Compumotor

# Fineserv Series
# User Guide

Compumotor Division
Parker Hannifin Corporation
p/n 88-011806-01 A

Parker

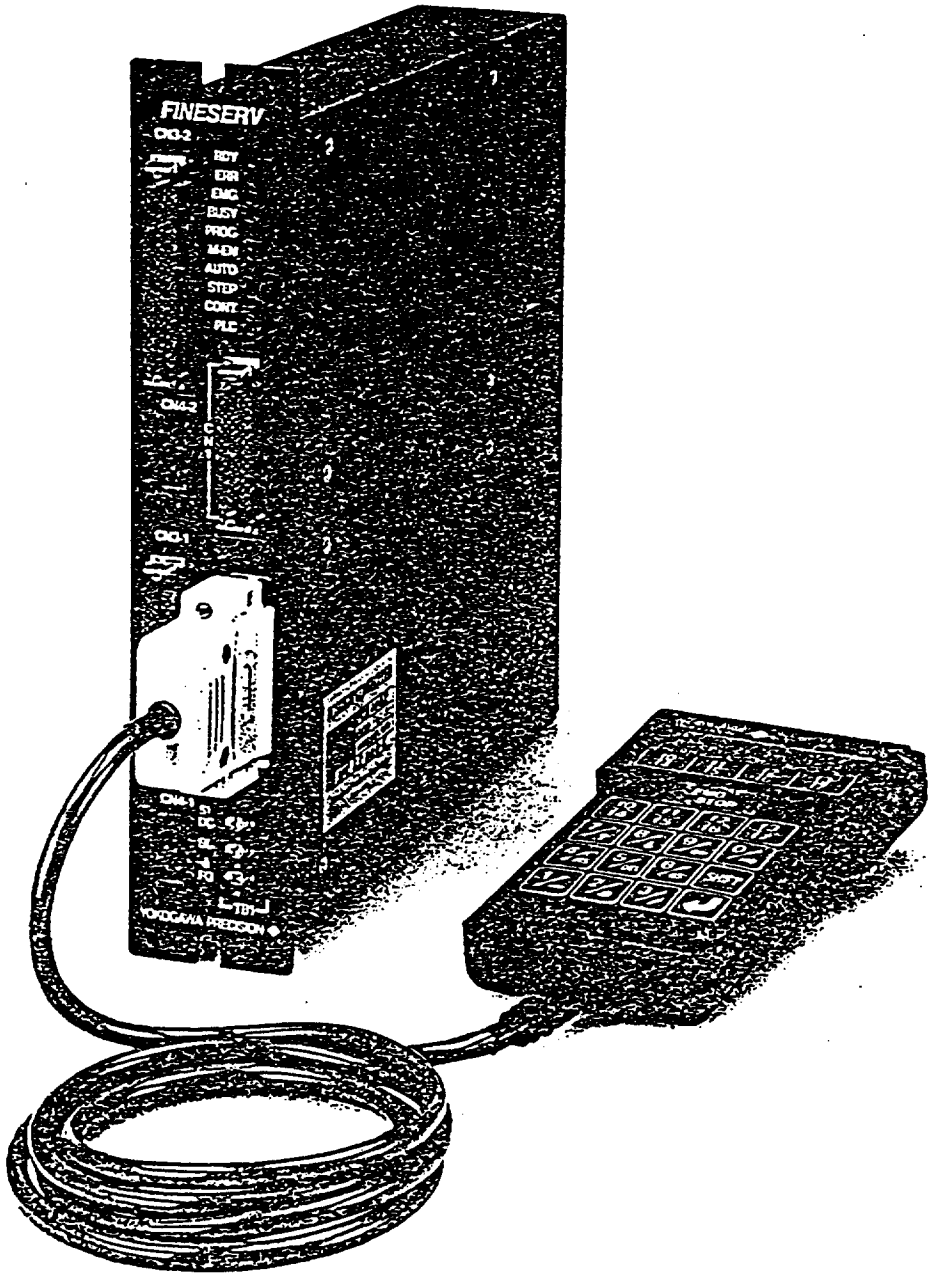
# Instruction Manual

# FINESERV

**Model PC-A Positioning Controller**

**(Dedicated to DYNASERV)**

[2nd Edition]




YOKOGAWA PRECISION ◆

Yokogawa Precision Corporation

IM PCA-01 E

## INTRODUCTION

Thank you very much for purchasing our "FINESERV" controller. This positioning controller is dedicated to the "DYNASERV" direct drive motor employed with a wide variety of FA related equipment including industrial robots, and its many versatile functions enable "DYNASERV" to fully display its characteristics.
In order to be able to utilize fully this controller and its functions, please read this manual and the "DYNASERV" instruction manual carefully.

*WARNING!*

- This instruction manual is not to be reproduced or copied in whole or in part without one permission.
- The contents of this manual may subject to change without notice in the future.
- The instructions contained herein have been prepared carefully. However, if you find mistakes, points of doubt and/or missing descriptions, please contact our sales office, your nearest Yokogawa representative and/or person in charge of service.
- We accept no any liability for errors and direct and/or indirect damage caused by using our products in accordance with this instruction manual.

# C O N T E N T S

# I . BASICS

## 1. GENERAL

This product is a positioning controller designed especially for use with our DYNASERV direct drive motor, and has been developed to display the DYNASERV's superlative performance to the fullest.

Among its features are:

(1) Maximum pulse frequency of 1.3 MPPS draws forth the DYNASERV's high speed and high resolution.

(2) Linear (trapezoidal) acceleration/deceleration curve and 3rd-order splines provide fast and smooth acceleration and deceleration. Cam curve is also available.

(3) Can be programmed using NC language.

(4) Position specification can be by angular specification or indexing specification, as well as pulse count.

(5) Abundant program capacity (3200 blocks).

(6) Easy interface to sequencers or personal computers.

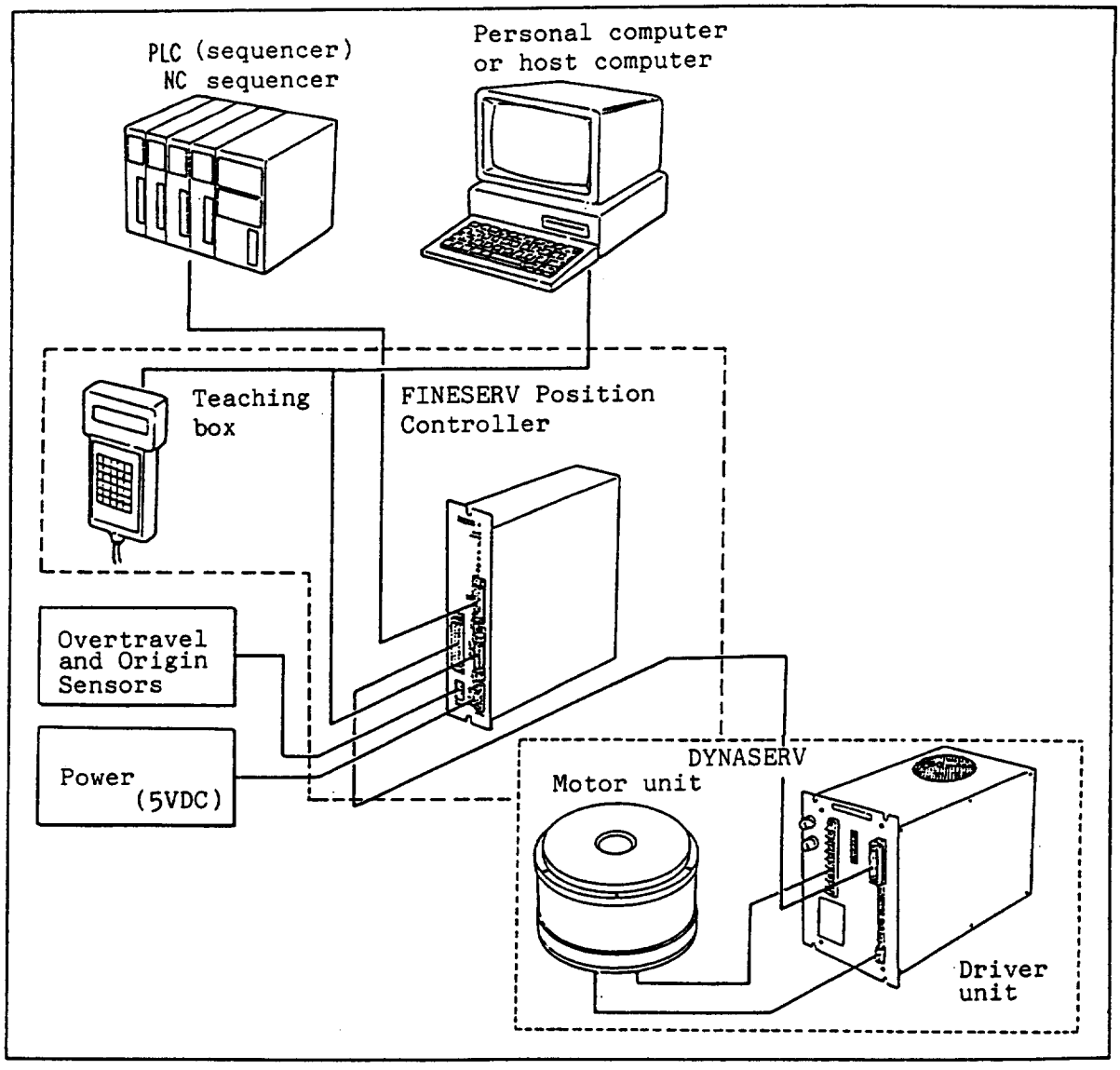



**Figure 1-1. FINESERV System Configuration**

## 2. Before Installation

### 2-1. Standard Configuration

When the FIMESERV is purchased, the standard configuration is as follows. Please verify that all standard equipment and accessories are present.

| Name | | Quantity | Description | Reference Number in Drawing |
|---|---|---|---|---|
| FINESERV Main Unit | | 1 | | Fig 2-1 ① |
| Standard accessories | Connector(CN1) | 1 | MR-34LM(Honda) | 〃 ② |
| | Connector(CN3) | 1* | MR-50LM(Honda) | 〃 ③ |
| | Connector(CN4) | 1* | XG4M-1030(Omron) | 〃 ④ |

Note: The table above applies for a 1-axis FINESERV. For 2-axis through 4-axis units the connector quantities marked with the *___ symbol will be multiplied by the number of axes.

### 2-2. Optional Parts

The following are available as optional parts for the FINESERV.

| Model Number | Name | Description | Reference Number in Drawing |
|---|---|---|---|
| PC000AT | Teaching Box | With 1.5m cable and connector | Fig 2-1 ⑤ |
| CP000AS-0022 | Cable (0.2m) | Between FINESERV and MYNASERV (with 50p connector at both ends) | 〃 ⑥ |
| CP000AS-0042 | Cable (0.4m) | | |
| CP000AS-0102 | Cable (1m) | | |
| CP000AS-0202 | Cable (2m) | | |
| 0P001C | Power Supply(5VDC/3A) | Nagoya Dengen, Model K10A-5 | 〃 ⑦ |
| 0F001C | Power Filter | TDK, Model ZGB2203-01U | 〃 ⑧ |

## 2-3. Other Required Items

The FINESERV standard configuration and options are described above. This section describes other items which will be required for actual installation. Note that the DYNASERV to be connected to the FINESERV must be procured separately. The overall configuration and connections are shown in the accompanying diagram.

(1) Teaching Box Connection:

- The Teaching Box ⑤ is an option and must be purchased separately.
- The FINESERV ① Power Supply (DC5V) ⑦ is offered as an option, but any equivalent unit may be employed. A line filter ⑧ (option or equivalent) should be installed for noise prevention.
- The origin sensor and overtravel sensor ⑨ must be provided by the user; see page 25 for sensors that may be employed. The standard accessory ④ should be used as the connector.
- For the connection between the FINESERV and DYNASERV, cables of several different lengths are available as options, but you may also make the cable yourself using the standard accessory connector ③ . See pages 7, 27 and 28 concerning cable fabrication.

(2) Connection to personal computer or host computer:

- The personal computer or host computer must be provided by the user. Other aspects are the same as for the Teaching Box.

(3) Sequencer connection:

·Except for the provision of the sequencer, other aspects are the same as in the cases of the Teaching Box and personal computer. For the interface connector, use the standard accessory ② .

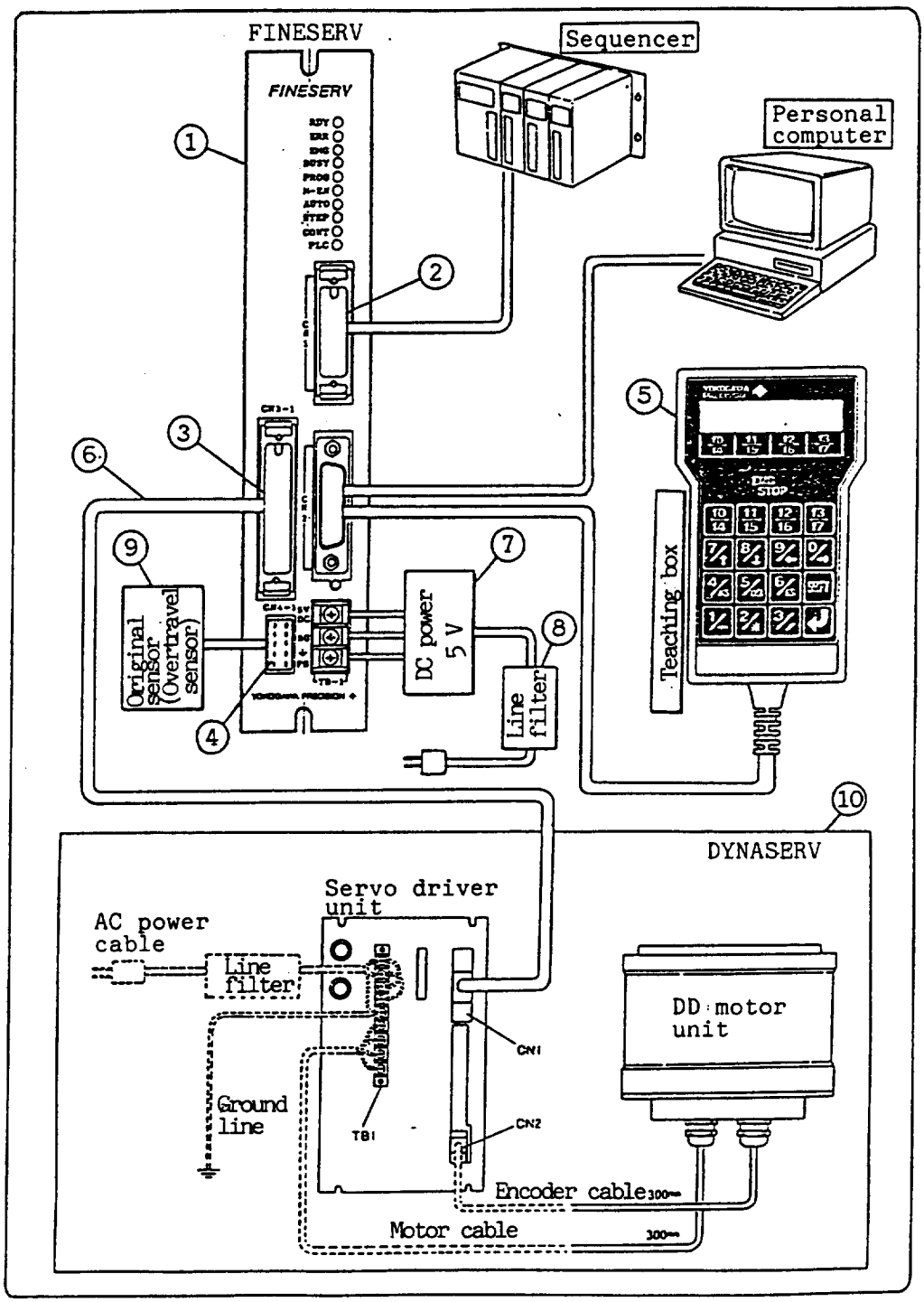



Figure 2-1

## 3. Individual Device Setup and Connections

### 3-1. DYNASERV Driver Setting

When setting up the equipment, first set the jumpers inside the DYNASERV driver unit as described below.

But do not necessary setting in the case of new DYNASERV, because of driver shipped from factory already set up as follow. See the DYNASERV instruction manual and p-24 on how to make those settings.

(1)Set the feedbck pulse.

(2)Set the operating mode to position control mode.

(3)Set the multiplying factor mode time one.

### 3-2. Power Supply Connection

Connect the previously recommended power supply unit or an equivalent as described below.

(1) Use a 5VDC power supply with capacity of 2A or greater.

(2) Keep power supply cable as short as possible. If there is no way to avoid using a long cable, use thick conductors (cross-sectional area 0.75 sq mm or more) to reduce voltage drop. Make sure that voltage at TB1 terminals is maintained at 5V± 3%.

(3) To suppress noise, use a noise filter in the AC line. Also, use a power supply having a dielectric strength of at least 1000V between the AC line and output terminals.

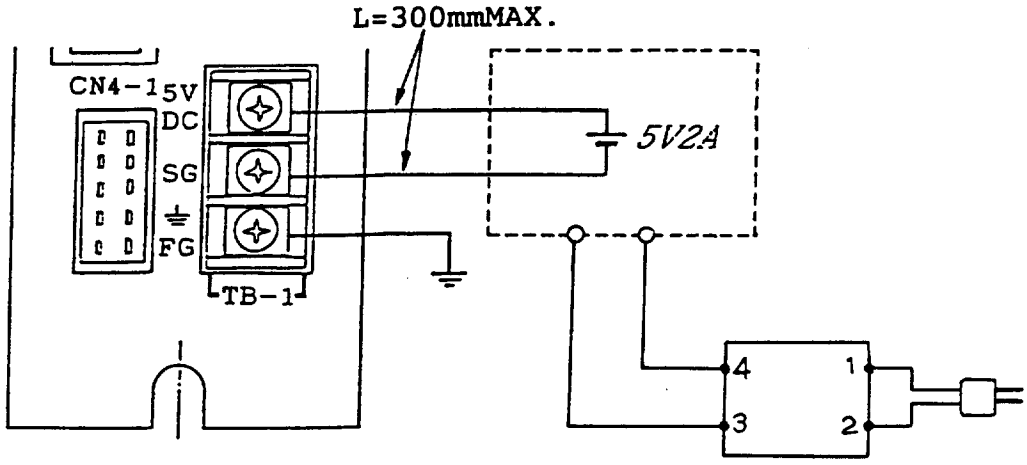



Fig. 3-1

3-3. DYNASERV Connection

The specifications of the cable between the DYNASERV and FINESERV should be as shown below.

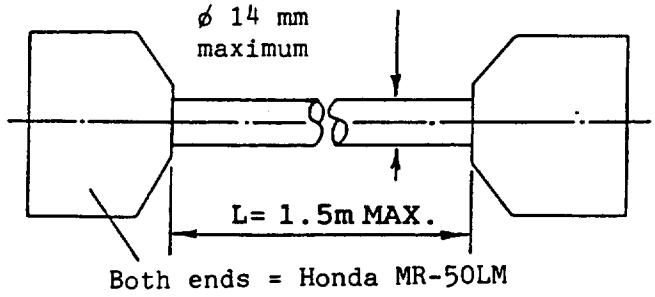



Fig. 3-2

Current: 100 mADC max. Power line size: Shielded twist pair, 0.2 sq mm max tin-plated soft copper conductors.

The explanation that follows assumes that the cable to be used between FINESERV connector CN3-1 and DYNASERV connector CN1 has already been fabricated. If you are using the accessory connectors to make a cable yourself, refer to the descriptions given later (pages 27 and 28) concerning pin number and signal relationships. For connections with two or more axes, refer to page 20.

3-4. Teaching Box Connections

For the Teaching Box, just connect the cable end connector as is to FINESERV CN2. Tighten the screws firmly at each end of the cable.

The above completes connection of the FINESERV to its power unit (do not turn the switch on yet) to the DYNASERV, and to the Teaching Box. Please refer to the DYNASERV instruction manual for information on connections at the DYNASERV.

3-5. Motor Type Setting

FINESERV is dedicated to the DYNASERV, the motor type must be set so as to match each DYNASERV model in accordance with the following, otherwise, the DYNASERV will not function normally.

1) Motor type setting

DYNA SERV model and type No. correspondence settings are as shown in the following table.

| Series name | Motor type | Type No. |
|---|---|---|
| DM series | DM1015B DM1030B DM1045B DM1060B | 0 |
| | DM1050A DM1100A DM1150A DM1200A | 1 |
| DR series | DR1015B DR1030B DR1045B DR1060B | 2 |
| | DR1070E DR1100E DR1130E DR1160E DR1220E DR1250E | 3 |
| | DR1050A DR1100A DR1150A DR1200A DR1300A DR1400A | 4 |

Note: The DR series can use only the serial pulse model.

Setting method

L40: P1: P2

(P1: Axial No.1 to 4)

(P2: Motor type 0 to 4)

Default: 0

2) Set the motor type and the following gain simultaneously. Has the following meaning for each motor type.

| Motor type | P3 | Gain |
|---|---|---|
| 0～1 | 0 | ×1 |
| | 1 | ×10 |
| 2～4 | 0 | ×1 |
| | 1 | ×4 |
| | 2 | ×7 |
| | 3 | ×10 |
| | 4 | ×13 |
| | 5 | ×16 |
| | 6 | ×19 |
| | 7 | ×22 |

Setting method

L35: P1: P2: P3

(P1: Axial No.1 to 4)

(P2: Servo ON/1, Servo OFF/0)

(P3: Gain 0 to 7

(Note) Always set the gain (L35:P3) to [0] prior to setting the motor type, otherwise the pulse inhibitor may keep turning ON. If gain setting according to load is required, first set the gain to [0], then re-set it.

## 4. Basic Operation (Using Teaching Box)

### 4-1. Precautions for Use

(1) Turn ON the DC power supply after connecting the Teaching Box to FINESERV connector CN2.

(2) For the above reasons, after connecting the cable to CN2 you should lock the connector by firmly tightening its screws.

(3) Be sure that the voltage at the FINESERV power input terminals (TB1) is 5V ± 3%, and that the polarity is correct.

(4) When storing the unit, please keep it in a cool, dry place where it will not be hit by direct sunlight.

(5) Since a lithium battery is used for memory battery backup, a program can be retained for up to 20,000 hours. For long-term storage, please store the conditions stipulated above.

(6) When changing the battery, the replacement should be completed within five minutes after turning OFF the 5V power. Note that the battery must be replaced only with the type that Yokogawa specifies. (Consult Yokogawa concerning the battery type for replacement.)

## 4-2. Teaching Box Key Names and Usage

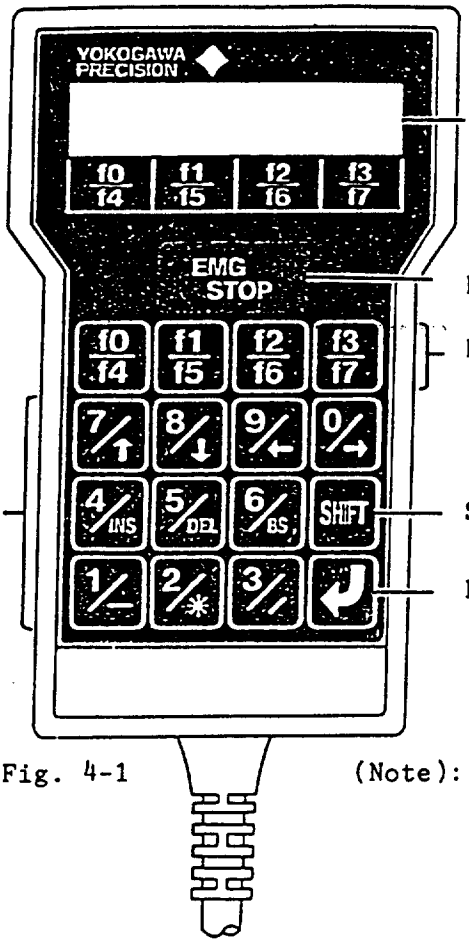
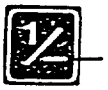



Fig. 4-1

(Note): When key indications are separated by "-" or "/", a function displayed on the top line (or left top) can be entered just by pressing its key as-is, while to enter a function displayed on the bottom line you should hold the shift key depressed while pressing the function key.

Cursor movement keys:
Arrows indicate directions.

Scroll keys:
Arrows indicate direction.

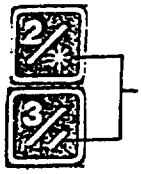


Minus (-) key

Insert key
(Character insert):
Pressing this key followed by character keys inserts those characters ahead of the cursor position.
(Example)
[X5000...]
[INS 12]
[X125000...]
To cancel insert mode press [INS] again, or press cursor key or return key.

Back-space key:
Moves cursor back one space and deletes one character.
(Example)
[X15000...]
[BS]
[X1000...]

Delete key (Character delete):
Pressing this key deletes the character above the cursor. cursor no moves.
(Example)
[X15000...]
[DEL]
[X1000...]



Not used at this time.

## 4-3. Basic Operating Procedures

As a basic manual, this manual explains basic operation using the Teaching Box. For information on how to use the unit with a personal computer, host computer or sequencer, refer to the applications manual.

The Teaching Box keys and how to use them were explained in the preceding subsection. As for the display, the top line shows entries, or replies from the FINESERV. The bottom line displays labels indicating the meanings of the function keys below them. Each display line can show up to 16 characters. Since the bottom line contains delimiting spaces, in practice the line displays 3 + 3 + 3 + 4 nonspace characters.

