Model 1736-B1A

U-Port Adapter for 2160-2188 Series Serial Highway Drivers

INSTRUCTION MANUAL

May, 1990

Model 1736-B1A

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JRH:rem (WP\JRH)

KineticSystems Corporation

Standardized Data Acquisition and Control Systems **1730-Series**

Serial Highway Driver Port Options

FEATURES

- **Bit-serial and byte-serial modes to five megahertz**
- **Conforms to IEEE Standard 595**

APPLICATION

- **Interfaces the 2050-88 and 2160-88 Serial Highway Drivers to the CAMAC Serial Highway via D-Port or U-Port**

GENERAL DESCRIPTION

The 1730-Series of Port Options provides the Models 2050-2088 and 2160-2188 Serial Highway Drivers (SHDs) with a variety of serial transmission schemes. The Defined Port (D-Port) option is generally used for bit-serial or byte-serial data transmission when the transmission distance is relatively short and the common-mode voltage is relatively low. When increased distance, speed, and/or highway isolation is required, a suitable U-Port adapter should be used.

1730 D-PORT ADAPTER

The Model 1730 D-Port Adapter provides for bit-serial or byte-serial operation of the Serial Highway Driver. The clock and data signals conform to those specified for the defined ports in IEEE Standard 595. The D-Port signal levels follow EIA Standard RS-422 and exhibit a 12-volt, common-mode noise immunity. The data rate can be set from 100 kilobits per second to five megabytes per second.

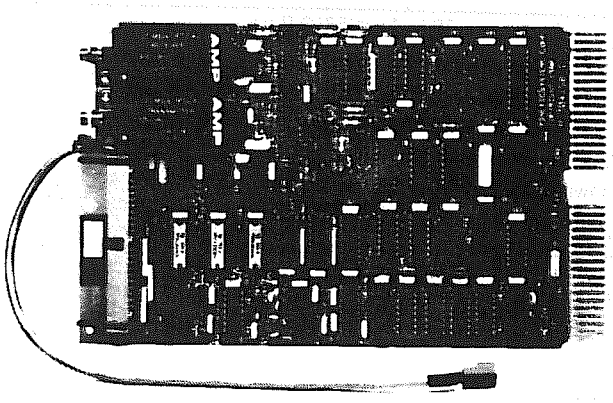
1733 AND 1736 TRANSFORMER-ISOLATED U-PORT ADAPTERS

The Models 1733 and 1736 are bit-serial U-Port Adapters (UPAs) providing a 500-volt, galvanic isolation through transformer coupling and using biphase signal encoding of clock and data over a single twisted pair. In addition to the high common-mode performance, these UPAs generally provide a 60% increase in acceptable loop distance for the same cable conditions and operating speed as a D-Port highway. The operating speed for these UPAs can range from 100 kilobits per second to five megabits per second. The 1733-B1A is arranged for dual-loop operation for systems that require redundant highways. This UPA can be used in the 2050-2088 Serial Highway Drivers. Appropriate versions of the 1736 are used in the 2050-88 Series as well as the 2160-88 Serial Highway Drivers. The companion UPA modules for the 1733 and 1736 are the 3933 and 3936, respectively.

1735 and 1738 FIBER OPTIC U-PORT ADAPTERS

The Models 1735 and 1738 U-Port Adapters (UPAs) use fiber optic cables to provide signal transmission that is immune to electromagnetic interference and does not cause signal radiation. Being a nearly perfect insulator, the fiber optic cable allows operation with a high voltage potential difference between the Serial Highway Driver and the crates on the highway. These UPAs convert the clock and data to a biphase signal that is transmitted optically through the cable.

The 1735 and 1738 are similar bit-serial units that operate at data rates from 100 kilobits per second to five megabits per second, using an optical wavelength of 820 nanometers. The maximum fiber optic cable length from the 1735 or 1738 is two kilometers. Since the limiting factor is optical loss and not data rate, a five megabit per second rate can be achieved up to the two kilometer limit. The 1735 is used in the 2050-2088 SHDs, while the 1738 is used in the 2160-88 SHDs. The companion UPA module for both the 1735 and 1738 is the 3938.



The 1739 U-Port Adapter shown which mounts in the Serial Highway backplane.

