



USB interface compatible

X7000A evaluation kit

X7000 SERIES EV.KIT

User's Manual Ver. 1.0.0

株式会社 キョーパル

<http://www.kyopal.co.jp/>

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1. Overview

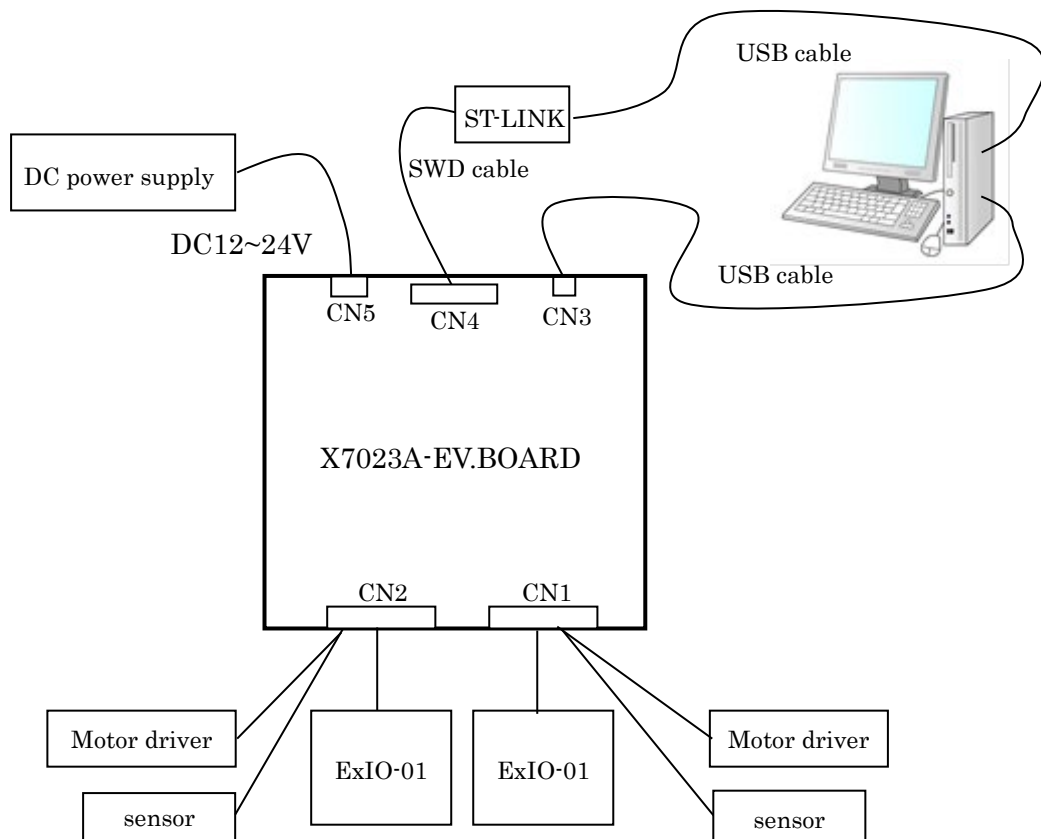
1-1 Introduction

X7000 SERIES EV.KIT is a kit to evaluate the performance of motion control LSI (X7083A / X7043A / X7023A). This kit uses X7023A (2-axis). X7000 series is software compatible and has the same characteristics, it can also be used for evaluation on the X7083A (8-axis) and X7043A (4-axis).

This kit uses ARM (STM32F103VET6) for the CPU. You can rewrite and debug your own firmware through the 6PIN debug interface.

For external input / output, there are sensor driver I / F for 2-axis, CN1 and CN2. CN1 is a differential I / F and CN2 is an open collector I / F. By connecting ExIO-01 to CN1 and CN2 of X7023A-EV.BOARD, you can evaluate the X7000 series and debug the created software without the actual machine.

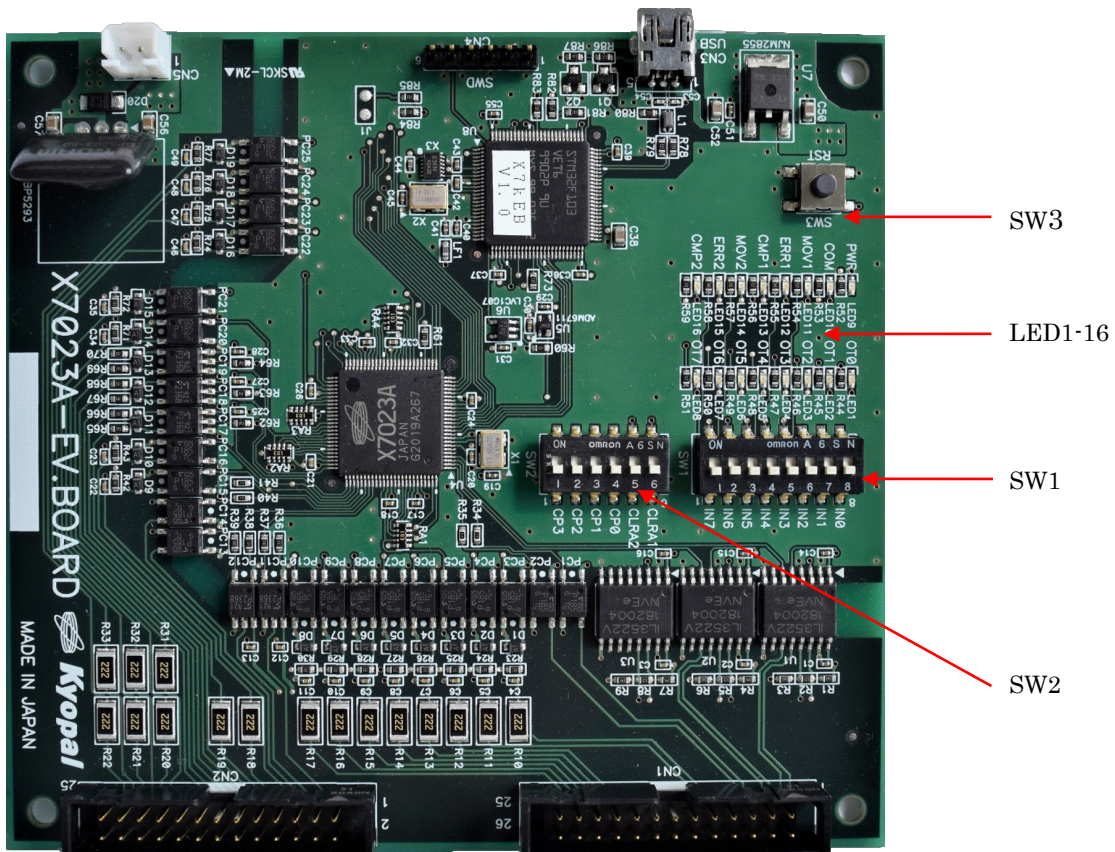
1-2 Constitution



1-3 Description of configuration

connector	Description
CN1	Connect the differential I / O motor driver and the open collector sensor IO. If you connect ExIO-01, you can evaluate and debug the software without the actual machine.
CN2	Connect the open collector motor driver and sensor IO. If you connect ExIO-01, you can evaluate and debug the software without the actual machine.
CN3	Connect your PC and X7023A-EV.BOARD via USB (A miniB). You can check the basic functions and usage of X7023A by starting the Windows application (X7023-Controller) of this kit. The internal circuit of this board uses a USB power supply.
CN4	SWD interface for debugging and programming Cortex-M. Connect ST-LINK. You can also program using the STMicroelectronics development board.
CN5	External power input for sensors and drivers. Input DC12 ~ 24V.

1-4 X7023A-EV.BOARD switch and LED description



① SW1

No.	Signal	Description
1	IN7	It is an 8-bit parallel input connected from IN0 (LSB) to IN7 (MSB) of X7023A. IN0 can be interrupted by changing from OFF to ON.
2	IN6	
3	IN5	
4	IN4	
5	IN3	
6	IN2	
7	IN1	
8	IN0	

② SW2

No.	Signal	Description
1	CP3	It is connected to CP3 of X7023A. If it is turned ON during linear interpolation, it will decelerate.
2	CP2	It is connected to CP2 of X7023A. If it is turned ON during linear interpolation, the speed will be constant.
3	CP1	It is connected to CP1 of X7023A. If it is turned ON during linear interpolation, it will decelerate and stop.
4	CP0	It is connected to CP0 of X7023A. If it is turned ON during linear interpolation, it will stop immediately.
5	CLRA2	If it is turned ON, counter A of Axis # 2 will be cleared to 0.
6	CLRA1	If turned ON, counter A of Axis # 1 will be cleared to 0.

③ SW3

This is a reset signal. Pressing the push button will reset the CPU and X7023A.

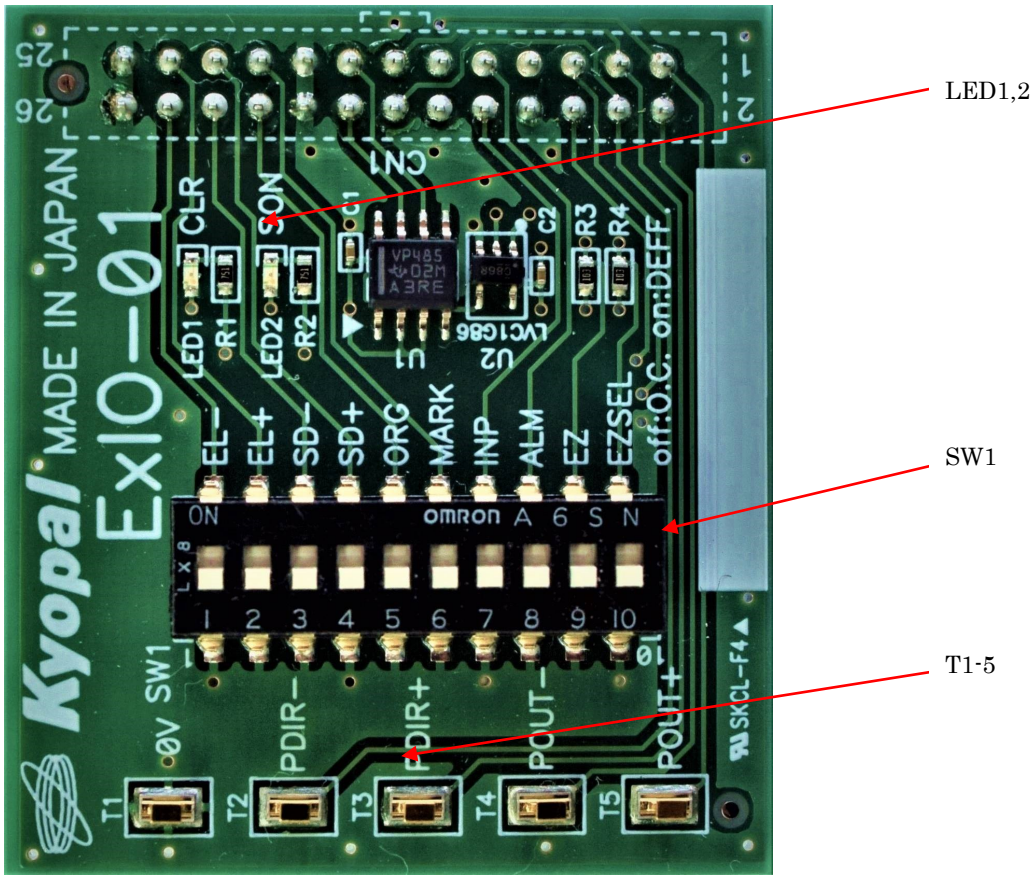
④ LED 1-8

No.	Signal	Description
1	OT0	Lights when the general-purpose output OUT0 is turned ON.
2	OT1	Lights when the general-purpose output OUT1 is turned ON.
3	OT2	Lights when the general-purpose output OUT2 is turned ON.
4	OT3	Lights when the general-purpose output OUT3 is turned ON.
5	OT4	Lights when the general-purpose output OUT4 is turned ON.
6	OT5	Lights when the general-purpose output OUT5 is turned ON.
7	OT6	Lights when the general-purpose output OUT6 is turned ON.
8	OT7	Lights when the general-purpose output OUT7 is turned ON.

⑤ LED 9-16

No.	Signal	Description
9	PWR	When connected to a PC via USB, the power turns on and lights up.
10	COM	Lights when USB communication is performed with the PC.
11	MOV1	Lights when Axis #1 is driven.
12	ERR1	Lights when Axis #1 stops due to an error.
13	CMP1	Lights when the condition of the Axis #1 comparator is satisfied.
14	MOV2	Lights when Axis #2 is driven.
15	ERR2	Lights when Axis #2 stops due to an error.
16	CMP2	Lights when the condition of Axis #2 comparator is satisfied.

