

SECTION 6 P370 PROGRAMMER

The P370 Programmer (Figure 6-1) is the primary interface for the programming and monitoring of the MICRO 84 Programmable Controller. The programmer is a rugged, portable, hand-held unit that contains a function keyboard and a liquid crystal display (LCD). The LCD consists of a 4 (row) X 7 (column) node display and shows the power flow in a network in relay ladder diagram form. When a logic element is programmed into a specific row and column, that location is indicated by a node, or point of light, on the network display. The actual element is not shown. Specific information about an individual logic element (the logic element under the cursor) is displayed in the REFERENCE, DATA, STATUS, and Element Display areas of the LCD.

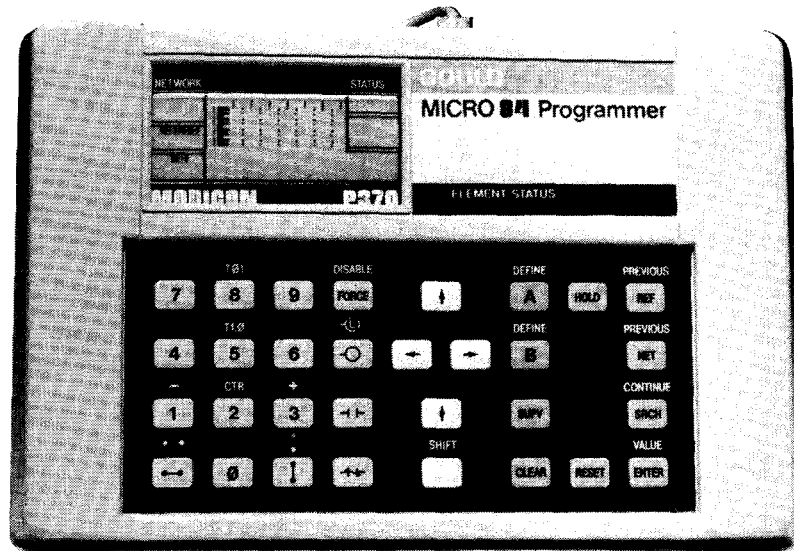


Figure 6-1. P370 Programmer

The programmer is connected to the MICRO 84 Programmable Controller, through a cable assembly. It provides a simple method of programming the user's portion of the memory from a ladder diagram. The "language" used to program the controller utilizes familiar relay symbols; there is no requirement to learn a programming language. In addition, the LCD readout allows rapid and easy system checkout and maintenance.

The front of the programmer's panel is divided into an upper section and a lower section. The upper section consists of the liquid crystal display area and an Element Status light; the lower section consists of the function keyboard and keylock switch.

6.1 PROGRAMMER OPERATING MODES

The P370 Programmer operational functions may be broken down into four distinct modes:

- EXAMINE Mode (including Hold State)
- DATA ENTRY Mode
- SUPERVISORY Mode
- ERROR Mode

Each mode has specific effects on the display and keyboard operations.

6.1.1 Examine Mode

- Normal monitoring of network power flow and status of any node within the network.
- Monitoring the value or status of any register or coil (using the REF key) that is not associated with the node located at the cursor position.
- In the HOLD state, the contents of the Data display are frozen, allowing examination of the reference value.

The programming panel enters the EXAMINE mode automatically after the power up diagnostics have successfully completed. The cursor is positioned at row 1, column 1 of network 1.

6.1.2 Enter Mode

In the Enter mode, new information is entered into the programmer for subsequent entry into the controller. This can be new nodes, updating existing node information (reference, element type), register values, etc.

6.1.3 Supervisory Mode

The Supervisory mode allows the user to enter and initiate the supervisory commands for the controller's internal memory.

6.1.4 Error Mode

In the event of a programmer or controller error condition (diagnostic error, communication error, or user error in entering data), the programmer automatically enters the error mode and displays the appropriate error code.

Depending on the error code present, certain keys will be operational. The RESET key or the SHIFT/RESET keys are used to recover from an error condition (see Appendix A).

6.2 DISPLAY AREA

The upper section of the programming panel is the LCD and consists of three display areas:

- Reference Data
- Node and Element
- Status

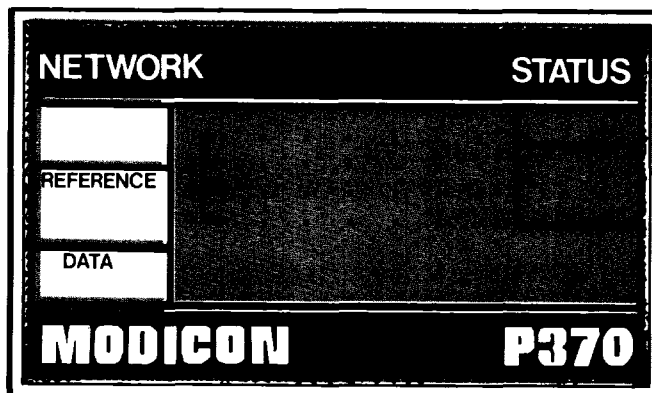


Figure 6-2. Reference Data Area

The intensity of the display can be controlled by the knurled, slotted plastic screw on the bottom of the panel. Rotating the screw clockwise increases the intensity of the display.

