General Purpose

Application Specific Function Block Manual

Part Number M.1300.7192
Version 11.0.2

Giddings & Lewis
Controls, Measurement and Sensing

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M.1300.7192

Release 0201

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CHAPTER 1 Application Specific Function Block Guidelines

Installation

The following guidelines are recommended ways of working with Application Specific Function Blocks (i.e. ASFBs) from Giddings & Lewis.

The Applications CD includes the ASFB package as follows:

- .LIB file(s) containing the ASFB(s)
- source .LDO(s) from which the ASFB(s) was made
- example LDO(s) with the ASFB(s) incorporated into the ladder which you can then use to begin programming from or merge with an existing application ladder

When you install the Applications CD, the ASFB paths default to:

C:\Program Files\Giddings & Lewis\Applications **v*xx.x.r***\ASFB

and

C:\Program Files\Giddings & Lewis\Applications **v*xx.x.r***\Examples

where **v*xx.x*** *is the PiCPro for Windows version number that these ASFBs and examples were built under. The* ***.r*** *is the revision number of the Application software itself.*

The .LIB files and source .LDO files are put in the ASFB subdirectory. The example .LDO files are put in the Examples subdirectory.

Revisions

The first four networks of each ASFB source ladder provide the following information:

Network 1

The first network just informs you that the ASFB is provided to assist your application development.

Network 2

The second network is used to keep a revision history of the ASFB. Revisions can be made by Giddings & Lewis personnel or by you.

The network identifies the ASFB, lists the requirements for using this ASFB, the name of the library the ASFB is stored in, and the revision history.

The revision history includes the date, ASFB version (see below), the version of PiCPro used while making the ASFB, and comments about what the revision involved.

When an ASFB is revised, the number of the first input (EN_ _ or RQ_ _) to the function block is changed in the software declarations table. The range of numbers available for Giddings & Lewis personnel is 00 to 49. The range of numbers available for you is 50 to 99. See chart below.

Revision	Giddings & Lewis revisions	User revisions
1st	EN00	EN50
2nd	EN01	EN51
.	.	.
.	.	.
.	.	.
50th	EN49	EN99

Network 3

The third network describes what you should do if you want to make a revision to the ASFB.

ASFB Input/Output Descriptions

Network 4

The fourth network describes the ASFB and defines all the inputs and outputs to the function block.

Using ASFBs

When you are ready to use the ASFB in your application, there are several approaches you can take as shown below.

- Create a new application LDO starting with the example LDO for the ASFB package. The advantage is that the software declarations table for the ASFB has been entered for you.
- If you already have an application LDO, copy and paste the example LDO into yours. The software declaration tables for both LDOs will also merge.

CHAPTER 2 General Purpose ASFBs

These are the general purpose application specific function blocks. Included in this package are the following files.

NOTE: Every .LDO file on the CD has a corresponding .REM file. The REM files contain all the comments found in the LDO files. If you move an .LDO file to a different location, be sure to move its REM file to the same directory.

Communications ASFBS		
	G_COMM.LIB	Library which contains communications application specific function blocks
	G_COMMEX.LDO	Example .LDO that uses the application specific function blocks in G_COMM library
	G_CONFIG.LDO	Source file for ASFB that opens and configures a serial port
	G_RCVSTR.LDO	Source file for ASFB that receives strings from a serial port
	G_SNDSTR.LDO	Source file for ASFB that sends strings out a serial port
Data Type Conversion ASFBs		
	G_DATTYP.LIB	Library which contains data type conversion application specific function blocks
	G_DTYPEX.LDO	Example .LDO that uses the application specific function blocks in G_DATTYP library
	G_BN2STR.LDO	Source file for ASFB that converts a DWORD to a string, displaying the data in a binary format
	G_BOO2DW.LDO	Source file for ASFB that converts 32 BOOLs to a DWORD
	G_BOO2WD.LDO	Source file for ASFB that converts 16 BOOLs to a WORD
	G_BY2BIT.LDO	Source file for ASFB that returns one bit of a BYTE
	G_DW2BIT.LDO	Source file for ASFB that returns one bit of a DWORD
	G_DW2BOO.LDO	Source file for ASFB that converts a DWORD to 32 BOOLs

	G_HX2STR.LDO	Source file for ASFB that converts a DWORD to a string, displaying the data in a hex format
	G_NM2STR.LDO	Source file for ASFB that converts a DINT to a string including decimal point and sign
	G_WD2BIT.LDO	Source file for ASFB that returns one bit of a WORD
	G_WD2BOO.LDO	Source file for ASFB that converts a WORD to 16 BOOLs
Evaluation ASFBS		
	G_EVAL.LIB	Library which contains evaluate application specific function blocks
	G_EVALEX.LDO	Example .LDO that uses the application specific function blocks in G_EVAL library
	G_BETWN.LDO	Source file for ASFB that sets an output if an input is in between two other inputs
	G_GE_ALL.LDO	Source file for ASFB that sets an output if an input is greater than or equal to all of the other inputs
	G_GE_ANY.LDO	Source file for ASFB that sets an output if an input is greater than or equal to any of the other inputs
	G_LE_ALL.LDO	Source file for ASFB that sets an output if an input is less than or equal to all of the other inputs
	G_LE_ANY.LDO	Source file for ASFB that sets an output if an input is less than or equal to any of the other inputs
RAMDISK File Manipulation ASFBS		
	G_FILE.LIB	Library which contains RAMDISK file manipulation application specific function blocks
	G_FILEEX.LDO	Example .LDO that uses the application specific function blocks in G_FILE library
	G_FILMNG.LDO	Source file for file manager ASFB for creating and editing recipes or part programs on the RAMDISK

	G_READFL.LDO	Source file for ASFB that reads a file from the RAMDISK into a structure or array
	G_WRITFL.LDO	Source file for ASFB that writes a file from a structure or array to the RAM-DISK

Miscellaneous ASFBS

	G_MISC.LIB	Library which contains miscellaneous application specific function blocks
	G_MISCEX.LDO	Example .LDO that uses the application specific function blocks in G_MISC library
	G_C2F.LDO	Source file for ASFB that converts temperature from Celsius to Fahrenheit
	G_D2ARMP.LDO	Source file for ASFB that produces an output command based on an input command and the allowable rate of change of the input
	G_DEG2RD.LDO	Source file for ASFB that converts an angle in degrees to radians
	G_DRMSEQ.LDO	Source file for ASFB that implements a drum or step sequencer
	G_F2C.LDO	Source file for ASFB that converts temperature from Fahrenheit to Celsius
	G_HSTGRM.LDO	Source file for ASFB that collects a contact histogram for up to 8 inputs
	G_RD2DEG.LDO	Source file for ASFB that converts an angle in radians to degrees

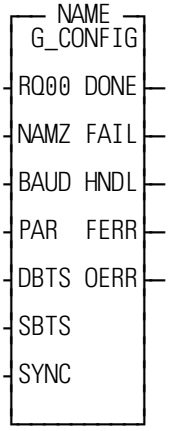
Shift Register ASFBS

	G_SHFTRG.LIB	Library which contains shift register application specific function blocks
	G_SHFTEX.LDO	Example .LDO that uses the application specific function blocks in G_SHFTRG library
	G_CHK_32.LDO	Source file for ASFB that returns number of highest or lowest bit set in array of 32 BOOLs
	G_CHKBIT.LDO	Source file for ASFB that returns number of highest or lowest bit set in array of BOOLs
	G_SHIFT.LDO	Source file for ASFB that shifts an array of BOOLs right or left
	G_SHL_32.LDO	Source file for ASFB that performs a shift left on an array of 32 BOOLs

