

5: SPECIAL FUNCTIONS

Introduction

The SmartAXIS supports many features in addition to instructions.

For functions that require advanced setup including the functions to upload, download, and protect user programs and the network settings, first configure those settings on the Function Area Settings dialog, and then download the user program to the SmartAXIS. Constant scan time and forced I/O can be used without advanced setup.

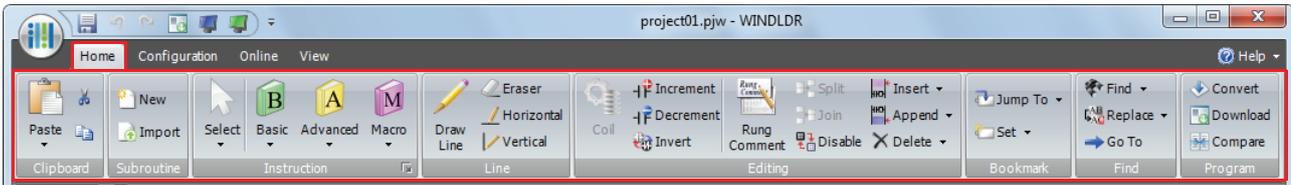
This chapter describes the SmartAXIS special functions, how to configure them, and examples of their use.

Function List

Function name	Overview	Reference	Setup location
Stop input	The SmartAXIS can be started/stopped with a specified input.	5-4	Function area settings
Reset input	The device values of the SmartAXIS can be cleared with a specified input.	5-4	
Run/stop selection at memory backup error	Whether to start or stop the SmartAXIS when the SmartAXIS is powered up after the "keep" data in the RAM has been lost can be specified.	5-5	
Run/stop selection at power up	Whether to start or stop the SmartAXIS regardless of the M8000 status when the SmartAXIS is powered up can be specified.	5-6	
Keep and clear devices	Whether to clear or keep the device values, such as counter current values, when the SmartAXIS starts running can be specified.	5-7	
High-speed counter	The high-speed counters can be used to count input pulses from rotary encoders or proximity switches regardless of the scan time.	5-9	
Catch input	The catch input can be used to receive short pulses from sensors regardless of the scan time.	5-28	
Interrupt input	When a quick response to an external input is required, such as in positioning control, the interrupt input can call a subroutine to execute an interrupt program.	5-30	
Frequency measurement	The pulse frequency of input signals to input terminals can be counted regardless of the scan time.	5-32	
Input filter	The input filter rejects short input pulses when the SmartAXIS is used with input signals containing noises.	5-34	
Analog input	Analog voltage inputs, such as inputs from pressure sensors, can be read and stored in special data registers as digital values.	5-35	
Timer interrupt	When executing the same program repeatedly regardless of the scan time is required, the timer interrupt can call a subroutine at specified time interval.	5-37	Monitor
Forced I/O function	The inputs or outputs of the SmartAXIS can forcibly be turned on or off regardless of the actual inputs and outputs status.	5-39	
Communication ports	Communication mode and parameters for each communication port can be configured for the SmartAXIS to communicate with external devices.	5-42	Function area settings
Memory cartridge	The user program in a memory cartridge can be downloaded to the ROM in the SmartAXIS when the SmartAXIS is powered on.	5-45	
SD memory card	DLOG and TRACE instructions can save the device values in CSV files and store those files in an SD memory card inserted to the SmartAXIS.	5-48	Instructions
Backlight ON Time	SmartAXIS Pro LCD backlight on time setting	5-53	Function area settings
Monitoring Ladder Program	Settings for running the ladder program monitor on the SmartAXIS Pro LCD	5-54	
Message Settings	Common settings for messages displayed on the SmartAXIS Pro LCD with the MSG instruction	5-56	
32-bit data storage setting	The order of upper and lower words for 32-bit data can be specified.	5-58	
User program protection	The user program in the SmartAXIS can be protected with a password against the user program upload or download.	5-60	
Watchdog timer settings	The watchdog timer monitors the SmartAXIS operation and the watchdog time preset value can be changed.	5-62	Special data registers
Constant scan time	The scan time of the SmartAXIS can be made constant by specifying the constant scan time.	5-63	
Daylight savings time	The internal clock of the SmartAXIS can automatically be adjusted according to the configured daylight saving time period.	5-64	Function area settings
Clock function	The SmartAXIS can operate according to the current date and time and be used in applications, such as lighting or air conditioning.	5-65	Instructions
Network settings	Configuring the network settings of the SmartAXIS is required to connect the SmartAXIS to the network.	5-68	Function area settings
Connection settings	Communication mode and parameters for the Ethernet communication can be configured for each connection so that the SmartAXIS can communicate with other network devices over the Ethernet.	5-69	
Remote host list	The remote host devices on the network that the SmartAXIS communicates with can be registered and managed in the Remote Host List.	5-71	Remote host list

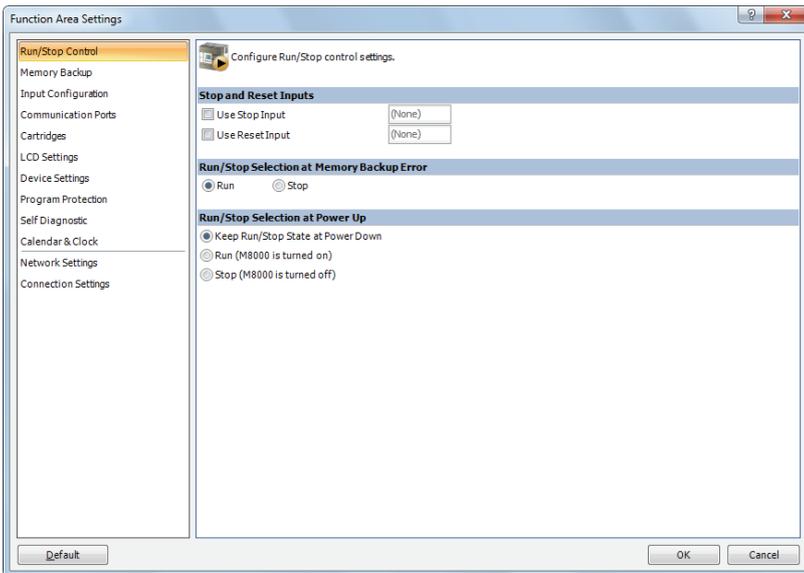
Function Area Settings

Various special functions of the SmartAXIS are configured in the Function Area Settings of WindLDR PLC programming software.



From the WindLDR menu bar, select **Configuration > Run/Stop Control**.

The Function Area Settings dialog box is displayed.



Function Description

- | | |
|---------------------|--|
| Run/Stop Control | <p>Configure the following run/stop control settings.</p> <ul style="list-style-type: none"> • Stop input • Reset input • Run/stop selection at memory backup error • Run/stop selection at power up |
| Memory Backup | <p>When the SmartAXIS starts running, device values in the RAM are kept or cleared. Configure the keep/clear settings for the following devices.</p> <ul style="list-style-type: none"> • Internal relays • Shift registers • Counters • Data registers |
| Input Configuration | <p>Configure the inputs to use special functions, such as the input filters or high-speed counters.</p> <ul style="list-style-type: none"> • High-speed counter • Catch input • Interrupt input • Frequency measurement • Input filter • Analog input • Timer interrupt |

Communication Ports	Configure the communication ports for the SmartAXIS to communicate with external devices equipped with RS232C or RS485 ports. <ul style="list-style-type: none">• Maintenance communication• User communication• Modbus RTU master/slave
Cartridges	Downloads the user program in a memory cartridge to the SmartAXIS module's ROM.
LCD Settings	Configure the LCD settings for the SmartAXIS. <ul style="list-style-type: none">• Backlight ON Time• Monitoring Ladder Program• Message Settings
Device Settings	Configure the order to store the upper and lower words for 32-bit data.
Program Protection	Applies the protection to the user program by configuring a password so unauthorized users cannot inadvertently upload or download it.
Self Diagnostic	Configure the watchdog timer monitoring the operating status of the SmartAXIS.
Calendar & Clock	The SmartAXIS is equipped with an internal clock and its calendar data (year, month, day, day of the week) and clock data (hour, minute, second) can be used in user programs. Daylight savings time can also be configured for the internal clock.
Network Settings	Configure the network settings to connect the SmartAXIS to the network using the Ethernet port.
Connection Settings	Configure server/client communication used by the SmartAXIS Ethernet port. <ul style="list-style-type: none">• Maintenance communication server• User communication server/client• Modbus TCP communication server/client• Remote I/O master

Stop Input and Reset Input

As described on "Start/Stop Operation" on page 4-9, the SmartAXIS can be started and stopped using a stop input or reset input, which can be designated from the Function Area Settings menu. When the designated stop or reset input is turned on, the SmartAXIS stops operation. For the system statuses in the stop and reset modes, see "Start/Stop Operation Using the Power Supply" on page 4-10.

Since these settings relate to the user program, the user program must be downloaded to the SmartAXIS after changing any of these settings.

Programming WindLDR

1. From the WindLDR menu bar, select **Configuration > Run/Stop Control**.

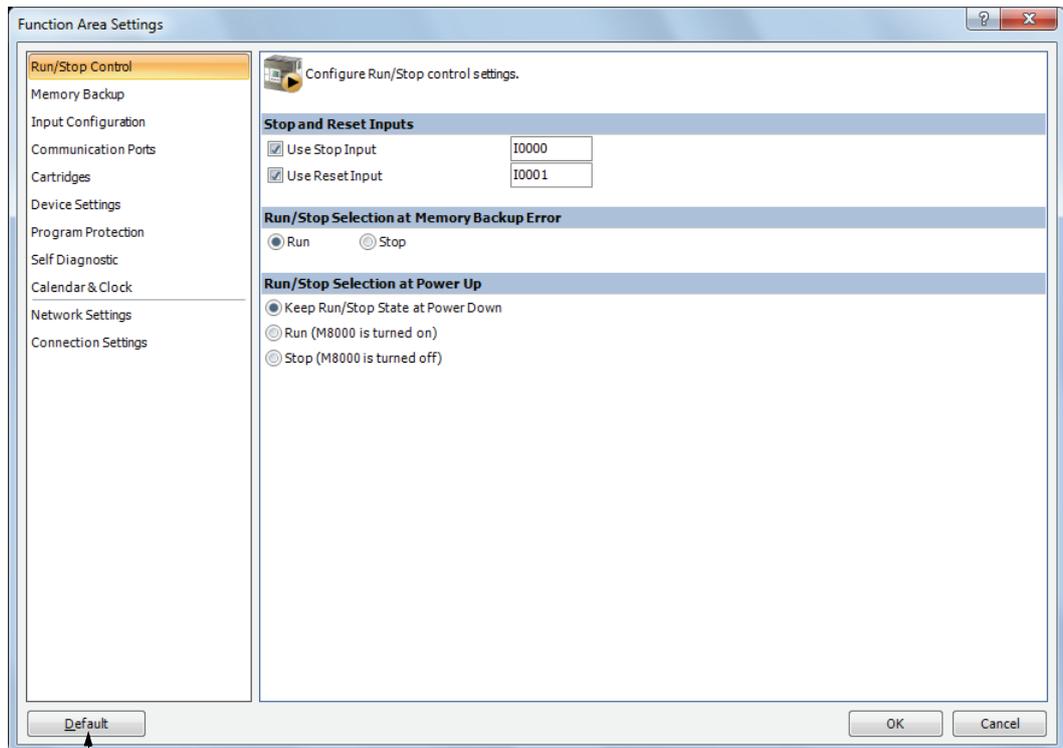
The Function Area Settings dialog box for Run/Stop Control appears.

2. Click the check box under the Stop and Reset Inputs.

Stop Input: Click the check box on the left of Use Stop Input and type a desired input number available on the SmartAXIS in the Stop Input field.

Reset Input: Click the check box on the left of Use Reset Input and type a desired reset number available on the SmartAXIS in the Reset Input field.

This example designates input I0 as a stop input and input I1 as a reset input.



Resets all Function Area Settings values to defaults.

Default: No stop and reset inputs are designated.

3. Click the **OK** button.

Run/Stop Selection at Memory Backup Error

Start control special internal relay M8000 maintains its status when the SmartAXIS is powered down. After the SmartAXIS has been off for a period longer than the battery backup duration, the data designated to be maintained during power failure is lost. The Run/Stop Selection at Memory Backup Error dialog box is used to select whether to start or stop the SmartAXIS when attempting to restart operation after the "keep" data in the SmartAXIS RAM has been lost.

When memory backup error occurs, Run/Stop Selection at Memory Backup Error is more preferred than Run/Stop Selection at Power Up.

When a built-in lithium battery is fully charged, data of internal relays, shift registers, counters, and data registers stored in the RAM are maintained for approximately 30 days.

Since this setting relates to the user program, the user program must be downloaded to the SmartAXIS after changing this setting.

Programming WindLDR

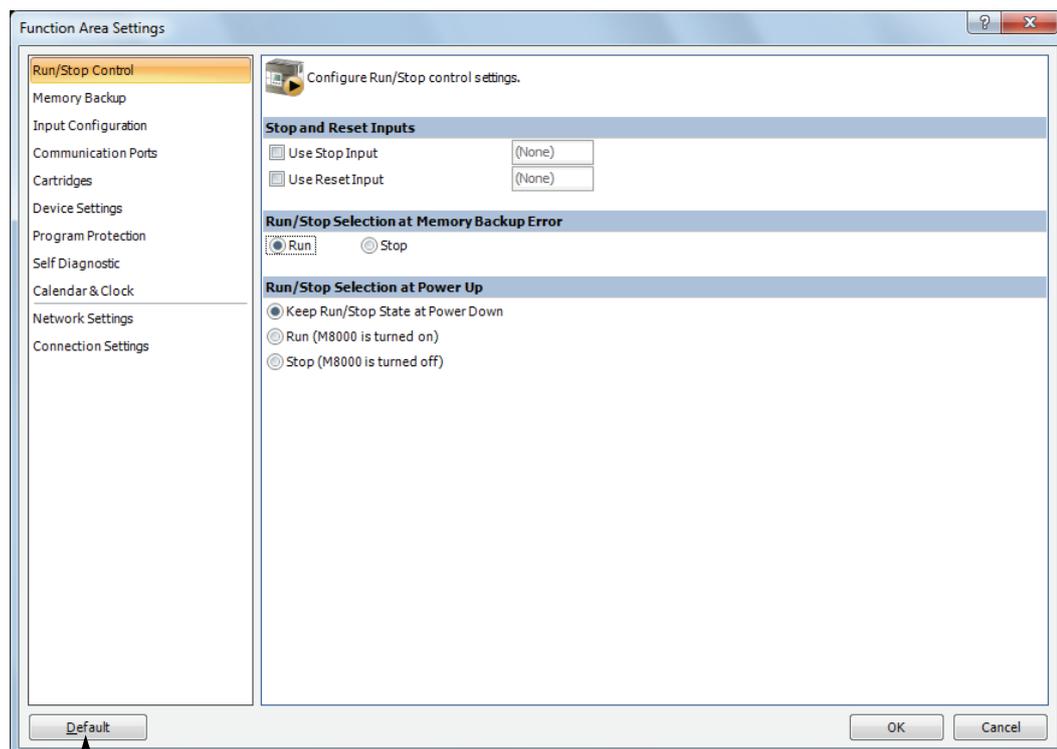
1. From the WindLDR menu bar, select **Configuration > Run/Stop Control**.

The Function Area Settings dialog box for Run/Stop Control appears.

2. Click the **Run** or **Stop** button.

Run (Default): Click the button on the left to start the SmartAXIS at memory backup error.

Stop: Click the button on the right to stop the SmartAXIS when attempting to start at memory backup error. When the SmartAXIS does not start because of the Stop selection, the SmartAXIS cannot be started alone, then the SmartAXIS can still be started by sending a start command from WindLDR to turn on start control special internal relay M8000. For start/stop operation, see "Start/Stop Operation" on page 4-9.



Resets all Function Area Settings values to defaults.

3. Click the **OK** button.

Run/Stop Selection at Power Up

Start control special internal relay M8000 maintains its status when the SmartAXIS is powered down. When powered up, the SmartAXIS is started or stopped according to the M8000 status. The Run/Stop Selection at Power Up is used to select whether to start or stop the SmartAXIS regardless of the M8000 status when the SmartAXIS is powered up.

When a memory cartridge is installed on a SmartAXIS, the SmartAXIS is started or stopped according to the M8000 status of the SmartAXIS. The SmartAXIS can always be started regardless of the M8000 status by using Run/Stop Selection at Power Up. WindLDR software is not needed to start the SmartAXIS.

Stop and Reset inputs have priority over start control special internal relay M8000. When the memory backup error occurs, the SmartAXIS is started or stopped according to Run/Stop Selection at Memory Backup Error regardless of Run/Stop Selection at Power Up. For start/stop operation, see "Start/Stop Operation" on page 4-9.

Since this settings relate to the user program, the user program must be downloaded to the SmartAXIS after changing this settings.

Programming WindLDR

1. From the WindLDR menu bar, select **Configuration > Run/Stop Control**.
The Function Area Settings dialog box for Run/Stop Control appears.

2. Click the button under Run/Stop Selection at Power Up.

Keep Run/Stop State at Power Down (Default):

Click this button to keep the run/stop status at power down when the SmartAXIS is powered up.

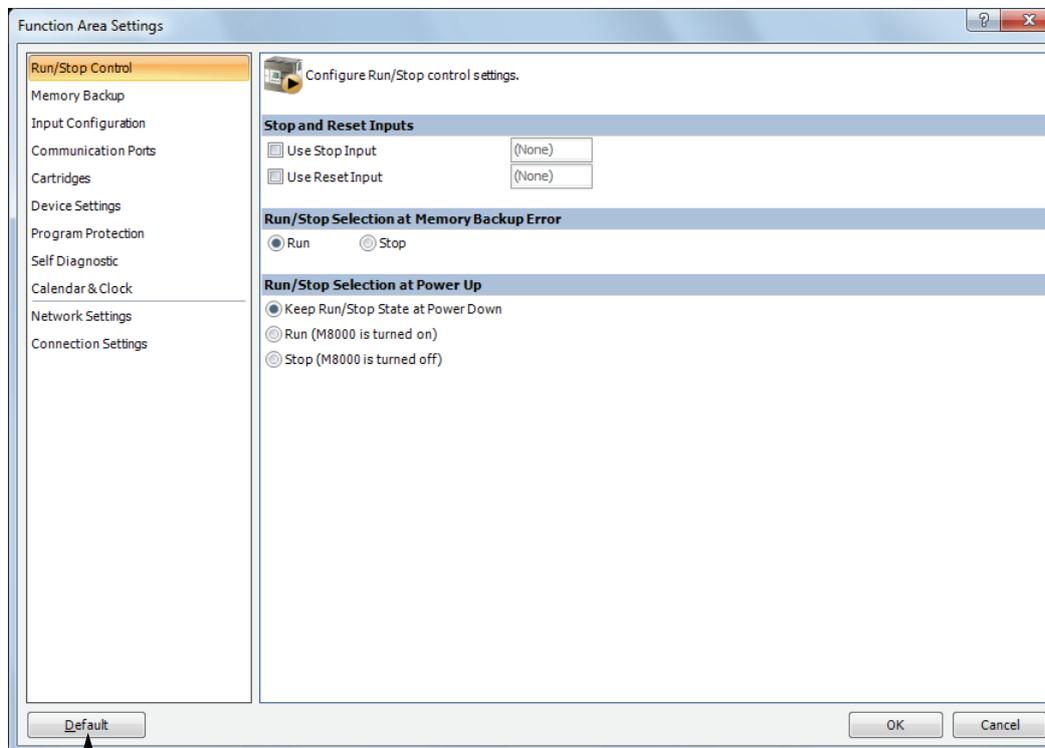
Run (M8000 is turned on):

Click this button to always start the SmartAXIS when the SmartAXIS is powered up.

Stop (M8000 is turned off):

Click this button to always stop the SmartAXIS when the SmartAXIS is powered up.

This example designates
Keep Run/Stop Status at
Power Down.



Resets all Function Area Settings values to defaults.

3. Click the **OK** button.

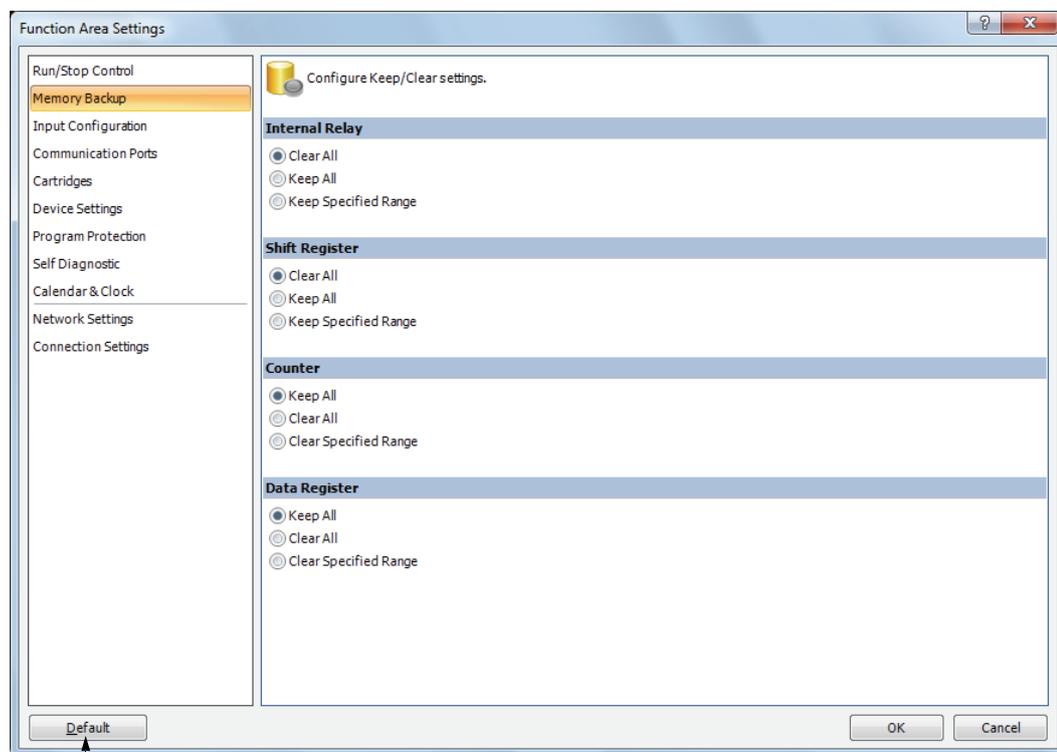
Keep Designation for Internal Relays, Shift Registers, Counters, and Data Registers

The statuses of internal relays and shift register bits are usually cleared at startup. It is also possible to designate all or a block of consecutive internal relays or shift register bits as “keep” types. Counter current values and data register values are usually maintained at powerup. It is also possible to designate all or a block of consecutive counters and data registers as “clear” types. When the SmartAXIS is stopped, these statuses and values are maintained. When the SmartAXIS is reset by turning on a designated reset input, these statuses and values are cleared despite the settings in the Configure Keep/Clear Settings dialog box shown below. The keep/clear settings in this dialog box are not maintained when restarting the SmartAXIS.

Since these settings relate to the user program, the user program must be downloaded to the SmartAXIS after changing any of these settings.

Programming WindLDR

1. From the WindLDR menu bar, select **Configuration > Memory Backup**.
The Function Area Settings dialog box for Configure Keep/Clear Settings appears.
2. Click the buttons under Internal Relay, Shift Register, Counter, and Data Register to clear all, keep all, or keep/clear specified range as required.



Resets all Function Area Settings values to defaults.

Internal Relay 'Keep' Designation

- Clear All:** All internal relay statuses are cleared at startup (default).
- Keep All:** All internal relay statuses are maintained at startup.
- Keep Specified Range:** A specified range of internal relays are maintained at startup. Enter the start "keep" number in the left field and the end "keep" number in the right field. The start "keep" number must be smaller than or equal to the end "keep" number.

Valid internal relay numbers are M0 through M1277. Special internal relays cannot be designated.

Internal Relay

Clear All

Keep All

Keep Specified Range

M0050 through M0100

Start Keep Number End Keep Number (\geq Start Keep Number)

When a range of M50 through M100 is designated as shown in the example above, M50 through M100 are keep types, M0 through M47 and M101 through M1277 are clear types.

Shift Register 'Keep' Designation

- Clear All:** All shift register bit statuses are cleared at startup (default).
- Keep All:** All shift register bit statuses are maintained at startup.
- Keep Specified Range:** A specified range of shift register bits are maintained at startup. Enter the start "keep" number in the left field and the end "keep" number in the right field. The start "keep" number must be smaller than or equal to the end "keep" number.

Valid shift register bit numbers are R0 through R127.

When a range of R17 through R32 is designated, R17 through R32 are keep types, R0 through R16 and R33 through R127 are clear types.

Counter 'Clear' Designation

- Keep All:** All counter current values are maintained at startup (default).
- Clear All:** All counter current values are cleared at startup.
- Clear Specified Range:** A specified range of counter current values are cleared at startup. Enter the start "clear" number in the left field and the end "clear" number in the right field. The start "clear" number must be smaller than or equal to the end "clear" number.

Valid counter numbers are C0 through C199.

When a range of C0 through C10 is designated, C0 through C10 are clear types, and C11 through C199 are keep types.

Data Register 'Clear' Designation

- Keep All:** All data register values are maintained at startup (default).
- Clear All:** All data register values are cleared at startup.
- Clear Specified Range:** A specified range of data register values are cleared at startup. Enter the start "clear" number in the left field and the end "clear" number in the right field. The start "clear" number must be smaller than or equal to the end "clear" number.

Valid data register numbers are D0 through D1999. Special data registers cannot be designated.

When a range of D100 through D1999 is designated, D0 through D99 are keep types, and D100 through D1999 are clear types.

High-Speed Counter

This section describes the high-speed counter for counting high-speed pulses from devices such as rotary encoders and proximity switches. The high-speed counter is a function that counts high-speed pulses with the SmartAXIS hardware that cannot be read in the execution of a normal user program. The high-speed counter has a comparator function to compare the current value and a preset value (target value). When the current value and the preset value match, an external output is turned on or an interrupt program is executed.

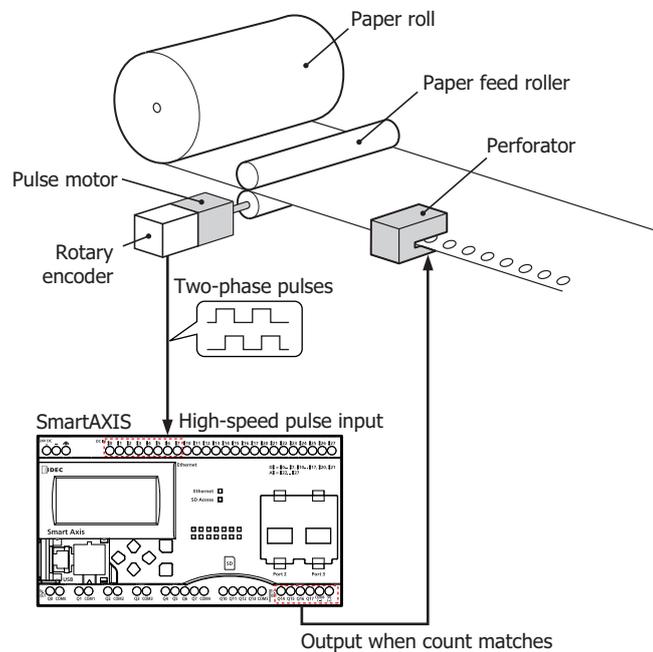
The high-speed counter has a single-phase high-speed counter and a two-phase high-speed counter.

To use the high-speed counter, the WindLDR function area settings, data registers, special internal relays, and special data registers must be configured. The AC power type does not support the high-speed counter. In situations where the high-speed counter function is required, use the DC power type.

• Application example

This application example punches holes into a roll of paper at a regular interval. The two pulses (A-phase, B-phase) that carry the phase difference output from the rotary encoder are counted by the SmartAXIS two-phase high-speed counter.

When the current value reaches the preset value, the specified external output turns on and the perforator punches a hole in the roll of paper.



High-speed counter operation modes

The high-speed counter has the following two operation modes:

- Single-phase high-speed counter
- Two-phase high-speed counter

High-speed counting modes

The high-speed counter has the following four counting modes:

- Adding counter (single-phase high-speed counter)
- Up/down selection reversible counter (single-phase high-speed counter)
- 2-edge count (two-phase high-speed counter)
- 4-edge count (two-phase high-speed counter)

Example: The input allocation when external input group 1 is specified as a two-phase high-speed counter

External input	I0	I1	I2
	↓	↓	↓
High-speed counter	A-phase	B-phase	External clear input (Z-phase)

High-speed Counter External Inputs

The SmartAXIS can use a maximum of six single-phase high-speed counters and a maximum of two two-phase high-speed counters. The 12-I/O type can only use a maximum of four single-phase high-speed counters and a maximum of two dual-phase high-speed counters.

Single-phase high-speed counter

The 24-, 40-, and 48-I/O types can use external inputs I6 and I7 as single-phase the high-speed counters.

The 12-I/O type cannot use external inputs I6 and I7 as single-phase high-speed counters. External inputs I6 and I7 are normal inputs.

Group	1		2	3		4	5	6
External input	I0	I1	I2	I3	I4	I5	I6	I7
Single-phase high-speed counter	Pulse input	Up/down selection input (Note)	Pulse input/ external clear input	Pulse input	Up/down selection input (Note)	Pulse input/ external clear input	Pulse input	Pulse input

Note: Can only be used when the counting mode is specified as the up/down selection reversible counter.

Two-phase high-speed counter

External inputs I0/I1 (group 1) and I3/I4 (group 3) can be used as two-phase high-speed counters. External inputs I2 and I5 can be used as external clear inputs for group 1 and group 3. In this situation, external inputs I2 and I5 cannot be used as single-phase high-speed counters.

Group	1		2	3		4	5	6
External input	I0	I1	I2	I3	I4	I5	I6	I7
Two-phase high-speed counter	Pulse input (A-phase)	Pulse input (B-phase)	External clear input (Note) (Z-phase)	Pulse input (A-phase)	Pulse input (B-phase)	External clear input (Note) (Z-phase)	—	—

Note: If not used as the external clear input (Z-phase), group 2 and group 4 can be used as single-phase high-speed counters.

High-Speed Counter Operation

The high-speed counter turns on an external output or executes an interrupt program when the current value matches the preset value (target value).

The high-speed counter has two operation modes, the adding counter and the up/down selection reversible counter.

For how to configure the function to turn on an external output, see "Comparison Actions" on page 5-13.

• Single-phase high-speed counter

Group 1, group 3 single-phase high-speed counter

- These groups support the adding counter and the up/down selection reversible counter that can count both up and down.
- These groups support 100 kHz maximum pulse input and are capable of counting in a range from 0 to 4,294,967,295 (32 bits).
- When the current value and the preset value match or an overflow or underflow occurs, a comparison output turns on or an interrupt program is executed.
- These groups support resetting the current value by the reset special internal relay or external clear input. When the reset is executed, the current value returns to the reset value specified by the special data registers. For the reset input details, see "Reset input" on page 5-20.

Counting mode	Frequency
Adding counter	Group 1, 3: 100 kHz
Up/down selection reversible counter	Group 1: 100 kHz Group 3: 50 kHz

Group 2, group 4, group 5, group 6 single-phase high-speed counter

- These groups only support the adding counter.
- These groups support 100 kHz maximum pulse input and are capable of counting in a range from 0 to 4,294,967,295 (32 bits).
- When the current value and the preset value match or an overflow or underflow occurs, an external output turns on or an interrupt program is executed.
- These groups only support the reset input via a special internal relay. When the reset is executed, the current value returns to the reset value specified by the special data registers.

Counting mode	Frequency
Adding counter	Group 2, 4, 5, 6: 100 kHz

• Two-phase high-speed counter

Group 1, group 3 two-phase high-speed counter

- The two-phase high-speed counter counts by the phase difference between the A-phase and B-phase pulse input.
- These groups support 50 kHz maximum pulse input and are capable of counting in a range from 0 to 4,294,967,295 (32 bits).
- Even higher speed counting is possible by specifying 2-edge count or 4-edge count.
- When the current value and the preset value match or an overflow or underflow occurs, an external output turns on or an interrupt program is executed.
- These groups support resetting the current value by the reset special internal relay or external clear input (Z-phase). When the reset is executed, the current value returns to the reset value specified by the special data registers.

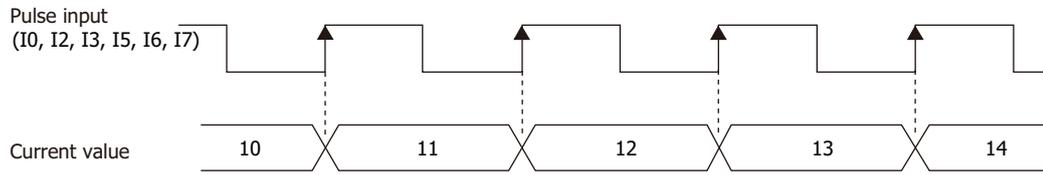
Group	Frequency
Group 1	2-edge count: 50 kHz
	4-edge count: 25 kHz
Group 3	2-edge count: 25 kHz
	4-edge count: 12.5 kHz

Counting mode

The high-speed counter as the following four counting modes.

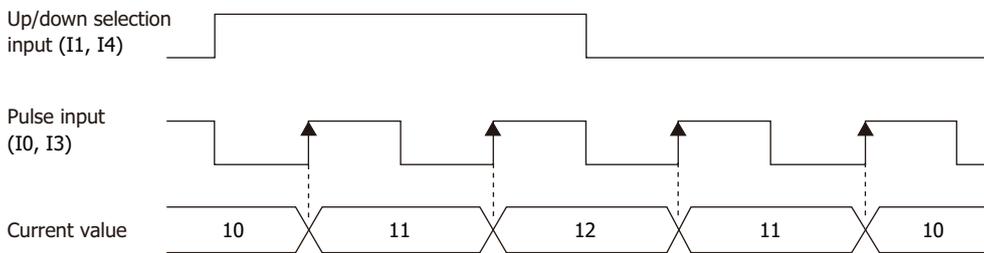
• **Adding counter (single-phase high-speed counter)**

The adding counter counts up with the rise in pulse input.



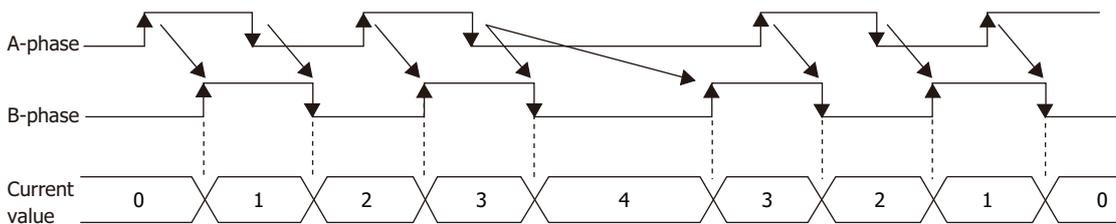
• **Up/down selection reversible counter (single-phase high-speed counter)**

Up/down selection reversible counter can switch between addition and subtraction by pulse input with the up/down selection input. When the up/down selection input is on, the counter counts up with the rise in pulse input. When the up/down selection input is off, the counter counts down with the rise in pulse input.



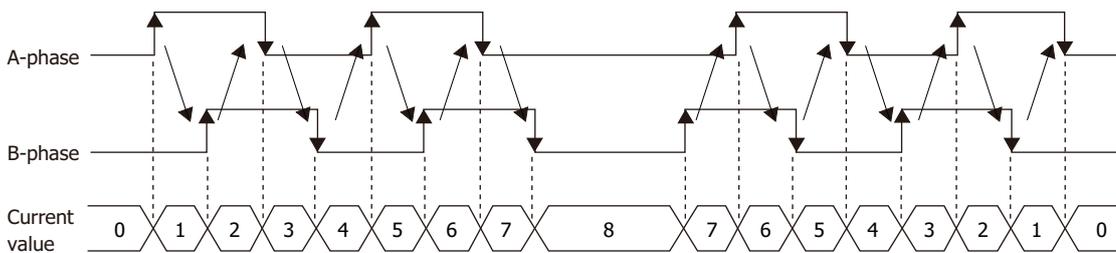
• **2-edge count (two-phase high-speed counter)**

This counter counts by the phase difference between the A-phase and B-phase pulse input. When the A-phase precedes the B-phase, the counter counts up with the rise and fall of the B-phase. When the B-phase precedes the A-phase, the counter counts down with the rise and fall of the B-phase.



• **4-edge count (two-phase high-speed counter)**

This counter counts by the phase difference between the A-phase and B-phase pulse input. When the A-phase precedes the B-phase, the counter counts up with the rise and fall of the A-phase and the B-phase. When the B-phase precedes the A-phase, the counter counts down with the rise and fall of the A-phase and the B-phase.



Comparison Actions

The operating condition when comparing values is configured in the WindLDR **High-speed Counter Settings**, under **Comparison Action**.

The action when comparing values is **Comparison Output** or **Interrupt Program**, so specify an external output number or label number when comparing.

Operation

When the preset value and the current value are compared and the values match, the specified output is turned on or the interrupt program is executed.

A maximum of six high-speed counter preset values can be configured. For one preset value, the current value is compared with the same preset value each time.

When multiple preset values are configured, the preset value is changed each time the current value and preset value match.

For example, if four preset values are configured, when preset value 1 matches the current value, the comparison subject changes to preset value 2 → 3 → 4 in order.

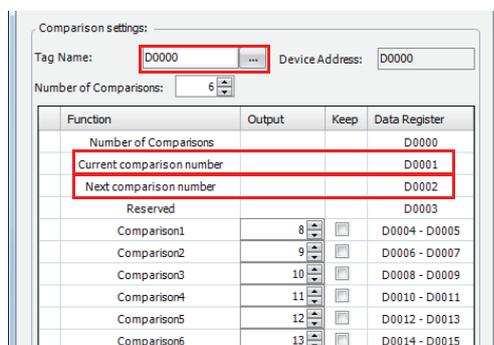
When the final preset value 4 matches the current value, the preset value returns to preset value 1 and the values are compared.

- **Preset value storage locations**

The preset values during high-speed counter operation are stored as 2 words in special data registers.

Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
Preset Value (Upper word)	D8052	D8058	D8064	D8070	D8136	D8142	R
Preset Value (Lower word)	D8053	D8059	D8065	D8071	D8137	D8143	

Specify the data registers to store the preset values in WindLDR and store those preset values in the user program. Specify the start address of the data registers to allocate the data registers to the individual settings in the comparison settings. When the high-speed counter is executed, the preset value with the number stored in **Current Preset Value Number** is active. The active preset value number for each comparison is stored in **Current Preset Value Number** and the next active preset value number is automatically stored in **Next Preset Value Number**. By changing the value of **Next Preset Value Number** in the user program, the next active preset value number can be changed. The active preset value is stored for each group in the special data registers shown in the table above.



