

Not Recommended for New Installations.

Please contact Technical Support for more information.

Single Channel 20 mA Current Loop Serial Card

Models CLCC1 & CLICC1
Documentation Number CLCC2595

Each of these models is a current loop serial card and uses the same printed circuit board. The model CLICC1 is equipped with an isolated DC-DC converter that allows the board to be configured as an active current loop interface without any external power supplies.

This product

**Designed and Manufactured
In Ottawa, Illinois
USA**

of domestic and imported parts by

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Chapter 1: GENERAL INFORMATION

Introduction

The B&B Electronics' current loop serial interface cards are designed for the IBM PC, XT, AT and compatibles.

The cards can be configured for any address and any available interrupt as well as the standard COM1 - COM4 addresses and interrupts. To use one of the "non-standard" addresses or interrupts, the serial software used must also offer that flexibility. If you are writing your own application, be sure the communications routines used support any address and IRQ. B&B Electronics' SimpCom Communications Drivers support these features.

Features

- Switch selectable addresses, from 0 to hex 3F8, including COM1 - COM4
- Jumper selectable interrupts: 2, 3, 4, 5, 6, 7, 10, 11, 12, 14, and 15
- Supports TD and RD lines
- Loop current up to 60 mA with modification
- Baud rates to 38,400 baud

Specifications

Bus: IBM PC ISA Bus

Slot: Requires 1 full length slot for complete IRQ selectability. When installed in a short slot, IRQs 10-15 will not be available.

Dimensions: 3.7 x 6.2 inches

I/O connection: 25 pin male D-sub connector

Baud rates: 1 - 38,400 Baud

Character length: 5, 6, 7, or 8 bits

Parity: Even, odd or none

Stop bits: 1, 1.5, or 2

Interrupt: IRQ 2, 3, 4, 5, 6, 7, 10, 11, 12, 14, or 15

Address: Switch programmable, 0 to hex 3F8

Transmit Circuit

Device: CNY17 - III optical isolator

ON Voltage Drop: 0.4 V maximum

Breakdown Voltage: 70 V

Receive Circuit

Device: 6N135 optical isolator

Voltage Drop: 1.8 V maximum

Maximum Power Requirements:

CLCC1: +5 VDC, 150 mA 0.75 W

CLICC1: +5 VDC, 480 mA 2.40 W

Chapter 2: INSTALLATION

Inspection

Your CLCC1/CLICC1 serial card has been tested for proper operation. It should be in perfect mechanical and electrical condition upon receipt.

Remove the card from its protective packaging. Handle the card only by its edges being careful not to touch the gold connection fingers. Save the packaging for storage or shipping if the card needs repair.

Address Switch Setup

The cards are factory configured for COM1, IRQ4, and passive mode. If you plan on installing the card as standard COM1, you may skip to the Current Loop Operation section of this manual.

The cards use a 7 position DIP switch to program the binary I/O address of each port on the card. Figure 1 is a drawing of the printed circuit board that shows the locations of the setup switches and jumpers on the current loop cards.

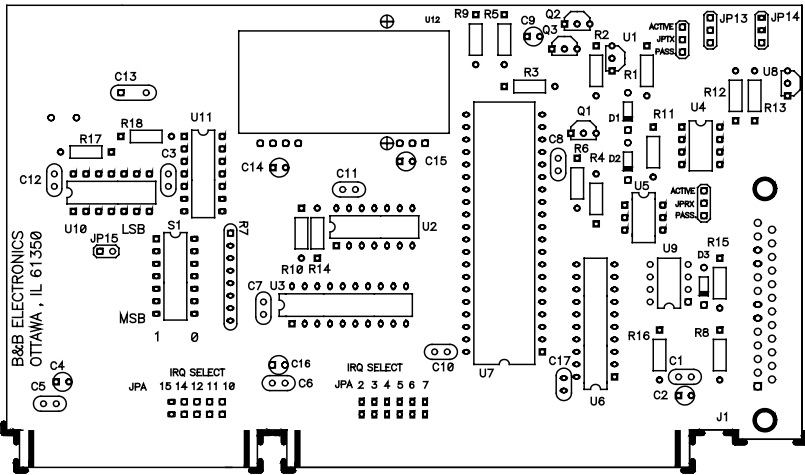


Figure 1. Silk Screen Plot of CLCC1 PCB

Switch S1 configures the I/O address of the port. Switches represent a binary 0 in the ON position, binary 1 when OFF. Least significant bit (LSB) and most significant bit (MSB) are labeled on the card. Table 1 shows the numerical weight and electrical connection of each switch position.

