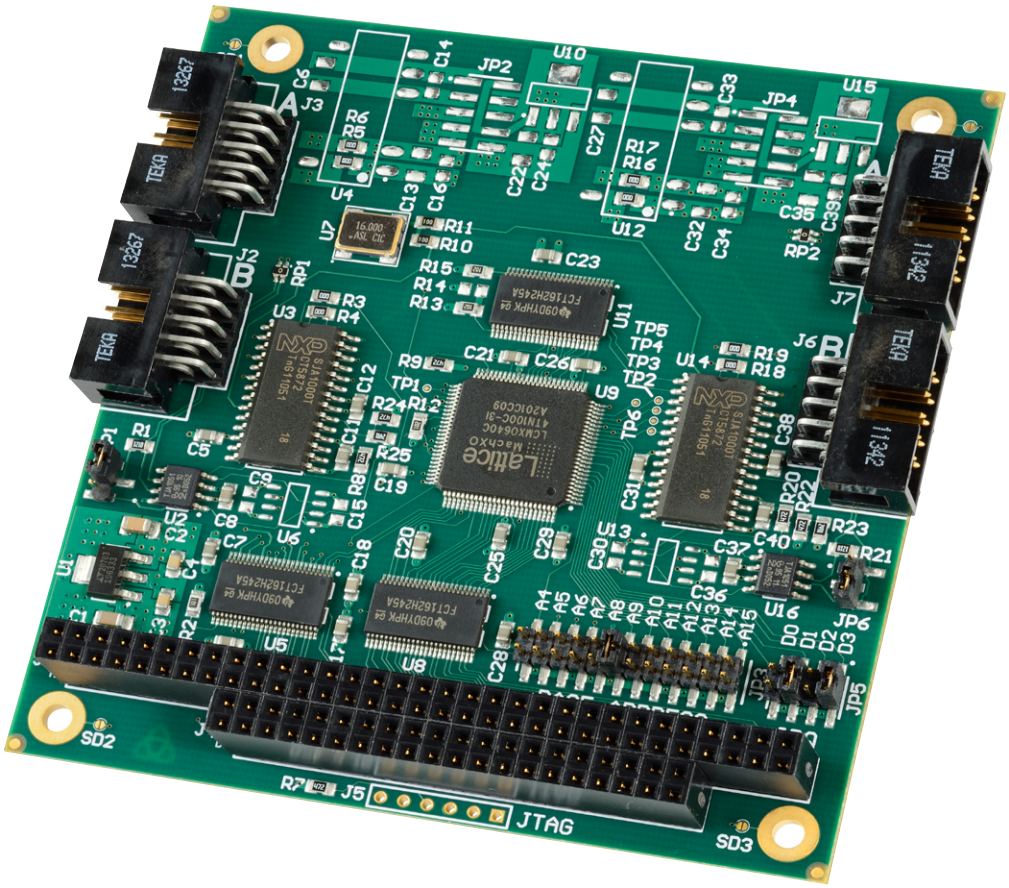
PCM-CAN-2

Dual Channel Control Area Network PC/104 I/O Module

PCM-CAN-1

Single Channel Control Area Network PC/104 I/O Module

PRODUCT MANUAL



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MANUAL REVISION HISTORY

P/N G400-0385-000D (PCM-CAN-2, PCM-CAN-1)

Revision Date Code	ECO Number
130610	Original
140611	13-83
140703	

TABLE OF CONTENTS

BEFORE YOU BEGIN

WinSystems offers best practice recommendations for using and handling WinSystems products. These methods include valuable advice to provide an optimal user experience and to prevent damage to yourself and/or the product.