The display system provides, as described below, five basic kinds of displays: the Opening Screen, Menu 1 (direct entry screen 1), Menu 2 (direct entry screen 2), Menu 3 (program entry screen), and the Edit Screen.

(1) Opening Screen: This screen has no particular meaning except to serve as the opening screen.

(2) Menu 1: This screen and Menu 2 are provided with ease of operation in mind to enable direct entry of the most commonly used commands such as start/stop, return to origin, servo ON, servo OFF, and alarm reset.

(3) Menu 2

(4) Menu 3: Intended for program entry, so all operations can be done through this screen alone.

(5) Edit Screen: Used for editing operations such as additions, modifications or deletions to programs.

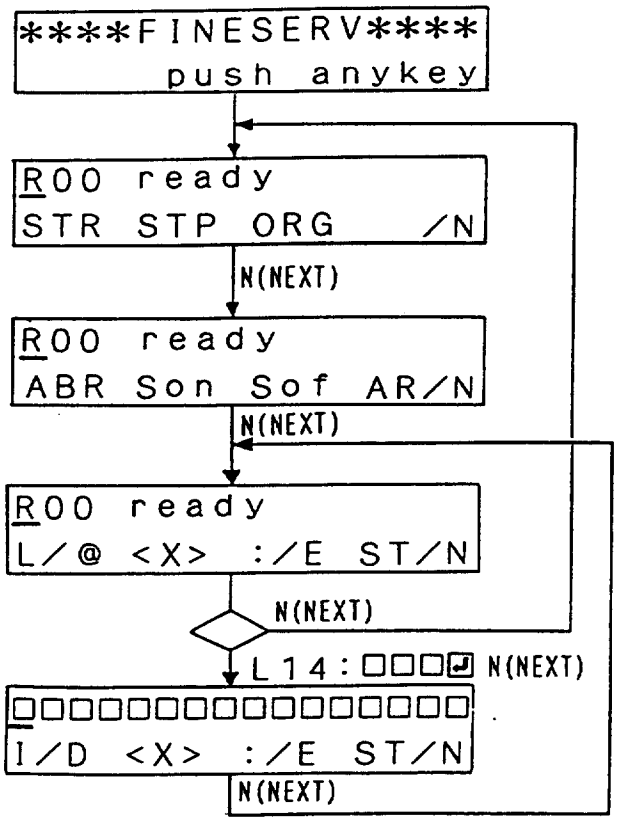
(1) Opening screen

(2) Menu 1

(3) Menu 2

(4) Menu 3

(5) Edit screen



So let's go through these in order starting from the menu screens.

| Key operations | Display |
|---|---|
| At power ON or reset return, the following opening screen appears. | ****FINESERV****<br>push anykey |
| Press any key except [EMG] or [SHIFT]. Menu 1 will come up. The first character will be flashing, indicating the current entry area.<br><br>The bottom line shows the function key assignments:<br>[f0] -STR (start)<br>[f1] -STP (stop)<br>[f2] -ORG (return to origin)<br>[f3] -spare space<br>[SHIFT] + [f3/7]<br>-N (Next: Go to next menu) | R00 ready<br>STR STP ORG /N |
| Press [SHIFT] + [f3/7]. Menu 2 will appear. The function key assignments on this menu are:<br>[f0] -ABR (abort emergency stop)<br>[f1] -Son (servo ON)<br>[f2] -Sof (servo OFF)<br>[f3] -AR (alarm reset)<br>[SHIFT] + [f3/7]<br>-N (Next: Go to next menu) | R00 ready<br>ABR Son Sof AR/N |
| Press [SHIFT] + [f3/7]. Menu 3 will appear. The function key assignments on this menu are:<br>[f0] -L (key in L command character)<br>[SHIFT] + [F0/4] -@ (key in "@" character)<br>[f1] -< (select command character.)<br>[SHIFT] + [F1/5] -> (select command character.) | R00 ready<br>L/@ <X> :/E ST/N |

| | |
|---|---|
| [f2] -: (key in delimiting colon)<br>[SHIFT] + [F2/6] -E (key in END)<br>[f3] -ST (ST: set)<br>[SHIFT] + [f3/7] -N (Next: Go to next menu.)<br>If you press [SHIFT] + [f3/7] at this point, you will return to menu 1.<br>As this has shown, with the Teaching Box you give commands to the FINESERV using the three menus above. | |

Next we will drive the motor with an actual program.

| Key operations | Display |
|---|---|
| Call up Menu 3. | R00 ready<br>L/@ <X> :/E ST/N |
| Press [f0]. | L_<br>L/@ </> :/E ST/N |
| Press [3] [9] [f2] [1] [f2] [0] [f2] [0]. | L39:1:0:0_<br>L/@ <X> :/E ST/N |
| Press [ ↵ ].<br>(The command [L39:1:0:0] is sent to the FINESERV, and the display shows that an answer was returned. This command disables axis 1 overtravel. As shown here, on the program entry screen, when you key in a command on the top line and press [ ↵ ], the command is sent to the FINESERV, and if an "OK" answer comes back the screen displays "R00 ready".) | R00 ready<br>L/@ <X> :/E ST/N |

| | |
|---|---|
| Press [f0] [2] [7] [f2] [0]. | L27:0_<br>L/@ <X> :/E ST/N |
| Press [ ↵ ].<br>The command [L27:0] was sent to the FINESERV, and the display shows that an answer was returned. This command disables origin return as a condition for program execution. | R00 ready<br>L/@ <X> :/E ST/N |

Next, if you wish to do a test run on one axis only in a unit set up for two or more axes, perform the following operations.

| | |
|---|---|
| Press [f0] [4] [7] [f2] [2] [f2] [0]. | L47:2:0_<br>L/@ <X> :/E ST/N |
| Press [ ↵ ].<br>The command [L47:2:0] was sent to the FINESERV, and the display shows that an answer returned. This command disables the second axis. Press the reset switch. If you send the next command without pressing the reset switch, error E30 "COM. INHIBIT" will occur.<br>When similarly disabling axes 3 and 4, change the fifth character "[2]" to "[3]" or "[4]" to disable the respective axes. You must press the reset switch each time.<br>Note: The above procedure is not required if the axes have been disabled using the onboard DIP switches. (See page 23 concerning DIP switches.) | R00 ready<br>L/@ <X> :/E ST/N |
| Next, press [f0] [3] [5] [f2] [1] [f2] [1]. | L35:1:1_<br>L/@ <X> :/E ST/N |

| | |
|---|---|
| Press [ ↵ ].<br>(The servo ON command [L35:1:1] is sent out and the display shows that an answer returned.) | R00 ready<br>L/@ <X> :/E ST/N |
| Next press [f0] [1] [0]. | L10_<br>L/@ <X> :/E ST/N |
| Press [ ↵ ].<br>(The command [L10] was sent, and an answer returned. This command selects the MDI/ manual data input mode.) | R00 ready<br>L/@ <X> :/E ST/N |
| Next press [f1].<br>Each time you press [f1], the letter between the < > brackets on the bottom line will change in sequence:<br>X → Y → Z → W → F → M → N → A → B → C → D → P → Q → R → G → X.<br>(Pressing 15 times in all will bring you back to X.) Next press [SHIFT] + [f1/5]. The letter between the < > brackets will change in the reverse order. Return the displayed letter to X. | _<br>L/@ <Y> :/E ST/N |
| Next press [f3].<br>("X" is keyed in and the cursor moves right one position.) | X_<br>L/@ <X> :/E ST/N |
| Key in [1] [0] [0] [0] [0] [0]. | X100000_<br>L/@ <X> :/E ST/N |
| Press [ ↵ ].<br>The cursor returns to the starting position, and simultaneously the motor turns clockwise an amount equal to 100,000 pulses. If the unit is connected to a B phase motor, 1/6 turn 1 rps, if to an A phase motor 1/10 turn 0.7 rps (if set up for B phase). | X100000<br>L/@ <X> :/E ST/N |

| | |
|---|---|
| When the motor stops turning the display will change as shown. | R00 ready<br>L/@ <X> :/E ST/N |

Now let's create a program file.

| Key operations | Display |
|---|---|
| Key in [f1] [1] [5] [f2] [1]. | L15:1_<br>L/@ <X> :/E ST/N |
| Press [ ↵ ].<br>The unit is now ready for you to enter file 1. | R00 ready<br>L/@ <X> :/E ST/N |
| Press [SHIFT] + [f1/5] once, changing the letter in < > from X to G.<br>Next press [f3] to select G. | G_<br>L/@ <G> :/E ST/N |
| Continue on pressing [9] [1] [f1] (< > goes to X) [f3] [1] [0] [0] [0] [0]. | G91X100000_<br>L/@ <X> :/E ST/N |
| Next press [f1] four times, changing < > to F. Press [f3] to select it. | G91X100000F_<br>L/@ <F> :/E ST/N |
| Continue pressing [5] [0] . | G91X100000F50_<br>L/@ <F> :/E ST/N |
| Press [ ↵ ].<br>This will enter the command G91X100000F50. This command means: G91 = incremental mode; X100000 = positive X-axis rotation 100,000 pulses; F50 = speed 50K pulse/sec. Since at this point we are in program entry, the motor does not move. | R00 ready<br>L/@ <F> :/E ST/N |

| | |
|---|---|
| Again, press [SHIFT] + [f1/5] four times to return < > to X. Then press [f3] to enter. | X_<br>L/@ <X> :/E ST/N |
| Key in [SHIFT] + [1/-] [1] [0] [0] [0] [0] [0], [f1] four times, [f3] [2] [0] [ ↵ ]. The program means: X-100000 = reverse (CCW) X-axis rotation 100,000 pulses; F20 = speed 20K pulse/sec. (Make sure that < > went to F.) | X-100000F20_<br>L/@ <F> :/E ST/N<br><br>R00 ready<br>L/@ <F> :/E ST/N |
| Next press [f1] once to change < > to M. Select with [f3]. | M_<br>L/@ <M> :/E ST/N |
| Press [3] [0]. | M30_<br>L/@ <M> :/E ST/N |
| Press [ ↵ ]. | R00 ready<br>L/@ <M> :/E ST/N |
| Press [SHIFT] + [f2/6] to select END. | END_<br>L/@ <M> :/E ST/N |
| Press [ ↵ ]. END is entered, ending file creation. | R00 ready<br>L/@ <M> :/E ST/N |

Now let's check the program we just entered.

| Key operations | Display |
|---|---|
| Press [f0] [1] [4] [f2] [1]. | L14:1_<br>L/@ <M> :/E ST/N |
| Press [ ↵ ]. | R00 ready<br>L/@ <M> :/E ST/N |

| | |
|---|---|
| Press [SHIFT] + [f3/7] to change to the Edit Screen. Pressing [SHIFT] + [8/↓ ] displays the program one block at a time. Verify that the three program blocks, G91X100000F50, X-100000F20, and M30, are entered correctly. | G91X100000F50<br>I/D <M> :/E ST/N<br>X-100000F20<br>I/D <M> :/E ST/N<br>M30<br>I/D <M> :/E ST/N |

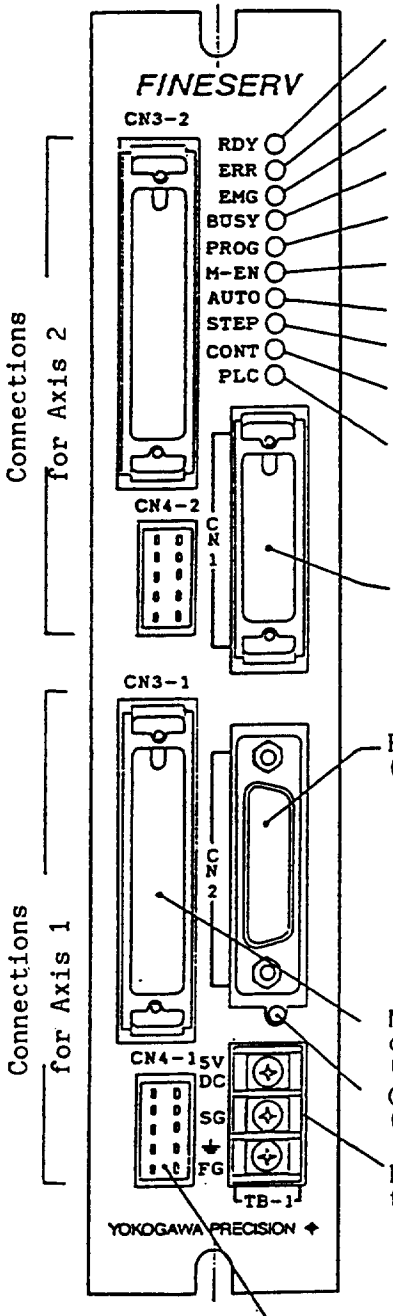
Now let's execute this program.

| | |
|---|---|
| Press [SHIFT] + [f3/7] to change to Menu 1. | R00 ready<br>STR STP ORG /N |
| Press [1] to select Program 1 which we just filed. | 1_<br>STR STP ORG /N |
| Now when we press [f0], the motor will begin to move exactly as we programmed. | 1<br>STR STP ORG /N |
| When the motor stops, the R00 answer appears, and if we press [f0] the same action will be repeated. At his point we do not have to specify the file number; the unit will execute the program of the previously entered file number. | R00 ready<br>STR STP ORG /N |

# II . APPLICATIONS

## 1. Names and Functions of Components

Fig. 1-1
(Panel for 1 or 2 Axes)




(Meaning when LED is on.)

Controller ready (if flashing: Backup battery replacement required)

Error occurred

Emergency stop switch is ON.

Command execution in progress.

Program running

M end, (ENABLE)

Program operation mode = Auto (Execute to program end)

Program operation mode = Step (Execute one step at a time)

Program operation mode = Continuous (Repeat continuously)

PLC (sequencer) mode selected

Sequencer interface connector

RS-232C interface connector (Teaching box or personal computer)

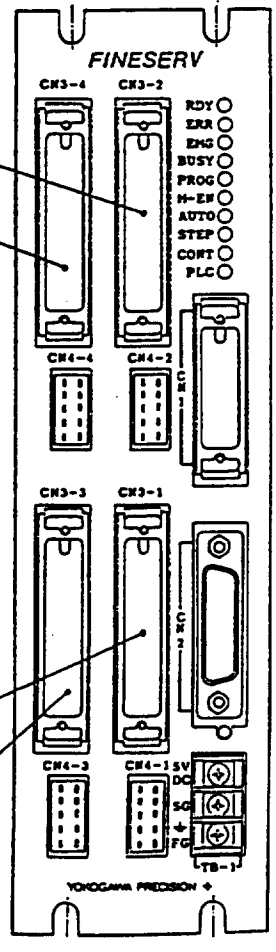
Motor drive interface connector (to DYNASERV CN1)

CPU reset switch (When reset, all LED's light)

Power (5 V DC) input terminals

External sensor input connector (Origin sensor, overtravel)

Fig. 1-2
(Panel for 3 to 4 Axes)




Connections for Axis 2

Connections for Axis 4

Connections for Axis 1

Connections for Axis 3

## 2. Operation Flow

The preceding description of operating procedure reduces essentially to a flow chart like that below. You should follow this in the subsequent examples for Teaching Box, personal computer and sequencer connections.

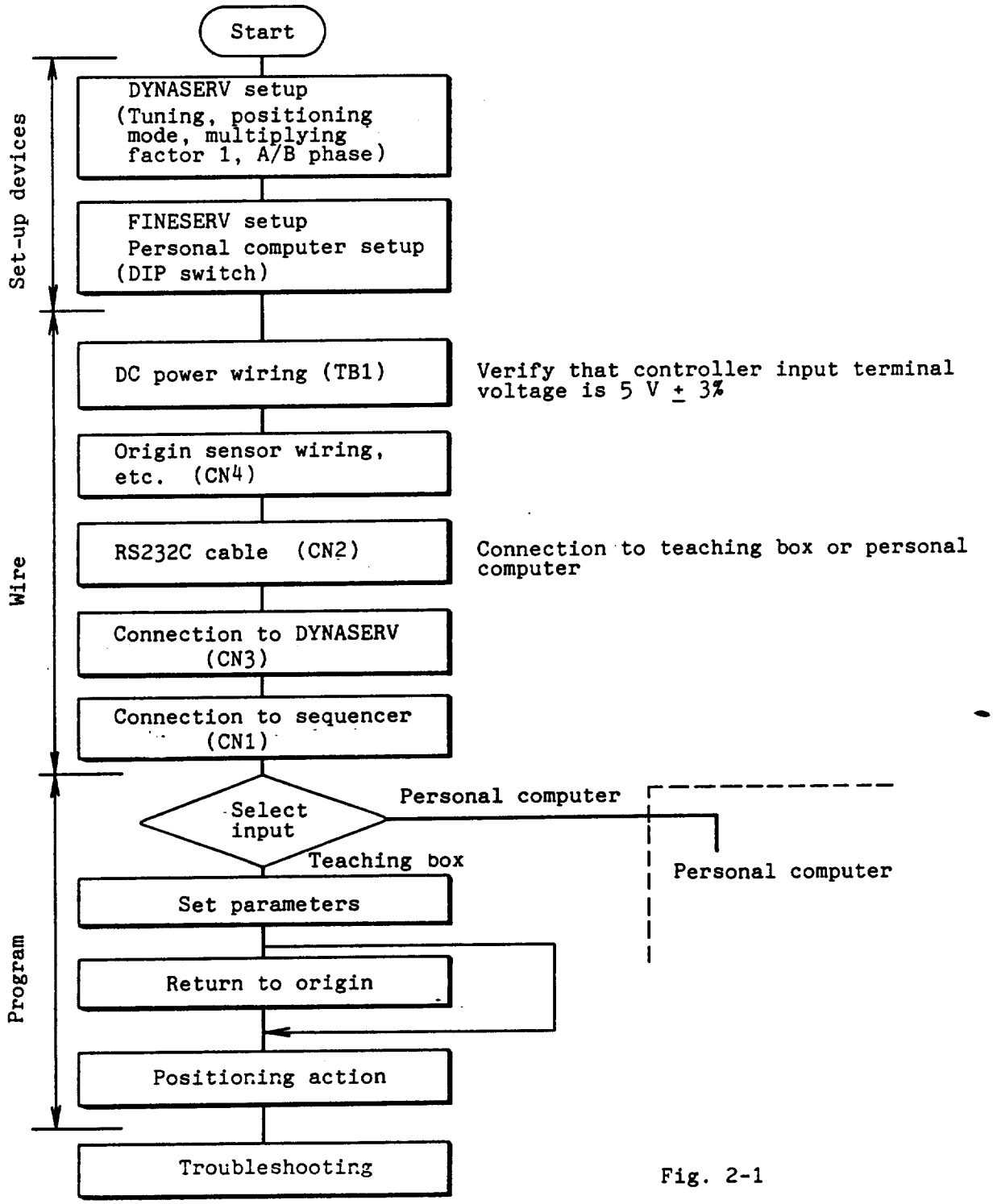



Fig. 2-1

# 3. Installation and Preparation

## 3-1. FINESERV Setup

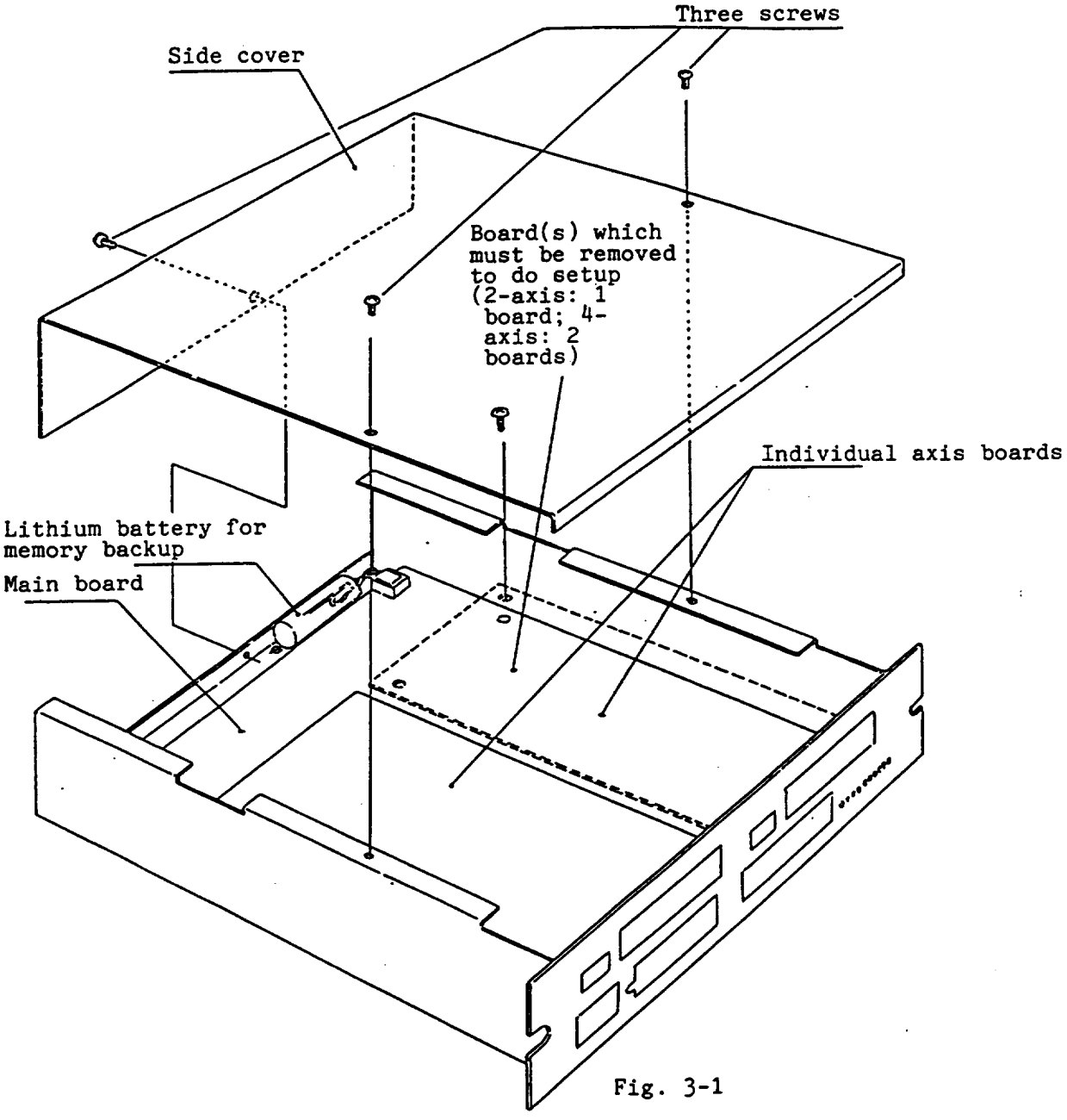



Fig. 3-1

In order to make the DIP switch and jumper settings which we will describe next, you must first remove the controller side cover.

- The side cover can be removed by removing three screws as shown above.
- In a 1-axis unit you can make the adjustments that follow

with no further disassembly, but in units with 2 to 4 axes you will need to remove the boards for each axis to do some of the adjustments. In those cases, remove the four mounting screws and posts (in the 4-axis case), and remove the boards before doing the operations.

◆ When replacing the battery, be sure to place the battery is in its proper position before attaching the cover.

(1) Locations of settings on main board:

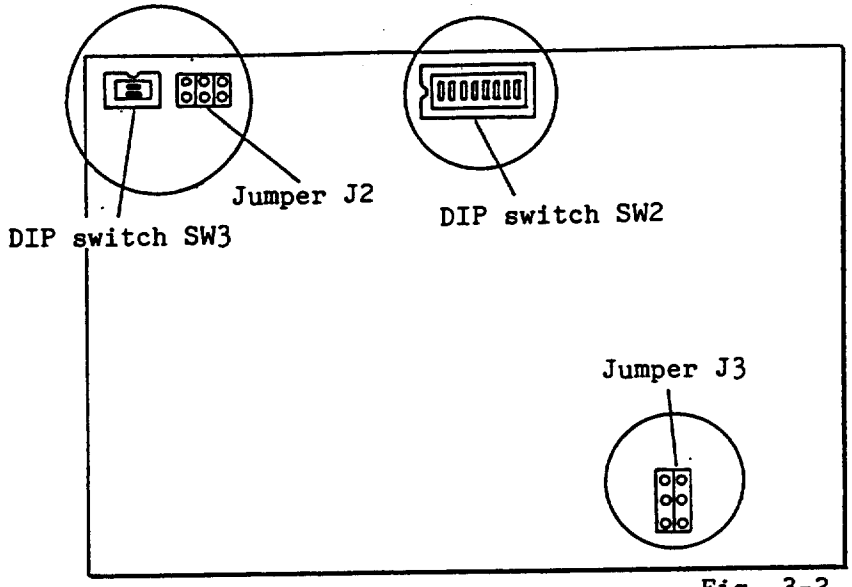



Fig. 3-2

(2) DIP switch settings:

· SW2 settings (axis selection and RS-232C settings)

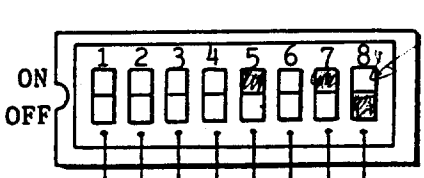



Fig. 3-3

| | 1200 | 2400 | 4800 | 9600 (Transmission speed) |
|---|---|---|---|---|
| Baud rate 8 | ON | ON | OFF | OFF |
| 7 | ON | OFF | ON | OFF |

Parity type 6 ON/Odd OFF/Even

Parity? 5 ON/No OFF/Yes

Axis select (OFF to select)

4 W axis (Axis 4)
3 Z axis (Axis 3)
2 Y axis (Axis 2)
1 X axis (Axis 1)

Note: When shipped from factory, only axes installed are selected, and unit is set for no parity, baud rate 2400.

