INSTRUCTION MANUAL
MODEL 176
BYTE SERIAL BYPASS UNIT

CAMAC

INSTRUMENTATION FOR
SCIENCE AND INDUSTRY

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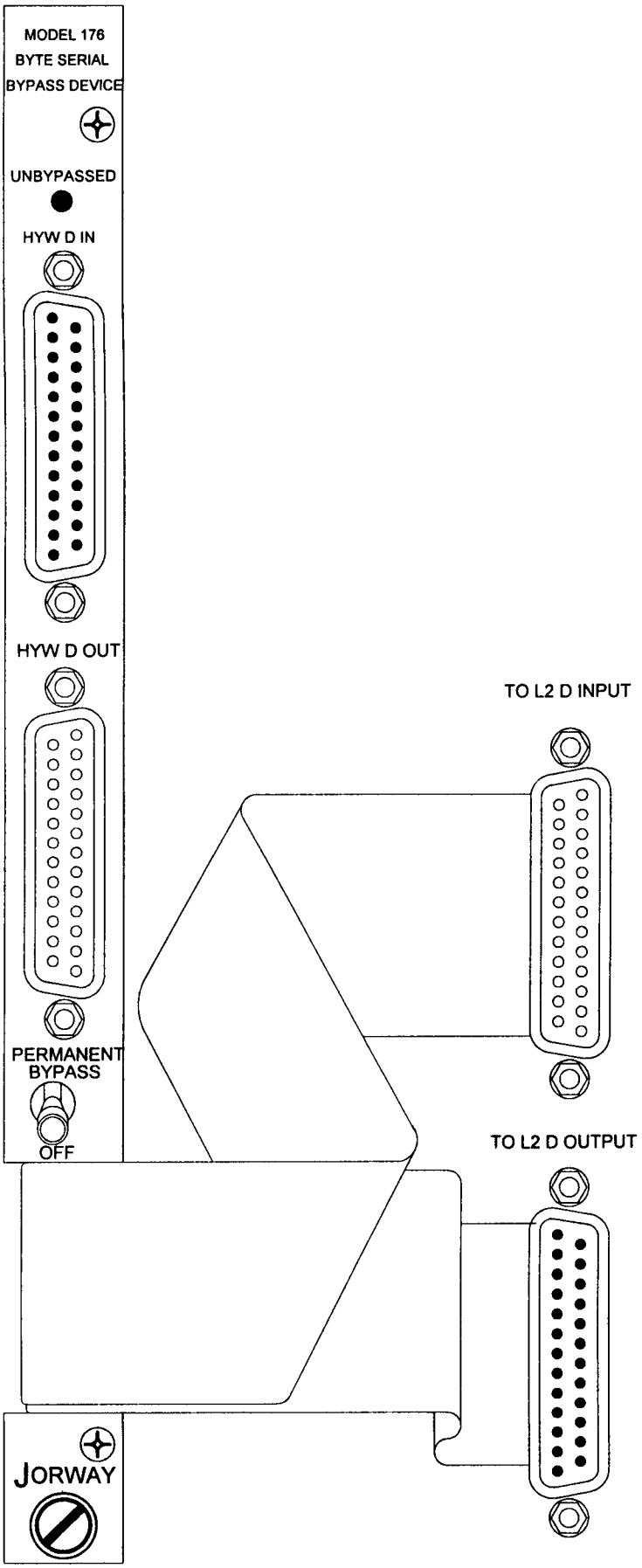

MODEL 176
BYTE SERIAL
BYPASS DEVICE
UNBYPASSED
HYW D IN
HYW D OUT
PERMANENT
BYPASS
OFF
TO L2 D INPUT
TO L2 D OUTPUT
JORWAY

STANDARD WARRANTY

Jorway Corporation warrants to the original purchaser that equipment of its manufacture is free from defects in material and workmanship. This warranty is effective for a period of one year after shipment of the instrument to the original purchaser.

Liability under this warranty is limited to servicing or adjusting any instrument returned to the Jorway Corporation factory for this purpose. Equipment to be returned for repair under warranty shall be returned transportation charges prepaid. If factory inspection discloses that defect developed under normal and proper use and within the warranty period, repair will be made and equipment returned with transportation charges paid by Jorway. Return shipment will be made via UPS where available or by insured parcel post. Other modes of shipment can be made at the customer's request and then only on a collect basis.

If equipment is not covered under warranty terms, an estimated cost of repair will be submitted to the customer, and upon his authorization, repairs will be accomplished and billed at cost, including US Customs clearance charges and return insured transportation charges, F.O.B. Westbury, New York, USA

Equipment sold outside the USA will not be accepted for warranty repair unless prior approval and shipping instructions have been obtained from the Jorway Corporation. If equipment is covered under warranty, shipments will be returned prepaid to the foreign port of entry.

This warranty is expressly in lieu of all other obligations or liabilities on the part of Jorway Corporation. Jorway Corporation does not assume, nor authorize any other person, including representatives of Jorway Corporation to assume for them, any other liabilities in connection with the sale of Jorway instruments.

