DASP-52104

14-bit Isolated 4 Analog Output w/ Free-Running Card

User's Manual

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ESD Precautions

Integrated circuits on computer boards are sensitive to static electricity. To avoid damaging chips from electrostatic discharge, observe the following precautions:

Do not remove boards or integrated circuits from their anti-static packaging until you are ready to install them.

Before handling a board or integrated circuit, touch an unpainted portion of the system unit chassis for a few seconds. This helps to discharge any static electricity on your body.

Wear a wrist-grounding strap, available from most electronic component stores, when handling boards and components.

Trademarks Acknowledgments

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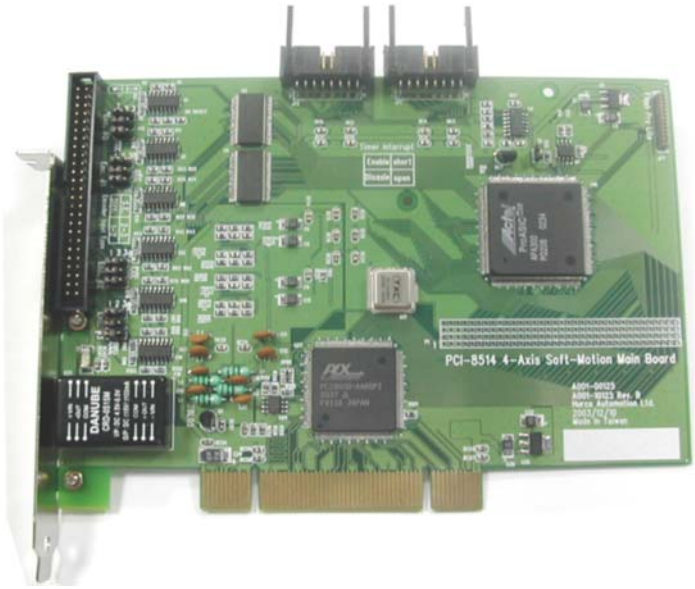
Chapter 1
Introduction



The DASP-52104 is a PCI-bus, 14-bit, 4 isolated analog output card. The DASP-52104 features an all new free-running mechanism to reduce S/W development effort, and provides an on-board watchdog timer to output safety D/A values after a system reset. These enhance system safety and save developing efforts.

Advanced S/W Mechanism: Free-running

Free-running is a brand new data-retrieving mechanism to mainly save software SW RD 30% ~ 50% of the time and effort in developing application programs. It helps software RD by using several rows of simple programs to read data, instead of countless numbers in the past.

On-board watchdog timer

Users can set up time intervals for the timer. While the application programs within the time interval have not connected with DASP/DASA products, the DASP/DASA will be sending out a preset safety value to a devices linked to the DASP/DASA. This helps maintain a stable system.

1.1 Features

- **14-bit 4 analog output channels**
- **On-board watchdog timer supported**
- **Output safety D/A value after system reset**
- **D/A Software programmable zero calibration**
- **Free-running D/A output**
- **Isolated analog Output**
- **Serial number on EEPROM supported**
- **Windows® 98/NT/2000/XP and Labview 6.0/7.0 driver supported**
- **Complete sample program- VB, VC, BCB, Delphi**

1.2 Specifications

Analog to Digital Converter (A/D)

- **Channels: 4**
- **Resolution: 14-Bit**
- **Output type: differential output**
- **Optical isolated: 2500V_{DC}**
- **Cycle time: 128μs (free-running)**
- **Voltage output: ±10V**
  Current drive: ±5mA
- **Current output: sink 0-20mA**
  Excitation voltage: 9-44V
- **Zero calibration: EEPROM on board**
- **Accuracy: ±3 LSB max.**
- **Offset error: ±2 LSB**
- **Driving capability: 15mA**

General Environment

- **I/O connector: 37-pin female D-Sub**
- **Power consumption: +5V @ 900mA (max.)**
- **Operating temperature: 0 ~ 60°C**
- **Storage temperature: -20 ~ +70°C**
- **Humility: 0 ~ 90% non-condensing**
- **Dimensions: 185mm x 122 mm**

1.3 Accessories

To make the DASP-52104 functionality complete, we carry a versatility of accessories for different user requirements in the following items:

Wiring Cable

- **CB-89037-2:**
  37-pin female D-sub type cable with 2m length
- **CB-89037-5:**
  37-pin female D-sub type cable with 5m length

The shielded D-sub cable with 2m and 5m are designed for the DASP-52104 analog output connector, respectively.