6.2.1 Reference Data Area

The reference data area contains three separate displays; network, reference, and data. (See Figure 6-2.)

6.2.1.1 Network Display

The two digit network display indicates which of 9 (18 in the M48A-002) networks is currently being viewed. The keyboard allows the user selection of any network. Each network can contain up to 28 logic elements.

6.2.1.2 Reference Display

The four digit reference display, when used in conjunction with the cursor's position, displays an element's assigned reference number if any. If the cursor is positioned on the upper node of a double node element, the preset is displayed. For the lower node, the reference number of the holding register is displayed.

6.2.1.3 Data Display

The four character data display contains the register contents, or element status, of the logic element at the current cursor position. The register contents is a numeric value in the range from 000 to 1023. The element status is either OFF or ON.

6.2.2 Node and Element Display

The node display (see Figure 6-3) is the area where power flow for each node within a network is displayed in ladder diagram form. Power flow through a node's associated element illuminates that node. A particular node can be selected by moving the cursor; the node on which the cursor is positioned blinks and the element is displayed in the element display area. (Figure 6-3 Node Display Area.)

The element display (see Figure 6-4) has two sections; the left section for single node elements (contacts, coils), the right section for the upper or lower half of double node elements (counters, timers, arithmetic operations). When the cursor is positioned on a node, only one section of the element display illuminates, indicating the type of element contained within that node. If the cursor is placed on the top node of a double node element, only the top node is displayed. (See Figure 6-4 Element Display Area.)

6.2.3 Status Indicators

Five status indicators are contained on the right section of the programming panel. Four of the indicators are a part of the LCD display while the fifth (ELEMENT STATUS) is on the face of the panel.

