

Gould P190 Programmer

USER'S MANUAL



GOULD
Electronics

Gould P190 Programmer

USER'S MANUAL

SUBJECT: Description of the Gould P190 Programmer and information concerning its operation.

March, 1985

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PREFACE

This manual provides the user with a description of the Gould P190 Programmer with instructions for its operation. This manual should be used in conjunction with the appropriate PC reference manual which provides detailed information on programming techniques, codes, references, and specific tape functions and capabilities.

SECTION 1 provides general information about the P190 Programmer, and lists its specifications.

SECTION 2 provides screen display and keyboard descriptions.

SECTION 3 provides general tape care information.

SECTION 4 provides information about physical connections between the P190 Programmer and the various Gould PC's and interfaces.

The GLOSSARY contains definitions of words pertaining to PC's, particularly as they relate to the P190 Programmer.

Related Documents

184/384	User's Manual Programming Tapes/P190	ML-1384-000 ML-384T-USE
484	User's Manual P190/484 Reference Guide	ML-C484-USE PI-P190-001
584	User's Manual (584A) Programming Guide (584L) Programming Guide (584M) P190/584 Reference Guide	ML-584A-000 PI-584L-002 PI-584M-002 PI-P190-002
684	684 User's Manual	ML-684A-USE
884	Programming Guide Tape Loader User's Guide	PI-884A-001 PI-884A-005
984	Programming Guide System Planning and Installation	PI-984A-001 PI-984A-002
Micro 84	User's Manual Programming Guide/P190 Programmer	ML-M84A-USE PI-M84A-001
2184 Motion Controller	User's Manual	ML-2184-USE

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Micro 84	384	884
Modbus	484	P180
Modvue	584	P190
Modway	584M	

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SECTION 1 INTRODUCTION

1.1 INTRODUCTION

This manual will familiarize you with the layout and operation of the Gould P190 Programmer. It provides you with a basic knowledge of how the P190 works as a programming device for the Gould family of PC's, and how it interfaces with other peripheral equipment (for example, printers). You should consult the appropriate PC reference and programming manuals for detailed information concerning specific PC's, programming techniques, software tape information, and software label function definitions.

1.2 WHAT IS A P190?

The P190 is a CRT device used to program 184/384, 484, 584, 884, 984, and Micro 84 Programmable Controllers and the 2184 Motion Controller. The P190 is your primary interface with a programmable controller. It is used to enter, edit, monitor and design user programs on any of the above mentioned controllers.

The P190's tape drive allows you to load programs into the controller using software tapes, and also to record your PC programs on tape for later use or reference.

Also featured is a nine inch black and white CRT screen that displays user logic and programming information. This screen allows on-line monitoring of a user's logic programs, and off-line programming and configuration. Entire logic programs are displayed, network by network, for monitoring or editing.

In addition to the tape drive and CRT screen, the P190 Programmer features a typewriter-style keyboard and 31 fixed function control keys.

Table 1-1 provides specifications for the P190 Programmer.

Table 1-1. P190 Specifications

Physical:	
Dimensions (WxHxD):	17.5 in. x 11.0 in. x 24.0 in. (444.5 mm x 279.4 mm x 609.6 mm)
Weight:	30.0 lbs. (13.6 kg)
Environmental:	
Operating Temperature:	5 to 40°C (41 to 104°F)
Storage Temperature:	- 20 to 60°C (- 41 to 140°F)
Operating Humidity:	20 to 80% relative humidity, noncondensing
Storage Humidity:	0 to 95% relative humidity, noncondensing
Power:	
P190-212	95 to 130 VAC, 47 to 63 Hz, 100 W
P190-222	190 to 260 VAC, 47 to 63 Hz, 100 W
Fuse:	1.5 amp., Modicon No. 57-0051-000
Tape Drive:	
Capacity:	at the maximum record size (1/3 Kbyte), 96 Kbytes per tape

INTRODUCTION

The P190 is packaged in a rugged case, which is easily moved to the work site or placed in a centralized control site.

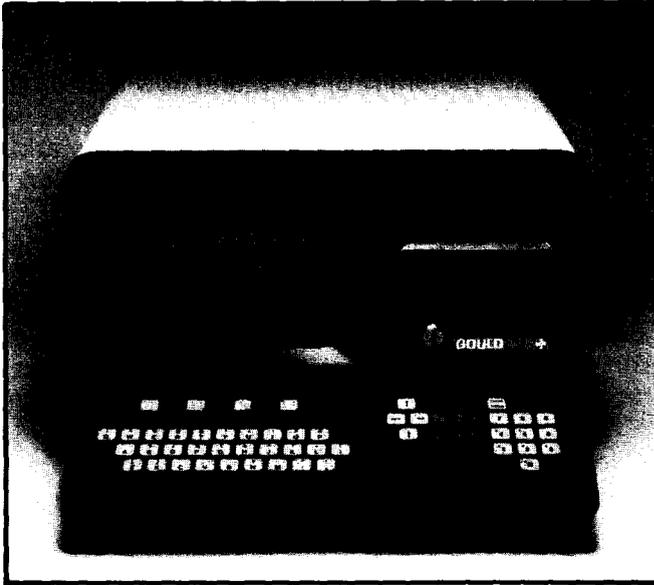


Figure 1-1. P190 Programmer — Front View

The P190 is a portable, rugged unit designed for use in harsh industrial environments. It operates in locations where electromagnetic noise, high temperatures, humidity, and mechanical shock are present.

The P190 Programmer can be used in a horizontal position (for example, on a table top), as shown in Figure 1-1, or in a vertical position (for example, standing upright on the floor) as in Figure 1-2.



Figure 1-2. P190 Programmer — Vertical Position

SECTION 2 P190 PROGRAMMER DESCRIPTION

This section describes the physical arrangement and basic functions of the P190 Programmer. It also describes the keys on the keyboard and tells you how and when to use them. The P190 is described as a separate unit, independent of the device being programmed.

The P190 Programmer has three primary user-oriented features; the CRT screen, the keyboard, and the tape drive. The CRT screen provides a graphic representation of user programs and communications with the controller (using ladder logic symbols), and displays information to assist in programming. The keyboard is used to enter programs and to communicate with the controller. The tape drive is used to load P190 operating software into the programmer's memory; to load user programs into various controllers; and to record programs from various controllers. (Each PC has its own library of related tapes; Tape Loader and Programming Tapes, for example. See Section 3.5 for a current listing of all Software Tapes.)

Throughout the text of this manual, references to fixed function keys which are located on the programming panel will be capitalized (START/NEXT, ENTER, etc.), and references to software label keys (see Section 2.2.1) will be in quotation marks ("Attach", "Proceed", etc.).

2.1 CRT SCREEN DESCRIPTION

The P190 has a nine inch CRT screen which displays the development of user logic and specific status information. The screen displays change with the different program tapes used with each PC. The screen displays common to most program tapes are the Logic Screen and the Alternate Screen. (These screens are not used with all of the program tapes. Consult the appropriate reference manual for screen display information relating to specific controllers.)

2.1.1 Logic Screen

The logic screen is divided into five parts; the logic area, the reference area, the error line, the status line, and the software labels. A sample logic screen, with these five areas identified, is shown in Figure 2-1. (This sample screen is displayed during 584 PC programming.)

LOGIC AREA — This area is for the display and creation of user-programmed logic. Each logic display contains a single network. Each network has up to a total 77 elements (11 horizontal elements, including coils, on each of 7 rungs). See the appropriate PC programming guide for more information.

NOTE

In Micro 84 Programming, each network contains a maximum of 28 elements; 7 horizontal elements, including coils, on each of 4 rungs.

P190 PROGRAMMER DESCRIPTION

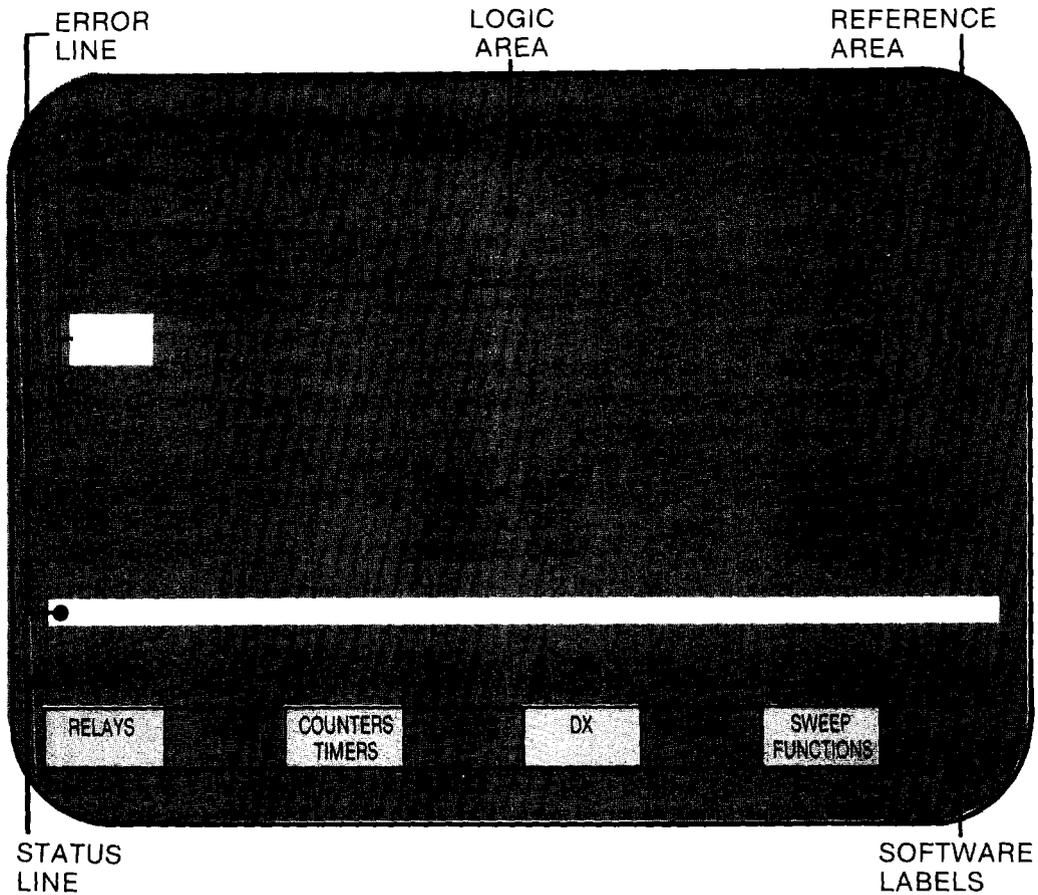


Figure 2-1. Sample Logic Screen

REFERENCE AREA — The reference area displays the value or state of any reference (registers and/or discrete inputs and outputs), in the attached programmable controller.