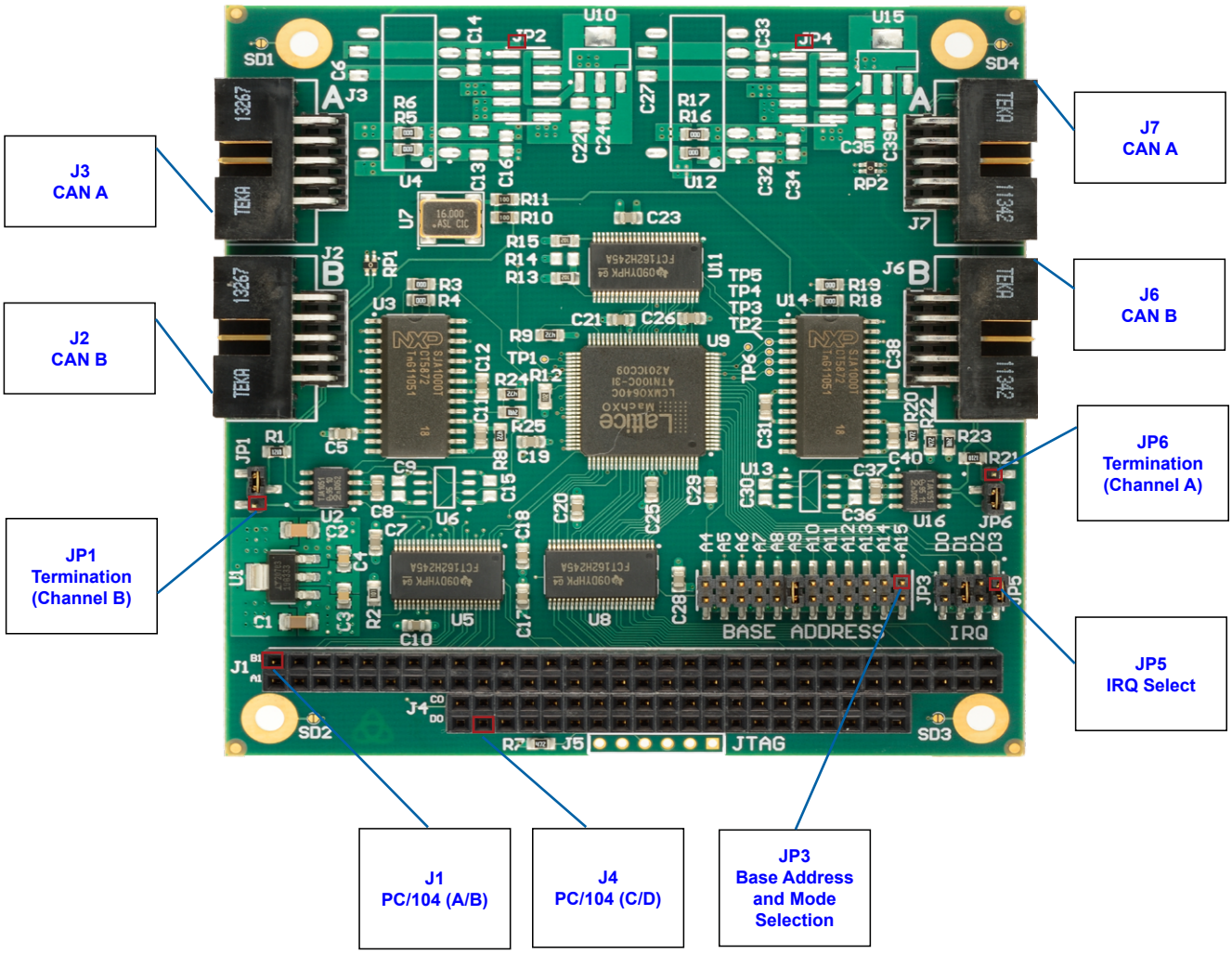
YOU MAY VOID YOUR WARRANTY AND/OR DAMAGE A PRODUCT BY FAILING TO COMPLY WITH THESE BEST PRACTICES.

Reference **Appendix - A** for **Best Practices**.

Please review these guidelines carefully and follow them to ensure you are successfully using your product.

For any questions you may have on WinSystems products, contact our Technical Support Group at (817) 274-7553, Monday through Friday, between 8 AM and 5 PM Central Standard Time (CST).

