SHARP SERVICE MANUAL

CODE: 00ZMZ1E02//-E

GP I/O INTERFASE

MODEL MZ-1E02

CONTENTS

SHARP CORPORATION

1. WHAT IS A GP I/O INTERFACE?

The General Purpose Input/Output Interface (GP I/O) is designed for connecting general low-speed peripheral units (e.g. measuring instruments, printers, X-Y plotters, etc.) and providing information exchange between the main computer unit and peripheral devices in a parallel I/O mode.
However, there are many different standards and features in parallel interfaces, and they do not always provide satisfactory information exchange for units having parallel interfaces.
It is requested that the user fully understand this instruction manual and specifications of the peripheral units before using this I/O interface.
Sharp cannot provide either hardware or software support for special customer applications. Moreover, Sharp cannot in any way be responsible for damages that arise as a result of customer misuse.
However, this instruction manual describes information necessary for exchanging information between the main computer unit and peripheral units in so far as is possible.

2. SPECIFICATIONS

Model:	MZ-1E02
Input/output mode:	Parallel input/output mode (byte serial)
Number of channels:	1 channel
Input ports:	12 pins (8 data input pins and 4 control signal input pins)
Output ports:	12 pins (8 data output pins and 4 control signal output pins)
Data code:	8-bit ASCII or 7-bit ASCII code
Data rate:	Approximately 5 K bytes/sec. max.
Transmission mode:	Automatic handshaking or manual mode
Parity format:	Even parity, odd parity, or no parity bit
Command words:	GMODE, GSET, GIN, GOUT, and GBIT
Electronic components:	Integrated circuits and discrete components
Operating temperature:	10 to 35°C
Outer dimensions:	140 (W) x 142 (D) x 15 (H) mm
Weight:	160 g
Accessories:	Instruction manual (this manual), FDOS Master

Note: One main computer unit can accomodate up to two interface units (i.e. two channels).
The interface unit is mounted in slot 1, 2, 3 or 4 of MZ-1U02 Option Expansion Unit taht mounted in the Model-3500 Series Business Computer Main Unit (for two units combinations of slots 1 and 3 or slots 2 and 4 are not allowed). The channel number is determined by the slot number of the interface unit:

Slot 1 or 3 .... Channel number: 0
Slot 2 or 4 .... Channel number: 1

Two interface units may be mounted in any of four combinations:

Combination	Slot 1	Slot 2	Slot 3	Slot 4
1	Channel 0	Channel 1	X	X
2	Channel 0	X	X	Channel 1
3	X	Channel 1	Channel 0	X
4	X	X	Channel 0	Channel 1

3. DATA INPUT/OUTPUT FORMAT

The input/output format for data and control signals including positive/negative logic, code length (8-bit/7-bit code), and parity mode (even parity/odd parity/no parity) should be set up in accordance with the input/output format of the peripheral unit to be connected. The method of setting the format will be described in Part VII, Programming, p.1 5.

1. 8-BIT CODE AND 7-BIT CODE

8-bit code uses eight bits (eight pins) to express data and the 7-bit code uses seven bits (seven pins) to express data. Either 8-bit or 7-bit code can be set for this I/O interface. This interface unit has eight pins for each data input and output, and setup of the 7-bit code permits the use of the remaining bit (one pin) as a parity bit, as will be described below.

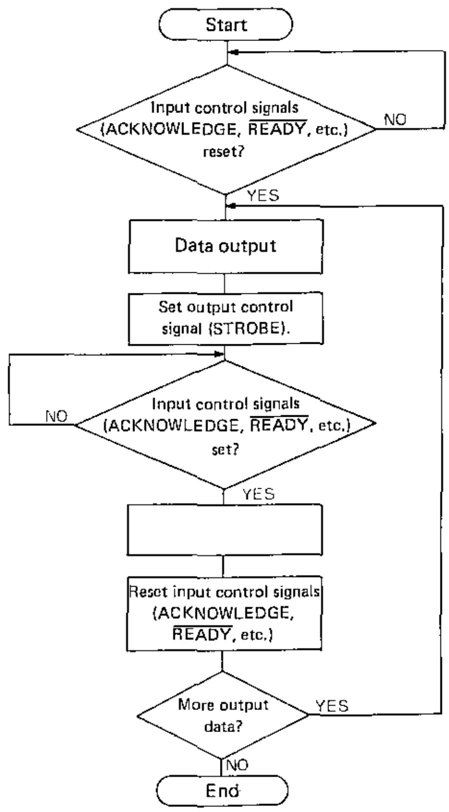
2. PARITY CHECK

A parity bit can be added to 7-bit data so as to provide a parity check of the data. An even parity check verifies that the total number of 1 (logical "1") bits of data and the parity bit is an even number, and an odd parity check verifies that the total number of 1 bits is an odd number. This I/O interface can be set to either an even parity check, odd parity check or no parity check when the 7-bit code is used.

3. AUTOMATIC HANDSHAKING MODE

Automatic handshaking is one of the data transmission modes, and it generally transfers data automatically in the following procedures. Although automatic handshaking is a basic feature of this I/O interface, manual mode can also be selected.

Data transmission in the automatic handshaking mode (data output).



Data input is handled similarly.

4. **POSITIVE LOGIC AND NEGATIVE LOGIC**
This I/O interface can be set for positive logic or negative logic independently for input data, output data, input control signals, and output control signals. The logical mode of output control signals is set by the DIP switch on the interface PC board and the logical mode of other signals is set using a command word (GSET command). For further details, see Part VII, Programming, p. 15 and Appendix 4, Setup of the DIP switch, p. A–5.

4. INPUT/OUTPUT PINS

1. **INPUT PINS**
This I/O interface has 12 input pins, eight for data and four for control signals.
The 12 input pins correspond to signals I1 through I12. Signals I1 to I8 are data signals and I9 to I12 are control signals. These signals have the following magnitudes (weights):
1. I1, I9 .... 2^0
2. I2, I10 .... 2^1
3. I3, I11 .... 2^2
4. I4, I12 .... 2^3
5. I5 .... 2^4
6. I6 .... 2^5
7. I7 .... 2^6
8. I8 .... 2^7 or used as a parity bit or not used.

2. **OUTPUT PINS**
This I/O interface has 12 output pins, eight for data and four for control signals.
The 12 output pins correspond to signals O1 through O12. These signals have the following magnitudes (weights):
1. O1, O9 .... 2^0
2. O2, O10 ...... 2^1
3. O3, O11 ...... 2^2
4. O4, O12 ...... 2^3
5. O5 .... 2^4
6. O6 .... 2^5
7. O7 .... 2^6
8. O8 .... 2^7 or used as a parity bit or not used.

After power has been switched on, signals O1 to O8 are ON (high level) and signals O9 to O12 may be ON (high level) or OFF (low level) as set by the DIP switch on the interface PC board. For further details, see Appendix 4, Setup of the DIP switch, p. A–5.

