

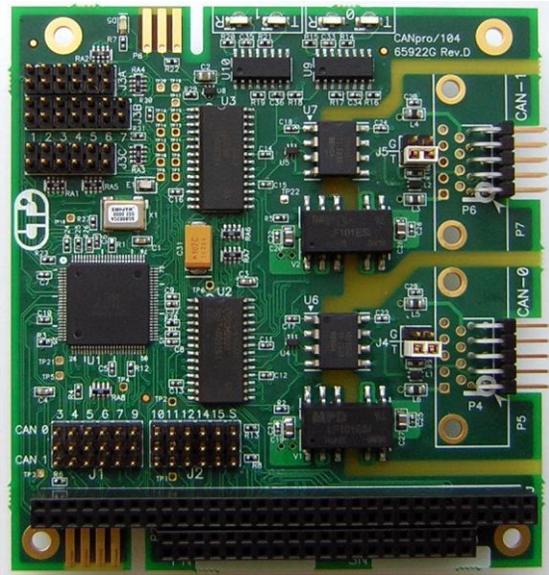


**Connect Tech Inc.**  
*Industrial Strength Communications*

# USER MANUAL

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## CANpro/104



CTIM-00043 (0.02) - January 15, 2010

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## Revision History

<b>Revision 0.02</b>	<b>January 15, 2010</b> Updated manual with Rev.C (or later) Boards
<b>Revision 0.01</b>	<b>December 22, 2008</b> Updated manual to new format Updated Table 3
<b>Revision 0.00</b>	<b>Original Document</b>

## Introduction

CANpro/104 combines the power of two independent NXP SJA1000 CAN controllers with the compact size and rugged stability of PC/104. CANpro/104 is ideal for industrial control applications exposed to harsh conditions or environments. CANpro/104 Opto models feature 2.5 kV of data and power isolation.

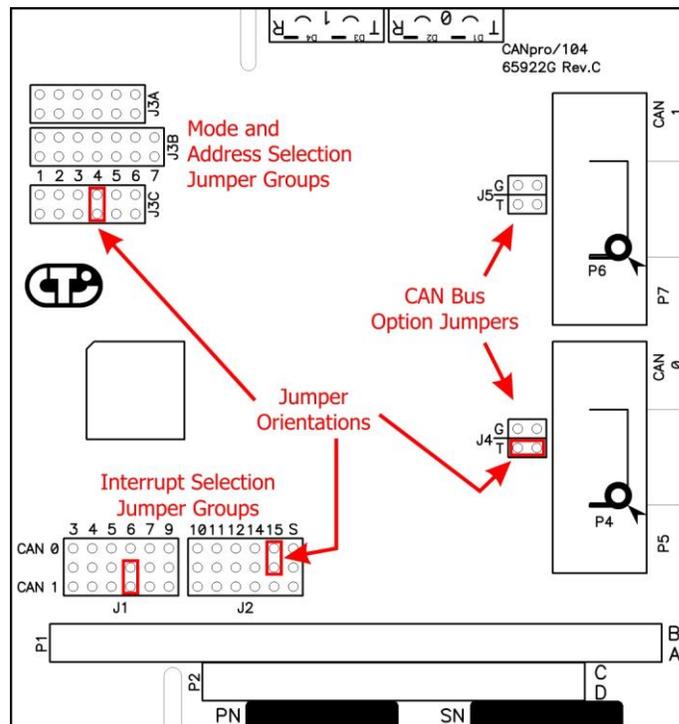
## Features

- Two independent, industry standard NXP SJA1000 CAN controllers
- PC/104 compliant
- 16MHz input clock (24MHz build option available)
- Fail-safe power-up/power-down using on-board impedance transceivers to maximize nodes on the bus and ensure glitch-free operation.
- Supports up to 1.0 Mbps operation and over 120 nodes on the bus
- 2000 V(AC) 50/60 Hz sine wave, 2500 V (peak) signal and power isolation for each port from the host system (on CANpro/104 Opto models only)
- Jumper configurable:
  - address range and interrupt sharing
  - output slew rate limiting for lower radiated emissions
  - -120 Ohm CAN bus termination
- Decoded address range is configurable for BasicCAN and PeliCAN modes
- Ten pin right angled header standard as an I/O connector (DB-9 option available)
- Operating temperature range of -40°C to +85°C
- +5V power output on some models
- RoHS compliant

## Hardware Installation – Rev C & Later

The **Connect Tech CANpro/104** board provides two (2) industry standard SJA1000 CAN Bus controllers in a PC/104 board format which supports both I/O and Memory mapping configurability.

All the configuration options are setup with jumpers, identified as **J1, J2, J3A, J3B, J3C, J4 and J5**. Jumpers are always oriented as indicated in the drawing below.



The jumper positions are numbered on the PCB (and are shown in the above drawing). **J1 and J2** are **Interrupt Selection** jumpers, and the numbers (3, 4, 5, 6, 7, 9, 10, 11, 12, 14 and 15) refer to the actual interrupt number being selected. **J3A, J3B and J3C** positions are numbered sequentially from left to right. J3A and J3C have 6 positions, J3B has 7 positions. **J4 and J5** positions are labeled “T” and “G”.

## Memory vs I/O Spaces

The first decision to make when configuring this board, it to select whether the board will operate within the **Memory** or **I/O address Space** of the computer system in which the board is installed. First a quick description of the two different **Spaces**.