1.0 GENERAL DESCRIPTION

The Jorway Model 176 Series Bypass Devices are single width CAMAC Modules that provide the ability to bypass type L-2 Serial Crate Controllers operating in the Byte Serial Mode. All ports operate in the normal CAMAC signal transmission standard EIA-422. This eliminates the need for costly U-port converters using non-CAMAC transmission standards. Furthermore, the serial highway may operate with clock rates from DC to 5 MHz without adjustment of any components. The clock rate can be varied between these limits. Bypass is controlled by the bypass relay in the Type L-2 Controller. As a result of power down of the crate and controller, the Model 176 will provide a "Bypass" function using relays to channel the serial D port highway input signals directly to the serial D port highway outputs. In addition, the relays in the Model 176 accommodate switching out the 100 Ohm line to line highway terminations when "Bypass" is in effect. When module power is available the serial highway signal inputs are buffered by differential receivers within the Model 176 to eliminate the 100 Ohm termination of the L-2 from being seen by the bypassed highway. This allows the type L2 controller to monitor the serial highway messages while in the bypass condition in order to respond to a unbypass command.

Although the Model 176 provides for highway continuity in the event of power down of a crate controller, an "unbypassed" and defective crate controller may not pass serial highway traffic. A front panel switch can be used to force the Model 176 to be in the bypass state. This feature might be desirable when the controller cannot be commanded to bypass, for example, when the controller is defective or a software command cannot be conveniently issued.

AVAILABLE MODELS

MODEL 176

The standard Model 176 is an optically isolated unit which in addition to providing bypass for the serial crate controllers also provides electrical isolation between adjacent crates on the serial highway. The Model 176 isolates the incoming byte serial highway from the type L2 controller. A DC to DC converter powers differential line receivers for incoming clock and data lines. Optical isolators isolate the clock and data lines before driving the corresponding L2 serial highway inputs. In the unbypassed state the L2 serial highway outputs are switched by the bypass relays so they drive the downstream crate. This is an ohmic connection including the L2 signal ground. The next Model 176 will provide isolation between crates. When the Model 176 is in the bypass state, relays disconnect the outgoing highway from the L2 highway output and connect directly to the incoming serial highway. The L2 ground line is also switched to the incoming highway ground line so that the serial highway now completely bypasses the crate. If power is available at the crate, the DC-DC converter will power the Model 176 circuits so that the L2 controller can monitor the serial highway messages in order to respond to an unbypass command.

MODEL 176-R

The Model 176-R is identical to the Model 176 but does not provide optical isolation. Ground is common between the serial highway and the L2 serial crate controller.

1.1 OPTIONAL BYPASS by LOOP COLLAPSE signal

A front panel switch can be used to force the Model 176 to be in the bypass state in the event that a defective crate controller may not pass serial highway traffic. It may be desirable to attempt to correct this situation remotely. One method of remotely disabling a defective but powered up serial crate controller is to use the Loop Collapse control in a Serial Crate Controller. A PCB jumper is available to enable a Loop Collapse feature. When enabled, the Input Serial Highway Loop Collapse pin can be used to control the Model 176 Bypass function. If the serial highway cables contain the loop collapse connection, the next upstream serial crate controller will force the downstream Model 176 into the "bypass" mode when it is commanded to select Loop Collapse. This feature does not provide complete remote control of all serial controllers. For example, only the first of the two adjacent controllers can issue the Loop Collapse command to the next crate. Two adjacent defective controllers cannot be disabled by this method. In addition a defective controller may not pass serial highway messages and considerable trial and error operations may be required to remotely locate a defective controller.

1.2 INSTALLATION

Installation of these modules is extremely simple, and requires no additional cables. The Model 176 Bypass module may be placed in any vacant slot adjacent to the crate controller. The incoming and out going Serial Highway cables are moved from the L2 crate controller to equivalent connectors on the bypass module. Short cables that are captive to the bypass module connect to the crate controller. The serial system requires no other changes.

In the event that the L2 crate controller is to be removed from the crate the while the serial highway is operating the manual bypass switch should be placed in the "Permanent Bypass" position. This will ensure that the Model 176 remains bypassed when the type L2 controller is disconnected. Disconnection of the L2 controller would otherwise appear to the Model 176 that an unbypass condition exists (Open contact on the bypass signal line). It is also possible to remove the Model 176 from a powered down crate while the highway is operating. The bypass module should be carefully removed and not jarred severely as the highway signals are carried by relays that could momentarily open.

1.2 BIT SERIAL OPERATION

The Model 176 will operate in the bit serial mode as well as the byte serial mode. In bit serial mode only the clock and data bit 1 wiring need be included in the serial highway cabling. The Model 176 provides for a direct connection of the Free Bus 1 and Free Bus 2 connections between the D Port Highway Input and D Port Highway Output connectors. These Free bus connections may be used in conjunction with bit serial operation using a single cable and turn around connectors.

