The Embedded I/O Company

TEWS TECHNOLOGIES

TIP903

Three Channel Extended CAN Bus Adapter

Version 1.1

User Manual

Issue 1.1.1

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TIP903-10R

Three Channel Extended CAN Bus interface, extended temperature range

Style Conventions

Hexadecimal characters are specified with prefix 0x, i.e. 0x029E (that means hexadecimal value 029E).

For signals on hardware products, an ‚Active Low' is represented by the signal name with # following, i.e. IP_RESET#.

Access terms are described as:

W	Write Only
R	Read Only
R/W	Read/Write
R/C	Read/Clear
R/S	Read/Set

Issue	Description	Date
1.0	First issue	January 1996
1.1	Programming hints added	February 1996
1.2	FPGA speed grade changed	September 1997
1.3	General revision	July 2003
1.4	New address TEWS LLC	September 2006
1.1.0	Hardware minor version update to V1.1 Rev.A	June 2012
1.1.1	General Revision	August 2014

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1 Product Description

The TIP903 is an IndustryPack® compatible module with three extended CAN bus interfaces using three 82527 CAN controllers.

The controllers support the standard data and remote frame as well as the extended data and remote frame according to CAN specification 2.0 part A and part B (standard 11 bit identifier and extended 29 bit identifier).

It has the capability to transmit, receive and perform message filtering on extended and standard messages.

The TIP903 supports a 16 bit bus interface which permits word and byte accesses to the internal registers of the three CAN controllers. The physical interface supports CAN High Speed according to ISO11898 for each of the three channels.

The bus line termination is selectable by jumpers separate for each bus line. The data transfer rates of up to 1 Mbps are supported for a bus line length of 40 m.