Table 1. Address Switches

switch position	7	6	5	4	3	2	1
bus connection	SA9	SA8	SA7	SA6	SA5	SA4	SA3
decimal weight	512	256	128	64	32	16	8
hex weight	200	100	80	40	20	10	8

To install the CLCC1 or CLICC1 card as COM1, 2, 3, or 4, follow the switch settings shown in Table 2.

Table 2. Standard Port Addresses

	Base Hex Address	Binary Equivalent	Switch Settings	
			MSB	LSB
COM1	3F8	1111111000	1	1
COM2	2F8	1011111000	1	0
COM3	3E8	0111111000	0	1
COM4	2E8	0011111000	0	0

ON = 0 OFF = 1

If you already have COM1 - 4 installed, or simply wish to install at another address, refer to Table 3 for a list of frequently unused I/O addresses.

Table 3. Frequently Unused Port Addresses

Base Hex Address	Binary Equivalent	Switch Settings		I/O Space Description
		MSB	LSB	
200	1000000000	1000000		game port
208	1000001000	1000001		game port
300	1100000000	1100000		prototype
308	1100001000	1100001		prototype
310	1100010000	1100010		prototype
318	1100011000	1100011		prototype
380	1110000000	1110000		SDLC
388	1110001000	1110001		SDLC
3A0	1110100000	1110100		bisync com
3A8	1110101000	1110101		bisync com

If you want to install at another address, follow the procedure below.

1. Select the address: Using an I/O port usage table (one is included in Appendix A) select an unused hex address space. Note that the serial card occupies 8 bytes of I/O space. Use caution when selecting a "non-standard" port address. It is very important that nothing else is installed at the selected address.
2. Convert the hex address to its binary equivalent.
3. Throw away the 3 least significant bits.
4. The remaining 7 digits represent the switch address. 1's represent an OFF switch. 0's represent an ON switch.

Interrupt Jumper Setup

The current loop cards allow the use of interrupts (IRQ) 2, 3, 4, 5, 6, 7, 10, 11, 12, 14, and 15. Table 4 shows the standard serial port IRQ settings.

Table 4. Standard IRQ settings

COM1	IRQ4
COM2	IRQ3
COM3	IRQ4
COM4	IRQ3

Notice that only two interrupts are assigned to the serial ports. "Sharing" interrupts is not a good idea if both ports may be used at the same time. Table 5 is a reference for hardware interrupts in AT and XT type machines.

Table 5. Hardware Interrupts

IRQ	AT machines	XT machines
2	routed to IRQ controller 2	reserved
3	serial port COM2,4	serial port COM2,4
4	serial port COM1,3	serial port COM1,3
5	LPT2	hard disk
6	floppy disk	floppy disk
7	LPT1	parallel printer port 1 (LPT1)
8	real-time clock	not available
9	re-directed to IRQ2	not available
10	unassigned	not available
11	unassigned	not available
12	unassigned	not available
13	coprocessor	not available
14	hard disk	not available
15	unassigned	not available

Select an interrupt that is unused on your machine, and that is supported by your software. Move the IRQ select jumpers to the corresponding pins of JP1 for each port.

Current Loop Operation

The current loop serial interface is unique in that it uses the switching of current flow rather than voltage levels to carry data. There are many variations of digital current loops in use ranging from 60 mA to 20 mA and from 105 VDC and down. Most current loop equipment operates at 20 mA with open circuit voltages around 12 VDC.