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1739 FIBER OPTIC U-PORT ADAPTERS

The 1739 operates in byte-serial mode at highway rates from one to five megabytes per second. This transmission is accomplished over a single fiber by converting each byte to a bit-serial, biphase, signal at a 10X rate (50 megabits/sec for a 5 megabyte/sec highway rate). Options of the 1739, operating at an 820 nanometer wavelength, are available for both the 2050-88 and the 2160-88 Series Serial Highway Drivers. With the appropriate fiber optic cable, each link on the highway can extend to one kilometer (approximately 3,300 feet). Versions of the 1739, operating at a 1300 nanometer wavelength, provide extended performance to three kilometers (approximately 10,000 feet) per link. *These extended-length UPAs are available for the 2160-88 Series only.* Since the distance is limited by the relatively frequency-independent optical loss, the full five megabyte/sec highway rate can be achieved for the one- or three-kilometer limits just discussed.

COMPATIBLE CABLE/UPAs (for 2160-2188 Serial Highway Drivers)

Model	Description	Mating Cable Assembly	Compatible UPA Module
1730	Bit/Byte D-Port	5800-Axyz/5800-Bxyz	None (See Note 1)
1736	Bit-serial cable UPA	5800-Cxyz/5800-Dxyz	3936
1738	Bit-serial FO UPA	5802-Cxyz/5802-Dxyz (See Note 2)	3938, 3954
1739-ZyD	Byte-serial FO UPA (820 nm)	(See Note 3)	3939-Z1A, 3939-Z2A
1739-ZyC	Byte-serial FO UPA (1300 nm)	5802-Exyz/5802-Fxyz (See Note 4)	3939-Z1C

Notes: 1. The 1730 is used for configuring a D-Port highway. It can also be used with other D-Port devices, such as the 2800 Highway Switch
2. The 1738 uses 100 micrometer fiber optic highway cable.
3. The 1739-ZyD operates with 100 micrometer fiber optic highway cable (5802-Cxyz/5802-Dxyz) and all options of the 3939 UPA module. When used with the 3939-Z2A, the following cables can be used: 50 (5802-Exyz), 62.5, 85, and 100 micrometer (provided that the optical loss is less than 5 dB/km).
4. The 1739-ZyC uses 50 or 62.5 micrometer cable with a loss of less than 1.5 dB/km to achieve the bandwidth required for a three kilometer link.

ORDERING INFORMATION (for 2160-2188 Serial Highway Drivers)

Weight: 0.45 kg. (1 lb.)

Description	2160 (Note 2)	2165	2170	2185	2188
Bit/Byte D-Port Adapter	1730-D1B	1730-D2B	1730-D2B	1730-D2B	1730-D1B
Bit-serial U-Port Adapter Twisted-pair cable	1736-B1B	1736-B2B	1736-B2B	1736-B2B	1736-B1B
Bit-serial U-Port Adapter Fiber optic cable, 820 nm	1738-Z1B	1738-Z2B	1738-Z2B	1738-Z2B	1738-Z1B
Byte-serial U-Port Adapter Fiber optic cable, 820 nm	1739-Z1D	1739-Z2D	1739-Z2D	1739-Z2D	1739-Z3D
Byte-serial U-Port Adapter Fiber optic cable, 1300 nm	1739-Z1C	1739-Z2C	1739-Z2C	1739-Z2C	1739-Z3C

Notes: 1. **Caution: Refer to the COMPATIBLE CABLE/UPAs chart above to assure proper system compatibility.**
2. The 2160-Z1A/-Z1B card sets accept a cable from the 1730 D-Port Adapter. The 1736 and 1738 UPAs each include a dual-height card for the Q-bus™ backplane. The 1739 UPA includes two dual-height cards. The +5V current rating is 0.5A for the 1736 and 1738 cards and 2.4A total for the 1739.

ORDERING INFORMATION (for 2050-2088 Serial Highway Drivers)

Weight: 0.45 kg. (1 lb.)

