PISO-PS400 Function Reference

(Version 2.3)

ICP DAS CO., LTD.

泓格科技股份有限公司

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1.1 Introduction

- **This documentation provides the detailed information of PISO-PS400 functions, including the declarartion and parameters of PISO-PS400 functions.**
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  - **Chapter 2 - Basic function Setting**
  - **Chapter 3 - Status setting and read back**
  - **Chapter 4 - Interrup setting and handling**
  - **Chapter 5 - Operation of FR-Net**
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  - **Chapter 7 - Axis Control**

1.2 Function Structure explanation

● **Function name(argument 1*, argument 2,* …….)**
Function : Basic Function Explanation。

Argument: Defintion of associated argument in this function。

Return: Return Value。

Smaple: Simple Demo Program。(Sample Program in this manual is coded with VC++)

Remark: Remakr and Explanation。

1.3 API List

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2 Basic Setting Function

2.1 Code numbers for axes

Card of each PISO-PS400 motion card is defined by the on-board swith SW1.Up to16 cards can be supported in the same system. Each axis is m apped in the following talbe Tab 2-1. The axis is represented by bit in the axis parameter which is word type variable.

bit3	bit2	bit1	bit0
U	Z	Y	X

Axsi mapping table :

Table 2-1

Axis	X	Y	Z	U	XY	XZ	XU	YZ
Code	0x1	0x2	0x4	0x8	0x3	0x5	0x9	0x6
Var.	AXIS_X	AXIS_Y	AXIS_Z	AXIS_U	AXIS_XY	AXIS_XZ	AXIS_XU	AXIS_YZ
Axis	YU	ZU	XYZ	XYU	XZU	YZU	XYZU	
Code	0xa	0xc	0x7	0xb	0xd	0xe	0xf	
Var.	AXIS_YU	AXIS_ZU	AXIS_XYZ	AXIS_XYU	AXIS_XZU	AXIS_YZU	AXIS_XYZU	

2.2 Card initialization

- short PS400_Card_Init(void)

Fun.: User can use this function to initialize the card on the PCI bus.After successful initialization the card can activitate its functions

Para.: None

Return: SUCCESS_NO_ERROR
NO_CARD_FOUND：no available PISO-PS400 is found on system

Sample :

```
# define MaxCards 16
short CardID[MaxCards];
PS400_Card_Init ();
short card_num = PS400_Total_Card();
for (BYTE i = 0; i < card_num; i++)
{
    CardID[i] = PS400_Get_CardNo(i);
}
```

```
short CardNo = CardID[0];
//Initialize all cards, and assign the CardNo with the 1st CardID
```

- **short PS400_Card_Close(void)**

Func.: Release the resource of the card allocated by the Windows OS. User should apply this function to terminate or exit its application program.

Para.: None

Return: SUCCESS_NO_ERROR

Sample:

```
# define MaxCards 16
short CardID[MaxCards];
// Initialize all cards, and assign the CardNo
PS400_Card_Init();
short card_num = PS400_Total_Card();
for (BYTE i = 0; i < card_num; i++)
{
    CardID[i] = PS400_Get_CardNo(i);
}
short CardNo = CardID[0];

//PS400_Card_Init() can be re-initialize only after calling PS400_Card_Close()
PS400_Card_Close();

//re-initialize all cards again
PS400_Card_Init();
```

- **short PS400_Total_Card(void)**

Func.: Get the total no. of successfully initialized cards.

Para.: None

Return: Number of cards

Sample:

```
# define MaxCards 16
short CardID[MaxCards];
short card_num = PS400_Total_Card();
for (BYTE i = 0; i < card_num; i++)
{
    CardID[i] = PS400_GET_CardNo(i);
}
//find all available cards and assign the CardNo
```

- **short PS400_Get_CardNo(BYTE *index*)**

Func.: Get the Card ID based on the order that the cards were found

Para.: ***index***: card ID on the card
Return.: card ID.

Sample:
```
//Initialze all cards and get card ID。
# define MaxCards 16
short CardID[MaxCards];
short card_num;
PS400_Card_Init();
card_num = PS400_Total_Card();
for (BYTE i = 0; i < card_num; i++)
{
    CardID[i] = PS400_Get_CardNo(i);
}
BYTE CardNo = (BYTE)CardID[0];          //Assign the CardID with index=0
PS400_Set_Command(CardNo, AXIS_XYZU, 0);
PS400_Set_Position(CardNo, AXIS_XYZU, 0);
```

2.3 Card Reset

- **short PS400_Reset_Card(BYTE *cardNo*)**

Func.: Use this function to reset the card without exiting the application program。

Para.: ***cardNo***: assigned card ID

Return: SUCCESS_NO_ERROR
CARD_NUMBER_ERROR: the *cardNo* is invalid
INVALID_DEVICE_ERROR: no active device is related to the cardNo

Sample:
```
PS400_Reset_Card(1);
//Reset card 1 。
```

2.4 Set Pulse output mode

- **short PS400_Set_PulseMode(BYTE *cardNo*, WORD *axis*, BYTE *Mode*)**

Func.: **Set Pulse mode，include CW/CCW , PULSE/DIR，and rising/falling edge。**

Para.: ***cardNo*:** **card ID**
***axis*:** **axis no(Table3-1)**
***Mode*:** **mode(Table3-2)**

Pulse output mode (Table 3-2)

Type	Mode	Dir.	Output Pulse	
			nPP	nPM
CW / CCW	0		CW(rising)	CCW(rising)
	1		CW(falling)	CCW(falling)
PULSE / DIR	2	+	PULSE(rising)	DIR(LOW)
	3		PULSE(falling)	DIR(LOW)
	4	−	PULSE(rising)	DIR(LOW)
	5		PULSE(falling)	DIR(LOW)

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR : some error occurred in internal Motion-ASIC,
please call PS400_GET_ERROR_CODE() for detailed information

Sample: **PS400_Set_PulseMode(1, AXIS_XYZ, 2);**
// Set card 1 axis X/Y/Z as mode 2。

2.5 Set Maximum Speed range

- **short PS400_Set_MaxSpeed(BYTE *cardNo*, WORD *axis*, DWORD Data)**

Func.: **Set Maximum pulse output rate**

Para.: ***cardNo*:** **card ID**
***axis*:** **Axis no.**
Data **Set Max. Speed from 8,000 to 4,000,000**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter

CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample： **PS400_Set_MaxSpeed(1, AXIS_XYZU, 200000)**
// Set card 1 4-Axes max. speed as 200K PPS。

2.6 Set Limit Swith (EL) logic and action

- **short PS400_Set_Limit(BYTE *cardNo*, WORD *axis*, BYTE Logic, BYTE StopMode)**

Func.: **Set the logic and action of limit switches "±EL ", logic High/Low , slow-down stop / immediate-stop。**

Para.: ***cardNo*: card ID**
***axis*: Axis no.(Table3-1)**
***Logic*: 0=Low active, 1=High active**
***StopMode*： 0=immediate stop,1=slow-down stop**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
LOGIC_SETTING_ERROR: the *Logic* parameter is invalid

Sample: **PS400_Set_Limit(1, AXIS_XYZU, 0, 0);**
// Set card 1 X Y Z U low-active and immediate stop

2.7 Set ORG and NORG logic

- **short PS400_Set_Home(BYTE *cardNo*, WORD *axis*, BYTE *HLogic,* BYTE *NHLogic,* BYTE *ZLlogic*)**

Func.: **Set ORG/NORG logic。**

Para.: ***cardNo*: card ID**
***axis*: axis no.(Table3-1)**
***HLogic*: ORG: 0=low active, 1=high active**
***NLlogic*: NORG: 0=low active, 1=high active**
***ZLogic* : Z-Phae: 0=low active, 1=high active**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid a*xis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
LOGIC_SETTING_ERROR: the *Logic* parameter is invalid

Sample: **PS400_Set_Home(1, AXIS_XYZU, 1, 1);**
//Set card 1 X Y Z U ORG and NORG as high active。

2.8 Set software limit (±SEL）

- **short PS400_Set_SoftLimit(BYTE *cardNo*, WORD *axis*, long PLimit, long NLimit, BYTE *Type*)**

Func.: Set software limit SEL or comparator (C±) function。

Para.:

	cardNo:	card ID
	axis:	axis no.(Table3-1)
	Plimit:	Positive software limit range(-2,147,483,648 ~ +2,147,483,647)
	NLimit:	Negative software limit range(-2,147,483,648 ~ +2,147,483,647)
	Type:	comparator source: 0=Command,1=Encoder

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
LOGIC_SETTING_ERROR: the *Logic* parameter is invalid
MODE_SETTING_ERROR: the *Type* parameter is invalid

Sample:
```
PS400_Set_SoftLimit(1, AXIS_XYZU, 20000, -3000, 0);
// Set card 1 X Y Z U axis PSEL=20000，NSEL=-3000 and comparator source as command position。
```

Notice:

When SEL is enabled, the CMP INT factor MUST be disabled. Please use PS400_Set_INT_Factor() to reset the condition to 0.

- **short PS400_Disable_SoftLimit(BYTE *cardNo*, WORD *axis*)**

Func.: Disable software limit (±SEL）function。

Para.:

	cardNo:	card ID
	axis:	axis no.(Table3-1)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
PS400_Disable_SoftwareLimit(1, AXIS_XYZU);
//Disable card1  X Y Z U axis software limit。
```

2.9 Set Encoder input mode

- **short PS400_Set_EncoderMode(BYTE *cardNo*, WORD *axis*, BYTE *Mode*)**

Func.: **Set Eencoder input mode（1AB/2AB/4AB or CW/CCW）。**

Para.: ***cardNo*:** **card ID**
***axis*:** **axis no.(Table3-1)**
***Mode*:** **encoder mode : 0 = 1AB,**
1 = 2AB,
2 = 4AB,
3 = CW/CCW

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MODE_SETTING_ERROR: the *Mode* parameter is invalid

Sample: **PS400_Set_EncoderMode(1, AXIS_XYZU, 0, 0);**
//set card1 X Y Z U axiswith AB phase mode input。

2.10 Set Servo_ON

- **short PS400_Set_Servo_ON(BYTE *cardNo*, WORD *axis, BYTE Mode*)**

Func.: **Set DO to switch Servo ON/OFF.**

Para.: ***cardNo*:** **card ID**
***axis*:** **axis(Table3-1)**
Mode*：** ***0=ON, 1=Off

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MODE_SETTING_ERROR: the *Mode* parameter is invalid

Sample: **PS400_Set_Servo_ON(1, AXIS_XYZU);**
//Set card1 X Y Z U axis Servo_ON。

2.11 Set ALM logic and action

- **short PS400_Set_Alm(BYTE *cardNo*, WORD *axis*, BYTE *Mode*, BYTE *Logic*)**

Func.: **Set ALM logic and action for servo dirver/motor。**

Para.:
	***cardNo*:**	**card ID**
	***axis*:**	**axis no(Table3-1)**
	***Mode*:**	**mode: 0=disable,1=enable**
	***Logic*:**	**0=low active, 1=high active**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
LOGIC_SETTING_ERROR: the *Logic* parameter is invalid
MODE_SETTING_ERROR: the *Mode* parameter is invalid

Sample:
```
PS400_Set_Alm(1, AXIS_XY, 1, 0);
//Set card 1XY axis，ALARM) enable with low active。
```

2.12 Set INP logic and action

- **short PS400_Set_Inp(BYTE *cardNo*, WORD *axis*, BYTE *Mode*, BYTE *Logic*)**

Func.: **Set INP Input logic and action for servo driver/motor。**

Para.:
	***cardNo*:**	**card ID**
	***axis*:**	**axis no(Table3-1)**
	***Mode*:**	**mode: 0=disable,1=enable**
	***Logic*:**	**0=low active, 1=high active**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
LOGIC_SETTING_ERROR: the *Logic* parameter is invalid
MODE_SETTING_ERROR: the *Mode* parameter is invalid

Sample:
```
PS400_Set_Inp(1, AXIS_X, 1, 0);
//Set card 1 X axis，INP enable with low active。
```

Notice: **Please check the wiring。**

2.13 Set filter for DI input

short PS400_Set_Filter(BYTE *cardNo*, WORD *axis*, WORD *Mode*, WORD *TC*)

Func.: Set filter for DI input 。

Para.: ***cardNo*:** card ID

***axis*:** axis no.(Table3-1)

***Mode*:** Filter index code (0~31）in the following table:

code	Function
1	EMG,PEL,NEL,ORG,NORG
2	Encoder Z phae
4	INP,ALM
8	nEXPP, nEXPM, EXPLSN
16	(IN3)

***TC*:** Filter time parameter (0~7) in the following table:

code	Noise width	delay
0	1.75μSEC	2μSEC
1	224μSEC	256μSEC
2	448μSEC	512μSEC
3	896μSEC	1.024mSEC
4	1.792mSEC	2.048mSEC
5	3.584mSEC	4.096mSEC
6	7.168mSEC	8.192mSEC
7	14.336mSEC	16.384mSEC

Return: SUCCESS_NO_ERROR

INVALID_DEVICE_ERROR: no active device is related to the cardNo

INVALID_AXIS_ERROR: invalid *axis* parameter

CARD_NUMBER_ERROR: the *cardNo* is invalid

MODE_SETTING_ERROR: the *Mode* parameter is invalid

Sample: PS400_Set_Filter(1, AXIS_XYZU, 21, 3);

//Set card1 X Y Z U axis，(21=1+4+16) 1→EMG,PEL,NEL,NORG,ORG，4→INP,ALM，16→IN3 enable with filter time = 1.024mSEC。

2.14 Set counter as Variable-Ring

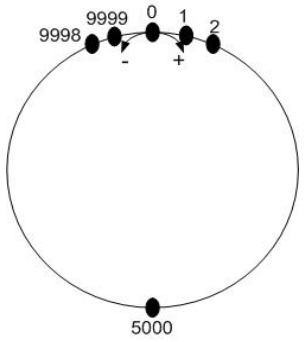
- **short PS400_Set_Vring(BYTE *cardNo*, WORD *axis*, BYTE Mode, DWORD *Value*)**

Func.: **Set ring counter (see attached fig.)。**

Para.: ***cardNo*:** **card ID**
***axis*:** **axis no.(Table3-1)**
Mode： **0:(Disable), 1:(Enable)**
***Alue*:** **ring counter range：-2,147,483,648 ~ +2,147,483,647**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MODE_SETTING_ERROR: the *Mode* parameter is invalid

Sample: PS400_Set_ Vring(1, AXIS_X, 10000);
//Set card 1 X axis，ring counter with 10000 Pulse/Revolution。



Ring counter=9999

Notice:

This function will set both Pulse/Encoder couters as Ring-Counter.

This function is mutual-exclusive to PS400_Set_SoftLimit ( ).

2.15 Set Triangle velocity profile

- **short PS400_Set_AvTri(BYTE *cardNo*, WORD *axis, BYTE Mode*)**

Func.: **Enable or disable triangle velocity profile action。**

Para.: ***cardNo*:** **card ID**
***axis*:** **axis no (Table3-1)**
Mode： ***0=Disable, 1=Enable***

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter

CARD_NUMBER_ERROR: the *cardNo* is invalid
MODE_SETTING_ERROR: the *Mode* parameter is invalid

Sample: **PS400_ Set_AvTri(1, AXIS_X);**
//Set card1 X axis，enable triangle velocity profile protection。

2.16 Set comparator

- **short PS400_Set_Compare(BYTE *cardNo,* WORD *axis,* BYTE *CmpSource,*BYTE *CmpMode,* long *CmpValue*)**

Func.: **Set comparator parameter , include Compare source、Mode and Value。**

Para.: ***cardNo*: card ID**
***axis*: axis no**
***CmpSource* ： Compare source：0=Command, 1=Encoder**
***CmpMode* ： Compare mode：0=increase, 1=decrease**
***CmpValue* ： Comapre Value：-2,147,483,648 ~ +2,147,483,648**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MODE_SETTING_ERROR: the *CmpMode* parameter is invalid

Sample: **PS400_ Set_Compare(1, AXIS_X, 0, 0, -50000);**
//Set card1 X axis，comparator with increase mode and value =50000。
PS400_Set_Compare(1, AXIS_Y, 1, 1, 50000);
//Set card 1 X axis，comparator with decreas mode and value =-50000。

2.17 Set Manual Pulser

- **short PS400_Set_ManualPulsar(BYTE *cardNo*, WORD *axis*, BYTE *Mode*, DWORD *Command*)**

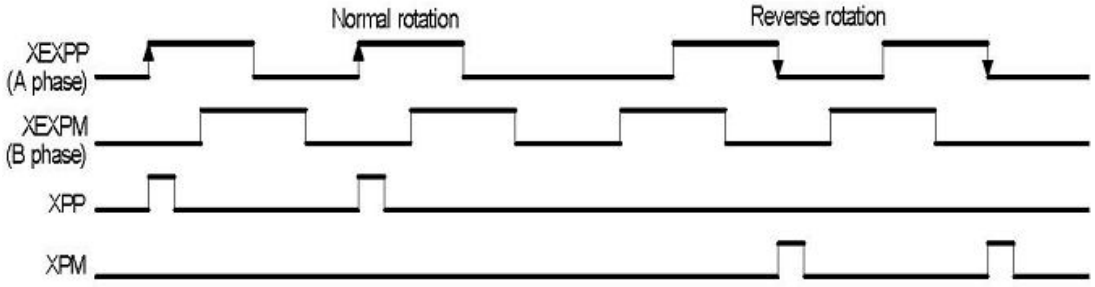
Func.: **Set the operation of Manual Pulse Generator.**

Para.: ***cardNo*: card ID**
***axis*: axis no.(1 or 2 or 4 or 8)**
***Mode*: 0 : disable**
1 : AB phase input ，specified pulse output
2 : CW/CCW ，specified pulse output
3 : CW/CCW continuous mode。

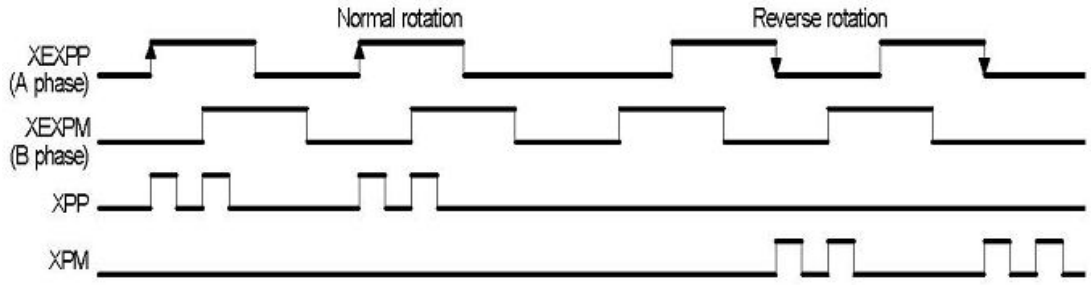
***Command*:** **Specified (mode 1/2) or continuous(mode 3) mode**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MODE_SETTING_ERROR: the *Mode* parameter is invalid

Sample: PS400_Set_ManualPulsar(1, AXIS_X, 1, 1);
//Set card1 X axis，MPG 1 Pulse。



PS400_Set_ManualPulsar(1, AXIS_X, 1, 2);
//Set card1 X axis，MPG 2 Pusle。



2.18 Set IN3 action

- **short PS400_Set_Input(BYTE *cardNo*, WORD *axis*, BYTE *Mode*, BYTE *Logic*)**

Func.: Set IN3 input enable/disable function。

Para.: ***cardNo*:** **card ID**
***axis*:** **axis no. (1 or 2 or 4 or 8)**
***Mode*:** **0 : Disable，1 : Enable**
Logic **0=low active, 1=high active**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo

INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
LOGIC_SETTING_ERROR: the *Logic* parameter is invalid
MODE_SETTING_ERROR: the *Mode* parameter is invalid

Sample: **PS400_Set_Input(1, AXIS_X, 1, 1);**
//Set card 1 X axis，IN3 Enable with high active logic。

3 Status Setting and readback

3.1 Set and Get Command Pulse

- **short PS400_Set_Command(BYTE *cardNo*, WORD *axis*, long *Command*)**

Func.: Set command pulse。

Para.: *cardNo*: card ID
axis: axis no.(Table3-1)
Command: range：-2,147,483,648 ~ +2,147,483,647

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
PS400_Set_Command(1, AXIS_XYZU, 0);
//Set card1 X Y Z U axis，current position as 0。
```

- **short PS400_Get_Command(BYTE *cardNo*, WORD *axis,* long* *pCommand*)**

Func.: Read command pulse。

Para.: *cardNo*: card ID
axis: axis no(1 or 2 or 4 or 8)
pCommand: point to the memory of the returned command.

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
long X_LP;
PS400_Get_Command(1, AXIS_X, &X_LP);
//Get card1 X axis，current command position。
```

3.2 Set and Get Encoder Pulse

- **short PS400_Set_Position(BYTE *cardNo*, WORD *axis*, long *Position*)**

Func.: Set Encoder Pusle。

Para.: *cardNo*: card ID

axis: axis no(Table3-1)
Position: Set Encoder pulse（range -2,147,483,648 ~ +2,147,483,647）

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
PS400_Set_Position(1, AXIS_XYZU, 0);
//Set card1 X Y Z U axis，current ENCODER as 0。
```

- **short PS400_Get_Position(BYTE *cardNo*, WORD *axis,* long* *pPosition*)**

Func.: Get Encoder feedback pulse。

Para.: *cardNo*: card ID
axis: axis no(1 or 2 or 4 or 8)
pPosition: point to the memory of the returned encoder position.

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
long X_EP;
PS400_Get_Position(1, AXIS_X, &X_EP);
//Get card1 X axis，current ENCODER feedback pulse。
```

3.3 Get current speed

- **short PS400_Get_Speed(BYTE *cardNo*, WORD *axis,* long* *pSpeed*)**

Func.: Set current speed。

Para.: *cardNo*: card ID
axis: axis no (1 or 2 or 4 or 8)
pSpeed: point to the memory of the returned speed.

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
long X_Speed;
PS400_Get_Speed(1, AXIS_X, &X_Speed);
//Get card1 X axis，current speed。
```

3.4 Get current acceleration

- **short PS400_Get_Acceleration(BYTE *cardNo*, WORD *axis,* long* *pAcc*)**

Func.: Get current acceleration。

Para.:
- ***cardNo***: card ID
- ***axis***: axis no(1 or 2 or 4 or 8)
- ***pAcc***: point to the memory of the returned acceleration.

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
long X_ACC;
PS400_Get_Acceleration (1, AXIS_X, &X_ACC);
//Get card1 X axis，current acceleration。
```

3.5 Get DI status

- **short PS400_Get_DI_Status(BYTE *cardNo*, WORD *axis*, WORD* *pStatus*)**

Func.: Get DI status。

Para.:
- ***cardNo***: card ID
- ***axis***: axis no (1 or 2 or 4 or 8)
- ***pStatus***: point to the memory of the returned DI status.
- ****pStatus***: the each bit of variable that pStatus points to means:
  - Bit0 → DRIVING (Check Pusle output)
  - Bit1 → LIMIT+ (Check Limit switch)
  - Bit2 → LIMIT- (Check Limit swithc)
  - Bit3 → EMERGENCY (Check EMG)
  - Bit4 → ALARM (Check ALM)
  - Bit5 → HOME (Check ORG)
  - Bit6 → NEAR HOME (Chenck NORG)
  - Bit7 → IN3 (Check IN3)
  - Bit8 → INPOS (Check INP)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
WORD Status;
PS400_Get_DI_Status(1, AXIS_X, &Status);
```

```
if ( Status&0x02 )
 {
      //Get card1   X axis current limit switch.
 }
```

3.6 Get or Clear error status

● **short PS400_Get_Error_Status(BYTE *cardNo*)**

Func.: Get error status。

Para.: ***cardNo***: card ID

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC,
please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
if (PS400_Get_Error_Status (1) == MOTION_STATUS_ERROR)
{
     //Get card1 error status。
}
```

● **short PS400_Get_Error_Code(BYTE *cardNo*, WORD *axis*, BYTE* *pErrCode*)**

Func.: Get error code。

Para.:
cardNo: card ID
axis: axis no(1 or 2 or 4 or 8)
pErrCode: point to the memory of the returned Error Code.

***pErrCode* will be the combination of the following values:**

code	cause	description
0x1	SOFT LIMIT+	Positive Software Limit
0x2	SOFT LIMIT-	Negative Software Limit
0x4	LIMIT+	Positive limit
0x8	LIMIT-	Negative limit
0x10	ALARM	Alarm
0x20	EMERGENCY	Emergency
0x40	Reserved	Reserve
0x80	HOME	Z-phase and HOME on

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:

```
BYTE ErrCode;
PS400_Get_Error_Code(1, AXIS_X, &ErrCode);

