Connect Tech Inc.
Industrial Strength Communications

Intellicon NT960

Intelligent Serial Communications Subsystem

User Manual

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Intellicon-NT960; ACM/16; ACM/Flex16

Connect Tech Inc. declares that the product(s) covered by the contents of this manual have been tested and found compliant with the below listed standards as required by the Electromagnetic Compatibility (EMC) Directive for General Immunity Compliance, EN 50 0082.1:1997

EN 55022   Conducted and Radiated emissions
CISPR 22 Class A

EN 55024   Immunity to Disturbances

| EN 61000-4-2 | EN 61000-4-4 |
| EN 61000-4-3 | EN 61000-4-6 |

The above satisfy the requirements of:

USA: FCC – CFR47, Part 15, part 2
Canada: ICES-003
Europe: EMC Directive
Japan: VCCI
Australia/New Zealand: AS/NZS

General

The above agency conformances were met by independent laboratory testing of Connect Tech Inc. product(s) with shielded cables, with metal hoods, attached to either the terminating connectors or cable assemblies supplied with the product(s). **Failure to follow good EMC/EMI compliant cabling practices may produce more emissions or less immunity than were obtained in laboratory measurements.**

Operation of this equipment in a residential area may cause unacceptable interference to radio a TV reception, requiring the user to take whatever steps necessary to correct the interference.

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Customer Support Overview

If you experience difficulties after reading the manual and/or using the product, contact the Connect Tech reseller from which you purchased the product. In most cases the reseller can help you with product installation and difficulties.

In the event that the reseller is unable to resolve your problem, our highly qualified support staff can assist you. Our support section is available 24 hours a day, seven days a week on our website at:
www.connecttech.com/sub/support/support.asp. See the contact information section below for more information on how to contact us directly. Our technical support is always free.

Contact Information

We offer three ways for you to contact us:

Mail/Courier
You may contact us by letter and our mailing address for correspondence is:
Connect Tech Inc.
Technical Support
42 Arrow Road
Guelph, Ontario
Canada N1K 1S6

Email/Internet
You may contact us through the Internet. Our email and URL addresses on the Internet are:

sales@connecttech.com
support@connecttech.com
www.connecttech.com

> **Note:**
> Please go to the **Download Zone** or the **Knowledge Database** in the **Support Center** on the Connect Tech website for product manuals, installation guides, device driver software and technical tips.
> Submit your technical support questions to our customer support engineers via the **Support Center** on the Connect Tech website.

Telephone/Facsimile
Technical Support representatives are ready to answer your call Monday through Friday, from 8:30 a.m. to 5:00 p.m. Eastern Standard Time. Our numbers for calls are:

Telephone: 800-426-8979 (North America only)
Telephone: 519-836-1291 (Live assistance available 8:30 a.m. to 5:00 p.m. EST, Monday to Friday)
Facsimile: 519-836-4878 (on-line 24 hours)

Introduction

The Intellicon-NT960 is a high performance intelligent multi-port subsystem that allows you to connect up to 128 serial devices through one expansion slot. The NT960 Host Adapter provides the high speed interface between a host computer and an external ACM/16, ACM/16RJ or ACM/Flex16 communication module. The NT960 Host Adapter off loads from the host computer the task of managing the serial communication component of an application.

The Intellicon-NT960 subsystem consists of the following components:

Intellicon-NT960 Host Adapter
Intellicon-NT960 ACM/16, ACM/16RJ or ACM/Flex16, power supply, and bus cable
Intellicon-NT960 Device Drivers

Features

- Connects up to eight ACM/16, ACM/16RJ and/or ACM/Flex16 modules giving you a total of 128 asynchronous RS-232 and/or RS-422/485 and/or 20mA Current Loop serial ports out of one slot.
- 512 KB to 2 MB of SRAM for data and program storage.
- 64 KB to 256 KB of dual ported SRAM for the interface between the ISA bus and the Intel i960. The dual ported SRAM appears as an 8 KB window in the PC address space. You may use this SRAM for program storage on Host Adapters without Flash EEPROM.
- 256 KB to 512 KB Flash EEPROM for storage of the NT960 real-time executive and other NT960 programs. The user can reprogram this memory for custom applications.
- 8 or 16-bit data transfers.
- Polled or interrupt modes. (Check with Connect Tech Customer Service about software support for this feature in your application)

Figure 1: NT960 Host Adapter
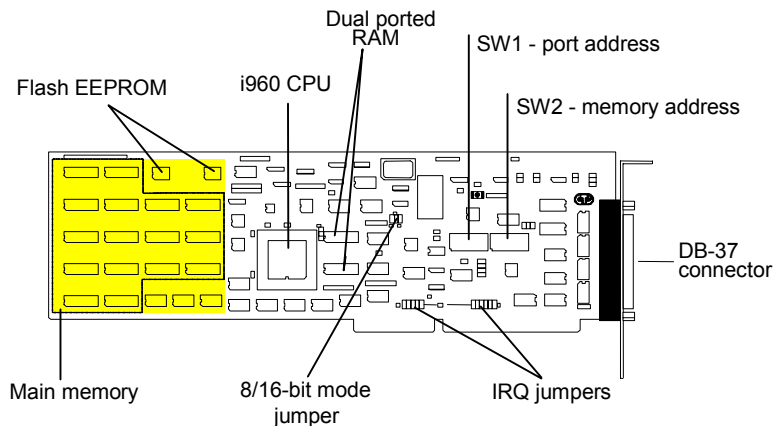
Intellicon-NT960 ACM/16

The ACM/16 (Asynchronous Communication Module) is an external module that connects to the NT960 Host Adapter via a high speed 37 pin external bus cable.

Features

- 16 asynchronous RS-232-C serial ports
- Four CLCD1400 RISC-like quad UARTs with 12 bytes of receive and 12 bytes of transmit FIFO for each port.
- Each port is individually programmable for baud rates up to 115 Kbps.
- Each port supports the following signals: TxD, RxD, DTR, DSR, RTS, CTS, DCD, RI.
- Support for 5 to 8 data bits per character plus optional parity; odd, even, no or forced parity; and 1, 1.5, or 2 Stop Bits.
- Includes a 37 pin bus cable and an external power supply.
- Up to eight ACM/16s, ACM/16RJs and/or ACM/Flex16s can connect to an Intellicon-NT960 Host Adapter providing up to 128 serial ports.

Figure 2: ACM/16 module
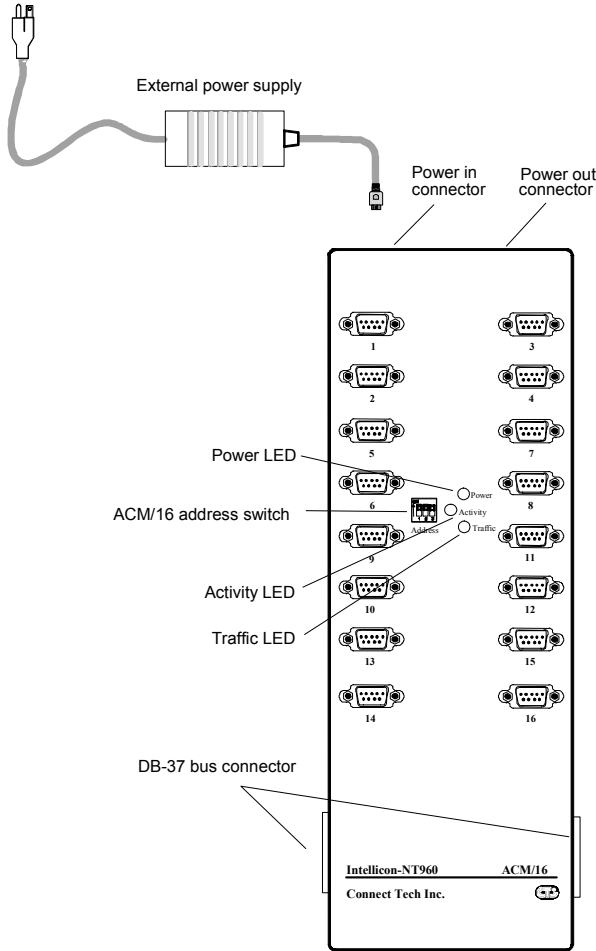
Intellicon-NT960 ACM/16RJ

The ACM/16RJ (Asynchronous Communication Module) is an external module that connects to the NT960 Host Adapter via a high speed 37 pin external bus cable. Figure 3 shows a top view of the ACM/16RJ.

Features

- 16 asynchronous RS-232-C serial ports
- 16 RJ-45 (8 pin) connectors
- Four CLCD1400 RISC-like quad UARTs with 12 bytes of receive and 12 bytes of transmit FIFO for each port.
- Each port is individually programmable for baud rates up to 115 Kbps.
- Each RS-232 port supports the following signals: TxD, RxD, DTR, RTS, CTS, DCD.
- Support for 5 to 8 data bits per character plus optional parity; odd, even, no or forced parity; and 1 or 2 Stop Bits.
- Includes a 37 pin bus cable and an external power supply.
- Up to eight ACM/16s, ACM/16RJs and/or ACM/Flex16s can connect to an Intellicon-NT960 Host Adapter providing up to 128 serial ports.

Figure 3: ACM/16RJ module
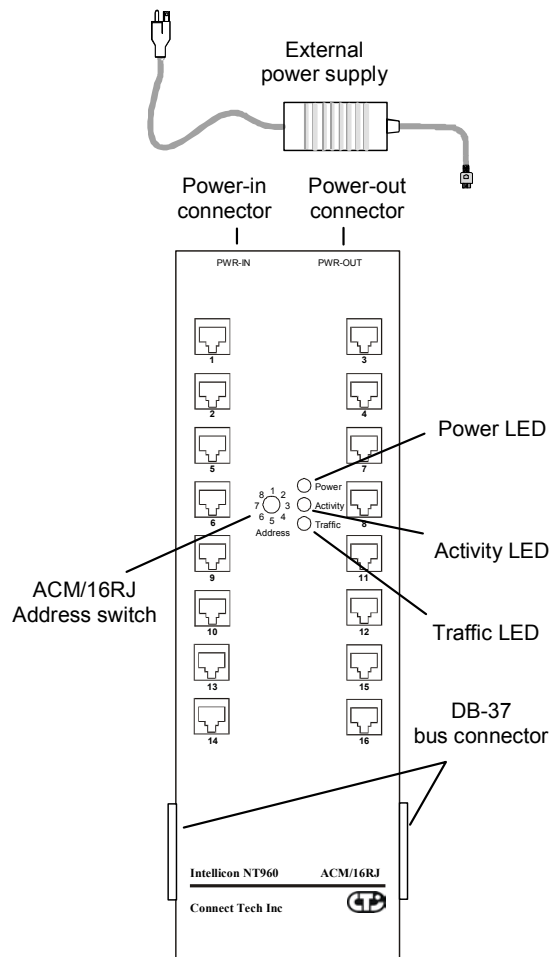
Intellicon-NT960 ACM/Flex16

The ACM/Flex16 (Asynchronous Communication Module) is an external module that connects to the NT960 Host Adapter via a high speed 37 pin external bus cable. Figure 4 shows a top view of the ACM/Flex16. The ACM/Flex16 offers the following features:

Features

- 16 asynchronous RS-232-C and/or RS-422/485 and/or 20mA Current Loop serial ports
- The RS-232, RS-422/485 and 20mA Current Loop electrical interfaces are on field upgradeable Serial Line Interface Modules (SLIM). This allows you to run different line interfaces on the ACM/Flex16 at the same time.
- Four CLCD1400 RISC-like quad UARTs with 12 bytes of receive and 12 bytes of transmit FIFO for each port.
- Each port is individually programmable for baud rates up to 115 Kbps.
- Each port supports the following signals: TxD, RxD, DTR, DSR, RTS, CTS, DCD, RI. *Note: ports 3, 4, 7, 8, 11, 12, 15 and 16 do not support the RI signal.*
- Support for 5 to 8 data bits per character plus optional parity; odd, even, no or forced parity; and 1, 1.5, or 2 Stop Bits.
- Includes a 37 pin bus cable and an external power supply.
- Up to eight ACM/16s, ACM/16RJs and/or ACM/Flex16s can connect to an Intellicon-NT960 Host Adapter providing up to 128 serial ports.

