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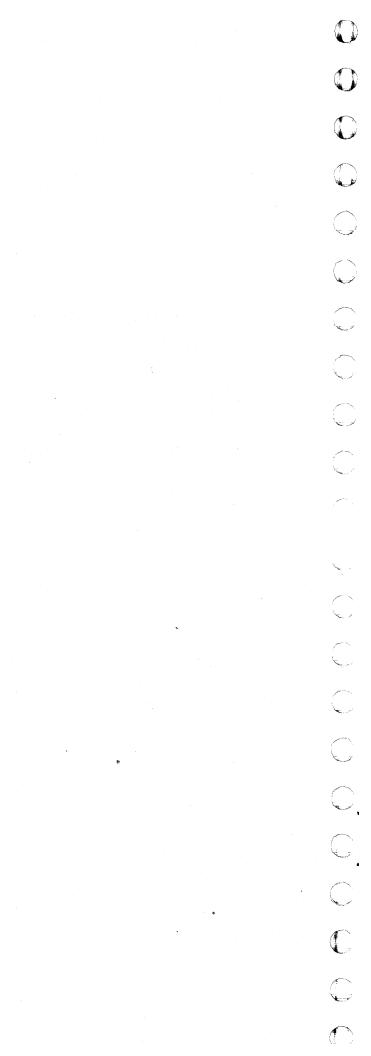| PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV
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PREFACE

This manual provides operator and user information for the MPX Program Command Console (PCC) package which resides on the MPX library.

This manual applies to PCC execution with MPX/RT and MPX/OS operating systems.

> This product is intended for use only as described in this document. Control Data cannot be responsible for the proper functioning of undescribed features or parameters.

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PROGRAM COMMAND CONSOLE

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Interface: CDC® 714 Display Terminal

The program command console (PCC) program is a debugging aids package loadable with the user's programs (see MPX/RT Reference Manual 14062300 and MPX/OS Reference Manual 10817300, TASK statement). The MP-60 system loader passes control to PCC after completion of the load. The user communicates with PCC through a keyboard display. The user may execute programs in a trace, breakpoint, or snap-mode environment (using PCC command entries) and observe the results of the execution at the display. The basic functions provided by PCC are:

- Inspect memory
- Change memory.
- Catalog changes to a change file on mass storage.
- Close or release change file.
- Snapshot memory to standard output.
- Dump memory to standard output.
- Trace program.
- Run program in interpretive mode.
- Stop program running in interpretive mode.
- Run program in direct execution mode.
- Breakpoint program.
- Change registers or P address.
- Copy the CRT screen image to standard output device.
- Enter new user symbol names.

This section provides the general operating rules, the conventions used when entering commands to PCC, and lists and describes each command and function key available to PCC.

PCC OPERATION

The PCC program is controlled by the user through the display keyboard. The user types the desired command and presses a PCC function key, which causes the command to be read and executed and the results displayed on the CRT screen. If parameter errors are detected when checking the legality of any command, INVALID is displayed and the user regains control to enter another command.

COMMAND ENTRY CONVENTIONS

The following are the conventions to be used when entering commands to PCC.

Addresses are entered as a symbolic label (subprogram name or user symbol name) and may be followed by a plus* or minus hexadecimal displacement. Entering absolute addresses is not allowed. A symbolic label consists of one to eight characters, of which the first character must be an alphabetic character. The hexadecimal displacement can range from zero to four characters. When addressing common and data areas the format is: C/scratch block name and D/data block name.

Spaces are used as message delimiters. The number of spaces is not important.

The SEND key is used as a convention by PCC to indicate that a PCC command message is to be processed. Certain other function keys are used to indicate PCC operational modes and do not include command messages.

Hexadecimal data is entered as eight characters (0 through F) or less for a single precision value. If the number of characters is less than eight, the characters are right-justified and zero-filled.

Decimal numbers are indicated by a decimal point. Data entered in this format is converted to floating point. Double precision data is preceded by a D. Examples of decimal data are -489.06 and D7683.

PCC COMMAND CALL CODES

The following paragraphs identify the legal call codes grouped by general types, the legal format for each call, the operation performed by PCC, and what is displayed on the CRT at the conclusion of the call.

---

*A semicolon may be used in place of the plus sign for ease of entry.

