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NT21, NT31, and NT631 Series

Programmable Terminals

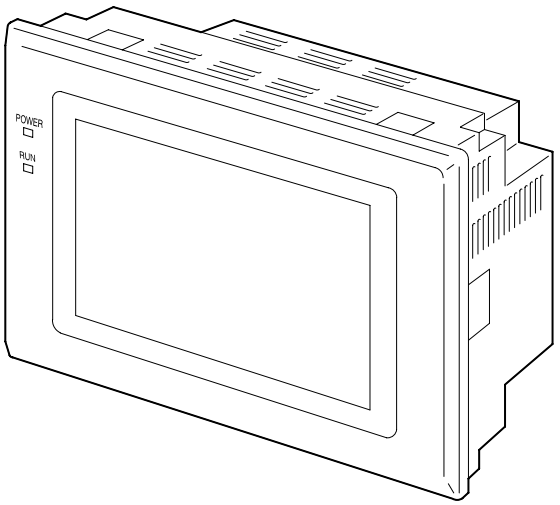
Reference Manual

OMRON

NT21, NT31, and NT631 Series Programmable Terminals

Reference Manual

Revised February 2008



Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

⚠ DANGER Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Additionally, there may be severe property damage.

⚠ WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.

⚠ Caution Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

All OMRON products are capitalized in this manual. The word “Unit” is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation “Ch,” which appears in some displays and on some OMRON products, often means “word” and is abbreviated “Wd” in documentation in this sense.

The abbreviation “PC” means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1, 2, 3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

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About this Manual:

This manual describes the basic functions and operation procedures of the NT-series NT21, NT31, NT31C, NT631, and NT631C Programmable Terminals, their operations when connected to a PC (Programmable Controller) or other host, and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to install and operate the Programmable Terminal.

Section 1 describes the functions of the PT.

Section 2 gives basic information on the method for connecting to the host and communication methods, and describes the names and functions of the parts of the PT.

Section 3 how to use the functions provided by the PT.

Section 4 gives an overview of memory link operations and contains explanations centered on communications between the PT and host when using memory link.

Section 5 presents a collection of simple practical examples that will give you hints on how to make best use of the functions of the PT.

Section 6 describes the action to take when PT errors occur.

The ***Appendices*** provide the specifications, compatibility with screen data of other PT models, NT30/620 emulation mode, PC memory maps, and keycode tables.

⚠WARNING Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

Related Manuals:

Related manuals are listed below.

The □ symbol at the end of the catalog number is the revision number.

Connecting and Setting Up the Programmable Terminal

- NT21 PT Setup Manual (V068-E1-□)
- NT31 and NT31C PT Setup Manual (V062-E1-□)
- NT631 and NT631C PT Setup Manual (V063-E1-□)

These manuals are used separately for the different models of PT. They describe connecting the Programmable Terminals to a host and peripheral devices and settings required for communications and applications.

The functions and actual operating messages for the NT21, NT31, NT31C, NT631, and NT631C PTs are provided in the *Reference Manual* (V069-E1-□).

Programmable Terminal Functions and Operation

- NT21, NT31, and NT631 Series PT Reference Manual (V069-E1-□, this manual)

This manual is used for any of the following PTs: NT21, NT31, NT31C, NT631, and NT631C. It describes screen configurations, part functions, host control methods, and other application information.

PT connection and setup procedures are described in the *NT21 PT Setup Manual* (V068-E1-□), *NT31 and NT31C PT Setup Manual* (V062-E1-□), and the *NT631 and NT631C PT Setup Manual* (V063-E1-□).

Creating and Transferring Screen Data, and Installing the System Program

- NT-series Support Tool for Windows Ver. 4.□ Operation Manual (V061-E1-□)

The screens displayed on the NT21, NT31, NT31C, NT631, and NT631C PTs are created with the Support Tool and transferred to the PT. This manual describes how to create and transfer screen data. It also describes how to download a system program to a PT using the System Installer.

The NT-series Support Tool for Windows is normally referred to as merely the Support Tool.

Connecting to Controllers Not Made by OMRON

- PC Connection Manual (V042-E1-□)

The NT31, NT31C, NT631, and NT631C PTs can be connected to controllers in the following series: Mitsubishi's A Series and FX Series. This manual describes the connection and setup methods for these controllers.

The NT-series Support Tool for Windows Version 4.□ is required to connect the NT31, NT31C, NT631, and NT631C PTs to Mitsubishi controllers.