Figure 4: ACM/Flex16 module
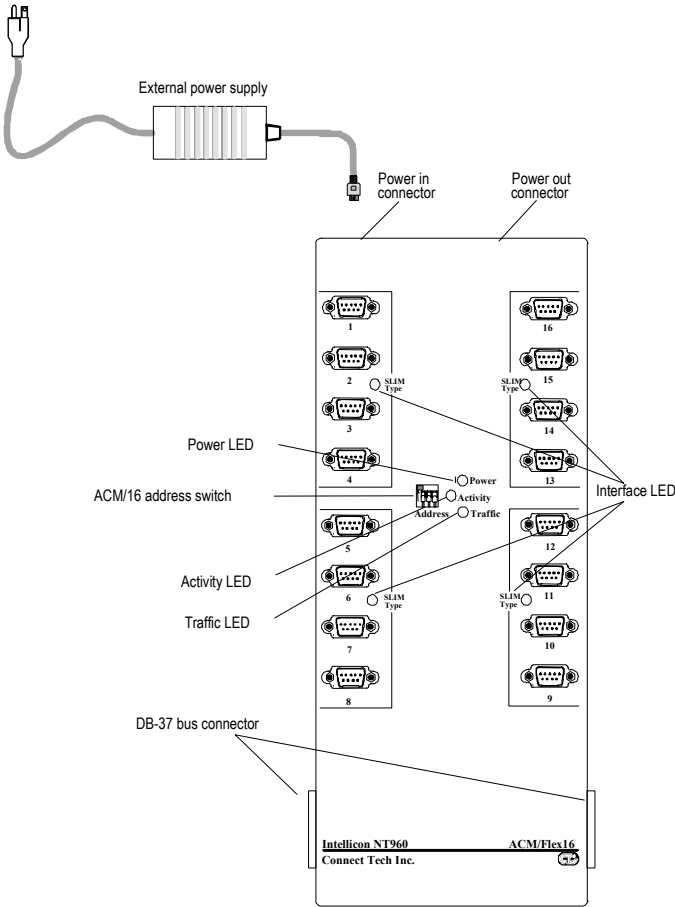
The Intellicon-NT960 subsystem can accommodate both small and large multi-channel applications. The NT960 Host Adapter can connect up to eight ACM/16, ACM/16RJ and/or ACM/Flex16 modules for a total of 128 ports.

Figure 5: Intellicon-NT960 32 port configuration example
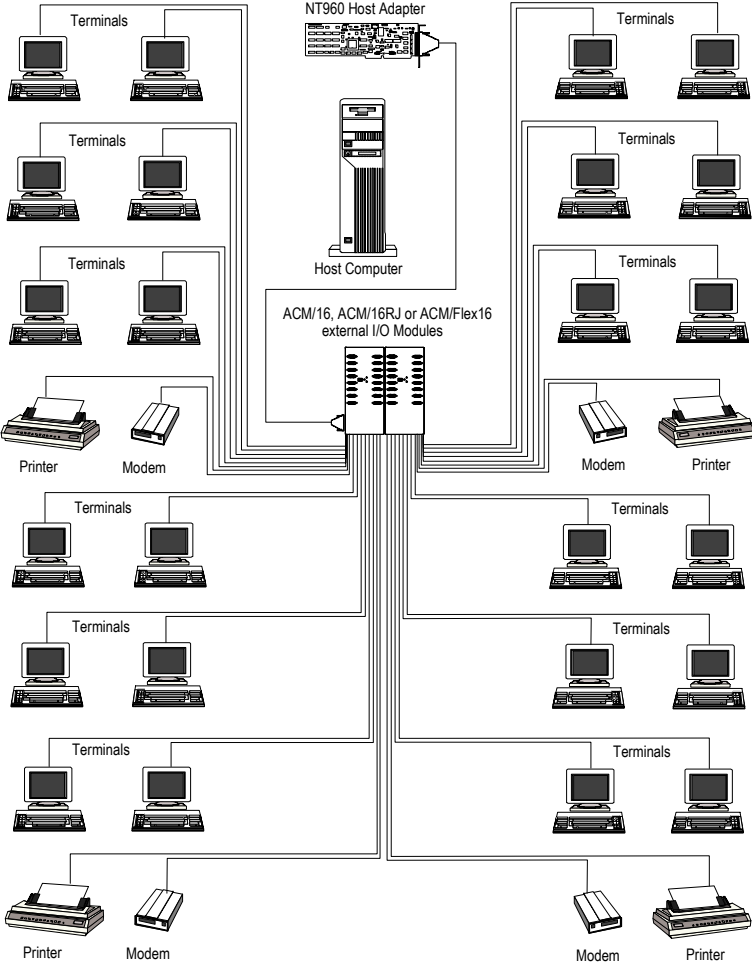
Hardware Installation

Hardware installation involves configuration of the following:

The NT960 Host Adapter
One or more ACM/16, ACM/16RJ or ACM/Flex16 external modules

> **Note:**
> **If you connect or plan to connect more than 32 ports to one NT960 adapter, use the NT960 Host Adapter deluxe model which has 2 MB of SRAM (part number NTHOST-2MB).**

Installing the NT960 Host Adapter

Installation of the NT960 Host Adapter consists of:

1. Selection of I/O port addresses.
2. Selection of base memory addresses.
3. Selection of IRQs.
4. Selection of 8 or 16-bit data transfers.
5. Installing the Host Adapter in your computer.
6. Connecting one or more ACM/16, ACM/16RJ or ACM/Flex16 external modules.

You must configure the various settings before installing the Host Adapter in the computer. In order to insure a successful installation, please follow the steps in the order specified above.

> **The NT960 Host Adapter is very sensitive to static electricity. Make sure that before you remove the card from the anti-static shipping bag, you wear an anti-static wristband. When you remove the board from the anti-static bag, handle it only by the edges and place it on the anti-static bag or an anti-static mat.**

▲
ATTENTION
Contents
Static Sensitive

I/O Port Address Selection

In order for the host computer to communicate with the NT960 Host Adapter, each Host Adapter requires an unique I/O address block (four consecutive I/O port addresses) in your computer's I/O address space. Switch block SW1 configures the I/O port addresses for the NT960. Figure 6 shows the location and orientation of SW1.

Figure 6: I/O port address switch block (SW1) set for the factory default setting of 300 - 303h

SW1

I/O port address switches
        default setting of 300 - 303h
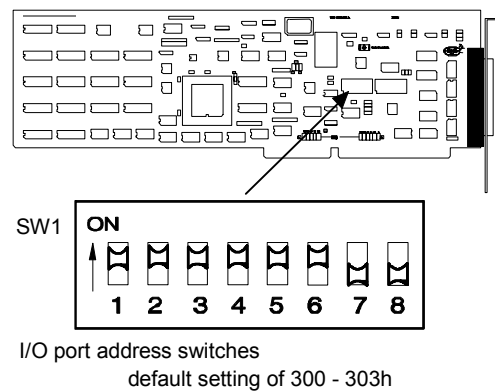
The NT960 Host Adapter ships with SW1 factory set for port addresses 300h-303h. However many other devices may require port addresses in your computer's I/O address space. In most cases the factory setting is sufficient, but when there is a conflict, SW1 may require a different setting. **Table 1** summarizes typical I/O port address usage and **Table 2** lists all the possible switch settings on SW1 for port addresses.

> *Warning*:
> *Do not use a pencil to set the DIP switches as the lead graphite may short-circuit the switch.*

> Note:
> If you install more than one NT960 Host Adapter in a computer, you must choose a different I/O port address for each adapter.

Table 1: Typical port address usage

Port Address (Hex)	Usage
000 - 0FF	Reserved
170 - 177	Fixed disk controller (primary)
1F0 - 1F7	Fixed disk controller (secondary)
200 - 207	Game port
278 -27F	Parallel port (LPT2)
2C0 - 2CF	EGA video adapter (#2)
2F8 - 2FF	Asynchronous serial port (COM2)
360 - 36F	Parallel port (LPT1)
370 - 377	Floppy disk controller (secondary)
378 - 37F	Parallel port (LPT1)
380 - 38F	SDLC adapter (#2)
3A0 - 3AF	SDLC adapter (#1)
3B0 - 3BF	Video adapters
3F0 - 3F7	Floppy disk controller (primary)
3F8 - 3FF	Asynchronous serial port (COM1)

Table 2: Port address switch settings (SW1)

Port Address (Hex)	SW1 switch settings							
	1	2	3	4	5	6	7	8
100 - 103	on	on	on	on	on	on	off	on
104 - 107	off	on	on	on	on	on	off	on
108 - 10B	on	off	on	on	on	on	off	on
10C - 10F	off	off	on	on	on	on	off	on
110 - 113	on	on	off	on	on	on	off	on
114 - 117	off	on	off	on	on	on	off	on
118 - 11B	on	off	off	on	on	on	off	on
11C - 11F	off	off	off	on	on	on	off	on
120 - 123	on	on	on	off	on	on	off	on
124 - 127	off	on	on	off	on	on	off	on
128 - 12B	on	off	on	off	on	on	off	on
12C - 12F	off	off	on	off	on	on	off	on
130 - 133	on	on	off	on	on	on	off	on
134 - 137	off	on	off	on	on	on	off	on
138 - 13B	on	off	off	on	on	on	off	on
13C - 13F	off	off	off	on	on	on	off	on
140 - 143	on	on	on	on	off	on	off	on
144 - 147	off	on	on	on	off	on	off	on
148 - 14B	on	off	on	on	off	on	off	on
14C - 14F	off	off	on	on	off	on	off	on
150 - 153	on	on	off	on	off	on	off	on
154 - 157	off	on	off	on	off	on	off	on
158 - 15B	on	off	off	on	off	on	off	on
15C - 15F	off	off	off	on	off	on	off	on
160 -163	on	on	on	off	off	on	off	on
164 - 167	off	on	on	off	off	on	off	on
168 - 16B	on	off	on	off	off	on	off	on
16C - 16F	off	off	on	off	off	on	off	on
170 - 173	on	on	off	off	off	on	off	on
174 - 177	off	on	off	off	off	on	off	on
178 - 17B	on	off	off	off	off	on	off	on
17C - 17F	off	off	off	off	off	on	off	on
180 - 183	on	on	on	on	on	off	off	on
184 - 187	off	on	on	on	on	off	off	on
188 - 18B	on	off	on	on	on	off	off	on
18C - 18F	off	off	on	on	on	off	off	on
190 - 193	on	on	off	on	on	off	off	on
194 - 197	off	on	off	on	on	off	off	on
198 - 19B	on	off	off	on	on	off	off	on
19C - 19F	off	off	off	on	on	off	off	on
1A0 - 1A3	on	on	on	off	on	off	off	on
1A4 - 1A7	off	on	on	off	on	off	off	on
1A8 - 1AB	on	off	on	off	on	off	off	on
1AC - 1AF	off	off	on	off	on	off	off	on

Table 2 (continued): Port address switch settings (SW1)

Port Address (Hex)	SW1 switch settings							
	1	2	3	4	5	6	7	8
1B0 - 1B3	on	on	off	on	on	off	off	on
1B4 - 1B7	off	on	off	on	on	off	off	on
1B8 - 1BB	on	off	off	on	on	off	off	on
1BC - 1BF	off	off	off	on	on	off	off	on
1C0 - 1C3	on	on	on	on	off	off	off	on
1C4 - 1C7	off	on	on	on	off	off	off	on
1C8 - 1CB	on	off	on	on	off	off	off	on
1CC - 1CF	off	off	on	on	off	off	off	on
1D0 - 1D3	on	on	off	on	off	off	off	on
1D4 - 1D7	off	on	off	on	off	off	off	on
1D8 - 1DB	on	off	off	on	off	off	off	on
1DC - 1DF	off	off	off	on	off	off	off	on
1E0 - 1E3	on	on	on	off	off	off	off	on
1E4 - 1E7	off	on	on	off	off	off	off	on
1E8 - 1EB	on	off	on	off	off	off	off	on
1EC - 1EF	off	off	on	off	off	off	off	on
1F0 - 1F3	on	on	off	off	off	off	off	on
1F4 - 1F7	off	on	off	off	off	off	off	on
1F8 - 1FB	on	off	off	off	off	off	off	on
1FC - 1FF	off	off	off	off	off	off	off	on
200 - 203	on	on	on	on	on	on	on	off
204 - 207	off	on	on	on	on	on	on	off
208 - 20B	on	off	on	on	on	on	on	off
20C - 20F	off	off	on	on	on	on	on	off
210 - 213	on	on	off	on	on	on	on	off
214 - 217	off	on	off	on	on	on	on	off
218 - 21B	on	off	off	on	on	on	on	off
21C - 21F	off	off	off	on	on	on	on	off
220 - 223	on	on	on	off	on	on	on	off
224 - 227	off	on	on	off	on	on	on	off
228 - 22B	on	off	on	off	on	on	on	off
22C - 22F	off	off	on	off	on	on	on	off
230 - 233	on	on	off	on	on	on	on	off
234 - 237	off	on	off	on	on	on	on	off
238 - 23B	on	off	off	on	on	on	on	off
23C - 23F	off	off	off	on	on	on	on	off
240 - 243	on	on	on	on	off	on	on	off
244 - 247	off	on	on	on	off	on	on	off

