

EtherCAT compatible
16ch STEPPING MOTOR CONTROLLER
PM16C-16EC2
USER'S MANUAL

No. 4108(rev.3)



APPLICATION OF ELECTRONIC DEVICES

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1 Abstract

1-1 Introduction

PM16C-16EC2 is a stepping motor controller equipped with EtherCAT Slave function and is an upward compatible product of PM16C-16EC2. The basic functions are based on PM16C-16, so those who use PM16C-04XDL and PM16C-16 can use it with the same feeling.

The difference with PM16C-04XDL is described below.

1. PM16C-16EC2 controls 16 motors at the same time by EtherCAT, RS-232C, and GP-IB communication.
2. The command which reads the state of all channel was added.
3. “Answer all mode” which adds an answer to all the commands was added.
4. Two axis interpolation commands which starts with “C0” or “C1” , Oscillation drive command which starts with “Y”, and auto change scan drive command which starts with “ACS” are not supported in firmware version 1.03.

The differences from PM16C-16 are listed below.

1. Removed the Ethernet port and added the EtherCAT port. This works as EtherCAT Slave.

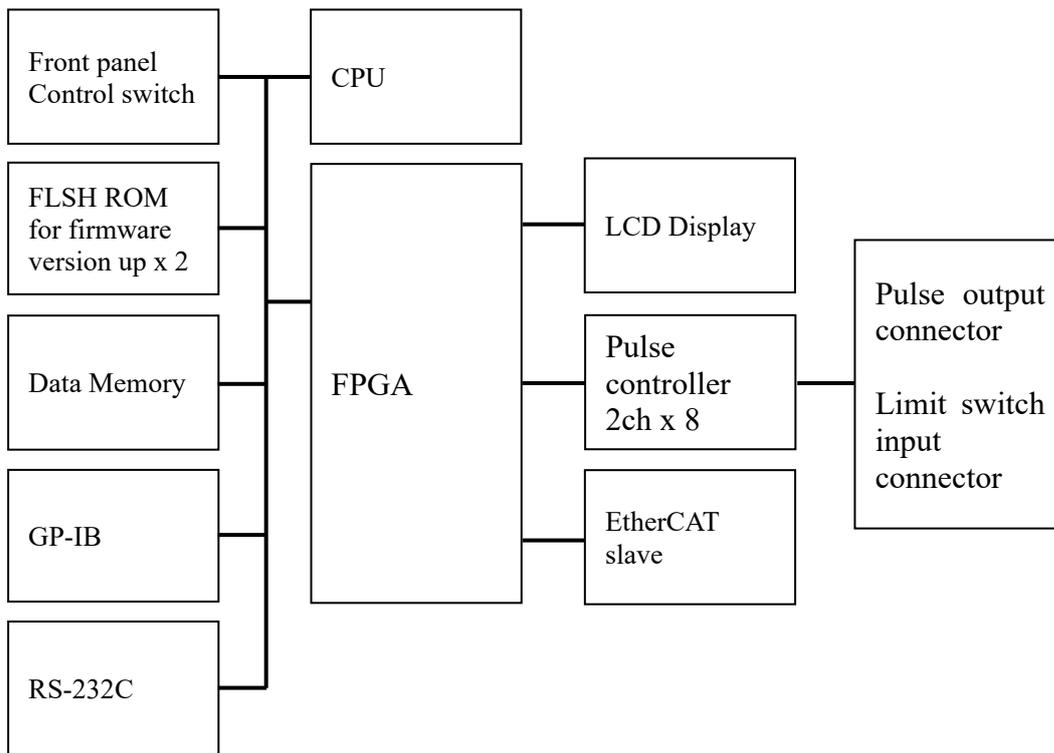
The differences from PM16C-16EC2 are listed below.

1. The PDO data update cycle has been sped up.

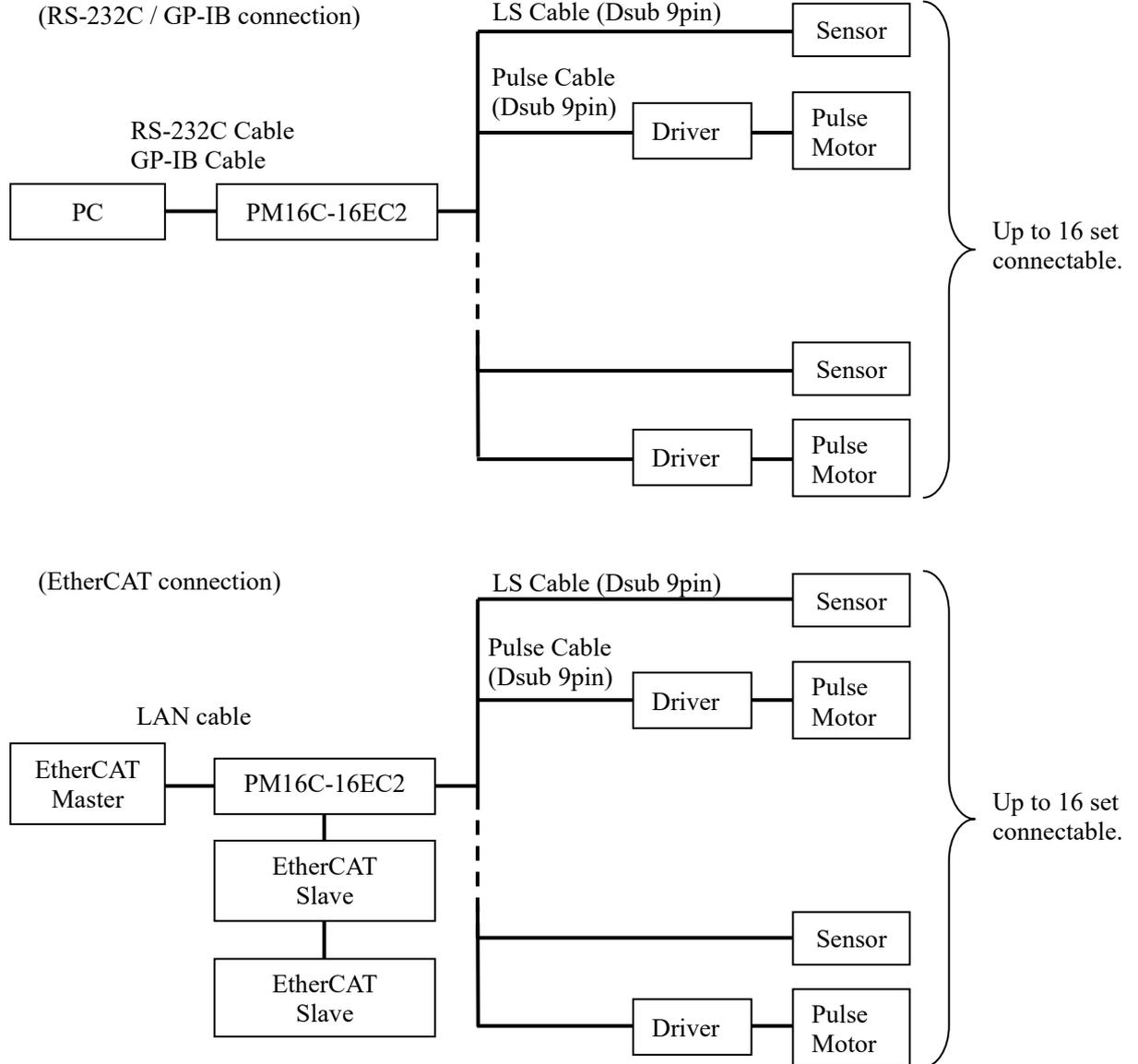
Take over the following functions of PM16C-04XDL.

1. Count pulse step bit is 32bits. Numerical range is -2,147,483,647 to +2,147,483,647.
2. Each characteristics (HSPD, MSPD, LSPD, RATE, LMSW, DGLS) is available for each channel.
3. Absolute position drive, relative position drive, continuous drive, and find home position drive is available. These drive have 3 acceleration and deceleration mode, constant, trapezoid, and “S” shaped.
4. The output of trigger pulse or gate signal (TTL) is available at the arbitrary sections and intervals.
5. There are five kinds of the way of stopping motor.
 - by the limit switch signal
 - by the home position limit switch signal
 - by the digital limit switch signal
 - when the “STOP” button is pushed
 - when the stop command is published
6. Firmware ROM update via communication line is available.

1-2 Architecture

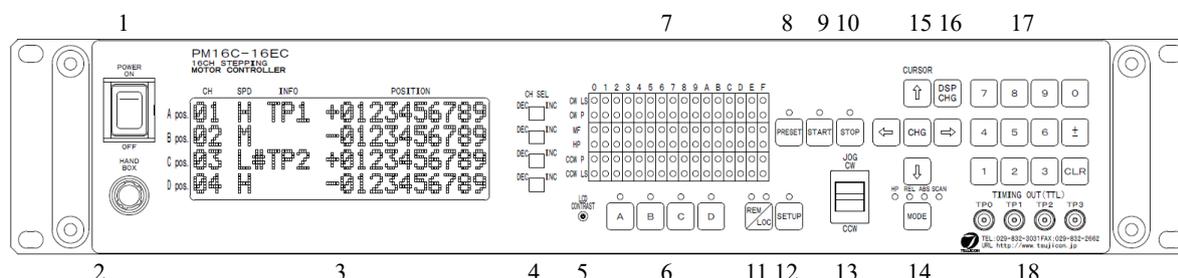


1-3 Connection Diagram



2 Parts names and function

2-1 Front Panel



No.	Name	Function
1	POWER switch	This is the power switch of PM16C-16EC2.
2	Hand Box connector	Connect the Hand Box here (option). See page 18.
3	LCD display	20 character and 4 line LCD. Motor drive status and each channel data are displayed here.
4	CH select switch	Any 16 motor channel is allocated to A, B, C, D position. Select the motors to control with this switch. In SETUP mode, setup channel No. is changeable with a pos. ch select switch.
5	LCD contrast volume	Adjusts LCD contrast with + screw driver.
6	Motor active button	Set motor drive active or non-active for each position. Bright position shows active state. In local mode, motor drives active position only.
7	Motor status LED	These LED shows the motor status. Details are shown at page 7.
8	PRESET button	When motor drive mode is scan, current pulse position is set to preset value.
9	START button	All activated motor start driving according to the motor drive mode.
10	STOP button	All activated driving motor stop at local mode. All driving motor stop at remote mode.
11	REM/LOC button	Exchanges local mode and remote. If you push this button when turning on the power, <u>various types of parameter except the current pulse value are initialized.</u>
12	SETUP button	Goes to motor initial data setting mode (SETUP) when all motors are stop and local mode. If push it again, exits SETUP mode.

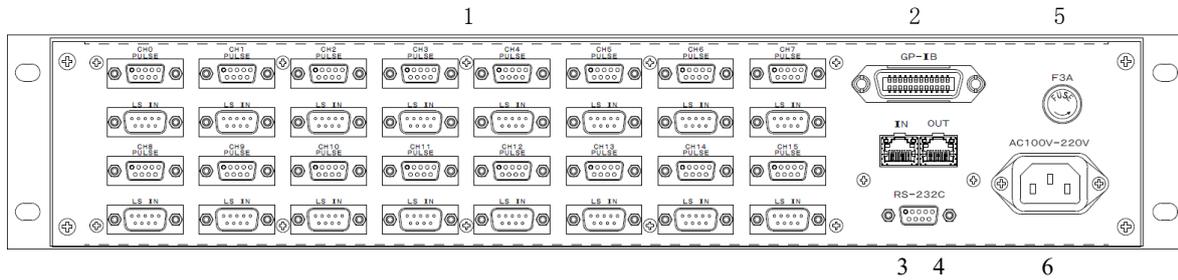
No.	Name	Function
13	JOG switch	Starts CW or CCW JOG operation. Motor drives just JOG set pulse with one push. If you hold over 0.4 sec., motor drives while holding. In SETUP mode, changes the page of setup function.
14	MODE button	Select the drive mode when pushing start button. Bright LED mode is selected mode. Drive mode changes every pushing.
15	cursor button	Move the cursor position with these keys. Changes set data at SETUP mode with "CHG" button.
16	DSPCHG button	Exchanges motor drive screen and mode disp. screen.
17	numeric keys	Entry the numeric data at SETUP mode. Sign inversion with "±" button, data input cancel with "CLR" button. If you push "CLR" button when turning on the power, pulse value of all channels are reset to zero.
18	TIMING/OUT connector (LEMO)	TTL level pulse signal or gate signal according to pulse position data are output. See "8 Timing out signal output" (page 51) in details.

● MOTOR STATUS LED

	0	1	...	E	F	The channel is shown.
CW LS	●	●	...	●	●	LED lights when CW direction limit switch is activated.
CW P	●	●	...	●	●	LED lights when CW direction pulse is output.
MF	●	●	...	●	●	LED lights when motor hold off signal is output.
HP	●	●	...	●	●	LED lights when Home Position limit switch is activated.
CCW P	●	●	...	●	●	LED lights when CCW direction pulse is output.
CCW LS	●	●	...	●	●	LED lights when CCW direction limit switch is activated.

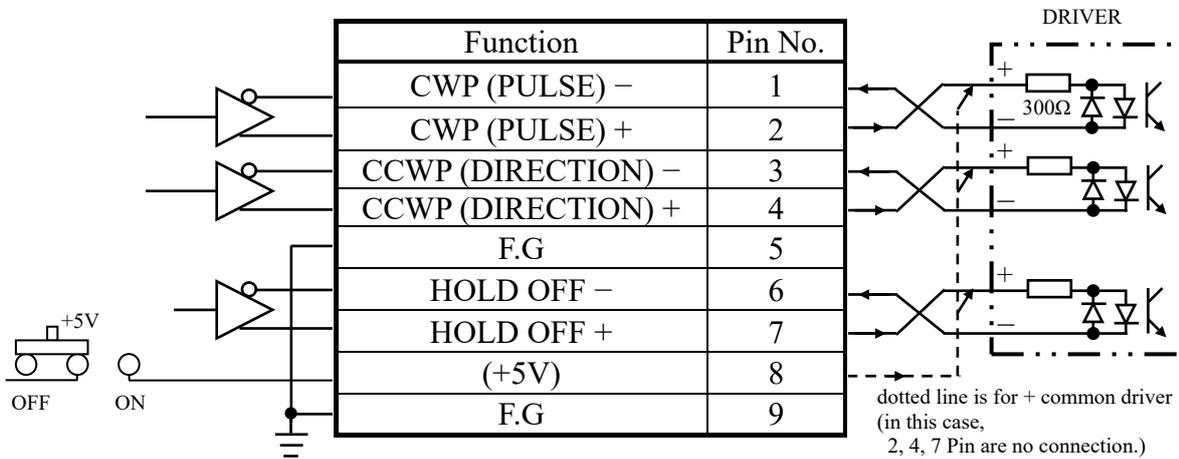
LED of limit switch blinks when digital limit switch described at page 24 was turned on.