INSPECT COMMANDS

INSPECT displays the contents of 15 memory locations in various formats beginning at the given address (denoted by a symbolic label plus hexadecimal relocation factor). The 32 file registers and the state of the bit register are also displayed.

The legal INSPECT commands and their meanings are:

Command		Definition
I	PROGNAME+20	Inspect memory beginning at address PROGNAME+20. Display in hexadecimal format followed by a mnemonic MP-60 instruction representation. If a scratch common area is being inspected, only a hexadecimal display is provided.
IF	PROGNAME+20	Inspect memory beginning at address PROGNAME+20. Display in hexadecimal format followed by the value in decimal representation.
IFD	PROGNAME+20	Inspect memory beginning at address PROGNAME+20. Display in hexadecimal format followed by the double-precision decimal representation.
IA	PROGNAME+20	Inspect memory beginning at address PROGNAME+20. Display in hexadecimal format followed by the ASCII character representation. Each word is represented by four characters (an ASCII blank is displayed where the internal code does not represent a character.)

To inspect the next 15 locations of memory, make certain the first character of the CRT screen is blank, as it is from a previous inspect request; then press INSPECT FORWARD, which is function key F5.

To inspect the previous 15 locations of memory, press INSPECT BACKWARD, which is function key F2.

CHANGE CAPABILITIES

PCC allows the user to make changes to a program, and to record these changes on a disk file. Each change command is placed on the change file if one has been created during this run of PCC. Four commands are available to the user to accomplish this: change, allocate/open change file, and close or release change file. Each command is detailed in the paragraphs that follow.

CHANGE COMMANDS

The CHANGE command allows the user to change continuous memory locations starting at the given address (denoted by a symbolic label and relocation factor). The changes can be given in hexadecimal, decimal, or double-precision decimal format. The display provided when the CHANGE function has been performed by PCC is identical to that provided for INSPECT. An example of the CHANGE command and its meaning is:

    C PROGNAME+50   489.6   D478.3   D43210

Change memory words beginning at address PROGNAME+50. The floating point value for 489.6 is stored at PROGNAME+50, the double precision floating point value for D478.3 in PROGNAME+51 and 52, and the hexadecimal value 00D43210 in PROGNAME+53.

OPEN, OPEN/CLEAR CHANGE FILE COMMAND

The OPEN command allows the user to open and load the contents of a change file on the system device. If the requested file name is not found in the label file, a change file is allocated and opened in the initial state (no changes). The legal OPEN commands and their meanings are:

Command	Definition
O FILENAME	If the file already exists on disk, the command opens the file and loads whatever changes are on the file. As each change request is read from the disk file, it is written on the standard output device, thus giving the user a hard copy of the change file.
	If the file did not exist, a new file is allocated and opened.
OC FILENAME	If the file already exists on disk, the command opens the file but clears the information found there. Changes that were present before the file was cleared are not processed.
	If the file did not exist, a new file is allocated and opened.

The FILENAME field is any name, eight characters or less, that starts with an alpha character. This name is used as the file name while a standard owner, access key, and addition number are supplied by PCC. Only one change file can be in use by PCC at a time. There is no way to delete any one change request from the change file, even if portions of the request are invalid. The change file will be processed in order, so future changes can correct erroneous changes. Loading the change file will not abort on an illegal change request.

CLOSE, RELEASE CHANGE FILE COMMAND

The CLOSE change file command enables the user to close a change file, but it is not released from the disk. The legal command is U.

The RELEASE change file command enables the user to close and release a change file from the disk. The legal command is UR.

The FILENAME required in the OPEN request need not be specified here since only one change file can be used by PCC at a time.

NOTE: The change file is pack closed and closed by PCC when a normal exit (Z request) is taken from PCC, if the user did not already close the change file.

CHANGE FILE REGISTER CONTENTS

The user file register contents may be altered beginning with the file register indicated in the command. The notation X0-X7, H0-H7, and R0-RF must be used to denote the file registers to change. Values may be given hexadecimal, decimal, or double-precision decimal format.

An example of a legal change file register command and its meaning is:

    X7   D567   -49.8   3

The contents of file register X7 is changed to 0000D567, H0 to the floating point value for -49.8, and H1 is changed to 00000003.

An XC command, terminated by the SEND key, will clear all registers.

DUMP COMMAND

The PCC DUMP command dumps memory in dexadecimal format to the standard output device. If no LWA is given, 100 words are dumped as a default option. If the LWA provided is less than the FWA, the command is invalid.

