4CH STEPPING MOTOR CONTROLLER

PM4C-05A

USER'S MANUAL

(1149B VER.1)

TSUJICON

APPLICATION OF ELECTRONIC DEVICES

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PM4C－05A COMMAND LIST

for GP－IB, RS232C (delimiter:CR+LF(fixed))

MODE	COMMAND	REPLY ETC.
R	S100	cancel A CH SRQ GP-IB only
	S101	SRQ set when A MOTOR stopped 〃
	S110	cancel B CH SRQ 〃
	S111	SRQ set when B motor stopped 〃
	S120	cancel C CH SRQ 〃
	S121	SRQ set when C motor stopped 〃
	S130	cancel D CH SRQ 〃
	S131	SRQ set when D motor stopped 〃
R/L	S18	SRQ flag read R0□ □：1/A POS., 2/B POS. 3/A,B POS. ・・・
R	S19	SRQ out CH read R0□ □：1/A POS., 2/B POS. 3/A,B POS. ・・・
R/L	S200	A CH position data read RA±DDDDDDDD D：decimal
	S201	A CH CPU status read RAHH H：hex code, b0 BIT:BUSY
	S202	A CH LS, HP, HOLD OFF status read 0:CWLS,b1:CCWLS,b2:HP,b3:H.OFF
	S210	B CH position data read RB±DDDDDDDD D：decimal
	S211	B CH CPU status read RBHH H：hex code, b0 BIT:BUSY
	S212	B CH LS, HP, HOLD OFF status read 0:CWLS,b1:CCWLS,b2:HP,b3:H.OFF
	S220	C CH position data read RC±DDDDDDDD D：decimal
	S221	C CH CPU status read RCHH H：hex code, b0 BIT:BUSY
	S222	C CH LS, HP, HOLD OFF status read 0:CWLS,b1:CCWLS,b2:HP,b3:H.OFF
	S230	D CH position data read RD±DDDDDDDD D：decimal
	S231	D CH CPU status read RDHH H：hex code, b0 BIT:BUSY
	S232	D CH LS, HP, HOLD OFF status read 0:CWLS,b1:CCWLS,b2:HP,b3:H.OFF
R	S30□□	A POSITION 2 BYTE COMMAND □□：COMMAND 08:+JOG, 09:-JOG 0C:+CSPD SCAN 0D:-CSPD SCAN 0E:+SCAN 0F:-SCAN 16:PAUSE ON 17:PAUSE OFF 18:HOLD OFF 19:HOLD ON 1E:+SCAN & HP STOP 1F:-SCAN & HP STOP 40:SLOW STOP 80:EM.STOP
	S31□□	B POSITION 2 BYTE COMMAND □□：COMMAND 08:+JOG, 09:-JOG 0C:+CSPD SCAN 0D:-CSPD SCAN 0E:+SCAN 0F:-SCAN 16:PAUSE ON 17:PAUSE OFF 18:HOLD OFF 19:HOLD ON 1E:+SCAN & HP STOP 1F:-SCAN & HP STOP 40:SLOW STOP 80:EM.STOP
	S32□□	C POSITION 2 BYTE COMMAND □□：COMMAND 08:+JOG, 09:-JOG 0C:+CSPD SCAN 0D:-CSPD SCAN 0E:+SCAN 0F:-SCAN 16:PAUSE ON 17:PAUSE OFF 18:HOLD OFF 19:HOLD ON 1E:+SCAN & HP STOP 1F:-SCAN & HP STOP 40:SLOW STOP 80:EM.STOP
	S33□□	D POSITION 2 BYTE COMMAND □□：COMMAND 08:+JOG, 09:-JOG 0C:+CSPD SCAN 0D:-CSPD SCAN 0E:+SCAN 0F:-SCAN 16:PAUSE ON 17:PAUSE OFF 18:HOLD OFF 19:HOLD ON 1E:+SCAN & HP STOP 1F:-SCAN & HP STOP 40:SLOW STOP 80:EM.STOP
	S380 ±DDDDDDDHH	A POSITION DECIMAL INDEX COMMAND HH: 10:CSPD INDEX SCAN 11:CSPD ABSOLUTE INDEX SCAN 12:INDEX SCAN 13:ABSOLUTE SCAN