In current loop operation, the absence of current indicates a logic 0, sometimes referred to as *spacing*. Logic 1's are represented by the flow of current (for example 20 mA). This is the idle state for a current loop interface, and is called *marking*. Data is created when the transmitter switches the current on and off. The receiver simply monitors whether or not there is current flowing.

A current loop transmitter can be thought of as an on/off switch, and a receiver is a light emitting diode (LED) which turns on when current flows, and off when current is absent. With this model in mind, the missing component is the current source. The current source can be added anywhere in the loop, the transmitter or receiver. The end of the loop which has the current source is ACTIVE. The other side of the loop must then be PASSIVE.

With this background, there are two basic rules when making a current loop connection:

1. Transmitters must always be connected to receivers and vice versa.
2. An ACTIVE port must be connected to a PASSIVE port.

The first step in making the connection then is determining which port is active and which is passive. On one piece of equipment, the transmitter may be active and the receiver passive. It's not safe to assume that both are the same. If the instruction manual for the equipment isn't available, active and passive ports can be determined with a DC voltmeter. Check for DC voltage across the output or input pairs. The presence of a voltage indicates an active loop.

The CLCC1 and CLICC1 card's transmitters and receivers can be configured as active or passive independently allowing the user to match them with any piece of current loop equipment.

Current loop interfaces normally consist of four wires. They are usually labeled T+, T-, R+, and R-. The T+ and T- pair is the transmitter that switches the flow of current. The R+ and R- pair is the receiver that monitors current flow.

Current Loop Configuration

Two jumpers are used to configure the current loop. JPTX configures the transmit current loop as active or passive. JPRX configures the receive current loop as active or passive. Note that model CLCC1 may only be used in active mode if an external power supply is connected through the DB25 connector. Figure 2 is an example of how to wire the CLCC1 to configure both TX and RX as active.

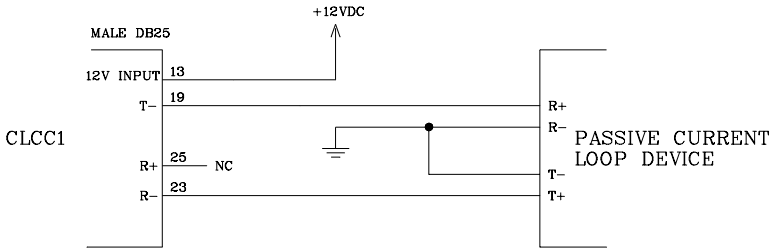


Figure 2. CLCC1 Wired as Active

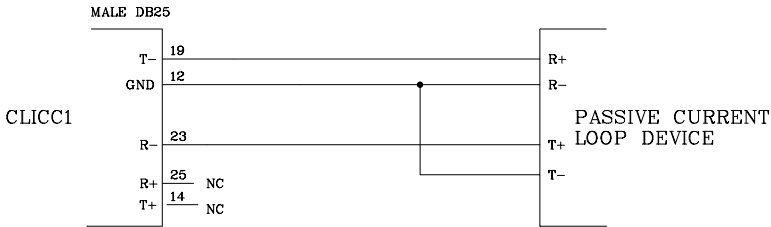


Figure 3. CLICC1 Wired as Active

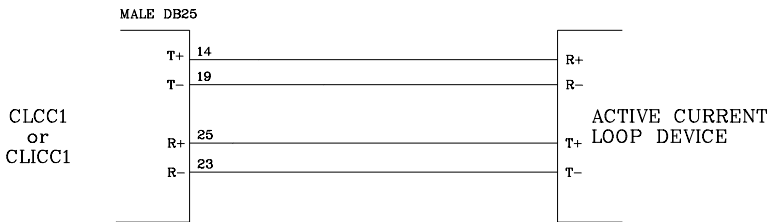


Figure 4. CLCC1 and CLICC1 Wired as Passive

Installing the Card

1. Turn the power to your computer off.
2. Remove the cover of the computer.
3. Pick any full length (16 bit) unused slot. Although the card will work in a short (8 bit) slot, IRQ's 10-15 will not be available.
4. Remove the expansion slot cover, save the screw for installation of the card.
5. Install the CLCC1 or CLICC1 card into the unused slot. Be certain that the card is inserted completely into the slot.
6. Secure the card with the mounting screw.