Table 2 (continued): Port address switch settings (SW1)

Port Address (Hex)	SW1 switch settings							
	1	2	3	4	5	6	7	8
248 - 24B	on	off	on	on	off	on	on	off
24C - 24F	off	off	on	on	off	on	on	off
250 - 253	on	on	off	on	off	on	on	off
254 - 257	off	on	off	on	off	on	on	off
258 - 25B	on	off	off	on	off	on	on	off
25C - 25F	off	off	off	on	off	on	on	off
260 - 263	on	on	on	off	off	on	on	off
264 - 267	off	on	on	off	off	on	on	off
268 - 26B	on	off	on	off	off	on	on	off
26C - 26F	off	off	on	off	off	on	on	off
270 - 273	on	on	off	off	off	on	on	off
274 - 277	off	on	off	off	off	on	on	off
278 - 27B	on	off	off	off	off	on	on	off
27C - 27F	off	off	off	off	off	on	on	off
280 - 283	on	on	on	on	on	off	on	off
284 - 287	off	on	on	on	on	off	on	off
288 - 28B	on	off	on	on	on	off	on	off
28C - 28F	off	off	on	on	on	off	on	off
290 - 293	on	on	off	on	on	off	on	off
294 - 297	off	on	off	on	on	off	on	off
298 - 29B	on	off	off	on	on	off	on	off
29C - 29F	off	off	off	on	on	off	on	off
2A0 - 2A3	on	on	on	off	on	off	on	off
2A4 - 2A7	off	on	on	off	on	off	on	off
2A8 - 2AB	on	off	on	off	on	off	on	off
2AC - 2AF	off	off	on	off	on	off	on	off
2B0 - 2B3	on	on	off	on	on	off	on	off
2B4 - 2B7	off	on	off	on	on	off	on	off
2B8 - 2BB	on	off	off	on	on	off	on	off
2BC - 2BF	off	off	off	on	on	off	on	off
2C0 - 2C3	on	on	on	on	off	off	on	off
2C4 - 2C7	off	on	on	on	off	off	on	off
2C8 - 2CB	on	off	on	on	off	off	on	off
2CC - 2CF	off	off	on	on	off	off	on	off
2D0 - 2D3	on	on	off	on	off	off	on	off
2D4 - 2D7	off	on	off	on	off	off	on	off
2D8 - 2DB	on	off	off	on	off	off	on	off
2DC - 2DF	off	off	off	on	off	off	on	off
2E0 - 2E3	on	on	on	off	off	off	on	off
2E4 - 2E7	off	on	on	off	off	off	on	off
2E8 - 2EB	on	off	on	off	off	off	on	off
2EC - 2EF	off	off	on	off	off	off	on	off
2F0 - 2F3	on	on	off	off	off	off	on	off
2F4 - 2F7	off	on	off	off	off	off	on	off
2F8 - 2FB	on	off	off	off	off	off	on	off
2FC - 2FF	off	off	off	off	off	off	on	off

Table 2 (continued): Port address switch settings (SW1)

Port Address (Hex)	SW1 switch settings							
	1	2	3	4	5	6	7	8
300 - 303	on	on	on	on	on	on	off	off
304 - 307	off	on	on	on	on	on	off	off
308 - 30B	on	off	on	on	on	on	off	off
30C - 30F	off	off	on	on	on	on	off	off
310 - 313	on	on	off	on	on	on	off	off
314 - 317	off	on	off	on	on	on	off	off
318 - 31B	on	off	off	on	on	on	off	off
31C - 31F	off	off	off	on	on	on	off	off
320 - 323	on	on	on	off	on	on	off	off
324 - 327	off	on	on	off	on	on	off	off
328 - 32B	on	off	on	off	on	on	off	off
32C - 32F	off	off	on	off	on	on	off	off
330 - 333	on	on	off	on	on	on	off	off
334 - 337	off	on	off	on	on	on	off	off
338 - 33B	on	off	off	on	on	on	off	off
33C - 33F	off	off	off	on	on	on	off	off
340 - 343	on	on	on	on	off	on	off	off
344 - 347	off	on	on	on	off	on	off	off
348 - 34B	on	off	on	on	off	on	off	off
34C - 34F	off	off	on	on	off	on	off	off
350 - 353	on	on	off	on	off	on	off	off
354 - 357	off	on	off	on	off	on	off	off
358 - 35B	on	off	off	on	off	on	off	off
35C - 35F	off	off	off	on	off	on	off	off
360 - 363	on	on	on	off	off	on	off	off
364 - 367	off	on	on	off	off	on	off	off
368 - 36B	on	off	on	off	off	on	off	off
36C - 36F	off	off	on	off	off	on	off	off
370 - 373	on	on	off	off	off	on	off	off
374 - 377	off	on	off	off	off	on	off	off
378 - 37B	on	off	off	off	off	on	off	off
37C - 37F	off	off	off	off	off	on	off	off
380 - 383	on	on	on	on	on	off	off	off
384 - 387	off	on	on	on	on	off	off	off
388 - 38B	on	off	on	on	on	off	off	off
38C - 38F	off	off	on	on	on	off	off	off
390 - 393	on	on	off	on	on	off	off	off
394 - 397	off	on	off	on	on	off	off	off
398 - 39B	on	off	off	on	on	off	off	off
39C - 39F	off	off	off	on	on	off	off	off
3A0 - 3A3	on	on	on	off	on	off	off	off
3A4 - 3A7	off	on	on	off	on	off	off	off
3A8 - 3AB	on	off	on	off	on	off	off	off
3AC - 3AF	off	off	on	off	on	off	off	off

Table 2 (continued): Port address switch settings (SW1)

| Port Address (Hex) | SW1 switch settings | | | | | | | |
	1	2	3	4	5	6	7	8
3B0 - 3B3	on	on	off	off	on	off	off	off
3B4 - 3B7	off	on	off	on	on	off	off	off
3B8 - 3BB	on	off	off	on	on	off	off	off
3BC - 3BF	off	off	off	on	on	off	off	off
3C0 - 3C3	on	on	on	on	off	off	off	off
3C4 - 3C7	off	on	on	on	off	off	off	off
3C8 - 3CB	on	off	on	on	off	off	off	off
3CC - 3CF	off	off	on	on	off	off	off	off
3D0 - 3D3	on	on	off	on	off	off	off	off
3D4 - 3D7	off	on	off	on	off	off	off	off
3D8 - 3DB	on	off	off	on	off	off	off	off
3DC - 3DF	off	off	off	on	off	off	off	off
3E0 - 3E3	on	on	on	off	off	off	off	off
3E4 - 3E7	off	on	on	off	off	off	off	off
3E8 - 3EB	on	off	on	off	off	off	off	off
3EC - 3EF	off	off	on	off	off	off	off	off
3F0 - 3F3	on	on	off	off	off	off	off	off
3F4 - 3F7	off	on	off	off	off	off	off	off
3F8 - 3FB	on	off	off	off	off	off	off	off
3FC - 3FF	off	off	off	off	off	off	off	off

Base Memory Address Selection

The NT960 Host Adapter communicates with the host computer through 8 KB blocks of shared memory. This block of shared memory lies within the first megabyte of the computer's memory address space.

DIP switches 1 through 5 on switch block SW2 select the base address for this 8 KB block of shared memory. Please refer to **Figure 7** for the location and orientation of SW2.

Figure 7: Base memory switch block (SW2) set to default base memory of D0000h
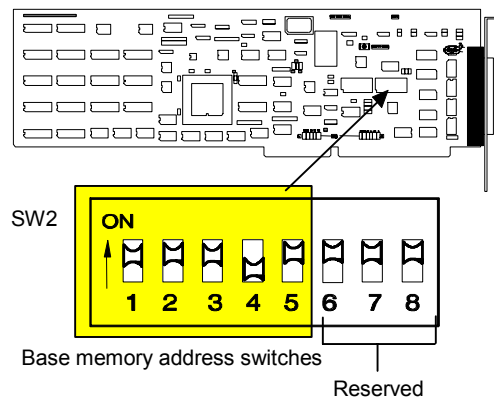
The NT960 Host Adapter ships with SW2 set for a base memory of D0000h. In most cases this setting is sufficient, but where there are many different expansion devices installed in the host computer, SW2 may require a different base address setting in order to avoid a conflict.

Do not use a pencil to set the DIP switches as the lead graphite may short-circuit the switch.

Note: **If you install more than one NT960 Host Adapter in a computer, you must choose the same base address for each adapter.**

Table 3: Base addresses for some typical devices

Device	Address Range	Size
Upper user RAM	80000h - 9FFFFh	128 KB
Video buffer RAM	A0000h - BFFFFh	128 KB
EGA/VGA video memory	A0000h - BFFFFh	128 KB
MDA video memory	B0000h - B7FFFh	32 KB
CGA video memory	B8000h - BFFFFh	32 KB
ROM expansion	C0000h - DFFFFh	128 KB
EGA BIOS ROM	C0000h - C3FFFh	16 KB
PGA comm area	C6000h - C63FFh	1 KB
Cluster adapter BIOS	D0000h - D7FFFh	32 KB
Adaptec controllers	DC000h - DFFFFh	15 KB
BIOS expansion	E0000h - EFFFFh	64 KB
BIOS	F0000h - FFFFFh	64 KB

Technical Tips:

1. To avoid conflicts please disable shadow memory in the region of the Intellicon-NT960 base memory address settings. Most BIOS's offer a range of upper memory to shadow, sometimes in 8 KB, 32 KB, or 64 KB blocks. Shadow memory essentially copies code from slow BIOS ROMs on video or SCSI adapters to faster main memory.

2. Please disable system cache if your Intellicon-NT960 adapter malfunctions. Some systems BIOS cache the upper memory region (640 KB to 1 MB). This caching may cause some adapters using shared memory in the upper regions to malfunction.

3. The Intellicon-NT960 is not a Plug and Play (PnP) adapter. It requires an IRQ, I/O port addresses and an 8 KB segment of shared memory in the region between 640 KB and 1 MB. It is often necessary to go into the CMOS setup (BIOS) and ensure that the resources used by the Intellicon-NT960 are available to Non-PnP ISA devices. Look in the CMOS setup for PnP or ISA setup options.

4. The compressed Intellicon-NT960 driver file includes the memory test utility **ctimtest.exe.** This is a DOS program that you can use to verify that the Intellicon-NT960 memory is available for use. Please see the file **ctimtest.zip** for more information. You should run this program with DOS 5.0 or better. This program will give erroneous results under Windows NT.

Table 4: *Base memory addresses (SW2)*

Base address (8 KB blocks - Hex)	DIP switch settings (SW2)				
	1	2	3	4	5
C0000 - C1FFF	on	on	on	on	on
C2000 - C3FFF	off	on	on	on	on
C4000 - C5FFF	on	off	on	on	on
C6000 - C7FFF	off	off	on	on	on
C8000 - C9FFF	on	on	off	on	on
CA000 - CBFFF	off	on	off	on	on
CC000 - CDFFF	on	off	off	on	on
CE000 - CFFFF	off	off	off	on	on
D0000 - D1FFF	on	on	on	off	on
D2000 - D3FFF	off	on	on	off	on
D4000 - D5FFF	on	off	on	off	on
D6000 - D7FFF	off	off	on	off	on
D8000 - D9FFF	on	on	off	off	on
DA000 - DBFFF	off	on	off	off	on
DC000 - DDFFF	on	off	off	off	on
DE000 - DFFFF	off	off	off	off	on
E0000 - E1FFF	on	on	on	on	off
E2000 - E3FFF	off	on	on	on	off
E4000 - E5FFF	on	off	on	on	off
E6000 - E7FFF	off	off	on	on	off
E8000 - E9FFF	on	on	off	on	off
EA000 - EBFFF	off	on	off	on	off
EC000 - EDFFF	on	off	off	on	off
EE000 - EFFFF	off	off	off	on	off
F0000 - F1FFF	on	on	on	off	off
F2000 - F3FFF	off	on	on	off	off
F4000 - F5FFF	on	off	on	off	off
F6000 - F7FFF	off	off	on	off	off
F8000 - F9FFF	on	on	off	off	off
FA000 - FBFFF	off	on	off	off	off
FC000 - FDFFF	on	off	off	off	off
FE000 - FFFFF	off	off	off	off	off

IRQ Selection

Each Intellicon-NT960 Host Adapter requires one interrupt request vector (IRQ) to communicate with the Central Processing Unit (CPU) on the host computer.

