4I23 SERIAL PORT MANUAL

Version 1.2

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HANDLING PRECAUTIONS

STATIC ELECTRICITY

The CMOS integrated circuits on the 4I23 can be damaged by exposure to electrostatic discharges. The following precautions should be taken when handling the 4I23 to prevent possible damage.

A. Leave the 4I23 in its antistatic bag until needed.

B. All work should be performed at an antistatic workstation.

C. Ground equipment into which 4I23 will be installed.

D. Ground handling personnel with conductive bracelet through 1 megohm resistor to ground.

E. Avoid wearing synthetic fabrics, particularly Nylon.

INTRODUCTION

GENERAL

The 4I23 is a COMX compatible, four channel serial port card implemented on a stackable PC/104 bus card. The 4I23 is available in three versions: quad RS-232, a model with two RS-232 and two RS-422 channels, and quad RS-422. The model names of the cards are (respectively) 4I23A, 4I23B, and 4I23C

The 4I23 uses 16C550 type FIFO'ed UART's. These UART's have built-in 16 byte receive and transmit FIFO's. The 16 character FIFO's reduce interrupt overhead and allow higher data rates without losing characters. The receive FIFO's also increase the allowable interrupt latency. This is especially important when using programs like WINDOWS that disable interrupts for comparatively long periods of time.

Unlike many serial cards, the 4I23 is implemented with the 16 bit bus connector so that each of the four serial ports on the 4I23 can uses any of the 11 available AT bus interrupts. The 4I23 also has an shared interrupt capability. The four serial port interrupts can be logically or'ed to a common interrupt. The or'ed interrupts are individually maskable. The interrupt status of all four channels is readable at a single port location to allow quick response to the shared interrupt. All additional I/O necessary to implement the shared interrupt logic uses aliased addresses so that no extra I/O port locations are required.

The RS-422 ports have one handshake-in and one handshake-out line. The RS-422 drivers can be software enabled and disabled for bus (RS-485) type applications. Jumper selectable RS-422 termination is provided on card. A jumper selectable double baud rate option allows RS-422 channels to run at up to 230.4K baud. The double baud rate option applies to two of the four 4I23 channels.

Serial port connectors are 10 pin headers that match 9 pin AT type RS-232 serial port pinout when terminated with an IDC type 9 pin subminiature D connector. RS-422 pinout is similar to the RS-449 secondary channel pinout. Serial port addresses are set with a socketed PAL device. Eight different sets of port locations can be selected by option jumpers. MESA can supply custom port address PALs if desired.

The 4I23 requires only +5V for operation, as all RS-232 power is generated on card. All CMOS technology keeps power dissipation to a minimum.

CONFIGURATION

GENERAL

The 4I23 has a number of jumper configurable options that must be properly set to match the application. Each group of jumpers will be discussed separately by function. In the following discussions, when the words "up", "down", "right", and "left" are used it is assumed that the 4I23 serial I/O card is oriented with its bus connectors J1 and J2 at the bottom edge of the card (nearest the person doing the configuration).

The four serial channels are referred to as channel 0, channel 1, channel 2, and channel 3. Channel 0 connects to the top 10 pin header.

DEFAULT JUMPER SETTINGS

Factory default 4I23 jumpering is as follows:

FUNCTION	JUMPER(S)	SETTING	
Channel 0 port address	W58-W60	3F8H	(COM1)
Channel 1 port address	W58-W60	2F8H	(COM2)
Channel 2 port address	W58-W60	3E8H	(COM3)
Channel 3 port address	W58-W60	2E8H	(COM4)
Channel 0 interrupt select	W7-W18	IRQ4	(COM1 IRQ)
Channel 1 interrupt select	W20-W31	IRQ3	(COM2 IRQ)
Channel 2 interrupt select	W32-W43	NONE	(COM3 IRQ)
Channel 3 interrupt select	W45-W56	NONE	(COM4 IRQ)
Global interrupt select	W44	Set to Channel 3	
Ch 0 RS-422 termination	W6	Disabled (4I23C)	
Ch 1 RS-422 termination	W19	Disabled (4I23C)	
Ch 2 RS-422 termination	W57	Disabled (4I23B,C)	
Ch 3 RS-422 termination	W63	Disabled (4I23B,C)	
Ch 0 RS-422 driver enable	W1	Off at reset (4I23C)	
Ch 1 RS-422 driver enable	W2	Off at reset (4I23C)	
Ch 2 RS-422 driver enable	W3	Off at reset (4I23B,C)	
Ch 3 RS-422 driver enable	W4	Off at reset (4I23B,C)	
Double Baud Rate select	W5	Disabled	
RS-232 Power Source	W61,W62	Local +- power	

CONFIGURATION

DEFAULT JUMPER SETTINGS

CONFIGURATION

PORT ADDRESS SELECTION

The I/O addresses of the four serial channels on the 4I23 are selected by location jumpers W58, W59, and W60. These jumpers select one of eight options. Each serial channel occupies 8 contiguous addresses in I/O space. The 4I23 is shipped with channel 0 set as COM1, channel 1 set as COM2 , channel 2 set as COM3, and channel 3 set as COM4 (OPTION 0).

The PAL device that sets the port addresses is socketed and can be replaced if a different set of port addresses is desired. Contact MESA if you application requires different port addresses.

OPTION #	W58	W59	W60	Ch 0	Ch 1	Ch 2	Ch 3
0	down	down	down	COM1	COM2	COM3	COM4
1	down	down	up	COM2	COM3	COM4	COM5
2	down	up	down	COM3	COM4	COM5	COM6
3	down	up	up	COM4	COM5	COM6	COM7
4	up	down	down	COM5	COM6	COM7	COM8
5	up	down	up	COM6	COM7	COM8	COM9
6	up	up	down	COM7	COM8	COM9	COM10
7	up	up	up	COM8	COM9	COM10	COM11

The I/O address for COM1 through COM11 are as follows:

COM PORT #	ADDRESS (hex)
COM1	3F8
COM2	2F8
COM3	3E8
COM4	2E8
COM5	100
COM6	108
COM7	110
COM8	118
COM9	120
COM10	128
COM11	130

CONFIGURATION

PORT ADDRESS JUMPER LOCATIONS
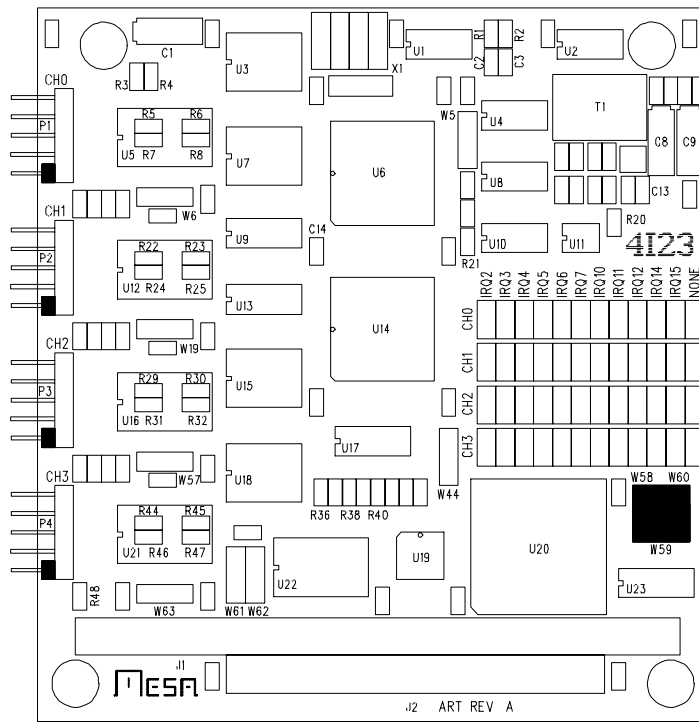
CONFIGURATION

