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SYSMAC CV-series
CV500-MP311-E

Graphic Programming Console

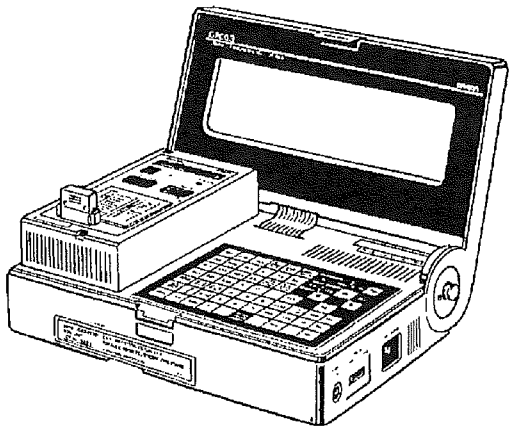
OPERATION MANUAL

OMRON

SYSMAC CV-series
Graphic Programming Console

Operation Manual

Produced July 1992



Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify warnings in this manual. Always heed the information provided with them.

Caution Indicates information that, if not heeded, could result in minor injury or damage to the product.

DANGER! Indicates information that, if not heeded, could result in loss of life or serious injury.

OMRON Product References

All OMRON products are capitalized in this manual. The word "Unit" is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation "Ch," which appears in some displays and on some OMRON products, often means "word" and is abbreviated "Wd" in documentation in this sense.

The abbreviation "PC" means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1, 2, 3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

TABLE OF CONTENTS

About this Manual:

This manual describes the installation and operation of the SYSMAC CV-series Graphic Programming Console (GPC), and includes the sections described below. This GPC is designed to be used with the CV500 and/or CV1000.

Please read this manual completely and be sure you understand the information provide before attempting to install and operation the GPC.

Section 1 provides basic reference material that should be useful when using the GPC, including lists of operations, tables of ladder-diagram instructions, and a PC data area table.

Section 2 describes the names and functions of Graphics Programming Console and Memory Card Adapter components.

Section 3 provides procedures for setting up and connecting the GPC and its accessories. It also provides procedures for basic maintenance, such as battery replacement. Details on peripheral devices are provided in *Section 5 Peripheral Devices.*

Section 4 describes basic aspects of operation, including the operation of keys, GPC memory and file structure, and inserting/removing Memory Cards.

Section 5 provides details and examples of switch setting and connections for peripheral devices such as printers and floppy disk drives. Actual GPC operations to use these peripheral devices are provided in the following two sections.

Section 6 describes programming and other operations that can be used when not connected (offline) to a PC.

Section 7 describes programming and other operations that can be used when connected (online) to a PC.

Section 8 explains error messages that may appear while using the GPC.

Appendix A provides lists of standard models.

Appemdix B provides specifications.

SECTION 1
Introduction

This section provides basic reference material that should be useful when using the GPC. The lists of operations include the main operations covered in the manual with page references. The tables of ladder-diagram instructions can be used to find instructions either by function code, functional group, or mnemonic, and the PC data area table outlines the data areas available for use in programming.

1-1 Graphics Programming Console Features

Graphics Programming Consoles (GPCs) are equipped with a variety of special features that simplify the development of PC programs.

CV-series Compatibility

CV-series ladder diagram programs can be created in the GPC in mnemonic or in ladder-diagram form. By connecting the GPC to a PC, programs can be created, modified, or erased in the PC itself.

C-series Peripheral Device Compatibility

The GPC has a Peripheral Device Connector, allowing connection to a Printer Interface Unit or Floppy Disk Interface Unit.

Monitoring and Debugging

Program execution can be monitored and the program can be debugged from the GPC using the monitoring and tracing functions.

Memory Card Adapter

A CV500-MCA01 Memory Card Adapter can be connected to the GPC to allow programs or other data in the GPC and PC to be copied to Memory Cards for storage.

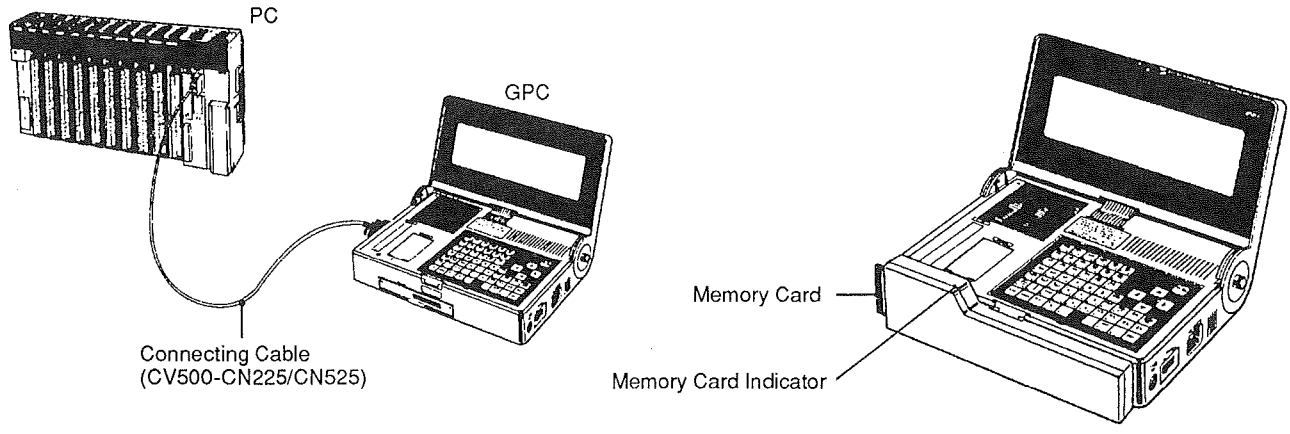
The Memory Card can store data that exceeds the GPC memory capacity, i.e., data in excess of 32K words for the program, 8K words for Data Memory (DM), 12K words for comments, as well as any Extended Data Memory (EM) being used with the CV1000.

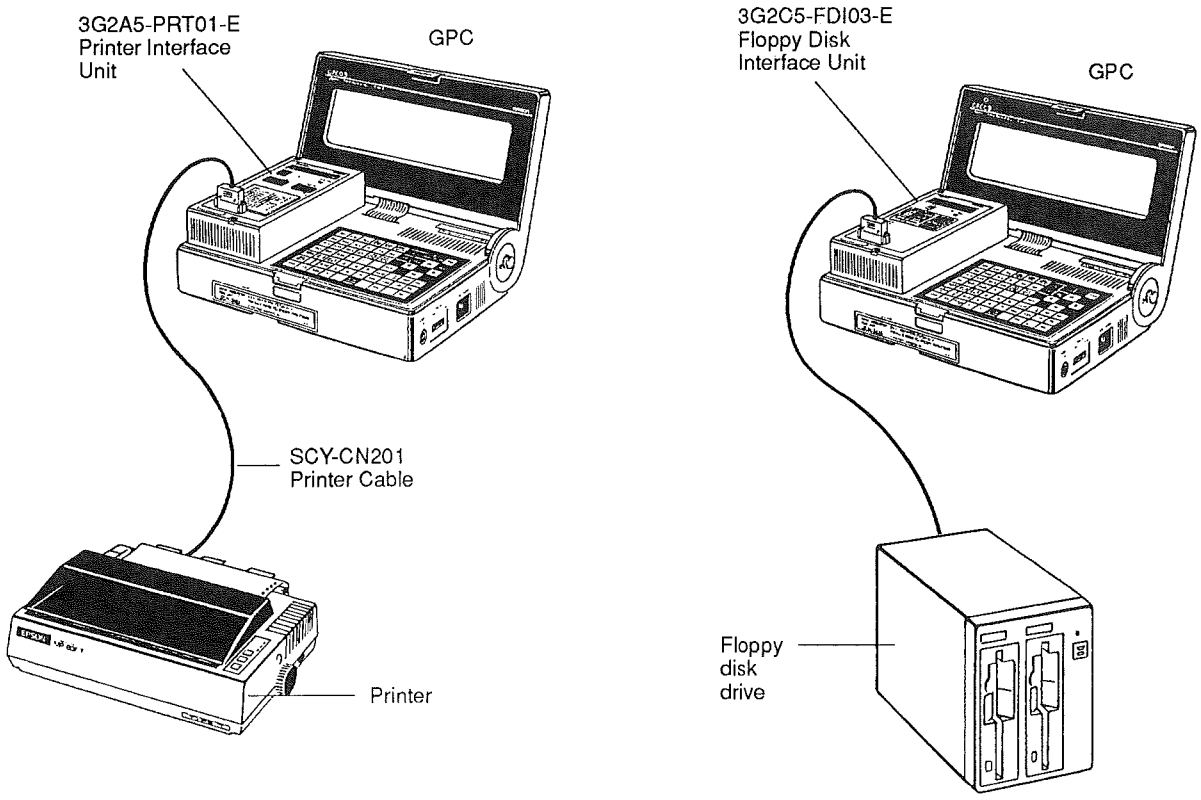
Communications with PC Networks

When the GPC is connected to a PC that is part of a SYSMAC NET Link or SYSMAC LINK Network, the GPC can communicate with any PC in the network or in remote networks. The GPC can also communicate with PCs in other networks through a Bridge.

1-2 System Configuration

The GPC can be used offline to prepare programs and data, or it can be connected to a PC to upload/download data or to manipulate data directly. The GPC can also be interfaced to a Memory Card via the Memory Card Adapter, to a printer via the Printer Interface Unit, or to floppy disk drive via the Floppy Disk Interface Unit. These various connections are shown in the following illustrations.





1-3 Precautions

1-3-1 GPC

There are two versions of the GPC available. One operates on 110 VAC and the other operates on 220 VAC, as shown below.

Model	Operating voltage
3G2C5-GPC03-E	100 VAC to 120 VAC
3G2C5-GPC04-E	200 VAC to 240 VAC

Handling the GPC

The GPC has an LCD display that can be damaged if the GPC is dropped or struck forcefully. Handle the GPC carefully to avoid damaging the LCD display.

Turn the GPC off when it will not be used for some time, particularly when the case is closed. The quality of the LCD display will be affected if the GPC is left on for extended periods with the case closed.

In very dry areas, static electricity can build up to high levels. When the air is dry (e.g., on cold winter days), touch a grounded piece of metal before touching the GPC to discharge any accumulated static electricity.

Cleaning the GPC

Use a commercial alcohol or benzine-based cleaner to remove dirt from the GPC. Never use paint thinner on the GPC, as it might discolor or damage the surface.

Storing the GPC

The GPC contains a lithium battery that backs up its internal memory. Do not store the GPC in locations subject to high temperatures or high humidity.

Maintaining the GPC

We recommend keeping spare maintenance parts such as fuses and batteries, so the GPC can be restored to service quickly if necessary.

GPC Battery

The GPC contains a battery that provides back-up power for the GPC internal memory. The battery has a life expectancy of 5 years at 25°C (77°F). When the

battery begins to expire, the message "BAT ERR" will be displayed on the GPC screen. The battery should be replaced within a week after the message appears.

Caution Do not short the terminals, charge, cut, or heat the battery; doing so may cause the battery to ignite, explode, or leak.

PC Connecting Cable

Use one of the cables listed in the following table to connect the GPC to a CV500 or CV1000 PC. These cables are sold separately.

Cable length	Model
2 m	CV500-CN225
5 m	CV500-CN525

Note

1. A Peripheral Interface Unit is not required to connect the GPC to a PC.
2. The GPC cannot be used with C-series PCs when the CV500-MP311 Memory Pack is installed.

1-3-2 Memory Cards

The GPC can store up to 32K words of program data, 8K words of Data Memory (DM) data, and 12K words of I/O comment data internally. If the internal GPC memory is insufficient, use a 128K byte or larger Memory Card. With a Memory Card, up to 64K words of program data, 24K words of Data Memory (DM) data, and 12K words of I/O comment data can be stored, as well as Extended Data Memory (EM) data.

Memory Cards that use RAM memory contain a battery that provides back-up power. The life of this battery depends on the amount of RAM memory in the card, as shown in the following table. The life expectancies are for Memory Cards used at 20°C (68°F).

Model	Capacity	Life expectancy
HMC-ES641	64K bytes	5 yrs
HMC-ES151	128K bytes	3 yrs
HMC-ES251	256K bytes	1 yr
HMC-ES551	512K bytes	0.5 yr

When the battery begins to expire, the message "CARD BATTERY ERR" will be displayed on the GPC screen. The battery should be replaced within a week after the message appears.

Turn the GPC off before inserting a Memory Card and never remove a card when the Memory Card indicator is ON. Data on the card may be destroyed if the card is removed while data is being transferred.

1-3-3 System Memory Cassette

The System Memory Cassette Package includes the System Memory Cassette itself, the CV-series Keyboard Sheet, and this manual, as shown in the following table.

Item	Model/catalog no.
System Memory Cassette	CV500-MP311
Keyboard Sheet	CV500-CKF01
Graphic Programming Console Operation Manual	W216-E1-1

Installation

Always turn off the GPC before installing or removing the System Memory Cassette or changing its fuse.

The programs, I/O comments, and DM data in the GPC will become unusable when the GPC is turned on after a C-series System Memory Cassette has been replaced by a CV-series System Memory Cassette or vice-versa.

When a CV-series System Memory Cassette is installed, any CV-series programs, I/O comments, or DM data in the GPC will be cleared.

C-series and CV-series Differences

The following lists describe capabilities of the CV500-MP311 System Memory Cassette that are not available in C-series System Memory Cassettes.

1, 2, 3...

1. Programming
   a) Instruction operands are displayed on the same line as the instruction.
   b) I/O comments up to 30 characters long can be input.
   c) A program created with the Online Edit operation is created directly in the PC's memory. (The Online Edit operation does not affect the GPC's internal memory.)

   Note SFC programs cannot be created or monitored with the GPC. Only the action and transition programs of the SFC program in the PC can be displayed or edited with the GPC.

2. Online Operations
   a) Communication is possible between the GPC an PC even if the program stored in the GPC's internal memory differs from the one stored in the PC. (See 1c above.)
   b) The GPC can be connected directly to the PC's CPU; a Peripheral Interface Unit is not required.
   c) Up to 4 Peripheral Devices (including the CVSS and DAC) can be connected to a PC. Possible combinations are shown in the following table.

Connected Unit	Possible combinations		
CPU	1	0	0
I/O Interface Unit	0	1	0
SYSMAC BUS/2 Remote I/O Slave Unit	3*		4*

   Note *Up to 2 Units can be connected under one Master.

   d) When PC names have been assigned to nodes in a network, the GPC can connect to a node by specifying only the PC name.

3. C-series Peripheral Devices
   a) The Floppy Disk Interface Unit and Printer Interface Unit can be mounted to the GPC, but the PROM Writer cannot be used. A Memory Cassette is not required with the Printer Interface Unit.
   b) When the GPC is connected to a Floppy Disk Interface Unit or Printer Interface Unit, data from the PC can be output to a disk drive or printer.

1-4 GPC Operations

The following tables list the main operations available on GPC menus.

1-4-1 Offline Operations

GPC Settings

Name	Description	Page
Printer	Used to specify the baud rate of communications with the printer, as well as the width of paper used and the beginning print column.	110
Floppy	Used to specify the drive number of the floppy disk drive and the type of disk being used.	110
PC Name Table	Used to set the name of the file that contains the PC name referenced at PC selection.	111
Response Monitoring Time	Used to set the response monitoring time for communications with the PC.	111

PC Setup and PC Name File Edit

Name	Description	Page
PC Setup	Reads the PC Setup information from GPC memory for editing. After editing, transfer the new PC Setup information to the PC with the online "Block Transfer" operation.	112
Edit PC Name File Edit	Used to assign PC names to PCs in SYSMAC NET Link and SYSMAC LINK networks.	98
Node Selection	Used to select the PC with which the GPC is to communicate in online operations.	153

Programming

Name	Description	Page
Clear User Program Memory	Used to delete the programs from GPC memory and the Memory Card. The entire program can be deleted or only the part after a specified address.	53
Display Memory	Used to display the amount of GPC memory used for the program.	56
Switch Display	Used to switch the display form for ladder diagrams between ladder diagrams and mnemonic ladder diagrams.	54
Program	Used to create, edit, or delete programs on the GPC screen in the display form designated above.	57, 78
Store/Store Insert	Used to write programs displayed on the GPC screen into GPC memory. Not necessary when writing programs directly in mnemonic form.	69
Save	Used to save programs, program sections, or other data to the Memory Card.	73
Find	Used to search for instructions (including operands).	73, 83
Global Change	Used to globally change bit or word addresses designated in programs in GPC memory.	93
Edit Interrupt Program	Used to create I/O interrupt, scheduled interrupt, power off interrupt, and power on interrupt programs.	84
Program Check	Used to check the program for syntax errors.	85

Data Transfer

Name	Description	Page
Transmit	Used to transfer program, DM, and I/O comment data between the GPC memory, Memory Card, and floppy disk drive.	105

File Management

Name	Description	Page
Formatting	Used to format floppy disks or Memory Cards.	103
File List	Used to display a list of files on a floppy disk or Memory Card.	103
Delete File	Used to delete an existing file from a floppy disk or Memory Card.	103
Rename File	Used to change the name of an file on a floppy disk or Memory Card.	103
Copy/Compare Files	Used to copy or compare all files on the floppy disk in the first drive to the files on the floppy disk in the second drive.	104

Printing

Name	Description	Page
Ladder Diagram	Used to print portions of ladder diagram programs in normal ladder-diagram form.	107
Mnemonic List	Used to print portions of ladder diagram programs in mnemonic form.	107
DM or EM List	Used to print the contents of a specified area of the GPC's DM or the Memory Card's EM.	108
I/O Comment List	Used to print I/O comments.	109
Screen Printout	Used to print the current contents of the GPC screen.	106

DM Operations

Name	Description	Page
Data Clear	Used to delete the DM data in GPC memory and the EM data in the Memory Card.	93
Data Fill	Used to copy the same word to multiple DM or EM words.	92
Data Copy	Used to copy a specified area of DM or EM memory.	91
Data Input	Used to display or modify DM data.	91

List Operations

Name	Description	Page
Usage List	Used to display information about the usage of data area words and bits in GPC memory or programs on the Memory Card.	99
Cross-reference List	Used to display cross-references of data area words and bits in GPC memory or programs on the Memory Card.	99

Comment Operations

Name	Description	Page
Clear Memory	Used to delete the all I/O comments.	89
Create	Used to write, read, or find I/O comments.	86
Copy	Used to copy I/O comments one at a time.	89

1-4-2 Online Operations

Some online operations are identical with the corresponding offline operations. The page references for these are thus in the offline section of the manual. Refer to pages 126 and 155 for differences and PC mode restrictions.

GPC Settings

Name	Description	Page
Printer	Used to specify the baud rate of communications with the printer, as well as the width of paper used and the beginning print column.	110
Floppy	Used to specify the drive number of the floppy disk drive and the type of disk.	110
PC Name Table	Used to set the name of the file containing the PC name referenced at PC selection.	152
Response Monitoring Time	Used to set the response monitoring time for communications with the PC.	111

PC Setup and PC Name File Edit

Name	Description	Page
PC Setup	Reads the PC Setup information from GPC memory for editing.	155
CPU Bus Unit Settings	Used to read or input operating parameters for CPU Bus Units (i.e., SYSMAC NET Link, SYSMAC LINK, SYSMAC BUS/2 Master, and BASIC Units.)	151
PC Name File Edit	Used to assign PC names in SYSMAC NET Link and SYSMAC LINK networks.	152
Node Selection	Used to select the PC with which the GPC is to communicate in online operations.	153

Programming

Name	Description	Page
Clear User Program Memory	Used to delete the program from the PC.	127
Display Memory	Used to display the amount of memory used for the program in the PC.	56
Switch Display	Used to switch the display for ladder diagrams between diagrams and mnemonics.	54
Program	Used to create, edit, or delete the program in the PC. The contents of the program in the PC's memory will be displayed on the screen.	126
Store/Store Insert	Used to write the program displayed on the GPC screen into the PC's memory. Not necessary when writing programs in mnemonic form.	69
Find	Used to search for instructions (including operands) in the program in the PC.	73
Edit Interrupt Program	Used to create I/O interrupt, scheduled interrupt, power off interrupt, and power on interrupt programs in the PC's memory.	84

Monitoring

Name	Description	Page
Read/Clear Errors	Used to read and clear errors that have occurred in the PC. Also used to read and clear messages generated by execution of MSG(195) instructions in the program.	134
I/O Bit Monitor	Used to monitor the status of input and output bits in the section of ladder diagram displayed on the screen. Bits that are OFF are displayed normally, while bits that are ON are displayed in bold.	135
I/O Monitor	Used to monitor up to 6 I/O bits, words, DM or EM words, timers, counters, steps, or transitions using two rows in the bottom left corner of the screen.	135
Force Set/Reset	Used to force-set or force-reset bits that are being monitored with I/O Monitor. Also used to clear force-set or force-reset status.	136
Change PV	Used to change the contents of words being monitored with I/O Monitor.	137
Multibit Monitor	Used to monitor up to 10 I/O bits, words, DM or EM words, timers, counters, steps, or transitions.	137
Word Monitor	Used to monitor a word. The word is displayed at the bottom of the screen in both 4-digit hexadecimal and 16-digit binary and the status of each bit can be changed.	138

Name	Description	Page
Change SV	Used to change the SV of a timer or counter. The SV is displayed at the bottom of the screen.	139
Pause Monitor	Used to freeze the I/O Monitor screen display when a specified bit turns OFF or ON.	139
Differentiation Monitor	Used to display and change the differentiated status of an I/O bit that is being monitored with the I/O Monitor operation.	140
Set System Clock	Used to read and/or set the clock in the PC.	140
Read Cycle Time	Used to read and display the cycle time of the PC.	141
Online Edit	Used to modify the ladder-diagram portions of the program in the PC.	141

Data Transfer

Name	Description	Page
Transmit	Used to transfer data such as the PC Setup, program, I/O memory, DM, EM, I/O comments, and the PC name table data between the PC and the GPC, as well as the floppy disk and Memory Cards in the PC or GPC.	132

File Management

Name	Description	Page
Formatting	Used to format the Memory Card in the PC.	103
File List	Used to display a list of files on the Memory Card in the PC.	103
Delete File	Used to delete an existing file from the Memory Card in the PC.	103
Rename File	Used to change the name of an file on the Memory Card in the PC.	103

Printing

Name	Description	Page
Ladder Diagram	Used to print portions of the PC program in normal ladder-diagram form.	107
Mnemonic List	Used to print portions of the PC program in mnemonic form.	107
DM or EM List	Used to print the contents of a specified area of the PC's DM or EM memory.	108

DM Operations

Name	Description	Page
Data Clear	Used to delete all DM and EM data in the PC.	150
Data Fill	Used to copy the same word to multiple DM or EM words in the PC.	150
Data Copy	Used to copy a specified area of DM or EM memory in the PC.	150
Data Input	Used to display or modify DM or EM data in the PC.	150

I/O Table Operations

Name	Description	Page
Generate I/O Table	Used to register in the PC the Units mounted to PC and allocate words to them.	129
Change I/O Table	Used to display and change the I/O table in the PC.	131
Verify I/O Table	Used to compare the actual Units mounted to PC with the I/O table in the PC.	131

Tracing Operations

Name	Description	Page
Instruction Trace	Used to trace instructions and display the results.	142
Mark Trace	Used to trace marks and display the results.	144
Data Trace	Used to trace data and display the results.	146

Error Log

Name	Description	Page
Error Log	Used to read error logs.	153

1-5 Ladder Diagram Instructions

This section provides tables of the ladder-diagram instructions for reference in inputting programs. The first table can be used to find instructions by function code. The second table can be used to find instructions by mnemonic.

Refer to the *CV500/CV1000 Operation Manual: Ladder Diagrams* for programming details on ladder-diagram instructions.

1-5-1 Function Codes

The following table lists the instructions that have function codes. Each instruction is listed by mnemonic, with the variations given in parentheses afterward, and by instruction name. The function code for any instruction is derived by using the numbers in the leftmost column as the leftmost digits and the number in the column heading as the rightmost digit.

Code	Rightmost digit										Instruction group
	0	1	2	3	4	5	6	7	8	9	
00	**NOP** NO OPERATION	**END** END	**IL** INTERLOCK	**ILC** INTERLOCK CLEAR	**JUMP** JUMP	**JME** JUMP END	**FAL (↑)** FAILURE ALARM AND RESET	**FALS** SEVERE ALARM FAILURE	**STEP** STEP DEFINE	**SNXT** STEP START	Sequence Control Instructions
01	**NOT** NOT	**KEEP (I)** KEEP	**CNTR** REVERSIBLE COUNTER	**DIFU (I)** DIFFERENTIATE UP	**DIFD (I)** DIFFERENTIATE DOWN	**TIMH** HIGH-SPEED TIMER	**SET (↑I↓)** SET	**RSET (↑I↓)** RESET			
02	**CMP (I)** COMPARE	**CMPL** DOUBLE COMPARE	**BCMP (↑)** BLOCK COMPARE	**TCMP (↑)** TABLE COMPARE	**MCMP (↑)** MULTIPLE COMPARE	**EQU (↑)** EQUAL					Data Compare Instructions
03	**MOVE (↑I)** MOVE	**MVN (↑)** MOVE NOT	**MOVL (↑)** DOUBLE MOVE	**MVNL (↑)** DOUBLE MOVE NOT	**XCHG (↑)** DATA EXCHANGE	**XCGL (↑)** DOUBLE DATA EXCHANGE	**MOVR (↑)** MOVE TO REGISTER	**MOVQ** MOVE QUICK			Data Move Instructions
04	**XFER (↑)** BLOCK TRANSFER	**BSET (↑)** BLOCK SET	**MOVB (↑)** MOVE BIT	**MOVD (↑)** MOVE DIGIT	**DIST (↑)** DATA DISTRIBUTE	**COLL (↑)** DATA COLLECT					
05	**SFT** SHIFT REGISTER	**SFTR (↑)** REVERSIBLE SHIFT REGISTER	**ASFT (↑)** ASYNCHRONOUS SHIFT REGISTER	**WSFT (↑)** WORD SHIFT							Data Shift Instructions
06	**ASL (↑)** SHIFT LEFT	**ASR (↑)** SHIFT RIGHT	**ROL (↑)** ROTATE LEFT	**ROR (↑)** ROTATE RIGHT	**ASLL (↑)** DOUBLE SHIFT LEFT	**ASRL (↑)** DOUBLE SHIFT RIGHT	**ROLL (↑)** DOUBLE ROTATE LEFT	**RORL (↑)** DOUBLE ROTATE RIGHT	**SLD (↑)** SHIFT DIGIT LEFT	**SRD (↑)** SHIFT DIGIT RIGHT	
07	**ADD (↑)** BCD ADD	**SUB (↑)** BCD SUBTRACT	**MUL (↑)** BCD MULTIPLY	**DIV (↑)** BCD DIVIDE	**ADDL (↑)** DOUBLE BCD ADD	**SUBL (↑)** DOUBLE BCD SUBTRACT	**MULL (↑)** DOUBLE BCD MULTIPLY	**DIVL (↑)** DOUBLE BCD DIVIDE	**STC (↑)** SET CARRY	**CLC (↑)** CLEAR CARRY	BCD Calculation Instructions
08	**ADB (↑)** BINARY ADD	**SBB (↑)** BINARY SUBTRACT	**MLB (↑)** BINARY MULTIPLY	**DVB (↑)** BINARY DIVIDE	**ADBL (↑)** DOUBLE BINARY ADD	**SBBL (↑)** DOUBLE BINARY SUBTRACT	**MLBL (↑)** DOUBLE BINARY MULTIPLY	**DVBL (↑)** DOUBLE BINARY DIVIDE			Binary Calculation Instructions
09	**INC (↑)** INCREMENT BCD	**DEC (↑)** DECREMENT BCD	**INCB (↑)** INCREMENT BINARY	**DECB (↑)** DECREMENT BINARY	**INCL (↑)** DOUBLE INCREMENT BCD	**DECL (↑)** DOUBLE DECREMENT BCD	**INBL (↑)** DOUBLE INCREMENT BINARY	**DCBL (↑)** DOUBLE DECREMENT BINARY			Increment/ Decrement Instructions
10	**BIN (↑)** BCD TO BINARY	**BCD (↑)** BINARY TO BCD	**BINL (↑)** DOUBLE BCD TO DOUBLE BINARY	**BCDL (↑)** DOUBLE BINARY TO DOUBLE BCD	**NEG (↑)** 2'S COMPLEMENT	**NEGL (↑)** DOUBLE 2'S COMPLEMENT	**SIGN (↑)** SIGN				Data Format Conversion Instructions
11	**MLPX (↑)** 4-TO-16 DECODER	**DMPX (↑)** 16-TO-4 ENCODER	**SDEC (↑)** 7-SEGMENT DECODER	**ASC (↑)** ASCII CONVERT	**BCNT (↑)** BIT COUNTER	**LINE (↑)** COLUMN TO LINE	**COLM (↑)** LINE TO COLUMN				Data Conversion Functions
12	**TTIM** ACCUMULATIVE TIMER	**TIML** LONG TIMER	**MTIM** MULTI-OUTPUT TIMER	**TCNT** TRANSITION COUNTER	**TSR (↑)** READ STEP TIMER	**TSW (↑)** WRITE STEP TIMER					Special Counter and Timer Instructions
13	**ANDW (↑)** LOGICAL AND	**ORW (↑)** LOGICAL OR	**XORW (↑)** EXCLUSIVE OR	**XNRW (↑)** EXCLUSIVE NOR	**ANDL (↑)** DOUBLE LOGICAL OR	**ORWL (↑)** DOUBLE LOGICAL OR	**XORL (↑)** DOUBLE EXCLUSIVE OR	**XNRL (↑)** DOUBLE EXCLUSIVE NOR	**COM (↑)** COMPLEMENT	**COML (↑)** DOUBLE COMPLEMENT	Logical Instructions

Code	Rightmost digit										Instruction group
	0	1	2	3	4	5	6	7	8	9	
14	**ROOT (↑)** SQUARE ROOT	**FDIV (↑)** FLOATING POINT DIVIDE	**APR (↑)** ARITHMETIC PROCESS	**SEC (↑)** HOURS TO SECONDS	**HMS (↑)** SECONDS TO HOURS	**CADD (↑)** CALENDAR ADD	**CSUB (↑)** CALENDAR SUBTRACT				Special Instructions
15	**SBN** SUBROUTINE ENTRY	**SBS (↑)** SUBROUTINE CALL	**RET** SUBROUTINE RETURN	**MSKS (↑)** INTERRUPT MASK	**CLI (↑)** CLEAR INTERRUPT	**MSKR (↑)** READ MASK					Subroutine Instructions Interrupt Instructions
16	**SSET (↑)** SET STACK	**PUSH (↑)** PUSH ONTO STACK	**LIFO (↑)** LAST-IN, FIRST-OUT	**FIFO (↑)** FIRST-IN, FIRST-OUT	**SRCH (↑)** DATA SEARCH	**MAX (↑)** FIND MAXIMUM	**MIN (↑)** FIND MINIMUM	**SUM (↑)** SUM			Table Data Processing Instructions
17	**TRSM** TRACE MEMORY	**EMBC (↑)** SELECT DM BANK	**CCL (↑)** LOAD FLAGS	**CCS (↑)** SAVE FLAGS	**MARK** MARK TRACE	**REGL (↑)** LOAD REGISTER	**REGS (↑)** SAVE REGISTER				Trace Instructions Special Instructions
18	**FILR (↑)** READ DATA FILE	**FILW (↑)** WRITE DATA FILE	**FILP (↑)** READ PROGRAM FILE	**FLSP (↑)** CHANGE STEP PROGRAM	**IORF (↑)** I/O REFRESH			**IOSP (↑)** DISABLE ACCESS	**IORS** ENABLE ACCESS	**IODP (↑)** I/O DISPLAY	File Processing Instructions and
19	**READ** READ I/O	**WRIT** WRITE I/O	**SEND (↑)** NETWORK SEND	**RECV (↑)** NETWORK RECEIVE	**CMND (↑)** DELIVER COMMAND	**MSG (↑)** MESSAGE					I/O Processing Instructions
20			**TOUT** TRANSITION OUTPUT								SFC Control Instructions
21	**SA (↑)** ACTIVATE STEP	**SP (↑)** PAUSE STEP	**SR (↑)** RESTART STEP	**SF (↑)** END STEP	**SE (↑)** DEACTIVATE STEP	**SOFF (↑)** RESET STEP					
22											---
23							**CNR (↑)** RESET TIMER/ COUNTER				---

1-5-2 Alphabetic List of Mnemonics

Mnemonic	Code	Name
ADB (↑)	080	BINARY ADD
ADBL (↑)	084	DOUBLE BINARY ADD
ADD (↑)	070	BCD ADD
ADDL (↑)	074	DOUBLE BCD ADD
AND (!↑↓)	None	AND
ANDL (↑)	134	DOUBLE LOGICAL AND
AND LD	None	AND LOAD
AND NOT (!)	None	AND NOT
ANDW (↑)	130	LOGICAL AND
APR (↑)	142	ARITHMETIC PROCESS
ASC (↑)	113	ASCII CONVERT
ASFT (↑)	052	ASYNCHRONOUS SHIFT REGISTER

Mnemonic	Code	Name
ASL (↑)	060	ARITHMETIC SHIFT LEFT
ASLL (↑)	064	DOUBLE SHIFT LEFT
ASR (↑)	061	ARITHMETIC SHIFT RIGHT
ASRL (↑)	065	DOUBLE SHIFT RIGHT
BCD (↑)	101	BINARY-TO-BCD
BCDL (↑)	103	DOUBLE BINARY-TO-DOUBLE BCD
BCMP (↑)	022	BLOCK COMPARE
BCNT (↑)	114	BIT COUNTER
BIN (↑)	100	BCD-TO-BINARY
BINL (↑)	102	DOUBLE BCD-TO-DOUBLE BINARY
BSET (↑)	041	BLOCK SET

Mnemonic	Code	Name
CADD (↑)	145	CALENDAR ADD
CCL (↑)	172	LOAD FLAGS
CCS (↑)	173	SAVE FLAGS
CLC (↑)	079	CLEAR CARRY
CLI (↑)	154	CLEAR INTERRUPT
CMND (↑)	194	DELIVER COMMAND
CMP (!)	020	COMPARE
CMPL	021	DOUBLE COMPARE
CNR (↑)	236	RESET TIMER/COUNTER
CNT	None	COUNTER
CNTR	012	REVERSIBLE COUNTER
COLL (↑)	045	DATA COLLECT
COLM (↑)	116	LINE TO COLUMN
COM (↑)	138	COMPLEMENT
COML (↑)	139	DOUBLE COMPLEMENT
CSUB (↑)	146	CALENDAR SUBTRACT
DCBL (↑)	097	DOUBLE DECREMENT BINARY
DEC (↑)	091	DECREMENT BCD
DECB (↑)	093	DECREMENT BINARY
DECL (↑)	095	DOUBLE DECREMENT BCD
DIFD (!)	014	DIFFERENTIATE DOWN
DIFU (!)	013	DIFFERENTIATE UP
DIST (↑)	044	SINGLE WORD DISTRIBUTE
DIV (↑)	073	BCD DIVIDE
DIVL (↑)	077	DOUBLE BCD DIVIDE
DMPX (↑)	111	16-TO-4 ENCODER
DVB (↑)	083	BINARY DIVIDE
DVBL (↑)	087	DOUBLE BINARY DIVIDE
EMBC (↑)	171	SELECT EM BANK
END	001	END
EQU (↑)	025	EQUAL
FAL (↑	006	FAILURE ALARM
FALS (↑)	007	FAILURE ALARM
FDIV (↑)	141	FLOATING POINT DIVIDE
FIFO (↑)	163	FIRST IN FIRST OUT
FILP (↑)	182	READ PROGRAM FILE
FILR (↑)	180	READ DATA FILE
FILW (↑)	181	WRITE DATA FILE
FLSP (↑)	183	CHANGE STEP PROGRAM
HMS (↑)	144	SECONDS TO HOURS

Mnemonic	Code	Name
IL	002	INTERLOCK
ILC	003	INTERLOCK CLEAR
INBL (↑)	096	DOUBLE INCREMENT BINARY
INC (↑)	090	INCREMENT BCD
INCB (↑)	092	INCREMENT BINARY
INCL (↑)	094	DOUBLE INCREMENT BCD
IODP (↑)	189	I/O DISPLAY
IORF (↑)	184	I/O REFRESH
IORS	188	ENABLE ACCESS
IOSP (↑)	187	DISABLE ACCESS
JME	005	JUMP END
JMP	004	JUMP
KEEP (!)	011	KEEP
LD (!↑↓)	None	LOAD
LD NOT (!)	None	LOAD NOT
LIFO (↑)	162	LAST IN FIRST OUT
LINE (↑)	115	COLUMN TO LINE
MARK	174	MARK TRACE
MAX (↑)	165	FIND MAXIMUM
MCMP (↑)	024	MULTIPLE COMPARE
MIN (↑)	166	FIND MINIMUM
MLB (↑)	082	BINARY MULTIPLY
MLBL (↑)	086	DOUBLE BINARY MULTIPLY
MLPX (↑)	110	4-TO-16 DECODER
MOV (!↑)	030	MOVE
MOVB (↑)	042	MOVE BIT
MOVD (↑)	043	MOVE DIGIT
MOVL (↑)	032	DOUBLE MOVE
MOVQ	037	MOVE QUICK
MOVR (↑)	036	MOVE TO REGISTER
MSG (↑)	195	MESSAGE
MSKR (↑)	155	READ MASK
MSKS (↑)	153	INTERRUPT MASK
MTIM	122	MULTI-OUTPUT TIMER
MUL (↑)	072	BCD MULTIPLY
MULL (↑)	076	DOUBLE BCD MULTIPLY
MVN (↑)	031	MOVE NOT
MVNL (↑)	033	DOUBLE MOVE NOT

Mnemonic	Code	Name
NEG (↑)	104	2'S COMPLEMENT
NEGL (↑)	105	DOUBLE 2'S COMPLEMENT
NOP	000	NO OPERATION
NOT	010	NOT
OR (!↑↓)	None	OR
OR NOT (!)	None	OR NOT
OR LOAD	None	OR LOAD
ORW (↑)	131	LOGICAL OR
ORWL (↑)	135	DOUBLE LOGICAL OR
OUT (!)	None	OUTPUT
OUT NOT (!)	None	OUTPUT NOT
PUSH (↑)	161	PUSH ONTO STACK
READ	190	I/O READ
RECV (↑)	193	NETWORK RECEIVE
REGL (↑)	175	LOAD REGISTER
REGS (↑)	176	SAVE REGISTER
RET	152	SUBROUTINE RETURN
ROL (↑)	062	ROTATE LEFT
ROLL (↑)	066	DOUBLE ROTATE LEFT
ROOT (↑)	140	SQUARE ROOT
ROR (↑)	063	ROTATE RIGHT
RORL (↑)	067	DOUBLE ROTATE RIGHT
RSET (!↑↓)	017	RSET
SA (↑)	210	ACTIVATE STEP
SBB (↑)	081	BINARY SUBTRACT
SBBL (↑)	085	DOUBLE BINARY SUBTRACT
SBN	150	SUBROUTINE ENTER
SBS (↑)	151	SUBROUTINE CALL
SDEC (↑)	112	7-SEGMENT DECODER
SE (↑)	214	DEACTIVATE STEP
SEC (↑)	143	HOURS TO SECONDS
SEND (↑)	192	NETWORK SEND
SET (!↑↓)	016	SET
SF (↑)	213	END STEP
SFT	050	SHIFT REGISTER
SFTR (↑)	051	REVERSIBLE SHIFT REGISTER
SIGN (↑)	106	SIGN
SLD (↑)	068	SHIFT DIGIT LEFT

Mnemonic	Code	Name
SNXT	009	STEP START
SOFF (↑)	215	RESET STEP
SP (↑)	211	PAUSE STEP
SR (↑)	212	RESTART STEP
SRCH (↑)	164	DATA SEARCH
SRD (↑)	069	SHIFT DIGIT RIGHT
SSET (↑)	160	SET STACK
STC (↑)	078	SET CARRY
STEP	008	STEP DEFINE
SUB (↑)	071	BCD SUBTRACT
SUBL (↑)	075	DOUBLE BCD SUBTRACT
SUM (↑)	167	SUM
TCMP (↑)	023	TABLE COMPARE
TCNT	123	TRANSITION COUNTER
TIM	None	TIMER
TIMH	015	HIGH-SPEED TIMER
TIML	121	LONG TIMER
TOUT	202	TRANSITION OUTPUT
TRSM	170	TRACE MEMORY
TSR (↑)	124	READ STEP TIMER
TSW (↑)	125	WRITE STEP TIMER
TTIM	120	ACCUMULATIVE TIMER
WRIT	191	I/O WRITE
WSFT (↑)	053	WORD SHIFT
XCGL (↑)	035	DOUBLE DATA EXCHANGE
XCHG (↑)	034	DATA EXCHANGE
XFER (↑)	040	BLOCK TRANSFER
XNRL (↑)	137	DOUBLE EXCLUSIVE NOR
XNRW (↑)	133	EXCLUSIVE NOR
XORL (↑)	136	DOUBLE EXCLUSIVE OR
XORW (↑)	132	EXCLUSIVE OR

1-6 PC Data Areas

The following table outlines the data areas provided in the PC. Refer to the *CV500/CV1000 Operation Manual: Ladder Diagrams* for programming details on ladder-diagram instructions

Area	PC	Range	Function
I/O Area	CV500	Words: CIO 0000 to CIO 0031 Bits: CIO 000000 to CIO 003115 ($0000 to $001F)	Allocated to I/O in the System and used to control I/O points. Bits not used to control I/O points can be used as work bits. The PC Setup can be used to control allocations. Once I/O table has been registered, input bits are displayed on GPC with an I; output bits, with a Q.
	CV1000	Words: CIO 0000 to CIO 0063 Bits: CIO 000000 to CIO 006315 ($0000 to $003F)	
Work Area	CV500	Words: CIO 0032 to CIO 0199 Bits: CIO 003200 to CIO 019915 ($0020 to $00C7)	These bits are used in the program to manipulate or to temporarily store data.
	CV1000	Words: CIO 0064 to CIO 0199 Bits: CIO 006400 to CIO 019915 ($0040 to $00C7)	
SYSMAC BUS/2 Area	CV500	Words: CIO 0200 to CIO 0599 Bits: CIO 020000 to CIO 059915 ($00C8 to $0257)	These bits are used for remote I/O points in the SYSMAC BUS/2 Remote I/O System unless the default allocations are changed in the PC Setup. Bits not used to control I/O points can be used as work bits.
	CV1000	Words: CIO 0200 to CIO 0999 Bits: CIO 020000 to CIO 099915 ($00C8 to $03E7)	
Link Area	Both	Words: CIO 1000 to CIO 1199 Bits: CIO 100000 to CIO 119915 ($03E8 to $04AF)	These bits are used for SYSMAC NET Link and SYSMAC LINK Systems. Bits not used for data links can be used as work bits. These bits can be set as holding bits via PC Setup.
Holding Area	Both	Words: CIO 1200 to CIO 1499 Bits: CIO 120000 to CIO 149915 ($04B0 to $05DB)	Used to store data and to retain the data values when the power is turned off.
CPU Bus Unit Area	Both	Words: CIO 1500 to CIO 1899 Bits: CIO 150000 to CIO 189915 ($05DC to $076B)	Used to store the operating status of CPU Bus Units. Bits not used by CPU Bus Units can be used as work bits. These bits can be set as holding bits via the PC Setup.
Work Area	Both	Words: CIO 1900 to CIO 2299 Bits: CIO 190000 to CIO 229915 ($076C to $08FB)	These bits are used in the program to manipulate or to temporarily store data. These bits can be set as holding bits via the PC Setup.
SYSMAC BUS Area	CV500	Words: CIO 2300 to CIO 2427 Bits: CIO 230000 to CIO 242715 ($08FC to $097B)	These bits are used for remote I/O points in the SYSMAC BUS Remote I/O System unless the default allocations are changed in the PC Setup. Bits not used to control I/O points can be used as work bits. Up to word 2399 can be set as holding bits via the PC Setup.
	CV1000	Words: CIO 2300 to CIO 2555 Bits: CIO 230000 to CIO 255515 ($08FC to $09FB)	
Temporary Relay Area	Both	TR0 to TR7 (bits only) ($09FF)	Used to temporarily store execution conditions. TR bits are not input when programming directly in ladder diagrams.
CPU Bus Link Area	Both	Words: G000 to G255 Bits: G00000 to G25515 ($0A00 to $0AFF)	G000 is the PC Status Area; G001 to G004, the Clock Area. G008 to G127 contain PC output bits; G128 to G255, CPU Bus Unit output bits.
Auxiliary Area	Both	Words: A000 to A511 Bits: A00000 to A51115 ($0B00 to $0CFF)	Contains flags and bits with special functions.

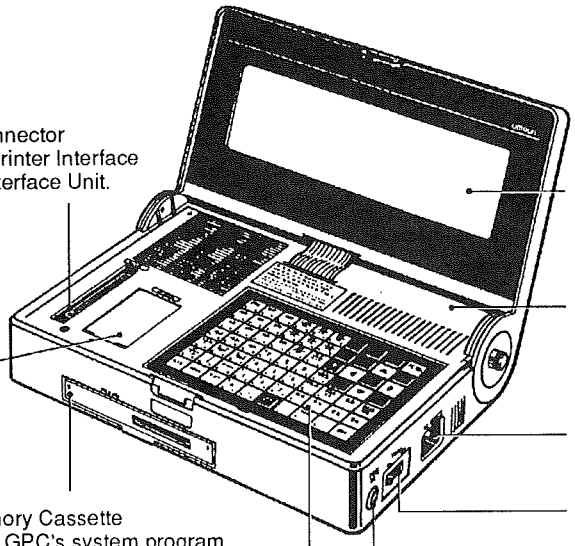
Area	PC	Range	Function
Transition Area	CV500	TN0000 to TN0511 ($0D00 to $0D1F)	Transition Flags for the transitions in the SFC program.
	CV1000	TN0000 to TN1023 ($0D00 to $0D3F)	
Step Area	CV500	ST0000 to ST0511 ($0E00 to $0E1F)	Step Flags for the steps in the SFC program. A step is active when its flag is ON.
	CV1000	ST0000 to ST1023 ($0E00 to $0E3F)	
Timer Area	CV500	T0000 to T0511 (Completion Flags: $0F00 to $0F1F Present Values: $1000 to $11FF)	Used to define timers (normal, high-speed, and totalizing) and to access Completion Flags, PV, and SV.
	CV1000	T0000 to T1023 (Completion Flags: $0F00 to $0F3F Present Values: $1000 to $13FF)	
Counter Area	CV500	C0000 to C0511 (Completion Flags: $0F80 to $0F9F Present Values: $1800 to $19FF)	Used to define counters (normal, reversible, and transition) and to access Completion Flags, PV, and SV.
	CV1000	C0000 to C1023 (Completion Flags: $0F80 to $0FBF Present Values: $1800 to $1BFF)	
DM Area	CV500	D00000 to D08191 ($2000 to $3FFF)	Used for internal data storage and manipulation.
	CV1000	D00000 to D24575 ($2000 to $7FFF)	
EM Area	CV1000	E00000 to E32765 for each bank; 2, 4, or 8 banks ($8000 to $8FFD)	EM functions just like DM. An Extended Data Memory Unit must be installed.
Index registers	Both	IR0 to IR2	Used for indirect addressing.
Data registers	Both	DR0 to DR2	Generally used for indirect addressing.

SECTION 2
Unit Components and Switch Settings

The names and functions of the Graphics Programming Console and Memory Card Adapter components are described in this section.

2-1 GPC Components

Top, Front, and Right Sides



Peripheral Device Connector
Used to connect the Printer Interface Unit or Floppy Disk Interface Unit.

LCD Panel
Displays programs, menus, and other information. Contains a backlight.

The cover for the Peripheral Device Connector can be stored here.

Battery Compartment
Contains the lithium battery that backs up the GPC's internal memory.

Power Cord Socket
Connect the AC power cable supplied with the GPC here.

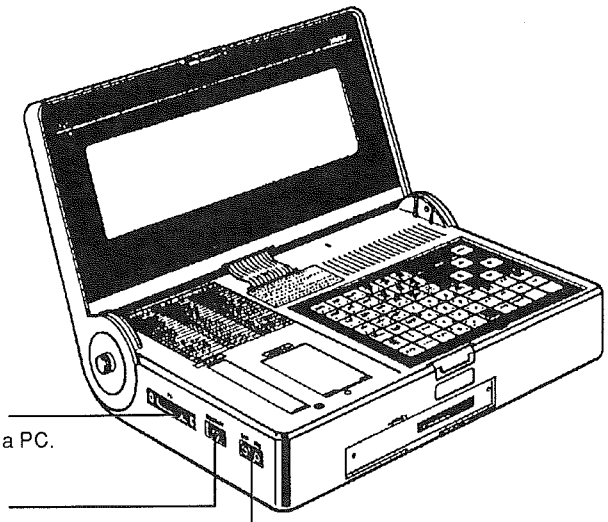
System Memory Cassette
Contains the GPC's system program.
Use model number CV500-MP311.

Power Switch
Used to turn the GPC on and off.

Fuse Compartment
Contains the GPC's 2-A power fuse.

Keyboard
Used to operate the GPC. Attach the CV500-CKF01 Keysheet here.

Left Side



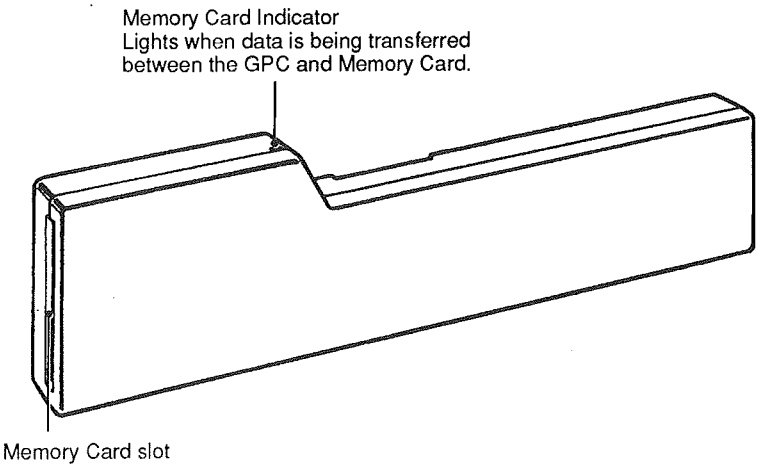
PC Connector
Used to connect a PC.

Contrast Adjustment
Used to adjust the contrast of the LCD panel.

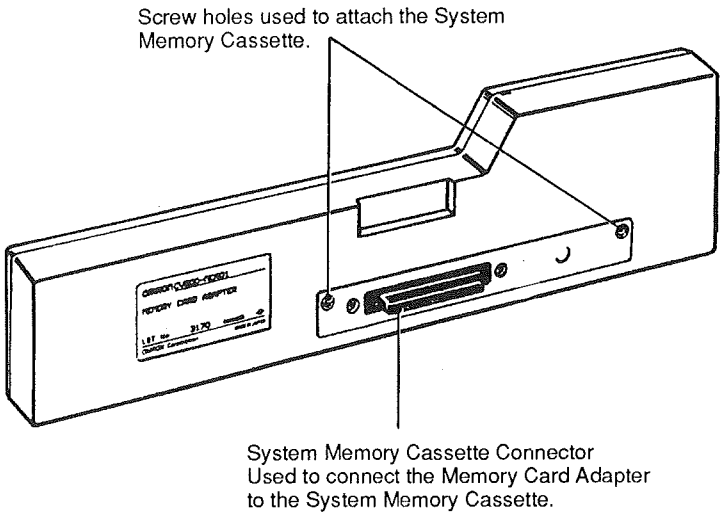
Cassette Tape Recorder Jack
Not used with the CV Series.

2-2 Memory Card Adapter Components

Front



Back



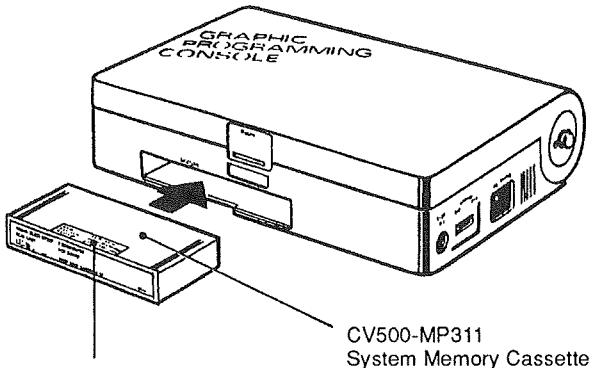
SECTION 3
Installation

This section provides procedures for setting up and connecting the GPC and its accessories. It also provides procedures for basic maintenance, such as battery replacement. Details on peripheral devices are provided in *Section 5 Peripheral Devices*.