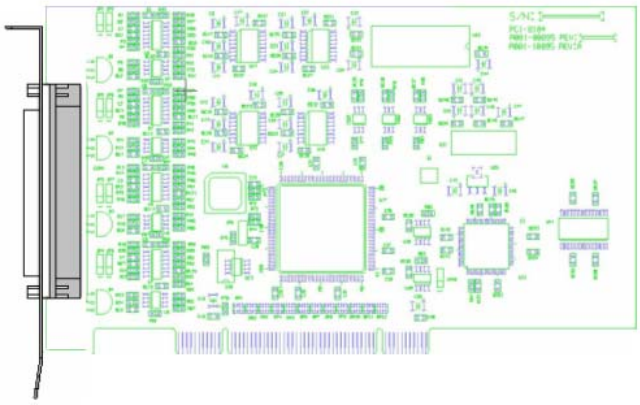
Terminal Block

- **TB-88037:**
  D-sub 37P female terminal block with DIN-rail mounting

The terminal block is directly connected to analog output connector of the DASP-52104.

Chapter 2
Hardware Installation

2.1 Board Layout



Board Layout for DASP-52104

2.2 Signal Connections

2.2.1 Signal Connection Descriptions

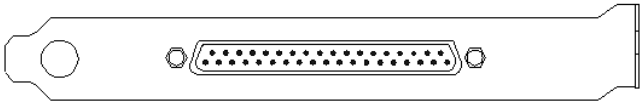
Signal Connections for DASP-52104

Referring to the above figure, the accessories of the DASP-52104 are depicted and described as below.

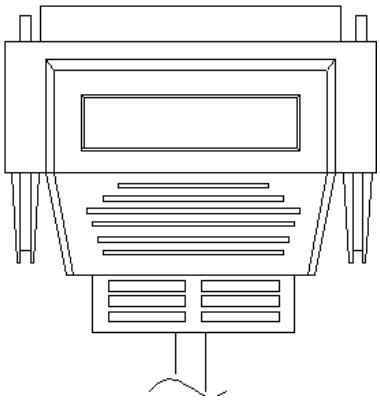
- **CON1:**
  The I/O connector CON1 on the DASP-52104 is a 37-pin D-sub connector for differential type analog input signals. CON1 enables you to connect to accessory TB-88037 with the shielded cable CB-89037-2 or CB-89037-5.

2.2.2 D/A Connector CON1

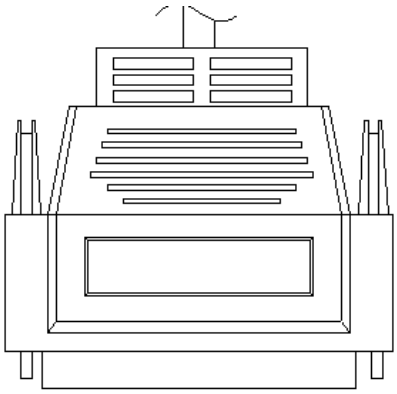
- **CON1: A/D Connector Pin Assignment**