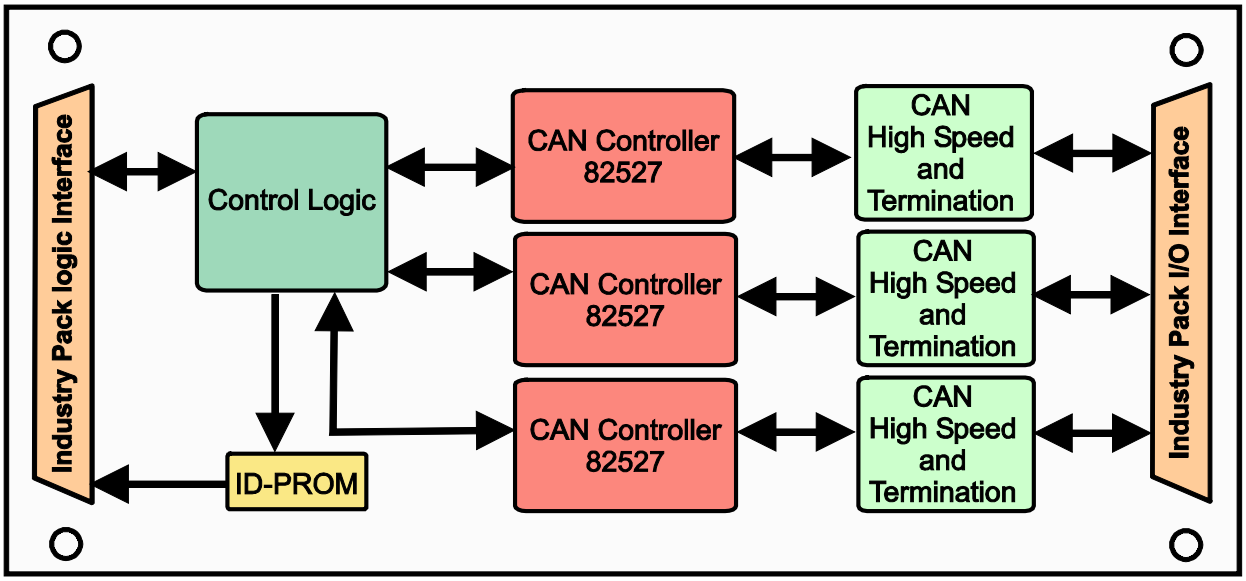

Figure 1-1 : Block Diagram

2 Technical Specification

IP Interface		
Interface	Single Size IndustryPack® Logic Interface compliant to ANSI/VITA 4-1995	
ID ROM Data	Format I **IDSel#:** 0 wait states	
I/O Space	Not used	
Memory Space	Used **MemSel#:** 1 wait state minimum	
Interrupts	IntReq0# used **IntSel#:** 0 wait states	
DMA	Not supported	
Clock Rate	8 MHz	
Module Type	Type I	
On Board Devices		
Control Logic	Lattice ispMACH 4000ZE CPLD	
CAN Controller	3x 82527 CAN Controller	
Physical Interface	3x NXP TJA1050 CAN High Speed Transceiver (ISO11898)	
I/O Interface		
Interface Connector	50-conductor flat cable	
Bus Line Termination	On board 120Ω, selectable by jumper for each channel	
Number of nodes	Up to 110 on one bus line	
Transfer Rate	From 60 kbit/s up to 1 Mbit/s 1 Mbit/s -> maximum bus line length 40m	
Power Requirements	60mA typical @ +5V DC	
Physical Data		
Temperature Range	Operating Storage	-40°C to +85 °C -40°C to +85°C
MTBF	1418000 h MTBF values shown are based on calculation according to MIL-HDBK-217F and MIL-HDBK-217F Notice 2; Environment: $G_{B\ 20°C}$. The MTBF calculation is based on component FIT rates provided by the component suppliers. If FIT rates are not available, MIL-HDBK-217F and MIL-HDBK-217F Notice 2 formulas are used for FIT rate calculation.	
Humidity	5 – 95 % non-condensing	
Weight	34 g	

Table 2-1 : Technical Specification

3 ID PROM Contents

Address	Function	Contents
0x01	ASCII 'I'	**0x49**
0x03	ASCII 'P'	**0x50**
0x05	ASCII 'A'	**0x41**
0x07	ASCII 'C'	**0x43**
0x09	Manufacturer ID	**0xB3**
0x0B	Model Number	**0x1C**
0x0D	Revision	**0x10**
0x0F	Reserved	**0x00**
0x11	Driver-ID Low - Byte	**0x00**
0x13	Driver-ID High - Byte	**0x00**
0x15	Number of bytes used	**0x0D**
0x17	CRC	**0xD4**
0x19	Version	**0x0A**

Table 3-1 : ID PROM Contents

4 IP Addressing

4.1 Memory Space Addressing

The complete register sets of all three CAN controllers of the TIP903 and the Interrupt Vector Register are accessible in the memory space of the IP. Byte and word accesses to the register sets of the three CAN controllers are supported.

Address	Symbol	Description	Size (Bit)
0x000 to 0x0FF	CANCH1	CAN Controller Channel 1 Register Set	2048
0x100 to 0x1FF	CANCH2	CAN Controller Channel 2 Register Set	2048
0x200 to 0x2FF	CANCH3	CAN Controller Channel 3 Register Set	2048
0x301	INTVEC	Interrupt Vector Register	8

Table 4-1 : Memory Space

4.1.1 CAN Controller Register Set

For more information about the register sets of the CAN controllers refer to the "Architectural Overview" document of the 82527 Serial Communications Controller.

4.1.2 Interrupt Vector Register

The Interrupt Vector Register INTVEC is a byte wide read/write register located at address 0x301. The INTVEC is a common register for all three CAN channels but each CAN channel will create an individual interrupt.

Bit	Description	Access	Reset Value
7:2	Interrupt Vector written by software	R/W	000000
1:0	Interrupt from corresponding channel 00 = interrupt from channel 1 01 = interrupt from channel 2 10 = interrupt from channel 3	R/W	00

Table 4-2 : Interrupt Vector Register INTVEC

Example: If the Interrupt Vector Register INTVEC is loaded with 0x60, CAN Channel 1 will create an interrupt at vector 0x60, Channel 2 at vector 0x61 and Channel 3 at vector 0x62.

Each of the three CAN channels generates interrupts on interrupt request line IntReq0# of the IP bus.

The lower two bits of the Interrupt Vector Register will only indicate interrupts of the three CAN channels if it is being read during an Interrupt Acknowledge (IACK) Cycle. If it is read via Memory Access the 8 bits show the value which was written to it via Memory Write Access.

5 Interrupt Handling

There can be different reasons for each of the 82527 CAN controllers to assert an interrupt. It is possible that a CAN controller generates an interrupt when more than one internal source of the CAN controller request interrupt service.

Please make sure that there is no other interrupt pending inside the CAN Controller when the interrupt service is finished. Otherwise, the pending interrupt will not get an interrupt service.

To make sure there is no other pending interrupt of the CAN controller, the "Interrupt Register" of the currently serviced CAN controller (0x05F for Channel 1, 0x15F for Channel 2 or 0x25F for Channel 3) has to be 0x00.

6 Installation

Each end of a CAN bus line must be terminated by a 120Ω resistor. If a CAN bus controller of the TIP903 is located at the end of a CAN bus line the on board bus line termination must be activated.

6.1 Jumper Configuration

If jumpers on the jumper field "J2" are installed the CAN bus line for the according CAN bus channel is terminated by a 120Ω resistor.