	G_SHR_32.LDO	Source file for ASFB that performs a shift right on an array of 32 BOOLs
Timer ASFBS		
	G_TIMER.LIB	Library which contains timer application specific function blocks
	G_TMREX.LDO	Example .LDO that uses the application specific function blocks in G_TIMER library
	G_ELTMR.LDO	Source file for ASFB that keeps track of the total elapsed time an input has been energized
	G_FLTMR.LDO	Source file for ASFB that flashes an output on and off when an input is energized

G_CONFIG

Configures serial port **USER/G_COMM**



Inputs: RQ00 (BOOL) - set for one scan to enable execution

NAMZ STRING) - the name of the port to open

BAUD (INT) - defines the baud rate of the port

PAR (USINT) - defines the parity of the port

DBTS (USINT) - defines the number of data bits

SBTS (USINT) - defines the number of stop bits

SYNC (USINT) - defines the synch mode of the port

Outputs: DONE (BOOL) - set when the port has been configured successfully

FAIL (BOOL) - set if an error occurred during configure

HNDL (INT) - the handle assigned to the port

FERR (INT) - error code from OPEN or CONFIG function

OERR (INT) - error code not from OPEN or CONFIG function

This function block opens and configures a serial port.This function block only needs to be called once, on the first scan of your application ladder. When it has finished executing, the send string and receive string application specific function blocks (G_SNDSTR and G_RCVSTR) can be used to read from and write to the serial port.

The string at the NAMZ input must either be 'USER:$00' or the name used in the ASSIGN function for that device. The name must be followed by $00.

The number entered at the BAUD input must be one of the following values: 110, 300, 600, 1200, 2400, 4800, 9600, or 19200.

The number entered at the PAR input must be one of the following values: 0 for no parity, 1 for even parity, or 2 for odd parity.

The number entered at the DBTS input must be 7 or 8.

The number entered at the SBTS input must be 1 or 2.

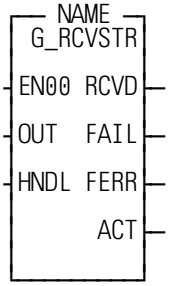
The number entered at the SYNC input must be one of the following values: 0 for no synch mode, 1 for send only, 2 for receive only, 3 for both send and receive, or 4 for hardware synch mode.

The HNDL output variable is used as an input to the send and receive application specific function blocks (G_SNDSTR and G_RCVSTR).

If an error occurred from the OPEN or CONFIG function, the error code will be stored in the FERR output. See appendix B of the PiC900 software manual for a description of these errors.

If an error occurred not from the OPEN or CONFIG function that prevented this function block from executing, an error code will be stored in the OERR output. A listing of these errors is shown below:

OERR	Description
0	No error
1	BAUD input not an allowable value.
2	PAR input not 0, 1, or 2.
3	DBTS input not 7 or 8.
4	SBTS input not 1 or 2.
5	SYNC input greater than 4.



Inputs: EN00 (BOOL) - set continuously to enable execution

OUT (STRING) - the string read from the serial port

HNDL (INT) - the handle of the port

Outputs: RCVD (BOOL) - set for one scan when string was successfully read from the port

FAIL (BOOL) - set if an error occurred during read

FERR (INT) - error code from STATUS or READ function

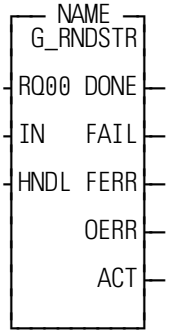
ACT (INT) - the number of bytes read

This function block receives strings from a serial port.

The port must be opened and configured using the configure port application specific function block (G_CONFIG) before calling this function.

The HNDL input is the same as the output HNDL from the open and configure port function block (G_CONFIG).

If an error occurred from the STATUS or READ function, that error code will be stored in the FERR output. A complete listing of these error codes can be found in the Appendix B of the PiC900 software manual.



Inputs: RQ00 (BOOL) - set for one scan to initiate string send

IN (STRING) - the string to send

HNDL (INT) - the handle of the port

Outputs: DONE (BOOL) - reset when request is made, set when string was successfully sent out the port

FAIL (BOOL) - reset when request is made, set if an error occurred during send

FERR (INT) - error code from WRITE function block

OERR (INT) - error code for error not from WRITE function block.

ACT (INT) - the number of bytes sent

This function block sends a string out a serial port.

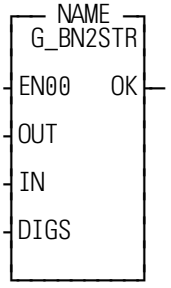
The serial port must be opened and configured using the configure port application specific function block (G_CONFIG) before calling this function.

The HNDL input is the same as the HNDL output from the open and configure port function block (G_CONFIG).

If an error occurred from the WRITE function that error code will be stored in the FERR output. A complete listing of these errors can be found in the Appendix B of the PiC900 software manual.

If an error occurred not from the WRITE function that prevented this function block from executing, that error code will be stored in the OERR output. A listing of these errors is shown below:

OERR	Description
0	No error
1	A request was made and the previous request was not complete.
2	The length of the string at IN is zero.



Inputs: EN00 (BOOL) - enables execution

OUT (STRING) - output string

IN (DWORD) - the data to convert

DIGS (USINT) - the number of binary digits to display

Outputs: OK (BOOL) -execution complete

This function block converts a double word to a string, displaying the double word in binary format.

The number entered at the DIGS input must be from 1 and 32. If it is not, then the OK will not be set.

EXAMPLES:

If IN = 16#F0F0 and DIGS = 16

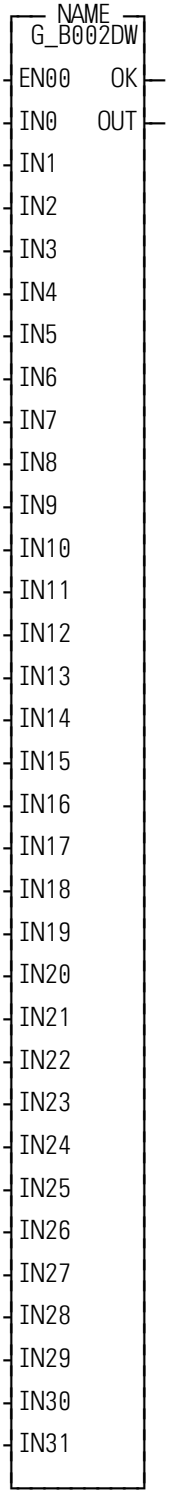
then OUT = '1111000011110000'

If IN = 16#F0F0 and DIGS = 32 then

OUT = '00000000000000001111000011110000'

If IN = 16#3 and DIGS = 8

then OUT = '00000011'