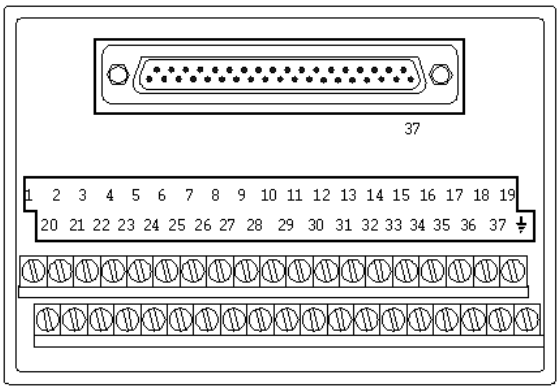
CON1



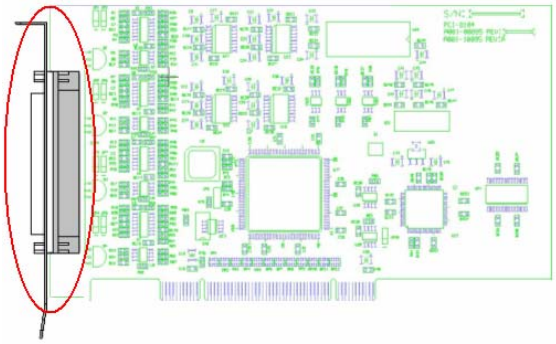
CB-89037



TB-88037

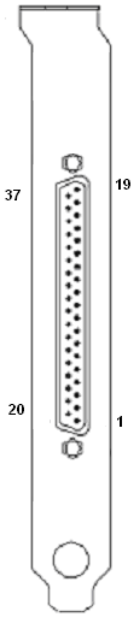


AIO Signal Connections for DASP-52104



D-Sub 37-pin Connector

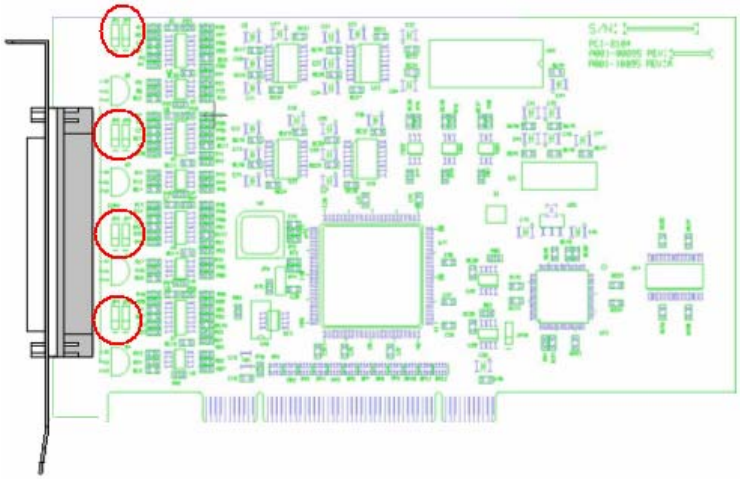
Pin	Description	Pin	Description
		19	DA current output 3-
37	DA current output 3+	18	DA current output 2-
36	DA current output 2+	17	DA current output 1-
35	DA current output 1+	16	DA current output 0-
34	DA current output 0+	15	
33	DA voltage output 3-	14	DA voltage output 3+
32	DA voltage output 2-	13	DA voltage output 2+
31	DA voltage output 1-	12	DA voltage output 1+
30	DA voltage output 0-	11	DA voltage output 0+
29		10	
28	AGND	9	AGND
27		8	
26		7	
25		6	
24		5	
23		4	
22		3	
21		2	
20		1	

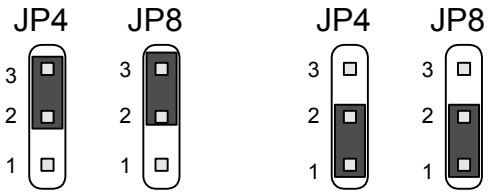


2.3 Jumper Setting

2.3.1 D/A Voltage Output Jumper Setting (JP4/8, JP3/7, JP2/6, JP1/5)

Analog Output Type (D/A Channel 0 – D/A Channel 3)