- NT31/NT631 Multivendor Connection Manual (V060-E1-□)

The NT31 and NT31C PTs can be connected to controllers in the following series: Allen-Bradley SLC 500 Series, GE Fanuc 90-20 and 90-30 Series, and Siemens S7-300 and S7-400 Series. This manual describes the connection and setup methods for these controllers.

Read and Understand this Manual

Please read and understand this manual before using the product. Please consult your OMRON representative if you have any questions or comments.

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

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OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this manual.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

Disclaimers

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

PERFORMANCE DATA

Performance data given in this manual is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

ERRORS AND OMISSIONS

The information in this manual has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

PRECAUTIONS

This section provides general precautions for using the Programmable Terminal.

The information contained in this section is important for the safe and reliable application of the Programmable Terminal. You must read this section and understand the information contained before attempting to set up or operate a Programmable Terminal.

1 Intended Audience xvi
2 General Precautions xvi
3 Safety Precautions xvi

1 Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of introducing FA systems into production facilities.
- Personnel in charge of designing FA systems.
- Personnel in charge of installing and connecting FA systems.
- Personnel in charge of managing FA systems and facilities.

2 General Precautions

The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions that are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

This manual provides information for using the Programmable Terminal. Be sure to read this manual before attempting to use the software and keep this manual close at hand for reference during operation.

⚠ WARNING It is extremely important that Programmable Terminals and related devices be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying Programmable Terminals to the above-mentioned applications.

⚠ WARNING Do not use input functions such as PT touch switches for applications where danger to human life or serious damage is possible, or for emergency switch applications.

3 Safety Precautions

Read these safety precautions carefully and make sure you understand them before using the Programmable Terminal so that you can use it safely and correctly.

Safety Conventions and their Meanings

This operation manual uses the following conventions and symbols to indicate cautions, warnings, and dangers in order to ensure safe use of the NT21. The cautions, warnings, and dangers shown here contain important information related to safety. The instructions in these cautions, warnings, and dangers must be observed.

The conventions used and their meanings are presented below.

⚠ WARNING Indicates information that, if not heeded, could possibly result in loss of life or serious injury.

Caution Indicates information that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

⚠ WARNING

Do not attempt to take the Unit apart and do not touch any internal parts while the power is being supplied. Doing either of these may result in electrical shock.

SECTION 1
General

This section provides fundamental information about the functions and features of the PTs, types of connection, communication methods, etc. This information will enable you to understand the applications of the PTs.

1-1 Role and Operation of the PT 2
1-1-1 Operation of a PT at an FA Production Site 2
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1-6 Before Operating 37

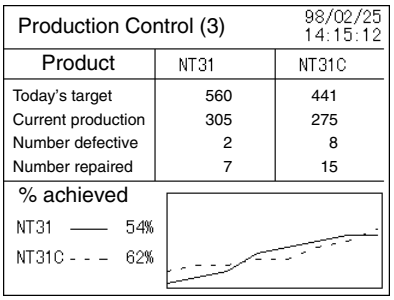
1-1 Role and Operation of the PT

The NT21, NT31, NT31C, NT631, and NT631C are sophisticated operator interfaces (Programmable Terminals) that automatically display information and can also be used for operations when necessary. The following gives a general description of the role and operation of the PT for those using a Programmable Terminal (PT) for the first time.

1-1-1 Operation of a PT at an FA Production Site

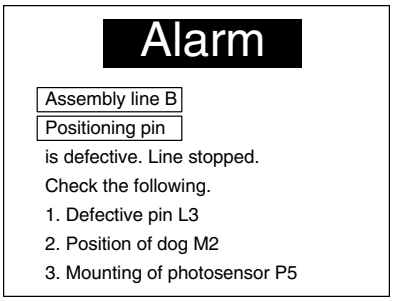
Production Line Status Monitoring

The PT displays real-time information about the system and equipment operating status, etc. Its power of expression is enhanced by graphs and other visuals, making the displays easy to understand.



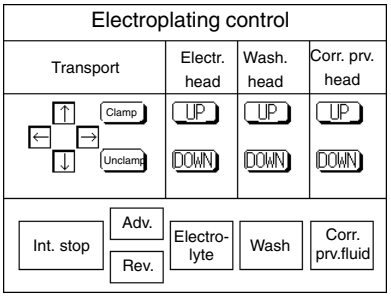
Directions to Workers on the Shop Floor

The PT warns of system or equipment failures and prompts the appropriate remedial action.