R	S381 ±DDDDDDDHH	B POSITION DECIMAL INDEX COMMAND HH: 10:CSPD INDEX SCAN 11:CSPD ABSOLUTE INDEX SCAN 12:INDEX SCAN 13:ABSOLUTE SCAN	
	S382 ±DDDDDDDHH	C POSITION DECIMAL INDEX COMMAND HH: 10:CSPD INDEX SCAN 11:CSPD ABSOLUTE INDEX SCAN 12:INDEX SCAN 13:ABSOLUTE SCAN	
	S383 ±DDDDDDDHH	D POSITION DECIMAL INDEX COMMAND HH: 10:CSPD INDEX SCAN 11:CSPD ABSOLUTE INDEX SCAN 12:INDEX SCAN 13:ABSOLUTE SCAN	
	S3900DDD	A POSITION HSPD set DDD:3 digit(000～187)	data available 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 ±DDDDDD	A POSITION counter preset DDDDDDD:7 digit(0000000～8388607)	
	S3910DDD	B POSITION HSPD set DDD:3 digit(000～187)	data available 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 ±DDDDDD	B POSITION counter preset DDDDDDD:7 digit(0000000～8388607)	
	S3920DDD	C POSITION HSPD set DDD:3 digit(000～187)	data available 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 ±DDDDDD	C POSITION counter preset DDDDDDD:7 digit(0000000～8388607)	
	S3930DDD	D POSITION HSPD set DDD:3 digit(000～187)	data available 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 ±DDDDDD	D POSITION counter preset DDDDDDD:7 digit(0000000～8388607)
R/L	S400	A POSITION HSPD read　　RAH□□□□
	S401	A POSITION MSPD read　　RAM□□□□
	S402	A POSITION LSPD read　　RAL□□□□
	S403	A POSITION RATE read　　RAR□□□□
	S404	A POSITION JOG pulse read　　RAJP□□□□
	S405	A POSITION status read　　RAS□□□□
	S410	B POSITION HSPD read　　RBH□□□□
	S411	B POSITION MSPD read　　RBM□□□□
	S412	B POSITION LSPD read　　RBL□□□□
	S413	B POSITION RATE read　　RBR□□□□
	S414	B POSITION JOG pulse read　　RBJP□□□□
	S415	B POSITION status read　　RBS□□□□
	S420	C POSITION HSPD read　　RCH□□□□
	S421	C POSITION MSPD read　　RCM□□□□
	S422	C POSITION LSPD read　　RCL□□□□
	S423	C POSITION RATE read　　RCR□□□□
	S424	C POSITION JOG pulse read　　RCJP□□□□
	S425	C POSITION status read　　RCS□□□□
	S430	D POSITION HSPD read　　RDH□□□□
	S431	D POSITION MSPD read　　RDM□□□□
	S432	D POSITION LSPD read　　RDL□□□□
	S433	D POSITION RATE read　　RDR□□□□
	S434	D POSITION JOG pulse read　　RDJP□□□□
	S435	D POSITION status read　　RDS□□□□
	S48	Front panel information read R○□HHhh　○：L:LOCAL R:REMOTE　□：C:CONDITION N:NORMAL HH：b0:A POS.　b1:B POS.　b2:C POS.　b3:D POS. hh：b0:ABS　b1:IND　b2:H.P　b3:SCAN b4:H speed b5:M speed b6:L speed
	S70R	REMOTE MODE CHANGE
	S70L	LOCAL　MODE CHANGE
R	S71H	H SPEED CHANGE
	S71M	M SPEED CHANGE
	S71L	L SPEED CHANGE

