Reference section

Some parameters can be provided by the actual value of another programmed function as following.

■ 1/2 Series ：

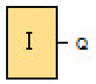
- Analog comparator: Ax - Ay
- Analog threshold trigger: Ax
- Analog amplifier: Ax
- Up/Down counter: Cnt

■ 5/6 Series：

- Analog comparator: Ax - Ay
- Analog threshold trigger: Ax
- Analog amplifier: Ax
- Up/Down counter: Cnt
- On-delay: Ta
- Off-delay: Ta
- On-/Off-delay: Ta
- Retentative on-delay: Ta
- Wiping relay (pulse output): Ta
- Edge triggered wiping relay: Ta
- Asynchronous pulse generator: Ta
- Stairway lighting switch: Ta
- Multiple functions switch: Ta
- Stopwatch : AQ
- Threshold trigger: Fre
- Mathematical instruction: AQ
- Analog multiplexer: AQ
- Analog ramp: AQ
- PI controller: AQ
- Max/Min: Ax
- Analog filter : AQ
- Average value : AQ
- BCD : AQ
- BIN : AQ
- ROL : AQ

- ROR : AQ
- SHL : AQ
- SHR : AQ
- AND_MASK : AQ
- OR_MASK : AQ
- NOT_MASK : AQ
- NAND_MASK : AQ
- NOR_MASK : AQ
- XOR_MASK : AQ
- ARRMX_MI_AV : AQ
- ACMX_MI_AV : AQ
- RAND : AQ
- MOD : AQ
- REM : AQ
- LOG : AQ
- SQRT : AQ
- ABS : AQ
- GCD : AQ
- LCM : AQ
- POW2 : AQ
- EXP : AQ
- FIX : AQ
- ROUND : AQ
- SIN : AQ
- COS : AQ
- TAN : AQ
- COT : AQ
- SEC : AQ
- CSC : AQ
- MEM : AQ
- Quadratic equation : AQ
- ENCODER : Cnt

Inputs



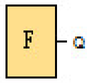
Input blocks represent the input terminals of 1/2/5/6 Series.
There are up to 256 digital inputs available to you.

These inputs are categorized into 8 groups which are shown as follows :

Module	Input Number
Main	I000 ~ I031
Ext. 1	I100 ~ I131
Ext. 2	I200 ~ I231
Ext. 3	I300 ~ I331
Ext. 4	I400 ~ I431
Ext. 5	I500 ~ I531
Ext. 6	I600 ~ I631
Ext. 7	I700 ~ I731

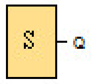
Each input block has a unique number in the circuit program.

Function Keys



The ATP module has five function keys that can be used as digital inputs in the circuit program. You program the function keys in the same way as other inputs of your circuit program. Function keys can save both switches and inputs, and allow operator control of the circuit program.

Shift register bits

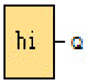


The 1/2 series provides 16 shift register bits S0 to S15, which are read-only attribute in the circuit program. The content of shift register bits can only be modified by means of the shift register special function.

The 5/6 series provides a maximum of 64 shift registers bits S0.0 to S3.15.

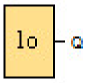
Permanent logical levels

Status 1 (high)



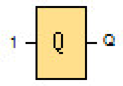
Set the block input to logical **hi** (high) to set it permanently to logical 'H' state.

Status 0 (low)



Set the block input to logical **lo** (low) to set it permanently to logical 'L' state.

Outputs



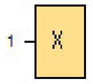
Output blocks represent the output terminals of 1/2/5/6 Series. There are up to 128 digital outputs available to you.

These outputs are categorized into 8 groups which are shown as follows :

Module	Output Number
Main	Q000 ~ Q015
Ext. 1	Q100 ~ Q115
Ext. 2	Q200 ~ Q215
Ext. 3	Q300 ~ Q315
Ext. 4	Q400 ~ Q415
Ext. 5	Q500 ~ Q515
Ext. 6	Q600 ~ Q615
Ext. 7	Q700 ~ Q715

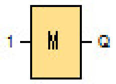
Each output block has a unique number in the circuit program.

Open connectors

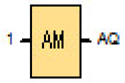


You can connect the output of an block to the open connector block. The block is different from the output block. Imagine the open connector block as a terminal.
Number of the open connectors: 128.

Flags



Analog Flags



The size of a digital flag is 1 bit.The flag block outputs its input signal. 1/2/5/6 series provides 512 digital flags M0 to M511 and 512 analog flags AM0 to AM511. Each flag block has a unique number in the circuit program.

Analog Flags: AM0 to AM511

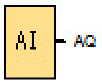
The size of an analog flag is 2 bytes. The analog flag can be used as markers for analog inputs or analog instruction blocks. The analog flag merely accepts an analog value as input and outputs that value.

Message text character set flag: M511 (5/6 series only)

The M511 flag determines whether the message texts of the primary or the secondary character set will display if used. Select the two character sets from either the Msg Config menu of 5/6 series or the File → Message Text Settings menu command of PC Soft. Then when configure message texts , select whether a particular message text consists of characters from the primary character set (Character Set 1) or the secondary character set (Character Set 2).

In the circuit program, M511 can enable the message texts of either the primary or secondary character set and disable the message texts of the other. When M511 = 0 (low), the primary character set display message texts. When M511 = 1 (high), the secondary character set displays the message texts from the secondary character set.

Analog inputs



Analog input blocks represent the analog input terminals of 1/2/5/6 Series. There are up to 64 analog inputs available to you. These inputs are categorized into 8 groups which are shown as follows. Each input block has a unique number in the circuit program.

Module	Input Number
Main	AI000 ~ AI007
Ext. 1	AI100 ~ AI107
Ext. 2	AI200 ~ AI207
Ext. 3	AI300 ~ AI307
Ext. 4	AI400 ~ AI407
Ext. 5	AI500 ~ AI507
Ext. 6	AI600 ~ AI607
Ext. 7	AI700 ~ AI707

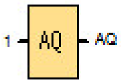
The analong inputs have a dual definition: they can be used as either digital or analog inputs. You don't have to make any settings.

	11/51 Series Input	21/61 Series Input
AI	0 ~ 10V	0 ~ 10V
DI	status low : < +2VDC status high : > 4VDC~30VDC	**AC Supply TYPE:** status low : < 40VAC status high : >79VAC DC Supply TYPE : status low: < 5VDC status high: > 8.5VDC

Example

In **1x89 / 2x89 / 5x89 / 6x89 Series**, an input signal, which comes from AI0, is also detected on DI4.

Analog outputs



Analog output blocks represent the analog output terminals of 1/2/5/6 Series. There are up to 32 analog outputs available to you. These outputs are categorized into 8 groups which are shown as follows. Each output block has a unique number in the circuit program.

Module	Output Number
Main	AQ000 ~ AQ003
Ext. 1	AQ100 ~ AQ103
Ext. 2	AQ200 ~ AQ203
Ext. 3	AQ300 ~ AQ303
Ext. 4	AQ400 ~ AQ403
Ext. 5	AQ500 ~ AQ503
Ext. 6	AQ600 ~ AQ603
Ext. 7	AQ700 ~ AQ703

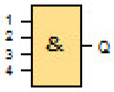
Note that the analog output value ranges between 0 and 1000.

As of the 5/6 device series, The behavior of analog outputs in Init mode is configuable. Analog outputs can retain their last values when 5/6 series goes to Init mode. Alternatively,

you can configure and set specific values for AQ when 5/6 series goes to Init mode.
As of the 5/6 device series, you can also set the analog output value range. There are two choices:

- **0-10 V or 0-20 mA** (Default)
- **4-20 mA**

AND

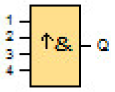


The output of an AND function is only 1 if **all** inputs are 1, that is, when they are closed.
A block input that is not used (x) is assigned: x = 1.

AND function logic table:

Input1	Input2	Input3	Input4	Output
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	1

AND with edge evaluation

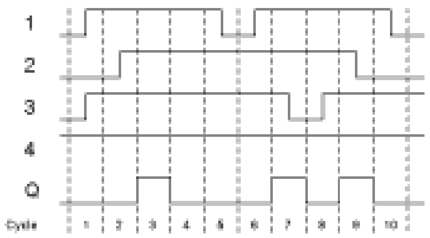


The output of an AND with edge evaluation is only 1 if **all** inputs are 1 and **at least one** input was 0 during the last cycle.

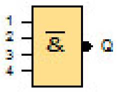
The output is set to 1 for the duration of one cycle and must be reset to 0 for the duration of the next cycle before it can be set to 1 again.

A block input that is not used (x) is assigned: x = 1.

Timing diagram of an AND with edge evaluation:



NAND

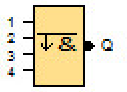


The output of an NAND function is only 0 if **all** inputs are 1, i.e. when they are closed.

A block input that is not used (x) is assigned: x = 1.

Input 1	Input 2	Input 3	Input 4	Output
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0

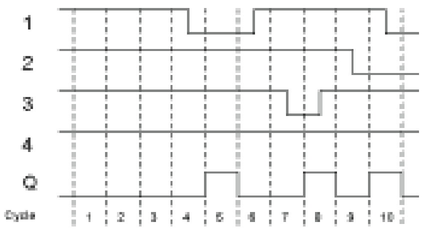
NAND with edge evaluation



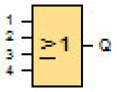
The output of a NAND with edge evaluation is only 1 if **at least one** input is 0 and **all** inputs were 1 during the last cycle.

The output is set to 1 for the duration of one cycle and must be reset to 0 at least for the duration of the next cycle before it can be set to 1 again.

A block input that is not used (x) is assigned: x = 1.



OR



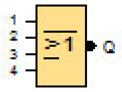
The output of an OR is 1 if **at least one** input is 1 (closed).

A block input that is not used (x) is assigned: x = 0.

OR function logic table:

Input 1	Input 2	Input 3	Input 4	Output
0	0	0	0	0
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	1
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

NOR



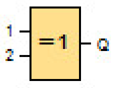
The output of a NOR (NOT OR) is only 1 if **all** inputs are 0 (open). When one of the inputs is switched on (logical 1 state), the output is switched off.

A block input that is not used (x) is assigned: x = 0.

NOR function logic table:

Input 1	Input 2	Input 3	Input 4	Output
0	0	0	0	1
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0

XOR



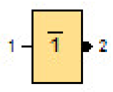
The XOR (exclusive OR) output is 1 if the signal status of the inputs is **different**.

A block input that is not used (x) is assigned: x = 0.

XOR function logic table:

Input 1	Input 2	Output
0	0	0
0	1	1
1	0	1
1	1	0

NOT



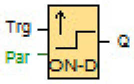
The output is 1 if the input is 0. The NOT block inverts the input status.

Advantage of the NOT, for example: PC soft no longer requires break contacts. You simply use a make contact and convert it into a break contact with the help of the NOT function.

NOT function logic table:

Input 1	Output
0	1
1	0

On-Delay



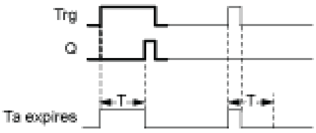
The output is not switched on until a configured delay time has expired.

Connection	Description
Input **Trg**	The on delay time is triggered via the Trg (Trigger) input.
Parameter	**T** represents the on delay time after which the output is switched on (output signal transition 0 to 1). **Retentivity** on = the status is retentive in memory.
Output **Q**	Q switches on after a specified time T has expired, provided Trg is still set.

Parameter T

The time in parameter T can be provided by the value of another already programmed function. Please refer to reference section.

Timing diagram



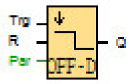
Description of the function

The time Ta (the current time in 1/2/5/6 series) is triggered with the 0 to 1 transition at input Trg.

If the status at input Trg stays 1 at least for the duration of the configured time T, the output is set to 1 when this time has expired (the on signal of the output follows the on signal of the input with delay).

The time is reset if the status at input Trg changes to 0 again before the time T has expired. The output is reset to 0 when input Trg is 0.

Off-Delay



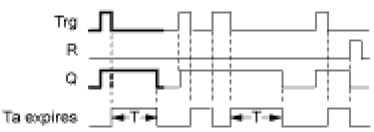
The output with off delay is not reset until a defined time has expired.

Connection	Description
Input **Trg**	Start the off delay time with a negative edge (1 to 0 transition) at input Trg (Trigger).
Input **R**	Reset the off delay time and set the output to 0 via the R (Reset) input. Reset has priority over Trg.
Parameter	**T:** The output is switched off on expiration of the delay time T (output signal transition 1 to 0). **Retentivity** on = the status is retentive in memory.
Output **Q**	Q is switched on for the duration of the time T after a trigger at input Trg.

Parameter T

The time in parameter T can be provided by the value of another already programmed function. Please refer to reference section.

Timing diagram



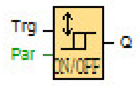
Description of the function

Output Q is set to 1 instantaneously with a 0 to 1 transition at input Trg.

At the 1 to 0 transition at input Trg, 1/2/5/6 series retrigger the current time T, and the output remains set. The output Q is reset to 0 when Ta reaches the value specified in T (Ta=T) (off delay).

A one-shot at input Trg retriggers the time Ta.
You can reset the time Ta and the output via the input R (Reset) before the time Ta has expired.

On-/Off-Delay



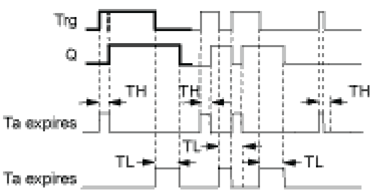
The on/off delay function block is used to set an output after a configured on delay time and then reset it again upon expiration of a second configured time.

Connection	Description
Input **Trg**	You trigger the on delay with a positive edge (0 to 1 transition) at input Trg (Trigger). You trigger the off delay with a negative edge (1 to 0 transition).
Parameter	**TH** is the on delay time for the output (output signal transition 0 to 1). **TL** is the off delay time for the output (output signal transition 1 to 0). **Retentivity** on = the status is retentive in memory.
Output **Q**	Q is switched on upon expiration of a configured time TH if Trg is still set. It is switched off again upon expiration of the time TL and if Trg has not been set again.

Parameters TH and TL

For the **5/6** series devices, the on-/off-delay time in parameter T_H and T_L that can be provided by the value of another already programmed function. Please refer to reference section.

Timing diagram



Description of the function

The time T_H is triggered with a 0 to 1 transition at input Trg.
If the status at input Trg is 1 for at least the duration of the configured time T_H, the output is set to logical 1 upon expiration of this time (output is on delayed to the input signal).

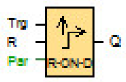
The time T_H is reset if the status at input Trg is reset to 0 before this time has expired.

The time T_L is triggered with the 1 to 0 transition at the output.

If the status at input Trg remains 0 at least for the duration of a configured time T_L, the output is reset to 0 upon expiration of this time (output is off delayed to the input signal).

The time T_L is reset if the status at input Trg returns to 1 before this time has expired.

Retentive On-Delay



A one-shot at the input triggers a configurable time. The output is set upon expiration of this time.

Connection	Description
Input **Trg**	Trigger the on delay time via the Trg (Trigger) input.
Input **R**	Reset the on delay time and reset the output to 0 via input R (Reset). Reset takes priority over Trg.
Parameter	**T** is the on delay time for the output (output signal transition 0 to 1). **Retentivity** on = the status is retentive in memory.
Output **Q**	Q is switched on upon expiration of the time T.

Parameter T

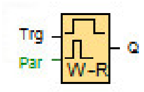
The time set in parameter T can be formed by the actual value of another already programmed function. Please refer to reference section.

Timing diagram

Description of the function

The current time Ta is triggered with a 0 to 1 signal transition at input Trg. Output Q is set to 1 when Ta reaches the time T. A further pulse at input Trg does not affect Ta.
The output and the time Ta are only reset to 0 with a 1 signal at input R.
If retentivity is not set, output Q and the expired time are reset after a power failure.

Wiping relay (pulse output)



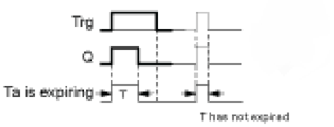
An input signal generates an output signal of a configurable length.

Connection	Description
Input **Trg**	You trigger the time for the wiping relay with a signal at input Trg (Trigger).
Parameter	**T** represents the time after which the output is reset (output signal transition 1 to 0). **Retentivity** on = the status is retentive in memory.
Output **Q**	A pulse at Trg sets Q. The output stays set until the time T has expired and if Trg = 1 for the duration of this time. A 1 to 0 transition at Trg prior to the expiration of T also resets the output to 0.

Parameter T

For the **5/6** series devices, the off time T can be provided by the value of another already programmed function. Please refer to reference section.

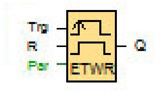
Timing diagram



Description of the function

With the input signal Trg = 1, output Q is set to 1. The signal also triggers the time Ta, while the output remains set.
When Ta reaches the value defined at T (Ta=T), the output Q is reset to 0 state (pulse output).
If the signal at input Trg changes from 1 to 0 before this time has expired, the output is immediately reset from 1 to 0.

Edge triggered wiping relay



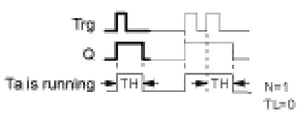
An input pulse generates a preset number of output pulses with a defined pulse/pause ratio (retriggerable), after a configured delay time has expired.

Connection	Description
Input **Trg**	You trigger the times for the Edge-triggered wiping relay with a signal at input Trg.
Input **R**	The output and the current time Ta are reset to 0 with a signal at input R.
Parameter	**T_H, T_L:** The pulse width T_H and the interpulse width T_L are adjustable. **N** determines the number of pulse/pause cycles T_L / T_H. Value range: 1...9. **Retentivity** on = the status is retentive in memory.
Output **Q**	Output Q is set when the time T_L has expired and is reset when T_H has expired.

Parameters TH and TL

For the **5/6** series devices, the width T_H (Paluse) and T_L (Interpaluse) can be provided by the value of another already programmed function. Please refer to reference section.

Timing diagram

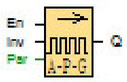


Description of the function

With the change at input Trg to 1, the time T_L (time low) is triggered. After the time T_L has expired, output Q is set to 1 for the duration of the time T_H (time high).

If input Trg is retriggered prior to the expiration of the preset time (T_L + T_H), the time Ta is reset and the pulse/pause period is restarted.

Asynchronous Pulse Generator



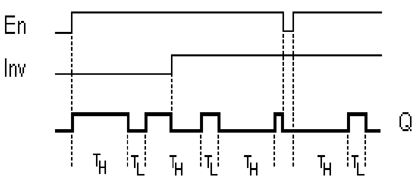
The pulse shape at the output can be modified by a configurable pulse/pause ratio.

Connection	Description
Input **En**	You enable/disable the asychronous pulse generator with the signal at input En.
Input **Inv**	The Inv input can be used to invert the output signal of the active asynchronous pulse generator.
Parameter	**T_H,T_L:** You can customize the pulse width (T_H) and the interpulse width (T_L). **Retentivity** on = the status is retentive in memory.
Output **Q**	Q is toggled on and off cyclically with the pulse/pause times T_H and T_L .

Parameters T_H and T_L

For the **5/6** series devices, the width T_H (Paluse) and T_L (Interpaluse) can be provided by the value of another already programmed function. Please refer to reference section.

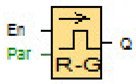
Timing diagram



Description of the function

You can set the pulse/pause ratio at the T_H (Time High) and T_L (Time Low) parameters.
The INV input can be used to invert the output signal. The input block INV only inverts the output signal if the block is enabled with EN.

Random Generator



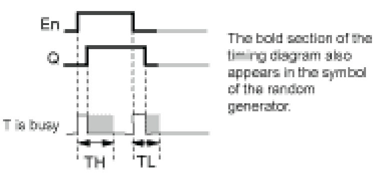
The output of a random generator is toggled within a configurable time.

Connection	Description
Input **En**	The positive edge (0 to 1 transition) at the enable input En (Enable) triggers the on delay for the random generator. The negative edge (1 to 0 transition) triggers the off delay for the random generator.
Parameter	**TH:** The on delay is determined at random and lies between 0 s and TH. **TL:** The off delay is determined at random and lies between 0 s and TL.
Output **Q**	Q is set on expiration of the on delay if En is still set. It is reset when the off delay time has expired and if En has not been set again.

Parameters TH and TL

For the **5/6** series devices, the on-/off-delay time T_H and T_L can be provided by the value of another already programmed function. Please refer to reference section.

Timing diagram



Description of the function

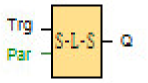
With the 0 to 1 transition at input En, a random time (on delay time) between 0 s and T_H is set and triggered. If the status at input En is 1 for at least the duration of the on delay, the output is set to 1 when this on delay time has expired.

The time is reset if the status at input En is reset to 0 before the on delay time has expired.

When input En is reset 0, a random time (off delay time) between 0 s and T_L is set and triggered. If the status at input En is 0 at least for the duration of the off delay time, the output Q is reset to 0 when the off delay time has expired.

The time is reset if the status at input En returns to 1 before the on delay time has expired.

Stairway Lighting Switch



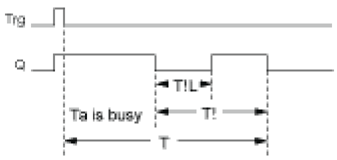
The edge of an input pulse triggers a configurable time. The output is reset when this time has expired. An off warning can be output prior to the expiration of this time.

Connection	Description
Input **Trg**	You trigger the time (off delay) for the stairway switch with a signal at input Trg (Trigger).
Parameter	**T :** The output is reset (1 to 0 transition) when the off delay time T has expired. **T!** determines the triggering time for the prewarning. **T!L** determines the length of the prewarning time. **Retentivity** on = the status is retentive in memory.
Output **Q**	Q is reset after the time T has expired. A warning signal can be output before this time has expired.

Parameters T, T! and T!L

For the **5/6** series devices, the prewarning time $T_!$ and the prewarning period $T_{!L}$ can be provided by the value of another already programmed function. Please refer to reference section.

Timing diagram



Time base T	Prewarning time	Prewarning period
Seconds*	750 ms	50 ms
Minutes	15 s	1 s
Hours	15 min	1 min

* only for programs with a cycle time < 25 ms

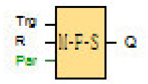
Description of the function

Output Q is set to 1 with a 0 to 1 signal transition at input Trg. The 1 to 0 transition at input Trg triggers the current time and output Q remains set.

Output Q is reset to 0 when Ta reaches the time T. Before the off delay time (T - $T_{!}$) has expired, you can output a prewarning that resets Q for the duration of the off prewarning time $T_{!L}$.

Ta is retriggered (optional) at the next high/low transition at input Trg and if Ta is expiring.

Multiple Function Switch



Switch with two different functions :

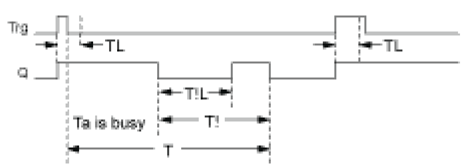
- Pulse switch with off delay
- Switch (continuous light)

Connection	Description
Input **Trg**	A signal at input Trg (Trigger) sets output Q (permanent light) or resets Q with an off delay. When active, output Q can be reset with a signal at input Trg.
Input **R**	A signal at input R resets the current time Ta and resets the output.
Parameter	**T:** determines the off delay time. The output is reset (1 to 0 transition) when the time T expires. **TL** determines the period during which the input must be set in order to enable the permanent light function. **T!** determines the on delay for the prewarning time. **T!L** determines the length of the prewarning time period. **Retentivity** on = the status is retentive in memory.
Output **Q**	Output Q is set with a signal at input Trg, and it is reset again after a configured time has expired and depending on the pulse width at input Trg, or it is reset with another signal at input Trg.

Parameters T, TL, T! and T!L

For the 5/6 series devices, the permanent light time T_L (off-delay), the prewarning time $T_!$ (on-delay), and the prewarning time period $T_{!L}$ can be provided by the value of another already programmed function. Please refer to reference section.

Timing diagram



The time base for the T, $T_!$ and $T_{!L}$ must be identical.

Description of the function

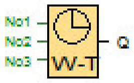
Output Q is set to 1 with a 0 to 1 signal transition at Trg.

If output Q = 0, and input Trg is set hi for at least the duration of T_L, the permanent lighting function is enabled and output Q is set accordingly.

The off delay time T is triggered when the status at input Trg changes to 0 before the time T_L has expired. Output Q is reset when the Ta = T.

You can output an off-warning signal prior to the expiration of the off delay time (T - $T_!$) that resets Q for the duration of the off prewarning time $T_{!L}$. A subsequent signal at input Trg always resets T and output Q.

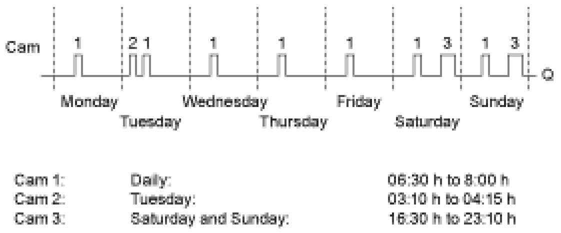
Weekly timer



The output is controlled by means of a configurable on/off date. The function supports any combination of weekdays.

Connection	Description
Parameter	At the No1, No2, No3 (Cam) parameters you set the on and off time triggers for each cam of the weekly timer. The parameter units are the days and the time of day.
Output **Q**	Q is set when the configured cam is actuated.

Timing diagram (three practical examples)



Description of the function

Each weekly timer is equipped with three cams. You can configure a time hysteresis for each individual cam. At the cams you set the on and off hysteresis. The weekly timer sets the output at a certain time, provided it is not already set.

The weekly timer resets the output at the off time if you configured an off time, or at the end of the cycle if you specified a pulse output. A conflict is generated in the weekly timer when the on time and the off time at another cam are identical. In this case, cam 3 takes priority over cam 2, while cam 2 takes priority over cam 1.

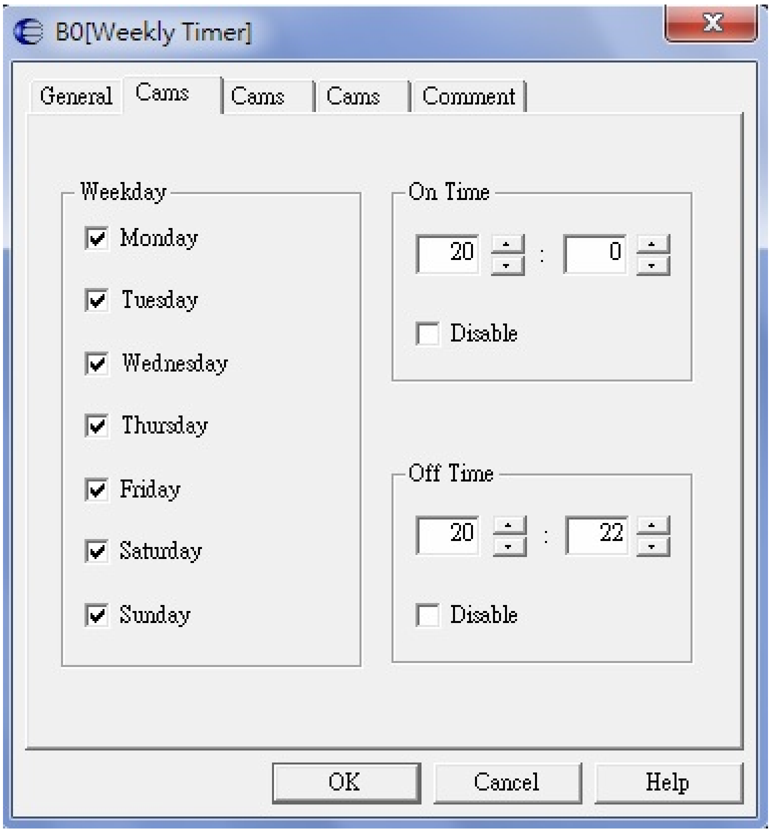
The switching status of the weekly timer is determined by the status at the No1, No2 and No3 cams.

