# User's Manual

# Model US1000
# Digital Indicating Controller
# Communication Functions

IM 5D1A01-10E

YOKOGAWA
Yokogawa Electric Corporation

IM 5D1A01-10E
3rd Edition

# Introduction

This instruction manual describes the communication functions of the US1000 Digital Indicating controller and contains information on how to create communication programs.

Read the manual carefully to understand the communication functions of the US1000.

**The US1000 Digital Indicating controller has the following communication protocols.**

1) MODBUS communication protocol
2) PC link communication protocol

Note that the US1000 Digital Indicating controller cannot communicate with a higher-level device with a communication protocol other than these.

## ■ Intended Readers

This manual is intended for people familiar with the functions of the US1000 Digital Indicating Controller and control engineers and personnel in charge of maintaining instrumentation and control equipment.

You are required to understand as a background knowledge the communication specifications of higher-level devices, in regard to their communication hardware, language used for creating communication programs, and so on.

* Higher-level devices: PCs, PLCs (sequencers), graphic panels, and others

## ■ Related Documents

The following instruction manuals all relate to the communication functions.

Read them as necessary. The codes enclosed in parentheses are the document numbers.

- *US1000 Digital Indicating Controller–Operation* (IM 5D1A01-01E)
  Explains the basic operation of the US1000 controller.
  Supplied with the US1000 Digital Indicating Controller.
- *US1000 Digital Indicating Controller–Functions* (IM 5D1A01-02E)
  Explains the functions of the US1000 controller in detail.
  Supplied with the US1000 Digital Indicating Controller.
- *LL1100 PC-based Parameters Setting Tool* (IM 5G1A01-01E)
  An instruction manual for setting the parameters of the US1000 controller from a personal computer. Supplied with the LL1100 PC-Based Parameters Setting Tool.
- *LL1200 PC-based Custom Computation Building Tool* (IM 5G1A11-01E)
  An instruction manual for creating US1000 custom computations. The manual also presents some examples of custom computations. Note that this tool includes the entire functionality of the LL1100 PC-based Parameters Setting Tool. Supplied with the LL1200 PC-Based Custom Computation Building Tool.
- *LL1200 PC-based Custom Computation Building Tool* User's Reference (IM 5G1A11-02E)
  An instruction manual that describes the functions needed to create US1000 custom computations. Refer to this manual if you are not familiar with the types of functions available or how these functions work. Supplied with the LL1200 PC-based Custom Computation Building Tool.

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# Documentation Conventions

## ■ Symbols

The following symbols are used in this manual.

●Symbols Used in the Main Text

**CAUTION**

Draws attention to information that is essential for understanding the operation and/or features of the product.

**NOTE**

Gives additional information to complement the present topic and/or describe terms specific to this document.

**See Also**

Gives reference locations for further information on the topic.

## ■ Description of Displays

(1) Some of the representations of product displays shown in this manual may be exaggerated, simplified, or partially omitted for reasons of convenience when explaining them.

(2) Figures and illustrations representing the controller's displays may differ from the real displays in regard to the position and/or indicated characters (upper-case or lower-case, for example), to the extent that they do not impair a correct understanding of the functions and the proper operation and monitoring of the system.

# Notices

## ■ Regarding This Instruction Manual

(1) This manual should be passed on to the end user. Keep at least one extra copy of the manual in a safe place.
(2) Read this manual carefully to gain a thorough understanding of how to operate this product before you start using it.
(3) This manual is intended to describe the functions of this product. Yokogawa Electric Corporation (hereinafter simply referred to as Yokogawa) does not guarantee that these functions are suited to the particular purpose of the user.
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(5) The contents of this manual are subject to change without prior notice.
(6) Every effort has been made to ensure accuracy in the preparation of this manual. Should any errors or omissions come to your attention however, please contact your nearest Yokogawa representative or our sales office.

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(2) The following safety symbols are used on the product and/or in this manual.

●Symbols Used on the Product and in This Manual

**CAUTION**

This symbol on the product indicates that the operator must refer to an explanation in the instruction manual in order to avoid the risk of injury or death of personnel or damage to the instrument. The manual describes how the operator should exercise special care to avoid electrical shock or other dangers that may result in injury or loss of life.



Protective Grounding Terminal

This symbol indicates that the terminal must be connected to ground prior to operating the equipment.



Functional Grounding Terminal

This symbol indicates that the terminal must be connected to ground prior to operating the equipment.

●Symbol Used in This Manual Only

**WARNING**

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.

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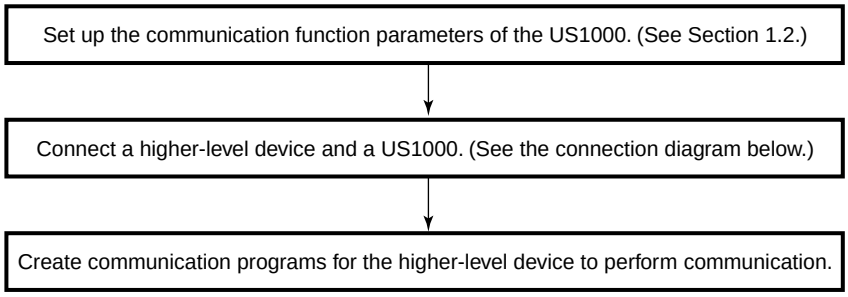
# Contents

# 1. Setup

This chapter describes the setup procedure required to be able to use the communication functions (MODBUS and PC link) and the communication parameters of the US1000.