Inputs: EN00 (BOOL) - enables execution
IN0 (BOOL) - bit 0 of OUT (least significant bit)
IN1 (BOOL) - bit 1 of OUT
IN2 (BOOL) - bit 2 of OUT
IN3 (BOOL) - bit 3 of OUT
IN4 (BOOL) - bit 4 of OUT
IN5 (BOOL) - bit 5 of OUT
IN6 (BOOL) - bit 6 of OUT
IN7 (BOOL) - bit 7 of OUT
IN8 (BOOL) - bit 8 of OUT
IN9 (BOOL) - bit 9 of OUT
IN10 (BOOL) - bit 10 of OUT
IN11 (BOOL) - bit 11 of OUT
IN12 (BOOL) - bit 12 of OUT
IN13 (BOOL) - bit 13 of OUT
IN14(BOOL) - bit 14 of OUT
IN15 (BOOL) - bit 15 of OUT
IN16 (BOOL) - bit 16 of OUT
IN17 (BOOL) - bit 17 of OUT
IN18 (BOOL) - bit 18 of OUT
IN19 (BOOL) - bit 19 of OUT
IN20 (BOOL) - bit 20 of OUT
IN21 (BOOL) - bit 21 of OUT
IN22 (BOOL) - bit 22 of OUT
IN23 (BOOL) - bit 23 of OUT
IN24 (BOOL) - bit 24 of OUT
IN25 (BOOL) - bit 25 of OUT
IN26 (BOOL) - bit 26 of OUT
IN27 (BOOL) - bit 27 of OUT
IN28 (BOOL) - bit 28 of OUT
IN29 (BOOL) - bit 29 of OUT
IN30 (BOOL) - bit 30 of OUT
IN31 (BOOL) - bit 31 of OUT (most significant bit)

Outputs: OK (BOOL) - execution complete
OUT (DWORD) - packed double word from inputs

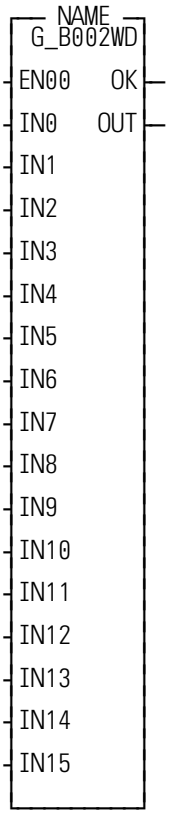
EXAMPLES:

If IN0 is OFF and IN1 through IN31 are ON, then OUT will be 16#FFFFFFFE.

If IN31 is OFF and IN0 through IN30 are ON, then OUT will be 16#7FFFFFFF.

If IN0 is ON and IN1 through IN31 are OFF, then OUT will be 16#1.

If IN31 is ON and IN0 through IN30 are OFF, then OUT will be 16#80000000.



Inputs: EN00 (BOOL) - enables execution
IN0 (BOOL) - bit 0 of OUT (least significant bit)
IN1 (BOOL) - bit 1 of OUT
IN2 (BOOL) - bit 2 of OUT
IN3 (BOOL) - bit 3 of OUT
IN4 (BOOL) - bit 4 of OUT
IN5 (BOOL) - bit 5 of OUT
IN6 (BOOL) - bit 6 of OUT
IN7 (BOOL) - bit 7 of OUT
IN8 (BOOL) - bit 8 of OUT
IN9 (BOOL) - bit 9 of OUT
IN10 (BOOL) - bit 10 of OUT
IN11 (BOOL) - bit 11 of OUT
IN12 (BOOL) - bit 12 of OUT
IN13 (BOOL) - bit 13 of OUT
IN14(BOOL) - bit 14 of OUT
IN15 (BOOL) - bit 15 of OUT (most significant bit)
Outputs: OK (BOOL) - execution complete
OUT (DWORD) - packed word with inputs

This function block packs 16 BOOLs into a WORD.

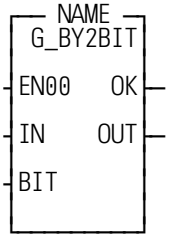
EXAMPLES:

If IN0 is OFF and IN1 through IN15 are ON, then OUT will be 16#FFFE.

If IN15 is OFF and IN0 through IN14 are ON, then OUT will be 16#7FFF.

If IN0 is ON and IN1 through IN15 are OFF, then OUT will be 16#1.

If IN15 is ON and IN0 through IN14 are OFF, then OUT will be 16#8000.



Inputs: EN00 (BOOL) - enables execution
IN (BYTE) - input data
BIT (USINT) - the bit number to return

Outputs: OK (BOOL) - execution complete
OUT (BOOL) - the state of bit BIT in IN

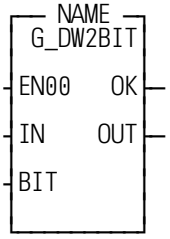
This function block returns one bit of a BYTE variable.

The number entered at the BIT input must be between 0 and 7 or the OK output will not be set.

EXAMPLES

If IN=16#80 and BIT=7 then OUT will be 'ON'.

If IN=16#FE and BIT=0 then OUT will be 'OFF'.



Inputs: EN00 (BOOL) - enables execution
IN (DWORD) - the input data
BIT (USINT) - the bit number to return

Outputs: OK (BOOL) - execution complete
OUT (BOOL) - the state of bit BIT in IN

This function block returns one bit of a DWORD variable.

The number entered at the BIT input must be between 0 and 31 or the function will not execute and the OK output will not be set.

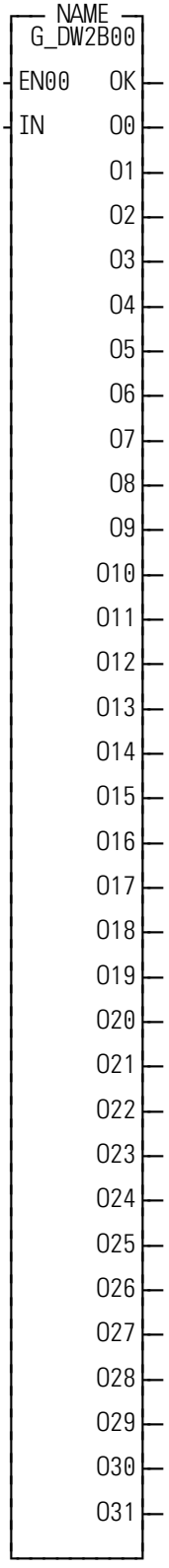
EXAMPLES:

If IN = 16#80000000 and BIT = 31 then OUT will be 'ON'.

If IN = 16#FFFFFFFE and BIT = 0 then OUT will be 'OFF'.

G_DW2B00

Converts DWORD to 32 BOOLs **USER/G_DATTYP**



Inputs: EN00 (BOOL) - enables execution
IN (DWORD) - the data to convert

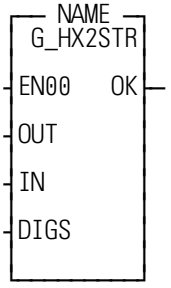
Outputs: OK (BOOL) - execution complete
O0 (BOOL) - bit 0 of IN (least significant bit)
O1 (BOOL) - bit 1 of IN
O2 (BOOL) - bit 2 of IN
O3 (BOOL) - bit 3 of IN
O4 (BOOL) - bit 4 of IN
O5 (BOOL) - bit 5 of IN
O6 (BOOL) - bit 6 of IN
O7 (BOOL) - bit 7 of IN
O8 (BOOL) - bit 8 of IN
O9 (BOOL) - bit 9 of IN
O10 (BOOL) - bit 10 of IN
O11 (BOOL) - bit 11 of IN
O12 (BOOL) - bit 12 of IN
O13 (BOOL) - bit 13 of IN
O14 (BOOL) - bit 14 of IN
O15 (BOOL) - bit 15 of IN
O16 (BOOL) - bit 16 of IN
O17 (BOOL) - bit 17 of IN
O18 (BOOL) - bit 18 of IN
O19 (BOOL) - bit 19 of IN
O20 (BOOL) - bit 20 of IN
O21 (BOOL) - bit 21 of IN
O22 (BOOL) - bit 22 of IN
O23 (BOOL) - bit 23 of IN
O24 (BOOL) - bit 24 of IN
O25 (BOOL) - bit 25 of IN
O26 (BOOL) - bit 26 of IN
O27 (BOOL) - bit 27 of IN
O28 (BOOL) - bit 28 of IN
O29 (BOOL) - bit 29 of IN
O30 (BOOL) - bit 30 of IN
O31 (BOOL) - bit 31 of IN (most significant bit of IN)

This function block converts a DWORD to 32 BOOLs

EXAMPLES:

If IN = 16#FFFFFFFE then O0 will be OFF and O1 through O31 will be ON.