3-1 System Memory Cassette

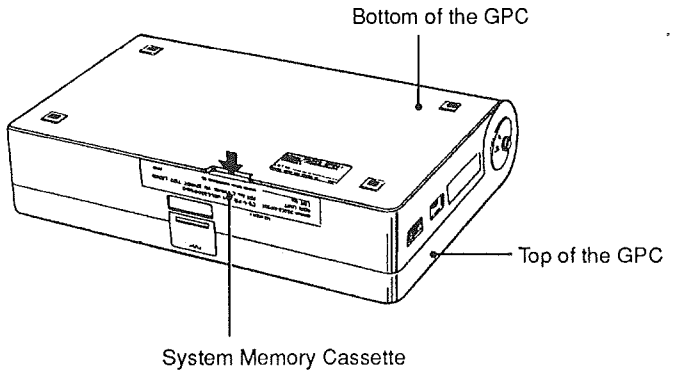
3-1-1 Installation

The GPC is shipped without a System Memory Cassette. Turn off the GPC, and insert the System Memory Cassette into the GPC with the caution label facing up, as shown in the following diagram. The front of the System Memory Cassette will be flush with the front of the GPC when fully inserted.



3-1-2 Removal

Before removing the System Memory Cassette, turn off the GPC and turn it over so that the bottom is facing up, as shown in the following diagram.



Grip the System Memory Cassette by the notch indicated by the arrow in the diagram above and pull. The cassette should slide out of the GPC.

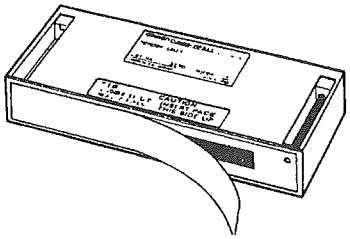
3-2 Memory Card Adapter

3-2-1 Installation

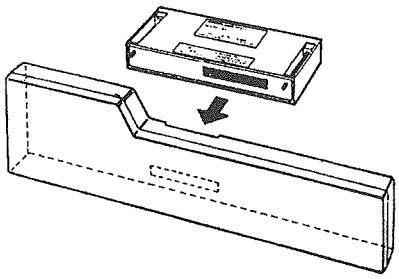
The list below describes the steps required to install the Memory Card Adapter. A CV500-MCA01 Memory Card Adapter is required to use Memory Cards.

1, 2, 3...

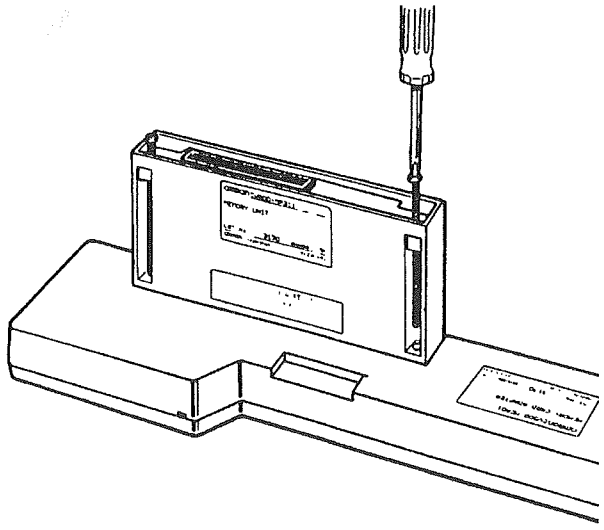
1. Remove the seal covering the front of the CV500-MP311 System Memory Cassette.



2. Join the connector on the front of the System Memory Cassette to the connector on the back of the Memory Card Adapter. Press the two together until the space between them disappears.

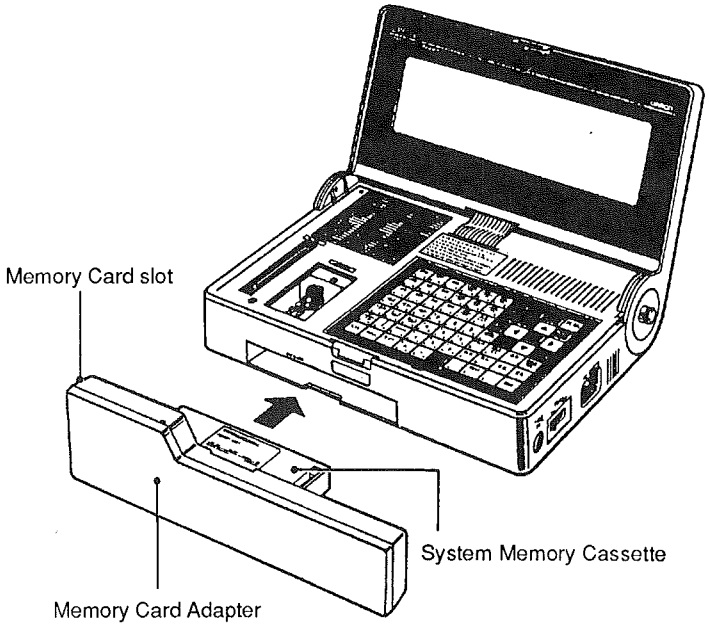


3. After removing the M4×6 bolts from the System Memory Cassette, fasten the System Memory Cassette to the Memory Card Adapter using the M3×65 bolts supplied with the Memory Card Adapter.

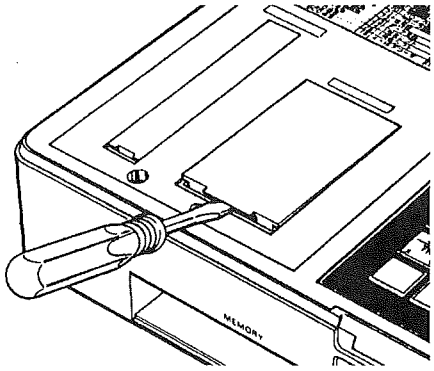


4. Be sure that the GPC is off.
5. Position the Memory Card Adapter and System Memory Cassette so that the Memory Card slot is on the left and insert the System Memory Cassette into the GPC. Insert the System Memory Cassette until there is no space between the Memory Card Adapter and the GPC.

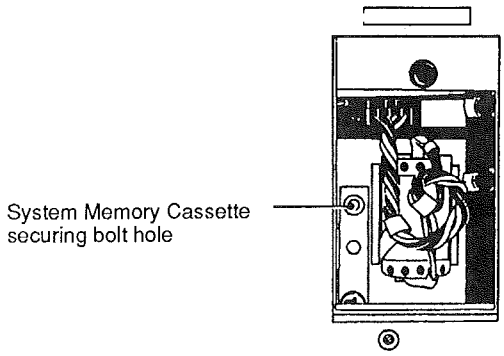
Note If a securing bolt is in place in the battery compartment (see #6), it will have to be unscrewed enough to allow the System Memory Cassette to be inserted.

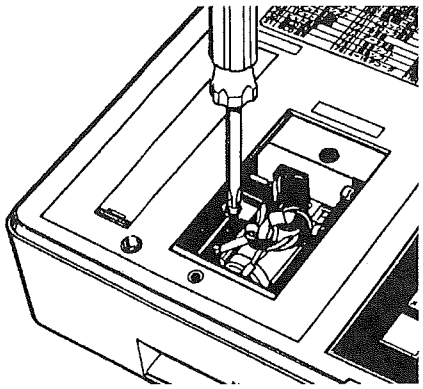


6. Lift off the cover of the battery compartment with a standard screwdriver.

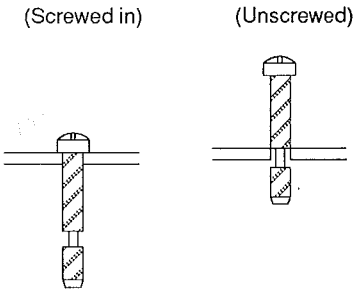


7. An M3×14 bolt that secures the System Memory Cassette to the GPC is supplied with the Memory Card Adapter. Screw the System Memory Cassette securing bolt into the hole on the left side of the battery compartment, as shown below.



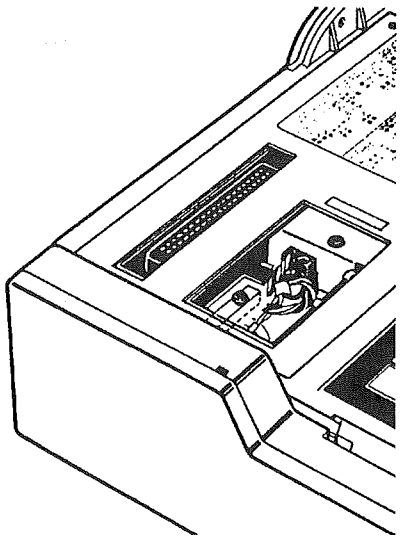


A section of the System Memory Cassette securing bolt has no threads, so it can be removed only partially after being screwed in.

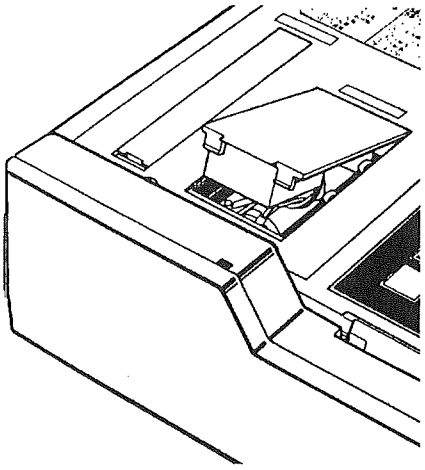


Note Take care not to drop the securing bolt into the GPC.

Once the securing bolt has been tightened, the Memory Card Adapter cannot be pulled out or fall out accidentally.



8. Replace the cover of the battery compartment.



Note

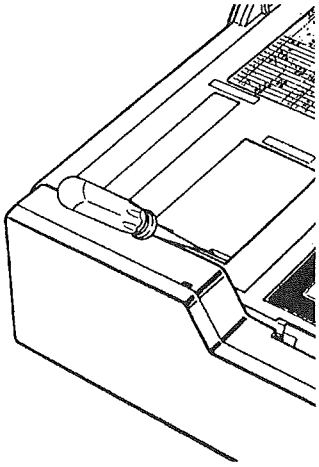
1. Always tighten the securing bolt when the Memory Card Adapter is installed to prevent the Memory Card Adapter from falling out accidentally when the GPC is being operated or moved.
2. The securing bolt is not tightened when using a C-series System Memory Cassette.

3-2-2 Removal

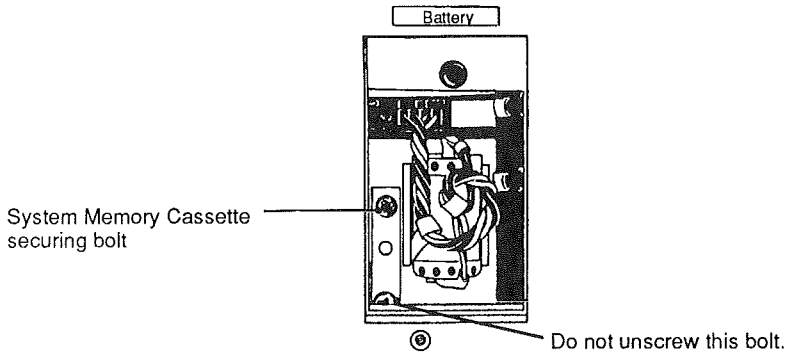
The list below describes the steps required to remove the Memory Card Adapter.

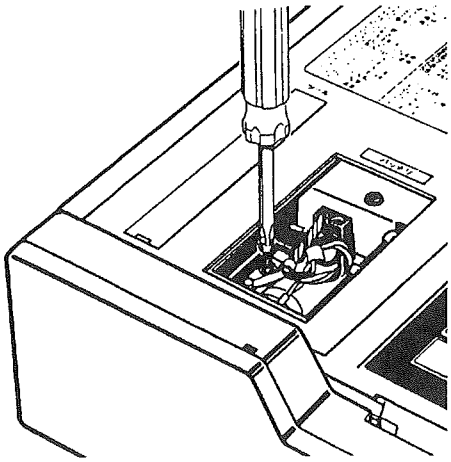
1, 2, 3... 1. Turn off the GPC.

2. Lift off the cover of the battery compartment with a standard screwdriver.

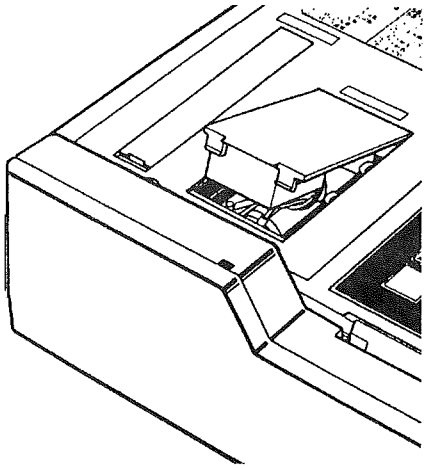


3. Unscrew the System Memory Cassette securing bolt until the section without threads is reached (see #7. in *3-2-1 Installation*).

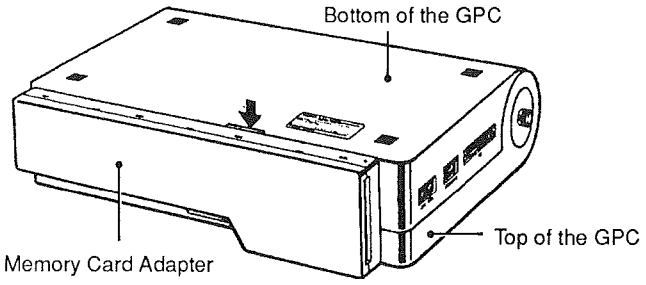




4. Replace the cover of the battery compartment.



5. Turn the GPC over so that the bottom is facing up, as shown in the following diagram.



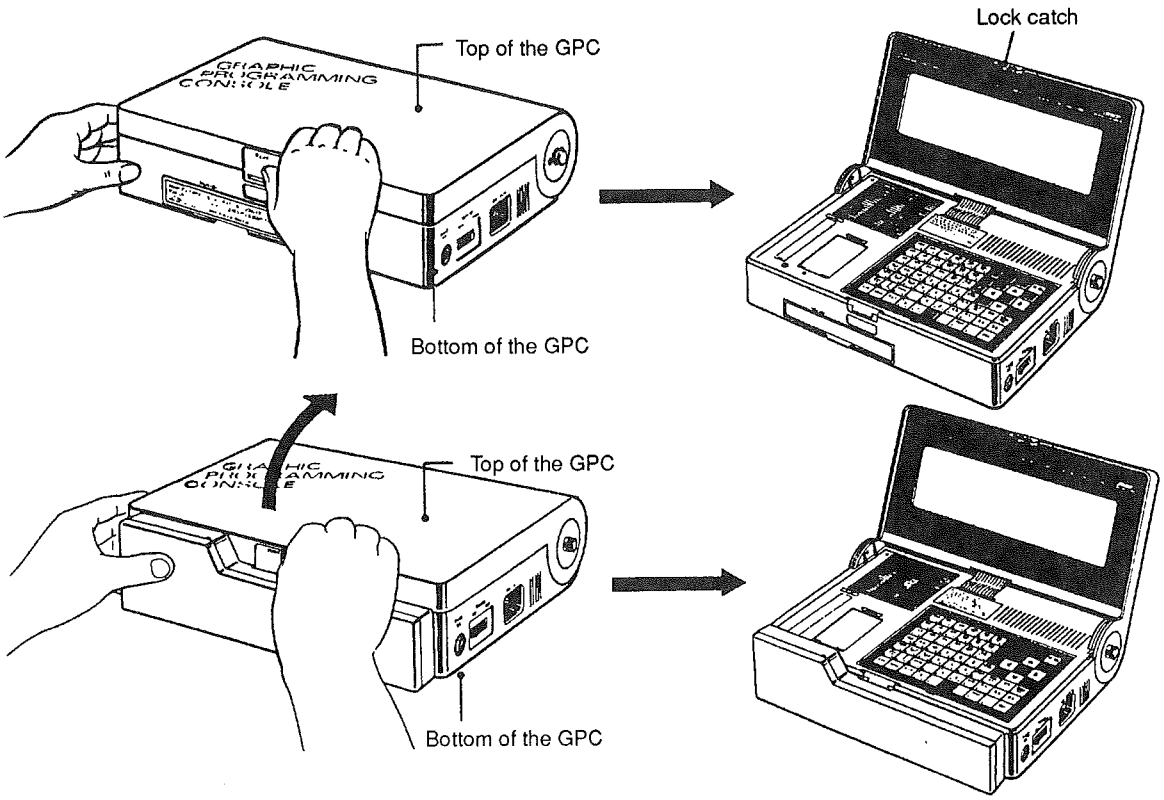
6. Grip the Memory Card Adapter by the notch indicated by the arrow in the diagram above and pull to remove.

   To remove the Memory Card Adapter from the System Memory Cassette, reverse steps 1, 2, and 3 in *3-2-1 Installation*.

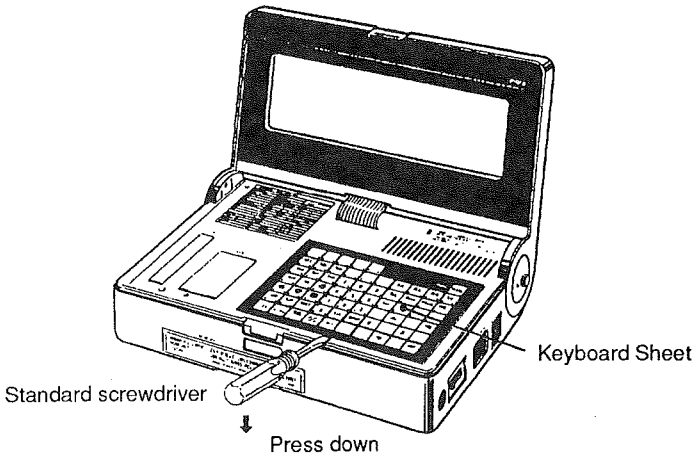
3-3 Keyboard Sheet Replacement

The GPC is shipped with a C-series Keyboard Sheet installed, so it is necessary to replace the Keyboard Sheet with the CV-series version (CV500-CKF01) supplied with the System Memory Cassette.

The first step in replacing the Keyboard Sheet is opening the cover of the GPC. To open the GPC, hold the bottom of the GPC with your left hand, press the handle marked "push" in the top of the GPC, and swing the top of the GPC up until it clicks into its upright position.



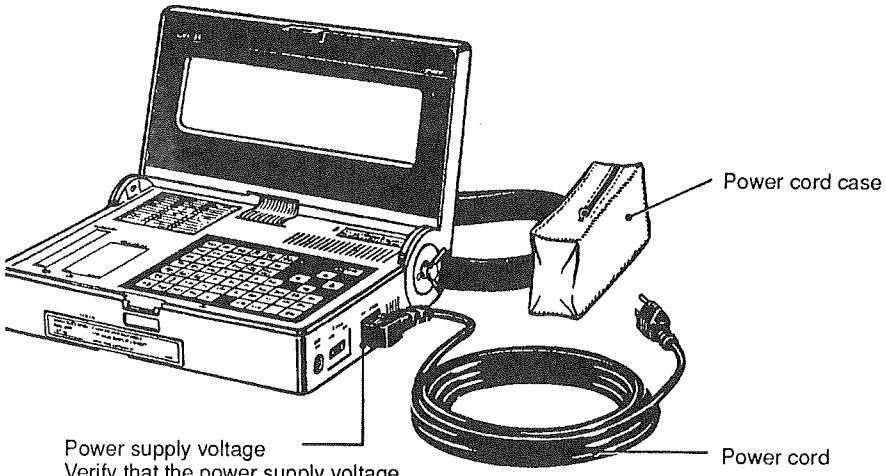
Lift off the C-series Keyboard Sheet with a standard screwdriver, as shown in the diagram below, and replace it with the CV-series version (CV500-CKF01).



Caution Close the cover of the GPC carefully. Closing the cover of the GPC too forcefully might damage the LCD panel or the case.

3-4 Power Cord Connection

The power cord is contained in the power cord case supplied with the GPC. Remove the power cord from its case and connect it to the power cord socket on the right side of the GPC, as shown below.



Turning on the GPC

Verify that the power supply voltage indicated next to the power cord socket matches the voltage of the electrical outlet, plug in the GPC, and turn on the power switch. The display in the diagram below should appear on the GPC's screen when a CV500-MP311 System Memory Cassette is installed.

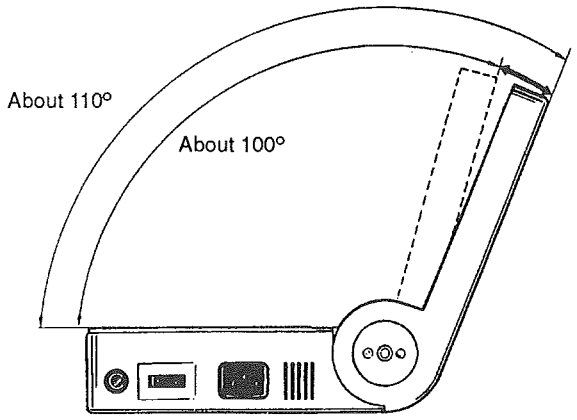
```
*** GRAPHIC PROGRAMMING CONSOLE <GPC> SYSTEM ***

 ■ SELECT ITEM                          ( )          :TURN KEY
  (0):SERVICE PC                        (SHIFT)+(SELECT):TO ORIGINAL MENU
  (1):PC SETUP                          (CTRL)+(0):UM USED  <W>
  (2):CPU BUS UNIT SETTINGS             (CTRL)+(1):BUZZER            ON/OFF
  (3):PC NAME FILE EDIT                 (CTRL)+(2):COMMENT USED
  (9):GPC SETTINGS                      (CTRL)+(3):DISPLAY CLOCK YES/NO
                                        (CTRL)+(SELECT):COPY DISPLAY
                                        (CTRL)+(PC CON):PC ONLINE/OFFLINE

                                                    PC OFFLINE
                                                                32KW
```

Note Be sure that the operation manual being used is written for the System Memory Cassette installed in the GPC. The GPC will not operate properly if the wrong manual is used.

3-5 Component Adjustment

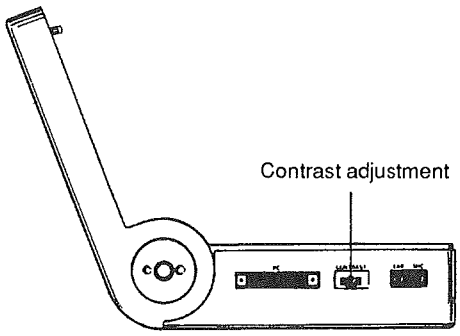
Screen Angle

The angle of the GPC's screen can be set at either of two angles, as shown in the diagram below. Tilt the screen until it clicks into position. Set the screen at the angle that provides the clearest display.



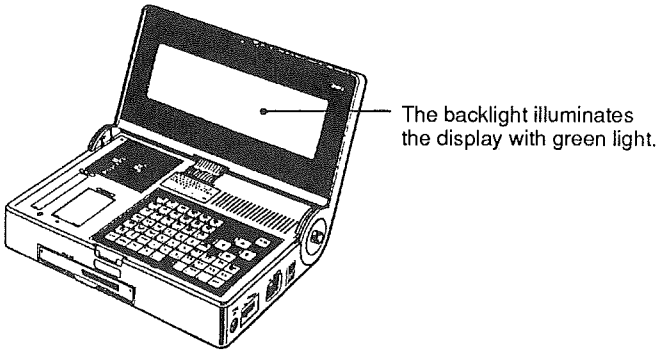
Display Contrast

The contrast of the GPC's display can be adjusted with the contrast adjustment on the left side of the GPC.



Backlight Function

The GPC's display is equipped with a backlight to allow operation even in dark locations. The backlight goes on automatically when the power is turned on and goes off automatically if a key is not pressed for 10 minutes. The backlight will go on again when the keyboard* is used again.



Note *The backlight will not go on when the shift key and some combinations of the control key and other keys are pressed.

Buzzer Operation

The GPC is equipped with a buzzer that sounds whenever a key is pressed. The buzzer can be turned on and off by holding down the control key and pressing 1.

3-6 Basic Maintenance

Keep the following spare parts on hand to return the GPC to service as soon as possible if one should fail.

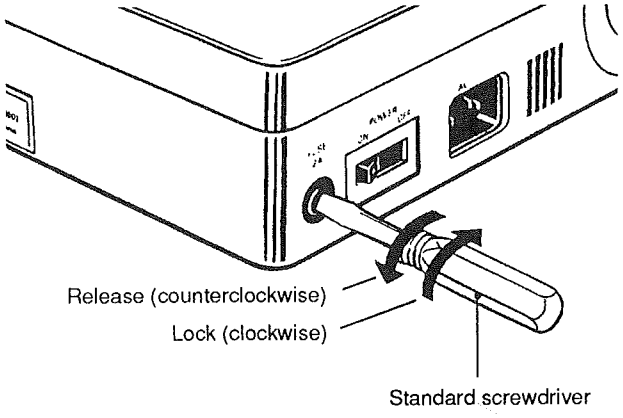
Part	Specification/model number
Power fuse	2 A, 250 V (MF61NR)
GPC Battery	3G2A9-BAT08
Memory Card Battery	HMC-BAT01

Power Fuse Replacement

Follow the procedure below to replace the power fuse.

1, 2, 3...

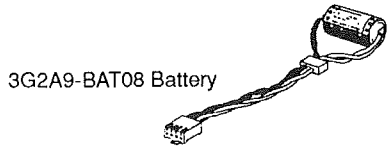
1. Turn the GPC off at the power switch.
2. Remove the fuse holder by turning it counterclockwise about 50°, as shown below.



3. The fuse will come out with the holder when the holder is pulled out. Remove the blown fuse from the holder.
4. Place a new fuse in the holder and insert it into the GPC.
5. Lock the fuse holder by turning it clockwise about 50°.

GPC Battery Replacement

The life expectancy of the 3G2A9-BAT08 battery (shown below) is very sensitive to temperature. The battery will last about 5 years at 25°C (77°F), but only 1 year at 50°C (122°F).



Note When the battery expires, replace the battery, wires, and connectors shown above at the same time.

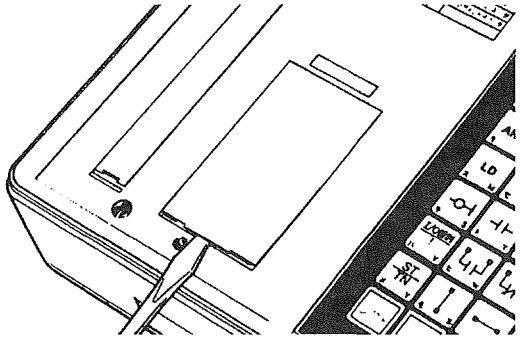
When the GPC battery begins to expire, the message "BAT ERR" will appear on the GPC display. Replace the battery within a week after this message appears.

Follow the procedure below to replace the GPC's battery. The battery must be replaced within 5 minutes after the old battery is removed to ensure retention of data in the GPC.

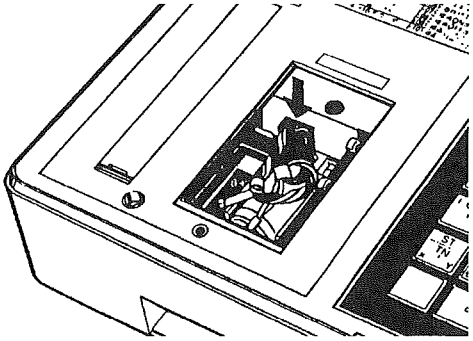
1, 2, 3...

1. Turn the GPC off at the power switch.

2. Lift off the cover of the battery compartment with a standard screwdriver.



3. Disconnect the connector indicated by the arrow in the diagram below and replace the battery.



4. Replace the cover of the battery compartment.

Caution Do not short the terminals, charge, cut, or heat the battery; doing so might cause the battery to ignite, explode, or leak.

Memory Card Battery Replacement

Memory Cards that use RAM memory contain a battery that provides back-up power. The life of this battery depends on the amount of RAM memory in the card, as shown in the following table.

Model	Capacity	Life expectancy*
HMC-ES641	64K bytes	5 yrs
HMC-ES151	128K bytes	3 yrs
HMC-ES251	256K bytes	1 yr
HMC-ES551	512K bytes	0.5 yr

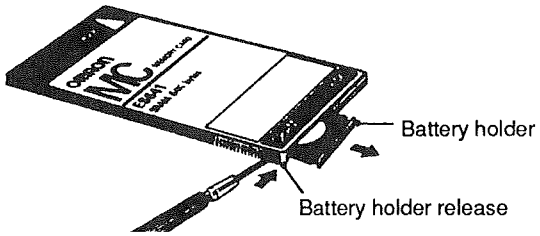
Note The life expectancies are for Memory Cards used at 20°C (68°F). Battery life is shorter at higher temperatures.

When the battery begins to expire, the message "CARD BATTERY ERR" will be displayed on the GPC screen. The battery should be replaced within a week after the error message appears.

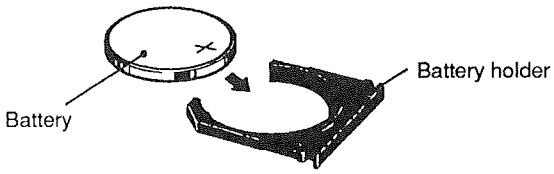
Use the following procedure to replace a Memory Card battery. Steps 3 to 6 must be completed within 1 minute to ensure retention of data in the Memory Card.

1, 2, 3...

1. Turn the GPC off at the power switch.
2. Remove the Memory Card from the Memory Card Adapter.
3. Use the tip of a pen, pencil, etc., to press the battery holder release on the side of the Memory Card and slide out the battery holder, as shown below.



4. Remove the old battery.
5. Place the new battery into the battery holder with the positive side up.



6. Insert the battery holder all the way into the Memory Card and make sure that the release catch locks so the holder will not slide out.

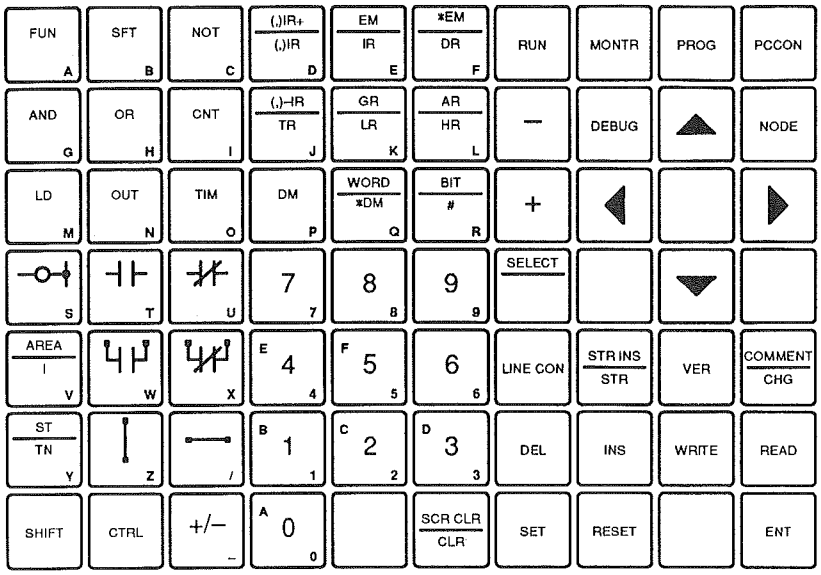
Caution Do not short the terminals, charge, cut, or heat the battery; doing so might cause the battery to ignite, explode, or leak.

SECTION 4
Basic Operation

This section describes basic aspects of operation, including the operation of keys, GPC memory and file structure, and inserting/removing Memory Cards.

4-1 Keyboard

CV-series Keyboard Sheet (CV500-CKF01)



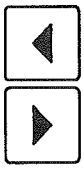
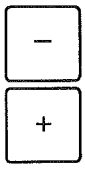
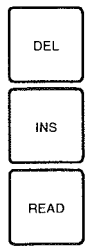
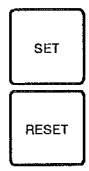
Keys

The following table describes the function of the keys on the keyboard when pressed alone, while holding the Shift Key, and while holding the Control Key. Dashes (---) indicate the key or key combination has no function.

Key names are derived either directly from the letters on the key (all-caps, e.g., the PC CON Key) or from a description of the graphic on the key (initial-caps, e.g., the Up Key).

Note There are two sets of keys for the LOAD, LOAD NOT, AND, AND NOT, OR, OR NOT, OUTPUT, and OUTPUT NOT instructions. The keys with graphics on them are used when manipulating programs in ladder-diagram form. The keys with the instruction mnemonics on them (e.g., LD) are used when manipulating graphics in mnemonic form.

Key(s)	Name	Function	Function with Shift Key	Function with Control Key
PCCON	PC CON Key	---	---	Switches GPC between online and offline modes.
RUN PROG DEBUG MONTR	Mode Keys	---	---	Change the PC mode.
NODE	NODE Key	Used to select a PC in the network.	---	---
▲ ▼	Up and Down Keys	Move the cursor up and down.	Delete or create an empty line.	---

Key(s)	Name	Function	Function with Shift Key	Function with Control Key
	Left and Right Keys	Move the cursor left and right.	Delete filename or comment characters. Delete or create an empty line. Move left or right in a data trace screen.	---
	Plus and Minus Keys	Read out one instruction block in a ladder diagram. Scroll up and down a mnemonic display.	Increment or decrement a value being changed.	---
	SELECT Key	---	Returns the screen to the previous menu.	Prints a copy of the current screen.
	LINE CON Key	Draws a line between two points in a ladder diagram.	---	---
	STR Key	Saves a ladder diagram to memory.	Appends a ladder diagram to memory.	---
	VER Key	Used when verifying.	---	---
	CHG Key	Switches the screen between ladder diagram and mnemonic displays. Overwrites characters when inputting filenames or I/O comments.	Switches screen to comment display.	---
	DEL, INS, and READ Keys	Change the GPC mode for programming.	---	---
	WRITE Key	Changes the GPC mode for programming.	---	Used to save to the Memory Card, copy or change comments, input the password when deleting the program or PC Setup, or set the online edit mode.
	SET and RESET Keys	Set and reset bits. Specify up and down differentiated instructions.	Force-set and force-reset bits.	---
	ENT Key	Used to input or confirm an operation.	Searches for an instruction containing a specified operand.	Used to search from the beginning of the program.
	CLR Key	Deletes an input.	Deletes a ladder diagram program section.	---

Key(s)	Name	Function	Function with Shift Key	Function with Control Key
...	Numeric Keys (0 to 5 Keys)	Used to input numbers 0 to 5.	Used to input hexadecimal numbers A to F.	---
...	Numeric Keys (6 to 9 Keys)	Used to input numbers 6 to 9.	---	---
T	(Ladder) LD/AND Key	Used to write input conditions in ladder diagrams.	---	---
U	(Ladder) LD NOT/AND NOT Key			
W	(Ladder) OR Key			
X	(Ladder) OR NOT Key			
Z / /	Vertical and Horizontal Line Keys	Used to write vertical and horizontal lines in ladder diagrams.	---	---
S	(Ladder) Output Key	Used to write outputs in ladder diagrams.	---	---
FUN A	FUN Key	Used to input instructions that have function codes.	---	---
AREA I V	! (Immediate Refresh) Key	Specifies an immediate refresh instruction.	Inputs a user-defined I/O name.	---
ST TN Y	TN Key	Specifies a transition.	Specifies a step.	---
(,)IR+ (,)IR D	Indirect IR Key	Specifies an indirectly addressed index register.	Specifies auto-incremented indirectly addressed index register.	---
EM IR E	Direct IR Key	Specifies a directly addressed index register.	Specifies the Extended Data Memory (EM).	---
DR F	DR Key	Specifies a data register.	Specifies indirectly addressed EM.	---
(,)-IR TR J	TR Key	Specifies a TR bit.	Specifies auto-decremented indirectly addressed index register.	---
GR LR K	LR Key	---	Specifies the CPU Bus Link Area (G).	---
AR HR L	HR Key	---	Specifies the Auxiliary Area (A).	---
DM P	DM Key	Specifies the Data Memory Area (DM).	---	---

Key(s)	Name	Function	Function with Shift Key	Function with Control Key
WORD / *DM Q	*DM Key	Specifies indirectly addressed DM.	Specifies a CIO Area word.	---
BIT / # R	# Key	Specifies a constant.	Specifies a CIO Area bit.	Specifies an 8-digit constant.
CNT I TIM O	TIM and CNT Keys	Specifies a timer or counter instruction, or a timer or counter Completion Flag.	---	---
LD M OUT N AND G OR H	(Mnemonic) LD, OUT, AND, and OR Keys	Used to write input instructions when programming in mnemonics.	---	---
NOT C	NOT Key	Used to specify an normally closed condition.	---	Clears the force-set or force-reset status of multiple bits.
SFT B	SFT Key	Used to specify the SHIFT instruction when programming in mnemonics.	---	---

4-2 Memory Configuration and Data File Structure

GPC Memory Configuration

The GPC's internal memory is divided into the 6 areas shown in the table below. The GPC's memory is backed up by a battery, so data is not lost when the power is turned off.

Data area name	Capacity
Program memory area	32K words (in the CV500)
DM Area	8K words (in the CV500)
I/O comment area	12K words (743 I/O comments)
PC Setup area	8K words
Word grouping (custom data areas) area	60 words
Function code table area	143 words

Data File Structure

The files that can be created on data disks and memory cards are listed in the following table. New floppy disks must be formatted with the Initialize Media operation in the main offline menu before they can be used as data disks.

File type.	Filename extension	Capacity	Function	Operations using file
Object	.OBJ	64K words	Contains program file data in machine language.	Programming, Data Transfer, Printing
I/O comment	.CMT	322K words	Contains the I/O comments that are displayed on the screen or printed out when creating the program. Up to 10,000 I/O comments can be stored per file.	Edit I/O comments, Print
I/O memory	.IOM*	3,072 words	Contains I/O Area, Work Area, SYSMAC BUS/2 Area, SYSMAC BUS Area, CPU Bus Link Area, and Auxiliary Area data.	Data Transfer
DM	.IOM*	24K words	Contains Data Memory data.	Edit DM, Data Transfer, Printing
EM	.IOM*	32K words	Contains Extended Data Memory data.	Edit DM, Data Transfer, Printing
PC name table	.PCN	2.5K words (approx.)	Contains the PC names assigned to nodes in SYSMAC NET Link and SYSMAC LINK Systems. Up to 500 PC names can be stored per file.	Edit PC names, Data Transfer, Printing
PC parameters	.STD	8K words	Contains all of the PC system data for backup including: PC Setup settings, the I/O table, routing tables, I/O allocation table, function code table, and CPU Bus Unit Setup information.	Data Transfer
Word grouping	.ARE	60 words	Contains data for backing up custom data areas.	Data Transfer
Function code table	.MEI	143 words	Contains a backup of the function code table.	Data Transfer

Note *The I/O memory, DM, and EM files all use the same ".IOM" filename extension, so different filenames must be used to identify these data files.

Compatibility with CVSS

Some data files used in the GPC cannot be used in a host computer running CVSS and vice-versa. Interchangeability of data files is described in the following table.

File type	Compatibility
Object	Compatible Convert from machine language with the Convert UM operation for use in CVSS.
I/O comment	Files created in the GPC can be used in CVSS systems, but those created in CVSS systems cannot be used in the GPC.
I/O memory	Incompatible
DM, EM	Compatible The filename extension of CVSS data files must be changed to ".IOM" for use in the GPC.
PC name table	Compatible
PC parameters	This type of file can be used in the GPC only.
Word grouping	This type of file can be used in the GPC only.
Function code table	This type of file can be used in the GPC only.

Note In the GPC, lower case characters are distinguished from upper case characters in filenames, but in the CVSS, lower case characters are automatically converted to upper case. Files that have been saved in the GPC with filenames including lower case characters will not be usable in CVSS systems, so save files

with upper case characters in the GPC if those files might be used in the CVSS at some later time.

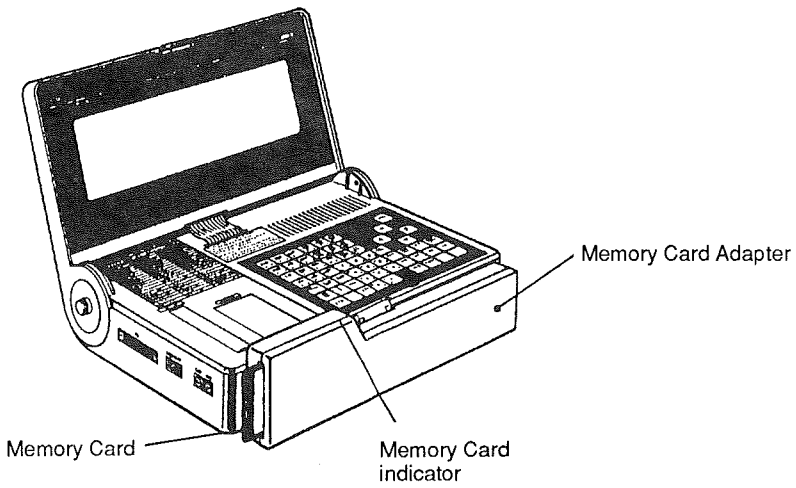
4-3 Memory Card Insertion and Removal

Insertion

Turn the GPC off before inserting the Memory Card.

Removal

The Memory Card indicator lights to indicate that data is being transferred between the Memory Card and the GPC. Be sure that the indicator is off before removing the Memory Card to prevent destroying data in the card.

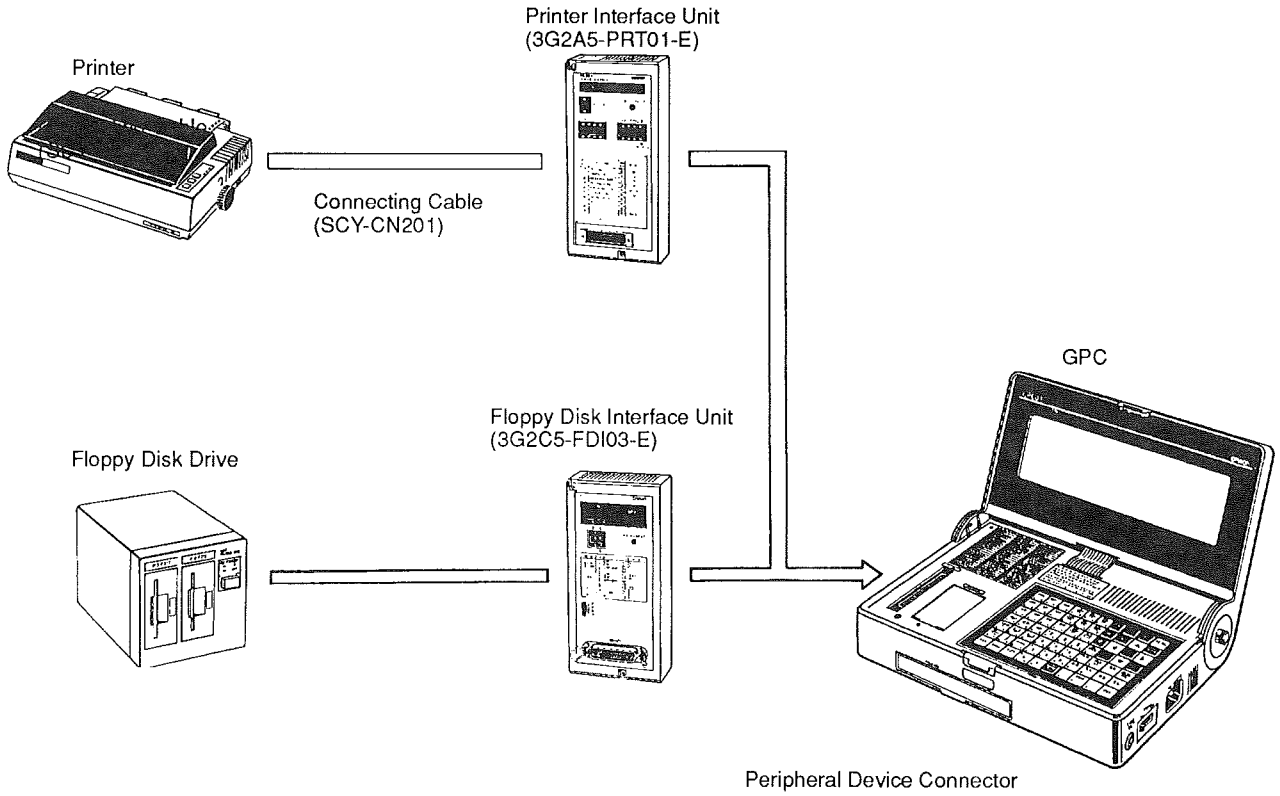


SECTION 5
Peripheral Devices

This section provides details and examples of switch setting and connections for peripheral devices such as printers and floppy disk drives. Actual GPC operations to use these peripheral devices are provided in the following two sections.

5-1 System Configuration

Two peripheral devices, the 3G2A5-PRT01-E Printer Interface Unit and the 3G2C5-FDI03-E Floppy Disk Interface Unit, can be connected to a GPC with a CV500-MP311 System Memory Cassette installed. The 3G2A5-PRT01-E Printer Interface Unit can be used with or without a CV500-MP311 System Memory Cassette installed.



5-2 Printers

We recommend using an Epson FX-800 printer with the 3G2A5-PRT01-E Printer Interface Unit. Either an #8148 serial interface board is also required. Order the serial interface board separately from Epson.

The switch settings, cable connections, and GPC Setup procedures required to operate this printer are described below.

5-2-1 Switch Settings

FX-800

The table below shows the required pin settings for DIP switch 1 (SW1).

Pin no.	Setting	Function
1	OFF	Sets character emphasis to normal.
2	OFF	Sets the zero character style to 0.
3	OFF	Sets condensed characters to ordinary.
4	OFF	Enables the buzzer.
5	ON	Disables automatic tearoff.
6 to 8	OFF	Sets the international character set to Japanese.

#8148 Interface Board

The tables below show the pin settings required to set the board for a baud rate of 4,800 bps, no parity, 8 data bits, and 1 stop bit. The first table shows settings for DIP switch 1 (SW1).

Pin no.	Setting	Function
1	OFF	Sets 8 data bits.
2	OFF	Sets no parity.
3	OFF	
4	OFF	Sets flag polarity to positive.
5	OFF	Sets baud rate to 4,800 bps.[1, 2]
6	ON	
7	OFF	
8	ON	

The table below shows the required pin settings for DIP switch 2 (SW2).

Pin no.	Setting	Function
1	ON	Enables the interface board.
2	ON	Enables buffer operation.
3	OFF	Buffer full: 216 bytes.
4	OFF	Disables self diagnosis.

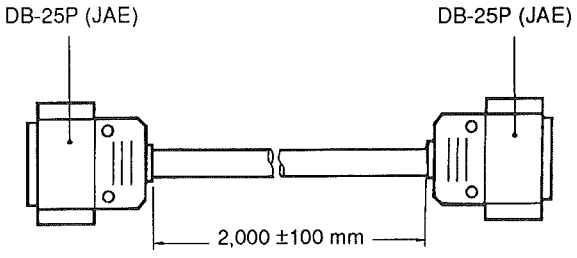
Note

1. The DIP switch on the Printer Interface Unit is not used. The baud rate of the GPC is set in the GPC Settings.
2. The printer's baud rate should match the GPC's baud rate set in the GPC Setup. For 2,400 bps set as follows: pin 5 OFF, pin 6 ON, pin 7 ON, pin 8 OFF. For 9,600 bps set as follows: pin 5 OFF, pin 6 ON, pin 7 OFF, pin 8 OFF.

5-2-2 Cable Connections

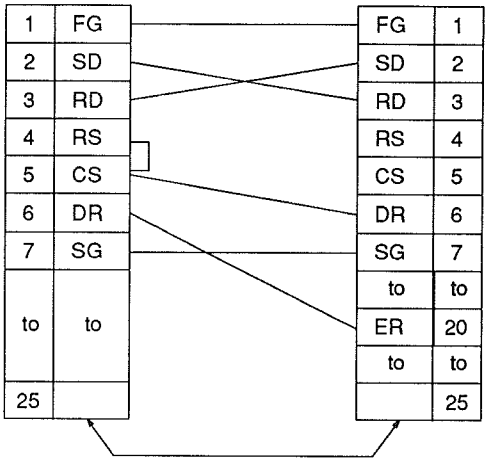
Connecting Cable

Use a 6-m, 25-pin serial cable to connect the printer to the Printer Interface Unit. The 2-meter SCY-CN201 connecting cable is shown below.



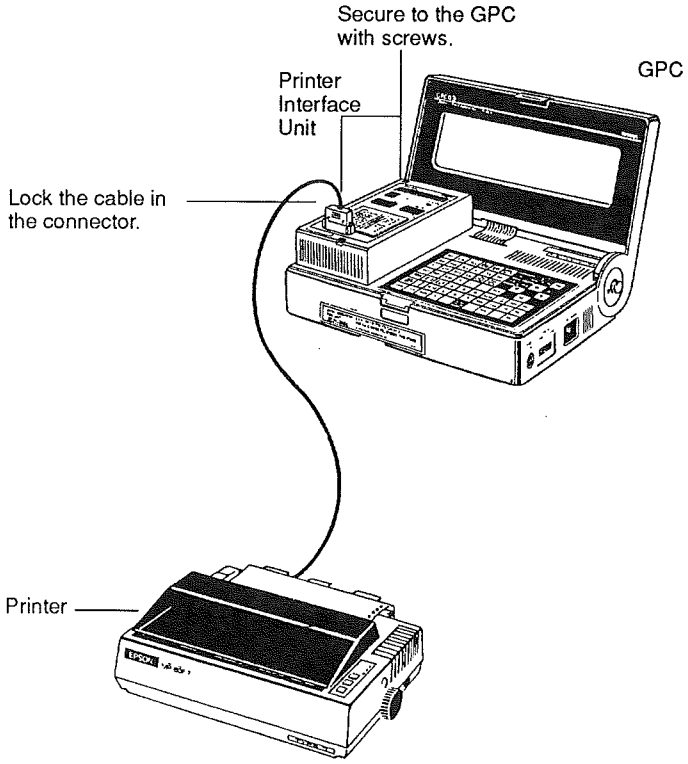
Connections

The following diagram shows the connection of signals between the Printer Interface Unit and the printer.



5-2-3 Operation

Use the following procedure to operate the printer.



1, 2, 3...

1. Set the printer's DIP switches as described in *5-2-1 Switch Settings*. Communications should be set for 4,800 bps, 8, N, 1. Also set the printer for 1/6 inch paper delivery, 80 characters/line, and no-paper detection, and disable 1" perforations.
2. Attach the Printer Interface Unit to the GPC and secure it by tightening the screw. It is not necessary to set the DIP switches on the Printer Interface Unit.

   The Printer Interface Unit and printer can be used even without a System Memory Cassette installed in the GPC.
3. Connect the Printer Interface Unit and printer with the appropriate connecting cable (e.g., SCY-CN201).

4. Lock the cables to the connectors to ensure good connections.
5. Turn on the GPC.
6. Set the printer's specifications in the GPC from the GPC Settings menu. (See below.)
7. Turn on the printer.*
8. Print data using the Print operation from either the online or offline menus.

Note *If the printer is on when it is connected to the GPC, any data in the print buffer before connection might be printed when the Print operation is executed.

Setting Printer Specifications

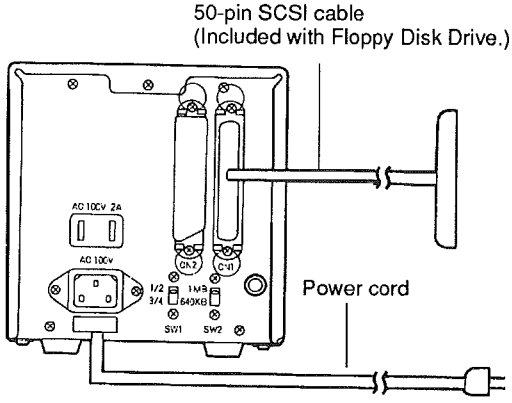
Set printer specifications in the GPC with the Customize Printer operation described in *6-7-1 GPC Settings*.

5-3 Floppy Disk Drive

The switch settings and wiring for 3 NEC Floppy Disk Drives are described in this section. The format of floppy disks initialized on NEC Floppy Disk Drives might not be compatible with other disk drives.

