(92)	114	H	MCELL	0	0	0	2	tx_cir_r:109 bt_mx_r:76 :33
-	94	F	DFF	4	0	3	3	tx_cir_r:109 bt_mx_r:76 :36
(91)	113	H	DFF	0	0	3	0	tx_cir_r:109 bt_mx_r:76 :41
-	64	D	DFF	0	0	2	2	tx_cir_r:109 bt_mx_r:77 :4
-	80	E	DFF	0	0	1	2	tx_cir_r:109 bt_mx_r:77 :5
-	79	E	MCELL	0	0	0	2	tx_cir_r:109 bt_mx_r:77 :33
-	93	F	DFF	4	0	3	3	tx_cir_r:109 bt_mx_r:77 :36
-	63	D	DFF	0	0	3	0	tx_cir_r:109 bt_mx_r:77 :41
-	62	D	DFF	0	0	2	2	tx_cir_r:109 bt_mx_r:78 :4
-	78	E	DFF	0	0	1	2	tx_cir_r:109 bt_mx_r:78 :5

-	77	E	MCELL	0	0	0	2	tx_cir_r:109 bt_mx_r:78 :33
-	92	F	DFF	4	0	3	3	tx_cir_r:109 bt_mx_r:78 :36
-	61	D	DFF	0	0	3	0	tx_cir_r:109 bt_mx_r:78 :41
-	60	D	DFF	0	0	2	2	tx_cir_r:109 bt_mx_r:80 :4
-	110	G	DFF	0	0	1	2	tx_cir_r:109 bt_mx_r:80 :5
-	109	G	MCELL	0	0	0	2	tx_cir_r:109 bt_mx_r:80 :33
-	59	D	DFF	4	0	3	3	tx_cir_r:109 bt_mx_r:80 :36
-	58	D	DFF	0	0	3	0	tx_cir_r:109 bt_mx_r:80 :41
-	108	G	DFF	0	0	2	2	tx_cir_r:109 bt_mx_r:81 :4
-	107	G	DFF	0	0	1	2	tx_cir_r:109 bt_mx_r:81 :5
-	106	G	MCELL	0	0	0	2	tx_cir_r:109 bt_mx_r:81 :33
-	57	D	DFF	4	0	3	3	tx_cir_r:109 bt_mx_r:81 :36
-	105	G	DFF	0	0	3	0	tx_cir_r:109 bt_mx_r:81 :41
-	32	B	DFF	1	0	6	4	tx_cir_r:109 ds_dn_r:91 SEND
-	31	B	DFF	0	0	2	2	tx_cir_r:109 ds_dn_r:91 :81
-	30	B	DFF	0	0	1	2	tx_cir_r:109 ds_dn_r:91 :104
-	29	B	DFF	0	0	1	2	tx_cir_r:109 ds_dn_r:91 :106
-	28	B	DFF	0	0	5	2	tx_cir_r:109 ds_dn_r:91 :136
-	27	B	DFF	0	0	5	1	tx_cir_r:109 ds_dn_r:91 :137
-	26	B	DFF	0	0	3	1	tx_cir_r:109 ds_mx_r:97 RELEASE
(85)	101	G	DFF	1	1	1	3	tx_cir_r:109 ds_mx_r:97 :57
(90)	104	G	DFF	0	0	2	2	tx_cir_r:109 ds_mx_r:97 :58
-	91	F	DFF	4	0	3	3	tx_cir_r:109 ds_mx_r:97 :72
(89)	103	G	DFF	1	1	1	5	tx_cir_r:109 ds_mx_r:97 :76
-	25	B	DFF	0	0	3	1	tx_cir_r:109 ds_mx_r:98 RELEASE
(30)	24	B	DFF	1	1	1	3	tx_cir_r:109 ds_mx_r:98 :57
(29)	23	B	DFF	0	0	2	2	tx_cir_r:109 ds_mx_r:98 :58
-	90	F	DFF	4	0	3	3	tx_cir_r:109 ds_mx_r:98 :72
(25)	19	B	DFF	1	1	1	5	tx_cir_r:109 ds_mx_r:98 :76
-	76	E	DFF	0	0	2	2	tx_cir_r:109 req_mx_r:99 :4
(24)	18	B	DFF	0	0	1	2	tx_cir_r:109 req_mx_r:99 :5
(26)	20	B	MCELL	0	0	0	4	tx_cir_r:109 req_mx_r:99 :33
-	89	F	DFF	4	0	3	3	tx_cir_r:109 req_mx_r:99 :36
-	75	E	DFF	0	0	3	0	tx_cir_r:109 req_mx_r:99 :41

REPLACEMENT SHEET

26 JUL 1996

Logic Array Block 'A':

[illegible]

10	->	-	-	-	-	-	-	-	-	-	-	e	-	-	-	REQ_I
17	->	-	-	-	-	-	-	-	-	-	-	e	-	-	-	SEL_I
14	->	-	-	-	-	e	-	e	-	-	-	e	e	-	-	SER_I
15	->	-	-	-	-	-	e	e	-	e	e	-	-	e	-	STAT_I
72	->	-	-	-	-	-	-	-	-	-	-	-	-	-	e	VLTN
MC96 -> - - - - - * - - - - - * - - - - e - -																
rx_cir_r:82 s_dmx_r:101 :42																
MC121->- - - - - * * - - - - * - e																
tx_cir_r:109 bt_mx_r:75 :4																
MC118->- - - - - * * - - - - - - e																
tx_cir_r:109 bt_mx_r:75 :5																

**** MACROCELL INTERCONNECTIONS ****

Logic Array Block 'B':

[illegible]

REPLACEMENT SHEET

26 JUL 1996

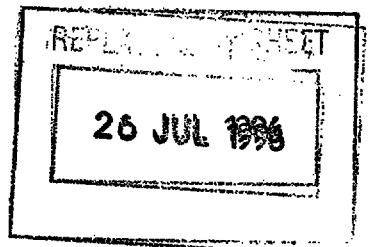
Pin	Signal	Value	Signal	Value	Signal	Value
20	->	-	-	-	-	ADR_IN
51	->	-	*	*	*	CLOCK
11	->	-	@	-	@	DATA_IN
24	->	-	*	*	*	-
DAT_IN_D						
9	->	-	-	-	@	DISC_IN
54	->	-	*	-	*	DO0
59	->	-	-	-	@	DO5
60	->	-	-	-	@	DO6
61	->	-	-	-	@	DO7
64	->	-	-	-	@	DO8
65	->	-	@	-	@	DO9
70	->	-	@	-	@	DSTRB
52	->	-	*	*	-	LOS
98	->	-	*	*	*	MR
22	->	-	-	-	@	MRK0_IN
21	->	-	-	-	@	OP_IN
10	->	-	-	-	@	REQ_IN
17	->	-	-	-	@	SEL_IN
14	->	-	@	-	@	SER_IN
25	->	-	*	*	*	-
SER_IN_D						
15	->	-	-	-	@	STAT_IN
72	->	-	-	-	@	VLTN
MC5	->	-	-	-	*	CMD_OUT
MC1	->	-	*	-	@	OP_OUT
MC13	->	-	*	*	@	-
rx_cir_r:82 ds_det_r:60 :3						
MC112	->	-	-	-	*	-
tx_cir_r:109 as_syn_r:93 :58						
MC111	->	-	*	-	*	-
tx_cir_r:109 as_syn_r:93 :65						
MC76	->	-	-	-	*	-
tx_cir_r:109 req_mx_r:99 :4						

REPLACEMENT SHEET

26 JUL 1996

Logic Array Block 'C':

[illegible]



70

```
70  -> - - - - - e | e e e e - - - e | DSTF
98  -> * * * * * * * * * * * * * * * * | * * * * * * * * * | MR
22  -> - - - - - - - - - - - - - - - - | - - - - - e - - - | MRK0_1
21  -> - - - - - - - - - - - - - - - - | e - - - - - e - - - | OP_1
10  -> - - - - - - - - - - - - - - - - | - - - e - - - - - | REQ_1
17  -> - - - - - - - - - - - - - - - - | - - - e - - - - - | SEL_1
14  -> - - - - - - - - - - - - - - - - | e e - - - - - - - | SER_1
15  -> - - - - - - - - - - - - - - - - | e - - e - e - - - | STAT_1
72  -> - - - - - - - - - - - - - - - - | - - - - - - - - e | VLTM
96  -> - - - - - - - - - - - - - - - - | - - - * - - - - - | WD_F
MC128-> * * * * * * * * * * * * * * * * | - - - * - - - - - | e
|ala_drv:83|wd_cntr:123|:2
MC127-> * * * * * * * * * * * * * * * * | - - - * - - - - - | e
|ala_drv:83|wd_cntr:123|:4
MC126-> * * * * * * * * * * * * * * * * | - - - * - - - - - | e
|ala_drv:83|wd_cntr:123|:6
MC125-> * * * * * * * * * * * * * * * * | - - - * - - - - - | e
|ala_drv:83|wd_cntr:123|:7
MC1  -> - - - - - - - - - - - - - - - * | e * * * - - - - | OP_OU
MC111-> * * * * * * * * * * * * * * * * | - * * - * - - | e *
|tx_cir_r:109|as_syn_r:93|:65
```

**** MACROCELL INTERCONNECTIONS ****

Logic Array Block 'D':

```
      M M M M M M M M M M M M M M M M
      C C C C C C C C C C C C C C C C
      5 5 5 5 5 5 5 4 6 6 6 6 6 5 5 5
      6 5 4 3 2 1 0 9 4 3 2 1 0 9 8 7
MCELL | | | | | | | | | | | | | | | | A B C D E F G H | Name
MC56 -> e - - - - - - - - - - - - - - - - | - - - e - - - - -
BUS_OUT0
MC55 -> - e - - - - - - - - - - - - - - - - | - - - e - - - - -
BUS_OUT1
MC54 -> - - e - - - - - - - - - - - - - - - - | - - - e - - - - -
BUS_OUT2
MC53 -> - - - e - - - - - - - - - - - - - - - - | - - - e - - - - -
BUS_OUT3
MC52 -> - - - - e - - - - - - - - - - - - - - - - | - - - e - - - - -
BUS_OUT4
MC51 -> - - - - - e - - - - - - - - - - - - - - - - | - - - e - - - - -
BUS_OUT5
MC50 -> - - - - - - e - - - - - - - - - - - - - - - - | - - - e - - - - -
BUS_OUT6
MC49 -> - - - - - - - e - - - - - - - - - - - - - - - - | - - - e - - - - -
BUS_OUT7
MC64 -> - - - - - - - - - - - - - - - - - | - - - e * * - - -
|tx_cir_r:109|bt_mx_r:77|:4
MC63 -> - - - - - - - e - - - - - - - - - - - | - - - e - - - - -
|tx_cir_r:109|bt_mx_r:77|:41
```

```

MC62 -> - - - - - | - - - @ * * - -
|tx_cir_r:109|bt_mx_r:78|:4
MC61 -> - - - - - | - - - @ - - - -
|tx_cir_r:109|bt_mx_r:78|:41
MC60 -> - - - - - | - - - @ - - * -
|tx_cir_r:109|bt_mx_r:80|:4
MC59 -> - - - - - | - - - @ - - * -
|tx_cir_r:109|bt_mx_r:80|:36
MC58 -> - - - - - | - - - @ - - - -
|tx_cir_r:109|bt_mx_r:80|:41
MC57 -> - - - - - | - - - @ - - * -
|tx_cir_r:109|bt_mx_r:81|:36

```

```

Pin
20 -> - - - - - | - - - - - @ | ADR_I
29 -> - - - - - | - - - * * - - | BUS_IN
30 -> - - - - - | - - - * * - - | BUS_IN
51 -> - - - - - | - - - * * * * * | CLOC
11 -> - - - - - | @ @ - - - - - | DATA_I
9 -> - - - - - | - - - @ - - - - - | DISC_I
54 -> * * * * * | * * * * - - - - - | DO0
55 -> * - - - - | * - - * - - - - - | DO1
56 -> - * - - - | * - - * - - - - - | DO2
57 -> - - * - - | * - - * - - - - - | DO3
58 -> - - - * - | * - - * - - - - - | DO4
59 -> - - - @ - | @ - - @ - - - - - | DO5
60 -> - - - - @ - | @ - - @ - - - - - | DO6
61 -> - - - - @ - | @ - - @ - - - - - | DO7
64 -> - - - - @ - | @ - - @ - - - - - | DO8
65 -> - - - - - | - @ @ - - - - - - | DO9
70 -> @ @ @ @ @ @ @ @ @ | @ @ @ @ @ - - @ | DSTR
98 -> * * * * * | * * * * * * * * | MR
22 -> - - - - - | - - - - - @ - - - | MRK0_I
21 -> - - - - - | @ - - - - - @ - - - | OP_I
10 -> - - - - - | - - - @ - - - - - | REQ_I
17 -> - - - - - | - - - @ - - - - - | SEL_I
14 -> - - - - - | @ @ - - - - - - - | SER_I
15 -> - - - - - | @ - - @ - - @ - - - | STAT_I
72 -> - - - - - | - - - @ - - - - - @ | VLTN
MC1 -> * * * * * | @ * * * - - - - - | OP_OU
MC112-> - - - - - | * - - * * * * * @ *
|tx_cir_r:109|as_syn_r:93|:58
MC30 -> - - - - - | - * - * - @ - * - * -
|tx_cir_r:109|ds_dn_r:91|:104
MC29 -> - - - - - | - * - * - @ - * - * -
|tx_cir_r:109|ds_dn_r:91|:106

```

**** MACROCELL INTERCONNECTIONS ****

Logic Array Block 'E':

REPLACEMENT SHEET

26 JUL 1996

```

Pin
20  -> - - - - - - - | - - - - - - - @ | ADR_IN
51  -> - - - - * * | - * * * * * * * | CLOCK
11  -> - - - - - - - | @ @ - - - - - - - | DATA_IN
9   -> - - - - - - - | - - - @ - - - - - | DISC_IN
59  -> - - - - - - - | @ - - @ - - - - - | DO5
60  -> - - - - - - - | @ - - @ - - - - - | DO6
61  -> - - - - - - - | @ - - @ - - - - - | DO7
64  -> - - - - - - - | @ - - @ - - - - - | DO8
65  -> - - - - - - - | - @ @ - - - - - - | DO9
70  -> - - - - - - - | @ @ @ @ - - - - - | DSTRB
98  -> * - * - * * | * * * * * * * * | MR
22  -> - - - - - - - | - - - - - - - @ - | MRK0_IN
21  -> - - - - - - - | @ - - - - - - - @ | OP_IN
10  -> - - - - - @ | - - - - - @ - - - | REQ_IN
17  -> - - - - - - - | - - - @ - - - - - | SEL_IN
14  -> - - - - - - - | @ @ - - - - - - - | SER_IN
15  -> - - - - - - - | @ - - @ - - @ - - | STAT_IN
72  -> - - - - - - - | - - - - - - - @ | VLTN
MC112-> - - - - - * - | - - * - * * * @ * |
|tx_cir_r:109|as_syn_r:93|:58
MC111-> * - * - - - - | - - * * - * - @ * |
|tx_cir_r:109|as_syn_r:93|:65
MC64 -> * * - - - - - | - - - @ * * - - | |tx_cir_r:109|bt_mx_r:77|:4
MC62 -> - - * * - - - | - - - @ * * - - | |tx_cir_r:109|bt_mx_r:78|:4

```

Logic Array Block 'F':

M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M									
C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C									
8	8	8	8	8	8	8	8	9	9	9	9	9	9	9	9	9	8											
1	2	3	4	5	6	7	8	6	5	4	3	2	1	0	9													
MCELL																				A	B	C	D	E	F	G	H	Name
MC81 ->	@	@	@	@	@	@	@	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	@	*	-	DIO

26 JUL 1996


```
MC82 -> - - - - - | - - - - - | e - - DI1  
MC83 -> - - - - - | - - - - - | e - - DI2  
MC84 -> - - - - - | - - - - - | e - - DI3  
MC85 -> - - - - - | - - - - - | e - - DI4  
MC86 -> - - - - - | - - - - - | e - - DI5  
MC87 -> - - - - - | - - - - - | e - - DI6  
MC88 -> - - - - - | - - - - - | e - - DI7  
MC96 -> - - - - - | * - - - - | e - -  
|rx_cir_r:82|s_dmx_r:101|:42  
MC95 -> - @ - - - - - | - - - - - | e - -  
|tx_cir_r:109|bt_mx_r:75|:36  
MC94 -> - - @ - - - - - | - - - - - | e - -  
|tx_cir_r:109|bt_mx_r:76|:36  
MC93 -> - @ - - - - - | - - - - - | e - -  
|tx_cir_r:109|bt_mx_r:77|:36  
MC92 -> - - - @ - - - - - | - - - - - | e - -  
|tx_cir_r:109|bt_mx_r:78|:36  
MC91 -> - - - @ - - - - - | - - - - - | e - -  
|tx_cir_r:109|ds_mx_r:97|:72  
MC90 -> - - - @ - - - - - | - - - - - | e - -  
|tx_cir_r:109|ds_mx_r:98|:72  
MC89 -> - - - @ - - - - - | - - - - - | e - -  
|tx_cir r:109|req mx r:99|:36
```

[illegible]

REPLACEMENT SHEET

26 JUL 1996

```

MC4  -> - - - - - * - - - - - | e - - - - * - - | SER_OUT
MC112-> * - - - - - * * * * * | - * - * * * e * |
|tx_cir_r:109|as_syn_r:93|:58
MC121-> - * - - - - - - - - - | * - - - - * - e |
|tx_cir_r:109|bt_mx_r:75|:4
MC116-> - - * - - - - - - - - | - - - - - * - e |
|tx_cir_r:109|bt_mx_r:76|:4
MC64  -> - - - * - - - - - | - - - e * * - - |
|tx_cir_r:109|bt_mx_r:77|:4
MC62  -> - - - * - - - - - | - - - e * * - - |
|tx_cir_r:109|bt_mx_r:78|:4
MC30  -> - - - - - * * * * * | - e - * - * - - |
|tx_cir_r:109|ds_dn_r:91|:104
MC29  -> - - - - - * * * * * | - e - * - * - - |
|tx_cir_r:109|ds_dn_r:91|:106
MC26  -> - - - * - - - - - | - e - - - * * - |
|tx_cir_r:109|ds_mx_r:97|RELEASE
MC25  -> - - - * - - - - - | - e - - - * - - |
|tx_cir_r:109|ds_mx_r:98|RELEASE
MC76  -> - - - - - * - - - - | - * - - e * - - |
|tx_cir_r:109|req_mx_r:99|:4
-----

```

**** MACROCELL INTERCONNECTIONS ****

Logic Array Block 'G':

```

          M M M M M M M M M M M M M M M M
          C C C C C C C C C C C C C C C C
          1 9 9 9 1 1 1 1 1 1 1 1 1 1 1 1
          0 9 7 8 0 1 1 1 0 0 0 0 0 0 0 0
MCELL    0 | | | 2 2 1 0 9 8 7 6 5 1 4 3 | A B C D E F G H | Name
MC100-> - - - - - - - - - - - - - - - - | - - - - - e - | CO0
MC99  -> - - - - - - - - - - - - - - - - | - - - - - e - | CO1
MC97  -> - - - - - - - - - - - - - - - - | - - - - - e - | DI8
MC98  -> - - - - - - - - - - - - - - - - | - - - - - e - | DI9
MC102-> - - - - e - - - - - - - - - - - | - - - - - e * | STROBE
MC112-> - - - - - e e - - e - - - - - - | - * - * * * e * |
|tx_cir_r:109|as_syn_r:93|:58
MC111-> - - - - - e - - - e - e - e - e | - * * - * - e * |
|tx_cir_r:109|as_syn_r:93|:65
MC110-> - - - - - e - - - - - - - - - - | - - - - - e - |
|tx_cir_r:109|bt_mx_r:80|:5
MC109-> - - - - e e e - - - - - - - - - | - - - - - e - |
|tx_cir_r:109|bt_mx_r:80|:33
MC108-> - - - e - - - - - e e - - - - - | - - - - - e - |
|tx_cir_r:109|bt_mx_r:81|:4
MC107-> - - - - - - - - e - - - - - - - | - - - - - e - |
|tx_cir_r:109|bt_mx_r:81|:5
MC106-> - - - e e e - - - - - - - - - - | - - - - - e - |
|tx_cir_r:109|bt_mx_r:81|:33
MC105-> - - - - - e - - - - - - - - - - | - - - - - e - |
|tx_cir_r:109|bt_mx_r:81|:41

```

REPLACEMENT SHEET

26 JUL 1996

```

MC101-> - - - - @ @ @ - - - - - - - - @ - | - - - - - - - @ - |
|tx_cir_r:109|ds_mx_r:97|:57
MC104-> - - - - - - - - - - - - @ - @ - | - - - - - - - @ - |
|tx_cir_r:109|ds_mx_r:97|:58
MC103-> - - - - - @ @ @ - - - - - - - - @ - | - - - - - - - @ - |
|tx_cir_r:109|ds_mx_r:97|:76

```

```

Pin
85 -> - - - - * - - - - - - - - - - - - * - |
ACKNL DGE
20 -> - - - - - - - - - - - - - - - - - - @ | ADR_IN
51 -> - - - - * * * - - * - - * - * - | - * * * * * * * * | CLOCK
11 -> - - - - - - - - - - - - - - - - - - @ @ | DATA_IN
9 -> - - - - - - - - - - - - - - - - - - @ - | DISC_IN
59 -> - - - - - - - - - - - - - - - - - - @ - | DO5
60 -> - - - - - - - - - - - - - - - - - - @ - | DO6
61 -> - - - - - - - - - - - - - - - - - - @ - | DO7
64 -> - - - - - - - - - - - - - - - - - - @ - | DO8
65 -> - - - - - - - - - - - - - - - - - - @ @ | DO9
70 -> - - - - - - - - - - - - - - - - - - @ @ @ @ | DSTRB
98 -> * * - - - * * * - * * - * * * * | * * * * * * * * | MR
22 -> - - - - - - - - - - - - @ - - - - - @ - | MRK0_IN
21 -> - - - - - - - - - - - - @ - - - - - @ - | OP_IN
10 -> - - - - - - - - - - - - - - - - - - @ - | REQ_IN
17 -> - - - - - - - - - - - - - - - - - - @ - | SEL_IN
14 -> - - - - - - - - - - - - @ @ - - - - - | SER_IN
15 -> - - - - - - - - - - - - @ - - @ - @ - | STAT_IN
72 -> - - - - - - - - - - - - - - - - - - @ - | VLTN
MC33 -> - - - - * * * - - - - - - - - - - @ - | * *
|ala_drv:83|WD_SEND
MC5 -> - - - - - - - - - - - - - - - - - - @ * | CMD_OUT
MC81 -> - - - * * - - - - - - - - - - - - @ * | DIO
MC13 -> - - - - - - - - - - - - - - - - - - @ * |
|rx_cir_r:82|ds_det_r:60|:3
MC9 -> - - - - * * * - - - - - - - - - - @ - |
|tx_cir_r:109|bt_mx_r:75|:33
MC114-> - - - - * * * - - - - - - - - - - - - * @ |
|tx_cir_r:109|bt_mx_r:76|:33
MC79 -> - - - - * * * - - - - - - - - - - - - @ - * - |
|tx_cir_r:109|bt_mx_r:77|:33
MC77 -> - - - - * * * - - - - - - - - - - - - @ - * - |
|tx_cir_r:109|bt_mx_r:78|:33
MC60 -> - - - * - - - * * - - - - - - - - - - @ - * - |
|tx_cir_r:109|bt_mx_r:80|:4
MC59 -> - - - * - - - - - - - - - - - - - - - - @ - * - |
|tx_cir_r:109|bt_mx_r:80|:36
MC57 -> - - - * - - - - - - - - - - - - - - - - @ - * - |
|tx_cir_r:109|bt_mx_r:81|:36
MC32 -> - - - - * * * - - - - - - - - - - - - @ - * - |
|tx_cir_r:109|ds_dn_r:91|SEND
MC26 -> - - - - - - - - - - - - * - * - - - - @ - * * - |
|tx_cir_r:109|ds_mx_r:97|RELEASE
MC24 -> - - - - * * * - - - - - - - - - - - - @ - * - |
|tx_cir_r:109|ds_mx_r:98|:57

```

REPLACEMENT SHEET

26 JUL 1996

26 JUL 1998

76

```
MC19 -> - - - - * * * - - - - - | - @ - - - - * - |
|tx_cir_r:109|ds_mx_r:98|:76
MC20 -> - - - - * * * - - - - - | - @ - - - - * - |
|tx_cir_r:109|req_mx_r:99|:33
-----
```

