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SL385 PC- CARD
USER'S GUIDE

REVISION HISTORY

ISSUE	PAGES	DATE	NOTES
1	15	28.05.2002	FIRST ISSUE
2	15	21.06.2002	Electrical spec details added

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1. OVERVIEW

The SL385 is a dual port multi-standard asynchronous serial card with the following features:

- Dual 16C550 industry standard UARTS.
- Switchable RS232 or RS422/RS485 mode on each channel.
- Switchable full or half-duplex RS485 mode per channel with in-card connection of TXD and RXD signals in half duplex mode.
- RS422 mode includes differential RTS and CTS modem control signals and permanently enabled TX driver and receiver.
- Switchable per channel between auto TX enable and RTS override TX enable when in RS485 half-duplex mode.
- Switchable local TX character echoing when in RS485 half-duplex mode (setting common to both ports).
- Hardware switchable x1 or x8 baud rate provides transmission rates up to 921.6Kbaud (setting common to both ports).
- Windows 95 (osr2), 98, 98SE, Me, 2000, XP compatible using O.S. standard drivers
- True multi-function Type II design.
- Works at 3.3V or 5V.
- Full hardware modem control line support on both ports
- Standard PC IO port decode for COM1 to COMn
- "Any" IO port and interrupt decode option for best PnP flexibility
- ESD protection on drivers and receivers.
- TX drivers fitted with short-circuit and thermal overload protection.
- Low power consumption
- Full fail-safe open/short circuitry on RS422/RS485 inputs.
- Supplied with 300mm dual DB25-male terminated cable with "standard" COM port pin-out.

This guide aims to familiarise you with the way that the SL385 works and so will help you to maximise its performance in your application.

Elan will be happy to quote for either customisation of the SL385 if its exact specifications do not quite meet your needs, or to create complete application software.

2. ABOUT THE SL385

The SL385 card is a dual port multi-standard asynchronous serial card using Elan's own 16550 compatible UART ASIC device, called the VPU16550. The serial data and control lines on both ports are buffered using ESD protected, hardware configurable RS232/RS422/RS485 multi-protocol transceivers.

Industry standard baud rates up to 115.2K baud are supported, together with 16-byte deep TX and RX FIFOs. Additionally DIP switches on the rear of the card allow selection of "x1" or "x8" baud rate multipliers for each port. This feature allows up to 921KBaud operation without needing special device drivers on the host. In x8 mode you simply multiply the setting shown on the host by 8 to get the real serial data rate (e.g. 19200 Baud set on host with x8 mode gives 153600Baud true rate in hardware). See section 5 for the switch settings.

Along with the baud rate multiplier, the DIP switches on the rear of the card also control the selection of the following:

- RS232 or RS422/RS485 mode
- Half or full duplex in RS485 mode
- Auto TX enable or RTS override TX enable in RS485 half duplex mode
- Local TX character echo enable/disable in RS485 half-duplex mode.

Both UARTs run from the same internal clock source and are hence synchronous to each other.

For further information about the VPU16550, please refer to the data sheet available from our website, http://www.pccard.co.uk

3. INSTALLING THE SL385

3.1 DOS & Windows 3.1x, NT4

The SL385 is not suited to use in DOS or Windows 3.1x because it is a true multi-function PC-Card. 3rd party Card and Socket Services drivers for such cards do not exist (multi-function cards were defined sometime during Windows95 roll-out and correspondingly DOS drivers were not updated and were left to support only single function cards). This is simply a function of available software and is NOT a shortcoming of the SL385 hardware.

A similar situation is found with Windows NT4 although it is more likely that 3rd party tools may exist to support this O.S.

3.2 Windows 95, 98, 98SE, Me, 2000, XP

The "generic" serial drivers in these Operating Systems support the SL385. No extra driver software is needed but you will need to install Card Center Pro to get the SL385 registered with the O.S. Simply run SETUP and follow the instructions given. Note that you **must** reboot the PC after installation, to allow the COM ports to be assigned port numbers by the O.S.