### Memory Space

Most (but not all) PC/104 CPU System board vendors provide one or more regions of **Memory Addresses** that can be configured (or allocated) to the PC/104 Expansion bus connector(s) on CPU System board. This setup may be performed via the BIOS setup or via jumpers or switches on the System board. This memory region is usually located at addresses below the 1-Meg CPU memory address (commonly referred to as the **Upper Memory** addresses), although some System boards allow the PC/104 Expansion Bus to be allocated to blocks of addresses within the first 16-Meg of memory.

### I/O Space

This region is supported by all PC/104 CPU System board vendors, and commonly consists of *I/O Addresses* from 0x000 to 0x3FF, although some System boards support I/O addresses beyond 0x3FF. (Note: Some I/O mapped PC/104 expansion boards only decode the lowest 10 bits of the I/O address, therefore these boards restrict the usable I/O space to 0x3FF).

## CTI CANpro/104 Spaces

### Memory Space

The **CTI CANpro/104** board can be configured to operate in the CPU Memory Address Space between addresses **0x000000 and 0xCFE000**. The board decodes an 8192/0x2000 byte block of memory selectable at numerous address locations throughout the first 16-Meg of CPU address range. The selection is always on an 8192/0x2000 byte address boundary.

### I/O Space

The **CTI CANpro/104** board can be configured to operate in the CPU I/O Address Space between addresses **0x000 and 0x7C0**. The board decodes either a 256/0x100 byte block or a 64/x40 byte sized block depending on the selection of either the *PeliCAN* or *BasicCAN* mode (more on this selection later).

- When the *PeliCAN* mode is selected, the board decodes a 256/0x100 byte block (on a 256/0x100 byte address boundary) at I/O addresses from **0x000 to 0x700**.
- When the *BasicCAN* mode is selected, the board decodes a 64/0x40 byte block (on a 64/0x40 byte address boundary) at I/O addresses from **0x000 to 0x7C0**.

The selection of either Memory or I/O space is made with Jumper **J3A Position #1**.

J3A Position #1	Function
Removed	Memory Space operation enabled
Installed	I/O Space operation enabled

**Table 1**

### Memory Space Enabling

Some CPU System board BIOS's will scan certain regions of the CPU memory below the 1-Meg boundary looking for ROM's to boot from, **and** if the **CTI CANpro/104** board is setup to operate within these memory regions, the BIOS might accidentally confuse this board as being a ROM. To prevent this, this board has the ability to power-up (or after a system reset) with the Memory Space **disabled**.

There are 2 ways to enable the Memory Space. First, it can be enabled **permanently** by using Jumper **J3C Position #1**.

J3C Position #1	Function
Removed	Memory Space is always enabled
Installed	Memory Space powers-up (or resets) as disabled

**Table 2**

Secondly, the Memory Space can be enabled by Application or Driver software, after the Operating system has started. This can be accomplished by writing a data value to an I/O Space Address which is decoded by the following **J3B** Jumper settings. **Only one byte** of the I/O Space is decoded at this I/O Address, and the location is **Write Only**.

J3B			I/O Address
Position #5	Position #6	Position #7	
Removed	Removed	Removed	0x200
Removed	Removed	Installed	0x240
Removed	Installed	Removed	0x280
Removed	Installed	Installed	0x2C0
Installed	Removed	Removed	0x300
Installed	Removed	Installed	0x340
Installed	Installed	Removed	0x380
Installed	Installed	Installed	0x3C0

**Table 3**

Notes:

1. These I/O address choices **do NOT** access the CAN Controllers, they are used in Memory Mode to **enable** the Memory Space address decoding.
2. Writing a data value of **0xA5** will enable the Memory Space, and a data value of **0x5A** will disable the Memory Space. All other data values written will be ignored.
3. When the Memory Space is **permanently** enabled (when J3C-1 is removed), any data value written to the “**Memory Enable**” I/O address will be ignored.

## Base Address Decoding

The CTI CANpro/104 board decodes its Base Address setting (in either Memory or I/O Spaces) by comparing (matching) various Jumper settings with PC/104 Bus Address bits.

If a Jumper is **installed**, then the corresponding Address Bit will be matched as a **logical “1”**.

If a Jumper is **removed**, then the corresponding Address Bit will be matched as a **logical “0”**.

The matching of Jumper settings to Address bits depends on whether the board is operated in Memory or I/O Spaces, and whether PeliCAN or BasicCAN mode is selected.

Jumper Group	Position	Memory Space Address Bit	I/O Space Address Bit	
			PeliCAN	BasicCAN
J3A	2	23	X	X
	3	22	X	X
	4	19	X	X
	5	18	X	X
	6	17	10	10
J3B	1	16	9	9
	2	15	8	8
	3	14	X	7
	4	13	X	6

**Table 4**

Notes:

1. X = Address bit is ignored (and the corresponding Jumper is Not Used).
2. When Memory Space is selected, PC/104 Address bits 20 and 21 are **always decoded as logical “0”**.

To determine which Jumpers to install and which to remove, the desired Address needs to be broken down into a **binary** number, all the Jumpers that correspond to “1-bits” must be installed, and all Jumpers corresponding to “0-bits” must be removed.

The remaining **lower bits** of the PC/104 Bus Address are either, ignored, or are used to select and address the Registers of the SJA1000 CAN controllers, in the following manner.

