MITSUBISHI

General Purpose AC Servo

MELSERVO-J2-A

Communication Function Operating Installation Guide

MITSUBISHI ELECTRIC

CONTENTS

1. COMMUNICATIONS

1.1 Introduction

When used for communications, the MELSERVO-J2 series is designed to reply to an instruction received. A device which gives this instruction (personal computer or other computer) is called a master and a device which replies to the instruction (MR-J2-A servo amplifier) is called a slave. To fetch data consecutively, the master repeats a data request command.

1.2 Electrical Characteristics

The signal voltage levels, High/Low definitions, communication speed, etc. are defined below. In this communication function, the signal level conforms to the international standard RS-232C. The servo amplifier can be connected with a master marked "RS-232C" or "in conformance with RS-232C".

Item	Description
Slave's communication connector (CN3)	Half-pitch 20 pins
Signal level	Conforms to RS-232C.
Baudrate	9600/19200bps, asynchronous
Start bit	1 bit
Data length	8 bits
Parity	Even
Stop bit	1 bit
Transfer system	Character method Variable frame Half-duplex communication
Functions	Operating status monitoring, servo diagnostic, alarm data read, parameter read/write, test operation

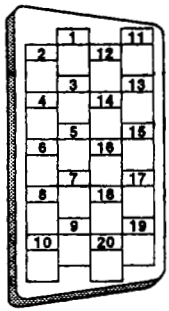
1.3 Communication Protocol

The protocol used in this communication function is dedicated to the MELSERVO-J2 series and cannot be altered. A program which will match this protocol should be created on the master side.

2. CABLE CONNECTION

2.1 Connector Pins and Signals

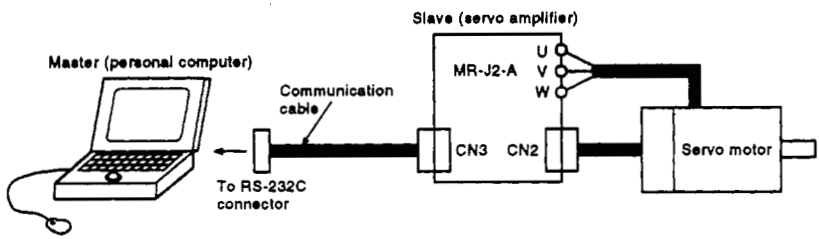
CN3



Pin Number	Signal Name	I/O	Application
1	GND		Control common
2	RXD	I	Receive data
3 to 10	Reserved		Used for other purpose than RS-232C communication
11	GND		Control common
12	TXD	O	Send data
13 to 20	Reserved		Used for other purpose than RS-232C communication
Plate	FG		Grounding for shield

2.2 Fabrication of Communication Cable

2.2.1 Configuration diagram



2.2.2 Precautions for wiring

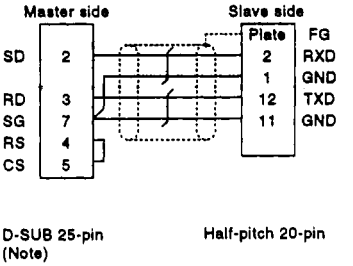
Use the optional communication cable (MR-CPC98CBL3M or MR-CP-CATCBL3M) for connection of the slave and master. When fabricating the cable, refer to Section 2.2.3 and note the following:

1) Always use a multi-core shielded cable and connect the shield to FG of the slave securely.
2) The wiring distance is 15m maximum in offices or the like where noise influence is minimal. The cable used should be as short as possible.

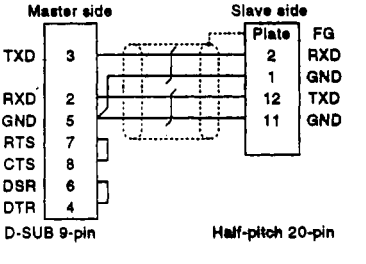
2.2.3 Connection diagram

Communication cable	Connector	
	Master side (Personal computer)	Slave side (Servo amplifier)
MR-CPC98CBL3M	Honda Tsushin make GM-25LM	3M make 10120-6000EL (connector) 10320-3210-0000 (shell kit)
MR-CPCATCBL3M	Honda Tsushin make GM-9LM	

• MR-CPC98CBL3M



• MR-CPC98CBL3M

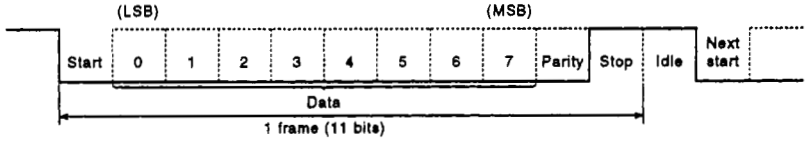


Note: Some PC98 Notes have the half-pitch 14-pin connectors. Check the RS-232C connector shape of your personal computer.