2-2 Rear Panel



No.	Name	Function
1	Pulse out connector (PULSE) Limit switch connector (LS IN)	CH0 to CH15 pulse output Dsub9 female connector and limit switch input Dsub9 male connector are attached. Pin assignment are shown below.
2	GP-IB connector	Connect the GP-IB cable here.
3	RS-232 connector	Connect the RS-232C cross cable here.
4	EtherCAT LAN connector	When controlling with EtherCAT communication, connect the LAN cable from the upper level to IN and the LAN cable to the lower level to OUT.
5	Fuse holder (250 V 3A)	250V, 3A fuse is equipped here.
6	Power cable connector	Insert attached AC cable here. 100 ~ 220V AC power is available.

● Pulse out Dub connector (PULSE) Pin assignment



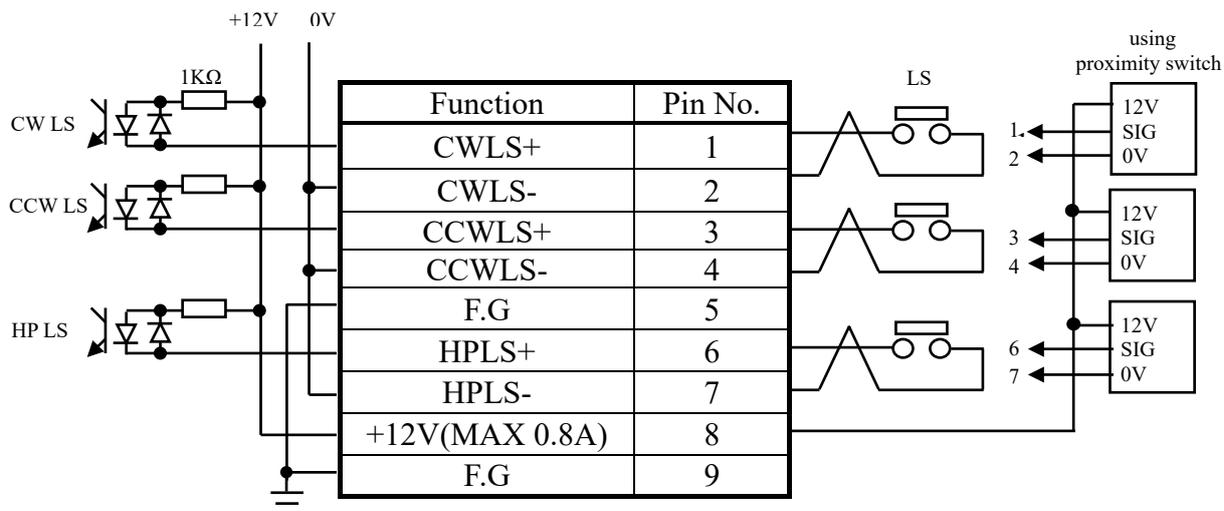
Pin-7 is set to +5V at the time of shipment, but it is possible to output +12V from pin-7 of the same channel by switching SW0~15 (corresponding to the ch number) to the +12V side.

For pin-8, +5V can be supplied by opening the top lid and turning on / off the red slide switch (SW16) on the board behind the connector.

It is set to OFF at the time of shipment.



● Limit switch input Dsub connector (LS IN) Pin assignment



Both a-contact limit switch and b-contact are available.

Logic inverting is also available at PM16C-16EC2 settings.

Use Dsub connector which shell width is under 35mm, since each Dsub connector pitch is 37.6mm. DE-C1-J6 (JAE), XM2S-0911 (OMRON), HDE-CTF (HIROSE) etc. are recommended connectors.

● RS-232C connector

The pin assignment of Dsub 9pin connector at PM16C-16EC2 side is shown right. Use cross cable between PM16C-16EC2 and your PC.

Function	Pin No.
—	1
RXD	2
TXD	3
—	4
GND	5
—	6
—	7
—	8
—	9

3 Preparation of a communication line

3-1 The outline of communication control

PM16C-16EC2 is equipped with communication control by RS-232C, and GP-IB. In addition, PM16C-16EC2 is equipped with EtherCAT slave function. The initial settings required for each communication are described. Both initial settings can be done in SETUP mode.

- The display method of a SETUP screen
 1. After Power on, the 1.REM/LOC button is pushed and a green LED is made turn on.
 2. Since a screen will change if the 2.SETUP button is pushed, please push down 3.JOG switch in the direction of CW or CCW, and change a page.



1 2 3

3-2 Configuration of RS-232C and GP-IB communication

JOG switch is moved to the CW position several times, and page 9 (right screen) are displayed. Right photograph is the state of initial setting.

The blinking cursor is moved on the figure of B.RATE by CURSOR button. If the central CHG button is pushed, baud rate can be chosen from 1200, 2400, 4800, 9600, 19200, and 38400. It is only baud rate that can set up and other values are being fixed to DATA BIT: 8, STOP BIT: 1, NO FLOW CONTROL, NO PARITY.

A configuration of GP-IB only sets up address. A cursor is moved on the figure of ADDRESS and address is set up within the limits of 2 to 31.

IF change is completed, the SETUP button will be pushed, and escape from SETUP screen.



3-3 About delimiter character

The format of command is ASCII data, and the delimiter is CR + LF (0x0d + 0x0a).

After receiving CR + LF, command interpretation begins. When sending commands, “CR + LF” must be added at the end of the command, though the “CR + LF” are omitted in the command.

3-4 Ether communication

There is no particular initial setting for EtherCAT slave communication. Have the connected master read the ESI file for PM16C-16EC2.

4 The outline of motor control

4-1 Remote mode and Local mode

PM16C-16EC2 have two ways of control mode, remote mode and local mode. In local mode, PM16C-16EC2 controls motor with switches attached front panel and hand box. Commands from communication line which drives motor and overwrite the motor setting are invalid, but which reads the data are available.

In remote, switches attached front panel are unable except  and .

4-2 Drive mode

There are 4 drive modes at motor control, ABS, REL, SCAN, and H.P. In local mode, you can change the drive mode with . Current drive mode is indicated by LED above . In remote mode, you can select drive mode with command directly.

- REL mode Relative pulse drive mode
 LOCAL: Push , and motor drives toward the destination by preset value from present position.
 REMOTE: Motor drives by entered value.
- ABS mode Absolute pulse drive mode
 LOCAL: Push , and motor drives to preset destination value.
 REMOTE: Motor drives by entered position.
- SCAN mode Continuous drive mode to CW, CCW direction
 LOCAL: Push , and click “CW or CCW” jog switch, motor drives to dedicated direction continuously.
 A push on the PRESET button will set a pulse to the value set up beforehand.
- HP mode Drive detecting origin point of pulse count for each channel.
 Details are in chap5.6 “Home position setting”.

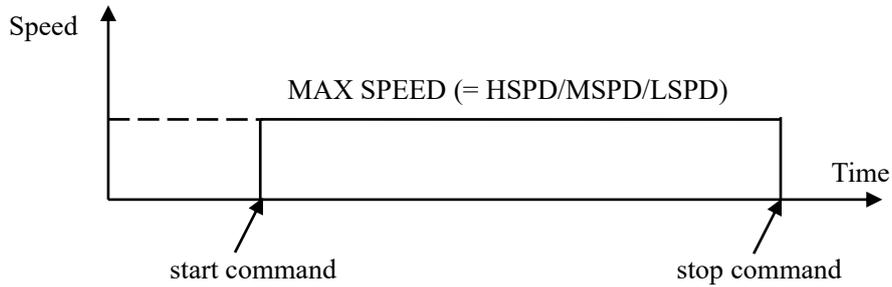
All motor drive are stopped with  or limit switch or HP switch signal, or enter motor stop command.

4-3 Drive speed setting

High speed (HSPD), middle speed (MSPD), low speed (LSPD) and acceleration rate is set individually for each channel. These setting are modified by remote commands or SETUP mode “Page1 Speed setting (Page 21)”.

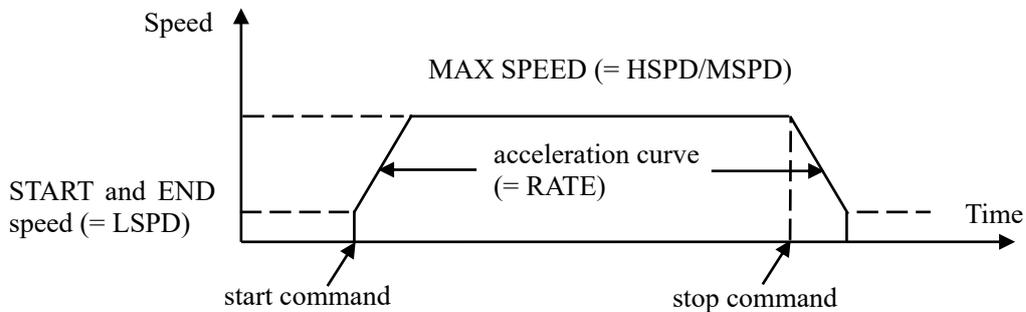
Acceleration and deceleration method have the three modes, “Const”, “Trape”, and “Schar”. These setting are modified by remote commands or SETUP mode “5-2 Page2 Motor operation, Hold-off function setting (Page 22)”. Refer to the page 34 for the setting command of speed.

- Constant drive (Const)



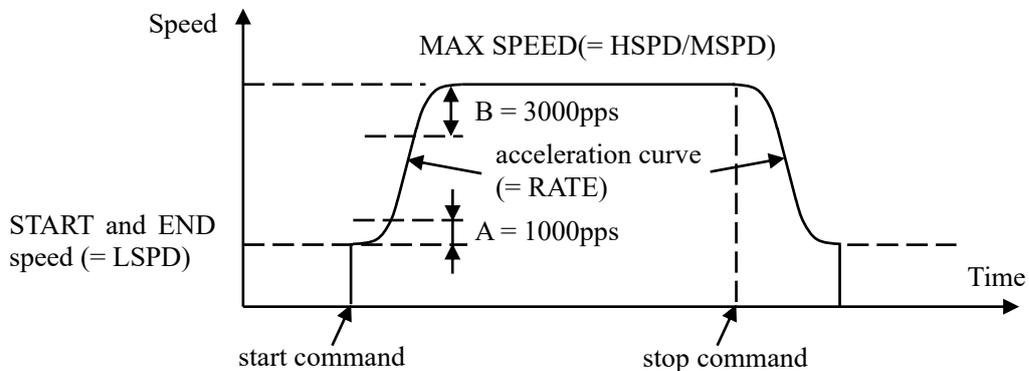
Motor drives at MAX speed as soon as drive execution, and stops immediately as soon as stop operation. Too fast drive speed causes motor step out.
Low speed drive is always constant drive at all drive mode.

- Trapezoidal form acceleration drive (Trape)



Acceleration operation is carried out until it will reach MSPD or HSPD by making LSPD into initial velocity, if a motion command is executed.
 When a stop command is input, the motor starts deceleration. And the motor stop when speed reached LSPD. Acceleration and deceleration curve become rapid, and time to reach maximum speed shortens so that Rate value shown by acceleration and deceleration code (See page 45) is large.
Large value of "LSPD" may not make smooth start of the motor.

- S shaped form acceleration drive (Schar)



Although it is fundamentally the same as trapezoidal form acceleration drive, the velocity change at the time of acceleration and deceleration start and the time of acceleration and deceleration stop is performed according to S shaped form approximated to the parabola.

Large value of "LSPD" may not make smooth start of the motor.

The start region A and the stop region B are fixation. When LSPD is more than or equal LSPD + 4000pps, it calculates automatically so that a curve may become smooth.

4-4 Control screen

● Initial screen

*	*	*	*	P	M	1	6	C	-	1	6	E	C	2	*	*	*	*	*	
S	T	E	P	P	I	N	G			M	O	T	O	R						
C	O	N	T	R	O	L	L	E	R			V	e	r	<	1	.	0	0	>
T	S	U	J	I	-	D	E	N	S	H	I			C	o	.	L	T	D	,

This screen is displayed immediately after the power is turned on.

It shows which version of firmware you are booting from.

(Firmware version 1.02 or later does not display the version on the upper screen, but automatically switches to the following page and the firmware and hardware versions are displayed.)

*	*	*	*	P	M	1	6	C	-	1	6	E	C	2	*	*	*	*	*
F	I	R	M	W	A	R	E			v	e	r	.	<	1	.	0	2	>
H	A	R	D	W	A	R	E			v	e	r	.	:	2				

● Motor drive screen

A Pos.	0	0	H	T	P	0				0	1	2	3	4	5	6	7	8	9
B Pos.	0	1	H	#	T	P	1		-	0	1	2	3	4	5	6	7	8	9
C Pos.	0	2	M	#	T	P	2		-	0	1	2	3	4	5	6	7	8	9
D Pos.	1	5	L	T	P	3				0	1	2	3	4	5	6	7	8	9
		1	2	3	4														5

This is default screen when you control the motors. 4 channels which allocated Pos. A to D pulse position are displayed. Colored area means cursor moveable area at local mode.

Motor drive screen

No.	Data	Function
1	Channel No.	The display of the allocated channel at A to D Position. You can change these channel with “CH SEL” switch and numeric keys. The same channel at two position is prohibited.
2	Drive speed	You can select motor driving speed from “HSPD”, “MSPD”, and “LSPD” with “CHG” button. Please check the exact speed at SETUP mode (page 21) or remote commands.
3	Timing signal	The display of timing out signal status. If displayed “#” here, timing out signal output status is ready. If not, signal is not outputted. Each time the “CHG” button is pushed, a state changes. See “8 Timing out signal output” (page 51) in detail.
4	Timing signal output port Channel comment	The display of from which port a timing signal is outputted. “---” is displayed when the output port is not assigned to all the port. You can select display data at this area with “CHG” button. •Timing signal output port Timing out port 0 to 3 are allocated at displayed position A to D. •Channel comment Each channel is able to be named 3 letter. See “9-1 Channel comment setting” (Page 56) in detail. (V1.02 ~) Battery When the backup battery (CR2032) becomes empty and various settings cannot be saved, "BATT EMPTY" is displayed at regular intervals in this column. If this symptom does not improve after turning the power off and then on again, replace the battery.
5	Current pulse position	Displays current pulse position for each position.