If IN = 16#80000000 then O31 will be ON and O0 through O30 will be OFF.



Inputs: EN00 (BOOL) - enables execution
OUT (STRING) - output string
IN (DWORD) - the data to convert
DIGS (USINT) - the number of hex digits to display

Outputs: OK (BOOL) - execution complete

This function converts a DWORD to a hex formatted string.

The value at DIGS must be between 1 and 8 or this function will not execute and the OK will not be set.

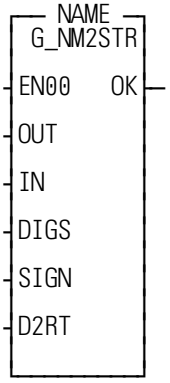
EXAMPLES:

If IN = 16#ABCDE and DIGS = 8 then OUT will be '000ABCDE'.

If IN = 16#FEDCBA and DIGS = 2 then OUT will be 'BA'.

G_NM2STR

Converts DINT to formatted string **USER/G_DATTYP**



Inputs: EN00 (BOOL) - enables execution

OUT (STRING) - output string

IN (DINT) - defines the data to be converted

DIGS (USINT) - defines the maximum number of digits for the number

SIGN (USINT) - defines if a + or - sign should be placed in front of the number

D2RT (USINT)= defines the number of digits to the right of the decimal point

Outputs: OK (BOOL) - execution complete

This function block converts a DINT to a formatted string.

The number entered at the DIGS input is the maximum number of digits the number can have, not including decimal point or sign. If the value of IN is too large to fit into the number of digits at DIGS, the output string will be all @ signs.

The number entered at the SIGN input should be a 0 if no sign should be placed in front of the number, or a 1 if a + or - sign should be placed in front of the number in the output string. If SIGN is 0 and the number at IN is negative, then the OUT string will be all @ signs.

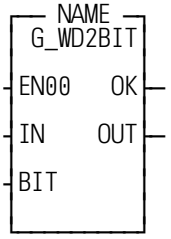
The number entered at the D2RT input should be a 0 if no decimal point should be displayed, or the number of digits desired to the right of the decimal point.

EXAMPLES:

If IN = 1234567, DIGS = 7, SIGN= 1, and D2RT = 4 then OUT will be '+123.4567'.

If IN = -123, DIGS = 7, SIGN = 1, and D2RT = 4, then OUT will be ' -.0123'.

If IN = 567, DIGS = 5, SIGN = 0, and D2RT = 0 then OUT will be ' 567'.



Inputs: EN00 (BOOL) - enables execution
IN (WORD) - input data
BIT (USINT) - the bit number to return

Outputs: OK (BOOL) - execution complete
OUT (BOOL) - the state of BIT in IN

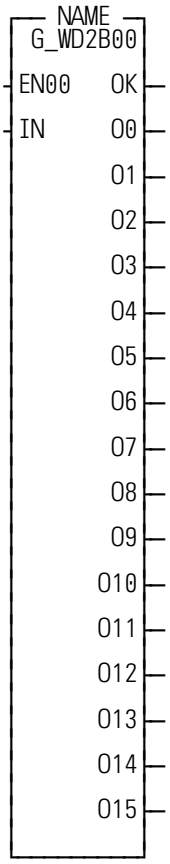
This function block returns one bit of a WORD variable.

The value entered at BIT must be from 0 to 15 for this function to execute.

EXAMPLES:

If IN = 16#8000 and BIT = 15, then OUT will be ON.

If IN = 16#FFFE and BIT = 0, then OUT will be OFF.



Inputs: EN00 (BOOL) - enables execution
IN (WORD) - the data to convert

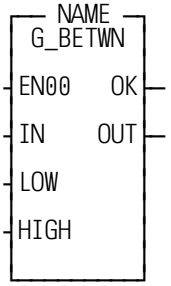
Outputs: OK (BOOL) - execution complete
O0 (BOOL) - bit 0 of IN (least significant bit)
O1 (BOOL) - bit 1 of IN
O2 (BOOL) - bit 2 of IN
O3 (BOOL) - bit 3 of IN
O4 (BOOL) - bit 4 of IN
O5 (BOOL) - bit 5 of IN
O6 (BOOL) - bit 6 of IN
O7 (BOOL) - bit 7 of IN
O8 (BOOL) - bit 8 of IN
O9 (BOOL) - bit 9 of IN
O10 (BOOL) - bit 10 of IN
O11 (BOOL) - bit 11 of IN
O12 (BOOL) - bit 12 of IN
O13 (BOOL) - bit 13 of IN
O14 (BOOL) - bit 14 of IN
O15 (BOOL) - bit 15 of IN (most significant bit)

EXAMPLES:

This function block converts a WORD to 16 BOOLs.

If IN = 16#8000, then O15 will be ON and O0 through O14 will be OFF.

If IN = 16#FFFE, then O0 will be OFF and O1 through O15 will be ON.



Inputs: EN00 (BOOL) - enables execution

IN (DINT) - defines the input to be compared to the other inputs

LOW (DINT) - defines the lower limit for comparison

HIGH (DINT) - defines the upper limit for comparison

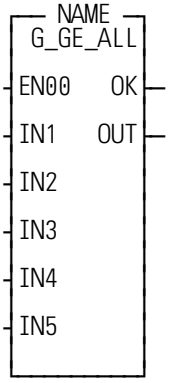
Outputs: OK (BOOL) - execution complete

OUT (BOOL) - set if IN is in between LOW and HIGH

This function block compares an input with two other inputs and sets an output if the first input is in between the other two.

If LOW <= IN <= HIGH, then OUT will be set.

If IN < LOW or if IN > HIGH, then OUT will be reset.



Inputs: EN00 (BOOL) -enables execution

IN1 (DINT) - this input will be compared to all the other inputs

IN2 (DINT) - first input to compare to IN1

IN3 (DINT) - second input to compare to IN1

IN4 (DINT) - third input to compare to IN1

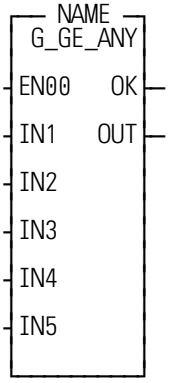
IN5 (DINT) - fourth input to compare to IN1

Outputs: OK (BOOL) - execution complete

OUT (BOOL) - ON or OFF depending on result of comparison

This function block compares the first input with all of the other inputs and sets an output if the first input is greater than or equal to all of the other inputs.If IN1 is greater than or equal to IN2, IN3, IN4, and IN5, then OUT will be ON.

If IN1 is less than IN2, IN3, IN4, or IN5, then OUT will be OFF.



