



SEPTEMBER 1998

CL050A

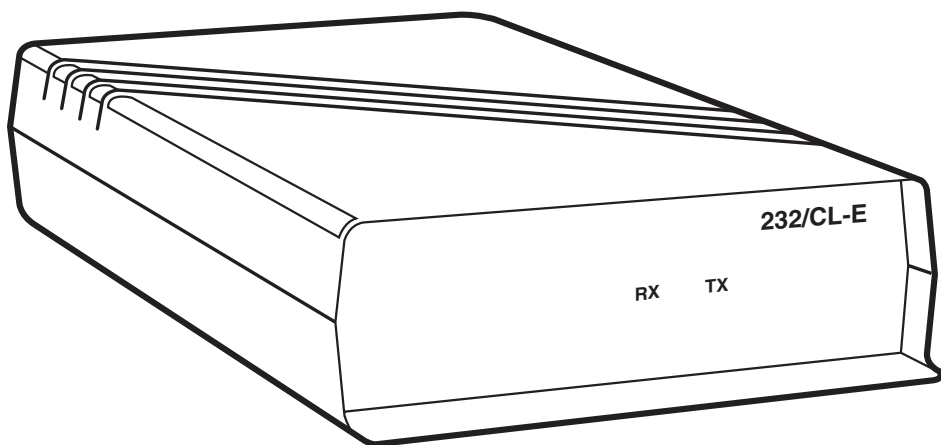
CL050A-R2

CL050C

CL050AE

RM005

RS-232 ↔ Current Loop Interface Converter (232/CL-E)



**CUSTOMER
SUPPORT
INFORMATION**

Order **toll-free** in the U.S. 24 hours, 7 A.M. Monday to midnight Friday: **877-877-BBOX**
FREE technical support, 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**
Mail order: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
Web site: www.blackbox.com • E-mail: info@blackbox.com

**FEDERAL COMMUNICATIONS COMMISSION
AND
CANADIAN DEPARTMENT OF COMMUNICATIONS
RADIO FREQUENCY INTERFERENCE STATEMENTS**

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par le ministère des Communications du Canada.

NORMAS OFICIALES MEXICANAS (NOM)

ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

TRADEMARKS

All applied-for and registered trademarks are the property of their respective owners.

CONTENTS

1. Specifications	8
2. Introduction	9
3. Installation	10
4. The Current-Loop Interface	11
4.1 Testing for Other Active Devices on the Current Loop	11
4.1.1 LED Test	11
4.1.2 Voltmeter Test	12
4.2 Connecting the Current Loop Wires to the CL050A	12
4.2.1 4-Wire Current Loop	12
4.2.2 2-Wire Current Loop	13
4.3 Switch SWA	17
4.4 Switch SWB	17
5. The RS-232C Interface	18
5.1 The RS-232C Interface Pinout	18
5.2 Switch SWC	19
5.2.1 DCE	19
5.2.2 DTE	19
6. Operations and Troubleshooting	20
6.1 Indicators	20
6.2 Self Test	21
7. Current Loop Rack and Cards	22
7.1 Description	22
7.2 Specifications for RM005	23

1. Specifications

Connectors —	RS-232/CCITT V.24: DB25 (female) Current Loop: 4 screw terminals
Indicators —	(2) LEDs indicating RS-232 port activity: RX for Receive Data from an RS-232 external device TX for Transmit Data to an RS-232 external device
Switches —	10-position DIP switch for current-loop transmission mode 10-position DIP switch for RS-232 DTE or DCE configuration 4-position DIP switch for electrical current in the current loop
Maximum Transmission	
Distance —	(based on using 24-AWG solid copper wire): at 9600 bps: 300 to 400 meters (984 to 1,312 feet) at 300 bps: 1000 to 3000 meters (3,281 to 9,843 feet)
Power —	Input — 115/220 VAC, 50 to 60 Hz, 12W Output — 18 VAC, center tapped, 8VA
Size —	1.75"H x 5.5"W x 8.5"D (4.4 x 14 x 21.6 cm)
Weight —	1.5 lb. (0.7 kg)

CAUTION

Make sure you have the right power supply for your local power. If not, call Technical Support to get a replacement power supply.