Note that for Win9x and Me the port numbers assigned **cannot** be changed and are a function of the other ports you have in your system.

Special Note for Windows2000 and XP:
These O.S.' allow you to change the COM port numbers. Go to the Device Manager and expand the Ports branch. There you will find the "First SL385 Com Port" and "Second SL385 Com Port". Double click on either of these and use the Properties page to adjust the COM port numbering that Windows assigned by default. You will also find that 2000 and XP assign default port numbers that are "backwards" i.e. the "First" port gets the higher COM number…this is because the O.S. enumerates the ports on the SL385 in reverse order. You are free to change these as described however.

3.3 Windows CE, PocketPC

The SL385 will not work in either of these O.S.' because of a limitation in the handling of true multi-function PC-Cards.

4. SL385 REGISTER INTERFACE

Full details of the SL385's register interface can be found in the VPU16550 data sheet, available at Elan's website

http://www.pccard.co.uk

5. HARDWARE SPECIFICATION

5.1 PINOUT

The SL385 is supplied with a 300mm long Type 48 cable that terminates with two DB25 Male connectors with female screwlocks. When the SL385 is used in RS232 mode, the pin-out matches that of a standard comms port.

The pin-outs below apply to **both** of the SL385 DB25 male connectors on the supplied cable.

BOTH DB25 COM PORT PINOUTS (MALE) – RS232 MODE

PIN	NAME	FUNCTION
1	-	-
2	TXD	Transmit Data output
3	RXD	Receive Data input
4	RTS	Request To Send output
5	CTS	Clear To Send input
6	DSR	Data Set Ready input
7	GND	GROUND
8	DCD	Data Carrier Detect input
9	-	-
10	-	-
11	RTS+	RS422 output. Held low in RS232 Mode
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	DTR	Data Terminal Ready output
21	-	-
22	RI	Ring Indicate input
23	-	-
24	-	-
25	-	-

BOTH DB25 COM PORT PINOUTS (MALE) – RS422/RS485 MODE

PIN	NAME	FUNCTION
1	-	-
2	TXD-	Transmit Data inverting output
3	RXD+	Receive Data non-inverting input
4	RTS-	Request To Send inverting output
5	CTS+	Clear To Send non-inverting input
6	CTS-	Clear To Send inverting input
7	GND	GROUND
8	RXD-	Receive Data inverting input
9	-	-
10	-	-
11	RTS+	Request To Send non-inverting output
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	TXD+	Transmit Data non-inverting output
21	-	-
22	RI	RS232 input. Receiver disabled in RS422/RS485 Mode
23	-	-
24	-	-
25	-	-

Note: " – " indicates no-connect.

5.2 ELECTRICAL

All figures quoted are typical parameters @ 25°C

RS232 SIGNALS:	Minimum output level ±5.0V
RS422 SIGNALS:	Minimum differential output level 2V
RS485 SIGNALS:	Minimum differential output level 1.5V
ESD PROTECTION:	All RS232/RS422/RS485 signal lines on the SL385 card are protected against electrostatic discharge (ESD) to 2kV.
UART CLOCK SPEED:	Switch selectable Baud rate multiplier per port: x1: UART CLOCK is 1.8432MHz ->115.2KBaud max. x8: UART CLOCK is 14.7456MHz->921.6KBaud max.

5.3 POWER SUPPLY

All figures quoted are typical parameters @ 25°C

SUPPLY VOLTAGE:	3.3V or 5V.
SUPPLY CURRENT:	25mA typical at 5V with no connections. 55mA typical at 5V, RS232 mode, 921KBaud TX & RX both ports. 70mA typical at 5V, RS422/RS485, 921KBaud TX & RX both ports.