2.0 SPECIFICATIONS

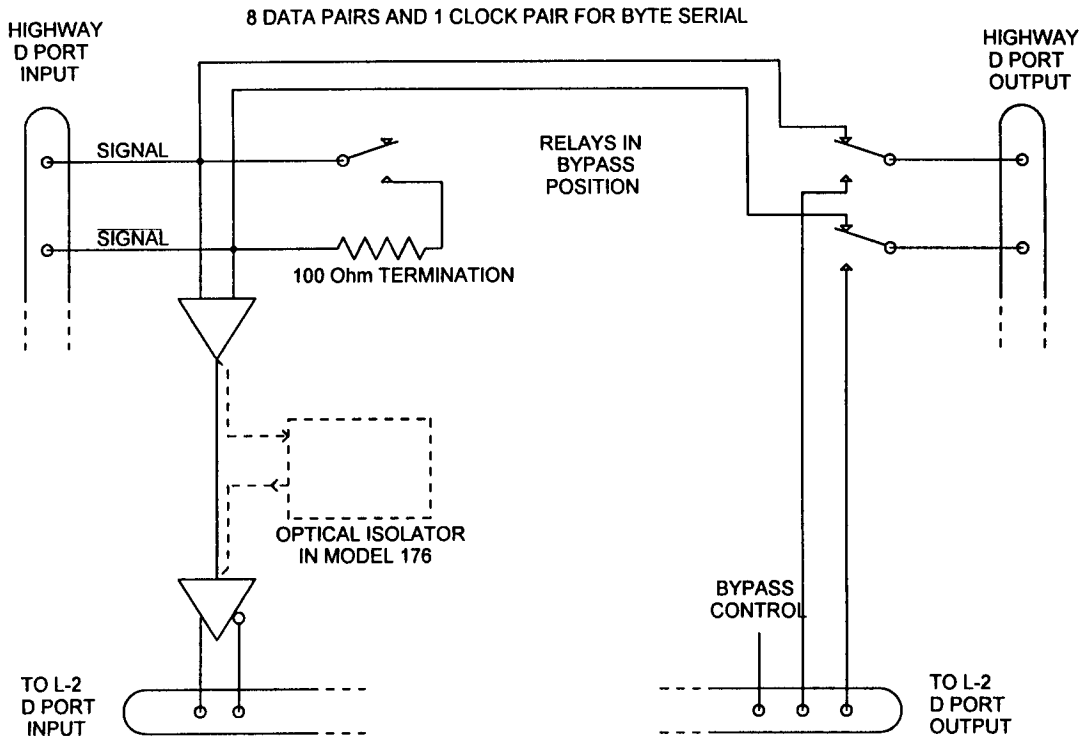
Size:	Single width CAMAC module
Serial highway ports:	Differential EIA RS-422 signals. Input impedance, 100 Ohms line to line (Unbypassed).
Serial clock rate:	DC to 5 MHz.
Relay switching time:	Less than 20 Milliseconds.
Relay contact resistance:	0.2 Ohms typical.
Indicators	"Unbypassed" green LED indicating relays are in the unbypassed position.
Propagation Delays Input Highway to Output Highway:	75 nanoseconds typical with module in bypassed state excluding L2 propagation delay.
Differential Skew Input Highway to L2 D port input:	Total difference in propagation delay between data line pairs or clock and data line pairs; 10 nanoseconds typical 15 nanoseconds max.
Power:	1500 ma at + 6 volts.
Isolation:	DC-DC converter = 500V Opto Isolators = ≈ 600V

3.0 MODULE OPERATION

The Jorway Model 176 Series Bypass Devices utilizes relays to control the signal paths during bypass or unbypassed operation of a serial crate controller. Figure 1 is a simplified diagram of the Model 176 series.

FIGURE 1

TYPICAL CIRCUIT FOR SIGNAL PAIR



Shown in the bypasses condition, serial highway signals are routed directly from the Highway D Port Input to the Highway D Port Output. If the Model 176 is powered, differential line receivers buffer the incoming highway signals and apply them to the D Port Input of an L2 Serial Crate Controller. This buffering prevents the 100 Ohm termination in the serial crate controller from being seen by the bypassed serial highway. A down stream serial highway device will provide the highway termination in this bypassed situation. In the Model 176-R the single ended output of the line receiver directly drives a differential live driver at the port for L2 input. In the case of the Model 176 an optical isolator is inserted between the receiver and the driver. A DC-DC isolated converter is provided in the module to power the line receivers and the input of the optical isolators. The upstream serial highway remains isolated from the L2 Crate Controller. When the Model 176 becomes unbypassed the relays are powered and the Highway D Port Output becomes directly connected to the L2 D Port Output. A 100 Ohm termination is connected to each incoming signal pair to terminate the highway. Note that the ground for the Output Highway which was continued from the Input Highway in the bypassed condition is switched to the L2 ground when unbypassed.

3.1 CIRCUIT DETAILS ; MODEL 176

3.11 Data and Clock Circuits

Schematic diagrams for the Model 176 are shown on page 9 thru 11. Referring to sheet 1, a typical bit such as the Bit 5 highway input, channels differential signals directly to relay X14. X14 which is shown in the bypassed condition (powered down) routes this signal pair directly to Bit 5 at the Highway output. When the module is unbypassed, relay power is applied and the relays switch to the opposite state. Relay X14 now connects the L2 D Output to the Highway Output. Relay X5 also closes and a 100 Ohm termination R9 is connected across the Highway Input pair. Differential line receiver U3 buffers Bit 5 and supplies a single ended TTL signal to the internal HIN_BUS. The balance of the 7 data bits and clock are handled in an identical manner and are illustrated on sheet 1 and 2. On sheet 2 relay X1 switches the ground for the Highway Output from pin 11 (Highway Input ground when bypassed) to pin 9 (L2 controller ground when unbypassed). Sheet 2 also illustrates the free bus connections that can be used in a bit serial highway operation. Sheet 3 illustrates the signal path for the single ended outputs of the line receivers. Each signal drives a photo-diode thru a current limiting resistor for an opto-isolator i.e. (R18 and pin 1 and 2 of IC U8 for bit 5). The single ended output of the opto-isolator drives a differential driver for connection to the L2 D Port Input. Note that for the clock signal line at U4 pin 1 and 2 an RC network is provided to provide trimming of the clock propagation delay. Although high speed opto-isolators are used to provide a minimum of propagation delay for the clock and data signals, some differences exist between each signal channel. Change in the value of R10 (or the addition of a Pot R20) or the addition of a cap C1 can be used to adjust the clock propagation delay with respect to data signals. Ideally the clock delay should fall half way between the longest and shortest data propagation delay in order to make the Model 176 have a minimum effect on speed performance of the serial highway. In most cases the value of R20 will zero and C1 will be between 0 and 10 PF.