NEC PC-9831-VW2/MF2

The PC-9831-VW2 uses 3.5" disks and the PC-9831-MF2 uses 5.25" disks.



1, 2, 3...

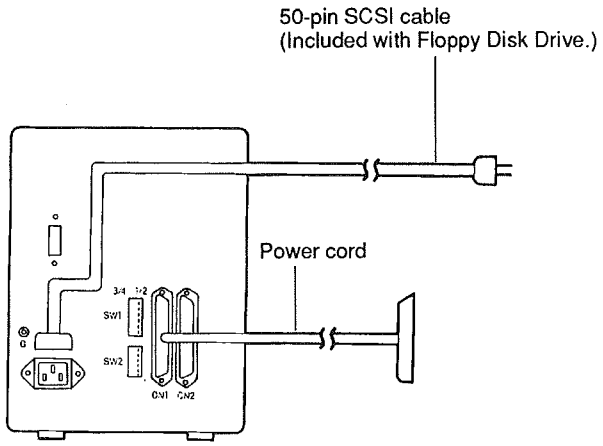
1. Connect the 50-pin SCSI cable (included with the Disk Drive) to connector CN1.
2. Set switch 1 (SW1) to "½".
3. The switch 2 (SW2) setting depends on the type of floppy disk being used. Set to "1MB" if high-density disks are being used and to "640KB" if low-density disks are being used.

NEC PC-9831-UW1

The PC-9831-UW1 uses 3.5" disks, like the PC-9831-VW2, but has a 36-pin connector. Use an OMRON C500-CN124 Connecting Cable to connect this disk drive to the Floppy Disk Interface Unit.

NEC PC-9881N

The PC-9881N uses 8" disks.

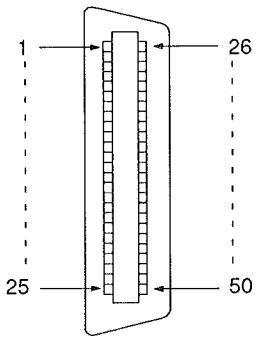


1, 2, 3...

1. Connect the 50-pin SCSI cable (included with the Disk Drive) to connector CN1.
2. Set all pins on DIP switches 1 and 2 (SW1 and SW2) to "½".

3G2C5-FDI03-E Connections

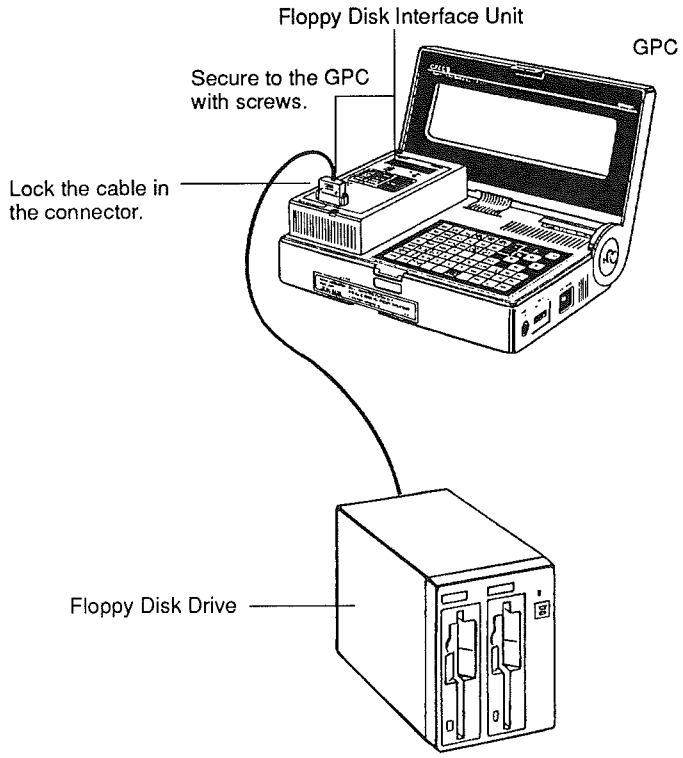
The table below shows the functions of the Floppy Disk Interface Unit's connector pins.



Pin no.	Signal
1	WID
2	MFM
3	RDT
4	PRT
5	TK0
6	WGT
7	WDT
8	STP
9	DIR
10	NC
11	NC
12	DS2
13	DS1
14	SYC
15	RDY
16	IDX
17	HLD
18	NC
19	SSL
20	NC
21	TSD
22	MTR
23	FUS
24	FLR
25	LWC
26 to 50	GND

3G2C5-FDI03-E Operation

Follow the procedure described in the list below to operate the 3G2C5-FDI03-E Floppy Disk Interface Unit.



1, 2, 3...

1. Attach the Floppy Disk Interface Unit to the GPC and secure it by tightening the screws. It is not necessary to set the Floppy Disk Interface Unit's DIP switches.
2. Connect the Floppy Disk Interface Unit and disk drive with the appropriate connecting cable. Lock the cables to the connectors to ensure good connections.
3. Turn on the GPC.
4. Set the disk drive's specifications in the GPC from the GPC Setup menu. (See below.)
5. Turn on the floppy disk drive.
6. Transfer data between the GPC and floppy disks using the Transfer operation from either the online or offline menus.

Setting Disk Drive Specifications

Set the floppy disk drive specifications in the GPC with the Customize Printer operation described in *6-7-1 GPC Settings*.

SECTION 6
Offline Operations

This section describes the operations that can be performed when the GPC is operating independently from a PC, i.e., operations performed in the GPC memory.

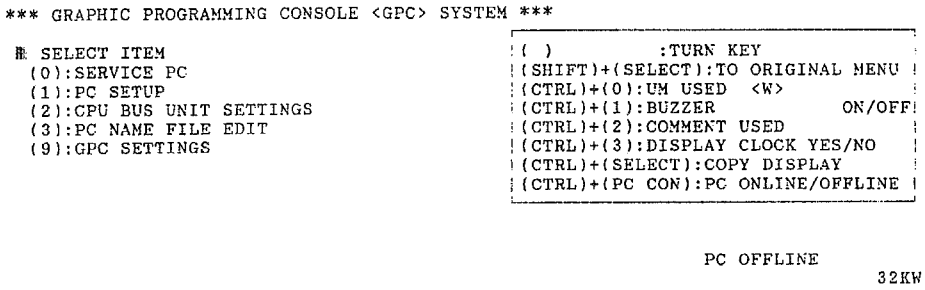
6-1 Overview of Offline Operations

Offline operations are performed when the GPC is not in direct communications with the PC.

6-1-1 Main Offline Menu

Offline operations are selected from the main offline menu, shown below.

Service PC and GPC Settings are general categories. Specific operations are selected from sub-menus that appear when the general category is selected.



6-1-2 Operation List

The table below lists the operations that can be selected from the main offline menu. Service PC and GPC Settings are general categories. Specific operations are selected from the sub-menus on the right side of the Operation column.

Operation		Description	Page
(0): Service PC	(0): Clear User Program Memory	Used to delete the programs from GPC memory and the Memory Card. The entire program can be deleted or only the part after a specified address.	53
	(1): Program	Used to create, edit, or delete programs on the GPC screen as either ladder diagrams or mnemonic lists. Programs can be saved to GPC memory or the Memory Card.	57
	(2): Program Check	Used to check the program for syntax errors.	85
	(3): Transmit	Used to transfer program, DM, and I/O comment data between the GPC memory, Memory Card, and floppy disk drive.	105
	(4): File	Used to format floppy disks or Memory Cards as well as manipulate files on the floppy disks and Memory Cards	103
	(5): Print	Used to print portions of programs (either ladder diagrams or mnemonic lists), contents of the GPC's DM or EM, I/O comments, or the current screen.	107
	(6): Input DM	Used to display, modify, or delete DM data in GPC memory and EM data in the Memory Card.	93
	(7): List	Used to display usage or cross-reference information on words and bits in GPC memory or programs on the Memory Card.	99
	(8): Global Change	Used to globally change bit or word addresses designated in programs in GPC memory.	93
	(9): Create Comment	Used to write, read, delete, or find I/O comments.	89
(1): PC Setup		Reads the PC Setup information from GPC memory for editing. After editing, transfer the new PC Setup information to the PC using the online transmit operation.	112
(2): CPU Bus Unit Settings		Can be performed in online mode only.	151
(3): PC Name File Edit		Used to assign PC names to PCs in SYSMAC NET Link and SYSMAC LINK networks.	111

Operation		Description	Page
(9): GPC Settings	(0): Printer	Used to specify the baud rate of communications with the printer, as well as the width of paper used and the beginning print column.	110
	(1): Floppy	Used to specify the drive number of the floppy disk drive and the type of disk being used.	110
	(2): PC Name Table	Used to set the name of the file that contains the PC name referenced at PC (node) designation.	111
	(3): Response Monitoring Time	Used to set the response monitoring time for communications with the PC.	111

6-2 Programming

Offline programming creates or edits programs in GPC memory or in the Memory Card installed in the GPC. The PC program can be accessed directly in online programming.

All programming operations are on the Service PC sub-menu. Select (0): Service PC from the main offline menu to bring up the Service PC sub-menu shown below.

```
*** PC OFFLINE ***                    |(SHIFT)+(SELECT):TO ORIGINAL MENU |

 SELECT ITEM
  (0):CLEAR USER PROGRAM MEMORY
  (1):PROGRAM
  (2):PROGRAM CHECK
  (3):TRANSMIT
  (4):FILE
  (5):PRINT
  (6):INPUT DM
  (7):LIST
  (8):GLOBAL CHANGE
  (9):CREATE COMMENT

                                                    PC OFFLINE
                                                          32KW
```

6-2-1 Clear User Program Memory

This operation is used to clear ladder-diagram programs from GPC memory or from the Memory Card installed in the GPC. Always clear the memory before creating a new program.

When using a Memory Card for the first time, format the card with the Formatting operation on the File menu. It is not necessary to perform the Clear User Program Memory operation on a newly formatted Memory Card.

It is possible to clear the entire program (including all interrupt programs) or only the part after a specified address. Interrupt programs can be deleted one at a time using the Program operation.

1, 2, 3...

1. Select (0): Service PC from the main offline menu.
2. Select (0): Clear User Program Memory from the Service PC menu.
3. Select the program or comment memory.
4. Programs from either GPC memory or from the Memory Card installed in the GPC can be deleted.
   a) To delete a program from GPC memory, press 0, ENT, and ENT.
   b) To delete a program from the Memory Card, press 1 and ENT. Move the cursor to the undesired program filename with the Up and Down Keys (the Plus and Minus Keys act as Page Up and Page Down) and press ENT. It is also possible to enter the filename manually after pressing 1 and ENT. Press WRITE, input the filename (up to 8 characters long), and then press ENT twice.

5. Next, specify whether the entire program will be cleared or only the part after a specified address.
   a) To delete the entire program, press CTRL and WRITE together, 9713, and ENT.
   b) To delete a program from a particular program address on, press WRITE, the program address, and ENT.

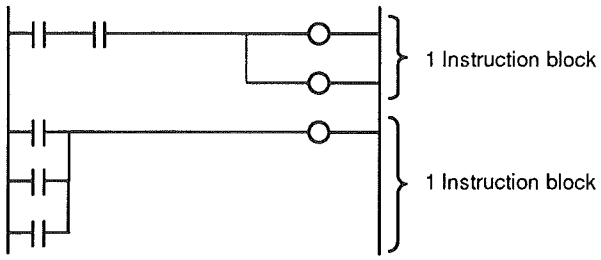
   The ladder-diagram write screen will appear when the program or program section has been cleared.

6-2-2 Switching Display Modes

The program can be displayed in four ways: as a ladder diagram with or without comments or as a mnemonic list with or without comments. The program data in GPC or Memory Card memory is the same regardless of the display method. Initially, the program is displayed as a ladder diagram without comments.

Instruction Blocks

An instruction line and all the instruction lines with which it interconnects are called an instruction block. Instruction blocks requiring more than 22 program lines cannot be written in ladder form and must be written in mnemonic form instead.



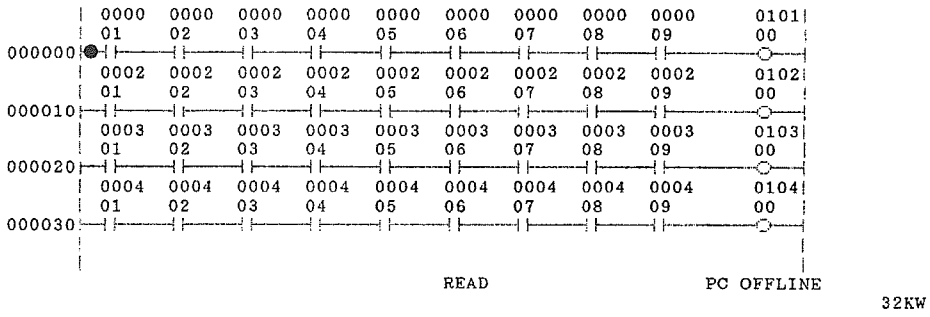
Display Modes

Ladder Diagram without Comments

The program can be displayed, modified, and input in this display mode. Up to 22 instruction lines can be input at one time; instruction blocks longer than 22 instruction lines must be input in mnemonic form.

When inputting in ladder-diagram form, program changes will be lost if the display mode is changed without first saving the ladder program using the store or store insert operations.

The program must be stored after each 22 instruction lines (or fewer) are input. Multiple lines are required for OR conditions, SFT instructions, and other multiple-input instructions. Each page can display up to 4 instruction lines.

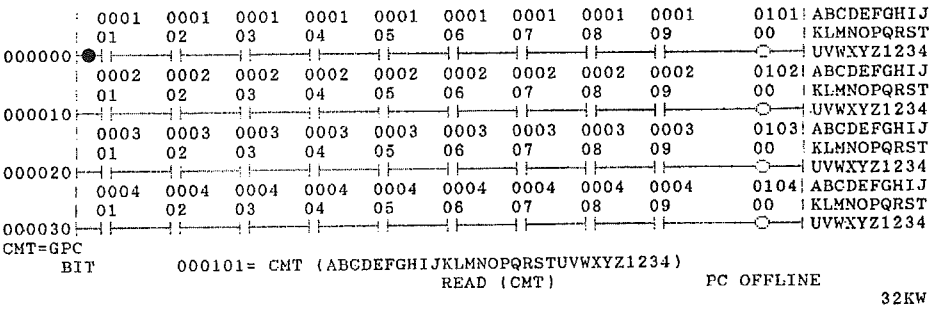


Note
1. If a program that contains a block with more than 22 instruction lines is read from memory, the display mode will automatically switch to mnemonic form.
2. When a program is being created on the Memory Card, it must be saved to the card with the Save operation.

Ladder Diagram with Comments

The program cannot be modified or saved when displayed as a ladder diagram with comments. Each page can display up to 4 instruction lines.

Comments created with the Create Comment operation appear to the right of the program. Up to three 10-character lines can be created for each instruction line. I/O comments, which describe the use of input bits or instruction operands, can be displayed at the bottom of the screen by selecting them with the cursor and reading them out.



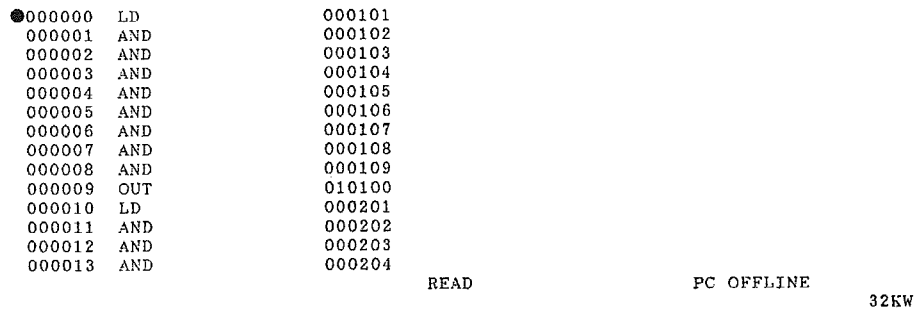
Note

1. If a program that contains a block with more than 22 instruction lines is read, the display mode will automatically switch to mnemonic form.
2. Comments created with CVSS cannot be used in the GPC.

Mnemonic List without Comments

When a program is created in mnemonic form, it is automatically written to the GPC's internal memory. When creating or modifying a program on a Memory Card, the program must be saved to the card with the Save operation by pressing the CTRL+WRITE Keys.

Fourteen lines of the mnemonic list will be displayed on the screen at a time.

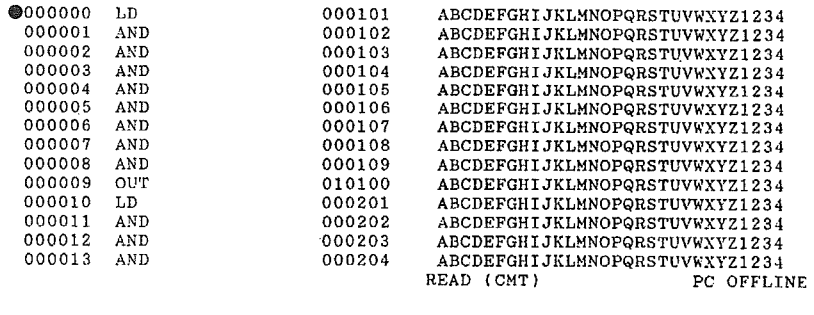


Note *When a program is being created or modified as a Memory Card file, it must be saved to the card with the Save operation.

Mnemonic List with Comments

When a program is created in mnemonic form, it is automatically written to the GPC's internal memory.* When creating or modifying a program on a Memory Card, the program must be saved to the card with the Save operation by pressing the CTRL and WRITE Keys together.

Fourteen lines of the mnemonic list will be displayed on the screen at a time. Comments created with the Create Comment operation appear on the right side of the screen. Each comment can be up to 30 characters long.



Note *When a program is being created or modified as a Memory Card file, it must be saved to the card with the Save operation.

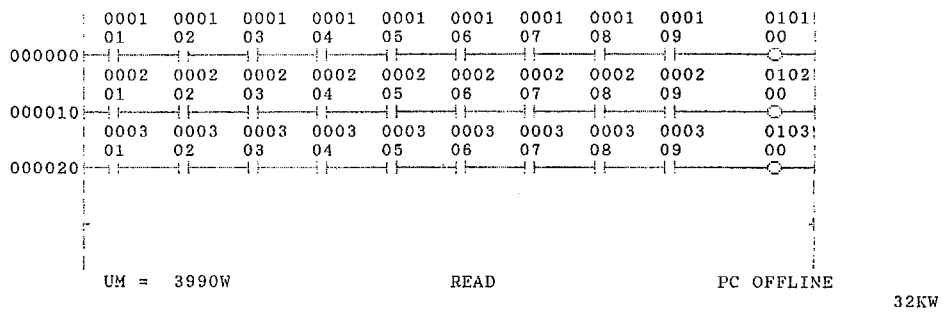
Switching Between Display Modes

The display mode can be changed in the read mode only. To switch between ladder diagram and mnemonic list, press the CHG Key. To switch between a display with comments and without comments, press the CTRL+CHG Keys. It is also possible to switch between a ladder diagram with comments and without comments by pressing the READ Key.

6-2-3 Display Memory

This operation is used to display the amount of the GPC's internal memory occupied by the program. The Display Memory operation is available in all display modes, but cannot be used when Memory Card memory is indicated. To determine the amount of Memory Card memory occupied by program files, display the Memory Card's file directory using the File operation.

Press the CTRL+0 Keys. The amount of memory in words will be displayed in the lower-left-hand corner of the screen, as shown below.



6-2-4 Programming in Ladder Form

The display mode must be ladder diagram without comments to create or modify a program in ladder form. The program cannot be modified or saved when displayed as a ladder diagram with comments.

Delete the contents of the memory with the Clear User Program Memory operation before creating a new program. Existing programs will be overwritten if not deleted before a new program is written.

Before creating a program on a new Memory Card, the card must be formatted with the Formatting operation on the File menu.

Entering Write Mode

Follow the procedure below to put the GPC in write mode. The GPC enters write mode automatically after the Clear User Program Memory operation is performed.

1, 2, 3...

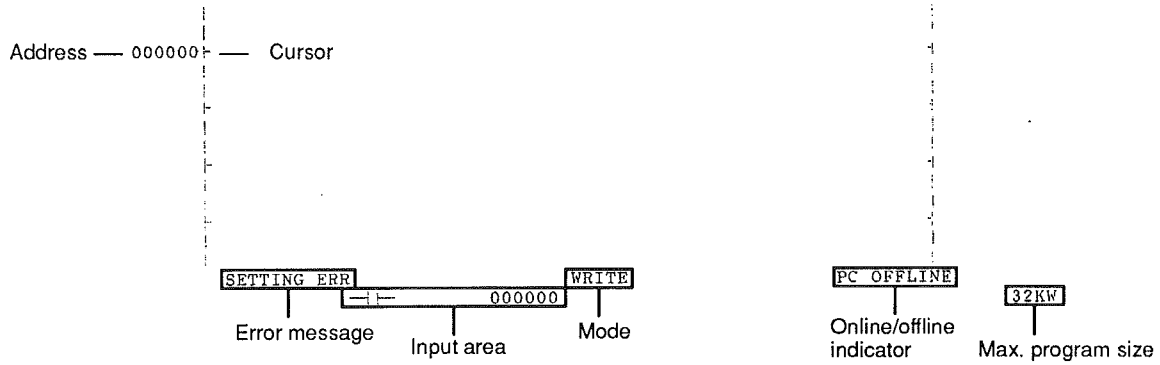
1. Select (0): Service PC from the main offline menu.
2. Select (1): Program from the Service PC menu.
3. Select the program memory.
4. A program can be created in either GPC memory or the Memory Card installed in the GPC.
   a) To create a program in GPC memory, press 0, ENT, and ENT.
   b) To modify a program previously saved to the Memory Card, press 1 and ENT. Move the cursor to the desired program filename with the Up and Down Keys (the Plus and Minus Keys act as Page Up and Page Down) and press ENT. To create a new program on the Memory Card, press 1, ENT, and WRITE, input the new filename (up to 8 characters long) and then press ENT twice. When inputting a filename, the cursor can be moved left and right with the Left and Right Keys and the character at the cursor can be deleted with the SHIFT+Left or SHIFT+Right Keys. The CLR Key deletes all characters in the input area.

   Note a) In the GPC, lower case characters are distinguished from upper case characters in filenames, but in the CVSS, lower case characters are automatically converted to upper case. Files that have been saved in the GPC with filenames including lower case characters will not be usable in CVSS systems, so save files with upper case characters in the GPC if those files might be used in CVSS systems.

   b) The contents of the GPC's internal memory will be overwritten with a program that is created or modified for storage on the Memory Card.
5. Press the 0 Key to select the main program. Refer to page 84 for details on creating and modifying interrupt programs.
6. Press the ENT Key to display the ladder-diagram program.
7. Press the WRITE Key to enter write mode.

Entering Ladder Diagrams

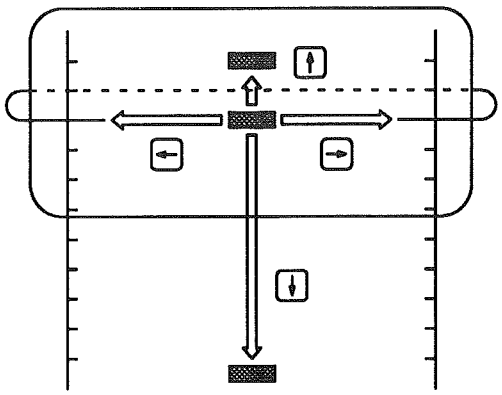
To enter or edit a ladder diagram, the GPC must be in write mode and the display mode must be ladder diagram without comments. The word write will be displayed at the bottom of the screen when the GPC is in write mode.



The instruction and operand input in the input area will be written to the program at the cursor position when the ENT Key is pressed.

Moving the Cursor

The cursor can be moved on the ladder diagram as described below.



1, 2, 3...

1. Press the Up and Down Keys to move the cursor up and down.
2. Press the Left Key to move the cursor left. From the left edge of the sheet, the cursor will move to the right edge.
3. Press the Right Key to move the cursor right. From the right edge of the sheet, the cursor will move to the left edge.

The program section displayed as a ladder diagram can contain a maximum of 22 instruction lines, but only 4 will be visible on the screen. Instruction blocks longer than 22 instruction lines cannot be written as ladder diagrams and must be written in mnemonics. In general, program sections should be saved before they reach 22 instruction lines in length.

Entering Conditions

The cursor will be displayed at the first line, address 000000. If a program already exists at the cursor position, the symbol and bit address will appear in the input area at the bottom of the screen. Enter conditions on the ladder diagram using the following procedure:

1, 2, 3...

1. Move the cursor to the required position.
2. Enter the required condition. The selected symbol will appear in the input area.
3. Enter the bit address for the condition and press the ENT Key.

Instructions can be entered using the key sequences shown in the table below.

Entering Conditions on the Ladder Diagram

Instruction	Symbol	Key Inputs	Remarks
LD, AND		*Bit_address* **ENT**	—
LD NOT, AND NOT		LOAD NOT/AND NOT Key *Bit_address* **ENT**	—
		NOT *Bit_address* **ENT**	
OR		OR Key *Bit_address* **ENT**	—
OR NOT		OR NOT Key *Bit_address* **ENT**	—
		OR Key **NOT** *Bit_address* **ENT**	
Immediate refresh instruction	!	*Instruction* **!** *Bit_address* **ENT**	To set both the immediate refresh (!) and differentiate instructions, enter them consecutively. However, only the immediate refresh instruction, !, is available with the NOT instructions. The differentiated instructions cannot be used.
Differentiate up instruction	↑	*Instruction* **SET** *Bit_address* **ENT**	
Differentiate down instruction	↓	*Instruction* **RESET** *Bit_address* **ENT**	

Entering Other Instructions

To enter basic righthand instructions, move the cursor to the right of the rightmost input. A break will appear in the connecting line if an output is entered when the cursor is not to the right of the rightmost input. Use the line connect operations (see page 64) to rejoin the connection if this problem occurs.

The number of conditions permitted on a line depends on the number of operands for the righthand instruction. If it is not possible to enter all conditions on a single line, use the continue operation to join the line to the next line. Refer to page 63 for information on the continue operation.

Instructions can be entered using the key sequences shown in the table below. Refer to *1-5 Ladder Diagram Instructions* for the table listing instructions and their function codes. Refer to *CV500/CV1000 Operation Manual: Ladder Diagrams* for information on the operands for each instruction.

Instruction	Symbol	Key inputs	Remarks
OUT		Output Key, *Bit address*, **ENT**	—
OUT NOT		Output Key, **NOT**, *Bit address*, **ENT**	
TIMER	TIM	**TIM**, *Timer number*, **ENT** # *SV*, **ENT**	To enter a constant as the SV, input #SV. To set the SV from a word, enter the word address only.
COUNTER	CNT	**CNT**, *Counter number*, **ENT** # *SV*, **ENT**	
Advanced instruction	—	**FUN**, *Function code*, **ENT** *Operand*, **ENT** *Operand*, **ENT** *Operand*, **ENT**	Input leading zeros for the function code. The number of operands varies according to the instruction.
Immediate refresh instructions	!	OUT and OUT NOT: Output Key, (**NOT**), **!** *Bit address*, **ENT** Special instructions: **FUN**, *Function code*, **!**, **ENT** *Operand*, **ENT** *Operand*, **ENT** *Operand*, **ENT**	Applicable only to OUT, OUT NOT, KEEP(011), DIFU(013), DIFD(014), SET(016), RSET(017), CMP(020), and MOV(030).

Instruction	Symbol	Key inputs	Remarks
Differentiate up instructions	↑	**FUN**, *Function code*, **SET**, **ENT** *Operand*, **ENT** *Operand*, **ENT** *Operand*, **ENT**	—
Differentiate down instructions	↓	**FUN**, *Function code*, **RESET**, **ENT** *Operand*, **ENT** *Operand*, **ENT** *Operand*, **ENT**	Applicable to SET(016) and RSET(017) only.

Bit/Word Addresses and Data

When entering a bit address, press the SHIFT+# Keys. When entering a word address, press the SHIFT+*DM Keys. It is not necessary to input leading zeros for addresses or SVs. If a mistake is made while entering an address, press the CLR Key and re-enter the value.

Item	Bit address	Word address	Display on ladder diagram
Auxiliary Area	**SHIFT+HR**, *Bit address*	**SHIFT+HR**, *Word address*	A
CIO Area	*Bit address*	*Word address*	I: Input[1] Q: Output[1]
Counter Area	**CNT**, *Counter number*	**CNT**, *Counter number*	C
Constant (4-digit)	—	**#**, *Value*	#
Constant (8-digit)	—	**CTRL+#**, *Value*	#
CPU Bus Link Area	**SHIFT+LR**, *Bit address*	**SHIFT+LR**, *Word address*	G
Data register (DR)[2]	—	**DR**, *Number*	DR
DM Area	—	**DM**, *DM address*	D
EM Area	—	**SHIFT+IR**, *EM address*	E
Index register (IR)[2]	—	**IR**, *IR number*	IR
Indirect Index register[2]	**, IR**, *IR number*	**, IR**, *IR number*	, IR
Constant Offset IR[2]	**, IR**, *IR number* **#**, (+/–), *# Offset*, **ENT**	**, IR**, *IR number* **#**, (+/–), *# Offset*, **ENT**	# Offset , IR
DR Offset IR[2]	**, IR**, *IR number* DR, *DR number*, **ENT**	**, IR**, *IR number* **DR**, *DR number*, **ENT**	DR, IR
Auto-increment IR[2]	**SHIFT+, IR**, (SHIFT+, IR), *IR number*, **ENT**	**SHIFT+, IR**, (**SHIFT+, IR**), *IR number*, **ENT**	, IR+ (, IR++)
Auto-decrement IR[2]	**SHIFT+TR**, (SHIFT+TR), *IR number*, **ENT**	**SHIFT+TR**, (**SHIFT+TR**), *IR number*, **ENT**	, –IR (, —IR)
Indirect DM address	—	***DM**, *DM address*	*D
Indirect EM address	—	**SHIFT+DR**, *EM address*	*E
Step Area	**SHIFT+TN**, *Step number*	—	ST
Timer Area	**TIM**, *Timer number*	**TIM**, *Timer number*	T
Transition Area	**TN**, *Transition number*	—	TN
User-defined data area	**SHIFT+!**, *User's code*, *Bit address*	**SHIFT+!**, *User's code*, *Word address*	User's code

Note
1. I and Q are displayed only after the I/O table is registered and the GPC is online.
2. Refer to the *CV500/CV1000 Operation Manual: Ladder Diagrams* for information on using Data Registers and Index Registers (DR and IR).

Examples

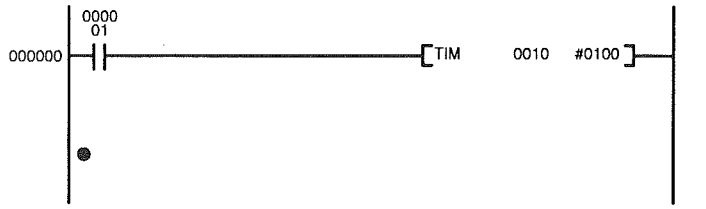
Basic Instructions

An example for inputting basic instructions is given below.

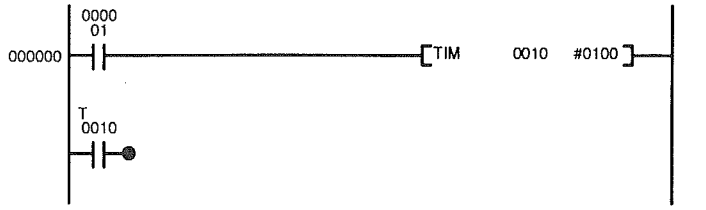
1, 2, 3... 1. Start with the GPC in ladder diagram without comments display mode and the write mode.

2. Press 1 and ENT.
   (It is not necessary to input leading zeros for bit addresses.)

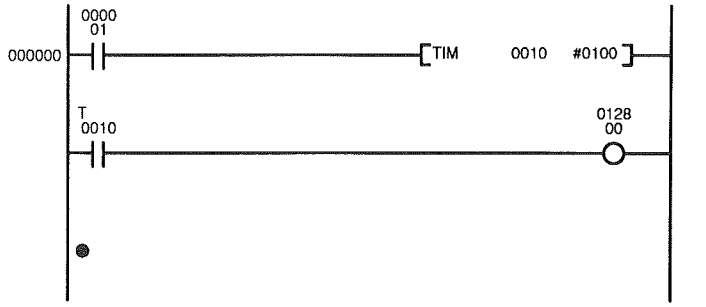
3. Press TIM, 10, ENT, 100, ENT.



4. Press the Ladder LD/AND Key and then TIM, 10, and ENT.
   To designate timer or counter Completion Flags, press a ladder diagram symbol key followed by TIM or CNT and the timer or counter number.



5. Press the Ladder Output Key and then 12800 and ENT.



6. Press the STR Key and ENT to store the program.

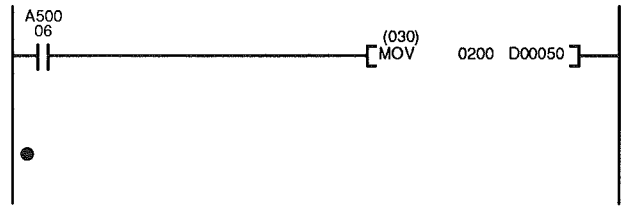
Using Function Codes

An example for inputting a ladder program using a function code is given below.

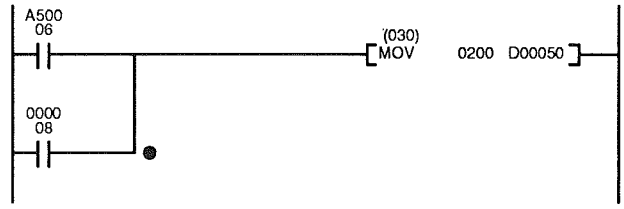
1, 2, 3... 1. Start with the GPC in ladder diagram without comments display mode and the write mode.

2. Press SHIFT+HR, 50006, and ENT.

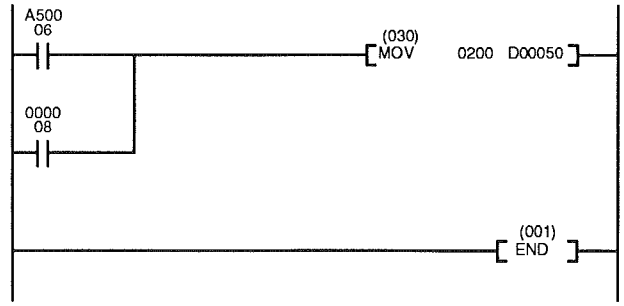
3. Press FUN, 030, ENT, 200, ENT, DM, 50, and ENT. Input leading zeros for function codes.



4. Press the Ladder OR Key and then 8 and ENT.



5. Press the Down Key, Left Key, FUN, 001, and ENT.



6. Press the STR Key and ENT to store the program.

Line Continuation

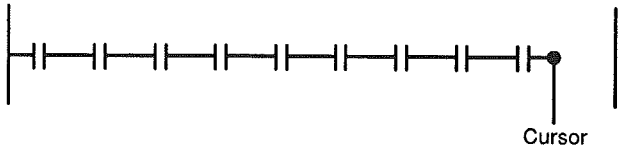
Up to 9 conditions can be input in a single line when an OUTPUT instruction is used. Fewer conditions can be written in a single line if an instruction requiring operands, such as TIM and special instructions, is used.

If all required conditions and instruction cannot fit in a single line, the program will automatically continue on the next line. The number of conditions that can fit on a line depends on the number of operands in the righthand instruction.

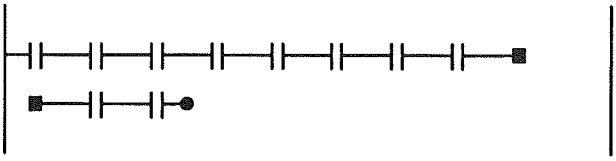
Example 1

The following procedure shows how to add a 10th condition in an instruction line.

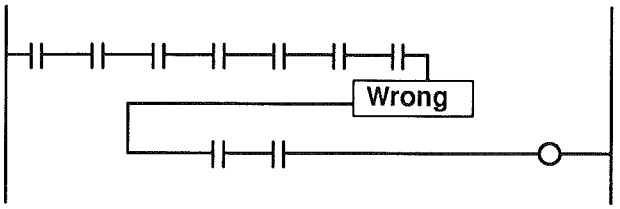
1, 2, 3... 1. Move the cursor to the 10th column (extreme right).



2. When the cursor is in the 10th column, the usual initial display will not appear in the input area. Press the Ladder LD/AND Key and then 10 and ENT to enter the condition.
   The 9th and 10th conditions will be displayed on the next line.



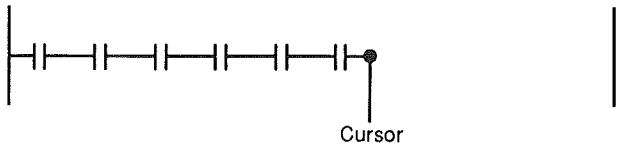
Note A program error will occur if lines are connected with the Line Connect operation as shown in the following diagram.



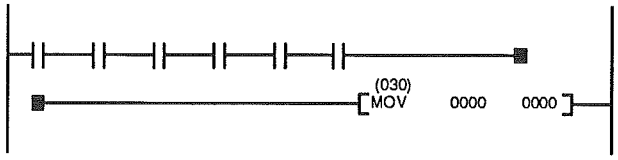
Example 2

The following procedure shows how to enter six conditions for a MOVE instruction.

1, 2, 3... 1. Enter the six conditions.



2. Press FUN, 030, and ENT to enter a MOVE instruction. The instruction will automatically be shifted to the next line if there isn't space on the first line.



Line Connections

Use the key sequences in the following table to make lines connecting points in the ladder diagram.

Connection	Key sequence	Function
Horizontal line	Horizontal Line Key, ENT	Creates a horizontal line the length of one condition.
Vertical line	Vertical Line Key, ENT	Creates a vertical line to the previous instruction line.
Line connect	(position cursor at start point) LINE CON (position cursor at end point) ENT	Connects two points in a ladder diagram. The points can be in the same instruction line or in different instruction lines.

To delete a connecting line, press the Delete Key to enter delete mode, position the cursor at the undesired line, and press ENT.

Note Connections cannot be made between points more than 22 instruction lines apart (a maximum of 22 lines is permitted in an instruction block).

Example 1

This example shows how to make a connection using the Horizontal Line Key. The lines created this way are the length of one condition.

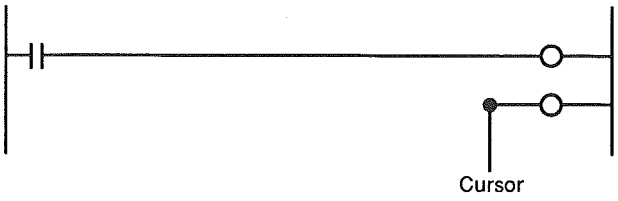
To connect a horizontal space, move the cursor to the left side of the space, press the Horizontal Line Key and ENT.

Example 2

This example shows how to connect instruction lines vertically to create an OR LD or AND LD condition. Move the cursor to the bottom connection point, press the Vertical Line Key and ENT.

Example 3

This example shows how to connect instruction lines vertically to attach two righthand instructions to the same condition. Move the cursor to the bottom connection point, press the Vertical Line Key and ENT.



Example 4

This example shows how to connect two points in the same instruction line using the Line Connect Key. This method is convenient for making long horizontal connections.

1, 2, 3... 1. Move the cursor to the first connection point.

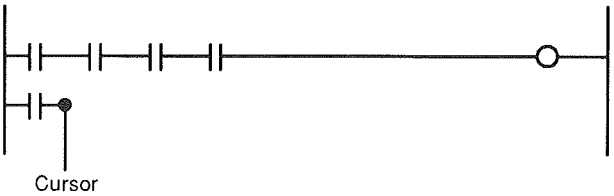
2. Press the Line Connect Key and move the cursor to the second connection point.

3. Press the ENT Key.

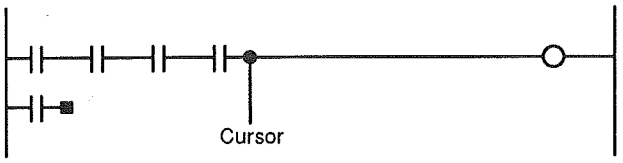
Example 5

This example shows how to connect two points in different instruction lines using the Line Connect Key.

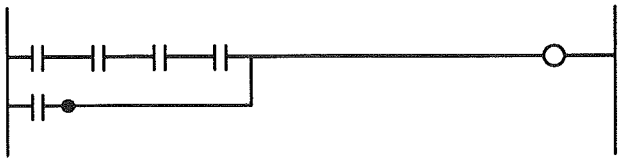
1, 2, 3... 1. Move the cursor to the first connection point.



2. Press the Line Connect Key and move the cursor to the second connection point.



3. Press the ENT Key.



Editing Ladder Programs

The procedure for editing a ladder program is described below. Ladder programs can be edited in the write, delete, or insert modes. Do not forget to store the edited program. Also, if editing a program from the Memory Card, be sure to save the program by pressing the CTRL+WRITE Keys.

See *3-8 Changing Addresses* for globally changing bit or word addresses in the entire program in a single operation.

Editing in Write Mode

Operation	Key sequence	Comments
Deleting all 22 program lines of the ladder diagram	**SHIFT+CLR**	—
Clearing data from input area	**CLR** (or re-input the symbol)	—
Creating a Blank Column	**SHIFT**+Right Key	A blank column is created at the cursor position. If an instruction block contains more than one line, a blank column is created at the cursor position in every line of the instruction block. The operation will be cancelled unless a blank column can be created at the cursor position in every line (up to 22) being displayed.
Deleting a Blank Column	**SHIFT**+Left Key	The blank column at the cursor position is deleted. If an instruction block contains more than one line, the blank column is deleted at the cursor position in every line of the instruction block at the cursor position. The delete operation will be cancelled unless a blank column exists at the cursor position in every line (up to 22) being displayed.
Creating a Blank Line	**SHIFT**+Down Key	A blank line is created above the cursor position. No blank lines can be created if the program already contains 22 instruction lines.
Deleting a Blank Line	**SHIFT**+Up Key	The blank line at the cursor position is deleted. The delete operation will be cancelled if the line at the cursor position contains ladder elements, including any instructions.

Editing in Insert and Delete Modes

Operation	Key sequence	Comments
Inserting a symbol	**INS**, Position cursor, Input symbol, *Bit address*, **ENT**	The symbol is entered at the cursor position. The conditions to the right of the cursor are shifted one space to the right. This operation cannot be performed if there is not room for another condition. In this case, switch to write mode and extend the instruction line to the next line with line continuation.
Deleting a symbol	Deleting a condition, instruction, or horizontal connection: Delete, Position cursor, **ENT** Deleting a vertical line: Delete, Position cursor, Vertical Line Key, **ENT**	The symbol to the right of the cursor will be deleted. To delete a righthand instruction, place the cursor at the beginning of the instruction's function code and press ENT. To delete a vertical line, place the cursor at the bottom-right of the line, press the Vertical Line Key and then ENT.

Editing Examples

Changing a Bit Address

In this example, the bit address 000100 in the program below is changed to 000300.

Press the WRITE Key to put the GPC in write mode and position the cursor just in front of the condition that is to be changed. The current bit address should appear in the input area at the bottom of the screen.

Press 300 and ENT.

Changing LD to LD NOT

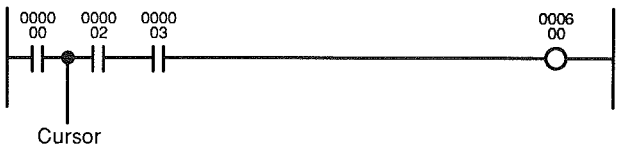
In this example, the LD symbol in the program below is changed to LD NOT without changing the bit address, 000300.

Position the cursor just in front of the symbol that is to be changed. The current symbol and bit address should appear in the input area at the bottom of the screen.

Press the Ladder LD NOT/AND NOT Key and then 300 and ENT.

Inserting a Symbol

In this example, a condition (AND 000001) is inserted between the first and second conditions in the following program.



1, 2, 3...

1. Press the INS Key to put the GPC in insert mode and position the cursor where the new symbol is to be inserted.
2. Press the Ladder LD NOT/AND NOT Key and then 1 and ENT.

Deleting a Vertical Connection

In this example, the vertical connection in the OR LD instruction is deleted from the following program.

1, 2, 3...

1. Position the cursor at the bottom-right of the line that is to be deleted.

2. Press the Delete Key, Vertical Line Key, and ENT.

Creating and Deleting a Blank Column

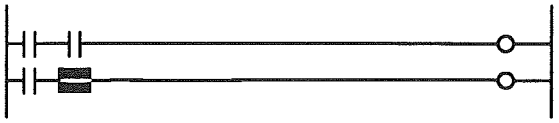
Press the WRITE Key to put the GPC in write mode and position the cursor where a blank column is to be created.

Press the SHIFT+Right Keys and a blank column will be created.

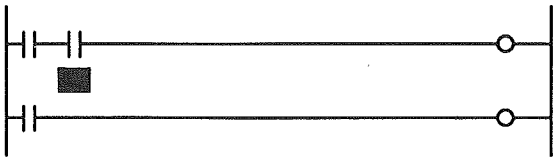
Press the SHIFT+Left Keys. The blank column will be deleted.

Creating and Deleting a Blank Line

Press the WRITE Key to put the GPC in write mode and position the cursor on the line above which a blank line is to be created.



Press the SHIFT+Down Keys and a blank line will be created.



Press the SHIFT+Up Keys. The blank column will be deleted.

6-2-5 Store/Store Insert

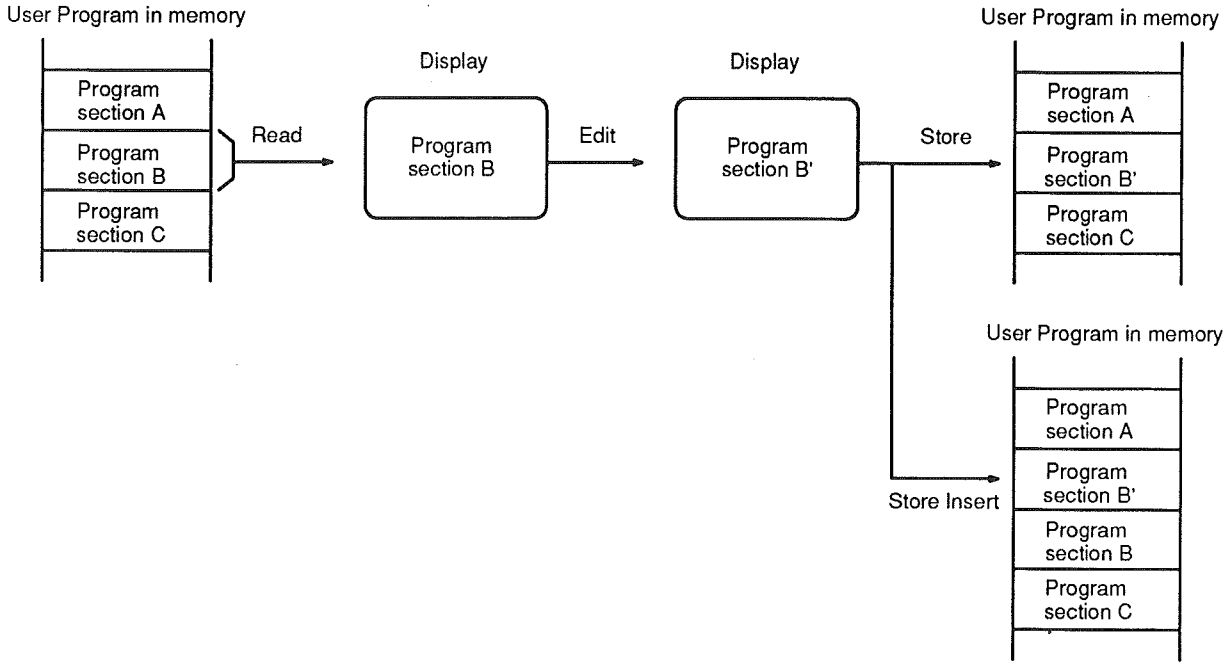
These operations are used to write a ladder program created on the screen to the GPC's internal memory. Use the Store or Store Insert operations before the ladder program exceeds 22 lines (the maximum number permitted in a program section).

Ladder programs created on the screen but not saved with the Store or Store Insert operations will be lost when menus are switched, the reset switch is pressed, or the POWER switch is turned off.

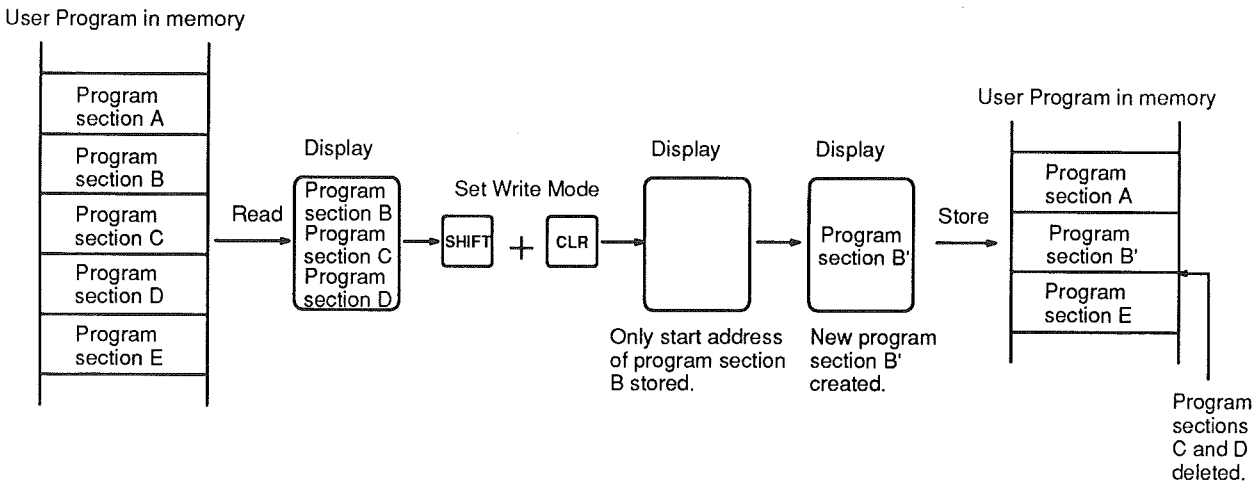
Item	Key sequence	Comments
Store	**STR, ENT**	Writes the ladder program section created on the screen (with a maximum of 22 instruction lines) to the GPC's internal memory. A message will appear in the lower-left-hand corner of the screen indicating that the program is being stored. After the program is stored, the screen will return to the write mode and the next address will be displayed. The addresses of the instruction blocks are assigned when the program is stored, and will be displayed again the next time the program is read. When a program section is read, edited, and stored, the edited version of the program section overwrites the previous version.
Store Insert	**SHIFT+STR, ENT**	Writes the ladder program section created on the screen (with a maximum of 22 instruction lines) to the GPC's internal memory in front of the previously read program section. The previous program section remains unchanged in memory, after the new, inserted program section. A message will appear in the lower-left-hand corner of the screen indicating that the program is being stored. After the program is stored, the screen will return to the write mode and the next address will be displayed.

Store vs Store Insert

The store operation is used to write a new ladder program section to memory when editing program sections as ladder diagrams. The Store Insert operation is also used to insert an unchanged or partially edited program section in memory in front of its original position.



A program section read from memory and then deleted on the screen will be permanently lost if the store operation is used to write it back to memory. Take particular care in cases like the example below, where several program sections are read and deleted on screen and another program section is created. When the new program section is stored to memory, the program sections read originally will all be lost. They would not be lost if the Store Insert operation was used.



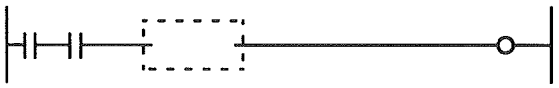
Program Sections Not Applicable to Store/Store Insert

An error message (LADDER ERR) will be displayed in the lower-left-hand corner of the screen and the store/Store Insert operation cancelled if an attempt is made to use the store/Store Insert operations with an incorrect program section or one which cannot be processed by the GPC. Correct and edit the program section if this problem occurs.