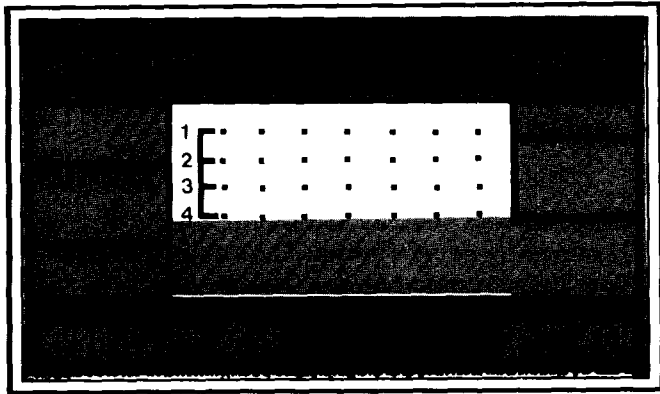


Figure 6-3. Network Display Area

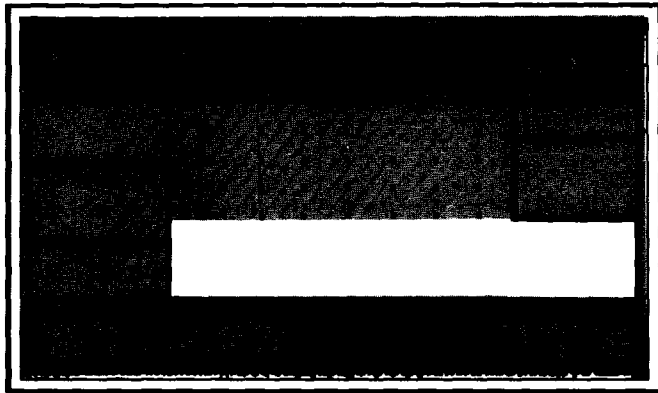


Figure 6-4. Element Display Area

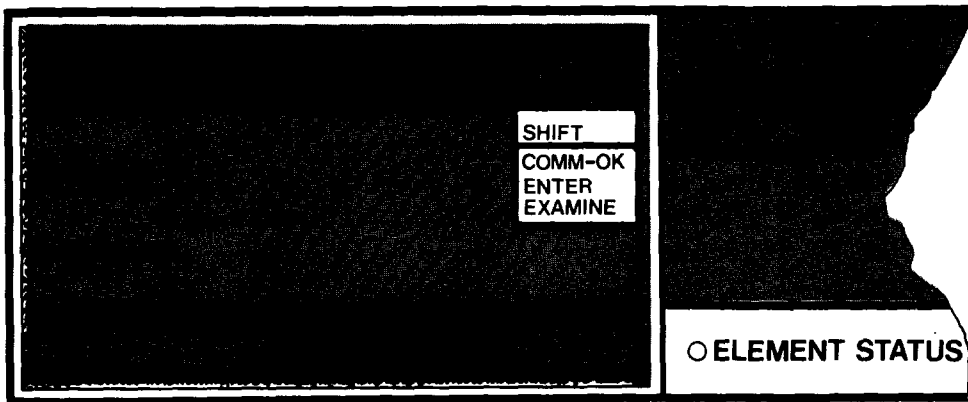


Figure 6-5. Status Indicators

SHIFT

Indicates that the next keystroke will have its shifted value. The legends printed on the panel indicated the shifted function while the legend on the key caps indicated the normal (unshifted) function.

COMM-OK

Indicates that the connection between the panel and controller is secure.

ENTER

Indicates that data is being changed. When the ENTER pushbutton is pressed, the data that is displayed on the programmer is entered into the controller. The ENTER indicator remains on until the data is transferred and entered into the processor. After the data is entered, the ENTER indicator is extinguished and EXAMINE is illuminated.

EXAMINE

Informs the user that the logic element under the cursor's position is being viewed in the reference data, node display, and element display areas.

ELEMENT STATUS

A light emitting diode (LED) is located on the front panel and is illuminated when power is flowing through the logic element under the cursor. This is necessary because it is impossible to determine power flow through the logic element at the cursor position because the cursor is constantly blinking. The blinking is necessary for cursor identification and it overrides any other indicator in a node.

6.3 KEYBOARD

The lower section of the P370 Programmer contains the function keyboard. The function keyboard contains the control keys necessary to enter numeric data and logic elements, move the cursor, and perform the various programmer functions (see Figure 6-6). When using the keyboard, press each key in the keystroke sequence firmly. Pressing a key lightly or quickly may result in that keystroke being ignored.

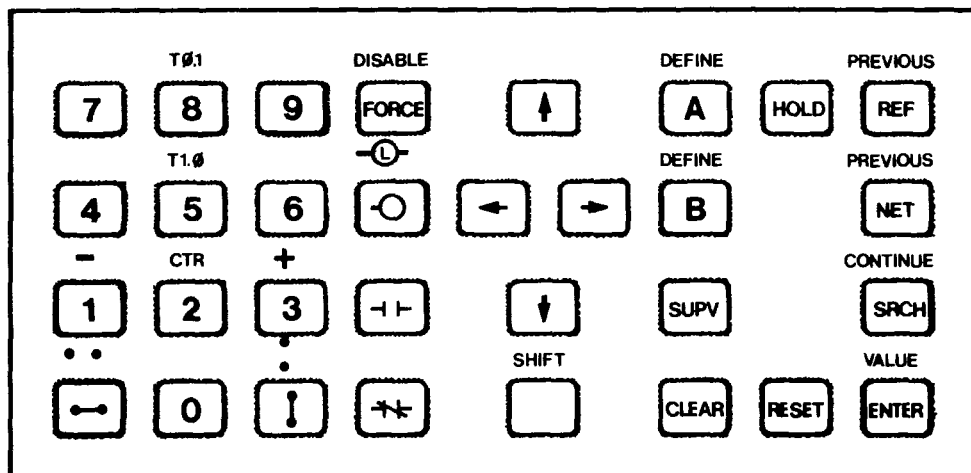


Figure 6-6. Function Keyboard

6.3.1 Numeric Keys

Numeric keys 0-9 are used for entering the required numeric data (reference numbers, preset values, register controls, etc.). See Figure 6-7.