(3) Dip switch SW3 setting

Set the CR (carriage return) and LF (line feed) return on the personal computer side.

Set 2 to ON: Both the CR and LF return.

Set 2 to OFF: Only the CR returns.

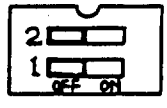



Fig 3-4

(Note) Set this switch when required so as to meet the function of the personal computer to be connected. SW3 [1] is not used and should always be set to the OFF side. Both 1 and 2 are set to OFF prior shipment.

(3) Jumper setup:

J2 setup (Teaching Box connection):

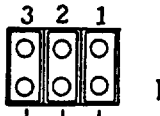



Fig 3-5

EMG — Teaching box EMG switch enable or disable selection

+5V, GND — Power supply to teaching box

Note: All three positions jumpered when shipped from factory.

J3 setup ( EMG STOP, SERVO ON signal logic polarity selection at sequencer interface connector)

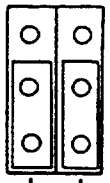



Fig 3-6

(NOTE:when shipped from factory, both are set to positive)

EMG STOP (Positive) current on, to EMG <switch on at Fig 7-1/P-69>

(Negative) current off, to EMG <switch off at Fig 7-1/P-69>

SERVO ON (Positive) current on, to SERVO OFF

(Negative) current off, to SERVO OFF

3-2. DYNASERV Setup

When connecting the FINESERV to the motor driver, you must set the jumpers on boards in the the driver unit as follows. For details, refer to the DYNASERV instruction manual.

(1)Set feedback pulse (signal indicating motor position) out put type to A/B phase.
  [DM series: <J2> A and B shorted, U and D open]
  [DR series: <J2> UD and AB shorted]

(2)Set the operating mode to position control mode.
  [DM series: <J2> M shorted]
  [DR series: <J2> MOD shorted]

(3)Set the multiplying factor mode to time one.
  [DM series: <J2> R1 and R0 shorted]
  [DR series: <J2> RATE#1 and RATE#2 shorted]

## 3-3. Origin Sensor Mounting and Connections

The origin sensor should as a rule be mounted on the load. If there is no alternative to mounting the detection target on the motor, remove the two M4 bolts at the periphery of the bottom of the rotating part of the motor, and mount it there.
However, when doing this never remove both bolts at the same time, always work with one bolt at a time.
When reinstalling the bolts, tighten them to a torque of 40 kg-f-cm.

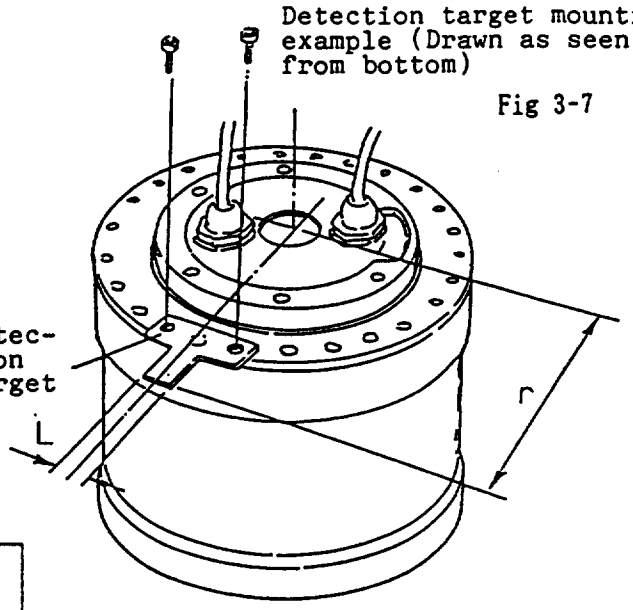


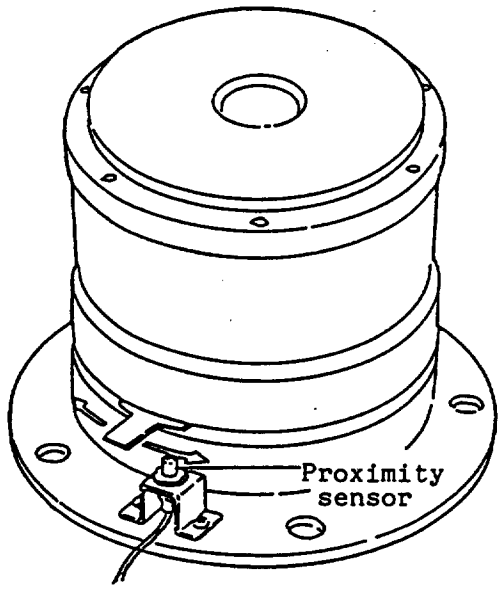

Fig 3-7

$L \geqq 0.06\pi rN$

N: Rotation rate (rps), 0.3 rps maximum.
r: Distance from axis of rotation (mm)
L: Detection target width (mm)

Although the detection target width is determined by the above formula, when mounting the sensor on the rotating part you should design so that the sensor detection duration will be at least 30 msec at the rotation rate (0.3 rps max). For the proximity sensor, use one of the products listed below. With respect to detailed precautions for use, conform to the sensor product specifications.

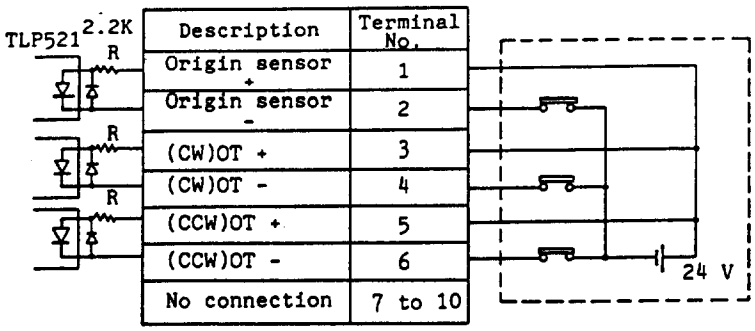
Omron (Tateishi Electric) Models
- Model TL-X
- Model E2C-GE4A
- Model E2E




Detection Target and Proximity Sensor Mounting Example

Fig 3-8

The above origin sensors can also be used in common for overtravel.
Both origin sensor and overtravel should be normally ON, OFF upon detection.




| Description | Terminal No. |
|---|---|
| Origin sensor + | 1 |
| Origin sensor - | 2 |
| (CW)OT + | 3 |
| (CW)OT - | 4 |
| (CCW)OT + | 5 |
| (CCW)OT - | 6 |
| No connection | 7 to 10 |

OT: Overtravel

CN4-1

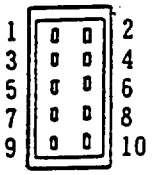



Fig 3-9

Number of input points:
3 points (separate grounding)
Input voltage: 24V DC
Voltage specification:
Photocoupler isolated
Rated input current:
10 mA per circuit

Note: If sensors for origin and overtravel will not be installed, connect terminals 1, 3, and 5 to 24V, and terminals 2,4, and 6 to GND. However, this is not required if the functions are disabled by program.

3-4. DYNASERV Connections

(1) FINESERV and driver input/output signals:(DM series)

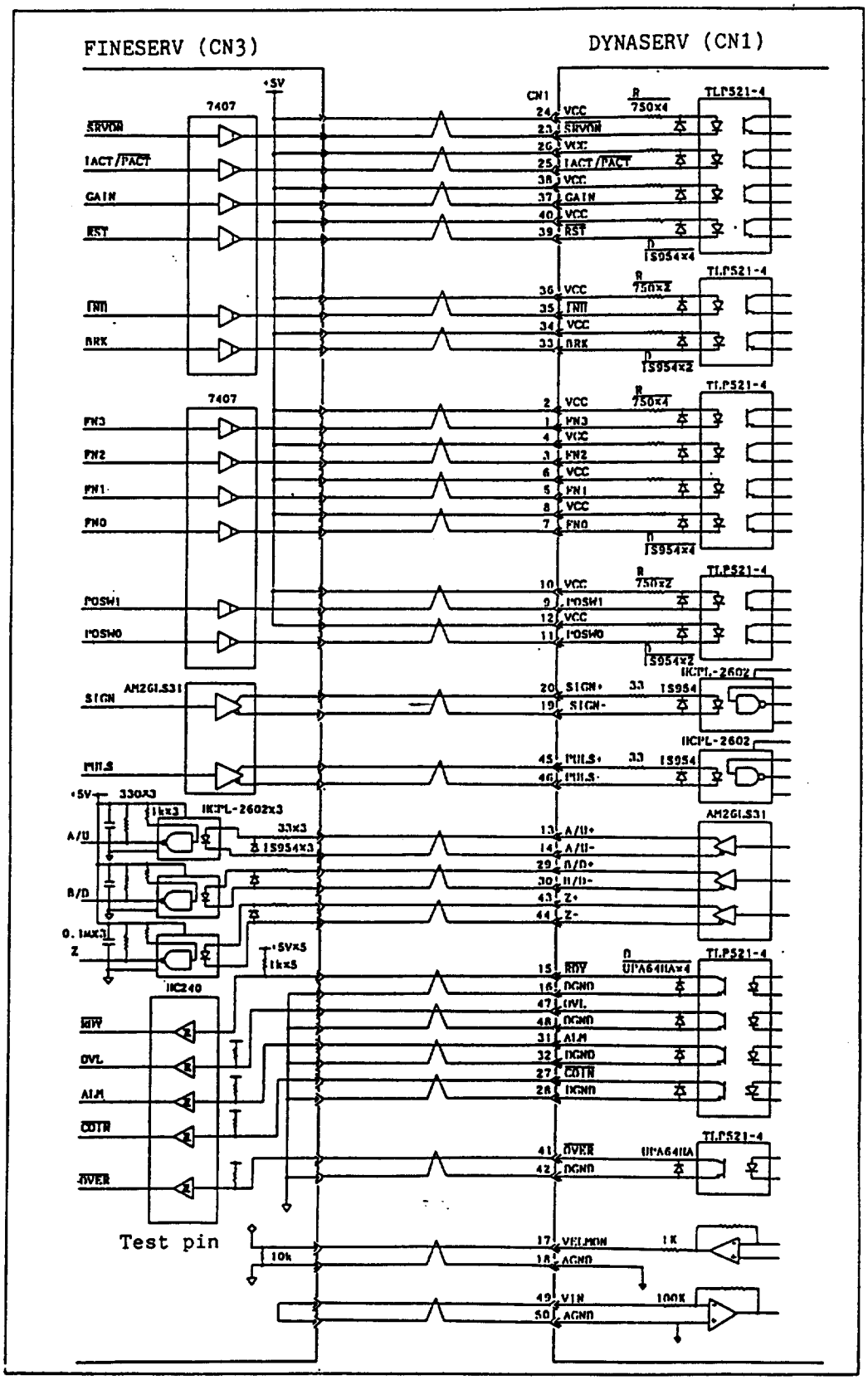



Fig 3-10

(2)FINESERV and driver input/output signals: (DR series)

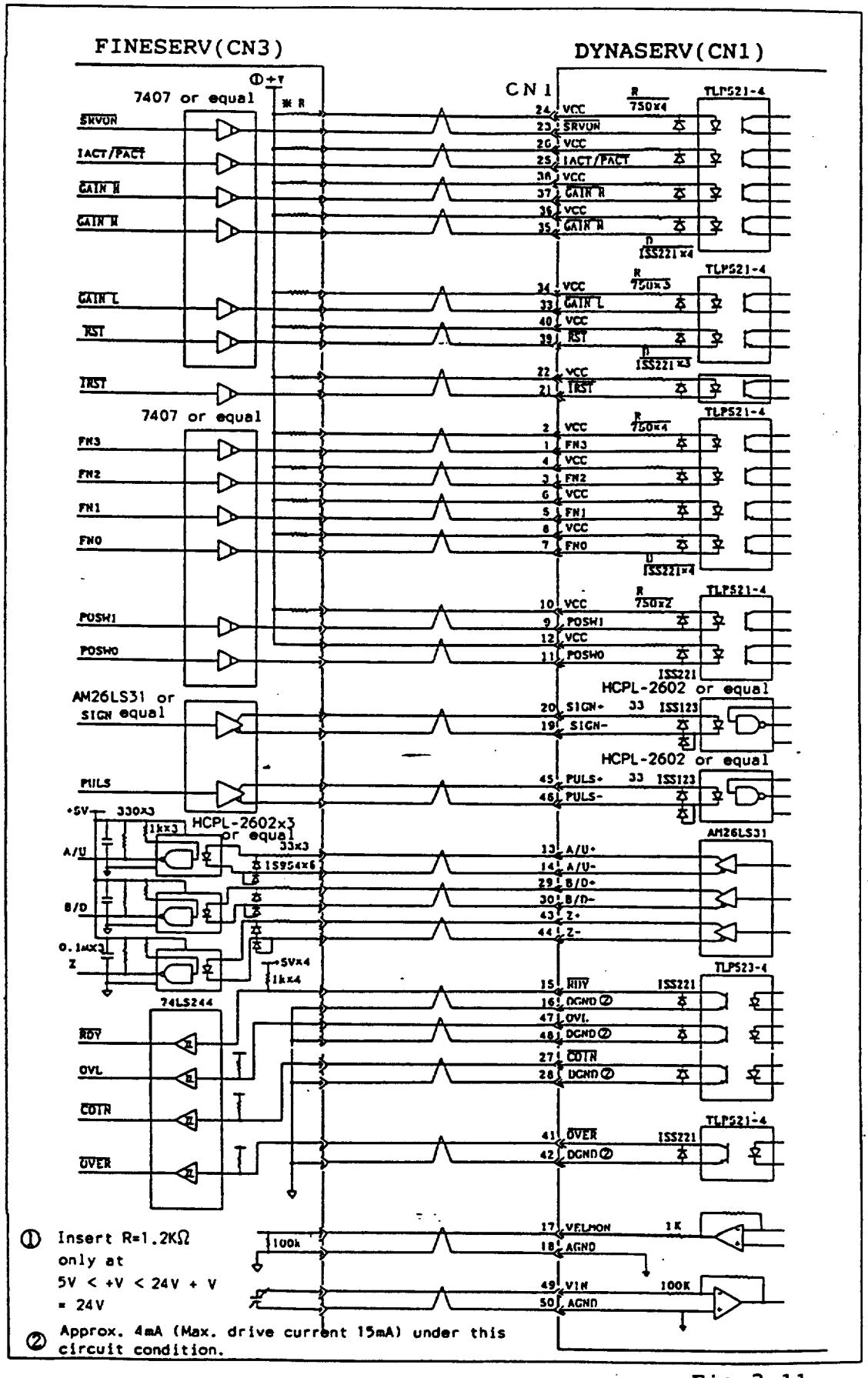



Fig 3-11

(3) Input/output signal table:

| Pin # | Signal name | input output | Description | |
|---|---|---|---|---|
| | | | DM series | DR series |
| 1 | FN 3 | I | Compliance setting 3 input signal | same left |
| 2 | Vcc | I | Power supply input for signal | // |
| 3 | FN 2 | I | Compliance setting 2 input signal | // |
| 4 | Vcc | I | Power supply input for signal | // |
| 5 | FN 1 | I | Compliance setting 1 input signal | // |
| 6 | Vcc | I | Power supply input for signal | // |
| 7 | FN 0 | I | Compliance setting 0 input signal | // |
| 8 | Vcc | I | Power supply input for signal | // |
| 9 | POSW 1 | I | Positioning end pulse width setting 1 input signal | // |
| 10 | Vcc | I | Power supply input for signal | // |
| 11 | POSW 0 | I | Positioning end pulse width setting 0 input signal | // |
| 12 | Vcc | I | Power supply input for signal | // |
| 13 | A+/U+ | O | A phase/UP pulse output signal (+) | // |
| 14 | A-/U- | O | A phase/UP pulse output signal (-) | // |
| 15 | $\overline{RDY}$ | O | Servo ready output signal | // |
| 16 | DGND | O | Digital ground | // |
| 17 | VELMON | O | Speed monitor output signal | // |
| 18 | AGND | O | Analog ground | // |
| 19 | SIGN- | I | Motor rotation direction command input signal | // |
| 20 | SIGN+ | I | Power supply input for signal | // |
| 21 | $\overline{IRST}$ | I | ——— | Integral capacitor reset |
| 22 | Vcc | I | ——— | Power supply input for signal |
| 23 | $\overline{SRVON}$ | I | Servo on input signal | same left |
| 24 | Vcc | I | Power supply input for signal | // |
| 25 | IACT/$\overline{PACT}$ | I | Integral/proportional action selection input signal | // |
| 26 | Vcc | I | Power supply input for signal | // |
| 27 | $\overline{COIN}$ | O | Positioning end output signal | // |
| 28 | DGND | O | Digital ground | // |
| 29 | B+/D+ | O | B phase/DOWN pulse output signal (+) | // |
| 30 | B-/D- | O | B phase/DOWN pulse output signal (-) | // |
| 31 | ALM | O | Alarm output signal | ——— |
| 32 | DGND | O | Digital ground | ——— |
| 33 | $\overline{BRK}$ | I | Brake input signal | |
| | $\overline{GAIN\ L}$ | I | | Gain selection |
| 34 | Vcc | I | Power supply input for signal | same left |
| 35 | $\overline{INH}$ | I | Positioning command pulse inhibit input signal | |
| | $\overline{GAIN\ M}$ | I | | Gain selection |
| 36 | Vcc | I | Power supply input for signal | same left |
| 37 | GAIN | I | Gain selection input signal | |
| | $\overline{GAIN\ H}$ | I | | Gain selection |
| 38 | Vcc | I | Power supply input for signal | same left |
| 39 | $\overline{RST}$ | I | CPU reset input signal | // |
| 40 | Vcc | I | Power supply input for signal | // |
| 41 | $\overline{OVER}$ | O | Deviation counter overflow output signal | // |
| 42 | DGND | O | Digital ground | // |
| 43 | Z+ | O | Origin pulse output signal (+) | // |
| 44 | Z- | O | Origin pulse output signal (-) | // |
| 45 | PULS+ | I | Positioning command pulse input signal (+) | // |
| 46 | PULS- | I | Positioning command pulse input signal (-) | // |
| 47 | OVL | O | Overload output signal | // |
| 48 | DGND | O | Digital ground | // |
| 49 | VIN | I | Speed command input signal | // |
| 50 | AGND | I | Analog ground | // |

If you are fabricating your own cable as described in the previous section for the the FINESERV to DYNASERV connection, refer to the above signal and pin numbers.

# 4. Function Outline

## 4-1. Function List

The FINESERV functions can be broadly classified as shown below.

| Function | | | Command | Description | Reference pages |
|---|---|---|---|---|---|
| Controller functions | Mode control function (L code) | Start operation | [L1 to 3] | [Start, stop] | P-40 |
| | | Alarm reset function | [L4] | [Alarm reset] | P-40 |
| | | Running mode selection | L5 to 7, 10, [13] | Auto, MDI, return to origin | P-40 |
| | | Remote mode select | @ L19 | RS232C, sequencer mode selection | P-41 |
| | | File management | L14 to L18 | File setting, delete, read, select | P-40, 41 |
| | | Statement function | L25 to L49 [L35] | Parameter set [L35] Servo ON/OFF | P42 to 47 |
| | Program function (NC language) | N code | N*** | Sequence No. | P-48 |
| | | G code | G*** | Preparatory functions (special operations) | P-93, 94 |
| | | XYZW | X** (7 digits) | Dimension words (DATA) Position, index number, acceleration time, timer setting | P-48 |
| | | M code | M*** | Miscellaneous functions | P-95 |
| | | F, A, B, C, D | | Speed settings (KPPS) | P-49 |
| | | P, Q, R | | Branching functions | P-49,50 |
| | PLC functions: Auto mode external control | | | | P-69 to 75 |

Note: Functions in [] can be directly controlled from the Teaching Box or sequencer.

To take full advantage of the above functions, you should use the Teaching Box or a personal computer to send commands to the unit. The FINESERV will execute the commands and return answer commands.

In the Teaching Box, dedicated keys are provided for the most frequently used of the above commands (those in []).

The sequence functions make it possible to control the unit by using a sequencer or switches to call up, run and stop program files created via the Teaching Box or personal computer, and connect to the user's system by means of the M-code functions (miscellaneous functions).

## 4-2. Mode Control Functions

The L-codes are the command codes provided by the FINESERV. With these command codes, you can select the various operational modes, manage files, set internal parameters, read parameter values, and start operations via RS232C from Teaching Box or personal computer.

Note that although the L commands resemble NC language, this controller cannot be used in an NC program.

(Format)

[Ln:P1:P2:P3:P[ ↵ ]]

n: L-code number 0 to 49

P1 to P4: Parameters

### (1) Start/Stop Operation

The Start/Stop Operations are as follows.

| Operation | Command | Remarks |
|---|---|---|
| Forced Stop | [L1:99] | Soft EMG #1 |
| Stop | [L2] | Block Stop #2 |
| Emergency Stop | Hard Interrupt (DI/DO) | Hard EMG #3 |
| Start | [L3] | Automatic or return-to-origin start<br>Note: Axis parameter required only for return-to-origin. Axes 1 through 4 correspond to bits 0 through 3.<br>Thus for Axis 1 only: [L3:1]<br>Axis 1 & 2: [L3:3] (bits 0 & 1 ON)<br>All 4 axes: [L3:15] (all bits ON) |

* This command erases everything in the memory

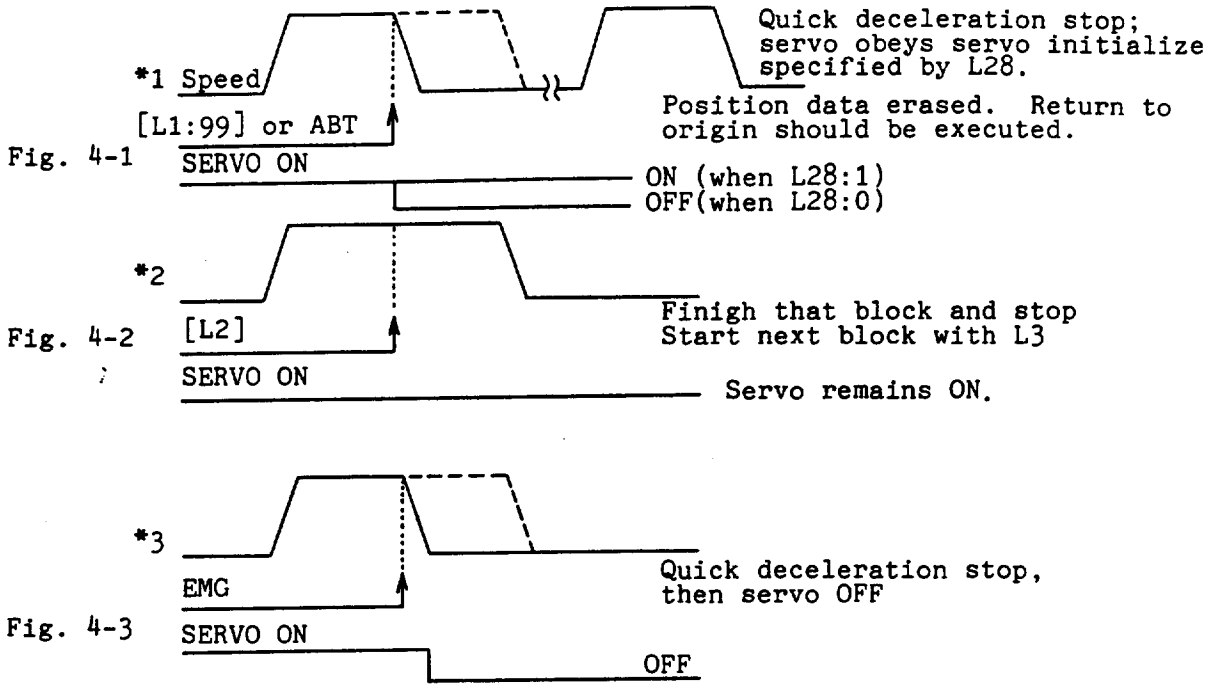



Fig. 4-1




Fig. 4-2




Fig. 4-3

(2) Operating mode:

The unit has the following operating modes:

- Program operating modes — AUTO mode : L5
  STEP mode : L6
  CONTINUOUS mode: L7
- MDI (manual data input) mode : L10
- ORIGIN mode : L13

(2-1) AUTO mode <select mode with L5, execute with L3>:

Execute file specified by L18:*** or PLC DI/DO DATA 0-7 up to program end (M30). Default is AUTO mode.

(2-2) STEP mode <select mode with L6, execute with L3>:

Execute block at execution address in specified file, and advance address by one. Note that when program end (M30) is executed the address returns to the starting address. Useful for program verification.

(2-3) CONTINUOUS mode <select mode with L7, execute with L3>:

Execute specified file, and on reaching program end (M30) return to start and continue on to repeat execution.

Since this is an endless mode, it is not possible to make file changes or change to MDI mode from an L2 stop or PLC stop input (DI0). To exit from the file, stop with L2, and then switch to AUTO mode (L5) and restart (L3) to execute up to M30.
Stopped at EMG (emergency) stop [L1: 99 abort] and RESET in the PLC mode to enable exit from the file. However, in this case, the coordinate system will be lost.