**When Memory Space is selected**

PC/104 Bus Address Bit	SJA1000 Selection or Register Address Bit
12	Address bit is ignored
11	Address bit is ignored
10	Address bit is ignored
9	Address bit is ignored
8	Address bit is ignored
7	Select SJA1000 device =0, selects the CAN-0 Port =1, selects the CAN-1 Port
6	6
5	5
4	4
3	3
2	2
1	1
0	0

**Table 5**
**When I/O Space is selected**

PC/104 Bus Address Bit	SJA1000 Selection or Register Address Bit	
	PeliCAN Addressing Mode	BasicCAN Addressing Mode
10	Decoded (see Table 4)	Decoded (see Table 4)
9	Decoded (see Table 4)	Decoded (see Table 4)
8	Decoded (see Table 4)	Decoded (see Table 4)
7	Select SJA1000 device =0, selects the CAN-0 Port =1, selects the CAN-1 Port	Decoded (see Table 4)
6	6	Decoded (see Table 4)
5	5	Select SJA1000 device =0, selects the CAN-0 Port =1, selects the CAN-1 Port
4	4	4
3	3	3
2	2	2
1	1	1
0	0	0

**Table 6**

## PeliCAN vs BasicCAN Addressing Modes

The SJA1000 can operate in 2 different modes, the *PeliCAN* mode which has extended features and additional registers and which consume 128 bytes of address space per device (there are 2 devices on this board). And, the *BasicCAN* mode which has reduced functionality but only consumes 32 bytes of register space per device.

**Note: The mode of operation of the SJA1000 is performed by changing Bit-7 of the Clock Divider Register (which defaults to BasicCAN mode whenever a PC/104 Bus Reset occurs).**

When the SJA1000's are operated in BasicCAN mode, it is desirable to accommodate the smaller number of registers by decoding a smaller amount of I/O Space (because the I/O Space region is limited in total size).

The selection of Addressing Mode is done with Jumper **J3C Position #2**. This selection has no meaning when Memory Space operation is enabled (see Jumper J3A above).

J3C Position #2	Function
Removed	PeliCAN Addressing mode enabled
Installed	BasicCAN Addressing mode enabled

Table 7

## Addressing Examples

**Example #1:** Memory Address 0x4A6000 (this address is **above** the 1-Meg boundary)  
 0x4A6000 = **0100.1010.011X.XXXX.CJJJ.JJJJ** (binary)  
 Address bits in **red** are matched against their respective Jumper settings.  
 X = Address bits that are ignored by the board.  
 C = Address bit that is used to select the SJA1000 controller.  
 J = Address bits that are used to select the SJA1000 registers.

Address Bit	Bit Value	J3A or J3B Position	Installed or Removed
23	0	J3A-2	Removed
22	1	J3A-3	Installed
21	0	Address Bit always decoded as "0"	
20	0	Address Bit always decoded as "0"	
19	1	J3A-4	Installed
18	0	J3A-5	Removed
17	1	J3A-6	Installed
16	0	J3B-1	Removed
15	0	J3B-2	Removed
14	1	J3B-3	Installed
13	1	J3B-4	Installed

Table 8

**Example #2:** Memory Address 0x0C8000 (this address is **below** the 1-Meg boundary)  
 0x0C8000 = **0000.1100.100X.XXXX.CJJJ.JJJJ** (binary)

Address Bit	Bit Value	J3A or J3B Position	Installed or Removed
23	0	J3A-2	Removed
22	0	J3A-3	Removed
21	0	Address Bit always decoded as "0"	
20	0	Address Bit always decoded as "0"	
19	1	J3A-4	Installed
18	1	J3A-5	Installed
17	0	J3A-6	Removed
16	0	J3B-1	Removed
15	1	J3B-2	Installed
14	0	J3B-3	Removed
13	0	J3B-4	Removed

**Table 9**

**Example #3:** I/O Address 0x340 (BasicCAN mode)  
 0x340 = **XXXX.XXXX.XXXX.X011.01CJ.JJJJ** (binary)

Address Bit	Bit Value	J3A or J3B Position	Installed or Removed
23 -> 11	X	---	---
10	0	J3A-6	Removed
9	1	J3B-1	Installed
8	1	J3B-2	Installed
7	0	J3B-3	Removed
6	1	J3B-4	Installed

**Table 10**

**Example #4:** I/O Address 0x600 (PeliCAN mode)  
 0x600 = **XXXX.XXXX.XXXX.X110.CJJJ.JJJJ** (binary)

Address Bit	Bit Value	J3A or J3B Position	Installed or Removed
23 -> 11	X	---	---
10	1	J3A-6	Installed
9	1	J3B-1	Installed
8	0	J3B-2	Removed

**Table 11**

### CAN Controller Addressing Table

Once the Base Memory or I/O Address is setup, the 2 SJA1000 CAN controllers are accessed at the following address offsets.

Accessed Resource	Offset from Base Address		
	Memory Space	I/O Space	
		BasicCAN mode	PeliCAN mode
CAN-0 Port (SJA1000)	0x000 ⇒ 0x07F	0x000 ⇒ 0x01F	0x000 ⇒ 0x07F
CAN-1 Port (SJA1000)	0x080 ⇒ 0x0FF	0x020 ⇒ 0x03F	0x080 ⇒ 0x0FF
Memory Enable Bit	At the I/O Address setup with JB3 Positions 5,6,7	N/A	N/A

**Table 12**

The SJA1000 Register offsets can be found in the documentation from NXP Semiconductor (formerly Philips). [www.nxp.com](http://www.nxp.com) (enter SJA1000 into their search tool).

### Common Memory Space Address Selections

Most System boards allow the PC/104 Bus stack to be allocated a portion of the memory address located in the 256K region of memory just below the 1-Meg address boundary (Addresses 0x0C0000 to 0x0FFFFFF). Different BIOS's allow different sized regions to be allocated. The CANpro/104 board requires 8K (8192 bytes) of memory space.

The following table shows the Jumpers required to set up the Base Memory Address within this 256K region.

