

NT20M/NT2000M **Programmable Terminal**

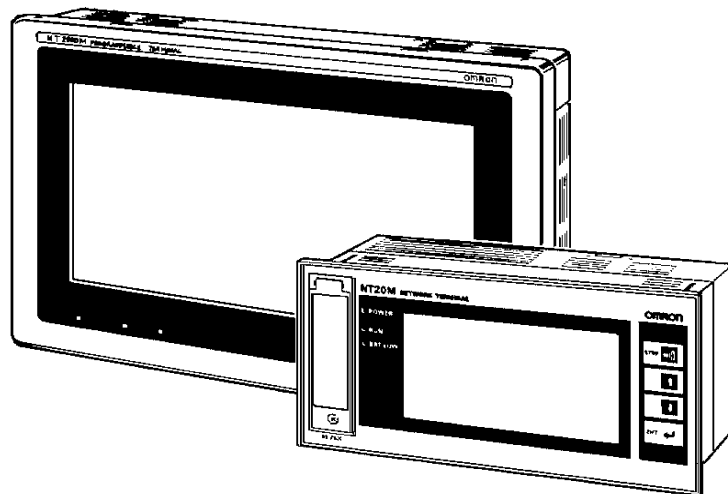
OPERATION MANUAL

OMRON

NT20M/NT2000M Programmable Terminal

Operation Manual

Revised September 1993



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 warnings in this manual. Always heed the information provided with them.

DANGER! Indicates information that, if not heeded, could result in loss of life or serious injury.

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

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.

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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... Indicates lists of one sort or another, such as procedures, precautions, etc.

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About this Manual:

Programmable Terminals (PTs) are terminals used mainly at FA production sites. The PT is connected to a host such as a Programmable Controller or an FA Computer, and is used to display the operating conditions of various devices and equipment. In addition, it can be used as a control panel with lamps and switches, or it can be used for inputting data. This manual describes the installation and operation of the NT20M and NT2000M Programmable Terminals and includes the sections described below. Further information is provided on manuals on the Host Interface Units and Support Tool. Refer to the list in *Section 1 Introduction*.

Please read this manual completely and be sure you understand the information provide before attempting to install and operation a Programmable Terminal.

Section 1 introduces the PTs, describes the terminology used in this manual, and provides examples of system configurations for programming and operation.

Section 2 provides procedures and specifications required to set up a PT system, including hardware switch settings and installation.

Section 3 provides steps required for initial PT operation.

Section 4 describes functions used to create screens and control display attributes on the PT. Included is automatic transfer of data from the host computer via character string and numeral tables.

Section 5 describes functions used to input data on-screen and transfer it to the host computer via the numeral table.

Section 6 describes basic data transfer and maintenance functions.

Section 7 describes transferring screens online to and from the host computer.

Section 8 provides troubleshooting and basic maintenance methods, including battery replacement.

Appendices of OMRON products used with PTs and PT specifications are provided at the back of the manual.

SECTION 1

Introduction

This section provides information necessary to familiarize you with the features and parts of a PT system.

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1-1 Introduction

This manual describes the installation and operation of NT20M and NT2000M Programmable Terminals (PTs). Both models can come with or without touch panels. Programmable Terminals have three main functions: 1) monitoring operating conditions, 2) directing on-site personnel, and 3) inputting data.

1) PTs can monitor, in real time, system and equipment operating conditions, production quantities, and so on. The PT display can show, for example, whether the production line is operating normally, and what percentage of the production target has been met. Bar graphs can be continually updated as data is received from the host. On-screen characters can be displayed as plain, reverse video, blinking, or reverse blinking. In addition, lamps, bar graphs, and figures can all be created. Screen data can be registered at the PT in advance, and can be displayed simply by transmitting the appropriate screen number from the host.

2) PTs can inform on-site personnel of current conditions that need to be addressed. Depending on the nature of the situation, built-in or external buzzers can be sounded to alert personnel to problems that have developed. Depending on factors such as distance from the host, the number of devices connected, and the response time, any of a variety of communications methods may be selected.

3) PTs can input data for controlling certain operations and communicating information to the host. Setting switches and a ten-key pad allows a PT to be used as a control panel. In the example shown below, touch switches used for inputs to the host are displayed. When this screen is displayed, the on-site operator can control a device by means of touch switches.

Aside from touch switches, the PT can provide inputs by means of numeric settings and externally connected switches. The illustration below shows a numeric setting screen that can be used for inputting numeric data.

The screens used for these operations can be created in advance by using the "Support Tool" software on a personal computer. The screen data that is created using the Support Tool can be printed out, saved to a diskette, or transferred to the PT. Either an FA Computer or a Programmable Controller can be used as the host.

1-2 Features

Clear Display

The display is extremely clear due to an STN liquid crystal display with a backlight. For long life, the backlight can be set to turn off automatically. With the NT20M-D□131 and the NT2000M-D□131 models, the backlight is replaceable.

Industry's Largest LCD Screen

By increasing the dot size, the display screen for the NT2000M has been enlarged.

Industry's First CFL Two-color Backlight Display

With the NT20M-D□131 and the NT2000M-D□131 models, the backlight can be switched between white and red. It is ordinarily white, but under extreme circumstances it can be switched to red for greater visibility.

Display Functions

Up to 250 screens can be registered. A total of 256 touch switches and rectangular or circular lamps can be created and registered, with up to 64 touch switches and/or lamps for a single screen. In addition, up to 32 messages (strings of 32 characters) and 128 eight-digit numbers can be registered. Fig-

ures and bar graphs can also be created and displayed. Marks (16 dots x 16 dots) can also be created with the NT20M/NT600M Support Tool and displayed.

| | |
|--------------------------------------|--|
| Input Functions | Up to 64 touch switch inputs can be registered per screen for Terminals with a touch panel (DT). |
| Drip-proof, Oil-proof Panel | The NT20M PTs (except for those connected to the NT20M-FK210) have a drip-proof front panel structure when the dust cover is mounted to protect the display area and the key input area. For protection against oil spray, the front-panel sheets and moulded parts use oil-resistant materials. In addition, the NT2000M PTs have a completely water-proof structure when the panel is mounted. |
| Two-way Communications | Messages and numbers transferred from the host can be displayed at programmed locations. In addition, numbers from touch panel and function key inputs can be transferred back to the host. |
| Host Interface Communications | Five types of Host Interface Unit enable general RS-232C and RS-422 communications, special-purpose SYSMAC BUS (Wired) communications, C200H Host Interface communications to the C200H, and Host Link direct connection communications. |
| System Configuration | NT-series Terminals have common communications protocol and peripheral devices. Select the Terminal you need based on screen size, memory capacity, and host interface. |
| Program Reusability | Programs for communicating with Programmable Controllers are upwardly compatible so the program can easily be reused when adding functions. |
| Stand-alone Capability | Screens can be changed on-site, without requiring instructions from the host. At the time when the screens are created by the Support Tool in advance, screen-changing functions can be allocated to touch switches or function keys, thereby making it possible to easily change to any screen. |
| Online Transfer Capability | When an RS-232C or RS-422 Interface Unit is mounted to the Host Interface Unit, screen data can be changed by means of commands from the host. |
| Direct Connection | Direct connection is a function whereby host data areas can be made to directly correspond to PT operations. Ordinarily, operating instructions to the PT and inputs from the PT are carried out by means of command execution at the host. The direct connection function eliminates the need for such host commands and programming, thereby greatly reducing the size and complexity of the host program. Direct connection is possible for PTs with touch panels when a Host Link Interface Unit is mounted. In addition, the NT20M-ZASAT-EV4 Support Tool and the NT20M-SMR31-E are required. |

1-3 NT-series Terminology

The following are definitions for the names of items in this manual related to the NT Series of Programmable Terminal and SYSMAC C-series Programmable Controllers.

Abbreviations The following abbreviations are used in the text.

| Abbreviation | Term | Meaning |
|--------------|-------------------------|---|
| PT | Programmable Terminal | Refers to an OMRON NT-series Programmable Terminal. |
| PC | Programmable Controller | Refers to an OMRON SYSMAC C-series or CV-series Programmable Controller, or programmable controllers manufactured by other companies. |
| I/F | interface | A communications device that connects the Programmable Terminal with peripheral devices. |
| I/O | input/output | Refers to PT and PC inputs and outputs. |

SYSMAC Terminology

| Terminology | Explanation |
|------------------|---|
| SYSMAC | A generic name for OMRON's Programmable Controllers. |
| Host Link System | A system employing SYSMAC C-series Host Link Units used to create a communications bus between PCs, between PCs and PTs, etc. |
| SYSMAC BUS | A remote I/O network created between SYSMAC C-series PCs and input/output devices. |
| C200H | An OMRON SYSMAC C-series Programmable Controller. |

NT-series Manuals

The NT20M/NT2000M Series and NT600M Series are covered in the four manuals described below.

| Name of Manual | Contents | Manual No. |
|--|---|------------|
| NT20M/NT2000M Operation Manual | This manual provides specifications, functions, and operating instructions for the NT20M and NT2000M Programmable Terminals. | V001 |
| NT600M Operation Manual | This manual provides specifications, functions, and operating instructions for NT600M Programmable Terminals. | V002 |
| NT-series Host Interface Unit Operation Manual | This manual covers the commands, controls, and communications specifications for operating the NT20M and the NT600M. Refer to this manual when programming host computer communications. | V003 |
| NT20M/NT600M Support Tool Operation Manual | This manual covers methods for creating screens, including screen data preparation, switches, lights, and alarms. | V004 |
| NT-series Host Interface Unit Direct Connection Operation Manual | This manual covers the Direct Connection feature which has been added to the Host Interface Unit. | V015 |
| NT-series RS-232C/RS-422 Interface Unit Operation Manual | This manual covers the commands, controls, and communications specifications for operating the NT20M and the NT600M with the RS-232C/RS-422 Interface Unit. Refer to this manual when programming host computer communications. | V016 |

1-4 Models

1-4-1 NT20M Programmable Terminals

The various NT20M PT models are shown in the table below. Several of these models employ two-color backlights. The two-color backlight incorporates red and white lights, one of which is selected according to operational requirements. The two-color backlights are replaceable, and are sold separately.

System ROM is sold separately for all models. Select the System ROM according to the Host Interface Unit that is mounted to the PT, as described in *Host Interface Units and Conforming System ROM* on the following page.

| NT20M type | Model number | Backlight | Image data memory |
|--------------------------|----------------|--------------|--|
| With touch panel (DT) | NT20M-DT121-V2 | White | I/C socket: None of these models come with image data memory chips mounted. Purchase them separately, following the specifications in the "Memory Chips" table on the following page. |
| | NT20M-DT131 | White or red | |
| Without touch panel (DN) | NT20M-DN121-V2 | White | |
| | NT20M-DN131 | White or red | |

1-4-2 NT2000M Programmable Terminals

The NT2000M-DT, touch-panel type and the NT2000M-DN131, non-touch-panel type models employ a two-color backlight (changeable between white and red), which is replaceable and is sold separately. The NT2000M-DN131, like the NT20M models described above, does not come with an image data memory chip mounted. This must be purchased separately.

System ROM is also sold separately. Select the System ROM according to the Host Interface Unit that is mounted to the PT, as described in *Host Interface Units and Conforming System ROM* below.

Memory Chips

In order for images to be saved, screen data memory is required. The following memory chips can be purchased separately and mounted in the socket.

| Type | Memory capacity | Model | Recommended memory chips |
|--------|-----------------|-----------|-----------------------------|
| SRAM | 32K bytes | RAM22-15 | HM62256ALP-15 (Hitachi). |
| | 128K bytes | RAM13-10 | HM628128LP-10 (Hitachi). |
| EPROM* | 64K bytes | ROM-KD-B | M5M27C512AK-12 (Mitsubishi) |
| | 128K bytes | ROM13-12B | HN27C101AG-12 (Hitachi). |
| EEPROM | 32K bytes | EER22-20 | HN58C256P-20 (Hitachi). |

- Notes**
1. When using EPROM, use a PROM writer to write the data that was created by the Support Tool, and then mount the chip in the PT.
 2. If memory chips other than the recommended ones are used, the memory backup battery capacity may not be sufficient.

Memory Capacity and Number of Screens

Screen memory capacity varies according to which Screen Data Memory Board is installed. The screen memory capacity, in turn, determines the number of screens that can be registered. Use the table below as a guide to select the amount of memory suitable for your needs.

| Screen memory capacity | Number of registered screens |
|------------------------|--|
| 32K bytes | Mostly messages: 140 screens Mostly graphics: 50 screens |
| 64K bytes | Mostly messages: 250 screens Mostly graphics: 100 screens |
| 128K bytes | Mostly messages: 250 screens Mostly graphics: 200 screens |

- Note** The table above is strictly a guide. If the messages or other display data per screen increase, the number of screens that can be registered will decrease. Likewise, if the messages decrease, the number of screens (250 screens max.) that can be registered will increase.

Host Interface Units and Conforming System ROM

Host Interface Units provide the interface for communications between the PT and the host, which may be either a C-series Programmable Controller or an FA computer. The System ROM is ROM which contains the programs necessary for operating the PT. Select the System ROM according to the Host Interface Unit that is to be mounted to the PT. System ROM is used in common for both NT20M and NT2000M PTs.

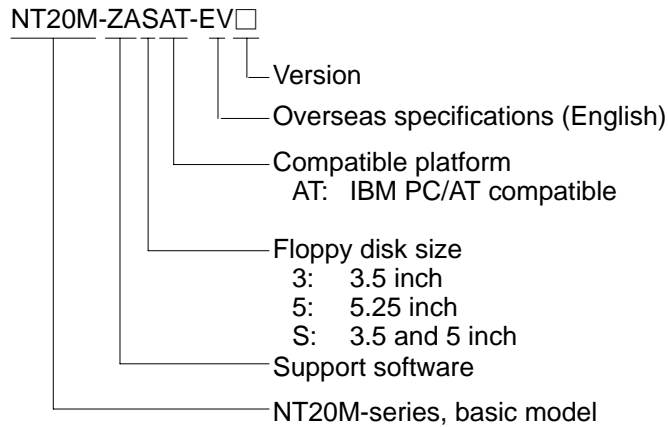
| Host Interface Unit | System ROM |
|---|---------------|
| NT600M-LK201 (RS232C/SYSMAC WAY) NT600M-LK202 ((RS-422) NT600M-RT121 (SYSMAC BUS) | NT20M-SMR01-E |
| NT600M-LB121 (C200H Host Interface) | NT20M-SMR02-E |
| NT600M-LK201 (Host Link direct connection) | NT20M-SMR31-E |

1-4-3 12-key Function Key Units (for DN-type)

Function-key input for NT20M non-touch panel (DN) type models is made possible by attaching an NT20M-FK210 12-key Function Key Unit.

1-5 Support Tool

Screen data, memory table data, and system data are all created by the Support Tool. In order to fully utilize the functions of the NT20M and NT2000M PTs, use a Support Tool version of NT20M-ZASAT-EV4 or higher. Screen data is interchangeable for NT20M and NT2000M PTs.

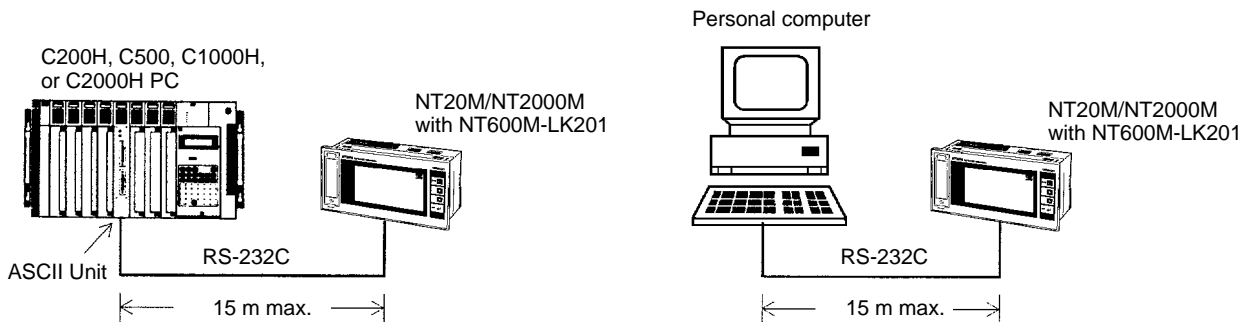


1-6 System Configuration

The Host Interface Unit mounted on the back of the PT is connected to the host (i.e., a personal computer or Programmable Controller) via communication cable. The PT must be used with a Host Interface Unit. If no Host Interface Unit is mounted, the PT will not operate. Refer to the *NT-series Host Interface Unit Operation Manual* for details on connecting between the Host Interface Unit and the host.

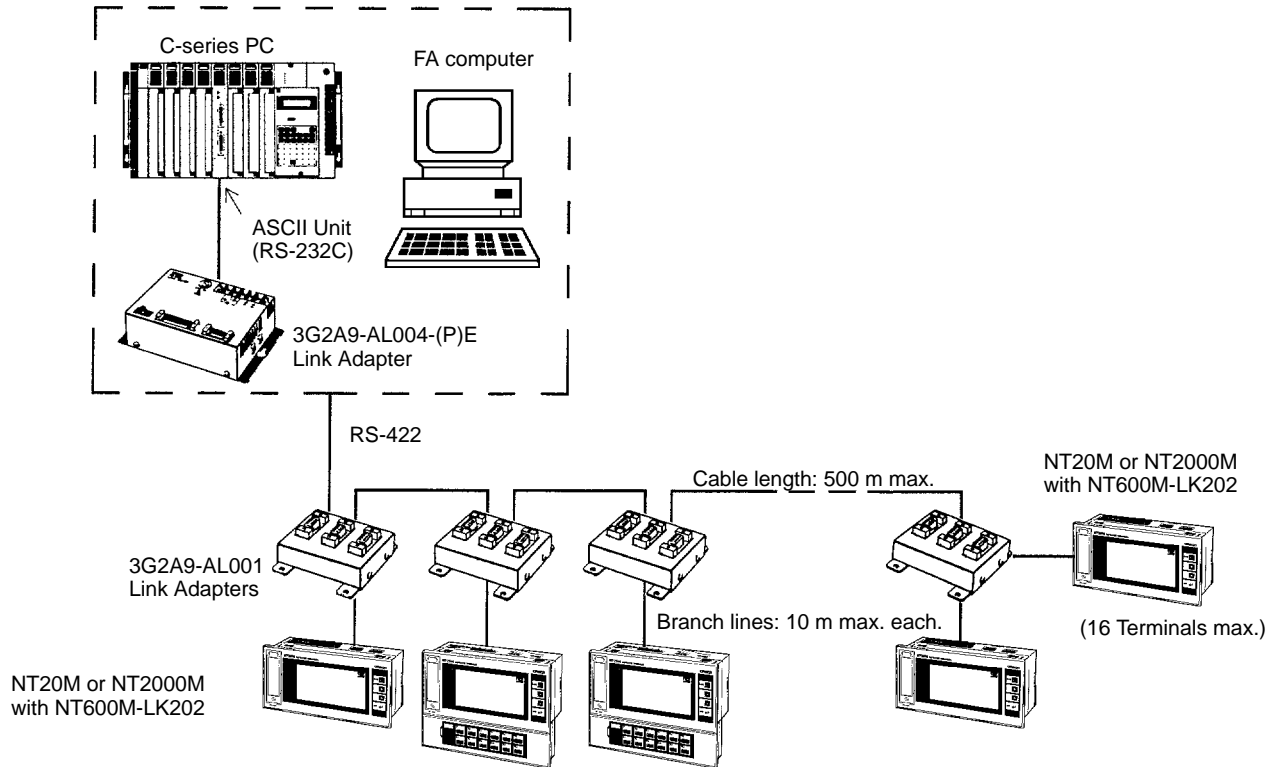
RS-232C Interface (NT600M-LK201)

Using the N600M-LK201 Host Interface Unit, the Programmable Terminal can be connected one-to-one to a PC through an ASCII Unit, or to personal computer.



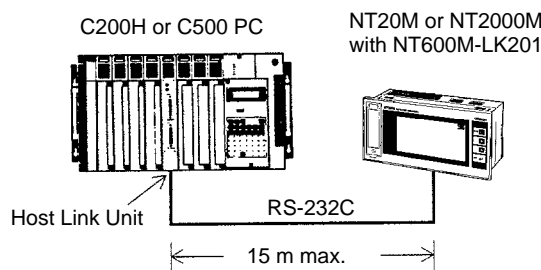
**RS-422 Interface
(NT600M-LK202)**

Using NT600M-LK202 Host Interface Units, up to 16 NT20M or NT2000M Programmable Terminals can be connected to a PC through an ASCII Unit, or to an FA computer.



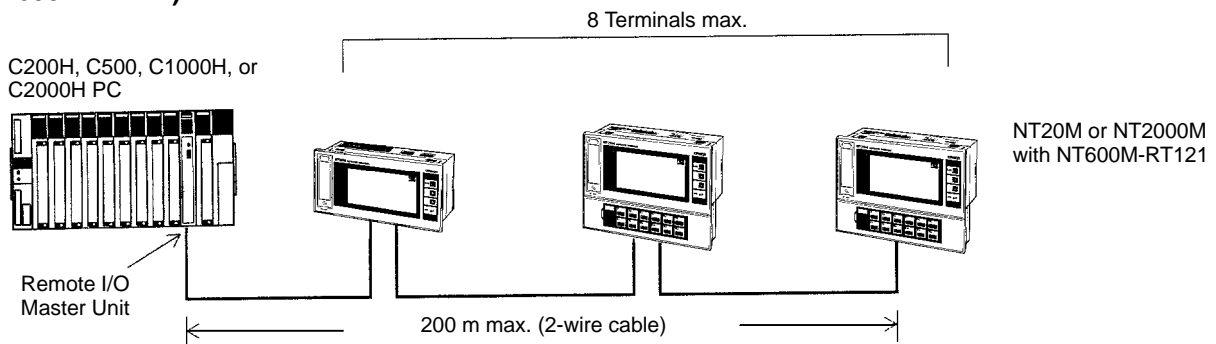
**Host Link Unit Interface
(NT600M-LK201)**

Using the NT600M-LK201 Host Interface Unit and RS-232C cable, the Programmable Terminal can be connected one-to-one to a PC through a Host Link Unit.



**Wired SYSMAC BUS
Interface
(NT600M-RT121)**

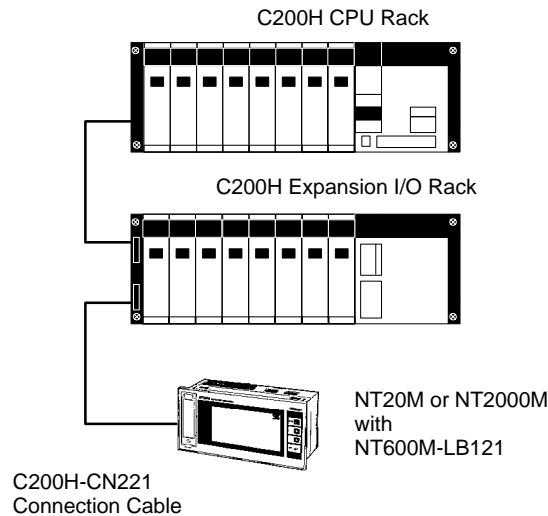
Using NT600M-RT121 Host Interface Units, up to 8 Programmable Terminals can be connected to a PC through a Wired Remote I/O Master Unit.



C200H Host Interface (NT600M-LB121)

With the C200H Host Interface Units, the interface is set up simply by connecting with cable to the C200H CPU Rack or Expansion I/O Rack. It is also possible to connect to C20H, C28H, C40H, and C60H CPU Units or I/O Units. Be sure to use a noise filter when connecting C□□H. Refer to the *Host Interface Units Operation Manual* for details.