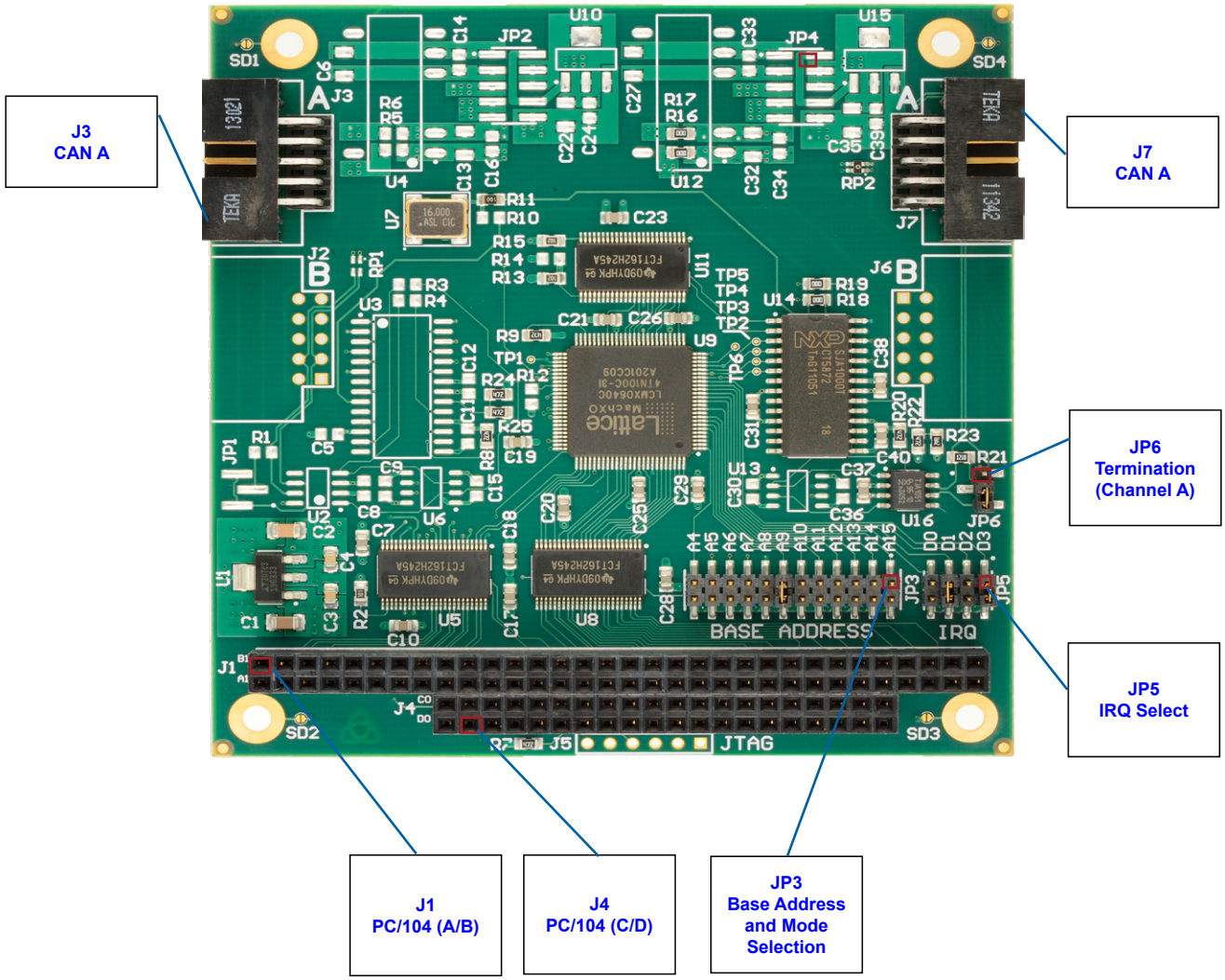
Visual Index - Top View (Connectors & Jumpers) - PCM-CAN-2



RESERVED - J5

NOTE: The reference line to each component part has been drawn to Pin 1, and is also highlighted with a square, where applicable.

Visual Index - Top View (Connectors & Jumpers) - PCM-CAN-1



RESERVED - J2, J5, J6, JP1, JP2

NOTE: The reference line to each component part has been drawn to Pin 1, and is also highlighted with a square, where applicable.

INTRODUCTION

This manual is intended to provide the necessary information regarding configuration and usage of the PCM-CAN-2 and PCM-CAN-1 modules. WinSystems maintains a Technical Support Group to help answer questions not adequately addressed in this manual. Contact Technical Support at (817) 274-7553, Monday through Friday, between 8 AM and 5 PM Central Standard Time (CST).

FEATURES

CAN Module

- Two NXP SJA-1000 CAN controllers (PCM-CAN-2)
  - Single channel version available (PCM-CAN-1)
- Transfer rates up to 1 Mbps
- Compliant with CAN specifications 2.0A (11-bit ID) and 2.0B (29-bit ID)
- Jumper selectable termination resistors
- Jumper selectable IRQ and I/O base address
- Software drivers available for Linux and Windows®
- Custom OEM configurations available
- RoHS compliant

Industrial Operating Temperature

- -40°C to 85°C

Power

- +5V required

Mechanical

- PC/104-compliant
- Dimensions: 3.6 x 3.8 inches (90 x 96 mm)
- Weight: 2.4 oz (68g)

System

The PCM-CAN is a PC/104-compliant, Control Area Network (CAN) peripheral module. The PCM-CAN-2 board uses two Philips/NXP SJA-1000 CAN controller ICs with advanced features for use in automotive and industrial applications. The PCM-CAN-1 board is a single channel version based on the design.

CAN is a serial, asynchronous, multi-master communication protocol for connecting electronic control modules, sensors and actuators in automotive and industrial applications. The signal is encoded in a non-return-to-zero (NRZ) pattern and is sensed by all nodes. The CAN bus physical interface is similar to RS-485 two-wire, half-duplex communications.