3. BASIC PROTOCOL

3.1 Frames

Communication protocols are classified into a fixed frame length format and a variable frame length format. In the variable frame length format, a send data length may be transmitted as part of data at the beginning of communication or a control code may be used as a terminator. The MELSERVO-J2 series uses the variable frame length format with a control code.
A frame means a single character of control code, instruction, data or the like, and consists of 11 bits as shown below:



3.2 Character Codes

The characters are defined in ASCII as listed below:

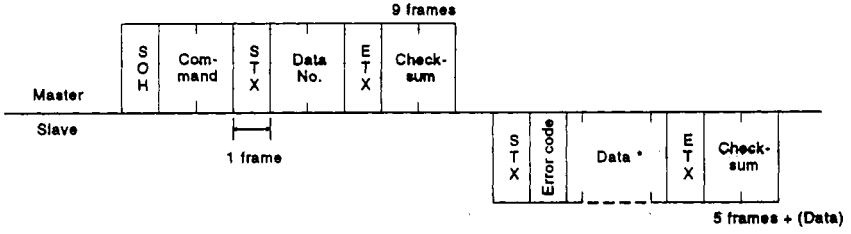
	HEX	0	1	2	3	4	5	6	7
HEX	BIN	0000	0001	0010	0011	0100	0101	0110	0111
0	0000	NUL 0	16	SP 32	0 48	@ 64	P 80	` 96	p 112
1	0001	SOH 1	17	! 33	1 49	A 65	Q 81	a 97	q 113
2	0010	STX 2	18	" 34	2 50	B 66	R 82	b 98	r 114
3	0011	ETX 3	19	# 35	3 51	C 67	S 83	c 99	s 115
4	0100	EOT 4	20	$ 36	4 52	D 68	T 84	d 100	t 116
5	0101	5	21	% 37	5 53	E 69	U 85	e 101	u 117
6	0110	6	22	& 38	6 54	F 70	V 86	f 102	v 118
7	0111	7	23	' 39	7 55	G 71	W 87	g 103	w 119
8	1000	8	24	(40	8 56	H 72	X 88	h 104	x 120
9	1001	9	25	) 41	9 57	I 73	Y 89	i 105	y 121
A	1010	10	26	* 42	: 58	J 74	Z 90	j 106	z 122
B	1011	11	27	+ 43	; 59	K 75	[91	k 107	{ 123
C	1100	12	28	, 44	< 60	L 76	¥ 92	l 108	| 124
D	1101	13	29	- 45	= 61	M 77	] 93	m 109	} 125
E	1110	14	30	. 46	> 62	N 78	^ 94	n 110	~ 126
F	1111	15	31	/ 47	? 63	O 79	_ 95	o 111	DEL 127

As data delimiters, the control codes are defined as follows:

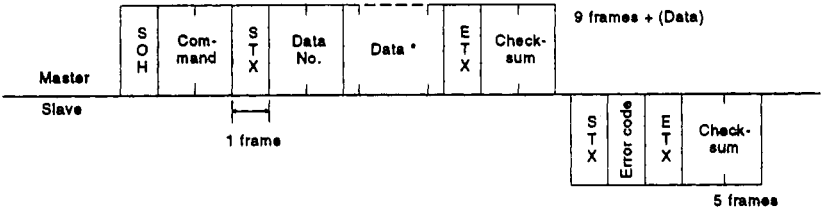
Code Name	Hexadecimal (ASCII code)	Contents	Conventional Key Operations at a Personal Computer or Terminal
SOH	01H	start of header (Communication start)	ctrl + A
STX	02H	start of text (Text start)	ctrl + B
ETX	03H	end of text (Text end)	ctrl + C
EOT	04H	end of transmission (Communication interruption)	ctrl + D

3.3 Send and Receive Data Format

3.3.1 Reading data from the slave



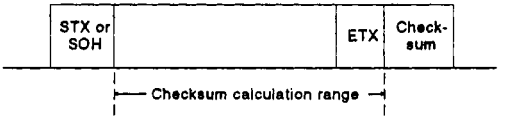
3.3.2 Writing data to the slave



Note: Select the data length from among 4, 8, 12 and 16 frames. (The data length depends on the command.)