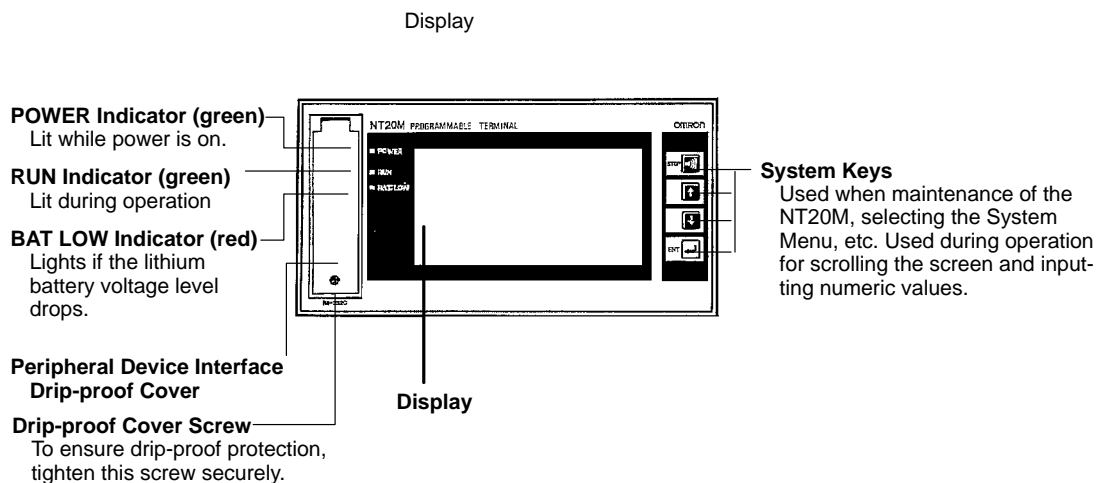
In a C200H PC System, you can ordinarily connect two Expansion I/O Racks to the CPU Rack. The C200H Host Interface Unit itself, however, functions as an Expansion I/O Rack, and therefore when using a C200H Host Interface Unit, you can only connect one other Expansion I/O Rack.



1-7 Nomenclature and Functions

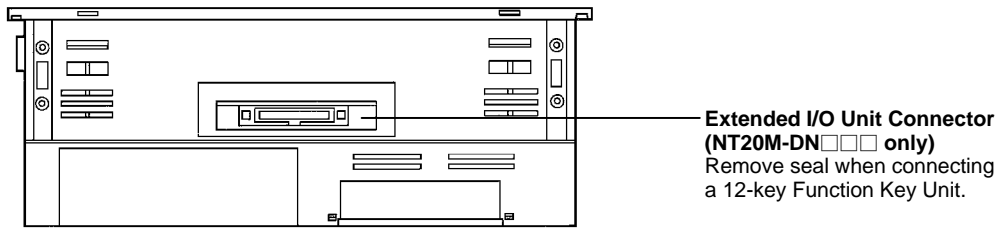
1-7-1 NT20M-D□121-V2/D□13□

Front Panel



Note If there are is no battery installed, the BAT LOW indicator will light.

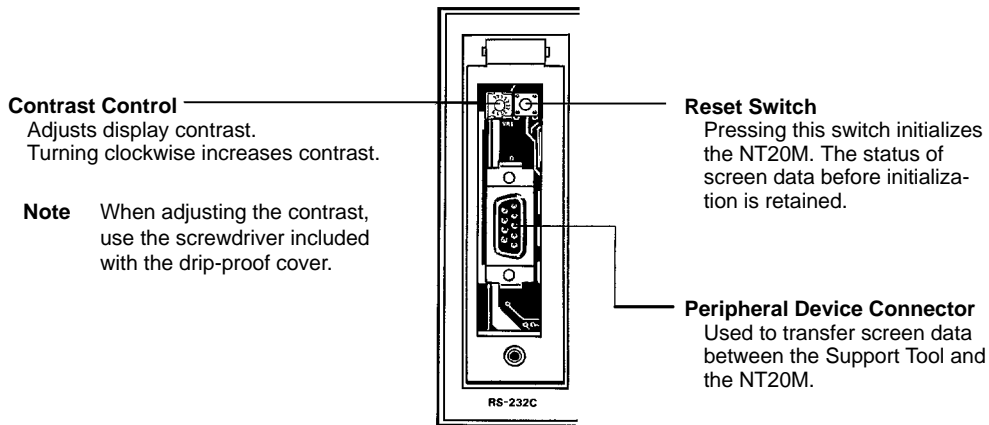
Bottom



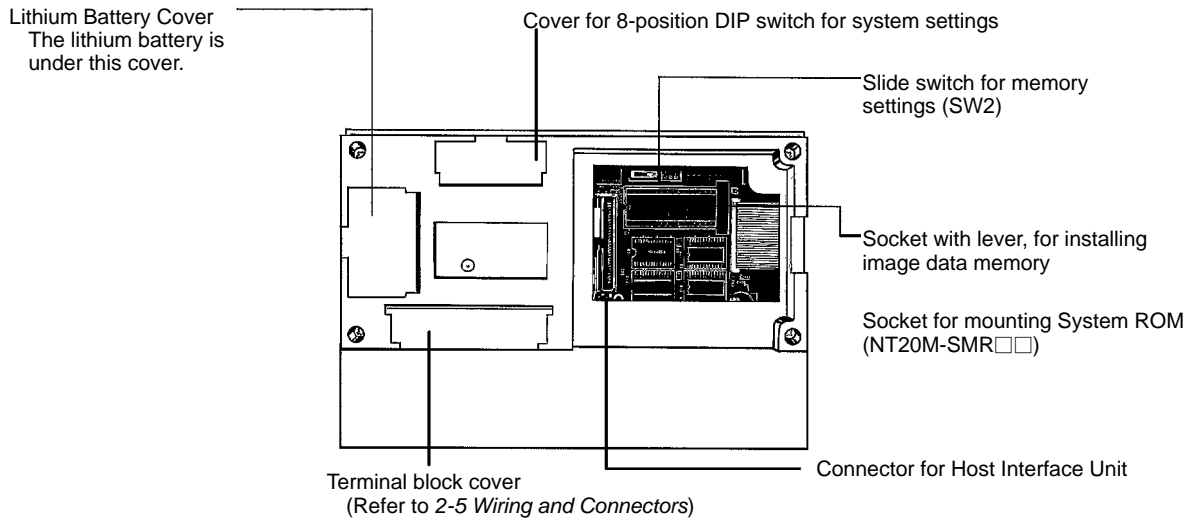
Components under Drip-Proof Cover

NT20M-D□121-V2

The illustration below is for the NT20M-D□121-V2. The NT20M-D□13□ is basically similar except for the contrast control being in a slightly different position.

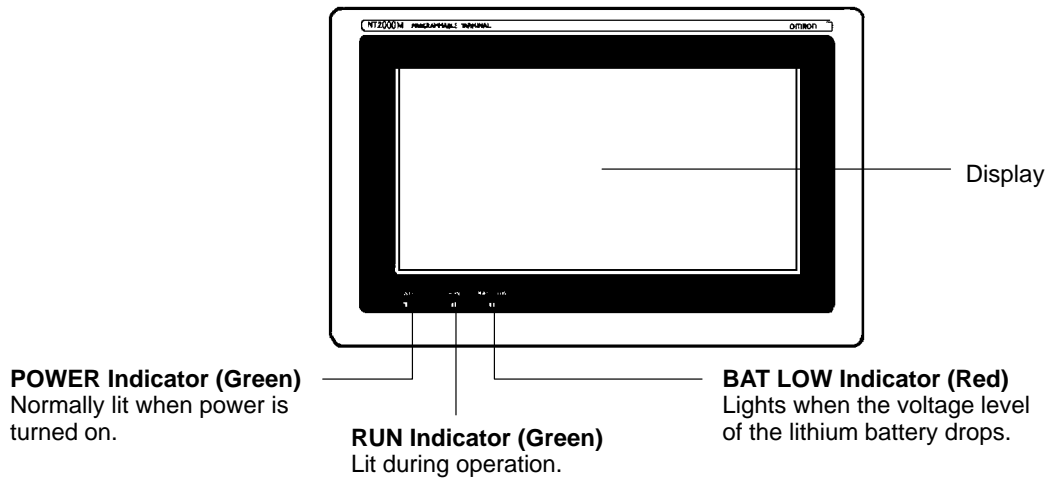


Rear Panel



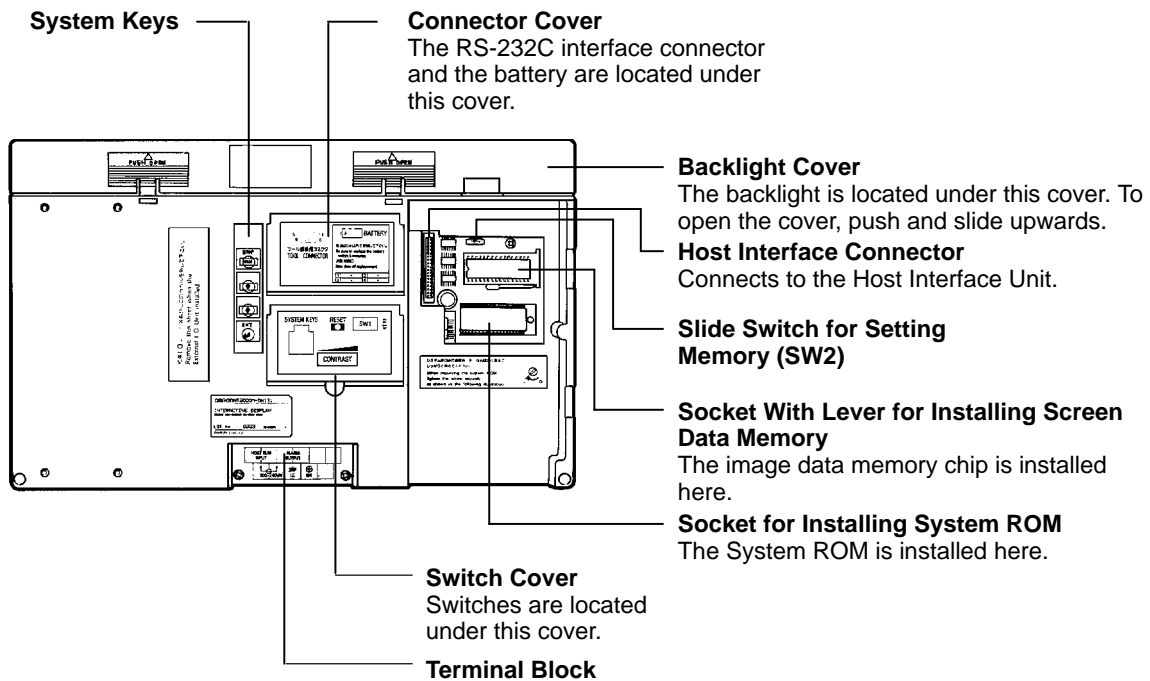
1-7-2 NT2000M-D□131

Front Panel

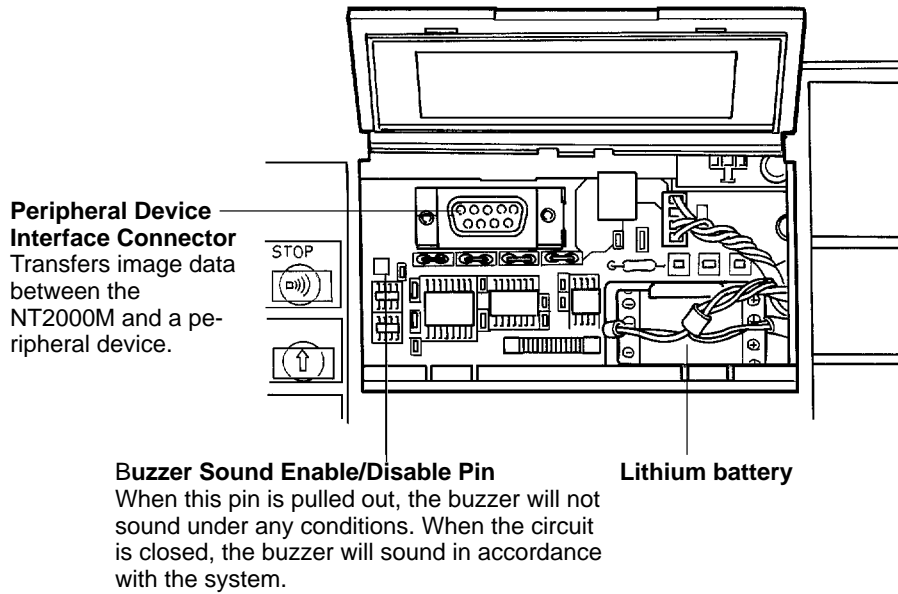


Note When no battery is installed, BAT LOW indicator operation is unstable.

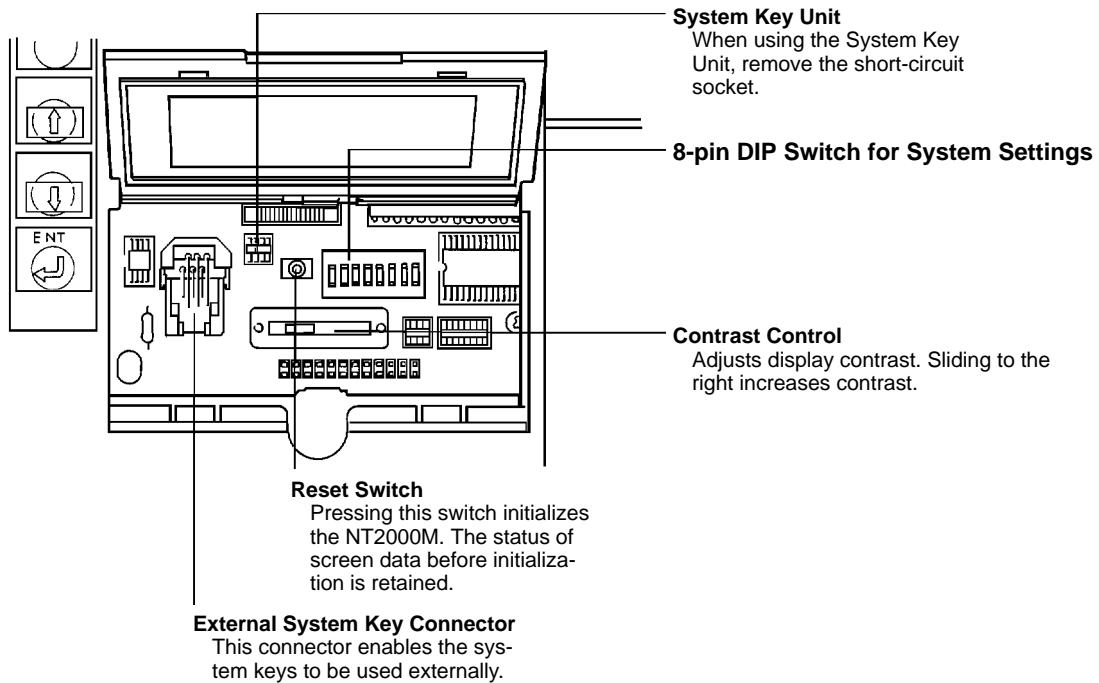
Rear Panel



Components Under the Connector Cover



Components Under the Switch Cover



SECTION 2

Settings and Installation

This section provides procedures to set hardware switches and install the PT.

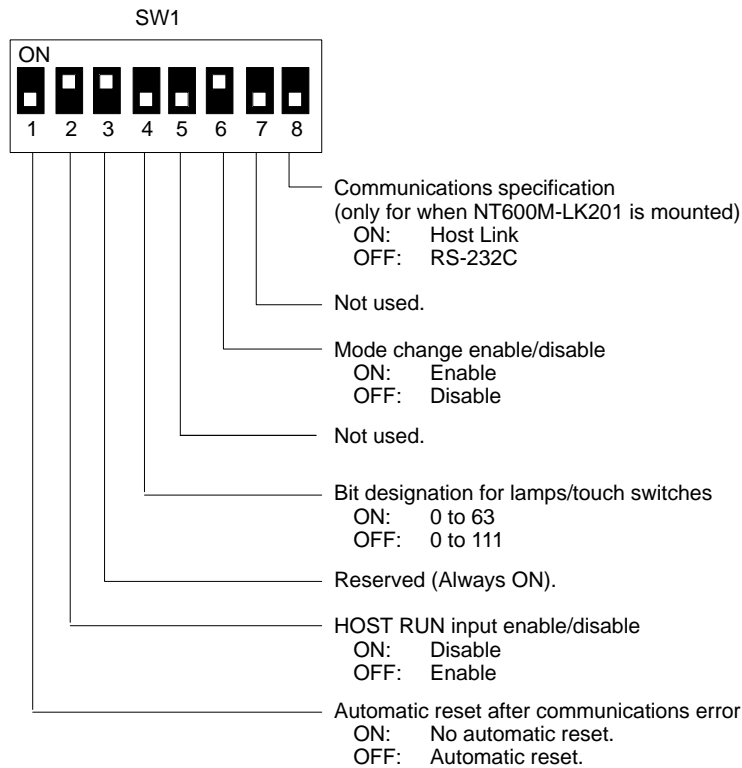
| | | |
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2-1 Switch Settings

There are switches to set under the switch cover on the back of the Terminal, and also on each Host Interface Unit. For Host Interface Unit switch settings, refer to the *Host Interface Unit Operation Manual*. Be sure to set the switches before installation if the installation location prevents access to the switches after installation.

2-1-1 System DIP Switch Settings (SW1)

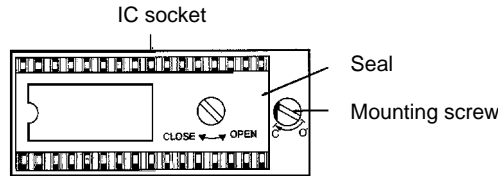
The 8-pin DIP switch for system settings is located under the DIP switch cover on the back of the Terminal. Be sure that power is off when changing switch settings.



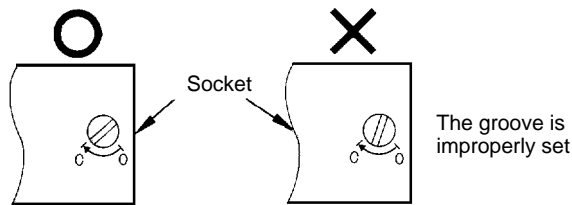
| | |
|---|--|
| Automatic reset after communications error | “Automatic reset” means that, when an error occurs, no error message will be displayed and the next command will be executed when received. “No Automatic reset” means that, when an error occurs, an error message will be displayed and operation will stop. |
| HOST RUN input enable/disable | If this pin is turned OFF then, when the HOST RUN INPUT turns OFF, Host Error will be displayed regardless of other conditions and processing will stop. |
| Bit designation for lamps and touch switches | This pin designates the bits for lamp and touch switch display control for when Host Link Interface Units, C200H Host Interface Units are used. |
| Mode change enable/disable | “Mode change” refers to changing between the System Menu and Transmit Mode, Maintenance Mode, or RUN Mode. When an RS-232C or RS-422 Host Interface Unit is used, mode changes can be prohibited by means of a command from the host. |
| Communications specification | When an NT600M-LK201 Host Link Unit is used, the communications specification must be set to either Host Link or RS-232C. If the PC setting and the Host Interface Unit setting do not match, operation will not be possible. |
| Pin 3 | Pin 3 is factory-set to OFF and must be turned ON by the user. Screens will not be displayed properly unless this pin is ON. |

2-1-2 System ROM Mounting

- 1, 2, 3... 1. Turn off the power to the PT.
2. Set the groove of the mounting screw on the right edge of the IC socket to O (Open).
3. Mount the System ROM in the direction of the seal on the IC socket and set the groove of the mounting screw to C (Close) to lock the System ROM.



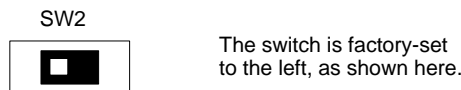
4. Make sure that the groove of the mounting screw is set to C, otherwise the System ROM will not be locked.



- Note**
1. Be sure to turn off the PT when mounting or dismantling the System ROM to the IC socket, otherwise the internal memory of the PT may be damaged.
 2. Be sure to lock the System ROM after mounting, otherwise the operation of the PT will be unstable.
 3. OMRON Corporation has the copyright of the System ROM program. Making a copy of the program is prohibited without the prior consent of the OMRON Corporation.

2-1-3 Memory Setting (SW2)

This switch is used to set the type of data memory to be installed in the socket at the back of the Terminal.



| SW 2 | Screen data memory |
|--------|--------------------|
| Left | SRAM |
| Right | EPROM |
| Center | EEPROM |

- Note**
1. Be sure that the power is off when changing the setting.
 2. Carefully check the switch settings and the memory chip before turning the power on. If memory is not installed in accordance with this switch setting, the Terminal will not operate properly and memory may be destroyed.

2-1-4 Inserting the Screen Data Memory

- 1, 2, 3... 1. Turn off the power to the PT.
2. Set switch 2 to match the memory chip that is to be inserted.

3. Raise the IC socket lever, and insert the memory chip in the direction indicated on the seal. The chip will have either 28 or 32 pins. Line it up with the position shown on the seal.
4. Check to be sure that the memory chip is inserted securely, and then lock the lever back into place.

Note Be sure to turn the power off before removing the memory chip.

2-2 Installation Environment

The NT20M and NT2000M PTs have strong environmental resistance and high reliability, but you can maximize system reliability and make the most of their functions by observing the following considerations during installation.

2-2-1 Installation Site

Avoid installing the PT in a location where any of the following conditions exist.

- Ambient temperatures exceeding a range of 0°C to 45°C for the NT20M or 0°C to 50°C for the NT2000M.
- Abrupt temperature changes or condensation.
- Relative humidity exceeding a range of 35% to 85%.
- Corrosive or inflammable gasses.
- Strong magnetism.
- Excessive dust, salt, or iron dust.
- Direct vibration or shock.
- Direct sunlight.
- Spray from water, oil, or chemicals (even though the front panel of the NT20M is drip-proof and the entire NT2000M is waterproof).

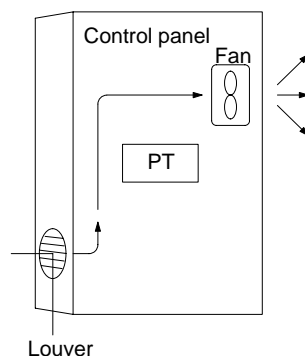
2-2-2 Mounting Position

The PT employs a liquid crystal display, so the angle of vision should be considered when mounting. Install the Terminal at a height and direction that make it easy for the operator to see.

Ambient Temperature

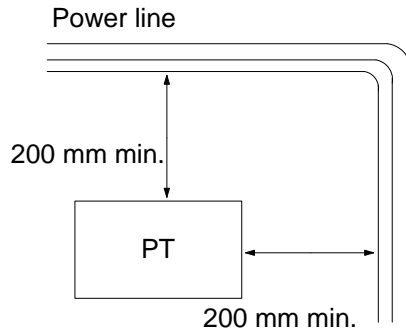
The ambient operating temperature range is 0°C to 45°C for the NT20M and 0°C to 50°C for the NT2000M. Take the following factors into consideration.

- Leave sufficient ventilation space.
- Do not install directly above machinery that radiates a lot of heat (e.g., heaters, transformers, high-capacity resistors).
- If the ambient temperature rises above 45°C, set up a fan or air conditioner.

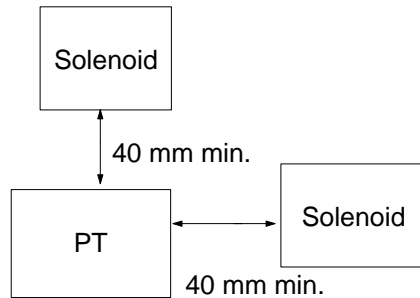


Operation and Maintenance For safety during operation and maintenance, place the PT as far as possible from high-voltage machinery and power equipment.

Improving Noise Resistance Do not install the PT in a panel with high-voltage devices, and install it at least 200 mm from electric power lines.



When installing the Terminal near devices with strong electrical or magnetic fields (such as solenoids), allow a distance of at least 40 mm, more if necessary.