Jumper	Bus line termination for CAN bus channel
(1-2) installed	Channel 1 termination active
(3-4) installed	Channel 2 termination active
(5-6) installed	Channel 3 termination active

Table 6-1 : Jumper Configuration

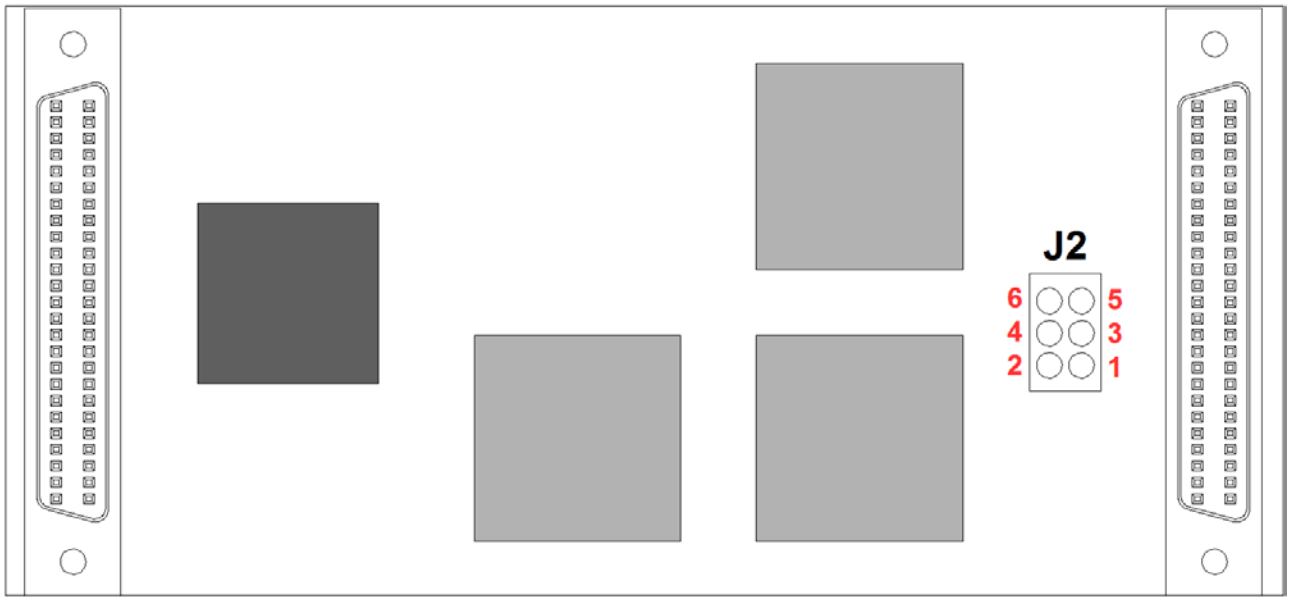

Figure 6-1 : Jumper Location

7 Pin Assignment – I/O Connector

Pin	Signal
1	N/C
2	N/C
3	Channel 1 CANL
4	Channel 1 CANH
5	GND
6	N/C
7	N/C
8	N/C
9	N/C
10	N/C
11	N/C
12	Channel 2 CANL
13	Channel 2 CANH
14	GND
15	N/C
16	N/C
17	N/C
18	N/C
19	N/C
20	N/C
21	Channel 3 CANL
22	Channel 3 CANH
23	GND
24	N/C
25	N/C

Pin	Signal
26	N/C
27	N/C
28	N/C
29	N/C
30	N/C
31	N/C
32	N/C
33	N/C
34	N/C
35	N/C
36	N/C
37	N/C
38	N/C
39	N/C
40	N/C
41	N/C
42	N/C
43	N/C
44	N/C
45	N/C
46	N/C
47	N/C
48	N/C
49	N/C
50	N/C