**** MACROCELL INTERCONNECTIONS ****
Logic Array Block 'H':

```

      M M M M M M M M M M M M M M M
      C C C C C C C C C C C C C C C
      1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
      1 2 2 2 2 2 2 2 2 1 1 1 1 1 1
MCELL 9 8 7 6 5 4 3 2 0 1 8 7 6 5 4 3 | A B C D E F G H | Name
MC119-> - - - - - - - - - - - - - - | - - - - - - @ | ACTIVITY
MC128-> - @ @ @ @ @ @ @ - - - - - | - - - - - * - - - @ |
|ala_drv:83|wd_cntr:123|:2
MC127-> - - @ @ @ @ @ @ - - - - - | - - - - - * - - - @ |
|ala_drv:83|wd_cntr:123|:4
MC126-> - - - @ @ @ @ @ - - - - - | - - - - - * - - - @ |
|ala_drv:83|wd_cntr:123|:6
MC125-> - - - - @ @ @ @ - - - - - | - - - - - * - - - @ |
|ala_drv:83|wd_cntr:123|:7
MC124-> @ - - - - - - - - - - - - | - - - - - @ | |ala_drv:83|:2
MC123-> @ - - - - - - - - - - - - | - - - - - @ | |ala_drv:83|:3
MC122-> - - - - - - - @ - - - - - | - - - - - @ | |ala_drv:83|:96
MC120-> - - - - - - - - - - - - | - - - - - @ | FAULT
MC121-> - - - - - - - - - - @ - - - - | * - - - - * - - @ |
|tx_cir_r:109|bt_mx_r:75|:4
MC118-> - - - - - - - - - - - - | * - - - - - - @ |
|tx_cir_r:109|bt_mx_r:75|:5
MC117-> - - - - - - - - - - @ - - - - | - - - - - - - @ |
|tx_cir_r:109|bt_mx_r:75|:41
MC116-> - - - - - - - - - - @ @ - - | - - - - - * - @ |
|tx_cir_r:109|bt_mx_r:76|:4
MC115-> - - - - - - - - - - @ - - - | - - - - - - - @ |
|tx_cir_r:109|bt_mx_r:76|:5
MC114-> - - - - - - - - - - - - | - - - - - - * @ |
|tx_cir_r:109|bt_mx_r:76|:33
MC113-> - - - - - - - @ - - - - | - - - - - - - @ |
|tx_cir_r:109|bt_mx_r:76|:41

```

```

Pin
20 -> - - - - - - - - - - @ - - - - - @ | ADDR_IN
51 -> - * * * * - - - - * - * * - - * | - * * * * * * * * | CLOCK
11 -> - - - - - - - - - - - - | @ @ - - - - - - | DATA_IN
9 -> - - - - - - - - - - - - | - - @ - - - - - | DISC_IN
59 -> - - - - - - - - - - - - | @ - - @ - - - - - | DO5
60 -> - - - - - - - - - - - - | @ - - @ - - - - - | DO6
61 -> - - - - - - - - - - - - | @ - - @ - - - - - | DO7
64 -> - - - - - - - - - - - - | @ - - @ - - - - - | DO8
65 -> - - - - - - - - - - - - | - @ @ - - - - - | DO9
70 -> - - - - - - @ - - - - - | @ @ @ @ - - - @ | DSTRB

```

```

52  -> - - - - - * - - - - - | - * - - - - - * | LOS
98  -> - * * * * * * * - * * * * * - * | * * * * * * * * | MR
22  -> - - - - - - - - - - - - - - - | - - - - - @ - - - | MRKO_IN
21  -> - - - - - - - - - - - @ - - - - - | @ - - - - - @ - - - | OP_IN
10  -> - - - - - - - - - - - - - - - | - - - - - @ - - - - - | REQ_IN
17  -> - - - - - - - - - - - - - - - | - - - - - @ - - - - - | SEL_IN
14  -> - - - - - - - - - - - @ @ - - - - - | @ @ - - - - - @ - - - | SER_IN
15  -> - - - - - - - - - - - - - - - | @ - - - @ - @ - - - | STAT_IN
72  -> - - - - - @ - - - - - - - - - - - | - - - - - @ - - - - - | VLTN
MC47 -> - - - - - * * * - - - - - - - - | - - - - - @ - - - - - * |
|ala_drv:83|wd_cntr:123|:8
MC33 -> - - - - - * - - - - - - - - - - - | - - - @ - - - - - * * |
|ala_drv:83|WD_SEND
MC102-> - - - - - * - - - - - - - - - - - | - - - - - @ * - - - - | STROBE
MC112-> - - - - - * - - - - - * - - - - - | - * - * * * @ * - - |
|tx_cir_r:109|as_syn_r:93|:58
MC111-> - * * * * - - - - - * - - - - - | - * * - * - @ * - - |
|tx_cir_r:109|as_syn_r:93|:65
-----

```

**** EQUATIONS ****

```

ACKNLGE : INPUT;
ADR_IN   : INPUT;
BUS_INP  : INPUT;
BUS_IN0  : INPUT;
BUS_IN1  : INPUT;
BUS_IN2  : INPUT;
BUS_IN3  : INPUT;
BUS_IN4  : INPUT;
BUS_IN5  : INPUT;
BUS_IN6  : INPUT;
BUS_IN7  : INPUT;
CLOCK    : INPUT;
DASD     : INPUT;
DATA_IN  : INPUT;
DAT_IN_D : INPUT;
DISC_IN  : INPUT;
DIV_A_B  : INPUT;
DO0      : INPUT;
DO1      : INPUT;
DO2      : INPUT;
DO3      : INPUT;
DO4      : INPUT;
DO5      : INPUT;
DO6      : INPUT;
DO7      : INPUT;
DO8      : INPUT;
DO9      : INPUT;
DSTRB    : INPUT;
LOS      : INPUT;
MR        : INPUT;
MRKO_IN  : INPUT;
OP_IN    : INPUT;

```

REPLACEMENT SHEET

26 JUL 1996

```

REQ_IN   : INPUT;
SEL_IN   : INPUT;
SER_IN   : INPUT;
SER_IN_D : INPUT;
STAT_IN  : INPUT;
VLTN     : INPUT;
WD_EN    : INPUT;

```

```

ACTIVITY = _MC119;
_MC119 = MCELL( _EQ001 $ VCC );
_EQ001 = !_MC123 & !_MC124;

```

```

% ADR_OUT = |rx_cir_r:82|ad_dmx_r:99|TAG %
ADR_OUT = _MC008;
_MC008 = DFF( _EQ002 $ GND, DSTRB, _EQ003, VCC );
_EQ002 = DO0 & DO2
# !DO0 & _MC008;
_EQ003 = _MC001 & !_MC016 & MR;

```

```

% BUS_OUTP = |rx_cir_r:82|bt_dmx_r:91|BUS %
BUS_OUTP = _MC040;
_MC040 = DFF( _EQ004 $ GND, DSTRB, _EQ005, VCC );
_EQ004 = DO0 & _MC040
# !DO0 & DO9;
_EQ005 = _MC001 & MR;

```

```

% BUS_OUT0 = |rx_cir_r:82|op_dmx_r:83|BUS %
BUS_OUT0 = _MC056;
_MC056 = DFF( _EQ006 $ GND, DSTRB, _EQ007, VCC );
_EQ006 = DO0 & _MC056
# !DO0 & DO1;
_EQ007 = _MC001 & MR;

```

```

% BUS_OUT1 = |rx_cir_r:82|ad_dmx_r:99|BUS %
BUS_OUT1 = _MC055;
_MC055 = DFF( _EQ008 $ GND, DSTRB, _EQ009, VCC );
_EQ008 = DO0 & _MC055
# !DO0 & DO2;
_EQ009 = _MC001 & MR;

```

```

% BUS_OUT2 = |rx_cir_r:82|bt_dmx_r:85|BUS %
BUS_OUT2 = _MC054;
_MC054 = DFF( _EQ010 $ GND, DSTRB, _EQ011, VCC );
_EQ010 = DO0 & _MC054
# !DO0 & DO3;
_EQ011 = _MC001 & MR;

```

```

% BUS_OUT3 = |rx_cir_r:82|s_dmx_r:101|BUS %
BUS_OUT3 = _MC053;
_MC053 = DFF( _EQ012 $ GND, DSTRB, _EQ013, VCC );
_EQ012 = DO0 & _MC053
# !DO0 & DO4;
_EQ013 = _MC001 & MR;

```

REPLACEMENT SHEET

26 JUL 1996

```

% BUS_OUT4 = |rx_cir_r:82|d_dmx_r:102|BUS %
BUS_OUT4 = _MC052;
_MC052 = DFF( _EQ014 $ GND, DSTRB, _EQ015, VCC );
_EQ014 = DO0 & _MC052
# !DO0 & DO5;
_EQ015 = _MC001 & MR;

% BUS_OUT5 = |rx_cir_r:82|c_dmx_r:96|BUS %
BUS_OUT5 = _MC051;
_MC051 = DFF( _EQ016 $ GND, DSTRB, _EQ017, VCC );
_EQ016 = DO0 & _MC051
# !DO0 & DO6;
_EQ017 = _MC001 & MR;

% BUS_OUT6 = |rx_cir_r:82|bt_dmx_r:89|BUS %
BUS_OUT6 = _MC050;
_MC050 = DFF( _EQ018 $ GND, DSTRB, _EQ019, VCC );
_EQ018 = DO0 & _MC050
# !DO0 & DO7;
_EQ019 = _MC001 & MR;

% BUS_OUT7 = |rx_cir_r:82|bt_dmx_r:90|BUS %
BUS_OUT7 = _MC049;
_MC049 = DFF( _EQ020 $ GND, DSTRB, _EQ021, VCC );
_EQ020 = DO0 & _MC049
# !DO0 & DO8;
_EQ021 = _MC001 & MR;

% CMD_OUT = |rx_cir_r:82|c_dmx_r:96|TAG %
CMD_OUT = _MC005;
_MC005 = DFF( _EQ022 $ GND, DSTRB, _EQ023, VCC );
_EQ022 = DO0 & DO6
# !DO0 & _MC005;
_EQ023 = _MC001 & MR;

CO0 = _MC100;
_MC100 = MCELL( !MR $ GND );

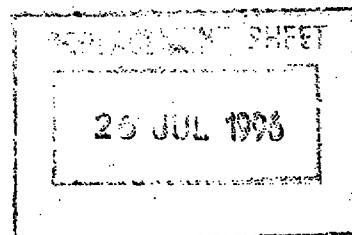
CO1 = _MC099;
_MC099 = MCELL( !MR $ GND );

% DATA_OUT = |rx_cir_r:82|d_dmx_r:102|TAG %
DATA_OUT = _MC003;
_MC003 = DFF( _EQ024 $ GND, DSTRB, _EQ025, VCC );
_EQ024 = DO0 & DO5
# !DO0 & _MC003;
_EQ025 = _MC001 & !_MC015 & MR;

% DIO = |tx_cir_r:109|as_syn_r:93|:70 %
DIO = _MC081;
_MC081 = DFF( _MC112 $ GND, CLOCK, MR, VCC );

DI1 = _MC082;
_MC082 = MCELL( _EQ026 $ GND );

```



```

_EQ026 = _MC081 & _MC121
        # !_MC081 & _MC095;

DI2      = _MC083;
_MC083   = MCELL( _EQ027 $ GND );
_EQ027   = _MC081 & _MC116
        # !_MC081 & _MC094;

DI3      = _MC084;
_MC084   = MCELL( _EQ028 $ GND );
_EQ028   = _MC064 & _MC081
        # !_MC081 & _MC093;

DI4      = _MC085;
_MC085   = MCELL( _EQ029 $ GND );
_EQ029   = _MC025 & _MC081
        # !_MC081 & _MC090;

DI5      = _MC086;
_MC086   = MCELL( _EQ030 $ GND );
_EQ030   = _MC026 & _MC081
        # !_MC081 & _MC091;

DI6      = _MC087;
_MC087   = MCELL( _EQ031 $ GND );
_EQ031   = _MC062 & _MC081
        # !_MC081 & _MC092;

DI7      = _MC088;
_MC088   = MCELL( _EQ032 $ GND );
_EQ032   = _MC076 & _MC081
        # !_MC081 & _MC089;

DI8      = _MC097;
_MC097   = MCELL( _EQ033 $ GND );
_EQ033   = _MC060 & _MC081
        # _MC059 & !_MC081;

DI9      = _MC098;
_MC098   = MCELL( _EQ034 $ GND );
_EQ034   = _MC081 & _MC108
        # _MC057 & !_MC081;

DRV_OE   = _MC022;
_MC022   = MCELL( !LOS $ GND );

FAULT    = _MC120;
_MC120   = MCELL( _EQ035 $ _MC122 );
_EQ035   = LOS & !_MC122;

% HOLD_OUT = |rx_cir_r:82|bt_dmx_r:90|TAG %
HOLD_OUT = _MC002;
_MC002   = DFF( _EQ036 $ GND, DSTRB, _EQ037, VCC );
_EQ036   = DO0 & DO8

```

REPLACEMENT SHEET

26 JUL 1996


```

      # !DO0 & _MC002;
_EQ037 = _MC001 & MR;

% MRK0_OUT = |rx_cir_r:82|bt_dmx_r:91|TAG %
MRK0_OUT = _MC017;
_MC017 = DFF( _EQ038 $ GND, DSTRB, _EQ039, VCC );
_EQ038 = DO0 & DO9
      # !DO0 & _MC017;
_EQ039 = _MC001 & MR;

% OP_OUT = |rx_cir_r:82|op_dmx_r:83|TAG %
OP_OUT = _MC001;
_MC001 = DFF( _EQ040 $ GND, DSTRB, MR, VCC );
_EQ040 = DO0 & DO1
      # !DO0 & _MC001;

RLY_DRV = _MC021;
_MC021 = MCELL( !LOS $ GND );

% SEL_OUT = |rx_cir_r:82|bt_dmx_r:85|TAG %
SEL_OUT = _MC006;
_MC006 = DFF( _EQ041 $ GND, DSTRB, _EQ042, VCC );
_EQ041 = DO0 & DO3
      # !DO0 & _MC006;
_EQ042 = _MC001 & MR;

% SER_OUT = |rx_cir_r:82|s_dmx_r:101|TAG %
SER_OUT = _MC004;
_MC004 = DFF( _EQ043 $ GND, DSTRB, _EQ044, VCC );
_EQ043 = DO0 & DO4
      # !DO0 & _MC004;
_EQ044 = _MC001 & !_MC011 & !_MC012 & MR;

% STROBE = |tx_cir_r:109|as_syn_r:93|STRB %
STROBE = _MC102;
_MC102 = DFF( _EQ045 $ VCC, !CLOCK, _EQ046, VCC );
_EQ045 = _MC009 & _MC019 & _MC020 & _MC024 & _MC032 & _MC033 &
      _MC077 & _MC079 & _MC101 & _MC103 & _MC106 & _MC109 &
      _MC114;
_EQ046 = _X001;
_X001 = EXP( ACKNLGGE & _MC102 );

% SUPR_OUT = |rx_cir_r:82|bt_dmx_r:89|TAG %
SUPR_OUT = _MC007;
_MC007 = DFF( _EQ047 $ GND, DSTRB, _EQ048, VCC );
_EQ047 = DO0 & DO7
      # !DO0 & _MC007;
_EQ048 = _MC001 & MR;

% |ala_drv:83|wd_cntr:123|:2 %
_MC128 = DFF( VCC $ _MC128, CLOCK, _EQ049, VCC );
_EQ049 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:4 %

```

REPLACEMENT SHEET

26 JUL 1996

```

_MC127 = DFF( _MC128 $ _MC127, CLOCK, _EQ050, VCC );
_EQ050 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:5 %
_MC048 = DFF( _EQ051 $ _MC048, CLOCK, _EQ052, VCC );
_EQ051 = _MC034 & _MC035 & _MC036 & _MC037 & _MC038 & _MC039 &
         _MC041 & _MC042 & _MC043 & _MC044 & _MC045 & _MC046 &
         _MC047 & _MC125 & _MC126 & _MC127 & _MC128;
_EQ052 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:6 %
_MC126 = DFF( _EQ053 $ _MC126, CLOCK, _EQ054, VCC );
_EQ053 = _MC127 & _MC128;
_EQ054 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:7 %
_MC125 = DFF( _EQ055 $ _MC125, CLOCK, _EQ056, VCC );
_EQ055 = _MC126 & _MC127 & _MC128;
_EQ056 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:8 %
_MC047 = DFF( _EQ057 $ _MC047, CLOCK, _EQ058, VCC );
_EQ057 = _MC125 & _MC126 & _MC127 & _MC128;
_EQ058 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:9 %
_MC046 = DFF( _EQ059 $ _MC046, CLOCK, _EQ060, VCC );
_EQ059 = _MC047 & _MC125 & _MC126 & _MC127 & _MC128;
_EQ060 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:10 %
_MC045 = DFF( _EQ061 $ _MC045, CLOCK, _EQ062, VCC );
_EQ061 = _MC046 & _MC047 & _MC125 & _MC126 & _MC127 &
         _MC128;
_EQ062 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:11 %
_MC044 = DFF( _EQ063 $ _MC044, CLOCK, _EQ064, VCC );
_EQ063 = _MC045 & _MC046 & _MC047 & _MC125 & _MC126 & _MC127 &
         _MC128;
_EQ064 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:12 %
_MC043 = DFF( _EQ065 $ _MC043, CLOCK, _EQ066, VCC );
_EQ065 = _MC044 & _MC045 & _MC046 & _MC047 & _MC125 & _MC126 &
         _MC127 & _MC128;
_EQ066 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:13 %
_MC042 = DFF( _EQ067 $ _MC042, CLOCK, _EQ068, VCC );
_EQ067 = _MC043 & _MC044 & _MC045 & _MC046 & _MC047 & _MC125 &
         _MC126 & _MC127 & _MC128;
_EQ068 = !_MC111 & MR;

```

REPLACEMENT SHEET

26 JUL 1996

```

% |ala_drv:83|wd_cntr:123|:14 %
_MC041 = DFF( _EQ069 $ _MC041, CLOCK, _EQ070, VCC );
_EQ069 = _MC042 & _MC043 & _MC044 & _MC045 & _MC046 & _MC047 &
        _MC125 & _MC126 & _MC127 & _MC128;
_EQ070 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:15 %
_MC039 = DFF( _EQ071 $ _MC039, CLOCK, _EQ072, VCC );
_EQ071 = _MC041 & _MC042 & _MC043 & _MC044 & _MC045 & _MC046 &
        _MC047 & _MC125 & _MC126 & _MC127 & _MC128;
_EQ072 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:16 %
_MC038 = DFF( _EQ073 $ _MC038, CLOCK, _EQ074, VCC );
_EQ073 = _MC039 & _MC041 & _MC042 & _MC043 & _MC044 & _MC045 &
        _MC046 & _MC047 & _MC125 & _MC126 & _MC127 & _MC128;
_EQ074 = !_MC111 & MR;

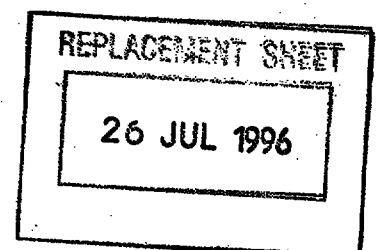
% |ala_drv:83|wd_cntr:123|:17 %
_MC037 = DFF( _EQ075 $ _MC037, CLOCK, _EQ076, VCC );
_EQ075 = _MC038 & _MC039 & _MC041 & _MC042 & _MC043 & _MC044 &
        _MC045 & _MC046 & _MC047 & _MC125 & _MC126 & _MC127 &
        _MC128;
_EQ076 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:18 %
_MC036 = DFF( _EQ077 $ _MC036, CLOCK, _EQ078, VCC );
_EQ077 = _MC037 & _MC038 & _MC039 & _MC041 & _MC042 & _MC043 &
        _MC044 & _MC045 & _MC046 & _MC047 & _MC125 & _MC126 &
        _MC127 & _MC128;
_EQ078 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:19 %
_MC035 = DFF( _EQ079 $ _MC035, CLOCK, _EQ080, VCC );
_EQ079 = _MC036 & _MC037 & _MC038 & _MC039 & _MC041 & _MC042 &
        _MC043 & _MC044 & _MC045 & _MC046 & _MC047 & _MC125 &
        _MC126 & _MC127 & _MC128;
_EQ080 = !_MC111 & MR;

% |ala_drv:83|wd_cntr:123|:20 %
_MC034 = DFF( _EQ081 $ _MC034, CLOCK, _EQ082, VCC );
_EQ081 = _MC035 & _MC036 & _MC037 & _MC038 & _MC039 & _MC041 &
        _MC042 & _MC043 & _MC044 & _MC045 & _MC046 & _MC047 &
        _MC125 & _MC126 & _MC127 & _MC128;
_EQ082 = !_MC111 & MR;

```



```

% |ala_drv:83|WD_SEND %
_MC033 = DFF( _EQ083 $ VCC, CLOCK, MR, _EQ084 );
_EQ083 = !DIV_A_B & _MC034 & _MC035 & _MC036 & _MC037 & _MC038 &
        _MC039 & _MC041 & _MC042 & _MC043 & _MC044 & _MC045 &
        _MC046 & _MC047 & _MC048 & _MC125 & _MC126 & _MC127 &
        _MC128 & WD_EN
# DIV_A_B & _MC042 & _MC043 & _MC044 & _MC045 & _MC046 &
        _MC047 & _MC125 & _MC126 & _MC127 & _MC128 & WD_EN
# !_MC033 & WD_EN;
_EQ084 = _X002;
_X002 = EXP( !_MC033 & _MC111 );

% |ala_drv:83|:2 %
_MC124 = DFF( _MC033 $ GND, _MC102, _EQ085, VCC );
_EQ085 = MR & _X003;
_X003 = EXP( _MC047 & _MC125 & _MC126 & _MC127 & _MC128 );

% |ala_drv:83|:3 %
_MC123 = DFF( GND $ VCC, DSTRB, _EQ086, VCC );
_EQ086 = MR & _X003;

% |ala_drv:83|:96 %
_MC122 = DFF( GND $ VCC, VLTN, _EQ087, VCC );
_EQ087 = MR & _X003;

% |rx_cir_r:82|ad_dmx_r:99|:19 %
_MC016 = DFF( DASD $ GND, !OP_IN, _MC008, VCC );

% |rx_cir_r:82|d_dmx_r:102|:26 %
_MC015 = DFF( !_MC013 $ GND, DATA_IN, _EQ088, VCC );
_EQ088 = _MC001 & _MC003 & MR;

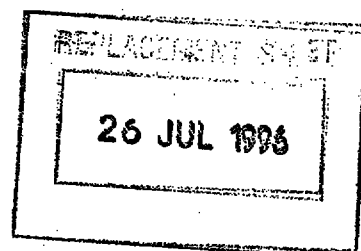
% |rx_cir_r:82|ds_det_r:60|:2 %
_MC014 = DFF( GND $ VCC, _EQ089, _EQ090, VCC );
_EQ089 = _X004;
_X004 = EXP( DATA_IN & !_MC014 & SER_IN );
_EQ090 = _MC001 & MR & !OP_IN & STAT_IN;

% |rx_cir_r:82|ds_det_r:60|:3 %
_MC013 = DFF( !DATA_IN $ GND, _MC014, _EQ091, VCC );
_EQ091 = _MC001 & MR & !OP_IN & STAT_IN;

% |rx_cir_r:82|s_dmx_r:101|:26 %
_MC012 = DFF( !_MC013 $ GND, SER_IN, _EQ092, VCC );
_EQ092 = _MC001 & _MC004 & MR;

% |rx_cir_r:82|s_dmx_r:101|:41 %
_MC011 = DFF( _EQ093 $ GND, STAT_IN, _EQ094, VCC );
_EQ093 = DASD & _MC096;
_EQ094 = _MC004 & MR;