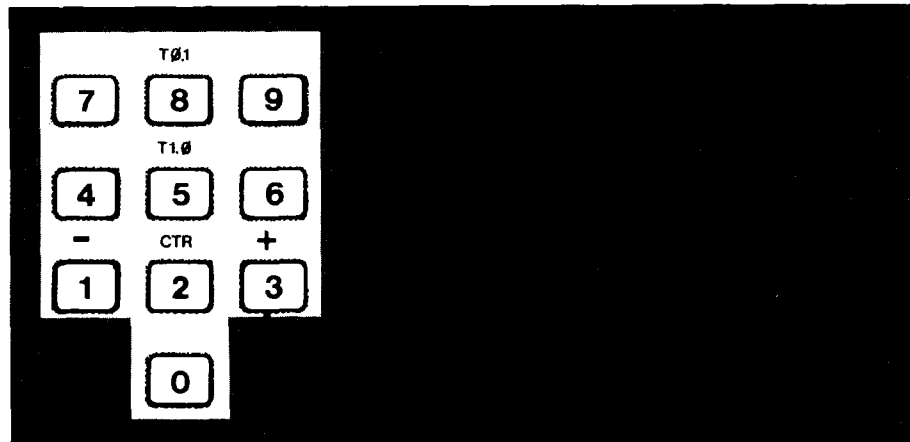


Figure 6-7. Numeric Keys

6.3.2 Logic Element Keys

The logic element keys (see Figure 6-8) are used to select the logic element to be placed at each node in a ladder logic network. Some of the logic elements are shifted values of a similar element or numeric key.

6.3.3 Cursor Control Keys

A set of four keys are provided to control cursor movements (see Figure 6-9). When pressed, each key moves the blinking cursor one node in the direction indicated by the arrow on the key cap.

Positioning the cursor beyond the first or seventh column on the network display causes the cursor to appear in column seven or column one of the same row (wraparound). The cursor also wraps around when being moved up and down.

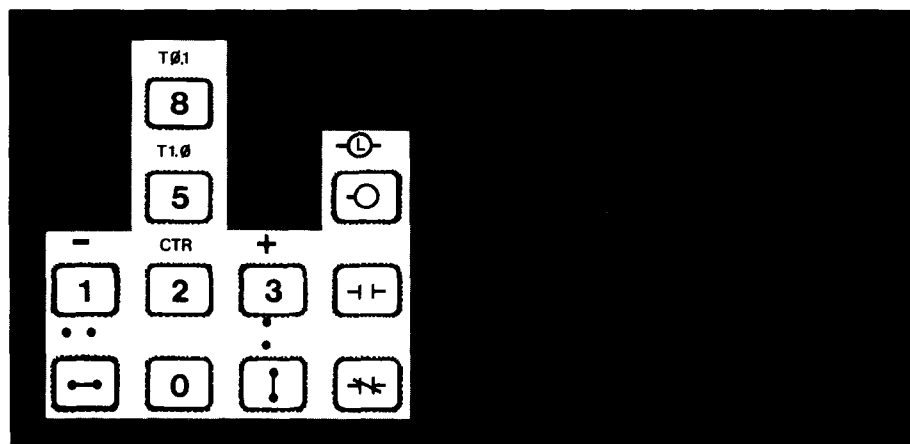


Figure 6-8. Logic Element Keys

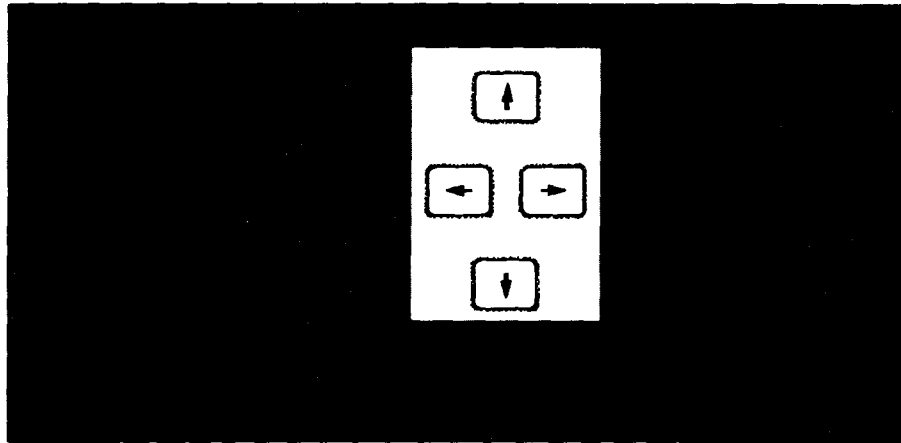


Figure 6-9. Cursor Movement Keys

6.3.4 Function Keys

The function keys provide direct user interaction with the controller (see Figure 6-10).