Pinouts

Table 6. Pinout Description

Pin	Name	Description
12	Gnd	Isolated signal ground
13	+12Vin	12V input (CLCC1 active mode only)
14	T+	Transmit Data +
19	T-	Transmit Data -
23	R-	Receive Data -
25	R+	Receive Data +

Chapter 3: IF YOU HAVE TROUBLE

Troubleshooting

If you are unable to communicate with the card from your software:

1. Consult your software manual to be sure it supports the address and interrupt that you have configured.
2. Double check that the address and interrupt are properly set.
3. Try another software package for troubleshooting. Windows 3.1 terminal program and Procomm Plus are two popular applications that can be used to communicate with any address and most interrupts.
4. There is a terminal program on the B&B Electronics website www.bb-elec.com that can be used to verify the setup of any serial card. Instructions for downloading and using the program are listed in Appendix B.
5. Check the loop current. If available, use an ammeter to check that the current in each loop is approximately 20 mA under idle conditions. If no current is indicated, check that one end of each loop is configured as an active port.
6. Call B&B Electronics' Technical Support. Technicians are available at (815) 433-5100 to answer your questions from 8 a.m. – 5:00 p.m. weekdays (Central Time).

Appendix A: Hardware I/O Map

Table A.1 I/O map of XT class machines

hex address	Address function in XT class machines
000-00F	DMA controller (8237A)
020-021	interrupt controller (8259A)
040-043	timer (8253)
060-063	PPI(8255A)
080-083	DMA page register (74LS612)
0A0-0AF	NMI - non maskable interrupt
200-20F	game port joystick controller
210-217	expansion unit
2E8-2EF	COM4 serial port
2F8-2FF	COM2 serial port
300-31F	prototype card
320-32F	hard disk
378-37F	parallel print
380-38F	SDLC
3B0-3BF	MDA - monochrome adapter and printer
3D0-3D7	CGA - color graphics adapter
3E8-3EF	COM3 serial port
3F0-3F7	floppy diskette controller
3F8-3FF	COM1 serial port

Table A.2 Hardware I/O map of AT class machines

000-01F	DMA controller #1 (8237A-5)
020-03F	interrupt controller #1 (8259A)
040-05F	timer (8254)
060-06F	keyboard (8042)
070-07F	NMI - non maskable interrupt & CMOS RAM
080-09F	DMA page register (74LS612)
0A0-0BF	interrupt controller #2 (8259A)
0C0-0DF	DMA controller #2 (8237A)
0F0-0FF	80287 math coprocessor
1F0-1F8	hard disk
200-20F	game port joystick controller
258-25F	Intel Above Board
278-27F	parallel printer port 2
2E8-2EF	COM4 serial port
2F8-2FF	COM2 serial port
300-31F	prototype card
378-37F	parallel printer 1
380-38F	SDLC or bisync com 2
3A0-3AF	bisync com 1
3B0-3BF	MDA - monochrome adapter
3BC-3BE	parallel printer on monochrome adapter
3C0-3CF	EGA - reserved
3D0-3D7	CGA - color graphics adapter
3E8-3EF	COM 3 serial port
3F0-3F7	floppy diskette controller
3F8-3FF	COM1 serial port

Any eight byte space not used by one of the devices listed in the table and not used by any other equipment in your system may be used for the serial port.

Appendix B: Troubleshooting with SimpDemo

B&B Electronics BBS is available 24 hours a day.
(815) 434-2927
300, 1200, 2400 Baud, N, 8, 1

The file SimpDemo.EXE was written as a demonstration of B&B Electronics SimpCom serial port driver software. The demo program is a terminal program that can be used to communicate with one or two ports, installed at any address using any interrupt.