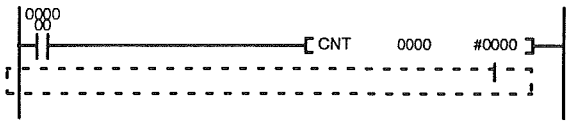
Incomplete Instruction Lines

a) No righthand instruction

b) Broken connection



c) Instruction line not entered for an execution condition



d) Extra line

e) No conditions on an instruction line

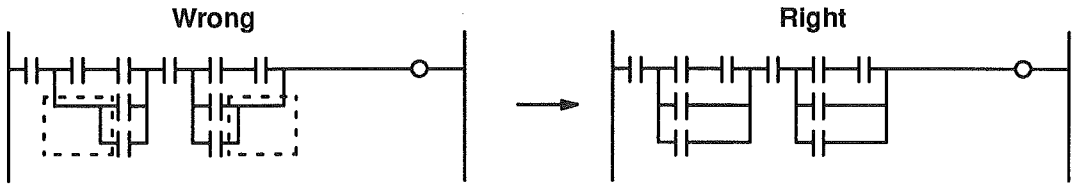
f) Short-circuited conditions

g) Instruction line doubles back

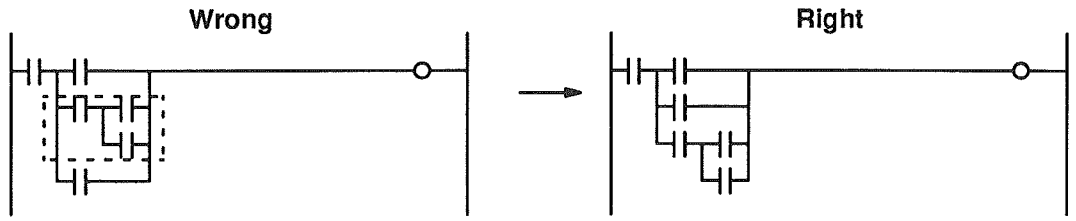
Program Sections the GPC Cannot Process

Each of the incorrect program sections on the left can be corrected as shown on the right.

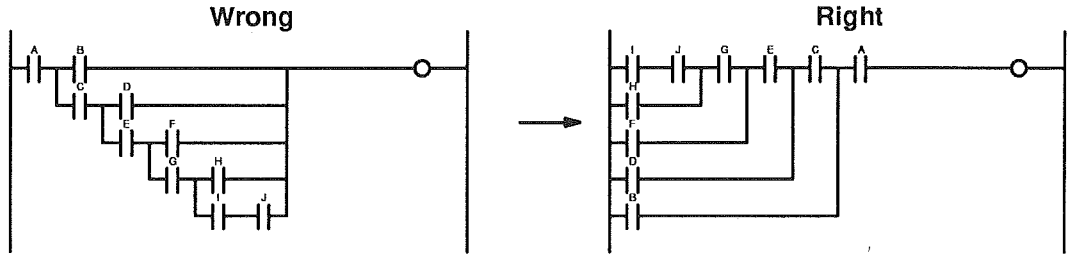
a) A horizontal line has been placed in front of OR instruction with no condition on the line. Conditions must be aligned on the left.



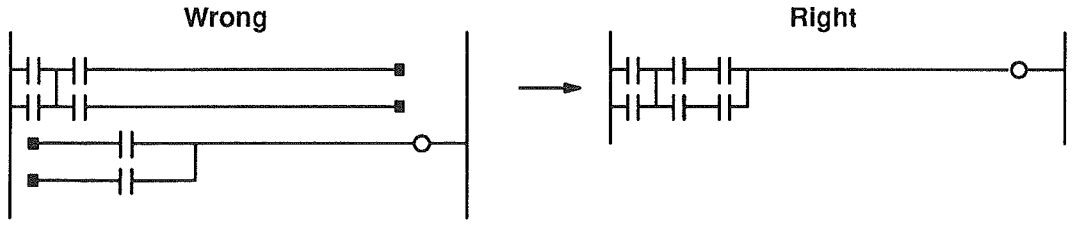
b) AND and OR instructions have been placed inside an OR instruction. Move AND and OR to the bottom of the OR.



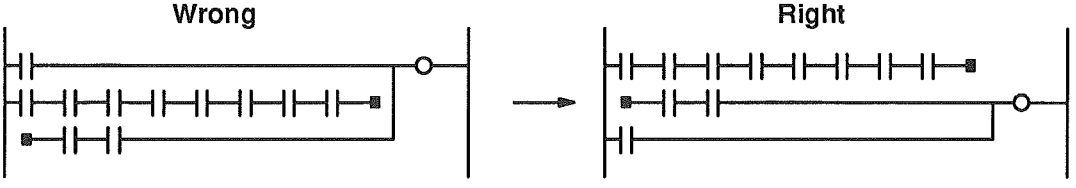
c) More than 8 LD instructions have been used.



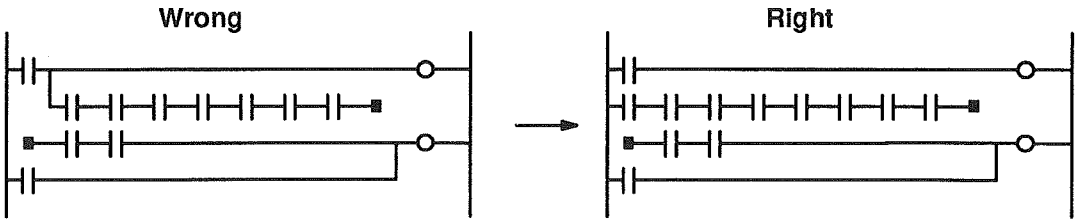
d) Multiple continue operations have been used. Do not use continue operations in parallel.



e) A continue operation has been used in second, or lower, line of an OR program section. Move the continue operation to the top line.



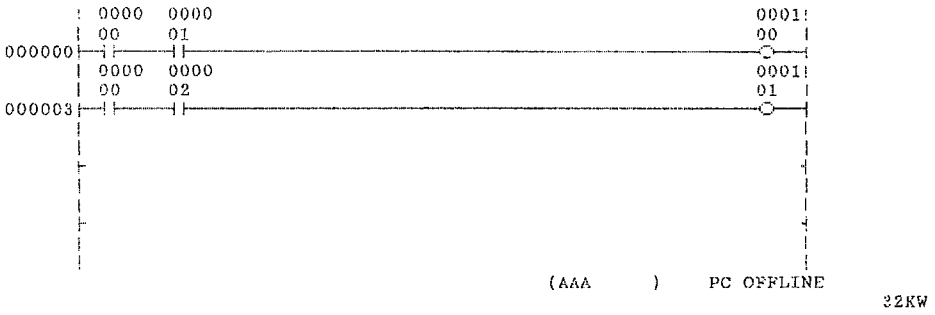
f) A branching continue operation or OR program section has been used. Eliminate branching from the continue portion of the program.



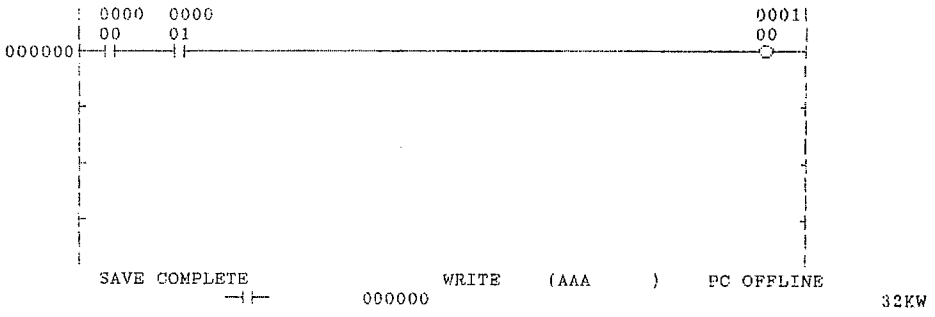
6-2-6 Saving Programs to Memory Card

Once a program has been completed in memory, it can be saved to a specified file in the Memory Card using the Save operation. Programs created in memory but not saved with to the Memory Card with the Save operation will be lost when the menu is switched with the SHIFT+SELECT Keys or the POWER switch is turned off.

1, 2, 3... 1. Press the CTRL+WRITE Keys. A message requesting confirmation of the Save operation will appear in the lower-left-hand corner of the screen.



2. Press the ENT Key to save the program. A message will appear in the lower-left-hand corner of the screen indicating that the program is being saved. Another message indicating that the program has been saved will appear after the program has been saved.



6-2-7 Reading and Searching Ladder Diagrams

The following operation is used to read the program from the memory and display it on the screen as a ladder diagram. When the Memory Card is specified, the specified file will be transferred to the GPC's memory automatically and displayed on the screen.

Press the READ Key to switch to Read mode from other modes.

Reading and Searching Ladder Programs

Follow the procedures in the table below to display the specified instruction blocks. Press the CTRL+ENT Keys to begin the search from address 00000.

Operation	Key sequence	Description
Reading a specified program address	**READ** *Address* **ENT**	It is not necessary to input leading zeros, e.g., address 00000 can be input as 0. The instruction block containing the specified address will be displayed on the screen.
Finding a specified condition or output	Specifying an input: LD Key *Bit_address* **ENT** **(CTRL+ENT)** Specifying an output: Output Key *Bit_address* **ENT** **(CTRL+ENT)** Specifying input or output: **SHIFT+#** *Bit_address* **ENT** **(CTRL+ENT)**	It is not necessary to input leading zeros. Finds any conditions (LD, LD NOT, AND, AND NOT, OR, or OR NOT) containing the specified address if the ladder diagram symbol for any condition is entered. Finds any outputs (OUT or OUT NOT) containing the specified address if either ladder diagram symbol is entered. Finds any conditions or outputs (OUT or OUT NOT) containing the specified address if SHIFT+# is entered.
Finding timer instructions	**TIM** *Timer_number* **ENT** **(CTRL+ENT)**	It is not necessary to input leading zeros of the timer or counter number.
Finding counter instructions	**CNT** *Counter_number* **ENT** **(CTRL+ENT)**	
Finding an instruction from its function code	Instructions executed every cycle: **FUN** *Function_code* **ENT** **(CTRL+ENT)** Differentiate up instructions: **FUN** *Function_code* **SET, ENT** **(CTRL+ENT)** Differentiate down instructions: **FUN** *Function_code* **RESET, ENT** **(CTRL+ENT)** Immediate refresh instructions: **FUN** *Function_code* **!, ENT** **(CTRL+ENT)**	Input leading zeros of the function code.
Finding instructions containing operands	**FUN** *Function_code* **ENT** *Operand* **SHIFT+ENT** *Operand* **SHIFT+ENT** *Operand* **SHIFT+ENT** **ENT** **(CTRL+ENT)**	Input leading zeros of the function code. Press the SHIFT+Right Keys to move the cursor when not specifying an operand. Press the READ Key to find another instruction.
Finding instructions from an operand	*Operand* **ENT** **(CTRL+ENT)**	Specify bit or word addresses as the operand. This operation is identical to the "finding a specified condition or output" operation when a bit address is specified.

Finding Instructions

After specifying the read or find operation as described in the previous table, follow the procedure below.

1, 2, 3...

1. Press the CTRL+ENT Keys to start searching from address 00000.

   Press the ENT Key alone to start searching from the instruction block after the one displayed on the screen.

2. When the specified condition or instruction is found, the instruction block it is contained in will be displayed. If an instruction line consisting of more than 22 lines is read, the display mode will automatically switch to mnemonic. The display mode can be switched back to ladder diagram mode by pressing the CHG Key if the next instruction block consists of 22 or fewer lines.

3. Press the ENT Key to repeat the search.
4. When the search of the final area is complete, the message "NOT FOUND" will be displayed in the lower-left corner of the screen.

   Press the ENT Key to resume searching from address 00000 or follow the relevant procedure in the table above to find a different address, condition, output, instruction, or operand.

Reading the Previous or Next Instruction Block

Press the Plus or Minus Keys to read the instruction blocks before or after the currently displayed instruction block.

Key	Description
Plus	Read the next instruction block.
Minus	Read the previous instruction block.

Scrolling Large Instruction Blocks

If the currently displayed instruction block is more than 4 lines long, the Up or Down Keys can be used to scroll up or down in the instruction block.

Key	Description
Down	Press the Down Key when the cursor is on the bottom line of the screen to display the next instruction line.
Up	Press the Up Key when the cursor is on the top line of the screen to display the previous instruction line.

Note The Up and Down Keys can be used to view the current instruction block, but not to access adjacent instruction blocks.

Example of Reading a Ladder Program

Reading a Specified Program Address

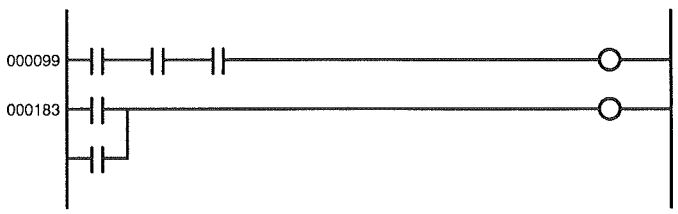
In this example, the instruction block containing address 100 is read from a program.

1, 2, 3...

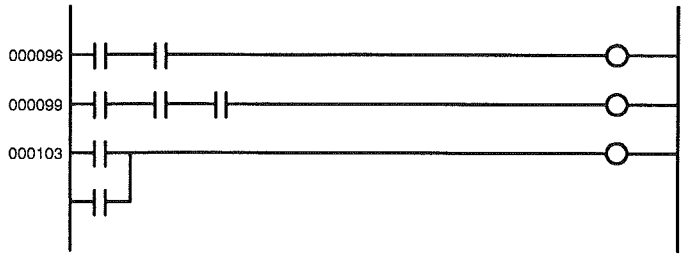
1. Press READ, 100, and ENT. The instruction block containing program address 100 will appear.

2. Press the Plus Key to display the next instruction block.

   The original instruction block will remain on the screen, if space allows.



3. Press the Minus Key to display the previous instruction block.
   The original instruction block will remain on the screen, if space allows.

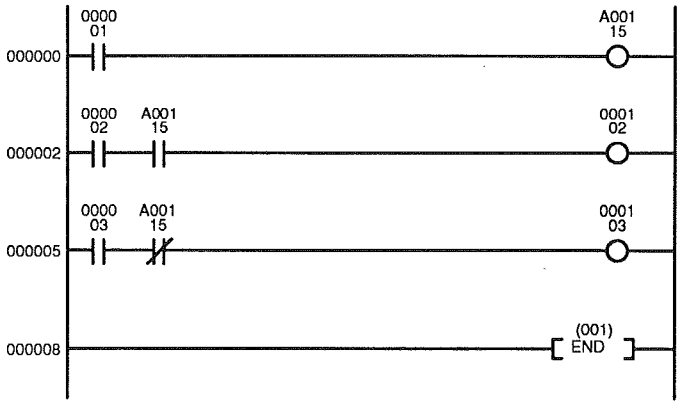


4. Press the Down Key to display subsequent lines if the instruction block is more than 4 lines long.

Finding a Specified Condition or Instruction

Finding Conditions with A00115

We'll assume the following user program is in memory.

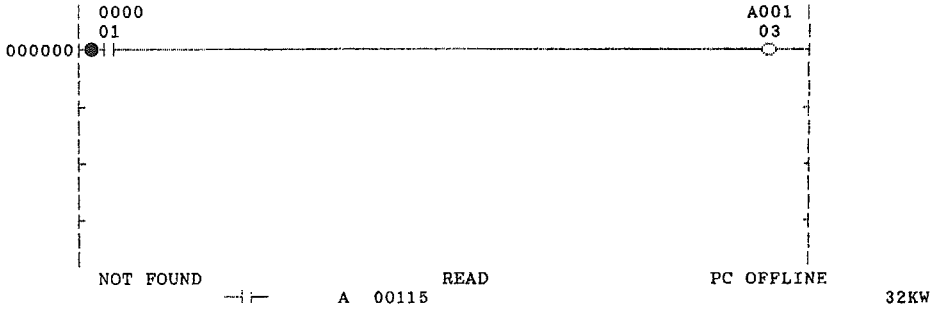


1, 2, 3...

1. Press the Ladder LD/AND Key and then SHIFT+HR, 115, and CTRL+ENT.
   When CTRL+ENT is pressed, the search begins from address 00000 for a condition with A00115. The cursor stops at the first instruction block containing a condition with A00115; in this case the first instruction block containing a condition with A00115 is at address 00002.

2. When ENT is pressed, the search begins for the next condition with A00115. The cursor stops at the next first instruction block containing a condition with A00115, at address 000006.

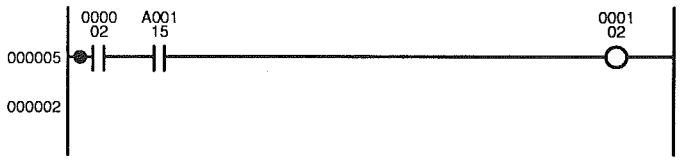
3. When ENT is pressed again and no conditions with A00115 are found by the end of the program, the message "NOT FOUND" will be displayed in the lower-left corner of the screen and the instruction block at address 00000 will be displayed.



4. When ENT is pressed again, the search begins again from address 00000 and the cursor stops at the first instruction block containing a condition with A00115.

Finding MOV(030) with the Function Code

To find the first MOV(030) instruction in the program using the function code, press FUN, 030, and CTRL+ENT. (Leading zeroes must be entered.)



Press ENT again to search for the next MOV(030) instruction.

Finding a MOV(030) with a Specific Operand

Follow the procedure below to find a specific instruction with one or more specific operands. In this case, the search is for the first MOV(030) instruction in the program with D00010 as its second operand.

1, 2, 3...

1. Press FUN, 030, and SHIFT+ENT. The MOV(030) instruction will appear in the input area and the cursor will be located at OP1, operand 1.
2. Press the SHIFT+Right Keys to move the cursor to operand 2, and then press DM, 10, and SHIFT+ENT to input D00010 as the second operand.
3. Press CTRL+ENT to begin the search from address 000000.

   Once the first MOV(030) instruction in the program with D00010 as its second operand has been found, the search for the next such instruction can be started by pressing ENT.

   Press the READ Key to enter a different instruction.

Finding a Specific Bit

The following procedure will find the specified bit whether it is used as an input or output. In this case the search is for 001008.

1, 2, 3...

1. Press SHIFT+# and 1008 to enter the bit address, and CTRL+ENT to begin the search from address 000000.
2. Continue the search by pressing ENT.

Finding a Specific Word

The following procedure will find the specified word wherever it is used as an operand. In this case the search is for D00100.

1, 2, 3...

1. Press DM and 100 to enter the word address, and CTRL+ENT to begin the search from address 000000.
2. Continue the search by pressing ENT.

6-2-8 Programming in Mnemonics

In the GPC's memory, ladder programs created with mnemonics are identical to programs created in ladder form, allowing programs to be created and read in either display mode. Programs can be created as mnemonic lists in either mnemonic list display mode (with comments or without).

Programs created in the mnemonics are automatically written to memory, so it is not necessary to use the Store operations. However, when creating or modifying a program from a Memory Card file, the program must be saved to the card with the Save operation.

Delete the contents of the memory with the Clear User Program Memory operation before creating a new program. Existing programs will be overwritten if not deleted before a new program is written.

Entering Write Mode

Follow the procedure below to put the GPC in write mode. The GPC enters write mode automatically after the Clear User Program Memory operation is performed.

1, 2, 3...

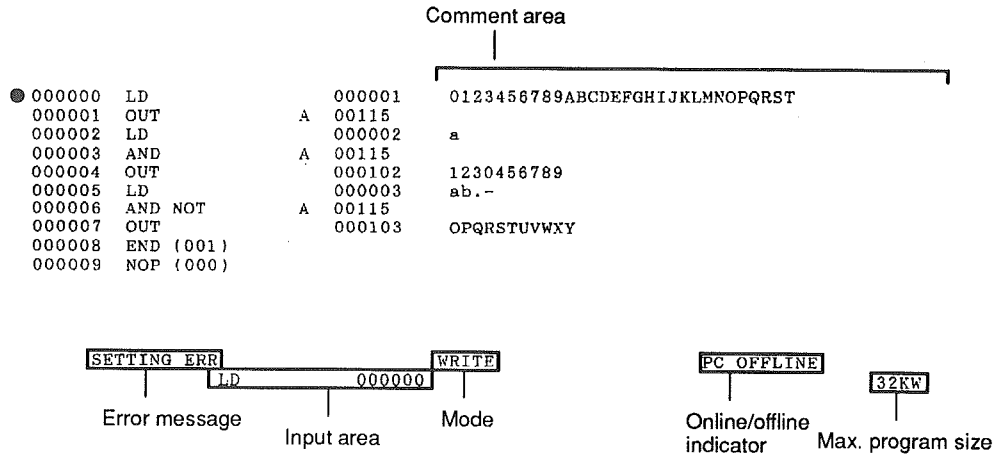
1. Select (0): Service PC from the main offline menu.
2. Select (1): Program from the Service PC menu.
3. Select the program memory.
4. A program can be created in either GPC memory or the Memory Card installed in the GPC.
   a) To create a program in GPC memory, press 0, ENT, and ENT.
   b) To modify a program previously saved to the Memory Card, press 1 and ENT. Move the cursor to the desired program filename with the Up and Down Keys (the Plus and Minus Keys act as Page Up and Page Down) and press ENT. To create a new program on the Memory Card, press 1, ENT, and WRITE, input the new filename (up to 8 characters long) and then press ENT twice. When inputting a filename, the cursor can be moved left and right with the Left and Right Keys and the character at the cursor can be deleted with the SHIFT+Left or SHIFT+Right Keys. The CLR Key deletes all characters in the input area.

   Note a) In the GPC, lower case characters are distinguished from upper case characters in filenames, but in the CVSS, lower case characters are automatically converted to upper case. Files that have been saved in the GPC with filenames including lower case characters will not be usable in CVSS systems, so save files with upper case characters in the GPC if those files might be used in CVSS systems.

   b) The contents of the GPC's internal memory will be overwritten with a program that is created or modified for storage on the Memory Card.
5. Press the 0 Key to select the main program. Refer to page 84 for details on creating and modifying interrupt programs.
6. Press the ENT Key to display the program as a ladder diagram without comments.
7. Press the CHG Key to change the display mode to mnemonic list without comments.
8. Press the WRITE Key to enter write mode.

Mnemonic Programming Screen

Up to 14 lines of the mnemonic list can be displayed on the screen. The screen below shows a program displayed in the write mode as mnemonic list with comments.



Moving the Cursor

Press the Up and Down Keys to move the cursor up and down the display.

Press the Plus and Minus Keys to display the next and previous page.

Entering Programs

The GPC should be in insert mode when entering programs with mnemonics. Switch to insert mode by pressing the INS Key. Instructions entered in insert mode will be inserted in the program at the location indicated by the cursor. If there is already an instruction at the cursor, it will be forced to the next address.

Programs entered with mnemonics are not automatically checked for syntax errors. Always check the program for errors with the program check operation.

Entering Conditions

The following table shows the key sequences for entering conditions into a mnemonic list. Refer to the table on page 60 for information on entering bit addresses.

Instruction	Key sequence	Comments
LD	**LD** *Bit_address* **ENT**	—
AND	**AND** *Bit_address* **ENT**	
OR	**OR** *Bit_address* **ENT**	
LD NOT	**LD NOT** *Bit_address* **ENT**	
AND NOT	**AND NOT** *Bit_address* **ENT**	
OR NOT	**OR NOT** *Bit_address* **ENT**	
AND LD	**AND LD ENT**	
OR LD	**OR LD ENT**	
LD TR	**LD TR** *TR_number* **ENT**	
Immediate refresh variation of conditions	(**Normal key sequence**) **!** *Bit_address* **ENT**	To enter variations that combines the immediate refresh variation with a differentiate up or down variation, press ! and then ↑ or ↓.
Differentiate up variation of instructions with function codes	(**Normal key sequence**) **SET** *Bit_address* **ENT**	The immediate refresh variation cannot be applied to "NOT" conditions.
Differentiate down variation of instructions with function codes	(**Normal key sequence**) **RESET** *Bit_address* **ENT**	

Entering Instructions

The following table shows the key sequences for entering outputs and other right-hand instructions into a mnemonic list. Refer to the table on page 60 for information on entering bit addresses.

Instruction	Key sequence	Comments
OUT	**OUT** *Bit_address* **ENT**	—
OUT NOT	**OUT NOT** *Bit_address* **ENT**	
OUT TR	**OUT TR** *TR_number* **ENT**	
TIMER (TIM)	**TIM** *Timer_number* **ENT # SV ENT**	To set a word address for the SV, enter the word address instead of # SV.
COUNTER (CNT)	**CNT** *Counter_number* **ENT # SV ENT**	
Normal variation of instructions with function codes	**FUN** *Function_code* **ENT** *Operand* **ENT** *Operand* **ENT** *Operand* **ENT**	Input leading zeros for the function code. The number of operands varies.
Immediate refresh variation of instructions with function codes	OUT/OUT NOT: **OUT (NOT) !** *Bit_address* **ENT** Other instructions: **FUN** *Function_code* **! ENT** *Operand* **ENT** *Operand* **ENT**	Can be used with OUT, OUT NOT, KEEP(011), DIFU(013), DIFD(013), SET(016), RSET(017), CMP(020), and MOV(030) only.
Differentiate up variation of instructions with function codes	**FUN** *Function_code* **SET ENT** *Operand* **ENT** *Operand* **ENT** *Operand* **ENT**	—
Differentiate down variation of instructions with function codes	**FUN** *Function_code* **RESET ENT** *Operand* **ENT** *Operand* **ENT** *Operand* **ENT**	Can be used with SET(016) and RSET(017) only.

Programming Example

This example demonstrates how to input the program shown below.

```
000000  LD              000001
000001  AND             000002
000002  OUT             000100
000003  LD              000003
000004  MOV (030)
                            0001
                      D   00010
000005  END (001)
```

```
                                  INSERT          PC OFFLINE
NOP (000)                                                    32KW
```

1, 2, 3... 1. Begin with the GPC in read mode.

```
●000000  NOP (000)
```

```
                        READ          PC OFFLINE
                                                 32KW
```

2. Press the INS Key to switch to insert mode.

   The initial screen has an NOP(000) instruction. Leave this instruction at the end of the program until the program is completed. The NOP(000) instruction will be replaced and moved to the next address as new instructions are entered.

```
● 000000  NOP (000)


                                  INSERT                PC OFFLINE
NOP (000)                                                          32KW
```

3. Enter the first instruction by pressing LD, 1, and ENT. It is not necessary to enter leading zeroes.

```
  000000  LD                000001
● 000001  NOP (000)


                                  INSERT                PC OFFLINE
NOP (000)                                                          32KW
```

4. Enter the rest of the instructions as shown below.
   a) AND, 2, ENT
   b) OUT, 100, ENT
   c) LD, 3, ENT
   d) FUN, 030, ENT (Leading zeroes must be entered in function codes.)
      1, ENT
      DM, 10, ENT
   e) FUN, 001, ENT

The following screen will appear if the instructions have been entered correctly:

```
000000  LD                000001
000001  AND               000002
000002  OUT               000100
000003  LD                000003
000004  MOV (030)
                          0001
                      D   00010
000005  END (001)


                                  INSERT                PC OFFLINE
                NOP (000)                                          32KW
```

Note Always use the check program operation; program errors are not detected automatically when programming with mnemonics.

Editing Programs

Move the cursor to the instruction column to insert or delete an instruction. Instructions cannot be inserted or deleted when the cursor is at an operand.

It is not necessary to store a program after it is edited in the mnemonic display mode. The edited program will be automatically stored in the GPC's memory. However, always use the check program operation to avoid storing incorrect programs.

When creating or editing a program on the Memory Card, always save the program to the card with the save operation before checking the program.

Changing an Instruction

1, 2, 3...

1. If necessary, press the WRITE Key to select the Write mode.
2. Move the cursor to the instruction to be changed, enter the new instruction and press the ENT Key.

Inserting an Instruction

1, 2, 3...

1. If necessary, press the INS Key to select the Insert mode.
2. Move the cursor to the position where the instruction is to be inserted, enter the instruction and press the ENT Key.

   The instruction will be inserted at the cursor position and subsequent lines of the original program will move down. The cursor will move to the position of the original instruction.

Deleting an Instruction

1, 2, 3...

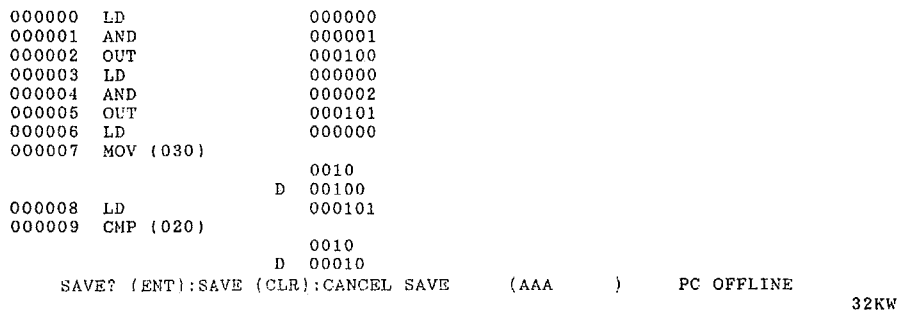
1. If necessary, press the WRITE Key to select the Write mode.
2. Move the cursor to the instruction to be deleted and press the ENT Key. The instruction at the cursor position will be deleted.

Saving Programs to Memory Card

Once a program has been completed in memory, it can be saved to a specified file in the Memory Card using the Save operation. Programs created in memory but not saved with to the Memory Card with the Save operation will be lost when the menu is switched with the SHIFT+SELECT Keys or the POWER switch is turned off.

1, 2, 3...

1. Press the CTRL+WRITE Keys. A message requesting confirmation of the Save operation will appear in the lower-left-hand corner of the screen.



2. Press the ENT Key to save the program. A message will appear in the lower-left-hand corner of the screen indicating that the program is being saved. Another message indicating that the program has been saved will appear after the program has been saved.

```
000000  LD                  000000
000001  AND                 000001
000002  OUT                 000100
000003  LD                  000000
000004  AND                 000002
000005  OUT                 000101
000006  LD                  000000
000007  MOV (030)
                            0010
                        D   00100
000008  LD                  000101
000009  CMP (020)
                            0010
                        D   00010
                                                        PC OFFLINE
  SAVE COMPLETE                     WRITE     (AAA      )    PC OFFLINE        32KW
            NOP (000)                                                          32KW
                            000001
```

Reading and Searching Programs

The following operation is used to read the program from the memory and display it on the screen. When the Memory Card is specified, the specified file will be transferred to the GPC's memory automatically and displayed on the screen.

Press the READ Key to switch to Read mode from other modes.

Follow the procedures in the table below to display 14 lines, beginning with the specified instruction. Press the CTRL+ENT Keys to begin the search from address 00000.

Operation	Key sequence	Description
Reading a specified program address	*Address* **ENT**	It is not necessary to input leading zeros, e.g., address 00000 can be input as 0.
Finding a specified condition or output	**Instruction Key** *Bit_address* **ENT** (**CTRL+ENT**)	Finds the condition or output specified by the Instruction Key(s) (LD, AND, OR, OUT, and NOT) containing the specified address.
Finding timer instructions	**TIM** *Timer_number* **ENT** (**CTRL+ENT**)	It is not necessary to input leading zeros of the timer or counter number.
Finding counter instructions	**CNT** *Counter_number* **ENT** (**CTRL+ENT**)	
Finding an instruction from its function code	Instructions executed every cycle: **FUN** *Function_code* **ENT** (**CTRL+ENT**) Differentiate up instructions: **FUN** *Function_code* **SET, ENT** (**CTRL+ENT**) Differentiate down instructions: **FUN** *Function_code* **RESET, ENT** (**CTRL+ENT**) Immediate refresh instructions: **FUN** *Function_code* **!, ENT** (**CTRL+ENT**)	Input leading zeros of the function code.
Finding instructions containing operands	**FUN** *Function_code* **ENT** *Operand* **SHIFT+ENT** *Operand* **SHIFT+ENT** *Operand* **SHIFT+ENT** **ENT** (**CTRL+ENT**)	Input leading zeros of the function code. Press the SHIFT+Right Keys to move the cursor when not specifying an operand. Press the READ Key to find the next instruction.
Finding instructions from an operand	*Operand* **ENT** (**CTRL+ENT**)	Specify bit or word addresses as the operand. This operation is identical to the "finding a specified condition or output" operation when a bit address is specified.

Example: Finding MOV(030) with a Specific Operand

Follow the procedure below to find an instruction with one or more specific operands. In this case, the search is for the first MOV(030) instruction in the program with D00010 as its second operand.

1, 2, 3...

1. Press FUN, 030, and SHIFT+ENT. The MOV(030) instruction will appear in the input area and the cursor will be located at OP1, operand 1.
2. Press the SHIFT+Right Keys to move the cursor to operand 2, and then press DM, 10, and SHIFT+ENT to input D00010 as the second operand.
3. Press CTRL+ENT to begin the search from address 000000.
   Once the first MOV(030) instruction in the program with D00010 as its second operand has been found, the search for the next such instruction can be started by pressing ENT.
   Press the READ Key to enter a different instruction.
4. Continue the search by pressing ENT.

6-2-9 Writing and Editing Interrupt Programs

When writing an interrupt program it is necessary to assign an interrupt number to it. The interrupt numbers are assigned according to the type of interrupt the program is written for, as shown in the following table.

Interrupt number	Interrupt
INT00 to INT31	I/O interrupts 0 to 31
INT32	Scheduled interrupt 0
INT33	Scheduled interrupt 1
INT34	Power OFF interrupt
INT35	Power ON interrupt

Create the interrupt program in the same memory location (GPC memory or in the same Memory Card file) as the main program.

Accessing Interrupt Programs

Follow the procedure below to access interrupt programs.

1, 2, 3...

1. Select (0): Service PC from the main offline menu.
2. Select (1): Program from the Service PC menu.
3. Select the program or memory.
4. A program can be created in either GPC memory or the Memory Card installed in the GPC.
   a) To create a program in GPC memory, press 0, ENT, and ENT.
   b) To create a program on the Memory Card, press 1, ENT, input the filename (up to 8 characters long), and press ENT.
5. Press 1 to select the interrupt programs.
6. Select the number of the program you wish to create or edit. The table above shows which interrupts correspond to the interrupt numbers.

Registering an Interrupt Program

The first step in reading or creating interrupt programs is registering the interrupt number of the program you wish to read or create.

1, 2, 3...

1. If necessary, press the WRITE Key to select the Write mode.
2. Move the cursor to the interrupt number and press the ENT Key.
   Asterisks (*) will appear next to the registered interrupt numbers.

Reading/Creating Interrupt Programs

1, 2, 3...

1. If necessary, press the READ Key to select the Read mode.
2. Move the cursor to the registered interrupt number (indicated by an asterisk) and press the ENT Key.
3. The selected interrupt program will appear on the screen as a ladder diagram without comments. From this point, the program can be created or edited just like the main program.

Deleting Interrupt Programs

1, 2, 3...

1. Press the Delete Key to select the Delete mode.
2. Move the cursor to the registered interrupt number (indicated by an asterisk) of the program you wish to delete and press the ENT Key.

   Deleted programs cannot be recovered.

Changing Interrupt Numbers

The registered interrupt number (indicated by an asterisk) can be changed to another number. A registered interrupt number can be changed to a number that is not currently registered. Also, registered interrupt numbers can be interchanged.

1, 2, 3...

1. Press the CTRL+WRITE Keys to select the CHG mode.
2. Move the cursor to the registered interrupt number (indicated by an asterisk) of the program you wish to change.
3. Input the new number and press the CTRL+ENT Key.

6-2-10 Checking the Program

The following operations are used to check to see if the program in memory is correct. These operations can be used regardless of whether the program was written in ladder or mnemonic form.

Always use the check operation to check a newly created or edited ladder program. When creating a program on the Memory Card, use the check operation after saving the program to the card with the Save operation.

Procedure

Follow the procedure below to check the program.

1, 2, 3...

1. Select (2): Check Program from the main offline menu.
2. Indicate the program that is to be checked. Programs can be in either GPC memory or the Memory Card installed in the GPC.
   a) To check a program in GPC memory, press 0, ENT, and ENT.
   b) To check a program on the Memory Card, press 1, ENT, input the filename (up to 8 characters long), and press ENT.
3. Select the check level by pressing the check level number and pressing ENT.

   The 3 possible check levels are described below. The tables at the end of this section describe error levels.

Check level	Description
0	Checks for errors of all levels: A, B, and C.
1	Checks for errors of levels A and B.
2	Checks for level A errors only.

4. Select the PC model by pressing the 0 or 1 and pressing ENT. Enter 0 for the CV1000 or 1 for the CV500.
5. Press the ENT Key to start the program check. Both the main program and interrupt programs in memory (either the GPC's memory or the specified Memory Card file) will be checked for errors up to the END(001) instruction.

If no errors were found, the message "OK" will appear on the screen.

If errors were found, a list of the errors will be displayed when the program check is complete. If the errors cannot be displayed on a single page, press the ENT Key to display the next page. Correct the program and run the program check again.

The time required for the program check depends on the size of the program. It can take over 2 minutes.

Error Levels

The following table describes the grouping of errors in error levels.

Error level	Description
A	Errors that prevent execution of the program, or result in treatment of instructions as NOP(000).
B	Non-fatal structural errors
C	Parts left out of the program or output timing errors

Error Messages

The following table provides the probable causes and possible remedies of errors.

Level	Message	Description	Remedy
A	????	Program contents destroyed. Invalid instruction code.	Enter correct instructions at the ???? parts of the program.
	JUMP ERR	No JME corresponding to JMP.	Check and correct program.
	LADDER ERR	Syntax error in instruction block. Number of LD instructions disagrees with number of logic block instructions (OR LD, AND LD).	Check the program.
	LOC. ERROR	Instruction used in incorrect memory area	Check use of instruction and correct program.
	NO END INSTRUCTION	No END instruction in the program	Enter an END instruction at the end of the program.
	NUMBER DUP ERR	SBN or JME number used twice.	Check and correct program.
	OPERAND ERR	Incorrect operand set for an instruction.	Enter correct operand.
	SBN missing	No SBN corresponding to SBS.	Check and correct program.
	STEP ERROR	STEP, SNXT used incorrectly.	
	UNDEF. STEP #	Step number used incorrectly.	
B	IL-ILC error	IL, ILC not used in pairs.	Check and correct program.
	SBN-RET error	RET instruction or SBN-RET used incorrectly.	
C	Dup output err	Same output bit specified for more than one instruction controlling its status.	Correct the bit addresses. This problem can cause racing.
	JMP missing	No JMP address corresponding to JME address.	Check and correct program
	SBS missing	No SNS address corresponding to SBN address.	
	Error overflow	More than 255 errors have occurred; more cannot be displayed.	Continue checking the program and correcting errors.

6-3 Editing

This section provides the procedures required to edit programming. Editing is performed using menus and examples of their use are provided. Read the CV500/CV1000 Operation Manuals and Installation Guide before editing.

6-3-1 Creating Comments

I/O comments are displayed in a table for each data area to allow them to be written, corrected, edited, printed or searched.

I/O comments can be written, corrected, or edited with these operations in either GPC memory or the Memory Card, and are automatically stored or saved; it is not necessary to use the Store or Save operations to write them to memory.

The I/O comments edited with these operations are displayed in either the ladder diagram with comments or mnemonic list with comments display modes.

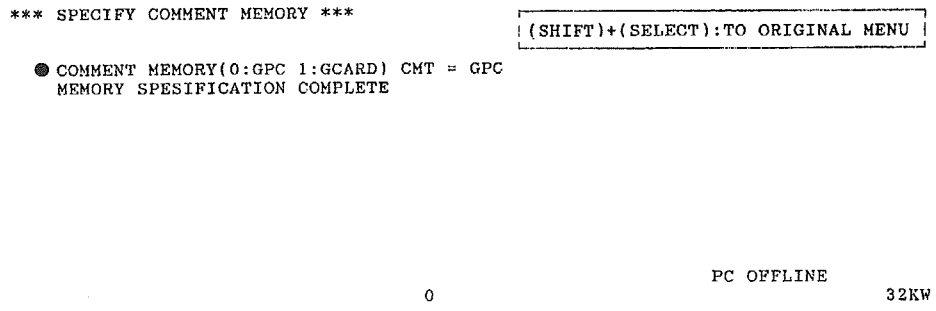
Comment files created on the GPC and saved to a floppy disk can be used on a computer running CVSS, but comment files created with CVSS cannot be used in the GPC.

Selecting Memory

I/O comments can be created in either GPC memory or the Memory Card. Follow the procedure below to specify the memory location of the I/O comments.

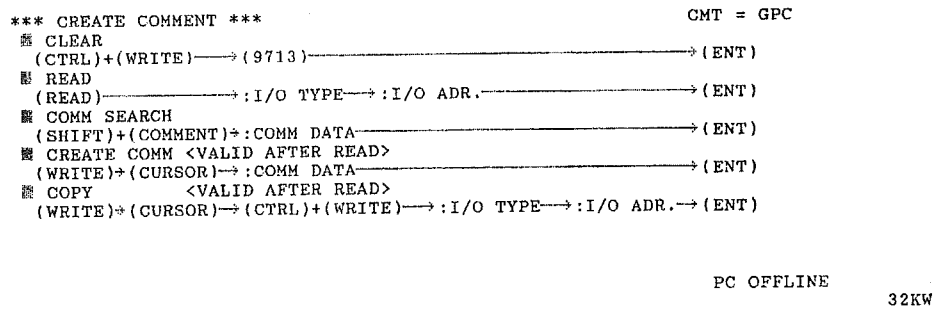
1, 2, 3...

1. Select (0): Service PC from the main offline menu.
2. Select (9): Create Comment from the Service PC menu. The following screen will appear:



3. Follow procedure a) to select GPC memory or b) to select the Memory Card.
   a) Press 0, ENT, and ENT.
   b) To modify a file previously saved to the Memory Card, press 1 and ENT. Move the cursor to the desired program filename with the Up and Down Keys (the Plus and Minus Keys act as Page Up and Page Down) and press ENT. To create a new file on the Memory Card, press 1, ENT, and WRITE, input the new filename (up to 8 characters long) and then press ENT twice. When inputting a filename, the cursor can be moved left and right with the Left and Right Keys and the character at the cursor can be deleted with the SHIFT+Left or SHIFT+Right Keys. The CLR Key deletes all characters in the input area.

   The following screen, called the create comments menu, will appear:



Reading I/O Comments

Follow the procedure below to display a list of I/O comments for a data area beginning with the specified word address or bit address:

1, 2, 3...

1. Go to the create comments menu (see above) and press the READ Key to select read mode.
2. Input the word or bit address that will head the list and press ENT. The key sequences for inputting addresses are provided in the table below.

Ten word or bit addresses and their corresponding I/O comments will be displayed on the screen. Use the Up and Down Keys to scroll up and down, and the Plus and Minus Keys to go the the end or beginning of the list.

Key Sequences

Data Area	Bit address	Word address
Auxiliary Area	**SHIFT+#, SHIFT+HR,** *Bit address*	**SHIFT+*DM, SHIFT+HR,** *Word address*
CIO Area	**SHIFT+#,** *Bit address*	**SHIFT+*DM,** *Word address*
Counter Area	**SHIFT+#, CNT,** *Counter number*	**SHIFT+*DM, CNT,** *Counter number*
CPU Bus Link Area	**SHIFT+#, SHIFT+LR,** *Bit address*	**SHIFT+*DM, SHIFT+LR,** *Word address*
DM Area	—	**DM,** *DM address*
EM Area	—	**SHIFT+IR,** *EM address*
Indirect DM address	—	**SHIFT+*DM,** *DM address*
Indirect EM address	—	**SHIFT+IR,** *EM address*
Timer Area	**SHIFT+#, TIM,** *Timer number*	**SHIFT+*DM, TIM,** *Timer number*
User-defined data area	**SHIFT+#, SHIFT+!,** *User's code, Bit address*	**SHIFT+*DM, SHIFT+!,** *User's code, Word address*

Writing I/O Comments

Before writing I/O comments, display the list of I/O comments beginning with the desired word or bit address as described above, then follow the procedure below.

1, 2, 3...

1. Press the WRITE Key to select write mode.
2. Position the cursor next to the address for which you want to write an I/O comment. The comments will appear in the input area at the bottom of the screen as they are written.

   Press the ENT Key to input the I/O comment into the table and move the cursor down the next line. I/O comments can be up to 30 alphanumeric characters long. Lower-case characters can be input by holding down the SHIFT Key while typing the letters.

```
                                                    CMT = GPC
 I/O ADR.   COMM DATA
   ● 0000
     0001
     0002
     0003
     0004
     0005
     0006
     0007
     0008
     0009
          ↓
 EDIT     →                          ←
                          WRITE (CMT)          PC OFFLINE
KEYS=0-9,A-Z  WORD        0000                          32KW
```

Moving the Cursor Use the Left and Right Keys to move the cursor left and right.

Deleting Characters Press the SHIFT+Left Keys or SHIFT+Right Keys to delete the character at the cursor. Press the CLR Key to delete all characters in the input area.

Finding I/O Comments

This operation searches through I/O comments for the specified character string. The search is performed through all data areas in the following order:

CIO bits, CIO words, Auxiliary Area bits, Auxiliary Area words, Timer Area, Counter Area, CPU Bus Link Area bits, CPU Bus Link Area words, DM Area, EM Area, *DM Area, *EM Area

Procedure

1, 2, 3...

1. Go to the Create Comments menu (see Selecting Memory on page 89).
2. Press the CTRL+CHG Keys. An input area will appear at the lower-left corner of the screen.

3. Enter the character string you want to find and press the ENT Key.

   If matching data is found, the word containing the I/O comment will be displayed. Press the ENT Key to resume the search for the next occurrence of the character string.

   The message "NOT FOUND" will be displayed in the lower-left corner of the screen if a matching character string is not found.

Copying I/O Comments

This operation copies the I/O comment from one bit or word address to another.

1, 2, 3...

1. Display the list of I/O comments beginning with the desired word or bit address as described in *Reading I/O Comments* on page 87.
2. Position the cursor next to the address that has the I/O comment you want to copy.
3. Press the WRITE Key to select write mode. Press the CTRL+WRITE Keys to copy the I/O comment.
4. Input the bit or word address to which you want to copy the I/O comment and press ENT. The copied I/O comment will appear next to the new address.

   Repeat step 4 to copy the same I/O comment to another bit or word address.

Clearing I/O Comments

This operation clears all I/O comment data in the selected memory (GPC memory or the Memory Card memory).

Procedure

1, 2, 3...

1. Go to the create comments menu (see Selecting Memory on 87).
2. Press the CTRL+WRITE Keys, 9713, and ENT.

   A message will be displayed in the lower-left corner of the screen indicating the operation has been completed when all I/O comments have been deleted from the selected memory.

Number of I/O Comments

Press the CTRL+2 Keys to display the number of I/O comments written in the selected memory (GPC memory or the Memory Card memory). This operation can be performed during any I/O comment editing operation once the create comments menu has been displayed.

The number of I/O comments in memory will be displayed in the lower-left corner of the screen. The maximum number of I/O comments that can be contained in memory is shown below.

Memory	Maximum number of I/O comments
Internal GPC	743
Memory Card	10,000

6-3-2 Editing Data Memory

The following operations are used to write and edit DM and EM Area data. DM data can be written in either GPC or Memory Card memory, but EM data can be written in the Memory Card only. DM and EM data is stored or saved automatically; it is not necessary to use the Store or Save operations to write the new or edited data to memory.

DM and EM data written on the GPC can be used on a host computer running CVSS, and vice-versa. Use .IOM file name extensions when saving DM and EM data files with the CVSS.

Memory Capacity

The following table shows the DM and EM Area data capacity in the GPC and Memory Card.

Data area	GPC capacity	Memory Card capacity*
DM Area	D00000 to D08191 (8K words)	D00000 to D24575 (24K words)
EM Area (CV1000 only)	—	E00000 to E32765 (32K words)

Note The memory capacity is equal to the total memory capacity for smaller Memory Cards.

Selecting Memory

DM data can be created in either GPC memory or the Memory Card, while EM data can be created only in the Memory Card. Follow the procedure below to specify the memory location.

1, 2, 3...

1. Select (0): Service PC from the main offline menu.
2. Select (6): Edit DM from the Service PC menu. The following screen will appear:

```
***  SPECIFY DM  ***

  ● DM          ( 0:GPC 1:G CARD)       DM  =
    EM          ( 0:*** 1:G CARD)       EM  =

                                                    PC OFFLINE
                        0                                       32KW
```

3. Position the cursor next to the data area you want to access, DM or EM.
4. Follow procedure a) to select GPC memory or b) to select the Memory Card.
   a) Press 0, ENT, and ENT.
   b) To modify a file previously saved to the Memory Card, press 1 and ENT. Both DM and EM files will be listed together. Move the cursor to the desired program filename with the Up and Down Keys (the Plus and Minus Keys act as Page Up and Page Down) and press ENT. To create a new file on the Memory Card, press 1, ENT, and WRITE, input the new filename (up to 8 characters long) and then press ENT twice. When inputting a filename, the cursor can be moved left and right with the Left and Right Keys and the character at the cursor can be deleted with the SHIFT+Left or SHIFT+Right Keys. The CLR Key deletes all characters in the input area.

   The following display, called the Input DM menu, will appear:

```
***  INPUT DM  ***                              DM = GPC
 ■ SELECT ITEM

  (0): DATA  CLEAR
  (1): DATA  FILL
  (2): DATA  COPY
  (3): DATA  INPUT

                                                    PC OFFLINE
                                                            32KW
```

Reading DM Data

Follow the procedure below to display a list of DM addresses and their contents beginning with the specified address.

1, 2, 3...

1. Go to the Input DM menu (see above) and press 3.
2. Press READ, input the address that will head the list and press ENT.

   Ten DM addresses and their contents will be displayed on the screen. Use the Up and Down Keys to scroll up and down, and the Plus and Minus Keys to display the previous or next 10 addresses.
3. To display the ASCII equivalents of the DM data, press the SHIFT+CHG Keys. The ASCII equivalents will be displayed next to the hexadecimal content of each address. Press the READ Key to cancel the display of ASCII equivalents.

Inputting DM Data

DM data can be entered as either hexadecimal or ASCII data.

Entering Hexadecimal Data

1, 2, 3...

1. Follow the procedure described in *Reading DM Data* on page 91 to display the DM addresses and their contents on the screen.
2. Press the WRITE Key to select write mode.
3. Move the cursor to the desired DM address, input the data, and press ENT.

   Numbers A to F are input by pressing SHIFT+0 to SHIFT+5.

Entering ASCII Data

1, 2, 3...

1. Follow the procedure described in *Reading DM Data* on page NO TAG to display the DM addresses and their contents on the screen.
2. Press the SHIFT+CHG Keys to display the ASCII equivalents of the DM data.
3. Press the WRITE Key to select write mode.
4. Move the cursor to the desired DM address, input the alphanumeric data, and press ENT.

   To input lower-case characters, hold the SHIFT Key and press the character.

   To input a space, press the SHIFT+Right Keys.

   Press the CLR Key to clear the input area and return to the "??" display.

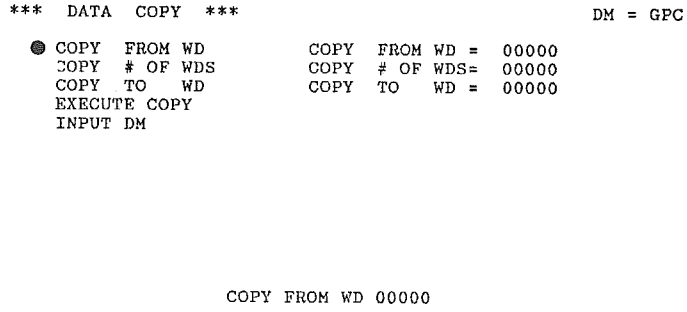
   Enter data as hexadecimal data when inputting 0000.

Copying DM Data

Use this operation to copy a block of data from one location in the DM Area to another.

1, 2, 3...

1. Go to the Input DM menu (see *Selecting Memory* on page 90) and press 2. The following display will appear:



2. Input the starting address of the source words and press ENT.[1, 2]
3. Input the number of words to be copied and press ENT.[1, 2]
4. Input the starting address of the destination words and press ENT.[1, 2]
5. Position the cursor next to "Execute Copy" and press ENT to copy the data in the source words to the destination words.
6. When the cursor next to "Input DM", press ENT twice to display the destination words.

   The operation can be repeated with other settings as many times as necessary.

Note

1. Be sure that the source words do not overlap the destination words.
2. If the specified source or destination words exceed the DM Area, the operation will be executed only up to the highest DM address.