ERROR LINE — The error line displays all error messages and prompts from the P190 Programmer to the user.

STATUS LINE — The status line displays the current status of the P190 Programmer and the screen display as shown in Figure 2-2. The line is made up of the following parts:

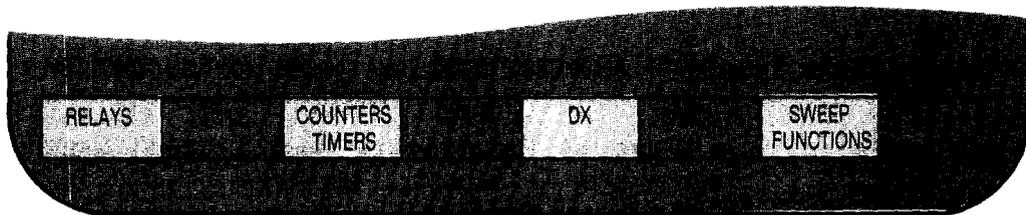


Figure 2-2. Sample Status Line and Software Labels

NET — The number of the network currently displayed in the logic area of the screen.

UNIT — The unit number of the controller that is presently attached to the P190 programmer.

SEG — The logic segment which contains the currently displayed network (584 PC only)

AVAIL — Displays the amount of memory, in words, that is still available

USED — Displays the total amount of memory, in words, that has been used

TRACE — The network number from which the most recent trace was originated. This number will be "0" if no traces exist.

AR — This is the assembly register. The AR holds the reference numbers or the values to be used in programming and utility support operations. Each number is displayed as it is entered in the register. (Press the CLEAR AR key on the programming panel to clear this register to all zeros.)

SET SEARCH — The cursor is positioned in this area of the screen when search parameters are to be set.

SOFTWARE LABELS — These labels define the functions of the software label keys on the top of the programming panel. These software labels correspond directly to the software label keys just below them on the programming panel. The function indicated on a white software label is accessed by pressing the white software label key directly below it on the programming panel. Likewise, the function indicated on a black software label is accessed by pressing the grey software label key directly below it. Figure 2-2 illustrates the software labels. They are located below the status line on the CRT screen.

The functions of these keys vary from one PC to another. Consult the appropriate PC programming guide for a more detailed description of these keys and how they function. (See Section 2.2.1)

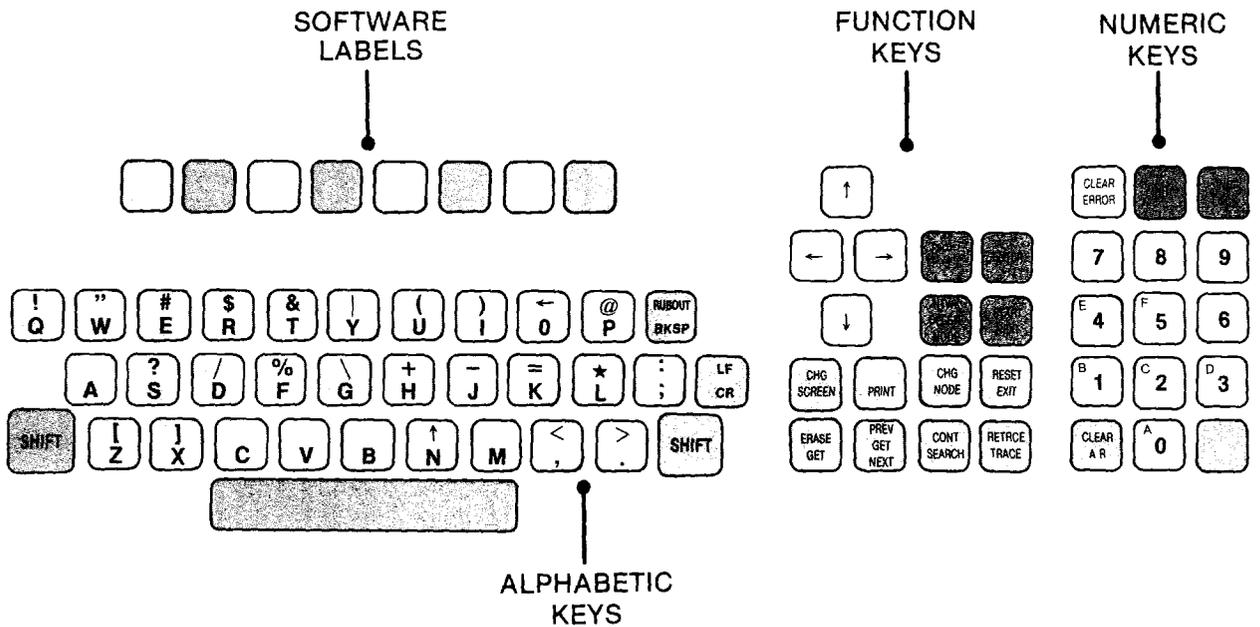


Figure 2-4. P190 Keyboard

2.2.1 Software Label Keys

Eight software label keys are located above the alphabetic keyboard (See Figure 2-5). These keys alternate in color from white to black and correspond with the software labels on the CRT screen. The functions of these keys are defined by the program tapes, and change with each tape used. These keys provide access to the highest level of programming functions available with the P190.

In some cases, the software label is blank. This indicates that the key is has no function in that particular menu. (A menu is a selection of the operations you can perform at any given point in your programming.) If the key is pressed, an error message will appear in the error line of the CRT screen. To remove any error message, press the CLEAR ERROR key located directly above the numeric keyboard.



Figure 2-5. Software Label Keys

P190 PROGRAMMER DESCRIPTION

2.2.2 Alphabetic Keyboard

The alphabetic keyboard is arranged typewriter-style, with 33 keys and a space bar. It is used to enter messages for the controller's memory and headers for ladder listings. This keyboard has two SHIFT keys that function the same way as the SHIFT keys on a typewriter. When the keys are pressed and held, any double function key pressed will assume the upper function. See Figure 2-6.

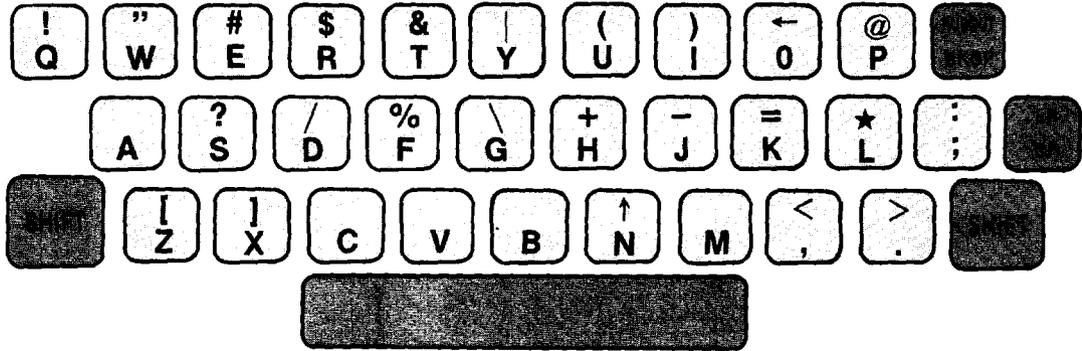


Figure 2-6. P190 Alphabetic Keyboard

2.2.2.1 SHIFT Keys



These keys provide access to the upper functions of all double function keys on the P190 programming panel, and the software labels displayed during programming. Press the SHIFT key and the desired function key simultaneously to access the key's upper function.

NOTE

Some controller-specific software tapes assign a SHIFT LOCK function to one of the unassigned keys on the keyboard. But this function is not standard, so consult the appropriate PC reference manual before attempting to utilize this function.

2.2.2.2 RUBOUT/BKSP Key



Press the BKSP key to delete the last character entered and to move the cursor one position to the left. Press the SHIFT/RUBOUT keys to delete the entry on which the cursor is located and to move the cursor to the first location of the data field.

2.2.2.3 LF/CR Key



Press the CARRIAGE RETURN key to return the cursor to the first space at the beginning of the same line. Press the SHIFT/LINE FEED keys to move the cursor down to the next line of the screen display.

NOTE

This key is used only in the ASCII Programming mode which is, at this time, only available with the 584 Programmable Controller.

2.2.3 Function Keyboard

The P190's function keyboard has sixteen keys. The blank orange key located next to the ENTER key is not assigned a function in general P190 programming. However, some P190 related software does assign a SHIFT LOCK function to this key. This is not true for all software tapes, so consult the appropriate reference manual before attempting to use this key.

