

# 4CH STEPPING MOTOR CONTROLLER

PM4C-05A

USER'S MANUAL

(1149B VER.1)



APPLICATION OF ELECTRONIC DEVICES

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# PM4C - 05A COMMAND LIST

for GP - IB , RS 2 3 2 C (delimiter:CR+LF(fixed))

| MODE | COMMAND                | REPLY ETC.  |
|------|------------------------|---|
| R    | S 1 0 0                | cancel A CH SRQ <span style="float:right">GP-IB only</span>   |
|      | S 1 0 1                | SRQ set when A MOTOR stopped <span style="float:right">"</span>   |
|      | S 1 1 0                | cancel B CH SRQ <span style="float:right">"</span>  |
|      | S 1 1 1                | SRQ set when B motor stopped <span style="float:right">"</span>   |
|      | S 1 2 0                | cancel C CH SRQ <span style="float:right">"</span>  |
|      | S 1 2 1                | SRQ set when C motor stopped <span style="float:right">"</span>   |
|      | S 1 3 0                | cancel D CH SRQ <span style="float:right">"</span>  |
|      | S 1 3 1                | SRQ set when D motor stopped <span style="float:right">"</span>   |
| R/L  | S 1 8                  | SRQ flag read R 0 : 1/A POS., 2/B POS. 3/A,B POS. . . .   |
| R    | S 1 9                  | SRQ out CH read R 0 : 1/A POS., 2/B POS. 3/A,B POS. . . .   |
| R/L  | S 2 0 0                | A CH position data read R A ± D D D D D D D D D D : decimal   |
|      | S 2 0 1                | A CH CPU status read R A H H H : hex code, b0 BIT:BUSY  |
|      | S 2 0 2                | A CH LS, HP, HOLD OFF status read 0:CWLS,b1:CCWLS,b2:HP,b3:H.OFF  |
|      | S 2 1 0                | B CH position data read R B ± D D D D D D D D D D : decimal   |
|      | S 2 1 1                | B CH CPU status read R B H H H : hex code, b0 BIT:BUSY  |
|      | S 2 1 2                | B CH LS, HP, HOLD OFF status read 0:CWLS,b1:CCWLS,b2:HP,b3:H.OFF  |
|      | S 2 2 0                | C CH position data read R C ± D D D D D D D D D D : decimal   |
|      | S 2 2 1                | C CH CPU status read R C H H H : hex code, b0 BIT:BUSY  |
|      | S 2 2 2                | C CH LS, HP, HOLD OFF status read 0:CWLS,b1:CCWLS,b2:HP,b3:H.OFF  |
|      | S 2 3 0                | D CH position data read R D ± D D D D D D D D D D : decimal   |
|      | S 2 3 1                | D CH CPU status read R D H H H : hex code, b0 BIT:BUSY  |
|      | S 2 3 2                | D CH LS, HP, HOLD OFF status read 0:CWLS,b1:CCWLS,b2:HP,b3:H.OFF  |
| R    | S 3 0                  | A POSITION 2 BYTE COMMAND<br>: COMMAND<br>08:+JOG, 09:-JOG 0C:+CSPD SCAN 0D:-CSPD SCAN<br>0E:+SCAN 0F:-SCAN 16:PAUSE ON 17:PAUSE OFF<br>18:HOLD OFF 19:HOLD ON 1E:+SCAN & HP STOP 1F:-SCAN & HP STOP<br>40:SLOW STOP 80:EM.STOP |
|      | S 3 1                  | B POSITION 2 BYTE COMMAND<br>: COMMAND<br>08:+JOG, 09:-JOG 0C:+CSPD SCAN 0D:-CSPD SCAN<br>0E:+SCAN 0F:-SCAN 16:PAUSE ON 17:PAUSE OFF<br>18:HOLD OFF 19:HOLD ON 1E:+SCAN & HP STOP 1F:-SCAN & HP STOP<br>40:SLOW STOP 80:EM.STOP |
|      | S 3 2                  | C POSITION 2 BYTE COMMAND<br>: COMMAND<br>08:+JOG, 09:-JOG 0C:+CSPD SCAN 0D:-CSPD SCAN<br>0E:+SCAN 0F:-SCAN 16:PAUSE ON 17:PAUSE OFF<br>18:HOLD OFF 19:HOLD ON 1E:+SCAN & HP STOP 1F:-SCAN & HP STOP<br>40:SLOW STOP 80:EM.STOP |
|      | S 3 3                  | D POSITION 2 BYTE COMMAND<br>: COMMAND<br>08:+JOG, 09:-JOG 0C:+CSPD SCAN 0D:-CSPD SCAN<br>0E:+SCAN 0F:-SCAN 16:PAUSE ON 17:PAUSE OFF<br>18:HOLD OFF 19:HOLD ON 1E:+SCAN & HP STOP 1F:-SCAN & HP STOP<br>40:SLOW STOP 80:EM.STOP |
|      | S 3 8 0<br>± DDDDDDDHH | A POSITION DECIMAL INDEX COMMAND<br>HH: 10:CSPD INDEX SCAN 11:CSPD ABSOLUTE INDEX SCAN<br>12:INDEX SCAN 13:ABSOLUTE SCAN  |

|        |  |  |                        |                                       |
|--------|--|--|------------------------|---------------------------------------|
| R      | S 3 8 1<br>± DDDDDDDHH                                 | B POSITION DECIMAL INDEX COMMAND<br>HH: 10:CSPD INDEX SCAN 11:CSPD ABSOLUTE INDEX SCAN<br>12:INDEX SCAN 13:ABSOLUTE SCAN |                        |                                       |
|        | S 3 8 2<br>± DDDDDDDHH                                 | C POSITION DECIMAL INDEX COMMAND<br>HH: 10:CSPD INDEX SCAN 11:CSPD ABSOLUTE INDEX SCAN<br>12:INDEX SCAN 13:ABSOLUTE SCAN |                        |                                       |
|        | S 3 8 3<br>± DDDDDDDHH                                 | D POSITION DECIMAL INDEX COMMAND<br>HH: 10:CSPD INDEX SCAN 11:CSPD ABSOLUTE INDEX SCAN<br>12:INDEX SCAN 13:ABSOLUTE SCAN |                        |                                       |
|        | S3900DDD   | A POSITION HSPD set  | DDD:3 digit(000 ~ 187) | data available<br>after "S71" command |
|        | S3901DDD   | A POSITION MSPD set  | DDD:3 digit(000 ~ 187) |                                       |
|        | S3902DDD   | A POSITION LSPD set  | DDD:3 digit(000 ~ 187) |                                       |
|        | S3903DD  | A POSITION RATE set  |                        | DD:2 digit( 00 ~ 18 )                 |
|        | S3904DDDD  | A POSITION JOG pulse DDDD:4 digit(0000 ~ 9999)   |                        |                                       |
|        | S3905D   | A POSITION LS STOP MODE set D: 0:SLOW STOP 1:FAST STOP   |                        |                                       |
|        | S3906D   | A POSITION PB STOP MODE set D: 0:FAST STOP 2:SLOW STOP   |                        |                                       |
|        | S3907D   | A POSITION HOLD OFF set/reset D: 0:set 4:reset   |                        |                                       |
|        | S3908D   | A POSITION HP SCAN DIR set D: 0:CCW 8:CW   |                        |                                       |
|        | S3909<br>± DDDDDD                                      | A POSITION counter preset<br>DDDDDD:7 digit(0000000 ~ 8388607)   |                        |                                       |
|        | S3910DDD   | B POSITION HSPD set  | DDD:3 digit(000 ~ 187) | data available<br>after "S71" command |
|        | S3911DDD   | B POSITION MSPD set  | DDD:3 digit(000 ~ 187) |                                       |
|        | S3912DDD   | B POSITION LSPD set  | DDD:3 digit(000 ~ 187) |                                       |
|        | S3913DD  | B POSITION RATE set  |                        | DD:2 digit( 00 ~ 18 )                 |
|        | S3914DDDD  | B POSITION JOG pulse DDDD:4 digit(0000 ~ 9999)   |                        |                                       |
|        | S3915D   | B POSITION LS STOP MODE set D: 0:SLOW STOP 1:FAST STOP   |                        |                                       |
|        | S3916D   | B POSITION PB STOP MODE set D: 0:FAST STOP 2:SLOW STOP   |                        |                                       |
|        | S3917D   | B POSITION HOLD OFF set/reset D: 0:set 4:reset   |                        |                                       |
|        | S3918D   | B POSITION HP SCAN DIR set D: 0:CCW 8:CW   |                        |                                       |
|        | S3919<br>± DDDDDD                                      | B POSITION counter preset<br>DDDDDD:7 digit(0000000 ~ 8388607)   |                        |                                       |
|        | S3920DDD   | C POSITION HSPD set  | DDD:3 digit(000 ~ 187) | data available<br>after "S71" command |
|        | S3921DDD   | C POSITION MSPD set  | DDD:3 digit(000 ~ 187) |                                       |
|        | S3922DDD   | C POSITION LSPD set  | DDD:3 digit(000 ~ 187) |                                       |
|        | S3923DD  | C POSITION RATE set  |                        | DD:2 digit( 00 ~ 18 )                 |
|        | S3924DDDD  | C POSITION JOG pulse DDDD:4 digit(0000 ~ 9999)   |                        |                                       |
|        | S3925D   | C POSITION LS STOP MODE set D: 0:SLOW STOP 1:FAST STOP   |                        |                                       |
|        | S3926D   | C POSITION PB STOP MODE set D: 0:FAST STOP 2:SLOW STOP   |                        |                                       |
|        | S3927D   | C POSITION HOLD OFF set/reset D: 0:set 4:reset   |                        |                                       |
|        | S3928D   | C POSITION HP SCAN DIR set D: 0:CCW 8:CW   |                        |                                       |
|        | S3929<br>± DDDDDD                                      | C POSITION counter preset<br>DDDDDD:7 digit(0000000 ~ 8388607)   |                        |                                       |
|        | S3930DDD   | D POSITION HSPD set  | DDD:3 digit(000 ~ 187) | data available<br>after "S71" command |
|        | S3931DDD   | D POSITION MSPD set  | DDD:3 digit(000 ~ 187) |                                       |
|        | S3932DDD   | D POSITION LSPD set  | DDD:3 digit(000 ~ 187) |                                       |
|        | S3933DD  | D POSITION RATE set  |                        | DD:2 digit( 00 ~ 18 )                 |
|        | S3934DDDD  | D POSITION JOG pulse DDDD:4 digit(0000 ~ 9999)   |                        |                                       |
|        | S3935D   | D POSITION LS STOP MODE set D: 0:SLOW STOP 1:FAST STOP   |                        |                                       |
| S3936D | D POSITION PB STOP MODE set D: 0:FAST STOP 2:SLOW STOP |  |                        |                                       |
| S3937D | D POSITION HOLD OFF set/reset D: 0:set 4:reset         |  |                        |                                       |
| S3938D | D POSITION HP SCAN DIR set D: 0:CCW 8:CW               |  |                        |                                       |

