DASP-52506

6-Axes Motion Control Board

User's Manual

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Chapter 1
Introduction

1.1 Descriptions

DASP-52506 based on the ASIC can provide 6 axes servo or stepping motor motion control with DDA (Digital Differential Analyzer) algorithm. The DASP-52506 has two operation modes: The first mode is to work with a velocity mode servo drive. The DASP-52506 compares the segmental movement commands from Host PC and the encoder feedback from servo motor, calculates, via P controls, the analog output command, then send the command to the velocity mode drive to control servo motor. The second mode is to convert the segmental movement command into well behaved, from frequency variance standpoint, pulse train and feed to either the use position mode servo drive or a stepper drive to control the motor. At control of each axis, there is one set sensor input point, including home point, upper stroke ultimate and lower stroke ultimate. In addition, there are prohibit signal output points, Position ready output point and emergency stop input point. For other input / output points, this board uses wiring saving IO design, which can be expanded to 128 points input and 128 points output maximum.

1.2 Function Features

- Six ,configurable, axes position control for servos or steppers
- The Linear DDA law is designed to do fine interpolation.
- Output Interface can be analog or pulse train and direction
- PI plus feed forward control law
- 6 encoder channels with a 32-bit counter
- 6 DAC channels with a 16-bit resolution
- Encoder resolution can be amplified by×1,×2 or×4 rates
- 28 I/O points
- PCI bus interface

1.3 DASP-52506 System Configuration

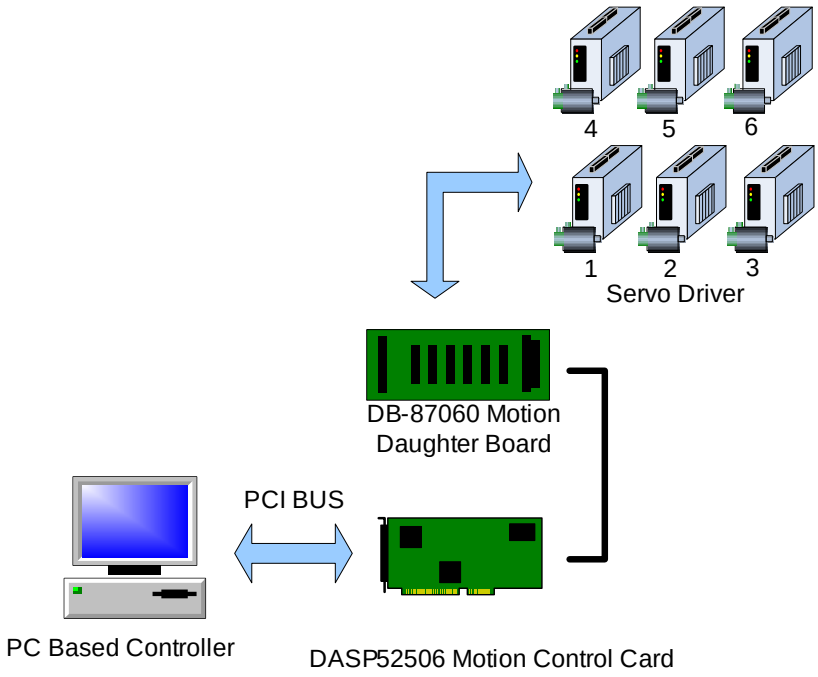

Fig. 1-1

1.4 DASP-52506 Function Blocks

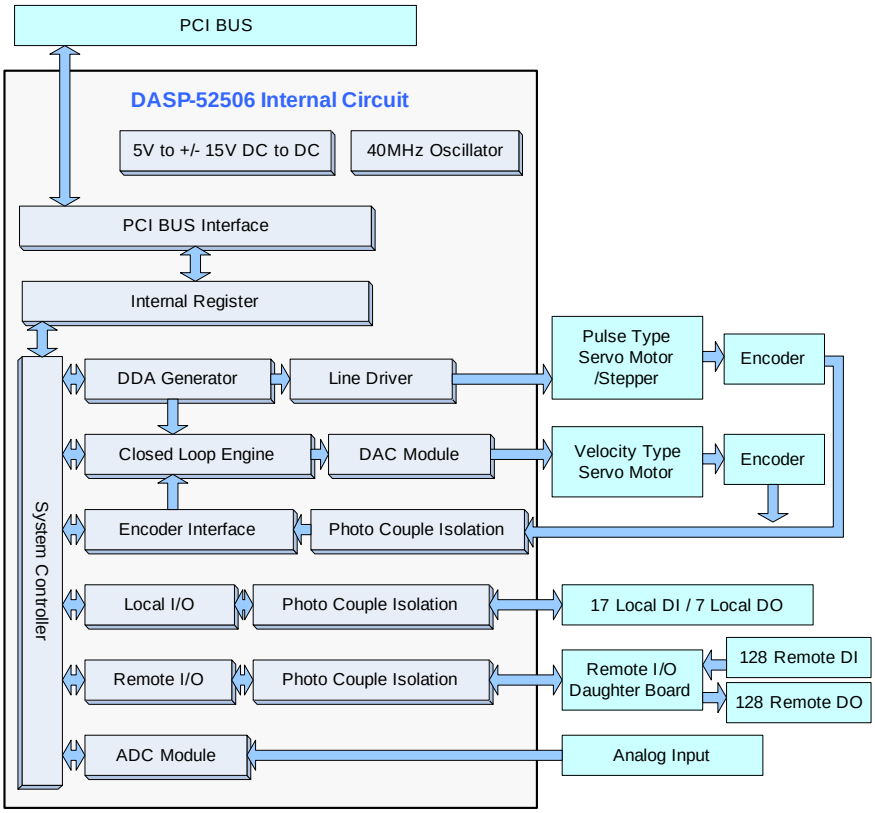

Fig.1-2

1.5 DASP-52506 Specifications

1.5.1 Bus Interface

- 16 bits PCI Interface
- Local Bus Clock Base Frequency: 40MHz
- Programmable IO Wait State (1-8 Wait State)
- PCI I/O Map
- System Software Reset

1.5.2 Motion Control Operation Mode

The DASP-52506 has two operation modes: Open-Loop Pulse Output Controls and Closed-Loop Velocity Output Controls. The first mode is to convert the segmental movement command into well behaved, from frequency variance standpoint, pulse train and feed to either the use position mode servo drive or a stepper drive to control the motor. The second mode is to work with a velocity mode servo drive. The DASP-52506 compares the segmental movement commands from Host PC and the encoder feedback from servo motor, calculates, via P controls, the analog output command, then send the command to the velocity mode drive to control servo motor.

Open-Loop Pulse Output Controls

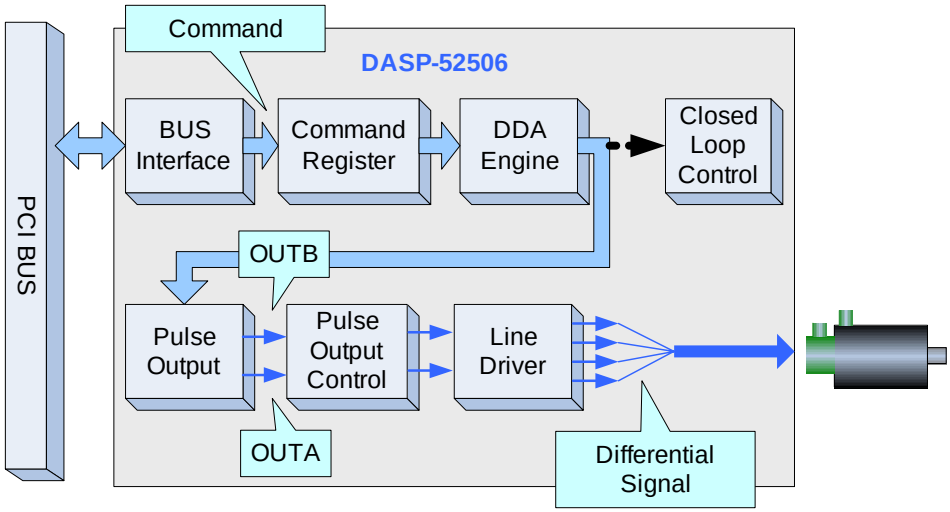

Fig.1-3

- Movement Command Format: one direction bit plus 10~15 bits movement value (Unit: Square Pulse)
- Pulse Output Mechanism: DDA ENGINE
- Max. Control Axes: 6 Axes
- DDA Specifications:
- Enable/Disable: Programmable DDA enable or disable (Default: disable)
- DDA Engine Length: 10~15 bits
- Max. Output Pulses ranged from 1024 to 32767 (DDA Engine Length is 0-15 bits) for each DDA cycle time.
- Pulse Width Extender (for Pulse/Direction and CW/CCW format): 12 bits
- Pulse Width = 25(ns) × n, n=1～4096, (default n=1)

