OEMAX™ CONTROLS

Maximum Value for OEMs℠

NX7/NX7s Series Controller

User Manual

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will OE Max Controls be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, OE Max Controls cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by OE Max Controls with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of OE Max Controls is prohibited.

Throughout this manual we use notes to make you aware of safety considerations.

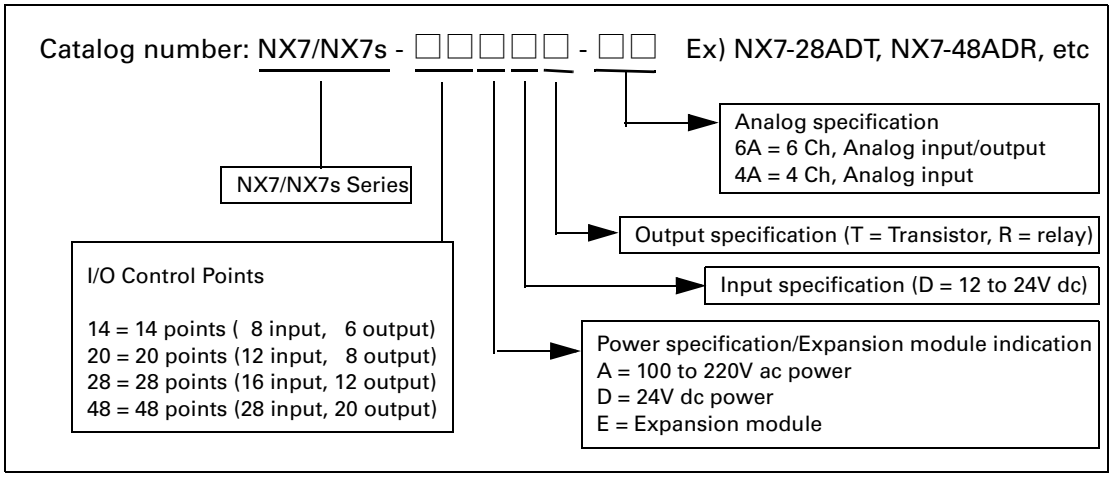
WARNING 	Identifies information about practices or circumstances which may lead to serious personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION 	Identifies information about practices or circumstances that can lead to minor personal injury, property damage, economic loss, or product malfunction. However, depending on circumstances, failure to follow the directions accompanying this symbol may also lead to serious consequences.

Contents

Before You Start

Welcome to the user manual for OE MAX NX7 and NX7s series programmable logic controller.

- Please read this manual thoroughly and familiarize yourself with the directions before using the product to ensure normal operation and your safety.
- Please check that the product is what you ordered and there are no damaged or missing parts in the package.
- Make sure to perform initialization (refer to) *Initialization* on page 97, Appendix if you use the product for the first time. Ensure that the built-in battery is connected before using the product.



IMPORTANT Catalog numbers are subject to change without notice, due to functional enhancements of the product or other reasons.

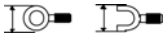
Safety Instructions

Please read this manual and the related documentation thoroughly and familiarize yourself with the directions before installing, operating, performing inspection and preventive maintenance. Make sure to follow the directions correctly to ensure normal operation of the product and your safety.

- When designing a system using this product, consider proper prevention against external environmental fluctuations, power failure and noise, etc., in accordance with installation requirements. Design and implement an external circuit that allows your system to operate continually and safely in any system failure.
- Make sure to disconnect the external power to the product before performing mounting, wiring, inspection, maintenance and cleaning. Never touch the power terminal when the power is on. Otherwise, it may cause an electrical shock.
- Do not connect AC-powered products to a DC I/O terminal. Do not connect externally- powered products to an internal 24V DC output terminal.
- If you need to perform a special operation during run, such as program editing, operation control or forced output, make sure to perform it after ensuring safety.
- Do not connect an external device or a hand-held programmer (HHP) that uses internal power to the product when running. Make sure to stop the system and ensure safety before connecting them.
- Make sure to use an external device to PLC when configuring the protective circuit breakers for emergencies.
- When the self-diagnostics functionality detects an error, such as internal arithmetic error, watchdog time error, and/or connection failure, power continues to be provided to the controller's power supply so that your system still works. Design and configure the circuits so that your system runs safely under those conditions.
- The internal 24V DC power supplied to the circuits inside the PLC may have voltage fluctuations, depending on the volume of load. These voltage fluctuations may cause malfunction of the PLC or I/O devices connected. Therefore, use the internal power within the allowed rating.
- Do not apply an impact to the terminal blocks or the product itself when the power is on. Otherwise, it may cause malfunction and failure of the product, or electrical shock.

- Operate and keep the product under the allowed conditions directed in product specifications. During installation, be sure that all debris (metal chips, wire stands, etc.) is kept from falling into the product.

  Do not expose the product to high temperature, high humidity, dusty conditions, salt, metal chips, corrosive gas, inflammable gas, solvents, abrasive oil, and/or direct sunlight.

  Avoid vibrations and crashes with other objects. Otherwise, it may cause a fire, damage, malfunction or aging to the product.
- Fix cables as directed in the wiring instructions. We recommend you do not connect the line to the terminals marked with the symbol '•'.
- When wiring with the terminal block, use the following specifications:
  Screw: 3.0 M, Torque: 0.5 N·m (5 kgf·cm)
  Terminal width: 6.35 mm or less (0.25 in) 
- Input/output and communication cables should be separated from power cables. Give at least 200 mm space between them. Otherwise, generated noise may cause product malfunction.
- We recommend installing an insulation transistor near the front of the PLC. Make sure to use twisted cables to prevent input noise.
- For frame grounding, perform class 3 grounding at 100Ω or less ground resistance or independent class D grounding using a $2mm^2$. Do not perform common grounding to high voltage devices.
- Do not disassemble or remodel the product. If you need to repair the product, contact the service center.
- This manual does not include detailed explanation on all of the instructions and functions supported by the product. Please refer to other related manuals for more information.
- Use the product only for the purposes stated on the product or in this user manual.
- When disposing the product, make sure to follow your local regulations and guidelines on industrial waste disposal.

1

Introduction

Features

Small footprint and optimized functions

The NX7 and NX7s PLC has a small footprint and is optimized to meet your environmental needs for control.

- NX7s provides 10 and 14 control points and Trimpot is mounted in it.
- NX7 is designed optimally for micro to small scale applications that require up to 104 control points. Base 28 or 48 control points are provided by default. An expansion module provides 14 or 28 points and up to 2 expansion modules can be connected to NX7. Therefore, max. 104 points (48 base points + 2 x 28 expansion points) are available.
- Improves system productivity since major functions such as PID (proportional integral differential) control, HSC (high-speed counter), pulse output, and pulse catch are provided according to Input and output signal.
- Provides two communication ports which enable your PLC system to connect directly to a touch screen and exchange large volume data at high speed.

Instructions modify while running

Designed to allow you to modify and execute Instructions quickly while the CPU is running.

High-capacity programming and memory backup

NX7 supports up to 9K words program (NX7s supports up to 2K). Flash ROM backup allows you to save your programs separately and safely.

Real time clock (RTC) and specialty function

The built-in real time clock function enables time and date related programming tasks. You can implement a simple link function that allows data communications between CPUs.

Compatibility of peripherals

Supports backward compatibility with the existing programming device (WinGPC), which allows easier programming, CPU state checkups, forced input/output, input/output monitoring, and program download and upload.

Two built-in communication ports

2 built-in communication ports allow easy connection to computers and peripheral devices without additional communication modules.

Self-diagnostics

The convenient self-diagnostics function makes your system diagnostics and troubleshooting easier.

Built-in PID control (Only for NX7)

Equipped with built-in 8-loop PID control logic, which allows you to easily implement applications for your analog control needs such as temperature and/or motion control.

Installation Environment

ATTENTION

Do not install your PLC system under the following conditions:

- Ambient temperature outside the range of 0 to 55 °C (32 to 131 °F).
- Direct sunlight.
- Humidity outside the range of 20 to 90% (non-condensing).
- Chemicals that may affect electronic parts.
- Excessive or conductive dust, or salinity.
- High voltage, strong magnetic fields, or strong electromagnetic influences.
- Direct impact and excessive vibration.
- Organic solvents or cutting oil.
- Corrosive gas.

ATTENTION

Follow these directions to prevent your PLC system from malfunctioning:

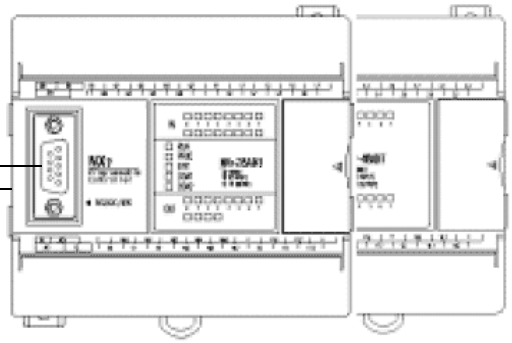
- Use an isolation transformer and noise filter on the incoming power to your controller system if there are any high capacity equipment, high voltage or strong electromagnetic influences nearby.
- Separate the main PLC grounding from all the groundings of other equipment. Make sure to use class 3 grounding.
- Make sure to use the external 24V dc power provided inside the NX7 and NX7s module within the allowed ratings.
- Familiarize yourself with the PLC instructions and then design and implement your programs to ensure that system fault or malfunction is not caused by program error.
- Perform preventive maintenance to your PLC system, and inspect equipment and wiring status periodically. Make sure to ensure safety before operating your PLC system.

2

System Configuration

System Configuration

■ WinGPC
version 3.8 or higher



COM1 (located at the front, 9-pin D-Sub type)
- NX7=RS-232C or RS-485
- NX7s=Only support RS-232C

COM2 (located at the side, 8-pin RJ45 modular type)
- NX7=RS-232C or RS-485
- NX7s=Only support RS-485

10/14/28-point

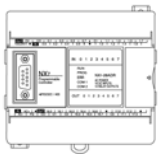
48-point and Analog

ATTENTION

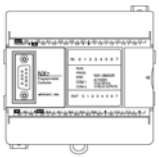
During running, do not connect any devices that are connected to the internal power supply and consume significant amount of instantaneous power. Make sure to connect them after stopping the system and ensuring safety.

Digital Expansion I/O Configurations for NX7s

10 points

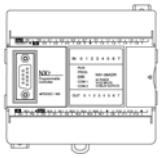


14 points

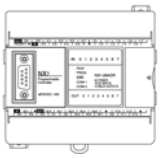


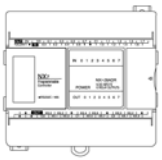
Digital Expansion I/O Configurations for NX7

28 points

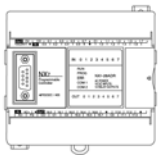


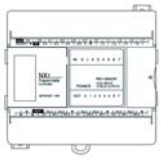
56 points





84 points



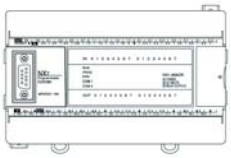


Base module (48 points)

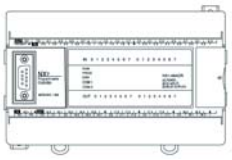
Expansion 1 (28 points)

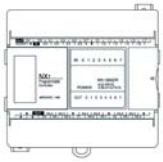
Expansion 2 (28 points)

48 points

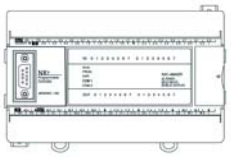


76 points





104 points



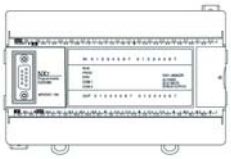
Base module (48 points)

Expansion 1 (28 points)

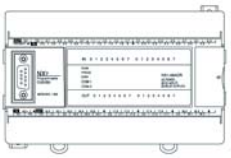
Expansion 2 (28 points)

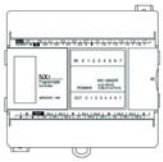
Digital Expansion I/O Configurations with Analog module

DIO:20 points
AIO:4/6 Ch.

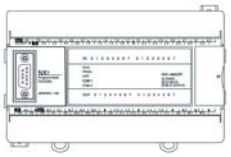


DIO:48 points
AIO:4/6 Ch.





DIO:76 points
AIO:4/6 Ch.



Base module (48 points)

Expansion 1 (28 points)

Expansion 2 (28 points)

Product List

NX7 base module

Catalog number	Input power	I/O specifications	Remarks
NX7-28ADR	100 to 240V ac power supply	16-point dc input 12-point relay output	• Built-in 9k steps memory • Several μs per step processing speed • Built-in 1 HSC input channel • Built-in 2 pulse output channels built in • 2 communication ports • Expandable to up to two expansion modules (NOTE: Some relevant contacts are unavailable when HSC input or pulse output channels are used.)
NX7-28ADT		16-point dc input 12-point TR output	
NX7-48ADR		28-point dc input 20-point relay output	
NX7-48ADT		28-point dc input 20-point TR output	
NX7-28DDR	24V dc power supply	16-point dc input 12-point relay output	
NX7-28DDT		16-point dc input 12-point TR output	
NX7-48DDR		28-point dc input 20-point relay output	
NX7-48DDT		28-point dc input 20-point TR output	
NX7-20ADR-4A	100 to 240V ac power supply	12-point dc input 8-point relay output 4 Ch. Analog input	
NX7-20ADR-6A		12-point dc input 8-point relay output 4 Ch. Analog input 2 Ch. Analog output	
NX7-20ADT-4A		12-point dc input 8-point TR output 4 Ch. Analog input	
NX7-20ADT-6A		12-point dc input 8-point TR output 4 Ch. Analog input 2 Ch. Analog output	

NX7s base module

Catalog number	Input power	I/O specifications	Remarks
NX7s-10ADR	100 to 240V ac power supply	6-point dc input 4-point relay output	• Built-in 2k steps memory • Several μs per step processing speed • Built-in 1 HSC input channel • Built-in 2 pulse output channels built in • 2 communication ports COM1: RS232C COM2: RS485 • Expansion unsupported (NOTE: Some relevant contacts are unavailable when HSC input or pulse output channels are used.)
NX7s-10ADT		6-point dc input 4-point TR output	
NX7s-14ADR		8-point dc input 6-point relay output	
NX7s-14ADT		8-point dc input 6-point TR output	
NX7s-20ADR		12-point dc input 8-point relay output	
NX7s-20ADT		12-point dc input 8-point TR output	
NX7s-28ADR		16-point dc input 12-point relay output	
NX7s-28ADT		16-point dc input 12-point TR output	
NX7s-40ADR		24-point dc input 16-point relay output	
NX7s-40ADT		24-point dc input 16-point TR output	
NX7s-48ADR		28-point dc input 20-point relay output	
NX7s-48ADT		28-point dc input 20-point TR output	

Expansion module

Catalog number	Input power	I/O specifications	Remarks
NX-14EDR	24V dc power supply	8-point dc input 6-point relay output	• 8-point 24V dc input • 6-point relay output 2A per point
NX-14EDT	24V dc power supply	8-point dc input 6-point TR output	• 8-point 24V dc input • 6-point TR output 0.4A per point
NX7-28EDR	24V dc power supply	16-point dc input 12-point relay output	• 16-point 24V dc input • 12-point relay output 2A per point
NX7-28EDT	24V dc power supply	16-point dc input 12-point TR output	• 16-point 24V dc input • 12-point TR output 0.4A per point

Programming software

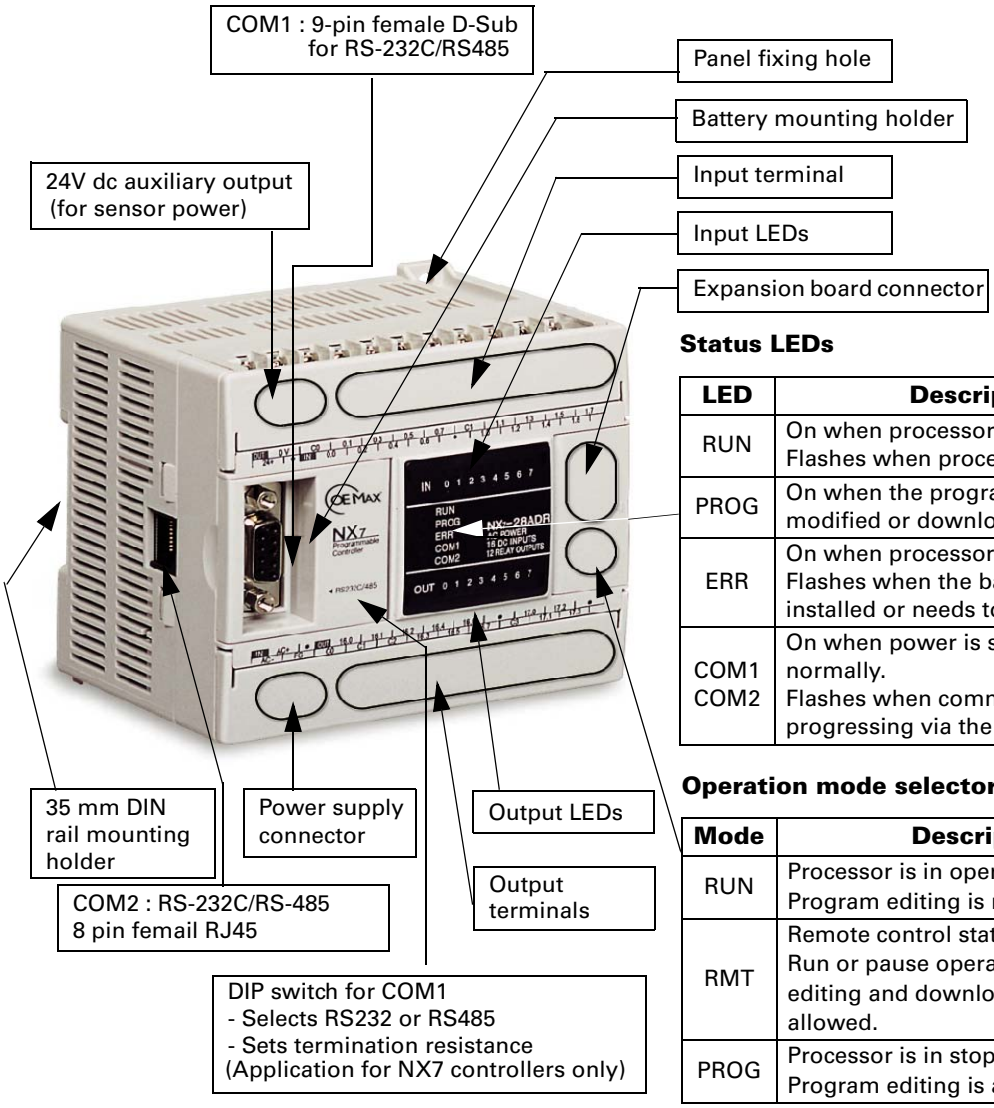
Programming software	Catalog number	Specifications	Remarks
WinGPC (Windows)	-	Allows you to perform the following tasks on a remote computer: • PLC program editing and monitoring • file management • program backup • online editing • error and status check-up, network status check-up • I/O mapping • time chart monitoring	For Windows 2000/NT/XP

Cables

Catalog number	Specifications	Remarks
NX_CBLCPU02	PLC to PC communication (WinGPC) cable length : 2 m	Communication cable for both RS232 and RS485
NX_CBLCPU05	PLC to PC communication (WinGPC) cable length : 5 m	

Hardware Features

NX7



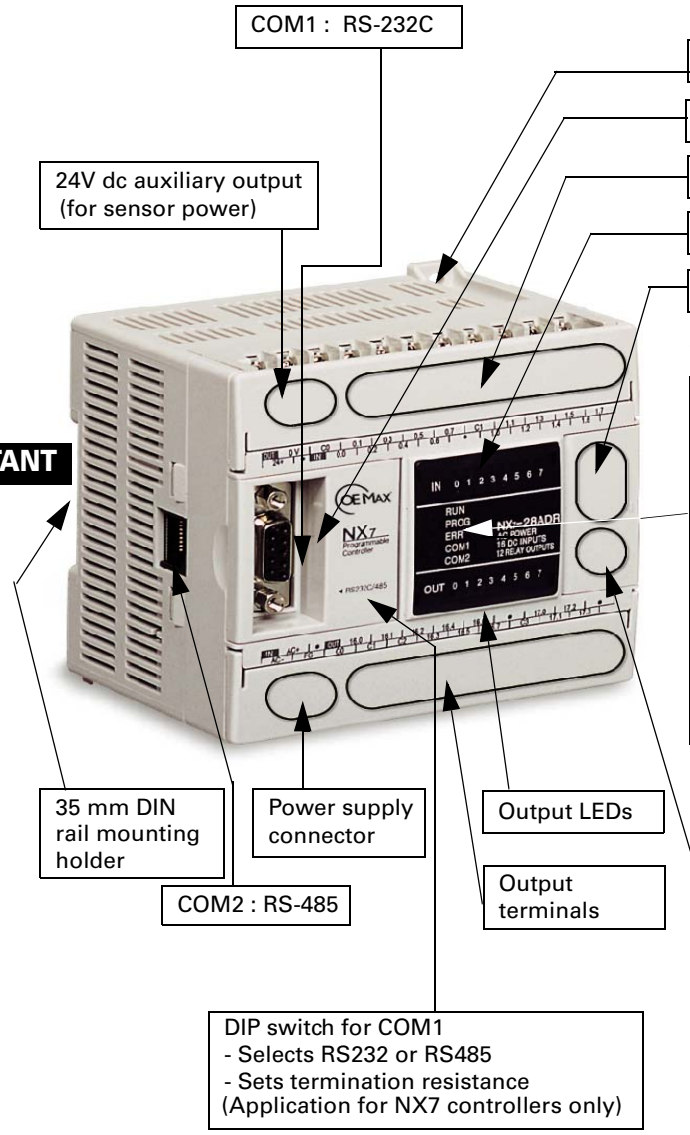
Status LEDs

LED	Description
RUN	On when processor is in operation. Flashes when processor is pausing.
PROG	On when the program can be modified or downloaded.
ERR	On when processor fault is detected. Flashes when the battery is not installed or needs to be replaced.
COM1 COM2	On when power is supplied normally. Flashes when communication is progressing via the port

Operation mode selector switch

Mode	Description
RUN	Processor is in operation. Program editing is not allowed.
RMT	Remote control status. Run or pause operation, program editing and downloading are allowed.
PROG	Processor is in stop mode. Program editing is allowed.