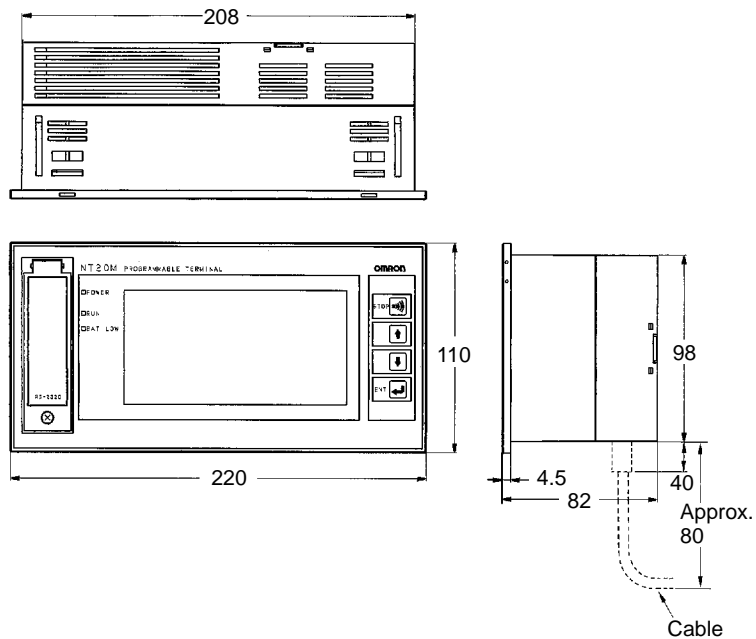


2-3 Dimensions

All dimensions are in millimeters.

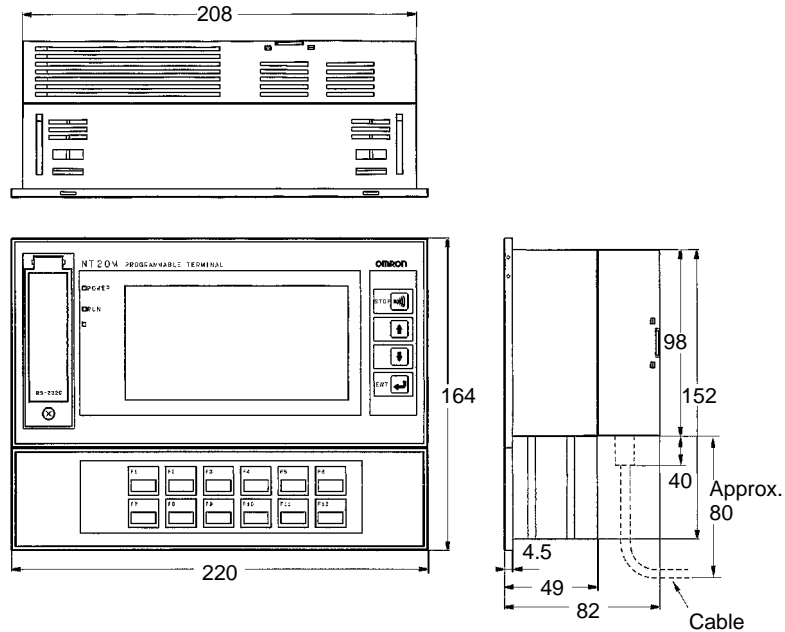
2-3-1 NT20M Programmable Terminals

Terminals With and Without Touch Panels



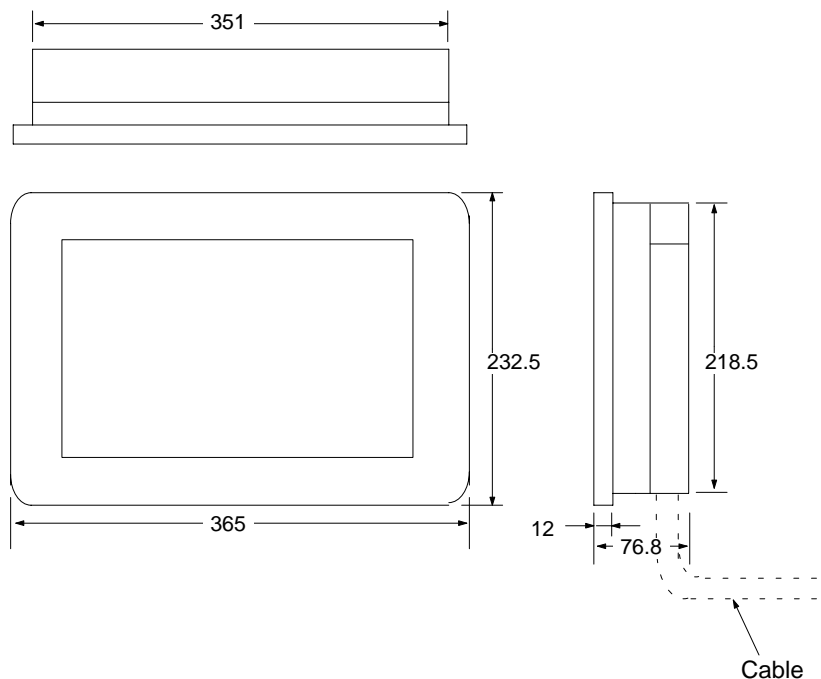
Terminals With Function Keys

An NT20M-FK210 12-key Function Key Unit can be connected to PTs without touch panels (i.e., DN type PTs).



2-3-2 NT2000M Programmable Terminals

NT2000M-DN131



2-4 Installing in a Panel

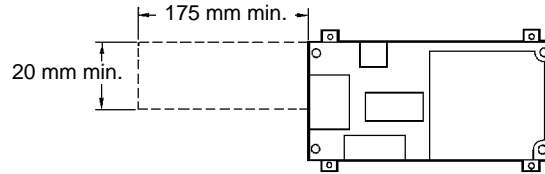
The NT20M is designed to be installed in a panel. Install it as follows:

- 1, 2, 3... 1. Cut a hole in the panel in accordance with the recommended dimensions shown below. The panel should be between 1.6 and 4.8 mm thick. For PTs that have the backlight replaced from the side (i.e., NT20M-DT/

DN131), however, the panel should only be from 1.6 to 2.0 mm thick, in order to allow enough space to replace the backlight.

Side Space for Backlight Replacement:

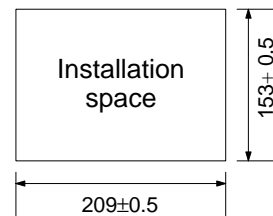
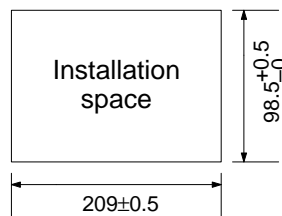
When mounting the NT20M to a panel, leave open the space marked with dotted lines on the left of the rear panel as shown below.



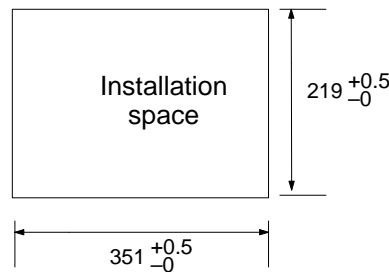
NT2000M PTs have the backlight replaced from the back, so they need not be accessed from the side. All dimensions shown below are in millimeters.

NT20M-D□121-V2
NT20M-D□131

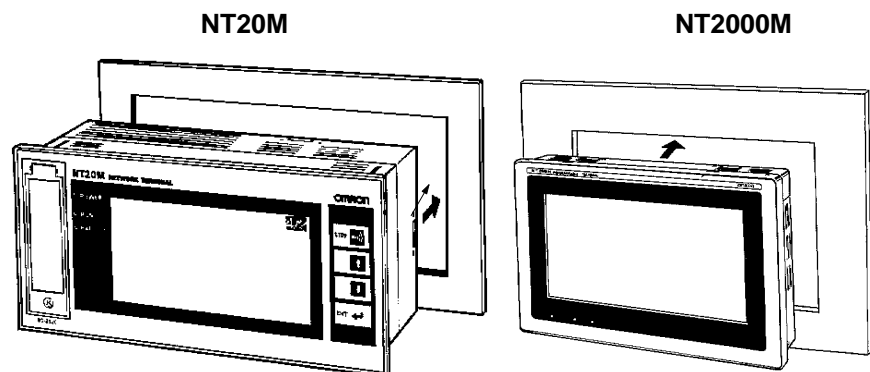
NT20M-DN121-V2 with NT20M-FK210
NT20M-DN131 with NT20M-FK210



NT2000M-DN131

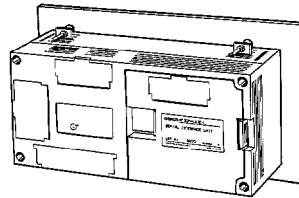


2. Insert the Terminal into the hole from the front of the panel.

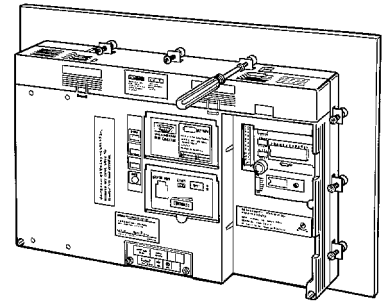


- Use the accessory metal fittings and tool to fasten the Terminal to the panel surface. Do not use a screwdriver on the fittings, otherwise the fittings or the terminal of the NT20M may become damaged.

NT20M

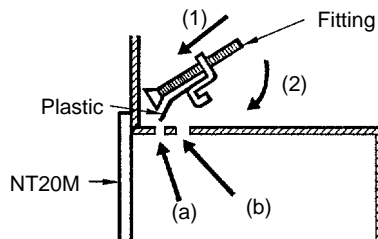


NT2000M



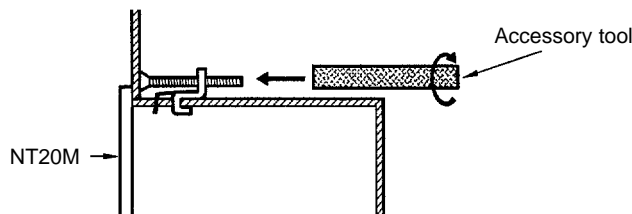
Securing the NT20M to the Panel

After setting the NT20M into the panel, secure it as shown below.

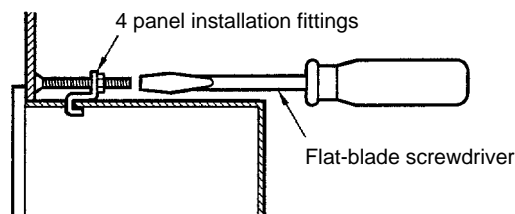


- First pass the plastic part of the fitting through slot (a).
- Next, put the hook of the fitting into slot (b) and pull so that the leg catches in the NT20M case.

Turn the screw with the tool that comes with the NT20M, and secure the NT20M to the panel. When you are finished, rotate the tool in the reverse direction and remove it from the screw.



- To remove the NT20M from the panel, use a flat-blade screwdriver. (For the NT2000M, use a Phillips screwdriver.)

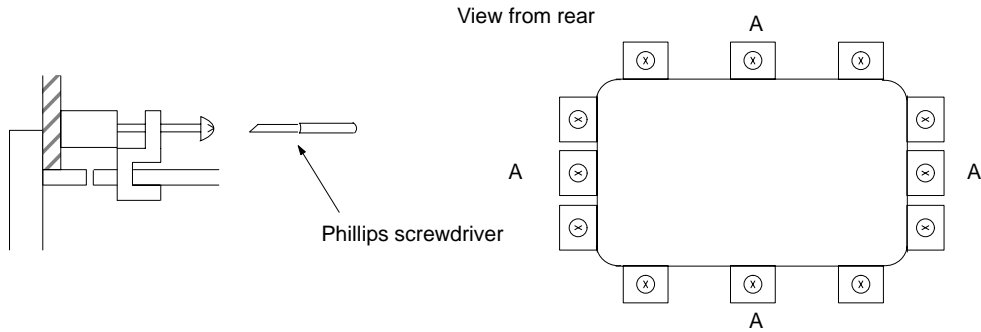


Securing the NT2000M to the Panel

Using the tool that comes with the NT2000M, secure the NT2000M to the panel from behind. When not making it waterproof, the four places marked "A" in the illustration below must not be tightened. Use a tightening torque of no more than 6 kg.

When making the NT2000M waterproof, tighten all twelve places shown in the illustration, including the places marked "A." Use a tightening torque of at least 8 kg and no more than 10 kg.

To remove the NT2000M from the panel, use a Phillips screwdriver.

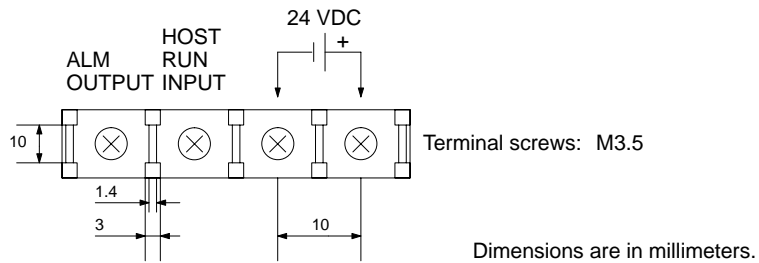


2-5 Wiring and Connectors

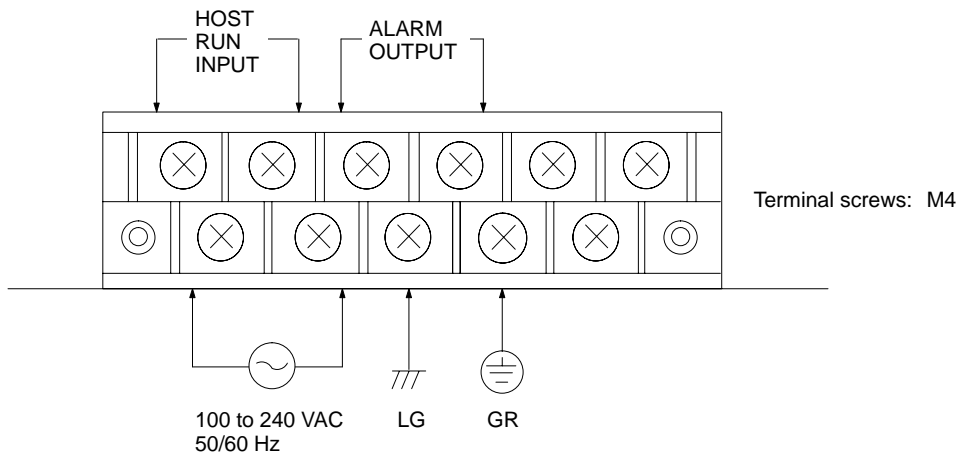
2-5-1 Terminal Block

The terminal blocks illustrated below are located under the respective terminal block covers of the NT20M and the NT2000M.

NT20M

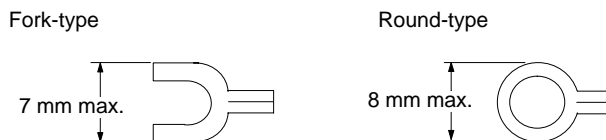


NT2000M



Crimp-style Terminals for Wiring

Use crimp-style terminals for wiring. If twisted wires are connected directly, there is a possibility of poor contact or short-circuiting. For the NT20M, use crimp-style terminals with holes to match M3.5 screws. For the NT2000M, use crimp-style terminals with holes to match M4 screws. The dimensions shown in the illustration below are for the NT20M. For the NT2000M, the dimensions would be 8.6 mm max. for both the fork-type and the round-type.



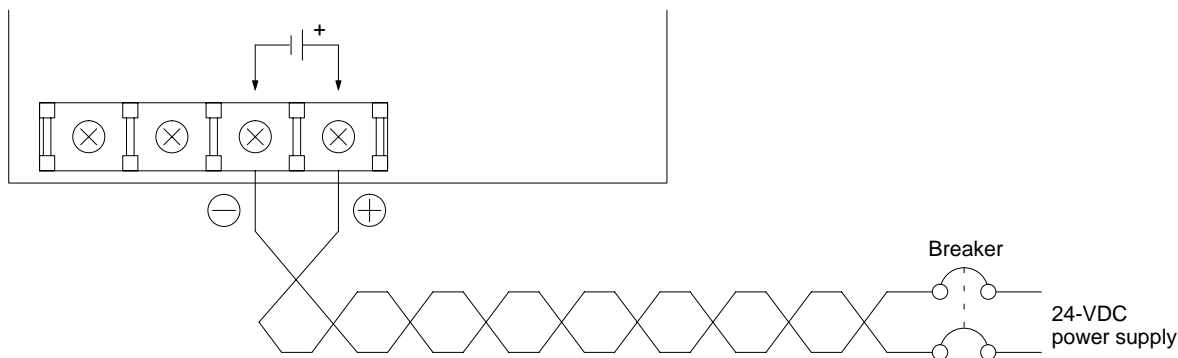
Conforming Crimp-style Terminals

| Maker | Fork-type (NT20M) | Round-type (NT20M) | Fork-type (NT2000M) | Round-type (NT2000M) | Conforming wire (twisted) |
|-------------------------------|-------------------|--------------------|---------------------|----------------------|------------------------------|
| Japan Solderless Terminal MFG | 2-YS3A | 2-3.5 | 2-4A | 2-4 | 1.04 to 2.63 mm ² |
| Fuji Terminals | 2-YAS3.5 | V2-S3.5 | 2-YA4 | V2-4 | |
| Nichifu Terminals | 2Y-3.5 | 2-3.5 | 2Y-4 | 2-4 | |

2-5-2 Power Supply and Battery Wiring

24 VDC (NT20M)

These are the power supply input terminals for running the NT20M.



NT20M Power Supply Wiring

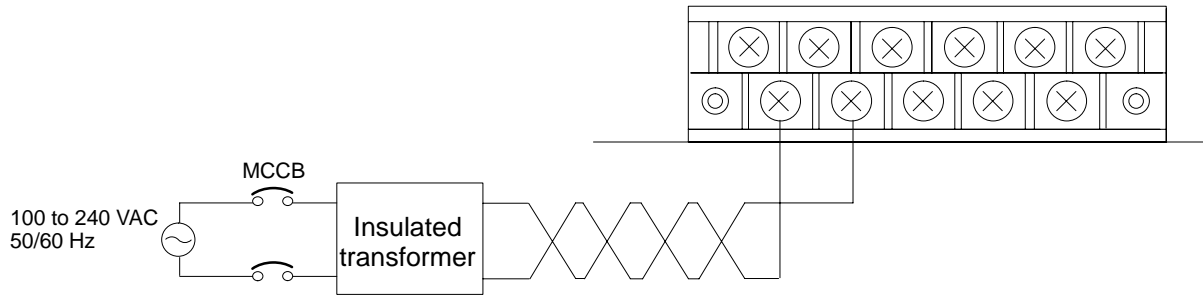
- Provide 24-VDC power.
- Use a power supply within the allowable voltage range.

| Power supply voltage | Allowable voltage range |
|----------------------|-------------------------|
| 24 VDC | 20.4 to 26.4 VDC |

- Use a power supply with a rated capacity of at least 15 W at 24 VDC.
- If power lines are long, then use wires of at least 2 mm² to avoid a drop in voltage.
- Use twisted-pair cables.
- Turn off the power before wiring.
- Be careful not to reverse the positive and negative terminals.
- Do not run the wiring between the 24-VDC power supply and the PT power supply input terminal parallel to or in close proximity with high-voltage or high-current power lines.
- If you anticipate noise levels exceeding specifications, use noise-prevention measures such as installing a noise filter at the power supply. Use a common mode filter as the noise filter, and install no more than 100 mm of wiring from the PT to the filter.
- If you use a 24-VDC power supply with no output short-circuit prevention, then wire a breaker into the circuit.

AC Input (NT2000M)

These are the power supply input terminals for running the NT2000M.



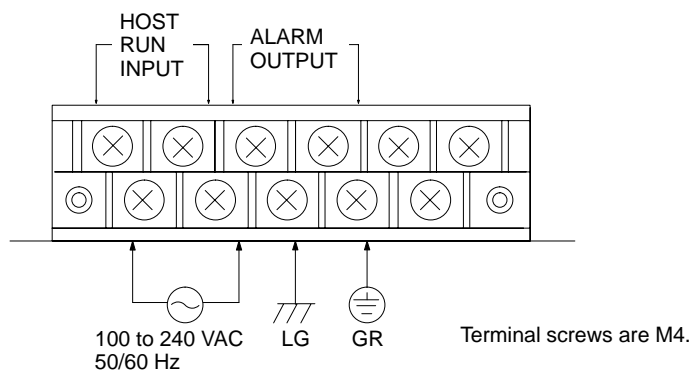
NT2000M Power Supply Wiring

- Provide a 100 to 240 VAC power.
- Use a power supply within the allowable voltage range.

| Power supply voltage | Allowable voltage range |
|----------------------|-------------------------|
| 100 to 240 VAC | 85 to 264 VAC |

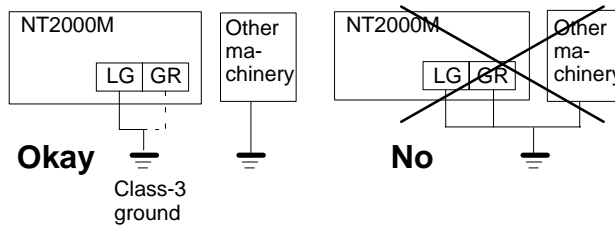
- Insulated Transformer
The NT2000M has built-in anti-noise features which are sufficient for handling general noise from power lines, but ground noise can be greatly reduced by supplying power through a 1:1 insulated transformer. The secondary side of the insulated transformer should be an isolated neutral system.
- Power Capacity
Use a rated power supply of at least 50 VA.
- If power lines are long, then use wires of at least 2 mm² to avoid a drop in voltage.
- Use twisted-pair cables.

2-5-3 LG and GR Terminals



- GR is the ground terminal. In order to avoid electric shock, use separate ground wire (at least 2 mm²) and a class-3 ground (ground resistance 100 Ω or less).
- LG is the noise filter neutral terminal. If malfunction results from excessive noise, or to prevent electrical shock, short-circuit LG and GR and use a class-3 dedicated ground.
- The ground line should be 20 m or less.

- Sharing a ground line with other machinery or grounding to the girders of a building may be ineffective and even harmful.

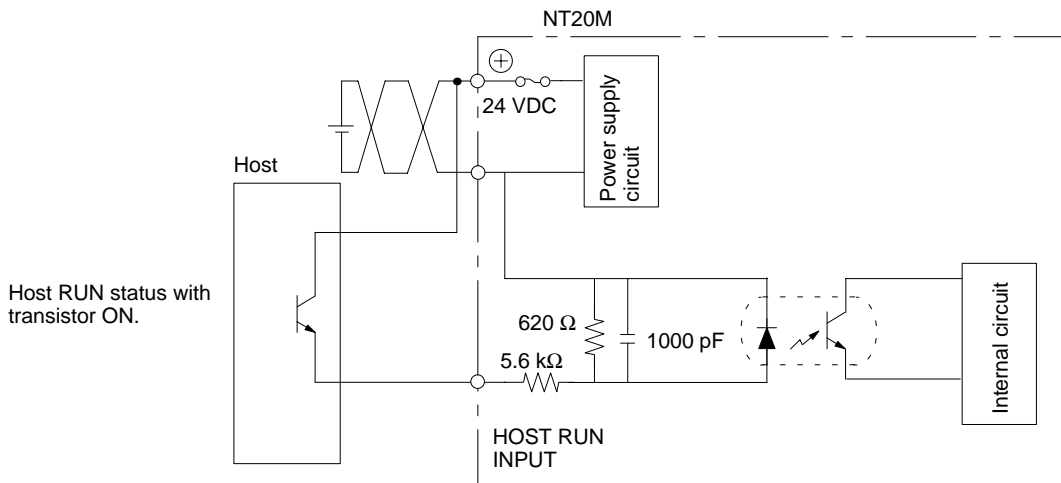


2-5-4 HOST RUN INPUT Terminal

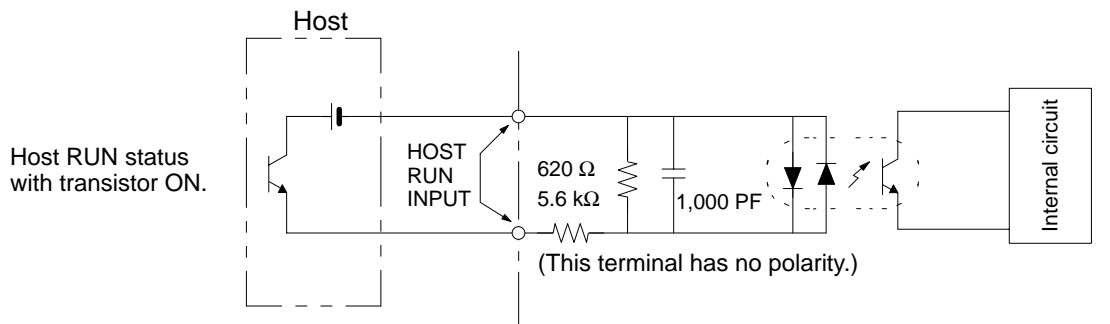
Use the HOST RUN INPUT when you want to monitor the RUN status of the host. When this input terminal is enabled by pin 2 of DIP switch 1, then, if the HOST RUN INPUT turns OFF, PT processing will be interrupted and a priority message will be displayed indicating that a host error has occurred. This condition will be maintained until the host RUN status is restored.