```



```

% |rx_cir_r:82|s_dmx_r:101|:42 %
_MC096 = DFF( _EQ095 $ GND, _MC004, MR, VCC );
_EQ095 = !BUS_INP & BUS_IN0 & BUS_IN1 & BUS_IN2 & BUS_IN3 &
        BUS_IN4 & BUS_IN5 & BUS_IN6 & BUS_IN7 & _MC010 &
        !STAT_IN;

% |rx_cir_r:82|s_dmx_r:101|:43 %
_MC010 = DFF( _EQ096 $ GND, _MC004, MR, VCC );
_EQ096 = _MC007 & !STAT_IN;

% |tx_cir_r:109|as_syn_r:93|:58 %
_MC112 = DFF( _EQ097 $ !_MC112, !CLOCK, MR, VCC );
_EQ097 = _MC009 & _MC019 & _MC020 & _MC024 & _MC032 & _MC033 &
        _MC077 & _MC079 & _MC101 & _MC103 & _MC106 & _MC109 &
        !_MC112 & _MC114;

% |tx_cir_r:109|as_syn_r:93|:65 %
_MC111 = DFF( _MC112 $ GND, !CLOCK, _EQ098, VCC );
_EQ098 = MR & _X005;
_X005 = EXP( _MC009 & _MC019 & _MC020 & _MC024 & _MC032 &
        _MC033 & _MC077 & _MC079 & _MC101 & _MC103 & _MC106 &
        _MC109 & _MC114 );

% |tx_cir_r:109|bt_mx_r:75|:4 %
_MC121 = DFF( _MC117 $ GND, _EQ099, MR, VCC );
_EQ099 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:75|:5 %
_MC118 = DFF( _MC121 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|bt_mx_r:75|:33 %
_MC009 = MCELL( !_MC121 $ _MC118 );

% |tx_cir_r:109|bt_mx_r:75|:36 %
_MC095 = DFF( _EQ100 $ GND, _EQ101, MR, VCC );
_EQ100 = _X006;
_X006 = EXP( _X007 & _X008 & _X009 );
_X007 = EXP( !_MC029 & _X006 );
_X008 = EXP( !BUS_IN0 & _MC029 & _MC030 );
_X009 = EXP( !_MC030 & _X006 );
_EQ101 = CLOCK & !_MC112;

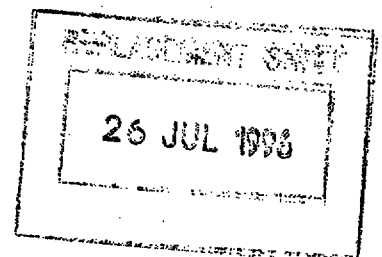
% |tx_cir_r:109|bt_mx_r:75|:41 %
_MC117 = DFF( !OP_IN $ GND, CLOCK, MR, VCC );

% |tx_cir_r:109|bt_mx_r:76|:4 %
_MC116 = DFF( _MC113 $ GND, _EQ102, MR, VCC );
_EQ102 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:76|:5 %
_MC115 = DFF( _MC116 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|bt_mx_r:76|:33 %
_MC114 = MCELL( !_MC116 $ _MC115 );

```



```

% |tx_cir_r:109|bt_mx_r:76|:36 %
_MC094 = DFF( _EQ103 $ GND, _EQ104, MR, VCC );
_EQ103 = _X010;
_X010 = EXP( _X011 & _X012 & _X013 );
_X011 = EXP( !_MC029 & _X010 );
_X012 = EXP( !BUS_IN1 & _MC029 & _MC030 );
_X013 = EXP( !_MC030 & _X010 );
_EQ104 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:76|:41 %
_MC113 = DFF( !ADR_IN $ GND, CLOCK, MR, VCC );

% |tx_cir_r:109|bt_mx_r:77|:4 %
_MC064 = DFF( _MC063 $ GND, _EQ105, MR, VCC );
_EQ105 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:77|:5 %
_MC080 = DFF( _MC064 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|bt_mx_r:77|:33 %
_MC079 = MCELL( !_MC064 $ _MC080 );

% |tx_cir_r:109|bt_mx_r:77|:36 %
_MC093 = DFF( _EQ106 $ GND, _EQ107, MR, VCC );
_EQ106 = _X014;
_X014 = EXP( _X015 & _X016 & _X017 );
_X015 = EXP( !_MC029 & _X014 );
_X016 = EXP( !BUS_IN2 & _MC029 & _MC030 );
_X017 = EXP( !_MC030 & _X014 );
_EQ107 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:77|:41 %
_MC063 = DFF( !SEL_IN $ GND, CLOCK, MR, VCC );

% |tx_cir_r:109|bt_mx_r:78|:4 %
_MC062 = DFF( _MC061 $ GND, _EQ108, MR, VCC );
_EQ108 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:78|:5 %
_MC078 = DFF( _MC062 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|bt_mx_r:78|:33 %
_MC077 = MCELL( !_MC062 $ _MC078 );

% |tx_cir_r:109|bt_mx_r:78|:36 %
_MC092 = DFF( _EQ109 $ GND, _EQ110, MR, VCC );
_EQ109 = _X018;
_X018 = EXP( _X019 & _X020 & _X021 );
_X019 = EXP( !_MC029 & _X018 );
_X020 = EXP( !BUS_IN5 & _MC029 & _MC030 );
_X021 = EXP( !_MC030 & _X018 );
_EQ110 = CLOCK & !_MC112;

```

REPLACEMENT SHEET

26 JUL 1996

```

% |tx_cir_r:109|bt_mx_r:78|:41 %
_MC061 = DFF( !STAT_IN $ GND, CLOCK, MR, VCC );

% |tx_cir_r:109|bt_mx_r:80|:4 %
_MC060 = DFF( _MC058 $ GND, _EQ111, MR, VCC );
_EQ111 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:80|:5 %
_MC110 = DFF( _MC060 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|bt_mx_r:80|:33 %
_MC109 = MCELL( !_MC060 $ _MC110 );

% |tx_cir_r:109|bt_mx_r:80|:36 %
_MC059 = DFF( _EQ112 $ GND, _EQ113, MR, VCC );
_EQ112 = _X022;
_X022 = EXP( _X023 & _X024 & _X025 );
_X023 = EXP( !_MC029 & _X022 );
_X024 = EXP( !BUS_IN7 & _MC029 & _MC030 );
_X025 = EXP( !_MC030 & _X022 );
_EQ113 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:80|:41 %
_MC058 = DFF( !DISC_IN $ GND, CLOCK, MR, VCC );

% |tx_cir_r:109|bt_mx_r:81|:4 %
_MC108 = DFF( _MC105 $ GND, _EQ114, MR, VCC );
_EQ114 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:81|:5 %
_MC107 = DFF( _MC108 $ GND, _MC111, MR, VCC );

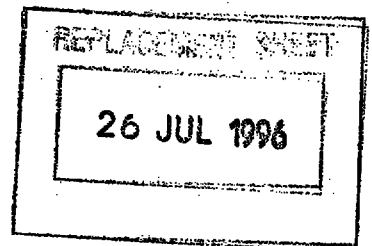
% |tx_cir_r:109|bt_mx_r:81|:33 %
_MC106 = MCELL( !_MC108 $ _MC107 );

% |tx_cir_r:109|bt_mx_r:81|:36 %
_MC057 = DFF( _EQ115 $ GND, _EQ116, MR, VCC );
_EQ115 = _X026;
_X026 = EXP( _X027 & _X028 & _X029 );
_X027 = EXP( !_MC029 & _X026 );
_X028 = EXP( !BUS_INP & _MC029 & _MC030 );
_X029 = EXP( !_MC030 & _X026 );
_EQ116 = CLOCK & !_MC112;

% |tx_cir_r:109|bt_mx_r:81|:41 %
_MC105 = DFF( !MRK0_IN $ GND, CLOCK, MR, VCC );

% |tx_cir_r:109|ds_dn_r:91|SEND %
_MC032 = DFF( _EQ117 $ _MC032, CLOCK, MR, _EQ118 );
_EQ117 = DATA_IN & DAT_IN_D & _MC027 & _MC028 & _MC031 &
_MC032 & SER_IN & SER_IN_D;
_EQ118 = _X030;
_X030 = EXP( !_MC032 & _MC111 );

```



```

% |tx_cir_r:109|ds_dn_r:91|:81 %
_MC031 = DFF( _EQ119 $ VCC, CLOCK, _EQ120, VCC );
_EQ119 = !_MC013 & !_MC031;
_EQ120 = _MC032 & MR;

% |tx_cir_r:109|ds_dn_r:91|:104 %
_MC030 = DFF( GND $ GND, !DAT_IN_D, VCC, _EQ121 );
_EQ121 = _MC013 & !_MC026;

% |tx_cir_r:109|ds_dn_r:91|:106 %
_MC029 = DFF( GND $ GND, !SER_IN_D, VCC, _EQ122 );
_EQ122 = _MC013 & !_MC025;

% |tx_cir_r:109|ds_dn_r:91|:136 %
_MC028 = DFF( _MC027 $ GND, CLOCK, _EQ123, VCC );
_EQ123 = DATA_IN & DAT_IN_D & _MC031 & SER_IN & SER_IN_D;

% |tx_cir_r:109|ds_dn_r:91|:137 %
_MC027 = DFF( _EQ124 $ GND, CLOCK, _EQ125, VCC );
_EQ124 = DATA_IN & DAT_IN_D & _MC031 & SER_IN & SER_IN_D;
_EQ125 = DATA_IN & DAT_IN_D & _MC031 & SER_IN & SER_IN_D;

% |tx_cir_r:109|ds_mx_r:97|RELEASE %
_MC026 = DFF( !DAT_IN_D $ GND, _EQ126, MR, VCC );
_EQ126 = CLOCK & !_MC112;

% |tx_cir_r:109|ds_mx_r:97|:57 %
_MC101 = DFF( GND $ GND, _MC026, MR, _EQ127 );
_EQ127 = _X031;
_X031 = EXP( _MC104 & _MC111 );

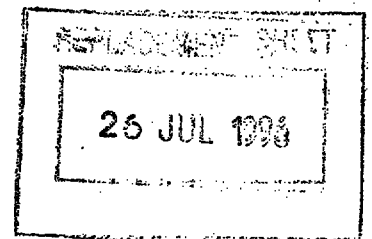
% |tx_cir_r:109|ds_mx_r:97|:58 %
_MC104 = DFF( _EQ128 $ VCC, CLOCK, MR, VCC );
_EQ128 = _MC101 & _MC103;

% |tx_cir_r:109|ds_mx_r:97|:72 %
_MC091 = DFF( _EQ129 $ GND, _EQ130, MR, VCC );
_EQ129 = _X032;
_X032 = EXP( _X033 & _X034 & _X035 );
_X033 = EXP( !_MC029 & _X032 );
_X034 = EXP( !BUS_IN4 & _MC029 & _MC030 );
_X035 = EXP( !_MC030 & _X032 );
_EQ130 = CLOCK & !_MC112;

% |tx_cir_r:109|ds_mx_r:97|:76 %
_MC103 = DFF( _EQ131 $ VCC, !_MC026, MR, _EQ132 );
_EQ131 = _MC005 & !_MC013;
_EQ132 = _X031;

% |tx_cir_r:109|ds_mx_r:98|RELEASE %
_MC025 = DFF( !SER_IN_D $ GND, _EQ133, MR, VCC );
_EQ133 = CLOCK & !_MC112;

```




```

% |tx_cir_r:109|ds_mx_r:98|:57 %
_MC024 = DFF( GND $ GND, _MC025, MR, _EQ134 );
_EQ134 = _X036;
_X036 = EXP( _MC023 & _MC111 );

% |tx_cir_r:109|ds_mx_r:98|:58 %
_MC023 = DFF( _EQ135 $ VCC, CLOCK, MR, VCC );
_EQ135 = _MC019 & _MC024;

% |tx_cir_r:109|ds_mx_r:98|:72 %
_MC090 = DFF( _EQ136 $ GND, _EQ137, MR, VCC );
_EQ136 = _X037;
_X037 = EXP( _X038 & _X039 & _X040 );
_X038 = EXP( !_MC029 & _X037 );
_X039 = EXP( !BUS_IN3 & _MC029 & _MC030 );
_X040 = EXP( !_MC030 & _X037 );
_EQ137 = CLOCK & !_MC112;

% |tx_cir_r:109|ds_mx_r:98|:76 %
_MC019 = DFF( _EQ138 $ VCC, !_MC025, MR, _EQ139 );
_EQ138 = _MC005 & !_MC013;
_EQ139 = _X036;

% |tx_cir_r:109|req_mx_r:99|:4 %
_MC076 = DFF( _MC075 $ GND, _EQ140, MR, VCC );
_EQ140 = CLOCK & !_MC112;

% |tx_cir_r:109|req_mx_r:99|:5 %
_MC018 = DFF( _MC076 $ GND, _MC111, MR, VCC );

% |tx_cir_r:109|req_mx_r:99|:33 %
_MC020 = MCELL( _EQ141 $ VCC );
_EQ141 = !_MC018 & !_MC025 & !_MC026 & _MC076
# _MC018 & !_MC025 & !_MC026 & !_MC076;

% |tx_cir_r:109|req_mx_r:99|:36 %
_MC089 = DFF( _EQ142 $ GND, _EQ143, MR, VCC );
_EQ142 = _X041;
_X041 = EXP( _X042 & _X043 & _X044 );
_X042 = EXP( !_MC029 & _X041 );
_X043 = EXP( !BUS_IN6 & _MC029 & _MC030 );
_X044 = EXP( !_MC030 & _X041 );
_EQ143 = CLOCK & !_MC112;

% |tx_cir_r:109|req_mx_r:99|:41 %
_MC075 = DFF( !REQ_IN $ GND, CLOCK, MR, VCC );

```

```

%
Shareable Expanders that are Duplicated in Multiple LABs:
(none)
%

```

- Copyrighted April 6, 1992 by FiberCom, Inc.

REPLACEMENT SHEET

26 JUL 1996



CLAIMS

What is claimed is:

1. An apparatus for use in connecting a first computer device and a second computer device through a dual line cable assembly, the first and second computer devices having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:

a first bus and tag sub-assembly including:

a first connector for mating with the first interface in the first device,

a first multi-line cable assembly having a first end and a second end, the first end connected to the first connector assembly,

a first converter adapter connected to the multi-line cable assembly second end,

a second connector connected to the converter adapter, the second connector assembly for mating with the second interface in the first device, and

the first converter adapter including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in the first device and sending such multiplexed serial information over a first line of the dual line cable assembly to the second computer device and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly and sending such parallel and demultiplexed information to the first and second interfaces of the first device.

2. The apparatus of Claim 1, further comprising:

a dual line cable assembly having a first line and a second line, a first end of the dual line cable assembly connected to the first converter adapter; and



* C L M S *

REPLACEMENT SHEET

26 JUL 1996



a second bus and tag sub-assembly including:

a third connector for mating with the first interface in the second device,

a second multi-line cable assembly having a first end and a second end, the first end connected to the third connector,

a second converter adapter connected to the second cable assembly second end and a second end of the dual line cable assembly,

a fourth connector connected to the second converter adapter, the fourth connector for mating with the second interface in the second device, and

the second converter adapter including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in the second device and sending such multiplexed serial information over the second line of the dual line cable assembly and (2) deserializing and then demultiplexing serial bus and tag information received through the second line of the dual line cable assembly and sending such parallel and demultiplexed information to the first and second interfaces of the second device.

3. The apparatus of Claim 1, wherein the bus and tag subassembly is electro-optic.

4. The apparatus of Claim 2, wherein the bus and tag subassemblies are electro-optic and the dual line cable assembly is a fiber optic cable assembly.

5. The apparatus of Claim 2, wherein the dual line cable assembly is an electrical cable assembly.

6. The apparatus of Claim I, wherein the first and/or the second connector is a bus or tag adapter which converts a first or external wiring/terminal connection scheme, grid or geometry

DOCUMENT SHEET

26 JUL 1996



* C L M S *



to a second or internal wiring/terminal scheme, grid or geometry.

7. The apparatus of Claim 2, wherein the first, the second, the third and/or the fourth connectors are bus or tag adapters which convert a first or external wiring/terminal connection scheme, grid or geometry to a second or internal wiring/terminal scheme, grid or geometry.

8. The apparatus of Claim 1, wherein the second connector connected to the first converter adapter can be contained within a box approximately 1 inch (2.54 centimeters) by 4 inches (10.16 centimeters) by 4.5 inches (11.43 centimeters).

9. The apparatus of Claim 1, wherein the integrated circuit means further emulates TAG signals to reduce apparatus including cable induced delays.

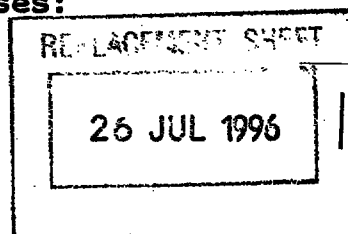
10. The apparatus of Claim 1, wherein the integrated circuit means comprises:

an erasable programmable logic device, a nonerasable programmable logic device, or a custom design programmable logic device;

a transmitter section including a serializer for receiving a plurality of parallel multiplexed signals from the programmable device over conductive paths, encoding the signals, serializing the signals, converting the signals to emitter coupled logic (ECL) levels and shifting the converted signals out on a conductive path; and

a receiver section including a deserializer for receiving serialized signals and continuously deserializing, decoding and latching parallel data through parallel conductive paths to the programmable device.

11. The apparatus of Claim 10, wherein the converter adapter further comprises:





26 JUL 1996

-93-

a printed circuit board with conductive paths;
one or more fifth connector connecting the second end of the first multi-line cable assembly and some of the conductive paths;

one or more sixth connector connecting the second connector and some of the conductive paths;

one or more seventh connector for connecting some of the conductive paths to one or more power sources;

a receiver connector connected to some of the conductive paths and for connecting to a connector on one end of the dual line cable assembly to receive signals over one of the lines in the dual line cable assembly; and

a transmitter connector connected to some of the conductive paths and for connecting to the connector on the end of the cable assembly to send signals over the other one of the lines in the dual line cable assembly.

12. The apparatus of Claim 11, wherein the converter adapter further comprises:

terminator networks connected by some of the paths to the fifth and sixth connectors; and

line drivers/receivers connected by some of the paths to the terminator networks and to programmable device.

13. The apparatus of Claim 12, wherein the transmitter section further comprises:

an ECL to current translator connected by paths to the serializer and the transmitter connector.

14. The apparatus of Claim 13, wherein the receiver section further comprises:

a photodiode and preamplifier for converting optical light pulses received from the dual line cable assembly to an analog voltage output; and

a data quantizer connected by paths to the photodiode and preamplifier and the deserializer, the data quantizer



* C L M S *



26 JUL 1996

amplifies and converts the analog voltage signals to a constant level output that is ECL compatible.

15. An apparatus for use in connecting a first computer device and a second computer device through a dual line cable assembly, the first and second computer devices having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:

- a first connector for connecting to the second interface in the first device;

- a converter adapter adjacent and connected to the first connector, the converter adapter comprising:

- a printed circuit board with conductive paths;

- one or more second connector connected to some of the conductive paths and for receiving signals from the first interface in the first device;

- one or more third connector connecting the first connector and some of the conductive paths;

- one or more fourth connector for connecting some of the conductive paths to one or more power sources;

- a receiver connector connected to some of the conductive paths and for connecting to a connector on one end of the dual line cable assembly to receive signals over one of the lines in the dual line cable assembly; and

- a transmitter connector connected to some of the conductive paths and for connecting to the connector on the end of the cable assembly to send signals over the other one of the lines in the dual line cable assembly;

- terminator networks connected by some of the paths to the second and third connectors;

- line drivers/receivers connected by some of the paths to the terminator networks;

- integrated circuit means connected to the line drivers/receivers and for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in the first device and sending such multiplexed serial information over a first line of the dual





26 JUL 1996

line cable assembly and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly from the second computer device and sending such parallel and demultiplexed information to the first and second interfaces of the first device, wherein the integrated circuit means comprises:

- an erasable programmable logic device, a nonerasable programmable logic device, or a custom design programmable logic device, the device connected by some of the paths to the line drivers/receivers;

- a transmitter section including;

- a serializer for receiving a plurality of parallel multiplexed signals from the programmable device over conductive paths, encoding the signals, serializing the signals, converting the signals to emitter coupled logic (ECL) levels and shifting the converted signals out on a conductive path; and

- an ECL to current translator connected by paths to the serializer and the transmitter connector; and

- a receiver section including a deserializer for receiving serialized signals and continuously deserializing, decoding and latching parallel data through parallel conductive paths to the programmable device.

16. An apparatus for use in connecting a first computer device and a second computer device through a dual line cable assembly, the first and second computer devices having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:

- a first bus and tag sub-assembly including:

- a first connector for mating with the first interface in the first device,

- a first converter adapter connected to the first connector,

- a first multi-line cable assembly having a first end and a second end, the first end connected to the first converter adapter,



* C L M S *



a second converter adapter connected to the multi-line cable assembly second end, a second connector connected to the second converter adapter, the second connector assembly for mating with the second interface in the first device, and

the first and second converter adapter including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in the first device and sending such multiplexed serial information over a first line of the dual line cable assembly to the second computer device and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly and sending such parallel and demultiplexed information to the first and second interfaces of the first device.

17. An apparatus for use in connecting a first computer device and a second computer device through a pair of dual line cable assemblies, the first and second computer devices having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:

a first connector for mating with the first interface in the first device;

a first converter adapter connected to the first connector;

a second connector for mating with the first interface in the second device;

a second converter adapter connected to the second connector;

a first dual line cable assembly having a first line and a second line, a first end of the first dual line cable assembly connected to the first converter adapter and a second end of the first dual line cable assembly connected to the second converter adapter;

a third connector for mating with the second interface in the first device;



* C L M S *

REPLACEMENT SHEET

26 JUL 1996

a third converter adapter connected to the third connector;

a fourth connector for mating with the second interface in the second device;

a fourth converter adapter connected to the fourth connector;

a second dual line cable assembly having a first line and a second line, a first end of the second dual line cable assembly connected to the third converter adapter and a second end of the second dual line cable assembly connected to the fourth converter adapter; and

the converter adapters including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in either the first device or the second device and sending such multiplexed serial information over the dual line cable assemblies and (2) deserializing and then demultiplexing serial bus and tag information received through the dual line cable assemblies and sending such parallel and demultiplexed information to the first and second interfaces of the either the first device or the second device.

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1996



* C L M S *

TITLE OF THE INVENTION

ELECTRO-OPTIC APPARATUS FOR CONNECTING COMPUTER DEVICES

ABSTRACT OF THE DISCLOSE

The present invention relates to an apparatus for connecting computer devices and, more specifically, where the apparatus comprises a first connector, a cable assembly, a converter adapter and a second connector.

Figure 3.