3.12 Bypass Control

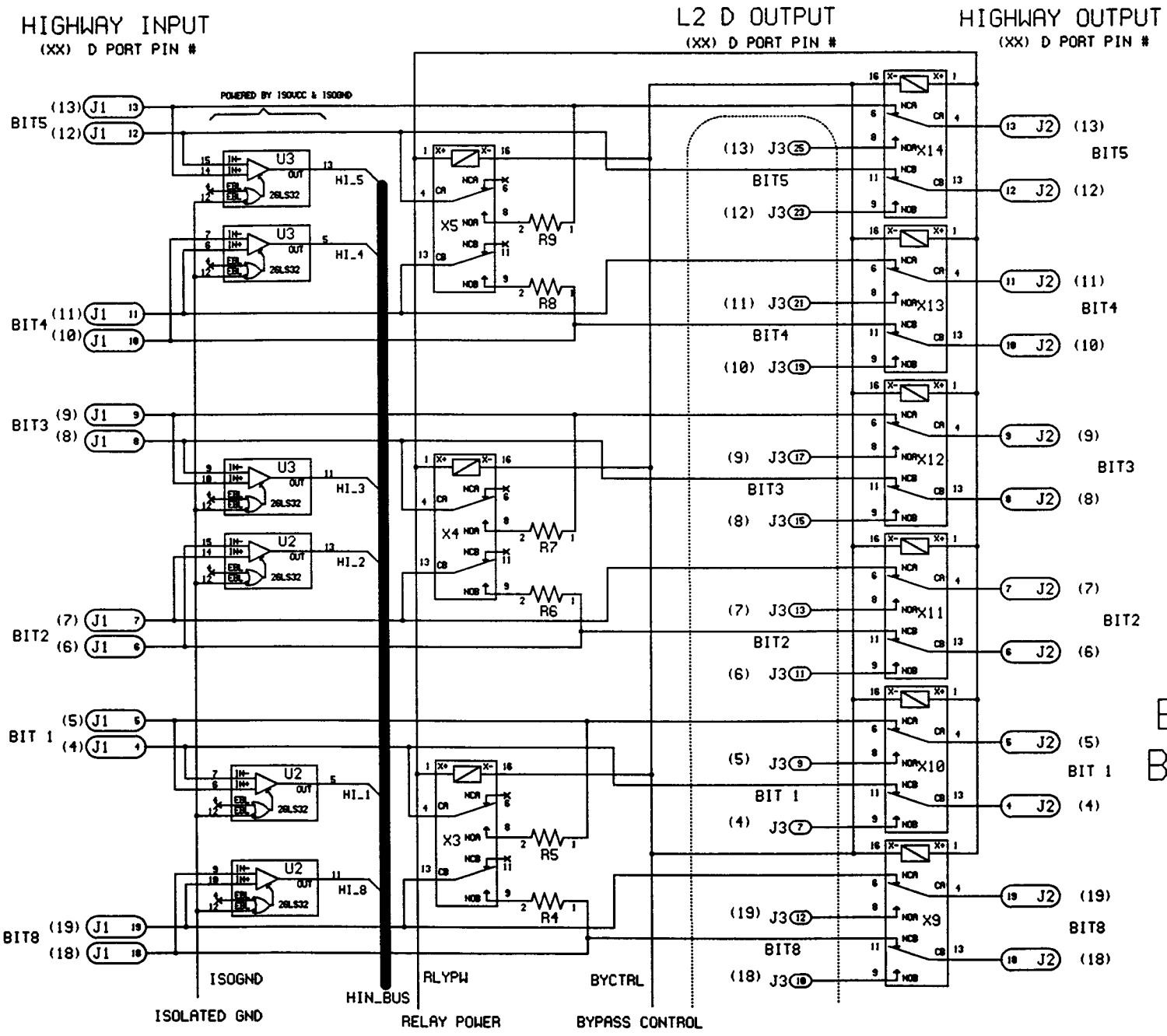
Bypass relays are powered from the + 6 volt dataway bus thru a filter L1 and a diode CR8 that reduces the relay voltage to 5.2 volts. The relays are switched by transistor Q2. The attached L2 controllers bypass control is a relay contact to ground that is normally closed at power up or when in the bypass condition. This condition provides a low at U12-5 resulting in Q2 being turned off. When the L2 controller is unbypassed its bypass control contact opens, a high is applied to U12-5 and Q2 turns on. Q2 turning on energizes the Model 176 relays putting them in the unbypassed mode. If the manual switch is placed in the Permanent Bypass position Q2 will be turned off regardless of the state of the L2 bypass control contact.