- Enable: Turn OFF SW1, pin 2.
- Disable: Turn ON SW1, pin 2.

NT20M



NT2000M



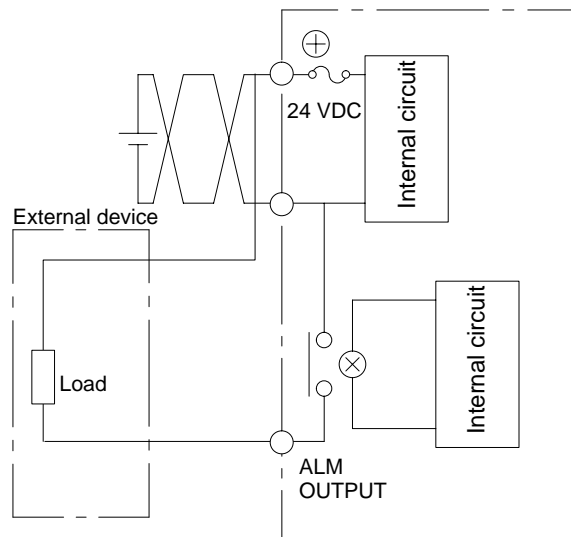
Input Specifications (For Both NT20M and NT2000M)

| Item | Content |
|---------------------|----------------------------|
| Rated input voltage | 24 VDC +10%/−15% |
| Input impedance | 5.6 kΩ |
| Input current | 4.1 mA typical (at 24 VDC) |
| ON voltage | 15.5 V min. |
| OFF voltage | 5.0 V max. |
| ON delay | 2.5 ms max. |
| OFF delay | 2.5 ms max. |
| Insulation method | Photocoupler |

2-5-5 ALM OUTPUT (Alarm Output)

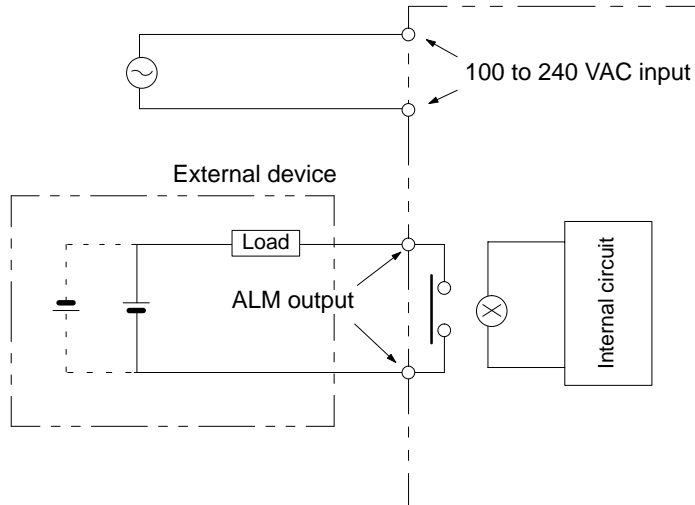
This terminal outputs the PT alarm signal. Use this terminal when you want to externally monitor status.

NT20M



| Item | Content |
|----------------------------|------------------|
| Output type | Relay output |
| Rated load | 24 VDC +10%/−15% |
| Maximum load current | 1 A |
| Minimum switching capacity | 10 mA at 5 VDC |
| Leakage current | 0.1 mA max. |
| Residual current | 1.0 V max. |
| ON delay | 2.5 ms max. |
| OFF delay | 2.5 ms max. |

NT2000M



| Item | Content |
|----------------------------|----------------|
| Output type | Relay output |
| Rated load | 1 A at 24 VDC |
| Maximum load current | 1 A |
| Minimum switching capacity | 10 mA at 5 VDC |

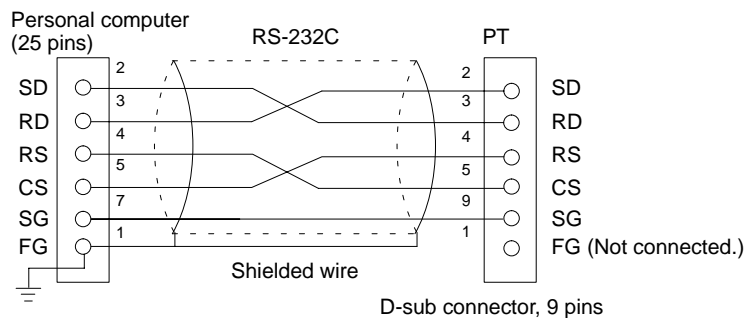
2-6 RS-232C Interface Connector

The RS-232C interface connector is used during communications between the PT and the Support Tool. It is located under the RS-232C interface connector cover on the front of the NT20M or NT2000M.

Pin Allocation

| Pin no. | Symbol | Name |
|---------|--------|-------------------------|
| 1 | FG | Frame Ground (not used) |
| 2 | SD | Send Data |
| 3 | RD | Receive Data |
| 4 | RS | Request to Send |
| 5 | CS | Clear to Send |
| 9 | SG | Signal Ground |

Connection Diagram



- Note**
1. RS-232C communications conditions are set automatically by the NT20M Support Tool.
 2. Connectors can be connected and disconnected with power turned on.
 3. This connection diagram cannot be used for the Host Interface Unit.

**Applicable Connectors
(Cable Side)**

Plug: XM2A-0901 (OMRON) or equivalent.
Hood: XM2S-0911 (OMRON) or equivalent.

Recommended Cables

AWG 28 x 5P IFVV-SB (Fujikura Cable, Ltd.)
CO-MA-VV-SB 5P x 28 AWG (Hitachi Cable, Ltd.)

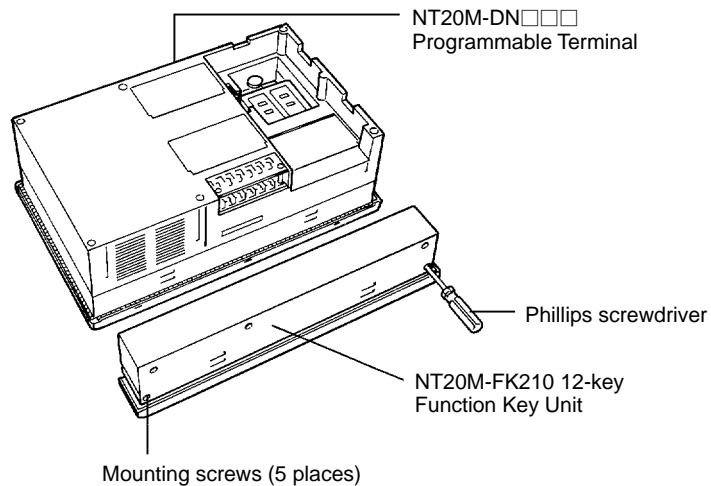
Cable Set

CV500-CN228 (OMRON)
Cable length: 2 m

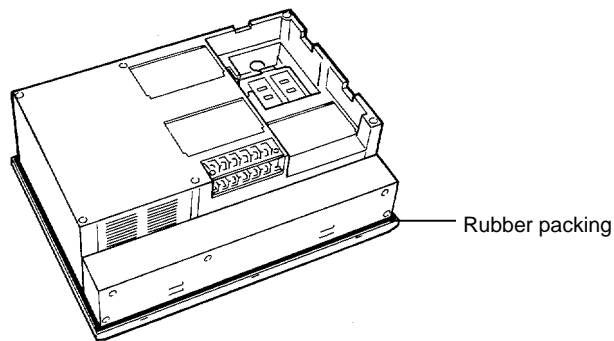
2-7 Mounting Function Key Units (to DN-type PTs)

Mounting Procedure

- 1, 2, 3...
1. Remove the rubber packing and bottom connector seal from the DN-type PT.
 2. Mount the 12-key Function Key Unit to the PT, matching the connectors. Using a Phillips screwdriver, tighten the five mounting screws.



3. Attach the rubber packing that comes with the 12-key Function Key Unit.



4. Mount to the panel.

SECTION 3

Initial Operation

This section provides an introduction to the operations necessary to use a PT for the first time and to the menus and keys used to control PT operation.

| | | |
|-------|--|----|
| 3-1 | Powering Up | 30 |
| 3-2 | Initialization | 30 |
| 3-2-1 | Initializing Memory | 30 |
| 3-2-2 | Menus | 31 |
| 3-3 | Transferring Data to and from the Support Tool | 32 |
| 3-4 | Initial Settings | 33 |

3-1 Powering Up

When first starting up the system, do not connect the Host Interface Unit to the host. When power is turned on to the PT, either a “Connecting to host” message or the initial screen set by the Support Tool will be displayed. The “Connecting to host” message will be displayed if a Host Link Interface Unit, a SYSMAC BUS Interface Unit, or a C200H Host Interface Unit is mounted. The initial screen will be displayed if an RS-232C/RS-422 Interface Unit is mounted.

If there is no image data registered for the PT, or if there is an error in the image data that is registered, then the System Menu will be displayed instead, with an error message at the bottom. In that case, it will be necessary to initialize the memory and transmit the correct data.

3-2 Initialization

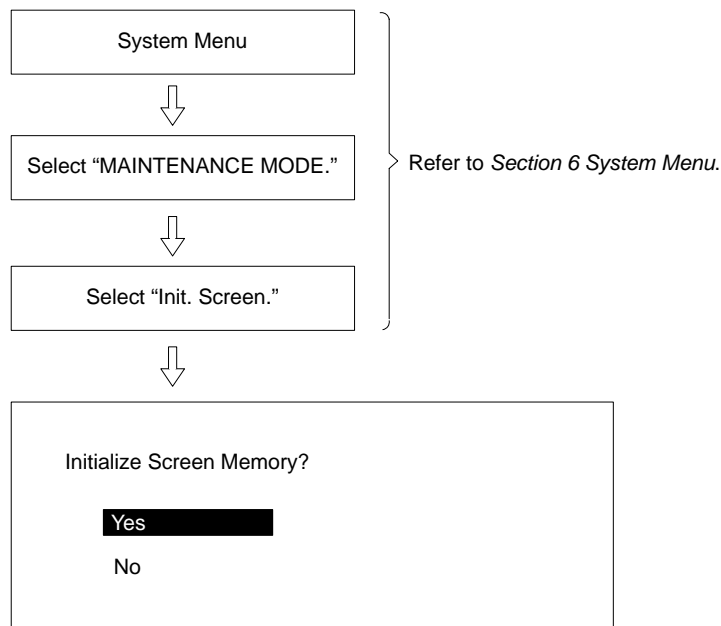
Initialize the memory in the PT using the procedure described below. This procedure can also be used later to completely delete data from the PT. Always be careful not to initialize and delete essential data.

3-2-1 Initializing Memory

Perform the initialization if the screen memory is either SRAM or EEPROM. Check to be sure that the screen memory is installed.

Memory initialization can be used to initialize screen memory, memory tables, and history data. Initializing screen memory completely deletes the contents of the screen memory, including the contents of numeral tables and text string memory tables. Initializing memory tables overwrites numeral tables and text string memory tables with the initial values set by the Support Tool. Initializing the display history deletes all of the display history data.

To initialize the screen memory, first access the system menu by simultaneously pressing the Buzzer Key, Up Key, and Down Key. Then proceed as shown below.



If you select yes, then memory will be initialized and all data used for displays will be erased. After initialization, operation will begin.

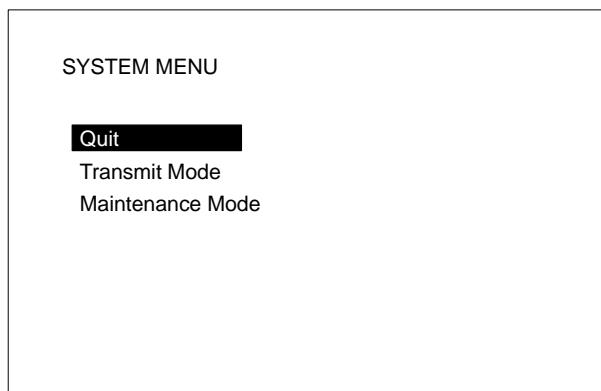
If you select no, then operation will begin without initialization.

When entering RUN Mode after initialization, nothing will be displayed on the screen and the Terminal will wait for a command from the host.

Caution Screen memory must be initialized before using a new PT. If the PT is used as shipped from the factory without initialization, messages indicating errors in the host will not be displayed properly.

3-2-2 Menus

The System Menu is called up by using the system keys during operation.



Using System Keys

| Operation | Content |
|--|--|
| Press the Buzzer Key, Up Key, and Down Key simultaneously. | The System Menu shown above is displayed during operation. If actions are executed while the System Menu is being displayed, the system returns to operation. With the Buzzer Key pushed down, press the Up Key and Down Key simultaneously. |
| Press the Up Key. | Moves the bar cursor upward. |
| Press the Down Key. | Moves the bar cursor downward. |
| Press the Enter Key. | Selects the menu at the position of the bar cursor. |

Quit

Use either of the following two methods to leave the System Menu and return to operation.

- 1, 2, 3...**
1. Select "Quit."
- OR
2. Press the Buzzer Key, Up Key, and Down Key simultaneously. In addition, if there are no key inputs within 10 s of calling up the System Menu, the system will automatically return to normal operation.

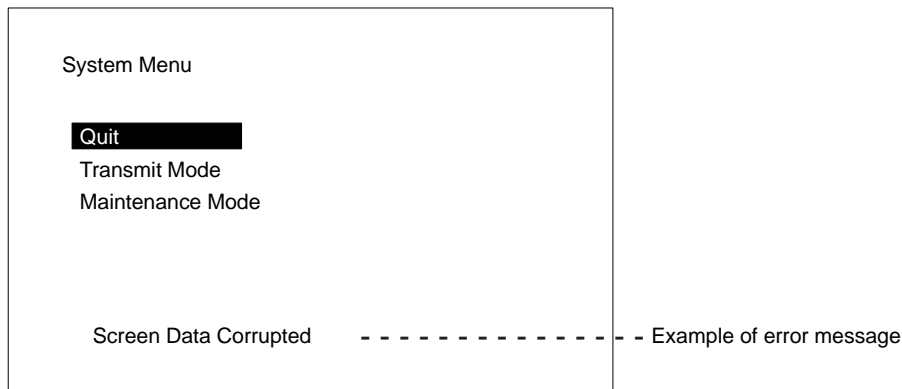
Selecting Items

To select an item, move the cursor to that item and press the Enter Key.

| Selected item | Function |
|------------------|---|
| Quit | Quits and return to normal operation. |
| Transmit Mode | Shifts to Transmit Mode. Select when transferring data between the PT and Support Tool. For details, refer to 3-3 <i>Transferring Data to and from the Support Tool</i> . |
| Maintenance Mode | Shifts to Maintenance Mode. Used to check the setting status of the PT and conducts self-testing. |

Error Messages

When there is an error in screen data registered in the PT, the System Menu will appear before entering RUN Mode, and the error message will be displayed on the bottom line.



There are three types of error messages, as shown below. Operation will not begin again until the error has been corrected.

| Error message | Error Content and Correction |
|-----------------------|--|
| Screen Data Corrupted | This is displayed when registered screen data is corrupted. Initialize the screen data and re-register the screen data. Operation will not begin again until the data is restored. |
| Mark Data Corrupted | This is displayed when registered mark data is corrupted. Initialize the screen data and transfer the screen data files. The mark data is included in the screen data files. Re-register the mark data. Operation will not begin again until the data is restored. |
| Memory Not Formatted | This is displayed when the screen data area is not formatted. Initialize the screen data memory. All registered screen data, mark data, and system data will be deleted by the initialization, so they will have to be transferred again from the Support Tool. In addition, if the image data memory is the IC socket type, recheck the socket memory and its settings. |

3-3 Transferring Data to and from the Support Tool

The following data can be transferred between the PT and the Support Tool.

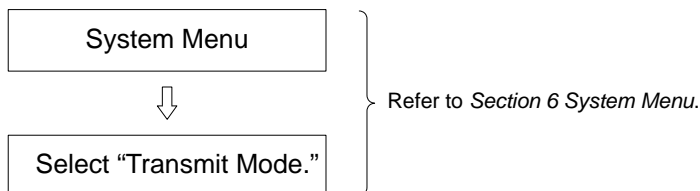
| Data | Support Tool to PT | PT to Support Tool |
|--|---------------------------|---------------------------|
| Screen data | All screens or one screen | All screens or one screen |
| Text string table | YES | YES |
| Numeral table | YES | YES |
| Mark data | YES | YES |
| Display history data | None | YES |
| System Memory* (Initial screen after power-up) | YES | YES |

Note System Memory is the first (initial) screen after the PT is powered up.

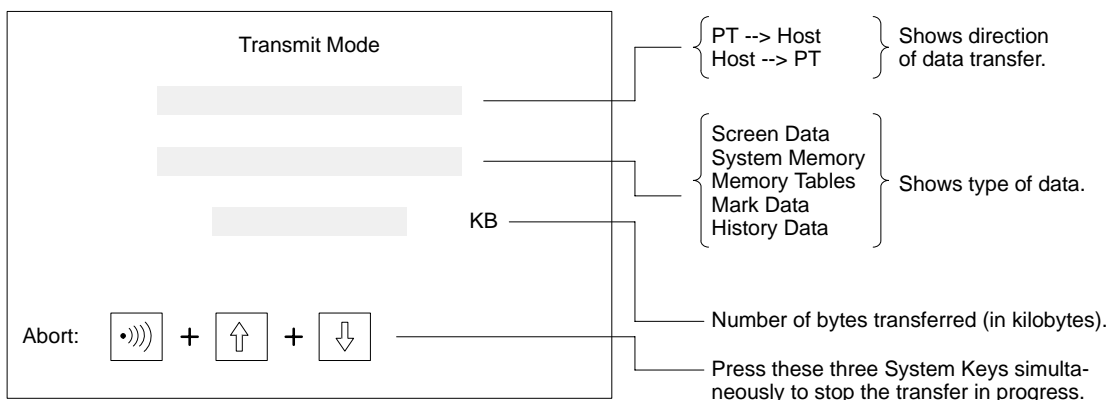
Procedure

Use the following procedure to transfer data.

- 1, 2, 3... 1. Connect the PT and personal computer running the Support Tool.
2. Select Transmit Mode from the System Menu.



3. Perform the transfer operation from the Support Tool. The screen shown below will be displayed during the transfer.



4. In the event of a disconnected cable or other disruption while the transfer is in progress, the PT screen will go blank and a message telling you that transfer was not possible will be displayed at the Support Tool. If the transfer is completed successfully, then at the end of the transfer the PT screen will go blank and a message telling you that the transfer has been completed will be displayed at the Support Tool.
5. To return from Transmit Mode to RUN Mode, press the Buzzer Key, Up Key, and Down Key simultaneously.

Note After completion of the transfer, be sure to change to Maintenance Mode. If power is turned off or the reset switch is pressed before changing to Maintenance Mode, the data that is transferred will be damaged. When using the EEPROM as a screen data memory, screens cannot be transferred screen by screen from the Support Tool to the PT. The screen data must be transferred in file units after initializing the memory.

3-4 Initial Settings

When power is turned on, the PT's internal status is initialized to the following settings.

| Item | Initial value |
|--------------------------|---|
| Character string memory | Screen data memory content |
| Numeral memory | Screen data memory content |
| Lamp/touch switch status | OFF |
| Key Press Sound | ON (When a battery is installed, the previously set value is retained.) |
| Backlight Off | 10 minutes (When battery is installed, the previously set value is retained.) |
| Display | No display or initial screen (At the Support Tool you can set either no display or initial screen.) |

SECTION 4

Display Functions

This section describes the functions used to create screens and control display attributes on the PT. Functions used to input data on-screen are described in *Section 5 Input Functions*. Data transfer and maintenance functions are described in *Section 6 System Menu*. Transferring screens online to and from the host computer is described in *Section 7 Online Transfer*.

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4-1 Character Displays on Screen

The type, size, and attributes of characters that can be displayed on the NT20M and NT2000M screens are shown below. Character type, size, and attributes are set at the time of creation on the Support Tool. When an RS-232C or RS-422 Host Interface Unit is used, coordinates, characters, etc., can be designated with commands from the host in Terminal Mode.

4-1-1 Types of Characters

| | |
|--------------------------------------|--|
| Half-size characters (8 x 8 dots) | Alphanumeric characters and symbols. |
| Normal-size characters (8 X 16 dots) | Alphanumeric characters and symbols. |
| Marks (16 X 16 dots) | Pictographs defined by the user (up to 64 possible). |

4-1-2 Designating Display Positions

The display positions can be designated in increments of display dots. When characters overlap, characters written last overwrite those written earlier.

4-1-3 Character Scale

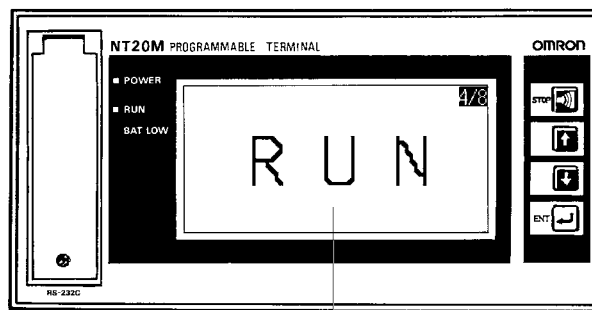
It is possible to designate normal, double-width, double-height, 4x, 9x, or 16x character size. When enlarging by 4x or more, the Programmable Terminal's automatic smoothing process (a process that removes the notches from characters when they are enlarged) makes the characters easier to read.

4-1-4 Display Attributes

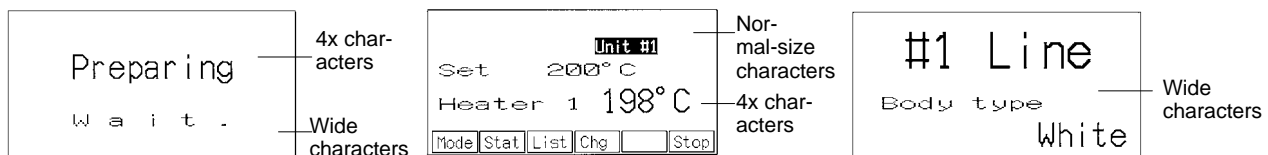
Besides the standard display (black characters on a white background), you can designate individual characters as inverse, blinking, or inverse/blinking.



Note You cannot designate the blinking cycle.



16x characters



4-2 Normal Screen Changes

The displayed screen can be changed to another screen by designating the screen number from the host (a Programmable Controller or personal com-

puter). The designated screen must have already been created at the Support Tool and downloaded to the PT.

4-2-1 Procedure for Changing Screens

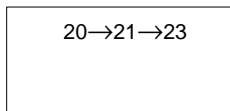
- 1, 2, 3... 1. By designating a screen number (0 to 250) from the host, you can switch to the designated screen.
2. When an ordinary screen is displayed, the screens cannot be changed by means of the Up and Down Keys on the front panel of the NT20M.
3. For details on screen-changing procedures for each interface, refer to the *Host Interface Unit Operation Manual*.

Note Screen no. 0 is white with no characters.

4-3 Continuous Screens

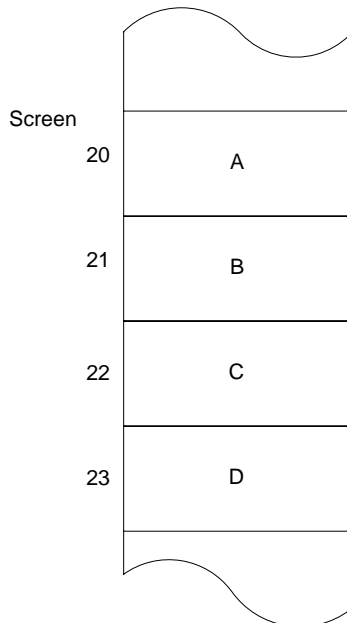
Screens can be linked to display consecutively, without breaks. A maximum of eight screens can be made consecutive, and treated as one screen.