|         |                   |  |
|---------|-------------------|--|
| R       | S3939<br>± DDDDDD | D POSITION counter preset<br>DDDDDD:7 digit(000000 ~ 8388607)  |
| R/L     | S 4 0 0           | A POSITION HSPD read RAH   |
|         | S 4 0 1           | A POSITION MSPD read RAM   |
|         | S 4 0 2           | A POSITION LSPD read RAL   |
|         | S 4 0 3           | A POSITION RATE read RAR   |
|         | S 4 0 4           | A POSITION JOG pulse read RAJP   |
|         | S 4 0 5           | A POSITION status read RAS   |
|         | S 4 1 0           | B POSITION HSPD read RBH   |
|         | S 4 1 1           | B POSITION MSPD read RBM   |
|         | S 4 1 2           | B POSITION LSPD read RBL   |
|         | S 4 1 3           | B POSITION RATE read RBR   |
|         | S 4 1 4           | B POSITION JOG pulse read RBJP   |
|         | S 4 1 5           | B POSITION status read RBS   |
|         | S 4 2 0           | C POSITION HSPD read RCH   |
|         | S 4 2 1           | C POSITION MSPD read RCM   |
|         | S 4 2 2           | C POSITION LSPD read RCL   |
|         | S 4 2 3           | C POSITION RATE read RCR   |
|         | S 4 2 4           | C POSITION JOG pulse read RCJP   |
|         | S 4 2 5           | C POSITION status read RCS   |
|         | S 4 3 0           | D POSITION HSPD read RDH   |
|         | S 4 3 1           | D POSITION MSPD read RDM   |
|         | S 4 3 2           | D POSITION LSPD read RDL   |
|         | S 4 3 3           | D POSITION RATE read RDR   |
|         | S 4 3 4           | D POSITION JOG pulse read RDJP   |
|         | S 4 3 5           | D POSITION status read RDS   |
|         | S 4 8             | Front panel information read<br>R ○ H H h h ○ : L:LOCAL R:REMOTE : C:CONDITION N:NORMAL<br>HH : b0:A POS. b1:B POS. b2:C POS. b3:D POS.<br>hh : b0:ABS b1:IND b2:H.P b3:SCAN<br>b4:H speed b5:M speed b6:L speed |
|         | S 7 0 R           | REMOTE MODE CHANGE   |
| S 7 0 L | LOCAL MODE CHANGE |  |
| R       | S 7 1 H           | H SPEED CHANGE   |
|         | S 7 1 M           | M SPEED CHANGE   |
|         | S 7 1 L           | L SPEED CHANGE   |

