User’s Guide

Ω: OMEGA
An OMEGA Technologies Company

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RD100A/RD1800
Recorder S4 Option
(RS-422-A Communications)
<table>
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<tr>
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<th></th>
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<td></td>
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<td>e-mail: <a href="mailto:nl@omega.com">nl@omega.com</a></td>
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<tr>
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<td></td>
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<tr>
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<td>FAX: (33) 130-699-120</td>
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<td>Toll Free in France: 0800-4-06342</td>
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<td>e-mail: <a href="mailto:france@omega.com">france@omega.com</a></td>
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<td>e-mail: <a href="mailto:germany@omega.com">germany@omega.com</a></td>
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It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

**WARNING:** These products are not designed for use in, and should not be used for, patient connected applications.
Unpacking Instructions

Remove the Packing List and verify that you have received all equipment, including the following (quantities in parentheses):

- RS-422-A Interface (1)
- Operator’s Manual (1).

If you have any questions about the shipment, please call the OMEGA Customer Service Department. When you receive the shipment, inspect the container and equipment for signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor damage claims unless all shipping material is saved for inspection. After examining and removing contents, save packing material and carton in the event reshipment is necessary.
# TABLE OF CONTENTS

**RD100A/RD1800 S4 Option**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>1 Installation of the RS-422-A Interface</strong></td>
<td>1</td>
</tr>
<tr>
<td>1.1 Interface Functions</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Interface Terminal</td>
<td>2</td>
</tr>
<tr>
<td>1.2.1 Terminal Arrangement</td>
<td>2</td>
</tr>
<tr>
<td>1.2.2 Cable Termination</td>
<td>2</td>
</tr>
<tr>
<td>1.3 Communication Wiring</td>
<td>3</td>
</tr>
<tr>
<td>1.4 Data Configuration</td>
<td>4</td>
</tr>
<tr>
<td>1.4.1 Start-Stop Communication</td>
<td>4</td>
</tr>
<tr>
<td>1.4.2 Text</td>
<td>5</td>
</tr>
<tr>
<td>1.4.3 Input Buffer</td>
<td>6</td>
</tr>
<tr>
<td>1.4.4 Buffer Overflow</td>
<td>6</td>
</tr>
<tr>
<td>1.5 How to Set the RS-422-A Interface Communications</td>
<td>7</td>
</tr>
<tr>
<td><strong>2 Receiving Functions</strong></td>
<td>8</td>
</tr>
<tr>
<td>2.1 Program Set Commands</td>
<td>8</td>
</tr>
<tr>
<td>2.1.1 Program Set Commands and Functions</td>
<td>9</td>
</tr>
<tr>
<td>2.1.2 Range Setting</td>
<td>9</td>
</tr>
<tr>
<td>2.1.3 Alarm Setting</td>
<td>12</td>
</tr>
<tr>
<td>2.1.4 Unit Setting</td>
<td>13</td>
</tr>
<tr>
<td>2.1.5 Chart Speed Setting</td>
<td>13</td>
</tr>
<tr>
<td>2.1.6 Clock Setting</td>
<td>14</td>
</tr>
<tr>
<td>2.1.7 Copy Channel Setting</td>
<td>14</td>
</tr>
<tr>
<td>2.1.8 Trend Recording Format Setting</td>
<td>14</td>
</tr>
<tr>
<td>2.1.9 Zone Recording Setting</td>
<td>14</td>
</tr>
<tr>
<td>2.1.10 Partial Expanded Recording Setting</td>
<td>15</td>
</tr>
<tr>
<td>2.1.11 Periodic Printout Setting</td>
<td>15</td>
</tr>
<tr>
<td>2.1.12 Tag Setting</td>
<td>15</td>
</tr>
<tr>
<td>2.1.13 Message Setting</td>
<td>16</td>
</tr>
<tr>
<td>2.1.14 Chart Speed 2 Setting</td>
<td>16</td>
</tr>
<tr>
<td>2.1.15 Setting of Daylight Savings Time (Option)</td>
<td>16</td>
</tr>
<tr>
<td><strong>2.2 Program Control Commands</strong></td>
<td>17</td>
</tr>
<tr>
<td>2.2.1 Program Control Commands and Functions</td>
<td>17</td>
</tr>
<tr>
<td>2.2.2 Start/Stop the Recording</td>
<td>17</td>
</tr>
<tr>
<td>2.2.3 Manual Printout Start/Stop</td>
<td>17</td>
</tr>
<tr>
<td>2.2.4 List Printout Start/Stop</td>
<td>17</td>
</tr>
<tr>
<td>2.2.5 SET UP List Printout Start/Stop</td>
<td>17</td>
</tr>
<tr>
<td>2.2.6 Message Printout Start</td>
<td>18</td>
</tr>
<tr>
<td>2.2.7 Message Buffer Clear</td>
<td>18</td>
</tr>
<tr>
<td>2.2.8 Alarm Acknowledge</td>
<td>18</td>
</tr>
</tbody>
</table>
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.9 Alarm Buffer Clear</td>
<td>18</td>
</tr>
<tr>
<td>2.2.10 Selection of Display</td>
<td>18</td>
</tr>
<tr>
<td>2.2.11 Designation Sequence of Byte Output (Binary Output)</td>
<td>19</td>
</tr>
<tr>
<td>2.2.12 Selection of Output Data</td>
<td>19</td>
</tr>
<tr>
<td>2.2.13 Selection of Output Format for Measured Data</td>
<td>20</td>
</tr>
<tr>
<td>2.2.14 Selection of Output Format for Setting Parameters,</td>
<td></td>
</tr>
<tr>
<td>Unit/Decimal Point Information</td>
<td>20</td>
</tr>
<tr>
<td>2.3 Escape Sequence</td>
<td>20</td>
</tr>
<tr>
<td>2.3.1 Execution of Trigger</td>
<td>20</td>
</tr>
<tr>
<td>2.3.2 Status Output</td>
<td>20</td>
</tr>
<tr>
<td>2.3.3 Open Command</td>
<td>22</td>
</tr>
<tr>
<td>2.3.4 Close Command</td>
<td>22</td>
</tr>
<tr>
<td>3 Transmitting Functions</td>
<td>23</td>
</tr>
<tr>
<td>3.1 Introduction to Output Data Formats</td>
<td></td>
</tr>
<tr>
<td>3.1.1 TS0</td>
<td>23</td>
</tr>
<tr>
<td>3.1.2 TS1, TS2</td>
<td>24</td>
</tr>
<tr>
<td>3.2 Output Data Formats</td>
<td>24</td>
</tr>
<tr>
<td>3.2.1 Output Format of Measured Values in the ASCII Mode</td>
<td>24</td>
</tr>
<tr>
<td>3.2.2 Output Format of Measured Values in the Binary Mode</td>
<td>25</td>
</tr>
<tr>
<td>3.2.3 Output Format of Setting Parameters</td>
<td>27</td>
</tr>
<tr>
<td>3.2.4 Output Format of Information on Unit and Decimal Point</td>
<td>27</td>
</tr>
<tr>
<td>3.3 Status Byte Format</td>
<td>28</td>
</tr>
<tr>
<td>4 Time Chart</td>
<td>29</td>
</tr>
<tr>
<td>5 Initial Status</td>
<td>30</td>
</tr>
<tr>
<td>6 Errors During RS-422-A Output</td>
<td>32</td>
</tr>
<tr>
<td>6.1 Preventing Errors</td>
<td>32</td>
</tr>
<tr>
<td>6.2 How to Request for Error Message Output</td>
<td>34</td>
</tr>
<tr>
<td>6.3 Timing of Resetting Error Status</td>
<td>34</td>
</tr>
<tr>
<td>7 Sample Programs</td>
<td>35</td>
</tr>
<tr>
<td>7.1 Sample Programs for NEC PC 9801</td>
<td>35</td>
</tr>
<tr>
<td>7.1.1 Program to Read Setting Parameters from the RD100A/RD1800 Display on Screen and Write to Disc</td>
<td>35</td>
</tr>
<tr>
<td>7.1.2 Program to Read Setting Parameters From Disc, Display on Screen, and Set the RD100A/RD1800</td>
<td>35</td>
</tr>
<tr>
<td>7.1.3 Program to Read Information on Unit and Decimal Point from the RD100A/RD1800 Display on Screen and Write to Disc</td>
<td>36</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td>7.1.4</td>
<td>Program to Output Measured Data (ASCII Code) from the RD100A/RD1800 and Write to Disc</td>
</tr>
<tr>
<td>7.1.5</td>
<td>Program to Output Measured Data (Binary code) from the RD100A/RD1800 and Write to Disc</td>
</tr>
<tr>
<td>7.2</td>
<td>Sample Programs for YEWMAC</td>
</tr>
<tr>
<td>7.2.1</td>
<td>Program to Read Setting Parameters from the RD100A/RD1800 and Display on Screen</td>
</tr>
<tr>
<td>7.2.2</td>
<td>Program to Read Information on Unit and Decimal Point from the RD100A/RD1800 and Display on Screen</td>
</tr>
<tr>
<td>7.2.3</td>
<td>Program to Output Measured Data (ASCII Code) from the RD100A/RD1800 and Display on Screen</td>
</tr>
<tr>
<td>7.2.4</td>
<td>Program to Output Measured Data (Binary code) from the RD100A/RD1800 and Display on Screen</td>
</tr>
<tr>
<td>7.3</td>
<td>Sample Programs for IBM PC</td>
</tr>
<tr>
<td>7.3.1</td>
<td>Program to Read Setting Parameters from the RD100A/RD1800 Display on Screen and Write to Disc</td>
</tr>
<tr>
<td>7.3.2</td>
<td>Program to Read Setting Parameters from Disc, Display on Screen, and Set the RD100A/RD1800</td>
</tr>
<tr>
<td>7.3.3</td>
<td>Program to Read Information on Unit and Decimal Point from the RD100A/RD1800, Display on Screen, and Write to Disc</td>
</tr>
<tr>
<td>7.3.4</td>
<td>Program to Output Measured Data (ASCII Code) from the RD100A/RD1800 and Write to Disc</td>
</tr>
<tr>
<td>7.3.5</td>
<td>Program to Output Measured Data (Binary Code) from RD100A/RD1800 and Write to Disc</td>
</tr>
</tbody>
</table>
Introduction