1-5 ExIO-01 switch and LED description



① SW1

No.	Signal	Description
1	EL-	You can turn on / off the sensor input -EL.
2	EL+	You can turn on / off the sensor input +EL.
3	SD-	You can turn on / off the sensor input -SLD.
4	SD+	You can turn on / off the sensor input +SLD.
5	ORG	You can turn on / off the sensor input ORG.
6	MARK	You can turn on / off the sensor input MARK.
7	INP	You can turn on / off the sensor input INP.
8	ALM	You can turn on / off the sensor input ALM.
9	EZ	You can turn on / off the sensor input EZ.
10	EZSEL	Turns ON when ExIO-1 is connected to CN1 and OFF when connected to CN2.

② LED1,2

No.	Signal	Description
1	CLR	Lights when the CLR output is ON.
2	SON	Lights when the SON output is ON.

③ T1-5

No.	Signal	Description
1	T1	It is connected to 0V of DC12 ~ 24V power supply connected to CN5.
2	T2	PDIR- and EB- are loopback connected. Check pin for waveform measurement.
3	T3	PDIR+ and EB+ are loopback connected. Check pin for waveform measurement.
4	T4	POUT- and EA- are loopback connected. Check pin for waveform measurement.
5	T5	POUT+ and EA+ are loopback connected. Check pin for waveform measurement.

2. About the application

2-1 Application configuration

Application installation folder

— X7023-Controller.exe	Application launch file
— X7023-Controller.exe.Config	Application configuration file
— Language folder	
— Chinese.xml	Chinese dictionary file
— English.xml	English dictionary file
— Japanese.xml	Japanese dictionary file

2-2 Launch application

LED9 (PWR) lights up when the CN3 of the X7023A-EV.BOARD is connected to the USB port of the PC. Double-click X7023-Controller.exe to display the main screen.



2-3 Description of the main screen

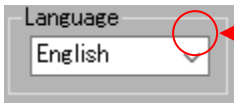
The screenshot shows the main interface of the X7023A-EV Ver1.01. It is divided into several functional areas:

- Counter display:** A table showing counts for two counters (#1 and #2) across channels A, B, C, D, F, and PPS. All counts are currently 0.
- Parameters:** A table for setting parameters R0 through R8 and CMP for both counters. Values are shown in hexadecimal.
- Language:** A dropdown menu currently set to 'English'.
- Operation Status:** A grid of buttons for counter control (CLR, INT, DONE, ERR, DOWN, UP, MOVE) for both counters.
- Sensor Status:** A grid of buttons for sensor control (+EL, -EL, +SLD, -SLD, ORG, EZ, MRK) for both counters.
- Driver:** A grid of buttons for driver control (CLR, SON, ALM, INP) and a Comparator section with 'P=Q' indicators.
- General-purpose inputs/outputs:** A grid of buttons for IN0-7 and OUT0-7.
- Message window:** A small box at the bottom left displaying 'Connected to COM7'.
- Drive operation:** A section for setting drive modes (Constant speed, Deceleration, Stop) and starting the motor for both counters.
- Emergency stop:** A prominent red button for emergency stop.

Red arrows point from text labels to specific elements on the screen:

- Counter display:** Points to the counter count table.
- Various settings and sub-status display buttons:** Points to the top-right area containing the Parameters table and Language dropdown.
- parameter settings:** Points to the Parameters table.
- Language change:** Points to the Language dropdown menu.
- Exit application:** Points to a close button (X) in the top right corner.
- Message window:** Points to the 'Connected to COM7' box.
- Main status and output operations:** Points to the Operation Status and Sensor Status sections.
- Drive operation:** Points to the Drive mode and Start buttons.
- Drive command and mode:** Points to the Bulk set and Index drive controls.
- Counter operation and general-purpose output batch setting:** Points to the Driver and General-purpose inputs/outputs sections.

2-4 Language change

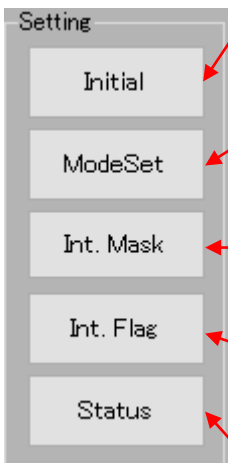


Click the arrow to see a list of languages.



The display on the main screen changes when you select the language to use from Japanese, English, and Chinese. From the next time, it will be displayed in the selected language.

2-5 Display button of the various settings and sub-status



Click the initial setting button to display the initial setting screen. After power-on reset, it is necessary to set the initialization register at least once.

Click the mode setting button to display the control mode setting screen. After power-on reset, it is necessary to set the control mode at least once before driving.

Click the interrupt mask button to display the interrupt mask setting screen.

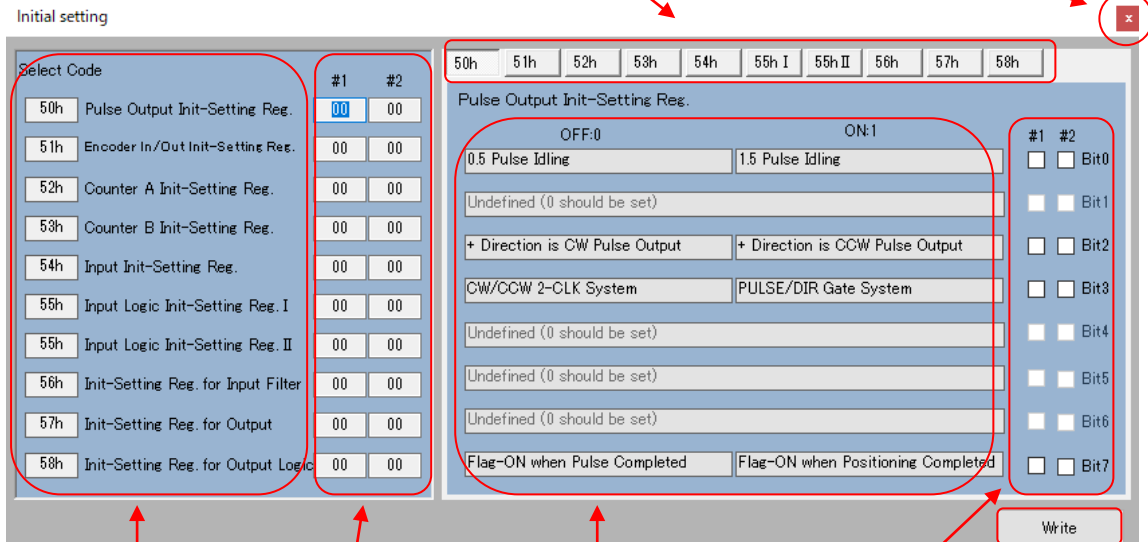
Click the interrupt flag button to display the interrupt flag status. You can reset the interrupt flag on this screen.

Click the status button to display the sub-status display screen. In the sub status, you can check the stop factor and the status of the comparator.

2-5-1 Initial setting screen and setting method.

Each initialization register can be changed by switching 10 tabs.

Click when you exit the initial setting.



Initial setting register type and select code.

Register bit description.

Change by turning the check ON / OFF for each bit. The changes are reflected in the value (hexadecimal) of each initialization register.

The value of each initial setting register. (Hexadecimal)

When you click the button writing the value of each initial setting register (hexadecimal) is set to X7023A.

① Pulse output initial setting register

50h	51h	52h	53h	54h	55h I	55h II	56h	57h	58h	
Pulse Output Init-Setting Reg.										
OFF:0				ON:1				#1	#2	
0.5 Pulse Idling				1.5 Pulse Idling				<input type="checkbox"/>	<input type="checkbox"/>	Bit0
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit1
+ Direction is CW Pulse Output				+ Direction is CCW Pulse Output				<input type="checkbox"/>	<input type="checkbox"/>	Bit2
CW/CCW 2-CLK System				PULSE/DIR Gate System				<input type="checkbox"/>	<input type="checkbox"/>	Bit3
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit4
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit5
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit6
Flag-ON when Pulse Completed				Flag-ON when Positioning Completed				<input type="checkbox"/>	<input type="checkbox"/>	Bit7

When using ExIO-01 for loopback counting, use the 2-clock method.

② Encoder input initial setting register.

50h	51h	52h	53h	54h	55h I	55h II	56h	57h	58h	
Encoder In/Out Init-Setting Reg.										
EA, EB Input Mode Code 1				#1	2 CLK, NEG Logic				#1	#2
EA, EB Input Mode Code 2				#2	2 CLK, NEG Logic				<input type="checkbox"/>	<input type="checkbox"/>
Undefined (0 should be set)									<input type="checkbox"/>	<input type="checkbox"/>
Undefined (0 should be set)									<input type="checkbox"/>	<input type="checkbox"/>
Undefined (0 should be set)									<input type="checkbox"/>	<input type="checkbox"/>
Undefined (0 should be set)									<input type="checkbox"/>	<input type="checkbox"/>
Undefined (0 should be set)									<input type="checkbox"/>	<input type="checkbox"/>
Undefined (0 should be set)									<input type="checkbox"/>	<input type="checkbox"/>
Undefined (0 should be set)									<input type="checkbox"/>	<input type="checkbox"/>

- 2 CLK, NEG Logic
- 2 CLK, NEG Logic
- 2-Phase CLK, x 4 multi
- 2-Phase CLK, x 2 multi
- 2-Phase CLK, x 1 multi

You can also change it from the pull-down menu.

When using ExIO-01, use 2-clock negative logic.

It will be reflected in the check.

③ Initial setting register of counter A

50h	51h	52h	53h	54h	55h I	55h II	56h	57h	58h	
Counter A init-Setting reg										
OFF:0					ON:1					#1 #2
Internal oscillation pulse count disable					Internal oscillation pulse count enable					<input type="checkbox"/> <input type="checkbox"/> Bit0
Encoder count disable					Encoder count enable					<input type="checkbox"/> <input type="checkbox"/> Bit1
Undefined (0 should be set)										
Encoder input forward count					Encoder input reverse count					<input type="checkbox"/> <input type="checkbox"/> Bit3
Undefined (0 should be set)										
Count for -8,388,608 to 8,388,607					Count for 0 to 16,777,215					<input type="checkbox"/> <input type="checkbox"/> Bit5
24-bit Mode					32-bit Mode					<input type="checkbox"/> <input type="checkbox"/> Bit6
Undefined (0 should be set)										

Absolute value count, 2's complement count, 24-bit mode, and 32-bit mode can be selected. The settings are reflected in the display of the count value on the main screen and the input of the count operation.

The count of the object you can choose the internal oscillation pulse or encoder feedback pulse. If you want to use it as a deviation counter, check bits0,1,3.

④ Initial setting register of counter B

50h	51h	52h	53h	54h	55h I	55h II	56h	57h	58h	
Counter B init-Setting reg.										
OFF:0					ON:1					#1 #2
Internal oscillation pulse count disable					Internal oscillation pulse count enable					<input type="checkbox"/> <input type="checkbox"/> Bit0
Encoder count disable					Encoder count enable					<input type="checkbox"/> <input type="checkbox"/> Bit1
Undefined (0 should be set)										
Encoder input forward count					Encoder input reverse count					<input type="checkbox"/> <input type="checkbox"/> Bit3
Undefined (0 should be set)										
Count for -8,388,608 to 8,388,607					Count for 0 to 16,777,215					<input type="checkbox"/> <input type="checkbox"/> Bit5
24-bit mode					32-bit mode					<input type="checkbox"/> <input type="checkbox"/> Bit6
Undefined (0 should be set)										

It is similar to the initial setting register of the counter A.