INTERRUPT SELECT

Each channel of the 4I23 can be configured to generate interrupts on various status conditions. These interrupts can be routed to any of the 11 PC-BUS interrupt lines. A shorting jumper placed in the interrupt select matrix determines which interrupt is generated by each channel. The interrupt select matrix is located on the middle right hand side of the card. The interrupt select matrix is labeled horizontally with IRQ numbers and vertically with channel numbers

A jumper is placed at the intersection of a channel number and an IRQ number to select a specific interrupt for that channel. To disable a channel's interrupt, place the jumper for that channel in the NONE position. You should never have more than one channel connected to a single interrupt.

The 4I23 is shipped with channel 0 configured to generate IRQ 4 and channel 1 configured to generate IRQ 3, the standard interrupts for COM1 and COM2 respectively. Channel 2 and channel 3 interrupts are disabled.

The following table shows the jumper settings for selecting interrupts:

INTERRUPT JUMPER MATRIX

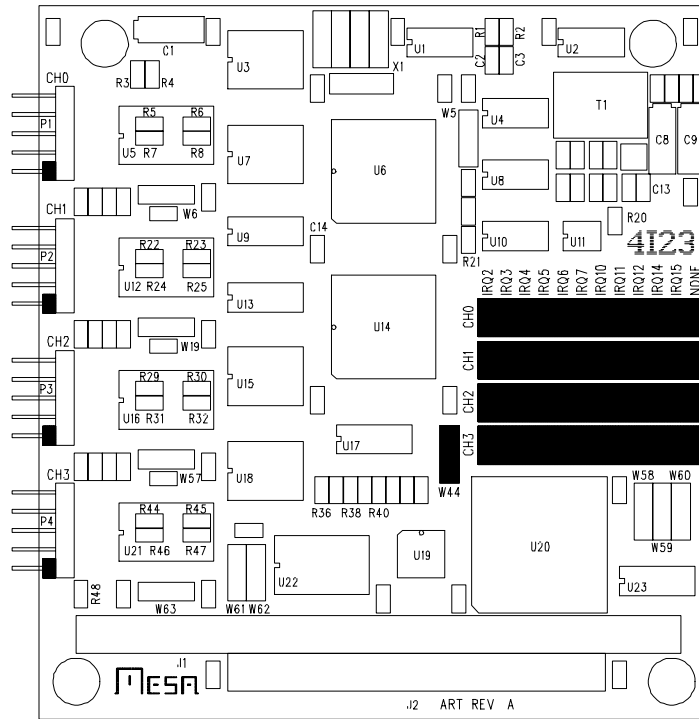|	IRQ 2	IRQ 3	IRQ 4	IRQ 5	IRQ 6	IRQ 7	IRQ 10	IRQ 11	IRQ 12	IRQ 14	IRQ 15	NONE
CH 0	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18
CH 1	W20	W21	W22	W23	W24	W25	W26	W27	W28	W29	W30	W31
CH 2	W32	W33	W34	W35	W36	W37	W38	W39	W40	W41	W42	W43
CH 3	W45	W46	W47	W48	W49	W50	W51	W52	W53	W54	W55	W56

SHARED INTERRUPT SELECT

The 4I23 is capable of logically ORing on card interrupts to conserve system interrupts. This is especially useful in 8 bit systems where available bus interrupts are scarce. Shared interrupt mode is selected by setting jumper W44 into the down position. This 'steals' channel 3's interrupt select jumpers and connects them to the shared interrupt logic. W44 should be left in the up position for normal operation.

See the SHARED INTERRUPTS paragraph in the operation section of this manual for more information on using shared interrupts.

CONFIGURATION

INTERRUPT SELECT JUMPER LOCATIONS

CONFIGURATION

RS-422 TERMINATION

The differential receiver inputs on the 4I23 can be terminated with an on-card 130 ohm resistor.