This Instruction Manual describes the RS-422-A option for the RD100A/RD1800 pen and dot printing recorders. For details concerning the operation of the pen recorder or dot printing models, refer to the appropriate Operator’s manuals (M2349 and M2353).

1 Installation of the RS-422-A Interface

The option-S4 includes EIA (Electronic Industries Association) RS-422-A communications interface to output measured values, read setting parameters, and change setting parameters. However, this interface does not include operations of the power switch, key-lock switch, and chart feed. Setting of SET UP Mode cannot be controlled.

1.1 Interface Functions

<table>
<thead>
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<th>Communication system:</th>
<th>Four-wire, half-duplex, multi-drop connection 1:n (host computer: RD100A/RD1800 recorder) n=1 to 16 Start-stop system</th>
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<tr>
<td>Transmission speeds:</td>
<td>75, 150, 300, 600, 1200, 2400, 4800, and 9600 bits/second</td>
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<td>Start bit:</td>
<td>One bit</td>
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<tr>
<td>Stop bit:</td>
<td>One or two bits</td>
</tr>
<tr>
<td>Parity:</td>
<td>Even, odd, or no parity</td>
</tr>
<tr>
<td>Word length:</td>
<td>Seven or eight bits</td>
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</table>
Electrical signal characteristics: EIA-standard electrical characteristics for the interchange signals and associated circuitry. Functional isolation.

Communication distance: Up to 500 meters (between an isolated line converter or an isolated computer and a RD100A/RD1800 recorder).

1.2 Interface Terminal

1.2.1 Terminal Arrangement

---

WARNING

To prevent an electric shock, ensure that the main power supply is turned OFF.

---

Connect RD to TD of computer, and connect SD to RD of computer.

Figure 1. Terminal Arrangement

1.2.2 Cable Termination

---

WARNING

To prevent an electric shock, ensure that the main power supply is turned OFF.
1.3 Communication Wiring

If the host (PC) is equipped with a RS-422-A interface, the RD100A/RD1800 can be connected directly. If the host (PC) is equipped with a RS-232-C interface, the RD100A/RD1800 can be connected using a converter (CAT-285 or equivalent).

Shown in Figure 3 are two wiring examples that are same except for the case shielding. If there is to be a connection between other panels, wiring should be done as shown in part b of Figure 3. (R in Figure 3 indicates a terminal resistance. \( R = 100 \, \Omega \), 1/2 W min: adjust according to the impedance. The converter is of the inverter type. The + and – polarity depend on the type of converter.) In the wiring shown in Figure 3 a, use two pairs of 24 AWG (minimum) twisted shielded cables or equivalent.

In the case of wiring as shown in Figure 3 b, use three pairs of 24 AWG (minimum), twisted, shielded cables or equivalent. One pair is used for SG in the case of figure b. (Characteristic impedance: 100 \( \Omega \), capacitance 50 pF/m.) Keep the terminated, unshielded section to a minimum and be sure to keep it clear of the RD100A/RD1800 recorder ground line.

---

**WARNING**

To prevent an electric shock, ensure that the main power supply is turned OFF.
1.4 Data Configuration

The relation between the signal and the potential of the RS-422-A terminals is as follows:

A<B: 1
A>B: 0

1.4.1 Start-Stop Communication

The RS-422-A interface communicates with the start-stop system. The start-stop system first adds the start bit to the head and then in turn adds the data bits (seven to eight bits), parity bit and stop bit(s) in every transmission of one character (see Figure 4). Specify the address, communication (baud) rate, data length, parity bit, and stop bit(s) in the SET UP Mode. The start bit is automatically added, and no setting is necessary.
1.4.2 Text

Communication data usually takes the form of more than one character to which a terminator is added. This is called "text." (See also Figure 5.)

The RS-422-A interface identifies a text by regarding the reception of a terminator as the end of text. (See also Figure 6.)

Figure 5. Structure of Text

Figure 6. Example of Two Texts, Where the Terminator is CR-LF
The RD100A/RD1800 identifies text by regarding "LF" or ",," as the terminator when receiving the data (and will send CR and LF as the terminator). As in the example shown in Figure 6, when CR and LF are used as the terminator, CR is ignored. Therefore, when communication is performed with a PC, the terminator LF might not be sent. Exercise care.

1.4.3 Input Buffer
The input buffer takes the form of rotary buffer (capacity of 256 bytes). The rotary buffer (see Figure 7) outputs a text on the first-in, first-out basis while storing data in turn. It is not necessary for the user to be aware of in the program, however, be careful to prevent buffer overflow. A merit of the rotary buffer is that it can flexibly cope with more than one text being sent contiguously because of low loss against variable text length.

1.4.4 Buffer Overflow
As described before, the input buffer is necessary for data communication. The capacity, however, is limited (256 bytes for the RD100A/RD1800). Thus, in the receiver, the buffer capacity may become shorted if large amounts of data are sent in a short time. These impair data communications (buffer overflow).
To prevent buffer overflow, it is recommended that you confirm the status of the RD100A/RD1800 using the ESC S command just after commands have been sent (from the PC). Note that you cannot send an ESC S command after having sent an LF or FM command.

After the RD100A/RD1800 receives the ESC S command, it will output its status to the PC. Actually, the RD100A/RD1800 will store the ESC S command in the input buffer, and this command will be read from this buffer. Then the status will be output to the PC.

If the computer sends other commands before the status of the RD100A/RD1800 has been received, the input buffer will not be empty (the ESC S command will be still in there), which means the RD100A/RD1800 cannot receive other commands yet.

1.5 How to Set the RS-422-A Interface Communications

Setting Procedure:
1. Remove the recorder packing material, as described in the Operator's Manuals of the RD100A/RD1800 and remove the lock screw.
2. Enter the SET UP Mode by turning ON the power while pressing the ENT key.
3. Use the UP/DOWN keys to select the display SETUP=OPT and press the ENT key.
4. Use the UP/DOWN keys to select the display OPT=COMM and press the ENT key.
5. Set the RS-422-A address (possibilities are from 01 to 16) using the UP/DOWN keys. The initial value is 01. 00 is invalid. Press the ENT key.
6. Select the transmission speed (baud rate). The speed is selectable from 75, 150, 300, 600, 1200, 2400, 4800, and 9600 bits/second using the UP/DOWN keys. After selection, press the ENT key. The initial value is 9600 bps.
7. Select the data length. The length is selectable from seven or eight bits using the UP/DOWN keys. After selection, press the ENT key. The initial value is eight bits.
8. Select the parity bit. This bit is selectable from ODD, EVEN, or NONE using the UP/DOWN keys. After selection, press the ENT key. The initial value is EVEN.
9. Select the number of stop bits. This is selectable from 1 or 2, using the UP/DOWN keys. After selection, press the ENT key. The initial value is one bit.
10. The display *COMM SET* will appear. The settings for the communication are completed, but have not been stored yet. You can now adjust other settings in the SET UP Mode, using the ESC key.

