Cat. No. W244-E1-1

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SYSMAC CV-series

CV500-TDL21

Temperature Controller Data Link Unit

OPERATION MANUAL

OMRON

No. 6182
OMRON Corporation

Read and Understand this Manual

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

Warranty and Limitations of Liability

WARRANTY

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

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

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

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

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

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

Disclaimers

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

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

DIMENSIONS AND WEIGHTS

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

PERFORMANCE DATA

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

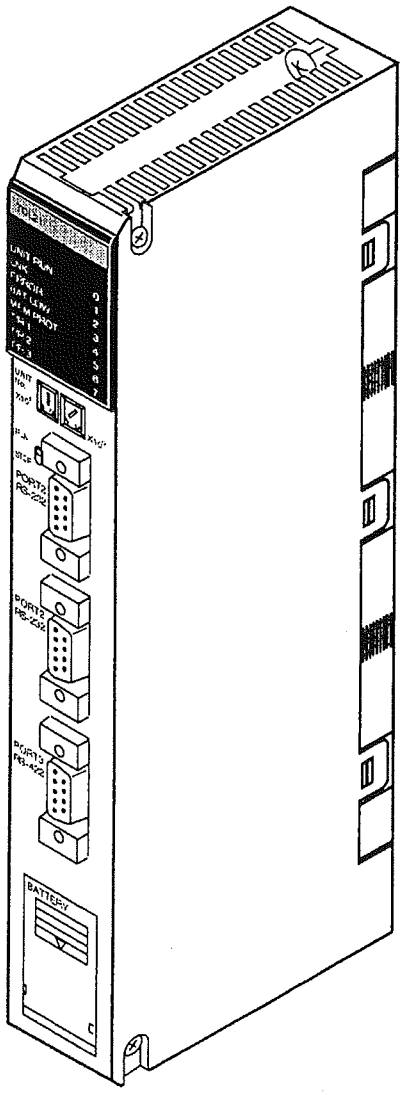
ERRORS AND OMISSIONS

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

CV500-TDL21
Temperature Controller Data Link Unit

Operation Manual

Produced March 1994



Notice:

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

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

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

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

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

OMRON Product References

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

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

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

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

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Appendices

About this Manual:

This manual describes the installation and operation of the CV500-TDL21 Temperature Controller Data Link Unit and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to install and operate the CV500-TDL21 Temperature Controller Data Link Unit.

Section 1 provides general information and features of the Temperature Controller Data Link Unit.

Section 2 provides information on the nomenclature and functions of the Temperature Controller Data Link Unit.

Section 3 provides information on the preparations required for the CV500-TDL21 Temperature Controller Data Link Unit to communicate with Temperature Controllers.

Section 4 provides information on the DM allocation of each area, and the area contents and settings that are required for communications with Temperature Controllers.

Section 5 provides the basic information required for communications with Temperature Controllers, user program examples that include upload and download processing, and the general-purpose command.

Section 6 provides operation examples for the CV500-TDL21 Temperature Controller Data Link Unit.

Section 7 provides information on troubleshooting using the indicators on the CV500-TDL21's front panel and each Unit connected to the CV500-TDL21.

The **Appendices** provide information on specifications, dimensions, monitoring cycle, program restoration, link adapters, interfaces, Temperature Controllers, DM setting, ASCII codes, and the battery set.

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

SECTION 1
Introduction

This section provides general information and features of the CV-series CV500-TDL21 Temperature Controller Data Link Unit.

1-1 Features

No Program Required for Data Exchange with PC
The CV500-TDL21 used with a PC does not require any program for data exchange with the PC because the CV500-TDL21 exchanges data with the PC using the PC's data memory.

Centralized Monitoring of Temperature Controllers
The CV500-TDL21 enables the PC's data memory to monitor the process value and status of each Temperature Controller connected to the CV500-TDL21.

Set Values Changed with Ease
By allocating more than one DM area to a single Temperature Controller, the set values of the Temperature Controller can be altered with ease by just selecting the required DM area.

Complete Set Value Change
By changing the data of the PC's data memory, the CV500-TDL21 will cyclically access each Temperature Controller connected to the CV500-TDL21 to change a whole group of Temperature Controller set values.

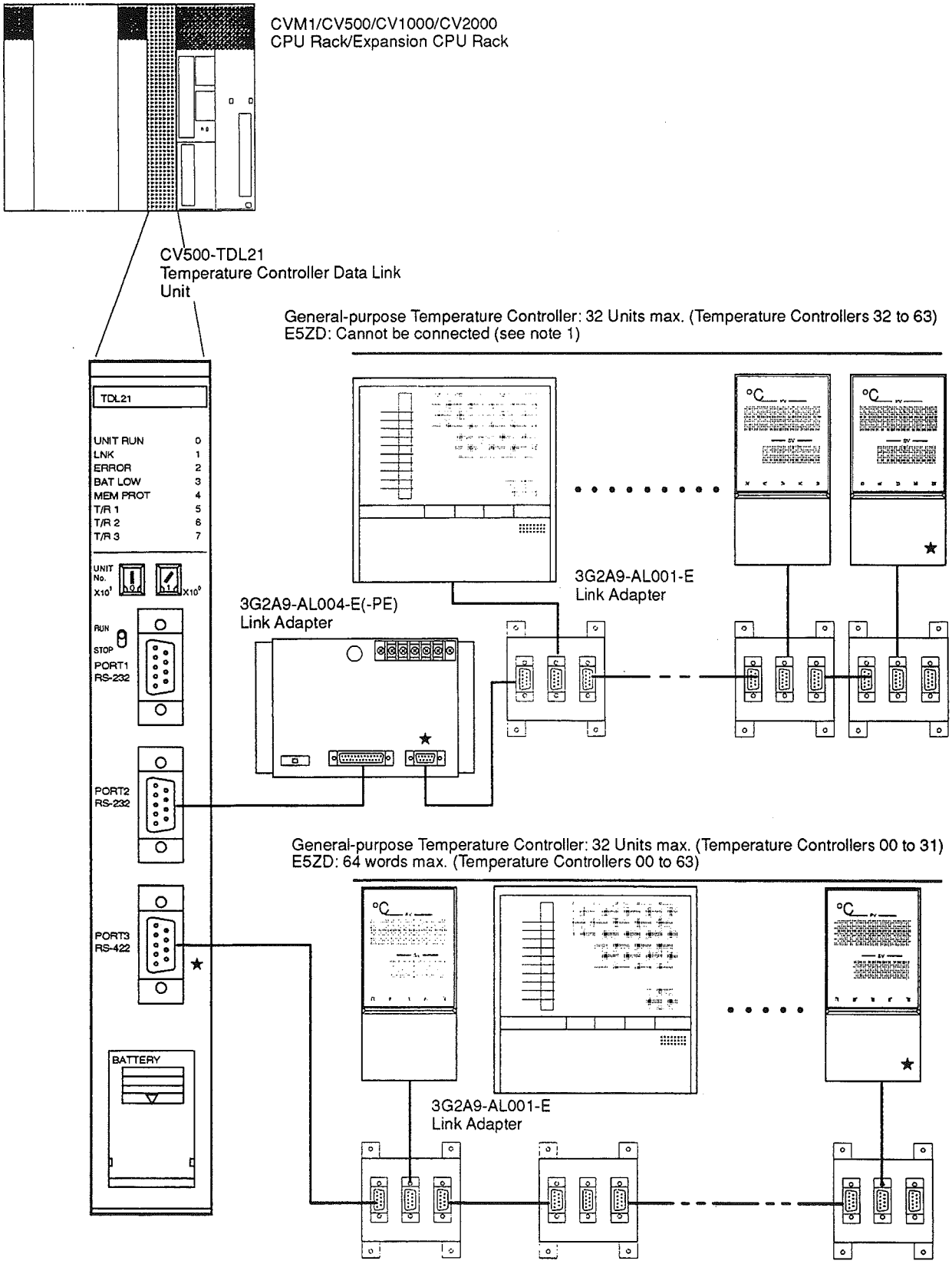
Controlled with PC's User Program
The CV500-TDL21 incorporates a general-purpose command function, with which each Temperature Controller connected to the CV500-TDL21 can be controlled by the PC using the communication function of each Temperature Controller.

Connected to a Maximum of 64 Temperature Controllers
The CV500-TDL21 incorporates two communication ports which connect to a maximum of 64 Temperature Controllers (see note 1).

A Variety of Temperature Controllers Can be Connected
The CV500-TDL21 connects to most of OMRON's Temperature Controllers if they incorporates a communication function (see note 2).

Note
1. The CV500-TDL21 has a total of 64 points available for the E5ZD Multipoint Temperature Controllers.
2. The CV500-TDL21 cannot connect to the E5M.

1-2 System Configuration



Note 1. The E5ZD Multipoint Temperature Controllers use PORT3 only.
2. Turn ON the termination resistor of each Unit marked by a "★."

1-2-1 Rack Mounting

The CV500-TDL21 can be mounted to CV-series CPU and Expansion CPU Racks but cannot be mounted to Expansion I/O Racks. Do not mount more than one CV500-TDL21 Unit to a single Backplane.

1-2-2 Temperature Controller Connections

- Each Temperature Controller connected to the CV500-TDL21 must incorporate a communication function and RS-422 interface.
- E5ZD Multipoint Temperature Controllers cannot be used in combination with general-purpose Temperature Controllers.
- Connect the Temperature Controllers and the RS-422 trunk lines in each system using 3G2A9-AL001-E Link Adapters.
- The 3G2A9-AL004-E(-PE) Link Adapter is required to convert RS-232C into RS-422 if the CV500-TDL21's PORT2 is used.
- The Unit number for each general-purpose Temperature Controller connected to the CV500-TDL21 must be within the ranges allocated to the CV500-TDL21's ports.

1-3 Operation as a CPU Bus Unit

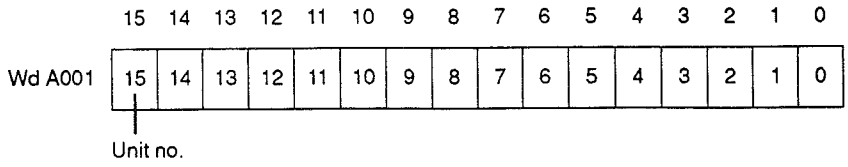
The CV500-TDL21 is a CV-series CPU Bus Unit. How the CV500-TDL21 works as a CPU Bus Unit is described in the following.

1-3-1 RUN/STOP

The CV500-TDL21's CPU Bus Unit system setup area must be set so that the CV500-TDL21 can start and stop operation with the RUN/STOP selector on the CV500-TDL21's front panel. Refer to *3-5 PC Settings* for details on the settings of CPU Bus Unit system setup area.

1-3-2 Hardware Reset (Restart)

Word A001 of the CV500-TDL21's auxiliary area is used as a CPU Bus Unit restart bits. A single bit of the word is allocated to the CV500-TDL21 according to the CV500-TDL21's unit number.



When restarting the CV500-TDL21, turn on the bit corresponding to the unit number that has been preset with the unit number selector on the CV500-TDL21's front panel. The CV500-TDL21 will not restart after changing the unit number or the settings of the CPU Bus Unit system setup area, in which case turn the CPU off and on.

1-3-3 Data Exchange with PC

The CV500-TDL21 incorporates an event function which enables the CV500-TDL21 mounted to a PC to exchange data with the PC. If data has been input to the PC's data memory, the CV500-TDL21 uses its internal program to access the data, thus enabling the PC to communicate with the Temperature Controllers connected to the CV500-TDL21.

Influence on Other CPU Bus Units

When CV500-TDL21 Units are used in combination with other CPU Bus Units in a system, such as SYSMAC BUS/2 Masters and BASIC Units, the cycle time of each PC in the system is prolonged lengthened by approximately 1.8 ms per CV500-TDL21 Unit.

1-4 Temperature Control Data Processing

To exchange data with Temperature Controllers, the CV500-TDL21 cyclically accesses all the Temperature Controllers connected to it.

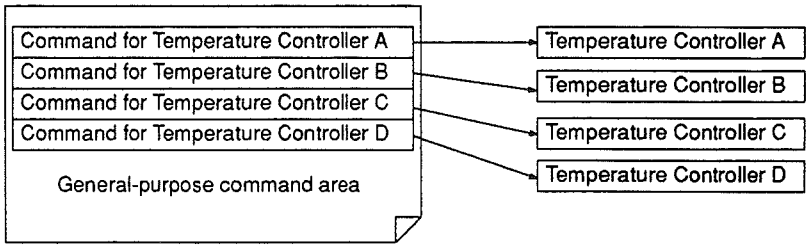
Basic Data Processing

Upload processing is a basic operation of the CV500-TDL21. General-purpose command processing and download processing are executed only when required.

Processing Procedure and Contents

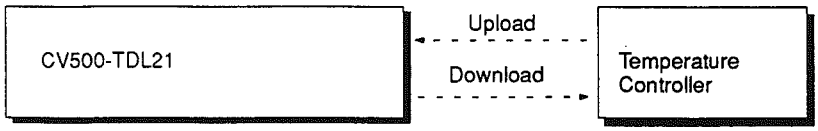
Each Temperature Controller connected to the CV500-TDL21 executes general-purpose command processing and upload and download processing cyclically in this order. In general-purpose command processing, a command string is set in advance and then each communication command is transmitted in sequence according to the order the communication commands are set.

General-purpose command processing



During upload and download processing, temperature control data items such as the PV and SP corresponding to the unit number of each Temperature Controller are exchanged.

Upload/Download processing



In general-purpose command processing, a command is transmitted individually to each Temperature Controller according to the Temperature Controller's unit number that the command includes. In upload and download processing, however, temperature control data items are exchanged with Temperature Controllers 0 to 63 in sequence regardless of the number of Temperature Controllers connected to the CV500-TDL21. By using the online and offline functions of each Temperature Controller and applying upload and download processing to only the Temperature Controllers set to online, the whole processing time of the system is shortened.

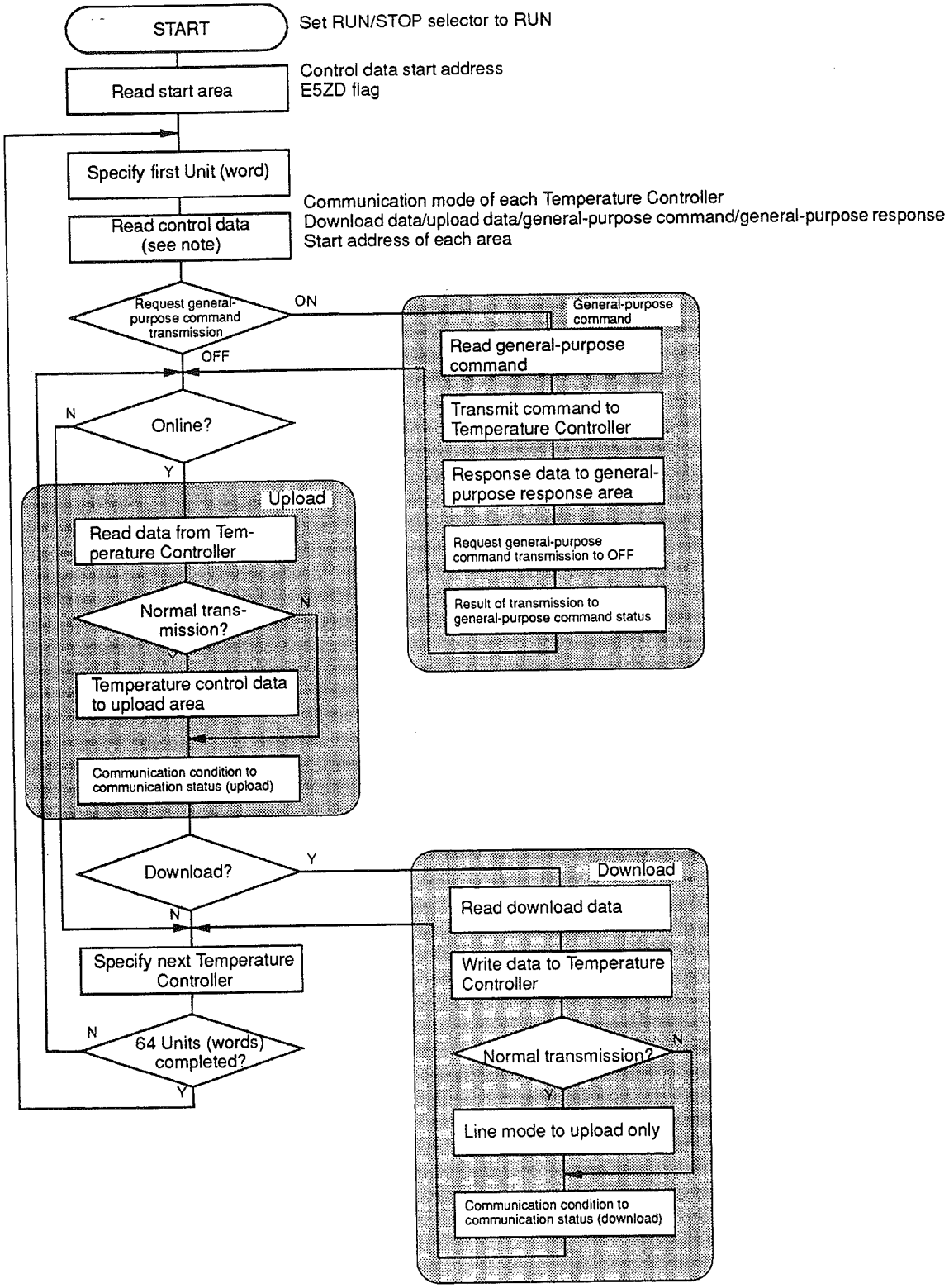
Data Switching

The Temperature Controller data area to be processed is specified by the first address of each area. Therefore, when multiple data items are prepared, a command string in general-purpose command processing and Temperature Controller data item in upload and download processing can be selected with ease by specifying the first address.

E5ZD Multipoint Temperature Controller Number

Unlike the general-purpose Temperature Controllers connected to the CV500-TDL21, each E5ZD Multipoint Temperature Controller connected to the CV500-TDL21 is specified by the E5ZD Multipoint Temperature Controller's unit number and word number. For example, Temperature Controller 10 is specified as word 3 of unit number 2.

Data Processing

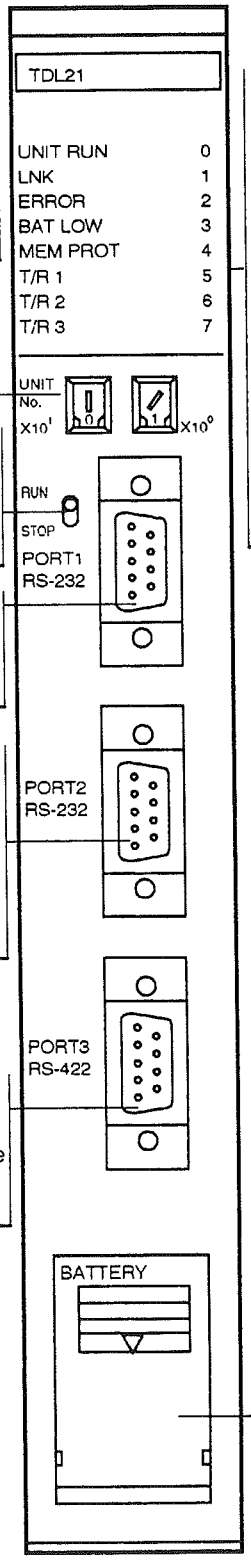


Note Each E5ZD Multipoint Temperature Controller connected to the CV500-TDL21 reads the unit number, word number, and port number when reading the start area.

SECTION 2
Nomenclature and Functions

This section provides information on the nomenclature and functions of the CV500-TDL21 Temperature Controller Data Link Unit.

2-1 Front Panel



Unit Number Selectors

The unit number selectors are used in pairs. The left selector is for 10's digit and the right selector is for 1's digit. Use a flat-blade screwdriver to set the unit number selectors to a unused number in a range of 00 to 15. The unit number set must not be used by any other CPU Bus Unit.

RUN/STOP Selector

The CV500-TDL21 operates when the RUN/STOP selector is set to RUN. Be sure to set the RUN/STOP selector to RUN before operating the CV500-TDL21.

PORT1

PORT1 is used for maintenance purposes. Nothing should be connected to PORT1 when the CV500-TDL21 is in operation.

PORT2 (RS-232C)

PORT2 is a communication port for general-purpose Temperature Controllers 32 to 63. Connect the Temperature Controllers to PORT2 via the 3G2A9-AL004-E(-PE) Link Adapter when converting RS-422 to RS-232C.

PORT3 (RS-422)

PORT3 is a communication port for general-purpose Temperature Controllers 00 to 31 and E5ZD Multi-point Temperature Controllers 00 to 63.