● Mode setup screen

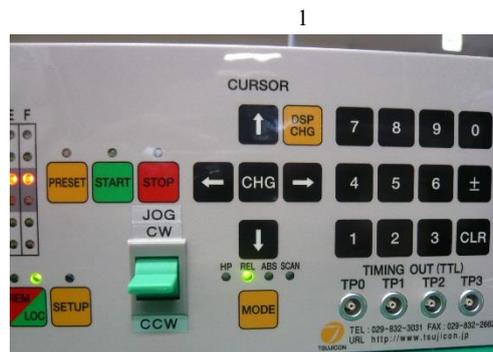
0	0		M		R	E	L			0	1	2	3	4	5	6	7	8	9
0	1		M		R	E	L		-	0	1	2	3	4	5	6	7	8	9
0	2		M		R	E	L		-	0	1	2	3	4	5	6	7	8	9
1	5		L		R	E	L			0	1	2	3	4	5	6	7	8	9

Push 1: **DSP CHG** at motor drive screen, display changes into mode setup screen.

On this screen, various parameter setup at the time of a motor drive is performed.

Push 2: **MODE**, changes motor active mode “REL → ABS → SCN → H.P → REL”. Setting value differ in each mode.

LED on the 3: **SETUP** blinks during mode setup screen.



Display value for each motor active mode are below.

REL : Enter relative drive pulse value when you push **START** .

ABS : Enter absolute drive pulse value when you push **START** .

SCN : Enter preset value when you push **PRESET** .

H.P : If you have found the home position at this position, displays its data. If not, displays “NO_HOME POS.”. Home position data is rewritable if you have found it.

When you change these values, move the cursor where you change with cursor button and enter the new value with numeric keys. Inverts the Sign of value with **±** , resets entering value with **CLR** .

Entering value is displayed with zero suppression. If you move cursor up and down, entering value is fixed and displayed with zero-fill.

4-5 Home Position Set and Search drive

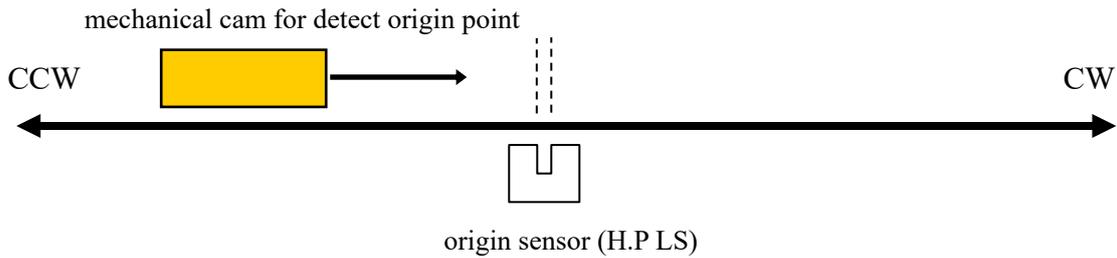
Home position of the unit is set by home position search drive. If the sensor of the origin point (H.P switch) is detected, motor will stop automatically and the moving direction and the origin point at the time of detection are memorized on a main unit.

- At the beginning

A setup of H.P can be set up by connecting with H.P LS switch of LS connector and detecting the origin point sensor arranged at the mechanical origin point.

To set H.P, you need to decide the direction of detecting origin point.

In the case of the following figure, detect way is CW.



Once detect the origin point, motor stopped automatically and memorize the direction and H.P pulse data. In this case, motor speed must be low within response time of sensor. You need to check the set speed.

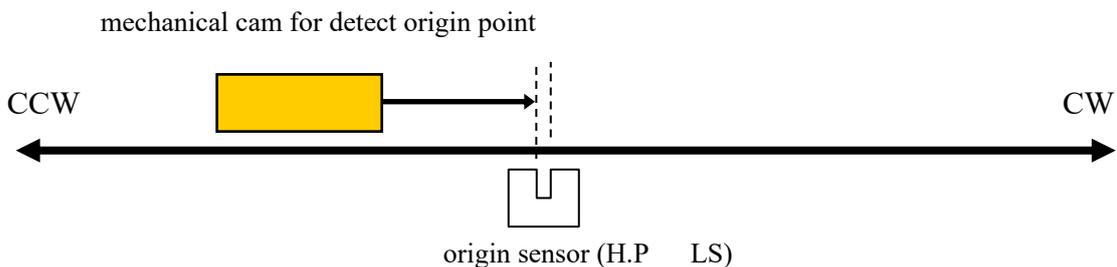
- Selection of detecting ways

There are three ways of detecting origin point.

Some are in case of memorized data had existed and another is in case of no memorized data.

METHOD	ORIGINAL STATE	DETECT WAY	PROCEDURES	ACCURACY	TIME
A	NO MEMORIZED DATA	MANUAL	Manual operation JOG CW, CCW or START + JOG CW,CCW	AVERAGE	SHORT
B	NO MEMORIZED DATA	SEMI AUTOMATICAL	Hold "START" switch more than 1 sec.	GREAT	LONG
C	EXISTED MEMORIZED DATA	SEMI AUTOMATICAL	Push "START" switch.	GREAT	SHORT

[METHOD A]



When you set H.P to direction CW, you have to set motor position to CCW side against origin sensor, then move motor from CCW to CW side by operation switch JOG CW or START + JOG CW.

Once detect the origin point, motor stopped suddenly, origin point procedures finished.

Then the position of pulse data is memorized and the direction approaching a sensor is also memorized. (In the case of the above figure the CW direction)

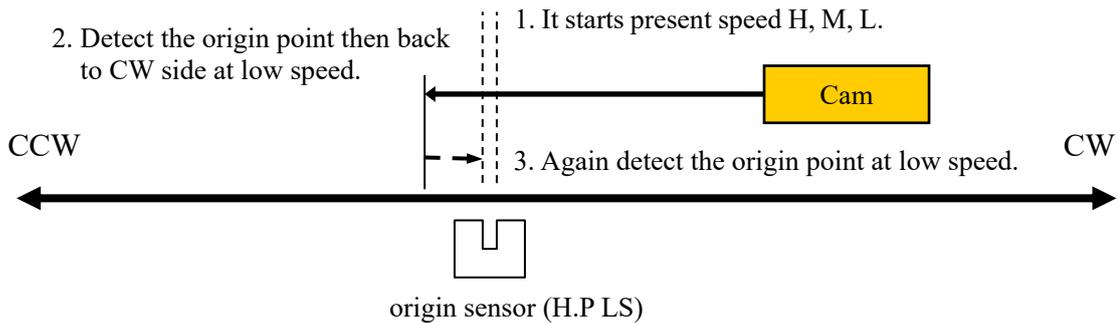
This way is applicable also to the detection in the case of using HP sensor as CWLS or CCWLS. (In that case, input CWLS or CCWLS also into HPLS)

[METHOD B]

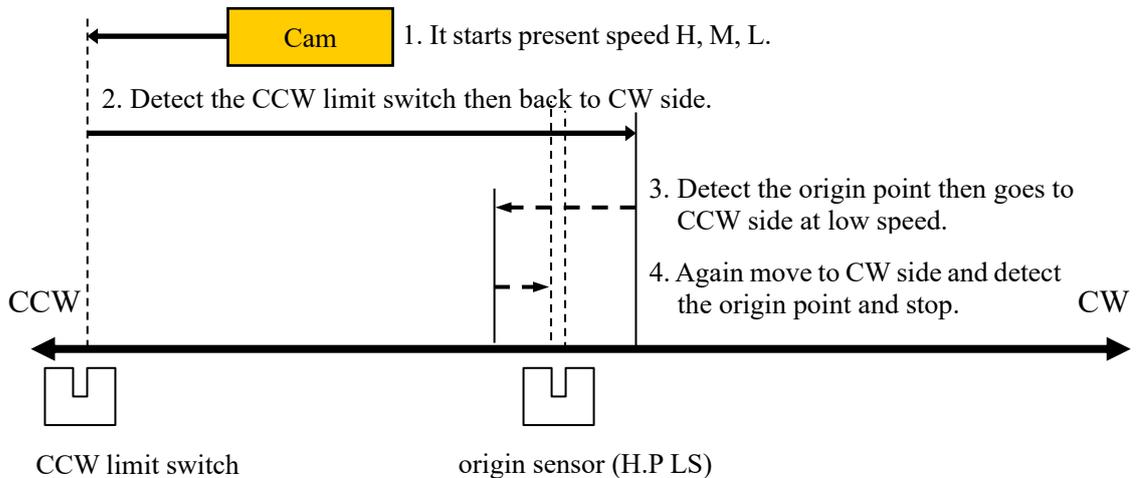
The following example is the case that the direction of the origin point detection is CW. The start direction of the origin point detection set in the opposite direction of the direction of the origin point detection.

(You can set at “ Page6 Home position setting” (Page 26))

(a). In case of start position is in CW side against origin point



(b). In case of start position is in CCW side against origin point

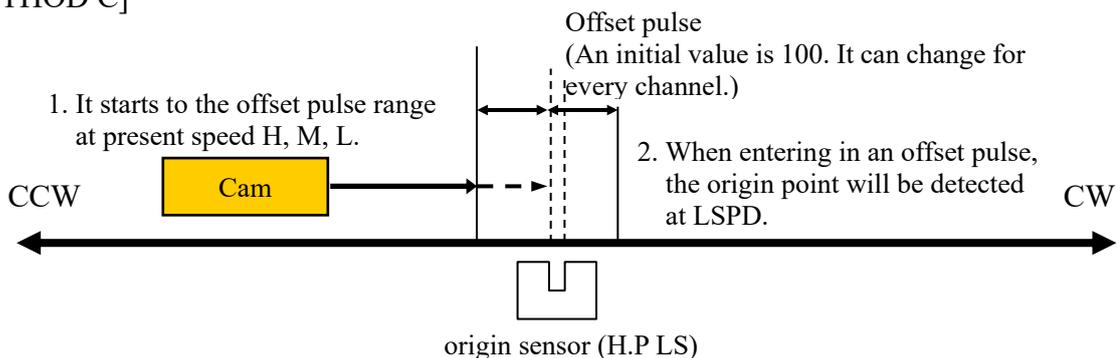


If a starting point sensor is detected, it will pass at first. And it will stop, if it passes completely, and it goes to the origin point by LSPD. Motor stopped suddenly, if the origin point sensor is detected from a direction opposite to the direction which started detection of the origin point. Then the position of pulse data is memorized and the direction approaching a sensor is also memorized.

While in this procedures, if you stop this operation by “STOP” switch or command, H.P hadn't been finished.

If in this procedures, CW or CCW limit switch or digital limit switch is activate, detecting procedures continue until “STOP” switch on.

[METHOD C]



This way is used when the origin point information is memorized by the way previously described. The origin point is detected automatically based on the information memorized.

If you push START button, motor goes to origin point ± offset pulse area by preset speed. When motor enter the offset area, then goes to origin point at low speed. Motor stopped suddenly, if the origin point sensor is detected, and H.P procedures finished.

While in this procedures, CW, CCW limit switch activate or push STOP button, this procedure stopped. In this case the origin point position information is cleared.

When you want to set up the origin point using old origin point detection data, setting data can be returned by “ Page6 Home position setting” (Page 26) of SETUP screen.

4-6 Hand box (Optional)

In local mode operation, you can control a motor using the panel directly.

In addition, you can control a motor using Hand box (sold separately).

Connect the Hand box to HAND BOX connector.

And select the type of the Hand box in the item "HAND BOX CONT" in the page 9 of the SETUP mode from the below types.



● 04TYPE Hand box controller (PM16-HDX 4 axis control)

You can select one channel from A, B, C, D that are displayed on LCD, and you can control it.

1. Channel select switch

Select one channel from A, B, C, D that are displayed on LCD.

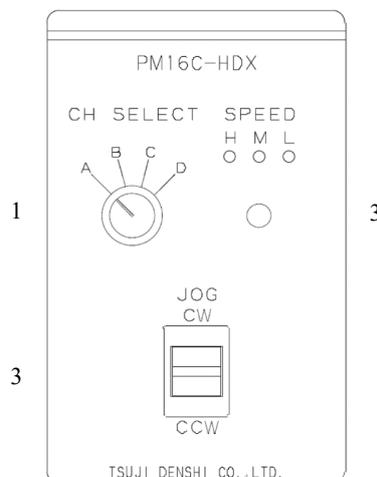
2. Speed change switch

In local mode, you can change the speed of the specified channel from HSPD, MSPD and LSPD.

In remote mode, it becomes the STOP button.
(see below)

3. JOG switch

When you press once, it gives the instruction once in the direction (CW or CCW) in which you move the JOG switch.



It is same function of the JOG switch of PM16C-16EC2 front panel.

● 02TYPE Hand box controller (PM16-HDX2 2 axis simultaneous control)

Simultaneous control of channels A and B, which is displayed on the display is possible.

1. Speed change switch

In local mode, you can change the speed of the channel A, B from HSPD, MSPD and LSPD.

In remote mode, it becomes the STOP button.
(see below)

2. CH A JOG switch

It is the same function as the JOG switch of the front panel of PM16C-16EC2, and it operates the channel A which is displayed on LCD display.

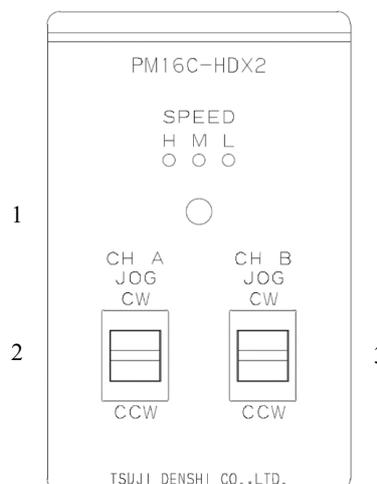
When you press once, it gives the instruction once in the direction (CW or CCW) in which you move the JOG switch.

If press and hold, it continues to operate.

3. CH B JOG switch

It is the same function as the JOG switch of the front panel of PM16C-16EC2, and it operates the channel B which is displayed on LCD display.

When you press once, it gives the instruction once in the direction (CW or CCW) in which you move the JOG switch. If press and hold, it continues to operate.



- 16TYPE Hand box controller (PM16-HDX16 16 axis selected control)
Control a channel that is selected from 16 channels.

1. Channel indicated LED

It displays the channel that is controlled, and it displays a channel as Hexadecimal number (0 ~ F).

2. Channel select switch (useful in local mode)

Select the channel that want to control by this switch.

3. Speed change switch (useful in local mode)

In local mode, you can change the speed of the channel A, B from HSPD, MSPD and LSPD. In remote mode, it becomes the STOP button. (see below)

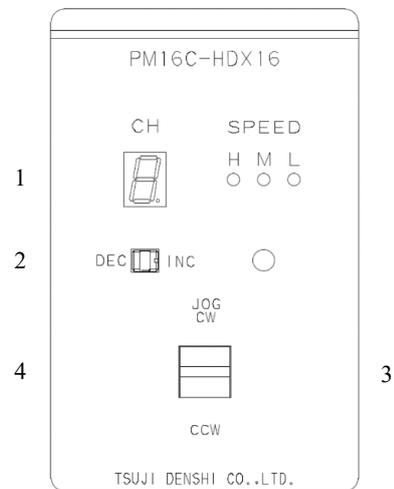
4. JOG switch (useful in local mode)

When you press once, it gives the instruction once in the direction (CW or CCW) in which you move the JOG switch. If press and hold, it continues to operate.