The function keyboard contains the cursor control keys, formatting, and basic logic functions. The range of functions is greatly expanded through use of the software label keys. Not all of the keys described below are active on all program tapes. Refer to the appropriate manual to find which keys are used with a specific tape. See Figure 2-7.

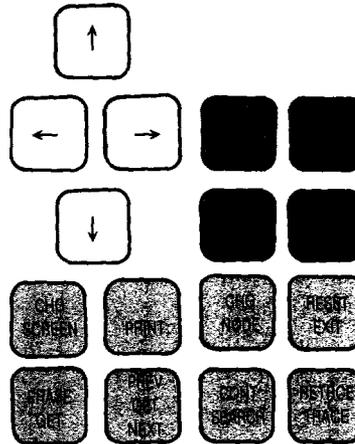
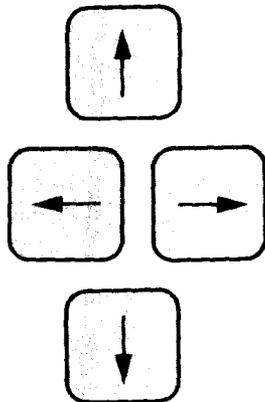


Figure 2-7. P190 Function Keyboard

2.2.3.1 Cursor Control Keys



The cursor control keys move the cursor, up or down, or to the left or right. Each time you press a cursor control key, the cursor moves one space in the direction indicated by the arrow on the key. The cursor will continue to move in the indicated direction, one space at a time, each time the key is pressed. When the cursor reaches the last position in any one direction, it "wraps around" and appears in the first position of the same line on the opposite side of the screen.

2.2.3.2 ENTER Key



Press the ENTER key to move a value from the AR to a reference (for example, 10301) or to a numeric area under the cursor. This function validates the data so that no illegal data may be entered.

P190 PROGRAMMER DESCRIPTION

2.2.3.3 DELETE NETWORK/DELETE NODE Key



Press the DELETE NODE key to delete the node (element) and vertical short (if present) where the cursor is currently positioned. When the SHIFT/DELETE NETWORK keys are pressed, the network that is displayed on the screen is deleted from user logic. The next network in sequence will automatically be displayed. If the deleted network was the last in memory, the CRT will display a message stating this fact.

2.2.3.4 START NEXT Key



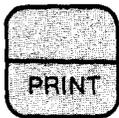
Press the START NEXT key to start a new network. The new network is automatically inserted after the network currently on display.

2.2.3.5 CHANGE SCREEN Key



Press the CHANGE SCREEN key to change the screen display from logic screen to alternate screen and back. The P190 panel "remembers" the contents of each screen display so that you can easily switch from one to the other.

2.2.3.6 PRINT Key



Press the PRINT key to print the currently displayed screen. An RS-232-C compatible printing device must be attached to Port 2 of the P190 Programmer. This function provides documentation of programming and maintenance activities.

2.2.3.7 CHANGE NODE Key



Press the CHANGE NODE key to access the most powerful level of software label keys. These keys control the insertion and replacement of nodes (elements) in user logic and the selection of search parameters. (See Section 2.2.1 for a definition of the software label keys.)

2.2.3.8 RESET/EXIT Key



Press the EXIT key to access a series of software label keys that control detailed operations, such as programming or ladder listing. Press the SHIFT/RESET keys to access basic information about the attached controller. It also accesses a level of software keys that control fundamental actions such as "Attach," "Start PC," "Stop PC," and "Clear PC memory." Consult the appropriate programming manual for further explanation of these keys.

2.2.3.9 ERASE/GET Key



Press the GET key to retrieve and display networks, registers, or discretes specified in the AR. Only one network will be displayed at a time, but multiple registers or discretes may be displayed concurrently. Press the SHIFT/ERASE keys to erase the displayed network or reference from the CRT screen. The ERASE function affects the P190 CRT screen only; it does not affect the memory of the attached controller.

2.2.3.10 GET PREV/GET NEXT Key



Press the GET NEXT key to retrieve and display the network, register, or discrete reference that directly follows the one presently displayed on the screen. Press the SHIFT/GET PREV key to retrieve and display the network, register, or discrete reference which is just before the one currently displayed on the screen.

If the cursor is in the logic field when this key is pressed, it will get the applicable network. If the cursor is in the reference area when the key is pressed, it will get the applicable reference.

2.2.3.11 CONT/SEARCH Key



Press the SEARCH and CONTINUE SEARCH keys, one after the other, to quickly “search” an entire logic program for a specific reference or coil number. The keys, used in conjunction with each other, provide a comprehensive search procedure. Press the SEARCH key to display the first network containing the complete or partial node specified in the search parameters. (The cursor must be in the “Search” block before search parameters can be set.) Press the SHIFT/CONT key to display the next network containing the specified node. The SHIFT/CONT key must be pressed after each network is displayed in order to continue the search. (Software label keys are used to set search parameters. See the appropriate PC manual for further instructions.)

2.2.3.12 RETRACE/TRACE Key



Press the TRACE key to display the network that drives the referenced coil. The cursor must be on a relay contact referencing a coil when the key is pressed. Press the SHIFT/RETRACE key to return to the network displayed before the TRACE was begun.

2.2.4 Numeric Keyboard

The numeric keyboard is located at the right-hand side of the P190 keyboard. It is composed of fifteen keys arranged three across by five down. The blank key in the lower right hand corner of the keyboard is not assigned a function at this time. Figure 2-8 shows the numeric or alphanumeric keys A/0, B/1, C/2, D/3, E/4, F/5, 6, 7, 8, and 9. Decimal and hexadecimal data can be entered in the P190 assembly register as reference numbers, function codes, register contents, etc.

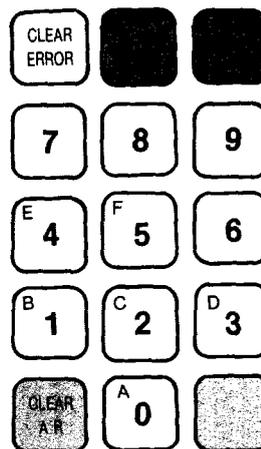


Figure 2-8. P190 Numeric Keyboard

P190 PROGRAMMER DESCRIPTION

To access the alphabetic characters, press the SHIFT key together with the appropriate numeric key. For example, to enter an "E" press SHIFT/"4". To enter a "4" press "4".

The CLEAR ERROR, CLEAR AR, INIT, AND INIT LOCK keys are also on the Numeric Keyboard. These keys perform the functions discussed below.

2.2.4.1 CLEAR AR Key



Press the CLEAR AR key to remove any value from the assembly register and clear the register to zeros. This key also clears the screen of any error messages which relate to the assembly register.

2.2.4.2 CLEAR ERROR Key



Press the CLEAR ERROR key to clear an error message from the screen. For example, if you enter a network number that is greater than the the number of the last existing network, an error message will be displayed on the error line of the screen. This message describes the error. To continue processing, press the CLEAR ERROR key. This removes the incorrect network number from the assembly register and removes the error message. You can now enter the correct network number.

2.2.4.3 INIT and INIT LOCK Keys



Press the INIT and INIT LOCK keys, located in the upper right-hand corner of the numeric keyboard, to clear (initialize) the memory of the PC. Do this each time a new tape is inserted in the tape drive. Press both the keys at the same time. If there is no tape in the drive when these keys are pressed, the P190 will display a prompt telling you to insert a program tape.



The tape inserted in the P190's Tape Drive after power-up is automatically loaded. Subsequent tape loadings must be started using the INIT and INIT LOCK keys. The two keys must be pressed simultaneously to load or reload a tape into the P190 programmable memory. The INIT and INIT LOCK keys are also used to restart the P190's operations after a parameter change has been made using the DIP switches on the back of the programmer. See Section 2.5.3.

2.3 TAPE DRIVE

The P190 Programmer's memory is loaded from a tape via a built-in data-cartridge tape drive. This tape drive is located in the upper right-hand corner of the front panel of the P190. The door has a spring hinge, and must be held down when inserting a tape into the drive. This keeps the door to the tape drive closed and helps prevent environmental damage to the tape drive, such as dust, dirt, moisture, etc. Figures 2-9 and 2-10 illustrate tape loading and removal.

To load a tape into the P190 Programmer:

1. Select appropriate tape.
2. Open the tape drive door. Hold the door open while inserting the tape.
3. Hold the tape so that the bottom metal plate is down and the exposed tape area is toward the tape drive.
4. Insert tape and press firmly until the tape clicks into place.
5. Release the tape drive door.
6. The first tape inserted after P190 power-up is automatically loaded. Subsequent tape loadings must be started by pressing the INIT and INIT LOCK keys simultaneously.

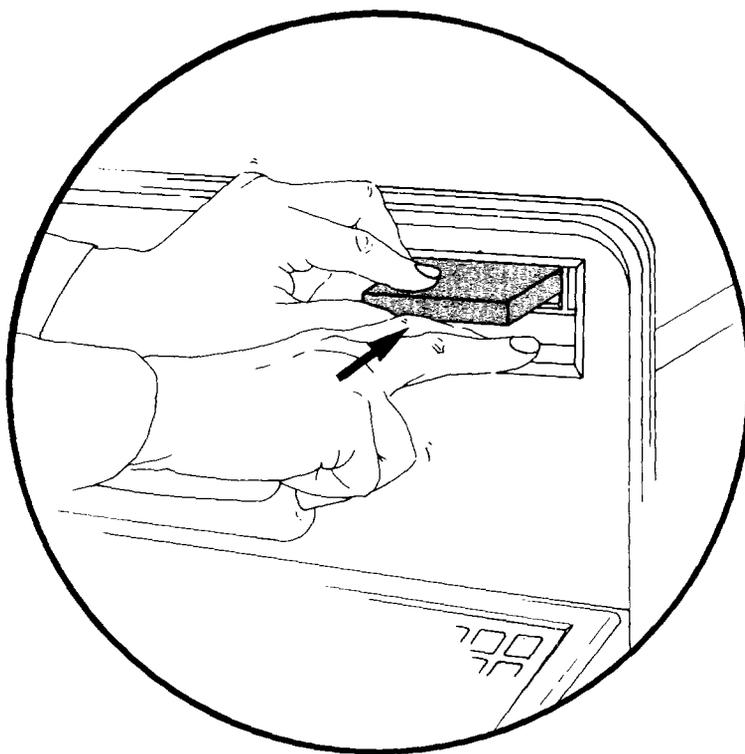


Figure 2-9. Inserting a Tape into the P190

P190 PROGRAMMER DESCRIPTION

To remove tape from the P190 Programmer:

1. Open the tape drive door and hold down.
2. Push the EJECT button and remove tape from the tape drive.
3. Return the tape to its storage case.