2. Introduction

The RS-232 ↔ Current Loop Interface Converter (CL050) is a bidirectional self-contained unit that enables the interconnection of a digital 20/30/60mA unipolar current-loop interface with an RS-232 interface. The CL050 cannot be used with an analog current loop (4 to 20 mA) or bipolar current loop.

Current loop was designed to transfer data in a noisy environment with as much integrity as possible. The maximum distance that the CL050 can be placed from other devices on the current loop (see **Chapter 1**) is based on using 24 AWG under ideal conditions, with the CL050 designated as the active device in a point-to-point configuration.

The CL050 can act as either an active or passive device on the current loop. As an active device, the CL050 supplies 20, 30, or 60 ma loop current at 18 VDC for operation. As a passive device,

the CL050 will not supply loop current, but it will operate with 20, 30, or 60 ma unipolar current at up to 30 VDC.

WARNING!

Only one device on the current loop may be active. If more than one device is active, each of the devices will be permanently damaged.

Refer to **Sections 4.1** and **4.2** for instructions on testing the current loop and connecting it to the CL050.

Switch selections allow for half-duplex or full-duplex operation; 20, 30, or 60 mA loop current; and configuring the CL050 as either DTE or DCE.

Two LEDs monitor data flow.

If you ordered the CL050A-R2, you should have received cables with it.

A 220-volt power supply (CL050E) is also available.

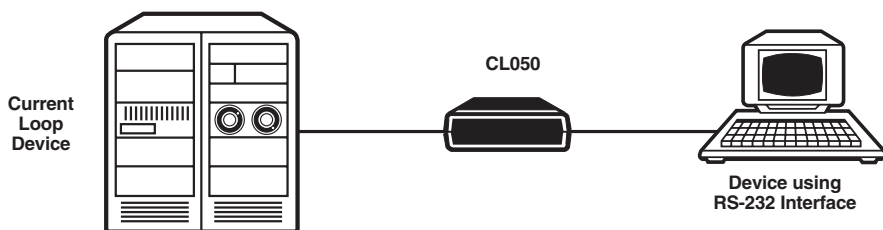


Figure 2-1. With the CL050, you can interconnect a current loop interface and an RS-232 interface.

3. Installation

1. Remove the screw located at the center of the bottom cover.
2. Remove the top cover.
3. Lift the back panel from its guide.
4. Insert the power supply receptacle into the 4-prong plug (See Figure 7-1 on page 16. The 4-prong plug is near W1). The receptacle should be aligned so that the lip is on the upward side. **DO NOT PLUG THE POWER SUPPLY INTO AN AC OUTLET!**
5. Test your current loop for active devices. See **Section 4.1** on page 11.
6. Connect your current loop to the CL050. See **Section 4.2** on page 12.
7. Insert the back panel into its guide, making sure the power-supply cable and current-loop cable exit through the holes provided for them.
8. Set switches SWA, SWB and SWC to the desired positions. The CL050 is shipped with SWA set to Full-Duplex, Passive; SWB set to 20mA receive; 20mA transmit; and SWC set to DTE. See Sections 4.3, 4.4, and 5.2, respectively, on pages 11 and 13 for more information on these switches.
9. Replace the top cover.
10. Replace the screw.
11. Attach your RS-232C cable.
12. Plug the power supply into an AC outlet. The CL050 is now ready for operation.

4. The Current-Loop Interface

4.1 Testing for Other Active Devices on the Current Loop

You must test for an active device on the current loop if you plan to have the CL050 supply loop current.

WARNING!

Only one device on the current loop may be active. If more than one device is active at the same time, each device will be permanently damaged.

There are two tests that you can run. Either is sufficient.

4.1.1 LED TEST

- (1) Unplug the CL050 from the AC outlet.
- (2) Set the SWA switch to full duplex, passive.
- (3) Attach the T- of the 4-wire current loop device (or “-” in a 2-wire current loop) to R- of the CL050A.
- (4) Attach the T+ of the 4-wire current loop device (or “+” in a 2-wire current loop) to R+ of the CL050A. See Figure 4-1 (4-wire current loop) or Figure 4-2 (2-wire current loop).
- (5) Plug the CL050 into the AC outlet.