Termination should be used at each end of the cable only. Jumper W6 controls termination on channel 0, jumper W19 controls termination on channel 1, jumper W57 controls termination on channel 2, and jumper W63 controls termination on channel 3.

Placing the jumpers in the left hand position connects the termination resistor to the receive input. Placing the jumper in the right hand position disconnects the termination resistor.

RS-422 DRIVER ENABLE

The RS-422 drivers on the 4I23 can be disabled (TRI-STATED) under software control to allow network or multi-drop type applications.

The RS-422 drivers are controlled by the RTS bit of the respective UART's and the RS-422 driver mode jumpers. The jumpers allow the power up driver enable state to be selected. Jumpers W1 through W4 control the enable polarity of channels 0 through 3

When jumper W1 through W4 are set to the down position, the corresponding RS-422 driver will be disabled at reset, and setting the RTS bit in modem control register will *enable* the driver. This is the default jumpering for 4I23B and C cards and the suggested mode of operation for multi-drop applications. When jumper W1 through W4 are set to the up position, the corresponding RS-422 driver will be enabled at reset, and setting the RTS bit in modem control register will *disable* the driver.

CONFIGURATION

RS-422 CONFIGURATION JUMPERS
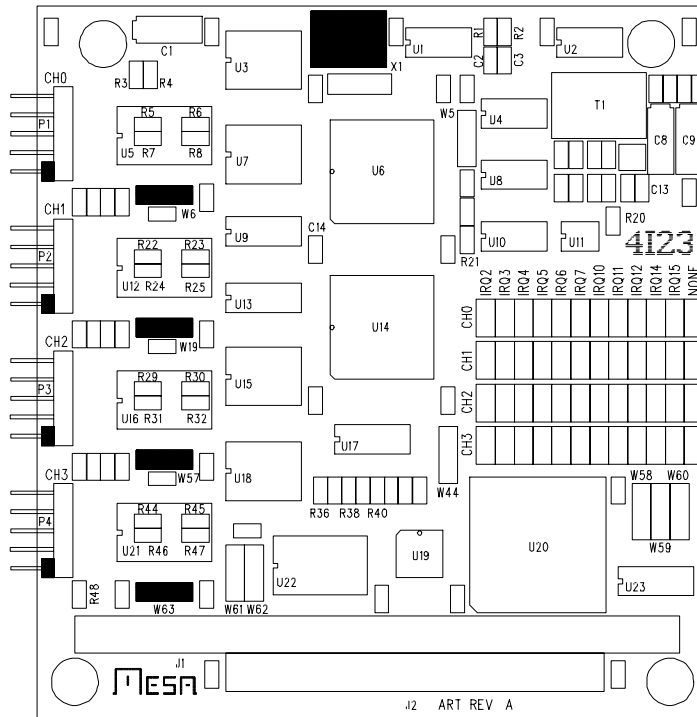
CONFIGURATION

RS-232 POWER

The 4I23 can use system +-12V power for the RS-232 ports or on card generated RS-232 power. This allows the 4I23 to operate in 5V only systems. To use on card RS-232 power, Jumpers W60 and W61 should be set in the down position. This is the default 4I23 jumpering. To use +-12V system power, jumpers W60 and W62 should be set in the up position. If you select system RS-232 power, be sure that the +12V and -12V power **NEVER** exceeds 13.5V or you may destroy the CMOS serial interface chips on the 4I23.

You should select system power when RS-232 powered peripherals are connected to the 4I23. This includes serial mice, trackballs, serial port powered modems, etc.

QUAD BAUD RATE SELECTION

The 4I23 is capable of operating at four times the normal baud rate on channels 2 and 3. To select the quad baud rate option, W5 is set to the up position. The normal baud rates are selected with W5 down.