- Movement Command Register: 64 Sets Command Buffers, execute one movement command for each DDA cycle time.
- Structure: 64 Words FIFO (first in first out)
- Format: one direction bit plus 10~15 bits movement value
- Full and Empty FIFO Flags
- Pulse Output Format (denotes OutA, OutB)
- Pulse/Direction (Default)
- CW/CCW
- A/B (Movement Command divide by 4)
- Inhibit
- Pulse Output Controls (Invert and Swap Function)
- Line driver: MC3487 5V DIFFERENTIAL Output

Closed-Loop Velocity (Voltage) Output Controls

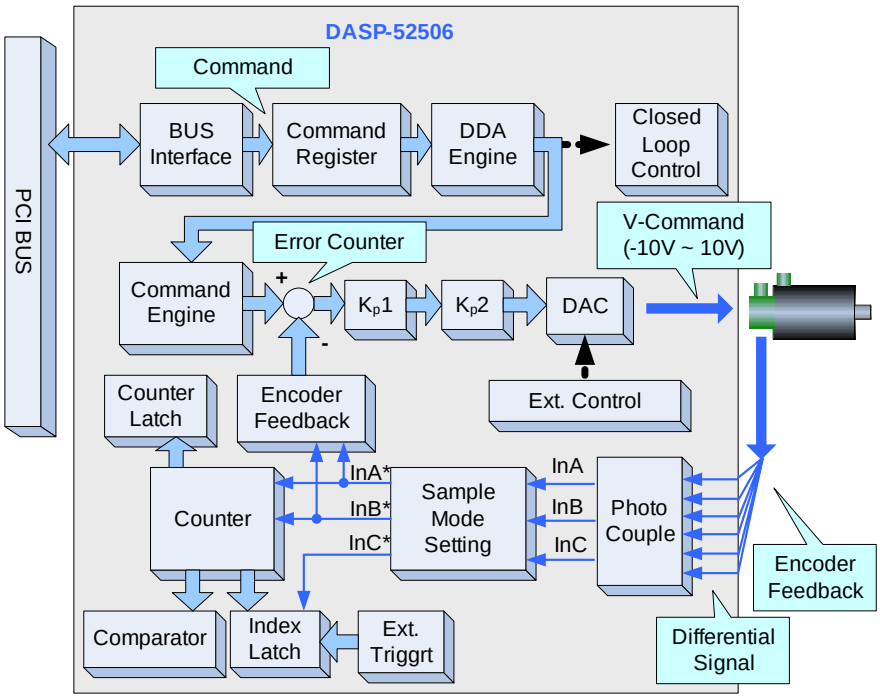

Fig.1-4

- Movement Command: one direction bit plus 10~15 bits movement value
- Max. Control Axes: 6 axes
- Velocity Command: DAC output +/- 10V
- DDA Specification (See 1.5.2.1 for detailed)
- Movement Command Registers (See 1.5.2.1 for detailed)
- Control Law: P type
- Error Counter: Length 16BITS
- Kp1:close loop scaling gain
- Kp2:close-loop shift gain
- DAC Specifications:

- Channels: 6 Sets
- Resolutions: 16 bits
- DASP-52506 Power on Value: 0V
- DAC Interface:
- Impedance: larger than 2KΩ
- Output Voltage : ±10V

Encoder Input:

- 6 Axes
- Interface: differential with photocoupler (1MHz)
- Input Format:
  - A/B/Z Phase
  - Pulse /Direction
  - CW/CCW
- Decoder: x0, x1, x2, x4
- Software programmable in A/B/Z phase input
- Position Counter: 32 bits
- Latch: 15 trigger signal for each axis

1.5.3 Digital I/O

- 19 Digital Input
  - Serves as Individual D/I Function
  - Operation Voltage: DC 24V±10%
  - Logic 1 (ASIC = 0): 18V~30V
  - Logic 0 (ASIC = 1): 0V~1V
  - Isolation: Optocoupler
  - Classify
    - upper over travel inputs: 6 points (OT+_I1, OT+_I2, OT+_I3, OT+_I4,OT+_I5, OT+_I6)
    - lower over travel inputs: 6 points (OT-_I1, OT-_I2, OT-_I3, OT-_I4,OT-_I5, OT-_I6)
    - home sensor inputs: 6 points (HOME_I1, HOME_I2, HOME_I3, HOME_I4, HOME_I5, HOME_I6)
    - emergency stop input:: 1 point (E_STOP)
    - One Internal Power Status
- 7 Digital Output
  - Operation Voltage: DC 24V ±10%
  - Driving Type: OPEN COLLECTOR
  - Max. Driving Current: 60 mA
  - Isolation: Opto
  - Classify

- Output inhibits: 6 points (INH_O1, INH_O2, INH_O3, INH_O4, INH_O5, INH_O6)
- POSITION READY: 1point
- One pulse/DA output enable bit

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Chapter 2
Installation

2.1 Installation Procedures

A. Turn off the computer and all of control equipments.

B. Select PC PCI BUS Expansion SLOT (16 bits)

C. Secure DASP-52506 board in place at PCI BUS slot

D. Connects SCSI II 100PIN Connector with DASP-52506 Board (J1) and other Connector.

2.2 Board Outline Drawing

2.2.1 Board Layout

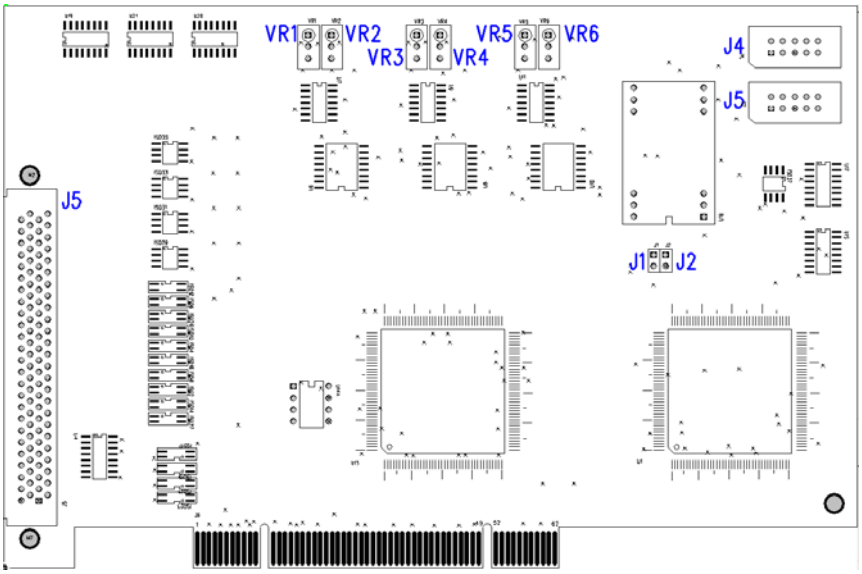


Fig.2-1

2.2.2 Connector PIN Assignment

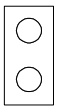
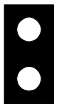
SCSI II 100PIN PIN Assignment (J5)