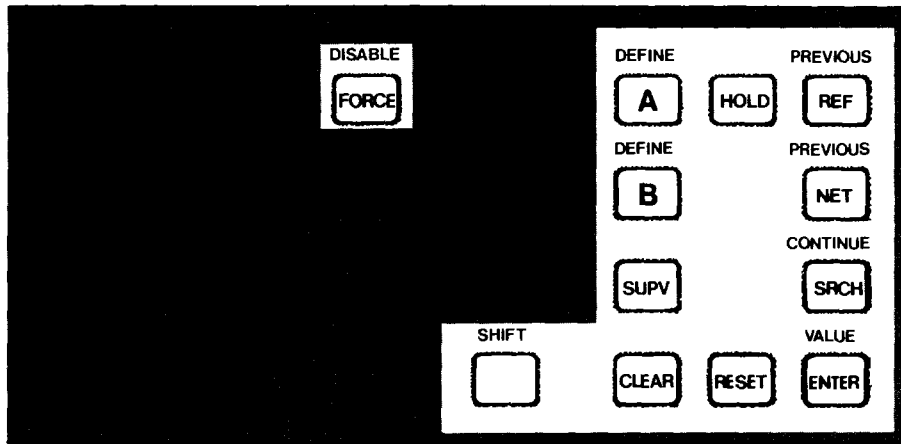


Figure 6-10. Function Keys

6.3.4.1 SHIFT

When the Shift function is on, the shifted operation of a double function key will be performed when the function key is pressed. The shift function is obtained by pressing the SHIFT key. The shifted operations are printed on the P370 Programming Panel surface above the key. When used with keys having only a single (lower) key function, the SHIFT function is ignored.

The SHIFT function is cancelled by pressing any key other than REF, NET, or SRCH.

6.3.4.2 A - SHIFT/DEFINE A B - SHIFT/DEFINE B

The A and B keys are assigned by the controller to specific registers; the A key is assigned to register 4010 and the B key is assigned to register 4020. When either key is pressed, the register number assigned to that key appears in the reference display and the current contents of the register appear in the data display. This allows the user to recall a register (4010 or 4020) and view its contents using one keystroke. Normally, five keystrokes (4-digit register number and REF) are required to recall a register and its contents.

The register number assigned to the A and B keys can be changed to any of the available registers (40XX only) whose contents are viewed frequently. These new assignments will be in effect until changed (i.e., assignments are not affected by power down).

To change the assigned register number, enter the desired register number into the data display, then press SHIFT/A or SHIFT/B as appropriate. The SHIFT is required to choose the DEFINE A or DEFINE B function. The register number entered appears in the reference display and the register contents appear in the data display. During this interval the element display goes blank.

NOTE

The redefined A and B register assignments will not be maintained when the user's program logic is dumped to the P371 Program Deck. When the logic is reloaded, the 4010 and 4020 assignments will be in effect.

6.3.4.3. SUPV

The supervisory mode can only be used if the Memory Protect feature is OFF. It is entered by pressing the SUPV key. When in any mode other than the supervisory mode, pressing the SUPV key causes the following displays to blank: network, data, power flow and cursor, element type, enter, examine, and element status light. The REFERENCE display reads SUP0 for panel mode operation. COMM OK remains illuminated.

The supervisory commands allow the user to control processor operation. Table 6-1 contains the supervisory commands, associated code number, and the action taken by the controller.

To enter a supervisory command, press SUPV, the code number, and ENTER, in that sequence. When using SUPV 4, it is not necessary to press the ENTER key to initiate the action (i.e., SUPV and 4 is all that is necessary). Pressing ENTER a second time causes the controller to perform the indicated action.

Table 6-1. Supervisory Codes and Actions

COMMAND	CODE	ACTION
EXIT	0	Returns Programmer to EXAMINE mode.
STOP CONTROLLER	1	Halts the logic solving (SCAN) controller operation.
START CONTROLLER	2	Starts the logic solving (SCAN) controller operation. Coil status (ON or OFF) is retained as it was prior to stopping the controller. To clear coils, either reload program from Program Pack or power-down and power-up the mainframe, or turn off coils prior to stopping controller.
CLEAR MEMORY	3	Initiates the erasing of the data contained in the user's portion of the processor memory. The controller must be stopped (SUPV 1) before memory is cleared.
REAL TIME	4	Displays power flow as it is updated by controller scanning. Fast changing power flow is accurately displayed. Scan time is slightly increased.
DUMP MEMORY	5	Initiates the loading of the user's portion of the processor's memory into the program pack.

Before pressing the ENTER key a second time, the DATA display area reads CONF (confirm). Pressing the ENTER key a second time causes the command associated with the supervisory code to be performed. The REFERENCE display area contains SUP "n" where "n" is the code of the command being processed. When the supervisory function is completed the DATA display reads DONE.

The supervisory mode can be exited in three ways:

- Entering supervisory Code 0 and pressing the ENTER key causes the programming panel to enter the EXAMINE mode.
- Pressing the RESET key causes the programming panel to enter the EXAMINE mode. The cursor returns to the position it was in prior to entering the Supervisory mode.
- Pressing the SHIFT key and then the RESET key resets the panel and returns the cursor to the power-up "home" position (row 1, column 1) in the EXAMINE mode.

