AIM104-CAN

Introduction

The AIM104-CAN is an 8-bit PC/104 module providing a single channel, optically isolated, Controller Area Network (CAN) interface. In addition, the board is fitted with an E²PROM for configuration information and an output port for driving three bi-colour LED's.

Features

- Single channel, opto isolated CAN (ISO11898) interface utilising Philips SJA1000 Standalone CAN Controller.
- Up to 1Mb/s baud rate
- Supports the following CAN standards:
  - CAN 2.0a - Error passive to extended 29 bit identifiers (BasicCAN)
  - CAN 2.0b - Full support for CAN with extended 29 bit Identifiers
- On board link-selectable CAN termination network (124R)
- Link selectable slew rate control for CAN line drivers
- Fieldbus power ground signal fault protection
- Diagnostic LEDs:
  - Module access LED
  - CAN bus activity indicator LED
  - CAN bus transmit indicator LED
- On board serial E²PROM (128 bytes) for parameter storage
- 6 bit output port to drive 3 bi-colour indicator LEDs (24mA source/sink)
- 8 bit PC/104 (IEEE996) interface
- Link selectable base address (on 32 byte boundary)
- Link selectable interrupt (IRQ2,3,4,5,6,7)
- EMC guard plane
- Operating temperature range: -20°C to +70°C
- Power requirements:
  - PC/104 Interface: +5V @ 180mA typical
  - Isolated CAN: +9V to +27V @ 50mA max
- MTBF: 552,900 hours (using generic failure rates from MIL-HDBK-217F at ground benign)

Operation

The AIM104-CAN uses the Philips SJA1000 device to handle all aspects of the CAN communications protocol.

The 32 registers of the SJA1000 are mapped directly into the I/O space of the module and are accessed by standard input and output operations from the host CPU board.

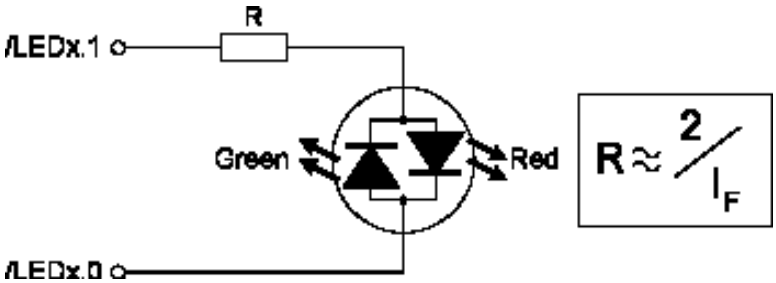
An interrupt can be generated by the SJA1000 upon certain conditions occurring (transmit, receive and error conditions) which is routed to either IRQ2,3,4,5,6 or 7 by a link. Note that the AIM/104-CAN does not support PC/104 interrupt sharing.

In addition to the registers of the SJA1000, the AIM104-CAN implements two other registers. One register is used to access the on-board E²PROM and the other for accessing the off-board indicator LEDs (nominally three bi-colour LEDs).

Full software support for the CAN driver device, the E²PROM and the indicator LEDs is provided in the AIM104-CAN software library. In addition, higher level protocol support may be purchased from Arcom. Contact Arcom sales for further details.

Connection of Bi-Colour LEDs

The AIM104-CAN has a six bit output port that is designed to drive three Bi-colour indicator LEDs. The following circuit should be used for connecting these LEDs:



I/O Map

Address	Device**	Reg Name	Access	Function
Base +0x00	SJA1000	CR	R/W	Control Register
Base +0x01	SJA1000	CMR	Write Only	Command Register
Base +0x02	SJA1000	SR	Read Only	Status Register
Base +0x03	SJA1000	IR	Read Only	Interrupt Register
Base +0x04	SJA1000	AC	R/W*	Acceptance Code Register
Base +0x05	SJA1000	AM	R/W*	Acceptance Mask Register
Base +0x06	SJA1000	BTR0	R/W*	Bus Timing Register 0
Base +0x07	SJA1000	BTR1	R/W*	Bus Timing Register 1
Base +0x08	SJA1000	OCR	R/W*	Output Control Register
Base +0x09	SJA1000	TR	-	Test Register (Used for Philips Production Test Only)
Base +0x0A	SJA1000	TB	R/W*	Transmit Buffer (2 descriptor bytes + 8 data bytes)
Base +0x14	SJA1000	RB0/RB1	Read Only	Receive Buffers (2 descriptor bytes + 8 data bytes each)
Base +0x1F	SJA1000	CDR	R/W	Clock Divisor Register
Base +0x20	SJA1000	LED	Write Only	Output Register for bi-colour LEDs
Base +0x21	SJA1000	E²PROM	R/W	I/O Register for accessing the EEPROM

*Access to these registers may be restricted depending on the operating mode or conditions within the SJA1000.