Panel Switch Functions

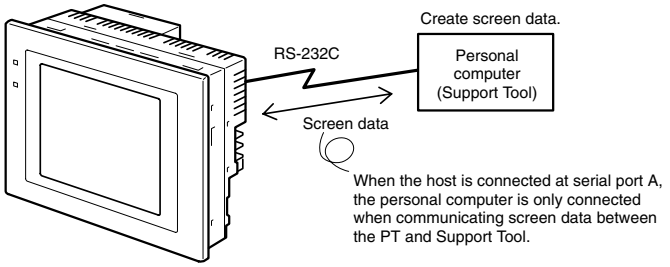
Setting touch switches on the PT allows workers to use the PT as an operating panel; the results of the operations are transmitted to the host.



1-1-2 Operations of the PT

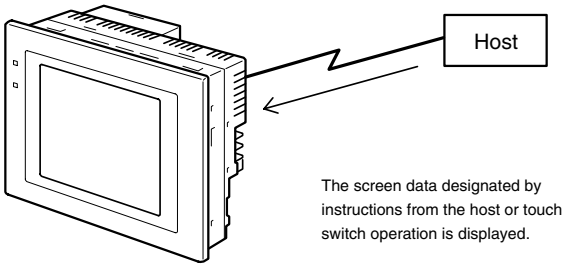
Transferring Screen Data

The screen data to be displayed on the PT can be created on a personal computer using the Support Tool. Connect the PT to the personal computer with an RS-232C cable and transfer the screen data to the PT.



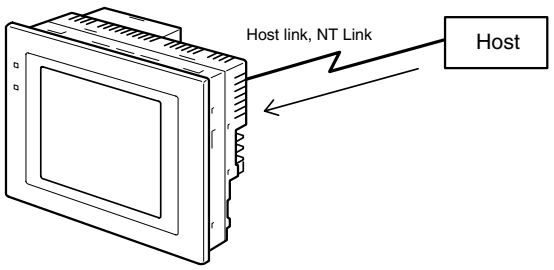
Displays Screens

The information to be displayed (screen data) can be created on a computer using the Support Tool and stored in the PT. The screen data can be displayed on the PT in response to instructions from the host or touch switch operation.



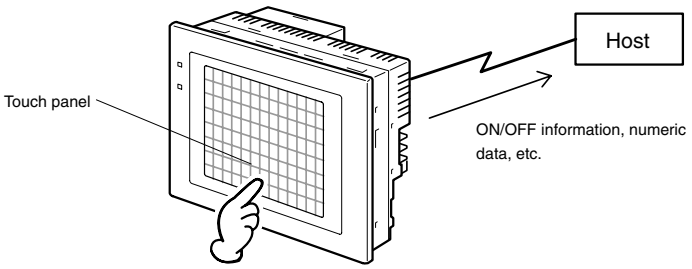
Receives Data from a Host

The PT can be connected to the host by a host link or NT Link and receive necessary data from the host.



Sends Data to a Host

Data input using the touch panel (switch ON/OFF statuses, numeric values, character strings) can be transmitted to the host.



1-2 Functions of the NT21, NT31/NT31C and NT631/NT631C

The NT21, NT31/NT31C and NT631/NT631C have the following features.

