

DISK TEST PROGRAM GENERATOR (DPG)

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INTRODUCTION

DPG is a general-purpose Disk Diagnostic Program for the CHI 2130. It is capable of testing CHI 1114's or IFA's in their native mode, as well as testing any disk drive in IBM-Compatible mode.

DPG is actually a simple programming language. It provides the ability to construct any sequence of desired disk operations and then execute them either once or continuously in a loop. Since most Test Engineers are not Programmers, the instruction set of DPG is purposely quite limited and specific.

DPG is intended for two purposes. The first of these is in-house testing of newly assembled equipment prior to shipment to the customer. The second is debugging of Drive and/or Controller problems both in the field and in the lab.

For in-house testing, each Drive/Controller configuration is subjected to certain standard tests intended to exercise all of the functions which the system is capable of performing. Some of these standard tests have been constructed with DPG and "saved" in the form of self-loading decks.

The "IF" command uses the language element "Relational Test."
There are six Relational Tests.

The last language element is the "Preposition". There are three prepositions, "FROM", "TO", and "BY". Prepositions have no effect on either the content of syntax of instructions, and are included only for readability.

Instructions in DPG are numbered sequentially. This number is referred to as the "Statement Number" or IAR". Some instructions reference other instructions. They do so by means of the "Value", which must be a decimal constant of the statement number being referenced.

Following is a definition of the Commands and Variables of DPG.

COMMANDS

SEEK - Causes the disk drive to seek to the cylinder in the variable "CYL". If CYL contains a value of "HOME", it will seek minus 203 on the 1114 or a "RESTORE" on the IFA. If CYL contains a value outside the range 0-MXCYL, it will divide that value by MXCYL and get the remainder for a valid cylinder number. If the program arm position is already at the desired CYL, it will do nothing, except that a CYL value of "HOME" always causes a seek.

- SELECT - Selects the surface number contained in the variable "SURF". If the DRIVE is 0-4, it will do nothing. If SURF contains a value outside the range 1-MXSURF, it will calculate a valid surface no., such that surface 21 is equivalent to surface 1. The "SELECT" command will also select the IFA drive number contained in "DRIVE" where IFA drive 0 is represented as "8".
- READ - Reads the sector number contained in the variable "SCTR". If SCTR contains a value outside the range 0- MXSCTR, it will divide that value by MXSCTR and use the remainder. If an error occurs, the variable "FAILS" will be set to a 1. It is left upto the program to decide if a retry is applicable and to do the operation. If no error occurs, "FAILS" will be zero.
- READCK - Will perform a read-check operation on the sector number contained in the variable "SCTR". If SCTR contains a value outside the range 0-MXSCTR, it will divide that value by MXSCTR and use the remainder.
- WPROT - Issues an enable command for the sector protection feature of the 1114 or IFA.
- FILL - Fills the Write buffer with whichever pattern is specified by the variable PATNO. If PATNO is outside the range 0-4, divides PATNO by 5 and uses the remainder.

RCOMP - Compares the entire Read vuffer to the pattern value specified by the first data word in the READ buffer. If that word contains a value outside the range 0-4, it will type the message "Undefined Pattern". If the pattern no. is valid but the buffer does not match that pattern, it will type the message "Compare Error" with the identifying information. If an error occurs the variable "FAILS" will be set to a 1. It is left up to the program to decide if a retry is applicable and to do the operation. If no error occurs, "FAILS" will be zero.

SET - This command sets a Variable to a Value. The value may be a decimal, hexadecimal, or figurative constant. The figurative constant "HOME" is meaningful only for the Variable "CYL". A DECIMAL value may be from 1 to 5 digits, 0-32767 and it may be preceded by a dash ('-') to denote a negative value. A HEXADECIMAL value is identified by a / (slash) character preceding the value. It may contain 1 to 4 digits, each of which may assume of 0-F. The figurative constant "RANDOM" will pick up the current value of the random number generator. The SET PATVAL command will also SET PATNO to its maximum value, 4, and replace the last entry in the pattern table.

The variable "OUTPUT" is used to control console output of error messages. This variable may be set to one of three values.

- "NONE" Will surpress ALL console error messages.
- "ALL" Will restore the output to a normal status.
- "E" Will cause the console to log one red E for every error. This condition may also be set if DATA ENTRY SWITCH 1 is on and the output is in an ALL status.