⑤ Input initial setting register

50h	51h	52h	53h	54h	55h I	55h II	56h	57h	58h	
Input Init-Setting Reg.										
OFF:0				ON:1				#1	#2	
+SLD and -SLD are Dec. inputs				+SLD and -SLD are Dec. stop inputs				<input type="checkbox"/>	<input type="checkbox"/>	Bit0
+SLD and -SLD are Level inputs				+SLD and -SLD are Edge inputs				<input type="checkbox"/>	<input type="checkbox"/>	Bit1
ORG is a low-sensitivity input				ORG is a high-sensitivity input				<input type="checkbox"/>	<input type="checkbox"/>	Bit2
MARK is a low-sensitivity input				MARK is a high-sensitivity input				<input type="checkbox"/>	<input type="checkbox"/>	Bit3
CLRA is the level clear input				CLRA is the edge clear input				<input type="checkbox"/>	<input type="checkbox"/>	Bit4
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit5
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit6
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit7

⑥ Input logic of the initial setting register I

50h	51h	52h	53h	54h	55h I	55h II	56h	57h	58h	
Input Logic Init-Setting Reg. I										
OFF:0				ON:1				#1	#2	
+EL is a NEG logic input				+EL is a POS logic input				<input type="checkbox"/>	<input type="checkbox"/>	Bit0
-EL is a NEG logic input				-EL is a POS logic input				<input type="checkbox"/>	<input type="checkbox"/>	Bit1
ALM is a NEG logic input				ALM is a POS logic input				<input type="checkbox"/>	<input type="checkbox"/>	Bit2
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit3
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit4
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit5
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit6
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit7

⑦ Input logic of the initial setting register II

50h	51h	52h	53h	54h	55h I	55h II	56h	57h	58h
-----	-----	-----	-----	-----	-------	--------	-----	-----	-----

Input Logic Init-Setting Reg. II

OFF:0	ON:1	#1	#2	
ORG is NEG logic	ORG is POS logic	<input type="checkbox"/>	<input type="checkbox"/>	Bit0
EZ is NEG logic	EZ is POS logic	<input type="checkbox"/>	<input type="checkbox"/>	Bit1
+SLD is a NEG logic input	+SLD is a POS logic input	<input type="checkbox"/>	<input type="checkbox"/>	Bit2
-SLD is a NEG logic input	-SLD is a POS logic input	<input type="checkbox"/>	<input type="checkbox"/>	Bit3
INP is a NEG logic input	INP is a POS logic input	<input type="checkbox"/>	<input type="checkbox"/>	Bit4
MARK is a NEG logic input	MARK is a POS logic input	<input type="checkbox"/>	<input type="checkbox"/>	Bit5
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/>	Bit6
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/>	Bit7

⑧ Initial setting register (F) for input filter

50h	51h	52h	53h	54h	55h I	55h II	56h	57h	58h
-----	-----	-----	-----	-----	-------	--------	-----	-----	-----

Init-Setting Reg. for In-Filter

Set sensitivity of + EL, -EL, ALM, + SLD, -SLD (1 to 256)
Sensitivity is one cycle of $16 \times F \times \text{reference CLK}$

#1	#2
256	256

Enter in the range of 1-256 in the input text box. The value of the initial setting register in hexadecimal When you enter the Enter key will be reflected.

⑨ Output initial setting register

50h	51h	52h	53h	54h	55h I	55h II	56h	57h	58h	
Init-Setting Reg. for Output										
OFF:0				ON:1				#1	#2	
CLR is 1-shot output				CLR is general-purpose output				<input type="checkbox"/>	<input type="checkbox"/>	Bit0
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit1
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit2
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit3
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit4
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit5
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit6
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit7

⑩ Initial Setting Register for Output Logic

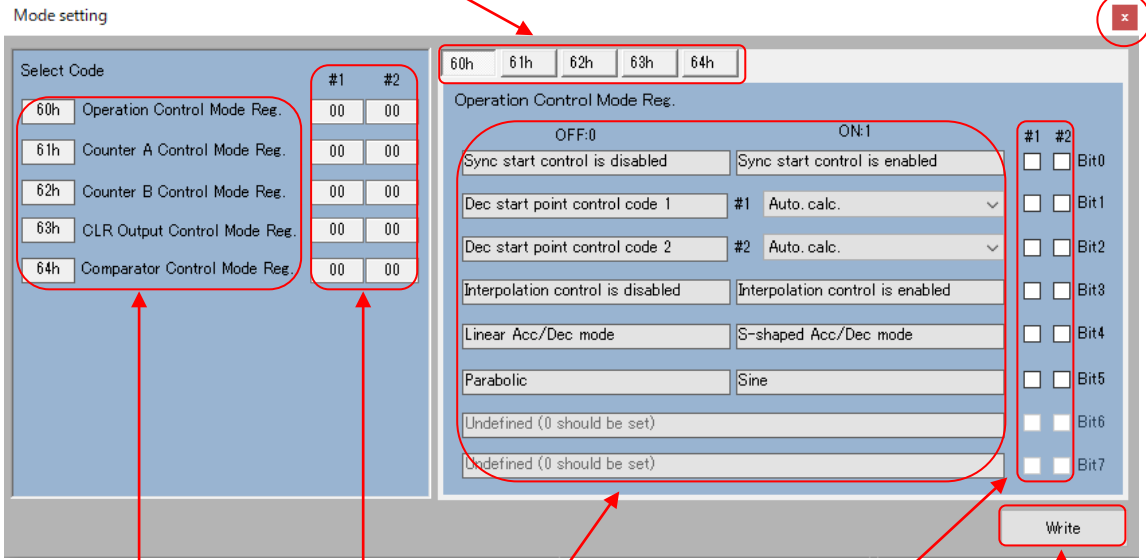
50h	51h	52h	53h	54h	55h I	55h II	56h	57h	58h	
Init-Setting Reg. for Output Logic										
OFF:0				ON:1				#1	#2	
POUT is a NEG logic output				POUT is a POS logic output				<input type="checkbox"/>	<input type="checkbox"/>	Bit0
PDIR is a NEG logic output				PDIR is a POS logic output				<input type="checkbox"/>	<input type="checkbox"/>	Bit1
CLR is a NEG logic output				CLR is a POS logic output				<input type="checkbox"/>	<input type="checkbox"/>	Bit2
INT is a NEG logic output				INT is a POS logic output				<input checked="" type="checkbox"/>	<input type="checkbox"/>	Bit3
ERROR is a NEG logic output				ERROR is a POS logic output				<input type="checkbox"/>	<input type="checkbox"/>	Bit4
MOVE is a NEG logic output				MOVE is a POS logic output				<input type="checkbox"/>	<input type="checkbox"/>	Bit5
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit6
Undefined (0 should be set)								<input type="checkbox"/>	<input type="checkbox"/>	Bit7

Bit3 INT logic is fixed to negative logic.

2-5-2 Mode setting screen and setting method

Each mode setting register can be changed by switching 5 tabs.

Click when you exit the mode setting.



Mode setting register type and select code.

Value of each mode setting register (hexadecimal)

Register bit description.

Change by turning the check ON / OFF for each bit. The change is reflected in the value (hexadecimal number) of each mode setting register.

Click the write button to set the value (hexadecimal) of each mode setting register to X7023A.

① Operation control mode setting register

60h	61h	62h	63h	64h
Operation Control Mode Reg.				
OFF:0		ON:1		#1 #2
Sync start control is disabled		Sync start control is enabled		<input type="checkbox"/> <input type="checkbox"/> Bit0
Dec start point control code 1		#1 Auto. calc.	<input type="checkbox"/> <input type="checkbox"/> Bit1	
Dec start point control code 2		#2 Auto. calc.	<input type="checkbox"/> <input type="checkbox"/> Bit2	
Interpolation control is disabled		Interpolation control is enabled		<input type="checkbox"/> <input type="checkbox"/> Bit3
Linear Acc/Dec mode		S-shaped Acc/Dec mode		<input type="checkbox"/> <input type="checkbox"/> Bit4
Parabolic		Sine		<input type="checkbox"/> <input type="checkbox"/> Bit5
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit6
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit7

You can also change it from the pull-down menu.

Auto. calc.

Auto. calc.

Offset setting

Manual setting

No deceleration

It will be reflected in the check.

#1 Drive mode		#2 Drive mode	
<input type="checkbox"/> Sync control	Linear acc/dec	<input type="checkbox"/> Sync control	Linear acc/dec
<input type="checkbox"/> Interpolation	Auto. calc.	<input type="checkbox"/> Interpolation	Auto. calc.

The operation control mode setting is reflected in the drive mode on the main screen.

② Counter A Control Register

60h	61h	62h	63h	64h
Counter A Control Reg.				
OFF:0		ON:1		#1 #2
Auto. clr does not occur after error stop		Auto. clr occurs after error stop		<input type="checkbox"/> <input type="checkbox"/> Bit0
Auto. clr does not occur after normal stop		Auto. clr occurs after normal stop		<input type="checkbox"/> <input type="checkbox"/> Bit1
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit2
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit3
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit4
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit5
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit6
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit7

③ Counter B Control Register

60h	61h	62h	63h	64h
Counter B Control Reg.				
OFF:0		ON:1		#1 #2
Auto. clr does not occur after error stop		Auto. clr occurs after error stop		<input type="checkbox"/> <input type="checkbox"/> Bit0
Auto. clr does not occur after normal stop		Auto. clr occurs after normal stop		<input type="checkbox"/> <input type="checkbox"/> Bit1
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit2
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit3
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit4
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit5
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit6
Undefined (0 should be set)				<input type="checkbox"/> <input type="checkbox"/> Bit7

④ CLR output control mode register

60h	61h	62h	63h	64h
CLR Output Control Mode Reg.				
OFF:0		ON:1		#1 #2
CLR is not Out-Auto after error stop	CLR is Out-Auto after error stop	<input type="checkbox"/>	<input type="checkbox"/>	Bit0
CLR is not Out-Auto after normal stop	CLR is Out-Auto after normal stop	<input type="checkbox"/>	<input type="checkbox"/>	Bit1
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/>	Bit2
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/>	Bit3
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/>	Bit4
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/>	Bit5
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/>	Bit6
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/>	Bit7

⑤ Comparator control mode setting register

60h	61h	62h	63h	64h
Comparator Control Mode Reg.				
OFF:0		ON:1		#1 #2
P input select code 1	#1 Counter A	<input type="checkbox"/>	<input type="checkbox"/>	Bit0
P input select code 2	#2 Counter A	<input type="checkbox"/>	<input type="checkbox"/>	Bit1
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/>	Bit2
Q input select code 1	#1 Counter A	<input type="checkbox"/>	<input type="checkbox"/>	Bit3
Q input select code 2	#2 Counter A	<input type="checkbox"/>	<input type="checkbox"/>	Bit4
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/>	Bit5
Absolute value comparison	2 complement comparison	<input type="checkbox"/>	<input type="checkbox"/>	Bit6
Comparator output is P = Q	Comparator output is P > Q	<input type="checkbox"/>	<input type="checkbox"/>	Bit7

Counter A
Counter A
 Counter B
 Counter C
 Comparator Reg.

You can also change it from the pull-down menu.

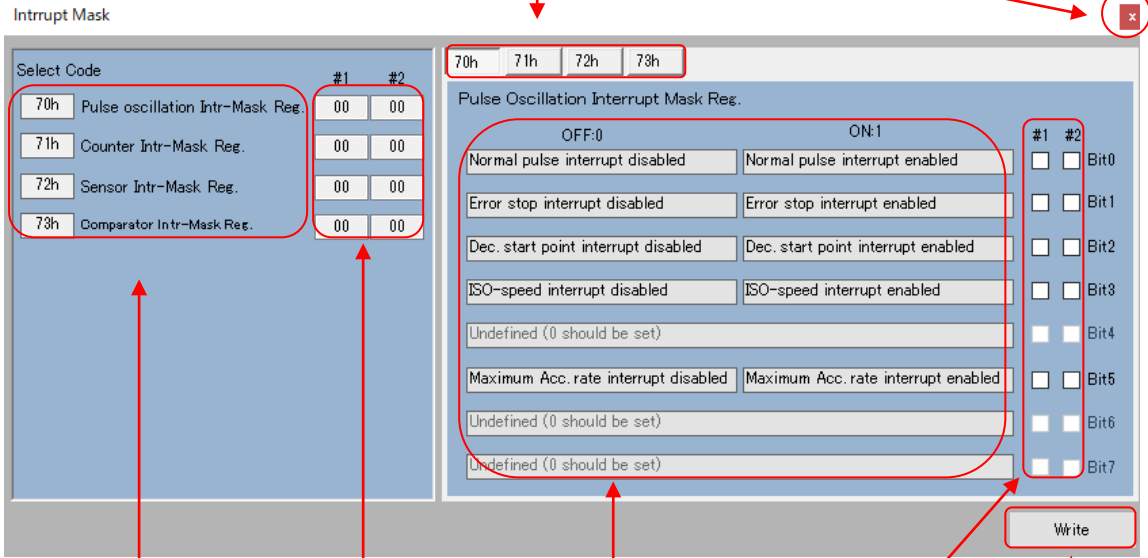
It will be reflected in the check.

Changes in the comparator control mode are reflected in the CMP parameter settings in the main menu, the comparator status display, and the CMP1 and 2 LEDs on the board.

2-5-3 Interrupt mask setting screen and setting method

Each interrupt mask register can be changed by switching 4 tabs.

Click when you exit the interrupt mask setting.



Interrupt mask register type and select code.

Register bit description.

Value of each interrupt mask register (hexadecimal)

Change by turning the check ON / OFF for each bit. The change is reflected in the value (hexadecimal number) of each interrupt mask setting register.

Click the write button to set the value (hexadecimal) of each interrupt mask register to X7023A.