3.13 Bypass by Loop Collapse Control

The feature of control of the Model 176 by an upstream controller by its loop collapse control must be enabled by a shorting jumper between JP1 and JP2. The loop collapse control in an upstream controller is a relay contact to ground normally open at power up. When this feature is enabled the upstream controller with an open contact will result in a high at opto-isolator U8-7 and U12-5. This allows the Model 176 bypass to be controlled by the attached L2 controller. When the upstream controller is set for loop collapse current flows thru the U8 photo-diode and R19 returning via the highway ground and U12-4 goes low overriding any signal at U12-5. Q2 goes off and the Model 176 exerts Bypass.

3.14 Isolated DC-DC Converter

The differential receivers and photo-diodes of the opto-isolators are powered by an isolated DC-DC converter DC2. The DC-DC converter unregulated output provides a flat voltage to load characteristic that maintains supply voltage limits over the load range. To provide an isolated Vcc of a nominal 5.2 volts the DC-DC converter input is driven at a nominal 4.8 volts. The 4.8 volts is generated by a dropping diode CR9 from the nominal 5.2 volt VCC.



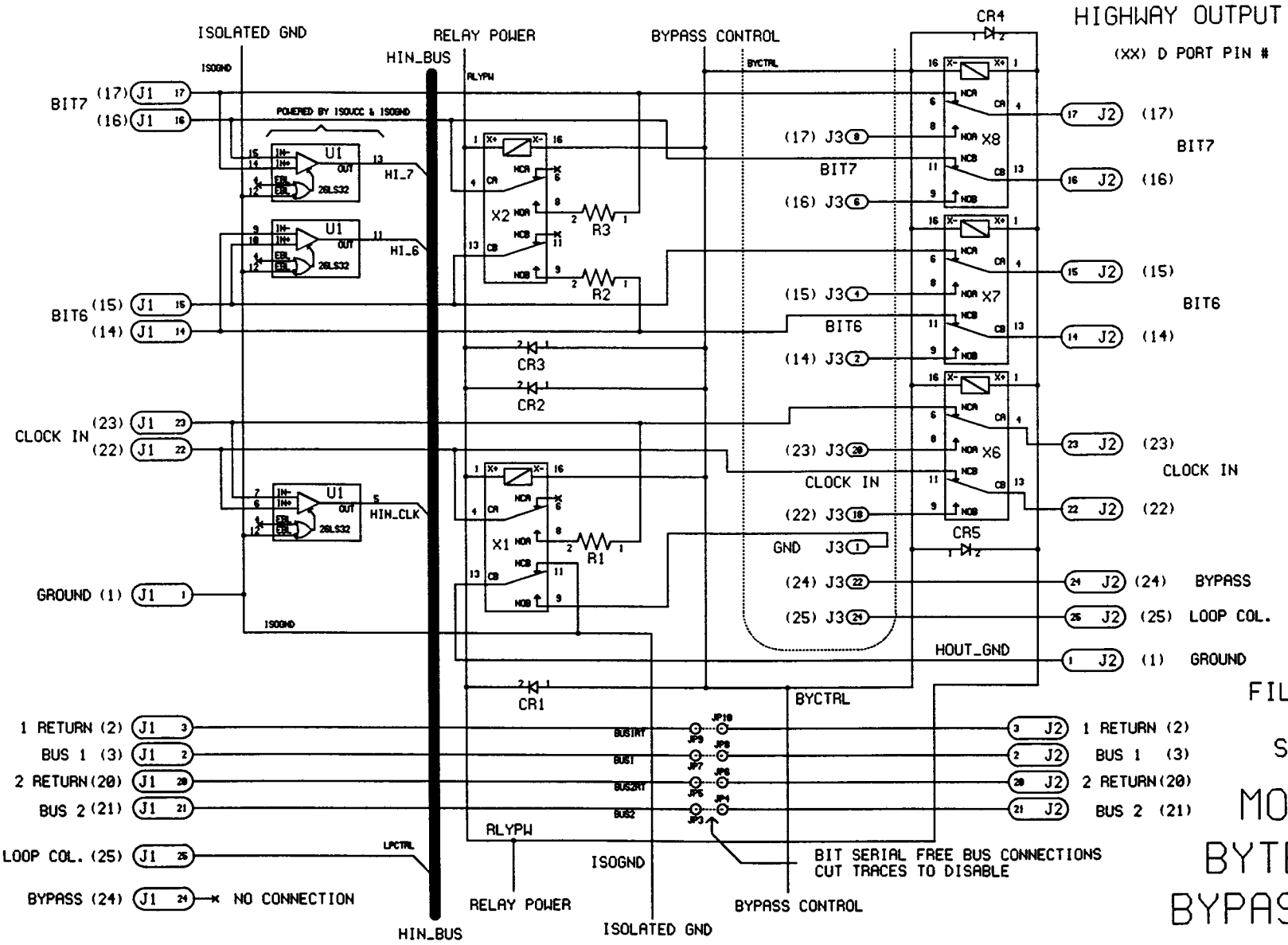
(CONTINUED ON SHEET 2)

FILE:M176S1

SHEET 1

MODEL 176 BYTE SERIAL BYPASS MODULE

(CONTINUED FROM SHEET 1)