Operation Indicators

UNIT RUN: Lit when the CV500-TDL21 is operating normally.

LINK: Lit when the program of the CV500-TDL21 is running.

ERROR: Lit when there is a program error in the CV500-TDL21.

BAT LOW: Lit when the voltage of the built-in battery is low.

MEM PROT: Lit when the program of the CV500-TDL21 is read only.

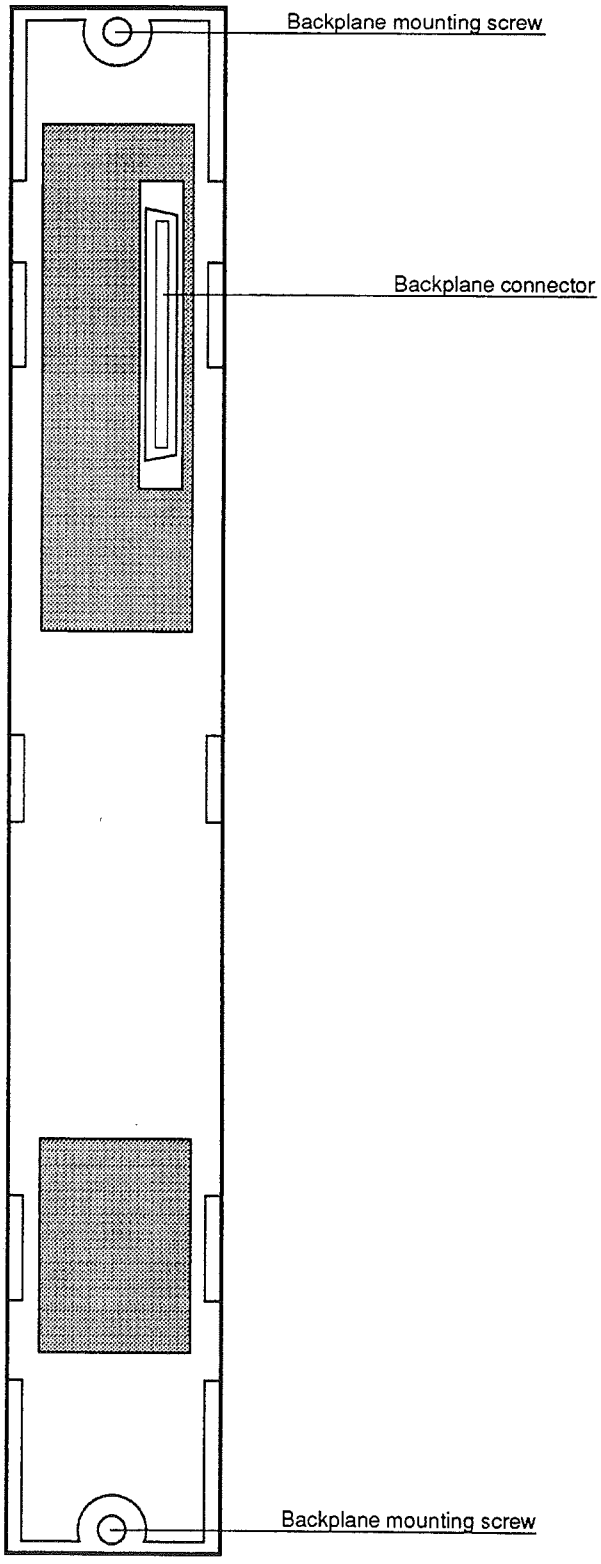
T/R 1, T/R 2, T/R 3: Lit when the CV500-TDL21 is receiving or transmitting data via its ports.

0 to 7: Displays the error contents. Refer to *Section 7 Troubleshooting* for details.

Battery Case

There is a DIP switch and C500-BAT08 Battery Set under this cover. The DIP switch connects or disconnects the termination resistor of the CV500-TDL21 and the 3G2A9-BAT08 Battery backs up the memory of the CV500-TDL21 when there is a power failure.

2-2 Rear Panel



SECTION 3
Preparations

This section provides information on the preparations required for the CV500-TDL21 Temperature Controller Data Link Unit to communicate with Temperature Controllers. Refer to *Section 4 DM Allocation* and *Section 5 Temperature Control Data Communication* for details on the communication data settings and method required for the CV500-TDL Temperature Controller Data Link Unit to communicate with Temperature Controllers.

3-1 General Procedure

Take the following steps so that the CV500-TDL21 can communicate with the connected Temperature Controllers.

1, 2, 3...

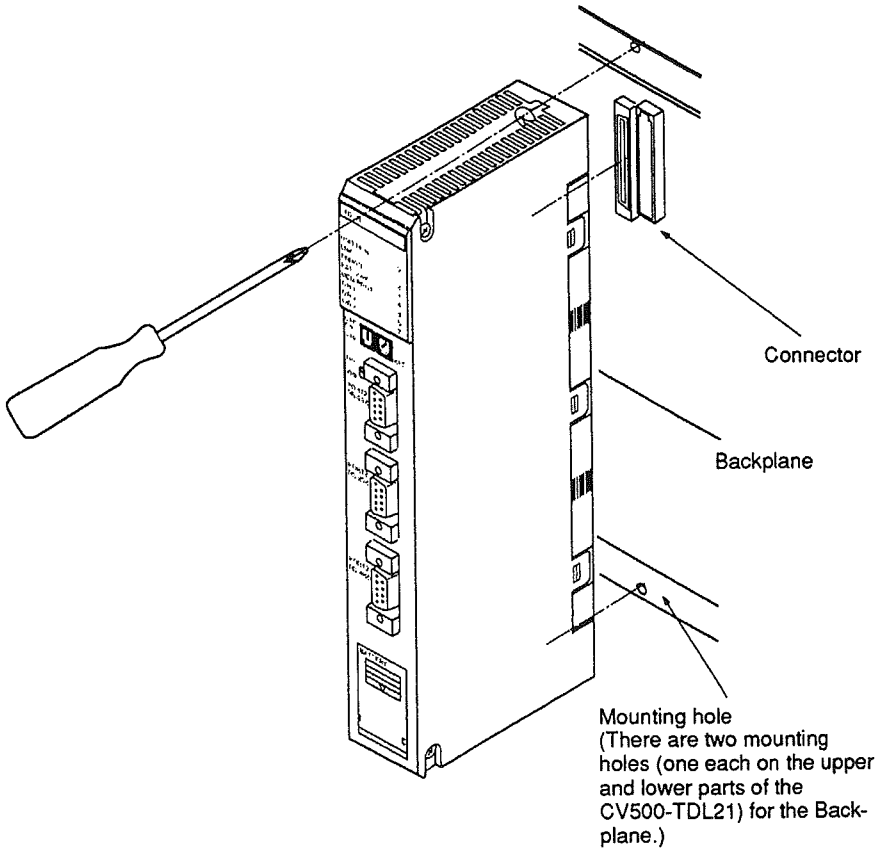
1. Mount the CV500-TDL21 to the Backplane.
2. Connect the Temperature Controllers with cables.
3. Set the selectors on the CV500-TDL21's front panel.
4. Set the PC's CPU Bus Unit system setup area.
5. Set the selectors and communication parameters of the Temperature Controllers.
6. Clear the data memory so that all areas to be used will be 0.
7. Set the data memory (refer to *Section 4 DM Allocation.*)
8. Communicate with the Temperature Controllers (refer to *Section 5 Temperature Control Data Communication.*)

3-2 Mounting

Take the following steps to mount the CV500-TDL21 to the Backplane.

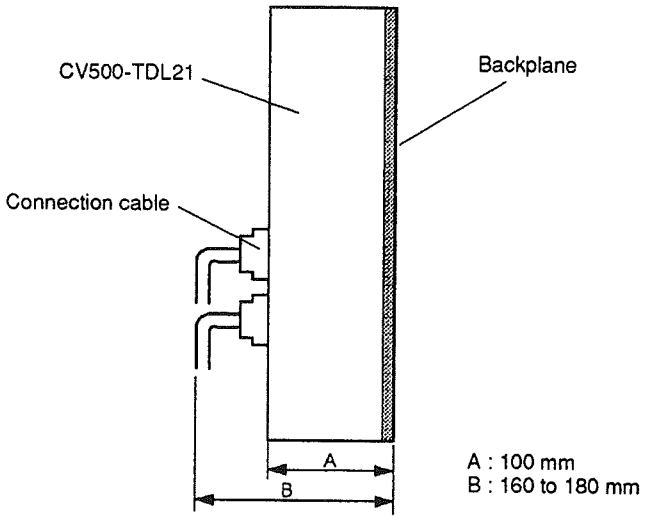
1, 2, 3...

1. Connect the connector on the CV500-TDL21's rear panel to the Backplane.
2. Use a screwdriver and tighten the mounting screws on the CV500-TDL21's upper and lower parts securely.



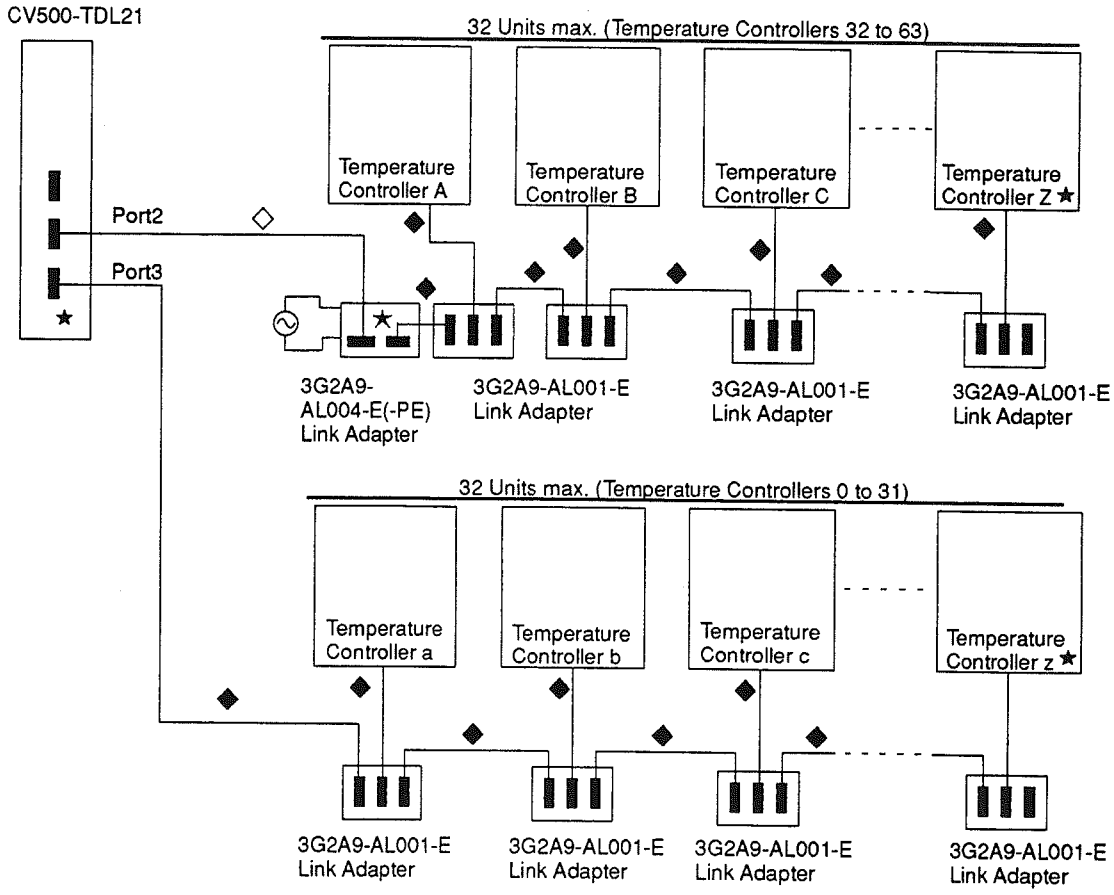
WARNING Be sure to turn off the CV500-TDL21 before mounting the CV500-TDL21 to the Backplane or dismounting the CV500-TDL21 from the Backplane.

Mounting Dimensions



3-3 Cable Connections

Connection with General-purpose Temperature Controllers



- Turn on the termination resistor of each Unit marked by a "★."
- The cable marked with a white diamond symbol connects to an RS-232C interface.
- Each cable marked with a black diamond symbol connects to an RS-422 interface.

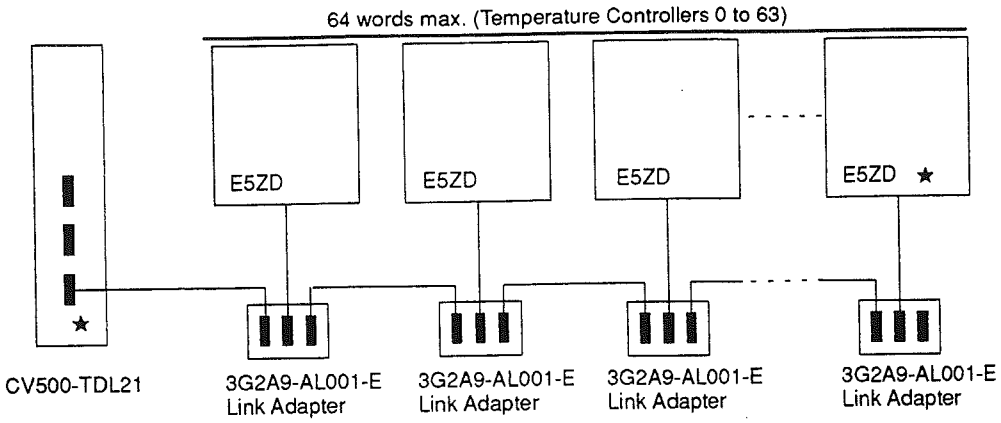
The CV500-TDL21's PORT2 connects to Temperature Controllers 32 to 63 and PORT3 connects to Temperature Controllers 00 to 31. If the number of Tempera-

ture Controllers connected to the CV500-TDL21 is 32 or less, use the CV500-TDL21's PORT3. Connect Temperature Controllers to the CV500-TDL21's PORT2 via the 3G2A9-AL004-E(-PE) Link Adapter because the CV500-TDL21's PORT2 is an RS-232C interface.

Refer to *Appendix E Interface* when preparing the cables.

A termination resistor is required on each end of the system when CV500-TDL21's PORT3, which is an RS-422 interface, is used. The CV500-TDL21, 3G2A9-AL004-E(-PE) Link Adapter, and Temperature Controllers each incorporate a termination resistor, which can be turned on or off with the termination resistor selector available on each Unit. Turn on the termination resistor of the Temperature Controller that is the farthest from the CV500-TDL21.

Connecting to E5ZD Multipoint Temperature Controllers



- Turn on the termination resistor of each Unit marked by a "★."
- Each cable connects to an RS-422 interface.

Connect all the E5ZD Units to the CV500-TDL21's PORT3.

E5ZD Multipoint Temperature Controller numbers are designated by data memory settings. Unlike general-purpose Temperature Controllers, E5ZD Multipoint Temperature Controller numbers do not correspond to unit numbers. For example, Temperature Controller 10 is specified as word 3 of unit number 2.

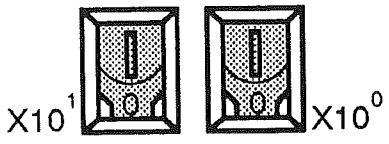
Refer to *Appendix E Interface* when preparing the cables.

A termination resistor is required on each end of the system when CV500-TDL21's PORT3, which is an RS-422 interface, is used. The CV500-TDL21 and E5ZD each incorporate a termination resistor, which can be turned on or off with the termination resistor selector available on each Unit. Turn on the termination resistor of the E5ZD Unit that is the farthest from the CV500-TDL21.

3-4 Switch Settings

The following selector and DIP switch settings are factory set.

Unit Number



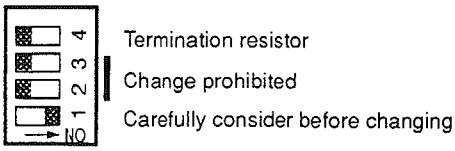
The CV500-TDL21's unit number selectors are used in pairs. The left selector is for 10's digit and the right selector is for 1's digit. Use a flat-blade screwdriver to set the unit number selectors to a unique number in a range of 00 to 15. The unit

number set must not be used by any other CPU Bus Unit such as the BASIC Unit, SYSMAC LINK Unit, SYSMAC NET Link Unit, SYSMAC BUS/2 Remote Master Unit, Personal Computer Unit, or mini-MAP Unit.

RUN/STOP Selector

The CV500-TDL21 operates when the CV500-TDL21's RUN/STOP selector is set to RUN. Be sure to set the RUN/STOP selector to RUN before operating the CV500-TDL21. Before setting the RUN/STOP selector to RUN, the CPU Bus Unit system setup of the PC is required. Refer to *3-5 PC Settings* for details.

DIP Switch



Turn pin 4 of the DIP switch to ON if the CV500-TDL21 is the terminator when the CV500-TDL21's PORT3 (RS-422 interface) is used. The DIP switch is under the cover of the battery case. Press and slide the cover downwards to remove the cover.

Note

1. Do not change the settings of pins 2 and 3 of the DIP switch.
2. Pin 1 of the DIP switch may be operated only when the CV500-TDL21 has an error. Do not set this pin to OFF when the CV500-TDL21 is operating normally, or the CV500-TDL21 may malfunction. Refer to *Section 7 Trouble-shooting* for details.

3-5 PC Settings

Before setting the RUN/STOP selector of the CV500-TDL21 to RUN, the CPU Bus Unit system setup of the PC is required. The CPU Bus Unit system setup area of the PC corresponds to each unit number.

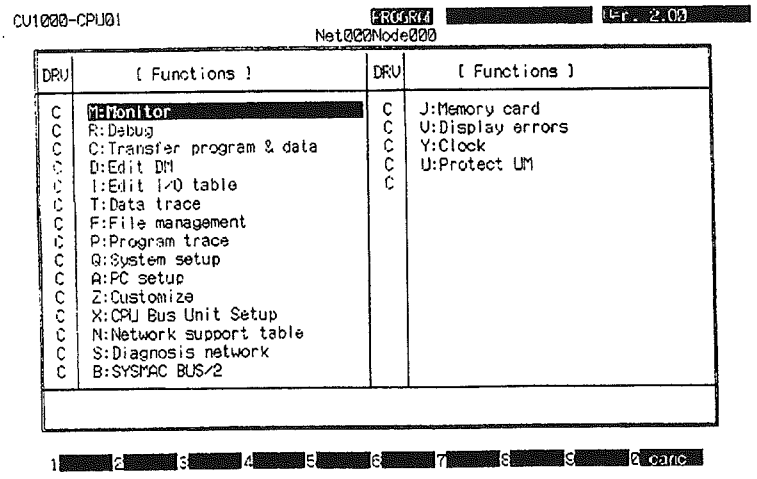
The CPU Bus Unit system setup area must be set with the CV Support Software (CVSS) running on an IBM PC/AT or compatible. Refer to the *CV Support Software Operation Manuals* for details.

Setting Procedure

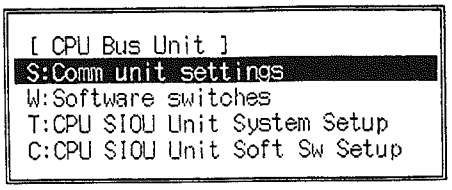
Take the following steps to set the CPU Bus Unit system setup area.

1, 2, 3...

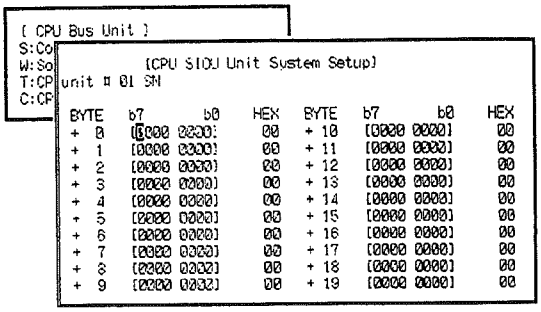
1. Connect the personal computer to the PC and press the Shift+F1 Keys from the main offline menu to go online and display the CVSS online menu.



2. Select "X:CPU Bus Unit Setup" from the main online menu to access the following menu.



3. Select "T:CPU SIOU Unit System Setup" from the CPU Bus Unit Setup menu. The display for the CPU Bus Unit with the lowest unit number will appear.



4. Use the PgUp and PgDn Keys to scroll the display.
5. Press the F10 Key and input the unit number of the CPU Bus Unit to be set if it is not the one already shown. The unit number will be displayed at the top left of the screen.
6. Move the cursor to the location to be set.
7. Input 0 or 1 and press the Enter Key.

or Press the Shift+Right Arrow Keys to move to the hexadecimal input area, input the hexadecimal value, and press the Enter Key. You can return to the binary input area by pressing the Shift+Left Arrow Keys.