On times

The on time is any time between 00:00 h and 23:59 h.

Special characteristics to note when configuring

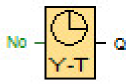
The block properties window offers a tab for each one of the three cams. Here you can set the day of the week for each cam. Each tab offers you in addition an option of defining the on and off times for each cam in hour and minute units. Hence, the shortest switching cycle is one minute. Also on each tab you have the option of specifying a pulse output for the cam.
You can disable the on and off times individually. You can achieve switching cycles extending across more than one day, for example, by setting the on time for cam 1 to Monday 7:00 h and the off time of cam 2 to Wednesday 13:07 h, while disabling the on time for cam 2.



Backup of the real-time clock

The internal real-time clock of 1/2/5/6-Series is buffered against power loss.

Yearly timer

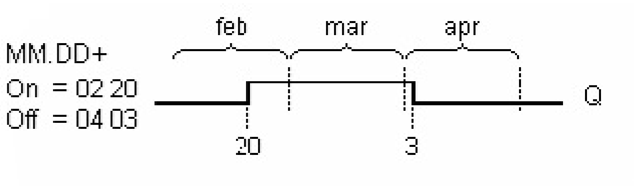


■ For 1/2 Series :

The output is controlled by means of a configurable on/off date.

Connection	Description
Parameter	At the No (cam) parameter you set the on and off trigger for the cam of the yearly timer.
Output **Q**	Q is set on when the configured cam is switched on.

Timing diagram



Description of the function

The yearly timer sets and resets the output at specific on and off times.
The off-date identifies the day on which the output is reset again. The first value defines the month, the second the day.
When you select the **Monthly** check box, the yearly clock switches on or off at a certain day of **Monthly**.

Backup of the real-time clock

The internal real-time clock of device is buffered against power failure.

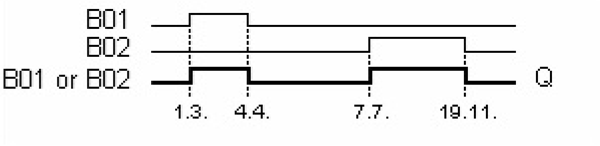
Special characteristics to note when configuring

A click on the dialog box enables direct keyboard input of the month and day values. The values entered may not exceed the logical maximum of the relevant input boxes, otherwise PC soft returns an error message.

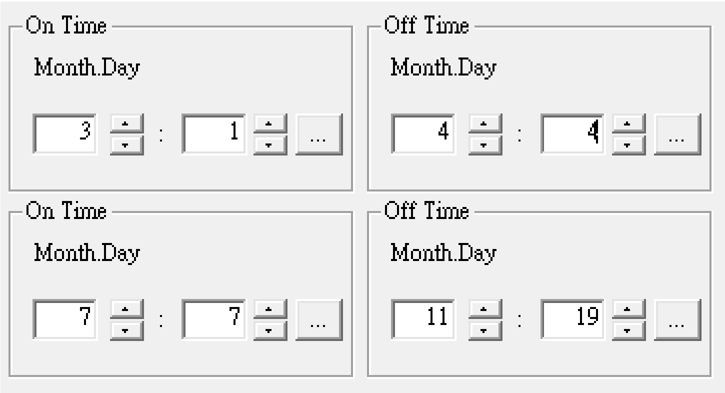
The **calendar** icon offers you an easy way of setting the date. It opens a window where you can set the days and months by clicking the relevant buttons.

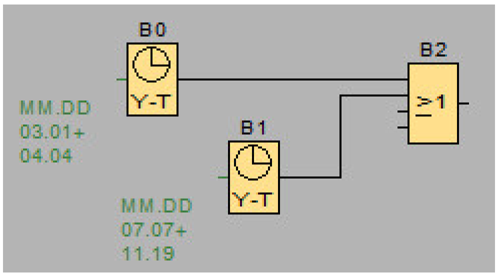
Sample configuration

The output of a device is to be switched on annually, from 1st of March to 4th of April and from 7th of July to 19th of November. This requires two blocks for configuring the specific on times. The outputs are then linked via an OR block.



Place two yearly timer switch SFBs on your programming interface and configure the blocks as specified.





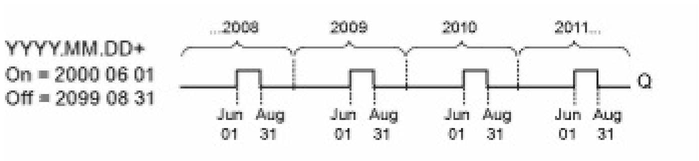
■ **for 5/6 Series :**

The output is controlled by means of a configurable on/off date such as activate on a yearly, monthly, or user-defined time basis. With any mode, output can also be pulsed by configuring timer during the defined time period. The time period is configurable within the date range of January 1, 2000 to December 31, 2099.

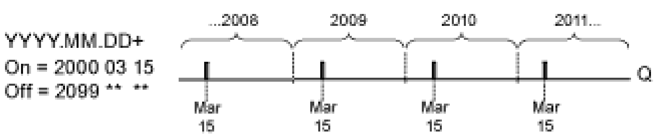
Connection	Description
Parameter	At the No (cam) parameter you set the on and off trigger for the cam of the yearly timer.
Output **Q**	Q is set on when the configured cam is switched on.

Timing diagrams

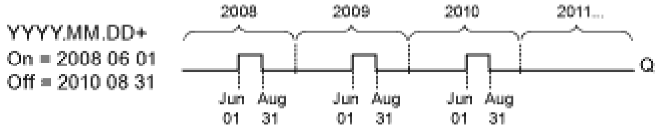
Example 1: If you choose "**Yearly selected"** and set On Time = 2000.06.01, Off Time = 2099.08.31, every year on June 1 the timer output will switch and remain on until August 31 to switch off.



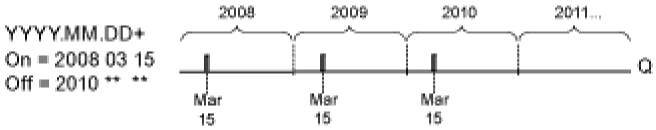
Example 2: If you choose "**Yearly** selected" and "**Pulse** selected" and set On Time = 2000.03.15, Off Time = 2099.**.**,every year on March 15 the timer will switch on for one cycle.



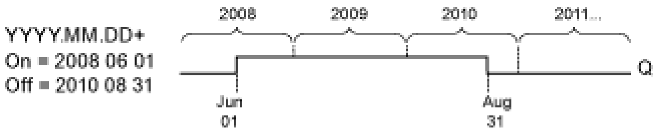
Example 3: If you choose "**Yearly** selected" and set On Time = 2008.06.01, Off Time = 2010.08.31. the timer output will switch and remain on June 1 of 2008, 2009, and 2010 until August 31.



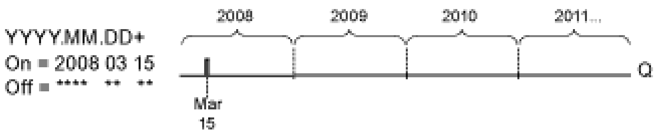
Example 4: If you choose "**Yearly** selected" and "**Pulse** selected" and set On Time = 2008.03.15, Off Time = 2010.**.**, the timer output will switch on March 15 of 2008, 2009, and 2010for one cycle.



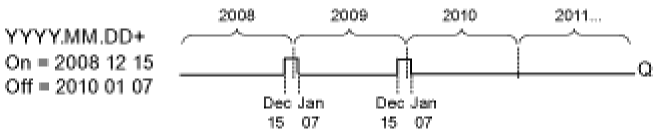
Example 5: If you choose "**Monthly** not selected" and "**Yearly** not selected" and set On Time = 2008.06.01, Off Time = 2010.08.31, the timer output will switch and remains on June 1, 2008 until August 31, 2010.



Example 6: If you choose "**Monthly** not selected", "**Yearly** not selected", "**Pulse** selected" and set On Time = 2008.03.15, Off Time = ****.**.**, the timer switches on March 15, 2008 for one cycle. Because the timer neither has monthly action nor yearly action, the timer output will only pulse one time at the specified On Time.

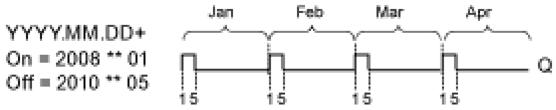


Example 7: If you choose "**Yearly** selected" and set On Time = 2008.12.15, Off Time =2010. 01.07, the timer output will switch and remains on December 15 of 2008 and 2009 until January 7 of the following year. When the timer output turns off on January 7, 2010, it **WILL NOT** turn on again the following December 15.



Example 8: If you choose "**Monthly** selected" and set On Time = 2008.**.01, Off Time =

2010.**.05, the timer output switches on the first day of each month (starting in 2008) and switches off on the fifth day of the month. The timer continues in this pattern through the last month of 2010.



Description of the function

The yearly timer sets and resets (executed 00:00) the output at specific on and off dates. If application requires a different time, use both weekly and yearly timer together in the circuit program.

The On Time specifies the month and day when the timer is set. The Off Time identifies the month and day on which the output is reset again. The first value defines the year, the second the month and the third the day.

When you select the **Monthly** check box, the timer output switches on and remain the specified day of each month(start time) until the specified day of the Off Time. The “On Year” = the timer is activated. The “Off Year” = the timer turns off. **The maximum year is 2099.

If you select the **Yearly** check box, the timer output switches on and remain the specified month and day of each year (start time) until the specified month and day of the Off Time. The “On Year” = the timer is activated. The “Off Year” = the timer turns off. **The maximum year is 2099.
If you select the **Pulse** check box, the timer output switches on for one cycle and then it is reset. Pulsing a timer on a monthly or yearly basis, or just a single time is allowable.

If none of the Monthly, Yearly, or Pulse check boxes are be selected, On/Off time can be defined a specific time period. It can span any time period that is choosen.

For a process that is to be switched on/off at multiple but irregular times during the year, multiple yearly timers can be defined with the outputs connected by an **OR** function block.

Backup of the real-time clock

The internal real-time clock of 5/6 series buffer retains the time function working properly while power failure.

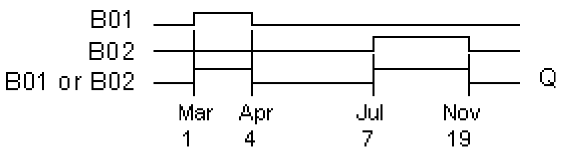
Special characteristics to note when configuring

Numerically enter values to the month and day fields is allowable. PC soft returns an error message if you enter values which is not logical range.

The **calendar** icon helps you setting the date easily. It opens a window where you can set the days and months by clicking the relevant buttons.

Sample configuration

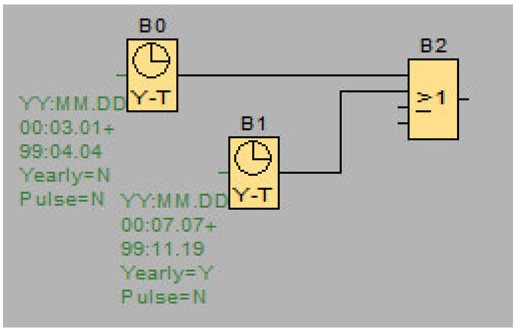
The output of 5/6 series is to be switched on annually, from 1st of March to 4th of April and from 7th of July to 19th of November. This requires two blocks for configuring the specific on times. The outputs are then linked via an OR block.



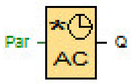
Place two yearly timer switch SFBs on programming interface.

1) Configure the On Time : 00.03.01 for the first yearly timer and 99.04.04. (Off time)
2) Configure the On Time : 00.07.07 for the second yearly timer and 99.11.19. (Off time)

Create a standard **OR** block and connect with two timers. The **OR** output is 1 if at least one of the yearly timer switches is set.

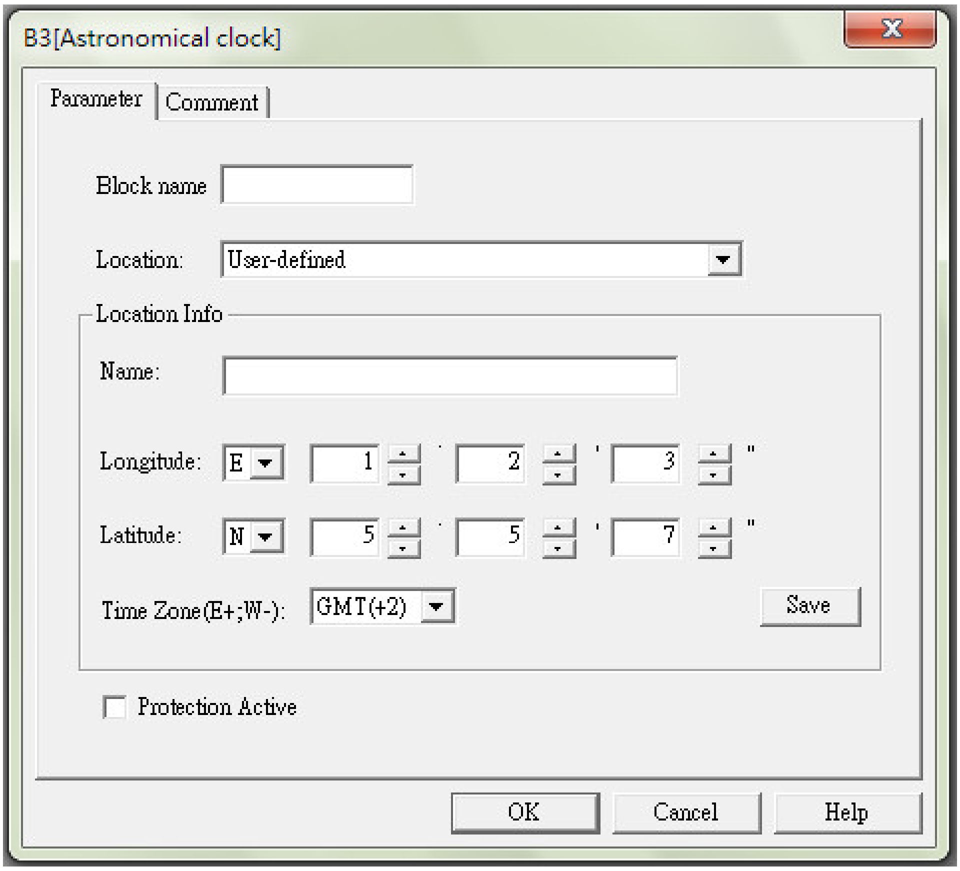


Astronomical clock



For Geographical location of 5/6 series, the astronomical clock SFB sets an output high between sunrise and sunset based on the local time. The output status of astronomical clock function depends on the configuration of summer and winter time conversion.

Connection	Description
Parameter	The location info contains longitude, latitude and time zone.
Output **Q**	Q is set to hi when sunrise time is reached and holds until sunset time is reached.



In the astronomical clock function window, one of the following time zone location of 5/6 series can be selected :

- Beijing
- Berlin

- London
- Rome
- Moscow
- Tokyo
- Washington
- Ankara
- Madrid
- Amsterdam

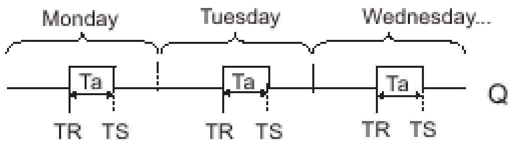
If anyone of these locations has been selected, PC soft uses the latitude, longitude, and time zone of your selection.

Alternatively, set a specific latitude, longitude, and time zone for your location and provide a name for this custom location is allowable.

The correct sunrise and sunset time of current day of 5/6 series will be calculated based on the location and time zone. The configured block also takes summer and winter time, if PC soft is installed on the computer.

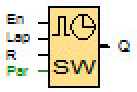
Configuration: select check box of "Automatically adjust clock for daylight for saving changes" in the "Date and Time Properties" dialog.

Timing diagram



The function calculates the value at the input and sets or resets **Q** depending on the sunrise and sunset time at the configured location and time zone of the module.

Stopwatch

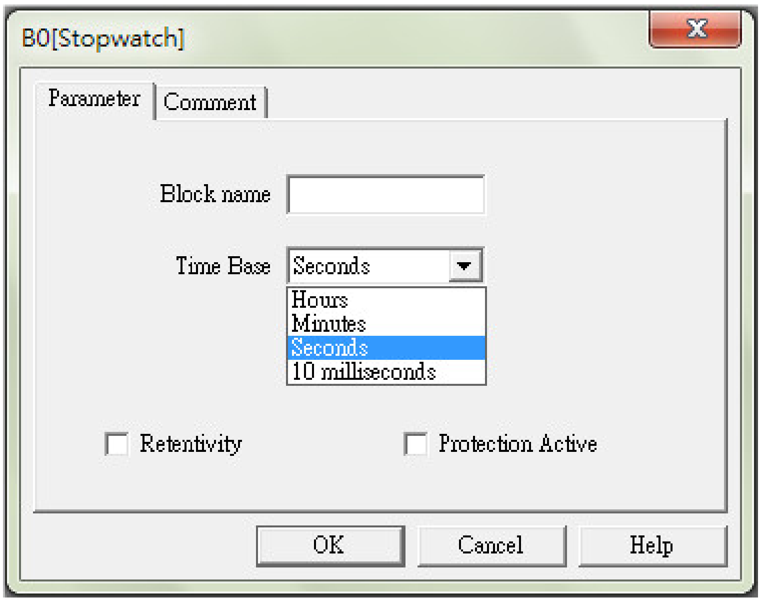


The function of stopwatch is to record the time elapsed when it was enabled.

Connection	Description
Input **En**	En (**En**able) is the monitoring input. The elapsed time starts counting when En transitions from 0 to 1. If En transitions from 1 to 0, the elapsed time will be frozen.
Input **Lap**	Input Lap (positive edge (0 to 1 transition)) pauses the stopwatch and sets output to lap time. Input Lap (negative edge (1 to 0 transition)) resumes the stopwatch and sets the output to current elapsed time.
Input **R**	input R (Reset) is to clear the current elapsed time and lap time.
Parameter	Elapsed time that can set hours, minutes, seconds, or 1/100ths of seconds.
Output **AQ**	When input lap is negative edge (1 to 0 transition), the value of output AQ will be current elapsed time. When input lap is positive edge (0 to 1 transition), the value of output AQ will be Lap time. The value of output AQ will be reseted to 0 when it is positive edge (0 to 1 transition).

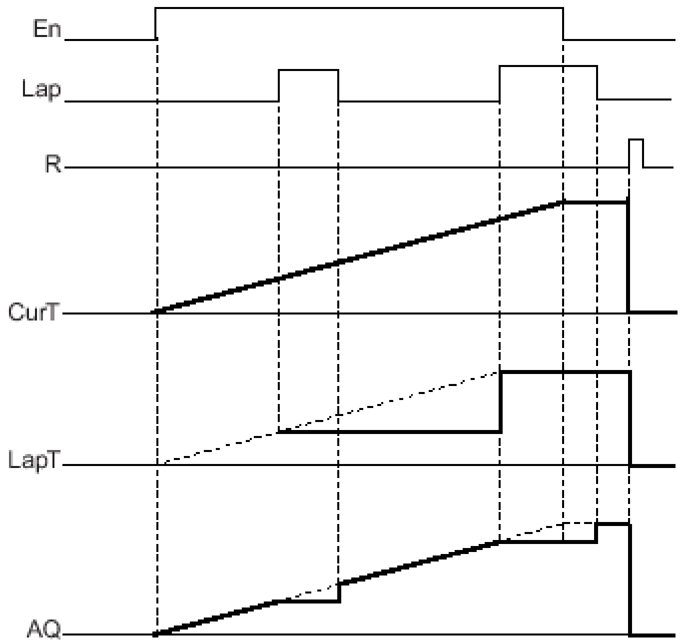
Parameters Time base

The time base can be set for the analog output:



The elapsed time of time base can be in hours, minutes, seconds, or 1/100ths of seconds (units of 10 milliseconds). The smallest time base is 10 milliseconds, or 1/100ths of seconds.

Timing diagram



Description of the function

When En = 1, the current time increases.

When En = 0, the current time counting pauses.

When En = 1 and Lap = 0, the value of output AQ is current elapsed time.

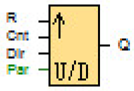
When En = 1 and Lap = 1, the current time continue increasing, but the value output AQ is Lap time.

When En = 0 and Lap =1, the value of output AQ is Lap time.

When En = 0 and Lap = 0, the value output AQ is latest current time.

When R = 1, both the current time and the Lap time are reset.

Up/Down counter



An input pulse increments or decrements an internal value, depending on the parameter setting. The output is set or reset when a configured threshold is reached. The direction of count can be changed with a signal at input Dir.

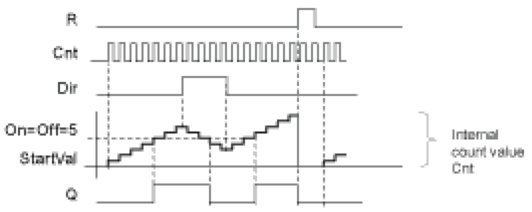
Connection	Description
Input **R**	You reset the output and the internal counter value to the start value (StartVal) with a signal at input R (Reset).
Input **Cnt**	This function counts the 0 to 1 transitions at input Cnt. It does not count 1 to 0 transitions. ● Use the inputs I0~ I3 for high-frequency counts: max. 15 kHz, if the fast input is directly connected to the Up/Down counter function block. ● Use any other input or circuit element for low-frequency counts (typically 5 Hz).
Input **Dir**	Input Dir (Direction) determines the direction of count: Dir = 0: Up Dir = 1: Down
Parameter	**On:** On threshold Value range: 0 ~ 999999 **Off:** Off threshold Value range: 0 ~ 999999 **StartVal:** Initial value from which to begin counting either down or up. Value range: 0 ~ 999999 **Retentivity** on = the status is retentive in memory.
Output **Q**	Q is set and reset according to the actual value at Cnt and the set thresholds.

* Start value (StartVal) is always equal to 0 for 1/2 series devices.

Parameters On and Off

The on threshold On and off threshold Off can be provided by the value of another already programmed function. Please refer to reference section.

Timing diagram



Description of the function

The function increments (Dir = 0) or decrements (Dir = 1) the internal counter by one count with every positive edge at input Cnt.

You can reset the internal counter value to the start value with a signal at the reset input R. As long as R=1, the output Q is 0 and the pulses at input Cnt are not counted.
Output Q is set and reset according to the actual value at Cnt and the set thresholds. See the following rules for calculation.

Calculation rule

If the on threshold >= off threshold, then:
  Q = 1, if Cnt >= On
  Q = 0, if Cnt < Off.

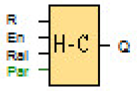
If the on threshold < off threshold, then:
  Q = 1, if On <= Cnt < Off.
  Q = 0, if Cnt >= Off or Cnt < On

Caution

The function polls the limit value of the counter once in each cycle.
Thus, if the pulses at the fast inputs I0~ I3 are faster than the scan cycle time, the SFB might not switch until the specified limit has been exceeded.

Example: Up to 100 pulses per cycle can be counted; 900 pulses have been counted so far. On = 950; Off = 1000. The output is set in the next cycle, after the value has reached 1000.
The output would not be set at all if the value Off = 980.

Hours counter



A configured time is triggered with a signal at the monitoring input. The output is set when this time has expired.

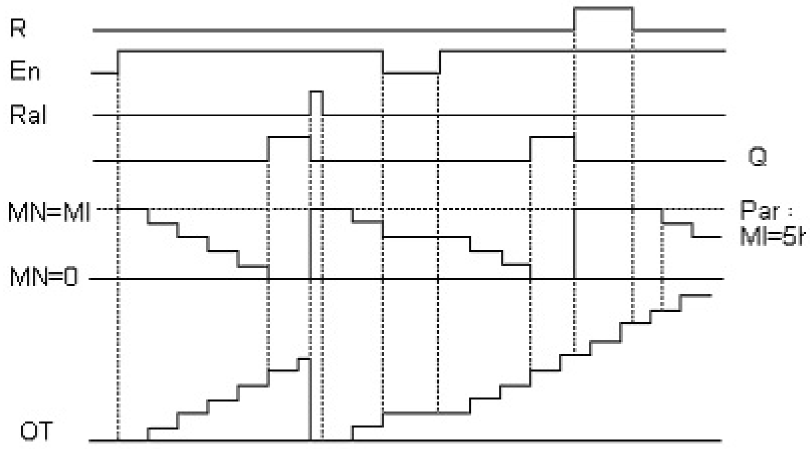
Connection	Description
Input **R**	A positive edge (0 to 1 transition) at input R resets output Q and sets a configured value MI at the counter for the duration of the time-to-go (MN).
Input **En**	En is the monitoring input. 1/2/5/6-Series scan the On Time of this input.
Input **Ral**	A positive edge at input Ral (Reset all) resets the hours counter (OT) and the output, and sets the time-to-go value (MN) to the configured maintenance interval (MI): ● Output Q = 0 ● The measured operating hours OT = 0 ● The time-to-go of the maintenance interval MN=MI.
Parameter	**MI:** Maintenance interval to be specified in units of hours and minutes. Value range : 0000...9999 h, 0…59 m (*) **OT:** Accumulated total operating time. An offset start time can be specified in hours and minutes. Value range : 00000...99999 h, 0...59 m (*) **Q→** 0: ● When "R" is selected: Q = 1, if MN = 0; Q = 0, if R = 1 or Ral = 1 ● When "R+En" is selected: Q = 1, if MN = 0; Q = 0, if R = 1 or Ral = 1 or En = 0.
Output **Q**	The output is set when the time-to-go MN = 0. The output is reset: ● When "Q→ 0:R+En", if R = 1 or Ral = 1 or En = 0 ● When "Q→ 0:R", if R = 1 or Ral = 1.

* MI and OT are not support minutes unit for 1/2 series devices.

Parameter MI

For the **5/6** series devices,the maintenance interval MI can be provided by the actual value of another already programmed function. Please refer to reference section.

Timing diagram



MI = Configured time interval
MN = Time-to-go
OT = Total time expired since the last 1 signal at the Ral input
These values are always retentive.

Description of the function

The hours counter monitors input En. As long as the status at this input is 1, 1/2/5/6 Series calculate the expired time and the time-to-go MN. 1/2/5/6 Series display these times when set to configuration mode. The output is set to 1 when the time-to-go is equal to zero.

You reset output Q and the time-to-go counter to the specified value MI with a signal at input R. The operation hour counter OT remains unaffected.

You reset output Q and the time-to-go counter to the specified value MI with a signal at input Ral. The operation hour counter OT is reset to 0.

Depending on your configuration of the Q parameter, the output is either reset with a reset signal at input R or Ral ("Q → R"), or when the reset signal is 1 or the En signal is 0 ("Q → R+En").

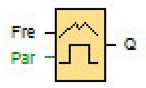
Limit value of OT

The value of the operating hours in OT are retained when you reset the hours counter with a signal at input R. The hours counter OT continues the count as long as En = 1, irrespective of the status at the reset input R. The counter limit of OT is 99999 h. The hours counter stops when it reaches this value.

In programming mode, you can set the initial value of OT. The counter starts operation at any value other than zero. MN is automatically calculated at the START, based on the MI and OT values.