NX7s



Status LEDs

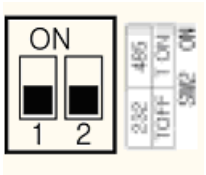
LED	Description
RUN	On when processor is in operation. Flashes when processor is pausing.
PROG	On when the program can be modified or downloaded.
ERR	On when processor fault is detected. Flashes when the battery is not installed or needs to be replaced.
COM1 COM2	On when power is supplied normally. Flashes when communication is progressing via the port

Operation mode selector switch

Mode	Description
RUN	Processor is in operation. Program editing is not allowed.
RMT	Remote control status. Run or pause operation, program editing and downloading are allowed.
PROG	Processor is in stop mode. Program editing is allowed.

COM1 communication mode DIP switch (SW2)

Open the communication housing case and adjust the DIP switch as follows:



No.	Status	Description
1	Off	Enables RS-232C communication for COM1
	On	Enables RS-485 communication for COM1 (Used for hand-held programmer and multi-drop connections, etc.)
2	Off	Disables termination for RS-485 communication
	On	Enables termination for RS-485 communication

WARNING

The baud rate is automatically detected and adjusted within the range of 4800 to 38400 bps. No separate speed setting is required. Once a speed is assigned, it is maintained until there is no communication for more than one minute. Then, the speed is automatically detected and configured again. Use of the COM1 DIP switch is applicable for NX7 controllers only. NX7s controllers support RS232C only on COM1.The termination resistance is connected to the end of the communication line to remove mutual communication interferences or signal distortions that can occur between connected controllers and peripherals.
Use an external connector for termination for COM2 port.

3

Specifications

General Specifications

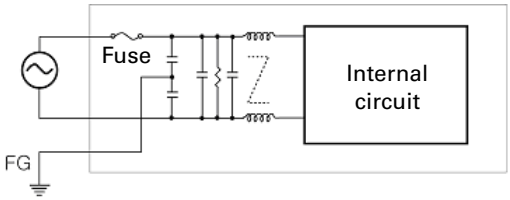
Item		Specifications
Ambient Temperature	Operating	0 to 55 °C
	Storage	-20 to 70 °C
Ambient Humidity	Operating	10 to 90% RH (Non-condensing)
Withstand voltage		1500V AC for 1 minute between external terminal (AC) and frame ground (FG) 500V AC for 1 minute between external terminal (DC) and frame ground (FG)
Allowed momentary power failure		20 ms or less
Noise immunity		1500 V_{p-p} pulse width 50 ns, 1 μs (generated by noise simulator)
Insulation resistance		10 M Ω
Vibration immunity		10 to 55 Hz /1 min, amplitude 0.75 mm, each direction of X, Y, Z for 10 min
Dust condition		No conductive dust
Chemicals		No cutting oil and organic solvents
Corrosive gas		No corrosive gas
Shock immunity		98m/S^2 or more, 4 times X, Y, Z each direction
Grounding		Class 3 grounding (100 Ω or less)
Case material		PC/ABS
Cooling method		Natural air cooling
Ambience		IP20 (No corossive gas, no excessive dust)

Power Supply Specifications

Item	AC input power		DC input power	
Catalog Number	NX7- 28Axx NX7- 48Axx NX7- 20Axx-4A NX7- 20Axx-6A NX7s - 20Axx NX7s - 28Axx NX7s - 40Axx NX7s - 48Axx	NX7s- 10Axx NX7s- 14Axx	NX7- 28Dxx NX7- 48Dxx	NX7s-10Dxx NX7s- 14Dxx
Rated voltage	110 to 220V ac, free voltage			24V dc
Allowable voltage range	85 to 264V ac			24V ± 10% dc
Maximum Power Consumption	33 Watts	25 Watts	15 Watts	6 Watts
Input power frequency	47 to 63 Hz			
Inrush current	AC120V 25A for 8ms AC240V 40A for 4ms		DC24V 20A or less	
Rated external output	0.4A at 24V	0.3A at 24 V	Same power as 24V input	-

AC power circuit configuration

85 to 264V ac



Performance Specifications

Processor		NX7 SERIES	NX7s SERIES
Control method		Stored program, cyclic operation	
External Input/output		Base 20/28/48 points. 14/28 expansion points. Expandable to max. two expansion modules	Base 14 points (Expansion unsupported)
Instructions	Basic	30 types	
	Advanced	139 types	
Processing speed	Basic	Several μs per step	
	Advanced	Several to several tens of μs per step	
Program capacity		9k words	2k words
Memory size	I/O (R)	R000.00 to R31.15 (512 points, 32 words)	
	Special internal contact (R)	R032.00 to R127.15 (1436 points, 96 words)	
	Link contact (L)	L000.00 to L063.15 (1024 points, 64 words)	
	Internal contact (M)	M000.00 to M127.15 (2048 points, 128 words)	
	Keep contact (K)	K000.00 to K127.15 (2048 points, 128 words)	
	Special contact (F)	F000.00 to F015.15 (256 points, 16 words)	
	Timer/Counter (TC or TIM)	256 channels (Timer + Counter), Set value range: 0 to 65535 Timer: 0.01 Second: TC000 to TC063 (64 Channels) 0.1 Second: TC064 to TC255 (192 Channels) Counter: TC000 to TC255 (256 channels)	
	Data register (W)	• W0000 to W2047 (2048 words) • Power fail program & data backup	• W0000 to W2047 (2048 words) • Power fail program backup
	Special register (SR)	SR000 to SR511 (512 words)	
Communications	Speed	9600, 19200, 38400, 4800 bps, auto baud (Manual baud rate selection with CPU version 2.2 or later)	
	Port	Port1: RS232/RS485, 9-pin female D-SUB Port2: RS232/RS485, 8-pin modular terminal	Port1: RS232, 9-pin female D-SUB Port2: RS485, 8-pin modular terminal
	Number of ports	2 ports	
	Supporting functions	• 2 of 4 step communications protocol (Port 1 and 2) • Modbus slave (Port 1 and Port 2) • User-defined communications, Modbus slave (Port 2)	
Special functions	High-speed counter	1 channel/32 bits built-in, single phase 8K, two-phase 4K	
	Pulse output	Built in 5KHz 2 channels (TR output controllers) Built in PTO function (with firmware version 2.3 or later) Acceleration/Deceleration(with firmware version 2.3 or later)	
	Input pulse catch	4 contacts built-in	
Others	RTC	Built-in	Unsupported
	PID	Supports 8 loop PID Control Unsupported	
Programming Tools	Programming S/W	Supports WinGPC 3.8 or higher for Windows	
Memory backup		Battery backup, Backup using flash ROM	Backup using flash memory (Battery is unnecessary for NX7s-10xxx and NX7s-14xxx)

Input Specifications

Item		DC input
Input type		DC voltage
Insulation method		Photocoupler
Rated input voltage		12 to 24V dc
Voltage range		10.8 to 26.4V
Max. input current		12 mA or less
Min. On voltage/current		10.0V or more/3.0 mA or more
Max. Off voltage/current		5V or less/0.6 mA or less
Input impedance		Approx. 3.6 K
Respons e time	Off → On	2 ms or less
	On → Off	2 ms or less
Internal current consumption		50 mA or less at 5V
Polarity		None
Common method		8 points per common or 16 points per common
Status display		LED
External connection method		Terminal block (M3.0), terminal width: 6.4 mm or less
Recommended wire size		0.5 to 1.25 mm^2

Output Specifications

Relay output

Item		Relay output module
Catalog number		NX7x-xxxxR
Insulation method		Relay insulation
Rated input voltage		250V ac, 30V dc
Load voltage range		85 to 264V ac, 10 to 30V dc
Max. load current		2A per point. 6A per common (for 6 points)
Response time	Off → On	10 ms or less
	On → Off	10 ms or less
Surge absorber		Not applicable
Common method		1, 4, and 6 points per common
Status display		LED
External connection method		Terminal block (M3.0), terminal width: 6.4 mm or less
Recommended wire size		0.5 to 1.25 mm^2

Transistor output

Item		Transistor output
Catalog number		NX7x-xxxxD
Insulation method		Photocoupler
Rated load voltage		12 to 24V dc
Load voltage range		10 to 30V dc
Polarity		- common (Sink type, NPN)
Max. load current		0.4A per point, 1.0A per common
Max. inrush current		3A, 10 ms or less
Off state leak current		100 μA or less
Response time	Off → On	1 ms or less
	On → Off	1 ms or less
Common method		1, 4, and 6 points per common
Status display		LED
External connection method		Terminal block (M3.0), terminal width: 6.4 mm or less
Recommended wire size		0.5 to 1.25 mm^2

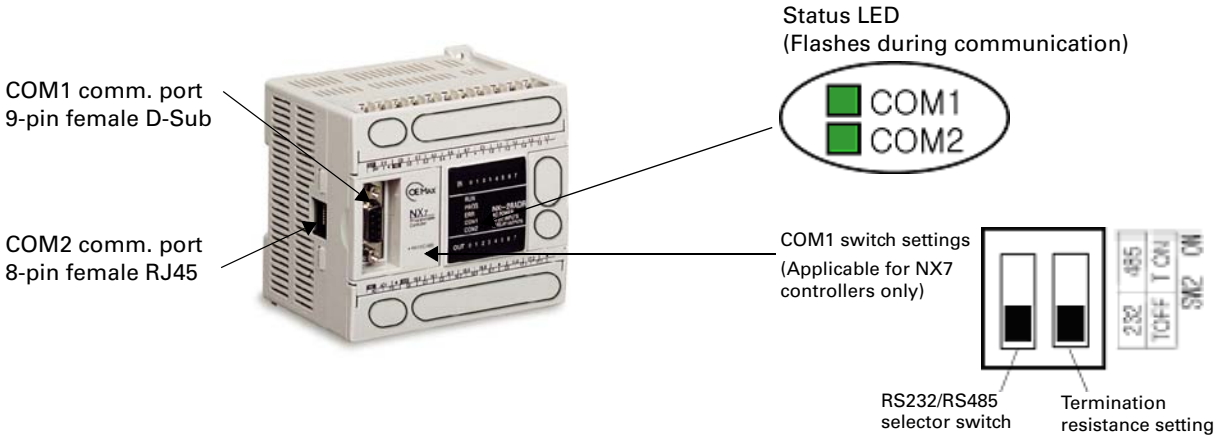
Analog Input/Output Specifications

Item	Analog Input		Analog Output	
	Voltage	Current	Voltage	Current
Input Range	0 to 10V DC	0 to 20 mA	0 to 10V	0 to 20 mA
Converter	12 Bit		12 Bit	
Channel	4 Ch.[1)]		2 (NX7-20xxx-6A)[2)] None. (NX7-20xxx-4A)[3)]	
Input/Output Data	0 to 4095		0 to 4095	
Max. Resoultion	2.5 mV	5.0 μA	2.5 mV	5.0 μA
Accuracy	°æ1.25% / F.S(25°…)			
Response time	10 ms		10 ms	
Impedance	200kΩ	125Ω	0.1Ω	1MΩ
I/O registers	4 Words		2 Words	

Isolation method	• Between Input/Ouput Channel and internal circuit : DC to DC Converter, Photocoupler • Between Input and Ouptut : non-isolation • Between two Iiput/Output Channels : non-isolation			
Analog input Words	4 Words (R4 to R7)	4 Words (R20 to R21)	4 Words (R4 to R7)	4 Words (R20 to R21)

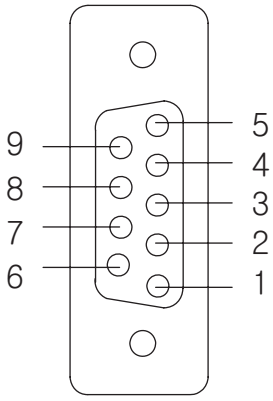
1) : For each input channel, wire to either voltage or current but not both.
2) : For each output channel, it is possible to wire to both voltage and current but the same ouput value applies to both.
3) : Models marked NX7-20xxx-4A have only 4 input channels. (No output channel

Communication Specifications



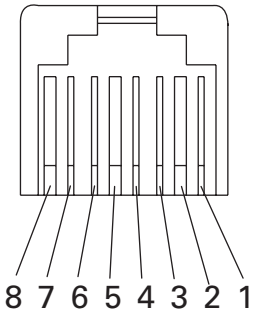
Item	Specifications
Interface	COM1: RS-232C or RS-485, 9-pin D-Sub • DIP switch - select RS232 or RS485 - enable RS485 termination resistance (150 Ohm) • NX7s controllers support RS-232C only on COM1
	COM2: RS-232C or RS-485, 8-pin modular • RS232C or RS485 automatically recognized (by wiring method) • NX7s controllers support RS-485 only on COM2
Baud rate	• 38400, 19200, 9600, and 4800, auto baud (default) For COM2 user-defined communications, the register SR510 can be manually set to an appropriate baud rate.) • Manual setting address (COM1 = SR509 /COM2 = SR510) - Bit 15 : 0=auto, 1=Manual - Bit 1,0 : 00=9600, 01=19200, 10=38400, 11:4800 • With autobaud, the baud rate cannot be changed uless communications is paused for one minute.
Protocol	NX or Modbus RTU protocols only / For user defined, full duplex is possible.
Data bit	COM1 : 8 bits / COM2 : User-defined (See *page 51* for more details)
Parity	COM1 : None / COM2 : User-defined (See *page 51* for more details)
Stop bit	1 bit
Communication distance	RS-232: 15 m or less, RS-485: 1.2 Km or less
Termination resistance (For RS485 Only)	- COM1: Internal 120 Ohm resistor enabled by DIP switch - COM2: Registor must be supplied by User For COM1/COM2, a 120 Ohm resistor (total of two) is placed at extreme ends of the network to reduce noise due to reflections
Transmission cable	Twisted pair cable (Shielded cable)

PLC Port1 (COM1)
(9-pin female D-sub)



No	Nx7	Nx7s
1	-	-
2	TXD	TXD
3	RXD	RXD
4	RTS	-
5	GND	GND
6	485-	-
7	485+	-
8	CTS	-
9	Vcc	-

PLC Port2 (COM2)
(8-pin female RJ45)



The terminals #1 and #3, and #2 and #4 are connected internally, respectively

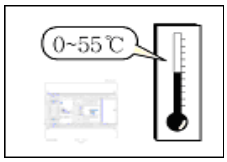
No	Nx7	Nx7s
1	485+	485+
2	485-	485-
3	485+	485+
4	485-	485-
5	Reserved	-
6	Signal GND	-
7	232C/RXD	-
8	232C/TXD	-

IMPORTANT

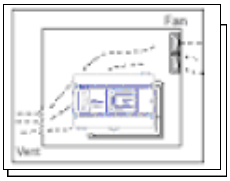
Use NX_CBLCPU02 or NX_CBLCPU05 cable from your personal computer's serial port to COM1 port. See *Appendix, Using WinGPC* for more information about wiring

Installation and Wiring

Avoid places where the temperature is outside of the range of 0 to 55 °C (32 to 131 °F), and the relative humidity is more than 85%.

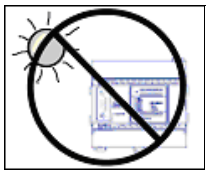


Keep ambient temperature less than 55 °C (131 °F) by operating a fan or air conditioner if necessary.



Avoid places subject to rapid temperature fluctuations and condensation.

Avoid places exposed to direct sunlight.



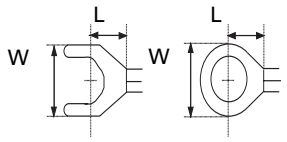
Avoid the presence of water, corrosive or flammable gases, solvents, grinding fluids, cutting oil, dense dust, salinity, and/or debris (metal chips, wire stands, etc.).

Avoid places subject to direct impact or vibrations.

Wiring

Wire Requirements

- Use the terminals that comply with the specifications given below.
- Set terminal wiring torque to from 5 to 7kgfcm.
- Use wiring cables of #16 to #22 AWG.



Terminal size
w = 6.35 mm (0.25 in) or

Solderless terminal	Wiring torque
M3.0	0.5 to 0.7 Nm (5 to 7 kgfcm)

ATTENTION

Set terminal wiring torque to within the specified range (0.5 to 0.7 Nm) when wiring with terminal block. Otherwise, it may cause terminal block damage or contact defects leading to product damage or personal injury.

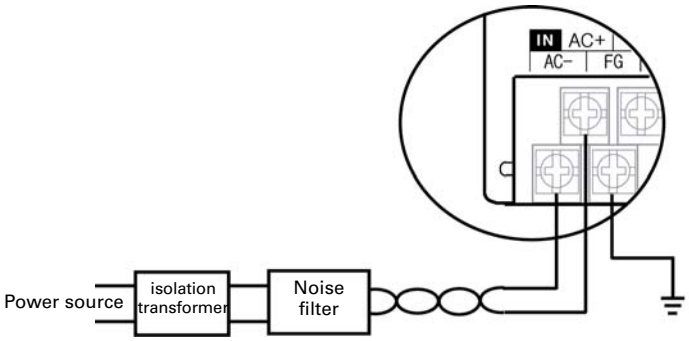
WARNING

Make sure to disconnect power to the controller system before performing installation, wiring, maintenance and cleaning. Never touch the power terminals when the power is on. Otherwise it may cause electrical shock.

Route wires of different signal characteristics by separate paths. Separate incoming power to the controller by a path separate from the I/O device wiring. Shield the signal lines to prevent noises which can cause product malfunction.

AC Power Supply Wiring

Make sure to connect to the controller system a stable power that has voltage fluctuations within 10% deviation from the rated input voltage. The frame ground terminal must be grounded with Class 3 (100Ω or less of ground resistance) or Class D grounding to prevent voltage mixing between the frame ground and the power input terminals.

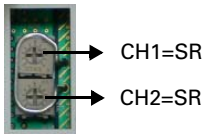


Ground the frame ground terminal with a dedicated Class 3 (100 Ω or less of ground resistance) or Class D grounding.

* If the secondary side of the isolation transformer and the noise filter is too far from the controller system and noise becomes excessive, it does not have any significant effect.

Trim Pot for NX7s-10, 14

There are two analog Trim Pots on NX7s-10 and NX7s-14.



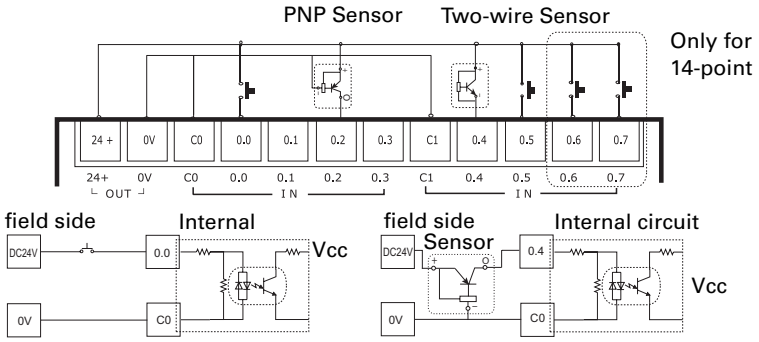
The 8bit-data trim pots has a range between 0 and 255. Channel 1 can be read from SR449. Channel 2 can be read from SR450.

Digital Input Wiring Diagrams

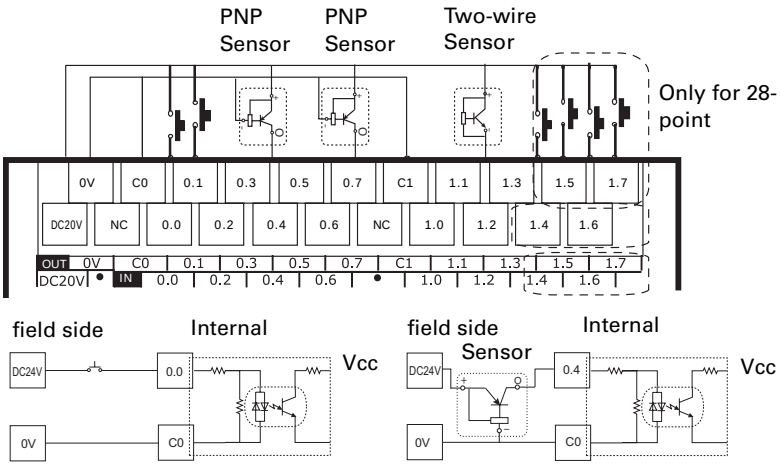
IMPORTANT In the following input wiring diagrams,

- "NC" terminals are not intended for use as connection points.
- Using a two-wire sensor may need an additional circuit configuration so that total current consumption does not exceed the allowable current consumption.
- For all NX7 and NX7s controllers, all the commons on the input terminal block are isolated internally with each other.

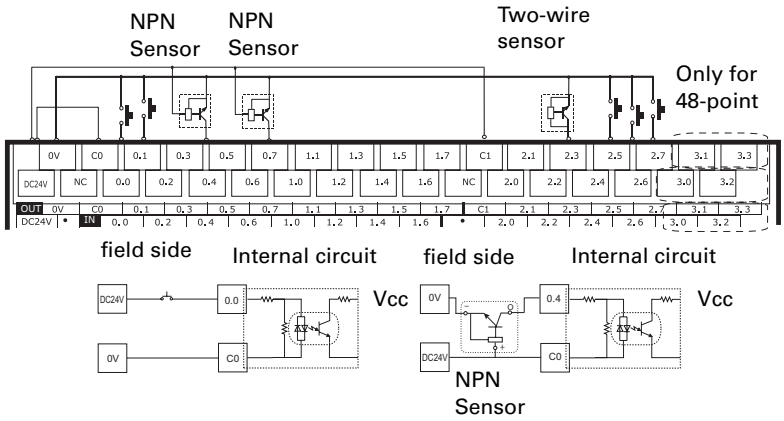
-COM Wiring Example Using a 10, 14-point Controller



- COM Wiring Example Using a 20, 28-point Controller



+COM Wiring Example Using a 40, 48-point Controller

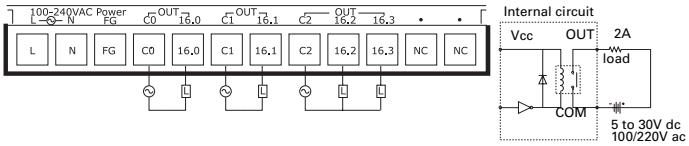


Digital Output Wiring Diagrams

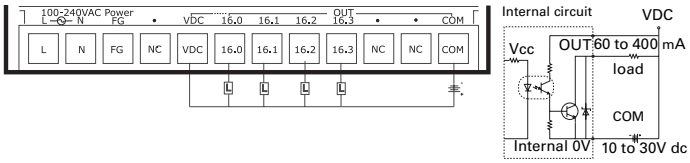
IMPORTANT In the following output wiring diagrams,

- "NC" terminals are not intended for use as connection points.
- For all relay output controllers (NX7-xxxxR and NX7s-xxxxR controllers), all the commons on the output terminal block are isolated internally each other.
- For all transistor output controllers (NX7-xxxxT and NX7s-xxxxT controllers), all the commons on the output terminal block are connected internally, that is, they are not isolated each other.