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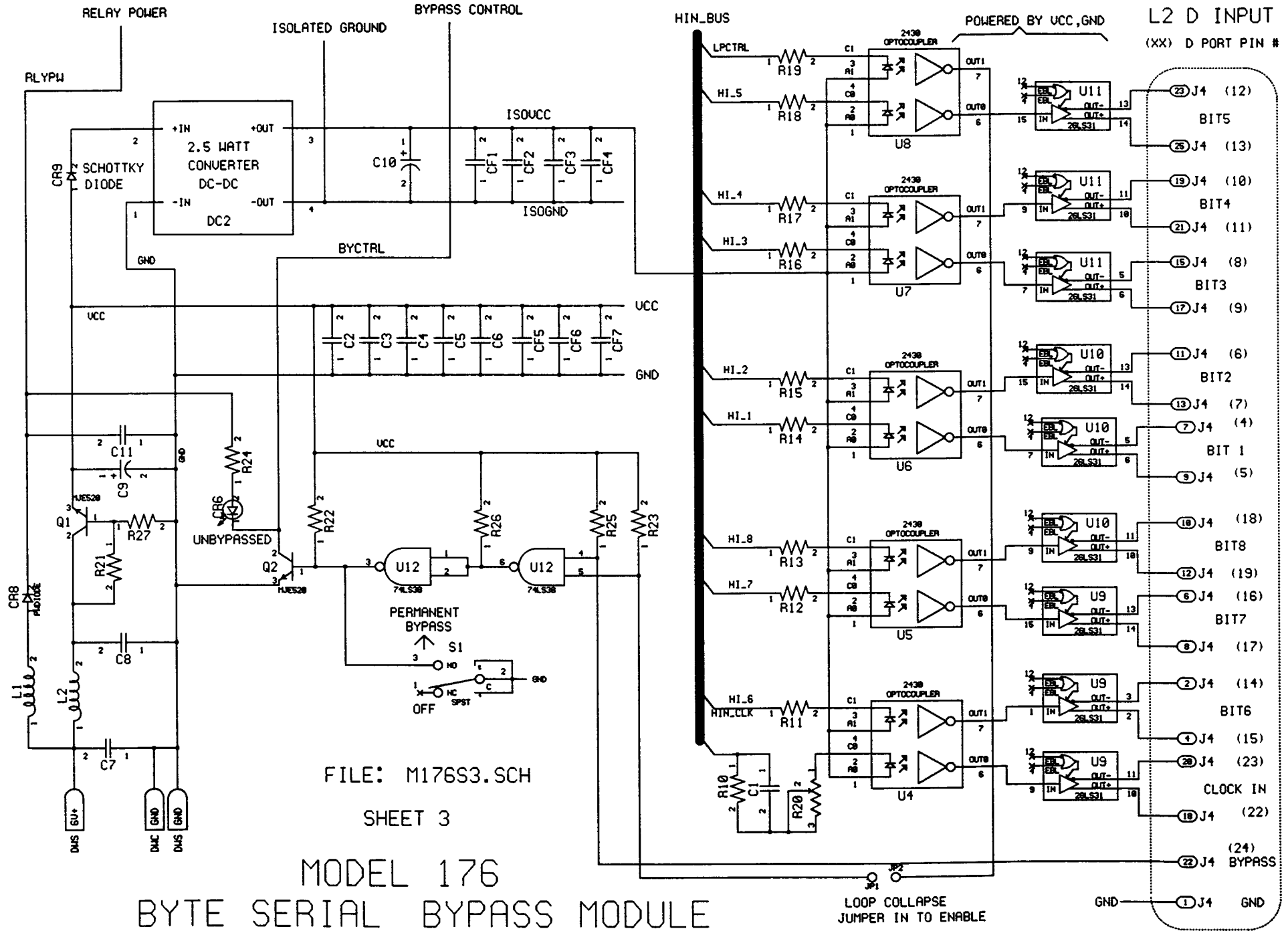
SHEET 2