The format of the DUMP command is as follows:

    D   PROGNAME+20   PROGNAME+50

Locations PROGNAME+20 through PROGNAME+50 are dumped on standard output.

ENTER NEW USER SYMBOLIC LABELS

Instead of using a program name plus relocation factor for locations that will be referenced often, or simply to reduce the length of the program name, new symbolic labels may be entered into a user symbol table. A maximum of 10 user symbols are allowed. Example: to enter a new user symbol with the name, NEW, with an address equal to PROGNAME+20, use the following command format.

    E   NEW   PROGNAME+20

Only one symbol may be entered at a time with the E command. The address of the new symbol cannot be altered once entered into the user table and entries cannot be removed from the table.

BREAKPOINT COMMANDS

When PCC encounters a breakpoint location, control returns to the user at the CRT with a display of instructions and contents of file registers after the execution of the instruction at that location. A maximum of eight breakpoint locations may be designated at any one time. At the conclusion of any breakpoint request, the breakpoint locations are displayed.

NOTE: BREAKPOINT and SNAP commands must not be entered at locations which are modified by the user program (such as a return jump entry point).

The legal BREAKPOINT commands and their meanings are as follows:

Command				Definition
B	PROGNAME+20	LABEL+30	SYMBOL+2	Enter breakpoints at the given addresses PROGNAME+20, LABEL+30, and SYMBOL+2, provided there is room in the breakpoint table.
BC	LABEL+30	SYMBOL+2		Clear the given breakpoints.
BC				Clear all breakpoints from the table.
BD				Display all breakpoints now in force.

SNAP COMMANDS

When PCC encounters a SNAP location, a snapshot dump of the associated memory range and user file register contents is sent to standard output after the execution of the instruction at that location.

The execution of the user program continues. The format of the snapshot dump is in hexadecimal with instruction mnemonics, ASCII, decimal, or double-precision decimal, as requested. A maximum of eight SNAP locations may be designated at any one time. There is no limit to the snapshot dump range, except that the FWA must be less than or equal to the LWA.

The legal SNAP commands along with their meanings are given below:

Command				Definition
S	PROG+1	PROG+10	PROG+200	After the instruction at location PROG+1 is executed, print the contents of PROG+10 through PROG+200 on standard output in hexadecimal format followed by a mnemonic representation of MP-60 instructions. If the snapshot range is in a scratch common area, only a hexadecimal dump is provided.
SA	PROG+2	PROG+200	PROG+300	After the instruction at location PROG+2 is executed, print the contents of PROG+200 through PROG+300 on standard output in hexadecimal format, followed by the contents of each location in ASCII codes.
SF	PROG+3	PROG+20	PROG+70	After execution of the instruction at PROG+3, print the contents of PROG+20 through PROG+70 on standard output in hexadecimal format, followed by the contents of each of these locations in decimal.
SFD	PROG+4	PROG+30	PROG+7F	After the instruction at location PROG+4 is executed, print the contents of PROG+30 through PROG+7F on standard output in hexadecimal format, followed by the contents of each of these locations in double-precision decimal.
SC	PROG+2	PROG+4		Clear the given snapshots.
SC				Clear all snapshots.
SD				Display all snapshot locations and their associated ranges, and snap type.

EXECUTE USER PROGRAM

The user program may be executed in interpretive step mode, interpretive run mode, direct go mode, or direct return jump go mode. The execution commands and their meaning are listed below.

NOTE: Function keys which initiate commands are shown in parentheses.

Command			Definition
J	PROG+1	(SEND)	The user P address is set to PROG+1, but no execution of any instruction is made.
(F1)			Advance program execution by one instruction and display results.
(F4)			Begin continuous interpretative execution at the user current P address. Execution does not stop until a breakpoint, snap, or STOP function key is detected or an illegal instruction or page fault occurs.
G	PROG	(SEND)	Begin direct execution of the user program at PROG. PCC regains control only at a breakpoint or snap location, page fault, or illegal instruction. The STOP function key has no effect.
G	(SEND)		Begin direct execution of the user program at the user current P address. PCC regains control as in the G ADDRESS call.
GR	PROG	(SEND)	Begin direct execution of the user program with an RTJ to PROG. PCC regains control as in the G ADDRESS call but then exits through the PCC exit processor.
GR	(SEND)		Begin direct execution of the user program with an RTJ to the user current P address. PCC regains control as in the GR PROG call above.