(2-4) MDI mode <select mode with L10>:

In this mode, each NC program block entered will be executed immediately. Example: [L10[ ↵ ]] ... in MDI mode [X655360F655[ ↵ ]] ... motor rotates one full turn in CW direction at 1 rps.

This is useful for system operation checks. (for DMB series motor)

(2-5) ORIGIN (return to origin) mode <select mode with L13, execute with L3>:

This function determines the origin point which serves as the positioning reference; the origin point is determined by the origin sensor and the origin pulse output signal (Z phase output) from the motor. When starting with L3, error #35 will occur if the axes are not specified in the parameters following L3. Note that the origin sensor should be positioned using the calibration mode (see L-code overview, page 40), so

that the number of positioning pulses between the origin sensor and the origin pulse falls over the prescribed range.

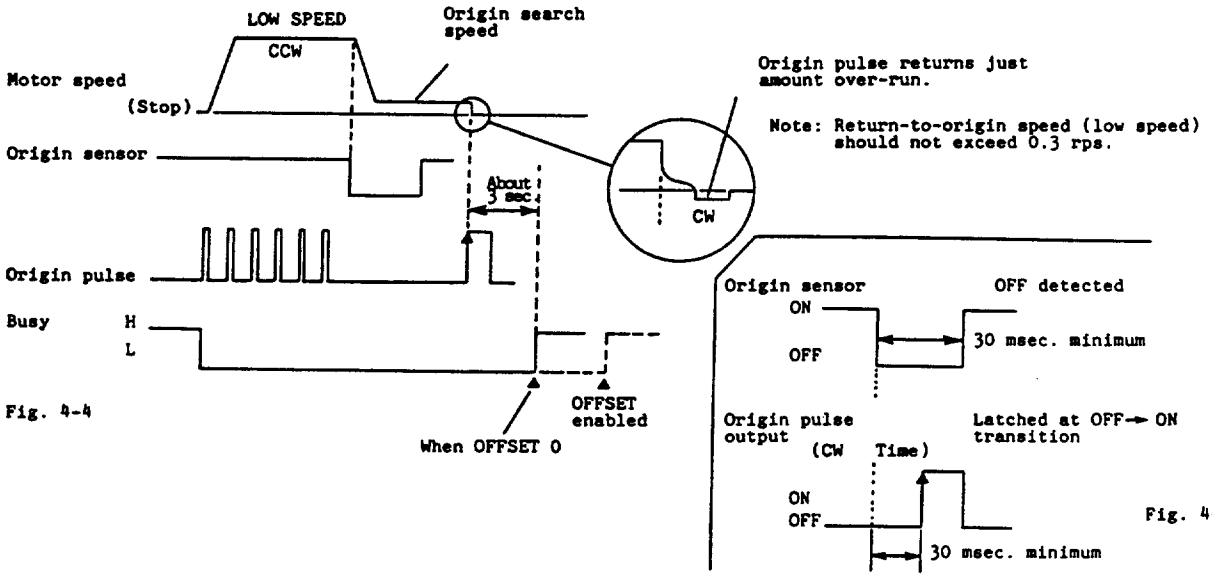



Fig. 4-4

Fig. 4-5

Note:① If within origin sensor (OFF), move first CW, and after moving out slightly in the vicinity of the origin sensor move back CCW and perform operations shown in the preceding timing chart.

② Origin search speed is either 1/100 of the low speed, or 1KPPS, whichever is faster.

③ Low speed is specified using L-code (L41).

④ Offset is value (number of pulses) specified with L-code (L43).

Default is 0. Offset movement is done at the above-mentioned low speed.

⑤ Return to origin precision is ± 2 sec.

⑥ Driver control mode should always be made IACT at time of return to origin. You must also perform motor tuning properly.

(3) File Control

Up to 128 files can be registered.

(3-1) FILE IN

[L15: □□□ ]

Specifies File No. □□□ and puts NC program into input mode. File No. is 1 to 128 (decimal). After entering program, input is ended with entry of [END [ ↵ ]], and unit exits from input mode.

Note:① Number of files is 128 maximum. There is no particular limit on the number of blocks within a file, but the NC program memory capacity is 32K bytes (about 32,000 characters).

② Note that since BCD code input is used when you call up a file in PLC mode the range is 1 to 99. However, since the actual file call-up is via a binary code (hexadecimal) file numbers up to 128 (80 hexadecimal). The default PLC file input mode is BCD code.

(3-2) FILE OUT

[L14: □□□ ]

Requests the contents of the NC program specified by File No. □□□ . When it receives this command the controller transmits the program from the specified file.

(3-3) FILE DELETE

[L16: □□□ ]

Specifies File No. □□□ , deleting the program.

(3-4) FILE DIR

[L17: □□□ ]

Only the used memory status when there is no parameter, the all-file memory status at parameter [0] and the specified file status is transferred when the file No. is input.

(3-5) FILE SELECT

[L18: □□□ ]

Selects file number. A file number must always be selected to operate the unit in AUTO mode. In PLC mode this is specified as DI/DO DATA 0 to 7.

The selected file number will not be reset until execution of one of the file management commands (L14-18) or ALL CLEAR (L49:99). Note that ALL CLEAR erases all programs, so exercise care.

(4) Statement Functions

These functions are used to set the DYNASERV parameters and drive patterns.

L-Code Numbers

- L25-34/ (including reserved) -- Parameter 1 only.
- L35-48/ -- Parameter 1 is axis number designation, and can be set for each axis. If axis number is set to 0, then all usable axes are controlled. Note that this is different from the origin start time axis designation

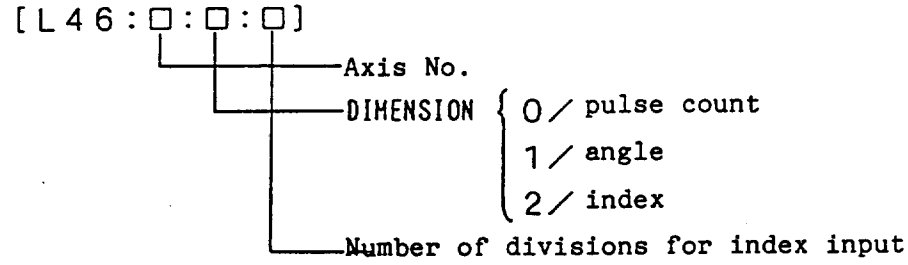
method, so exercise care.

■ [L49:99]/ALL CLEAR -- When this command is sent, all parameters return to their default values (initial values). Exercise care in its use, as it also clears all files.

Below we describe the DIMENSION (position input units) command, one of the features.

Although the motor is controlled by a pulse train input, with the FINESERV you can also use index or angle inputs as well as pulse inputs.

The DIMENSION designation is done with an L-code.




(4-1) Pulse Count Input

[L46:1:0]

Position data is given as number of pulses.

Example: [X655360[ ↵ ]] -- turn CW 655360 pulses.

Position data maximum value is 9,999,999.

Note: Although the internal counter goes to $2^{31}$, when turning in a given direction, even in incremental mode, counter overflow may occur in the A series at about 2000 revolutions. If the unit will be turning repeatedly in the same direction, you should use angle designation input or index mode.

(4-2) Angle Designation Input

[L46:1:1]

In this case the position data is specified as an angle, with the origin as 0 degrees, and a full turn divided into 360 degrees in units of 1/1000 degree. Data is entered as a signed angle, with the sign representing direction of rotation. The sign is explicitly specified only when minus (-), for counter-clockwise rotation. The angle input range is 0 to 360,000. Several examples are given below.

Examples:

[G90X270000] ... move in CW direction to 270 degree position (G90 is for absolute designation)

[ X100000] ... move CW to 100 degrees.

[X-0] ... move CCW to 0 degrees.

[G91X-90000] ... move CCW to 270 degrees. (G91 is for incremental designation)

[X180000] ..... move CW to 90 degrees.

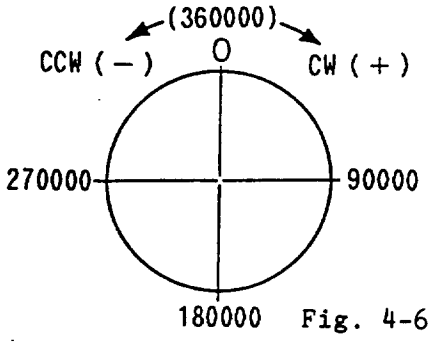


Fig. 4-6

(4-3) Index Mode (Division Mode)

Position data is input as number of divisions. Letting the total number of divisions be n, and the origin 0,

then a full rotation is divided into 1/n divisions up to n-1.

The data is input as sign of rotational direction (only minus sign explicitly given for CCW direction) plus index value (input range 0 to n).

Examples: for n=12 (12 divisions)

[L46:1:2:12[ ■ ]]

[G90X9] ... move CW to position 9/12.

[X4] ... move CW to position 4/12.

[X-0] ... move CCW to position 0.

[G91X-3] .. move CCW to position 9/12.

[X-6] ... move CW to position 3/12.

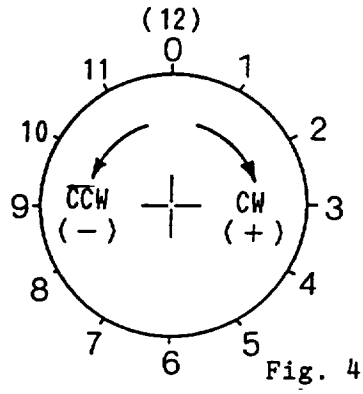



Fig. 4-7

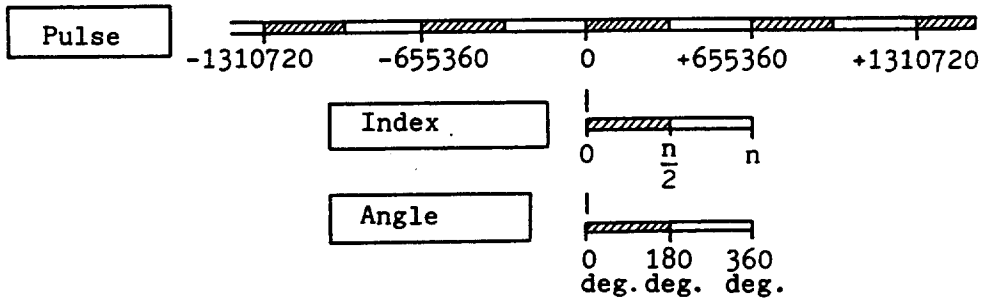
Note: ① Interpretation of the data differs from that for pulse input. For an ABS (absolute) command, a pulse input data sign is an absolute value; but for an index input or angle input it indicates the direction of rotation. For an incremental command, the sign is directional.

② Entering a data value greater than n, or greater than 360000 for angle input, will generate an error.

③ When the data resolution does not be divided exactly with the specified index or angle, the unit selects the position of minimum error. Such errors do not accumulate.

④ The counter will not overflow.

⑤ If the settings are not correct for the motor used, the angle will be incorrect.



(5) L-Code List Asterisks denote default values (Set at time of shipment, or when ALL CLEAR executed by L49:99).

| Code No. | Parameters | | | | Remarks |
|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th | |
| 0 | Output type<br>0 to 39 | | | | Status request (see page 87) |
| 1 | 99 | | | | ABORT -- if motor turning, forced stop and set to initial condition.<br>FORMAT: [L1:99] |
| 2 | | | | | STOP -- halt program. On completion of program block being executed at time STOP was entered, program goes to halt state.<br>FORMAT: [L2] (no parameters required) |
| 3 | Axis selection selection (ORG. only)<br>The axis 1 through 4 are represented by binary bits, but entered as a decimal no.<br>Axis 1: 1 Axis 1 only: 1<br>Axis 2: 2 Axis 1 & 2 : 3<br>Axis 3: 4 Axis 1~3 : 7<br>Axis 4: 8 Axis 1~4 :15 | | | | START (PROGRAM, ORIGIN) -- performs program start or return to origin.<br>FORMAT: [L3] P1=Axis No., input only for ORIGIN start. In programmed operation mode, start will cause error 34 if no program has been selected; in this case, select program with L18 and then do start.<br>At ORIGIN mode start, an invalid axis designation or no axis specification will generate error 35. |
| 4 | | | | | RESET ALARM -- reset and clear from error stop state. After RESET ALARM, unit returns to initial state. Note that a program input into stop state by EMG will go back into error stop state if EMG is not turned off.<br>When input in other than error stop state, this code generates error 32.<br>FORMAT: [L4] (no parameters) |
| 5 | | | | | AUTO mode -- selects programmed operation AUTO mode. Preserved through power-ON and reset.<br>ALL CLEAR [L49:99] selects AUTO mode.<br>FORMAT: [L5] (no parameters) |
| 6 | | | | | STEP mode -- selects programmed operation STEP mode. Preserved through power-ON and reset.<br>ALL CLEAR [L49:99] selects AUTO mode.<br>FORMAT: [L6] (no parameters) |
| 7 | | | | | Selects programmed operation CONTINUOUS mode. Preserved through power-ON and reset.<br>ALL CLEAR [L49:99] selects AUTO mode.<br>FORMAT: [L7] (no parameters) |
| 8 | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 9 | | | | | Calibration mode. Rotate CCW at 670 PPS and count and store to memory the number of pulses between origin sensor and first origin pulse. Detail show P-47<br>FORMAT:[L9][L3: □] □ axis designation required. |
| 10 | | | | | Selects MDI mode. FORMAT: [L10] (no parameters) |
| 11<br>12 | | | | | |
| 13 | | | | | ORIGIN -- sets return to origin mode.<br>When starting with L3, error 28 generated if axis designation parameters do not follow L3.<br>FORMAT: parameter |
| 14 | FILE# | | | | FILE OUT -- transmits contents of NC program with the specified file number. Generates error 34 if file not registered.<br>FORMAT: [L14:P1] P1= File No. (1 to 128) |
| 15 | FILE# | | | | FILE IN -- waits for input of program into specified file.<br>FORMAT: [L15:P1] P1= File No. (1 to 128) |
| 16 | FILE# | | | | FILE DELETE -- deletes specified file.<br>Generates error 34 if file not registered.<br>FORMAT: [L15:P1] P1= File No. (1 to 128) |
| 17 | FILE# | | | | FILE DIR -- transmits information about specified file. Generates error 34 if file not registered.<br>FORMAT: [L17:P1] P1= File No. (1 to 128)<br>Information for all files only registered, if the 1st parameter is 0 or no input made. |
| 18 | FILE# | | | | Program select -- selects file number of program to be executed in AUTO mode.<br>Generates error 34 if file not registered.<br>FORMAT: [L18:P1] P1= File No. (1 to 128) |
| 19 | | | | | PLC mode -- transfers right of control from RS232C to PLC. (Default is RS232C.)<br>FORMAT: [L19] (no parameters)<br>"0" returns control to RS232C. In PLC mode commands other than "0" are not accepted. |
| 20<br>21<br>22<br>23<br>24 | Reserve<br>Reserve | | | | |

| Code No. | Parameter 1 | Parameter 2 | Parameter 3 | Parameter 4 | Remarks |
|---|---|---|---|---|---|
| 25 | 0: disable*<br>1: enable | | | | Disables or enables optional stop (M01).<br>FORMAT:[L25:P1]<br>P1=0: disable (ignores M01 during program execution - the default condition)<br>P1=1: enable (stop program on M01) |
| 26 | 0: disable<br>1: enable* | | | | COIN: disable or enable motor's coin signal (motor settling signal)<br>FORMAT: [L26:P1]<br>P1=0: off (after completing output of motor drive pulses, ignores coin signal and proceeds to next block).<br>P1=1: on (after completing output of motor drive pulses, waits until coin signal detection before permitting execution of next step. |
| 27 | 0: No<br>1: Yes* | | | | Specifies whether return to origin will be as condition for program execution in the automatic modes (AUTO, STEP, CONTINUOUS).<br>FORMAT: [L27:P1]<br>P1=0: No (program execution possible even without return to origin)<br>P1=1: Yes (program execution impossible without return to origin) |
| 28 | 0: OFF*<br>1: ON | | | | SERVO INITIALIZE -- specifies whether servo to be turned ON or OFF at time of power-ON or reset recovery (all axes).<br>FORMAT: L28:P1]<br>P1=0: Turn servo OFF (sets L35 parameter 2 to 0)<br>P1=1: Turns servo ON (sets L35 parameter 2 to 1)<br>Default is servo OFF |

| | | | | | |
|---|---|---|---|---|---|
| 29 | 0: disable*<br>1: enable | | | | Specifies whether to disable or enable auxiliary function (M output). When enables, if unit encounters M** in program the M enable terminal and DATA 0-7 are turned ON and the unit goes to standby state. When M end signal is received, M enable turns OFF and execution of the next command is permitted.<br>FORMAT: [L29:P1]<br>P1=0: disable, do not output<br>P1=1: enable |
| 30 | 0: BCD input*<br>1: binary input | | | | Specifies data type for file selection input in PLC mode. (Data 0-7)<br>FORMAT: [L30:P1]<br>P1=0: BCD input (input range 01-99, 99 files)<br>P1=1: binary input (input range 01-80HEX, 128 files) |
| 31<br>32<br>33<br>34 | Reserve<br><br>Reserve<br>Reserve | | | | |
| 35 | Axis No.<br>1, 2, 3, 4 | 0:SERVO OFF*<br>1:SERVO ON | see p-8 | | Specifies motor servo ON/OFF, gain selection.<br>[L35:P1:P2:P3] |
| 36 | Axis No.<br>1, 2, 3, 4 | 0:NOMAL*<br>1:DRIVER RESET | | | Selects motor reset and inhibit ON/OFF<br>[L36:P1:P2 ] |
| 37 | Axis No.<br>1, 2, 3, 4 | 0:IACT*<br>1:PACT | FN 0 to 15<br>(FN=0*) | POSW 0 to 3<br>(POSW=0*) | Selects motor control mode I/P, set response frequency FN0 to 15, and set COIN (settling width).<br>[L37:P1:P2:P3:P4]<br>P3= 0 to 15: Corresponds to Fc switch; default is P3=0<br>P4=0 to 3: Corresponds to POS switch; default is P4=0 |

| | | | | | |
|---|---|---|---|---|---|
| 38 | Axis No.<br>1, 2, 3, 4 | 0:(CW)<br>disable*<br>1:(CW)<br>enable | 0:(CCW)<br>disable*<br>1:(CCW)<br>enable | | Disables or enables soft limits set by L42.<br>[L38:P1:P2:P3]<br>P2=0: disable CW soft limit<br>P2=1: enable CW soft limit<br>P3=0: disable CCW soft limit<br>P3=1: enable CCW soft limit<br>If over-limit condition detected in program when limit enabled, motor drive ceases and error #5 to #8 is generated.<br>Error reset is done by L4 in AUTO mode (or alarm reset, in PCL mode). You should do an electrical return to origin (G28).<br>In MDI mode input must be re-entered. |
| 39 | Axis No.<br>1, 2, 3, 4 | 0:(CW)<br>disable<br>1:(CW)<br>enable* | 0:(CCW)<br>disable<br>1:(CCW)<br>enable* | | Disables or enables over travel hard limits.<br>[L39:P1:P2:P3]<br>P2=0: disable CW hard limit<br>P2=1: enable CW hard limit<br>P3=0: disable CCW hard limit<br>P3=1: enable CCW hard limit<br>If over-limit condition detected in program when limit enabled, motor decelerates to stop and error is generated.<br>At this time the absolute position value is stored in memory. Error reset is done by L4 in AUTO mode (or alarm reset, in PCL mode). L4 not required in MDI mode.<br>Switch to MDI mode and move in opposite direction far enough to disengage limit switch.<br>Note that if at end of movement motor stop position is in area prohibited by limit switch, error will be generated even for movement in opposite direction. |

| | | | | | |
|---|---|---|---|---|---|
| 40 | Axis No.<br>1,2,3,4 | see p-8 | | | Sets motor type.<br>[L40:P1:P2]<br>Note: The basic control constants such as speed, angle, etc. differ, so be careful. In particular, note that the defaults and ALL CLEAR [L49:99] set the unit to the 0 type motor specifications. |
| 41 | Axis No.<br>1,2,3,4 | LOW SPEED<br><br>Motor type<br>0/13Kpps<br>1/10Kpps<br>2/ 5Kpps<br>3/ 6Kpps<br>4/ 8Kpps | HIGH SPEED<br><br>Motor type<br>0/655Kpps<br>1/512Kpps<br>2/254Kpps<br>3/307Kpps<br>4/410Kpps | | Specifies the HIGH SPEED used for the default speed and for fast feed with G00, and the LOW SPEED used for return to origin.<br>[L41:P1:P2:P3]<br>P2: LOW SPEED -- setting range 1 to 1310Kpps<br>If not specified:<br>see left colume<br><br>Default is 0 type value.<br>P3: HIGH SPEED -- setting range 1 to 1310Kpps<br>If not specified:<br>see left colume<br><br>Default is to 0 type value. |
| 42 | Axis No.<br>1,2,3,4 | SOFT LIMIT value (+)<br>0:* | SOFT LIMIT value (-)<br>0:* | | Sets soft limit values.<br>[L42:P1:P2:P3]<br>P2: CW soft limit value; default = 0.<br>P3: CCW soft limit value; default = 0. |
| 43 | Axis No.<br>1,2,3,4 | OFFSET 1 | | | Sets return to origin offset value<br>[L43:P1:P2]<br>P2: Offset value (pulse count)<br>CW direction, setting range 0 to ± 999999999 |

| | | | | | |
|---|---|---|---|---|---|
| 44 | Axis No.<br>1, 2, 3, 4 | ACC TYPE<br>0:3rd-order spline*<br>1:Linear (trapezoid)<br>2~9:<br>Cam curve | ACC TIME<br>(msec)<br>350 msec*<br>2 to 9:<br>Invalid<br>(On cam curve)<br>input range<br>1~10000msec | | Selects acceleration/ deceleration type and time.<br>[L44:P1:P2:P3]<br>P2=0: 3rd-order spline<br>P2=1: linear (trapezoid)<br>P3: Acceleration/deceleration time (in msec); default = 350 msec.<br>Acceleration/deceleration time is time from stopped condition to lrps. |
| 45 | Axis No.<br>1, 2, 3, 4 | Absolute accuracy compensation<br>0:OFF*<br>1:ON | | | Sets absolute accuracy compensation (optional) ON or OFF.<br>[L45:P1:P2]<br>P2=0: OFF<br>P2=1: ON<br>Note: When using absolute accuracy compensation, note that the default is P2=0, so always use P2=1 to turn it ON. |
| 46 | Axis No.<br>1, 2, 3, 4 | DIMENSION | INDEX RESOLUTION | | Sets input units (DIMENSION).<br>[L46:P1:P2:P3]<br>P2=0: pulse input mode<br>P2=1: angle input mode<br>P2=2: index input mode<br>P3: index number<br>Note: Input units can also be specified using G-code. When specified with G-code, these parameters are also changed.<br>When DIMENSION changes are made, position data is cleared to 0. |

(Note) Setting the 1st axial designation parameter of L35 to L42 to 0 controls all the effective axle.

Reserve: Do not use.

| | | | | | |
|---|---|---|---|---|---|
| 47 | Axis No.<br>1, 2, 3, 4 | 0:axis<br>disable<br>1:axis<br>enable | | | Although for multi-axis use the enabled axes may be specified with the FINESERV CPU board DIP switches, this command makes it possible to disable in software an axis enabled at the DIP switches.<br>[L47:P1:P2]<br>Note: Once this command has been executed its re-execution is prohibited.<br>To clear this prohibition, set the reset switch to ON.<br>Note that this command cannot enable an axis disabled by the DIP switches. |
| 48 | | | | | |
| 49 | 99 | | | | ALL CLEAR PARAMETER<br>Sets all parameters to their default values, and erase all files. |
| 50<br>〜<br>55 | Reserve | | | | |

<Addendam> Calibration mode

Calibration measurement method as follows.

① L 9 ↵ Selects programmed operation CALIBRATION Mode.

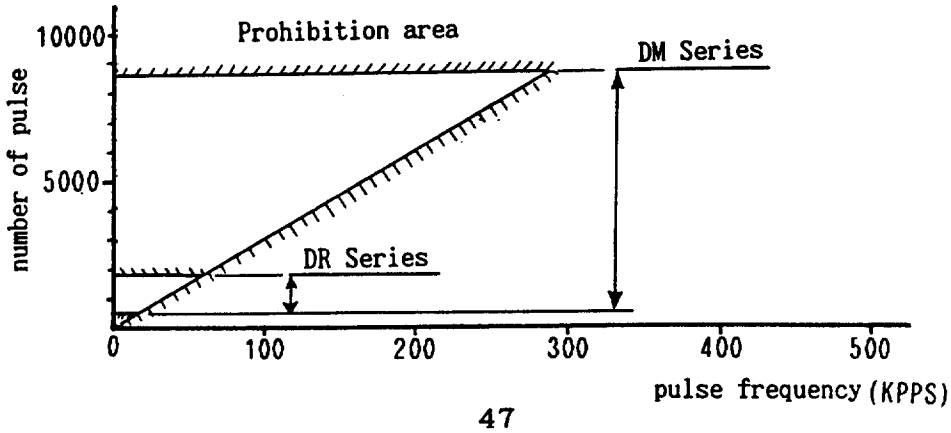
② L 3 : □ ↵ Start,

□ axis designnation axis No.1:1/ axis No.2:2 / axis No.3:4/ axis No.4:8

Rotate CCW at 670PPS and count and store to memory the number of pulses between origin senser and first origin pulse.