Before leaving the SET UP Mode, you have to store your new settings. Press the ESC key to return to the SETUP=OPT display and then select the SETUP=END display. Press the ENT key. Select END=STORE to keep your new settings or END=ABORT and press the ENT key. After a few seconds, the Operation Mode will appear.
2 Receiving Functions

This section describes program set commands and program control commands. Remember first to open a device by the ESC 0 command before the set or control commands can be sent.

2.1 Program Set Commands

Commands are represented by ASCII codes and divided into an identifier, parameters, delimiters and a terminator.

Example:  

```
SR 01, VOLT, 20mV, 0, 10000
```

**Identifier**
- Defined by two alphabetical, capital characters.

**Parameter**
- Parameters are separated by a delimiter (comma).
- Numeric data are displayed by integers (e.g., +20, -240).
- When parameters are numeric, the effective setting ranges depend on these parameters.
- Spaces preceding and following a parameter, or a space within a parameter are ignored. Spaces within a parameter specified by ASCII character (units and messages) are valid.
- Parameters that do not need to be changed can be omitted. Delimiters, however, cannot be omitted. (e.g., SR01, 20mV: mode is unchanged)
- A string of delimiters at the end of a command/parameter string may be omitted (see example below);
  (e.g., SR01, VOLT can be omitted)
- The length of the following parameters is fixed. If the length differs, syntax errors will occur.
  
  Date and time: YY/MM/DD (eight characters)
  HH:MM:SS (eight characters)
  
  Channel: CC (two characters; e.g., channel 1 must be entered as 01)

**Terminator**

A command ends with one of the following terminators:

- CR + LF
- LF
- ; (semicolon).
2.1.1 Program Set Commands and Functions

<table>
<thead>
<tr>
<th>Type</th>
<th>Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set</td>
<td>SR</td>
<td>Range setting</td>
</tr>
<tr>
<td></td>
<td>SA</td>
<td>Alarm setting</td>
</tr>
<tr>
<td></td>
<td>SN</td>
<td>Unit setting</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>Chart speed setting</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>Clock setting</td>
</tr>
<tr>
<td></td>
<td>SY</td>
<td>Copy channel setting</td>
</tr>
<tr>
<td></td>
<td>SS</td>
<td>Trend recording format setting (dot model only)</td>
</tr>
<tr>
<td></td>
<td>SZ</td>
<td>Zone setting</td>
</tr>
<tr>
<td></td>
<td>SP</td>
<td>Partial expanded setting</td>
</tr>
<tr>
<td></td>
<td>SF</td>
<td>Periodic printout setting</td>
</tr>
<tr>
<td></td>
<td>ST</td>
<td>Tag setting</td>
</tr>
<tr>
<td></td>
<td>SG</td>
<td>Message setting</td>
</tr>
<tr>
<td></td>
<td>SE</td>
<td>Chart speed 2 setting</td>
</tr>
<tr>
<td></td>
<td>SW</td>
<td>Daylight Savings Time setting (option)</td>
</tr>
</tbody>
</table>

For restrictions concerning settings, refer to the RD100A/RD1800 Operator's Manual.

2.1.2 Range Setting

**SKIP:** Prevents the specified channel from being measured, recorded, and displayed.

Format: SRp1, mode designation

p1: channel number (CC)

mode designation: SKIP

Example: SR01, SKIP

**VOLT, TC, RTD, and DELT**

Format: SRp1, mode designation, p2, p3, p4

p1: channel number (CC)

mode designation: VOLT, TC, RTD

DELT (difference computation of measured values between set channel and reference channel)
p2: Range designation
In the case of VOLT: 20mV, 60mV, 200mV, 2V, 6V, 20V.
In the case of TC: R, S, B, K, E, J, T, N, W (C), L (JDIN), U (TDIN).
In the case of RTD: JPT, PT.
In the case of DELT: the reference channel number. Note that the reference channel number must be lower than the set channel.

p3: The minimum value of the recording span. Enter within five digits, regardless of the decimal point and + or –.

p4: The maximum value of the recording span. Enter within five digits, regardless of the decimal point and + or –.

Table 1. Input Ranges

<table>
<thead>
<tr>
<th>Input type DC Voltage</th>
<th>Range</th>
<th>Input</th>
<th>Measurement range</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Voltage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20mV</td>
<td>20mV</td>
<td>-20.00mV to 20.00mV</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>60mV</td>
<td>60mV</td>
<td>-60.00mV to 60.00mV</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>200mV</td>
<td>200mV</td>
<td>-200.0mV to 200.0mV</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>2V</td>
<td>2V</td>
<td>-2.000V to 2.000V</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>6V</td>
<td>6V</td>
<td>-6.000V to 6.000V</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>20V</td>
<td>20V</td>
<td>-20.00V to 20.00V</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input type TC</th>
<th>Range</th>
<th>Measurement range</th>
<th>Measurement range</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>0.0 to 1760.0°C</td>
<td>32 to 3200°F</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>0.0 to 1760.0°C</td>
<td>32 to 3200°F</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>0.0 to 1820.0°C</td>
<td>32 to 3300°F</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>-200.0 to 1370.0°C</td>
<td>-328.0 to 2498.0°F</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>-200.0 to 800.0°C</td>
<td>-328.0 to 1472.0°F</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>-200.0 to 1100.0°C</td>
<td>-328.0 to 2012.0°F</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>-200.0 to 400.0°C</td>
<td>-328.0 to 752.0°F</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>0.0 to 1300.0°C</td>
<td>32 to 2372°F</td>
<td></td>
</tr>
<tr>
<td>W=C</td>
<td>0.0 to 2315.0°C</td>
<td>32 to 4199°F</td>
<td></td>
</tr>
<tr>
<td>L=JDIN</td>
<td>-200.0 to 900.0°C</td>
<td>-328.0 to 1652.0°F</td>
<td></td>
</tr>
<tr>
<td>U=TDIN</td>
<td>-200.0 to 400.0°C</td>
<td>-328.0 to 752.0°F</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input type RTD</th>
<th>Range</th>
<th>Measurement range</th>
<th>Measurement range</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JPT</td>
<td>-200.0 to 600.0°C</td>
<td>-328.0 to 1112.0°F</td>
<td></td>
</tr>
<tr>
<td>PT</td>
<td>-200.0 to 550.0°C</td>
<td>-328.0 to 1022.0°F</td>
<td></td>
</tr>
</tbody>
</table>
**DI (Digital Input)**

**Format:** SRp1, mode designation, p2

p1: Channel number (CC)
mode designation: D1 (digital input)
p2: Type designation selectable from LEVL (level) or CONT (contact)

**Example:** SR01, DI, CONT

---

**SCL (Scaling)**

**Format:** SRp1, mode designation, p2, p3, p4, p5, p6, p7, p8

p1: Channel number (CC)
mode designation: SCL
p2: Mode designation selectable from VOLT, TC, or RTD.
p3: Range designation.
p4: The minimum value of the recording span (SPAN L). Enter five digits, regardless of the decimal point and + or −.
p5: The maximum value of the recording span (SPAN R). Enter five digits, regardless of the decimal point and + or −.
p6: The minimum value of the scale (SCL 1). Enter six digits, regardless of the decimal point and + or −.
p7: The maximum value of the scale (SCL r). Enter six digits, regardless of the decimal point and + or −.
p8: Decimal point position of scaling value (0 to 4, which stands for the number of digits after the decimal point).

**Example:** SR01, SCL, VOLT, 20mV, 0, 1000, −1000, 1000, 1

This example performs 0 to 10mV input in channel 01 and is scaled from −100.0 to 100.0.