3.4 Checksum

A checksum is required at the end of send data from the master. Since a checksum is also appended to receive data from the slave, use it to check for an error in the receive data. To find a checksum to be appended, the hexadecimal numbers of character codes between the one following the first control code and ETX are summed, and the two least significant digits of the sum are converted into hexadecimal.



(Example)

STX	[A]	[1]	[3]	[C]	[E]	[1]	[A]	[2]	[3]	ETX	[0]	[4]
02H	41H	31H	33H	43H	45H	31H	41H	32H	33H	03H	30H	34H
											Checksum	

Checksum calculation:

```
  41H
+ 31H
+ 33H
+ 43H
+ 45H
+ 31H
+ 41H
+ 32H
+ 30H
+ 03H
------
  204H
   |
  [0] [4]
  30H 34H
```

3.5 Retry and Time-Out Processings

The slave may not reply to an instruction from the master if:

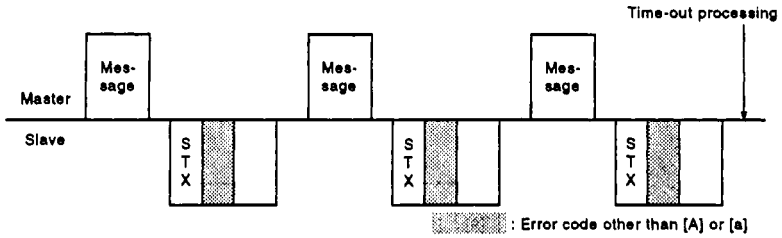
1) The communication cable is broken or the connector is not in proper contact; or
2) Control code STX or ETX is not received.

As the problem in 2) may be solved by repeating the instruction, make retries. If the problem still persists after three retries, the communication path has a problem. In this case, perform time-out processing to suspend communication.

3.5.1 Reply contains an error code

<Factor>
1) The command or data returned contains an unrecognizable character code.
2) Error was detected in parity check.
3) Checksum error.
4) Data or data No. received does not exist in the specifications.

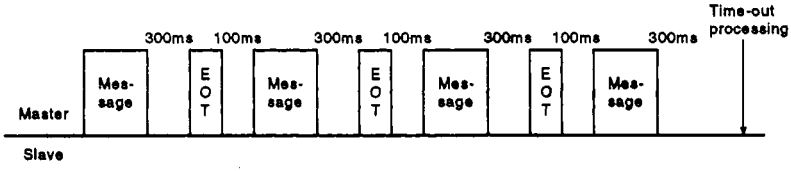
<Action>
Make retries since the error code in the data returned is a negative acknowledge code (B to F, b to f).



3.5.2 No reply (for longer than 300ms)

<Factor>
1) The command or data sent has not reached.
2) The control code as a terminator is not recognized by the slave and the master judged that the slave did not receive the entire message.

<Action>
The slave may be in the receive mode. If a command or data is sent in this mode, the slave cannot recognize it properly. Transmit EOT once to place the slave in the receive neutral mode, and then make retries. Each retry should be made 100ms after EOT has been sent.