目　次

PM4C－05A　User's Manual

1. Abstract

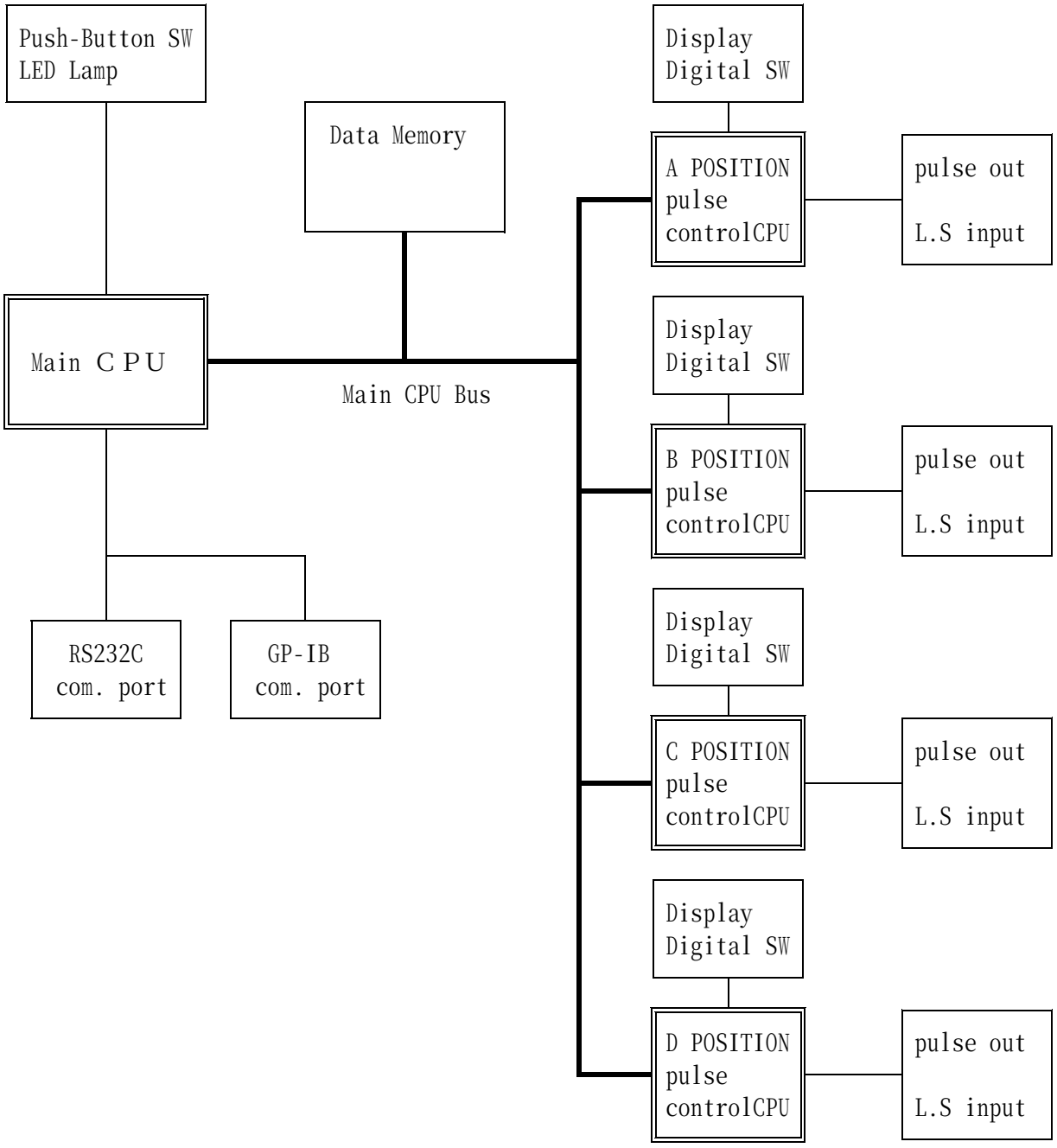
1) Characteristics

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

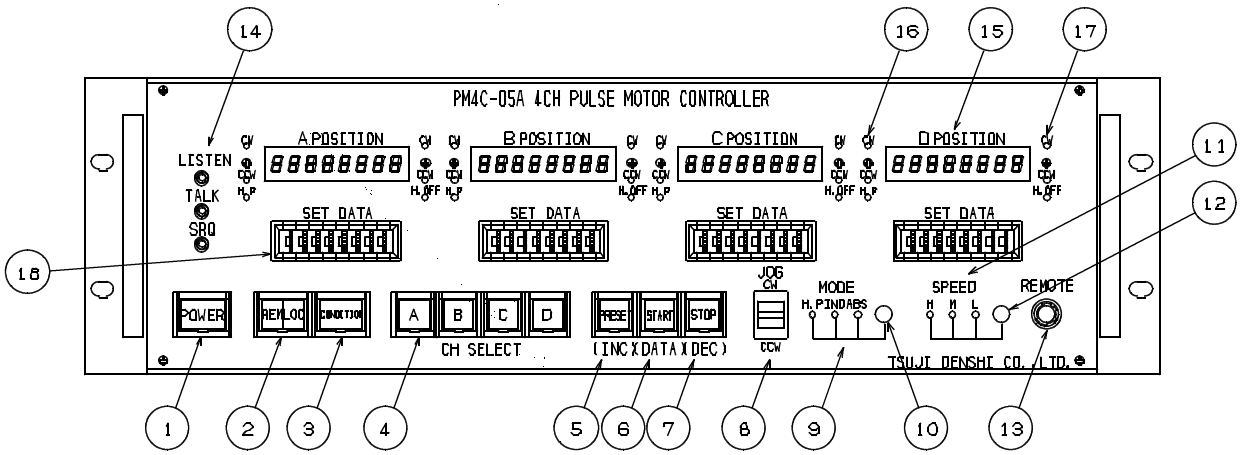
Stepping motor controller ;PM4C-05A has ① a CPU which controls the hole of the system, ② four CPU which control the stepping motors. The four CPU control four channels independently. Present positions, present velocities, differential velocities in starting and stopping phase, etc. are stored in the 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



① 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.

② 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.

③ Each Position control data set SW (CONDITION)

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.

④ 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.

⑤ Preset switch

At Local mode pushing this switch set ±7 digit digital switch data on the panel to the position counter which is enabled by ④ 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.

⑥ Start switch

At local mode pushing this switch start pulse output driving for the channel that are set by ④ and the mode shown by ⑨ and by the speed shown by ⑪.
When ⑨ 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.

⑦ 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.

⑧ Jog switch

This switch is for inching that is available except SCAN mode (all lamp off shown by ⑨)
Throwing on this switch cause pulse output to the CW/CCW direction. [1)]
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.

⑨ Run mode LED indicator
⑩ Run mode change switch

The LED lamp (⑨) indicate current run mode and the switch (⑩) 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 ±7 digit digital switch.
2) IND mode : move to relative indexed position
   Can move to the relative position that is shown by ±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(⑥), then decide scan direction by JOG SW(⑧).
Pulse out can be stopped by STOP button or LIMIT SW.