Example Parent screen for consecutive screens
Screen no. 09

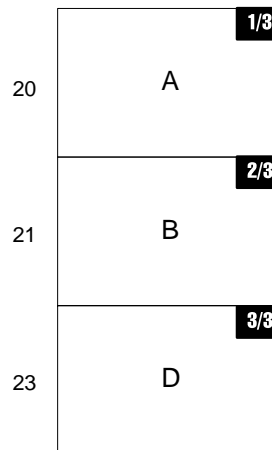


Register the screen numbers of the child screens that you want to make consecutive. (You can set screen numbers in any order you want.)

Screen contents



Screen no. 9: Screens displayed



- 1, 2, 3... 1. If screen 09 is designated from the host, screen 20 is displayed first.
2. Screens B and D will be displayed in order, either by line or screen scroll when the Down Key is pressed, depending on the scroll unit setting.
 - With line scroll, pressing the Down or Up Key will scroll eight dots at a time.
 - With screen scroll, one screen will be scrolled at a time.
 - Line and screen scroll are designated by the Support Tool when registering continuous screens. Screens with variable character string displays, numeric displays, graph displays, touch switches, lamps, or numeric settings cannot be scrolled by line.

- Screens with numeric settings cannot be designated as a child screen for any consecutive screen.
- A continuous screen cannot be registered as a child screen.

Note The parent screens (screen no. 09 in this case) cannot have screen data. They can be treated only as parent screens.

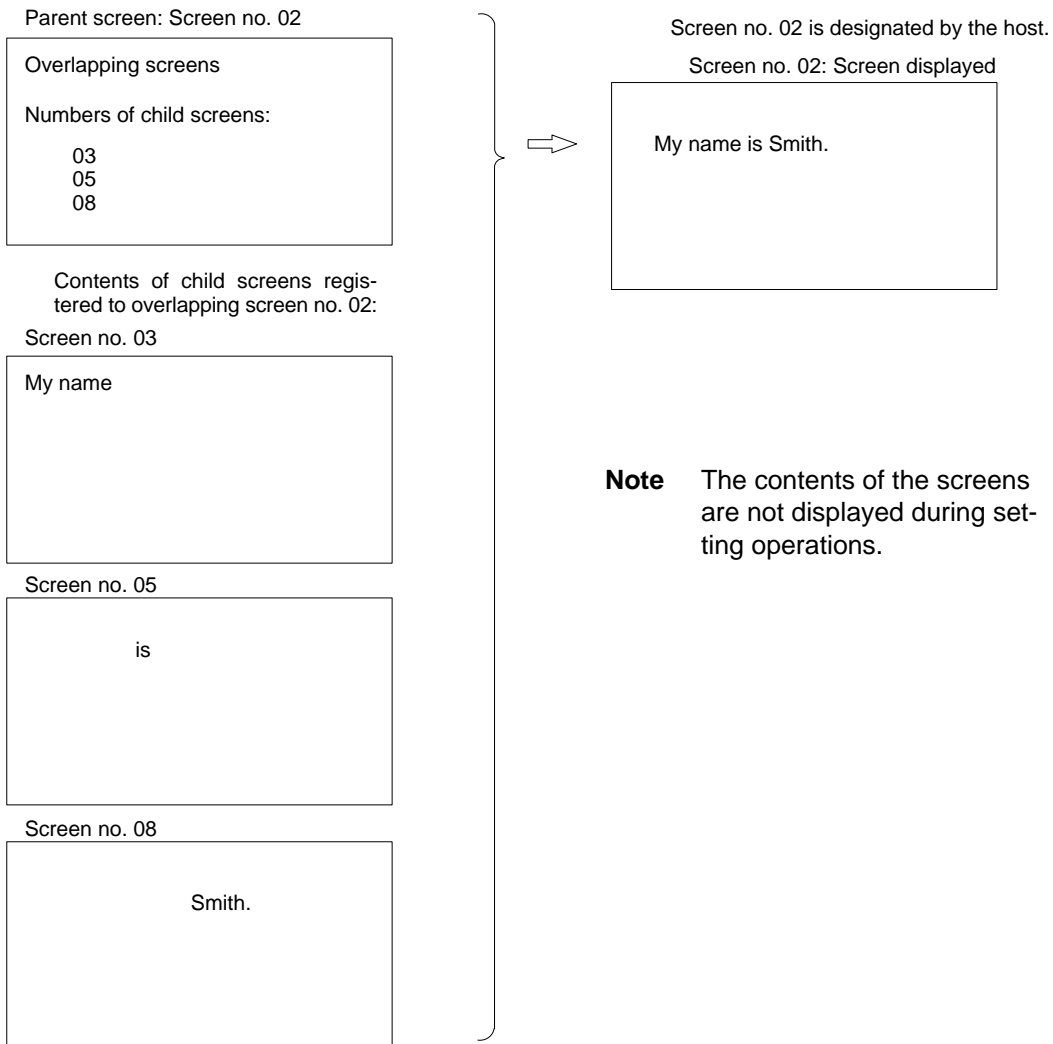
4-4 Overlapping Screens

The contents of multiple screens can be laid one on top of another and registered as one screen, when the screens are created on the Support Tool. Just as with ordinary screens, if the number of a screen registered as an overlapping screen is designated from the host, then the overlapping screens corresponding to that number are displayed.

- A maximum of eight screens may be overlapped.
- Screens with touch switches, lamps, graphs, character strings, and numeric displays can be overlapped.
- An overlapping screens cannot be registered as a child screen.

Example

If screen 02 is designated from the host, then screens 03, 05, and 08 are displayed.

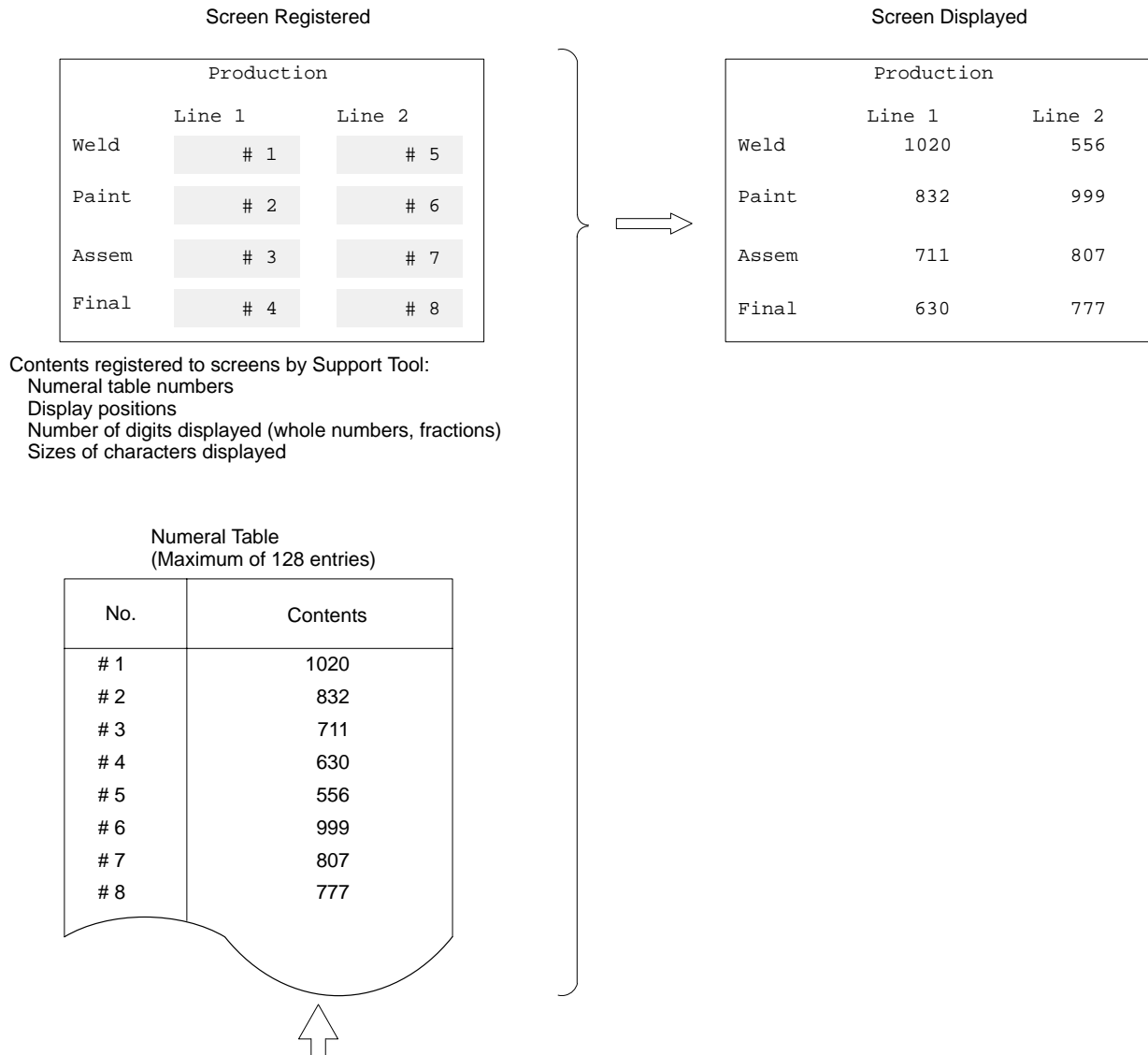


Note The parent screens (screen 02 in this case) cannot have screen data. They can be treated only as parent screens.

4-5 Numeric Displays

A numeral table is stored in the PT, and you can display numeric values from the table at programmed positions on a screen. In addition, the values in the table can be transferred from the host so that they are renewed each time a new value is transferred. The display positions are set in advance with the Support Tool.

Example



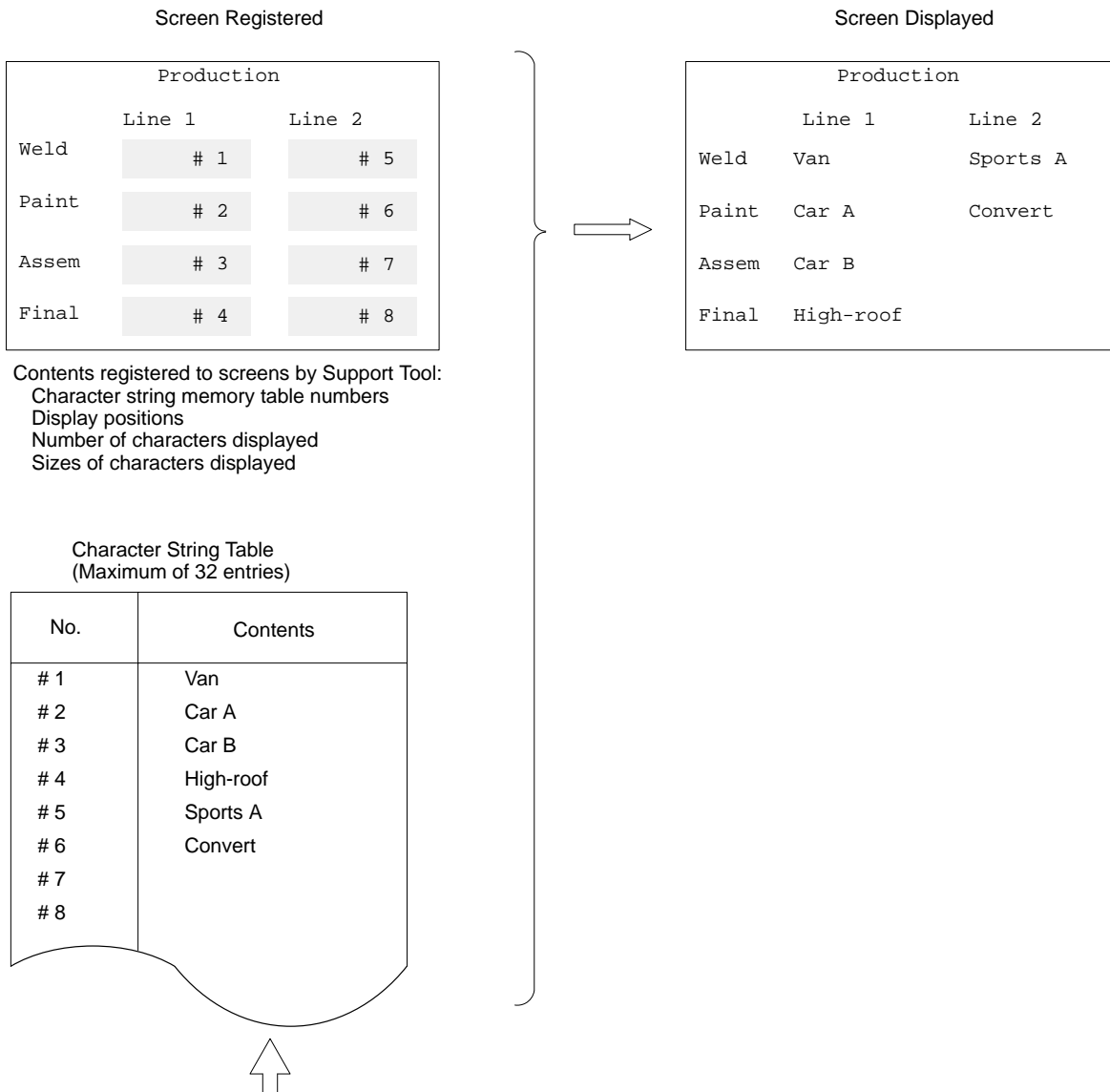
These contents are transmitted from the host.

When the PC is used as the host, for example, these values will be transferred via the Host Interface Unit and updated on screen when the contents of the DM Area are changed.

4-6 Character Strings

This function displays variable character strings on the screen. These character strings can be changed with transmissions from the host. A character string memory table is stored in the PT. By changing, from the host, the memory table values corresponding to the display position, you can update the characters displayed. The designation of the display positions is set in advance at the Support Tool.

Example



Contents registered to screens by Support Tool:
 Character string memory table numbers
 Display positions
 Number of characters displayed
 Sizes of characters displayed

Character String Table
 (Maximum of 32 entries)

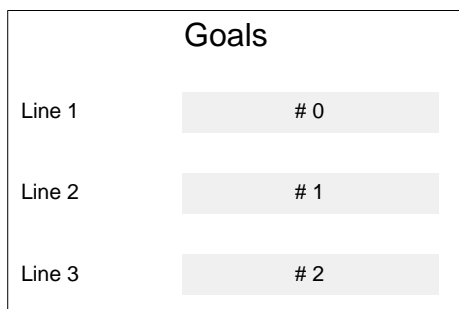
These contents are transmitted from the host.

When the PC is used as the host, for example, these values will be transferred via the Host Interface Unit and updated on screen when the contents of the DM Area are changed.

4-7 Bar Graphs

If the numeric values that you want to make into a bar graph have been input into the numeral table in advance, then that graph can be displayed simply by designating the screen on which the graph is registered. Just as with numeric displays, the graph display is also updated when the contents of the numeral table are updated. Bar graphs can be displayed either horizontally or vertically.

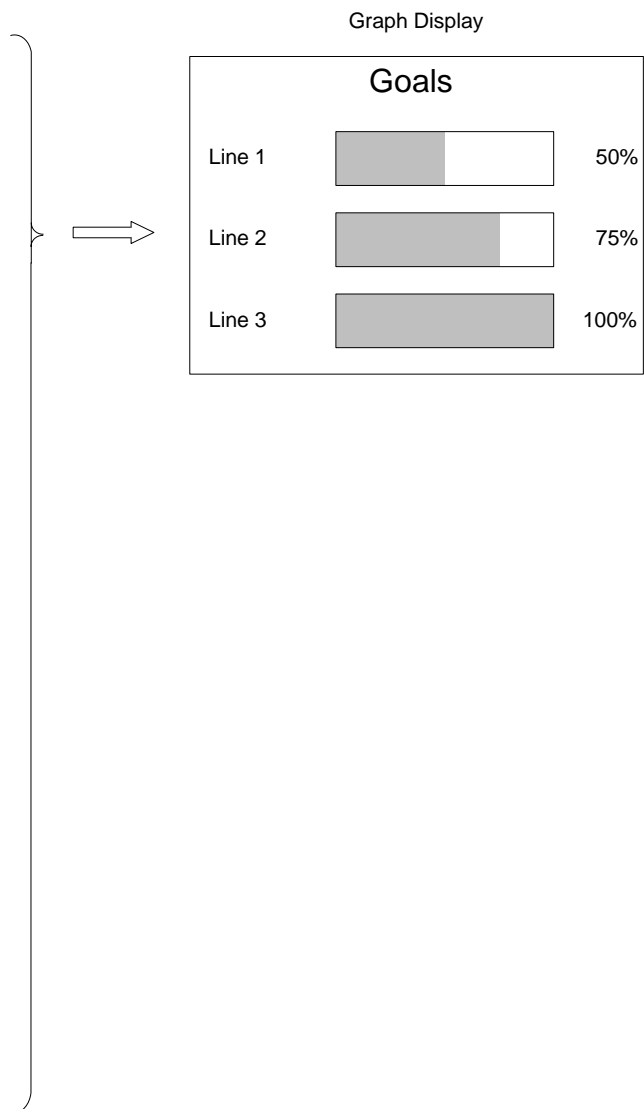
Example



- Contents registered to screens by Support Tool:
- Display positions (50 bars max.)
 - Graph width (2 to 255 dots)
 - Graph orientation (horizontal and vertical)
 - Display direction (normal or inverted direction)
 - 100% value
 - With or without % numeric display
 - Position of % numeric display
 - % numeric font
 - Enlarged % numeric display
 - Numeral table numbers to be referred to
 - With or without +/- symbol
 - With or without graph frames

Numeral Table
(Maximum of 128 entries)

| No. | Contents |
|-----|----------|
| # 0 | 1020 |
| # 1 | 832 |
| # 2 | 711 |



4-8 Lamps

With the Support Tool you can set lamp areas in the display screen, and the lamps can be made to light (or blink) by means of a designation from the host. Lamps are registered in advance at the Support Tool.

- Display position: Can be set as desired, but must match the switch frames when combining lamps with the switch function.
- Shape: Square and circle.
- Size: The size of the square or circle can be freely set.

Number of settings: The total number of lamps must not be greater than 64 per screen.

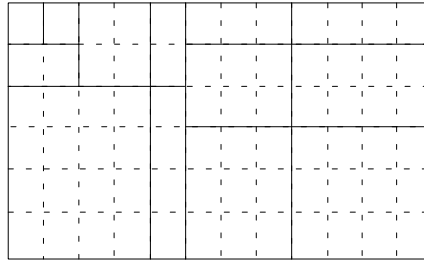
Display attribute: Lit or flashing (used for bit designation).

Guide characters: With or without (selectable).

Lamps set from the host can be turned on and off by either of two methods: number designation or bit designation. For details, refer to the *Host Interface Unit Operation Manual*.

Example 1: Usage with Switch Frames

If using a lamp together with a switch, then set the lamp within the switch frames, of which there are 12 horizontal and 6 vertical.



Example 2: Emphasis

The display of the number defective can be emphasized setting it to blink.

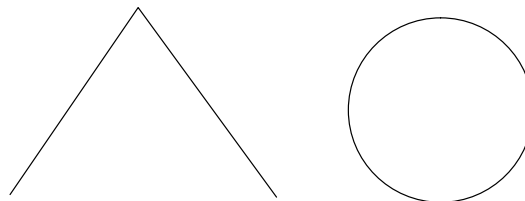
| | |
|-----------|------|
| Goal | 1234 |
| Complete | 600 |
| Defective | 2 |

4-9 Graphics Display

Unbroken straight lines (polylines) and circles can be created by the Support Tool and displayed at the PT. When an RS-232C or RS-422 Interface Unit is used, the graphics can be displayed by using the terminal function and transmitting commands from the host. (The terminal function can be used with all versions. See 4-10-7 Terminal Function.)

Designating Display Positions

Graphics display positions can be designated in dot units. In cases where graphics and characters overlap, the graphics will be overwritten. Polylines and circles are both drawn with a width of one dot.



4-10 Special Controls

The status of the PT can be controlled from the host during operation.

4-10-1 Backlight On/Off

In order to prolong the life of the backlight, the backlight can be set to turn off when it is not needed during operation.

Note If there is any key input or screen-change command while the backlight is off, the backlight will turn on again.

4-10-2 Backlight Red/White

The backlight can be changed from white to red during operation. This is possible for the following models: NT20M-DT13□/DN131 and NT2000M-D□131.

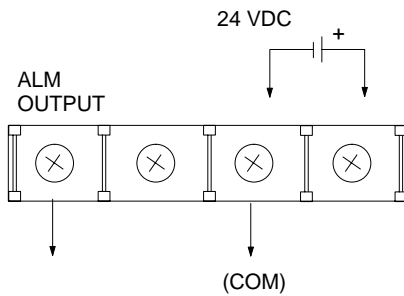
4-10-3 Buzzer On/Off

The built-in buzzer can be turned on and off from the host. There are two types of buzzers, continuous and intermittent. The buzzer also sounds when a screen registered with the buzzer is displayed. The buzzer stops when the Buzzer Key is pressed. The NT2000M allows for the buzzer to be disabled when the setting pin is disabled.

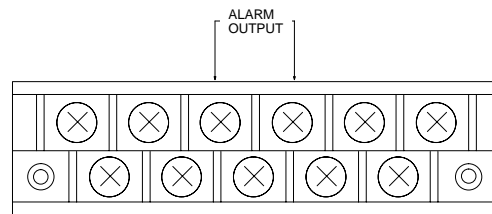
4-10-4 Alarm Output On/Off

The ALM OUTPUT can be turned ON and OFF from the host. The ALM OUTPUT terminal ON/OFF is also output when a screen registered for an alarm is displayed, or when an error occurs. This terminal can be used for large lamps or sound devices.

NT20M



NT2000M



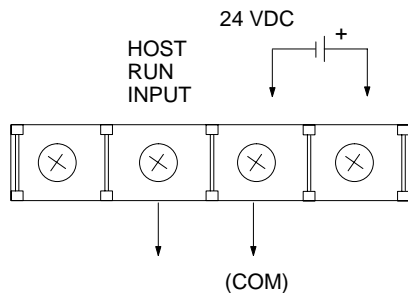
4-10-5 HOST RUN INPUT

The HOST RUN INPUT detects when the host is not in RUN, and displays the host error screen. Pin 2 of SW1 is used to enable and disable this input.

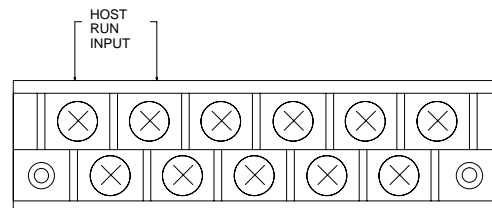
Pin 2 of SW1 ON:
Pin 2 of SW1 OFF:

HOST RUN INPUT disable.
HOST RUN INPUT enable.

NT20M



NT2000M



4-10-6 Display History Clear

History data in the PT can be cleared (initialized) by the host. Until this operation is executed, history data continues to be registered.

4-10-7 Terminal Function

This function allows you the option of displaying, by transmission on command, the codes (coordinates, type, etc.) of characters and figures you want to display from the host, in addition to screens registered in advance. This function is possible only when the Host Interface Unit is the NT600M-LK201 (RS-232C specifications) or the NT600M-LK202 (RS-422 specifications). For details, refer to the terminal commands listed in the *Host Interface Unit Operation Manual*.

| Item | Content |
|-----------------------|---|
| Display position | Optional |
| Character size | Normal, half-size, high, wide, 4x, 9x, or 16x |
| Display attributes | Normal, inverse, blinking, inverse blinking |
| Character designation | ASCII |
| Graphics | Polyline, circle |

- Note**
1. If a displayed character string exceeds the line, that string is displayed beginning from the left side of the next line.
 2. In addition, strings that do not fit at the bottom of the screen over-write from the top left side of the same screen.

SECTION 5

Input Functions

This section describes the functions used to input data on-screen. Functions used to create screens and control display attributes on the PT are described in *Section 4 Display Functions*. Data transfer and maintenance functions are described in *Section 6 System Menu*. Transferring screens online to and from the host computer is described in *Section 7 Online Transfer*.