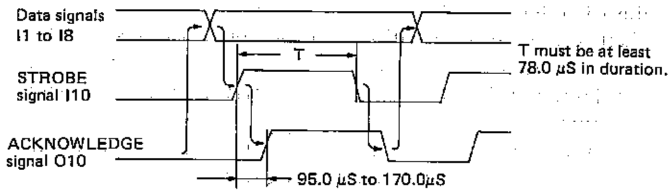
3. **ELECTRICAL CHARACTERISTICS OF INPUT/OUTPUT PINS**

1) Output signals
ON (high) : > 2.4 V 0.25 mA
OFF (low) : < 0.5 V 48 mA

2) Input signals
ON (high) : 2.0 ~ 5.25 V
OFF (low) : -0.5 ~ 0.5 V
Maximum input voltage : 5.25 V

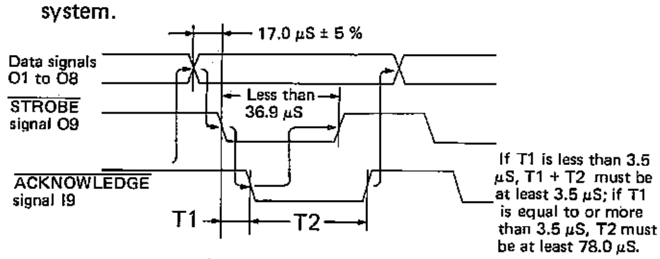
5. SIGNAL TIMING IN AUTOMATIC HANDSHAKING MODE

1. **SIGNAL TIMING FOR DATA INPUT**
For data input in the automatic handshaking mode, signal lines I1 to I8 are used for input data, I10 is used for the STROBE signal in data input and O10 is used for the ACKNOWLEDGE signal which indicates that the interface unit (MZ-1E02) has received data.
The following illustrates the timing of signals, assuming that signals on lines I10 and O10 are in a positive logic system.



The ACKNOWLEDGE signal on signal line O10 can be replaced with the READY, REQUEST TO SEND (transmission request) or the BUSY signal.

2. **SIGNAL TIMING FOR DATA OUTPUT**
For data output in the automatic handshaking mode, signal lines O1 to O8 are used for output data, O9 is used for the STROBE signal and I9 is used for the ACKNOWLEDGE signal which indicates that the peripheral unit has received data. The following illustrates the timing of signals, assuming that signals on lines O9 and I9 are in a negative logic system.



The ACKNOWLEDGE signal on line I9 can be replaced with the READY, REQUEST TO SEND (transmission request) or the BUSY signal.
As described above in aautomatic handshaking, signal lines I1 to I8 are used for data input and I10 and O10 are used for control signals during data input. Signal lines O1 to O8 are used for data output and O9 and I9 are used for control signals. Input lines I11 and I12 and output lines O11 and O12 are not used in the automatic handshaking mode and these lines can be used arbitrarily. The following shows some examples of signals to be transmitted on these four lines. Also refer to the GBIT command, p. 30.

Signal line	Example of signal
I11, I12	ERROR signal, WARNING signal, PAPER END signal, ALARM signal, FAULT signal, WAIT signal, etc.
O11, O12	MACHINE SELECT signal, REMOTE POWER-ON signal, INITIAL RESET signal, FAULT RESET signal, etc.

Note: If data input or output does not operate satisfactorily in the automatic handshaking mode and the system hangs up in the wait state (e.g., the system waits for the STROBE signal in data input or the ACKNOWLEDGE signal in data output), the system can be released from this state by pressing the HALT button.

6. CONNECTION OF PERIPHERAL DEVICES

1. PERIPHERAL DEVICES THAT CAN BE CONNECTED.
General low-speed peripheral devices (e.g., measuring instruments, printers, X-Y plotters, etc.) having parallel interfaces can be connected. The Model-3500 Series Business Computer Main Unit can also be connected to another computer having a parallel interface.
Processing of control signals and operation (timing) of the automatic handshaking modes differ for each device and the specifications of each device must be satisfied. For further details, see the following paragraph.

2. PRECAUTIONS FOR CONNECTION
The user should first carefully check the specifiecations of each peripheral device before connection is made.
This paragraph describes general precautions.
   1) **Electrical characteristics of the input/output pins**
   Confirm that the peripheral device to be connected satisfies the characteristics shown in Part IV, 3, Electrical characteristics of input/output pins, p. 0.
   In particular, make sure to check that the output voltage of the peripheral device does not exceed the maximum input voltage of the MZ-1E02 interface. Excessive signal voltage can cause damage to the interface unit.
   2) **Automatic handshaking mode**
   Confirm that data is transmitted to the peripheral device in accordance with the flow chart for data transmission, as described in Part III, 3, Automatic handshaking mode, p. 8. The timing of the signal on line O10 at data input and the signal on line O9 at data output must satisfy the specifications of the peripheral device.
   The setup time for the signal on line I10 at data input and the signal on line I9 at data output must be long enough, as specified, to achieve satisfactory data transmission.
   3) **Manual mode**
   If data transmission does not operate satisfactorily in the automatic handshaking mode, carry out data transmission in the manual mode where control signals are input and output by the program (GBIT command). Data transmission in the manual mode takes 10 seconds or more, and the timing of each control signal must be considered carefully.
   4) **Other**
   When a printer is connected as a peripheral device, set the CR code of the printer to the carriage return (without line feed) function, i.e., turn off the automatic line feed. A CR code and an LF code are output automatically following data output.

3. CONNECTING PROCEDURE
Note) **Switch off the power supplies to the Model-3500 Series Business Computer Main Unit and peripheral devices before making connection.**
   1) **Installing the MZ-1E02**
   Install the MZ-1E02 in one of slots 1, 2, 3 or 4 of MZ-1U02 Expansion Unit that mounted in the Model-3500 Series Business Computer Main Unit. After installation, secure the MZ-1E02 with screws that closed the slot cover.
   The interface unit is assigned channel 0 when it is mounted in slot 1 or 3, or the unit is assigned channel 2 when it is mounted in slot 2 or 4. (See the following table.)

Slot number	1	2	3	4
Channel number	0	1	0	1

   2) **Wiring**
   Solder the each loose wire of optional GP I/O interface cable [MZ-1C19] with a proper connector of peripheral device according to Appendix 3. MZ-1E02 Contact signal table. Connect all GND lines (24 wires) of the cable to the GND pins of the peripheral device.
   Extension of the cable must be within 2 meters and sufficient precautions must be taken for noise protection to ensure reliability.
   3) **Attaching the connector**
   Connect the interface MZ-1E02 and the peripheral device with the cable [MZ-1C19].
   And then fasten it with two screws on the both end sides of the connector.
   4) **Power-ON**
   Set the GP I/O interface controlling FDOS Master disk (accessories) in the Mini-Floppy Disk Drive unit (channel-drive number A0) that located on the right hand side of the Model-3500 Series Business Computer Main Unit.
   Turn power on the peripheral device (CRT display, etc.), then the Model-3500 Series Business Computer Main Unit.
   (The FDOS Master attached with Model-3500 Series Business Computer Main Unit and that of version No. V2.0 are not applicable.)

7. PROGRAMMING

For ease of understanding of the syntax and rules of command words, the syntax notation is defined as follows. This notation is effective only in describing the syntax and rules, and should not be used in actual programs.