Theory of Operation

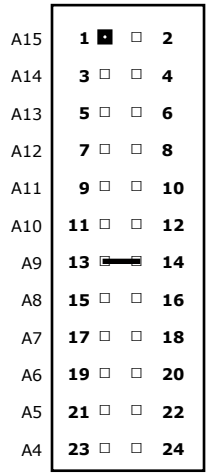
The PCM-CAN card provides independent and user accessible isolated Control Area Network (CAN) interface(s). Each CAN controller occupies either 32 or 128 adjacent I/O registers depending on CAN 2.0A (BasicCAN) or CAN 2.0B (PeliCAN) mode selection. Additionally, when two CAN controllers are present, they share a single user configurable interrupt. There is no provision for separating the two controller's interrupts on the PCM-CAN board. This is important when writing a driver or ISR, since it is necessary for the program to read both CAN controllers to determine which controller was the source of the interrupt.

Jumper Reference

NOTE: Jumper Part# SAMTEC 2SN-BK-G is applicable to all jumpers. These are available in a ten piece kit from WinSystems (Part# KIT-JMP-G-200).

JP3 - Base Address and Mode Selection

JP3



Factory Setting
Address 0200 and CAN 2.0A shown.

JP3 is used to select the base address and operation mode of the CAN controller(s). **JP3:1-22** represent the upper ISA address lines with an installed jumper equivalent to a binary 1. The user should set these jumpers to the desired binary base address of the CAN controller(s). A few examples are in the table below for clarity.

JP3 - Base Address Examples											
1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	Jumper
-	-	-	-	-	-	-	X	-	-	-	0x0100 Hex
-	-	-	-	-	-	-	X	X	-	-	0x0180 Hex
-	-	-	-	-	-	X	-	-	-	-	0x0200 Hex
-	-	-	-	-	-	X	X	-	-	-	0x0300 Hex
X	-	X	-	-	-	-	-	-	-	-	0x0A00 Hex

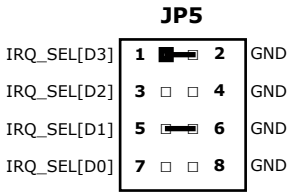
X - Jumper Installed

Jumper location **JP3:23-24** sets the CAN controller(s) operational mode. The module is configured for CAN 2.0A (BasicCAN) mode operation from the factory, requiring 32 adjacent I/O registers per controller. To enable CAN 2.0B (PeliCAN) mode, requiring 128 adjacent I/O registers per controller, a jumper should be installed at **JP3:23-24**.

CAN 2.0A Mode Address Example Base Address = 0x0A00 Hex		
CAN Controller A		0xA00Hex
↓		↓
CAN Controller A		0x0A1F Hex
CAN Controller B		0x0A20 Hex
↓		↓
CAN Controller B		0x0A3F Hex

CAN 2.0B Mode Address Example Base Address = 0x0A00 Hex		
CAN Controller A		0xA00Hex
↓		↓
CAN Controller A		0x0A7F Hex
CAN Controller B		0x0A80 Hex
↓		↓
CAN Controller B		0x0AFF Hex

JP5 - Interrupt Selection

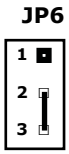


Factory IRQ shown.

JP5 is the interrupt selection jumper used to set the desired interrupt used by the CAN controllers. Dual controllers share an interrupt. An installed jumper represents binary 1. The user should set these jumpers to represent the desired binary IRQ number.

IRQ Selection (JP5)			
D_3, D_2, D_1, D_0	Interrupt	D_3, D_2, D_1, D_0	Interrupt
0000	-	1000	-
0001	-	1001	IRQ9
0010	-	1010	IRQ10
0011	IRQ3	1011	IRQ11
0100	IRQ4	1100	IRQ12
0101	IRQ5	1101	-
0110	IRQ6	1110	IRQ14

JP6 - Termination (Channel A)

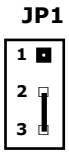


CAUTION: An improperly terminated CAN bus can result in reduced data rates, node capacity and bus length.

120Ω termination resistor for Channel A	1-2 or 2-3
No termination resistor for Channel A	OPEN

JP6 is used to insert or remove a 120Ω termination resistor for CAN Channel A. Installing the jumper in either of the two possible positions (1-2 or 2-3) will result in placing a 120Ω resistor across the CAN differential transceiver pins. The end user must review the CAN bus system topology to determine whether this termination is desired. Typically, this termination is only required when the node is at either end of a bus. Other locations on the bus do not normally require termination.

JP1 - Termination (Channel B)



CAUTION: An improperly terminated CAN bus can result in reduced data rates, node capacity and bus length.

120Ω termination resistor for Channel B	1-2 or 2-3
No termination resistor for Channel B	OPEN

JP1 is used to insert or remove a 120Ω resistor for CAN Channel B. Installing the jumper in either of the two possible positions (1-2 or 2-3) will result in placing a 120Ω resistor across the CAN differential transceiver pins. The end user must review the CAN bus system topology to determine whether this termination is desired. Typically, the impedance is only required when the node is at either end of a bus. Other locations on the bus do not normally require termination.