Inputs: EN00 (BOOL) -enables execution

IN1 (DINT) - this input will be compared to all the other inputs

IN2 (DINT) - first input to compare to IN1

IN3 (DINT) - second input to compare to IN1

IN4 (DINT) - third input to compare to IN1

IN5 (DINT) - fourth input to compare to IN1

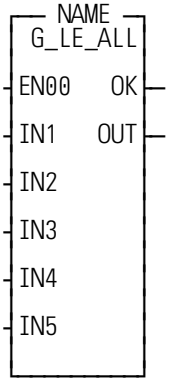
Outputs: OK (BOOL) - execution complete

OUT (BOOL) - ON or OFF depending on result of comparison

This function block compares the first input with all of the other inputs and sets an output if the first input is greater than or equal to any of the other inputs.

If IN1 is greater than or equal to IN2, IN3, IN4, or IN5, then OUT will be ON.

If IN1 is less than IN2, IN3, IN4 and IN5, then OUT will be OFF.



Inputs: EN00 (BOOL) -enables execution

IN1 (DINT) - this input will be compared to all the other inputs

IN2 (DINT) - first input to compare to IN1

IN3 (DINT) - second input to compare to IN1

IN4 (DINT) - third input to compare to IN1

IN5 (DINT) - fourth input to compare to IN1

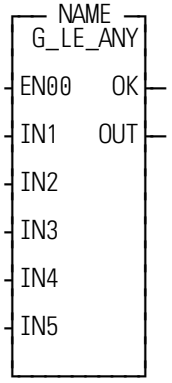
Outputs: OK (BOOL) - execution complete

OUT (BOOL) - ON or OFF depending on result of comparison

This function block compares the first input with all of the other inputs and sets an output if the first input is less than or equal to all of the other inputs.

If IN1 is less than or equal to IN2, IN3, IN4, and IN5 then OUT will be ON.

If IN1 is greater than IN2, IN3, IN4 or IN5 then OUT will be OFF.



Inputs: EN00 (BOOL) - enables execution

IN1 (DINT) - this input will be compared to all the other inputs

IN2 (DINT) - first input to compare to IN1

IN3 (DINT) - second input to compare to IN1

IN4 (DINT) - third input to compare to IN1

IN5 (DINT) - fourth input to compare to IN1

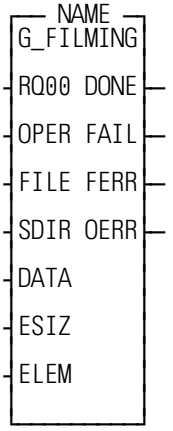
Outputs: OK (BOOL) - execution complete

OUT (BOOL) - ON or OFF depending on result of comparison

This function block compares the first input with all of the other inputs and sets an output if the first input is less than or equal to any of the other inputs.

If IN1 is less than or equal to IN2, IN3, IN4, or IN5, then OUT will be ON.

If IN1 is greater than IN2, IN3, IN4, and IN5, then OUT will be OFF.



Inputs: RQ00 (BOOL) - one-shot to start any operation

OPER (USINT) - requested file operation

FILE (STRING) - file name to edit

SDIR (STRING) - the RAMDISK subdirectory where the file is located

DATA (STRUCT) - data to be edited or read

ESIZ (INT) - Size of DATA structure in bytes

ELEM (INT) - element number to read, replace, insert after, insert before or delete

Outputs: DONE (BOOL) - set if file operation completes successfully

FAIL (BOOL) - set if file operation is terminated due to an error condition

FERR (INT) - error code from OPEN, READ, or CLOSE function blocks

OERR(INT) - error code not from OPEN, READ, or CLOSE function blocks

The data list file manager is used for creating and editing recipes or part programs on the PiC900 RAMDISK.

Each part program or recipe is stored as an individual file on the RAMDISK. The file name is specified at the FILE input. The name can be up to eight characters, with an extension of up to three characters. The last character of the FILE string must be a $00. EXAMPLE: '\FILENAME.EXT$00

If the file is in a subdirectory on the RAMDISK, then the SDIR input defines the name of the subdirectory. The name can be up to eight characters, and can not have an extension. EXAMPLE: 'SUBDIR'.

NOTE: If you want the file to be placed in the main directory, then enter a string with no initial value at the SDIR input.

Each file consists of one or more elements.

Each element in the file must be the same size and have the same format. The format for an element is defined by creating a structure. That structure is then placed at the DATA input of this function block.

To request an operation the RQ00 input must be one-shot and the operation desired must be placed in the OPER input. A table of allowable operations is shown below:

OPER	Description
1	Create new file with one element.
2	Delete existing file.
20	Read element from file into DATA structure.
21	Replace element in file with new data from DATA structure.
22	Insert new element from DATA structure into file after element in ELEM.
23	Insert new element from DATA structure into file before element in ELEM.
24	Delete element specified by ELEM in file.

The data that is being inserted into the file, or read from the file, is always stored in the DATA structure. The DATA structure must be of a fixed format.

The size of the DATA structure in bytes must always be present at the ESIZ input. This tells the function block how many bytes to read or write to the file.

The ELEM input tells the function which element in the file to insert after, insert before, read, replace, or delete. The elements of the file are numbered beginning with element 0.

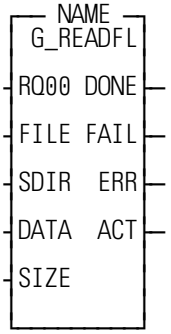
The DONE output will be cleared when RQ00 is energized, and then set if the requested operation completed successfully.

The FAIL output will be cleared when RQ00 is energized, and then set if the requested operation is terminated due to an error condition.

The FERR output will be cleared when RQ00 is energized. If an error occurs during the execution of an OPEN, READ, SEEK, CLOSE, or WRITE function block that prevented the requested operation from completing, the error code will be stored in the FERR output. A complete listing of these errors can be found in the Appendix B of the PiC900 Software Manual.

The OERR output will be cleared when RQ00 is energized. If an error is detected which prevents the requested operation from being attempted, OERR is set to a value indicating what error has been detected. A listing of these errors is shown below:

OERR	Description
0	No error.
1	OPER is not a valid number.
3	Seek past end occurred during element read.
4	File I/O error occurred during element insert operation.
10	New file operation requested and file already exists.



Inputs: RQ00 (BOOL) - requests file read

FILE (STRING) - the file name

SDIR (STRING) - the RAMDISK subdirectory where the file is located

DATA (STRUCTURE OR ARRAY) - defines where the data read from the file will be placed

SIZE (INT) - defines the number of bytes to read

Outputs: DONE (BOOL) - reset when file read requested, set when read file is complete with no error

FAIL (BOOL) - reset when file read requested, set instead of the DONE output if file read failed

ERR (INT) - error number that occurred during file read

ACT (INT) - the number of bytes read

This function block reads a file from RAMDISK into a structure or array.

The RQ00 input must be one-shot to initiate the file read.

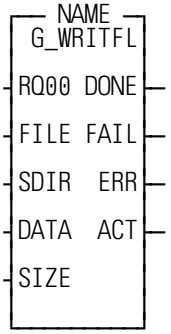
The file name can be up to eight characters with a three character extension.

EXAMPLE: FILENAME.EXT

If the file is in a subdirectory on the RAMDISK, then the SDIR input defines the name of the subdirectory. The name can be up to eight characters, and can not have an extension. EXAMPLE: 'SUBDIR'

NOTE: If you want the file to be placed in the main directory, then enter a string with no initial value at the SDIR input.

If an error occurs in reading the file, an error code will be stored in the ERR output. A complete listing of error codes can be found in the Appendix B of the PiC900 software manual.