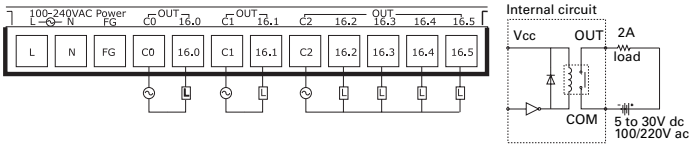
NX7s-10ADR Output Wiring Diagrams



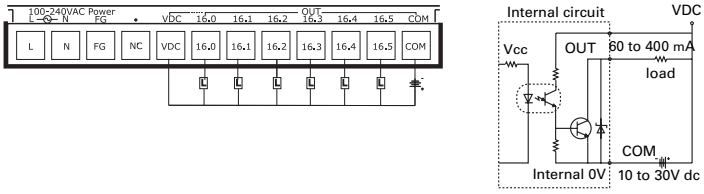
NX7s-10ADT Output Wiring Diagrams



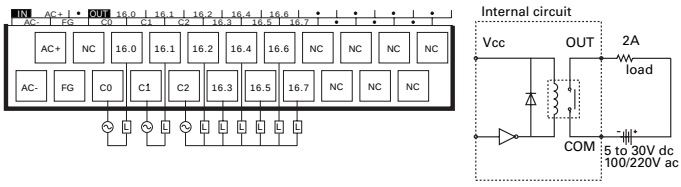
NX7s-14ADR Output Wiring Diagrams



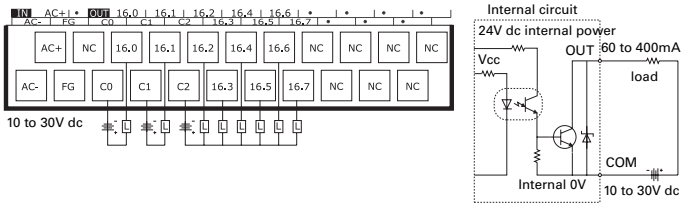
NX7s-14ADT Output Wiring Diagrams



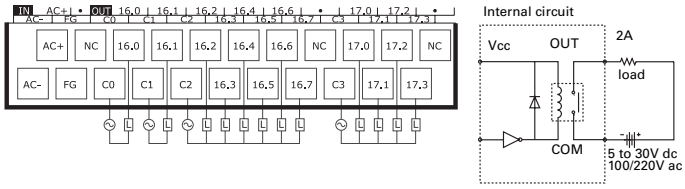
NX7s-20ADR Output Wiring Diagrams



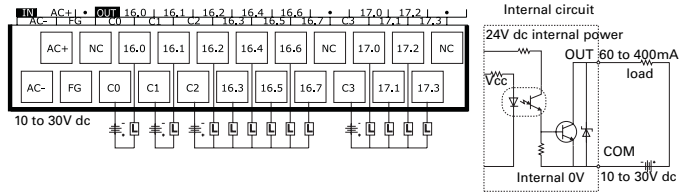
NX7s-20ADT Output Wiring Diagrams



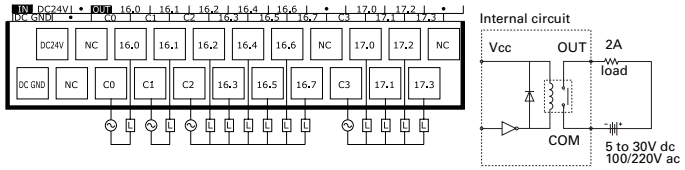
NX7-28ADR, NX7s-28ADR Output Wiring Diagrams



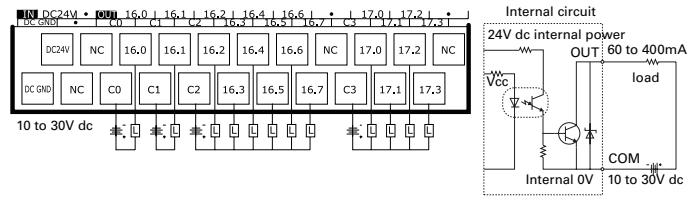
NX7-28ADT, NX7s-28ADT Output Wiring Diagrams



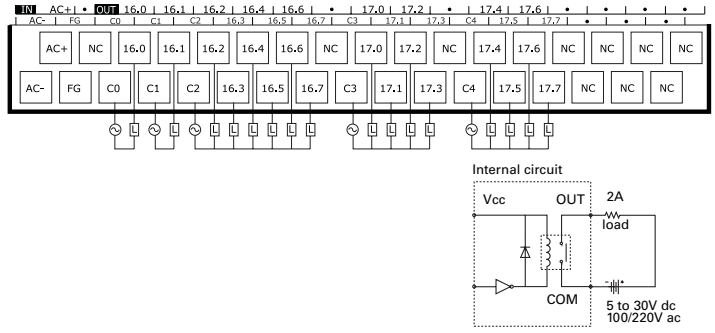
NX7-28DDR Output Wiring Diagrams



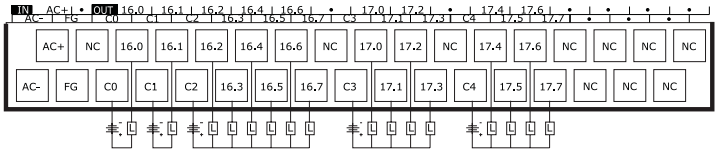
NX7-28DDT Output Wiring Diagrams



NX7s-40ADR Output Wiring Diagram

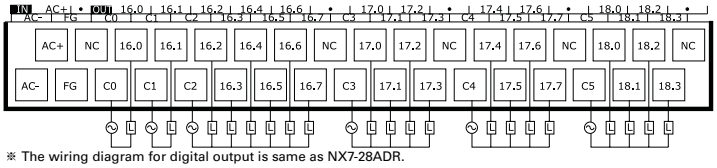


NX7s-40ADT Output Wiring Diagram



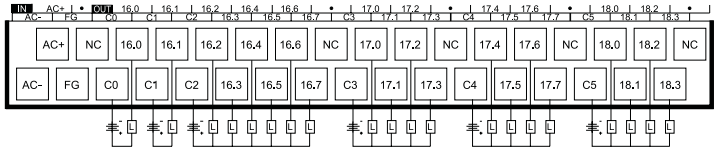
※ The wiring diagram for digital output is same as NX7-28ADT.

NX7-48ADR, NX7s-48ADR Output Wiring Diagram



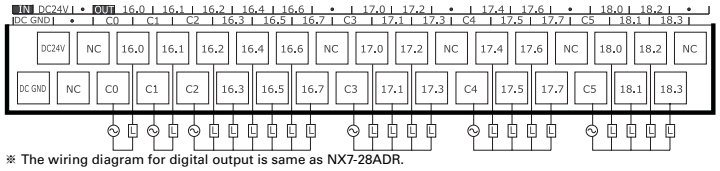
※ The wiring diagram for digital output is same as NX7-28ADR.

NX7-48ADT, NX7s-48ADT Output Wiring Diagram



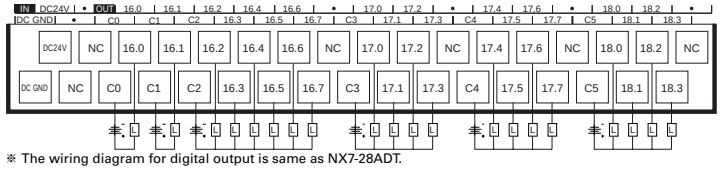
※ The wiring diagram for digital output is same as NX7-28ADT.

NX7-48DDR Output Wiring Diagram



※ The wiring diagram for digital output is same as NX7-28ADR.

NX7-48DDT Output Wiring Diagram

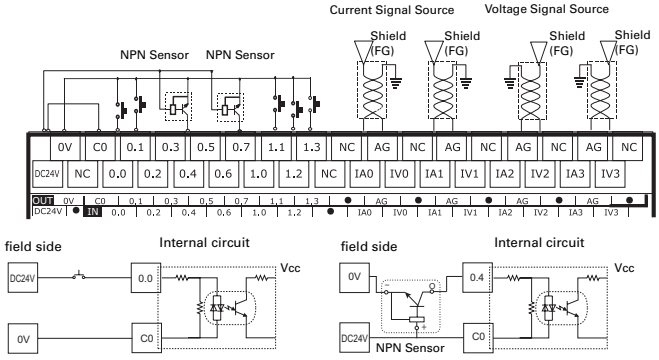


※ The wiring diagram for digital output is same as NX7-28ADT.

Analog Input Wiring Diagrams

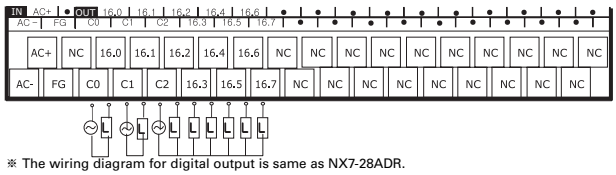
+COM/ Analog Wiring Example with the following models

- NX7-20ADR - 4A
- NX7-20ADR - 6A
- NX7-20ADT - 4A
- NX7-20ADT - 6A



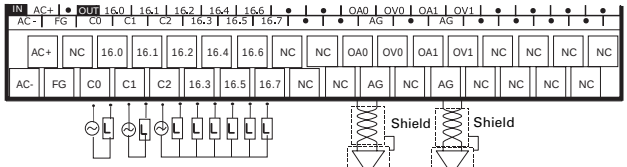
Analog Output Wiring Diagrams

Relaly/ Analog Wiring Example with NX7-20ADR-4A



※ The wiring diagram for digital output is same as NX7-28ADR.

Relay/ Analog Wiring Example with NX7-20ADR-6A

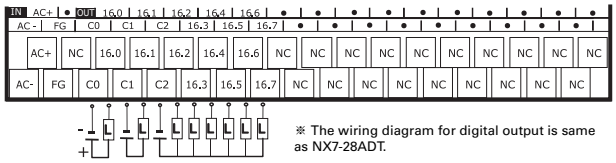


※ The wiring diagram for digital output is same as NX7-28ADR.

Current Load Device (Impedance) below 500 Ω)

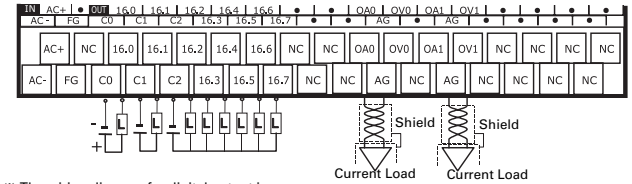
Current Load Device (Impedance) below 500 Ω)

TR/ Analog Wiring Example with using NX7-20ADT-4A



※ The wiring diagram for digital output is same as NX7-28ADT.

TR/ Analog Wiring Example with NX7-20ADT-6A



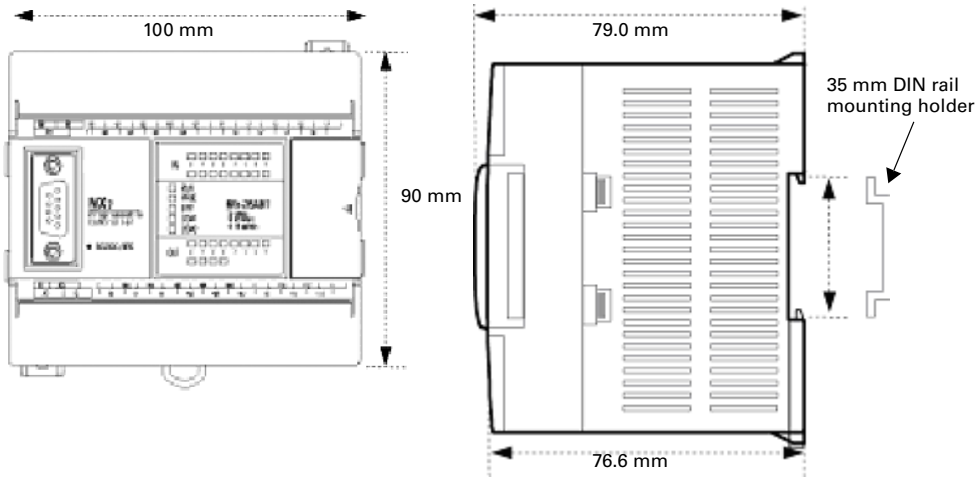
※ The wiring diagram for digital output is same as NX7-28ADT.

Current Load Device (Impedance) below 500 Ω)

Current Load Device (Impedance) below 500 Ω)

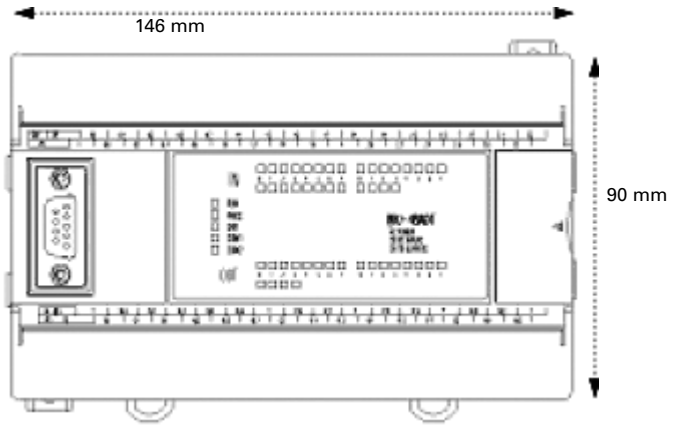
Product dimensions

28 points (base and expansion)

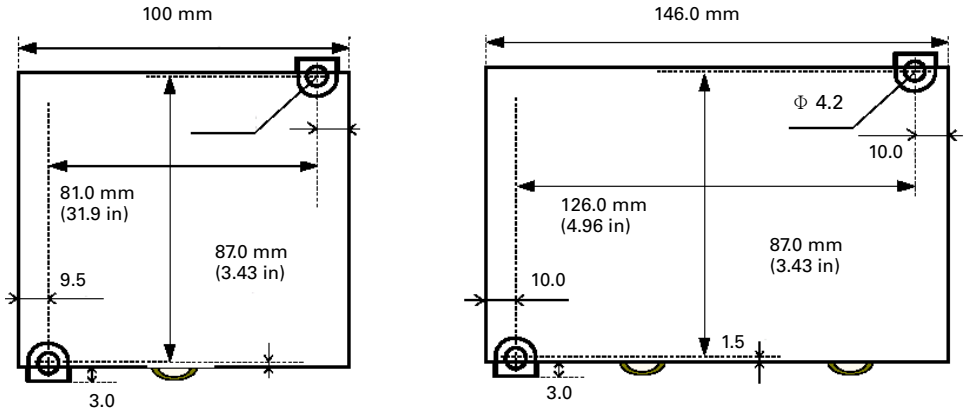


48 points

* 48 points

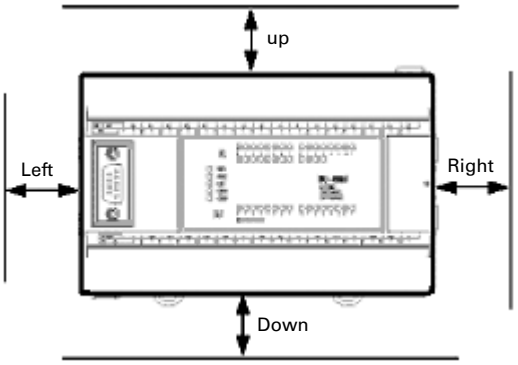


Installation dimensions



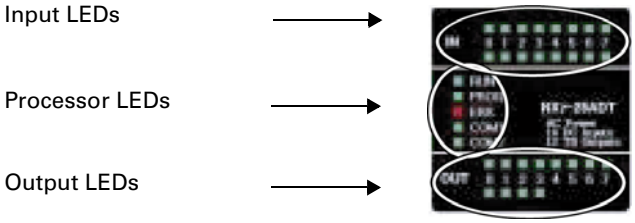
Installation space

Allow at least 2 inch (50 mm) space on all sides of the controller system for adequate ventilation, as shown in the figure below.



Status LEDs

The following figure shows the LEDs indicating PLC status:



Processor LEDs

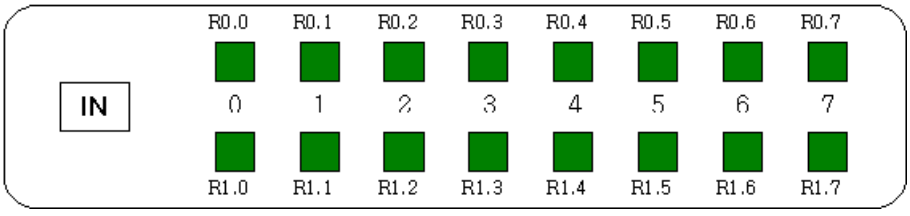
Five LEDs are used to indicate processor status:

- RUN is On when the processor is operating normally. Flashing indicates that the processor is pausing. Pause means that input/output is being progressed or the processor retains data.
- PROG is On when the program in the processor module can be edited.
- ERR is On when a processor error occurs or operation cannot proceed due to an abnormal program. Flashing indicates that a battery is not installed, or a minor error that does not hold processor operation has occurred.
- COM1 flashes when communications are proceeding normally through COM1 port (9-pin D-Sub).
- COM2 flashes when communications are proceeding normally through COM2 port (MJ).

Input LEDs

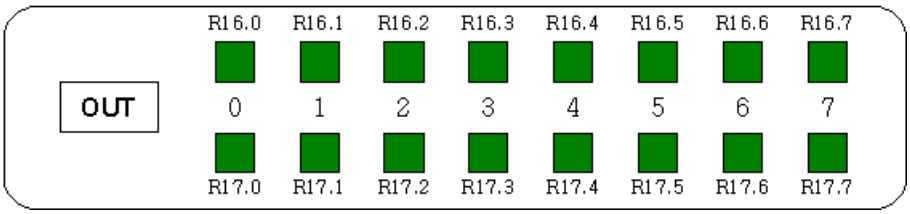
For 28-point controller, the top input LEDs show the status for R000 input word. The bottom input LEDs show the status for R001 input word.

For 48-point controller, the top input LEDs show the status for R000 and R001 input words. The bottom input LEDs show the status for R002 and R0003 input words.



Output LEDs

The top output LEDs show the status for R016 output word. The bottom output LEDs show the status for R017 output word.



4

Addressing and Operation

Addressing Space

All the memory used for external I/O processing and internal data processing has always both address and data (the content).

Addressing space is classified as R, L, M, K, F, W, TC, SV, PV, and SR. These letters are used to designate a specific area in memory as shown in the following table.

Memory areas	Addresses	Description
External I/O	R000.00 to R31.15	• I/O area • 512 points, 32 words
Special internal contact	R32.00 to R127.15	• Special internal area • 1536 points, 96 words
Link contact	L000.00 to L063.15	• Shared link area • 1024 points, 64 words • A point can be used as an internal contact when it is not used for the link function.
Internal contact	M000.00 to M127.15	• Internal auxiliary area • 2048 points, 128 words
Keep contact	K000.00 to K127.15	• Retentive internal auxiliary area • 2048 points, 128 words • Clears when 'Reset retentive area' is performed.
Special contact	F000.00 to F015.15	• Special internal area • 256 points, 16 words
Timer/Counter	Channels: 0 to 255 Set value: SV0 to SV255 Current value: PV0 to PV255 Contact: TC0 to TC255	• 256 shared channels (No duplicated use allowed) • TC indicates contact point area. • SV indicates set value area. PV indicates current or present value area. • SV can be addressed to from 0 to 65535
Data register	W0000 to W2047	• Area that retains the data in case of power failure • Cannot be designated with a bit • Cleared when 'Initialize retentive area' is selected
Special register	SR000 to SR511	• Special internal area for processor and RTC status

Bit and Word Addressing

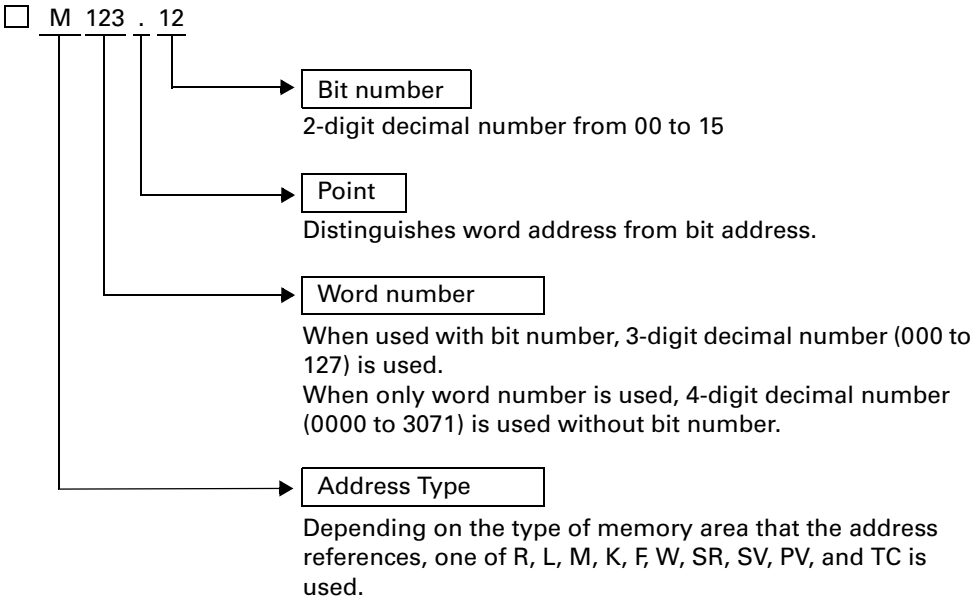
A bit address is composed of a character (R, L, M, K, F) that identifies the type of memory area, a 3-digit decimal number(000 to 127) that indicates a word, and a 2-digit decimal number(00 to 15) that indicates a bit. A timer/counter contact is represented by the label TC followed by 3-digit decimal like TC000. The 3-digit decimal indicates a timer/ counter channel number from TC000 to TC255.However, the hand-held programmers (HHP) PGM-10, 12S and 300A use the label TIM instead of TC. For example, TIM000 is used instead TC000 to address the first timer/counter channel.

A word address is composed of a character(R, L, M, K, F, W, SV, PV, SR) that identifies the type of memory area, and a 4-digit decimal number (0000 to 2047) that indicates word. Special registers SR000 to SR511 can be represented as W2560 to W3071.