CONNECTOR REFERENCE

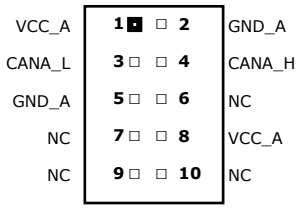
Controller Area Network (CAN)

J3, J7 - CAN A

Visual Index

PCB Connector: **TEKA SRC205C425M126-0 (J3, J7)**
Mating Connector: **ITW-PANCON 050-010-455A**

J3, J7



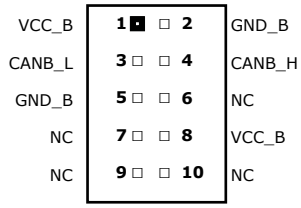
Connectors **J3** and **J7** are configured in parallel and provide connection to **CAN Channel A**. Either **J3** or **J7** can be used to access **Channel A** or both can be used to daisy chain the bus through the module. The interface is wired to a 10-pin 0.100 inch right angle header. WinSystems offers an optional cable CBL-123-G-1-1.0, which provides a standard DB9 interface connector.

J2, J6 - CAN B

Visual Index

PCB Connector: **TEKA SRC205C425M126-0 (J2, J6)**
Mating Connector: **ITW-PANCON 050-010-455A**

J2, J6



Connectors **J2** and **J6** are configured in parallel and provide connection to **CAN Channel B**. Either **J2** or **J6** can be used to access **Channel B** or both can be used to daisy chain the bus through the module. The interface is wired to a 10-pin 0.100 inch right angle header. WinSystems offers an optional cable CBL-123-G-1-1.0, which provides a standard DB9 interface connector.

J1, J4 - PC/104

Visual Index

PCB Connector: **TEKA PC232-A-1A7-M (J1)**
TEKA PC220-A-1A7-M (J4)

The PC/104 bus is electrically equivalent to the 16-bit ISA bus. Standard PC/104 I/O cards can be stacked on PCM-CAN-2 and PCM-CAN-1's connectors, located at **J1** and **J4**. The interface does not support hot swap capability. The PC/104 bus connector pin definitions are provided below for reference. Refer to the PC/104 Bus Specification for specific signal and mechanical specifications.

J4 (C/D)

GND	D0	C0		GND
MEMCS16#	D1	C1		SBHE#
IOCS16#	D2	C2		LA23
IRQ10	D3	C3		LA22
IRQ11	D4	C4		LA21
IRQ12	D5	C5		LA20
IRQ15	D6	C6		LA19
IRQ14	D7	C7		LA18
DACK0#	D8	C8		LA17
DRQ0	D9	C9		MEMR#
DACK5#	D10	C10		MEMW#
DRQ5	D11	C11		SD8
DACK6#	D12	C12		SB9
DRQ6	D13	C13		SD10
DACK7#	D14	C14		SD11
DRQ7	D15	C15		SD12
+5V	D16	C16		SD13
MASTER#	D17	C17		SD14
GND	D18	C18		SD15
GND	D19	C19		KEY

J1 (A/B)

IOCHK#	A1	B1		GND
SD7	A2	B2		RESET
SD6	A3	B3		+5V
SD5	A4	B4		IRQ
SD4	A5	B5		-5V
SD3	A6	B6		DRQ2
SD2	A7	B7		-12V
SD1	A8	B8		SRDY#
SD0	A9	B9		+12V
IOCHRDY	A10	B10		KEY
AEN	A11	B11		SMEMW#
SA19	A12	B12		SMEMR#
SA18	A13	B13		IOW#
SA17	A14	B14		IOR#
SA16	A15	B15		DACK3#
SA15	A16	B16		DRQ3
SA14	A17	B17		DACK1#
SA13	A18	B18		DRQ1
SA12	A19	B19		REFRESH#
SA11	A20	B20		BCLK
SA10	A21	B21		IRQ7
SA9	A22	B22		IRQ6
SA8	A23	B23		IRQ5
SA7	A24	B24		IRQ4
SA6	A25	B25		IRQ3
SA5	A26	B26		DACK2#
SA4	A27	B27		TC
SA3	A28	B28		BALE
SA2	A29	B29		+5V
SA1	A30	B30		OSC
SA0	A31	B31		GND
GND	A32	B32		GND