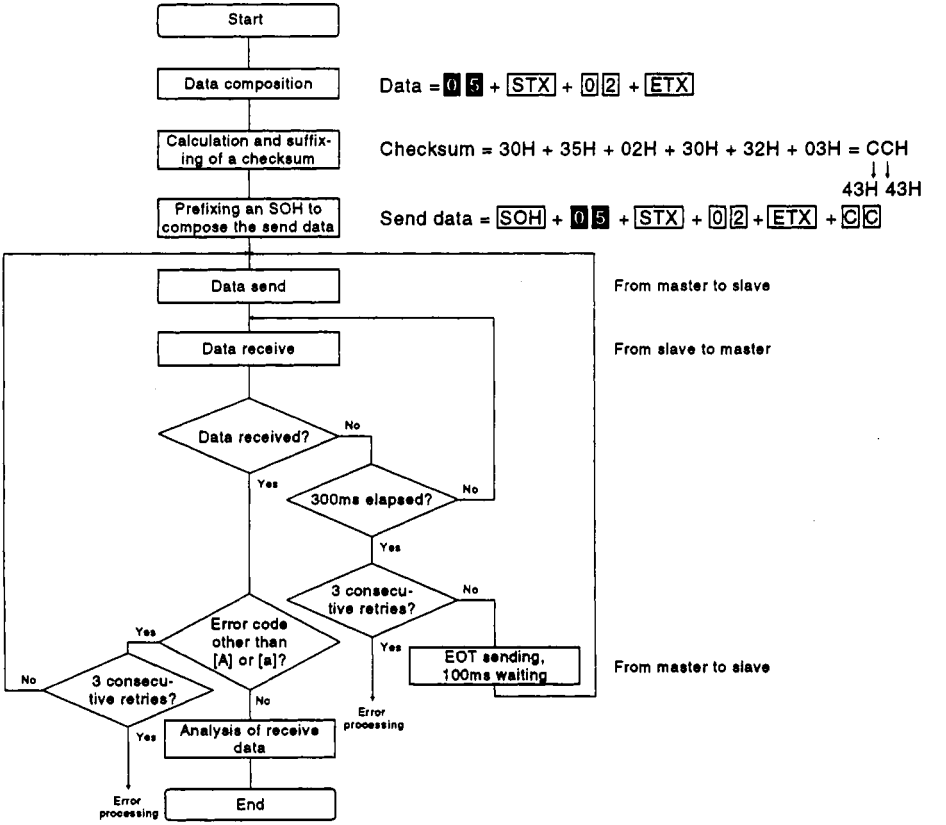
3.6 Initializing

After the slave is switched on, it cannot reply to any communication until internal initialization processing finishes. Hence, when the slave has been switched on, normal communication should be started after:

1) More than 1s has elapsed after the slave was switched on; or
2) Performing parameter read or other operation, which will not pose a problem to safety, to ensure that communication may be made properly. (In this case, use the method described in Section 3.5.2.)

3.7 Communication Procedure Example

The following example assumes that command 0 5 and data No. 0 2 are used to read the value set for auto tuning in parameter No. 2 on the MR-J2-A servo amplifier.



4. COMMUNICATION COMMANDS

4.1 Read Commands

Command	Data No.	Description	Frame Length
01	80 to 8C	Data value and processing information of status display	12
02	00	Current alarm number	4
05	00 to 31	Current values of corresponding parameters (the decimal numbers in data No. correspond to the parameter numbers)	8
12	40	External input pin states	8
12	C0	External output pin states	8

Command	Data No.	Description	Frame Length
33	10	Alarm number in alarm history (first alarm in the past)	4
33	11	Alarm number in alarm history (second alarm in the past)	4
33	12	Alarm number in alarm history (third alarm in the past)	4
33	13	Alarm number in alarm history (fourth alarm in the past)	4
33	14	Alarm number in alarm history (fifth alarm in the past)	4
33	15	Alarm number in alarm history (sixth alarm in the past)	4
33	20	Time of alarm occurrence alarm history (first alarm in the past)	4
33	21	Time of alarm occurrence alarm history (second alarm in the past)	4
33	22	Time of alarm occurrence alarm history (third alarm in the past)	4
33	23	Time of alarm occurrence alarm history (fourth alarm in the past	4
33	24	Time of alarm occurrence alarm history (fifth alarm in the past)	4
33	25	Time of alarm occurrence alarm history (sixth alarm in the past)	4
35	80 to 8C	Data value and processing information of status display at alarm occurrence	12

4.2 Write Commands

Command	Data No.	Description	Setting Range	Frame Length
81	00	Status display data clear	1EA5	4
82	00	Alarm reset	1EA5	4
82	20	Alarm history clear	1EA5	4
84	00 to 31	Write of corresponding parameters (the decimal numbers in data No. correspond to the parameter numbers)	Aries according to parameter number	8
8B	00	Test operation mode selection	0000 to 0004	4