8. Press the Esc Key to write the current settings to the PC.

3-6 Temperature Controller Settings

3-6-1 General-purpose Temperature Controller

Unit Number

The unit number of each Temperature Controller connected to the CV500-TDL21's PORT3 must be set in a range of 0 to 31 and the unit number of each Temperature Controller connected to the CV500-TDL21's PORT2 must be set in a range of 32 to 63. All the unit numbers must be unique.

Communication Parameters

Set the following communication parameters for each Temperature Controller connected to the CV500-TDL21.

Baud rate	9,600 bps
Bit length	7 (ES100 only)
Parity	Even (ES100 only)
Stop bit	2 (ES100 only)

Remote/Local Mode Setting

Each Temperature Controller connected to the CV500-TDL21 must be in remote mode. If the Temperature Controllers are in local mode, no set values or instructions can be changed or executed. Communication commands can change the modes of some of OMRON's Temperature Controllers.

Termination Resistor

Turn on the termination resistor of the Temperature Controller that is the farthest from the CV500-TDL21.

3-6-2 E5ZD Multipoint Temperature Controller

Allocation of Temperature Controller Number

Unlike general-purpose Temperature Controllers, E5ZD Multipoint Temperature Controller numbers do not correspond to unit numbers. Therefore allocate Temperature Controller numbers 00 to 63 to the connected E5ZD Units using E5ZD unit numbers 0 to F and E5ZD word numbers 0 to 7. For example, Temperature Controller 01 is allocated to word 1 of E5ZD unit number 1 and Temperature Controller 02 to word 2 of E5ZD unit number 2.

Unit Number

Allocate a unique unit number in numerical order starting with 0 to each E5ZD Unit connected to the CV500-TDL21.

Communication Parameters

Set the baud rate of each E5ZD Multipoint Temperature Controller connected to the CV500-TDL21 to 9,600 bps. Each E5ZD Multipoint Temperature Controller's bit length, parity, and stop bit cannot be changed.

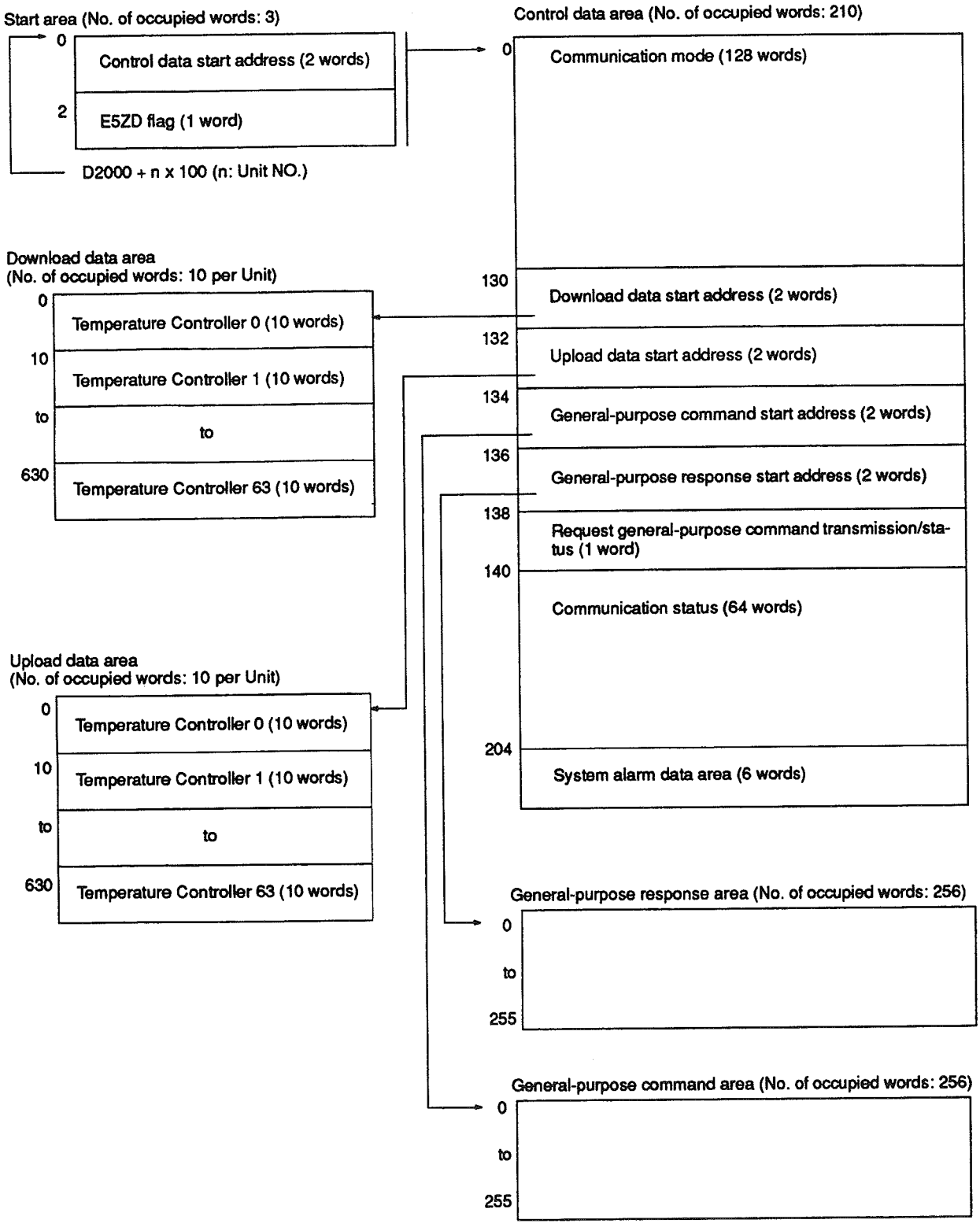
Termination Resistor

Turn on the termination resistor of the E5ZD Multipoint Temperature Controller that is the farthest from the CV500-TDL21.

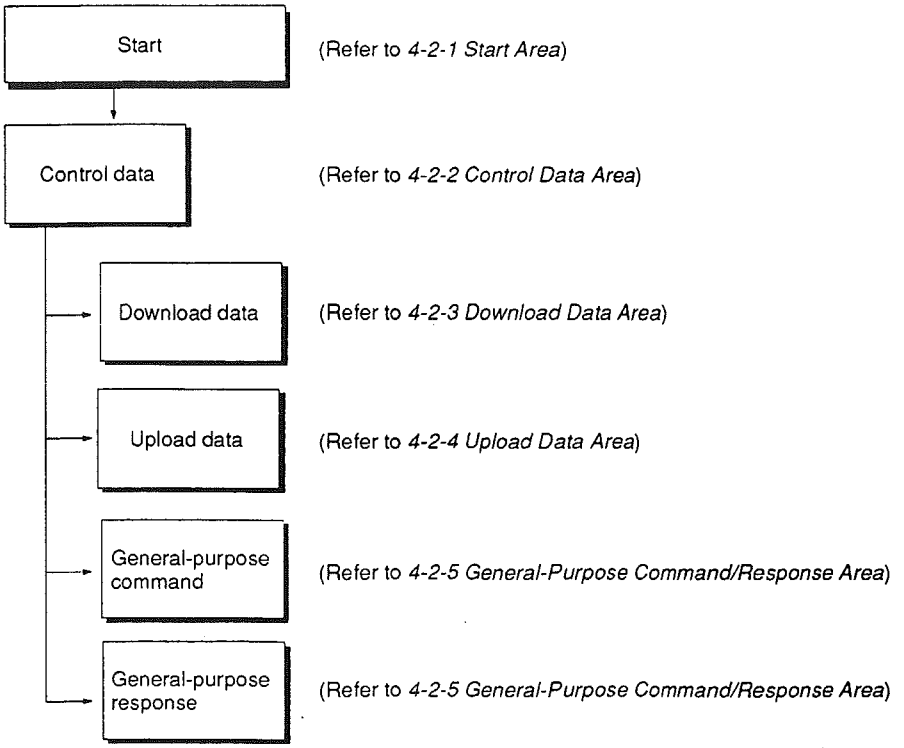
SECTION 4
DM Allocation

This section provides information on the DM allocation of each area, and the area contents and settings that are required for communications with Temperature Controllers.

4-1 Relationship of Each Area



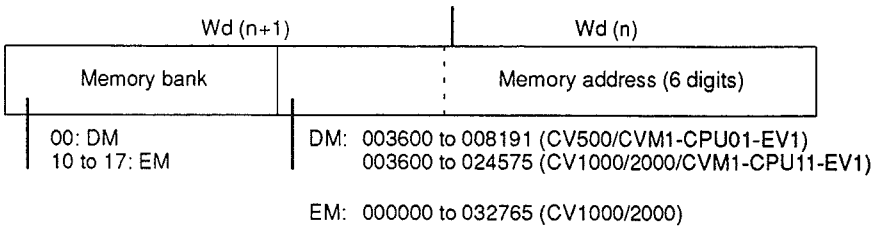
4-1-1 Start Address



- The CV500-TDL21 allocates each area that is required for the CV500-TDL21 to operate, beginning with the start address of each area. Therefore the data memory of the PC used with the CV500-TDL21 can be utilized flexibly.
- The CV500-TDL21's program recognizes the first address of each area by referring to the start address of each area. Therefore the start address and first address of each area must coincide.
- The start area of each area uses the CPU Bus Unit area, the address of which is fixed.
- The start address of the control data area is set to words 0 and 1 of the start area.
- The download data area, upload data area, general-purpose command area, and general-purpose response area are set to words 130 to 137 of the control data area. Each of these areas uses two words.

4-1-2 Configuration of Start Address

Refer to the following for the configuration of each start address.



The following areas of the data memory have been already allocated. Use the other areas in the specified ranges.

D00000 to D01999 for the SYSMAC NET and SYSMAC LINK
D02000 to D03599 for CPU Bus Units

Address Description of Each Area

The first address of the CV500-TDL21's each area changes with the start address of the area. Therefore, word numbers instead of DM addresses express

the location of all the data of each area. For example, the fifth data is expressed by word 5, the DM address of which is obtained by adding 5 to the start address. For example, if the start address (first address) of the control data area is D04000, word 5 of the control data area is D04005.

4-2 Area Contents and Settings

4-2-1 Start Area

First Address

The first address of each area is obtained by the following formula.

2000 + (unit number n x 100)

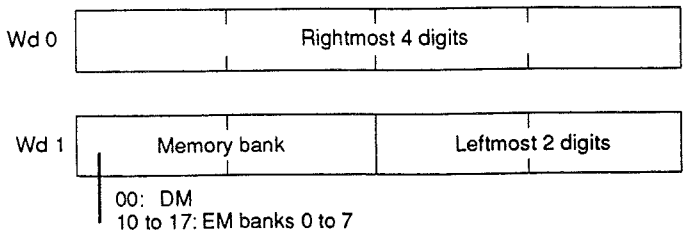
If the unit number is 2, the start area is D02200 (2000 + 200 = 2200).

Contents

Control Data Start Address (Words 0 and 1)

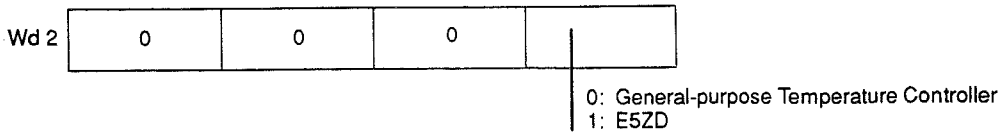
The control data start address is the first address of control data. Words 0 and 1 are used in combination with the memory bank to set the control data start address. Set word 0 to rightmost four digits and word 1 to leftmost two digits (i.e., a total of six digits) in BCD using 0 to 9 for each digit. The following setting ranges are available.

DM: 003600 to 008191 for the CV500 and CVM1-CPU01-EV1
DM: 003600 to 024575 for the CV1000, CV2000, and CVM1-CPU11-EV1
EM: 000000 to 032765 for the CV1000 and CV2000



E5ZD Flag (Word 2)

The E5ZD flag specifies the type of Temperature Controllers connected to the CV500-TDL21. Set the rightmost digit of word 2 to 0 in BCD for general-purpose Temperature Controllers and set the digit to 1 in BCD for E5ZD Units.



4-2-2 Control Data Area

First Address

The CV500-TDL21 refers to the control data start address (words 0 and 1) of the start area.

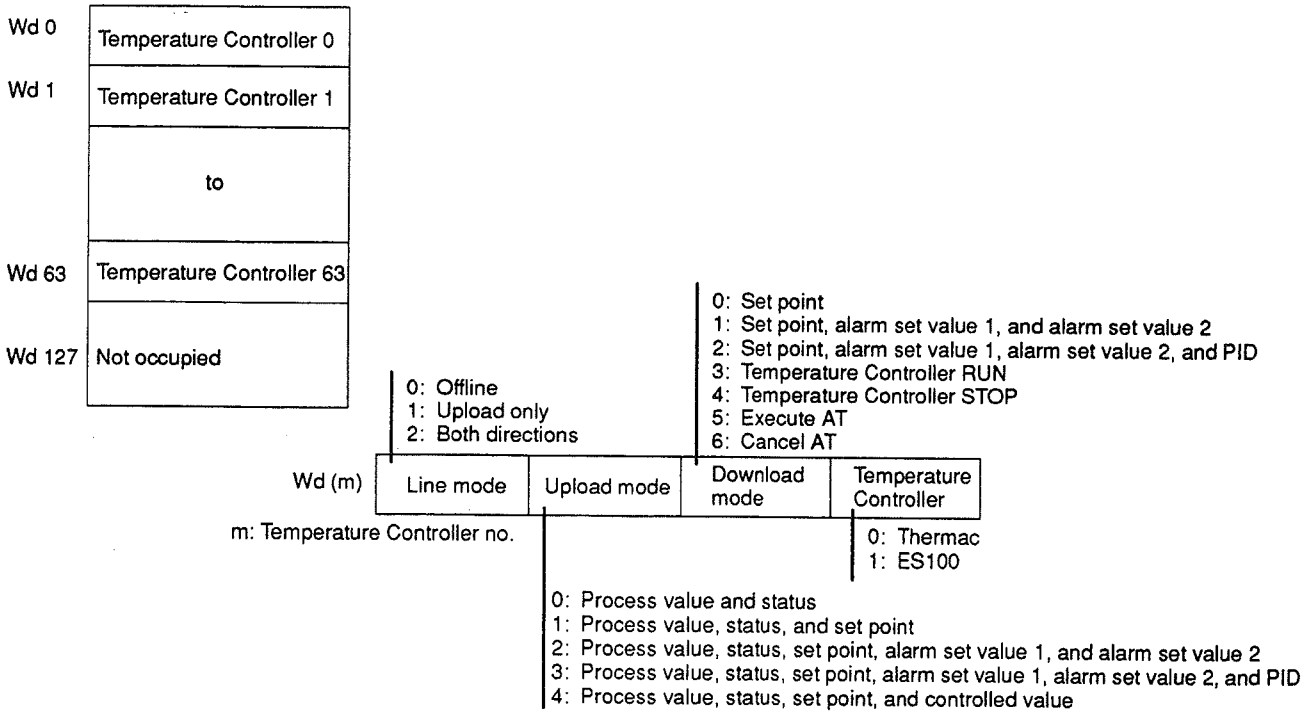
Contents

Communication Mode (General-purpose Temperature Controller): Words 0 to 63

Each word is allocated to Temperature Controller numbers (m: 0 to 63) in sequence. The following modes are available for upload and download processing.

Line mode	Specifies the communication line status of temperature control data.
Upload mode	Specifies parameters used at the time of upload processing.
Download mode	Specifies parameters used at the time of download processing.
Temperature Controller mode	Specifies Thermac or ES100 models as the Digital Controllers connected to the CV500-TDL21.

Communication Mode Area (General-purpose Temperature Controller)



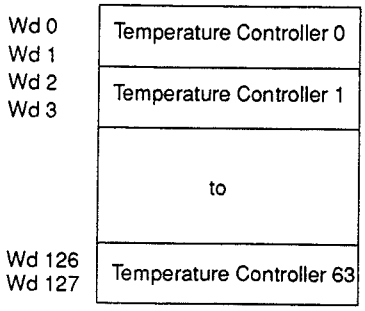
If any other value is specified, the CV500-TDL21 regards the value as 0 and operates.

Communication Mode (E5ZD): Words 0 to 127

Groups of two words are allocated to Temperature Controller numbers (m: 0 to 63) in sequence. The following modes can be specified with the first word for upload and download processing.

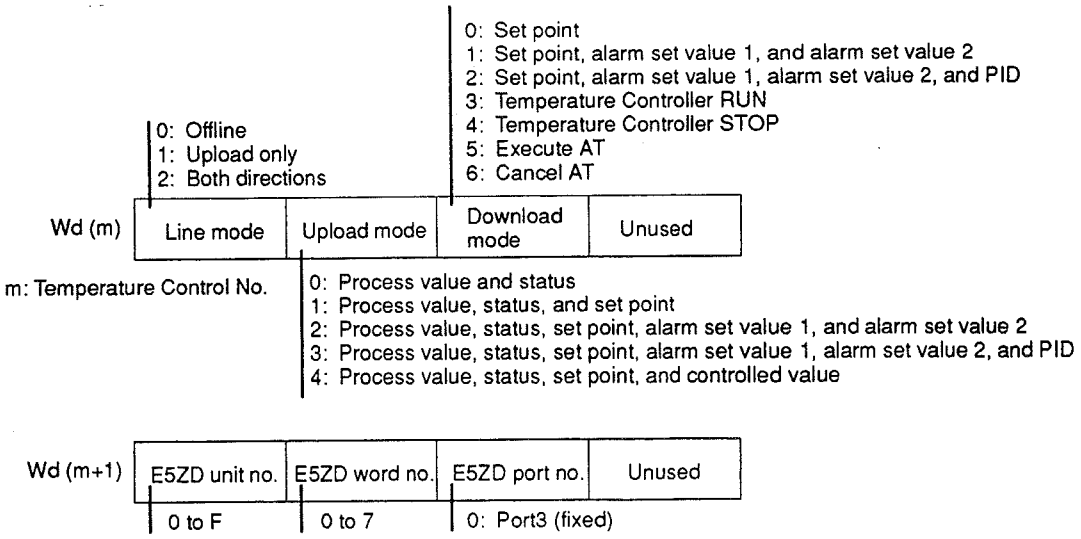
Line mode	Specifies the communication line status of temperature control data.
Upload mode	Specifies parameters used at the time of upload processing.
Download mode	Specifies parameters used at the time of download processing.

Communication Mode Area (E5ZD)



The unit numbers and word numbers that correspond to the Temperature Controller numbers are specified by the second word. For example, if word 3, which

is the setting area for Temperature Controller 2, is set to 2300, Temperature Controller 2 will correspond to word 3 of unit 2.

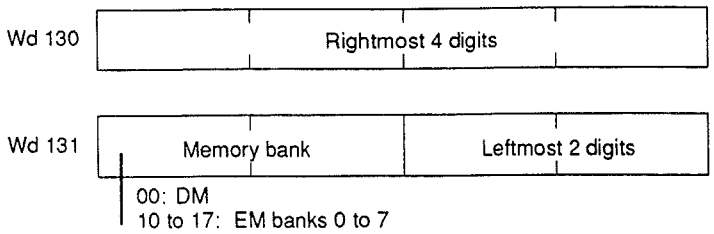


If any other value is specified, the CV500-TDL21 regards the value as 0 and operates.

Download Data Start Address: Words 130 and 131

Words 130 and 131 of the data memory are used in combination with the memory bank to set the first address of the download data area. Set word 130 to rightmost four digits and word 131 to leftmost two digits (i.e., a total of six digits) in BCD using 0 to 9 for each digit. The following setting ranges are available.

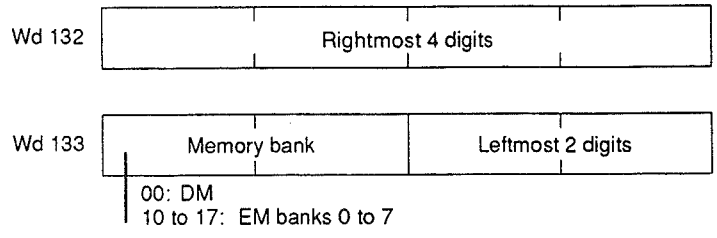
DM: 003600 to 008191 for the CV500 and CVM1-CPU01-EV1
DM: 003600 to 024575 for the CV1000, CV2000, and CVM1-CPU11-EV1
EM: 000000 to 032765 for the CV1000 and CV2000



Upload Data Start Address: Words 132 and 133

Words 132 and 133 of the data memory are used in combination with the memory bank to set the first address of the upload data area. Set word 132 to rightmost four digits and word 133 to leftmost two digits (i.e., a total of six digits) in BCD using 0 to 9 for each digit. The following setting ranges are available.