Both of bit and word addresses can be used to address the memory areas of R, L, M, K, F. However, be cautious that instructions use a specific type of address, either bit or word address, and the used addresses are resolved automatically depending on the type of instruction.

Bit address can have the content of either On (1) or Off (0) state. Word address is composed of 16 bits and holds a data value from 0 to 65,535. Double word address is composed of 32 bits and holds a data value from 0 to 4,294,967,295.

Addressing example

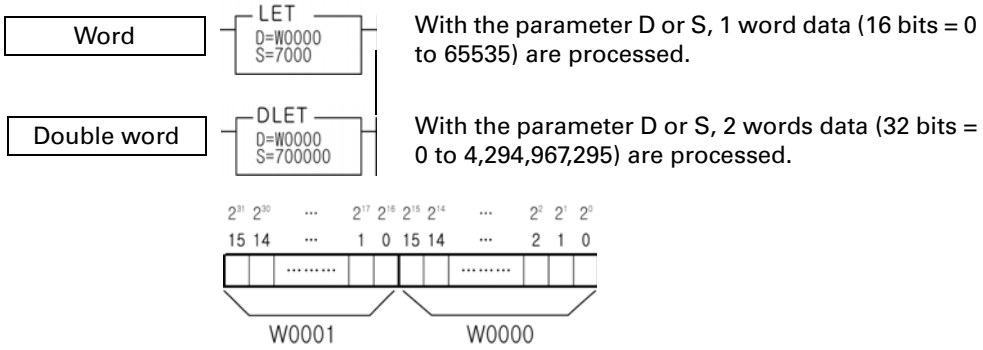


Whether an instruction uses bit address or word address depends on instruction type. Commonly, the basic instructions use bit address to reference a contract. Comparison and advanced instructions use values referenced by 4 digit word addresses.

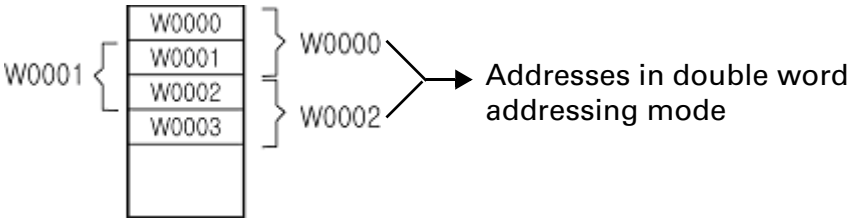
Double Word Addressing

- Double word addressing is the same as word addressing, except that 32-bit data is referenced by the specified address and its next address.
- The type of instruction used determines which addressing, word or double word, is applied.
- When using a double word comparison instruction with GPC5, press Ctrl+T in Edit mode to set the addressing mode to 'double', and then enter comparison instruction. The addresses you enter will be recognized as double word address. The character ‘D’ will appear in the instruction box on the ladder program to indicate double word addressing mode.

Example 1) Identifying word and double word addressing

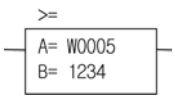


For example, as shown in the figure below, the double word, W0000, is composed of two words, W0000 and W0001. The bits of W0000 become the least significant bits (LSB) and those of W0001 become the most significant bits (MSB). Likewise, the double word address, W0001, represents the combination of two words W0001 and W0002. If a word is addressed in more than one place, like the word W0001 referenced by the two double words W0000 and W0001 as shown in the following figure, be cautious because duplicate use of the same word may cause problems.



Example 2) Comparison instruction in WinGPC

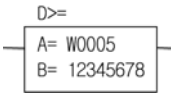
Word



On the WinGPC screen, select the advanced instruction input option. Enter the symbol >=. The screen will be displayed as shown in the figure.

Operands such as W0005 and 1234 are 16-bit word values.

Double word



On the WinGPC screen, select the advanced instruction inputt option. Enter D first and then enter the symbol >=. Double word addressing is applied for the addresses you enter.

Double word W0005 is composed with combination of two words W5 and W6. M3 is made up of M3 and M4. The comparison is performed on 32-bit data.

I/O Addressing

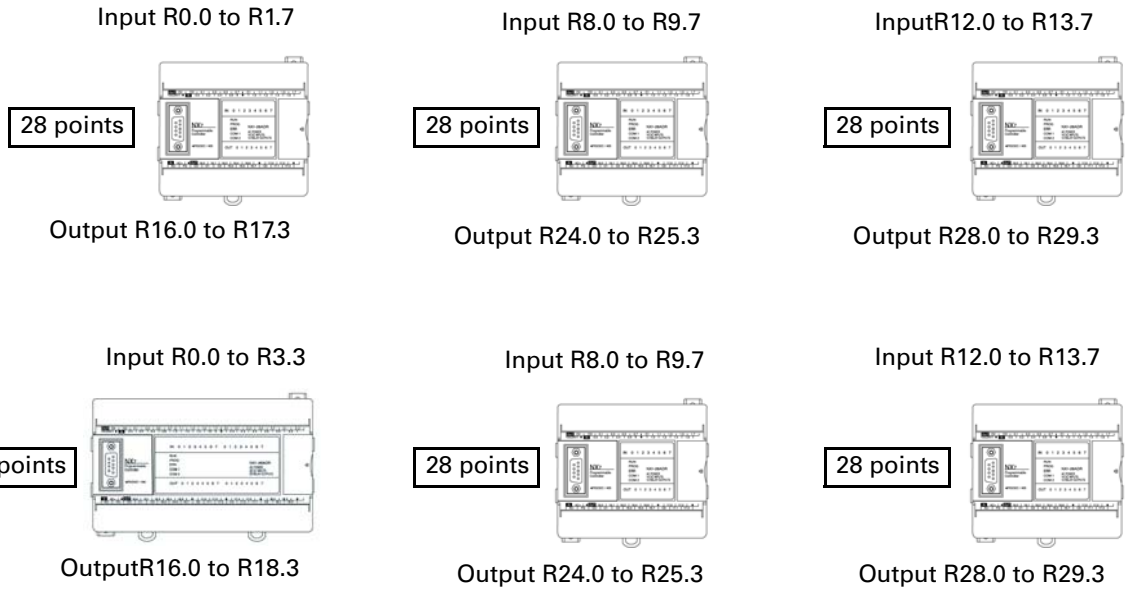
Addressing is based on the location of the module.

I/O addressing method: Fixed addressing

- I/O address range
  - Input address: R000.00 to R015.07
  - Output address: R016.00 to R031.07
  - Special function address: R032 to R127 words (addressable as bit addresses.)

Base (8 words)	Expansion 1 (4 words)	Expansion 2 (4 words)
Input: R00 to R07	Input: R08 to R11	Input: R12 to R15
Output: R16 to R23	Output: R24 to R27	Output: R28 to R31

Addressing example

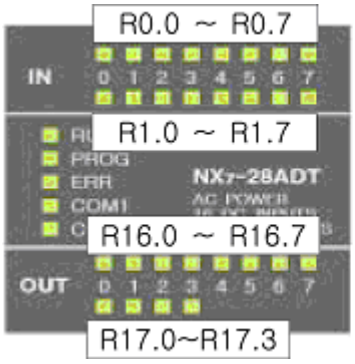


IMPORTANT I/O addresses are allocated by byte. But, word addressing is used for internal arithmetic.
The addresses of an expansion module are fixed. They are configured automatically as Expansion 1 or Expansion 2.

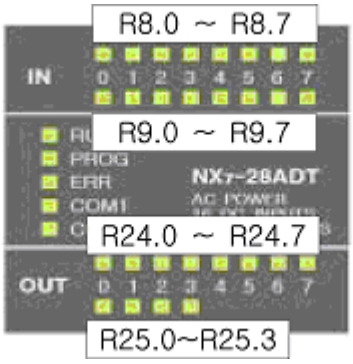
I/O LEDs

The following figures illustrate I/O LEDs and their corresponding memory addresses.

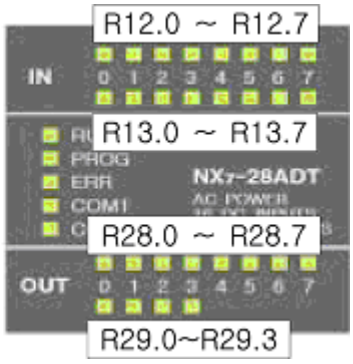
28-point base module



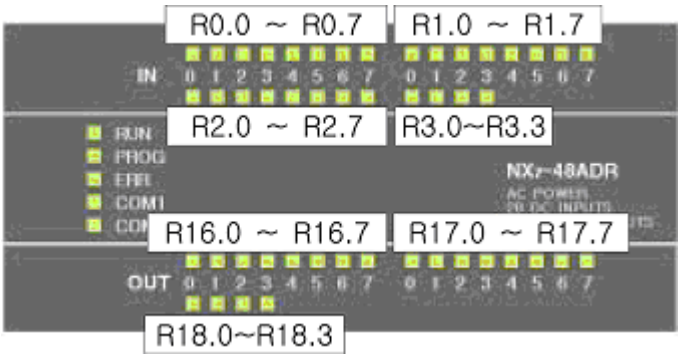
Expansion 1



Expansion 2



48-point base module



Special Internal Addresses

Word registers F000 to F015

Address	Function	Description
F0	System diagnostics and control	System self-diagnostics, program check-up, operation control
F1	System diagnostics and clock	Internal clock, operation result, carry flag
F2 to F7	Link control area	Link installation, operation mode, status information, etc.
F8 to F10	Reserved system area	Reserved area
F11 to F13	System control	User-defined communication, RTC installation, system control, etc.
F14	PID control	PID operation mode and operation control flag (channels 0 to 3)
F15	PID control	PID operation mode and operation control flag (channels 4 to 7)

Functions of the F0.00 to F0.15 bits for PLC control

Address	Function	Description
F0.00	System diagnostics	The system starts self-diagnostics on system boot. If there is any fault, this address turns on
F0.01	CPU ROM check (ROM Checksum)	The system diagnoses ROM on system boot. If there is any fault, this bit and the error lamp turn on and output and operation are halted.
F0.02	CPU RAM check	The system diagnoses RAM on system boot. If there is any fault, this bit turns on and operation is halted.
F0.03	User memory error	If user program memory and/or program content are damaged, this bit and the error lamp turn on and output and operation are halted.
F0.04	Program syntax error	The processor verifies program syntax at the first run. If there is error, this bit and the error lamp turn on and output and operation are halted.
F0.05	I/O module range error	On when an invalid address that is larger than R64 word is used.
F0.06	Module change error	On when an I/O error occurs during system operation. If the operation mode is Remote, the operation is halted. In RUN mode, the error lamp turns on and the processor continues processing.
F0.07	Module type error (abnormal module)	If the type of the module that is mounted actually is different from I/O module information that is stored in the CPU, this bit and the error lamp turn on and operation is halted.
F0.08	Input data control	Set to Off if you do not want input module data to be input to the processor, i.e., input update is set to No.
F0.09	Output data control	Set to Off if you do not want to output processor's operation result to the output modules, i.e., output update is set to No. The output modules retain the last values prior to turning off this bit.
F0.10	All output Off	Turns all outputs off in Run mode, i.e., sets output enable to No.
F0.11	Constant cycle interrupt	On when a constant cycle interrupt instruction is being executed.
F0.12	Watchdog error	On when a scan time exceeds the watchdog time.
F0.13	Disable module type check	Set to On if you want to check the program without I/O module type check on system boot.
F0.14	Program edit during run	Set to On if you want to edit the program when the processor is running (RUN mode). If any syntax error occurs, the processor is stopped.
F0.15	Processor run status	On when the processor is in the Run mode. Off when it is stopped or paused.

Functions of the F1.00 to F1.15 bits for PLC control

Address	Function	Description
F1.00	First 1 scan on	On for the first scan whenever the operation mode changes from Stop to Run.
F1.01	Scan clock	Toggles at every scan. (1 scan On and 1 scan Off)
F1.02	0.02 second clock	Repeats 10 ms On and 10 ms Off.
F1.03	0.1 second clock	Repeats 50 ms On and 50 ms Off.
F1.04	1 second clock	Repeats 500 ms On and 500 ms Off.
F1.05	Momentary power failure	On when power is Off for 20 ms or more.
F1.06	CPU switch/Run status	On when the processor is in operation in the Run mode. However, be cautious that this bit turns Off when the processor is in operation in the Remote mode
F1.07	Keep contact area error status	On when the K area data are destroyed and/or changed.
F1.08	Carry flag	On when carry occurs with arithmetic instruction.
F1.09	Division by zero error	On when the denominator of division instruction is zero
F1.10	Range error	On when an absolute address exceeds the range.
F1.11	Reserved	System area
F1.12	W area error	System area
F1.13	Reserved	System area
F1.14	Reserved	System area
F1.15	Reserved	System area

IMPORTANT The 16 bits of the F1 word provide the processor's special functions and self-diagnostics results. They are read only, and will not receive user inputs and can't be modified. (Except that the user can set the bit F1.5, momentary power failure, only to off.)

Functions of the F11 word for user-defined communication via COM2 port

Address	Function	Description
F11.00	Requests user-defined communication data send	1 (On): Data send request
F11.01	Reports data sending failure	1 (On): Data send failure display
F11.02	Enables the start code condition in ASCII communication mode	1 (On): Start code enable
F11.03	Enables the end code condition in ASCII communication mode	1 (On): End code enable
F11.04	Completed receiving user-defined communication data	1 (On): Data receive complete
F11.05	Resets the receive memory (Sets to '1' after reading the data received)	1 (On): Receive memory reset
F11.06	Received data are duplicated	1 (On): Receive data duplicate
F11.07	Received data has error	1 (On): Error occurrence
F11.08	Displays ASCII data received in ASCII format	1 (On): ASCII data update

Functions of the F11 word for user-defined communication via COM2 port *(Continued)*

Address	Function	Description
F11.09	Ignores receive errors	1 (On): Ignores error if it occurs.
F11.10	Enables parity operation	1 (On): Uses parity
F11.11	Enables odd or even parity	0 (Off): odd parity, 1 (On): even parity
F11.12	Sets the communication data mode to 8-bit or 7-bit	0 (Off): 8-bit mode, 1 (On): 7-bit mode
F11.13	Specifies communication data format via port 2	0 (Off): ASCII format, 1 (On): hex format (Note 2)
F11.14	Reserved	System area
F11.15	Enables CRC-16 calculation	1 (On): Performs CRC-16 calculation

Functions of the words F12 and F13 for system control

Address	Function	Description
F12.00	Indicates RTC existence	On if the RTC functions exist
F12.01	Indicates remote map enable/disable	On when the remote I/O MAP is enabled.
F12.02	Indicates flash memory existence	On when the 9.6 KW flash memory is installed.
F12.03	Indicates flash memory existence	On when the 16/20 KW flash memory is installed
F12.05	Indicates battery error	When the battery is not connected or the voltage is lower than the backup voltage, the error LED flashes
F12.07	Indicates constant cycle scan error	On when any error occurs during executing a constant cycle program.
F12.08	Enables user-defined communication	Sets the COM2 terminal mode to user-defined communication mode.
F12.09	Enables Modbus communication	Sets the COM2 terminal mode to Modbus communication mode.
F12.10	Indicates RTC setting error	On if there is RTC setting error. Turns off if there is no error.
F12.11	Indicates successful saving of program to Flash memory and booting check	Off when the program is normally saved to Flash memory by setting F12.15 to On.
F12.12	EEPROM backup check	On when the program in EEPROM is the same with that in RAM.
F12.13	RTC Setting 1	On when you change the year, month, date, or day of the week.
F12.14	RTC Setting 2	On when you change the hour, minute, or second. Off when data setting is done normally.
F12.15	Saving programs to Flash memory	Set to On when you want to save the program to the flash memory. Turns off when saving is finished normally.
F13.00	Indicates module change	On when the I/O module is changed.
F13.01	Indicates program resave	On when you restore the program that is backed up in the Flash memory to SRAM.
F13.02	Reserved	System area
F13.03	COM1 port communication status	ON when the protocol is transfered normally via COM1 (Supported for CPU version V 1.30 or higher)
F13.04	COM2 port communication status	ON when the protocol is transfered normally via COM2 (Supported for CPU version V 1.30 or higher)
F13.05	Analog error	On if there is analog function error (Only for analog model)
F13.06 to F13.15	Reserved	System area

Functions of the F14 and F15 words for PID control

Address	Function	Description
F14.00	PID Loop0 control	Loop0 PID control - 1: operating, 0: stop
F14.01		Parameter range error flag - 1: error, 0: normal
F14.02		PID arithmetic mode - 1: manual, 0: auto
F14.03		PID control complete flag - 1: complete, 0: in operation
F14.04 to F14.07	PID Loop1 control	Loop1 PID control: The functions are the same with Loop0.
F14.08 to F14.11	PID Loop2 control	Loop2 PID control: The functions are the same with Loop0.
F14.12 to F14.15	PID Loop3 control	Loop3 PID control: The functions are the same with Loop0.
F15.00 to F15.03	PID Loop4 control	Loop4 PID control: The functions are the same with Loop0.
F15.04 to F15.07	PID Loop5 control	Loop5 PID control: The functions are the same with Loop0.
F15.08 to F15.11	PID Loop6 control	Loop6 PID control: The functions are the same with Loop0.
F15.12 to F15.15	PID Loop7 control	Loop7 PID control: The functions are the same with Loop0.

Special Register (SR) Area

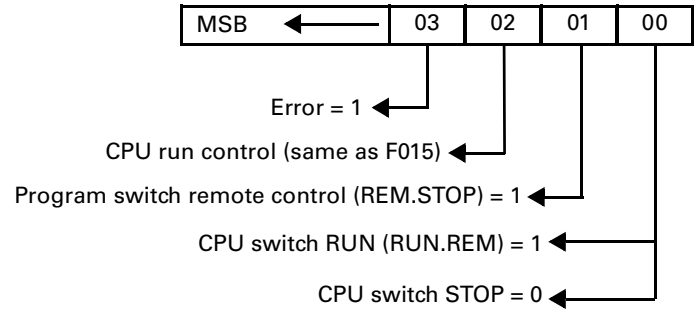
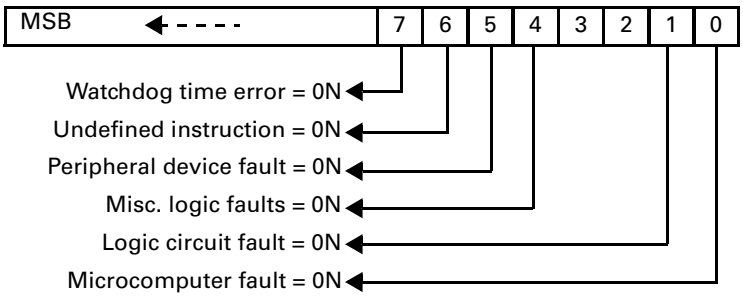
The SR area consists of the range of SR000 (absolute address $0C00) to SR511 (absolute address $0DFF). Programmers who cannot use the SR key can use W2560 to W3071 instead.

The SR area and W area are essentially the same (ex: SR000 = W2560). In some cases, SR000 is automatically specified when W2560 is selected. 'SR' must be used in WinGPC.

Functions of SR000 (W2560) to SR511 (W3071)

Word addresses		Function	Description
SR000 to SR004	W2560 to W2564	CPU status	Indicates current CPU status data.
SR005 to SR007	W2565 to W2567	Reserved	System area
SR008	W2568	PID control	Specifies the start address for PID control function
SR009 to SR016	W2569 to W2576	Reserved	System area
SR017 to SR048	W2577 to W2608	Program error information	Displays the detailed information about error that occurs during processing the program.
SR049 to SR288	W2609 to W2848	Reserved	System area
SR289 to SR297	W2849 to W2857	RTC	Sets and indicates real time clock information
SR298 to SR373	W2858 to W2933	User-defined communication	Controls user-defined communication protocol for COM2 port.
SR449 to SR450	W3009 to W3010	Trimpot	Trimpot input data
SR509 to SR510	W3069 to W3070	Serial communication	Serial communication speed setting
Others	-	Reserved	System area

Functions of SR000 to SR029 (W2560 to W2589): CPU, Link, Remote and Error Status

Address		Function	Description
SR000	W2560	CPU ID number	Indicates the CPU ID number in the lower 8 bits. 0 to 223 are the valid user-defined values, 255 is the default value.
SR001	W2561	CPU status	Indicates current CPU information state. (run/stop/remote control/error)  i.e. Stop = 010, REM/Pause = 011, REM/RUN = 111, RUN/RUN = 101
SR002	W2562	Watchdog time	Indicates the user program watchdog time (module: msec)
SR003	W2563	Scan time	Indicates the scan time when executing a program. Updated at every scan (module: msec)
SR004	W2564	Max. scan time	Indicates maximum value of scan time when executing a program.
SR005 ~SR007	W2565 ~W2567	Reserved	System area
SR008	W2568	PID control	Refer to the start address designation for the PID control function
SR009 ~SR016	W2569 ~W2576	Reserved	System area
SR017	W2577	System error information.	Gives result of self-diagnosis by CPU. Indicates error content when F0.0 is turned On and saves it. 
SR018	W2578	Location of undefined instruction	Indicates the location of the instruction (the step number) that caused an undefined instruction error during program execution.
SR019	W2579	Reserved	System area
SR020	W2580	Multiplication	Stores high order bit values upon executing 16 bit multiplication instructions.
SR021	W2581	Lower remainder	Stores the low order bit value of remainder after a division instruction has been executed.
SR022	W2582	Higher remainder	Stores the high order bit value of the remainder after a division instruction has been executed.
SR023 ~SR029	W2583 ~W2589	Reserved	System area

Functions of SR30 to SR48 (W2590 to W2608): Syntax Error Information

.