·About Speed change switch

In remote mode, all of LED H/M/L will light, if the button is pressed and held more than 3 seconds. And Speed change switch will act as STOP button at this time.

This feature will be canceled, if the button is pressed and held more than 3 seconds, again.



5 SETUP MODE

All channel motor initial data and communication line setting operation is available at this mode. Push SETUP button at Local mode, LOCAL drive mode and SETUP mode are exchanged. SETUP mode contains 11 pages. You can increment the page with clicking JOG switch to CW, and decrement to CCW.

The colored area shows cursor moveable point.

Unless specified otherwise, you can change the parameters by the center of the cursor key "CHG" button.

5-1 Page1 Speed setting

1																			
C	H	:	0	3			S	P	E	E	D	(P	P	S)	P	1	
H	:	5	0	0	0	0	0	0			J	O	G	:	9	9	9	9	9
M	:	1	0	0	0	0	0	0			R	A	T	E	:		0	3	2
L	:	0	1	0	0	0	0	0			1	0	.	5	0	m	s	/	k
2																			

1. : SETUP channel selection
It shows the channel under setting. You can change the channel by the numeric keypad. "±" button increments channel number. "CLR" button decrements channel number. You can use Channel select switch in A pos. to change setting channel.
2. : Driving speed setting
Setting range: 5 ~ 9,999,999
(Can be set in increments of 5; rounded up if there is a remainder)
Initial Value: HSPD/3,700 MSPD/650 LSPD/10
You can set the speed when moving HSPD (high speed), MSPD (middle speed), and LSPD (low speed). The setting unit is pps (pulse per second).
Please enter it using the numeric keypad.
These rates will be used in 4-3 Drive speed setting on page 11.
3. : JOG STEP value Setting range: 1 ~ 99,999 initial value: 1
Set the number of steps of the JOG switch in local mode by numeric keypad.
4. : Acceleration and deceleration rate Setting range: 0 ~ 115 initial value: 13
Set the acceleration when the motor is accelerating or decelerating by numeric keypad. It becomes sudden stop or sudden acceleration this value is larger.
At the bottom, the real value of the set acceleration code is displayed in the time required to accelerate 1000pps.
For more information, please refer to the rate table "7-4 Acceleration and Deceleration Rate". (Page 45)

5-5 Page5 REL/ABS/SCAN PRESET data setting

1																				
C	H	:	0	0				M	O	D	E	_	D	A	T	A			P	5
R	E	L						:		-	0	1	2	3	4	5	6	7	8	9
A	B	S						:		-	0	1	2	3	4	5	6	7	8	9
P	R	E	S	E	T			:			0	1	2	3	4	5	6	7	8	9

Also in the “mode display screen”, settings on this page is available.

1. : SETUP channel selection
Same as Page 1.
2. : REL mode set value
Setting range: -2,147,483,647 ~ +2,147,483,647
Initial value: +10,000
Set the pulse value that relative movement when you press the START button in local mode.
3. : ABS mode set value
Setting range: -2,147,483,647 ~ +2,147,483,647
Initial value: 0
Set the absolute movement of the pulse value when you press the START button in local mode.
4. : SCAN mode set value
Setting range: -2,147,483,647 ~ +2,147,483,647
Initial value: 0
Set the value to be preset when you press the PRESET button in local mode.

5-6 Page6 Home position setting

C	H	:	0	0		H	P	L	S	:	E	N	A		N	O	_	P	6	
O	R	G	.	S	T	A	R	T	:	C	C	W		M	(C	C	W)	
O	F	F	S	E	T	.	P	U	L	S	E	:			9	9	9	9	9	
M	E	M	.	P	O	S	:			N	O	_	H	O	M	E	.	P	O	S

1. : SETUP channel selection
Same as Page 1.
2. : Home position switch setting: ENA/DIS default: ENA
Set the enable or disable of the home position switch.
ENA: It detects the home position signal
DIS: It does not detect the home position signal.
3. : Home position switch contact setting: N.O/N.C default: N.O
Set the contact logic of the home position switch.
The right "_" will change to "□" when home position switch is active.
N.O: Select when using the home position switch normally open (A contact).
N.C: Select when using the home position switch normally close (B contact).
4. : Selection of running direction for detect the origin point: CW/CCW default: CW
In carrying out the home position detection in automatic, it is the direction you want to move to the first by pressing the START button.
CW: Set to CW the origin detection start direction
CCW: Set to CCW the origin detection start direction
5. : Origin detection direction: CW/CCW
When it is stopped by detecting the origin, direction heading for the origin will be recorded. You cannot change this value.
6. : Origin detection offset pulse:
Setting range: 0 ~ 99999
Initial value: 100
In carrying out the re-detection of the origin, set the range to be detected at a reduced speed at the origin around the position.
7. : Home position of origin point:
Setting range: -2,147,483,647 ~ +2,147,483,647
Initial value: NO_HOME.POS
When origin point had been set, this position data is displayed.
When origin point hadn't been set, display is "NO H.P."
In the case of undetected origin, the origin that was last set will be set by the "CHG" button. When the origin has been set, you can change the origin position by entering a value in the numeric keypad. In addition, it is possible to cancel to the state of origin undetected in the "CHG" button at this time.

5-7 Page7 TIMING OUT setting

For more information about the TIMING OUT signal, see page 50.

1										2									
C	H	:	0	0	T	.	O	U	T	:	P	.	1	m	s		P	7	
S	T	A	R	T	:		-	0	1	2	3	4	5	6	7	8	9		3
S	T	O	P	:		-	0	1	2	3	4	5	6	7	8	9		4	
P	.	I	N	T	V	:		-	0	1	2	3	4	5	6	7	8	9	5

1. : SETUP channel selection
Same as Page 1.
2. : TIMING OUT mode set
DIS/GATE/P.200ns/P.10us/P.100us/P.1ms
Manual/M.1us/M.10us/M.100us/M.1ms
default: P.1ms
Select the type of when outputting TIMING OUT signal.
DIS : Signal output disabled.
GATE : GATE mode output. Signal out between START and STOP.
P.200ns~1ms : Pulse output of 200ns, 10us, 100us, 1ms.
Manual : Manual output.
M.1us~1ms : Outputs a pulse with a manually set width once.
3. : TIMING OUT Start Position
Setting range:-2,147,483,647 ~ +2,147,483,647
Initial value: +1000
Set the starting point of the interval to perform TIMING OUT signal output of the above.
4. : TIMING OUT Stop Position
Setting range: -2,147,483,647 ~ +2,147,483,647
Initial value: +10000
Set the end point of the interval to perform TIMING OUT signal output of the above.
5. : TIMING OUT Interval Pulse
Setting range: 0 ~ +2,147,483,647
Initial value: 200
When TIMING OUT signal is a pulse, you can set the pulse interval in TIMING OUT output period.

5-8 Page8 TIMING OUT channel setting

It displays which channels are assigned to TIMING OUT four output ports
TIMING OUT In fixed channel mode, set which channel to assign on this screen.

T	I	M	I	N	G			T	P	0	:	C	H	0	0		P	8
O	U	T						T	P	1	:	C	H	0	1			
C	H	A	N	N	E	L		T	P	2	:	C	H	0	2			
M	O	D	E	:	D	S	P	T	P	3	:	C	H	0	3			

1

2

- : TIMING OUT mode setting DSP/FIX default: NOM
Select the TIMING OUT output channel setting mode.
DSP: Output from the channel being displayed.
(This is the same as PM16C-04XDL.)
FIX: Output from the channel that has been set.
(TIMING OUT channel fixed mode)
Regardless of the display, the signal of the channel that has been set is output.
- : TIMING OUT output channel
When you select the FIX in 1, you can set the channels that will be assigned.
Set by using the CH SEL switch or numeric keypad.
It cannot be set to the same channel as two or more locations.

5-9 Page9 Parameters of remote mode setting

R	E	M	O	T	E		C	O	N	T	R	O	L				P	9	
R	S	-	2	3	2	C	B	.	R	A	T	E	:	3	8	4	0	0	
G	P	I	B		A	D	D	R	:	3	1		R	E	P	:	D	I	S
H	A	N	D		B	O	X		C	O	N	T	:	0	4	T	Y	P	E

2

- : RS-232C baud rate set Initial value: 38400
Select the baud rate of the RS-232C communication from 2400, 4800, 9600, 19200, 38400
- : GP-IB address Setting range: 2 ~ 31 Initial value: 7
Set the address of the GP-IB communication with numeric keypad.
- : Hand box type 04TYPE/02TYPE/16TYPE default: 04TYPE
Set this parameter to match the type of hand box connected.
See "4-6 Hand box (Optional)" (page 18) for details of the hand box.
- : Settings for all response mode ENA/DIS/L--/R/--G other default: DIS
In remote communication, there are commands that do not response (like "OK" or "NG"). In PM16C-16EC2, mode of adding the response to all commands have been added. You can enable / disable the mode. For more information, please refer to "9-2 All reply mode" (page 59)

5-10 Page10: Program version change, return time from mode set screen, and LCD brightness adjustment

													1						
P	R	O	G	R	A	M		C	H	A	N	G	E			P	1	1	
						N	E	W		V	e	r		<	1	.	0	0	>
D	S	P	/	C	H	G		R	E	T	U	R	N		:	6	0	S	2
L	C	D	.	B	R	I	G	H	T	N	E	S	S	:	1	0	0	%	3

1. : To change software version NEW/OLD
Select the firmware version.
See "11 Firmware version up" (Page 64) for more information.
2. : Return time from mode set screen Setting range: 0 ~ 99 Initial value: 60
In the "control screen", it changes to "mode display screen" by pressing the "DSP CHG" button. If you do not operate during the number of seconds set here, the screen will return to the "control screen".
It does not return until you press the "DSP CHG" button again if it is set to 00.
3. : LCD brightness adjustment Setting range: 1 ~ 100 Initial value: 100
Set the brightness of LCD with numeric keypad.

6 Operation of Motor

Here, you will move the motor actually.
Prior to actually drive, complete the following settings.

- Connecting to an external device driver, limit switches, etc. (Page 8)
- Configuring the driving speed. (Page 21)
- Configuring the amount of movement (only the absolute value and relative value movement) (Page 13)

Operate the motor, after the setup is complete.

6-1 Local mode operation

- 1: Display the channel of the motor moving on LCD.
If it does not appear, try changing the channel using the CH SEL switch.
- 2: Press the A ~ D button that corresponds to move the motor, and light the LED on upper side of button.
Motor that is indicated by LED, will move when you operate the JOG switch or press green START button.
- 3: Press the MODE button, and choose how to move from four types of REL, ABS, SCAN, and HP.
The moving method that is showed by lit, is currently selected.
- 4: Start the motor moving, when the START button is pressed.
 - (REL) Move relative movement amount that has been set.
 - (ABS) Move for absolute point amount that has been set.
 - (SCAN) Green lamp at start button keep blighting, and start moving for the direction of jog switch you pushed.
 - (HP) See 4-5 Home Position Set and Search drive (Page 16) in detail.
- 5: Motor stops moving if you press the STOP button or limit switch is activated or etc.

6-2 Remote/Local switching command

On REMOTE mode, you can choose the motor for driving by commands.
Commands for motor move and setting are ignored at LOCAL mode.

Command	REM	LOC	Select REMOTE control mode or LOCAL control mode.
Reply	Nothing		
Remarks	It is valid only when all motor is stopped.		

6-3 Command to read out of motor status

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	STS?	Read motor status which is displayed on LCD.
Reply		<RL><0123>/<DIR>/<LS>/<MT>/<POS>/<POS>/<POS>/<POS>
	<RL>	R/ REMOTE control mode L/ LOCAL control mode
	<0123>	Show displayed motor CH No. at 1 digit hex. The order of this data is applied on <DIR>, <LS>, <MT>, and <POS>.
	<DIR>	P/ Moving for CW direction S/ Stopping N/ Moving for CCW direction
	<LS>	Hold off and LS status (hex) When these signals are activating, its bits stands 1. b3: HOLD off b2: HP LS b1: CCW LS b0: CW LS
	<MT>	Indicate current motor status by 2 digit hex. b7: ESEND :Emergency stop command executed. b6: SSEND :Normal stop command executed. b5: LSEND :Stopped by LS signal. b4: COMERR : Command error b3: ACCN :Decelerating b2: ACCP :Accelerating b1: DRIVE :Motor is moving. b0: BUSY :Driving or dealing with command.
	<POS>	Displaying current position with signed 7 digit decimal. Digit is increased if data is more than 10 million.
Example	STS? Reply: R1234/PSSN/0A80/07300003/+0002784/+0000000/-0001239/-0005009	
Remarks	This command is not supported for EtherCAT command communication. It responds with "Unsupported at EtherCAT". The information of this command is always in the communication data table, so refer to that.	

Command	STS<ch>?	Read the specified CH motor data. Data format is same of "STS" command.
Reply		<RL><CH><DIR><LS><MT><POS> Data format is same as "STS?" except <CH>.
	<CH>	Shows read out CH on hex.
Example	STS1? Reply: R1P007+0002784	
Remarks		

6 Operation of Motor

Command	STS_16?	Read all 16ch motor status.
Reply	<DIR><DIR>...<DIR>/<MT><MT><MT><MT>...<MT><MT><MT><MT>	
	<DIR>	P/ Moving for CW direction S/ Stopping N/ Moving for CCW direction The order of data is from CH0 to CHF, and one character a motor, and describes 16 characters.
	<MT>	Indicate current motor status by 2 digit hex. b7:ESSEND :Emergency stop command executed. b6:SSEND :Normal stop command executed. b5:LESEND :Stopped by LS signal. b4:COMERR : Command error b3:ACCN :Decelerating b2:ACCP :Accelerating b1:DRIVE :Motor is moving. b0:BUSY :Driving or dealing with command. The data is in order from CH0 to CHF.
Example	STS_16? Reply: SSSSPSSSSSNSSSS/00000080030000000000000300000000	
Remarks	.	