Jumper blocks J1 and J2 program the NT960 Host Adapter for an IRQ. J1 is a five position block and J2 is a six position block. The corresponding IRQ numbers are beside the block positions. **Figure 8** shows the location and orientation of J1 and J2 on the NT960.

Figure 8: J1 & J2 IRQ jumpers location, set to default IRQ setting of IRQ 10
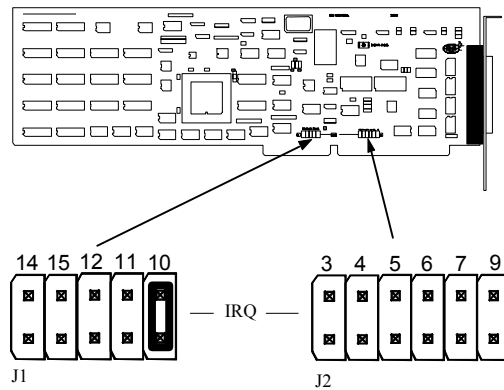
Technical Tip:
The Intellicon-NT960 is not a Plug and Play (PnP) adapter. It requires an IRQ, I/O port addresses and an 8 KB segment of shared memory in the region between 640 KB and 1 MB. It is often necessary to go into the CMOS setup (BIOS) and ensure that the resources used by the Intellicon-NT960 are available to Non-PnP ISA devices. Look in the CMOS setup for PnP or ISA setup options.

Many other devices such as the keyboard and disk drives also require an IRQ. **Table 5** shows some typical IRQ assignments.

Table 5: Typical IRQ assignments

IRQ	Device
0	Timer output
1	Keyboard
2	Reserved
3	COM2, COM4, SDLC
4	COM1, COM3, SDLC
5	Unassigned (typically)
6	Floppy disk controller
7	LPT1
8	Real-time clock
9	Reserved
10	Unassigned (typically)
11	Unassigned (typically)
12	Unassigned (typically)
13	Co-processor
14	Primary fixed disk controller

| 15 | Secondary fixed disk controller |

In most cases the default IRQ setting for the NT960 is satisfactory. If an IRQ conflict exists between the NT960 Host Adapter and another expansion device, you must choose another IRQ. To select an IRQ simply install the jumper across the corresponding pins for that IRQ on J1 or J2.

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The NT960 Host Adapter is very sensitive to static electricity. When setting the jumpers make sure that you wear an anti-static wristband. Handle the adapter by its edges and place it on the anti-static bag or an anti-static mat.

Note: If you install more than one NT960 Host Adapter in a computer you must select a unique IRQ for each adapter.

8/16-bit Transfer Selection

The NT960 Host Adapter can support both 8 and 16-bit data transfers. Jumper block J12 programs the data transfer width on the NT960. **Figure 11** shows the location and orientation of J12 on the NT960 Host Adapter.

Figure 9: 8 and 16-bit data transfer jumper (J12)

16 bit mode setting

J12

8 bit mode (default setting)

J12
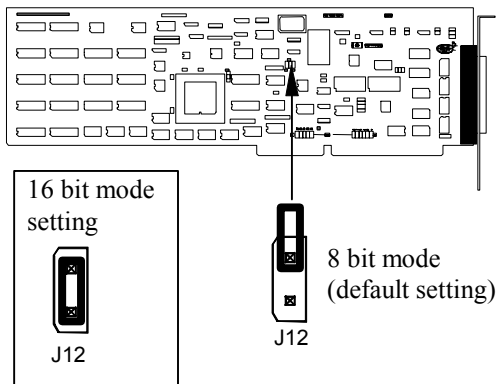
The NT960 Host Adapter ships with J12 set for 8 bit data transfers. To set the adapter for 16 bit data transfers simply install the jumper across the pins on J12.

Technical Tip:
Due to the architecture of the ISA bus, 8 and 16-bit devices(i.e. video adapters, SCSI and ESDI adapters, network adapters, multi-port communication adapters) addressed in the same 128 KB block of memory may cause conflicts. If you install the NT960 hardware and software correctly and your computer behaves erratically, you may have a conflict. Power the computer off and re-configure the NT960 for 8-bit mode.

Installing the NT960 Host Adapter in your System

The NT960 Host Adapter is very sensitive to static electricity. When setting the jumpers make sure that you wear an anti-static wristband. Handle the adapter by its edges and place it on the anti-static bag or an anti-static mat.

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To install the NT960 Host Adapter in your computer follow these steps:

1. Turn the power off to your computer.
2. Open your computer to expose the expansion slots (consult your system documentation for more information on this procedure.)
3. Choose an available full-length 16-bit expansion slot.
4. Remove the screw and the expansion slot cover from the slot you select and save both.
5. Place the NT960 in the expansion slot and push down gently until the card seats fully in the slot. *Do not force the card into the expansion slot*. If you meet a great deal of resistance, remove the board and try again.
6. Align the mounting bracket and secure the board with the screw that you saved.
7. Close your computer.

Installing an ACM/16, ACM/16RJ and/or ACM/Flex16

The installation of an ACM/16, ACM/16RJ or ACM/Flex16 external module consists of:

1. Setting the ACM/16, ACM/16RJ or ACM/Flex16 address number
2. Installing the Serial Line Interface Modules (SLIMs) in the ACM/Flex16
3. Connecting one or more ACM/16, ACM/16RJ or ACM/Flex16 modules to the NT960 Host Adapter

To insure a successful installation, you must configure the appropriate settings and follow the steps in the order specified.

ACM/16/16RJ/Flex16 Address Selection

The ACM/16, ACM/16RJ and ACM/Flex16 address switch block assigns a number for each port on the ACM/16, ACM/16RJ and ACM/Flex16. This switch setting enables the Host Adapter to identify each port. You must set each ACM/16, ACM/16RJ or ACM/Flex16 connected to a NT960 Host Adapter for a unique address. Please refer to **Figures 10** and **11** for the location and orientation of the ACM/16, ACM/16RJ and ACM/Flex16 address switch block.

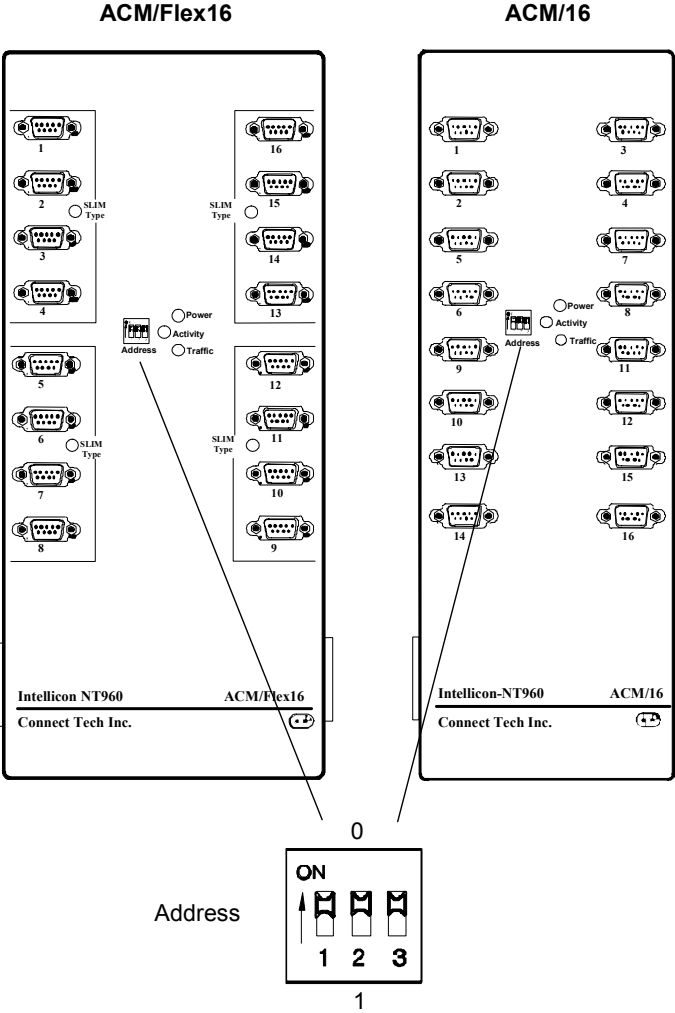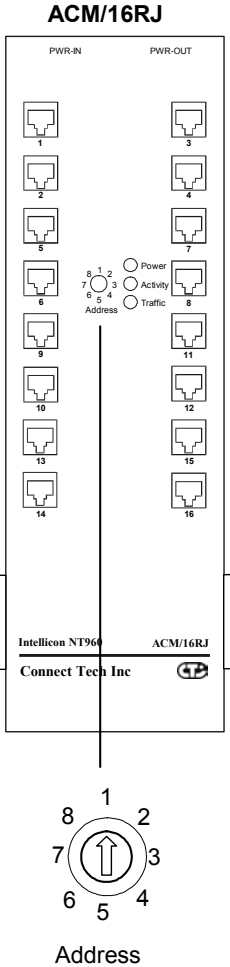*Figure 10: ACM/16/Flex16 address switch block*

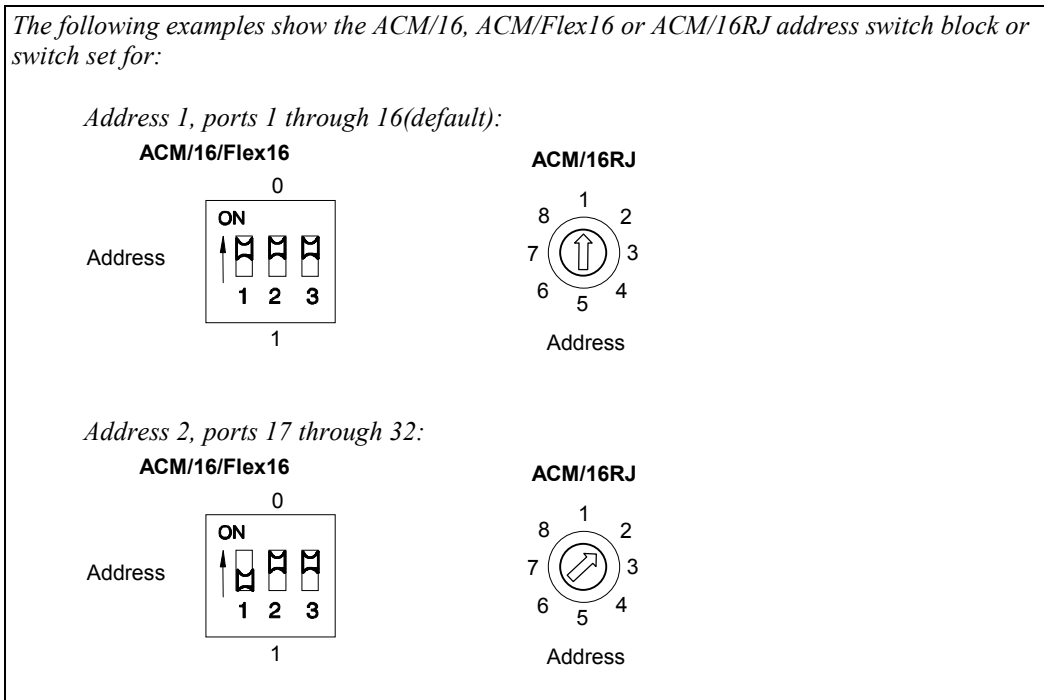***Figure 11: ACM/16RJ address switch block***

The ACM/16, ACM/16RJ and ACM/Flex16 ship with the address switch block set for address 1, which assigns numbers 1 through 16 to the serial ports. If you are connecting only one ACM/16, ACM/16RJ or ACM/Flex16 to the Host Adapter then use this setting. If you are connecting more than one ACM/16 or ACM/Flex16 then configure each ACM/16, ACM/16RJ or ACM/Flex16 with a unique address. **Table 6** outlines all the switch settings for the address switch block and their corresponding address and port numbers.