Address		Function	Detail
SR030	W2590	Displays error info.	Bit 0 = On if the I/O number range of bit instruction is beyond the specified range. Bit 1 = On if the channel number of the timer or the counter exceeds 255 or is duplicated. Bit 2 = On if the bit or word number in the advanced instruction is beyond the specified range or if it designates external address that cannot be used. Bit 3 = On if a word number in the refresh instruction INPR or OUTR is beyond the specified range, Bit 4 = On if an undefined instruction exists. Bit 5 = On in event of a user program memory writing error. Bit 6 = On in event of miscellaneous errors. Bit 7 = On if the user program memory is abnormal. Bit 8 = On if an error on external I/O address and bit/word/double word numbers used occurs. Bit 9 = On if the label numbers of the JMP or CALL instructions exceed 63, the corresponding instruction LBL or SBR does not exist, and/or the corresponding LBL/SBR instructions exist prior to JMP/CALL instructions. Bit 10 = On if the label number of the LBL instruction exceeds 63 and/or is duplicated. Bit 11 = On if the JMPS/JMP instructions are mistakenly combined and/or used. Bit 12 = On if the FOR/NEXT instructions are mistakenly combined and/or used more than four times. (Loop) Bit 13 = On if SBR/RET instructions are not combined and/or used and/or the SBR instructions overlap or exceed 63. Bit 14 = On if INT/RETII instructions are not used properly. Bit 15 = On if no END instruction inserted automatically.
SR031	W2591	-	System area
SR032	W2592	Displays CPU Error info.	The step number used for an error in using the bit range.
SR033	W2593		The step number used for an error in using the T/C range.
SR034	W2594		The step number used for an error in using the word range.
SR035	W2595		The step number used for an error in using I/O refresh.
SR036	W2596		The step number used for an error in using an abnormal code.
SR037	W2597		Program memory
SR038	W2598		Miscellaneous
SR039	W2599		System operation
SR040	W2600		The step number used for an I/O syntax error.
SR041	W2601		The step number used for a JMP/Call syntax error.
SR042	W2602		The step number used for an error in using LBL number.
SR043	W2603		The step number used for a JMPS/JMPE syntax error.
SR044	W2604		The step number used for a FOR/NEXT syntax error.
SR045	W2605		The step number used for a SBR/RET syntax error.
SR046	W2606		The step number used for an INT/RETI syntax error.
SR047	W2607		The step number used for an error in using END instruction.
SR048	W2608		System area

Functions of SR289 to SR297 (W2849 to W2857)

Sets the time of the built-in clock (RTC) and stores and displays the present time. Data is stored in BCD format. (It is only for NX7)

Classification	Address		Bit address / Description	Details															
				15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Present time	SR289	W2849	Year (4-digit)	O	O	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	SR290	W2850	Date: day	O	O	X	X	X	X	X	X	O	O	O	O	O	X	X	X
	SR291	W2851	Year: month	O	X	X	X	X	X	X	X	O	O	O	X	X	X	X	X
	SR292	W2852	Second: 00	O	O	X	X	X	X	X	X	O	O	O	O	O	O	O	O
	SR293	W2853	Hour: minute	O	O	X	X	X	X	X	X	O	X	X	X	X	X	X	X
Time setting	SR294	W2854	Date: day	O	O	X	X	X	X	X	X	O	O	O	O	O	X	X	X
	SR295	W2855	Year: month	O	X	X	X	X	X	X	X	O	O	O	X	X	X	X	X
	SR296	W2856	Second: 00	O	O	X	X	X	X	X	X	O	O	O	O	O	O	O	O
	SR297	W2857	Hour: minute	O	O	X	X	X	X	X	X	O	X	X	X	X	X	X	X

O: bit = 0; X: bit change

Functions of SR298 to SR373 (W2858 to W2933)

In user-defined communication area, data can be exchanged between PLC and other communication devices through COM2 terminal (modular jack type).

Address		Function	Detail
SR298 to SR333	W2858 to W2893	Transmitted data area	36 words, absolute address 3370
SR334 to SR369	W2894 to W2929	Received data area	36 words, absolute address 3406
SR370	W2930	Length of transmitted data	Byte length of transmitted data
SR371	W2931	Length of received data	Byte length and information of received data
SR372 SR373	W2932 W2933	Start code storage area Finish code storage area	Keeps the start code when communicating in ASCII (Only uses low order byte)
SR449	W3009	Trim pot data CH1	8 bit analog Volume (0 to 255)
SR450	W3010	Trim pot data CH2	
SR509	W3069	Baudrate setting CH1	Bit No. 15 - 0 : Auto detector baud rate - 1 : Manual Setting Bit 01.00 - 00 =9600 baud - 01 =19200 baud - 10 =38400 baud - 11 = 48000 buad
SR510	W3070	Baudrate setting CH2	

Functions of SR and miscellaneous areas.

Do not control the undefined SR area, which is reserved for system use, otherwise it might cause an error or breakdown.

Timer/Counter Area

Addresses for timer/counter set value and present value

Channel	Set value (SV)	Present value (PV)	Channel	Set value (SV)	Present value (PV)	Channel	Set value (SV)	Present value (PV)
0	W2048	W2304	40	W2088	W2344	80	W2128	W2384
1	W2049	W2305	41	W2089	W2345	81	W2129	W2385
2	W2050	W2306	42	W2090	W2346	82	W2130	W2386
3	W2051	W2307	43	W2091	W2347	83	W2131	W2387
4	W2052	W2308	44	W2092	W2348	84	W2132	W2388
5	W2053	W2309	45	W2093	W2349	85	W2133	W2389
6	W2054	W2310	46	W2094	W2350	86	W2134	W2390
7	W2055	W2311	47	W2095	W2351	87	W2135	W2391
8	W2056	W2312	48	W2096	W2352	88	W2136	W2392
9	W2057	W2313	49	W2097	W2353	89	W2137	W2393
10	W2058	W2314	50	W2098	W2354	90	W2138	W2394
11	W2059	W2315	51	W2099	W2355	91	W2139	W2395
12	W2060	W2316	52	W2100	W2356	92	W2140	W2396
13	W2061	W2317	53	W2101	W2357	93	W2141	W2397
14	W2062	W2318	54	W2102	W2358	94	W2142	W2398
15	W2063	W2319	55	W2103	W2359	95	W2143	W2399
16	W2064	W2320	56	W2104	W2360	96	W2144	W2400
17	W2065	W2321	57	W2105	W2361	97	W2145	W2401
18	W2066	W2322	58	W2106	W2362	98	W2146	W2402
19	W2067	W2323	59	W2107	W2363	99	W2147	W2403
20	W2068	W2324	60	W2108	W2364	100	W2148	W2404
21	W2069	W2325	61	W2109	W2365	101	W2149	W2405
22	W2070	W2326	62	W2110	W2366	102	W2150	W2406
23	W2071	W2327	63	W2111	W2367	103	W2151	W2407
24	W2072	W2328	64	W2112	W2368	104	W2152	W2408
25	W2073	W2329	65	W2113	W2369	105	W2153	W2409
26	W2074	W2330	66	W2114	W2370	106	W2154	W2410
27	W2075	W2331	67	W2115	W2371	107	W2155	W2411
28	W2076	W2332	68	W2116	W2372	108	W2156	W2412
29	W2077	W2333	69	W2117	W2373	109	W2157	W2413
30	W2078	W2334	70	W2118	W2374	110	W2158	W2414
31	W2079	W2335	71	W2119	W2375	111	W2159	W2415
32	W2080	W2336	72	W2120	W2376	112	W2160	W2416
33	W2081	W2337	73	W2121	W2377	113	W2161	W2417
34	W2082	W2338	74	W2122	W2378	114	W2162	W2418
35	W2083	W2339	75	W2123	W2379	115	W2163	W2419
36	W2084	W2340	76	W2124	W2380	116	W2164	W2420
37	W2085	W2341	77	W2125	W2381	117	W2165	W2421
38	W2086	W2342	78	W2126	W2382	118	W2166	W2422
39	W2087	W2343	79	W2127	W2383	119	W2167	W2423

Addresses for timer/counter set value and present value *(Continued)*

Channel	Set value (SV)	Present value (PV)
120	W2168	W2424
121	W2169	W2425
122	W2170	W2426
123	W2171	W2427
124	W2172	W2428
125	W2173	W2429
126	W2174	W2430
127	W2175	W2431
128	W2176	W2432
129	W2177	W2433
130	W2178	W2434
131	W2179	W2435
132	W2180	W2436
133	W2181	W2437
134	W2182	W2438
135	W2183	W2439
136	W2184	W2440
137	W2185	W2441
138	W2186	W2442
139	W2187	W2443
140	W2188	W2444
141	W2189	W2445
142	W2190	W2446
143	W2191	W2447
144	W2192	W2448
145	W2193	W2449
146	W2194	W2450
147	W2195	W2451
148	W2196	W2452
149	W2197	W2453
150	W2198	W2454
151	W2199	W2455
152	W2200	W2456
153	W2201	W2457
154	W2202	W2458
155	W2203	W2459
156	W2204	W2460
157	W2205	W2461
158	W2206	W2462
159	W2207	W2463
159	W2208	W2464
160	W2209	W2465
161	W2210	W2466
162	W2211	W2467
163	W2212	W2468
164	W2213	W2469

Channel	Set value (SV)	Present value (PV)
166	W2214	W2470
167	W2215	W2471
168	W2216	W2472
169	W2217	W2473
170	W2218	W2474
171	W2219	W2475
172	W2220	W2476
173	W2221	W2477
174	W2222	W2478
175	W2223	W2479
176	W2224	W2480
177	W2225	W2481
178	W2226	W2482
179	W2227	W2483
180	W2228	W2484
181	W2229	W2485
182	W2230	W2486
183	W2231	W2487
184	W2232	W2488
185	W2233	W2489
186	W2234	W2490
187	W2235	W2491
188	W2236	W2492
189	W2237	W2493
190	W2238	W2494
191	W2239	W2495
192	W2240	W2496
193	W2241	W2497
194	W2242	W2498
195	W2243	W2499
196	W2244	W2500
197	W2245	W2501
198	W2246	W2502
199	W2247	W2503
200	W2248	W2504
201	W2249	W2505
202	W2250	W2506
203	W2251	W2507
204	W2252	W2508
205	W2253	W2509
206	W2254	W2510
207	W2255	W2511
208	W2256	W2512
209	W2257	W2513
210	W2258	W2514
211	W2259	W2515

Channel	Set value (SV)	Present value (PV)
212	W2260	W2516
213	W2261	W2517
214	W2262	W2518
215	W2263	W2519
216	W2264	W2520
217	W2265	W2521
218	W2266	W2522
219	W2267	W2523
220	W2268	W2524
221	W2269	W2525
222	W2270	W2526
223	W2271	W2527
224	W2272	W2528
225	W2273	W2529
226	W2274	W2530
227	W2275	W2531
228	W2276	W2532
229	W2277	W2533
230	W2278	W2534
231	W2279	W2535
232	W2280	W2536
233	W2281	W2537
234	W2282	W2538
235	W2283	W2539
236	W2284	W2540
237	W2285	W2541
238	W2286	W2542
239	W2287	W2543
240	W2288	W2544
241	W2289	W2545
242	W2290	W2546
243	W2291	W2747
244	W2292	W2548
245	W2293	W2549
246	W2294	W2550
247	W2295	W2551
248	W2296	W2552
249	W2297	W2553
250	W2298	W2554
251	W2299	W2555
252	W2300	W2556
253	W2301	W2557
254	W2302	W2558
255	W2303	W2559

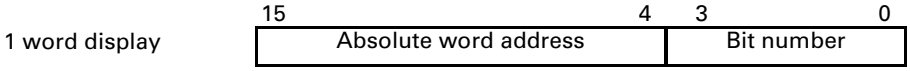
Absolute Addressing

In LDR, DLDR, STO, and DSTO instructions, the absolute address is used to perform indirect addressing to register or utilize the built-in communication port.

Memory area	Register address	Absolute address	
		Dec.	Hex.
External I/O	R0000	0	0000
	R0001	1	0001
	R0002	2	0002
	...	...	...
	R0126	126	007E
	R0127	127	007F
Link area	L0000	128	0080
	L0001	129	0081
	L0002	130	0082
	...	...	...
	L0062	190	00BE
	L0063	191	00BF
Internal contact	M0000	192	00C0
	M0001	193	00C1
	M0002	194	00C2
	M0003	195	00C3
	...	...	...
	M0064	256	0100
	M0065	257	0101
	...	...	...
	M0126	318	013E
	M0127	319	013F
Internal Keep contact	K0000	320	0140
	K0001	321	0141
	K0002	322	0142
	K0003	323	0143
	...	...	...
	K0126	446	01BE
	K0127	447	01BF

Memory area	Register address	Absolute address	
		Dec.	Hex.
Special internal contact	F0000	448	01C0
	F0001	449	01C1
	F0002	450	01C2
	...	...	...
	F0014	462	01CE
	F0015	463	01CF
Data area	W0000	512	0200
	W0001	513	0201
	W0002	514	0202
	...	...	...
	W512	1024	0400
	...	...	...
	W1024	1536	0600
	...	...	...
	W1536	2048	0800
	...	...	...
	W2046	2558	09FE
	W2047	2559	09FF
T/C set value	W2048	2560	0A00
	W2049	2561	0A01
	...	...	...
	W2303	2815	0AFF
T/C present value	W2304	2816	0B00
	W2305	2817	0B01
	...	...	...
	W2559	3071	0BFF
Status display	SR000	3072	0C00
	SR001	3073	0C01
	...	...	...
	SR511	3583	0DFF

When accessing a bit absolute address using the program loader port communication protocol, the bit address (0 to 15 or $0 to $F) is kept separate from the word address (as shown below).

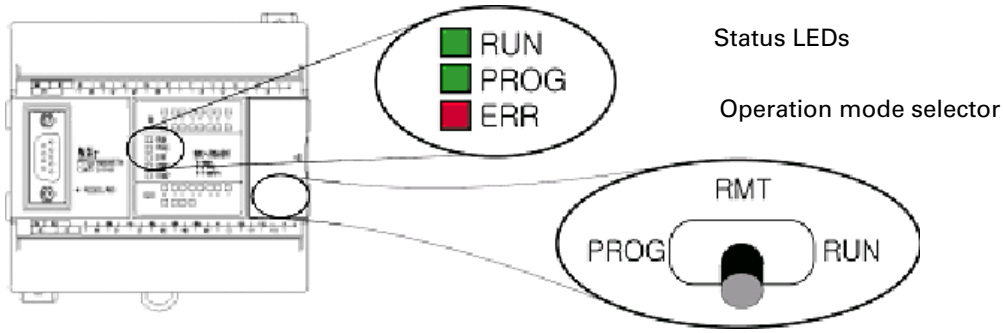


For example, the absolute bit address for K127.12 internal contact is $1BFC (hex). (Word absolute address = $01BF + Bit number = $C = $1BFC)

Processor Operation Mode

What is the processor operation mode?

The processor has an external RUN/REMOTE/PROG switch. The PLC performs a system check that determines the position of the switch. The switch position determines which operating mode the PLC is in. It can set to RUN, STOP, REMOTE, or ERROR mode.



Processor operation modes

Operation mode selector switch	Operation mode	LED status		Program change	Data change	Operation mode at power off to on
		RUN	PROG			
RUN	RUN	☼	●	Disabled	Enabled	RUN
	STOP	●	◑	Disabled	Enabled	RUN
RMT (REMOTE)	RUN	☼	☼	Enabled	Enabled	RUN
	PAUSE	◑	☼	Enabled	Enabled	PAUSE
PROG	STOP	●	☼	Enabled	Enabled	STOP

IMPORTANT

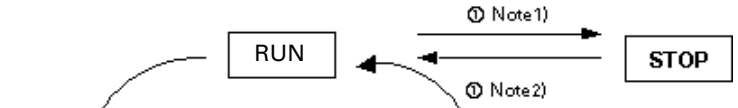
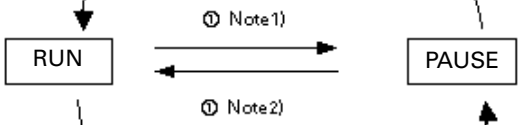
LED status - ☼: On, ◑:Flashing, ●:Off

When the PROG.LED is on, you can change the user program.

When the mode switch is set to REMOTE and power is switched from Off to On, the previous mode of operation is restored.

When debugging the user program, the mode switch should be set to REMOTE.

Changes of operation mode according to operation mode selector switch position

Switch position	Operation mode change
RUN	
RMT	
PROG	

As in the status indicator, if an error occurs within a mode during RUN state, set the mode change to STOP or PAUSE automatically base on the type of error information, and the error lamp is turned on. However, an arithmetic error will occur during the operation when, the error lamp is turned on and is changed to STOP. Afterwards, after the PROCESSOR has been halted, the error lamp may be turned off.

Mode switches in status will be remotely changed when the error is canceled.

Be cautious during programming since the status switch of Note 1) or Note 2) changes even when setting the F0.15 contact that controls operation modes is turned to On/Off.

RUN Mode

The PLC reads the external input signals and executes the user program stored in memory. The external outputs are updated on every scan based on program results. (Run LED maintains On.)

PAUSE Mode

A user program is operated at every scan and the I/O and result value is maintained. This mode is used when checking and debugging a program at every scan. This mode is similar to the Stop mode, but it does not initialize data. (RUN LED flickers.)

STOP Mode

The user program is stopped and the external outputs are turned Off. In the Stop mode, you may correct, delete or transfer the program.

ERROR Mode

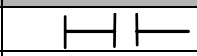
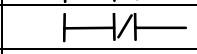
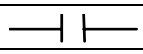
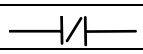
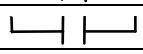
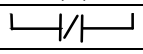
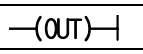
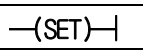
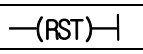
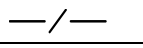
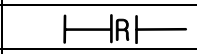
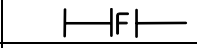
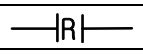
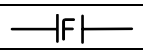
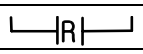
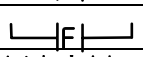
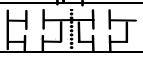
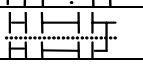
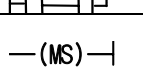
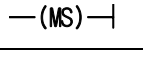
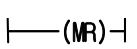
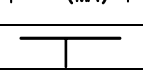
The ERROR mode occurs when the PLC finds an error after running the self-diagnosis routine. When an error occurs, the PROCESSOR decides whether the operation continues, and displays either STOP or RUN. The Error can be cleared by changing the power from Off to On, switching operation mode from STOP to RUN, or downloading programs after checking the error code and taking the appropriate measures

5

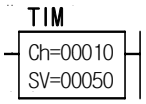
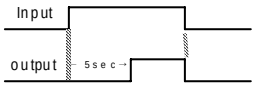
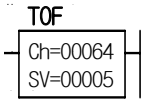
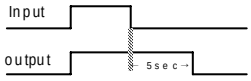
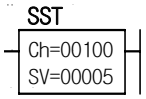
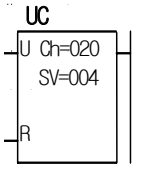
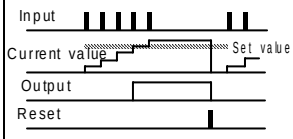
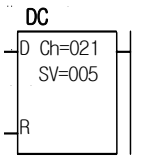
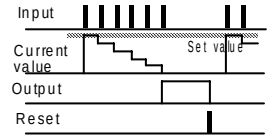
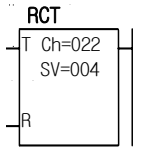
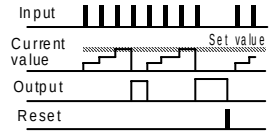
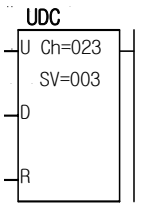
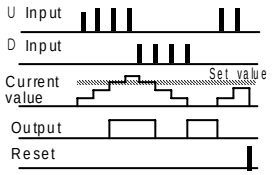
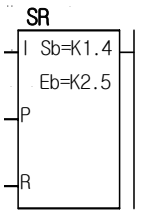
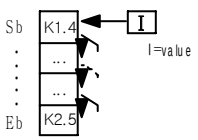
Programming Instructions

IMPORTANT Refer to the NX7/NX70 Instruction Set Reference Manual for detailed information on the NX7 and NX70 instruction set and for application examples to show the instruction set in use.