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| 5-1-3 | Using Function Keys | 47 |
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5-1 On-screen Switch Inputs

The DT-type PT can transmit to the host the status of touch switches set on screens. A maximum of 64 switches can be set per screen. The DN-type can transmit to the host the inputs of 12-key Function Key Units and External I/O Units.

5-1-1 Transmitting to the Host

There are two ways to transmit the status of switches to the host. These methods are described briefly below. For more detail, refer to the *Host Interface Unit Operation Manual*.

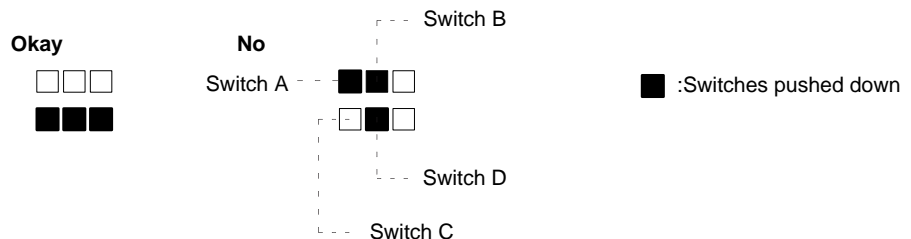
Switch-Number Method

When a switch is pressed, the number corresponding to that switch is transmitted to the host as a numeric value in three digits of BCD. When two switches are pressed, the first one is given priority in transmission. When using an NT600M-LK201 or NT600M-RT121/LB121 Host Interface Unit, send the data to the host by means of the strobe signal in the PT status information which is output when switches are pressed.

Bit-Switch Method

The status of each switch is transmitted to the host as a bit status. This is the method used when substituting for ordinary operating switches. You can use it for ordinary bit input switches from a Programmable Controller. In order to use this method, you must set "bit input" in advance at the Support Tool or use the Host Link Interface direct connection function.

Note With this method, it is possible to push a number of switches simultaneously as long as they are in the same vertical row or the same horizontal column. Do not simultaneously press switches that are in both different rows and in different columns. At the right in the following example, simultaneously pressing switches A, B, and D will automatically turn switch C to ON.



For details, refer to the *Host Interface Unit Operation Manual*.

5-1-2 Creating Touch Switches (DT Type Only)

Just as with lamps, touch switches are created and registered with the Support Tool. The setting content is as follows:

| Frame Display | Standard/Cubic Type/Without |
|-------------------------|-----------------------------|
| Inversion at input time | With/Without |
| Guide character | With/Without |

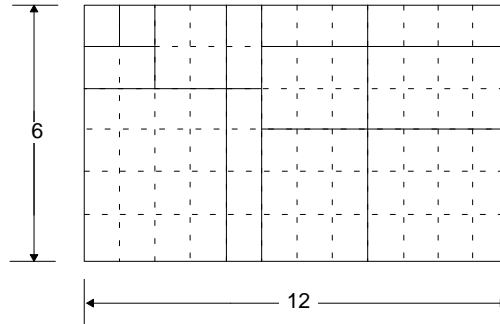
Setting Parameters

Combine your choices of rectangular sections from the among the 72 blocks shown in the diagram below, and designate them as switches. Switches must be set in increments of these blocks.

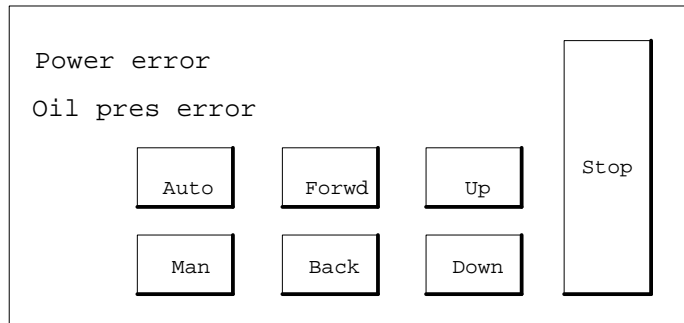
Number of Settings

You can set a maximum total of 64 switches per screen. If you wish, the whole screen can also be set as one input switch.

Screen Configuration Example



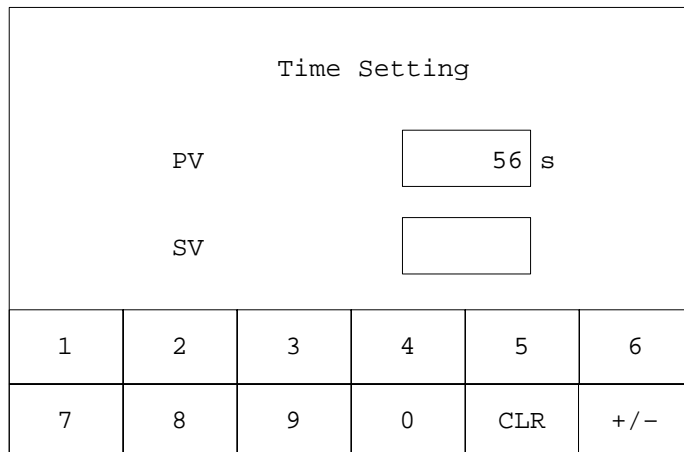
Example of On-screen Touch Switches



5-1-3 Using Function Keys

The function keys all have the same size screen display frames. You can display customized function names on the screen to identify them. When a 12-key Function Key Unit or an External I/O Unit is connected to a DN-type PT, the functions of the keys can be allocated. Up to two function keys can be pressed simultaneously when using an NT20M-FK210 Function Key Unit.

Example of Function Key Input Screen



5-2 Inputting Numeric Settings

Numeric values input while the numeric setting screen is being displayed are written to the designated numeral table and transmitted to the host.

Numeric Setting Screens

The standard numeric setting screen is as shown below. This screen is reserved for system use by the Support Tool. Standard screen key arrange-

ments and functions are fixed. In order to change the key arrangement or add keys (such as a decimal point) for numeric input, set the “numeric setting” item under “screen attributes” to “user.” (When it is set to “system,” the standard screen will be displayed.) For instructions on registering numeric setting screens, refer to the *NT-series Support Tool Operation Manual*.

Standard Screen (Screen Attribute: System)

| | | | | | |
|---|---|---|---|-----|-----|
| | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | 8 | 9 | 0 | CLR | +/- |

User-set Screen Example (Screen Attribute: User)

| | | | |
|--------|--------|--------|---------|
| Tank A | Tank B | HOME | MENU |
| 0654 | 0650 | 1 | 2 3 ↑ |
| Tank C | Tank D | 4 | 5 6 ↓ |
| 0000 | 0550 | 7 | 8 9 ← |
| Tank E | Tank F | 0 | · CLR → |
| 0800 | 0990 | CHANGE | SET |

Creating Numeric Setting Screens

When creating a numeric setting screen with the Support Tool, take note of the following points.

- 1) A numeric setting screen cannot be set as the child screen of a continuous screen.
- 2) Ordinary touch switches can be set in numeric input screens, but touch switch numbers 244 through 255 cannot be used.
- 3) When “10-key” is set to “user” in the screen attributes, touch switch numbers 231 through 255 cannot be used for purposes other than numeric input.
- 4) The numeric setting function cannot be used when the screen attribute “bit input” is enabled for PTs with no touch panel.

Inputting Numeric Values (PTs With Touch Panels)

1) Inputting Numeric Values with the Standard Screen:

- The numeral shifts from the rightmost digit to the left each time a screen key is pressed.
- If a decimal point is set, the shift is from the rightmost digit in the decimal area to the integer side.

2) Inputting Numeric Values with a User-set Screen:

- The numeral shifts from the rightmost digit to the left each time a screen key is pressed.
- If a decimal point is set, the integer portion is received first, and with each numeric key input there is a shift from the rightmost digit to the left.
- When the decimal point key is pressed, the decimal portion will then be received. From that point on, with each numeric key input there is a shift from the rightmost digit in the decimal portion to the left.

Inputting Numeric Values (PTs Without Touch Panels)

Use the 12-key Function Key Unit (NT20M only) or the 32/16 Terminal for an External I/O Unit. The 10/02 Terminal cannot be used for numeric input.

1) Inputting Numeric Values with the Standard Screen:

Use the corresponding function keys. Numeric input is the same as for PTs with touch panels.

2) Inputting Numeric Values with a User-set Screen:

Use the corresponding function keys. Numeric input is the same as for PTs with touch panels.

Numeric Input Example

This example shows numeric input with a user-set screen. The display settings made with the Support Tool are as follows:

- Number of digits displayed: 7
- Number of integer digits: 4
- Number of decimal digits: 3
- Zero suppress: No
- Plus/minus mark display: No

The following table shows the inputs and the resulting changes in the display.

| Input operation | Set value |
|-----------------|-----------|
| Initial display | 1234.567 |
| Input "CLR" | 0000.000 |
| Input "2" | 0002.000 |
| Input "7" | 0027.000 |
| Input "." | 0027.000 |
| Input "2" | 0027.002 |
| Input "1" | 0027.021 |
| Input "9" | 0027.219 |
| Input "↵" | 0027.219 |

Numeric values input with the input keys are stored in the numeral table justified to the right, as shown above. When the CLR Key is pressed for the first time, the initial display is cleared. If zero suppress were enabled, the number displayed would be "0.000" instead of "0000.000." When the "2" is then input, it is registered at the rightmost integer position, as described on the preceding page. The "2" is then shifted to the left as the "7" is input. After the decimal point is input, numerals are then registered at the leftmost decimal position. (To return to integer input status, press the CLR Key again.) Finally, pressing the Enter Key causes the numeral table data to be transmitted to the host.

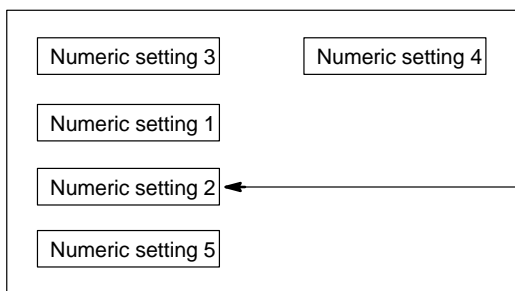
Direction Keys and Home Key

Pressing the direction keys (i.e., the arrow keys) moves the cursor to other numeric setting columns. Pressing the Home Key moves the cursor to the upper left of the screen.

Differences in Cursor Movement

When multiple numeric setting areas are created for a numeric setting screen, cursor movement will be different depending on whether system keys or touch switches are used.

Screen Example



Numeric setting n: "n" represents the order in which numeric setting areas are created by the Support Tool.

Present cursor position

1) When System Keys are Used:

When system keys are used, the cursor moves from area to area in the order in which the areas were created by the Support Tool. Thus, in the screen example shown above, the cursor would start at numeric setting 2 and move in order to numeric settings 3, 4, 5, and back to 1.

2) When Touch Switches are Used:

When touch switches are used, the cursor moves from area to area according to the layout of the screen. Thus, in the screen example shown above, the Down Key would move the cursor from numeric setting 2 to numeric setting 5. After that, the Down Key cannot move the cursor any further.

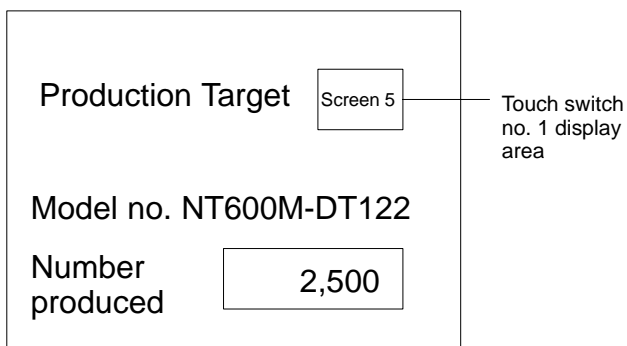
Pressing the Up Key would then move the cursor back to numeric setting 2, and then continue to move it upward in order to numeric settings 1 and 3. The Right Key would then have to be used to move the cursor to numeric setting 4.

5-3 Standalone Function

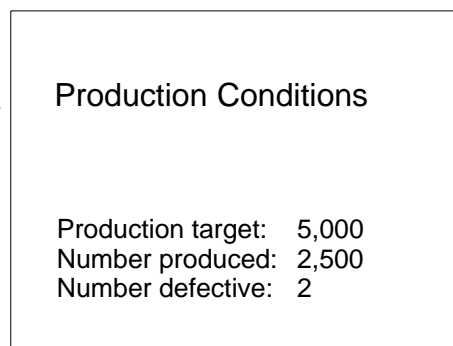
When a screen for which the standalone function has been set by the Support Tool is displayed, the screen can be changed by means of touch switches and function keys.

Example

Registered Screen



Screen No. 5



- Items Registered to Screen by Support Tool
- Standalone function setting
 - Touch switch or function key number
 - Screen number to be displayed when touch switches or function keys are input

Example
 Standalone function is set.
 Touch switch number: No. 1
 Screen to be displayed: No. 5

When touch switch no. 1 is input, screen no. 5 is displayed.

SECTION 6

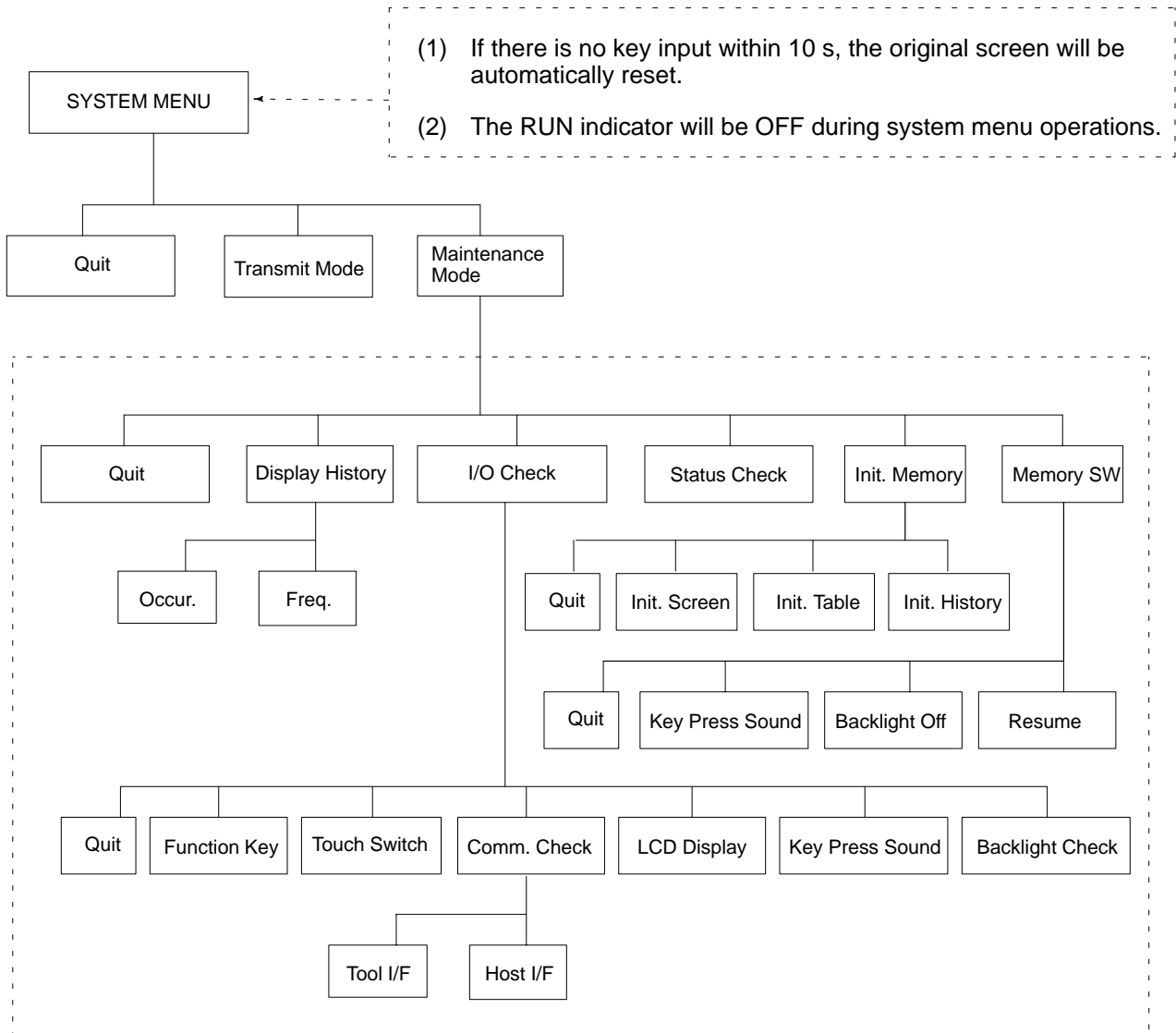
System Menu

This section describes data transfer and maintenance functions. Functions used to create screens and control display attributes on the PT are described in *Section 4 Display Functions*. Functions used to input data on-screen are described in *Section 5 Input Functions*. Transferring screens online to and from the host computer is described in *Section 7 Online Transfer*.

| | | |
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6-1 Configuration of System Menu

The system menu is used to set PT system parameters in advance and perform maintenance. With the system menu you can, in addition to determining the PT's status, check switch settings and perform simple I/O checks.



To return to the original screen after selecting Maintenance Mode, do one of the following:

Select Quit, and press the Enter Key.

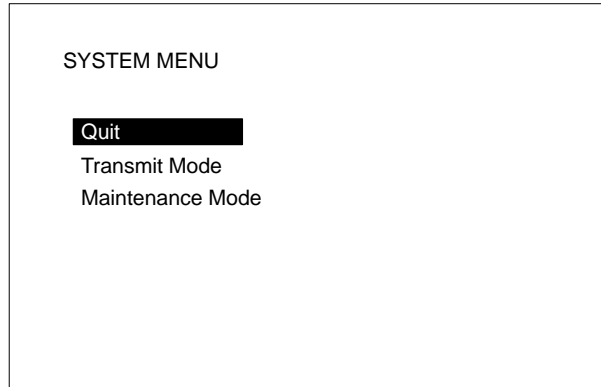
Or press the Buzzer Key, Up Key, and Down Key simultaneously.

The RUN indicator on the front panel is OFF while the System Menu is being displayed.

6-2 System Menu

6-2-1 Quit

The System Menu is called up by using the system keys during operation. To leave the System Menu and return to RUN Mode, select Quit. If no key is pressed for 10 seconds, the PT will automatically return to RUN Mode.



For details on key operation and content, refer to *3-2 Initialization*.

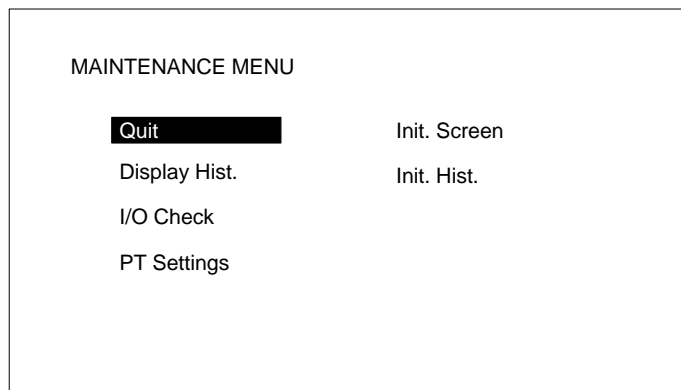
6-2-2 Transmit Mode

This mode is used to transfer data between the PT and the Support Tool.

6-3 Maintenance Mode

When making PT system settings or when there is an operating error, select Maintenance Mode and conduct all the checks.

Maintenance Mode Menu



6-3-1 Display History

The PT saves into memory and can display the history of screens displayed during operation if the history attribute is set for them. The history can be displayed either in order of occurrence or in order of frequency. This function can be used to help identify the causes of malfunctions or to enable the operator to know which functions are often being used.

Setting History Data

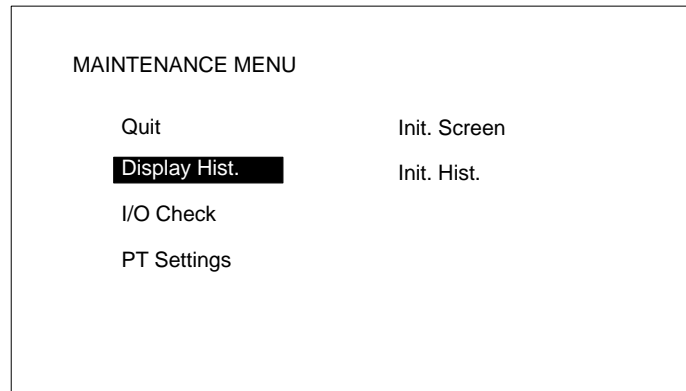
When creating screens with the Support Tool, use screen attribute designations to register history attributes and messages (within 24 characters) for the screens you want to save in the history.

Whenever the screen number registered for history attributes is designated by the host, the occurrence and message are saved in memory.

- The capacity of the history is 256 screens.
- The only things that can be recorded are screen numbers and messages. History record data is backed up by a battery, so, as long as the lithium battery is installed, the contents will be retained even when the power is turned off.
- Before beginning to record, initialize the history data by transmitting an Initialize History command from the host, or by selecting Init. Hist. from the Maintenance Mode.
- If the history data capacity is exceeded, newly occurring history data will not be saved.

Reading History Data

Enter Maintenance Mode from the System Menu.



Move the bar cursor to History Record by pressing the Up and Down Keys. Then press the Enter Key.

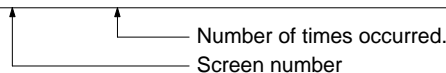


Select whether the history is to be displayed in order of occurrence or in order of frequency. First move the bar cursor to your selection by means of the Up and Down Keys, and then press the Enter Key.

Order of Occurrence

Record data is displayed in order of occurrence.

| No. | Of | Times | Message |
|-----|-----|-------|--------------|
| 1 | () | | Coolant Mal. |
| 5 | () | | Motor Mal. |
| 200 | () | | Comp. Mal. |
| 150 | () | | Press |



- One screen displays six items of record data.
- If not all of the record data shows on the screen, then use the Down Key to scroll down.
- To return to RUN mode, press the Buzzer Key, Up Key, and Down Key simultaneously.
- When record data is displayed chronologically, the chronology number is not displayed.

Order of Frequency

Record data is displayed in order of frequency.

| No. | Of Times | Message |
|-----|----------|--------------|
| 200 | (2) | Comp. Mal. |
| 1 | (1) | Coolant Mal. |
| 5 | (1) | Motor Mal. |

When different messages occur with the same frequency, they are displayed in order beginning with the lowest screen number.

When there is no display data, the following message will be displayed (for both order of occurrence and order of frequency).

History Record Not Found

Initializing History Data

If you select Init. Hist. from the Maintenance Mode menu, the history data which is currently recorded will be deleted. Select Maintenance Mode from the System Menu. The Maintenance Mode Menu will be displayed.

```

MAINTENANCE MENU

Quit                Init. Screen
Display Hist.      Init. Hist
I/O Check
PT Settings
  
```

Move the bar cursor to Init. Hist. by pressing the Up and Down Keys. Then press the Enter Key.

```

Initialize History?
Yes
No
  
```

Select whether or not the history will be initialized. If you select Yes, then initialization will be executed. All recorded history will be deleted. If you select No, then operation will commence without initialization.

6-3-2 I/O Checks

In the Maintenance Mode Menu, use the Up and Down Keys to move the bar cursor to I/O Check. When you then press the Enter Key, the following menu will be displayed.

| I/O CHECK MENU | |
|----------------|-----------------|
| Quit | LCD Display |
| Function Key | Buzzer |
| Touch Switch | Backlight Check |
| Comm. Check | |

Move the bar cursor to the item you want to check, and then press the Enter Key.

Function Key Check

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 |
| F9 | F10 | F11 | F12 | F13 | F14 | F15 | F16 |
| F17 | F18 | F19 | F20 | F21 | F22 | F23 | F24 |
| F25 | F26 | F27 | F28 | F29 | F30 | F31 | F32 |
| F33 | F34 | F35 | F36 | F37 | F38 | F39 | F40 |
| F41 | F42 | F43 | F44 | F45 | F46 | F47 | F48 |
| F49 | F50 | F51 | F52 | F53 | F54 | F55 | F56 |
| F57 | F58 | F59 | F60 | F61 | F62 | F63 | F64 |

The operation of the function keys can be checked if a 12-key Function Key Unit is connected. Press a function key. If the number of that key is displayed in reverse video on the screen, then it is operating properly. Key numbers are not transmitted to the host during the check operation. Up to two keys can be pressed simultaneously.