> ***Do not use a pencil to set the DIP switches as the lead graphite may short-circuit the switch.***

Table 6: *ACM/16/Flex16/16RJ address settings*

Address	Port numbers assigned	ACM/16RJ Switch settings	ACM/16/Flex16 DIP Switch settings		
			1	**2**	**3**
1	1 - 16	1	on	on	on
2	17 - 32	2	off	on	on
3	33 - 48	3	on	off	on
4	49 - 64	4	off	off	on
5	65 - 80	5	on	on	off
6	81 - 96	6	off	on	off
7	97 - 112	7	on	off	off
8	113 - 128	8	off	off	off

Figure 12: *Address Switch setting examples*

The following examples show the ACM/16, ACM/Flex16 or ACM/16RJ address switch block or switch set for:

Address 1, ports 1 through 16(default):

Address 2, ports 17 through 32:

SLIM Installation (ACM/Flex16)

The ACM/Flex16 module has four 72 pin SLIM sockets that accept line transceiver modules. Each transceiver module provides the RS-232 or RS-422/485 or 20mA Current Loop receivers and transmitters to condition four serial ports. SLIM 1 interfaces ports 1, 2, 3, 4; SLIM 2 interfaces ports 5, 6, 7, 8; SLIM 3 interfaces ports 9, 10, 11, 12; and SLIM 4 interfaces ports 13, 14, 15, 16.

Begin by removing the back cover of the ACM/Flex16, as per Figure 13.

The RS-232, RS-422/485 and 20mA Current Loop SLIMs are very sensitive to static electricity. Make sure that before you remove the SLIMs from the anti-static shipping bag, you wear an anti-static wristband. When you remove the board from the anti-static bag, handle it only by the edges and place it on the anti-static bag or an anti-static mat.

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Figure 13: ACM/Flex16 back cover removal: **ACM/Flex16 back cover removal**
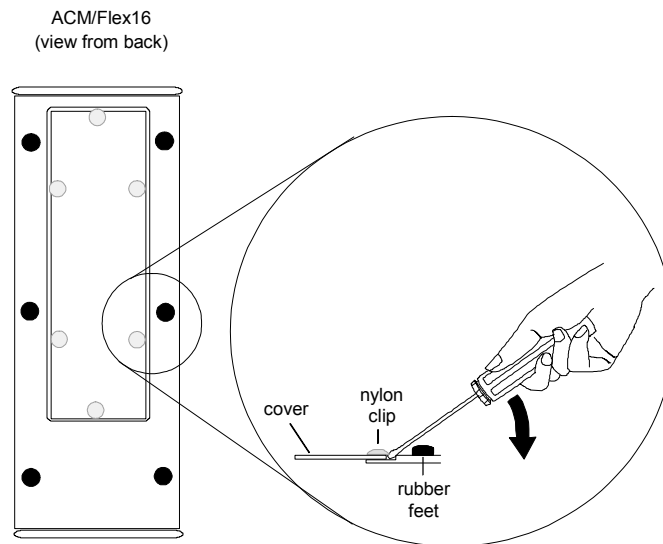
To remove the cover on the back of an ACM/Flex16, pry up the six nylon clips with a small screwdriver.

Figure 14: ACM/Flex16: SLIM socket locations

ACM/Flex16
(view from back with cover removed)

SLIM 4 socket
(SM4)

SLIM 1 socket
(SM1)

SLIM 3 socket
(SM3)

SLIM 2 socket
(SM2)
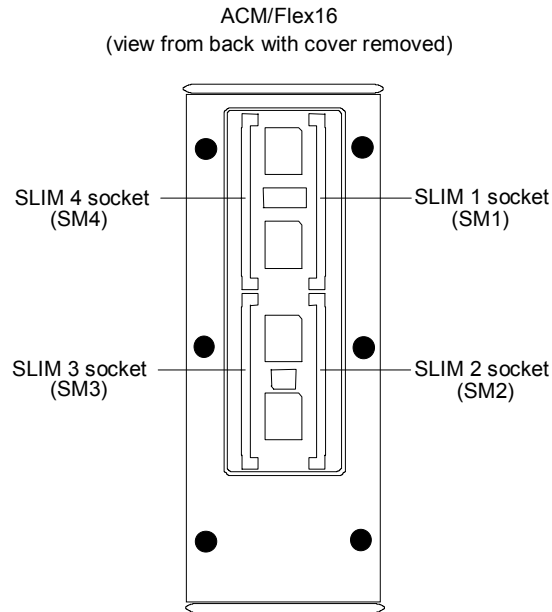
1. Ensure you have your SLIM configured to your specifications. (See SLIM options for configuration choices.) Place the SLIM into the socket almost vertically (about 75-degree angle), making sure that it is properly oriented and fully inserted into the socket.

2. Press downward and sideways on the SLIM until it latches into the socket. **Do NOT force the SLIM**, the installation process requires a small force and should be very smooth and easy. If you encounter resistance then re-check the orientation and insertion depth.

Figure 15: SLIM insertion (ACM/Flex16)

1

2

Hole

Peg
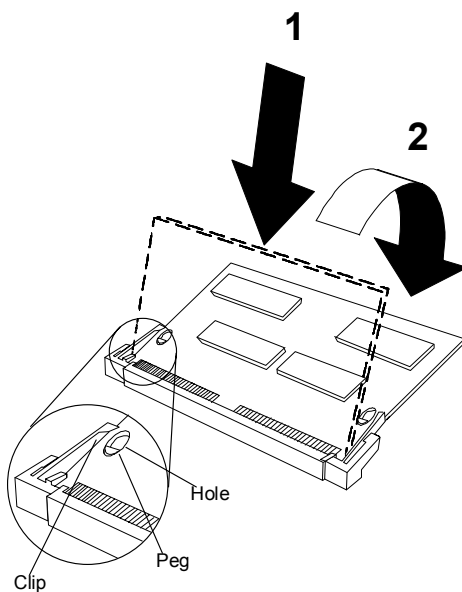
Clip

SLIM Removal

1. Using both hands, place your thumbs on the clips that hold the SLIM into the socket, and place your index fingers on the edge of the SLIM.

2. Push outwards (with your thumbs) on the clips until the SLIM is released from the clips. Your index fingers can then raise the SLIM past the clips. The SLIM is then free to be removed from the ACM/Flex16 board. The force required to open the clips is small and the SLIM naturally springs upwards as soon as the clips are open wide enough. If removal is difficult, then you are probably trying to raise the SLIM before the clips are open.

Figure 16: SLIM removal (ACM/Flex16)
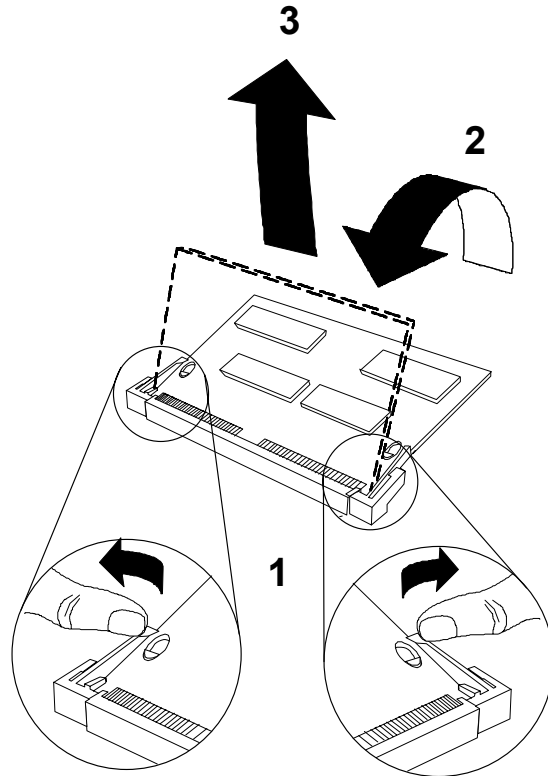
SLIM Options

The ACM/Flex16 has four SLIM sockets to accept Connect Tech's RS-232 and/or RS-422/485 and/or 20mA Current Loop Serial Line Interface Modules (SLIM). Each SLIM controls four ports, and LEDs on the ACM/Flex16 indicate the electrical interface in use for specific groups of four ports. SLIMS are field upgradeable, providing you with more flexibility for your application.

RS-232 SLIM Option

You may order the ACM/Flex16 external module with RS-232 Serial Line Interface Modules (SLIM). The RS-232 SLIM offers the RS-232 electrical interface, an industry standard that offers connection to a wide range of peripheral devices.
Please refer to **Figure 17** for a partial schematic of the RS-232 SLIM.
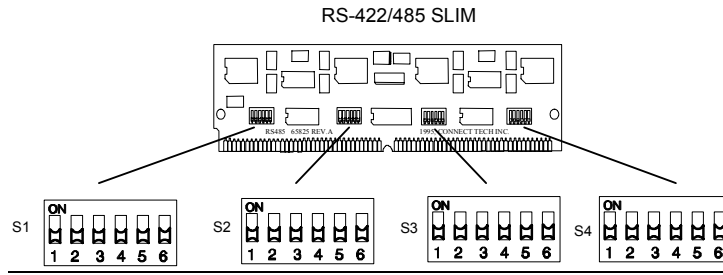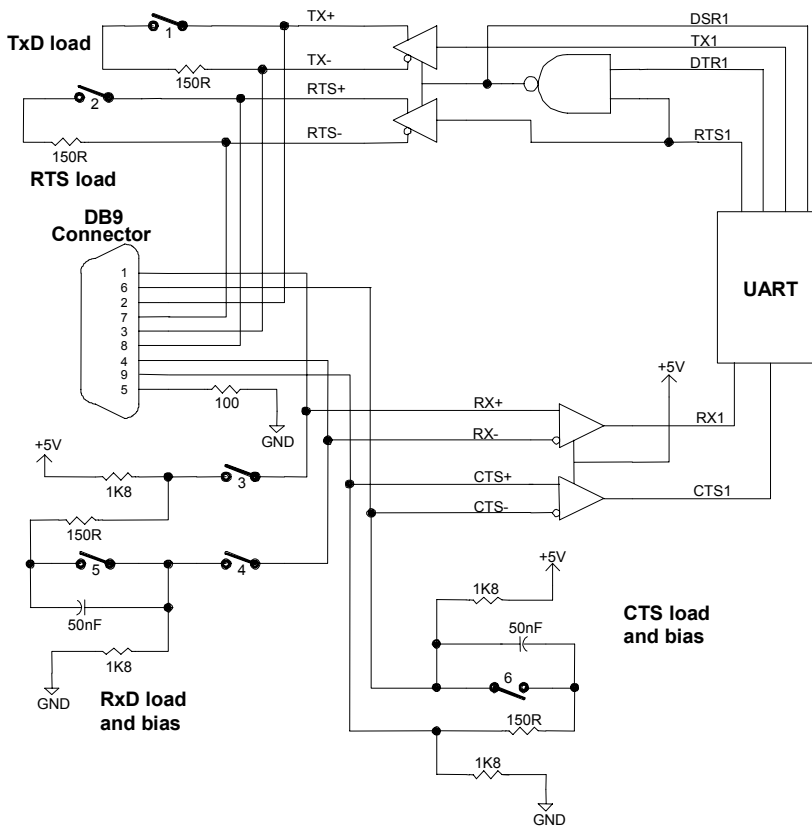
Figure 17: RS-232 SLIM partial schematic

RS-232 SLIM partial schematic
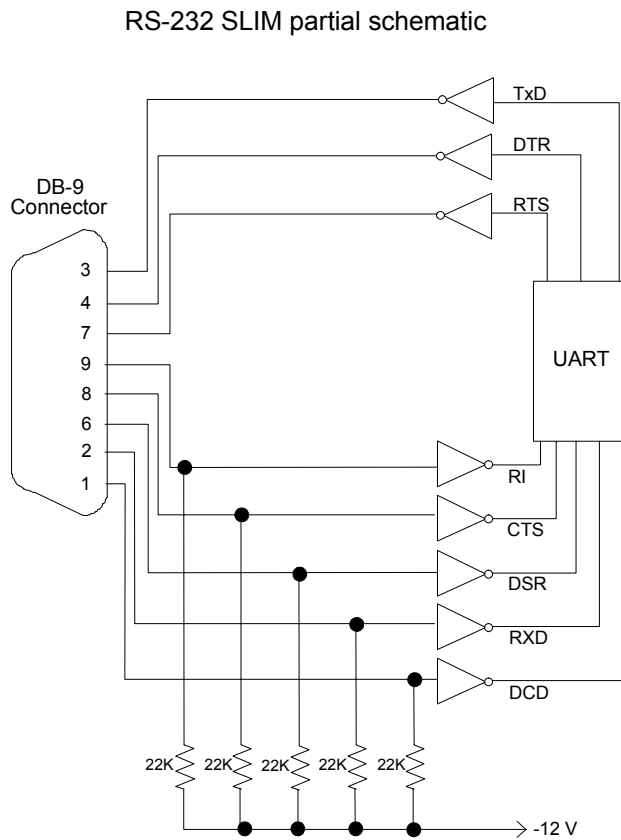
Note: **The RS-232 Serial Line Interface Module controls four ports, and therefore the schematic shows only a portion of the circuit.**

RS-422/485 Option

You may order the ACM/Flex16 external module with RS-422/485 Serial Line Interface Modules (SLIM). The RS-422/485 SLIM offers the RS-422/485 electrical interface, a reliable high speed serial link that offers superior noise immunity and multi-drop network connectivity.