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# PM4C - 05A User's Manual

## 1 . Abstract

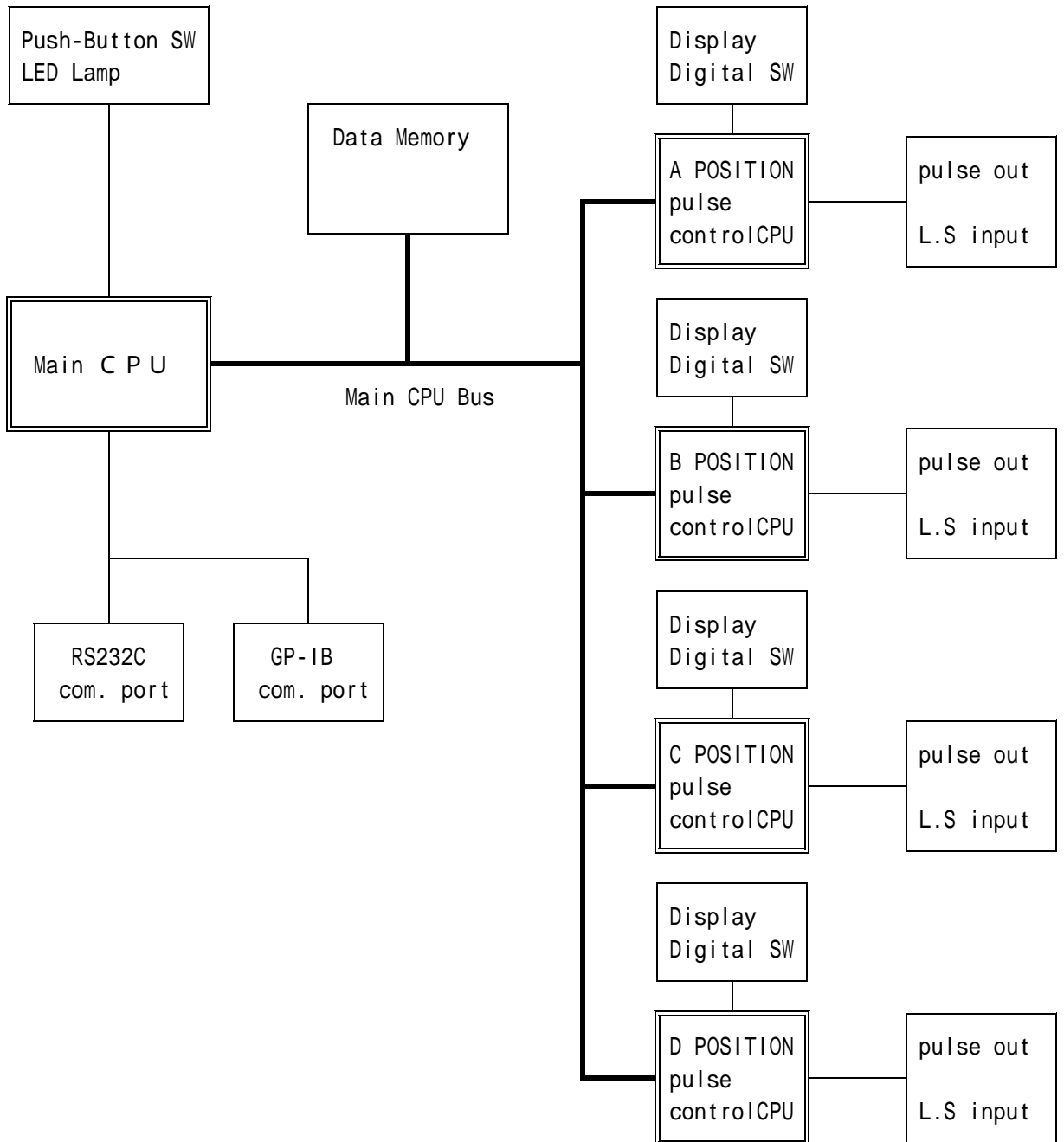
### 1) Characteristics

Can control 4 stepping motors at a time.  
Can set individual characteristics (HSPD,MSPD,LSPD,RATE,LMSW)  
Scan to set position by trapezoidal driving (INDEX mode)  
( Absolute/Relative position are available )  
Can stop when limit switch is detected.  
Limit SW status can be set(N.O/N.C, Enable/Disable) individually.  
Can stop by stop push button when scanning.  
1 step driving( set pulse driving 0~9999 pulse).  
inching driving.  
continuous driving(RUN)  
H.P STOP driving.  
Enabled channel and driving mode are shown by LED lamp.  
Can change driving mode.  
Can choose slow/EM stop mode when stop push button or Limit SW.  
Set data and position data are battery back upped over five years.  
Four motors can be driven synchronously.  
If start more than one motor, they start synchronously(Local mode).  
HAND BOX is useful when checking mechanical position needed by yourself.  
By HAND BOX you can choose one of the motors and jog drive direction.  
Each channel has LED lamps that indicate LS status and pulse out status.  
Hold-off characteristics for each channel  
If you start driving hold-off channel, hold-off state is automatically  
reset and after driving automatically set to hold-off state.(Local mode)  
Hold-off control is also set by communication command.  
It has a GP-IB(IEEE-488) and a RS-232C communication port.  
One of which is available at a time by switch selection.

### 2) Concept of PM4C control

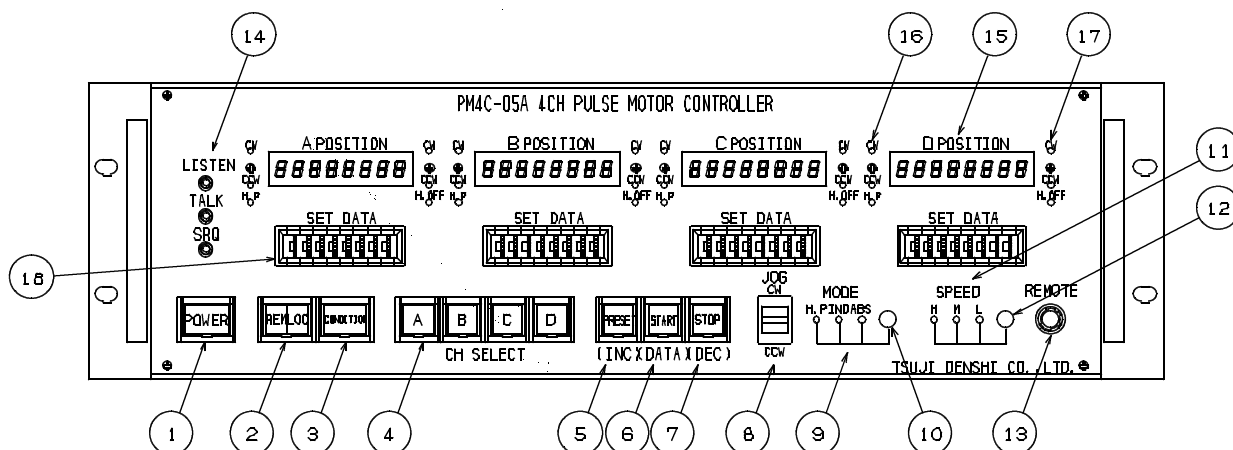
Stepping motor controller ;PM4C-05A has a CPU which controls the whole of the system, four CPU which control the stepping motors. The four CPU control four channels independently. Present positions, present velocities, differential velocities in starting and stopping phase, etc. are stored in the memories as battery back up, which are read out and renewed any time you need.

< Schematics of internal circuit >



## 2 . Panel layout

### 1) Front panel layout



#### Power switch

It turns on/off the power supply of the unit(PM4C-05A).  
The lamp of the switch is on when the power is on.

#### Remote/Local mode change SW

The switches on the panel are available when the mode is Local.  
The command control are available when the mode is Remote.  
This switch changes the mode LOC REM LOC alternately.

#### Each Position control data set SW ( C O N D I T I O N )

You can change speed data, up/down rate data, etc., of each position control  
in the condition mode that is made by this switch.  
This switch can't work when this unit is Remote mode or driving motors.

#### Control channel select switch

Choose the channels that is to be controlled.  
At the local mode or condition mode, pushing these switches change on/off state  
which is known by LED display on the switches.



### Preset switch

At Local mode pushing this switch set  $\pm 7$  digit digital switch data on the panel to the position counter which is enabled by control channel selection.  
At condition mode pushing this switch increment (+1) the data shown in the display.  
If you keep the SW to be pushed more than 0.5 seconds, continuous increment, that is about 50 - 60 per second, is started.  
This switch is not available at remote mode.

### Start switch

At local mode pushing this switch start pulse output driving for the channel that are set by and the mode shown by and by the speed shown by .  
When indicate nothing (all lamp off) this switch is used for preparation to SCAN driving. Preparation state is shown by start switch lamp on.  
After JOG switch on SCAN starts to the direction that is given by the JOG switch.  
At the condition mode pushing this switch increment (+1) the mode of the display.  
This switch is not available at remote mode.

### Stop switch

It can stop pulse output both at Local and Remote mode.  
At the condition mode pushing this switch decrement (-1) the data shown in the display.  
If you keep the SW to be pushed more than 0.5 seconds, continuous increment, that is about 50 - 60 per second, is started.

### Jog switch

This switch is for inching that is available except SCAN mode (all lamp off shown by )  
Throwing on this switch cause pulse output to the CW/CCW direction. <sup>1)</sup>  
If you keep the SW to be thrown on more than 0.5 seconds or after the end of JOG pulse number, continuous pulse output is started.  
It will stop when you throw off the switch.  
This switch is not available at remote mode.

1) Number of pulses are set by JOG pulse number setting (1 to 9999) in the condition mode 5.

### Run mode LED indicator Run mode change switch

The LED lamp ( ) indicate current run mode and the switch ( ) change the mode. These are 4 mode.

- 1) ABS mode : move to absolute indexed position  
Can move to the absolute position that is shown by  $\pm 7$  digit digital switch.
- 2) IND mode : move to relative indexed position  
Can move to the relative position that is shown by  $\pm 7$  digit digital switch.
- 3) H.P mode : move to home position

Continuous scan and stop at home position by home position sensor.  
The start direction (CW/CCW) should be set in the condition mode in advance.

#### 4) SCAN mode (all lamp off)

Continuous pulse out to CW or CCW direction.

After preparation (start switch lamp on) of SCAN by START SW( ), then decide scan direction by JOG SW( ).

Pulse out can be stopped by STOP button or LIMIT SW.

Speed select LED indicator

Speed select switch

The LED lamp ( ) indicate current set speed and the switch ( ) select the speed.  
These are 3 mode.

##### 1) H SPEED

Pulse out by HSPD data <sup>1)</sup> that was set in advance.

##### 2) M SPEED

Pulse out by MSPD data <sup>2)</sup> that was set in advance.

##### 3) L SPEED

Pulse out by LSPD data <sup>3)</sup> that was set in advance.

- 1) Speed data (0 - 187) set by condition mode 1 (HSPD setting)
- 2) Speed data (0 - 187) set by condition mode 1 (MSPD setting)
- 3) Speed data (0 - 161) set by condition mode 1 (LSPD setting)

See speed data table on page 11 table 1.

Connector for Hand box

It is use for the Hand box attached to PM4C-05A.

To use hand box only connect to the connector here.