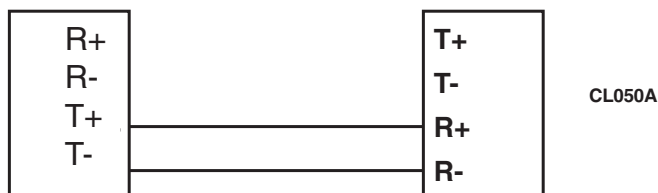


Figure 4-1. Wiring configuration for a 4-wire current loop LED test.

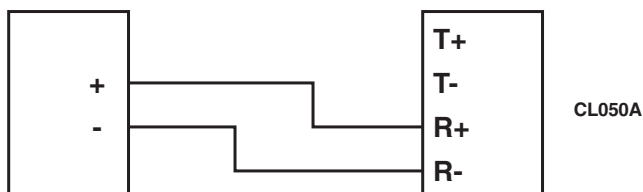


Figure 4-2. Wiring configuration for a 2-wire current loop LED test.

	Terminals			
	1 (T+)	2 (T-)	3 (R+)	4 (R-)
4-Wire Full-Duplex	+ Receive	- Receive	+ Transmit	- Transmit
2-Wire Half-Duplex Passive	+ Loop	Jumper to 3 (R+)	Jumper to 2 (T-)	- Loop
2-Wire Half-Duplex Active	No Connection	+ Loop	- Loop	No Connection

Table 1. Current Loop Cable Connections.

(6) Test results:

(a) If the TX LED on the CL050 is off, the other device is active.

(b) If the TX LED on the CL050 lights continuously, there is no current in the loop. Therefore, the other current-loop device is passive.

(c) If the TX LED flashes, the current loop is sending data. This indicates that the other device is active.

(7) Unplug the CL050 from the AC outlet and remove the R- to R- and R+ to R+ wires.

4.1.2 VOLTMETER TEST

Attach the voltmeter to the two Transmit lines (T+ and T-) of a current loop device (not the CL050). If the voltmeter reads voltage, the device is active. If no voltage registers, the device is passive.

4.2 Connecting the Current Loop Wires to the CL050A

When you attach current loop wires to the CL050, the unit should not be connected to an AC outlet. Unless very fine stranded-wire cable is used, wire tinning is not required. Just insert the wire into the receptacle and tighten the screw. The wire will be firmly gripped by the terminal. Table 1 details how the current loop should be connected to the CL050. Refer also to Figures 4-3 through 4-7 on pages 8, 9, and 10.

4.2.1 4-WIRE CURRENT LOOP

Regardless of whether the CL050 is active or passive, attach the current loop wires as indicated in Table 1 and as shown in Figures 4-3 or 4-4.

4.2.2 2-WIRE CURRENT LOOP

Connections to a 2-wire half-duplex multipoint current loop depend on whether the CL050 is used as an active or passive unit. Note the connections in Table 1. The connections are also shown in Figures 4-5, 4-6, and 4-7.

Note: Not all 2-wire current loops are bidirectional half-duplex. Some current loops are simplex.

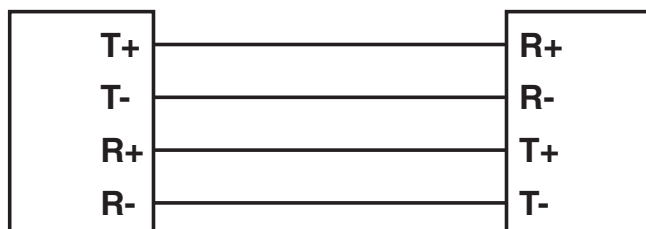


Figure 4-3. 4-Wire Point-to-Point.