** Full information on the 82C200 can be found in the appropriate data sheet available from a Philips distributor.

PeliCAN address alocation -RESET mode

Address	Device	Reg Name	Access	Description
Base +0x00	SJA1000	MOD	Read/Write	Mode Register
Base +0x01	SJA1000	CMR	Write Only	Command Register
Base +0x02	SJA1000	SR	Read Only	Status Register
Base +0x03	SJA1000	IR	Read Only	Interrupt Register
Base +0x04	SJA1000	IER	Read/Write	Interrupt Enable Register
Base +0x05	SJA1000	reserved		reserved
Base +0x06	SJA1000	BTR0	Read/Write	Bus Timing 0 Register
Base +0x07	SJA1000	BTR1	Read/Write	Bus Timing 1 Register
Base +0x08	SJA1000	OCR	Read/Write	Output Control Register
Base +0x09	SJA1000	test		Used for Philips Production Test Only
Base +0x0A	SJA1000	reserved		reserved
Base +0x0B	SJA1000	ALC	Read Only	Arbitration Lost Capture Register
Base +0x0C	SJA1000	ECC	Read Only	Error Code Capture Register
Base +0x0D	SJA1000	EWLR	Read/Write	Error Warning Limit Register
Base +0x0E	SJA1000	RXERR	Read/Write	Receive Error Counter Register
Base +0x0F	SJA1000	TXERR	Read/Write	Transmit Error Counter Register
Base +0x10	SJA1000	ACR0	Read/Write	Acceptance Code Register 0
Base +0x11	SJA1000	ACR1	Read/Write	Acceptance Code Register 1
Base +0x12	SJA1000	ACR2	Read/Write	Acceptance Code Register 2
Base +0x13	SJA1000	ACR3	Read/Write	Acceptance Code Register 3
Base +0x14	SJA1000	AMR0	Read/Write	Acceptance Mask Register 0
Base +0x15	SJA1000	AMR1	Read/Write	Acceptance Mask Register 1
Base +0x16	SJA1000	AMR2	Read/Write	Acceptance Mask Register 2
Base +0x17	SJA1000	AMR3	Read/Write	Acceptance Mask Register 3
Base +0x18	SJA1000	reserved		reserved
Base +0x19	SJA1000	reserved		reserved
Base +0x1A	SJA1000	reserved		reserved
Base +0x1B	SJA1000	reserved		reserved
Base +0x1C	SJA1000	reserved		reserved
Base +0x1D	SJA1000	RMC	Read Only	Receive Message Counter Register
Base +0x1E	SJA1000	RBSA	Read/Write	Receive Buffer Start Address Register
Base +0x1F	SJA1000	CDR	Read/Write	Clock Divider Register
Base +0x20	Module	LED	Write Only	Output Register for bi-colour LEDs
Base +0x21	Module	E^2PROM	Read/Write	I/O Register for E^2PROM access

PeliCAN address alocation -Operating mode

Address	Device	Reg Name	Access	Description
Base +0x00	SJA1000	MOD	Read/Write	Mode Register
Base +0x01	SJA1000	CMR	Write Only	Command Register
Base +0x02	SJA1000	SR	Read Only	Status Register
Base +0x03	SJA1000	IR	Read Only	Interrupt Register
Base +0x04	SJA1000	IER	Read/Write	Interrupt Enable Register
Base +0x05	SJA1000	reserved		reserved
Base +0x06	SJA1000	BTR0	Read Only	Bus Timing 0 Register
Base +0x07	SJA1000	BTR1	Read Only	Bus Timing 1 Register
Base +0x08	SJA1000	OCR	Read Only	Output Control Register
Base +0x09	SJA1000	test		Used for Philips Production Test Only
Base +0x0A	SJA1000	reserved		reserved
Base +0x0B	SJA1000	ALC	Read Only	Arbitration Lost Capture Register
Base +0x0C	SJA1000	ECC	Read/Write	Error Code Capture Register
Base +0x0D	SJA1000	EWLR	Read Only	Error Warning Limit Register
Base +0x0E	SJA1000	RXERR	Read Only	Receive Error Counter Register
Base +0x0F	SJA1000	TXERR	Read Only	Transmit Error Counter Register
Base +0x10 to Base +0x1C	SJA1000	TXB	Write	Transmit buffer consisting of TX frame information byte, TX Identifier bytes (2 for SFF[1], 4 for EFF[2]) and 8 data bytes
Base +0x10 to Base +0x1C	SJA1000	RXB	Read	Receive buffer consisting of RX frame information byte, RX Identifier bytes (2 for SFF[1], 4 for EFF[2]) and 8 data bytes
Base +0x1D	SJA1000	RMC	Read Only	Receive Message Counter Register
Base +0x1E	SJA1000	RBSA	Read Only	Receive Buffer Start Address Register
Base +0x1F[3]	SJA1000	CDR	Read/Write[4]	Clock Divider Register
Base +0x20	Module	LED	Write Only	Output Register for bi-colour LEDs
Base +0x21	Module	EEPROM	Read/Write	I/O Register for EEPROM access

1 Standard Frame Format (11 bit Identifier)
2 Extended Frame Format (29 bit Identifier)
3 Note that although the SJA1000 CAN controller supports internal RAM addresses from 3210 to 12710 (TX buffer and RX FIFO), these are not accessible to the CPU board
4 Some bits of the CDR can be written in RESET mode only

LED Register

The LED register is used to light three external bi-colour LEDs. All bits are write only.