DM Data Fill

Use this operation to write the same data to a block of DM addresses.

1, 2, 3...

1. Go to the Input DM menu (see *Selecting Memory* on page 90) and press 1. The following display will appear:

```
***  DATA  FILL  ***                                  DM = GPC

   ● WRITE START   WD       START   WD = 00000
     WRITE END     WD       END     WD = 00000
     WRITE DATA             DATA      = 0000
     EXECUTE FILL
     INPUT DM


                                                 PC OFFLINE
START WD     00000                                        32KW
```

2. Input the starting address of the destination words and press ENT.[1, 2]
3. Input the last address of the destination words and press ENT.[1, 2]
4. Input the hexadecimal data and press ENT.[1, 2]
5. Position the cursor next to "Execute Fill" and press ENT to write the data to the destination words.
6. When the cursor next to "Input DM", press ENT twice to display the destination words from the beginning of the block.

   The operation can be repeated with other settings as many times as necessary.

Clearing DM Data

This operation clears all DM data in the selected memory (GPC memory or the Memory Card memory).

Procedure

1, 2, 3... 1. Go to the Input DM menu (see *Selecting Memory* on page 90) and press 0. The following display will appear:

```
***  DATA CLEAR  ***                                    DM = GPC

DATA CLEAR
(CTRL)+(WRITE)→(9713)→(ENT)




                                                    PC OFFLINE
                                                              32KW
```

2. Press the CTRL+WRITE Keys, 9713, and ENT. All writeable DM Area words in the selected memory will be cleared.

6-3-3 Changing Addresses (Global Change)

The following operations are used to globally change the bit or word addresses used in a program. The operator can also specify whether I/O comments are changed. If an error occurs during operation, the change will not be performed and the addresses which could not be changed will be listed.

Operation	Key sequence	Notes
Change bit address	**SHIFT+#**, *Old bit address*, **WRITE**, *New bit address*, **ENT**	Changes bit addresses. (Cannot be used for DM, EM, *DM, or *EM addresses.)
Change word address	**SHIFT+*DM**, *Old word address*, **WRITE**, *New word address*, **ENT**	Changes word addresses (including DM and EM addresses) and timer/counter numbers.
Change bit and word addresses	**SHIFT+*DM**, *Old word address*, **CTRL+WRITE**, *New word address*, **ENT**	Changes bit and word addresses at the same time. Words in the CIO, Auxiliary, or CPU Bus Link Areas cannot be changed to timers or counters. If timers or counters are changed to words in the CIO, Auxiliary, or CPU Bus Link Areas, only the word addresses will be changed. When a timer is changed to another timer or a counter is changed to another counter, the timer or counter number will be changed. When a timer is changed to a counter or vice-versa, the timer or counter number will not be changed. (Cannot be used for DM, EM, *DM, or *EM addresses.)

Note 1. When a change operation is completed, a message will be displayed either indicating successful completion or listing the parts that could not be changed.

2. "NO END INSTRUCTION" will be displayed in the lower-left corner of the screen if there isn't an END(001) instruction in the program.

Selecting Memory

Bit and word addresses can be globally changed in either programs or I/O comments. The programs or I/O comments can be located in either GPC memory or the Memory Card. Follow the procedure below to specify the program or I/O comments and the memory location.

1, 2, 3...

1. Select (0): Service PC from the main offline menu.
2. Select (8): Global Change from the Service PC menu. The following display will appear:

```
*** SPECIFY PROGRAMMING MEMORY ***                 ┌(SHIFT)+(SELECT):TO ORIGINAL MENU ┐

  ● USER PROGRAM  (0:GPC 1:GCARD) UM  = GPC
    COMMENT MEMORY(0:GPC 1:GCARD) CMT = GPC
    MEMORY SPECIFICATION COMPLETE

                                                                  PC OFFLINE
                                0                                          32KW
```

3. Position the cursor next to program or I/O comments.
4. Follow procedure a) to select GPC memory or b) to select the Memory Card.
   a) Press 0, ENT, and ENT.
   b) To modify a file previously saved to the Memory Card, press 1 and ENT. Move the cursor to the desired filename with the Up and Down Keys (the Plus and Minus Keys act as Page Up and Page Down) and press ENT. To create a new file on the Memory Card, press 1, ENT, and WRITE, input the new filename (up to 8 characters long), and then press ENT twice. When inputting a filename, the cursor can be moved left and right with the Left and Right Keys and the character at the cursor can be deleted with the SHIFT+Left or SHIFT+Right Keys. The CLR Key deletes all characters in the input area.

   The following display will appear:

```
*** GLOBAL CHANGES ***                                          UM  = GPC
                                                                CMT = GPC
 ■(SHIFT)+(BIT) ┬→:I/O TYPE─┬→:ADDRESS─┬→(WRITE):*I/O CHANGE1
  (SHIFT)+(WD)──┘           ↑          └→(CTRL)+(WRITE):*I/O CHANGE2
  (DM)/(SHIFT)+(EM)─────────┤
  (*DM)/(SHIFT)+(*EM)───────┘

 ■*I/O CHANGE1,*I/O CHANGE2
  (SHIFT)+(BIT) →:I/O TYPE─┬→:ADDRESS──→(ENT)
  (SHIFT)+(WD)──┘          ↑
  (DM)/(SHIFT)+(EM)────────┤
  (*DM)/(SHIFT)+(*EM)──────┘

                                                                PC OFFLINE
                                                                        32KW
```

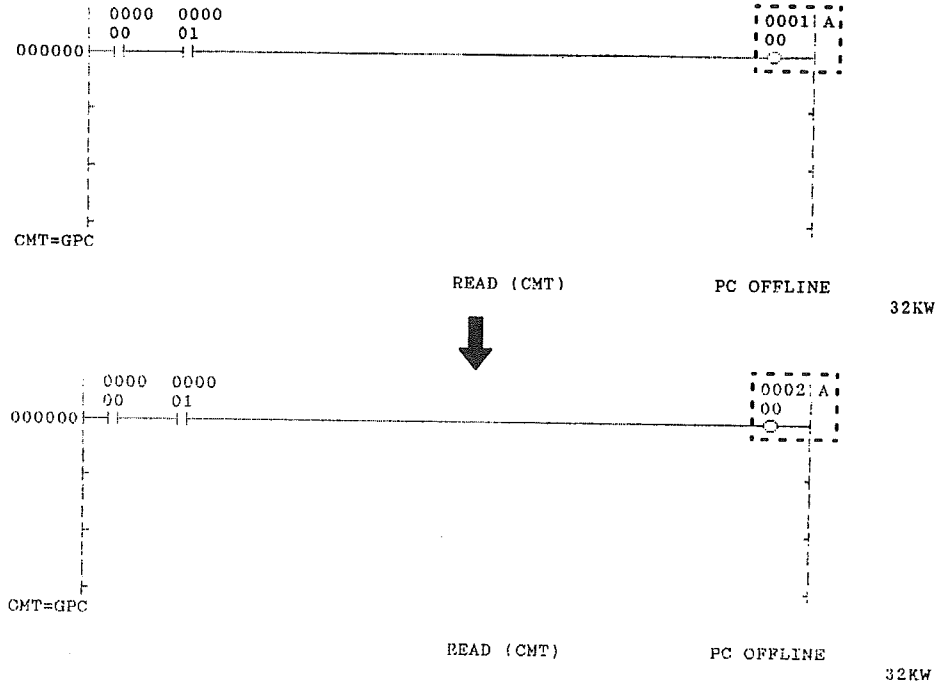
Change Bit Address Examples

Two examples of the change bit address operation are provided below.

Changing a Bit Address

In the following example, bit 000100 is changed to bit 000200.

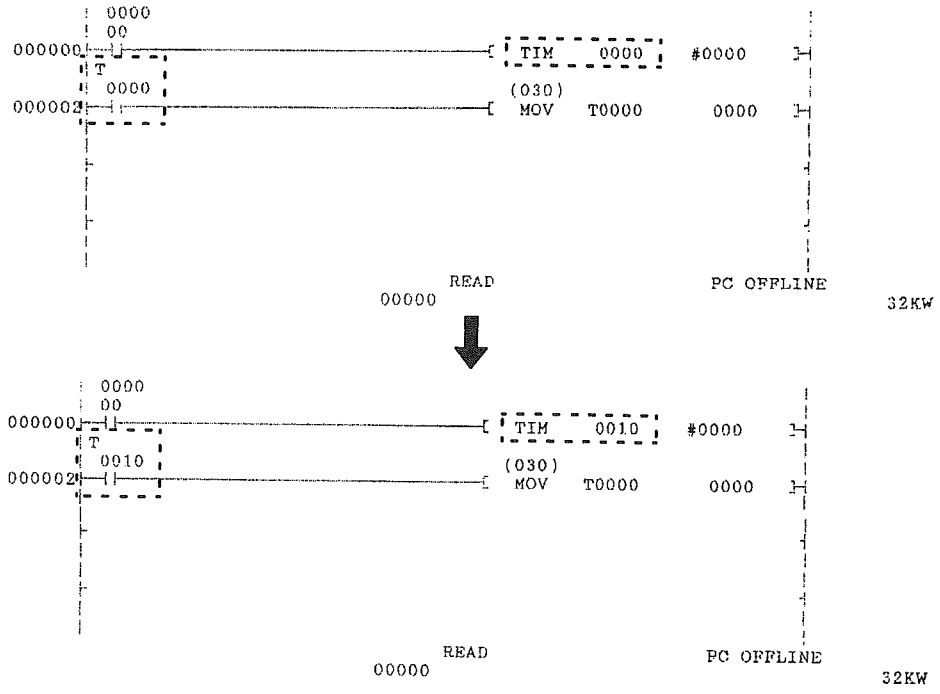
Press SHIFT+#, 100, WRITE, 200, and ENT.



Changing a Timer Number as a Bit Address

When one timer or counter number is changed to another as a bit address, the number will be changed in the timer/counter instruction and wherever it is used to indicate the Completion Flag. Timer/counter numbers used as word operands (indicating the timer/counter PV) will not be changed. In the following example, T0000 is changed to T0010.

Press SHIFT+#, TIM, 0, WRITE, 10, and ENT.



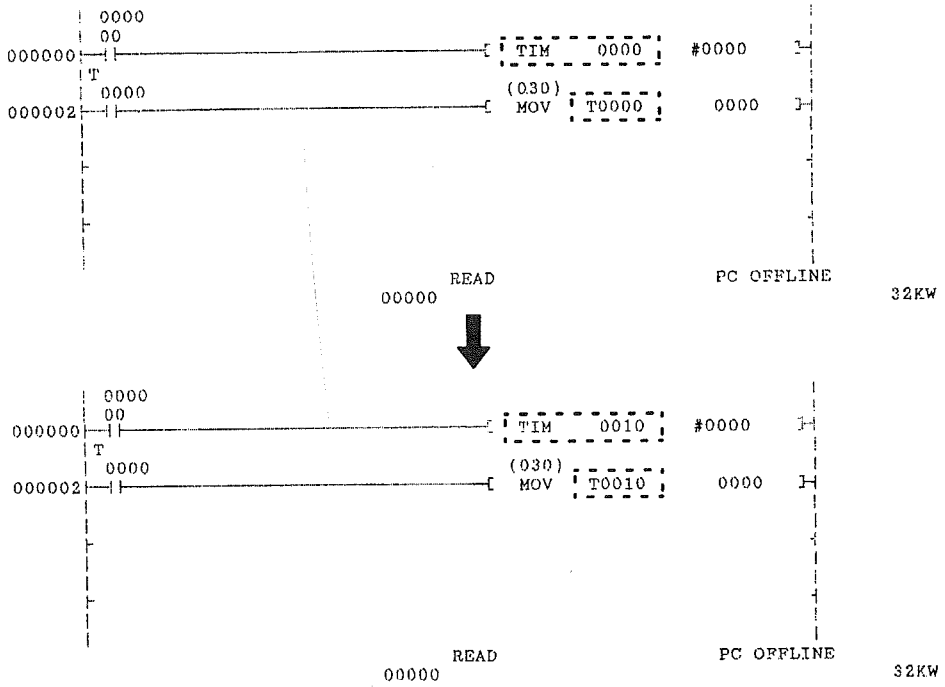
Change Word Address Examples

Two examples of the change word address operation are provided below.

Changing a Timer Number as a Word Address

When one timer or counter number is changed to another as a word address, the number will be changed in the timer/counter instruction and wherever it is used as a word operand (indicating the timer/counter PV). The timer/counter number will not be changed where it is used as a bit operand (indicating the Completion Flag). In the following example, T0000 is changed to T0010.

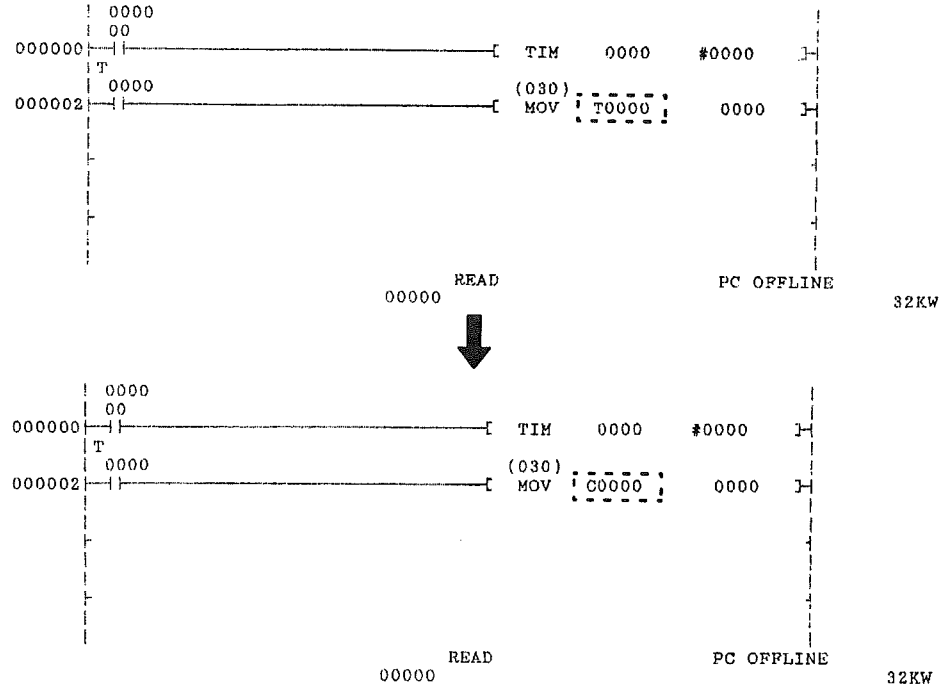
Press SHIFT+*DM, TIM, 0, WRITE, 10, and ENT.



Changing a Timer to a Counter as a Word Address

When a timer is changed to a counter with the same timer/counter number, the number will be changed only where it is used as a word operand (indicating the timer/counter PV). The timer/counter number will not be changed in the timer/counter instruction or where it is used as a bit operand (indicating the Completion Flag). In the following example, T0000 is changed to C0000.

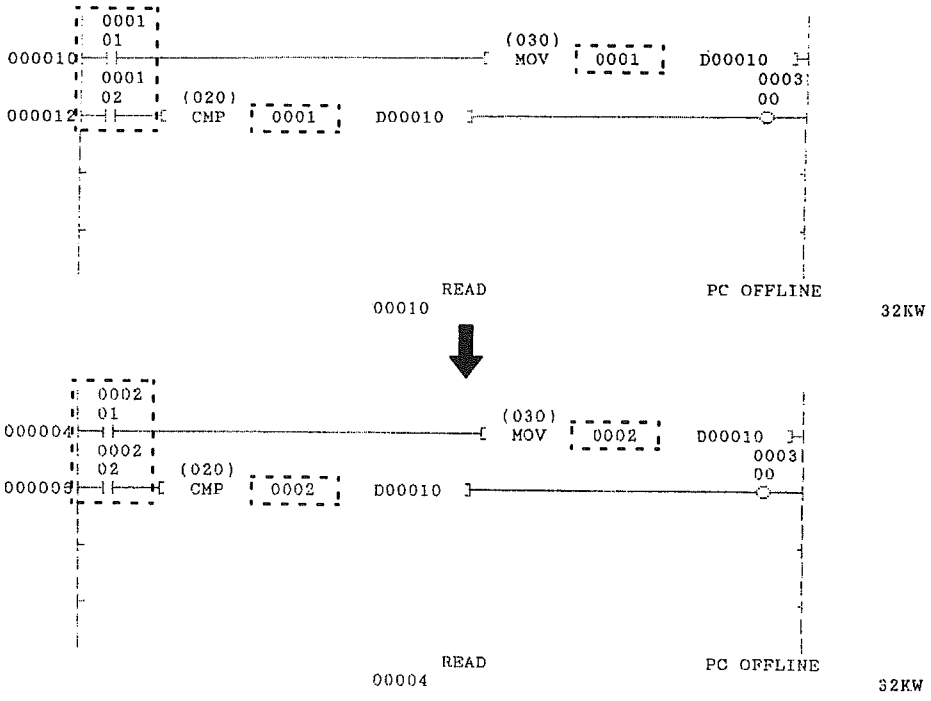
Press SHIFT+*DM, TIM, 0, WRITE, CNT, and ENT.



Change Bit and Word Addresses Example

In the following example, 0001 is changed to 0002 wherever it occurs in the program, i.e., where 0001 is used as a word operand or a bit in 0001 is used as a bit operand.

Press SHIFT+*DM, 1, CTRL+WRITE, 2, and ENT.



6-3-4 Editing PC Names (IDs)

A PC ID is a name assigned to each node of a SYSMAC NET or SYSMAC LINK network. Once set, the assigned name can be specified instead of the network and node addresses. The PC ID table is created in the Memory Card, and cannot be created in GPC memory.

Once the PC ID table has been created, follow the procedure below to communicate with a PC.

1, 2, 3...

1. Select the effective PC ID file in the GPC Settings. Refer to GPC Settings for details.
2. Go to the main offline menu and press the NODE Key. The PC ID file selected in the GPC Settings will be displayed on the screen. There are two ways to select a PC:
   a) Move the cursor to the desired PC and press ENT.
   b) Press the WRITE Key and enter the network and node addresses manually. In this case, it is possible to enter 000 for both the network and node addresses to indicate the PC that is connected directly to the GPC.

Creating a PC ID Table

Follow the procedure below to create or edit a PC ID table.

1, 2, 3...

1. Select (3): Edit PC Names from the main offline menu.
2. Press the WRITE Key, input the filename (up to 8 characters long) of the PC ID file you want to create or edit, and press ENT.

   The input is case-sensitive: upper-case and lower-case letters are treated as different characters. To input lower-case characters, hold the SHIFT Key and press the character.

   Press the Right an Left Keys to move the cursor right and left.

   Press the SHIFT+Right or SHIFT+Left Keys to delete the character at the cursor. Press the CLR Key to delete all characters in the input area.

   A PC ID table, like the one below, will appear when the filename is entered:

```
***  PC NAME TABLE   ***                          NAME FILE = CARD(A        .PCN)

   #       PC NAME       NETW'K   NODE
 ● 000
   001
   002
   003
   004
   005
   006
   007
   008
   009
 END
                                        PC NAME                PC OFFLINE
   CARD                                                                    32KW
```

3. Press the WRITE Key to select write mode.
4. Input the PC ID (up to 8 characters long) and press ENT. More than one PC ID cannot be assigned to a single node and the same PC ID cannot be assigned to more than one node.

   The input is case-sensitive: upper-case and lower-case letters are treated as different. To input lower-case characters, hold the SHIFT Key and press the character.

   Press the Right and Left Keys to move the cursor right and left.

   Press the SHIFT+Right or SHIFT+Left Keys to delete the character at the cursor. Press the CLR Key to delete all characters in the input area.
5. Input the network address in the range 0 to 127 and press the ENT Key. Network address 0 indicates the network of the PC which is connected to the GPC.

6. Input the node address and press the ENT Key. The node address can be in the range 1 to 62 for a SYSMAC LINK network, or 1 to 126 for a NET Link network. Do not enter a node address of 0.
7. Repeat steps 4 through 6 to enter another PC ID. Up to 500 PC IDs can be entered.

   When more than 10 PC IDs have been entered, the Plus or Minus Keys can be used as page up or page down Keys to display the previous or next page.
8. Press CTRL+WRITE to save the PC IDs to the Memory Card.

Inserting a PC ID Table Entry Follow the procedure below to insert an entry into a PC ID table.

1, 2, 3...

1. Follow the previous procedure (under the heading *Creating a PC ID Table*) through step 2 to display the PC ID table. If the GPC is in write mode, press the CLR Key to cancel the write mode.
2. Move the cursor to the line where you want to insert a new entry and press the INS Key. A blank line will be created at the cursor location.
3. Follow the previous procedure from step 3 to add an entry.

   Note A PC ID table with a blank line cannot be saved to the Memory Card by pressing CTRL+WRITE. Add a new entry or delete the blank line before attempting to save the table.

Deleting a PC ID Table Entry Follow the procedure below to delete an entry from a PC ID table.

1, 2, 3...

1. Follow the procedure on page 100 (under the heading *Creating a PC ID Table*) through step 2 to display the PC ID table. If the GPC is in write mode, press the CLR Key to cancel the write mode.
2. Move the cursor to the entry you want to delete and press the Delete Key. The entry will be deleted.
3. Save the table to the Memory Card by pressing CTRL+WRITE.

6-4 Data Area Lists

The following operations can be used to display information on the usage of the specified bits and words in programs in GPC memory or on the Memory Card.

The following two types of data area lists can be displayed.

Operation	Function
Bit and word usage	Displays a table showing how the specified bits, timers, counters, or DM words are used in the program. I/O comments are displayed at the same time.
Cross-references	Displays a table showing the addresses and instructions in which the specified bits, timers, counters, or DM words are used in the program. I/O comments are displayed at the same time.

Selecting Memory

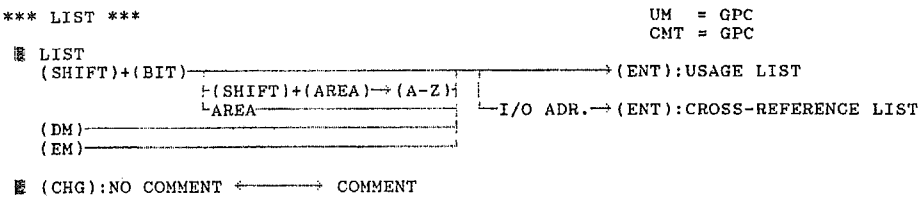
Information can be displayed about programs in GPC memory or on the Memory Card. Follow the procedure below to specify the memory location.

1, 2, 3...

1. Select (0): Service PC from the main offline menu.
2. Select (7): List from the Service PC menu.
3. Position the cursor next to program or comment memory.
4. Follow procedure a) to select GPC memory or b) to select the Memory Card.
   a) Press 0, ENT, and ENT.
   b) To modify a file previously saved to the Memory Card, press 1 and ENT. Move the cursor to the desired program filename with the Up and Down

Keys (the Plus and Minus Keys act as Page Up and Page Down) and press ENT. To input a filename manually, press 1, ENT, and WRITE, input the filename and then press ENT twice. When inputting a filename, the cursor can be moved left and right with the Left and Right Keys and the character at the cursor can be deleted with the SHIFT+Left or SHIFT+Right Keys. The CLR Key deletes all characters in the input area.

The following display, called the List menu, will appear:



5. Input the bit address (or word address for DM and EM) and press ENT. The key sequences for inputting addresses are provided in the table below.

Data Area	Key Sequence
Auxiliary Area	**SHIFT+#**, **SHIFT+HR**, *Bit address*, **ENT**
CIO Area	**SHIFT+#**, *Bit address*, **ENT**
Counter Area	**SHIFT+#**, **CNT**, *Counter number*, **ENT**
CPU Bus Link Area	**SHIFT+#**, **SHIFT+LR**, *Bit address*, **ENT**
DM Area	**SHIFT+*DM**, **DM**, *DM address*, **ENT**
EM Area	**SHIFT+*DM**, **SHIFT+IR**, *EM address*, **ENT**
Timer Area	**SHIFT+#**, **TIM**, *Timer number*, **ENT**
User-defined data area	**SHIFT+#**, **SHIFT+!**, *User's code*, *Bit address*, **ENT**

6. Press ENT when "CONTINUE" is displayed in the lower-left corner of the screen to display the next page of the list.

   When changing just the address and not the data area, just input the address and press ENT. When changing the data area, press the CLR Key and input the entire key sequence.

Press the CHG Key to display I/O comments (or remove comments already displayed). Press the CHG Key before pressing ENT.

Sample Lists

The example below shows a list for CIO bit usage with comments displayed. (An "I" indicates the bit is used as an input bit only, "O" as an output bit only, "*" as both an input and an output bit, and "–" indicates the bit is not used.)

```
*** IOM LIST(+COMMENTS) *** (I:IN O:OUT *:I/O -:UNUSED) UM   = GPC
WD   0000                                                  CMT = GPC
BIT          COMM                          BIT          COMM
00 I  ABCDEFGHIJKLMNOPQRSTUVWXYZ1234       10 -
01 I  ABC                                  11 -
02 -  ABC                                  12 -
03 -  ABC                                  13 -
04 -  ABC                                  14 -
05 -  ABC                                  15 -
06 -  ABC
07 -  ABC
08 -  ABC
09 -  ABCDEFGHIJKLMNOPQRSTUVWXYZ1234
CONT
                                                        PC OFFLINE
                  BIT          0001                                  32KW
```

The example below shows a list for CIO bit usage without comments.

```
*** IOM LIST ***   (I:IN O:OUT  *:I/O -:UNUSED)          UM  = GPC

WD   15 14 13 12 11 10  9  8  7  6  5  4  3  2  1  0
 0001 -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  O
 0002 -  -  -  -  -  -  I  I  I  I  I  I  I  I  I  -
 0003 -  -  -  -  -  -  I  I  I  I  I  I  I  I  I  -
 0004 -  -  -  -  -  -  I  I  I  I  I  I  I  I  I  -
 0005 -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
 0006 -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
 0007 -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
 0008 -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
 0009 -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
 0010 -  -  -  -  -  -  -  -  -  -  -  -  -  -  -  -
CONT
                                                        PC OFFLINE
                  BIT          0011                                  32KW
```

The example below shows a list for timer usage without comments. The CHG Key can be pressed to display comments.

```
*** TIM LIST ***                                          UM  = GPC

      STEP   ADR.  SV                          STEP   ADR.  SV
           -0010                                    -0020
           -0011                                    -0021
           -0012                                    -0022
           -0013                                    -0023
           -0014                                    -0024
           -0015                                    -0025
           -0016                                    -0026
           -0017                                    -0027
           -0018                                    -0028
           -0019                                    -0029
CONT
                                                        PC OFFLINE
                  NO.        TIM 0030                              32KW
```

The example below shows a list for DM usage without comments.

(A "D" indicates the bit is used as DM only, "*" as indirectly addressed DM only, and "W" indicates the bit is used for both.)

```
*** DM/*DM LIST ***  (D:DM *:*DM W:DM/*DM BLANK:UNUSED) UM  = GPC

ADR.  D/* ADR.  D/* ADR.  D/* ADR.  D/* ADR.  D/* ADR.  D/* ADR.  D/* ADR.  D/*
00010     00020     00030     00040     00050     00060     00070     00080
00011     00021     00031     00041     00051     00061     00071     00081
00012     00022     00032     00042     00052     00062     00072     00082
00013     00023     00033     00043     00053     00063     00073     00083
00014     00024     00034     00044     00054     00064     00074     00084
00015     00025     00035     00045     00055     00065     00075     00085
00016     00026     00036     00046     00056     00066     00076     00086
00017     00027     00037     00047     00057     00067     00077     00087
00018     00028     00038     00048     00058     00068     00078     00088
00019     00029     00039     00049     00059     00069     00079     00089
CONT
                                                        PC OFFLINE
                  WD         DM 00090                              32KW
```

The example below shows a list for CIO bit cross-reference with comments.

```
*** CROSSREF LIST(+COMENT)***                          UM  = GPC
                                                       CMT = GPC
        000000 - ---|--
```

```
END                                    ABCDEFGHIJKLMNOPQRSTUVWXYZ1234
                                                        PC OFFLINE
                  BIT          000000                                32KW
```

6-5 File Operations

This section provides the procedures required to manage files on the Memory Card and floppy disks, and to transfer data between the GPC memory, the Memory Card, and floppy disks.

6-5-1 File Management

This section provides the procedures required to manage files on the Memory Card and floppy disks. Read the CV500/CV1000 Operation Manuals and Installation Guide before performing file operations.

Operation	Function
Initialization	Formats memory cards and floppy disks.
File list	Displays a directory of the files on the Memory Card or floppy disk.
Delete file	Deletes files.
Rename file	Renames files.
Copy FD1 to FD2	Copies all files from floppy disk 1 to floppy disk 2.
Compare FD1 and FD2	Compares the contents of floppy disk 1 to floppy disk 2.

The Memory Card must be installed in a Memory Card Adapter that is mounted to the GPC. The write-protect switch must be set to OFF for all operations except file directory and compare FD1 and FD2. The Memory Card must be EEPROM or RAM for all operations except file directory.

Be sure that the correct floppy disk drive and disk type have been set with the Floppy operation in the GPC Settings menu. The floppy disk's write-protection must be OFF for all operations except file directory and compare FD1 and FD2. Refer to *6-7-1 GPC Settings* for details on GPC settings and *5-3 Floppy Disk Drive* for details on connecting the disk drive to the GPC.

Selecting Operations

Follow the procedure below to specify the file management operation you want to perform and select the Memory Card or floppy disk.

1, 2, 3...

1. Select (0): Service PC from the main offline menu.
2. Select (4): File from the Service PC menu.

   The following screen, called the File menu, will appear:

```
*** MEMCARD/FLOPPY  ***                    FLOPPY = FD0
  SELECT ITEM
● FORMATTING     (0:G CARD 1:FLOPPY)
  FILE LIST      (0:G CARD 1:FLOPPY)
  DELETE FILE    (0;G CARD 1:FLOPPY)
  RENAME FILE    (0:G CARD 1:FLOPPY)
  COPY    FD1  →  FD2
  VERIFY FD1 ←→  FD2


                                    PC OFFLINE
0                                              32KW
```

3. Position the cursor next to desired operation.
4. Press 0 and ENT to select the Memory Card or 1 and ENT to select the floppy disk.

Initialization

The following operation can be used to format a Memory Card or a floppy disk to enable it to store data. All existing data is cleared during initialization.

Procedure

1, 2, 3...

1. Go to the File menu and position the cursor next to Formatting.
2. Press 0 and ENT to select the Memory Card or 1 and ENT to select the floppy disk.
3. Press WRITE and ENT. Press ENT again to confirm the operation and begin disk formatting.

   A message will appear indicating that the disk is being formatted, and another will appear when the operation is completed. Press the SELECT Key to return to the File menu.

File Directory

The following operation can be used to display a list of all files on the Memory Card or floppy disk. The list also shows the size of each file and the date that it was created.

All files created in the GPC will have a date of 00–00–00 and will be located in the root directory. Files created with CVSS and saved to subdirectories on a floppy disk cannot be listed on the GPC.

Procedure

1, 2, 3...

1. Go to the File menu and position the cursor next to File List.
2. Press 0 and ENT to select the Memory Card or 1 and ENT to select the floppy disk. The file directory will be displayed.
3. If the message "CONTINUE" appears on the screen, press ENT to display the next page of the directory.

   Press the SELECT Key to return to the File menu.

Deleting Files

The following operation can be used to delete files from a Memory Card or a floppy disk.

Procedure

1, 2, 3...

1. Go to the File menu and position the cursor next to Delete File.
2. Press 0 and ENT to select the Memory Card or 1 and ENT to select the floppy disk. The file directory will be displayed.
3. Position the cursor next to file you want to delete and press ENT.

   Use the Up and Down Keys to scroll up and down through files in the directory. Use the Plus/Minus Keys to display the next/previous page.
4. Press ENT again to confirm the operation and delete the file, or press the CLR Key to cancel the operation.

   A message will appear indicating that the file has been deleted. The deleted file's filename will remain on the screen, but it will be gone the next time the directory is displayed.

   Press the SELECT Key to return to the File menu.

Changing Filenames

The following operation can be used to change the names of files in the Memory Card or floppy disk.

Procedure

1, 2, 3...

1. Go to the File menu and position the cursor next to Rename File.
2. Press 0 and ENT to select the Memory Card or 1 and ENT to select the floppy disk. The file directory will be displayed.

3. Position the cursor next to filename you want to change and press ENT.

   Use the Up and Down Keys to scroll up and down through files in the directory. Use the Plus/Minus Keys to display the next/previous page.

4. Input the filename (up to 8 characters long) and press ENT.

   When inputting a filename, the cursor can be moved left and right with the Left and Right Keys and the character at the cursor can be deleted with the SHIFT+Left or SHIFT+Right Keys. The CLR Key deletes all characters in the input area.

   A message will appear indicating that the operation has been completed. The old filename will remain on the screen, but it will be changed the next time the directory is displayed.

   Press the SELECT Key to return to the File menu.

Note Upper-case and lower-case characters are treated as different characters in the GPC, while lower-case characters input into filenames are automatically converted to upper-case in the CVSS. Filenames created in the GPC with lower-case characters will not be usable in the CVSS, so input only upper-case characters if the files might be used in the CVSS.

Copy FD1 to FD2

The following operation can be used to copy the contents of the floppy disk in disk drive 1 to the floppy disk in disk drive 2. The floppy disk in disk drive 2 must be formatted beforehand.

Procedure

1, 2, 3...

1. Go to the File menu, position the cursor next to Copy FD1 to FD2, and press ENT.
2. Press WRITE and ENT. Press ENT again to confirm the operation and begin copying.

   A message will appear indicating that the disk is being copied. The operation will take about 8 minutes and cannot be stopped while in progress. A message will appear when the operation is completed.

   Press the SELECT Key to return to the File menu.

Comparing FD1 and FD2

The following operation can be used to compare the contents of the floppy disk in disk drive 1 to the contents of the floppy disk in disk drive 2.

Procedure

1, 2, 3...

1. Go to the File menu, position the cursor next to Verify FD1 and FD2, and press ENT.
2. Press ENT to begin comparing.

   A message will appear indicating that the disks are being compared, and another will appear when the operation is completed.

   Press the SELECT Key to return to the File menu.

6-5-2 File Transfer

The following operations are used to transfer various types of data files between the GPC memory, the Memory Card, and floppy disks.

The files that can be created in GPC memory, floppy disks, and memory cards are listed in the following table. A "YES" indicates the type of file can be created in that memory, and a "NO" indicates it cannot.

File type	Filename extension	GPC memory	Memory Card	Floppy disk
PC Setup[1]	—	NO	NO	NO
Object	.OBJ	YES	YES	YES
CIO Area[2]	.IOM	NO	YES	YES
DM Area	.IOM	YES	YES	YES
EM Area	.IOM	NO	YES	YES
I/O comment	.CMT	YES	YES	YES
PC name table	.PCN	NO	YES	YES
PC parameters[3]	.STD	NO	YES	YES
Custom data areas	.ARE	YES	YES	YES
Function code table	.MEI	YES	YES	YES

Note

1. The PC Setup file can be transferred between the GPC memory and the PC only when the GPC is online.
2. The CIO Area file is the file that has been saved to the memory card or floppy disk in an online operation.
3. The PC parameters can be transferred to a memory card mounted in the PC's CPU in an online operation. The memory card can then be moved to the GPC.

Be sure that the memory card or floppy disk has been formatted and is not write-protected. The Memory Card must be EEPROM or RAM.

The floppy disk drive that will be used and disk type must be set with the Floppy operation in the GPC Settings menu. Refer to *6-7-1 GPC Settings* for details on GPC settings and *5-3 Floppy Disk Drive* for details on connecting the disk drive to the GPC.

Selecting Operations

Follow the procedure below to specify the file transfer operation you want to perform.

1, 2, 3...

1. Select (0): Service PC from the main offline menu.
2. Select (3): Transmit from the Service PC menu.

   The following screen, called the Transmit menu, will appear:

```
***  TRANSMIT    ***
■ SELECT FILE
  (0):PC SETUP (ONLINE)
  (1):USER PROGRAM
  (2):IOM AREA
  (3):DM
  (4):EM
  (5):I/O COMMENTS
  (6):PC NAME TABLE
  (7):PC PARAMETERS
  (8):CUSTOM AREAS
  (9):FUNCTION CODE TABLE

                              TRANS                    PC OFFLINE
                                                                32KW
```

3. Input the number (1 to 9) of the file you want to transfer and press ENT.

4. Input the source of the transfer (0 to 2) and press ENT.
5. Input the destination of the transfer (0 to 2) and press ENT. The source and destination cannot be the same.
6. Select the source file. If the memory card or floppy disk are being used, a file directory will be displayed on the right side of the screen. The file can be selected in two ways:
   a) Position the cursor next to file you want to transfer and press ENT. Use the Up and Down Keys to scroll up and down through files in the directory. Use the Plus/Minus Keys to display the next/previous page.
   b) Press the WRITE Key, input the filename, and press ENT. When inputting a filename, the cursor can be moved left and right with the Left and Right Keys and the character at the cursor can be deleted with the SHIFT+Left or SHIFT+Right Keys. The CLR Key deletes all characters in the input area.
7. When a different filename will be used in the destination, press WRITE, input the filename, and press ENT. If the filename of an existing file is used, the existing file will be overwritten and its contents lost.
8. Input the number corresponding to the operation you want to perform (0 for transfer only, 1 for verification only, or 2 for both) and press ENT. Press ENT again to confirm the operation and begin the transfer.

   A message will appear indicating that the file is being transferred and another message will appear when the operation is completed. The operation can be cancelled while in progress by pressing the CLR Key.

   Transferring 10,000 I/O comments between the memory card and a floppy disk takes about 18 minutes.

6-6 Printing

The following operations can be used to print ladder diagrams, mnemonic lists, DM contents, I/O comment lists, and screen contents. Before printing, connect the Printer Interface Unit and printer as described in *Section 5 Peripheral Devices*, and perform the Printer operation as described in *5-2-3 Operation.*

Item	Printed material
Ladder diagram	Prints programs in GPC memory or the memory card as ladder diagrams. The nesting level of interlocks and jumps can be indicated alongside the program.
Mnemonic list	Prints programs in GPC memory or the memory card as mnemonic lists.
DM data	Prints DM data from GPC memory or the memory card. The ASCII values of the data can be displayed alongside the hexadecimal values.
EM data	Prints DM data from the memory card. The ASCII values of the data can be displayed alongside the hexadecimal values.
I/O comments list	Prints I/O comments from GPC memory or the memory card.
Screen printout*	Prints the contents of the GPC screen.

Note *Press the CTRL+WRITE Keys to print the screen contents.

Selecting Operations

Follow the procedure below to specify the print operation you want to perform.

1, 2, 3...

1. Select (0): Service PC from the main offline menu.
2. Select (5): Print from the Service PC menu.

The following screen, called the Print menu, will appear:

```
*** PRINT ***
 SELECT ITEM
● LADDER       LIST (0:GPC 1:G CARD)
  MNEMONIC     LIST (0:GPC 1:G CARD)
  DM           LIST (0:GPC 1:G CARD)
  EXTENDED DM  LIST (0:*** 1:G CARD)
  I/O COMMENT  LIST (0:GPC 1:G CARD)


                                PRINT                    PC OFFLINE
                           0                                        32KW
```

3. Position the cursor next to the item you would like to print.
4. Press 0 and ENT to select GPC memory or 1 and ENT to select the memory card.
5. If the memory card was selected, a file directory will be displayed on the right side of the screen. (DM and EM data files both have the same ".IOM" filename extensions.) The file can be selected in two ways:
   a) Position the cursor next to file you want to transfer and press ENT. Use the Up and Down Keys to scroll up and down through files in the directory. Use the Plus/Minus Keys to display the next/previous page.
   b) Press the WRITE Key, input the filename, and press ENT.
6. The printing procedures are continued in this section. Refer to the appropriate heading below for the rest of the procedure.

Ladder Diagram/Mnemonic List

The following screen will appear when the memory location and filename have been selected.

```
***  LADDER DIAGRAM  ***                          UM  = GPC

● RANGE      (0:NO 1:YES)= NO
  PAGE#                  = 0001
  PAGE BREAK(0:NO 1:YES)= NO
  FUNCTIONS (0:NO 1:IL/JMP)
                         = NO
  OUTPUT LIST


                              PRINT                    PC OFFLINE
                         0                                        32KW
```

1, 2, 3...

1. Move the cursor to each print setting (described in the table below) and set as desired. When ready to print, move the cursor to OUTPUT LIST and press ENT. Press ENT again to confirm the operation and begin printing.

   A message will appear indicating that the file is being printed. The message will be cleared when printing is completed. Printing can be cancelled while in progress by pressing the CLR Key.

Print Settings

The print settings are described in the following table.

Item	Input	Description
Print range	0	The main program and all interrupt programs will be printed.
	1	Main program only: Select 1 to print only the main program. Set the first and last addresses of the printing range. Be sure that the first addresses is less than or equal to the last. If the last address is set to 999999, printing will continue up to the last address. Interrupt program only: Select 2 to print only interrupt programs. If the interrupt number is set to 99, all interrupt programs will be printed.
Start page	0000 to 9999	If the next setting is set for new pages, page numbers will be printed. This setting specifies the page number of the first page.
New page	0	Printing of pages will not be controlled. Page numbers and the title will not be printed.
	1	Printing of pages will be controlled to prevent data from overlapping pages. The page number and title will be printed on each page. Input the title with the Printer operation in the GPC Settings.
Nesting level	0	Nesting levels will not be printed.
	1	The nesting levels of interlocks and jumps will be printed alongside the ladder diagram.

DM Data/EM Data

The following screen will appear when the memory location and filename have been selected.

```
***  DM LIST  ***                                IOM = GPC

 ● START  WD                    = 00000
   END    WD                    = 99999
   DATA TYPE  (0:BIN 1:ASCII  ) = BIN
   PAGE BREAK (0:NO  1:YES    ) = NO
   OUTPUT LIST


                      PRINT                  PC OFFLINE
00000                                                  32KW
```

1, 2, 3...

1. Move the cursor to each print setting (described in the table below) and set as desired. When ready to print, move the cursor to OUTPUT LIST and press ENT. Press ENT again to confirm the operation and begin printing.

   A message will appear indicating that the file is being printed. The message will be cleared when printing is completed. Printing can be cancelled while in progress by pressing the CLR Key.

Print Settings

The print settings are described in the following table.

Item	Input	Description
Start address	00000 to 99999	Specifies the first DM or EM address that will be printed.
End address	00000 to 99999	Specifies the last DM or EM address that will be printed. Be sure that the end address is greater than or equal to the start address. If the end address exceeds the DM or EM Area, printing will continue up to the last address.
Data type	0	DM or EM contents printed as hexadecimal data only.
	1	The ASCII equivalent of the data will be printed alongside the hexadecimal value.
New page	0	Printing of pages will not be controlled. Page numbers and the title will not be printed.
	1	Printing of pages will be controlled to prevent data from overlapping pages. The page number and title will be printed on each page. Input the title with the Printer operation in the GPC Settings.

I/O Comments List

The following screen will appear when the memory location and filename have been selected.

```
***  I/O COMMENT LIST  ***                    CMT = GPC

 ●PAGE BREAK (0:NO 1:YES)          = NO
  OUTPUT LIST

                                PRINT                    PC OFFLINE
                           0                                        32KW
```

1, 2, 3...

1. Move the cursor to the new page print setting (described in the table below) and set as desired. When ready to print, move the cursor to OUTPUT LIST and press ENT. Press ENT again to confirm the operation and begin printing.

   A message will appear indicating that the file is being printed. The message will be cleared when printing is completed. Printing can be cancelled while in progress by pressing the CLR Key.

Print Settings

The print settings are described in the following table.

Item	Input	Description
New page	0	Printing of pages will not be controlled. Page numbers and the title will not be printed.
	1	Printing of pages will be controlled to prevent data from overlapping pages. The page number and title will be printed on each page. Input the title with the Printer operation in the GPC Settings.

6-7 System Setup

- This section describes the various parameters that can be set to control GPC and PC operation and provides the procedures to change these parameters from their default settings. The System Setup contains parameters that control GPC operation, such as the type of program being created or the PC that will be connected to for online operations. The PC Setup contains a wide range of parameters that can be used to control PC operation, including settings for controlling word allocation and error treatment. The Customize parameters enable changing function codes, data area prefixes, and data area boundaries. Read the CV500/CV1000 Operation Manuals and Installation Guide before using the GPC.

6-7-1 GPC Settings

There are 5 operations in the GPC Settings menu:

- The Printer operation is used to set printing parameters.
- The Floppy operation is used to set floppy disk drive parameters.
- The PC ID File operation is used to select the file that contains the PC ID table that will be used during PC Selection.
- The Response Monitoring Time operation is used to set the response monitoring time.

Printer

Follow the procedure below to set the baud rate of communications with the printer and other printing parameters.

1, 2, 3...

1. Press 9 to select the GPC Settings operation from either the main online or main offline menu.
2. Press 0 to select the Printer operation from the GPC Settings menu.
3. Press the WRITE Key to enter write mode.
4. Move the cursor to the desired setting with the Up or Down Keys and select the appropriate options by inputting the number shown in the table below. The current settings are shown on the right side of the screen.

Setting	Function	Options
Initial Column	The GPC prints 80 columns/line. If the printer prints 135 columns/line, this setting can be used to center the text on the page.	1 to 51
Maximum Column	Specifies whether the page has 80 or 135 columns/line. When set to 135, the previous page's initial column setting is carried over.	0: 80 columns 1: 135 columns
Baud Rate	Specifies the baud rate of communications through the Printer Interface Unit's RS-232C port. Be sure that the baud rate set on the printer matches this setting.	0: 4,800 bps 1: 9,600 bps 2: 2,400 bps
Output	Specifies whether the ladder diagram is printed as ASCII or as a bit image.	0: Bit image 1: ASCII
Printer Type	Specifies whether the printer is set for ASCII or Kanji printing. If the printer is set for ASCII, differentiated inputs will be identified by up and down carats (^ and v.) If the printer is set for kanji printing, differentiated inputs will be identified by up and down arrows (↑ and ↓.)	0: ASCII 1: Kanji printing
Title Input	Specifies whether a title will be output before printing text. A title up to 69 characters long can be printed. The title is printed when the print function is set for New Page.	When entering a title, the cursor can be moved with the Left and Right Keys. Characters can be erased by pressing the SHIFT and Left or Right Keys. The CLR Key erases the whole title.

Floppy

Follow the procedure below to specify the type of disk and the drive number of the floppy disk drive being used.

1, 2, 3...

1. Press 9 to select the GPC Settings operation from either the main online or main offline menu.

2. Press 1 to select the Floppy operation from the GPC Settings menu.
3. Press the WRITE Key to enter write mode.
4. Move the cursor to the Drive setting with the Up or Down Key and press 0 or 1 to select disk drive 1 or 2. The current setting is shown on the right side of the screen.
5. Move the cursor to the Disk Type setting with the Up or Down Key and enter the number of the desired option from the table below. The current setting is shown on the right side of the screen.

Setting	Function	Options
Drive	This setting selects which disk drive in the Floppy Disk Drive will be used.	0: Disk drive 1 1: Disk drive 2
Disk Type	This setting specifies what type of disk is being used in the disk drive.	0: 3.5", 2HD 1: 5.25", 2HD 2: 8", 2D 3: 3.5", 2DD 4: 5.25", 2DD

PC Name File Edit

Follow the procedure below to select a PC ID file from the GPC's memory card. The PC ID table in the selected file will be used in the PC Selection operation to select the PC with which the GPC will communicate when online.

1, 2, 3...

1. Press 9 to select the GPC Settings operation from the main offline menu.
2. Press 2 to select the Select PC Name File Edit operation from the GPC Settings menu.
3. Press the WRITE Key, input the filename (up to 8 characters long) of the desired PC ID file, and press ENT.

   Press the Right an Left Keys to move the cursor right and left.

   Press the SHIFT+Right or SHIFT+Left Keys to delete the character at the cursor. Press the CLR Key to delete all characters in the input area.
4. Press the SHIFT+SELECT Keys to return to the GPC Settings menu.

When the main online menu is on the screen and the NODE Key is pressed, the PC ID table in the selected file will be displayed on the screen. Move the cursor to the PC ID of the PC with which you want the GPC to communicate and press ENT.

Response Monitoring Time

Follow the procedure below to set the response monitoring time. The response monitoring time can be set between 2 and 60 s. If transmission errors occur, increase the response monitoring time.

1, 2, 3...

1. Press 9 to select the GPC Settings operation from the main offline menu.
2. Press 3 to select the Response Monitoring Time operation from the GPC Settings menu.
3. Press the WRITE Key to enter write mode, input the desired response monitoring time, and press ENT.

6-7-2 PC Setup

The PC Setup is used to specify operating parameters for the PC. When the GPC is offline, the PC Setup can be changed in the GPC's internal memory, and later transferred to the PC in an online operation. When the GPC is online, the PC Setup in the PC can be changed directly.

The first step in initializing or setting the PC Setup parameters is displaying the PC Setup menu. Press 1 to select the PC Setup operation from the main offline menu. The PC Setup menu (below) will appear.

```
*** PC SETUP ***                                SYSTEM SETTINGS = GPC
  CLEAR SETUP DATA
    (CTRL)+(WRITE)→(9713)→(ENT)
  SELECT ITEM
    (0):HOLD AREA              (10):SCHED INTERRUPT        (99):CONTINUOUS
    (1):HOLD ON INTR           (11):START WORDS
    (2):HOLD AT POWER ON       (12):MOMEN POWER INTR
    (3):STARTUP MODE           (13):CYCLE TIME
    (4):UM AT POWER ON         (14):CYCLE MONITOR TIME
    (5):I/O REFRESH METHOD     (15):ERROR LOG AREA
    (6):RUN CONTROL 1          (16):STARTUP DISP MODE
    (7):RUN CONTROL 2          (17):CUSTOM AREAS
    (8):HOST LINK              (18):FUN CODES
    (9):EM SETTINGS            (19):CPU BUS LINK SETTINGS
                                                    PC OFFLINE
                          0                                    32KW
```

Initializing the Parameters

Follow the procedure below to reset all PC Setup parameters to the default values listed in the table on page 120.

1, 2, 3...

1. Press 1 to select the PC Setup operation from the main offline menu. The PC Setup menu will appear.
2. Press the CTRL+WRITE Keys, 9713, and ENT.

Setting the Parameters

Follow the procedure below to change the PC Setup parameters.

1, 2, 3...

1. Press 1 to select the PC Setup operation from the main offline menu. The PC Setup menu will appear.
2. There are two ways to display PC Setup parameters.
   a) When changing one parameter, input the number (0 to 19) corresponding to the parameter and press ENT. The menu for that particular parameter will appear on the screen.
   b) When changing several parameters, input the number 99 and press ENT. It is then possible to scroll through the menus for all parameters with the Plus and Minus Keys.
3. To change a parameter's setting, display the menu for that parameter and press the WRITE Key to enter write mode.

   The settings are different for each parameter; some parameters even have sub-menus. The procedures for setting each parameter are described below.