SCSI II-100PIN CONNECTOR			
PIN Definition	**PIN**	**PIN**	**PIN Definition**
AGND	1	51	AGND
DAC/D1	2	52	DAC/D4
DAC/D2	3	53	DAC/D5
DAC/D3	4	54	DAC/D6
VCC_OUT(+5V)	5	55	COM-
COM+	6	56	COM-
COM	7	57	E_STOP
COM	8	58	P_RDY
HOME_I1	9	59	HOME_I2
OT+_I1	10	60	OT+_I2
OT-_I1	11	61	OT-_I2
INH_O1	12	62	INH_O2
HOME_I3	13	63	HOME_I4
OT+_I3	14	64	OT+_I4
OT-_I3	15	65	OT-_I4
INH_O3	16	66	INH_O4
HOME_I5	17	67	HOME_I6
OT+_I5	18	68	OT+_I6

SCSI II-100PIN CONNECTOR			
PIN Definition	**PIN**	**PIN**	**PIN Definition**
OT-_I5	19	69	OT-_I6
INH_O5	20	70	INH_O6
XENC_INA1	21	71	XENC_INA2
~XENC_INA1	22	72	~XENC_INA2
XENC_INB1	23	73	XENC_INB2
~XENC_INB1	24	74	~XENC_INB2
XENC_INC1	25	75	XENC_INC2
~XENC_INC1	26	76	~XENC_INC2
XENC_INA3	27	77	XENC_INA4
~XENC_INA3	28	78	~XENC_INA4
XENC_INB3	29	79	XENC_INB4
~XENC_INB3	30	80	~XENC_INB4
XENC_INC3	31	81	XENC_INC4
~XENC_INC3	32	82	~XENC_INC4
XENC_INA5	33	83	XENC_INA6
~XENC_INA5	34	84	~XENC_INA6
XENC_INB5	35	85	XENC_INB6
~XENC_INB5	36	86	~XENC_INB6
XENC_INC5	37	87	XENC_INC6
~XENC_INC5	38	88	~XENC_INC6

SCSI II-100PIN CONNECTOR			
PIN Definition	**PIN**	**PIN**	**PIN Definition**
XDDA_OUTA1	39	89	XDDA_OUTA2
~XDDA_OUTA1	40	90	~XDDA_OUTA2
XDDA_OUTB1	41	91	XDDA_OUTB2
~XDDA_OUTB1	42	92	~XDDA_OUTB2
XDDA_OUTA3	43	93	XDDA_OUTA4
~XDDA_OUTA3	44	94	~XDDA_OUTA4
XDDA_OUTB3	45	95	XDDA_OUTB4
~XDDA_OUTB3	46	96	~XDDA_OUTB4
XDDA_OUTA5	47	97	XDDA_OUTA6
~XDDA_OUTA5	48	98	~XDDA_OUTA6
XDDA_OUTB5	49	99	XDDA_OUTB6
~XDDA_OUTB5	50	100	~XDDA_OUTB6

Master/Slave Board Jumper Setting (J1/J2)

J1	Master/Slave Setting
	OPEN PIN: The board serves as slave board (* In this situation, the clock signal of the slave board should be directly connected to the master board which provide the source of servo clock, i.e., one-by-one connected both J2 PIN together)
	SHORT PIN: The board serves as Master board (Default) (Servo Clock Provider)

DAC Offset Compensation (VR1-VR6)

VR1-VR6 are used for the DAC 1-DAC6 offset compensation, respectively.