Model	Description	Mating Cable Assembly	Compatible UPA Module
1730-D1A	D-Port interface	5800-Axyz/5800-Bxyz	None (See Note 1)
1733-B1A	Bit-serial U-Port, dual loop	5800-Cxyz/5800-Dxyz	3933
1735-Z1A	Bit-serial U-Port, fiber optic (820 nm)	5802-Cxyz	3938, 3954
1736-B1A	Bit-serial U-Port, transformer	5800-Cxyz/5800-Dxyz	3936
1739-Z1A	Byte-serial U-Port, fiber optic (820 nm)	5802-Cxyz	3939-Z1A, 3939-Z2A

Notes: 1. The 1730 is used for configuring a D-Port highway. It can also be used with other D-Port devices, such as the 2800 Highway Switch
2. The 1730 can operate at strap-selectable rates from 100 kilobits/sec to 5 megabytes/sec; the 1733, 1735, and 1736 can operate from 100 kilobits/sec to 5 megabits/sec; the 1739 can operate from 1 to 5 megabits/sec.

Accessories — Refer to charts above.

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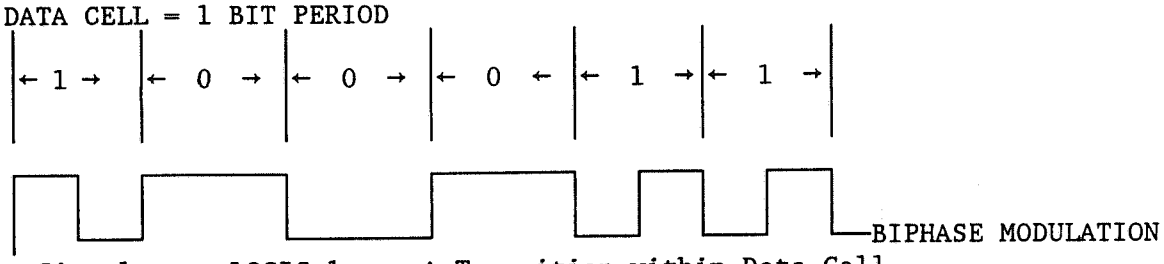
Model 1736-B1A

GENERAL DESCRIPTION

The Model 1736-B1A U-Port Adapter provides a biphase modulated signal transmission for 2050-Series Serial Highway Drivers used in the bit-serial mode. Use of the 1736 allows a 2050-Series Highway Driver to drive serial systems using the Model 3936 U-Port Adapter in remote crates. Both the 1736 and 3936 U-Port Adapters provide compatible multiplexed biphase signals and transformer isolation. This reduces interference with data signals in high noise environments as well as allowing for increased operation speed and/or distance.

SIGNAL CONSIDERATIONS

D-PORT vs. MULTIPLEXED SIGNAL. The normal D-Port signals consist of a clock and NRZ (non-return-to-zero) data. A logic ONE is represented by a voltage of one polarity and a ZERO by a voltage of opposite polarity. The Model 1736 uses both clock and data signals to produce a biphase signal. The signal format is shown here:



Biphase Signal: LOGIC 1 - A Transition within Data Cell.
LOGIC 0 - No Transition within Data Cell.

The serial highway input and output connections are isolated by transformers for high common mode rejection. This is necessary when the transient ground potential difference between adjacent crates on the serial highway exceeds approximately 10 volts or very high electrostatic or magnetic fields couple into the serial highway. Clock and data are transmitted over a single pair in the form of the biphase signal. This signal format was chosen because it contains no d-c component that can readily be coupled through transformers. The use of the 1736 can provide a substantial increase in reliable operating speed over a given cable or an increase in distance at a given operating speed.

BASIC OPERATION

A simplified block diagram of the 1736 is shown in Figure 1. The biphase signal is normally fed through the input line transformer. An adjustable equalizer (high frequency peaker) enhances operation over long cables. The high sensitivity line receiver converts the input signal to TTL level. Hysteresis is provided for greater stability on signals with slow rise time.

The biphase signal is fed into the demultiplexer, which converts that signal to serial highway D-Port clock and NRZ data signals. These signals are coupled into the D-In port of the serial highway driver (2050 - 2060). The D-Out port from the SD or SCC is coupled to the 1736 multiplexer. This multiplexer converts the clock and NRZ data to the biphase signal. This signal is coupled to the line driver and the highway via isolating transformers.

The use of the 1736 can provide a substantial increase in reliable operating speed over a given cable or an increase in distance at a given operating speed. Refer to the oscilloscope traces in Figure 2, Comparison of Data Recovery. Note that for D-Port signals the low frequency components in the data are attenuated far less than the high frequency components. When the data is asymmetrical, a d-c offset is produced. This causes the data to barely reach the zero-crossing point, resulting in a very narrow pulse for the recovered data; this precludes D-Port operation with this combination of speed and cable.