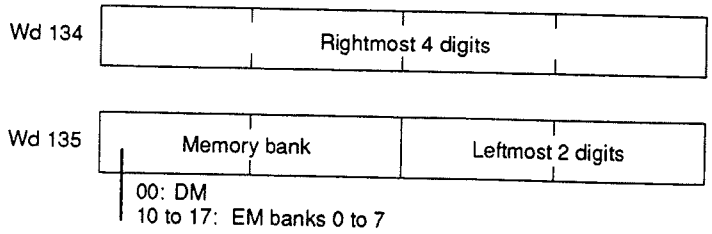
DM: 003600 to 008191 for the CV500 and CVM1-CPU01-EV1
DM: 003600 to 024575 for the CV1000, CV2000, and CVM1-CPU11-EV1
EM: 000000 to 032765 for the CV1000 and CV2000



General-purpose Command Start Address: Words 134 and 135

Words 134 and 135 of the data memory are used in combination with the memory bank to set the first address of the general-purpose command area. Set word 134 to rightmost four digits and word 135 to leftmost two digits (i.e., a total of six digits) in BCD using 0 to 9 for each digit. The following setting ranges are available.

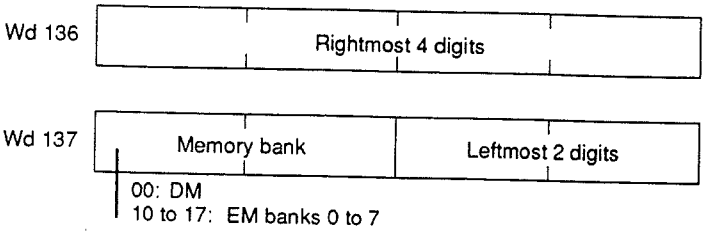
DM: 003600 to 008191 for the CV500 and CVM1-CPU01-EV1
DM: 003600 to 024575 for the CV1000, CV2000, and CVM1-CPU11-EV1
EM: 000000 to 032765 for the CV1000 and CV2000



General-purpose Response Start Address: Words 136 and 137

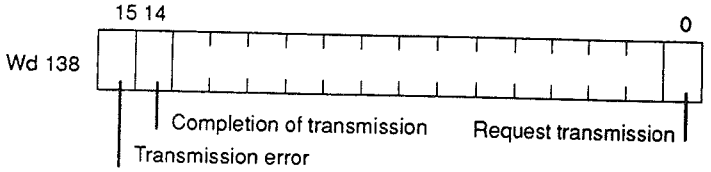
Words 136 and 137 of the data memory are used in combination with the memory bank to set the first address of the general-purpose response area. Set word 136 to rightmost four digits and word 137 to leftmost two digits (i.e., a total of six digits) in BCD using 0 to 9 for each digit. The following setting ranges are available.

DM: 003600 to 008191 for the CV500 and CVM1-CPU01-EV1
DM: 003600 to 024575 for the CV1000, CV2000, and CVM1-CPU11-EV1
EM: 000000 to 032765 for the CV1000 and CV2000



General-purpose Command Transmission Request/Status: Word 138

Word 138 of the data memory is used to store the transmission request flag for the general-purpose command and the status flag for transmission results. Set the transmission request flag (bit 0) to 1 before transmitting the general-purpose command. If the general-purpose command has been transmitted normally, the transmission request flag will be 0 and the transmission completion flag of word 138 (bit 14) will be set to 1. If the general-purpose command has been transmitted abnormally, the transmission request flag will be 0 and the transmission error flag of word 138 (bit 15) is set to 1. The contents of the transmission completion flag and transmission error flag are put on hold until the next general-purpose command is transmitted.



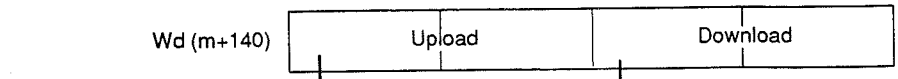
Communication Status: Words m (0 to 63) + 140

Words m (0 to 63) + 140 of the data memory are used to store the status of communication with the Temperature Controllers connected to the CV500-TDL21. Each word is allocated in sequence to each Temperature Controller (Temperature Controllers 0 to 63) connected to CV500-TDL21.

Communication Status Area

Wd 140	Temperature Controller 0
Wd 141	Temperature Controller 1
	to
Wd 203	Temperature Controller 63

The following codes, except FF (offline) and 00 (normal completion), indicate abnormal upload and download processing. If upload or download processing is abnormal, the contents of the abnormality will be set with the end code. If upload processing is abnormal, the upload data of the corresponding Temperature Controller will not be refreshed.



m: Temperature Controller no.

FF: Offline
00: Normal completion
04: Address over
0D: Command execution disabled (execution prohibited, setting prohibit data, or error condition)
10: Parity error
11: Framing error
12: Overrun error
13: Command data FCS error
14: Format error
15: Numeric data error
16: No relevant instruction
18: Frame length error
21: Non-volatile memory write error
97: Response data FCS error
99: Time out

The same as the upload data.

System Alarm Data Area: Words 204 to 209

Words 204 to 209 of the data memory are used to store the CV500-TDL21's system alarm data. Refer to *Section 7 Troubleshooting* for details.

Wd 204	No. of the program line where the error resulted (rightmost digit)	
Wd 205	No. of the program line where the error resulted (leftmost digit)	
Wd 206	Error contents (error code)	
Wd 207	Time of the error (minute)	Time of the error (second)
Wd 208	Date of the error (day)	Time of the error (hour)
Wd 209	Date of the error (year) (rightmost 2 digits)	Date of the error (month)

4-2-3 Download Data Area

First Address

The CV500-TDL21 refers to the download data start address of the control data area.

Contents

Ten words of the download data area are allocated to each Temperature Controller. The first address for each Temperature Controller is obtained from the following formula.

The first address of Each Temperature Controller = Temperature Controller number m (0 to 63) x 10

The following is the data configuration of the download data area for each Temperature Controller.

Wd +0	Unused			
Wd +1	Unused			
Wd +2	Unused			
Word + 3 (see note 1) Set point (rightmost)	10^{-1}	10^{-2}	10^{-1}	0
Word + 4 Set point (leftmost)	10^3/F/A (see note 2)	10^2	10^1	10^0
Word + 5 Alarm set value 1	10^3/F/A (see note 2)	10^2	10^1	10^0
Word + 6 Alarm set value 2	10^3/F/A (see note 2)	10^2	10^1	10^0
Word + 7 Proportional band (P)	10^2	10^1	10^0	10^{-1}
Word + 8 Integral time (I)	10^3	10^2	10^1	10^0
Word + 9 Derivative time (D)	10^3	10^2	10^1	10^0

Note

1. The word + 3 area is not available to Thermac Temperature Controllers.
2. Set one of the following values according to the set range.
   1 to 9: 1 to 9; – (minus): F; –1: A
   For example, set F999 for –999 and A000 for –1000.

Multiple Data Items

If an ES100 Digital Controller connected to the CV500-TDL21 has multiple data items, the AT-P-I-D, alarm set value, and run items correspond to the following parameters:

AT-P-I-D	Valid PID group
Alarm set value	Valid pattern, and events 1 and 2 of the step (bank)
RUN	Valid pattern (bank)

If an E5ZD Multipoint Temperature Controller connected to the CV500-TDL21 has multiple data items, the download data area corresponds to the bank that has been selected.

4-2-4 Upload Data Area

First Address

The CV500-TDL21 refers to the upload data start address of the control data area.

Contents

Ten words of the upload data area are allocated to each Temperature Controller. The first address for each Temperature Controller is obtained from the following formula.

The first address of Each Temperature Controller = Temperature Controller number m (0 to 63) x 10

The following are the data configurations of the upload data area for each Temperature Controller.

Modes 0 to 3

Word + 0 (see note 1) Process value (rightmost)	10^{-1}	10^{-2}	10^{-1}	0
Word + 1 Process value (leftmost)	10^3/F/A (see note 2)	10^2	10^1	10^0
Word + 2	Status			
Word + 3 (see note 1) Set point (rightmost)	10^{-1}	10^{-2}	10^{-1}	0
Word + 4 Set point (leftmost)	10^3/F/A (see note 2)	10^2	10^1	10^0
Word + 5 Alarm set value 1	10^3/F/A (see note 2)	10^2	10^1	10^0
Word + 6 Alarm set value 2	10^3/F/A (see note 2)	10^2	10^1	10^0
Word + 7 Proportional band (P)	10^2	10^1	10^0	10^{-1}
Word + 8 Integral time (I)	10^3	10^2	10^1	10^0
Word + 9 Derivative time (D)	10^3	10^2	10^1	10^0

Note

1. The word + 0 or word + 3 area is not available to Thermac Temperature Controllers.
2. Set one of the following values according to the set range.
   1 to 9: 1 to 9; – (minus):F; –1: A
   For example, set F999 for –999 and A000 for –1000.

Mode 4

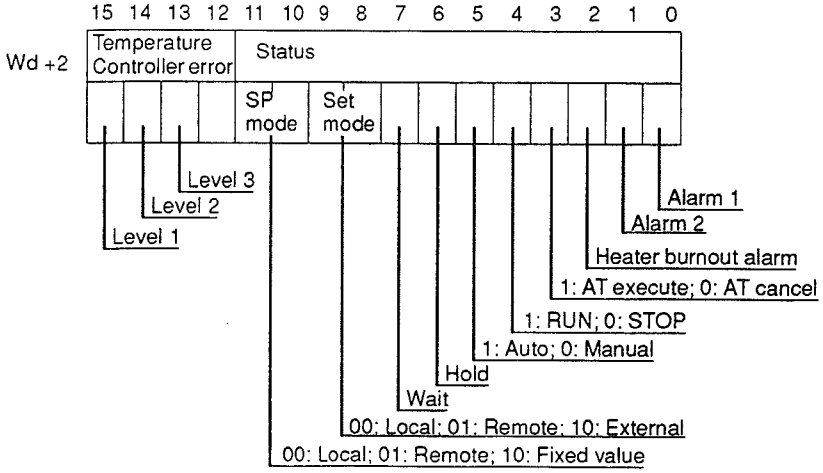
Word + 0 (see note 1) Process value (rightmost)	10^{-1}	10^{-2}	10^{-1}	0
Word + 1 Process value (leftmost)	10^3/F/A (see note 2)	10^2	10^1	10^0
Word + 2	Status			
Word + 3 (see note 1) Set point (rightmost)	10^{-1}	10^{-2}	10^{-1}	0
Word + 4 Set point (leftmost)	10^3/F/A (see note 2)	10^2	10^1	10^0
Word + 5 (see note 3) Controlled value	10^2/F (see note 2)	10^1	10^0	10^{-1}
Word + 6 to + 9	Unused			

Note

1. The word + 0 or word + 3 area is not available to Thermac Temperature Controllers.
2. Set one of the following values according to the set range.
   1 to 9: 1 to 9; – (minus):F; –1: A
   For example, set F999 for –999 and A000 for –1000.
3. If the E5ZD-□V□□□ (heating/cooling model) is used, the controlled value is available on the heating side only.

Status (Word + 2) (General-purpose Temperature Controller)

Any bit without a numerical description in the following diagram turns ON when the value is 1. Bits 12 to 15 are for abnormal levels and bits 0 to 11 indicate the present working status.

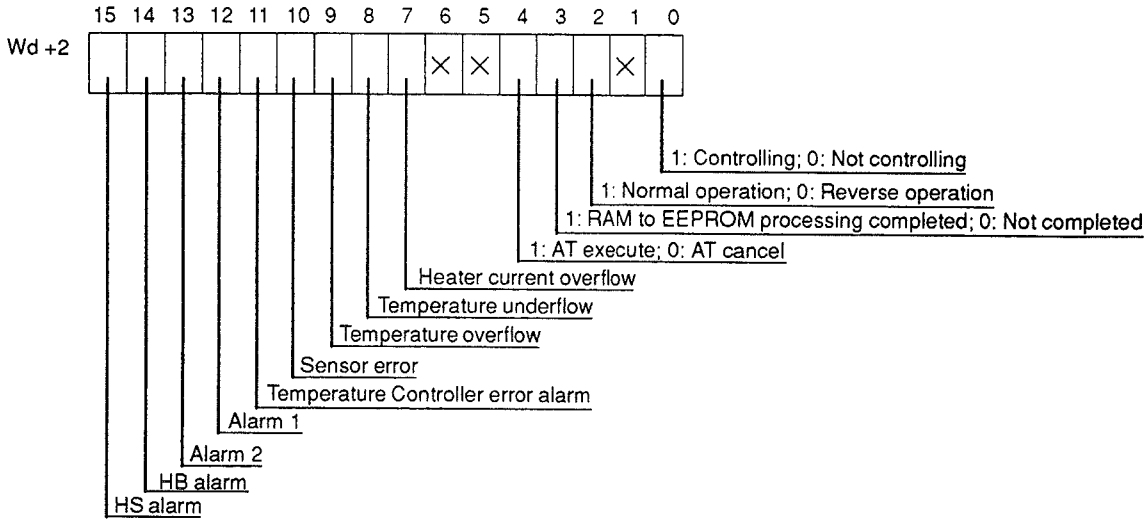


Abnormal Levels

Model	Level 1 Repairs are required	Level 2 Location of Temperature Controllers needs to be checked	Level 3 Settings need to be checked
ES100	WDT error RAM R/W error RAM sum error Correction data error Internal voltage error Cold bit error A/D error	PV error Analog input 1 error Analog input 2 error Potential meter error	Set value confirmation alarm Motor calibration setting error
Thermac	RAM data error A/D error	Overflow Underflow Input error Sensor error	

Status (Word + 2) (E5ZD)

Any bit with no numerical description in the following diagram turns ON when the value is 1. Any bit marked by an "X" is an undefined bit. Bits 7 to 15 are error or alarm bits and bits 0 to 4 indicate the present working status.



4-2-5 General-purpose Command Area/Response Area

First Address

The CV500-TDL21 refers to the general-purpose command start address or general-purpose response start address of the control data area.

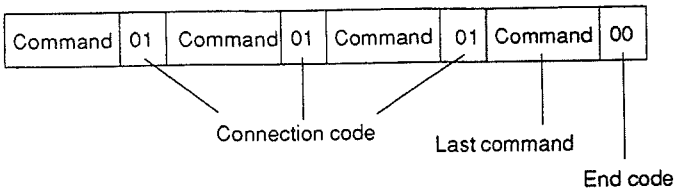
Contents

Command

The command string storage area of the general-purpose command area consists of 256 words. Therefore, a maximum of 512 characters including a connection code (01) and end code (00) can be stored. Commands must be described in ASCII codes and set from word 0 as shown in the following.

Wd 0	Character 0	Character 1
Wd 1	Character 2	Character 3
to	to	to
Wd 255	Character 510	Character 511

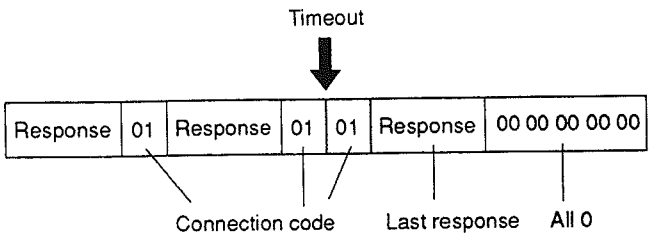
Command String Configuration



Response

The words are set with responses received in sequence beginning with word 0 and a connection code (01) is inserted between each adjacent response. If the responses are less than 256 words, the remaining area is filled with 0. If the responses are more than 256 words, only 256-word responses will be set (i.e., a response may be corrupted). If there is a timeout or an FCS error, only a connection code is inserted.

Response Configuration



SECTION 5
Temperature Control Data Communication

This section provides the basic information required for communications with Temperature Controllers, user program examples that include upload and download processing, and the general-purpose command. Refer to *Section 4 DM allocation* for details on the contents and methods of the data settings that are required for the CV500-TDL21 Temperature Controller Data Link Unit to communicate with Temperature Controllers.

5-1 DM Preparations

Make the following preparations so that the CV500-TDL21 can communicate with the connected Temperature Controllers.

- Allocate each area.
- Set the parameters of the control data area.
- Create the transmission data.
- Set the start address of the control data.
- Set the E5ZD flag.
- Set the start address of the download data area.
- Set the start address of the upload data area.
- Set the start address of the general-purpose command and response area.

Refer to *Appendix G DM Setting Table* for details on the allocation of each area and the contents and setting method of temperature control data.

5-1-1 Upload

Upload processing enables the CV500-TDL21 to receive the data and status of each Temperature Controller according to the parameters of the communication mode selected and set the data with the upload data area.

5-1-2 Download

Download processing enables the CV500-TDL21 to transmit the data of the download data area to each Temperature Controller according to the parameters of the communication mode selected.

5-1-3 General-purpose Command

The general-purpose command enables the CV500-TDL21 to transmit communication commands to each Temperature Controller according to the command strings of the general-purpose command area. Each Temperature Controller's response is set with the general-purpose response area.

5-1-4 DM Editing

Use the CV Support Software running on an IBM PC/AT or compatible to edit the contents of the data memory. Before editing the contents of the data memory, be sure to save the contents. For efficient editing, edit the contents of the data memory offline and transfer the edited data. Refer to the *CV Support Software Operation Manuals* for details on DM editing.

5-1-5 Allocation of Each Area

Decide the size and start address of each area first.

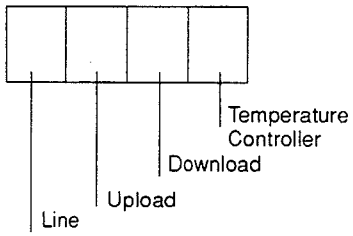
Area	Size	Start address
Start area	Three words	Check the unit number and decide the first address of the start area. The first address of the start area is obtained from the following formula. The first address of the start area = 2000 + (unit no. n x 100)
Control data area	210 words	Set the DM or EM address according to the PC model.
Download data/Upload data area	Each Temperature Controller requires 10 words (e.g., if 64 Temperature Controllers are connected to the CV500-TDL21, 640 words are required.)	Set the DM or EM address according to the PC model.
General-purpose command/Response area	256 words each for the general-purpose command and response areas.	Set the DM or EM address according to the PC model.

Note
1. Be careful not to set any address that will not be supported or address without any memory space.
2. Each address set must be unique and not be duplicated.

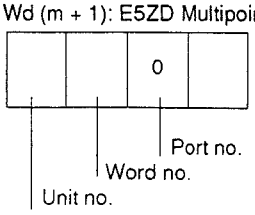
5-1-6 Parameter Settings

Set the initial values of the communication mode area in the control data area.

Wd m: m= Temperature Controller no.



Wd (m + 1): E5ZD Multipoint Temperature Controllers only



Line Mode

All the areas of Temperature Controllers 0 to 63 will be set to 0 (offline) if the CV500-TDL21 is in line mode.

Temperature Controller Mode

Set the Temperature Controller mode of the CV500-TDL21 to 0 when Thermac Temperature Controllers are connected. Set the Temperature Controller mode to 1 when ES100 Digital Controllers are set. Set this mode to 0 for any area that is not connected any Temperature Controller. This mode setting is not required when E5ZD Multipoint Temperature Controllers are connected.

E5ZD Parameters

When E5ZD Multipoint Temperature Controllers are connected, set the unit numbers and word numbers of the E5ZD Multipoint Temperature Controllers corresponding to the Temperature Controller numbers of the E5ZD Multipoint Temperature Controllers and set the port number to 0.

5-1-7 Creation of Transmission Data

Create download and general-purpose command data as required.

Download data (per unit)

+0	Unused
+1	Unused
+2	Unused
+3	Set point (rightmost)
+4	Set point (leftmost)
+5	Alarm set value 1
+6	Alarm set value 2
+7	P
+8	I
+9	D

Download Data

Download data is not required if the Temperature Controllers connected to the CV500-TDL21 are controlled with the general-purpose command only.

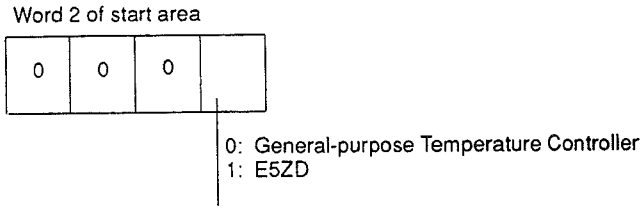
Set transmission data for each Temperature Controller.

When download processing is executed, only the data values specified with the CV500-TDL21 in download mode are transmitted. Therefore set only the specified data values correctly. When more than one area is used, one of the areas must correspond to the start address set for control data.