● Limit switch(LS) status read command

Command	LS?	Read displayed 4 CH motor on LCD LS status.
Reply	<0123><LS>	
	<0123>	Show displayed motor CH No. at 1 digit hex. The order of this data is applied on <LS>.
	<LS>	Hold off and LS status (hex) When these signals are activating, its bits stands 1. b3: HOLD off b2: HP LS b1: CCW LS b0: CW LS
Example	LS? Reply: 0123888B	
Remarks		

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	HDSTLS?	Read displayed 4 CH motor on LCD hardware and software LS status.
Reply	<0123><HDLS><STLS>	
	<0123>	Show displayed motor CH No. at 1 digit hex. The order of this data is applied on <LS>.
	<HDLS> <STLS>	Hold off and LS status (hex) When these signals are activating, its bits stands 1. <HDLS> means from connected LS signal. <STLS> means from software LS signal. Data bit at b3 and b2 is always 0 on <STLS>. b3: 0 (fixed value) b2: HP LS b1: CCW LS b0: CW LS
Example	HDSTLS?	Reply: 0123888B0000
Remarks		

Command	LS_16?	Read all 16CH motor LS status.
Reply	<LS><LS>...<LS><LS>	
	<LS>	Hold off and LS status (hex) When these signals are activating, its bits stands 1. b3: HOLD off b2: HP LS b1: CCW LS b0: CW LS The data is in order from CH0 to CHF.
Example	LS_16?	Reply: 888B888888888888
Remarks		

● Commands for current positon read or set

Command	PS? <ch>	Read current position of specified motor.
Argument	<ch>	Channel
Reply	± ddddddd (Signed Integer 7-digit and more)	
Example	PS?4	Reply: -0000135
Remarks		

<ch>: 0 ~ F(Hexadecimal) for channel

Command	PS_16?	Display current position for all channel.
Reply	<POS>/<POS>/.../<POS>	
	<POS>	Display the current position with the signed Integer 7-digit and more, in order from ch0. Each channel is separated by "/".
Example	PS_16? Reply: +0000000/-0015000/-0004500/.../+0018000/+0001000	
Remarks	This command is not supported for EtherCAT command communication. It responds with "Unsupported at EtherCAT". The information of this command is always in the communication data table, so refer to that.	

Command	PS<ch><pos>	Preset current position.
Argument	<pos> position	-2,147,483,647 ~ +2,147,483,647
Reply	Nothing	
Example	PS2+10000 Current position of CH2 set to +10000.	
Remarks	Only remote mode. And the motor is stopped.	

6-4 Motor control command

- JOG step drive command

Command	JOG<d><ch>	Move 1 pulse.
Argument	<d> Direction	P/CW N/CCW
Reply	Nothing	
Example	JOGP1 CH1 moves 1 pulse for CW direction.	
Remarks	Only remote mode. And the motor is stopped.	

- Speed select command

Command	SPD<sp><ch>	Select motor move speed.
Argument	<sp> Speed	L/LSPD(Start speed, low speed) M/MSPD H/HSPD
Reply	Nothing	
Example	SPDHA Motor move speed of CH10 set to HSPD	
Remarks	Only remote mode. And the motor is stopped.	

Command	SPD?<ch>	Check the motor speed setting.
Reply	LSPD/MSPD/HSPD	
Example	SPD?1 Reply: HSPD Motor move speed of CH1 is HSPD.	
Remarks		

<ch>: 0 ~ F(Hexadecimal) for channel.

- Continuous move commands

Command	SCAN<d><ch>		Start continuous move. Same as SCAN move on LOCAL mode.
Argument	<d>	Direction	P/CW N/CCW
Reply	Nothing		
Example	SCANN2 Start continuous move for CCW direction at CH2.		
Remarks	Only remote mode. And the motor is stopped.		

Command	CSCAN<d><ch>		Start constant-speed continuous move. (No acceleration and deceleration)
Argument	<d>	Direction	P/CW N/CCW
Reply	Nothing		
Example	CSCANN2 Start continuous move for CCW direction at CH2.		
Remarks	Only remote mode. And the motor is stopped. Be careful of LSPD value, because too fast LSPD value causes motor step out.		

Command	SCANH<d><ch>		It is the same as "SCAN" command, except stop moving if home position sensor activates. It is a move that corresponds to the method 1 of the Home Position Set and Search drive (page 16).
Argument	<d>	Direction	P/CW N/CCW
Reply	Nothing		
Example	SCANHN2 Start continuous move for CCW direction at CH2.		
Remarks	Only remote mode. And the motor is stopped.		

<ch>: 0 ~ F(Hexadecimal) for channel.

- Absolute drive command(ABS)

Command	ABS<ch><deg>		Start absolute move.
Argument		Backlash	(None)/ Without backlash move B/ With backlash (no auto adjust)* S/ With backlash (auto adjust)*
	<deg>	Destination	-2,147,483,647 ~ +2,147,483,647
Reply	Nothing		
Example	ABS3+10000 Start absolute move to 10000 point at CH3. ABS0S-2500 Start absolute move to -2500 point with auto adjust backlash at CH0.		
Remarks	Only remote mode. And the motor is stopped. Please see below topics about backlash move.		

- Relative drive command (REL)

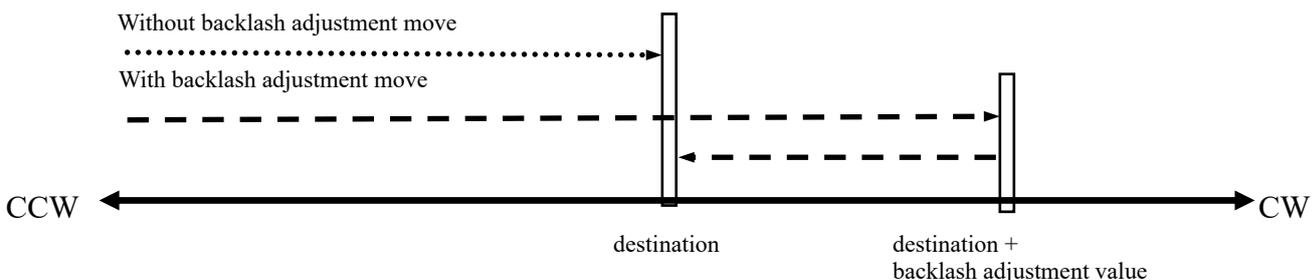
Command	REL<ch><deg>		Start relative move.
Argument		Backlash	(None)/ Without backlash move B/ With backlash (no auto adjust)* S/ With backlash (auto adjust)*
	<deg>	Value	-2,147,483,647 ~ +2,147,483,647
Reply	Nothing		
Example	RELC+10000 Start CW 10000 pulse move at CH12. REL0S-5000 Start CCW 5000 pulse move with auto adjust backlash at CH0.		
Remarks	Only remote mode. And the motor is stopped. Please see below topics about backlash move.		

***Backlash adjustment move**

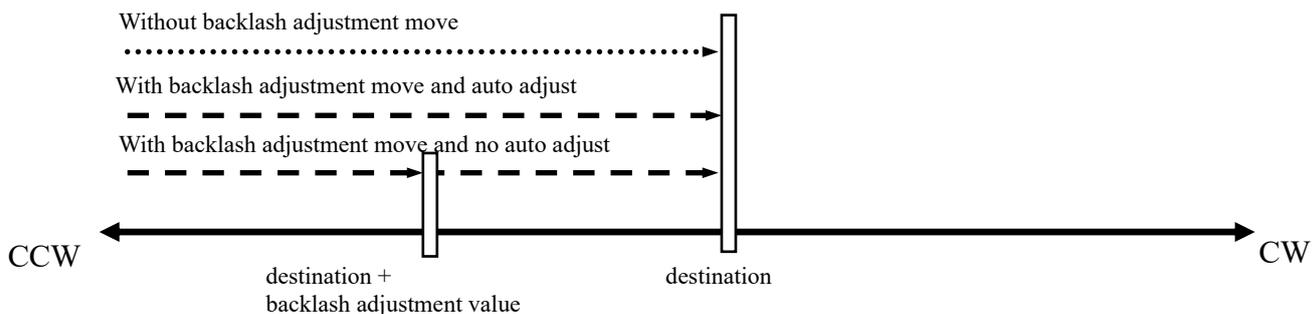
When you execute absolute or relative move, moves extra backlash adjustment value before reaching the destination point.

For example, adjustment value is +500, moves destination point plus 500 point and moves relative -500 value. Backlash adjustment move pattern is changed by sign of adjustment value and motor move direction. Please see the example the below.

Ex.1) Move direction is CW and adjustment value is positive



Ex.2) Move direction is CW and adjustment value is negative



If move direction is CCW, these two drive routine are exchanged.

Backlash adjustment value is checked and changed at Page2 on SETUP mode or this command.

<ch>: 0 ~ F(Hexadecimal) for channel

Command	B?<ch>	Check the backlash adjustment value.
Reply	± dddd (signed 4 digit decimal.)	
Example	B?3 Reply: +0500 Backlash adjustment value of CH3 is 500.	
Remarks		

Command	B<ch><deg>	Set the backlash adjustment value.
Argument	<deg>	Value -9,999 ~ +9,999
Initial value	+100	
Reply	Nothing	
Example	B0+400 Set backlash adjustment value of CH3 to 500.	
Remarks	Only remote mode. And the motor is stopped.	

<ch>: 0 ~ F(Hexadecimal) for channel.

- Home position return commands

Command	FDHP<ch>	If you have not found home position, start home position search move. It is a move that corresponds to the method 2 of the Home Position Set and Search drive (page 16).
Reply	Nothing	
Example	FDHP2 Start home position search move at CH2.	
Remarks	Only remote mode. And the motor is stopped.	

Command	GTHP<ch>	If you have found home position, move for memorized home position. It is a move that corresponds to the method 3 of the Home Position Set and Search drive (page 16)
Reply	Nothing	
Example	GTHP2 Start home position search move at CH2.	
Remarks	Only remote mode, and the motor is stopped.	

6-5 STOP commands

These commands are available both REMOTE mode and LOCAL.

Command	SSTP<ch>	ESTP<ch>	Stop the specified motor.
Reply	Nothing		
Example	SSTP1 Stop the motor at CH 1. ESTP7 Stop the motor at CH 7 immediately.		
Remarks	SSTP is stop with deceleration, and ESTP is stop without it.		

Command	ASSTP	AESTP	Stop all motor.
Reply	Nothing		
Example	ASSTP Stop all motor. AESTP Stop all motor immediately.		
Remarks	ASSTP is stop with deceleration, and AESTP is stop without it.		

6-6 Speed change command while driving

Command	SPC<ch><deg>		Moving motor speed changes on PPS unit.
Argument	<deg>	Speed	1 ~ 5,000,000
Reply	Nothing		
Example	SPC110 CH1 motor moving speed changes to 10 pps.		
Remarks	Only remote mode and the motor is moving.		

6-7 Command for Synchronous start for action pending

These commands are for synchronous start of motors.
 All motor except moving are changed standby status by “PAUSE ON” command.
 In this status, PM16C-16EC2 reserves all motor moving commands.
 If release standby status by “PAUSE OFF” command, reserved commands are all executed.

Command	PAUSE ON PAUSE OFF	Set all motor standby status or release it.
Reply	Nothing	
Example	PAUSE ON All stopped motors get standby status.	
Remarks	Only remote mode.	

Command	PAUSE?	Check the motor standby status.
Reply	ON/OFF	
Example	PAUSE? Reply: ON All motor is standby status.	
Remarks		

6-8 Command of SRQ output function

This function is to notify the motor stop on GPIB, LAN, and RS-232C communication.
 Outputs SRQ signal on GPIB line, sends “STOPx” (x: SRQ output CH) command on RS-232C communication.

- SRQ for GPIB communication

Serial poll register on GPIB is always 0x10 when SRQ signal is outputted.
 To check which CH have sent the SRQ signal, send ”SRQ_OUT?” command.

Command	SRQ_OUT?	Check the CH that SRQ signal have outputted.
Reply	HHHH(4 digit hex) b15:CHF ~ b0:CH0	
Example	SRQ_OUT? Reply : 0201 This reply shows SRQ signal has output on CH 0 and 9.	
Remarks	If you have checked the response, SRQ output flag will be cleared. Different from PM16C-04XDL, serial pool register does not show which ch have sent SRQ signal.	

<ch>: 0 ~ F(Hexadecimal) for channel

Command	SRQ<ch><md>	Set or reset SRQ signal output flag.
Argument	<md> Mode	0/SRQ flag reset 1/SRQ flag set
Reply	Nothing	
Example	SRQ71 Set SRQ output flag for the channel 7.	
Remarks	Command SRQG0 cancels SRQ output flag of all channels. Flag will be cleared when SRQ signal is outputted.	

Command	SRQ?<ch> SRQ?G	Check SRQ output flag. In the case of "SRQ?G", check all CH.
Reply	0/SRQ output flag off 1/SRQ output flag on HHHH(4 digit hex) b15:CHF ~ b0:CH0 (SRQ?G sent) Bit has been set as "1", and SRQ output flag has been set to this bit.	
Example	SRQ?0 Reply:1 SRQ output flag at CH 0.	
Remarks		

- SRQ for RS-232C communication

Command	RS_SRQ<ch><md>	Set or reset SRQ output flag.
Argument	<md> Mode	0/SRQ reset 1/SRQ set
Reply	Nothing	
Example	RS_SRQ71 Set SRQ output flag at CH7.	
Remarks	All CH SRQ flag are cleared by "LN_SRQG0" command. SRQ flag is cleared after SRQ signal is outputted.	

Command	RS_SRQ?<ch> RS_SRQ?G	Check SRQ output flag on RS-232C. In the case of "RS_SRQ?G", check all CH.
Reply	0/SRQ output flag off 1/SRQ output flag on HHHH(4 digit hex) b15:CHF ~ b0:CH0 (when RS_SRQ?G is sent.) Bit has been set as "1", and SRQ output flag has been set to this bit.	
Example	RS_SRQ?0 Reply:1 SRQ output flag has been set to CH0.	
Remarks		

7 Commands for parameter set up

This section explains the commands for parameter set up when the motor is working.

7-1 Basic configuration of motor

<ch>: 0 ~ F(Hexadecimal) for channel

Command	SETMT<ch><en><hd><ac><pl>		Set basic configuration of motor
Argument	<en>	Motor enable	0/ Disable Motor operation 1/ Enable Motor operation When set to 0, The situation is a state similar as LS (CW and CCW) activation. And the operation involving the movement is disabled.
	<hd>	Hold off	0/ Output hold off signal 1/ No output hold off signal If Hold off is 0, the hold-off signal is outputted to the external driver during the motor stops.
	<ac>	Acceleration and deceleration method	0/ Constant 1/ Trapezoidal 2/ S-character Please refer to Drive speed setting (page 11) for details.
	<pl>	Pulse output method	0/ Pulse-Pulse 1/ Pulse-Direction (In CW, direction = H.) 2/ Pulse-Direction-Reverse(In CCW, direction = H)
Reply	Nothing		
Example	SETMT01110 Selected ch0, enable motor operation, no output hold off signal, trapezoidal mode, pulse-pulse output.		
Remarks	Only remote mode. Item that is shaded is the default settings at parameter reset.		