CAUTION

Never attempt to remove a tape from the drive while the tape is loading. You may damage the tape. Wait until the tape has been loaded before removing.

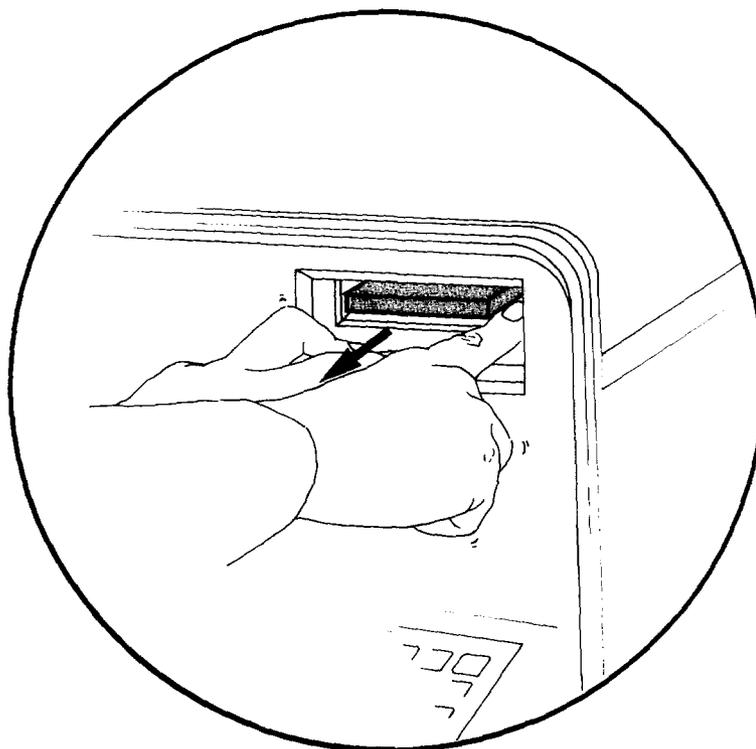


Figure 2-10. Removing a Tape from the P190

2.4 KEYLOCK/MEMORY PROTECT

The P190 Programmer has a keylock located to the right of the CRT screen, directly under the tape drive. This is a security device that controls access to the programming and configuration operations on the tapes.

When the key is in the UNLOCK position (Figure 2-11), the P190 is in program mode and you can monitor, configure, and program P190 operations. When the key is in the LOCK position (Figure 2-12), the P190 is in a monitor mode and you can not access any configuration and programming operations.

The P190 periodically monitors the status of the Keylock/Memory Protect. If the position of the switch is changed while the P190 is running, the P190 will automatically "logout", or detach, from the controller.

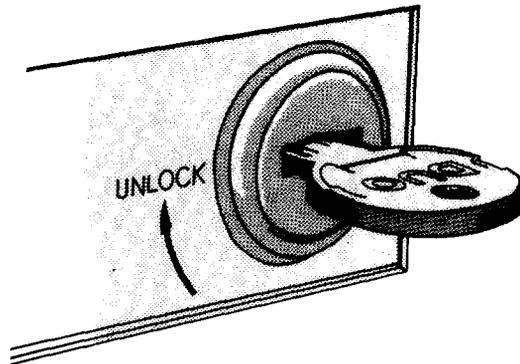


Figure 2-11. UNLOCKED Position

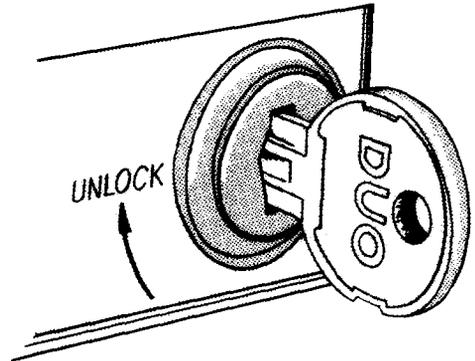


Figure 2-12. LOCKED Position

2.5 REAR PANEL CONTROLS, SWITCHES, AND OTHER PHYSICAL FEATURES

The following controls, switches, and other physical features are located on the rear panel of the P190 Programmer; identification plate, ON-OFF switch, parameter selection switches, brightness and contrast controls, composite video connector, AC power connection, fuse, and two EIA RS-232-C communication ports. Figure 2-14 illustrates the various features located on the back panel of the P190.

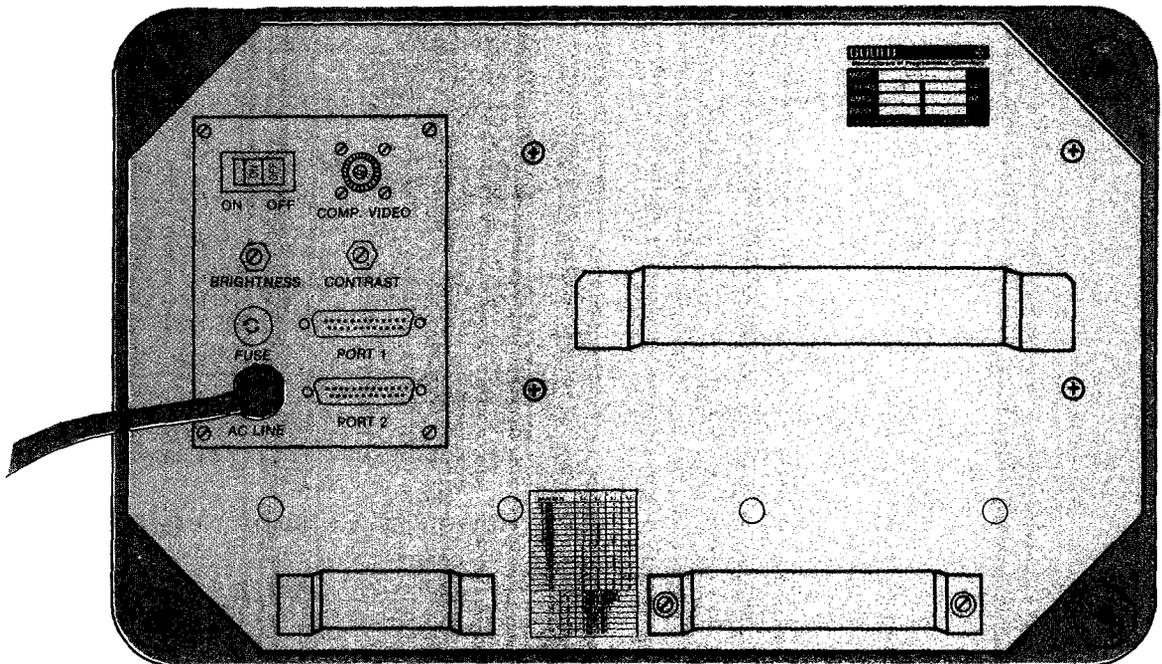


Figure 2-13. P190 Rear Panel

P190 PROGRAMMER DESCRIPTION

2.5.1 OFF/ON Power Switch

This switch applies power to the P190 in the ON position and shuts off power in the OFF position.

2.5.2 Identification Plate

The identification plate displays the P190 Programmer model number, serial number, and power information (current, voltage, and frequency). The space for baud rate is not applicable since the baud rate is selectable. See Section 2-5-3.

2.5.3 Parameter Selection Switches

Two eight-switch DIP switch packs are used to set parity, stop bit, and data bit parameters for the two RS-232-C peripheral ports. The switches on the left set parameters for Port 1, and the switches on the right set parameters for Port 2. Baud rates for both ports are set at the factory to 9600 baud.

The switch settings are shown on a parameter selection label which is located to the right of the ports. Figure 2-14 shows this label. Note that 1 = UP (ON), and 0 = DOWN (OFF). Switches must be placed all the way up or all the way down to insure a proper selection.

BAUD RATE	S1	S2	S3	S4
19,200	1	1	1	1
9,600	1	1	1	0
7,200	1	1	0	1
4,800	1	1	0	0
3,600	1	0	1	1
2,400	1	0	1	0
2,000	1	0	0	1
1,800	1	0	0	0
1,200	0	1	1	1
600	0	1	1	0
300	0	1	0	1
150	0	1	0	0
134.5	0	0	1	1
110	0	0	1	0
75	0	0	0	1
50	0	0	0	0
S5	1	PARITY ENABLE		
	0	PARITY DISABLE		
S6	1	EVEN PARITY		
	0	ODD PARITY		
S7	1	1 STOP BIT		
	0	2 STOP BITS		
S8	1	7 DATA BITS		
	0	8 DATA BITS		

Figure 2-14. Parameter Selection Label

NOTE

Any parameter change (while the P190 is running) requires pressing the INIT and INIT LOCK keys simultaneously. This instructs the P190 to "read" these new switch settings.