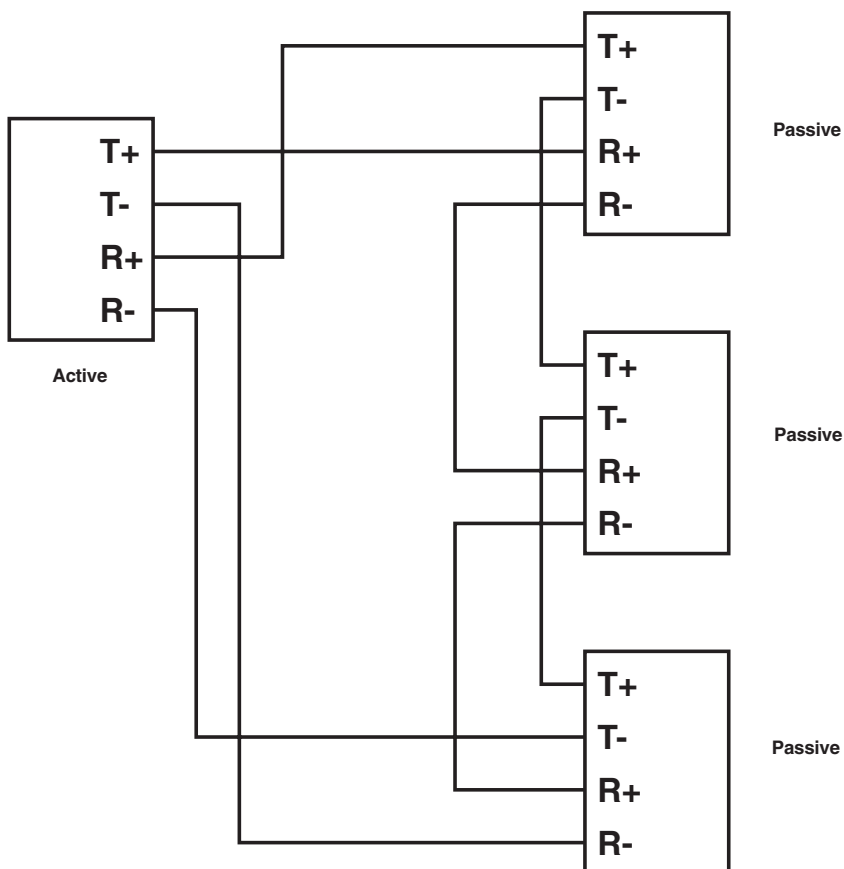


Figure 4-4. 4-Wire Multipoint.

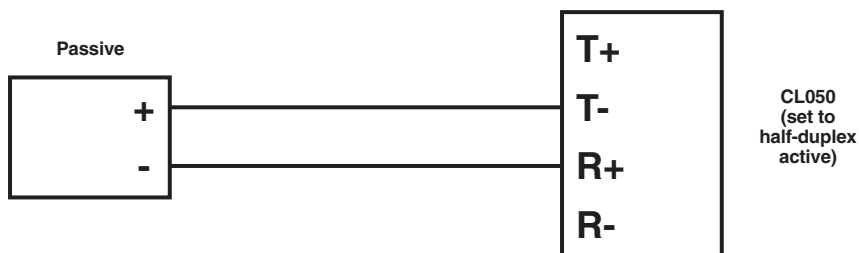


Figure 4-5. 2-Wire Point-to-Point (half-duplex).

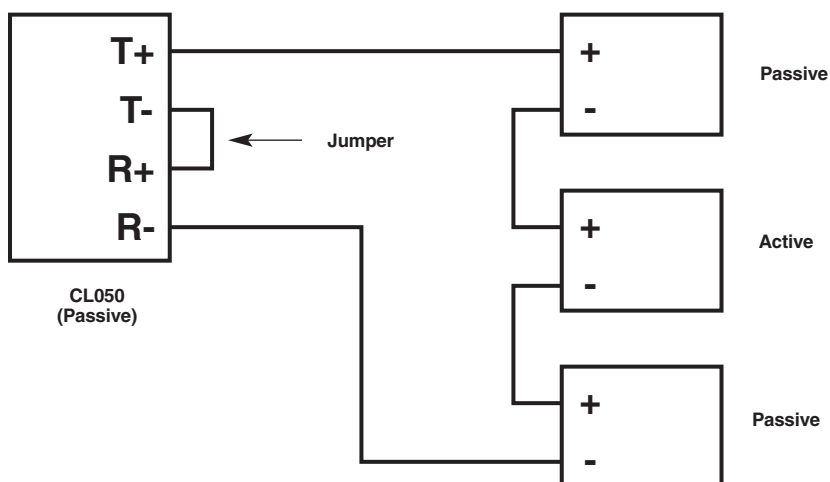


Figure 4-6. 2-Wire Half-Duplex Multipoint (CL050 passive).