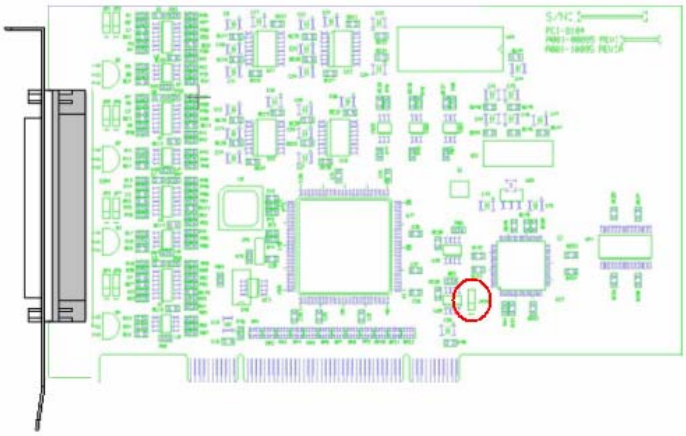




Jumper	Single Ended Output	Differential Output (Default)
JP4	2-3	1-2
JP8	2-3	1-2

- **Note**
  - D/A Channel 0: JP4/JP8
  - D/A Channel 1: JP3/JP7
  - D/A Channel 2: JP2/JP6
  - D/A Channel 3: JP1/JP5

2.3.2 Watchdog Timer Jumper Setting (JP10)



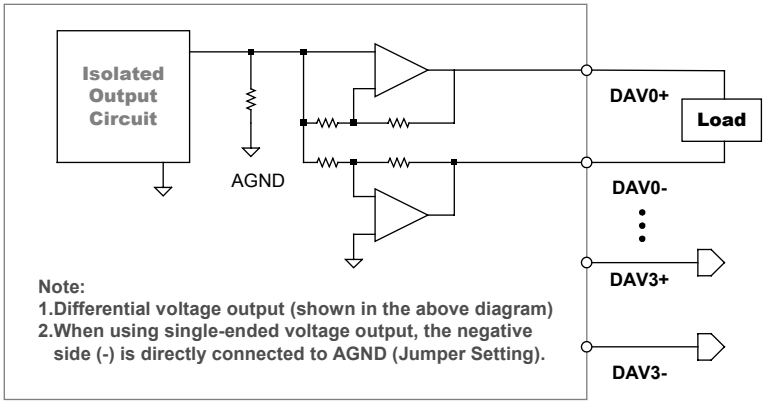
Jumper	Disable (Default)	Enable
JP10	1-2	2-3

2.4 A/D Circuits and Wiring

The analog output and wiring block diagram of DASP-52104 is depicted as below.

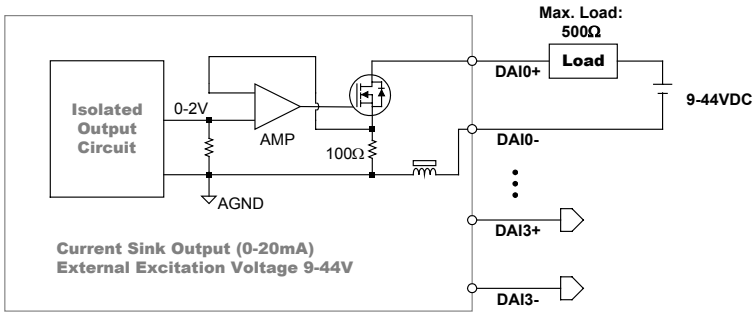
Output Signals: 4-channel Analog Output (DA0-DA3)

- **Voltage Output (± 10V)**



Analog Voltage Output Block Diagram for DASP-52104

- **Current Sink Output (0-20mA)**



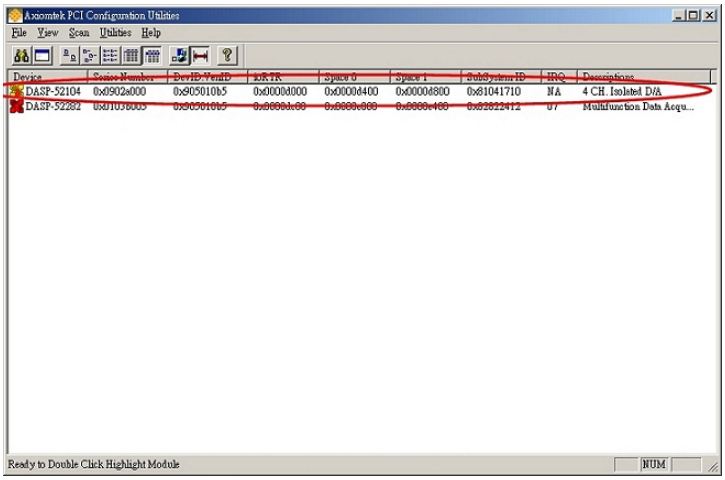
Analog Current Output Block Diagram for DASP-52104