The biphase signal-fundamental frequency components cover only a two-to-one frequency range. The variation in cable attenuation with frequency can be equalized by a single capacitor. The capacitance value is determined by cable length and frequency. A 100 pf capacitor produced the waveform shown. A high quality signal is obtained from the line receiver, and the demultiplexer provides the clock and data signals for the D-Port. Tests with the Beldfoil 22 gauge cable indicate that the maximum reliable speed for a 500-foot D-Port link is one megabit per second. With the 1736, this can be increased to five megabits. Also for this cable, the maximum distance for a reliable D-Port link at five megabits is 100 feet. Therefore, the 1736 provides a five-fold increase in speed or distance under these conditions.

REGISTER

The Model 1736 U-Port Adapter has a 4 bit register which can be read at offset 20_8 from the selectable base address of the 2050-Series Serial Highway Driver. Bits one and three should always be written zero, while bit two should be written one and bit four will be written one when a signal is present on the highway or zero if there is no signal.

Registers

Bit	Access	Description
1	Read/Write	"1" on power up
2	Read/Write	"1" on power up, allows transmission in this state; in its "0" state, cuts off transmission.
3	Read Only	"0" on power up
4	Read Only	A "1" indicates a signal is received on the Serial Highway; "0" indicates no signal present

MODULE CONNECTIONS

The U-Port Highway connections are made via cables with nine contact "D" sockets; the out connections are made via cables with nine contact "D" pins. Shielded twisted pair cable is strongly recommended. As shipped (no GSB strap), the shield is connected to ground only at one end. Under certain noise conditions, grounding the shield at both ends (GSB installed) will improve operation. (GSB strap location is on the front panel insert PC Board near chip C.)

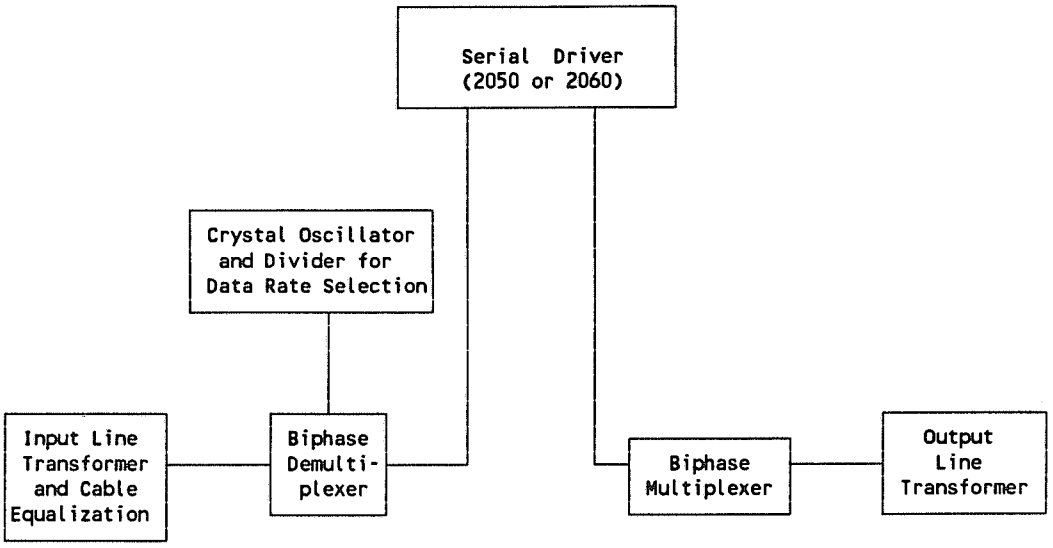


FIGURE 1 - Simplified Block Diagram

HIGHWAY LENGTH

The maximum highway length (or the maximum data rate at a particular highway length) depends upon several conditions:

1. Cable loss.

2. Number of crates allowed to be in proper bypass ("transparent" no-repeat) state with guaranteed operation.

3. Noise environment.

Generally, operation should be satisfactory with a maximum unrepeated link cable loss of 12 decibels (1.38 nepers) at the bit frequency. This results in a received signal level (at the U-Port) with a peak-to-peak amplitude approximately 25% of the transmitted level. In some cases, operation at losses beyond this will give satisfactory results.