The use of these pseudo variables is reserved solely to the "OUTPUT" variable. No other variable may reference the values NONE, ALL, or E.

The syntax of the SET statement is SET VARIABLE (TO) VALUE.
The value may also be another variable.

ADD - The Add command adds a Value to a Variable. The value must be a decimal, hexadecimal constant or another variable. The syntax of the ADD command is ADD Value (TO) Variable.

SUB - The SUB command subtracts a Value from a Variable. The Value must be a decimal, hexadecimal constant or another variable. The Syntax of the SUB command is SUB Value (FROM) Variable.

- GO - The GO command transfers program control to another statement. The statement number is entered as a decimal constant. The Syntax of the GO command is GO [TO] Value. If no command has been entered for the specified statement, the message "STNO XXX GO TO OUT OF RANGE" is typed.
- LOG - The LOG command will cause DPG to output a value on the console device when the statement is encountered. The format of the LOG command is one of two possible modes:
- A. LOG current position:
LOG
 - B. LOG a variable and its current value:
LOG VARIABLE
- MULTIPLY - The MULTIPLY command multiplies a VALUE by a Variable. The Value must be a decimal or hexadecimal constant or a second variable. The syntax of the MULTIPLY command is MULTIPLY VARIABLE [BY] VALUE.
- DIVIDE - The DIVIDE command divides a VALUE into a VARIABLE. The result is an integer quotient, the remainder is lost. The value must be a decimal or hexadecimal constant or a second variable. The syntax of the DIVIDE command is DIVIDE VARIABLE [BY] CONSTANT.

START

- The START command is a non-executable statement. It is used to provide the execution address for the saved program. Refer to the "PUNCH" command for a self-loading deck. The syntax of the statement is START VALUE.

HEADR

- The HEADR command is used to identify the self-loading deck. This heading is logged once when the deck is loaded. The length of the heading may not exceed 42 characters. The syntax of the command is:
HEADR [HEADING]

INSERT

- The INSERT command permits the operator to insert a statement out of sequence. It will cause all statements starting at the requested value to the end of the program to be pushed down one statement and all GO addresses to be corrected. A NOP statement is inserted and the operator is given a chance to replace this default. If the statement to be inserted is an "IF", a second insert should be performed as the IF is actually two statements. The syntax of the statement is INSERT VALUE.

LIST

- The LIST command will produce a source listing of the current DPG program on an available printer. If no printer is available the listing is on the console.

- NOP - This is a FILLER command which does absolutely nothing.
- DELAY - The DELAY statement will suspend all disk activity for a proportional time to the value given. The value must be a hexadecimal or decimal constant or a second variable. The syntax of the command is DELAY VALUE.
- SEEKA - The SEEKA command is similar to the SEEK described earlier except that it will produce an absolute seek on the IFA rather than a displacement seek. On a non-IFA drive, the displacement seek is used.
- RESTORE - The RESTORE command will issue a RESTORE (RE-CALIBRATE) command to the IFA. On non-IFA drives it will seek home.
- MASK - The MASK command will select the IFA drive and mask interrupts. It will be a NOP on non-IFA drives.
- UNMASK - The UNMASK command will select the IFA drive and unmask interrupts. It will be a NOP on non-IFA drives.
- READONLY - The READONLY command is similar to the WPROT command described earlier except that it will set READ-ONLY STATUS on the sector.

- SNSCTR - The SNSCTR command will sense the sector bits from the drive and place the next available sector in the user variable "D".
- ENTER - The ENTER command will accept a variable setting from the operator. The mode if input is controlled by the setting of the "CONSOLE/KEYBOARD" switch.
- CONSOLE = DATA ENTRY SWITCHES
KEYBOARD = KEYBOARD
- The syntax of the command is ENTER VARIABLE.
- STOP - The STOP command causes DPG to wait until program start is pushed. The IAR is shown in the HEX DISPLAY.
- END - The END command causes DPG to type out the values of the Variables OPS and OFLOWS, as well as the program counter ERRORS, unless all are zero, then to terminate the current program being executed. At this point execution may be resumed at any point, or additional commands may be entered.
- XEQ - The XEQ command causes DPG to begin execution of a program at the statement number specified as a Decimal Constant Value. If no command has been entered for this statement no., the message "ENTRY ERROR" is typed. The Syntax of the XEQ Command is XEQ Value.