Writing a logic 1 to any bit position causes the corresponding output to go low (active). After reset

7	6	5	4	3	2	1	0
Reserved		LED2.1	LED2.0	LED1.1	LED1.0	LED0.1	LED0.0

all bits are logic 0. Reserved bits should be written as logic 0.

E²PROM Register

The E²PROM register directly accesses the serial lines on a 93C46 serial E²PROM as shown in the register below. All implemented bits are Read/Write except the DO bit which is read only.

7	6	5	4	3	2	1	0
Reserved				SCK	CS	DI	DO

Writing a logic 1 to a bit causes the corresponding signal on the E²PROM to go high, a logic zero makes that signal low. After reset all bits in this register are logic 0. All reserved bits should be written as logic 0 for future software compatibility.

E²PROM Contents

The E²PROM on the AIM104-CAN is shipped from the factory with a default programming. This information is divided into two records. Both records are readable using the supplied software, only the second record is writeable.

Data is organised in 16 bit words and the byte order is as follows for larger data units:

Object Type	First Data Word		Second Word	
	Most Sig Byte	Least Sig Byte	Most Sig Byte	Least Sig Byte
32 bit number	Least Significant Word		Most Significant Word	
Byte Arrays (strings)	2nd Byte	1st Byte	4th Byte	3rd Byte

The default contents of the data are as follows:

Product Data Record

Offset (word)	Size (words)	Description	Value
0x00	1	DeviceNet Vendor Id (Arcom's)	126
0x01	1	SDS Partner Number (Arcom's)	0xFFFF
0x02	2	Unique 32 bit serial number	----
0x04	1	Encoded Arcom Product Number	10552*
0x05	1	Encoded Arcom Version Control Code	10100*
0x06	11	Manufacturer String	"Arcom Control Systems"
0x11	9	Stock Number String	"6040-00552-001-101"*
0x1A	12	Product Description String	"AIM104-CAN"
0x26	2	Date Code String mmYY	"0397"*
0x28	1	16 bit CRC check mode	----

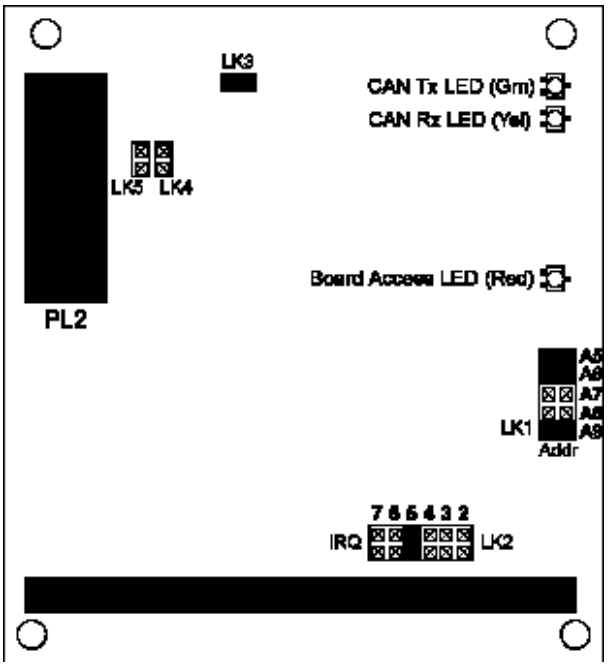
* This information may vary to reflect the build of the product that is shipped.

Application Data Record

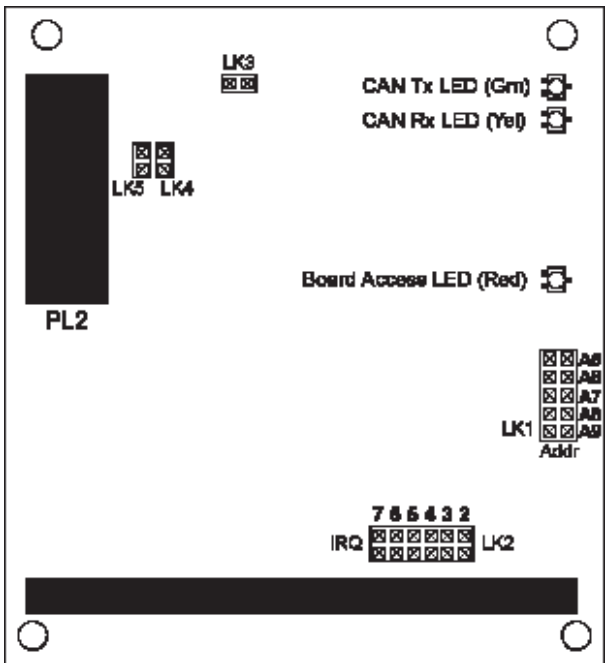
Offset (word)	Size (words)	Description	Value
0x29	1	Encoded baud rate	500
0x2A	1	Network Address	0xFFFF
0x2B	4	User Data Array	{0,0,0,0}
0x2F	16	User Tag Area	""
0x3F	1	16 bit CRC check code	----