After the user P register has been initialized by a J request, the user could run a program directly with a G or GR request. In this go mode, PCC regains control only by reaching a breakpoint or snap location, page fault, or illegal instruction. If a snap location is reached, the snapshot dump is made under control of PCC; control is immediately returned to the user program with no operator intervention. If a breakpoint location is

reached, a display of the user program surrounding this breakpoint is output to the CRT; then PCC waits for the operator to key in another PCC request. If a page fault is detected, PCC flags the instruction, causing the page fault with an F character to be the leftmost character of the CRT line containing this instruction. If an illegal instruction is detected, the illegal instruction is flagged with an I character as the leftmost character of the CRT display line containing this instruction. Note that the address returned by the MPX monitor is actually one or two executed instructions beyond the address of the instruction causing the fault. PCC does not attempt to correct the address returned by the monitor.

EXIT REQUEST

The request provided to exit from PCC is a Z character in the first character position. If any other characters follow the Z, they are ignored.

NOTE: Function key is shown in parentheses.

For example:

    Z   (SEND)   Return control to MPX

FUNCTION KEYS RECOGNIZED BY PCC

The following function keys are recognized by PCC. Several function keys are used by themselves as a PCC request without a preceding PCC call code command. The listing that follows summarizes the function keys and the resulting action taken by the PCC.

Function Key	PCC Interpretation	Use by PCC
SEND	CONTROL MESSAGE	Causes PCC to read and react to a call code.
F4	RUN	PCC begins execution of the user program in interpretative mode from the user P-address.
F1	STEP	Begin stepping at address input with a J call code. Subsequent STEP requests by themselves advance program execution by one instruction.
F6	STOP	When in interpretative execution mode, this function key causes the user program to be halted.
PRINT	PRINT	Copies the screen image onto the standard output device.

Function Key	PCC Interpretation	Use by PCC
F2	INSPECT BACKWARD	Inspects the 15 memory locations preceding the last 15 locations inspected by an inspect request. Subsequent INSPECT BACKWARD requests continue to roll back the inspect display.
F5	INSPECT FORWARD	Inspects the next 15 memory locations beyond the last inspect request. Subsequent INSPECT FORWARD requests continue to roll forward the inspect display.

PAGE FAULTS AND ILLEGAL INSTRUCTIONS

When the execution of a user instruction, whether in direct run mode or in interpretive run or step mode, causes a page fault or is an illegal instruction, the MPX monitor returns control to PCC from the page fault and illegal instruction interrupt processors, rather than causing a system abort. If a page fault was detected, PCC will flag the instruction causing the fault with an F character as the leftmost character of the CRT display line containing this instruction. If an illegal instruction was detected, the illegal instruction is flagged with an I character as the leftmost character of the CRT display line containing this instruction.

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PROGRAM COMMAND CONSOLE 2

Interface: Standard ASCII Terminals

The program command console (PCC) program is a debugging aids package loadable with the user's programs (see MPX/RT Reference Manual 14062300 and MPX/OS Reference Manual 10817300, TASK statement). The MP-60 system loader passes control to PCC after completion of the load. The user communicates with PCC through a keyboard display. The user may execute programs in a trace, breakpoint, or snap-mode environment (using PCC command entries) and observe the results of the execution at the display. The basic functions provided by PCC are:

- Inspect memory.

- Change memory.

- Catalog changes to a change file on mass storage.

- Close or release change file.

- Snapshot memory to standard output.

- Dump memory to standard output.

- Trace program.

- Run program in interpretive mode.

- Stop program running in interpretive mode.

- Run program in direct execution mode.

- Breakpoint program.

- Change registers or P address.

- Copy the CRT screen image to standard output device.

- Enter new user symbol names.

This section provides the general operating rules, the conventions used when entering commands to PCC, and lists and describes each command and function available to PCC.

PCC OPERATION

The PCC program is controlled by the user through the display keyboard. The user types the desired command and presses the ETX key, which causes the command to be read and executed and the results displayed on the CRT screen. If parameter errors are detected when checking the legality of any command, INVALID is displayed and the user regains control to enter another command.

COMMAND ENTRY CONVENTIONS

The following are the conventions to be used when entering commands to PCC.