Inputs: RQ00 (BOOL) - requests file write

FILE (STRING) - the file name

SDIR (STRING) - defines the subdirectory on the RAMDISK where the file is located

DATA (STRUCT or ARRAY) - the data to write to the RAMDISK

SIZE (INT) - defines the number of bytes to write to the file

Outputs: DONE (BOOL) -reset when file write is requested, set if file write completed successfully

FAIL (BOOL) - reset when file write is requested, set if an error occurred during file write

ERR (INT) - the error number that occurred

ACT (INT) - the number of bytes written to the file

This function block writes a file to the RAMDISK from a structure or array.

The RQ00 input must be one-shot to initiate the file write.

The file name can be up to eight characters with a three character extension.

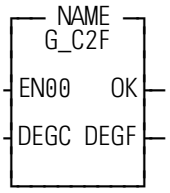
EXAMPLE: FILENAME.EXT

If the file is in a subdirectory on the RAMDISK, then the SDIR input defines the name of the subdirectory. The name can be up to eight characters, and can not have an extension.

EXAMPLE: SUBDIR

NOTE: If you want the file to be placed in the main directory, then enter a string with no initial value at the SDIR input.

If an error occurs in reading the file, an error code will be stored in the ERR output. A complete listing of error codes can be found in the Appendix B of the PiC900 software manual.



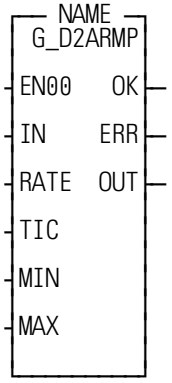
Inputs: EN00 (BOOL) - enables execution

DEGC (DINT) - the temperature in Celsius

Outputs: OK (BOOL) - execution complete

DEGF (DINT) - the temperature in degrees Fahrenheit

This function converts temperature from Celsius to Fahrenheit.



Inputs: EN00 (BOOL) - enables execution

IN (INT) - the input command

RATE (INT) - the maximum number of counts that OUT can change by every time tick

TIC (TIME) - the time tick

MIN (INT) - the OUT value will never be allowed to be less than MIN

MAX (INT) - the OUT value will never be allowed to be greater than MAX

Outputs: OK (BOOL) - execution complete

ERR (INT) - error number

OUT (INT) -the output command

This function block produces an output command based on the input command and the allowable rate of change of the input. The output of this function block would be tied directly to the input of the analog output function.

The EN00 input of this function block should be set every scan.

This function will not execute and the OK output will not be set if any of the following error conditions are present: MAX is less than or equal to MIN, RATE is less than or equal to zero, TIC is equal to zero, or if an error occurs in the calculations for OUT.

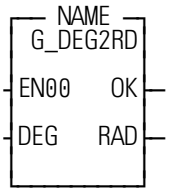
If the OK is not set, the ERR output will hold a code describing the error that occurred. A table of these errors is listed below:

ERR	Description
0	No error.
1	MAX is less than or equal to MIN.
2	Rate is less than or equal to zero.
3	TIC is zero.
4	An error occurred in calculating OUT.

EXAMPLES:

If OUT = 0 , RATE = 1000, TIC = 1 sec, MIN = -32767, and MAX = 32767 and IN is changed to 10000, then the value of OUT will be 1000 after 1 sec, 2000 after 2 sec, 3000 after 3 sec, and 10000 after 10 seconds have elapsed.

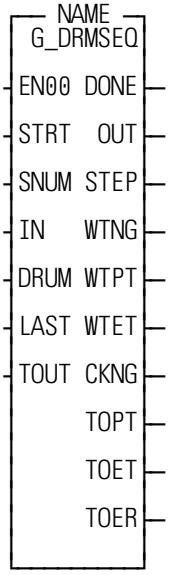
If OUT = 10000, RATE = 1000, TIC = 1 sec, MIN = -32767, and MAX = 32767, and IN is changed to 5600, then the value of OUT will be 9000 after 1 sec, 8000 after 2 sec, 7000 after 3 sec, 6000 after 4 sec,and then 5600 after 5 seconds have elapsed.



Inputs: EN00 (BOOL) - enables execution
DEG (REAL) - the angle in degrees

Outputs: OK (BOOL) - execution complete
RAD (REAL) - the angle in radians

This function converts an angle in degrees to radians.



Inputs: EN00 (BOOL) - enables execution

STRT (BOOL) - start sequence

SNUM (UINT)) - starting step number

IN (DWORD) - user defined inputs

DRUM (ARRAY of STRUCT) - structure to define sequence pattern

LAST (UINT) - number of steps in sequence

TOUT (BOOL) - enables/disables timeout option

Outputs: DONE (BOOL) - sequence complete

OUT (DWORD) - user defined outputs

STEP (UINT) - active step number

WTNG (BOOL) - set while wait time elapses

WTPT (TIME) - preset wait time for this step

WTET (TIME) - elapsed wait time for this step

CKNG (BOOL) - set while checking input states

TOPT (TIME) - preset timeout time for this step

TOET (TIME) - elapsed timeout time for this step

TOER (BOOL) - timeout error occurred

This function block sequences through an array of output patterns. Sequencing is accomplished by matching a user-defined input pattern and by a user-defined step timer.

This function block operates like a drum sequencer. A simple example of a drum sequencer is a rotary drum music box. A music box uses raised portions of the drum to play the notes of the song as the drum turns. The musical notes are the outputs of the sequence. The song is comprised of many steps. Each step of the song requires different output notes. Sequencing through the notes is accomplished by having the listener turn the crank on the side of the music box. The crank is an input to the sequence. It determines when the music box advances to the next step of notes.

This function block operates in a similar fashion. The sequence is defined by the programmer. The programmer defines how many steps are in the sequence, the output for each step, and the input and/or time delay required to advance to the next step.

The function block input which defines each step is the DRUM input. The DRUM input is an array of structures. The DRUM structure has five members. It must be declared as follows:

DRUM	**STRUCT(0..???)**
.OUTPUTS	**DWORD**
.WAITTIME	**TIME**
.INPUTS	**DWORD**
.MASK	**DWORD**
.TIMEOUT	**TIME**

The number of elements in the DRUM array should match the number of steps in the sequence. For example, if the sequence has 35 steps, the DRUM array should have 35 elements.

The output for each step is defined in the .OUTPUTS member of the DRUM structure. For example, the output for step #2 would be defined in DRUM(2).OUTPUTS. The DRUM(2).OUTPUTS value will appear at OUT when step #2 is active.

The conditions required to advance to the next step in the sequence are defined in the .INPUTS, .MASK, .WAITTIME and .TIMEOUT members of the DRUM structure.

In order to advance to the next step of the sequence, two conditions must be met. First, the wait timer must elapse (the duration of the wait timer is defined by the .WAITTIME member of the DRUM structure). Second, the value at IN must satisfy the input conditions for the current step. NOTE: The input conditions will not be checked until the wait timer has elapsed.

After the wait time has elapsed, the inputs will be checked. If the TOUT input is energized, then the inputs will only be checked for the amount of time specified in the .TIMEOUT member of the DRUM structure. After this timeout time has elapsed, if the inputs are not in the correct state, then a timeout error will be set. If the TOUT input is not energized, then the inputs will be checked forever until the input conditions are satisfied.

The input conditions are defined by the .INPUTS and the .MASK members of the DRUM structure. The .MASK member defines which of the 32 bits of IN and the .INPUTS member must match. The .INPUTS member defines what the state of these bits should be.