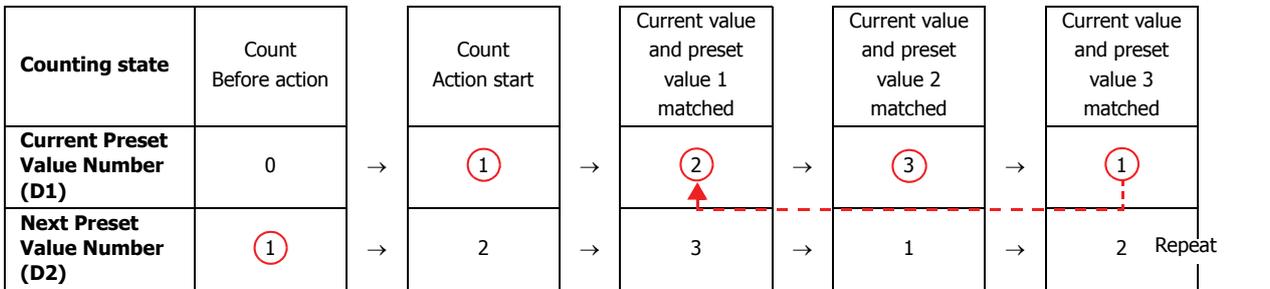
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Example: Group 1, number of preset values is 3, set to device address D0

When the current value matches preset value 1, **Current Preset Value Number** becomes 2 and 3 is stored in **Next Preset Value Number**.

When the device address is configured as D0, **Current Preset Value Number** is stored in D1 and **Next Preset Value Number** is stored in D2.

For the group 1 preset value, the value of the data registers (D4, D5) allocated to preset value number 1 is stored in D8052 and D8053 as shown in the table above and it is compared to the current value.



Before the count action, set the Next Preset Value Number and preset value 1 to 3 to the count values with the initialize pulse.

Preset value 1 is set to **Current Preset Value Number**

Preset value 2 is set.

Preset value 3 is set.

Once again, preset value 1 is set.

Note: When the **Next Preset Value Number** preset value becomes active, the high-speed counter preset value during execution does not change, even when the preset value for that preset value number is changed. When the current value and the current preset value match, the preset value with the number stored in **Next Preset Value Number** becomes active. Changes to the **Next Preset Value Number** data register must be performed before the preset value becomes active.

Comparison operation flow

The comparison operation flow is as follows.

1. Start (run) the SmartAXIS.

For the first scan, **Next Preset Value Number** is set to the number for preset value 1 with the initialize pulse.

For the second scan, an I/O refresh is performed in END processing and the value of **Next Preset Value Number** is transferred to **Current Preset Value Number**.

The content of **Next Preset Value Number** becomes the preset value n + 1 ("2" in this example).

When the number of preset values is 1, **Next Preset Value Number** is always "1".

The data register that stores the preset value (target value). Specify the starting address.

The outputs (external outputs) when the values match.

Transfer

The preset value with the number that became active is the comparison subject with the current value and is stored in the special data registers.

Example: For group 1
Storage destination for the preset value that became active.
Stored by group.

Group	Group 1 (I0 to I1)	Read/Write
Preset Value (Upper word)	D8052	R/W
Preset Value (Lower word)	D8053	

2. Start the high-speed counter count operation.

Turn on the gate input to start the count operation.

3. Compare the **Current Preset Value Number** preset value and the current value. When the current value and the preset value match, the next number for the preset value becomes active and the high-speed counter continues counting.

Execute **Comparison Output** or **Interrupt Program**. (**Comparison Output** in this example)

- Turn on the comparison (special internal relay) for only one scan.
- Overwrite **Current Preset Value Number** with **Next Preset Value Number** and start the count with the preset value for **Current Preset Value Number**.
- Add 1 to **Next Preset Value Number**.

4. When the procedure is executed up to preset value 6, repeat again from the beginning with preset value 1.

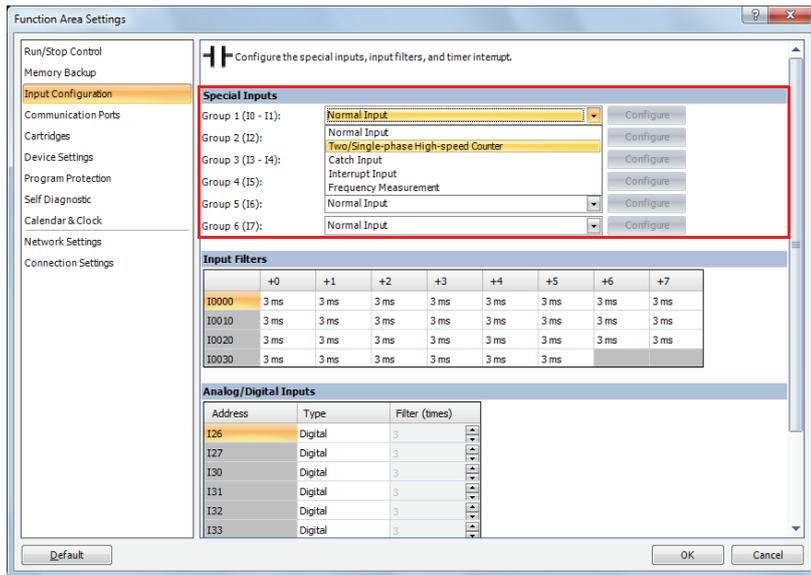
Note: The **Current Preset Value Number** data register cannot be written to. It is read-only. **Next Preset Value Number** and **Preset Value 1** to **Preset Value 6** can be read and written to.

Programming WindLDR

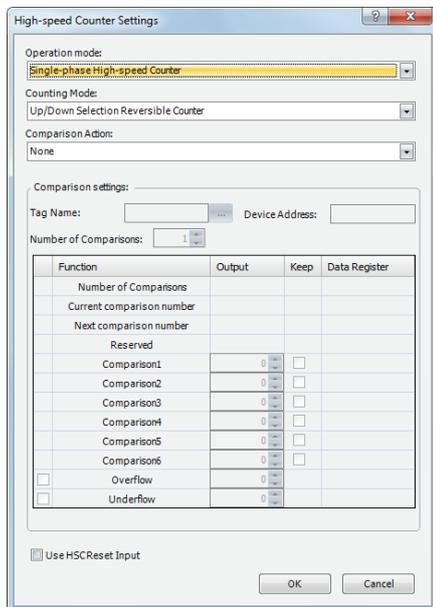
To use the high-speed counter, a normal external input must be specified as **Two/Single-phase High-speed Counter** in the WindLDR **Function Area Settings**. The function for external inputs I0 to I7 on the SmartAXIS can be selected as normal input, high-speed counter, catch input, interrupt input, and frequency measurement.

When using normal input, catch input, interrupt input, or frequency measurement, the high-speed counter cannot be used.

1. From the WindLDR menu bar, select **Configuration > Input Configuration**.
The Function Area Settings dialog box is displayed.
2. Select **Two/Single-phase High-speed Counter** for the group to use the high-speed counter.



The High-speed Counter Settings dialog box is displayed.



3. Configure the operation mode and the counting mode.
To use comparison actions, configure the comparison settings.
4. Click **OK**.
This concludes configuring the settings.

Settings

- **Operation mode**

For group 1 and group 3, you can select **Single-phase High-speed Counter** or **Two-phase High-speed Counter**.

When group 1 is selected as the high-speed counter, group 2 (I2) can be used as the external clear input.

When group 3 is selected as the high-speed counter, group 4 (I5) can be used as the external clear input.

The external inputs for group 2, group 4, group 5, and group 6 can only be used as single-phase high-speed counters.

- **Counting mode (single-phase high-speed counter)**

When the single-phase high-speed counter is specified for **Operation mode** for group 1 or group 3, the counting mode can be selected as **Adding counter** or **Up/down selection reversible counter**. The adding counter can only be used for the group 2, group 4, group 5, and group 6 high-speed counters.

Adding counter

The adding counter counts up with the rise in pulse input.

Up/down selection reversible counter

Up/down selection reversible counter can switch between addition and subtraction with the up/down selection input. When the up/down selection input is on, the counter counts up with the rise in pulse input. When the up/down selection input is off, the counter counts down with the rise in pulse input.

- **Counting mode (two-phase high-speed counter)**

When the two-phase high-speed counter is specified for **Operation mode** for group 1 or group 3, the counting mode can be selected as **2-edge count** or **4-edge count**. The two-phase counter cannot be used for the group 2, group 4, group 5, and group 6 high-speed counters.

2-edge count

This counter counts at double the frequency of the input pulse.

This counter counts by the phase difference between the A-phase and B-phase pulse input. When the A-phase precedes the B-phase, the counter counts up with the rise and fall of the B-phase. When the B-phase precedes the A-phase, the counter counts down with the rise and fall of the B-phase.

4-edge count

This counter counts at quadruple the frequency of the input pulse.

This counter counts by the phase difference between the A-phase and B-phase pulse input. When the A-phase precedes the B-phase, the counter counts up with the rise and fall of the A-phase and the B-phase. When the B-phase precedes the A-phase, the counter counts down with the rise and fall of the A-phase and the B-phase.

- **Comparison action**

The comparison action is a function that compares the high-speed counter's current value with a preset value (target value).

It can use either the comparison output or an interrupt program.

- When **Comparison Output** is selected, the specified external output is turned on when the current value and the preset value match.
- When **Interrupt Program** is selected, the subroutine program with the specified label number is executed as the interrupt program when the current value and the preset value match.

Overflow and underflow can also be used for the comparison conditions.

For details on the comparison actions, see "Comparison Actions" on page 5-13.

Comparison settings

When using the comparison output or the interrupt program as the comparison action for the high-speed counter, configure the external output number or the label number when there is a match. A maximum of six preset values can be specified for **Number of preset values** (preset value number 1 to 6).

Tag name

This setting specifies the starting address of the data register region to store the preset values.

Device address

This item shows the address of the data register specified by the tag name.

Number of preset values

You can configure a maximum of six preset values (target values) for the comparison action.

Notes :

- The preset value becomes active by the END processing in the second scan after the SmartAXIS starts operation. Store **Preset Value** in the data registers with initialize pulse M8120 input.
- When the preset value (special data register) is changed before the comparison, the preset value currently being used for the comparison is discarded in the program's END processing, and the comparison is performed with the newly configured preset value.
- Configure the settings so that an interval of 1 ms or more is present between instances of the preset value and the current value matching. If this interval is less than 1 ms in length, the next Comparison ON status may be missed.

Output

When a comparison action is selected, these are the external outputs specified for preset value 1 to 6.

The external outputs that can be used as comparison outputs are listed by model as follows. Remote outputs cannot be configured.

Model number	Comparison output
12-I/O type	Q0 to Q3
24-I/O type	Q0 to Q7
40-I/O type	Q0 to Q7, Q10 to Q17
48-I/O type	Q0 to Q7, Q10 to Q17, Q20 to Q21

Overflow

Select this check box to use overflow in the comparison action conditions (when the current value exceeds 4,294,967,295).

Underflow

Select this check box to use underflow in the comparison action conditions (when the current value falls below 0).

Note: When the comparison action is **Comparison Output** and either a preset value, overflow, or underflow has been enabled as a comparison condition, the text box to enter the comparison output is enabled. The comparison output can be specified for each of these match conditions.

• Keep

After the current value matches the preset value, select to reset the current value to a reset value or to keep the value. Select this check box to keep the current value.

• Use HSC Reset Input

Select this check box to reset the current value to a reset value with external input (high-speed counter reset input).

High-speed counter reset input can only be specified for group 1 and group 3.

Group	External input
Group 1	I2
Group 3	I5

When the high-speed counter reset input is turned on, the current value is reset to a reset value.

If the high-speed counter reset input is not used, I2 and I5 are normal inputs.

High-speed counter devices

The high-speed counter operates according to special internal relay and special data register settings. While the high-speed counter is operating, the current value, control output, and operating status value are reflected in the special internal relays and special data registers with each scan.

The high-speed counter start and stop control signals and the current value, preset values, and reset values are allocated to the special internal relays and special data registers.

Device allocation table

The devices used by the high-speed counter are as follows.

Special internal relay list

Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
Comparison Output Reset	M8030	M8040	M8045	M8055	M8166	M8173	R/W
Gate Input	M8031	M8041	M8046	M8056	M8167	M8174	
Reset Input	M8032	M8042	M8047	M8057	M8170	M8175	
Reset Status	M8033	—	M8050	—	—	—	R
Comparison ON Status	M8034	M8043	M8051	M8060	M8171	M8176	
Overflow	M8035	M8044	M8052	M8061	M8172	M8177	
Underflow	M8036	—	M8053	—	—	—	
Count Direction flag	M8037	—	M8054	—	—	—	

Special data register list

Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
Current Value (Upper word)	D8050	D8056	D8062	D8068	D8134	D8140	R
Current Value (Lower word)	D8051	D8057	D8063	D8069	D8135	D8141	
Preset Value (Upper word)	D8052	D8058	D8064	D8070	D8136	D8142	R/W
Preset Value (Lower word)	D8053	D8059	D8065	D8071	D8137	D8143	
Reset Value (Upper word)	D8054	D8060	D8066	D8072	D8138	D8144	
Reset Value (Lower word)	D8055	D8061	D8067	D8073	D8139	D8145	

When using the devices above with instructions where the data type unit can be specified, specify the data type as double word (D). When the 32-bit data storage setting in the function area settings is set to **From Lower Word**, the lower word is stored in the first device.

- **Start/stop high-speed counter**

The high-speed counter can be started and stopped per group by turning the gate input on or off.

Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
Gate Input	M8031	M8041	M8046	M8056	M8167	M8174	R/W

- **Current value storage locations**

The current value for the single-phase high-speed counter is stored in special data registers as 2 words per group.

Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
Current Value (Upper word)	D8050	D8056	D8062	D8068	D8134	D8140	R
Current Value (Lower word)	D8051	D8057	D8063	D8069	D8135	D8141	

When the 32-bit data storage setting in the function area settings is set to **From Lower Word**, the lower word is stored in the first device.

- **Comparison ON status**

When the current value and the preset value match, the special internal relay turns on for only one scan.

Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
Comparison ON Status	M8034	M8043	M8051	M8060	M8171	M8176	R

5: SPECIAL FUNCTIONS

• Overflow

When the current value exceeds 4,294,967,295, the special internal relay turns on for only one scan. When the current value overflows, it becomes 0.

Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
Overflow	M8035	M8044	M8052	M8061	M8172	M8177	R

• Underflow

When the current value falls below 0, the special internal relay turns on for only one scan. When the current value underflows, it becomes 4,294,967,295.

Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
Underflow	M8036	—	M8053	—	—	—	R

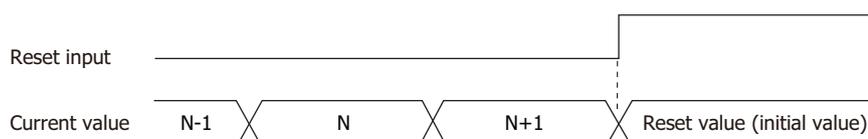
• Comparison output reset

When the special internal relay turns on, the comparison output selected on **High-speed Counter Settings** turns off.

Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
Comparison Output Reset	M8030	M8040	M8045	M8055	M8166	M8173	R/W

• Reset input

When reset input is turned on, the current value returns to the reset value.



Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
Reset Input	M8032	M8042	M8047	M8057	M8170	M8175	R/W

• Preset value, reset value storage locations

The preset value and the reset value for the high-speed counter are stored in special data registers as 2 words.

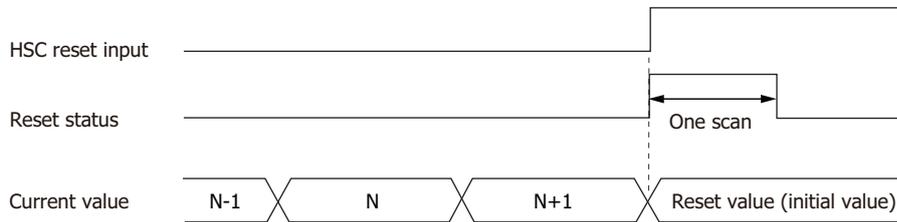
Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
Preset Value (Upper word)	D8052	D8058	D8064	D8070	D8136	D8142	R/W
Preset Value (Lower word)	D8053	D8059	D8065	D8071	D8137	D8143	
Reset Value (Upper word)	D8054	D8060	D8066	D8072	D8138	D8144	
Reset Value (Lower word)	D8055	D8061	D8067	D8073	D8139	D8145	

When the 32-bit data storage setting in the function area settings is set to **From Lower Word**, the lower word is stored in the first device.

• **HSC reset input and reset status**

When the HSC reset input is enabled in group 1 or group 3, turn on HSC reset input I2 or I5 to return the current value to the reset value.

In this situation, reset status turns on for only one scan.



Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
HSC Reset Input	I2	—	I5	—	—	—	—
Reset Status	M8033	—	M8050	—	—	—	R

To use the reset input with the group 1 or group 3 single-phase high-speed counter, use I2 (group 2) or I5 (group 4). When not using I2 or I5 as a reset input, they can be used as normal input, high-speed counters, catch input, interrupt input, or frequency measurements.

• **Count direction flag**

These special internal relays maintain whether the group 1 or group 3 current value count is being added or subtracted.

When these special internal relays are on, they indicate addition. When they are off, they indicate subtraction.

Group	1 (I0 to I1)	2 (I2)	3 (I3 to I4)	4 (I5)	5 (I6)	6 (I7)	Read/Write
Count Direction flag	M8037	—	M8054	—	—	—	R

Timing chart 1

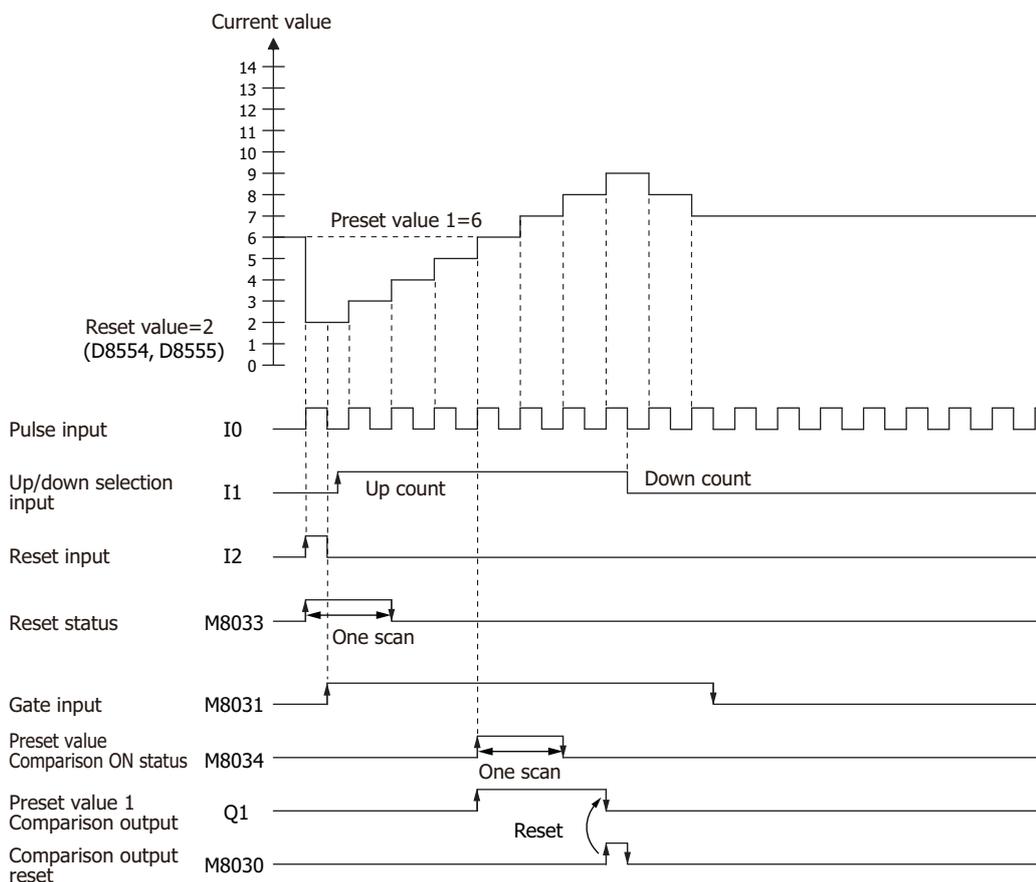
Single-phase high-speed counter (group 1) timing chart

Operating conditions

The counting mode is set to **Up/down selection reversible counter** and reset input (I2) is used.

One preset value is used, and when the values match, output Q1 turns on and the current value is kept.

Overflow and underflow are not used.



1. When reset input (I2) turns on, the reset value (D8054, D8055) is stored in the current value (D8050, D8051). In this situation, reset status (M8033) turns on for only one scan.
2. When gate input (M8031) turns on, the counting begins.
3. The counting direction (count up/count down) is determined by the on/off state of the up/down selection input (I1), and the pulse input (I0) is counted. The current value is updated with each scan.
4. When the current value and preset value 1 (D8052, D8053) match, the preset value 1 comparison output (Q1) and Comparison ON status (M8034) turn on. When the **Keep** check box is selected in the settings in the WindLDR **High-speed Counter Settings**, the current value is kept.
5. Q1 maintains the on state until comparison output reset (M8030) turns on. M8034 turns on for only one scan.
6. When the gate output turns off, counting stops.

Note: High-speed counter usage precautions

The high-speed counter starts the count operation with the following two conditions:

- The SmartAXIS starts operation
- The gate input is turned on

To start the count operation, turn the gate input on from off while the SmartAXIS is running. When the gate input is already on and the SmartAXIS is stopped, the count operation starts when the SmartAXIS is switched from stop to run.

When a user program is downloaded during the count operation, the count operation stops. The count operation will restart by setting the SmartAXIS to run.

Timing chart 2

Two-phase high-speed counter (group 1) timing chart

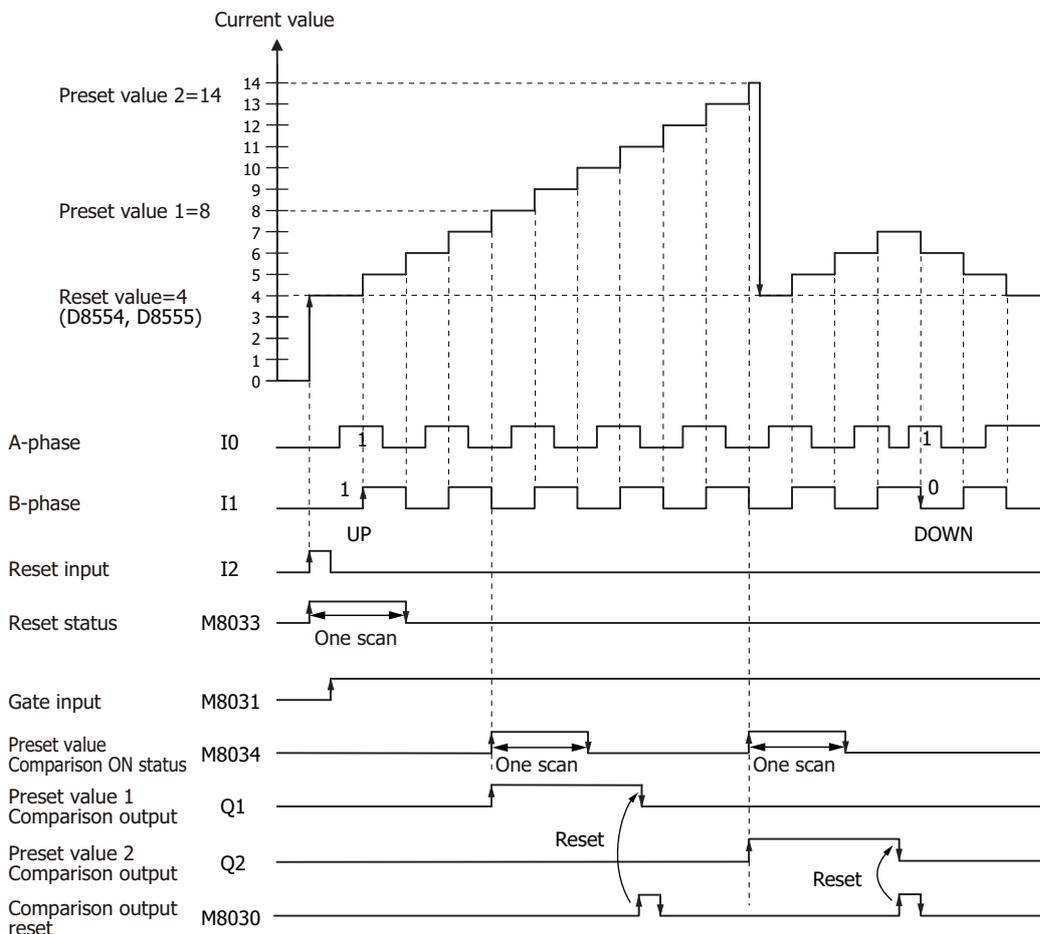
Operating conditions

The counting mode is set to **2-edge count** and reset input (I2) is used.

Two preset values are used, and when preset value 1 matches, output Q1 turns on and the current value is kept.

When preset value 2 matches, output Q2 turns on and the current value is cleared.

Overflow and underflow are not used.



1. When reset input (I2) turns on, the reset value (D8054, D8055) is stored in the current value (D8050, D8051). In this situation, reset status (M8033) turns on for only one scan.
2. When gate input (M8031) turns on, the counting begins.
3. When the A-phase pulse (I0) precedes the B-phase pulse (I1), the count goes up. When the B-phase pulse (I1) precedes the A-phase pulse (I0), the count goes down.
4. When the current value and preset value 1 (D8052, D8053) match, the preset value 1 comparison output (Q1) and setting value match (M8034) turn on. When preset value 1 matches, preset value 2 is stored in the preset value (D8052, D8053) as the new preset value and counting continues.
5. The preset value 1 comparison output (Q1) maintains the on state until comparison output reset (M8030) turns on. M8034 turns on for only one scan.

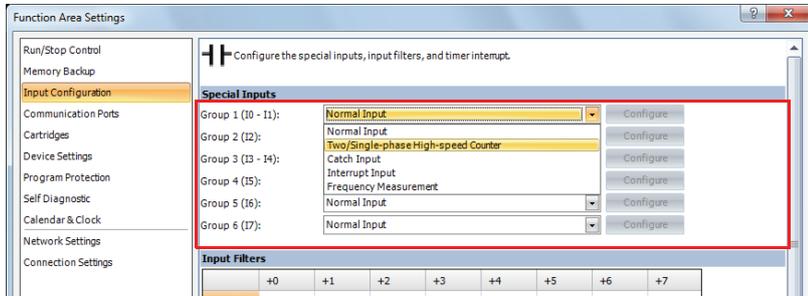
Example program 1

Using the single-phase high-speed counter, this example program turns on external output Q2 when 1000 pulses are counted.

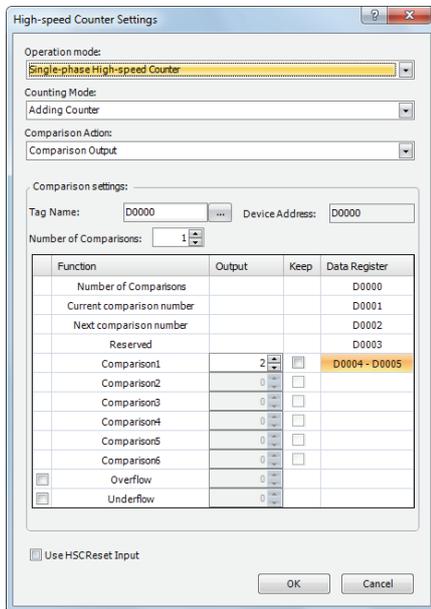
Application description

When pulses are input to external input I0 and the count reaches 1000, external output Q2 is turned on.

In the WindLDR **Function Area Settings**, select **Two/Single-phase High-speed Counter** for **Group 1**.



In **High-speed Counter Settings**, configure the settings as follows.



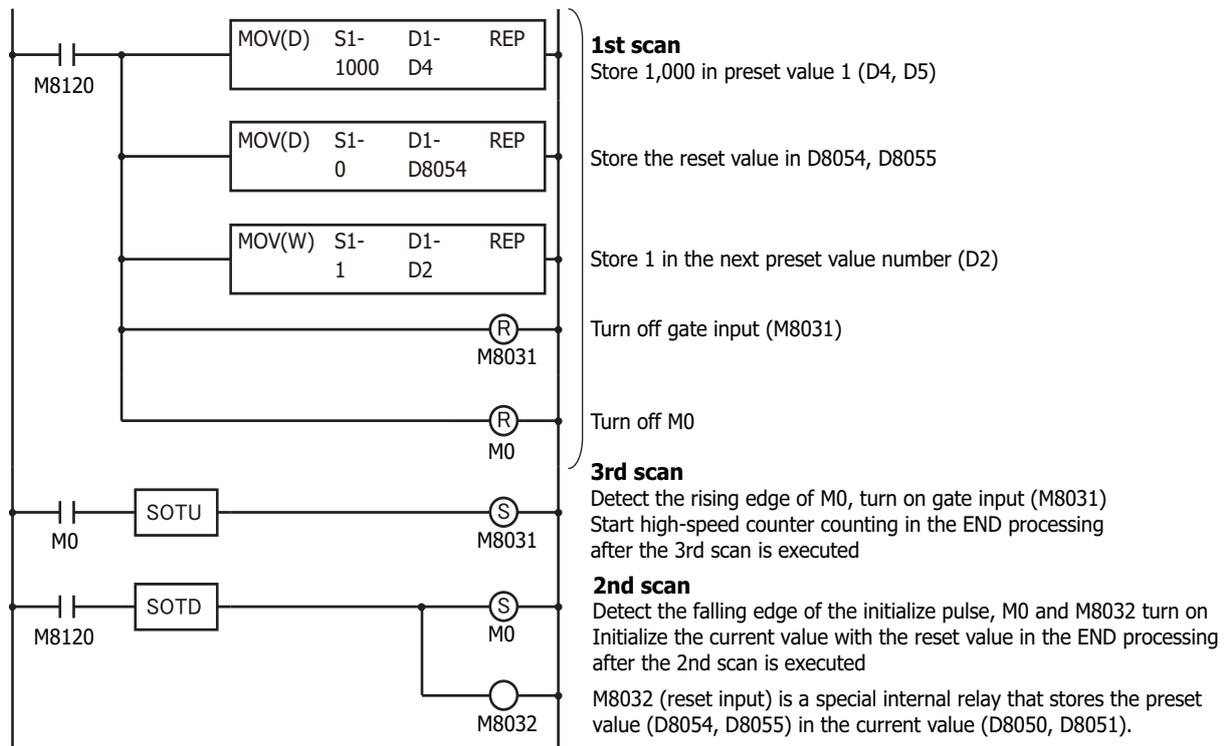
- External input : Group 1 (I0 to I1)
- Operation mode : Single-phase High-speed Counter
- Counting Mode : Adding Counter
- Comparison Action : Comparison Output

Comparison settings

- Tag name/device address : D0 (data register)
- Number of preset values : 1
- Comparison output : Q2 (external output when matched)
- Preset value 1 (D4) : 0 (upper word)
- Preset value 1 (D5) : 1,000 (lower word)
- Keep : Cleared
- Reset value (D8054) : 0 (upper word)
- Reset value (D8055) : 0 (lower word)
- Overflow : Cleared
- Underflow : Cleared
- Use HSC Reset Input : Cleared

Program

M8120 (initialize pulse) is a special internal relay that turns on when the SmartAXIS runs.

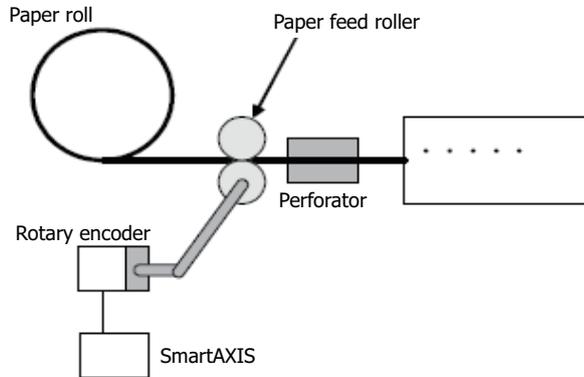


Example program 2

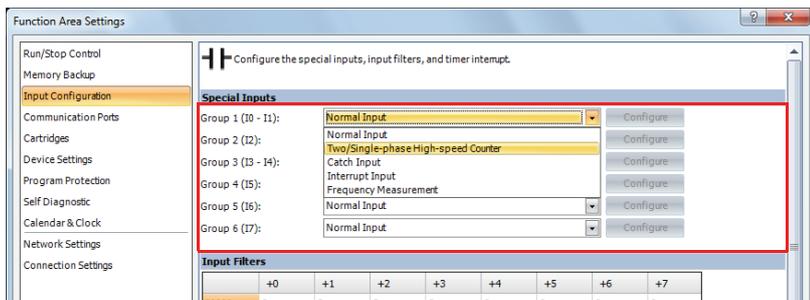
Using the two-phase high-speed counter, the pulses from a rotary encoder are input to the SmartAXIS and a continuous workpiece is marked at a regular interval.

Application description

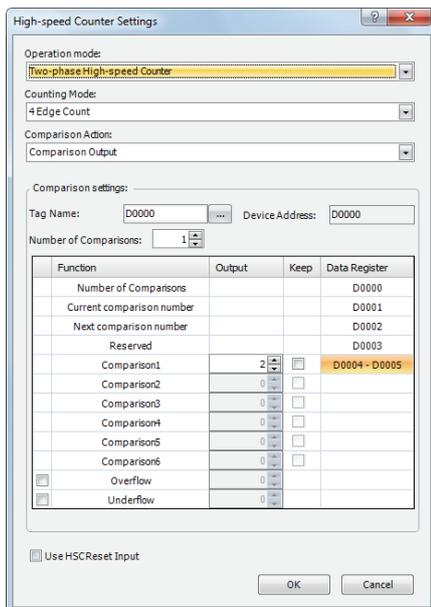
- The rotary encoder pulses are input to external input I0. A continuous sheet of paper is marked (holes are punched) at a regular interval (every 2,700 pulses).
- The rotary encoder is directly connected to the paper feed roller, and output pulses are counted by the high-speed counter and controlled.
- The cycle time is the time to count 2,700 pulses. When the hole punch time is 0.5 seconds, the operation condition is 2,700 pulse count time > 0.5 seconds.



In WindLDR **Function Area Settings**, select **Two/Single-phase High-speed Counter** for **Group 1**.



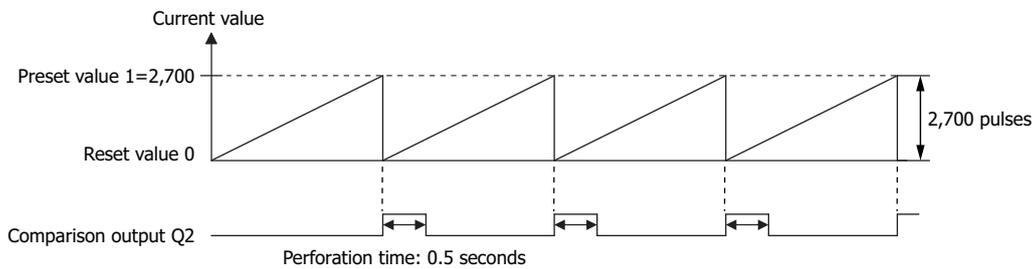
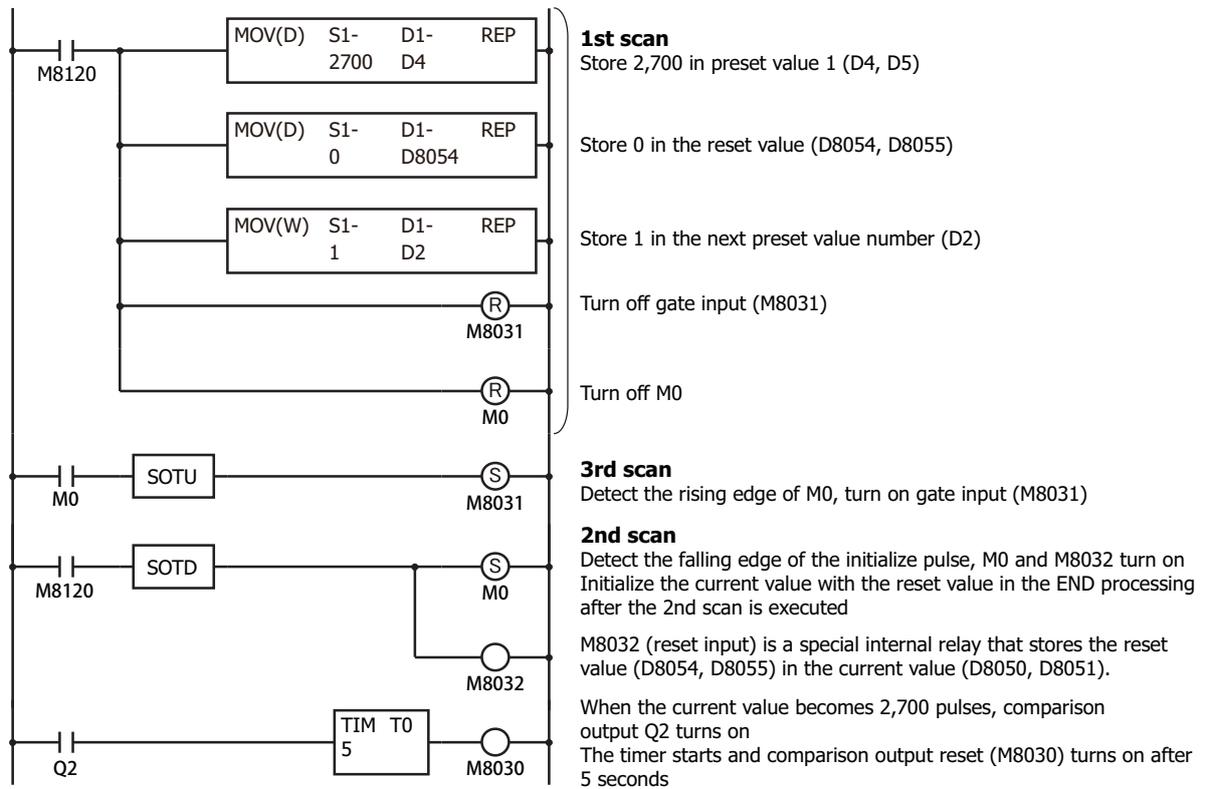
In **High-speed Counter Settings**, configure the settings as follows.



- External input : Group 1 (I0 to I1)
 - Operation mode : Two-phase High-speed Counter
 - Counting Mode : 4-edge Count
 - Comparison Action : Comparison Output
- Comparison settings**
- Tag name/device address : D0 (data register)
 - Number of preset values : 1
 - Comparison output : Q2 (external output when matched)
 - Preset value 1 (D4) : 0 (upper word)
 - Preset value 1 (D5) : 2,700 (lower word)
 - Keep : Cleared
 - Reset value (D8054) : 0 (upper word)
 - Reset value (D8055) : 0 (lower word)
 - Overflow : Cleared
 - Underflow : Cleared
 - Use HSC Reset Input : Cleared

Program

M8120 (initialize pulse) is a special internal relay that turns on when the SmartAXIS runs.