Symbol	Meaning
|	Indicates the separation for selection.
[ ]	The part enclosed in brackets [ ] can be omitted. When this is omitted, the function is merely invalidated or a different function is validated.
{ }	The part enclosed in braches { } can be written repeatedly using a comma (,).
⟨ ⟩	The aprt enclosed in angles ⟨ ⟩ can be written repeatedly using a semicolon (;).
n	Indicates an iteger. (Example: 10)
S, T	Indicates a character constant. (Example: "NAME")
A	Indicates a numeric variable (including a numeric array variable). (Example: NO)
A$	Indicates a $- or @-type character variable (including character array variable). (Example: DA$)
N	Indicates a variable (numeric or character variable) (including an array variable).
X, Y, Z	Indicates a numeric expression.
C, D, E	Indicates a character string.
——→	Indicates a flow of syntax.
	Indicates selection.
	Indicates repetition.
	Indicates omission.

Note 1) **In actual operation, ENTER key must be pressed at the end of each program step. (For multiple statement entry, statements must be separated using a colon (:).)**

Note 2) **Enter the program with the MZ-1E02 installed.**

1. GMODE

This command sets up the input/output channel modes.

The setup modes include the automatic handshaking mode or manual mode for input/output ports, 8-bit or 7-bit code for the automatic handshaking mode, and the parity check mode.

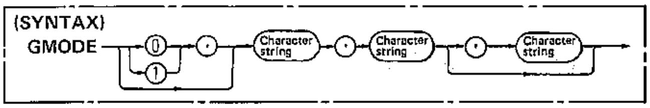
Format) GMODE 〔X,〕 C, D 〔,E〕

X : Channel number (0, 1)

C : Port
- I .... Input port
- O .... Output port

D : Mode
- A .... Automatic handshaking mode
- B .... Manual mode

E : Data format
- 8 .... 8-bit code
- 7E .... 7-bit code with even parity bit
- 7O .... 7-bit code with odd parity bit
- 7 .... 7-bit code without parity bit



Numeric expression X selects the channel with character string C selecting which port and character string D selecting the mode (automatic handshaking mode/manual mode). When the automatic handshaking mode is specified by D, data format can be specified by the character string E. If 〔X,〕 is omitted, channel 0 is set automatically. If E is omitted in the specification of the automatic handshaking mode, 8-bit data code is set automatically. After power has been switched on, the input and output ports of each channel are set to the automatic handshaking mode with 8-bit data code.

Note) For data I/O in the 7-bit ASCII code system, the SI/SO (shift-in/shift-out) state is automatically set to SI by execution of this command.

Example) `10 GMODE "O","A","7E"`

This program specifies the automatic handshaking mode for 7-bit code with even parity check for the output port of channel 0.

Addendum) SI/SO (shift-in/shift-out)

The 7-bit ASCII code system has the SI/SO state for handling as much data as an 8-bit code system does.
The SO code (CHR$ &0E) switches the SI state to the SO state, and the SI code (CHR$ &0F) switches the SO state to the SI state. Accordingly, data in the 7-bit ASCII code system includes SI codes and SO codes. These codes must be taken into consideration in programming when the amount of data is significant. The SI and SO states are independent for the input and output ports and for each channel.
After power has been switches on, the SI state is automatically set.

2. GSET

This command specifies the logical polarity of input/output data signals and input control signals.

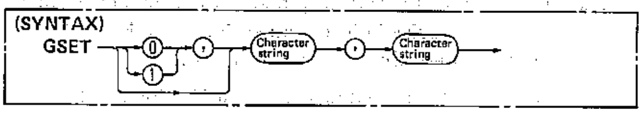
This command is effective only for channels and ports in the automatic handshaking mode.

Format) GSET 〔X,〕 C, D

X : Channel number (0, 1)

~~C : Type of signals~~
- ID .... Input data signals
- OD .... Output data signals
- IC .... Input control signals

D : Positive logic/Negative logic



This command specifies the logical polarity of signals on a channel, as indicated respectively by the character strings D and C, and the expression X.
The logical polarity of signals can be specified in two ways:

i) Specification for a group of signals (8 data bits or 4 bits) as designated by string C:
Character string D: Positive logic .... "1"
Negative logic .... "0"

ii) Specification of individual signals as designated by character string C:
Character string D:
Example for input control signals:

```
"0 1 0 1"
 ↑ ↑ ↑ ↑
 │ │ │ └──Positive logic for signal I9
 │ │ └────Negative logic for signal I10
 │ └──────Positive logic for signal I11
 └────────Negative logic for signal I12
```

If 〔X,〕 is omitted, the logical polarity for channel 0 is set.
After power has been switched on, positive logic is set for all input/output data signals and input control signals for each channel.

Example) `10 GSET "OD","0"`

This program specifies negative logic for all output data signals (8 bits) on channel 0.

Addendum) The logical polarity of the output control signals is set by the DIP switch on the interface PC board. (This command cannot be used for that purpose.) For details, see Appendix 4, Setup of the DIP switch, p. A–5.

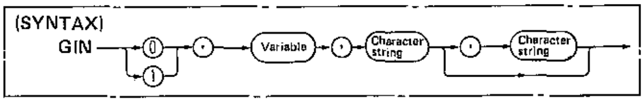
3. GIN

This command enters data.

The syntax differs in the automatic handshaking mode and manual mode. Format 1 applies to the automatic handshaking mode input command, and Format 2 applies to the manual mode input command.

Format 1) GIN X, N, C [, D]

X : Channel number (0, 1)
N : Variable for inputting data
C : End code 1
D : End code 2



This command (**Format 1**) is used in the automatic handshaking mode.
The GIN command inputs data to variable N unitl end codes are read (will be described shortly) as designated by the character strings C and D for a channel as designated by the numeric expression X. The end codes are not input to the variable N.
If the area for variable N overflows, ERROR 205 occurs.
The NULL code has no effect and is not input to the variable. For character strings C and D, only the first character is valid as an end code.

- End code
  When one end code is specified (,D is omitted), data is input until the end code as designated by the character string C is met.
  Whe two end codes are specified, data is input until one of the end codes as designated by character strings C or D is met. In this case, if the end code as designated by character string C is met, the succeeding statement will be executed next. If the end code as designated by character string D is met, the statement in the subsequent program step will be executed next.

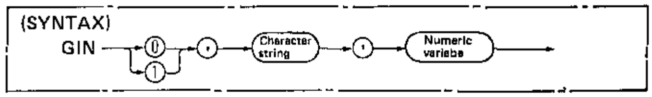
Example)
```
10 GIN 0,A$,CHR$ &7F,CHR$ &0D:GO TO 10
20 DISP "A$=";A$
```

This program inputs data to the character variable A$ until the DEL (delete) code (i.e. CHR$ & 7F) or CR (carriage return) code (i.e. CHR$ & 0D) is met.
Upon input of the DEL code the statement 'GO TO 10' will be executed next, or upon input of the CR code, the statement 'DISP "A$=" ;A$' in the subseqûent program step will be executed next.

Note 1) **Null code is invalid to input even in @-type character variables.**
Note 2) **For input data in negative logic as specified by the GSET command, complementary data (having an inverted polarity) will be input.**
Note 3) **The data of 253 bytes or less is available to input at a time, more bytes of data input invite error (ERROR 125).**
Note 4) **If CHR$ &01 through &1F and CHR$ &81 through &9F is specified as the end code in the 7-bit code system, the end code is detected using 7-bit data irrespective of the SI/SO state. If CHR$ &20 through &7F and CHR$ &A0 through &FF is specified as the end code, the end code is detected using the SI/SO state and 7-bit data.**

Format 2) GIN X, E, A

X : Channel number (0, 1)
E : Type of signals
  D .... Data signals
  C .... Control signals
A : Numeric variable for inputting data



Format 2 of the GIN command is used in manual mode.
The GIN command inputs the logical level (ON or high, and OFF or low) of a signal as designated by the character string E to the numeric variable A as binary data for the channel as designated by the numeric expression X.
Binary data produced by this command will have the magnitude of 1, 2, 4, 8, 16, 32, 64 or 128, or any sum of these values depending on the bit position in the ON state (high level), irrespective of the logical polarity specified by the GSET command. Bit positions in the OFF state (low level) give a value of 0.