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1996

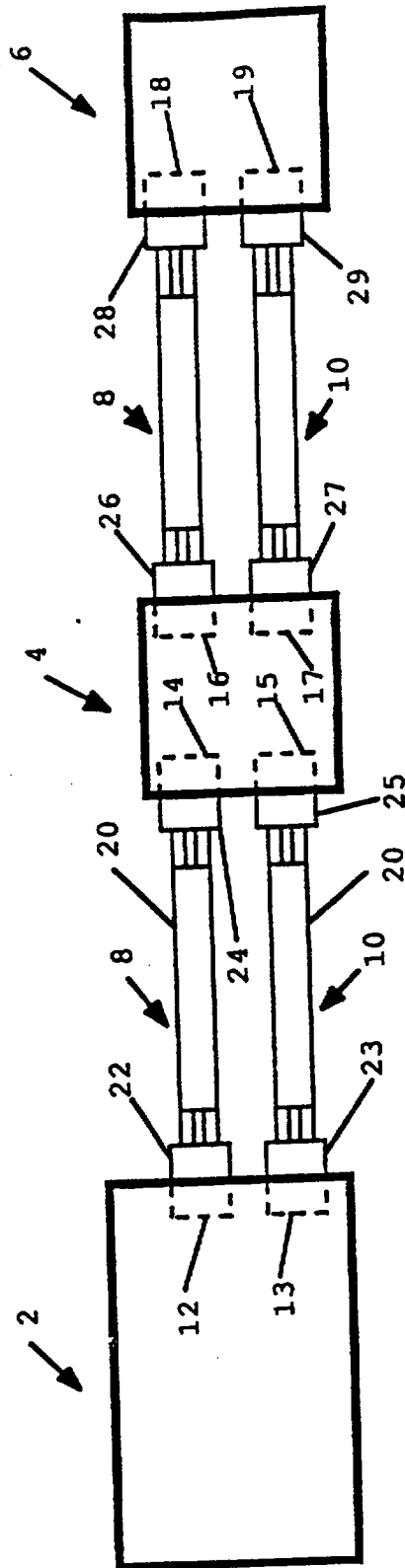
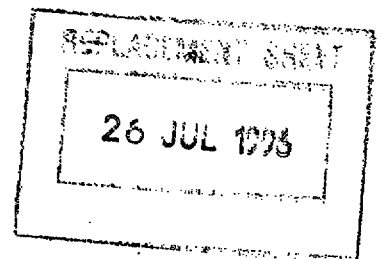


Fig. 1



This Sheet Has Been Replaced



- 2 -

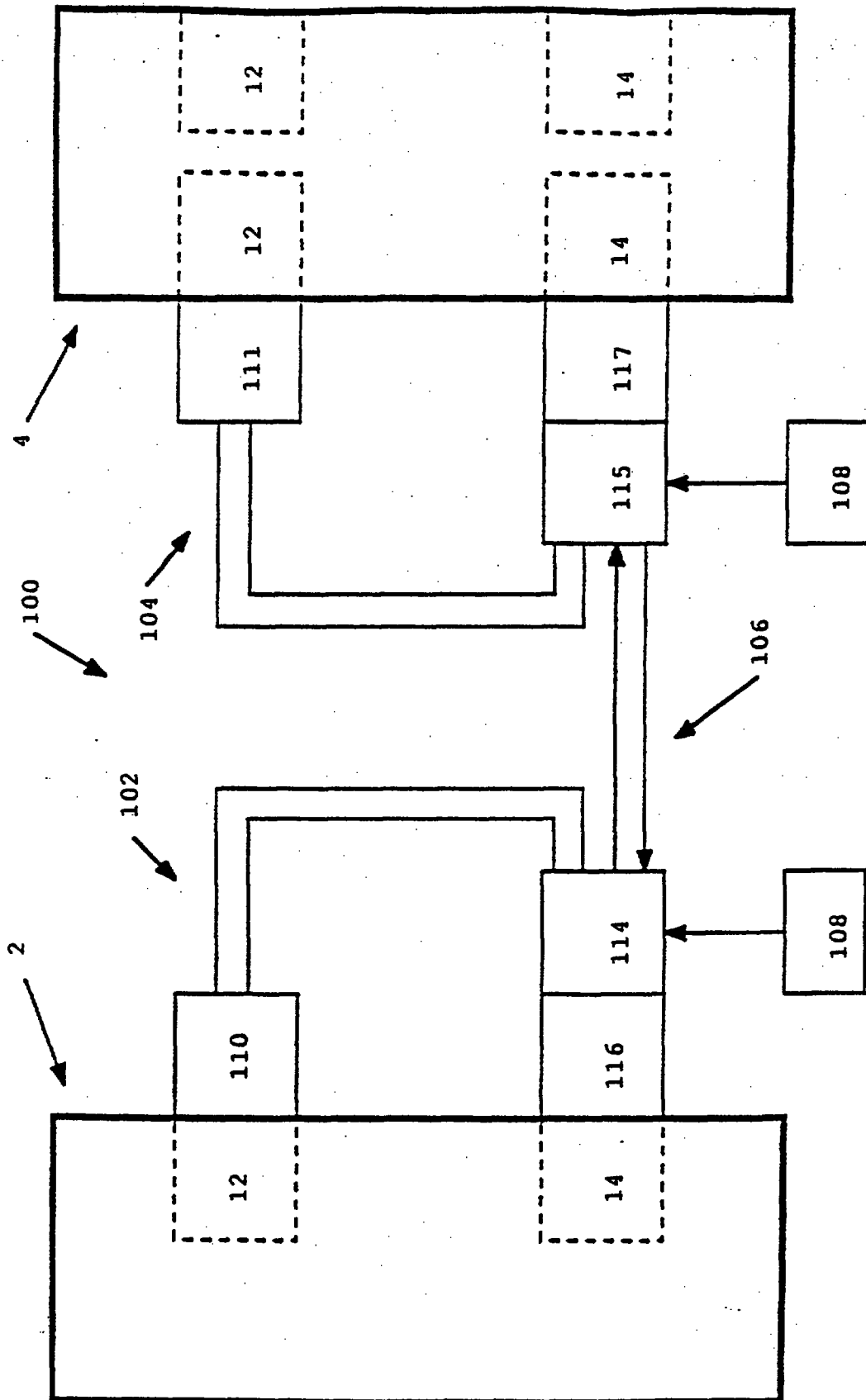
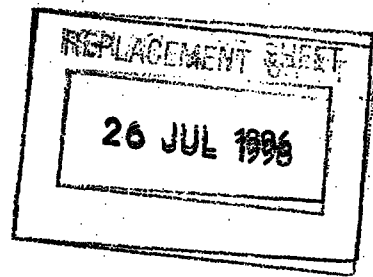


Fig. 2

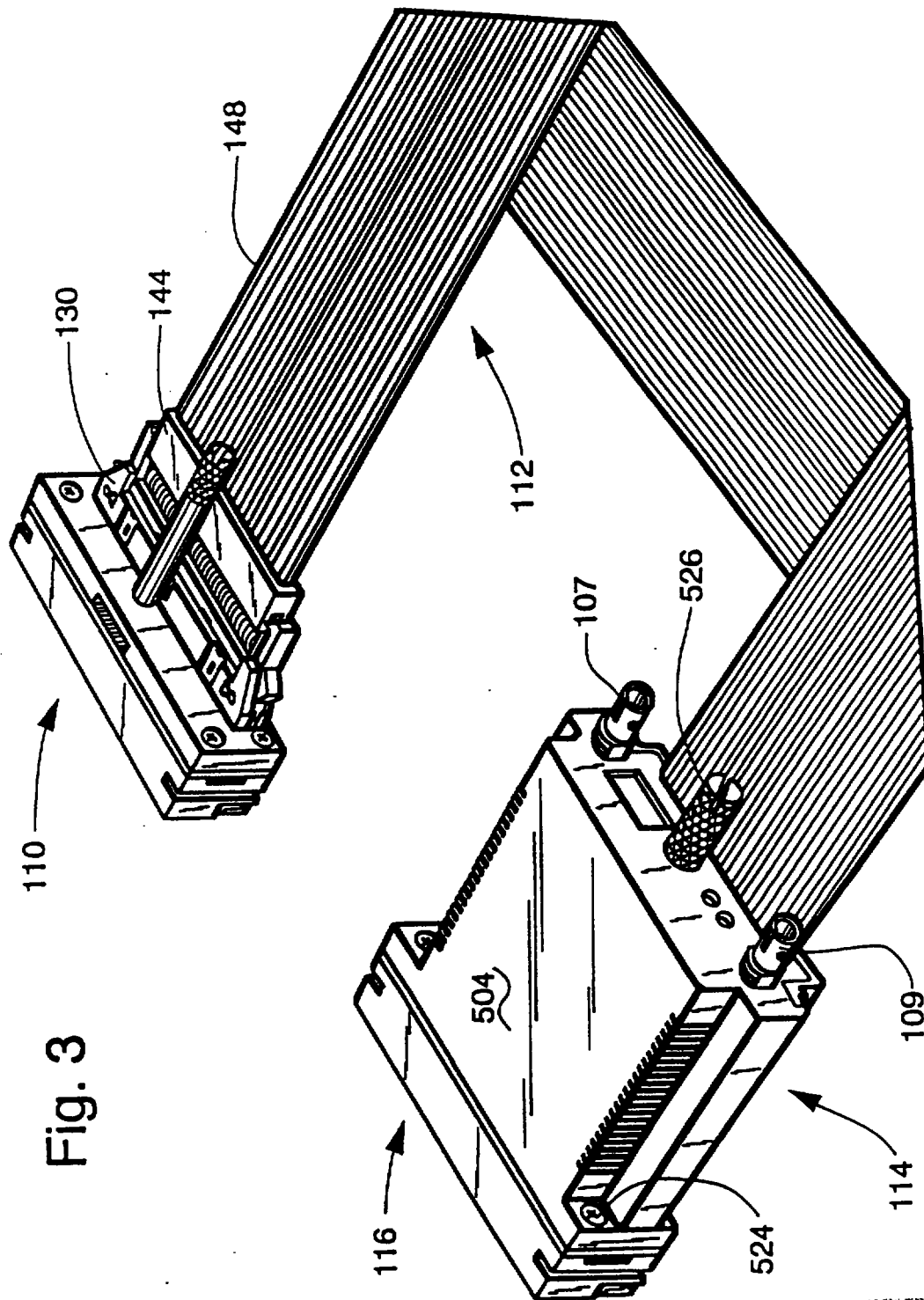


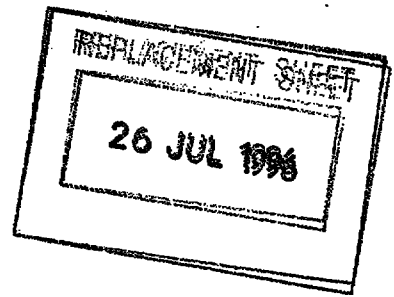
Fig. 3

This Sheet Has Been Replaced



REPLACEMENT SHEET

26 JUL 1996



- 4 -

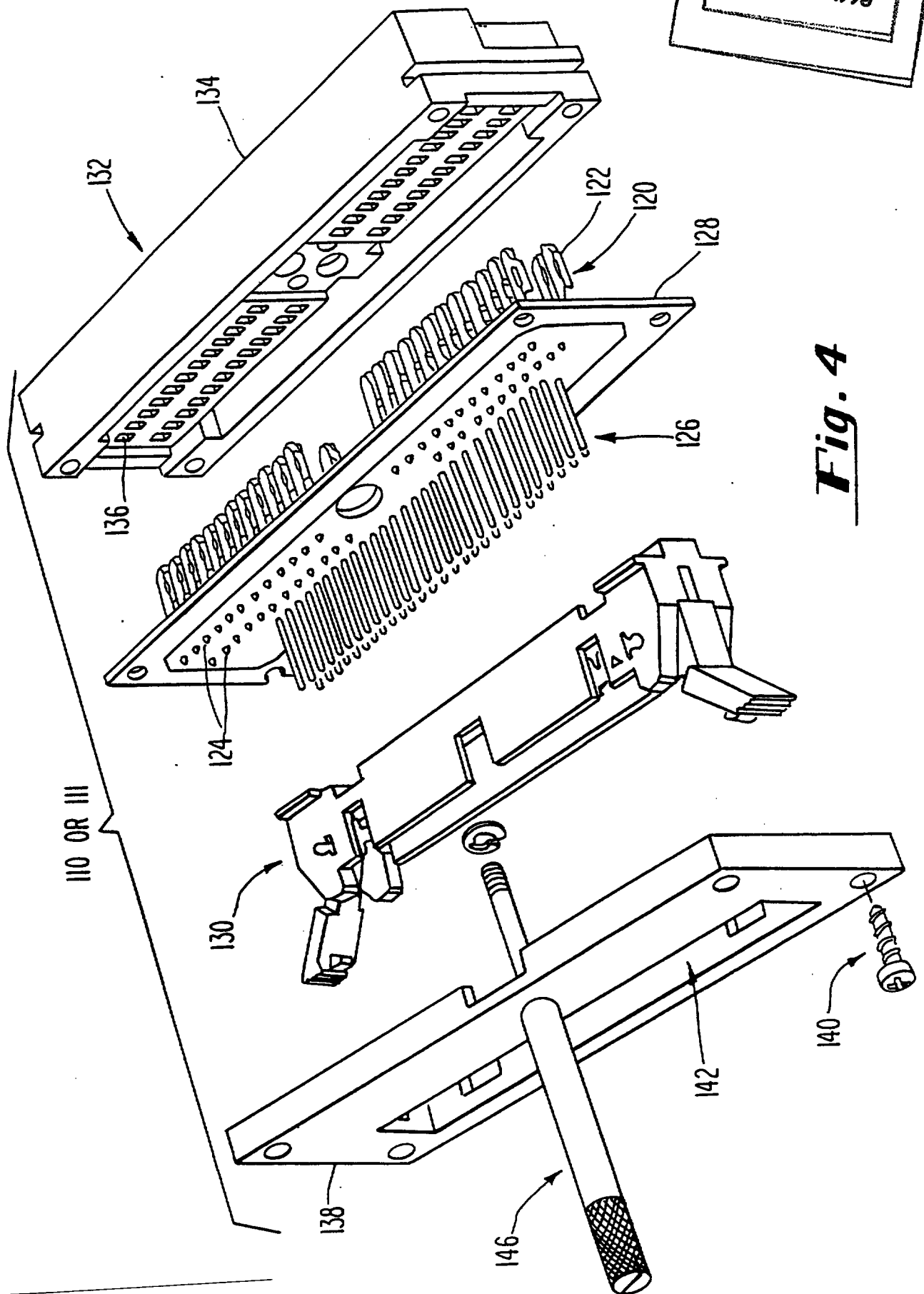


Fig. 4

This Sheet Has Been Replaced



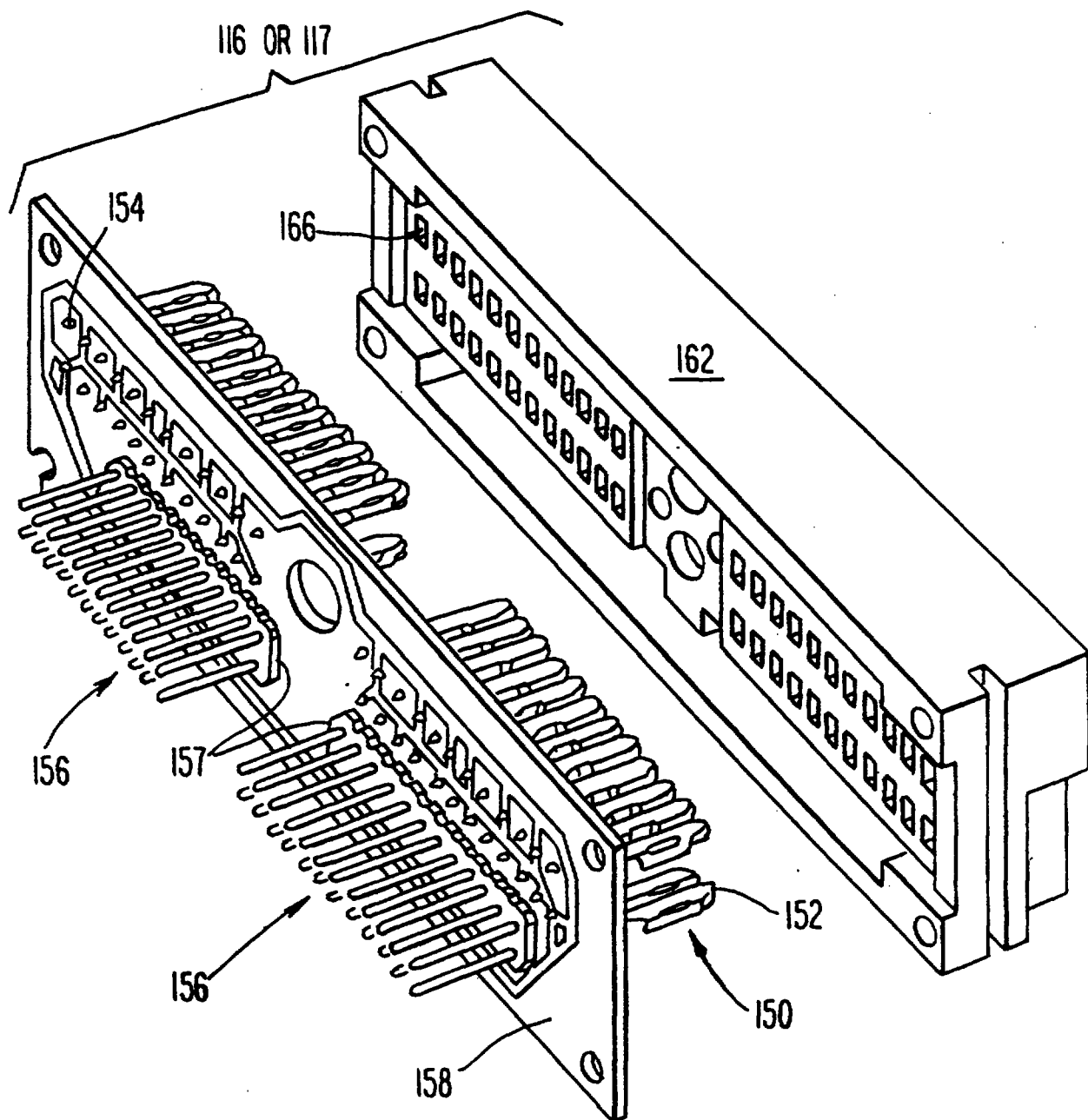
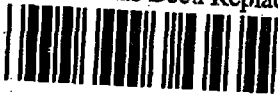


Fig. 5



This Sheet Has Been Replaced



- 6 -

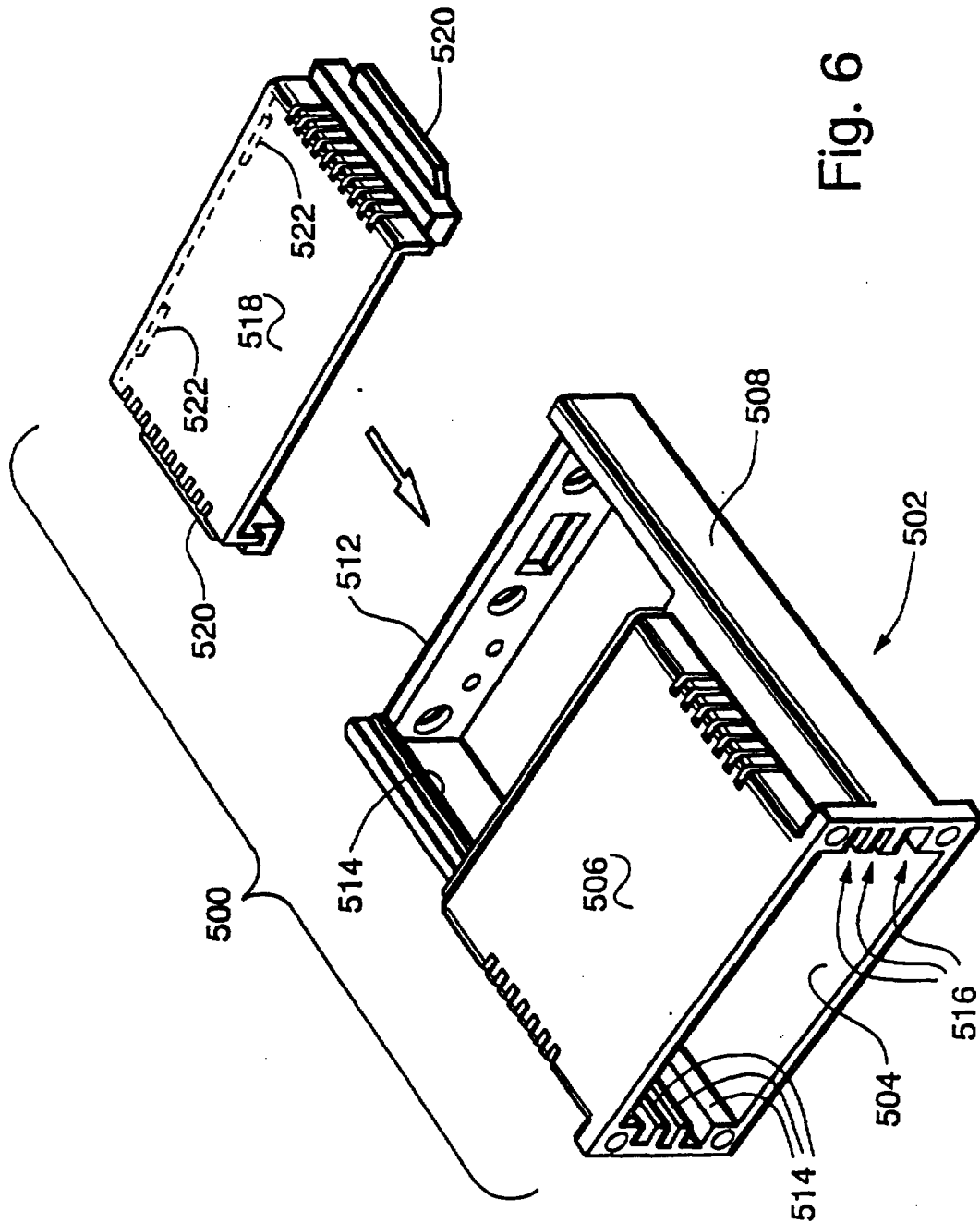
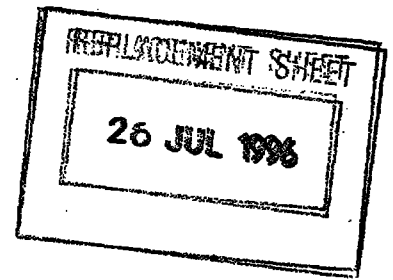


Fig. 6

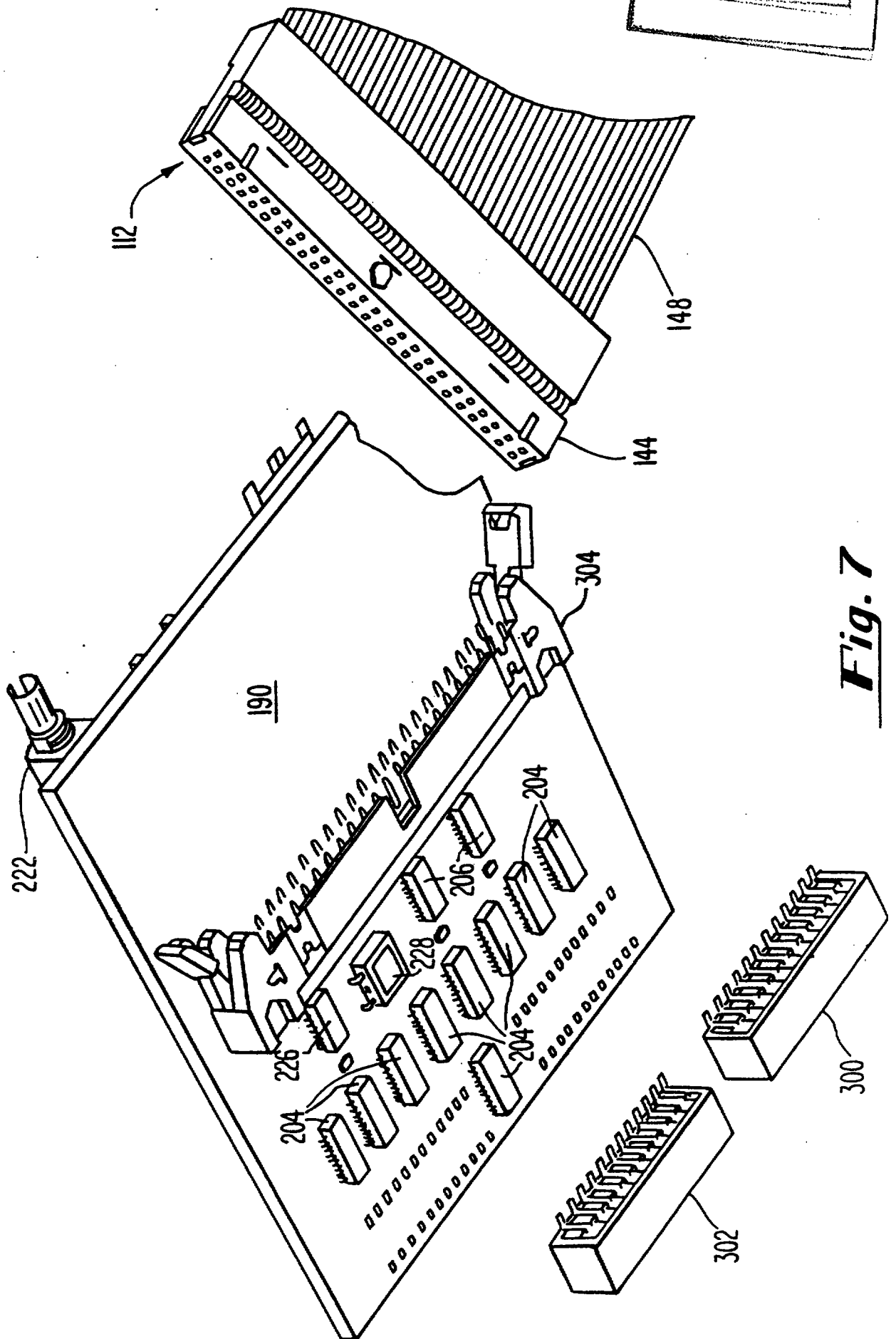
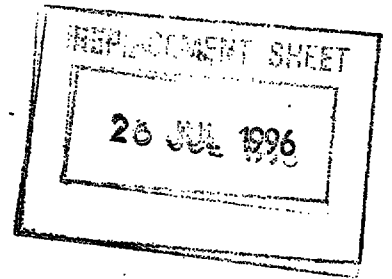


