Customer Support Engineering Tech Note #5

Setting up a Timer Interrupt

Abstract

Many applications have tasks or subroutines that need to be executed at regular intervals. While this can be done by calling the appropriate subroutines from within the body of your program, it is much more convenient to set them up as a periodic timer interrupt.

Description

Timer interrupts use MotionBASIC’s EVENT DIO@ and timed DIO@ features. EVENT DIO@ allows you to define a subroutine that will be executed whenever a particular DIO@ point is turned on. Timed DIO@ allows you to cause a DIO@ output to turn on (or off) after a specified delay.

Each timer interrupt uses one of the primary 16 DIO@ locations on the controller’s I/O board. While you do not need to install an actual I/O module in a location used by a timer interrupt, the location cannot be used for any other purpose.

Implementation

The following code initializes the DIO@ EVENT interrupt:

```motionbasic
TIME.INT = 1 'pick a DIO point from 1-16
IO.MODE@(TIME.INT) = "O" 'define the DIO point as an output
ON EVENT DIO@(TIME.INT) GOSUB INT.ROUTINE
PERIOD = 200 'the interrupt period will be 200 ms
```

The first three lines assign an I/O point to be the interrupt, configure the point as an output and set up the interrupt subroutine.

Line 4 sets up a variable for the interrupt period in milliseconds. It is used in a timed DIO@ statement to turn the TIME.INT output on after the specified time.

This code enables the interrupt:

```motionbasic
EVENT ON 'enable all events
EVENT DIO@(TIME.INT) ON 'turn the timer event processing on
DIO@(TIME.INT) = -PERIOD 'turn the interrupt output ON after PERIOD ms
```

The interrupt routine is:

```motionbasic
INT.ROUTINE:
  'whatever you want to do
  DIO@(TIME.INT) = -PERIOD 'restart the timed output
RETURN
```

After doing whatever it is you want done in the interrupt routine, you set up the interrupt output to turn on again and retrigger the interrupt after PERIOD milliseconds.

Placing the DIO@(TIME.INT) = -PERIOD immediately before the RETURN statement guarantees the rest of your program will execute for PERIOD milliseconds before the interrupt.
occurs again. The interrupt routine will be executed every PERIOD + X milliseconds, where X is the time the routine takes to execute. Placing the DIO@(TIME.INT) = -PERIOD at the beginning of the interrupt routine makes the frequency more predictable but does not guarantee how much time the rest of your program has before being interrupted again.

Performance Considerations

DIO@ EVENT subroutines are called immediately after completion of the MotionBASIC® statement that was executing when the interrupt I/O point is activated. These means there is a random latency depending on what statement your program is executing when the interrupt occurs.

While the program is executing the interrupt routine, the subroutine your program was in when the interrupt occurred, is not executing. The time your interrupt routine takes to execute, introduces an identical delay in your program. You may need to suspend interrupt processing using EVENT DIO@(TIME.INT) STOP when executing critical parts of your program. EVENT DIO@(TIME.INT) ON will re-enable the interrupt and respond to the input if it turned on during the suspension. EVENT STOP and EVENT ON will do the same thing for all interrupts.

The frequency at which you call the interrupt (PERIOD) and the time your interrupt routine takes to execute determine the overall affect on performance. The average time for a given section of code to execute will increase by a factor of:

\[
1 + \frac{X}{\text{PERIOD}}
\]

Example:

- 100 passes through a loop in your program takes 12 seconds without the interrupt.
- Your interrupt takes 20 ms to execute.
- PERIOD is set to 200 ms.

With the interrupt enabled, 100 passes through your original loop will take approximately:

\[
= 12 \cdot \left(1 + \frac{20}{200}\right)
\]

\[
= 12 \cdot 1.1
\]

\[
= 13.2 \text{ seconds}
\]

Note: If you place the DIO@(TIME.INT) = -PERIOD statement at the beginning of the interrupt routine, you should use PERIOD - X in place of PERIOD in the above equations.

Additional Information

For additional information on MotionBASIC® EVENT and timed DIO@ features refer to the MotionBASIC® Hypertext Manual.