Links

Default Link Position Diagram (Address is 180h)



User Configuration Record



Address Link

LK1 is the address decode link. The desired board base address is set on this link. Note that the base address can be set on any 32 byte boundary and that 34 bytes are decoded. A successful decode to any of these 34 locations will cause the red module access LED to light momentarily.

Interrupt Link

LK2 is the interrupt select link. This can be set for IRQ2 through to IRQ7. (Note that IRQ2 will map onto IRQ9 in an AT type PC host CPU.) PC/104 interrupt sharing is not supported by this module. Note that certain PC/104 host boards may not be able to use all of the possible link options. The following table should be used as a guide:

Link Position	PC Compatible*	Target386EX	Target188EB
IRQ2	4		4
IRQ3	4		4
IRQ4	4	4	4
IRQ5		4	
IRQ6	4	4	4
IRQ7			

* Consult your PC AT Manual to see if these IRQs are committed to other devices.

Controlled Slew Rate Link

LK3 is the slew rate control link. It may be removed at baud rates below 250kbaud for a slower slew on the CAN signals. This may reduce EMC emissions on unscreened twisted pair wiring.

Line Termination Links

LK4 and **LK5** are used to attach the CAN termination network. If the AIM104-CAN is at an end on the CAN bus, terminations should be attached. To attach the termination **both** links should be fitted. If no termination is required **both** links should be removed.

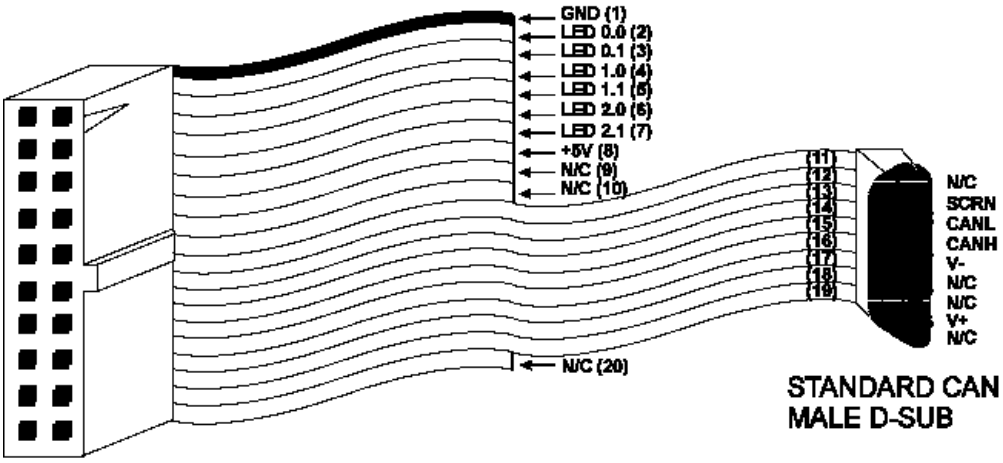
Connector (PL2) Pin Assignments

Pin No	Function	Pin No	Pin No
1	GND	2	/LED0.0
3	/LED0.1	4	/LED1.0
5	/LED1.1	6	/LED2.0
7	/LED2.1	8	+5V
9	n/c	10	n/c
11	n/c	12	SCRN
13	CAN_L	14	CAN_H
15	V-	16	n/c
17	n/c	18	V+
19	n/c	20	n/c

Note that PL2 is used for both the isolated CAN line drivers and the non-isolated indicator LEDs. Care should be taken to separate the appropriate signals.

Also note that the power for the LEDs is not protected in any way and should not be used for driving any apparatus other than the indicator LEDs.

The ribbon cable can be split to form a standard CiA 9-way D-sub CAN connection.



AIM104-CAN

Alternatively, Arcom supply Panel Mountable breakout boards with mounted bi-colour LED's for D-sub and screw terminal (DeviceNet) cabling. Contact Arcom Sales and enquire about SERT-DNET.