5.4 MECHANICAL

MASS:	12g typical.
FORM FACTOR:	TypeII PC-Card

5.5 ENVIRONMENTAL

HUMIDITY:	<80% non-condensing
TEMP:	0-50°C ambient

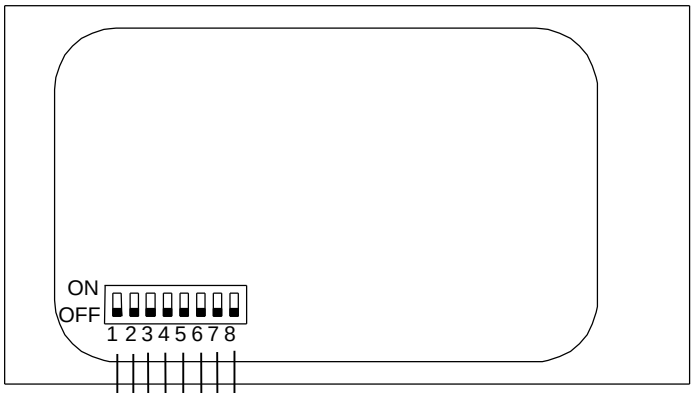
5.6 NOTES ON SERIAL DATA THROUGHPUT

The maximum serial baud rate of 921KBits/sec does not imply that the maximum sustained throughput rate of the serial port will be as high. The actual throughput rate that can be achieved depends on many factors including the host PC speed, the serial data source's data block size and whether the block are "back-to-back", whether the interrupt in use on the host is being shared by other devices leading to increased latency etc.

As a simple rule of thumb, using the standard serial drivers on a fast PC will allow throughput rates of 400-600KBits/sec although these rates can't be guaranteed and will be application specific.

5.7 SL385 MODE CONFIGURATION

The SL385 can be configured using a small bank of DIP switches arranged at the rear of the PC-Card. The diagram below shows the function of each switch. The switches should be set to the desired mode of operation before the card is inserted and used.



SW	OFF	ON
8	RS232 Mode (port 2)	RS422/RS485 Mode (port 2)
7	Full Duplex (port 2)	Half Duplex (port 2)
6	RTS TX Enable (port 2)	Auto TX Enable (port 2)
5	Local TX Echo On (common)	Local TX Echo Off (common)
4	Baud x8 (common)	Baud x1 (common)
3	RTS TX Enable (port 1)	Auto TX Enable (port 1)
2	Full Duplex (port 1)	Half Duplex (port 1)
1	RS232 Mode (port 1)	RS422/RS485 Mode (port 1)

Figure 5.7-1 SL385 DIP Switch Settings

5.7.1 RS232 or RS422/RS485 Mode Selection

Switches 1 and 8 control the protocol selection for ports 1 and 2 respectively. When set to RS232 mode, the pin functions on the appropriate DB25 connector conform to those of a standard computer comms port. In addition to the TXD and RXD signals, all of the modem control signals are available.

When set to RS422/RS485 mode, the pin functions are multiplexed to provide differential serial transmit and receive signals. In addition,

the modem control signals RTS and CTS are available in differential form.

5.7.2 Full or Half Duplex Selection

Switches 2 and 7 control the duplex selection for ports 1 and 2 respectively when in RS422/RS485 mode. When set to half duplex, the receiver inputs for the RXD and CTS signals are connected internally to the driver outputs of the TXD and RTS signals respectively. The RXD and CTS pins themselves however become open circuit, so all connections in half-duplex mode should be made via the TXD and RTS pins.
The duplex selection switches have no effect when the ports are in RS232 mode.

5.7.3 RTS or Auto TX Enable Selection

Switches 3 and 6 control the TXD driver enable signal selection for ports 1 and 2 respectively when in RS485 half duplex mode. When set to RTS, the transmitter is enabled when the RTS signal of the UART is asserted. The transmitter is tri-stated when the RTS signal is de-asserted.
If the TX Enable Selection switch is set to Auto, the TXD driver is automatically enabled by the hardware only when data is in the process of being transmitted.