Note: In this example, Z-phase reset input is not used.

Catch Input

The catch input function is used to receive short pulses from sensor outputs regardless of the scan time. Input pulses shorter than one scan time can be received. Six inputs I0, I2, I3, and I5 through I7 can be designated to catch a rising or falling edge of short input pulses, and the catch input statuses are stored to special internal relays M8090 through M8095, respectively.

The Function Area Settings dialog box is used to designate inputs I0, I2, I3, and I5 through I7 as a catch input.

Normal input signals to input terminals are read when the END instruction is executed at the end of a scan.

Since these settings relate to the user program, the user program must be downloaded to the SmartAXIS after changing any of these settings.

Catch Input Specifications

Minimum Turn ON Pulse Width	5 μ s
Minimum Turn OFF Pulse Width	5 μ s

Note: Input filter settings have no effect on the catch inputs. For the input filter function, see "Input Filter" on page 5-34.

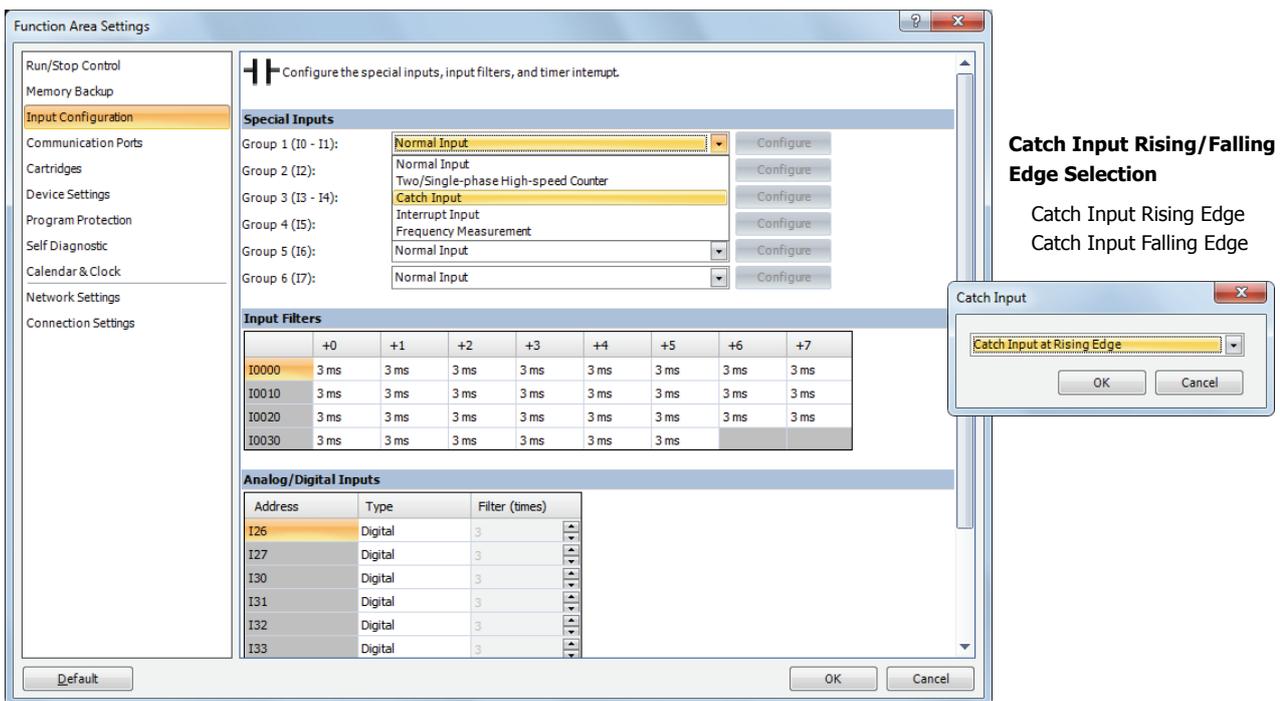
Catch Input Terminals and Special Internal Relays for Catch Inputs

Group	Catch Input No.	Special Internal Relay for Catch Input
Group 1	I0	M8090
Group 2	I2	M8091
Group 3	I3	M8092
Group 4	I5	M8093
Group 5	I6	M8094
Group 6	I7	M8095

Note: Only the 24-, 40-, and 48-I/O types can use external inputs I6 and I7 as catch inputs. The 12-I/O type cannot use external inputs I6 and I7 as catch inputs.

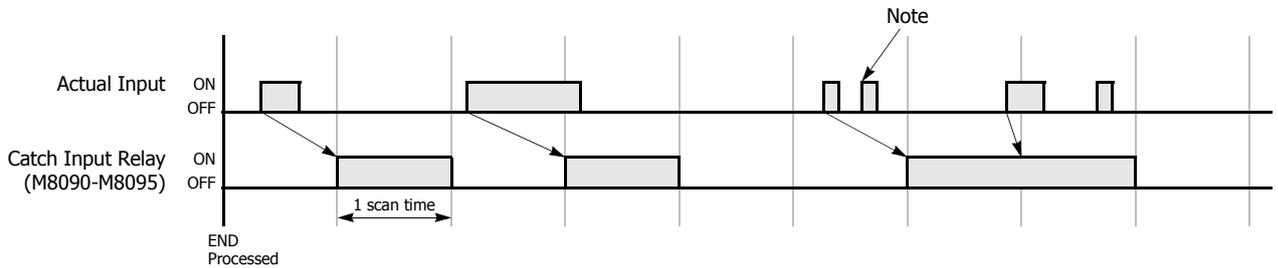
Programming WindLDR

- From the WindLDR menu bar, select **Configuration > Input Configuration**.
The Function Area Settings dialog box for Input Configuration appears.

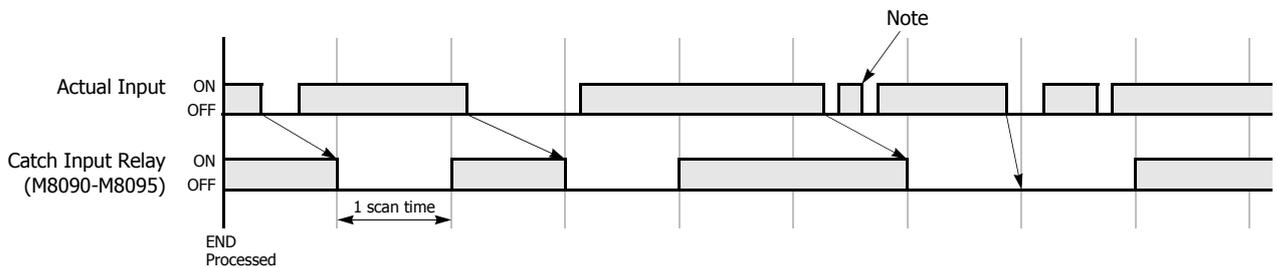


2. Select **Catch Input** in the Groups 1 through 4 pull-down list boxes. The Catch Input dialog box appears.
3. Select **Catch Input Rising Edge** or **Catch Input Falling Edge** in the pull-down list.

Catching Rising Edge of Input Pulse



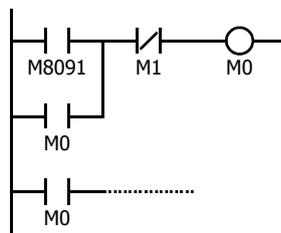
Catching Falling Edge of Input Pulse



Note: When two or more pulses enter within one scan, subsequent pulses are ignored.

Example: Maintaining Catch Input

When a catch input is received, the catch input relay assigned to a catch input is turned on for only one scan. This example demonstrates a program to maintain a catch input status for more than one scan.



Input I2 is designated as a catch input using the Function Area Settings.

When input I2 is turned on, special internal relay M8091 is turned on, and M0 is maintained in the self-holding circuit.

When NC input M1 is turned off, the self-holding circuit is unlatched, and M0 is turned off.

M0 is used as an input condition for the subsequent program instructions.

Interrupt Input

When a quick response to an external input is required, such as positioning control, the interrupt input can call a subroutine to execute an interrupt program.

Six inputs I0, I2, I3, and I5 through I7 can be designated to execute interrupt at a rising and/or falling edge of input pulses. When an interrupt is initiated by inputs I0, I2, I3, and I5 through I7, program execution immediately jumps to a predetermined label number stored in special data registers D8032 through D8035, D8037, and D8038 respectively. The Function Area Settings dialog box is used to designate inputs I0, I2, I3, and I5 through I7 as an interrupt input, normal input, high-speed counter input, or catch input.

Normal input signals to input terminals are read when the END instruction is executed at the end of a scan.

Since these settings relate to the user program, the user program must be downloaded to the SmartAXIS after changing any of these settings.

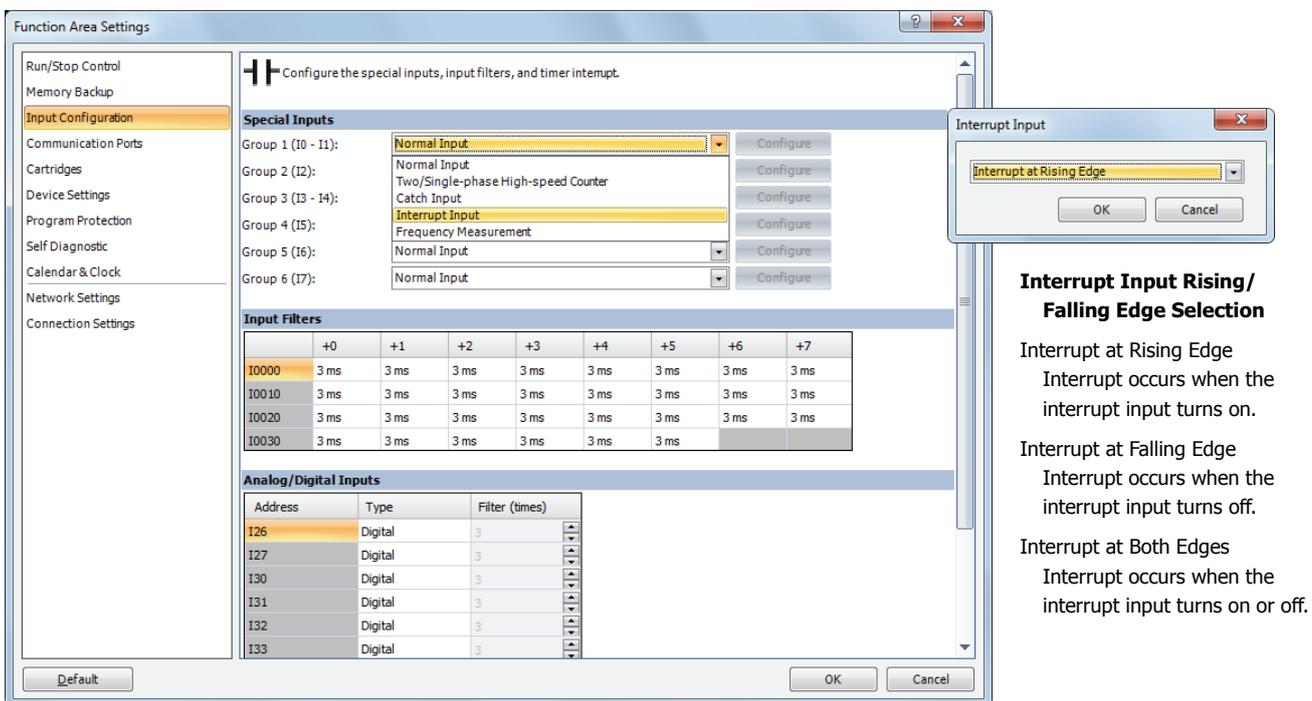
Interrupt Input Terminals, Special Data Registers, and Special Internal Relays for Interrupt Inputs

Group	Interrupt Input No.	Interrupt Input Jump Destination Label No.	Interrupt Input Status
Group 1	I0	D8032	M8070
Group 2	I2	D8033	M8071
Group 3	I3	D8034	M8072
Group 4	I5	D8035	M8073
Group 5	I6	D8037	M8074
Group 6	I7	D8038	M8075

Note: Only the 24-, 40-, and 48-I/O types can use external inputs I6 and I7 as interrupt inputs. The 12-I/O type cannot use external inputs I6 and I7 as interrupt inputs.

Programming WindLDR

- From the WindLDR menu bar, select **Configuration > Input Configuration**. The Function Area Settings dialog box for Input Configuration appears.



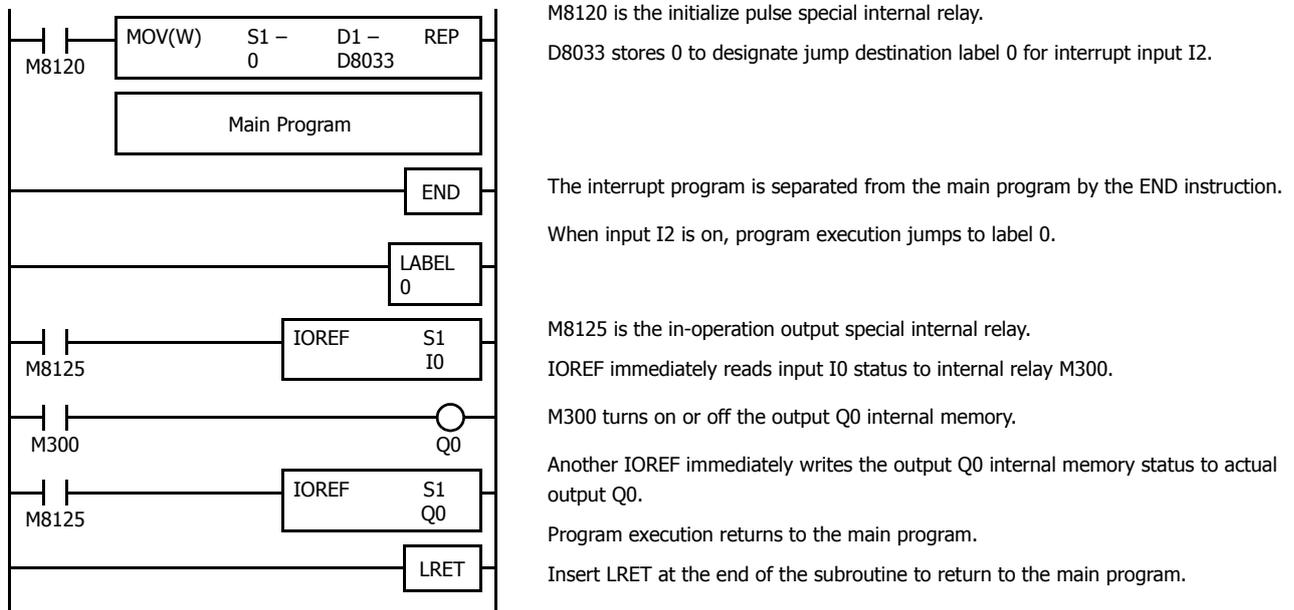
- Select **Interrupt Input** in the Groups 1 through 6 pull-down list boxes. the Interrupt Input dialog box appears.
- Select an interrupt edge in the pull-down list for each group.

Disable and Enable Interrupts

The interrupt inputs I0, I2, I3, and I5 through I7 and timer interrupt are normally enabled while the SmartAXIS is running, and can also be individually disabled using the DI instruction or enabled using the EI instruction. When interrupt inputs I0, I2, I3, and I5 through I7 are enabled, special internal relay M8070 through M8075 are turned on, respectively. See Chapter 16 "Interrupt Control Instructions" - "Special Internal Relays M8070-M8075 and M8144: Interrupt Status" in the "SmartAXIS Ladder Programming Manual".

Example: Interrupt Input

The following example demonstrates a program using the interrupt input function, with input I2 designated as an interrupt input. When the interrupt input is turned on, the input I0 status is immediately transferred to output Q0 using the IOREF (I/O refresh) instruction before the END instruction is executed. For the IOREF instruction, See Chapter 21 "Trigonometric Function Instructions" in the "SmartAXIS Ladder Programming Manual".

**Notes for Using Interrupt Inputs and Timer Interrupt:**

- When using an interrupt input or timer interrupt, separate the interrupt program from the main program using the END instruction at the end of the main program.
- When an interrupt program calls another subroutine, a maximum of 3 subroutine calls can be nested. If more than 3 calls are nested, a user program execution error occurs, turning on special internal relay M8004 and the ERR LED.
- When using an interrupt input or timer interrupt, include the label number of the interrupt program to be executed when an interrupt occurs. The label numbers stored in data registers D8032 through D8035, D8037, and D8038 specify the interrupt programs for interrupt inputs I0, I2, I3, and I5 through I7 and timer interrupt, respectively.
- When more than one interrupt input is turned on at the same time, interrupt program execution is given priority to inputs I0, I2, I3, I5, I6, and I7, in that order. If an interrupt is initiated while another interrupt program is executed, the subsequent interrupt program is executed after the prior interrupt is completed. Multiple interrupt programs cannot be executed simultaneously.
- Make sure that the execution time of the interrupt program is shorter than interrupt intervals sufficiently.
- Interrupt programs cannot use the following instructions: SOTU, SOTD, TML, TIM, TMH, TMS, TMLO, TIMO, TMHO, TMSO, CNT, CDP, CUD, CNTD, CDPD, CUDD, SFR, SFRN, WEEK, YEAR, MSG, DI, EI, XYFS, CVXTY, CVYTX, AVRG, PULS, PWM, RAMP, ZRN, ARAMP, DTML, DTIM, DTMH, DTMS, TTIM, FIFO, NDSRC, HOUR, TXD, RXD, ETXD, ERXD, DLOG, and TRACE.

Frequency Measurement

This section describes frequency measurement, which measures the frequency of pulses input to an external input. Frequency measurement is a function that measures the frequency of pulses input to an external input.

These input pulses are processed with dedicated hardware device in SmartAXIS, so frequencies can be measured with no relation to the scan time. Groups that do not use frequency measurement can be used as normal inputs, high-speed counters, catch input, and interrupt input. The measurement results are stored in special data registers and they are updated with each scan.

Function Specification

The SmartAXIS external inputs are used by switching between normal input, high-speed counters, catch input, interrupt input, and frequency measurement. To use frequency measurement, specify the relevant group as **Frequency Measurement** in the WindLDR **Function Area Settings**.

The frequency measurement results are stored in the following special data registers (Read-only):

Group		1	2	3	4	5	6
External input		I0	I2	I3	I5	I6	I7
Frequency measurement value (32 bits)	Upper word	D8050	D8056	D8062	D8068	D8134	D8140
	Lower word	D8051	D8057	D8063	D8069	D8135	D8141
Frequency measurement range		1 Hz to 100 kHz		200 Hz to 100 kHz			
Measurement error		Less than $\pm 1\%$ (Truncated after the decimal point)					
Calculation cycle		Each scan time					

Notes:

- If the input pulse cycle is longer than the scan time, the measurement results are updated at pulse cycle + 1 scan time.
- The data registers for the upper word and the lower word of the measurement value change according to the 32-bit data storage method specified. For details, see "32-bit Data Storage Setting" on page 5-58.

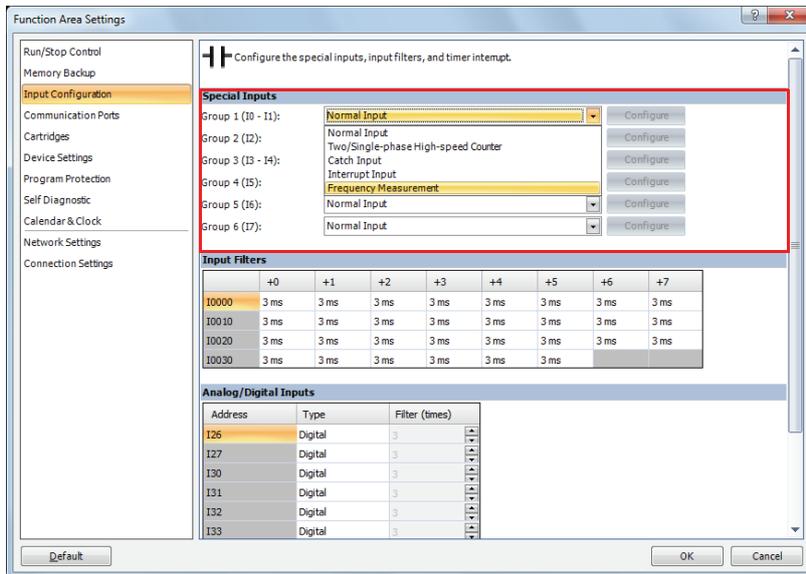
Applicable Models

- The AC power type does not support frequency measurement. In situations where the frequency measurement function is required, use the DC power type.
- Of the DC power types, only the the 24-, 40-, and 48-I/O types can use external inputs I6 and I7 for frequency measurement. The 12-I/O type cannot use external inputs I6 and I7 as the frequency measurement function.

Programming WindLDR

To use frequency measurement, you must configure the **Function Area Settings** in WindLDR and download the user program to the SmartAXIS. Frequency measurements will start when you download the user program and set the SmartAXIS to run.

1. From the WindLDR menu bar, select **Configuration > Input Configuration**.
The Function Area Settings dialog box is displayed.
2. Specify **Frequency Measurement** for the group to use frequency measurement.



3. Click **OK**.
This concludes configuring the settings.

Input Filter

The input filter function is used to reject input noises. The catch input function described in the preceding section is used to read short input pulses to special internal relays. To the contrary, the input filter rejects short input pulses when the SmartAXIS is used with input signals containing noises.

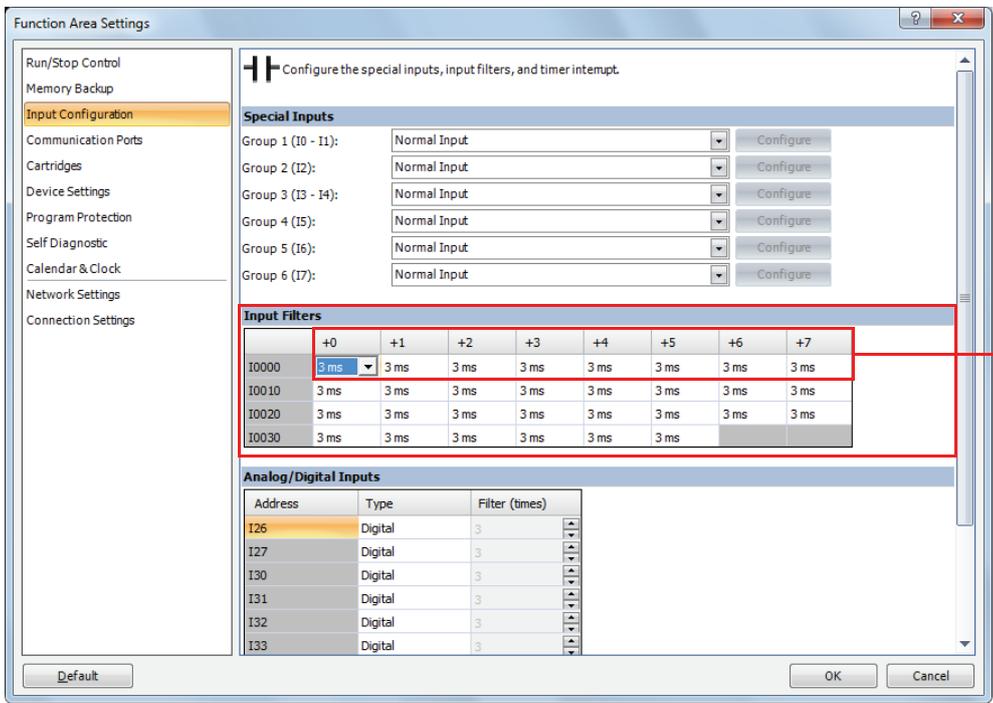
Different input filter values can be selected for inputs I0 through I7 in four groups using the Function Area Settings. Selectable input filter values to pass input signals are 0ms, and 3 through 15ms in 1ms increments. Default value is 3ms for all inputs I0 through I7. Inputs I10 and above on SmartAXIS are provided with a fixed filter of 3ms. The input filter rejects inputs shorter than the selected input filter value minus 2ms.

Normal inputs require a pulse width of the filter value plus one scan time to receive input signals. When using the input filter function, select **Normal Input** under Special Inputs on the Input Configuration dialog box in the Function Area Settings.

Since these settings relate to the user program, the user program must be downloaded to the SmartAXIS after changing any of these settings.

Programming WindLDR

- From the WindLDR menu bar, select **Configuration > Input Configuration**.
The Function Area Settings dialog box for Input Configuration appears.



The columns displayed next to I0 indicate I0 to I7.

- Select an input filter value for each group of inputs.

Input Filter Values and Input Operation

Depending on the selected values, the input filter has three response areas to reject or pass input signals.

- Reject area:** Input signals do not pass the filter (selected filter value minus 2 ms).
- Indefinite area:** Input signals may be rejected or passed.
- Pass area:** Input signals pass the filter (selected filter value).

Example: Input Filter 8ms

To reject input pulses of 6ms or less, select input filter value of 8ms. Then input pulses of 8ms plus one scan time are accepted correctly at the END processing.

	6ms	8ms + 1 scan
Input	Rejected	Indefinite
	Accepted	

Analog Input

This section describes input analog signals such as those from pressure sensors.

The SmartAXIS is equipped with embedded analog inputs. This function acquires 0 to 10V DC voltage analog input by converting it into 0 to 1000 digital values. The converted analog signals are stored in special data registers. External inputs that are not specified as analog inputs are digital inputs.

For the on/off threshold value when digital input is specified, see "Product Specifications" on page 2-1.

Note: When analog input is configured as digital input, the input filter is active.

Analog input value storage locations

A maximum of eight analog inputs can be used. The converted analog signals are stored in special data registers (D8040 to D8047: read-only) as values between 0 and 1000. These values are updated with each scan.

Analog input (I)	0	1	2	3	4	5	6	7
Special data register that stores the analog input value	D8040	D8041	D8042	D8043	D8044	D8045	D8046	D8047

Analog Input Filter

The analog input data is averaged by the specified filter count. This can reduce rapid fluctuations in analog input.

The larger this value is set, the slower the tracking of the change in analog input becomes.

Count	Description
0	No filtering
1 to 255	The input value is set as the average value of n samples of analog input data. (n: Count)

When filtering, the input value is calculated with the equation below.

$$\text{Analog input value after filtering} = \frac{\text{Total analog input values for filter count (n) worth of scans}}{\text{Filter count n}}$$

Analog Input Allocation

The analog inputs are shared with the digital inputs. The allocation of analog inputs varies based on to the model.

12-I/O type

Input (I)	0	...	5	6	7
Analog input (AI)	—	—	—	0	1
Special data register that stores the analog input value	—	—	—	D8040	D8041

24-I/O type

Input (I)	0	...	13	14	15	16	17
Analog input (AI)	—	—	—	0	1	2	3
Special data register that stores the analog input value	—	—	—	D8040	D8041	D8042	D8043

40-I/O type

Input (I)	0	...	21	22	23	24	25	26	27
Analog input (AI)	—	—	—	0	1	2	3	4	5
Special data register that stores the analog input value	—	—	—	D8040	D8041	D8042	D8043	D8044	D8045

48-I/O type

Input (I)	0	...	25	26	27	30	31	32	33	34	35
Analog input (AI)	—	—	—	0	1	2	3	4	5	6	7
Special data register that stores the analog input value	—	—	—	D8040	D8041	D8042	D8043	D8044	D8045	D8046	D8047

5: SPECIAL FUNCTIONS

Applicable Models

The number of inputs that can be used for analog input varies based on the model.

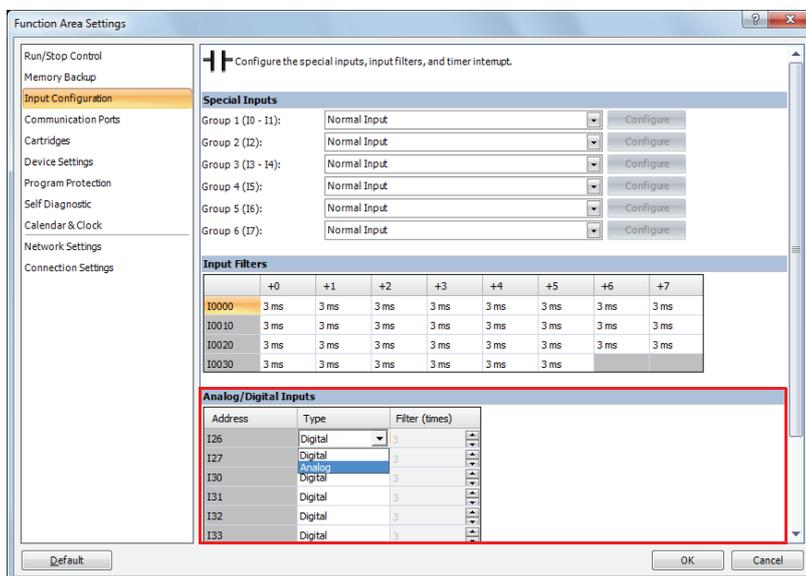
The AC power type does not support analog input. In situations where the analog input function is required, use the DC power type.

Power supply voltage	100 to 240V AC				24V DC			
Type	12-I/O type	24-I/O type	40-I/O type	48-I/O type	12-I/O type	24-I/O type	40-I/O type	48-I/O type
Analog inputs	0				2	4	6	8

Programming WindLDR

To use analog input, you must configure the Function Area Settings in WindLDR and download the user program to the SmartAXIS.

- From the WindLDR menu bar, select **Configuration > Input Configuration**.
The Function Area Settings dialog box is displayed.
- Specify **Analog** for the external input to use as analog input and configure **Filter Count**.
Click **Default** to set all the external inputs to digital.



- Click **OK**.
This concludes configuring the settings.

Timer Interrupt

In addition to the interrupt input as described in the preceding section, all SmartAXIS have a timer interrupt function. When a repetitive operation is required, the timer interrupt can be used to call a subroutine repeatedly at predetermined intervals of 10 through 140ms.

The Function Area Settings dialog box is used to enable the timer interrupt and to specify the interval, from 10 to 140ms, to execute the timer interrupt. When the timer interrupt is enabled, the program execution repeatedly jumps to the jump destination label number stored in special data register D8036, while the SmartAXIS is running. When the interrupt program is completed, the program execution returns to the main program at the address where the interrupt occurred.

Since these settings relate to the user program, the user program must be downloaded to the SmartAXIS after changing any of these settings.

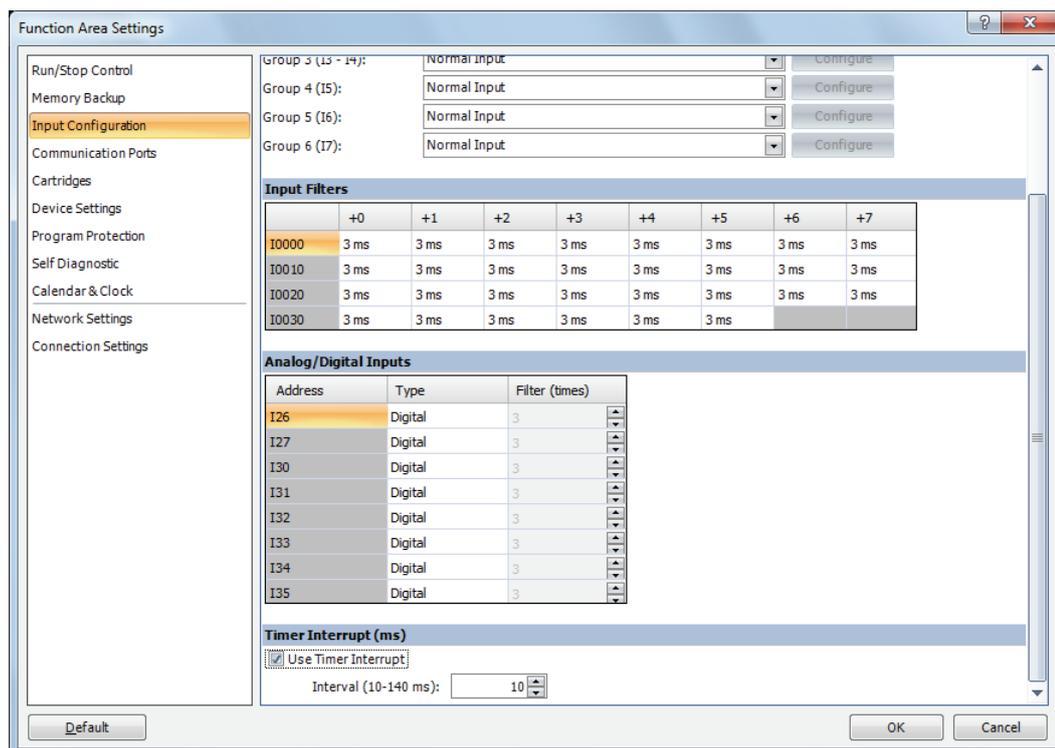
Special Data Register and Special Internal Relay for Timer Interrupt

Interrupt	Special Data Register for Timer Interrupt Jump Destination Label No.	Special Internal Relay for Timer Interrupt Status
Timer Interrupt	D8036	M8144

Note: A label is the starting address of the program branch to jump to, and it is specified by the LABEL instruction.

Programming WindLDR

- From the WindLDR menu bar, select **Configuration > Input Configuration**.
The Function Area Settings dialog box for Input Configuration appears.



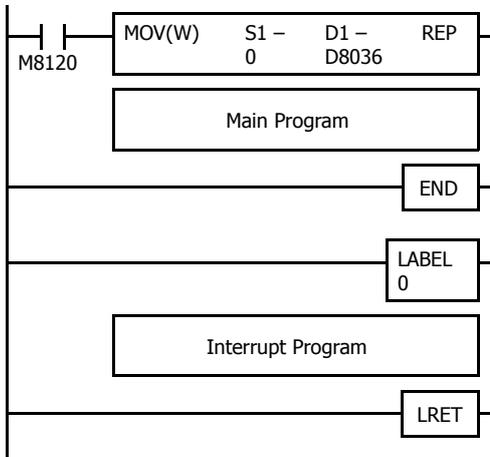
- Under the Timer Interrupt, click the check box to use the timer interrupt function.
- Select an interval to execute the timer interrupt, from 10 to 140ms.

Disable and Enable Interrupts

The timer interrupt and interrupt inputs I0, I2, I3, and I5 through I7 are normally enabled while the SmartAXIS is running, and can also be individually disabled using the DI instruction or enabled using the EI instruction. When timer interrupt is enabled, M8144 is turned on. When disabled, M8144 is turned off. See Chapter 14 "Program Branching Instructions" in the "SmartAXIS Ladder Programming Manual".

Example: Timer Interrupt

The following example demonstrates a program of using the timer interrupt function. The Function Area Settings must also be completed to use the timer interrupt function as described on the preceding page.



M8120 is the initialize pulse special internal relay.

D8036 stores 0 to designate jump destination label 0 for timer interrupt.

The interrupt program is separated from the main program by the END instruction.

While the SmartAXIS is running, program execution jumps to label 0 repeatedly at intervals selected in the Function Area Settings.

Each time the interrupt program is completed, program execution returns to the main program at the address where timer interrupt occurred.

Insert LRET at the end of the subroutine to return to the main program.

Notes for Using Timer Interrupt and Interrupt Inputs:

- When using a timer interrupt or interrupt input, separate the interrupt program from the main program using the END instruction at the end of the main program.
- When an interrupt program calls another subroutine, a maximum of 3 subroutine calls can be nested. If more than 3 calls are nested, a user program execution error occurs, turning on special internal relay M8004 and the ERR LED.
- When using a timer interrupt or interrupt input, include the label number of the interrupt program to be executed when an interrupt occurs. The label numbers stored in data registers D8032 through D8035, D8037, and D8038 specify the interrupt programs for interrupt inputs I0, I2, I3, and I5 through I7 and timer interrupt, respectively.
- If an interrupt is initiated while another interrupt program is executed, the subsequent interrupt program is executed after the prior interrupt is completed. Multiple interrupt programs cannot be executed simultaneously.
- Make sure that the execution time of the interrupt program is shorter than interrupt intervals sufficiently.
- Interrupt programs cannot use the following instructions: SOTU, SOTD, TML, TIM, TMH, TMS, TML0, TIMO, TMHO, TMSO, CNT, CDP, CUD, CNTD, CDPD, CUDD, SFR, SFRN, WEEK, YEAR, MSG, DI, EI, XYFS, CVXTY, CVYTX, AVRG, PULS, PWM, RAMP, ZRN, ARAMP, DTML, DTIM, DTMH, DTMS, TTIM, FIFOF, NDSRC, HOUR, TXD, RXD, ETXD, ERXD, DLOG, TRACE, and SCRPT.

Forced I/O function

Inputs can be forced on/off regardless of the status of physical inputs, and outputs can be forced on/off regardless of the ladder logic using the forced I/O function in WindLDR. The force input function can be used to monitor or online edit mode to test the ladder logic without the need of wiring the input terminals or turning on the actual inputs. The force output function can be used to turn on/off the outputs to the external devices.



Caution

- The forced I/O may cause unexpected operation of the SmartAXIS. Make sure of safety before forcing inputs or outputs.

Devices

All the inputs and outputs of the SmartAXIS can be forced on/off individually.

Type	Device Range	
	Inputs	Outputs
12-I/O type	I0 to I7	Q0 to Q3
24-I/O type	I0 to I17, I40 to I75, I80 to I115, I120 to I155	Q0 to Q7, Q40 to Q61, Q80 to Q101, Q120 to Q141
40-I/O type	I0 to I27, I40 to I75, I80 to I115, I120 to I155	Q0 to Q17, Q40 to Q61, Q80 to Q101, Q120 to Q141
48-I/O type	I0 to I35, I40 to I75, I80 to I115, I120 to I155	Q0 to Q21, Q40 to Q61, Q80 to Q101, Q120 to Q141

Forced I/O Status

Events of the SmartAXIS and effects on the forced I/O settings are shown below.

Events	Forced I/O Status
When the SmartAXIS starts running	The force settings are retained. The forced inputs and outputs are kept on/off even after the SmartAXIS is stopped, regardless of the status of M8025 (maintain outputs while SmartAXIS is stopped).
When the SmartAXIS is stopped.	
When the SmartAXIS is powered up	The force settings are retained, but the force is suspended. If the battery is dead, the force settings are cleared.
When user program download is executed	The force settings are retained, and whether the force will be suspended or not can be selected in the Download Program dialog box.
When Reset Input is turned on	The force settings are cleared.
When Clear All Devices is executed in the PLC Status dialog box of WindLDR	
When the system software download is executed	

Note: Force function has no effect on high-speed counters, catch inputs, or interrupt inputs. The stop or reset input can be initiated using the force function, but the force settings will be cleared as soon as the reset input is turned on.