CONFIGURATION

RS-232 POWER AND QUAD BAUD RATE JUMPER LOCATIONS
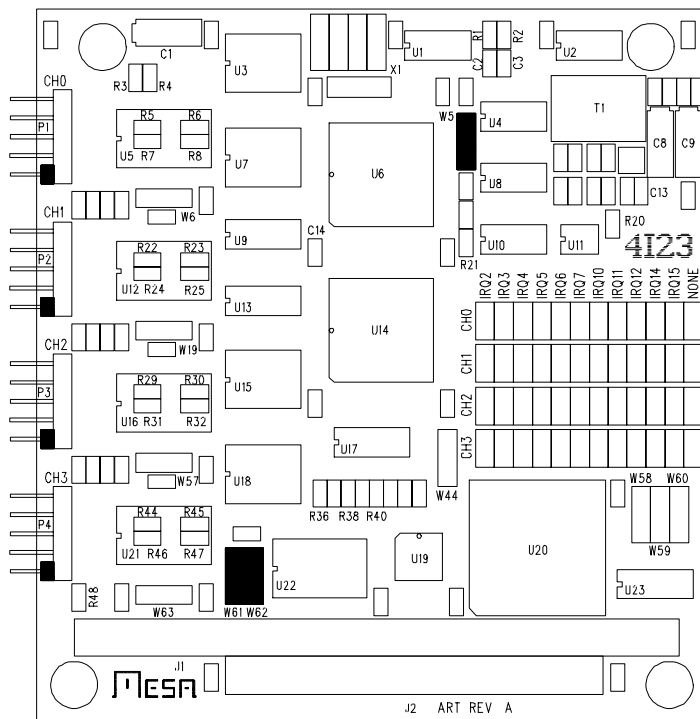
INSTALLATION

GENERAL

When the 4I23 has been properly configured for its application, it can be inserted into a PC/104 stack. The standoffs should then be tightened to secure the 4I23 in its place. When the 4I23 is secured in the stack the 10 pin headers can be plugged in from the side.

OPERATION

CONNECTOR PIN-OUT

When using the RS-232 interface, the 10 pin headers are normally terminated with IDC cables having 9 pin male DB9 connectors on the far end. When terminated this way, the 9 pin D connectors have the same pin-out as PC-AT type serial ports. When used in the RS-422 mode the pin-out is similar to the RS-422 secondary channel standard (RS-449). The pin numbers titled DB9 below reflect the 9 pin D connector pin numbers. The pin numbers titled HDR10 below reflect the 4I23 10 pin header pin numbers.

RS-232 CONNECTOR PIN-OUT:

DB9	HDR10	SIGNAL	FUNCTION
1	1	CD (Carrier Detect)	Control input to 4I23
2	3	RXD (Received Data)	Serial Data to 4I23
3	5	TXD (Transmitted Data)	Serial Data from 4I23
4	7	DTR (Data Term. Ready)	Control Output from 4I23
5	9	Ground	Signal Ground
6	2	DSR (Data Set Ready)	Control input to 4I23
7	4	RTS (Request To Send)	Control output from 4I23
8	6	CTS (Clear To Send)	Control input to 4I23
9	8	RI (Ring Indicator)	Control input to 4I23
NC	10	+5V (Header only)	Adapter power

RS-422 CONNECTOR PIN-OUT:

DB9	HDR10	SIGNAL	FUNCTION
1	1	Ground	Frame Ground
2	3	No Connection	
3	5	TXDA (Transmitted Data B)	Serial Data from 4I23
4	7	RXDA (Received Data A)	Serial Data to 4I23
5	9	Ground	Signal Ground
6	2	RXDB (Received Data B)	Serial Data to 4I23
5	4	RTS (Request To Send)	Control output from 4I23
8	6	CTS (Clear To Send)	Control input to 4I23
9	8	TXDB(Transmitted Data B)	Serial Data from 4I23
NC	10	+5V (Header only)	Adapter power

OPERATION

SHARED INTERRUPTS

Interrupts on the 4I23 can be combined (OR'ed) to allow sharing of interrupts by two or more serial channels. Interrupts can be OR'ed between the two or more channels on one card. Each shared interrupt can be individually masked via a common interrupt control register. When the 4I23 is first powered-up or reset, the shared interrupt feature is disabled, and interrupt operation is exactly the same as standard COMX ports.