Example: MI = 100, OT = 130, the result is MN = 70

Threshold trigger



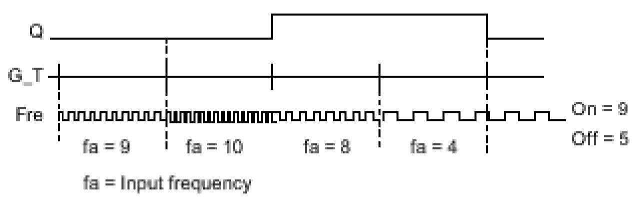
The output is switched on and off depending on two configurable frequencies.

Connection	Description
Input **Fre**	The function counts 0 to 1 transitions at input Fre. Transitions from 1 to 0 are not counted. ● Use the inputs I0, I1, I2, and I3 for high-frequency counts: max 15kHz (hi-speed checked), if the fast input is directly connected to the threshold trigger function block ● Use any other input or circuit element for low frequencies (typical 5 Hz).
Parameter	**On:** On threshold. Value range: 0000...9999 **Off:** Off threshold. Value range: 0000...9999 **G_T:** Time interval or gate time during which the input pulses are measured. Value range: 00:00s...99:99s
Output **Q**	Q is set or reset according to the threshold values.

Parameter G_T

For the **5/6** series devices,the gate time G_T can be provided by the actual value of another already programmed function. Please refer to reference section.

Timing diagram



Description of the function

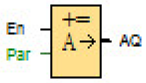
The trigger measures the signals at input Fre. The pulses are captured during a configurable period G_T. Q is set or reset according to the set thresholds. See the following calculation rule.

Calculation rule

- If the threshold (On) ≥ threshold (Off), then:
  Q = 1, if fa > On ;
  Q = 0, if fa ≤ Off.

- If the threshold (On) < threshold (Off), then
  Q = 1, if On <= fa < Off.

Mathematical instruction



The Mathematical instruction calculates the value AQ of an equation formed from the user-defined operands and operators.

Connection	Description
Input **En**	Enable the function of Mathematical instruction.
Parameter	**V1**: Value 1: First operand **V2**: Value 2: Second operand **V3**: Value 3: Third operand **V4**: Value 4: Fourth operand **Operator1**: First operator **Operator2**: Second operator **Operator3**: Third operator **Priority1**: Priority of first operation **Priority2**: Priority of second operation **Priority3**: Priority of third operation **p**: Number of decimals Range of values : 0, 1, 2, 3, 4, 5
Output **AQ**	The result of AQ is equation formed from the operand values and operators.

Parameters V1, V2, V3, and V4

The values V1, V2, V3, and V4 can be provided by the actual value of another programmed function. Please refer to reference section.

Parameter p (number of decimals)

Parameter p applies to the display of V1, V2, V3, V4 and AQ in a message text.

Description of the function

The Mathematical instruction function equation is combined by four operands and three operators. The operator can be any one of the four operators: +, -, *, or /. For each operator, you must set a unique priority of High ("H"), Medium ("M"), or Low ("L"). The high operation, followed by the medium operation, will be performed first, and then by the low operation. Exactly one operation of each priority is required. The operand values can refer to previously-defined function to provide the value.

The number of operand values is fixed at four and the number of operators is fixed at 3. To use fewer operands, you can use constructions such as " + 0" or " * 1" to fill the remaining parameters.

You can also configure the behavior of the function when the Enable parameter "En"=0. The function block can either retain its last value or be set to 0.

Examples

The following tables show some simple example Mathematical instruction block parameters, resulting equations and output values:

V1	Operator1 (Priority 1)	V2	Operator2 (Priority 2)	V3	Operator3 (Priority 3)	V4
12	+ (M)	6	/ (H)	3	- (L)	1

Equation: (12 + (6 / 3)) - 1
Result: 13

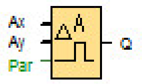
V1	Operator1 (Priority 1)	V2	Operator2 (Priority 2)	V3	Operator3 (Priority 3)	V4
2	+ (L)	3	* (M)	1	+ (H)	4

Equation: 2 + (3 * (1 + 4))
Result: 17

V1	Operator1 (Priority 1)	V2	Operator2 (Priority 2)	V3	Operator3 (Priority 3)	V4
100	- (H)	25	/ (L)	2	+ (M)	1

Equation: (100 – 25) / (2 + 1)
Result: 25

Analog comparator



The output is set or reset depending on two configurable thresholds (hysteresis).

Connection	Description
Inputs **Ax**, **Ay**	Inputs Ax, Ay are two analog signals.
Parameter	**A:** Gain Value range: +- 10.00 **B:** Zero offset Value range: +- 10,000 **On:** On threshold Value range: +- 20,000 **Off:** Off threshold Value range: +- 20,000 **p:** Number of decimals Value range: 0, 1, 2, 3
Output **Q**	Q is set or reset depending on the set thresholds.

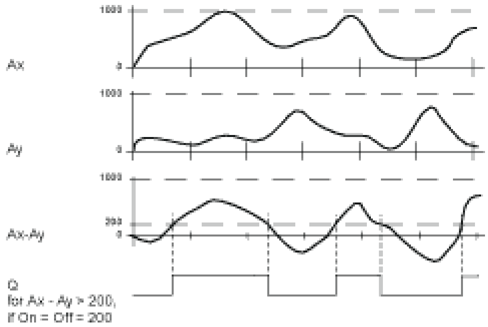
Parameters On and Off

For the 5/6 series devices,the on threshold On and the off threshold Off can be provided by the actual value of another programmed function. Please refer to reference section.

Parameter p (number of decimals)

Parameter p applies only to Ax, Ay, Delta, On and Off values displayed in a message text. Parameter p does not apply to the comparison of on and off values. (The compare function ignores the decimal point.)

Timing diagram



Description of the function

The function reads the value of the signal at the analog input Ax.
This value is multiplied by the value of parameter A (gain). Parameter B (offset) is added to the product, hence

(Ax × gain) + offset = Actual value Ax.
(Ay × gain) + offset = Actual value Ay.

Output Q is set or reset depending on the difference of the actual values Ax – Ay and the set thresholds. See the following calculation rule.

Calculation rule

- If threshold On >= threshold Off, then:
  Q = 1, if (actual value Ax - actual value Ay) > On
  Q = 0, if (actual value Ax - actual value Ay) <= Off.

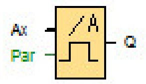
- If threshold On < threshold Off, then Q = 1, then:
  On <= (actual value Ax - actual value Ay) < Off.

Reducing the input sensitivity of the analog comparator

You can delay the output of the analog comparator selectively by means of the "on delay" and "off delay" SFBs. By doing so, you determine that output Q is only set if the input trigger length Trg (= output of the analog comparator) exceeds the defined on delay time.

This way you can set a virtual hysteresis, which renders the input less sensitive to short changes.

Analog threshold trigger



The output is set or reset depending on two configurable thresholds (hysteresis).

Connection	Description
Input **Ax**	Input Ax is one of analog signals.
Parameter	**A:** Gain Value range: +- 10.00 **B:** Zero offset Value range: +- 10,000 **On:** On threshold Value range: +- 20,000 **Off:** Off threshold Value range: +- 20,000 **p:** Number of decimals Value range: 0, 1, 2, 3
Output **Q**	Q is set or reset depending on the set thresholds.

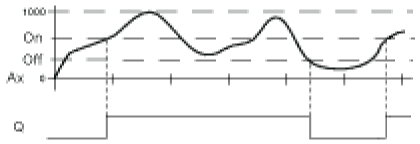
Parameters On and Off

For 5/6 series devices, the On and Off parameters can be provided by the actual value of another programmed function.

Parameter p (number of decimals)

Parameter p applies only to the display of On, Off and Ax values in a message text.
Parameter p does not apply to the comparison of On and Off values. (The compare function ignores the decimal point.)

Timing diagram



Description of the function

The function reads the value of the signal at the analog input Ax.
This value is multiplied by the value of parameter A (gain). Parameter B (offset) is added to the product, hence

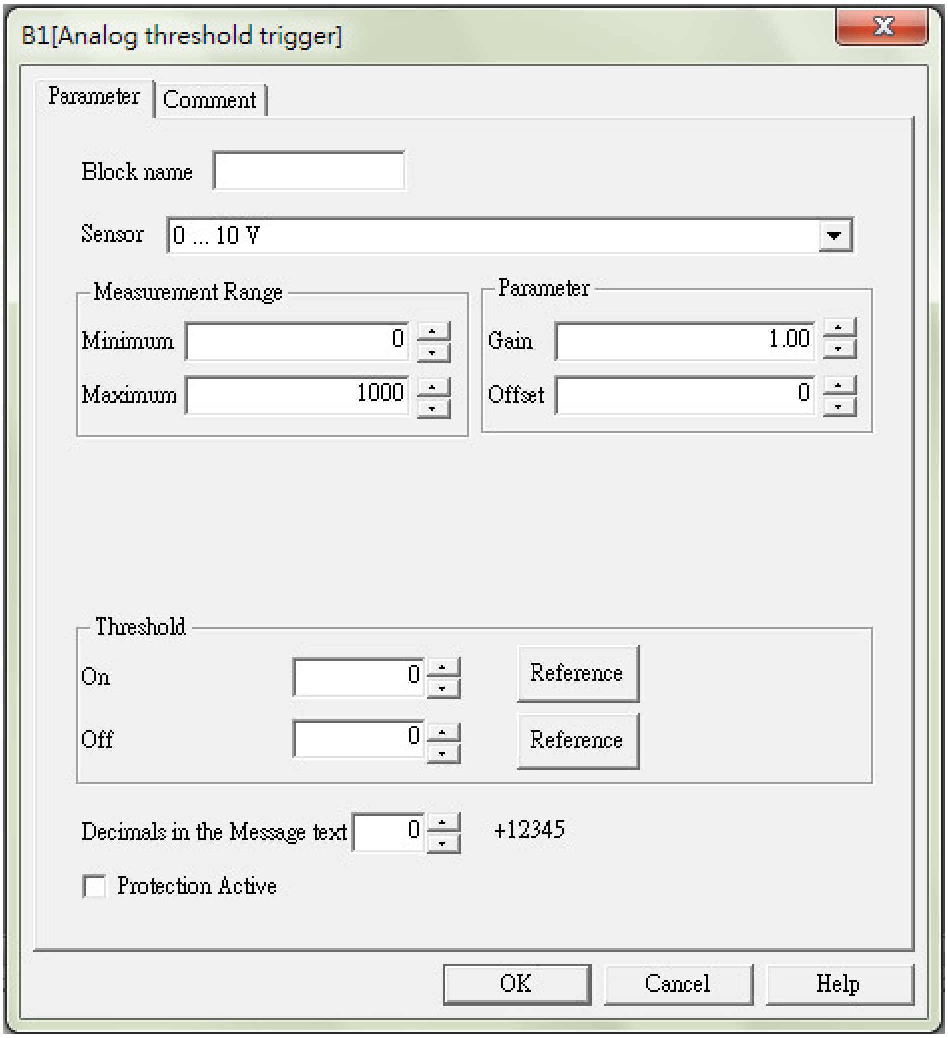
(Ax * Gain) + Offset = Actual value Ax.

Output Q is set or reset depending on the set threshold values. See the following calculation rule.

Calculation rule

- If threshold (On) >= threshold (Off), then:
  Q = 1, if the actual value Ax > On
  Q = 0, if the actual value Ax <= Off.
- If threshold (On) < threshold (Off), then Q = 1, if
  On <= the actual value Ax < Off.

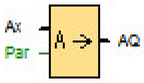
Particular characteristics to be noted when configuring



Note

The decimal point setting must be identical in the minimum and maximum range.

Analog amplifier



This SFB amplifies an analog input value and returns it at the analog output.

Connection	Description
Input **Ax**	Input Ax is a analog signals.
Parameter	**A:** Gain Value range: +- 10.00 **B:** Zero offset Value range: +- 10,000 **p:** Number of decimals Value range: 0, 1, 2, 3
Output **AQ**	Value range for AQ: -32768...+32767

Parameter p (number of decimals)

Parameter p applies only to the display of Ax and Ay values in a message text.
Parameter p does not apply to the comparison of On and Off values. (The compare function ignores the decimal point.)

Description of the function

The function reads the value of an analog signal at the analog input Ax.

This value is multiplied by the gain parameter A. Parameter B (offset) is added to the product, as follows:

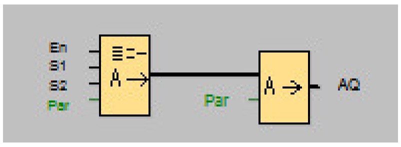
(Ax × gain) + offset = Actual value Ax.

The actual value Ax is output at AQ.

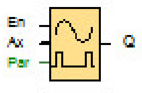
Analog output

If you connect this special function to a real analog output, then note that the analog output can only process values from 0 to 1000. To do this, connect an additional amplifier between the analog output of the special function and the real analog output. With this amplifier you standardize the output range of the special function to a value range of 0 to 1000.

Example: additional amplifier behind an analog multiplexer.



Analog watchdog



This special function saves the process variable of an analog input to memory, and sets the output when the output variable exceeds or drops below this stored value plus a configurable offset.

Connection	Description
Input **En**	A positive edge (0 to 1 transition) at input En saves the analog value at input Ax ("Aen") to memory and starts monitoring of the analog range Aen +- Delta.
Input **Ax**	You apply the analog signal to be monitored at input Ax. Use the analog inputs AI, the analog flags AM, the block number of a function with analog output, or the analog outputs AQ. AI: 0 - 10 V corresponds with 0 - 1000 (internal value).
Parameter	**A:** Gain Value range: +- 10.00 **B:** Zero offset Value range: +- 10,000 **Threshold 1 (upper +):** Difference value above Aen: on/off threshold Value range: 0 - 20,000 (*) **Threshold 2 (lower -):** Difference value below Aen: on/off threshold Value range: 20,000 - 0 (*) **p:** Number of decimals Value range: 0, 1, 2, 3
Output **Q**	Q is set/reset, depending on the stored analog value and the offset.

* For 1/2 series devices , Threshold = upper+ = lower-.

Parameters Threshold 1 and Threshold 2

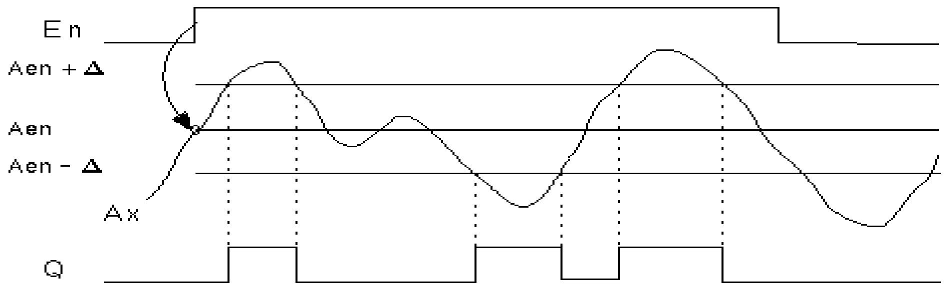
For 5/6 series devices, the two threshold (Threshold 1 and Threshold 2) parameters can be provided by the actual value of another programmed function. Please refer to reference section.

Parameter p (number of decimals)

Does not apply to the display of On, Off and Ax values in a message text.

Does not apply to the comparison of On and Off values! (The compare function ignores the decimal point.)

Timing diagram



Description of the function

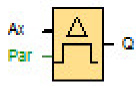
A 0 to 1 transition at input En saves the value of the signal at the analog input Ax. This saved process variable is referred to as Aen".

Both the analog actual values Ax and Aen are multiplied by the value at parameter A (gain), and parameter B (offset) is then added to the product, i.e.
(Ax × gain) + offset = Actual value Aen, when input En changes from 0 to 1, or
(Ax × gain) + offset = Actual value Ax.

Output Q is set when the signal at input En = 1 and if the actual value at input Ax is out of range of Aen+upper / Aen-lower.

Output Q is reset, when the actual value at input Ax lies within the range of Aen+upper / Aen-lower, or when the signal at input En changes to lo.

Analog differential trigger



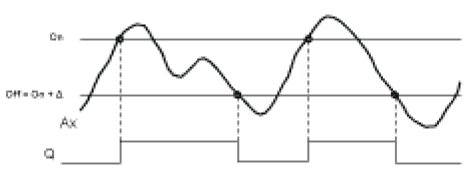
The output is set and reset depending on a configurable threshold and a differential value.

Connection	Description
Input **Ax**	You apply the analog signal to be analyzed at input Ax. Use the analog inputs AI, the analog flags AM, the block number of a function with analog output, or the analog outputs AQ. 0 - 10 V is proportional to 0 - 1000 (internal value).
Parameter	**A**: Gain Range of values: ±10.00 **B**: Zero offset Range of values: ±10,000 **On**: On/Off threshold Range of values: ±20,000 **Δ**: Differential value for calculating the off parameter Range of values: ±20,000 **p**: Number of decimals Range of values: 0, 1, 2, 3
Output **Q**	Q is set or reset, depending on the threshold and difference values.

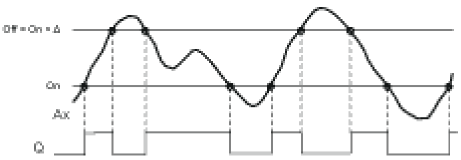
Parameter p (number of decimals)

Parameter p applies only to the display of On, Off and Ax values in a message text.
Parameter p does not apply to the comparison of On and Off values. (The compare function ignores the decimal point.)

Timing diagram A: Function with negative difference Delta



Timing diagram B: Function with positive difference Delta



Description of the function

The function fetches the analog signal at input Ax.
Ax is multiplied by the value of the A (gain) parameter, and the value at parameter B (offset) is added to product, i.e.
(Ax * gain) + offset = actual value of Ax.

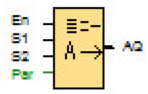
Output Q is set or reset, depending on the set (On) threshold and difference value (Delta). The function automatically calculates the Off parameter: Off = On + Delta, whereby Delta may be positive or negative. See the calculation rule below.

Calculation rule

- When you set a negative differential value Delta, the On threshold >= Off threshold, and:
  Q = 1, if the actual value Ax > On
  Q = 0, if the actual value Ax <= Off.
  See the timing diagram A.

- When you set a positive differential value Delta, the On threshold < the Off threshold, and Q = 1, if:
  On <= the actual value Ax < Off.
  See the timing diagram B.

Analog MUX



When Analog MUX is enabled, the analog multiplexer SFB displays one of four pre-defined analog values, depending on input conditions.

Connection	Description
Input **En**	1 on input En (Enable) switches, dependent on S1 and S2, a parameterized analog value to the output AQ. 0 on input EN switches 0 to the output AQ.
Inputs **S1** and **S2**	S1 and S2 (selectors) for selecting the analog value to be issued. S1 = 0 and S2 = 0: The value V1 is issued S1 = 0 and S2 = 1: The value V2 is issued S1 = 1 and S2 = 0: The value V3 is issued S1 = 1 and S2 = 1: The value V4 is issued
Parameter	**V1-V4**: Analog values (Value) that will be issued. Value range: -32768 to +32767 **p**: Number of decimal places. Possible settings: 0, 1, 2, 3
Output **AQ**	Analog output , Value range for AQ: -32768 to +32767

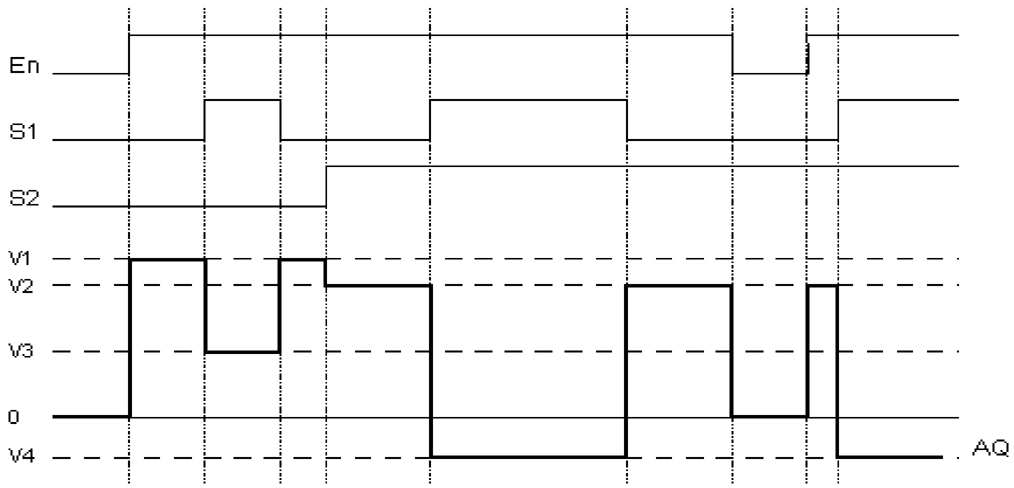
Parameters V1…V4

The values for V1…V4 can be provided by the value of another programmed function. Please refer to reference section.

Parameter p (number of decimal places)

Parameter p only applies to the display of AQ, V1, V2, V3 and V4 values in message text.

Timing diagram



Description of function

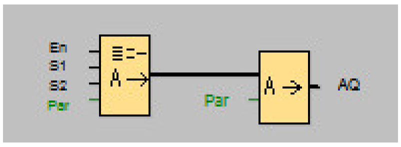
If input En is set, the function issues one of four possible analog values V1 to V4 at the output AQ, and depending on the inputs S1 and S2.
If the input En is not set, the function issues the analog value 0 at output AQ.

Particular characteristics to be noted when configuring.

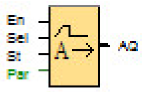
Analog output

If you connect this special function to a real analog output, the analog output can only process values from 0 to 1000. To do this, connect an additional amplifier between the analog output of the special function and the real analog output. With this amplifier you standardize the output range of the special function to a value range of 0 to 1000.

Example: additional amplifier behind an analog multiplexer.



Analog Ramp



The Analog Ramp allows the output to be changed from the current level to the selected level at a specified rate.

Connection	Description
Input **En**	A change in the status from 0 to 1 at input En (Enable) applies the start/stop level (Offset "B" + StSp) to the output for 100 ms and starts the ramp operation to the selected level. A change in the status from 1 to 0 immediately sets the current level to Offset "B", which makes output AQ equal to 0.
Input **Sel**	Sel = 0: The step 1 (level 1) is selected. Sel = 1: The step 2 (level 2) is selected. A change in status of Sel causes the current level to start changing to the selected level at the specified rate.
Input **St**	A change in the status from 0 to 1 at input St (Decelerated Stop) causes the current level to decrease at a constant rate until the start/stop level (Offset "B" + StSp) is reached. The start/stop level is maintained for 100 ms and then the current level is set to Offset "B", which makes output AQ equal to 0.
Parameter	**Level1** and **Level2**: Levels to be reached. Value range for each level: -10,000 to +20,000 **MaxL**: Maximum value that must not be exceeded. Value range: -10,000 to +20,000 **StSp**: Start/Stop offset: value that is added to Offset "B" to create the start/stop level. If the Start/Stop offset is 0, then the start/stop level is Offset "B"). Value range: 0 to +20,000 **Rate**: Speed with which level 1, level 2 or 0ffset is reached. Steps/seconds are issued. Value range: 1 to 10,000 **A**: Gain Value range: 0 to 10,00 **B**: Offset Value range: +- 10.000 **p**: Number of decimal places Value range: 0, 1, 2, 3
	The output AQ is scaled using the formula: (Current Level - Offset "B") / Gain "A"

Output **AQ**	Note: When AQ is displayed in parameter mode or message mode, it is displayed as an unscaled value (engineering units: current level). Value range for AQ: 0...+32767

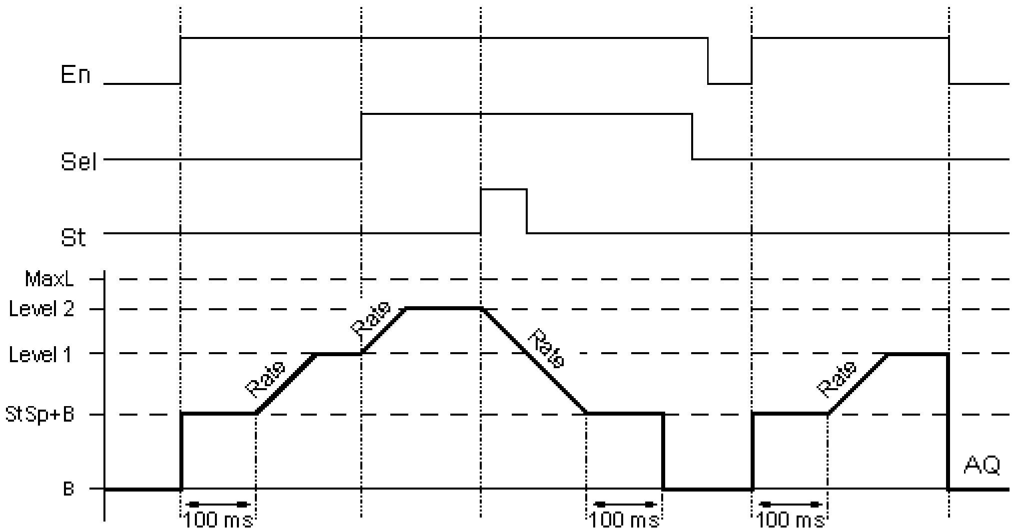
Parameters Level1 and Level2

The level parameters Level1 and Level2 can be provided by the actual value of another programmed function. Please refer to reference section.

Parameter p (number of decimal places)

Parameter p only applies to display the values of AQ, level 1, level 2, MaxL, StSp, and Rate in message text.

Timing diagram for AQ



Description of function

If the input En is set, the function sets the value StSp + Offset "B" for 100 ms.
The function runs from the level StSp + Offset "B" to either level 1 or level 2 at the acceleration set in Rate that depends on the connection of Sel.

If the input St is set, the function runs to a level of StSp + B at the acceleration set in Rate. Then the function holds the level at StSp + Offset "B" for 100 ms.

After 100 ms, the level is set to Offset "B". output AQ, and the scaled value (output AQ) is 0.

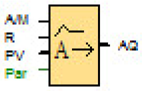
If the input St is set, the function can only be restarted once the inputs St and En have been reset.

If input Sel has been changed, the function runs from the current target level to the new target level at the rate that is specified, and depending on the connection of Sel.

If the input En is reset, the function immediately sets the current level to Offset "B".

The current level is updated every 100 ms.
Note the relationship between output AQ and the current level:
Output AQ = (current level – Offset "B") / Gain "A"

PI controller



PI controller is a proportional-action and integral-action controller that can be used on both proportional action and integral action individually or combined.