6.3.4.4. CLEAR

When pressed in the DATA ENTRY or EXAMINE mode, the CLEAR key places 0000 in the DATA display, blanks the ELEMENT TYPE display and leaves the panel in the DATA ENTRY mode.

In SUPV and ERROR modes, the CLEAR key is not operational.

6.3.4.5 HOLD

When pressed, the HOLD key causes the updating of the DATA display to cease and the most current data or status to be "held" in the Data display. The Hold state is visually indicated by an uppercase or lowercase H in the leftmost character position of the Data display. An uppercase H is displayed if the most significant digit of the numeric value being displayed (leftmost number) is 1. A lowercase h is displayed if the most significant digit is 0.

The HOLD key is functional in the EXAMINE mode.

Pressing any key causes an exit from the Hold state.

6.3.4.6 RESET-SHIFT/RESET

The RESET and SHIFT/RESET keys are the only keys that can be used after an error or after a search is completed. Pressing RESET will cause the panel to return to the EXAMINE mode at the current cursor position. If the error condition still exists, an error message will reappear. Certain panel or controller diagnostic and communication error states can only be exited by a SHIFT/RESET (see Appendix A).

In all modes, RESET has the same effect as described above. It overrides any existing mode and brings the panel back to EXAMINE mode at the node for the current cursor position.

SHIFT/RESET has the effect of restarting the panel, and is equivalent to a power-up. Full diagnostics are run and, if passed successfully, the panel enters EXAMINE mode at network 1, row 1, column 1.

6.3.4.7 REF-SHIFT/PREVIOUS REF

Depending on the current panel operating mode, pressing the REF (reference) key causes one of several actions:

Enter Mode — While in the Enter mode, pressing the REF key, after entering a reference number into the DATA display (via the keyboard), causes that reference number to appear in the REF display. The DATA display continuously shows the data or status of the new reference number.

Examine Mode — Pressing the REF key while in the EXAMINE mode causes the reference number in the REF display to increment by one, and the data or state of the new reference number to appear in the DATA display. Entry of an invalid reference number causes an error code to appear in the DATA display.

In the SHIFT mode, pressing the REF key causes the PREVIOUS REF command to occur. This decrements the reference number viewed in the REF display by one, and the data or state of the new reference number appears in the DATA display.

The programming panel is aware of the controller's memory size and automatically provides wraparound if incrementing or decrementing the reference number exceeds the maximum limit. Any reference number may be used. For sequencer reference numbers, incrementing, decrementing, and wraparound effect only the two righthand digits.

If the input logic element being examined is disabled, the DATA display indicates the condition by placing a small "d" in front of the "ON" or "OFF" mnemonic. Output coils will show only their ON or OFF condition and not if they are disabled. The disabled condition of a coil can be determined in EXAMINE mode when the cursor is on the coil.

While examining a reference, the power flow display and the Element Status light continue to show the power condition at the cursor position previous to the initiation of the REF mode. The Element Type display goes blank when the REF key is pressed.

6.3.4.8 NET-SHIFT/PREVIOUS NET

The NETWORK key is used to access a desired network. This key operates in any of the following three modes: Pressing the NET key causes the next network in sequence to be selected, displays the new power flow information, and increments the NETWORK display number. If the last network is being viewed and the NET key is pressed, the first network (1) is selected (wraparound).

Any network can be displayed by entering a valid network number (1-18) into the DATA display and then pressing the NET key. The network requested appears in the POWER FLOW display and the new network number appears in the NETWORK display.

Pressing the NET key while in the SHIFT mode causes the previous network in sequence to be selected, and displays the new power flow information, and decrements the NETWORK display number. If the present network viewed is network 1 and SHIFT/NET is pressed, the last network is accessed (wraparound).

In all cases, the accessed network places the cursor in the home position (row 1, column 1) and displays the new power flow information.

6.3.4.9 SRCH-SHIFT/CONTINUE SRCH

The SEARCH function enables a search through the logic networks for the occurrence of a specific reference number or node type. There are four types of search which are designated by parameters 1 to 4 as follows:

<u>SEARCH TYPE</u>	<u>SEARCH DESCRIPTION</u>
1	Search for a coil with a given reference number.
2	Search for a single node with a specified reference number.
3	Search for a double node which employs a register with a specified reference number. This includes implied references associated with adders and subtractors.
4	Search for a given node type. This search looks only for the basic node type regardless of the existence of verticals or latches.

To use the SEARCH function, enter the desired search type into the DATA field and press the SRCH key. Next, enter the appropriate reference number or node and press the SRCH key a second time.

For example, to search for coil 0007; press the following keys:

1 0007

The search is started from Network 1, Column 1, Row 1 of the user logic and proceeds from Row 1 to Row 4 of each column and from column 1 to column 7 of each network through all the networks until the first occurrence of the reference or node is found. The search stops in EXAMINE mode with the cursor on the node which has just been found.