- Magnitude of bit positions in the ON state (high level):

I1, I9	1
I2, I10	2
I3, I11	4
I4, I12	8
I5	16
I6	32
I7	64
I8	128

The range of magnitude of data signals is 0 to 255, and that of control signals is 0 to 15.

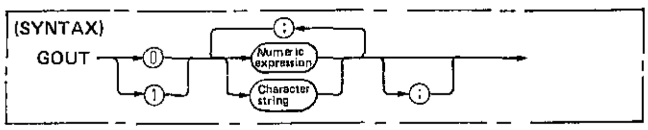
4. GOUT

This command output data.

Syntax 1 and 2 apply to operation in automatic handshaking mode, and Format 3 applies to operation in manual mode.

Format 1) GOUT X, 《Y C》 [;]

X : Channel number (0, 1)
Y : Numeric data to be output
C : Character data to be output



Format 1 of the GOUT command is used in automatic handshaking mode.
The GOUT command outputs numeric data designated by the numeric expression, or literal data designated by the character string C to a channel designated by the numeric expression X. With a semicolon attached at the end of the last numeric expression or literal string, no CR code (CHR$ &0D) nor LF code (CHR$ &0A) is output following the output of data. Conversely, if a semicolon is omitted at the end of the last numeric expression or literal string, a CR code and an LF code are output automatically following the output of data.

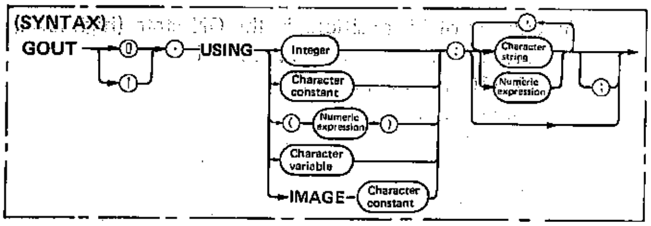
Example) `10 GOUT 0,"ABC"`

This program outputs literal string (literal constant) "ABC" data followed by a CR code and LF code for channel 0.

Note) For output data in negative logic as specified by the GSET command, complementary data (having inverted polarity) will be output. (This rule also applies to Format 2.)

Format 2) GOUT X, USING n | S | (Y) | A$ | IMAGE T ; [{Z | C} [;]]

X : Channel number (0, 1)
n : Line number value of IMAGE statement
S : Line label name of IMAGE statement
Y : Line number (numeric expression) of IMAGE statement
A$: Character variable for specified format (image symbol)
T : Character constant indicating image symbol
Z : Numeric data to be output
C : Character data to be output



Format 2 of the GOUT command is used in the automatic handshaking.
The GOUT command outputs numeric data designated by the numeric expression Z or literal data designated by the character string C in a format designated by the IMAGE statement.
This syntax conforms to Function 2 of the PRINT statement described in the MZ-3500 BASIC LANGUAGE MANUAL. Also refer to the IMAGE statement.
If a semicolon is attached to the end of the last numeric expression or literal string, no CR code (CHR$ &0D) nor LF code (CHR$ &0A) is output following the output of data.
Conversely, if a semicolon is omitted, an LF code is output automatically at end of the data (No CR code is output).
If {Z | C} [;] is omitted, neither CR code nor LF code is output.
The CR code and LF code can be set using the IMAGE statement.

Example 1) `10 GOUT 1,USING 500;X$,Y$`

This program outputs character strings X$ and Y$ in the format specified by the IMAGE statement for channel 1.

Example 2)

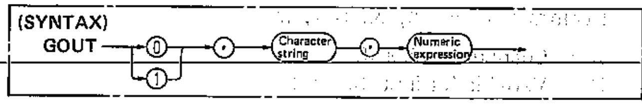
```
10 H$="TRANSISTORS":K=1320
20 GOUT 0,USING 100;H$,K
30 END
100 IMAGE ^11A 5X "PRICE" 4X $#,### C'
```

This program outputs data in the following format, where S_P, C_R, and L_F signify a space code, CR code and LF code, respectively.

T R A N S I S T O R S S_P S_P S_P S_P S_P P R I C E
S_P S_P S_P S_P $ 1 , 3 2 0 C_R L_F

Format 3) GOUT X, E, Y

X : Channel number (0, 1)
E : Type of signals
  D . . . . Data signals
  C . . . . Control signals
A : Numeric data to be output



Format 3 of the GOUT command is used in the manual mode.
The GOUT command outputs numeric data designated by the numeric expression Y in binary format with the logical polarity of the signals designated by the character string E to a channel designated by the numeric expression X. This command outputs an ON state (high level) for a 0 bit, irrespective of the logical polarity specified by the GSET command. The logical polarity of output control signals is determined by the DIP switch on the interface PC board (See p. A–5.) When the character string E is set to data signals, the magnitude of the numeric expression Y must be within the range from 0 to 15. If this range is exceeded, ERROR 127 occurs.
No CR code (CHR$ &0D) nor LF code (CHR$ &0A) is output at the end of the output data.

Note) Use this command for data in the 8-bit code system.

Addendum) The NULL code can be output.

Example) `10 GOUT 0,"D",0%`

This program outputs a NULL code for channel 0.

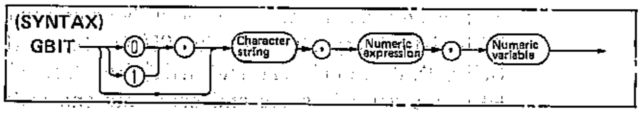
5. GBIT

This command verifies and sets the logical level of signals.

This command is effective for ports in both automatic handshaking and manual modes. The command has no relation to the logical polarity specified by the GSET command. The logical polarity of the output control signals is determined by the DIP switch on the interface PC board. See Appendix 4, Setup of the DIP switch, p. A–5.

Format 1) GBIT [X,] C, Y, A

X : Channel number (0, 1)
C : Type of signals
  ID . . . . Input data signals
  IC . . . . Input control signals
Y : Pin number
  0 . . . . I1, I9
  1 . . . . I2, I10
  2 . . . . I3, I11
  3 . . . . I4, I12
  4 . . . . I5
  5 . . . . I6
  6 . . . . I7
  7 . . . . I8
A : Numeric variable for inputting data



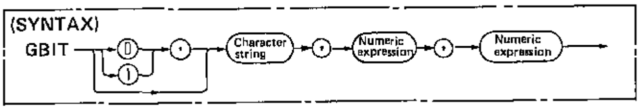
The GBIT command verifies the logical level of a pin designated by the numeric expression Y for an input signal designated by the character string C for a channel designated by the numeric expression X, and assigns "1" to numeric variable A if the state is ON (high level) or assigns "0" to numeric variable A if the state is OFF (low level).
If [X,] is omitted, a signal on channel 0 is verified.