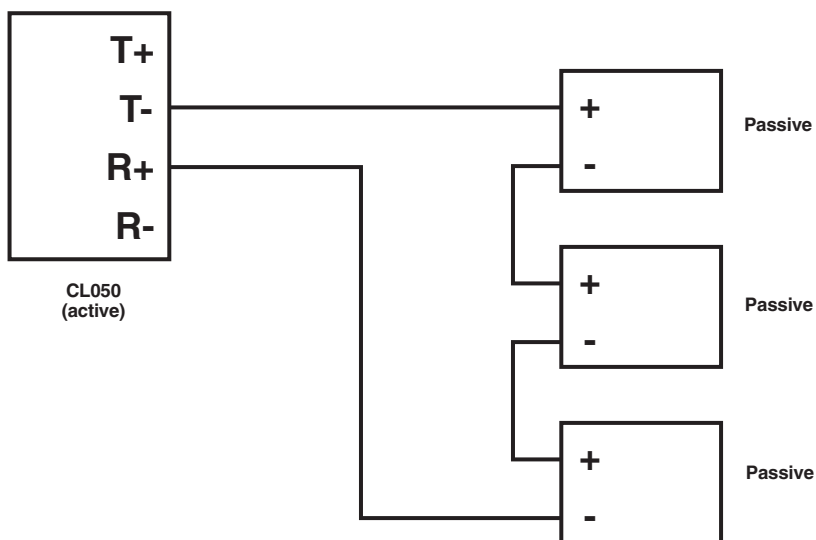


Figure 4-7. 2-Wire Half-Duplex Multipoint (CL050 active).

4.3 Switch SWA

Switch SWA controls the Current Loop Configuration. The CL050 is shipped with the SWA in a “Full-Duplex, Passive” configuration.

Note: 0 indicates “OPEN” and 1 indicates “CLOSED.”

SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10	Loop Configuration
0	1	0	1	0	0	1	0	1	0	Full-Duplex, Passive
1	0	1	0	1	1	0	1	0	1	Full-Duplex, Active
0	1	0	1	0	1	0	1	0	1	Full-Duplex, Passive Receive/Active Transmit
1	0	1	0	1	0	1	0	1	0	Full-Duplex, Active Receive/Passive Transmit
0	1	0	1	0	0	1	0	1	0	Half-Duplex, Passive (2-wire operation)
0	1	0	0	1	1	1	0	1	0	Half-Duplex, Active (2-wire operation)

4.4 Switch SWB

Switch SWB controls loop current (20/30/60 mA). The CL050 is shipped with the SWB in a “20mA receive; 20mA transmit” configuration.

Note: 0 indicates “OPEN” and 1 indicates “CLOSED.”

SW1	SW2	SW3	SW4	Loop Current
0	0	0	0	20mA receive; 20mA transmit loops
1	1	1	1	60mA receive; 60mA transmit loops
1	1	0	0	60mA receive; 20mA transmit loops
0	0	1	1	20mA receive; 60mA transmit loops
1	0	1	0	30mA receive; 30mA transmit loops

5. The RS-232C Interface

5.1 The RS-232C Interface Pinout

Pin	Circuit	Description	Direction
1	AA	Protective Ground	—
2	BA	Transmit Data	To DCE
3	BB	Receive Data	From DCE
4	CA	Request to Send	To DCE
5	CB	Clear to Send	From DCE
6	CC	Data Set Ready	From DCE
7	AB	Signal Ground	—
20	CD	Data Terminal Ready	To DCE

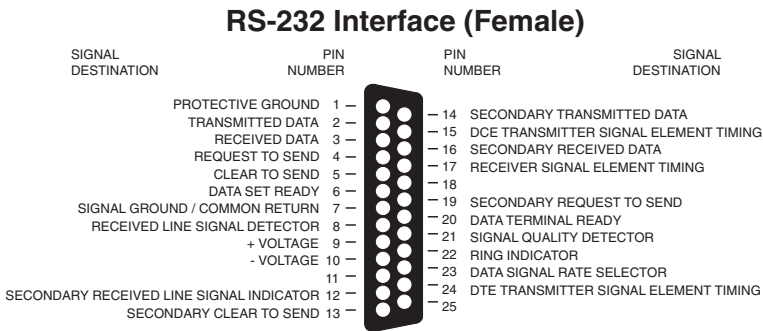


Figure 5-1. The RS-232C Interface.