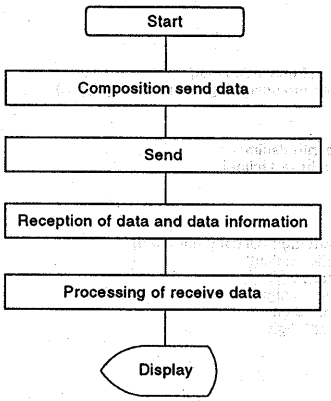
Command	Data No.	Description	Setting Range	Frame Length
90	00	External input signal inhibit	1EA5	4
90	03	External output signal inhibit	1EA5	4
90	10	External input signal inhibit cancel	1EA5	4
90	13	External output signal inhibit cancel	1EA5	4
92	00	Input signals for test operation		8
92	A0	Forced output of signal pins		8
A0	10	Test operation mode speed data write	0000 to permissible speed	4
A0	11	Test operation mode acceleration/deceleration time constant write	00000000 to 00004E20	8
A0	12	Test operation mode acceleration/deceleration time constant cancel	1EA5	4
A0	13	Test operation mode travel amount write	80000000 to 7FFFFFFF	8
A0	15	Temporary stop for test operation mode	1EA5	4

5. COMMANDS USED WITH SPECIFIC FUNCTIONS

5.1 Communication Procedure

When "command + data No." or "command + data No. + data" are transmitted from the master to the slave, the servo amplifier returns a reply or data according to the intended purpose. These send and receive data include numeric information on decimal, hexadecimal or other representation.
Receive data used are data whose numerical values have been converted and decimal point positions have been processed. Send data to be transmitted should have been processed according to this rule.

Example:
To obtain data used to show the analog speed command voltage [V] on the CRT of the master.



If the display type is 0, 8-character hexadecimal data is converted into a decimal number and a decimal point is placed according to the decimal point position information.
If the display type is 1, the 8-character data remains unchanged.
Example:
If receive data is ▒▒ 3000000929
00000929H is converted into 2345. As the decimal point position is 3 (third least significant digit), 23.45 is displayed.
Whether data needs processing or not and its processing method depend on the monitor, parameter, etc. Refer to the corresponding detailed explanation.
Data□□□□ in the following description means the frame shown in Section 3.3.
The frames marked ▒ in the data are meaningless.

5.2 Status Display

5.2.1 Status display read

Status display data is read. For status display data, its data value and data processing information are returned when the data No. (for assignment, refer to the table below) is transmitted.

Command Data No. Data No.
0 1 [8][0] to [8][C] : Data value and processing information of status display

The data value is read in hexadecimal. Data is displayed in hexadecimal or in decimal after conversion, and may include a decimal point.
Whether hexadecimal data has been converted into decimal or not and the decimal point position command are indicated as follows:

Reply:

Data length, 32 bits (given in hexadecimal)
(Data may need conversion according to the display type.)

Display type
[0]: Must be converted into decimal
[1]: Used unchanged in hexadecimal

Decimal point position
[0]: No decimal point
[1]: First least significant digit (Usually not used)
[2]: Second least significant digit
[3]: Third least significant digit
[4]: Fourth least significant digit
[5]: Fifth least significant digit
[6]: Sixth least significant digit

Data No. Assignment Table

Data No.	Monitored Data
80	Cumulative feedback pulses
81	Motor speed
82	Droop pulses
83	Cumulative command pulses
84	Command pulse frequency
85	Analog speed command (limit) voltage
86	Analog torque command (limit) voltage
87	Regenerative load ratio
88	Effective load ratio
89	Peak load ratio
8A	Within-one-revolution position
8B	ABS counter
8C	Load inertia moment rate

5.2.2 Status display data clear

Command Data No.
8 1 [0][0] : Status display data clear

Clears the cumulative command pulses or cumulative feedback pulses of the status display. Send this command immediately after reading the corresponding status display item. Only the status display item sent is cleared and its data is reset to zero.

Send data: [1][E][A][5]

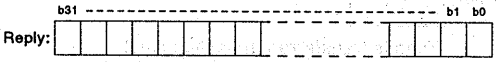
Example:
After sending command 0 1, data No. [8][0] and receiving its information, transmit command 8 1, data No. [0][0] and send data [1][E][A][5] to reset the cumulative feedback pulse value to zero.

5.3 Diagnostic

5.3.1 External I/O signal states

The ON/OFF states of the external I/O pins are read.

Command Data No.
1 2 [4][0] : External input pin states



Command for each bit is sent to the slave in hexadecimal.