- In = Jumper installed (Corresponding Memory Address bit is = "1")  
 Out = Jumper removed (Corresponding Memory Address bit is = "0")  
 [xx] = Corresponding Memory Address bit number

Base Memory Address	J3A					J3B			
	2 [23]	3 [22]	4 [19]	5 [18]	6 [17]	1 [16]	2 [15]	3 [14]	4 [13]
0x0C0000	Out	Out	In	In	Out	Out	Out	Out	Out
0x0C2000	Out	Out	In	In	Out	Out	Out	Out	In
0x0C4000	Out	Out	In	In	Out	Out	Out	In	Out
0x0C6000	Out	Out	In	In	Out	Out	Out	In	In
0x0C8000	Out	Out	In	In	Out	Out	In	Out	Out
0x0CA000	Out	Out	In	In	Out	Out	In	Out	In
0x0CC000	Out	Out	In	In	Out	Out	In	In	Out
0x0CE000	Out	Out	In	In	Out	Out	In	In	In
0x0D0000	Out	Out	In	In	Out	In	Out	Out	Out
0x0D2000	Out	Out	In	In	Out	In	Out	Out	In
0x0D4000	Out	Out	In	In	Out	In	Out	In	Out
0x0D6000	Out	Out	In	In	Out	In	Out	In	In
0x0D8000	Out	Out	In	In	Out	In	In	Out	Out
0x0DA000	Out	Out	In	In	Out	In	In	Out	In
0x0DC000	Out	Out	In	In	Out	In	In	In	Out
0x0DE000	Out	Out	In	In	Out	In	In	In	In
0x0E0000	Out	Out	In	In	In	Out	Out	Out	Out
0x0E2000	Out	Out	In	In	In	Out	Out	Out	In
0x0E4000	Out	Out	In	In	In	Out	Out	In	Out
0x0E6000	Out	Out	In	In	In	Out	Out	In	In
0x0E8000	Out	Out	In	In	In	Out	In	Out	Out
0x0EA000	Out	Out	In	In	In	Out	In	Out	In
0x0EC000	Out	Out	In	In	In	Out	In	In	Out
0x0EE000	Out	Out	In	In	In	Out	In	In	In
0x0F0000	Out	Out	In	In	In	In	Out	Out	Out
0x0F2000	Out	Out	In	In	In	In	Out	Out	In
0x0F4000	Out	Out	In	In	In	In	Out	In	Out
0x0F6000	Out	Out	In	In	In	In	Out	In	In
0x0F8000	Out	Out	In	In	In	In	In	Out	Out
0x0FA000	Out	Out	In	In	In	In	In	Out	In
0x0FC000	Out	Out	In	In	In	In	In	In	Out
0x0FE000	Out	Out	In						

**Table 13**

## Performance Enhancement

PC/104 Memory and I/O Bus cycles are typically about 700 nS long in total, but the access speed of the SJA1000 is considerably faster. The PC/104 Bus allows Memory and I/O Bus cycles to be shortened by the assertion of the SRDY\* signal at the appropriate time in the Bus Cycle. This shortening of the PC/104 Bus Cycle can yield some significant performance improvements in some applications.

The CTI CANpro/104 board allows the PC/104 Bus cycle to be shortened by **about 30%** with Jumper **J3C Position #6**.

J3C Position #6	Function
Removed	Normal PC/104 Bus Cycle length
Installed	Shortened PC/104 Bus Cycle length

**Table 14**

**Note: Not all System boards will support Bus Cycle shortening via the PC/104 SRDY\* signal.** Consult with the manufacturer of your System board to determine if this feature is supported.

## CAN Bus Options

The board supports 2 CAN Bus Options with Jumper J4 and J5.

- J4 is associated with CAN Port-0, and J5 is for CAN Port-1.
- CAN Bus Termination
- Ground the Shell of the 9D Connector

### Termination

A 120 ohm termination resistor is placed across the CAN Bus signals (CANH and CANL), by placing a jumper on **Position "T"** of either J4 or J5. It is desirable to place a termination resistor at each **physical** end on a CAN Bus segment.

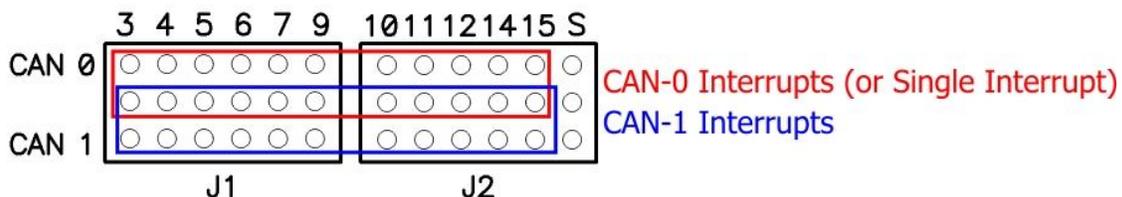
### 9D Connector Shell Ground

On CANpro/104 boards equipped with a 9D CAN Bus connector, the Metal Shell of that connector can be connected to the Isolated Ground of the board (each CAN Port has a separate Ground), by placing a jumper on **Position "G"** of either J4 or J5. This might be useful in some installations to reduce noise.

## Interrupt Mode and Selections

The board can be operated with either one or two interrupts, the interrupt(s) can be shared with another PC/104 board (which supports shared interrupts), and the Pull-down resistor, which is required for shared interrupts, can be enabled on this board.

The Jumper Blocks consist of 2 groups of Interrupt Selections, one group for the CAN-0 controller (red box) and the other for the CAN-1 controller (blue box).