( NOTE: Rotate very slowly at above condition, and then it will be finish faster by start from CW side of vicinity of origin senser )

③ L 0 : 23 ↵ Above calibration measurement result to display by hexadecimal. Convert to decimal and read rotate speed by belows chart, or move the origin senser to meat number of pulse for needed rotate speed.



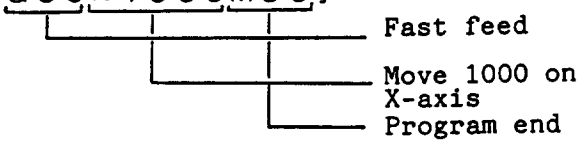
## 4-3. Program Functions

The FINESERV programming language conforms to NC language. NC language uses the word address format shown below.

· Word Address Format:

This is a format in which each block (step) contains one or more entities called words, which consist of a letter of the alphabet followed by numerals, each word having a meaning determined by its initial letter. The letters is called the word address.

Example: [G00X1000M30]




· This Controller's Word Address Format:

[N□ □ □ G□ □ □ XYZW□ □ □ □ □ □ □ F□ □ □ □ ABCD□ □ □ □ P□ □ □ Q□ □ □ R□ □ □ □ M□ □ □ ]

Note: The boxes after each letter show the number of digits effective for the data. The boxes after XYZW and ABCD indicate the number of effective digits for each of those letters.

(1) N-Code -- Block Label Number:

Effective digits = 3, unsigned.

The label numbers indicate the sequence of operations from the start time. It is not mandatory to enter a label number in each block; blocks can be constructed without them. However, when the P or Q code (jump) is used, a number is required at the jump destination.

(2) G-Code -- PREPARATORY FUNCTION:

Effective digits = 3, unsigned.

The G codes have functions used to prepare the controller for specific operations. (For details of G codes, see the overview table on page 93).

(3) XYZW -- DIMENSION WORD

Effective digits = 7, signed.

A dimension word is composed of an address code, ± sign, (+ may be omitted), and absolute (or incremental) numeric value.

X, Y, Z, and W are used mainly to specify position data for axes 1 to 4, respectively, but depending on the G-code may also be used to specify various parameter (index number, acceleration time, etc.) dwell times and such. Note that there are many cases where they are used in tandem with a G-code.

(4) F-Code -- FEED FUNCTION-1 (Feed Speed Function)

Effective digits = 4, unsigned.

Specified as address code F followed by a 4-digit numeric value. Units are KPPS (for example, F1024 ... 1024 KPPS<KHz>). F settings apply to all axes, and continue in force until changed.

(5) ABCD Codes -- FEED FUNCTION-2 (Feed Speed Function)

Effective digits = 4, unsigned.

As with the F-code, these are speed designation in units of KPPS. The difference from the F code is that A, B, C, and D correspond respectively to X, Y, Z, and W; in other words, while F applies to all axes in common, A through D can be used to specify speeds for individual axes.

If both F and any of the letters A through D are specified together in the same block, The letters A through D codes take priority.

Examples: [F1024] ... All 4 axes, 1024 KPPS

[B655] ... 655 KPPS on Y axis, all others 1024 KPPS

[F1000] ... All 4 axes, 1000 KPPS

[F500A100] ... 100 KPPS on X axis, all others 500 KPPS

Note:For F and A through D, speed will not exceed the rated speed for the axis even if a value exceeding the rating is specified.

(6) P, Q and R Codes -- Jump Commands

Effective digits = 3, unsigned.

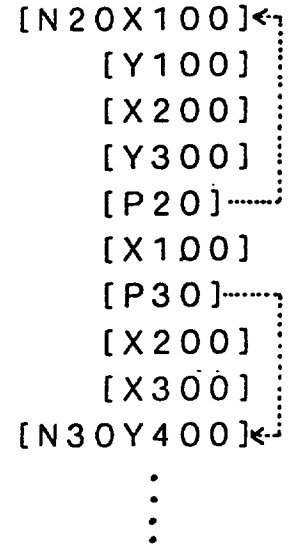
P: Corresponds to JUMP or GOTO statement.

Q: Corresponds to CALL or GOSUB statement.

R: Corresponds to FOR/NEXT statement.

6-1) Pn: "n" corresponds to label number Nn.

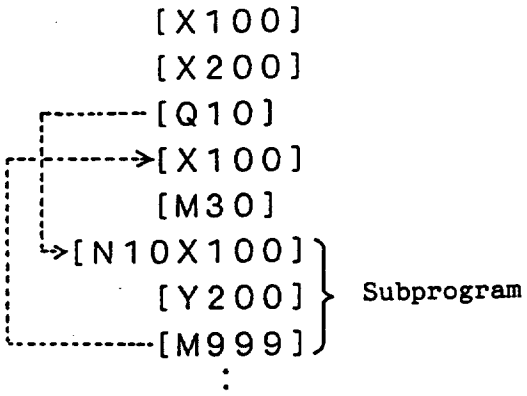
Example:



6-2) Qn: "n" corresponds to label number Nn.

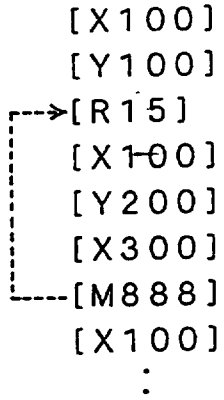
Note: Use with M999 (return). Nest to depth of 5.

Example:



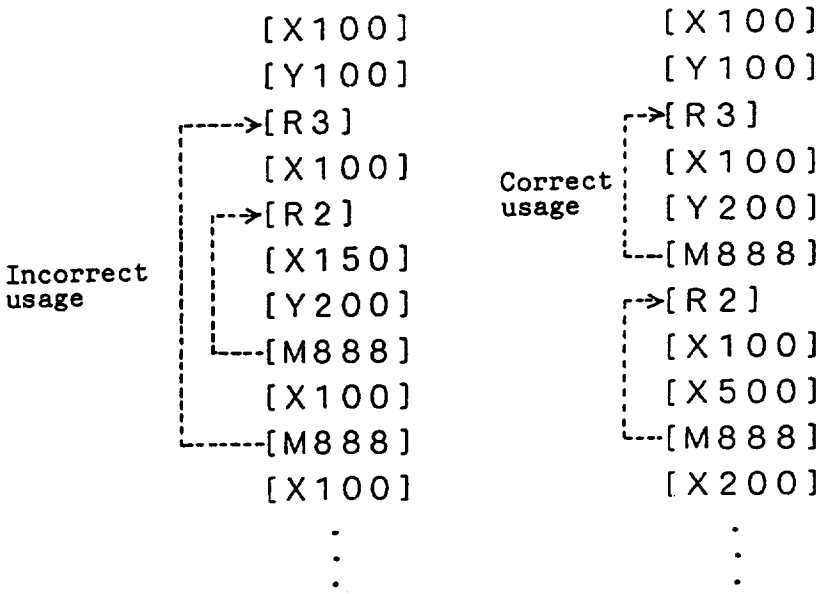

6-3) Rm: "m" represents number or repetitions. Use M888 for NEXT.

Example:




Note that Rm...M888 cannot be nested.

Examples:




(7) M Code -- MISCELLANEOUS FUNCTIONS (Supplementary Functions)

Effective digits = 3, unsigned.

An M function is composed of the address code M and a number up to 3 digits. In the FINESERV the functions differ between the 2-digit and 3-digit M codes.

7-1) The 2-digit M codes are general M functions.

- ◆ When a 2-digit number follows M (M00-99), a 2-digit BCD coded signal and M ENABLE signal are output from the DO port. (But only when M output has been enabled by L29.)
- ◆ If there is a movement command within the block, the above action is done after the movement command ends. After execution of an M output, input of the M end signal ends the M output and advances the program to the next block.

  Note that the above two actions can be inhibited by the parameter setting L29 (supplementary function lock).

◆ The following M codes have unique meanings.

M00 -- Program stop

M01 -- Optional stop

M02 -- End of program

M30 -- Ditto

7-2) The 3-digit M codes have specific meanings, and are not treated as output signals.

M100-115 .. X axis Fc settings (corresponding to 0 to 15)

M120-123 .. X axis COIN setting (POSW 0,1)

M130 .. X axis I action (IACT)

M131 .. X axis P action (PACT)

| | | | |
|---|---|---|---|
| M140 | Gain setting | Motor type 0~1/× 1 | Motor type 2~4/× 1 |
| M141 | Gain setting | Motor type 0~1/× 10 | Motor type 2~4/× 4 |
| M142 | Gain setting | | Motor type 2~4/× 7 |
| M143 | Gain setting | | Motor type 2~4/× 10 |
| M144 | Gain setting | | Motor type 2~4/× 13 |
| M145 | Gain setting | | Motor type 2~4/× 16 |
| M146 | Gain setting | | Motor type 2~4/× 19 |
| M147 | Gain setting | | Motor type 2~4/× 22 |

M200-299 .. Y axis (same as those above for X axis)

M300-399 .. Z axis (same as those above for X axis)

M400-499 .. W axis (same as those above for X axis)

M888 "NEXT" for program FOR/NEXT (R)

M999 Subprogram return for CALL statement (Q)

Note: 3-digit M codes other than the above are ignored, but do not generate errors. (See the list on page 95 for M code details.)

## 4-4. Error Codes

| Error code | ERROR MESSAGE (for personal computer) | Description |
|---|---|---|
| E 0 | | |
| 1 | | |
| ** 2 | SCU status error | SCU error occurred during RS232C receive. |
| * 3 | EMG stop | EMG input received. |
| 4 | | |
| * 5 | X axis limit | Sensed hardware or software limit. Note that if motor is stopped or driving in direction. opposite to limit after time of stop, an error does not result. |
| * 6 | Y axis limit | |
| * 7 | Z axis limit | |
| * 8 | W axis limit | |
| ** 9 | slave cal error | SLAVE MPU calculation error. |
| ** 10 | slave ram error | MEMORY CHECK ERROR |
| ** 11 | master ram error | MEMORY CHECK ERROR |
| * 12 | battery error | Information that was supposed to be backed up has been lost because backup battery was removed or discharged. |
| 13 | | |
| 14 | | |
| ** 15 | slave set error | Slave setting error |
| 16 | | — |
| * 17 | driver servo off | Driver servo is OFF (sensed when movement command is issued.) |
| * 18 | driver error | Driver is in error status. |
| * 19 | driver overload | The driver is in the overload status. |
| 20 | | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | servo sw off | The L command turned ON the servo at DI/O servo on SW-OFF. |
| 25 | under operation | A command was entered which should not be entered during execution. |
| 26 | illegal start | Start was attempted when not in program mode or origin mode. |
| 27 | illegal L-code | Underfined L-code used. |
| 28 | L-code format | Error in L-code format or parameter. |
| 29 | program starting | Entered a command not usable while a program is running. |
| * 30 | command inhibited | L-code entry prohibited. |

| Error code | ERROR MESSAGE (for personal computer) | Description |
|---|---|---|
| * 31 | NC date inhibited | NC data input inhibited. |
| 32 | not EMG or ERROR | L4 entered though not in EMG or error stop status. |
| 33 | under PLC | L command entered while in PLC mode. |
| 34 | illegal file no. | Attempted to call file number not registered. |
| 35 | illegal axis no. | Used invalid axis code. |
| 36 | file not set | No program called up. |
| * 37 | CR not found | Could not find CR (carriage return). |
| * 38 | unfit value | Incorrect value used in program. |
| * 39 | unfit word | Invalid word used in program. |
| * 40 | illegal G no. | Undefined G code was used. |
| * 41 | origin not set | Attempted to start program run without returning to origin. |
| * 42 | file dir overflow | File dictionary overflowed. Exceeded 128 registered files. |
| * 43 | not found N | Destination for jump command not specified. |
| 44 | under error stop | L command entered while in error stop. |
| * 45 | NC format error | Format error found in NC program during file load. |
| 46 | not used message | Used undefined parameter in LO command. |
| * 47 | data area over | Data exceeded 32K bytes. |
| 48 | | |
| 49 | | |

**: These are malfunctions; please consult Yokogawa.

* : Determine cause of error and reset alarm.

Other alarms should be reset just by correcting the input.

Note: In this controller, an error command is dispatched whenever an error occurs, turning ON the warning LED and turning ON the DI/DO error output (pin 23).

When error messages are displayed on the Teaching Box they are abbreviated from those displayed on a personal computer, due to space limitations. In the above list, the underlined parts of the messages represent the Teaching Box displays.

## 5. Using the Unit as Connected to the Teaching Box

### 5-1. Connected to the Teaching Box

The basics of connection to the Teaching Box have already been described in the basic manual. This section explains the remaining aspects.

First of all, before connecting the unit, please check the jumpers on the controller board.

The three jumper locations of J2 are normally all jumpered when the unit is shipped.

After checking the above, connecting the Teaching Box interface connector to CN2 will enable operation of the unit. If the connector is disconnected the unit will automatically go into personal computer mode.

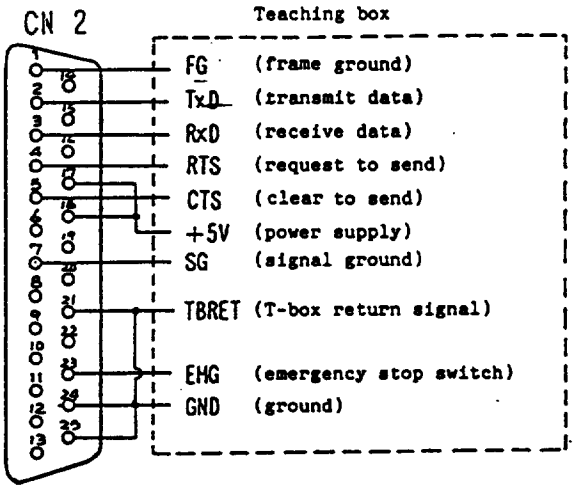



Fig. 5-1

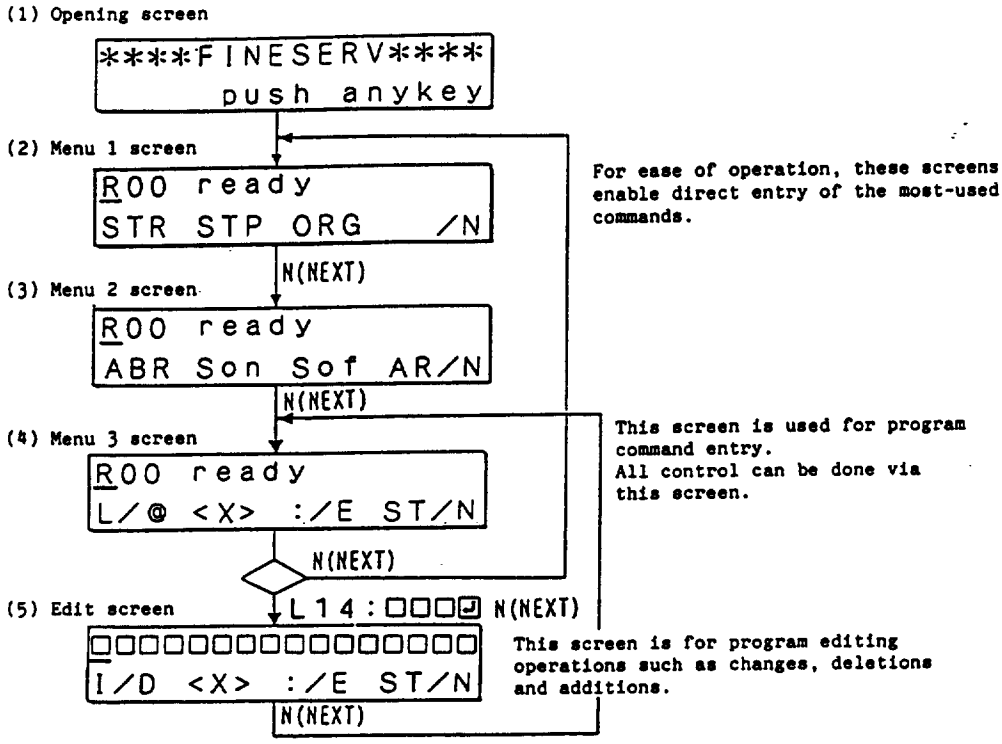
Note: Pins 17-18 and 24-25 are shorted internally.

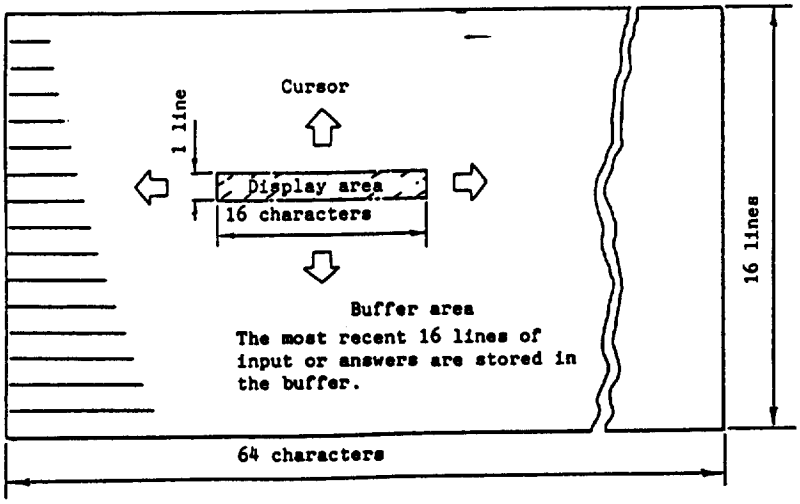
If connecting as an RS232C port to a personal computer or other device, exercise care with respect to those terminals at the +5V and GND levels.

## 5-2. Teaching Box Display Configuration

As was previously described, the Teaching Box displays consist of an opening screen followed by the direct entry screens (Menus 1 and 2), the program entry screen (Menu 3), and the edit screen.

As shown in th figure, the display has two lines of 16 characters each. The bottom line shows the meanings of the function keys (f0 through f7) at the corresponding positions. The top line displays the entries and the answers from the FINESERV. The unit contains a buffer with space for 16 × 64-character lines from the top line, and you can move the display window around this buffer with the cursor keys for display or input. For file input and output there is no particular limit on the number of 64-character lines.


(1) Opening screen
****FINESERV****
push anykey
(2) Menu 1 screen
R00 ready
STR STP ORG /N
N(NEXT)
(3) Menu 2 screen
R00 ready
ABR Son Sof AR/N
N(NEXT)
(4) Menu 3 screen
R00 ready
L/@ <X> :/E ST/N
N(NEXT)
L14:□□□ N(NEXT)
(5) Edit screen
□□□□□□□□□□□□□□□□
I/D <X> :/E ST/N
N(NEXT)
For ease of operation, these screens enable direct entry of the most-used commands.
This screen is used for program command entry.
All control can be done via this screen.
This screen is for program editing operations such as changes, deletions and additions.


Cursor
1 line
Display area
16 characters
Buffer area
The most recent 16 lines of input or answers are stored in the buffer.
16 lines
64 characters

## 5-3. Direct Entry Screens

As was previously described in the function list, the Teaching Box provides direct entry screens (Menus 1 and 2) to enable the frequently used L-commands to be keyed in directly. Here, continuing on from the basic operations described in the basic manual, we will show additional operation examples for these direct entry screens and the program entry screen, but fundamentally these are the same as the descriptions for the individual functions.

(1) Start (AUTO Mode, Return to Origin)

■ Program Start in AUTO mode:

| Key Operations | Display |
|---|---|
| Call Menu 1. | R00 ready<br>STR STP ORG /N |
| Enter file number.<br>[1] [5] | 15_<br>STR STP ORG /N |
| Press [f0] to execute program. | _<br>STR STP ORG /N |
| When program ends, answer will be returned. | R00 ready<br>STR STP ORG /N |

Notes: 1. In CONTINUOUS mode, the "ready" answer will not appear until there is a stop or a stop entry during program execution.

2. If no file number is entered, the unit will execute the last file previously executed or selected. If an unregistered file is entered, error 34 will occur when start is pressed.

■ Program Start in ORG (Return to Origin) Mode:

When selecting return to origin mode with [f2] (ORG) or [L13], specify axis number. This is explained in the item on return to origin operation.

(2) Stop (AUTO Mode, Return to Origin)

You can press [f1] to perform a temporary stop in AUTO mode.

This is the same action as [L2[ ↵ ]].

(3) Return to Origin

Call up Menu 1 as shown at right.

```
R00 ready
STR STP ORG    /N
```

Enter the axis number for return to origin. The axes 1 through 4 are represented by binary bits, but entered as a decimal number.

```
□_
STR STP ORG    /N
```

Examples:

| | | |
|---|---|---|
| Axis 1 (X axis) | bit 0, decimal 1 | Axis 1 only : 1 |
| Axis 2 (Y axis) | bit 1, decimal 2 | Axes 1 & 2 : 3 |
| Axis 3 (Z axis) | bit 2, decimal 4 | Axes 1, 2 & 3 : 7 |
| Axis 4 (W axis) | bit 3, decimal 8 | Axes 1, 2, 3, & 4: 15 |

When [f2] is pressed the motor will turn and start the return to origin operation.
(If no axis is specified, error 28 will result.
If an invalid axis is specified error 35 will result.)
When the return to origin operation ends, the display will return to the initial screen.

```
_
STR STP ORG    /N
```

```
R00 ready
STR STP ORG    /N
```

(4) Forced Stop (Abort)
Press [SHIFT] + [f3/7] to call up Menu 2.
Pressing [f0] will cause a forced stop. This acts the same as [L1:99[ ◪ ]].
For information on the stop pattern, see the item on activation stop.

```
R00 ready
ABR Son Sof AR/N
```

(5) Servo ON/OFF entry
These keys control servo ON/OFF directly. When it is necessary to select an axis, enter the axis number first (X=1, Y=2, Z=3, W=4) and then select and press Servo ON or Servo OFF. If you enter axis number = 0, then you will control all enabled axes.
This acts the same as [L35:□ :□ [ ◪ ]].

```
R00 ready
ABR Son Sof AR/N
```

(6) Alarm Reset
[f3] is used to reset/clear error stop conditions.
After reset the unit will return to its initial state.
Entering this key when the unit is not in error stop will generate an error.
The above action is the same as [L4[ ◪ ]].

```
R00 ready
ABR Son Sof AR/N
```

## 5-4. Program Entry Screen

The program entry screen (Menu 3) can be used for all control.

Any of the commands previously discussed under direct entry can also be entered via this screen.

The previously described control functions, program function L commands and NC programs are entered into the top line of the screen, and the commands sent out by pressing the ↵ key.

## 5-5. Edit Screen

The Teaching Box provides simple editing functions.

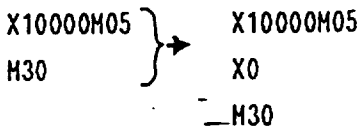
| Key Operations | Display |
|---|---|
| Call Menu 3. | R00 ready<br>L/@ <X> :/E ST/N |
| Select the file number of the file you wish to edit. Keying in [f0] [1] [4] [f2] [1] calls up file number 1. | L14:1_<br>L/@ <X> :/E ST/N |
| Press [↵]. | R00 ready<br>L/@ <X> :/E ST/N |
| Press [SHIFT] + [f3/7] to call the editor screen. The display shows the first block of the selected file. Pressing [SHIFT]+ [8/↓] displays the program contents one line at a time. | □□□□□□□□□□□□□□□□<br>I/D <X> :/E ST/N |

(1) Program Changes

| | |
|---|---|
| Display the block you wish to change. For example let us suppose you wish to change X20000 to X10000M05. | X20000_<br>I/D <x> :/E ST/N |
| Using the cursor, delete and insert keys, change the [2] to [1]. Then press [f1] until M is displayed in < >, and when M comes up press [f3] to place it in the display. Next key in [0] [5]. | X10000M05_<br>I/D <x> :/E ST/N |
| Press [↵] to complete the change. | R00 ready<br>I/D <x> :/E ST/N |

(2) Program Insert

Example:




When making an insertion into a program as shown above, bring to the screen the block following the block where you wish to make the insert (here, M30), and key in [X] [0]. Next, press [f0] (I: line insert) to insert the line into the program. When the insertion is completed, the display will show the next block (M30).

(3) Program Erase

When deleting a block from a program, display the block. Pressing [SHIFT] + [f0/4] (D: Line delete) deletes that block. When the deletion is completed the screen will show the next line in the program.

(4) Ending Program Edit

When you finish editing the program, pressing NEXT screen will bring up Menu 3 (program entry screen) and end the edit.

# 6. Using the FINESERV Connected to a Personal Computer

## 6-1. Connection to a Personal Computer

To interface a personal computer or host computer, connect it to connector CN2 (RS232C port) in the same way as the Teaching Box. The FINESERV RS232C specifications are as shown below.