2.3 Wiring Diagrams

2.3.1 Closed-Loop Velocity Output Controls

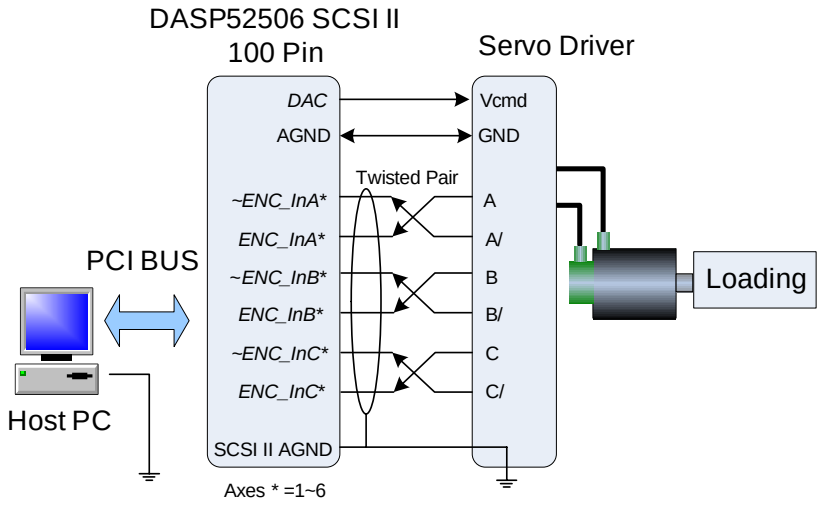


Fig. 2-4

2.3.2 Open-Loop Pulse Output Controls

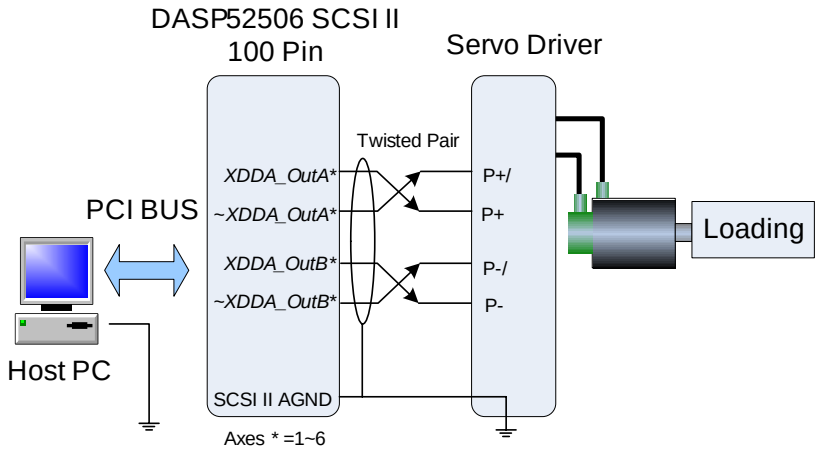


Fig. 2-5

2.3.3 DASP-52506 Digital I/O Wiring Diagram

Digital Output

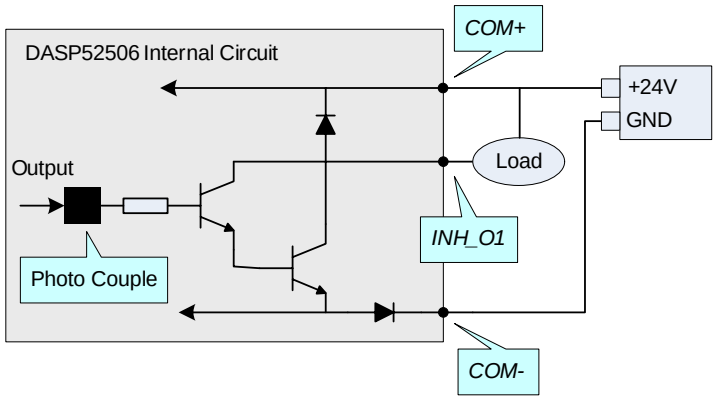


Fig. 2-6

Digital Input

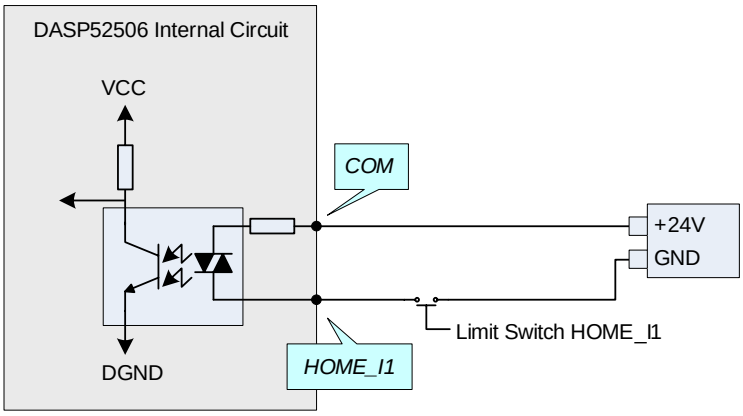


Fig. 2-7

DASP-52506 Digital I/O Layout

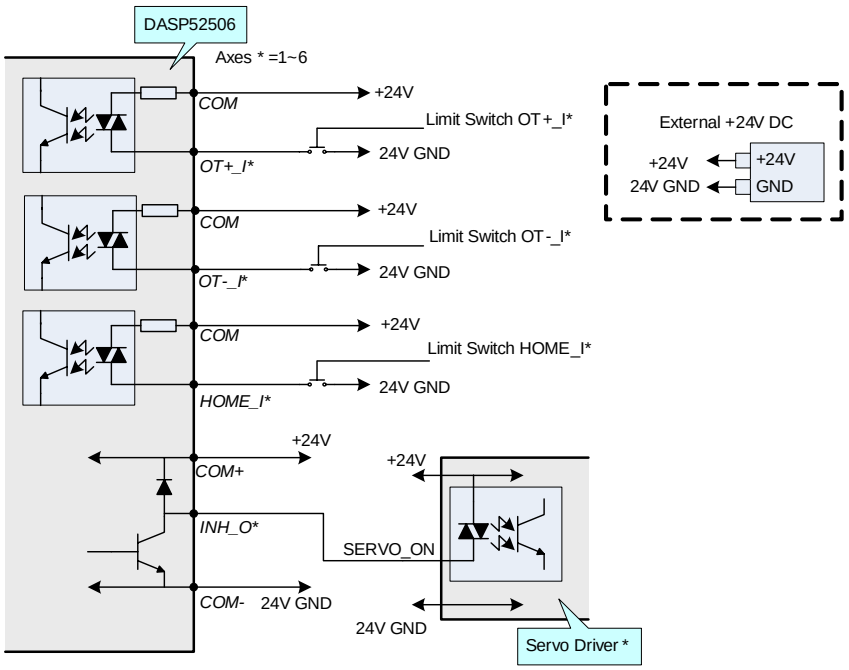


Fig. 2-8

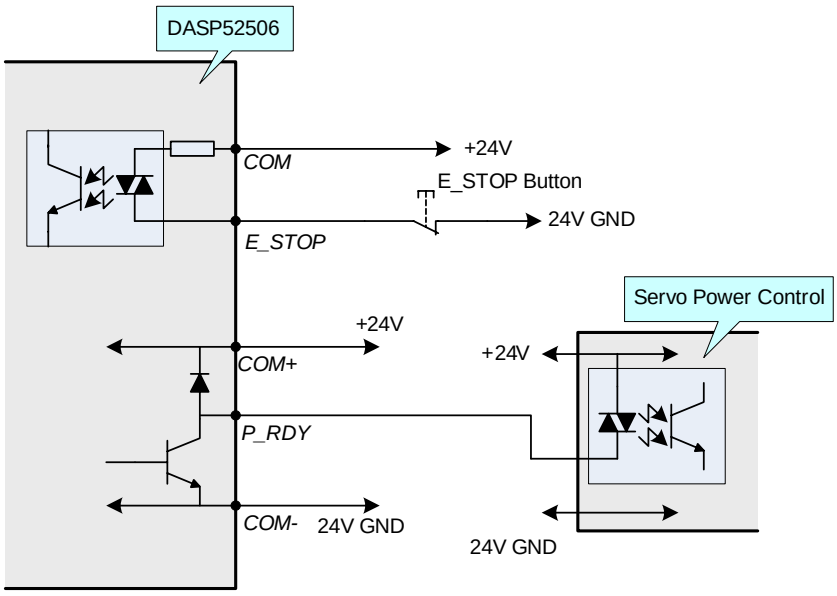

DASP52506
COM
+24V
E_STOP Button
24V GND
E_STOP
Servo Power Control
+24V
+24V
COM+
P_RDY
COM-
24V GND
24V GND

Fig. 2-9

Chapter 3
Parameters Setting

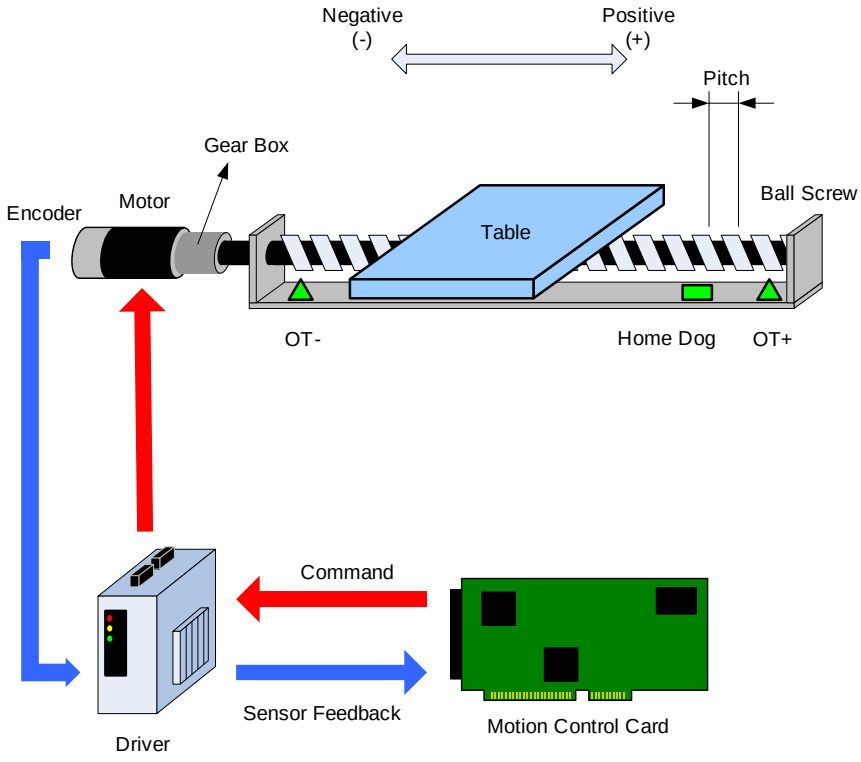
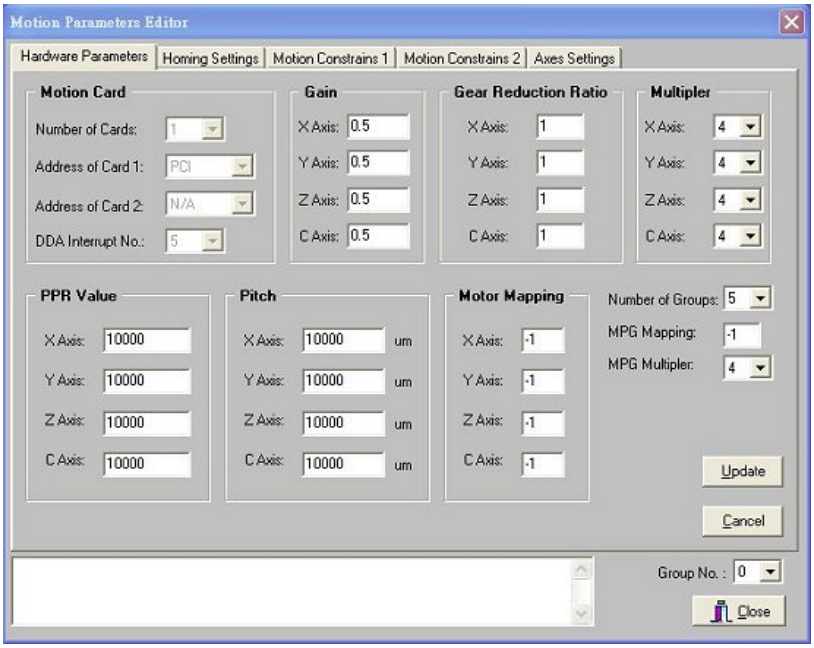


Fig. 3-1 Servo-Driver System Configuration Diagram

OT (+/-) : Over-Travel (+/-) sensor.