2.5.4 Brightness/Contrast Controls

These controls are located above Port 1. They control the overall brightness of the CRT screen (Brightness Control) and the brightness of the characters on the screen relative to the background (Contrast Control).

2.5.5 Composite Video Connector

The Composite Video Connector is located next to the ON/OFF switch. This connector allows the use of an external video monitor with the P190. If other video monitors are used, they should have the following characteristics:

Monitor type:	black and white, raster scan CRT
Signal characteristics:	EIA RS-170
Video response:	10 MHz
Scan width:	10% underscan
Horizontal frequency:	16,041 Hz (15,750 + 1.8%)
Vertical frequency:	51.4 Hz (noninterlaced)

NOTE

Some monitors may require magnetic shielding or external mounting of the power transformer to eliminate "swim." Some compatible monitors which meet these specifications are:

Panasonic	WV 5310
Panasonic	WV 5311
Ball Brothers	TD 12
Ball Brothers	TD 53
Ball Brothers	TD 20
Motorola	M 3560-155

2.5.6 Communication Ports

Two EIA RS-232 ports allow communication between the P190 and the mainframe PC as well as other peripheral devices. Port 1 is used to connect the P190 to a PC, and Port two is used to connect the P190 to a printer. Port parameters are set by the parameter selection switches.

2.5.7 Power Connection and Fuse

The AC Power Connection and the fuse are located to the left of Port 1. To replace the fuse:

1. Turn the P190 OFF.
2. Disconnect P190 from AC power.
3. Push fuse casing in and turn to the left. This will free the fuse and it will "pop" out.
4. Verify that the replacement fuse is the proper amperage. Replace fuse.
5. Push fuse casing in and turn to the right. The fuse should "click" into place.
6. Reconnect the P190 to the AC power source.

SECTION 3 GENERAL TAPE INFORMATION

This section describes the evaluation of blank tapes, the duplication of master tapes, the labeling of tapes, and the care of tapes and the tape drive. The tapes you buy from Gould are master tapes; they contain the appropriate software but are not used directly for programming. A copy of a master tape called a working tape must be made for programming.

NOTE

There is no need to duplicate master tapes when using a Gould 884 or Micro 84 PC. All tapes supplied by Gould for use with these PC's are "working tapes."

3.1 TAPE EVALUATION

Before a blank tape (new or used) can be made into a working tape, it must go through the tape evaluation procedure on the Tape Loader Tape (T190-001). The evaluation procedure writes and verifies the quality of a blank tape, making two staggered passes so that the entire tape is evaluated and slack caused by temperature changes is eliminated. The evaluation procedure takes about twenty minutes (10 minutes per pass) to complete.

NOTE

Working tapes are not used with all controllers. The Tapes supplied with 884 and Micro 84 PC's are all "working tapes." There is no need to duplicate these tapes. Also, the 884 and Micro 84 PC's have their own Tape Loader Tapes which are only used with these controllers. Please refer to the appropriate programming manual for more detailed information.

To evaluate a tape:

1. If evaluating a used tape, first erase the tape with a bulk tape eraser. Slide the "record" tab to the left, so that the tape is in a "write enabled" state. See Figure 3-1.
2. Place the Tape Loader Tape in the tape drive. If this is the first tape inserted after power-up, it is loaded automatically. If switching from another tape, press the INIT and INIT LOCK keys to load the tape. (Loading takes approximately fifty seconds.)
3. When the tape is loaded, the following software labels appear across the bottom of the screen:

Remove the Tape Loader Tape and insert the tape that is to be evaluated. Press the software label key that corresponds to the "Evaluate Tape" software label. A new set of software labels appear:

Press the "Proceed" key to begin the tape evaluation process.

GENERAL TAPE INFORMATION

4. If the tape is usable, a message will appear on the screen indicating that the tape evaluation has been successful. Erase the tape and use it for the creation of a working tape.

If the evaluation is not successful, a message will appear on the screen indicating that the tape is not usable. You may want to erase the tape and evaluate it once again before discarding it.

NOTE

Do not attempt to evaluate a working tape, as this function will erase it. If a working tape is suspect, first make another copy of it from the master tape, then erase the working tape and evaluate it.

3.2 TAPE DUPLICATION

Gould offers a line of master tapes and blank tapes to be used with each particular PC. Master tapes are used to create working tapes. Working tapes are used to load data into a P190 programmer, but they cannot be duplicated.

NOTE

Software tapes supplied with the 884 and Micro 84 PCs are all working tapes. The tape duplication procedure for creating "working" tapes does not apply to software tapes used with these controllers.

To create a working tape:

1. Select the desired master tape. Place the tape in the tape drive. If inserted immediately upon power-up, the tape loads automatically. If switching from another tape, press the INIT and INIT LOCK keys to begin loading the tape. Loading takes approximately fifty seconds.
2. A message appears on the P190's screen to prompt your next action. The first such prompt is "REMOVE TAPE."
3. Remove the master tape. The CRT screen displays the message "LOAD WRITE ENABLED SCRATCH TAPE." Select a blank tape that has already been evaluated. Make sure that the "record" tab in the upper left-hand corner of the tape is pushed all the way to the left, so that it is "write enabled." See figure 3-1.
4. Insert the tape into the tape drive. Once inserted, writing begins, and the CRT screen displays the "DUPLICATING" message.
5. When duplication is complete, the CRT screen displays the "REMOVE TAPE" message.
6. Remove the tape from the tape drive and slide the "record" tab all the way to the right. This puts the tape in a "write protected" state; nothing can be written over the existing data. You may also remove the tab and replace it at a later time. See Figure 3-2.
7. Label the tape with the appropriate tape number and information.

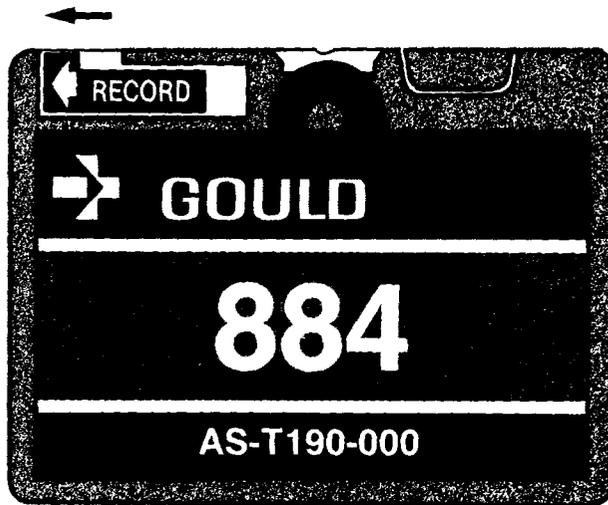


Figure 3-1. "Write Enabled" Blank Tape



Figure 3-2. "Write Protected" Tape

8. When you have finished duplicating tape(s) press the INIT and INIT LOCK keys to reinitialize the P190. If you do not do this, the P190 attempts to create a working tape out of any tape that is inserted into the tape drive.

NOTE

If an error occurs during the duplication process a tone sounds, and an error message is displayed. To reset the P190 Programmer, remove the tape and press the INIT and INIT LOCK keys simultaneously. Erase the scratch tape and begin the procedure over again, starting with Step 1.

GENERAL TAPE INFORMATION

3.3 TAPE LABELING

Clear, consistent tape labeling is essential to the identification and control of all program tapes. All master tapes are labeled with the tape name and number (for example, P190 Tape Loader, AS-T190-001), and also the revision level. All working tapes should be labeled with the following information:

Tape Name:
Tape Number:
Date of Master Tape:
Revision Level of Master Tape:

All of the information above is displayed on the CRT screen while the working tape is being created. The correct label date is the date the master tape was released, not the date that the working tape was made.

3.4 CARE OF TAPES AND TAPE DRIVE.

The estimated life of a tape is approximately 5000 complete passes. The estimated life of the tape drive is 40,000 tape cycles. Proper care and maintenance of the tapes and tape drive is essential to insure maximum useful life.

3.4.1 Care of Software Tapes

Extreme high or low temperatures may cause stretching or sagging of the program tapes. This damage may result in poor tape performance due to slack in the tape. The storage and shipping environment specifications are shown in Table 3-1.

If it is known that a tape has been exposed to minimum or maximum temperature extremes, you should evaluate the tape before attempting to use it. (See Section 3.1.) If tapes are not going to be used immediately, make sure that they are stored in the proper environment.

CAUTION

Always isolate tapes from any magnetic field. Do not store or carry tapes so that they come into contact with motors or magnetized screwdrivers. Never place a tape on top of the P190. There are magnetic fields within the P190 which may damage the tape.

Table 3-1. Tape Storage and Shipping Environment

Temperature:	5 to 50°C (41 to 113°F)
Relative Humidity:	20 to 80% noncondensing
Maximum wet bulb temperature:	28°C (79°F)

3.4.2 Care of Tape Drive

The tape head and drive puck should be cleaned once every 1,000 - 1,500 tape cycles, or once every 24 hours of continuous operation. In harsh environments, cleaning on a more frequent basis may be required. These components are located approximately 2.5 inches inside the tape drive. See Figure 3-3.

To clean these components, moisten a cotton swab with ethyl alcohol and gently rub the head and then the drive puck to loosen and remove dirt deposits.