Connection	Description
Input **A/M**	Set the mode of the controller: 0: manual mode 1: automatic mode
Input **R**	Use the input R to reset the output AQ. As long as this input is set, the input A/M is disabled. The output AQ is set to 0.
Input **PV**	Analog value: process value, influences the output
Parameter	**Sensor**: Type of sensor being used **Min**.: Minimum value for PV Value range: -10,000 to +20,000 **Max**.: Maximum value for PV Value range: -10,000 to +20,000 **A**: Gain Value range: +- 10.00 **B**: Offset Value range: +- 10,000 **SP**: Set-value assignment Value range: -10,000 to +20,000 **Mq**: Value from AQ with manual mode. Value range: 0 to 1,000 **Parameter sets**: application-related presets for KC, TI and Dir (see below) **KC**: Gain Value range: 00.00 to 99.99 **TI**: Integral time Value range: 00:01 min to 99:59 min **Dir**: Action direction of the controller Value range: + or - **p**: Number of decimal places Value range: 0, 1, 2, 3
Output **AQ**	Analog output (manipulated variable) Value range for AQ: 0 to 1,000

Parameters SP and Mq

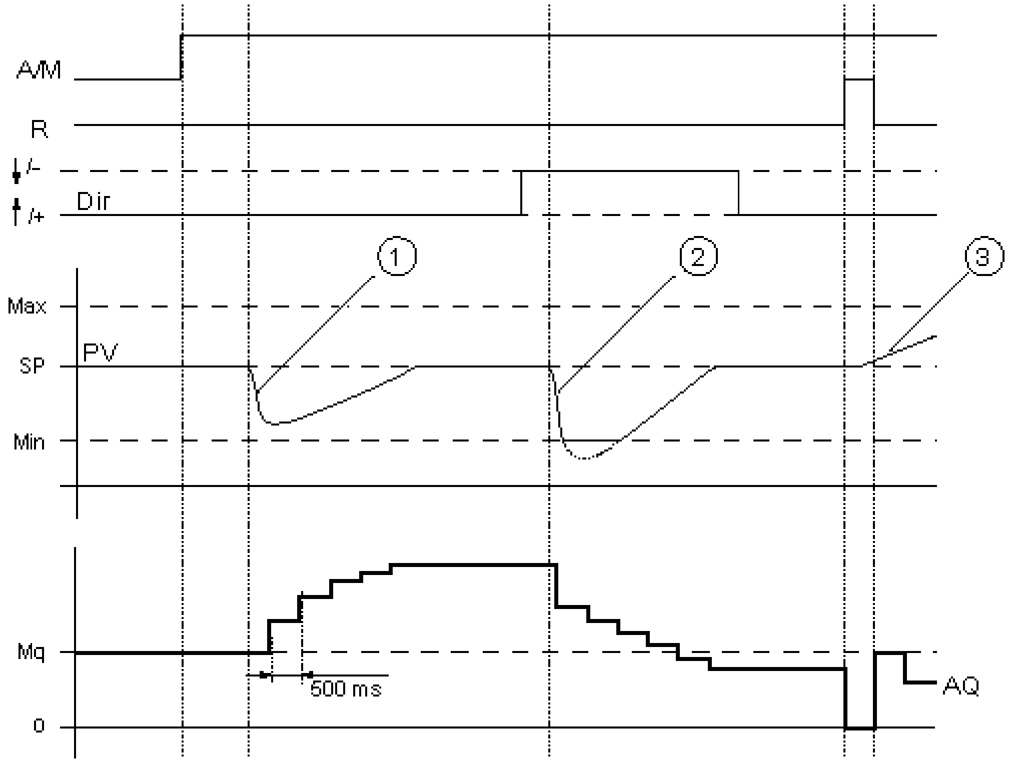
The set-value SP and the value for Mq can be provided by the actual value of another programmed function. Please refer to reference section.

Parameter P (number of decimal places)

Parameter p only applies to display the values from PV, SP, Min. and Max. in essage text.

Timing diagram

The nature, manner and speed with which the AQ changes depends on the parameters KC and TI. Thus, the course of AQ in the diagram is merely an example. A control action is continuous; therefore the diagram portrays just an extract.



1	A disturbance causes the PV to drop, as Dir is positioned upwards, AQ increases until PV corresponds again to SP.
2	A disturbance causes the PV to drop, as Dir is positioned upwards, AQ decreases until PV corresponds again to SP. Dir is coordinated to the basic conduct of a control loop. The direction (dir) cannot be changed during the term of the function. The change in Dir here is shown for the purposes of clarification.
3	As AQ is set to 0 by means of the input R, PV changes. This is based on the fact that PV increases, which on account of Dir = upwards causes AQ to drop.

Description of Function

If the input A/M is set to 0, the special function issues output AQ with the value that you set with

parameter Mq.
If the input A/M is set to 1, automatic mode commences.
As an integral sum the value Mq is adopted, the controller function begins the calculations in accordance with the formulas.
The updated value PV is used in the formulas.
Updated value PV = (PV * gain) + offset

If the updated value PV = SP, the special function does not change the value of AQ.

Dir = upwards/+ (timing diagram number 1,3)
If the updated value PV > SP, then the special function reduces the value of AQ.
If the updated value PV < SP, then the special function increases the value of AQ.

Dir = downwards/- (timing diagram number 2)
If the updated value PV > SP, the special function increases the value of AQ.
If the updated value PV < SP, the special function reduces the value of AQ.

With a disturbance, AQ increases or decreases until the updated value PV again corresponds to SP.
The speed with which AQ changes depends on the parameters KC and TI.

If the input PV exceeds the parameter Max., the updated value PV is set to the value of Max.
If the PV falls short of the parameter Min., the updated value PV is set to the value of Min.

If the input R is set to 1, the AQ output is reset.
As long as R is set, the input A/M is disabled.

Sampling time

The sampling time is fixed at 500 ms.

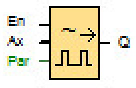
Parameter sets

In order to simplify the use of the PI controller, the parameters of KC, TI and Dir are already given as sets for the following applications:

Parameter set	**Application example**	**Parameter KC**	**Parameter TI (s)**	**Parameter Dir**
Temperature fast	Temperature, cooling control of small spaces; small volumes	0.5	30	+

Temperature slow	Heating, ventilation, temperature, cooling control of large spaces; large volumes	1.0	120	+
Pressure 1	Quick pressure change, compressor control	3.0	5	+
Pressure 2	Slow pressure change, differential pressure control (flow controller)	1.2	12	+
Full level 1	Vat and/or reservoir filling without drain	1.0	99:59	+
Full level 2	Vat and/or reservoir filling with drain	0.7	20	+

PWM



The Pulse Width Modulator (PWM) modulates the analog input value Ax to a pulsed digital output signal. The pulse width is proportional to the analog value Ax.

Connection	Description
Input **En**	A positive edge (0 to 1 transition) at input En enables the PWM function block.
Input **Ax**	Analog signal to be modulated to a pulsed digital output signal.
Parameter	**A**: Gain Range of values: -10.00 to +10.00 **B**: Zero offset Range of values: -10,000 to +10,000 **PT**: Periodic time over which the digital output is modulated **Out** : Q0 ~ Q3(High speed) , disable (low speed) **p**: Number of decimals Possible settings: 0, 1, 2, 3
Output **Q**	Q is set or reset for the proportion of each time period according to the proportion of the standardized value Ax to the analog value range (when selected Q0 to Q3 , block output Q is always 0).

Parameter PT

The periodic time PT can be provided by the actual value of programmed function. Please refer to reference section.

Parameter p (number of decimals)

Parameter p only applies to the display of the Ax value in message text.

Description of the function

The function reads the value of signal at the analog input Ax.
This value is multiplied by the value of parameter A (gain). Parameter B (offset) is added to the product, as follows:

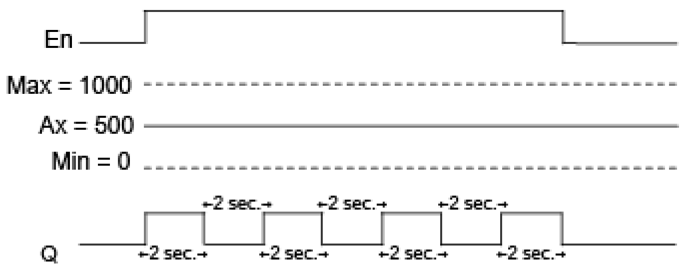
(Ax * Gain) + Offset = Actual value Ax

The function block calculates the proportion of the value Ax to the range. The block sets the digital output Q high for the same proportion of the PT (periodic time) parameter, and sets Q low for the remainder of the time period.

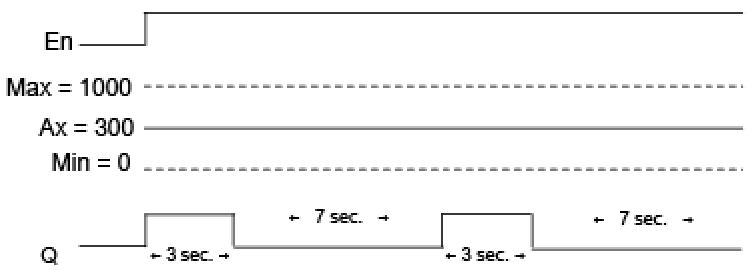
Examples with Timing Diagrams

The following examples show how the PWM instruction modulates a digital output signal from the analog input value:

Example 1: Analog input value: 500 (range 0...1000)   Periodic time T: 4 seconds
The digital output of the PWM function is 2 seconds high, 2 seconds low, 2 seconds high, 2 seconds low and continues in that pattern as long as parameter "En" = high.



Example 2: Analog input value: 300 (range 0...1000)   Periodic time T: 10 seconds
The digital output of the PWM function is 3 seconds high, 7 seconds low, 3 seconds high, 7 seconds low and continues in that pattern as long as parameter "En" = high

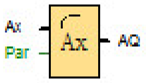


Calculation rule

Q = 1, for (Ax – Min) / (Max – Min) of time period PT
Q = 0, for PT – [(Ax – Min) / (Max – Min)] of time period PT.

Note: Ax in calculation refers to the actual value Ax as calculated using the Gain and Offset.
Min and Max refer to the minimum and maximum values specifed for the range.

Analog filter

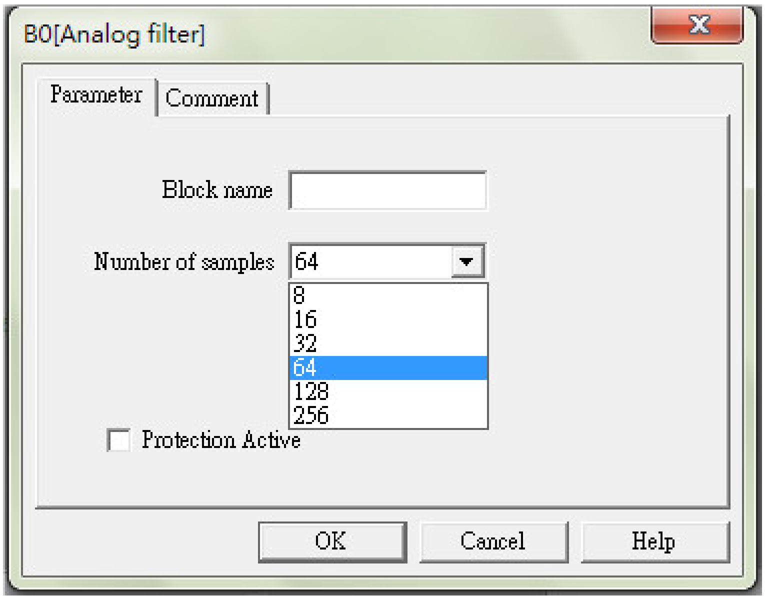


Connection	Description
Input **Ax**	Input **Ax** is one of the following analog signals: ● AI (*) ● AM ● AQ ● The block number of a function with analog output
Parameter	**Sn** (Number of samples): determines how many analog values are sampled within the program cycles that are determined by the set number of samples. 51/61 series samples an analog value within every program cycle. The number of program cycles is equal to the set number of samples. Possible settings: 8, 16, 32, 64, 128, 256
Output **AQ**	**AQ** outputs an average value of the analog input **Ax** over the current number of samples, and it is set or reset depending on the analog input and the number of samples.

* AI : 0 to 10 V corresponds with 0 to 1000 (internal value).

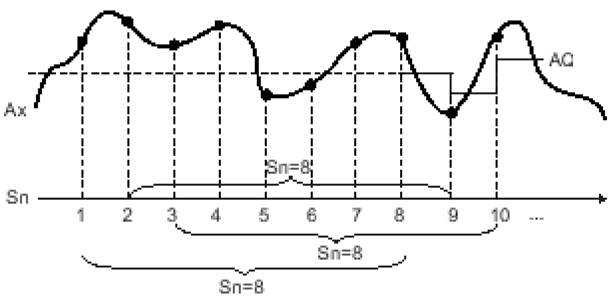
Parameter

You can set the number of samples to the values as shown below:



After you set the parameter, the analog filter calculates the average value of the samples and assigns this value to AQ.

Timing diagram

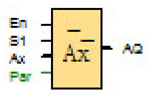


Description of function

The function outputs the average value after sampling the analog input signal according to the set number of samples. This SFB can reduce the error of analog input signal.

Note : Maximum eight analog filter function blocks which are available to use in the circuit program.

Max/Min



The Max/Min function block records the maximum or minimum value.

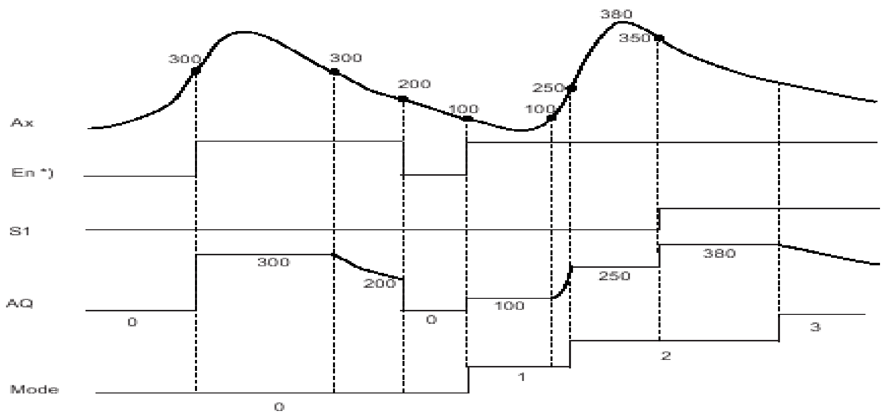
Connection	Description
Input **En**	The function of input En (**En**able) depends on the settings of parameter Mode and the selection of check box "when En = 0, reset Max/Min".
Input **S1**	This input is enabled when you set **Mode =2:** A positive transition (0 to 1) at input **S1** sets the output **AQ** to the maximum value.. A negative transition (1 to 0) at input **S1** sets the output **AQ** to the minimum value.
Input **Ax**	Input **Ax** is one of the following analog signals: ● AI (*) ● AM ● AQ ● The block number of a function with analog output
Parameter	**Mode:** Possible settings: 0, 1, 2, 3 Mode = 0: AQ = Min Mode = 1: AQ = Max Mode = 2 and S1= 0 (low): AQ = Min Mode = 2 and S1= 1 (high): AQ = Max Mode = 3 or a block value is referenced: AQ = Ax
Output **AQ**	**AQ** ouptuts a minimum, maximum, or actual value depending on the inputs, or is reset to 0 if configured to do so when function is disabled

* AI : 0 to 10 V corresponds with 0 to 1000 (internal value).

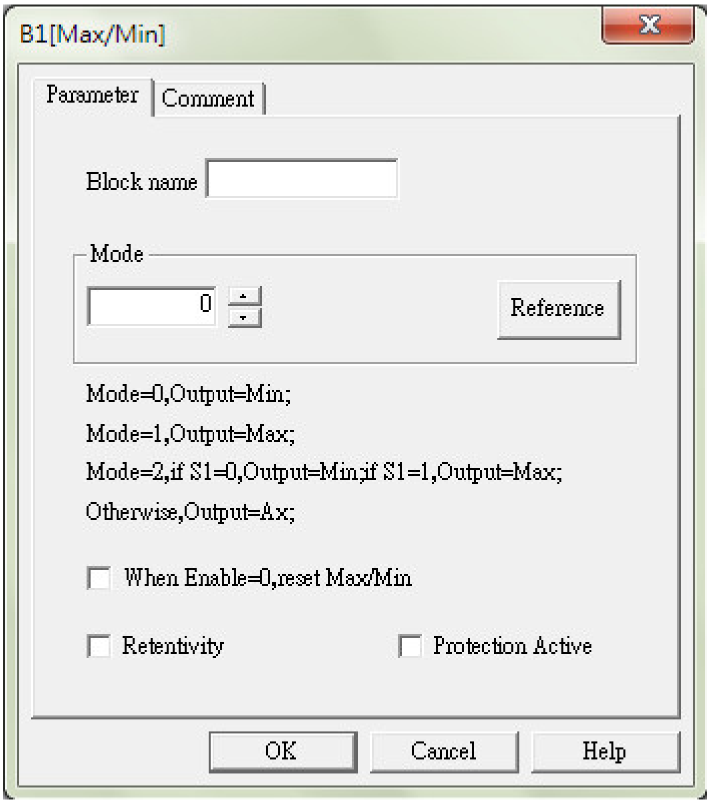
Parameter Mode

You can set the values for parameter Mode which is based on the actual values of programmed function.

Timing diagram



Description of the function



If you select the check box "when En = 0, reset Max/Min":

En = 0: The function sets the AQ value to 0.

En = 1: The function outputs a value at AQ, depending on the settings of Mode and S1.

If you do not select the check box "when En = 0, reset Max/Min":

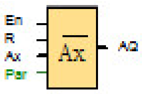
En = 0: The function holds the value of AQ at the current value.

En = 1: The function outputs a value at AQ, depending on the settings of Mode and S1.

Mode = 0: The function sets AQ to the minimum value

Mode = 1: The function sets AQ to the maximum value
Mode = 2 and S1 = 0: The function sets AQ to the minimum value
Mode = 2 and S1 = 1: The function sets AQ to the maximum value
Mode = 3 or a block value is referenced: The function outputs actual analog input value.

Average Value



The average value function samples the analog input signal during configured time period and outputs the average value at AQ.

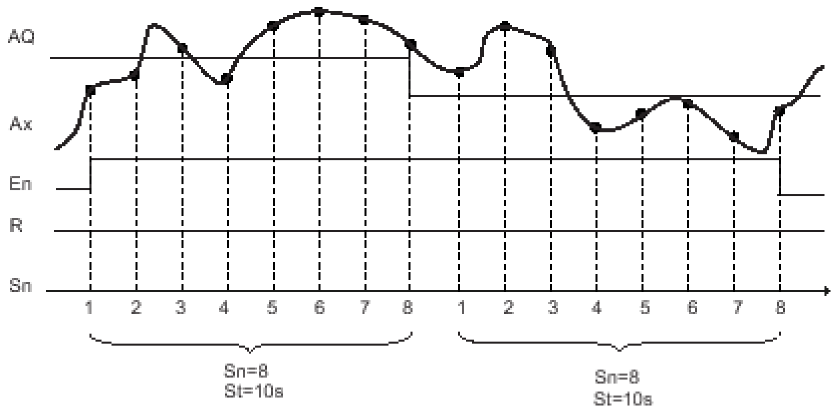
Connection	Description
Input **En**	A positive edge (0 to 1 transition) at input En (**En**able) sets the output **AQ** to the average value of input Ax after the configured time. A negative edge (1 to 0 transition) holds the output at its last calculated value.
Input **R**	A positive edge (0 to 1 transition) at input R (**R**eset) resets the output AQ to 0.
Input **Ax**	Input **Ax** is one of the following analog signals: ● AI (*) ● AM ● AQ ● The block number of a function with analog output
Parameter	**St** (Sampling time): You can set it to Seconds, Days, Hours or Minutes. Range of values: If St = Seconds: 1 to 59 If St = Days: 1 to 365 If St = Hours: 1 to 23 If St = Minutes: 1 to 59 **Sn** (Number of samples): Range of values: If St = Seconds: 1 to St*100 If St = Days: 1 to 32767 If St = Hours: 1 to 32767 If St = Minutes and St ≤ 5 minutes: 1 to St*6000 If St = Minutes and St ≥ 6 minutes: 1 to 32767
Output **AQ**	**AQ** outputs the average value over the specified time of sampling.

* AI : 0 to 10 V corresponds with 0 to 1000 (internal value).

Parameter St and Sn

Parameter St represents the sampling time, and parameter Sn represents the number of samples.

Timing diagram

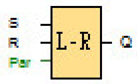


Description of the function

When En = 1, the average value function calculates the average value of the samples during the configured time interval.

At the end of the sampling time, this function sets output AQ to this calculated average value. When En = 0, the calculation stops, and AQ retains the last calculated value. When R = 0, AQ is reset to 0.

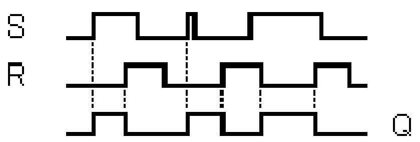
Latching relay



A signal at input S sets output Q. A signal at input R resets output Q.

Connection	Description
Input **S**	Set output Q with a signal at input S (Set).
Input **R**	Reset output Q with a signal at input R (Reset). Output Q is reset if S and R are both set (reset has priority over set).
Parameter	**Retentivity** set (on) = the status is retentive in memory.
Output **Q**	Q is set with a signal at input S and remains set until it is reset with signal at input R.

Timing diagram



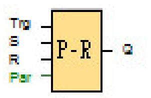
Description of the function

The latching relay represents a simple binary memory logic. The output value depends on the input states and the previous status at the output.
Logic table of the latching relay:

S	R	Q	Remark
0	0	x	Status unchanged
0	1	0	Reset
1	0	1	Set

When retentivity is enabled, the output signal corresponds with the signal status prior to the power failure.

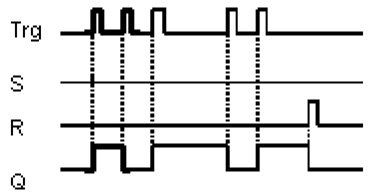
Pulse relay



The output is set and reset with a short one-shot at the input.

Connection	Description
Input **Trg**	You switch output Q on or off with a signal at input Trg (Trigger) input.
Input **S**	A one-shot at input S (Set) sets the output to logical 1.
Input **R**	A one-shot at input R (Reset) resets the output to logical 0
Parameter	**Selection:** RS (input R priority), or SR (input S priority) **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	Q is switched on with a signal at Trg and is reset again at the next Trg pulse, if both S and R = 0.

Timing diagram



Description of the function

The status of output Q changes with each 0 to 1 transition at input Trg and if both S and R = 0, that is, the output is switched on or off.

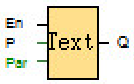
Input Trg does not influence the SFB when S = 1 or R = 1.
A one-shot at input S sets the pulse relay, that is, the output is set to logical 1.
A one-shot at input R resets the pulse relay to its initial state, that is, the output is set to logical 0.

Either the input R takes priority over input S (the signal at input S has no effect as long as R = 1), or the input S takes priority over input R (the signal at input R has no effect as long as S = 1), depending on your configuration.

Caution

If Trg = 0 and Par = RS, the "Pulse relay" SFB corresponds with the "Latching relay" SFB function.

Message text



■ For 1/2 Series :

This function displays message texts and parameters of other blocks on 1/2-Series when it is in RUN mode.

Connection	Description
Input **En**	A 0 to 1 transition at En (Enable) triggers the output of the message text.
Input **P**	P is the priority of the message text. 0 is the lowest, 15 is the highest priority. Ack: Acknowledgement of the message text
Parameter	**Text:** Input of the message text **Par:** Parameter or actual value of another, already configured function **Time:** Shows the continuously updated time-of-day **Date:** Shows the continuously updated date **EnTime:** Shows the time of the 0 to 1 transition **EnDate:** Shows the 0 to 1 transition of the date
Output **Q**	Q remains set as long as the message text is queued.

Description of the function

With a 0 to 1 transition of the signal at input En, the display outputs your configured message text (actual value, text, TOD, date) in Normal mode.

Acknowledgement disabled (Ack = Off):
The message text is hidden with a 0 to 1 signal transition at input En.

Acknowledgement enabled (Ack = On):
After input En is reset to 0, the message text is displayed until acknowledged by pressing the OK button. The message text cannot be acknowledged as long as input En is high.

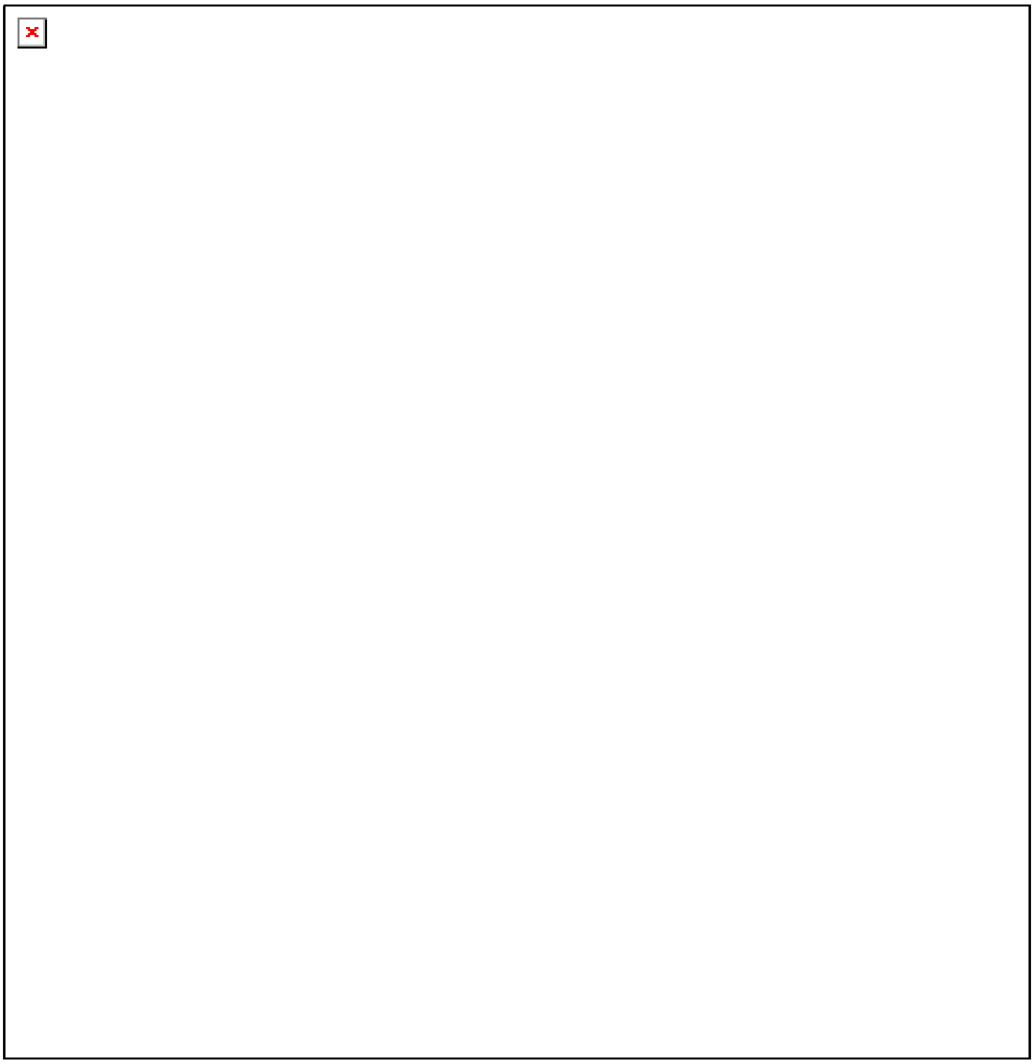
If several message text functions were triggered with En=1, the message with the highest priority (0

= lowest, 15 = highest) is displayed. This also implies that a new message text is only displayed if its priority is higher than that of previously enabled message texts.

After a message text is disabled or acknowledged, the function automatically shows the previously active message text that takes the highest priority.

Of several message text functions triggered with En=1, the one with the highest priority is displayed. Low-priority messages can also by displayed by pressing the ▼ button.
You can switch between the standard display and the message text display by means of the buttons ▲ and▼.