Name	Remarks
0: Hold areas	Input the lower address and then the higher address.
1: Hold Racks	To specify that a Rack or Master is to maintain status, use the Left, Right, Up, and Down Keys to move the cursor to the Rack or Master, then press 1 and ENT. The next time the I/O table is registered, asterisks will be displayed next to Racks and Masters that have been specified.
2: Startup hold	Input the desired number (0 to 5) and press ENT. (IOM Hold Bit (A00012): hold=0, clear=1 Forced Status Hold Bit (A00013): hold=2, clear=3 Restart Continuation Bit (A00011): hold=4, clear=5)

Name	Remarks
3: Startup mode	Input the desired number (0 to 3) and press ENT. (PROGRAM=0, DEBUG=1, MONITOR=2, RUN=3)
4: Startup processing	Input 0 or 1 and press ENT. (do not transfer=0, transfer=1)
5: I/O refresh	Input the desired number (0 to 2) and press ENT. (cyclic=0, zero-cross=1, scheduled=2) If scheduled refreshing is selected, input the interval between refreshes. If the interval is set to 00, cyclic, zero-cross, and scheduled refreshing will be disabled.
6: Execution controls 1	Input the desired number (0 to 3) and press ENT. When the desired number is entered, a sub-menu will appear. Default settings are 0. 0: Detect low battery (Sub-menu: 0=enable, 1=disable) 1: CPU standby (Sub-menu: 0=enable, 1=disable) 2: Error on power off (Sub-menu: 0=disable, 1=enable) 3: Measure CPU Bus Unit cycle (Sub-menu: 0=disable, 1=enable)
7: Execution controls 2	Input the desired number (0 to 7) and press ENT. When the desired number is entered, a sub-menu will appear. Default settings are 0. 0: Execute process (Sub-menu: 0=asynchronous, 1=synchronous) 1: I/O interrupts (Sub-menu: 0=no priority, 1=priority order) 2: Power OFF interrupt (Sub-menu: 0=no program, 1=execute program) 3: Duplicate action error (Sub-menu: 0=error, 1=not an error) 4: Step timer (Sub-menu: 0=0.1 s units, 1=1 s units) 5: Startup trace (Sub-menu: 0=do not trace, 1=trace) 6: Indirect DM binary/BCD (Sub-menu: 0=BCD, 1=binary) 7: Comparison error process (Sub-menu: 0=run with error, 1=do not run with error)
8: Host link settings	Input 0 or 1 and press ENT. (Input 0 to set default settings or 1 to change the settings.) If 1 is input, the cursor will move to the first setting automatically. Default settings are 0. Unit number: Input the unit number (00 to 31). Baud rate: 0=9600 bps, 1=4800 bps, 2=2400 bps, 3=1200 bps, 4=19,200 bps Data bits: 0=7 bits, 1=8 bits Parity: 0=even, 1=no parity, 2=odd Stop bits: 0=2 bits, 1=1 bit
10: Scheduled interrupt	Input the units for scheduled interrupts. (0=10 ms, 1=1 ms, 2= 0.5 ms)
11: First words	Input the desired number (0 to 3) and press ENT. When the desired number is entered, a sub-menu will appear. 0: Local Racks. Move the cursor to the desired rack number and input the first word (000 to 511) for word allocation. Words will be allocated from CIO 0000 to any Racks that are not set here. 1:Group-1 and group-2 Slaves. Move the cursor to the desired rack number and input the first word (0000 to 0999) for word allocation. 2:Group-3 Slaves. Move the cursor to the rack number of the desired Master and press ENT. The Slaves connected to that Master will be displayed. Press the WRITE Key to enter write mode, move the cursor to the unit number of the Slave you want to change, input the first word, and press ENT. 3: I/O Terminals. Press the WRITE Key to enter write mode, move the cursor to the rack number of the Master you want to change, input the first word (0000 to 2555), and press ENT.
12: Momentary power interruption time	To change the setting, press the WRITE Key to enter write mode, input the new setting (0 to 9 ms), and press ENT.
13: Cycle time	To set a minimum cycle time, press the WRITE Key to enter write mode, press 1, ENT, input the minimum cycle time (1 to 32,000 ms), and press ENT.
14: Cycle time monitoring time	To set a maximum cycle time, press the WRITE Key to enter write mode, input the maximum cycle time (10 to 40,000 ms), and press ENT.
15: Error log area	The first word of the error log area can be set anywhere in the DM or EM Areas. If the EM Area is selected, be sure to input the bank number. Up to 2,047 records can be specified.

Name	Remarks
16: Display modes at startup	To change the setting, press the WRITE Key and input the desired number (1 to 3). 1: The first word allocated to the Rack will be displayed. 2: The display will be determined by the settings for each unit. Refer to each unit's *System Manual*. 3: The output of IODP(189) instructions will be displayed.
17: Custom data areas	The CIO Area can be divided into up to 18 areas. Once a group of words in the CIO Area has been assigned a code, that code must be used to access those words. To identify CIO words that have been assigned a code, press the SHIFT+! Keys, and input the code. To assign codes, press the WRITE Key to enter write mode, move the cursor to the desired code, and input the first and last words of the group (0000 to 2555). To clear code assignment, move the cursor to the undesired code, press the CLR Key and ENT.
18: Function codes	The function codes used to identify two instructions can be interchanged. To interchange two function codes, first press 0. A list of the instructions, their default function codes, and their current function codes will be displayed. Press the WRITE Key to enter write mode, move the cursor to the first instruction, and input the second instruction's function code. Move the cursor to the second instruction and input the first instruction's function code. If FUN(???) is displayed, the function code that was input cannot be used. After interchanging function codes, check for duplicate settings. Press the SHIFT+SELECT Keys to return to the original menu and press 1. The message "NUMBER DUP ERR" will appear if two instructions have the same function code.
19: CPU bus link setting	Input 0 or 1. (0=CPU bus link will not be used. 1=CPU bus link will be used.)

PC Setup Parameters

The following tables list the parameters in the PC Setup, provide examples of normal application, and provide the default values.

PC Setup Overview

No.	Name		Function	Normal application(s)
0	Hold area		To specify which bits are to maintain status when power is turned off.	To extend the Holding Area beyond CIO 300.
1	Hold Racks (Hold bits)		To specify Racks or Masters (Remote I/O Subsystems) that are to maintain status when operation is stopped or modes are changed.	To maintain output status for specific Racks or Remote I/O Subsystems.
2	Startup hold	Forced Status Hold Bit status (A00013) (Forced status)	To maintain the status of the Forced Status Hold Bit when power is turned off and on.	To maintain the status of bits forced ON or OFF.
		IOM Hold Bit (A00012) status (I/O bits)	To maintain the status of the IOM Hold Bit when power is turned off and on.	To prevent I/O status from being cleared when power is turned on.
		Restart Continuation Bit status (A00011) (Power on flag)	To maintain the status of the Restart Continuation Bit when power is turned off and on.	These parameters must be set to YES when using restart continuation.
3	Startup mode		To specify the initial PC operating mode.	To automatically start the PC when power is turned ON. Set the mode to MONITOR or RUN when using restart continuation.
4	Startup processing		To specify whether the user program is loaded from the Memory Card when power is turned on.	To enable using a ROM Memory Card without a backup battery.

No.	Name		Function	Normal application(s)
5	I/O refresh		To set the refresh method to cyclic, zero-cross, or scheduled.	To reduce the cycle time by using immediate refreshing or to reduce surge voltages for AC outputs.
6	Execution controls 1 (Execute control 1)	Detect low battery	To specify detection of CPU battery errors.	To disable detection when batteries are not being used.
		Error on power off	To specify if momentary power interruptions are to be treated as errors.	To generate an error for momentary power interrupts when they adversely affect system operation.
		CPU standby	To specify whether the CPU is to go on standby or start operation while initializing the system or detecting terminators in SYSMAC BUS/2 Systems.	
		Measure CPU Bus Unit (CPU SIOU) cycle	To specify whether or not the CPU Bus Unit servicing cycle is to be measured.	
7	Execution controls 2 (Execute control 2)	Execute process	To specify whether Peripheral Devices are to be serviced synchronously or asynchronously with program execution.	To increase processing capacity (speed) by using asynchronous processing.
		I/O interrupts	To specify whether higher-priority I/O interrupts are to be executed before a current I/O interrupt.	
		Power OFF interrupt	To specify whether a power off interrupt is to be executed.	To save system status when power turns off.
		Duplicate action error	To specify whether an error is to be generated when the same action is executed simultaneously from two different locations in the program.	
		Step timer	To set the unit for the step timer to 0.1 or to 1 s.	
		Startup trace	To specify whether a trace is to be automatically executed when power is turned on.	
		Indirect DM binary/BCD (*DM BIN/BCD)	To specify whether indirect addresses are treated as binary (memory addresses) or BCD (data area addresses).	To enable indirectly addresses for the entire DM and EM areas by using binary addresses.
		Comparison error process	To specify whether I/O verification errors are to be fatal or non-fatal.	
8	Host link		To set communications parameters for the host link interface.	These settings must be made when using the host link interface.
9	EM settings		Not used.	
10	Scheduled interrupt		To set the unit for setting the scheduled interrupt to 10.0, 1.0, or 0.5 ms.	
11	First words	For local racks (1st Rack addr)	To set the first word for each of the CPU, Expansion CPU, and Expansion I/O Racks.	To simplify word allocations, to prevent changes in allocations, or to allow for expansion without changes in allocations.
		For group-1 and group-2 Slaves (Group 1,2 1st addr)	To set the first word for group-1 and group-2 Slaves for each Master.	To prevent overlapping of word allocations when group-1 and group-2 Slaves require more then 50 words per Master.
		For I/O Terminals (Trans I/O addr)	To set the first word for I/O Terminals for each Master.	To separate I/O Terminal allocations from those for other Slaves.
		For Slaves Rack (Group 3 RT 1st addr)	To set the first word for each Slave Rack.	To simplify word allocations, to prevent changes in allocations, or to allow for expansion without changes in allocations.
12	Momentary power interruption time (Power break)		To set the length of time to be treated as a momentary power interruption.	To enable ignoring short primary voltage drops for poor power supplies.

No.	Name	Function	Normal application(s)
13	Cycle time	To set a minimum cycle time.	To eliminate irregular I/O delays.
14	Cycle time monitoring time (Watch cycle time)	To set a maximum cycle time.	To stop operation when a specified cycle time is exceeded or to enable longer cycle times by setting a high maximum.
15	Error log area	To set the number of records recorded and the words in which they are recorded.	To increase the number or error records that are maintained.
16	Display modes at startup (IORF, RT display)	To set the startup display mode for the 7-segment displays on I/O Control Units, I/O Interface Units, and SYSMAC BUS/2 Slave Racks.	
17	Custom data areas	To assign codes to groups of CIO words, dividing the CIO Area into up to 18 areas.	To simplify the allocation of a large number of I/O points.
18	Function codes	To interchange function codes between two instructions.	
19	CPU bus link setting	To specify whether or not CPU bus links are to be created.	To enable linking of two or more BASIC Units.

PC Setup Details

No.	Name		Operation
0	Hold area		The status of bits specified here will be maintained when power is turned off and on. The holding bits can be set in any continuous range between CIO 1000 to CIO 2399. (Default: CIO 1200 to CIO 1499)
1	Hold Racks (Hold bits)		The output status on Racks specified here or in all Slaves connected to Masters specified here will be maintained when operation is stopped or when PC operating modes are changed. Status will not be maintained for these outputs when power is turned off. Regenerate the I/O table or turn PC power off and on after changing this parameter. (Default: nothing held)
2	Startup hold	Forced Status Hold Bit status (A00013) (Forced status)	Specify whether the status of the Forced Status Hold Bit is to be maintained or reset to OFF when power is turned on. This setting is effective the next time the power is turned ON. (Default: A00013 turned OFF)
		IOM Hold Bit status (A00012) (I/O bits)	Specify whether the status of the IOM Hold Bit is to be maintained or reset to OFF when power is turned on. This setting is effective the next time the power is turned ON. (Default: A00012 turned OFF)
		Restart Continuation Bit status (A00011) (Power on flag)	Specify whether the status of the Restart Continuation Bit is to be maintained or reset to OFF when power is turned on. This setting is effective the next time the power is turned ON. (Default: A00011 turned OFF) The following settings are required to continue operation after a power interruption: IOM Hold Bit (A00012): ON and maintained Forced Status Hold Bit (A00013): ON and maintained IOM Hold Bit status: Hold Restart Continuation Bit status: Hold Startup mode: RUN Power OFF interrupt: Exists
3	Startup mode		Designate the PC operating mode to be set when PC power is turned ON. This setting is valid the next time the power is turned ON. (Default: PROGRAM)

No.	Name		Operation
4	Startup processing		Designate whether the user program (AUTOEXEC.OBJ) is automatically transferred from the card to PC memory when the power is turned ON. DIP switch pin #5 on the CPU can be turned ON to transfer both the user program (AUTOEXEC.OBJ) and the PC setup (AUTOEXEC.STD). Refer to information on the Memory Card for details. (Default: Don't transfer)
5	I/O refresh		Designate the I/O refresh method as cyclic, zero-cross, scheduled, or immediate. Cyclic refreshing will occur once each cycle at the end for user program execution. Zero-cross refreshes are synchronized with the times the voltage of the commercial power supply is 0 V. Set this method to more accurately turn off outputs when using AC power supplies. Scheduled refreshed occur at a specific timer interval. The scheduled refresh interval must also be set. Set the execution interval between 10 and 120 ms. Fixed interval refresh is effective only when the program execution CPU is not synchronized with the communications CPU. Immediate refreshing is also possible using certain instructions from the user program. To refresh using only these instructions, set scheduled refreshes and then set the refresh interval to 00 ms. If this is done, I/O status will be refreshed only when instruction in the user program call for it. This setting is effective immediately. (Default: Cyclic)
6	Execution controls 1 (Execute control 1)	Detect low battery	Designate whether battery errors are detected. This setting is effective immediately. (Default: Detect) The following bits will be turned ON when a battery error is detected. A40204 Battery Low Flag (PC or memory card) A42614 Memory Card Battery Low Flag A42615 PC Battery Low Flag
		Error on power off	Designate whether a momentary power interruption is treated as an error. If momentary power interrupts are treated as errors, they will be recorded in the error log (see setting F). This setting is effective immediately. (Default: Non-fatal)
		CPU standby	Designate whether the CPU is placed on standby during initialization and until SYSMAC BUS/2 terminators are properly detected. (Default: CPU waits)
		Measure CPU-bus Unit (CPU SIOU) cycle	Designate whether or not the time between CPU-bus Unit services is to be measured. If measured, the cycle is stored starting at A310. This setting is effective immediately. (Default: Don't measure cycle)

No.	Name		Operation
7	Execution controls 2 (Execute control 2)	Execute process	Designate whether instruction execution and Peripheral Device servicing are to be carried out synchronously or asynchronously. If synchronous execution is used, IOM cannot be accessed from a Peripheral Device during user program execution. (Default: Parallel)
		I/O interrupts	Designate whether or not I/O interrupt execution is interrupted for higher-priority I/O interrupts. The I/O interrupt program with the lowest input number has highest priority. Power OFF interrupts, power ON interrupts, and scheduled interrupts take priority over I/O interrupts regardless of this setting. This setting is effective immediately. (Default: Nesting)
		Power OFF interrupt	Designate whether or not power OFF interrupts are generated. If an interrupt is generated, the power OFF interrupt program will be executed. This setting is effective immediately. (Default: Disable)
		Duplicate action error	Designate whether or not a non-fatal SFC error is generated when the same action is executed simultaneously from multiple program steps. This setting is effective immediately. (Default: Error)
		Step timer	Designate whether the step timer is set in increments of 0.1 s or 1.0 s. This setting is effective immediately. (Default: 0.1 s)
		Startup trace	Designate whether a trace is executed automatically according to the preset conditions when the power is turned on or the operating mode is changed. This setting is effective the next time power is turned on. (Default: Don't start trace)
		Indirect DM binary/BCD (*DM BIN/BCD)	Designate whether indirect DM and EM addresses are binary (PC memory addresses) or BCD (DM and EM area addresses). This setting is effective immediately. (Default: BCD)
		Comparison error process	Designate whether or not to enable operation for I/O verification errors. Once the PC starts operating, the operation continues even if an I/O verification error has occurred. This setting is effective immediately. (Default: Run after error)
8	Host link	Baud rate	Designate 1200, 2400, 4800, 9600, or 19200 bps. (Default: 9600 bps)
		Stop bits	Designate either 1 stop bit or 2 stop bits. (Default: 2 stop bits)
		Parity	Designate even, odd, or no parity. (Default: Even parity)
		Data length (Data bits)	Designate either 7-bit or 8-bit data. (Default: 7-bit data)
		Unit number	Designate the unit number between 00 and 31. The unit number must not be the same as the unit number of another PC. This setting is effective immediately. (Default: 00)
10	Scheduled interrupt interval		Designate whether the scheduled interrupt time is set in increments of 10.0 ms, 1.0 ms, or 0.5 ms. This setting is effective the next time the power is turned ON. (Default: 10 ms)

No.	Name		Operation
11	First words	For local racks (1st Rack addr)	Designate the first word for each CPU, Expansion CPU, and Expansion I/O Rack. The first word can be set between 0 and 511. Do not allow word allocations to overlap. Recreate the I/O table after changing this setting. (Default: 0 for CPU Rack, no designation for other Racks (continue on from previous Racks))
		For group-1 and group-2 Slaves (Group 1,2 1st addr)	Designate the first words for each Master for SYSMAC BUS/2 group-1 and group-2 Slaves to between CIO 0000 and CIO 0999. Recreate the I/O table after changing this setting. (Default: Group 1: 50 words per Master starting at intervals of 200 words with the first interval starting from CIO 200. Group 2: 50 words per Master starting at intervals of 200 words with the first interval starting from CIO 250.)
		For I/O Terminals (Trans I/O addr)	Designate the first word for each Master for SYSMAC BUS I/O Terminals between CIO 0000 and CIO 2555. Allocations will not be changed unless the first word allocated to the Master is changed. Recreate the I/O table after changing this setting. Do not allow words allocated to these I/O Terminals to overlap with the bits set as holding bits. Outputs that are ON at the end of operation will remain ON when operation is stopped if I/O Terminals are allocated words also specified as holding bits. (Default: 32 words per I/O Terminal starting from CIO 2300)
		For group-3 Slaves (Group 3 RT 1st addr)	Designate the first word for each SYSMAC BUS group-3 Slave between CIO 0000 and CIO 0999 and for each SYSMAC BUS Slave Rack between CIO 0000 and CIO 2555. Recreate the I/O table after changing this setting. Do not allow words allocated to Slave to overlap with the bits set as holding bits. Outputs that are ON at the end of operation will remain ON when operation is stopped if Slaves are allocated words also specified as holding bits. (Default: Normal allocation using consecutive words)
12	Momentary power interruption time (Power break)		Designate the momentary power interruption time between 0 and 10 ms. Operation will continue for momentary power interruptions if the power supply is restored within this time after a power interruption. If the momentary power interruption time is set to greater than 0 ms, Peripheral Device communications may be disrupted and may go on standby for momentary power interruptions. This setting will be ignored and the default value will be used if a C500 Expansion I/O Rack is connected to the System. This setting is effective immediately. (Default: 0 ms)
13	Cycle time		Set the minimum cycle time to between 0 and 32,000 ms. If the actual cycle time is less than the set cycle time, execution will be halted until the set cycle time elapses before the next scan is executed. If the actual cycle time exceeds the set cycle time, the setting is ignored and the next cycle is executed when the current cycle is complete. This setting is effective immediately. In the actual operation of the PC, there may be a deviation of 3 to 4 ms. If a break-in program is being executed, a further deviation due to the execution of the break-in program will be involved. (Default: Variable cycle)
14	Cycle time monitoring time (Watch cycle time)		Designate the maximum cycle time between 10 and 40,000 ms. If the cycle time exceeds this value, a fatal error will occur and A40108 will be turned ON (Cycle Time Too Long Flag). This setting is effective immediately. (Default: 1,000 ms)

No.	Name	Operation
15	Error log area	Designate the size and range of the error log. When a error occurs, information about the error is saved in this memory area together with the time that the error occurred. Refer to the *CV500/CV1000 Operation Manual: Ladder Diagrams* for details about the error log. This setting is effective the next time the power is turned ON. (Default: 20 records of 5 words each in A100 to A199)
16	Display modes at startup (IORF, RT display)	Designate the display mode to be used for the 7-segment displays on I/O Interface Units, the I/O Control Unit, and SYSMAC BUS/2 Remote I/O Slave Units when the power is turned ON. This setting is effective the next time the power is turned ON. (Default: Mode 1)
17	Custom data areas	The CIO Area (0000 to 2555) can be divided into up to 18 areas. Once a group of words in the CIO Area has been assigned a code, that code must be used to access those words. To identify CIO words that have been assigned a code, press the SHIFT+! Keys, and input the code. (Default: No custom areas)
18	Function codes	The function codes used to identify two instructions can be interchanged. (Default: Original function codes)
19	CPU bus link setting	Designate whether or not CPU bus links are used. CPU bus links are used between BASIC Units only. The CPU bus link service interval is 10 ms. Any change in setting will be reflected immediately. (Default: Don't use CPU bus link)

PC Setup Default Settings

No.	Name	Default setting
0	Holding area	CIO 1200 to CIO 1499
1	Holding Racks	Nothing held
2	Startup hold	Forced Status Hold Bit: Not held IOM Hold Bit: Not held Restart Continuation Bit: Not held
3	Startup mode	PROGRAM
4	Startup processing	User program not transferred.
5	I/O refresh	Cyclic refresh
6	Execution controls 1 (Execute control 1)	Detect low battery: Detect Power interruption: Fatal CPU standby: CPU waits (RUN waits) CPU-bus Unit cycle: Not measured
7	Execution controls 2 (Execute control 2)	CPU operation: Asynchronous — Step timer: 0.1 s increments I/O interrupts: Nesting interrupts — Startup trace: No Power OFF interrupt: Disable — Indirect DM: BCD Dup action process: Error — Comparison error: RUN
8	Host link	Baud rate: 9,600 bps — Data length: 7 Stop bits: 2 — Unit number: 00 Parity: Even
10	Scheduled interrupt interval	10 ms

No.	Name		Default setting
11	First words	For local racks (1st Rack addr)	CPU Rack: 0000 Others: None
		For group-1 and group-2 Slaves (Group 1,2 1st addr)	RM &0 RM &1 RM &2 RM &3 Group 1 0200 0400 0600 0800 Group 2 0250 0450 0650 0850
		For I/O Terminals (Trans I/O addr)	RM &0 RM &1 RM &2 RM &3 RM &4 RM &5 RM &6 RM &7 2300 2332 2364 2398 2428 2460 2492 2524
		For group-3 Slaves (Group 3 RT 1st addr)	Group-3 Slaves (SYSMAC BUS/2) RM #0 RM #1 RM #2 RM #3 0300 0500 0700 0900 SYSMAC BUS Systems RM #0 to RM #7 defaults are identical to those for I/O Terminals, above.
12	Momentary power interruption time (Power break)		0 ms
13	Cycle time		Variable cycle
14	Cycle time monitoring time (Watch cycle time)		1,000 ms
15	Error log area		20 records of 5 words each, A100 to A199
16	Display modes at startup (IORF, RT display)		Mode 1
17	Custom data area		No custom areas
18	Function codes		Original function codes
19	CPU bus links		No CPU bus links

SECTION 7
Online Operations

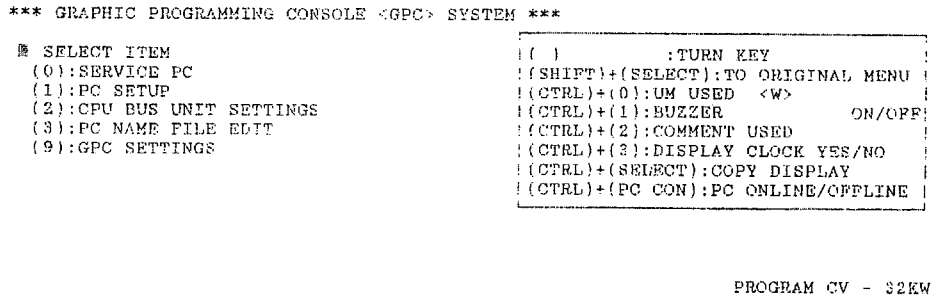
This section describes GPC operations that can be performed online, i.e., while the GPC is connected to and communicating with a PC.

7-1 Overview of Online Operations

Online operations are performed when the GPC is in direct communication with the PC.

7-1-1 Main Online Menu

When the GPC is turned on, the main offline menu is displayed. To make the online connection to the PC, first connect the GPC and PC with the connecting cable and turn on the PC and GPC, and then press the CTRL+PC CON Keys. The main online menu, shown below, will be displayed.



Changing the PC Mode

The PC's current operating mode is displayed in the lower-right corner of the screen. The mode can be changed at any time while the GPC is online by holding down the CTRL Key and pressing one of the Mode Keys (PROG, DEBUG, MONTR, or RUN).

7-1-2 Operation List

The table below lists the operations that can be selected from the main online menu. Service PC and GPC Setup are general categories. Select specific operations in these general categories from the sub-menus on the right side of the Operation column.

Some of the following operations are identical to the ones of the same name in offline operations and reference pages for these refer to the section on offline operations.

Operation		Description	Page
(0): Service PC	(0): Clear User Program Memory	Used to delete the programs and memory are data from the PC. If SFC programming is being used, the entire SFC program can be deleted or individual action and transition programs can be deleted.	127
	(1): Program	Used to create, edit, or delete programs in the PC as either ladder diagrams or mnemonic lists. Operations are the same as in the offline mode, but a program check is not possible. The Store/Store Insert operation is required to save programs input in ladder-diagram form.	127

Operation			Description	Page
(0): Service PC (continued)	(2): Monitor	Read/Clear Errors	Used to read and deleted errors from the PC.	134
		Message Read	Used to read messages generated by the MSG(195) instruction.	134
		I/O Bit Monitor	Used to monitor the status a ladder diagram execution in the PC.	135
		I/O Monitor	Used to monitor the status of up to six of the following: bits, words (including DM and EM), timers, counters, index registers, data registers, Step Flags, and Transition Flags.	135
		Force Set/Reset	Used to control the status of specific bits during the I/O Monitor operation.	136
		Change PC	Used to change the contents of words in memory during the I/O Monitor operation.	137
		Multibit Monitor	Used to monitor the status of up to 10 of the following: bits, words (including DM and EM), timers, counters, index registers, data registers, Step Flags, and Transition Flags. Can be combined with I/O Monitor and Word Monitor operations to monitor the status of up to 17 memory locations.	137
		Word Monitor	Used to monitor the status of a data area word (including DM and EM), index register, or data register in either binary or hexadecimal form. Bit status can be changed while monitoring.	138
		Change SV	Used to change the SV of timers and counters.	139
		Pause Monitor	Used to freeze the I/O Monitor according to the status of A00814, a specified bit, or a specified word.	139
		Differentiation Monitor	Used to monitor the status of bits in the I/O Bit Monitor operation.	140
		Set System Clock	Used to read and set the PC's clock.	140
		Read Cycle Time	Used to read out the cycle time of the PC.	137
		Online Edit	Used to change the user program while the program is being edited.	137
	(3): Transmit		Used to transfer program, PC Setup, memory area, I/O comment, P name table, PC parameter, custom data area, and function code table data between the PC and the GPC memory, GPC Memory Card, PC Memory Card, or floppy disk drive.	132
	(4): File		Used to format floppy disks or Memory Cards as well as manipulate files on the floppy disks and Memory Cards	155
	(5): Print		Used to print portions of programs (either ladder diagrams or mnemonic lists) or contents of the PC's DM or EM Area.	155
	(6): Input DM		Used to display, modify, or delete DM or EM data in PC memory.	150
	(7): I/O Table		Used to create, change, or compare the PC's I/O table.	129
	(8) Trace	Instruction	Used to trace and display the sequence of PC program execution.	142
		MARK	Used to trace and display the sequence of PC program execution according to MARK(174) instructions.	144
		Data	Used to trace memory status during program execution.	146
	(9): Error Log		Used to read the error log.	153
(1): PC Setup			Used to change the PC Setup in the PC.	155
(2): CPU Bus Unit Settings			Used to set software switches for CPU Bus Units.	151

Operation		Description	Page
(3): PC Name File Edit		Used to assign PC names to PCs in SYSMAC NET Link and SYSMAC LINK networks.	152
(9): GPC Settings	(0): Printer	Used to specify the baud rate of communications with the printer, as well as the width of paper used and the beginning print column.	91
	(1): Floppy	Used to specify the drive number of the floppy disk drive and the type of disk being used.	110
	(2): PC Name Table	Used to set the name of the file that contains the PC name referenced at PC selection.	152
	(3): Response Monitoring Time	Used to set the response monitoring time for communications with the PC.	111

7-2 Programming

Online programming can be performed only when the PC is in PROGRAM mode. Only programs in the PC's memory are read, written, or edited with online programming; programs in the GPC's internal memory are not affected.

If the program in the PC is an "SFC+Ladder" program created with CVSS, only the ladder portion of the program can be read or edited with the GPC. Use CVSS to read or edit the SFC portion.

The Program Check and Global Change operations cannot be performed online. To check the a program in the PC or make global changes to it, first transfer the program to the GPC with the Transfer operation and then perform the Program Check or Global Change operation offline.

After writing or editing a program, use the Store or Store Insert operation to save it to memory.

Service PC Menu

All programming operations are in the Service PC menu. Select (0): Service PC from the main online menu to bring up the Service PC menu shown below.

```
*** PC ONLINE ***                          (SHIFT)+(SELECT):TO ORIGINAL MENU

 ■ SELECT ITEM
  (0):CLEAR USER PROGRAM MEMORY
  (1):PROGRAM
  (2):MONITOR
  (3):TRANSMIT
  (4):FILE
  (5):PRINT
  (6):INPUT DM
  (7):I/O TABLE
  (8):TRACE
  (9):ERROR LOG

                                                    PROGRAM CV - 32KW
```

Procedures

The procedures for all programming operations are the same except for clearing memory. Refer to the following table for applicable PC modes and relevant procedures. Global changes and program check can be performed only by transferring the program to the GPC.

Name	Description	Page	RUN	MONIT	DEBUG	PROG
Display Memory	Used to display the amount of memory used for the program in the PC.	56	OK	OK	OK	OK
Switch Display	Used to switch the display for ladder diagrams between diagrams and mnemonics.	54				
Store/Store Insert	Used to write the program displayed on the GPC screen into the PC's memory. Not necessary when writing programs in mnemonic form.	69	No	No	No	OK
Program	Used to create, edit, or delete the program in the PC. The contents of the program in the PC's memory will be displayed on the screen.	57, 78				
Find	Used to search for instructions (including operands) in the program in the PC.	73	OK	OK	OK	OK
Edit Interrupt Program	Used to create I/O interrupt, scheduled interrupt, power off interrupt, and power on interrupt programs in the PC's memory.	84	No	No	No	OK

Clearing Memory Areas

This operation clears programs or data areas in the PC; it is possible only in PROGRAM mode.

RUN	MONITOR	DEBUG	PROGRAM
No	No	No	OK

When the program in the PC is a ladder program, both the main program and all interrupt programs will be cleared.

When the program is SFC+Ladder, the entire program can be cleared, or just the action or transition programs. If the program is cleared, programming will change from "SFC+Ladder" to "Ladder."

Clearing the Entire Program

Follow the procedure below to clear the entire program.

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. If "PROGRAM" is not displayed in the lower-right corner of the screen, press the CTRL+PROG Keys to switch the PC to PROGRAM mode.
3. Select (0): Clear User Program Memory from the Service PC menu.
4. Press 0 to specify the entire program, and then press CTRL+WRITE, 9713, and ENT to confirm the operation.

   The ladder-diagram write screen will appear when the program has been cleared.

Clearing Action or Transition Programs

Follow the procedure below to clear action or transition programs.

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. If "PROGRAM" is not displayed in the lower-right corner of the screen, press the CTRL+PROG Keys to switch the PC to PROGRAM mode.
3. Select (0): Clear User Program Memory from the Service PC menu.
4. Press 1 to specify action programs or 2 to specify transition programs.
5. Press WRITE, input the number of the action or transition program you want to delete, and press ENT.

   The specified action or transition program will be cleared and the ladder-diagram write screen will appear.

Clearing Data Areas

Follow the procedure below to clear data areas.

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. If "PROGRAM" is not displayed in the lower-right corner of the screen, press the CTRL+PROG Keys to switch the PC to PROGRAM mode.

3. Select (0): Clear User Program Memory from the Service PC menu.
4. If the program is a ladder program, press 1 to specify data areas. If the program is SFC+Ladder, press 3 to specify data areas.

   The following display will appear:

```
*** CLEAR I/O MEMORY ***

  * MOVE CURSOR TO AREA. WITHOUT CLEAR PRESS ENT.
    I/O BIT                    EM BANK 0                  CLEAR
    G BIT                      EM BANK 1
    A BIT                      EM BANK 2
    TIM                        EM BANK 3
    CNT                        EM BANK 4
    DM                         EM BANK 5
                               EM BANK 6
                               EM BANK 7

    SPECIFY = (I/O BIT)       / (G BIT) / (A BIT) / (TIM) / (CNT) / (DM)
              (EM0) / (EM1) / (EM2) / (EM3) / (EM4) / (EM5) / (EM6) / (EM7)
                                    CLEAR I/O MEMORY
                                                        PROGRAM CV - 32KW
```

   The data areas that will be cleared are listed at the bottom of the screen. To remove a data area from this list, move the cursor next to that data area (on the left side of the screen), and press ENT. That data area will be removed from the list at the bottom of the screen.

   If a data area is removed accidently, it can be restored to the list by moving the cursor next to that data area and pressing ENT.

   When using a PC that does not have an EM Unit installed (including the CV500), it is not necessary to remove the EM banks from the list.

5. After removing the data areas that you don't want to clear from the list at the bottom of the screen, press the Right Key to move the cursor to "Clear" on the right side of the screen and press ENT.

   When the specified data areas have been cleared, a message will appear indicating the operation is completed.

7-3 I/O Tables

This section describes how to carry out the following operations:

- Register the actual Units mounted to the PC in the I/O table.
- Display the I/O table in the PC.
- Edit the I/O table in the PC.
- Compare the actual Units mounted to the PC and the I/O table in the PC.

Note I/O table registration and editing operations cannot be carried out from a GPC connected to a Remote I/O Slave Unit.

I/O Table Menu

All I/O table operations are in the I/O Table menu. Select (7): I/O Table from the main online menu to bring up the I/O Table menu shown below.

```
*** I/O TABLE ***                          ┌──────────────────────────────┐
                                           │(SHIFT)+(SELECT):TO ORIGINAL MENU │
 * PROGRAM MODE                            └──────────────────────────────┘
  *GENR
  (WRITE)  →(ENT)
  *CHNG VALID AFTER READ
  (CTRL)+(WRITE)→(CURSOR)→0-9,A-Z→(ENT)
 * PROG/DEBUG/MON/RUN MODE
  *READ
  (READ) →(ENT)
  *VERIFY
  (VER)  →(ENT)

                                                        PROGRAM CV - 32KW
```

Creating the I/O Table

This operation generates an I/O table in the PC according to the I/O Units actually mounted in the PC. This operation cannot be performed from a GPC connected to a Remote I/O Slave Unit.

RUN	MONITOR	DEBUG	PROGRAM
No	No	No	OK

Procedure

Follow the procedure below to create an I/O table in the PC.

1, 2, 3...

1. Go to the I/O Table menu, press WRITE and then ENT.
2. Specify whether to clear the CPU Bus Unit Settings or not. Generation of the I/O table will begin when 1 or 0 is pressed.

   Press 0 to retain the CPU Bus Unit Settings in the PC. Press 1 to clear the CPU Bus Unit Settings. (Normally, the CPU Bus Unit Settings is cleared.)

   When the I/O table has been created, a message will appear indicating the operation is completed. Press the SHIFT+SELECT Keys to return to the I/O Table menu.

Reading the I/O Table

This operation reads the I/O table from the PC and displays it on the GPC's screen.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

Procedure

Follow the procedure below to read the I/O table in the PC and display it on the GPC's screen.

1, 2, 3...

1. Go to the I/O Table menu, press READ and then ENT.

   The I/O table for the CPU Rack will be displayed on the left side of the screen and information on CPU Bus Units will be displayed on the right. A sample display is shown below.

```
*** I/O TABLE ***                          CPU BUS I/O
RACK# = 0     WD     |  UNIT#      UNIT#       UNIT#       UNIT#
  0U =****           |    00         10          20          30
  1U =****           |    01         11          21          31
  2U =****           |    02         12          22
  3U =****           |    03         13          23
  4U =****           |    04         14          24
  5U =****           |    05         15          25
  6U =****           |    06         16          26
  7U =****           |    07         17          27
  8U =****           |    08         18          28
  9U =****           |    09         19          29
                     |

      CONT                          READ
                     RACK# = 0                          PROGRAM CV - 32KW
```

2. From this point, the procedure for displaying I/O table information is different for Expansion I/O Racks, SYSMAC BUS/2 Slave Racks, SYSMAC BUS Slave Racks, and I/O Terminals.
   a) To display the I/O tables for the CPU and Expansion I/O Racks, press the rack number (0 to 7) and ENT.
   b) To display the I/O tables for SYSMAC BUS/2 Slave Racks, press the SHIFT+Right Keys to move the cursor to the right side of the screen where the CPU Bus Units are listed. Move the cursor to the desired Master (RM#, # = master number 0 to 3) and press ENT.
   Finally, press 1, 2, or 3 to select the I/O table for group 1, 2, or 3.
   c) To display the I/O tables for SYSMAC BUS Racks and I/O Terminals, move the cursor to the desired Remote I/O Master (RM#, # = master number 0 to 7) and press ENT. SYSMAC BUS Masters are not CPU Bus

Units so they are displayed on the left side of the screen above. Finally, press 1 to display the I/O tables for Slave Racks 0 to 3 (press 4 and ENT to display the I/O tables for Slave Racks 4 to 7.) Press 2 to display the I/O table for I/O Terminals.

Codes in I/O Tables

The tables below show the codes used in the I/O tables. A help screen is also provided to explain the codes. Press the Plus Key to display the help screen. Press the Plus Key again to return to the I/O table.

Codes for I/O Units on CPU Racks, Expansion I/O Racks, or Slave Racks:

Code	I/O Unit
o	8-point output
O	16-point output
G	64-point output
i	8-point input
I	16-point input
L	64-point input
*	Not allocated
N	16-point dummy
H	64-point dummy

Codes for I/O Terminals:

Code	I/O Terminal
O	8-point output
I	8-point input
W	Both input and output

Codes for SYSMAC BUS Masters:

RM#, where # is master number (0 to 7).

Codes for Interrupt Units:

INT#, where # is Interrupt Unit number (0 to 3).

Codes for CPU Bus Units:

Code	CPU Bus Unit
RM#*	SYSMAC BUS/2 Master
SN	SYSMAC NET Link Unit
SL	SYSMAC LINK Unit
BA	BASIC Unit
VP	Personal Computer Unit

Note *Where # is the master number (0 to 3)

Changing the I/O Table

This operation allows the user to change the I/O table in the PC in order to reserve I/O words for empty slots. I/O words cannot be reserved for CPU Bus Units, SYSMAC BUS Masters, I/O Terminals, or Interrupt Units. Furthermore, this operation cannot be performed from a GPC connected to a Remote I/O Slave Unit.

RUN	MONITOR	DEBUG	PROGRAM
No	No	No	OK

Procedure

Follow the procedure below to change the I/O table in the PC.

1, 2, 3...

1. Follow the procedure described under the heading *Reading the I/O Table* on page 129 to display the I/O table of the Rack you want to change. Move the cursor to the slot you want to change.
2. Press CTRL+WRITE to switch to edit mode. An input area will be displayed on the bottom of the screen.
3. Input the key sequences in the table below to change a slot's I/O allocation. Only those slots with "****" displayed can be changed.[1]

Code	I/O Unit	Key sequence
o	8-point output	SHIFT+TIM, ENT
O	16-point output	TIM, ENT (or 0, ENT)
G[2]	64-point output	AND, ENT
i	8-point input	SHIFT+CNT, ENT
I	16-point input	CNT, ENT (or 1, ENT)
L[2]	64-point input	HR, ENT
N	16-point dummy	OUT, ENT (or 2, ENT)
H[2]	64-point dummy	OR, ENT

Note

1. An I/O verification error will occur if the I/O allocation is changed in a slot that doesn't have "****" displayed.
2. The G, L, and H settings are made in pairs, i.e., either 2 (128 pts) or 4 (256 pts) of these codes can be entered.

If the PC is switched to RUN or MONITOR mode after I/O words have been allocated to an empty slot, an I/O verification error will occur.

Verifying the I/O Table

This operation is used to compare the actual Units mounted to the PC to the I/O table in the PC and display any differences found; it is possible in any PC mode.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

Procedure

Follow the procedure below to compare the actual PC configuration to the I/O table in the PC.

1, 2, 3...

1. Go to the I/O Table menu, press VER and then ENT.

   When the comparison is finished, the message "OK" and a list of the points where the I/O table* did not agree with the actual configuration will be displayed on the screen.

   If no differences were found, the message "OK" will be displayed in the lower-left corner of the screen.

   Note *If I/O words have been reserved for Input or Output Units, those points will be listed. Words that have been reserved without specifying the type of unit will not be listed.

2. The message "CONTINUE" will appear at the bottom of the screen if the list doesn't fit on one page. Press the ENT Key to display the next page.
3. Press SHIFT+SELECT to return to the I/O Table menu.

7-4 Transferring Programs and Data

This section describes how to transfer and compare data in the GPC, GPC Memory Card, floppy disks, PC, and the PC Memory Card.

The files that can be contained in the various memory media are listed in the following table. A "YES" indicates the type of file can be transferred to that memory medium, and a "NO" indicates it cannot.

File type	Filename extension	Memory Medium				
		GPC memory	GPC Mem. Card	Floppy disk	PC memory	PC Mem. Card
PC Setup[1]	---	YES	NO	NO	YES	NO
Object	.OBJ	YES	YES	YES	YES	YES
CIO Area[2]	.IOM	NO	YES	YES	YES	NO
DM Area	.IOM	YES	YES	YES	YES	YES
EM Area	.IOM	NO	YES	YES	YES	YES
I/O comment	.CMT	YES	YES	YES	NO	YES
PC name table	.PCN	NO	YES	YES	NO	YES
PC parameters[3]	.STD	NO	NO	NO	YES	YES
Custom data area	.ARE	YES	YES	YES	NO	NO
Function code table	.MEI	YES	YES	YES	NO	NO

Note

1. The PC Setup file includes PC parameters and custom data area data.
2. Includes the CIO Area, TR Area (TR 0 to TR 7), CPU Bus Link Area (G000 to G255), and Auxiliary Area (A000 to A511). Data cannot be transferred to read-only areas of PC memory (G000 to G007 and A256 to A511).
3. The PC parameters include the PC Setup, I/O table, data link tables (for the SYSMAC LINK and NET Link Systems), Basic Unit Setup, and Customized settings (custom data area and function code table).

Transferring to the PC

Files can be transferred to PC memory only when the PC is in PROGRAM mode.

RUN	MONITOR	DEBUG	PROGRAM
NO	NO	NO	OK

Transferring to Other Media

Files can be transferred to other memory media regardless of the PC's operating mode.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

Procedure

Follow the procedure below to compare the actual PC configuration to the I/O table in the PC.

1, 2, 3...

1. Select (3): Transmit from the main online menu. The following menu will appear.

```
***  TRANSMIT    ***
■ SELECT FILE
  (0):PC SETUP (ONLINE)
  (1):USER PROGRAM
  (2):IOM AREA
  (3):DM
  (4):EM
  (5):I/O COMMENTS
  (6):PC NAME TABLE
  (7):PC PARAMETERS
  (8):CUSTOM AREAS
  (9):FUNCTION CODE TABLE

                                TRANS
                                        PROGRAM CV - 32KW
```

2. Press the number (0 to 9) corresponding to the file you want to transfer.
3. Input the source of the transfer (0 to 4) and press ENT.
4. Input the destination of the transfer (0 to 4) and press ENT. The source and destination cannot be the same.
5. Select the source file. If the GPC memory card, floppy disk, or PC memory card are the source of the transfer, a file directory will be displayed on the right side of the screen. Position the cursor next to file you want to transfer and press ENT.
6. When a different filename will be used in the destination, press WRITE and input the filename.
7. Input the number corresponding to the operation you want to perform (0 for transfer only, 1 for verification only, or 2 for both).
8. Move the cursor next to "EXECUTE" and press ENT. Press ENT again to confirm the operation and begin the transfer.

   A message will appear when the operation is completed.

7-5 Monitoring

Monitor operations monitor various aspects of ladder program operation. The table below lists the Monitor operations and shows the modes they can be performed in.

Valid PC Modes

Operation	RUN	MONITOR	DEBUG	PROGRAM
Clearing errors[1]	OK	OK	OK	OK
Displaying messages	OK	OK	OK	OK
I/O bit monitor	OK	OK	OK	OK
I/O monitor	OK	OK	OK	OK
Force-set/reset	No	OK	OK	OK
Changing PV	No	OK	OK	OK
Multibit monitor	OK	OK	OK	OK
Word monitor[2]	OK	OK	OK	OK
Changing SV	No	OK	OK	OK
Pause monitor	OK	OK	OK	OK
Differentiate monitor	OK	OK	OK	OK
Set system clock	OK	OK	OK	OK
Read cycle time	OK	OK	No	No
Online edit	No	OK	OK	OK

Note

1. Fatal errors (those that stop the PC) can be cleared in PROGRAM mode only.
2. PVs can be changed during the Word Monitor operation, unless the PC is in RUN mode.

Selecting I/O Comments

Follow the procedure below to select I/O comments.

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. Select (2): Monitor from the Service PC menu.
3. Position the cursor next to "I/O Comments," press 0 to specify GPC memory or 1 to specify the GPC Memory Card, and press ENT.
4. If the GPC Memory Card was selected, a list of the files on the card will be displayed on the right side of the screen. Move the cursor next to the desired file and press ENT.

Selecting the Program

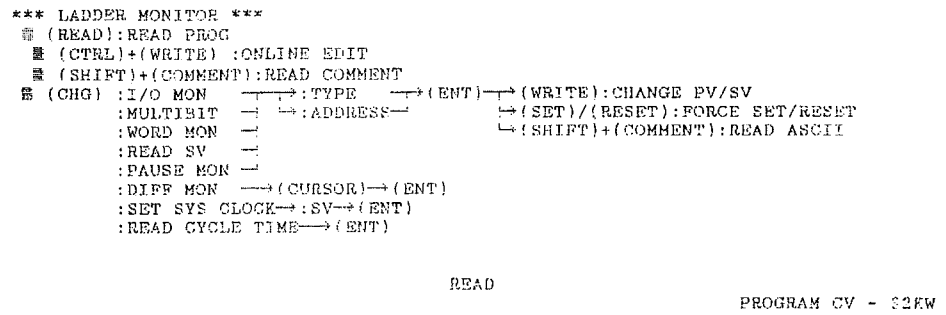
Follow the procedure below to select the program.

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. Select (2): Monitor from the Service PC menu.
3. Position the cursor next to "Program" and press ENT.
4. Position the cursor next to the type of program and press ENT.
   a) For "Ladder" programming, select either the main program or interrupt programs. When interrupt programs have been selected, input the desired interrupt number and press ENT.
   b) For "SFC+Ladder" programming, select either action or transition programs. After selecting action or transition programs, input the desired action or transition number and press ENT.

Monitor Menu

The Monitor menu (below) will appear when the program has been selected.



7-5-1 Clearing Errors

This operation is used to display and clear errors from PC memory and is possible in any PC mode, except that fatal errors can be cleared in the PROGRAM mode only.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

1, 2, 3...

1. Press the READ Key to put the GPC in read mode.
2. Press FUN and ENT to display the first error message in the lower-left corner of the screen.
3. Press ENT to clear the currently displayed error message and display the next error message.
4. Press ENT repeatedly until all error messages have been displayed and cleared. If an error message isn't cleared when ENT is pressed, remove the cause of the error and press ENT again.

   The message "ERR READ OK" will be displayed when all error messages have been displayed and cleared.

7-5-2 Displaying Messages

This operation is used to display messages generated by the execution of MSG(195) instructions in the program; it is possible in any PC mode.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

1, 2, 3...

1. Press the READ Key to put the GPC in read mode.
2. Press the SHIFT+FUN Keys and ENT to display the first message at the bottom of the screen. The message number (M1 to M7) will be displayed before the message.

3. If more than one MSG(195) instruction has been executed, press ENT to display the next message.
4. Press ENT repeatedly until all of the messages have been displayed. The message "MSG READ OK" will be displayed when all of the messages have been displayed and cleared.
5. Press RESET and ENT to clear all messages from the PC's memory.

7-5-3 I/O Bit Monitor

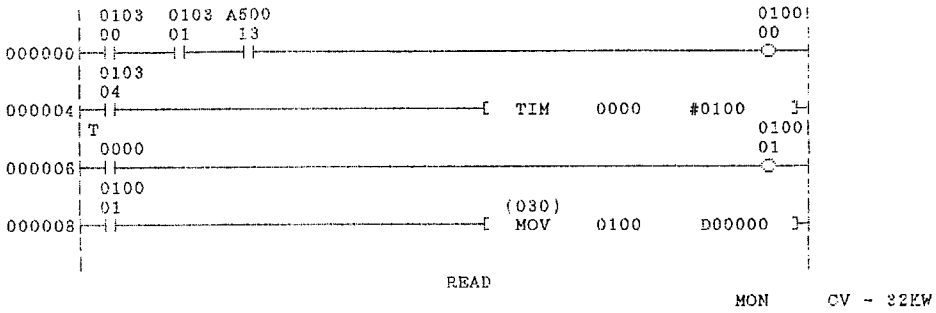
This operation is used to display sections of the program as ladder diagrams and indicate the status of I/O bits in the displayed program section; it is possible in any PC mode.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

1, 2, 3...

1. Display the Monitor menu (see page 127).
2. Press READ and ENT to display the beginning of the program.

   As shown in the following screen, the content of words used as operands will be displayed above their addresses and the ladder symbols of I/O bits that are ON will be displayed in bold.



3. Press the Plus or Minus Keys to display the next or previous instruction block.

   It is also possible to find instruction blocks by addresses or instructions that they contain as described in *7–2–7 Reading and Searching Ladder Diagrams*.

   Press the SHIFT+CHG Keys to display I/O comments or remove them from the screen.
4. The Monitor operation will be changed in the following order each time the CHG Key is pressed:

   I/O monitor, Multibit monitor, Word monitor, Change SV, Pause monitor, Differentiate monitor, Set system clock, Read cycle time
5. Press the READ Key to return to read mode.

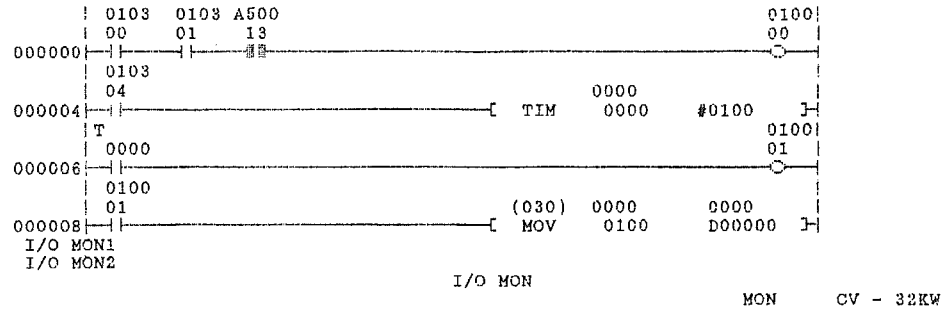
7-5-4 I/O Monitor

This operation is used to monitor the content of up to 6 specified words or bits; it is possible in any PC mode.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

1, 2, 3...

1. Display the Monitor menu (see page 127).
2. Press READ and ENT to display the I/O bit monitor screen.
3. Press the CHG Key and ENT to enter I/O monitor mode. Two input areas will appear in the lower-left corner of the screen next to the words "I/O Monitor 1" and " I/O Monitor 2," as shown below.



4. Input the addresses of the words and bits you want to monitor and press ENT. Refer to the table on page 60 for the key sequences.

   Move the cursor with the SHIFT+Up, SHIFT+Down, SHIFT+Left, or SHIFT+Right Keys.

Note

1. Step and transition flags can be monitored only when the PC is set for "SFC+Ladder" programming.
2. Other PCs on SYSMAC LINK or NET Link Networks can be specified in the "I/O Monitor 1" and "I/O Monitor 2" areas by pressing the NODE Key, the 1 Key, and then entering a PC ID or the network address.

   Up to 3 words or bits can be monitored for each PC specified (one in "I/O Monitor 1" and the other in "I/O Monitor 2").
3. The delays in displaying bit and word status will differ between the I/O monitor and the ladder diagram, as well as between different PCs.

7-5-5 Force Set/Reset

This operation is used to force-set/reset bits that are being monitored with the I/O monitor operation (see *7-5-4 I/O Monitor*) or to clear bits that have been force-set/reset. This operation is possible in any PC mode except RUN mode.

Other operations can be carried out while forced set or reset is applied. The set/reset status remains unchanged.

RUN	MONITOR	DEBUG	PROGRAM
No	OK	OK	OK

The letters S and R will be displayed next to bits and flags in the input area and the I/O monitor area to indicate forced status. The letter S indicates force-set status and the letter R indicates force-reset status.

These operations act on bit addresses, and timer, counter, step, and transition flags only.

1, 2, 3...

1. Monitor the bit or flag you want to force-set/reset using the I/O monitor operation and move the cursor to that bit or flag where it is displayed in the I/O monitor area.

2. The desired bit or flag will be displayed at the bottom of the screen. Press the appropriate key sequence (shown in the table below) to force-set, force-reset, or clear the bit's forced status.