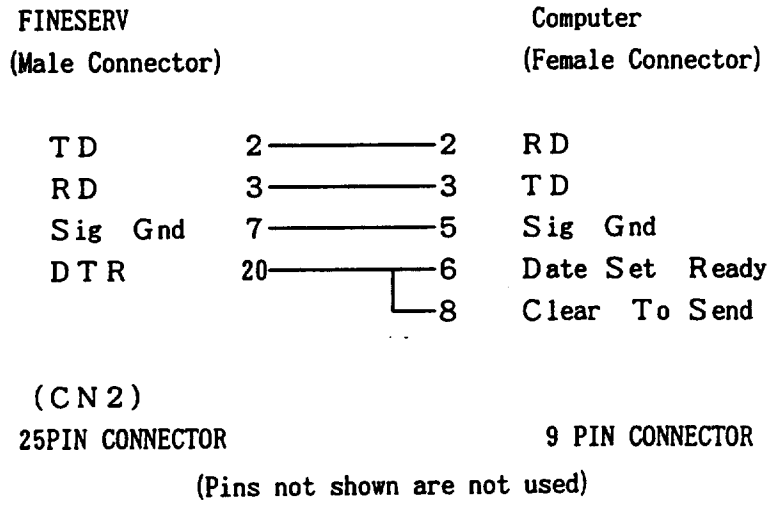
Transmission system: Asynchronous
Transmission speed : Variable (9600, 4800, 2400, 1200 [BPS])
Stop bits : 1 bit (fixed)
Data length : 8 bits (fixed)
Parity : Selectable (Even, Odd, None)

As was shown earlier, these settings are made on the FINESERV internal circuit board; set them as appropriate for the interface specification.

When connecting to a personal computer, taking as an example the IBM PC-AT.

For the CR (carriage return) and LF (Line field) return settings on the personal computer side, see page 20.

Fig. 6-1




(Pins not shown are not used)

## 6-2. Operating Procedure

Commands (described below) will be sent from the personal computer to the controller via the RS232C link. The controller will receive these commands and execute them. When command execution is complete, or an error occurs, the unit will return appropriate answer commands to the computer.

In the following we will describe the above operations using the IBM PC-AT as an example. If using a different computer, please follow that computer's instruction manuals.

Step 1. Bring up BASICA or GWBASIC.

Step 2. Enter the following program.

```
10 ' ***************************************************************
20 '     FINESERV OPERATING SAMPLE PROGRAM FOR IBM PC-AT
30 '             2/20/1989      BY YOKOGAWA (H.A)
40 ' ***************************************************************
50 '
60  OPEN "COM1:2400,N,8,1,LF" AS #1  : 'LF is necessary.
70  WHILE INKEY$ <>"": WEND          :' Clear Key Buffer.
80  INPUT "Command..";CMND$         :' Input Command.
90  PRINT #1, CMND$
100 IF LOC(1)<>0 THEN 140
110 ANYKEY$=INKEY$
120 IF ANYKEY$<>"" THEN 70
130 GOTO 100
140 LINE INPUT #1, ANS$              :' Read Fsrv's answerback.
150 PRINT ANS$                       :' Display the answerback.
160 FOR I = 1 TO 200 : NEXT          :' Wait
170 IF LOC(1)<>0 THEN GOTO 140
180 GOTO 70
190 CLOSE                            :' Close the COM1 file.
200 END
```

Step 3. Run program and enter commands.

Example:

```
[@ ↵]                    : Change to personal computer input mode.
[R00 READY]              : "Ready" answer returned if no error.
[L35:1:1:0↵]             : Turn servo ON.
[R00 READY]              :
[L39:1:0:0↵]             : Disable hard limit.
[R00 READY]
[L27:0↵]                 : Return to origin not a condition for
                           program execution.
[R00 READY]
[L40:1:1]                : If you have A type motor(DM/A series).
[L46:1:0]                : Set pulse input mode.
[L10↵]                   : Select MDI mode.
[R00 READY]              :
[X100000↵]               : Rotate positive 100,000 pulses.
[R00 READY]              : "Ready" answer returned when motor stops.
```

MDI mode

```
[L15:1↵]              : Create file 1.
[R00  READY]          :
[G91X100000F50↵]      : G91: Set incremental mode.
                        F50: Set speed to 50K pulse/sec.
[R00  READY]          :
[X-100000F20↵]        : 100,000 pulses reverse, speed 20KPPS.
[R00  READY]          :
[M30↵]                : Input program end (M30).
[R00  READY]          :
[END↵]                : File 1 creation complete.
[L18:1↵]              : Select file 1.
[R00  READY]          :
[L5↵]                 : AUTO mode.
[R00  READY]          :
[L3↵]                 : Start program (drive motor).
[R00  READY]          :
[L7↵]                 : CONTINUOUS MODE.
[R00  READY]          :
[L3↵]                 : Start.  During this period motor repeats
                        driving forward and reverse.
[L2↵]                 : Stop.  to stop ,hit any key and L 2 ↵
[R00  READY]          :
[L5↵]                 : Return to AUTO mode.
[R00  READY]          :
[L3↵]                 : Go on from point where continuous mode
                        stopped to program end, and stop there.
[R00  READY]          :
```

First thing you should get is an answerback, [R00 READY] from FINESERV after you type @ and ↵.

If you have no answerback please check the following.

1) Check the cable connection in accordance with the connection in Fig.6-1.
2) Check the communication parameters such as,
   Band rate : 2400(Factory set when shipping)
   Parity : None( 〃 )
   Data length: 8 bit(fixed)
   Stop bit : 1 bit( 〃 )
   The OPEN Command in the sample program spcifies the above parameters.
   Please refer to (2)DIP switch setting in page 23 to make sure.
3) Check the program you made carefully.

# 7. Using the FINESERV Connected to a Sequencer.

## 7-1. Interfacing to the Sequencer (CN1)

1) Input signals : No. of input points : 16 points (common I/O ground)
Input voltage : 24 V DC
Electrical specifications : Photocoupler isolated

2) Output signals : No. of output points : 16 points (common I/O ground)
Electrical specifications : Transitor, open collector

CN 1(34PIN)

| | Description | PIN NO. |
|---|---|---|
| Input | +24V | 1 |
| | EMG STOP | 2 ※ |
| | SERVO ON | 3 ※ |
| | STOP | 4 |
| | START | 5 |
| | ORIGIN | 6 |
| | INTER LOCK | 7 |
| | RESET | 8 |
| | M end signal | 9 |
| | DATA 0 | 10 |
| | DATA 1 | 11 |
| | DATA 2 | 12 |
| | DATA 3 | 13 |
| | DATA 4 | 14 |
| | DATA 5 | 15 |
| | DATA 6 | 16 |
| | DATA 7 | 17 |
| Output | EMG (B contact) | 18 |
| | BUSY | 19 |
| | PROG | 20 |
| | M-ENABLE | 21 |
| | SERV RDY | 22 |
| | ALARM | 23 |
| | BATTERY | 24 |
| | C-RDY | 25 |
| | Moutput0 | 26 |
| | Moutput1 | 27 |
| | Moutput2 | 28 |
| | Moutput3 | 29 |
| | Moutput4 | 30 |
| | Moutput5 | 31 |
| | Moutput6 | 32 |
| | Moutput7 | 33 |
| | GND | 34 |

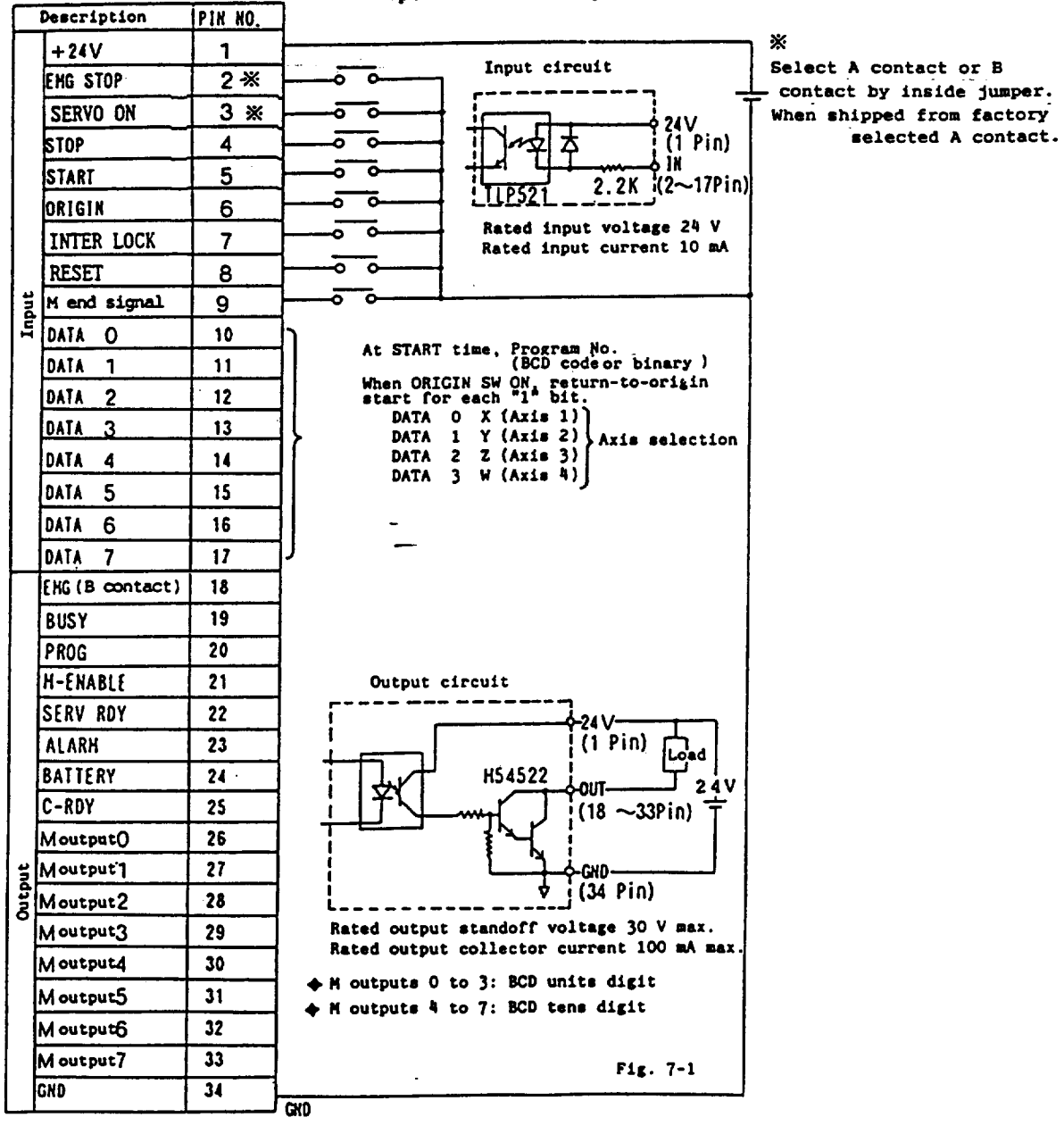



Fig. 7-1

Note: If the load connected to the output has inductive characteristics (relay, solenoid, motor, solenoid valve, etc.), be sure to connect a surge killer matching the load.

## 7-2. PLC (Sequencer) Functions

The PLC mode has been provided to enable the FINESERV to be operated remotely from a sequencer, and uses the DI/DO (CN1). For mode selection, [L19 ↵ ] is used to switch from RS-232C (Teaching Box or personal computer mode) to PLC mode, and [@ ↵ ] is used to switch from PLC mode to RS-232C mode.

The following inputs are enabled only in PLC mode:

STOP, START, ORIGIN, ALARM RESET, DATA 0-7.

The others, M END Signal and EMG STOP, SERVENABLE are enabled in all modes.

◆ Inputs:

(1) STOP (Pin #4)

The STOP signal is used to perform a temporary stop during programmed operation. When STOP is ON, the unit goes into the stopped state after completion of the currently executing block (step), and BUSY turns OFF. Also, BUSY goes OFF if execution has reached program end, but remains ON if it has not reached program end. Note that in CONTINUOUS mode program in progress remains ON even if execution has reached program end. To clear program in progress you must use [@ ↵ ] to switch to RS232C mode, and do a start after setting the unit to AUTO mode.

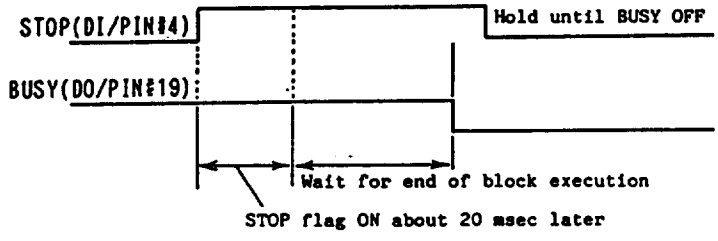


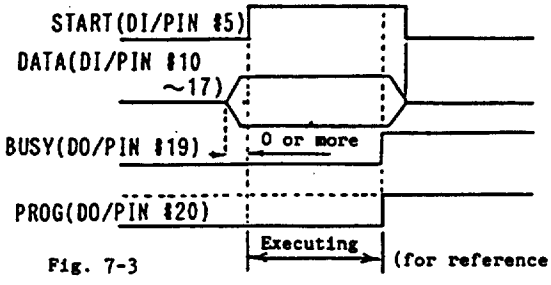

Fig. 7-2

(2) START (Pin #5)

The START signal is used to start program execution (Program No. set by DATA 0-7, BCD or binary ), or restart it after a stop. (DATA type depend on L30 designation)

Start timing

START is disabled when BUSY (DO/PIN #19) or ALARM (DO/PIN #20) is ON.




START and DATA must be held valid until BUSY goes ON. That is, START and DATA can be turned OFF after BUSY is confirmed. Note that DATA (Program No.) is not required when PROG is ON.

Fig. 7-3

(3) ORIGIN (Pin #6)

The ORIGIN signal is used for return to origin (hardware origin point). The affected axes are specified by DATA bits 0-3. Note that ALARM will turn ON if the selected axes include any which are not enabled, or if none is specified.

DATA Bit 0 ... Corresponds to X axis

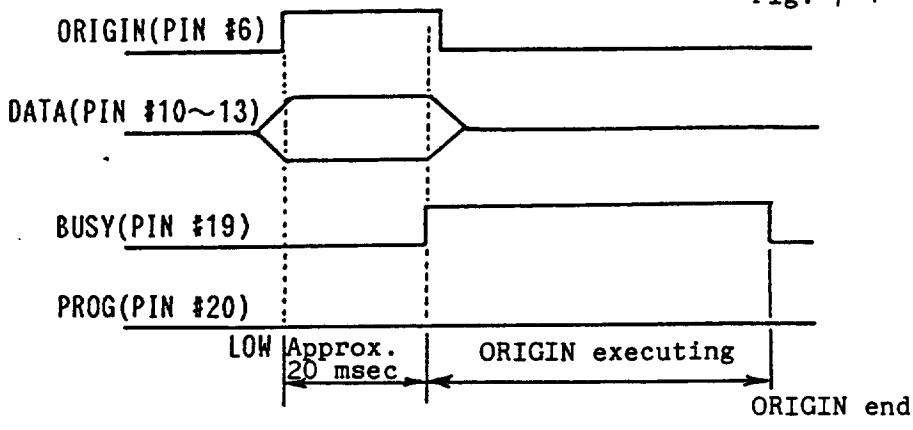
1 ... Corresponds to Y axis

2 ... Corresponds to Z axis

3 ... Corresponds to Z axis

Origin timing

Fig. 7-4




ORIGIN DATA 0-3 must be held until BUSY turns ON.

BUSY turns OFF at ORIGIN end.

(4) RESET(Pin #8)

To default status in power on same as [L 1 : 99].

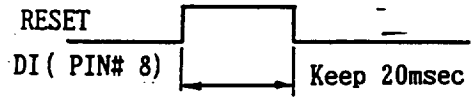



*Fig 7-5*

In PLC mode an error No. is output via the M output, timing as follow.

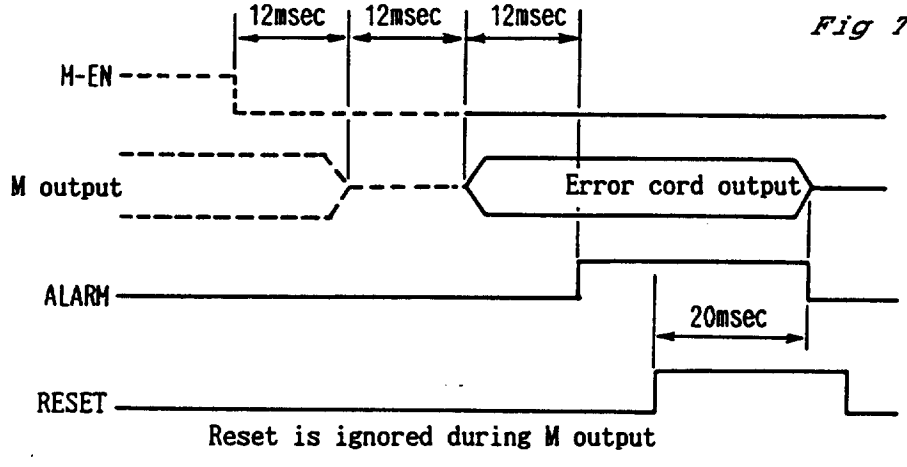



*Fig 7-6*

(5) M END Signal (Pin #9)

If the program contains a 2-digit M-code, and the function has been enabled by parameter setting L29 (M output), then the M-code is output via the M outputs (BCD, 2 digits) together with M-EN (M-Enable). When this occurs the PLC must read M-EN and the M outputs with an AND, and after this processing return an M-END signal to the positioning controller. On receiving this signal the positioning controller will advance to the next block. The controller does not move to the next block until M completion is turned OFF.

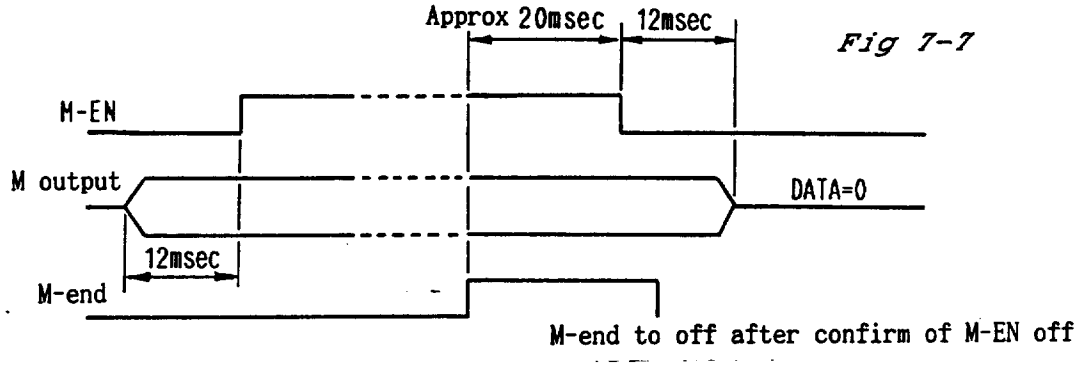



*Fig 7-7*

(6) SERVO ON (PIN#3)

Turning the servo-OFF invalidates the coordinate system and origin return end, whereas turning the servo input ON can change the logic.

(See jumper J3 setting on P-20.)

(7) EMG STOP (Emergency Stop, Pin #2)

Used for emergency stop. Emergency stop can also be used outside of PLC mode. See page 24 concerning stopping method. When EMG STOP is activated EMG (B contact) goes from ON to OFF. (The same holds for the Teaching Box EMG switch.) When this occurs the ERR and EMG LED's on the

panel turn ON, too. Note that the EMG STOP input can be changed from positive logic to negative logic (normally ON). See J3 setup on page 24.

The servo turns OFF after an emergency and should therefore be turned ON again if necessary.

(8) INTERLOCK (PIN#7)

Valid only during axle movement. Turning the interlock ON reduces speed and stops the motor if it is moving. If the interlock is returned to OFF, the remainder is continued. If the interlock is turned ON during stop, there is no axle movement, but if the interlock is returned to OFF, it starts moving.

◆ Outputs

(1) EMG <B Contact> (Pin #18)

When an EMG STOP input is received (either from PLC or Teaching Box), this output goes from ON to OFF as the emergency stop takes place.

(2) BUSY (Pin #19)

ON when motor is driving. See pages 72 and 73 for output timing.

(3) PROG (Pin #20) <AUTO, STEP, CONTINUOUS>

ON during execution in program mode. See page 72 for output timing.

(4) M ENABLE (Pin #21) and M OUTPUT 0-7 (Pins #26-33)

If a 2-digit M-code is executed after the L command "L29:1" (M output enable), then the M-code itself is output as data via M outputs 0-7 (pins #26-33). This condition is maintained until the PLC outputs an M-END (Pin #9). See page 73 for timing.

(5) SERVO RDY (Pin #22)

Servo Ready is ON when the servo is ON.

(6) ALARM (Pin #23)

In PLC mode all general errors such as a program error or program number designation error, etc. will cause an error stop and turn ON the ALARM (Pin #23) output. When this occurs the error status code number will be output in BCD at the M OUTPUT terminals.

(7) BATTERY (Pin #24)

This signal turns ON when the memory backup battery reaches end of life. When that occurs, replace the lithium battery.

(8) C-RDY (Pin #25)

This signal turns ON when the FINESERV is in ready status.

# 8. Programming Examples

## 8-1. Software Operation Flow

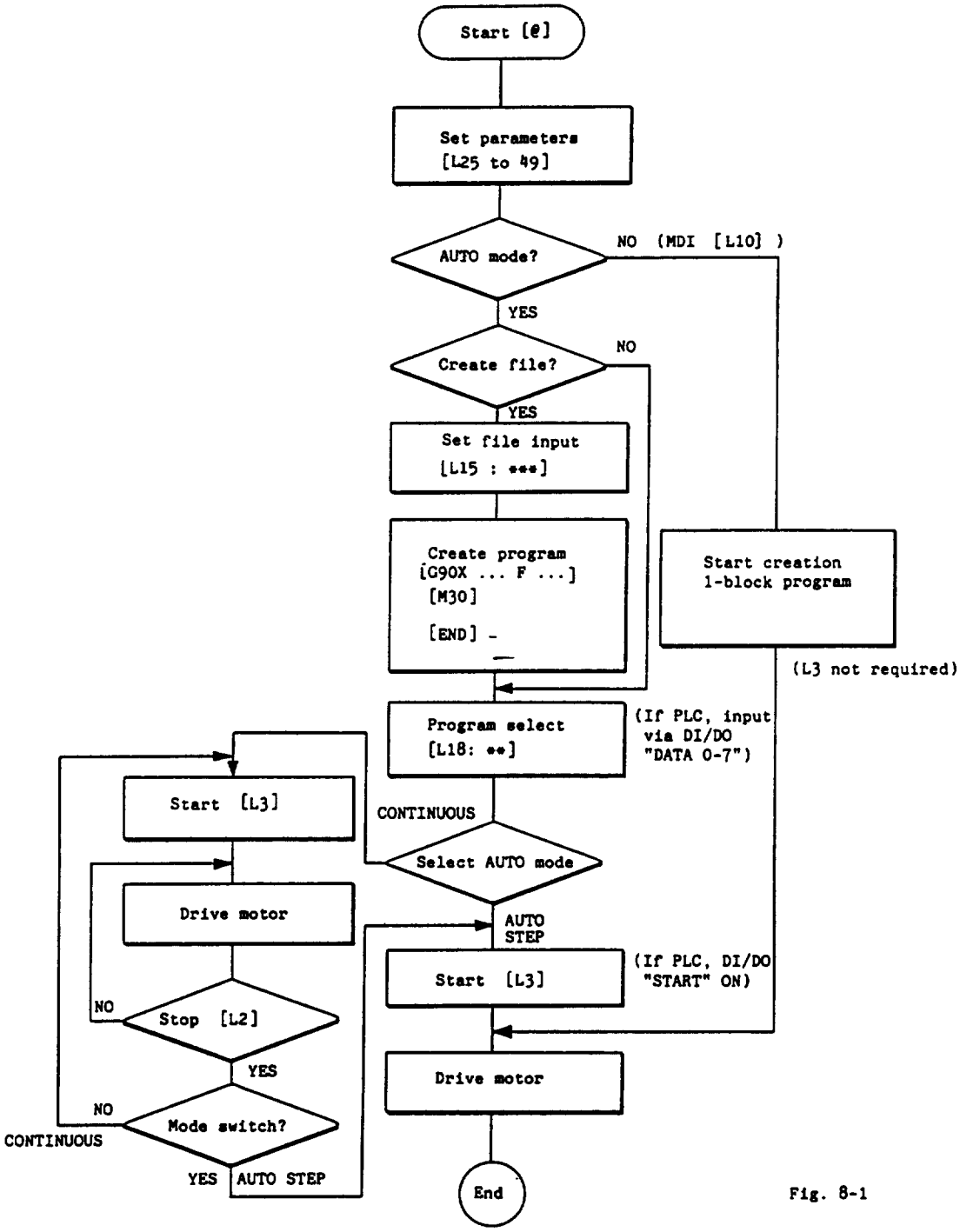



Fig. 8-1

When entering a program into the FINESERV via a personal computer, the program editing function cannot be used. Therefore, we recommend that you use the BASIC program given later in this section, which enables you to edit the program in the DATA area from line 1000 on, and send then send it to the FINESERV.
(The optional Teaching Box sold separately provides simple editing functions.)

## 8-2. Absolute Input (ABS) and Incremental Input (INC)

Program Example:

①[G90X200000F1310] ··· G90: Set for ABS input
X200000: Rotate positive 200000 pulses on axis 1
F1310: Speed = 1310KPPS (B series 2 rps)

②[X-300000] ··· Reverse to absolute position -300000 pulses on axis 1

③[G91X655360] ··· G91: Set for INC input
X655360: Rotate positive 655360 pulses on axis 1 (B series 2 rps).

④[G90X0M30] ··· X0: Return to origin with absolute position
M30: Program end; if M-output enabled, output data 30 on DO.