General-purpose Command

The general-purpose command is not required if the Temperature Controllers connected to the CV500-TDL21 are controlled by download processing only. Be sure to insert a connection code between each adjacent command and add a end code to the last command. When more than one area is used, one of the areas must correspond to the start address set for control data.

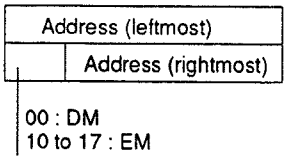
5-1-8 E5ZD Flag Setting



E5ZD Multipoint Temperature Controllers in combination with general-purpose Temperature Controllers (Thermac or ES100 Digital Controllers) cannot be connected to the CV500-TDL21.

The E5ZD flag is set with word 2 of the start area. Set 0001 as the data of the flag for E5ZD Multipoint Temperature Controllers and 0000 as the flag data for general-purpose Temperature Controllers.

5-1-9 Start Address Setting



Refer to the following table and set the start address of each area.

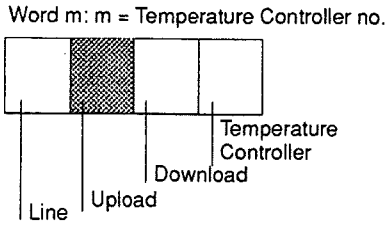
Area	Start address storage position	
	Area	Word
Control data	Start	0 and 1
Download data	Control data	130 and 131
Upload data		130 and 131
General-purpose command		130 and 131
General-purpose response		130 and 131

Line Mode

When replacing a Temperature Controller used in a system, set the line mode of the Temperature Controller to 0 (offline) so that the Temperature Controller can be replaced without interrupting the whole system. Set the line mode of any Temperature Controller that does not always need monitoring to 1 (online) only when the user needs to see the data of the Temperature Controller. This way, the processing time required by the whole system will be shortened.

5-2 Upload

Upload Mode



Upload processing is a basic operation of the CV500-TDL21. When an upload data area is prepared for each Temperature Controller, upload processing sets up in the upload data area data for each Temperature Controller that has been designated by the CV500-TDL21 in upload mode. Each Temperature Controller uses 10 words of the upload data area. The capacity of the upload data area must be large enough for the number of Temperature Controllers connected to the CV500-TDL21.

Upload processing is executed for each Temperature Controller, the line mode of which is set to 1 or 2 (online). The Temperature Controllers in any unconnected line or inactive line must be set to 0 (offline).

The following data items are set with the upload data area.

Kind of data	Upload mode				
	0	1	2	3	4
Process value	Yes	Yes	Yes	Yes	Yes
Status	Yes	Yes	Yes	Yes	Yes
Set point	Yes	Yes	Yes	Yes	Yes
Alarm set value 1	---	---	Yes	Yes	---
Alarm set value 2	---	---	Yes	Yes	---
P	---	---	---	Yes	---
I	---	---	---	Yes	---
D	---	---	---	Yes	---
Control value	---	---	---	---	Yes

Upload Data per Unit

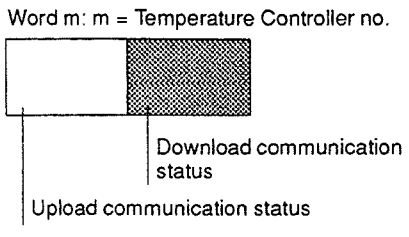
+0	Process value (rightmost)
+1	Process value (leftmost)
+2	Status
+3	Set point (rightmost)
+4	Set point (leftmost)
+5	Alarm set value 1/Controlled value
+6	Alarm set value 2
+7	P
+8	I
+9	D

Non-objective parameters are not refreshed. For example, if the mode of the CV500-TDL21 is switched from mode 2 to mode 1, the last data set with alarm set value 1 (word + 5) and alarm set value 2 (word + 6) of the CV500-TDL21 will remain unchanged.

If a Temperature Controller has a communication error, the area of the Temperature Controller does not refresh any data. Be sure to monitor the data of each Temperature Controller after confirming that the communication status of each Temperature Controller is 00 (i.e., each Temperature Controller's communication is normal). The status (word + 2) contains the operating condition and error data of each Temperature Controller. The process value and other data may be invalid if an error occurs.

5-2-1 Monitoring Communication Status

Communication Status



The result of upload communication with each Temperature Controller is set with the communication status area (control data area) of the CV500-TDL21. The contents of the upload data area are effective only when the communication status is 00 (i.e., each Temperature Controller's communication is normal).

The following communication status codes are used.

Code	Meaning
FF	Offline
00	Normal completion
04	Address over
0D	Command execution disabled
10	Parity error
11	Framing error
12	Overrun error
13	Command data FCS error
14	Format error
15	Numerical data error
16	No corresponding instruction
18	Frame length error
21	Non-volatile memory write error
97	Response data FCS error
99	Time out

If a Temperature Controller communicating with the CV500-TDL21 has a communication error, the CV500-TDL21 sets an error code with the Temperature Controller and starts communicating with the next Temperature Controller.

5-2-2 Upload User Program

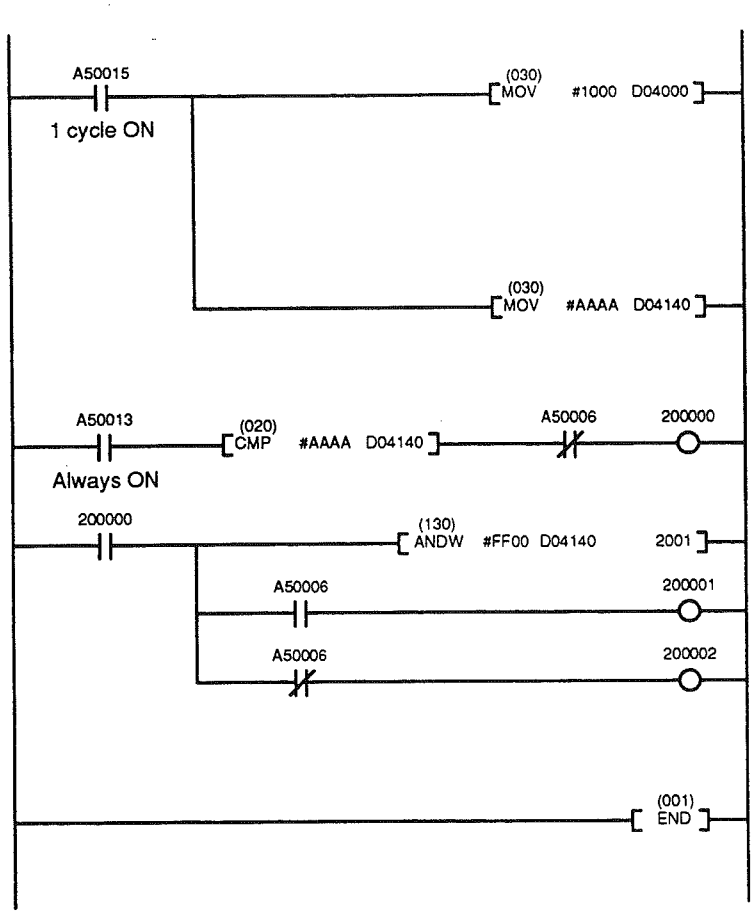
The following program enables the CV500-TDL21 to read the set point of Temperature Controller 0 and confirm the result of communication.

Conditions

The following conditions are given.

Control data start address	D04000
Communication mode	D04000 (Temperature Controller 0)
Communication status	D04140 (Temperature Controller 0)
Upload data start address	D06000

Preparation Connect general-purpose Temperature Controller 0 (E5EX).



Executes upload processing when the CV500-TDL21 starts operating and sets the communication mode of Temperature Controller 0 to #1000.

#1000
- Thermac
- Download mode
- Upload mode (PV status)
- Online (upload only)

Sets the communication status area of Temperature Controller 0 to #AAAA. The code "AA" will be used as a dummy code because it is undefined.

Confirms the execution of upload processing. If the communication status is other than "AA," 200000 will be ON.

Checks the communication status (upload) if upload processing is executed (i.e., if 200000 is ON).

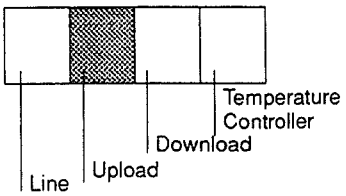
If the upload processing completes normally, 200001 will be ON.

If the upload processing completes with an error, 200002 will be ON.

5-3 Download

Download Mode

Word m: m = Temperature Controller no.



Download processing is executed to change Temperature Controller parameters or to give instructions to any Temperature Controller(s) connected to the CV500-TDL21. The Temperature Controller parameters must be set to the download data area of the CV500-TDL21. Each Temperature Controller uses 10 words of the download data area. The capacity of the download data area must be large enough for the number of Temperature Controllers connected to the CV500-TDL21.

Download processing is executed for each Temperature Controller, the line mode of which is set to 2 (online). After download processing is executed, the line mode of each of these Temperature Controllers will be set to 1 automatically. Only upload processing can be executed if the line mode is set to 1. Therefore, set the line mode to 2 before executing download processing.

The following data items are set with the download data area.

Kind of data	Download mode						
	0	1	2	3	4	5	6
Set point	Yes	Yes	Yes	---	---	---	---
Alarm set value 1	---	Yes	Yes	---	---	---	---
Alarm set value 2	---	Yes	Yes	---	---	---	---
P	---	---	Yes	---	---	---	---
I	---	---	Yes	---	---	---	---
D	---	---	Yes	---	---	---	---

Download Data per Unit

+0	Unused
+1	Unused
+2	Unused
+3	Set point (rightmost)
+4	Set point (leftmost)
+5	Alarm set value 1
+6	Alarm set value 2
+7	P
+8	I
+9	D

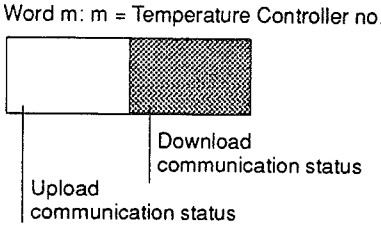
Non-objective parameters are not refreshed.

Download modes 3 to 6 are not data. The following commands are transmitted in these modes.

Mode	Command
3	Temperature Controller RUN
4	Temperature Controller STOP
5	AT execute
6	AT cancel

5-3-1 Monitoring Communication Status

Communication Status



The result of download communication for each Temperature Controller is set with the communication status area (control data area) of the CV500-TDL21.

If a Temperature Controller has an error, an error code for the error is set with the Temperature Controller, in which case any download data or operation instruc-

tion after the occurrence of the error will be invalid. Therefore data re-transmission to the Temperature Controller is required.

The following communication status codes are used.

Code	Meaning
FF	Offline
00	Normal completion
04	Address over
0D	Command execution disabled
10	Parity error
11	Framing error
12	Overrun error
13	Command data FCS error
14	Format error
15	Numerical data error
16	No corresponding instruction
18	Frame length error
21	Non-volatile memory write error
97	Response data FCS error
99	Time out

If a Temperature Controller communicating with the CV500-TDL21 has a communication error, the CV500-TDL21 sets an error code with the Temperature Controller and starts communicating with the next Temperature Controller.

5-3-2 Download User Program

The following program enables the CV500-TDL21 to write a set point to Temperature Controller 0 and confirm the result of communication.

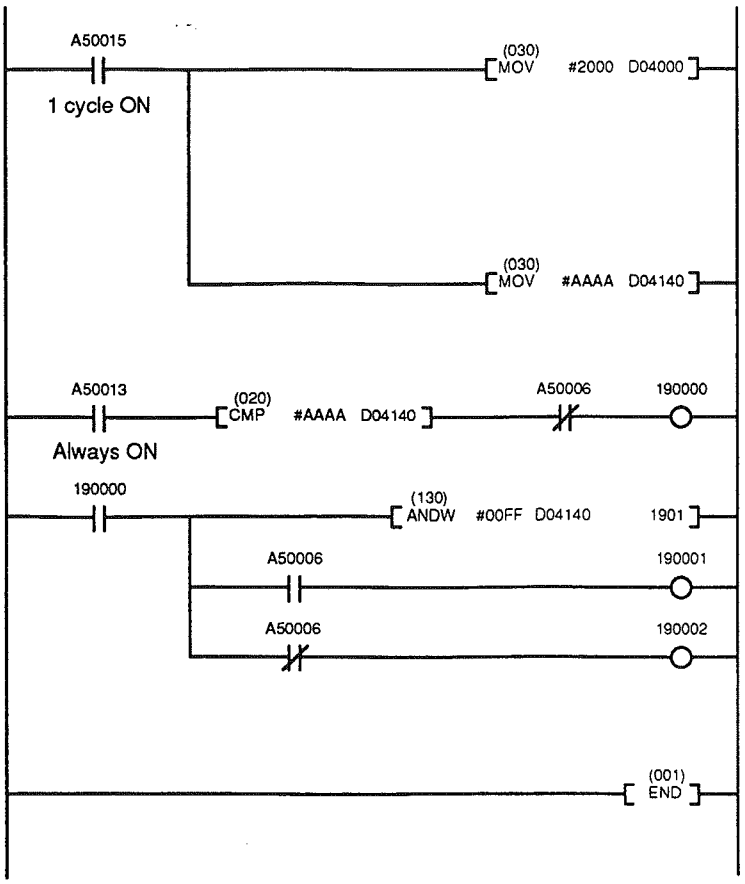
Conditions

The following conditions are given.

Control data start address	D04000
Communication mode	D04000 (Temperature Controller 0)
Communication status	D04140 (Temperature Controller 0)
Download data start address	D05000

Preparation

Connect general-purpose Temperature Controller 0 (E5EX). Download data must be set in D05000 and its succeeding addresses.



Executes download processing when the CV500-TDL21 starts operating and sets the communication mode of Temperature Controller 0 to #2000.

#2000
- Thermac
- Download mode (SP)
- Upload mode (PV status)
- Online (in both direction)

Sets the communication status area of Temperature Controller 0 to #AAAA. The code "AA" will be used as a dummy code because it is an undefined status.

Confirms the execution of download processing. If the communication status is other than "AA," 190000 will be ON.

Checks the communication status (download) if download processing is executed (i.e., if 190000 is ON).

If the download processing completes normally, 190001 is ON.

If the download processing completes with an error, 190002 will be ON.

5-4 General-purpose Command

The general-purpose command enables the CV500-TDL21 to transmit communication commands to each Temperature Controller independently.

5-4-1 General-purpose Command Transmission Procedure

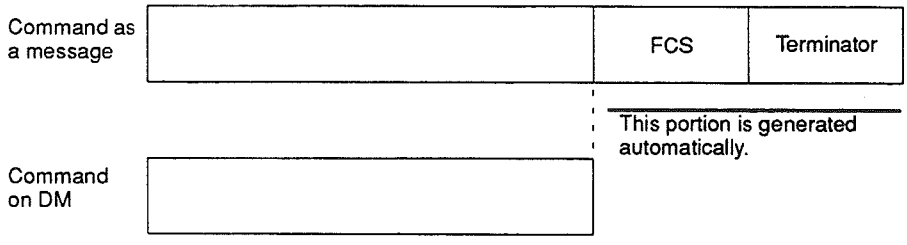
1, 2, 3...

1. Sets a command string with the general-purpose command area.
2. Turns the transmission request flag ON to instruct command transmission.
3. Confirms the transmission result of the command string.
4. Confirms the response for each command.

5-4-2 Preparation of Command String

Command Configuration

A command set with the general-purpose command area consists of the communication command format that is transmitted to each Temperature Controller excluding the FCS (frame check sequence) and terminator portions.

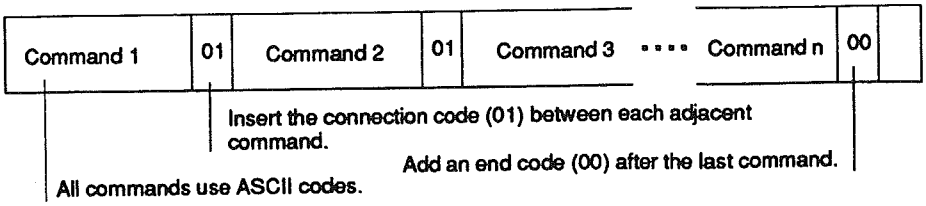


Command String Configuration

A command string consists of commands, connection codes, and a end code. A total of 512 characters are set with each command area. If more characters must be set, prepare another command area with a new start address.

All commands must be set in ASCII. Refer to *Appendix H* for a list of ASCII codes.

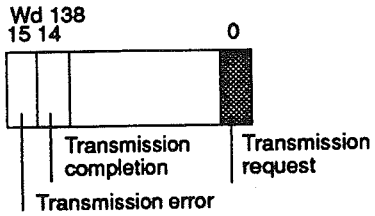
Before setting a command string with a command area, clear the command area. This will prevents the omission of the end code for the command string.



ASCII Input

The Edit DM of the CV Support Software (CVSS) has a HEX ↔ ASCII item. When this item is set to ASCII, the CVSS will be in ASCII input mode and commands can be input in ASCII. Set this item to HEX, however, when inputting the connection codes and end code for each command string.

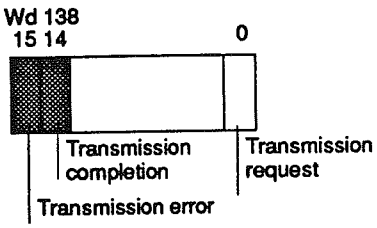
5-4-3 Transmission of Command String



Turn ON the transmission request flag of the general-purpose command transmission request and status area for command transmission.

The transmission request flag is set to 0 automatically when command transmission is finished. Be sure to set the transmission request flag to 1 before transmitting the general-purpose command.

5-4-4 Confirmation of Transmission Result

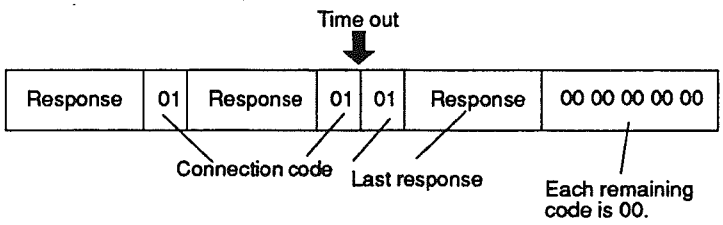


The transmission result of each general-purpose command is confirmed with the transmission completion flag or transmission error flag of both the control data and status area transmission requests.

The transmission completion flag will be set to 1 when the general-purpose command has been transmitted normally. The transmission error flag will be set to 1 when the general-purpose command has been transmitted abnormally. These flags will not be reset automatically. Reset these flags to 0 before the next transmission request is transmitted. If there is a transmission timeout or the response data for a general-purpose command has an FCS error, a transmission error will result.

5-4-5 Response

The response for each command is set in sequence with the general-purpose response area. The connection code (01) is inserted between each adjacent response. The response for each command that has been abnormally transmitted will not be set, only the connection code will be set.



Response Overflow

If the character string of the response for a command in a command string exceeds 256 words, all the responses for the command string will not be set.

5-4-6 General-purpose Command User Program

The following program enables the CV500-TDL21 to transmit remote set commands to Temperature Controller 4 (ES100).

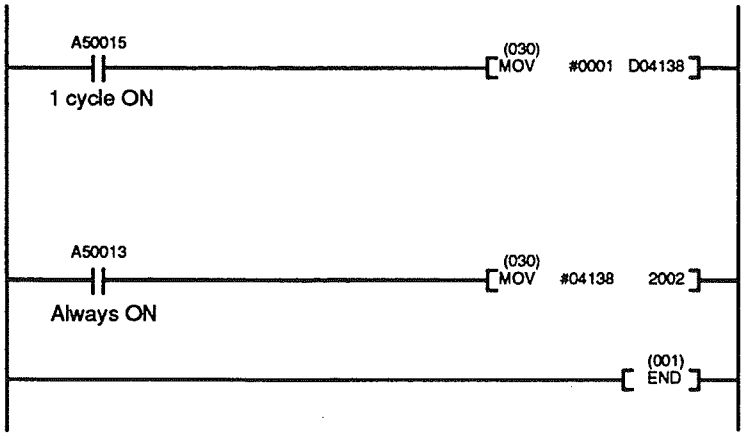
Conditions

The following conditions are given.

Control data start address	D04000
General-purpose command transmission request/Status	D04138
General-purpose command start address	D07000
General-purpose response start address	D07100

Preparation

Connect general-purpose Temperature Controller 4 (ES100). Data @04FB03005040000 (ASCII) must be set in D07000 and its succeeding addresses. Be sure to set 00 (HEX) following the data.



Executes download processing when the Temperature Controller Data Link Unit starts operating and sets the communication mode of Temperature Controller 0 to #2000.