The NT20M-FK210 has 12 standard function keys, so you can use F1 to F12.

To return to the I/O Check Menu, press the Buzzer Key, Up Key, and Down Key simultaneously.

Touch Switches (DT-type PTs)

A touch switch operation check can be carried out for PTs with touch panels (i.e., DT-type PTs) by pressing each switch displayed on the screen. If a given switch is displayed in reverse video after being pressed for approximately 0.5 second, then that switch is okay. If "key input sound" is set to ON in the Memory Switch Menu in Maintenance Mode, then the buzzer sounds simultaneously with the reverse video display. The switch numbers are not transmitted to the host. To return to the I/O Check Menu, press the Buzzer, Up, and Down system keys simultaneously.

External Function Key Input Check

When external input terminals turn ON, the corresponding function keys are displayed in reverse video. When a 12-key Function Key Unit is connected, F1 through F12 correspond to IN0 through IN11.

To return to the I/O Check Menu, press the Buzzer, Up, and Down system keys simultaneously.

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 |
| F9 | F10 | F11 | F12 | F13 | F14 | F15 | F16 |
| F17 | F18 | F19 | F20 | F21 | F22 | F23 | F24 |
| F25 | F26 | F27 | F28 | F29 | F30 | F31 | F32 |
| F33 | F34 | F35 | F36 | F37 | F38 | F39 | F40 |
| F41 | F42 | F43 | F44 | F45 | F46 | F47 | F48 |
| F49 | F50 | F51 | F52 | F53 | F54 | F55 | F56 |
| F57 | F58 | F59 | F60 | F61 | F62 | F63 | F64 |

Lamp Output Check

When “lamp output check” is displayed in reverse video, L1 will light. This indicates that output 1 is ON. Use the Up Key and the Down Key to move from lamp to lamp to check their respective outputs. When the Up Key is pressed, the next lamp to the right is displayed in reverse video. When the Down Key is pressed, the next lamp to the left is displayed in reverse video. When a 32/16 Terminal or a 10/02 Terminal is connected, the output corresponding to the lamp displayed in reverse video turns ON. To return to the I/O Check Menu, press the Buzzer, Up, and Down system keys simultaneously.

| | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|
| L1 | L2 | L3 | L4 | L5 | L6 | L7 | L8 |
| L9 | L10 | L11 | L12 | L13 | L14 | L15 | L16 |
| L17 | L18 | L19 | L20 | L21 | L22 | L23 | L24 |
| L25 | L26 | L27 | L28 | L29 | L30 | L31 | L32 |
| L33 | L34 | L35 | L36 | L37 | L38 | L39 | L40 |
| L41 | L42 | L43 | L44 | L45 | L46 | L47 | L48 |
| L49 | L50 | L51 | L52 | L53 | L54 | L55 | L56 |
| L57 | L58 | L59 | L60 | L61 | L62 | L63 | L64 |

Note If a load (e.g., a buzzer or alarm light) is connected to a 10/02 Terminal or a 32/16 Terminal, it will actually operate. This can potentially be dangerous, so take the necessary precautions.

Communications Check

When “Communications Check” is selected, the Communications Check Menu will be displayed.

| | |
|---------------------------|------------|
| COMMUNICATIONS CHECK MENU | |
| Tool Interface | |
| Host Interface | |
| | Select one |

Tool Interface Check

Data received from a connected Support Tool is displayed as is, in hexadecimal. If any numbers are displayed, that means that the tool interface is okay. If nothing is displayed, then there may be a Support Tool, communications cable, or communications hardware error.

Tool Interface

Data transmitted from the Support Tool is displayed in hexadecimal.

Tool I/F Input Check
1B 24 15 20

Host Interface (NT600M-LK201)

RS-232C I/F Input Check
1B 51 30 33

Data which is received will be displayed in hexadecimal.

Host Interface (NT600M-LK202)

RS-422 I/F Input Check
1B 24 15 20

Data which is received will be displayed just as it is, in hexadecimal.

LCD Display Check



The lines of the display are reversed one at a time, starting from the top of the screen. When the reversal is finished, then they are cleared one at a time. When all of them have been cleared, the I/O Check Menu is returned to. You can interrupt the check and return to the I/O Check Menu by pressing the Buzzer Key, Up Key, and Down Key simultaneously while the check is in progress.

Buzzer Check

By selecting "Buzzer" from the I/O Check Menu, the PT buzzer can be checked. The buzzer should produce a continuous sound. To stop the buzzer, press the Buzzer Key. While the buzzer is sounding, it will not be possible to change screens or stop the buzzer by pressing the Buzzer Key, Up Key, and Down Key simultaneously. The NT2000M has a buzzer enable/disable pin. If this pin is removed, the buzzer cannot sound.

Backlight Check

If "Backlight" is selected, the cycle from white (1 s) to red (1 s) to off will be repeated. To stop the backlight check, press the Buzzer Key, Up Key, and Down Key simultaneously. The NT20M-DT121-EV2 and the NT20M-DN121-EV2 do not have red backlights.


6-3-3 PT Settings Check

The status of the PT and Host Interface Unit can be displayed, as well as the settings of switches. Select "PT Settings" from the Maintenance Mode Menu.

There are two screens, one for the PT and one for the Host Interface Unit, and you can scroll up and down with the Up and Down Keys.

Internal Settings


When PT Settings is selected, the internal settings of the PT are displayed first.

| PT Settings | | Page  |
|---------------|-----------------------|--|
| Memory Type | RAM | |
| Memory Size | 128 KB | |
| Mode Changes | No | |
| Exp. I/O Unit | Standard (See Note 2) | |


- Note**
1. Memory type and memory size are displayed only when the screen data memory has been initialized. If it has not been initialized, then "N.A." is displayed.
 2. If the PT is a DN type, and if an Expansion I/O Unit is connected, then the types of Expansion I/O Unit will be displayed.
 Standard: 12-key Function Key Unit
 Not Connected
 - If an 12-key Function Key Unit becomes disconnected during operation, a continuous buzzer will sound and a "No Expansion I/O Unit" error message will be displayed.
 - To clear the error message, turn off the power supply and reconnect the Expansion I/O Unit. Then turn the power supply back on.

Host Interface Unit Settings To display the DIP switch settings on the Host Interface Unit, press the Down Key while the PT settings are being displayed.

RS-232C Host Link Units (NT600M-LK201)

| RS-232C I/F Settings | | Page  |
|----------------------|----------|--|
| Data Length | 7 bits | |
| Stop Bits | 2 bits | |
| Parity | Even | |
| Flow Control | XON/XOFF | |
| Baud Rate | 9600 bps | |

RS-422 Host Interface Units (NT600M-LK202)

| RS-422 I/F Settings | | Page  |
|---------------------|----------|--|
| Terminal No. | 01 | |
| Data Length | 7 bits | |
| Stop Bits | 2 bits | |
| Parity | Even | |
| Flow Control | No | |
| Baud Rate | 9600 bps | |

For details on other Host Interface Unit models, refer to the *Host Interface Unit Operation Manual*. To return to the Maintenance Mode Menu, press the Buzzer Key, the Up Key, and the Down Key simultaneously.

6-3-4 Initialization

You must initialize the image data memory when using the SRAM or EE-PROM for the first time. Initialization can also be used to clear all or part of the data already registered in the PT.

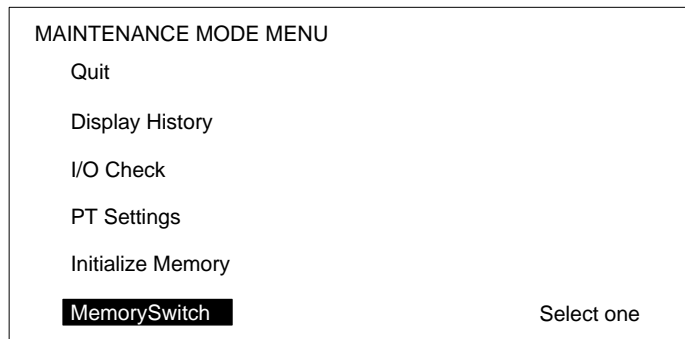
Initializing Memory

If you select Init. Memory in Maintenance Mode, a screen will be displayed providing a selection of data to be initialized (i.e., image data, memory table data, or history data). After one of the choices has been selected, another screen will be displayed to confirm that you actually want to initialize that data.

If you select Yes, then initialization will be executed and all of the selected data will be deleted. (If memory table data is initialized, then the values set by the Support Tool will be restored.)

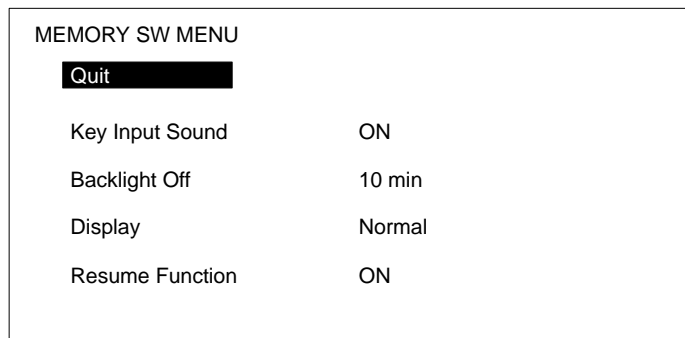
6-4 Memory Switch Settings

Memory switch settings set the NT20M display and key input sounds. Select "Memory SW" from the Maintenance Mode Menu.



Liquid Crystal Display Type

Move the cursor to the item that is to be set and press the Enter Key. Each time that it is pressed, the set value will change. After the settings have been made, press the Buzzer, Up, and Down keys to return to RUN Mode. If the power to the NT20M is turned off at this point, the settings will not be registered.



EL Display Type

| | |
|-------------------------------------|------|
| MEMORY SW MENU | |
| Quit | |
| Key Input Sound | ON |
| Residual Image Elimination Function | 1 hr |
| Resume Function | ON |

Contents of Settings

| Item | Setting | Contents | |
|---|---------------|---|--|
| Key input sound | ON | The buzzer sounds for 0.2 second when a system key, touch switch, or function key is input. | |
| | OFF | The buzzer does not sound when a system key, touch switch, or function key is input. | |
| Backlight off (LCD type) | 10 min | If no key input (see note 1) or command (see note 2) is received for 10 minutes while a screen is being displayed, the backlight turns off. | If a backlight-off command is transmitted from the host, the backlight turns off regardless of this setting. |
| | 1 hr | If no key input (see note 1) or command (see note 2) is received for one hour while a screen is being displayed, the backlight turns off. | |
| | None | The backlight stays on constantly. | |
| Display (LCD type) | Normal | The screen display is normal. | |
| | Reverse video | The screen is displayed with dark and light reversed. | |
| Residual image elimination function (EL type) | 10 min | If no key input (see note 1) or command (see note 2) is received for 10 minutes while a screen is being displayed, the screen turns off. | |
| | 1 hr | If no key input (see note 1) or command (see note 2) is received for one hour while a screen is being displayed, the screen turns off. | |
| | None | The screen stays on constantly. The residual image elimination function does not operate, so turn off the screen periodically by means of the host program. | |
| Resume function | ON | The contents of memory tables written by the host during operation are retained even if the NT20M power turns off or a reset is executed. | |
| | OFF | If power to the NT20M is turned off or a reset is executed, the contents of the memory table are overwritten by the contents of data created by the Support Tool. | |

- Note**
1. **Key Inputs**
System keys, touch switches, function keys
 2. **Commands**
Screen-change command
Setting screen overlap command (serial systems only)
On-line transfer completed command (Restart with change to RUN Mode)
Backlight-on command
 3. The shaded areas represent the default settings.

Operating Conditions for the Backlight Off and Residual Image Elimination Functions

When either “backlight off” or residual image elimination” is set to either “10 minutes” or “one hour,” the internal timer starts counting as soon as the key input or command is received. When the time is up, the backlight or EL screen turns off. The relevant key inputs and commands are as follows:

When any one of the above key inputs or commands is received, the backlight will be turned back on and the internal timer will start counting again. If a key input or command is then received before the time is up, the timer will be reset and the count will start over.

Resume Function

The resume function retains character string and numeral table data when power is interrupted or when the reset switch is pressed.

1, 2, 3...

1. When the Resume Function is Set to Off

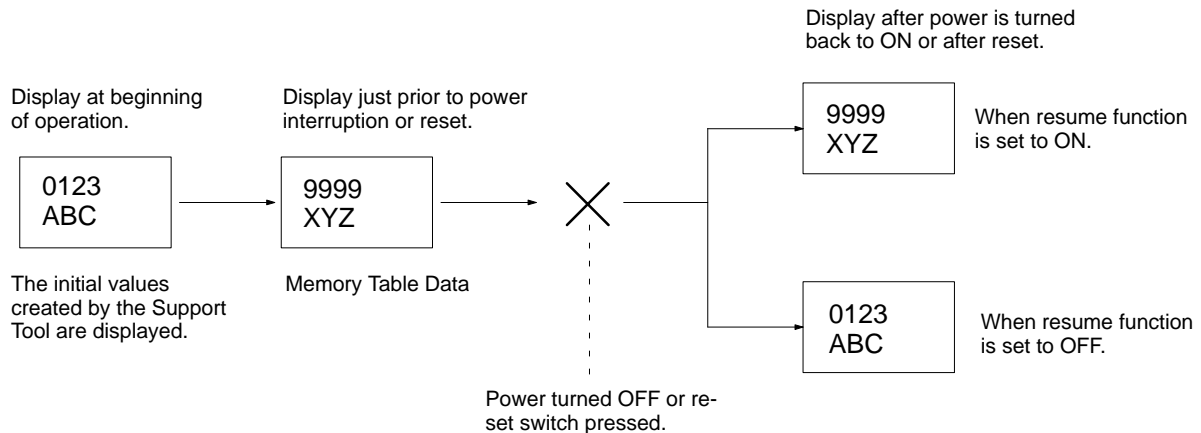
The contents of character string and numeral tables are cleared when the power to the PT is turned off or when the reset switch is pressed. After the power is turned back on, or after the reset, character string and numeral table data is read from the screen memory and operation begins again. If new character string or numeral table data is transferred from the Support Tool, that new data overwrites the data in the memory tables.

2. When the Resume Function is Set to On

If the power to the PT is turned off, or if the reset switch is pressed, the character string or numeral table data prior to the power interruption or reset is retained. If new character string or numeral table data is transferred from the Support Tool, the contents of the screen memory are refreshed but the memory table data does not change. In order to return the contents of the memory tables to the initial values that were created by the Support Tool, execute "initialize memory table."

Display Examples

Depending on the setting of the resume function, the display at the time of powering up will be as follows:



SECTION 7

Online Transfer

This section describes transferring screens online to and from the host computer. Functions used to create screens and control display attributes on the PT are described in *Section 4 Display Functions*. Functions used to input data on-screen are described in *Section 5 Input Functions*. Data transfer and maintenance functions are described in *Section 6 System Menu*.

Screen data can be transmitted online (i.e., in RUN Mode) by means of a Host Interface Unit command. For details on commands, refer to information on online transfers in the *Host Interface Unit Operation Manual*. This function is valid only for RS-232C and RS-422 Host Interface Units.

| | | |
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| 7-4 | Online Transmission and Resume Function | 65 |

7-1 Transferring Screen Data

Screen data can be transferred along with screen numbers. Set the desired screen number. If you set a screen number which is identical with one already registered in the PT, then the screen data for that number will be overwritten.

In addition to screen data, you can transfer memory tables and marks.

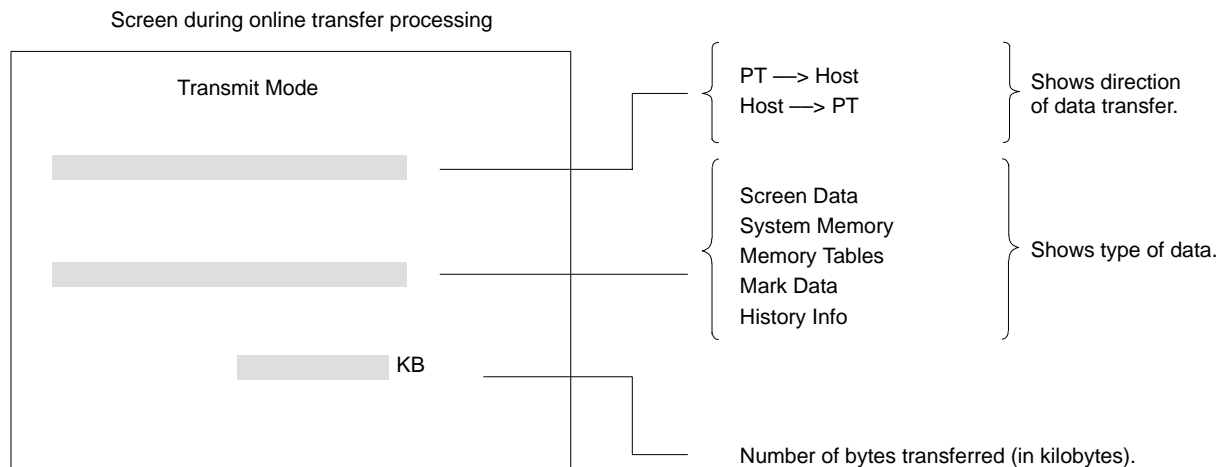
7-2 Host to PT

Screen data is transferred along with screen numbers. Any screen numbers can be set. You can make a setting to transfer all screens or a screen of your choice.

In addition to screen data, you can transfer memory tables, marks, and history.

If data transmission is interrupted by a system key operation, the data received up to that point will be stored, but all data after that point will be corrupted.

If transmission of mark data is interrupted, the mark data will be received but the accuracy of the data cannot be ensured. When the System Menu is brought up, a message will be displayed indicating that the mark data has been corrupted.



7-3 PT to Host

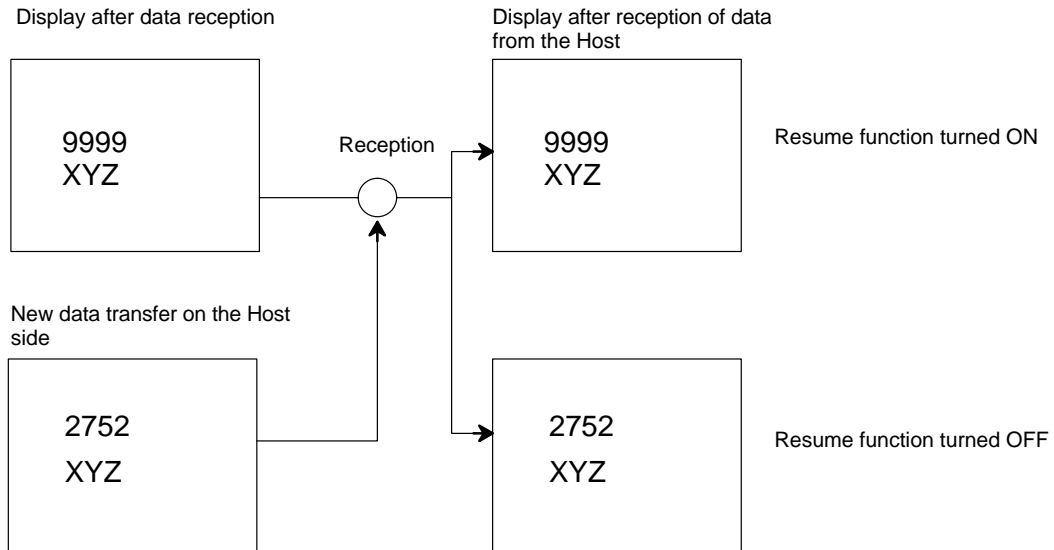
Screen data can be transferred along with screen numbers. All screens or desired screens can be transferred.

The memory table, mark, and display history can be transferred as well.

Screen data will not be corrupted when data transfer is interrupted with the System Key.

7-4 Online Transmission and Resume Function

Online transfer enables the Host to write data directly to the screen data memory just like data transfer to the Support Tool. Therefore, the contents of the display are influenced by the settings of the resume function.



SECTION 8

Maintenance and Inspection

This section provides troubleshooting and basic maintenance methods, including battery replacement.

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8-1 Checking Operation

The hardware status of the PT can be checked with the Maintenance Menu. Symptoms and corrective measures for errors that cannot be checked are shown in the table below.

| Symptom | Probable cause | Corrective measures, processing |
|---|---|---|
| POWER indicator does not light. | Power is not being input, or power supply is connected in inverse. | Provide a power supply with a rated voltage of 24 VDC. Do not reverse polarity. |
| | A fuse is blown. | Contact your OMRON representative. |
| Message indicates no Host Interface. | No Host Interface Unit is mounted. | Mount a Host Interface Unit. |
| | The System ROM is not compatible with the Host Interface Unit. | Match the specifications of the System ROM and the Host Interface Unit. |
| Screen does not display. | System ROM is not installed, or connections are faulty. | Check to be sure that the System ROM is installed, and tighten the screws. |
| | The memory installed does not match the settings of SW2, or no memory chip is installed. | Install a memory chip in socket and set SW2 correctly. |
| | Contrast is not correct. | Adjust the contrast with the contrast control. |
| Cannot communicate with Support Tool. | PT is not in Transmit Mode. | Select Transmit Mode from the System Menu. |
| | There is a faulty connection with the Support Tool. | Check connecting cables. |
| Cannot communicate using Host Interface Unit (serial communications) | Switch settings are not correct. | Check PT settings under the Maintenance Mode and be sure that settings match the host settings. |
| | Host Interface Unit connections are faulty. | Check wiring of connecting cables. Use shielded wire. Check whether the cables are within the maximum lengths. |
| | For the NT600M-LK202, terminator settings are not correct. | When using RS-422 communications, specify only the last Terminal from the host as the terminator (turn on termination resistance on the last Terminal only). |
| Cannot communicate using Host Interface Unit (parallel communications) | The timing is off for communications with the host interface. | Check the timing of the DIP switch settings and the host's clock output. Conduct a check using the "Communications Check" in Maintenance Mode. |
| Lamp status is retained when screens are changed. | Lamps and touch switches are overlapping. | Use touch switches as lamps just as they are. (Touch switches have lamp functions.) |
| The buzzer sounds, the RUN LED indicator goes out, operation suddenly stops, or the display goes off and does not return. | 1) System ROM is not properly installed. 2) Malfunction occurred due to external noise. | 1) Install the System ROM properly and lock it securely in place. 2) Remove the communications cable from the source of noise. Attach a noise filter to the power supply line. |
| Screen suddenly goes blank. | Screen has changed to screen no. 0 at the host. | There is no error. |
| Corrupted Screen Data | Screen data memory is bad. The power was turned off or the reset button was pressed during transmission | 1.) Replace the memory. 2.) Initialize the screen data memory and re-transfer the data. |

8-2 Changing the Lithium Backup Battery

A lithium battery is used in the NT20M and in the NT2000M. If the BAT LOW indicator on the front panel lights, replace the battery within ten days.

| | |
|---------------------|---|
| Battery model | 3G2A9-BAT08 |
| Battery backup time | 5 years at 25°C. |
| Replacement time | Within 5 minutes from the time power is turned off. |

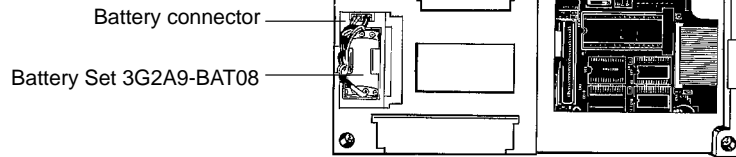
Replacing the Battery

- 1, 2, 3... 1. Turn the power off. If the power has not been on, turn it on for at least one minute and then turn it off again before replacing the battery.
2. Take off the battery cover on the back of the PT.
3. Remove the battery from the connector and put in a new battery. Be sure that the connector is straight when inserted.