Restrictions
Up to 16 message text functions are available.
Particular characteristics to be noted when configuring



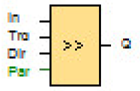
	"General" area

1	Here you will find the following settings:· ● Priority of the message text ● Check box for message text acknowledgement
2	**"Blocks" area** Shows a list of all the circuit program blocks and their parameters.
3	**"General parameters" area** Shows general parameters such as the current date.
4	**"Block parameters" area** Shows the parameters of a block selected from the "Blocks" area which you can output in the message text.
5	**"Insert" button** Button for inserting a parameter selected from the **"Block parameters"** or **"General parameters"** area into the message text.
6	**"Messages" area** You arrange the message text in this area. Information entered in this area corresponds with that on the display.

To arrange the message text

1. From the **"Blocks"** area, select the block whose parameters you want to output.
2. Drag and drop the parameters required from the **"Block parameters"** to the **"Messages"** area. You may also use the **"Insert"** button to do so.
3. In the **"Messages"** area, you can add parameter data as required.

Shift register

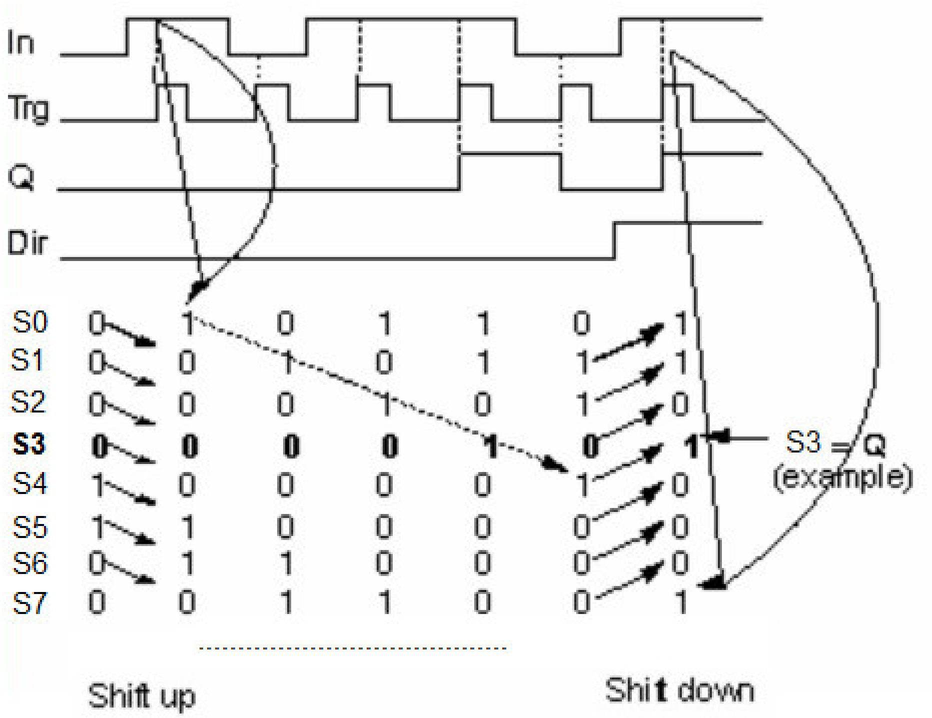


■ for 1/2 Series :

The shift register function can be used to read an input value and to shift the bits. The output value corresponds with the configured shift register bit. The shift direction can be changed at a special input.

Connection	Description
Input **In**	The function when started reads this input value.
Input **Trg**	The SFB is started with a positive edge (0 t 1 transition) at input Trg (Trigger). A 1 to 0 transition is irrelevant.
Input **Dir**	You define the shift direction of the shift register bits S0...S15 at the Dir input: Dir = 0: shift up (S0 >> S15) Dir = 1: shift down (S15 >> S0)
Parameter	**Shift register bit** that determines the value of output Q. Possible settings: S0 ... S15 **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	The output value corresponds with the configured shift register bit.

Timing diagram



Description of the function

The function reads the value of input In with a positive edge (0 to 1 transition) at input Trg (Trigger).

This value is written to shift register bits S0 or S15, depending on the set shift direction:

- Shift up: S0 accepts the value of input In; the previous value of S0 is shifted to S1, S1 is shifted to S2.

- Shift down: S15 accepts the value of input In; the previous value of S15 is shifted to S14, S14 is shifted to S13.

Q outputs the value of the configured shift register bits.

If retentivity is not enabled, the shift function restarts at S0 or S15 after a power loss.

Note :

The special function shift register can be used only once in the circuit program.

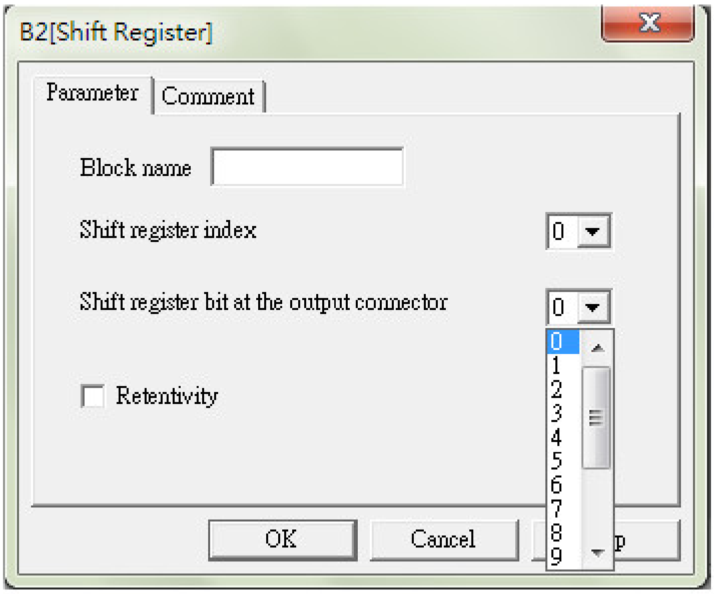
■ for 5/6 Series :

The shift register function reads an input value and shifts the bits. The output value corresponds with the configured shift register bit. The shift direction can be changed at a special input.
You can use a maximum of four shift registers with 16 bits for each shift register in one circuit program.

Connection	Description
Input **In**	The function when started reads this input value.
Input **Trg**	The SFB is started with a positive edge (0 to 1 transition) at input Trg (Trigger). A 1 to 0 transition is irrelevant.
Input **Dir**	You define the shift direction of the shift register bits Sx.0 to Sx.15 at the Dir input: Dir = 0: shift up (Sx.0 >> Sx.15) Dir = 1: shift down (Sx.15 >> Sx.0) **NOTE:** "x" refers to the index of the shift register.
Parameter	**Shift register index:** the index of shift register in the circuit program. Possible settings: 0 to 3 **Shift register bit** that determines the value of output Q. Possible settings: 0 to 15 **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	The output value corresponds with the configured shift register bit.

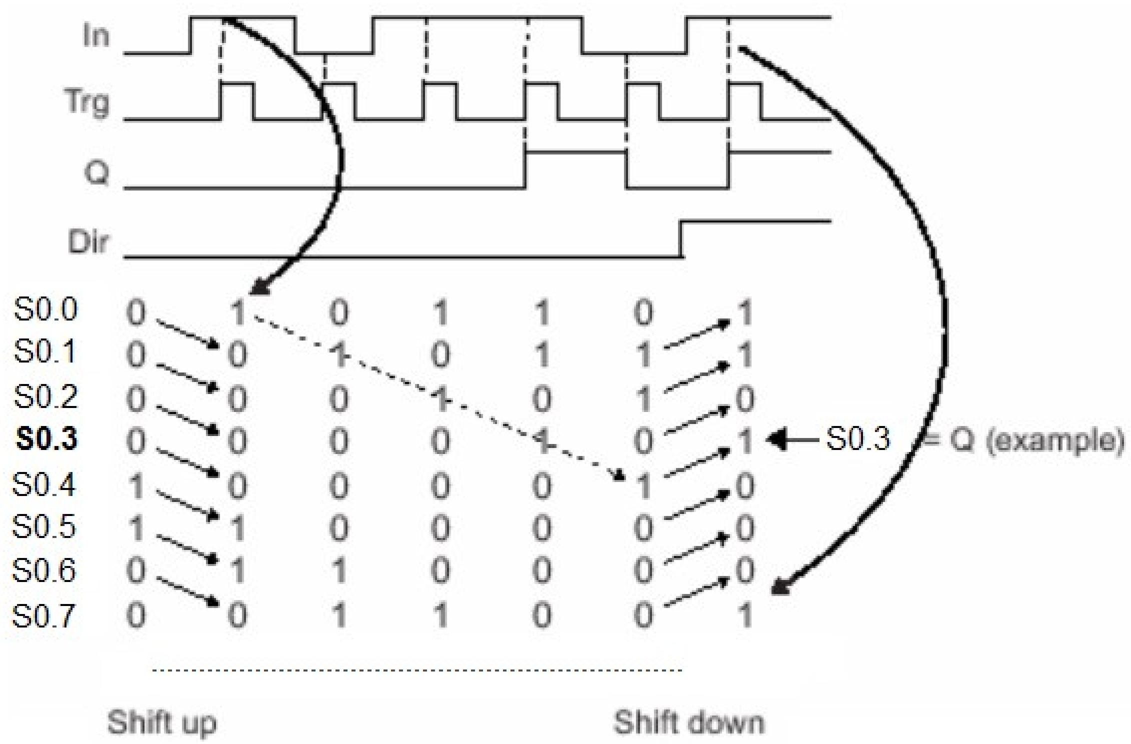
Parameter

5/6 series devices provide four shift registers, with 16 bits for each shift register. The shift register index correponds to one of the four shift registers in the circuit program. The shift register bits are numbered in Sx.y, in which x is the index, and y is the bit number.



Timing diagram

If the shift register index is 0, the shift register bits will be S0.0 to S0.15.



Description of the function

The function reads the value of input In with a positive edge (0 to 1 transition) at input Trg (Trigger).

This value is written to shift register bits Sx.0 to Sx.15, depending on the set shift direction:

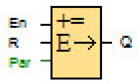
- Dir = 0 (Shift up): Sx.0 accepts the value of input In, the previous value of Sx.0 is shifted to Sx.1, Sx.1 to Sx.2 ... Sx.14 to Sx.15

- Dir = 1 (Shift down): Sx.15 accepts the value of input In; the previous value of Sx.15 is shifted to Sx.14, Sx.14 to Sx.13 ... Sx.1 to Sx.0.

Q outputs the value of the configured shift register bits.

If retentivity is not enabled, the shift function restarts at Sx.0 or Sx.15 after a power failure.

MathDetection



The Mathematical instruction error detection block sets an output if an error has occurred in the referenced Mathematical instruction function block.

Connection	Description
Input **En**	Enable the mathematic instruction error detection function block.
Input **R**	Reset the output.
Parameter	**Referenced FB:** block number of an mathematic instruction **Error to detect:** Zero division, Overflow, or Zero division OR Overflow. **Auto Reset:** Reset the output when the failure condition clears.
Output **Q**	Q is set high if the error to detect occurred in the last execution of the referenced mathematic instruction function block.

Parameter Referenced FB

The value for the Referenced FB parameter references the block number of a programmed Mathematical instruction function block.

Description of the function

The Mathematical instruction error detection block sets the output when the referenced Mathematical instruction function block has an error. You can program the function to set the output on a zero division error, an overflow error, or when either type of error occurs.

If you select the Automatically reset checkbox, the output is reset prior to the next execution of the function block.
If not, the output retains its state until the Mathematical instruction error detection block is reset with the R parameter.

In any scan cycle, if the referenced Mathematical instruction function block executes before the Mathematical instruction error detection function block, the error is detected in the same scan cycle. If the referenced Mathematical instruction function block executes after the Mathematical instruction error detection function block, the error is detected in the next scan cycle.

Mathematical instruction error detection logic table

In the table below, Error to Detect represents the parameter of the Mathematical instruction error detection instruction that selects which type of error to detect.

Zero represents the zero division bit set by the Mathematical instruction instruction at the end of its execution: 1 if the error occurred, 0 if not.

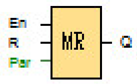
OF represents the overflow bit set by the Mathematical instruction instruction: 1 if the error occurred, 0 if not. Zero division OR Overflow represents the logical OR of the zero division bit and the overflow bit of the referenced Mathematical instruction instruction.

Output (Q) represents the output of the Mathematical instruction error detection function. An “x” indicates that the bit can be either 0 or 1 with no influence on the output.

Error to Detect	Zero	OF	Output (Q)
Zero division	1	x	1
Zero division	0	x	0
Overflow	x	1	1
Overflow	x	0	0
Zero division OR Overflow	1	0	1
Zero division OR Overflow	0	1	1
Zero division OR Overflow	1	1	1
Zero division OR Overflow	0	0	0

If the Referenced Mathematical instruction FB is null, then the output is always 0.

Modbus Read



When the signal at En is high, the Modbus Read block will be activated. And the controller can communicate with a peripheral device as a master via RS232 or RS485 interface. Furthermore, the output will be switched on if the communication is established successfully, otherwise the output remains "off" if the communication is failed.

A signal at input R resets output Q and disables the block at the same time.

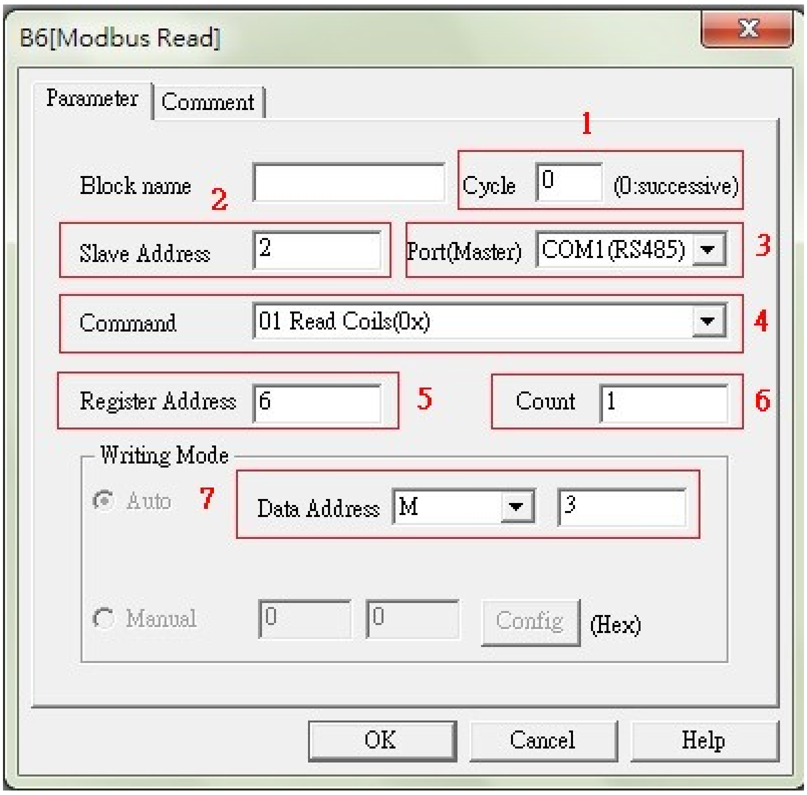
Connection	Description
Input **En**	A high signal at En input activates the "Modbus Read" function block.
Input **R**	Reset the value read from peripheral and set the output to 0 via the input R (Reset). Reset has higher priority than En.
Parameter	**Cycle :** transmission times: 0 ~ 9999 (cycle = 0 : continuous transmission) **Slave address :** 1 ~ 255, the default value is 1. **Port(Master) :** COM0(RS232) or COM1(RS485) or COM2(RS485) **Command :** Modbus function code : 01 Read Coils(0x) 02 Read Discrete Inputs(1x) 03 Read Holding Registers(4x) 04 Read Input Registers(3x) **Register Address :** The address of the first coil/input/register to be read data. **Count :** The total number of coils/inputs/registers requested. count <= 128 , if command = 01 or 02. count <= 32, if command = 03 or 04. **Data Address :** The starting address of the memoy to store the read data.
Output **Q**	Q is set or reset depending on the communication status. Q=1, if the communication is successful. Q=0, if the communication is failed.

Note : This function is available only if the Model of COM Port is set to Master.

Example : Read the status of the digital input I6 (address = 00007) of a Slave controller, which is a remote I/O module and its Slave Address is 2, and then save the status of I6 to M3 via COM1

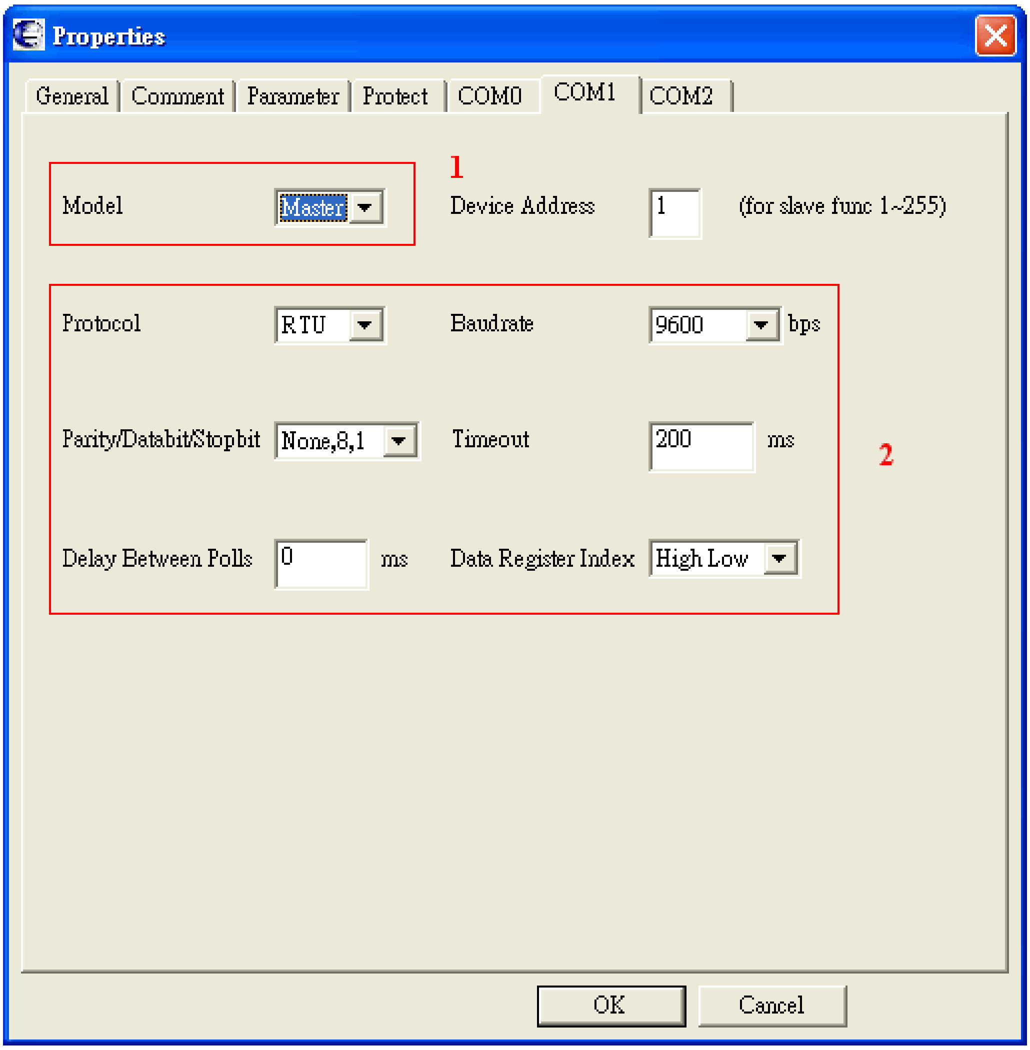
(RS485).

Setp 1 : Place a Modbus Read function block into your circuit program and set the parameters.



(1). Cycle = 0 (successive)
(2). Slave Address = 2
(3). Port(Master) = COM1(RS485)
(4). Command = 01 Read Coils(0x)
(5). Register Address = 6 (Modbus address = 00007, start address = 0007 - 1 = 0006)
(6). Count = 1
(7). Data Address = M3

Step 2 : Make the following settings.

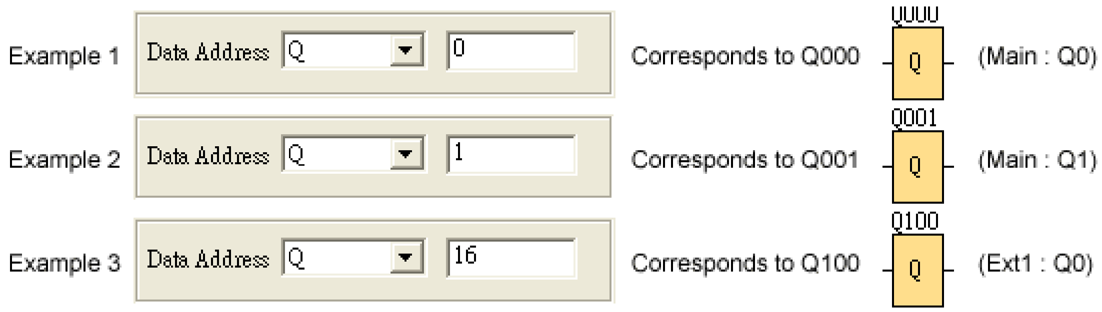


(1). Options → Properties → COM1 : Model = Master.
(2). Choose a protocol and communication settings.

Step 3 : When En =1, controller sends the Modbus messages via COM1 continuously.

Q=1, if communication is successful.
Q=0, if communication is failed.

Note : The numbers of Q, I, AI, AQ and AM in Data Address are continuous. In Example 3 below, the number of Q should be set as Q16 instead of Q100. The same rule is applicable to I, AI, AQ and AM. The rule is also applicable to the Modbus Write function block.



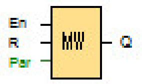
The following table illustrates how to set the parameters.

MODEL	Modbus Dialog Box	I,Q,AI,AQ Number	I,Q,AI,AQ Block
Main	I0-I31	I000-I031	Main : I0-31
	Q0-Q15	Q000-Q015	Main : Q0-Q15
	AI0-AI7	AI000-AI007	Main : AI0–AI7
	AQ0-AQ3	AQ000-AQ003	Main : AQ0-AQ3
Expansion 1 (Ext1)	I32-I63	I100-I131	Ext1 : I0 - I31
	Q16-Q31	Q100-Q115	Ext1 : Q0-Q15
	AI8-AI15	AI100-AI107	Ext1 : AI0-AI7
	AQ4-AQ7	AQ100-AQ103	Ext1 : AQ0-AQ3
Expansion 2 (Ext2)	I64-I95	I200-I231	Ext2 : I0-I31
	Q32-Q47	Q200-Q215	Ext2 : Q0-Q15
	AI16-AI23	AI200-AI207	Ext2 : AI0-AI7
	AQ8-AQ11	AQ200-AQ203	Ext2 : AQ0-AQ3
The contents of Ext3 ~ Ext7 are the same as Ext1's and Ext2's.			

Data format instructions

Name	Data format
I , Q , M	Bit
AI , AQ , AM	Signed Short Integer (16 bits)

Modbus Write



When the signal at En is high, the Modbus Write block will be activated and the controller can communicate with a peripheral device as a master via RS232 or RS485 interface. Furthermore, the output will be switched on if the communication is established successfully, otherwise the output remains "off" if the communication is failed.

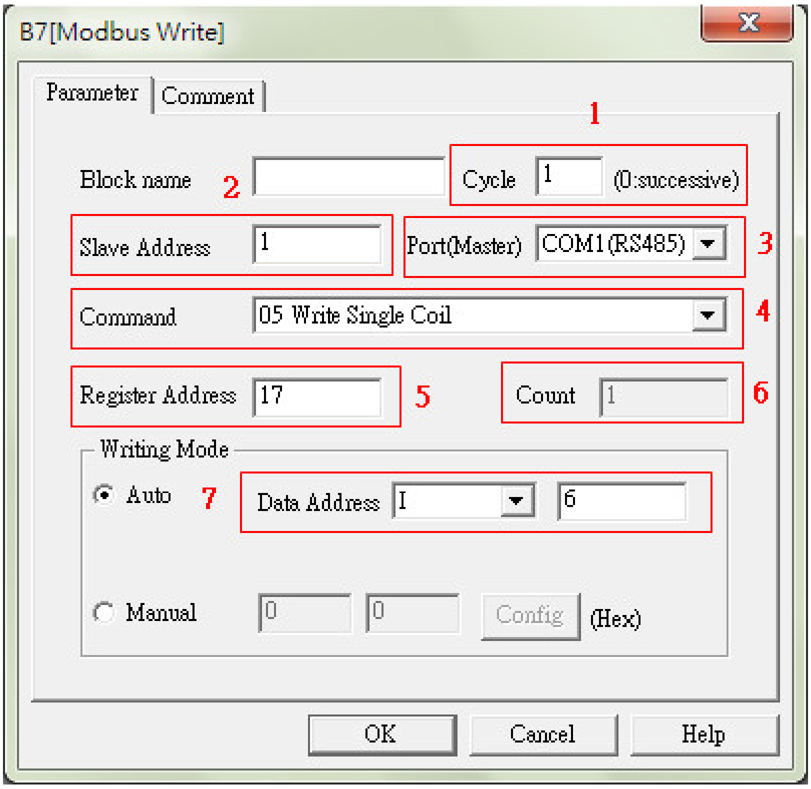
A signal at input R resets output Q and disables the block at the same time.

Connection	Description
Input **En**	A high signal at En input activates the "Modbus Write" function block.
Input **R**	Reset the output. Reset has higher priority than En.
Parameter	**Cycle :** transmission times: 1 ~ 9999 , cycle = 0 --> continuous transmission **Slave address :** 1 ~ 255, the default value is 1. **Port(Master) :** COM0(RS232) or COM1(RS485) or COM2(RS485) **Command :** Modbus function code : 05 Write Single Coil 06 Write Single Register 15 Write Multiple Coils 16 Write Multiple Registers **Register Address :** The address of the first coil/register to store the **write** data. **Count :** The total number of coils/registers written. count = 1 , if command = 05 or 06. count <= 32 , if command = 15. count <= 2, if command = 16. **Writing Mode :** The mode can be either of the following options: **Auto --> Data Address :** The starting address of the memoy to be **write** data. The data is then written to Register Address. **Manual :** The assigned value is written to Register Address.
Output **Q**	Q is set or reset depending on the communication status. Q=1, if the communication is successful. Q=0, if the communication is failed.

Note : This function is available only if the Model of COM Port is set to Master.