1-2-1 Features

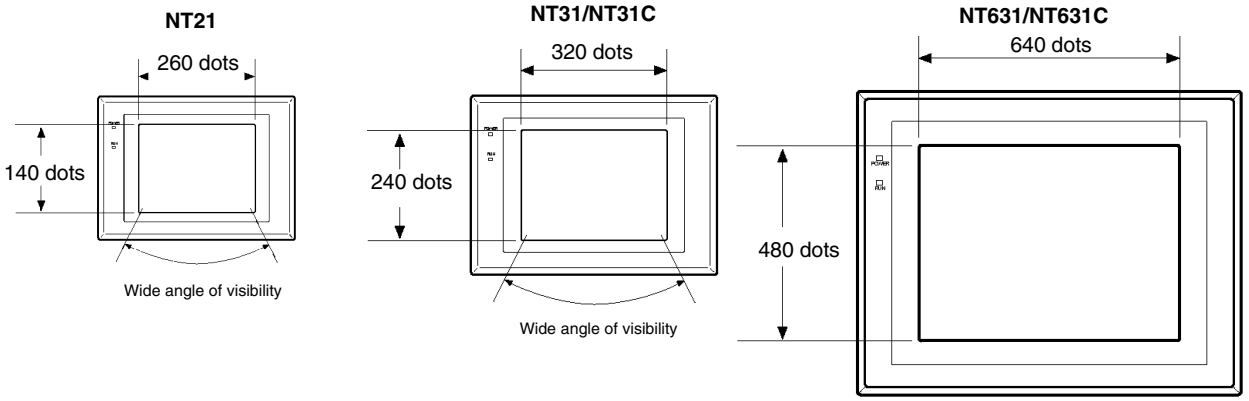
Slim Construction

- The PT is slimmer but retains the same functions. The depth is 50 mm max. when mounted in a panel with the recommended thickness (1.6 to 4.8 mm.)
- The communication cable connectors are housed in the unit so that they do not protrude from the unit.

Ideal Construction for an FA Environment

- NT21-ST121□-E: STN monochrome LCD with backlight
- NT31-ST123□-EV3: STN monochrome LCD with backlight
- NT31C-ST143□-EV3: STN color LCD with backlight
- NT631-ST211□-EV2: High-contrast EL display
- NT631C-ST141□-EV2: STN color LCD with backlight
- NT631C-ST153□-EV3: TFT color bright LCD with backlight
- The backlight unit and battery can be replaced onsite. (The backlight on the NT21 cannot be replaced.)
- Degree of protection equivalent to IP65F with oil resistance (See note.), water resistance equivalent to NEMA4

Note The panel can not be used in some IP65F environments requiring long-term exposure to oil.



Panel Contrast and Brightness Adjustment

On the NT31, NT31C, and NT631C, the contrast and brightness are adjustable by touch switch operations. (These features are not supported on NT631 models and NT631C-ST153□-EV3.) On the NT21, the contrast is adjustable by switch operations on the back panel.

Compatibility with Other PTs

- There is upward compatibility between the following models for screen data and user programs: NT20S, NT30, NT30C, NT600S, NT21, NT31, NT31C NT610G, NT610C, NT620S, NT620C, NT625C, NT631, NT631C. (After being read to the Support Tool, screens must be modified in accordance with the screen size. Depending on the function used, partial modification of programs may also be necessary. For details, refer to *Appendix B Compatibility with Screen Data of Other PT Models* (page 435) and the *Support Tool Operation Manual*.)
- The panel cut-out dimensions for the NT21 are the same as the dimensions for the NT20S, the panel cut-out dimensions for the NT31/NT31C are the same as the dimensions for the NT30/NT30C, and the panel cut-out dimensions for the NT631/NT631C are the same as the dimensions for the NT625C.

Two Ports Featured as Standard:
Port A for Common Use by Support Tool/Host and Port B for Exclusive Use by the Host

- Communication with the host is possible via another port while connected to the Support Tool.
- Reading bar code data from a bar code reader is possible via another port while communicating with the host.

Rapid System Program & Screen Data Changes Possible Using a Memory Unit.

- Installing a Memory Unit (NT-MF261) on the rear of the NT21, NT31/NT31C or NT631/NT631C makes it easy to write screen data into the PT onsite. This enables a rapid response to setup changes.
- The NT21, NT31/NT31C, and NT631/NT631C can store a system program into a Memory Unit. This enables the system to handle more flexible setups.

Screen Data Check Function

Screen data can be checked simply by operations in the NT21, NT31/NT31C, or NT631/NT631C system menu, without connecting up to the Support Tool.

Increased Screen Data Capacity (NT21 and NT31/NT31C)

The NT21 data capacity of 512 Kbytes is over five times that of the NT20S and the NT31/31C data capacity of 1 MB is twice that of the NT30/NT30C, enabling storage of a larger quantity of screen data.

Large Increase in Maximum Number of Registered Elements

The number of elements that can be registered on one screen has been considerably increased, making it possible to create more expressive screens. For details, refer to *Display Restrictions* (page 431).

Binary Data can be Read to/Written from the Host

It is now possible to write binary data stored in words at the host directly to the PT. This makes data conversion by a program at the host unnecessary, reducing the load on the host.

Character Display Using High Definition Fonts

Any ×4 characters are displayed with a 32-dot high-definition font.

Simple Upgrades

By using the system installer supplied with the ZJCAT1-EV4.6 Support Tool, the system program at the NT21, NT31/NT31C or NT631/NT631C can be changed easily from a personal computer.