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EQUALIZATION SELECTION

Capacitance	Front Panel Switch	Comments
------	0	Open-not a valid position
100 pf	1	Do not use below 5 MHz
220 pf	2	Do not use below 2.5 MHz
470 pf	4	Do not use below 1 MHz
Strap	8	As supplied, no equalization; input strapped to output. A customer-supplied capacitor will be used here (1000 pf 500 KHz, 2200 pf for 250 KHz 4700 pf for 100 KHz)

Note that operation may be satisfactory with the equalization in Position 8 for any operating speed in a particular system. The capacitor peaking becomes more important at higher cable losses and may allow operation with more crates in a power bypassed state.

For operation below 100 KHz, the input and output transformers should be replaced with 20 mH transformers.

Strap Options

Option	Description
GSB	When installed, this strap allows the shields on the HWY OUT connectors to be grounded in the 1736.

Front Panel

Test Points

RA	Monitors the Biphase Analog Signal
RD	Monitors the Biphase Digital Signal
TX	Monitors the Biphase Signal transmitted over the Serial Highway
GND	Ground

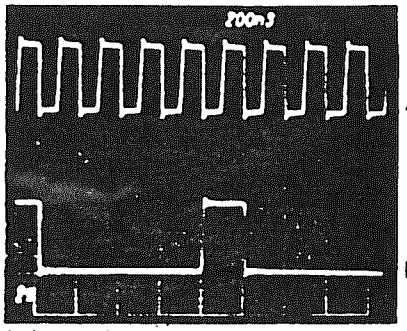
Model 1736-B1A

U-Port Connectors	Type	Mating Connector Kits
HWY IN	DE9P	KSC # 5930-Z1A
HWY OUT	DE9S	KSC # 5931-Z1A

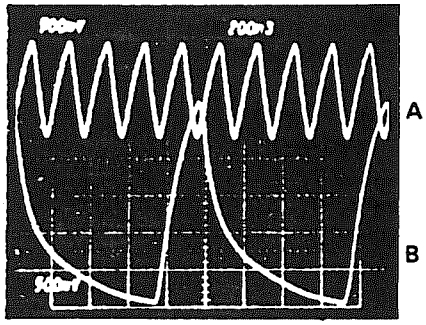
Model 1736-B1A

Serial highway path is 500 ft. 22 guage Beldfoil cable; clock rate is 5 megabits per second.