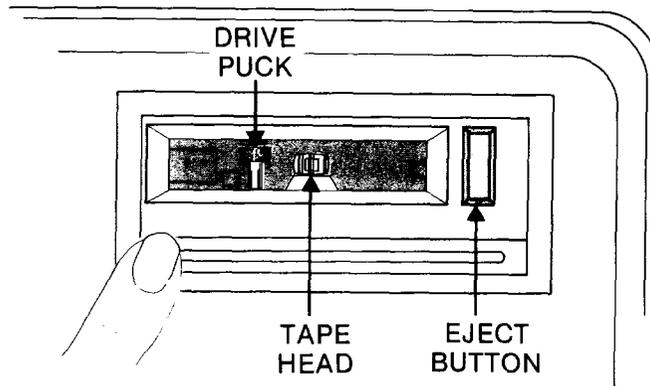


Figure 3-3. Tape Head and Drive Puck Location

3.5 P190 PROGRAMMING TAPES

Following is a list of all currently available software tapes used with the P190 Programmer. Please see your sales representative to obtain copies of the most recent product and price lists before ordering any program tapes from Gould Inc., Programmable Control Division.

184/384 Programmable Controller

P190 Tape Loader Tape	T190-001
384 Programmer Tape	T384-001
384 Utility Tape	T384-002

484 Programmable Controller

P190 Tape Loader Tape	T190-001
484 Programmer Tape	T484-001
484 Utility Tape	T484-002

584A Programmable Controller

P190 Tape Loader Tape	T190-201
584 Programmer Tape	T584-201
584 Utility and Configuration Tape Package	T584-202
584 ASCII Tape	T584-003
584 Configurator Tape	T584-204
584 PID Tape	T584-101
584 Modbus Master Pack	T584-102

GENERAL TAPE INFORMATION

584M Programmable Controller

P190 Tape Loader Tape	T190-001
584 Programmer Tape	T584-001
584 Utility	T584-002
584 ASCII Tape	T584-003
584 Configuration Tape	T584-004
584 PID Tape	T584-101
584 Modbus Master Pack	T584-102

584L Programmable Controller

P190 Tape Loader Tape	T190-201
584 Programmer Tape	T584-201
584 Utility and Configuration Tape Package	T584-202
584 ASCII Tape	T584-003
584 Configuration Tape	T584-204
584 Utility Tape	T584-205
584 Redundancy Tape	T584-006
Redundancy Supervisor Tape	T211-001
584 PID Tape	T584-101
584 Modbus Master Pack	T584-102

Micro 84 Programmable Controller

M84 Programmer/Tape Loader/ Configurator Tape	TM84-001
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884 Programmable Controller

884 Programmer/Configurator Tape	T884-001
884 Tape Loader Tape	T884-002
884 Ladder Lister Tape	T884-004

984 Programmable Controller

984 Programmer Tape	T984-201
984 Configuration Tape	T984-204
984 Utility Package Tape (Ladder Lister)	T984-205
984 ASCII Programmer Tape	T984-003
984 PID Module Tape	T984-101

2184 Motion Controller

2184 Tape Assembly (Programmer, Tape Loader, and Executive)	TP84-000
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SECTION 4 P190 PHYSICAL CONNECTIONS

4.1 CABLES OPTIONS LISTING

Following is a listing of cable options to be used with all devices that hook up with the P190 Programmer. Consult the section covering your specific device (PC, printer, etc.) to see which cables are used with your particular system.

Consult the appropriate System Planning and Installation Guide before attempting to connect the P190 to any devices using the cables listed below.

The last three digits of the cable assembly number indicate the cable length. Refer to Cable Assembly Data Sheets for more information about specific assemblies.

	CABLE NO.	FUNCTION
W190-XXX	W190-015 -025 -050 -100 -200	The W190 Cable Assembly connects the P190 Programmer directly to a 584 PC.
W191-XXX	W191-015 -025 -050	The W191 Cable Assembly connects the P190 Programmer to a modem and also connects the P190 and the J478 Interface.
W192-XXX	W192-006 -015 -025 -050	The W192 Cable Assembly connects the 584 PC to a modem or a J162-010 Telephone Interface.
W193-XXX	W193-015 -025 -050	The W193 Cable Assembly connects the P190 Programmer to a RS-232-C compatible Printer. This cable has a female connector on the printer side.
W194-XXX	W194-015 -025 -050	The W194 Cable Assembly connects the P190 Programmer to a RS-232-C compatible Printer. This cable has a male connector on the printer side.
W195-XXX	W195-015 -025 -050	The W195 Cable Assembly connects the P190 Programmer to a J470 Interface.

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W196-XXX	W196-015 -025 -050	The W196 Cable Assembly connects the P190 Programmer to the J146 Interface.
W807-XXX	-012 -025 -050	The W807 Cable Assembly directly connects the P190 Programmer and the 884 PC. It also connects the P190 to A J375 Modbus Adapter.
W907-XXX	W907-006 -015 -025 -050 -200	The W907 Cable Assembly directly connects the P190 Programmer and the 984 PC.
ASW02M-XXX	ASW02M-015 -025 -050	The ASW02 Cable Assembly connects the P190 to a 2184 Motion Controller.

4.2 P190 — 184/384 CONNECTIONS

The P190 can be connected to 184 and 384 PC's using either an I646 Interface or a J146 Interface. These interface units are connected to the P190 Programmer using a W196-XXX cable assembly.

4.3 P190 — 484 CONNECTIONS

The P190 must be connected to a 484 PC using an interface device.

CAUTION

Direct connection between a P190 and a 484 will cause damage to one or both of the components.

The J470 Interface connects the P190 Programmer to the 484 PC using a W195 Cable Assembly.

The P190 may also be connected to the 484 using a J478 Modem. A W191 Cable Assembly connects the P190 and the J478. A J474 completes the connection to the 484 PC.

The P190 may also be connected to the 484 via a telephone interface. The P190 is connected to an AJ342 acoustic coupler (or equivalent). This coupler is then connected to a T158-611 Telephone Interface, which in turn is connected to the 484 via a J470 Interface.

4.4 P190 — 584 CONNECTIONS

The P190 may be directly connected to a 584 PC using a W190-XXX cable assembly.

Modems can also be used to complete a P190 — 584 connection. A W191 cable assembly is used to connect the P190 to a modem and a W192 cable assembly is used to connect the 584 to a modem.

A telephone interface can also be used to connect a P190 Programmer and a 584 controller. The P190 is connected to a J162-010 Telephone Interface (or equivalent) while the 584 is connected to a J162-010 Telephone Interface via a W192-XXX cable assembly.

NOTE

J160-010 (300 baud) and/or J161-010 (300 baud) telephone interfaces may also be used.

4.5 P190 — 884 CONNECTIONS

The P190 Programmer connects directly to an 884 PC using a W807-XXX cable assembly.

4.6 P190 — 984 CONNECTIONS

The P190 Programmer connects directly to a 984 PC using a W907-XXX cable assembly.

4.7 P190 — MICRO 84 CONNECTIONS

The P190 Programmer connects to a Micro 84 PC using a J375 Modbus Adapter. The J375 fits into the M84's I/O rack, and is directly connected to the Micro 84. The P190 is then connected to the J375 using the W807-XXX cable assembly.

4.8 P190 — 2184 MOTION CONTROLLER CONNECTIONS

The P190 connects to a 2184 controller using an ASW02M-XXX cable assembly.

4.9 P190 — PRINTER CONNECTIONS

The P190 Programmer connects to a RS-232-C compatible printer using a W193-XXX (female connector on printer side), or W194-XXX (male connector on printer side) cable assembly.

GLOSSARY

A

ADDRESS: A numeric value used to identify a specific I/O channel and/or module.

ANALOG I/O MODULE: A module (input, for example) that receives an analog signal from a user device. An analog signal is one that is continuously varying, such as a voltage or current level. The input module performs an analog to digital conversion and provides the digital result to the programmable controller. An analog output module converts the digital output from the PC to the analog signal required by the user device.

ASCII: A 7-bit digital coding of standard alphanumeric characters as established by the American National Standards Institute. ASCII stands for the American Standard Code for Information Interchange.

ASCII DEVICE: A unit which can send and/or receive ASCII characters. This includes CRT's, printers, alphanumeric displays, keyboards, bar code readers, multiplexers, badge/card readers, and floppy disks.

B

BAUD: A unit of data transmission speed equal to the number of code elements (bits) per second.

BCD (Binary Coded Decimal): A system of numbers representing decimal digits (0-9) using four binary digits (On or Off). BCD is a recognized industrial standard; BCD input (e.g., thumbwheels) and output (e.g., numerical displays) devices are readily available.

BINARY: A numeric system wherein values are represented only by numbers 1 and 0 (ON/OFF). Also called "base two". This system is commonly employed in modern electronic hardware since circuits can be economically designed for ON/OFF status.

BIT: Contraction of binary digit. A single number whose value can be either a ONE or a ZERO. The smallest division of a PC word.

BUS: An electrical channel used to send or receive data.

BYTE: A sequence of binary digits (bits) operated on as a unit. The exact number depends on the system, but normally a byte contains eight bits.

C

CANCEL: A command used to instruct the programmer to terminate the current process.

CHANNEL: A group of I/O modules that are separately connected to the mainframe. For example, a channel of I/O can contain up to 128 input points and 128 output points.

GLOSSARY

CHARACTER: One symbol of a set of elementary symbols, such as a letter of the alphabet or a decimal numeral. Characters may be expressed in many binary codes. For example, an ASCII character is a group of seven bits.

CLEAR: To return a memory or entry to the nonprogrammed state.

COIL: A discrete logical conclusion to a series of logical operations performed by the programmable controller (PC). The results can be outputs to the real world via an output module to activate motor starters, solenoids, relays, or pilot lamps. Coils are turned OFF when power is removed from the mainframe. (see LATCH.)

COMMUNICATION NETWORK: A serial data link which provides communication among multiple stations such which may be separate PC's, computers, or data terminals. It eliminates the need for separate, independently wired data links. Whether communicating or not, all stations can function independently

COMPARE FUNCTION: This function causes two matrices to be compared on a bit-by-bit basis to find all the bit locations which differ, and save the result for later use. The contents of these matrices are only examined; they are not altered in any way by using the COMPARE function.