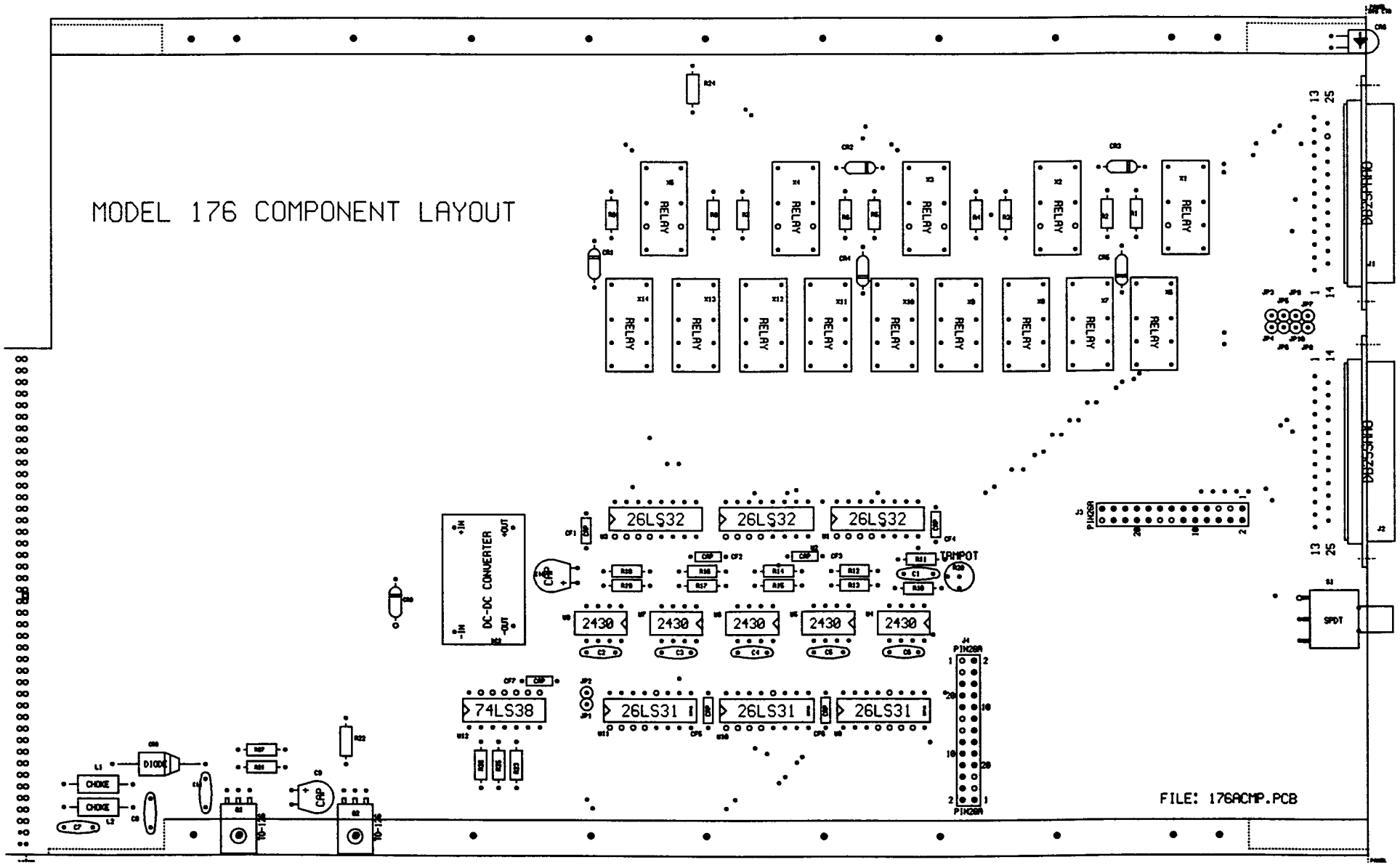
MODEL 176 BYTE SERIAL BYPASS MODULE



MODEL 176
BYTE SERIAL BYPASS MODULE

Title: Model 176 Assembly
Reference Drawing: 176ACMP.PCB Last ECO:
Disk File *A5575.LST 23-JUN-96

REFERENCE DESIGNATION	QUANTITY	PART NUMBER	DESCRIPTION	MFR.	MFR.PART NUMBER
C9,C10	2	C-0226-000	Cap.,Tant.,Dipped,22uf,20%,15V	Kemet	T368B226M015AS
CF1 THRU CF15	15	C-0104-003	Cap.,Ceramic,.1uf,50V,20%,Z5U	Sprague	1C25Z5U104M050B
CR1-CR5	5	CR-9140-000	Diode,Silicon,100 PRV	FSC	1N4148
CR6	1	CR-0000-112	Diode,Light Emitting,Green	H.P.	HLMP-1503
CR8	1	CR-4001-000	Diode,Silicon,1A,50V PRV	Mot	1N4001
CR9	1	CR-5817-000	Diode,Schottky Barrier	Motorola	1N5817
Q1,Q2	2	Q-0000-104	Transistor,NPN	Mot.	2N4921
U1,U2,U3	3	IC-0000-149	Integrated Circuit,DIP,Plastic	AMD	AM26LS32PC
U4,U5,U6,U7,U8	5	IC-2430-500	Optical Isolator	H.P.	HCPL-2430
U9,U10,U11	3	IC-0000-150	Integrated Circuit,DIP,Plastic	AMD	AM26LS31PC
U12	1	IC-7438-002	Integrated Circuit,DIP,Plastic	TI	SN74LS38N
X1-X14	14	K-0000-112	Relay,Lo Profile,DPDT,5V DC	Omron	G6A-274P-ST-US
J1	1	J-0025-104	Connector,D,25 Pin,Male,Mass Term.	Cir Asse	CA-25DPID
J2	1	J-0025-105	Connector,D,25 Pin,Fem.,Mass Term.	Cir Asse	CA-25DSID
J3,J4	2	J-0026-002	Connector,P.C.B./Flat Cable,26 Pin	3M	3926-0000T
J5	1	J-0025-106	Connector,D,25 pin,Male,Right angle	AdamTech	DB25-PH-CTS-SL
J6	1	J-0025-107	Connector,D,25 pin,Female,Right Ang.	AdamTech	
	4	H-0000-164	Lock,Connector	Cannon	D20418-2
JP1,JP2	1	X-0000-228	Socket,2 Pos.,Shorting	AMP	531220-2
JP1,JP2	2	H-0002-523	Pin,.025" sq.,.430" Length	Samtec	T-1S6-07-G-2
L1,L2	2	L-0474-000	Inductor,Molded,.47uh	Jeffers	4425-2M
S1	1	S-0000-025	Switch,Toggle,SPDT,Lock.,Rt.Ang.P.C.	C&K	7101KAB
R21	1	W-0004-040	Jumper,#24 Wht Teflon,0.400" length	Squires	J 0.400 x 0.250 T24
R22	1	R-0221-101	Resistor,1/4W. 220 OHM 5%	AB	RC07
R24	1	R-0331-101	Resistor,1/4W. 330 OHM 5%	AB	RC07
R10-19	10	R-0681-101	Resistor,1/4W. 680 OHM 5%	AB	RC07
R23,R25,R26	3	R-0222-101	Resistor,1/4W. 2.2K 5%	AB	RC07
R1-R9	9	R-0101-101	Resistor,1/4W. 100 OHM 5%	AB	RC07
R20	1	W-0004-010	Jumper,#24 Wht Teflon,.100" length	Squires	J 0.100 x 0.250 T24
	1	E-0000-227	DC to DC Converter	Pico	5B5S
	1	TB-0176-001	Printed Circuit Board	Jorway	176-200 Rev.A
	1	MP-1153-000	Front Panel,Model 176	Jorway	176-C-400
	1	H-0000-114	Jackscrew,4mm	Deutsch	F7500-4MM-B-4
	2	H-0000-148	Rail,Camac	Technifa	P3200
	2	H-0000-230	Standoff,1/4"Hex x 5/16",4-40	RAF	032185-A
	1	MP-2257-001	Cover,Vinyl Clad Aluminum	Jorway	SK0140A
	28	W-0002-115	Cable,Flat,26 Cond.(Quant.in Inch.)	Spec Str	843-191-2001-126