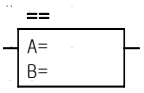
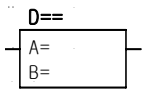
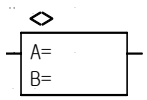
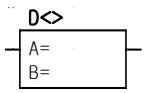
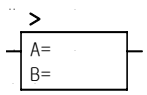
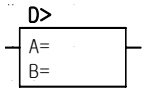
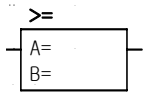
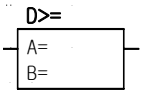
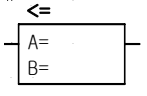
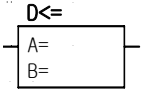
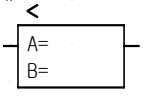
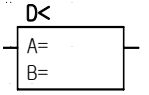
Basic Sequence Instructions

Mnemonic	Name	Ladder Symbol	Description
STR	Start		Starts contact A.
STN	Start Not		Starts contact B.
AND	And		Contact A series circuit
ANN	And Not		Contact B series circuit
OR	Or		Contact A parallel circuit
ORN	Or Not		Contact B parallel circuit
OUT	Out		Arithmetic result output
SET	Set		Sets output and retains On.
RST	Reset		Resets output and retains Off.
NOT	Not		Inverts circuit.
STR DIF	Start Differential		Starts rising edge contact  .
STR DFN	Start Dif. Not		Starts falling edge contact .
AND DIF	And Dif.		Rising edge series connection 
AND DFN	And Dif. Not		Falling edge series connection
OR DIF	Or Dif		Rising edge parallel connection 
OR DFN	Or Dif. Not		Falling edge parallel connection
ANB	And Block		Circuit blocks series connection.
ORB	Or Block		Circuit blocks parallel connection.
MS	Master block Set		Starts master block. (for processor version 2.0 or higher)
MR	Master block Reset		Ends master block. (for processor version 2.0 or higher)
MCS	Master Control Set		Starts circuit branch.
MCR	Master Control Reset		Ends circuit branch.
-	Extension		Extension (Used in pairs with AND condition when extending. Exclusive for WinGPC, GPC5, etc)

Timer, Counter and Shift Register Instructions

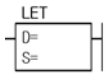
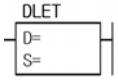
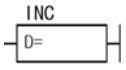
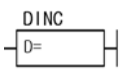
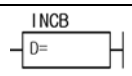
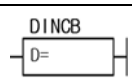
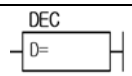
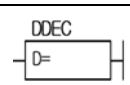
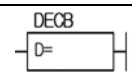
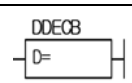
Mnemonic	Name	Ladder Symbol	Description	Remarks
TIM	On Delay Timer		Turns on after set delay time from input on 	Time base: Ch 0 to 63 = 0.01s Ch 64 to 255 = 0.1s Setting range: SV = 0 to 65535 Contact indicator: TC + channel number
TOF	Off Delay Timer		Turns off after set delay time from input off 	Time base: Ch 0 to 63 = 0.01s Ch 64 to 255 = 0.1s Setting range: SV = 0 to 65535 Contact indicator: TC + channel number
SST	Single Shot Timer		Turns off after set delay time from input on 	Time base: Ch 0 to 63 = 0.01s Ch 64 to 255 = 0.1s Setting range: SV = 0 to 65535 Contact indicator: TC + channel number
UC	Up Counter		Up counter 	Channel range: Ch 0 to 255 (Shared with timer) Setting range: SV = 0 to 65535 Contact indicator: TC + channel number
DC	Down Counter		Down counter 	Channel range: Ch 0 to 255 (Shared with timer) Setting range: SV = 0 to 65535 Contact indicator: TC + channel number
RCT	Ring Counter		Ring counter 	Channel range: Ch 0 to 255 (Shared with timer) Setting range: SV = 0 to 65535 Contact indicator: TC + channel number
UDC	Up-Down Counter		Up-Down counter 	Channel range: Ch 0 to 255 (Shared with timer) Setting range: SV = 0 to 65535 Contact indicator: TC + channel number
SR	Shift Register		Shift Register 	Usable address areas for Sb and Eb: M, K 1 bit shift on each p input. Stores the status value I in Sb for every P input. Max. number of instructions: 256

Comparison Instructions

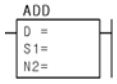
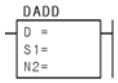
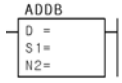
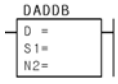
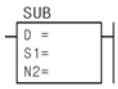
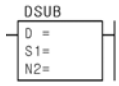
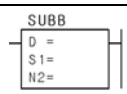
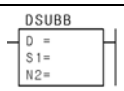
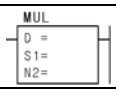
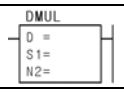
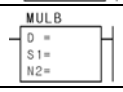
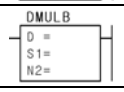
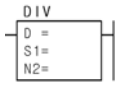
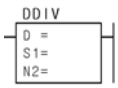
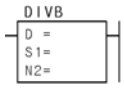
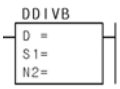
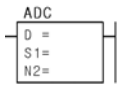
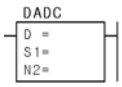
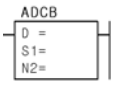
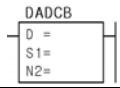
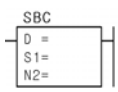
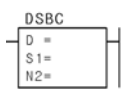
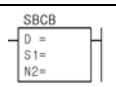
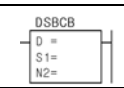
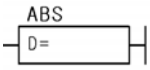
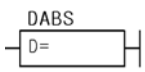
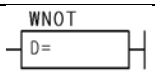
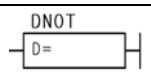
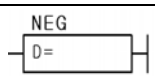
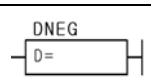
Mnemonic	Name	Word ladder symbol	Double word ladder symbol	Description
STR == AND == OR ==	START == AND == OR ==			On if A is equal to B. A and B are word/double word or data value.
STR <> AND <> OR <>	START <> AND <> OR <>			On if A is not equal to B. <> is same with ≠ . A and B are word/double word or data value
STR > AND > OR >	START > AND > OR >			On if A is greater than B.
STR >= AND >= OR >=	START >= AND >= OR >=			On if A is equal to or greater than B.
STR <= AND <= OR <=	START <= AND <= OR <=			On if A is equal to or less than B.
STR < AND < OR <	START < AND < OR <			On if A is less than B.

IMPORTANT For double word comparison instructions, the letter D should precede the word comparison instructions in the Mnemonic program.

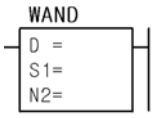
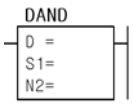
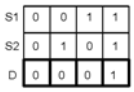
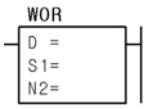
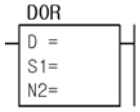
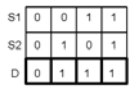
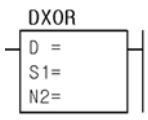
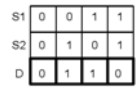
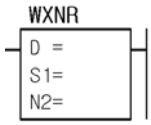
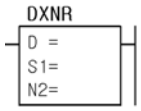
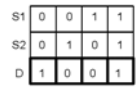
Substitution, Increment and Decrement Instructions

Mnemonic	Name	Word ladder symbol	Double word ladder symbol	Description
LET (DLET)	Let (Substitution)			Store the value of S into D.
INC (DINC)	Decimal increment			Increment D by 1 whenever input goes on.
INCB (DINCB)	BCD increment			Increment D by 1 in BCD mode whenever input goes on.
DEC (DDEC)	Decimal decrement			Decrement D by 1 whenever input goes on.
DECB (DDECB)	BCD decrement			Decrement D by 1 in BCD mode whenever input goes on.

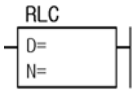
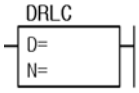
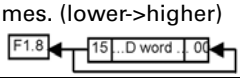
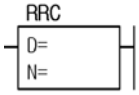
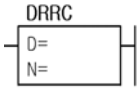
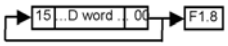
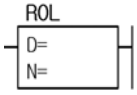
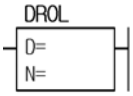
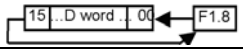
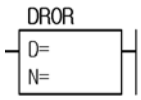
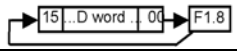
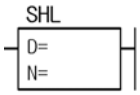
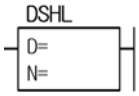
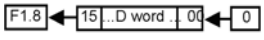
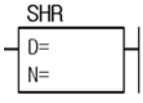
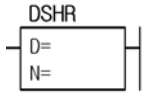
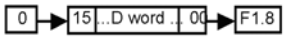
Arithmetic Instructions

Mnemonic	Name	Word ladder symbol	Double word ladder symbol	Description
ADD (DADD)	Decimal addition			D = S1 + S2 (Decimal operation)
ADDB (DADDB)	BCD addition			D = S1 + S2 (BCD operation)
SUB (DSUB)	Decimal subtraction			D = S1 - S2 (Decimal operation)
SUBB (DSUBB)	BCD subtraction			D = S1 - S2 (BCD operation)
MUL (DMUL)	Decimal multiplication			D = S1 x S2 (Decimal operation)
MULB (DMULB)	BCD multiplication			D = S1 x S2 (BCD operation)
DIV (DDIV)	Decimal division			D = S1/S2 (Decimal operation), Error when S2= 0
DIVB (DDIVB)	BCD division			D = S1/S2 (BCD operation) Error when S2 = 0
ADC (DADC)	Decimal addition with carry			D = S1 + S2 + CY (Decimal operation, include carry)
ADCB (DADCB)	BCD addition with carry			D = S1 + S2 + CY (BCD operation, include carry)
SBC (DSBC)	Decimal subtraction with carry			D = S1 - S2 – CY (Decimal operation, include carry)
SBCB (DSBCB)	BCD subtraction with carry			D = S1 - S2 - CY (BCD operation, include carry)
ABS (DABS)	Absolute value			D = |D| (Absolute value operation)
WNOT (DNOT)	NOT (1's complement)			Store 1's complement of D in D
NEG (DNEG)	Negative (2's complement)			Store 2's complement of D in D (1's complement + 1) (- Result)

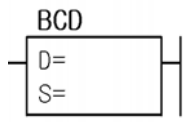
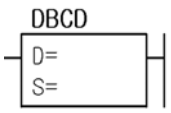
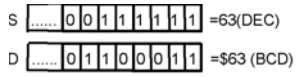
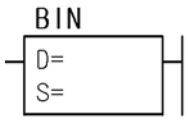
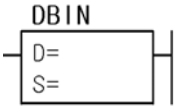
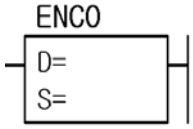
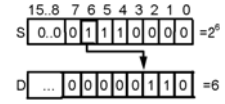
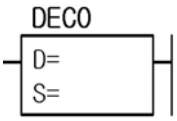
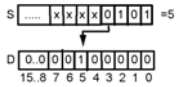
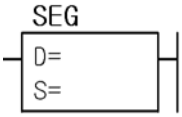
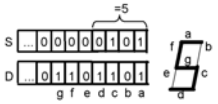
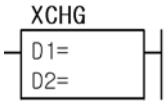
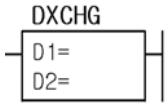
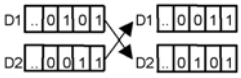
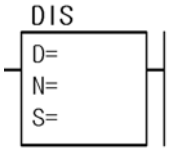
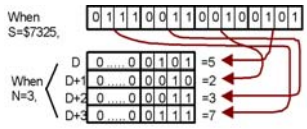
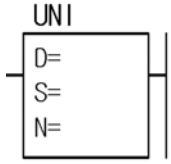
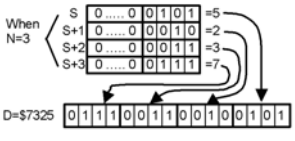
Logical Instructions

Mnemonic	Name	Word ladder symbol	Double word ladder symbol	Description
WAND (DAND)	AND (logical multiply)			Store AND of S1 and S2 in D 
WOR (DOR)	OR (logical sum)			Store OR of S1 and S2 in D 
WXOR (DXOR)	Exclusive OR (exclusive logical sum)			Store exclusive OR of S1 and S2 in D 
WXNR (DXNR)	Exclusive OR NOT (equivalence)			Store exclusive OR NOT of S1 and S2 in D 1 (ON if they are equal) 

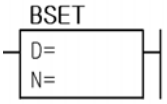
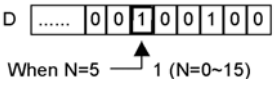
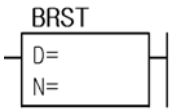
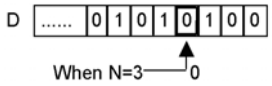
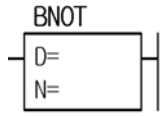
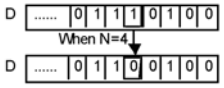
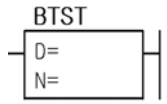
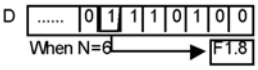
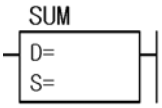
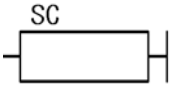
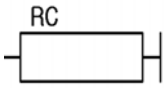
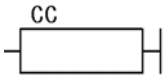
Rotation Instructions

Mnemonic	Instruction	Word ladder symbol	Double word ladder symbol	Description
RLC (DRLC)	Rotate left without carry			Rotate the content of D to the left N times. (lower->higher) 
RRC (DRRC)	Rotates right without carry			Rotate the content of D to the right N times (higher->lower) 
ROL (DROL)	Rotate left with carry			Rotate (shift) to the left N times (Input F1.8 value to the lowest bit) 
ROR (DROR)	Rotate right with carry			Rotate (shift) to the right N times (higher->lower) (Input F1.8 value to the highest bit) 
SHL (DSHL)	Shift left			Shift the content of D to the left N times (input 0 to the lowest bit) 
SHR (DSHR)	Shift right			Shift the content of D to the right N times (input 0 to the highest bit) 

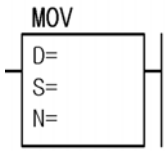
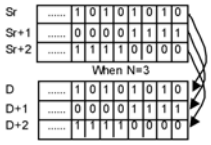
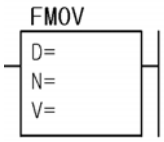
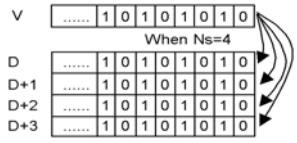
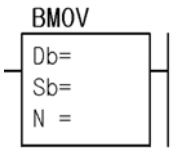
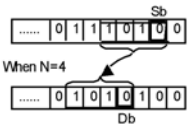
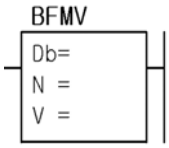
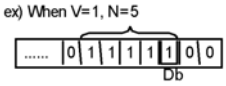
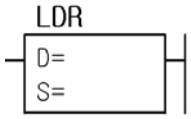
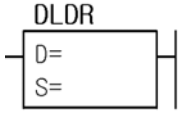
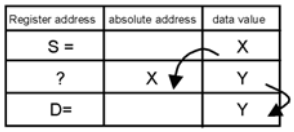
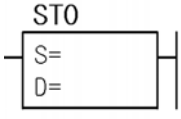
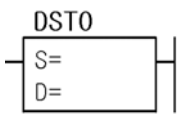
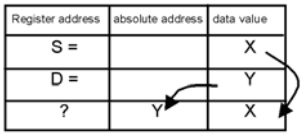
Word Conversion Instructions

Mnemonic	Name	Word ladder symbol	Double word ladder symbol	Description
BCD (DBCD)	BCD Conversion			Convert binary value of S to BCD and store it in D. 
BIN (DBIN)	Binary Conversion			Convert BCD of S to binary number and store it in D. 
ENCO	Encode		———	Store the location of the highest set bit in S in D. 
DECO	Decode		———	Convert the low-order 4-bit value of S to a power of 2 (2^S) and store it in D. 
SEG	7-Segment		———	Converts the low-order 4-bit value of S to 7-segment display pattern and store them in D. 
XCHG (DXCHG)	Exchange			Exchange D1 and D2 values. 
DIS	Dissemble		———	Separate S into N+1 units, 4 bits each, and store them in the low 4 bits of words starting at D. 
UNI	Unify		———	Combine the low 4 bits of S+1 words starting at S, and store them in D (N= 0 to 3). 

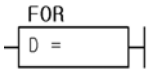
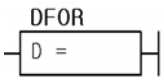
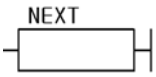
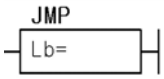
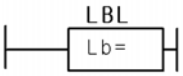
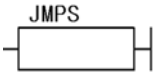
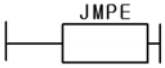
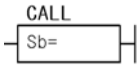
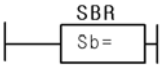
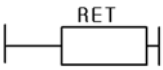
Bit Conversion Instructions

Mnemonic	Name	Word ladder symbol	Double word ladder symbol	Description
BSET	Bit Set		———	Set N^{th} bit of D to 1. 
BRST	Bit Reset		———	Reset N^{th} bit of D to 0. 
BNOT	Bit Not		———	Invert N^{th} bit of D. 
BTST	Bit Test		———	Store the value of N^{th} bit of D to F1.8. 
SUM	Sum		———	Store the number of bits in S that are 1 to D. 
SC	Set Carry		———	Set carry bit (F1.8) to 1. 
RC	Reset Carry		———	Reset carry bit (F1.8) to 0. 
CC	Complement Carry		———	Invert carry bit (F1.8). 

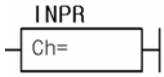
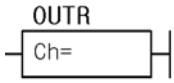
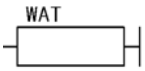
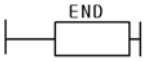
Move Instructions

Mnemonic	Name	Word ladder symbol	Double word ladder symbol	Description
MOV	Move		———	Copy Ns words from Sr to D. 
FMOV	Fill Move		———	Repeatedly copy the value V to the Ns words starting from D. 
BMOV	Bit Move		———	Move Ns bits from the bit address Sb to the bit address Db. 
BFMV	Bit Fill Move		———	Repeatedly copy the bit value V to the N bits staring from the bit address Db. (V=0, 1)(N=1…256) (Db is bit address) 
LDR (DLDR)	Load D ← (S)			Store to D the value of the register whose absolute address is the value of S. (Refer to the manual for information about absolute address.) 
STO (DSTO)	Store (D) ← S			Store the value of S to the register whose absolute address is the value of D. (Refer to the manual for information about absolute address.) 

Program Control Instructions

Mnemonic	Name	Word ladder symbol	Double word ladder symbol	Description
FOR (DFOR)	For Loop			Execute instructions in the block between FOR and corresponding NEXT. Repeat execution D times.
NEXT	Next		———	Decrement D of FOR instruction by 1. If it is not zero, repeat execution from FOR instruction.
JMP	Jump		———	Jump to the position marked LBL L (label number). (L: 0 to 63)
LBL	Label		———	Position jumped to by the corresponding JMP instruction. (L:0 to 63)
JMPS	Jump Start		———	Jump to the JMPE instruction.
JMPE	Jump End		———	Position jumped to by the corresponding JMPS instruction.
CALL	Call Subroutine		———	Call subroutine Sb. (Sb = 0 to 63)
SBR	Subroutine Start		———	Start subroutine Sb. (Sb = 0 to 63)
RET	Subroutine Return		———	End of subroutine. Return execution to the instruction after CALL.

System Control Instructions

Mnemonic	Name	Word ladder symbol	Double word ladder symbol	Description
INPR	Input Refresh		———	Refresh external input (Receive input signal during program execution). Ch is external input word address.
OUTR	Output Refresh		———	Refresh external output (Send output signal during program execution). Ch is external output word address.
WAT	Watchdog Timer		———	Clear watchdog scan time.
END	END		———	End of program. This instruction is automatically added by WinGPC.

6

Special Functions

High-Speed Counter Input Function

Overview

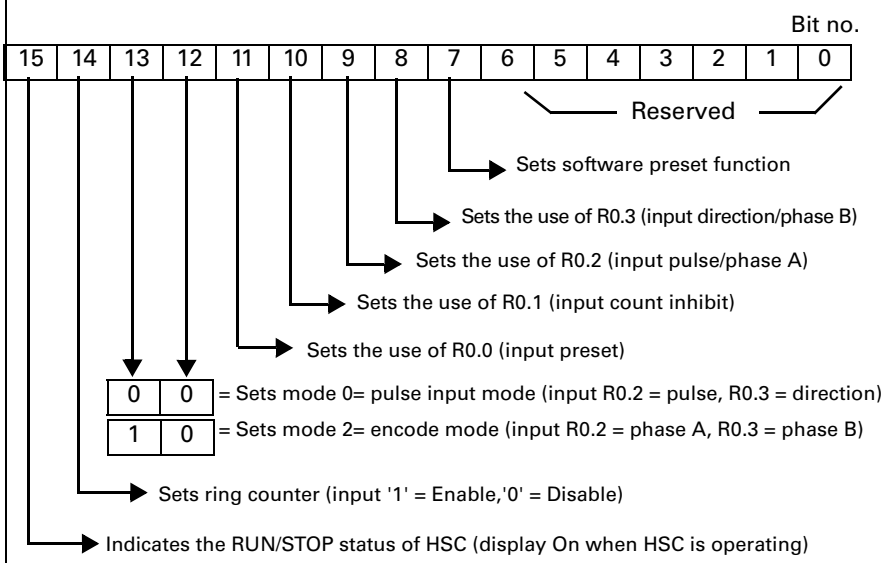
The High-speed counter (HSC) counts faster and shorter pulses than the speed frequency (scan time), with which the CPU uses to run programs, and for sequence and arithmetic operations. It is designed to use 'R0.0 to R0.3' for general contacts, as the internal bit setting points for the high-speed counter. Similar to contacts, the signal types that can be supported at the dc voltage range of 12V to 24V.

The HSC input allows you to count up to 8 kHz pulses in the single-phase pulse mode and do up to 4 kHz in encode mode. There are two types of high-speed counter input modes: pulse input mode and encode mode.

Input terminal

Address	Signal	Description
R0.0	HSC, Preset	Stores the preset value as the counter's present value. When the contact is on, the preset value is stored as the present value. (Operates only when R40.11 is set.)
R0.1	HSC, Inhibit	Inputs count inhibit (The counter stops when the contact is On.) (Operates only when R40.10 is set.)
R0.2	HSC, IN 0	When setting Mode 0, input counter pulse. When setting Mode 2, input encoder phase A.
R0.3	HSC, IN 1	When setting Mode 0, input counter direction. (Off = Increase, On = Decrease) When setting Mode 2, input encoder phase B.

High-speed counter registers

Address	Signal	Description
R40	High-speed counter mode setting	
R41	-	Reserved
R42	CH0 PV_LO	Stores the counter present value, low word (low 16 bits)
R43	CH0 PV_HI	Stores the counter present value, high word (high 16 bits)
R44	CH0 STR_LO	Stores the preset value (low word)
R45	CH0 STR_HI	Stores the preset value (high word)
R46 to 55	-	Reserved
R56	H0 SV_LO	Stores the set value (low word)
R57	H0 SV_HI	Stores the set value (high word)
R58	-	Reserved
R59	-	Reserved
R60	CH0 CATCH_LO	Stores the present value (low word) at the point of inputting the preset (H0 PV_LO)
R61	CH0 CATCH_HI	Stores the present value (high word) at the point of inputting the preset (H0 PV_HI)
R62 to 64	-	Reserved

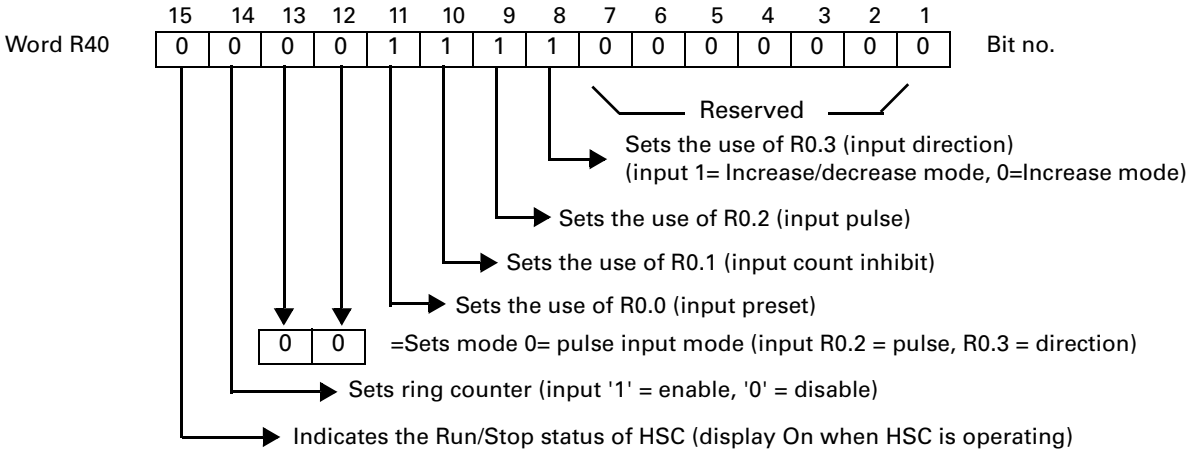
Address	Signal	Description
R65.0	HSC Enable	Sets the operation of high-speed counter ('1' = enable, '0' = disable)
R65.1	-	Reserved
R65.2	HSC Start	Sets the counting of counter ('1' = enable, '0' = disable)
R65.3	-	Reserved
R65.4 to 5	-	Reserved
R65.6	Ring Counter	Sets ring counter mode ('1' = enable, '0' = disable)
R65.7	-	Reserved

Pulse input mode (Mode 0)

The pulse input mode is executed by setting the contacts R40.13 and R40.12 to ‘0’. It counts input pulses that enter the R0.2 input terminal. The counter value increases when the R0.3 terminal signal that determines the direction is set to Off, and it decreases when the R0.3 terminal signal is set to On. If the bit of the direction setting input R40.8 is set to Off (set as '0'), then the count will always increase.