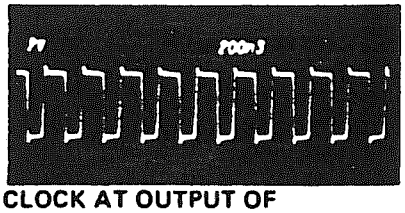
SIGNAL BY D-PORT PATH



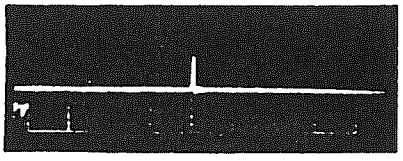
(A) CLOCK
(B) NRZ DATA



(A) RECEIVED CLOCK
(B) RECEIVED DATA

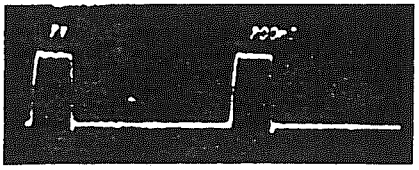


CLOCK AT OUTPUT OF LINE RECEIVER

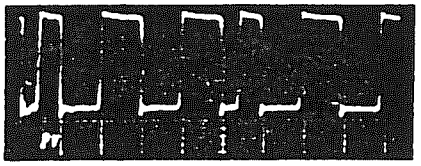


DATA AT OUTPUT OF LINE RECEIVER

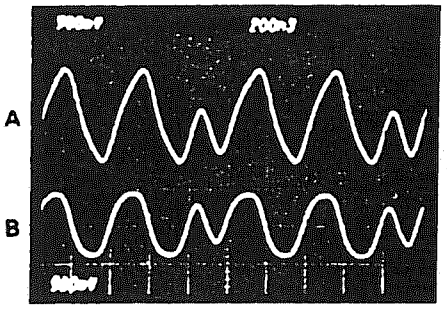
SIGNAL THROUGH 3932s or 3936s



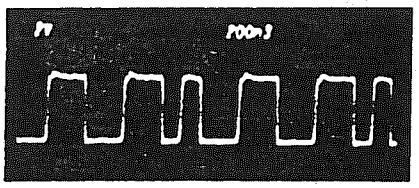
NRZ DATA



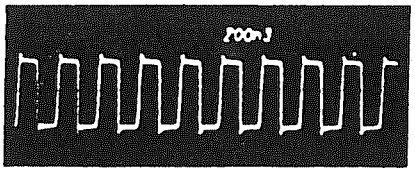
DATA AFTER BEING BIPHASE ENCODED



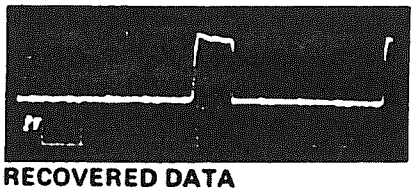
(A) RECEIVED BIPHASE SIGNAL
(B) AFTER EQUALIZER