GP-IB line monitor LED

When communication over GP-IB line used these LED lamp indicate listener, talker.  
Also SRQ is requested SRQ LED lamp indicates the status.

Pulse counter data display

At the Local mode, it indicate current position.

Left side of the display window is for the polarity indicate , "-" shows minus and blank shows plus sign.

An extent of the data is +8388607 ~ 0 ~ -8388608.

At the condition mode it display setting data for confirmation.

Left side data shows mode No that is now set, and 4 digit of right side shows setting data and the other will shows blank.

(See 3. Setting the motor characteristics)

LED indicator for external switch input

Indicate the status of external switches, LIMIT SW (CW/CCW), H.P LS (H.P).

Indicator LED for pulse output & hold-off

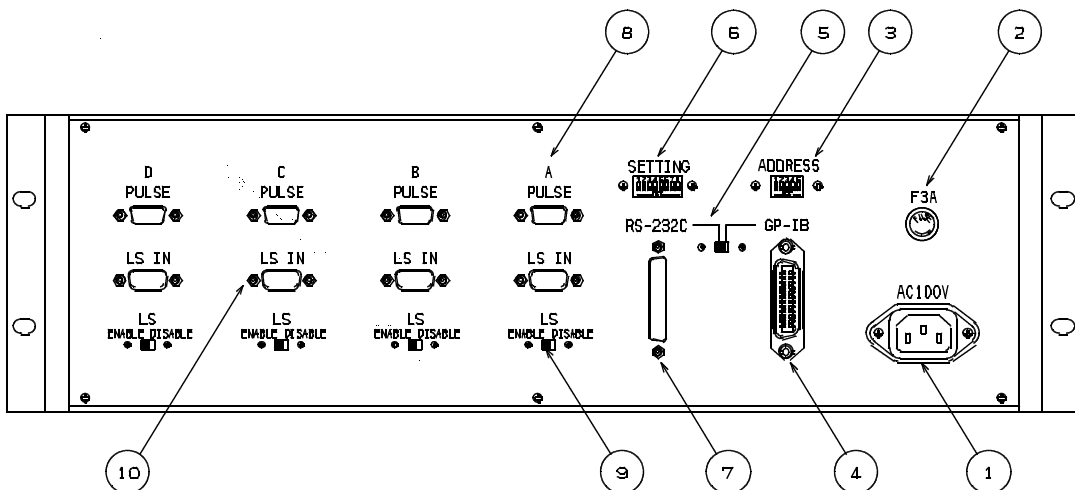
LED indicates pulse output status, hold-off status.  
If the LED lamp is on, it indicate active status.

±7 digit digital rotary switch

It gives the data for ABS RUN, IND RUN, PRESET DATA.

, , , , above are provided for each channel.

## 2) Rear panel layout



AC100V/200V power supply connector

Inlet type AC connector for AC100V/200V power supply.  
Use AC cable attached.

Fuse holder

For safety of AC power line.  
3A mini fuse available.  
Address set switch

For use of GP-IB communication port address.  
Address data is read only power on timing.  
If Address is changed you must power on the unit again.  
(Details are 5.REMOTE mode driving 2. b)

GP-IB communication connector

24P connector for GP-IB

Communication port select switch

Select communication port (RS232C or GP-IB)  
Switch status is read only power on timing.  
If the status is changed you must power on the unit again.

Setting switch for RS232C

Set data for RS232C communication.  
Switch status is read only power on timing.  
If the status is changed you must power on the unit again.

(Details are 5. REMOTE mode driving 2. c)

RS232C connector

D-Sub 25P (socket type)

Pulse output connector

Three signals are from this connector, CW, CCW pulse and Hold-off signal.  
D-Sub 9P (socket type)  
(Connection details are 7. Connection with external equipment)

External switch input connector

External switches (CW, CCW, Home position limit switch) are connected.  
D-Sub 9P (pin type)  
(Connection details are 7. Connection with external equipment)

Limit switch mode change

Can choose mode whether limit switches are enable or disable.  
When mode is DISABLE side, pulse output never stop by limit switch.

### 3 . Setting the motor characteristics

In PM4C-05A each data of four stepping motors can be set and stored, which is kept as battery back up. The data are kept to be memorized until reset. Then accurate control is realized for any system. In setting mode, pulse out is stopped. Data can not be set during motor moving.

#### 1) Power on

When Power SW is turned on, status become to be default mode within 1 second.

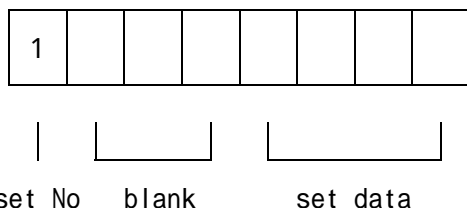
|         | operation mode | driving mode | driving position | speed setting |
|---------|----------------|--------------|------------------|---------------|
| default | LOCAL          | REL          | memorized        | MID           |

Other data are set as the value which are the one last time turned off the power, because the all of these data are kept by battery back up.

(Preparation)

- a) Set to Local mode by REM/LOC button.
  - b) Set to Condition mode by CONDITION button.
- Then all channel select button lamp are off.

Display window



Select channel by channel select button, the display window changes above.

Set number is 1 to 6, and can be changed by DATA button (START button).

Set data can be changed by INC(PRESET)/DEC (STOP) button.

If you keep the SW to be pushed on more than 0.5 seconds, continuous increment or decrement will start.

#### 2) HSPD (Highest Speed) Setting No.1

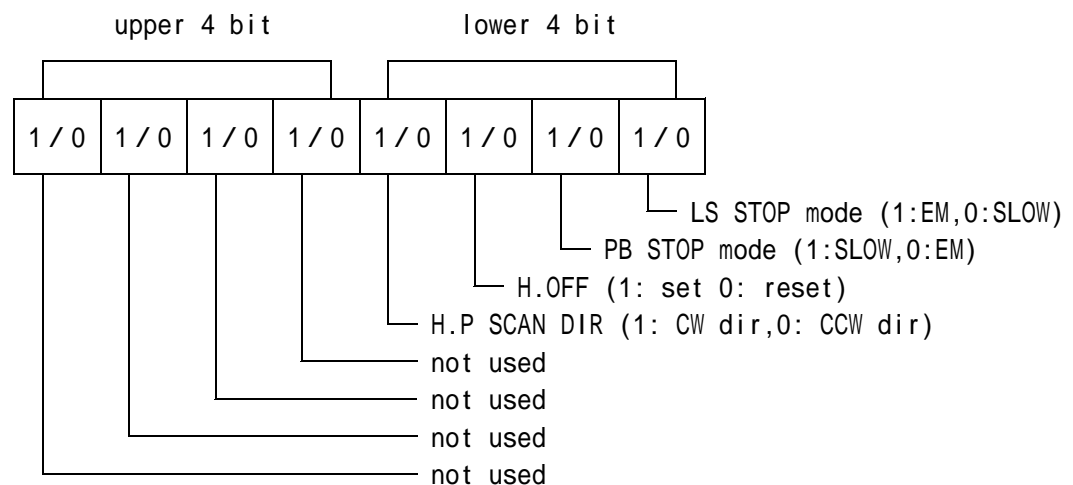
- a) Select set No.1 by DATA (START) button.  
(It's the state just entered this mode)
- b) Set new data by INC (PRESET) button, DEC (STOP) button.  
See table 1 about the relation between data and speed.
- c) Set data are written as decimal data (0 to 187).

#### 3) MSPD (Medium Speed) Setting No.2

- a) Select set No.2 by DATA (START) button.
- b) Set new data by INC (PRESET) button, DEC (STOP) button.  
See table 1 about the relation between data and speed.
- c) Set data are written as decimal data (0 to 187).

- 4) LSPD ( Low Speed) Setting No.3
- Select set No.3 by DATA (START) button.
  - Set new data by INC (PRESET) button, DEC (STOP) button.  
See table 1 about the relation between data and speed.
  - Set data are written as decimal data (0 to 161).
- 5) RATE ( Speed up/down rate) Setting No.4
- Select set No.4 by DATA (START) button.
  - Set new data by INC (PRESET) button, DEC (STOP) button.  
See table 2 about the relation between data and rate.
  - Set data are written as decimal data (0 to 18).
- 6) JOG pulse number Setting No.5
- Select set No.5 by DATA (START) button.
  - Set new data by INC (PRESET) button, DEC (STOP) button.
  - Set data are written as decimal data (1 to 9999).
  - The number of JOG pulse is available when jog SW is used (default number = 1).
- 7) Flags ( STOP mode, etc. Setting No.6
- Select set No.6 by DATA (START) button.
  - Set new data by INC (PRESET) button, DEC (STOP) button.
  - Set data are written as decimal data (0 to 15).

