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PDP-7 HYBRID COMPUTER PROGRAM,
VARIABLE MONITORING AND TRIP SYSTEM
PROGRAM TRIP\$

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PDP-7 HYBRID COMPUTER PROGRAM

VARIABLE MONITORING AND TRIP SYSTEM PROGRAM TRIP\$

Function

TRIP\$ provides the capability of monitoring any number of program variables comparing their values to some pre-determined trip point. If the trip point is reached a selected user subroutine will be entered continuously until the trip system is re-initialized.

Calling Sequence

CLL	
...	/ONE OR MORE INSTRUCTIONS MUST
...	/BE USED TO DETERMINE A CONDITIONAL SKIP
STL	/COME HERE TO START MONITORING
LAW MNTR1	/COME HERE TO STOP MONITORING AND RE-INITIALIZE
JMS TRIP\$	
CONTINUE	/RETURN POINT

MNTR1 is the beginning of a table with the following format:

MNTR1,	...	/FIRST VARIABLE TO BE MONITORED
TRIP1,	...	/TRIP POINT FOR VARIABLE IN MNTR1
ACT1,	...	/ADDRESS OF SUB-ROUTINE TO BE ENTERED
MNTR2,	...	/IF TRIP1 IS REACHED
TRIP2,	...	
...		
MNTRN,	...	^A /LAST VARIABLE TO BE MONITORED
TRIPN,	...	/TRIP POINT FOR LAST VARIABLE
ACTN,	...	
	Ø	/ZERO INDICATES END OF TABLE

Method of Use

The table of variables and trip points, is examined in order from top to bottom. A zero located in any of the locations, generally containing the variable to be monitored, will end the monitoring at that point in the table. Any variable beyond that point will be ignored.

The calling sequence must appear in a loop of the user's program. The program must be entered at a rate which will satisfy user requirements for two conditions. First, the variables to be monitored will be checked once for each entry. The possible rate of change of these variables must be considered. Second, after a trip point is reached a user's subroutine will be entered once each time TRIP\$ is entered; this must also be taken into consideration.

At any time the user may stop entry to his subroutines and stop the monitoring of all variables by taking some action to change the conditional skip at the entry point of the subroutine to cause the link to be cleared. If at some later time the subroutine is again entered with the link set to one, the variable values will again be compared to the trip points and the subroutines will not be entered until the trip points are again reached.

Example

Assume a table of thirteen locations was originally established in the user's program and for a particular case it is desired to monitor only two variables, X and Y. Assume also that if X reaches a value of 200.00 volts the subroutine PROG1 should be entered, and if Y reaches the value of LAM the subroutine PROG2 should be entered. One should do the following in the table:

MNTR1,	X	/X SHOULD BE MONITORED
	200.00	/TRIP POINT
	PROG1	
MNTR2,	Y	/Y SHOULD BE MONITORED
	LAM	/TRIP POINT
	PROG2	
MNTR3,	Ø	
	...	
	...	
MNTR4,	...	
	...	
	...	
	Ø	

The contents of the locations in the table following MNTR3 will be ignored since a zero is encountered.

It should be pointed out that the variable value does not have to be exactly equal to the trip point setting. If it crosses over the trip point, the trip action is taken. This means that if in the above example, Y goes from 777776 to 000000 without 777777 PROG2 will still be entered.

Theory

The means by which it is determined if a trip point is reached is through two flags for each variable. Since the variable may never be exactly equal to the trip point setting, the difference between the trip point and the variable value is examined and determined to be positive or negative. If positive one flag is set and if negative the other flag is set. When both flags have been set the trip point is assumed reached and the subroutine is entered. When the user re-initializes TRIP\$ both flags are cleared and the process is repeated.

The two flags are stored in bits two and three of the locations where the variables to be monitored are specified. These bits are cleared when TRIP\$ is first entered with the link set and then are changed only as described above.

Block Diagram

The following diagram shows the program logic of TRIP\$.