Checking the Forced I/O Function Execution State

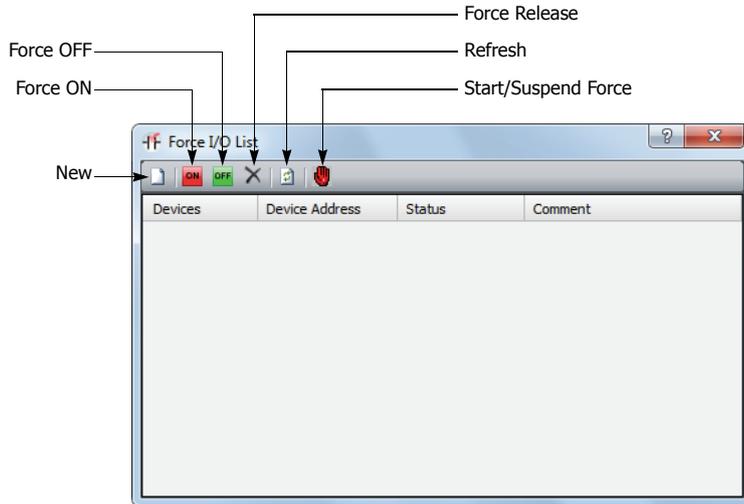
The state of the forced I/O function (running or stopped) can be checked with WindLDR, with the SmartAXIS module error status LED (SmartAXIS Lite only), or with the RUN or STOP screen on the module's LCD (SmartAXIS Pro only). The forced I/O function execution state while stopped cannot be checked with the module's power/run status LED. For the power/run status LED, see "Product Specifications" on page 2-1.

Programming WindLDR

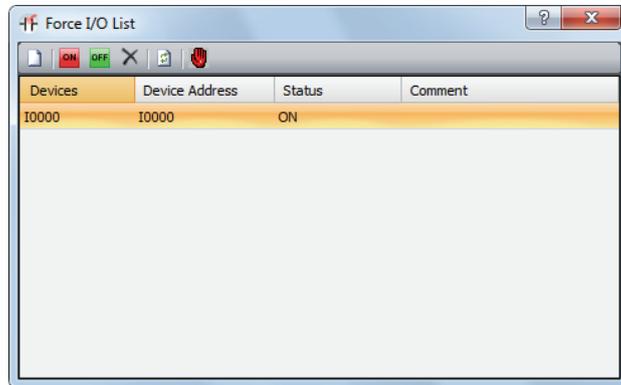
1. From the WindLDR menu bar, select **Online > Monitor > Monitor**.
Online mode is activated.

2. From the WindLDR menu bar, select **Online > Forced I/O**.

The Forced I/O List dialog box appears and shows a list of forced inputs and outputs. I/O numbers and force I/O statuses can be specified in this dialog box.

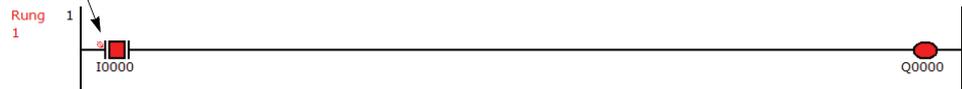


3. Click the New button and type an input or output number under Device in the list.
Click the Force On button or Force Off button to force on or off the designated input or output.



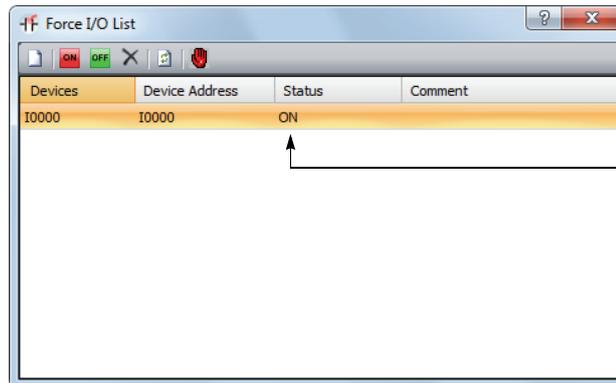
4. To start the forced I/O function, click the Start/Suspend Force button .

A sign is displayed to show input I0 is forced.



The forced I/O can be suspended temporarily by clicking the Start/Suspend Force button again.

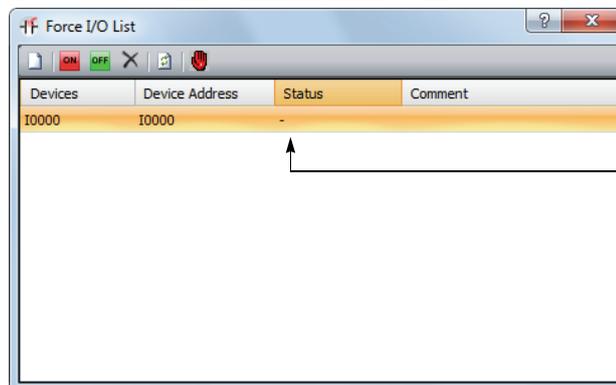
5. To suspend the forced I/O, click the Start/Suspend Force button .



Even though I0 is designated, forced I/O is suspended and actual input status is read to the SmartAXIS.

The forced inputs or outputs remain designated until the forced I/O designation is released.

6. To release the forced I/O designation, click the Force Release button .



Input I0 is released from the forced I/O designation. Even when forced I/O is enabled, actual input status is read to the SmartAXIS.

Now input I0 works as a normal input.

Note: Make sure that all the forced inputs and outputs are released when the test using the forced I/O function is finished. Select **Delete All** from the right click menu in the Forced I/O List dialog box to release all the forced inputs and outputs at once.

Communication Ports

This section describes how to connect the SmartAXIS to other devices and how to communicate with them.

The SmartAXIS is equipped with a USB port, expansion communication ports (RS232C and RS485), and an Ethernet port. The SmartAXIS can communicate with connected devices via maintenance communication, user communication, Modbus communication, and remote I/O by configuring the port and communication method for connected devices.

• Communication ports

All models are equipped with a USB port. The 24-, 40-, and 48-I/O types are equipped with optional RS232C or RS485 expansion communication ports. The 24-, 40-, and 48-I/O types are equipped with an Ethernet port.

USB port	Maintenance communication can be performed by connecting the SmartAXIS and a computer with a USB cable.
Ethernet port	The SmartAXIS can communicate with Ethernet-compatible devices such as computers and operator interfaces. Maintenance communication, user communication, Modbus communication, and remote I/O are all possible.
Expansion communication ports	Maintenance communication, user communication, and Modbus RTU communication are all possible.

• Communication functions

For details on the communications functions, see the chapter for each function.

Maintenance communication (Chapter 9)	Maintenance communication enables you to check the operating status and I/O status of the SmartAXIS, monitor and change device values, and download and upload user programs using a computer or operator interface.
User communication (Chapter 10)	The SmartAXIS can communicate with external devices equipped with RS232C, RS485, or Ethernet ports using user communication.
Modbus communication (Chapter 11)	The SmartAXIS can send and receive data with Modbus compliant devices on RS232C, RS485, or Ethernet port.

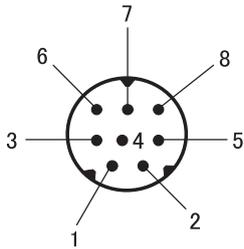
Communication Ports and Communication Methods

The communication methods supported by each communication port are as follows.

Communication Methods		USB Port	Expansion Communication Port (port 2, 3)		Ethernet Port
			RS232C	RS485	
Maintenance communication	System firmware downloads	Yes	No	No	No
	User program downloads/uploads		No	No	Yes
	Monitoring/ changing devices		Yes	Yes	Yes
User communication		No	Yes	Yes	Yes
Modbus RTU	Master	No	Yes	Yes	No
	Slave				
Modbus TCP	Client	No	No	No	Yes
	Server				
Remote I/O	Master	No	No	No	Yes
	Slave				

Expansion Communication Port Wiring Diagram

The mini-DIN connector pin assignments and signal names are as follows.



RS232C (FT1A-PC1)

Pin Number	Signal Name		Cable Color	Signal Direction	Peripheral Device (D-SUB)
	Port 2	Port 3			
Cover	Port 2	Port 3	Shield	—	RS232C
1	RS (RTS)	RS (RTS)	Black	→	(DR)
2	ER (DTR)	ER (DTR)	Yellow	→	(CTS)
3	SD (TXD)	SD (TXD)	Blue	→	RD
4	RD (RXD)	RD (RXD)	Green	←	SD
5	DR (DSR)	DR (DSR)	Brown	←	RS
6	SG	SG	Gray	None	SG
7	SG	SG	Red		SG
8	NC	NC	White		NC

RS485 (FT1A-PC2)

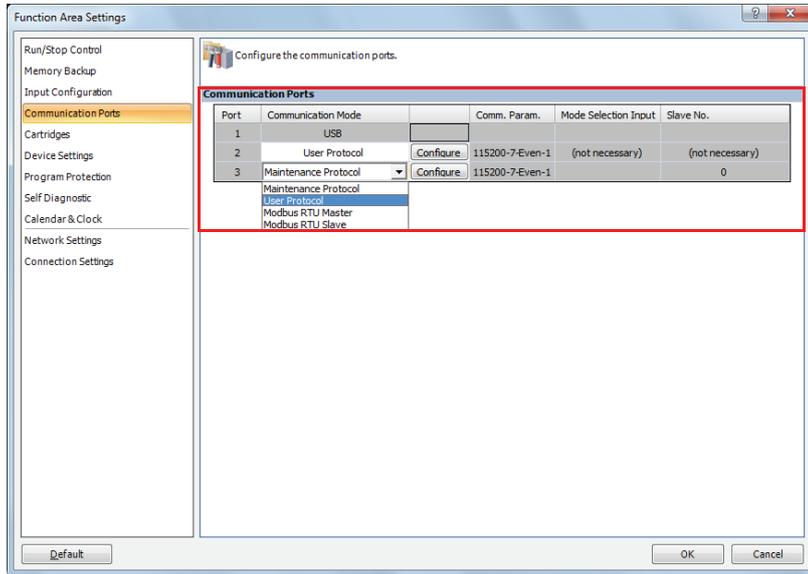
Pin Number	Signal Name		Cable Color	Signal Direction	Peripheral Device (D-SUB)
	Port 2	Port 3			
Cover	Port 2	Port 3	Shield	—	RS485
1	A	A	Black	↔	A
2	B	B	Yellow	↔	B
3	NC	NC	Blue		NC
4			Green		
5			Brown		
6			Gray		
7	SG	SG	Red	—	SG
8	NC	NC	White	None	NC

Note: Do not connect cables to NC. There is a risk of malfunction or failure.

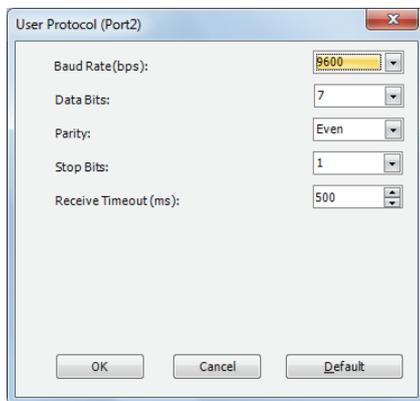
Programming WindLDR

Configure the communication format according to the communication specifications of the device.

1. From the WindLDR menu bar, select **Configuration > Comm. Ports**.
The Function Area Settings dialog box is displayed.
2. In the **Communication Mode** pull-down list for the appropriate port, select the communication mode.
The configuration dialog that corresponds to the communication mode is displayed.



3. Change the settings on the configuration dialog according to the communication format for the destination device.
A user communication example is shown below.



4. Click **OK**.
This concludes configuring the settings.

Memory Cartridge

This section describes the memory cartridge used to save SmartAXIS user programs.

A user program can be saved on the memory cartridge. Insert a memory cartridge into the SmartAXIS and the user program on that memory cartridge is subject to priority execution over the user program in the SmartAXIS module's ROM. If a user program is not present in the memory cartridge, the user program in the SmartAXIS module's ROM is executed.

Memory Cartridge	User Program to Execute
Equipped	The user program on the memory cartridge is executed.
Not equipped	The user program in the SmartAXIS module's ROM is executed.

Specifications

Name	Function/Purpose	Model Number
Memory cartridge	User program save memory (One user program can be saved)	FT1A-PM1

Downloading and uploading user programs

The user program on the memory cartridge can be downloaded to the SmartAXIS module when the SmartAXIS is powered with the function area settings. Or when uploading to the memory card is configured with WindLDR, the user program can be uploaded to the memory cartridge inserted in the SmartAXIS.

For the SmartAXIS Pro, the user program on the memory cartridge can be downloaded or uploaded to the SmartAXIS Pro module with the LCD and operation buttons.

Notes:

- Always turn the SmartAXIS off before removing or installing a memory cartridge. If the memory cartridge is inserted or removed with the power on, SmartAXIS operation cannot be guaranteed. There is a risk of the product failing.
- The memory cartridge may break if dropped. Take care not to drop it when removing it.

SmartAXIS system firmware compatibility

If the user program on the inserted memory cartridge includes instructions or functions not supported by the SmartAXIS module's system firmware, a program error will occur. Update the SmartAXIS module's system firmware to the latest version with WindLDR.

Download Settings

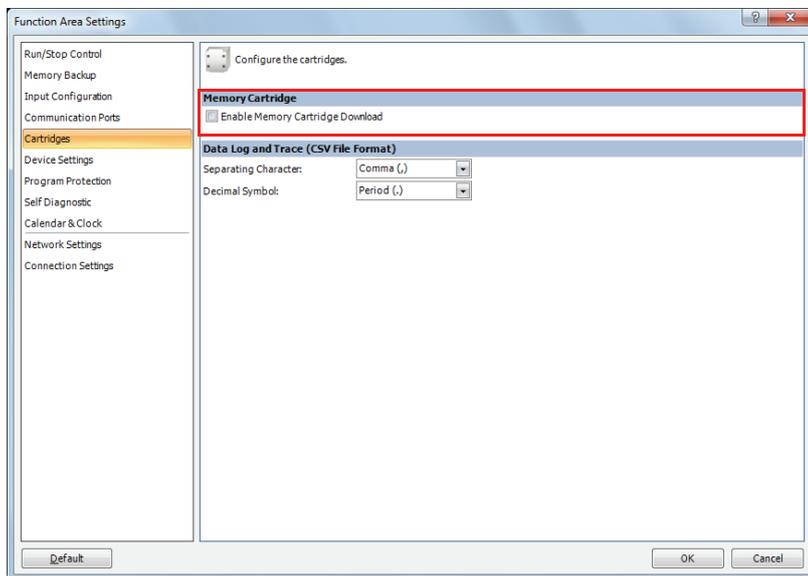
The user program on the memory cartridge can be downloaded to the SmartAXIS module. If a user program already exists on the SmartAXIS module, that user program will be overwritten.

First configure the user program to automatically download to the SmartAXIS module in the WindLDR function area settings, then download the user program to the memory cartridge. When a memory cartridge configured with download settings is inserted into the SmartAXIS and the power is turned on, the user program on the memory cartridge is automatically downloaded to the SmartAXIS. For the SmartAXIS Pro, the user program can also be downloaded using the LCD and operation buttons.

Programming WindLDR

Insert the memory cartridge into the SmartAXIS, turn the power on, and then connect the SmartAXIS to the computer (WindLDR).

1. From the WindLDR menu bar, select **Configuration > Cartridge**.
The Function Area Settings dialog box is displayed.
2. Select the **Enable memory cartridge download** check box.



3. Click **OK**.
This concludes configuring the settings for the memory cartridge to download the user program to the SmartAXIS.
4. Download the user program from the memory cartridge that is inserted in the SmartAXIS.
5. Turn off the SmartAXIS power and remove the memory cartridge.
6. Insert the memory cartridge into the SmartAXIS you want to download the user program to, and turn the power on.
The user program on the memory cartridge is automatically downloaded to the SmartAXIS module.

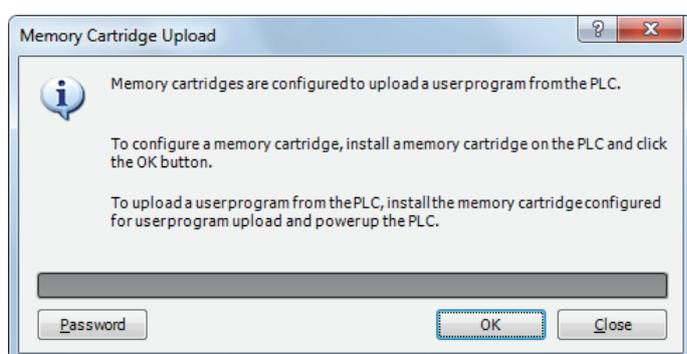
Upload Settings

The SmartAXIS module user program can be uploaded to the memory cartridge. First configure the settings for the memory cartridge to automatically upload the user program from the SmartAXIS module in WindLDR. If a user program already exists on the memory cartridge, the user program on the memory cartridge is deleted and the upload settings are configured. When a memory cartridge configured with upload settings is inserted in the SmartAXIS and the power is turned on, the user program on the SmartAXIS module is automatically uploaded to the memory cartridge. The upload to the memory cartridge configured with upload settings is valid only one time. To upload the user program again, configure the settings for the memory cartridge to automatically upload the user program. For the SmartAXIS Pro, the user program on the SmartAXIS module can be uploaded to the memory cartridge with the LCD and operation buttons. If a user program already exists on the memory cartridge, the user program on the memory cartridge is deleted and the user program is uploaded.

Programming WindLDR

1. Insert the memory cartridge into the SmartAXIS, turn the power on, and then connect the SmartAXIS to the computer (WindLDR).
2. From the WindLDR menu bar, select **Online > Upload > Memory Cartridge Upload**.

The Memory Cartridge Upload dialog box is displayed.



Note: If the user program on the SmartAXIS to upload is password protected, click **Password** and enter the password.

3. Click **OK**.
The user program on the memory cartridge is deleted at this time.
4. Turn off the SmartAXIS power and remove the memory cartridge.
This concludes configuring the settings for the memory cartridge to upload the user program from the SmartAXIS.
5. Insert the memory cartridge with the completed upload settings into the SmartAXIS and turn the power on.
The user program is automatically uploaded from the SmartAXIS module to the memory cartridge.

Notes:

In the following situations, a memory cartridge transfer error will occur. If the error occurs, the user program is not uploaded to the memory cartridge, and SmartAXIS operation stops.

- When the SmartAXIS user program upload protection is set to **Prohibited**
- When the SmartAXIS user program password protection is set and the memory cartridge password does not match

For user program protection, see "User Program Protection" on page 5-60.

User Program Passwords

When password protection is configured for the SmartAXIS module user program, uploads and downloads only happen when the password configured for the memory cartridge and the SmartAXIS module user program password match.

For user program protection, see "User Program Protection" on page 5-60.

Type	Password match	Password does not match
SmartAXIS Pro	Enter the password with the module's LCD and operation buttons.	Enter the password with the module's LCD and operation buttons.
SmartAXIS Lite	Automatic upload/download	Automatic upload/download not possible

SD Memory Card

This section describes how to save log data to the SD memory card and maintain the SD memory card.

The 40- and 48-I/O types SmartAXIS are equipped with an SD memory card slot, and SD memory cards with 32GB maximum capacity can be used. Device values (log data) can be output to the SD memory card as CSV files using the DLOG (data log) and the TRACE (data trace) instructions. This enables log saved and analyzed when problems occur. The contents of the files saved to the SD memory card can be checked on a computer. The files saved to the SD memory card can be uploaded using WindLDR.

Function	Description	Reference
Save log data	Specified device values can be saved to the SD memory card as CSV files using the DLOG and TRACE instructions.	5-48
SD memory card maintenance with WindLDR	The SD memory card data can be read to a computer or deleted by using WindLDR. SD memory card data can be managed and checked.	5-49
Format SD memory card with the SmartAXIS	The SD memory card can be formatted using the LCD and operation buttons on the module. (SmartAXIS Pro only)	6-25

For the SD memory card hardware specifications, see "Product Specifications" on page 2-1.

Notes:

- Set the write-protect switch on the SD memory card to the off position before inserting it.
- Insert and remove the SD memory card in the direction indicated on the SmartAXIS module.
- Do not remove the SD memory card while it is being accessed. There is a risk of damage to the SD memory card and the data stored on it.

Save Log Data

Using the DLOG (data log) and the TRACE (data trace) instructions, specified device values are saved to the SD memory card as the log data (CSV files). The DLOG instruction outputs the date and time and the device values of the specified devices to the CSV file in the specified folder. The TRACE instruction outputs the date and time and the device values of the previous number of scans for the specified devices to the CSV file in the specified folder. For details, see "Data Log Instructions" in the SmartAXIS Ladder Programming Manual.

The SmartAXIS cannot write data to the SD memory card when its write-protect switch is on. Always set the write-protect switch of the SD memory card to off position before inserting it to the SmartAXIS.

• CSV file output sample with the DLOG instruction

Time	D0010	D0011
2011/09/07 15:40:00	12345	1
2011/09/07 15:41:00	1212	3
2011/09/07 15:42:00	345	4

• CSV file output sample with the TRACE instruction

Triggered at:	2011/09/07 15:40		
Scan	D0010	D0011	D0012
Old	1	9	17
	2	10	18
New	3	11	19

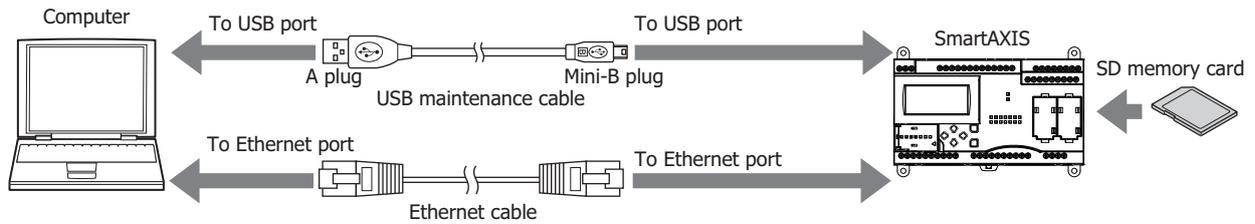
SD Memory Card Maintenance with WindLDR

You can browse and manipulate files on the SD memory card inserted in the SmartAXIS using Data File Manager of WindLDR.

- Browse folders and files on the SD memory card.
- Upload files on the SD memory card.
- Delete folders and files on the SD memory card.
- Format the SD memory card.

To browse and manipulate the files on the SD memory card inserted in the SmartAXIS using the Data File Manager, connect the computer and the SmartAXIS with either of these methods.

- Connect the USB port on the computer and the USB port on the SmartAXIS with a USB maintenance cable.
- Connect the Ethernet port on the computer and the Ethernet port on the SmartAXIS with an Ethernet cable.



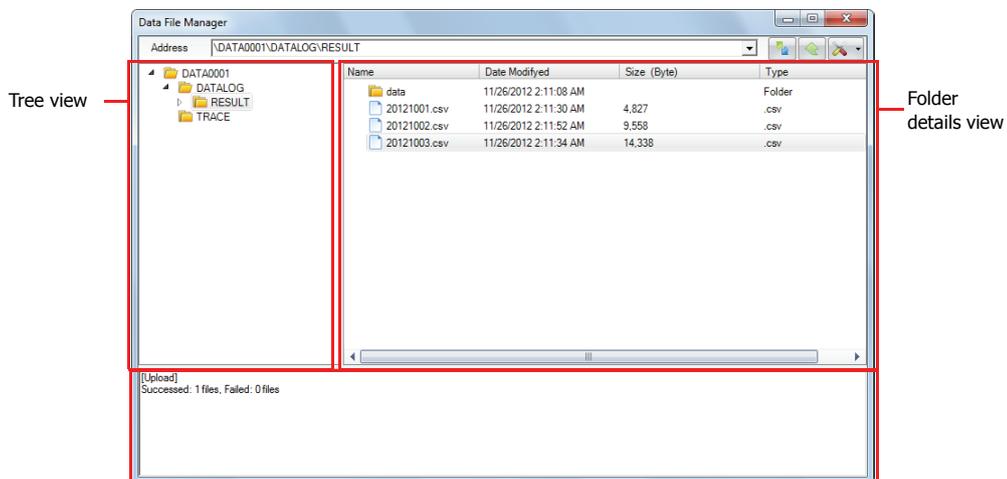
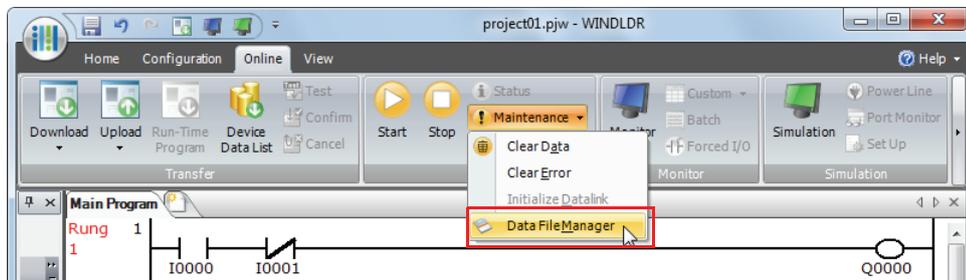
Notes:

- The Data File Manager cannot be used when an SD memory card is not inserted into the SmartAXIS.
- The Data File Manager cannot be used while the SmartAXIS is running.
- The Data File Manager uses the maintenance communication protocol of SmartAXIS, so it can be used only when the maintenance communication is possible. For example, the communication over Ethernet is not possible if the port number is different.
- The operating speed varies according to the state of communications with the SmartAXIS and the capacity of the SD memory card.
- The Data File Manager cannot perform certain operations such as downloading files, creating folders, and changing file names.
- The basic restrictions of SD memory cards and the file system are the same as the restrictions for the DLOG and the TRACE instructions.

Starting the Data File Manager

Operation procedure

1. Select **Online > PLC > Maintenance > Data File Manager**.
The Data File Manager dialog box opens.



Execution log view

The execution log view shows the results of accessing and manipulating files and folders on the tree view and the folder details view.

Exiting the Data File Manager

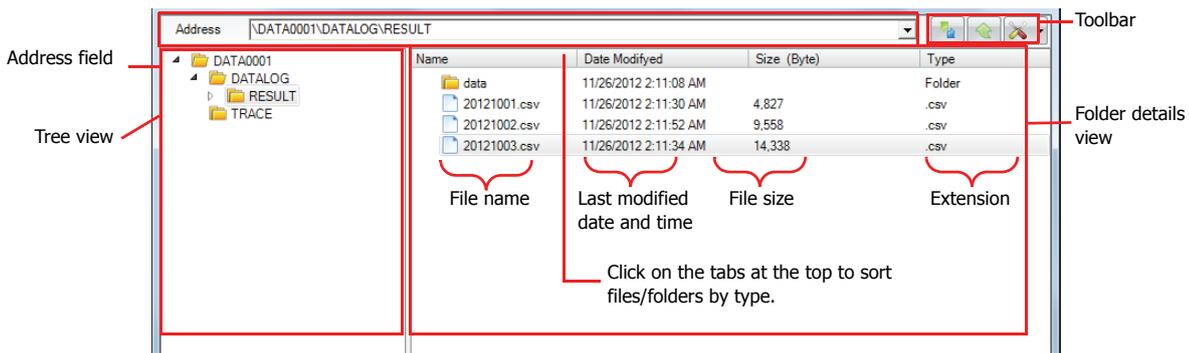
Operation procedure

1. Click **X** at the upper-right corner of the Data File Manager.
The Data File Manager exits.

Browsing folders

Operation procedure

1. In the address field, enter the folder path to the data.
The contents of the folder are displayed.



Click **Refresh** button on the toolbar to refresh the view with the latest status.

If you double click on a folder on the tree view or the folder details view in the Data File Manager, the contents of the folder are displayed.

Deleting files and folders

Operation procedure

1. On the details view, right click on a file or folder and select **Delete**.
2. On the delete confirmation dialog, click **Yes**.
The file or folder is deleted.

Uploading files

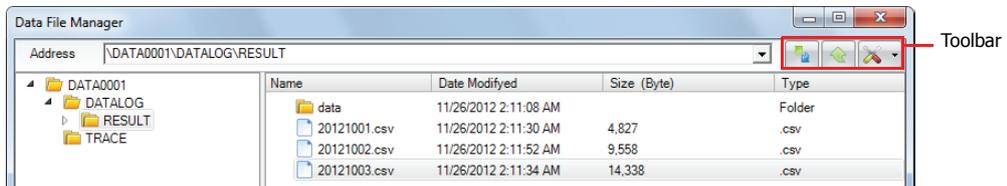
Operation procedure

1. Click **Upload** button on the toolbar.
A dialog box is displayed for you to enter the location to save the selected files.
2. Enter the location and click **OK**.
The files uploaded from the SD card is saved to the specified location.

Formatting the SD memory card

Operation procedure

1. Click **Tools** button on the toolbar.



2. Select **Format SD Memory Card**.

A warning message is displayed. To execute the format, click **Yes**, and then the format will be executed.

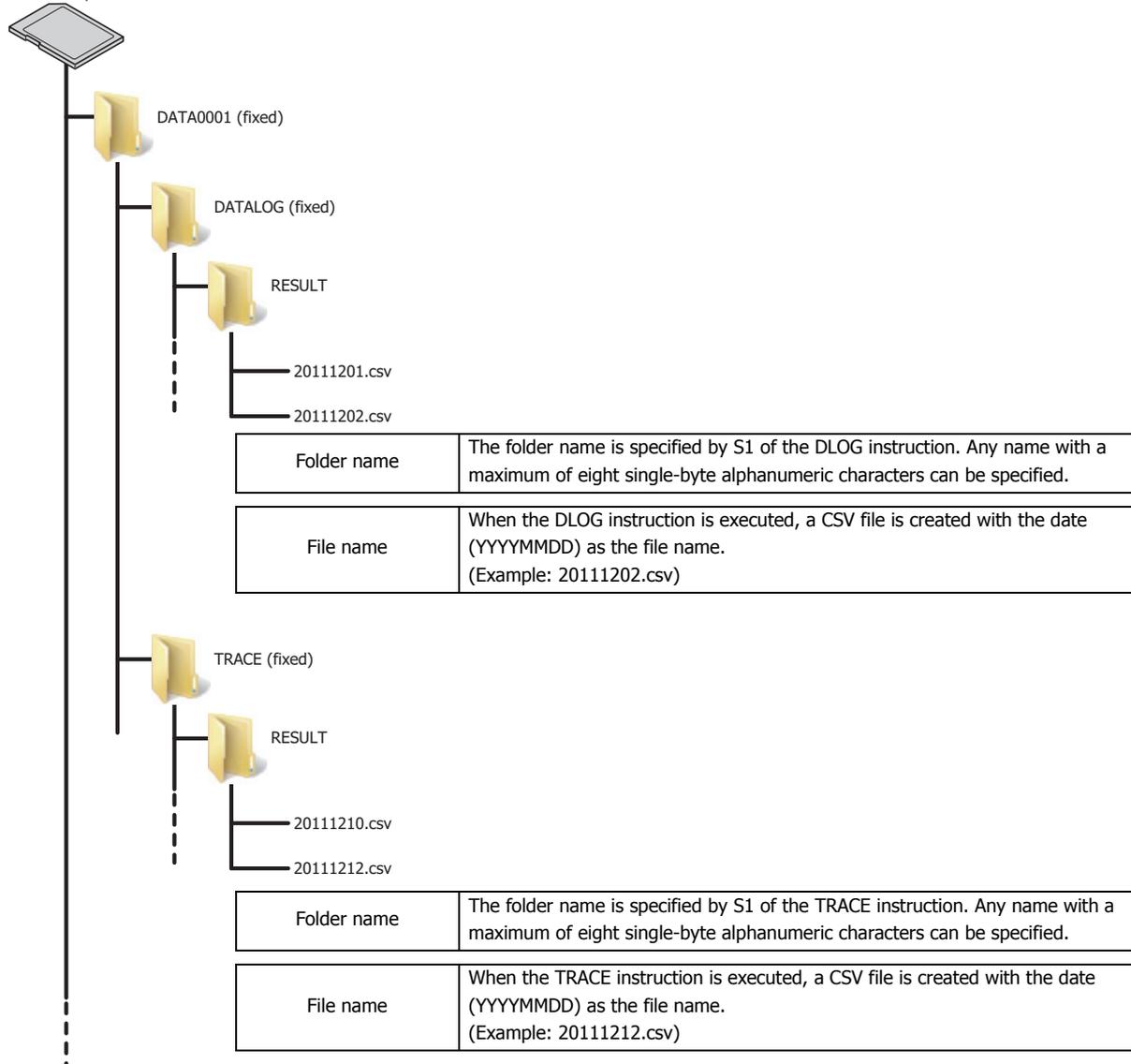
Notes:

- The volume label given to the SD memory card when formatted is fixed as "IDEC_FT1A."
- Formatting the SD memory card on the SmartAXIS is equivalent to formatting it with the quick format option in Windows.

File Structure

The save destination for log data varies depending on the instruction. For the DLOG (data log) instruction, the files are saved under the DATALOG folder. For the TRACE (data trace) instruction, the files are saved under the TRACE folder. The name of folder storing files is specified in the DLOG and the TRACE instructions.

SD memory card



5: SPECIAL FUNCTIONS

SD Memory Card Status LED and SD Memory Card Status

The status LED turns on or flashes when the SD memory card is being formatted or during reading and writing.

SD memory card status LED	SD memory card state	Operation
On	The standby state where the SD memory card can be written or read	The SD memory card can be removed.
Slow flashing (1 second interval)	<ul style="list-style-type: none"> While the SmartAXIS is recognizing the SD memory card While the SmartAXIS is stopping the access due to SD memory card access stop flag (M8076) turning on (slow flashing, then off) 	Do not remove the SD memory card.
Quick flashing (100 millisecond interval)	Reading from or writing to the SD memory card	
Off	<ul style="list-style-type: none"> When an SD memory card is not inserted When an unsupported or unformatted SD memory card is inserted When access to the SD memory card is stopped by SD memory card access stop flag (M8076) When the SmartAXIS is turned off 	The SD memory card can be removed.

Special Internal Relays for the SD Memory Card

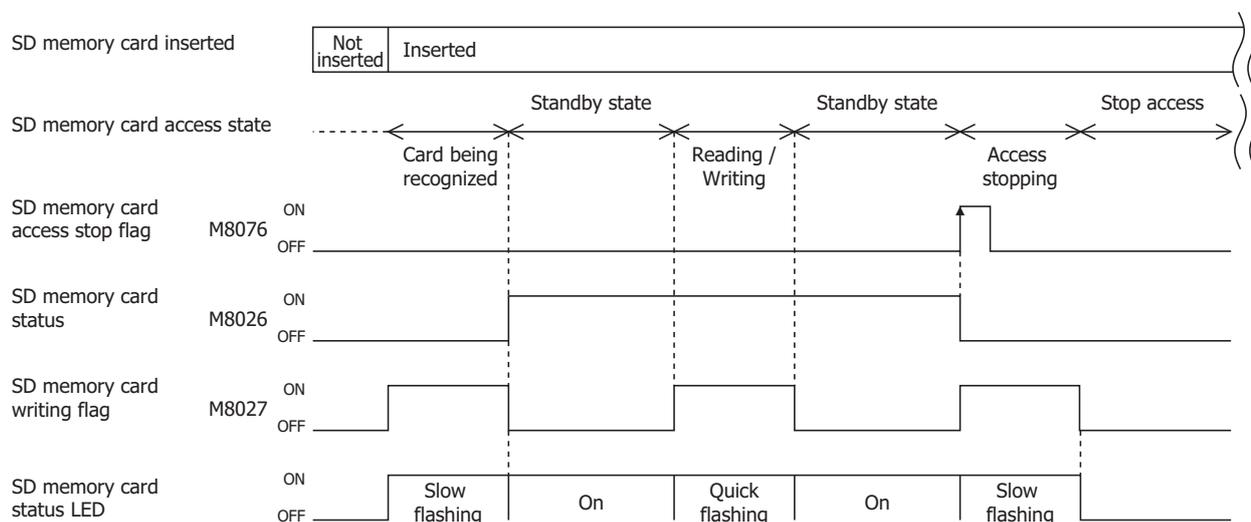
The special internal relays (M8026 and M8027) turn on and off according to the installation status and the access state of the SD memory card. Access to the SD memory card can be stopped by special internal relay M8076.

Address	Function	Description	Read/Write
M8026	SD Memory Card Status	This special internal relay turns on when the SD memory card has been inserted into the SmartAXIS, the card has been recognized, and the card is in a usable state. This special internal relay turns off when the SD memory card is not inserted or when the SD memory card is not recognized.	R
M8027	SD Memory Card Writing Flag	This special internal relay turns on when the SD memory card is being accessed. This special internal relay turns off when the access has finished.	
M8076	SD Memory Card Access Stop Flag	When this special internal relay changes from off to on, access to the SD memory card is stopped. Once the access to the SD memory card is stopped, insert the card into the SmartAXIS again to make it accessible.	R/W

Note: R/W is the abbreviation for read/write. R/W indicates that the relay can be read and written. R indicates that the relay can only be read. W indicates that the relay can only be written.

Timing Chart

The special internal relays turn on and off according to the installation status and the access state of the SD memory card as shown below.



Backlight ON Time

This section describes the function to change the backlight ON time for the SmartAXIS Pro.

Function Specification

When you press operation buttons on the SmartAXIS Pro, the LCD backlight is turned on. The backlight is turned off automatically when there are no user operations. The backlight ON time can be configured with D8074 between 1 to 65,535 seconds. When the backlight ON time is 0, the backlight is always ON. The default value is 10 seconds and can be configured in the Function Area Settings dialog box of WindLDR.

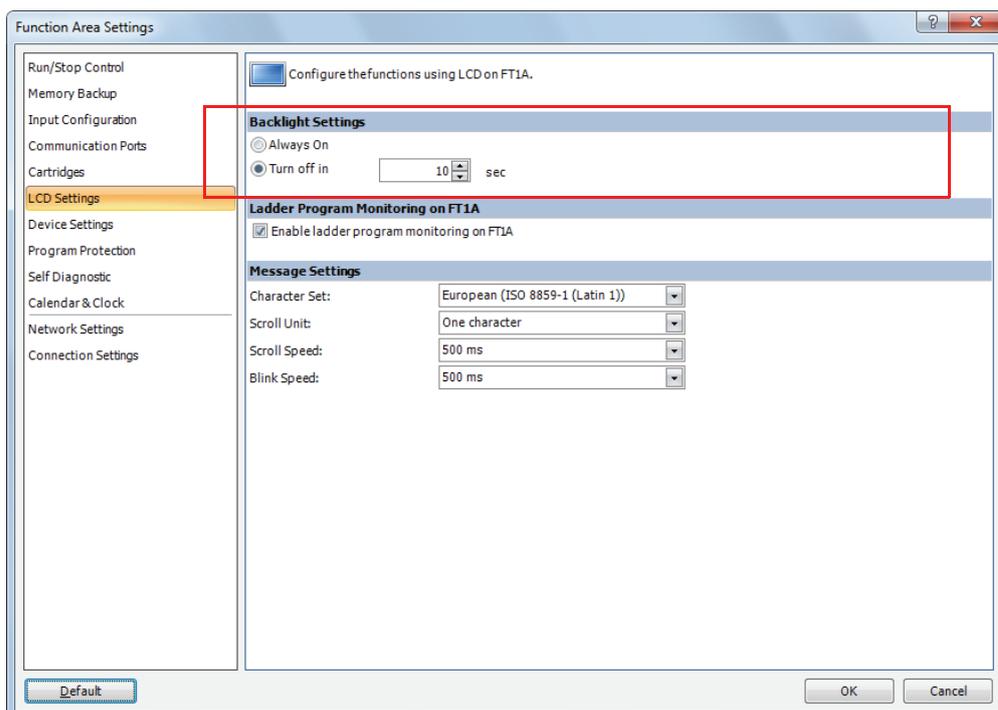
Address	Description	Read/Write
D8074	Backlight ON Time	R/W

Notes

- The default value configured in the Function Area Settings is stored in D8074 once the user program downloaded is completed.
- If the backup battery is dead, the default value is stored in D8074.
- The backlight ON time can be configured with HMI function of SmartAXIS Pro. For details, see "Setting the LCD Backlight ON Time" on page 6-10.