Details of data



HOLD OFF

IF some torque is required to keep the motor remaining stationary, power should be kept to be turned on.

But, if there is not such a requirement, some motor drivers can be hold off to prevent the heating up and to save the power.

When you use these types of drivers, motor can be more effectively driven by this bit operation. When this bit is 1, hold off signal is disable so that power is kept to be turned on all time. When this bit is 0 in manual mode, the power is turned on 0.1s before jog starting, and turned off 0.1s after jog finishing.

- \* The motor, whose power is required to be hold off in remote mode, should be controlled by the sequence, in which the "hold off" is set to be disable before jog starting, and reset to be enable after jog finishing.

Table 1 Speed data

| No. | PPS  | No. | PPS  | No. | PPS   | No. | PPS   |
|-----|------|-----|------|-----|-------|-----|-------|
| 000 | 5    | 047 | 3600 | 094 | 8600  | 141 | 17990 |
| 001 | 10   | 048 | 3700 | 095 | 8800  | 142 | 18180 |
| 002 | 25   | 049 | 3800 | 096 | 9000  | 143 | 18380 |
| 003 | 50   | 050 | 3900 | 097 | 9200  | 144 | 18660 |
| 004 | 75   | 051 | 4000 | 098 | 9400  | 145 | 18940 |
| 005 | 100  | 052 | 4100 | 099 | 9600  | 146 | 19230 |
| 006 | 150  | 053 | 4200 | 100 | 9800  | 147 | 19530 |
| 007 | 200  | 054 | 4300 | 101 | 10000 | 148 | 19840 |
| 008 | 250  | 055 | 4400 | 102 | 10200 | 149 | 20160 |
| 009 | 300  | 056 | 4500 | 103 | 10400 | 150 | 20500 |
| 010 | 350  | 057 | 4600 | 104 | 10600 | 151 | 20830 |
| 011 | 400  | 058 | 4700 | 105 | 10800 | 152 | 21190 |
| 012 | 450  | 059 | 4800 | 106 | 11010 | 153 | 21550 |
| 013 | 500  | 060 | 4900 | 107 | 11210 | 154 | 21930 |
| 014 | 550  | 061 | 5000 | 108 | 11410 | 155 | 22320 |
| 015 | 600  | 062 | 5100 | 109 | 11600 | 156 | 22730 |
| 016 | 650  | 063 | 5200 | 110 | 11800 | 157 | 23150 |
| 017 | 700  | 064 | 5300 | 111 | 11990 | 158 | 23590 |
| 018 | 750  | 065 | 5400 | 112 | 12200 | 159 | 24040 |
| 019 | 800  | 066 | 5500 | 113 | 12400 | 160 | 24510 |
| 020 | 900  | 067 | 5600 | 114 | 12600 | 161 | 25000 |
| 021 | 1000 | 068 | 5700 | 115 | 12790 | 162 | 25510 |
| 022 | 1100 | 069 | 5800 | 116 | 12990 | 163 | 26040 |
| 023 | 1200 | 070 | 5900 | 117 | 13200 | 164 | 26600 |
| 024 | 1300 | 071 | 6000 | 118 | 13400 | 165 | 27170 |
| 025 | 1400 | 072 | 6100 | 119 | 13620 | 166 | 27620 |
| 026 | 1500 | 073 | 6200 | 120 | 13810 | 167 | 28090 |
| 027 | 1600 | 074 | 6300 | 121 | 14000 | 168 | 28570 |
| 028 | 1700 | 075 | 6400 | 122 | 14200 | 169 | 29070 |
| 029 | 1800 | 076 | 6500 | 123 | 14400 | 170 | 29590 |
| 030 | 1900 | 077 | 6600 | 124 | 14620 | 171 | 30120 |
| 031 | 2000 | 078 | 6700 | 125 | 14830 | 172 | 30680 |
| 032 | 2100 | 079 | 6800 | 126 | 15010 | 173 | 31250 |
| 033 | 2200 | 080 | 6900 | 127 | 15200 | 174 | 31850 |
| 034 | 2300 | 081 | 7000 | 128 | 15390 | 175 | 32470 |
| 035 | 2400 | 082 | 7100 | 129 | 15580 | 176 | 33110 |
| 036 | 2500 | 083 | 7200 | 130 | 15770 | 177 | 33780 |
| 037 | 2600 | 084 | 7300 | 131 | 15970 | 178 | 34480 |
| 038 | 2700 | 085 | 7400 | 132 | 16180 | 179 | 35210 |
| 039 | 2800 | 086 | 7500 | 133 | 16400 | 180 | 35970 |
| 040 | 2900 | 087 | 7600 | 134 | 16610 | 181 | 36500 |
| 041 | 3000 | 088 | 7700 | 135 | 16830 | 182 | 37040 |
| 042 | 3100 | 089 | 7800 | 136 | 17060 | 183 | 37600 |
| 043 | 3200 | 090 | 7900 | 137 | 17240 | 184 | 38170 |
| 044 | 3300 | 091 | 8000 | 138 | 17420 | 185 | 38760 |
| 045 | 3400 | 092 | 8200 | 139 | 17600 | 186 | 39370 |
| 046 | 3500 | 093 | 8400 | 140 | 17800 | 187 | 40000 |

Table 2 Rate data

| No. | ms/1000 PPS |
|-----|-------------|
| 000 | 1000        |
| 001 | 800         |
| 002 | 600         |
| 003 | 500         |
| 004 | 400         |
| 005 | 300         |
| 006 | 200         |
| 007 | 150         |
| 008 | 125         |
| 009 | 100         |
| 010 | 75          |
| 011 | 50          |
| 012 | 30          |
| 013 | 20          |
| 014 | 15          |
| 015 | 10          |
| 016 | 7.5         |
| 017 | 5.0         |
| 018 | 3.0         |

#### 4 . LOCAL mode driving

Only when remote/local SW is set to be local, the motor can be driven in local mode.  
If this SW is remote, you need to push the SW once, and reenter into local mode.

##### 1) Speed selection

By use of speed selecting PB, any speed can be selected from the three speed that are preset in each channel, which are HSPD, MSPD and LSPD.  
Starting speed of acceleration and final speed of deceleration is LSPD.

##### 2) Changing the driving mode

By use of driving mode selecting PB, you can select the mode as you like: HP,REL, ABS and scan (scan mode is the case that all LED which show driving mode are turned off).  
Just after power on, REL mode is selected.

##### 3) Channel select

In LOCAL mode, you can choose the channel that you want to drive by channel select button A, B, C, D.

##### 4) Relative or incremental indexed scan (RUN mode = IND)

In IND mode when START PB pressed the motor steps relatively by the digital SW data.  
If more than one motor is selected, they start synchronously.  
After finishing the set pulse out, it stops automatically.  
In this mode it can stop by STOP button or limit switch input.

##### 5) Absolute indexed scan (RUN mode = ABS)

In ABS mode when START PB pressed the motor steps to the absolute data that the digital SW indicate.  
If more than one motor is selected, they start synchronously.  
After finishing the set pulse out, it stops automatically.  
In this mode it can stop by STOP button or limit switch input.  
In this mode it can stop by STOP button or limit switch input.

##### 6) Scan and stop at home position (RUN mode = HP)

In HP mode when START PB pressed the motor scans to one direction that are set in advance in condition mode, then when HP sensor turns on it stops automatically.  
In this mode it can stop by STOP button or limit switch input.

##### 7) Continuous scan (RUN mode = SCAN (all lamp off))

In this mode the motor scans continuously.  
When START button is pressed, the lamp on the button is on and prompt to decide moving direction. Then throw on JOG switch to one direction side you want.  
In this mode it can stop by STOP button or limit switch input.