COMPUTER: A device incorporating a CPU, memory, I/O facilities, power supply, and cabinet that accepts information, processes it in a prescribed manner, and supplies the results of these processes.

COMPUTER INTERFACE: A device designed for data communication between an intelligent device, such as a host computer and other units such as a programmable controller.

COUNTER: A type of logic that is used to simulate the operation of external counters. In relay panel hardware, a counter is an electro-mechanical device which can be wired and preset to control other devices according to the total cycle of one ON or OFF function. In a PC, a counter is internal to the processor, which is to say it is an electronic function controlled by a user programmed instruction.

CPU (Central Processor Unit): The "brain" of the controller system, wherein the program logic and the system executive is stored. All logic solving and decision making is performed by the processor. Also called a mainframe.

CRT TERMINAL (Cathode Ray Tube): A terminal containing a cathode ray tube used to display programs as ladder diagrams that use instruction symbols similar to relay characters. The terminal can also display data lists and application reports.

CURSOR: A visual movable pointer used on a CRT or programming panel by the programmer to indicate where an instruction is to be added to the ladder diagram. The cursor is also used for editing functions.

D

DIAGNOSTIC PROGRAM: A test program to help isolate hardware malfunctions in the programmable controller and application

DIGITAL: Having discrete states. Digital logic can have up to 16 states. However, most digital logic is binary logic with two states (ON or OFF).

DISCRETE REFERENCE: A reference that can be either ON or OFF. A discrete reference can be an input, output, or internal logic element.

DISTRIBUTED SYSTEM: Any combination of PC's, computers, and data terminals intercommunicating by means of a communication network.

DUMP: Recording the entire contents of user memory onto a storage medium (e.g., magnetic tape, floppy disc, etc.).

E

EDIT: To deliberately modify the user program in the PC memory.

EIA (ELECTRONIC INDUSTRIES ASSOCIATION): This organization has established several sets of communication standards, one of which is RS-232-C.

ELEMENT: The basic building block of the PC ladder logic. An element can be a relay contact, horizontal short, vertical short, fixed numeric value, register reference, coil, or function block. Sometimes referred to as a logic element.

ENABLE: To activate a logic coil or discrete input after it has been disabled.

EXECUTIVE: An operating system that processes the user's logic program.

H

HARD COPY: Any form of printed document such as a ladder diagram program listing.

HARDWARE: The mechanical, electrical, and electronic devices which compose a programmable controller and its application. Electrical devices connected through physical wiring.

HEXADECIMAL: Also called "Base 16." The numbering system that represents all possible ON/OFF combinations of four bits with sixteen unique digits (0-9 then A-F).

HOST COMPUTER: A computer which monitors and controls other computers and peripheral devices.

I

INPUT: A signal that provides information to the controller; can be either discrete input (pushbutton, relay contacts, limit switches, etc.) or numeric input (thumbwheel, external solid-state device, etc.).

INPUT DEVICES: Devices such as limit switches, pressure switches, pushbuttons, etc., that supply data to a programmable controller. These discrete inputs can have a common return or an individual return (referred to as isolated inputs). Other inputs include analog devices and digital encoders.

GLOSSARY

INPUT MODULE: A device which is used to connect the PC with the input devices. The input module contains the circuitry required to convert the incoming voltages to signal levels compatible with processor.

INTERFACING: Interconnecting a PC with its application devices and data terminals through various modules and cables. Interface modules convert PC logic levels into external signal levels and vice-versa.

I/O: Input/Output, the controller connection to the "real world"; includes both discrete and register outputs.

L

LADDER DIAGRAM: An industry standard for representing control logic relay systems with logic lines representing rungs on a ladder. It expresses the user programmed logic of the controller in relay equivalent symbology.

LADDER LISTING: A hard copy listing of the user's logic program.

LCD: Acronym for Liquid Crystal Display. It provides reflective visual readout. Since its segments are displayed only by reflected light, it has extremely low power consumption as contrasted with LED which emits light.

LED: Acronym for Light Emitting Diode.

LINE: In communications, this term describes cables, telephone lines, etc., over which data is transmitted.

LINE PRINTER: A high-speed printing device that prints an entire line at one time.

LOGIC: A systematic interconnection of digital switching functions, circuits, or devices, as in electronic digital computers.

LOGIC DIAGRAM: A graphic description of logic functions and conditions. It is used to find the result of an addition of the contents of two registers; a logical compare of two matrices; as well as other arithmetic operations.

LOGIC ELEMENT: Any one of the elements that can be used in a ladder logic diagram. These elements include relays, coils, shunts, timers, counters, arithmetic functions, and DX functions

LOGIC LINE: A line of user logic used to construct the unique logic for the application.

M

MEMORY: Storage for binary data and programs.

MEMORY PROTECT: The hardware capability to prevent a portion of the memory from being altered by an external device. This hardware feature is under keylock or password control.

MENU: A selection of the operations you can perform at any given point the programming process. The menu will appear on the CRT screen.

MODEM: A contraction of MODulator/DEModulator. A modem converts digital signals to analog signals, which are suitable for telephone wire transmission. It also converts these analog signals back to digital signals suitable for computer communication.

MODULE: Hardware subassembly that can be easily replaced for maintenance purposes. If a failure occurs, the module is rapidly replaced to restore the control system with minimum downtime.

N

NETWORK: A group of logic elements that are connected together to form a specific function (e.g., a motor starter control circuit).

NODE: A point on a ladder diagram that can receive power from the left or provide power flow to the right. This can be an input to logic element (left side) or an output from a logic element (right side).

NOISE: Extraneous electrical signals; any disturbance which causes interference with the desired signal or operation.

O

OFF-LINE OPERATION: Describes equipment or devices that are not connected to the communications line.

ON-LINE OPERATION: Describes operations where the programmable controller is directly controlling the machine or process.

OPTICAL COUPLER: A device which couples input and output using a light source and detector in the same package. It is used to provide electrical isolation between input circuitry and output circuitry.

OUTPUT: A signal provided from the controller to the "real world"; can be either discrete output (e.g., solenoid valve, relay, motor starter, indicator lamp, etc.) or numeric output (e.g., display of values stored within the controller).

OUTPUT DEVICES: Devices such as solenoids, motor starters, etc., that receive signals from the programmable controller.

P

PARITY: Method of verifying the accuracy of recorded data.

PARITY BIT: An additional bit added to a memory word to make the sum of the number of "1's" in a word always "even parity" or "odd parity."

PARITY CHECK: A check that tests whether the number of "1's" in an array of binary digits is odd or even.

PC: Abbreviation for Programmable Controller.

GLOSSARY

PERIPHERAL EQUIPMENT: Units that may communicate with the programmable controller, but are not part of the programmable controller. (e.g., teletype, cassette recorder, CRT terminal, tape reader, programming panel, etc.).

PORT: An I/O connection on a processor or a peripheral device.

PROCEED: A command used to instruct the programmer to start or continue with the indicated operation.

PROCESSOR: The "brain" of the controller system, wherein all the user's logic and executive are stored. All logic solving and decision making is performed by the processor. Also called the CPU or mainframe.

PROGRAMMABLE CONTROLLER (PC): A solid-state control system which has user programmable memory for storage of instructions to implement specific functions such as; I/O control logic, timing, counting, arithmetic and data manipulation. A PC consists of a central processor, an input/output interface, memory, and a programming device that typically uses relay equipment symbols. A PC is purposely designed as an industrial control system that can perform functions equivalent to a relay panel or a wired solid-state logic control system.

PROGRAMMING PANEL (PROGRAMMER): A user's primary interface with the programmable controller. A device used for editing, inserting, and monitoring programs in a PC.

PROM (PROGRAMMABLE READ-ONLY MEMORY): A retentive memory used to store data. Once programmed, the contents of this memory are not easily altered.

PROTOCOL: A defined means of establishing criteria for receiving and transmitting data through communication channels.

R

RAM (RANDOM ACCESS MEMORY): A semiconductor memory where data can be entered, altered, or retrieved at any time. RAM memory is volatile; it loses its stored contents when power to the memory is removed. A battery back-up system is required. Random Access Memory is used to store the state (ON or OFF) of discrete references.

READ: To sense the presence of information in some type of storage, storage which includes: RAM memory, magnetic tape, punched tape, etc.

REAL TIME: The actual time during which physical events take place.

REFERENCE NUMBERS: Numbers which identify the elements of the relay ladder logic. References can be either discrete (logic coils, inputs, or sequencer steps) or register (input or holding registers).

REGISTER: A location in the controller's memory allocated to the storage of numerical values. There are three types of registers: input registers whose contents are controlled by the "real world" outside the controller; holding registers whose contents are controlled from within the controller; and output registers, which are special holding registers since their contents can also be provided to the "real world." All holding registers are retentive on power failure.

REGISTER MODULE: A device used to select, convert, and condition binary coded decimal (BCD) and analog signals that pass between the user's device(s) being controlled and the PC.

RELAY: An electromagnetic device operated by a variation in conditions of an electric circuit. When so operated, it controls other devices such as switches.

RELAY ELEMENT: A logic symbol used to simulate the effect of an electrical relay. Contacts can be normally open, normally closed, or transitional contacts.

REMOTE I/O: The portion of the controller's I/O that is installed at a location away from the controller. Communication between the Remote I/O and the controller is provided via a single cable or two cables.

ROM (Read-Only Memory) is a digital storage device specified for a single function. Data is loaded permanently into the ROM when it is manufactured. This data is available whenever the ROM address lines are scanned.