Programming WindLDR

1. From the WindLDR menu bar, select **Configuration > LCD Settings**.
The Function Area Settings dialog box is displayed.



2. Select Always On or Turn off in in the backlight settings.
When you select Turn off in, enter the time period from the backlight is turned on until it is turned off. The time can be configured between 1 and 65,535 seconds in increments of 1 second.
3. Click the OK button.
This concludes configuring the settings.

Monitoring Ladder Program

This section describes the function to monitor the ladder program on the LCD of the SmartAXIS.

Function Specification

Two lines of the ladder program stored in the ROM can be displayed on the LCD. You can show the ladder program at the specified line number by specifying it using the operation buttons. The SmartAXIS saves the monitored ladder line when ladder program monitoring is finished, and you can resume to monitor the ladder program from the same ladder line.

You can display the details of instruction parameters or switch the on/off state of contacts using the operation buttons.

The ladder program can be monitored regardless of the Run/Stop status of the SmartAXIS.

Notes:

- The default value of the previously monitored ladder line number is one.
- The previously monitored ladder line number is lost at the following conditions:
 - SmartAXIS Pro is powered up.
 - A user program is downloaded to the SmartAXIS Pro.

In order to monitor the ladder program on the LCD of the SmartAXIS Pro, you need to configure settings using WindLDR.

There are two restrictions in creating the ladder programs that can be displayed on the LCD. Create ladder programs considering those restrictions.

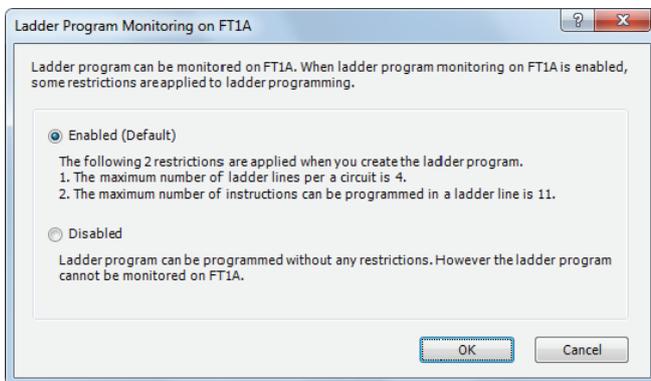
- A maximum of four ladder lines can be programmed in each ladder circuit.
- A maximum of eleven instructions can be programmed in each ladder line.

Programming WindLDR

■ Configuration at the start up of WindLDR

1. Launch WindLDR.

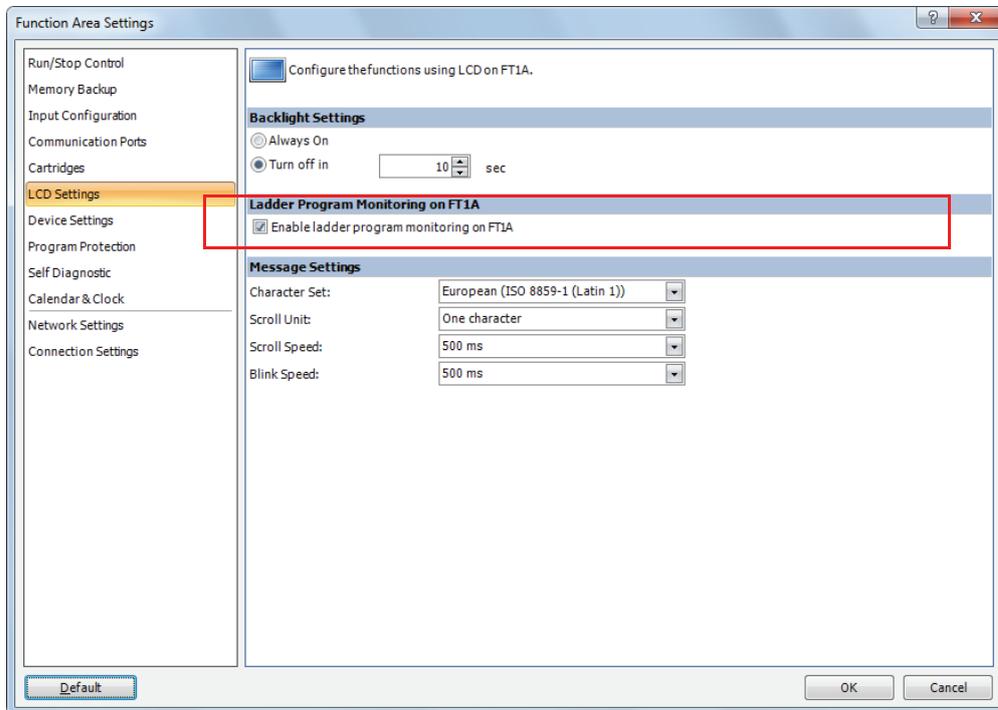
The Ladder Program Monitoring on FT1A dialog box is displayed.



2. Select **Enabled (Default)** and click the **OK** button.

■ Configuration in the Function Area Settings

1. From the WindLDR menu bar, select **Configuration > LCD Settings**.
The Function Area Settings dialog box is displayed.



2. Select the **Enable ladder program monitoring on FT1A** check box.
3. Click the **OK** button.
This concludes configuring the settings.

Note: The setting you select in the Ladder Program Monitoring on FT1A dialog box at the start up of WindLDR can be changed in the Function Area Settings dialog box later.

Message Settings

The customized messages can be displayed on the LCD of the SmartAXIS Pro. This section describes the common settings, character set, scroll, and blinking settings, for all messages to display.

Function Specification

Any messages can be displayed on the LCD of the SmartAXIS Pro using MSG (Message) instructions.

The character set, scroll unit, scroll speed, and blinking speed are the common settings between all MSG instructions programmed. Those common settings can be configured in the Message Settings of the Function Area Settings dialog box.

For details on the MSG instruction, see Chapter 13 "Display Instructions" in the SmartAXIS Ladder Programming Manual.

■Character Set

The character set used for the messages can be configured.

Selection	Character Set	Languages usable in the MSG instruction
European	ISO-8859-1 (Latin 1)	Italian, English, Dutch, Spanish, German, French
Japanese	Shift-JIS	Japanese
Chinese	GB2312	Chinese (simplified)
Cyrillic	ANSI 1251	Russian

■Scroll Unit

The unit to scroll the texts can be configured.

1 character	Scrolls the text in 1 character units.
1 dot	Scrolls the text in 1 dot units.

■Scroll Speed

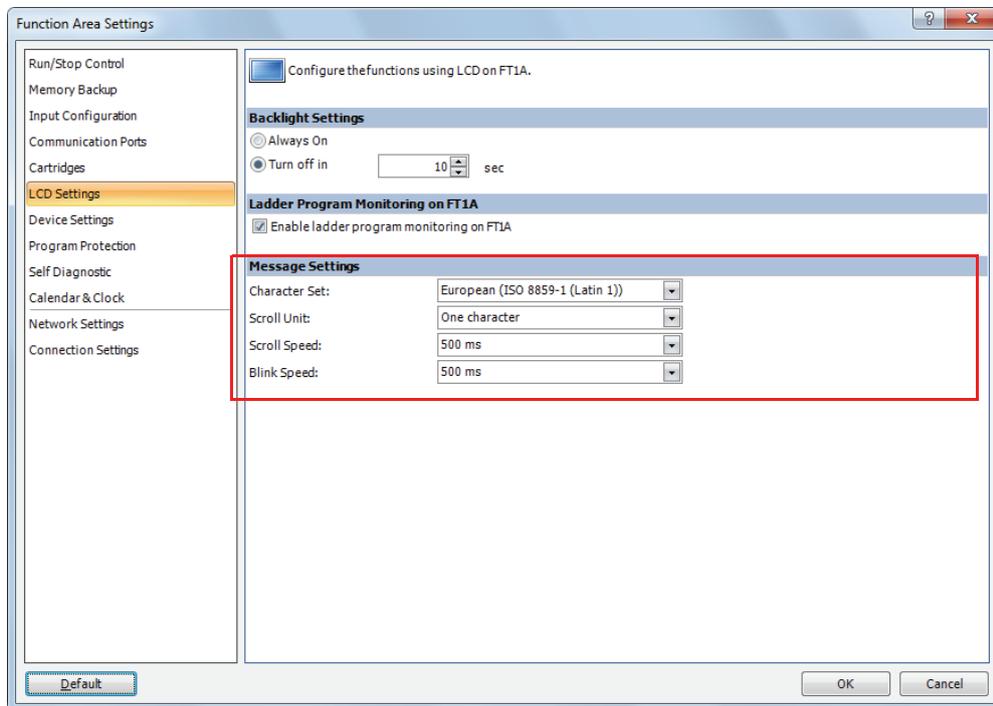
The speed to scroll the texts can be configured. The setting range is 500 to 1000 ms.

■Blinking Speed

The speed to blink the texts can be configured. The setting range is 500 to 1000 ms.

Programming WindLDR

1. From the WindLDR menu bar, select **Configuration > LCD Settings**.
The Function Area Settings dialog box is displayed.



2. Configure the character set, scroll unit, scroll speed, and blinking speed in the message settings.
3. Click the **OK** button.
This concludes configuring the settings.

32-bit Data Storage Setting

When the double-word, long, or float data type is selected for the source or destination device, the data is loaded from or stored to two consecutive data registers. The order of the two devices can be selected from the following two settings in the Function Area Settings.

Setting	Description
From Upper Word (Default)	When a data register, timer, or counter is used as a double-word device, the high-word data is loaded from or stored to the first device selected. The low-word data is loaded from or stored to the subsequent device. This is identical with the 32-bit data storage of OpenNet Controller and FC4A/FC5A MicroSmart.
From Lower Word	When a data register, timer, or counter is used as a double-word device, the low-word data is loaded from or stored to the first device selected. The high-word data is loaded from or stored to the subsequent device.

Devices

When the devices listed below are used as a double-word device, two consecutive devices are processed according to the 32-bit data storage settings.

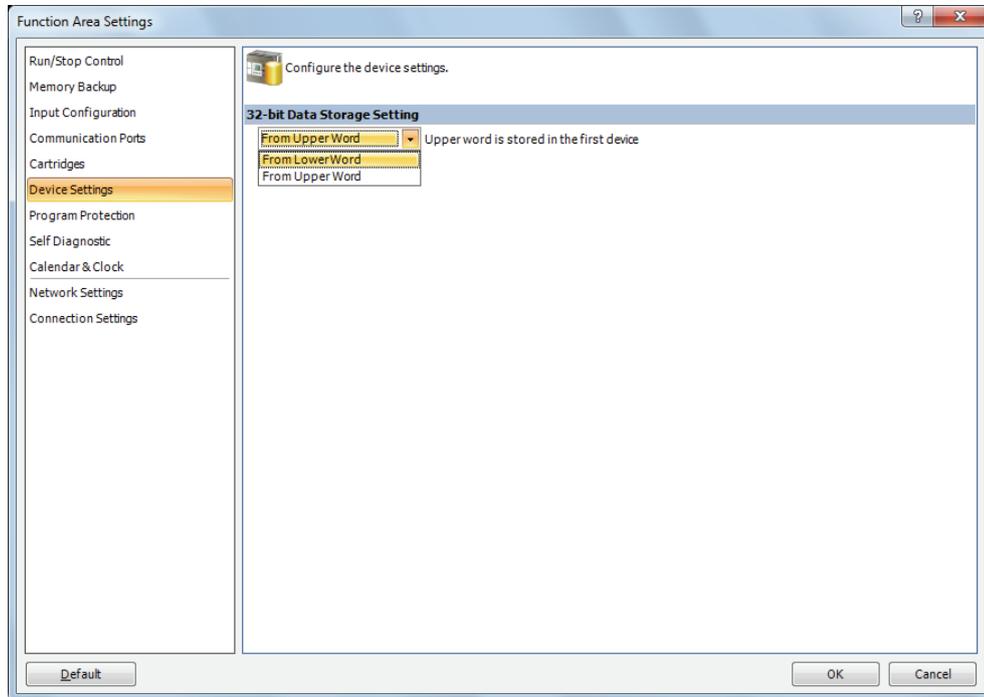
Device	Device Address
Data Register	D0 - D1999
Special Data Register	D8000 - D8199
Timer	T0 - T199
Counter	C0 - C199

Data : The following data composed of 32 bits is subject to this setting.

- Device values of advanced instructions with the data processing units D (double word), L (long), F (float)
- Pulse output preset values and current values
- High-speed counter function current values, preset values, and reset values
- Frequency measurement values in frequency measurement
- Double word counter instruction preset values

Programming WindLDR

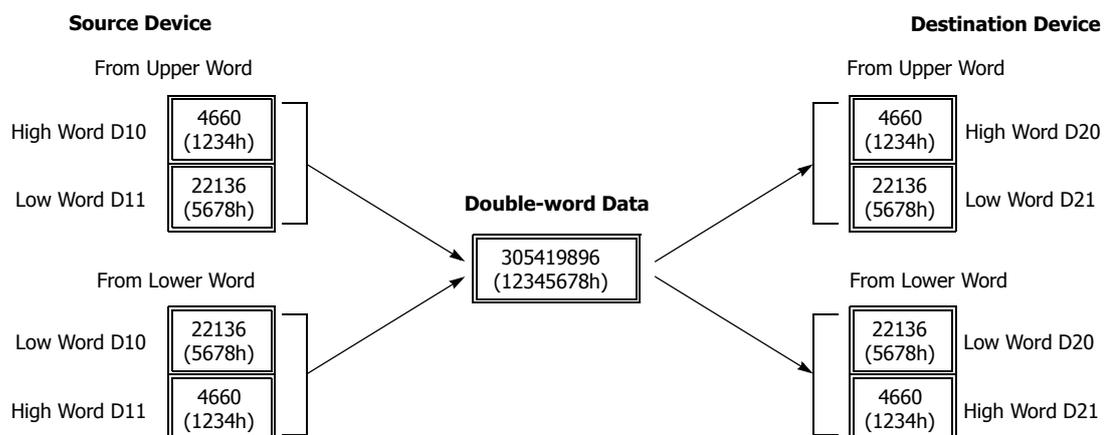
- From the WindLDR menu bar, select **Configuration > Device Settings**.
The Function Area Settings dialog box for Device Settings appears.



- Under **32-bit Data Storage Setting**, select **From Upper Word** or **From Lower Word** in the pull-down list.

Example: 32-bit Data Storage Setting

When data register D10 is designated as a double-word source device and data register D20 is designated as a double word destination device, the data is loaded from or stored to two consecutive devices according to the 32-bit data storage setting as illustrated below.



User Program Protection

With user program protection, you can apply protection against user program editing by using the LCD and operation buttons on the SmartAXIS module (SmartAXIS Pro only) and against uploading and downloading user programs with WindLDR. This enables you to prevent third parties from altering, deleting, or stealing your SmartAXIS user programs.

User program protection can be individually configured for user program uploads and downloads and for editing user programs with the LCD and operation buttons on the module. There are three types of protection modes, which are detailed as follows:

Mode	Description
Unprotected	The user program is unprotected.
Password protected	A password must be entered when downloading or uploading the user program. The password is single-byte alphanumeric characters (8 characters max), and one password can be configured for one user program. When applying password protection to both user program uploads and downloads, the same password is used.
Prohibited	The user program cannot be uploaded. Prohibited protection can only be configured for user program uploads. User program downloads cannot be prohibited.

If the user program is protected, you will be prompted to enter your password when executing a download or an upload. The download or upload can be executed by entering the correct password.

Note: Protection is also enabled when transferring user programs between the memory cartridge and the SmartAXIS.

For the SmartAXIS Lite, the password for the user program on the memory cartridge and the password for the user program on the SmartAXIS must match. For the SmartAXIS Pro, the password must be entered with the LCD and operation buttons on the module.

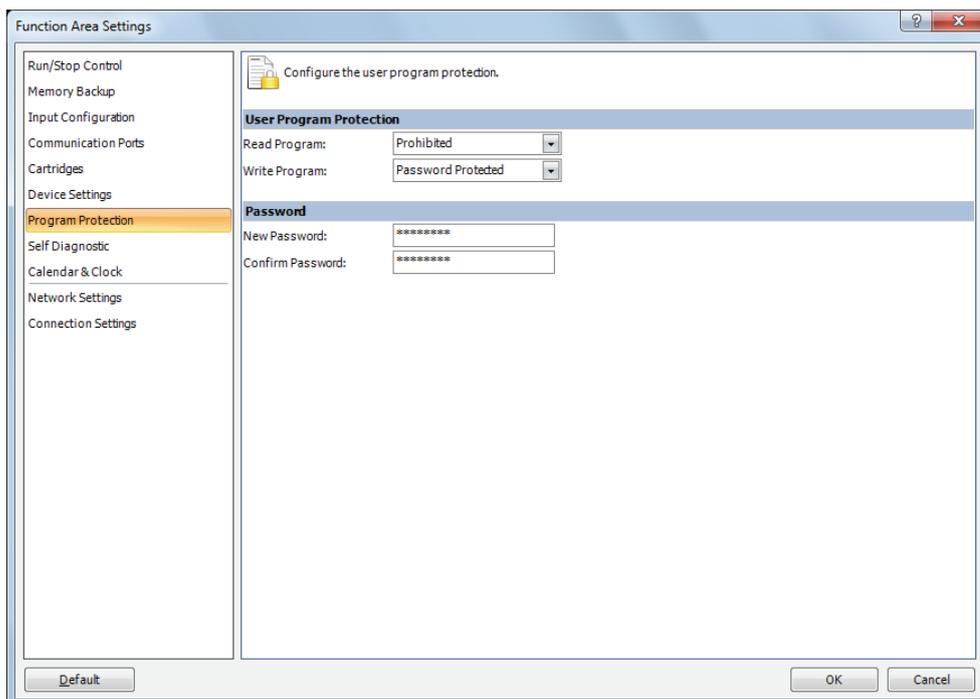
Note:

- Before proceeding with the following steps, make sure to note the protect code, which is needed to disable the user program protection. If the user program in the SmartAXIS is write- or read/write-protected, the user program cannot be changed without the protect code.
- If the user program is read-protected without using a password, the read protection cannot be temporarily disabled using the password, thus the user program cannot be read out by any means. To disable the read protection, download another user program without user program protection.

Programming WindLDR

1. From the WindLDR menu bar, select **Configuration > Program Protection**.

The Function Area Settings dialog box for Program Protection appears.



- Under **User Program Protection**, select required protect modes for **Read Program** and **Write Program** in the pull-down list.

Unprotected:	The user program in the SmartAXIS can be read and written without a password.
Password Protected:	Prevents unauthorized copying or inadvertent replacement of the user program. This protection can be temporarily disabled using a predetermined password.
Prohibited:	Prevents copying of the user program completely. This option is available for read protection only and can not be temporarily disabled using a password.

- After selecting a required protect mode, enter a password of 1 through 8 ASCII characters from the key board in the **New Password** field, and enter the same password in the **Confirm Password** field.
- Click the **OK** button and download the user program to the SmartAXIS after changing any of these settings.

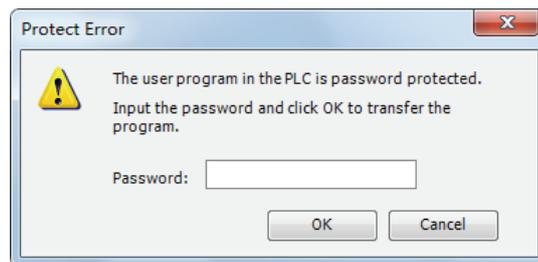
Disabling Protection

When the user program is password-protected against read and/or write, the protection can be temporarily disabled using WindLDR.

If the user program is read-prohibited, the read protection cannot be disabled, thus the user program cannot be read by any means. To disable the read protection, download another user program without user program protection.

- From the WindLDR menu bar, select **Online > Download or Upload**.

When the user program in the SmartAXIS is read and/or write protected, the Protect Error dialog box appears. When program verification or online edit is attempted, the Protect Error dialog box appears.



- Enter the password and click the **OK** button.
The user program protection is disabled only temporarily. When the SmartAXIS is powered up again, the protection designated in the user program takes effect again.
To disable or change the protection permanently, change the protection settings and download the user program.

Watchdog Timer Setting

This section describes watchdog timer setting.

A watchdog error occurs when the processing time for one scan exceeds the allowed time while the user program is running.

If a watchdog error occurs, the system is reset with the purpose of returning the system to normal operation.

If the watchdog error occurs frequently, you can assume that there is a hardware problem and that the SmartAXIS requires replacement.

Some of the reasons why a watchdog timer will occur are problems with the SmartAXIS hardware and length of the processing time in the ladder logic program. If the processing time for one scan of the ladder logic program exceeds the time configured for the watchdog timer, place an NOP (no operation) instruction in the ladder logic program. The watchdog timer is reset when the NOP instruction is executed.

Watchdog timer setting time

The watchdog timer setting time can be changed in the function area settings. Decide on the watchdog timer setting time in either of the following two ways.

- **Decide by user system specification**

Determine the maximum on time (milliseconds) so the output signals do not stay on if the SmartAXIS loses control and set that value as the watchdog timer setting time. However, if the ladder logic program processing time takes longer than the design specification, use an NOP (no operation) instruction in the ladder logic program. For example, when the watchdog timer is set to 100ms and the maximum value for one scan is 120ms, insert an NOP instruction in the ladder logic program to ensure that the error does not occur.

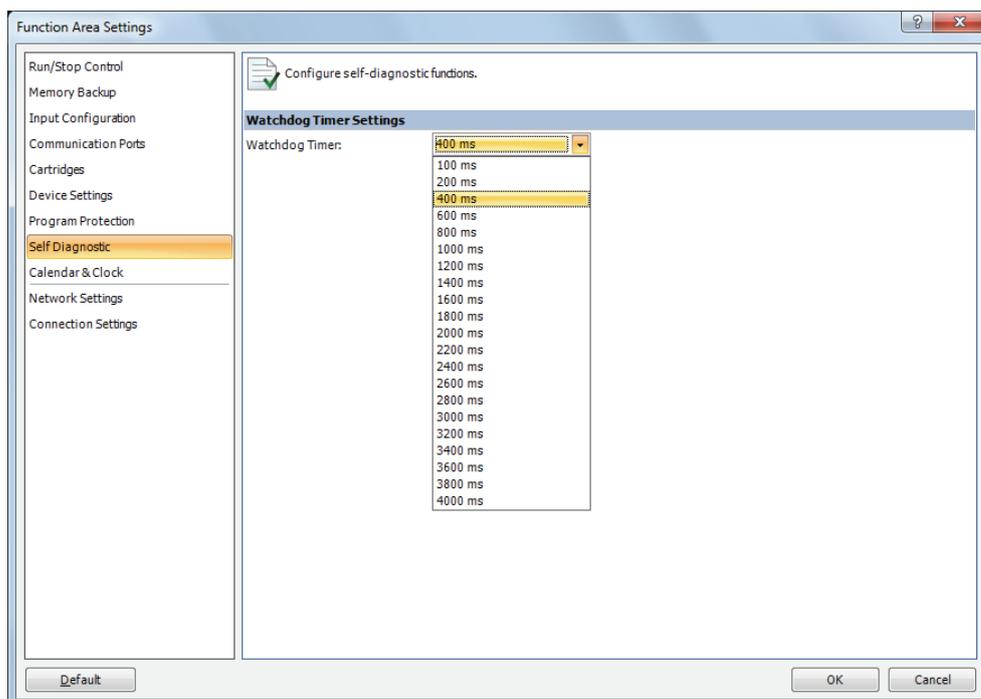
- **Match the ladder logic program processing time**

Check the maximum value for one scan (D8024) and set the watchdog timer value as a value with a safety margin added to the maximum value.

Note: When changing the watchdog timer setting value, select an appropriate value that fully takes into consideration the safety of the system. The maximum value of one scan while the SmartAXIS is running can be checked with special data register D8024.

Programming WindLDR

1. Select **Configuration** from the WindLDR menu bar, and then click **Self Diagnostic**.
The Function Area settings dialog box appears.



Watchdog timer Settings

Select the watch dog timer setting between 100ms and 4000ms. The default time is 400ms.

Constant Scan Time

The scan time may vary whether basic and advanced instructions are executed or not depending on input conditions to these instructions. The scan time can be made constant by entering a required scan time preset value into special data register D8022 reserved for constant scan time. When performing accurate repetitive control, make the scan time constant using this function. The constant scan time preset value can be between 1 to 1,000ms.

The scan time error is ±1 ms of the preset value normally. When the data link or other communication functions are used, the scan time error may be increased to several milliseconds.

When the actual scan time is longer than the scan time preset value, the scan time cannot be reduced to the constant value.

Special Data Registers for Scan Time

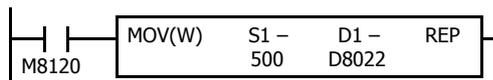
In addition to D8022, three more special data registers are reserved to indicate current, maximum, and minimum scan time values.

Note: R/W is the abbreviation for read/write. When R/W, it can be read and written. When R, it can only be read. When W, it can only be written.

D8022	Constant Scan Time Preset Value (1 to 1,000ms)
D8023	Scan Time Current Value (ms)
D8024	Scan Time Maximum Value (ms)
D8025	Scan Time Minimum Value (ms)

Example: Constant Scan Time

This example sets the scan time to a constant value of 500 ms.



M8120 is the initialize pulse special internal relay.

When the SmartAXIS starts operation, the MOV (move) instruction stores 500 to special data register D8022.

The scan time is set to a constant value of 500ms.

Daylight Savings Time

This section describes the function that automatically adjusts the SmartAXIS time according to daylight savings time settings. For regions where the SmartAXIS is used that implement daylight savings time, this function can automatically adjust the SmartAXIS clock using the daylight savings time settings. When the time reaches the daylight savings start time, the clock is set an hour forward. When the time reaches the the daylight savings time end, the clock is set an hour back.

The SmartAXIS adjusts the clock for daylight savings time on the start day and the end day. However, the clock is also adjusted for daylight savings time under the following conditions.

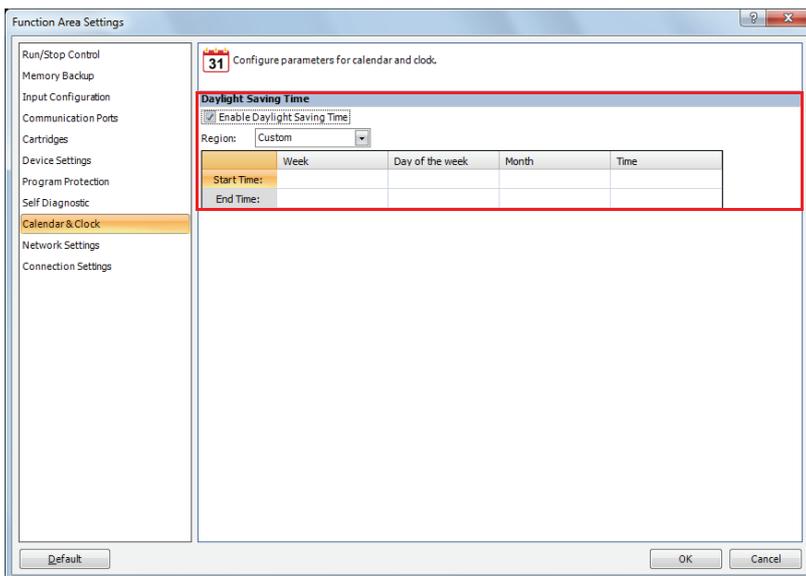
- When a user program was downloaded to the SmartAXIS.
- When the SmartAXIS power was turned on.

When the current time of the SmartAXIS' internal clock is set using WindLDR or the operator interface, the time is not adjusted for daylight savings time, even if the time after it was set is within the daylight savings time period. Set the time to the time adjusted for daylight savings time. The set date and time becomes the date and time after being adjusted for daylight savings time.

Programming WindLDR

Configure daylight savings time on the SmartAXIS.

1. From the WindLDR menu bar, select **Configuration > Calendar & Clock**.
The Function Area Settings dialog box is displayed.
2. Select the **Enable daylight savings time** check box.



3. Configure the start time and the end time. Specify the region using the **Region** list box.
If you select **Custom**, you are able to select any desired start time and end time.

Region	Start time	End time
Custom	User specified	User specified
USA or Canada	March, 2nd Sunday, 2:00 AM	November, 1st Sunday, 2:00 AM
Europe	March, last Sunday, 1:00 AM	October, last Sunday, 1:00 AM
Australia	October, 1st Sunday, 2:00 AM	April, 1st Sunday, 3:00 AM

4. Click **OK**.
This concludes configuring the settings.

Clock Function

This section describes the internal clock function on the SmartAXIS.

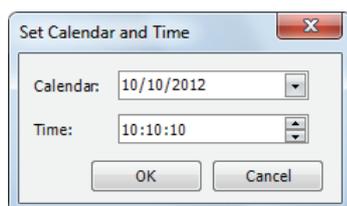
This function enables you to control the time schedule for lighting or air conditioning equipment using the current time data stored in special data registers. The internal clock data is backed up by a secondary lithium battery. The current time is reset when the backup data is lost, so the current time will need to be set again.

Function	Description
Read clock	The current time (calendar, clock) is updated every 500 ms and automatically stored in the special data registers.
Set clock	Sets the current time (calendar, clock). Set the current time with WindLDR or a user program that uses the special data registers.
Adjust function	When clock data adjust flag M8021 is turned on from off, the seconds for the current time are rounded up or rounded down based on 30 seconds to correct the seconds data for the internal clock. If the current seconds are between 0 and 29 seconds, the seconds are set to 0 when M8021 is turned on from off. If the current seconds are between 30 and 59 seconds, the minutes are set to + 1 and the seconds are set to 0 when M8021 is turned on from off.
Calendar/clock error	M8013: This relay turns on if clock write processing or a clock adjust processing could not be executed normally. M8014: This relay turns on if an error occurs while calendar/clock data is read from the internal clock to the special data registers (D8008 to D8014).

Setting the Clock with WindLDR

Set the current time on the SmartAXIS with WindLDR.

- From the WindLDR menu bar, select **Online > Monitor > Monitor**.
WindLDR enters monitor mode.
- Select **Online > PLC > Status**.
The PLC Status dialog box is displayed.
- Click **Change** for **Calendar**.
The Calendar Settings dialog box is displayed. The current time on the computer is displayed in the dialog box as the initial value. The settings can also be changed as necessary.



- Click **OK**.
The date and time configured in the dialog box is written to the SmartAXIS.

5: SPECIAL FUNCTIONS

Setting the Clock with a User Program

A user program can write the clock data from an operator interface without using WindLDR by using special data registers D8015 to D8021. Undefined values are stored in special data registers D8015 to D8021. Always store an appropriate value before turning on M8016, M8017, or M8020.

Calendar Data Write Flag (M8016)

After writing data to the write calendar special data registers (D8015 to D8018), turn M8016 off to on to set the internal clock with the data in D8015 to D8018 as the calendar data (year, month, day, day of the week).

Clock Data Write Flag (M8017)

After writing data to the write clock special data registers (D8019 to D8021), turn M8017 off to on to set the internal clock with the data in D8019 to D8021 as the clock data (hour, minute, second).

Calendar/Clock Data Write Flag (M8020)

After writing data to the write calendar/clock special data registers (D8015 to D8021), turn M8020 off to on to set the internal clock with the data in D8015 to D8021 as the calendar data (year, month, day, day of the week) and the clock data (hour, minute, second).

Calendar and clock data storage locations

The calendar/clock data is stored in the following special data registers.

Special data register	Description	Range	Setting timing
D8008	Calendar/Clock Current Data (Read only)	Year	Every 500 ms (Note)
D8009		Month	
D8010		Day	
D8011		Day of the week	
D8012		Hour	
D8013		Minute	
D8014		Second	
D8015	Calendar/Clock New Data (Write only)	Year	—
D8016		Month	
D8017		Day	
D8018		Day of the week	
D8019		Hour	
D8020		Minute	
D8021		Second	

Note: If the scan time is 500 ms or longer, D8008 to D8014 are updated with each scan.

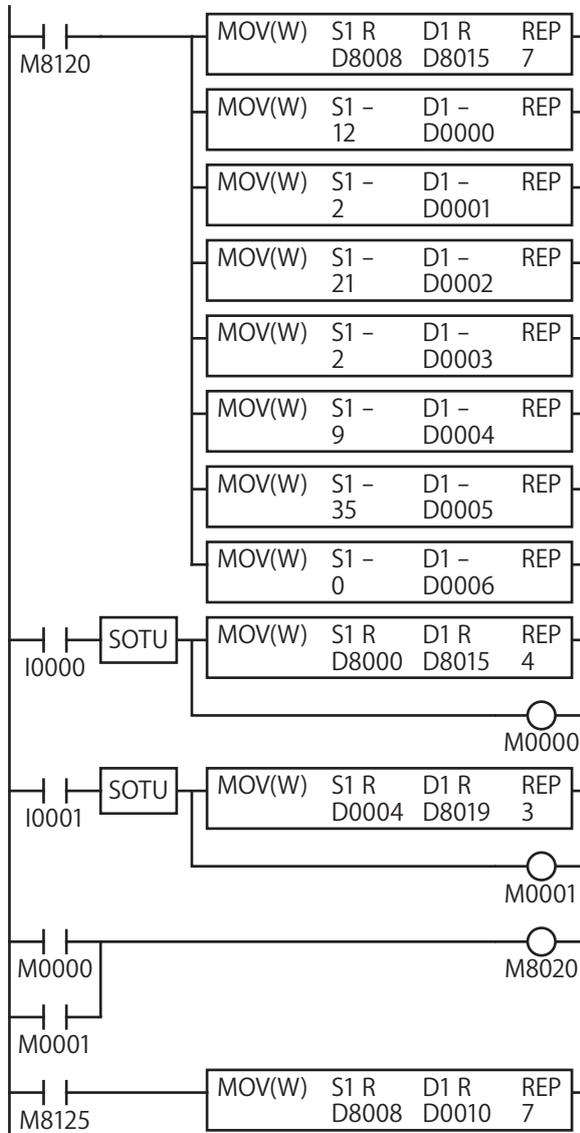
For the day of the week data, the values below are stored in the special data registers.

Day of the week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Value	0	1	2	3	4	5	6

Example program 1

This example sets the calendar and clock in a user program.

If you turn on M8020 with the new calendar/clock data set in the write-only data registers D8015 to D8021, the internal clock on the SmartAXIS is updated with the current time (calendar, clock). In this example, the SmartAXIS internal clock is set to 9:35:00 on Tuesday February 21, 2012.



M8120 is the initial pulse that turns on for only one scan at the start of operation.
When the SmartAXIS starts operating, the current calendar/clock data is stored in D8015 to D8021 and the new calendar/clock data is stored in D0 to D6 with the MOV (move) instruction.

When external input I0 turns on, the new calendar data is stored in special data registers D8015 to D8018.
Internal relay M0 turns on for one scan only.

When external input I1 turns on, the new clock data is stored in special data registers D8019 to D8021.
Internal relay M1 turns on for one scan only.

When external input M0 or M1 turns on, M8020 turns on and the calendar/clock data is written to the internal clock.
(M8020: Calendar/Clock Data Write Flag)

M8125 is a special internal relay that is always on during operation.
While the SmartAXIS is running, the current time (calendar, clock) is stored in D10 to D16 with the MOV instruction.

Example program 2

When I1 turns off to on, the seconds on the internal clock are corrected to 0 seconds.



When input I1 turns on, clock data adjust flag M8021 turns on to correct the seconds on the internal clock.

Note: The internal clock backup time is approximately 30 days (25°C TYP). If the power loss time exceeds the backup time, the retained clock data is lost and the current time is initialized as 00:00:00 on January 1, 2000.

Network Settings

This section describes the network settings of the SmartAXIS.

These settings are used to configure the network to use the SmartAXIS Ethernet port. All SmartAXIS models are equipped with an Ethernet port except for the 12-I/O type. Configure the SmartAXIS network settings in the same manner as the network settings for a computer.

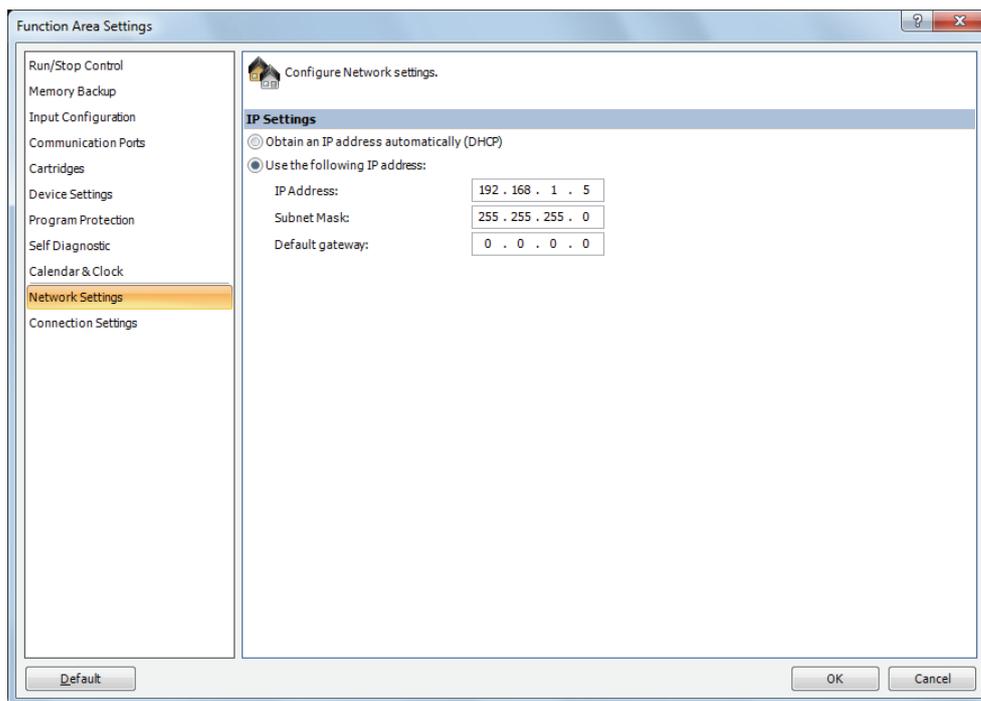
The network settings can be configured with either of the methods below.