IAR

- The IAR command permits the user to patch over commands previously entered, by entering a new command to overlay the old one. The Syntax of the IAR command is IAR Value. This Command causes the IAR to be reset, normally to a smaller value, for one instruction only. After the user replaces that instruction the IAR will revert to its previous value. The Syntax of the IAR Command is IAR Value.

IF

- The IF command provides the facility to test the current value of a variable, and to alter the program sequence according to the result of that test. The Syntax of the IF command is IF Variable Relational Test Value Command. The Command is executed only if the Relational Test is true. It may be any Command other than another IF. Thus the IF command is actually two commands, and occupies two statement numbers. The six possible Relational Tests are:

EQ - Equal

NE - Not Equal

LT - Less Than

GT - Greater Than

LE - Less Than or equal

GE - Greater Than or equal

The Relation Test compares the Variable to the Value. Thus the "LT" Relational Test is true if the Variable is less than the Value. The Value must be a Decimal or Hexadecimal Constant or a second variable.

VARIABLES

- DRIVE - The drive number on which disk operations are to be performed. The drive number selects the area code which will be used to address the drive. Drives 0-4 select the IBM area codes, 4 and 17-20. Drives 5 and 6 select the 1114 "native mode" area codes, 22 and 16 respectively. Drives 8-11 select the IFA drives 0-3 respectively. Drive 7 is mapped to physical drive 0.
- SURF - The surface number on which disk operations are to be performed. The surface number is part of the unique sector ID which is the first word of every Sector on a pack. Surfaces 1-20 correspond to heads 0-19 on the 1114 or IFA. If the 1114 is addressed through an IBM-compatible area code, the surface number must correspond to the surface number dialed in on the 1114 Controller. On smaller disk drives, the surface number must correspond to the surface number used when the pack was initialized.
- CYL - The cylinder number on which disk operations are to be performed. The cylinder number is also part of the unique sector ID. Cylinders are numbered 0-202, regardless of drive type.

- SCTR - The sector number on which disk operations are to be performed. The sector number completes the unique sector ID of cylinder, surface, and sector. Sectors are number 0-7.
- RETRY - The RETRY count determines how many times DPG will retry a disk operation that results in an error. If the error persists after all retries have been exhausted, the program will stop if data switch 2 is on. Those disk errors that indicate a condition in the drive or controller requiring manual intervention will always cause a stop, even before retrying.
- OPS - Can be used to count the number of operations being performed, or to perform a program loop a specific number of times. This counter is completely under the user's control, so that an "operation" can be either a single disk operation or a sequence of several disk operations. It can also be used to introduce a time delay between disk operations.
- OFLOWS - This is another counter completely under the user's control. It is normally used to count the number of times the OPS counter has overflowed during a long run.
- PATNO - The data pattern most recently read from the disk, or the data pattern about to be written to the disk. There are currently five data patterns - FF7F, DB6C, 5555, AAAA, and 8CEF. They are numbered 0-4.

- A,B,C,D - User variables. The use of these variables are undefined except for the setting of "D" in the SNSCTR command.
- PHASE - Subsection of a diagnostic routine. The use of this variable is undefined and its setting is logged on all errors.
- FAILS - The FAILS variable is reset to zero at the start of a disk operation and is incremented by 1 for every error. This is the user's indication that an error has occurred.
- ERRORS - The use of the ERRORS variable is undefined and is logged at the end of the diagnostic run if needed.
- OUTPUT - The setting of this variable is used to control all output of errors on the console. It must be set to one of the three figurative constants "ALL," "NONE," or "E". If it is not set, "ALL" is assumed.
- AREA - The AREA CODE of the drive may be altered by changing this variable. The value may vary from 0 to 31.
- ILSW - This variable controls the expected ILSW bit for LEVEL 2. This value may range from 0 to 15.