3.1 Hardware Parameters



- Gain: The gain value of the voltage command control mode, it should operated with the setting of [Axes Setting → PCL Axis] is ON. Range: 0.001 ~ 1000.
- Gear Reduction Ratio: Gear reduction ratio of each axis.
- Multiplier and PPR (Pulse Per Revolution): (Fig.3-2)

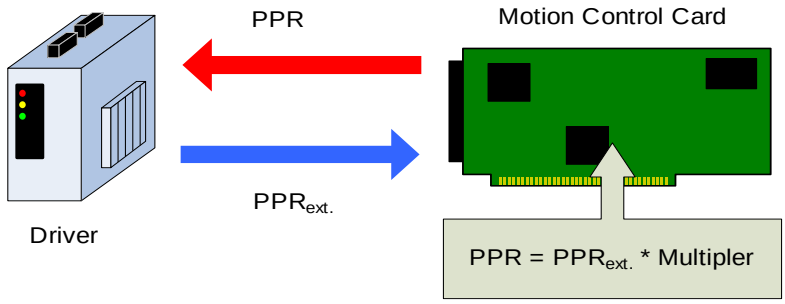
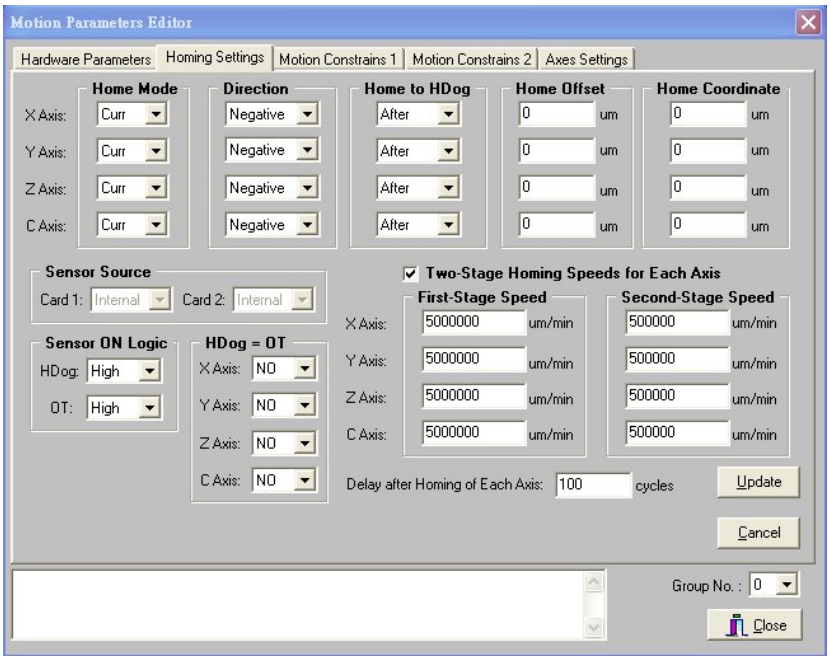


Fig. 3-2

- PPRext. : Pulse input pre revolution from external device (such as driver).
- Multiplier : Multiplier of each axis.
- PPR : Pulse output pre revolution from DASP-52506.
- Pitch : The linear platform offset produced by each revolution of the motor.
- Motor Mapping : The mapping of axis symbol(X,Y,Z,C) to the actual index of the motion control board. (-1: NA)
- Number of Group : Total group number of the system.
- MPG Mapping : The actual index of motion control board which MPG (Manual Pulse Generator) mapped to. (-1: NA)
- MPG Multiplier : The Multiplier of the MPG axis.
- Group No : Current configuration group index.

3.2 Home Settings



- Home Mode:
  - 1Dir: The platform moves along the homing direction to search the home dog sensor. If the platform triggers the limit sensor before the home dog is searched, the system stops homing and gives the alarm. (Fig. 3-3)

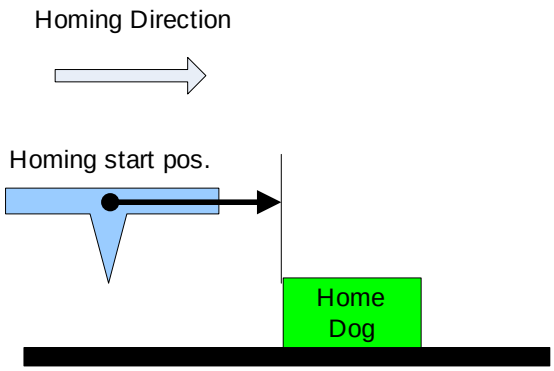


Fig. 3-3

- Auto: The platform moves along the homing direction to search the home dog sensor. It triggers the limit sensor of positive direction and moves backward the reverse direction to search the home dog sensor if the home sensor can not be found in the positive homing direction. If the platform triggers the limit sensor in the reverse direction before the home dog is found, the system stops homing and gives the alarm. (Fig. 3-4)

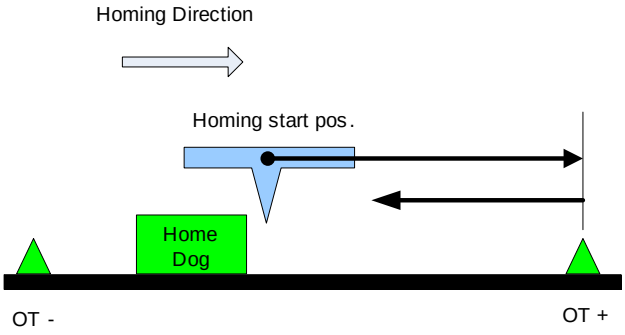


Fig. 3-4

- Curr : Set the current machine position as the homing position.
- Half : Reserved.
- Any : Reserved.
- Index : The platform moves along the homing direction and sets the encoder index to the homing position.

- Direction: The assignment of homing direction (Positive/Negative).
- Home to HDog: Assign the position of home sensor is before or after the home dog. The result relates to the homing direction.(Fig.3-5 (a)(b))

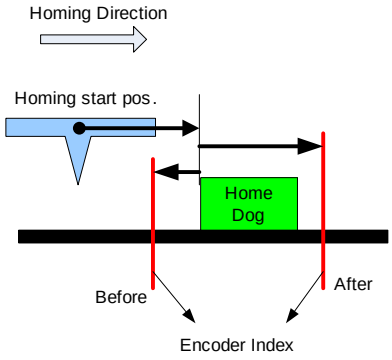


Fig. 3-5(a)

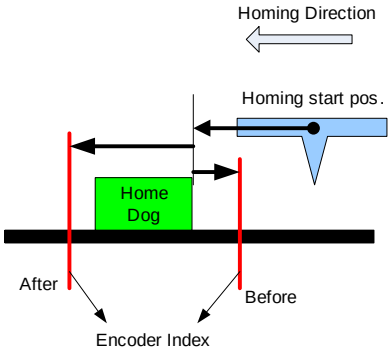


Fig. 3-5(b)

- Home Offset : The offset of the platform after encoder index is found in homing procedure. The final position will be set to the home finish position. This parameter is effective in the homing mode 1Dir, Auto and Index.(Fig. 3-6)