### Single Interrupt Mode

This mode routes the interrupt signal from both SJA1000 CAN controllers to one PC/104 Bus Interrupt signal. This mode is set up by installing Jumper **J1/J2 Position “S”** (either the CAN-0 or the CAN-1 “S” position can be used). When this jumper is installed, the Interrupt signal occurs on the “CAN-0 row” of J1 and J2 (red box).

### Dual Interrupt Mode

This mode routes the interrupt signal from the CAN-0 SJA1000 CAN controller to the CAN-0 PC/104 Bus Interrupt signal and the CAN-1 SJA1000 CAN controller to the CAN-1 PC/104 Bus Interrupt signal. This mode is set up by removing Jumper **J1/J2 Position “S”**.

J1/J2 Position “S”	Function
Removed	Dual Interrupt Mode
Installed	Single Interrupt Mode

**Table 15**

### Shared Interrupt Mode

In either the Single or Dual interrupt modes, the PC/104 Bus Interrupt Signal can be shared with a similarly selected interrupt on another PC/104 board (which supports shared interrupts). There are 2 jumpers which control this sharing on **J3C Positions #3 and #4**.

J3C Position	Function	
	Jumper Installed	Jumper Removed
3	CAN-1 Interrupt Shared	CAN-1 Interrupt Not Shared
4	CAN-0 Interrupt Shared	CAN-0 Interrupt Not Shared

**Table 16**

### Shared Interrupt Pull-Down

When shared interrupts are employed, there **MUST** be one board (among the boards that share the same interrupt) that **MUST** be setup to activate a Pull-Down resistor on the Interrupt signal. This is accomplished by Jumper **J3C Position #5**.

J3C Position #5	Function
Removed	Shared Interrupt(s) Pull-Down disabled
Installed	Shared Interrupt(s) Pull-Down enabled

**Table 17**

### Interrupt Selection

In either of the CAN-0 or CAN-1 groups there is 11 possible interrupts that can be selected. The jumpers are numbered by the PC/104 Bus Interrupt number (3, 4, 5, 6, 7, 9, 10, 11, 12, 14 or 15). Only **one** jumper should be installed in the appropriate group.

### CAN Bus Dominant Timeout and Minimum Speed

The CANpro/104 board implements a CAN Bus transceiver which has a “**Dominant State timeout feature**”. This feature prevents the board from permanently holding the CAN bus in the “Dominant state”. Due to this feature, the **minimum** CAN Bus data rate supported is 20K bps.

## Security ID Feature

Some users may wish to associate the operation of their software with a particular hardware installation. To support this ability, an **ID** mechanism is available which uses a simple, somewhat unusual (but predictable) Write/Read mechanism by which software can determine that the CTI CANpro/104 board is installed. This feature is only available when the CANpro/104 board is operated in “Memory Mode”. Contact CTI Technical Support for information about the method and algorithm required to use this feature.

## Jumper Summaries

The following tables of Jumper settings are useful once the user is familiar with the operations performed by those jumpers.

### J1

Position	Function (for either CAN-0 or CAN-1)	
	Jumper Installed	Jumper Removed
3	PC/104 Interrupt #3 Selected	PC/104 Interrupt #3 Not Selected
4	PC/104 Interrupt #4 Selected	PC/104 Interrupt #4 Not Selected
5	PC/104 Interrupt #5 Selected	PC/104 Interrupt #5 Not Selected
6	PC/104 Interrupt #6 Selected	PC/104 Interrupt #6 Not Selected
7	PC/104 Interrupt #7 Selected	PC/104 Interrupt #7 Not Selected
9	PC/104 Interrupt #9 Selected	PC/104 Interrupt #9 Not Selected

**Table 18**

Only one position can be jumpered.

### J2

Position	Function (for either CAN-0 or CAN-1)	
	Jumper Installed	Jumper Removed
10	PC/104 Interrupt #10 Selected	PC/104 Interrupt #10 Not Selected
11	PC/104 Interrupt #11 Selected	PC/104 Interrupt #11 Not Selected
12	PC/104 Interrupt #12 Selected	PC/104 Interrupt #12 Not Selected
14	PC/104 Interrupt #14 Selected	PC/104 Interrupt #14 Not Selected
15	PC/104 Interrupt #15 Selected	PC/104 Interrupt #15 Not Selected
S	Single Interrupt Mode	Dual Interrupt Mode

**Table 19**

Only one interrupt numbered position can be jumpered.

### J3A

Position	Function	
	Jumper Installed	Jumper Removed
1	“I/O” Space operation enabled	“Memory” Space operation enabled
2	Mem Addr[23] = 1	Mem Addr[23] = 0
3	Mem Addr[22] = 1	Mem Addr[22] = 0
4	Mem Addr[19] = 1	Mem Addr[19] = 0
5	Mem Addr[18] = 1	Mem Addr[18] = 0
6	Mem Addr[17] or I/O Addr[10] = 1	Mem Addr[17] or I/O Addr[10] = 0

**Table 20**

**J3B**

Position	Function	
	Jumper Installed	Jumper Removed
1	Mem Addr[16] or I/O Addr[9] = 1	Mem Addr[16] or I/O Addr[9] = 0
2	Mem Addr[15] or I/O Addr[8] = 1	Mem Addr[15] or I/O Addr[8] = 0
3	Mem Addr[14] = 1 or I/O Addr[7] = 1 (BasicCAN mode only)	Mem Addr[14] = 0 or I/O Addr[7] = 0 (BasicCAN mode only)
4	Mem Addr[13] = 1 or I/O Addr[6] = 1 (BasicCAN mode only)	Mem Addr[13] = 0 or I/O Addr[6] = 0 (BasicCAN mode only)
5	Memory Space Enable Bit-2 [Note 1]	
6	Memory Space Enable Bit-1 [Note 1]	
7	Memory Space Enable Bit-0 [Note 1]	

**Table 21**

The 3 Memory Space Enable bits select 8 choices of I/O Addresses for the Memory Enable feature.