if ( (ErrCode & 0x01 == 0x1) || (ErrCode & 0x2) )
{
    //Get card1 Xaxis，positive or negative limit.
}
```

4 Interrupt Handling

4.1 Enable / Disable interrupt function

- **short PS400_Enable_INT(BYTE *cardNo*)**

Func.: **Enable interrupt function。**

Para.: ***cardNo*:** **card ID**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
IOCTL_FAIL_ERROR: the DeviceIoControl( ) failed, please call GetLastError( ) for further information

Sample:
```
PS400_Enable_INT(1);
//Set card1 interrupt enable。
```

- **short PS400_Disable_INT(BYTE *cardNo*)**

Func.: **Disable interrupt function。**

Para.: ***cardNo*:** **card ID**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
IOCTL_FAIL_ERROR: the DeviceIoControl( ) failed, please call GetLastError( ) for further information

Sample:
```
PS400_Disbale_INT(1);
//Set card1 interrupt enable。
```

4.2 Set interrupt factor

- **short PS400_Set_INT_Factor(BYTE *cardNo*, WORD *axis*, WORD *Factor*)**

Func.: **Set interrupt factor。**

Para.: ***cardNo*:** **card ID**
***axis*:** **axis no(Table3-1)**
***Factor*:** **interrupt factor in the following table**

no	Code	Description
0	RST	Reset
1	PULSE	First pulse happens
2	P>=C-	Counter is greater than Comparator in negative

		direction
3	P<C-	Counter is smaller than Comparator in negative direction
4	P>=C+	Counter is greater than comparator in positive direction
5	P<C+	Counter is smaller than comparator in positive direction
6	C-END	Constant speed is ended
7	C-STA	Constant speed starts
8	D-END	Deceleration is ended
9	H-END	Homing is ended
10	SYNC	Synchronization is active

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MODE_SETTING_ERROR: the *Factor* parameter is invalid

Sample: PS400_Set_INT_Factor(1, AXIS_XY, 8);
// Set card 1 Interrupt active when deceleration is ended

Notice:

When PS400_Set_INT_Factor() configures interrupt with CMP revelant factors, the Software Limit be disabled. Please call PS400_Disable_SoftLimit( ) to disable software interrupt.

4.3 Get interrupt status

- short PS400_Get_INT_Status(BYTE *cardNo,* WORD *axis,* WORD* *pINTSts*)

Func.: Get interrupt status。

Para.: *cardNo*: card ID
axis: axis no (1 or 2 or 4 or 8)
pINTSts: point to the memory of the returned Inetrrupt-Status.

***pINTSts* will be the combination of the following values:**

code	Cond.	description
0x0001	PULSE	First pulse happens
0x0002	P>=C-	Counter is greater than Comparator in negative direction
0x0004	P<C-	Counter is smaller than Comparator in negative direction
0x0008	P<C+	Counter is greater than comparator in positive direction
0x0010	P<=C-	Counter is smaller than comparator in negative

		direction
0x0020	C-END	Constant speed is ended
0x0040	C-STA	Constant speed starts
0x0080	D-END	Deceleration is ended

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
IOCTL_FAIL_ERROR: the DeviceIoControl( ) failed, please call GetLastError( ) for further information

Sample:
```
WORD wIntStatus;
PS400_Get_INT_Status(0, AXIS_X, &wIntStatus);
//Get card 0  Xaxis，interrupt status
```

Notice:

This function will get the correct status after enabling Interrupt with PS400_Enable_INT( ).

4.4 Attach/DettachEVENT objects for Interrupt notification

- short PS400_Attach_INT(BYTE *cardNo,* HANDLE **eHandle_List*)

Func.: Attache the EVENT objects to the related Interrupt. The EVENT object will be raised when the Interrupt occurs. WaitForSingleObjcet( ) is need, and usually applied in independent Thread.

Para.: *cardNo*: card ID
eHandle_List: the start-address of EVENT-HANDLE array. The array with 4-EVENT handles must be decalared in user's program.

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
EVENT_CREATE_ERROR: the CreateEvent( ) function failed.
CARD_NUMBER_ERROR: the *cardNo* is invalid
IOCTL_FAIL_ERROR: the DeviceIoControl( ) failed, please call GetLastError( ) for further information.

Sample:
```
HANDLE Event_Handle_List[4];
PS400_Attach_INT (1, Event_Handle_List);
//attach the Event Handle array to Card 1
WaitForSingleObject( Event_Handle_List[0], 5000 );
//wait the EVENT of AXIS_X in 5000 ms
```

- **short PS400_Dettach_INT(BYTE *cardNo*)**

Func.: **Dttache the EVENT objects to the related Interrupt and release the created resource.**

Para.: ***cardNo*:** **card ID**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
IOCTL_FAIL_ERROR: the DeviceIoControl( ) failed, please call GetLastError( ) for further information.

Sample:

```
PS400_Dettach_INT (1);
//deattch the EVENT-HANDLE and release the allocated resources
```

5 Read&Write from&to FRnet

5.1 Read or Wirde data

- **short PS400_Read_FRnet(BYTE *cardNo*, WORD *RA*, WORD* *pRAData*, BOOL *bDirectAccess* = TRUE)**

Func.: Read FRnet input

Para.: *cardNo*: card ID
RA: RA8~RA15
pRAData: point to the memory of the returned FRnet input.
bDirectAccess:
TRUE: Direct access the FRnet modelus (default)
FALSE: Read the digital input that saved by periotic Timer-ISR.

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
INVALID_MODE_ERROR: the *RA* parameter is invalid
IOCTL_FAIL_ERROR: the DeviceIoControl( ) failed, please call GetLastError( ) for further information.

Sample:
```
WORD IN_Data;
PS400_Read_FRnet(1, 8, &IN_Data);
//Set card1，RA = 8，IN_Data in 16-bits。
```

- **short PS400_Write_FRnet(BYTE *cardNo, WORD SA, WORD data*)**

Func.: Write FRnet output。

Para.: *cardNo*: card ID
SA: groupSA0~SA7
dara: 16-bits data

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
INVALID_MODE_ERROR: the *SA* parameter is invalid
IOCTL_FAIL_ERROR: the DeviceIoControl( ) failed, please call GetLastError( ) for further information.

Sample:
```
PS400_Write_FRnet(1, 0, 0xffff);
//Set card1，SA = 0，16-bits data is 0xffff。
```

5.2 Enable/Disable FRnet DO functionality

- **short PS400_Set_FRnetDO(BYTE cardNo, BYTE *Mode*)**

Func.: **Enable/Disable the DO functionality.**

Para.: ***cardNo*:** **card ID**
***Mode:*:** **0:Disable, 1:Enable**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
IOCTL_FAIL_ERROR: the DeviceIoControl( ) failed, please call GetLastError( ) for further information.

Sample:
```
// Enable card1 FRnet DO functionality
PS400_Set_FRnetDO(1, 1);
```

5.3 Ckect available FRnet DI modules

- **short PS400_Get_FRnetStatus(BYTE *cardNo, WORD* pStatus*)**

Func.: **check the on-line FRnet DI modules.**

Para.: ***cardNo*:** **card ID**
pStatus: **point to the memory of the returned available DI modules. The bit 0~bit7 of *pStatus stands for every FRnet DI module. For instance, 0x42 means two available FRnet DI modules set with RA9 and RA14.**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
IOCTL_FAIL_ERROR: the DeviceIoControl( ) failed, please call GetLastError( ) for further information.

Sample:
```
// check all on-line FRnet DI modules of card1
WORD FRnet_DI_Status;
short Error_Code;
Error_Code = FRnet_DI_Status=PS400_Get_FRnetStatus(1, &FRnet_DI_Status);
```

5.4 Reset FRnet DO

- **short PS400_Reset_FRnet(BYTE *cardNo*)**

Func.: **reset all attached FRnet DO modules.**

Para.: ***cardNo*:** **card ID**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
IOCTL_FAIL_ERROR: the DeviceIoControl( ) failed, please call GetLastError( ) for further information.

Sample:
```
// reset all FRnet DO modules of card1
PS400_Reset_FRnet(1);
```

5.5 Enable periodic FRnet DI

- **short PS400_Enable_FRnet_Scan(BYTE *cardNo,* BYTE *PeriodFactor*)**

Func.: **enable internal Timer of FRNet, the ISR will read FRnet DI module periodically.**

Para.: ***cardNo*:** **card ID**
***PeriodFactor*:** **assign the period of FRnet Time (0~255).**
T = 2.88 ms * (***PeriodFactor*** + 1)

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
IOCTL_FAIL_ERROR: the DeviceIoControl( ) failed, please call GetLastError( ) for further information.

Sample:
```
// assign card1 the period of 0.0288s
PS400_Enable_FRnet_Scan(1, 9);
```

5.6 Disable periodic FRnet DI

- **short PS400_Disable_FRnet_Scan(BYTE *cardNo*)**

Func: **disable internal Timer of FRNet**

Para.: ***cardNo*:** **card ID**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
IOCTL_FAIL_ERROR: the DeviceIoControl( ) failed, please call GetLastError( ) for further information.

Sample:
```
// disable FRnet internal Timer
PS400_Disable_FRnet_Scan(1);
```

6 Auto-Homing

PS400 supports hardware auto-homing function,please follow the following steps to complete the related setting.:

- **high-speed to search NORG**
- **low-speed to search ORG**
- **low-speed to get Z-phase of encoder**
- **high-speed to move to assigned offset point**

Not all the above is necessary in the setting, some steps can skipped if necessary。

6.1 Set Auto-homing parameter

- **short PS400_Set_HomeSpeed(BYTE *cardNo*, WORD *axis*, *DWORD SV* ,DWORD *V,* DWORD *A,* DWORD *HV*)**

Func.: Set homing speed。

Para.:

	***cardNo*:**	**card IDd**
	axis:	**axis no(Table3-1)**
	***SV*：**	**start-speed**
	***V*：**	**constant speed**
	***A*：**	**acceleration**
	***HV*:**	**speed after NORG (Vmin~Vmax PPS)**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
PS400_ Set_HomeSpeed(1, AXIS_X, 500, 20000, 10000, 5000);
//Set card1 X axis，start speed is 500PPS，constant speed is 20000PPS，
  accelerationis 10000PPS/Sec, speed after NORG is 5000 PPS。
```

6.2 Set limit switch as ORG

- **short PS400_Set_LimitHome(BYTE *cardNo*,WORD *axis*, BYTE *Mode*)**

Func.: Set limit switch EL as ORG。

Para.:

	***cardNo*:**	**card IDd**
	***axis*:**	**axis no (Table3-1)**
	***Mode*:**	**0=cancel ,1= enable**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample: PS400_ Set_LimitHome(1, AXIS_X, 0);
//Set card1 X axis，cancel Limit as ORG。

6.3 Set homing mode

- short PS400_Set_HomeMode(BYTE *cardNo*, WORD *axis*, WORD *Step1*, WORD *Step2*, WORD *Step3*, WORD *Step4* ,long *Offset*)

Func.: Set homing mode and related parameter。

Para.:
cardNo: card ID
axis: axis no. (Table3-1)
Step1: 0= skip,1=positive direction search,2=negative direction search
Step2: 0= skip,1= positive direction search,2= negative direction search
Step3: 0= skip,1= positive direction search,2= negative direction search
Step4: 0= skip,1= positive direction search,2= negative direction search
Offset: offset (range：0 ~ 2,147,483,647)

The Homing Steps are defined as follows:

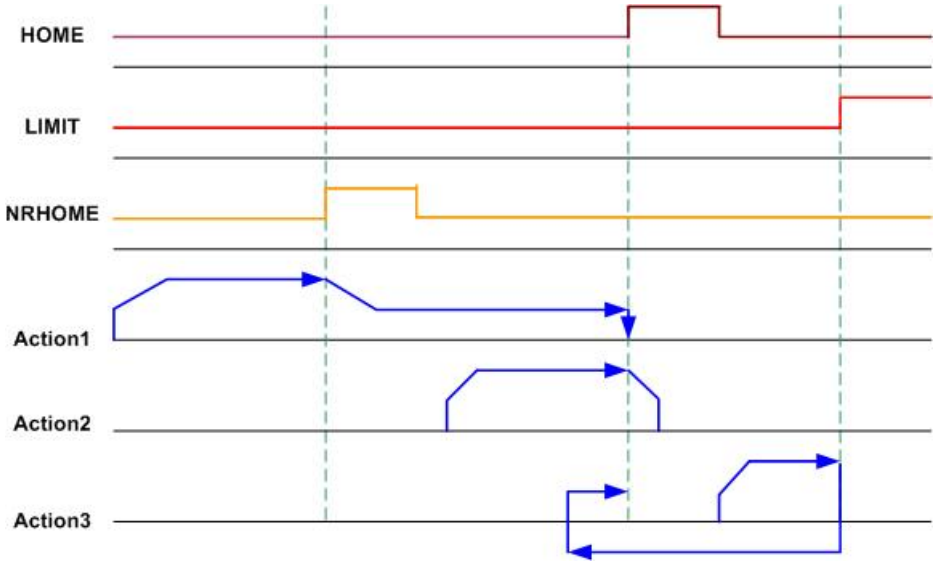
Step	Action	Speed	Sensor input
Step 1	High-speed to NORG	(V)	NORG(IN0)
Step 2	Low-speed to ORG	(HV)	ORG(IN1)
Step 3	Low-speed to Z-phase	(HV)	Z-phase(IN2)
Step 4	High-speed to offset	(V)	

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
BYTE bDone;
PS400_Set_MaxSpeed(1, AXIS_X, 200000);
// Set card1，4-axis max. speed as 200K PPS。
PS400_Set_HomeSpeed(1, AXIS_X, 5000, 20000, 10000, 500);
PS400_Set_HomeMode(1, AXIS_X, 2, 2, 0, 1, 0);
PS400_Home_Start(1, AXIS_X);
PS400_Home_Done(1, AXIS_X, &bDone);
//Set card1 X axis with the following setting:
```

	Input	Direction	Speed
step 1	NORG (IN0) Low active	－	20000 (PPS) (V)
step 2	ORG (IN1) Low active	－	500 (PPS) (HV)
step 3	Z-phase (IN2) High active	None	500 (PPS) (HV)
step 4	0 pulse (offset)	＋	20000 (PPS) (V)

IN3 is reserved for user-defined input



The diagram illustrates the above homing sequence

6.4 Start homing process

- **short PS400_Home _Start(BYTE *cardNo*, WORD *axis*)**

Func.: **Start homing process after finish the related setting。**

Para.: ***cardNo*:** **card ID**
***axis*:** **axis no (Table3-1)**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample: **PS400_ Home_Start(1, AXIS_X);**
//Set card1 X axis，starts homing process。

6.5 Wait for homing completion

- **BYTE PS400_Home_Done(BYTE *cardNo*, WORD *axis,* BYTE* *pDone*)**

Func.: **uses this to wait for homing completion。**

Para.: ***cardNo*:** **card ID**
***axis*:** **axis no (Table3-1)**
***pDone*:** **point to the memory that indidates the completion of Homing.**
YES -- completed
NO -- not-completed

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
BYTE bDone;
PS400_Home_Done(1, AXIS_X, &bDone);
If ( bDone == NO)
{
    //Check card1 X axis , homing is not completed。
}
```

7 Axis control

- **Multiple axes can be commanded for single axis motion。**
- **T-curve and S-curve velocity profile are supported**
- **2~3 axis linear-interpolation。**
- **2-axis circular-interpolation。**
- **3-axis helical-interpolation。**
- **2-axis proportional movement。**