Command	SETMT?<ch>	Confirm basic configuration of motor
Reply	<en><hd><ac><pl>	Please refer to "SETMTx" for meaning.
Example	SETMT?3 reply: 1011	
Remarks		

Command	HOLD<ch><on>		Set the output of hold off signal.
Argument	<on>	state	OFF/ Enable the output of hold off signal. ON/ Disable the output of hold off signal.
Reply	Nothing		
Example	HOLD3ON Disable the output of ch3's hold off signal.		
Remarks	Only remote mode. Item that is shaded is the default settings at parameter reset. It is the same as the hold off setting of the command SETMT.		

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	HOLD?<ch>	Confirm the output of hold off signal.
Reply	OFF/ Enable the output of hold off signal. ON/ Disable the output of hold off signal.	
Example	HOLD?3 reply: ON CH3's hold off signal has disabled.	
Remarks		

Command	H_ONTM<ch><t>	Set the time from excitation to the motor to actual movement.
Argument	<t>	Excitation time Setting range: 50 ~ 3000msec, in 10ms increments Initial value 80msec
Reply	Nothing	
Example	H_ONTM7500 CH7 will operate 500ms after the holdoff is released.	
Remarks	Only remote mode.	

Command	H_ONTM?<ch>	Check the time from exciting the motor to the actual movement.
Reply	DDDmsec.	
Example	H_ONTM?A reply: 100msec. CH-A will start operating 100ms after the holdoff is released.	
Remarks		

Command	H_OFTM<ch><t> HOLDTM<ch><t>	Set the time to output the hold-off signal after the motor has stopped. Both commands have the same behavior.
Argument	<t>	Excitation time Setting range: 50 ~ 3000msec, in 10ms increments Initial value 500msec
Reply	Nothing	
Example	H_OFTMC1200 CH-C outputs a hold-off signal 1200ms after it has stopped.	
Remarks	Only remote mode.	

Command	H_OFTM?<ch> HOLDTM?<ch>	Check the time to output the hold-off signal after the motor has stopped. Both commands have the same behavior.
Reply	DDDmsec.	
使用例	H_OFTM?5 reply: 1000msec. CH5 starts operating 1000ms after the holdoff is released.	
Remarks		

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	STOPMD<ch><pb><ls>		Set the way to stop motor.
Argument	<pb>	Stop by STOP button	0/ deceleration stop 1/ emergency stop
	<ls>	Stop by limit switch	
Initial value	<pb>:0 <ls>:0		
Reply	Nothing		
Example	STOPMD001 In CH0, the STOP button is set to the deceleration stop, and LS switch is set to the emergency stop.		
Remarks	Only remote mode.		

Command	STOPMD?<ch>	Confirm the way to stop motor.
Reply	<pb><ls> Please refer to "STOPMDx" for meaning.	
Example	STOPMD?3 reply: 01	
Remarks		

7-2 Moving speed setting

Command	SPD<sp><ch><pps>		Set the speed for LSPD, MSPD, HSPD.
Argument	<sp>	Speed	L/ LSPD M/ MSPD H/ HSPD Select the speed at which you want to set.
	<pps>	Speed (pps)	Set the speed at 5~10,000,000 pps units, in 5pps increments. (pps: pulses per second)
Initial value	LSPD/10pps MSPD/650pps HSPD/3,700pps		
Reply	Nothing		
Example	SPDH02000 Set the speed to 2000pps for when ch0's HSPD is selected. SPDLF50 Set the speed to 50pps for when chF's LSPD is selected.		
Remarks	Only remote mode. And the motor is stopped.		

Command	SPD<sp>?<ch>	Confirmed the speed for HSPD, MSPD, LSPD.
Argument	H/HSPD M/MSPD L/LSPD Display the speed of the setting value in the motor.	
Reply	DDDDDD (Integer of 6 or more digits)	
Example	SPDL?F reply: 000050 LSPD of chF is 50pps.	
Remarks		

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	SPDAL?	Display the speed that has been set to the motor that displays in LCD.
Reply	<0123>/<sp>dddddd/<sp>dddddd/<sp>dddddd/<sp>dddddd	
	<0123>	Expressed in hexadecimal notation of four-digit channel which is displayed on the display. Display the following parameters in this order.
	<sp>	H/HSPD M/MSPD L/LSPD Display the speed that has been set to the motor.
	dddddd	Display the speed as pps.
Example	SPDAL? Reoky: 0123/M000650/H010000/L000100/M000650	
Remarks	If the motor is in operation, display of ddddd part appears in 000000.	

7-3 Acceleration and deceleration Rate Setting

Command	RTE<ch><cd>	Set the code in the acceleration and deceleration rate.
Argument	<cd>	acceleration and deceleration code Enter the code a number between 0 ~ 115. Refer to page 45 about the relationship of acceleration and deceleration of the actual code.
Initial value	013	
Reply	Nothing	
Example	RTE040 Set to 40 for the acceleration and deceleration rate of CH0.	
Remarks	Only remote mode. And the motor is stopped.	

Command	RTE?<ch>	Confirm the code in the acceleration and deceleration rate.
Reply	DDD (3-digit integer)	
Example	RTE?0 reply: 050 The acceleration and deceleration rate of CH0 is 50.	
Remarks		

Command	RRATE<ch><rrt>	Set the acceleration / deceleration rate as a real number.
Argument	<rrt>	Rate value 1000~0.00125
Initial value	300.000	
Reply	Nthing	
Example	RTE02.5 Set the acceleration / deceleration rate for channel 0 to 2.5ms / 1000pps.	
Remarks	Valid only when the motor is stopped and when remote, see the next page for details.	

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	RRATE?<ch>	Check the acceleration / deceleration rate with a real number.
Reply	DDD.ddd (Real number with 3 decimal places)	
Example	RRATE?0 Reply:2.500 CH-0 has an acceleration / deceleration rate of 2.5ms / 1000pps.	
Remarks		

7-4 Acceleration and Deceleration Rate

Acceleration and Deceleration Rate are given by code number 0 ~ 115 those mean actual rate data below.

unit: ms/1000pps

(It's the requirement time to reach the speed of 1000pps from 0pps.)

NO	RATE	NO	RATE								
0	1000	20	150	40	22	60	3.3	80	0.47	100	0.068
1	910	21	130	41	20	61	3	81	0.43	101	0.062
2	820	22	120	42	18	62	2.7	82	0.39	102	0.056
3	750	23	110	43	16	63	2.4	83	0.36	103	0.051
4	680	24	100	44	15	64	2.2	84	0.33	104	0.047
5	620	25	91	45	13	65	2	85	0.3	105	0.043
6	560	26	82	46	12	66	1.8	86	0.27	106	0.039
7	510	27	75	47	11	67	1.6	87	0.24	107	0.036
8	470	28	68	48	10	68	1.5	88	0.22	108	0.033
9	430	29	62	49	9.1	69	1.3	89	0.2	109	0.030
10	390	30	56	50	8.2	70	1.2	90	0.18	110	0.027
11	360	31	51	51	7.5	71	1.1	91	0.16	111	0.024
12	330	32	47	52	6.8	72	1	92	0.15	112	0.022
13	300	33	43	53	6.2	73	0.91	93	0.13	113	0.020
14	270	34	39	54	5.6	74	0.82	94	0.12	114	0.018
15	240	35	36	55	5.1	75	0.75	95	0.11	115	0.016
16	220	36	33	56	4.7	76	0.68	96	0.1		
17	200	37	30	57	4.3	77	0.62	97	0.091		
18	180	38	27	58	3.9	78	0.56	98	0.082		
19	160	39	24	59	3.6	79	0.51	99	0.075		

Real rate setting

With PM16C-16EC2, it is possible to set with real values only when setting remotely. The settable range varies depending on the maximum speed (HSPD, MSPD value) of each axis. If it is set outside the configurable range, it will be set to the upper and lower limits that can be set.

Max speed is 150,000 or less: 1000 ~ 0.1 (ms/1000pps, 0.1steps)
 Max speed is 1,500,000 or less: 100 ~ 0.01 (ms/1000pps, 0.01steps)
 Max speed is faster than 1,500,000: 20 ~ 0.00125 (ms/1000pps, 0.00125steps)

7-5 Setting of the limit switch-related

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	SETLS<ch><D><lsv><lsiv>		Set the basic operation of the limit switch.
Argument	<D>	Digital LS enable	0/ Disable digital limit switch 1/ Enable digital limit switch
	<lsv>	LS enable	0/ LS disable 1/ LS enable In lsv=0, motor does not stop, even if the limit switch detects the limit. Expressed in three-digit binary number like 111, it will be displayed in the order of HPLS, CCWLS, and CWLS.
	<lsiv>	LS polarity	0/ N.Open (A-contact) 1/ N.Close (B-contact) Select the polarity of the limit switch. Format similar to <lsv>. Expressed in three-digit binary number.
Reply	Nothing		
Example	SETLS201110011 Disable digital LS of CH2, enable all of LS, set N.Open in HPLS, set N.Close in CCWLS, and set N.Close in CWLS.		
Remarks	Only remote mode. Item that is shaded is the default settings at parameter reset.		

Command	SETLS?<ch>	Confirm the basic operation of the limit switch.
Reply	<D><lsv><lsiv>	Refer to "SETLS" for meaning.
Example	SETLS?2 reply: 01110000	
Remarks		

Command	<D>L<ch><dls>		Set the threshold of digital LS that is enabled.
Argument	<D>	Setting side	F/ CW side B/ CCW side
	<dls>	Setting value	-2,147,483,647 ~ +2,147,483,647
Initial value	CCW side: -1,000,000 CW side: +1,000,000		
Reply	Nothing		
Example	FL0+1000000 Set 10,000,000 to CW digital LS value of CH0. BL0-1000 Set -1,000 to CCW digital LS value of CH0.		
Remarks	Only remote mode. And the motor is stopped.		

Command	<D>L?<ch>		Confirmed the threshold of digital LS that is enabled.
Argument	<D>	Setting side	F/ CW side B/ CCW side
Reply	± ddddddd (Signed Integer 7-digit and more)		
Example	FL?2 reply: +1000000		
Remarks			

7-6 Setting of the home position related

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	SETHP<ch>0<hpf><hpd><atd>		Change How to set the home position, and rewrite the detection situation.
Argument	<hpf>	state of home position	0/ not found 1/ found
	<hpd>	direction of home position	0/ CW 1/ CCW Record the direction that had been moved when detects the home position.
	<atd>	direction of start of automatic home position detection	0/CW 1/CCW If the home position is not set, this is the direction to move first when the automatic home position is detected.
Reply	Nothing		
Example	SETHP00001 CH0, hpf is "not found", hpd is CW, atd is CCW		
Remarks	Only remote mode. Item that is shaded is the default settings at parameter reset.		

Command	SETHP?<ch>	Confirm the information of the home position, and how to set the home position.
Reply	0<hpf><hpd><atd> refer to "SETHP" for meaning.	
Example	SETHP?2 reply: 0110 detected the home position.	
Remarks		

Command	SHP<ch><pos>	Normally the home position data is automatically set by HP mode, but this command changes the data by force.
Argument	<pos>	position -2,147,483,647 ~ +2,147,483,647
Reply	Nothing	
Example	SHP5+10000 Set 10,000 to CH5's home position.	
Remarks	Only remote mode.	

Command	SHP?<ch>	Read out the home position data.
Reply	The home position was found. / ± ddddddd(Signed Integer 7-digit and more) The home position was not found. / NO H.P	
Example	SHP?5 reply: +0010000	
Remarks		

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	SHPF<ch><off>		Set the home position offset. When you detect home position by command "GTHPx", home position searching starts from the distance of offset value from current home position.
Argument	<off>	offset	0 ~ 99,999
Initial value	100		
Reply	Nothing		
Example	SHPF51000 Set 1,000 to the offset of CH5.		
Remarks	Only remote mode.		

Command	SHPF?<ch>	Confirm the home position offset.
Reply	dddd (4-digit)	
Example	SHPF?5 reply: 0100	
Remarks		

7-7 Setting of the local mode data

Command	S<mode><ch><pos>		Set the various values to be used in local mode.
Argument	<mode>	Mode	REL/ Value of the relative movement by START button in REL mode. ABS/ Value of the absolute movement by START button in ABS mode. PRS/ Value to be set by PRESET button in SCAN mode.
	<pos>	Set position	-2,147,483,647 ~ +2,147,483,647
Initial value	REL:+10000 ABS:0 PRS:0		
Reply	Nothing		
Example	SPRSB+10000 Set +10000 to the preset value of CH11 for when PRESET button will be pressed.		
Remarks	Only remote mode.		

Command	S<mode>?<ch>		Confirm the various values to be used in local mode.
Argument	<mode>	Mode	REL/ Value of the relative movement by START button in REL mode. ABS/ Value of the absolute movement by START button in ABS mode. PRS/ Value to be set by PRESET button in SCAN mode.
	Reply		
Reply			± ddddddd (Signed integer 7 digits or more)
Example	SPRS?1 reply: +0002500 Preset value is +2500, when PRESET button on the CH1 is pressed.		
Remarks			

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	SETJG<ch><pos>	In local mode, set the amount of movement of a operation of JOG switch.
Argument	<pos> Step number	0 ~ 9,999
Initial value	1	
Reply	Nothing	
Example	SETJG7200	Outputted 200 pulse when JOG switch for CH7 is operated one time.
Remarks	Only remote mode.	

Command	SETJG?<ch>	Confirm the amount of movement of a operation of JOG switch.
Reply	dddd (4-digit integer)	
Example	SETJG?1	reply: 0050
Remarks		

7-8 Display setting

Command	SETCH<ch><ch><ch><ch>	Select channels to be displayed on LCD.
Argument	<ch> channel	Set the channel number (Hexadecimal) to display in order as A, B, C, D. Please enter "-" if the channel doesn't change. It is not possible to display two or more places at the same time the same CH.
Reply	Nothing	
Example	SETCH0123	Display CH0,1,2,3 in order from Pos.A on the LCD.
	SETCH--8A	Display CH8 to Pos.C of LCD. And display CH10 to Pos.D .
Remarks	Only remote mode. And it is effective when the motor that is displayed on the LCD has stopped all.	

Command	SETCH?	Confirm channels to be displayed on LCD.
Reply	XXXX (4-digit, hexadecimal)	Display in order as A, B, C, D .
Example	SETCH?	reply: 0123
Remarks		

<ch>: 0 ~ F(Hexadecimal) for channel.