2.5 Quick Setup and Test

To install a new DASP-52104 into an IBM PC compatible computer, at first, power-off the PC and open its chassis, then plug the DASP-52104 into a PCI slot. The DASP-52104 is a plug and play device for MS Windows, and the OS will detect your DASP-52104 after you power on the PC. The detail of driver and software installation is described in software manual of DASP-52104.

After the hardware and software installation, user can emulate and test DASP-52104 step by step as follows.

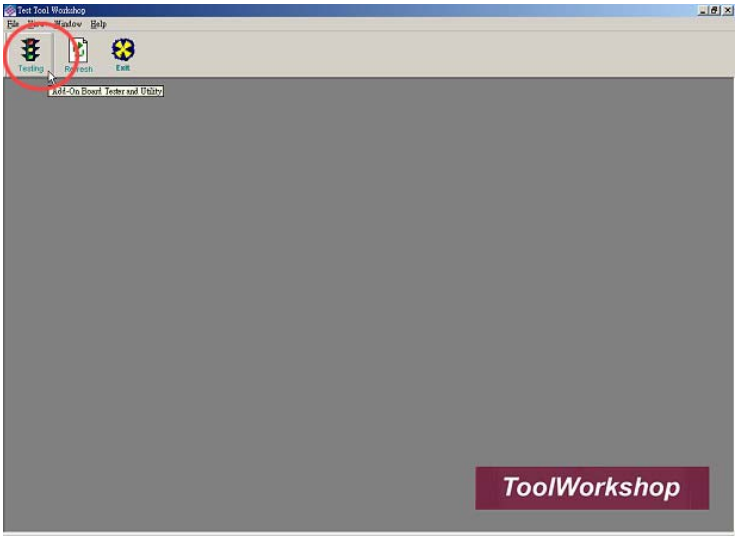
- To perform a complete test of the DASP-52104, we can route the output signals of the DASP-52104 to a voltage / current measurement equipment for read-out. And then, by following the DASP-52104 test branch of the *ToolWorkShop* which will fully test I/O channels of the DASP-52104 as descried in the following paragraphs.
- Launch the '*PCI Configuration Utility*' of DASP-52104 to ensure that the resource of DASP-52104 is properly dispatched by the OS. Press the scan button in the toolbar of the '*PCI Configuration Utility*' to find the installed DASP-52104, and then check the resource list as show in following.



Scan DASP-52104 with PCI Configuration Utility and Check the Dispatched Resource

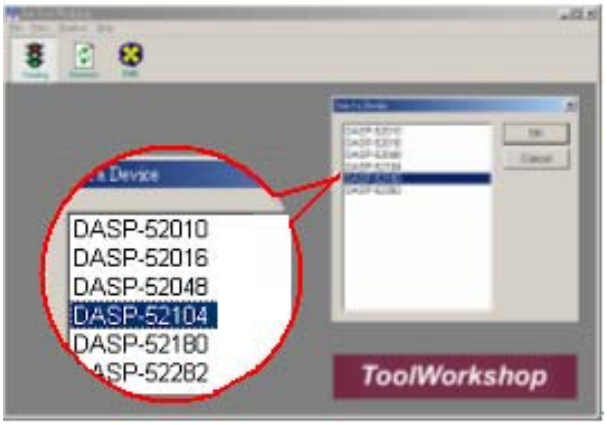
- Exit the '*PCI Configuration Utility*' and launch the '*ToolWorkShop*' for DASP-52104. As shown in following.