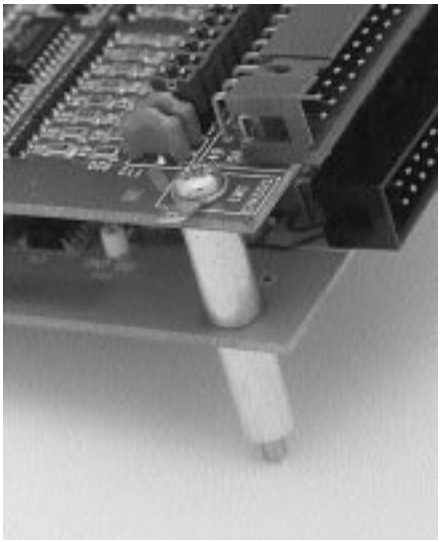
Isolated CAN Transceiver

The CAN transceiver on the AIM104-CAN is optically isolated from the PC/104 interface and requires external powering in order to function. A regulator on the isolated side of the circuit allows a wide range of voltage (on the V+/V-) input from 9V to 27V.

The V- signal is the nominal ground reference for the line driver. A protection circuit prevents damage to the line drivers should this signal become disconnected whilst all the other signals remain connected.

The optical isolation is designed to prevent ground loops and voltage drop causing problems on a distributed CAN bus system. Although the isolation voltage is in excess on 48V, the isolation must not be used as a safety feature.