For example, if step #1 of the sequence is active and the data for step #1 is...

```
DRUM(1)
.OUTPUTS    = 16#FF00 0000    = 2#1111 1111 0000 0000 0000 0000 0000 0000
.WAITTIME   = T#3s
.INPUTS     = 16#0000 0009    = 2#0000 0000 0000 0000 0000 0000 0000 1001
.MASK       = 16#0000 000F    = 2#0000 0000 0000 0000 0000 0000 0000 1111
.TIMEOUT    = T#5s
```

The DRUM(1).MASK value of 16#0000 000F indicates that the four least significant bits of DRUM(1).INPUTS must match the four least significant bits of IN. When these bits match the next step will be enabled.

So, when IN =16#0000 0029 =2#0000 0000 0000 0000 0000 0000 0010 1001

the four least significant bits match, and the next step will be enabled.

The STRT input is used to start or reset the sequence. The sequence will begin at the step number specified at the SNUM input.

The number of steps in the sequence is specified at the LAST input. When the last step of the sequence is completed the DONE output will be energized.

The 32-bit input DWORD is specified at IN.

The step number active is present at the STEP output.

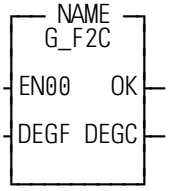
The 32-bit output for the active step is present at the OUT output.

When a new step is begun, the outputs will be set to their new state and the WTNG output will be set until the wait time has elapsed. The preset wait time is present at the WTPT output, and the elapsed wait time is present at the WTET output.

After the wait timer has elapsed, the CKNG output will be set .

If the TOUT input is energized, the inputs will be checked for the amount of time in TOPT. If the inputs are not in the correct state by the time TOPT elapses, then the TOER (timeout error) output will be set. If the inputs are in the correct state before TOPT elapses, then the sequence will advance to the next step.

If the TOUT input is not energized, then the CKNG output will remain on until the inputs have satisfied the input condition specified for the active step. When the inputs are in the correct state, then the sequence will advance to the next step.



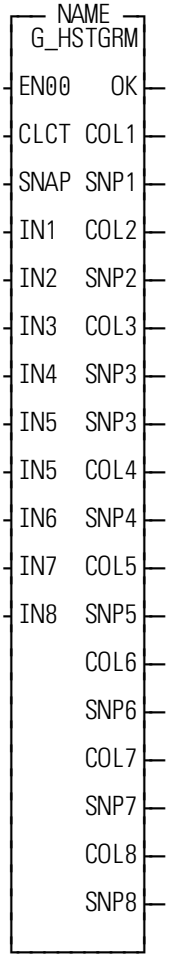
Inputs: EN00 (BOOL) - enables execution

DEGF (DINT) - the temperature in degrees Fahrenheit

Outputs: OK(BOOL) - execution complete

DEGC (DINT) - the temperature in Celsius

This function converts temperature in degrees Fahrenheit to Celsius.



Inputs: EN00 (BOOL) - enables execution
CLCT (BOOL) - data collection input
SNAP (BOOL) - data snapshot input
IN1 (BOOL) - first input to collect data for
IN2 (BOOL) - second input to collect data for
IN3 (BOOL) - third input to collect data for
IN4 (BOOL) - fourth input to collect data for
IN5 (BOOL) - fifth input to collect data for
IN6 (BOOL) - sixth input to collect data for
IN7 (BOOL) - seventh input to collect data for
IN8 (BOOL) - eighth input to collect data for

Outputs: OK (BOOL) - execution complete
COL1 (DWORD) - collected data for IN1
SNP1 (DWORD) - snapshot data for IN1
COL2 (DWORD) - collected data for IN2
SNP2 (DWORD) - snapshot data for IN2
COL3 (DWORD) - collected data for IN3
SNP3 (DWORD) - snapshot data for IN3
COL4 (DWORD) - collected data for IN4
SNP4 (DWORD)- snapshot data for IN4
COL5 (DWORD) - collected data for IN5
SNP5 (DWORD) - snapshot data for IN5
COL6 (DWORD) - collected data for IN6
SNP6 (DWORD) - snapshot data for IN6
COL7 (DWORD) - collected data for IN7
SNP7 (DWORD) - snapshot data for IN7
COL8 (DWORD) - collected data for IN8
SNP8 (DWORD) - snapshot data for IN8

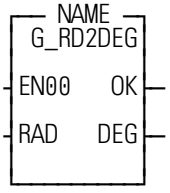
This function collects a contact histogram for up to eight BOOL variables.

The EN00 input of this function block should be set every scan.

This function block can collect histogram data two different ways.

When the CLCT input is ON, data will be collected every scan for each of the eight inputs. The collected data is stored in the outputs COL1 to COL8. When this input is OFF, the values of COL1 through COL8 will remain unchanged. The least significant bit of each COL output is the most recent value.

When the SNAP input makes an OFF to ON transition, the state of all eight inputs will be saved for that scan and the next 31 scans in the outputs SNP1 to SNP8. The least significant bit of each SNP output is the value of the input on the 32nd scan.



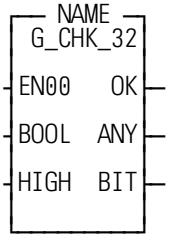
Inputs: EN00 (BOOL) - enables execution
RAD (REAL) - the angle in radians

Outputs: OK (BOOL) - execution complete
DEG (REAL) - the angle in degrees

This function converts an angle in radians to degrees.

G_CHK_32

Return bit set in BOOL array, size=32 **USER/G_SHFTRG**



Inputs: EN00 (BOOL) - enables execution

BOOL (BOOL (0..31)) - array of BOOLs to check

HIGH (BOOL) - defines whether to return highest or lowest bit set

Outputs: OK (BOOL) - execution complete

ANY (BOOL) - set if any BOOL is ON

BIT (UINT) - the number of the BOOL which was found ON

This function block returns the number of the highest or lowest bit set in an array of 32 BOOLs.

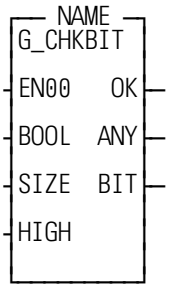
The array of BOOLs at the BOOL input must be dimensioned to a size of 32.

If the HIGH input is OFF, then BIT will be the number of the lowest BOOL set in the array.

If the HIGH input is ON, then BIT will be the number of the highest BOOL set in the array.

For example, if BOOL(0) and BOOL(31) are ON and BOOL(1) through BOOL(30) are all OFF, then if HIGH is OFF, BIT will be 0, but if HIGH is ON, BIT will be 31. In both cases, the ANY output will also be ON indicating that at least one BOOL in the array is ON.

If the ANY output is OFF, then none of the BOOLs in the array are ON.



Inputs: EN00 (BOOL) - enables execution

BOOL (BOOL (0..?)) - array of BOOLs to check

SIZE (UINT) - size of array at BOOL input

HIGH (BOOL) - defines whether to return highest or lowest numbered bit set

Outputs: OK (BOOL) - execution complete

ANY (BOOL) - set if any BOOL is ON

BIT (UINT) - number of highest or lowest BOOL energized

This function block determines the highest or lowest numbered energized BOOL in an array of BOOLs.

The size of the array at the BOOL input must be a multiple of 32. This size is entered at the SIZE input.

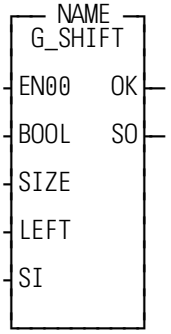
If the HIGH input is OFF, then BIT will be the lowest numbered BOOL set in the array. If the HIGH input is ON, then BIT will be the highest numbered BOOL set in the array. BIT will be a number from 0 to SIZE - 1.

This function block will not execute and the OK will not be set if SIZE is not a multiple of 32.