Complies with International Standards

The PTs meet UL/CSA standards and EC Directives.

Compatible with Other Vendors' Devices (NT31/NT31C and NT631/NT631C)

Compatible with the Mitsubishi A Series (Calculator Link) and FX Series (Programming Console), Allen-Bradley SLC 500 Series, GE Fanuc 90-20 and 90-30 Series, and Siemens S7-300 and S7-400 Series, Modicon TSX Series, Sequencers. Specialized system programs can be installed that allow the NT31/NT31C or NT631/NT631C to be controlled from other companies' Sequencers. (The NT21 does not support PCs made by other companies.)

Multiple Windows

Up to 3 windows can be displayed simultaneously in the normal display. A 9-word window control area has been allocated in the host; the contents of these 9 words can be changed from the Host to open, close, and move windows.

High-speed 1:N NT Link

The V3 versions are compatible with the high-speed 1:N NT Link as well as the earlier standard 1:N NT Link.

Additional Mathematical Functions

Operands (values referenced by equations) can be registered to allow the PT to perform calculations automatically and write the results of those calculations to numeral memory table entries or words in the host.

Device Monitor Function

The new device monitor function can be used to change the PC's operating mode or display/change values in the PC's memory areas. The PVs of several words can be listed with the device monitor.

Interlock Function

PT operations and inputs can be disabled from the PC if interlock bits have been allocated in the PC for the corresponding PT touch switches, numeric inputs, or string inputs.

Improved Lamp/Touch Switch Guide Characters

The following displays can be performed with lamp or touch switch guide characters:

- Display several lines of guide characters.
- Switch the display between different guide characters when OFF and ON.
- Display numeral memory table contents as guide characters.
- Display string memory table contents as guide characters.

NT30/NT30C, and NT620S/NT620C/NT625C Compatible

The word configuration of the PT status control area and PT status notify area can be set to emulate those of the NT20S, NT30/NT30C, or NT620S/NT620C/NT625C; this mode is called NT20S or NT30/620 compatible mode.

When the PT is operating in a compatible mode, it will be equivalent to an NT20S, NT30/NT30C, or NT620S/NT620C/NT625C in the functions listed below. The PT retains full V2, V3 functionality in all functions other than the ones listed below. Refer to *Appendix C NT20S and NT30/620 Compatible Modes* for more details.

- Word configuration and functions of the PT status control area and PT status notify area
- Image/library codes
- Insertion of image/library data into character strings

Additional CS/CJ-series PC Data Areas Accessible

Data areas in CS/CJ-series PCs that were previously inaccessible can be accessed.

All banks in the EM Area, Timer Completion Flags (TU), Counter Completion Flags (CU), Work Area (WR), Task Flags (TK), and the HR Area.

Recipe Function

You can set the data (numeric values) for multiple words in record units using the tabular elements on the PT screen, and write these settings in a single operation to words on the host (i.e., PC or PT memory) using a touch switch operation on the PT Unit. Also, multiple words of numeric data can be read from the host in one operation. In this way, groups of parameter settings can be edited at the PT Unit, and written to or read from the host.

Adjusting Contrast and Brightness During PT Operation

You can display the brightness and contrast adjustment screen using either the touch switch or commands from the host, even while the PT is in operation.

1-2-2 Comparison between NT21, NT31, NT31C, NT631, and NT631C

NT21

The NT21 models are shown in the following table.

Item	NT21
Models	NT21-ST121-E (Beige) NT21-ST121B-E (Black)
Display	STN monochrome LCD (with white backlight)

NT31/NT31C

Two models are available: the monochrome NT31 and the 8-color NT31C. The differences between the NT31 and NT31C are shown in the following table.

Item	NT31	NT31C
Front panel color	NT31-ST123-EV3 (Beige) NT31-ST123B-EV3 (Black)	NT31C-ST143-EV3 (Beige) NT31C-ST143B-EV3 (Black)
Display	STN monochrome LCD (with white backlight)	STN color LCD (with white backlight)

NT631/NT631C

Two models are available: the NT631 has a monochrome (yellow EL) display and the NT631C has an 8-color display. The differences between the NT631 and NT631C are shown in the following table.