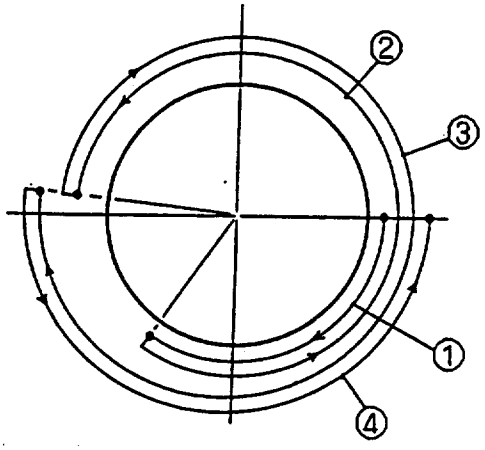



Fig. 8-2

8-3. Timer (Dwell) Function (add timer to above example)

Program Example:

```
[G90X200000F1310]
[G4X500]              ... 500 msec timer (units = msec)
[X-300000]
[G4X1000]             ... 1000 msec timer
[G91X655360F655]
[G4X1000]             ... 1000 msec timer
[G90X0]
[G4X600000M30]        ... 600,000 msec = 10 minute (maximum)
```

8-4. Index Mode

Set input to index mode with [L46:1:2:15 ↵ ] (15 divisions).

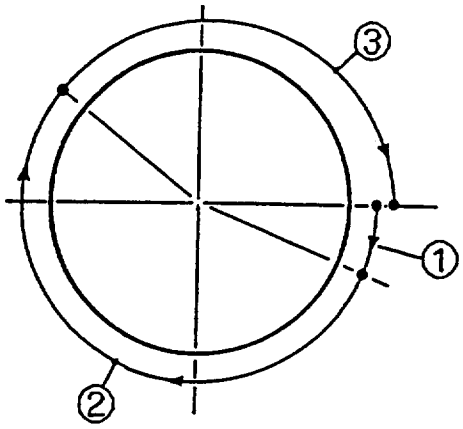
Program Example:

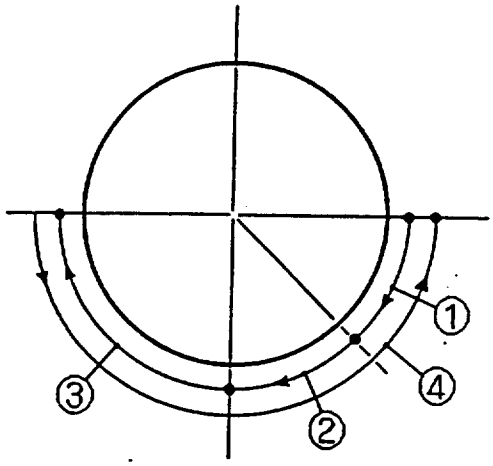
```
①[G90X1F5]   ... Rotate positive 1/15 (B series:  43,691 pulses)
②[G91X8]     ... Rotate positive 8/15 (B series: 349,525 pulses)
③[G90X0M30]  ... Rotate positive 6/15 (B series: 262,144 pulses)
```

Notes:1. Even when as above the resolution cannot be evenly divided by the number of index divisions, the resulting remainder errors do not accumulate.

2. The index mode absolute value range is 0 to 1. Even if [X-0] is input in ABS mode after rotating 11/5 (2 turns + 1/5 turn) on incremental input, the rotation will be only 1/5 in the CCW direction.

3. Similarly, in the angle input mode the absolute position range is 0 to 360 degrees.




8-5. Using M-END Enable

This program will rotate the index table, output a start signal to the next operation (measurement or machining) on DI/DO data, and at the end of that operation receive an M-END signal and rotate the index to the next position.

Program Example

[L46:1:1↵] ··· Set for angle input

[L29:1 ↵ .] ··· Enable M output

①[G90X45000F100M08] ··· X45F100: Rotate positive 45 degrees at 100 KPPS speed
M08 : After motor stops, turn D3 and M-ENABLE ON, and advance to next block at M-END signal ON.

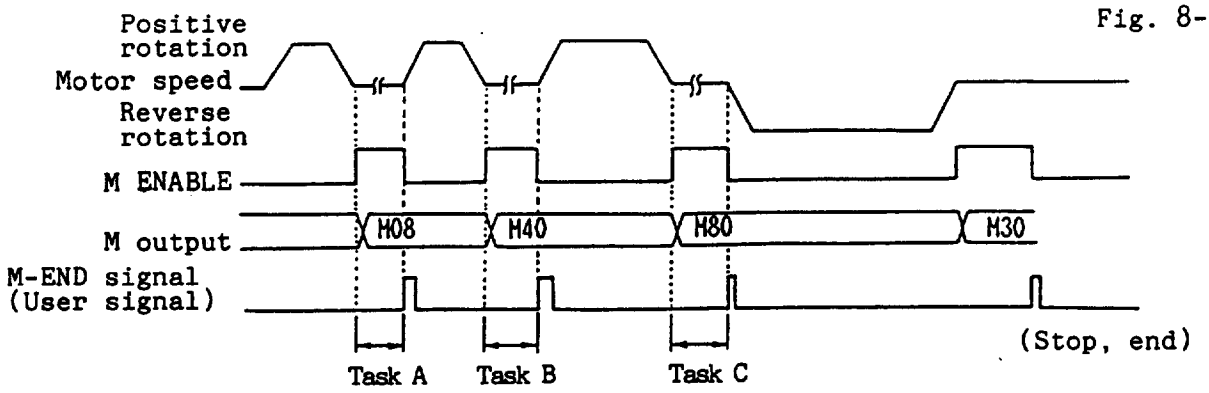
②[·····X90000M40] ··· Rotate positive to 90 degrees then output M40 (D6 ON, M ENABLE ON)

③[·····X180000M80] ··· Rotate positive to 180 degrees then output M80 (D7 ON, M ENABLE ON)

④[·····X-0M30] ··· Return to origin with reverse rotation and end program (D4 & D5 ON)

Notes:1. Since M30 (program end) too is an M-output, execution will not return to the file's starting block until the M-END signal is received. Thus, it will not be possible to restart.

Fig. 8-5




M-output ENABLE: DI/DO (CN1) Pin 25

M-output Pin numbers in ( )
Circle indicates ON

| | D0 (26) | D1 (27) | D2 (28) | D3 (29) | D4 (30) | D5 (31) | D6 (32) | D7 (33) |
|---|---|---|---|---|---|---|---|---|
| M08 | | | | ○ | | | | |
| M40 | | | | | | | ○ | |
| M80 | | | | | | | | ○ |
| M30 | | | | | ○ | ○ | | |

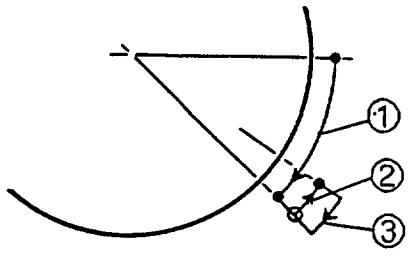
Notes:1. M-output is binary coded. Use hexadecimal to enter from personal computer.

2. Since certain M-output codes such as 00, 01, 02, and 30 are reserved and have specific meanings, in exchanges with other devices you should use BCD 2-digit numbers other than those reserved codes.

## 8-6. JUMP

[P□ □ □ ] causes an unconditional jump to the block having the same sequence number as that specified.

Program Example:




①[G90X81920F1310]
②[N10G91X-10000F50]
[G4X500]
③[X10000]
[M00]
[P10] ··· Jump to block N10, restart with L3.
[M30]

Note: Without [M00] the jump would be repeated endlessly. When [M00] is present, then after making the jump one time the program waits at the jump point for restart by L3. Affix sequence numbers to the required blocks as labels.

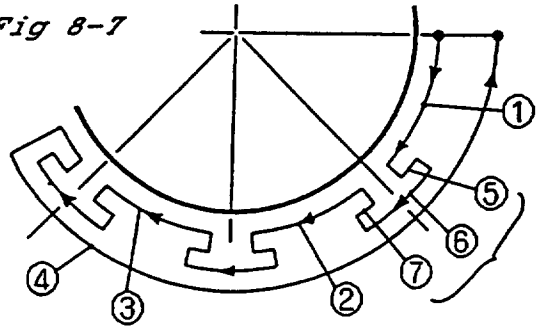
## 8-7. CALL

[Q□□□] causes a jump to the block having the same sequence number as that specified. On encountering M999 (return) at the jump destination, execution returns to the following block.

①[G90X81920F655]
[Q50] ··· Q50: Jump to block N50
②[G90X163840F655] ··· On M999 return to this block
[Q50] ··· Jump to N50
③[G90X245760F655] ··· On M999 return to this block
[Q50] ··· Jump to N50
④[G90X0F655] ··· On M999 return to this block
[M30] ··· Program end
⑤[N50G91X-10000F30M10] ··· Come to this block from Q50
⑥[X20000M20]
⑦[X-10000]
[M999] ··· Return to block following the Q50 from which we came

Note: In programs such as this which jump with Q□□□, M30 (program end) is not necessarily the last block in the file.

*Fig 8-7*



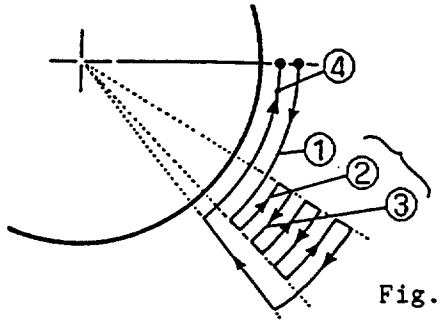




Fig. 8-8

## 8-8. FOR NEXT

Repeat the program blocks between [R□□□] and M888 exactly the number of times specified by [R□□□].

```
①[G90X81920F1310]
  [R3]                    ··· Repeat blocks between this block and M888
                              three times.
②[G91X-10000F50]
  [G4X500]
③[X10000M888]
④[G90X0M30]
```

8-9. The Following shows one example of program input.

```
10 ' ********************************************************************
20 '     FINESERV OPERATING SAMPLE PROGRAM FOR IBM PC-AT
30 '       YOKOGAWA CORPORATION OF AMERICA (2/20/1989)
40 ' ********************************************************************
50 '
60  OPEN "COM1:2400,N,8,1,LF" AS #1  : 'LF is necessary.
70  WHILE INKEY$ <>"": WEND          :' Clear Key Buffer.
80  INPUT "Command..";CMND$         :' Input Command.
90  IF CMND$="S1" THEN GOTO 650      :' Type S1 to download the program to Fsrv.
100 IF CMND$="SET" THEN GOTO 230     :' Type SET for initial prameters.
110 PRINT #1,CMND$                   :' Send Command to Fserv.
120 IF LOC(1)<>0 THEN 160            :' Jump 160 after getting answerback frm Fsrv.
130 ANYKEY$=INKEY$
140 IF ANYKEY$<>"" THEN 70
150 GOTO 120
160 LINE INPUT #1, ANS$             :' Read Fsrv's answerback.
170 PRINT ANS$                      :' Display the answerback.
180 IF LOC(1)<>0 THEN GOTO 160
185 'FOR I = 1 TO 200 : NEXT        :' Wait
190 GOTO 70
200 CLOSE                           :' Close the COM1 file.
210 END
220 '
230 'Downloading Initial Parameters
240 RESTORE 340
250 READ X$
260 IF X$="END" THEN 80
270 PRINT #1,X$ : PRINT X$,
280 LINE INPUT #1, B$ : PRINT B$
290 GOTO 250
300 '
310 ' Initial Set Prameters
320 ' (You may want to select the following Parmeters for
330 '   your application.)
340 '  DATA "L10"            :'MDI MODE
350 '  DATA "L4"             :'Reset ERR STOP
360 DATA "L5"              :'AUTO mode
370 '  DATA "L6"             :'STEP mode
380 '  DATA "L7"             :'CONTINUOUS mode
390 '  DATA "L9"             :'CALIBRATION mode
400 '  DATA "L10"            :'MDI mode
410 '  DATA "L13"            :'ORIGIN
415 DATA "L18:1"           :'SELECT FILE #
420 '  DATA "L19"            :'PLC/RS232C mode SW(@)
430 '  DATA "L25:1"          :'OPTIONAL Stop SW (L25:0)
440 DATA "L26:0"           :'COIN ON/OFF SW (L26:1)
450 DATA "L27:0"           :'RETURN Origin SW (L27:1)
460 '  DATA "L28:1"          :'SERVO Initialize (L28:0)
470 '  DATA "L29:1"          :'M Output SW (L29:0)
480 '  DATA "L30:1"          :'FILE DATA TYPE in PLC mode (L30:0)
490 DATA "L35:0:1:0"     :'SERVO ON/OFF & GAIN SW (L35:0:0:0)
500 '  DATA "L36:0:1:0"      :'motor RESET & INHIBIT SW (L36:0:0:0)
510 '  DATA "L37:0:1:0:0"    :'I/P mode & FC & POSW SW (L37:0:0:0:0)
520 '  DATA "L38:0:1:1"      :'SOFT LIMIT sw (L38:0:0:0)
530 DATA "L39:0:0:0"     :'HARD LIMIT sw (L39:0:1:1)
540 '  DATA "L40:0:1"        :'set MOTOR TYPE (L40:0:0)
550 '  DATA "L41:0:10:512"   :'set LOW/HI SPEED (L41:0:13:656)
560 '  DATA "L42:0:0:0"      :'set SOFT LIMIT value (L42:0:0:0)
570 '  DATA "L43:0:100"      :'set ORIGIN OFFSET value  (L43:0:0)
580 '  DATA "L44:0:1:350"    :'set ACC/DCC type & value (L44:0:0:350)
590 '  DATA "L45:0:1"        :'HI ACCURACY comp. sw (L45:0:0)
600 DATA "L46:1:2:24"    :'set INPUT UNIT(dimension) (L46:1:0)
610 '  DATA "L47:0:1"        :'SOFT AXES DISABLE  (L47:0:0)
620 '  DATA "
630 DATA "END"
640 '
650 'Downloading the Operating Program
660 RESTORE 750
670 READ X$
680 PRINT #1,X$ : PRINT X$,
690 LINE INPUT #1, B$ : PRINT B$
700 IF X$="END" THEN 80
710 GOTO 670
720 '
730 ' Operating Sample Program
740 ' (You want to modify the following operating program.)
750 DATA "L15:1"
760 DATA "G91F1000"
770 DATA "R10","X1","G04X200","M888"
780 'DATA "R5","X-4Y2","G04X200","M888"    :'X & Y axes start at the same time.
790 'DATA "R2","X12","Y-2","G04X200","M888" :'Y axis moves after X12.
800 DATA "R4","X6", "G04X400","M888"
810 DATA "R4","X-6","G04X200","M888"
820 DATA "G90X0","G04X1000"
830 DATA "M30","END"
```

# 9. Miscellaneous Functions

## 9-1. Reset Switch

The reset switch resets the FINESERV CPU. During reset, the motor control signals all go to "H", the DI/DO output signals all go to OFF, and all status LED's light.

After reset is released, the unit will recover in about one second if there is no malfunction. On reset, the parameter file statuses do not change, except that all servo parameters go to their initial settings.

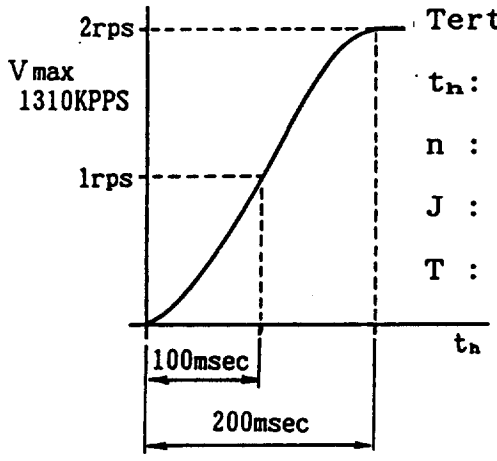
## 9-2 Acceleration/Deceleration Time

Acceleration/deceleration time is set to 1rps irrespective of the motor type.

<Example> 1st axis motor type: 0 L40: 1: 0

Acceleration/deceleration time $t_n$ = 100 m sec

L44: 1: 0: 100




Tertiary spline

$t_n$: Acceleration/deceleration time (sec.)

n : Revolution speed (rps)/Calculated at n=1

J : Load inertia (Kg·m²)

T : Max. motor torque (N·m)

Settings are made in m sec., therefore, enter the $t_n$ value 1,000 times.

## 9-3 Cam Curve

In addition to a straight line (trapezoid) and tertiary spline, 8 cam curves are also available as acceleration/deceleration curves.

The cam curve is designated by the L command or G code as follows.

<L command>

L44: P1: P2: P3

(P1: Axial No.1 to 4)

(P2: Acc type Tertiary spline/0 Straight line/1
Cam curve/2 to 9)

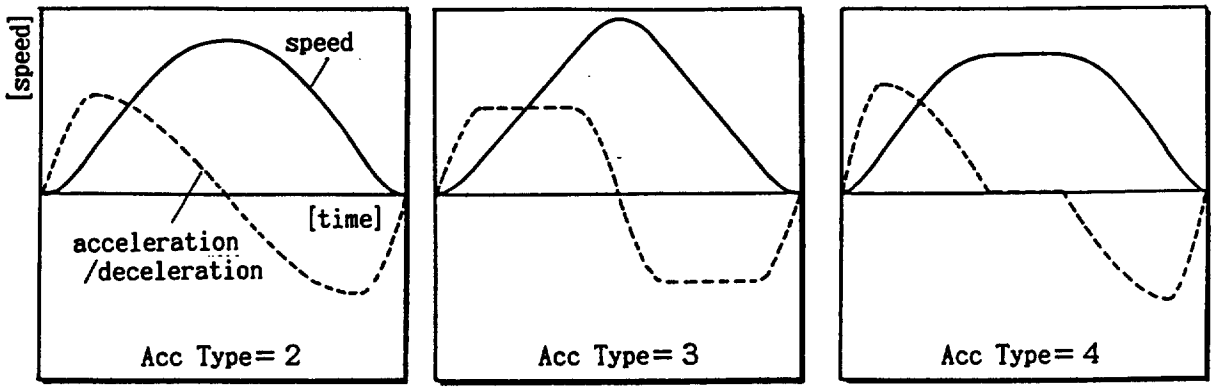
(P3: Acc time Invalid at cam curve)

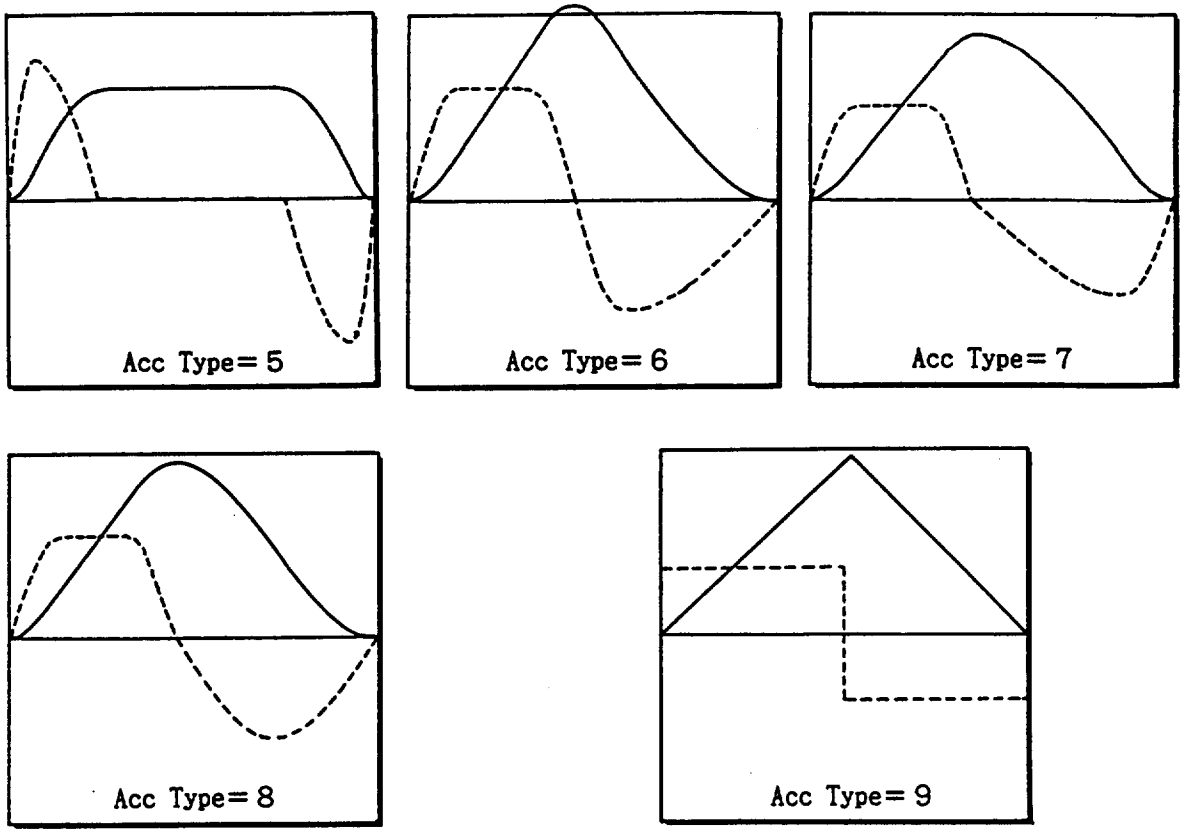
<G code>

G102X Acc Type Y Acc Type Z Acc type W Acc Type
(Acc Type meaning: Same as the <L Command>)

The A, B, C, D axis movement command codes express the time required for movement in m sec. However, an error occurs if the maximum speed exceeds the rated motor speed in a combination of movement time and distance data.

The cam speed and acceleration curves with respect to the ACC type numerals are as shown in the following.






9-4. Absolute Accuracy Compensation (Option)

Although the DYNASERV is a highly precise actuator, there will typically be angular errors of 30 seconds due to internal encoder shape errors, etc. In the FINESERV the origin point is determined by a high-accuracy origin return (± 1 pulse), and with this option it is possible to improve the angular accuracy by measuring and correcting for the errors at several tens of points.

9-5. Program Search

This function is provided so that when executing a program in AUTO mode you can check before execution whether the program contains any errors.

## 9-6. Status Display

The status display makes it possible to monitor the status of individual parameters or the selected file number, etc. using L-codes.

L0 command:

Function: Requests controller, driver status and data, or transmission of individual data item per parameter 1.

Format : L0:P1 P1 is one of 40 codes from 0 to 39. Four data items will be output for each code 1 specified.

(All data are output in hexadecimal, and must be converted to binary as required.)