Fig. 7

is Sheet Has Been

INVESTIGATION SHEET

26 JUL 1996



100-443887-100

- 9 -

26 JUL 1996

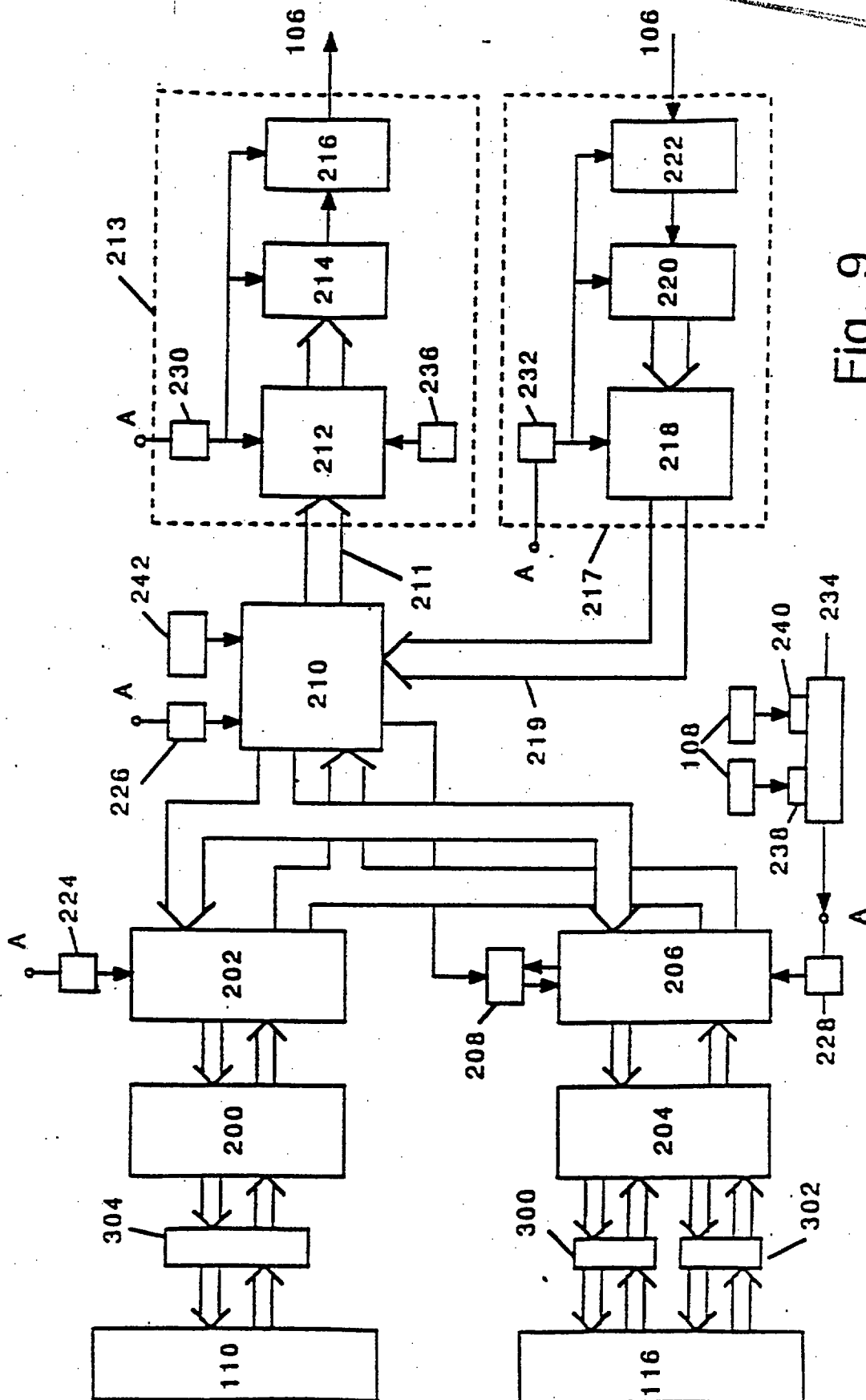


Fig. 9

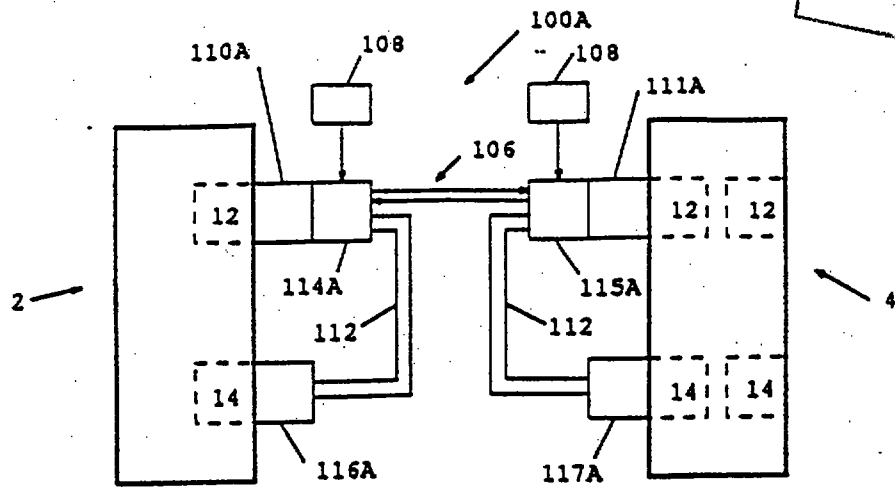
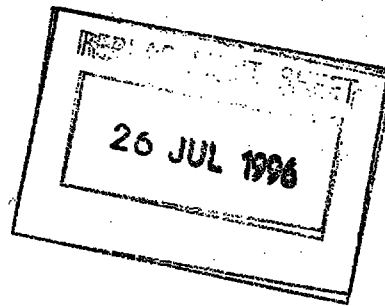


Fig. 10

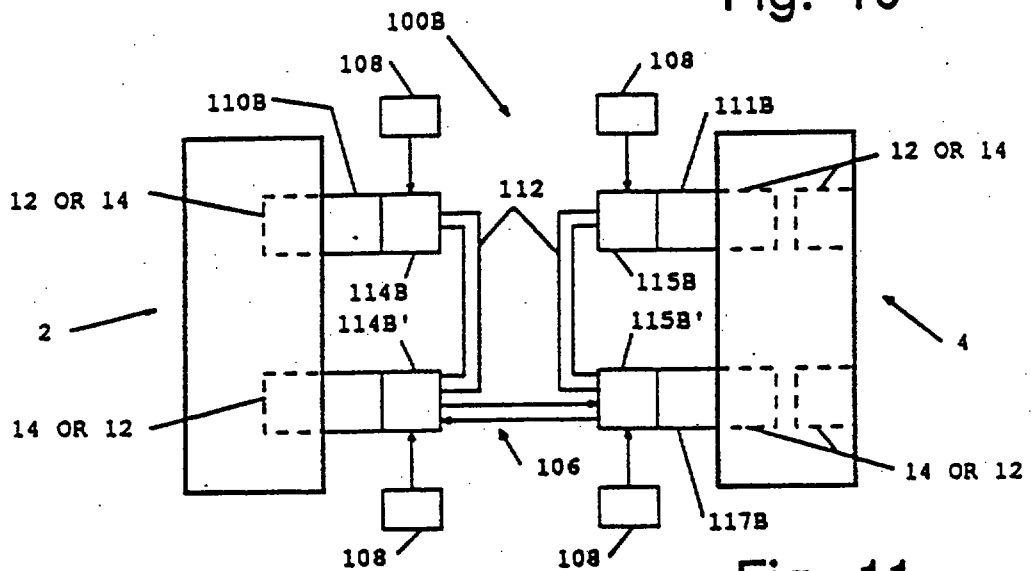


Fig. 11

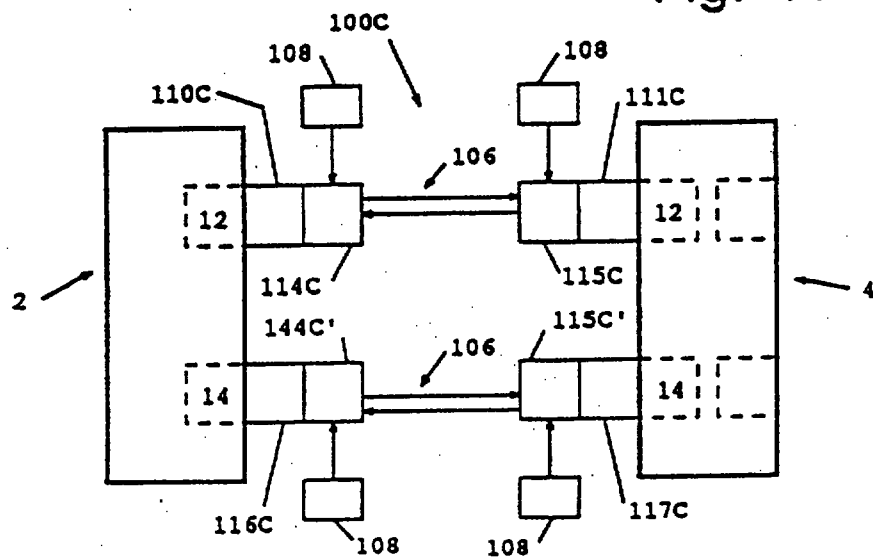


Fig. 12

- 11 -

adapters 116 and 117 as required in IBM Publication GA22-6974-09. Each adapter 116,117 further includes an insulative housing 162. The housing 162 includes passages 166 for receiving the first plurality of terminals 150 for mating with
 5 the connector 12,14 in the first device 2 or second device 4, respectively. Preferred adapters for use as the adapters 116 and 117 in the present invention are described in U.S. Patent 4,585,284. Preferred adapters 116 and 117 are parts of assemblies commercially available under part nos. 92643-001
 10 (dark) and 92644-001 (light) from Du Pont.

Figure 6 is a perspective view of a housing 500 for the converter adapter 114,115. The housing 500 has a main rectangularly shaped frame 502 with a first top wall 504, a second bottom wall 506, a third side wall 508, a fourth side
 15 wall 510 and a fifth end wall 512. The side walls are parallel and spaced from one another and have internal longitudinal rails or ridges 514 defining grooves 516 between a pair of the rails or ridges 514. Edges of circuit board 190 slide in the grooves 516 such that the adjacent rails or ridges 514 hold the
 20 circuit board 190 in place in the housing 500. The housing 500 includes a cover 518 with ribs 520 that slide in grooves 516 defined by a pair of the rails or ridges 514. The cover 518 also has projections 522 that snap over an edge of the end side 512 of the frame 502 to secure the cover 518 on the frame 502.
 25 The housing 500 can be made of a conductive material (e.g., aluminum) or an insulative material (e.g., plastic). If the housing is made of plastic, it can be coated with a metallized or conductive layer. Alternatively, a conductive or metallized sheet can be slid in grooves 515 adjacent the top wall 504
 30 and/or the bottom wall 506 to enhance electrical performance. After the printed circuit board 190 is inserted in the housing 500, the housing 500 is secured to the second connector printed circuit board 158 and the second connector housing 162, such as, by screws 524. A jack screw assembly 526 (such as the
 35 assembly commercially available from Du Pont under part number 92645-001) can extend through the housing 500 and the adapter 116,117 for use in securing the converter adapter 114 combined

REPLACED SHEETS	SG
☒ Description : paged 15 to paged 17	
☐ Claim(s) : paged 10 to paged 100	
☒ Drawing(s) : paged 40 to 40, 40, 40, 40	
☒ Abstract : paged 101 to paged 101	
DATE OF RECEIPT	

REPLACEMENT SHEETS	SG
☒ Description : paged 15 to paged 17	
☒ Claim(s) : paged 10 to paged 100	
☒ Drawing(s) : paged 40, 40, 40, 40	
☒ Abstract : paged 101 to paged 101	
DATE OF RECEIPT 2/5/17	



selection for DASH and the current command is being chained from a previous command, it drops 'service out'. This may occur before the channel has recognized the fall of 'status in.

5 Two report files generated by a Max+Plus II Compiler for an EPM5130WC-1 chip from Altera Corp. are included in Appendices A and B to this specification and appear immediately before the claims. The report files in Appendices A and B show how embodiments of the EPLD 210 in each one of the adapters 114
10 and 115, respectively, can be implemented. These report files are sufficient information for one of ordinary skill in the art to reproduce the designs of these embodiments.

Alternatively, the multiplexing and demultiplexing means 210 can include a nonerasable programmable logic device
15 (PLD) or a custom design programmable logic device, such as an application specific Integrated circuit (ASIC). If an ASIC is used, it can be designed to perform other functions than those included in the EPLD. For instance, such other functions can include the functions performed by any or all other components
20 on the printed circuit board 190. Such alternatives are equivalent to the embodiments disclosed in more detail using the EPLD. The structure for performing the functions performed by any or all components on the printed circuit board 190 can be referred to as integrated circuit means.

25 The integrated circuit means can include a transmitter section 213 and a receiver section 217.

The bus 211 of parallel traces connects the programmed EPLD 210 to a serializer 212 within the transmitter section 213. The serializer 212 converts parallel data to serial data.
30 More specifically, the serializer 212 receives a plurality of parallel multiplexed signals from the 10-bit bus 211 and sends it to an encoder latch to convert the 10-bit bus to a 12-bit encoded word. this encoding is used to maximize bit boundary transitions to help balance the data pattern and aid in the
35 timing recovery on the receiving side. The 12-bit word is then fed to a shift register where the contents are serially shifted out in a single stream on one line. The serializer 212 can be

REPLACEMENT SHEET

24 MAY 1997

a transparent synchronous transmitter-receiver interface (TAXI) commercially available under part no. AM-7968 from Advanced Micro Devices with offices in Sunnyvale, California. A quartz crystal oscillator and clock generator 236 can
5 provide a fixed clock frequency to the serializer 212. In summary, the serializer 212 encodes the data, serializes it, converts the data to emitter coupled logic (ECL) levels (which are voltage signals), and shifts the data out over balanced lines. This data is fed to an ECL to current
10 translator 214 which feeds current pulses to the transmitter connector 216 which can contain a light emitting diode device. The transmitter connector 216 connects to the connector on the end of the cable assembly 106 to send optical data pulses over one line of the fiber optic lines in
15 the cable assembly 106. Alternatively, current data pulses from the ECL to current translator 214 are fed through an electrical transmitter connector and an electrical line of the electrical cable assembly 106.

Signals or data pulses are transmitted over another
20 line of the cable assembly 106 and received by the receiver section 217. If the cable assembly 106 is fiber optic, the receiver section 217 includes the receiver connector 222 which can be a photodiode and preamplifier which converts groups of photons or optical light pulses to an analog
25 voltage output. The photodiode and preamplifier 222 can be a positive intrinsic negative (PIN) photodiode and preamplifier, such as, commercially available under part no. HFBR2614TC from Hewlett Packard. The output from the photodiode and preamplifier 222 is fed into a data quantizer
30 220 which amplifies and converts the voltage signals to a constant level output that is ECL compatible. The data quantizer 220 also provides a status indication or a loss of signal to the EPLD 210 indicating whether there is a connection at the distal end of the cable assembly 106. The
35 data quantizer can be part no. NE5224 commercially available from Signetics with offices in Sunnyvale, California. The output of the data quantizer 220 is fed into a deserializer 218 which receives and the serialized ECL levels and continuously deserializes, decodes and latches

REPLACEMENT SHEET

24 MAY 1997

parallel data through the 10 bit parallel bus 219 to the EPLD 210. The deserializer 218 can be part no. AM7969 commercially available from Advanced Micro Devices.

One or more voltage regulator 224, 226, 228, 230, 232 can be connected to provide a constant voltage supply to the line drivers/receivers 202, 206, the EPLD 210, the serializer 212 and the deserializer 218. The voltage regulators can be connected to a power input circuit 234 which can be "OR" connected to redundant power supplies 108. Thus, if the primary power supply 108 fails, power is automatically supplied from a second power supply 108.

Thus, data inputted to the bus and tag sub-assembly 102 from the bus and tag interfaces 12 and 14 is transmitted over the dual line cable assembly 106 and the bus and tag subassembly 104 and appears at the receiving device interfaces 12 and 14 exactly duplicated, only delayed in the time domain by the serialization and deserialization function and the propagation delay of the pulses in the lines which is length dependent (approximately 5 microseconds for each kilometer of optical fiber).

Figures 10-12 are block diagrams illustrating second, third and fourth embodiments of apparatus 100A, 1008 and 100C for connecting one computer device 2 to another computer device 4 in accordance with the present invention. Figure 10 illustrates the apparatus 100A similar to the apparatus 100 illustrated in Figure 2, except the converter adapters 114A, 115A are connected directly to the connectors 110A, 111A connected to bus interfaces 12, rather than to the connectors 116A, 117A connected to the tag interfaces 14.

Figure 11 illustrates an apparatus 1008 similar to the apparatus 100 illustrated in Figure 2, except the functions performed by the converter adapters 114 and 115 in Figure 2 are now performed by converter adapters 114B, 114B', 115B and 115B' which are connected directly to the connectors 110B, 116B, 111B and 117B, respectively. One of the cable assemblies 112 interconnects adapters 114B and 114B'. Another one of the cable assemblies 112 interconnects adapters 115B and 115B'. Each

REPLACEMENT SHEET

24 MAY 1997

What is claimed is:

1. An apparatus for use in connecting a first computer device and a second computer device through a dual line cable assembly, the first and second computer devices each having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:
 - a first bus and tag sub-assembly including:
 - a first connector for mating with the first interface in the first device,
 - a first multi-line cable assembly having a first end and a second end, the first end connected to the first connector,
 - a first converter adapter connected to the second end of the first multi-line cable assembly and being adapted for connection to the dual line cable assembly,
 - a second connector connected to the first converter adapter and being mated with the second interface in the first device, and
 - the first converter adapter including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in the first device and sending such multiplexed serial information over a first line of the dual line cable assembly to the second computer device and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly and sending such parallel and demultiplexed information to the first and second interfaces of the first device.
2. The apparatus of claim 1, wherein the dual line cable assembly has a first end and a second end, said first end of the dual line cable assembly connected to the first converter adapter, the apparatus further comprising:
 - a second bus and tag sub-assembly including:
 - a third connector for mating with the first interface in the second device,
 - a second multi-line cable assembly having a first end and a second end, the first end connected to the third connector,



REPLACEMENT SHEET

24 MAY 1997

- a second converter adapter connected to the second end of the second multi-line cable assembly and to the second end of the dual line cable assembly,
 - a fourth connector connected to the second converter adapter and being mated with the second interface in the second device, and
 - the second converter adapter including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in the second device and sending such multiplexed serial information over the second line of the dual line cable assembly and (2) deserializing and then demultiplexing serial bus and tag information received through the first line of the dual line cable assembly and sending such parallel and demultiplexed information to the first and second interfaces of the second device.
3. The apparatus of claim 2, wherein the bus and tag sub-assemblies are electro-optic and the dual line cable assembly is a fiber optic cable assembly.
4. The apparatus of claim 2, wherein the dual line cable assembly is an electrical cable assembly.
5. The apparatus of claim 2, wherein the first, the second, the third and/or the fourth connectors are bus or tag adapters which convert a first or external wiring/terminal connection scheme, grid or geometry to a second or internal wiring/terminal scheme, grid or geometry.
6. The apparatus of claim 1, wherein the bus and tag sub-assembly is electro-optic.
7. The apparatus of claim 1, wherein the first and/or the second connector is a bus or tag adapter which converts a first or external wiring/terminal connection scheme, grid or geometry to a second or internal wiring/terminal scheme, grid or geometry.



REPLACEMENT SHEET

24 MAY 1997

8. The apparatus of claim 1, wherein the second connector connected to the first converter adapter can be contained within a box approximately 1 inch (2.54 centimeters) by 4 inches (10.16 centimeters) by 4.5 inches (11.43 centimeters).

9. The apparatus of claim 1, wherein the integrated circuit means further emulates TAG signals thereby reducing signal delays introduced by the apparatus including cable induced delays.

10. The apparatus of claim 1, wherein the integrated circuit means comprises:

an erasable programmable logic device, a nonerasable programmable logic device, or a custom design programmable logic device;

a transmitter section including a serializer for receiving a plurality of parallel multiplexed signals from the programmable device over conductive paths, encoding the signals, serializing the signals, converting the signals to emitter coupled logic (ECL) levels and shifting the converted signals out on a conductive path; and

a receiver section including a deserializer for receiving serialized signals and continuously deserializing, decoding and latching parallel data through parallel conductive paths to the programmable device.

11. The apparatus of claim 10, wherein the converter adapter further comprises:

a printed circuit board with conductive paths;

one or more fifth connector connecting the second end of the first multi-line cable assembly and some of the conductive paths;

one or more sixth connector connecting the second connector and some of the conductive paths;

one or more seventh connector for connecting some of the conductive paths to one or more power sources;

a receiver connector connected to some of the conductive paths and for connecting to a connector on one end of the dual line cable assembly to receive signals over one of the lines in the dual line cable assembly; and

a transmitter connector connected to some of the conductive paths and for connecting to the connector on the end of the cable assembly to send signals over the other one of the lines in the dual line cable assembly.



* C L M S *

REPLACEMENT SHEET

24 MAY 1997

12. The apparatus of claim 11, wherein the converter adapter further comprises:

terminator networks connected by some of the paths to the fifth and sixth connectors; and

line drivers/receivers connected by some of the paths to the terminator networks and to programmable device.

13. The apparatus of claim 12, wherein the transmitter section further comprises:

an ECL to current translator connected by paths to the serializer and the transmitter connector.

14. The apparatus of claim 13, wherein the receiver section further comprises:

a photodiode and preamplifier for converting optical light pulses received from the dual line cable assembly to an analog voltage output; and

a data quantizer connected by paths to the photodiode and preamplifier and the deserializer, the data quantizer amplifies and converts the analog voltage signals to a constant level output that is ECL compatible.

15. The apparatus of claim 1, wherein said first converter adapter is configured to transmit bus and tag information on said dual-line cable assembly a distance exceeding about 500 feet and configured to receive bus and tag information on said dual-line cable assembly from a distance exceeding about 500 feet.

16. An apparatus for use in connecting a first computer device and a second computer device through a dual line cable assembly, the first and second computer devices each having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:

a first connector for connecting to the second interface in the first device;

a converter adapter adjacent and connected to the first connector and being adapted for connection to the dual line cable assembly, the converter adapter comprising:
a printed circuit board with conductive paths;
one or more second connectors connected to at least some of the conductive paths for receiving signals from the first interface in the first device;



REPLACEMENT SHEET

24 MAY 1997

one or more third connectors connecting the first connector and some of the conductive paths;

one or more fourth connectors for connecting at least some of the conductive paths to one or more power sources;

a receiver connector connected to at least some of the conductive paths and for connecting to a connector on one end of the dual line cable assembly to receive signals over one of the lines in the dual line cable assembly; and

a transmitter connector connected to at least some of the conductive paths and for connecting to the connector on the end of the cable assembly to send signals over the other one of the lines in the dual line cable assembly;

terminator networks connected by at least some of the paths to the second and third connectors;

line drivers/receivers connected by at least some of the paths to the terminator networks;

integrated circuit means connected to the line drivers/receivers for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in the first device and sending such multiplexed serial information over a first line of the dual line cable assembly and (2) deserializing and then demultiplexing serial bus and tag information received from a second line of the dual line cable assembly from the second computer device and sending such parallel and demultiplexed information to the first and second interfaces of the first device, wherein the integrated circuit means comprises:

an erasable programmable logic device, a nonerasable programmable logic device, or a custom design programmable logic device, the device connected by at least some of the paths to the line drivers/receivers;

a transmitter section including;

a serializer for receiving a plurality of parallel multiplexed signals from the programmable device over conductive paths, encoding the signals, serializing the signals, converting the signals to emit-



* C L H S *

REPLACEMENT SHEET

24 MAY 1997

ter coupled logic (ECL) levels and shifting the converted signals out on a conductive path; and an ECL to current translator connected by at least some of the paths to the serializer and the transmitter connector; and

a receiver section including a deserializer for receiving serialized signals and continuously deserializing, decoding and latching parallel data through parallel conductive paths to the programmable device.

17. The apparatus of claim 16, wherein said converter adapter is configured to transmit bus and tag information on said dual-line cable assembly a distance exceeding about 500 feet and configured to receive bus and tag information on said dual-line cable assembly from a distance exceeding about 500 feet.

18. An apparatus for use in connecting a first computer device and a second computer device through a dual line cable assembly, the first and second computer devices each having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:

- a first bus and tag sub-assembly including:
 - a first connector for mating with the first interface in the first device,
 - a first converter adapter connected to the first connector,
 - a first multi-line cable assembly having a first end and a second end, the first end connected to the first converter adapter,
 - a second converter adapter connected to the second end of the first multi-line cable assembly and being adapted for connection to the dual line cable assembly,
 - a second connector connected to the second converter adapter, the second connector assembly for mating with the second interface in the first device, and
- the first and second converter adapter including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in the first device and sending such multiplexed serial information



REPLACEMENT SHEET

24 MAY 1997

over a first line of the dual line cable assembly to the second computer device and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly and sending such parallel and demultiplexed information to the first and second interfaces of the first device.