Address and setting for pulse input mode

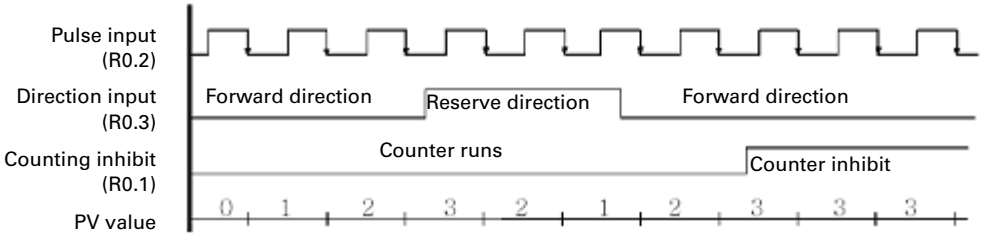
Address	Setting	Description
R65.0	1	Sets the operation of high-speed counter ('1' = enable, '0' = disable)
R65.2	1	Sets the counting of counter ('1' = enable, '0' = disable)



Address and setting for I/O

Address	Setting	Description
R0.0	1	Stores the preset as the counter’s present value (Operates at a rising edge)
R0.1	1	Inputs count inhibit (The counter stops when the contact is On.)
R0.2	1	When setting Mode 0 (pulse input mode), inputs counter pulse.
R0.3	1	When setting Mode 0 (pulse input), inputs counter direction (Off = Increase, On = Decrease)

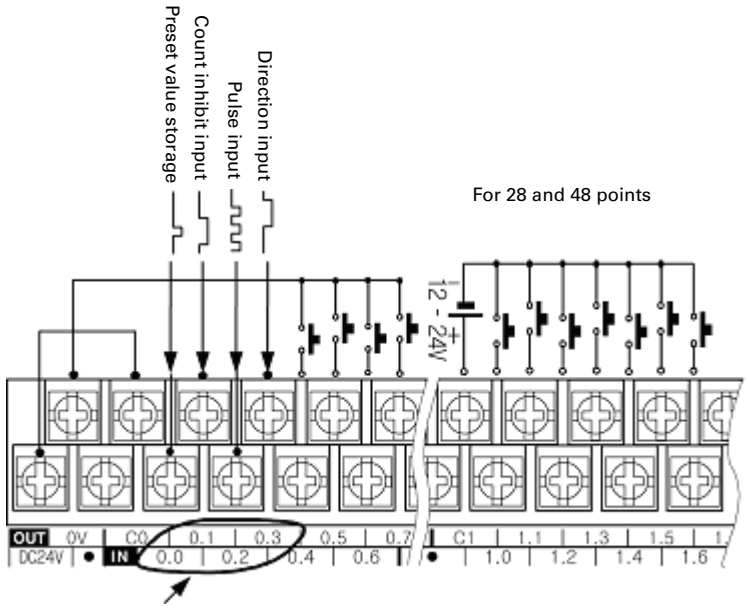
Counting graph in pulse input mode



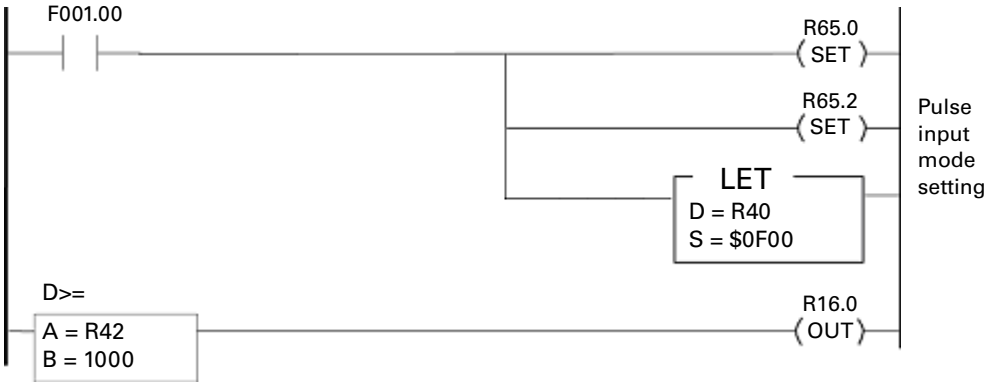
In the case of the pulse input mode, the HSC performs counting when a pulse is falling. The present value of the counter is scaled up when the direction input is Off, and is scaled down when the direction input is On.

When the counter inhibit input is set to On, the counter stops counting regardless of the direction.

Example of pulse input mode wiring



Program example of pulse input mode



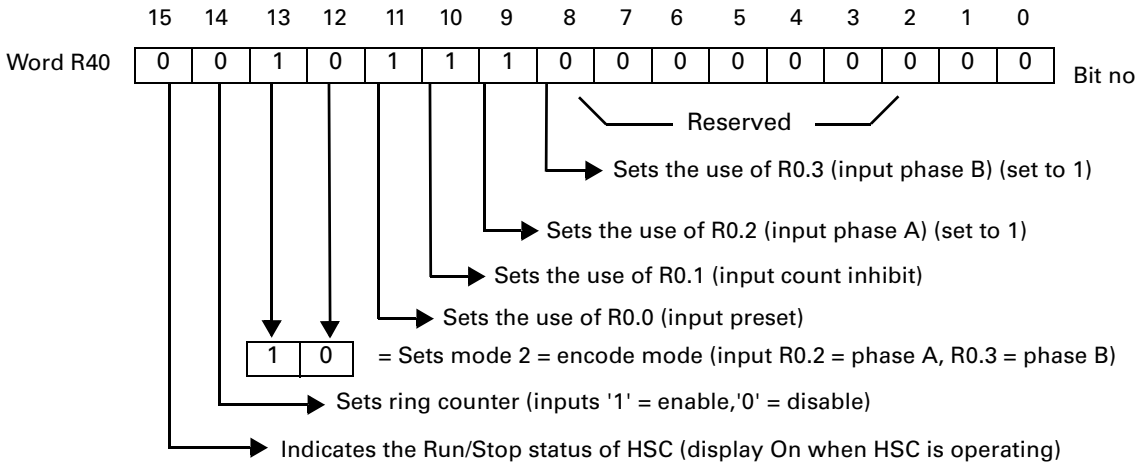
Example of the pulse value (R42) usage:
If the pulse value is grater than 1,000, the output R16.0 is set to On.

Encode mode (Mode 2)

This mode processes phase A and phase B. There is a 90° angle difference between the phase A and B. When the phase A is set to On and the phase B is input, the count value increases. This value decreases when the phase A is input after phase B is set to On.

Address and setting for encode mode

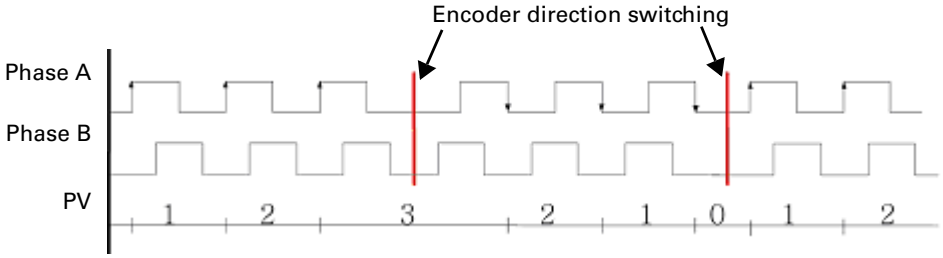
Address	Setting	Description
R65.0	1	Sets the operation of high-speed counter ('1' = enable, '0' = disable)
R65.2	1	Sets the counting of counter ('1' = enable, '0' = disable)



Address and setting for I/O

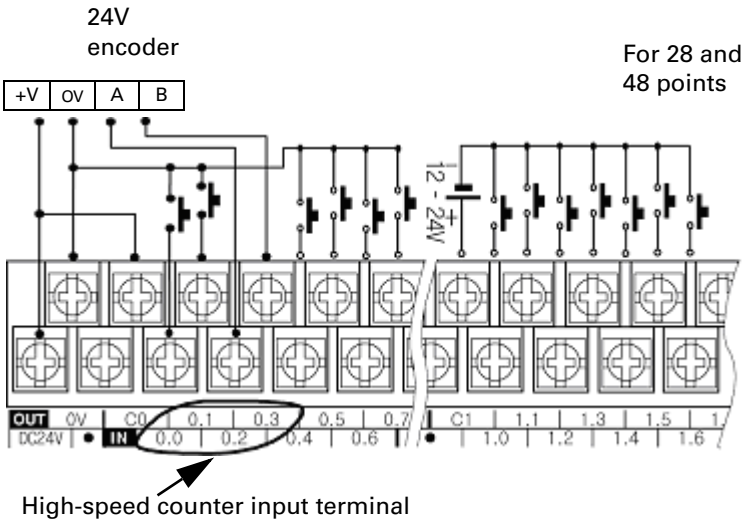
Address	Setting	Description
R0.0	1	Stores the preset value as the present value.
R0.1	1	Inputs count inhibit (The counter stops when the contact is On.)
R0.2	1	In encode mode, inputs phase A input terminal
R0.3	1	In encode mode, inputs phase B input terminal

Counting graph in encode mode (two-phase input)

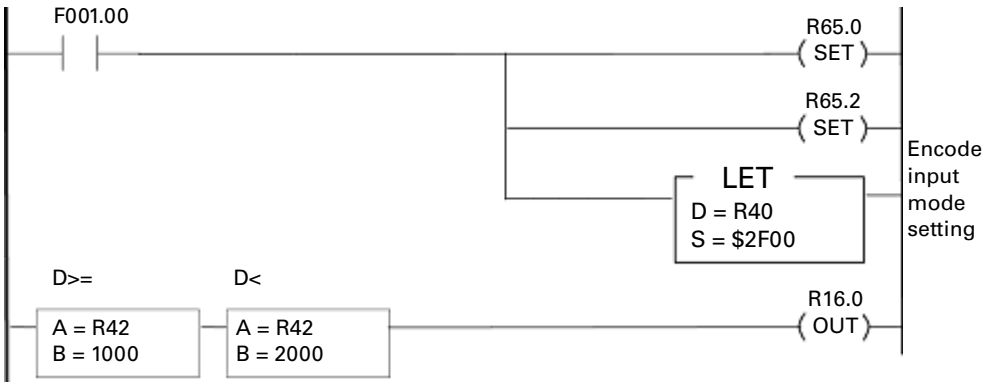


The present value of the counter is going up when the phase angle of phase A is followed by that of phase B, while B is going down, and when phase B is followed by phase A. Essentially, when the phase A value is input first, the count increases as the phase A value rises (incremental edge), but when the phase A value is input later, the count decreases as the phase A value falls (decremented edge).

Example of encode mode wiring



Program example of encode input mode



Example of the pulse value (R42) usage:
If the pulse value is between 1,000 and 2,000, the output R16.0 is set to On.

Input Pulse Catch Function

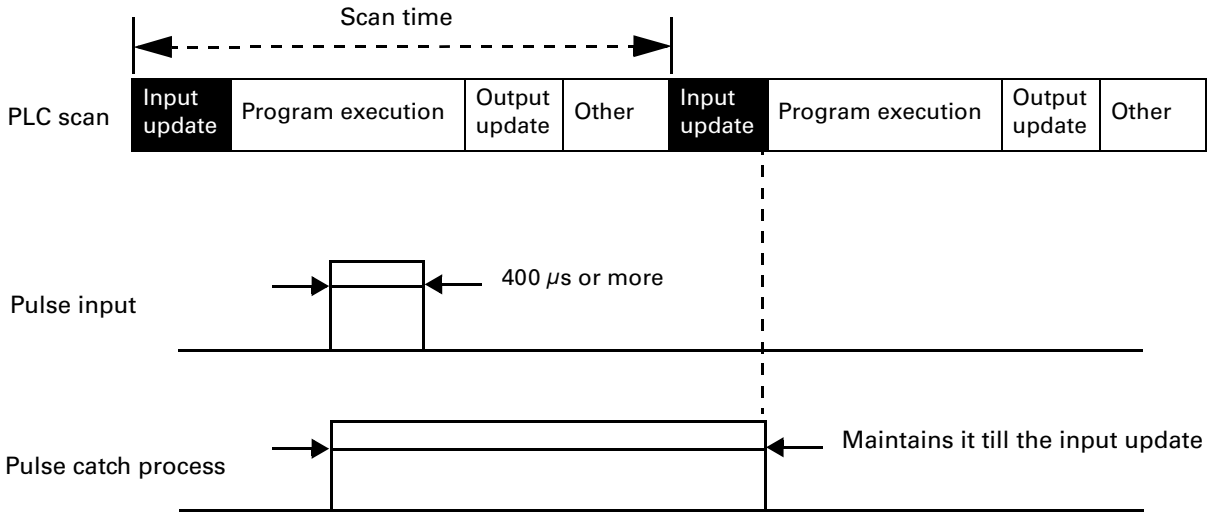
Overview

Four input contacts (R0.0, R0.1, R0.4, and R0.5) have a pulse catch function, which maintains the On status until the scan is completed, even when a shorter pulse than the scan time is input. This function allows these contacts to process the high-speed pulses, which are shorter than the scan time, and without the additional cost.

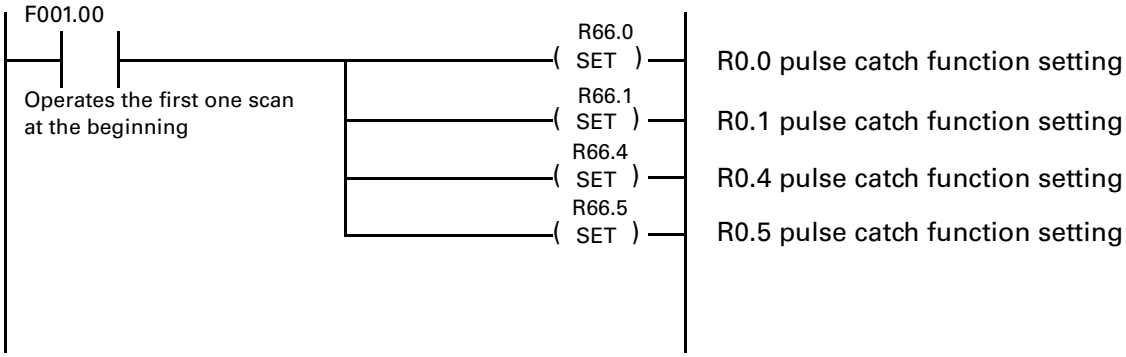
Address settings

Address	Signal	Description
R66.0	P_CATCH_0	Sets the use of R0.0 pulse catch function ('1' = enable, '0' = disable)
R66.1	P_CATCH_1	Sets the use of R0.1 pulse catch function ('1' = enable, '0' = disable)
R66.4	P_CATCH_4	Sets the use of R0.4 pulse catch function ('1' = enable, '0' = disable)
R66.5	P_CATCH_5	Sets the use of R0.5 pulse catch function ('1' = enable, '0' = disable)

Time chart



Program example of pulse catch function



Pulse Output Function (Available only for TR Output Models)

Overview of Pulse Output

Pulse output function is used to control servo or stepping motors by outputting consistent pulses that are faster than the speed (scan time) that CPU processes a program. This function is available only for TR Output models, and can be executed by setting internal data from R16.0 to R16.3 used for general contact output. Signals use DC 12V to 24V as output along with TR output contacts and in some cases, you can adjust load voltage/current by connecting registance according to output load.

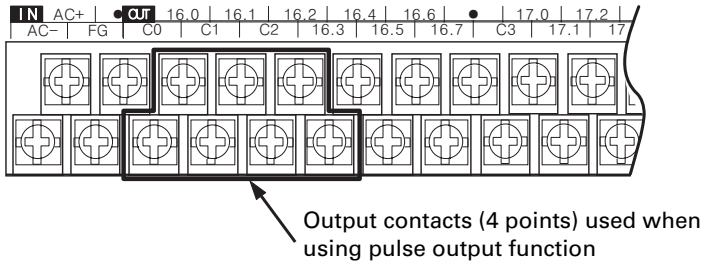
Output frequency standard of pulse output supports 10 KHz when using 1 channel only and 5 KHz when using 2 channels (PTO: 1 CH 10 KHz, 2 CH 5 KHz / PWM: 1,2 CH 5 KHz). You choose from PWM output and Pulse output modes, and for ROM version 2.20 or higher of CPU, 32 bit PTO function (Pulse Train Output: enables smooth and precise control by gradually increasing or decreasing frequency) is supported in Pulse output mode.

Terminal for Pulse Output

Terminal for pulse output supports two channels. It is designed to use R16.0 contact (pulse output) and R16.2 contact (direction discrimination) for CHO, R64.0 (determining whether to use pulse function) and R64.2 (transmitting pulse output) for internal contact, and R16.1 contact (pulse output), R16.3 contact (direction discrimination), R64.1 (determining whether to use pulse function) and R64.3 (transmitting pulse output) for CH1. Detailed functions are described in the table below.

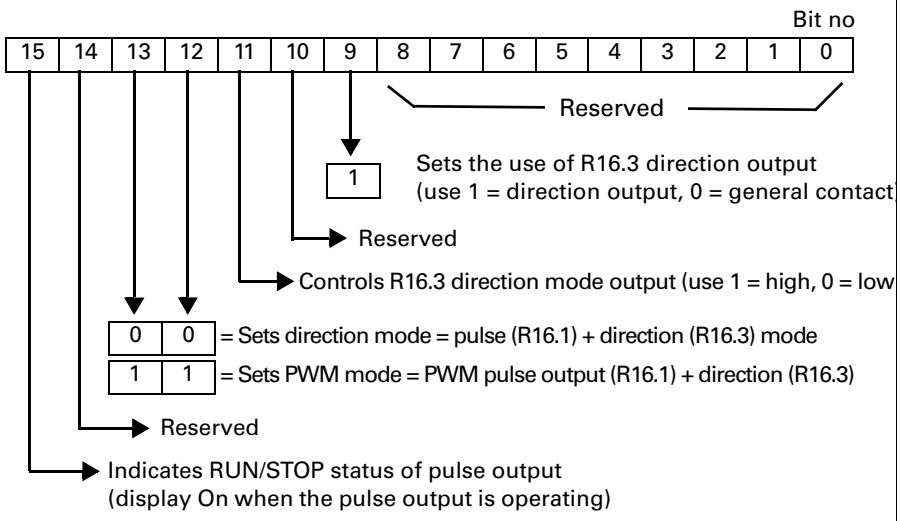
Address	Signal	Description
R16.0	CH0_PLS	Pulse output signal at channel 0
R16.1	CH1_PLS	Pulse output signal at channel 1
R16.2	CH0_DIR	Direction output signal at channel 0 (available when R80.9 contact is '1')
R16.3	CH1_DIR6623q	Direction output signal at channel 1 (available when R90.9 contact is '1')
R64.0	PLS 0_EN	Determining whether to use pulse output (CH0) function (1 = for pulse, 0 = for contact)
R64.1	PLS 1_EN	Determining whether to use pulse output (CH1) function (1 = for pulse, 0 = for contact)
R64.2	PULSE_CH0_START	Determining whether to start pulse output at channel 0 (1=START, 0=STOP)
R64.3	PULSE_CH1_START	Determining whether to start pulse output at channel 1 (1=START, 0=STOP)

Contact for Pulse Output



Setting Register for Pulse Output

Address	Signal	Description
R80	Pulse output: Channel 0 Mode setting	Pulse Output Channel 0, Control Register Bit no: 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 Reserved 1 = Sets the use of R16.2 direction output (use 1 = direction output, 0 = general contact) Reserved Controls R16.2 direction mode output (use 1 = high, 0 = low) 0 0 = Sets direction mode = pulse (R16.0 + direction (R16.2) mode 1 1 = Sets PWM mode = PWM pulse output (R16.0) + direction (R16.2) Reserved Indicates RUN/STOP status of pulse output (display On when the pulse output is operating)
R81	CH0 FREQ.	Frequency Value of Pulse Output – Single phase (using 1 channel): 10 KHz, Double phase (using 2 channels): 5 KHz (for ROM Ver. 2.10 or lower, both single phase and double phase support 5 KHz)
R82 (to R83)	CH0 DUTY or CH0 SV (number of pulses)	Set Duty Ratio of pulse output or the number of output pulses (32 bit) – In case of PWM Mode: Duty Ratio (25% to 75%) – In case of Pulse + Dir: Number of output pulses (Max. 65535 for ROM Ver. 2.10 or lower)
R84 (to R85)	CH0 PV	Display the number of output pulse at Channel 0 (32 bit) (16 bit value for ROM Ver. 2.10 or lower. Max. 65535)
R86	Start Frequency at CH0	Area to set Start/Stop Frequency at Pulse Out PTO mode (setting at higher than 40)
R87	Number of Rising Pulses at CH0	Area to set the number of rising pulses at pulse output PTO mode
R88	Number of Falling Pulses at CH0	Area to set the number of falling pulses at pulse output PTO mode
R89	Reservation	Reserved

R90	Pulse Output Channel 1 Mode Setting	Pulse Output Channel 1, Control Register 
R91	CH1 FREQ.	Frequency Value of Pulse Output – Single phase (using 1 channel): 10 KHz, Double phase (using 2 channels): 5 KHz (for ROM Ver. 2.10 or lower, both single phase and double phase support 5 KHz)
R92 (to R93)	CH1 DUTY or CH1 SV (number of pulse)	Set Duty Ratio of pulse output or the number of output pulses (32 bit) – In case of PWM Mode: Duty Ratio (25% to 75%) – In case of Pulse + Dir: Number of output pulses (Max. 65535 for ROM Ver. 2.10 or lower)
R94 (to R95)	CH1 PV	Display the number of output pulses at Channel 1 (32 bit) (16 bit value for ROM Ver. 2.10 or lower. Max. 65535)
R96	CH1 Start Frequency	Area to set Start/Stop Frequency at Pulse Output PTO mode (setting at 40 or higher)
R97	CH1 Number of Rising Pulses	Area to set the number of rising pulses at Pulse Output PTO mode
R98	CH1 Number of Falling Pulses	Area to set the number of falling pulses at Pulse Output PTO mode
R99	Reservation	Reserved

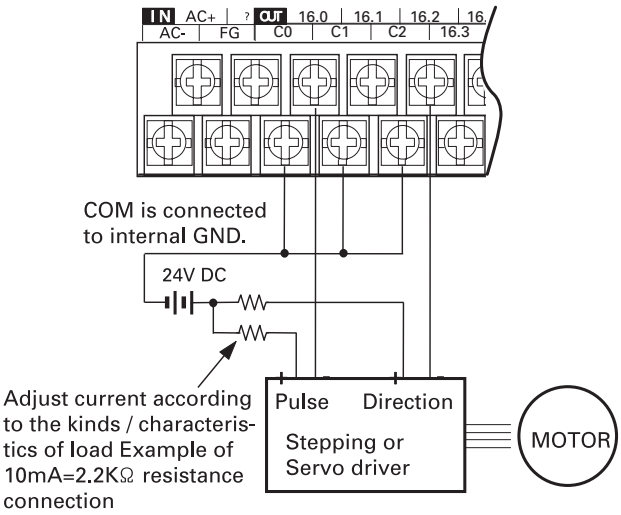
NOTE For ROM Version 2.10 or lower of CPU, address changes as shown below:

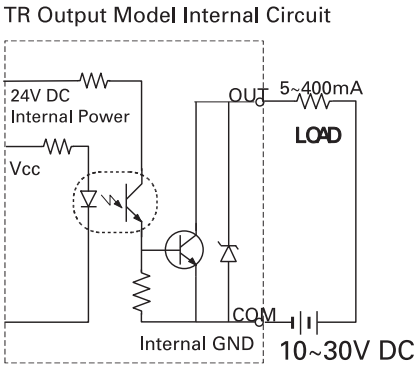
– For Pulse output at CH0, you must change from R80 to R32, R81 to R33, R82 to R34 and R84 to R35.