- Automatically acquire an IP address (DHCP)
A DHCP server must be present on the network where the SmartAXIS is located. The SmartAXIS automatically acquires its network settings from the DHCP server. The network settings are acquired from the DHCP server when the user program is finished downloading and when the SmartAXIS is turned on.
- Use the following IP address
Enter the SmartAXIS network settings as a fixed IP address, subnet mask, and default gateway. The network settings are applied when the user program is finished downloading. Consult the network administrator regarding the IP address to configure.

Note: The SmartAXIS default settings are: IP address 192.168.1.5, subnet mask 255.255.255.0, default gateway 0.0.0.0.

Programming WindLDR

1. Select **Configuration** from the WindLDR menu bar, and then click **Network Settings**.
The Function Area settings dialog box appears.



2. Select **Automatically acquire an IP address (DHCP)** or **Use the following IP address**.
When **Use the following IP address** is selected, enter the IP address, subnet mask, and default gateway.
3. Click **OK**.
This concludes configuring the settings.

Connection Settings

This section describes the configurations of the SmartAXIS module for client/server connections..

Applications

The SmartAXIS supports Ethernet communication functions with a maximum of three connections. Using those connections, maintenance communication, Modbus TCP communication, user communication, and remote I/O communication can be used. Those communications can be configured in the Function Area Settings dialog box.

Description of functions

The SmartAXIS has a maximum of three connections for the maintenance communication server, user communication server, Modbus TCP communication server, user communication client, Modbus TCP communication client and remote I/O master.

To limit the access to the SmartAXIS, IP address flitting can be used. By specifying the IP address that can access the SmartAXIS, anonymous access can be prevented.

Connection Status and Connected IP Address

The connection status of connections with remote hosts can be confirmed with special internal relays M8110 to M8112. When a connection with a remote host is established, the corresponding special internal relay is turned on. When the connection is disconnected, the corresponding special internal relay is turned off. The IP addresses of the remote hosts can be confirmed with special data registers D8110 to D8121.

Note: R/W is the abbreviation for read/write. When R/W, it can be read and written. When R, it can only be read. When W, it can only be written.

Special Internal Relays

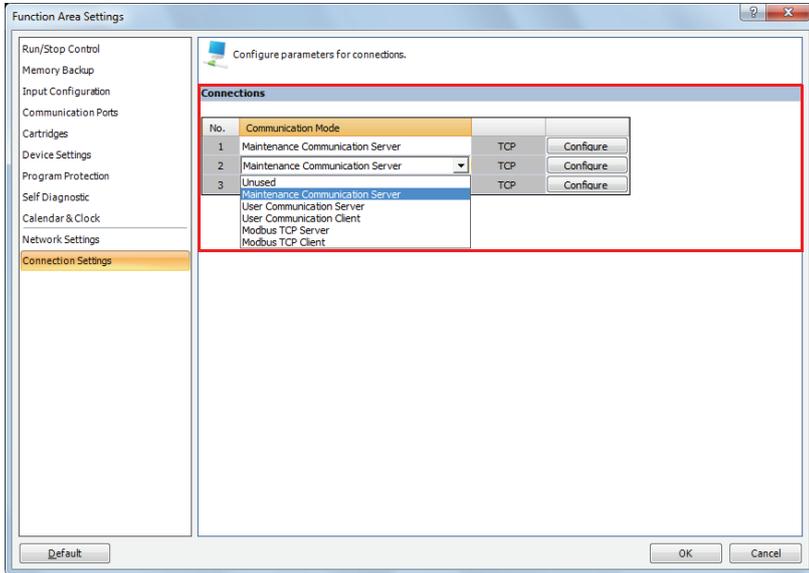
Device Address	Description	Details
M8110	Connection 1 Status	While a connection is established with a remote host, the special internal relay will be on. When no connection is established, it will be off.
M8111	Connection 2 Status	
M8112	Connection 3 Status	

Special Data Registers

Device Address	Description	Details
D8110-D8113	Connection 1 Connected IP Address	IP address is stored in the corresponding special data registers. For example, when the IP address is aaa.bbb.ccc.ddd, each value is stored as follows: D8110=aaa, D8111=bbb, D8112=ccc, and D8113=ddd.
D8114-D8117	Connection 2 Connected IP Address	
D8118-D8121	Connection 3 Connected IP Address	

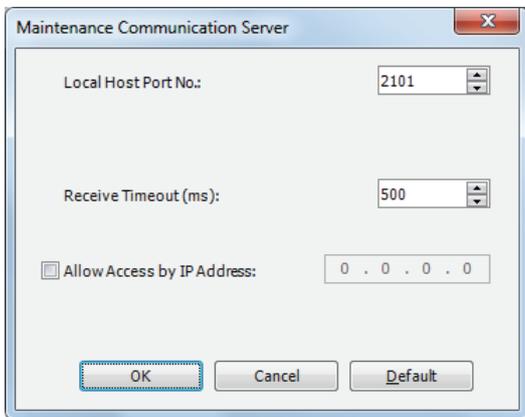
Programming WindLDR

1. From the WindLDR menu bar, select **Configuration > Connection Settings**.
The Function Area Settings dialog box is displayed.
2. Select **Communication Mode** for the connection to use.



Configure the communication mode allocated to a maximum of three connections that can be used as client or server. Each connection can be set to a different port number. Set connections that are not used to **Unused**.

3. Select **Maintenance Communication Server**.
The Maintenance Communication Server dialog box is displayed.



4. Specify the parameters.
Click **OK**.
This concludes configuring the settings.

Remote Host List

This chapter describes how to configure a list of network devices (remote hosts) in the network to which the SmartAXIS communicates.

Applications

When the SmartAXIS accesses and communicates with other network devices in the network, the remote host device should be specified. The remote host list is required to use the following functions:

- ETXD/ERXD Instructions (User communication over Ethernet)
- Modbus TCP Client

Description of Functions

The remote host consists of an **IP Address** or a **Host Name** and a **Port Number**.

When a remote host is specified with an IP address, and the SmartAXIS establishes connection with the remote host that has the specified IP address and the corresponding port number, then communication is started.

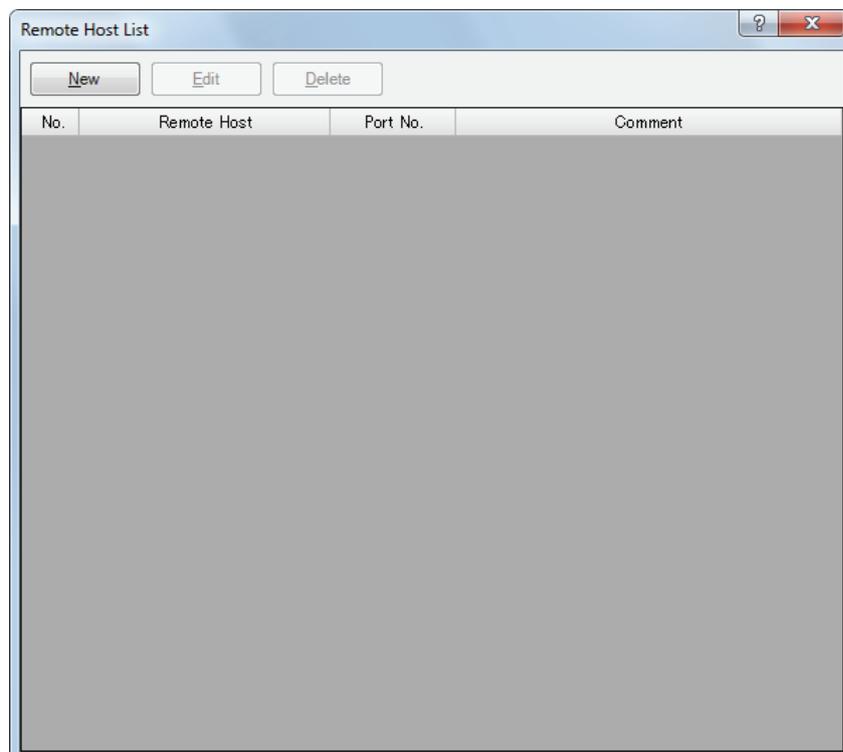
When a remote host is specified with a host name, the SmartAXIS tries to obtain the IP address from the specified host name using the DNS server. If the IP address is successfully obtained, the SmartAXIS establishes connection with the remote host that has the specified IP address and the corresponding port number, then communication is started.

For details about DNS server settings, see Network Settings in the Function Area Settings.

Programming WindLDR

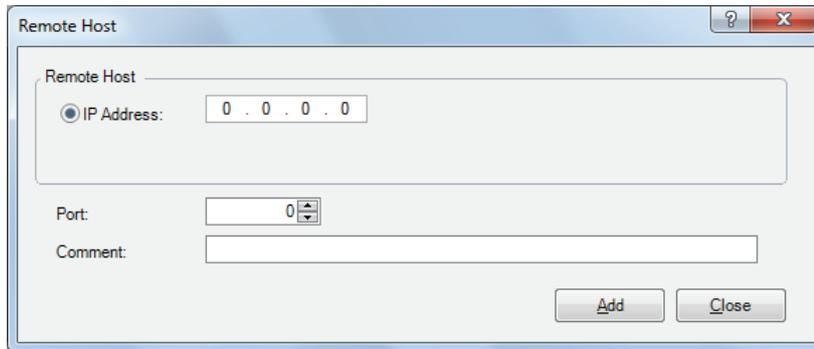
1. Double-click on the Remote Host List in the **Project Window**.

The Remote Host List dialog box appears.



5: SPECIAL FUNCTIONS

2. Click **New** button or select an existing remote host and click **Edit** button.
The Remote Host dialog box appears.



IP Address: Specify the remote host with an IP address.

Port Number: Specify the port number of the remote host. This port number is the TCP communication port number. It differs from the SmartAXIS USB port number (port 1) and the expansion communication port numbers (port 2, 3).

Comment: The comment for the remote host can be assigned. The contents or the length of the comment has no effect on the SmartAXIS operation.

3. Configure the parameters in the Remote Host dialog box and then click on **Add** button.
A new remote host will be added in the Remote Host List dialog box. If you want to add additional remote hosts, repeat the same procedure. After adding remote hosts has been completed, click on **Close** button.
4. If you want to delete an unused remote host, select that remote host in the Remote Host List dialog box and click on **Delete** button.
Once a remote host is deleted, the remote host numbers of the following remote hosts are changed. As a result, the functions referring to those remote hosts, such as Modbus TCP client, or User communication client, will be affected,

6: HMI FUNCTION

Introduction

You can run and stop the user program, monitor device values, and modify settings on the SmartAXIS Pro by using the LCD and operation buttons on the SmartAXIS. This chapter describes how to modify the user program and device values with the operation buttons.

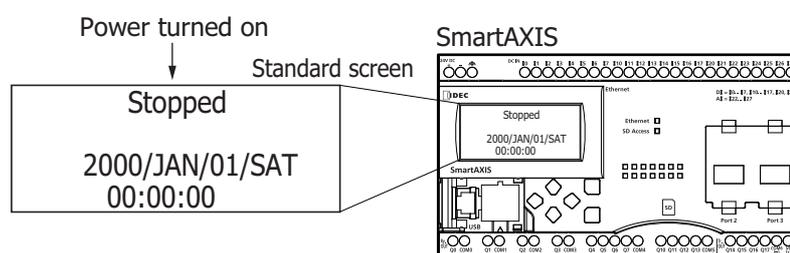
Function Description

The following functions can be used with SmartAXIS button operations.

Type	Function		Description
Run/stop operation	Switching run/stop		The program running state (run/stop) can be changed with the operation buttons on the SmartAXIS.
Edit Program	Confirming/Clearing changed timer/counter preset values		Change timer/counter preset values or writes them to the user program in the ROM.
Configurations	Environment settings	Slave Number/ Message Scroll/Blink Menu Language/ LCD backlight ON time	Some of the function area settings (slave number, message scroll speed, scroll unit, blinking speed, and LCD backlight ON time) can be modified. The system menu language can also be changed.
	Calendar/Clock		Configures the calendar/clock of the SmartAXIS internal clock.
Monitors	Device Monitor		Displays/modifies the specified device values.
	Program Monitor		Displays the ladder program. The on/off state of bit devices can be changed.
	Status Monitor		Displays the system software version, operating status, scan time, and protection status.
	Error Monitor		Enables you to check errors that have occurred on the SmartAXIS.
Message display	Message display		Displays messages with pre-configured formats on the SmartAXIS LCD using the MSG instruction.
Memory Cartridge	Uploading user program		The user program in the SmartAXIS can be transferred to the memory cartridge.
	Downloading user program		The user program on the memory cartridge can be transferred to the SmartAXIS.
SD memory card	Stop Access		Stops the access to the SD memory card in order to remove the SD memory card from the SmartAXIS.
	Format		Formats the SD memory card.

Initial Screen

The screen below is displayed when the SmartAXIS is purchased and first turned on.



The default menu language is English. To switch the menu language to Japanese, see "Changing the Menu Language" on page 6-8.

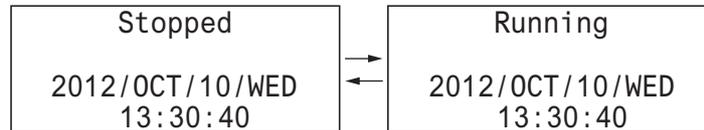
About the Menu Screen

This section describes SmartAXIS menu screen.

When switching from the standard screen to the system menu screen, the menu items are displayed on the LCD.

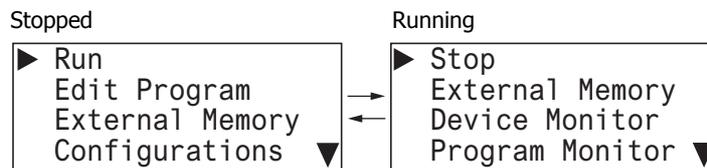
Standard Screen

The standard screen is the screen that is displayed after the SmartAXIS is turned on. It shows the current date, time, and operating status (stopped/running).



System Menu

You can execute operations, such as running and stopping the SmartAXIS, monitoring devices, and modifying the settings, on the system menu. The menu items displayed on the LCD differ according to the operating status (running/stopped) of the SmartAXIS.



System Menu when SmartAXIS is stopped

The menu items displayed while the SmartAXIS is stopped are as follows.

- Run
- Edit Program
- External Memory
- Configurations
- Device Monitor
- Program Monitor
- Status Monitor
- Error Status

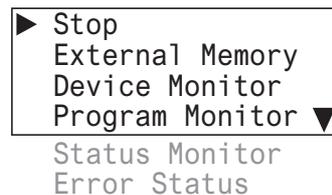


The ▼ symbol is displayed when menu items continue below.

System Menu while SmartAXIS is running

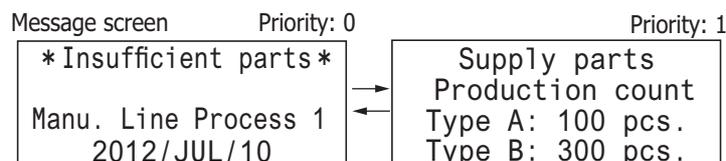
The menu items displayed while the SmartAXIS is running are as follows.

- Stop
- External Memory
- Device Monitor
- Program Monitor
- Status Monitor
- Error Status



Message Screen

The SmartAXIS can display messages on the LCD using the MSG (message) instruction. While the SmartAXIS is running, the message is displayed when the input conditions of MSG (message) instructions are ON. Multiple message screens with different priorities can be switched and displayed with the ⬆ (up) and ⬇ (down) buttons.



Basic Operations

This section describes how to use the SmartAXIS buttons.

The SmartAXIS Pro has the  (up),  (down),  (left),  (right),  (ESC), and  (OK) buttons, and these buttons are used to operate the screens displayed on the LCD.

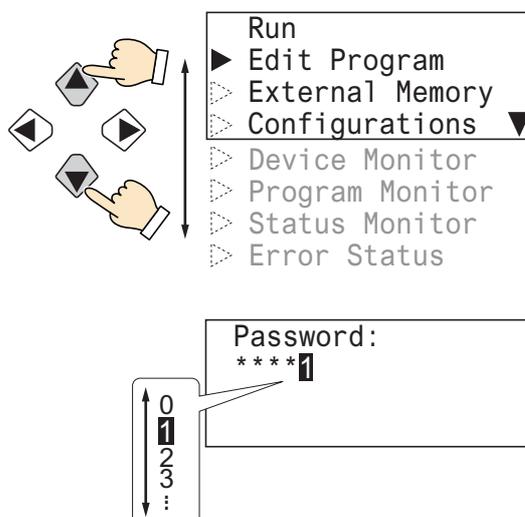
Pushing the Switches

The operation of the buttons differs by how they are pressed. There are two ways to push the buttons, which are detailed below.

Press/Hold	Operation
Press (short press)	The switch is pressed for 0.1 seconds or more and less than two seconds and then released.
Press and hold (long press)	The switch is pressed for two seconds or more and then released.

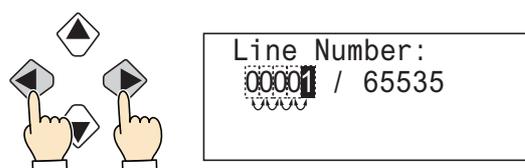
(up), (down) buttons

Moves the cursor up and down to select menu items. These buttons are also used to modify numeric values and enter passwords.



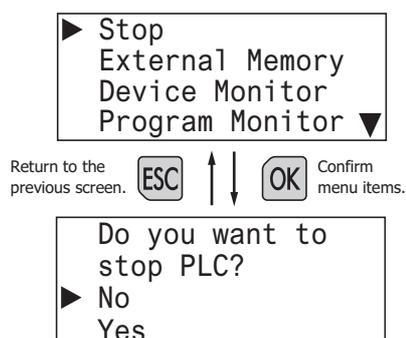
(left), (right) buttons

Moves the cursor left and right. These buttons are used to move the cursor while changing digits, entering password, or operating on the ladder display screen.



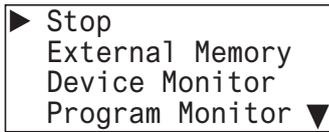
(ESC), (OK) buttons

Confirm menu items with the  (OK) button. Return to the previous screen with the  (ESC) button.



6: HMI FUNCTION

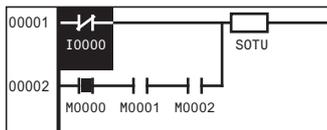
List of Button Operations on the System Menu Screen



Switch	Press/Hold	Basic operation
▲	Press	Moves the cursor up one line. If the cursor is at the start of the item list, nothing happens.
	Press and hold	Repeats the press operation.
▼	Press	Moves the cursor down one item. If the cursor is at the end of the item list, nothing happens.
	Press and hold	Repeats the press operation.
◀	Press	Nothing happens.
	Press and hold	
▶	Press	
	Press and hold	
OK	Press	Executes the function selected with the cursor (depending on the function, displays additional menus).
	Press and hold	Nothing happens.
ESC	Press	Returns to the previous screen (the calling screen).
	Press and hold	While pressing the ESC (ESC) button, press the OK (OK) button to return to the top screen of the system menu.

List of Button Operations on the Ladder Monitor Screen

Ladder monitor screen



Switch	Press/Hold	Basic operation
▲	Press	Moves the cursor up one line. When the cursor is on the top line of the rung, nothing happens.
	Press and hold	Moves the cursor to the top line of one rung above. If the cursor is on the top rung, it moves the cursor to the top line of that rung.
▼	Press	Moves the cursor down one line. When the cursor is on the last line of the ladder, nothing happens.
	Press and hold	Moves the cursor to the top line of one rung below. If the cursor is on the bottom rung, it moves the cursor to the top line of that rung.
◀	Press	Moves the cursor once to the left. When the cursor is at the left edge of the line, nothing happens.
	Press and hold	Moves the cursor to the left edge. When the cursor is at the left edge of the line, nothing happens.
▶	Press	Moves the cursor once to the right. When the cursor is at the right edge of the line, nothing happens.
	Press and hold	Moves the cursor to the right edge. When the cursor is at the right edge of the line, nothing happens.
OK	Press	If the instruction selected by the cursor is a NO contact or a NC contact, toggles the on/off state. If the instruction selected by the cursor is not a NO contact or a NC contact, nothing happens.
	Press and hold	Displays the parameter details for the instruction selected with the cursor.
ESC	Press	Ends ladder monitor mode.
	Press and hold	Not valid.

List of Button Operations after Executing a System Menu Item

System menu

(Ladder monitor line setting)

Menu language selection

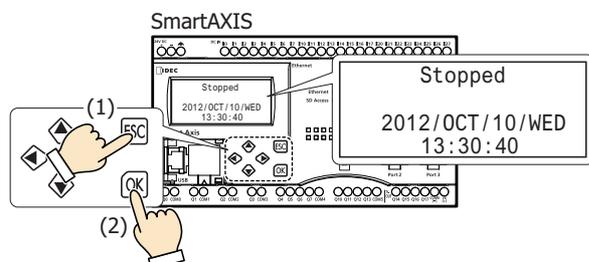
Line Number: 00001 / 65535	Menu Languages: Japanese
-------------------------------	-----------------------------

Switch	Press/Hold	Basic operation
◆	Press	Adds 1 to the number selected with the cursor. Shows the item above the item selected with the cursor. If the top of the item list is displayed, nothing happens.
	Press and hold	Repeats the press operation.
◆	Press	Subtracts 1 from the number selected with the cursor. Shows the item below the item selected with the cursor. If the bottom of the item list is displayed, nothing happens.
	Press and hold	Repeats the press operation.
◆	Press	Moves the cursor once to the left.
	Press and hold	Repeats the press operation.
◆	Press	Moves the cursor once to the right.
	Press and hold	Repeats the press operation.
OK	Press	Confirms the modification.
	Press and hold	Not valid.
ESC	Press	Discards the modification.
	Press and hold	While pressing the ESC (ESC) button, press the OK (OK) button to discard the modification and return to the top screen of the system menu.

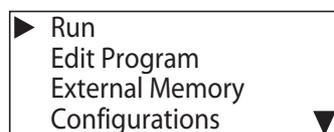
Switching to the System Menu

This section describes how to switch to the system menu from the standard screen.

1. On the standard screen, while pressing the **ESC** (ESC) button, press the **OK** (OK) button.
In further descriptions, this is explained as "**ESC** (ESC) + **OK** (OK) buttons". (1) and (2) in the diagram indicate the order to push the switches.



The system menu is displayed.



While the SmartAXIS is running, the top screen for the running system menu is displayed.

On the system menu screen, press the **ESC** (ESC) + **OK** (OK) buttons to return to the standard screen.

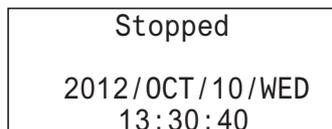
Switching run/stop

You can run and stop the SmartAXIS with the button operations.

Running the SmartAXIS

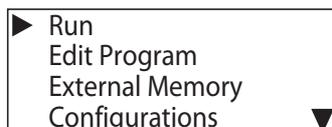
This section describes the steps to run the SmartAXIS.

1. On the standard screen, press the  (ESC) +  (OK) buttons.

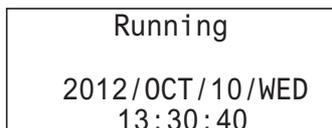


The system menu is displayed.

2. Select **Run** and press the  (OK) button.



The SmartAXIS is set to run.

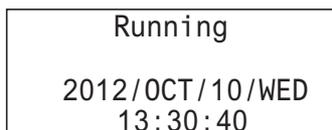


Caution When setting the SmartAXIS to run by using the buttons on the SmartAXIS module, fully ensure the safety before doing so.

Stopping the SmartAXIS

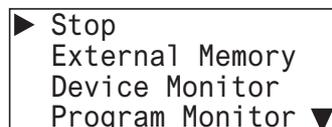
This section describes the steps to stop the SmartAXIS.

1. On the standard screen, press the  (ESC) +  (OK) buttons.

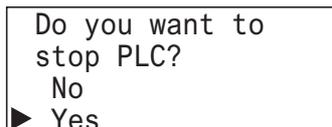


The system menu is displayed.

2. Select **Stop** and press the  (OK) button.



3. Select **Yes** with the  (down) button and press the  (OK) button.



The SmartAXIS is set to stop.



SmartAXIS Environment Settings

When the SmartAXIS is stopped, you can configure the menu language, internal clock, slave number, and the scroll unit/speed and blinking speed for messages displayed with the message (MSG) instruction. These cannot be configured while the SmartAXIS is running.

Changing the Menu Language

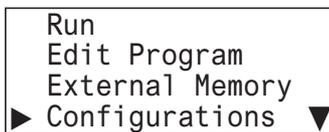
When the SmartAXIS is stopped, you can change the menu language between Japanese, English, and Chinese. This cannot be changed while the SmartAXIS is running. The menu language is set to English when the SmartAXIS is shipped from the factory, so this section describes how to switch the language to Japanese.

1. On the standard screen, press the  (ESC) +  (OK) buttons.

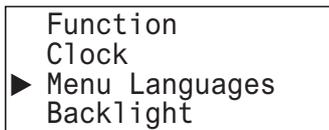


The system menu is displayed.

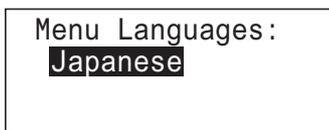
2. Select **Configurations** with the  (up) and  (down) buttons and press the  (OK) button.



3. Select **Menu Languages** and press the  (OK) button.



4. Select **Japanese** with the  (down) button, and then press the  (OK) button to confirm.



- **Selectable menu languages**

The menu languages that can be selected are as follows.

English/Japanese/Chinese

Setting the Calendar/Clock

This section describes how to adjust the internal clock in the SmartAXIS. This cannot be adjusted while the SmartAXIS is running.

1. On the standard screen, press the **ESC** (ESC) + **OK** (OK) buttons.

```

Stopped
2012/OCT/10/WED
13:30:40
  
```

The system menu is displayed.

2. Select **Configurations** with the **▲** (up) and **▼** (down) buttons and press the **OK** (OK) button.

```

Run
Edit Program
External Memory
▶ Configurations ▼
  
```

3. Select **Clock** with the **▲** (up) and **▼** (down) buttons and press the **OK** (OK) button.

```

Function
▶ Clock
Menu Languages
Backlight
  
```

4. Select the year, month, or day to modify with the **◀** (left) and **▶** (right) buttons.

For example, modify **Day**.

```

2012/10/10
13: 30: 40
  
```

5. Modify **Day** with the **▲** (up) and **▼** (down) buttons.

```

2012/10/11
13: 30: 40
  
```

6. From **Day** position, press the **▶** (right) button to select the clock.

For example, modify **Minute**.

```

2012/10/11
13: 30: 40
  
```

7. Modify **Minute** with the **▲** (up) and **▼** (down) buttons.

```

2012/10/11
13: 35: 40
  
```

8. Press the **OK** (OK) button to confirm the modifications to the calendar/clock.

• Calendar/clock configuration range

The calendar/clock configuration range is as follows.

Year	Month	Day	Hour	Minute	Second
2000 to 2099	01 to 12	00 to 31	00 to 23	00 to 59	00 to 59

Notes:

- When the date is modified, the day of the week automatically changes. The day of the week is not displayed on the configuration screen.
- If an invalid date is set, an error message is displayed. When the error message is displayed, press the **ESC** (ESC) button or the **OK** (OK) button to return to the configuration screen, and then set a valid date.

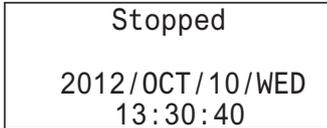
6: HMI FUNCTION

Setting the LCD Backlight ON Time

When the SmartAXIS operation buttons are pressed, the backlight turns on.

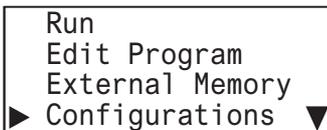
After an operation button is pressed and the backlight turns on, the backlight automatically turns off if the operation buttons are not pressed. On the system menu, you can adjust the time from when the backlight turns on until it turns off.

1. On the standard screen, press the  (ESC) +  (OK) buttons.

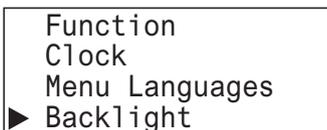


The system menu is displayed.

2. Select **Configurations** with the  (up) and  (down) buttons and press the  (OK) button.



3. Select **Backlight** with the  (up) and  (down) buttons and press the  (OK) button.



4. Move the cursor with the  (left) and  (right) buttons.



5. Select the value with the  (up) and  (down) buttons, and then press the  (OK) button to set the backlight ON time.



• Backlight ON time configuration range

The backlight ON time configuration range is as follows.

0 to 65535 seconds

Notes:

- The default backlight ON time is 10 seconds. The default value can be modified in WindLDR Function Area Settings dialog box. For details, see "Backlight ON Time" on page 5-53.
- The backlight ON time can be changed by modifying the value of D8074.
- When the backlight ON time is set from the system menu, the value of D8074 is modified.
- The value of D8074 returns to the default value when the battery backup dies.
- If the backlight ON time is 0, the backlight is always on.

Configuring the Slave Number

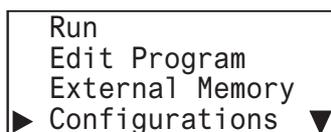
When the SmartAXIS is stopped, you can configure the slave number used in maintenance communication or Modbus RTU communication. This cannot be configured while the SmartAXIS is running.

1. On the standard screen, press the  (ESC) +  (OK) buttons.



The system menu is displayed.

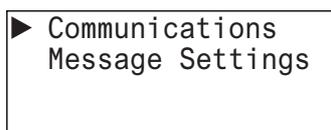
2. Select **Configurations** with the  (up) and  (down) buttons and press the  (OK) button.



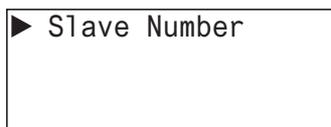
3. Select **Function** with the  (up) and  (down) buttons and press the  (OK) button.



4. Select **Communications** with the  (up) and  (down) buttons and press the  (OK) button.



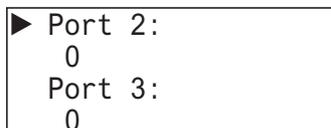
5. Select **Slave Number** with the  (up) and  (down) buttons and press the  (OK) button.



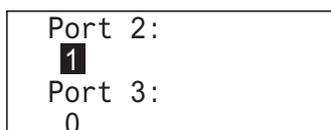
The port selection screen is displayed.

6. Select **Port 2** with the  (up) and  (down) buttons and press the  (OK) button.

For example, change the slave number of the port 2 to **1**.



7. Specify **1** with the  (up) and  (down) buttons and press the  (OK) button.



- **Selectable slave numbers**

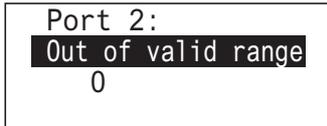
The slave numbers that can be selected are as follows.

Port 2	Port 3
0 to 255	0 to 255

6: HMI FUNCTION

Notes:

- When the slave number is modified from the system menu, the value in the slave number type (constant/special data register) configured with WindLDR is modified. The slave number type cannot be changed from the system menu.
- If the slave number type configured with WindLDR is **Constant**, when the slave number is modified from the system menu and the  button is pressed, the modified slave number is reflected in the function area settings for the user program. If **Special Data Register**, the values of D8027 and D8028 are modified. (The modification is not reflected in the function area settings for the user program.)
- The values of D8027 and D8028 return to the default values when the battery backup dies.
- The slave number configuration range differs according to the communication mode (maintenance communication/Modbus RTU slave). If a value outside the configuration range is set, the following message is displayed. Press the  (ESC) button or the  button to return to the configuration screen, and then set the correct slave number again.



- For maintenance communication, see "Maintenance Communication via Expansion Communication Port" on page 9-3, and for Modbus RTU slaves, see "Modbus Communication via RS-232C/RS-485" on page 11-1.

Modifying the Function Settings

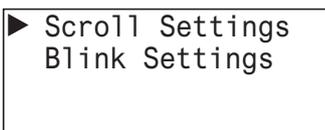
Modifying the Scroll Speed

While the SmartAXIS is stopped, you can configure the scroll speed for messages displayed with the message (MSG) instruction. This cannot be configured while the SmartAXIS is running.

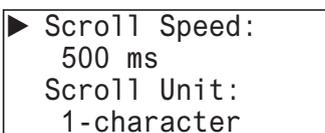
1. In step 4 of **Configuring the Slave Number**, select **Message Settings** and press the  (OK) button.



2. Select **Scroll Settings** with the  (up) and  (down) buttons and press the  (OK) button.

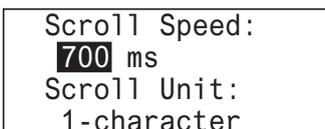


3. Select **Scroll Speed** with the  (up) and  (down) buttons and press the  (OK) button.



4. Modify the value with the  (up) and  (down) buttons and press the  (OK) button.

For example, change the value to 700 ms.



- **Selectable scroll speeds**

The scroll speeds that can be selected are as follows.

500/600/700/800/900/1000 ms

Configuring the Scroll Unit

When the SmartAXIS is stopped, you can configure the scroll unit for messages displayed with the message (MSG) instruction. This cannot be configured while the SmartAXIS is running.

1. In step 3 of **Modifying the Scroll Speed**, select **Scroll Unit** and press the  (OK) button.

```

Scroll Speed:
  500 ms
▶ Scroll Unit:
  1-character

```

2. Modify the scroll unit with the  (up) and  (down) buttons and press the  (OK) button.

```

Scroll Speed:
  500 ms
Scroll Unit:
  1-dot

```

- **Selectable scroll units**

The scroll units that can be selected are as follows.

1 character/1 pixel

Configuring the Blinking Speed

When the SmartAXIS is stopped, you can configure the blinking speed for messages displayed with the message (MSG) instruction. This cannot be configured while the SmartAXIS is running.

1. In step 2 of **Configuring the Scroll Speed**, select **Blink Settings** and press the  (OK) button.

```

Scroll Settings
▶ Blink Settings

```

2. Select **Blinking Speed** with the  (up) and  (down) buttons and press the  (OK) button.

```

▶ Blinking Speed:
  500 ms

```

3. Modify the value with the  (up) and  (down) buttons and press the  (OK) button. For example, change the value to 700 ms.

```

▶ Blinking Speed:
  700 ms

```

- **Selectable blinking speeds**

The blinking speeds that can be selected are as follows.

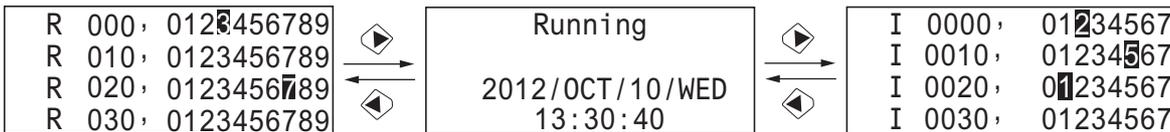
500/600/700/800/900/1000 ms

Monitoring the SmartAXIS

Monitoring Device Values

You can check device values on the SmartAXIS. When you switch the SmartAXIS to the device monitor mode from the standard screen, you can check device values, but you cannot modify them. To modify device values, run **Device Monitor** on the system menu. Device values can be monitored regardless of the SmartAXIS operating status (run/stop). This section describes the device monitor mode when the SmartAXIS is running.

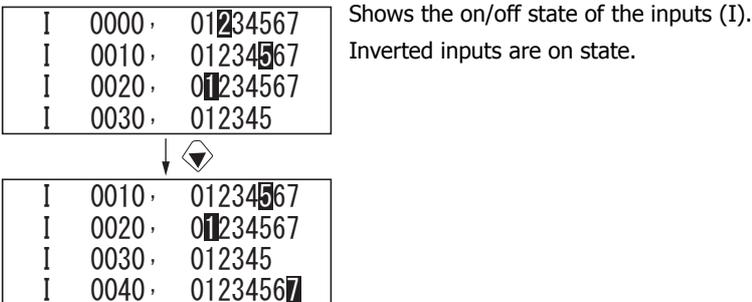
1. If you press the ◀ (left) and ▶ (right) buttons on the standard screen, the SmartAXIS switches to the device monitor mode and the device values can be monitored. Continue to press the ◀ (left) and ▶ (right) buttons to change the device type.



The device type changes in the order below.

I ⇔ Q ⇔ T ⇔ TC ⇔ TP ⇔ C ⇔ CC ⇔ CP ⇔ D (Data Register) ⇔ D (Special Data Register) ⇔ M (Internal Relay) ⇔ M (Special Internal Relay) ⇔ R

2. Press the ▲ (up) and ▼ (down) buttons.
The device numbers change.



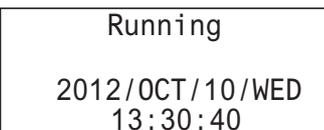
Modifying Device Values

This section describes how to specify a device and modify that device value.

Modifying a Bit Device Value

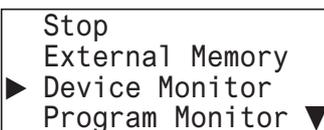
This section describes an example of switching on M0012 while the SmartAXIS is running.

1. On the standard screen, press the **ESC** (ESC) + **OK** (OK) buttons.

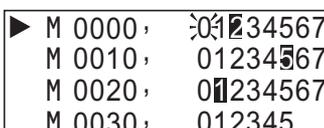


The system menu is displayed.

2. Select **Device Monitor** with the ▲ (up) and ▼ (down) buttons and press the **OK** (OK) button.
The SmartAXIS switches to the Device Monitor mode.



3. Select device type: M (internal relay) with the ◀ (left) and ▶ (right) buttons.
0 flashes to indicate the focus is on M0000.



4. With the  (up) and  (down) buttons, select M0010.
0 flashes to indicate the focus is on M0010.

M 0000:	01234567
▶ M 0010:	01234 5 67
M 0020:	01234567
M 0030:	012345

5. Move the cursor to **2** with the  (right) button and press the  (OK) button.

M 0000:	01234567
▶ M 0010:	01 2 34567
M 0020:	01234567
M 0030:	012345

M0012 turns on.

Modifying a Word Device Value

This section describes an example of changing D0002 to 500 while the SmartAXIS is running.

1. On the standard screen, press the  (ESC) +  (OK) buttons.

Running
2012/OCT/10/WED
13:30:40

The system menu is displayed.

2. Select **Device Monitor** with the  (up) and  (down) buttons and press the  (OK) button.
 The SmartAXIS switches to the Device Monitor mode.