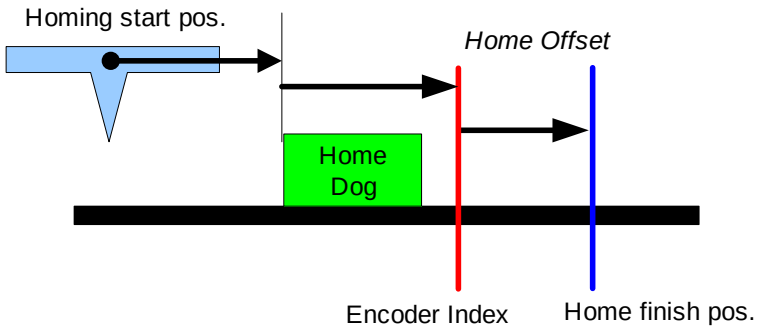
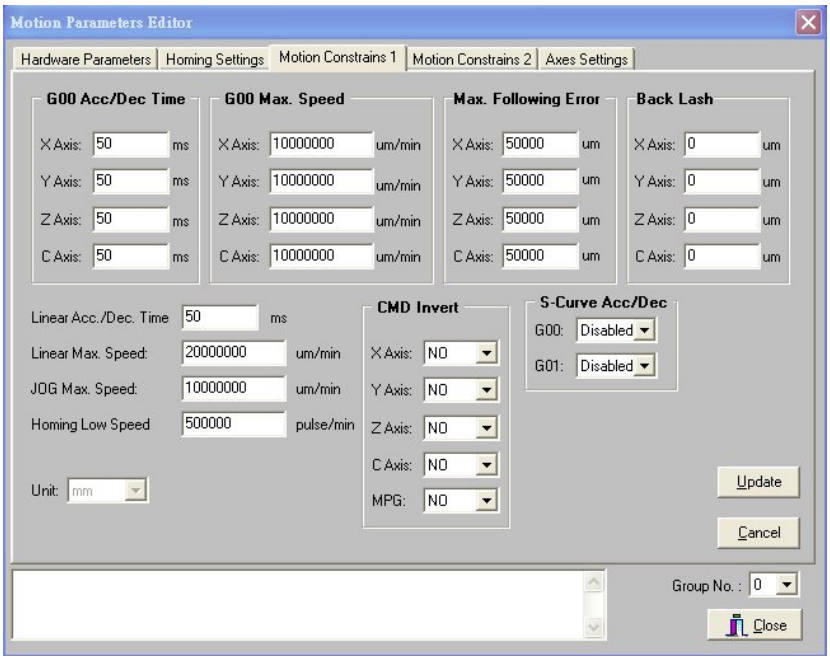


Fig. 3-6

- Home Coordinate: The coordinate after home finish.
- Sensor ON Logic: Assign the signal of HDog and sensors are active low or active high.
- HDog=OT: Assign the signal of home sensor and limit sensor if use the same signal source.
- Two-Stage Homing Speeds for Each Axis: Assign if homing command uses two-stage speed.
- First stage → The duration from starting homing to search HDog.
- Second stage → The duration from HDog searched to reach encoder index.
- First Stage Speed: The speed of first stage homing.
- Second Stage Speed: The speed of second stage homing.
- Delay after Homing of Each Axis: The delay time after each axis homing finish. The relay interval depends on the platform and operation system.

3.3 Motion Constrains 1

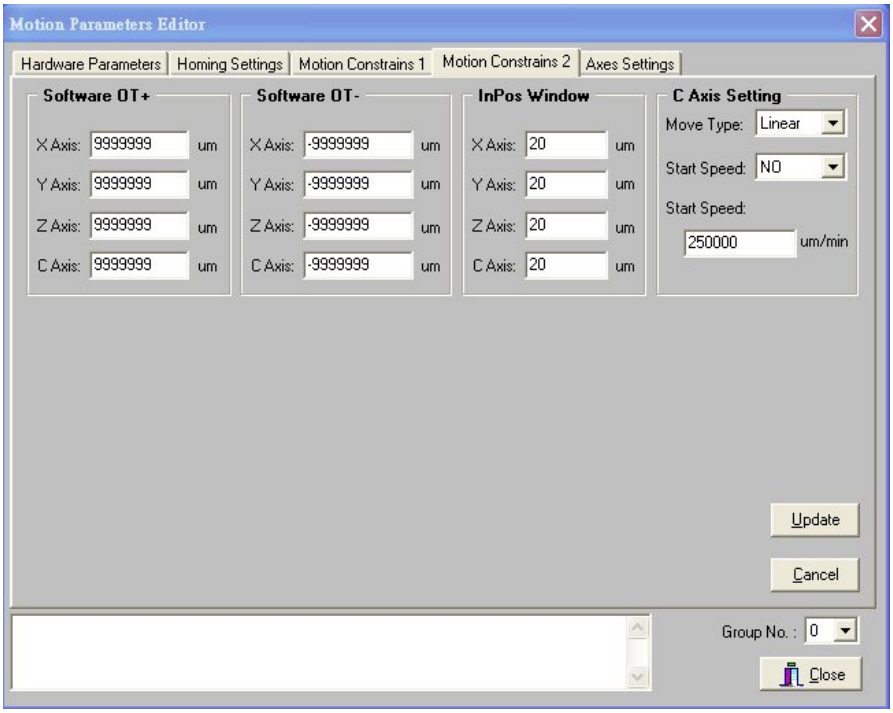


- G00 Acc/Dec Time: The acceleration and deceleration time of each axis.
- G00 Max. Speed: The max speed of each axis.
- Max. Following Error: The assignment of maximum following error. The system gives alarm if the running following error exceeds the setting value.
- Back Lash: The back lash compensation value of each axis.
- Linear Acc/Dec Time: The acceleration and deceleration time of the group. This parameter relates to the setting of G00 Acc/Dec Time.
- Linear Max. Speed: The maximum acceleration and deceleration time of the group. This parameter relates to the setting of G00 Acc/Dec Time.
- JOG Max. Speed: The maximum speed in jog moving.
- Homing Low Speed : If [Home Settings → Two-Stage

Homing Speeds for Each Axis] is not assigned, the system first stage homing is G00 Max. Speed and the second stage homing speed is Homing Low Speed.

- CMD Invert: Command of each axis is inverse or not.
- S-Curve Acc/Dec: Enable/disable the function of S-Curve acceleration and deceleration.

3.4 Motion Constrains 2



- Software OT +: The setting of positive software Over-Travel position of each axis.
- Software OT - : The setting of negative software Over-Travel position of each axis.

- InPos Window : Set the range of InPos checking window. The size of the InPos window is the double size of the setting value. (Fig. 3-7)

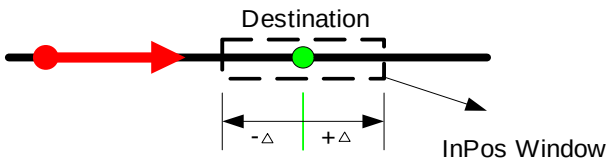
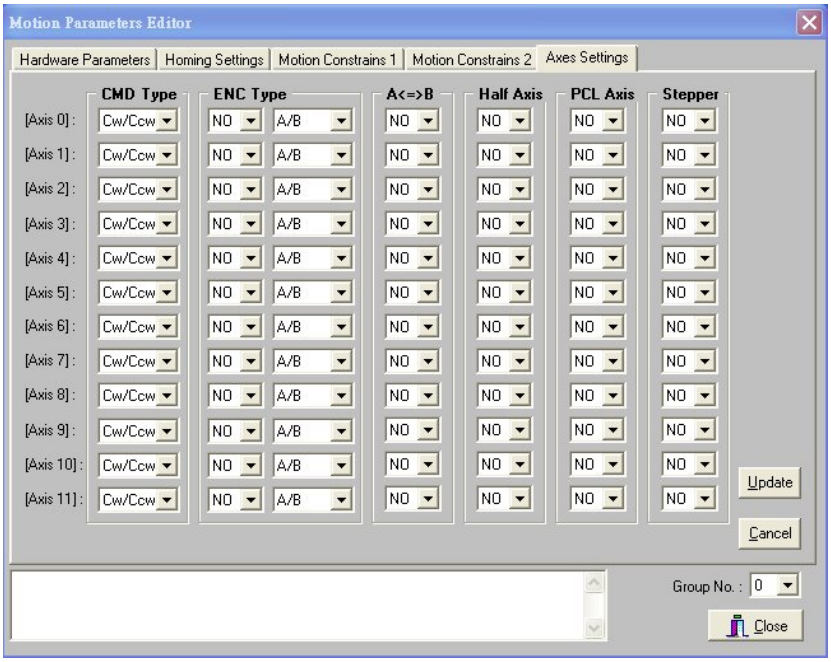


Fig. 3-7

- C Axis Setting : Set the function of axis C starting speed mechanism. It is available for the stepping motor。
- Move Type: Set axis C is a linear or a revolving axis
- Start Speed: Enable and assign the starting speed of axis C.