Addresses are entered as a symbolic label (subprogram name or user symbol name) and may be followed by a plus* or minus hexadecimal displacement. Entering absolute addresses is not allowed. A symbolic label consists of one to eight characters, of which the first character must be an alphabetic character. The hexadecimal displacement can range from zero to four characters. When addressing common and data areas the format is: C/scratch block name and D/data block name.

Spaces are used as message delimiters. The number of spaces is not important.

The ETX key is used as a convention by PCC to indicate that a PCC command message is to be processed. Certain other number keys are used to indicate PCC operational modes and do not include command messages.

Hexadecimal data is entered as eight characters (0 through F) or less for a single precision value. If the number of characters is less than eight, the characters are right-justified and zero-filled.

Decimal numbers are indicated by a decimal point. Data entered in this format is converted to floating point. Double precision data is preceded by a D. Examples of decimal data are -489.06 and D7683.

PCC COMMAND CALL CODES

The following paragraphs identify the legal call codes grouped by general types, the legal format for each call, the operation performed by PCC, and what is displayed on the CRT at the conclusion of the call.

---

*A semicolon may be used in place of the plus sign for ease of entry.

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INSPECT COMMANDS

INSPECT displays the contents of 15 memory locations in various formats beginning at the given address (denoted by a symbolic label plus hexadecimal relocation factor). The 32 file registers and the state of the bit register are also displayed.

The legal INSPECT commands and their meanings are:

Command		Definition
I	PROGNAME+20	Inspect memory beginning at address PROGNAME+20. Display in hexadecimal format followed by a mnemonic MP-60 instruction representation. If a scratch common area is being inspected, only a hexadecimal display is provided.
IF	PROGNAME+20	Inspect memory beginning at address PROGNAME+20. Display in hexadecimal format followed by the value in decimal representation.
IFD	PROGNAME+20	Inspect memory beginning at address PROGNAME+20. Display in hexadecimal format followed by the double-precision decimal representation.
IA	PROGNAME+20	Inspect memory beginning at address PROGNAME+20. Display in hexadecimal format followed by the ASCII character representation. Each word is represented by four characters (an ASCII blank is displayed where the internal code does not represent a character.)

NOTE: Keys which initiate commands are shown in parentheses.

To inspect the next 15 locations of memory, type 5 (ETX), which is INSPECT FORWARD.

To inspect the previous 15 locations of memory, type 2 (ETX), which is INSPECT BACKWARD.

CHANGE CAPABILITIES

PCC allows the user to make changes to a program, and to record these changes on a disk file. Each change command is placed on the change file if one has been created during this run of PCC. Four commands are available to the user to accomplish this: change, allocate/open change file, and close or release change file. Each command is detailed in the paragraphs that follow.

CHANGE COMMANDS

The CHANGE command allows the user to change continuous memory locations starting at the given address (denoted by a symbolic label and relocation factor). The changes can be given in hexadecimal, decimal, or double-precision decimal format. The display provided when the CHANGE function has been performed by PCC is identical to that provided for INSPECT. An example of the CHANGE command and its meaning is:

    C PROGNAME+50   489.6   D478.3   D43210

Change memory words beginning at address PROGNAME+50. The floating point value for 489.6 is stored at PROGNAME+50, the double precision floating point value for D478.3 in PROGNAME+51 and 52, and the hexadecimal value 00D43210 in PROGNAME+53.

OPEN, OPEN/CLEAR CHANGE FILE COMMAND

The OPEN command allows the user to open and load the contents of a change file on the system device. If the requested file name is not found in the label file, a change file is allocated and opened in the initial state (no changes). The legal OPEN commands and their meanings are:

Command	Definition
O FILENAME	If the file already exists on disk, the command opens the file and loads whatever changes are on the file. As each change request is read from the disk file, it is written on the standard output device, thus giving the user a hard copy of the change file.
	If the file did not exist, a new file is allocated and opened.
OC FILENAME	If the file already exists on disk, the command opens the file but clears the information found there. Changes that were present before the file was cleared are not processed.
	If the file did not exist, a new file is allocated and opened.

The FILENAME field is any name, eight characters or less, that starts with an alpha character. This name is used as the file name while a standard owner, access key, and addition number are supplied by PCC. Only one change file can be in use by PCC at a time. There is no way to delete any one change request from the change file, even if portions of the request are invalid. The change file will be processed in order, so future changes can correct erroneous changes. Loading the change file will not abort on an illegal change request.