RS-232-C: Electronic Institute of America (EIA) standard for data communications, RC-232 type C. Data is provided at various rates, eight data bits per character.

RUN LIGHT: An LED indicator on the processor that indicates, when lit, that logic is being processed.

S

SCAN: The technique of examining or solving logic networks one at a time in their numeric order. After the last logic network is solved, the next scan begins at network one; logic is always solved in this fixed cyclic process.

SCAN TIME: The time it takes to completely execute an entire PC program one time.

SEGMENT: A section of a logic program that contains one or more networks.

SELF-DIAGNOSTIC: The hardware and firmware within a controller which allows it to continuously monitor its own status and indicate any fault which may occur within it.

SERIAL OPERATION: Type of information transfer within a Programmable Controller whereby the bits are handled sequentially rather than simultaneously (as in parallel operation).

SOFTWARE: Application programs and internal programs used to support the performance of the controller function.

SOLID STATE: Circuitry designed using only integrated circuits, transistors, diodes, etc.; no electro-mechanical devices such as relays are utilized. High reliability is obtained with solid-state logic, reliability which would be degraded by depending upon electro-mechanical devices.

START-UP: The time between equipment installation and the full operation of the system.

GLOSSARY

STATE: The logic "1" or logic "0" condition in the PC memory or at a circuit's input or output.

SYSTEM: A collection of units combined to work as a larger integrated unit having the capabilities of all the separate units.

T

TABLE: A group of consecutive registers used to store numerical values.

TIMER: PC logic used to measure and record the time of an event or sequence of events. Timers can accumulate time in either seconds, tenths of seconds, or hundredths of seconds depending on the PC.

TOPOLOGY: The layout of the units within a system, including interconnections, specifications, and variables of layout.

W

WORD: A grouping or a number of bits in a sequence that is treated as a unit.

WRITE: The process of loading information into a memory.

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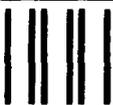
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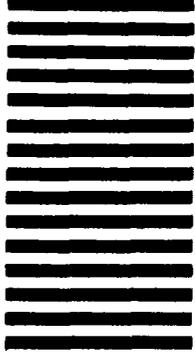
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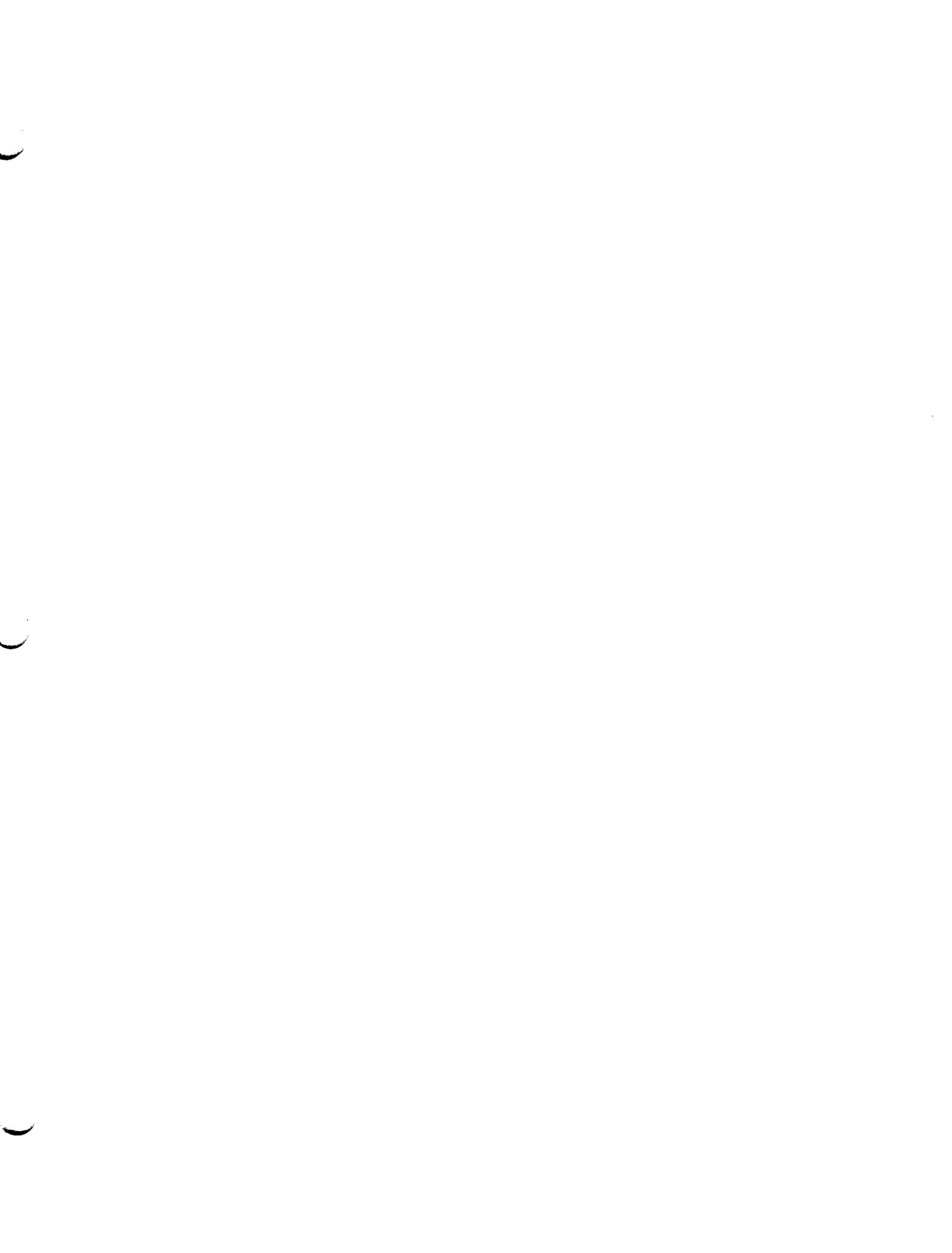
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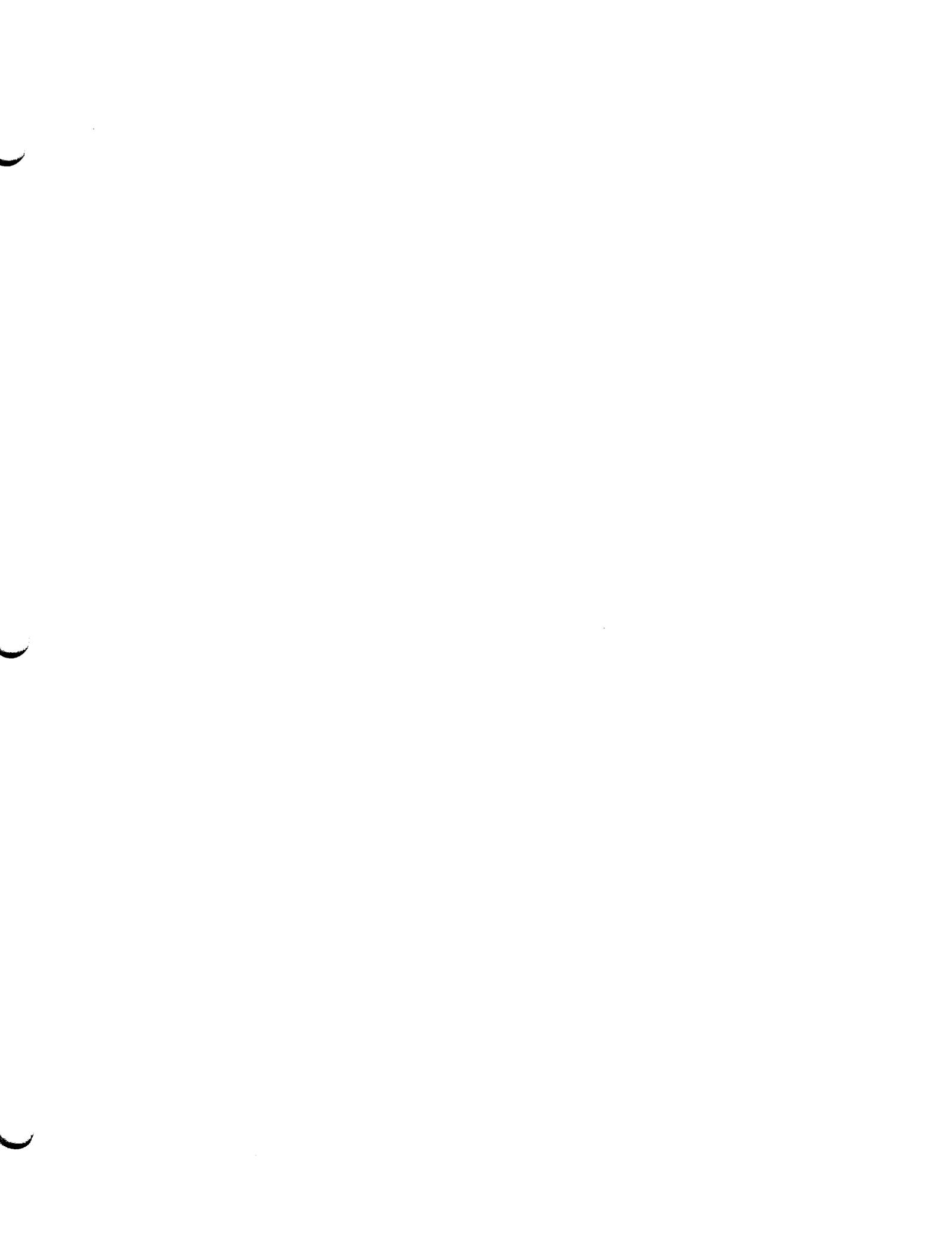
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