Example)
```
10 GBIT "IC",2,A
20 IF A=1 THEN "ERR"
```

This program checks signal I11 on channel 0, and branches the program to line label "ERR" if the signal is ON (high level).

Format 2) GBIT [X,] C, Y, Z

X : Channel number (0, 1)
C : Type of signals
  OD .... Output data signals
  OC .... Output control signals
Y : Pin number
  0......... O1, O9
  1......... O2, O10
  2......... O3, O11
  3......... O4, O12
  4......... O5
  5......... O6
  6......... O7
  7......... O8
Z : Set of signals
  0......... OFF (low level)
  1......... ON (high level)



When the character string C indicates that the signal is an output data signal, this command sets a pin designated by the numeric expression Y to ON (high level) if the magnitude of the numeric expression Z is "1", or sets the pin to OFF (low level) if Z is "0".
When the character string C indicates that the signal is an output control signal, setup of the DIP switch on the interface board functions inversely.
If [X,] is omitted, a signal on channel 0 is set.

Example)
```
10 GBIT "OC",0,1
```

This program sets signal O9 on channel 0 to ON (high level) if DIP switch 1 on the interface PC board is set to OFF. If the DIP switch 1 is set to ON, the pin is set to OFF (low level).

6. A SIMPLE PROGRAMMING EXAMPLE

Example 1)
Sample program describing data transfer with automatic handshaking mode using two sets of main unit Model 3500 series.

```
10 GMODE 0,"0","A","8" ················Sets the mode (Output port).
20 A$=" SHARP  "
30 GOUT 0,A$; ·························Output character data "SHARP".
40 GOUT 0,CHR$ &FF; ···················Output ending code "CHR$ &FF".
50 GMODE 0,"1","A","8"·················Sets the mode (Input port).
60 GIN 0,B$,CHR$ &FF···················Input character data.
70 DISP A$;B$
80 END
```

```
10 GMODE 0,"1","A","8"·················Sets the mode (Input port).
20 GIN 0,A$,CHR$ &FF···················Input character data.
30 GMODE 0,"0","A","8"·················Sets the mode (Output port).
40 B$="Model-3500"
50 GOUT 0,B$; ·························Output character data "Model-3500".
60 GOUT 0,CHR$ &FF;····················Output ending code "CHR$ &FF".
70 DISP A$;B$
80 END
```

Execution results
"SHARP Model-3500" is displayed onto the both of CRT A side and B side.

Cable connecting table
When executing program, use the cable corresponded as follows.

Side A		Side B	
Signal name	Contact No.	Contact No.	Signal name
O1	1	25	I1
O2	3	27	I2
O3	5	29	I3
O4	7	31	I4
O5	9	33	I5
O6	11	35	I6
O7	13	37	I7
O8	15	39	I8
O9	17	41	I9
O10	19	43	I10
I1	25	1	O1
I2	27	3	O2
I3	29	5	O3
I4	31	7	O4
I5	33	9	O5
I6	35	11	O6
I7	37	13	O7
I8	39	15	O8
I9	41	17	O9
I10	43	19	O10

- All GND (ground) contacts must be connected with those of partner.
- Unused contacts are open.

Example 2)

Sample program describing data transfer with manual mode using two sets of main unit Model-3500 series.

```
 10 GBIT 0,"OC",3,0 ------------ Output control signal O12 OFF.
 20 INPUT "A=";A
 30 INPUT "B=";B
 40 GMODE 0,"O","B" ------------ Sets the mode (Output port).
 50 GOUT 0,"D",A --------------- Output numeric data A.
 60 GBIT 0,"OC",3,1 ------------ Output control signal O12 ON.
 70 GBIT 0,"IC",2,X ------------ Verify input control signal I11.
 80 IF X=0 THEN 70
 90 GOUT 0,"D",B --------------- Output numeric data B.
100 GBIT 0,"OC",3,0 ------------ Output control signal O12 OFF.
110 GBIT 0,"IC",2,X ------------ Verify input control signal I11.
120 IF X=1 THEN 110
130 GMODE 0,"I","B" ------------ Sets the mode (Input port).
140 GIN 0,"D";C ---------------- Input numeric data.
150 DISP A;"+";B;"=";C
160 END
```

```
 10 GBIT 0,"OC",2,0 ------------ Output control singal O11 OFF.
 20 GBIT 0,"IC",3,X ------------ Verify input control signal I12.
 30 IF X=1 THEN 20
 40 GMODE 0,"I","B" ------------ Sets the mode (Input port).
 50 GBIT 0,"IC",3,X ------------ Verify input control signal I12.
 60 IF X=0 THEN 50
 70 GIN 0,"D",A ---------------- Input numeric data.
 80 GBIT 0,"OC",2,1 ------------ Output control signal O11 ON.
 90 GBIT 0,"IC",3,X ------------ Verify input control signal I12.
100 IF X=1 THEN 90
110 GIN 0,"D",B ---------------- Input numeric data.
120 DISP "A=";A:DISP "B=";B
130 C=A+B
140 GMODE 0,"O","B" ------------ Sets the mode (Output port).
150 GOUT 0,"D",C --------------- Output numeric data C.
160 GBIT 0,"OC",2,0 ------------ Output control signal O11 OFF.
170 END
```

Execution results

Result is displayed at A side after calculating at B side the total of two numeric datas which is input through A side.

Cable connecting table

When executing program, use the cable corresponded as follows.

Side A Signal name	Side A Contact No.	Side B Contact No.	Side B Signal Name
O1	1	25	I1
O2	3	27	I2
O3	5	29	I3
O4	7	31	I4
O5	9	33	I5
O6	11	35	I6
O7	13	37	I7
O8	15	39	I8
O12	23	47	I12
I1	25	1	O1
I2	27	3	O2
I3	29	5	O3
I4	31	7	O4
I5	33	9	O5
I6	35	11	O6
I7	37	13	O7
I8	39	15	O8
I11	45	21	O11

- All GND (ground) contacts must be connected with those of partner.
- Unused contacts are open.

Example 3)

Sample program describing data transfer with manual mode using a main unit Model-3500 series and printer [MZ-1P02].

```
 10 GMODE 0,"O","B" ------------ Sets the mode (Output port).
 20 GBIT 0,"OC",1,1 ------------ Output control signal O10 ON.
 30 GBIT 0,"OC",0,1 ----         (INPUT-PRIME signal at printer).
 40 READ A              '------- Output control signal O9 ON.
 50 IF A=0 THEN END              (DATA STROBE signal at printer).
 60 GOUT 0,"D",A --------------- Output numeric data.
 70 GBIT 0,"OC",0,0 }
 80 GBIT 0,"OC",0,1 } ---------- Output control signal O9 OFF, ON.
 90 GBIT 0,"IC",0,B ------------ Verify input control signal I9.
100 IF B=1 THEN 90               (BUSY signal at printer).
110 GO TO 40
200 DATA 29,83,72,65,82,80,10
210 DATA 31,83,72,65,82,80,10
220 DATA 30,83,72,65,82,80,10
230 DATA 31,83,72,65,82,80,10
240 DATA 0
```

Datas to make characters "SHARP"

LF code

Function code designating character pitch and double width.

Execution results

Executing this program gets the following kinds of character on printer.

SHARP ------ Character pitch to 16.5CPI.
SHARP ------ Character pitch to 16.5CPI, double width mode.
SHARP ------ Character pitch to 10CPI.
S H A R P ------ Character pitch to 10CPI, double width mode.