= Active Low Signal

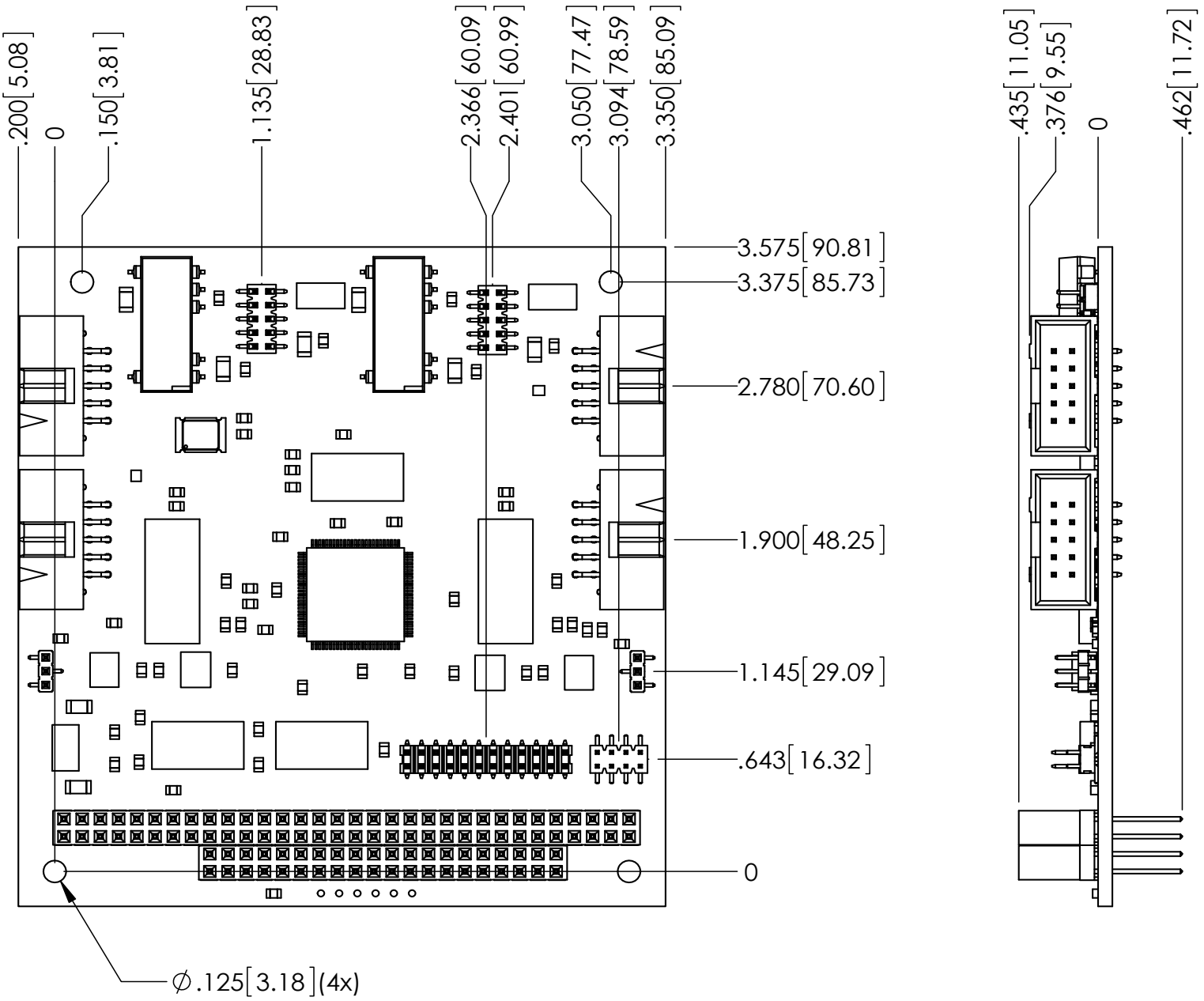
NOTES:

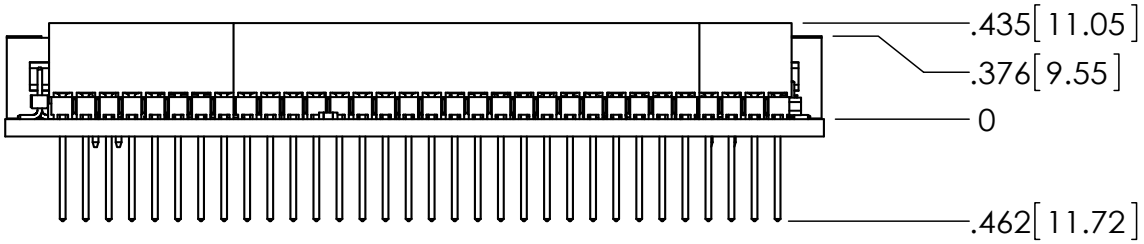
1. Rows C and D are not required on 8-bit modules.
2. B10 and C19 are key locations. WinSystems uses key pins as connections to GND.
3. Signal timing and function are as specified in ISA specification.
4. Signal source/sink current differ from ISA values.