To use shared interrupts, you must first route the shared interrupt output to the desired bus interrupt. This is done by setting jumper W44 to the down position. This connects channel 3's set of interrupt select jumpers to the shared interrupt driver. Then the desired bus IRQ for the shared interrupt is selected with channel 3's jumpers. The channels that will share an interrupt need to have their interrupt select jumper(s) set to the NONE position. Serial channels sharing an interrupt need to have their IRQ drivers enabled via setting the OUT2 bits of the respective channels (the normal way). The shared interrupt register must now be appropriately initialized to enable the shared interrupts.

When interrupts are or'ed, the interrupt service routine must determine which channel(s) caused the interrupt, and make sure that there are no pending interrupts from any other channel before returning.

The 4I23 utility disk has a OR'ed interrupt example program called 4I23OINT

SHARED INTERRUPT REGISTERS

The shared interrupt feature of the 4I23 is controlled by an 5 bit read/write parallel latch and a 5 bit read only status port. The interrupt bits are accessed at the location of the first serial channel + 8000H. For example: if the first serial port is located at 03F8H to 03FFH (the default location) the option bits would be accessed I/O addresses of 83F8H and 83F9. These addresses will not conflict with normal access to the 4I23.

Option bits are set or cleared by writing a 1 or 0 to the appropriate bit. The option bits can be read back by reading the option bit location. The data is read at bits 0..4, all other bits are undefined.

All bits are active high. After a system reset, all option bits are zeros, disabling all options. This leaves the 4I23 in a state that is compatible with standard COM X type serial ports.

OPERATION

SHARED INTERRUPT REGISTER

The following chart shows the bit definitions in the shared interrupt registers. BASE is the location of serial channel 1 + 8000H. All signals are active high (high true).

Write port @ BASE

BIT#	NAME	FUNCTION WHEN SET
0	IMASK0	Enables channel 0 or'ed interrupt
1	IMASK1	Enables channel 1 or'ed interrupt
2	IMASK2	Enables channel 2 or'ed interrupt
3	IMASK3	Enables channel 3 or'ed interrupt
4	SINTEN	Driver enable for shared interrupt

Read port @ BASE

BIT#	NAME	CURRENT LEVEL
0	INT0	Status of channel 0 interrupt
1	INT1	Status of channel 1 interrupt
2	INT2	Status of channel 2 interrupt
3	INT3	Status of channel 3 interrupt
4	1+PEND	One or more interrupts pending
5	2+PEND	Two or more one interrupts pending

Read port @ BASE + 1

BIT#	NAME	CURRENT LEVEL
0	IMASK0	Readback of IMASK0
1	IMASK1	Readback of IMASK1
2	IMASK2	Readback of IMASK2
3	IMASK3	Readback of IMASK3
4	SINTEN	Readback of SINTEN

OPERATION

RS-422 OPERATION

When RS-422 levels are used, the DCD, DSR, and RI (Data Carrier Detect, Data Set Ready, and Ring Indicator) input lines on each channel are not used. The DCD and DSR lines will be in the active state, and the RI line will be in the inactive state.

RS-485 OPERATION

The 4I23 can optionally be supplied with RS-485 capable driver and receiver chips. These chips have a wider operational common mode range than the RS-422 chips normally supplied. RS-485 drivers are also designed to not interfere with RS-485 bus operation when powered down. Because of these differences, RS-485 driver chips are more expensive than the RS-422 chips normally used. Contact MESA if you need the 4I23 supplied with RS-485 chips.