0: OFF 1:ON

bit	External Input Pin
0	CN1B-16
1	CN1B-17
2	CN1B-15
3	CN1B-5
4	CN1B-14

bit	External Input Pin
5	CN1A-8
6	CN1B-7
7	CN1B-8
8	CN1B-9

Command Data No.
1 2 [C][0] : External output pin states

Command for each bit is sent to the slave in hexadecimal.

0: OFF 1:ON

bit	External Output Pin
0	CN1A-19
1	CN1A-18
2	CN1B-19
3	CN1B-6
4	CN1B-4

bit	External Output Pin
5	CN1B-18
6	CN1A-14

5.3.2 Alarm history read

The history of alarms which occurred in the past are read.
Alarm numbers and occurrence times of alarms No. 0 (the latest alarm) to No. 5 (sixth alarm in the past) are read.

Command Data No. Data No.
3 3 [1][0] to [1][5] : Alarm number in alarm history

Provides the alarm number corresponding to the data No. (Refer to Section 4.1.)

Reply: | 0 | 0 | | |

The alarm number is transferred in decimal.

Example:
Data 0032 for A.32
Data 00FF for A.--

Command Data No. Data No.
3 3 [2][0] to [2][5] : Alarm occurrence time in alarm history

Provides the time when the alarm corresponding to the data No. occurred after the start of operation in terms of total time truncated to the hour unit. (Refer to Section 4.1.)

Reply: | | | | |

Time is transferred in hexadecimal.
Hexadecimal-to-decimal conversion is needed.

Example:
If power had been switched off 32 hours 43 minutes after power-on and an alarm occurred 6 hours 59 minutes after power was switched on again:
While actual time is 32:43+6:59=39:42,
the time displayed is 32:00+6:00=38:00 → 38 hours (data: 0026H)

5.3.3 Alarm history clear

Command Data No.
3 2 [2][0] : Alarm history clear

Clears the alarm history.

Send data: | 1 | E | A | 5 |

5.3.4 Test operation mode

(1) Test operation procedure

(a) Output signal forced-output

Procedure	Reference Command/Command Name
<Enter the operation mode>	
1) Inhibit the external output signals.	9003 External output signal inhibit
2) Select the operation mode.	8B00 Test operation mode selection
<Forcibly output the output signals>	
Set the forced output of signal pins.	92A0 Forced output of signal pins
<Cancel the operation mode>	
1) Select (cancel) the operation mode.	8B00 Test operation mode selection
2) Cancel the external output signal inhibit.	9013 Cancel of external output signal inhibit

(b) Test operation (jog operation, positioning operation, motor-less operation)

Procedure	Reference Command/Command Name
<Enter the operation mode>	
1) Switch off all the external input signals.	
2) Switch off all the input signals for test operation. (Note)	9200 Input signals for test operation
3) Inhibit the external input signals.	9000 External input signal inhibit
4) Select the operation mode.	8B00 Test operation mode selection
Note: When only SON is kept on, the test operation mode can be selected without the base circuit being switched off.	
<Set data and start operation>	
1) Enter data (command sped, acceleration/deceleration time constant).	A010, 11 Speed, acceleration/deceleration time constant
2) Set the input signals for test operation (SON, LSP, etc.).	9200 Input signals for test operation
3) Perform operation.	
• Positioning operation is performed by setting the travel.	A013 Travel
• Any other operation is performed under the control of the input signals for test operation.	9200 Input signals for test operation
4) To continue, send any command.	
5) To make a temporary stop, set a temporary stop for test operation mode.	A015 Temporary stop
Note: If communication stops for more than 1s during operation, the servo motor stops automatically and therefore the base circuit does not switch off.	
<Cancel the operation mode>	
1) Switch off all the input signals for test operation. (Note)	9200 Input signals for test operation
2) Reset the acceleration/deceleration time constant.	A012 Acceleration/deceleration time constant cancel
3) Select (cancel) the operation mode.	8B00 Test operation mode selection
4) Cancel the external input signal inhibit.	9010 Cancel of external input signal inhibit
Note: When only SON is kept on, the test operation mode can be canceled without the base circuit being switched off.	

Command Data No.
8 B 0 0 : Test operation mode selection

Performs speed control/position control operation, etc. without any external command.
To perform test operation, inhibit external inputs using command 9 0 .

Send data: 0 0 0 [ ]

Operation mode
0: Test operation mode cancel
1: Jog operation selection
2: Positioning operation selection
3: Motor-less operation selection
4: DO forced output selection

Command Data No.
9 0 0 0 : External input signal inhibit

Inhibits the input of external input signals.