Cable connecting table

When executing program, use the cable corresponded as follows.

Main unit side Signal name	Main unit side Contact No.	Printer side Contact No.	Printer side Signal name
O1	1	2	DATA BIT1
O2	3	3	DATA BIT2
O3	5	4	DATA BIT3
O4	7	5	DATA BIT4
O5	9	6	DATA BIT5
O6	11	7	DATA BIT6
O7	13	8	DATA BIT7
O8	15	9	DATA BIT8
O9	17	1	DATA STROBE
O10	19	31	INPUT-PRIME
I9	41	11	BUSY
I10	43	10	ACKNOWLEDGE
I11	45	12	PAPER END
I12	47	13	SELECT

- All GND (ground) contacts must be connected with those of partner.
- Unused contacts are open.

8. ERROR CODE TABLE

Error code number (E R N)	Meaning
(odd number)	
121	Parity error in data entry.
123	Improper input data in automatic handshaking mode.
125	The data entry variable overflows in automatic handshaking mode.
127	Improper output data in manual mode.

Note) An erroneous program step indicated by an odd number error code (ERN) can be skipped using the ON ERROR statement.

Error code number (E R N)	Meaning
(even number)	
120	Hardware error.
122	Improper operand in the command word.
124	Improper setting of the logical polarity, improper setting of the pin number, or improper setting of the end code.

For error codes other than those listed above, refer to Ⅵ. "Error code list" of the MZ-3500 BASIC LANGUAGE MANUAL Appendix.

9. INPUT CODE TABLE

Input data is processed as the following characters or functions in the Model-3500 Business Computer Main Unit.

1. 8-BIT ASCII CODE TABLE

Low \ High	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0			SP	0	@	P	`	p		●					'	•
1			!	1	A	Q	a	q								
2			"	2	B	R	b	r	Σ							
3			#	3	C	S	c	s	γ	π						
4			$	4	D	T	d	t	♠							
5			%	5	E	U	e	u								
6			&	6	F	V	f	v	◆	θ						
7			'	7	G	W	g	w	♥							
8			(	8	H	X	h	x	♣	β						
9			)	9	I	Y	i	y								
A	LF		*	:	J	Z	j	z		α						
B			+	;	K	[	k	{								″
C			,	<	L	¥	l	¦								
D			−	=	M	]	m	}								
E			.	>	N	^	n	~								○
F			/	?	O	_	o									

Note 1) LF : Carriage Return Line Feed
SP : Space

Note 2) Character codes which are left blank in the above table are used for Japanese characters, except for the character code 00.

2. 7-BIT ASCII CODE TABLE

	SI Side								SO Side							
Low \ High	0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
0			SP	0	@	P	`	p		●					'	•
1			!	1	A	Q	a	q								
2			"	2	B	R	b	r	Σ							
3			#	3	C	S	c	s	γ	π						
4			$	4	D	T	d	t	♠							
5			%	5	E	U	e	u								
6			&	6	F	V	f	v	◆	θ						
7			'	7	G	W	g	w	♥							
8			(	8	H	X	h	x	♣	β						
9			)	9	I	Y	i	y								
A	LF		*	:	J	Z	j	z		α						
B			+	;	K	[	k	{								″
C			,	<	L	¥	l	¦								
D			−	=	M	]	m	}								
E	SO		.	>	N	^	n	~	SO							○
F	SI		/	?	O	_	o		SI							

Note 2) LF : Carriage Return Line Feed
SO : Shift Out
SI : Shift In
SP : Space

Note 2) Character codes which are left blank in the above table are used for Japanese characters, except for the character code 00 on the SI side.

10. MZ-1E02 CONTACT SIGNAL TABLE

Following table shows the contact and input/output signal of the interface [MZ-1E02] coordinated with the each loose wire of optional GP I/O interface cable [MZ-1C19]. (The cable consists of 50 pcs. of loose wire and they are distincted from each other, with 5 kinds of color and number of colored 2 kinds.)

Contact No.	Signal name	Wire color	Mark color	Number of marks	Contact No.	Signal name	Wire color	Mark color	Number of marks
1	O1	Orange	Red	1	26	GND	White	Black	3
2	GND	Orange	Black	1	27	I2	Yellow	Red	3
3	O2	Gray	Red	1	28	GND	Yellow	Black	3
4	GND	Gray	Black	1	29	I3	Pink	Red	3
5	O3	White	Red	1	30	GND	Pink	Black	3
6	GND	White	Black	1	31	I4	Orange	Red	4
7	O4	Yellow	Red	1	32	GND	Orange	Black	4
8	GND	Yellow	Black	1	33	I5	Gray	Red	4
9	O5	Pink	Red	1	34	GND	Gray	Black	4
10	GND	Pink	Black	1	35	I6	White	Red	4
11	O6	Orange	Red	2	36	GND	White	Black	4
12	GND	Orange	Black	2	37	I7	Yellow	Red	4
13	O7	Gray	Red	2	38	GND	Yellow	Black	4
14	GND	Gray	Black	2	39	I8	Pink	Red	4
15	O8	White	Red	2	40	GND	Pink	Black	4
16	GND	White	Black	2	41	I9	Orange	Red	Many
17	O9	Yellow	Red	2	42	GND	Orange	Black	Many
18	GND	Yellow	Black	2	43	I10	Gray	Red	Many
19	O10	Pink	Red	2	44	GND	Gray	Black	Many
20	GND	Pink	Black	2	45	I11	Wwite	Red	Many
21	O11	Orange	Red	3	46	GND	White	Black	Many
22	GND	Orange	Black	3	47	I12	Yellow	Red	Many
23	O12	Gray	Red	3	48	GND	Yellow	Black	Many
24	GND	Gray	Black	3	49	Not used	Pink	Red	Many
25	I1	White	Red	3	50	GND	Pink	Black	Many

11. SETUP OF THE DIP SWITCH

The DIP switch on the interface PC board is used to establish the state of the output control signals immediately after power has been switched on, the logical polarity of the output control signals, etc.

Switch	Signal	Switch position	Initial state	Logical polarity	Output level in manual mode	
					0 *	1 *
1	O9	OFF	OFF (low level)	Positive logic	OFF (low level)	ON (high level)
		ON	ON (high level)	Negative logic	ON (high level)	OFF (low level)
2	O10	OFF	OFF (low level)	Positive logic	OFF (low level)	ON (high level)
		ON	ON (high level)	Negative logic	ON (high level)	OFF (low level)
3	O11	OFF	OFF (low level)	Positive logic	OFF (low level)	ON (high level)
		ON	ON (high level)	Negative logic	ON (high level)	OFF (low level)
4	O12	OFF	OFF (low level)	Positive logic	OFF (low level)	ON (high level)
		ON	ON (high level)	Negative logic	ON (high level)	OFF (low level)

* The level of each bit in accordance with Syntax 3 of the GOUT command, or the value of the numeric expression Z in accordance with Syntax 2 of the GBIT command.