- 8) Jog driving  
In the direction which is set by jog SW, pulses are sent and motor is driven.  
If you keep the SW to be pushed more than 0.5 seconds, continuous scan is started.  
Then you can stop the pulse by releasing the switch.  
This is not available in the SCAN mode.
- 9) Position counter preset  
By PRESET button the digital switch data set to the position counter.
- 10) Synchronous start driving  
You can drive each channel respectively, and also you can start two to four of them synchronously.  
If you select more than one motor, they start synchronously.
- 11) Auto hold off function  
In local mode, the motor, that is set as hold-off state in the condition mode, clear the hold-off state before starting and set hold-off state after finishing the scan again.
- 12) HAND BOX operation  
Can use Hand box operation, useful when checking the mechanical move.  
The rotary switch on the hand box can choose one of four channels.  
JOG switch works as the same one on the front panel.  
This function is available only in Local mode.

## 5 . REMOTE mode driving

This mode is possible when remote/local SW shows to be REMT.

If the remote/local SW shows LOCL, push the SW again or send the command externally to change the mode to be REMT. And, after that, continue to operate as below. Also remote/local change can be done by communication line.

### 1) Summary of the communication

|            |  |
|------------|--|
| data read  | CHANNEL POSITION DATA, HSPD, MSPD, LSPD, RATE<br>STOP MODE & LS, REM/LOC status etc.   |
| data write | HSPD, MSPD, LSPD, RATE, LMSW   |
| Command    | +JOG, -JOG, SCAN, CONSTANT SPEED RELATIVE INDEX SCAN,<br>CONSTANT SPEED ABSOLUTE INDEX SCAN, RELATIVE INDEX,<br>ABSOLUTE INDEX, SPEED SELECT, PAUSE ON/OFF, HOLD OFF SET/RESET,<br>SLOW STOP, EMergency STOP |

\* Data read is available in both REMOTE and LOCAL mode.

### 2) Communication specification

#### a) Introduction

A PM4C-05A has a GP-IB control IC;TMS9914A. and has a RS232C control IC;HD64941. In this system, nonsense command or impossible command (EX. reverse drive during normal drive) are ignored so that almost all time you can access from these communication lines (protect from hung up).

Receive form should be S . . . . CR+LF. \*) : ASCII

\* de-limiter is fixed to CR+LF.

When CR(ODH)+LF(OAH) is detected during receiving, the command is rapidly analyzed and done by PM4C-05A. However, if it can't be analyzed, no operation is done. When PM4C receives information that some data should be returned back, the data are rapidly prepared and sent back. These operations are done for about less than 1mS.

While using GP-IB line, you can use SRQ request so that you don't need to check the motor stop continuously.

When PM4C-05A needs some reply,

Send out forms are R . . . . . CR+LF

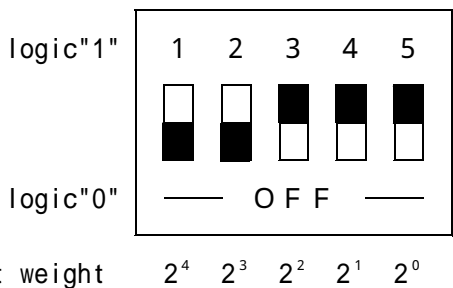
b) GP-IB port address setting

Five bit DIP slide switch in the rear panel is for GP-IB my address.

Setting should be done before power on timing.

The address shouldn't be the same as the other equipment that is connected to the same GP-IB line.

Address setting DIP slide switch



The address should be 1 to 3 0 .  
Don't use 0 or 3 1 .

Left sample shows address 07H(00111).

c) RS232C port setting

Eight bit DIP slide switch in the rear panel is for RS232C port setting.  
Setting should be done before power on timing.

The settings of counter side (PC etc.) should also be done.

R S 2 3 2 C port setting



Left sample shows  
4800 baud, 8 bit data,  
1 stop bit

S W No.

|  | SW1 | SW2 | SW6 | SW7 | SW8 |           |
|--|-----|-----|-----|-----|-----|-----------|
| 1 : <input type="checkbox"/> stop bit  | 0   | 0   | 0   | 0   | 0   | 75 BAUD   |
| 2 : <input type="checkbox"/>           | 0   | 1   | 0   | 0   | 1   | 150 BAUD  |
| 3 : always 0 set                       | 1   | 0   | 0   | 1   | 0   | 300 BAUD  |
| 4 : always 0 set                       | 1   | 1   | 0   | 1   | 1   | 600 BAUD  |
| 5 : 1:8 bit data, 0:7 bit data         |     |     | 1   | 0   | 0   | 1200 BAUD |
| 6 : <input type="checkbox"/>           |     |     | 1   | 0   | 1   | 2400 BAUD |
| 7 : <input type="checkbox"/> baud rate |     |     | 1   | 1   | 0   | 4800 BAUD |
| 8 : <input type="checkbox"/>           |     |     | 1   | 1   | 1   | 9600 BAUD |

6 . Command in detail ( for both RS232C and GP-IB )

Command is available only in ASCII code.

De-limiter is fixed to be CR+LF both in send data and receive data.

1) " S 1 " command

It can be used only GP-IB communication and is for SRQ request on GP-IB line.

It can be used during motor stop state.

If SRQ is set to one channel, SRQ signal occurs when the channel motor stops.

This command is available only in remote mode. <sup>1)</sup>

Send form of the commands are below.

The SRQ flags, that were set once before, are cleared at the SRQ send out timing.

< Command form >

|     |       |                          |             |
|-----|-------|--------------------------|-------------|
| S 1 | CR+LF | mark data                | mark data   |
|     |       | 0:A POSITION             | 1:SRQ set   |
|     |       | 1:B POSITION             | 0:SRQ clear |
|     |       | 2:C POSITION             |             |
|     |       | 3:D POSITION             |             |
|     |       | 8:current SRQ flag       |             |
|     |       | 9:SRQ reply channel read |             |

< < sample > >

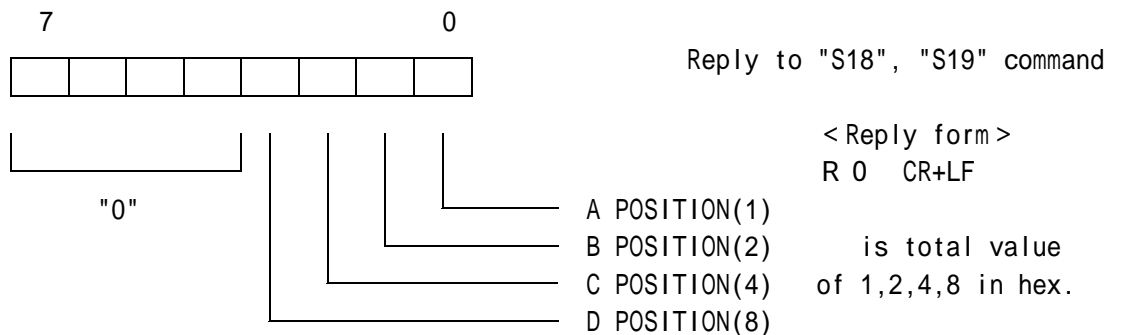
```

A POSITION SRQ set . . . . . S 1 0 1 CR+LF
B POSITION SRQ clear . . . . . S 1 1 0 CR+LF
Current SRQ flag read . . . S 1 8 CR+LF
SRQ reply channel read . . S 1 9 CR+LF
    
```

1) "S18" command is available both remote and local mode.

2) Can get channel information that replied SRQ by "S19" command.

After reply to "S19" command, channel information is cleared in the memory.



2) "S 2" command

Useful both in GP-IB and RS232C communication.

"S2" command is used to read position data, status, LS, HP and Hold-off status.

Can be used in all mode (REM/LOC/CONDITION).

Command form and reply forms are below.