19. The apparatus of claim 18, wherein the integrated circuit means emulates TAG signals thereby reducing signal delays introduced by the apparatus including cable induces delays.

20. The apparatus of claim 18, wherein said first and second converter adapters are configured to transmit bus and tag information on said dual-line cable assembly a distance exceeding about 500 feet and configured to receive bus and tag information on said dual-line cable assembly from a distance exceeding about 500 feet.

21. An apparatus for use in connecting a first computer device and a second computer device through a pair of dual line cable assemblies, the first and second computer devices each having first and second electrical interfaces having a plurality of rows and columns of bus and tag inputs and outputs, comprising:

- a first connector for mating with the first interface in the first device;
- a first converter adapter connected to the first connector;
- a second connector for mating with the first interface in the second device;
- a second converter adapter connected to the second connector;
- a first dual line cable assembly of the pair of assemblies having a first end and a second end, the first end of the first dual line cable assembly connected to the first converter adapter and the second end of the first dual line cable assembly connected to the second converter adapter;
- a third connector for mating with the second interface in the first device;
- a third converter adapter connected to the third connector;



REPLACEMENT SHEET

24 MAY 1997

- a fourth connector for mating with the second interface in the second device;
- a fourth converter adapter connected to the fourth connector;
- a second dual line cable assembly of the pair of assemblies having a first end and a second end, the first end of the second dual line cable assembly connected to the third converter adapter and the second end of the second dual line cable assembly connected to the fourth converter adapter; and

the converter adapters including integrated circuit means for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces in either the first device or the second device and sending such multiplexed serial information over the first and second dual line cable assemblies and (2) deserializing and then demultiplexing serial bus and tag information received through the dual line cable assemblies and sending such parallel and demultiplexed information to the first and second interfaces of the either the first device or the second device.

22. The apparatus of claim 21, wherein the integrated circuit means emulates TAG signals thereby reducing signal delays introduced by the apparatus including cable induced delays.

23. The apparatus of claim 21, wherein each of said converter adapters is configured to transmit bus and tag information on said dual-line cable assembly a distance exceeding about 500 feet and configured to receive bus and tag information on said dual-line cable assembly from a distance exceeding about 500 feet.

24. An apparatus used in connecting a plurality of computer devices using a dual line cable assembly, each computer device having at least two electrical interfaces, comprising:

- at least one converter adapter operatively coupled to at least one of the interfaces of each computer device, said dual line cable assembly having a first end connected to one converter adapter coupled to one computer device and having a second end connected to one converter adapter coupled to another computer device; and



REPLACEMENT SHEET

24 MAY 1997

each converter adapter being configured for (1) multiplexing and then serializing parallel bus and tag information received from the interfaces of the computer device to which the converter adapter is operatively coupled and sending such multiplexed serial information over the dual line cable assembly to the other computer device and (2) deserializing and then demultiplexing serial bus and tag information received through the dual line cable assembly and sending such parallel and demultiplexed information to the interfaces of the computer device to which the converter adapter is operatively coupled.

25. The apparatus of claim 24, wherein each computer device has at least a first and a second interface.

26. The apparatus of claim 25, wherein one converter adapter is operatively coupled to only one of the first and second interfaces of each of the plurality of computer devices.

27. The apparatus of claim 25, wherein one converter adapter is operatively coupled to each of the first and second interfaces of each of the plurality of computer devices and wherein two dual line cable assemblies are used to connect together two computer devices.

28. The of claim 25, further comprising:

at least one bus and tag sub-assembly comprising:

a first connector for mating with the first interface of a first of the plurality of computer devices,

a first multi-line cable assembly having a first end and a second end, the first end connected to the first connector and the second end connected to one converter adapter,

a second connector connected to the one converter adapter and being connected with the second interface in the first device.

29. The apparatus of claim 28, wherein a second converter adapter is connected between the first connector and the multi-line cable assembly in at least one of the bus and tag sub-assemblies.

30. The apparatus of claim 24, wherein the converter adapter comprises:



* C L M S *

REPLACEMENT SHEET

24 MAY 1997

- a printed circuit board with conductive paths;
- one or more first connectors connected to at least some of the conductive paths for receiving signals from a first of the two electrical interface in a first of the plurality of computer devices;
- one or more second connectors connecting the first connector and some of the conductive paths;
- one or more third connectors for connecting at least some of the conductive paths to one or more power sources;
- a receiver connector connected to at least some of the conductive paths and for connecting to a connector on one end of the dual line cable assembly to receive signals carried by the dual line cable assembly;
- a transmitter connector connected to at least some of the conductive paths and for connecting to the connector on the end of the dual line cable assembly to send signals over the dual line cable assembly;
- terminator networks connected by at least some of the conductive paths to the first and second connectors;
- line drivers/receivers connected by at least some of the conductive paths to the terminator networks;
- integrated circuit means connected to the line drivers/receivers for (1) multiplexing and serializing parallel bus and tag information received from the first and second interfaces in the first device and sending such multiplexed serial information over a first line of the dual line cable assembly and (2) deserializing and then demultiplexing serial bus and tag information received from a second line of the dual line cable assembly from a second of the plurality of computer devices and sending such parallel and demultiplexed information to the first and second interfaces of the first device, wherein the integrated circuit means comprises:
 - an erasable programmable logic device, a nonerasable programmable logic device, or a custom design programmable logic device, the device connected by at least some of the paths to the line drivers/receivers;



REPLACEMENT SHEET

24 MAY 1997

a transmitter section including;

a serializer for receiving a plurality of parallel multiplexed signals from the programmable device over conductive paths, encoding the signals, serializing the signals, converting the signals to emitter coupled logic (ECL) levels and shifting the converted signals out on a conductive path; and

an ECL to current translator connected by at least some of the conductive paths to the serializer and the transmitter connector; and

a receiver section including a deserializer for receiving serialized signals and continuously deserializing, decoding and latching parallel data through parallel conductive paths to the programmable device.

31. The apparatus of claim 24, wherein the integrated circuit means emulates TAG signals thereby reducing signal delays introduced by the apparatus including cable induced delays.

32. The apparatus of claim 24, wherein each of said converter adapters is configured to transmit bus and tag information on said dual-line cable assembly a distance exceeding about 500 feet and configured to receive bus and tag information on said dual-line cable assembly from a distance exceeding about 500 feet.



REPLACEMENT SHEET

24 MAY 1997

TITLE OF THE INVENTION

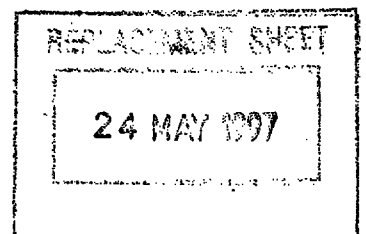
ELECTRO-OPTIC APPARATUS FOR CONNECTING COMPUTER DEVICES

ABSTRACT OF THE DISCLOSE

The present invention relates to an apparatus for connecting computer devices and, more specifically, where the apparatus comprises a first connector, a cable assembly, a converter adapter and a second connector.

Figure 3.

This Sheet Has Been Replaced





1

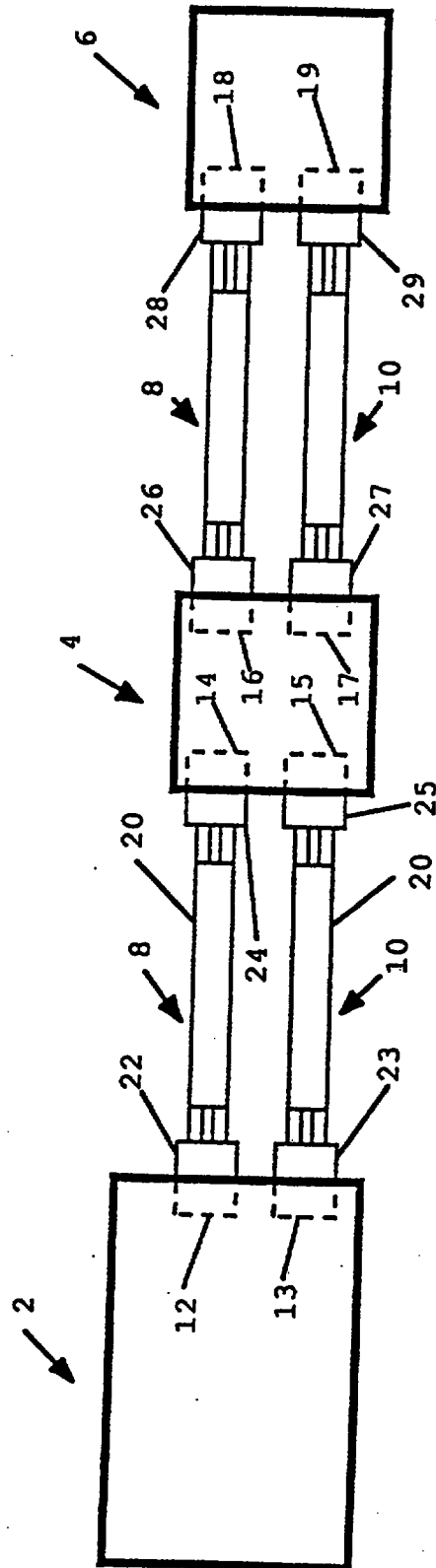


Fig. 1 (PRIOR ART)

REPLACEMENT SHEET

24 MAY 1997

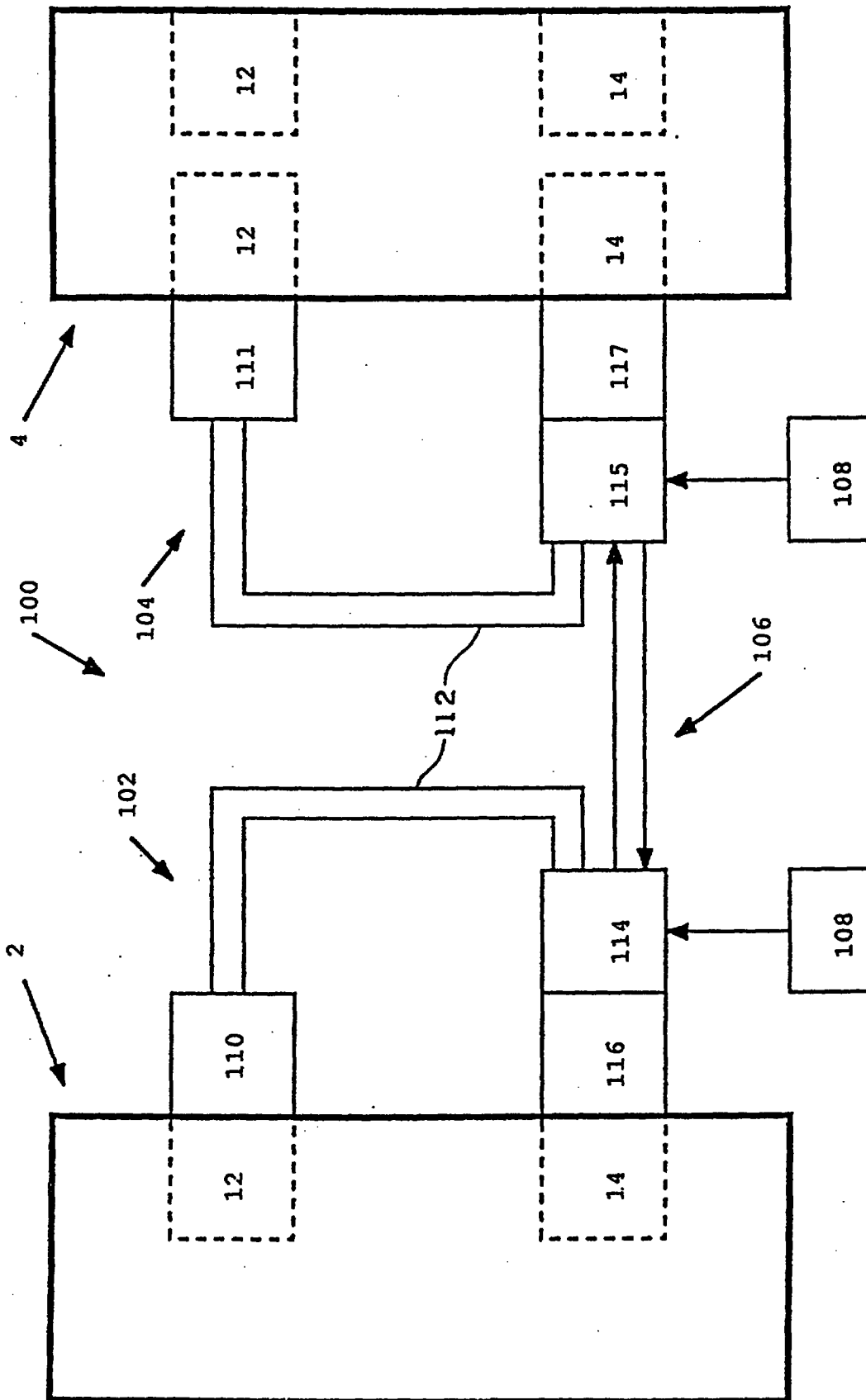


Fig. 2

REPLACEMENT SHEET
24 MAY 1997

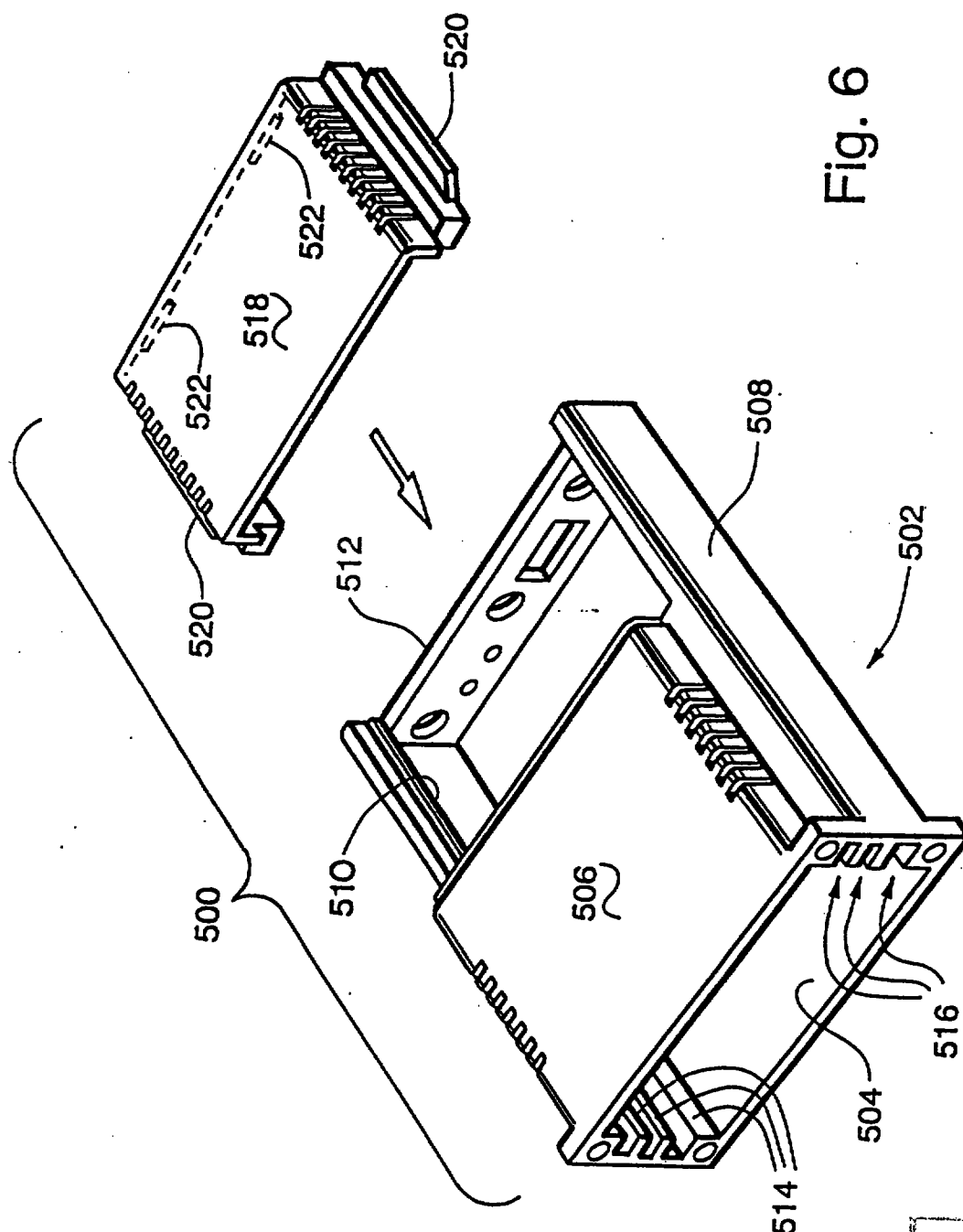
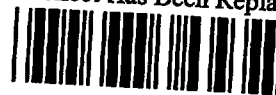
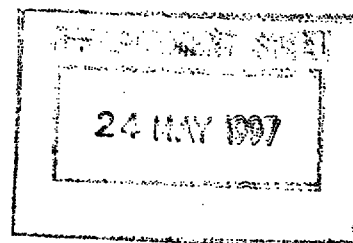


Fig. 6



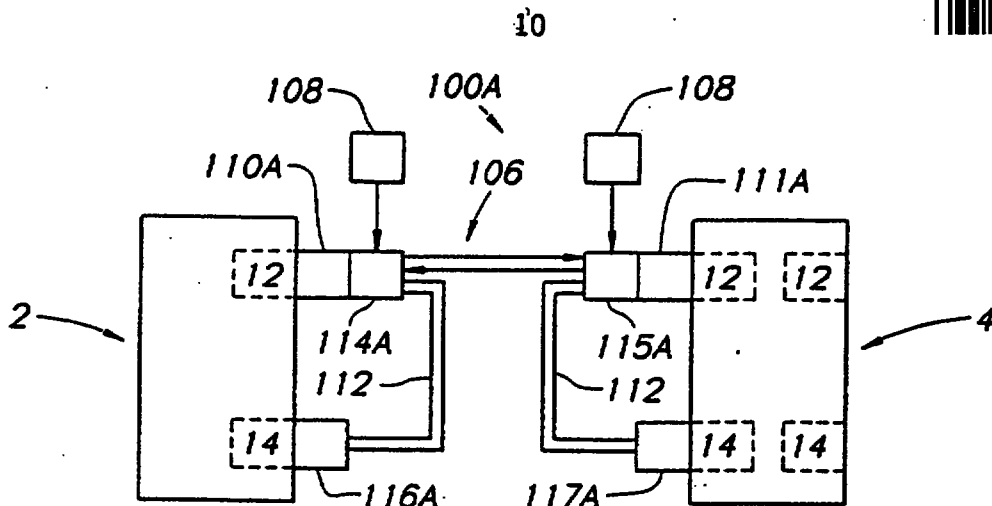


FIG. 10

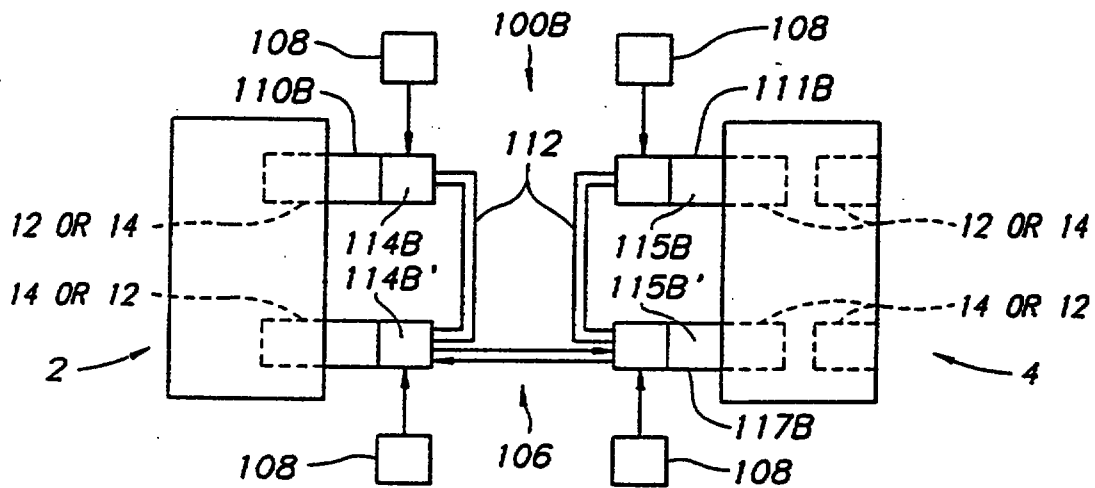


FIG. 11

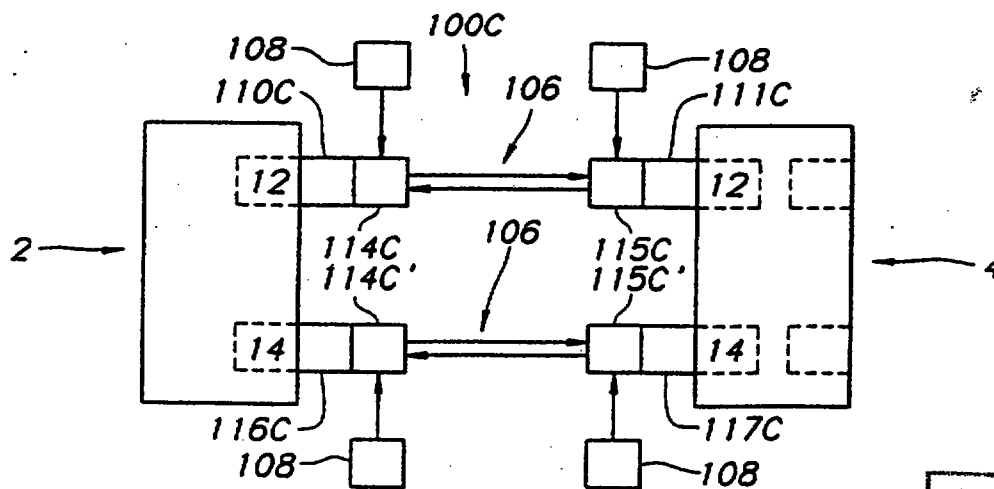
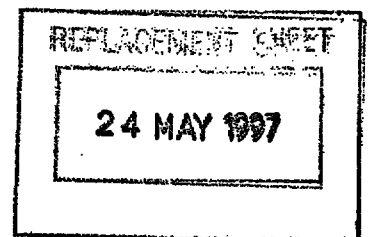


FIG. 12



- 2 -

include a plurality of bus and tag lines. The bus lines are used to transmit information including data, I/O-device address, commands, and control information. The tag lines are used for interlocking and controlling information on the bus lines and for special sequences. For a more detailed description of the bus and tag lines and their uses see Publication GA22-6974-09 entitled International Business Machines (IBM) System/360 and System/370 I/O Interface Channel to Control Unit Original Equipment Manufacturers' Information. Additional peripherals can be connected in series to the second peripheral 6 in a similar manner.

The mainframe 2 represents an IBM 360, 370, 43XX, 30XX, or ES/9000 mainframe computer, or a plug compatible mainframe. The peripherals 4,6 are plug compatible with the mainframe 2 and can be disk drives, tape drives, servers, printers or the like. The mainframe 2 and peripherals 4,6 have internal bus and tag serpent connectors 12-19, respectively, which mate with corresponding bus and tag serpent connectors 22-29, respectively, on ends of the electrical assemblies 8,10. The internal bus and tag serpent connectors 12-19 may be adapters which convert a first or external wiring/terminal connection scheme, grid or geometry to a second or internal wiring/terminal scheme, grid or geometry. For instance, the adapters 12-19 may convert from a spacing of 0.250 inches between centers of adjacent ones of a first or external plurality of rows and columns of terminals to a spacing of 0.125 inches between centers of adjacent ones of a second or internal plurality of rows and columns of terminals. The first or external terminals have serpent contacts for mating with serpent contacts in the bus and tag serpent connectors 22-29 on the electrical assemblies 8,10. The serpent contacts are hermaphroditic or gender neutral as defined in Federal Information Processing standards (FIPS) publication 60-2 published July 29, 1983 entitled I/O Channel Interface. The serpent adapters are also defined in IBM Publication GA22-6974-09 previously mentioned. The adapters 12-19 may be as disclosed in U.S. Patent 4,585,284.