**J3C**

Position	Function	
	Jumper Installed	Jumper Removed
1	Memory Space powers-up (or resets) disabled	Memory Space is always enabled
2	BasicCAN mode enabled	PeliCAN mode enabled
3	CAN-1 Interrupt Shared	CAN-1 Interrupt Not Shared
4	CAN-0 Interrupt Shared	CAN-0 Interrupt Not Shared
5	Shared Interrupt(s) Pull-Down enabled	Shared Interrupt(s) Pull-Down disabled
6	Shorten Memory and I/O Bus Cycles	Normal Memory and I/O Bus Cycles

**Table 22**
**J4 and J5**

Position	Function	
	Jumper Installed	Jumper Removed
T	CAN Bus Termination Resistor enabled	CAN Bus Termination Resistor disabled
G	9D Connector Shell Grounded [Note 1]	9D Connector Shell NOT Grounded

**Table 23**

The 9D Shell is Grounded to the Isolated Ground for the respective CAN Port.

## Hardware Installation – Rev A & B

Before you begin, take a minute to ensure that your package includes the required components that should have shipped with your CANpro/104.

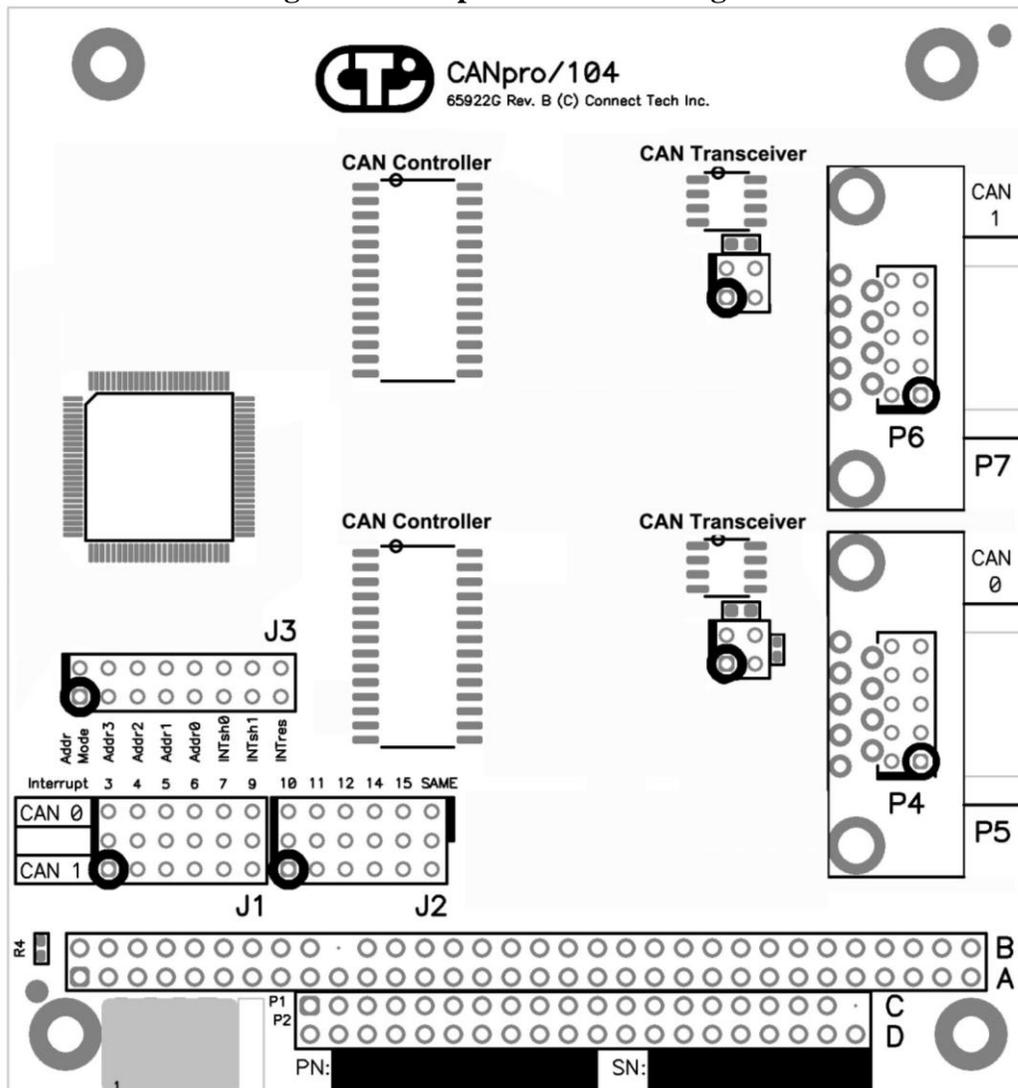
- One CANpro/104 CAN controller board
- One CD containing documentation

If any of these components is missing, contact [Connect Tech](#) (See Contact Details) or your reseller. Also, visit the [Download Zone](#) of the [Support Center](#) on the Connect Tech website for the latest product manuals, installation guides, diagnostic utilities and device driver software.

### CANpro/104 Opto Diagrams

[Figure 1](#) shows the locations of various hardware components found on the CANpro/104.