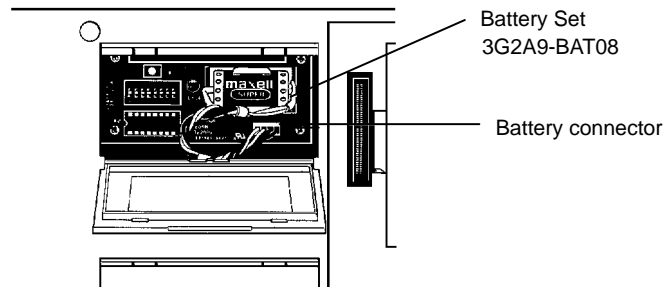
- Note**
- a) Do not take more than five minutes to replace the battery, otherwise the internal memory may be lost.
 - b) The battery can be replaced with the PT turned on, in which case there is no limitation for battery replacement time.

Caution Be sure not to touch the internal circuitry when replacing the battery with the PT turned on, otherwise the internal circuitry may be short-circuited or an electric shock accident may result.

NT20M



NT2000M



4. Replace the cover.

Caution The lithium battery can explode if placed into a fire, or it can explode, burn, or leak if the + and – terminals are short-circuited or if the battery is recharged or dismantled. Handle the battery with care.

Note If no battery is connected, BAT LOW indicator operation is not stable.

8-3 Replacing the Backlight

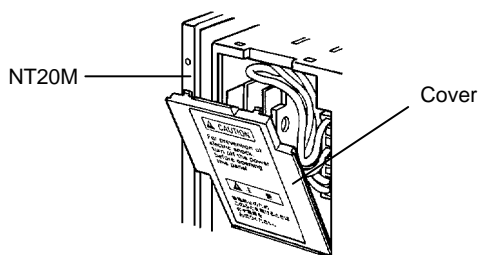
The backlight can be replaced for NT20M-DT13□, NT20M-DN□, and NT2000M-D□131 PTs. When the screen begins to flicker or get darker, replace the backlight by replacing the CFL Unit.

| | |
|-------------------------|--|
| CFL Unit model | For NT20M: NT20M-CFL01 For NT2000M: NT2000M-CFL01 |
| Service life (See note) | Approx. 20,000 hours at 25°C. |

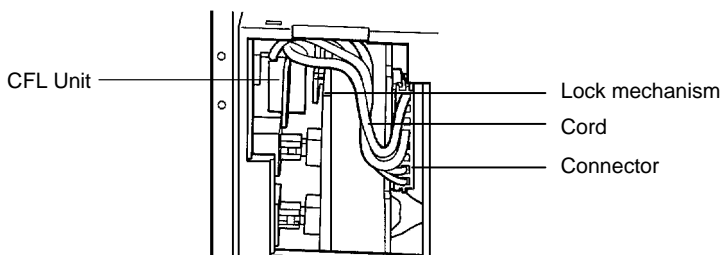
Note The service life is taken to be the time it takes for the backlight to lose 50% of its brightness.

NT20M-DT/DN13□ Backlights

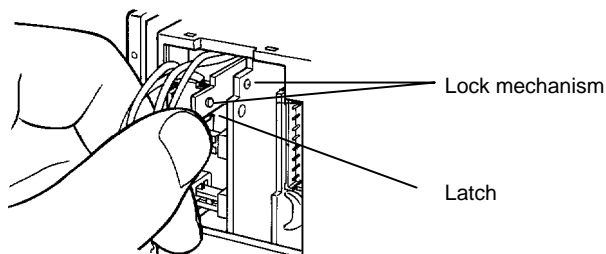
- 1) Turn off the power to the PT.
- 2) Pull out the backlight cover on the right side of the PT by placing your finger on the top and pulling it forward.



- 3) Pull out the attached CFL Unit cord and slowly pull off the connector, being careful to pull it straight.



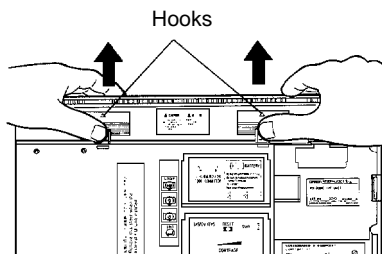
- 4) On the right side of the CFL Unit there is a latch. Bend it to the left (i.e., to the side of the PT display panel) to unlock the CFL Unit from the print board. Then pull the CFL Unit straight out. Be careful not to directly touch the fluorescent tube.



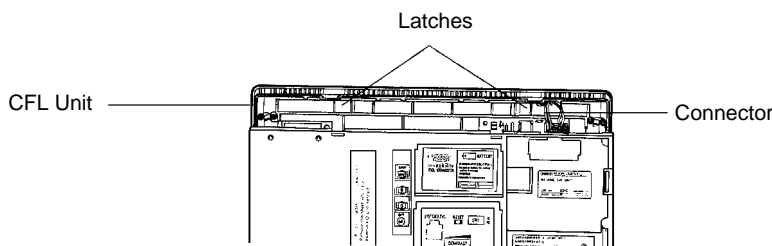
- 5) Insert the new CFL Unit, and bend the latch back to lock the CFL Unit to the print board. If it is difficult to insert it, the cord may be getting in the way. Do not try to force it, but just push the cord to the top and insert the CFL Unit slowly.
- 6) Insert the connector, being careful to match the polarity. Fit the cord in and replace the cover.

**NT2000M-D□131
Backlights**

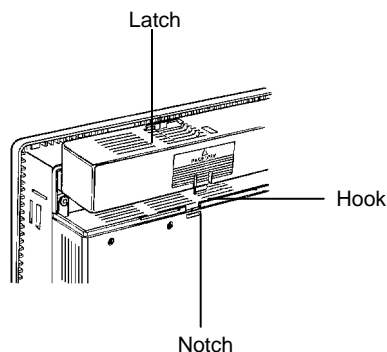
- 1) Turn off the power to the PT.
- 2) Remove the backlight case at the rear of the PT, by pressing on the place where it is indicated and pushing upward.



- 3) Pull off the attached CFL Unit connector and remove the CFL Unit.



- 4) Install the new CFL Unit and insert the connector, being careful to match the polarity.
- 5) Replace the backlight case, and snap it carefully in place.



Caution To avoid electrical shock, be sure to turn off the power before removing the backlight cover.
Be sure to put the cover back on after replacing the CFL Unit.

8-4 Maintenance and Inspection

8-4-1 Spare Terminals

In order to restore operations as quickly as possible in the event of a PT breakdown, it is a good idea to always keep a spare PT on hand.

8-4-2 Inspection

If the PT screen gets dirty, it will become hard to read. Be careful of the following points when cleaning it.

- When cleaning, wipe with a dry, soft cloth. If the dirt does not come off, then moisten the rag with water and rub hard.

- Wiping with a chemical cloth or with volatile solutions such as benzine or thinner may cause degeneration. A little alcohol may be used if necessary.
- Prolonged contact with rubber, vinyl products, or tape may leave marks.
- The PT's liquid crystal display and backlight can wear out. If they become hard to see, replace the PT. The backlight of the NT20M-DT121-V2 or DN121-V2 cannot be replaced.
- The standard inspection period is once every 6 to 12 months, but it should be moved up if the operating environment is harsh. If there is any deviation from the criterion, then it should be corrected.

| Inspection item | Inspection content | Criterion | Method/tools |
|-----------------------|--|---|----------------------|
| Power supply | Measure at the power supply terminal block. Are voltage fluctuations within the criterion? | Voltage fluctuation range: NT20M: 20.4 to 26.4 VDC NT2000M: 85 to 264 VAC | Tester |
| Operating environment | Is the ambient temperature (the temperature inside of the panel) suitable? | NT20M: 0°C to 45°C NT2000M: 0°C to 50°C | Thermometer |
| | Is the ambient humidity (the humidity inside of the panel) suitable? | 35% to 85% There should be no condensation. | Hydroscope |
| | Is dust collecting? | There should be no dust. | Visual |
| Installation | Is each Terminal firmly secured? | There should be no loose screws. | Phillips screwdriver |
| | Are the connectors for the connecting cable inserted perfectly and locked? | There should be no loose screws. | --- |
| | Are any screws for the external wiring coming loose? | There should be no loose screws. | Phillips screwdriver |
| | Is any external wiring loose or disconnected? | There should be no external abnormalities. | Visual |
| Replaceable parts | Can you read the characters on the liquid crystal display? Is the backlight illumination as bright as it should be? | Average life expectancy of liquid crystal: 50,000 hrs Average life expectancy of backlight: 20,000 hrs | Visual |

Precautions for Handling

- Turn off the power before replacing a PT.
- When you discover what seems to be a defective PT, check it again before replacing it to be sure that the problem is actually with the PT.
- When returning a defective PT for service, please describe the problem in as much detail as possible. Send the PT to the OMRON office closest to you.

Tools for Inspection

- Phillips and flat-blade screwdrivers
- Voltage tester or digital voltmeter
- Industrial alcohol and all-cotton cloth

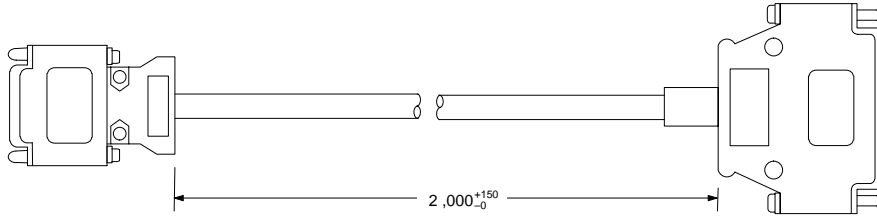
Measuring Instruments (Depending on Case)

- Synchroscope
- Oscilloscope with pen output
- Thermometer
- Hydroscope

Appendix A

Standard Models

RS-232C Connecting Cable for Connecting Devices (CV500-CN228)



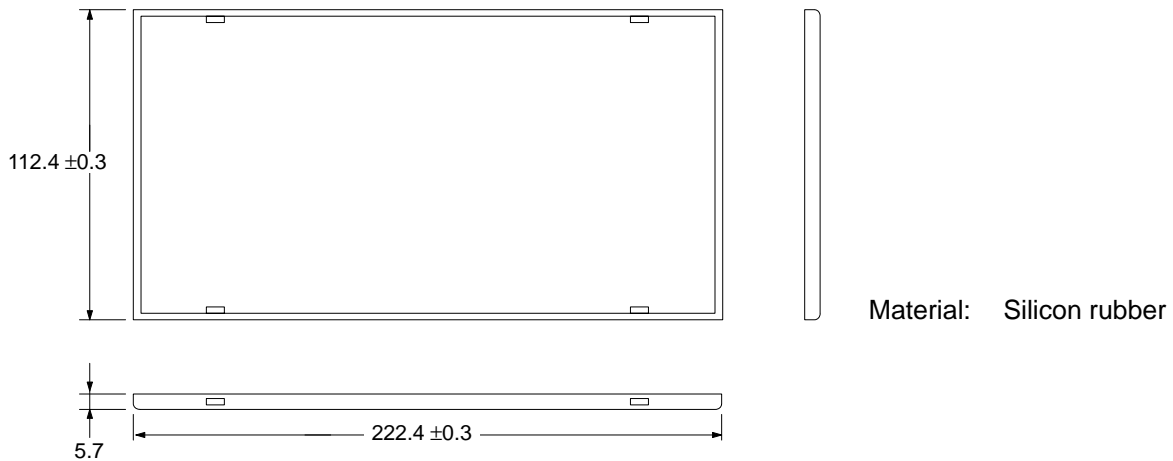
Note The personal computer end of the CV500-CN228 Connecting Cable is a 25-pin D-sub male connector. To connect to an IBM PC/AT or compatibles, a 9-pin or 25-pin D-sub female adapter is required.

Dustproof Cover

NT20M-KBA01 (for NT20M-DT/DN)

NT20M-KBA02 (for NT20M-DN connected to NT20M-FK210)

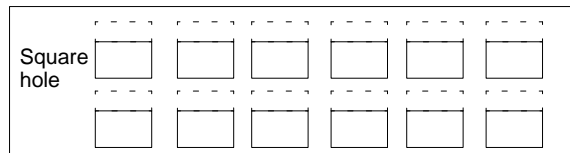
Under severe conditions, this cover can be used to protect the display area and controls from oil and dust.



NT20M-KBA01 dimensions (mm)

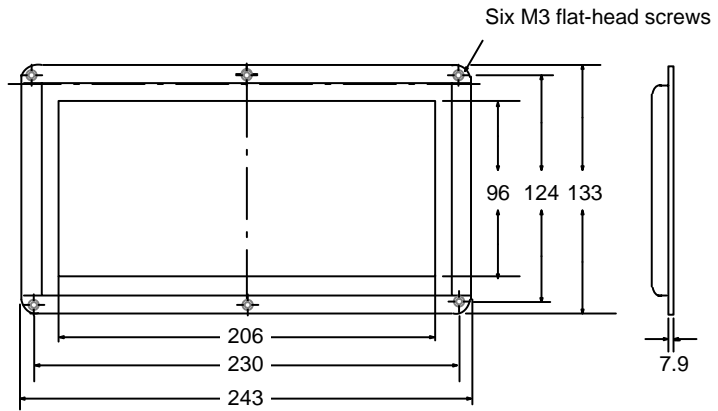
NT20M-CFK01 Key Sheets (Five Sheets)

Use these sheets for NT20M-FK210 function keys. By simply peeling them off of the paper, you can easily write on them and attach them. You can also rub off anything written with oil-base ink. If they get dirty, you can easily remove and replace them.



NT20M-KBA03 Oil Resistance Kit

Mount this kit to the display panel of the NT20M to protect from dirt and oil. (This kit cannot be mounted at the same time as an NT20M-FK210 Function Key Unit. In addition, when it is mounted it is not possible to access under the Support Tool connector cover.



Appendix B Specifications

General Specifications

| Item | NT20M | NT2000M |
|---|--|--|
| Power supply voltage | 24 VDC | 100 to 240 VAC |
| Allowable power supply voltage range | 20.4 to 26.4 VDC, (24 VDC $-15\%/+10\%$) | 85 to 264 VAC (50/60 Hz) |
| Power consumption | 12 W max. | 40 VA max. |
| Insulation resistance | — | 20 M Ω min. (at 500 VDC megger) between the AC external terminals and the GR terminal |
| Voltage resistance | — | 2300 VAC max. for 1 min. at 50/60 Hz (Leakage current: 0.8 mA max.) |
| Noise resistance (24 VDC) | Common (between power supply and panel): Normal: Pulse width: Pulse rise time: 1,000 V _{P-P} 300 V _{P-P} 100 ns to 1 μ s 1 ns | AC 1,000 V _{P-P} Pulse width: 100 ns to 1 μ s Pulse rise time: 1 ns |
| Vibration resistance | 10 Hz to 22 Hz: 1.5-mm double amplitude X, Y, and Z directions 22 Hz to 500 Hz: Acceleration: 1.5 G (14.7 m/s ²) X, Y, and Z directions for 30 min total | 10 Hz to 50 Hz: 0.5-mm single amplitude; Acceleration: 2.0 G (19.6 m/s ²) X, Y, and Z directions for 1 hour each |
| Shock resistance | 30 G (294 m/s ²) 3 times each in X, Y, and Z directions | |
| | 20 G (196 m/s ²) 3 times each in X, Y, and Z directions | |
| Ambient operating temperature | 0°C to 45°C (with no freezing) | 0°C to 50°C (with no freezing) |
| Ambient operating humidity | 35% to 85% (with no condensation.) | |
| Operating environment | No corrosive gas | |
| Storage temperature | -20°C to 70°C (with no freezing) | |
| Allowable power interruption time ¹⁾ | 5 ms max. (one minute or more after power is turned on) | 20 ms max. |
| Enclosure ratings | Front control panel IP52F (Drip-proof when dust cover is installed, as long as NT20M-FK210 is not mounted.) | |
| | Rear case: IP20 | |
| | Terminal section IP00 | |
| Weight | 1.2 kg max. | Approx. 3 kg |
| Dimensions | 220 (W) x 110 (H) x 82 (D) | 365 (W) x 232.5 (H) x 77 (D) |

Note 1. Even if a power interruption is outside of the allowable range, PT operation can still be continued but there is a possibility of data being corrupted if it occurs during communications with the Support Tool or the host when PT settings are made with system keys.

Characteristics

Display Specifications

| Item | Specifications |
|----------------|--|
| Display screen | Dot matrix STN liquid crystal display panel No. of dots: 256 x 128 NT20M: □0.407 mm NT2000M: □1.04 mm Effective display area: NT20M: 112 mm x 56 mm NT2000M: 275 x 138 mm Service life expectancy: 50,000 hrs min. View angle (right/left direction) NT20M-D□12□: ±30° NT20M-D□13□ } ±40° (when white backlight is lit) NT2000M-D□131 } ±45° (when red backlight is lit) Backlight White cold-cathode tube (NT20M-D□13□ and NT2000M-D□131 can change between red and white backlights.) Service life expectancy: 10,000 hrs min. (20,000 hrs average) Automatic turn-off: Can be set to not turn off, or to turn off in 10 min or 1 hr |
| Indicators | Three indicators: POWER indicator (Green LED): Lit when power is being supplied. RUN indicator (Green LED): Lit during operation. BAT LOW indicator (Red LED): Lit when battery voltage level drops. |

Control Panel Specifications

| Item | Specifications |
|--|--|
| System keys | Four keys: buzzer-stop, up-scroll, down-scroll, execute (enter) Functions: System Menu selection, buzzer off, bar cursor movement, up/down scroll for continuous screens, execution of numeric settings |
| Touch panel (DT type) | Maximum: 64 touch switches per screen Pressure-sensitive Operating force: 100 g max. Life expectancy: 1,000,000 operations min. |
| 12-key Function Key Unit NT20M-FK210 (Connectible to NT20M-DN type) | No. of keys: 12 (fixed) Switch type Pressure-sensitive Key sheets are replaceable. |

Note The 2-point output is the contact relay type. For the socket type, it can be replaced by a no-contact relay such as a transistor or triad.

Display Capacity

| Item | Specifications |
|--------------------------------|---|
| Display characters | Half-size characters (8 x 8 dots): Alphanumerics and symbols Normal characters (8 x 16 dots): Alphanumerics and symbols Marks (16 x 16 dots): User defined, 64 max. |
| Number of characters displayed | Standard-size characters: Max. 32 characters horizontal x 8 vertical Wide characters: Max. 16 characters horizontal x 8 vertical |
| Enlargement function | Horizontal, vertical, 4 times, 9 times, 16 times |
| Display attributes | Inverse, blinking, inverse blinking |
| Character displays | Displays any characters (screen number designation). |
| Graphics | Polylines (broken continuous line) and circles |
| Terminal mode | Characters, numeric values, and graphic designated by the host are displayed (RS-232C or RS-422 interface required). |
| String displays | Maximum 32 total, 8 per screen and 32 bytes per string |
| Numerical displays | Maximum 128 total, 50 per screen |

| Item | Specifications |
|----------------------------|---|
| Bar graph display | 2 to 255 dots; +/- area display;% display capability |
| Overlapping screens | Overlapping of a maximum of 8 registered screens is possible. |
| Continuous screens | Scrolling the display for a maximum of 8 registered screens is possible. |
| No. of registered screens | 250 max. |
| Screen registration method | Transfer to the PT data created at IBM PC/AT compatible, or mount EPROM chip containing data. |
| Screen saving method | Can be saved to SRAM (with backup battery), EEPROM or EPROM. |
| Screen attribute settings | Alarm, continuous buzzer, intermittent buzzer, function key bit input, touch switch bit input, display history, 10-key, backlight |

Data Quantities

| Item | Specifications |
|--------------|---|
| Mark data | 64 max. |
| String data | 32 characters (standard size characters) x 32 strings max. |
| Numeral data | 8 digits x 128 values max. |
| Switches | Switches and lamps combined: 256 max. |
| Lamps | (There is no limit when Host Link direct connection is used.) |

Special Features

| Item | Specifications |
|-------------------------|---|
| Alarm output | Relay output on rear terminal block. Rating: NT20M: 1 A at 24 VDC NT2000M: 1 A at 24 VDC Output condition: NO contact (Closes when a command is received from the host or when there is a screen called with an alarm-ON specification.) |
| Host RUN input | Photocoupler input on rear terminal block. Rating 24 VDC $+10\%$ / -15% When this input goes OFF, the PT will display "host error" regardless of other conditions. |
| Buzzers | Two types: Continuous sound and intermittent sound. ON: The buzzer will sound when a command is received from the host, or when a screen with a buzzer-ON specification is called. OFF: The buzzer is turned OFF when the Buzzer Key is pressed, when a command is received from the host, or when a screen without a buzzer-ON specification is displayed. Sound pressure: 80 dB min./87 dB average (Measured at 10 cm from front panel.) Enabled/disabled (NT2000M only): The buzzer sound can be enabled or disabled by means of a setting pin. If it is disabled, the buzzer will not sound under any conditions. |
| Maintenance functions | Self-test for memory, switches, etc. Status setting confirmation for communications and other conditions. Simple communications confirmation. |
| Battery backup | Data backed up by lithium battery when screen data memory is SRAM. Data backup time: 5 years (at 25°C) If there is a voltage drop, the BAT LOW indicator on the front panel will light and the Battery Low Flag to the host will turn ON. The battery can be replaced from the rear of the Terminal while power is on. |
| Key input sound setting | If Key Input Sound is set to ON in the Memory Switch Menu, a beep will sound for 0.2 s when a system key, function key, or touch switch is pressed. |

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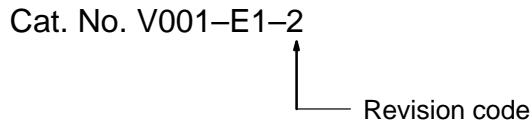
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Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

| Revision code | Date | Revised content |
|---------------|----------------|---|
| 1 | November 1991 | Original production |
| 1A | October 1992 | <p>Page 3: A row defining the C200H has been added to the SYSMAC terminology table. Manual numbers have been changed in the Reference Manuals table.</p> <p>Page 4: The numbers of registered screens have been changed in the Memory Capacity and Number of Screens table. The model legend for the system ROM has been changed to incorporate the C200H. A model number for the Host Interface Units has been added to the table.</p> <p>Page 5: C200H Interface has been added to the list of allowable interfaces for communications in <i>1-4-2 Operation</i>.</p> <p>Page 7: A C200H Interface description has been added.</p> <p>Page 10: "Transfer Mode" has been changed to "Transmit Mode" for pin 6 of the switch settings table.</p> <p>Page 11: SW1 has been changed to SW3 in the table.</p> <p>Page 23: "Transfer Mode" has been changed to "Transmit Mode" within the procedure.</p> <p>Page 26: The description within <i>4-1-3 Character Scale</i> has been changed.</p> <p>Page 32: NT20M-LB121-EV1 Host Interface Unit has been added to the Note at the bottom of the page.</p> <p>Page 49: A description for the C200H Host Interface Units (NT20M-LB121-EV1) has been added.</p> <p>Page 51: A description for the C200H Host Interface Units (NT20M-RT121-EV1) has been added.</p> <p>Page 59: A row for the C200H Host Interface Units has been added to the table.</p> |
| 2 | September 1993 | <p>Page 2: A general introduction was added, describing the basic functions of PTs.</p> <p>Pages 2 and 3: Some new features were added.</p> <p>Page 4: Descriptions of NT20M and NT2000M PTs were added.</p> <p>Page 5: Information was added about selecting System ROM.</p> <p>Page 6: Information was added about the Support Tool.</p> <p>Pages 7 and 8: Changes were made to system configuration illustrations.</p> <p>Pages 9 to 12: Illustrations were added showing features and components of PT.</p> <p>Page 14: Revisions were made to DIP switch settings.</p> <p>Page 15: Revisions were made to memory settings.</p> <p>Pages 15 to 20: NT2000M installation information was added.</p> <p>Pages 21 to 27: NT2000M wiring and connector information was added.</p> <p>Pages 30 to 31: Information was added concerning powering up and initializing the memory.</p> <p>Pages 36 to 44: Information was added regarding NT2000M display functions.</p> <p>Pages 48 to 50: Information was added regarding numeric input.</p> <p>Page 52: Changes were made to menu illustration.</p> <p>Pages 53 to 59: Changes were made to information regarding Maintenance Mode.</p> <p>Pages 64 to 69: Changes were made and information was added regarding maintenance and inspection procedures.</p> <p>Appendix A: Changes made to optional items.</p> <p>Appendix B: Changes made to specifications.</p> |

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