⑪ Speed select LED indicator
⑫ Speed select switch

The LED lamp (⑪) indicate current set speed and the switch (⑫) select the speed.
These are 3 mode.
1) H SPEED
Pulse out by HSPD data [1)] that was set in advance.
2) M SPEED
Pulse out by MSPD data [2)] that was set in advance.
3) L SPEED
Pulse out by LSPD data [3)] 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.

⑬ 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.

⑭ 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.

⑮ 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)

⑯ LED indicator for external switch input

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

⑰ Indicator LED for pulse output & hold-off

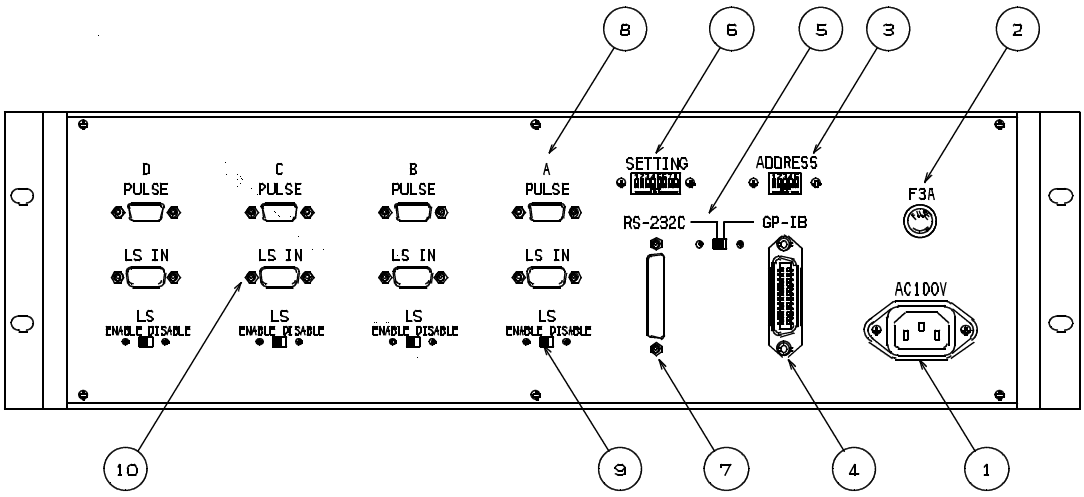
LED indicates pulse output status, hold-off status.
If the LED lamp is on, it indicate active status.

⑱ ±7 digit digital rotary switch

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

④, ⑮, ⑯, ⑰, ⑱ above are provided for each channel.

2) Rear panel layout



① AC100V/200V power supply connector

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

② Fuse holder

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

③ 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)

④ GP-IB communication connector

24P connector for GP-IB

⑤ 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.

⑥ 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)

⑦ RS232C connector

D-Sub 25P (socket type)

⑧ 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)

⑨ 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)

⑩ 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.

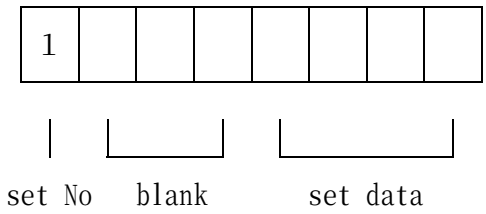
	operation mode	driving mode	driving position	speed setting
default	LOCAL	REL	memorized	MID

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

a) Select set No.3 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 161).

5) RATE (Speed up/down rate) Setting No.4

a) Select set No.4 by DATA (START) button.
b) Set new data by INC (PRESET) button, DEC (STOP) button.
See table 2 about the relation between data and rate.
c) Set data are written as decimal data (0 to 18).

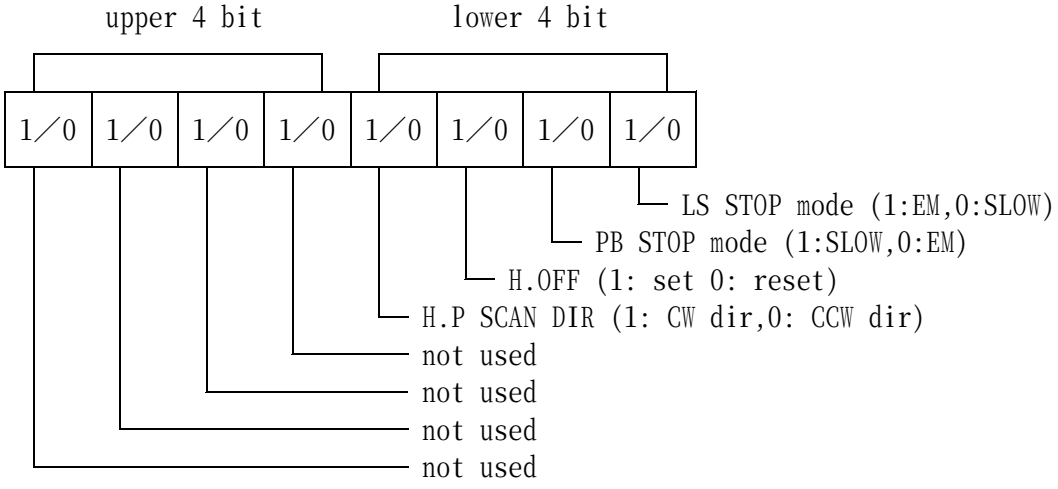
6) JOG pulse number Setting No.5

a) Select set No.5 by DATA (START) button.
b) Set new data by INC (PRESET) button, DEC (STOP) button.
c) Set data are written as decimal data (1 to 9999).
d) The number of JOG pulse is available when jog SW is used (default number = 1).