CLOSE, RELEASE CHANGE FILE COMMAND

The CLOSE change file command enables the user to close a change file, but it is not released from the disk. The legal command is U.

The RELEASE change file command enables the user to close and release a change file from the disk. The legal command is UR.

The FILENAME required in the OPEN request need not be specified here since only one change file can be used by PCC at a time.

NOTE: The change file is pack closed and closed by PCC when a normal exit (Z request) is taken from PCC, if the user did not already close the change file.

CHANGE FILE REGISTER CONTENTS

The user file register contents may be altered beginning with the file register indicated in the command. The notation X0-X7, H0-H7, and R0-RF must be used to denote the file registers to change. Values may be given in hexadecimal, decimal, or double-precision decimal format.

An example of a legal change file register command and its meaning is:

    X7   D567   -49.8   3

The contents of file register X7 is changed to 0000D567, H0 to the floating point value for -49.8, and H1 is changed to 00000003.

An XC (ETX) command will clear all registers.

DUMP COMMAND

The PCC DUMP command dumps memory in hexadecimal format to the standard output device. If no LWA is given, 100 words are dumped as a default option. If the LWA provided is less than the FWA, the command is invalid.

The format of the DUMP command is as follows:

    D   PROGNAME+20   PROGNAME+50

Locations PROGNAME+20 through PROGNAME+50 are dumped on standard output.

ENTER NEW USER SYMBOLIC LABELS

Instead of using a program name plus relocation factor for locations that will be referenced often, or simply to reduce the length of the program name, new symbolic labels may be entered into a user symbol table. A maximum of 10 user symbols are allowed.
Example: to enter a new user symbol with the name, NEW, with an address equal to PROGNAME+20, use the following command format.

    E   NEW   PROGNAME+20

Only one symbol may be entered at a time with the E command. The address of the new symbol cannot be altered once entered into the user table and entries cannot be removed from the table.

BREAKPOINT COMMANDS

When PCC encounters a breakpoint location, control returns to the user at the CRT with a display of instructions and contents of file registers after the execution of the instruction at that location. A maximum of eight breakpoint locations may be designated at any one time. At the conclusion of any breakpoint request, the breakpoint locations are displayed.

NOTE: BREAKPOINT and SNAP commands must not be entered at locations which are modified by the user program (such as a return jump entry point).

The legal BREAKPOINT commands and their meanings are as follows:

Command	Definition
B PROGNAME+20 LABEL+30 SYMBOL+2	Enter breakpoints at the given addresses PROGNAME+20, LABEL+30, and SYMBOL+2, provided there is room in the breakpoint table.
BC LABEL+30 SYMBOL+2	Clear the given breakpoints.
BC	Clear all breakpoints from the table.
BD	Display all breakpoints now in force.

SNAP COMMANDS

When PCC encounters a SNAP location, a snapshot dump of the associated memory range and user file register contents is sent to standard output after the execution of the instruction at that location.

The execution of the user program continues. The format of the snapshot dump is in hexadecimal with instruction mnemonics, ASCII, decimal, or double-precision decimal, as requested. A maximum of eight SNAP locations may be designated at any one time. There is no limit to the snapshot dump range, except that the FWA must be less than or equal to the LWA.

The legal SNAP commands along with their meanings are given below:

Command				Definition
S	PROG+1	PROG+10	PROG+200	After the instruction at location PROG+1 is executed, print the contents of PROG+10 through PROG+200 on standard output in hexadecimal format followed by a mnemonic representation of MP-60 instructions. If the snapshot range is in a scratch common area, only a hexadecimal dump is provided.
SA	PROG+2	PROG+200	PROG+300	After the instruction at location PROG+2 is executed, print the contents of PROG+200 through PROG+300 on standard output in hexadecimal format, followed by the contents of each location in ASCII codes.
SF	PROG+3	PROG+20	PROG+70	After execution of the instruction at PROG+3, print the contents of PROG+20 through PROG+70 on standard output in hexadecimal format, followed by the contents of each of these locations in decimal.
SFD	PROG+4	PROG+30	PROG+7F	After the instruction at location PROG+4 is executed, print the contents of PROG+30 through PROG+7F on standard output in hexadecimal format, followed by the contents of each of these locations in double-precision decimal.
SC	PROG+2	PROG+4		Clear the given snapshots.
SC				Clear all snapshots.
SD				Display all snapshot locations and their associated ranges, and snap type.