#0001

- Transmission request: ON
- Transmission result: Reset

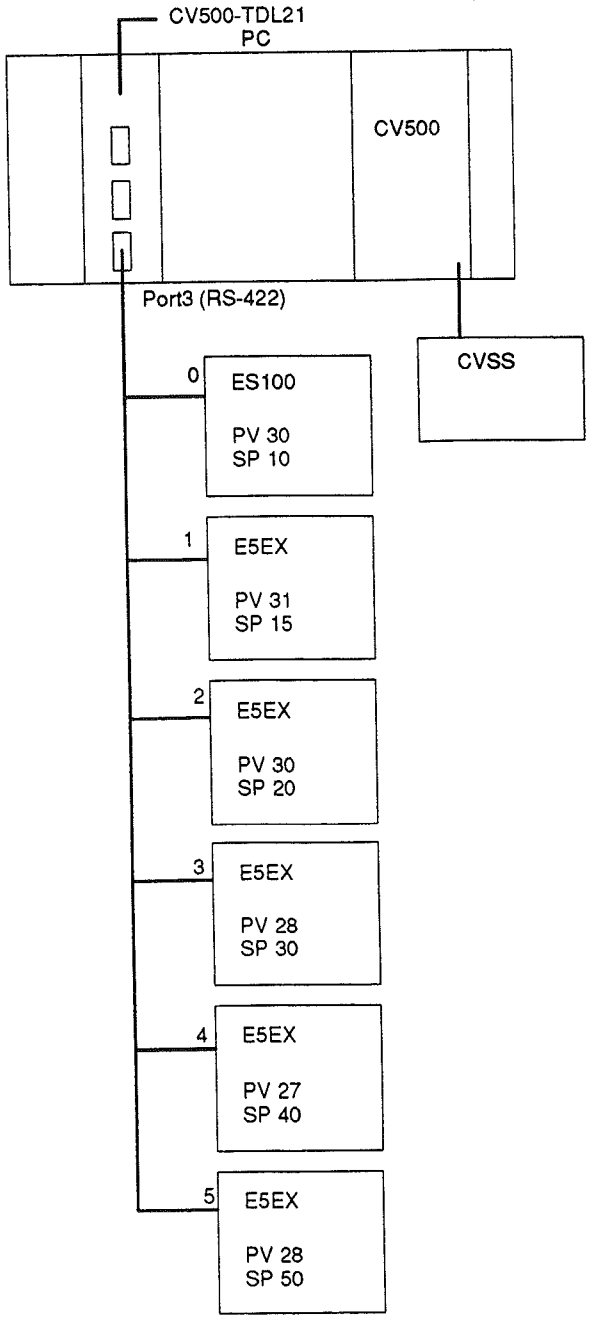
Sets the transmission result to 2002.
If the transmission was completed (i.e., if bit 14 is 1), 200214 will be ON.
If there is a transmission error (i.e., if bit 15 is 1), 200215 will be ON.

SECTION 6
Operation Examples

This section provides operation examples for the CV500-TDL21 Temperature Controller Data Link Unit. Refer to *Section 4 DM Allocation* for the data memory settings required when operating the CV500-TDL21 Temperature Controller Data Link Unit and *Section 5 Temperature Control Data Communication* for details on communication between the CV500-TDL21 Temperature Controller Data Link Unit and Temperature Controllers.

6-1 Preparation for Communication

This section explains how to use the CV500-TDL21 using the following system as an example.



System Configuration

Refer to the following table for the configuration of the above system.

Unit	Detail
CV500-TDL21 Temperature Controller Data Link Unit	No. of Units used:1 (unit no. 1) Connecting port: 3 (RS-422)
E5EX and ES100 Digital Controllers	No. of E5EX Temperature Controllers used: 5 No. of ES100 Digital Controllers used: 1
CVSS	CV Support Software running on an IBM PC/AT or compatible computer

DM Configuration

Refer to the following table for the DM configuration of the above system.

Area	Address
Start area	D02100 to D02102
Control data area	D04000 to D04209
Download data area	Area 1: D05000 to D05059 Area 2: D05100 to D05159
Upload data area	D06000 to D06059
General-purpose command area	Start address: D07000 to D07099
General-purpose response area	Start address: D07100 to D07355

Details of Communication

Refer to the following table for details on data communication using the above system.

Upload	Temperature Controllers 0 and 1: Always (high-speed monitor) Temperature Controllers 2 to 5: Occasionally (low-speed monitor)
Download	Temperature Controllers 0 to 5: Occasionally (for initial data settings and data changes)
General-purpose command	Temperature Controller 0: Initial stage (local and remote selectable)

Preparation

Connect the CV500-TDL21 to the Temperature Controllers and the CV500 to an IBM PC/AT or compatible with CVSS. Then set the unit number selectors, the PC's CPU Bus Unit system setup area, and the communication parameters of the Temperature Controllers.

Communication Data

Prepare the download data and general-purpose command string.

Initial Settings

Set the type of the system and each start address.

Communication Mode Settings

Set the line mode, upload mode, download mode, and types of Temperature Controllers.

RUN/STOP Selector

Set the RUN/STOP selector of the CV500-TDL21 to start operating the system.

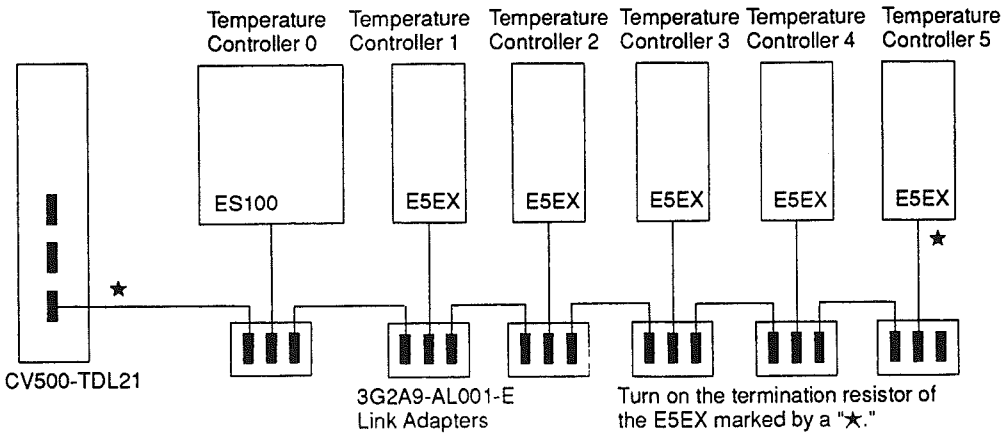
Data Communication

Download data 1 is transmitted to all the Temperature Controllers. Temperature Controllers 0 and 1 always used for upload processing (high-speed monitor) and Temperature Controllers 2 to 5 occasionally used for upload processing as required (low-speed monitor). The set point can be changed by selecting download area 1 or 2.

6-2 Preparation of System

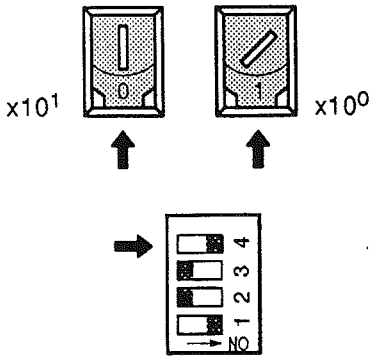
6-2-1 Mounting and Wiring

Refer to *3-1 Procedure* and mount the CV500-TDL21 to the backplane and connect the CV500-TDL21 to the Temperature Controllers with connecting cables as shown in the following diagram.



6-2-2 Unit Number Selectors

Set the unit number selectors to 01 and set pin 4 of the DIP switch to ON to turn on the termination resistor.



6-2-3 PC Settings

Set the CPU Bus Unit system setup area of the PC by using the "X:CPU Bus Unit Setup" from the CV Support Software main online menu. Refer to *3-5 PC Settings* for details.

6-2-4 Temperature Controller Settings

Refer to the following table to set the communication parameters of each Temperature Controller.

Temperature Controller no.	0	1	2	3	4	5
Unit	0	1	2	3	4	5
Baud rate	9600 bps					
Bit length	7	---				
Parity	Even	---				
Stop bit	2	---				

Note
1. Turn on the termination resistor of Temperature Controller 5.
2. Set Temperature Controllers 1 to 5 to remote mode. No operating instructions are executed if the Temperature Controllers are in local mode.

6-3 Preparations for Communication

This section describes the preparations required for system communication, including DM allocation, control data settings, and the creation of the data to be transmitted to the Temperature Controllers.

6-3-1 Creation of Transmission Data

Creation of Download Data

Prepare two areas for download data 1 and download data 2. The data to be created consists of a set point, alarm set value 1 and alarm set value 2.

Download Data 1

Temperature Controller	Set point (rightmost bit)	Set point (leftmost bit)	Alarm set value 1	Alarm set value 2
Temperature Controller 0	D05003 0000	D05004 0010	D05005 0100	D05006 0000
Temperature Controller 1	D05013 0000	D05014 0015	D05015 0100	D05016 0000
Temperature Controller 2	D05023 0000	D05024 0020	D05025 0100	D05026 0000
Temperature Controller 3	D05033 0000	D05034 0030	D05035 0100	D05036 0000
Temperature Controller 4	D05043 0000	D05044 0040	D05045 0100	D05046 0000
Temperature Controller 5	D05053 0000	D05054 0050	D05055 0100	D05056 0000

Note Upper value: bit address
Lower value: data

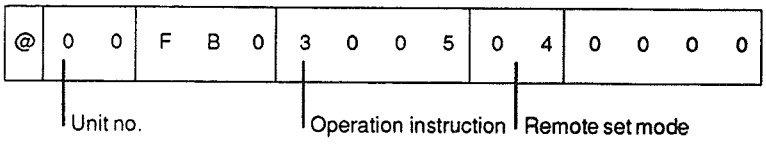
Download Data 2

Temperature Controller	Set point (rightmost bit)	Set point (leftmost bit)	Alarm set value 1	Alarm set value 2
Temperature Controller 0	D05103 0000	D05104 0020	D05105 0100	D05106 0000
Temperature Controller 1	D05113 0000	D05114 0030	D05115 0100	D05116 0000
Temperature Controller 2	D05123 0000	D05124 0035	D05125 0100	D05126 0000
Temperature Controller 3	D05133 0000	D05134 0050	D05135 0100	D05136 0000
Temperature Controller 4	D05143 0000	D05144 0060	D05145 0100	D05146 0000
Temperature Controller 5	D05153 0000	D05154 0070	D05155 0100	D05156 0000

Note Upper value: bit address
Lower value: data

Creation of General-purpose Command String

Prepare a command that puts Temperature Controller 0 in remote mode. The following is the configuration of the command.



Set data with the general-purpose command area as shown in the following. If D07000 to D07009 are cleared before setting data, the omission of the end code can be prevented.

D07000	40 (@)	30 (0)
D07001	30 (0)	46 (F)
D07002	42 (B)	30 (0)
D07003	33 (3)	30 (0)
D07004	30 (0)	35 (5)
D07005	30 (0)	34 (4)
D07006	30 (0)	30 (0)
D07007	30 (0)	30 (0)
D07008	00	00
D07009	00	00

Data in parentheses are in ASCII.

End code.

6-3-2 Start Area Settings

Set the following control data start address and E5ZD flag with the start area.

Item	Address	Data	Content
Control data start address	D02100 D02101	4000 0000	D04000
E5ZD flag	D02102	0000	General-purpose Temperature Controller

6-3-3 Control Data Area Settings

Communication Mode

Make the following communication mode parameter settings for each Temperature Controller.

1, 2, 3...

1. Set the line mode of each Temperature Controller to offline.
2. Upload processing applies to the process value, status, set point, alarm set value 1, and alarm set value 2.
3. Download processing applies to the set point, alarm set value 1, and alarm set value 2.
4. An ES100 Digital Controller is used as Temperature Controller 0. Thermac Temperature Controllers are used as the other Temperature Controllers.

Temperature controller no.	Mode			
	Line	Upload	Download	Temperature controller
0	0	2	1	1
1	0	2	1	0
2	0	2	1	0
3	0	2	1	0
4	0	2	1	0
5	0	2	1	0

Start Address

Make the following settings for each start address.

Area	Address	Data	Content
Download data	D04130	5000	D05000
	D04131	0000	
Upload data	D04132	6000	D06000
	D04133	0000	
General-purpose command	D04134	7000	D07000
	D04135	0000	
General-purpose response	D04136	7100	D07100
	D04137	0000	

6-4 Communication with Temperature Controllers

When the system and communication data have been prepared, execute communication with the Temperature Controllers connected to the CV500-TDL21.

Operation of CV500-TDL21

Set the RUN/STOP selector on the front panel of the CV500-TDL21 to RUN so that the LNK indicator on the front panel will lit and the CV500-TDL21 will start operating. After the CV500-TDL21 starts operating, the system must be controlled with the CVSS. Select the Edit DM item of the CV Support Software.

Executing Remote Setting Mode

Turn the general-purpose command transmission request flag ON (D04138: 0001) so that commands will be transmitted from the general-purpose command area and Temperature Controller 0 will be put in remote setting mode.

Transmission of Initial Data

Set the line mode of each Temperature Controller to 2 (download) to transmit the initial data of the CV500-TDL21.

Operation of Temperature Controllers

Set the download mode of Temperature Controller 0 to 3 (RUN) so that the ES100 will start operating. This means all the Temperature Controllers are in operation at this stage.

Data Monitoring

Start data monitoring, which is a basic operation of the CV500-TDL21. Refer to the following table to change the line mode of each Temperature Controller.

Temperature Controller no.	Mode
0 and 1	1 (upload processing only)
2 to 5	0 (offline)

Set the line mode of Temperature Controllers 2 to 5 to "1" for data monitoring.

6-4-1 Set Value Change

Take the following steps to change set values.

1, 2, 3...

1. Change the start address of the download area from D05000 to D05100, or vice versa.
2. Set the line mode of each Temperature Controller that needs a set value change to 2.

6-4-2 Reception Data

Reception data items such as upload data, the response for the general-purpose command, and communication results are set as described below if executed normally.

Upload Data

The data of each Temperature Controller is set with the upload data area (D06000 to D06059).

	Wd	0	1	2	3	4	5	6	7	8	9
Temperature Controller 0	06000	0000	0030	0530	0000	0010	0100	0000	0000	0000	0000
Temperature Controller 1	06010	0000	0031	0530	0000	0015	0100	0000	0000	0000	0000
Temperature Controller 2	06020	0000	0030	0530	0000	0020	0100	0000	0000	0000	0000
Temperature Controller 3	06030	0000	0028	0530	0000	0030	0100	0000	0000	0000	0000
Temperature Controller 4	06040	0000	0027	0530	0000	0040	0100	0000	0000	0000	0000
Temperature Controller 5	06050	0000	0028	0530	0000	0050	0100	0000	0000	0000	0000

Process value | Status | Set point | Alarm set value 1/2

General-purpose Response

The response data of Temperature Controller 0 is set with the general-purpose response area (D07000 to D07355) and 0 is set to any part of the area that is not occupied with the response data.

Wd	0	1	2	3	4	5	6	7	8	9
07000	4030	3046	4230	3033	3030	3530	3030	3000	0000	0000
07010	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
07020	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
07030	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
07040	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000
07050	0000	0000	0000	0000	0000	0000	0000	0000	0000	0000

@00 FB00 3005 0000 (ASCII) | Each remaining area is 0.

Communication Results

The result of the general-purpose command transmission is set with word 138 of the control data area (D04000 to D04209) and the result (communication status) of communication with each Temperature Controller is set with words 140 to 145.

Wd	0	1	2	3	4	5	6	7	8	9
04130	5000	0000	6000	0000	7000	0000	7100	0000	4000	0000
04140	0000	0000	0000	0000	0000	0000	FFFF	FFFF	FFFF	FFFF
04150	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
04160	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
04170	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
04180	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF

Normal completion | The unconnected area is offline. | Transmission completion

SECTION 7
Troubleshooting

This section provides information on troubleshooting using the indicators on the CV500-TDL21's front panel and each Unit connected to the CV500-TDL21.

7-1 Errors

If an error has resulted in a system, check the following table first and remedy the condition.

Power supply	Check if every Unit is turned ON.
Selector	Check if the selector settings of each Unit are correct.
Connector	Check if all the connectors and terminals of each Temperature Controller in the system are connected properly.
Cable	Check if the cables used in the system are connected properly without disconnection or short-circuit.
Communication conditions	Check if the communication conditions such as the transmission speed of each Unit are proper or within the ranges specified.

If there is no change after the above items are restored, check the indicators and condition of each Unit carefully.

7-2 Indicators

Normal Indication

If the CV500-TDL21 is operating normally, the indicators on the front panel are as follows:

Indicator	Status
UNIT RUN	Lit
LNK	Lit
ERROR	Not lit
BAT LOW	Not lit
MEM PROT	Lit
T/R 1	Not lit
T/R 2	Flashes
T/R 3	Flashes
Indicators 0 to 7	Not lit

No Indicators Lit

If no indicators are lit, refer to the following.

Probable cause	Remedy
The PC is turned off.	Turn on the PC.
The CV500-TDL21 is not mounted properly.	Mount the CV500-TDL21 properly.
Initial processing between the PC and CV500-TDL21 is abnormal.	Turn the restart bit of the CV500-TDL21 ON and OFF to restart the CV500-TDL21. If the CV500-TDL21 still operates abnormally after the CV500-TDL21 is restarted, replace the CV500-TDL21.

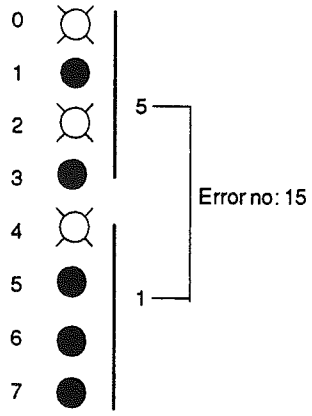
BAT LOW Indicator

If the BAT LOW indicator is lit, refer to the following.

Probable cause	Remedy
The battery connector is disconnected.	Connect the battery connector properly.
The voltage of the built-in Battery Set is low.	Replace the Battery Set.

ERROR Indicators

Error numbers are expressed by the combination of indicators 0 to 7. Indicator 0 corresponds to 2^0, indicator 1 corresponds to 2^1, etc. For example, if error number 15 (hexadecimal) results, indicators 0, 2, and 4 will be lit.



If an error number results, refer to the following table.

Error no.	Probable cause	Remedy
11	Not all the unit numbers are unique, although the unit number settings on the I/O table may seem correct. The CV500-TDL21 does not operate.	Check the I/O table with the CV Support Software and reconstruct the I/O table.
12	The unit number that the user has set has been already used by another Unit. The CV500-TDL21 does not operate.	Check the I/O table with the CV Support Software and reconstruct the I/O table.
13	The I/O table has not been registered. The CV500-TDL21's program does not work.	Reconstruct the I/O table.
14	The unit number of the CV500-TDL21 cannot be read properly from the PC. The CV500-TDL21 does not operate.	Set the unit number selector again. Replace the CV500-TDL21 if the unit number still cannot be read properly after the unit number selector is set.
15 and 16	The CV500-TDL21's cyclic operation with the PC is abnormal. The CV500-TDL21 does not operate.	Turn the PC off and on. If the condition does not change, the PC or CV500-TDL21 may be damaged.
07 to 00	A PC system setup area data read or write error has been resulted. The CV500-TDL21 works with the default value in the system setup area.	Turn the PC off and on. If the condition does not change, replace the PC.

System Alarm (Indicator 0)

Indicator 0 will be lit but the ERROR indicator will be OFF if the code used as the start address set value is not within the designated range, the start address set value is not within the permissible address range, or the designated DM or EM does not exist (i.e., memory bank specification inconsistency has been resulted), in which case correct the start address set value and restart the CV500-TDL21. To go into further details of the cause, refer to the system alarm data of the CV500-TDL21. Refer to *7-3 Errors Confirmed with DM* for details on the system alarm data area.

Transmission Error (Indicators 6 and 7)

Indicator 6 will be lit but the ERROR indicator will not be lit if there is a communication error while the CV500-TDL21 is communicating via CV500-TDL21's PORT2 with a Temperature Controller. Indicator 7 will be lit but the ERROR indicator will not be lit if there is a communication error while the CV500-TDL21 is communicating via CV500-TDL21's PORT3 with a Temperature Controller. In both cases, check the communication status of the CV500-TDL21 to restore the condition. Refer to *7-3 Errors Confirmed with DM* for details on the communication status.

7-3 Errors Confirmed with DM

Errors can be confirmed with the indicators on the front panel of the CV500-TDL21. The user will be able to know the further details of each error by referring to the CV500-TDL21's data memory.

7-3-1 System Alarm Data

When a system alarm turns ON, the following data will be stored in words 204 to 209 of the control data area.