REPLACEMENT SHEETS		SG
☒	Description	: paged 26-74, 14, 15, 18 to paged 27
☐	Claim(s)	: paged to paged
☒	Drawing(s)	: paged 14 to paged 15
☒	Abstract	: paged 18 to paged 19
DATE OF RECEIPT 20/7/88		

- 6 -

levels and shifting the converted signals out on a conductive path; and

an ECL to current translator connected by paths to the serializer and the transmitter connector; and a receiver section including a deserializer for receiving serialized signals and continuously deserializing, decoding and latching parallel data through parallel conductive paths to the programmable device.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention can be more fully understood from the following detailed description thereof in connection with accompanying drawings described as follows.

Figure 1 is a schematic illustration of a mainframe and a pair of peripherals interconnected by conventional electrical assemblies.

Figure 2 is a block diagram illustrating a first embodiment of an apparatus for connecting one computer device to another computer device in accordance with the present invention.

Figure 3 a perspective view of a bus and tag sub-assembly including a first connector, a cable assembly, a converter assembly and a second connector in accordance with the present invention.

Figure 4 is a perspective view of the first connector in accordance with the present invention with parts exploded from one another.

Figure 5 is a perspective view of the second connector in accordance with the present invention with parts exploded from one another.

Figure 6 is a perspective view of a housing for the converter adapter in accordance with the present invention.

Figure 7 is a perspective view of a first side of the converter adapter with its housing removed in accordance with the present invention with parts exploded from one another.

REPLACEMENT SHEET

20 JUL 1999

Figure 8 is a perspective view of a second side of the converter adapter with its housing removed in accordance with the present invention with parts exploded from one another.

Figure 9 is a block diagram of a converter circuit in the converter adapter in accordance with the present invention.

Figures 10-12 are block diagrams illustrating second, third and fourth embodiments of apparatus for connecting one computer device to another computer device in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Throughout the following detailed description, similar reference characters refer to similar elements in all figures of the drawings.

Referring to Figure 2, there is depicted a block diagram illustrating an apparatus 100 for connecting computer devices 2,4 in accordance with the present invention. Either one of the computer devices can be a mainframe, a peripheral, a disk drive, a tape drive, a server, a printer, a channel switch, a fiber optic or electrical cable channel extender, or the like. The apparatus 100 comprises a first, host or local bus and tag sub-assembly 102 and a second or remote bus and tag sub-assembly 104 joined by a dual line cable assembly 106. The bus and tag sub-assemblies 102,104 can be electro-optic or just electronic. If the bus and tag sub-assemblies 102,104 are electro-optic, the cable assembly 106 is a fiber optic cable including two fiber optic lines, such as a duplex fiber optic cable assembly. If the bus and tag sub-assemblies 102, 104 are just electronic, the cable assembly 106 is an electrical cable assembly including two lines, such as an electrical coaxial cable or twisted wire pair assembly. Power sources 108 connect with, in order to provide power to, the sub-assemblies 102 and 104.

Referring to Figures 2 and 3, each one of the bus and tag sub-assemblies 102,104 comprises a first connector 110,111, a multi-line electrical cable assembly 112 connected at a first end to the first connector 110,111, a converter adapter 114,115

REPLACEMENT SHEET

20 JUL 1999

- 9 -

center of adjacent terminals in the columns and 0.100 inches apart from center to center of terminals in 0.100 inches apart from center to center of terminals in different rows. The input/output adapter assembly 100,111 preferably further comprises means 128 for electrically interconnecting the second contacts of the first and second terminals 120,126. Preferably, the interconnecting means 128 is a printed circuit board or the like. The interconnecting means 128 can be different for each one of the adapters 110 and 111. Preferably, they are different in that the conductive paths in the circuit boards are arranged to interconnect the first and second terminals 120,126 in the adapters 110 and 111 as required in IBM Publication GA22-6974-09. Each adapter 110,111 preferably further includes an insulative shroud or header 130 for receiving the second plurality of terminals 126 and mating with the cable assembly 112. The header 130 can be a quick eject header commercially available under part no. 65863 from E. I. du Pont de Nemours and Company, hereafter "Du Pont", with offices at Wilmington, Delaware. Each adapter 110,111 further includes an insulative housing 132. Preferably, the housing 132 includes a first housing part 134 with passages 136 for receiving the first plurality of terminals 120 for mating with the connector 12,14 in the first computer device 2 or the second computer device 4, respectively. Preferably, the housing 132 includes a second housing part 138 attached to the printed circuit board 128 and the first housing part 134 with fasteners 140, such as screws. The second housing part 138 has a slot 142 through which the shroud 130 extends for mating with a connector 144 terminating one end of the cable assembly 112. A jack screw assembly 146 can extend through the adapter 110,111 for use in securing the adapter 110,111 to the mainframe 2 or peripheral 4. Preferred adapters for use as the adapters 110 and 111 in the present invention are described in U.S. Patent 4,585,284 and are commercially available under part nos. 69477-006 and 69477-005 from Du Pont.

Referring to Figures 3 and 7, preferably, the multi-line cable assembly 112 comprises a generally flat and

REPLACEMENT SHEET

20 JUL 1999

- 14 -

The converter adapter 115 does not contain a corresponding relay 208.

The drivers/receivers 202,206 are connected by board traces to means 210 for multiplexing signals received from the receivers 202,206 and demultiplexing signals sent to the drivers 202,206. The multiplexing and demultiplexing means 210 combines Bus signals and Tag signals onto a bus 231 having a plurality of lines (e.g., 10). The multiplexing and demultiplexing means 210 also separates Bus signals and Tag signals from a bus 219 having a plurality of lines (e.g., 10). This multiplexing synchronizes the Bus and Tag signals through a master clock generated by an onboard oscillator. Strobe and acknowledge signalling provides this synchronization by registering the 10 bit bus into an input latch. The data in the input latch is then passed over bus 211.

The multiplexing and demultiplexing means 210 further includes means for emulating TAG signals to reduce system and cable induced delays. The multiplexing and demultiplexing means 210 can be a programmed erasable programmable logic device (EPLD), such as the EPLD commercially available under part no. EPM5130-WC-1 from Altera Corp. with offices in San Jose, California. The EPLD can be programmed accordingly to follow the protocols defined by IBM Publication GA22-6974-09 with the following exceptions. The converter adapter 114 does not propagate reserved lines or special-use lines, except the J09 signal line, to the converter adapter 115. When the channel raises 'service out' ('data out') during dc-interlocked data transfer, the adapter 114 drops 'service in' ('data in'). This may occur before the control unit has recognized the rise of 'service out' ('data out'). After the control unit recognizes the rise of 'service out' ('data out'), it drops 'service in' ('data in') and the adapter 115 drops 'service out' ('data out'). This may occur before the channel has recognized the fall of 'service in' ('data in'). When the adapter 115 recognizes the rise of 'operational in' during initial selection for DASD, it drops 'address out'. When the adapter 115 recognizes the fall of 'status in' during initial

REPLACEMENT SHEET

20 JUL 1999

- 15 -

selection for DASD and the current command is being chained from a previous command, it drops 'service out'. This may occur before the channel has recognized the fall of 'status in'.

Two report files generated by a Max+Plus II Compiler for an EPM5130WC-1 chip from Altera Corp. are included in Appendices A and B to this specification and appear immediately before the claims. The report files in Appendices A and B show how embodiments of the EPLD 210 in each one of the adapters 114 and 115, respectively, can be implemented. These report files are sufficient information for one of ordinary skill in the art to reproduce the designs of these embodiments.

Alternatively, the multiplexing and demultiplexing means 210 can include a nonerasable programmable logic device (PLD) or a custom design programmable logic device, such as an application specific Integrated circuit (ASIC). If an ASIC is used, it can be designed to perform other functions than those included in the EPLD. For instance, such other functions can include the functions performed by any or all other components on the printed circuit board 190. Such alternatives are equivalent to the embodiments disclosed in more detail using the EPLD. The structure for performing the functions performed by any or all components on the printed circuit board 190 can be referred to as integrated circuit means.

The integrated circuit means can include a transmitter section 213 and a receiver section 217.

The bus 211 of parallel traces connects the programmed EPLD 210 to a serializer 212 within the transmitter section 213. The serializer 212 converts parallel data to serial data. More specifically, the serializer 212 receives a plurality of parallel multiplexed signals from the 10-bit bus 211 and sends it to an encoder latch to convert the 10-bit bus to a 12-bit encoded word. This encoding is used to maximize bit boundary transitions to help balance the data pattern and aid in the timing recovery on the receiving side. The 12-bit word is then fed to a shift register where the contents are serially shifted out in a single stream on one line. The serializer 212 can be

REPLACEMENT SHEET

20 JUL 1999

- 18 -

pair of the converter adapters 114B, 114B' and 115B, 115B' include integrated circuit means similar to the one previously described in detail in relation to the embodiment illustrated in Figure 9, but with parts located in two housings rather than one. In the embodiment depicted in Figure 11, the integrated circuit means in converter adapters 114B, 114B' is for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces 12, 14 in the first device 2 and sending such multiplexed serial information over a first line of the dual line cable assembly 106 to the second computer device 4 and (2) deserializing and then demultiplexing serial bus and tag information received through a second line of the dual line cable assembly 106 and sending such parallel and demultiplexed information to the first and second interfaces 12, 14 of the first device 2. In other words, the result achieved by converter adapter 114 in Figure 2 is achieved by converter adapters 114B and 114B' in Figure 11. Similarly, the result achieved by converter adapter 115 in Figure 2 is achieved by converter adapters 115B and 115B' in Figure 11.

Figure 12 illustrates the apparatus 100C similar to the apparatus 100 illustrated in Figure 2, except a converter adapter 114C, 114C', 115C, 115C' is attached to each of the four connectors 110C, 114C, 111C, 117C connected to the interfaces 12, 14 of the devices 2, 4. This is like the apparatus 100B in Figure 11 in that each pair of the converter adapters 114C, 114C' and 115C, 115C' include integrated circuit means similar to the one previously described in detail in relation to the embodiment illustrated in Figure 9, but with parts located in two housings rather than one. Further, a dual line cable assembly 106 interconnects both bus converter adapters 114C, 115C and a dual line cable assembly 106 interconnects both tag converter adapters 114C', 115C'. In the embodiment depicted in Figure 12, the integrated circuit means in converter adapters 114C, 114C' is for (1) multiplexing and then serializing parallel bus and tag information received from the first and second interfaces 12, 14 in the first device 2 and

REPLACEMENT SHEET

20 JUL 1999

- 101 -

APPARATUS FOR CONNECTING COMPUTER DEVICES**ABSTRACT**

An apparatus used in connecting computer devices which are coupled together by at least one dual line cable assembly. The invention comprises at least one converter adapter having an integrated circuit. The integrated circuit according to the invention is capable of (1) multiplexing and then serializing parallel bus and tag information received from one or more interfaces of one of the computer devices and sending such multiplexed serial information over a first line of the dual line cable assembly to another computer device and (2) deserializing and then demultiplexing serial bus and tag information received over a second line of the dual line cable assembly and sending such parallel and demultiplexed information to one or more interfaces of the first computer device.

Figure 2

REPLACEMENT SHEET

20 JUL 1999

- 1 -

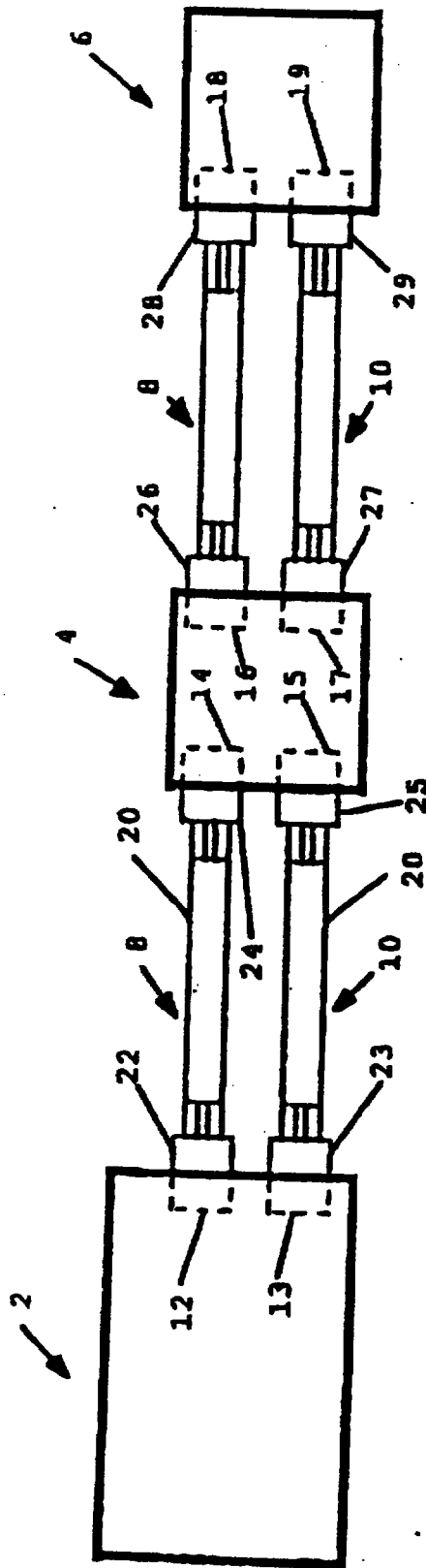


Fig. 1 (PRIOR ART)