Further occurrences of the specified reference or node can be looked for by pressing the SHIFT key and then the SRCH key. This continues the search. The Continue function is available only as the next step after a successful Search or Continue function. The only keys which can be pressed and preserve the Continue option are SHIFT, SEARCH, NET, and the CURSOR movement keys. A Continue function proceeds from the last found occurrence of the conditions, even if the cursor has been moved or the network number has been changed. A successful Continue operation leaves the panel in the EXAMINE mode with the cursor at the discovered node and the SHIFT ON.

If a Search or Search Continue operation proceeds to the end of the user logic without finding an occurrence of the specified conditions, error code 79 is displayed and the cursor is returned to its position immediately prior to starting the current Search or Continue operation. The SHIFT state is removed, if present.

6.3.4.10 ENTER

The ENTER key allows the user to enter initial information or change existing information associated with the node at the cursor's current

position. For single node functions the initial or altered information can be the reference number, element type, and vertical or horizontal connectors. For double-node functions, entry of initial information involves both the upper and lower nodes; changing existing information may involve only the upper or the lower node or both nodes.

Entering a Single-Node Logic Element

Any combination of allowable numeric values (reference numbers, preset values, etc.) and logic elements (contacts, coils, timers, etc.) can be entered for a single-node logic element. As soon as any numeric or element key is pressed, the controller goes into the ENTER mode. The last value entered for either the numeric value or logic element prior to pressing the ENTER key is the one that is valid and is entered into the controller (for example, after entering a normally closed contact, the user can have a change of mind and enter a normally open contact). There is no preferred sequence for entering numeric values and logic elements. When all the information is correct, press the ENTER key.

For example, to enter a normally closed contact with reference number 1017, place the cursor in the proper location, and press the following keys:

1017



The same sequence is required when changing the logic element (i.e., the reference number must be specified even if it is not changing).

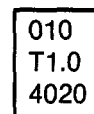
Entering a Double-Node Logic Element

Double-node logic elements are characterized by numeric values that must be entered into both the upper and lower nodes. The upper node contains a preset value (0-999) or the reference number of the register that contains the preset value (300X or 40XX). The lower node contains the reference number of the holding register (40XX). Double-node logic elements must be entered in specific sequence. If this sequence is not followed, an error code will be displayed.

1. Position the cursor at the location of the top half of the double-node logic element.
2. Enter the preset value. The preset value appears in the DATA display area.
3. Enter the double-node logic element type (counter, T1.0, T0.1, +, -). When this is entered, the preset value moves from the DATA display area to the REFERENCE display area. The Element display area contains the selected logic element.
4. Enter the reference number of the holding register (accumulated time, accumulated count, or overflow). Vertical connections can be entered also.
5. Press ENTER.

Example

To define a double-node logic element:



Place cursor in upper node location and press the following keys in sequence:

010

SHIFT

T1.0

4020

ENTER

Logic Element Entry Rules

The following rules and restrictions apply when entering logic element information.

1. Logic coils cannot be entered directly over existing double-node logic elements (error code 92). A coil can be entered over a single-node logic element (the overwritten logic element is deleted and replaced by the coil).

2. A double-node logic element cannot be entered over a coil.

In both cases above, the logic element to be replaced must first be erased by entering a horizontal open.

3. A double-node logic element can be entered over another double-node logic element or any logic element in the upper node position. To replace a logic element, the lower node must be a horizontal open. A double-node logic element cannot be entered where obliteration of one-half of another double-node logic element would occur (error code 92).
4. A double-node logic element cannot be entered where the lower node extends below the bottom rung of a network (error code 93).
5. A contact can be entered over a double-node logic element (either the upper or lower node). The other node is replaced by a horizontal open.
6. No vertical connectors can be entered in the bottom rung or in the seventh column.
7. Out of range or inappropriate reference numbers or preset values cause an error code (94) to appear.
8. A logic coil with a given reference number can occur only once in the user's logic. An attempt to write one results in error code 93. A logic coil reference number can be assigned to one or more contacts. The logic coil can then not only be used as a discrete signal to an output device, but also as a control for other user logic (for example, the latch in a seal circuit).
9. No data can be entered if the Memory Protect Switch is ON.
10. Any logic coil, whether disabled or enabled ON or OFF, is set to OFF when it is deleted by being replaced by another logic element.

6.3.4.11 SHIFT/ENTER VALUE

The SHIFT/ENTER VALUE function allows the user to insert a value into a register or to change the contents of a register. To use this function, first make sure the appropriate register reference number appears in the REF display. Using the numeric keypad, enter the desired value (0-999) for the contents of the register.