Item	NT631-ST211□-EV2	NT631C-ST141□-EV2	NT631C-ST153□-EV3
Front panel color	NT631-ST211-EV2 (Beige) NT631-ST211B-EV2 (Black)	NT631C-ST141-EV2 (Beige) NT631C-ST141B-EV2 (Black)	NT631C-ST153-EV3 (Beige) NT631C-ST153B-EV3 (Black)
Display	Monochrome EL display	STN color LCD (with white backlight)	Bright TFT color LCD (with white backlight)

1-2-3 Comparisons with Earlier Models

Comparison between NT20S and NT21

Item	NT20S	NT21
NT Support Tool used	NT-ZJCAT1-EV4 or NT-ZA3AT-EV2	NT-ZJCAT1-EV4
Effective display area	112 x 56 mm (horizontal x vertical)	117 x 63 mm (horizontal x vertical)
Screen dots (resolution)	256 x 128 dots (horizontal x vertical)	260 x 140 dots (horizontal x vertical)
Number of touch switches	12 x 6 (horizontal x vertical)	13 x 7 (horizontal x vertical)
DIP switch settings	On rear of Unit	None (software settings)
Use of Memory Unit	Not possible	Possible (transferring system program data and screen data)
RS-232C interface	Connector (9-pin) also used as port for screen data transfer.	- Serial port A connector (also used for screen data transfer, 9-pin) - Serial port B connector (for host communications only, 9-pin)
Backlight life expectancy	10,000 hours min.	50,000 hours min.
Replacement Backlight	NT20S-CFL01	Replacement not possible
Battery backup	None	Possible*1 (numeral table, string table, history data, recipe data)
System program data	Installed in PT (not replaceable)	The system installer and system program data are supplied with the NT Support Tool.
1:N NT Links	Standard only	Standard or high-speed
Memory Link	Not possible*2	Possible
Number of user-registered screens	Maximum of 500	Maximum of 3,999
Screen data capacity*3 (User program memory)	96 KB	512 KB
Numeral/character string table	Maximum of 128 entries each	Maximum of 2,000 entries each

Item	NT20S	NT21
Bit memory table	None	Maximum of 1,000 bits
Mathematical table	None	256 entries max. Calculations can be executed automatically in the PT.
Image data	None	Maximum of 4,095 (224 for compatibility with NT20S)
Library data	None	Maximum of 12,288 (896 for compatibility with NT20S)
Graphic figures (rectangles, polygons, circles/ovals, sectors, filling)	None	65,535 total per screen, including other fixed objects
Image library displays	None	256 per screen max.
Analog meters	None	50 per screen max.
Trend graphs	None	1 per screen max.
Broken-line graphs	None	1 per screen max.
Alarm lists/history	None	4 per screen max.
Recipe function	None	1 per screen max.
Windows	None	3 per max.
Method for storing numeric values (numeral memory data and PT Status Control Area)	BCD (binary-coded decimal)	BCD (binary-coded decimal) or binary
PT Status Control Area size	4 words	5 words (partial change of contents) (4 words for compatibility with NT20S)
PT Status Notify Area size	3 words	2 words (partial change of contents) (3 words for compatibility with NT20S)
Window Control Area size	None	9 words
Clock Data Area size	None	4 words
Registering continuous screens	Possible	Not possible (Use screen switches as a substitute.)
System tenkey	Possible	Not possible (Use normal tenkey as a substitute.)
Lamp/Touch switch labels	Fixed display (1 line only)	- Multiple lines can be displayed - ON/OFF switching is possible - Numeral display is possible - Character string display is possible
Interlock function	None	Operations can be disabled from the PC by allocating interlock bits to the corresponding touch switch, numeral input, character string input, thumbwheel switches, or recipe objects.
Programming Console function	Not possible.	Possible.
Bar code reader connection	Not possible.	Possible.
High-quality font display	Not possible.	Possible.
Character codes	CP437 (DOS)	CP437 (DOS) or ISO8859/1 (Windows)
Accessible CS/CJ PC data Areas	---	The data areas listed below can be accessed in addition to the data areas accessible with the NT20S.*4 - EM banks (EM_0 to EM_C) - Timer Completion Flags (TU) - Counter Completion Flags (CU) - Work Areas (WR) - Task Flags (TK) - HR Area (HR)

*1: The Battery is optional.
*2: The NT20S-ST128 supports RS-232C communications commands instead of memory links.
*3: This is the capacity of the flash memory that stores screen data.
*4: These data areas are accessible only when the PT is connected to the CS/CJ-series PC in a 1:N NT Link. (They are not accessible through host link communications.)

For differences in programming, refer to *Appendix B Compatibility with Screen Data of Other PT Models* on page 435.