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## Iterations with Loops

# Iterations with Loops - FOR

- The 'FOR' loop is used to repeat a block of code, a specific number of times
- The 'FOR' loop has a specific start and end point

```
FOR i := 1 TO 10 DO  
    //place code here  
END_FOR
```

# Iterations with Loops - FOR

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- 'i' is the iteration variable and is of type 'INT'
- In the below samples the 'FOR' loop will execute exactly 10 times within 1 PLC cycle

```
FOR i := 1 TO 10 DO  
    //place code here  
END_FOR
```

```
FOR i := 0 TO 9 DO  
    //place code here  
END_FOR
```

# Iterations with Loops - FOR

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- The start and the end are defined by the programmer

```
FOR i := -5 TO 3 DO  
    //place code here  
END_FOR
```

# Iterations with Loops - FOR

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- It is a common practice to use the iteration value as the index value in an array
- This will loop through each index of the array and set it's value to zero.

```
FOR i := 1 TO 10 DO  
    myArray[i] := 0;  
END_FOR
```

# Iterations with Loops - FOR

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- It is also possible to skip values in the iteration

```
FOR i := 1 TO 100 BY 10 DO  
    //place code here  
END_FOR
```

# Iterations with Loops - FOR

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- The start and end of the 'FOR' loop must be either literal values or must be defined as a 'CONSTANT'
- It is possible to use standard variables for the Start and End of the 'FOR' loop, but this must be handled with care
- The value to skip by can be a standard variable

```
VAR_GLOBAL CONSTANT  
    iMAX_VALUE : INT := 10;  
END_VAR
```

```
VAR_GLOBAL  
    iValue : INT;  
END_VAR
```

```
FOR i := 1 TO iMAX_VALUE BY iValue DO  
    //place code here  
END_FOR
```

# Iterations with Loops - FOR

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- When monitoring a 'FOR' loop online, the value of the iteration variable will always be 1 more than the end value

```
FOR i 11 := 1 TO 10 DO  
    myArray[i 11] ??? := 0;  
END_FOR
```

# Iterations with Loops - While

- The 'WHILE' loop monitors a Boolean condition
- While the Boolean condition is TRUE, the block of code will continuously repeat within the same PLC cycle

```
WHILE (a > b) DO  
    //place code here  
END_WHILE
```

Note: values from outside the PLC task should never be a condition of the 'WHILE' loop

- The 'WHILE' loop should be used with extreme caution!
- If the condition never results in a value of FALSE the WHILE loop will run indefinitely

```
WHILE (a > b) DO  
    a := a + 1;  
END_WHILE
```

Note: values from outside the PLC task should never be a condition of the 'WHILE' loop

- Typically the value being monitored by the 'WHILE' instruction will be altered by the code inside of the 'WHILE' loop

```
WHILE (a > b) DO  
    b := b + 1;  
END_WHILE
```

Note: values from outside the PLC task should never be a condition of the 'WHILE' loop

# Iterations with Loops – Repeat Until

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- The 'REPEAT' loop is similar to the 'WHILE' loop
- The difference is that the code in the loop is guaranteed to run a minimum of 1 time

```
REPEAT
    //place code here
UNTIL (a > b)
END_REPEAT;
```

Note: values from outside the PLC task should never be a condition of the 'REPEAT' loop

# Iterations with Loops – Repeat Until

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- After the block of code is executed, then condition is checked
- If the condition is TRUE then code will continue, if the Condition is FALSE the code will 'REPEAT'

```
REPEAT
    //place code here
UNTIL (a > b)
END_REPEAT;
```

Note: values from outside the PLC task should never be a condition of the 'REPEAT' loop

# Iterations with Loops – EXIT

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- It is possible to 'EXIT' a loop at any time

```
WHILE a < b DO
    a := a + 1;
    IF condition THEN
        EXIT;
    END_IF
END_WHILE
```

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