V.3.3-MULT/DIV   MULTIPLY OR DIVIDE TIME SERIES OPERATION

Identifier: MULT/DIV

Application: All programs

Description: This Operation either multiplies two time series together or divides one time series by the other.

The most common use of this Operation is to account for the effects of backwater. Since backwater is a function of the flow on two streams, the divide option can be used to calculate a ratio between the two flows, the Operation LOOKUP Operation can be used to find a correction factor based on this ratio and the correction factor time series can then be multiplied by one of the instantaneous flow time series. The results of the Operation are placed in a third time series.

The following rules apply to this Operation:

   1. All time series must have the same time intervals.

   2. Missing data is not allowed.

   3. If a zero is encountered in the second time series in the divide option, the flow is set equal to the previous value in the time series. The option of setting the flow to a constant, such as 1.0, was not used since it can result in a large jump in the output time series. Setting the flow to the previous value resulted in a smoother output time series.

   4. When the divide option is used, the two input time series must have the same units. The output time series will be dimensionless. When the multiply option is used, one input time series must be dimensionless and the other may have any dimension. The output time series has the dimensions of the dimensioned time series.

The data type DFAC has been created for use with this Operation.

The equations for this Operation are:

   $TSout = TS1 / TS2$ and $TSout = TS1 * TS2$

Allowable Data Time Intervals: 1, 2, 3, 4, 6, 8, 12 and 24 hours

Time Series Used: Time series used in this Operation are as follows:

```
                                              Form of  Data     Missing
                                              Output   Time     Values
General Type     Dimn    Units Use Required   T.S.     Interval Allowed

For multiplication:

Input            any 1/  any 1/  I    yes                any 2/    no
Input            dimensionless  I    yes                any 2/    no
Output           any 2/  any 2/  O    yes     replaces  any 2/    no

For division:

Input            any 1/  any 1/  I    yes                any 2/    no
Input            any 1/  any 1/  I    yes                any 2/    no
Output           dimensionless  O    yes     replaces  any 2/    no
```

1/ Two time series must be the same.

2 /All time series must be the same.

Input Summary: The card input for this Operation is as follows:

```
     Card    Format    Columns   Contents

      1      2X,2A4     3-10    Input time series 1 identifier

             1X,A4     12-15    Input time series 1 data type

             3X,I2     19-20    Input time series 1 time interval

             2X,2A4    23-30    Input time series 2 identifier to
                                multiply by or divide into time series 1

             1X,A4     32-35    Input time series 2 data type

             3X,I2     39-40    Input time series 2 time interval

      2      2X,2A4     3-10    Output time series identifier

             1X,A4     12-15    Output time series data type

             2X,I2     18-19    Multiply/divide indicator:
                                   0 = divide (default)
                                   1 = multiply
```


Sample Input and Output: Sample input is shown in Figure 1. Sample
output from the parameter print routine is shown in Figure 2. There
is no execution routine output.

Error and Warning Messages: The error and warning messages generated
by this Operation and the corrective action to take when they occur
are as follows:

A. Messages that can occur during setup:

   1. **ERROR** ALL SERIES DO NOT HAVE THE SAME UNITS.
      ID=XXXXXXXX DATA TYPE=XXXX UNITS=XXXX
      ID=XXXXXXXX DATA TYPE=XXXX UNITS=XXXX
      ID=XXXXXXXX DATA TYPE=XXXX UNITS=XXXX

      Action: Units of all time series must agree.

   2. **ERROR** OUTPUT TIME SERIES MUST HAVE "REAL" UNITS FOR
      DIVIDE OPTION.
      ID=xxxxxxxx DATA TYPE=xxxx UNITS=xxxx

   3. **ERROR** SECOND INPUT TIME SERIES MUST HAVE "REAL" UNITS
      FOR MULTIPLY OPTION.
      ID=xxxxxxxx DATA TYPE=xxxx UNITS=xxxx

B. Messages that can occur during execution:

   1. **WARNING** XXX FLOW VALUES WERE EQUAL TO ZERO. THESE FLOWS
      WERE SET EQUAL TO THE PREVIOUS FLOW.

Carryover Transfer Rules: This Operation has no carryover.

Punched card limitations: The values on the cards generated by the punched card subroutine should be identical to the original cards input for the Operation.

```
                   Figure 1.  Sample Card Input For Operation MULT/DIV


                                   - Column -
          5   10   15   20   25   30   35   40   45   50   55   60   65   70   75   80
       ----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+----+


       MULT/DIV    REMSEDIV
         REMSE     SQIN    6   WIBSE    QINE     6
         REMSEDIV DFAC    0


       MULT/DIV    REMSEMUL
         REMSE     SQIN    6   REMSELOC DFAC     6
         REMSEMUL SQIN    1
```

```
           Figure 2.  Sample Output From Operation MULT/DIV Print Parameter
                       Routine



       ********************

       MULT/DIV OPERATION     NAME=REMSEDIV    PREVIOUS NAME=

       ********************
       TIME SERIES #1 I.D.=REMSE      TYPE=SQIN   TIME INTERVAL= 6 HOURS
       DIVIDED BY
       TIME SERIES #2 I.D.=WIBSE      TYPE=QINE   TIME INTERVAL= 6 HOURS
       EQUALS OUTPUT TIME SERIES I.D.=REMSEDIV   TYPE=DFAC


       ********************

       MULT/DIV OPERATION     NAME=REMSEMUL    PREVIOUS NAME=

       ********************
       TIME SERIES #1 I.D.=REMSE      TYPE=SQIN   TIME INTERVAL= 6 HOURS
       MULTIPLIED BY
       TIME SERIES #2 I.D.=REMSELOC   TYPE=DFAC   TIME INTERVAL= 6 HOURS
       EQUALS OUTPUT TIME SERIES I.D.=REMSEMUL   TYPE=SQIN
```