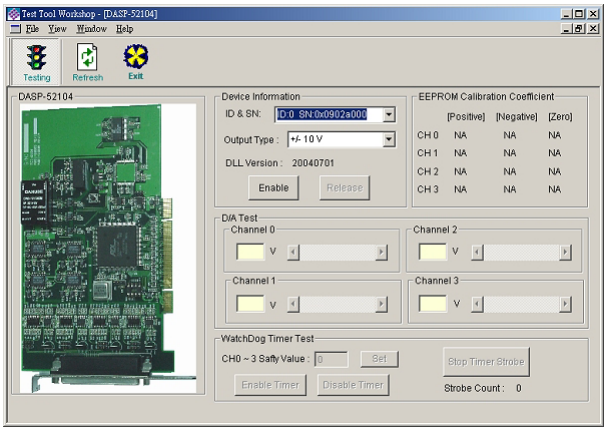
Launch ToolWorkShop



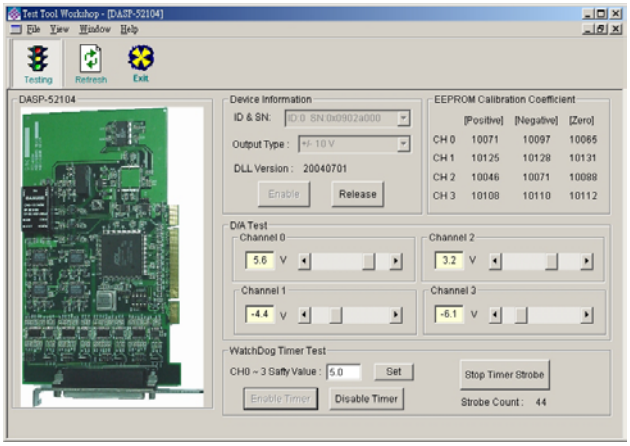
Select board Test

- Perform Timer/Counter and DIO test of DASP-52104 as shown in following.





Select Test Target: DASP-52104



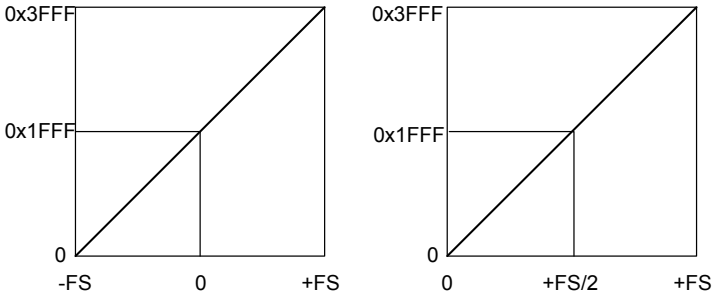
Check Device Information and Press 'Setup' Button to Load DASP-52104 Library. Perform Analog Input Test by Pressing the 'Run' Button to Read Back the AI Value of DASP-52104.

- Before exiting '*ToolWorkShop*', press 'Release' button to release DASP-52104 library.

Chapter 3

DA Output Range, DAC Code and DA Value

An almost linear mapping exists between the 14-bit DAC code and analog output for the DASP-52104. The following depicts the linear mapping of DA code of DASP-52104 and the analog input signal. FS denotes the full span of analog input under the user configured analog input range. The mapping of analog input to DAC code of DASP-52104 at ±FS and 0 input under different analog input ranges are listed in the below table.



Voltage Output **Current Output**

Mapping of 14-bit DAC Code and Analog Output for DASP-52104

Output Range	±10V	0~20mA
+Full Dcale	+9.99878	+19.99878
	0x3FFF/16383	0x3FFF/16383
Zero	±00.000	±00.000
	0x1FFF/8191	0x0/0
-Full Scale	-10.000	--
	0x0/0	--
Data Resolution	0.00122V	0.00122mA
	1LSB	1LSB

Input Range, Data/Code and Resolution of DASP-52104

Chapter 4
Register Structure and Format

4.1 Overview

The DASP-52104 board occupies 16 consecutive I/O address. The address of each register is defined as the board's base address plus an offset. The I/O registers and their corresponding functions are listed in the followings.