The ANY output will be set if at least one of the BOOLs in the array is ON.

EXAMPLE:

If SIZE is 64, and BOOL(0) and BOOL(63) are ON, and BOOL(1) through BOOL(62) are all OFF, then if HIGH is OFF, BIT will be 0, but if HIGH is ON, BIT will be 63. In both cases, the ANY output will be ON.



Inputs: EN00 (BOOL) - enables execution

BOOL (BOOL (0..?)) - array of BOOLs to shift

SIZE (UINT) - size of array at BOOL input

LEFT (BOOL) - defines direction to shift

SI (BOOL) - defines the new value to shift into the array

Outputs: OK (BOOL) - execution complete

SO (BOOL) - value shifted out of the array

This function block performs a shift left or shift right on an array of BOOLs.The size of the array at the BOOL input must be a multiple of 32. This size is entered at the SIZE input.

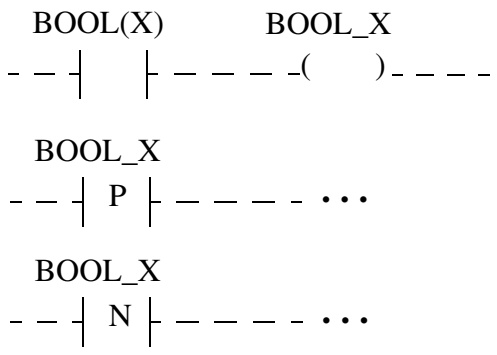
If the LEFT input is ON, then the array will be shifted to the left. The value that was in BOOL(0) will be moved to BOOL(1), the value that was in BOOL(1) will be moved to BOOL(2), etc.. The value that was in BOOL(SIZE - 1) will be moved into the SO output and the value from SI will be moved into BOOL(0).

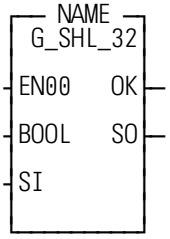
If the LEFT input is OFF, then the array will be shifted to the right. The value that was in BOOL(1) will be moved to BOOL(0), the value that was in BOOL(2) will be moved to BOOL(1), etc.. The value that was in BOOL(0) will be moved into the SO output and the value from SI will be moved into BOOL(SIZE - 1).

This function block will not execute and the OK will not be set if SIZE is not a multiple of 32.

IMPORTANT: Do not use a positive or negative transitional contact in your LDO with the BOOL array for the shift register ASFBs.

If it is necessary to set up a transitional contact with a Boolean in the BOOL array, use subsequent Boolean for the transitional contact as shown in the example below.





Inputs: EN00 (BOOL) - enables execution

BOOL (BOOL (0..31)) - array of BOOLs to shift.

SI (BOOL) - 'ON' or 'OFF' to shift into BOOL (0)

Outputs: OK (BOOL) - execution complete

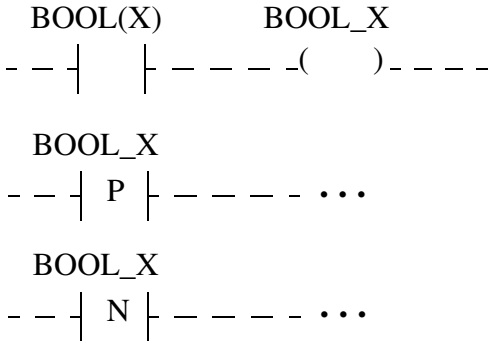
SO (BOOL) - 'ON' or 'OFF' shifted out of BOOL (31)

This function block performs a shift left on an array of 32 BOOLs.

The value that was in BOOL(0) will be moved to BOOL(1), the value that is in BOOL(1) will be moved to BOOL(2), etc.. The value that was in BOOL(31) will be moved into the SO output and the value from SI will be moved into BOOL(0).

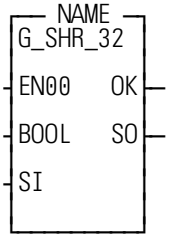
IMPORTANT: Do not use a positive or negative transitional contact in your LDO with the BOOL array for the shift register ASFBs.

If it is necessary to set up a transitional contact with a Boolean in the BOOL array, use subsequent Boolean for the transitional contact as shown in the example below.



G_SHR_32

Shifts array of 32 BOOLs right **USER/G_SHFTRG**



Inputs: EN00 (BOOL) - enables execution

BOOL (BOOL (0..31)) - array of BOOLs to shift.

SI (BOOL) - 'ON' or 'OFF' to shift into BOOL (31)

Outputs: OK (BOOL) - execution complete

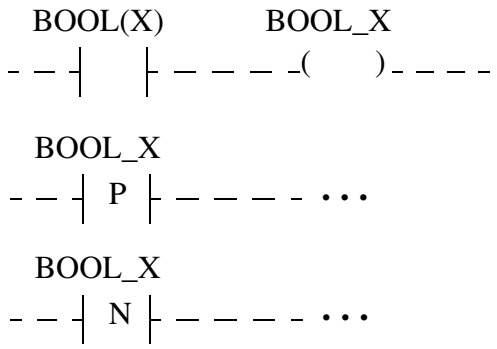
SO (BOOL) - 'ON' or 'OFF' shifted out of BOOL (0)

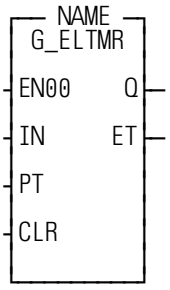
This function block performs a shift right on an array of 32 BOOLs.

The value that was in BOOL(1) will be moved to BOOL(0), the value that is in BOOL(2) will be moved to BOOL(1), etc.. The value that was in BOOL(0) will be moved into the SO output and the value from SI will be moved into BOOL(31).

IMPORTANT: Do not use a positive or negative transitional contact in your LDO with the BOOL array for the shift register ASFBs.

If it is necessary to set up a transitional contact with a Boolean in the BOOL array, use subsequent Boolean for the transitional contact as shown in the example below.





Inputs: EN00 (BOOL) - enables execution
IN (BOOL) - the input to time
PT (TIME) - defines the preset time
CLR (BOOL) - clear input

Outputs: Q (BOOL) - timer output
ET (TIME) - elapsed time

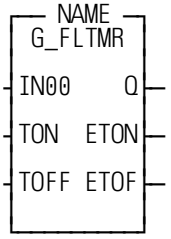
This function block energizes an output after an input has been energized for a period of time. If the input goes off and then on, the timer will resume timing where it left off. There is a clear input that will reset the elapsed time, and start timing over again.

The EN00 input of this function should be set every scan.

This function block will keep track of the total time that IN has been energized. The elapsed time will be stored in the ET output. If IN goes off and then comes back on, the elapsed time (ET) will continue counting where it left off.

When ET equals PT, then the Q output will be energized.

To reset the elapsed time, energize the CLR input.



Inputs: IN00 (BOOL) - when set, the output will pulse according to the duty cycle entered

TON (TIME) - defines the time that the Q output will remain on

TOFF (TIME) - defines the time that the Q output will remain off

Outputs: Q (BOOL) - timer output

ETON (TIME) - the elapsed time that Q has been on

ETOF (TIME) - the elapsed time that Q has been off

This function block pulses an output on and off when an input is energized.

When IN00 is ON, Q will be ON for the amount of time in TON, then OFF for the amount of time in TOFF, then ON for the amount of time in TON, etc.. The ETON output shows the amount of time that Q has been ON. The ETOFF output shows the amount of time that Q has been OFF.

If IN00 is OFF, Q will be OFF.

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