< Command form >

|     |       |              |                       |
|-----|-------|--------------|-----------------------|
| S 2 | CR+LF | mark data    | mark data             |
|     |       | 0:A POSITION | 0:pulse count data    |
|     |       | 1:B POSITION | 1:internal CPU status |
|     |       | 2:C POSITION | 2:LS·HP·H.OFF status  |
|     |       | 3:D POSITION |                       |

< < sample > >

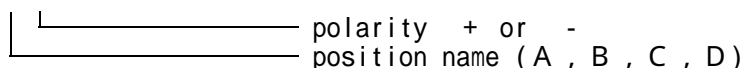
```

A POSITION pulse counter read . . . . . S 2 0 0 CR+LF
B POSITION internal CPU status read . . . . S 2 1 1 CR+LF
C POSITION LS·HP·H.OFF status read . . . . S 2 2 2 CR+LF
D POSITION internal CPU status read . . . . S 2 3 1 CR+LF
    
```

< Reply form >

a) For S2 0 command

R (7 digit decimal data)CR+LF

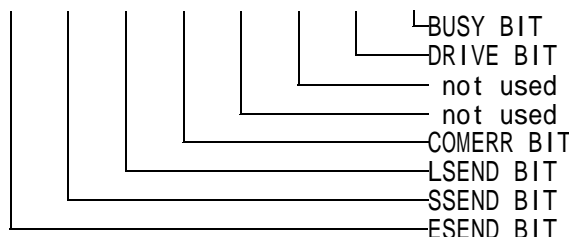
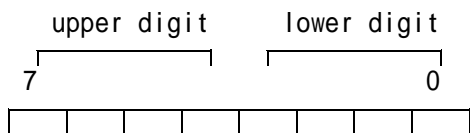


b) For S2 1 command

R (2 digit hex data) CR+LF



2 digit hex data bit map



bit information

- BUSY BIT : internal CPU is busy any command are receivable when bit=0 <sup>1)</sup>
- DRIVE BIT: internal CPU is now on pulse out status.
- COMERR BIT:command is not regal <sup>2)</sup>
- LSEND BIT :PULSE was stopped by limit switch. <sup>2,3)</sup>
- SSEND BIT :PULSE was stopped by slow stop command. <sup>2,3)</sup>
- ESEND BIT :PULSE was stopped by EM command. <sup>2,3)</sup>

- 1) Only SLOW STOP,EM STOP command are available in BUSY=1,DRIVE=1(on driving)state.
- 2) COMERR , LSEND , SSEND , ESEND BIT are valid in BUSY=0 status. These bit are cleared by next command.
- 3) LSEND , SSEND , ESEND BIT are valid only after end of driving.

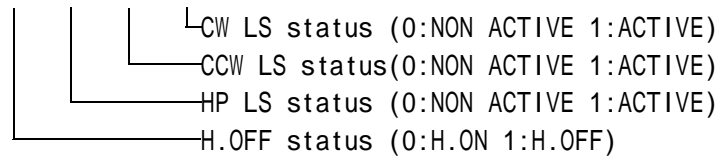
C) For S2 2 command

R (1 digit HEX data) CR+LF

\_\_\_\_\_ position name ( A , B , C , D )

1 digit hex data bit map

2<sup>3</sup> 2<sup>2</sup> 2<sup>1</sup> 2<sup>0</sup>



3) " S 3 " command

Useful both in GP-IB and RS232C communication.

"S3" command is used to pulse out or pulse stop and set condition data.

If the channel is scanning (BUSY BIT=1) these commands are ignored except pulse stop command.

< Command form type 1 >

S 3 (2 digit HEX data)CR+LF

mark data  
 0:A POSITION  
 1:B POSITION  
 2:C POSITION  
 3:D POSITION

2 digit HEX data  
 08,0A:+JOG(1 pulse)  
 09,0B:-JOG(1 pulse)  
 0C:+SCAN(no acc.)  
 0D:-SCAN(no acc.)  
 0E:+SCAN(with acc.)  
 0F:-SCAN(with acc.)  
 16:PAUSE ON <sup>1)</sup>  
 17:PAUSE OFF <sup>1)</sup>  
 18:HOLD OFF set  
 19:HOLD OFF clear  
 1E:HP STOP +SCAN(with acc.)  
 1F:HP STOP -SCAN(with acc.)  
 40:SLOW STOP  
 80:EM STOP

1) PAUSE on/off command controls one circuit line on the board, any position mark (A,B,C,D) will work as the same command.

< < sample > >

A POSITION +JOG command . . . . . S 3 0 0 8 CR+LF (or S 3 0 0 A CR+LF)  
 B POSITION HOLD OFF set . . . . . S 3 1 1 8 CR+LF  
 C POSITION +SCAN command . . . . . S 3 2 0 E CR+LF  
 D POSITION slow stop command . . . . . S 3 3 4 0 CR+LF

< Command form type 2 >

S 3 8 (±7 digit decimal data)(2 digit HEX data)CR+LF

| mark data    | 2 digit HEX data                  |
|--------------|-----------------------------------|
| 0:A POSITION | 10:INDEX SCAN (no acceleration)   |
| 1:B POSITION | 11:ABSOLUTE SCAN(no acceleration) |
| 2:C POSITION | 12:INDEX SCAN (acceleration)      |
| 3:D POSITION | 13:ABSOLUTE SCAN(acceleration)    |

±7 digit decimal data must be within ±8388607(0 ~ FFFFFFFH in HEX)

< < sample > >

|            |          |                          |         |                             |       |
|------------|----------|--------------------------|---------|-----------------------------|-------|
| A POSITION | +1234567 | INDEX SCAN(no acc.)      | · · · · | S 3 8 0 + 1 2 3 4 5 6 7 1 0 | CR+LF |
| B POSITION | -0200000 | ABSOLUTE SCAN(no acc.)   | · · · · | S 3 8 1 - 0 2 0 0 0 0 0 1 1 | CR+LF |
| C POSITION | +0000000 | INDEX SCAN(with acc.)    | · · · · | S 3 8 2 + 0 0 0 0 0 0 0 1 2 | CR+LF |
| D POSITION | -0000100 | ABSOLUTE SCAN(with acc.) | · · · · | S 3 8 3 - 0 0 0 0 1 0 0 1 3 | CR+LF |

< Command form type 3 >

S 3 9 <const.1>CR+LF

| mark data    | mark data          | const.1                               |
|--------------|--------------------|---------------------------------------|
| 0:A POSITION | 0:HSPD change      | —— 3 digit(000 ~ 187) <sup>2)</sup>   |
| 1:B POSITION | 1:MSPD change      | —— 3 digit(000 ~ 187) <sup>2)</sup>   |
| 2:C POSITION | 2:LSPD change      | —— 3 digit(000 ~ 161) <sup>2)</sup>   |
| 3:D POSITION | 3:RATE change      | —— 2 digit(00 ~ 18) <sup>3)</sup>     |
|              | 4:JOG pulse set    | —— 4 digit(0000 ~ 9999) <sup>4)</sup> |
|              | 5:LS STOP MODE set | - 1 digit(0:SLOW STOP 1:EM STOP)      |
|              | 6:PB STOP MODE set | - 1 digit(0:EM STOP 2:SLOW STOP)      |
|              | 7:H.OFF set/clear  | —— 1 digit(0:clear 4:set)             |
|              | 8:HP SCAN DIR set  | —— 1 digit(0:CCW 8:CW )               |
|              | 9:counter preset   | —— ±7 digit decimal(max±8388607)      |

2) It must be 3 digit data

3) It must be 2 digit data

4) It must be 4 digit data

< < < < Caution > > > >

Speed data change by this "S39" needs "S71" command to effective new data.  
"S71" command is the sign to start changing speed data.

< < sample > >

```
A POSITION HSPD set to 100 . . . . . S 3 9 0 0 1 0 0 CR+LF
B POSITION MSPD set to 15 . . . . . S 3 9 1 1 0 1 5 CR+LF
C POSITION LSPD set to 5 . . . . . S 3 9 2 2 0 0 5 CR+LF
D POSITION RATE set to 10 . . . . . S 3 9 3 3 1 0 CR+LF
A POSITION JOG pulse set to 1234 . . . . S 3 9 0 4 1 2 3 4 CR+LF
B POSITION LS STOP set to slow stop . . . . S 3 9 1 5 0 CR+LF
C POSITION LS STOP set to EM stop . . . . S 3 9 2 5 1 CR+LF
D POSITION PB STOP set to slow stop . . . . S 3 9 3 6 2 CR+LF
A POSITION H.OFF clear . . . . . S 3 9 0 7 0 CR+LF
B POSITION H.OFF set . . . . . S 3 9 1 7 4 CR+LF
C POSITION HP SCAN DIR set to CCW . . . . S 3 9 2 8 0 CR+LF
D POSITION HP SCAN DIR set to CW . . . . S 3 9 3 8 8 CR+LF
A POSITION counter preset +1234567 . . . . S 3 9 0 9 + 1 2 3 4 5 6 7 CR+LF
```

#### 4) "S 4" command

Useful both in GP-IB and RS232C communication.

"S4" command is mainly used to read setting data for each channel.

It can be used at any time whether pulse control CPU is busy or not, remote mode or local mode.