① Pulse oscillation interrupt mask register

70h	71h	72h	73h		
Pulse Oscillation Interrupt Mask Reg.					
OFF:0		ON:1		#1	#2
Normal pulse interrupt disabled		Normal pulse interrupt enabled		<input type="checkbox"/>	<input type="checkbox"/> Bit0
Error stop interrupt disabled		Error stop interrupt enabled		<input type="checkbox"/>	<input type="checkbox"/> Bit1
Dec. start point interrupt disabled		Dec. start point interrupt enabled		<input type="checkbox"/>	<input type="checkbox"/> Bit2
ISO-speed interrupt disabled		ISO-speed interrupt enabled		<input type="checkbox"/>	<input type="checkbox"/> Bit3
Undefined (0 should be set)				<input type="checkbox"/>	<input type="checkbox"/> Bit4
Maximum Acc. rate interrupt disabled		Maximum Acc. rate interrupt enabled		<input type="checkbox"/>	<input type="checkbox"/> Bit5
Undefined (0 should be set)				<input type="checkbox"/>	<input type="checkbox"/> Bit6
Undefined (0 should be set)				<input type="checkbox"/>	<input type="checkbox"/> Bit7

② Counter interrupt mask register

70h	71h	72h	73h		
Counter Interrupt Mask Reg.					
OFF:0		ON:1		#1	#2
Counter A carry interrupt disabled		Counter A carry interrupt enabled		<input type="checkbox"/>	<input type="checkbox"/> Bit0
Counter A borrow interrupt disabled		Counter A borrow interrupt enabled		<input type="checkbox"/>	<input type="checkbox"/> Bit1
Counter B carry interrupt disabled		Counter B carry interrupt enabled		<input type="checkbox"/>	<input type="checkbox"/> Bit2
Counter B borrow interrupt disabled		Counter B borrow interrupt enabled		<input type="checkbox"/>	<input type="checkbox"/> Bit3
Undefined (0 should be set)				<input type="checkbox"/>	<input type="checkbox"/> Bit4
Counter C borrow interrupt disabled		Counter C borrow interrupt enabled		<input type="checkbox"/>	<input type="checkbox"/> Bit5
Undefined (0 should be set)				<input type="checkbox"/>	<input type="checkbox"/> Bit6
Undefined (0 should be set)				<input type="checkbox"/>	<input type="checkbox"/> Bit7

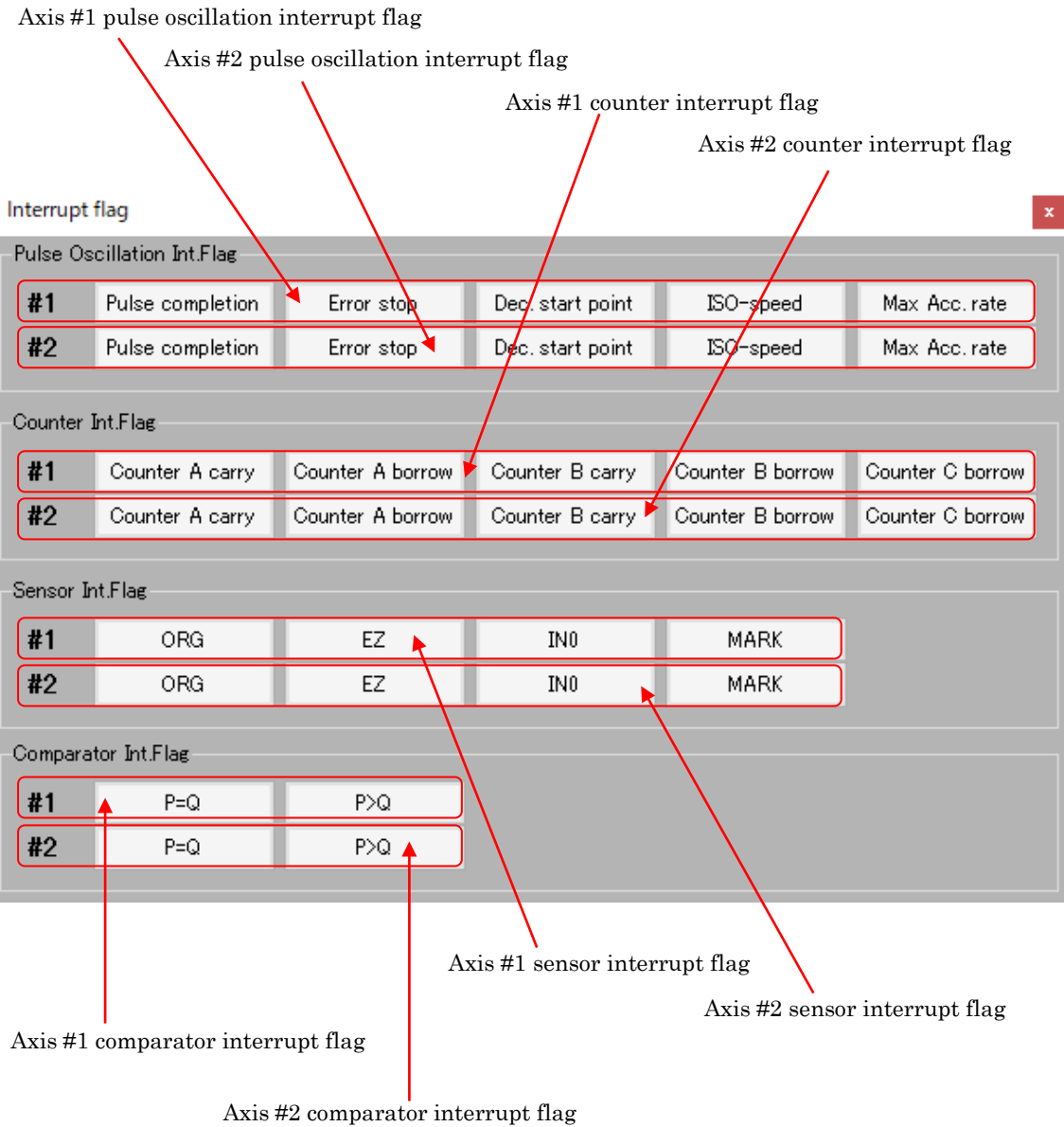
③ Sensor interrupt mask register

70h	71h	72h	73h
Sensor Interrupt Mask Reg.			
OFF:0		ON:1	
ORG interrupt disabled	ORG interrupt enabled	<input type="checkbox"/>	<input type="checkbox"/> Bit0
EZ interrupt disabled	EZ interrupt enabled	<input type="checkbox"/>	<input type="checkbox"/> Bit1
IN0 interrupt disabled	IN0 interrupt enabled	<input type="checkbox"/>	<input type="checkbox"/> Bit2
MARK interrupt disabled	MARK interrupt enabled	<input type="checkbox"/>	<input type="checkbox"/> Bit3
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/> Bit4
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/> Bit5
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/> Bit6
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/> Bit7

④ Comparator interrupt mask register

70h	71h	72h	73h
Comparator Intr-Mask Reg.			
OFF:0		ON:1	
P = Q interrupt disabled	P = Q interrupt enabled	<input type="checkbox"/>	<input type="checkbox"/> Bit0
P > Q interrupt disabled	P > Q interrupt enabled	<input type="checkbox"/>	<input type="checkbox"/> Bit1
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/> Bit2
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/> Bit3
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/> Bit4
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/> Bit5
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/> Bit6
Undefined (0 should be set)		<input type="checkbox"/>	<input type="checkbox"/> Bit7

2-5-4 Interrupt flag register and reset



① Pulse oscillation interrupt flag

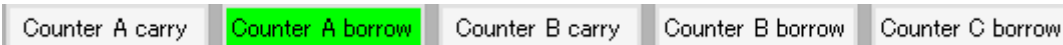


Type	Color	Description
Pulse output completed	Green	Pulse output completion interrupt flag is ON
Error stop	Red	Error stop interrupt flag is ON
Deceleration start point	Green	Deceleration start point interrupt flag is ON
Constant speed	Green	Constant speed interrupt flag is ON
Maximum acceleration	Green	Maximum acceleration rate interrupt flag is ON

When the flag is ON, the button is displayed in green. When you click the button, the flag will be reset.

The pulse output completion and error stop are reset by the A0h command, so they are reset at the same time.

② Counter interrupt flag



Type	Color	Description
Counter A carry	Green	Counter A carry interrupt flag is ON
Counter A borrow	Green	Counter A borrow interrupt flag is ON
Counter B carry	Green	Counter B carry interrupt flag is ON
Counter B borrow	Green	Counter B borrow interrupt flag is ON
Counter C borrow	Green	Counter C borrow interrupt flag is ON

When the flag is ON, the button is displayed in green. When you click the button, the flag will be reset.

③ Sensor interrupt flag



Type	Color	Description
ORG	Green	ORG interrupt flag is ON
EZ	Green	EZ interrupt flag is ON
IN0	Green	IN0 interrupt flag is ON
MARK	Green	MARK interrupt flag is ON

The EZ will generate an interrupt if the EZ becomes active after the ORG becomes active and deceleration is completed by the home return drive.

When the flag is ON, the button is displayed in green. When you click the button, the flag will be reset.

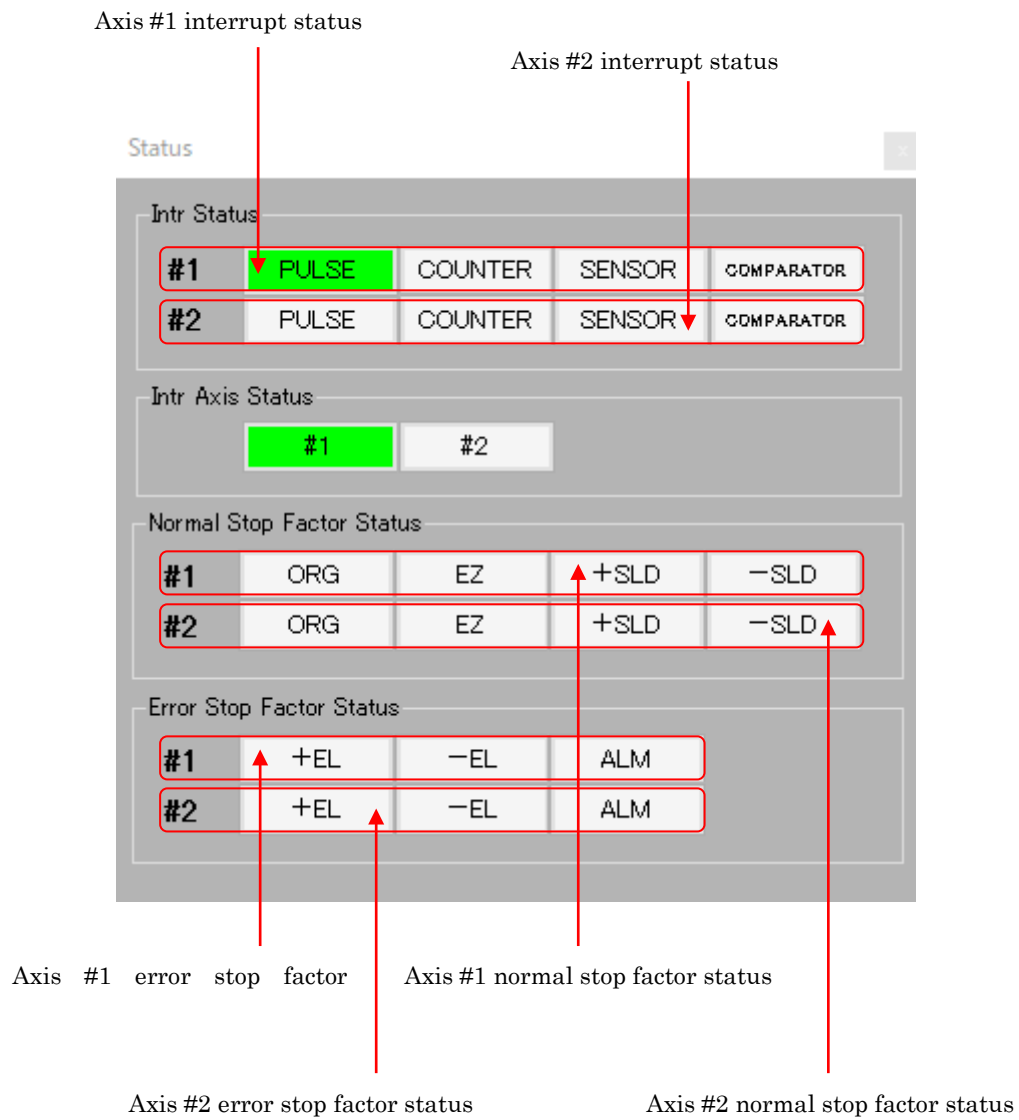
④ Comparator interrupt flag



Type	Color	Description
P=Q	Green	P = Q interrupt flag is ON
P>Q	Green	P > Q interrupt flag is ON

When the flag is ON, the button is displayed in green. When you click the button, the flag will be reset.

2-5-5 Display sub-status



① Interrupt status

The interrupt status indicates the type of interrupt.