---

**NOTE**

An error will occur if one of p6, p7, or p8 is omitted. However, it is possible to omit all three values in case you do not want to change them.
**SQRT (Square Root)**

Format: SRp1, mode designation, p2, p3, p4, p5, p6, p7

- **p1:** Channel number (CC)
- **mode designation:** SQRT
- **p2:** Range designation selectable from 20mV, 60mV, 200mV, 2V, 6V, 20V
- **p3:** The minimum value of the recording span (SPAN L). Enter five digits, regardless of the decimal point and + or –.
- **p4:** The maximum value of the recording span (SPAN R). Enter five digits, regardless of the decimal point and + or –.
- **p5:** The minimum value of the scale (SCL 1). Enter six digits, regardless of the decimal point and + or –.
- **p6:** The maximum value of the scale (SCL r). Enter six digits, regardless of the decimal point and + or –.
- **p7:** Decimal point position of scaling value (0 to 3, which stands for the number of digits after the decimal point).

Example: SR01, SQRT, 20mV, 0, 1000, -1000, 1000, 1

This example performs 0 to 10mV input in channel 01. From this value, the square root is taken and the value is scaled from -100.0 to 100.0.

---

**NOTE**

An error will occur if one of p5, p6, or p7 is omitted. However, it is possible to omit all three values in case you do not want to change them.

---

### 2.1.3 Alarm Setting

Format: SAp1, p2, ON/OFF, p3, p4, p5, p6

- **p1:** Channel number (CC)
- **p2:** Alarm level number (1 to 4)
- **ON/OFF:** Set alarm ON or OFF
p3: The type of alarm, selectable from:
   H: high limit alarm
   L: low limit alarm
   R: rate-of-change limit on increasing signal
   r: rate-of-change limit on decreasing signal
   h: difference high limit alarm
   l: difference low limit alarm

p4: The alarm set point. Enter within five digits, regardless of the decimal point and + or -. The decimal point position will be according to the range (or scaling) setting. Refer to the input range listing (Table 1).

p5: Activating the alarm output relay ON/OFF.

p6: The alarm output relay number. Selectable from 101 to 112, depending on your option.

Example: SA02, 1, ON, L, 1000, ON, I04

This example sets level 1, low limit, alarm to channel 2. The alarm set point is 10.00mV and if an alarm occurs, output relay number 4 will be activated.

2.1.4 Unit Setting
Format: SNp1, p2
   p1: Channel number (CC)
   p2: Unit characters (up to six)

Example: SN02, kg

This example assigns the unit “kg” to channel 2. Note that a unit can only be assigned to channels of the SCL or SQRT input.

2.1.5 Chart Speed Setting
Format: SCp1
   p1: The chart speed (in mm/h: 5 to 12000 mm/h for the pen model, 82 increments; 1 to 1500 mm/h for the dot printing model, 1.0 mm step).

Example: SC1000

This example changes the chart speed to 1000 mm/h.
2.1.6 Clock Setting
Format:  SDp1, p2

p1: Date (YY/MM/DD)

p2: Time (HH:MM:SS)

Example:  SD92/07/13, 15:02:00

2.1.7 Copy Channel Setting
Format:  SYp1, p2

p1: The channel number (CC) that you want to copy (origin).

p2: The channel number (CC) to where you want to copy (destination).

Example:  SY01, 03

This example copies all settings from channel 1 to channel 3.

---

You can only copy from a lower channel number to a higher channel number.

---

2.1.8 Trend Recording Format Setting
Format:  SSP1

p1: Selection of trend recording mode selectable from AUTO or FIX.

---

This setting applies only to the dot printing model.

---

2.1.9 Zone Recording Setting
Format:  SZp1, p2, p3

p1: The channel number (CC).

p2: Left boundary value (0 to 95).

p3: Right boundary value (5 to 100).
Example: SZ02, 30,50
This example results in zone recording for channel 2 in the band from 30 to 50 mm.

2.1.10 Partial Expanded Recording Setting
Format: SP1, p2, p3, p4

p1: The channel number (CC).

p2: Partial expanded recording ON/OFF.

p3: Percentage of the full recording span that will be compressed (1 to 99%).

p4: Boundary value (recording span +1 to recording span –1).

Example: SP01, ON, 25, 0000
This example results in partial expanded recording for channel 1 where the value at 25% of the chart corresponds with 0.000V.

The decimal point position will be according to the range (or scaling) setting. Refer to the input ranges (Table 1).

2.1.11 Periodic Printout Setting
Format: SFp1, p2

p1: The channel number (CC) for which you want to specify the periodic printout ON or OFF.

p2: ON or OFF

Example: SF01, OFF
This example results in no periodic printout for channel 1.

2.1.12 Tag Setting
Format: STp1, p2

p1: The channel number (CC) for which you want to set a tag.

p2: Tag characters (up to seven characters).

Example: ST01, TAG 1
2.1.13 Message Setting

Format: SGp1, p2

p1: The message number (selectable from MSG1, MSG2, MSG3, MSG4, MSG5).

p2: Message characters (up to 16 characters).

Example: SGMSG2, RD100A/RD1800 model
This example sets the message “RD100A/RD1800 model” as message number 2.

2.1.14 Chart Speed 2 Setting

Format: SEp1

p1: The second chart speed (in mm/h)
   (5 to 12000 mm/h for the pen model [82 increments] 1 to 1500 mm/h for the dot printing model [1 mm step]).

Example: SE1000
This example sets the second chart speed to 1000 mm/h.

2.1.15 Setting of Daylight Savings Time (Option)

Format: SWp1, p2

p1: The selection of summer or winter time, selectable from SUMMER or WINTER.

p2: YY/MM/DD HH

Example: SWSUMMER, 92/04/01_03
This example has as a result that the summer time will go into effect on April 1, 1992 at 03:00.

---

NOTE

Be sure to enter the p2 parameter completely. Do not leave out any characters or space.
2.2 Program Control Commands

2.2.1 Program Control Commands and Functions

<table>
<thead>
<tr>
<th>Type</th>
<th>Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>PS</td>
<td>Start/stop recording</td>
</tr>
<tr>
<td></td>
<td>MP</td>
<td>Manual printout start/stop</td>
</tr>
<tr>
<td></td>
<td>LS</td>
<td>List printout start/stop</td>
</tr>
<tr>
<td></td>
<td>SU</td>
<td>SETUP list printout start/stop</td>
</tr>
<tr>
<td></td>
<td>MS</td>
<td>Message printout start</td>
</tr>
<tr>
<td></td>
<td>MC</td>
<td>Message buffer clear</td>
</tr>
<tr>
<td></td>
<td>AK</td>
<td>Alarm acknowledge</td>
</tr>
<tr>
<td></td>
<td>AC</td>
<td>Alarm buffer clear</td>
</tr>
<tr>
<td></td>
<td>UD</td>
<td>Selection of display</td>
</tr>
<tr>
<td></td>
<td>BO</td>
<td>Designation sequence of byte output (binary output)</td>
</tr>
<tr>
<td></td>
<td>TS</td>
<td>Selection of output data</td>
</tr>
<tr>
<td></td>
<td>FM</td>
<td>Selection of output format of measured data</td>
</tr>
<tr>
<td></td>
<td>LF</td>
<td>Selection of output format for setting parameters</td>
</tr>
</tbody>
</table>

2.2.2 Start/Stop the Recording

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS0</td>
<td>Starts the recording</td>
</tr>
<tr>
<td>PS1</td>
<td>Stops the recording</td>
</tr>
</tbody>
</table>

2.2.3 Manual Printout Start/Stop

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP0</td>
<td>Starts the manual printout</td>
</tr>
<tr>
<td>MP1</td>
<td>Stops the manual printout</td>
</tr>
</tbody>
</table>

2.2.4 List Printout Start/Stop

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>LS0</td>
<td>Starts the list printout</td>
</tr>
<tr>
<td>LS1</td>
<td>Stops the list printout</td>
</tr>
</tbody>
</table>

2.2.5 SET UP List Printout Start/Stop

<table>
<thead>
<tr>
<th>Command</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SU0</td>
<td>Starts the SET UP list printout</td>
</tr>
<tr>
<td>SU1</td>
<td>Stops the SET UP list printout</td>
</tr>
</tbody>
</table>
2.2.6 Message Printout Start

Command Function
MSp1 Starts the message printout

Where p1 is the message number selectable from 1 (MSG1), 2 (MSG2), 3 (MSG3), 4 (MSG4), 5 (MSG5).