MODEL 176 COMPONENT LAYOUT
RELAY
26LS32
DC-DC CONVERTER
2430
74LS38
26LS31
TRIMPOT
DIODE
CHOKE
CAP
SPDT
FILE: 176ACMP.PCB

APPENDIX A.

CONSIDERATIONS IN OPERATING THE CAMAC SERIAL SYSTEM WITH BYPASS UNITS

The CAMAC Serial Highway when configured without Bypass Units provides a signal path with good predictable performance. All data signals are clocked into registers in the serial crate controller. The input clock is reshaped by the controller to maintain at least a 40 to 60% output clock duty cycle at 5 MHz. The clock is also realigned with data at the Type L-2 output so data transitions are within 0 to 20ns of the respective clock transition. With a known distance between crates and known signal properties at the interconnecting cables, a serial clock rate can be selected for reliable operation. The serial highway specs also require a predictable L2 CC (Crate Controller) response from a bypassed L2 CC. A Bypassed controller shall provide a reply of the proper length for the command received i.e. read, write or control. The status byte of the bypassed controllers reply shall provide a unique response of Q=1, X=0 status to indicate a bypass condition. The serial driver may interpret this condition to both indicate a bypass condition and no execution of the command issued to the controller.

Insertion of Serial Controller Bypass devices may result in a number of conditions which the system designer should consider in the system layout and operation.

HIGHWAY LENGTH.

As previously indicated in a serial system without bypass units signals are buffered and realigned with the clock at each controller. The length of the longest distance between crates will usually determine the highest clock rate for the system. This will also be the case for a system using bypass units when all bypass units are in the unbypassed condition. However when a bypass unit becomes bypassed, the serial highway incoming signal pair wires are connected directly to the output signal pair wires. This segment of the highway now becomes the length of the incoming cable plus the outgoing cable. If the highway had been operating near its maximum clock rate, this lengthening of the cable segment may result in highway signal errors. To restore reliable operation the clock rate will have to be reduced.

A special situation will occur on system power-up with all crate controllers being initially bypassed by their bypass devices (Model 176). In this case the serial highway cable length will be the entire length from serial driver output to serial driver input. Unbypass commands sent by the driver at a clock rate suitable for the all unbypassed condition is unlikely to return to the driver without severe errors due the highway length. The following are a few possible methods of system operation for highway start-up.

1. For system start-up select a start-up frequency which will operate the highway at its longest total length. After all crate controllers are unbypassed select the highest clock rate for normal unbypassed operation.

2. Leave the serial clock rate at that for unbypassed operation or at least for the two longest adjacent highway cables.. For system start-up issue a sequence of unbypass commands one for each crate controller in the system. Ignore the serial driver status as it will probably be corrupted by the excessive cable length The serial driver status will most probably show a time-out error. The serial driver unbypass commands will be at least 110 milliseconds long plus the time-out selection (in terms of bytes for the Model 411 serial driver). This time is the amount allowed for the controller and bypass unit to select unbypass mode. This method of unbypass requires that the sequence of unbypass commands are issued in the same order as the crate controller address number are physically encounter in the serial highway. The first controller in the serial loop will properly see the unbypass command and select unbypass mode. After 100 milliseconds the serial controller sends a reply but the reply is unlikely to arrive at the driver. The first crate is however unbypassed and the highway becomes shorter because of the signal buffering in the now unbypassed L2 CC. The sequence is repeated for each controller until all L2 CC's are unbypassed. The unbypassed sequence could be followed by a read L2 status from each crate to assure it in now unbypassed. Jorway L2 controllers can be issued an set on-line command and program Z along with the unbypass command to aid in initializing the crate.