3.5 Axes Settings



- CMD Type: The command format of each axis, DASP-52506 supports the Pul/Dir, Cw/Ccw, and A/B command type. (Fig.3-8)

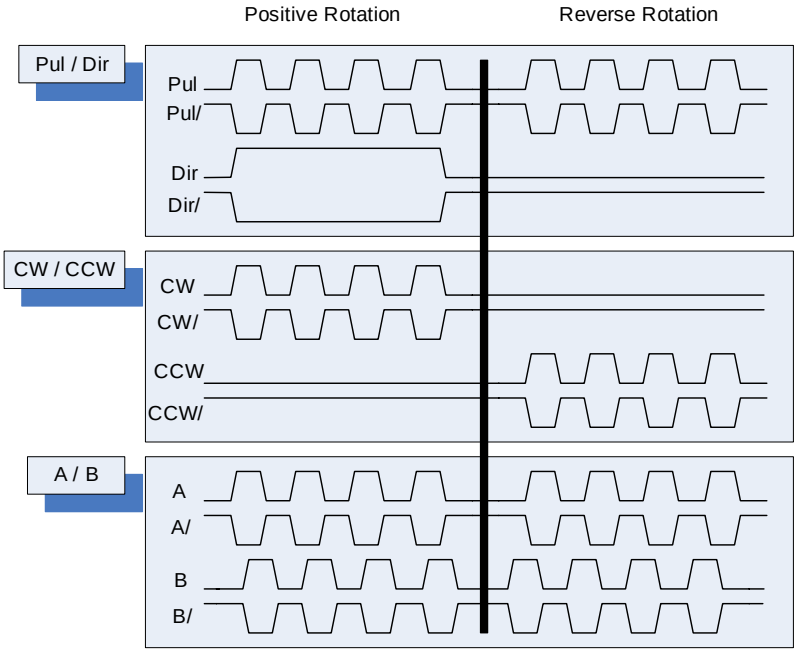


Fig. 3-8

- ENC Type : Assign type of the encoder feedback signal. DASP-52506 supports the Pul/Dir, Cw/Ccw, and A/B command type.
- A <=> B: Assign the A/B phase signal is inverse or not. The setting is effective when the encoder feedback type is A/B phase.
- Half Axis: The axis must be assigned to a half axis if the axis is utilized for a pure command output (such as MPG) or a command feedback (such as optical scale). The flowing error will not be generated if it is a half axis.
- PCL Axis: Enable voltage command close loop control if it a PCL axis.
- Stepper: Assign if the axis is a stepping motor.

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Chapter 4
Motion Test Utility

After installing the DASP5250x motion SDK, user can user can emulate and test the function of DASP5250x by **MotionTestUtility**. You can open the MotionTestUtility in [Start --> Program File --> Axiomtek --> Motion --> MotionTestUtility] to run the testing program. Press button Open to start testing, press button Close to stop testing (Fig. 4-1).

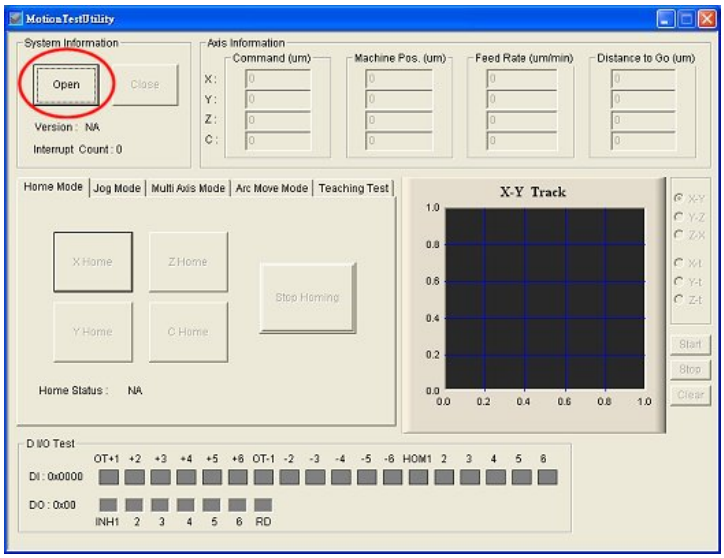

Fig. 4-1 MotionTestUtility

4.1 Basic Operation of MotionTestUtility

- Axis Information : display the information of each axis (X, Y, Z, C)(A)
- D I/O Test (B)
  - OT +/- n : OverTravel +/- signals of the n-th axis
  - HOMEn : home dog signal of the n-th axis
  - IMHn : digital output signal of the n-th axis
  - RD : the relay output signal of terminal board DB-87060

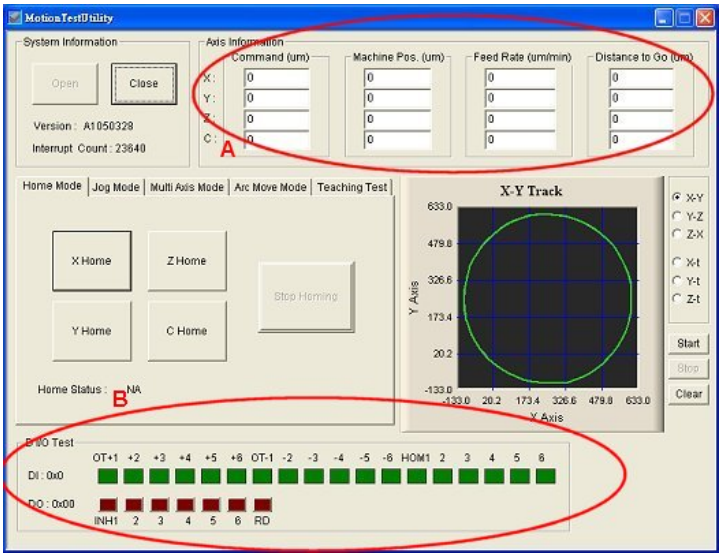

Fig. 4-2 Basic Operation

4.2 Homing Testing

- n Home : proceed the homing function of n axis.
- Stop Homing : press the button **Stop Homing** to halt the homing function

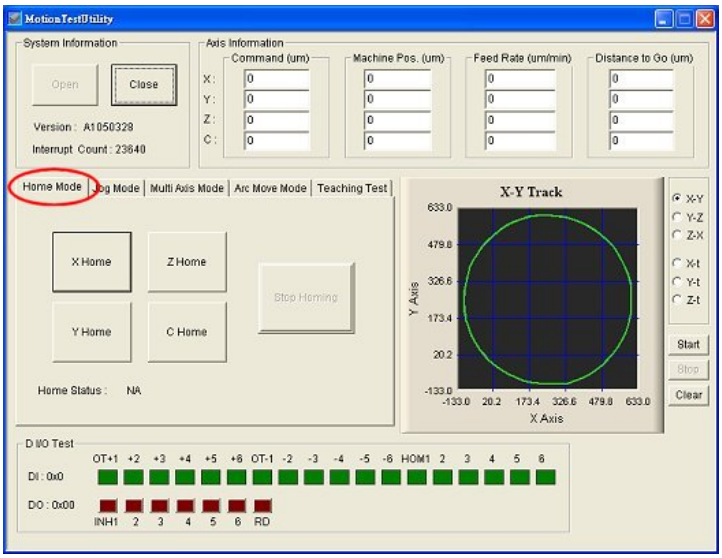

Fig. 4-3 Homing Testing

4.3 Jog Testing

- Jog Rate : Jog feed rate %, range 0 ~ 1.0 (0% ~ 100%)
- Jog Rate = G00 Max. Speed * rate % . About the parameter "G00 Max. Speed" and the additional jog setup, please refer to the utility - MotParam.
- Jog +/- : The motor rotates to positive (negative) direction when the Jog+(-) button pressed down. The motor stops when the button released.