Send data: 1 E A 5

Command Data No.
9 0 0 3 : External output signal inhibit

Inhibits the output of external output signals.

Send data: 1 E A 5

Command Data No.
9 0 1 0 : Cancel of external input signal inhibit

Cancels the input inhibit of external input signals.

Send data: 1 E A 5

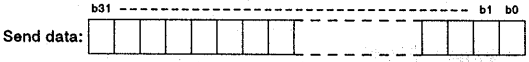
Command Data No.
9 0 1 3 : Cancel of external output signal inhibit

Cancels the output inhibit of external output signals.

Send data: 1 E A 5

Command Data No.
9 2 0 0 : Input signals for test operation

Allows input signals to be switched on/off forcibly to the ports.
Before using this command, inhibit external inputs using command 9 0.
The signal names corresponding to the bits depend on the model of the slave.
Refer to the following lists.



Command for each bit is sent to the slave as hexadecimal data.

0: OFF command, 1: ON command

bit	Signal Name
0	SON
1	LSP
2	LSN
3	TL
4	

bit	Signal Name
5	PC
6	RES
7	CR
8	
9	

bit	Signal Name
10	
11	ST1
12	ST2
13	
14	

Command Data No.
9 2 A 0 : Forced output of signal pins

Allows the signal pins to be switched on/off forcibly independently of each other. If they are output forcibly, the outputs will be returned by the internal processing of the slave. To prevent this, external outputs must be inhibited using command 9 0 , data No. 0 3 before executing forced output.

Command for each bit is sent to the slave as hexadecimal data.

0: OFF command, 1: ON command

bit	Signal Pin
0	CN1A-19
1	CN1A-18
2	CN1B-19
3	CN1B-6
4	CN1B-4

bit	Signal Pin
5	CN1B-18
6	CN1A-14

Command Data No.
A 0 1 0 : Speed

Used to specify the running speed for the test operation mode. Write the speed (unit: r/min) of the servo motor shaft in hexadecimal. Give this command after inhibiting the external DI/analog input using command 9 0 .

Example: 2000r/min → send data 07D0 (write a 4-digit value)

Command Data No.
A 0 1 1 : Acceleration/deceleration time constant

Used to specify the acceleration/deceleration time constant for the test operation mode. Write the acceleration/deceleration time constant (unit: ms) in hexadecimal.

Example: 1000ms → send data 00002710 (write an 8-digit value)
When shifting to ordinary operation after the end of test operation without switching power on again, execute command A 0 , data No. 1 2 to cancel the acceleration/deceleration time constant written for the test.

Command Data No.
A 0 1 2 : Acceleration/deceleration time constant cancel

Unless power is switched on again, the acceleration/deceleration time constant for test operation remains on memory and is also made valid for ordinary operation. When shifting to ordinary operation after the end of test operation, send the cancel instruction.

Send data: 1 E A 5

Command Data No.
A 0 1 3 : Travel

The travel for test operation is made valid when SON, LSP and LSN have been switched on with command 9 2 , data No. 0 0 .
Write a travel (unit: pulse) used for positioning operation in the test operation mode in hexadecimal. Provide a plus (+) sign to run the servo motor in the forward rotation or a minus (–) sign to run it in the reverse direction.
The number of pulses required to run the servo motor one revolution depends on the encoder resolution of the servo motor. Refer to the servo motor specifications given in the MELSERVO-J2 series specifications and installation guide.
Note that such functions as position smoothing and electronic gear are invalid in the test operation mode.

Example:
To run the HC-SF servo motor 15 revolutions (15 x 16384 pulses) on its shaft
Send data 0003C000

Command Data No.
A 0 1 5 : Temporary stop

Allows positioning operation to be decelerated to a stop at any point.

Send data: 1 E A 5

5.4 Current Alarm

5.4.1 Current alarm read

Information on the current alarm is provided.

Command Data No.
0 2 [0 0] : Current alarm number

Provides the current alarm number in 2-digit decimal.

Reply: 0 0 [ ] [ ]

The alarm number is transferred in decimal.

Example:
Data 0032 for A.32
Data 0050 for A.50
Data 00FF (no alarm) for A._

5.4.2 Status display data at alarm occurrence

The status display data at alarm occurrence is read.
When the data No. (for assignment, refer to the status display read/data No. assignment list in Section 5.1.1) is sent, the status display data is returned in the form of data value and data processing information.