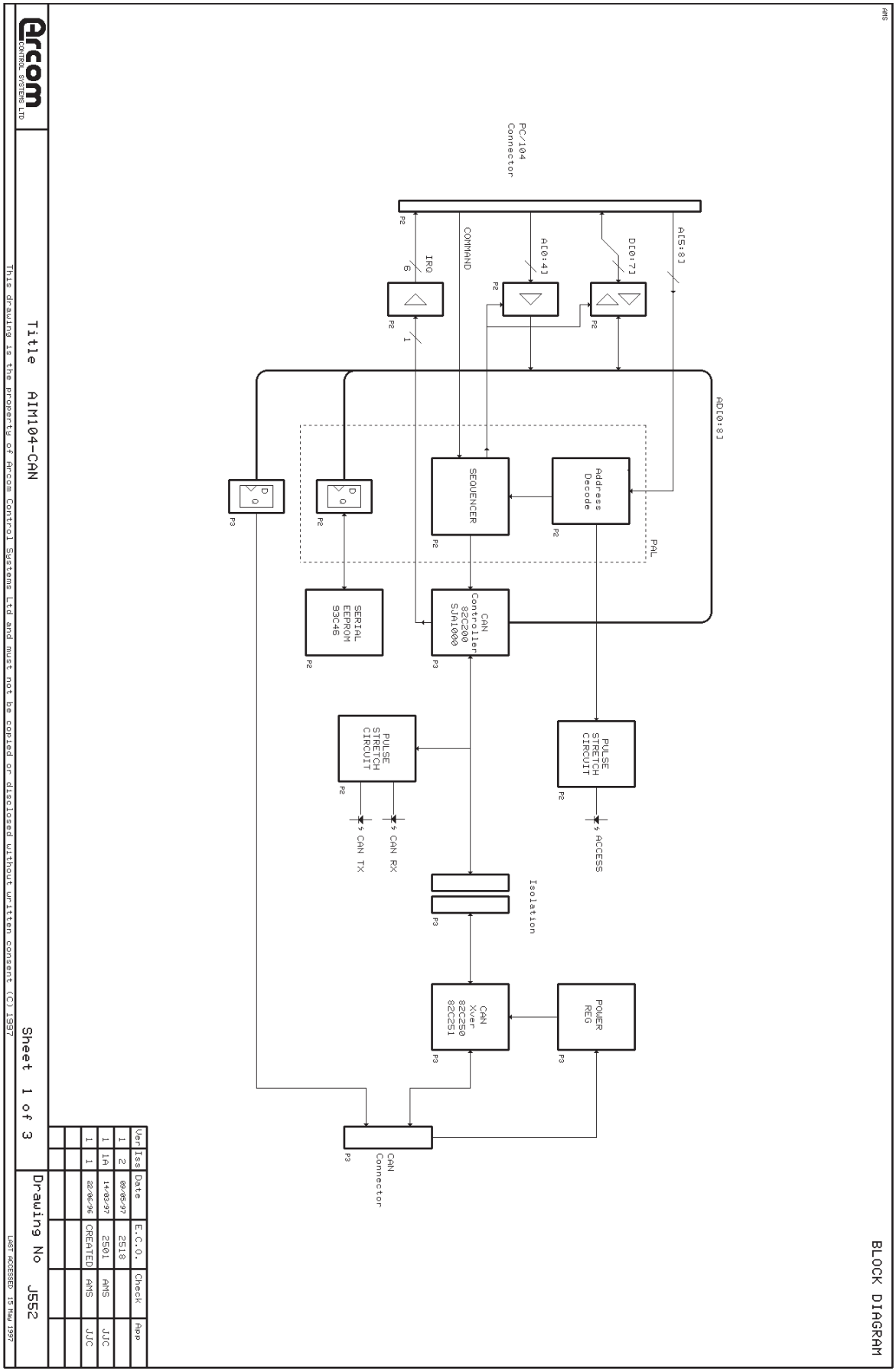
EMC Issues

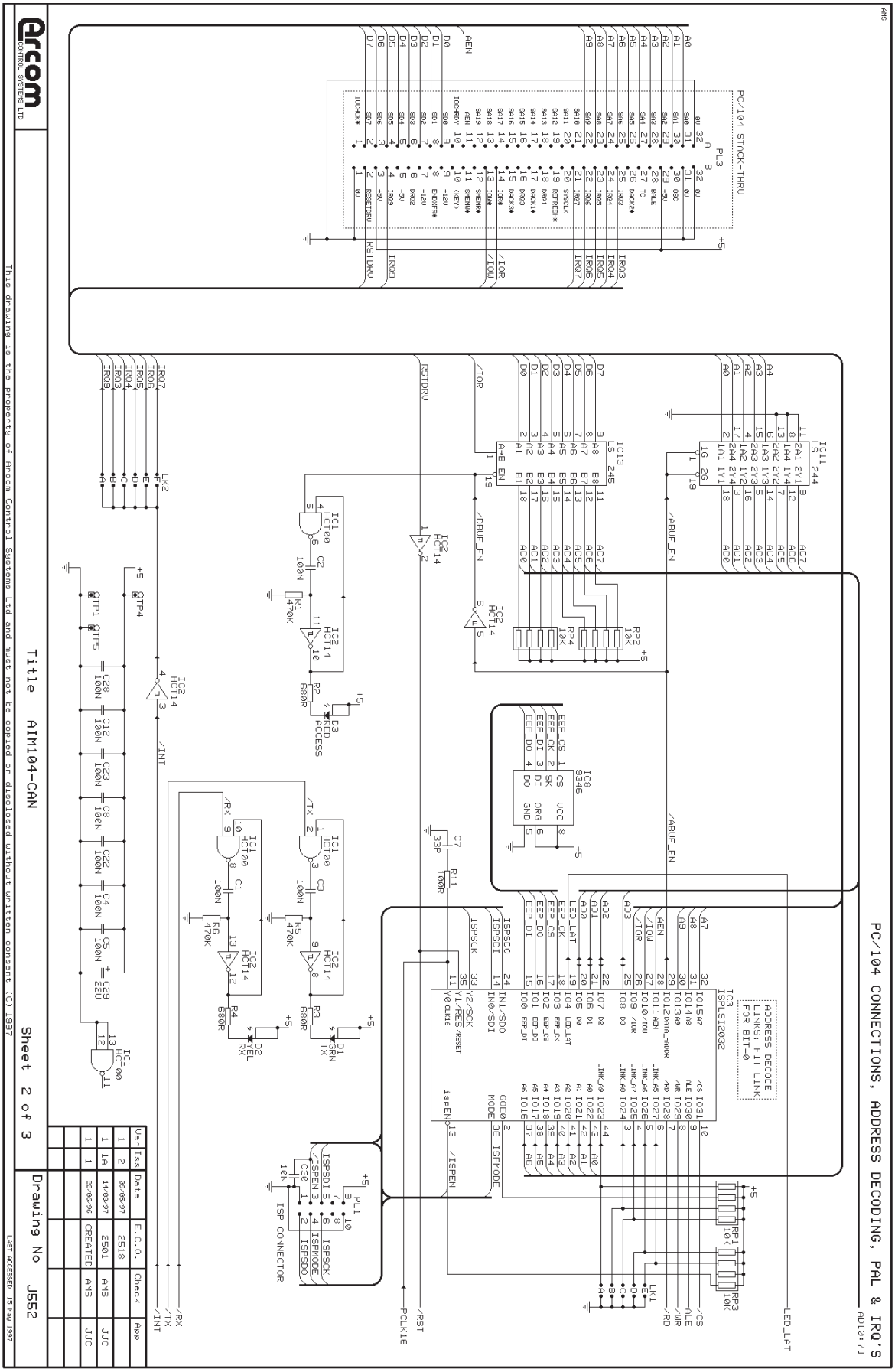


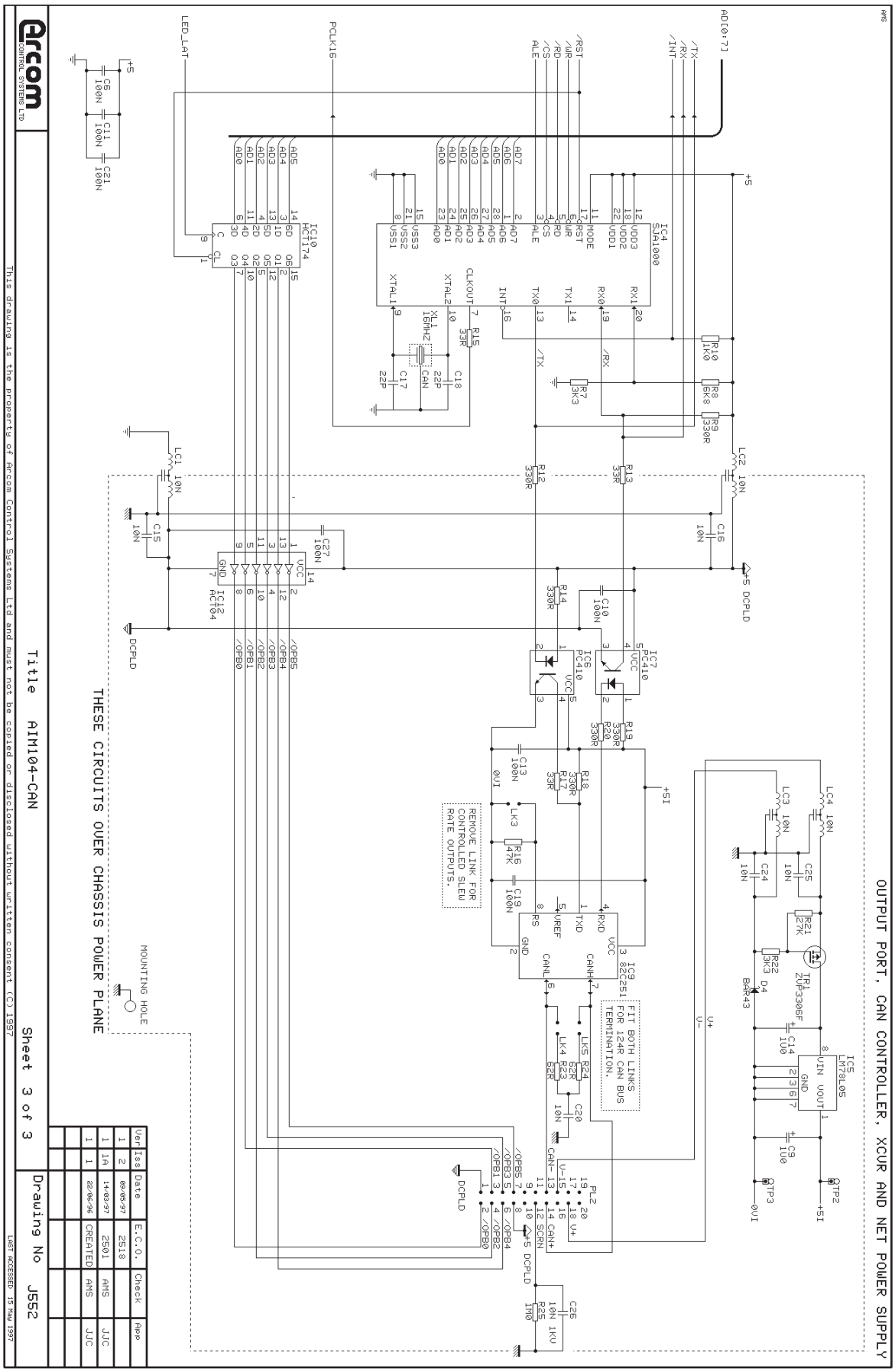
The opto-isolation provides a good barrier for noise emissions generated by the high frequency host PC/104 system. The AIM104-CAN includes additional filter components on board to minimise the emissions of high frequency noise. The filter requires that the earth tab supplied with the module is connected by a good earth wire to the chassis of the system.

If the electronic system requires input protection against high voltage transients (to meet CE requirements) it is recommended that an external interface board is located at the point where the external wiring enters the electronic system enclosure.

Circuit Diagrams




PC/104 CONNECTIONS, ADDRESS DECODING, PAL & IRQ'S
Arcom CONTROL SYSTEMS LTD
Title AIM104-CAN
Sheet 2 of 3
Drawing No J552