- /□□CR (1 byte)
- /□□□□CR (2 bytes)
- /□□ △□□ △□□ △□□CR (1 byte x 4)
  X-axis Y-axis Z-axis W-axis
- /□□□□□□□□ △□□□□□□□□ △ (4 bytes x 4)
  X-axis data Y-axis data
  □□□□□□□□ △□□□□□□□□CR
  Z-axis data W-axis data

| L0: | Description | Output Type |
|---|---|---|
| :0 | Error No. Display | 1: |
| 1 | Status display (same as front panel) | 1: (bit pattern display).<br>7 \| 6 \| 5 \| 4 \| 3 \| 2 \| 1 \| 0<br>PLC \| CONT \| STEP \| AUTO \| M-EN \| PROG \| BUSY \| EMG |
| 2 | Status display (L-code parameter status) | 1: (bit pattern display).<br>7 \| 6 \| 5 \| 4 \| 3 \| 2 \| 1 \| 0<br>ABS/INC \| * \| BCD \| COIN \| SV1 \| MOE \| QRE \| FRF<br>Bit 0: Program set status (L18)<br>0: Not set (program selected by L18)<br>1: Set |

| | | |
|---|---|---|
| | | Bit 1: Return-to-origin enable (L27)<br>0: Program start permitted even if return-to-origin not performed.<br>1: Program start prohibited if return-to-origin not performed.<br>Bit 2: M-END signal enable/disable (L29)<br>0: M-END signal disabled mode<br>1: M-END signal enabled mode<br>Bit 3: Servo output at time of power ON or reset (L28)<br>0: Servo always OFF<br>1: Status as set by L35<br>Bit 4: COIN signal enable/disable (L6, G107, 108)<br>0: COIN signal enabled mode<br>1: COIN signal disabled mode<br>Bit 5: PLC mode file selection setting (L30)<br>0: BCD input<br>1: Binary input<br>Bit 6: Not used<br>Bit 7: Operating mode (G90, G91)<br>0: Absolute mode<br>1: Incremental mode |
| 3 | Status display (enabled axes display) | 1: (bit pattern display).<br>7 \| 6 \| 5 \| 4 \| 3 \| 2 \| 1 \| 0<br>* \| * \| * \| * \| W \| Z \| Y \| X<br>1 when enabled, 0 when disabled |
| 4 | Status display (displays axes on which return-to-origin) | 1: (bit pattern display).<br>7 \| 6 \| 5 \| 4 \| 3 \| 2 \| 1 \| 0<br>* \| * \| * \| * \| W \| Z \| Y \| X<br>1 when completed, 0 when not completed |
| 5<br>6<br>7 | | |
| 8 | File No. display | 2: |
| 9<br>10<br>11<br>12<br>13<br>14<br>15 | | |
| 16 | Motor type display | 3: for each axis<br>0: B Series<br>1: A Series |

| | | |
|---|---|---|
| 17 | Acceleration/ deceleration type display | 3: for each axis<br>0: 3rd-order spline<br>1: Linear (trapezoid) |
| 18 | Axis enable/disable, soft limit input type display | 3: (bit pattern display).<br>7 \| 6 \| 5 \| 4 \| 3 \| 2 \| 1 \| 0<br>* \| AXIS VALID \| LIMIT- \| LIMIT+ \| \| \| \| \|<br>Bits 0-3: DIMENSION<br>0: Pulse<br>1: Angle<br>2: Index<br>Bits 4, 5: Soft limit enabled/disabled<br>0: Disabled<br>1: Enabled<br>Bit 6: Axis enabled/disabled<br>0: Disabled<br>1: Enabled |
| 19 | Overtravel enabled/ disabled display | 3:<br>7 \| 6 \| 5 \| 4 \| 3 \| 2 \| 1 \| 0<br>OT(-) \| OT(+) \| * \| * \| * \| * \| * \| *<br>0: Disabled 1: Enabled |
| 20 | Driver settings status | 3:<br>7 \| 6 \| 5 \| 4 \| 3 \| 2 \| 1 \| 0<br>* \| BRK \| INH \| RST \| GAIN \| I/P \| SERVON \| * |
| 21 | Driver settings status | 3: Convert hex display for each axis to binary.<br>7 \| 6 \| 5 \| 4 \| 3 \| 2 \| 1 \| 0<br>* \| * \| POSW1 \| POSW0 \| FN3 \| FN2 \| FN1 \| FN0 |
| 22 | Offset display | 4: |
| 23 | Calibration measurement result | 4: |
| 24 | Data (indicated value) display<br>Absolute position in program | 4: |
| 25 | Soft limit (+) value display | 4: |
| 26 | Soft limit (-) value display | 4: |
| 27 | Low speed value display | 4: |

| | | |
|---|---|---|
| 28 | High speed value display | 4: |
| 29 | Max. speed value display | 4: |
| 30 | Acc. time value (msec) display | 4: |
| 31 | Motor resolution display | 4: |
| 32 | Output speed value display | 4: |
| 33 | Index resolution display | 4: |
| 34 | Position (current value display<br>Absolute value in program (pulse value) | 4: |
| 35<br>36<br>37<br>38 | | |
| 39 | Motor absolute position display | 4:_ |

*: no mean

## 10. Problems and Corrective Actions

| Problem | Corrective Actions |
|---|---|
| ◆Can't communicate with personal computer. | ◇ Check communication cable.<br>◇ Check RS-232C settings at personal computer.<br>◇ Check position controller DIP switch settings. |
| ◆Front panel <ERROR> LED lit, and <READY> flashing. | ◇ Check whether power supply voltage (DC5V) is within ±3%.<br>◇ Check for noise or ripple on power supply line. |
| ◆No LED's lit. | ◇ Check power supply: polarity, and voltage correct?<br>◇ Check for blown fuse. |
| ◆Servo won't turn ON. | ◇ Turn on RESET switch.<br>◇ Memory backup battery dead.<br>(When battery dies, initial status information is destroyed. Do an ALL CLEAR with L49:99, then turn on RESET switch. You should finish battery replacement within 5 minutes after turning power OFF.) |
| ◆Error code was received. | ◇ Clear error per error code table. |
| ◆"READY" not returned at completion of operation. | ◇ Check motor tuning.<br>(Default enables motor settling (COIN) signal. Since if the motor is poorly tuned it may not settle, try returning the motor. Note that in the case of P action the torque depends solely on the position error, the motor will not settle if the settling width is too narrow. In such cases you should disable the COIN signal.) |
| ◆Can't start from PLC. | ◇ Check on panel LED whether unit is switched to PLC mode. |
| ◆Return-to-origin doesn't stop at end. | ◇ Driver feedback pulse output form is in U/D phase. Switch to A/B phase. |

- Yokogawa will repair free of charge any failures occurring under proper conditions of use due to manufacturing defects, for one year after date of purchase.
- If you believe that the unit has failed, please contact your Yokogawa sales or service person immediately.

# III. Reference Materials

## 1. Appendix Tables

### (1) Positioning Controller Function Summary

**Operating Mode Functions**

- AUTO
- STEP
- CONTINUOUS
- MDI
- ORIGIN

**Remote Functions**

- RS232C mode
  - ① Teaching box
  - ② Host computer
- Sequencer mode

**File Management Functions**

- FILE OUT
- FILE IN
- FILE DELETE
- DIRECTORY OUT

**Statement Functions**

- Operating mode setting
- Remote setting
- Return to origin parameter entry
  - ① Return to origin speed
  - ② Return to origin offset
- Coordinate setting
  - ① OFF SET 1
    OFF SET 2
  - ② Software limit
- Acceleration pattern setting
  - ① Trapezoidal
  - ② 3rd-order spline
  - ③ Cam curve
- Speed setting
  - ① HIGH SPEED (fast feed)
  - ② LOW SPEED (speed during return to origin)
- Acceleration setting
  - ① Acceleration time
- DIMENSION setting
  - ① Pulse setting
  - ② Angle setting
  - ③ Index setting
- File management
- Program selection
- Absolute accuracy compensation setting
  - ① Secondary compensation value entry
  - ② High-order compensation value entry
  - ③ Compensation type selection
- Program control setting
  - ① Optional stop
  - ② Block delete
  - ③ Block skip
- M-END signal enable flag
- LIMIT ENABLE FLAG
  - ① Overtravel
  - ② Soft limit
- ORIGIN ENABLE FLAG
- SERVO UNIT
  Servo unit initial status selection (servo ON or OFF)
- Motor type setting
  - ① DD series
- DYNASERV status setting
  - ① SERVO ON
  - ② GAIN
  - ③ RST
  - ④ INH
  - ⑤ IACT/PACT
  - ⑥ FN –
  - ⑦ POSW –

**Program Functions (1)**

- G-codes (PREPARATORY FUNCTION)
  1) G00: fast feed
  2) G04: dwell
  3) G27: return to origin (hard)
  4) G28: return to origin (soft)
  5) G90: absolute value mode
  6) G91: incremental value mode
  7) G92: Coordinate system reset
  8) G101: No. of indexes setting
  9) G102: cam curve
  10) G103: set acceleration time
  11) G104: pulse mode
  12) G105: angle mode
  13) G106: index mode
- M-codes (MISCELLANEOUS FUNCTION)
  1) M00: Program stop
  2) M01: Optional stop
  3) M02: } End of program
  4) M030: }
- Other 2-digit codes output as BCD via DO

- Special M-codes
  1) M100-115: X-axis FC setting
  2) M120-123: X axis COIN width setting
  3) M130,131: X-axis I/P action
  4) M140~147: X-axis gain sets
  5) M200 - : Y-axis (same as above)
  6) M300 - : Z-axis (same as above)
  7) M400 - : W-axis (same as above)

**Program Functions (2)**

- X, Y, W, Z (DIMENSION WORD)
- A, B, C, D (X, Y, Z, W FEED)
- F (FEED FUNCTION)
- P (JUMP)
- Q (CALL)
- R (FOR NEXT)

**DI/DO Functions (for PLC)**

- DI 16 bits
  Lower 8 bits FUNCTION
  Upper 8 bits DATA
- DO 16 bits
  Lower 8 bits FUNCTION
  Upper 8 bits DATA
  (2-digit BCD M-code output)

**Communication Functions**

- RS232C (serial communications)
  - ① 1 channel
  - ② asynchronous
  - ③ 9600, 4800, 2400, 1200 BPS
  - ④ 1 start bit
  - ⑤ 1 stop bit
  - ⑥ data length 8 bits
  - ⑦ even, odd, or no parity

  (hardware shared by TBX and host computer)

**Miscellaneous**

- 1 to 4 axis selection
- Internal DIP switches

(2) G-Codes (Preparatory Functions) -- 3 digits max.

1) G-Code Summary

| CODE | FUNCTION | FORMAT/RULES |
|---|---|---|
| G 00 | Fast feed | G 00 X_ Y_ Z_ W_ position data |
| 04 | Dwell | G 04 X_ Max value 600,000 msec |
| 27 | Return to origin (hard) | G 27 X_Y_Z_W_ |
| 28 | Return to origin (soft) | G 28 X_Y_Z_W_ |
| 90 | Absolute value input | |
| 91 | Incremental value input | |
| 92 | Coordinate settings | G 92 X_ Y_ Z_ W_ position data |
| 101 | Index mode division count setting | G101 X_ Y_ Z_ W_ index data |
| 103 | Acceleration/deceleration time setting | G103 X_ Y_ Z_ W_ Acceleration/ deceleration rate data (msec) |
| 104 | Pulse mode | G104 X Y Z W Axis code only |
| 105 | Angle (degree) mode | G105 X Y Z W Axis code only |
| 106 | Index mode | G106 X Y Z W Axis code only |
| 107 | COIN disable | |
| 108 | COIN enable | |

2) Details

G00: Function -- Select speed set by L41 parameter P3.
FORMAT -- [G00X] position data
G04: Function -- Set waiting time (timer) for axis following.
Data becomes timer setting.
FORMAT -- [G04X____] timer data (in msec, range 0 to 600,000 msec)
G27: Function -- Return to mechanical origin.
FORMAT -- [G27X____] only axis number specified.
G28: Function -- Return to software origin. Return speed is that previously set. If OFFSET not set, position on return to origin is same as G27 mechanical origin.
FORMAT -- [G28X____] only axis number specified.

G90: Function -- Select absolute value input mode.
FORMAT -- [G90] Note: Mode remains unchanged until G91 (incremental mode) is input. Default is absolute value mode.

G91: Function -- Select incremental input mode.
FORMAT -- [G91] Note: Mode remains unchanged until G90 (absolute value mode) is input or defaults are selected by ALL CLEAR.

G92: Function -- Change current absolute values to specified values.
FORMAT -- [G92X_Y_Z_W_] Data is same as usual position data. Same for angle input or index input. Note: When using so as to cause continuous rotation, clear absolute value with this code [G92X0] before internal counter overflows.

G101: Function -- Change number of divisions for index mode.
FORMAT -- [G101X_Y_Z_W_]
Notes: ① Executing this code sets the origin to the current position. To prevent the coordinates from changing, return to origin with G28 (or G27) before executing this.
② Executing this code also changes the L-code L46 parameter P3. Must be set again when returning to original condition.

G 102: Function -- Sets cam curve

FORMAT -- [G102 X__Y__Z__W__]

G103: Function -- Sets acceleration/deceleration time.
FORMAT -- [G103X_Y_Z_W_] Data becomes acceleration/deceleration time (in msec). Acceleration/deceleration time is time to achieve rated speed from 0.

G104-106: Function -- Change input units.
FORMAT -- [G104X__] only axis specified
[G104] change to pulse mode
[G105] change to angle mode
[G104] change to index mode
Notes: ① Executing this code sets the origin to the current position. To prevent the coordinates from changing, return to origin with G28 (or G27) before executing this.
② Executing this code also changes the L-code L46 parameter P2. Must be set again when returning to original condition.

G107, 108: Function -- Enables or disable COIN.
FORMAT -- [G107] disable COIN
[G108] disable COIN
Note: Executing this code also switches the L-code L46 parameter P1. Must be set again when returning to original condition.

(3) M-Code (Auxiliary Function) 3 digits max.

| CODE | FUNCTION |
|---|---|
| M 00 | Program stop: If in program, stop program. Next block will be first block executed on restart. |
| 01 | Optional stop: If in program, and L25 parameter P1 is 1 (optional stop enabled), then program stops. Next block after stop point will be first block executed on restart. |
| 02, 30 | End of program: When program ends, first block of program becomes next execution block. |
| 100 to 115 | X-axis FC setting -- FC values 0 to 15 correspond to 110 to 115.<br>Note: Executing this command also changes L37 parameter P3. Must set again to return to original condition. |
| 120 to 123 | X-axis COIN width (motor positioning completion band) setting -- COIN width settings POSW 0, 1 for 0 to 3 correspond to 120 to 123.<br>Note: Executing this command also changes L37 parameter P4. Must set again to return to original condition. |
| 130 to 131 | X-axis motor I/P control mode selection; 130...IACT 131...PACT<br>Note: Executing this command also changes L37 parameter P2. Must set again to return to original condition. |
| 140 to 147 | X-axis gain setting by motor type |
| 240 to 247 | ( same as M140~147) |
| 340 to 347 | ( same as M140~147) |
| 440 to 447 | ( same as M140~147) |
| M888<br>M999 | Used as "NEXT" for FOR NEXT branching instruction.<br>Used as "RETURN" for GOSUB RETURN branching instruction. |

## 2. Specifications

| | Item | Specification |
|---|---|---|
| General | Power supply voltage and current | DC5V ±3%, 2A |
| | Memory power | Lithium battery, 20,000 hr. |
| | Construction | Rackmount type |
| | Outer dimensions | See drawings |
| | Weight | 1.4 kg (1-axis), 1.6 kg (2-axis), 2.0 kg (3-axis), 2.2 kg (4-axis) |
| | Operating temperature range | 0 to 50 degC (humidity 20 to 90% RH) non-condensing |
| | Storage temperature range | -20 to 80 degC (humidity 20 to 90% RH) non-condensing |
| | Vibration | Conforms to JIS C-0911 (2G, excluding resonance points) |
| | Shock | Conforms to JIS C-0912 |
| Performance | Control axes | Up to 4 axes |
| | Control functions | Point to point |
| | Control language | NC language |
| | Maximum command value | 9 digits numeric value (±999999999) |
| | Output frequency | 1 kHz to 1.5 MHz (minimum setting unit 1kHz) |
| | Acceleration/deceleration | Trapezoidal, 3d-order spline, (1 msec to settings 32 msec, in 1 msec increments) |
| | Programming methods | Personal computer, Teaching Box |
| | Control command | Contact (sequencer), RS-232C (personal computer, switching box) |
| | Functions (parameter setting) | Operating mode (auto, single, continuous) Control mode (Teaching Box, personal computer)<br>Return to origin parameters<br>Coordinate setting<br>Motor type, motor setting conditions<br>Acceleration curve time, pattern<br>Speed<br>Position (pulse, 1/1000 degree, index divisions)<br>Timer (dwell) (1 msec to 10 sec in msec increments)<br>Acceleration/deceleration (variety of cam curves) |
| | Indicators (LED) | Status information (10 points)<br>RDY, ERR, EMG, BUSY, PROG, M-EN, AUTO, STEP, CONT, PLC |
| Programming | | Approximately 3200 blocks(32Kbytes), 128 program files max.<br>Block types/language codes<br>G: preparatory functions<br>XYZW: dimension word<br>ABCD: feed for XYZW<br>F: feed function<br>M: miscellaneous<br>P, Q, R: jump, call, for next<br>N: sequence number |
| Options | | Absolute accuracy compensation (motor and set) |

## 3. External Drawings (unit: mm)

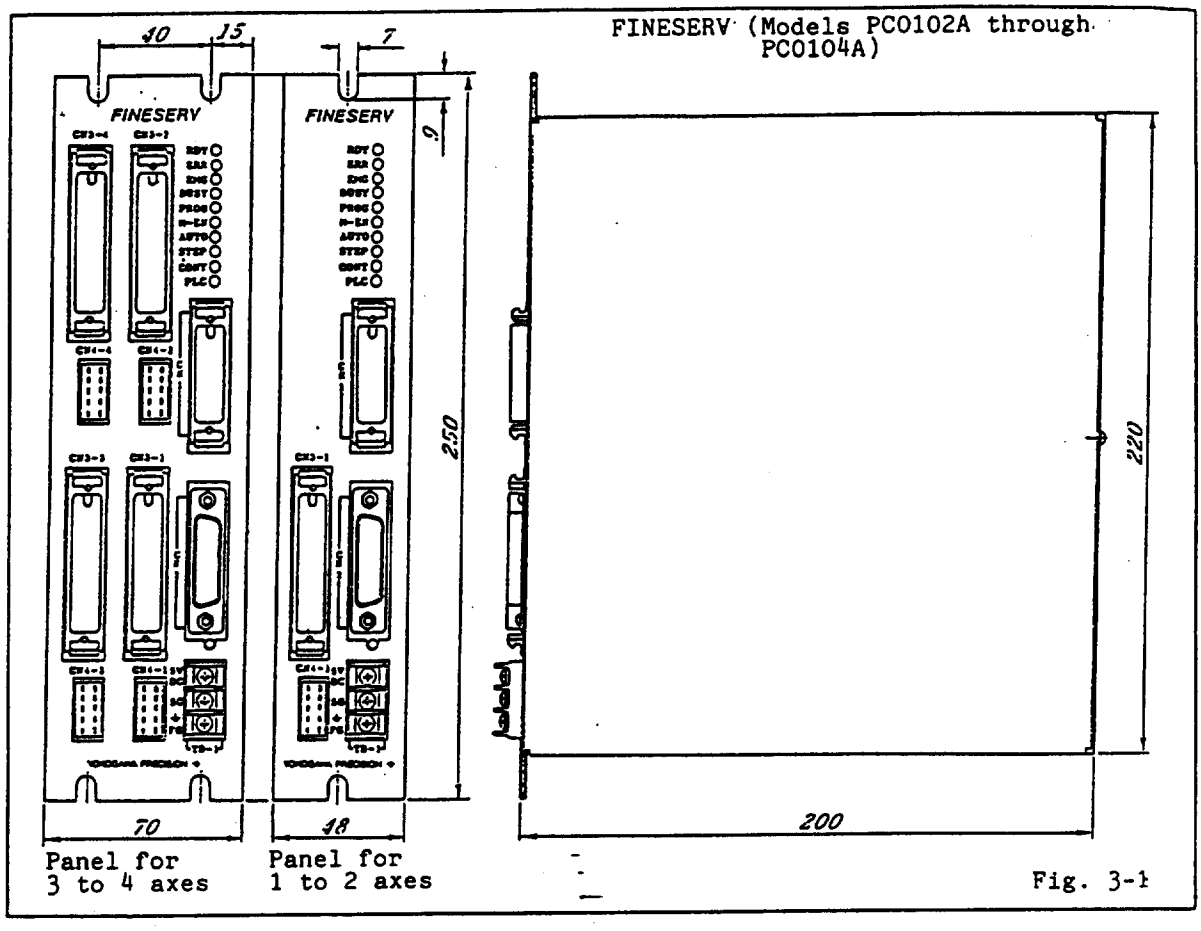



Fig. 3-1

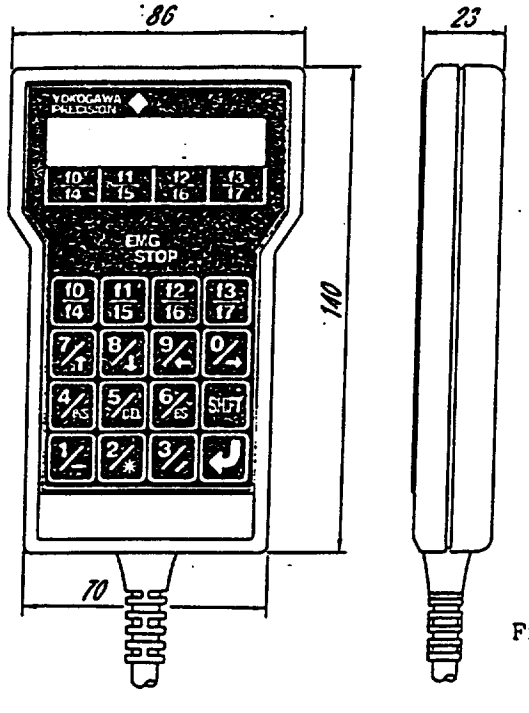
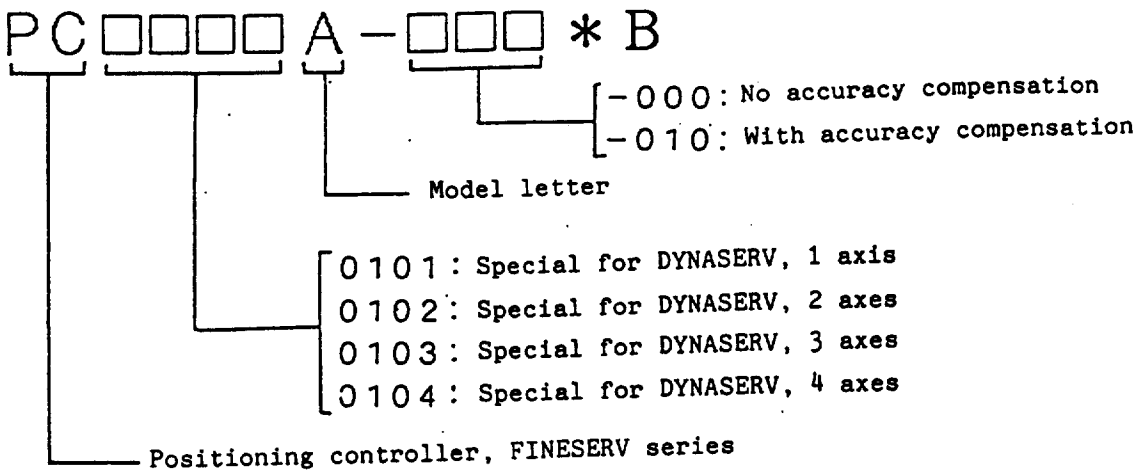



Fig. 3-2
Teaching box
(Model PC000AT)

With 1.5 m cable terminated with RS232C communication connector

## 4. Model Codes

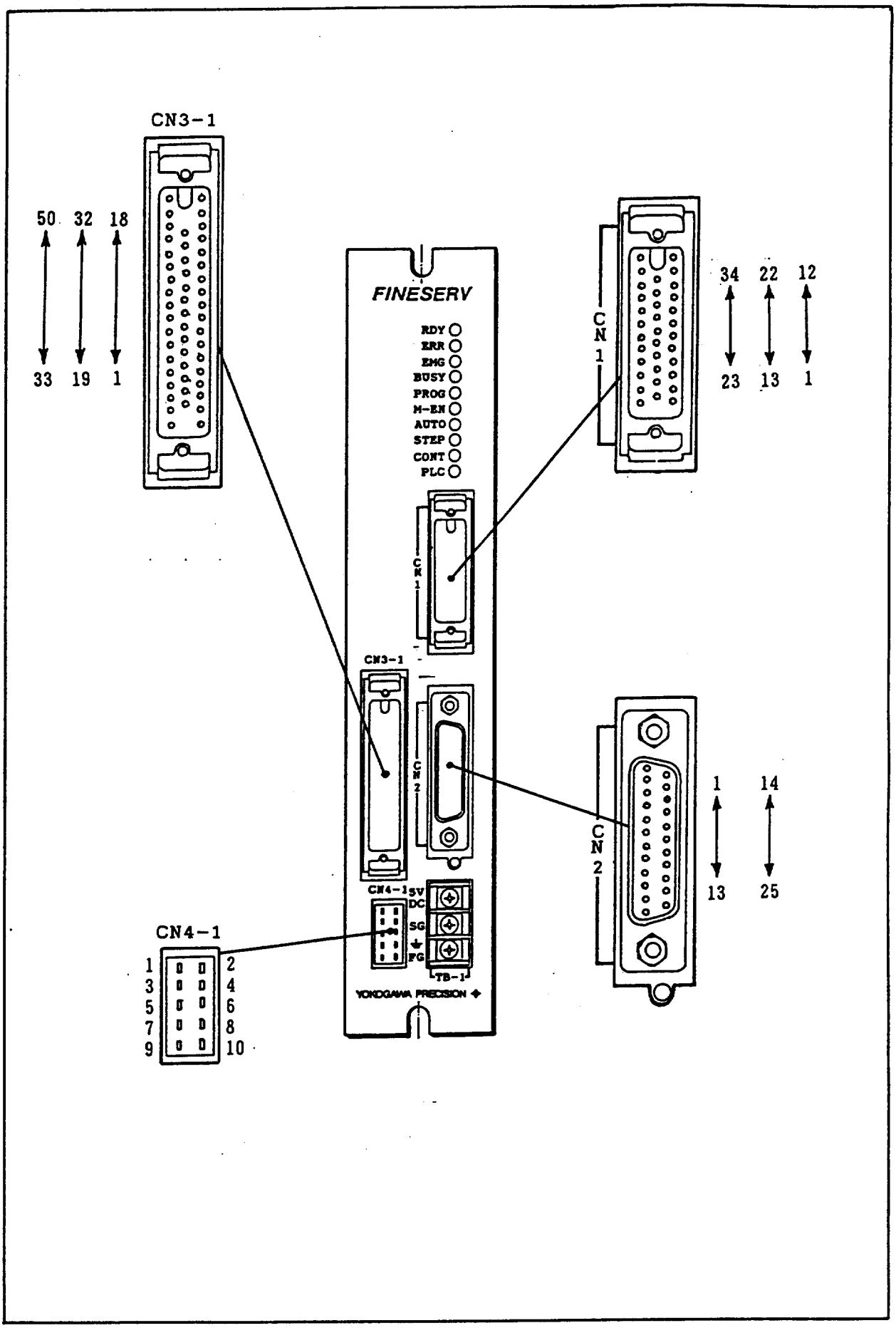



Example: PC0102A-010 "FINESERV"/2 axes with accuracy compensation

## 5. Optional Parts

| Model No./Part No. | Name | Reference |
|---|---|---|
| CP0303S-002 | Cable (0.2m) | FINESERV to DYNASERV (with 50P connector both ends) |
| CP0303S-004 | Cable (0.4m) | |
| CP0303S-010 | Cable (1m) | |
| CP0303S-020 | Cable (2m) | |
| 0P001C | Power supply (5 VDC/3 A) | Nagoya Power, Model ELCO-K10A-5 |
| 0F001C | Power filter | TDK, Model ZGB2203-01U |

## 6. Connectors Pin No. (CN 1-CN 4)



## —— ANY QUESTIONS ——

PLEASE CONTACT

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