5.7.4 Local TX Echo On/Off Selection

Switch 5 controls the local TX echo on/off selection. This setting is common to both ports. When Echo is set to on, the card not only receives data from other devices, it also receives echoes from its own transmitter.
By setting echo to off, the TX Enable signal is used to disable the local receiver when the TXD driver is activated.

NOTE: Only set Local TX Echo to off when in RS485 Half-Duplex mode. Because the TXD driver is always activated when Full Duplex mode is selected, the receiver would always be disabled if echo was set to off in this mode.

5.7.5 Baud Rate Multiplier Selection

Switch 4 controls the Baud rate multiplier selection. This setting is common to both ports. The table below illustrates the baud rate values available for each position of the switch:

HOST SETTING	SWITCH = x1	SWITCH = x8
300	300	2400
1200	1200	9600
2400	2400	19200
4800	4800	38400
9600	9600	76800
19200	19200	153600
38400	38400	307200
57600	57600	460800
115200	115200	921600

6. USING THE SL385 CARD IN RS422/RS485 MODE

6.1 TERMINATION

RS422 and RS485 lines should be terminated at the end of the main branch of the receiver with the cables characteristic impedance. These terminating impedances reduce signal reflections at the cable end. It is not necessary to terminate the transmitter end of the cable. The most common method of termination is to install a terminating resistor, typically with a value of 120 Ohm, at a single receiver.

The SL385 does not have internal terminating resistors fitted as standard. If required, a 120 Ohm resistor should be connected between the RXD+/- pins of the DB25 connector for full-duplex operation and across the TXD+/- pins in half-duplex mode. For RS422 applications, a terminating resistor will also be required between the CTS+ and CTS- pins.

6.2 FAIL SAFE PROTECTION

When an RS422/RS485 bus is shorted, open circuited, or idle, the differential bus voltage will go to zero. Unfortunately, this is in the middle of the specified RS422/RS485 receiver threshold range of +/- 200mV, so the receiver output state is indeterminate under both fault conditions and when no driver is actively driving the bus.

The SL385 card overcomes these problems by using transceivers with a precise receiver threshold range of –50mV to –200mV. If the differential receiver input voltage is greater than –50mV or less than –200mV, the receiver output is logic high or logic low respectively. In the case of a terminated bus with all transmitters disabled, the receivers differential input voltage is pulled to GND by the termination. This results in a logic high with a 50mV minimum noise margin.

6.3 TXD AND RTS DRIVERS

The RTS signal driver on the SL385 is always enabled when in RS422/RS485 mode, regardless of any other setting.

In addition to the standard method of tri-stating the TXD signal in RS485 mode using the RTS signal, the SL385 incorporates an automatic tri-state feature. The driver is enabled only when data is in the process of being transmitted. This mechanism removes the burden of flow control from the application software.

Note that when multiple characters are transmitted “back-to-back” the output drivers stay active for the entire duration of the transmission i.e. the drivers do not go in and out of tri-state for each character in a multi-character block.

6.4 RS422 OPERATION

Generally, in RS422 systems, all 8 signal lines from the DB25 connector are used. Thus 4 twisted pair cables are used, one pair for each of the 4 signals TXD, RXD, RTS and CTS. The RS422 arrangement allows data to be transmitted and received simultaneously since each signal has its own twisted pair.

6.5 RS485 OPERATION

The SL385 can be used for both half-duplex (one twisted pair) and full-duplex (two twisted pairs) arrangements. In half-duplex mode, the link between the TXD and RXD signals is made internally.

The handshaking signals RTS and CTS, although driven by the card, are usually not connected to another node. However, if required by the application software, to force the CTS signal input on the SL385 true, the RTS signals must be looped back to the CTS inputs. In half-duplex mode, this link is made internally by the card. In full-duplex mode however, the link must be made externally.