PC/104 STACK-THRU
ADDRESS DECODE LINKS; FIT LINK FOR BIT=0
ISPLSI2032
ISP CONNECTOR
Ver Iss Date E.C.O. Check App
1 2 09-05-97 2518 AMS JJC
1 1A 14-03-97 2501 AMS JJC
1 1 22-06-96 CREATED AMS JJC
This drawing is the property of Arcom Control Systems Ltd and must not be copied or disclosed without written consent (C) 1997
LAST ACCESSED 15 May 1997


OUTPUT PORT, CAN CONTROLLER, XCUR AND NET POWER SUPPLY
THESE CIRCUITS OVER CHASSIS POWER PLANE
REMOVE LINK FOR CONTROLLED SLEW RATE OUTPUTS.
FIT BOTH LINKS FOR 124R CAN BUS TERMINATION.
MOUNTING HOLE
Title AIM104-CAN
Drawing No J552
Sheet 3 of 3
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AIM104-CAN Software Library

AIM104-CAN

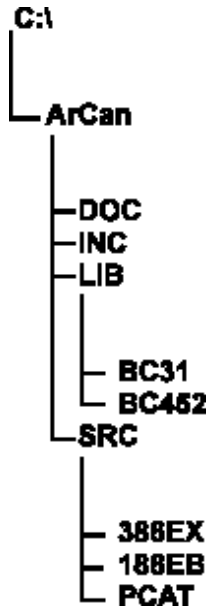
The AIM104-CAN is a more specialised module than the other modules in the range and the software structure is slightly different to accommodate this.