5.2 Switch SWC

Switch SWC controls the RS-232 Connector Configuration (DCE/DTE).

Note: “OPEN” indicates Off and “CLOSED” indicates On.

5.2.1 DCE

The CL050 default configuration is DCE. The 10-position DIP switch is set as follows:

SW1	Not Used	
SW2	OPEN	= SW2 and SW3 are ALWAYS in opposite positions
SW3	CLOSED	= With SW2 OPEN, Data Out is on Pin 3
SW4	OPEN	= SW4 and SW5 are ALWAYS in opposite positions
SW5	CLOSED	= With SW4 OPEN, Data In is on Pin 2
SW6	OPEN	= Pin 4 (RTS) not connected
SW7	CLOSED	= Ties Pin 5 (CTS) to Pin 20 (DTR)
SW8	OPEN	= Removes High on Pin 20 (DTR). If system does not use DTR, raise CTS by CLOSING both SW7 and SW8
SW9	CLOSED	= Place High on Pin 6 (DSR)
SW10	Not Used	

5.2.2 DTE

When configuring the CL050 as a DTE, the 10-position DIP switch is set as follows:

SW1	Not Used	
SW2	CLOSED	= With SW3 OPEN, Data Out is on Pin 2
SW3	OPEN	= SW2 and SW3 are ALWAYS in opposite positions
SW4	CLOSED	= With SW5 OPEN, Data In is on Pin 3
SW5	OPEN	= SW4 and SW5 are ALWAYS in opposite positions
SW6	CLOSED	= Place High on Pin 4 (RTS)
SW7	OPEN	= Pin 5 (CTS) not connected
SW8	CLOSED	= Place High on Pin 20 (DTR)
SW9	OPEN	= Pin 6 (DSR) not connected
SW10	Not Used	

6. Operations and Troubleshooting

6.1 Indicators

TX LED

On Continuously: Indicates

(1) receive current loop not attached; (2) no current flowing; or (3) you have an open loop. Check the polarity of the receive loop and/or the active/passive options.

Off: The CL050 is not connected to an AC outlet or loop current is flowing continuously (which is normal in an idle state).

Flashing: Data is being transmitted from the RS-232 port to the RS-232C interface.

RX LED

On Continuously: Error. Call Technical Support.

Off: No data being received by the RS-232 port.

Flashing: Data is being received by the RS-232 port from the RS-232C interface.

6.2 Self Test

Follow these instructions to test the internal circuitry of the CL050:

- (1) Unplug the CL050 from AC outlet.
- (2) Set switch SWA to full-duplex, transmit active, receive passive.
- (3) Set switch SWC to DCE configuration.
- (4) Attach a DTE device using a straight-pinned cable from the DTE to the CL050.
- (5) On the CL050, connect a wire from T- to R-.
- (6) On the CL050, connect a wire from T+ to R+.
- (7) Plug the CL050 into an AC outlet.
- (8) Set the DTE device to full-duplex.
- (9) Enter data.
- (10) The TX and RX LEDs should flash and the data should display on the DTE's monitor. If this occurs, all internal circuitry is operational.

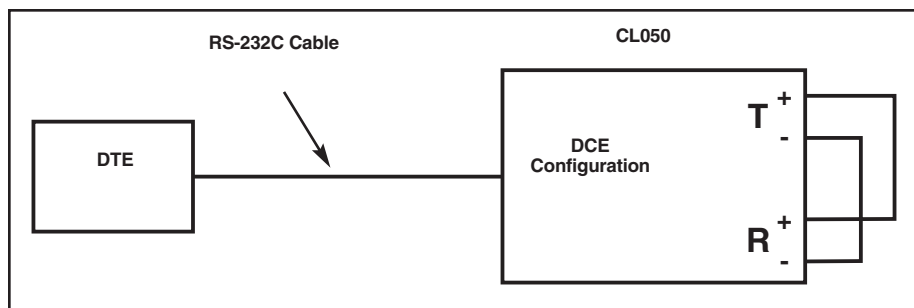


Figure 6-1. Wiring for the Internal Circuitry Test.