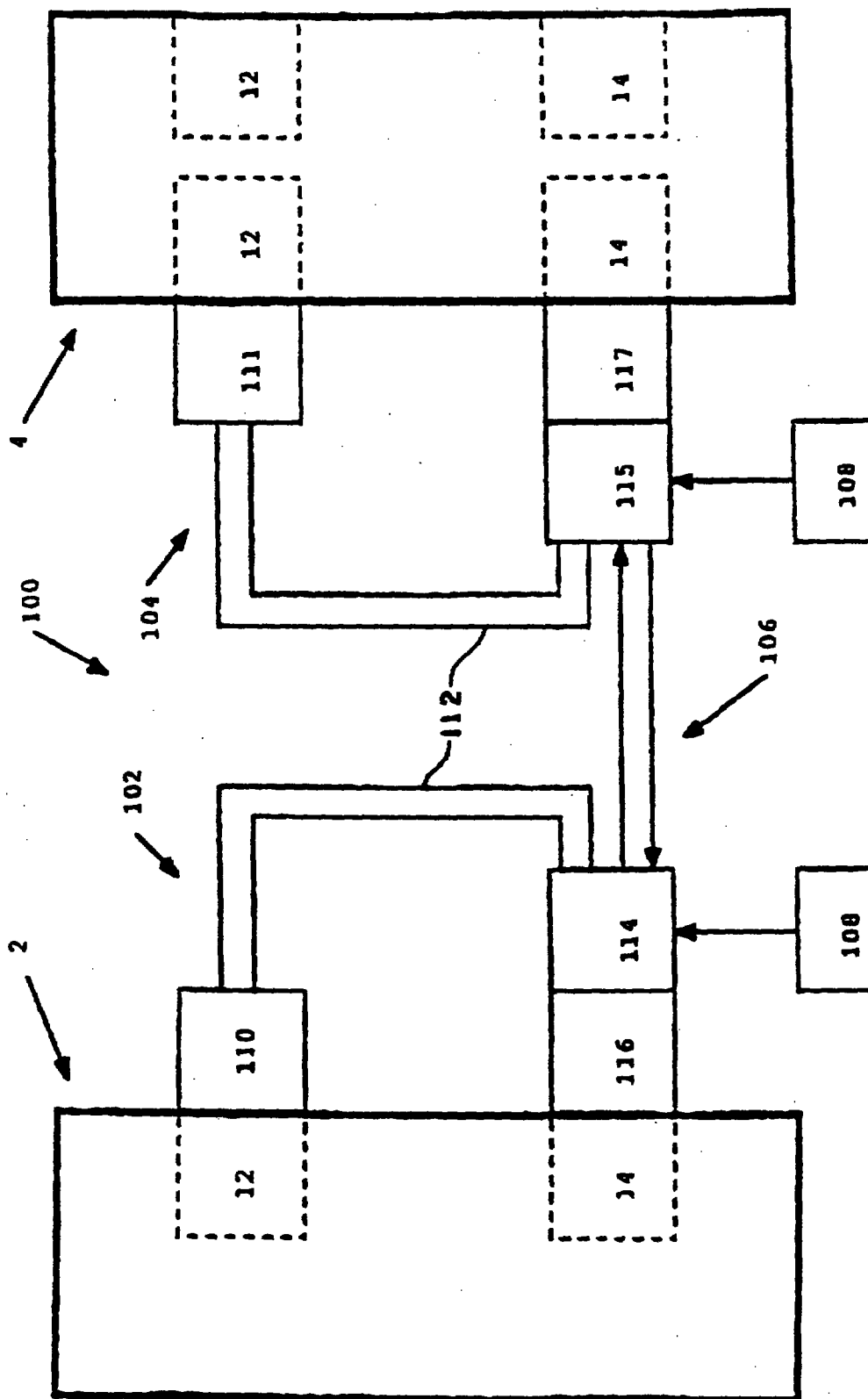


Fig. 2

- 3 -

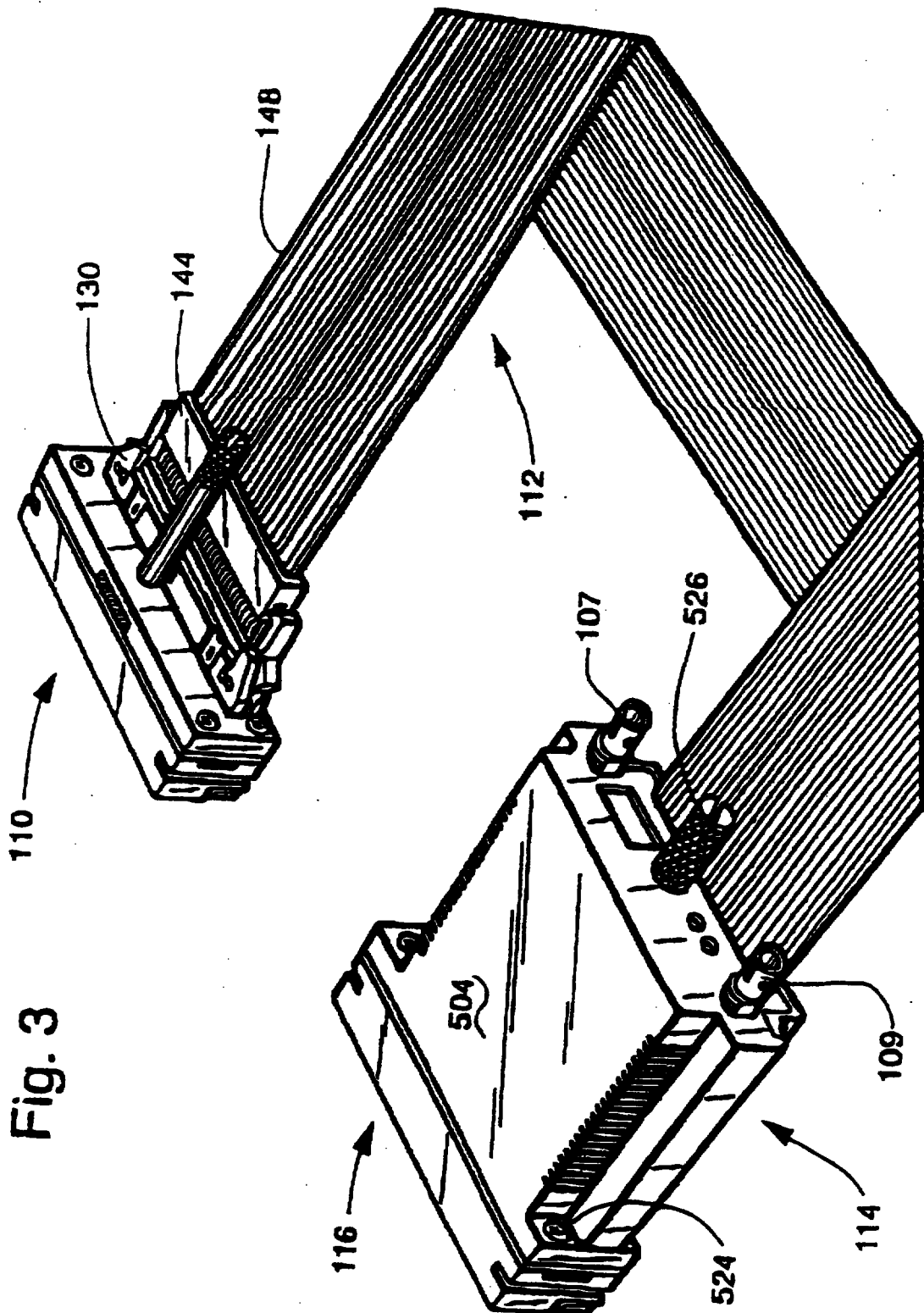


Fig. 3

REPLACEMENT SHEET

20 JUL 1999

- 4 -

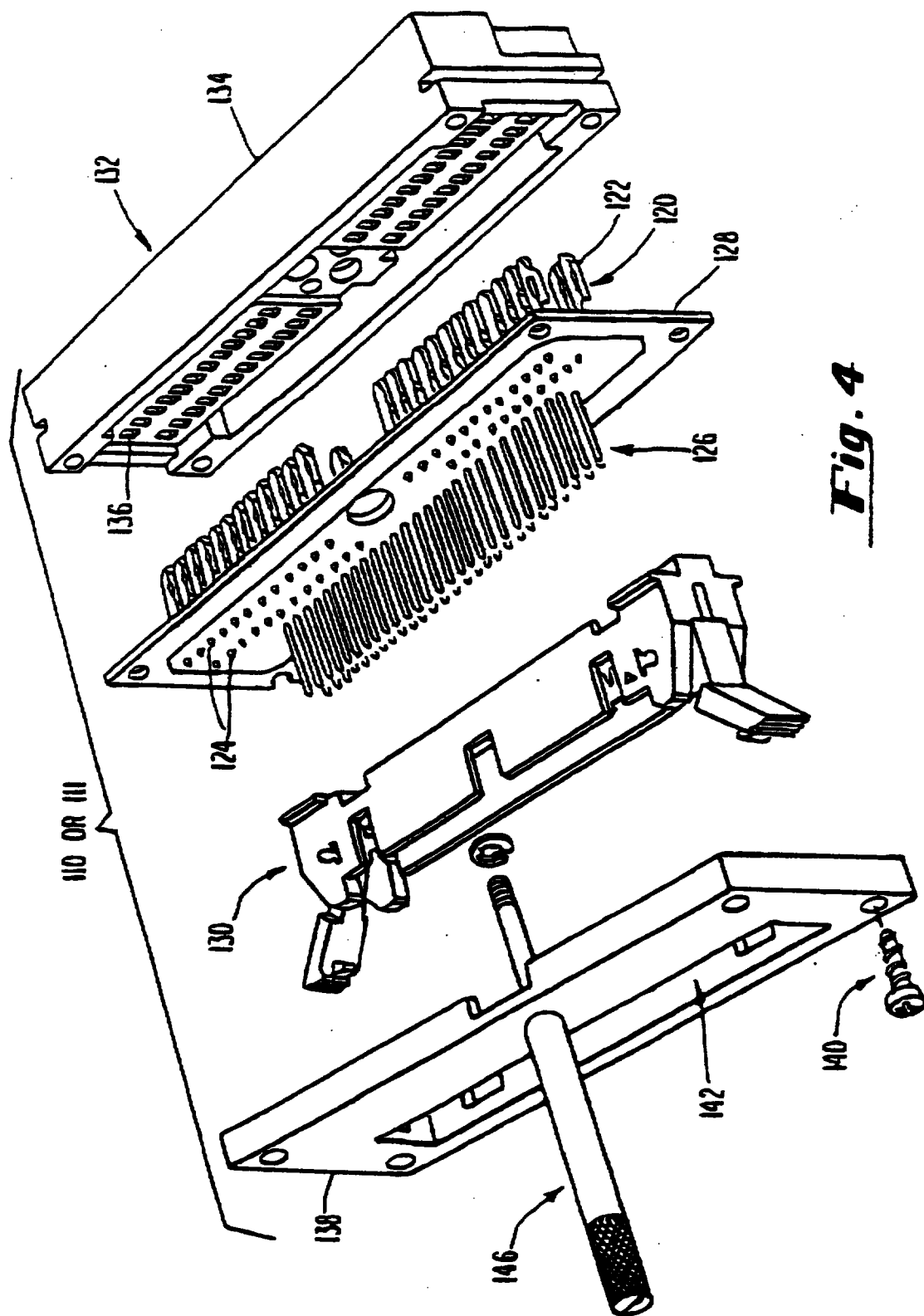
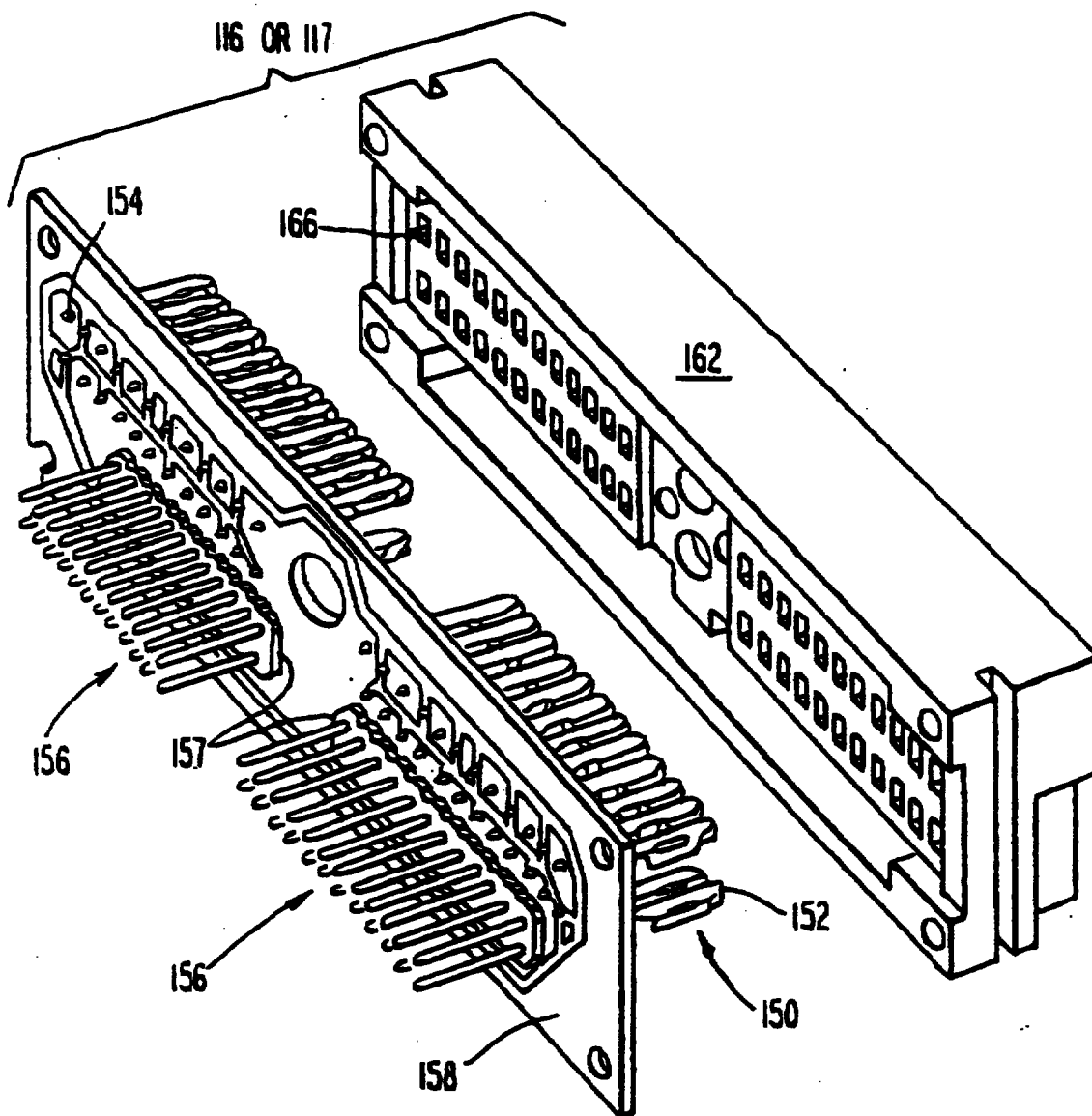
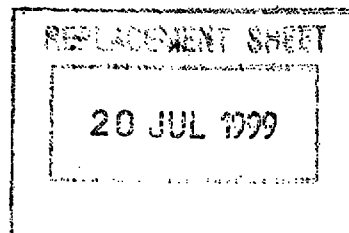


Fig. 4

REPLACEMENT SHEET

20 JUL 1999

- 5 -

***Fig. 5***

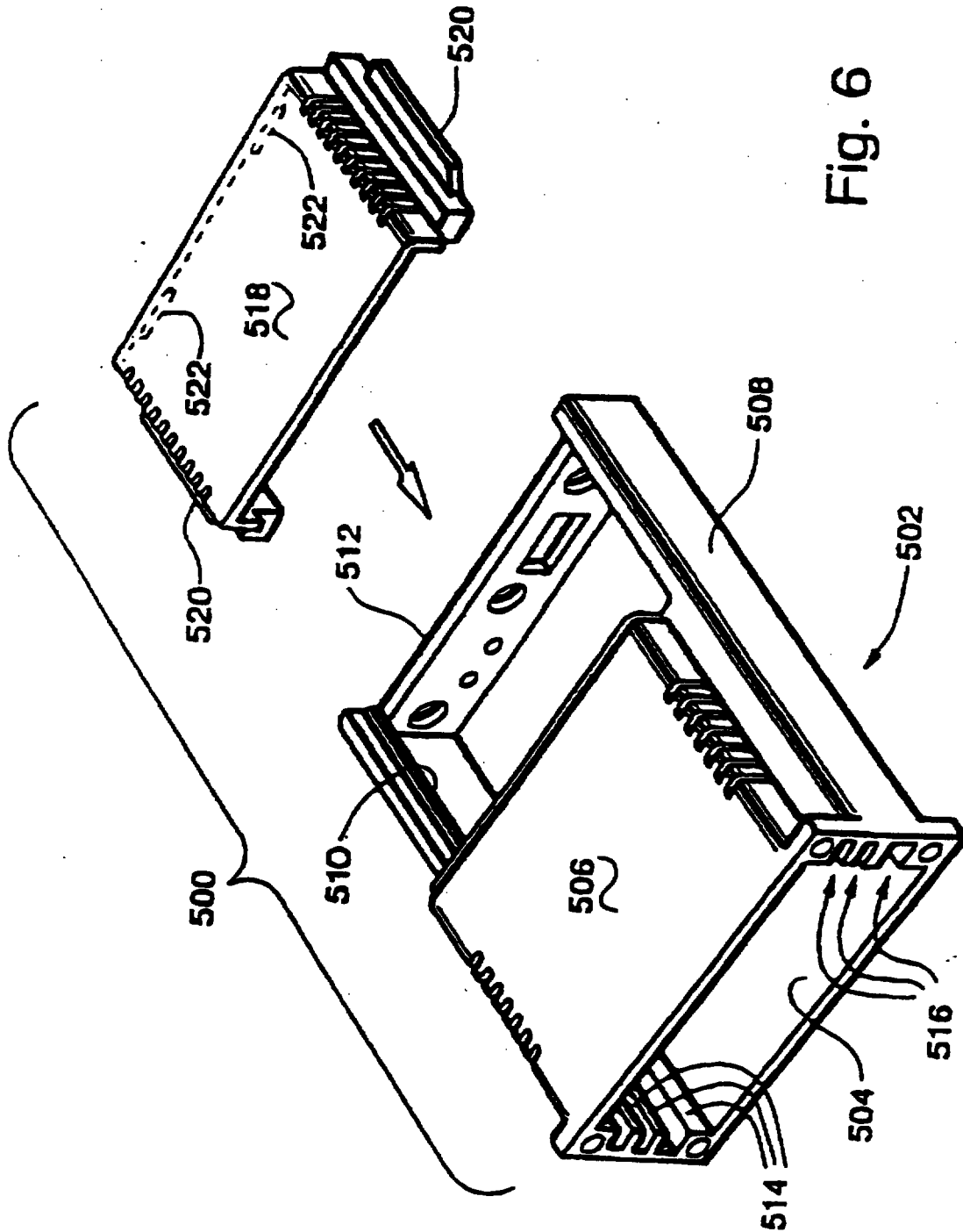


Fig. 6

REPLACEMENT SHEET

20 JUL 1999

- 7 -

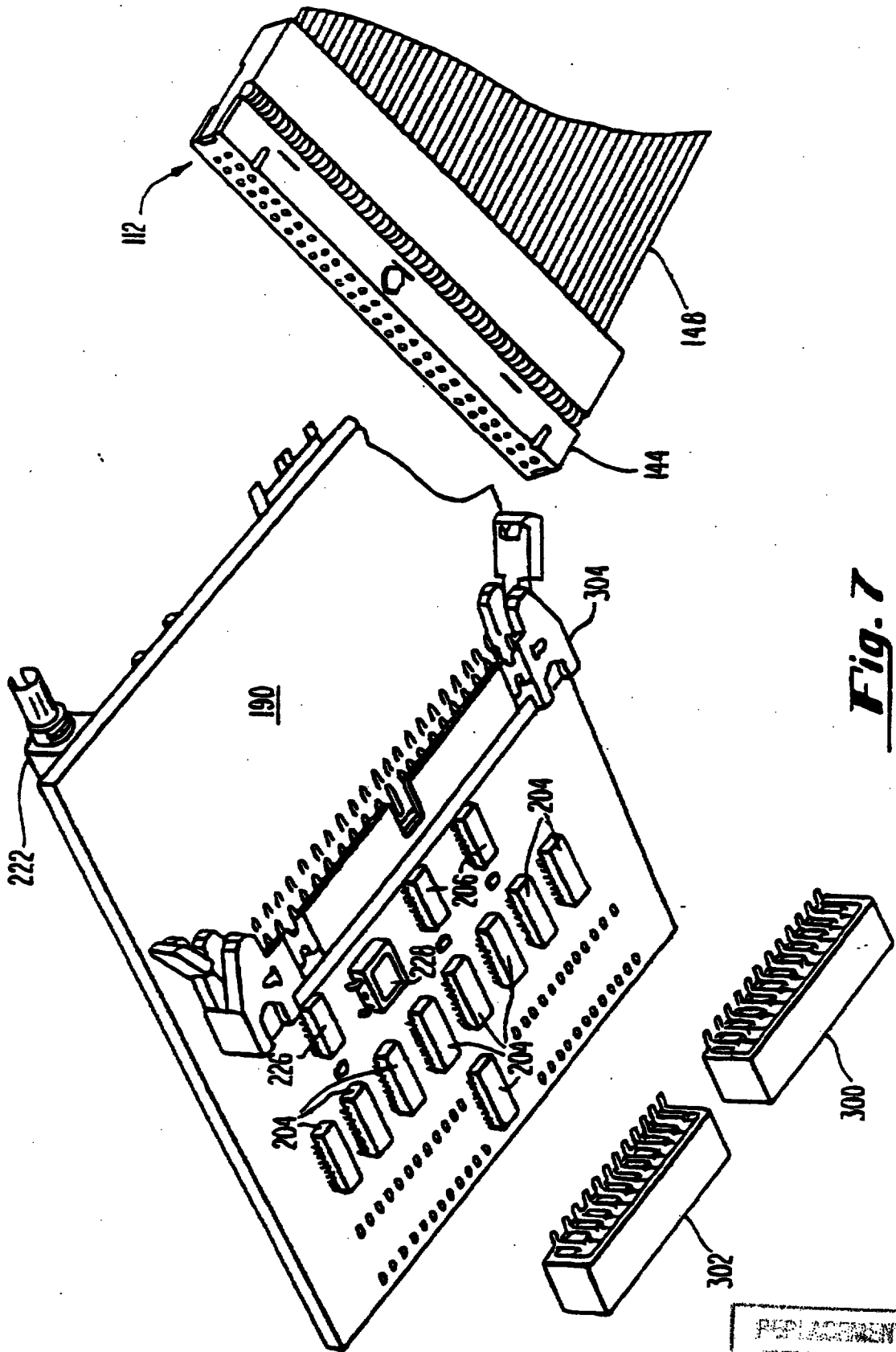


Fig. 7

REPLACEMENT SHEET
20 JUL 1999

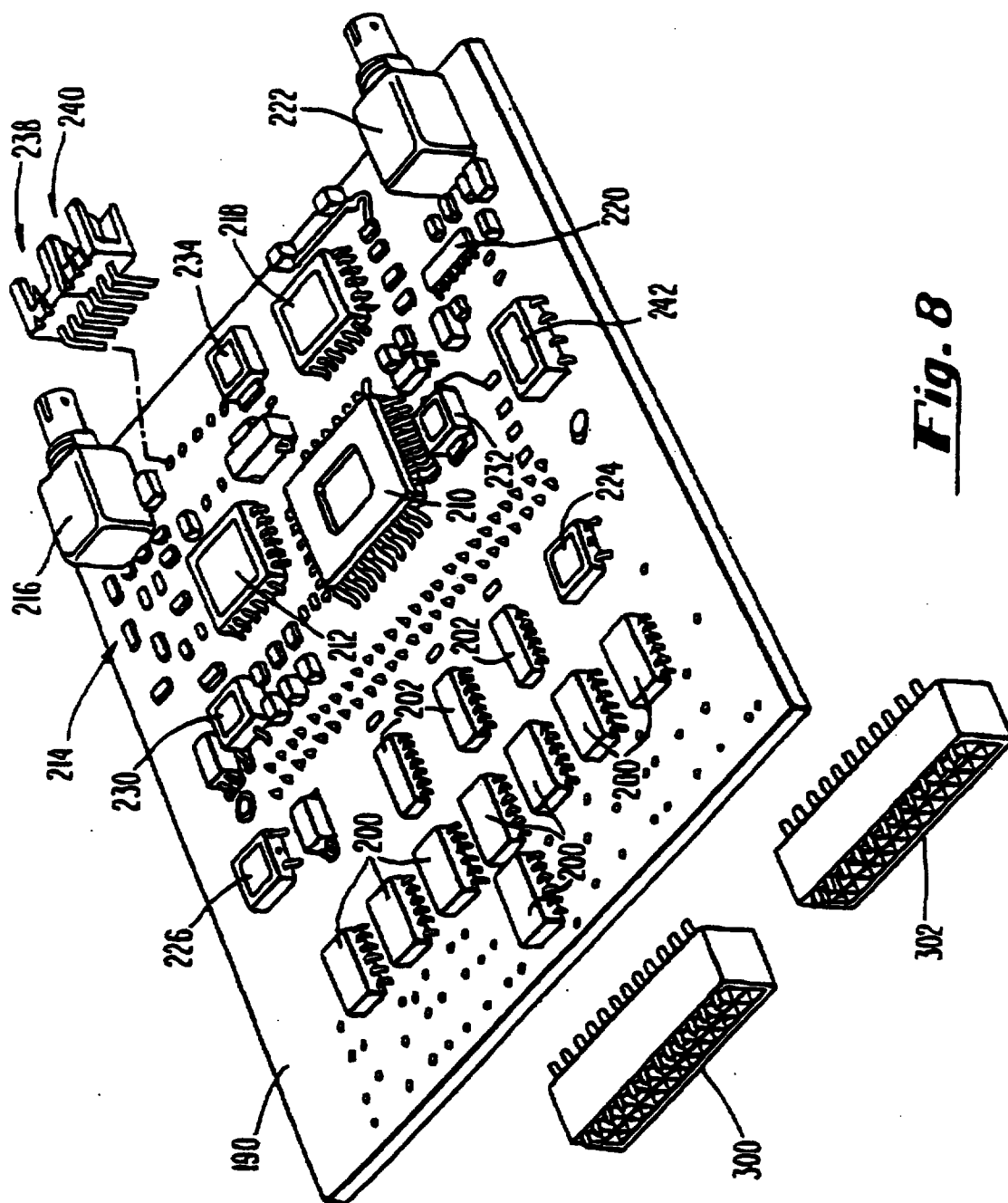
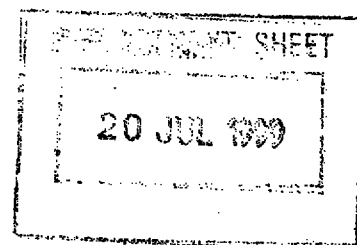


Fig. 8



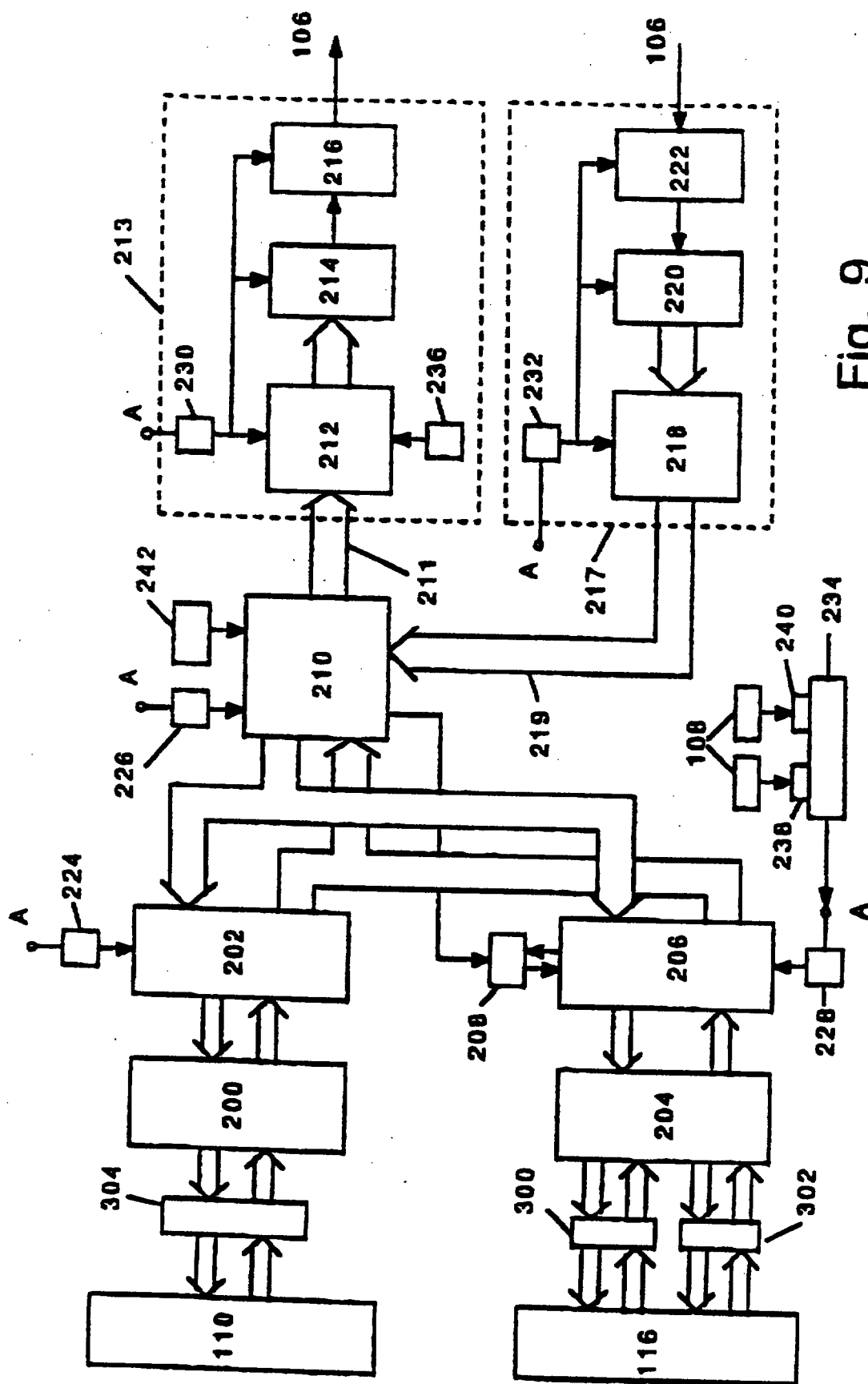


Fig. 9

- 10 -

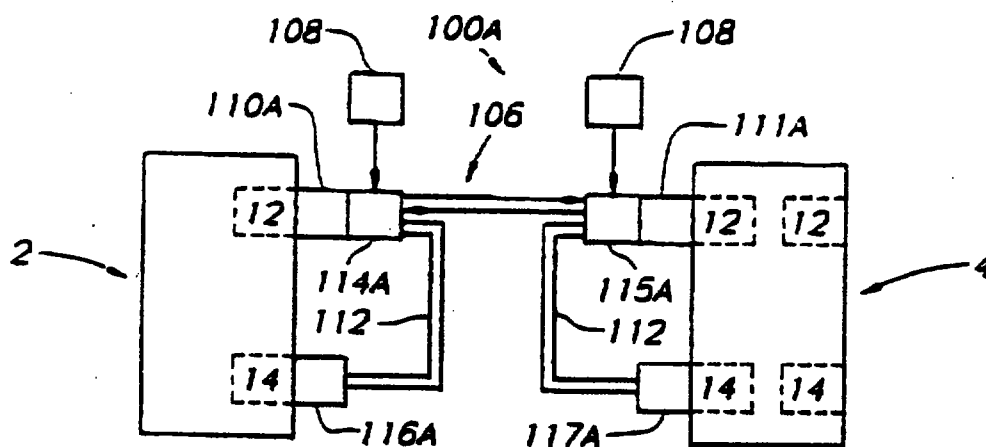


FIG. 10

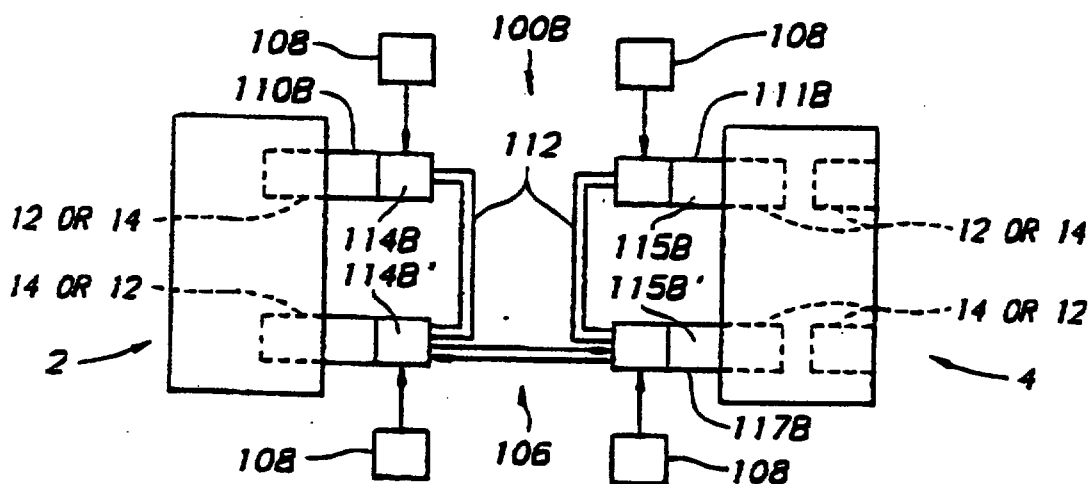


FIG. 11

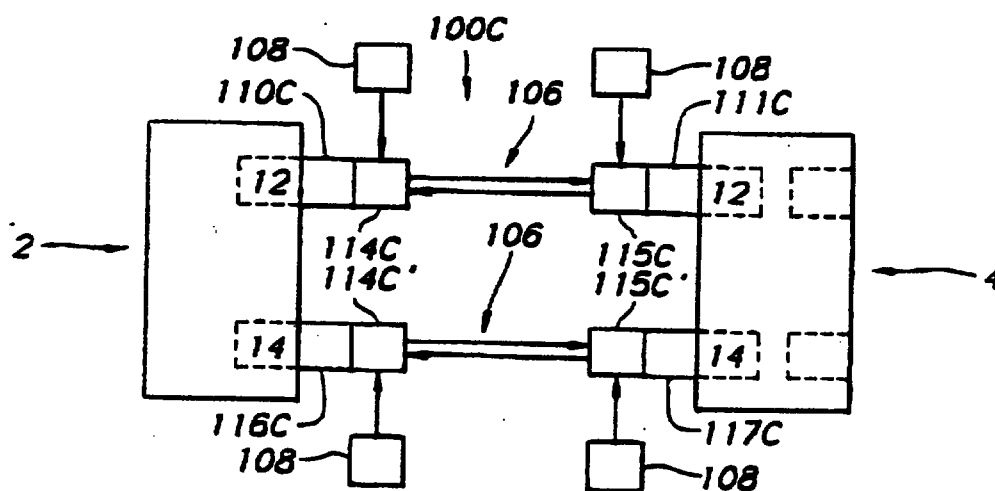


FIG. 12

REPLACEMENT SHEET

20 JUL 1999