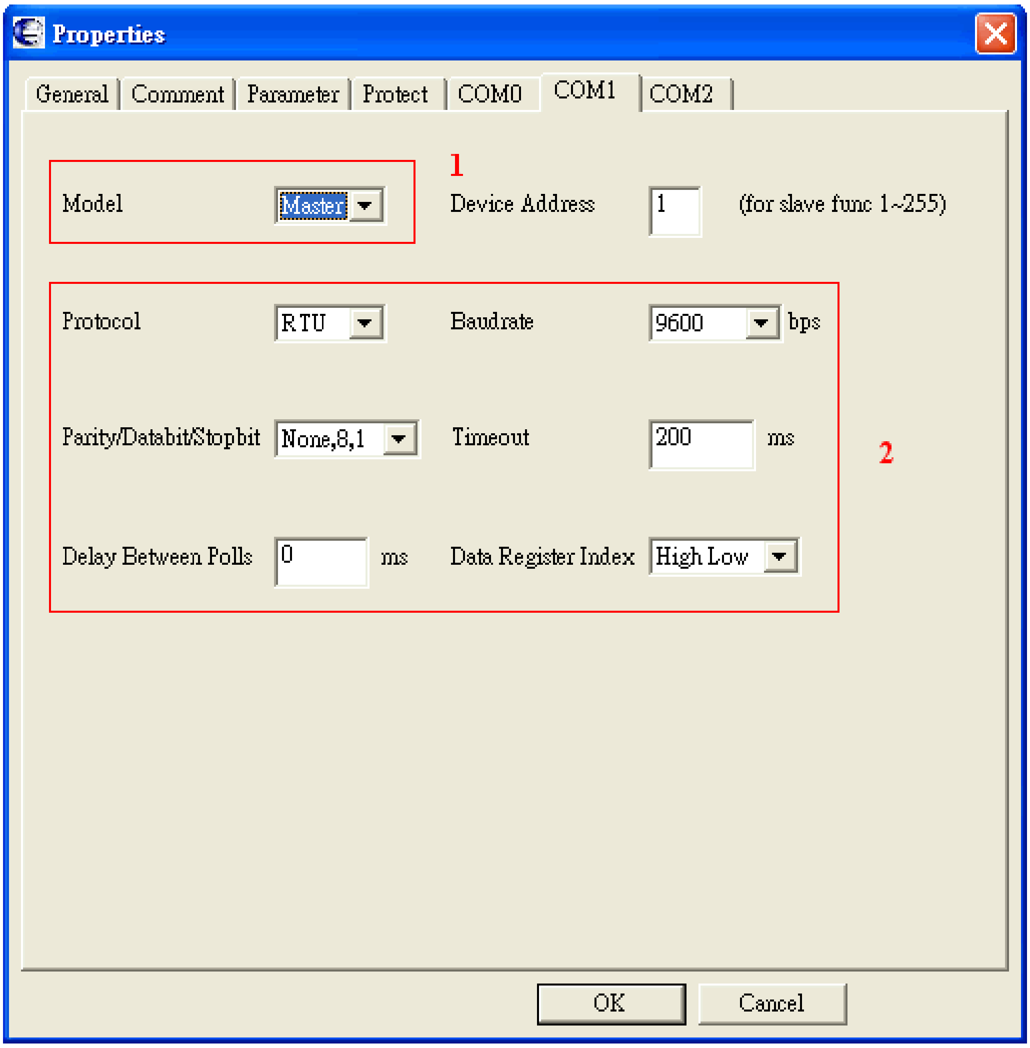
Example : Write the status of the digital input I6 (address = 00007) of a Master controller to the digital output Q2 (address = 00018) of a Slave controller via COM1(RS485). The Slave module is a remote I/O module and its Slave Address is 1.

Setp 1 : Place a Modbus Write function block into your circuit program and set the parameters.



(1). Cycle = 1
(2). Slave Address = 1
(3). Port(Master) = COM1(RS485)
(4). Command = 05 Write Single Coil
(5). Register Address = 0017 (Modbus address = 00018, start address = 0018 - 1 = 0017)
(6). Count = 1
(7). Data Address = I6

Step 2 : Make the following settings.

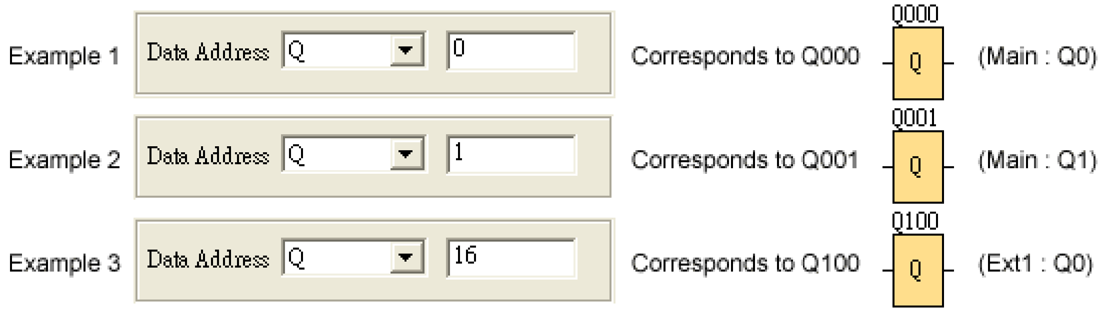


(1). Options → Properties → COM1 : Model = Master.
(2). Choose a protocol and communication settings.

Step 3 : When En =1, controller sends the Modbus messages via COM1 continuously.

Q=1, if communication is successful.
Q=0, if communication is failed.

Note : The numbers of Q, I, AI, AQ and AM in Data Address are continuous. In Example 3 below, the number of Q should be set as Q16 instead of Q100. The same rule is applicable to I, AI, AQ and AM. The rule is also applicable to the Modbus Read function block.



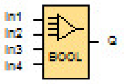
The following table illustrates how to set the parameters.

MODEL	Modbus Dialog Box	I,Q,AI,AQ Number	I,Q,AI,AQ Block
Main	I0-I31	I000-I031	Main : I0-31
	Q0-Q15	Q000-Q015	Main : Q0-Q15
	AI0-AI7	AI000-AI007	Main : AI0–AI7
	AQ0-AQ3	AQ000-AQ003	Main : AQ0-AQ3
Expansion 1 (Ext1)	I32-I63	I100-I131	Ext1 : I0 - I31
	Q16-Q31	Q100-Q115	Ext1 : Q0-Q15
	AI8-AI15	AI100-AI107	Ext1 : AI0-AI7
	AQ4-AQ7	AQ100-AQ103	Ext1 : AQ0-AQ3
Expansion 2 (Ext2)	I64-I95	I200-I231	Ext2 : I0-I31
	Q32-Q47	Q200-Q215	Ext2 : Q0-Q15
	AI16-AI23	AI200-AI207	Ext2 : AI0-AI7
	AQ8-AQ11	AQ200-AQ203	Ext2 : AQ0-AQ3
The contents of Ext3 ~ Ext7 are the same as Ext1's and Ext2's.			

Data format instructions

Name	Data format
I , Q , M	Bit
AI , AQ , AM	Signed Short Integer (16 bits)

Boolean function



The **BOOLEAN** function gives the value of the output according to the combination of inputs.
The function has four inputs, and therefore 16 combinations. These combinations can be found in a truth table; for each of these, the output value can be adjusted. The number of configurable combinations depends on the number of inputs connected to the function.
Non-connected inputs are set to 0.

The following diagram shows an example of part of the Boolean function truth table:

Index	In1	In2	In3	In4	Output Set
1	0	0	0	0	1
2	0	0	0	1	1
3	0	0	1	0	1
4	0	0	1	1	0
5	0	1	0	0	0
6	0	1	0	1	1
7	0	1	1	0	0
8	0	1	1	1	1
9	1	0	0	0	1
10	1	0	0	1	1
11	1	0	1	0	1
12	1	0	1	1	0
13	1	1	0	0	0
14	1	1	0	1	0
15	1	1	1	0	1
16	1	1	1	1	0

Combinations of Inputs   Output status

Parameters

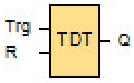
Having connected at least one input, you can configure the value of the output in the truth table, in the Parameters window.

The output values can be 0 for the Inactive state, and 1 for the Active state.

By selecting the Output ON if result is TRUE option, the output takes the value configured in the truth table.

By selecting the Output OFF if result is TRUE option, the output takes the inverse value of the value configured in the truth table.

TDT



Record the current time (year / month / day / hour / minute / second) to a specific memory.

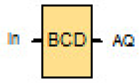
Connection	Description
Input **Trg**	When Trg is low to high , write date and time to memory (YYMMDDHHMMSS)
Input **R**	Reset output and memory data
Parameter	**Retentivity** set (on) = the status is retentive in memory.
Output **Q**	When writing success，Output Q = 1.

Calculation rule

When Input Trg = low to high, the accurate date will be recorded in the memory of functional block. The following table:

Modbus Address	Description	R/W	Note
42001	Output Status _ B0	R	B0
42002	YYMM (Year/Month) _ B0	R	B0
42003	DDHH (Day/Time) _ B0	R	B0
42004	MMSS (Minute/Second) _ B0	R	B0
42005	Output Status _ B1	R	B1
42006	YYMM (Year/Month) _ B1	R	B1
42007	DDHH (Day/Time) _ B1	R	B1
42008	MMSS (Minute/Second) _ B1	R	B1
....			

BCD



Binary to BCD conversion

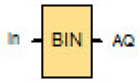
Connection	Description
Input **IN**	Integer value Value range : 0 ~ 9999
Output **AQ**	Integer value

Calculation rule

If Input IN = 1234 , then Output AQ = 0x1234

If Input IN = 9999 , then Output AQ = 0x9999

BIN



BCD to Binary conversion.

Connection	Description
Input **IN**	Integer value Value range : 0x0000 ~ 0x9999 and each of digit must not exceed 9
Output **AQ**	Integer value (Q=0 for invalid value)

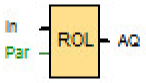
Calculation rule

If Input IN = 0x1234 , then Output AQ = 1234

If Input IN = 0x9999 , then Output AQ = 9999

If Input IN = 0x12A4 , then Output AQ = 0 (Q=0 for invalid value)

ROL



Make the bits of an integer rotate to the left. Rotation is made on 16 bits.

Connection	Description
Input **IN**	Any integer value
Parameter	**NbR** : Number of 1 bit rotations (in set [1..15])
Output **AQ**	Left rotated value (no effect if NbR <= 0)

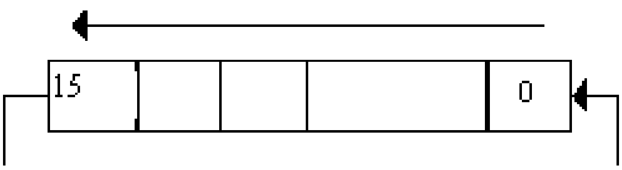
Parameters NbR

The NbR can be provided by the actual value of another programmed function.

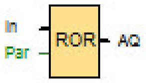
Calculation rule

IN = 21385 (Binary: 0101 0011 1000 1001) , NbS = 2

---> Output AQ = 20005 (Binary: 0100 1110 0010 0101)



ROR



Make the bits of an integer rotate to the right. Rotation is made on 16 bits.

Connection	Description
Input **IN**	Any integer value
Parameter	**NbR** : Number of 1 bit rotations (in set [1..15])
Output **AQ**	Right rotated value (no effect if NbR <= 0)

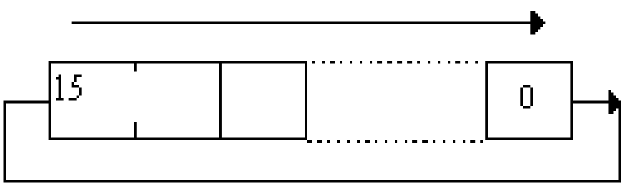
Parameters NbR

The NbR can be provided by the actual value of another programmed function.

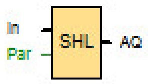
Calculation rule

IN= 5001 (Binary: 0001 0011 1000 1001) , NbS = 2

---> Output AQ = 17634 (Binary: 0100 0100 1110 0010)



SHL



Shifts the 16 bits of an integer to the left and places a 0 in the least significant bit.

Connection	Description
Input **IN**	Any integer value
Parameter	**NbS** : Number of 1 bit shifts (in set [1..15])
Output **AQ**	Left shifted value (no effect if NbS <= 0) 0 replaces the least significant bit

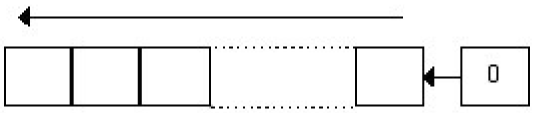
Parameters NbS

The NbS can be provided by the actual value of another programmed function.

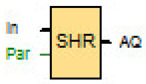
Calculation rule

IN= 5001 (Binary: 0001 0011 1000 1001) , NbS = 1

---> Output AQ = 10002 (Binary: 0010 0111 0001 0010)



SHR



Shifts the 16 bits of an integer to the right and places a 0 in the most significant bit.

Connection	Description
Input **IN**	Any integer value
Parameter	**NbS** : Number of 1 bit shifts (in set [1..15])
Output **AQ**	Right shifted value (no effect if NbS <= 0) 0 replaces the most significant bit

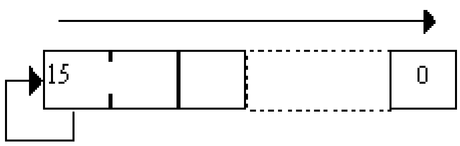
Parameters NbS

The NbS can be provided by the actual value of another programmed function.

Calculation rule

IN= 5001 (Binary: 0001 0011 1000 1001) , NbS = 1

---> Output AQ = 2500 (Binary: 0000 1001 1100 0100)



AND_MASK

Bit-to-bit logical **AND** between Input IN and MSK

Connection	Description
Input **IN**	Any integer value
Parameter	**MSK** : 16-bit value
Output **AQ**	Bit-to-bit logical **AND** between Input IN and MSK

Parameters MSK

The MSK can be provided by the actual value of another programmed function.

OR_MASK

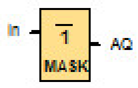
Bit-to-bit logical **OR** between Input IN and MSK

Connection	Description
Input **IN**	Any integer value
Parameter	**MSK** : 16-bit value
Output **AQ**	Bit-to-bit logical **OR** between Input IN and MSK

Parameters MSK

The MSK can be provided by the actual value of another programmed function.

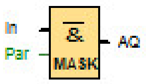
NOT_MASK



Bit-to-bit logical **NOT** of Input IN

Connection	Description
Input **IN**	Any integer value
Output **AQ**	Bit-to-bit logical **NOT** of Input IN.

NAND_MASK



Bit-to-bit logical **NAND** between Input IN and MSK

Connection	Description
Input **IN**	Any integer value
Parameter	**MSK** : 16-bit value
Output **AQ**	Bit-to-bit logical **NAND** between Input IN and MSK

Parameters MSK

The MSK can be provided by the actual value of another programmed function.

NOR_MASK

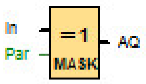
Bit-to-bit logical **NOR** between Input IN and MSK

Connection	Description
Input **IN**	Any integer value
Parameter	**MSK** : 16-bit value
Output **AQ**	Bit-to-bit logical **NOR** between Input IN and MSK

Parameters MSK

The MSK can be provided by the actual value of another programmed function.

XOR_MASK



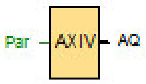
Bit-to-bit logical **XOR** between Input IN and MSK

Connection	Description
Input **IN**	Any integer value
Parameter	**MSK** : 16-bit value
Output **AQ**	Bit-to-bit logical **XOR** between Input IN and MSK

Parameters MSK

The MSK can be provided by the actual value of another programmed function.

ARRMX_MI_AV



Get the maximum / minimum / average of array.

Connection	Description
Parameter	**Mode** : MAX / MIN / AVG **Data address** : AMx / AIx / AQx Array starting address **Count** : the value of array [1~32]
Output **AQ**	The maximum / minimum / average of output array.

Parameters Mode and Number

The mode and the number can be provided by the actual value of another programmed function.

Calculation rule

Mode=MAX, Data address=AM2 , Count =3 , (AM2=2 , AM3=6, AM4=13) : Output AQ = 13

Mode=MIN, Data address=AM2 , Count =3 , (AM2=2, AM3=6, AM4=13) : Output AQ = 2

Mode=AVG, Data address=AM2 , Count =3 , (M2=2, AM3=6, AM4=13) : Output AQ = (2+6+13) / 3 = 7

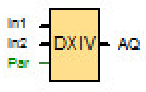
Mode=MAX, Data address=AQ3 , Count =2 , (AQ3=2 , AQ4=6) : Output AQ = 6

The following table illustrates how to set the parameters.

MODEL	ARR Dialog Box	AI,AQ Number	AI,AQ Block
Main	AI0-AI7	AI000-AI007	Main : AI0–AI7
	AQ0-AQ3	AQ000-AQ003	Main : AQ0-AQ3
Expansion 1 (Ext1)	AI8-AI15	AI100-AI107	Ext1 : AI0-AI7
	AQ4-AQ7	AQ100-AQ103	Ext1 : AQ0-AQ3
Expansion 2	AI16-AI23	AI200-AI207	Ext2 : AI0-AI7

(Ext2)	AQ8-AQ11	AQ200-AQ203	Ext2 : AQ0-AQ3
The contents of Ext3 ~ Ext7 are the same as Ext1's and Ext2's.			

ACMX_MI_AV



Get the maximum / minimum / average of IN1, IN2.

Connection	Description
Input **IN1**	Any 16-bit input value.
Input **IN2**	Any 16-bit input value.
Parameter	**Mode** : MAX / MIN / AVG.
Output **AQ**	Output maximum / minimum / average of IN1, IN2.

Parameters Mode

The mode can be provided by the actual value of another programmed function.

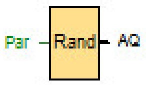
Calculation rule

IN1= 2 , IN2= 8 , Mode = MAX : Output AQ = 8

IN1= 2 , IN2= 8 , Mode = MIN : Output AQ = 2

IN1= 2 , IN2= 8 , Mode = AVG : Output Q = (2 + 8) / 2 = 5

RAND



Gives a random integer value in a given range.

Connection	Description
Parameter	**Base :** Defines the allowed set of number
Output **AQ**	Random value in set [0..base-1]

Parameters Base

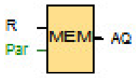
The base can be provided by the actual value of another programmed function.

Calculation rule

Base = 10 : Output AQ = 0 to 9

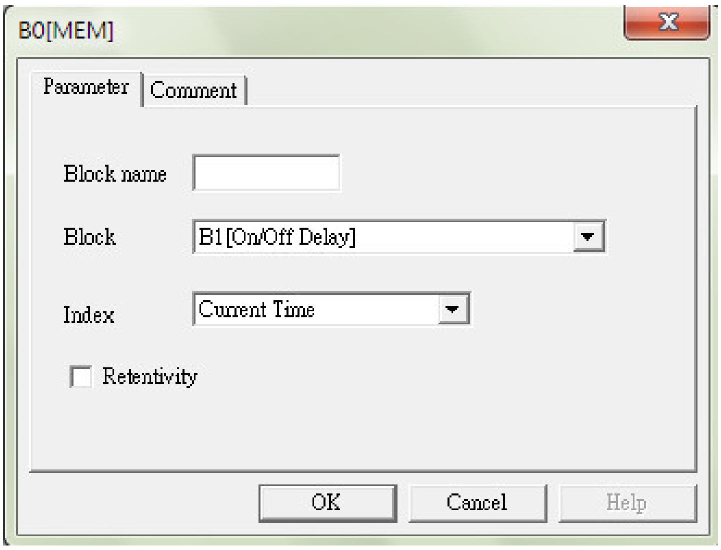
Base = 15 : Output AQ = 0 to 14

MEM



Get the parameter of another,already configured function.

Connection	Description
Input **R**	Reset output to 0
Parameter	**Par:** Parameter of another, already configured function.
Output **AQ**	Output the parameter value Value range : -32768 ~ 32767



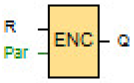
Calculation rule

If input reset = 0, then output AQ will directly output the current parameter.

(range : -32768 ~ 32767)

If input reset = 1, then output AQ = 0.

ENCODER



Get the encoder value from I0/I1 or I2/I3.

Connection	Description
Input **R**	Reset output
Parameter	**Start Value** :Initial value from which to begin counting. Value range: -999999 ~ 999999 **Encoder Source** : 0 --> I0/I1 , 1 --> I2/I3 **On**: On threshold Value range: -999999 ~ 999999 **Off**: Off threshold Value range: -999999 ~ 999999 **Retentivity** set (on) = the status is retentive in memory.
Output **Q**	Q is set and reset according to the actual value at Cnt and the set thresholds.

Parameters On and Off

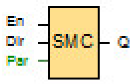
The on and off thresholds can be provided by the actual value of another programmed function.

Calculation rule

- If the on threshold >= off threshold, then:
  Q = 1, if Cnt >= On
  Q = 0, if Cnt < Off.

- If the on threshold < off threshold, then:
  Q = 1, if On <= Cnt < Off.
  Q = 0, if Cnt >= Off or Cnt < On

Stepping Motor Control



Generate pulse signal to drive stepping motor.

Connection	Description
Input **En**	0: Start to generate pulse signal. 1: Stop to generate pulse signal.
Input **Dir**	0 : CW (clock_wise) 1 : CCW (count clock-wise)
Parameter	**Mode :** Half step (1-2 phase excite megatic, each step 0.9 degree) Full step (1-2 phase excite megatic, each step 1.8 degree) **Pin :** Q0~Q3 Q4~Q7 **Speed :** 0.01 ms/step (Half step mode) 0.02 ms/step (Full step mode) Value range : 0 ~ 99999999
Output **Q**	Q is set and reset according to the Input En.

Parameters Period T

The Speed can be provided by the actual value of another programmed function.

Example

Set stepping motor 1000ms per circle(360 dgree).

- Mode = Half step
  A circle = 360 degree = 0.9(degree/step) x 400(step)
  --> 1000 ms needs to send 400 steps (pulses)
  --> A step need 1000/400 = 2.5 ms
  --> Speed = 2.5 / 0.01 = 250

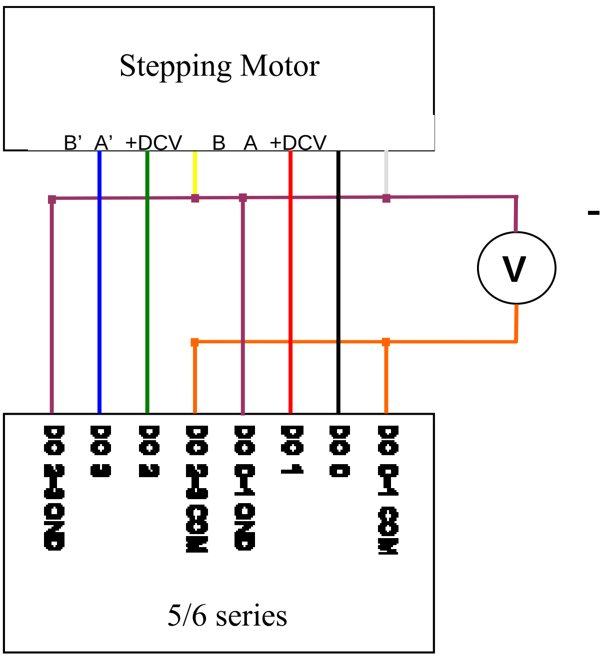
- Mode = Full step
  A circle = 360 degree = 1.8(degree/step) x 200(step)

--> 1000 ms needs to send 200 steps (pulses)

--> A step need 1000/200 = 5 ms

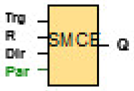
--> Period T = 5 / 0.02 = 250

Connection



* Only support 0.9 or 1.8 degree two phases of six wired stepping motor.

Stepping Motor Control (Edge)



Generate specific number of pulse signal to drive stepping motor.

Connection	Description
Input **Trg**	When trg=0 to 1 , start to generate specific number pulse signal.
Input **R**	Reset ouput and stop to generate pulse signal.
Input **Dir**	0 : CW (clock_wise) 1 : CCW (count clock-wise)
Parameter	**Mode :** Half step (1-2 phase excite megatic, each step 0.9 degree) Full step (1-2 phase excite megatic, each step 1.8 degree) **Out :** 0 --> Q0~Q3 1--> Q4~Q7 **Speed :** 0.01 ms/step (Half step mode) 0.02 ms/step (Full step mode) Value range : 0 ~ 99999999 **Steps :** Output the number of Steps. Value range : 0 ~ 99999999
Output **Q**	When output pulse signal, Output Q=1

Parameters T and Steps

The Speed and the Steps can be provided by the actual value of another programmed function.

Example

Set stepping motor 1000ms per circle (360 degree) and stop after 50 circles。

- Mode = Half step

A circle = 360 degree = 0.9(degree/step) x 400(step)
--> 1000 ms needs to send 400 steps (pulses)
--> A step need 1000/400 = 2.5 ms
--> Speed = 2.5 / 0.01 = 250 (0.01ms/step)
Steps = 50 (circles) x 400 (Steps/circle) = 2000 Steps

- Mode = Full step

A circle = 360 degree = 1.8(degree/step) x 200(step)

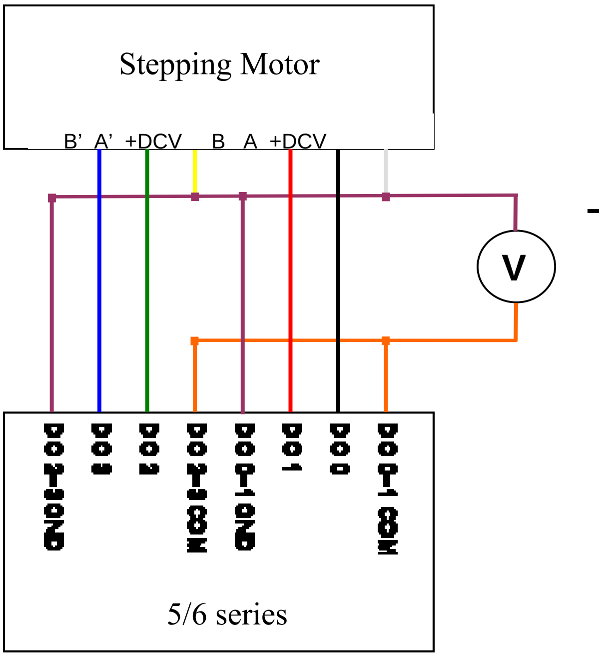
--> 1000 ms needs to send 200 steps (pulses)

--> A step need 1000/200 = 5 ms

--> Period T = 5 / 0.02 = 250 (0.02ms/step)

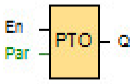
Steps = 50 (circles) x 200 (Steps/circle) = 1000 Steps

Connection



* Only support 0.9 or 1.8 degree two-phased of six wired stepping motor.

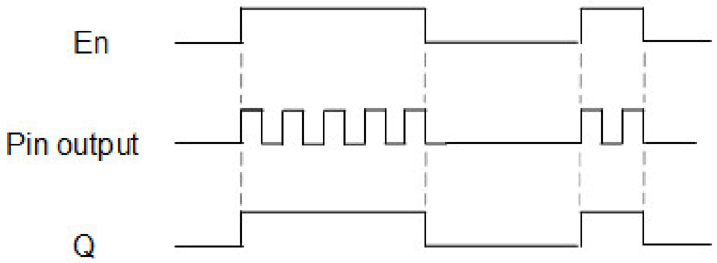
PTO (Pulse train output)



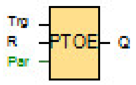
Pulse(duty=50%) continuous output.

Connection	Description
Input **En**	When En=1 , start to generate pulse continuous ouptput.
Parameter	**Pin :** Pulse output pin Q0 ~ Q3. Value range : 0 ~ 3 **Pulse width :** 0 ~ 10000000 (0.02ms / pulse). Value range : 0 ~ 99999999 ● pulse width = 1 → 1 x 0.02 ms/pulse → 0.00002 sec/pulse → 50K Hz ● pulse width = 10000000 → 10000000 x 0.02ms/pulse = 200000 ms/pulse → 200 sec/pulse → 0.005 Hz
Output **Q**	During the output pulse, Output = 1

Timing diagram



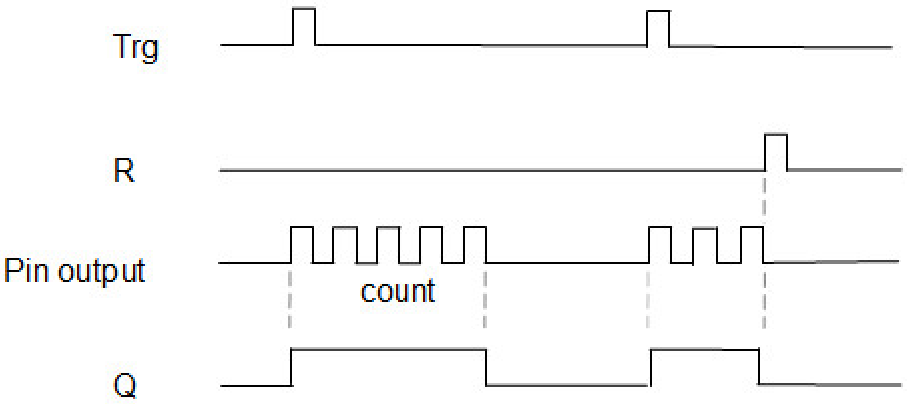
PTOE (Pulse train output)



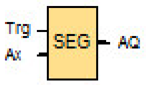
Output specific number of pulse(duty=50%).