2.2.7 Message Buffer Clear

Command Function
MC0 Clears the message buffer

2.2.8 Alarm Acknowledge

Command Function
AK0 Starts the alarm acknowledge function

2.2.9 Alarm Buffer Clear

Command Function
AC0 Clears the alarm buffer

2.2.10 Selection of Display

Command Function
UD0 Selects AUTO display
UD1, p1 Selects MANUAL display
UD2 Selects DATE display
UD3 Selects TIME display
UD4 Selects VIEW display

Where p1 is the channel number (CC).

2.2.11 Designation Sequence of Byte Output (Binary Output)

Command Function
BO0 Outputs from MSB (upper byte)
BO1 Outputs from LSB (lower byte)

2.2.12 Selection of Output Data

Command Function
TS0 Outputs measured values
TS1 Outputs values of setting parameters
TS2 Outputs unit and decimal point information
2.2.13 Selection of Output Format for Measured Data

**Command**    **Function**

FM0, p1, p2    Selects channels from which measured values are output in ASCII mode

FM1, p1, p2    Selects channels from which measured values are output in Binary mode

Where p1 is the channel number (CC) from where the output should start, and p2 is the channel number (CC) where the output should end.

---

**NOTE**

After you designated the output to be measured values (TS0 command), specify the format by this FM command.

2.2.14 Selection of Output Format for Setting Parameters, Unit/Decimal Point Information

**Command**    **Function**

LF, p1, p2    Selects channels from which values of setting parameters are output (TS1)

Selects channels from which unit/decimal point information is output (TS2)

Where p1 is the channel number (CC) from where the output should start, and p2 is the channel number (CC) where the output should end.

---

**NOTE**

After you designated the output by a TS1 or TS2 command, specify the format by this LF command.
2.3 Escape Sequence

Communications can be controlled by using the following escape commands.

2.3.1 Execution of Trigger

ESC T executes triggering. If an ESC T command is received:

- Measured data (when TS0 is specified), or
- Setting parameters output (when TS1 is specified), or
- Units and decimal point information (when TS2 is specified)
  are stored in a buffer.

Data output will start only after the output format has been designated (using the
FM or LF command). ESC T sends a character “T” following data of 1 byte (1B) H.

Example: If (ESC T) is output using PC 9801 Series:

```plaintext
PRINT #1,CHR$(&1H)+"T";
```

(In the case of the NEC PC 9801, the interface file number
should be 1 and should be opened.)

2.3.2 Status Output – ESC S Outputs Status

If the ESC S command is received, statuses of the commands that have been sent
so far are output. Output statuses range from ER00 to ER31. For the respective
contents, refer to Figure 8 and Table 2, which follow.

![Figure 8. Output Format after ESC S Command Has Been Sent](image)

The error “chart paper runs out” will be only reset by entering
new chart paper (level). In the case of all other errors: status
will be reset (0) after the error message has been output.

Example:

- A/D conversion ends

![Diagram of A/D conversion ends]

Status of error “A/D conversion ends”

![Diagram of status output]

20
Table 2. Status Output

<table>
<thead>
<tr>
<th>Status Output</th>
<th>A/D END</th>
<th>Syntax Error</th>
<th>Interval Timer Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ER00C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER01C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER02C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>ER03C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td></td>
</tr>
<tr>
<td>ER04C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>ER05C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER06C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER07C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>ER09C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER10C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER11C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td></td>
<td>●</td>
</tr>
<tr>
<td>ER12C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER13C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER14C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER15C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER17C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER18C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER19C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER20C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER21C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER22C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER23C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER25C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER26C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER27C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER28C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER29C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER30C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ER31C&lt;sub&gt;i&lt;/sub&gt;</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

● : Enabled status

If an error message is output, all error statuses will be reset, except for the error "chart paper runs out." This error will not be reset. If there are no statuses to be output when the ESC S command is received, ER00 will be output.
Data from the recorder is output using an FM or LF command. To allow time to output these data, do not send an ESC S command immediately after sending the FM or LF command. ESC S sends a character "S" following data of one byte (1B) H.

Example: If (ESC S) is output using PC 9801 Series:

```
PRINT #1,CHR$(&1HB) + 'S';
LINE INPUT #1, D$
PRINT D$
```

(In the case of NEC PC 9801, the interface file number should be 1 and should be opened.)

2.3.3 Open Command

(ESC O)_ □ □ CRLF where □ □ is the address (ASCII code 01 to 16)

The open command is to address a communication destination when a HOST (PC) is connected to more than one (up to 15) RD100A/RD1800 recorders.

This command always controls non-addressed devices. Before issuing an open command, make sure that the previous address device is closed by a close command. All commands (including ESC T) are valid for the addressed (after ESC O) device only.

2.3.4 Close Command

(ESC C)_ □ □ CRLF where □ □ is the address (ASCII code 01 to 16)

The close command is to close the addressed state of a device. Only the addressed device will respond to this command.
3 Transmitting Functions

This section describes different output formats.

3.1 Introduction to Output Data Formats

The format to output data can be specified by the following commands:

- TS0
- TS1
- TS2

NOTE

When you specify a TS command and send an ESC T command, the TS command will be reset. If you resend an ESC T command, the TS command will be set to the previous value.

3.1.1 TS0

After sending the TS0 and the ESC T command, you must specify the output format using an FM command. Data cannot be output when an FM command is omitted. However, after the FM command has been sent, data within the same sample can be output again by specifying the output format once more using an FM command. If the next FM command is sent before the specified data have been output completely, the newly requested data will be output.

Sequence

TS0

ESC T

FMx, xx, xx

(read data completely)

FMx, xx, xx

(read data completely)

NOTE

Do not send any FM or LF commands until the data have been sent completely. After sending an ESC T command, data will be stored in a buffer and the system will wait for FM or LF commands. (Regardless of whether the ESC T command is sent without executing FM or LF command, or whether data have been sent completely.) The ASCII code for ESC is (1B)H.
3.1.2 TS1, TS2

After sending the TS1 (or TS2) and the ESC T command, you must specify the output channel using an LF command. It is possible, after data have been output completely, to output data from another channel by specifying an LF command again.

Sequence
TS1
ESC T
LFxx, xx
(read data (end data))
LFxx, xx
(read data (end data))

---

NOTE

Do not send any FM or LF commands until the data have been sent completely. After sending an ESC T command, data will be stored in a buffer and the system will wait for FM or LF commands.

---

3.2 Output Data Formats

There are four formats that can be used to output data:

- TS0 + ESC T + FM0 (outputs measured values in ASCII mode)
- TS0 + ESC T + FM1 (outputs measured values in Binary mode)
- TS1 + ESC T + LF (outputs values of setting parameters)
- TS2 + ESC T + LF (outputs information on unit and decimal point).

3.2.1 Output Format of Measured Values in the ASCII Mode

When the TS0, ESC T, and FM0 commands are received, the measured value and the computed result are output in ASCII mode. When the ESC T command is received immediately after the TS0 command, the recorder data will be transferred to a buffer.

Output format:
DATEYYMMDDC_{R \rightarrow T} (year, month, day)
TIMEHMMSSC_{R \rightarrow T} (hour, minute, second)
3.2.2 Output Format of Measured Values in the Binary Mode
When the TS0, ESC T, and FM1 commands are received, the measured value and computed result are output in the Binary mode.

Output format

Transfer order

- Output byte number: 2 byte
- Date and time: 6 byte
- Measured data (1): 5 byte (7 byte in case of TLOG channel)
- Measured data (n): 5 byte
Output byte number

Output byte number = 5 x n+6 (order of output byte can be selected).
(Output byte number in case of TLOG channel = 7 x n+6 )

The output byte number is output from the most significant byte (MSB) or least significant byte (LSB) according to the output sequence (BO command). Note that in the mentioned formula the above mentioned, two bytes are not included.

Date and time

Year, Month, Day, Hour, Minute, Second

Year: 0 to 99 (00H to 63H)*
Month: 1 to 12 (01H to 0CH)*
Day: 1 to 31 (01H to 1FH)*
Hour: 0 to 23 (00H to 17H)*
Minute: 0 to 59 (00H to 3BH)*
Second: 0 to 59 (00H to 3BH)*

* Output is hexadecimal; therefore, numeric output needs to be converted.