TRIP SYSTEM ROUTINE TRIPS

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/ LIBRARY SUBROUTINE
/ GAW 1-4-59
/ THIS PROGRAM WILL MONITOR ANY NUMBER OF VARIABLES AND COMPARE
/ THEIR VALUES TO TRIP POINTS ESTABLISHED BY THE USER
/ IF THE TRIP POINTS ARE REACHED (OR PASSED BECAUSE OF STEP CHANGES)
/ A USER SUBROUTINE WILL BE ENTERED CONTINUOUSLY UNTIL THE
/ SYSTEM IS RE-INITIALIZED
/ THE CALLING SEQUENCE MUST APPEAR IN A PROGRAM LOOP WHICH IS
/ ENTERED AT A RATE NO LESS THAN A MINIMUM SAMPLING RATE
/ CALLING SEQUENCE:
/     CLL
/     ... / ONE OR MORE INSTRUCTIONS MUST BE USED TO
/     ... / ESTABLISH A CONDITIONAL SKIP WHICH WILL
/     STL / COME HERE TO INITIATE THE MONITORING
/     LAW MNTRI / COME HERE TO STOP MONITORING AND RE-INITIALIZE
/     JMS TRIPS
/     CONTINUE / RETURN POINT
/
/     MNTRI IS THE BEGINNING OF A TABLE OF THE FOLLOWING FORMAT
/
/     MNTRI, .... / FIRST VARIABLE TO BE MONITORED
/     TRIPI, .... / TRIP POINT FOR VARIABLE IN MNTRI
/     ACTI, .... / ADDR OF ROUTINE ENTERED IF TRIPI IS REACHED
/     MNTRI2, ....
/     ...
/
/     MNTRI2, ....
/     TRIPI2, ....
/     ACTI2, ....
/
/     2 / ZERO INDICATES END OF TABLE
/
/     THE TABLE MAY BE ANY LENGTH IF IN ANY CASE THE NUMBER
/     OF VARIABLES TO BE MONITORED IS LESS THAN N THE NEXT
/     VARIABLE TO BE MONITORED CAN BE A ZERO THIS WILL END
/     THE TABLE AT THAT POINT

TRIPS, 3
      AND (17777
      DAC TBL# / ADDRESS OF TABLE
      SNL!CLC / TIME TO MONITOR?
      JMP OUT / NO
      LAC ENTRY1 / YES
      SNA / FIRST ENTRY?
      JMP CONT1 / NO
      DZM ENTRY1 / YES
RTN, LAC I TBL / GET VARIABLE TO BE MONITORED
      AND (17777 / INITILIZE BY MASKING THE INSTRUCTION PORTION
      SNA / END OF TABLE?
      JMP I TRIPS / YES
      DAC I TBL / NO
      ISZ TBL
      ISZ TBL
      ISZ TBL
      JMP RTN

```

/ TRIPS PAGE 2

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CONTI,      LAC I TBL      / GET VARIABLE TO BE MONITORED
            ISZ TBL
            SNA            / END OF TABLE?
            JMP I TRIPS    / YES
            DAC MNTR#      / NO
            LMQ
            LAC I TBL
            ISZ TBL
            CAS I MNTR
            JMP NEG        / DIFFERENCE IS NEGATIVE
            JMP EQL        / THEY ARE EQUAL
            LAC (200000    / DIFFERENCE IS POSITIVE
            OMQ            / SET BIT 1 TO A ONE
            JMP RESET
NEG,         LAC (100000
            OMQ            / SET BIT 2 TO A ONE
RESET,       DAC MNTR
            LAC TBL
            ADD (DAC-2
            DAC . 2
            LAC MNTR
            XX
CHK,         LAC MNTR
            AND (300000
            XOR (300000
            SZA            / DIFFERENCE BEEN BOTH POSITIVE AND NEGATIVE?
            JMP OUTS       / NO CHECK NEXT
            LAC I TBL      / YES GO TO SUBROUTINE
            ADD (JMS
            DAC . 1
            XX            / JMS SUBROUTINE
OUTS,        ISZ TBL
            JMP CONTI
OUT,         DAC ENTRY1    / NEXT ENTRY WILL BE A FIRST ENTRY
            JMP I TRIPS
EQL,         LAC (300000    / TRIP POINT IS REACHED
            OMQ            / SET BITS 1 AND 2 TO ONES
            JMP RESET
ENTRY1,      LAM
LIBFRM TRIPS
START

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