Connection	Description
Input **Trg**	When trg = 0 to 1 , start to output the specific number of pulse.
Input **R**	Reset output and count value.
Parameter	**Pin :** Pulse output pin Q0 ~ Q3 , value range : 0 ~ 3 **Pulse width :** 0 ~ 99999999 (0.02ms / pulse). Value range : 0 ~ 99999999 ● pulse width = 1 → 1 x 0.02 ms/pulse → 0.00002 sec/pulse → 50K Hz ● pulse width = 10000000 → 10000000 x 0.02ms/pulse = 200000 ms/pulse → 200 sec/pulse → 0.005 Hz **Count :** The setting value of pulse number. Value range : 0 ~ 99999999
Output **Q**	During the output pulse, Output = 1

Timing diagram



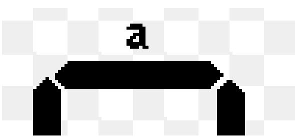
SEG



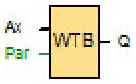
Turn hexadecimal values into seven-segment display encoding output.

Connection	Description
Input **Trg**	When Trg=1 , start to turn hexadecimal value into seven-segment display encoding output.
Input **Ax**	Hexadecimal value. value range : 0(Hex) ~ F(Hex)
Output **AQ**	Encoding output of seven-segment display.

Ax	- g f e d c b a	Output AQ
0	0 0 1 1 1 1 1 1	0x3F
1	0 0 0 0 0 1 1 0	0x06
2	0 1 0 1 1 0 1 1	0x5B
3	0 1 0 0 1 1 1 1	0x4F
4	0 1 1 0 0 1 1 0	0x66
5	0 1 1 0 1 1 0 1	0x6D
6	0 1 1 1 1 1 0 1	0x7D
7	0 0 0 0 0 1 1 1	0x07
8	0 1 1 1 1 1 1 1	0x7F
9	0 1 1 0 0 1 1 1	0x67
A	0 1 1 1 0 1 1 1	0x77
B	0 1 1 1 1 1 0 0	0x7C
C	0 0 1 1 1 0 0 1	0x39
D	0 1 0 1 1 1 1 0	0x5E
E	0 1 1 1 1 0 0 1	0x79
F	0 1 1 1 0 0 0 1	0x71



Word to Bit

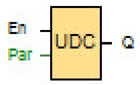


Obtained the value of a particular bit in 16-bit data.

Connection	Description
Input **Ax**	16-bit value.
Parameter	**Nb** : To take the first few bit output. Value range : 0 ~ 15
Output **Q**	Ouput the value of bit.

<table>
<tr><th>Input Ax</th><th>Binary</th><th>Nb</th><th>Output</th></tr>
<tr><td rowspan="16">0x1234</td><td rowspan="16">0001 0010 0011 0100</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td></tr>
<tr><td>2</td><td>1</td></tr>
<tr><td>3</td><td>0</td></tr>
<tr><td>4</td><td>1</td></tr>
<tr><td>5</td><td>1</td></tr>
<tr><td>6</td><td>0</td></tr>
<tr><td>7</td><td>0</td></tr>
<tr><td>8</td><td>0</td></tr>
<tr><td>9</td><td>1</td></tr>
<tr><td>10</td><td>0</td></tr>
<tr><td>11</td><td>0</td></tr>
<tr><td>12</td><td>1</td></tr>
<tr><td>13</td><td>0</td></tr>
<tr><td>14</td><td>0</td></tr>
<tr><td>15</td><td>0</td></tr>
</table>

UDC



Transmission of custom format data through communication port. When the transmission of prefix or end characters is selected, the transferred data will add a prefix or end characters. When receiving prefix or receiving end characters is selected, the received data will first check the prefix or end characters.If the information correct, the data will be filled in the receiving address.

Connection	Description
Input **En**	0 --> disable , 1-->enable.
Parameter	**Com port :** 0 ~ 2 (com0 ~ com2) **Tx_Pre_Char :** transmit prefix character **Tx_End_Char :** transmit end character **Tx_Start :** AI0~AI63 / AM0~AM511 / AQ0 ~ AQ31 **Tx_Num :** transmit words. Value range: 1~127 (not include prefix and end character) **Rx_Pre_Char :** receive prefix character **Rx_End_Char :** receive end character **Rx_Start :** AM0~AM511 **Rx_Num :** receive words. Value range: 1~127 (not include prefix and end character) **Cycle :** transmission times. Value range : 0 ~ 9999 (cycle = 0 : continuous transmission)
Output **Q**	When transmission success，output = 1

Example :

Tx_Pre_Char = 0x03, Tx_End_Char = 0x0A , Tx_Start = AM0, Tx_Num = 3,
Rx_Pre_Char = 0x03, Rx_End_Char = 0x0A, Rx_Start = AM16, Rx_Num = 4,
AM0=0x2211, AM1=4433, AM2=0x6655, Cycle = 1, Com port = 0.

- **Tx :**
  1. When Tx_Pre_Char and Tx_End_Char are unchecked, Input En = 1 --> the data frame below will be transmitted(once) in order from rs-232 port (com0)Data frame :
     Tx : 11 22 33 44 55 66 (Hex)

2. When Tx_Pre_Char and Tx_End_Char are checked, Input En = 1 --> the data frame below will be transmitted (once) in order from rs-232 port (com0).
Tx : 03 11 22 33 44 55 66 0A (Hex)

- **Rx :**

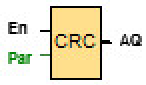
1. When Rx_Pre_Char and Rx_End_Char are unchecked, the data 4 words(8 bytes) receive via rs-232(com0) will be sequentially add into AM16 ~ AM19. Assuming receive the data 4 words (8 bytes) is :
Rx : 99 88 77 66 55 44 33 22 (Hex)
AM16 = 0x8899 , AM17 = 0x6677 , AM18 = 0x4455 , AM19 = 0x2233

2. When Rx_Pre_Char and Rx_End_Char are checked, the prefix and end characters receive via rs-232(com0) will be checked first. If they are correct, the prefix and end characters will be eliminated then add value into AM16~AM19. Assuming receive the data is :
Rx : 03 99 88 77 66 55 44 33 22 0A (Hex)
AM16 = 0x8899 , AM17 = 0x6677 , AM18 = 0x4455 , AM19 = 0x2233

The following table illustrates how to set the parameters.

MODEL	UDC Dialog Box	AI,AQ Number	AI,AQ Block
Main	AI0-AI7	AI000-AI007	Main : AI0–AI7
	AQ0-AQ3	AQ000-AQ003	Main : AQ0-AQ3
Expansion 1 (Ext1)	AI8-AI15	AI100-AI107	Ext1 : AI0-AI7
	AQ4-AQ7	AQ100-AQ103	Ext1 : AQ0-AQ3
Expansion 2 (Ext2)	AI16-AI23	AI200-AI207	Ext2 : AI0-AI7
	AQ8-AQ11	AQ200-AQ203	Ext2 : AQ0-AQ3
The contents of Ext3 ~ Ext7 are the same as Ext1's and Ext2's.			

CRC16



Calculate the value of CRC16.

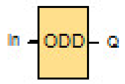
Connection	Description
Input **En**	When En=1 , start to calculate the value of CRC16.
Parameter	**Type :** CRC16 **Addrss_start :** startup address : AM0 ~ AM511 **Number :** number (words). Value range : 1~128
Output **AQ**	Directly output the value of CRC16

Example :

Start Address = AM0 , number = 5

When Input En = 1 ，Output AQ will output the value of CRC16 of AM0 ~ AM4.

ODD



Tests the parity of an integer: result is odd or even.

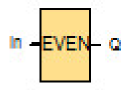
Connection	Description
Input **IN**	Any signed integer value
Output **Q**	TRUE if input value is odd FALSE if input value is even

Calculation rule

IN= 2 : Output Q = 0 (EVEN)

IN= 3 : Output Q = 1 (ODD)

EVEN



Tests the parity of an integer: result is even or odd

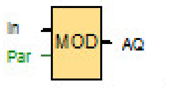
Connection	Description
Input **IN**	Any signed integer value
Output **Q**	TRUE if input value is even FALSE if input value is odd

Calculation rule

IN= 2 ---> Output Q = 1 (EVEN)

IN= 3 ---> Output Q = 0 (ODD)

MOD



Calculates the modulo of an integer value.

Connection	Description
Input **IN**	Any signed integer value
Parameter	**Base :** divisor
Output **AQ**	Modulo calculation (input MOD base) returns 0 if Base = 0

Parameters Base

The base can be provided by the actual value of another programmed function.

Calculation rule

1. If Input IN and Base are the sames sign, then the value of Output AQ and Input IN or Base are the same sign.

IN = 42 , Base = 5 --> 42 = 5 × 8 + 2 --> Output AQ = 2

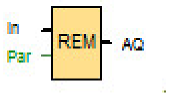
IN = - 42 , Base = - 5 --> - 42 = -5 × (-8) + (-2) --> Output AQ = - 2

2. If Input IN and Base have different sign, then the sign(positive or negative) of OutputAQ is depends on Base.

IN = 42 , Base = - 5 --> 42 = -5 × (-9) + (-3) --> Output AQ = -3

IN = - 42 , Base = 5 --> - 42 = 5 ×(-9) + 3 --> Output AQ = 3

REM



Calculates the remainder of an integer value.

Connection	Description
Input **IN**	Any signed integer value
Parameter	**Base :** divisor
Output **AQ**	Remainder calculation returns 0 if Base = 0

Parameters Base

The base can be provided by the actual value of another programmed function.

Calculation rule

1. Input IN and Base are the same sign --> The value of Output AQ and Input IN or Base are the same sign.

   IN = 42 , Base = 5 --> 42 = 5 × 8 + 2 --> Output AQ = 2

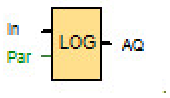
   IN = - 42 , Base = - 5 --> - 42 = -5 × (-8) + (-2) --> Output AQ = - 2

2. Input IN and Base have different sign --> The sign(positive or negative) of Output AQ is depend on Input IN

   IN = 42 , Base = - 5 --> 42 = -5 × (-8) + 2 --> Output AQ = 2

   IN = - 42 , Base = 5 --> - 42 = 5 × (-8) + (-2) --> Output AQ = - 2

LOG



Calculates the logarithm of a real value.

Connection	Description
Input **IN**	Must be greater than zero
Parameter	**Base**: e / 2 / 10 **Amp** : magnification (-10000.00 ~ 10000.00)
Output **AQ**	Logarithm of the input value multiply the value of Amp.

Parameters Base

The base can be provided by the actual value of another programmed function. Please refer to reference section.

Calculation rule

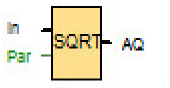
Output Q = $\log_{base}$(IN) × Amp

Base = 0 , IN = 10 , Amp = 10 : Output AQ = $\log_e(10) \times 10 = 2.30 \times 10 = 23$

Base = 1 , IN = 10 , Amp = 10 : Output AQ = $\log_2(10) \times 10 = 3.3 \times 10 = 33$

Base = 2 , IN = 10 , Amp = 10 : Output AQ = $\log_{10}(10) \times 10 = 1.0 \times 10 = 10$

SQRT



Calculates the square root of a real value.

Connection	Description
Input **IN**	Must be greater than or equal to zero
Parameter	**Amp** : magnification (-10000.00 ~ 10000.00)
Output **AQ**	Square root of the input value multiply the value of Amp. (if input IN<0, then Output AQ= -1)

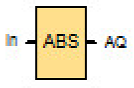
Calculation rule

Output Q = Sqr(IN) × Amp

IN = 9 , Amp = 1.0 : Output AQ = Sqrt(9) × 1.0 = 3

IN = 4 , Amp = 1.0 : Output AQ = Sqrt(4) × 1.0 = 2

ABS



Gives the absolute (positive) value of a real value

Connection	Description
Input **IN**	Any signed real value
Output **AQ**	Absolute value (always positive)

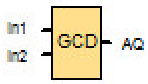
Calculation rule

Output Q = ABS(IN)

IN = 3 : AQ = ABS(3) = 3

IN = -3 : AQ = ABS(-3) = 3

GCD



Get Input IN1, IN2 greatest common divisor (GCD)

Connection	Description
Input **IN1**	Any 16-bit input value (IN1 > 0)
Input **IN2**	Any 16-bit input value (IN2 > 0)
Output **AQ**	The GCD of IN1 and IN2 . (AQ = 0 if Input IN1<=0 or IN2 <= 0)

Calculation rule

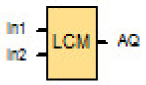
Output AQ = GCD(IN1 , IN2)

IN1 = 8 , IN2= 12 : AQ = GCD(8,12) = 4

IN1 = 3 , IN2= 5 : AQ = GCD(3,5) = 1

IN1 = -8 , IN2= 12 : AQ = GCD(-8,12) = 0 (Q=0 if IN1 <=0 or IN2<=0)

LCM



Get Input IN1 , IN2 lowest common multiple (LCM)

Connection	Description
Input **IN1**	Any 16-bit input value (IN1 > 0)
Input **IN2**	Any 16-bit input value (IN2 > 0)
Output **AQ**	The LCM of IN1 and IN2. (AQ = 0 if Input IN1<=0 or IN2<= 0)

Calculation rule

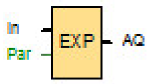
Output AQ = LCM(IN1 , IN2)

IN1 = 3 , IN2 = 5 : AQ = LCM(3,5) = 15

IN1 = 6 , IN2 = 9 : AQ = LCM(6,9) = 18

IN1 = -3 , IN2 = 5 : AQ = LCM(-3,5) = 0 (AQ=0 if IN1<=0 or IN2<=0)

EXP



Calculates the natural exponent value.

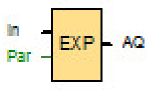
Connection	Description
Input **IN**	Any 16-bit input value
Parameter	**Amp** : Magnification Value range : -10000.00 ~ 10000.00
Output **AQ**	Output e to the power of Input IN then multiply the value of Amp

Calculation rule

Output AQ = e^{IN} × Amp

IN = 3 , Amp = 1.0 : Output AQ = e^3 × 1.0 = 20.085 = 20

EXP



Calculates the natural exponent value.

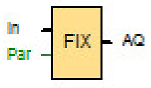
Connection	Description
Input **IN**	Any 16-bit input value
Parameter	**Amp** : Magnification Value range : -10000.00 ~ 10000.00
Output **AQ**	Output e to the power of Input IN then multiply the value of Amp

Calculation rule

Output AQ = e^{IN} × Amp

IN = 3 , Amp = 1.0 : Output AQ = e^3 × 1.0 = 20.085 = 20

FIX



Calculate the value of Input IN after round down.

Connection	Description
Input **IN**	Any 16-bit input value
Parameter	**Base** : Rounding down of numbers that begin from the first
Output **AQ**	The output value after round down(AQ=0 if Base exceed the digit of IN)

Parameters Base

The base can be provided by the actual value of another programmed function.

Calculation rule

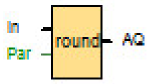
(1) IN >= 0 :

IN = 25836 , Base = 1 : Output AQ = 25830
IN = 25836 , Base = 2 : Output AQ = 25800
IN = 25836 , Base = 3 : Output AQ = 25000

(2) IN < 0 :

IN = -25836 , Base = 1 : Output AQ = -25830
IN = -25836 , Base = 2 : Output AQ = -25800
IN = -25836 , Base = 3 : Output AQ = -25000

ROUND



Calculate the value of Input IN after round off。

Connection	Description
Input **IN**	Any 16-bit input value
Parameter	**Base** : Rounding off of numbers that begin from the first
Output **AQ**	Output value after round off(AQ=0 if Base exceed the digit of IN)

Parameters Base

The base can be provided by the actual value of another programmed function.

Calculation rule

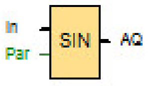
(1) IN >= 0 :

IN = 25836 , Base = 1 : Output AQ = 25840
IN = 25836 , Base = 2 : Output AQ = 25800
IN = 25836 , Base = 3 : Output AQ = 26000

(2) IN < 0 :

IN = -25836 , Base = 1 : Output AQ = -25840
IN = -25836 , Base = 2 : Output AQ = -25800
IN = -25836 , Base = 3 : Output AQ = -26000

SIN



Calculating sine of radians IN.

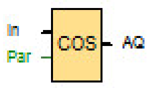
Connection	Description
Input **IN**	Any 16-bit input value (degree)
Parameter	**Amp** : Magnification Value range : -10000.00 ~ 10000.00
Output **AQ**	Sine of the input value (in set [-1.0 .. +1.0]) multiply the value of Amp

Calculation rule

RADIAN = Degree × (pi / 180)

Output AQ = Sin (Input IN × (pi / 180)) × Amp

COS



Calculating cosine of radians IN

Connection	Description
Input **IN**	Any 16-bit input value (degree)
Parameter	**Amp :** Magnification Value range : -10000.00 ~ 10000.00
Output **AQ**	Cosine of the input value (in set [-1.0 .. +1.0]) multiply the value of Amp

Calculation rule

RADIAN = Degree × (pi / 180)

Output AQ = Cos (Input IN × (pi / 180)) × Amp

TAN

Calculating tangent of radians IN.

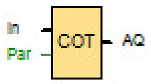
Connection	Description
Input **IN**	Cannot be equal to PI/2 modulo PI. (degree)
Parameter	**Amp** : Magnification Value range : -10000.00 ~ 10000.00
Output **AQ**	Tangent of the input value multiply the value of Amp (Output AQ = 32767 for invalid input)

Calculation rule

RADIAN = Degree × (pi / 180)

Output AQ = Tan (Input IN × (pi / 180)) × Amp

COT



Calculating cotangent of radians IN.

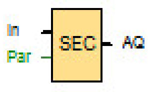
Connection	Description
Input **IN**	Cannot be equal to 0 modulo PI. (degree)
Parameter	**Amp** : Magnification Value range : -10000.00 ~ 10000.00
Output **AQ**	Cotangent of the input value multiply the value of Amp (Output AQ = 32767 for invalid input)

Calculation rule

RADIAN = Degree × (pi / 180)

Output AQ = Cot (Input IN × (pi / 180)) × Amp

SEC



Calculating secant of radians IN.

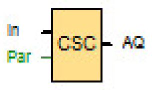
Connection	Description
Input **IN**	Cannot be equal to PI/2 modulo PI. (degree)
Parameter	**Amp** : Magnification Value range : -10000.00 ~ 10000.00
Output **AQ**	Secant of the input value multiply the value of Amp (Output AQ = 32767 for invalid input)

Calculation rule

RADIAN = Degree × (pi / 180)

Output AQ = Sec (Input IN × (pi / 180)) × Amp

CSC



Calculating cosecant of radians IN.

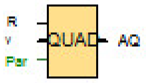
Connection	Description
Input **IN**	Cannot be equal to 0 modulo PI. (degree)
Parameter	**Amp** : Magnification value range : -10000.00 ~ 10000.00
Output **AQ**	Cosecant of the input value multiply the value of Amp (Output AQ = 32767 for invalid input)

Calculation rule

RADIAN = Degree × (pi / 180)

Output AQ = Csc (Input IN × (pi / 180)) × Amp

Quadratic equation



Calculates the result of quadratic equation.

Connection	Description
Input **Reset**	Reset output to 0
Input **y**	Any integer value
Parameter	**a,b,c :** Any integer value (a <> 0) **Dir :** Dir = 0 --> x = (-b + sqrt(b2-4a(c-y))) / 2a Dir = 1 --> x = (-b - sqrt(b2-4a(c-y))) / 2a **Amp :** Magnification Value range : -10000.00 ~ 10000.00
Output **AQ**	The x value(calculated) multiply the value of Amp

Calculation rule

$y = ax^2 + bx + c$

--> $ax^2 + bx + (c-y) = 0$

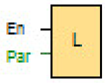
--> $x = (-b + sqrt(b^2-4a(c-y))) / 2a$ or $x = (-b - sqrt(b^2-4a(c-y))) / 2a$

- If a = 0 , then x = 0 : AQ = 0
- If $b^2-4a(c-y) < 0$, then x = 0 : AQ = 0
- If $b^2-4a(c-y) > 0$, then $x = (-b+sqrt(b^2-4a(c-y)))/2a$ (when Dir = 0)

  or $x = (-b-sqrt(b^2-4a(c-y)))/2a$ (when Dir = 1)

AQ = $\boldsymbol{x}$ x **Amp**

Data Log



You can configure Data Log to record the actual values of the function blocks and memory areas in circuit program. You can configure one data log per circuit program.

Connection	Description
Input **En**	The Data Log begins logging data with a positive edge (0 to 1 transition) at input En (Enable)

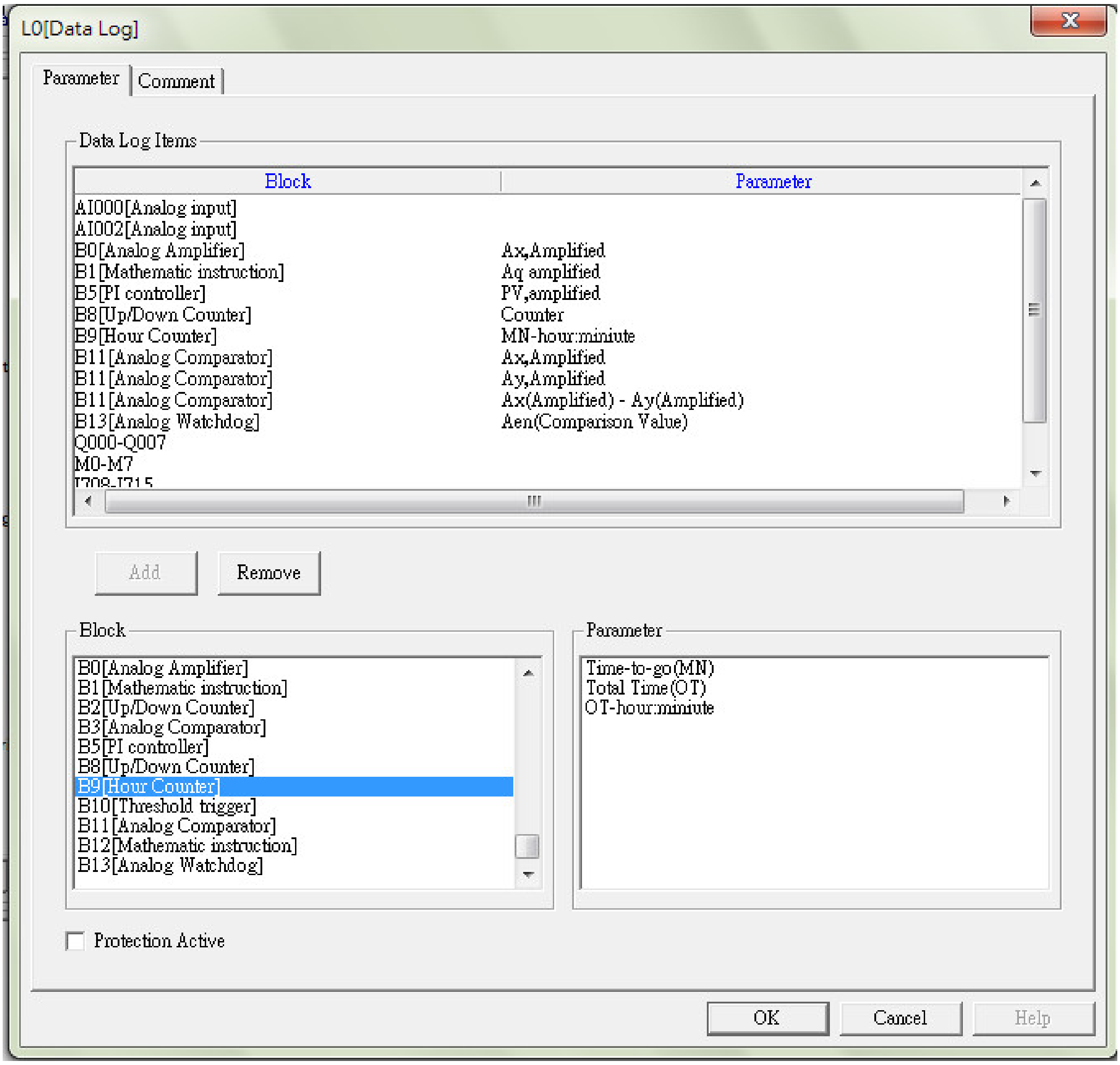
Configuring the Data Log

In circuit program, only one Data Log can be configured to record the actual values of function blocks, and the following memory areas:

- I
- Q
- M
- AI
- AQ
- AM

For digital I/O and memory, you must log data in groups of eight bits; for example: I0 to I7, Q8 to Q15, M16 to M23. For analog data, you select one value to be logged; for example: AI1, AQ2, or AM1.

You can log a maximum of 32 items (analog values or eight-bit digital groups) in the Data Log.

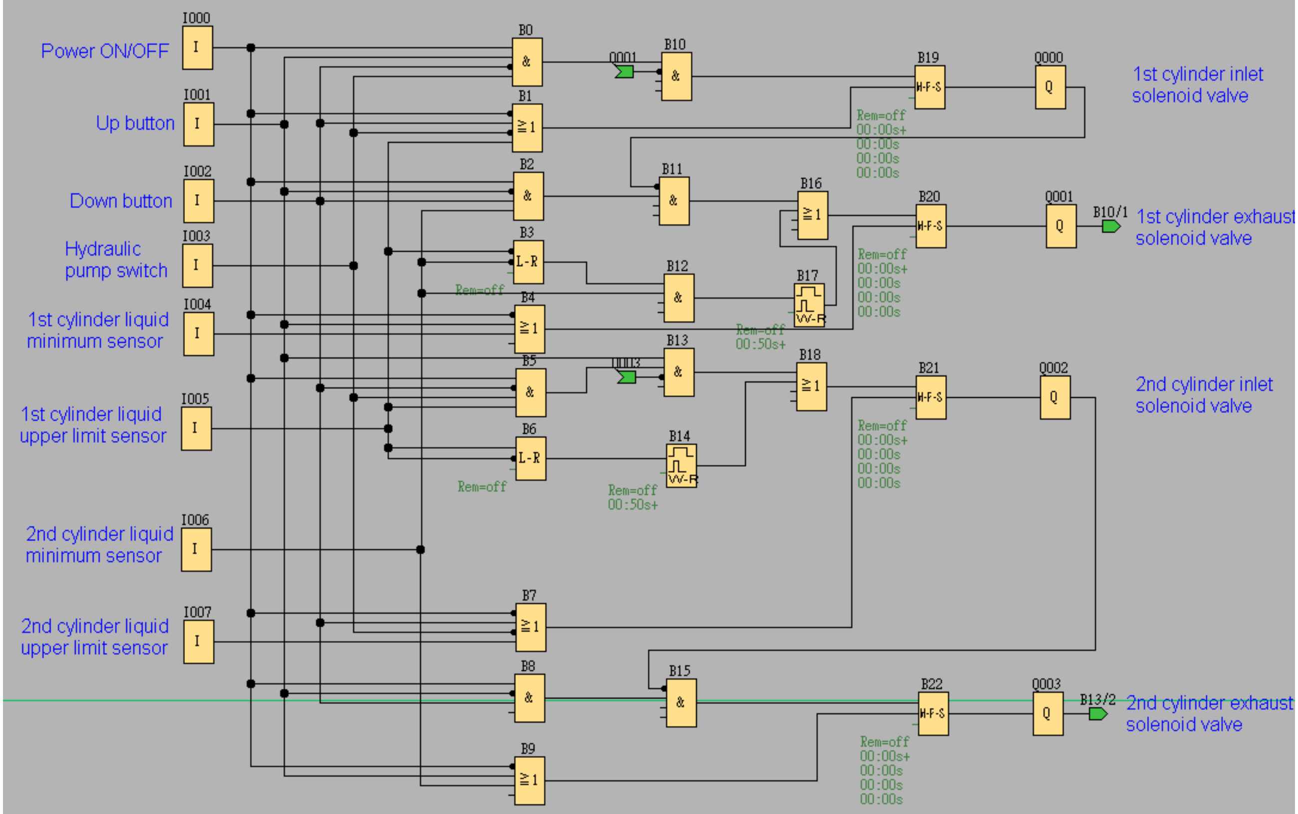


Data Log can only be configured from PC soft . The Data Log cannot be created, configured, or deleted from a 5/6 device.