Type	Color	Description
PULSE	Green	Pulse output interrupt flag is ON
COUNTER	Green	Counter interrupt flag is ON
SENSOR	Green	Sensor interrupt flag is ON
COMPARATOR	Green	Comparator interrupt flag is ON

② Interrupt axis status



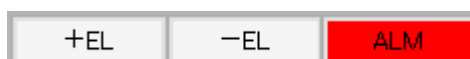
Type	Color	Description
#1	Green	Axis #1 interrupt flag is ON
#2	Green	Axis #2 interrupt flag is ON

③ Normal stop factor status



Type	Color	Description
ORG	Green	The return to origin by the ORG sensor is completed.
EZ	Green	Home return completed by ORG sensor and EZ sensor.
+SLD	Green	+ SLD sensor slowdown stop
-SLD	Green	- SLD sensor slowdown stop

④ Error stop factor status



Type	Color	Description
+EL	Red	Emergency stop by limit sensor +EL.
-EL	Red	Emergency stop by limit sensor -EL.
+SLD	Red	Emergency stop by limit sensor ALM.

2-6 About parameter

Parameters	#1	#2
R0	300	256
R1	0	0
R2	0	0
R3	100	4100
R4	5000	256
R5	20	9216
R6	20	0
R7	2050	0
R8	2115848	9732
CMP	0	0

The parameters of R0 to 8 are indefinite when the power-on reset of X7023A is performed. When the application is started, it is displayed in brown characters. When set, it becomes black characters. An error will occur if the drive is started when the characters are brown.

The comparator register (CMP) is initialized to 0 during power-on reset of the X7023A. It is always displayed in black characters.

Note

When the application is restarted without turning off the power, the X7023A retains the previous values of R0 to R8 and CMP. When the reset (RST) button of SW3 is pressed, R0 to R8 become indefinite values.

2-6-1 Parameter input

Move the cursor to the text box for the parameter you want to set. Back space key and 0 to 9 can be entered. In addition, depending on the parameters, - key can also be entered.

 ← Insert

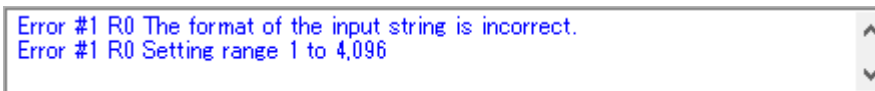
 ← Overwrite

When you enter the Enter key rewriting of the parameters it is done.

When the cursor moves from the text box being edited, the display returns to the currently set value.

2-6-2 error indication

If the setting is blank or outside the parameter setting range, it will be displayed in the message window.



2-6-3 Parameter register type and setting range

Symbol	Parameter register type	Setting range	
R ₀	Frequency multiplication ratio setting register	1~4,096	
R ₁	Output pulse count setting register	0~16,777,215	
R ₂	Deceleration start point setting register	0~16777,215	Manual setting mode
		-8,388,608~8,388,607	Offset setting mode
R ₃	Startup frequency setting register	1~16,383	Linear acceleration/deceleration mode or deceleration start point manual setting mode
		1~10,000	S-shaped acceleration/deceleration mode or deceleration start point automatic calculation mode
R ₄	Maximum frequency setting register	1~16,383	Linear acceleration/deceleration mode or deceleration start point manual setting mode
		1~10,000	S-shaped acceleration/deceleration mode or deceleration start point automatic calculation mode
R ₅	Acceleration rate setting register	1~16,383	
R ₆	Deceleration rate setting register	1~16,383	
R ₇	S-shaped acceleration/deceleration section setting register	1~8,191	
R ₈	Linear interpolation base setting register	1~16,777,215	
CMP	Comparator register	0~16,777,215	Absolute value comparison
		-8,388,608~8,388,607	2's complement comparison

2-6-4 Precautions for parameter setting

① R₅, R₆

In the deceleration start point automatic calculation mode, set the same setting value.

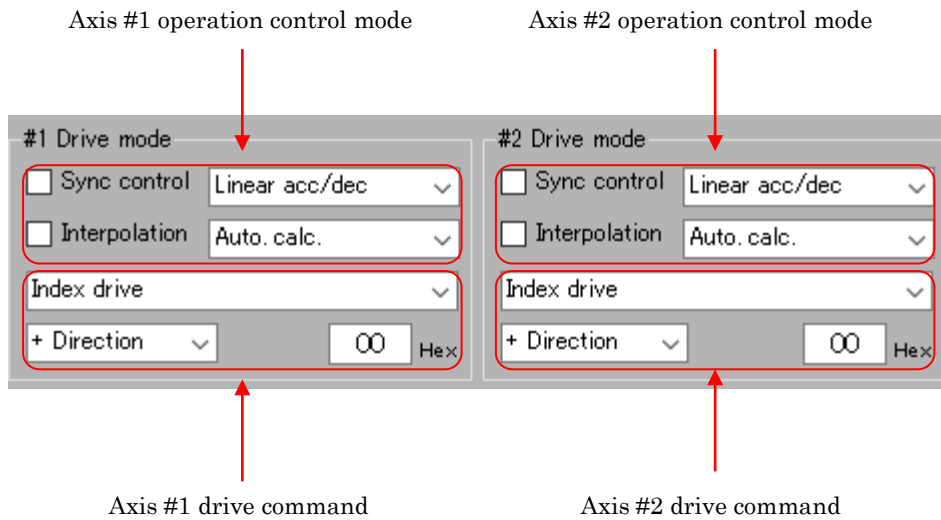
② R₇

The set value of register R₇ should be no more than $(R_4 - R_3)/2$.

③ R₈

Set $R_1 \leq R_8$. Make it greater than or equal to the setting value of the maximum movement axis for linear interpolation.

2-7 About drive mode



2-7-1 Operation control mode

The state set in the operation control mode of the mode setting is displayed in the drive mode of this main screen. The operation control mode can be changed even in this drive mode.

① Sync start control

Sync control ← When checked, sync start control will be applied.

② Interpolation control

Interpolation ← When checked, interpolation control is applied.

③ Acceleration / deceleration shape

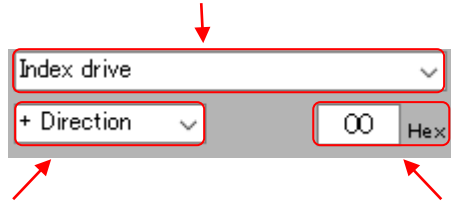
Linear acc/dec ↓ ← Select from the pull-down menu.
 Linear acc/dec
 Parabolic S-shaped acc
 Sine S-shaped acc/dec

④ Deceleration start point

Auto. calc. ↓ ← Select from the pull-down menu.
 Auto. calc.
 Offset setting
 Manual setting
 No deceleration

2-7-2 Command settings

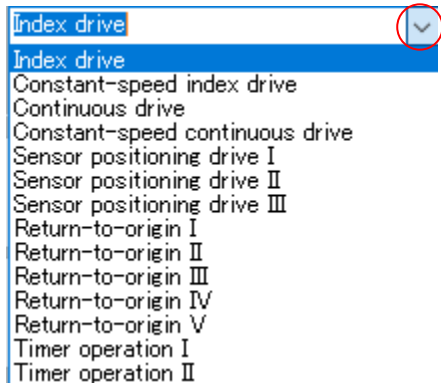
Select the command type.



Select the drive direction.

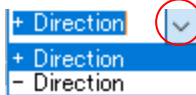
Displays the instruction code of the selected command in hexadecimal. You can also switch and execute commands by typing directly into this text box.

① Command type



Select from the pull-down menu.

② Drive direction



Select from the pull-down menu.

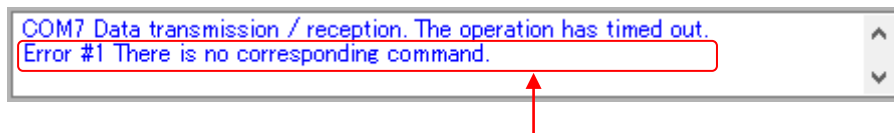
③ Command text box

It can be displayed or entered in hexadecimal. Back space key, the numbers 0 ~ 9, A ~ F, the letters of a ~ f you can enter. When you enter the Enter key type of command is determined.

For drive commands, the command type and drive direction text will change.

The interrupt flag reset, OUT0-7 general purpose output, and SON and CLR bit operations are performed immediately.

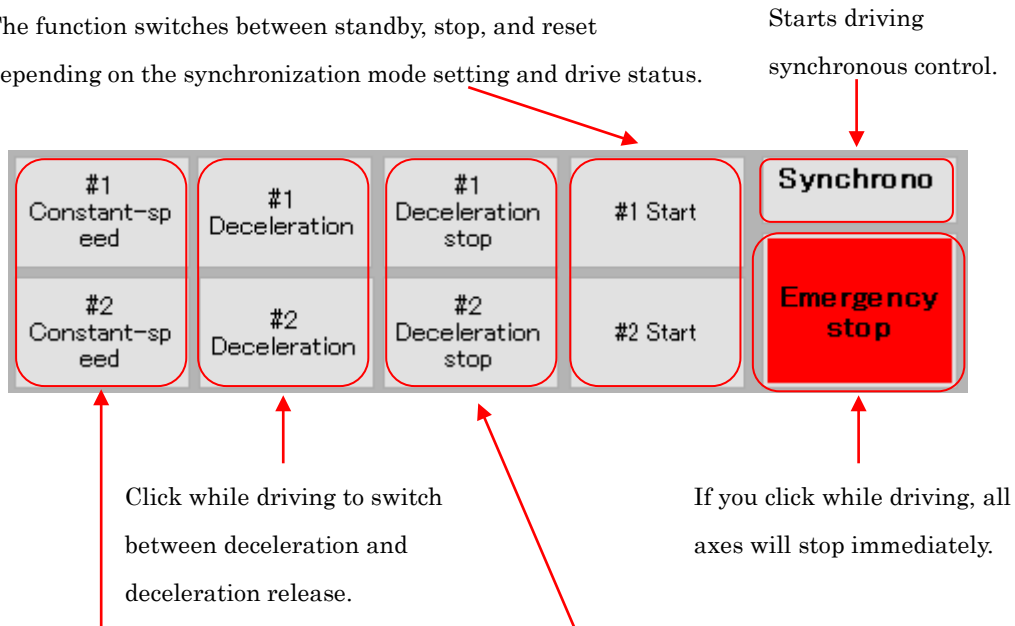
④ Command error



If there is no instruction code is an error displayed in the message window.

2-8 About drive operation buttons

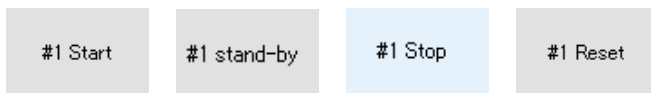
The function switches between standby, stop, and reset depending on the synchronization mode setting and drive status.



Click while driving to switch between constant speed and constant speed release.

Click while driving to decelerate and stop.

2-8-1 Start button



The function is switched as follows.

① Start

Click the start button to issue the settings and instruction code to the X7023A in the following order.

1. Operation control mode setting value
2. Register R₁ setting value
3. Register R_s setting value when the interpolation mode
4. Instruction code

For asynchronous control, the drive or timer starts. The button will display a stop.

In the case of synchronization control, it waits for the synchronization start button to be clicked. The button will display standby.

② Standby

Drive or timer when you click the button of synchronous start will start. Button will be the display of the stop.

③ Stop

It issued the instruction code of the immediate stop (30h), and then immediately stopped. When stopped, the button will display a reset.

④ Reset

The operation completion flag reset (A0h) instruction code is issued. Register R₁ setting value is the value of counter C. The button will display the start.

2-8-2 Constant speed button

#1
Constant-speed

#1
Constant-speed cancel

The function will switch.

① Constant speed

A constant speed (34h) instruction code is issued and fixed at the current speed. The button will display the constant speed release.

② Constant speed release

Issued the instruction code of the constant speed release (35h), and acceleration and deceleration resumes. The button will be the display of constant speed.

2-8-3 Deceleration button

#1
Deceleration

#2
Deceleration cancel

The function will switch.

① Decelerate

It issued the instruction code of deceleration (32h), to start the deceleration. The button will display the release deceleration.

② Release deceleration

The deceleration release (33h) instruction code is issued to release the deceleration. The button will display deceleration.

2-8-4 Deceleration stop button

By issuing the instruction code of deceleration stop (31h), and the deceleration stop.