The user program may be executed in interpretive step mode, interpretive run mode, direct go mode, or direct return jump go mode. The execution commands and their meaning are listed below.

NOTE: Keys which initiate commands are shown in parentheses.

	Command		Definition
J	PROG+1	(ETX)	The user P address is set to PROG+1, but no execution of any instruction is made.
1	(ETX)		Advance program execution by one instruction and display results.
4	(ETX)		Begin continuous interpretative execution at the user current P address. Execution does not stop until a breakpoint, snap, or STOP is detected or an illegal instruction or page fault occurs.
G	PROG	(ETX)	Begin direct execution of the user program at PROG. PCC regains control only at a breakpoint or snap location, page fault, or illegal instruction. The STOP function key has no effect.
G	(ETX)		Begin direct execution of the user program at the user current P address. PCC regains control as in the G ADDRESS call.
GR	PROG	(ETX)	Begin direct execution of the user program with an RTJ to PROG. PCC regains control as in the G ADDRESS call but then exits through the PCC exit processor.
GR	(ETX)		Begin direct execution of the user program with an RTJ to the user current P address. PCC regains control as in the GR PROG call above.

After the user P register has been initialized by a J request, the user could run a program directly with a G or GR request. In this go mode, PCC regains control only by reaching a breakpoint or snap location, page fault, or illegal instruction. If a snap location is reached, the snapshot dump is made under control of PCC; control is immediately returned to the user program with no operator intervention. If a breakpoint location is

reached, a display of the user program surrounding this breakpoint is output to the CRT; then PCC waits for the operator to key in another PCC request. If a page fault is detected, PCC flags the instruction, causing the page fault with an F character to be the leftmost character of the CRT line containing this instruction. If an illegal instruction is detected, the illegal instruction is flagged with an I character as the leftmost character of the CRT display line containing this instruction. Note that the address returned by the MPX monitor is actually one or two executed instructions beyond the address of the instruction causing the fault. PCC does not attempt to correct the address returned by the monitor.

EXIT REQUEST

The request provided to exit from PCC is a Z character in the first character position. If any other characters follow the Z, they are ignored.

NOTE: Termination key is shown in parentheses.

For example:

    Z   (ETX)   Return control to MPX

NUMBER KEYS RECOGNIZED BY PCC

The following number keys are recognized by PCC. Several number keys are used by themselves as a PCC request without a preceding PCC call code command. The listing that follows summarizes the number keys and the resulting action taken by the PCC.

Number Key	PCC Interpretation	Use by PCC
ETX	CONTROL MESSAGE	Causes PCC to read and react to a call code.
4 (ETX)	RUN	PCC begins execution of the user program in interpretative mode from the user P-address.
1 (ETX)	STEP	Begin stepping at address input with a J call code. Subsequent STEP requests by themselves advance program execution by one instruction.
6 (ETX)	STOP	When in interpretative execution mode, this function key causes the user program to be halted.
7 (ETX)	PRINT	Copies the screen image onto the standard output device.

Number Key	PCC Interpretation	Use by PCC
2 (ETX)	INSPECT BACKWARD	Inspects the 15 memory locations preceding the last 15 locations inspected by an inspect request. Subsequent INSPECT BACKWARD requests continue to roll back the inspect display.
5 (ETX)	INSPECT FORWARD	Inspects the next 15 memory locations beyond the last inspect request. Subsequent INSPECT FORWARD requests continue to roll forward the inspect display.

PAGE FAULTS AND ILLEGAL INSTRUCTIONS

When the execution of a user instruction, whether in direct run mode or in interpretive run or step mode, causes a page fault or is an illegal instruction, the MPX monitor returns control to PCC from the page fault and illegal instruction interrupt processors, rather than causing a system abort. If a page fault was detected, PCC will flag the instruction causing the fault with an F character as the leftmost character of the CRT display line containing this instruction. If an illegal instruction was detected, the illegal instruction is flagged with an I character as the leftmost character of the CRT display line containing this instruction.

COMMENT SHEET

MANUAL TITLE ___MP-60 Computer System Program___

___Command Console Reference Manual___

PUBLICATION NO. ___14391700___   REVISION ___-___

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