Measured data:

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A2</td>
<td>A1</td>
<td>A4</td>
<td>A3</td>
</tr>
</tbody>
</table>

- channel number (1 to 6)
- Alarm status
  - An=1; H: data + over: 7E7E is output
  - An=2; L: data – over: 8181 is output
  - An=3; h: skip: 8080 is output
  - An=4; l: skip: 8080 is output
  - An=5; R: skip: 8080 is output
  - An=6; r: skip: 8080 is output
  - An=0: No alarm or set to OFF
- measured value (order of output byte can be selected, using BO command)
3.2.3 Output Format of Setting Parameters

When the TS1, ESC T, and LF commands are received, setting parameters are output in the following order (the set values are output in the same format as input):

<table>
<thead>
<tr>
<th>Communication</th>
<th>Set Value Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS</td>
<td>Start/stop recording</td>
</tr>
<tr>
<td>SR</td>
<td>Range setting</td>
</tr>
<tr>
<td>SN</td>
<td>Unit setting</td>
</tr>
<tr>
<td>SA</td>
<td>Alarm setting</td>
</tr>
<tr>
<td>SC</td>
<td>Chart speed setting</td>
</tr>
<tr>
<td>SS</td>
<td>Trend recording format setting</td>
</tr>
<tr>
<td>SZ</td>
<td>Zone setting</td>
</tr>
<tr>
<td>SP</td>
<td>Partial expanded setting</td>
</tr>
<tr>
<td>SF</td>
<td>Periodic printout setting</td>
</tr>
<tr>
<td>ST</td>
<td>Tag setting</td>
</tr>
<tr>
<td>SG</td>
<td>Message setting</td>
</tr>
<tr>
<td>SE</td>
<td>Chart speed 2 setting</td>
</tr>
<tr>
<td>UD</td>
<td>Selection of display</td>
</tr>
<tr>
<td>EN</td>
<td>End of setting parameter output</td>
</tr>
</tbody>
</table>

3.2.4 Output Format of Information on Unit and Decimal Point

When the TS2, ESC T, and LF commands are received, information on units and decimal points are output in the following format. Channel numbers can be specified with the LF command.

```
  P: position of decimal point.
  This number indicates the number of digits after the decimal point (0 to 4)
  U: unit (6 characters)
  C: channel number (2 characters)
  S: data status  space: middle and other data
  E: final data
  I: N: normal
  D: differential
  S: skip
```
### 3.3 Status Byte Format

When an ESC S command is received, status is output in the following format:

\[ \text{ER} \ C_R \ C_F \]

<table>
<thead>
<tr>
<th>Status Output</th>
<th>A/D END Error</th>
<th>Syntax</th>
<th>Interval Timer Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ER00C_{r,f}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER01C_{r,f}</td>
<td>⬜</td>
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<td></td>
</tr>
<tr>
<td>ER02C_{r,f}</td>
<td>⬜</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER03C_{r,f}</td>
<td>⬜</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ER04C_{r,f}</td>
<td>⬜</td>
<td>⬜</td>
<td></td>
</tr>
<tr>
<td>ER05C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER06C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER07C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER09C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER10C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER11C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER12C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER13C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER14C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER15C_{r,f}</td>
<td>⬜</td>
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</tr>
<tr>
<td>ER17C_{r,f}</td>
<td>⬜</td>
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</tr>
<tr>
<td>ER18C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER19C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER20C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER21C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER22C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER23C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER25C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER26C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER27C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER28C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER29C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER30C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
<tr>
<td>ER31C_{r,f}</td>
<td>⬜</td>
<td></td>
<td>⬜</td>
</tr>
</tbody>
</table>

*・: Enabled status
4 Time Chart

The sample period is 125 ms for the pen model and 2.5 s for the dot printing model. When the ESC T command is received to output data before data is updated, the previous sample data will be output.

---

A/D and primary computation

ESC T command

Output of data
5 Initial Status

The initial status after turning the power ON is shown below.

TS0  Output format is designated to be measured values

FM0, 01, 06*  Output format is designated to be measured values in the ASCII mode
                 Output start channel: 01
                 Output end channel: 06

LF 01, 06*  Set channels to be output
                 Start channel: 01
                 End channel: 06

BO0  From most significant byte (MSB)

* Depending on the recorder model, the highest channel number will be the initial status.

---

NOTE

The contents of RS-422-A cannot be backed up by a battery.
## ASCII Code Table

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
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<td>p</td>
<td></td>
<td></td>
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</tr>
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<td>1</td>
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<td>a</td>
<td>q</td>
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<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td>2</td>
<td>B</td>
<td>R</td>
<td>b</td>
<td>r</td>
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<td></td>
<td></td>
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</tr>
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<td>f</td>
<td>v</td>
<td>U</td>
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<td></td>
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<td>8</td>
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<td></td>
</tr>
<tr>
<td>A</td>
<td>$\mathrm{L/F}$</td>
<td>*</td>
<td>:</td>
<td>J</td>
<td>Z</td>
<td>j</td>
<td>z</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>+</td>
<td>K</td>
<td>k</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
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<td>l</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>D</td>
<td>$\mathrm{C/R}$</td>
<td>-</td>
<td>M</td>
<td>m</td>
<td></td>
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<td></td>
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<td></td>
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<tr>
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<td></td>
<td>.</td>
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<td></td>
</tr>
</tbody>
</table>

### NOTE

The degree symbol (°) of °C or °F, should be selected as follows:

- In the case of Measured values output (TS0) and Unit, Decimal point output (TS2): ° = space (20H)
- In case of setting parameter output (TS1): ° = E1H
- In case of recorder setting: ° = E1H
6 Errors During RS-422-A Output

6.1 Preventing Errors

Do not send an FM or LF command until the measured data or set point data in the specified channel is output. If an FM or LF command is sent during data output, the communication will be interrupted.

If an LF command (to set TS0) or an FM command (to set TS1 or TS2) is sent, the communication will be interrupted.

If an ESC T command was already sent when TS0 is set, data (even in other formats) in any channel can be output with an FM command. Data received with the last ESC T is output.

If an ESC T command was already sent when TS1 or TS2 is set, data set in any channel can be output with an LF command. If an ESC T command was already sent, the measured data and set point data can be output on a channel-by-channel.

If and ESC T command has already been sent, the measured value and set value can be output over more than one time.

---

NOTE

When data are to be sent from the PC to the recorder, use the ESC S command to avoid buffer overflow. The RD100A/RD1800 recorder receives an ESC S request, and saves it in the buffer memory. This request is retrieved from the buffer memory and, after command acknowledgment, the status is sent to the PC. Do not send any other commands between sending the ESC S command to the recorder and reading the status from the recorder. Commands can be only received by the recorder when its input buffer is empty.

Example:

10 OPEN "COM1:N81N" AS #1
20 ,
30 PRINT #1,CHR$(&H1B) +"O 01"
40 PRINT #1, "SR01,VOLT,20mV,-2000,2000"
50 GOSUB *HANDSHAKE
60 PRINT #1, "PS0"
70 GOSUB *HANDSHAKE
80 PRINT #1,"UD0"
90 PRINT #1,CHR$(&H1B)+"C 01"
100 CLOSE
110 END
120 *HANDSHAKE
130 PRINT #1,CHR$(&H1B)+"S"; (sending ESC S) \{to prevent buffer
140 LINE INPUT #1,STS$ (reading status) \} overflow
150 RETURN
Command length of input buffer of the RD100A/RD1800 is 256 bytes.

---

When the PC9801 receives binary data from the recorder, set
the memory switches so that the PC9801 can use a DEL mode
as a BS(08) code. For memory setting, refer to the PC9801
Instruction Manual.

---

Binary data cannot use a LINE INPUT statement. To read binary data, use an
INPUT\$ statement.

**Example:**

10 OPEN "COM1:N81N" AS #1
20 
30 PRINT #1,CHR$(&H1B)+"O 01"
40 PRINT #1,"B01"
50 PRINT #1,"TS0"
60 PRINT #1,CHR$(&H1B)+"T";
70 PRINT #1,"FM1,01,04"
80 D$=INPUT$(2,#1) (to designate data length of read data)
90 CNT=CVI(D$)
100 D$=INPUT$(CNT,#1)
110 CLOSE
120 END

Execution of the above program may result in the following: After line 100 has
been executed, binary data will be stored in D$. If the output data length “CNT”
in line 90 exceeds 255, the read-data is separated into several parts. When binary
data is handled in an integer array on a two-byte basis, the least significant byte is
followed by the most significant byte, so an FM command should specify an
output byts from the LSB (least significant byte) (line 40).
6.2 How to Request for Error Message Output

If an error occurs when a supervisory computer sends a setting or control command to the recorder via the RS-422-A communication interface, an error message can be output from the RD100A/RD1800 upon receipt of a command from the computer.