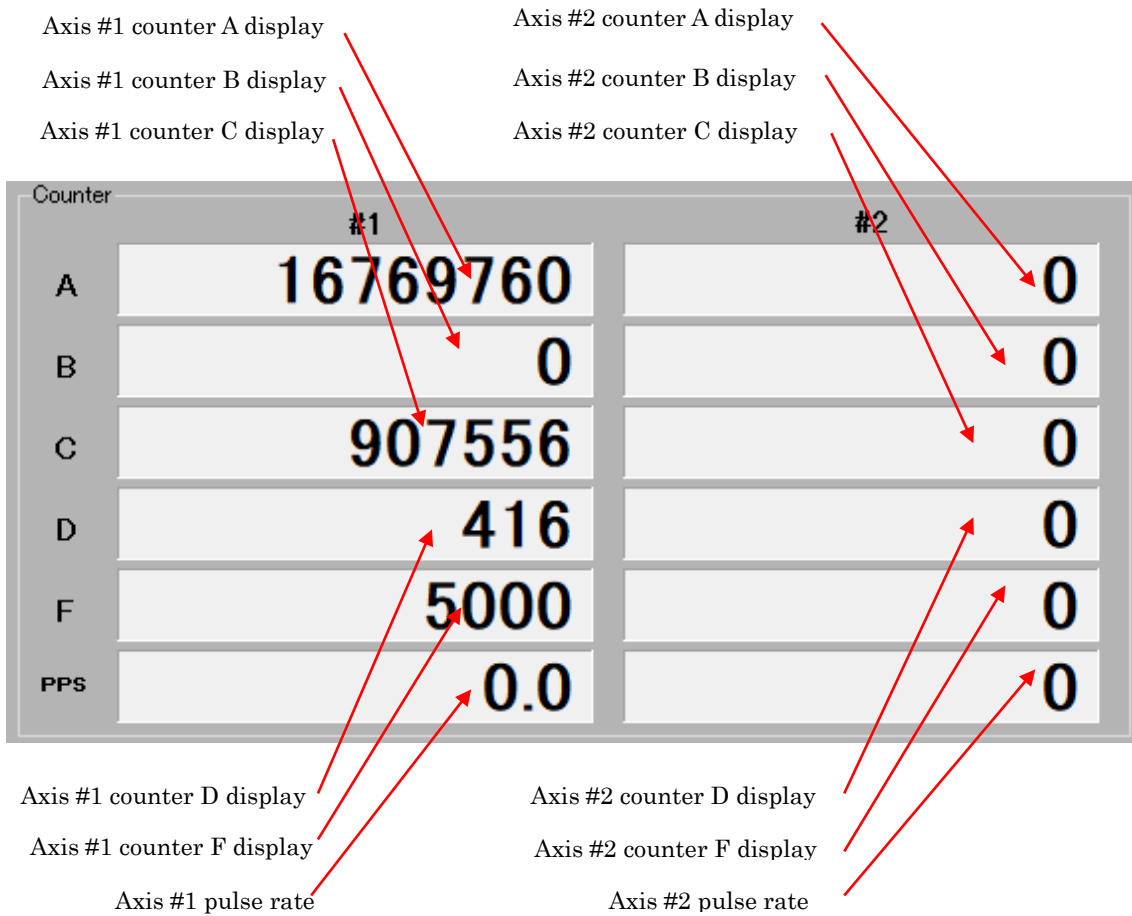
2-8-5 Synchronous start button

Drive or timer the axis of the standby display in the synchronization control starts.

2-8-6 Emergency stop button

All axes will stop immediately.

2-9 About counter display



2-9-1 Counter A, B

The display format of counters A and B changes depending on the initial settings of counters A and B.

Initial setting of counter A, B			Display format
bit5	Bit6	Setting	
0	0	24bit、2's complement	-8,388,608~8,388,607
0	1	24bit、Absolute value	0~16,777,215
1	0	32bit、2's complement	-2,147,483,648~2,147,483,647
1	1	32bit、Absolute value	0~4,294,967,295

2-9-2 Counter C

Counter C is changed to the value of R1 at the same time when the R1 parameter is rewritten.

Also, when the operation completion flag reset (A0h) instruction code is executed, the value of counter C is reflected in the R1 parameter.

2-9-3 Counter D

Display of counter D will vary according to the setting of the deceleration start point control code of the operation control mode.

Deceleration start point control codes			Display format
Code2	Code1	Setting	
0	0	Automatic calculation mode	0~16,777,215
0	1	Offset setting mode	-8,388,608~8,388,607
1	0	Manual setting mode	R ₂ register setting value
1	1	No deceleration mode	0~16,777,215

Counter D is changed to the value of R2 at the same time as the R2 parameter is rewritten.

When automatic calculation is set, 0 is cleared at the start of driving.

2-9-4 Counter F

Displays the value of the frequency counter F.

2-9-5 Pulse rate (pulses per second)

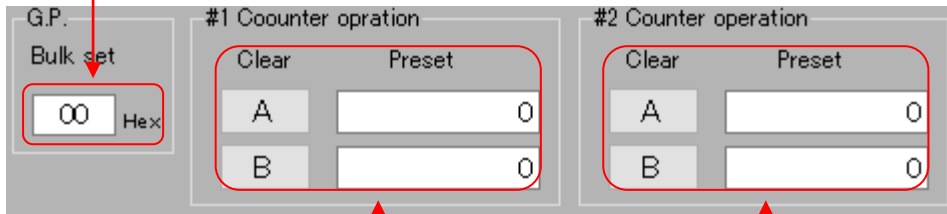
Displays the output pulse rate [pps].

$$\text{Pulse rate} = 300 \times F / R_0 \text{ [pps]}$$

When $R_0 > 300$, the display is in 0.1 units.

2-10 About counter operation and batch setting of general-purpose output

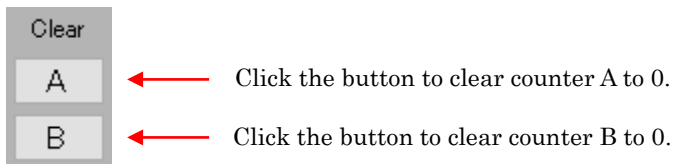
Batch setting input text for general-purpose output



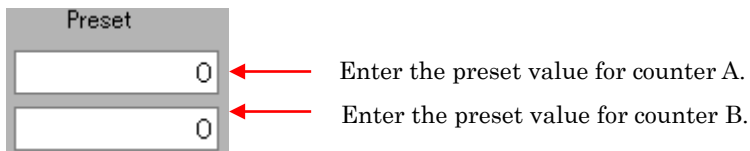
You can clear and preset axis #1 counter.

You can clear and preset axis #2 counter.

2-10-1 Clear the counter



2-10-2 Counter preset



① Input preset values

Move the cursor to the text box where you want to enter the preset values.

You can enter the Back space key and numbers from 0 to 9. Depending on the initial settings of counters A and B, you can also enter the '-'key.



Press Enter to preset the counter.

When the cursor moves from the text box being edited, the display becomes 0.

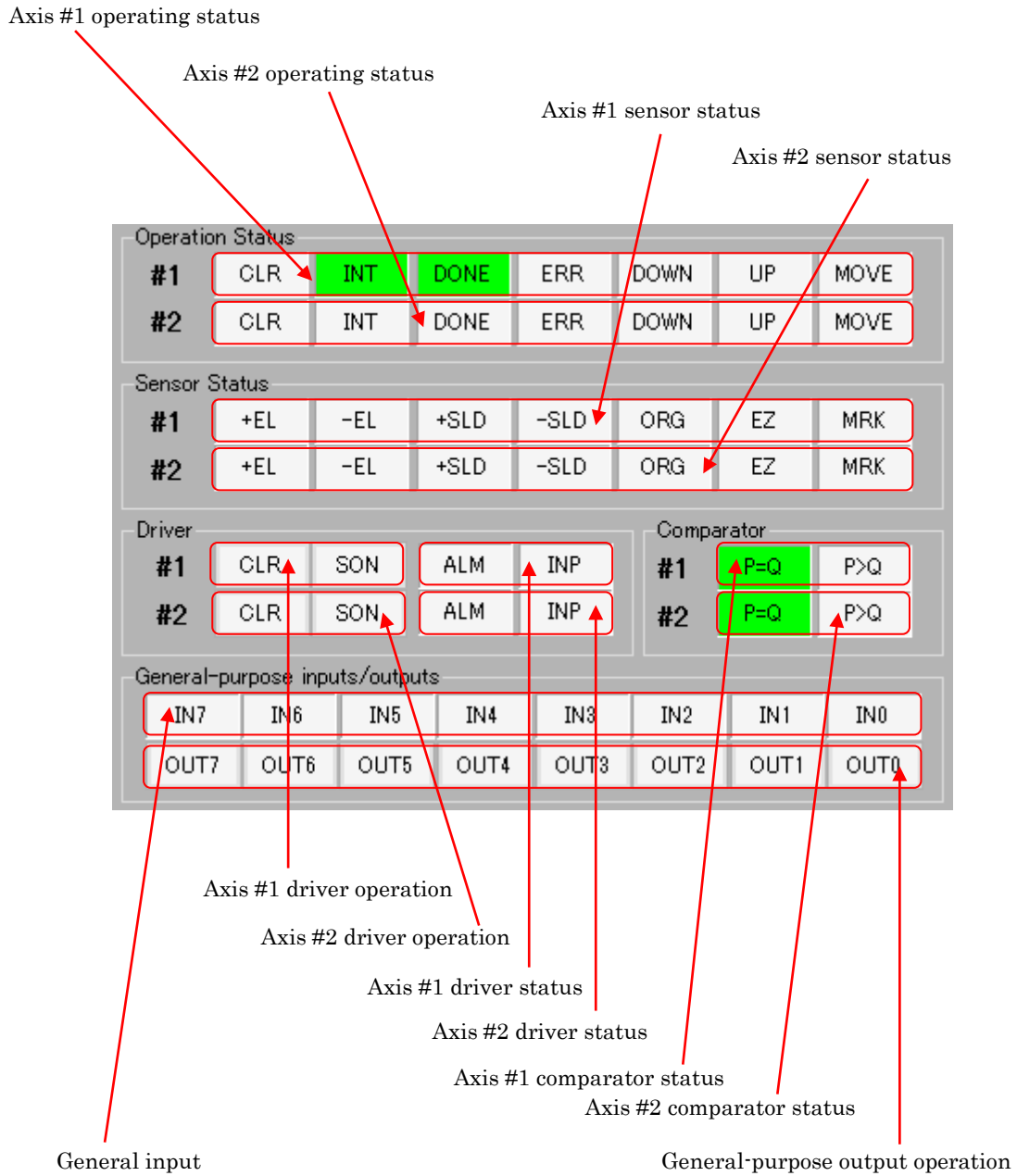
② Range of preset values

Initial setting of counter A, B			Setting range
bit5	Bit6	Setting	
0	0	24bit、2's complement	-8,388,608~8,388,607
0	1	24bit、Absolute value	0~16,777,215
1	0	32bit、2's complement	-2,147,483,648~2,147,483,647
1	1	32bit、Absolute value	0~4,294,967,295

2-10-3 General-purpose output batch setting (hexadecimal)

Move the cursor in the text box of the batch setting. Back space key, the numbers 0 ~ 9, A ~ F, the letters of a ~ f you can enter. When you enter the Enter key general-purpose output of 8bit is batch setting. When the cursor is moved from the text box will display the current state of the general-purpose output in hexadecimal.

2-11 About main status and output operation



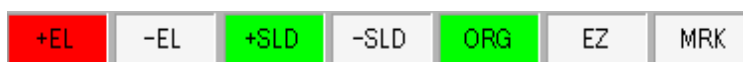
2-11-1 Operating status



Type	Color	Description
MOVE	Green	Operating
UP	Green	Accelerating
DOWN	Green	Decelerating
ERR	Red	Error flag is ON
DONE	Green	Stop flag is ON
INT	Green	Interrupt flag is ON
CLR	Green	CLR is ON

2-11-2 Sensor status

The real-time status is displayed.



Type	Color	Description
MRK	Green	MARK is ON
EZ	Green	EZ is ON
ORG	Green	ORG is ON
-SLD	Green	-SLD is ON
+SLD	Green	+SLD is ON
-EL	Red	-EL is ON
+EL	Red	+EL is ON

2-11-3 Driver status



Type	Color	Description
INP	Green	INP is ON
ALM	Red	ALM is ON

2-11-4 Driver operation



You can turn it on / off by bit operation by clicking the button.

Type	Color	Description
SON	Blue	SON is ON
CLR	Blue	CLR is ON

2-11-5 General-Purpose Input Status



Type	Color	Description
IN0	Green	IN0 is ON
IN1	Green	IN1 is ON
IN2	Green	IN2 is ON
IN3	Green	IN3 is ON
IN4	Green	IN4 is ON
IN5	Green	IN5 is ON
IN6	Green	IN6 is ON
IN7	Green	IN7 is ON

2-11-6 General-purpose output operation



You can turn it on / off by bit operation by clicking the button.

Type	Color	Description
OUT0	Blue	OUT0 is ON
OUT1	Blue	OUT1 is ON
OUT2	Blue	OUT2 is ON
OUT3	Blue	OUT3 is ON
OUT4	Blue	OUT4 is ON
OUT5	Blue	OUT5 is ON
OUT6	Blue	OUT6 is ON
OUT7	Blue	OUT7 is ON

2-11-7 Comparator status



Type	Color	Description
P=Q	Green	P = Q holds.
P>Q	Green	P>Q holds.