AFTER EQUALIZER AND LINE RECEIVER



RECOVERED CLOCK



RECOVERED DATA

FIGURE 2 - Comparison of Data Recovery

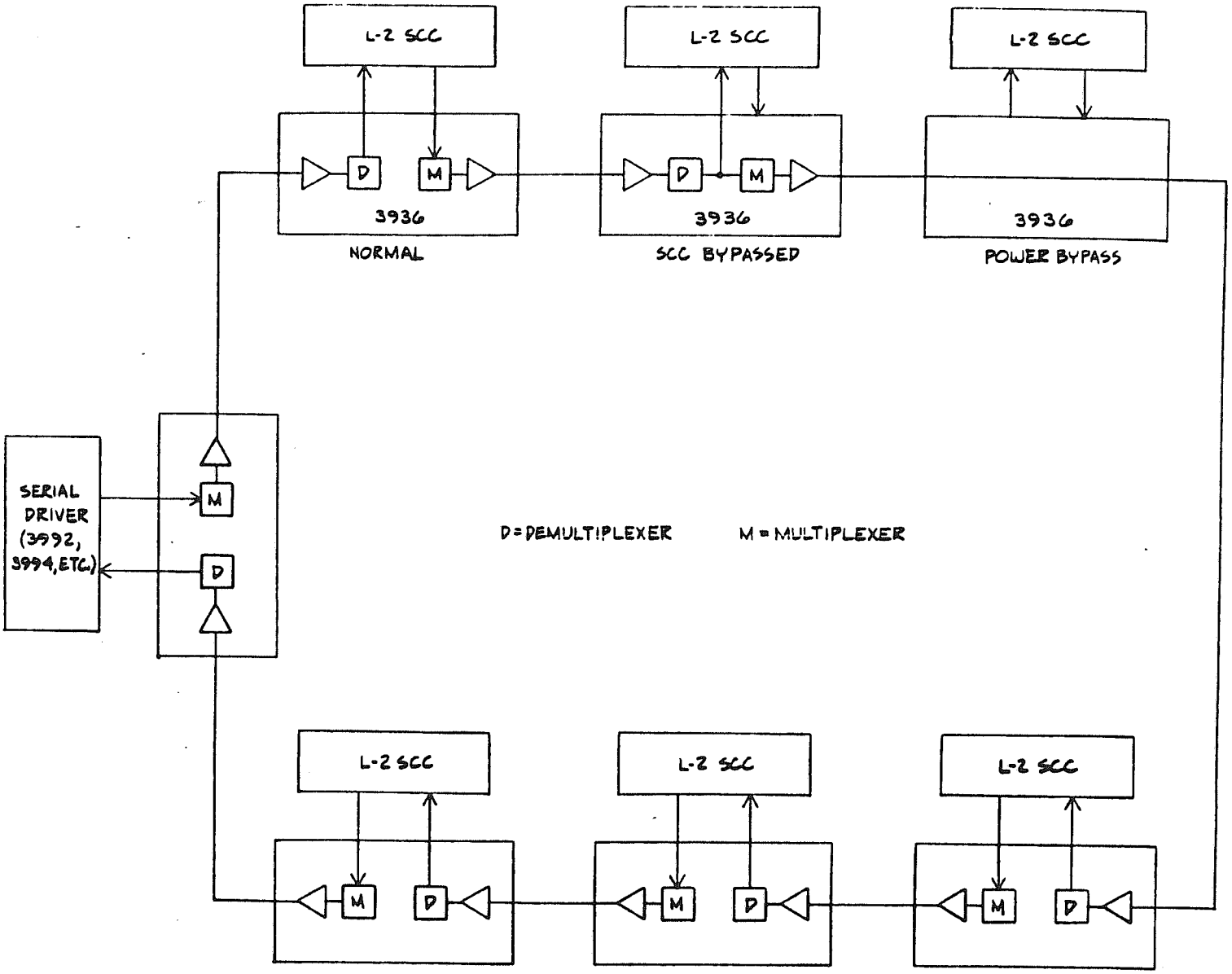


FIGURE 3 - A Multicrate System with Bypass

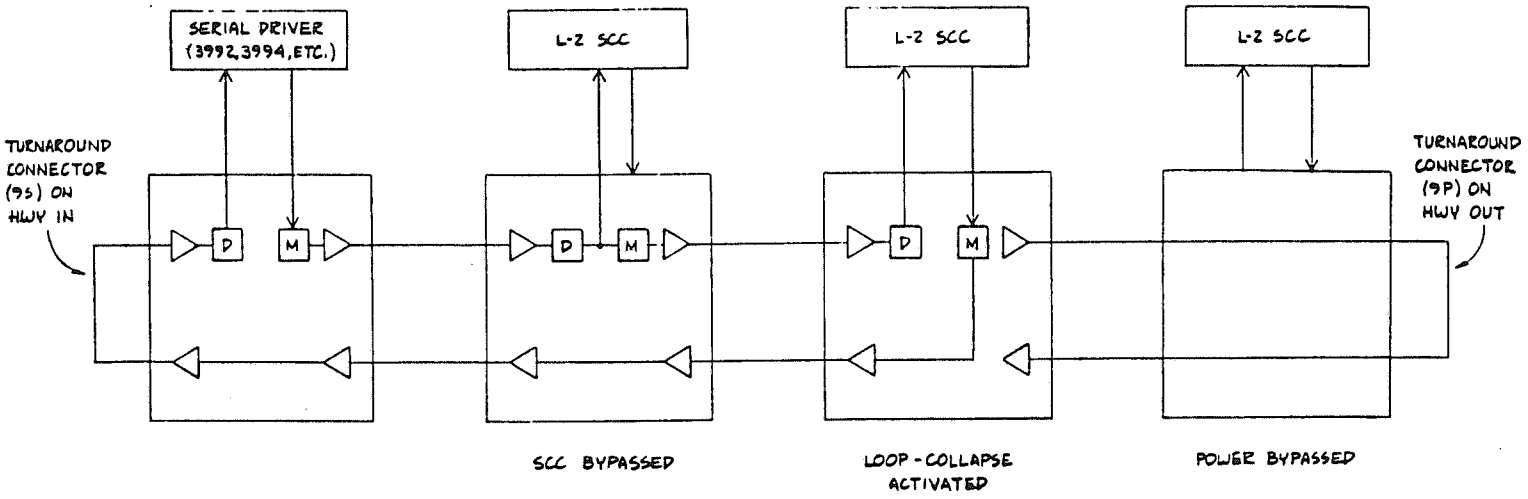
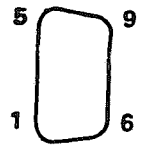


FIGURE 4 - A Multicrate System with Loop Collapse and Bypass

Model 1736 Highway In Connector Pin/Wire List



FACE VIEW

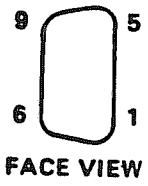
Pin/Wire List

9 PIN 'D'

PIN NO.	
5	NC
4	NC
3	Command In
2	Command In
1	GND

PIN NO.	
9	NC
8	NC
7	NC
6	NC

Model 1736 Highway Out Connector Socket/Wire List



Socket/Wire List

9 SOCKET 'D'

SOCKET NO.	
9	NC
8	NC
7	NC
6	NC

SOCKET NO.	
5	NC
4	NC
3	Command Out
2	Command Out
1	GSB Strap