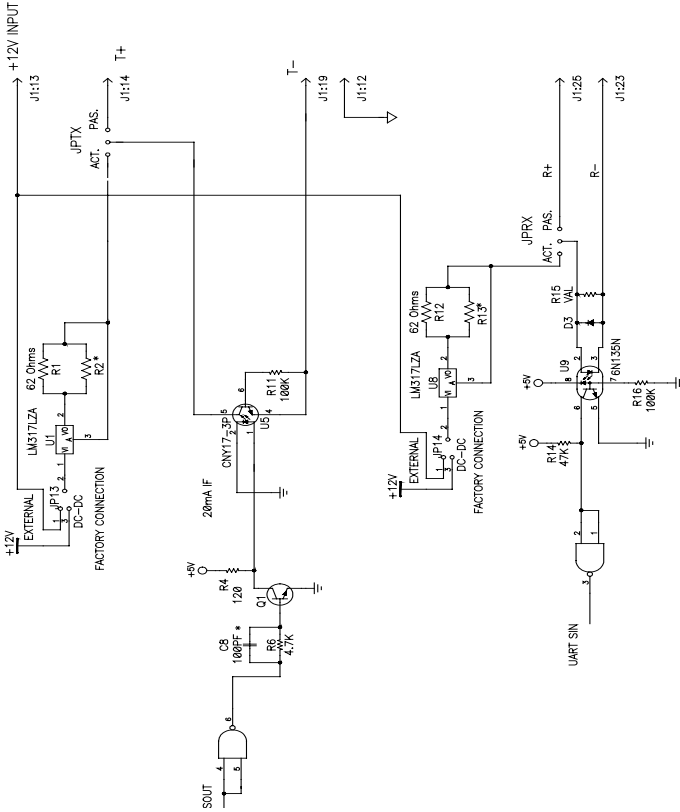
To obtain SimpDemo, download the self extracting file SIMPTEST.EXE from the BBS

To test your address and IRQ settings with SimpDemo:

With the serial card installed, run SimpDemo. The first screen allows the user to set the address and IRQ of each port. Change the parameters to match your serial card. The F1 key installs the first port. F2 installs the second port. F10 starts the communications drivers. After pressing F10, the program will give a response verifying the type of UART present. If the address set on the card doesn't match the address specified in SimpDemo, a *No UART Found* message will appear. If the IRQ is not correctly set, a *Bad IRQ Specified* message will appear.

Either one of these responses indicates that the switch or jumper settings are incorrect.

Appendix C: I/O Schematic



* RESISTORS CAN BE SELECTED FOR DESIRED CURRENT VALUES
PARTS WITH * DESIGNATOR ARE NOT STUFFED

Appendix D: Modifying the Loop Current

The CLCC1 and CLICC1 cards are configured at the factory for a loop current of 20 mA. The loop current can be modified, up to 60 mA, with several modifications to the board.

1. Current source modification (only needed for channels configured as ACTIVE).

A constant current source is used for each channel. The value of the loop current can be modified by changing a resistor on each circuit. R1 determines the loop current for the transmitter and R12 determines the loop current for the receiver. To calculate the new resistor value use the following equation.

$$R_{\text{new}} = 1.2 / I_{\text{loop}}$$

The printed circuit board has been designed with an extra resistor in parallel with R1 and R12. You may simply cut out R1 and install the new resistor in the space marked R2 for the transmit circuit. In the receive circuit, cut out R12 and install the new resistor in R13.

2. Driver circuit modification

The forward current of the driving optical isolator must be equal to or slightly greater than the loop current. For a loop current of 30 - 40 mA replace R4 with a 100 ohm resistor. For a loop current of 40 - 50 mA, replace R4 with a 82 ohm resistor. For a loop current of 50 - 60 mA, replace R4 with a 68 ohm resistor.

3. Receiver circuit modification

Some of the current in the receive circuit must be shunted through a resistor to protect the receiving optical isolator. Approximately 10 - 15 mA should flow through the optical isolator. the remaining loop current should be shunted through R15. Use the following equation to pick a value for R15.

$$R15 = 1.5 / (I_{\text{loop}} - .015)$$

Replace R15 with the value closest to that calculated.