Key Sequence	Operation	Description
SET	Temporary force-set	The selected bit will be forced ON as long as the SET Key is pressed.
RESET	Temporary force-reset	The selected bit will be forced OFF as long as the RESET Key is pressed.
SHIFT+SET	Force-set	The selected bit will be forced ON until its forced status is cleared.
SHIFT+RESET	Force-reset	The selected bit will be forced OFF until its forced status is cleared.
NOT	Clear	Clears the forced status of the selected bit.
READ, CTRL+NOT, ENT	Global clear	Clears the forced status of all bits and flags that have been force-set or force-reset. When the forced status of bits or flags in 2 PCs are being cleared, perform this operation separately for each PC.

Note With the C1000H, only the SET and RESET Keys can be used. The other key sequences shown above will not work.

7-5-6 Change PV

This operation is used to change the contents of DM, EM, data register, or index register words, or timer or counter PVs that are being monitored with the I/O monitor operation (see *7-5-4 I/O Monitor*). This operation is possible in any PC mode except RUN mode.

RUN	MONITOR	DEBUG	PROGRAM
No	OK	OK	OK

1, 2, 3...

1. Use the I/O monitor operation to monitor the word, timer, or counter you want to change and move the cursor to that bit or flag where it is displayed in the I/O monitor area. The desired word, timer, or counter will be displayed at the bottom of the screen.

   DM, EM, data register, and index register words, and timer and counter PVs can be changed with this operation.
2. The new value of words can be entered numerically or in ASCII code. New timer and counter PVs must be entered numerically.
   a) To enter the new value of a word or PV numerically, press WRITE, input the new value, and press ENT.
   b) To enter the new value of a word in ASCII code, press SHIFT+CHG, WRITE, input the new value in ASCII code, and press ENT. The new value will be displayed in ASCII code.
3. Press the CLR Key to return to the I/O monitor operation.

7-5-7 Multibit Monitor

This operation is used to indicate the word content or I/O bit status of up to 10 words and bits; it is possible in any PC mode. The multibit monitor, I/O monitor, and word monitor operations can be displayed simultaneously, so up to 17 words and bits can be monitored on the screen.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

The ON/OFF or forced status of bits is indicated on the screen, and the content of words is shown in hexadecimal, binary, and ASCII code. Both the PV and completion flag status of timers and counters are displayed, as shown below.

```
*** MULTIBIT MONITOR ***
     I/O NO                                        ASCII    PC NAME
     000103  -  OFF
     010301  -  OFF
     010304  -  OFF
     000001  -  OFF
 TIM    0000  -  0000      OFF
 C      0103  -  0000      0000 0000 0000 0000     '  '
 C      0001  -  0000      0000 0000 0000 0000     '  '
 DM   00000   -  0000      0000 0000 0000 0000     '  '
              -
              -
 I/O MON1              000103-OFF          010304-OFF        TIM  0000-0000 OFF
 I/O MON2          C     0103-0000       C     0100-0000     *DM  00000-0000
                                     MULTIBIT MON
                                                          MON      CV - 32KW
```

1, 2, 3...

1. Display the Monitor menu (see page 127).
2. Press READ and ENT to display the I/O bit monitor screen.
3. Press the CHG Key twice to enter the multibit monitor mode. The words "Multibit monitor" will be displayed at the bottom of the screen.
4. Input the addresses of the words and bits you want to monitor and press ENT. Refer to the table on page 60 for the key sequences. The words and bits will be listed in the order that they are input.

   Move the cursor with the SHIFT+Up, SHIFT+Down, SHIFT+Left, or SHIFT+Right Keys.

Note

1. Step and transition flags can be monitored only when the PC is set for "SFC+Ladder" programming.
2. Other PCs on SYSMAC LINK or NET Link Networks can be specified by pressing the NODE Key, the 1 Key, and then entering a PC ID or the network address.
3. The delays in displaying bit and word status will differ between the multibit monitor, I/O monitor, and word monitor, as well as between different PCs.

7-5-8 Word Monitor

This operation is used to display the content of a single DM, EM, data register, or index register word at the bottom of the screen; it is possible in any PC mode.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

The content of the specified word is shown in both hexadecimal and binary, as shown below.

```
*** MULTIBIT MONITOR ***
     I/O NO                                        ASCII    PC NAME
     000103  -  OFF
     010301  -  OFF
     010304  -  OFF
     000001  -  OFF
 TIM    0000  -  0000      OFF
 C      0103  -  0000      0000 0000 0000 0000     '  '
 C      0001  -  0000      0000 0000 0000 0000     '  '
 DM   00000   -  0000      0000 0000 0000 0000     '  '
     000000   -  OFF
              -
 I/O MON1              000103-OFF          010304-OFF        TIM  0000-0000 OFF
 I/O MON2          C     0103-0000       C     0100-0000     *DM  00000-0000
                                     WORD MON
                   WORD      DM 00000 0000     0000000000000000 MON      CV - 32KW
```

1, 2, 3...

1. Display the Monitor menu (see page 127).
2. Press READ and ENT to display the I/O bit monitor screen.
3. Press the CHG Key three times to enter the word monitor mode. The words "Word monitor" will be displayed at the bottom of the screen.
4. Input the address of the word you want to monitor and press ENT. The specified word and its content will be displayed at the bottom of the screen. Refer to the table on page 60 for the key sequences.

Note Indirectly addressed words and user-defined I/O names cannot be monitored.

Changing Bit Status

When a word is being monitored with the word monitor operation, its content can be changed by changing the ON/OFF status of the bits shown in binary. This operation is possible in any PC mode except RUN mode.

1, 2, 3...

1. Enter the word monitor mode and monitor the desired word as described above.
2. Press WRITE to enter write mode.
3. Move the cursor below the bit (where the word is shown in binary) that you want to change.
4. Press 0 or 1 (for OFF or ON) and ENT. The status of the bit will be changed.

7-5-9 Changing Set Values

This operation is used to display and change the set values of timers and counters. This operation is possible in any PC mode except RUN mode.

RUN	MONITOR	DEBUG	PROGRAM
No	OK	OK	OK

1, 2, 3...

1. Display the Monitor menu (see page 127).
2. Press READ and ENT to display the I/O bit monitor screen.
3. Press the CHG Key four times to enter the SV read mode. The words "SV read" will be displayed at the bottom of the screen.
4. Input the address of the desired timer or counter and press ENT. The specified timer or counter and its set value will be displayed at the bottom of the screen. Refer to the table on page 60 for the key sequences.
5. There are two ways to change the SV:
   a) The current SV can be incremented or decremented by pressing the SHIFT+Plus Keys or the SHIFT+Minus Keys.
   b) To input a new set value, press WRITE, input the new value, and press ENT. When changing the SV from a constant to a word address or vice-versa, be sure to press the SHIFT+*DM Keys to specify a word address or the Constant Key to specify a constant.

7-5-10 Pause Monitor

This operation is used to freeze the I/O bit monitor display. This operation is possible in any PC mode.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

There are three triggers that can be set to determine when the display will be frozen. The display can be frozen on the rising edge of A00814, the rising edge or falling edge of a specified bit, or when the content of a specified word reaches a set value.

Procedure

1, 2, 3...

1. Display the Monitor menu (see page 127).
2. Press READ and ENT to display the I/O bit monitor screen.
3. Press the CHG Key five times to enter the pause monitor mode. The words "Pause monitor" will be displayed at the bottom of the screen.
4. Set the trigger as described below. Press the CLR Key to cancel a key sequence and return to the original screen.

Trigger	Key sequence	Remarks
A00814	**0, ENT**	Monitoring will be paused when A00814 is ON.
Specified bit	**1,** *Bit_address*, **SET, ENT**	Monitoring will be paused when the specified bit is ON.
	1, *Bit_address*, **RESET, ENT**	Monitoring will be paused when the specified bit goes from ON to OFF.
Specified word	**2,** *Word_address*, **ENT,** *Set_value*, **ENT**	Monitoring will be paused when the content of the specified word equals the set value.

7-5-11 Differentiation Monitor

This operation indicates the rising edge or falling edge of a specified bit (i.e., when the bit goes from OFF to ON or from ON to OFF). The monitor display is not frozen. This operation is possible in any PC mode.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

Procedure

1, 2, 3...

1. Display the Monitor menu (see page 127).
2. Press READ and ENT to display the I/O bit monitor screen.
3. Press the CHG Key six times to enter the differentiate monitor mode. The words "Differentiate monitor" will be displayed at the bottom of the screen.
4. Move the cursor to the desired bit (in the ladder diagram). The selected bit will appear at the bottom of the screen.

   (Press the Up, Down, Left, and Right Keys to move the cursor on the screen. Press the Plus or Minus Keys to display the next or previous instruction block.)
5. Press the SET Key to specify the rising edge or press the RESET Key to specify the falling edge and press the ENT Key to start monitoring.

   When the differentiate up or down condition is met, the selected bit will appear in boldface.

7-5-12 Reading/Setting the System Clock

This operation is used to read the current time and date from the system clock in the PC, and set it if necessary. This operation is possible in any PC mode.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

Reading the Clock

1, 2, 3...

1. Display the Monitor menu (see page 127).
2. Press READ and ENT to display the I/O bit monitor screen.
3. Press the CHG Key seven times to enter the set system clock mode. The words "Set system clock" will be displayed at the bottom of the screen.
4. Press ENT. The current date and time will appear at the bottom of the screen.

Setting the Clock

1, 2, 3...

1. Display the current date and time as described above.
2. Move the cursor to the setting you want to change using the SHIFT+Right and SHIFT+Left Keys.
3. To change numeric values, input new number with the numeric keys. To change the day, press the SHIFT+Up or SHIFT+Down Keys.
4. Press ENT to set the PC's system clock to the date and time displayed on the screen.

7-5-13 Reading the Cycle Time

This operation is used to measure the cycle time of the program and display the maximum, minimum, and mean values. This operation is possible in RUN and MONITOR modes.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	No	No

Procedure

1, 2, 3...

1. Display the Monitor menu (see page 127).
2. Press READ and ENT to display the I/O bit monitor screen.
3. Press the CHG Key eight times to enter the read cycle time mode. The words "Read cycle time" will be displayed at the bottom of the screen.

   The maximum, minimum, and mean values of the cycle time will appear at the bottom of the screen.

7-5-14 Online Editing

The following operation can be used to change the PC's program in any PC operating mode except the RUN mode.

RUN	MONITOR	DEBUG	PROGRAM
No	OK	OK	OK

Only the program in the PC can be changed with this operation.

Procedure

1, 2, 3...

1. Display the Monitor menu (see page 127).
2. Press READ and ENT to display the I/O bit monitor screen.
3. Press the READ Key to enter read mode and then press the CTRL+WRITE Keys to enter write mode.

   The procedures for writing or changing a ladder diagram are identical to those described in for offline programming. Be sure to save changes with the Store or Store insert operations.

7-6 Tracing

Program tracing is used to trace the execution sequence of actions, specified instructions, or MARK(174) instructions in conjunction with the changes in memory content.

The trace flag display shows the status of the Trace Trigger Flag (A00814), Trace Completed Flag (A00812), and Trace Busy Flag (A00813).

Select "P:Data trace" from the menu. The program trace initial display will be displayed as shown below.

```
*** TRACE  ***

     INST TRACE ( 0:SET  1:RUN )
     MARK TRACE ( 0:SET  1:RUN )
     DATA TRACE ( 0:SET  1:RUN )
     TRACE DATA READ
     TRACE ABORT
```

```
                                        MON      CV - 32KW
```

7-6-1 Instruction Traces

Instruction traces are executed to store the sequence of ladder instruction executions in the PC's trace memory while monitoring specified memory contents. The instruction trace data stored in the PC's trace memory is then displayed on the screen. The content of two data words can be sampled during the instruction trace.

Instruction Trace Settings

Follow the procedure below to set the PC for an instruction trace.

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. Select (8): Trace from the Service PC menu.
3. Move the cursor next to "Inst trace," press 0 and ENT.
   The instruction trace setting menu (below) will appear.

```
***  INST TRACE  ***

     TRIGGER     = AR00814(TRIG FLAG)
     DELAY       = +000
     DATA 1      =
     DATA 2      =
     SETTING


                                TRACE SET
                                                MON     CV - 32KW
```

4. Press the WRITE key to enter write mode, move the cursor next to the setting you want to change, and press ENT.
   The individual settings are described below.

Trigger Condition

There are three possible triggers that determine when the instruction trace will begin. The trace can begin on the rising edge of A00814, the rising edge or falling edge of a specified bit, or when the content of a specified word reaches a set value. If the condition is already met when the trace is executed, tracing will being immediately.

Trigger	Remarks
A00814	Tracing will begin when A00814 is ON.
Specified bit	Tracing will begin when the specified bit is ON (up differentiated) or OFF (down differentiated).
Specified word	Tracing will begin when the content of the specified word equals the set value.

1, 2, 3...

1. Go to the instruction trace setting menu as described above, move the cursor next to "Trigger," and press ENT.
2. Move the cursor next to the desired trigger and press ENT. Input the required data for the trigger as described below.
   a) If A00814 was selected, no further data is required. Trigger selection is completed.
   b) If a specific bit was selected, input the bit address and press ENT. Press 0 and ENT to trigger tracing when the specified bit is ON, or press 1 and ENT to trigger tracing when the specified bit goes from ON to OFF. Move the cursor to "Setting" and press ENT.
   c) If a specific word was selected, input the word address and press ENT. Use the numeric keys (including SHIFT+0 to SHIFT+5) to input the set value that will trigger tracing and press ENT. Move the cursor to "Setting" and press ENT.

Note Always perform the "setting" operation after changing instruction trace settings.

Delay Value

The possible range of the delay value setting for the instruction trace depends upon the PC model and number of sampling words, as shown in the table below.

PC	Number of sampling words	Range
CV1000	0	–499 to 500
	1	–399 to 400
	2	–332 to 333
CV500	0	–249 to 250
	1	–199 to 200
	2	–165 to 166

1, 2, 3...

1. Go to the instruction trace setting menu (this procedure is described on page 144) and move the cursor next to "Delay."
2. Input a delay value within the range shown in the table above and press ENT.

Note Always perform the "setting" operation after changing instruction trace settings.

Data 1/Data 2

These settings specify the addresses of the words to be sampled.

1, 2, 3...

1. Go to the instruction trace setting menu (this procedure is described on page 144), move the cursor next to "Data 1," and press ENT.
2. Input the address of the first word you want to trace and press ENT. (Index registers and data registers cannot be input.)

Follow the same procedure to input an address for "Data 2."

Note Always perform the "setting" operation after changing instruction trace settings.

Setting Completed

Always perform the "setting" operation after changing instruction trace settings.

Go to the instruction trace setting menu (this procedure is described on page 144), move the cursor next to "Setting," and press ENT.

Executing the Instruction Trace

Instruction traces are possible in any PC mode except PROGRAM mode.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	No

Follow the procedure below to execute an instruction trace.

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. Select (8): Trace from the Service PC menu.
3. Be sure to perform the instruction trace settings procedure described above even if the current instruction trace settings are going to be used.
4. Move the cursor next to "Inst trace," press 1 and ENT.

   The results of the instruction trace will be displayed automatically when the instruction trace is completed. A sample screen is shown below:

```
Interrupt                                  Program
program   Data 1   Data 2  IL  PF         address     Instruction

          D00009   c0103       PF         STEP        INST

           0000     0000        0         000000      LD              010300
           0000     0000        0         000001      AND             010301
           0000     0000        0         000002      AND         A   50013
           0000     0000        0         000003      OUT             010000
           0000     0000        0         000004      LD              010304
           0000     0000        0         000005      TIM             0000
           0000     0000        0         000006      LD          T   0000
           0000     0000        0         000007      OUT             010001
           0000     0000        0         000008      LD              010001
           0000     0000        0         000009      MOV (030)
           0000     0000        0         000010      END (001)
           0000     0000        0         000000      LD              010300
                                            INST TRACE
                    DELAY=+0000                                  MON     CV - 32KW
```

The cursor can be moved with the Plus, Minus, Up, and Down Keys. Press the Plus or Minus Keys to display the next or previous page. Press the Up and Down Keys to move the cursor on the screen.

The information contained in the trace results screen is described below.

Item	Description
Interrupt program	If the instruction is in an interrupt program, the interrupt number is displayed here. Interrupt numbers 0 to 31 correspond to I/O interrupts 0 to 31. Interrupt numbers 32 and 33 correspond to scheduled interrupts 0 and 1. Interrupt numbers 34 and 35 correspond to the power OFF and power ON interrupts.
Data 1 data	Displays the content of Data 1 immediately before the instruction was executed.
Data 2 data	Displays the content of Data 2 immediately before the instruction was executed.
IL	Indicates whether the instruction is in an interlocked program section.
PF	The results of logical operations on input conditions from the PC bus displayed as 0 or 1.
Program address	Indicates the program addresses of the instructions executed by the instruction trace.
Delay	Indicates the position of the instruction at the cursor relative to the trigger instruction.

Stopping the Trace

Follow either of the procedures below to stop a trace in progress.

1, 2, 3...

1. Press the CLR Key, move the cursor to "Stop trace," and press ENT.
2. Press CLR and ENT. Press CLR again when the message "Abort" appears at the bottom of the screen.

When either of these procedures is used to interrupt a trace, the data in trace memory will be displayed on the screen. Since the trace is interrupted before the trigger condition is met, the trigger and delay value will not be displayed.

Reading Trace Results

To read the trace results, move the cursor to "Trace data read" and press ENT.

This operation is used to read the results of a trace when the results that are displayed automatically upon completion of the trace have been cleared from the screen.

The PC's trace memory is used to store data from all traces, so this operation will display the data from the last trace executed, whether it was an instruction trace, mark trace, or data trace.

7-6-2 Mark Traces

Mark traces can be used to store two data items in the PC's trace memory, the order of MARK(174) execution, and the content of two data words at the time of MARK(174) execution. The mark trace data stored in the PC's trace memory can then be displayed on the screen.

Mark Trace Settings

Follow the procedure below to set the PC for a mark trace.

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. Select (8): Trace from the Service PC menu.
3. Move the cursor next to "Mark trace," press 0 and ENT. Except for the title "Mark trace" at the top of the screen, the mark trace setting menu is identical to the instruction trace setting menu shown on page 144.
4. Press the WRITE key to enter write mode, move the cursor next to the setting you want to change, and press ENT.

   The individual settings for a mark trace are identical to those for an instruction trace except for the mark number setting in trigger conditions and the possible range of the delay value setting. Refer to *Instruction Trace Settings* on page 144.

Trigger Condition

The mark trace settings are identical to the instruction trace settings except for the mark number setting. Follow the procedure below to set the mark number.

1, 2, 3...

1. Go to the instruction trace setting menu as described above, move the cursor next to "Trigger," and press ENT.
2. Move the cursor next to "Mark number" and press ENT. Input the desired mark number for the trigger.
3. To complete the trigger condition setting, move the cursor next to "Setting" and press ENT.

Delay Value

The possible range of the delay value setting for the mark trace depends upon the PC model and number of sampling words, as shown in the table below.

PC	Number of sampling words	Range
CV1000	0	–665 to 666
	1	–499 to 500
	2	–399 to 400
CV500	0	–332 to 333
	1	–249 to 250
	2	–199 to 200

1, 2, 3...

1. Go to the mark trace setting menu and move the cursor next to "Delay."
2. Input a delay value within the range shown in the table above and press ENT.

Note Always perform the "Setting" operation after changing instruction trace settings.

Setting Completed

Always perform the "Setting" operation after changing mark trace settings.

Go to the mark trace setting menu (this procedure is described on page 144), move the cursor next to "Setting," and press ENT.

Executing the Mark Trace

Mark traces are possible in any PC mode except PROGRAM mode.

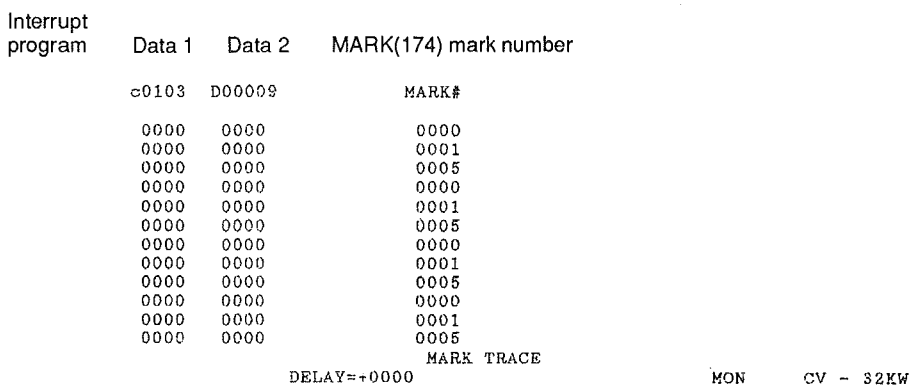
RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	No

Follow the procedure below to execute a mark trace.

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. Select (8): Trace from the Service PC menu.
3. Be sure to perform the mark trace settings procedure described above even if the current mark trace settings are going to be used.
4. Move the cursor next to "Mark trace," press 1 and ENT.

   The results of the mark trace will be displayed automatically when the mark trace is completed. A sample screen is shown below:



The cursor can be moved with the Plus, Minus, Up, and Down Keys. Press the Plus or Minus Keys to display the next or previous page. Press the Up and Down Keys to move the cursor on the screen.

The information contained in the trace results screen is described below.

Item	Description
Interrupt program	If the instruction is in an interrupt program, the interrupt number is displayed here. Interrupt numbers 0 to 31 correspond to I/O interrupts 0 to 31. Interrupt numbers 32 and 33 correspond to scheduled interrupts 0 and 1. Interrupt numbers 34 and 35 correspond to the power OFF and power ON interrupts.
Data 1 data	Displays the content of Data 1 immediately before the instruction was executed.
Data 2 data	Displays the content of Data 2 immediately before the instruction was executed.
Mark number	Indicates the mark number of the executed MARK(174) instruction.
Delay	Indicates the position of the instruction at the cursor relative to the trigger instruction.

Stopping the Trace

Follow either of the procedures below to stop a trace in progress.

1, 2, 3...

1. Press the CLR Key, move the cursor to "Stop trace," and press ENT.
2. Press CLR and ENT. Press CLR again when the message "Abort" appears at the bottom of the screen.

When either of these procedures is used to interrupt a trace, the data in trace memory will be displayed on the screen. Since the trace is interrupted before the trigger condition is met, the trigger and delay value will not be displayed.

Reading Trace Results

To read the trace results, move the cursor to "Trace data read" and press ENT.

This operation is used to read the results of a trace when the results that are displayed automatically upon completion of the trace have been cleared from the screen.

The PC's trace memory is used to store data from all traces, so this operation will display the data from the last trace executed, whether it was an instruction trace, mark trace, or data trace.

7-6-3 Data Traces

Data tracing can be used to facilitate debugging programs. Refer to the *CV500/CV1000 Operation Manual: Ladder Diagrams* for details on using TRSM(170) in ladder-diagram programming.

Introduction

Description

Up to 12 bits and up to 3 words may be designated for tracing. There are three ways to mark locations where specified data is to be stored in Trace Memory. The specified words and bits can be sampled at regular intervals, at the end of each cycle, or wherever a TRSM(170) is used in the program. Any one of these data sampling methods can be used.

There are three possible triggers that determine when data tracing will begin. The trace can begin on the rising edge of A00814, the rising edge or falling edge of a specified bit, or when the content of a specified word reaches a set value.

Data Trace Settings

Follow the procedure below to set the PC for a data trace.

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. Select (8): Trace from the Service PC menu.
3. Move the cursor next to "Data trace," press 0 and ENT.

The data trace setting menu (below) will appear.

```
***  DATA TRACE  ***

     TRIGGER     = AR00814(TRIG FLAG)
     SAMPLING(0:SCHED 1:1 CYCLE 2:TRSM)  = SCHED
     SAMPLING TIME       = 001 (X 5MS)
     DELAY       = +0000
     SETTING
      (BIT)              (BIT)              ( WD )
     X00 =              X06 =              X12 =
     X01 =              X07 =              X13 =
     X02 =              X08 =              X14 =
     X03 =              X09 =
     X04 =              X10 =
     X05 =              X11 =
                                  TRACE SET
                                                    PROGRAM CV - 32KW
```

4. Press the WRITE key to enter write mode, move the cursor next to the setting you want to change, and press ENT.

   The individual settings are described below.

Trigger Condition

There are three possible triggers that determine when the data trace will begin. The trace can begin on the rising edge of A00814, the rising edge or falling edge of a specified bit, or when the content of a specified word reaches a set value. If the condition is already met when the trace is executed, tracing will being immediately.

Trigger	Remarks
A00814	Tracing will begin when A00814 is ON.
Specified bit	Tracing will begin when the specified bit is ON (up differentiated) or OFF (down differentiated).
Specified word	Tracing will begin when the content of the specified word equals the set value.

1, 2, 3...

1. Go to the data trace setting menu as described above, move the cursor next to "Trigger," and press ENT.
2. Move the cursor next to the desired trigger and press ENT. Input the required data for the trigger as described below.
   a) If A00814 was selected, no further data is required. Trigger selection is completed.
   b) If a specific bit was selected, input the bit address and press ENT. Press 0 and ENT to trigger tracing when the specified bit is ON, or press 1 and ENT to trigger tracing when the specified bit goes is OFF. Move the cursor to "Setting" and press ENT.
   c) If a specific word was selected, input the word address and press ENT. Use the numeric keys (including SHIFT+0 to SHIFT+5) to input the set value that will trigger tracing and press ENT. Move the cursor to "Setting" and press ENT.

Note Always perform the "Setting" operation after changing data trace settings.

Data Sampling Method

There are three ways to determine when the contents of the specified words and bits will be sampled. The specified words and bits can be sampled at regular intervals, at the end of each cycle, or wherever a TRSM(170) is used in the program. Any one of these data sampling methods can be used.

No.	Sampling	Remarks
0	Regular intervals (Scheduled)	The data will be sampled at regular intervals independent of the cycle time. The interval can be set from 5 ms to 2,550 ms in 5 ms increments.
1	End of cycle (Cycle)	The data will be sampled at the end of each cycle.
2	TRSM(170)	The data will be sampled when TRSM(170) instructions are executed in the program.

1, 2, 3...

1. Go to the data trace setting menu as described above and move the cursor next to "Sampling."
2. Input the desired sampling method as described below.
   a) Input 0 for regular intervals and press ENT.
   The cursor will automatically move to the input area for the interval. Input an interval from 001 to 510 (5 ms to 2550 ms) and press ENT.
   b) Input 1 for end of cycle and press ENT.
   c) Input 2 for TRSM(170) and press ENT. (TRSM(170) instructions can be incorporated anywhere in a program, any number of times.)

Delay Value

The possible range of the delay value setting for the data trace depends upon the PC model and number of sampling words, as shown in the table below.

If the delay is set as a negative value, no delay value will be displayed when the data trace is read if the number of samples set with the delay value cannot be completed before the trigger condition is met.

PC	Number of sampling words	Range
CV1000	0	–1999 to 2000
	1	–999 to 1000
	2	–665 to 666
	3	–499 to 500
CV500	0	–999 to 1000
	1	–499 to 500
	2	–332 to 333
	3	–249 to 250

1, 2, 3...

1. Go to the data trace setting menu (this procedure is described on page 148) and move the cursor next to "Delay."
2. Input a delay value within the range shown in the table above and press ENT.

Note Always perform the "Setting" operation after changing data trace settings.

Sampling Bits/words

These settings specify the addresses of the words and bits to be sampled. Up to 12 bits and up to 3 words may be designated.

1, 2, 3...

1. Go to the data trace setting menu (this procedure is described on page 148) and move the cursor next to the next available word or bit input area.
2. Input the address of the word or bit you want to trace and press ENT. (Index registers and data registers cannot be input.)

Follow the same procedure to input an address for "Data 2."

Note Always perform the "Setting" operation after changing data trace settings.

Setting Completed

Always perform the "Setting" operation after changing data trace settings.

Go to the data trace setting menu (this procedure is described on page 148), move the cursor next to "Setting," and press ENT.

Executing the Data Trace

Data traces are possible in any PC mode except PROGRAM mode.

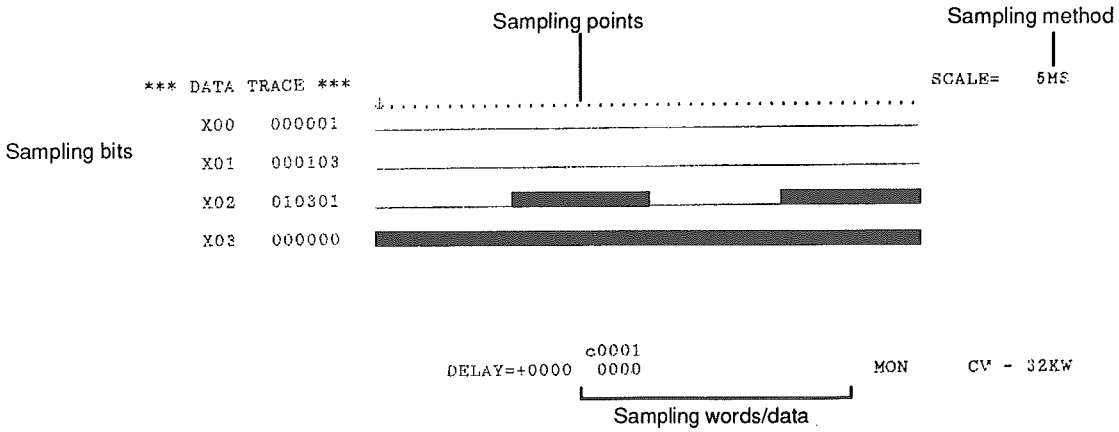
RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	No

Follow the procedure below to execute a data trace.

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. Select (8): Trace from the Service PC menu.
3. Be sure to perform the data trace settings procedure described above even if the current data trace settings are going to be used.
4. Move the cursor next to "Data trace," press 1 and ENT.

   The results of the data trace will be displayed automatically when the data trace is completed. A sample screen is shown below:



The cursor can be moved with the Plus, Minus, Up, and Down Keys. Press the Plus or Minus Keys to display the next or previous page. Press the Up and Down Keys to move the cursor on the screen.

The information contained in the trace results screen is described below.

Item	Description
Scale	The scale indicates the interval between sampling points, and depends on the sampling method being used. If data is being sampled at regular intervals, the scale equals the fixed interval. If data is being sampled at the end of each cycle, the scale equals 1 cycle. If data is being sampled at TRSM(170) instructions, the scale equals TRSM(170) execution.
Sampling bits	The ON/OFF status of up to 6 bits will be displayed in a time chart. Use the Up and Down Keys to display the other bits that are off-screen.
Sampling words/ data	The content of the 3 sampling words at the sampling point indicated by the cursor will be displayed in hexadecimal. Use the Left, Right, SHIFT+Left, and SHIFT+Right Keys to move the cursor to other sampling points.
Delay	Indicates the position of the instruction at the cursor relative to the trigger instruction. No delay will be displayed when the trigger condition is not met.

Stopping the Trace

To stop a trace in progress, press the CLR Key, move the cursor to "Stop trace," and press ENT.

When this procedure is used to interrupt a trace, the data in trace memory will be displayed on the screen. Since the trace is interrupted before the trigger condition is met, the trigger and delay value will not be displayed.

Reading Trace Results

To read the trace results, move the cursor to "Trace data read" and press ENT.

This operation is used to read the results of a trace when the results that are displayed automatically upon completion of the trace have been cleared from the screen.

The PC's trace memory is used to store data from all traces, so this operation will display the data from the last trace executed, whether it was an instruction trace, mark trace, or data trace.

7-7 Editing Data Memory

The procedures for online editing of DM and EM memory are identical to the offline editing procedures, but the online operations write and edit DM and EM Area data in the PC instead of the GPC.

Selecting Operations

Follow the procedure below to select DM Editing operations.

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. Select (6): Edit DM from the Service PC menu.
3. Move the cursor next to the memory area you want to edit (Data Memory or Extended Data Memory) and press ENT.

   If EM is selected, it is necessary to select the EM bank that will be edited. Input the EM bank number (0 to 7) and press ENT.
4. When the memory area has been selected, the following screen will appear. Input the number corresponding to the operation you want to perform and press ENT.

```
***  INPUT DM  ***                                DM = PC
 SELECT ITEM

  (0): DATA  CLEAR
  (1): DATA  FILL
  (2): DATA  COPY
  (3): DATA  INPUT


                                                PROGRAM CV - 32KW
```

Valid PC Modes

The table below lists the DM editing operations and shows the modes they can be performed in and the pages on which the procedures can be found.

Operation	RUN	MONITOR	DEBUG	PROGRAM	Page
Reading DM data	OK	OK	OK	OK	91
Writing DM data	No	OK	OK	OK	91
Copying DM data	No	OK	OK	OK	91
DM data fill	No	OK	OK	OK	92
Clearing DM data	No	OK	OK	OK	93

7-8 CPU Bus Unit Settings

The operations described in this section are used to read, write, edit, or clear CPU Bus Unit settings. CPU Bus Units include SYSMAC NET Link, SYSMAC LINK, SYSMAC BUS/2, and Basic Units. Refer to the specific unit's *System Manual* for descriptions of the settings.

These operations are possible in any PC operating mode except RUN mode.

RUN	MONITOR	DEBUG	PROGRAM
No	OK	OK	OK

Reading CPU Bus Unit Settings

Follow the procedure below to read CPU Bus Unit settings from the PC.

1, 2, 3...

1. Select (2): CPU Bus Unit Settings from the main online menu.
   The CPU Bus Unit Settings menu (below) will appear.

```
*** CPU BUS SERVICES ***                    ┌(SHIFT)+(SELECT):TO ORIGINAL MENU ┐

    UNIT#  = 00
    ID     = '  '
    LENGTH = 001
    FUN ( 0:READ  PC→GPC 1:WRITE GPC→PC 2:DELETE )=READ PC→GPC
    RUN
```

2. Move the cursor to "Unit no.," input the unit number set on the CPU Bus Unit's DIP switches (00 to 15) and press ENT.
3. Move the cursor to "ID," input the Identification code (see table below) for the CPU Bus Unit, and press ENT.
4. Move the cursor to "Length," input the number of words to be allocated in the CPU Bus Unit Settings area (shown in the table below) for the CPU Bus Unit, and press ENT.

CPU Bus Unit	ID code	Length
SYSMAC NET	SN	2
SYSMAC LINK	SL	1
SYSMAC BUS/2	RM	4
BASIC	BA	60

Note Once a CPU Bus Unit has been assigned a particular no. of words, the assigned no. of words cannot be increased without changing the unit number or ID code.

5. Move the cursor to "FUN," input 0, and press ENT. This function reads the settings for this CPU Bus Unit from the CPU Bus Unit Settings area in the PC for writing or editing.
6. Move the cursor to "Run" and press ENT. Press ENT again to confirm.
   The CPU Bus Unit's unit number, ID code, no. of words, and settings will be displayed.

Writing/Editing CPU Bus Unit Settings

Follow the procedure below to write or edit CPU Bus Unit settings.

1, 2, 3...

1. Follow the previous procedure (under the heading *Reading CPU Bus Unit Settings*) to display the desired CPU Bus Unit's unit number, ID code, Length, and settings.
2. Press the WRITE Key to enter write mode. The settings can be input in binary, hexadecimal, or ASCII code. Refer to the specific unit's *System Manual* for descriptions of the settings.
   Use the Left and Right Keys to move the cursor to the desired position and input the new value. (Use the Up or Down Keys to display the previous or next page.)

If the cursor is located in the binary area, input 0 or 1.
If the cursor is located in the hexadecimal area, input 0 to F.
If the cursor is located in the ASCII area, input an ASCII character. To input lower-case characters, press and hold the SHIFT Key while inputting the character.

3. Press the SHIFT+SELECT Keys to return to the CPU Bus Unit Settings menu.
4. Move the cursor to "FUN," input 1, and press ENT. This function writes the new or edited settings for this CPU Bus Unit to the CPU Bus Unit Settings area in the PC.
5. Move the cursor to "Run" and press ENT.
   The message "OK" will be displayed when the new settings have been written to the PC.
6. After changing the settings for a SYSMAC NET Link Unit, SYSMAC LINK Unit, or SYSMAC BUS/2 Master Unit, turn the PC off and then on again.

Clearing CPU Bus Unit Settings

Follow the procedure below to write or edit CPU Bus Unit settings. The CPU Bus Unit Settings menu will appear.

1, 2, 3...

1. Follow steps 1 through 4 of the procedure on page 153 (under the heading *Reading CPU Bus Unit Settings*).
2. Move the cursor to "FUN," input 2, and press ENT. This function clears the settings for this CPU Bus Unit from the CPU Bus Unit Settings area in the PC.
3. Move the cursor to "Run" and press ENT.
   The message "OK" will be displayed when the new settings have been written to the PC.

7-9 Editing PC Names

A PC ID is a name assigned to each node of a SYSMAC NET or SYSMAC LINK network. Once set, the assigned name can be specified instead of the network and node addresses. The PC ID table is created in the GPC's Memory Card.

Once a PC ID has been registered in the PC ID table, it can be selected in the PC selection operation and the GPC will communicate with that PC.

These operations are possible in any PC mode.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

Creating a PC ID Table

The procedure for creating a PC ID table online is identical to the offline procedure.

Selecting a PC

There are two steps in selecting a PC from a PC ID table. FIrst a PC ID table (file) is selected from the GPC's Memory Card, and then the PC ID can be selected from the table.

Selecting a PC ID File

1, 2, 3...

1. Select (9): GPC Setup from the main online menu.
2. Select (2): Select PC Name File from the GPC Settings menu.
3. Press the WRITE Key, input the filename (up to 8 characters long) of the desired PC ID file, and press ENT.
   Press the Right an Left Keys to move the cursor right and left.
   Press the SHIFT+Right or SHIFT+Left Keys to delete the character at the cursor. Press the CLR Key to delete all characters in the input area.
4. Press the SHIFT+SELECT Keys twice to return to the main online menu.

Selecting a PC from the File

1, 2, 3...

1. Press the NODE Key. The PC ID file selected above will be displayed on the screen.
2. There are two ways to select a PC:
   a) Move the cursor to the desired PC and press ENT. Use the Plus or Minus Keys to display the next or previous page.
   (If the selected file does not contain the desired PC or the memory card is not installed, the PC must be selected manually as described below.)
   b) Press the WRITE Key, input the network and node addresses manually, and press ENT. In this case, it is possible to enter 000 for both the network and node addresses to indicate the PC that is connected directly to the GPC.

Note If the selected PC is not in the network or is turned off, the message "OTHER NODE NOT IN NETWK," "NOT FOUND," or "COMMUNICATION ERR" will be displayed on the screen.

Valid Screens

A PC can be selected from the file when one of the following menus or screens is being displayed.

Online screens:

Main online menu
Program menu
Transmit menu
Error Log menu
I/O Monitor screen
Multibit Monitor screen

*Offline screens:

Main offline menu
Program menu

Note *If the PC is selected offline, the GPC will connect to that PC when the GPC is switched to online operation.

7-10 Error Log

This operation described in this section is used to display and clear the Error Log of the PC itself, the SYSMAC NET Link and SYSMAC LINK Units connected to the PC, or CPU Bus Units connected to the PC.

This operation is possible in any PC mode.

RUN	MONITOR	DEBUG	PROGRAM
OK	OK	OK	OK

7-10-1 Displaying the Error Log

1, 2, 3...

1. Select (0): Service PC from the main online menu.
2. Select (9): Error Log from the Service PC menu. The following menu will be displayed:

```
*** PC ERROR LOG ***
      ERROR DESCRIPTION              DETAIL                    TIME

      CPU SIOU SET ERR                  0 UNIT#          92/01/28 09:13:44
      I/O VERIFICATION ERR                               92/01/28 11:50:21
      CPU SIOU SET ERR                  0 UNIT#          92/01/28 11:50:21
      I/O VERIFICATION ERR                               92/01/28 12:11:57
      CPU SIOU SET ERR                  0 UNIT#          92/01/28 12:11:57
      FATAL SFC ERR                0003                  92/01/28 12:11:57
      I/O VERIFICATION ERR                               92/01/28 12:12:07
      CPU SIOU SET ERR                  0 UNIT#          92/01/28 12:12:07
      FATAL SFC ERR                0003                  92/01/28 12:12:07
      MEMORY ERR                   CARD TRANSFER ERR     92/01/31 17:35:03

        CONT
                                                          MON      CV - 32KW
```

3. Move the cursor to the Error Log you want to display.

The rest of the procedure for displaying the Error Log of a PC, SYSMAC NET Link Unit, or SYSMAC LINK Unit in the network is different from the procedure for CPU Bus Units.

PC, SYSMAC NET Link or SYSMAC LINK Unit

Follow the procedure below to display the Error Log of a PC, SYSMAC NET Link Unit, or SYSMAC LINK Unit in the network.

1, 2, 3...

1. Press the NODE Key. A menu will appear at the bottom of the screen.
2. To display the Error Log of the PC or unit* to which the GPC is connected, press 0 and ENT.

   To select another node in the network, press 1 and continue at step 3.
3. There are two ways to select a PC:
   a) Move the cursor to the desired PC and press ENT. Use the Plus or Minus Keys to display the next or previous page.
   (If the selected file does not contain the desired PC or the memory card is not installed, the PC must be selected manually as described below.)
   b) Press the WRITE Key, input the network and node addresses manually, and press ENT.

   The Error Log* will be displayed.

Note *Refer to the *CV500/CV1000 Operation Manual: Ladder* for details on the PC's Error Log. Refer to the particular unit's *System Manual* for details on the unit's Error Log.

CPU Bus Units

Follow the procedure below to display the Error Log of a CPU Bus Unit.

1, 2, 3...

1. Move the cursor to "CPU Bus Unit Error Log." An input area will appear at the bottom of the screen.
2. Input the unit number of the CPU Bus Unit (00 to 15) and press ENT To display the unit's Error Log.

   Refer to the unit's *System Manual* for details on the Error Log.

7-10-2 Clearing the Error Log

PC, SYSMAC NET Link or SYSMAC LINK Unit

Follow the procedure below to clear the Error Log of a PC, SYSMAC NET Link Unit, or SYSMAC LINK Unit in the network.

1, 2, 3...

1. Display the Error Log of the PC or unit according to the procedure above in *Displaying the Error Log.*
2. Press CTRL+ENT.

CPU Bus Units

Follow the procedure below to clear the Error Log of a CPU Bus Unit.

1, 2, 3...

1. Display the Error Log of the unit according to the procedure above in *Displaying the Error Log.*
2. Press CTRL+ENT.

7-11 File, Printing, and PC Setup Operations

File, printing, and PC Setup operations are the same as those performed offline expect for the following.

- EM files cannot be accessed.
- If the printing range is set to 0 (none) when using SFC, only the program for AC0000 will be printed.
- The PC Setup cannot be changed while the PC is in RUN mode.
- When the PC Setup is changed in online operations, it is not necessary to transfer the new settings because they are changed directly in the PC (but not in the GPC).

Refer to the page given for procedures.

Name	Possible in	Not possible in	Page
File Operations	Any PC mode	---	103
Printing	Any PC mode	---	106
PC Setup	MONITOR, DEBUG, or PROGRAM mode	RUN mode	112

SECTION 8
Error Processing

This section provides a list of error messages and probable causes of errors that can occur with the GPC.

Error Messages

The following table lists the error messages and probable causes of errors that can occur with the GPC.

Error message	Probable cause	Possible correction
ADDRESS OUT OF RANGE	Data beyond the highest address in the program has been read.	Check the address that was entered and reenter it correctly.
BATT ERR	Voltage has dropped in the GPC's battery.	Replace the battery.
BATTERY ERR	The battery isn't connected or it has expired.	Check the PC's battery and replace it if necessary.
CANNOT EXECUTE	The cursor is in the wrong position.	Reposition the cursor and execute again.
CANNOT READ	The trace data cannot be read because a trace is being executed in the PC.	Execute the read again after the trace has been completed or cancelled with the abort operation.
CARD BATTERY ERR (GPC)	Voltage has dropped in the battery of the Memory Card in the GPC.	Replace the battery.
CPU SIOU SET ERR	The unit number set on the CPU Bus Unit differs from the registered unit number.	Check the CPU Bus Unit in question.
CPU-BUS UNIT ERR	A parity error occurred during data transmission between a CPU Bus Unit and the PC.	Check the CPU Bus Unit in question.
CPU STANDBY	The start input terminals on the PC aren't connected.	Connect the start input terminals.
CPU BUS ERR	An error has occurred at the CPU bus.	Check the CPU bus.
CV SERIES ONLY	Cannot execute because the specified node is not a CV-series PC.	Check the selected PC name and the network address/node.
CYCLE TIME OVER	The cycle time has exceeded the maximum cycle time (cycle time monitoring time) set in the PC Setup.	Check the program.
DIFFERENT FILE TYPE	The indicated file was not made with the same function.	Check the file name and enter it correctly. DM, EM, and IOM files use the same ".IOM" file name extension, so be sure to differentiate between them in their file names.
DISPLAY OUT OF RANGE	The capacity of the edit screen has been exceeded. A single instruction block can be up to 22 lines long.	Check the program.
FAL EXECUTED	An FAL(006) instruction has been executed in the program. PC operation continues.	Check the program for the cause of the FAL(006) execution and correct if necessary.
FALS EXECUTED	An FALS(007) instruction has been executed in the program. PC stops.	Check the program for the cause of the FALS(007) execution and correct it.
FATAL SFC ERR	Program can't be executed because a fatal SFC error has occurred.	Check the SFC program.
FILE ACCESS ERR	The file couldn't be accessed (read/write). There was an error in the Memory Card or floppy disk. There was an error in the floppy disk drive. The Memory Card or floppy disk was removed while being accessed. The Memory Card or floppy disk hasn't been formatted.	Check the floppy disk being used matches the floppy disk format in the GPC System Setup. Make sure that the switches on the floppy disk drive are set correctly. Replace the Memory Card or floppy disk and create the read/write data again.
HEADER ERR	The indicated node does not exist in the SYSMAC LINK System.	Set a node that does exist.

Error message	Probable cause	Possible correction
INDIRECT DM ADDRESS NOT BCD	An indirect DM address that is not in BCD has occurred during program execution.	Check the data.
I/O BUS ERR	An error has occurred at the I/O bus.	Check connections between the CPU and I/O Units.
I/O SETTING ERR	The registered I/O table doesn't agree with the actual I/O Units installed. Input and Output Units might be mixed, Remote I/O Masters used incorrectly, or Optical I/O Units duplicated.	After verifying the I/O table online, either edit it or create it.
I/O VERIFICATION ERR	The registered I/O table doesn't agree with the actual I/O Units installed. Some planned I/O Units might not be installed yet.	After verifying the I/O table online, either edit it or create it.
INCORRECT NODE	Cannot execute because the indicated node isn't the polling unit.	Check the nodes in the network.
JUMP ERROR	A jump destination is missing.	Check the program.
LADDER ERR	The ladder diagram can't be saved with the "Store" operation. An instruction block with more than 22 lines can't be read as a ladder diagram.	Check the ladder diagram and correct it if necessary. If the instruction block exceeds 22 lines, it must be entered in mnemonics.
MEMORY ERR	There is an error in the program. There is an error in internal PC memory. There is an error in the Memory Card installed in the CPU.	Identify errant addresses in the program with the program check operation, correct the errors, and transfer the corrected program to the PC. Correct the data in the relevant memory locations. Verify that the Memory Card is properly installed. Correct the data in the relevant memory locations if necessary. Error locations can be identified from the error history.
MEMORY FULL	The data disk or Memory Card does not have sufficient capacity.	Use another floppy disk or Memory Card.
MODE ERR	The PC mode (RUN, MONITOR, or PROGRAM) is incorrect.	Set the correct PC mode as described in the Operation Manual.
NO ACCESS PERMISSION	Data cannot be written because data is being written from another device.	Write data when the other device has completed writing.
NO AREA TYPE	The indicated action/transition does not exist in program memory.	Check the program.
NO CORRESPONDING PROGRAM	The designated instruction is not in the program.	Check the designated instruction and input correctly.
NO DATA	The PC does not contain the indicated trace data.	The trace hasn't been executed; execute correctly.
NO END INSTRUCTION	The END(001) instruction is missing from the end of a ladder program when the change block operation was executed.	Write an END(001) instruction at the end of the program and save the new program.
NO FILE DEVICE	There isn't a Memory Card in the CPU, or a Memory Card isn't installed in the GPC. The GPC and floppy disk drive haven't been connected properly.	Install a Memory Card in the CPU or the GPC. Check the connections between the GPC and floppy disk drive. Also be sure that the floppy disk has been inserted properly.
NO INSTRUCTION	The timer or counter number indicated in the SV read operation is not in the program.	Check the timer or counter number that was indicated and reenter it correctly.

Error message	Probable cause	Possible correction
NO. OF ELEMENTS DIFFER	Cannot transfer because the size of the Memory Card file exceeds the size of the PC memory.	Check the size of the Memory Card file and indicate the correct file.
NO SETT	Cannot execute because some required data has not been set.	Set the required data and executed again.
NONFATAL SFC ERR	A non-fatal SFC error has occurred.	Check the SFC program.
NOT EXECUTABLE FROM SLAVE	Cannot execute because the GPC is connected to a Slave.	Execute again after connecting the GPC to a PC CPU.
NOT FOUND	The indicated comment can't be found. The indicated instruction is not in the program or the program contains only NOP(000) instructions.	Check the comment or instruction that was indicated and reenter it correctly.
NUMBER DUP ERR	Expansion I/O Rack numbers, CPU Bus Unit numbers, or I/O words allocated to I/O Units have been duplicated.	Check the rack numbers, unit numbers, and I/O word allocation in the PC System Setup.
OTHER NODE NOT IN NETWORK	The indicated node is not in the network.	Check which nodes are in the network.
PARAMETER ERROR	The parameters entered are incorrect.	Enter the correct parameters.
PARITY/CHECKSUM ERROR	A parity/checksum error has occurred in internal PC memory.	Write the program and PC Setup again.
PC MODE ERR	The PC mode (RUN, MONITOR, or PROGRAM) is incorrect.	Set the correct PC mode as described in the Operation Manual.
POWER OFF	Power to the PC was interrupted.	Check the PC's power supply and power supply lines.
PROGRAM ERR	PC program cannot be run because an error has occurred in the ladder program.	Check the program.
PROGRAM TYPE ERR	Cannot execute because the operation was selected with SFC and ladder programming.	Check the program contents. A host computer or FIT running CVSS (CV Support Software) must be used with SFC and ladder programs.
PROTECTED	The program area is protected.	Release program area protection using a host computer or FIT running CVSS.
READ ONLY	The Memory Card or floppy disk is write-protected. The Memory Card uses EEPROM or PROM.	Switch off the write protection. Use an SRAM Memory Card.
REQUIRED ITEM NOT SET	Trace cannot be executed because a required item has not been set.	Check the trace settings and execute again.
RUNNING, ILLEGAL OPR	The PC is in MONITOR or RUN mode.	Switch the PC to PROGRAM mode.
SAME DEVICE	The source node and the destination node are the same.	Check the source node and the destination node and execute again.
SETTING ERROR	Incorrect data was input or the wrong key was pressed.	Input the correct data or press the correct key.
SYSBUS ERR	An error has occurred in transmissions between a SYSMAC BUS System and the PC.	Check for problems such as loose cables.
SYSMAC BUS/2 ERR	An error has occurred in transmissions between a SYSMAC BUS/2 System and the PC.	Check for problems such as loose cables.
TOO MANY CMTS	The number of line comments has exceeded the maximum. The maximum allowed is 743 in the GPC, and 10,000 in a Memory Card.	Reduce the number of comments below the maximum.

Error message	Probable cause	Possible correction
TOO MANY I/O POINTS	The number of I/O Units has exceeded the maximum number allowed.	Reduce the number of I/O Units so that the number of I/O points used is below the maximum.
TOO MANY RELAY POINTS	There must not be more than 3 relay networks between the PC and the GPC.	Check the destination network address.
TOO SMALL	The memory capacity in the destination node is smaller than the data in the source node. (All of the program data cannot be transferred. Transfer only as much I/O comment or DM data as the destination node can contain.)	Check the size of the file or memory data to be transferred.
TRANSMISSION ERROR; STANDBY	The response to a transmitted command was not returned in time (response time-out.) An error has occurred in communications between the PC and GPC. The indicated node is not in the SYSMAC NET Link network.	Check the destination node. Check that cable connections are correct, the PC is ON, the System Setup is correct, etc. Enter the PC's network address/node correctly.
UNIT DOES NOT EXIST	The indicated Unit doesn't exist.	Check the I/O Unit and network configurations.
UNMONITORABLE OPERAND	Cannot display the contents of indirectly addressed Index Register, EM, or *EM words with I/O bit monitoring in the ladder diagram.	Monitor the contents of indirectly addressed Index Register, EM, or *EM words with I/O monitoring.
VERIFICATION ERROR	The compared data do not agree.	Check whether the indicated files are the same.
WDT ERR	A watchdog timer error has occurred due to noise or some other cause.	After eliminating the cause, turn the PC OFF and then ON.