< Command form >

```
S 4 CR+LF
```

| mark data         | mark data                                |
|-------------------|--|
| 0:A POSITION      | 0:HSPD data read (condition mode 1)      |
| 1:B POSITION      | 1:MSPD data read (condition mode 2)      |
| 2:C POSITION      | 2:LSPD data read (condition mode 3)      |
| 3:D POSITION      | 3:RATE data read (condition mode 4)      |
| 8:status of panel | 4:JOG pulse data read (condition mode 5) |
|                   | 5:status data read (condition mode 6)    |

< Receive data form >

#### a) POSITION data read

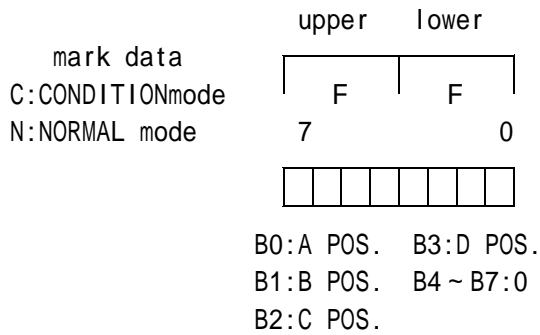
```
R <const.2>CR+LF
```

| mark data    | mark data                                 | const.2 is         |
|--------------|---|--------------------|
| A:A POSITION | H:HSPD data read (condition mode 1)       | 4 digit decimal    |
| B:B POSITION | M:MSPD data read (condition mode 2)       | data that is shown |
| C:C POSITION | L:LSPD data read (condition mode 3)       | in the panel when  |
| D:D POSITION | R:RATE data read (condition mode 4)       | condition setting. |
|              | JP:JOG pulse data read (condition mode 5) |                    |
|              | S:status data read (condition mode 6)     |                    |

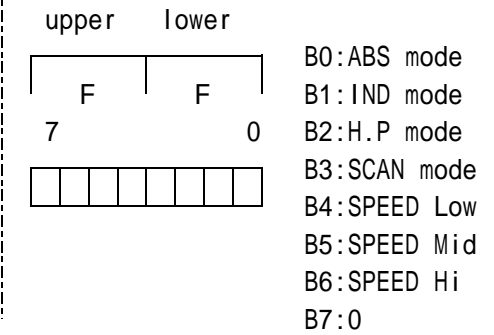
b) Status information for the panel

R <const.3><const.4>CR+LF

mark data const.3 is 2 digit hex code as the bit pattern shown below.



const.4 is 2 digit hex code as the bit pattern shown below.



< < sample > >

```

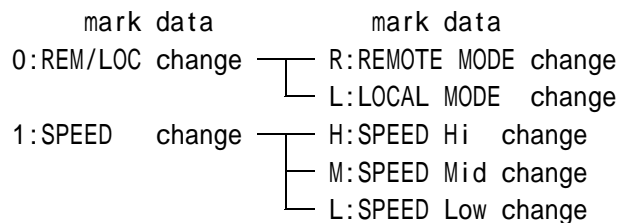
A POSITION HSPD data read . . . . . S 4 0 0 CR+LF
B POSITION MSPD data read . . . . . S 4 1 1 CR+LF
C POSITION LSPD data read . . . . . S 4 2 2 CR+LF
D POSITION RATE data read . . . . . S 4 3 3 CR+LF
A POSITION JOG pulse data read . . . . S 4 0 4 CR+LF
D POSITION status data read . . . . . S 4 3 5 CR+LF
status information for the panel . . . S 4 8 CR+LF
    
```

5) "S 7" command

Useful both in GP-IB and RS232C communication.  
It is used to change status of the panel.

< Command form >

S 7 CR+LF



< < sample > >

```

PM4C-05A REMOTE mode change . . . . S 7 0 R CR+LF
PM4C-05A LOCAL mode change . . . . S 7 0 L CR+LF
PM4C-05A SPEED Hi change . . . . . S 7 1 H CR+LF
PM4C-05A SPEED Mid change . . . . . S 7 1 M CR+LF
PM4C-05A SPEED Low change . . . . . S 7 1 L CR+LF
    
```

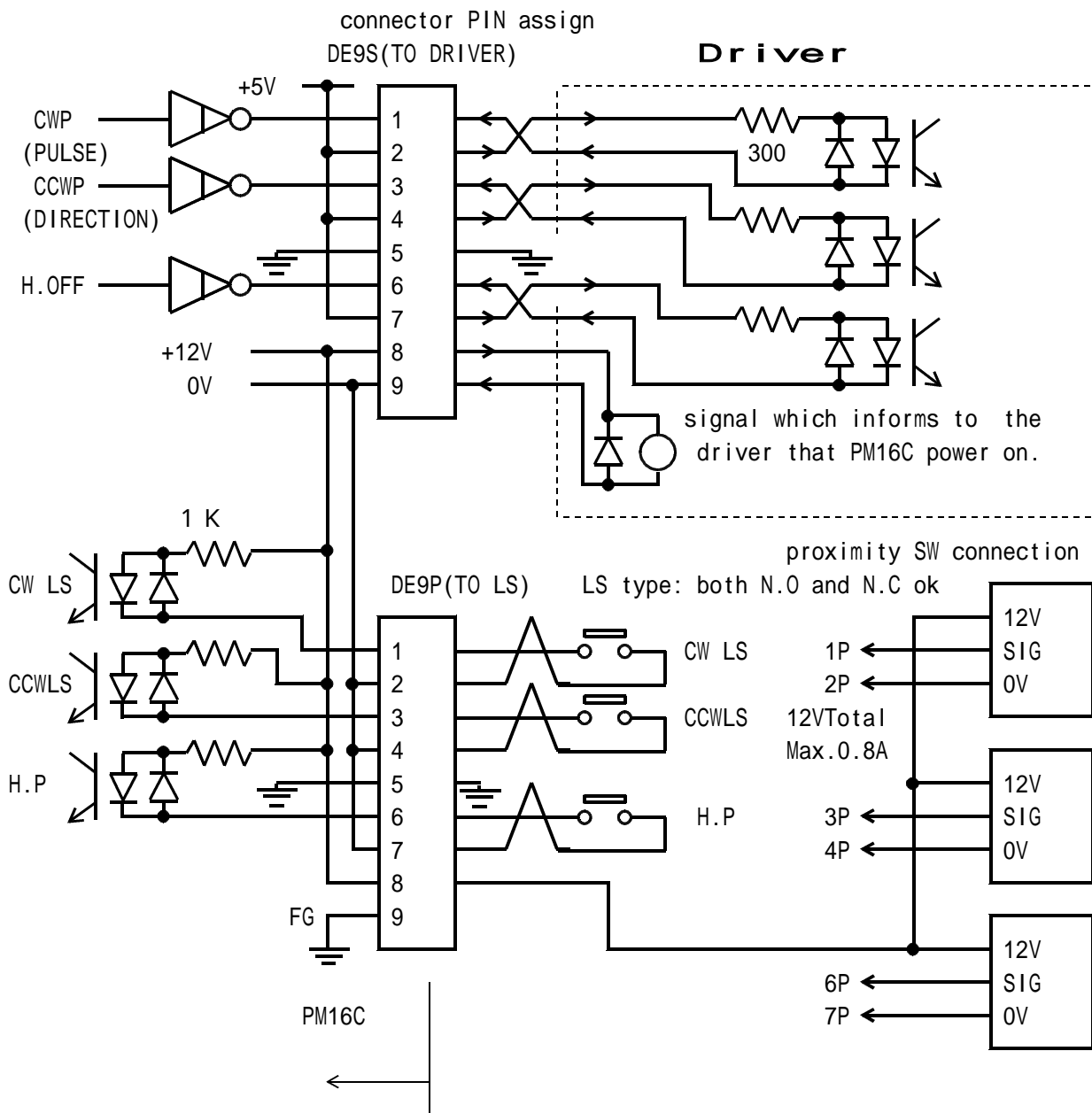




8. Connection with outer equipment

1) Connection with drivers

Connection cables are recommended to be shielded twist pair cable( more than 0.2mm<sup>2</sup>).



caution) Connector shell size of DE9P and 9S is varied from each maker's.

Outward form <35W can be used for PM16C.

DE-C1-J6(JAE), XM2S-0911(OMRON) and HDE-CTF(HIROSE) are possible to be used.