Note: The AIM104-CAN software library refers to the BAsic CAN mode of operation.

Installation

System Requirements

The system requirements for the AIM104-CAN software are as for the general AIM104 libraries. The setup program installs the following directory organisation for the CAN software:



In order to correctly access the header files and libraries, you will need either to move them to your development directories or configure your compiler/linker in order that the necessary files can be “seen”. Refer to your compiler documentation about how to do this.

Full Documentation

Full documentation for the software for the AIM1104-CAn is supplied in the form of WORD 2.0 file in the documentation directory of the above directory structure.

ArCan Library Functions

DATA TYPES: The ArCan software uses a number of elemental data types as follows:

UINT8 Unsigned 8 bit integer.
UINT16 Unsigned 16 bit integer.
UINT 32 Unsigned 32 bit integer.

SINT8 Signed 8 bit integer.
SINT16 Signed 16 bit integer.
SINT32 Signed 32 bit integer.

CAN Data structure used as “handle” once CAN communications are initialised.
CAN_MSG A data structure that embodies both the CAN identifier, message size and data.

INITIALISATION ROUTINES: Before the CAN hardware can be used it is necessary to initialise the module and obtain a handle to the channel:

CAN far *can_open(UINT16 ioaddr, SINT16 irqnum, UINT16 bufsiz, UINT32 baud)

- Initialises a CAN channel and returns a handle

void can_close(CAN far *can)

- Clears the CAN hardware and frees all resources.

COMMUNICATION ROUTINES: These are used for effecting communications on the CAN bus.

SINT16 can_send(CAN far *can, CAN_MSG far *msg)

- Transmits a message on the bus through the ring buffers.

SINT16 can_fetch(CAN far *can, CAN_MSG far *msg)

- Get a message from the receive ring buffer.

STATUS ROUTINES: Determine the operating status of the CAN channel.

SINT16 can_tx_ready(CAN far *CAN)

- Determines is the transmit buffer is able to accept a message.

SINT16 can_rx_ready(CAN far *can)

- Determines if the receive buffer contains a message or not.

SINT16 can_error(CAN far *can)

- Check the error status on the CAN channel.

ERROR RECOVERY: Routines used to detect and process error conditions on the CAN interface.

void can_clear_errors(CAN far *can)

- Clear the error flags on the CAN channel.

void can_txabort(CAN far *can)

- Aborts the current transmission on the CAN controller.

MESSAGE IDENTIFIER FILTERING: Functions that control the acceptance of incoming messages.

void can_set_filter(CAN far *CAN, UINT16 uFnum, UINT16 uAcceptCode,
UINT16 uAcceptMask, SINT16 (far *FilterFn)(CAN far *, UINT16))

- Configures the hardware and software acceptance filters and user supplied function.

ISR HOOKS: Other Hooks into the Interrupt Service Routine.

void can_set_txcallback(CAN far *can, void (far *TxCallBackFn)(CAN far *, UINT16))

- Installs an user function called upon successful transmission of a message.

void can_set_rxinform(CAN far *can, void (far *RxInformFn)(CAN far *, UINT16))

- Installs an user function called when received messages are placed in the buffer.

void_can_set_error(CAN far *can, void (far *ErrorFn) (CAN far *, UINT16))

- Installs an user function to handle changes in the error state.

INDICATOR LEDS: Functions to access the external indicator LEDs.

SINT16 wCanLed(UINT16 uBRDAddr, UINT16 uLed, UINT16 uState)

- Used to control the external indicator LEDs.

E²PROM: Functions to retrieve and write the data in the E²PROM.

SINT16 wCAN_ReadProcuctData (UINT16 uBrdAddr, EEP_ProductData far *pProdDat)

- Reads the product data record from the E²PROM.

SINT16 wCAN_ReadApplicationData(UINT16 uBrdAddr, EEP_ApplicationData far *pAppDat)

- Reads the application data record from the E²PROM.

SINT16 wCAN_WriteApplicationData(UINT16 uBrdAddr, EEP_ApplicationData far *pAppDat)

- Recalculates the CRC in the application data record and then writes to E²PROM.

Revision History

Manual	PCB	Comments	
Issue A	V1 Iss1	970324	First published in this format.
Issue B	V1 Iss2	970609	[ECO2518]
Issue C	V1 Iss2	981007	[ECR333}

Product Information

Full information about other Arcom products is available via the **Fax-on-Demand System**, (Telephone Numbers are listed below), or by contacting our **WebSite** at: **www.arcomcontrols.com**

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FoD: 0800 873600

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