1. Request to output error message number
   Command: ESC S
   (1B) H (53) H

2. Error message output from RD100A/RD1800 when ESC S is received.
   Output format: ERxx (CR) (LF) (xx = 00 to 31)

---

An error message is only output when an ESC S command is sent. If an ESC S command (request to send error message) is sent to the RD100A/RD1800 while data is being output due to the receipt of a TS0, TS1, or TS2 command, communication will be interrupted. When data is transmitted between a supervisory computer and the RD100A/RD1800, it is possible to monitor the errors during communication through the ESC S command.

6.3 Timing of Resetting Error Status

When the RD100A/RD1800 receives an ESC S command following the occurrence of an error, the recorder outputs the corresponding error message, and the error status is simultaneously reset.

```
error occurs   ESC S command is sent
```

- outputs error message
- resets the error

Figure 6.1 Timing
Sample Programs

7 Sample Programs

7.1 Sample Programs for the NEC PC 9801

Computer Used: NEC PC 9801
Mode: Eight-bit, NONE parity, stop bit 1, baud rate 9600 bps
Handshake: NONE

The file name used for writing to and reading from the disc is TEST.DAT.

7.1.1 Program to Read Setting Parameters from the RD100A/RD1800 Display on Screen and Write to Disc

10 OPEN "COM1:N81N" AS #1
20 OPEN "TEST.DAT" FOR OUTPUT AS #2
30 ,
40 PRINT #1,CHR$(&H1B)+"O 01"
50 PRINT #1,"TS1"
60 PRINT #1,CHR$(&H1B)+"T";
70 PRINT #1,"LF01,04"
80 LINE INPUT #1,D$
90 PRINT D$
100 PRINT #2,D$
110 IF LEFT$(D$,2)="EN" THEN GOTO 70
120 ,
130 PRINT #1, CHR$(&H1B)+"C 01"
140 CLOSE
150 END

7.1.2 Program to Read Setting Parameters from Disc, Display on Screen and Set the RD100A/RD1800

10 OPEN "COM1:N81N" AS #1
20 OPEN "TEST.DAT" FOR INPUT AS #2
30 ,
40 PRINT #1,CHR$(&H1B)+"O 01"
50 LINE INPUT #2,D$
60 PRINT D$
70 IF LEFT$(D$,2)="EN" THEN GOTO 130
80 PRINT #1,D$
90 PRINT #1,CHR$(&H1B)+"S";
100 LINE INPUT #1,D$

35
110 PRINT D$
120 GOTO 50
130 ' 
140 PRINT #1,CHR$(&H1B)+"C 01"
150 CLOSE
160 END

7.1.3 Program to Read Information on Unit and Decimal Point from the RD100A/RD1800, Display on Screen and Write to Disc
10 OPEN "COM1:N81N" AS #1
20 OPEN "TEST.DAT" FOR OUTPUT AS #2
30 ' 
40 PRINT #1,CHR$(&H1B)+"O 01"
50 PRINT #1,"TS2"
60 PRINT #1,CHR$(&H1B)+"T";
70 PRINT #1,"LF01,04"
80 LINE INPUT #1,D$
90 PRINT D$
100 PRINT #2,D$
110 IF MID$(D$,2,1)<">E" THEN GOTO 80
120 ' 
130 PRINT #1,CHR$(&H1B)+"C 01"
140 CLOSE
150 END

7.1.4 Program to Output Measured Data (ASCII Code) from the RD100A/RD1800 and Write to Disc
10 OPEN "COM1:N81N" AS #1
20 OPEN "TEST.DAT" FOR OUTPUT AS #2
30 ' 
40 PRINT #1,CHR$(&H1B)+"O 01"
50 PRINT #1,"TS0"
60 PRINT #1,CHR$(&H1B)+"T";
70 PRINT #1,"FM0,01,04"
80 LINE INPUT #1,D$
90 PRINT D$
100 PRINT #2,D$
110 IF MID$(D$,2,1)<">E" THEN GOTO 80
120 ' 
130 PRINT #1,CHR$(&H1B)+"C 01"
140 CLOSE
150 END

36
7.1.5 Program to Output Measured Data (Binary Code) from the RD100A/RD1800 and Write to Disc

```
10 OPEN "COM1:N811N" AS #1
20 OPEN "TEST.DAT" FOR OUTPUT AS #2
30 '
40 PRINT #1,CHR$(&H1B)+"0 01"
50 PRINT #1,"TS0"
60 PRINT #1,"BO1"
70 '
80 PRINT #1,CHR$(&H1B)+"T";
90 PRINT #1, "FM1,01,04"
100 D$=INPUT$(2, #1)
110 PRINT #2,D$
120 A=CVI(MID$(D$, 1, 2))
130 PRINT A
140 D$=INPUT$(A, #1)
150 PRINT #2,D$
160 PRINT ASC(MID$(D$, 1, 1)); PRINT "/";
170 PRINT ASC(MID$(D$, 2, 1)); PRINT "/";
180 PRINT ASC(MID$(D$, 3, 1)); PRINT ":
190 PRINT ASC(MID$(D$, 4, 1)); PRINT ":
200 PRINT ASC(MID$(D$, 5, 1)); PRINT ":"
210 PRINT ASC(MID$(D$, 6, 1))
220 '
230 L=0
240 FOR I=7 TO A
250 PRINT RIGHT$("0"+HEX$(ASC(MID$(D$, I, 1)))); PRINT " ";
260 L=L+1
270 IF L=5 THEN L=0 : PRINT
280 NEXT I
290 '
300 PRINT #1,CHR$(&H1B)+"C 01"
310 CLOSE
320 END
```
7.2 Sample Programs for YEWMAC

Computer Used: YEWMAC with RS 3 card installed (serial interface card) to line controller slot 3 and using port 1

Mode: Eight-bit, NONE parity, stop bit 1, baud rate 9600 bps

Handshake: NONE

7.2.1 Program to Read Setting Parameters from the RD100A/RD1800 and Display on Screen

10 ASSIGN RS3=3
20 RESET 3
30 CONTROL 3,105;1 ;; DATA LENGTH 8 bit
40 CONTROL 3,106;0 ;; STOP BIT 1
50 CONTROL 3,107;0 ;; PARITY NONE
60 CONTROL 3,108;13 ;; 9600 BAUD
70 !
80 DIM D$128
90 OUTPUT 3,1;CHR$(27)+“0 01”
100 OUTPUT 3,1;“TS1”
110 OUTPUT 3,1;CHR$(27)+“T”;
120 OUTPUT 3,1;“LF01,04”
130 ENTER 3,1;D$
140 PRINT D$
150 IF LEFT$(D$,2)<>“EN” THEN GOTO 130
160 OUTPUT 3,1;CHR$(27)+“C 01”
170 END

7.2.2 Program to Read Information on Unit and Decimal Point from the RD100A/RD1800 and Display on Screen

10 ASSIGN RS3=3
20 RESET 3
30 CONTROL 3,105;1 ;; DATA LENGTH 8 bit
40 CONTROL 3,106;0 ;; STOP BIT 1
50 CONTROL 3,107;0 ;; PARITY NONE
60 CONTROL 3,108;13 ;; 9600 BAUD
70 !
80 DIM D$128
90 OUTPUT 3,1;CHR$(27)+“0 01”
100 OUTPUT 3,1;“TS2”
110 OUTPUT 3,1;CHR$(27)+“T”;
120 OUTPUT 3,1;“LF01,04”
130 ENTER 3,1;D$
140 PRINT D$
150 IF MID$(D$,2,1) <>"E" THEN GOTO 130
160 OUTPUT 3,1;CHR$(27)+"C 01"
170 END