7.1 Fixed pulse with constant speed

- **short PS400_Const_Move(BYTE *cardNo*, WORD *axis*, DWORD *V*, long *Command*)**

Func.: **Set fixed pulse with constand speed movement。**

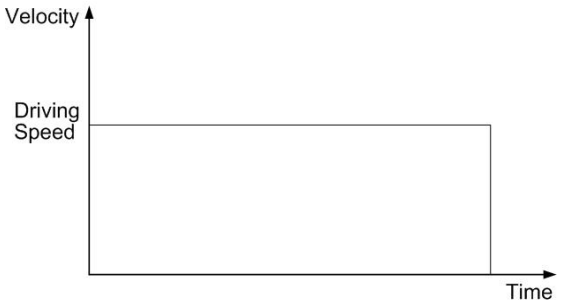
Para.:

	***cardNo*:**	**card ID**
	***axis*:**	**axis no (1 or 2 or 4 or 8)**
	***V*:**	**speed in (PPS)**
	***Command*:**	**Pusle (range：-2,147,483,648 ~ +2,147,483,647)**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
BYTE cardNo=0;
DWORD v=10000;
DWORD p=10000;
PS400_Set_MaxSpeed(cardNo, AxIS_XYZU, 200000)
// Set card 0, 4 axes max. speed as 200K PPS.
PS400_Const_Move(0, AXIS_X, v, p)
//Set card 0, X-axis 10000 pulse movement with constant speed as 10000 PPS.
```



7.2 Fixed pulse with T-curve velocity profile

- **short PS400_T_Move(BYTE *cardNo*, WORD *axis*, DWORD *SV*, DWORD *V*, DWORD *A*, short *AO*, long *Command*)**

Func.: **Set fixed pulse with symmetric T-curve velocity profile。**

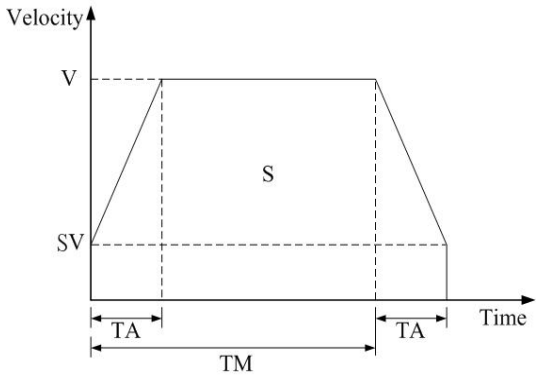
Para.:

	cardNo:	**card ID**
	axis:	**axis no (1 or 2 or 4 or 8)**
	SV:	**start speed (range：1~4M PPS)**
	V:	**Max. speed (range：1~4M PPS)**
	A:	**Acceleration (PPS/Sec) (range：(PS400_Set_MaxSpeed data)(÷64 ~ x125 PPS/Sec)**
	AO:	**Offset pulse (-32,768 ~ +32,767)**
	Command:	**pulse (-2,147,483,648 ~ +2,147,483,647)**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_SPEED_ERROR: invalid *SV* or *V* parameter
INAVLID_ACCELERATION_ERROR: invalid *A* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
BYTE cardNo=0;
DWORD sv=500;
DWORD v=10000;
DWORD a=5000;
short ao=0;
DWORD p=10000;
PS400_Set_MaxSpeed(cardNo, AXIS_XYZU, 200000);
// Set card0, 4 axes Max. speed as 200K PPS.
PS400_T_Move(cardNo, AXIS_X, sv, v, a, ao, p);
//Set card 0, X-axis with T-curve.
```



- **short PS400_T_As_Move(BYTE *cardNo*, WORD *axis*, DWORD *SV*, DWORD *V*, DWORD *A*, WORD *D*, short *AO*, long *Command*)**

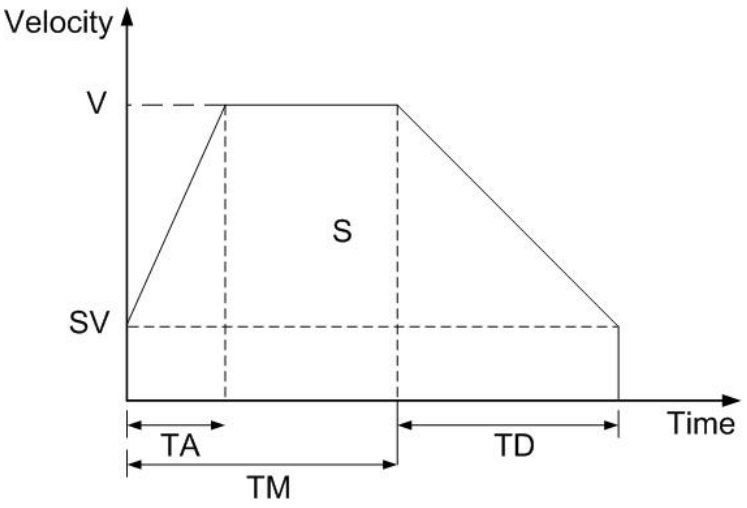
Func.: **Set fixed pulse non-symmetric T-curve velocity profile。**

Para.:

***cardNo*:**	**card ID**
***axis*:**	**axis no (1 or 2 or 4 or 8)**
***SV*:**	**start speed (range：1~4M PPS)**
***V*:**	**Max. speed (PPS)**
***A*:**	**Acceleration (PPS/Sec)**
***D*:**	**Deceleration(PPS/Sec)**
***AO*:**	**Offset Pulse (-32,768 ~ +32,767)**
***Command*:**	**pulse (-2,147,483,648 ~ +2,147,483,647)**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_SPEED_ERROR: invalid *SV* or *V* parameter
INAVLID_ACCELERATION_ERROR: invalid *A* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:
```
BYTE cardNo=0;
DWORD sv=500;
DWORD v=10000;
DWORD a=8000;
short ao=0;
DWORD d=2000;
DWORD p=10000;
PS400_Set_MaxSpeed(cardNo, AxIS_XYZU, 200000)
// Set card 0, 4-axes max. speed as 200K PPS.
PS400_T_As_Move(cardNo, AXIS_X, sv, v, a, d, ao, p);
//Set card0, X-axis with non-symmetric T-curve profile.
```



7.3 Fixed Pusle with S-curve velocity profile

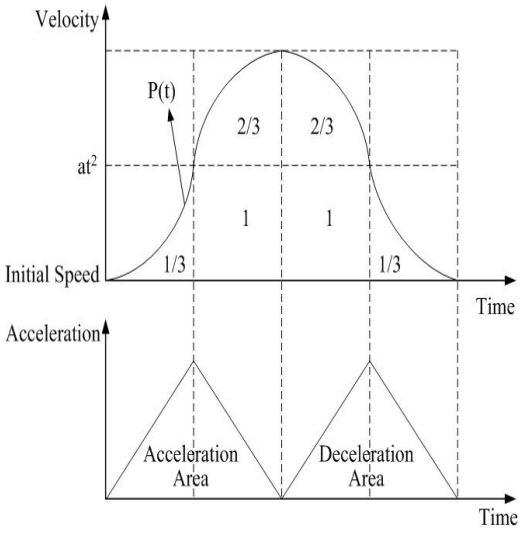
- **short PS400_S_Move(BYTE *cardNo*, WORD *axis*, DWORD *SV*, DWORD *V*, DWORD *K*, short *AO*, long *Command*)**

Func.: **Set fixed pulse with S-curve velocity profile。**

Para.:
- ***cardNo*: card ID**
- ***axis*: axis no(1 or 2 or 4 or 8)**
- ***SV*: start speed (range 1~4M PPS)**
- ***V*: speed (PPS)**
- ***K*: jerk (Jerk PPS/ Sec^2)**
- ***AO:* *Offset Pulse (-32,768 ~ +32,767)***
- ***Command*: pulse(range:-2,147,483,648 ~ +2,147,483,647)**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_SPEED_ERROR: invalid *SV* parameter
INAVLID_ACCELERATION_ERROR: invalid *K* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:
```
BYTE cardNo=0;
DWORD sv=500;
DWORD v=10000;
DWORD k=5000;
short ao=0;
DWORD p=10000;
PS400_Set_MaxSpeed(cardNo, AXIS_XYZU, 200000);
// Set card0, 4 axes mas. Speed as 200K PPS.
PS400_S_Move(cardNo, AXIS_X, sv, v, k, ao, p);
//Set card0, X-axis with symmetric  S-Curve profile.
```



Symmetric S-curve profile

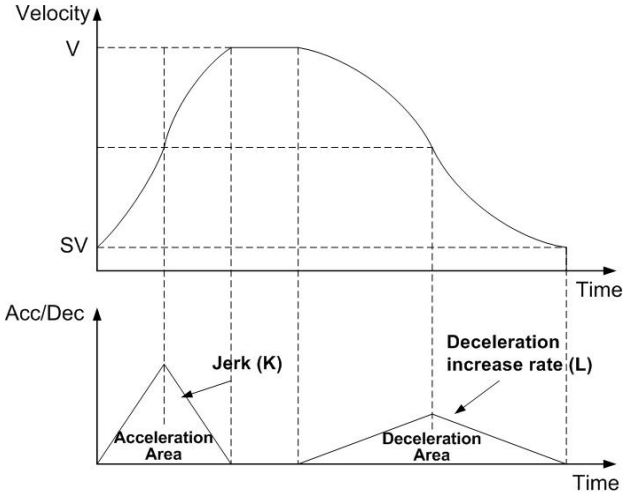
- **short PS400_S_As_Move(BYTE *cardNo*, WORD *axis*, DWORD *SV*, DWORD *V*, DWORD *K*, DWORD *L*, short *AO*, long *Command*)**

Func.: **Fixed pulse with non-symmetric S-curve velocity profile。**

Para.: ***cardNo*: card ID**
***axis*: axis no(1 or 2 or 4 or 8)**
***SV*: start speed (range：1~4M PPS)**
***V*: Max. speed(PPS)**
***K*: Acceleration Jerk (Jerk PPS/ Sec^2)**
***L*: Deceleration Jerk (Jerk PPS/ Sec^2)**
***AO*: Offset Pulse (-32,768 ~ +32,767)**
***Command*: pulse(-2,147,483,648 ~ +2,147,483,647)**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_SPEED_ERROR: invalid *SV* parameter
INAVLID_ACCELERATION_ERROR: invalid *K* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:
```
BYTE cardNo=0;
DWORD sv=500;
DWORD v=10000;
DWORD k=8000;
DWORD l=2000;
Short ao=0;
DWORD p=10000;
PS400_Set_MaxSpeed(cardNo, AXIS_XYZU, 200000);
// Set card 0, 4 axes max. speed as 200K PPS.
PS400_S_As_Move(cardNo, AXIS_X, sv, v, k, l, ao, p);
//Set card0, X-axis with non-symmetric S-Curve.
```



Non-symmetric S-curve

7.4 Continuous Movement

- **short PS400_Conti_move(BYTE *cardNo*, WORD *axis*, DWORD *SV*, long *V*, DWORD *A*, BYTE Dir)**

Func.: **Start continuous motion until the following situation occurs:**
- **calling PS400_Set_SdStop() or PS400_Set_EmgStop()**
- **satisifying the configuration of hardware/software limit**

Para.:

	***cardNo*:**	**card ID**
	***axis*:**	**axis no (1 or 2 or 4 or 8)**
	***SV*:**	**start speed (PPS) (range：1~4M PPS)**
	***V*:**	**max. speed (PPS)**
	***A*:**	**acceleration (PPS/Sec)**
	Dir	**Direction : 0 : Positive, 1 : Negative**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_SPEED_ERROR: invalid *SV* parameter
INAVLID_ACCELERATION_ERROR: invalid *A* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:
```
BYTE cardNo=0;
DWORD sv=500;
DWORD v=10000;
DWORD a=8000;
PS400_Set_MaxSpeed(cardNo, AXIS_XYZU, 200000);
// Set card0, 4 axes max. speed as 200K PPS.
PS400_Conti_Move(cardNo, AXIS_X, sv, v, a, 0);
//Set card 0, X-axis with T-curve profile.
```

7.5 Linear interpolation

- **short PS400_Line2_Move(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, BYTE *Mode*, DWORD *SV*, DWORD *V*, DWORD *A*, DWORD *K*,short *AO*, long *FP1*, long *FP2*)**

Func.: **2-axis linear interpolation in the same card。**

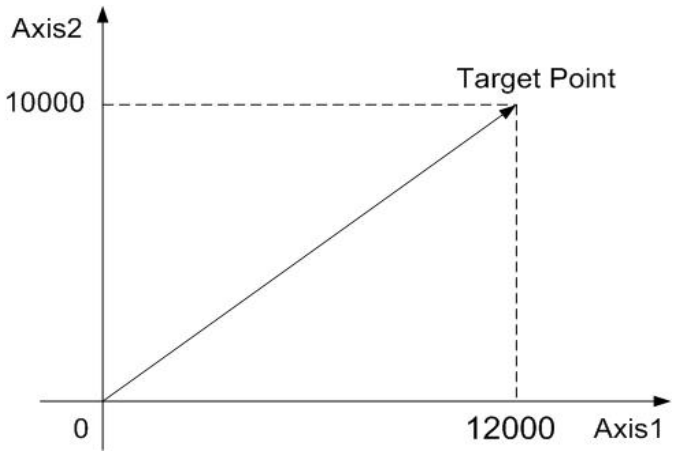
Para.:

	***cardNo*:**	**card ID**
	***axis1*:**	**first axis no.: X、Y、Z、U (1、2、4、8)**
	***axis2*:**	**second axis no: X、Y、Z、U (1、2、4、8)**
	***Mode*:**	**0 → fixed speed (V)**
		1 → Symmetric T-profile (SV、V、A、AO)
		2 → Symmetric S-curve (SV、V、K、AO)

***SV*:**	**Start speed (range：1~4M PPS)**
***V*:**	**Max. speed(PPS)**
***A*:**	**Acceleration**
***K*:**	**Jerk (Jerk PPS/ Sec^2)**
***AO*:**	**Offset Pulse (-32,768 ~ +32,767)**
***FP1*:**	**first axis Pulse (-2,147,483,648 ~ +2,147,483,647)**
***FP2*:**	**second axis Pulse(-2,147,483,648 ~ +2,147,483,647)**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1* or *axis2* parameter
INVALID_MODE_ERROR: invalid *Mode* parameter
INVALID_SPEED_ERROR: invalid *SV* parameter
INAVLID_ACCELERATION_ERROR: invalid *A or K* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:
```
BYTE cardNo=0;
BYTE Mode=1;
DWORD sv=500;
DWORD v=10000;
DWORD a=8000;
DWORD k=0; // k 可為任意值
short ao=0;
DWORD fp1=10000;
DWORD fp2=10000;
PS400_Set_MaxSpeed(cardNo, AXIS_XYZU, 200000);
// Set card1. 4 axes max. speed with 200K PPS.
PS400_Line2_Move(cardNo, AXIS_X, AXIS_Y, Mode, sv, v, a, k, ao, fp1, fp2);
//Set card0, XY axis with symmetric T-curve profile.
```



2-axis linear interpolation

- **short PS400_Line2_As_Move(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, BYTE *Mode*, DWORD *SV*, DWORD *V*, DWORD A, DWORD *D*, DWORD *K*, DWORD *L*, short *AO*, long *FP1*, long *FP2*)**

Func.: 2-axis non-symmetric linear interpolation。

Para.:

cardNo:	card ID
axis1:	first axis: X、Y、Z、U (1、2、4、8)
axis2:	second axis: X、Y、Z、U (1、2、4、8)
Mode:	0 → 2-axis constant speed (V)
	1 → non-symmetric T-curve (SV、V、A、AO)
	2 → non-symmetric S-curve (SV、V、A、D、AO)
SV:	Start speed (range：1~4M PPS)
V:	Max. speed(PPS)
A:	Acceleration Jerk (PPS/Sec)
D:	Deceleration Jerk (PPS/Sec)
K:	Jerk (Jerk PPS/ Sec^2)
L:	Deceleration Jerk (Jerk PPS/ Sec^2)
AO:	Offset Pulse (-32,768 ~ +32,767)
FP1:	first axis Pulse(-2,147,483,648 ~ +2,147,483,647)
FP2:	second axis Pulse(-2,147,483,648 ~ +2,147,483,647)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1* or *axis2* parameter
INVALID_MODE_ERROR: invalid *Mode* parameter
INVALID_SPEED_ERROR: invalid *SV* parameter
INAVLID_ACCELERATION_ERROR: invalid *A, D, K or L* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
BYTE cardNo=0;
DWORD sv=500;
DWORD v=10000;
DWORD a=8000;
DWORD d=2000;
DWORD k=0;// k can be any value
DWORD l=0;// l can be any value
 short ao=0;
DWORD fp1=10000;
DWORD fp2=10000;
PS400_Set_MaxSpeed(cardNo, AXIS_XYZU, 200000);
// Set card1, 4 axes max. speed as  200K PPS。
PS400_Line2_As_Move(cardNo, AXIS_X, AXIS_Y, 1, sv, v, a, d, k, l, ao, fp1, fp2);
//Set card0, XY axes with symmetric T-curve profile。
```

- **short PS400_Line3_Move(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, WORD *axis3*,**

BYTE *Mode*, DWORD *SV*, DWORD *V*, DWORD *A*,
DWORD *K*, short *AO*, long *FP1*, long *FP2,* long *FP3*)

Func.: **3-axis symmetric linear interpolation in the same card。**

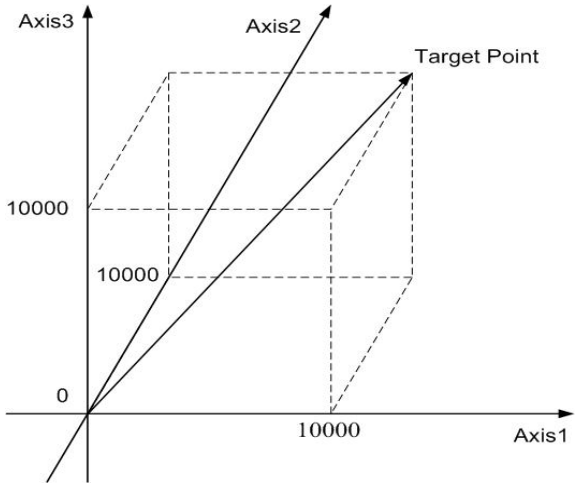
Para.:

***cardNo*:**	**card ID**
***axis1*:**	**first axis: X、Y、Z、U (1、2、4、8)**
***axis2*:**	**second axis: X、Y、Z、U (1、2、4、8)**
***axis3*:**	**third axis: X、Y、Z、U (1、2、4、8)**
***Mode*:**	**0 → fixed constant speed (V)**
	1 → symmetrci T-curve (SV、V、A、AO)
	2 → symmetric S-curve (SV、V、K、AO)
***SV*:**	**Start speed (PPS) (range：1~4M PPS)**
***V*:**	**Max. speed(PPS) (range：1~4M PPS)**
***A*:**	**Acceleration (PPS/Sec)**
***K*:**	**Acceleration Jerk (Jerk PPS/ Sec^2)**
***AO*:**	**Offset Pulse (-32,768 ~ +32,767)**
***FP1*:**	**first axis Pulse(-2,147,483,648 ~ +2,147,483,647)**
***FP2*:**	**second axis Pulse(-2,147,483,648 ~ +2,147,483,647)**
***FP3*:**	**third axis Pulse (-2,147,483,648 ~ +2,147,483,647)**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1, axis2* or *axis3* parameter
INVALID_MODE_ERROR: invalid *Mode* parameter
INVALID_SPEED_ERROR: invalid *SV or V* parameter
INAVLID_ACCELERATION_ERROR: invalid *A or K* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC,
please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
BYTE cardNo=0;
BYTE mode=2;
DWORD sv=500;
DWORD v=10000;
DWORD a=0;//a can be any value
DWORD k=8000;
 short ao=0;
DWORD fp1=10000;
DWORD fp2=10000;
DWORD fp3=10000;
PS400_Set_MaxSpeed(cardNo, AXIS_XYZU, 200000);
// Set card1, 4 axes with max. speed  200K PPS。
PS400_Line3_Move(cardNo, AXIS_X, AXIS_Y, AXIS_Z, mode, sv, v, a, k, ao, fp1, fp2,
fp3);
//Set card0, XYZ axes symmetric S-Curve。
```



3-axis linear interpolation

- **short PS400_Line3_As_Move(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, WORD *axis3*, BYTE *Mode*, DWORD *SV*, DWORD *V*, DWORD *A*, DWORD *D*, DWORD *K*, DWORD *L*, short *AO*, long *FP1*, long *FP2,* long *FP3*)**

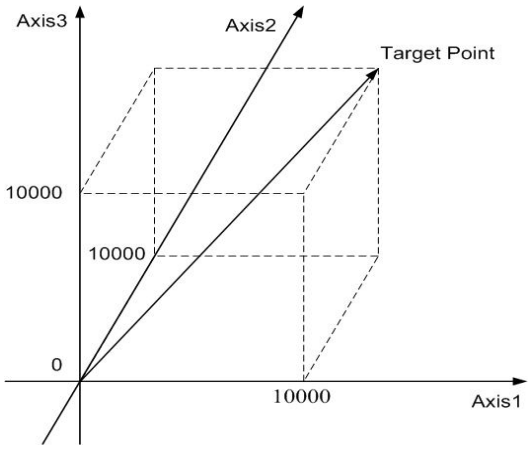
Func.: **3-axis non-symmetric linear interpolation in the same card。**

Para.: ***cardNo*: card ID**
***axis1*: first axis: X、Y、Z、U (1、2、4、8)**
***axis2*: second axis: X、Y、Z、U (1、2、4、8)**
***axis3*: third axis: X、Y、Z、U (1、2、4、8)**
***Mode*: 0 → fixed constant speed (V)**
1 → non-symmetric T-curve (SV、V、A、AO)
2 → non-symmetric S-curve (SV、V、A、D、AO)
***SV*: Start speed (range：1~4M PPS)**
***V*: Max. speed (range：1~4M PPS)**
***A*: Acceleration**
***D*: Deceleration**
***K*: Acceleratin Jerk (Jerk PPS/ Sec^2)**
***L*: 設定向量減速度變化率值 (Jerk PPS/ Sec^2)**
***AO*: Offset Pulse (-32,768 ~ +32,767)**
***FP1*:first axis Pulse(-2,147,483,648 ~ +2,147,483,647)**
***FP2*:second axis Pulse(-2,147,483,648 ~ +2,147,483,647)**
***FP3*:third axis Pulse(-2,147,483,648 ~ +2,147,483,647)**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1, axis2* or *axis3* parameter
INVALID_MODE_ERROR: invalid *Mode* parameter
INVALID_SPEED_ERROR: invalid *SV or V* parameter
INAVLID_ACCELERATION_ERROR: invalid *A, D, K or L* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample: **BYTE cardNo=0;**

```
BYTE mode=2;
DWORD sv=500;
DWORD v=10000;
DWORD a=0;//a can be any value
DWORD d=0;//d can be any value
DWORD k=8000;
DWORD l=4000;
short ao=0;
DWORD fp1=10000;
DWORD fp2=10000;
DWORD fp3=10000;
PS400_Set_MaxSpeed(cardNo, AXIS_XYZU, 200000);
// Set card1, 4 axes with max. speed as 200K PPS.
PS400_Line3_As_Move(cardNo, AXIS_X, AXIS_Y, AXIS_Z, mode, sv, v, a, d, k, l, ao, fp1, fp2,
fp3);
//Set card 0, XYZ axes as non-symmetric S-Curve.
```



3-axis non-symmetric linear interpolation

7.6 Circular interpolation

- **short PS400_Arc2_Move(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, BYTE *Mode*, BYTE Dir, DWORD *SV*, DWORD *V*, DWORD *A*, long *CP1*, long *CP2* , long *FP1*, long *FP2*)**

Func.: 2-axis circular interpolation。

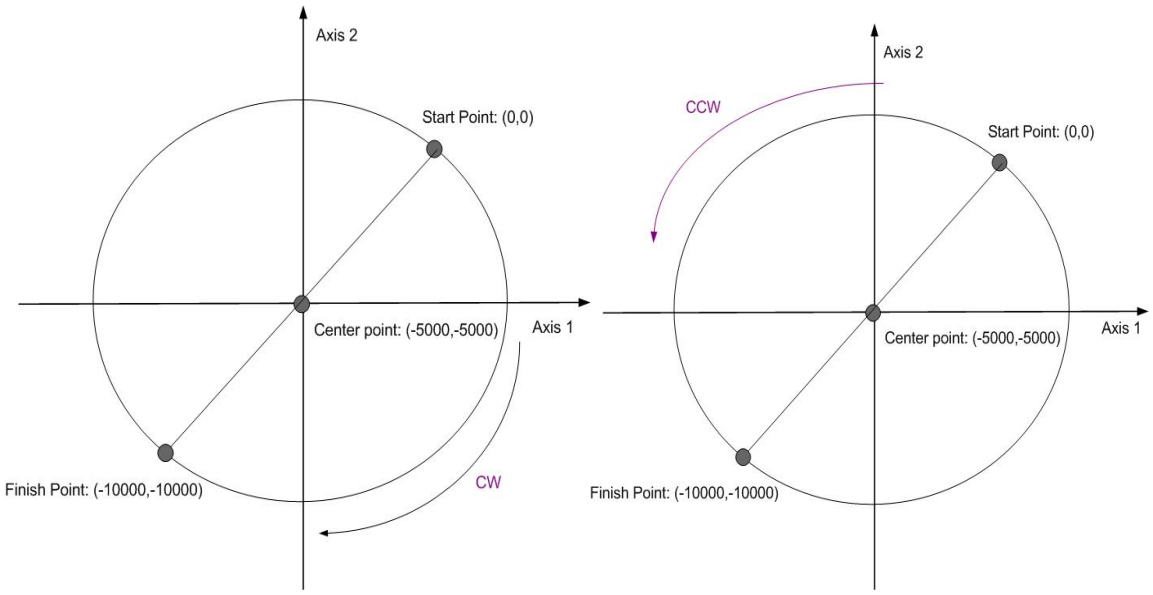
Para.:

***cardNo*:**	**card ID**
***axis1*:**	**first axis: X、Y、Z、U (1、2、4、8)**
***axis2*:**	**second axis: X、Y、Z、U (1、2、4、8)**
***Mode*:**	**0 → fixed constant speed (V)**
	1 → symmetric T-curve (SV、V、A)
Dir	**0: CW，clockwise；1:CCW，counter-clockwise**
***SV*:**	**Start velocity (PPS) (range：1~4M PPS)**
***V*:**	**Max. speed(PPS) (range：1~4M PPS)**
***A*:**	**Acceleration (PPS/Sec)**
***CP1*:**	**first axis center point (-2,147,483,648 ~ +2,147,483,647)**
***CP2*:**	**second axis center point (-2,147,483,648 ~ +2,147,483,647)**
***FP1*:**	**first axis Pulse(-2,147,483,648 ~ +2,147,483,647)**
***FP2*:**	**second axis Pulse(-2,147,483,648 ~ +2,147,483,647)**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1* or *axis2* parameter
INVALID_MODE_ERROR: invalid *Mode* parameter
INVALID_SPEED_ERROR: invalid *SV or V* parameter
INAVLID_ACCELERATION_ERROR: invalid *A* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
BYTE cardNo=0;
BYTE mode=1;
DWORD sv=500;
DWORD v=10000;
DWORD a=8000;
DWORD cp1=10000;
DWORD cp2=0;
DWORD fp1=0;
DWORD fp2=0;
PS400_Set_MaxSpeed(cardNo, AXIS_XYZU, 200000);
// Set card1 4axes with mas. Speed 200K PPS.
PS400_Arc2_Move(cardNo, AXIS_X, AXIS_Y, mode, 0, sv, v, a, cp1, cp2, fp1, fp2);
//Set card=0, XY axes with T-curve.
```



CW interpolation **CCW interpolation**

7.7 Synchronized Moton

- **short PS400_Set_SyncMotion(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, BYTE *Sync*, BYTE *Drv*)**

Func.: **Set synchronized motion in the same card。**

Para.: ***cardNo*:** **card ID**
***axis1*:** **main axis no (1 or 2 or 4 or 8)**
***axis2*:** **sync. Axis no. in the following table**

axis1 / axis2	X	Y	Z	U
0	none	none	none	none
1	Y	Z	U	X
2	Z	U	X	Y
3	YZ	ZU	UX	XY
4	U	X	Y	Z
5	YU	ZX	UY	XZ
6	ZU	UX	XY	YZ
7	YZU	ZUX	UXY	XYZ

***Sync*:** **Sync. Condition in the following table**

code	Cond.	Description
0x0000		Cancel Sync. Condition
0x0001	P≥C+	Pulse counter is greater than or equal to COMP+
0x0002	P<C+	Pulse counter is smaller than COMP+
0x0004	P<C-	Pusle counter is smaller than COMP-
0x0008	P≥C-	Pulse counter is greater than or equal to COMP-
0x0010	C-STA	Constant speed starts

0x0020	D-END	Deceleration is ended
0x0040	IN3↑	nIN3 is in rising edge
0x0080	IN3↓	nIN3 is in falling edge

For instance: P≥C+ and IN3↑ (0x0001 + 0x0040 = 0x0041)

Drv: Syn. Action is in the following table

code	Cond.	Description
0		Cancel Sync. Condition
1	FDRV+	Positive dir. Fixed pulse movement, please use PS400_Sync_Preset() to set new position
2	FDRV-	Negative dir. Fixed pulse movement, please use PS400_Sync_Preset() to set new position
3	CDRV+	Positive continuous movement
4	CDRV-	Negative continuous movement
5	SSTOP	Deceleration stop
6	ISTOP	Immediate stop

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1* or *axis2* parameter
INVALID_MODE_ERROR: invalid *Drv* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
BYTE cardNo=0;
PS400_Set_Compare(cardNo, AXIS_X, 0, 0, 20000);
//Set CP+ as 20000.
PS400_Set_MaxSpeed(cardNo, AXIS_XYZU, 200000);
// Set card 1, 4 axes max. speed as 200K PPS.
PS400_Set_SyncMotion(cardNo, AXIS_X, 1, 1, 3);
PS400_T_Move(cardNo, AXIS_X, 500, 10000, 5000, 0, 50000);
//Set X-axis with T-curve for 50000 pulses, when X-axis reaches 20000 pulse, Y axis
  starts continuous movement.
```

- **short PS400_Set_Latch(BYTE *cardNo,* WORD *axis1,* WORD *axis2,* BYTE *Sync,* BYTE *Latch*)**

Func.: Set position latch function in the same card。

Para.: *cardNo*: card ID
axis1: Main axis no. (1 or 2 or 4 or 8)
axis2: Sync. Axis no. in the following table

axis1 / axis2	X	Y	Z	U
0	None	None	None	None
1	Y	Z	U	X
2	Z	U	X	Y
3	YZ	ZU	UX	XY
4	U	X	Y	Z
5	YU	ZX	UY	XZ
6	ZU	UX	XY	YZ

7	YZU	ZUX	UXY	XYZ

Sync: Sync. Condition in the following table

code	Cond.	Description
0x0000		Cancel Sync. Action
0x0001	P≥C+	Pulse counter is greater than or equal to COMP+
0x0002	P<C+	Pulse counter is smaller than COMP+
0x0004	P<C-	Pusle counter is smaller than COMP-
0x0008	P≥C-	Pulse counter is greater than or equal to COMP-
0x0010	C-STA	Constant speed starts
0x0020	D-END	Deceleration is ended
0x0040	IN3↑	nIN3 is in rising edge
0x0080	IN3↓	nIN3 is in falling edge

For instance: P≥C+ and IN3↑ (0x0001 + 0x0040 = 0x0041)

Latch: Sync. Action in the following table

code	Cond.	Description
0		Cancel sync. action
1	LPSAV	Stors currnet position，[Command→BR]
2	EPSAV	Stors feedback position [Position→BR]

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1* or *axis2* parameter
INVALID_MODE_ERROR: invalid *Latch* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
PS400_Set_MaxSpeed(1, AXIS_XYZU, 200000);
// Set card1, 4 axes max. speed as 200K PPS.
PS400_Set_Latch(1, AXIS_X, 0, 0x0040, 2);
PS400_T_Move(1, AXIS_X, 500, 20000, 10000, 0, 100000);
// Set X axis with T-Curve, Latch position when IN3 is in rising edge.
```

● **long PS400_Get_Latch(BYTE *cardNo,* WORD *axis,* long* *pLatch*)**

Func.: Get latched data。

Para.: *cardNo*: card ID
axis: axis no. (1 or 2 or 4 or 8)
pLatch: point to the memory of the latched data.

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1* or *axis2* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
long data;
PS400_Get_Latch(1, AXIS_Y, &data);
//Get card1, Y axis , latched position
```

- **short PS400_Sync_Preset(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, BYTE *SYNC*, BYTE *Preset*)**

Func.: Set Sync. Axis motion condition in the same card。

Para.: *cardNo*: card ID
axis1: main axis no. X, Y, Z or U (1 or 2 or 4 or 8)
axis2: sync. Axis no. in the following table

axis1 / axis2	X	Y	Z	U
0	none	none	none	none
1	Y	Z	U	X
2	Z	U	X	Y
3	YZ	ZU	UX	XY
4	U	X	Y	Z
5	YU	ZX	UY	XZ
6	ZU	UX	XY	YZ
7	YZU	ZUX	UXY	XYZ

Sync: Sync. Condition in the following table

code	Cond.	Description
0x0000		Cancel sync. condition
0x0001	P≥C+	Pulse counter is greater than or equal to COMP+
0x0002	P<C+	Pulse counter is smaller than COMP+
0x0004	P<C-	Pusle counter is smaller than COMP-
0x0008	P≥C-	Pulse counter is greater than or equal to COMP-
0x0010	D-STA	Constant speed starts
0x0020	D-END	Deceleration is ended
0x0040	IN3↑	nIN3 is in rising edge
0x0080	IN3↓	nIN3 is in falling edge

For instance, P≥C+ and IN3↑ (0x0001 + 0x0040 = 0x0041)

Preset: Sync. Data is in the following table

code	Cond.	Description
0		Cancel Sync. data
1	LPSET	Set new command counter，[Command←PRESET_DATA]
2	EPSET	Set new feedback counter (Position)，[Position←PRESET_DATA]
3	OPSET	Set new positin (P)，[P←PRESET_DATA]
4	VLSET	Set new velocity (V)，[V←PRESET_DATA]

To be used together with PS400_Preset_Data。

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1* or *axis2* parameter
INVALID_MODE_ERROR: invalid *Preset* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

- **short PS400_Preset_Data(BYTE *cardNo*, WORD *axis*, long *Data*)**

Func.: Set Sync. Motion data。

Para.:

	cardNo:	card ID
	axis:	Sync. axis(Table3-1)
	Data:	Command: -2,147,483,648 ~ +2,147,483,647
		Position: -2,147,483,648 ~ +2,147,483,647
		P : 0 ~ 4,294,967,295

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_MODE_ERROR: PS400_Sync_Preset( ) is not called
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
PS400_Disable_SoftLimit(1, AXIS_X);
//Disable X axis software limit.
PS400_Sync_Preset(1, AXIS_X, AXIS_Y, 1, 2);
//Set card1 and enable X-axis sync. Condition as P >= C+, change Y-axis speed.
PS400_Preset_Data(1, AXIS_Y, 10000);
PS400_Set_Compare(1, AXIS_X, 1, 0, 1000);
//Set card1 X-axis，P as feedback position(EP)，C+ is 1K
//When X-axis EP >= 1,000, Set Y-axis speed as 10K
```

7.8 Continuous interpolation

7.8.1 2-axis rectangle continuous interpolation

- **short PS400_Rectangle(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, BYTE *Mode*, WORD *SP*, BYTE *Dir*, long *LP*, long *WP*, long *RP*, DWORD *RSV*, DWORD *RV*, DWORD *RA*, DWORD *RD*)**

Func.: 2-axis rectangle continuous interpolation。

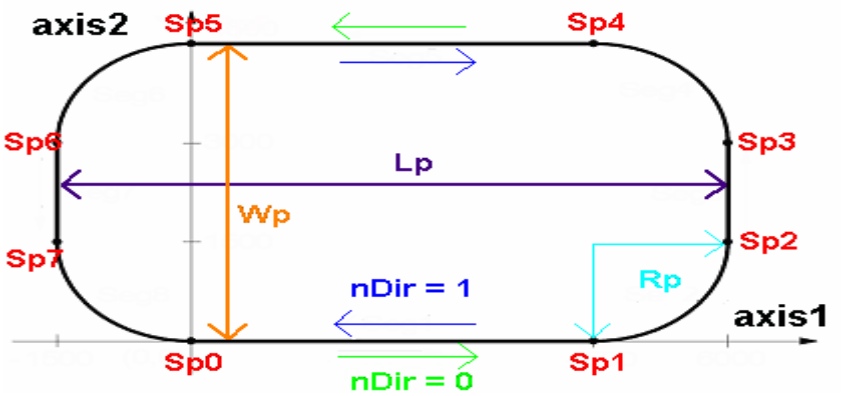
Para.:

	cardNo:	card ID
	axis1:	first axis: X、Y、Z、U (1、2、4、8)
	axis2:	second axis: X、Y、Z、U (1、2、4、8)
	Mode:	0 → constant speed
		1 → symmetric T-curve
	SP:	Start point 0 ~ 7 (Sp0 ~ Sp7 in the following fig.)
	Dir:	Direction with 0、1 (CCW or CW)
	LP:	Length Pulse no. (1 ~ 2,147,483,647)
	WP:	Width Pulseno.(1 ~ 2,147,483,647)
	RP:	Arc Pulse no.(1 ~ 2,147,483,647)
	RSV:	start velocity (range：1~4M PPS)
	RV:	max. velocity (range：1~4M PPS)
	RA:	acceleration
	RD:	deceleration

Return: SUCCESS_NO_ERROR

INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1* or *axis2* parameter
INVALID_PULSE_ERROR: invalid *LP, WP* or *RP* parameter
INAVLID_ACCELERATION_ERROR: invalid R*A or RD* parameter
INVALID_SPEED_ERROR: invalid *RSV* or *RV* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:
```
BYTE cardNo=1; // Set card 1.
Long sv=1000; // Set start velocity 1000 PPS.
Long v=10000; // Set max. velocity 10000 PPS.
Long a=5000; // Set acceleration 5000 PPS/s.
long d=5000; //Set deceleration 5000 PPS/s.
PS400_Set_MaxSpeed(cardNo, AxIS_XYZU, 200000)
// Set card1, 4 axes with max. speed  200K PPS.
PS400_Rectangle(
cardNo, AXIS_X, AXIS_Y, 1, 0, 0, 20000, 10000, 1000, sv, v, a, d);
//Set card 1, 2-axis rectangle interpolation with auto deceleration.
```



7.8.2 2-axis linear interpolation

- **short PS400_Set_Line2(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, DWORD *SV* , DWORD *V* , DWORD *A*)**

Func.: **Set 2-axis linear interpolation with symmetric T-curve。**

Para.:

***cardNo*:**	**card ID**
***axis1*:**	**first axis: X、Y、Z、U (1、2、4、8)**
***axis2*:**	**second axis: X、Y、Z、U (1、2、4、8)**
***SV*:**	**start velocity (PPS) (range：1~4M PPS)**
***V*:**	**Max. velocity (PPS) (range：1~4M PPS)**
***A*:**	**Acceleration (PPS/Sec)**

Return: SUCCESS_NO_ERROR

INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1* or *axis2* parameter
INAVLID_ACCELERATION_ERROR: invalid *A* parameter
INVALID_SPEED_ERROR: invalid *SV* or *V* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:

```
BYTE cardNo=1; // Set card 1.
long sv=300; // set start velocity as 300 PPS.
long v=18000; // set max. velocity as 18000 PPS.
long a=500000; // set acc. As 500000 PPS/s.
long loop1;
PS400_Set_MaxSpeed(cardNo, AxIS_XYZU, 200000)
// set card1, 4 axes with max. velocity as 200K PPS.
PS400_Set_Line2(cardNo, AXIS_X, AXIS_Y, sv, v, a);
for (loop1 = 0; loop1 < 10000; loop1++)
{
    PS400_ Line2_Start (cardNo, 0, 100, 100);
    PS400_ Line2_Start (cardNo, 0, -100, -100);
}
PS400_ Line2_Start (cardNo, 1, 100, 100);
// set card 1, X and Y axes linear interpolation
```

- **short PS400_Line2_Start(BYTE *cardNo*, BYTE *Mode*, long *FP1*, long *FP2*)**

Func.: **Start 2-axis linear interpolation in the same card。**

Para.:

***cardNo*:**	**card ID**
***Mode*:**	**0 → 2 axis linear interpolation**
	1 → 2 axis linear interpolation end
***FP1*:**	**first axis Pulse(-2,147,483,648 ~ +2,147,483,647)**
***FP2*:**	**second axis Pulse(-2,147,483,648 ~ +2,147,483,647)**

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
BYTE cardNo=1; // set card 1
long sv=300; // set start velocity as 300 PPS
long v=18000; // set max. velocity as 18000 PPS
long a=500000; // set acc. As 500000 PPS/s
```

```
long loop1;
PS400_Set_MaxSpeed(1, AxIS_XYZU, 200000)
// set card1, 4 axes max. velocity as 200K PPS
PS400_Set_Line2(cardNo, AXIS_X, AXIS_Y, sv, v, a);
for (loop1 = 0; loop1 < 10000; loop1++)
{
    PS400_ Line2_Start (cardNo, 0, 100, 100);
    PS400_ Line2_Start (cardNo, 0, -100, -100);
}
PS400_ Line2_Start (cardNo, 1, 100, 100);
//set card1, X and Y axes linear interpolation.
```

7.8.3 3-axis linear interpolation

- **short PS400_Set_Line3(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, WORD *axis3*, DWORD *SV* , DWORD *V* , DWORD *A*)**

Func.: Set 3-axis linear interpolationo in the same card

Para.:

cardNo:	card ID
axis1:	first axis no. : X、Y、Z、U (1、2、4、8)
axis2:	second axis no. : X、Y、Z、U (1、2、4、8)
axis3:	third axis no. : X、Y、Z、U (1、2、4、8)
SV:	start velocity (PPS) (range：1~4M PPS)
V:	max. velocity (PPS) (range：1~4M PPS)
A:	acceleration (PPS/Sec)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1, axis2* or *axis3* parameter
INAVLID_ACCELERATION_ERROR: invalid *A* parameter
INVALID_SPEED_ERROR: invalid *SV* or *V* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
BYTE cardNo=1; // set card 1
long sv=300; // set start velocity as 300 PPS
long v=18000; // set max. velocity as 18000 PPS
long a=500000; // set acc. As 500000 PPS/s
long loop1;
PS400_Set_Line3(cardNo, AXIS_X, AXIS_Y, AXIS_Z, sv, v, a);
for (loop1 = 0; loop1 < 10000; loop1++)
{
```

```
        PS400_ Line 3_Start(cardNo, 0, 100, 100, 100);
        PS400_ Line3_Satrt(cardNo, 0, -100, -100, -100);
    }
    PS400_ Line3_Start(cardNo, 1, 100, 100, 100);
    // set card1 , X、Y、Z   3-axis linear interpolation
```

- **short PS400_Line3_Start(BYTE *cardNo*, BYTE *Mode*, long *FP1*, long *FP2*, long *FP3*)**

Func.: start 3-axis linear interpolation

Para.:

cardNo:	card ID
Mode:	0 → 3-axis linear interpolation
	1 → 3-axis linear interpolation end
FP1:	first axis Pulse(-2,147,483,648 ~ +2,147,483,647)
FP2:	second Pulse(-2,147,483,648 ~ +2,147,483,647)
FP3:	third axis Pulse (-2,147,483,648 ~ +2,147,483,647)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
BYTE cardNo=1; //set card 1
long sv=300; //set start velocity as 300 PPS
long v=18000; //set max. velocity as 18000 PPS
long a=500000; //set acc. As 500000 PPS/s
long loop1;
PS400_Set_MaxSpeed(cardNo, AxIS_XYZU, 200000)
// set card1, 4 axes max. velocity as 200K PPS
PS400_Set_Line3(cardNo, AXIS_X, AXIS_Y, AXIS_Z, sv, v, a);
for (loop1 = 0; loop1 < 10000; loop1++)
{
    PS400_ Line 3_Start(cardNo, 0, 100, 100, 100);
    PS400_ Line3_Satrt(cardNo, 0, -100, -100, -100);
}
PS400_ Line3_Start(cardNo, 1, 100, 100, 100);
//set card1, X, Y and Z 3-axis linear interpolation
```

7.8.4 2-axis mixed interpolation

- **short PS400_Set_Mix2(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, BYTE *Acc*, DWORD *SV* , DWORD *V* , DWORD *A*)**

Func.: 2-axis mixed interpolation in the same card。

Para.:

cardNo:	card ID
axis1:	first axis : X、Y、Z、U (1、2、4、8)
axis2:	second axis : X、Y、Z、U (1、2、4、8)
nAcc:	0 → constant velocity (V)
	1 → symmetric T-curve (SV、V、A)
SV:	start velocity (PPS) (range：1~4M PPS)
V:	max. velocity(PPS) (range：1~4M PPS)
A:	acceleration (PPS/Sec)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1* or *axis2* parameter
INAVLID_ACCELERATION_ERROR: invalid *A* parameter
INVALID_SPEED_ERROR: invalid *SV* or *V* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:

```
BYTE cardNo=1; //set card1
unsigned short sv=300; //set start velocity as 300 PPS
unsigned short v=18000; //set max. velocity as 18000 PPS
unsigned long a=500000; //set acc. As 500000 PPS/s
unsigned short loop1;
PS400_Set_MaxSpeed(cardNo, AxIS_XYZU, 200000)
// set card1, 4 axes max. velocity as 200K PPS
PS400_Set_Mix2(cardNo, AXIS_X, AXIS_Y, 1, sv, v, a);
for (loop1 = 0; loop1 < 10000; loop1++)
{
    PS400_Mix2_Start (cardNo, 0, 1, 0, 0, 100, 100);
    PS400_Mix2_Start (cardNo, 0, 2, 100, 0, 100, 100);
}
PS400_Mix2_Start (cardNo, 1, 4, 100, 100, 0, 0);
//set card1, X and Y 2-axis linear interpolation
```

- **short PS400_Mix2_Start(BYTE *cardNo*, BYTE *Acc*, BYTE *Mode*, long *CP1,* long *CP2*, long *FP1*, long *FP2*)**

Func.: Start 2-axis mixed interpolation
間 Func.。

Para.:

cardNo:	card ID

Acc: 0 → continuous interpolation
1 → continuous interpolation end

Mode: 1： PS400_Line2( )
2： PS400_Arc2_Move()CW
3： PS400_Arc2_Move()CCW

CP1 first axis arc center (-2,147,483,648 ~ +2,147,483,647)
CP2 second axis arc center(-2,147,483,648 ~ +2,147,483,647)
FP1: first axis Pulse(-2,147,483,648 ~ +2,147,483,647)
FP2: second axis Pulse(-2,147,483,648 ~ +2,147,483,647)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INAVLID_MODE_ERROR: invalid *Mode* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC,
please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
BYTE cardNo=1; //set card 1
unsigned short sv=300; //set start velocity as 300 PPS
unsigned short v=18000; //set max. velocity as 18000 PPS
unsigned long a=500000; //set acc. As 500000 PPS/s
unsigned short loop1;
PS400_Set_MaxSpeed(cardNo, AxIS_XYZU, 200000)
// set card1, 4 axes max. velocity as 200K PPS
PS400_Set_Mix2(cardNo, AXIS_X, AXIS_Y, 1, sv, v, a);
for (loop1 = 0; loop1 < 10000; loop1++)
{
    PS400_Mix2_Start (cardNo, 0, 1, 0, 0, 100, 100);
    PS400_Mix2_Start (cardNo, 0, 2, 100, 0, 100, 100);
}
PS400_Mix2_Start (cardNo, 1, 4, 100, 100, 0, 0);
//set card 1, X and Y 2-axis linear interpolation
```

7.8.5 Multi-point Interpolation

- short PS400_Muti_Intp_Move(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, WORD *axis3*, BYTE *Acc*, DWORD *SV*, DWORD *V*, DWORD *A*, DWORD *D*, BYTE Mode*[ ]*, long CP*1[ ]*, long CP*2[ ]*, long FP*1[ ]*, long FP*2[ ]*,long FP*3[ ]*)

Func.: Multi-point interpolation in the same card。
Para.: *cardNo*: card ID

axis1: first axis no. : X, Y, Z or U (1、2、4、8)
axis2: second axis no. : X, Y, Z or U (1、2、4、8)
axis3: third axis no. : X, Y, Z or U (1、2、4、8)
Acc: 0 → constant velocity (V)
1 → symmetric T-curve (SV、V、A、D)
SV: start velocity (PPS) (range：1~4M PPS)
V: max. velocity (PPS) (range：1~4M PPS)
A: acceleration(PPS/Sec)
D: deceleration(PPS/Sec)
Mode[ ]: Max. points: 1024 (0 ~ 1023)，with the following mode：

1：PS400_Line2( )

2： PS400_Arc2_Move()CW direction

3： PS400_Arc2_Move()CCW direction

4： PS400_Line3D()

5： interpolation end

CP1[ ]: first axis arc center (-2,147,483,648 ~ +2,147,483,647)
CP2[ ]: second axis arc center(-2,147,483,648 ~ +2,147,483,647)
FP1[ ]: first axis Pulse(-2,147,483,648 ~ +2,147,483,647)

FP2[ ]: second axis Pulse(-2,147,483,648 ~ +2,147,483,647)

FP3[ ]: third axis Pulse(-2,147,483,648 ~ +2,147,483,647)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1, axis2* or *axis3* parameter
INAVLID_ACCELERATION_ERROR: invalid *A* or *D* parameter
INVALID_SPEED_ERROR: invalid *SV* or *V* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:
```
BYTE cardNo=1; //set card 1
long sv=100; //set start velocity as 100 PPS
long v=3000; //set max. velocity as 3000 PPS
long a=2000; //set acc. As  2000 PPS/s
long d=2000; //set deceleration as 2000 PPS/s
BYTE Mode[10]=  {     1,     2,     1,     2,     1,7,0,0,0,0};
long cp1[10]=   {     0, 10000,     0,     0,     0,0,0,0,0,0};
long cp2[10]=   {     0,     0,     0,-10000,     0,0,0,0,0,0};
long fp1[10]=   { 10000, 10000,  1000, 10000,-31000,0,0,0,0,0};
long fp2[10]=   { 10000, 10000,     0,-10000,-10000,0,0,0,0,0};
long fp3[10]=   {     0,     0,     0,     0,     0,0,0,0,0,0};
PS400_Set_MaxSpeed(1, AxIS_XYZU, 200000)
// set card1, 4 axes max. velocity as 200K PPS
PS400_Multi_Intp_Move(
cardNo, AXIS_X, AXIS_Y, 0, 1, sv, v, a, d, Mode,cp1, cp2, fp1, fp2, fp3);
//set card1, multi-point interpolation.
```

7.8.6 3-axis helical interpolation

- **short PS400_Helix3_Move(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, WORD *axis3*, BYTE *Dir*, DWORD *V* , long *CP1*, long *CP2*, long *Cycle*, long *Pitch*)**

Func.: 3-axis helical interpolation

Para.:

cardNo:	card ID
axis1:	first arc axis no. : X, Y, Z or U (1、2、4、8)
axis2:	second arc axis no. : X, Y, Z or U (1、2、4、8)
axis3:	Sync. Axis no.: X, Y, Z or U (1、2、4、8)
Dir:	0 → CW 1 → CCW
V:	velocity (PPS) (range：1~4M PPS)
CP1:	first arc axis center(-2,147,483,648 ~ +2,147,483,647)
CP2:	second ard axis center(-2,147,483,648 ~ +2,147,483,647)
Cycle:	circular cycles
Pitch:	helical pitch (-2,147,483,648 ~ +2,147,483,647)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1, axis2* or *axis3* parameter
INVALID_SPEED_ERROR: invalid *V* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
BYTE cardNo=1; //set card 1
PS400_Set_MaxSpeed(cardNo, AxIS_XYZU, 200000)
// set card1, 4 axes max. velocity as 200K PPS
//=============================================
long v=50000;
//set max. velocity as 50000 PPS.
PS400_HELIX_3D(cardNo, AXIS_Y, AXIS_Z, AXIS_X, 1, v, 0, 1000, 5, -2000);
//set card1, Y and Z circular interpolation, X axis sync.
//=============================================
long v=100000;
//set max. velocity as 100000 PPS
PS400_Helix3_Move(cardNo, AXIS_Y, AXIS_Z, AXIS_U, 1, v, 0, 25000, 50, 3600);
//set card1, Y and Z circular interpolation, X axis sync.
```

7.8.7 2-axis ratio movement

- **short PS400_Set_Ratio2(BYTE *cardNo*, WORD *axis1*, WORD *axis2*, DWORD *SV* , DWORD *V* , DWORD *A*, float R*atio*)**