7. Current Loop Rack and Cards

7.1 Description

The RM005 Rack can hold up to 16 CL050C printed circuit cards and fits in a standard 19-inch equipment rack. The RM005 comes complete with its own built-in AC power supply. The operation of the CL050C is the same as the CL050.

WARNING!

Do not apply primary power until after you have properly configured the RM005 power supply.

- For 115 VAC $\pm 15\%$ primary power: Set 115/230

voltage selector switch to 115 and make sure the input fuse is rated at 1 A.

- For 230 VAC $\pm 15\%$ primary power: The voltage selector switch must be set to 230 and the fuse must be rated 0.5 A.

Inside the fuseholder are two fuses. Open the fuseholder by pressing down on the cover, then release. The fuse closest to the cover is a spare. Select the correct fuses and place them in the Fuse Retaining Cover. Discard the incorrect fuses.

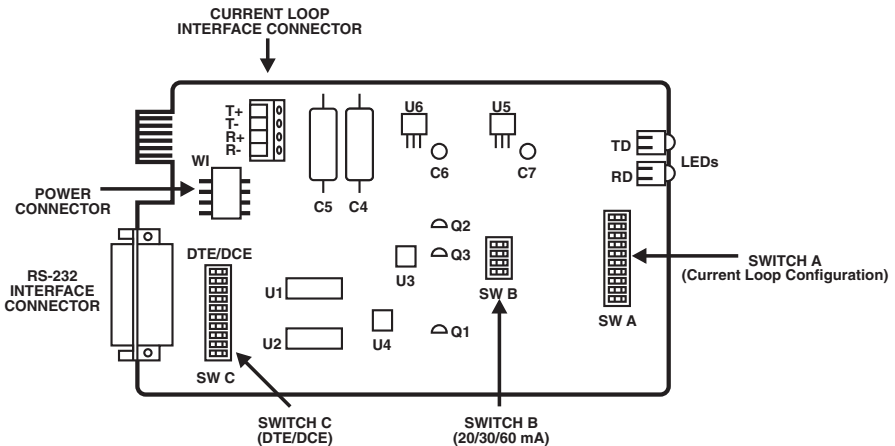


Figure 7-1. Component Layout.

7.2 Specifications for RM005

Power—115/230 VAC, 60/50 Hz, switch-selectable

Rack Size — Overall Width: 19" (48.3 cm)
Inside Width: 17" (43.2 cm)
Depth: 10.5" (26.7 cm)
Height: 5.25" (13.3 cm)

PC Card Size — Length: 7.5" (19.1 cm)
Width: 3.6" (9.1 cm)

Rack Weight — 19.6 lb. (8.9 kg) (without cards installed)

PC Card Weight — 4.5 ounces (128 g)

Rack Switches — On/Off Power Switch
115/230 VAC Selector Switch

Rack Indicators — None

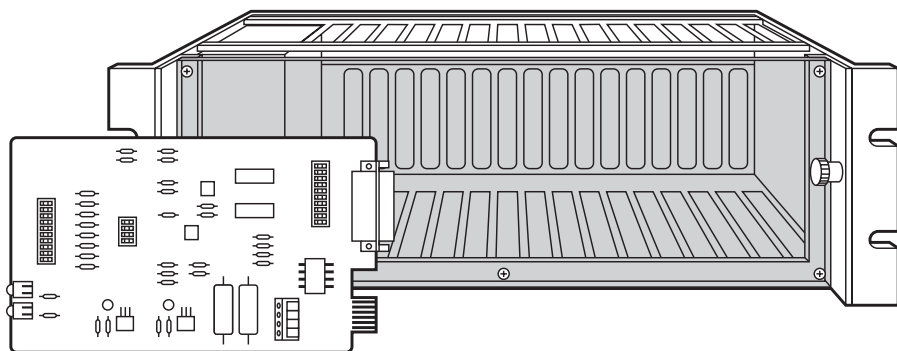


Figure 7-2. RM005 with CL050C.



© Copyright 1998. Black Box Corporation. All rights reserved.

1000 Park Drive • Lawrence, PA 15055-1018 • 724-746-5500 • Fax 724-746-0746