Stop
External Memory
▶ Device Monitor
Program Monitor ▼

3. Select device type: D (Data Register) with the  (left) and  (right) buttons.

▶ D 0000:	00100
D 0001:	00200
D 0002:	00300
D 0003:	00400

4. Select D0002 with the  (up) and  (down) buttons and press the  (OK) button.

D 0000:	00100
D 0001:	00200
▶ D 0002:	00300
D 0003:	00400

5. Move the digit with the  (right) button and modify the value with the  (up) and  (down) buttons.

Change Device Val.:
D 0000:00 5 00
DEC (W)

6. Press the  (OK) button to confirm.

D 0000:	00100
D 0001:	00200
▶ D 0002:	00500
D 0003:	00400

Writing/Clearing TP (Timer Preset Values) and CP (Counter Preset Values) in the User Program

Writing TP (Timer Preset Values) and CP (Counter Preset Values)

Even if you modify TP (Timer Preset Values) and CP (Counter Preset Values) with Device Monitor mode, those changes are not written to the user program in the ROM. To write the changed preset values to the ROM, you must stop the SmartAXIS and confirm the changes. When you modify TP (Timer Preset Values) and CP (Counter Preset Values) and attempt to leave Device Monitor mode, the message below is displayed.

```

Timer/counter preset
values are changed.
    
```

1. Press the **ESC** (ESC) button or the **OK** (OK) button to display the standard screen.

When the SmartAXIS is running When the SmartAXIS is stopped

```

Running
T/C is changed
2012/OCT/10/WED
13:30:40
    
```

```

Stopped
T/C is changed
2012/OCT/10/WED
13:30:40
    
```

When TP (timer preset values) and CP (counter preset values) differ from the device values in the ROM, **T/C is changed** is displayed on the standard screen.

When the SmartAXIS is running, put it to Stop mode. For the steps to stop the SmartAXIS, see "Switching run/stop" on page 6-7.

2. On the standard screen, press the **ESC** (ESC) + **OK** (OK) buttons.

```

Stopped
T/C is changed
2012/OCT/10/WED
13:30:40
    
```

The system menu is displayed.

3. Select **Edit Program** with the **▲** (up) and **▼** (down) buttons and press the **OK** (OK) button.

```

Run
▶ Edit Program
External Memory
Configurations ▼
    
```

4. Select **T/C Preset Values** and press the **OK** (OK) button.

```

▶ T/C Preset Values
    
```

5. Select **Confirm** with the **▲** (up) and **▼** (down) buttons and press the **OK** (OK) button.

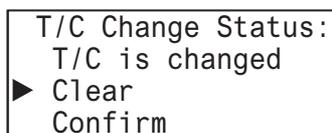
```

T/C Change Status:
T/C is changed
Clear
▶ Confirm
    
```

The changed preset values are written to the user program in the ROM.

Clearing TP (Timer Preset Values) and CP (Counter Preset Values)

- In step 5 of Writing TP (Timer Preset Values) and CP (Counter Preset Values), select **Clear** with the \blacktriangle (up) and \blacktriangledown (down) buttons, and press the OK (OK) button.



The changes made to the timer and counter preset values are deleted. The preset values of the user program in the ROM remain as they are before those values are modified. The device values return to the values before they are modified.

Note: Using WindLDR, you can also write the preset values to the user program in the ROM. Select **Online > Monitor > Start Monitor**. Select **Online > PLC > Status** to display the PLC Status dialog box, and click the **Confirm** button under **Timer/counter preset value modification** state. Once preset values are confirmed, they cannot be restored to their previous values, even if they are cleared.

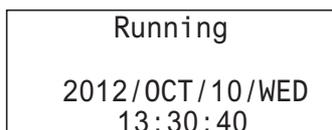
Monitoring the User Program

You can monitor the ladder program while the SmartAXIS is running or stopped.

The on/off state of bit devices can also be modified.

- On the standard screen, press the ESC (ESC) + OK (OK) buttons.

When the SmartAXIS is running



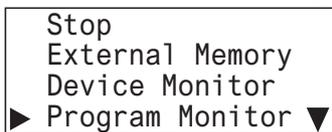
When the SmartAXIS is stopped



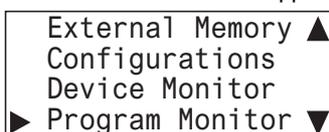
The system menu is displayed.

- Select **Program Monitor** with the \blacktriangle (up) and \blacktriangledown (down) buttons and press the OK (OK) button.

When the SmartAXIS is running

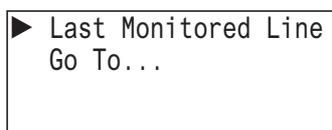


When the SmartAXIS is stopped

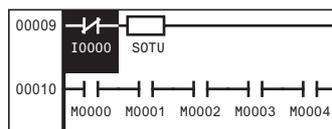


The SmartAXIS switches to the Program Monitor mode.

- Select **Last Monitored Line** with the \blacktriangle (up) and \blacktriangledown (down) buttons and press the OK (OK) button.



- The cursor can be moved with the \blacktriangle (up), \blacktriangledown (down), \blacktriangleleft (left), and \blacktriangleright (right) buttons.



For details on the ladder program monitor, see Chapter 2 "Ladder Program Monitor on SmartAXIS" in the SmartAXIS Ladder Programming Manual.

6: HMI FUNCTION

Monitoring the SmartAXIS Status

You can check the SmartAXIS system software version, operating status, scan time, and protection status.

1. On the standard screen, press the  (ESC) +  (OK) buttons.

When the SmartAXIS is running

```
Running
2012/OCT/10/WED
13:30:40
```

When the SmartAXIS is stopped

```
Stopped
2012/OCT/10/WED
13:30:40
```

The system menu is displayed.

2. Select **Status Monitor** with the  (up) and  (down) buttons and press the  (OK) button.

When the SmartAXIS is running

```
External Memory ▲
Device Monitor
Program Monitor
▶ Status Monitor ▼
```

When the SmartAXIS is stopped

```
Configurations ▲
Device Monitor
Program Monitor
▶ Status Monitor ▼
```

3. The system version is displayed. Press the  (down) button.

When the SmartAXIS is running

```
System Version:
1.00
Run/Stop Status:
Running ▼
```

When the SmartAXIS is stopped

```
System Version:
1.00
Run/Stop Status:
Stopped ▼
```

4. The scan time is displayed. Press the  (down) button.

```
Scan Time: ▲
Current: 2 ms
Maximum: 4 ms
Minimum: 2 ms ▼
```

5. The upload protection status is displayed. Press the  (down) button.

```
Protection Status: ▲
Read Program:
Prohibited ▼
```

6. The download protection status is displayed.

```
Protection Status: ▲
Write Program:
Password
```

Checking/Clearing Error Information

When an error occurs while the SmartAXIS is running, an error message is displayed on the LCD. This section describes the steps for checking the details and clearing the error.

1. When an error occurs, the following message is displayed.

When an error occurs while SmartAXIS is running and the SmartAXIS stops

```

Error!
PLC is stopped.
Press OK button for
more details.

```

When an error occurs while SmartAXIS is running and the SmartAXIS continues running

```

Error!
PLC is running.
Press OK button for
more details.

```

2. Press and hold the  (OK) button. The error code is displayed.

```

▶General Error: 3
Execution Error:0
Clear Error

```

Error details can also be checked from **Error Status** on the system menu.

3. Select the error type with the  (up) and  (down) buttons and press the  (OK) button. Only errors that have occurred are displayed.

```

General Error: 3
Power failure
Watchdog Timer

```

4. Press the  (ESC) button.
5. Select **Clear Error** with the  (down) button and press the  (OK) button.

```

General Error: 3
Execution Error:0
▶Clear Error

```

6. Select **Yes** with the  (down) button and press the  (OK) button.

```

Do you want to
clear error code?
No
▶Yes

```

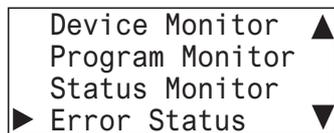
General errors and user program execution error are cleared.

Note: For details on error information, see "Troubleshooting" on page 12-1.

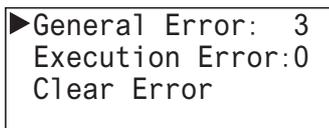
Checking Error Information from the System Menu

You can check error information from the system menu.

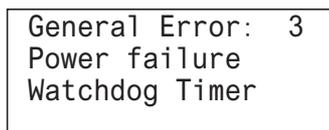
1. On the standard screen, press the  (ESC) +  (OK) buttons.
The system menu is displayed.
2. Select **Error Status** with the  (up) and  (down) buttons and press the  (OK) button.



3. The error code is displayed.



4. Select the error type with the  (up) and  (down) buttons and press the  (OK) button.
Only errors that have occurred are displayed.



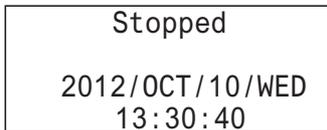
Uploading/Downloading the User Program

While the SmartAXIS is stopped, you can upload the user program in the SmartAXIS to the memory cartridge. You can also download the user program in the memory cartridge to the SmartAXIS.

Uploading the User Program (SmartAXIS to Memory Cartridge)

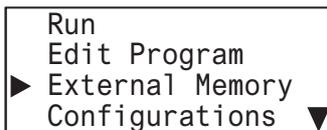
You can upload the user program in the SmartAXIS to the memory cartridge. This function cannot be used while the SmartAXIS is running.

1. On the standard screen, press the  (ESC) +  (OK) buttons.

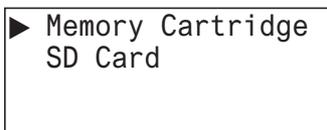


The system menu is displayed.

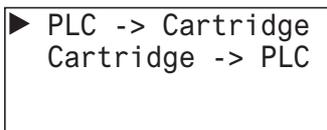
2. Select **External Memory** with the  (up) and  (down) buttons and press the  (OK) button.



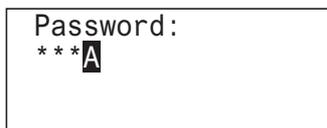
3. Select **Memory Cartridge** with the  (up) and  (down) buttons and press the  (OK) button.



4. Select **PLC -> Cartridge** with the  (up) and  (down) buttons and press the  (OK) button.



5. If the password is configured, you are prompted to enter the password.
Enter the password with the  (up),  (down),  (left), and  (right) buttons and press the  (OK) button.

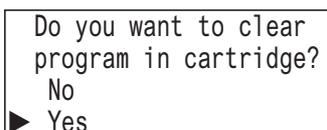


Entering the password is required for the following cases:

- The user program in the SmartAXIS is password-protected against the user program upload.
- The user program in the memory cartridge is password-protected against the user program download.

The confirmation screen is displayed.

6. Select **Yes** with the  (down) button and press the  (OK) button.

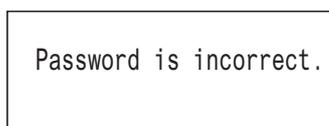


7. The screen below is displayed while the user program is uploaded. When the upload is finished, the screen in step 4 is displayed.



Notes:

- In either of the situations below, the password must be entered.
 - The user program on the SmartAXIS has been password protected for program uploads.
 - The user program on the memory cartridge has been password protected for program downloads.
- If an invalid password is entered in step 5, the screen below is displayed.



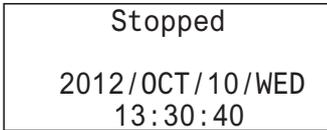
Press the  (ESC) button or the  (OK) button to return to step 4, and then enter the correct password in step 5.

6: HMI FUNCTION

Downloading the User Program (Memory Cartridge to SmartAXIS)

You can download the user program in the memory cartridge to the SmartAXIS. This function cannot be used while the SmartAXIS is running.

1. On the standard screen, press the **ESC** (ESC) + **OK** (OK) buttons.



The system menu is displayed.

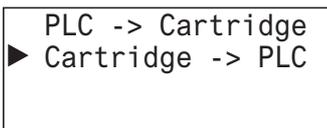
2. Select **External Memory** with the **▲** (up) and **▼** (down) buttons and press the **OK** (OK) button.



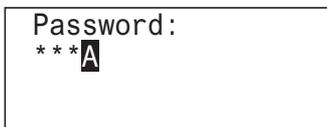
3. Select **Memory Cartridge** with the **▲** (up) and **▼** (down) buttons and press the **OK** (OK) button.



4. Select **Cartridge -> PLC** with the **▲** (up) and **▼** (down) buttons and press the **OK** (OK) button.



5. If the password is configured, you are prompted to enter the password.
Enter the password with the **▲** (up), **▼** (down), **◀** (left), and **▶** (right) buttons and press the **OK** (OK) button.

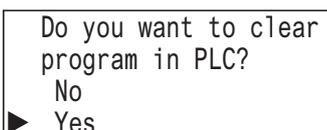


Entering the password is required for the following cases:

- The user program in the SmartAXIS is password-protected against the user program download.
- The user program in the memory cartridge is password-protected against the user program upload.

The confirmation screen is displayed.

6. Select **Yes** with the **▼** (down) button and press the **OK** (OK) button.

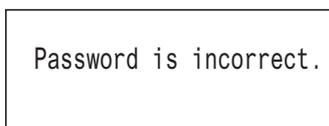


7. The screen below is displayed while the user program is downloaded. When the download is finished, the screen in step 4 is displayed.



Notes:

- In either of the situations below, the password must be entered.
 - The user program on the SmartAXIS has been password protected for program uploads.
 - The user program on the memory cartridge has been password protected for program downloads.
- If an invalid password is entered in step 5, the screen below is displayed.



Press the **ESC** (ESC) button or the **OK** (OK) button to return to step 4, and then enter the correct password in step 5.

Displaying Arbitrary Messages

The SmartAXIS can display messages on the LCD by executing the MSG (message) instruction.

When the display conditions for multiple MSG instructions are satisfied, the messages are displayed according to the priorities set for the MSG instructions. The message with the highest priority is displayed, out of all the MSG instructions with the inputs on, by pressing the  (up) button on the standard screen. By further pressing the  (up) button, the message with the next highest priority is displayed.

Switching between Multiple Message Screens

1. On the standard screen, press the  (up) button.

Running

2012/OCT/10/WED

13:30:40

The message with the highest priority is displayed out of all the MSG instructions with the inputs on.

Today's production count

Type A: 10000 pcs.

Type B: 30000 pcs.

2. Press the  (up) button.
The message with the next highest priority is displayed.

Insufficient parts

Manu. Line Process 1

2012/07/10

3. Press the  (down) button.

Today's production count

Type A: 10000 pcs.

Type B: 30000 pcs.

4. Press the  (ESC) button to return to the standard screen.

For details on the message instruction, see Chapter 13 "Display Instructions" in the "SmartAXIS Ladder Programming Manual".

Maintaining the SD Memory Card

Access to the memory card inserted into the SmartAXIS can be stopped while the SmartAXIS is running or stopped. The memory card inserted into the SmartAXIS can also be formatted while the SmartAXIS is stopped. The memory card cannot be formatted while the SmartAXIS is running.

Stopping Access to the SD Memory Card

This section describes how to stop the access to the SD memory card with the button operations on the SmartAXIS.

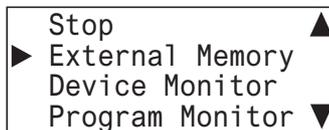
1. On the standard screen, press the  (ESC) +  (OK) buttons.



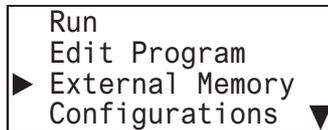
The system menu is displayed.

2. Select **External Memory** with the  (up) and  (down) buttons and press the  (OK) button.

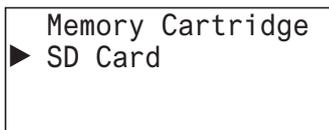
When the SmartAXIS is running



When the SmartAXIS is stopped



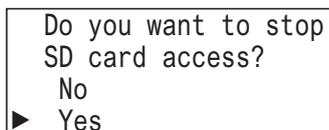
3. Select **SD Card** with the  (up) and  (down) buttons and press the  (OK) button.



4. Select **Stop Access** with the  (up) and  (down) buttons and press the  (OK) button.



5. Select **Yes** with the  (down) button and press the  (OK) button.



6. While the access to the SD memory card is being stopped, the screen below is displayed. When stopping the access is finished, the screen in step 4 is displayed.



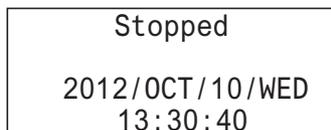
Notes:

- Set the write-protect switch on the SD memory card to insert into the SmartAXIS module to the off position.
- Insert and remove the SD memory card in the direction indicated on the SmartAXIS.
- Do not remove the SD memory card while the access to it is being stopped. There is a risk of damage to the SD memory card and the data stored on it. Check that the SD memory card access LED is off before removing the SD memory card from the SmartAXIS.

Format SD memory card with the SmartAXIS

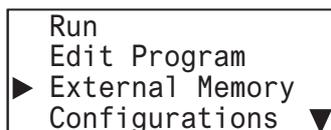
This section describes how to format the SD memory card in the SmartAXIS. In order to save the log data, format the SD memory card in the SmartAXIS.

1. On the standard screen, press the  (ESC) +  (OK) buttons.

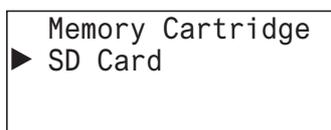


The system menu is displayed.

2. Select **External Memory** with the  (up) and  (down) buttons and press the  (OK) button.



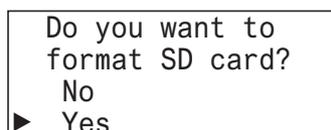
3. Select **SD Card** with the  (up) and  (down) buttons and press the  (OK) button.



4. Select **Format** with the  (up) and  (down) buttons and press the  (OK) button.



5. Select **Yes** with the  (down) button and press the  (OK) button.



6. While the SD memory card is being formatted, the screen below is displayed. When the format is finished, the screen in step 4 is displayed.



Entering a Password

This section describes how to unlock the password protection configured in the user program for uploading and downloading by WindLDR and the memory cartridge.

1. When the password screen is displayed, the cursor is on the first character.

Password:

2. With the  (up) and  (down) buttons, select an alphanumeric character. Following 0 through 9, you can select A through Z and a through z.

Password:

3. Move the cursor to the second character with the  (right) button.

Password:

4. With the  (up) and  (down) buttons, select an alphanumeric character.
5. Enter the password using the same steps and press the  (OK) button.

Password:

When the correct password is entered, the menu for the next step is displayed.

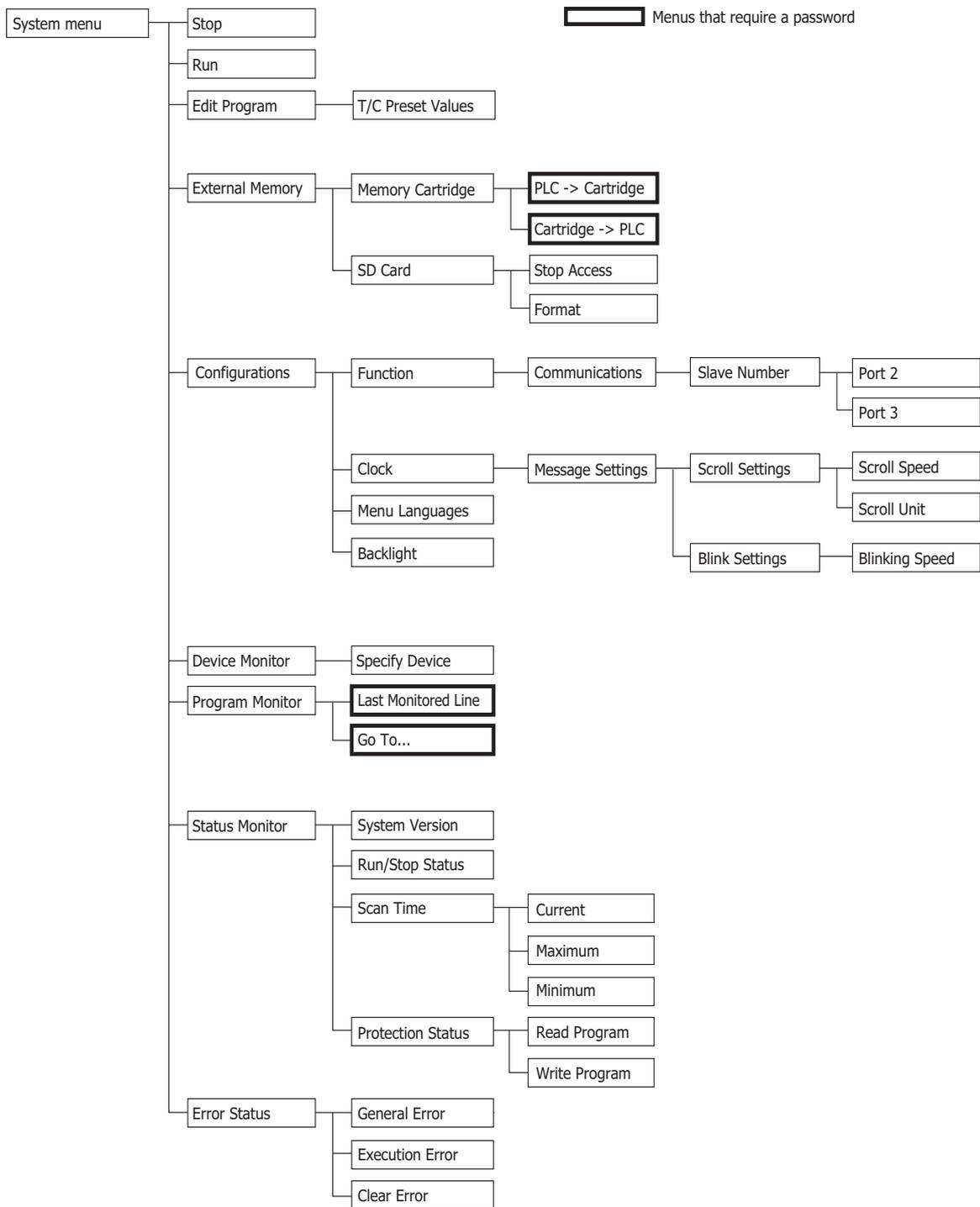
Notes:

- The characters that can be entered on the password screen are as follows. However, the space cannot be used as a password.

0	1	2	3	4	5	6	7	8	9
A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z	a	b	c	d
e	f	g	h	i	j	k	l	m	n
o	p	q	r	s	t	u	v	w	x
y	z								

- If you enter a wrong character, it can be deleted by selecting the space.

System Menu Hierarchy Diagram



7: DEVICE ADDRESSES

Introduction

This chapter describes device addresses available for the SmartAXIS. Special internal relays and special data registers are also described.

The SmartAXIS is programmed using devices such as inputs, outputs, remote inputs, remote outputs, internal relays, timers, counters, shift registers, and data registers.

Inputs (I) are relays to receive input signals through the input terminals.

Remote inputs (I) are relays to receive input signals from external devices connected to the remote I/O slaves.

Outputs (Q) are relays to send the processed results of the user program to the output terminals.

Remote outputs (O) are relays to send output signals to external devices connected to the remote I/O slaves.

Internal relays (M) are relays used in the CPU and cannot be outputted to the output terminals.

Special internal relays (M) are internal relays dedicated to specific functions.

Timers (T) are relays used in the user program, available in 1-sec, 100-ms, 10-ms, and 1-ms timers.

Counters (C) are relays used in the user program, available in adding counters and reversible counters.

Shift registers (R) are registers to shift the data bits according to pulse inputs.

Data registers (D) are registers used to store numerical data.

Special data registers (D) are dedicated to special functions.

Device Addresses

Available I/O numbers depend on the type of the SmartAXIS.

Device	FT1A-12		FT1A-24		FT1A-40		FT1A-48		FT1A-Touch	
	Device Address	Points	Device Address	Points	Device Address	Points	Device Address	Points	Device Address	Points
Input (I)	I0 - I7	8	I0 - I7 I10 - I17	16	I0 - I7 I10 - I17 I20 - I27	24	I0 - I7 I10 - I17 I20 - I27 I30 - I35	30	I0 - I7	8
Remote Input (I)	—	—	I40 - I75 I80 - I115 I120 - I155	90	I40 - I75 I80 - I115 I120 - I155	90	I40 - I75 I80 - I115 I120 - I155	90	—	—
Output (Q)	Q0 - Q3	4	Q0 - Q7	8	Q0 - Q7 Q10 - Q17	16	Q0 - Q7 Q10 - Q17 Q20, Q21	18	Q0 - Q3	4
Remote Output (Q)	—	—	Q40 - Q61 Q80 - Q101 Q120 - Q141	54	Q40 - Q61 Q80 - Q101 Q120 - Q141	54	Q40 - Q61 Q80 - Q101 Q120 - Q141	54	—	—
Internal Relay (M)	M0 - M317	256	M0 - M1277	1024	M0 - M1277	1024	M0 - M1277	1024	M0 - M1277	1024
Special Internal Relay (M)	M8000 - M8177	144	M8000 - M8177	144	M8000 - M8177	144	M8000 - M8177	144	M8000 - M8177	144
Shift Register (R)	R0 - R127	128	R0 - R127	128	R0 - R127	128	R0 - R127	128	R0 - R127	128
Timer (T)	T0 - T99	100	T0 - T199	200	T0 - T199	200	T0 - T199	200	T0 - T199	200
Counter (C)	C0 - C99	100	C0 - C199	200	C0 - C199	200	C0 - C199	200	C0 - C199	200
Data Register (D)	D0 - D399	400	D0 - D1999	2000	D0 - D1999	2000	D0 - D1999	2000	D0 - D1999	2000
Special Data Register (D)	D8000 - D8199	200	D8000 - D8199	200	D8000 - D8199	200	D8000 - D8199	200	D8000 - D8199	200

Notes:

- The least significant digit of input, output, internal relay, and special internal relay device address is an octal number (0 through 7). Upper digits are decimal numbers.
- Out of data registers D0 through D1999, D1000 through D1999 cannot be designated as "keep" types. Retained in STOP→RUN, but zeroed out when the power is turned on.

7: DEVICE ADDRESSES

Special Internal Relays

Special internal relays M8000 through M8177 are used for controlling the CPU operation and communication, and for indicating the CPU statuses. All special internal relays cannot be used as destinations of advanced instructions.

Internal relays M300 through M335 are used to read input device statuses of the IOREF (I/O refresh) instruction.

Note: Do not change the status of reserved special internal relays, otherwise the SmartAXIS may not operate correctly.

Special Internal Relay Device Addresses

Device Address	Description	CPU Stopped	Power OFF	Read/Write	
M8000	Start Control	Maintained	Maintained	Read/Write	
M8001	1-sec Clock Reset	Cleared	Cleared	Write	
M8002	All Outputs OFF	Cleared	Cleared	Write	
M8003	Carry (Cy) or Borrow (Bw)	Cleared	Cleared	Read	
M8004	User Program Execution Error	Cleared	Cleared	Read	
M8005	Remote I/O Slave 1 Communication Error	Operating	Cleared	Read	
M8006	Remote I/O Slave 2 Communication Error	Operating	Cleared	Read	
M8007	Remote I/O Slave 3 Communication Error	Operating	Cleared	Read	
M8010	In daylight saving time period (system version 1.10 or later)	Operating	Cleared	Read	
M8011- M8012	— Reserved —	—	—	—	
M8013	Calendar/Clock Data Write/Adjust Error Flag	Operating	Cleared	Read	
M8014	Calendar/Clock Data Read Error Flag	Operating	Cleared	Read	
M8015	— Reserved —	—	—	—	
M8016	Calendar Data Write Flag	Operating	Cleared	Write	
M8017	Clock Data Write Flag	Operating	Cleared	Write	
M8020	Calendar/Clock Data Write Flag	Operating	Cleared	Write	
M8021	Clock Data Adjust Flag	Operating	Cleared	Write	
M8022	User Communication Receive Instruction Cancel Flag (Port 2)	Cleared	Cleared	Write	
M8023	User Communication Receive Instruction Cancel Flag (Port 3)	Cleared	Cleared	Write	
M8024	BMOV/WSFT Executing Flag	Maintained	Maintained	Read	
M8025	Maintain Outputs While CPU Stopped	Maintained	Cleared	Read/Write	
M8026	SD Memory Card Status	Maintained	Cleared	Read	
M8027	SD Memory Card Writing Flag	Maintained	Cleared	Read	
M8030	High-speed Counter (Group 1/I0)	Comparison Output Reset	Cleared	Cleared	Read/Write
M8031		Gate Input	Maintained	Cleared	Read/Write
M8032		Reset Input	Maintained	Cleared	Read/Write
M8033		Reset Status	Maintained	Cleared	Read
M8034		Comparison ON Status	Maintained	Cleared	Read
M8035		Overflow	Maintained	Cleared	Read
M8036		Underflow	Maintained	Cleared	Read
M8037		Count Direction	Maintained	Cleared	Read
M8040	High-speed Counter (Group 2/I2)	Comparison Output Reset	Cleared	Cleared	Read/Write
M8041		Gate Input	Maintained	Cleared	Read/Write
M8042		Reset Input	Maintained	Cleared	Read/Write
M8043		Comparison ON Status	Maintained	Cleared	Read
M8044		Overflow	Maintained	Cleared	Read
M8045	High-speed Counter (Group 3/I3)	Comparison Output Reset	Cleared	Cleared	Read/Write
M8046		Gate Input	Maintained	Cleared	Read/Write
M8047		Reset Input	Maintained	Cleared	Read/Write
M8050		Reset Status	Maintained	Cleared	Read
M8051		Comparison ON Status	Maintained	Cleared	Read
M8052		Overflow	Maintained	Cleared	Read
M8053		Underflow	Maintained	Cleared	Read
M8054		Count Direction	Maintained	Cleared	Read

Device Address	Description		CPU Stopped	Power OFF	Read/Write
M8055	High-speed Counter (Group 4/I5)	Comparison Output Reset	Cleared	Cleared	Read/Write
M8056		Gate Input	Maintained	Cleared	Read/Write
M8057		Reset Input	Maintained	Cleared	Read/Write
M8060		Comparison ON Status	Maintained	Cleared	Read
M8061		Overflow	Maintained	Cleared	Read
M8062- M8067	— Reserved —		—	—	—
M8070	Interrupt Input I0 Status	(ON: Allowed, OFF: Prohibited)	Cleared	Cleared	Read
M8071	Interrupt Input I2 Status		Cleared	Cleared	Read
M8072	Interrupt Input I3 Status		Cleared	Cleared	Read
M8073	Interrupt Input I5 Status		Cleared	Cleared	Read
M8074	Interrupt Input I6 Status		Cleared	Cleared	Read
M8075	Interrupt Input I7 Status		Cleared	Cleared	Read
M8076	SD Memory Card Access Stop Flag		Operating	Cleared	Write
M8077	— Reserved —		—	—	—
M8080	Interrupt Input I0 Edge	(ON: Rising, OFF: Falling)	Cleared	Cleared	Read
M8081	Interrupt Input I2 Edge		Cleared	Cleared	Read
M8082	Interrupt Input I3 Edge		Cleared	Cleared	Read
M8083	Interrupt Input I5 Edge		Cleared	Cleared	Read
M8084	Interrupt Input I6 Edge		Cleared	Cleared	Read
M8085	Interrupt Input I7 Edge		Cleared	Cleared	Read
M8086 M8087	— Reserved —		—	—	—
M8090	Catch Input ON/OFF Status	Group 1/I0	Maintained	Cleared	Read
M8091		Group 2/I2	Maintained	Cleared	Read
M8092		Group 3/I3	Maintained	Cleared	Read
M8093		Group 4/I5	Maintained	Cleared	Read
M8094		Group 5/I6	Maintained	Cleared	Read
M8095		Group 6/I7	Maintained	Cleared	Read
M8096 M8097	— Reserved —		—	—	—
M8100	User Communication	Connection 1	Cleared	Cleared	Write
M8101	Receive Instruction Cancel Flag	Connection 2	Cleared	Cleared	Write
M8102		Connection 3	Cleared	Cleared	Write
M8103- M8107	— Reserved —		—	—	—
M8110	Connection Status	Connection 1 (ON: Connected, OFF: Not Connected)	Operating	Cleared	Read
M8111		Connection 2 (ON: Connected, OFF: Not Connected)	Operating	Cleared	Read
M8112		Connection 3 (ON: Connected, OFF: Not Connected)	Operating	Cleared	Read
M8113- M8117	— Reserved —		—	—	—
M8120	Initialize Pulse		Cleared	Cleared	Read
M8121	1-sec Clock		Operating	Cleared	Read
M8122	100-ms Clock		Operating	Cleared	Read
M8123	10-ms Clock		Operating	Cleared	Read
M8124	Timer/Counter Preset Value Changed		Maintained	Cleared	Read
M8125	In-operation Output		Cleared	Cleared	Read
M8126 M8127	— Reserved —		—	—	—
M8130	Disconnect User Communication Connection	Connection 1	Maintained	Cleared	Read/Write
M8131		Connection 2	Maintained	Cleared	Read/Write
M8132		Connection 3	Maintained	Cleared	Read/Write
M8133- M8143	— Reserved —		—	—	—

7: DEVICE ADDRESSES

Device Address	Description	CPU Stopped	Power OFF	Read/Write	
M8144	Timer Interrupt Status (ON: Allowed, OFF: Prohibited)	Cleared	Cleared	Read	
M8145- M8147	— Reserved —	—	—	—	
M8150	Comparison Result 1	Maintained	Cleared	Read	
M8151	Comparison Result 2	Maintained	Cleared	Read	
M8152	Comparison Result 3	Maintained	Cleared	Read	
M8153- M8157	— Reserved —	—	—	—	
M8160	Key Input Status	ESC Key + Up Key	Cleared	Cleared	Read
M8161		ESC Key + Down Key	Cleared	Cleared	Read
M8162		ESC Key + Left Key	Cleared	Cleared	Read
M8163		ESC Key +Right Key	Cleared	Cleared	Read
M8164 M8165	— Reserved —	—	—	—	
M8166	High-speed Counter (Group5/I6)	Comparison Output Reset	Cleared	Cleared	Read/Write
M8167		Gate Input	Maintained	Cleared	Read/Write
M8170		Reset Input	Maintained	Cleared	Read/Write
M8171		Comparison ON Status	Maintained	Cleared	Read
M8172		Overflow	Maintained	Cleared	Read
M8173	High-speed Counter (Group 6/I7)	Comparison Output Reset	Cleared	Cleared	Read/Write
M8174		Gate Input	Maintained	Cleared	Read/Write
M8175		Reset Input	Maintained	Cleared	Read/Write
M8176		Comparison ON Status	Maintained	Cleared	Read
M8177		Overflow	Maintained	Cleared	Read

M8000 Start Control

M8000 is used to control the operation of the CPU. The CPU stops operation when M8000 is turned off while the CPU is running. M8000 can be turned on or off using the WindLDR Online menu. When a stop or reset input is designated, M8000 must remain on to control the CPU operation using the stop or reset input.

M8000 maintains its status when the CPU is powered down. When the data to be maintained during power failure is broken after the CPU has been off for a period longer than the battery backup duration, the CPU restarts operation or not as selected in **Configuration > Run/Stop Control > Run/Stop Selection at Memory Backup Error**. For details on SmartAXIS Pro/Lite start control, see "Run/Stop Selection at Memory Backup Error" on page 5-5.

M8001 1-sec Clock Reset

While M8001 is on, M8121 (1-sec clock) is turned off.

M8002 All Outputs OFF

When M8002 is turned on, all outputs and remote outputs go off until M8002 is turned off. Self-maintained circuits using outputs also go off and are not restored when M8002 is turned off.

M8003 Carry (Cy) and Borrow (Bw)

When a carry or borrow results from executing an addition or subtraction instruction, M8003 turns on. M8003 is also used for the bit shift and rotate instructions. For the causes of carry (CY) and borrow (BW), See Chapter 4 "Instructions Reference" – "Carry and Borrow" in the "SmartAXIS Ladder Programming Manual".

M8004 User Program Execution Error

When an error occurs while executing a user program, M8004 turns on. The cause of the user program execution error can be checked using **Online > Monitor > Monitor**, then **Online > Status > Error Status > Details**.

For a list of Pro/Lite user program execution errors, see "User Program Execution Error" on page 12-6.

M8005 Remote I/O Slave 1 Communication Error

When an error occurs during communication with remote I/O slave 1, M8005 turns on. When the error is cleared, M8005 turns off.

M8006 Remote I/O Slave 2 Communication Error

When an error occurs during communication with remote I/O slave 2, M8006 turns on. When the error is cleared, M8006 turns off.

M8007 Remote I/O Slave 3 Communication Error

When an error occurs during communication with remote I/O slave 3, M8007 turns on. When the error is cleared, M8007 turns off.

M8010 In Daylight Saving Time Period

When the daylight saving time is enabled, M8010 is turned on while in the daylight saving time period. When the daylight saving time is disabled, M8010 is always off.

M8013 Calendar/Clock Data Write/Adjust Error Flag

When an error occurs while calendar/clock data is written or clock data is adjusted, M8013 turns on. If calendar/clock data is written or clock data is adjusted successfully, M8013 turns off.

M8014 Calendar/Clock Data Read Error Flag

When an error occurs while calendar/clock data is read from the internal clock to the special data registers (D8008 to D8014), M8014 turns on. If calendar/clock data is read successfully, M8014 turns off.

M8016 Calendar Data Write Flag

When M8016 is turned on, data in data registers D8015 through D8018 (calendar new data) are set to the internal clock.

M8017 Clock Data Write Flag

When M8017 is turned on, data in data registers D8019 through D8021 (clock new data) are set to the internal clock.

M8020 Calendar/Clock Data Write Flag

When M8020 is turned on, data in data registers D8015 through D8021 (calendar/clock new data) are set to the internal clock.

M8021 Clock Data Adjust Flag

When M8021 is turned on, the clock is adjusted with respect to seconds. If *seconds* are between 0 and 29 for current time, adjustment for *seconds* will be set to 0 and *minutes* remain the same. If *seconds* are between 30 and 59 for current time, adjustment for *seconds* will be set to 0 and *minutes* are incremented by one.

M8022 User Communication Receive Instruction Cancel Flag (Port 2)

When M8022 is turned on, all RXD2 instructions ready for receiving user communication through port 2 are disabled.

M8023 User Communication Receive Instruction Cancel Flag (Port 3)

When M8023 is turned on, all RXD3 instructions ready for receiving user communication through port 3 are disabled.

M8024 BMOV/WSFT Executing Flag

While the BMOV or WSFT is executed, M8024 turns on. When completed, M8024 turns off. If the CPU is powered down while executing BMOV or WSFT, M8024 remains on when the CPU is powered up again.

M8025 Maintain Outputs While CPU Stopped

Outputs are normally turned off when the CPU is stopped. M8025 is used to maintain the output statuses when the CPU is stopped. When the CPU is stopped with M8025 turned on, the output ON/OFF statuses are maintained. When the CPU restarts, M8025 is turned off automatically.