7) Flags (STOP mode, etc. Setting No.6

a) Select set No.6 by DATA (START) button.
b) Set new data by INC (PRESET) button, DEC (STOP) button.
c) 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 STOP MODE & LS, REM/LOC status etc.
data write	HSPD, MSPD, LSPD, RATE, LMSW
Command	+JOG, -JOG, SCAN, CONSTANT SPEED RELATIVE INDEX SCAN, CONSTANT SPEED ABSOLUTE INDEX SCAN, RELATIVE INDEX, ABSOLUTE INDEX, SPEED SELECT, PAUSE ON/OFF, HOLD OFF SET/RESET, SLOW STOP, EMergency STOP

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

2) Communication specification

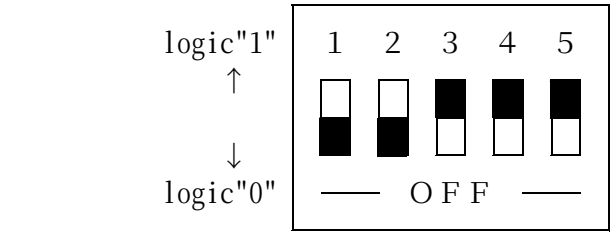
a) Introduction
A PM4C-05A has a GP-IB control IC;TMS9914A. and has a RS232C control IC;HD64941. In this system, nonsense command or impossible command (EX. reverse drive during normal drive) are ignored so that almost all time you can access from these communication lines (protect from hung up).
Receive form should be S□・・・・□CR+LF. *) □: ASCII
* de-limitter is fixed to CR+LF.

When CR(0DH)+LF(0AH)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 30.
Don't use 0 or 31.

Left sample shows address 07H(00111).

address bit weight 2^4 2^3 2^2 2^1 2^0

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.

RS232C port setting

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

SW No.

1 : ┐ stop bit
2 : ┘
3 : always 0 set
4 : always 0 set
5 : 1:8 bit data, 0:7 bit data
6 : ┐
7 : ├ baud rate
8 : ┘

SW1 SW2
0 0 ・・・reserved
0 1 ・・・1 stop bit
1 0 ・・・1.5 stop bit
1 1 ・・・2 stop bit

SW6 SW7 SW8
0 0 0 ・・・ 75 BAUD
0 0 1 ・・・ 150 BAUD
0 1 0 ・・・ 300 BAUD
0 1 1 ・・・ 600 BAUD
1 0 0 ・・・ 1200 BAUD
1 0 1 ・・・ 2400 BAUD
1 1 0 ・・・ 4800 BAUD
1 1 1 ・・・ 9600 BAUD

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

Command is available only in ASCII code.
De-limitter 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. [1)]
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

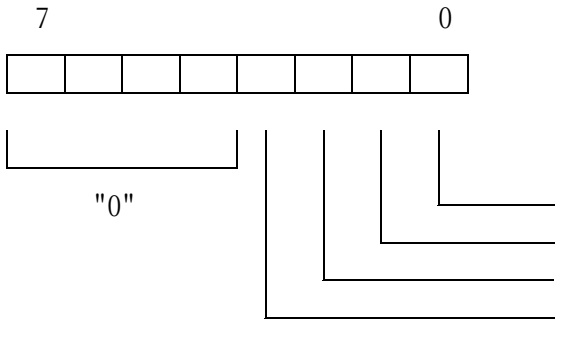
○ mark data
0:A POSITION
1:B POSITION
2:C POSITION
3:D POSITION
8:current SRQ flag
9:SRQ reply channel read

△ mark data
1:SRQ set
0:SRQ clear

<<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.



Reply to "S18", "S19" command

<Reply form>
R 0 □CR+LF

□ is total value of 1,2,4,8 in hex.

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

△ mark data
0:pulse count data
1:internal CPU status
2:LS･HP･H.OFF status

<<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>

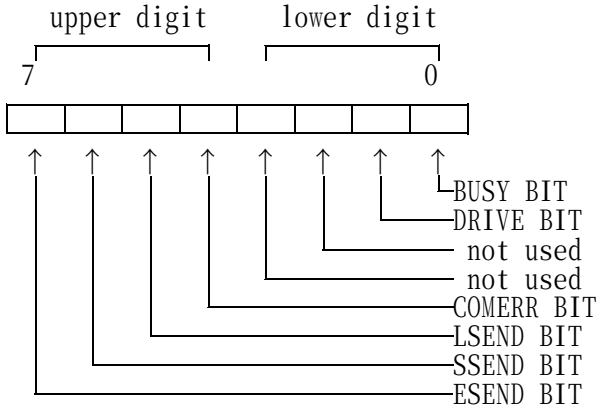
a) For S2※0 command

R○△(7 digit decimal data)CR+LF
polarity + or −
position name (A, B, C, D)

b) For S2※1 command

R○(2 digit hex data) CR+LF
position name (A, B, C, D)

2 digit hex data bit map



bit information

BUSY BIT : internal CPU is busy
any command are
receivable when bit=0 [1)]

DRIVE BIT: internal CPU is now on
pulse out status.