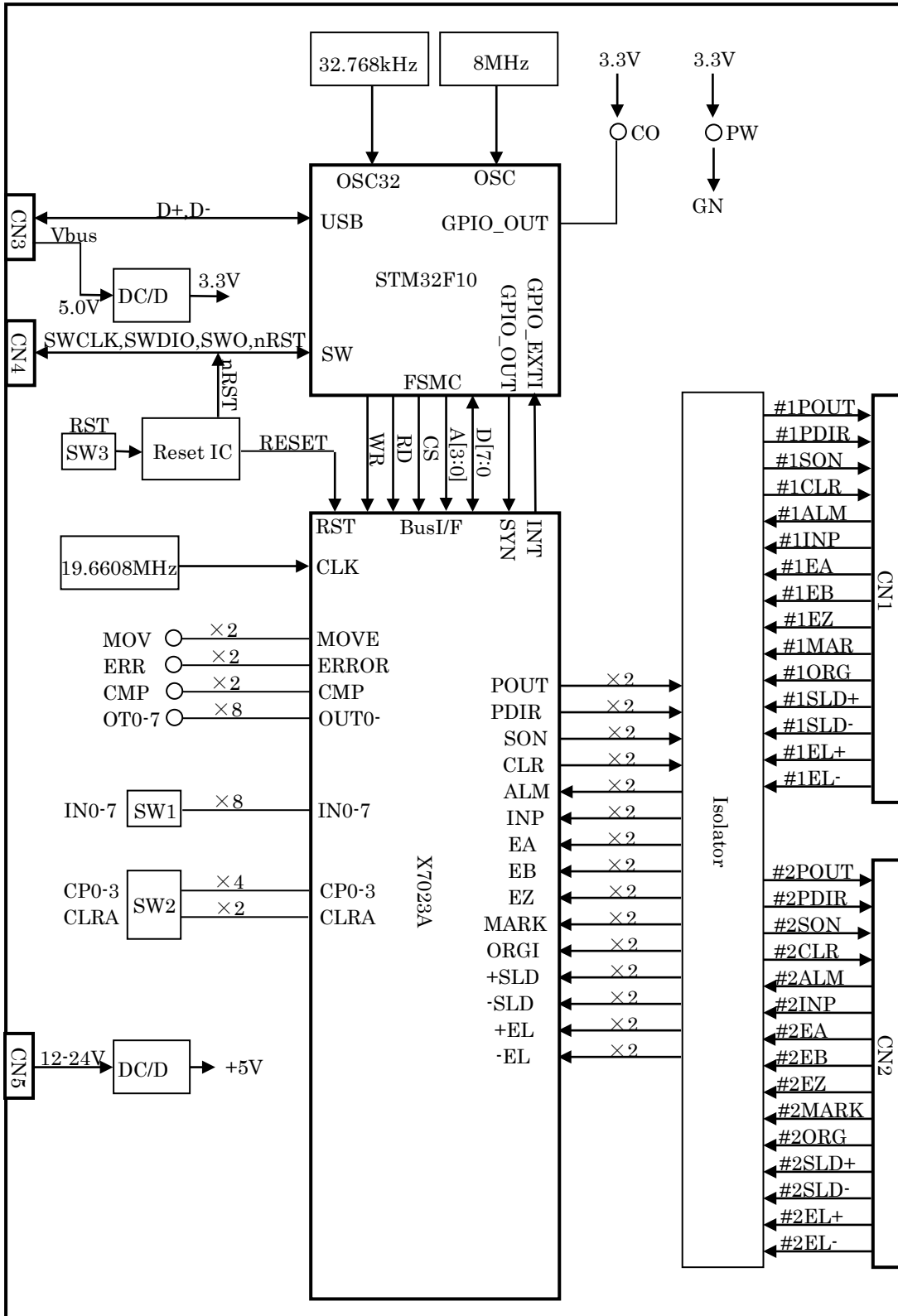
3 . About hardware

3-1 X7023A-EV.BOARD

3-1-1 Specifications List

Item		Specifications
Device	MCU	STM32F103 LQFP100
	Motion control LSI	X7023A 19.6608MHz 2-axis
Communication interface		USB2.0 Compliant 12Mbps
Program & Debug interface		SWD
Driver interface	Clock output	Gate control/2-clock switchable. Axis #1 Line driver output Axis #2 Open collector output
	Driver control output	In each axis, 2 points. Servo ON, deviation counter reset. Open collector, Photocoupler output.
	Driver signal input	In each axis, 2 points. Driver alarm input, Positioning end input. Photocoupler input.
Encoder interface		In each axis, 3 points. Phase A, Phase B, Phase Z. Axis #1 Differential (line receiver) input Axis #2 Photocoupler input.
Sensor input interface		In each axis, 6 points. Origin input, Mark sensor input, \pm End limit inputs, \pm Slow-down inputs.
LED display		Power supply ON (Blue) USB communication (Yellow) Axis #1 Driving, Axis #2 Driving (Blue) Axis #1 Error, Axis #2 Error (Red) Axis #1 Comparator, Axis #2 Comparator (Yellow) General-purpose output. 8点 (Yellow)
Operation switch		Reset (Push switch) General-purpose input 8点 (DIP SW) Axis #1 Counter reset, Axis #2 Counter reset (DIP SW) External linear interpolation signal input 4点
Power supply	Input Power	DC5V \pm 5% 500mA (Supplied from USB Vbus)
	Internal power supply	DC3.3V \pm 1%
	External power input	DC12~24V (For sensors and drivers)
	External power output	DC5V \pm 5% (MAX100mA) (For driver interface)
Board size		120 \times 110 (mm)

3-1-2 Block Diagram



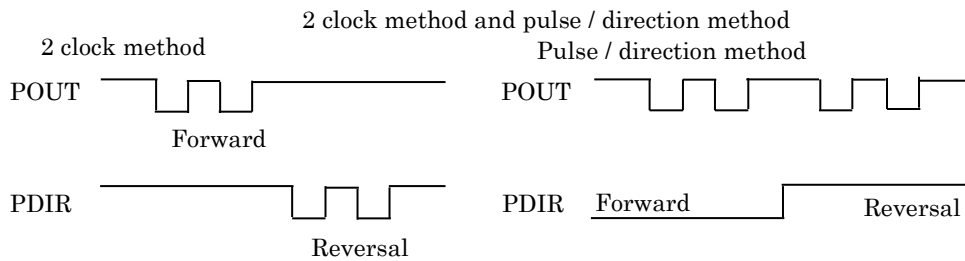
3-1-3 Input / output function

POUT+, POUT-

In the case of the 2-clock method, the command pulse in the CW direction is output, and in the case of the pulse / direction method, the command pulse is output. Axis #1 is a line driver output, axis #2 is an open collector output.

PDIR+, PDIR-

In the case of the 2-clock method, the command pulse in the CCW direction is output, and in the case of the pulse / direction method, the command direction is output. Axis #1 is a line driver output, axis #2 is an open collector output.



SON

It is mainly used to turn on the servo of the servo driver and turn on the excitation of the stepping motor. Open collector output. It can be used as a general-purpose output.

CLR

It is used to clear the deviation counter of the servo driver. Open collector output. It can be used as a general-purpose output.

EA, EB

Input for phase A and phase B of the incremental encoder. This is the external input of the X7023A counter. By setting the X7023A, you can select x1, x2, x4 and 2 clock inputs.

Axis #1 is the line receiver input and axis #2 is the open collector input.

EZ

This is the Z-phase input of the encoder. Axis #1 is the line receiver input and axis #2 is the open collector input.

ALM

This is the alarm input for the motor driver. It will stop immediately when it becomes active.

INP

This is the servo driver in-position input (positioning completed).

MARK

This is the sensor positioning input. It is used when positioning from the sensor position. When other than the sensor positioning operation, it can be used as general purpose input.

ORG

Origin sensor input. It is used when returning to the origin. When other than the origin return operation, it can be used as general purpose input. It can be used as an interrupt input.

SLD+

It is a slowdown input in the + direction. By setting the X7023A, you can select slow down or slow down stop.

SLD-

It is a slowdown input in the - direction. By setting the X7023A, you can select slow down or slow down stop.

EL+

It is an end limit input in the + direction. It will stop immediately when it becomes active.

EL-

It is an end limit input in the - direction. It will stop immediately when it becomes active.

CLRA

When it turns ON, counter A is cleared to 0. By setting the X7023A, you can select the level operation or edge operation.

CP0-3

You can test when performing linear interpolation using multiple X7000 series.

IN0-7

You can test the general-purpose input IN0-7. IN0 can be used as an interrupt input.

OT0-7

You can monitor the general-purpose output OUT0-7.

MOV

You can monitor the signal MOVE during pulse output.

ERR

You can monitor the error stop signal ERROR.

CMP

You can monitor the output of the comparator. By setting the X7023A, you can switch of = or >.

COM

Lights when the board and PC are communicating with each other via USB (CN3) connection.

PWR

Lights when 5V power is supplied from the USB (CN3) Vbus.

3-1-4 Connector signal arrangement / function

① Axis #1 sensor driver interface (CN1)

Connector XG4C-2631 (OMRON)

No.	Signal	Description	No.	Signal	Description
1	#1POUT+	Axis #1 CW / Pulse output +	14	#1EB-	Axis #1 encoder B-phase input -
2	#1POUT-	Axis #1 CW / Pulse output -	15	#1EZ+	Axis #1 encoder Z-phase input +
3	#1PDIR+	Axis #1 CCW / Direction output +	16	#1EZ-	Axis #1 encoder Z-phase input -
4	#1PDIR-	Axis #1 CCW / Direction output -	17	0V	External power supply 0V
5	#1SON	Axis #1 servo ON output	18	0V	External power supply 0V
6	#1CLR	Axis #1 deviation counter clear output	19	#1MARK	Axis #1 sensor positioning input
7	+5V_EX	+ 5V output	20	#1ORG	Axis #1 origin sensor input
8	0V	External power supply 0V	21	#1SLD+	Axis #1 + direction slowdown limit input
9	#1ALM	Axis #1 driver alarm input	22	#1SLD-	Axis #1 - direction slowdown limit input
10	#1INP	Axis #1 Positioning Complete Input	23	#1EL+	Axis #1 + direction limit input
11	#1EA+	Axis #1 encoder A-phase input +	24	#1EL-	Axis #1 - direction limit input
12	#1EA-	Axis #1 encoder A-phase input -	25	0V	External power supply 0V
13	#1EB+	Axis #1 encoder B-phase input +	26	0V	External power supply 0V

② Axis #2 sensor driver interface (CN2)

Connector XG4C-2631 (OMRON)

No.	Signal	Description	No.	Signal	Description
1	+5V_EX	+ 5V output	14	#2EB-	Axis #2 encoder B-phase input -
2	#2POUT-	Axis #2 CW / Pulse output -	15	#2EZ+	Axis #2 encoder Z-phase input +
3	+5V_EX	+ 5V output	16	#2EZ-	Axis #2 encoder Z-phase input -
4	#2PDIR-	Axis #2 CCW / Direction output -	17	0V	External power supply 0V
5	#2SON	Axis #2 servo ON output	18	0V	External power supply 0V
6	#2CLR	Axis #2 deviation counter clear output	19	#2MARK	Axis #2 sensor positioning input
7	+5V_EX	+ 5V output	20	#2ORG	Axis #2 origin sensor input
8	0V	External power supply 0V	21	#2SLD+	Axis #2 + direction slowdown limit input
9	#2ALM	Axis #2 driver alarm input	22	#2SLD-	Axis #2 - direction slowdown limit input
10	#2INP	Axis #2 Positioning Complete Input	23	#2EL+	Axis #2 + direction limit input
11	#2EA+	Axis #2 encoder A-phase input +	24	#2EL-	Axis #1 - direction limit input
12	#2EA-	Axis #2 encoder A-phase input -	25	0V	External power supply 0V
13	#2EB+	Axis #2 encoder B-phase input +	26	0V	External power supply 0V

③ USB I/F (CN3)

Connector UB-M5BR-DMP14-4S (JST)

No.	Signal	Description
1	Vbus	+5V
2	D-	-Data
3	D+	+Data
4	ID	NC
5	GND	GND

④ SWD I/F (CN4)

Connector XJ8B0611 (OMRON)

No.	Signal	Description
1	T_VCC	Target reference voltage
2	T_SWCLK	SWD clock signal
3	GND	GND
4	T_SWIO	IO data pin
5	T_NRST	Target reset signal
6	T_SWO	Trace port

⑤ External power input (CN5)

Connector B2B-XH-A(LF)(SN) (JST)