Appendix A
Standard Models

Graphic Programming Console (GPC)

To use the GPC with a CV-series PC, you will need the GPC itself, a CV-series Memory Pack, and a CV-series Keysheet. You will also need a Memory Card Adapter if you want to use Memory Cards and a PC Connecting Cable to connect the GPC to the PC.

GPC (Main Unit)

Model	Operating voltage
C500-GPC03	100 VAC to 120 VAC
C500-GPC04	200 VAC to 240 VAC

PC Connecting Cable

Use one of the cables listed in the following table to connect the GPC to a CV500 or CV1000 PC. These cables are sold separately.

Cable length	Model
2 m	CV500-CN225
5 m	CV500-CN525

CV-series Keyboard Sheet

CV500-CKF01

Memory Card Adapter

CV500-MCA01

Peripheral Devices

Unit	Model
Printer Interface Unit	3G2A5-PRT01-E
Floppy Disk Interface Unit	3G2C5-FDI03-E

Printer Cable

SCY-CN201

Recommended Printer

Maker	Printer
Epson	FX-800 (#8148)

Replacement Parts

Part	Model
GPC Battery	3G2A9-BAT08
Memory Card Battery	HMC-BAT01

Appendix B
Specifications

Ratings

Item	3G2C5-GPC03-E	3G2C5-GPC04-E
Supply voltage	100 to 120 VAC, 50/60 Hz	200 to 240 VAC, 50/60 Hz
Operating voltage range	85 to 132 VAC	170 to 264 VAC
Power consumption	40 VA max.	
Insulation resistance	10 MΩ (at 500 VDC) between external terminals and outer casing	
Dielectric strength	1,500 VAC, 50/60Hz, for 1 min between external terminals and outer casing	
Noise immunity	1,000 V_{p-p}; Rising time: 1 ns; Pulse width: 100 to 1 μs	
Vibration resistance	16.7 Hz, 1-mm double amplitude 1 hr each in X, Y, and Z directions	
Shock resistance	10G 3 times each in X, Y, and Z directions	
Ambient temperature	Operating: 0°C to 45°C Storage: −15°C to 55°C	
Ambient humidity	35% to 85%	
Ambient atmosphere	Must be free from corrosive gasses	
Weight	2.7 kg with Memory Cassette, 2.9 kg with Memory Cassette and Memory Card Adapter	
Dimensions	300 x 70 x 215.5 mm (WxHxD) (300 x 71 x 237 mm with Memory Card Adapter	

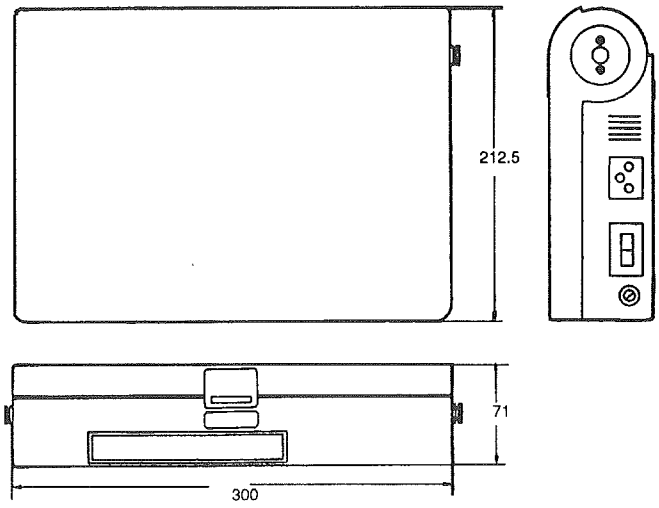
Characteristics

Item	3G2C5-GPC03-E/3G2C5-GPC04-E
Programming capacity	GPC memory: 32K words Memory Cards: 64K words each for 128K-byte cards
Applicable PCs	CV500 and CV1000
Peripheral Devices	The following C-series Devices (CRT Interface Unit and PROM Writer cannot be used): Printer Interface Unit Floppy Disk Interface Unit
Display device	LCD module (480 x 128 dots)
Displays	Horizontal: 1 to 9 conditions plus one output or special instruction (instruction and all operands displayed on same line) Vertical: 4 instruction line (rungs) and 4 lines of comments Maximum instruction block for ladder diagrams: 22 lines (longer if manipulated in mnemonic form)
Display characters	Alphanumerics and ladder diagram symbols
Cursor	Round dot
Controls	Flat keyboard with 70 keys
Operation confirmation	Valid keys: Buzzer sounds once Invalid keys: Buzzer sounds 3 times
GPC memory backup battery life	5 yrs. at 25°C; 1 yr at 50°C

Dimensions

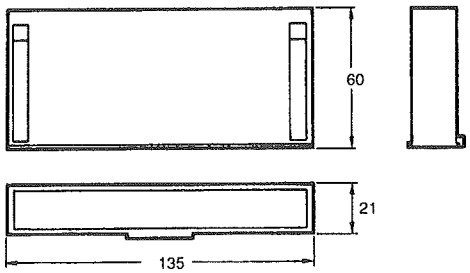
All dimensions are in millimeters.

3G2C5-GPC03-E/04-E



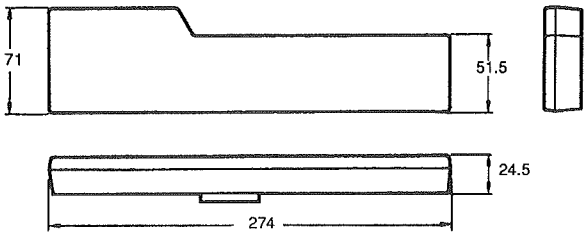
Weight: 2.7 kg

CV500-MP311



Weight: 125 g

CV500-MCA01



Weight: 210 g

Glossary

action — In SFC programs, the individual executable elements in an action block. An action can be defined either as a ladder diagram or as a single bit in memory.

Action Area — A memory area that contains flags that indicate when actions are active.

action block — A collection of all the actions for a single step in an SFC program. Each action is accompanied by its action qualifier, set value, and feedback variable.

action number — A number assigned to an action. Each action has a unique number. These numbers are used to access and to control the status of the action.

action program — A ladder diagram program written to define an action.

action qualifier — A designation made for a action to control when the action is to be executed in respect to the status of the step.

active status — One of the two main statuses that a step can be in. Active status includes pause, halt, and execute status.

active step — A step that is in either pause, halt, or execute status. There can be more than one active step.

address — A number used to identify the location of data or programming instructions in memory or to identify the location of a node on a network.

allocation — The process by which the PC assigns certain bits or words in memory for various functions. This includes pairing I/O bits to I/O points on Units.

analog — Something that represents or can process a continuous range of values as opposed to values that can be represented in distinct increments. Something that represents or can process values represented in distinct increments is called digital.

Analog I/O Unit — I/O Units that convert I/O between analog and digital values. An Analog Input Input converts an analog input to a digital value for processing by the PC. An Analog Output Unit converts a digital value to an analog output.

AND — A logic operation whereby the result is true if and only if both premises are true. In ladder-diagram programming the premises are usually ON/OFF states of bits or the logical combination of such states called execution conditions.

AQ — See *action qualifier.*

area prefix — A one or two letter prefix used to identify a memory area in the PC. All memory areas except the CIO area require prefixes to identify addresses in them.

ASCII — Short for American Standard Code for Information Interchange. ASCII is used to code characters for output to printers and other external devices.

asynchronous execution — Execution of programs and servicing operations in which program execution and servicing are not synchronized with each other.

Auxiliary Area — A PC data area allocated to flags and control bits.

auxiliary bit — A bit in the Auxiliary Area.

back-up — A copy made of existing data to ensure that the data will not be lost even if the original data is corrupted or erased.

bank — One of multiple sections of a storage area for data or settings. The EM Area is divided into banks each of which is accessed using the same addresses, but different bank numbers.

BASIC — A common programming language. BASIC Units are programmed in BASIC.

Basic Rack — Any of the following Racks: CPU Rack, Expansion CPU Rack, or Expansion I/O Rack.

BASIC Unit — A CPU Bus Unit used to run programs in BASIC.

baud rate — The data transmission speed between two devices in a system measured in bits per second.

BCD — Short for binary-coded decimal.

binary — A number system where all numbers are expressed in base 2, i.e., numbers are written using only 0's and 1's. Each group of four binary bits is equivalent to one hexadecimal digit. Binary data in memory is thus often expressed in hexadecimal for convenience.

binary-coded decimal — A system used to represent numbers so that every four binary bits is numerically equivalent to one decimal digit.

bit — The smallest piece of information that can be represented on a computer. A bit has the value of either zero or one, corresponding to the electrical signals ON and OFF. A bit represents one binary digit. Some bits at particular addresses are allocated to special purposes, such as holding the status of input from external devices, while other bits are available for general use in programming.

bit address — The location in memory where a bit of data is stored. A bit address specifies the data area and word that is being addressed as well as the number of the bit within the word.

bit number — A number that indicates the location of a bit within a word. Bit 00 is the rightmost (least-significant) bit; bit 15 is the leftmost (most-significant) bit.

block — See *logic block* and *instruction block*.

block comment — A comment placed in a ladder diagrams that provides user information on an instruction block.

branching — In SFC programs, a means of controlling program flow so that one step leads to two or more steps. See *conditional branch* and *parallel branch*.

buffer — A temporary storage space for data in a computerized device.

building-block PC — A PC that is constructed from individual components, or "building blocks." With building-block PCs, there is no one Unit that is independently identifiable as a PC. The PC is rather a functional assembly of Units.

bus — A communications path used to pass data between any of the Units connected to it.

bus bar The line leading down the left and sometimes right side of a ladder diagram. Instruction execution proceeds down the bus bar, which is the starting point for all instruction lines.

bus link A data link that passed data between two Units across a bus.

byte A unit of data equivalent to 8 bits, i.e., half a word.

central processing unit A device that is capable of storing programs and data, and executing the instructions contained in the programs. In a PC System, the central processing unit executes the program, processes I/O signals, communicates with external devices, etc.

channel See *word*.

character code A numeric (usually binary) code used to represent an alphanumeric character.

checksum A sum transmitted with a data pack in communications. The checksum can be recalculated from the received data to confirm that the data in the transmission has not been corrupted.

CIO Area A memory area used to control I/O and to store and manipulate data. CIO Area addresses do not require prefixes.

common (link) parameter table A table of settings in a SYSMAC LINK System that specifies what words are to be used in the data links for all PCs in the SYSMAC LINK System. See *refresh parameter table*.

common data Data that is stored in a memory of a PC and which is shared by other PCs in the same the same system. Each PC has a specified section(s) of the area allocated to it. Each PC writes to the section(s) allocated to it and reads the sections allocated to the other PCs with which it shares the common data.

Completion Flag A flag used with a timer or counter that turns ON when the timer has timed out or the counter has reached its set value.

condition A symbol placed on an instruction line to indicate an instruction that controls the execution condition for the terminal instruction. Each condition is assigned a bit in memory that determines its status. The status of the bit assigned to each condition determines the next execution condition. Conditions correspond to LOAD, LOAD NOT, AND, AND NOT, OR, or OR NOT instructions.

conditional branch A branch in an SFC program where one step is connected to multiple steps but the active status can be transferred to only one step at a time.

conditional join In an SFC program, a location where multiple steps coming from the same conditional branch return to a single step.

constant An input for an operand in which the actual numeric value is specified. Constants can be input for certain operands in place of memory area addresses. Some operands must be input as constants.

control bit A bit in a memory area that is set either through the program or via a Programming Device to achieve a specific purpose, e.g., a Restart Bit is turned ON and OFF to restart a Unit.

control signal A signal sent from the PC to effect the operation of the controlled system.

Control System — All of the hardware and software components used to control other devices. A Control System includes the PC System, the PC programs, and all I/O devices that are used to control or obtain feedback from the controlled system.

controlled system — The devices that are being controlled by a PC System.

count pulse — The signal counted by a counter.

counter — A dedicated group of digits or words in memory used to count the number of times a specific process has occurred, or a location in memory accessed through a TC bit and used to count the number of times the status of a bit or an execution condition has changed from OFF to ON.

CPU — See *central processing unit.*

CPU Bus Unit — A special Unit used with CV-series PCs that mounts to the CPU bus. This connection to the CPU bus enables special data links, data transfers, and processing.

CPU Rack — The main Rack in a building-block PC, the CPU Rack contains the CPU, a Power Supply, and other Units. The CPU Rack, along with the Expansion CPU Rack, provides both an I/O bus and a CPU bus.

C-series PC — Any of the following PCs: C2000H, C1000H, C500, C200H, C40H, C28H, C20H, C60K, C60P, C40K, C40P, C28K, C28P, C20K, C20P, C120, or C20.

custom data area — A data area defined by the user within the CIO Area. Custom data areas can be set from the CVSS and certain other Programming Devices.

CV Support Software — A programming package run on an IBM PC/AT or compatible to serve as a Programming Device for CV-series PCs.

CV-mode — A form of communications useable only with CV-series PCs. See *C-mode.*

CV-series PC — Either of the following PCs: CV500 or CV1000.

CVSS — See *CV Support Software.*

cycle — One unit of processing performed by the CPU, including SFC/ladder program execution, peripheral servicing, I/O refreshing, etc. The cycle is called the scan with C-series PCs.

cycle time — The time required to complete one cycle of CPU processing.

cyclic interrupt — See *scheduled interrupt.*

DAC — See *Data Access Console.*

Data Access Console — A Programming Device used to monitor and control memory area contents. The Data Access Console does not afford the wide range of programming capabilities as the GPC or CVSS and is designed for system monitoring and maintenance.

data area — An area in the PC's memory that is designed to hold a specific type of data.

data area boundary — The highest address available within a data area. When designating an operand that requires multiple words, it is necessary to ensure that the highest address in the data area is not exceeded.

data disk A disk that is used to store user data.

data length In communications, the number of bits that is to be treated as one unit in data transmissions.

data link An automatic data transmission operation that allows PCs or Units within PC to pass data back and forth via common data areas.

data link area A common data area established through a data link.

data link table A table of settings kept in memory that specifies what words are to be part of a data link for all PCs involved in the link.

data register A storage location in memory used to hold data. In CV-series PCs, data registers are used with or without index registers to hold data used in indirect addressing.

data trace A process in which changes in the contents of specific memory locations are recorded during program execution.

data transfer Moving data from one memory location to another, either within the same device or between different devices connected via a communications line or network.

debug A process by which a draft program is corrected until it operates as intended. Debugging includes both the removal of syntax errors, as well as the fine-tuning of timing and coordination of control operations.

DEBUG mode A mode of PC operation which enables basic debugging of user programs.

decimal A number system where numbers are expressed to the base 10. In a PC all data is ultimately stored in binary form, four binary bits are often used to represent one decimal digit, via a system called binary-coded decimal.

decrement Decreasing a numeric value, usually by 1.

default A value automatically set by the PC when the user does not specifically set another value. Many devices will assume such default conditions upon the application of power.

definer A number used as an operand for an instruction but that serves to define the instruction itself, rather that the data on which the instruction is to operate. Definers include jump numbers, subroutine numbers, etc.

destination The location where an instruction places the data on which it is operating, as opposed to the location from which data is taken for use in the instruction. The location from which data is taken is called the source.

differentiated instruction An instruction that is executed only once each time its execution condition goes from OFF to ON. Non-differentiated instructions are executed for each scan as long as the execution condition stays ON.

differentiation instruction An instruction used to ensure that the operand bit is never turned ON for more than one scan after the execution condition goes either from OFF to ON for a Differentiate Up instruction or from ON to OFF for a Differentiate Down instruction.

digit A unit of storage in memory that consists of four bits.

DIP switch Dual in-line package switch, an array of pins in a signal package that is mounted to a circuit board and is used to set operating parameters.

distributed control A automation concept in which control of each portion of an automated system is located near the devices actually being controlled, i.e., control is decentralized and 'distributed' over the system. Distributed control is a concept basic to PC Systems.

DM Area A data area used to hold only word data. Words in the DM area cannot be accessed bit by bit.

DM word A word in the DM Area.

downloading The process of transferring a program or data from a higher-level or host computer to a lower-level or slave computer. If a Programming Device is involved, the Programming Device is considered the host computer.

DR See *data register.*

dummy step A step in an SFC program that contains no actions, such as one used to transfer execution to a subroutine.

EEPROM Electrically erasable programmable read-only memory; a type of ROM in which stored data can be erased and reprogrammed. This is accomplished using a special control lead connected to the EEPROM chip and can be done without having to remove the EEPROM chip from the device in which it is mounted.

electrical noise Random variations of one or more electrical characteristics such as voltage, current, and data, which might interfere with the normal operation of a device.

EM Area Extended Data Memory Area; an area that can be optionally added to the CV1000H to enable greater data storage. Functionally, the EM Area operates like the DM Area. Area addresses are prefixes with E and only words can be accessed. The EM Area is separated into multiple banks.

entry step A step in SFC programming that begins a subchart or interrupt program.

entry terminal A triangular symbol in SFC programming that comes before the entry step in a subchart or interrupt program.

EPROM Erasable programmable read-only memory; a type of ROM in which stored data can be erased, by ultraviolet light or other means, and reprogrammed.

error code A numeric code generated to indicate that an error exists, and something about the nature of the error. Some error codes are generated by the system; others are defined in the program by the operator.

Error Log Area An area in System DM that is used to store records indicating the time and nature of errors that have occurred in the system.

even parity A communication setting that adjusts the number of ON bits so that it is always even. See *parity.*

event processing Processing that is performed in response to an event, e.g., an interrupt signal.

execution condition The ON or OFF status under which an instruction is executed. The execution condition is determined by the logical combination of conditions on the same instruction line and up to the instruction currently being executed.

execution cycle The cycle used to execute all processes required by the CPU, including program execution, I/O refreshing, peripheral servicing, etc.

execution time — The time required for the CPU to execute either an individual instruction or an entire program.

Expansion CPU Rack — A Rack connected to the CPU Rack to increase the virtual size of the CPU Rack. Units that may be mounted to the CPU Backplane may also be mounted to the Expansion CPU Backplane.

Expansion I/O Rack — A Rack used to increase the I/O capacity of a PC. In CV-Series PC, either one Expansion I/O Rack can be connected directly to the CPU or Expansion CPU Rack or multiple Expansion I/O Racks can be connected by using an I/O Control and I/O Interface Units.

FA — Factory automation.

factory computer — A general-purpose computer, usually quite similar to a business computer, that is used in automated factory control.

FAL error — An error generated from the user program by execution of an FAL(006) instruction.

FALS error — An error generated from the user program by execution of an FALS(007) instruction or an error generated by the system.

FAT — File Allocation Table. This is an area of a floppy or hard disk which contains information about the location of the files on the disk.

fatal error — An error that stops PC operation and requires correction before operation can continue.

fatal SFC error — An error in SFC programming that makes further program execution impossible.

FCS — See *frame checksum*.

feedback variable — One of the input fields in an action block in a SFC program. Memory area addresses can be input for feedback variables as desired by the user, but do not affect operation in any way.

file directory — A list of the files on a floppy or hard disk.

filename extension — The portion of a filename after the period. The extension can be no longer than 3 characters. It is usually used to indicate the type of the file (e.g. BAS indicates files containing BASIC programs, and DAT indicates files containing data).

FINS — See *CV-mode*.

flag — A dedicated bit in memory that is set by the system to indicate some type of operating status. Some flags, such as the carry flag, can also be set by the operator or via the program.

force reset — The process of forcibly turning OFF a bit via a programming device. Bits are usually turned OFF as a result of program execution.

force set — The process of forcibly turning ON a bit via a programming device. Bits are usually turned ON as a result of program execution.

forced status — The status of bits that have been force reset or force set.

frame checksum — The results of exclusive ORing all data within a specified calculation range. The frame checksum can be calculated on both the sending and receiving end of a data transfer to confirm that data was transmitted correctly.

function code — A two-digit number used to input an instruction into the PC.

FV — See *feedback variable.*

GPC — An acronym for Graphic Programming Console.

Graphic Programming Console — A programming device with advanced programming and debugging capabilities to facilitate PC operation. A Graphic Programming Console is provided with a large display onto which ladder-diagram programs can be written directly in ladder-diagram symbols for input into the PC without conversion to mnemonic form.

guidance display — Messages that appear on-screen to aid the operator.

halt — One of the three active statuses of steps in an SFC program. Steps in halt status are not executed.

hardware error — An error originating in the hardware structure (electronic components) of the PC, as opposed to a software error, which originates in software (i.e., programs).

hexadecimal — A number system where all numbers are expressed to the base 16. In a PC all data is ultimately stored in binary form, however, displays and inputs on Programming Devices are often expressed in hexadecimal to simplify operation. Each group of four binary bits is numerically equivalent to one hexadecimal digit.

hold bit — A bit in memory designated to maintain status when the PC's operating mode is changed or power is turned off and then back on.

hold Rack — A Rack designated to maintain output status when the PC's operating mode is changed or power is turned off and then back on.

holding area — Words in memory designated to maintain status when the PC's operating mode is changed or power is turned off and then back on.

host computer — A computer that is used to transfer data to or receive data from a PC in a Host Link system. The host computer is used for data management and overall system control. Host computers are generally small personal or business computers.

host interface — An interface that allows communications with a host computer.

Host Link System — A system with one or more host computers connected to one or more PCs via Host Link Units or host interfaces so that the host computer can be used to transfer data to and from the PC(s). Host Link Systems enable centralized management and control of PC Systems.

Host Link Unit — An interface used to connect a C-series PC to a host computer in a Host Link System.

I/O allocation — The process by which the PC assigns certain bits in memory for various functions. This includes pairing I/O bits to I/O points on Units.

I/O bit — A bit in memory used to hold I/O status. Input bits reflect the status of input terminals; output bits hold the status for output terminals.

I/O Block — Either an Input Block or an Output Block. I/O Blocks provide mounting positions for replaceable relays.

I/O capacity The number of inputs and outputs that a PC is able to handle. This number ranges from around one hundred for smaller PCs to two thousand for the largest ones.

I/O comment A comment in a program that is related to the use of operands.

I/O Control Unit A Unit mounted to the CPU Rack to monitor and control I/O points on Expansion CPU Racks or Expansion I/O Racks.

I/O delay The delay in time from when a signal is sent to an output to when the status of the output is actually in effect or the delay in time from when the status of an input changes until the signal indicating the change in the status is received.

I/O device A device connected to the I/O terminals on I/O Units, Special I/O Units, etc. I/O devices may be either part of the Control System, if they function to help control other devices, or they may be part of the controlled system.

I/O Interface Unit A Unit mounted to an Expansion CPU Rack or Expansion I/O Rack to interface the Rack to the CPU Rack.

I/O interrupt An interrupt generated by a signal from I/O.

I/O interrupt entry terminal An entry terminal for an I/O interrupt program.

I/O interrupt return terminal A return terminal for an I/O interrupt program.

I/O point The place at which an input signal enters the PC System, or at which an output signal leaves the PC System. In physical terms, I/O points correspond to terminals or connector pins on a Unit; in terms of programming, an I/O points correspond to I/O bits in the IR area.

I/O refreshing The process of updating output status sent to external devices so that it agrees with the status of output bits held in memory and of updating input bits in memory so that they agree with the status of inputs from external devices.

I/O response time The time required for an output signal to be sent from the PC in response to an input signal received from an external device.

I/O table A table created within the memory of the PC that lists the I/O words allocated to each Unit in the PC System. The I/O table can be created by, or modified from, a Programming Device.

I/O Terminal A Remote I/O Unit connected in a Wired Remote I/O System to provide a limited number of I/O points at one location. There are several types of I/O Terminals.

I/O Unit The most basic type of Unit mounted to a Backplane. I/O Units include Input Units and Output Units, each of which is available in a range of specifications. I/O Units do not include Special I/O Units, Link Units, etc.

I/O verification error A error generated by a disagreement between the Units registered in the I/O table and the Units actually mounted to the PC.

I/O word A word in the CIO area that is allocated to a Unit in the PC System and is used to hold I/O status for that Unit.

IBM PC/AT or compatible A computer that has similar architecture to, that is logically compatible with, and that can run software designed for an IBM PC/AT computer.

immediate refreshing A form of I/O refreshing that is executed by certain types of instruction when the instruction is executed to ensure that the most current input status is used for an operand or to ensure that an output is effective immediately.

inactive status The status of a step in an SFC program in which the actions within that step are not executed, with the exception of any actions with action qualifiers that extend execution beyond active status. Inactive status also enables a step to go into active status provided other conditions are met.

increment Increasing a numeric value, using by 1.

index register A data storage location used with or without a data register in indirect addressing.

initial step A step that automatically goes to active status when SFC program execution is begun.

initialize Part of the startup process whereby some memory areas are cleared, system setup is checked, and default values are set.

input The signal coming from an external device into the PC. The term input is often used abstractly or collectively to refer to incoming signals.

input bit A bit in the CIO area that is allocated to hold the status of an input.

Input Block A Unit used in combination with a Remote Interface to create an I/O Terminal. An Input Block provides mounting positions for replaceable relays. Each relay can be selected according to specific input requirements.

input device An external device that sends signals into the PC System.

input point The point at which an input enters the PC System. Input points correspond physically to terminals or connector pins.

input signal A change in the status of a connection entering the PC. Generally an input signal is said to exist when, for example, a connection point goes from low to high voltage or from a nonconductive to a conductive state.

Input Terminal An I/O Terminal that provides input points.

instruction A direction given in the program that tells the PC of the action to be carried out, and the data to be used in carrying out the action. Instructions can be used to simply turn a bit ON or OFF, or they can perform much more complex actions, such as converting and/or transferring large blocks of data.

instruction block A group of instructions that is logically related in a ladder-diagram program. A logic block includes all of the instruction lines that interconnect with each other from one or more line connecting to the left bus bar to one or more righthand instructions connecting to the right bus bar.

instruction execution time The time required to execute an instruction. The execution time for any one instruction can vary with the execution conditions for the instruction and the operands used in it.

instruction line A group of conditions that lie together on the same horizontal line of a ladder diagram. Instruction lines can branch apart or join together to form instruction blocks. Also called a rung.

interface — An interface is the conceptual boundary between systems or devices and usually involves changes in the way the communicated data is represented. Interface devices such as NSBs perform operations like changing the coding, format, or speed of the data.

intermediate code — A coding form for programs that is partway between the user-written code and machine language code.

intermediate instruction — An instruction other than one corresponding to a condition that appears in the middle of an instruction line and requires at least one more instruction between it and the right bus bar.

interrupt (signal) — A signal that stops normal program execution and causes a subroutine to be run or other processing to take place.

Interrupt Input Unit — A Rack-mounting Unit used to input external interrupts into a PC System.

interrupt program — A program that is executed in response to an interrupt.

inverse condition — See *normally closed condition.*

IOIF — An acronym for I/O Interface Unit.

IOM (Area) — A collective memory area containing all of the memory areas that can be accessed by bit, including timer and counter Completion Flags. The IOM Area includes all memory area memory addresses between 0000 and 0FFF.

JIS — An acronym for Japanese Industrial Standards.

joining — A process used in SFC programs to return execution from steps on multiple branch lines to a single step.

jump — A type of programming where execution moves directly from one point in a program to another, without sequentially executing any instructions in between. Jumps in ladder diagrams are usually conditional on an execution condition; jumps in SFC programs are conditional on the step status and transition condition status before the jump.

jump number — A definer used with a jump that defines the points from and to which a jump is to be made.

Kanji character — A character in one of the three sets of characters used to write the Japanese language

ladder diagram (program) — A form of program arising out of relay-based control systems that uses circuit-type diagrams to represent the logic flow of programming instructions. The appearance of the program is similar to a ladder, and thus the name.

ladder diagram symbol — A symbol used in drawing a ladder-diagram program.

leading zero — One of one or more consecutive zeros in the leftmost digits of an address or numeric value.

LED — Acronym for light-emitting diode; a device used as for indicators or displays.

leftmost (bit/word) — The highest numbered bits of a group of bits, generally of an entire word, or the highest numbered words of a group of words. These bits/words are often called most-significant bits/words.

link — A hardware or software connection formed between two Units. "Link" can refer either to a part of the physical connection between two Units or a software connection created to data existing at another location (i.e., data links).

Link Area — A data area that is designed for use in data links.

link parameter table — See *common link parameter table.*

Link System — A system used to connect remote I/O or to connect multiple PCs in a network. Link Systems include the following: SYSMAC BUS Remote I/O Systems, SYSMAC BUS/2 Remote I/O Systems, SYSMAC LINK Systems, Host Link Systems, and SYSMAC NET Link Systems.

Link Unit — Any of the Units used to connect a PC to a Link System. These include Remote I/O Units, SYSMAC LINK Units, and SYSMAC NET Link Units.

load — The processes of copying data either from an external device or from a storage area to an active portion of the system such as a display buffer. Also, an output device connected to the PC is called a load.

local network table — A table that specifies all of the networks that a PC belongs to and the unit numbers of the Units connecting the PC to each of these networks.

logic block — A group of instructions that is logically related in a ladder-diagram program and that requires logic block instructions to relate it to other instructions or logic blocks.

logic block instruction — An instruction used to locally combine the execution condition resulting from a logic block with a current execution condition. The current execution condition could be the result of a single condition, or of another logic block. AND Load and OR Load are the two logic block instructions.

loop-back — The processes of using an alternate communications path that runs in the reverse direction of the normal communications path to prevent communications from being disabled when communications along the normal path are not possible.

machine code — The binary program code that is actual executed by a CPU.

machine language — A programming language in which the program is written directly into machine code.

main program — All of a program except for subroutine and interrupt programs.

mark trace — A process in which changes in the contents of specific memory locations are recorded during program execution using MARK (174) instructions.

masked bit — A bit whose status has been temporarily made ineffective.

masking — 'Covering' an interrupt signal so that the interrupt is not effective until the mask is removed.

Master — Short for Remote I/O Master Unit.

master — In a SYSMAC NET Link System, a Unit specified to manage network communications.

master number — A number assigned to a master in a SYSMAC NET Link System. This number is different from the unit number.

MCR Unit Magnetic Card Reader Unit.

megabyte A unit of storage equal to one million bytes.

memory area Any of the areas in the PC used to hold data or programs.

memory card A data storage media similar to a floppy disk.

memory switch A bit or bits in memory that are used to set operating parameters similar to the way a hardware switch would be.

message number A number assigned to a message generated with the MSG(195) instruction.

mnemonic code A form of a ladder-diagram program that consists of a sequential list of the instructions without using a ladder diagram.

MONITOR mode A mode of PC operation in which normal program execution is possible, and which allows modification of data held in memory. Used for monitoring or debugging the PC.

most-significant (bit/word) See *leftmost (bit/word).*

MS-DOS An operating system in common use on smaller computers.

NC input An input that is normally closed, i.e., the input signal is considered to be present when the circuit connected to the input opens.

negative delay A delay set for a data trace in which recording data begins before the trace signal by a specified amount.

nesting Programming one loop within another loop, programming a call to a subroutine within another subroutine, or programming an IF–ELSE programming section within another IF–ELSE section.

Network Service Board A device with an interface to connect devices other than PCs to a SYSMAC NET Link System.

Network Service Unit A Unit that provides two interfaces to connect peripheral devices to a SYSMAC NET Link System.

network support table Tables of settings used to establish operating parameters for SYSMAC LINK and SYSMAC NET Link Systems.

NO input An input that is normally open, i.e., the input signal is considered to be present when the circuit connected to the input closes.

node One of the positions in a LAN. Each node incorporates a device that can communicate with the devices at all of the other nodes. The device at a node is identified by the node address.

noise interference Disturbances in signals caused by electrical noise.

nonfatal error A hardware or software error that produces a warning but does not stop the PC from operating.

non-fatal SFC error An error in SFC programming that does not make further program execution impossible, but that may be an indication of a problem in programming.

normal condition — See *normally open condition.*

normally closed condition — A condition that produces an ON execution condition when the bit assigned to it is OFF, and an OFF execution condition when the bit assigned to it is ON.

normally open condition — A condition that produces an ON execution condition when the bit assigned to it is ON, and an OFF execution condition when the bit assigned to it is OFF.

NOT — A logic operation which inverts the status of the operand. For example, AND NOT indicates an AND operation with the opposite of the actual status of the operand bit.

object code — The code that a program is converted to before actual execution. See *source code.*

octal — A number system where all numbers are expressed in base 8, i.e., numbers are written using only numerals 0 through 7.

odd parity — A communications setting that adjusts the number of ON bits so that it is always odd. See *parity.*

OFF — The status of an input or output when a signal is said not to be present. The OFF state is generally represented by a low voltage or by non-conductivity, but can be defined as the opposite of either.

OFF delay — The delay between the time when a signal is switched OFF (e.g., by an input device or PC) and the time when the signal reaches a state readable as an OFF signal (i.e., as no signal) by a receiving party (e.g., output device or PC).

offline — The state in which a Programming Device is not functionally connected to the CPU, although it may be connected physically.

offset — A positive or negative value added to a base value such as an address to specify a desired value.

ON — The status of an input or output when a signal is said to be present. The ON state is generally represented by a high voltage or by conductivity, but can be defined as the opposite of either.

ON delay — The delay between the time when an ON signal is initiated (e.g., by an input device or PC) and the time when the signal reaches a state readable as an ON signal by a receiving party (e.g., output device or PC).

online — The state in which a Programming Device is functionally connected to the CPU so that CPU data and programs can be monitored or accessed.

on-line removal — Removing a Rack-mounted Unit for replacement or maintenance during PC operation.

operand — The values designated as the data to be used for an instruction. An operand can be input as a constant expressing the actual numeric value to be used or as an address to express the location in memory of the data to be used.

operand bit — A bit designated as an operand for an instruction.

operand word — A word designated as an operand for an instruction.

operating error — An error that occurs during actual PC operation as opposed to an initialization error, which occurs before actual operations can begin.

optical cable link — In a Wired Remote I/O System, an optical cable connecting two Converting Link Adapters.

optical communications — A communications method in which signals are sent over optical fiber cable to prevent noise interference and increase transmission distance.

Optical I/O Unit — A Unit that is connected in an Optical Remote I/O System to provide 8 I/O points. Optical I/O Units are not mounted to a Rack.

Optical Master — Short for Optical Remote I/O Master Unit.

Optical Slave Rack — A Slave Rack connected through an Optical Remote I/O Slave Unit.

OR — A logic operation whereby the result is true if either of two premises is true, or if both are true. In ladder-diagram programming the premises are usually ON/OFF states of bits or the logical combination of such states called execution conditions.

output — The signal sent from the PC to an external device. The term output is often used abstractly or collectively to refer to outgoing signals.

output bit — A bit in the IR area that is allocated to hold the status to be sent to an output device.

Output Block — A Unit used in combination with a Remote Interface to create an I/O Terminal. An Output Block provides mounting positions for replaceable relays. Each relay can be selected according to specific output requirements.

output device — An external device that receives signals from the PC System.

output point — The point at which an output leaves the PC System. Output points correspond physically to terminals or connector pins.

output signal — A signal being sent to an external device. Generally an output signal is said to exist when, for example, a connection point goes from low to high voltage or from a nonconductive to a conductive state.

Output Terminal — An I/O Terminal that provides output points.

overflow — The state where the capacity of a data storage location has been exceeded.

overwrite — Changing the content of a memory location so that the previous content is lost.

parallel branch — A branch in an SFC program where one step is connection to multiple steps and the active status must be transferred to all of the steps.

parallel join — In an SFC program, a location where multiple steps coming from the same parallel branch return to a single step.

Parameter Area — A part of System DM used to designate various PC operating parameters.

Parameter Backup Area — A part of System DM used to back up the Parameter Area.

parity — Adjustment of the number of ON bits in a word or other unit of data so that the total is always an even number or always an odd number. Parity is generally used to check the accuracy of data after being transmitted by confirming that the number of ON bits is still even or still odd.

parity check Checking parity to ensure that transmitted data has not been corrupted.

pause One of the three active statuses of steps in an SFC program. Steps in pause status are not executed.

PC An acronym for Programmable Controller.

PC configuration The arrangement and interconnections of the Units that are put together to form a functional PC.

PC System With building-block PCs, all of the Racks and independent Units connected directly to them up to, but not including the I/O devices. The boundaries of a PC System are the PC and the program in its CPU at the upper end; and the I/O Units, Special I/O Units, Optical I/O Units, Remote Terminals, etc., at the lower end.

PCB An acronym for printed circuit board.

PC Setup A group of operating parameters set in the PC from a Programming Device to control PC operation.

Peripheral Device Devices connected to a PC System to aid in system operation. Peripheral devices include printers, programming devices, external storage media, etc.

peripheral servicing Processing signals to and from peripheral devices, including refreshing, communications processing, interrupts, etc.

PID Unit A Unit designed for PID control.

polling The process whereby a devices consecutively sends signals to other devices in the same network to pass data back and forth, e.g., as in a data link.

positive delay A delay set for a data trace in which recording data begins after the trace signal by a specified amount.

positive loop The normal loop used for communications. See *negative loop.*

power-off interrupt An interrupt executed when power to the PC is turned off.

power-on interrupt An interrupt executed when power to the PC is turned on.

present value The current value registered in a device at any instant during its operation. Present value is abbreviated as PV. The use of this term is generally restricted to timers and counters.

printed circuit board A board onto which electrical circuits are printed for mounting into a computer or electrical device.

PROGRAM mode A mode of operation that allows inputting and debugging of programs to be carried out, but that does not permit normal execution of the program.

Programmable Controller A computerized device that can accept inputs from external devices and generate outputs to external devices according to a program held in memory. Programmable Controllers are used to automate control of external devices. Although single-unit Programmable Controllers are available, building-block Programmable Controllers are constructed from separate components. Such Programmable Controllers are formed only when enough of these separate components are assembled to form a functional assembly, i.e., there is no one individual Unit called a PC.

programmed alarm — An alarm given as a result of execution of an instruction designed to generate the alarm in the program, as opposed to one generated by the system.

programmed error — An error arising as a result of the execution of an instruction designed to generate the error in the program, as opposed to one generated by the system.

programmed message — A message generated as a result of execution of an instruction designed to generate the message in the program, as opposed to one generated by the system.

Programming Console — The simplest form or programming device available for a PC. Programming Consoles are available both as hand-held models and as CPU-mounting models.

Programming Device — A Peripheral Device used to input a program into a PC or to alter or monitor a program already held in the PC. There are dedicated programming devices, such as Programming Consoles, and there are non-dedicated devices, such as a host computer.

PROM — Programmable read-only memory; a type of ROM into which the program or data may be written after manufacture, by a customer, but which is fixed from that time on.

PROM Writer — A peripheral device used to write programs and other data into a ROM for permanent storage and application.

prompt — A message or symbol that appears on a display to request input from the operator.

protocol — The parameters and procedures that are standardized to enable two devices to communicate or to enable a programmer or operator to communicate with a device.

PV — See *present value*.

Rack — An assembly that forms a functional unit in a Rack PC System. A Rack consists of a Backplane and the Units mounted to it. These Units include the Power Supply, CPU, and I/O Units. Racks include CPU Racks, Expansion I/O Racks, and I/O Racks. The CPU Rack is the Rack with the CPU mounted to it. An Expansion I/O Rack is an additional Rack that holds extra I/O Units. An I/O Rack is used in the C2000H Duplex System, because there is no room for any I/O Units on the CPU Rack in this System.

Rack PC — A PC that is composed of Units mounted to one or more Racks. This configuration is the most flexible, and most large PCs are Rack PCs. A Rack PC is the opposite of a Package-type PC, which has all of the basic I/O, storage, and control functions built into a single package.

RAM — Random access memory; a data storage media. RAM will not retain data when power is disconnected.

RAS — An acronym for reliability, assurance, safety.

read-only area — A memory area from which the user can read status but to which data cannot be written.

refresh — The process of updating output status sent to external devices so that it agrees with the status of output bits held in memory and of updating input bits in memory so that they agree with the status of inputs from external devices.

refresh parameter (table) A table of settings that specifies which words in the data links for a System are to be refreshed for a particular PC. See *common link parameter table.*

Register Area A memory are that contains both index registers and data registers.

relay network table A table of settings that specifies which node in a network must be passed through to reach another network.

relay-based control The forerunner of PCs. In relay-based control, groups of relays are interconnected to form control circuits. In a PC, these are replaced by programmable circuits.

Remote I/O Master Unit The Unit in a Remote I/O System through which signals are sent to all other Remote I/O Units. Remote I/O Master Unit is generally abbreviated to Master.

Remote I/O Slave Unit A Unit mounted to a Backplane to form a Slave Rack. Remote I/O Slave Unit is generally abbreviated to simply "Slave."

Remote I/O Subsystem A Master and all of the Remote I/O Units connected in series to it.

Remote I/O System A system in which remote I/O points on Slaves are controlled through one or more Masters mounted to a CPU or Expansion CPU Rack.

Remote I/O Unit Any of the Units in a Remote I/O System. Remote I/O Units include Masters, Slaves, Optical I/O Units, and I/O Terminals.

remote I/O word An I/O word allocated to a Unit in a Remote I/O System.

reserved bit A bit that is not available for user application.

reserved word A word in memory that is reserved for a special purpose and cannot be accessed by the user.

reset The process of turning a bit or signal OFF or of changing the present value of a timer or counter to its set value or to zero.

response monitoring time The time a device will wait for a response to a data transmission before assuming that an error has occurred.

Restart Bit A bit used to restart a Unit mounted to a PC.

restart continuation A process which allows memory and program execution status to be maintained so that PC operation can be restarted from the state it was in when operation was stopped by a power interruption.

retrieve The processes of copying data either from an external device or from a storage area to an active portion of the system such as a display buffer. Also, an output device connected to the PC is called a load.

retry The process whereby a device will re-transmit data which has resulted in an error message from the receiving device.

return step A step in SFC programming that ends a subroutine or interrupt program.

return terminal A triangular symbol in SFC programming that comes after the return step in a subroutine or interrupt program.

reverse video Displaying characters on a monitor so that the normal colors of the characters and the background are reversed.

right-hand instruction See *terminal instruction.*

rightmost (bit/word) The lowest numbered bits of a group of bits, generally of an entire word, or the lowest numbered words of a group of words. These bits/words are often called least-significant bits/words.

rising edge The point where a signal actually changes from an OFF to an ON status.

ROM Read only memory; a type of digital storage that cannot be written to. A ROM chip is manufactured with its program or data already stored in it and can never be changed. However, the program or data can be read as many times as desired.

routing table Tables of setting that specify what networks a device is a member of and what nodes must be passed through to reach other specific networks. See *local network table* and *relay network table.*

RS-232C interface An industry standard for serial communications.

RS-422 interface An industry standard for serial communications.

RUN mode The operating mode used by the PC for normal control operations.

rung See *instruction line.*

scan The process used to execute a ladder-diagram program. The program is examined sequentially from start to finish and each instruction is executed in turn based on execution conditions. The scan also includes peripheral processing, I/O refreshing, etc. The scan is called the cycle with CV-series PCs.

scan time The time required for a single scan of a ladder-diagram program.

scheduled interrupt An interrupt that is automatically generated by the system at a specific time or program location specified by the operator. Scheduled interrupts result in the execution of specific subroutines that can be used for instructions that must be executed repeatedly at a specified interval of time.

screen editor A program that is used on-screen to edit files.

self diagnosis A process whereby the system checks its own operation and generates a warning or error if an abnormality is discovered.

sequential function chart A programming method that allows overall processing to be programmed as a flowchart of steps and detailed processing to be programmed as actions within each step.

series A wiring method in which Units are wired consecutively in a string. In Link Systems wired through Link Adapters, the Units are still functionally wired in series, even though Units are placed on branch lines.

servicing The process whereby the PC provides data to or receives data from external devices or remote I/O Units, or otherwise handles data transactions for Link Systems.

set The process of turning a bit or signal ON.

set value The value from which a decrementing counter starts counting down or to which an incrementing counter counts up (i.e., the maximum count), or the time from which or for which a timer starts timing. Set value is abbreviated SV.

SFC — An acronym for sequential function chart.

SFC jump — A type of programming where execution moves directly from one step in a program to another step, without sequentially executing the steps in between.

SFC jump entry — The symbol or process used in an SFC program to indicate an SFC jump.

sheet — A unit of programming in an SFC program. There is a limit on the number of steps that can be contained within a single sheet and the types of processes that can take place between sheets.

SIOU — See *Special I/O Unit.*

Slave — See *Remote I/O Slave Unit.*

Slave Rack — A Rack containing a Remote I/O Slave Unit and controlled through a Remote I/O Master Unit. Slave Racks are generally located away from the CPU Rack.

software error — An error that originates in a software program.

software protect — A means of protecting data from being changed that uses software as opposed to a physical switch or other hardware setting.

software switch — See *memory switch.*

source code — The code in which a program is written, e.g., ASCII. Source code must be converted to object code before execution.

Special I/O Unit — A Unit that is designed for a specific purpose. Special I/O Units include Position Control Units, High-speed Counter Units, Analog I/O Units, etc.

SRAM — Static random access memory; a data storage media.

step — A basic unit of execution in an SFC program. Steps are used to organize an SFC program by process and control the overall flow of program execution.

Step Area — A memory area that contains a flag that indicates the status of steps in an SFC program.

step timer — A timer used to time execution of actions within a step in an SFC program.

string — A sequence of letters, numbers, and/or symbols stored in memory.

subchart — A section of an SFC program that is executed like a subroutine. See *subroutine.*

subchart dummy step — A step in an SFC program that is used to call (activate) a subchart.

subchart entry step — A step in SFC programming that begins a subchart.

subchart entry terminal — A triangular symbol in SFC programming that comes before the entry step in a subchart.

subchart return step — A step in SFC programming that ends a subchart.

subchart return terminal — A triangular symbol in SFC programming that comes after the return step in subchart.

sub-loop — A line mode used in a Remote I/O System to maintain communications when an error occurs on the positive line.

subroutine A group of instructions placed separate from the main program and executed only when called from the main program or activated by an interrupt.

subroutine number A definer used to identify the subroutine that a subroutine call or interrupt activates.

SV Abbreviation for set value.

synchronous execution Execution of programs and servicing operations in which program execution and servicing are synchronized so that all servicing operations are executed each time the programs are executed.

syntax The form of a program statement (as opposed to its meaning). For example, the two statements, `LET A=B+B` and `LET A=B*2` use different syntaxes, but have the same meaning.

syntax error An error in the way in which a program is written. Syntax errors can include 'spelling' mistakes (i.e., a function code that does not exist), mistakes in specifying operands within acceptable parameters (e.g., specifying read-only bits as a destination), and mistakes in actual application of instructions (e.g., a call to a subroutine that does not exist).

SYSMAC BUS/2 Remote I/O System A remote I/O system used to enable placing Slaves at remote locations to extend the applicable range of a PC System.

SYSMAC LINK System A communications system used to create data links and enable network communications between PCs.

SYSMAC NET Link System An optical LAN formed from PCs connected through SYSMAC NET Link Units. A SYSMAC NET Link System also normally contains nodes interfacing computers and other peripheral devices. PCs in the SYSMAC NET Link System can pass data back and forth, receive commands from any interfaced computer, and share any interfaced peripheral device.

SYSMAC NET Link Unit The Unit used to connect PCs to a SYSMAC NET Link System.

system configuration The arrangement in which Units in a System are connected. This term refers to the conceptual arrangement and wiring together of all the devices needed to comprise the System. In OMRON terminology, system configuration is used to describe the arrangement and connection of the Units comprising a Control System that includes one or more PCs.

System DM A dedicated portion of the DM area that is used for special purposes in controlling and managing the PC. Includes the Program Version, Parameter Area, Parameter Backup Area, User Program Header, and Error Log Area.

system error An error generated by the system, as opposed to one resulting from execution of an instruction designed to generate an error.

system error message An error message generated by the system, as opposed to one resulting from execution of an instruction designed to generate a message.

terminal instruction An instruction placed on the right side of a ladder diagram that uses the final execution conditions of an instruction line.

terminator The code comprising an asterisk and a carriage return (* CR) which indicates the end of a block of data in communications between devices. Frames within a mul-

	ti-frame block are separated by delimiters. Also a Unit in a Link System designated as the last Unit on the communications line.
timer	A location in memory accessed through a TC bit and used to time down from the timer's set value. Timers are turned ON and reset according to their execution conditions.
TR Area	A data area used to store execution conditions so that they can be reloaded later for use with other instructions.
TR bit	A bit in the TR Area.
trace	An operation whereby the program is executed and the resulting data is stored to enable step-by-step analysis and debugging.
trace memory	A memory area used to store the results of trace operations.
transfer	The process of moving data from one location to another within the PC, or between the PC and external devices. When data is transferred, generally a copy of the data is sent to the destination, i.e., the content of the source of the transfer is not changed.
transition	A status in a SFC program that determines when active status is transferred from one step to another. Transitions can be defined either as the status of a bit or as an execution condition resulting from a ladder diagram.
Transition Area	A memory area that contains Transition Flags.
Transition Flag	A flag that indicates when a transition is ON or OFF.
transition number	A number assigned to a transition and used to access its Transition Flag.
transmission distance	The distance that a signal can be transmitted.
trigger	A signal used to activate some process, e.g., the execution of a trace operation.
trigger address	An address in the program that defines the beginning point for tracing. The actual beginning point can be altered from the trigger by defining either a positive or negative delay.
UM area	The memory area used to hold the active program, i.e., the program that is being currently executed.
Unit	In OMRON PC terminology, the word Unit is capitalized to indicate any product sold for a PC System. Though most of the names of these products end with the word Unit, not all do, e.g., a Remote Terminal is referred to in a collective sense as a Unit. Context generally makes any limitations of this word clear.
unit number	A number assigned to some Link Units and Special I/O Units to facilitate identification when assigning words or other operating parameters to it.
unmasked bit	A bit whose status is effective. See *masked bit*.
uploading	The process of transferring a program or data from a lower-level or slave computer to a higher-level or host computer. If a Programming Devices is involved, the Programming Device is considered the host computer.
vector table	A work file created by CVSS that is used by the software to access ladder programs for editing. The vector table lists the first address of each ladder program block.

verification error — See *I/O verification error.*

volume label — The name of a volume of storage material (a floppy disk, hard disk, or memory card).

watchdog timer — A timer within the system that ensures that the scan time stays within specified limits. When limits are reached, either warnings are given or PC operation is stopped depending on the particular limit that is reached.

WDT — See *watchdog timer.*

wildcard — A special character used in a filename or extension to indicate zero or more possible characters.

wire communications — A communications method in which signals are sent over wire cable. Although noise resistance and transmission distance can sometimes be a problem with wire communications, they are still the cheapest and the most common, and perfectly adequate for many applications.

Wired Master — A Remote I/O Master Unit connected via 2-conductor wire cables.

Wired Master — A Remote I/O Slave Unit connected via 2-conductor wire cables.

Wired Slave Rack — A Slave Rack connected through a Wired Slave.

Wired System — A Remote I/O Master System connected via 2-conductor wire cables.

word — A unit of data storage in memory that consists of 16 bits. All data areas consists of words. Some data areas can be accessed only by words; others, by either words or bits.

word address — The location in memory where a word of data is stored. A word address must specify (sometimes by default) the data area and the number of the word that is being addressed.

word allocation — The process of assigning I/O words and bits in memory to I/O Units and terminals in a PC System to create an I/O Table.

Word Grouping — See *custom data area.*

work area — A part of memory containing work words/bits.

work bit — A bit in a work word.

work disk — The location is memory when data currently being worked with is stored.

work word — A word that can be used for data calculation or other manipulation in programming, i.e., a 'work space' in memory. A large portion of the IR area is always reserved for work words. Parts of other areas not required for special purposes may also be used as work words.

write protect switch — A switch used to write-protect the contents of a storage device, e.g., a floppy disk. If the hole on the upper left of a floppy disk is open, the information on this floppy disk cannot be altered.

write-protect — A state in which the contents of a storage device can be read but cannot be altered.

zero-cross refresh An I/O refresh process in which I/O status is refreshed when the voltage of an AC power supply is at zero volts.

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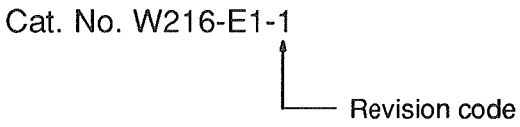

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