COMERR BIT:command is not regal [2)]

LSEND BIT :PULSE was stopped
by limit switch. [2,3)]

SSEND BIT :PULSE was stopped [2,3)]
by slow stop command.

ESEND BIT :PULSE was stopped [2,3)]
by EM command.

1) Only SLOW STOP,EM STOP command are available in BUSY=1,DRIVE=1(on driving)state.

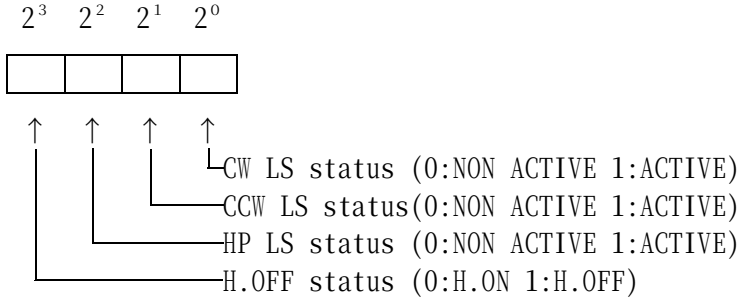
2) COMERR , LSEND , SSEND , ESEND BIT are valid in BUSY=0 status.
These bit are cleared by next command.

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



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	2 digit HEX data
0:A POSITION	08,0A:+JOG(1 pulse)
1:B POSITION	09,0B:-JOG(1 pulse)
2:C POSITION	0C:+SCAN(no acc.)
3:D POSITION	0D:-SCAN(no acc.)
	0E:+SCAN(with acc.)
	0F:-SCAN(with acc.)
	16:PAUSE ON [1)]
	17:PAUSE OFF [1)]
	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＞

Ｓ３８○(±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 ～ FFFFFFH in HEX)

＜＜sample＞＞

A POSITION　+1234567　INDEX SCAN(no acc.) ・・・・Ｓ３８０＋１２３４５６７１０CR+LF
B POSITION　-0200000　ABSOLUTE SCAN(no acc.)・・・Ｓ３８１－０２０００００１１CR+LF
C POSITION　+0000000　INDEX SCAN(with acc.) ・・・Ｓ３８２＋０００００００１２CR+LF
D POSITION　-0000100　ABSOLUTE SCAN(with acc.)・・Ｓ３８３－０００１００１３CR+LF