**Figure 1: CANpro/104 Board Diagram**



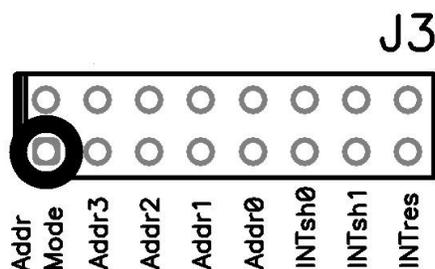


### Address Mode and Range Selection

The first five jumper locations of jumper block J3 are used for board address selection. The first jumper location (Addr Mode) selects the number of address bits to use for the decoding of the board address. The next four jumpers configure the actual board address.

If you intend to configure both of the board's controllers in BasicCAN mode, install a jumper in the Addr Mode location. This configures the board to respond to a 64 byte address range (32 bytes per controller).

Alternatively, if you intend to operate one or both of the CAN controllers in PeliCAN mode, leave the Addr Mode location unpopulated. This configures the board to respond to a 256 byte address range (128 bytes per controller).



The address range for the board itself is directly selected by the Addr3, Addr2, Addr1 and Addr0 jumper locations. The following table describes the base addresses of the controllers 0 and 1 (CAN 0 and CAN 1) for every possible combination of Addr Mode and AddrX jumper locations.

**Table 24: CAN 0 and CAN 1 Base Addresses**

Jumper Location				Board Mode Selection			
				ON (BasicCAN)		OFF (PeliCAN)	
Addr3	Addr2	Addr1	Addr0	CAN 0	CAN 1	CAN 0	CAN 1
ON	ON	ON	ON	0x000	0x020	0x000	0x080
ON	ON	ON	OFF	0x040	0x060	0x000	0x080
ON	ON	OFF	ON	0x080	0x0A0	0x000	0x080
ON	ON	OFF	OFF	0x0C0	0x0E0	0x000	0x080
ON	OFF	ON	ON	0x100	0x120	0x100	0x180
ON	OFF	ON	OFF	0x140	0x160	0x100	0x180
ON	OFF	OFF	ON	0x180	0x1A0	0x100	0x180
ON	OFF	OFF	OFF	0x1C0	0x1E0	0x100	0x180
OFF	ON	ON	ON	0x200	0x220	0x200	0x280
OFF	ON	ON	OFF	0x240	0x260	0x200	0x280
OFF	ON	OFF	ON	0x280	0x2A0	0x200	0x280
OFF	ON	OFF	OFF	0x2C0	0x2E0	0x200	0x280
OFF	OFF	ON	ON	0x300	0x320	0x300	0x380
OFF	OFF	ON	OFF	0x340	0x360	0x300	0x380
OFF	OFF	OFF	ON	0x380	0x3A0	0x300	0x380
OFF	OFF	OFF	OFF	0x3C0	0x3E0	0x300	0x380

### Interrupt Sharing

Jumper block J3 also plays a part in the interrupt sharing. PC/104 supports the sharing of an interrupt between multiple cards. For example, two separate CANpro/104 cards are able to share the same interrupt across all four controllers. To accomplish interrupt sharing, the following steps must be taken:

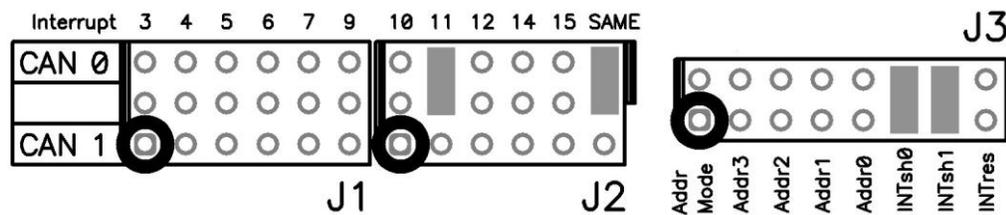
All cards that share the same interrupt, but are not actively asserting an interrupt, must tri-state their outputs. On CANpro/104 cards, this is accomplished by installing a jumper on the INTshrX jumper location of each CAN controller(s) you wish to share interrupts.

One 1K Ohm resistor must also be attached to each shared interrupt. With the example of two CANpro/104 cards, the INTres jumper would be installed on only one of the cards.

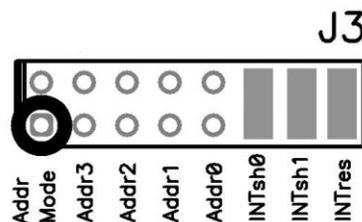
**NOTE:**

CANpro/104 has the capability to tri-state its interrupt outputs and the 1K Ohm resistor is jumper configurable. Other cards may not be able to share interrupts. Please check the manual for each card.

The example below has configured both cards to interrupt on IRQ 11. Both controllers will tri-state their outputs when not driving the interrupt line active. This example assumes that another card in the stack has enabled the 1K Ohm pull-down resistor. Only one card in the group of cards sharing the same interrupt should enable a pull-down resistor.



To enable the resistor, simply install a jumper on the INTres jumper location, as shown below.



Please note that the Interrupt Resistor Enable controls the Interrupt Resistor for all shared CAN controller interrupts on the card. You cannot enable the Interrupt Termination Resistor for one controller only if both are configured for interrupt sharing.

If a card has interrupt sharing enabled for only one of its controllers, the resistor will only be enabled on the interrupt of the controller that is sharing interrupts.

## Other On-board Jumper Selection

Near each I/O connector a 2x2 jumper block (either J4 or J5) will allow the configuration of both bus termination and slew rate limiting for the transceiver. J4 configures options for CAN controller 0, while J5 configures options for CAN controller 1.