$\overline{RD}$	$\overline{WR}$	A4	A3	A2	A1	Port Name
0	1	0	X	X	X	Reserved
1	0		0	X	X	Write D/A Channels 0 ~ 3
0	1	1	0	0	0	Reserved
1	0					Reserved
0	1	1	0	0	1	Reserved
1	0					Reserved
0	1	1	0	1	0	Reserved
1	0					Reserved
0	1	1	0	1	1	Reserved
1	0					Reserved
0	1	1	1	0	0	Reserved
1	0					Reserved
0	1	1	1	0	1	Read D/A Safety Value
1	0					Write D/A Safety Value
0	1	1	1	1	0	Read 93C46/WDT Control
1	0					Write 93C46/WDT Control
0	1	1	1	1	1	Read HAL ID
1	0					Reserved

4.2 I/O Register Map

4.2.1 Write D/A Channel 0-3 (Base Address + Offset 0x00-03)

D7	D6	D5	D4	D3	D2	D1	D0
D15	D14	D13	D12	D11	D10	D9	D8
16 bit D/A Data (D0-D15)							

4.2.2 Read/Write D/A Safety Value (Base Address + 0x0D)

D7	D6	D5	D4	D3	D2	D1	D0
D15	D14	D13	D12	D11	D10	D9	D8
16 bit D/A Safety Value after TIMEOUT (D0-D15)							

4.2.3 Read/Write 93C46/WDT Controls (Base Address + 0x0E)

D7	D6	D5	D4	D3	D2	D1	D0
Reserved				CS	SK	DI	DO

D15	D14	D13	D12	D11	D10	D9	D8
WD	TI1	TI0	TO	Reserved			

- **CS: 93C46 Chip Select Pin (default: 0)**
- **SK: 93C46 Serial Clock Pin (default: 0)**
- **DI: 93C46 Data Input Pin (default: 0)**
- **DO: 93C46 Data Output Pin**

- **Watchdog Timer:**

WD	TI1	TI0	Function Description
0	X	X	Disable Watchdog Timer (default)
1	0	0	Enable Watchdog Timer with Timer Interval of 64 ms
1	0	1	Enable Watchdog Timer with Timer Interval of 128 ms
1	1	0	Enable Watchdog Timer with Timer Interval of 192 ms
1	1	1	Enable Watchdog Timer with Timer Interval of 256 ms

- **TO: Time Out**

$\overline{RD}$	$\overline{WR}$	TO	Function Description
0	1	0	Normal
0	1	1	Watchdog Timer Timeout, D/A Output Safety Value Engaged
1	0	0	Clear Time Out Condition
1	0	1	Force Watch-Dog Time Out

4.2.4 Read HAL Product ID (Base Address + 0x0F)

D7	D6	D5	D4	D3	D2	D1	D0
Card ID: 00001101							
FPGA Version (00000000 ~ 11111111)							

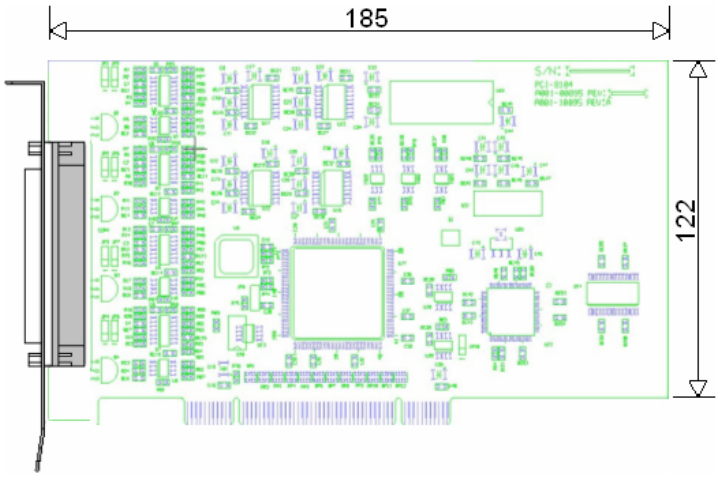
D15	D14	D13	D12	D11	D10	D9	D8
0	1	0	0	1	0	0	0
0	1	0	1	0	1	1	0

- **Note:**
  - 01001000 (48H): ASCII 'H' for HAL
  - 01010110 (56H): ASCII 'V' for Version
  - Remarks: Read this port twice to get both HAL product information.