＜Command form type ３＞

Ｓ３９○△<const.1>CR+LF

○ mark data　　△ mark data　　const.1
0:A POSITION　　0:HSPD change　――― 3 digit(000～187) 2)
1:B POSITION　　1:MSPD change　――― 3 digit(000～187) 2)
2:C POSITION　　2:LSPD change　――― 3 digit(000～161) 2)
3:D POSITION　　3:RATE change　――― 2 digit(00～18)　3)
　　4:JOG pulse set　――― 4 digit(0000～9999) 4)
　　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   ・・・・・・・S３９００１００CR+LF
B POSITION  MSPD  set to 15  ・・・・・・・・・S３９１１０１５CR+LF
C POSITION  LSPD  set to 5   ・・・・・・・・・S３９２２００５CR+LF
D POSITION  RATE  set to 10  ・・・・・・・・・S３９３３１０CR+LF
A POSITION  JOG pulse set to 1234    ・・・・S３９０４１２３４CR+LF
B POSITION  LS STOP set to slow stop ・・・・S３９１５０CR+LF
C POSITION  LS STOP set to EM stop ・・・・・S３９２５１CR+LF
D POSITION  PB STOP set to slow stop ・・・・S３９３６２CR+LF
A POSITION  H.OFF clear    ・・・・・・・・・・S３９０７０CR+LF
B POSITION  H.OFF set      ・・・・・・・・・・S３９１７４CR+LF
C POSITION  HP SCAN DIR set to CCW   ・・・・S３９２８０CR+LF
D POSITION  HP SCAN DIR set to CW  ・・・・・S３９３８８CR+LF
A POSITION  counter preset +1234567・・・・・S３９０９＋１２３４５６７CR+LF
```

4) "Ｓ４" 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 >

Ｓ４○△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		
A:A POSITION	H:HSPD data read	(condition mode 1)	const.2 is 4 digit decimal data that is shown in the panel when condition setting.
B:B POSITION	M:MSPD data read	(condition mode 2)	
C:C POSITION	L:LSPD data read	(condition mode 3)	
D:D POSITION	R:RATE data read	(condition mode 4)	
	JP:JOG pulse data read	(condition mode 5)	
	S:status data read	(condition mode 6)	

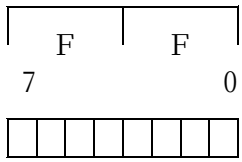
b) Status information for the panel

R○□<const.3><const.4>CR+LF

○ mark data
L:LOCAL mode
R:REMOTE mode

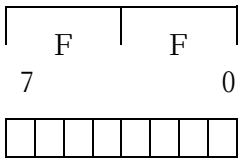
□ mark data
C:CONDITIONmode
N:NORMAL mode

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



B0:A POS.
B1:B POS.
B2:C POS.
B3:D POS.
B4～B7:0

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