Installing a jumper on the first location of J4 or J5 (the gray area above) will enable a 120 Ohm termination resistor across the CAN-H and CAN-L lines. Termination is recommended for improved signal integrity in longer transmission lines. Termination requirements should be evaluated on a case by case basis. Typically both ends of a CAN bus are terminated, but no termination is enabled on cards that sit in the middle of the bus.



Installing a jumper on the second location of J4 or J5 (the gray area above) will disable slew rate limiting for the associated CAN port. Slew rate limiting will reduce the emitted switching noise that is sent out onto the CAN bus lines and radiated from those lines. Switching noise may cause EMI / EMC incompatibilities depending on the cabling used to support the system. The use of slew rate limiting may aid in a system that is close to the limit of emissions already. Properly shielded cabling will dramatically reduce emissions.

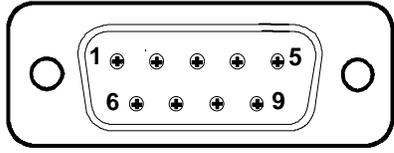
Slew rate limiting may only be used on busses operating at slower baud rates. With the jumper installed, full 1Mbps operation is possible.

## Connector Pinouts

**Table 25: DB-9 Cable Connector Pinouts**

Pin No.	Signal
1	+5V
2	CAN-L
3	CAN GND (isolated or non)
4	N/C
5	N/C
6	CAN GND (isolated or non)
7	CAN-H
8	N/C
9	+5V

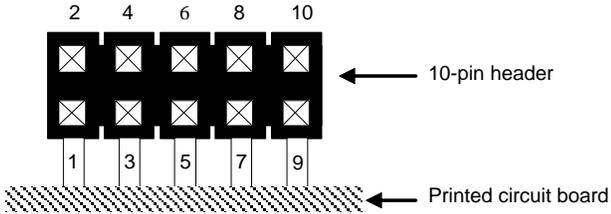
Male DB-9 Connector



For boards populated with right angled 2x5 0.100" headers, cable CAG104 will break out from the onboard 2x5 header to a DB-9 connector.

**Table 26: 10-pin Header Pinouts**

Pin No.	Signal
1	+5V
2	CAN-GND (isolated or non)
3	CAN-L
4	CANH
5	CAN-GND (isolated or non)
6	NC
7	NC
8	+5V
9	NC
10	NC



## Specifications

### Operating Environment

Storage temperature:	-40° C to 125° C
Operating temperature:	-40° C to 85° C
Humidity:	95%, non-condensing

### Power Requirements

+5 VDC @ 500mA (maximum)  
380 mA (minimum)

**NOTE:**

Power output on CAN connectors may draw up to an additional 1A per port (non-isolated models).  
190 mA per port (isolated models) given 150mA current draw in the +5V output.

### PC Bus Interface

PC/104

### Optical/Power Isolation (CANpro/104 Opto models only)

500V for each CAN port from the host system and other isolated CAN ports.

### Dimensions

Compliant to PC/104 specification 2.5

### Connectors/Interface

Standard: 10-pin, right angled header (+5V power output)  
Optional: DB-9

## Certification

### Certification for CANpro/104

The CANpro/104 product family is to be included into a device ultimately subject to FCC, DOC/IC, and CE certification. The customer is responsible for bringing the completed device into compliance prior to resale.

Connect Tech has designed CANpro/104 with EMI and EMC considerations such as:

- Ground and power planes
- Controlled slew-rate signals
- EMI/EMC reducing PCB layout

## Limited Lifetime Warranty

Connect Tech Inc. provides a Lifetime Warranty for all Connect Tech Inc. products. Should this product, in Connect Tech Inc.'s opinion, fail to be in good working order during the warranty period, Connect Tech Inc. will, at its option, repair or replace this product at no charge, provided that the product has not been subjected to abuse, misuse, accident, disaster or non Connect Tech Inc. authorized modification or repair.

You may obtain warranty service by delivering this product to an authorized Connect Tech Inc. business partner or to Connect Tech Inc. along with proof of purchase. Product returned to Connect Tech Inc. must be pre-authorized by Connect Tech Inc. with an RMA (Return Material Authorization) number marked on the outside of the package and sent prepaid, insured and packaged for safe shipment. Connect Tech Inc. will return this product by prepaid shipment service.

The Connect Tech Inc. lifetime warranty is defined as the serviceable life of the product. This is defined as the period during which all components are available. Should the product prove to be irreparable, Connect Tech Inc. reserves the right to substitute an equivalent product if available or to retract lifetime warranty if no replacement is available.

The above warranty is the only warranty authorized by Connect Tech Inc. Under no circumstances will Connect Tech Inc. be liable in any way for any damages, including any lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, such product.

## 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 online Support Center is available 24 hours a day, seven days a week on our website at: [www.connecttech.com/sub/support/support.asp](http://www.connecttech.com/sub/support/support.asp). Please go to the [Download Zone](#) or the [Knowledge Database](#) for product manuals, installation guides, device driver software and technical tips. Submit your questions to our technical support engineers at [support@connecttech.com](mailto:support@connecttech.com). Our technical support is always free.

## Contact Information

### 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:

Toll: 800-426-8979 (North America only) | Tel: 519-836-1291 | Fax: 519-836-4878 (online 24 hours)

### Email/Internet

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

[sales@connecttech.com](mailto:sales@connecttech.com) | [support@connecttech.com](mailto:support@connecttech.com) | [www.connecttech.com](http://www.connecttech.com)

### Mail/Courier

Connect Tech Inc.  
42 Arrow Road  
Guelph, ON N1K 1S6 Canada