The RS-422/485 SLIM for the ACM/Flex16 offers a wide range of configuration options. These options allow you to choose the line loads (DC or AC) and biasing for each port. DIP switch blocks S1, S2, S3, and S4 control these options. (See Figure 18) Connect Tech ships the RS-422/485 SLIM with all DIP switches set to the "OFF" position.

**Figure 18:** **ACM/Flex16 RS 422/485 SLIM settings**

Figure 19: RS 422/485 SLIM partial schematic

Note: The RS-422/485 Serial Line Interface Module controls four ports, and therefore the schematic shows only a portion of the circuit.

20mA Current Loop Option

You may order the ACM/Flex16 with 20mA Current Loop Serial Line Interface Modules. The 20mA Current Loop SLIM offers a passive 20mA Current Loop electrical interface; a reliable serial link that offers superior noise immunity and multi-drop network connectivity. In addition, the 20mA Current Loop receivers and transmitters are optically isolated
Please refer to **Figure 20** for a partial schematic of the 20mA Current Loop SLIM.

Figure 20: 20mA Current Loop partial schematic

20mA Current Loop SLIM: partial schematic
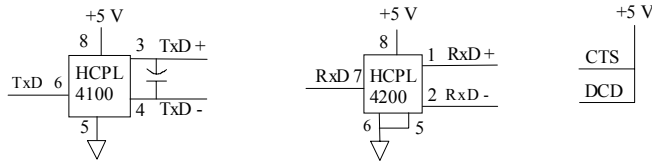
> Note: **The 20mA Current Loop Serial Line Interface Module controls four ports, and therefore the schematic shows only a portion of the circuit.**

The 20mA Current Loop module provides optically isolated 20mA passive Current Loop interfaces for four ports. For each port there is an optically isolated receiver, and an optically isolated transmitter.

> Note: **Please refer to the Hewlett Packard Optoelectronics Manual/Catalogue for a complete description of HPCL 4100 and HPCL 4200 specifications.**

To implement a passive interface, wire the transmitter and the receiver to an external current source.

Please refer to **Figure 32** for a 20mA Current Loop cable wiring configuration between one port of an ACM/Flex16 and another port of an external device.

> **There is a maximum loop resistance for a current loop circuit. The calculation for Maximum Loop Resistance (R_L) is:**
>
> $$Max\ R_L = \frac{V_{OC}\ -\ (S\ \times\ V_D)}{0.020}$$
>
> **S = the number of stations in the loop (TX's and RX's)**
> **V_D = the voltage drop for the HP opto couplers on the SLIM. V_D = 2.3 V for the HPCL 4100 and HPCL 4200. When you use other manufacturers' equipment in the loop the value of V_D may differ.**
> **V_{OC} = the open circuit voltage of the current source**

LED interface indicators (ACM/Flex16)

You can install RS-232 and/or RS-422/485 and/or 20mA Current Loop Serial Line Interface Modules in your ACM/Flex 16. The ACM/Flex16 has LED indicators on its front panel to show you the electrical interface in use for a specific group of four ports. When the LED is red the RS-422/485 interface is in use; when it is green the RS-232 interface is in use; and when it is amber the 20mA Current Loop interface is in use. Please refer to **Figure 14** for the location of these LED interface indicators.

Figure 21: *LED interface indicators (ACM/Flex16)*
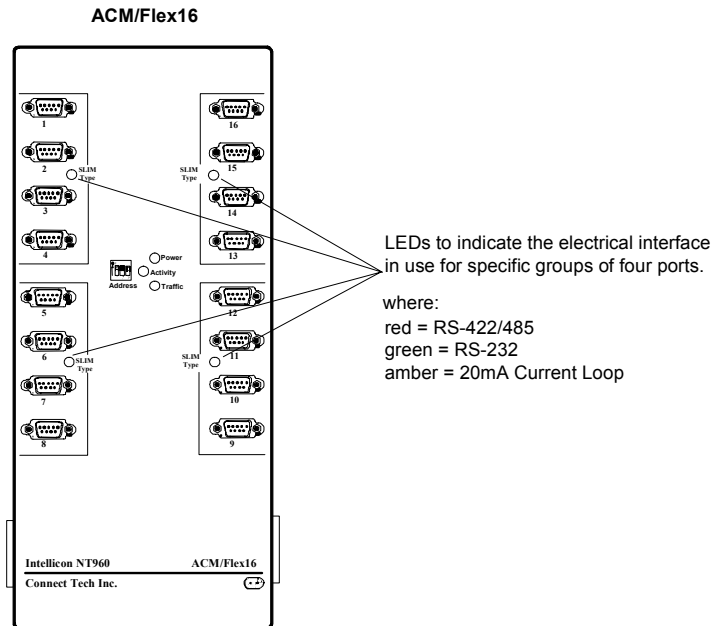
Note: **The Serial Line Interface Modules control four ports, and therefore the LED indicators show the electrical interface in use for four ports**

Connecting the ACM/16/16RJ/Flex16 to a NT960 Host Adapter

The steps to connect ACM/16, ACM/16RJ and ACM/Flex16 external modules to a NT960 Host Adapter are:

1. Turn off or disconnect the power to the computer containing the NT960 Host Adapter.

2. Connect the ACM/16, ACM/16RJ or ACM/Flex16 to the NT960 Host Adapter with the DB-37 bus cable supplied.

3. If you are connecting more than one ACM/16, ACM/16RJ or and/or ACM/Flex16 to the Host Adapter, verify that each module has a unique address switch setting.

4. The NT960 Host Adapter can connect up to a maximum of eight ACM/16, ACM/16RJ and/or ACM/Flex16 modules giving you a total of 128 ports. You can connect the modules directly to each other. When connecting the modules to each other please attach metal straps between each module.

5. After you connect the ACM/16, ACM/16RJ and/or ACM/Flex16 modules to the Host Adapter and to each other, connect the ACM/16, ACM/16RJ or ACM/Flex16 power supply to the module and then plug it into your power source.

6. Turn on or connect the power to your host computer.

Note:
If an existing installation has a two cable configuration, we recommend that you replace the cables with the newer cable assembly.
You should use no more than two bus cables for the entire subsystem.

External Power Supply

ACM/16 and ACM/16RJ

The ACM/16 and ACM/16RJ require the connection of only one external power supply for every 48 ports connected to a HOST Adapter. Please connect the power supply to the POWER IN connector on the first ACM/16 or ACM/16RJ module (16 ports) and then connect power cables between the POWER OUT and the POWER IN connectors on the ACM/16 or ACM/16RJ modules.

When you add another ACM/16 or ACM/16RJ module to bring the total to 64 ports you must connect another external NT960 power supply to the POWER IN connector on this additional ACM/16 orACM/16RJ module. If you add another 32 ports to bring the total to 96 ports you can once again connect power cables between the POWER OUT and POWER IN connectors on the ACM/16 or ACM/16RJ modules. Please refer to **Figure 22, Figure 23 and Figure 24** for connecting multiple ACM/16, ACM/16RJ or ACM/Flex16 modules.

ACM/Flex16, RS-232 and/or 20mA Current Loop

ACM/Flex16 with RS-232 and/or 20mA Current Loop interfaces only require the connection of one external power supply for every 48 ports connected to a HOST Adapter.

ACM/Flex16 with RS-422/485

The ACM/Flex16 with RS-422/485 only or a combination of RS-232 and RS-422/485 and 20mA Current Loop interfaces requires the connection of one external power supply for every 32 ports connected to a HOST Adapter.

Please connect the power supply to the POWER IN connector on the first ACM/Flex16 (or ACM/16/16RJ) module (16 ports) and then connect power cables between the POWER OUT and the POWER IN connectors on the ACM/16, ACM/16RJ and ACM/Flex16 modules.

When you add another ACM/Flex16 or ACM/16 or ACM/16RJ module to bring the total to 48 ports you must connect another external NT960 power supply to the POWER IN connector on this additional ACM/Flex16, ACM/16 or ACM/16RJ module. If you add another 16 ports to bring the total to 64 ports you can once again connect power cables between the POWER OUT and POWER IN connectors on the ACM/Flex16, ACM/16 or ACM/16RJ modules. Please refer to **Figures 15, 16** and **17** for connecting multiple ACM/16/16RJ/Flex16 modules.

Warning

When connecting or disconnecting an ACM/16, ACM/16RJ or ACM/Flex16 to a NT960 Host Adapter or to another ACM/16, ACM/16RJ or ACM/Flex16 module, you must turn off or disconnect the computer's power supply and the power supply to the external ACM module. Failure to observe this precaution will result in damage to the NT960 Host Adapter and/or external module.

You can connect only ACM/16, ACM/16RJ or ACM/Flex16 modules to a NT960 Host Adapter or to another ACM/16, ACM/16RJ or ACM/Flex16 module. Failure to observe this precaution will result in damage to the NT960 Host Adapter and/or external module.

Figure 22: *Connection of one ACM/16/16RJ/Flex16 module*
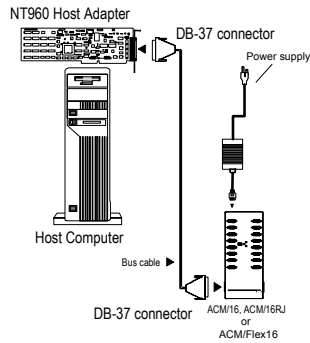
Figure 23: *Connection of three ACM/16/Flex16 modules*
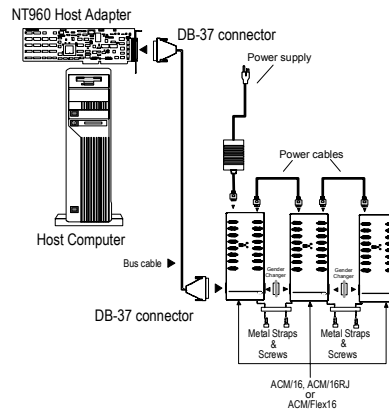
Note:
The ACM/Flex16 with RS-232 and/or 20mA Current Loop interfaces only requires the connection of one external power supply for every 48 ports connected to a HOST Adapter.

The ACM/Flex16 with RS-422/485 only or a combination of RS-232 and RS-422/485 and 20mA Current Loop interfaces requires the connection of one external power supply for every 32 ports connected to a HOST Adapter.

Please install all the metal straps provided to insure a proper connection between ACM/16/16RJ/Flex16 modules. You should install these straps between both the top and the bottom of the ACM/16/16RJ/Flex16 modules. Failure to do so will cause an intermittent connection that will disrupt communications.

Figure 24: *Connection of six ACM/16/16RJ/Flex16 modules*
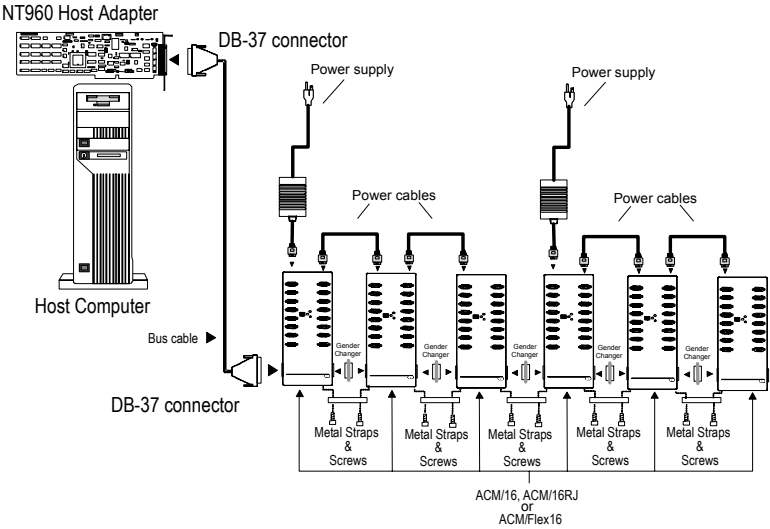
Software Installation

Intellicon-NT960 software device drivers support:

PC-DOS & MS-DOS
Versions 3.XX & up

QNX
Versions 2.XX
Versions 4.XX

UNIX
SCO UNIX
Interactive UNIX

Windows NT
Version 4.0

Before installing the Intellicon-NT960 software device driver, verify and note your switch and jumper settings for:

- The NT960 Host Adapter's base memory address
- The NT960 Host Adapter's I/O port addresses
- The NT960 Host Adapter's IRQ settings
- The ACM/16, ACM/16RJ and ACM/Flex16 module(s) address switch settings

---

Technical Tips:
1. Please read any install guides or README files on the CD shipped with the Intellicon-NT960 subsystem prior to installing your software.
2. If your operating system is missing, or you require additional information, please go to the **Download Zone** *of the* **Support Center** *on the Connect Tech website for product manuals, installation guides and device driver software.*

---

ntload Program

The NT960 ntload program is a conversion program that reads an Intel style HEX file and then writes it to the NT960 Host Adapter's flash memory as a binary file. The binary file will have the same name as the HEX file but with a **.bin** extension on it.