To connect the 4I23 to an RS-485 bus, you need to connect RXDA to TXDA and RXDB to TXDB. The RS485 I/O pair is then connected to TXDA and TXDB.

OPERATION

QUAD BAUD RATE OPERATION

The 4I23 is capable of operating at four times the normal baud rate on channels 2 and 3. The quad baud rate option is only useful with RS-422 (and RS485) ports. It connects the clock source of the channel 2 and 3 UARTs to 7.37 MHz instead of the standard 1.84 MHz. This allows baud rates of up to 460.8 K baud to be selected. Note that when using the double baud rate option, running standard software that initializes the serial port such as MODE, PROCOMM, etc. will result in baud rates that are exactly four times the selected value.

FIFO OPERATION

The 16C550 chips used in the 4I23 have a built in 16 byte receive and transmit FIFOs. These FIFOs can allow higher baud rates, or reduce the interrupt overhead in interrupt driven operation. The FIFOs are disabled at power up. Detailed FIFO operation is beyond the scope of this manual, but an example setup program 4I23FIFO is included on the 4I23 utility disk. For more information, see the National Semiconductor NS16550A data sheet, and their application note AN-491: The NS16550: UART Design and Application Considerations. National Semiconductors application note AN-493: A Comparison of the INS8250, NS16450 and NS16550AF Series of UARTs may also be helpful.

POWER CONSUMPTION

The 4I23 is capable of operating with quite low power consumption. The major portion of the supply current is consumed by the RS-422 driver and receiver chips plus the decode and interrupt sharing PALs. Low power RS-422 chips and PALs are available as an option. Please contact MESA if your application requires minimum power operation. Typical power consumption of a 4I23A (4 channel RS-232) is 50 Ma. with no load on the RS-232 outputs.

REFERENCE INFORMATION

SPECIFICATIONS

	MIN	MAX	UNIT
POWER SUPPLY			
Voltage	4.5	5.5	V
Supply current (RS-232 only)	---	50	mA
Supply current (RS-232 /RS422)	---	150	mA
Supply current (RS422 only)	---	250	mA
BUS LOADING:			
Input capacitance	---	15	pF
Input leakage current	---	5	uA
Output drive capability	150	---	pF
Output sink current	12	---	mA
RS232 INTERFACE LEVELS:			
RS-232 output voltage (local power)	+-5	+-12	Volts
(3.3k load -all outputs loaded)			
RS-232 output voltage (system power)	Vsys	Vsys-2	Volts
(3.3k load -all outputs loaded)			
ENVIRONMENTAL:			
Operating temperature range			
-I version	-40	+85	ºC
-C version	0	+70	ºC
Relative humidity	0	90	Percent
			Non-condensing

REFERENCE INFORMATION

WARRANTY

Mesa Electronics warrants the products it manufactures to be free effects in material and workmanship under normal use and service for the period of 2 years from date of purchase. This warranty shall not apply to products which have been subject to misuse, neglect, accident, or abnormal conditions of operation.

In the event of failure of a product covered by this warranty, Mesa Electronics, will repair any product returned to Mesa Electronics within 2 years of original purchase, provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may at its option, replace the product in lieu of repair.

With regard to any product returned within 2 years of purchase, said repairs or replacement will be made without charge. If the failure has been caused by misuse, neglect, accident, or abnormal conditions of operation, repairs will be billed at a nominal cost.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS, OR ADEQUACY FOR ANY PARTICULAR PURPOSE OR USE. MESA ELECTRONICS SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT, OR OTHERWISE.

If any failure occurs, the following steps should be taken:

1. Notify Mesa Electronics, giving full details of the difficulty. On receipt of this information, service data, or shipping instructions will be forwarded to you.

2. On receipt of the shipping instructions, forward the product, in its original protective packaging, transportation prepaid to Mesa Electronics. Repairs will be made at Mesa Electronics and the product returned transportation prepaid.

kREFERENCE INFORMATION

SCHEMATICS