Command Data No. Data No.
3 5 [8 0] to [8 C] : Data value and processing information of status display at alarm occurrence

Whether hexadecimal to decimal conversion is needed or not and the decimal pint position command are appended to the read data value. Process the display data according to the data.

Reply: [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

Data, 32 bits long (hexadecimal)
(Data may need conversion according to the display type.)

Display
[0]: Must be converted into decimal
[1]: Used unchanged in hexadecimal

Decimal point position
[0]: No decimal point
[1]: First least significant digit (Usually not used)
[2]: Second least significant digit
[3]: Third least significant digit
[4]: Fourth least significant digit
[5]: Fifth least significant digit
[6]: Sixth least significant digit

5.4.3 Current alarm reset

Command Data No.
8 2 0 0 : Alarm reset

Has the same function as the input from terminal RES, i.e. resets the alarm of the servo amplifier to make it operable. After removing the cause of the alarm, give this command without a command being entered.

Send data: 1 E A 5

5.5 Parameters

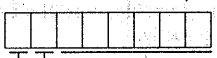
5.5.1 Parameter read

Use command 0 5 to read parameter values and processing information.

Command Data No. Data No.
0 5 0 0 to 3 1 : Current values of corresponding parameters

Whether hexadecimal to decimal conversion is needed or not and the decimal pint position command are appended to the read data value. Process the display data according to the data.
When data cannot be read, any of the display type data 8 to F is returned.

Reply:



Data is transferred in hexadecimal

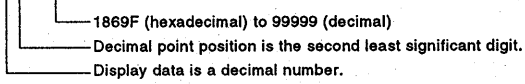
Decimal point display position
0: No decimal point
1: First least significant digit
2: Second least significant digit
3: Third least significant digit
4: Fourth least significant digit
5: Fifth least significant digit

Display type, etc.

Data	Display Type	Timing of making data valid
0	Hex	Write
1	Dec	Write
2	Hex	Power on
3	Dec	Power on
8 9 A B C D E F	Indicates that data cannot be read.	

Timing of making data valid
Indicates whether a new data written is made valid immediately after it is written or after power is switched on.

Example: 9999.9 (decimal display form)
for data "1 2 01869F"



1869F (hexadecimal) to 99999 (decimal)
Decimal point position is the second least significant digit.
Display data is a decimal number.

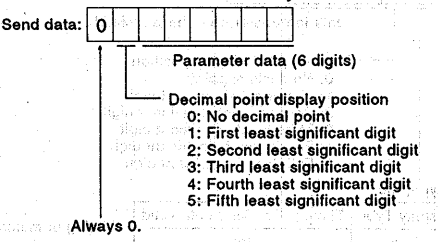
3ABC (hexadecimal display form) for data "0003ABC"

5.5.2 Parameter write

Any parameter value written should be within the setting range, which is given in the specifications and installation guide of the slave.

Command Data No. Data No.
84 00 to 31 : Write of corresponding parameters

When the data written is handled in decimal, the decimal point position must be specified. Otherwise, that data cannot be written. When the data is handled in hexadecimal, specify the decimal point position as 0.
Before writing, read the data of the parameter to be written to, confirm the decimal point position, and create send data. This will prevent an error from occurring. On completion of writing, read the same parameter data to check that it has been written correctly.



Note: Before writing any data, make sure that it is within the range of the upper and lower limit values given in the specifications and installation guide.

6. ERROR CODES

On receipt of any command from the master, the slave returns STX which is followed by a one-character error code. This error code returned is an upper-case alphabet when there is no alarm in the slave or a lower-case alphabet when there is an alarm. The master can use this error code to judge if the intended communication completed without fault and the slave is in an operable state (no alarm).

Error Code		Error Name	Description	Remarks
Servo normal	Servo alarm			
A	a	Normal operation	Data transmitted was processed properly.	Positive response
B	b	Parity error	Parity error occurred in the send data transmitted.	Negative response
C	c	Checksum error	Checksum error occurred in the send data transmitted.	
D	d	Character error	Character transmitted is not included in the specifications.	
E	e	Command error	Command transmitted is not included in the specifications.	
F	f	Data No. error	Data No. transmitted is not included in the specifications.	

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