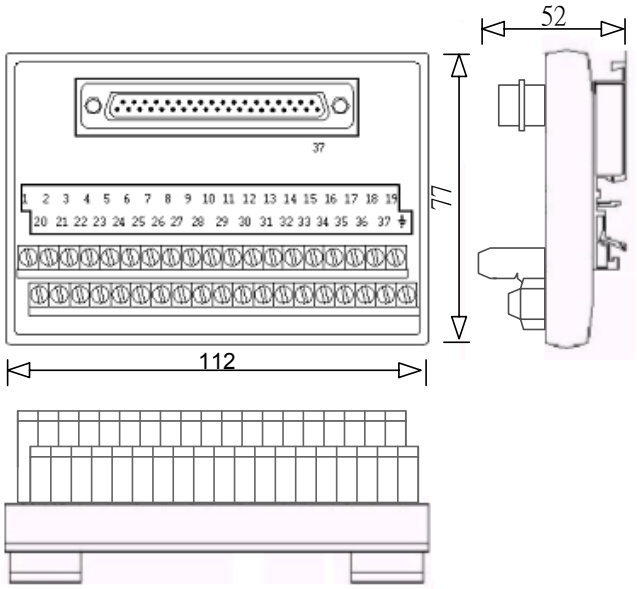
Appendix A

Dimension of DASP-52104 and Accessories

- **DASP-52104**



- **TB-88037**


52
37
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
77
112

Appendix B

The AD Calibration of DASP-52104

Zero Voltage Calibration

- Execute the calibration program: ***CalibrationDASP52104.exe***
- Select *(1) Reset EEPROM*
- Press <ESC> to exit calibration program
- Re-execute the calibration program: ***CalibrationDASP52104.exe***
- Press <Enter> under Calibration selection, the calibration coefficients update to 1000
- Press <Enter>
- Output "0" voltage under Analog Output (D/A) Test menu
- Recode the output voltage of each channel
- Press <ESC> to exit calibration program
- Select *(2) Write Zero Coefficient to EEPROM*
- Input the 0V calibration coefficients from DA0 to DA3. The coefficients are decided as following:
  - If the measurement voltage is higher than 0mV, the coefficient equals to 1000 + the integer part of measurement value (unit: mV)
  - If the measurement voltage is less than 0mV, the coefficient equals to 1000 - the integer part of measurement value (unit: mV)
- Press <ESC> to exit calibration program and repeat step 4 and 5
- The coefficient 08, 09, 10, 11 should be the previous input value and others were 10000
- Output "0" voltage under Analog Output (D/A) Test menu
- Measure the voltage of each channel, the value should be less then ±2mV

± 10V Voltage Calibration

- Execute the calibration program: ***CalibrationDASP52104.exe***
- Press <Enter> under Calibration selection, The coefficient from 00 to 07 should be 10000 and 08, 09, 10, 11 should be the previous input value
- Press <Enter>, output "10" voltage under Analog Output (D/A) Test menu
- Recode the output voltage of each channel
- Output "-10" voltage under Analog Output (D/A) Test menu
- Recode the output voltage of each channel
- Press <ESC> to exit calibration program and repeat step 1
- Select *(3)* ***Write Span Coefficient to EEPROM***
- Input the ±10V calibration coefficients from DA0 to DA3. The coefficients equal to the integer part of (1000 X measurement value (unit: mV))
- Repeat 7 and Press <Enter> under Calibration selection, The coefficient from should be the previous input value
- Press <Enter>, output "10" voltage under Analog Output (D/A) Test menu. The voltage of each channel should be in the range of 10V±2mV
- Press <Enter>, output "-10" voltage under Analog Output (D/A) Test menu. The voltage of each channel should be in the range of -10V±2mV
- Press <ESC> to exit calibration program