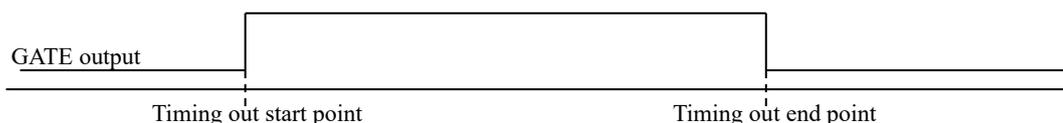
Command	LCDB <brt>	Adjust the brightness of the LCD backlight.
Argument	<brt> brightness	Please enter an integer of 1 ~ 100.
Initial value	100	
Reply	Nothing	
Example	LCDB 50	
Remarks	Only remote mode.	

Command	LCDB?	Confirm the brightness of the LCD backlight.
Reply	001 ~ 100, 3-digit integer	
Example	LCDB? reply: 050	
Remarks		

8 Timing out signal output

From the four channels that are displays on the LCD, you can get output signal of TTL level according to the current pulse position from LEMO connector on the front panel. Type of signal is available pulse signal and GATE signal.

- GATE signal

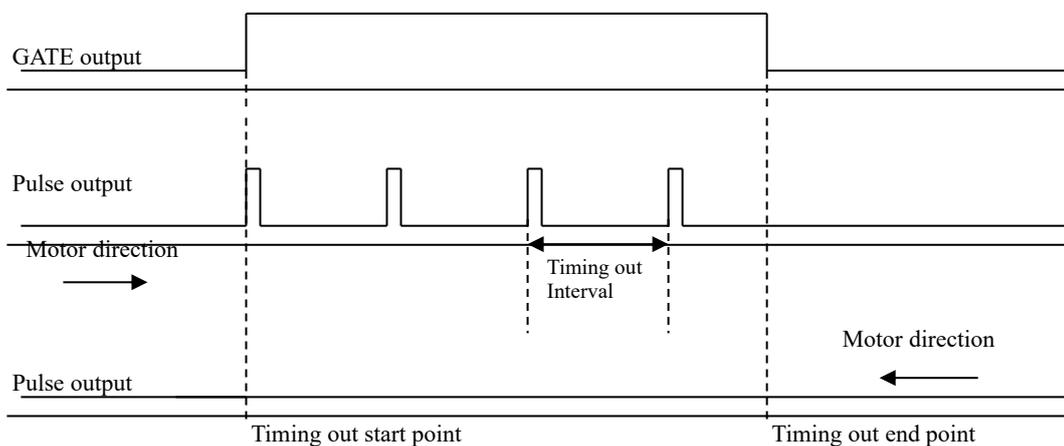


When the position is within the range of the end point from the start of the current point, the output is H level. The output is similar even if a number of start and end points are replaced.

When you have the same value of the start and end points, it will be output when the signal of the width of the pulse output speed has passed that point.

(Example) Set START=10000, STOP=10000 and 1000PPS,
GATE signal having a pulse width of 1ms is output when it has passed through the position 10000.

- Pulse signal



When the motor direction is to the end point from the start point, the pulse signal (width: 200ns ~ 1ms) is outputted if it passes through START. And the pulse signal is outputted every time the value of the interval only proceed until it passes through STOP from START.

If the motor direction is reversed, the pulse signal doesn't generated.

When the motor direction is CCW, and if you want to output the pulse, please set the value of the start point that is larger than the end point.

- Output method

1. Set the timing signal

In LOCAL mode, please refer to “Page7 TIMING OUT setting” (page 27) for setting.
In REMOTE mode, you can be set by the following commands.

<ch>: 0 ~ F(Hexadecimal) for channel

Command	TMGM<ch><type>		Select type of timing signal.
Argument	<type>	Type of signal	0/ no signal 1/ GATE signal 2/ 200ns pulse 3/ 10us pulse 4/ 100us pulse 5/ 1ms pulse 6/ Manual level output 7/ manual 1us pulse 8/ manual 10us pulse 9/ Manual 100us A/ Manual 1ms pulse
Reply	nothing		
Example	TMGM15		
Remarks	Only remote mode Item that is shaded is the default parameter settings at reset.		

Command	TMGM?<ch>	Confirm type of timing signal.
Reply	0 ~ 5 (1-digit integer)	please refer to "TMGMx" <type> for meaning.
Example	TMGM?2	reply: 1
Remarks		

Command	TMG<md>?<ch>		Read out the timing signal start point, or the timing signal end point.
Argument	<md>	mode	S/ start point E/ end point
Reply	± ddddddd (Signed 7-digit integer)		
Example	TMGE?2	reply: +0050000	
Remarks			

Command	TMGI<ch><data>		Set the interval of the timing pulse output.
Argument	<data>	interval	1 ~ 2,147,483,647
Initial value	200		
Reply	Nothing		
Example	TMGIF1000	CH-F's the interval of timing pulse will be set to 1000.	
Remarks	Only remote mode		

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	TMGI?<ch>	Confirm the interval of the timing pulse output.
Reply	ddddddd (8-digit integer)	
Example	TMGI?F reply: 00001000	
Remarks		

Command	TMG<md><ch><data>	Set the timing signal start point and end point.
Argument	<md> mode	S/ set start point E/ set end point
	<data> start/end point	-2,147,483,647 ~ +2,147,483,647
Initial value	Start point: +1,000 end point: +10,000	
Reply	Nothing	
Example	TMGS2+10000	CH2's timing signal start point will be set to 10,000.
	TMGE2+50000	CH2's timing signal end point will be set to 50,000.
Remarks	Only remote mode	

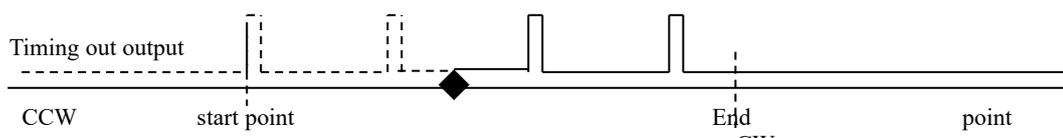
- In the case of pulse, the motor is moved on the outside of the start and end points of the timing signal.
Please move to the CCW side than the starting point if you want to observe the pulse in the move to the CW. And also, please move to the CW side than the starting point if you want to observe the pulse in the move to the CCW.
If the gate, you do not need this operation.
- Prepare the timing signal output.
In local mode, please add "#" to the appropriate channel on Motor drive screen (page 13). In remote mode, please enter the following command.

Command	TMGR?<ch>	Confirm the timing signal output preparation mode. At the time of manual output, the current output is answered.
Reply	YES/ The timing signal output preparation mode is ready. NO/ The timing signal output preparation mode is not ready.	
Example	TMGR?F reply: NO	
Remarks		

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	TMG<md><ch>		Set / clear the timing signal output preparation mode. At the time of manual output, the current output is answered.
Argument	<md>	state	R/ Ready H level, pulse output (manual) C/ Clear L level output (manual)
Initial value	Clear		
Reply	Nothing		
Example	TMGR0 Make the timing signal output preparation of ch0. In manual mode, if it is a level output, TMGR outputs an H level signal. Output L level with TMGC. If it is a pulse output, a pulse with the width set by TMGR is output once.		
Remarks	Only remote mode		

4. Motor is move to the end point direction, and the signal is generated from the time that has passed through the start point.
In gate mode, the signal is outputted between the start point with the end point until releasing the output preparation state of the timing signal.
In pulse mode, the output ready status is canceled and the output pulse once. However, the pulse is generated, if the motor has resumed to move in the same direction, until the motor pass through the end point, even if the motor stops in the middle.



In the moving to the CW direction, If you resume the operation from ◆ in the above figure that is stopped, the pulse is output with the solid line of Timing out output. The dotted line area is considered that has been already outputted. And, the pulse is not outputted, even if it has moved to the CCW direction.

If you don't want to output the pulse if it is moved to the CW direction after stop at ◆, please cancel the output ready by "TMGCx" command. And then, pulse is not output until the ready state to the next.

- Timing signal manual output mode
If you set <type> to 6 with the command "TMGM <ch> <type>", you can output the timing signal to the level output arbitrarily, and if you set 7 to A, you can output 1 pulse. In case of 6, H level is output by TMGR <ch> and L level is output by TMGC <ch>.
For 7 to A, a pulse with the set width is output once each time TMGR <ch> is input.
- Timing output channel fixed mode
In addition to the conventional mode (the timing signal output channels are linked to the display position on the LCD), mode to fix the output channel is available.
An example, If TP0 has been set to CH0, CH0's timing signal is outputted from TP0, even if it has not been displayed on the LCD top line. And this is the feature of the output channel fixed mode.
In local mode operation, you can change settings by "Page8 TIMING OUT channel setting" (page 28). In remote mode operation, make the setting with the following command.

<ch>: 0 ~ F(Hexadecimal) for channel.

Command	TMGFX <md>		Set the output channel mode of the timing signal.
Argument	<md>	Output mode	DS/ Output from the channel in the display. EN/ Output channel fixed mode
Reply	Nothing		
Example	TMGFX EN		
Remarks	Only remote mode, it's effective only when the motor of all channels is stopped. Item that is shaded is the default parameter settings at reset.		

Command	TMGFX?	Confirm the output channel mode of the timing signal.	
Reply	DS/ Output from the channel in the display. EN/ Output channel fixed mode		
Example	TMGFX?	reply: EN	
Remarks			

Output channel fixed mode when enabled, Set up the output channel by the command below. Confirmation is possible at any time, but the settings have not reflected that it is not the fixed mode.

Command	TMGCH<ch><ch><ch><ch>		Set the channel of the timing signal.
Argument	<ch>	channel	In order to TP3 from TP0, must be entered in hexadecimal notation the channel to output the signal. Please enter "-" in place that does not change the display. Can not be set at the same time two or more the same ch.
Reply	Nothing		
Example	TMGCH48CF Set TP0: CH4, TP1: CH8, TP2 CH12, TP3: CH15.		
Remarks	It is effective when the timing signal output channel fixed mode. At remote mode, before setting and after setting, it is effective when both channels are stopped. In remote mode, it is effective when both channels (before setting and after setting) are stopped.		

Command	TMGCH?	Confirm the channel of the timing signal.	
Reply	<ch><ch><ch><ch>		order: TP0,TP1,TP2,TP3 (hexadecimal)
Example	TMGCH?	Reply: 48CF	
Remarks			

Supplement: For channel switching of the timing signal output channel fixed mode

In timing signal output channel fixed mode, switching of the LCD display channel is possible by CH SEL switch "SETCH" command, even if it is the remote mode.

9 Other Operation

9-1 Channel comment setting

You can leave 3 characters for each channel. Channel comment is not displayed at the initial state. You can use the following methods to view comments.

Timing signal output port display

0	0		H		T	P	0			0	1	2	3	4	5	6	7	8	9
0	1		H	#	T	P	1		-	0	1	2	3	4	5	6	7	8	9
0	2		M	#	T	P	2		-	0	1	2	3	4	5	6	7	8	9
1	5		L		T	P	3			0	1	2	3	4	5	6	7	8	9

Channel comment display

0	0		H		C	H	0			0	1	2	3	4	5	6	7	8	9
0	1		H	#	C	H	1		-	0	1	2	3	4	5	6	7	8	9
0	2		M	#	C	H	2		-	0	1	2	3	4	5	6	7	8	9
1	5		L		C	H	F			0	1	2	3	4	5	6	7	8	9

In the communication command, you can display switching with the following command.

Command	LCD_DISP <md>		Switch the display of the LCD.
Argument	<md>	state	T/ Timing signal output port display C/ Channel comment display
Initial value	Timing signal output port display		
Reply	Nothing		
Example	LCD_DISP C		
Remarks	Remote mode only		

- How to set the channel comments (local mode)
 1. Move the cursor to where you want to enter a character.
 2. Select a letter kind by the letter kind selection button assigned to the numeric keypad.
 3. You can push feed button and return button many times until the target letter comes out.

		Z		z		9		∧
		Y		y		8		∩
		X		x		7		∪
		:		:		6		<
Feed	7	:	8	:	9	6	0	:
Letter kind selecting	4	M	5	m	6	5	±	:
Return	1	:	2	:	3	4	CLR	/
		:		:		3		.
		C		c		2		-
		B		b		1		,
		A		a		0		+

The symbol which can be inputted with a ten key are the below.
 + , - . / : ; < = > ? [¥] ^
 -

Example) If you want to comment as "A-4" to CH1.

0	0		H		C	H	0			0	1	2	3	4	5	6	7	8	9
0	1		H	#	C	H	1		-	0	1	2	3	4	5	6	7	8	9
0	2		M	#	C	H	2		-	0	1	2	3	4	5	6	7	8	9
1	5		L		C	H	F			0	1	2	3	4	5	6	7	8	9

1. In the channel comment display mode, move the cursor to the location where colored in the figure below.
2. In order to enter the "A", please press the numeric keypad "4" for select the uppercase letters.
 The "M" will appear in the cursor location. And press the numeric keypad "1" repeatedly until the uppercase letter "A" is displayed.
 After completed to input, the display shows as follows.

0	0		H		C	H	0			0	1	2	3	4	5	6	7	8	9
0	1		H	#	A	H	1		-	0	1	2	3	4	5	6	7	8	9
0	2		M	#	C	H	2		-	0	1	2	3	4	5	6	7	8	9
1	5		L		C	H	F			0	1	2	3	4	5	6	7	8	9

3. In order to enter "-", move the cursor to the location where colored in the figure above.
 Please press the numeric keypad "±" for select the symbol.
 The ":" will appear in the cursor location. And press the numeric keypad "CLR" repeatedly until the uppercase letter "-" is displayed.

9-2 All reply mode

In PM16C-16EC2, All reply mode have been added to add a response to the command with no response. Response that is added is the following five types. The command will reply with original response.

- OK Command arrives, and the process has completed successfully.
- MCC06 BUSY ERROR Motor control IC was busy and process did not complete.
- PARAMETER ERROR The input value is not in the configurable range.
- COMMAND ERROR The command that can be executed is not found.
- NG The command arrived, but the process did not complete.

Even if the reply is OK, it is not guarantee the behavior of as intended. So, please use as a tool of communication debugging only.

You can set this by 5-9 Page9 Parameters of remote mode setting on SETUP mode (page 28) for local mode. And you can set this by the following command for remote mode.

Command	ALL_REP <md> ALL_REP_ <md>	Set All reply mode. (V1.03~) Both commands are available.
Argument	<md> setting	EN/ Enable all reply mode DS/ Disable
Initial value	DS	
Reply	Nothing (the reply is OK when setting is EN.)	
Example	ALL_REP EN	
Remarks	Only remote mode, set only the communication port when sending commands	

Command	ALL_REP?	Confirm All reply mode or not
Reply	EN/ Enable All reply mode DS/ Disable	
Example	ALL_REP? Reply: DS	
Remarks	The settings on the communication port when the command is sent are read	

9-3 Maintenance command

Command	VER?	Read out firmware version.
Reply	Example) V1.00 17-07-20 PM16C-16EC2	
Remarks		

Command	VERH?	Read out hardware version.
Reply	Example) HD-VER 211111	
Remarks	(V1.02 ~) The first character is displayed on the startup screen.	