Wd 204	No. of the program line where the error resulted (rightmost digit)	
Wd 205	No. of the program line where the error resulted (leftmost digit)	
Wd 206	Error contents (error code)	
Wd 207	Time of the error (minute)	Time of the error (second)
Wd 208	Date of the error (day)	Time of the error (hour)
Wd 209	Date of the error (year) (rightmost 2 digits)	Date of the error (month)

The contents of each error can be checked with the error code in word 206. Refer to the following table for the probable cause and remedy corresponding to each error code.

Error code	Probable cause	Remedy
6 62 202 207	The address specification of the data memory is not within the permissible range.	Check the PC model and its memory configuration and Set the DM allocation so that the address will be in the permissible range.
99	The start address is not within the permissible range.	Set the start address within the permissible range.

Error Numbers and Error Codes

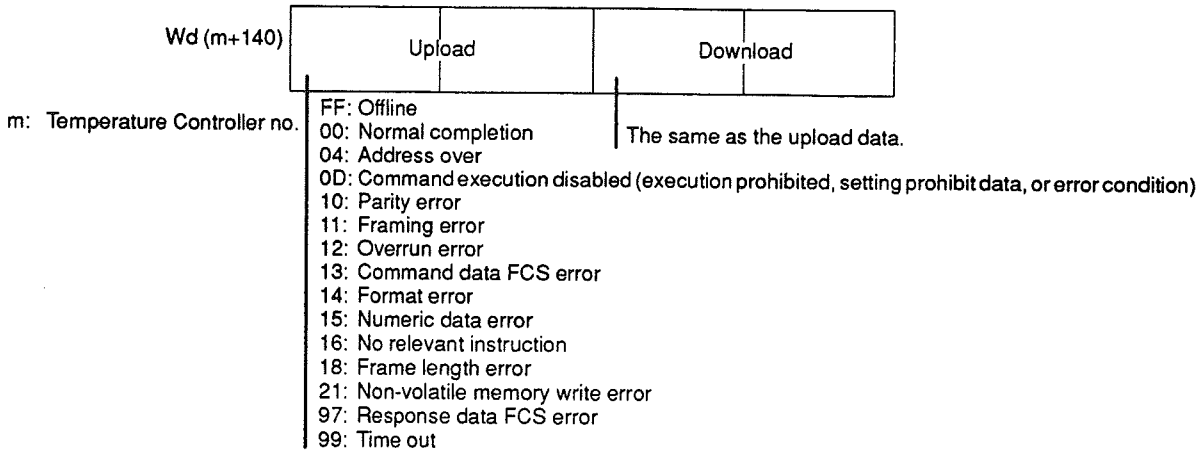
There is no relationship between error numbers and error codes. Refer to the following.

Error numbers	Expressed in hexadecimal by the combination of indicators 0 to 7 when the ERROR indicator is lit.
Error codes	Expressed in BCD in word 206 of the system alarm data area.

7-3-2 Communication Error

Download and Upload

Communication errors can be checked with the communication status in the control data area. Refer to the following for the storage area of each Temperature Controller and a list of error codes.



General-purpose Command

If there is a general-purpose command transmission error, bit 15 of the general-purpose command transmission request and status of the control data will be 1. A general-purpose command transmission error will result if there is a transmission timeout, there is no command or the command area does not have text "@," or the end code for the general-purpose command string is missing. If a general-purpose command transmission error results, connect the connector to the port properly and set the contents of the command area correctly.

Note If the contents of a command are incorrect, an error is recorded in the upload area's status as a Temperature Controller error. Refer to *7-3-3 Temperature Controller Error.*

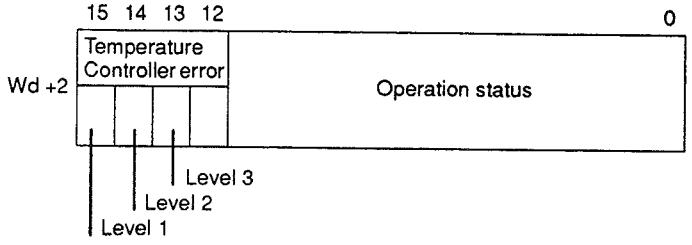
7-3-3 Temperature Controller Error

The contents of each Temperature Controller error obtained by communication are stored in the upload area's status (word + 2). If a Temperature Controller has an error, refer to the Temperature Controller's instruction manual to restore its condition back to normal.

The contents of general-purpose Temperature Controller errors and those of E5ZD Multipoint Temperature Controller errors are not the same.

General-purpose Temperature Controllers

The error levels of general-purpose Temperature Controllers can be checked.

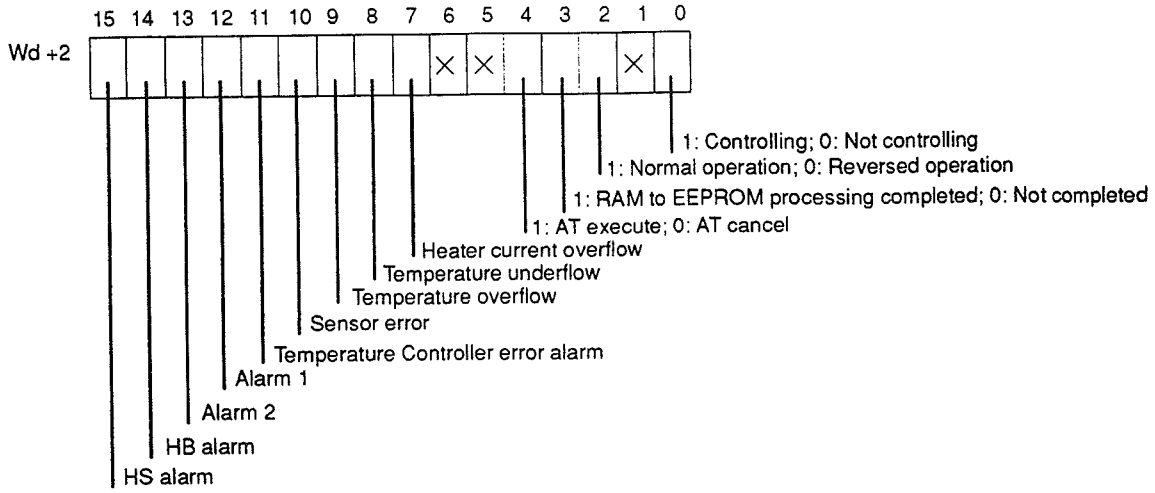


Refer to the following table for the error levels for the ES100 and Thermac Temperature Controllers.

Temperature Controller	Level 1 Repairs are required	Level 2 Connections must be checked	Level 3 Settings must be checked
ES100	WDT error RAM R/W error RAM sum error Correction data error Internal voltage error Cold contact error A/D error	PV error Analog input 1 error Analog input 2 error Potential meter error	Set value confirmation alarm Motor calibration setting error
Thermac	RAM data error A/D error	Overflow Underflow Input error Sensor error	

E5ZD Multipoint Temperature Controllers

E5ZD sets the status that is read with the RX command as the upload status. Therefore the upload status is the same as the response data obtained with the general-purpose command.



Note

1. Each bit marked by an "X" in the above figure is an indefinite bit.
2. Bits 7 to 15 are error or alarm bits.
3. Bits 0 to 4 indicate the present working status.

Error Confirmed with Process Value

The process value of the E5ZD will contain one of the following error codes if the E5ZD has an error.

Error code	Meaning
E001	Memory error
E002	Sensor A/D error
E003	Cold contact compensation error
E011	Sensor error
E012	Process temperature overflow
E013	Process temperature underflow

Appendix A
Specifications and Dimensions

General Specifications

The general specifications of the CV500-TDL21 Temperature Controller Data Link Unit conform to those of SYSMAC CV-series PCs.

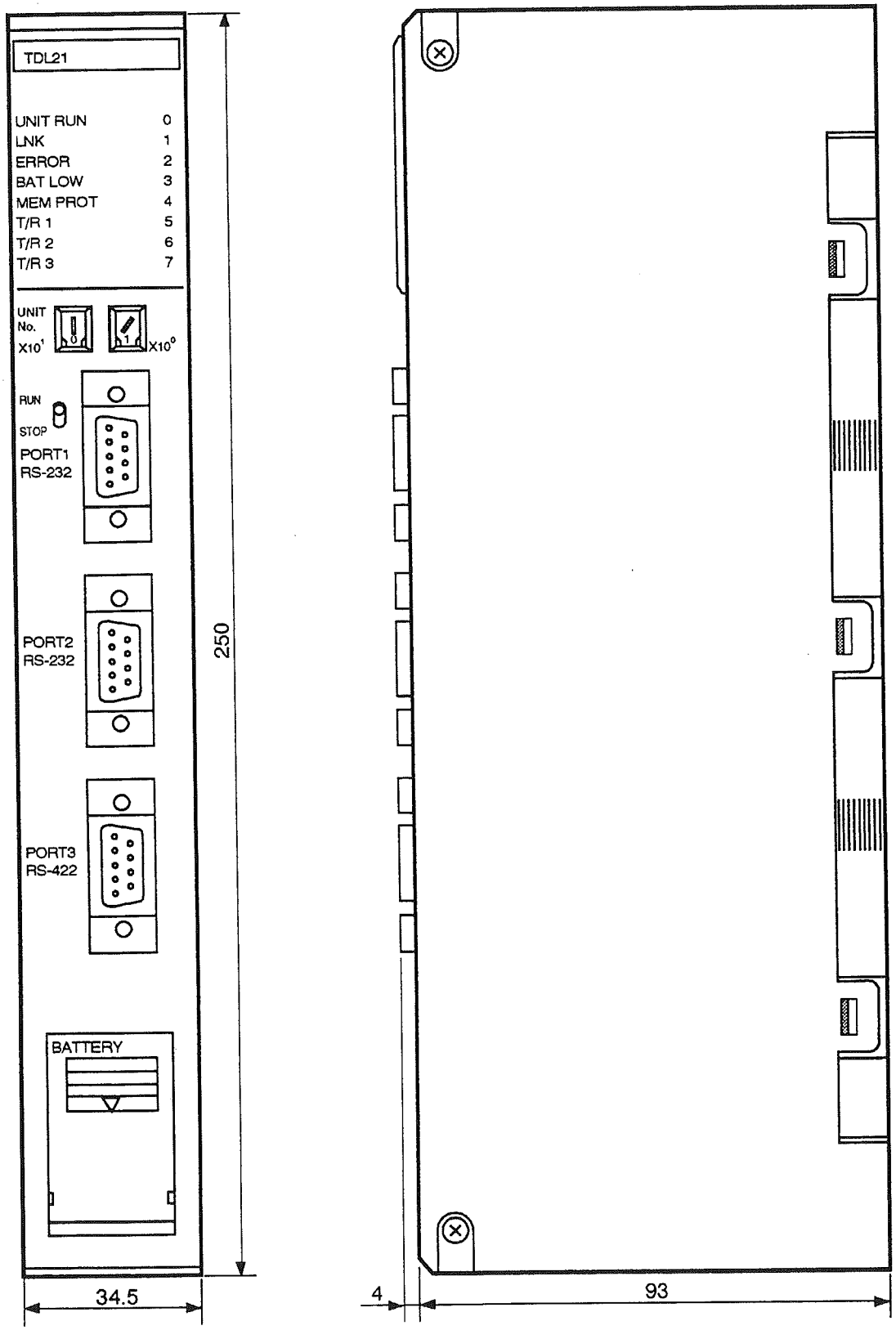
Performance Specifications

Item	Specification
Connectable PC	CVM1-, CV500-, CV1000-, and CV2000-series CPUs and Expansion CPU Racks
PC interface	Event
Temperature Controller interface	PORT2: RS-232C PORT3: RS-422
Diagnostic function	PC interface: Watchdog timer, battery-low detection (see note 1), and communication data FCS check CV500-TDL21: Bus disconnection check and communication data horizontal parity check
Connectable Temperature Controller	General-purpose Temperature Controllers (Thermac-series) and ES100 Digital Controllers and E5ZD incorporating a communication function (RS-422)
No. of connectable Temperature Controllers	General-purpose Temperature Controllers: 64 (Temperature Controllers 00 to 31 are connected to PORT3 and Temperature Controllers 32 to 63 are connected to PORT2) E5ZD: 64 words (connected to PORT3)
Upload function	PV, status, SP, alarm set value 1, alarm set value 2, P, I, D, and MV reception
Download function	SP, alarm set value 1, alarm set value 2, P, I, D, RUN/STOP, AT/AT cancel, and transmission
General-purpose command function	512 bytes (including connection codes and end code)
Monitoring cycle	Approximately 30 s for 64 Units at the time of PV or status upload processing with Thermac Temperature Controllers connected (see note 2)
Current consumption	0.5 A max.
Dimensions	34.5 x 250 x 93 (W x H x D)
Weight	550 g max.

Note 1. The built-in battery lasts five years. The memory backup time of the battery with the CV500-TDL21 turned off varies with the ambient temperature. If the BAT LOW indicator is lit, replace the battery with a new battery (3G2A9-BAT08) within a week.

2. The monitoring cycle of the CV500-TDL21 varies with the type of Temperature Controllers connected, upload mode, and whether or not download processing is executed. Refer to *Appendix B Monitoring Cycle* for details.

Dimensions


TDL21
UNIT RUN 0
LNK 1
ERROR 2
BAT LOW 3
MEM PROT 4
T/R 1 5
T/R 2 6
T/R 3 7
UNIT No.
X10¹
X10⁰
RUN
STOP
PORT1
RS-232
PORT2
RS-232
PORT3
RS-422
BATTERY
250
34.5
4
93

Appendix B
Monitoring Cycle

The monitoring cycle (data refreshing cycle of the PC's DM) of the CV500-TDL21 Temperature Controller Data Link Unit varies with the type and number of Temperature Controllers connected and whether or not upload or download processing is executed. The following formula is used to obtain the monitoring cycle of the CV500-TDL21 Temperature Controller Data Link Unit by using the processing time of each Temperature Controller. The processing time of each Temperature Controller varies with the system configuration. Therefore the result of the calculation should be used only as a reference value.

Formula

Monitoring cycle = [(The processing time of each type-A Temperature Controller) x (the number of type-A Temperature Controllers)] + [(the processing time of each type-B Temperature Controller) x (the number of type-B temperature Controllers)] + ... + [(the processing time of each Temperature Controller set to offline) x (the number of Temperature Controllers set to offline)]

Processing Time per Temperature Controller

Conditions

PC	CV1000-CPU01 (asynchronous operation with no CPU bus link)
CPU Bus Unit	A single CV500-TDL21

Actual Data Measured

Temperature Controller model	Upload mode/Download mode						Model used
	0/–	1/–	2/–	3/–	4/–	0/2	
E5EX	0.539 s	0.798 s	1.300 s	2.034 s	1.039 s	2.459 s	E5EX-A02TC
E5AX	0.511 s	0.738 s	1.192 s	1.872 s	0.959 s	3.509 s	E5AX-A02
E5□J	0.515 s	0.750 s	1.198 s	1.881 s	0.975 s	2.167 s	E5EJ-A2H02
ES100	1.553 s	1.800 s	2.406 s	2.750 s	2.045 s	3.136 s	ES100X-AAH04FE-E
E5ZD	0.689 s	1.114 s	1.580 s	2.211 s	1.327 s	2.538 s	E5ZD-8A02KJ-E
Offline	0.081 s						---

Cause of Monitoring Cycle Fluctuation

The refresh time of any other CPU Bus Unit may cause fluctuation of the monitoring cycle.

Calculation Example

Conditions

- Five E5EX Temperature Controllers and a single ES100 Temperature Controller are all operated in upload mode 0.
- The total processing time of the E5EX Temperature Controllers: 0.539 x 5 = 2.659
- The processing time of the ES100 Digital Controller: 1.553 x 1 = 1.553
- The offline processing time: 0.081 x (64 – 6) = 4.698
- Monitoring time = 2.659 + 1.553 + 4.698 = 8.91 s

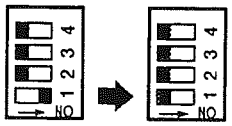
Appendix C
Program Restoration

The CV500-TDL21 Temperature Controller Data Link Unit stores programs in its EEPROM and RAM. The program to be executed exists in the RAM.

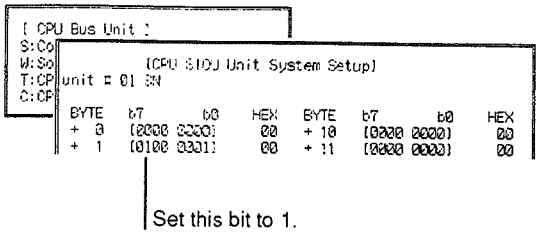
The program to be executed will be damaged if the built-in battery of the CV500-TDL21 is dead, in which case, take the following steps to transfer the backup program from the EEPROM to the RAM.

1. Set pin 1 of the DIP switch to OFF in order to cancel memory protect.

SW1: ON → OFF

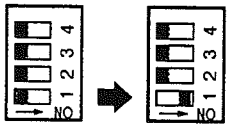


2. Change the +1 byte of the CPU Bus Unit system setup area from 0000 0001 (manual transfer) to 0100 0001 (EEPROM automatic transfer).

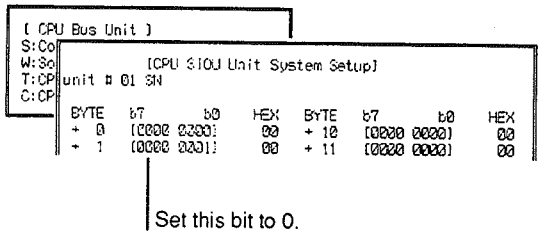


3. Turn the CV500-TDL21 off and on or restart the CV500-TDL21 so that the transfer of the program can be executed.
4. Set pin 1 of the DIP switch to ON to protect the memory.

SW1: OFF → ON



5. Change the +1 byte of the CPU Bus Unit system setup area from 0100 0001 (EEPROM automatic transfer) to 0000 0001 (manual transfer).

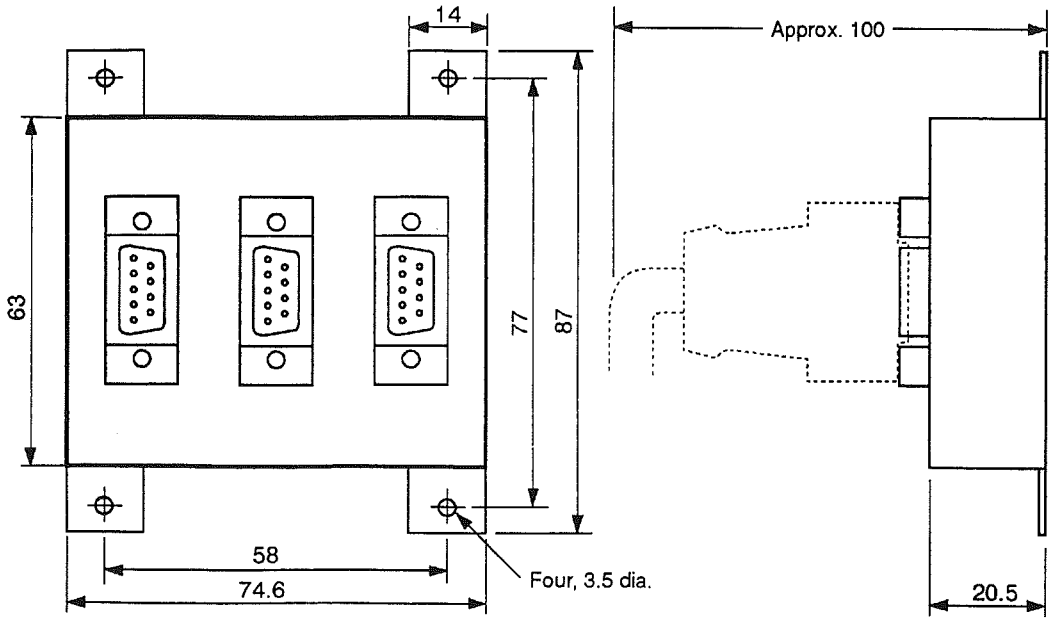


6. Turn the CV500-TDL21 off and on or restart the CV500-TDL21 so that the manual transfer of the program can be executed.