7.2.3 Program to Output Measured Data (ASCII Code) from the RD100A/RD1800 and Display on Screen
10 ASSIGN RS3=3
20 RESET 3
30 CONTROL 3,105;1  ; DATA LENGTH 8 bit
40 CONTROL 3,106;0  ; STOP BIT 1
50 CONTROL 3,107;0  ; PARITY NONE
60 CONTROL 3,108;13 ; 9600 BAUD
70 !
80 DIM D$128
90 OUTPUT 3,1;CHR$(27)+"O 01"
100 OUTPUT 3,1;"TS0"
110 OUTPUT 3,1;CHR$(27)+"T";
120 OUTPUT 3,1;"FMO,01,04"
130 ENTER 3,1;D$
140 PRINT D$
150 IF MID$(D$,2,1) <>"E" THEN GOTO 130
160 OUTPUT 3,1;CHR$(27)+"C 01"
170 END

7.2.4 Program to Output Measured Data (Binary Code) from the RD100A/RD1800 and Display on Screen
10 ASSIGN RS3=3
20 RESET 3
30 CONTROL 3,105;1  ; DATA LENGTH 8 bit
40 CONTROL 3,106;0  ; STOP BIT 1
50 CONTROL 3,107;0  ; PARITY NONE
60 CONTROL 3,108;13 ; 9600 BAUD
70 CONTROL 3,118;0  ; NO TERMINATOR
80 CONTROL 3,119;1  ; RECEIVE 1 BYTE
90 !
100 DIM D$1(128)
110 CR$=CHR$ (13)
120 LF$=CHR$ (10)
130 !
140 OUTPUT 3,1;CHR$(27)+"O 01"+CR$+LF$
150 OUTPUT 3,1;"TS0"+CR$+LF$
160  OUTPUT 3,1;"BO1"+CR$+LF$
170  OUTPUT 3,1;(CHR$(27)+"T"
180  OUTPUT 3,1;"FM1,01,04"+CR$+LF$
190  !
200  ENTER 3,1 NOFORMAT ; D$(*) : ! DATA BYTE QTY
210  A=ASC(D$(0))
220  ENTER 3,1 NOFORMAT ; D$(*)
230  A=A + ASC(D$(0))*256
240  PRINT A
250  !
260  ENTER 3,1 NOFORMAT ; D$(*) : ! YEAR
270  PRINT ASC(D$(0)); : PRINT "/";
280  ENTER 3,1 NOFORMAT ; D$(*) : ! MONTH
290  PRINT ASC(D$(0)); : PRINT "/";
300  ENTER 3,1 NOFORMAT ; D$(*) : ! DAY
310  PRINT ASC(D$(0)); : PRINT
320  ENTER 3,1 NOFORMAT ; D$(*) : ! HOUR
330  PRINT ASC(D$(0)); : PRINT ":";
340  ENTER 3,1 NOFORMAT ; D$(*) : ! MINUTE
350  PRINT ASC(D$(0)); : PRINT ":";
360  ENTER 3,1 NOFORMAT ; D$(*) : ! SECOND
370  PRINT ASC(D$(0))
380  !
390  L=0
400  FOR I=7 TO A
410  ENTER 3,1 NOFORMAT ; D$(*)
420  PRINT RIGHT$("0"+HEX$(ASC(D$(0))),2); : PRINT " ";
430  L=L+1
440  IF L=5 THEN L=0 : PRINT : ENDIF
450  NEXT I
460  !
470  OUTPUT 3,1;CHR$(27)+"C 01"
480  END

7.3 Sample Programs for IBM PC

Computer Used: IBM PC

Mode: eight-bit, NONE parity, stop bit 1, baud rate 9600 bps

Handshake: NONE

The file name used for writing to and reading from the disc is TEST.DAT.
7.3.1 Program to Read Setting Parameters from the RD100A/RD1800, Display on Screen and Write to Disc

10 OPEN "COM1:1200,N,8,1,LF" AS #1
20 OPEN "TEST.DAT" FOR OUTPUT AS #2
30 ' 
40 LF$=CHR$(&HA)  ;' Line feed = 0AH
50 PRINT #1,CHR$(27)+"O 01"
60 PRINT #1,"TS1"
70 PRINT #1,CHR$(27)+"T";
80 PRINT #1,"LF01,04"
90 LINE INPUT #1,D$
100 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
     ;' Remove "LF" of head string
110 PRINT D$
120 PRINT #2,D$
130 IF LEFT$(D$,2)<"EN" THEN GOTO 90
140 ' 
150 PRINT #1,CHR$(27)+"C 01"
160 CLOSE
170 END

7.3.2 Program to Read Setting Parameters from Disc, Display on Screen and Set the RD100A/RD1800

10 OPEN "COM1:1200,N,8,1,LF" AS #1
20 OPEN "TEST.DAT" FOR INPUT AS #2
30 ' 
40 PRINT #1,CHR$(27)+"O 01"
50 LINE INPUT #2,D$: PRINT D$
60 IF LEFT$(D$,2)="EN" THEN GOTO 130  ;' Watch data end
70 PRINT #1,D$
80 PRINT #1,CHR$(27)+"S";  ;' For protect receive buffer overflow
90 LINE INPUT #1,D$
100 PRINT D$
110 GOTO 50
120 ' 
130 PRINT #1,CHR$(27)+"C 01"
140 CLOSE
150 END
7.3.3 Program to Read Information on Unit and Decimal Point from the RD100A/RD1800, Display on Screen and Write to Disc

10 OPEN "COM1:1200,N,8,1,LF" AS #1
20 OPEN "TEST.DAT" FOR OUTPUT AS #2
30 ' 
40 LF$=CHR$(&HA)  : ' Line feed = 0AH
50 PRINT #1,CHR$(27)+"O 01"
60 PRINT #1,"TS2"
70 PRINT #1,CHR$(27)+"T";
80 PRINT #1,"LF01,04"
90 LINE INPUT #1,D$
100 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
     : ' Remove "LF" of head string
110 PRINT D$
120 PRINT #2,D$
130 IF MID$(D$,2,1)<"E" THEN GOTO 90
140 '
150 PRINT #1,CHR$(27)+"C 01"
160 CLOSE
170 END

7.3.4 Program to Output Measured Data (ASCII Code) from the RD100A/RD1800 and Write to Disc

10 OPEN "COM1:1200,N,8,1,LF" AS #1
20 OPEN "TEST.DAT" FOR OUTPUT AS #2
30 ' 
40 LF$=CHR$(&HA)  : ' Line feed = 0AH
50 PRINT #1,CHR$(27)+"O 01"
60 PRINT #1,"TS0"
70 PRINT #1,CHR$(27)+"E";
80 PRINT #1,"FM0.01,04"
90 LINE INPUT #1,D$
100 IF LEFT$(D$,1)=LF$ THEN D$=MID$(D$,2)
     : ' Remove "LF" of head string
110 PRINT D$
120 PRINT #2,D$
130 IF MID$(D$,2,1)<"E" THEN GOTO 90
140 '
150 PRINT #1,CHR$(27)+"C 01"
160 CLOSE
170 END

42
7.3.5 Program to Output Measured Data (Binary code) from the RD100A/RD1800 and Write to Disc

10 OPEN "COM1:1200,N,8,1,LF" AS #1
20 OPEN "TEST.DAT" FOR OUTPUT AS #2
30 
40 PRINT #1,CHR$(27)+"O 01"
50 PRINT #1,"TS0"
60 PRINT #1,"B01"
70 
80 PRINT #1,CHR$(27)+"T";
90 PRINT #1,"FM1,01,04"
100 D$=INPUT$(2,#1)
110 PRINT #2,D$
120 A=CVI(MID$(D$,1,2))
130 PRINT A
140 D$=INPUT$(A,#1)
150 PRINT #2,D$
160 PRINT ASC(MID$(D$,1,1));PRINT "/";
170 PRINT ASC(MID$(D$,2,1));PRINT "/";
180 PRINT ASC(MID$(D$,3,1));PRINT
190 PRINT ASC(MID$(D$,4,1));PRINT ":";
200 PRINT ASC(MID$(D$,5,1));PRINT ":";
210 PRINT ASC(MID$(D$,6,1))
220 
230 L=0
240 FOR I=7 TO A
250 PRINT RIGHT$("0"+HEX$(ASC(MID$(D$,I,1))),2)+" ";
260 L=L+1
270 IF L=5 THEN L=0 : PRINT
280 NEXT I
290 
300 PRINT #1,CHR$(27)+"C 01"
310 CLOSE
320 END
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3. Repair instructions and/or specific problems relative to the product.

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2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

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