– For Pulse output at CH1, you must change from R90 to R36, R91 to R37, R92 to R38 and R94 to R39

Example of Pulse Output Wire

<Example of CH0 Wire>



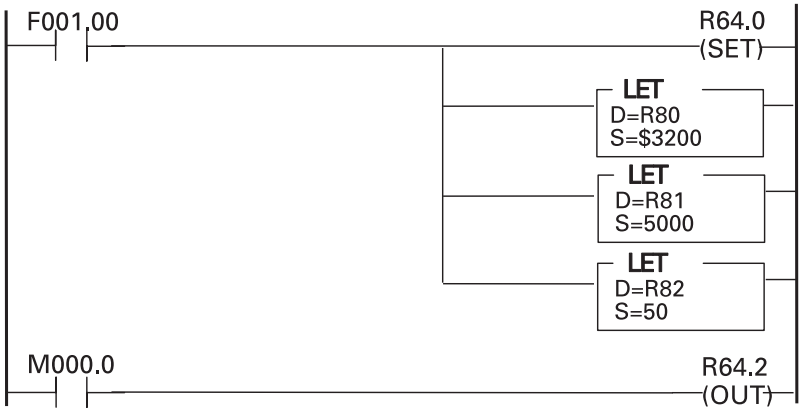


Example of Use of PWM (Pulse-width Modulation) Mode

PWM mode of pulse output is a function for adjusting and controlling the width of pulse by using frequency and duty ratio. This mode enables you to control the On/Off ratio of pulse and to output inverter speed command circuit.

It sends output pulse based on the order and method below:

- Set output mode data, frequency and duty ratio.
  Example) In case of channel 0, PWM mode, 5 KHz, 50% duty ratio
  - P0 Mode Setting (R80)= $3200 (0011 0010 0000 0000)
  - P0 Frequency Setting (R81)= 5000
  - P0 Duty Setting (R82)= 50
- Set R64.0 at SET ('1') to output pulse at channel 0.
- Set R64.2 at output (OUT) to output pulse at channel 0.
  => After setting as shown above, turn M000.0 on to output the PWM signal of 5 KHz and 50% duty ratio at channel 0 terminal.



Pulse Output (PTO Output) Mode

Pulse output mode is a function of outputting up to the number of pulses set by certain frequency. The ON/OFF ratio (duty = 50%) is identical for the widths of pulses, and the number of output pulses can be set within 32 bits. As output frequency is maximum of 10 KHz (5 KHz when using double phase) when using it for high speed rotations, you can run it by adjusting the ratio of electronic gear of servo driver.

PTO of pulse output is a function of adjusting output frequency linearly when starting and stopping pulse output, enabling smooth running and stopping.

Output frequency of pulse output supports 10 KHz when using 1 channel (single phrase) and 5 KHz when using 2 channels (double phase), and PTO function is supported for ROM Version 2.20 or higher.

In PTO function, the number of rising/falling pulses cannot exceed 50% of the total pulses. As the number of rising/falling pulses is added or subtracted by an integer in calculation, rising/falling might be output within the range smaller than the specified number of pulses.

Pulse is output at specified frequency by turning on or off the contacts (R64.2, R64.3) that control output, and the process and completion can be checked by using output pulse values (R84, R94).

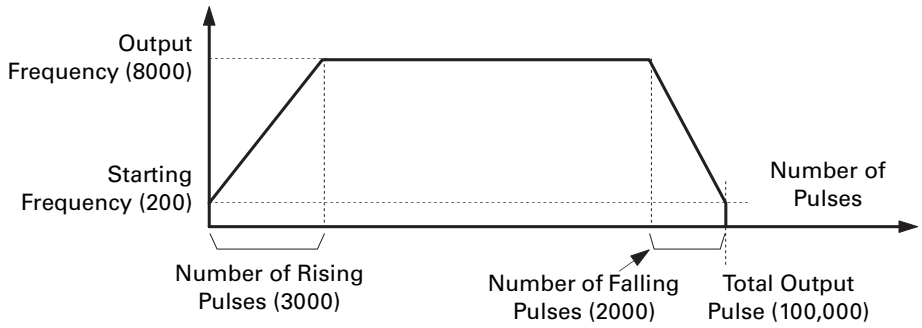
Example of Use of Pulse Output (PTO output)

When applying PTO function, you must set mode setting address R80 at $0A00 (Pulse + Direction mode), output frequency R81 at 8000 (8000Hz), the number of pulses R82 at 100,000, starting frequency R86 at 200, the number of rising pulses R87 at 3000 and the number of falling pulses R88 at 2000.

When R64.2 contact is turned on, pulse will be output.

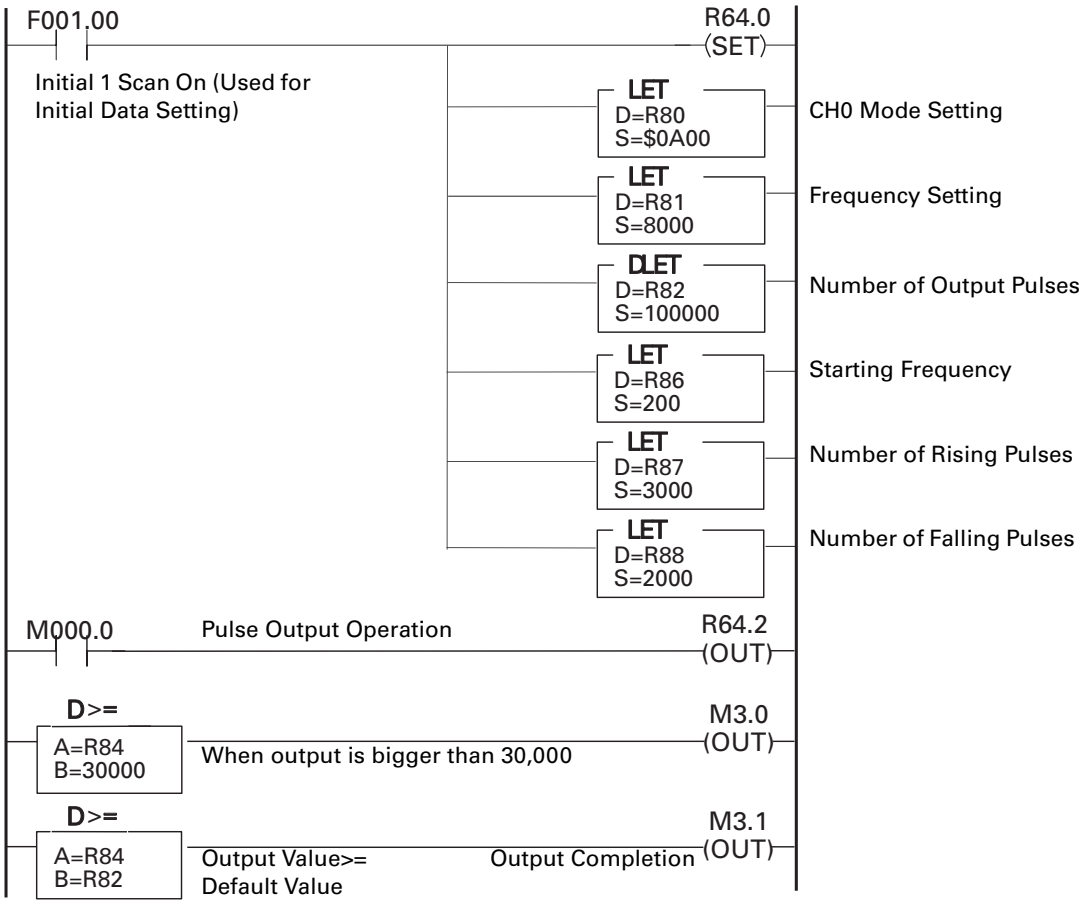
In order to check the pulse being output, you can use the value of output pulse number (R84).

However, the numbers of rising and falling pulses are automatically adjusted for integer calculation.



Example of Programming

This is an example of programming the above-mentioned PTO use.



User Defined Communication Function

Overview of User Defined Communication

User defined communication allows users to change communication protocol to ladder program through COM2 port of PLC. With this function you can communicate with other types of PLC or control device, and can connect to devices equipped with RS232C or RS485 communication port such as bar code, measuring instrument and temperature controller.

This function allows you to send or receive certain communication data (ASCII or HEX binary) to or from external devices through communication port 2, and can be operated by using special contact and special word register.

Transmission Process

- You must register information on ASCII, HEX or byte length (parity, 7/8 bit) to F11 special contact register by referring to characteristics of the device to which you want to connect.
- After making sure the system is in the process of transmitting data by checking F11.00 special contact, if the transmission is completed ('0'), store the data to send to transmission register SR298 within 36 words, 36 word and input the byte length of the data into SR370 register.
- After all the processes stated above are completed, you must conduct transmission requests by setting F11.00 transmission request special contact.
- After the system completes transmission, F11.00 contact turns to '0'.
  Status information such as errors that occurred during transmission is reported through F11.1.

Reception Process

- You must register information on ASCII, HEX or byte length (parity, 7/8 bit) to F11 special contact register by referring to characteristics of the device to which you want to connect.
- You must register that Port 2 operates at user defined communications mode by setting F12.8 special contact.

- After making sure that data reception from outside is completed by checking F11.04 contact (“1” means completion of data reception), if data reception is completed, you must receive data from SR334 register by using SR371 register (store the information on byte length of received data).
- After data recpetion is completed, you must notify the system in order to receive new data by setting F11.05.
- Information on errors that occurred during reception is displayed at F11.06, F11.07.

Reception Register Scope SR334 to SR369

Communication Mode

In user defined communication, you can choose from ASCII and HEX Binary modes for transmitting and receiving data, and can change the mode.

- ASCII Data Transmission/Reception
  - In case of ASCII format (reset F11.13 contact), HEX data written at transmission register SR298 is converted into ASCII format and sent outside. In this case, twice as much data as user-defined transmission length is transmitted.
  - You can convert received data into HEX or ASCII Code and store them to reception register by using F11.08 special contact during reception.
  - In this mode, you can use conditions for starting code and ending code.
  - When not using ending code condition, you must set the length of data to receive in advance after data was transmitted. After receiving data from external device as long as user defined, the system sets reception completion contact.
  - If more data is not received within 100 ms after receiving 1 byte, the system displays reception error.
- HEX Binary Data Transmission/Reception
  - In case of HEX (Set F11.13), user defined data is transmitted to external device. (In this mode, F11.08 function is not supported).
  - During HEX Binary communication, CRC-16 code is supported to check errors. You can use this by setting F11.15 special contact.
  - In this mode, in order to receive data from external device, users must set the expected length of data to receive in advance.

Related Special Word

Special Word	Description	Remarks
SR298 to SR333	User Transmission Data Area	36 words
SR334 to SR369	User Data Reception Area	36 words
SR370	Transmitted Data Length	Byte Length of Data to Transmit
SR371	Received Data Length	Information on Byte Length of Received Data
SR372	Starting Code Storage Area	It is set as word area. In practice, however, only lower Bytes are used.
SR373	Ending Code Storage Area	

Related Special Contact

Special Contact	Function	Remarks
F12.02	Whether or not to use COM1 Port Modbus communication	'1': Use Modbus communication
F12.08	Whether or not to use COM2 user defined communication	'1': User defined mode
F12.09	Whether or not to use COM2 Port Modbus communication	'1': Use Modbus communication

Special Contact for COM2 Port User Defined Communication

Special Contact	Function	Remarks
F11.00	Request User Data Transmission	1: Transmission Request
F11.01	Report Transmission Failure	1: Display Transmission Failure
F11.02	Use Starting Code Condition in ASCII communication Mode	1: Use Starting Code
F11.03	Use Ending Code Condition in ASCII communication Mode	1: Use Ending Code
F11.04	User Data Reception Completed	1: Display Reception Completed
F11.05	Initialize Reception Memory (After reading received data, set at '1')	1:Initialize Reception Memory
F11.06	Received Data Duplicated	1: Received Data Duplicated
F11.07	Received Data Error	1: An Error Occurred
F11.08	Display in ASCII data format during ASCII data reception	1: Renew ASCII Data
F11.09	Ignore when an error occurs during data reception	1: Ignore Errors
F11.10	Whether or not to operate Parity	1: Use Parity Conditon
F11.11	Define ODD/EVEN Parity	0: ODD, 1: EVEN
F11.12	Set 7 or 8 Bit Communication Mode	0: 8 bits, 1: 7 bits
F11.13	Specify Communication Data Format of Port 2	0: ASCII, 1: HEX
F11.14	Reserved	
F11.15	Whether or not to apply CRC-16 calculation (Automatic Insert)	1: Apply CRC-16 Calculation

Modbus Communication Function

Overview of Modbus Communication

Modbus communication converts communication port of PLC into Modbus communication mode, and for version 2.0 or higher, both COM1 and COM2 ports support Modbus function.

Protocol supports Modbus RTU and with simple setting of internal special contact, it can be converted into Modbus communication mode. If you convert port to Modbus while communicating with WinGPC, communication is blocked and a communication error message displays on PC because existing NX7 protocols are not supported during operation. This contact is maintained even when CPU is not running, and if you turn off the power and then on, the contact will be restored. When you convert port into Modbus through ladder program, you can stop CPU and turn on the power to communicate through NX7 protocol.

Related Special Contact

Special Contact	Function	Remarks
F12.02	Whether or not to use COM1 Port Modbus communication	'1': Use ModBUS communication
F12.09	Whether or not to use COM2 Port Modbus communication	'1': Use ModBUS communication

Example of COM2 Port Use)

Supported Function Code

Function codes supported in Modbus communication are 01, 02, 03, 04, 05, 06, 07, 0F, 10, 11, etc.

Bit Data Table (Example)

Function Code 01, 02, 05, 0F commands operate in the same way in system.

PLC Bit Address			Modbus Address		Remarks
Type	In/Out	Bits	Input	Output	
R	R000.00 to R127.15	2048	100001 to 102048	000001 to 002048	External Relay Contact
L	L000.00 to L063.15	1024	102049 to 103072	002049 to 003072	Link Data Contact
M	M000.00 to M127.15	2048	103073 to 105120	003073 to 005120	Internal Relay Contact
K	K000.00 to K127.15	2048	105121 to 107168	005121 to 007168	Interruption Holding Contact
F	F000.00 to F015.15	256	107169 to 107424	007169 to 007424	Special Relay Contact
TC	TC000 to TC255	256	107425 to 107680	007425 to 007680	Timer/Counter Contact

Register Data Table (Example)

Function Code 03, 04, 06, 16, commands operate in the same way in system.

PLC Bit Address			Modbus Address		Remarks
Type	In/Out	Words	Input	Output	
R	R000 to R127.15	128	300001 to 300128	400001 to 400128	External Relay Contact
L	L000 to L063	64	300129 to 300192	400129 to 400192	Link Data Contact
M	M000 to M127	128	300193 to 300320	400193 to 400320	Internal Relay Contact
K	K000 to K127.15	128	300321 to 300448	400321 to 400448	Interruption Holding Contact
F	F000 to F015.15	16	300449 to 300464	400449 to 400464	Special Relay Contact
TC	TC000 to TC255	16	300465 to 300480	400465 to 400480	Timer/Counter Contact
W	W0000 to W2047	2048	300513 to 302560	400563 to 402560	Word Register
SV	SV000 to SV255	256	302561 to 302816	402561 to 402816	Timer/Counter Setting value
PV	PV000 to PV255	256	302817 to 303072	402817 to 403072	Current Timer/Counter value
SR	SR000 to SR511	512	303073 to 303584	403073 to 403584	System Register

You may not be allowed to access addresses of all the areas at NX PLC at general Modbus Protocol.

In other words, it might be supported only for those areas accessible from Master.

Manual Setting of Communication Speed

Automatic Sensing of Communication Speed

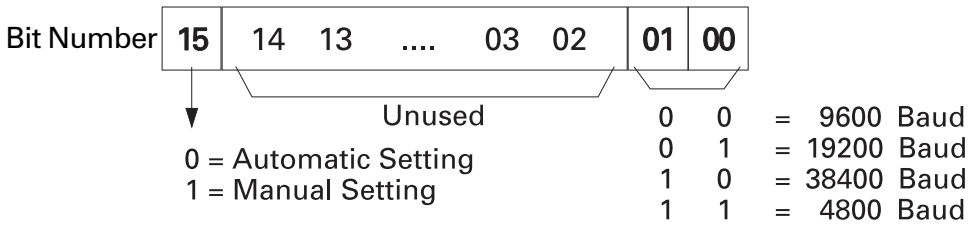
Communication speed of NX7/NX7S is adjusted by automatically sensing the communication speed requested by Master such as PC. As several communication queries are required in order to sense communication speed, data might be requested three or four times.

Manual Setting of Communication Speed

If you set communication speed manually, communication data of the set speed is only sensed, enabling swift adjustment of speed and stable operation when connecting to other devices.

This manual setting is supported for CPU ROM version 2.20 or higher. Setting areas by port are as follows.

- Manual Setting of COM1 Port Communication Speed: SR509 Word
- Manual Setting of COM2 Port Communication Speed: SR510 Word



- Manual setting can be done by designating with Ladder program or by setting Data.

Example of Use

Example of setting COM1 Port communication speed at 9600 bps

Example of setting COM2 Port communication speed at 38400 bps

Analog Input/Output Function

Overview

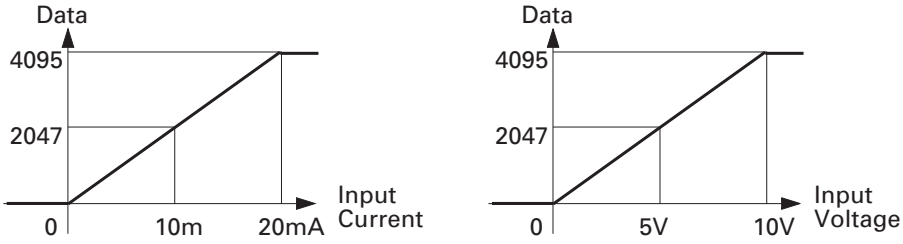
Four Input channels and two Output channels are embedded into analog models of NX7, and both Input and Output are designed for combined use of voltage and current.

For Input, you must select either voltage or current at each channel to use while Output is designed to use both voltage and current at the same time at each channel.

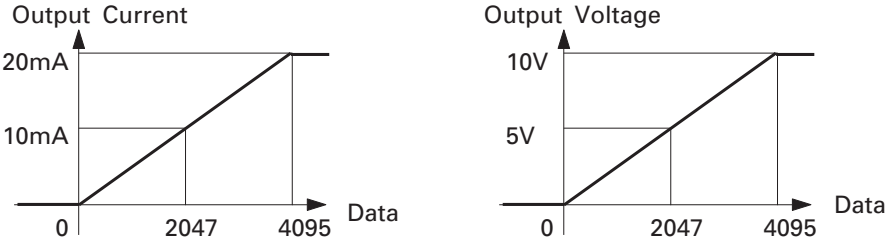
Analog Input/Output Address

For analog Input/Output Address, one word (Input=Ch0(R4), Ch1(R5), Ch2(R6), Ch3(R7), Output=Ch0(R20), Ch1(R21), etc.) is allocated to each channel and the addresses cannot be changed.

Input Range and Converted Data

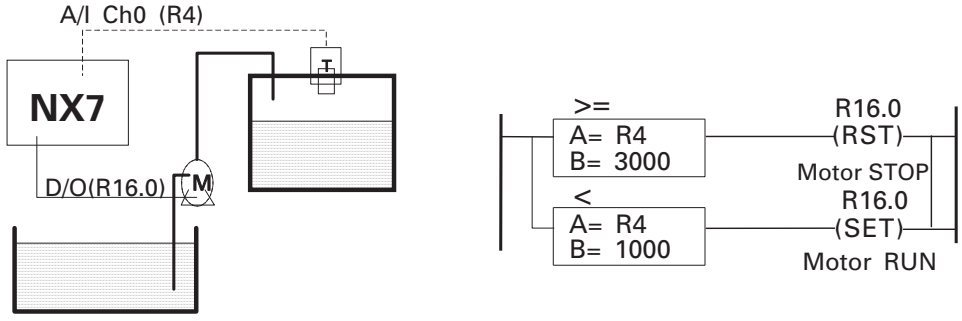


Output Range and Converted Data



Example of Use

Motor ON/OFF Controlling by Using Level at A/I Ch0



NX7 and NX7s Series Controller

OE MAX Controls

www.oemax.com

Publication NX7-UM001E-EN-P-November 2007