Transferring the Data Log

After configuring the Data Log, the circuit program can be downloaded into the 5/6 series devices and transferred the Data Log to SD card as .CSV format.

Hydraulic cylinder equipment



Hydraulic cylinder equipment

The hydraulic cylinder equipment control system is applied to buildings, parking tower, warehouse etc.
This demonstration can control cylinder platform up and down.

Equipment structure:

. 2 cylinders (top & bottom) to drive the platform.
. 4 solenoid valves to control cylinders inlet or exhaust.
. 1 pressure pump to support cylinders liquid.
. 1 pressure tank for storage and support cylinders liquid.
. 4 sensors to monitor cylinders position signal.

Blocks describe:

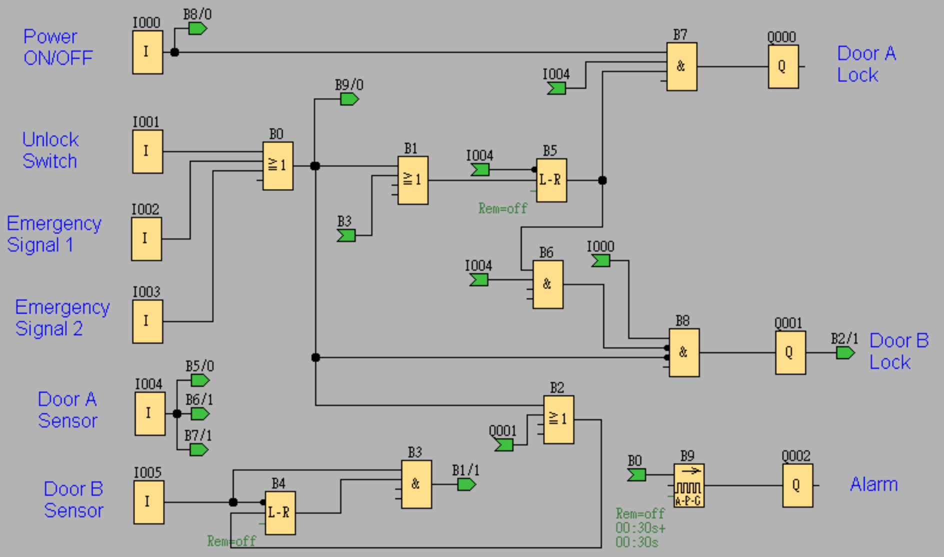
I000: Power ON/OFF.
I001: Up button to control cylinder up and up-stop.
I002: Down button to control cylinder down and down-stop.
I003: Hydraulic pump switch to control pressure pump on/off
I004: 1st cylinder (bottom) liquid minimum sensor to monitor bottom cylinder minimum liquid position.
I005: 1st cylinder (bottom) liquid upper limit sensor to monitor bottom cylinder upper liquid position
I006: 2nd cylinder (top) liquid minimum sensor to monitor top cylinder minimum liquid position
I007: 2nd cylinder (top) liquid upper limit sensor to monitor bottom cylinder upper liquid position
Q000: 1st cylinder inlet solenoid valve to control liquid inflow to 1st cylinder
Q001: 1st cylinder exhaust solenoid valve to control liquid outflow from 1st cylinder
Q002: 2nd cylinder inlet solenoid valve to control liquid inflow to 2nd cylinder
Q003: 2nd cylinder exhaust solenoid valve to control liquid outflow from 2nd cylinder

Process describe:

Cylinder up:
1.Before drive 1st and 2nd cylinders platform up, turn on the power (I000) and Hydraulic pump switch (I003), then I004 and I006 will on start position.
2.Push the up button (I001), the solenoid valve (Q000) will control liquid inflow to 1st cylinder and elevate platform then I004 auto-off.
3.When 1st cylinder liquid on upper limit position (I005), Q000 auto-off then solenoid valve (Q002) will auto-on to control liquid inflow 2nd cylinder and eleva platform then I006 auto-off.
4.When 2nd cylinder liquid on upper limit position (I007), Q002 auto-off.

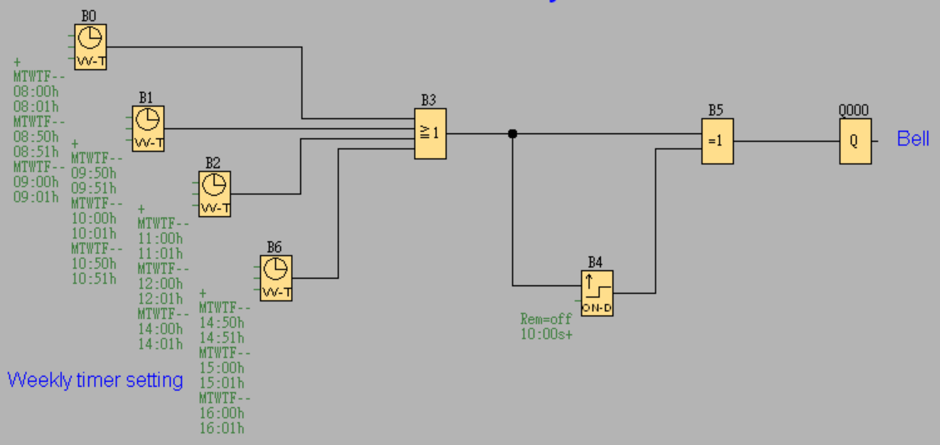
Cylinder down:
1.Push the down button (I002), the solenoid valve (Q003) will control liquid outflow from 2nd cylinder and degrade platform then I007 auto-off.
2.When 2nd cylinder liquid on minimum position (I006), Q003 auto-off then solenoid valve (Q001) will auto-on to control liquid outflow from 1st cylinder and degrade platform then I005 auto-off.
3.When 1st cylinder on minimum position (I004), Q001 auto-off.

One-way interlocking door control system



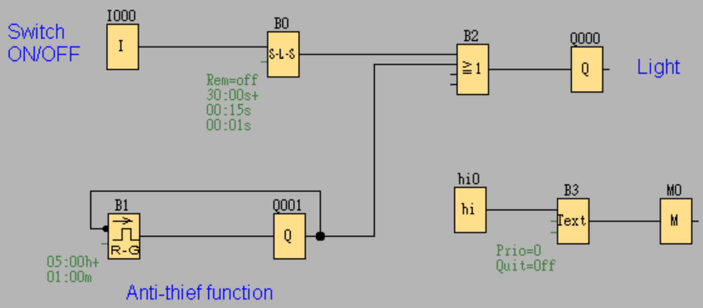
Process describing:
1.Before system working (power on), Door A (Q000) and Door B (Q001) can open momentarily. Door A (I004) and Door B (I005) sensors on On status
2.Turn on the power (I000), Door B lock (Q001).
3.Open Door A, the sensor (I004) auto-off. Then close Door A, the sensor (I004) auto-on and Door A lock (Q000) Door B open (Q001).
4.Open Door B, the sensor (I005) auto-off. Then close Door B, the sensor (I005) auto-on and Door B lock (Q001) Door A open (Q000).
5.Press the unlock switch (I001) or emergency signal (I002, I003) switch on, Door A (Q000) and Door B (Q001) can open momentarily.

School bell system



Process describing:
When school begins, break and end, the bell will ring 10 seconds on setting time.
Bell time is set on Monday to Friday at 8:00, 8:50, 9:00, 9:50, 10:00, 10:50, 11:00, 12:00, 14:00, 14:50, 15:00 and 16:00.

Stairway lighting switch and anti-thief light system



Process describing:

1.Turn the switch (I001) on, light (Q000) will on. Turn off the switch, light will off after 30 seconds.
2.Anti-thief function wills random work per 5 hours.
3.When switch-on time overlap with anti-thief function, light-off time decide by latest end-time.
4.B3 can display switch off count time on A series controller monitor.

118X Address Mapping

Supported Modbus Code: 01/02/05/15 (Readable & Writable in Normal Mode)

Address	Description	R/W	Note
00001 ~ 00032	Main Digital Input Value (I000 ~ I031)	R	(0/1)
00033 ~ 00064	Ext1 Digital Input Value (I100 ~ I131)	R	(0/1)
00065 ~ 00096	Ext2 Digital Input Value (I200 ~ I231)	R	(0/1)
00097 ~ 00128	Ext3 Digital Input Value (I300 ~ I331)	R	(0/1)
00129 ~ 00160	Ext4 Digital Input Value (I400 ~ I431)	R	(0/1)
00161 ~ 00192	Ext5 Digital Input Value (I500 ~ I531)	R	(0/1)
00193 ~ 00224	Ext6 Digital Input Value (I600 ~ I631)	R	(0/1)
00225 ~ 00256	Ext7 Digital Input Value (I700 ~ I731)	R	(0/1)
00257 ~ 00272	Main Digital Output Value (Q000 ~ Q016)	R	(0/1)
00273 ~ 00288	EXT1 Digital Output Value (Q100 ~ Q116)	R	(0/1)
00289 ~ 00304	EXT2 Digital Output Value (Q200 ~ Q216)	R	(0/1)
00305 ~ 00320	EXT3 Digital Output Value (Q300 ~ Q316)	R	(0/1)
00321 ~ 00336	EXT4 Digital Output Value (Q400 ~ Q416)	R	(0/1)
00337 ~ 00352	EXT5 Digital Output Value (Q500 ~ Q516)	R	(0/1)
00353 ~ 00368	EXT6 Digital Output Value (Q600 ~ Q616)	R	(0/1)
00369 ~ 00384	EXT7 Digital Output Value (Q700 ~ Q716)	R	(0/1)
00385 ~ 00896	0~511 Digital Flag (M0 ~ M511)	R	(0/1)
00897 ~ 00912	0~15 Shift register bit (S0 ~ S15)	R	(0/1)
00913	Flag of SCAN Time	R	(0/1)
01025 ~ 01056	Main Digital Input Force ON (I000 ~ I031)	R/W	(0/1)
01057 ~ 01088	Ext1 Digital Input Force ON (I100 ~ I131)	R/W	(0/1)
01089 ~ 01120	Ext2 Digital Input Force ON (I200 ~ I231)	R/W	(0/1)
01121 ~ 01152	Ext3 Digital Input Force ON (I300 ~ I331)	R/W	(0/1)
01153 ~ 01184	Ext4 Digital Input Force ON (I400 ~ I431)	R/W	(0/1)
01185 ~ 01216	Ext5 Digital Input Force ON (I500 ~ I531)	R/W	(0/1)
01217 ~ 01248	Ext6 Digital Input Force ON (I600 ~ I631)	R/W	(0/1)
01249 ~ 01280	Ext7 Digital Input Force ON (I700 ~ I731)	R/W	(0/1)
01281 ~ 01312	Main Digital Input Force OFF(I000 ~ I031)	R/W	(0/1)
01313 ~ 01344	Ext1 Digital Input Force OFF(I100 ~	R/W	(0/1)

	I131)		
01345 ~ 01376	Ext2 Digital Input Force OFF(I200 ~ I231)	R/W	(0/1)
01377 ~ 01408	Ext3 Digital Input Force OFF(I300 ~ I331)	R/W	(0/1)
01409 ~ 01440	Ext4 Digital Input Force OFF(I400 ~ I431)	R/W	(0/1)
01441 ~ 01472	Ext5 Digital Input Force OFF(I500 ~ I531)	R/W	(0/1)
01473 ~ 01504	Ext6 Digital Input Force OFF(I600 ~ I631)	R/W	(0/1)
01505 ~ 01536	Ext7 Digital Input Force OFF(I700 ~ I731)	R/W	(0/1)

Supported Modbus Code: 01/02 (Readable in Normal Mode)

Address	Description	R/W	Note
02001~02004	Status of Function Block B0	R	
02005~02008	Status of Function Block B1	R	
02009~02012	Status of Function Block B2	R	
....			
06093~06096	Status of Function Block B1023	R	

Supported Modbus Code: 03/04 (Readable in Normal Mode)

Address	Description	R/W	Note
40001	Com0 model	R	0x00 : Slave 0x01 : Master
40002	Com0 protocol	R	0x00 : RTU 0x01 : ASCII
40003	Com0 device address	R	1~255
40004	Com0 baudrate	R	0x00 : 1200 0x01 : 2400 0x02 : 4800 0x03 : 9600 0x04 : 14400 0x05 : 19200 0x06 : 28800 0x07 : 38400 0x08 : 57600 0x09 : 115200
40005	Com0 parity	R	0x00 : None 0x01 : Odd 0x02 : Even
40006	Com0 data bit	R	0x00 : 7-bit 0x01 : 8-bit
40007	Com0 stop bit	R	0x00 : 1-bit 0x01 : 2-bit
40008	Com0 timeout	R	50 ~ 65535 ms
40009	Com0 delay between polls	R	0 ~ 65535 ms
40010	Com0 data register index	R	0x00 : High Low 0x01:Low High
40011	Com0 status flag	R	
40012	Com1 model	R	0x00 : Slave 0x01: Master
40013	Com1 protocol	R	0x00 : RTU 0x01 : ASCII
40014	Com1 device address	R	1~255
40015	Com1 baudrate	R	0x00 : 1200 0x01 : 2400 0x02 : 4800 0x03 : 9600 0x04 : 14400 0x05 : 19200 0x06 : 28800 0x07 : 38400

			0x08 : 57600 0x09 : 115200
40016	Com1 parity	R	0x00 : None 0x01 : Odd 0x02 : Even
40017	Com1 data bit	R	0x00 : 7-bit 0x01 : 8-bit
40018	Com1 stop bit	R	0x00 : 1-bit 0x01 : 2-bit
40019	Com1 timeout	R	50 ~ 65535 ms
40020	Com1 delay between polls	R	0 ~ 65535 ms
40021	Com1 data register index	R	0x00 : High Low 0x01:Low High
40022	Com1 status flag	R	
40023	Com2 model	R	0x00 : Slave 0x01 : Master
40024	Com2 protocol	R	0x00 : RTU 0x01 : ASCII
40025	Com2 device address	R	1~255
40026	Com2 baudrate	R	0x00 : 1200 0x01 : 2400 0x02 : 4800 0x03 : 9600 0x04 : 14400 0x05 : 19200 0x06 : 28800 0x07 : 38400 0x08 : 57600 0x09 : 115200
40027	Com2 parity	R	0x00 : None 0x01 : Odd 0x02 : Even
40028	Com2 data bit	R	0x00 : 7-bit 0x01 : 8-bit
40029	Com2 stop bit	R	0x00 : 1-bit 0x01 : 2-bit
40030	Com2 timeout	R	50 ~ 65535 ms
40031	Com2 delay between polls	R	0 ~ 65535 ms
40032	Com2 data register index	R	0x00 : High Low 0x01:Low High
40033	Com2 status flag	R	

Supported Modbus Code: 03/04 (Readable in Normal Mode)

Address	Description	R/W	Note
40211	Module Name 1	R	118X Ex:0x1188
40212	Module Name 2	R	0x0000
40213	Firmware Version 1	R	A1.00 Ex:0xA100
40214	Firmware Version 2	R	0x0000
40215	Mac Serial Number 1	R	
40216	Mac Serial Number 2	R	
40217	Mac Serial Number 3	R	
40218	Mac Serial Number 4	R	
40219	Mac Serial Number 5	R	
40220	Mac Serial Number 6	R	
40221	Redundancy condition	R	0x00: None 0x01:Master 0x02:Slave
40222	Redundancy operating time (low word) (ms)	R	0x0000 ~ 0xFFFF
40223	Redundancy operating time (high word) (ms)	R	0x0000 ~ 0xFFFF
40224	LCM Control Register	R	

40225	Machine internal tempature (degree Celsius)	R	-32768 ~ 32767
40226	Controller Fault Status	R	
40227	System Status 1	R	
40228	System Status 2	R	
40229	Scan Cycle Time (ms)	R	1 ~ 65535
40230	Redundancy status	R	0x00 : stop 0x01:standby 0x02:active
40231	Power On Hours (hr)	R	0~65535
40232	COM0 communication success rate (times/min)	R	0~65535
40233	COM0 communication error rate (times/min)	R	0~65535
40234	COM1 communication success rate (times/min)	R	0~65535
40235	COM1 communication error rate (times/min)	R	0~65535
40236	COM2 communication success rate (times/min)	R	0~65535
40237	COM2 communication error rate (times/min)	R	0~65535
40238	COM3 communication success rate (times/min)	R	0~65535
40239	COM3 communication error rate (times/min)	R	0~65535
40240	COM4 communication success rate (times/min)	R	0~65535
40241	COM4 communication error rate (times/min)	R	0~65535
40242	COM5 communication success rate (times/min)	R	0~65535
40243	COM5 communication error rate (times/min)	R	0~65535
40244	COM6 communication success rate (times/min)	R	0~65535
40245	COM6 communication error rate (times/min)	R	0~65535
40246	COM7 communication success rate (times/min)	R	0~65535
40247	COM7 communication error rate (times/min)	R	0~65535
40248	Downloading number of times	R	0~65535
40249	History Temperature_min (degree Celsius)	R	-32768 ~ 32767
40250	History Temperature_max (degree Celsius)	R	-32768 ~ 32767
40251	High temperature protection point	R	-32768 ~ 32767
40252	Low temperature protection point	R	-32768 ~ 32767
40253	Power On Count (low word)	R	0x0000 ~ 0xFFFF
40254	Power On Count (high word)	R	0x0000 ~ 0xFFFF

40255	DOWNLOAD_STATUS	R	0x00 : normal 0x01 : fail
40256	Last shutdown time -Week_RTC	R	0 ~ 6
40257	Last shutdown time -Year_RTC	R	2010 ~ 2036
40258	Last shutdown time -Month_RTC	R	1 ~ 12
40259	Last shutdown time -Day_RTC	R	1 ~ 31
40260	Last shutdown time -Hour_RTC	R	0 ~ 23
40261	Last shutdown time -Min_RTC	R	0 ~ 59
40262	Last shutdown time -Sec_RTC	R	0 ~ 59
40263	RTC Calibrate sign	R	0:plus 1:minus
40264	RTC Calibrate value	R	0 ~ 30 (sec/week)

Supported Modbus Code: 03/04 (Readable in Normal Mode)

Address	Description	R/W	Note
40301	Week_RTC	R	0 ~ 6
40302	Year_RTC	R	2010 ~ 2036
40303	Month_RTC	R	1 ~ 12
40304	Day_RTC	R	1 ~ 31
40305	Hour_RTC	R	0 ~ 23
40306	Min_RTC	R	0 ~ 59
40307	Sec_RTC	R	0 ~ 59

Supported Modbus Code: 03/04 (Readable in Normal Mode)

Address	Description	R/W	Note
40501 ~ 40508	Main Analog Input Value (AI000 ~ AI007)	R	
40509 ~ 40516	EXT1 Analog Input Value (AI100 ~ AI107)	R	
40517 ~ 40524	EXT2 Analog Input Value (AI200 ~ AI207)	R	
40525 ~ 40532	EXT3 Analog Input Value (AI300 ~ AI307)	R	
40533 ~ 40540	EXT4 Analog Input Value (AI400 ~ AI407)	R	
40541 ~ 40548	EXT5 Analog Input Value (AI500 ~ AI507)	R	
40549 ~ 40556	EXT6 Analog Input Value (AI600 ~ AI607)	R	
40557 ~ 40564	EXT7 Analog Input Value (AI700 ~ AI707)	R	
40565 ~ 40568	Main Analog Output Value (AQ000 ~ AQ003)	R	
40569 ~ 40572	EXT1 Analog Output Value (AQ100 ~ AQ103)	R	
40573 ~ 40576	EXT2 Analog Output Value (AQ200 ~ AQ203)	R	
40577 ~ 40580	EXT3 Analog Output Value (AQ300 ~ AQ303)	R	
40581 ~ 40584	EXT4 Analog Output Value (AQ400 ~ AQ403)	R	

40585 ~ 40588	EXT5 Analog Output Value (AQ500 ~ AQ503)	R	
40589 ~ 40592	EXT6 Analog Output Value (AQ600 ~ AQ603)	R	
40593 ~ 40596	EXT7 Analog Output Value (AQ700 ~ AQ703)	R	
40597 ~ 41108	0 ~ 511 Analog Flag Value (AM0 ~ AM511)	R	

Supported Modbus Code: 03/04 (Readable in Normal Mode)

Address	Description	R/W	Note
42001~42004	Parameter of Function Block B0	R	
42005~42008	Parameter of Function Block B1	R	
42009~42012	Parameter of Function Block B2	R	
....			
46093~46096	Parameter of Function Block B1023	R	

More Information

Block Type	Address 1	Address 2	Address 3	Address 4
AND	Block Output (0xxxx)	X	X	X
AND (Edge)	Block Output (0xxxx)	X	X	X
NAND	Block Output (0xxxx)	X	X	X
NAND (Edge)	Block Output (0xxxx)	X	X	X
OR	Block Output (0xxxx)	X	X	X
NOR	Block Output (0xxxx)	X	X	X
XOR	Block Output (0xxxx)	X	X	X
NOT	Block Output (0xxxx)	X	X	X
On-Delay	Block Output (0xxxx)	X	Timer (4xxxx)	X
Off-Delay	Block Output (0xxxx)	X	Timer (4xxxx)	X
On-/Off-Delay	Block Output (0xxxx)	X	Timer (4xxxx)	X
Retentive On-Delay	Block Output (0xxxx)	X	Timer (4xxxx)	X
Wiping relay (pulse output)	Block Output (0xxxx)	X	Timer (4xxxx)	X
Edge triggered wiping relay	Block Output (0xxxx)	X	Timer (4xxxx)	X
Asynchronous Pulse Generator	Block Output (0xxxx)	X	Timer (4xxxx)	X
Random Generator	Block Output			

	(0xxxx)	X	Timer (4xxxx)	X
Stairway lighting switch	Block Output (0xxxx)	X	Timer (4xxxx)	X
Multiple function switch	Block Output (0xxxx)	X	Timer (4xxxx)	X
Weekly Timer	Block Output (0xxxx)	X	X	X
Yearly Timer	Block Output (0xxxx)	X	X	X
Up/Down counter	Block Output (0xxxx)	X	Count Value (l) (4xxxx)	Count Value (h) (4xxxx)
Hours Counter	Block Output (0xxxx)	X	MN Value (l) (4xxxx)	MN Value (h) (4xxxx)
Threshold trigger	Block Output (0xxxx)	X	Count Value (l) (4xxxx)	Count Value (h) (4xxxx)
Analog Comparator	Block Output (0xxxx)	X	Actual values(Ax-Ay) (l) (4xxxx)	Actual values(Ax-Ay) (h) (4xxxx)
Analog threshold trigger	Block Output (0xxxx)	X	Actual value Ax (l) (4xxxx)	Actual value Ax (h) (4xxxx)
Analog Amplifier	Block Output (4xxxx)	X	Actual value Ax (l) (4xxxx)	Actual value Ax (h) (4xxxx)
Analog watchdog	Block Output (0xxxx)	Actual value Aen (4xxxx)	Actual value Ax (l) (4xxxx)	Actual value Ax (h) (4xxxx)
Analog differential trigger	Block Output (0xxxx)	X	Actual value Ax (l) (4xxxx)	Actual value Ax (h) (4xxxx)
Latching Relay	Block Output (0xxxx)	X	X	X
Pulse Relay	Block Output (0xxxx)	X	X	X
Message texts	Block Output (0xxxx)	X	X	X
Shift register	Block Output (0xxxx)	X	Register Value (4xxxx)	X
Modbus Read	Block Output (0xxxx)	Count (4xxxx)	Data Address (4xxxx)	X
Modbus Write	Block Output (0xxxx)	Count (4xxxx)	Data1(Manual) / Data Address (Auto) (4xxxx)	Data2(Manual) (4xxxx)

Welcome to YottaEditor

YottaEditor is a graphical tool to help users configure 1/5-Series controllers. These configurations include: writing circuit programs, transfering data between PC and 1/5-Series, setting communication ports parameters, and more.

You can run YottaEditor on Windows XP/2000/2003/Vista/7.

Recommended System Requirements

Items	Recommended System Requirements
CPU	1 GHz 32-bit (x86) or 64-bit (x64) processor
Main Memory	At least 512 MB of memory
Hard Drive	1 GB of space with at least 300 MB of available space
Monitor	At least 640 x 480 with full color
Mouse	Windows compatible
RS-232/485 Port	COM1 to COM256

This document introduces the operation of YottaEditor. If you are not familar with this application, please go to user interface before continuing this documentation for more information.

You can learn how to create a circuit program, edit the layout, save documentation and simulate the program in tutorial.

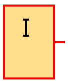
Starting the Simulation

Click on the Tools -> Simulation menu command or the simulation icon  in the standard toolbar to start simulation.

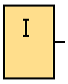
Please refer to simulation toolbar for more information on how to run a simulation.

Inputs

The input icon indicates the status. You can switch an input by clicking on an icon. When the input is switched on, the borderline of the icon is red; when the input is switched off, the borderline turns black.



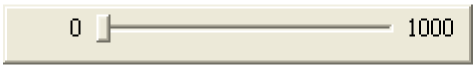
→ The input is actuated.



→ The input is not actuated.

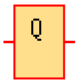
Analog Inputs

You can set the value for an analog input by means of a slide controller. Click on the relevant block to pop up and operate this slide controller directly.

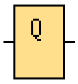


Outputs

The output icon indicates the status. You cannot switch an output by clicking on an icon. When the output is switched on, the borderline of the icon is red; when the output is switched off, the borderline turns black.



→ The output is switched on.



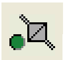
→ The output is switched off.

Set Output

In simulation mode, you can select the command **Set output** by right clicking on the digital output of a block. This command allows you to set the output to high or low, and also allows you to clear the setting. The output remains unchanged until you reset it or end the simulation. This way you can check how a circuit program reacts to certain states.

Power Failure

You can simulate a power failure by clicking on the **Power** icon. This helps you check how a circuit program reacts to a power failure and restart to all inputs. The simulation can also test the retentive values of the circuit program. Note that the power failure simulation is different from the start of simulation, which equals starting the loaded program in 1/5-Series and all of the values are reset.

 → The power supply is normal.

 → Simulate the power supply is interrupted.