Command	VERE?	Read out EtherCAT Slave board version.
Reply	Example) EtherCAT SLAVE V1.00	
Remarks		

Command	STSM?	Read contents of control IC (MCC06)'s Status port1.
Reply	AAAA/BBBB/CCCC/DDDD Regarding 4channels that are displayed, MCC06's status is displayed in hexadecimal four-digit.	
Example	0000/0000/0000/0000	
Remarks		

Command	ERRF? ERR?	Read out error status.
Reply	ERRF?	HH Hexadecimal two-digit. b7/BATTERY EMPTY b3/OTHER ERROR b2/PARAMETER ERROR b1/MCC06 BUSY ERROR b0/COMMAND ERROR
	ERR?	Example) MCC06 BUSY ERROR Displays the error information of the lower most of the bits that are happening in error. "NO ERROR", if there is no error.
Example	ERR? ERRF?	Reply: COMMAND ERROR Replu: 01
Remarks		

Command	ERRC<e>	Clear error flags	
Argument	<e>	Error type	No input/ clear all errors 0/ clear COMMAND ERROR 1/ clear MCC09 BUSY ERROR 2/ clear PARAMETER ERROR 3/ clear OTHER ERROR
Reply	Nothing		
Example	ERRC	Clear all errors	
Remarks			

Command	FROM?	There are two ROMs that store firmware. Confirm ROM which has been used for the firmware.
Reply	FROM0, FROM1	
Remarks		

Command	FROM0 FROM1	Select the one of two ROM that are stored the firmware.
Reply	Nothing	
Remarks	Please note that when you restart the equipment after you run this command, various parameters will be initialized. (V1.02 ~) Parameters are no longer initialized.	

Command	REST	Restart the equipment. This is the same as pressing power switch.
Reply	Nothing	
Remarks		

10 EtherCAT slave function

10-1 Communication specifications with EtherCAT master

PM16C-16EC2 has a built-in EtherCAT slave function and only performs PDO communication with the EtherCAT master. The default communication cycle is 1ms. PDO data consists of two areas, "Constantly updated data area" and "Command communication data area". The "Constantly updated data area" is an area where the position data and status data of each CH are constantly updated. The "data area for command communication" is used as an area for sending and receiving PM16C-16EC2 standard commands. By communicating the position data and status data of each CH in the "always updated data area", data can be acquired faster than before.

10-2PDO communication data list

Below is a list of PDO data.

Table. PDO communication data list (206 Byte)

data Classification	EtherCAT master master access	EtherCAT slave access	PDO data item	data size [Byte]	Definition
Always For communication data	Read	Write Write	s tatus, position, Remote mode Such	100	See the attached sheet.
command For communication data	Read	Write Write	answer standby	1	slave has received a command request from the EtherCAT master and that the ECAT slave is ready to return a command response. a) If the slave has not received a command request from the master, set "answer standby = 0". b) When the slave receives the command request from the master, "answer standby = 1" is set. c) When the command response from PM16C can be returned to the master, return to "answer standby = 0". * The slave accepts the command request from the master only when the command length changes from "0 to *". Read the command statement at that time and recognize the command. Even if only the command length changes from "5 to 8", the command request is ignored.
	Read	Write Write	busy	1	A status signal that PM16C is processing for command response. (* This signal is used only between the Slave IF board and PM16C, and the EtherCAT master does not need to be aware of it.)
	Write Write	Read	Command length	Four	When the master wants to request a command from the slave, it stores a number according to the length of the command statement. slave receives the command (answer standby = 0 → 1) and confirms the response from the slave (answer standby = 1 → 0), the command length is returned to 0. Even if the master wants to send consecutive commands, it is not possible to issue the next command after performing PDO communication with "command length = 0".
			Command statement	32	Only command statements are written in ASCII. Fixed length. Fill the remainder with Null.
	Read	Write Write	command Response length	Four	When the slave wants to send a command response, it stores a numerical value according to the length of the command response statement. a) Unless the command response is sent, the command response length is set to 0. b) time when the command response is sent to the master is the time when answer standby = 0 → 1. c) When the command length from the master becomes "*" → 0" and it is determined that the master has recognized the command response, the command response length is returned to 0.
command Response statement			64	Only command statements are written in ASCII. Fixed length. Fill the remainder with Null.	

10-3 Data content for constant communication in PDO communication

The constant communication data in the PDO communication message are described below.

“No” indicates the byte data address.

Table. Data content for constant communication (100 Byte)

No	b7	b6	b5	b4	b3	b2	b1	b0	No	b7	b6	b5	b4	b3	b2	b1	b0	No	b7	b6	b5	b4	b3	b2	b1	b0	No	b7	b6	b5	b4	b3	b2	b1	b0	
0									32									64									96	—	—	—	—	—	—	—	—	REM
1									33									65									97	—	—	—	—	—	—	—	—	—
2									34									66									98	—	—	—	—	—	—	—	—	—
3									35									67									99	—	—	—	—	—	—	—	—	—
4									36									68																		
5									37									69																		
6									38									70																		
7									39									71																		
8									40									72																		
9									41									73																		
10									42									74																		
11									43									75																		
12									44									76																		
13									45									77																		
14									46									78																		
15									47									79																		
16									48									80																		
17									49									81																		
18									50									82																		
19									51									83																		
20									52									84																		
21									53									85																		
22									54									86																		
23									55									87																		
24									56									88																		
25									57									89																		
26									58									90																		
27									59									91																		
28									60									92																		
29									61									93																		
30									62									94																		
31									63									95																		

STATUS1 [7: 0]
 [7]: ESEND (with sudden stop command)
 [6]: SSEND (with deceleration stop command)
 [5]: LSEND (limit switch stop)
 [4]: COMERR (command error)
 [3]: ACCN (decelerating)
 [2]: ACCP (accelerating)
 [1]: DRIVE (during pulse output)
 [0]: BUSY (data processing or drive running)

STATUS2 [7: 0]
 [7]: CCW moving
 [6]: CW moving
 [5]: CCW Digital LS
 [4]: CW Digital LS
 [3]: HOLD OFF
 [2]: HP LS
 [1]: CCW LS
 [0]: CW LS

POS [31: 0]
 : Position (-2147483648-2147483647)

REM
 : Remote mode

11 Firmware version up

PM16C-16EC2 can be done using the firmware version RS232C communication line. When updating the firmware, for safety, disconnect the connection between the main unit and the driver, or turn off the power of the driver.

Also, if you upgrade the version with FW V1.01 or earlier, various settings including the current pulse value will be initialized. If necessary, write down the setting values, or save the parameters with the trial software for PM16C-04XDL.

If the two ROMs contain V1.02 or later FW, various settings will no longer be reset by switching between version UP and FW. When upgrading to V1.02 or later FW for the first time, please perform the version upgrade work twice to write to two ROMs.

If you upgrade the version from V1.01 or earlier, or return to the FW of V1.01 or earlier, the settings will be reset as before.

http://www.tsuji-denshi.co.jp/manual_pdf/pm16c_04xd_vup_soft.pdf (PDF file)

Instruction manual for file transmission software,

http://www.tsuji-denshi.co.jp/download_file/lan_rs_file_send.EXE (EXE file)

File transmission software has been uploaded.

In this section, we will explain that the version is upgraded using the free software Tera Term.

Note:

When switching the FW used in "FIRMWARE CHANGE", if you change the ROM used for the next boot after downloading the latest FW, all the position data will be reset to 0 and the various setting values will be reset to the initial values.

(V1.02 or later) When both FWs are V1.02 or later, both the position and the set value are no longer reset.

1. Prepare the text-file for version upgrade to your PC.
2. Launch the program "Tera Term".
3. Operation is File -> New connection, then select "Serial communication".
4. Operation is SETUP ->, then set to be CR+LF in Receive and Transmit set. Mark on Local echo and "OK".
Send the command VER?, and the connection will be good if there is reply.
5. Set PM16C-16EC2 to REMOTE MODE. Also, disable all response modes.
(In Local mode, version up is not recognized, even if version up file has been sent. File transmission may fail if all response modes are enabled.)
If you set the REPLY: item on page 9 of the SETUP screen to DIS, all response modes will be disabled.
6. Operation is Tera Term's File -> Send file, and then the window displays a screen to select a file to send.
Choose the text file of version up that you prepared in the above section 1 (.S). Upload will begin. **DO NOT turn off the power while REM lamp is blinking.**
Depending on network conditions, it may take some time to send the file.
In that case, increase the window size of Tera Term.
7. REM lamp on the PM16C-16EC2 is blinking on and off slowly that indicate receiving the file by PM16C-16EC2.
After received all data, REM lamp turns on quick blinking mode. Then the data write procedure begins.
After finishing data write procedure to ROM, REM lamp turns off. And then LOC lamp

turns on.

Program upgrade procedure is finished.

8. Please disconnect the Tera Term and exit.

PM16-16EC2 will start with the new firmware, if restart the PM16C-16EC2 while pressing the REM/LOC button.

Also, PM16C-16EC2 will start with the new firmware, if the command "REST" is sent.

You can use the "PROGRAM CHANGE" on Page10 at SETUP mode, to switch the firmware you want to use.

NEW: Firmware that you downloaded to the last.

OLD: Firmware that you have downloaded to 2 times before.

Remark:

The position data will be set to all zero if the firmware is changed and started. (Switched the firmware to be used in the "PROGRAM CHANGE". Or, downloaded the latest firmware.)

In case of the failure of receiving version up file, REM lamp keeps blinking slowly over 5 minutes, or continue to light without quick blinking phase. Please reboot the main unit and retry sending the file.

If you shutdown the unit while the REM lamp is blinking quickly, firmware data may not be correctly written to the ROM, which causes program to run out of control, and initial display may not be displayed.

In this case, please power off and power with pushing ten-key "8" switch.

The unit runs from previous ROM version again. And you can try again upgrade procedure.

This method is useful at any time, but the display "NEW", "OLD" those are shown in LCD display in SETUP mode will not be changed.

NEW / OLD display changes after V1.02.

Even if by the above operation, program runs out of control you can start again next procedure.

There is an original program in CPU-ROM.

When you use this mode you have to pay attention to following procedures.

Please be careful about an electrical shock, when you have opening the cover of this unit.

First take out power cable of it.

If you have some troubles to do next procedure, please contact us.

1. Put off the power switch of this unit and open the top cover. Please find dip switch is on print circuit board "TEP743" Set the dip switch 2 to side "ON". (Dip switch 1 is still side "OFF".)
2. Put on the power line pushing ten-key switch "5". The "RED" led lamp that indicate "REMOTE" is flashing on and off for 15 seconds, then "RED" lamp turn on red continuously. At this stage LCD display is not correct yet.
3. Put off the power switch of this unit again, then set the dip switch 2 to side "OFF".
(Dip switch 1 is still side "OFF".)
4. Put on the power line pushing REL/LOC button. Program starts by Version 1.00 firmware.
(In this stage if LCD display may not be correct (the display shows "-----" on the position area), but don't care of it. It's OK if you can change remote-local mode by REM/LOC button.)
5. Please upload the latest file again with the normal firmware version up method 1 ~ 8.



12 Appendix

12-1 Command List

A

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-------------	----

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TMGFX DS	55
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TMGI?x	53
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TMGRx	53

V

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VERE?	60
VERH?	60

12-2 Battery backup battery replacement

PM16C-16EC2 uses a button battery for battery backup, even if the power is turned off. It holds the settings of each axis and the current position.

It has a life of 5 years or more, but if the battery runs out, it will not be possible to set and retain location information when the power is turned off. If you turn on the power in that state, " BATT EMPTY" will be displayed on the LCD at regular intervals, and the "ERR? " Command will respond with "BATTERY EMPTY".

Please have one CR2032 ready when you replace the backup battery.

When you open the top lid of the main body, the battery is stored in BAT1 at the lower left of the board in the center.

Push the battery in the opposite side of the claws on the battery (the part surrounded by the circle in the figure on the right), remove the battery, and replace it with a new one. When the replacement is complete, push the battery in so that the claws catch on the battery.



After replacing the battery, turn on the power of the main unit. "BATT EMPTY" is displayed when the power is turned on for the first time, but after that, the power is turned on again, and when the previous display disappears after the second time, the battery replacement is complete.

13 Revision History

Revision	Date	Revision history
2	2022/07/19	Initial version release. English version1 is matched with Japanese version 2.
3	2024/09/30	Added the notice that not available for “ACS” command at “1. Abstract” section. Added the description for limit input and pulse output connectors at “13. Performance and Specifications” section. Matched with Japanese manual version 4.

14 Performance and Specifications

Power	AC 85V ~ 264V, 47 ~ 440Hz, 50VA Battery Backup: CR2032 x1	
IN/OUT	Control motor	16 motors can be controlled
	Capability	Local mode: controls 4 motor units at the same time. Remote mode: controls 16 motor units at the same time.
	Out put	CW, CCW, HOLE OFF (5V, 8mA: line driven) for each 16 motor driver
	Pulse rate	1 ~ 5MPPS
	Pulse control number	0 ~ ±2,147,483,647
	Acceleration and deceleration rate	1048.56 ~ 0.0125 ms/kHz
	Acceleration and deceleration form	Constant speed, S-character form, trapezoidal form
	Output format	Pulse-Pulse, Pulse direction (Polarity of direction can be switched.)
	Pulse out connector	Dsub9S (with M2.6 female screwlock)
	Limit switch input	CW-LS, CCW-LS, HOME-LS 12V 5mA (minus common) and power supply +12V for censer for each motor (total 1A).
Limit switch connector	Dsub9P (with M2.6 female screwlock)	
LCD display	Characters and lines of display device	20characters × 4 lines (Size : 9.2H ×4.8W) with backlight
	Display contents in control mode	channel number, current position of ±10 digit number, speed display, contents of limit switch, relative moving value, preset count value, home position information, panel operation ready/not ready
	Display contents in data set mode	Limit switch setting information, pulse output mode, value of speed HSPD/MSPD/LSPD, acceleration and deceleration rate value, Push button stop mode, origin detect function, timing pulse generate function, RS232C settings, GP-IB settings, HAND BOX selection, FIRMWARE version selection
Remote control	Communication way	EtherCAT, GP-IB, RS232C port
EtherCAT Slave	Physical layer	100BASE-TX (IEEE802.3) 100Mbps
	connector	RJ 45 x2
	Process data	Fixed PDO size
	Mailbox	SDO information service, SDO upload, SDO download
	Synchronous mode	Freerun
Communication cycle	1ms or more	
Case	EIA 2 UNIT rack mount t type (88H × 482W × 325D)	

For the further information, feel free to ask us.

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