SPECIFICATIONS

MODELS	**PCM-CAN-2** **PCM-CAN-1**
Electrical (Inputs)	
VCC	+5VDC ±5% @ 500 mA typical (PCM-CAN-2) +5VDC ±5% @ 250 mA typical (PCM-CAN-1)
MTBF	124.86 years MTBF based on MIL-HDBK-217 Part Count Reliability Model assuming a ground benign operating environment, 30°C ambient operating temperature and 50°C junction temperatures.
Mechanical	
Dimensions	3.6 x 3.8 inches (90 x 96 mm)
Weight	2.4 oz (68g) PCM-CAN-2 2.2 oz (62g) PCM-CAN-1
Printed Circuit Board	0.078 inches 4-Layer FR4
Environmental	
Operating Temperature	-40°C to 85°C ambient
Random Vibration	MIL-STD-202G, Method 214A, Condition D .1g/Hz (11.95g rms), 20 minutes per axis, 3 axis
Mechanical Shock	MIL-STD-202G, Method 213B, Condition A 50g half-sine, 11 ms duration per axis, 3 axis

MECHANICAL DRAWING





PCM-CAN MECHANICAL

APPENDIX - A

BEST PRACTICES

POWER SUPPLY

The power supply and how it is connected to the Single Board Computer (SBC) is very important.

Avoid Electrostatic Discharge (ESD)
Only handle the SBC and other bare electronics when electrostatic discharge (ESD) protection is in place. Having a wrist strap and a fully grounded workstation is the minimum ESD protection required before the ESD seal on the product bag is broken.

Power Supply Budget
Evaluate your power supply budget. It is usually good practice to budget 2X the typical power requirement for all of your devices.

Zero-Load Power Supply
Use a zero-load power supply whenever possible. A zero-load power supply does not require a minimum power load to regulate. If a zero-load power supply is not appropriate for your application, then verify that the single board computer's typical load is not lower than the power supply's minimum load. If the single board computer does not draw enough power to meet the power supply's minimum load, then the power supply will not regulate properly and can cause damage to the SBC.

Use Proper Power Connections (Voltage)
When verifying the voltage, you should always measure it at the power connector on the SBC. Measuring at the power supply does not account for voltage drop through the wire and connectors.

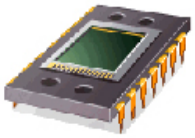
The single board computer requires +5V (±5%) to operate. Verify the power connections. Incorrect voltages can cause catastrophic damage.

Populate all of the +5V and ground connections. Most single board computers will have multiple power and ground pins, and all of them should be populated. The more copper connecting the power supply to the single board computer the better.

Adjusting Voltage
If you have a power supply that will allow you to adjust the voltage, it is a good idea to set the voltage at the power connector of the SBC to 5.1V. The SBC can tolerate up to 5.25V, so setting your power supply to provide 5.1V is safe and allows for a small amount of voltage drop that will occur over time as the power supply ages and the connector contacts oxidize.

Power Harness
Minimize the length of the power harness. This will reduce the amount of voltage drop between the power supply and the single board computer.

Gauge Wire
Use the largest gauge wire that you can. Most connector manufacturers have a maximum gauge wire they recommend for their pins. Try going one size larger; it usually works and the extra copper will help your system perform properly over time.



Contact Points
WinSystems' boards mostly use connectors with gold finish contacts. Gold finish contacts are used exclusively on high speed connections. Power and lower speed peripheral connectors may use a tin finish as an alternative contact surface. It is critical that the contact material in the mating connectors is matched properly (gold to gold and tin to tin). Contact areas made with dissimilar metals can cause oxidation/corrosion resulting in unreliable connections.

Pin Contacts
Often the pin contacts used in cabling are not given enough attention. The ideal choice for a pin contact would include a design similar to Molex's or Trifurcons' design, which provides three distinct points to maximize the contact area and improve connection integrity in high shock and vibration applications.

POWER DOWN

Make sure the system is **completely off/powered down** before connecting anything.

Power Supply OFF
The power supply should always be off before it is connected to the single board computer.

I/O Connections OFF
I/O Connections should also be off before connecting them to the single board computer or any I/O cards. Connecting hot signals can cause damage whether the single board computer is powered or not.

MOUNTING AND PROTECTING THE SINGLE BOARD COMPUTER

Do Not Bend or Flex the SBC
Never bend or flex the single board computer. Bending or flexing can cause irreparable damage. Single board computers are especially sensitive to flexing or bending around Ball-Grid-Array (BGA) devices. BGA devices are extremely rigid by design and flexing or bending the single board computer can cause the BGA to tear away from the printed circuit board.