12. MZ-1E02 (GPIO) TEST PROCEDURE

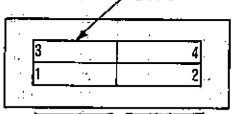
Tools required

(1) MZ-3500 Personal Computer
(2) MZ-1E02 (RS232C I/F PWB)
(3) Diagnostic program diskette (UKOG—0143 CSZZ)
(4) Cable (UKO-GG0078CSZZ)

Test procedure

1. Fix the optional slot panel on the back of the MZ-3500.
2. Insert the board to be tested in the slot number 3 or 1 of Channel 0. And, insert the testing board in the slot number 2 or 4 of Channel 1.
   Keep the board to be tested in Channel 0 at all times and change the testing board in Channel 1 after each test.

Fig. 1 Slot



Channel 0 Channel 1

NOTE: Before inserting the board in the slot, make sure that all dip switches are in OFF position. Any dip switch turned ON must be set OFF.

3. Connect boards using the cable (UKOGG0078CSZZ) dedicated for this service.
4. Insert the diagnostic program diskette (UKOG-0143CSZZ) in the MZ-3500 floppy disk drive and turn power on. The test starts automatically after power on.
5. The message as shown in Fig. 2 appears when the test ends normally.

Fig. 2

```
DIP SW ON      →(Push  Space Key)

MZ-3500  GP I/O CHECK PROGRAM
```

6. Turn all dip switches OFF of the board to be tested when the above message is displayed, then push the SPACEBAR. The test is satisfactory when the following message appears after depression of the SPACEBAR.

```
READY
>■

MZ-3500  GP I/O CHECK  OK!!
```

If there is any failure, the bit in failure will be shown on the display.

Example: The message as shown below appears when bits 1 and 2 of the I/O port is in failure.

```
READY
>■

MZ-3500  GP I/O  CHECK  ERROR

1  bit……ERROR
2  bit……ERROR
```

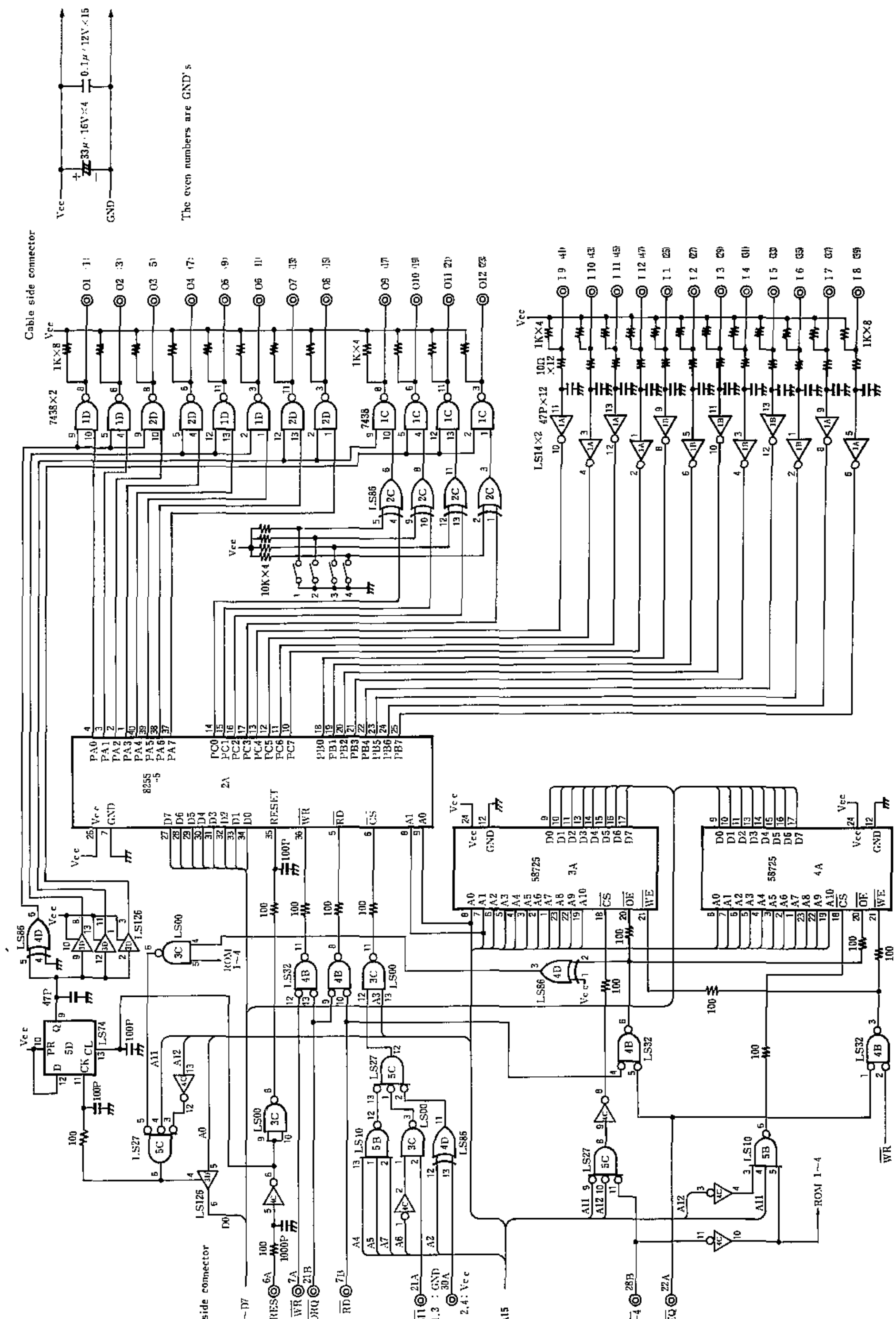
Error may also be indicated when the SPACEBAR is pushed after turning all dip switches ON.

(Error message)		Signal
1 bit……… ERROR	→	line O1 or I1 in failure
2 bit……… ERROR	→	〃 O2 or I2 in failure
3 bit……… ERROR	→	〃 O3 or I3 in failure
4 bit……… ERROR	→	〃 O4 or I4 in failure
5 bit……… ERROR	→	〃 O5 or I5 in failure
6 bit……… ERROR	→	〃 O6 or I6 in failure
7 bit……… ERROR	→	〃 O7 or I7 in failure
8 bit……… ERROR	→	〃 O8 or I8 in failure
9 bit……… ERROR	→	〃 O9 or I9 in failure
10 bit……… ERROR	→	〃 O10 or I10 in failure 〃
11 bit……… ERROR	→	〃 O11 or I11 in failure 〃
12 bit……… ERROR	→	〃 O12 or I12 in failure 〃