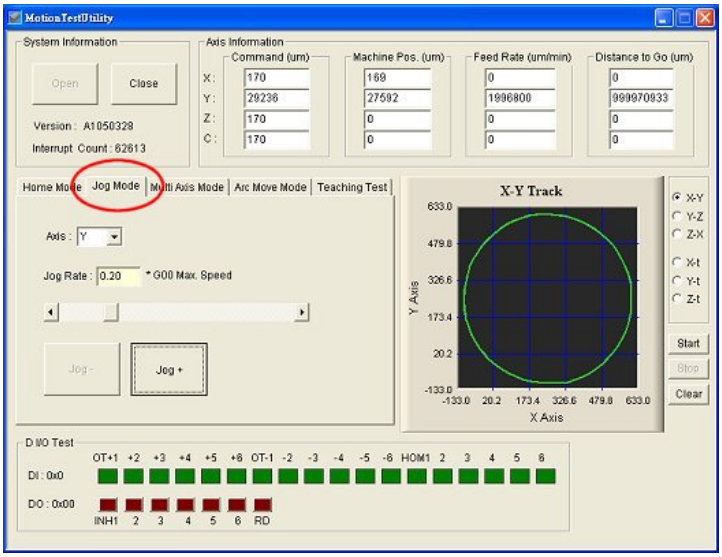

Fig 4-4 Jog Testing

4.4 Multi-axis linear movement testing

- Feed Rate : assign the moving speed
- Destination (Rel.) : assign the destination of each axis in relative coordinate presentation, press **Add** button to add the configuration to the command queue
- Destination (Absl.) : assign the destination of each axis in absolute coordinate presentation, press **Add** button to add the configuration to the command queue
- Go : Execute the command in the command queue
- Stop : Stop the current command in the command queue
- Command Queue: show the command queue is empty or not.

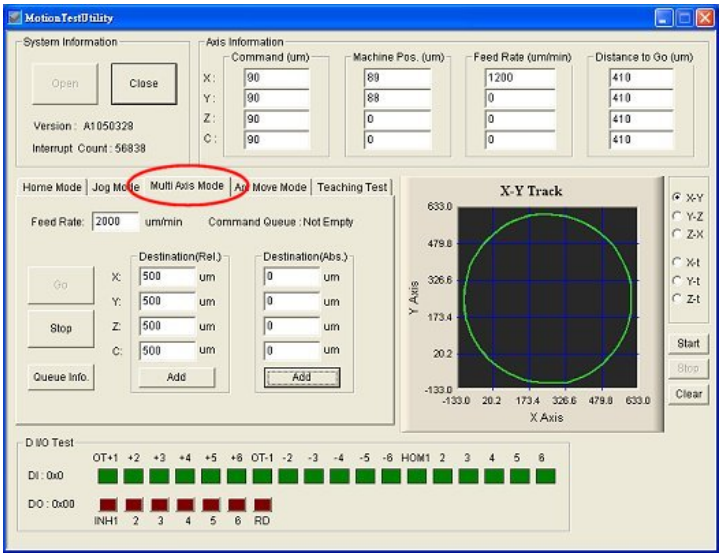

Fig 4-5 Multi-axis linear movement testing

4.5 Multi-axis arc movement testing

- Feed Rate : assign the moving speed
- Destination (Rel.) : assign the destination of each axis in relative coordinate presentation, press **Add** button to add the configuration to the command queue
- Destination (Absl.) : assign the destination of each axis in absolute coordinate presentation, press **Add** button to add the configuration to the command queue
- Plane : assign the plane of the arc command
- Direction : assign the direction of the arc command
- Go : Execute the command in the command queue
- Stop : Stop the current command in the command queue
- Command Queue : show the command queue is empty or not.

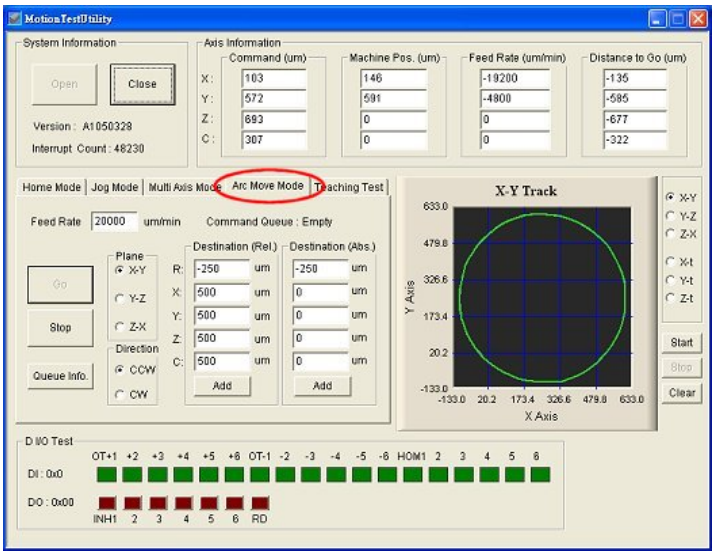

Fig 4-6 Multi-axis arc movement testing

4.6 [Application] Path Teaching and

recording

- Jog Mode : refer to the page of [Jog Mode]
- Feed Rate : assign the moving speed
- Add : Add the current machine position to the teaching buffer. The teaching buffer is a set of memory which maintained by the MotionTestUtility. It records a list of machine position temporally. The teaching buffer can be serialized by the Save/Load Path File function.
- Reset : Clear all the machine positions from the teaching buffer.
- Used Buffer(Max.) : the number of recorded machine position in the teaching buffer (the maximum available recorded count of teaching buffer)
- Save Path File : Save the recorded machine position in the teaching buffer to a file
- Load Path File : Load the machine position from a file to the teaching buffer
- Continue Run - Go : Run all the machine positions in the teaching buffer
- Continue Run - Stop : Halt the continue running mode.
- Single Step </> : execute a forward/backward single step command in the teaching buffer
- Single Step - Stop : Halt the current running command
- Current Index : show the current index of the running command

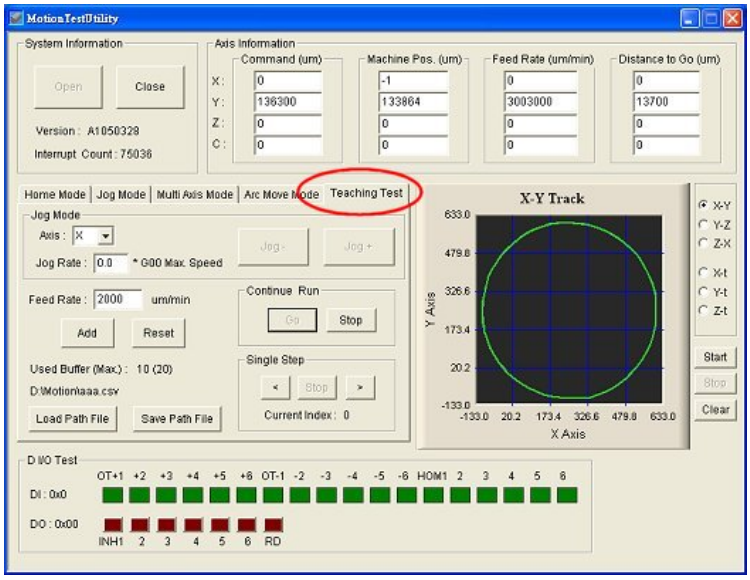

Fig 4-7 Path Teaching and recording