Func.: 2-axis ratio movement。

Para.:

	cardNo:	card ID
	axis1:	first axis no. : X、Y、Z、U (1、2、4、8)
	axis2:	second axis no. : X、Y、Z、U (1、2、4、8)
	SV:	start velocity (PPS) (range：1~4M PPS)
	V:	max. velocity(PPS) (range：1~4M PPS)
	A:	acceleration(PPS/Sec)，
	Ratio:	2-axis ratio

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
INVALID_AXIS_ERROR: invalid *axis1 or axis2* parameter
INAVLID_ACCELERATION_ERROR: invalid *A* parameter
INVALID_SPEED_ERROR: invalid *SV* or *V* parameter
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:

```
BYTE cardNo=1; //set card1
long sv=300; // set start velocity as 300 PPS
long v=18000; //set max. velocity as 18000 PPS
long a=500000; //set acc. As 500000 PPS/s
long loop1;
long loop2;
PS400_Set_MaxSpeed(cardNo, AxIS_XYZU, 200000)
// set card1, 4 axes max. velocity 200K PPS
PS400_Set_Ratio(cardNo, AXIS_U, AXIS_X, sv, v, a, 0.36f);
for (loop2 = 0; loop2 < 5; loop2++)
{
    for (loop1 = 0; loop1 < 5; loop1++)
    {
        PS400_Ratio2_Start(cardNo, 0, 3600, 0);
        PS400_Ratio2_Start(cardNo, 0, 3600, 1);
    }
    PS400_Ratio2_Start(cardNo, 0, 7200, 0);
    PS400_Ratio2_Start(cardNo, 0, 3600, 1);
}
PS400_Ratio2_Start(cardNo, 1, 7200, 0);
//set card1, start U and X 2-axis ratio movement.
```

- **short PS400_Ratio2_Start(BYTE *cardNo*, BYTE *nType*, long *data*, BYTE *nDir*)**

Func.: start 2-axis ratio movement

Para.:

cardNo:	card ID
Mode:	0 → ratio movement
	1 → ratio movement end
Data:	first axis Pulse(-2,147,483,648 ~ +2,147,483,647)
Dir:	second axis direction:
	0 → CW
	1 → CCW

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
BYTE cardNo=1; //set card1
long sv=300; // set start velocity as 300 PPS
long v=18000; //set max. velocity as 18000 PPS
long a=500000; //set acc. As 500000 PPS/s
long loop1;
long loop2;
PS400_Set_MaxSpeed(cardNo, AxIS_XYZU, 200000)
// set card1, 4 axes max. velocity as 200K PPS
PS400_Set_Ratio(cardNo, AXIS_U, AXIS_X, sv, v, a, 0.36f);
for (loop2 = 0; loop2 < 5; loop2++)
{
    for (loop1 = 0; loop1 < 5; loop1++)
    {
        PS400_Ratio2_Start(cardNo, 0, 3600, 0);
        PS400_Ratio2_Start(cardNo, 0, 3600, 1);
    }
    PS400_Ratio2_Start(cardNo, 0, 7200, 0);
    PS400_Ratio2_Start(cardNo, 0, 3600, 1);
}
PS400_Ratio2_Start(cardNo, 1, 7200, 0);
// set card1, starts U and X 2-axis ratio movement
```

7.9 Other functions

7.9.1 Set Axis Hold

- **short PS400_Drv_Hold(BYTE *cardNo*, WORD *axis*)**

Func.: this is used to hold axis movement before multi-axis simultaneous start is used

Para.: *cardNo*: card ID
axis: axis no. (table 3-1)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
PS400_Drv_Hold(1, AXIS_XY);
PS400_Set_MaxSpeed(1, AxIS_XYZU, 200000)
// set card1, 4 axes max. velocity as 200K PPS
PS400_T_Move(1, AXIS_X, 500, 50000, 10000, 0, 50000);
PS400_S_Move(1, AXIS_Y, 500, 50000, 15000, 0, 50000);
//set card1  X as T-curve, Y as S-Curve，use PS400_Drv_Satrt() to start these 2 axes
  simulatneously
PS400_Drv_Start(1, AXIS_XY);
```

7.9.2 Set Axis Start

- **short PS400_Drv_Start(BYTE *cardNo*, WORD *axis*)**

Func.: to issue multiple axes simultaneous start movement

Para.: *cardNo*: card ID
axis: axis no. (Table3-1)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
/PS400_Drv_Hold(1, AXIS_XY);
PS400_Set_MaxSpeed(1, AxIS_XYZU, 200000)
// set card1, 4 axes max. velocity as 200K PPS
PS400_T_Move(1, AXIS_X, 500, 50000, 10000, 0, 50000);
PS400_S_Move(1, AXIS_Y, 500, 50000, 15000, 0, 50000);
PS400_Drv_Start(1, AXIS_XY);
// set card1, X as T-curve, Y as S-Curve, use PS400_Drv_Satrt() to start these 2 axes
simulatneously
```

7.9.3 Set Axis Stop

- **short PS400_Set_SdStop(BYTE *cardNo*, WORD *axis*)**

Func.: set slow-down to stop the axis。

Para.: *cardNo*: card ID
axis: axis no. (table 3-1)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
PS400_Set_SdStop(1, AXIS_XY);
//set card1, X Y axes slow-down to stop
```

- **short PS400_Set_EmgStop(BYTE *cardNo*, WORD *axis*)**

Func.: set EMG to stop the axis。

Para.: *cardNo*: card ID
axis: axis no. (table 3-1)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
PS400_Set_EmgStop(1, AXIS_ZU);
//set card1, Z and U axes EMG stop。
```

7.9.4 Clear stop status

- **short PS400_Clear_Stop_Status(BYTE *cardNo*)**

Func.: Clear stop status. This function helps to clear the stop-status that is caused by Motion-Error or calling PS400_Set_SdStop() / PS400_Set_EmgStop(). It's recommended to remove the root-cause of Motion-Error and call this routine to clear the Stop-Status.

Para.: *cardNo*: card ID

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
PS400_Clear_Stop_Status(1);
//Clear card1 stop status。
```

7.9.5 Motion done check

- **short PS400_Move_Done(BYTE *cardNo*, WORD *axis,* BYTE* *pDone*)**

Func.: to check the motion done status。

Para.: *cardNo*: card ID
axis: axis no. (table 3-1)
pDone: point to the memory of returned status
YES: completed
NO : not completed

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid

Sample:
```
BYTE cardNo=1, Done; //set card1
PS400_T_Move(cardNo, AXIS_XYZU, 100, 10000, 5000, 0, 50000);
// XYZU axes move 50000 Pulse

PS400_Motion_Done(cardNo, AXIS_X, &Done);
if ( Done == NO)
{
    // check X axis motion done
}
```

7.9.6 Compare-and-Trigger Configuration

- **short PS400_CmpTrig_Config(BYTE *cardNo*, WORD *axis, BYTE Type, BYTE OutputLogic, BYTE PulseWidth, BYTE bDirection, long Pitch = 0, long* pOffset = NULL, DWORD dwOffLen = 0*)**

Func.: configure the Compare/Trigger functionality.

Para.: *cardNo*: card ID
axis: AXIS_X or AXIS_Y
Type: the operation mode is combined by two set configurations.
Counter for Comparator:
LOGIC_POSITION – using Pulse Command/Logic Position counter
ENCODER_POSITION – using Encoder counter
Compare mode :
CONSTANT_PITCH – constant pitch
VARIABLE_OFFSET – variable offset
OutputLogic: Output signal polarity
DCC_ACTIVE_HIGH: Normal Low, Active High
DCC_ACTIVE_LOW: Normal High, Active Low
PulseWidth: width of trigger signal
DCC_PULSE_WIDTH_100us: 100 micro-second

DCC_PULSE_WIDTH_200u: 200 micro-second
DCC_PULSE_WIDTH_1ms: 1 mini-second
DCC_PULSE_WIDTH_2ms: 2 mini-second
DCC_PULSE_WIDTH_10ms: 10 mini-second
DCC_PULSE_WIDTH_20ms: 20 mini-second

bDirection: motion direction
MOVE_DIRECTION_PLUS: forward moving (+ direction)
MOVE_DIRECTION_MINUS: reversemoving (- direction)

Pitch: the constant pulse number for CONSTANT_PITCH mode

pOffset: the array that stores the variable trigger offsets
(only for VARIABLE_OFFSET mode)

dwOffLen: indicate the number of variable offsets (only for VARIABLE_OFFSET)

Return: SUCCESS_NO_ERROR
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
INVALID_MODE_ERROR: invalid *OutputLogic* or *PulseWidth* parameter
INVALID_DIRECTION_ERROR: invalid *bDirection* parameter
INVALID_PULSE_ERROR: invalid *Pitch* parameter
INVALID_SCAN_OFFSET_DATA: the offset in *pOffset* are not absolute increasing/decreasing
INVALID_SCAN_OFFSET_LEN: invalid *dwOffLen* 的 parameter (valid value: 1~2048)
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Sample:

```
BYTE cardNo=1; //set card1
 short wError;
 long lOffset[2048], curPos;
 int i;

//set Compare-Trigger with X axis Command/Pulse counter,
    Constant-Picth (1000 pulse),
    Output signal polarity: Active-High
    Trigger signal width: 200 micro-second
    Forward motion
wError = PS400_CompTrig_Config(cardNo, AXIS_X, (CONSTANT_PITCH |
          LOGIC_POSITION), DCC_ACTIVE_HIGH, DCC_PULSE_WIDTH_200u,
          MOVE_DIRECTION_PLUS, 1000, NULL, 0);
:
:
//reset Compare-Trigger related configuration of X-axis
PS400_CmpTrig_Reset(cardNo, AXIS_X);

//read current Command/Pulse counter
PS400_Get_Command(cardNo, AXIS_X,&curPos);

//configure the variable offsets
curPos = curPos + 100; // make sure the 1st trigger occurs in next motion
for( i=0; i<100; i++)
    lOffset[i] = curPos + (i*i);
```

```
// set Compare-Trigger with X axis Command/Pulse counter,
    Variable-Offset Trigger (100 offsets)
    Output signal polarity: Active-High
    Trigger signal width: 200 micro-second
Forward motion
wError = PS400_CompTrig_Config(cardNo, AXIS_X, (VARIABLE_OFFSET |
            LOGIC_POSITION), DCC_ACTIVE_HIGH, DCC_PULSE_WIDTH_200u,
            MOVE_DIRECTION_PLUS, 0, lOffset, 100);
:
:
// reset Compare-Trigger related configuration of X-axis
PS400_CmpTrig_Reset(cardNo, AXIS_X);
```

Notice: **1. On terminal board, the X-DCC/Y-DCC (X/Y axis Deviation Counter Clear) and *Driving status* use the same output pin. After calling PS400_CmpTrig_Config() to enable the Compare/Trigger functionality, this output pin will switch to DCC.**

2. The CONSTANT_PITCH mode will change both Logic and Encoder couters to Ring counters automatically.

3. When VARIABLE_OFFSET is set, the two internal comparators are used to chech the Logic/Encoder counter. The compare-condition is updated in ISR (Interrupt Service Routine). Therefore, the other functions that need ISR will be disabled, including::

PS400_Enable_FRnet_Scan(),PS400_Set_INT_Factor(),PS400_Attach_INT()

The limitions of Variable-Offset are:

(i) must occurs in next motion (cannot at the start-point)

(ii) must be absolute increasing/decreasing

(iii) maximum offsets is 2048

7.9.7 Reset the Compare-Trigger configuration

- **short PS400_CmpTrig_Reset(BYTE *cardNo*, WORD *axis)***

Func.: **reset the Compare/Trigger configuration that is set with PS400_CmpTrig_Config.**

Para.: ***cardNo*:** **card ID**
***axis*:** **AXIS_X or AXIS_Y**

Return: **SUCCESS_NO_ERROR**
INVALID_DEVICE_ERROR: no active device is related to the cardNo
CARD_NUMBER_ERROR: the *cardNo* is invalid
MOTION_STATUS_ERROR: some error occurred in internal Motion-ASIC, please call PS400_GET_ERROR_CODE() for detailed information

Appendix：error code table

code	Description
0	SUCCESS_NO_ERROR
-1	GET_CARDNO_ERROR
-2	INITIAL_SETTING_ERROR
-3	NO_CARDS_FOUND
-4	INSTALL_DRIVER_ERROR
-5	CARD_NUMBER_ERROR
-6	MODE_SETTING_ERROR
-7	LOGIC_SETTING_ERROR
-8	MOTION_INT_ERROR
-9	PCI_INT_ERROR
-10	MOTION_STATUS_ERROR
-11	GETDI_SETTING_ERROR
-12	FILE_LOADING_ERROR
-13	CARD_INITIAL_EEROR
-14	IOCTL_FAIL_ERROR
-15	INn_RANGE_ERROR
-16	NO_SUPPORT_ERROR
-17	INVALID_DEVICE_ERROR
-18	INVALID_AXIS_ERROR
-19	INVALID_MODE_ERROR
-20	EVENT_CREATE_ERROR
-21	INVALID_SPEED_ERROR
-22	INVALID_ACCELERATION_ERROR
-23	INVALID_PULSE_ERROR
-24	DEVICE_OCCUPIED_ERROR
-25	CONFIG_NO_MATCH_ERROR
-26	INVALID_DECELERATION_ERROR
-27	INVALID_SCAN_OFFSET_DATA
-28	INVALID_SCAN_OFFSET_LEN
-29	INVALID_DIRECTION_ERROR
-30	INVALID_MAPPED_VIEW