> **When you are installing an Intellicon-NT960 for the first time, you must run the ntload program before you install the appropriate NT960 device driver for your operating system.**
> **To run the ntload program for a UNIX system, you must run the ntload program for DOS (found on the Intellicon-NT960 DOS driver diskette).**

The **ntload** program runs under DOS 5.0 or higher in a system with 512 KB memory or greater. Other versions of the **ntload** program run under QNX 2.XX, QNX 4.XX and Windows NT. You can find the appropriate ntload program on the Intellicon-NT960 DOS, QNX and Windows NT driver diskettes.

Command Line Syntax

The command line syntax for the **ntload** program is:
ntload [f=hexname[.hex]] [a=addr] [p=io_port] [+f] [+v]

Where [ ] is:

f=   This parameter specifies the firmware HEX file that will load into the NT960 Flash memory. You must specify this parameter.(**f=** has no default)

a=   This specifies the memory address configuration of the NT960. Refer to the hardware installation section for the setting of SW2 (**a=d000h** by default)

e=sec   Sets the erase timeout value (in seconds)

p=   This specifies the I/O address configuration of the NT960. Refer to the hardware installation section for the setting of SW1 (**p=300h** by default)

+f   Forces the conversion of the '.hex' file to occur even if the '.bin' file is up to date (off by default)

+P   Forces flash programming even if erasure does not complete

+v   Displays the version of the HEX load file and then stops.

If the **.bin** file already exists then the date/time of the **.bin** file is compared to the date/time of the **.hex** file. If the **.hex** file is newer than the **.bin** file then the conversion will take place. If not then a message on your screen indicates that the **.bin** file is up to date. You can force the conversion of the HEX file by the use of the **+f** argument.

Examples:
1. The following example loads the HEX file fqniu.hex information into the Host Adapters flash memory

    ntload f=fqniu

2. The following example loads the HEX file fsniu.hex information into the Host Adapters flash memory and forces HEX to binary conversion.

    ntload f=fsniu +f

3. The following example loads the HEX file fsniu.hex information into the Host Adapter's flash memory, where the Host Adapter has a base memory address of D200h and an I/O port address of 320h

    ntload f=fsniu a=d200 p=320

4. The following example will display on the screen a brief description of the ntload arguments

    ntload ?

The following messages will appear upon successful completion of the **ntload** *program:*

The flash memory is now programmed - NT960 initialization will begin ....
NT960 (re) programming has been successful
New firmware is NT960 [rev #] [date] [time] [year]

Specifications

NT960 Host Adapter

Processor

- Intel i960   32 bit RISC processor, 16MHz

Memory

- 512 KB or 2 MB of static RAM
- 64 KB or 256 KB of dual-ported RAM
- 256 KB of Flash EEPROM

PC Bus Interface

- Dual-ported RAM interface
- Memory appears as 8 KB window in PC address space
- 8 or 16 bit transfers
- Up to 8.33 MHz ISA bus speed
- Polled or interrupt modes available
- PC interrupt is jumper selectable, (3, 4, 5, 6, 7, 9, 10, 11, 12, 14, or 15)
- Base Address is DIP switch selectable, requires 4 consecutive addresses
- I/O port address is DIP switch selectable
- Memory starting address is DIP switch selectable (0C0000 to 0FE000)

Operating Environment

- Ambient temperature: 0 - 70 ° C
- Relative humidity: 0 - 90% no condensing
- Air movement: no requirement
- Altitude: 15,000 feet (5000 metres)

Power Requirements

- +5 VDC: 900 mA typical, 1.2 A maximum
- -5 VDC: 0
- +12 VDC: 20 mA typical   50 mA maximum
- -12 VDC: 0

Dimensions

- Length: 33.60 cm/13.23 in.
- Height: 10.60 cm/4.17 in.

NT960 ACM/16, ACM/16RJ and ACM/Flex16

Asynchronous Communication Module

ACM/16
- Four CLCD1400 RISC like quad UARTs with 12 bytes of FIFO per channel on the chip
- EIA RS-232-C Interface
- Sixteen RS-232 asynchronous ports with male DB-9 connectors
- Ports configurable from 50 bps up to 115 Kbps
- Programmable Baud Rate Generator

ACM/Flex16
- Four CLCD1400 RISC like quad UARTs with 12 bytes of FIFO per channel on the chip
- EIA RS-232-C and/or RS-422/485 Interface and/or 20mA Current Loop
- Sixteen RS-232 and/or RS-422/485 and/or 20mA Current Loop asynchronous ports with male DB-9 connectors
- Ports configurable from 50 bps up to 115 Kbps
- Programmable Baud Rate Generator

ACM/16RJ
- Four Cirrus Logic CD1400 RISC like quad UARTs with 24 bytes of FIFO per channel on the chip
- EIA RS-232-C Interface
- Sixteen RS-232 asynchronous ports with RJ-45 connectors
- Ports configurable from 50 bps up to 115 Kbps
- Programmable Baud Rate Generator

Operating Environment

ACM/16, ACM/16RJ and ACM/Flex16
- Ambient temperature: 0 - 70 ° C
- Relative humidity: 0 - 90% no condensing
- Air movement: no requirement
- Altitude: 15,000 feet (5,000 metres)

Power Requirements

ACM/16, ACM/16RJ and ACM/Flex16
- Power supply provided

Dimensions

ACM/16
- Length: 32.812 cm/12.92 in
- Width: 11.562 cm/4.55 in.
- Height: 4.062 cm/1.60 in.

ACM/Flex16
- Length: 32.812 cm/12.92 in.
- Width: 14.100 cm/5.55 in.
- Height: 4.062 cm/1.60 in.

ACM/16RJ
- Length: 32.85 cm/12.93 in.
- Width: 11.55 cm/4.55 in.
- Height: 4.84 cm/1.91 in.

NT960 Part Numbers

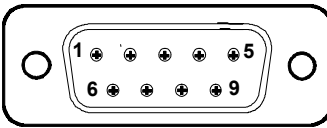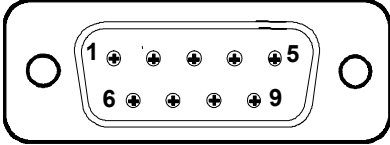|	
NTHOST-512	Intellicon-NT960 Host Adapter with 512 KB of RAM (for up to 32 ports per Host Adapter).
NTHOST-2MB	Intellicon-NT960 Host Adapter with 2 MB of RAM (for over 32 ports per Host Adapter).
NTACM16V2	Intellicon-NT960 ACM/16 external module with DB-9 male connectors.
NTACM16V3	Intellicon-NT960 ACM/16RJ external module with RJ-45 connectors.
NTACMF16	Intellicon-NT960 ACM/Flex16 external module with DB-9 male connectors.
NT232SLM	ACM/Flex16 RS-232 SLIM.
NT485SLM	ACM/Flex16 RS-422/485 SLIM.
NT20MASLM	ACM/Flex16 20mA Current Loop SLIM
NTCAB	Intellicon-NT960 bus cable, six feet long.
NTUPSLC	Intellicon-NT960 ACM/16, ACM/16RJ or ACM/Flex16 external module power supply, 110 volts, with power line cord. (one power supply for every three modules)
NTPS220	Intellicon-NT960 ACM/16, ACM/16RJ or ACM/Flex16 external module power supply, 220 volts, with no power line cord. (one power supply for every three modules)
NTACMPC	Intellicon-NT960 ACM/16, ACM/16RJ or ACM/Flex16 power cable. (only required to connect power between ACM modules)
CLIP001	Retaining clip for connecting ACM/16 modules, version 1, together.
CLIP002	Retaining clip for connecting ACM/16, version 2 modules, ACM/16RJ or ACM/Flex16 modules together.

Connector Pinouts

ACM/16 Pinouts

A cable with 37 pin connectors connects the Intellicon-NT960 host adapter to an ACM/16 external module. ACM/16, ACM/16RJ and ACM/Flex16 modules also connect to each other via 37 pin connectors. These connections are a proprietary external bus interface not a serial interface, and therefore no pinouts are given for the 37 pin connectors.

The ACM/16 provides male DB-9 connectors for each port. The pinouts are outlined in the following table.

Table 7: DB-9 pinouts - ACM/16

Pin No.	RS-232 Signal	Direction
1	DCD	input
2	RxD	input
3	TxD	output
4	DTR	output
5	SG	signal gnd.
6	DSR	input
7	RTS	output
8	CTS	input
9	RI	input

Male DB-9 Connector

Technical Tip:
Please ensure that you terminate the DCD or CTS signals if your application does not use them. The common way to do this is to connect DCD to DTR and/or to connect CTS to RTS. Failure to do so may result in a loss of a performance on your Intellicon-NT960 subsystem.

ACM/Flex16 Pinouts

A cable with 37 pin connectors connects the Intellicon-NT960 host adapter to an ACM/Flex16 external module. ACM/16, ACM/16RJ and ACM/Flex16 modules also connect to each other via 37 pin connectors. These connections are a proprietary external bus interface not a serial interface, and therefore no pinouts are given for the 37 pin connectors.

The ACM/Flex16 provides male DB-9 connectors for each port.

Table 8: DB-9 pinouts - ACM/Flex16

Pin No.	RS-232 Signal	Direction	RS-422/485 Signal	Direction	20mA Signal	Direction
1	DCD	input	RxD +	input	RxD -	input
2	RxD	input	TxD +	output	TxD +	output
3	TxD	output	TxD -	output	unused	
4	DTR	output	RxD -	input	unused	
5	SG	signal gnd.	SG	signal gnd.	unused	
6	DSR	input	CTS -	input	unused	
7	RTS	output	RTS -	output	TxD -	output
8	CTS	input	RTS +	output	RxD +	input
9	RI	input	CTS +	input	unused	

Male DB-9 Connector

Note: ports 3, 4, 7, 8, 11, 12, and 15 do not support the RI signal.

Technical Tip:
Please ensure that you terminate the DCD or CTS signals if your application does not use them. The common way to do this is to connect DCD to DTR and/or to connect CTS to RTS. Failure to do so may result in a loss of a performance on your Intellicon-NT960 subsystem.
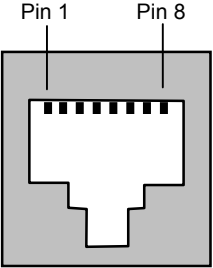
ACM/16RJ Pinouts

A cable with 37 pin connectors connects the Intellicon-NT960 host adapter to an ACM/16RJ external module. ACM/16, ACM/16RJ and ACM/Flex16 modules also connect to each other via 37 pin connectors. These connections are a proprietary external bus interface not a serial interface, and therefore no pinouts are given for the 37 pin connectors

The ACM/16RJ provides RJ-45 modular connectors for each port.

Table 9: RJ-45 pinouts - ACM/16RJ

Pin No.	RS-232 Signal	Direction
1	DCD	input
2	RTS	output
3	SR	
4	TxD	output
5	RxD	input
6	SR	
7	CTS	input
8	DTR	output

Pin 1   Pin 8

Technical Tip:
Please ensure that you terminate the DCD or CTS signals if your application does not use them. The common way to do this is to connect DCD to DTR and/or to connect CTS to RTS. Failure to do so may result in a loss of a performance on your Intellicon-NT960 subsystem.