B0:ABS mode
B1:IND mode
B2:H.P mode
B3:SCAN mode
B4:SPEED Low
B5:SPEED Mid
B6:SPEED Hi
B7:0

<<sample>>

A POSITION HSPD data read ・・・・・・S400CR+LF
B POSITION MSPD data read ・・・・・・S411CR+LF
C POSITION LSPD data read ・・・・・・S422CR+LF
D POSITION RATE data read ・・・・・・S433CR+LF
A POSITION JOG pulse data read・・・・S404CR+LF
D POSITION status data read・・・・・ S435CR+LF
status information for the panel ・・・S48CR+LF

5) "S7" command

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

<Command form>

S7○△CR+LF

○ mark data
0:REM/LOC change
1:SPEED change

△ mark data
R:REMOTE MODE change
L:LOCAL MODE change
H:SPEED Hi change
M:SPEED Mid change
L:SPEED Low change

<<sample>>

PM4C-05A REMOTE mode change ・・・・S70RCR+LF
PM4C-05A LOCAL mode change ・・・・・S70LCR+LF
PM4C-05A SPEED Hi change ・・・・・S71HCR+LF
PM4C-05A SPEED Mid change ・・・・S71MCR+LF
PM4C-05A SPEED Low change ・・・・S71LCR+LF

7. LIMIT SW logical setting

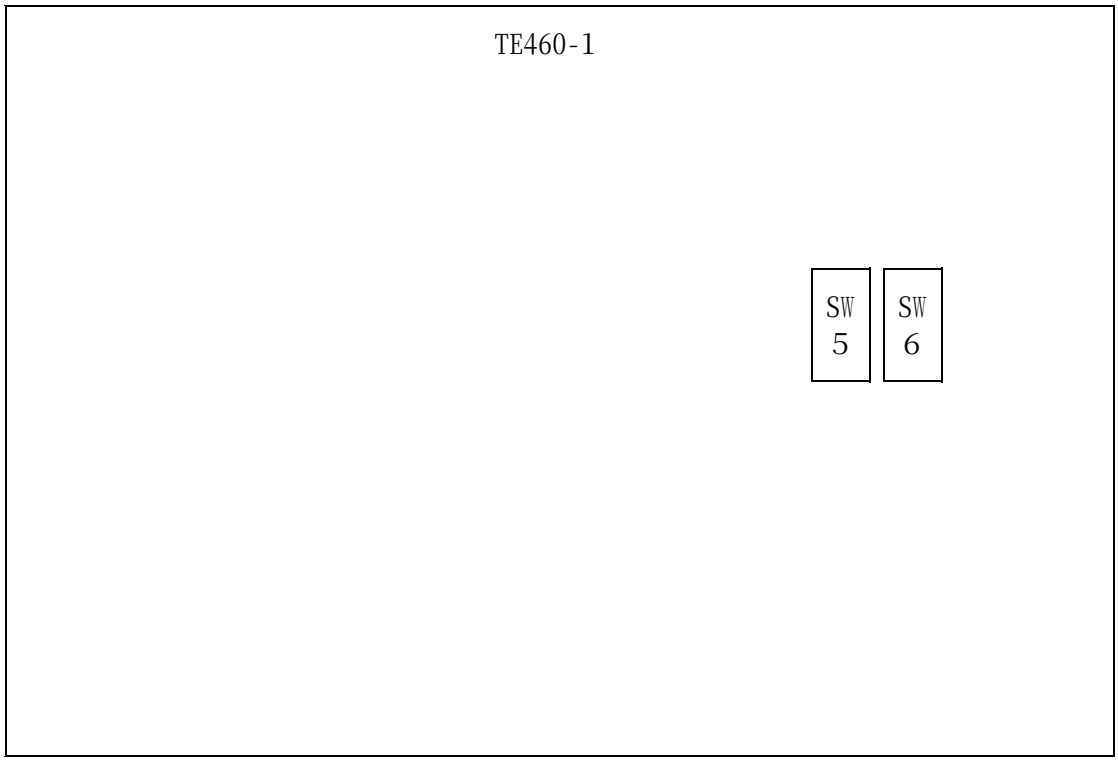
Logical setting switch for the external limit switches are on the main board. If you need logical change for the limit switches, you can remove upper cover and treat switches as follows.

<<< Warning !! >>>

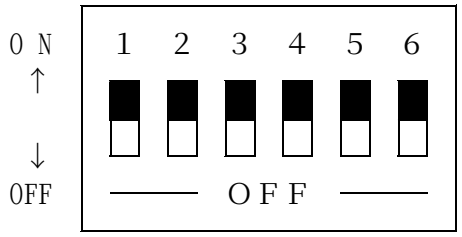
Be sure to disconnect main power supply cable before this process!

Board No. TE460－1

Switch No. for A and Bch：SW5
for C and Dch：SW6



SW5, 6 details



(default status is shown)

1：A(C) POSITION H.P
2：B(D) POSITION H.P
3：A(C) POSITION CW LS
4：A(C) POSITION CCW LS
5：B(D) POSITION CW LS
6：B(D) POSITION CCW LS

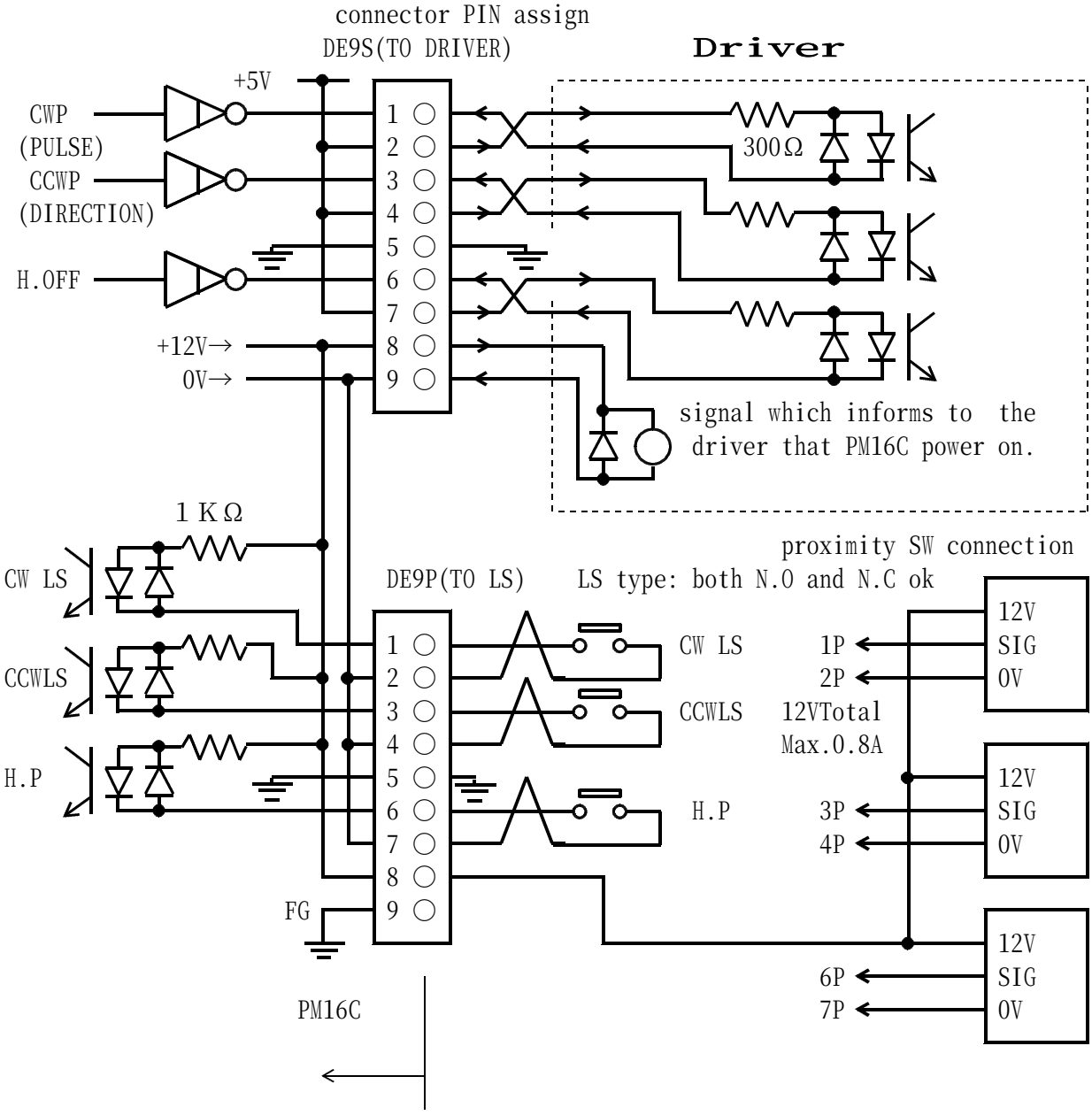
ON: A(N.O) type
OFF: B(N.C) type
ON: B(N.C) type
OFF: A(N.O) type

Default status is set CW・CCW as N.C and H.P as N.O.

8. Connection with outer equipment

1) Connection with drivers

Connection cables are recommended to be shielded twist pair cable(more than 0.2mm²).



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.