M8026 SD Memory Card Status

When an SD memory card is inserted into the SmartAXIS, M8026 turns on. When an SD memory card is not inserted, M8026 turns off.

M8027 SD Memory Card Writing Flag

While logging data is written to the SD memory card, M8027 turns on. When writing logging data is finished, M8027 turns off.

M8030-M8061 Special Internal Relays for High-speed Counter

Special internal relays used for the high-speed counter.

For details on the Pro/Lite high-speed counter, see "High-Speed Counter" on page 5-9.

M8070-M8075 Interrupt Input Status

Turns on when the corresponding user interrupt is allowed. When interrupt inputs are disabled, these internal relays are turned off.

M8070=Interrupt input I0 status, M8071=Interrupt input I2 status, M8072=Interrupt input I3 status

M8073=Interrupt input I5 status, M8074=Interrupt input I6 status, M8075=Interrupt input I7 status

M8076 SD Memory Card Access Stop Flag

Access to the SD memory card is stopped when M8076 is turned off to on.

M8080-M8085 Interrupt Input Edge (ON: Rising, OFF: Falling)

This flag indicates whether the interrupt input is triggered with a rising edge or falling edge.

M8090-M8095 Catch Input ON/OFF Status

When a rising or falling input edge is detected during a scan, the input statuses of catch inputs Group 1/I0 through Group 6/I7 at the moment are set to M8090 through M8095, respectively, without regard to the scan status. Only one edge is detected in one scan. For the catch input function, see "Catch Input" on page 5-28.

M8100-M8102 User Communication Receive Instruction Cancel Flag

When M8100, M8101, or M8102 is turned on, all ERXD instructions ready for receiving user communication through connection 1, connection 2, or connection 3 are disabled, respectively.

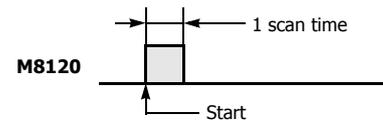
M8110-M8112 Connection Status

When SmartAXIS and a network device are connected via the maintenance communication server, user communication server/client, or Modbus TCP server/client, the connection status turns on. When no network devices are connected, the connection status turns off.

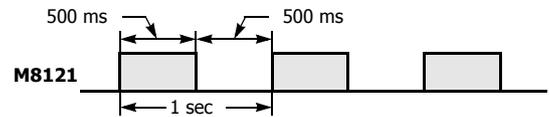
These relays are always off for the 12-I/O type (SmartAXIS without Ethernet port).

M8120 Initialize Pulse

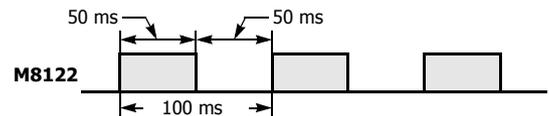
When the CPU starts operation, M8120 turns on for a period of one scan.

**M8121 1-sec Clock**

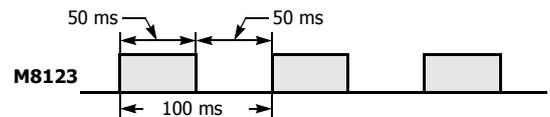
While M8001 (1-sec clock reset) is off, M8121 generates clock pulses in 1-sec increments, with a duty ratio of 1:1 (500ms on and 500ms off).

**M8122 100-ms Clock**

M8122 always generates clock pulses in 100ms increments, whether M8001 is on or off, with a duty ratio of 1:1 (50ms on and 50ms off).

**M8123 10-ms Clock**

M8123 always generates clock pulses in 10ms increments, whether M8001 is on or off, with a duty ratio of 1:1 (5ms on and 5ms off).

**M8124 Timer/Counter Preset Value Changed**

When timer or counter preset values are changed in the CPU module RAM, M8124 turns on. When a user program is downloaded to the CPU from WindLDR or when the changed timer/counter preset value is cleared, M8124 turns off. When a timer or counter is designated as a destination of an advanced instruction, the timer/counter preset value is also changed.

M8125 In-operation Output

M8125 remains on while the CPU is running.

M8130-M8132 Disconnect User Communication Connection

When SmartAXIS is connected to a remote host with the user communication client and a special internal relay corresponding to the connection is turned off to on, the connection is disconnected. Special internal relays M8130 through M8132 are allocated to connections 1 through 3, respectively.

These relays are enabled only when user communication client is used. These relays have no effect for the user communication server. Nothing happens for the 12-I/O type (SmartAXIS without Ethernet port) when these relays are turned on.

M8144 Timer Interrupt Status

When timer interrupt is enabled, M8144 is turned on. When disabled, M8144 is turned off.

M8150 Comparison Result 1

When the CMP= instruction is used, M8150 is turned on when the value of device designated by S1 is greater than that of device designated by S2 ($S1 > S2$). See Chapter 7 "Data Comparison Instructions" - "Special Internal Relays M8150, M8151, and M8152 in CMP=" in the "SmartAXIS Ladder Programming Manual".

When the ICMP>= instruction is used, M8150 is turned on when the value of device designated by S2 is greater than that of device designated by S1 ($S2 < S1$). See Chapter 7 "Data Comparison Instructions" - "Special Internal Relays M8150, M8151, and M8152 in ICMP>=" in the "SmartAXIS Ladder Programming Manual".

M8151 Comparison Result 2

When the CMP= instruction is used, M8151 is turned on when the value of device designated by S1 is equal to that of device designated by S2 ($S1 = S2$). See Chapter 7 "Data Comparison Instructions" - "Special Internal Relays M8150, M8151, and M8152 in CMP=" in the "SmartAXIS Ladder Programming Manual".

When the ICMP>= instruction is used, M8151 is turned on when the value of device designated by S3 is greater than that of device designated by S2 ($S3 > S2$). See Chapter 7 "Data Comparison Instructions" - "Special Internal Relays M8150, M8151, and M8152 in ICMP>=" in the "SmartAXIS Ladder Programming Manual".

M8152 Comparison Result 3

When the CMP= instruction is used, M8152 is turned on when the value of device designated by S1 is less than that of device designated by S2 ($S1 < S2$). See Chapter 7 "Data Comparison Instructions" - "Special Internal Relays M8150, M8151, and M8152 in CMP=" in the "SmartAXIS Ladder Programming Manual".

When the ICMP>= instruction is used, M8152 is turned on when the value of device designated by S2 is less than that of device designated by S1 and greater than that of device designated by S3 ($S1 > S2 > S3$). See Chapter 7 "Data Comparison Instructions" - "Special Internal Relays M8150, M8151, and M8152 in ICMP>=" in the "SmartAXIS Ladder Programming Manual".

M8160-M8163 Button Input Status

While the ESC button and direction buttons on the SmartAXIS Pro are simultaneously pressed, the corresponding special internal relays M8160 through M8163 turn on. When no buttons are pressed, M8160 through M8163 turn off.

M8166-M8177 Special Internal Relays for High-speed Counter

Special internal relays used for the high-speed counter.

For details on the Pro/Lite high-speed counter, see "High-Speed Counter" on page 5-9.

7: DEVICE ADDRESSES

Special Data Registers

Note: Do not change the data of reserved special data registers, otherwise the SmartAXIS may not operate correctly.

Special Data Register Device Addresses

Device Address	Description		Updated	See Page
D8000	Quantity of Inputs		When I/O initialized	7-11
D8001	Quantity of Outputs		When I/O initialized	7-11
D8002	SmartAXIS Type Information		Power-up	7-11
D8003	Memory Cartridge Information		Power-up	7-11
D8004	— Reserved —		—	—
D8005	General Error Code		When error occurred	7-11
D8006	User Program Execution Error Code		When error occurred	7-11
D8007	— Reserved —		—	—
D8008	Calendar/Clock Current Data (Read only)	Year	Every 500 ms	7-11
D8009		Month	Every 500 ms	7-11
D8010		Day	Every 500 ms	7-11
D8011		Day of Week	Every 500 ms	7-11
D8012		Hour	Every 500 ms	7-11
D8013		Minute	Every 500 ms	7-11
D8014		Second	Every 500 ms	7-11
D8015	Calendar/Clock New Data (Write only)	Year	—	7-11
D8016		Month	—	7-11
D8017		Day	—	7-11
D8018		Day of Week	—	7-11
D8019		Hour	—	7-11
D8020		Minute	—	7-11
D8021		Second	—	7-11
D8022	Scan Time Data	Constant Scan Time Preset Value (1 to 1,000 ms)	—	7-11
D8023		Scan Time Current Value (ms)	Every scan	7-11
D8024		Scan Time Maximum Value (ms)	At occurrence	7-11
D8025		Scan Time Minimum Value (ms)	At occurrence	7-11
D8026	Communication Mode Information (Port 2 and Port 3)		Every scan	7-11
D8027	Port 2 Slave Number		Every scan	7-11
D8028	Port 3 Slave Number		Every scan	7-11
D8029	System Software Version		Power-up	7-12
D8030	Communication Adapter Information		Power-up	7-12
D8031	Optional Cartridge Information		Power-up	7-12
D8032	Interrupt Input Jump Destination Label No. (I0)		—	7-12
D8033	Interrupt Input Jump Destination Label No. (I2)		—	7-12
D8034	Interrupt Input Jump Destination Label No. (I3)		—	7-12
D8035	Interrupt Input Jump Destination Label No. (I5)		—	7-12
D8036	Timer Interrupt Jump Destination Label No.		—	7-12
D8037	Interrupt Input Jump Destination Label No. (I6)		—	7-12
D8038	Interrupt Input Jump Destination Label No. (I7)		—	7-12
D8039	SD Memory Card Capacity (Megabytes)		Every 1 sec	7-12
D8040	Analog Input Value (AI0)		Every scan	7-13
D8041	Analog Input Value (AI1)		Every scan	7-13
D8042	Analog Input Value (AI2)		Every scan	7-13
D8043	Analog Input Value (AI3)		Every scan	7-13
D8044	Analog Input Value (AI4)		Every scan	7-13
D8045	Analog Input Value (AI5)		Every scan	7-13
D8046	Analog Input Value (AI6)		Every scan	7-13
D8047	Analog Input Value (AI7)		Every scan	7-13
D8048-D8049	— Reserved —		—	—

Device Address	Description		Updated	See Page	
D8050	High-speed Counter (Group 1/I0)	High Word	Current Value / Frequency Measurement Value (I0)	Every scan	7-13
D8051		Low Word			
D8052		High Word	Preset Value	—	7-13
D8053		Low Word			
D8054		High Word	Reset Value	—	7-13
D8055		Low Word			
D8056	High-speed Counter (Group 2/I2)	High Word	Current Value / Frequency Measurement Value (I2)	Every scan	7-13
D8057		Low Word			
D8058		High Word	Preset Value	—	7-13
D8059		Low Word			
D8060		High Word	Reset Value	—	7-13
D8061		Low Word			
D8062	High-speed Counter (Group 3/I3)	High Word	Current Value / Frequency Measurement Value (I3)	Every scan	7-13
D8063		Low Word			
D8064		High Word	Preset Value	—	7-13
D8065		Low Word			
D8066		High Word	Reset Value	—	7-13
D8067		Low Word			
D8068	High-speed Counter (Group 4/I5)	High Word	Current Value / Frequency Measurement Value (I5)	Every scan	7-13
D8069		Low Word			
D8070		High Word	Preset Value	—	7-13
D8071		Low Word			
D8072		High Word	Reset Value	—	7-13
D8073		Low Word			
D8074	Backlight ON Time		Every scan	7-13	
D8075-D8076	— Reserved —		—	—	
D8077	Out of Analog Input Range Status		—	7-13	
D8078	MAC Address (Read only)		Every 1 sec	7-13	
D8079					
D8080					
D8081					
D8082					
D8083					
D8084	IP Address (Current Data) Read only		Every 1 sec	7-13	
D8085					
D8086					
D8087					
D8088	Subnet Mask (Current Data) Read only		Every 1 sec	7-13	
D8089					
D8090					
D8091					
D8092	Default Gateway (Current Data) Read only		Every 1 sec	7-13	
D8093					
D8094					
D8095					
D8096-D8103	— Reserved —		—	—	
D8104	RS232C Control Signal Status (Ports 2 and 3)		Every scan	7-13	
D8105	RS232C DSR Input Control Signal Option (Ports 2 and 3)		When sending/ receiving data	7-14	
D8106	RS232C DTR Output Control Signal Option (Ports 2 and 3)		When sending/ receiving data	7-14	
D8107-D8109	— Reserved —		—	—	
D8110	Connection 1 Connected IP Address		Every 1 sec	7-14	
D8111					
D8112					
D8113					

7: DEVICE ADDRESSES

Device Address	Description		Updated	See Page	
D8114	Connection 2 Connected IP Address		Every 1 sec	7-14	
D8115					
D8116					
D8117					
D8118	Connection 3 Connected IP Address		Every 1 sec	7-14	
D8119					
D8120					
D8121					
D8122-D8129	— Reserved —		—	—	
D8130	Connection 1 Connected Port Number		Every 1 sec	7-14	
D8131	Connection 2 Connected Port Number		Every 1 sec	7-14	
D8132	Connection 3 Connected Port Number		Every 1 sec	7-14	
D8133	— Reserved —		—	—	
D8134	High-speed Counter (Group 5/I6)	High Word	Current Value / Frequency Measurement Value (I6)	Every scan	7-13
D8135		Low Word			
D8136		High Word	Preset Value	—	7-13
D8137		Low Word			
D8138		High Word	Reset Value	—	7-13
D8139		Low Word			
D8140	High-speed Counter (Group 6/I7)	High Word	Current Value / Frequency Measurement Value (I7)	Every scan	7-13
D8141		Low Word			
D8142		High Word	Preset Value	—	7-13
D8143		Low Word			
D8144		High Word	Reset Value	—	7-13
D8145		Low Word			
D8146	— Reserved —		—	—	
D8147	— Reserved —		—	—	
D8148	Remote I/O Slave 1	Communication Error Status		When error occurred	7-14
D8149		Analog Input (AI10)		Every scan	7-14
D8150		Analog Input (AI11)		Every scan	7-14
D8151		Analog Input (AI12)		Every scan	7-14
D8152		Analog Input (AI13)		Every scan	7-14
D8153		Analog Input (AI14)		Every scan	7-14
D8154		Analog Input (AI15)		Every scan	7-14
D8155		Analog Input (AI16)		Every scan	7-14
D8156		Analog Input (AI17)		Every scan	7-14
D8157	Remote I/O Slave 2	Communication Error Status		When error occurred	7-14
D8158		Analog Input (AI20)		Every scan	7-14
D8159		Analog Input (AI21)		Every scan	7-14
D8160		Analog Input (AI22)		Every scan	7-14
D8161		Analog Input (AI23)		Every scan	7-14
D8162		Analog Input (AI24)		Every scan	7-14
D8163		Analog Input (AI25)		Every scan	7-14
D8164		Analog Input (AI26)		Every scan	7-14
D8165		Analog Input (AI27)		Every scan	7-14
D8166	Remote I/O Slave 3	Communication Error Status		When error occurred	7-14
D8167		Analog Input (AI30)		Every scan	7-14
D8168		Analog Input (AI31)		Every scan	7-14
D8169		Analog Input (AI32)		Every scan	7-14
D8170		Analog Input (AI33)		Every scan	7-14
D8171		Analog Input (AI34)		Every scan	7-14
D8172		Analog Input (AI35)		Every scan	7-14
D8173		Analog Input (AI36)		Every scan	7-14
D8174		Analog Input (AI37)		Every scan	7-14
D8175-D8199	— Reserved —		—	—	

7: DEVICE ADDRESSES

D8028: Port 3 Slave Number

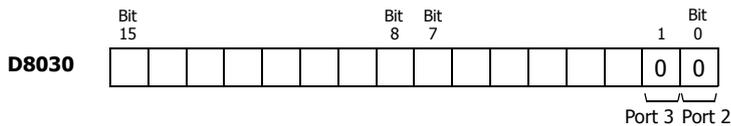
For SmartAXIS Pro/Lite maintenance communication, see "Maintenance Communication via Expansion Communication Port" on page 9-3. For Modbus RTU slaves, see "Modbus Communication via RS-232C/RS-485" on page 11-1.

D8029 System Software Version

The PLC system software version number is stored to D8029. This value is indicated in the PLC status dialog box called from the WindLDR menu bar. Select **Online > Monitor > Monitor**, then select **Online > Status**. See "Troubleshooting" on page 12-1.

D8030 Communication Adapter Information

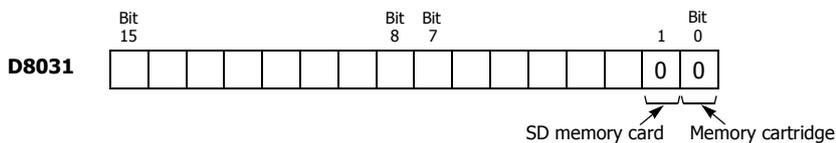
Information about the communication adapters installed on the port 2 and port 3 connectors is stored to D8030.



- 0: RS232C communication adapter is installed
- 1: RS485 communication adapter is installed or no communication adapter is installed

D8031 Optional Cartridge Information

Information about the optional cartridge installed on the SmartAXIS is stored to D8031.



- 0: No optional cartridge is installed
- 1: Memory cartridge is installed
- 2: SD memory card is installed
- 3: Memory cartridge and SD memory card are installed

D8032-D8035, D8037, D8038 Interrupt Input Jump Destination Label No.

Jump destination label numbers for interrupt inputs are stored in these special data registers. To use interrupt inputs, store the label number that corresponds to the special data register allocated to the interrupt input.

D8032=I0, D8033=I2, D8034=I3, D8035=I5, D8037=I6, D8038=I7

For details on SmartAXIS Pro/Lite interrupt inputs, see "Interrupt Input" on page 5-30l.

D8036 Timer Interrupt Jump Destination Label No.

The jump destination label number when the timer interrupt occurs is stored in D8036. To use the timer interrupt, store the corresponding label number.

For details on the SmartAXIS Pro/Lite timer interrupt, see "Timer Interrupt" on page 5-37.

D8039 SD Memory Card Capacity

The capacity of the inserted SD or SDHC (maximum size 32GB) memory card in megabytes is stored in D8039.

D8040-D8047 Analog Input Value

The analog input values (0 to 10V DC) to the analog input terminals are converted to digital values (0 to 1000) and stored in the corresponding special data registers.

D8040=AI0, D8041=AI1, D8042=AI2, D8043=AI3, D8044=AI4, D8045=AI5, D8046=AI6, D8047=AI7

D8050-D8073, D8134-D8145 High-speed Counter

These special data registers are used with the high-speed counter function and the frequency measurement function.

For details on the SmartAXIS Pro/Lite high-speed counter, see "High-Speed Counter" on page 5-9.

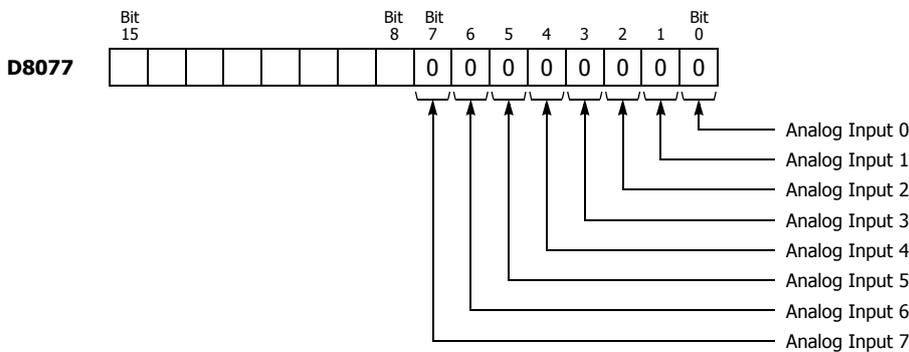
D8074 Backlight ON Time

The backlight ON time is stored. The backlight ON time can be configured by changing the value in D8074 between 1 to 65535 seconds. When D8074 is 0, the backlight is always ON. The backlight ON time can also be changed with the HMI function. For details, see "Backlight ON Time" on page 5-53.

D8077 Analog Input Out of Range Status

When an analog input value is 11V or higher, the corresponding bit of D8077 turns on. When an analog input value is lower than 11V, the corresponding bit of D8077 turns off.

The assignment of each analog input is as follows.



D8078-D8083 MAC Address (Read only)

MAC address of the SmartAXIS is stored in the special data registers in hexadecimal as shown below.

Example) MAC address: AA-BB-CC-DD-EE-FF

D8078=AAh, D8079=BBh, D8080=CCh, D8081=DDh, D8082=EEh, D8083=FFh

D8084-D8087 IP Address (Current Data) Read only

IP address of the SmartAXIS is stored in the special data registers as shown below.

Example) IP address: aaa.bbb.ccc.ddd

D8084=aaa, D8085=bbb, D8086=ccc, D8087=ddd

D8088-D8091 Subnet Mask (Current Data) Read only

Subnet mask of the SmartAXIS is stored in the special data registers as shown below.

Example) Subnet mask: aaa.bbb.ccc.ddd

D8088=aaa, D8089=bbb, D8090=ccc, D8091=ddd

D8092-D8095 Default Gateway (Current Data) Read only

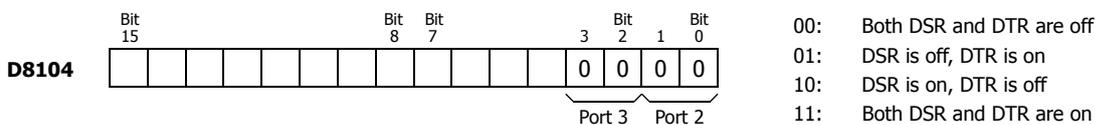
Default gateway of the SmartAXIS is stored in the special data registers as shown below.

Example) Default gateway: aaa.bbb.ccc.ddd

D8092=aaa, D8093=bbb, D8094=ccc, D8095=ddd

D8104 RS232C Control Signal Status (Port 2 and Port 3)

RS232C control signal status of port 2 and port 3 is stored in D8104.



8: INSTRUCTIONS REFERENCE

Introduction

SmartAXIS instructions are divided into basic instructions, which perform sequencing, and advanced instructions, which perform moves, comparisons, Boolean computations, binary arithmetic operations, bit shifts, and other operations. For details, see the SmartAXIS Ladder Programming Manual.

Basic Instruction List

Symbol	Name	Function
AND	And	Series connection of NO contact
AND LOD	And Load	Series connection of circuit blocks
ANDN	And Not	Series connection of NC contact
BPP	Bit Pop	Restores the result of bit logical operation which was saved temporarily
BPS	Bit Push	Saves the result of bit logical operation temporarily
BRD	Bit Read	Reads the result of bit logical operation which was saved temporarily
CC=	Counter Comparison (=)	Equal to comparison of counter current value
CC>=	Counter Comparison (>=)	Greater than or equal to comparison of counter current value
CDP	Dual Pulse Reversible Counter	Dual pulse reversible counter (0 to 65,535)
CDPD	Double-word Dual Pulse Reversible Counter	Double-word dual pulse reversible counter (0 to 4,294,967,295)
CNT	Adding Counter	Adding counter (0 to 65,535)
CNTD	Double-word Adding Counter	Double-word adding counter (0 to 4,294,967,295)
CUD	Up/Down Selection Reversible Counter	Up/down selection reversible counter (0 to 65,535)
CUDD	Double-word Up/Down Selection Reversible Counter	Double-word up/down selection reversible counter (0 to 4,294,967,295)
DC=	Data Register Comparison (=)	Equal to comparison of data register value
DC>=	Data Register Comparison (>=)	Greater than or equal to comparison of data register value
END	End	Ends a program
JEND	Jump End	Ends a jump instruction
JMP	Jump	Jumps a designated program area
LOD	Load	Stores intermediate results and reads contact status
LODN	Load Not	Stores intermediate results and reads inverted contact status
MCR	Master Control Reset	Ends a master control
MCS	Master Control Set	Starts a master control
OR	Or	Parallel connection of NO contact
OR LOD	Or Load	Parallel connection of circuit blocks
ORN	Or Not	Parallel connection of NC contact
OUT	Output	Outputs the result of bit logical operation
OUTN	Output Not	Outputs the inverted result of bit logical operation
RST	Reset	Resets output, internal relay, or shift register bit
SET	Set	Sets output, internal relay, or shift register bit
SFR	Shift Register	Forward shift register
SFRN	Shift Register Not	Reverse shift register
SOTD	Single Output Down	Falling-edge differentiation output
SOTU	Single Output Up	Rising-edge differentiation output
TIM	100-ms Timer	Subtracting 100-ms timer (0 to 6553.5 sec)
TIMO	100-ms Off-delay Timer	Subtracting 100-ms off-delay timer (0 to 6553.5 sec)
TMH	10-ms Timer	Subtracting 10-ms timer (0 to 655.35 sec)
TMHO	10-ms Off-delay Timer	Subtracting 10-ms off-delay timer (0 to 655.35 sec)

8: INSTRUCTIONS REFERENCE

Symbol	Name	Function
TML	1-sec Timer	Subtracting 1-sec timer (0 to 65535 sec)
TMLO	1-sec Off-delay Timer	Subtracting 1-sec off-delay timer (0 to 65535 sec)
TMS	1-ms Timer	Subtracting 1-ms timer (0 to 65.535 sec)
TMSO	1-ms Off-delay Timer	Subtracting 1-ms off-delay timer (0 to 65.535 sec)

Advanced Instruction List

Group	Symbol	Name	Valid Data Type				
			W	I	D	L	F
NOP	NOP	No Operation					
Move	MOV	Move	X	X	X	X	X
	MOVN	Move Not	X	X	X	X	
	IMOV	Indirect Move	X		X		X
	IMOVN	Indirect Move Not	X		X		
	BMOV	Block Move	X				
	IBMV	Indirect Bit Move	X				
	IBMVN	Indirect Bit Move Not	X				
	NSET	N Data Set	X	X	X	X	X
	NRS	N Data Repeat Set	X	X	X	X	X
	XCHG	Exchange	X		X		
TCCST	Timer/Counter Current Value Store	X		X			
Data Comparison	CMP=	Compare Equal To	X	X	X	X	X
	CMP<>	Compare Unequal To	X	X	X	X	X
	CMP<	Compare Less Than	X	X	X	X	X
	CMP>	Compare Greater Than	X	X	X	X	X
	CMP<=	Compare Less Than or Equal To	X	X	X	X	X
	CMP>=	Compare Greater Than or Equal To	X	X	X	X	X
	ICMP>=	Interval Compare Greater Than or Equal To	X	X	X	X	X
	LC=	Load Compare Equal To	X	X	X	X	X
	LC<>	Load Compare Unequal To	X	X	X	X	X
	LC<	Load Compare Less Than	X	X	X	X	X
	LC>	Load Compare Greater Than	X	X	X	X	X
	LC<=	Load Compare Less Than or Equal To	X	X	X	X	X
LC>=	Load Compare Greater Than or Equal To	X	X	X	X	X	
Binary Arithmetic	ADD	Addition	X	X	X	X	X
	SUB	Subtraction	X	X	X	X	X
	MUL	Multiplication	X	X	X	X	X
	DIV	Division	X	X	X	X	X
	INC	Increment	X	X	X	X	
	DEC	Decrement	X	X	X	X	
	ROOT	Root	X		X		X
	SUM	Sum (ADD) Sum (XOR)	X X	X	X	X	X
Boolean Computation	ANDW	AND Word	X		X		
	ORW	OR Word	X		X		
	XORW	Exclusive OR Word	X		X		
Shift and Rotate	SFTL	Shift Left					
	SFTR	Shift Right					
	BCDLS	BCD Left Shift			X		
	WSFT	Word Shift	X				
	ROTL	Rotate Left	X		X		
	ROTR	Rotate Right	X		X		

"X" indicates that the instruction is supported.

8: INSTRUCTIONS REFERENCE

Group	Symbol	Name	Valid Data Type				
			W	I	D	L	F
Data Conversion	HTOB	Hex to BCD	X		X		
	BTOH	BCD to Hex	X		X		
	HTOA	Hex to ASCII	X				
	ATOH	ASCII to Hex	X				
	BTOA	BCD to ASCII	X		X		
	ATOB	ASCII to BCD	X		X		
	ENCO	Encode					
	DECO	Decode					
	BCNT	Bit Count					
	ALT	Alternate Output					
	CVDT	Convert Data Type	X	X	X	X	X
	DTDV	Data Divide	X				
	DTCB	Data Combine	X				
	SWAP	Data Swap	X		X		
Week Programmer	WEEK	Weekly Timer					
	YEAR	Yearly Timer					
Interface	MSG	Message					
User Communication	TXD2	Transmit 2					
	TXD3	Transmit 3					
	RXD2	Receive 2					
	RXD3	Receive 3					
Program Branching	LABEL	Label					
	LJMP	Label Jump					
	LCAL	Label Call					
	LRET	Label Return					
	DJNZ	Decrement Jump Non-zero					
	DI	Disable Interrupt					
	EI	Enable Interrupt					
	IOREF	I/O Refresh					
Coordinate Conversion	HSCRF	High-speed Counter Refresh					
	XYFS	XY Format Set	X	X			
	CVXTY	Convert X to Y	X	X			
	CVYTX	Convert Y to X	X	X			
Pulse	AVRG	Average	X	X	X	X	X
	PULS1	Pulse Output 1					
	PULS2	Pulse Output 2					
	PULS3	Pulse Output 3					
	PULS4	Pulse Output 4					
	PWM1	Pulse Width Modulation 1					
	PWM2	Pulse Width Modulation 2					
	PWM3	Pulse Width Modulation 3					
	PWM4	Pulse Width Modulation 4					
	RAMP1	Ramp Pulse Output 1					
	RAMP2	Ramp Pulse Output 2					
	ZRN1	Zero Return 1					
	ZRN2	Zero Return 2					
	ARAMP1	Advanced Ramp 1					
	ARAMP2	Advanced Ramp 2					
Dual / Teaching Timer	DTML	1-sec Dual Timer					
	DTIM	100-ms Dual Timer					
	DTMH	10-ms Dual Timer					
	DTMS	1-ms Dual Timer					
	TTIM	Teaching Timer					

"X" indicates that the instruction is supported.

Group	Symbol	Name	Valid Data Type				
			W	I	D	L	F
Trigonometric Function	RAD	Degree to Radian					X
	DEG	Radian to Degree					X
	SIN	Sine					X
	COS	Cosine					X
	TAN	Tangent					X
	ASIN	Arc Sine					X
	ACOS	Arc Cosine					X
	ATAN	Arc Tangent					X
Logarithm / Power	LOGE	Natural Logarithm					X
	LOG10	Common Logarithm					X
	EXP	Exponent					X
	POW	Power					X
File Data Processing	FIFO	FIFO Format	X				
	FIEX	First-In Execute	X				
	FOEX	First-Out Execute	X				
	NDSRC	N Data Search	X	X	X	X	X
Clock	TADD	Time Addition					
	TSUB	Time Subtraction					
	HTOS	HMS to Sec					
	STOH	Sec to HMS					
	HOUR	Hour Meter					
Ethernet Instructions	ETXD	Transmit over Ethernet					
	ERXD	Receive over Ethernet					
Data Logging	DLOG	Data Logging					
	TRACE	Data Trace					

"X" indicates that the instruction is supported.

Advanced Instruction Applicable SmartAXIS

Applicable advanced instructions depend on the type of SmartAXIS as listed in the table below.

Group	Symbol	FT1A-12		FT1A-24		FT1A-40		FT1A-48		FT1A-Touch
		AC	DC	AC	DC	AC	DC	AC	DC	
NOP	NOP	X	X	X	X	X	X	X	X	X
Move	MOV	X	X	X	X	X	X	X	X	X
	MOVN	X	X	X	X	X	X	X	X	X
	IMOV	X	X	X	X	X	X	X	X	X
	IMOVN	X	X	X	X	X	X	X	X	X
	BMOV	X	X	X	X	X	X	X	X	X
	IBMV	X	X	X	X	X	X	X	X	X
	IBMVN	X	X	X	X	X	X	X	X	X
	NSET	X	X	X	X	X	X	X	X	X
	NRS	X	X	X	X	X	X	X	X	X
	XCHG	X	X	X	X	X	X	X	X	X
TCCST	X	X	X	X	X	X	X	X	X	
Data Comparison	CMP=	X	X	X	X	X	X	X	X	X
	CMP<>	X	X	X	X	X	X	X	X	X
	CMP<	X	X	X	X	X	X	X	X	X
	CMP>	X	X	X	X	X	X	X	X	X
	CMP<=	X	X	X	X	X	X	X	X	X
	CMP>=	X	X	X	X	X	X	X	X	X
	ICMP>=	X	X	X	X	X	X	X	X	X
	LC=	X	X	X	X	X	X	X	X	X
	LC<>	X	X	X	X	X	X	X	X	X
	LC<	X	X	X	X	X	X	X	X	X
	LC>	X	X	X	X	X	X	X	X	X
	LC<=	X	X	X	X	X	X	X	X	X
LC>=	X	X	X	X	X	X	X	X	X	
Binary Arithmetic	ADD	X	X	X	X	X	X	X	X	X
	SUB	X	X	X	X	X	X	X	X	X
	MUL	X	X	X	X	X	X	X	X	X
	DIV	X	X	X	X	X	X	X	X	X
	INC	X	X	X	X	X	X	X	X	X
	DEC	X	X	X	X	X	X	X	X	X
	ROOT	X	X	X	X	X	X	X	X	X
	SUM	X	X	X	X	X	X	X	X	X
Boolean Computation	ANDW	X	X	X	X	X	X	X	X	X
	ORW	X	X	X	X	X	X	X	X	X
	XORW	X	X	X	X	X	X	X	X	X
Shift and Rotate	SFTL	X	X	X	X	X	X	X	X	X
	SFTR	X	X	X	X	X	X	X	X	X
	BCDLS	X	X	X	X	X	X	X	X	X
	WSFT	X	X	X	X	X	X	X	X	X
	ROTL	X	X	X	X	X	X	X	X	X
	ROTR	X	X	X	X	X	X	X	X	X

"X" indicates that the instruction is supported.

Group	Symbol	FT1A-12		FT1A-24		FT1A-40		FT1A-48		FT1A-Touch
		AC	DC	AC	DC	AC	DC	AC	DC	
Data Conversion	HTOB	X	X	X	X	X	X	X	X	X
	BTOH	X	X	X	X	X	X	X	X	X
	HTOA	X	X	X	X	X	X	X	X	X
	ATOH	X	X	X	X	X	X	X	X	X
	BTOA	X	X	X	X	X	X	X	X	X
	ATOB	X	X	X	X	X	X	X	X	X
	ENCO	X	X	X	X	X	X	X	X	X
	DECO	X	X	X	X	X	X	X	X	X
	BCNT	X	X	X	X	X	X	X	X	X
	ALT	X	X	X	X	X	X	X	X	X
	CVDT	X	X	X	X	X	X	X	X	X
	DTDV	X	X	X	X	X	X	X	X	X
	DTCB	X	X	X	X	X	X	X	X	X
	SWAP	X	X	X	X	X	X	X	X	X
Week Programmer	WEEK	X	X	X	X	X	X	X	X	X
	YEAR	X	X	X	X	X	X	X	X	X
Interface	MSG	X (Note)								
User Communication	TXD2			X	X	X	X	X	X	
	TXD3					X	X	X	X	
	RXD2			X	X	X	X	X	X	
	RXD3					X	X	X	X	
Program Branching	LABEL	X	X	X	X	X	X	X	X	X
	LJMP	X	X	X	X	X	X	X	X	X
	LCAL	X	X	X	X	X	X	X	X	X
	LRET	X	X	X	X	X	X	X	X	X
	DJNZ	X	X	X	X	X	X	X	X	X
	DI	X	X	X	X	X	X	X	X	X
	EI	X	X	X	X	X	X	X	X	X
	IOREF	X	X	X	X	X	X	X	X	X
	HSCRF		X		X		X		X	X
Coordinate Conversion	XYFS	X	X	X	X	X	X	X	X	X
	CVXTY	X	X	X	X	X	X	X	X	X
	CVYTX	X	X	X	X	X	X	X	X	X
	AVRG	X	X	X	X	X	X	X	X	X

Note: MSG instructions can be used with Pro series only.

"X" indicates that the instruction is supported.

8: INSTRUCTIONS REFERENCE

Group	Symbol	FT1A-12		FT1A-24		FT1A-40		FT1A-48		FT1A-Touch
		AC	DC	AC	DC	AC	DC	AC	DC	
Pulse	PULS1						X	X	X	
	PULS2						X	X	X	
	PULS3						X (Note1)	X	X	
	PULS4						X (Note1)	X	X	
	PWM1						X	X	X	
	PWM2						X	X	X	
	PWM3						X (Note1)	X	X	
	PWM4						X (Note1)	X	X	
	RAMP1						X	X	X	
	RAMP2						X (Note2)	X (Note2)	X (Note2)	
	ZRN1						X	X	X	
	ZRN2						X	X	X	
	ARAMP1						X	X	X	
ARAMP2						X (Note2)	X (Note2)	X (Note2)		
Dual / Teaching Timer	DTML	X	X	X	X	X	X	X	X	X
	DTIM	X	X	X	X	X	X	X	X	X
	DTMH	X	X	X	X	X	X	X	X	X
	DTMS	X	X	X	X	X	X	X	X	X
	TTIM	X	X	X	X	X	X	X	X	X
Trigonometric Function	RAD	X	X	X	X	X	X	X	X	X
	DEG	X	X	X	X	X	X	X	X	X
	SIN	X	X	X	X	X	X	X	X	X
	COS	X	X	X	X	X	X	X	X	X
	TAN	X	X	X	X	X	X	X	X	X
	ASIN	X	X	X	X	X	X	X	X	X
	ACOS	X	X	X	X	X	X	X	X	X
	ATAN	X	X	X	X	X	X	X	X	X
Logarithm / Power	LOGE	X	X	X	X	X	X	X	X	X
	LOG10	X	X	X	X	X	X	X	X	X
	EXP	X	X	X	X	X	X	X	X	X
	POW	X	X	X	X	X	X	X	X	X
File Data Processing	FIFO	X	X	X	X	X	X	X	X	X
	FIEX	X	X	X	X	X	X	X	X	X
	FOEX	X	X	X	X	X	X	X	X	X
	NDSRC	X	X	X	X	X	X	X	X	X
Clock	TADD	X	X	X	X	X	X	X	X	X
	TSUB	X	X	X	X	X	X	X	X	X
	HTOS	X	X	X	X	X	X	X	X	X
	STOH	X	X	X	X	X	X	X	X	X
	HOUR	X	X	X	X	X	X	X	X	X
Ethernet Instructions	ETXD			X	X	X	X	X	X	
	ERXD			X	X	X	X	X	X	
Data Logging	DLOG					X	X	X	X	
	TRACE					X	X	X	X	

Note 1: When using RAMP1 in single-pulse output mode, PULS3 and PWM3 cannot be used. When using RAMP2 in single-pulse output mode, PULS4 and PWM4 cannot be used.

Note 2: When using RAMP1 or ARAMP1 in dual-pulse output mode, RAMP2 or ARAMP2 cannot be used.

"X" indicates that the instruction is supported.