- SW12 - The setting of these variables is controlled
SW13 by the DPG program. It will be set to a "0"
SW14 or a "1" depending whether the appropriate DATA
SW15 ENTRY SWITCHES 12, 13, 14, or 15. 0 denotes an
off setting while 1 denotes the on condition.
- MXDRIVE - The use of this variable is not strongly
recommended. It controls the maximum DRIVE
setting. This value should not exceed 11 as
unpredictable results may occur.
- MXSURF - The use of this variable is not strongly recommended.
It controls the number of surfaces on the selected
DRIVE.
- MXERRORS - This variable will cause DPG to STOP if the
setting of ERRORS exceeds this setting.
- MXOFLWS - This variable will cause DPG to END if the setting
of OFLOWS exceeds this setting.
- MXCYL - This variable will control the size of the selected
drive in number of cylinders.
- MXSCTR - This variable will control the size of the selected
drive in number of sectors per head.

PATVAL - A data pattern value other than one of the five standard data patterns. A pattern value entered by the user will replace the value of the last data pattern, number four, and will also set the variable PATNO to a value of 4.

THE FIGURATIVE CONSTANT "RANDOM"

DPG contains a random number generator which is based on the time taken by each disk operation. Thus the value of the RANDOM counter will change only when an actual disk operation is performed.

A value of RANDOM is permitted only for the SET command. The result of setting a variable RANDOM depends on the particular variable. The Variables DRIVE, SURF, CYL, SCTR, and PATNO are permitted to assume only those values that are meaningful to the operations that are performed with them. Thus a random SCTR will result only in a value 0-7, etc. The variables PATVAL, RETRY, OPS, and OFLOW are permitted to hold any random 16-bit value.

DPG OPERATING INSTRUCTIONS

DPG is a self-loading binary deck. Place the deck in the card reader then push IMM STOP, RESET, PROGRAM LOAD. DPG will load into the first 8K bank of core.

After loading DPG will type out the message "DISK TEST PROGRAM GENERATOR", return the carriage, then type out a statement No. If there have been no patch cards inserted into the deck, the Statement No. will have a value of 1.

The operator should now enter his program through the console keyboard, one statement at a time. Each statement is terminated by the "EOF" key. "ERASE FIELD" and "BACKSPACE" (left arrow) may be used to correct typing errors.

As each statement is entered, DPG will decode the statement and construct any entry in the Instruction Table. If the keyboard entry does not correspond to the syntax rules of DPG, the message "ENTRY ERROR" will be typed. In this case, the carriage is returned and the same statement no. typed out again, thus allowing the operator to try again. If the statement is valid, the statement no. is incremented by two.

The Instruction Table occupies the highest 512 words of core in the first 8K bank, locations/1F00 through /1FFF. Each statement no. requires two words in the table, thus allowing for 256 instructions in a DPG program (except that "IF" statements are actually two instructions).

Once a program has been entered into the Instruction Table, it may be executed and/or saved. A "program" may actually contain several "routines"; the operator must specify which statement no. at which to begin execution.

Seven instructions are never entered into the Instruction Table, but instead are acted upon immediately. The first of these is the XEQ instruction itself. Remember that when you are entering instructions through the keyboard you are building a program, not executing it. Only when you enter an XEQ instruction does actual operation begin.

The second instruction that is not entered into the Instruction Table is IAR. This instruction is used to "go back" and charge an instruction previously entered. It does this by charging the "IAR" or Statement No. to the value entered, for one instruction only. DPG will then type out this statement no. and accept a new instruction to overlay the previous one.

An IAR Value of zero causes DPG to clear the Instruction Table and start over with Statement no. 1.

The Interrupt Request Key may be used to terminate execution, at any time. Termination is also caused by encountering an END instruction or an "empty" instruction. Thus if there are no GO TO instructions in a program it will execute each instruction once and then automatically terminate.

The third instruction is the LIST command. This instruction will produce a source listing on the printer or console adapter if none is attached.

The fourth is the PUNCH command. This command will punch the command table and indicator words. The punched output must be on a 1442 card punch.

To use the self-loading cards, they must be inserted into a self-loading DPG deck, immediately in front of the last non-blank card. Thereafter, this completed deck may be used to execute the constructed program.

The fifth command is the START command. This command is used to specify an execution address for the self-loading deck punched by the PUNCH command.

The last command is the INSERT command. The use of this command enables the programmer to insert a statement immediately prior to a specified line. All statements are pushed down 1 command and references by the "GO" and "START" commands are corrected.