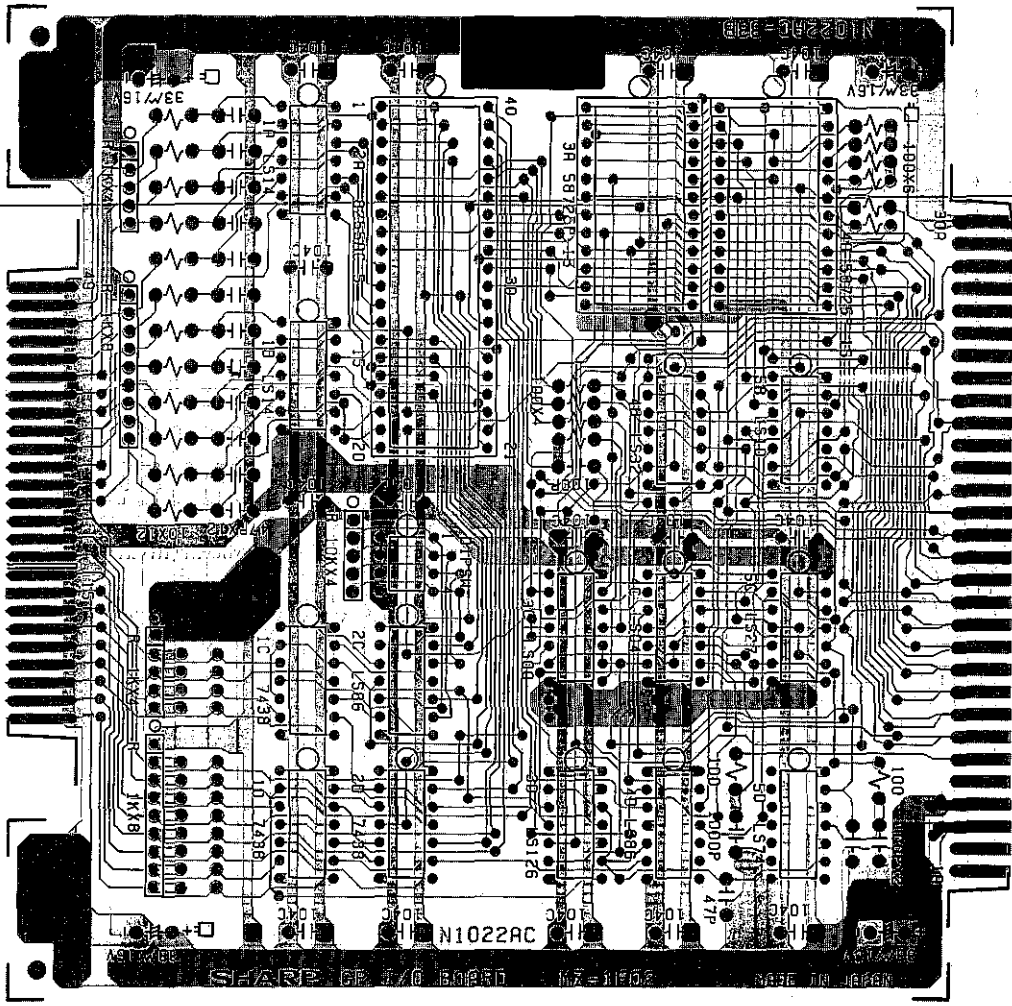
Dip switch remains ON.

NOTE: Be sure to turn power off before accessing of the board.

13. MZ-1E02 SCHEMATIC DIAGRAM



14. MZ-1E02 COMPONENT LOCATION



CPU Side

B	No.	A
	1	
	2	
GND	3	GND
Vcc	4	Vcc
	5	
	6	SYSRES
$\overline{RD}$	7	$\overline{WR}$
D0	8	D1
D2	9	D3
D4	10	D5
D6	11	D7
A0	12	A1
A2	13	A3
A4	14	A5
A6	15	A7
A8	16	A9
A10	17	A11
A12	18	
	19	
	20	
$\overline{TORQ}$	21	$\overline{M1}$
	22	$\overline{MREQ}$
	23	
	24	
	25	
	26	
	27	
$\overline{ROMX}$	28	
	29	
GND	30	SLOT

(PARTS SIDE)

Cable Side

	No.			
GND	2	O	1	1
	4	O	2	3
	6	O	3	5
	8	O	4	7
	10	O	5	9
	12	O	6	11
	14	O	7	13
	16	O	8	15
	18	O	9	17
	20	O	10	19
	22	O	11	21
	24	O	12	23
	26	i	1	25
	28	i	2	27
	30	i	3	29
	32	i	4	31
	34	i	5	33
	36	i	6	35
	38	i	7	37
	40	i	8	39
	42	i	9	41
	44	i	10	43
	46	i	11	45
	48	i	12	47
GND	50			49

(PARTS SIDE)

15. PARTS LIST

1 Electronic parts

NO.	PARTS CODE	PRICE RANK	NEW MARK	PART RANK	DESCRIPTION
1	LANGT1013ACZZ	AH		C	Angle for connector
2	QSÖCZ6424ACZZ	AE		C	IC socket (24pin)
3	QSÖCZ6440ACZZ	AG		C	IC socket (40pin)
4	QSW-Z9660KCZZ	AR		B	Dip SW.
5	XBPSM30P06KS0	AA		C	Screw
6	RMPTC4102QCKB	AC		B	Block resistor (1.0KΩ×4 1/8W ±10%)
7	RMPTC4103QCKB	AC		C	Block resistor (10KΩ×4 1/8W ±10%)
8	RMPTC8102QCKB	AD		C	Block resistor (1.0KΩ×8 1/8W ±10%)
9	VCCCPA1HH101J	AA		C	Capacitor (50WV 100pF)
10	VCCSPU1HL470J	AA		C	Capacitor (50V 47pF)
11	VCEAAA1CW336M	AB		C	Capacitor (16WV 33μF)
12	VCKYPA1HB102K	AA		C	Capacitor (50WV 1000pF)
13	VCTYPA1NX104M	AB		C	Capacitor (12V 0.1μF)
14	VHiM58725P-15	AZ		B	IC
15	VHiM74LS00/-1	AE		B	IC
16	VHiM74LS04/-1	AE		B	IC
17	VHiM74LS10/-1	AE		B	IC
18	VHiM74LS126-1	AH		B	IC
19	VHiM74LS14/-1	AM		B	IC
20	VHiM74LS27/-1	AF		B	IC
21	VHiM74LS32/-1	AF		B	IC
22	VHiM74LS74/-1	AG		B	IC
23	VHiM74LS86/-1	AF		B	IC
24	VHiM7438///-1	AE		B	IC
25	VHiUPD8255/-1	AV		B	IC
26	VRD-RV2EY100J	AA		C	Resistor (10ΩJ 0.5W)
27	VRD-RV2EY101J	AA		C	Resistor (1/4W 100Ω ±5%)

2 Accessory

NO.	PARTS CODE	PRICE RANK	NEW MARK	PART RANK	DESCRIPTION
1	SPAKA1087ACZZ	AC		D	Packing cushion for master
2	SPAKA1140ACZZ	AH		D	Packing cushion for 1E03
3	SPAKA1141ACZZ	AA		D	Packing cushion for 1E03
4	SPAKC1086ACZZ	AF		D	Packing case for master
5	SPAKC1242ACZZ	AP	N	D	Packing case
6	TiNSE1068ACZZ	BB	N	D	Instruction book
7	RMEMR1006AC19	BF			Master media

3 MZ1C19(MZ1E02)

NO.	PARTS CODE	PRICE RANK	NEW MARK	PART RANK	DESCRIPTION
1	SPAKA1105ACZZ	AD		D	Packing cushion
2	SPAKC1206ACZZ	AU	N	D	Packing case
4	TSELF1002ACZZ	AA		D	Sealing label

4 Tools

NO.	PARTS CODE	PRICE RANK	NEW MARK	PART RANK	DESCRIPTION
1	UKÖG-0143CSZZ	BK	N	E	Diag media
2	UKÖGG0078CSZZ	BN	N	E	Cable unit

SHARP

SHARP CORPORATION
Industrial Instruments Group
Reliability & Quality Control Department
Yamatokoriyama, Nara 639-11, Japan
Y.F Jun. 1983 Printed in Japan