No.	Signal	Description
1	+12~24V	Connect a 12 to 24V DC power supply.
2	0V	

3-1-5 LED display and operation switch

① LED display

No.	Signal	Description	
		Extinguishing light	Lighting
1	OT0	OUT0 is OFF	OUT0 is ON
2	OT1	OUT1 is OFF	OUT1 is ON
3	OT2	OUT2 is OFF	OUT2 is ON
4	OT3	OUT3 is OFF	OUT3 is ON
5	OT4	OUT4 is OFF	OUT4 is ON
6	OT5	OUT5 is OFF	OUT5 is ON
7	OT6	OUT6 is OFF	OUT6 is ON
8	OT7	OUT7 is OFF	OUT7 is ON
9	PWR	Vbus power OFF	Vbus power ON
10	COM	USB communication OFF	USB communication ON
11	MOV1	Axis #1 stopped	Axis #1 pulse output
12	ERR1	Axis #1 is not an error stop	Axis #1 is stopping error
13	CMP1	Axis #1 comparator condition not satisfied	Axis #1 comparator condition satisfied
14	MOV2	Axis #2 stopped	Axis #2 pulse output
15	ERR2	Axis #2 is not an error stop	Axis #2 is stopping error
16	CMP2	Axis #2 comparator condition not satisfied	Axis #2 comparator condition satisfied

② General-purpose input operation switch (SW1)

No.	Signal	Description	
		OFF	ON
1	IN7	Turn off general-purpose input IN7	Turn on general-purpose input IN7
2	IN6	Turn off general-purpose input IN6	Turn on general-purpose input IN6
3	IN5	Turn off general-purpose input IN5	Turn on general-purpose input IN5
4	IN4	Turn off general-purpose input IN4	Turn on general-purpose input IN4
5	IN3	Turn off general-purpose input IN3	Turn on general-purpose input IN3
6	IN2	Turn off general-purpose input IN2	Turn on general-purpose input IN2
7	IN1	Turn off general-purpose input IN1	Turn on general-purpose input IN1
8	IN0	Turn off general-purpose input IN0	Turn on general-purpose input IN0

③ CLRA, CP0 ~ 3 operation switch (SW2)

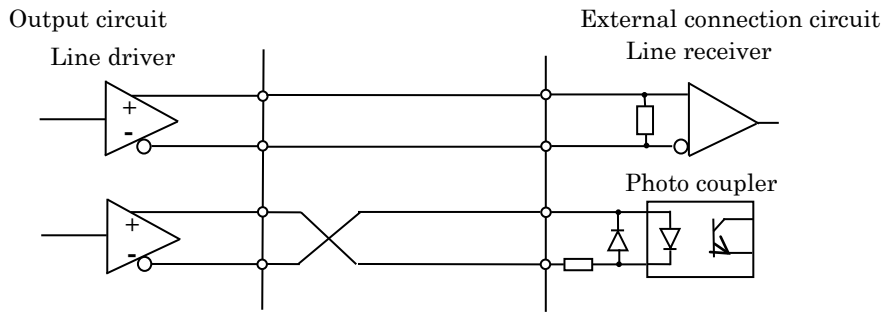
No.	Signal	Description	
		OFF	ON
1	CP3	Turn off the linear interpolation input CP3	Turn on the linear interpolation input CP3
2	CP2	Turn off the linear interpolation input CP2	Turn on the linear interpolation input CP2
3	CP1	Turn off the linear interpolation input CP1	Turn on the linear interpolation input CP1
4	CP0	Turn off the linear interpolation input CP0	Turn on the linear interpolation input CP0
5	CLRA2	Turn off the Axis #2 CLRA input	Turn on the Axis #2 CLRA input
6	CLRA1	Turn off the Axis #1 CLRA input	Turn on the Axis #1 CLRA input

④ Reset switch (SW3)

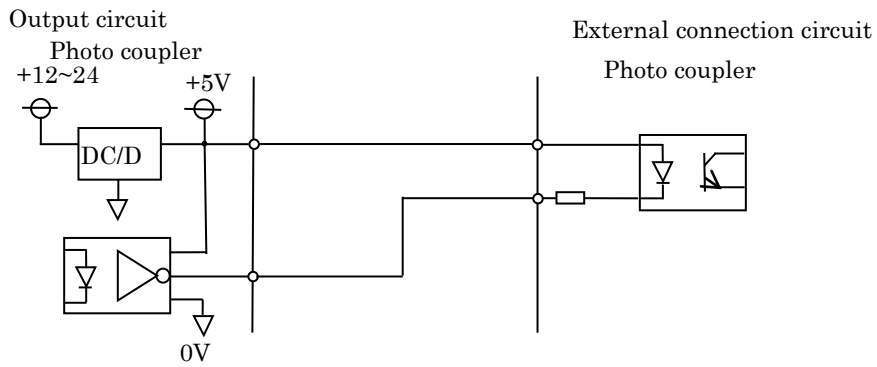
Resets the STM3232F103, X7023A and USB line when pressed.

3-1-6 I/O circuit and external connection

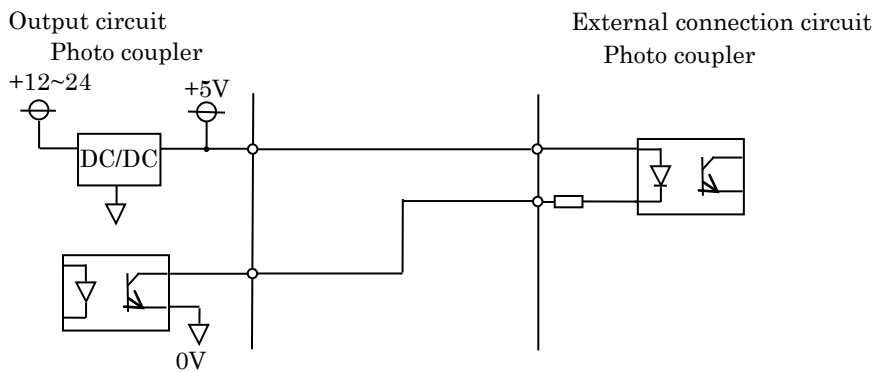
① Axis #1 POUT, PDIR



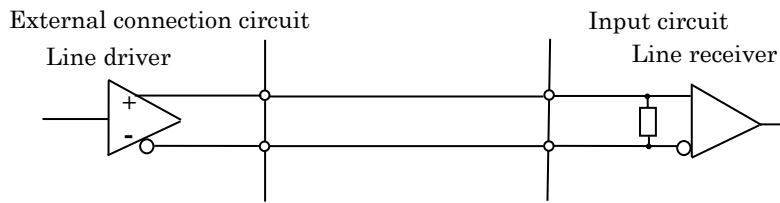
② Axis #2 POUT, PDIR



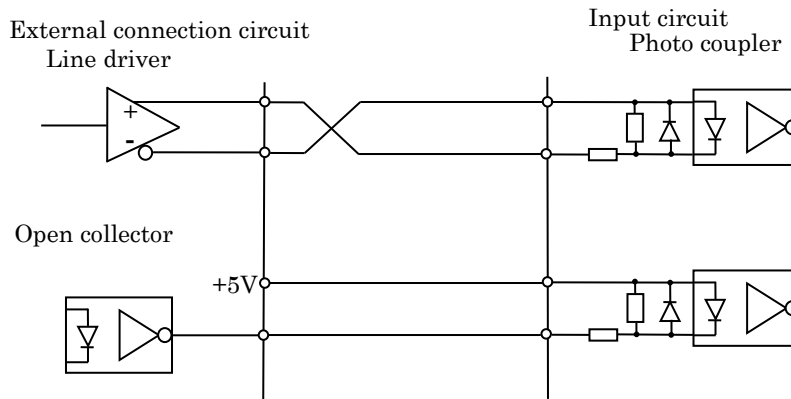
③ SON, CLR



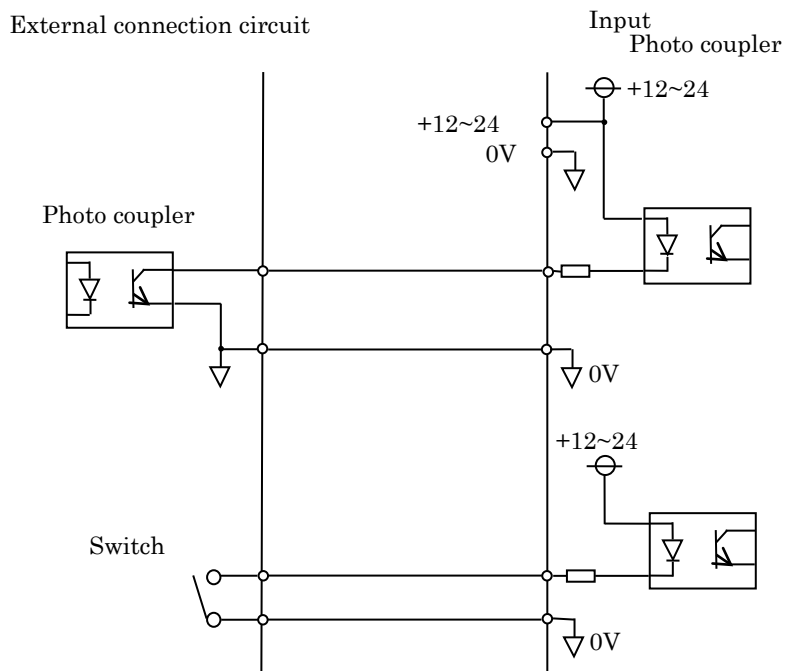
④ Axis #1 EA, EB, EZ



⑤ Axis #2 EA, EB, EZ



⑥ ALM, INP, MARK, ORG, SLD+, SLD-, EL+, EL-



3-1-7 Circuit diagram

[X7023A-EV-circuit.pdf](#)

3-1-8 BOM

[X7023A-EV-BOM.pdf](#)

3-2 ExIO-01

3-2-1 Connector signal arrangement / function

Connection plug (CN1)

Connector XG4H-2631 (OMRON)

No.	Signal	Description	No.	Signal	Description
1	POUT+	CW / pulse input +	14	EB-	Encoder B-phase output -
2	POUT-	CW / pulse input -	15	EZ+	Encoder Z-phase output +
3	PDIR+	CCW / Direction input +	16	EZ-	Encoder Z-phase output -
4	PDIR-	CCW / Direction input -	17	0V	Common
5	SON	Servo on input	18	0V	Common
6	CLR	Deviation counter clear input	19	MARK	Sensor positioning output
7	+5V_EX	+ 5V input	20	ORG	Origin sensor output
8	0V	Common	21	SLD+	+ direction slowdown output
9	ALM	Alarm output	22	SLD-	- direction slowdown output
10	INP	Positioning Complete output	23	EL+	+ direction limit output
11	EA+	Encoder A-phase output +	24	EL-	- direction limit output
12	EA-	Encoder A-phase output -	25	0V	Common
13	EB+	Encoder B-phase output +	26	0V	Common

3-2-2 LED display and operation switch

① LED display

No.	Signal	Description	
		Extinguishing light	Lighting
1	CLR	CLR is OFF	CLR is ON
2	SON	SON is OFF	SON is ON

② Sensor operation switch (SW1)

No.	Signal	Description	
		OFF	ON
1	EL-	Turn off -direction End limit output	Turn on -direction End limit output
2	EL+	Turn off +direction End limit output	Turn on +direction End limit output
3	SD-	Turn off -directional slowdown output	Turn on -directional slowdown output
4	SD+	Turn off +directional slowdown output	Turn on +directional slowdown output
5	ORG	Turn off the origin sensor output	Turn on the origin sensor output
6	MARK	Turn off the sensor positioning output	Turn on the sensor positioning output
7	INP	Turn off in-position output	Turn on in-position output
8	ALM	Turn off alarm output	Turn on alarm output
9	EZ	Turn off encoder Z-phase output	Turn on encoder Z-phase output
10	EZSEL	Encoder Z phase is an open collector	Encoder Z-phase output is differential

3-2-3 Check pin (T1~5)

No.	Signal	Description
1	T1	0V
2	T2	PDIR- and ExEB- (loopback connected)
3	T3	PDIR + and ExEB + (loopback connected)
4	T4	POUT- and ExEA- (loopback connected)
5	T5	POUT + and ExEA + (loopback connected)

3-2-4 circuit diagram

[ExIO-01-Circuit.pdf](#)

3-2-5 BOM

[EXIO-01-BOM200729.pdf](#)

4 . About firmware

4-1 STM32 development environment

4-1-1 Development environment

Development machine

OS

Windows10 64bit Japanese version

IDE

SW4STM32

Setup file : install_sw4stm32_win_64bits-v2.8.zip

Configuration tool

STM32CubeMX

Setup file : en.SetupSTM32CubeMX-5.1.0-RC6.Zip

Debugger

ST-LINK/V3

4-1-2 Development environment setup procedure

- ① Download and install the SW4STM32 setup file from STMicroelectronics' HP.
- ② Download and install the STM32CubeMX setup file from STMicroelectronics' HP.
- ③ Connect ST-LINK / V3 to the development machine via USB and install the driver if necessary.

Please refer to the STMicroelectronics documentation for settings and usage of each tool.

4-2 Setting

[X7023A_EV-Configuration.pdf](#)

Revision history

Year and month	Description	Ver.
2021/04/15	Preliminary version	Ver.0.0.0
2021/07/16	First edition	Ver.1.0.0