Table 7-1 : Pin Assignment I/O Connector

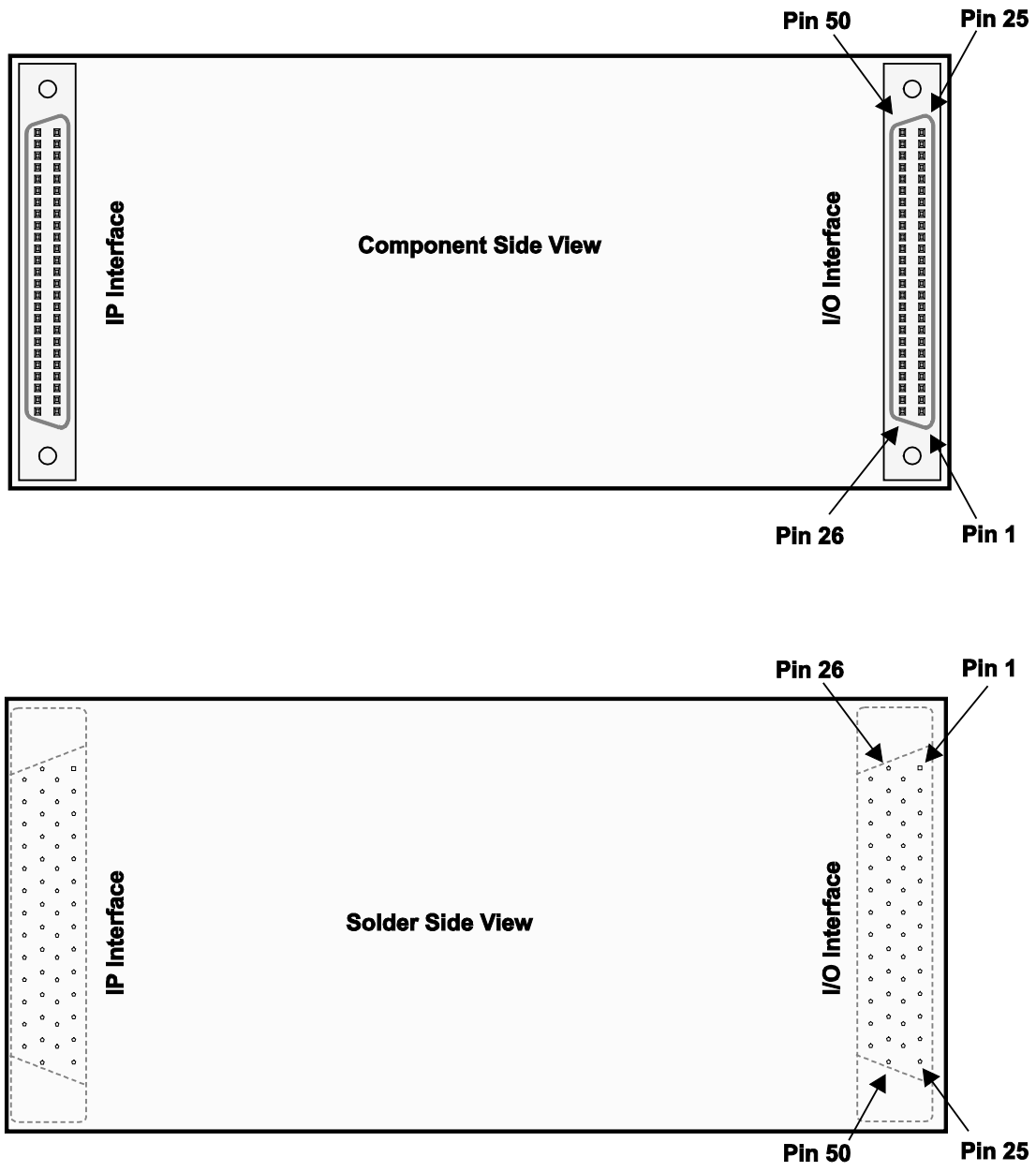

Figure 7-1 : IP Connector Orientation

7.1 CAN in Automation DB9 Connector

The 50-pin flat cable coming from the IP carrier board can be split into three 9-pin sections. Each of these 9-pin sections will fit directly to a DB9 male connector. The assignment of the DB9 connector meets the suggestion of the CiA (CAN in Automation).

7.1.1 CAN High Speed Channel 1

The lines 1-9 fit directly to a DB9 male connector.

50-pin flat cable	DB9	used by TIP903	Description according to CiA	
1	1	No	Reserved	
2	6	No	(GND)	Optional Input Ground
3	2	Yes	CAN_L bus line	CAN High Speed
4	7	Yes	CAN_H bus line	CAN High Speed
5	3	Yes	GND	Ground
6	8	No	Reserved	(error line)
7	4	No	Reserved	
8	9	No	(V+)	Optional Input Power
9	5	No	Reserved	

Table 7-2 : CAN High Speed Channel 1

7.1.2 CAN High Speed Channel 2

The lines 10-18 fit directly to a DB9 male connector.

50-pin flat cable	DB9	used by TIP903	Description according to CiA	
10	1	No	Reserved	
11	6	No	(GND)	Optional Input Ground
12	2	Yes	CAN_L bus line	CAN High Speed
13	7	Yes	CAN_H bus line	CAN High Speed
14	3	Yes	GND	Ground
15	8	No	Reserved	(error line)
16	4	No	Reserved	
17	9	No	(V+)	Optional Input Power
18	5	No	Reserved	

Table 7-3 : CAN High Speed Channel 2

7.1.3 CAN High Speed Channel 3

The lines 19-27 fit directly to a DB9 male connector.

50-pin flat cable	DB9	used by TIP903	Description according to CiA	
19	1	No	Reserved	
20	6	No	(GND)	Optional Input Ground
21	2	Yes	CAN_L bus line	CAN High Speed
22	7	Yes	CAN_H bus line	CAN High Speed
23	3	Yes	GND	Ground
24	8	No	Reserved	(error line)
25	4	No	Reserved	
26	9	No	(V+)	Optional Input Power
27	5	No	Reserved	

Table 7-4 : CAN High Speed Channel 3