Mounting Holes
The mounting holes are plated on the top, bottom and through the barrel of the hole and are connected to the single board computer's ground plane. Traces are often routed in the inner layers right below, above or around the mounting holes.

Never use a drill or any other tool in an attempt to make the holes larger.

Never use screws with oversized heads. The head could come in contact with nearby components causing a short or physical damage.

Never use self-tapping screws; they will compromise the walls of the mounting hole.

Never use oversized screws that cut into the walls of the mounting holes.

Always use all of the mounting holes. By using all of the mounting holes you will provide the support the single board computer needs to prevent bending or flexing.

Plug or Unplug Connectors Only on Fully Mounted Boards
Never plug or unplug connectors on a board that is not fully mounted. Many of the connectors fit rather tightly and the force needed to plug or unplug them could cause the single board computer to be flexed.

Avoid cutting of the SBC
Never use star washers or any fastening hardware that will cut into the single board computer.

Avoid Overtightening of Mounting Hardware
Causing the area around the mounting holes to compress could damage interlayer traces around the mouting holes.

Use Appropriate Tools
Always use tools that are appropriate for working with small hardware. Large tools can damage components around the mounting holes.

Placing the SBC on Mounting Standoffs
Be careful when placing the single board computer on the mounting standoffs. Sliding the board around until the standoffs are visible from the top can cause component damage on the bottom of the single board computer.

Avoid Conductive Surfaces
Never allow the single board computer to be placed on a conductive surface. Almost all single board computers use a battery to backup the clock-calendar and CMOS memory. A conductive surface such as a metal bench can short the battery causing premature failure.

ADDING PC/104 BOARDS TO YOUR STACK

Be careful when adding PC/104 boards to your stack.

Never allow the power to be turned on when a PC/104 board has been improperly plugged onto the stack. It is possible to misalign the PC/104 card and leave a row of pins on the end or down the long side hanging out of the connector. If power is applied with these pins misaligned, it will cause the I/O board to be damaged beyond repair.

CONFORMAL COATING

Applying conformal coating to a WinSystems product will not in itself void the product warranty, if it is properly removed prior to return. Coating may change thermal characteristics and impedes our ability to test, diagnose, and repair products. Any coated product sent to WinSystems for repair will be returned at customer expense and no service will be performed.

OPERATIONS / PRODUCT MANUALS

Every single board computer has an Operations manual or Product manual.

Manual Updates
Operations/Product manuals are updated often. Periodicially check the WinSystems website (http://www.winsystems.com) for revisions.

Check Pinouts
Always check the pinout and connector locations in the manual before plugging in a cable. Many single board computers will have identical headers for different functions and plugging a cable into the wrong header can have disastrous results.

Contact an Applications Engineer with questions
If a diagram or chart in a manual does not seem to match your board, or if you have additional questions, contact your Applications Engineer.

WARRANTY INFORMATION

(http://www.winsystems.com/company/warranty.cfm)

WinSystems warrants to Customer that for a period of two (2) years from the date of shipment any Products and Software purchased or licensed hereunder which have been developed or manufactured by WinSystems shall be free of any material defects and shall perform substantially in accordance with WinSystems' specifications therefore. With respect to any Products or Software purchased or licensed hereunder which have been developed or manufactured by others, WinSystems shall transfer and assign to Customer any warranty of such manufacturer or developer held by WinSystems, provided that the warranty, if any, may be assigned. Notwithstanding anything herein to the contrary, this warranty granted by WinSystems to the Customer shall be for the sole benefit of the Customer, and may not be assigned, transferred or conveyed to any third party. The sole obligation of WinSystems for any breach of warranty contained herein shall be, at its option, either (i) to repair or replace at its expense any materially defective Products or Software, or (ii) to take back such Products and Software and refund the Customer the purchase price and any license fees paid for the same. Customer shall pay all freight, duty, broker's fees, insurance charges for the return of any Products or Software to WinSystems under this warranty. WinSystems shall pay freight and insurance charges for any repaired or replaced Products or Software thereafter delivered to Customer within the United States. All fees and costs for shipment outside of the United States shall be paid by Customer. The foregoing warranty shall not apply to any Products of Software which have been subject to abuse, misuse, vandalism, accidents, alteration, neglect, unauthorized repair or improper installations.

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WARRANTY SERVICE

1. To obtain service under this warranty, obtain a return authorization number. In the United States, contact the WinSystems' Service Center for a return authorization number. Outside the United States, contact your local sales agent for a return authorization number.

2. You must send the product postage prepaid and insured. You must enclose the products in an anti-static bag to protect from damage by static electricity. WinSystems is not responsible for damage to the product due to static electricity.