The new register contents appear in the DATA display. Enter the contents into the register by pressing the SHIFT and ENTER keys sequentially.

To enter or change the contents of register 4021, position the cursor in the proper location, and press the following keys:

4021 REF nnnn SHIFT ENTER

where nnnn is the value of the register contents being entered.

6.3.4.12 DISABLE (SHIFT/FORCE)

The DISABLE (SHIFT/FORCE) function allows the user to disable a coil or an input. To disable a coil, the cursor must be positioned on top of the coil. To disable an input, the REF display must contain the reference number of the input logic element. When the SHIFT and FORCE keys are pressed, the input is either enabled or disabled, depending upon its previous state. If the new status is disabled, a "d" appears to the left of the status in the DATA display (dOFF or dON). If a coil is disabled, the Node display reflects the current power status.

To re-enable the logic element, press the SHIFT and FORCE keys a second time.

6.3.4.13 FORCE-SHIFT/DISABLE

The FORCE key is used to toggle the power status of a previously disabled coil or input. When the FORCE key is pressed and the REF display contains a disabled input (10XX), or the cursor is on a disabled coil (00XX), the DATA display shows the power status of the element.

6.4 MEMORY PROTECT KEYLOCK SWITCH

A keylock switch is located on the front of the P370 Programmer. This hardware feature is designed to prevent accidental or unauthorized changes from being made to the user portion of memory using the programmer. It does not inhibit the normal operation of the controller but does prevent any changes from being made to the user program in the controller. All other programmer functions are available (i.e., element status can be checked, register contents can be monitored, etc.). When the key is vertical, it can be removed and controller memory is protected. When the key is inserted and is in the horizontal position, controller memory is unprotected and changes to the user program can be made from the P370 Programmer. (User memory can be changed at any time using the Program Pack (see Section 8).)

6.5 PROGRAMMER OPERATIONS

Tables 6-2 through 6-4 provide a quick reference for each of the four programming panel operating modes and:

1. The liquid crystal displays active during each mode.
2. The function keys operational during each mode.
3. The function keys used for panel mode entry.

Table 6-2. LCD Displays During Panel Modes

DISPLAY AREA	PANEL MODE			
	EXAMINE	ENTER	SUPERVISORY	ERROR
NETWORK	Displays current network number	Displays current network number.	SUP4:Displays current network number. Others: Blank	Contains network number in which error occurred.
REFERENCE	Displays Reference Number or Preset Value	Blank or displays preset data just entered.	SUPX = Supervisory Code	Blank
DATA	If Reference field contains 00XX, 10XX, or 2RXX, displays H or h if in Hold mode, d if Disabled, ON or OFF for state if register ref displays 000-999.	Blank or displays data just entered.	1. Blank until command initiated, -Reads CONF (after first ENTER) then Reads DONE (after second ENTER)	Exy = Error Code
Power Flow and Cursor	Normal Power Flow Cursor	Normal Function	SUP4: Real-time power flow and cursor movement Others: Blank	Blank
Element Type	1. If monitoring node at cursor position, the node graphic is displayed. 2. No display if monitoring a reference not associated with cursor.	Blank or displays logic element just entered.	Blank	Blank
COMM OK	Normal Function:	ON for good communication, off for bad communication		
SHIFT	Normal Function:	ON if Shift key is depressed		
ENTER	Blank	ON	Blank	Blank
EXAMINE	ON	Blank	Blank	Blank
Element Status LED	Normal Function	Normal Function Function Others: Blank	SUP4: Normal Function	Normal

Table 6-3. Key Usage/Panel Mode

MODE	SHIFT RESET	RESET	CLEAR	SUPV	ENTER	NUMERICS	CURSOR	HOLD	ALL OTHERS
Examine Mode	X	X	X	X	X	X	X	X	X
Enter Mode	X	X	X	X	X	X	X		X
Supervisory Mode	X	X		X	X	X	X		
User Error	X	X							
Panel/Controller/ Communication Errors	X								

Table 6-4. Panel Mode Entry

FROM	TO: EXAMINE	SUPERVISORY	ENTER	HOLD STATE
Enter	Press ENTER, RESET, or SHIFT/RESET	Press SUPV Key	N/A	N/A
Supervisory	Press SUPV, 0 and ENTER, or RESET, or SHIFT/RESET	N/A	N/A	N/A
Error	Press RESET or SHIFT/RESET	N/A	N/A	N/A
Hold State	Press any key except logic element numeric, or CLEAR	Press SUPV	Press any logic element, numeric, or CLEAR	N/A
Examine	N/A	Press SUPV	Press any logic element, numeric, or CLEAR	Press HOLD