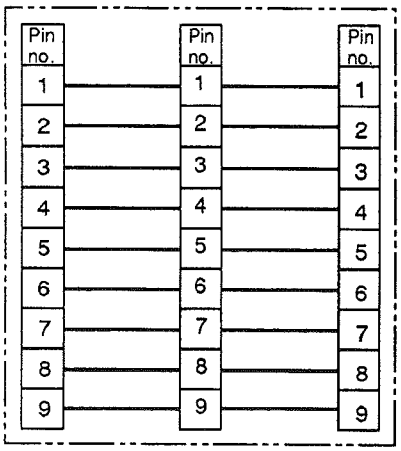
Appendix D
Link Adapter

3G2A9-AL001-E

Dimensions



Internal Configuration



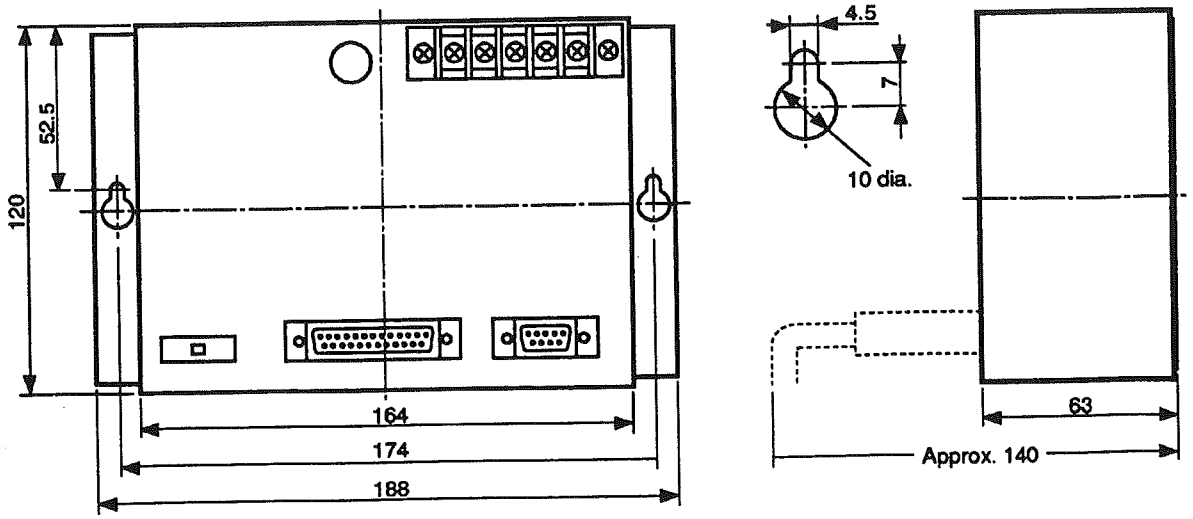
Available Connectors

Connector	Housing	Maker
XM2A-0901	XM2S-0911	OMRON (see note)
DE-9P	DE-CI-J6	JAE

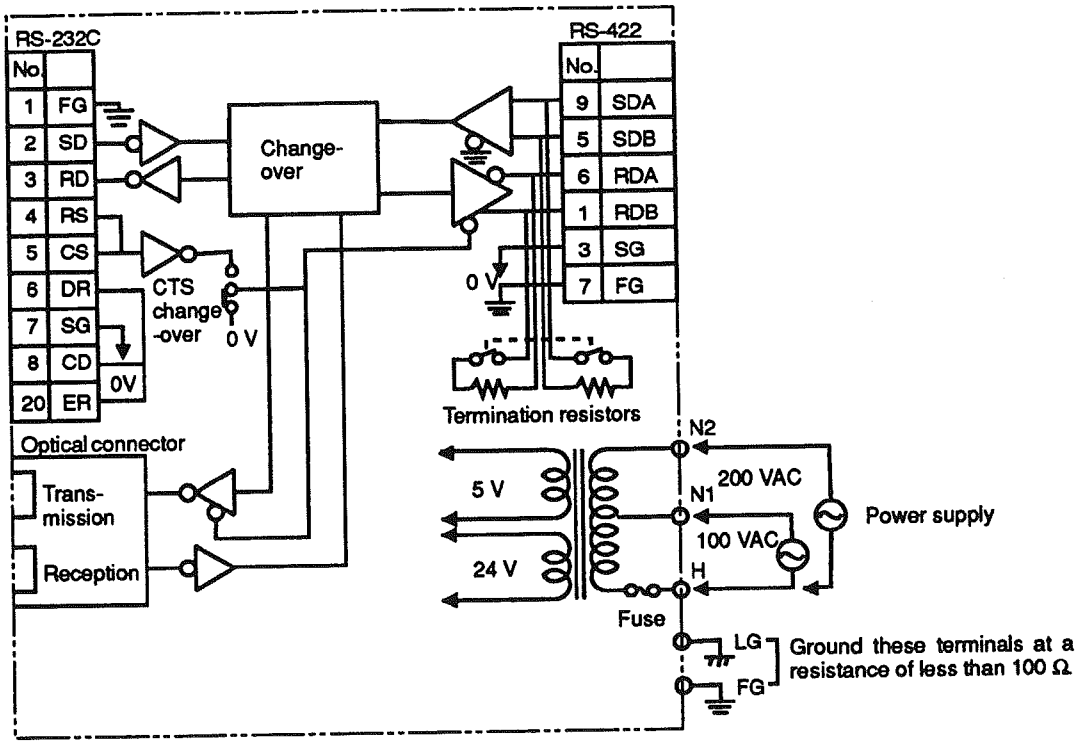
Note Three XM2A-0901 Connectors and three XM2S-0911 Housings are provided with the 3G2A9-AL001-E Link Adapter.

3G2A9-AL004-E(-PE)

Dimensions



Internal Configuration



Precautions

Optical Connector

Replace the cap on the optical connector when the optical connector is not used.

The maximum transmission distance of the Link Adapter varies with the cable. Refer to the following table.

Cable unit	3G2A9-AL004-PE	3G2A9-AL004-E
APF (all plastic fiber)	20 m	Impossible to connect
PCF (plastic-clad fiber)	200 m	800 m

Selectors

CTS (CS) selector	The CTS (CS) selector is used to specify the CTS signal of the RS-232C interface. 0 V: Always ON External:CTS (with pin 5)
Termination resistor selector	The termination resistor selector is used to turn the termination resistor ON or OFF.

Power Supply

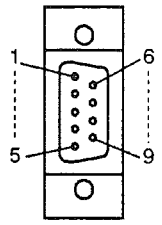
Connect power to the correct power supply terminals according to the AC voltage. The active AC line must be connected terminal H.

Terminal Board

Be sure to replace the cover over the terminal board after wiring.

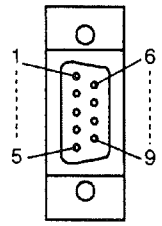
Appendix E
Interface

PORT2 (RS-232C)



Pin no.	Abbreviation	Name	Direction
1	FG	Frame ground	---
2	SD (TXD)	Send data	Output
3	RD (RXD)	Receive data	Input
4	RS (RTS)	Request transmission	Output
5	CS (CTS)	Can transmit	Input
6	---	Unused	---
7	DR (DSR)	Data set ready	Input
8	ER (DTR)	Data terminal ready	Output
9	SG	Signal ground	---
Metal part of the connector	FG	Frame ground	---

PORT3 (RS-422)



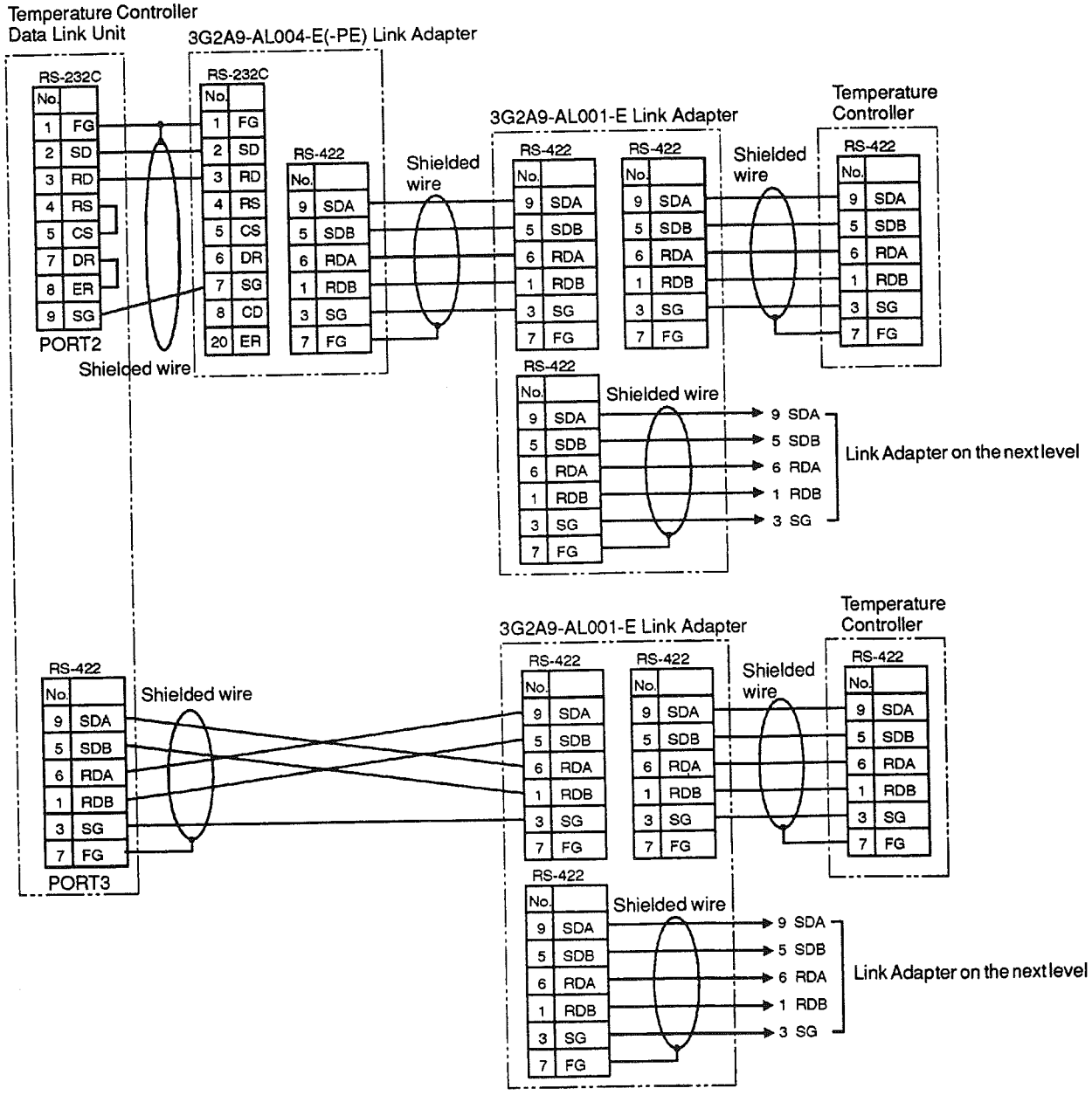
Pin no.	Abbreviation	Name	Direction
1	RD+ (RDB)	Reception data (+)	Input
2	---	Unused	---
3	---	Unused	---
4	---	Unused	---
5	SD+ (SDB)	Send data (+)	Output
6	RD– (RDA)	Receive data (–)	Input
7	FG	Frame ground	---
8	---	Unused	---
9	SD– (SDA)	Send data (–)	Output
Metal part of the connector	FG	Frame ground	---

Available Connector

Connector: OMRON's XM2A-0901 or equivalent

Housing: OMRON's XM2S-0911 or equivalent

Connection Diagram



Appendix F
List of Temperature Controllers

The following Temperature Controllers can be connected to the CV500-TDL21 Temperature Controller Data Link Unit.

General-purpose Temperature Controller				E5ZD
Thermac		ES100		
Series	Model	Series	Model	
E5AF-series Temperature Controller	E5AF-A02, E5AF-AH02, E5AF-A02-X, and E5AF-AH02-X	ES100X-series Digital Controller	ES100X-AAH04FE-E, ES100X-AAWH04FE-E, ES100X-RRP04FE-E, and ES100X-RRPW04FE-E	E5ZD-4H02KJ-E, E5ZD-4A02KJ-E, E5ZD-4H02P-E, E5ZD-4A02P-E, E5ZD-6H02KJ-E, E5ZD-6A02KJ-E, E5ZD-6H02P-E, E5ZD-6A02P-E, E5ZD-8H02KJ-E, E5ZD-8A02KJ-E, E5ZD-8H02P-E, E5ZD-8A02P-E, E5ZD-8H02KJM-E, E5ZD-8H02PM-E, E5ZD-4VH02KJ-E, E5ZD-4VA02KJ-E, E5ZD-4VH02P-E, E5ZD-4VA02P-E, E5ZD-6VH02KJ-E, E5ZD-6VA02KJ-E, E5ZD-6VH02P-E, E5ZD-6VA02P-E, E5ZD-8VH02KJ-E, E5ZD-8VA02KJ-E, E5ZD-8VH02P-E, E5ZD-8VA02P-E, E5ZD-8FH02KJ-E, E5ZD-8FA02KJ-E, E5ZD-8FH02P-E, E5ZD-8FA02P-E E5ZD-8FH02KJM-E, and E5ZD-8FH02PM-E
E5EF-series Temperature Controller	E5EF-A02TC, E5EF-AH02TC, E5EF-A02P, and E5EF-AH02P	ES100P-series Digital Controller	ES100P-AAH04FE-E and ES100P-RRP04FE-E	
E5EX-series Temperature Controller	E5EX-A02TC, E5EX-AH02TC, E5EX-A02P, and E5EX-AH02P			
E5AX-series Temperature Controller	E5AX-LA02, E5AX-LA02-X, E5AX-MA02, E5AX-MA02-X, E5AX-A02, E5AX-A02-X, E5AX-AH02, and E5AX-AH02-X			
E5EJ-series Temperature Controller	E5EJ-A2H02 and E5EJ-VAA1H02			
E5AJ-series Temperature Controller	E5AJ-A2H02 and E5AJ-VAA1H02			

Appendix G
DM Setting Table

Copy the pages of this section and use for data memory allocation.

Unit Number

□□ (00 to 15)

Start Area

DM address	Contents	Data	Setting range	Reference
D0□□00	Control data start address (rightmost digit)		See note.	Page 22
D0□□01	Control data start address (leftmost digit)			
D0□□02	E5ZD flag		0000,0001	

Note The following address setting ranges are possible.
CVM1/CV500: 00003600 to 00008191
CV1000/CV2000: 00003600 to 00024575, 10000000 to 10032765 (expansion data memory), ... 17000000 to 17032765 (expansion data memory)

Control Data Area

DM address	Contents	Data	Setting range	Reference
	Communication mode	Refer to page 74	Refer to page 74	Page 23
	Download data start address		See note.	
	Upload data start address		See note.	
	General-purpose command start address		See note.	
	General-purpose response start address		See note.	
	General-purpose command transmission request and status	---	---	
	Communication status	---	---	Page 24
	System alarm data	---	---	

Note The following address setting ranges are possible.
CVM1/CV500: 00003600 to 00008191
CV1000/CV2000: 00003600 to 00024575, 10000000 to 10032765 (expansion data memory), ... 17000000 to 17032765 (expansion data memory)

Communication Mode Area

Start address:

Refer to *4-2-2 Control Data Area* for details on the settings of the communication mode area. A word is allocated to each general-purpose Temperature Controller beginning with the start address and a total of 64 words are allocated. Two words are allocated to each E5ZD Multipoint Temperature Controller beginning with the start address and a total of 128 words are allocated.

Mode			Line	Upload	Download	Temperature Controller (see note 1)	Unit no. (see note 2)	Word no. (2)
Setting range			0 to 2	0 to 4	0 to 6	0, 1	0 to F	0 to 7
Temperature Controller	00	32						
	01	33						
	02	34						
	03	35						
	04	36						
	05	37						
	06	38						
	07	39						
	08	40						
	09	41						
	10	42						
	11	43						
	12	44						
	13	45						
	14	46						
	15	47						
	16	48						
	17	49						
	18	50						
	19	51						
	20	52						
	21	53						
	22	54						
	23	55						
	24	56						
	25	57						
	26	58						
	27	59						
	28	60						
	29	61						
	30	62						
	31	63						

Note 1. There is no need to set this item with the E5ZD Multipoint Temperature Controllers.
2. There is no need to set this item with the general-purpose Temperature Controllers.

Download Data Area

Area no.:

Start address:

Refer to page 25 for details on the settings of the download area. Each Temperature Controller requires 10 words beginning with the start address. The area number should be used when there is more than one download data value.

Parameter			Set point	Alarm set value 1	Alarm set value 2	P	I	D
Setting range			–1999.000 to 9999.000	–1999 to 9999	–1999 to 9999	000.0 to 999.9	0000 to 9999	0000 to 9999
Temperature Controller	00	32						
	01	33						
	02	34						
	03	35						
	04	36						
	05	37						
	06	38						
	07	39						
	08	40						
	09	41						
	10	42						
	11	43						
	12	44						
	13	45						
	14	46						
	15	47						
	16	48						
	17	49						
	18	50						
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	21	53						
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	23	55						
	24	56						
	25	57						
	26	58						
	27	59						
	28	60						
	29	61						
	30	62						
	31	63						

Note The set point range of each Thermac Temperature Controller is –1000 to 9999.

General-purpose Command Area

Refer to pages 26, 40, and 49 for details on the settings of the general-purpose command area. The area allocated to a single command string uses 512 bytes. Prepare a command string for each job and switch among the areas with a program.

Area/Start address	Contents of settings
0/	
1/	
2/	
3/	
4/	
5/	
6/	
7/	
8/	
9/	

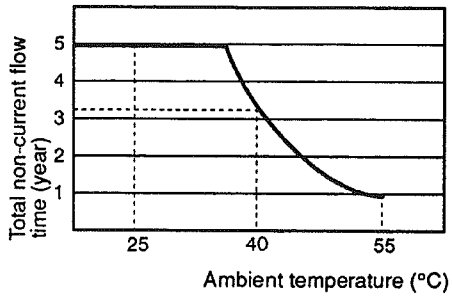
Appendix H
List of ASCII Codes

Hexadecimal	Leftmost bit	0	1	2	3	4	5	6	7
Rightmost bit	Binary	0000	0001	0010	0011	0100	0101	0110	0111
0	0000			SP	0	@	P		p
1	0001			!	1	A	Q	a	q
2	0010			"	2	B	R	b	r
3	0011			#	3	C	S	c	s
4	0100			$	4	D	T	d	t
5	0101			%	5	E	U	e	u
6	0110			&	6	F	V	f	v
7	0111			'	7	G	W	g	w
8	1000			(	8	H	X	h	x
9	1001			)	9	I	Y	i	y
A	1010			*	:	J	Z	j	z
B	1011			+	;	K	[	k	{
C	1100			,	<	L	¥	l	|
D	1101			-	=	M	]	m	}
E	1110			.	>	N	^	n	~
F	1111			/	?	O	_	o	DEL

Appendix I
Battery Set

Battery Life

The built-in Battery Set lasts a maximum of five years regardless of whether the CV500-TDL21 is turned ON. The memory backup time with the CV500-TDL21 turned off varies with the ambient temperature. Refer to the following graph.



Replace the built-in Battery Set with a new Battery Set within a week if the BAT LOW indicator of the CV500-TDL21 is lit.

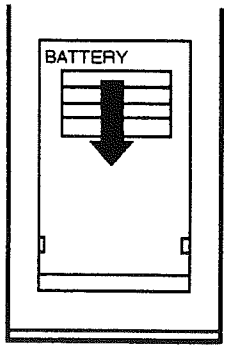
Battery Set

Use OMRON's 3G2A9-BAT08 Battery Set for the CV500-TDL21.

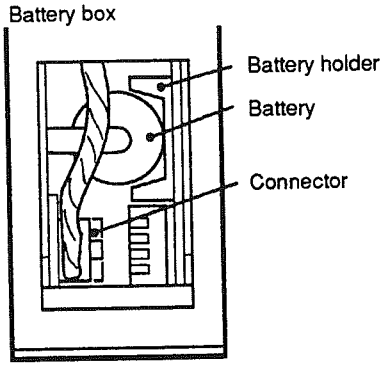
Replacement

1. Turn off the CV500-TDL21. If the CV500-TDL21 has been already turned off, turn on the CV500-TDL21 for at least one minute and then turn off the CV500-TDL21.
2. Press the upper part of the cover of the battery case and slide the cover downwards to remove the cover.

Opening the battery cover



3. Remove the Battery Set by disconnecting the battery connector and replace the Battery Set with a new Battery Set within five minutes.



4. Put the cover back on the battery case.

Caution Do not:
- Short-circuit the positive and negative terminals of the Battery Set.
- Charge the Battery Set.
- Disassemble the Battery Set.
- Throw the Battery Set into a fire.

Otherwise, the Battery Set may catch fire, explode, or the internal liquid of the Battery Set may leak.

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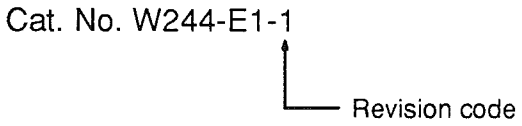
Revision History

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.

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