Table 10: ACM/Flex16 module SLIM socket pinouts

SLIM Pin No.	TTL Signal	RS-232 Signal	RS-422/485 Signal	Current Loop Signal
1	+12 V			
2	RxD 4			
3	TxD 4			
4	CTS 4			
5	RTS 4			
6	DSR 4			
7	DTR 4			
8	DCD 4			
9	+5 V			
10		DCD 4	RxD B(+) 4	RxD (-) 4
11		DSR 4	CTS A(-) 4	
12		RxD 4	TxD B(+) 4	TxD (+) 4
13		RTS 4	RTS A(-) 4	TxD (-) 4
14		TxD 4	TxD A(-) 4	
15		CTS 4	RTS B(+) 4	RxD (+) 4
16		DTR 4	RxD A(-) 4	
17		RI 4	CTS B(+) 4	
18		Ground	Signal ground	
19	RxD 3			
20	TxD 3			
21	CTS 3			
22	RTS 3			
23	DSR 3			
24	DTR 3			
25	DCD 3			
26	Reserved			
27	+5 V			
28		DCD 3	RxD B(+) 3	RxD (-) 3
29		DSR 3	CTS A(-) 3	
30		RxD 3	TxD B(+) 3	TxD (+) 3
31		RTS 3	RTS A(-) 3	TxD (-) 3
32		TxD 3	TxD A(-) 3	
33		CTS 3	RTS B(+) 3	RxD (+) 3
34		DTR 3	RxD A(-) 3	
35		RI 3	CTS B(+) 3	
36		Ground	Signal ground	

Table 10(continued): SLIM socket pinouts

SLIM Pin No.	TTL Signal	RS-232 Signal	RS-422/485 Signal	Current Loop Signal
37	Ground			
38	RxD 2			
39	TxD 2			
40	CTS 2			
41	RTS 2			
42	DSR 2			
43	DTR 2			
44	DCD 2			
45	RI 2			
46		DCD 2	RxD B(+) 2	RxD (-) 2
47		DSR 2	CTS A(-) 2	
48		RxD 2	TxD B(+) 2	TxD (+) 2
49		RTS 2	RTS A(-) 2	TxD (-) 2
50		TxD 2	TxD A(-) 2	
51		CTS 2	RTS B(+) 2	RxD (+) 2
52		DTR 2	RxD A(-) 2	
53		RI 2	CTS B(+) 2	
54		Ground	Signal ground	
55	RxD 1			
56	TxD 1			
57	CTS 1			
58	RTS 1			
59	DSR 1			
60	DTR 1			
61	DCD 1			
62	RI 1			
63	-12 V			
64		DCD 1	RxD B(+) 1	RxD (-) 1
65		DSR 1	CTS A(-) 1	
66		RxD 1	TxD B(+) 1	TxD (+) 1
67		RTS 1	RTS A(-) 1	TxD (-) 1
68		TxD 1	TxD A(-) 1	
69		CTS 1	RTS B(+) 1	RxD (+) 1
70		DTR 1	RxD A(-) 1	
71		RI 1	CTS B(+) 1	
72		Ground	Signal ground	

RS-422/485 SLIM Configuration options

The RS-422/485 SLIM on the ACM/FLEX16 offers line bias and line load configuration options.

You select these options and features by four (one for each port), 6 position DIP switches on the SLIM. Please refer to **Figure 25** for the locations of these DIP switches on the RS-422/485 SLIM. Please refer to **Table 12** for the port number/switch block relationship; and to **Table 13** for a summary of the line load options.

> **Warning:**
> **Do not use a pencil to set the DIP switches as the lead graphite may short-circuit the switch.**

Figure 25: RS 422/485 SLIM - DIP switches
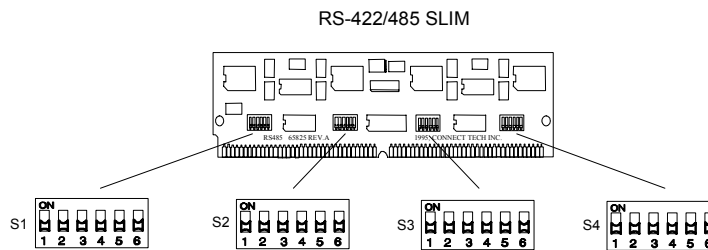
Table 11: RS-422/485 SLIM; port/switch block relation

Port number	SLIM socket	Switch block	Port number	SLIM socket	Switch block
1	SM1	S4	9	SM3	S4
2	SM1	S3	10	SM3	S3
3	SM1	S2	11	SM3	S2
4	SM1	S1	12	SM3	S1
5	SM2	S4	13	SM4	S4
6	SM2	S3	14	SM4	S3
7	SM2	S2	15	SM4	S2
8	SM2	S1	16	SM4	S1

Table 12: RS-422/485 SLIM; line load options

Switch Position	Configuration (when OFF)	Configuration (when ON)
1	TxD load is removed	TxD load enabled (150 ohms)
2	RTS load is removed	RTS load enabled (150 ohms)
3 & 4	RxD disconnected from bias and load circuits **Note:** *These two switches MUST be used together*	RxD connected to bias and load circuits
5	RxD load is AC (150 ohms in series with 50 nF and > 50 metres in length)	RxD load is DC (150 ohms and < 50 metres in length)
6	CTS load is AC (150 ohms in series with 50 nF)	CTS load is DC (150 ohms)

Technical Tip: We recommend that you set the switches 3, 4 and 5 on the RS-422/485 SLIM to the ON (up) position for most RS-422/485 configurations

Line bias feature

During the operation of a half duplex, or multi-drop RS-422/485 connection, there are situations (time intervals) when there is NO "generator station" driving the wires that interconnect the various stations. During these intervals the connection is susceptible to electrical interference from outside sources. The RS-422/485 SLIM has fixed bias circuits to reduce the sensitivity to electrical interference when no "generator station" (TxD and RTS) is driving the cable. These bias circuits force the "receiver stations" (RxD and CTS) into a known state.

Line load options

RS-422/485 lines normally need some type of load to prevent an impedance mismatch that causes signal interference. The RS-422/485 specification defines line termination loads placed on either end of a twisted pair cable segment.

Figure 26: Typical RS-422/485 circuit
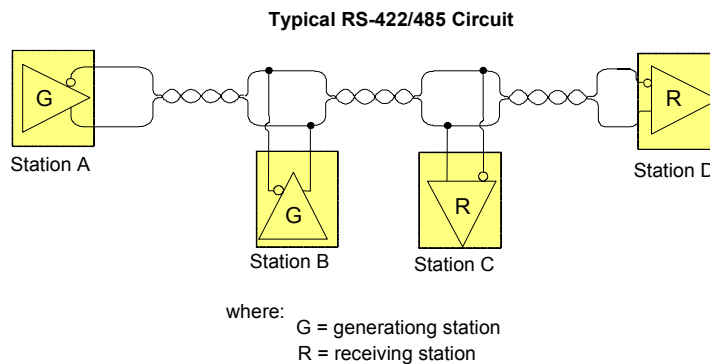
DIP switches S1, S2, S3, and S4 on the RS-422/485 SLIM allow you to select a "generator station" load and a "receiver station" load. The "generator station" is either the TxD or RTS signals. The "receiver station" is either the RxD or CTS signals.

The RS-422/485 SLIM also offers you additional functionality to disconnect the RxD signal pair COMPLETELY from the load and bias circuits. This allows you to multi-drop the RxD station on a half duplex communication line. You select this option with switch positions 3 and 4 on switch blocks S1, S2, S3, and S4. Please refer to the following examples concerning this option and their switch settings.
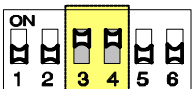
Figure 27: Example of RxD signal pair setting
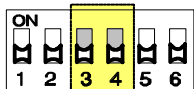
This example shows the RxD signal pairs on a ACM/Flex16 port disconnected from the load and bias circuits for multi-drop on a half duplex line.


This example shows the RxD signal pairs on a ACM/Flex16 port connected to the load and bias circuits.

Switch positions 1 and 2 on switch blocks S1, S2, S3 and S4 allow the "generator stations" (TxD and RTS) to have either no load or a **DC load** of 150 ohms. Please refer to the examples in Figure 28 for these configuration options and their switch settings.

Switch positions 5 and 6 on switch blocks S1, S2, S3, and S4 allow the "receiver stations" (RxD and CTS) to have either a **DC load** of 150 ohms or an **AC load** of 150 ohms in series with a 50 nF capacitor. Please refer to the examples in Figure 28 for these configuration options and their switch settings.
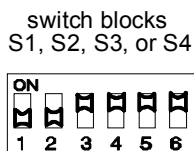
Figure 28: RS-422/485 switch setting examples

1. *The following example shows the switch settings for Station A as per* **Figure 26** *where TxD and RTS have a load of 150Ω.*

switch blocks
S1, S2, S3, or S4
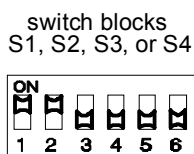
2. *The following example shows the switch settings for Station B and Station C as per* **Figure 26**

switch blocks
S1, S2, S3, or S4
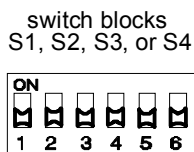
3. *The following example shows the switch settings for Station D as per* **Figure 26** *where RxD and CTS have a DC load of 150Ω.*

switch blocks
S1, S2, S3, or S4

4. *The following example shows the switch settings for Station D as per* **Figure 26** *where the circuit is > than 50 metres in length and RxD and CTS have an AC load of 150 Ω in series with 50 nF*

switch blocks
S1, S2, S3, or S4
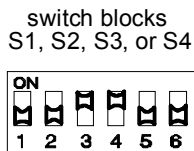
Cable Wiring

RS-422/485 Cable Wiring

You can wire your ACM/Flex16 with the RS-422/485 option in various ways to communicate with RS-422/485 peripherals. This section illustrates a few examples of RS-422/485 cabling schemes.
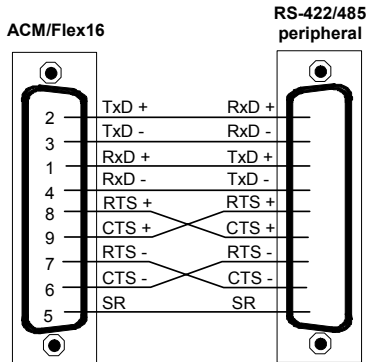
Figure 29: RS-422/485 wiring diagram (8 wire)

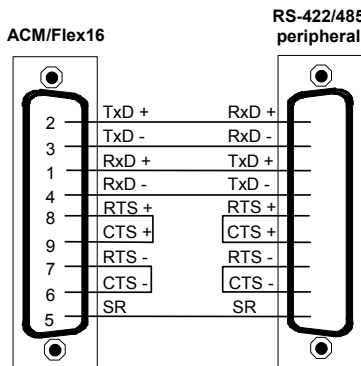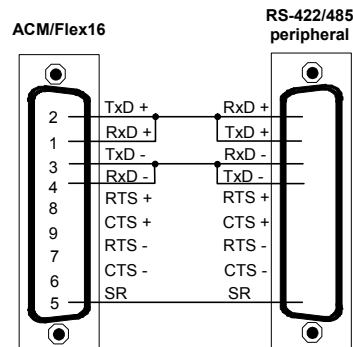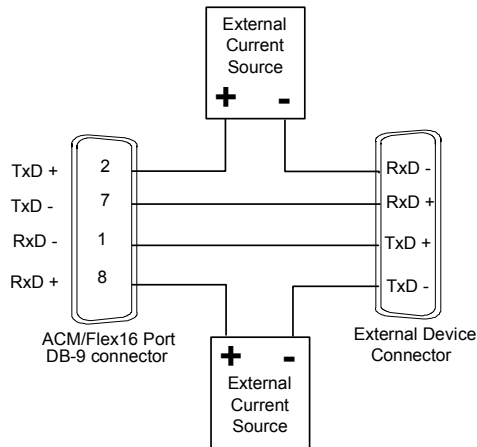*Figure 30: RS-422/485 wiring diagram (4 wire)*

Figure 31: RS-422/485 wiring diagram (2 wire)

Current Loop Cable Wiring

You can wire the ACM/Flex16 with the 20mA Current Loop option in various ways to communicate with 20mA Current Loop peripherals. This section will describe an example of a current loop cabling scheme.

Figure 32: Current Loop wiring diagram (4 wire)

TxD +	2
TxD -	7
RxD -	1
RxD +	8

ACM/Flex16 Port
DB-9 connector

External Device Connector

RxD -
RxD +
TxD +
TxD -

External Current Source + -

External Current Source + -

Note:
The example above illustrates a 20mA Current Loop cable wiring configuration between one port of the ACM/Flex16 and another port of an external device.

Factory Settings

NT960 Host Adapter

The NT960 Host Adapter ships with the following default settings:

I/O port address: 300h-303h
Base memory address: D0000h
IRQ (Interrupt Request line): IRQ 10
8/16-bit Mode: 8-bit mode

ACM/16, ACM/16RJ and ACM/Flex16 Module

The NT960 ACM/16, ACM/16RJ and ACM/Flex16 modules ship with the following default settings:

ACM/16, ACM/16RJ or ACM/Flex16 address: Address 1. (This setting assigns port numbers 1 through 16 to the serial ports)

ACM/Flex16: RS-422/485 SLIM options: All DIP switches set to the "OFF" position