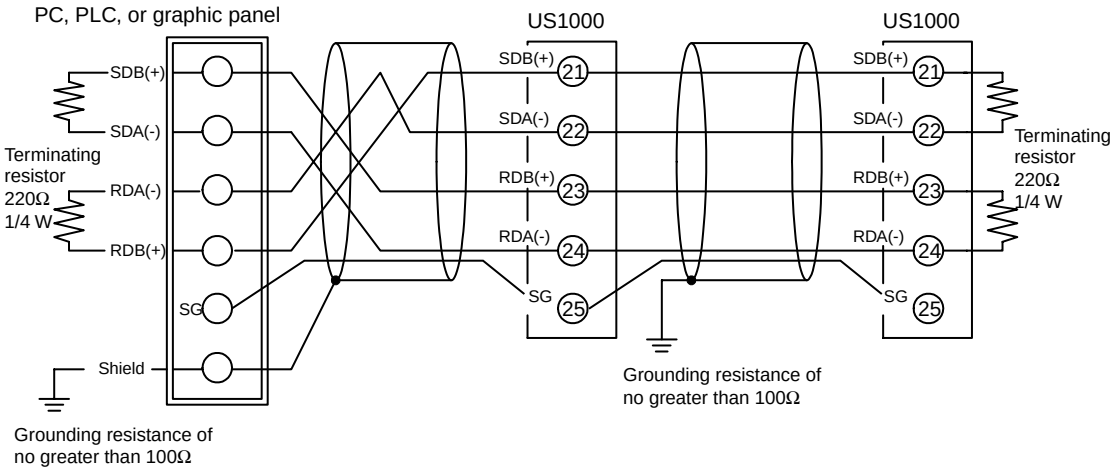
## 1.1 Setup Procedure

Set up the communication functions on the US1000 as follows:

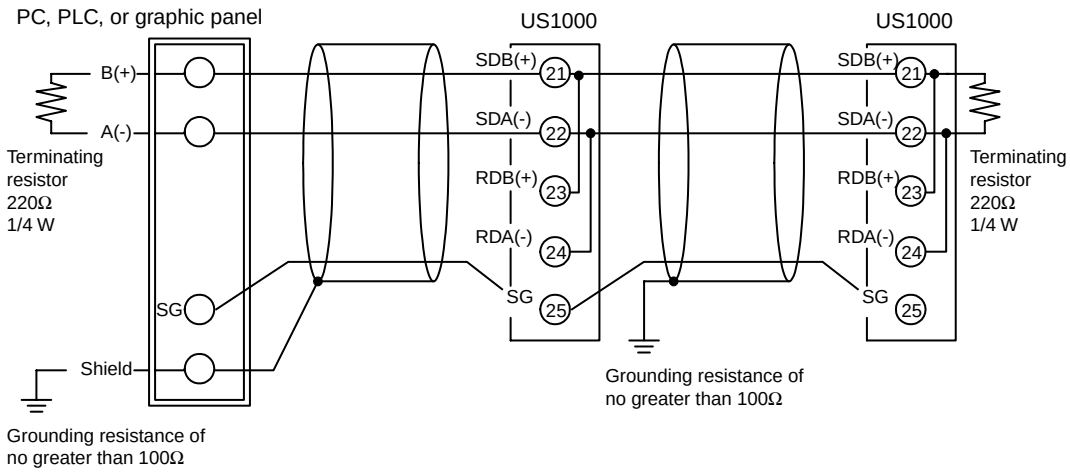



∗ Communication programs should be created referring to the documentation of each higher-level device.

● **For four-wire connection**




● **For two-wire connection**



# 1.2 Notes on Setting Parameters

This section describes the setting parameters for using the communication functions and their setting ranges.

**CAUTION**

The details of the US1000 communication functions need to be the same as those of the communication functions of the higher-level devices to be connected. Check the communication parameters of the higher-level device first, then set up those of the US1000.

**Table 1-1 Parameters to be Set for Communication Functions**

| Parameter Name | Symbol | Setting Range | | Default |
|---|---|---|---|---|
| Protocol selection | PSL | MODBUS communication | 0: ASCII mode<br>1: RTU mode | 0 |
| | | PC link communication | 2: without sum check<br>3: with sum check | |
| Communication rate | BPS | 600, 1200, 2400, 4800, 9600 (Note 1), 19200, 38400 | | 9600 |
| Parity | PARI | N: none, E: even, O: odd | | E |
| Stop bit | STP | 1, 2 | | 1 |
| Data length | DLN | 7, 8 (Note 2) | | 8 |
| Address | ADR | 1 to 99 | | 1 |
| Minimum response time | RSP.T | 0 to 10 (× 10 ms) | | 0 |

Note 1: When the RTU mode is selected for the MODBUS communication in protocol selection, the highest communication rate is 9600 bps.
Note 2: When "0: ASCII mode" is selected for MODBUS communication in protocol selection, the data length is fixed to "7."
When "1: RTU mode" is selected, it is fixed to "8."

● **Protocol selection (PSL)**

Set the same communication protocol as that of the higher-level device to be connected. The US1000 has both MODBUS communication and PC link communication functions.

● **Communication rate (BPS)**

Set the same communication rate as that of the higher-level device to be connected. (Otherwise, proper communication cannot be achieved.) The unit of the communication rate is bps (bits per second).

● **Parity (PARI)**

Set the handling of parity to be carried out when data is sent or received. Set the same parity state as that of the higher-level device to be connected.

● **Stop bit (STP)**

Set the same stop bit as that of the higher-level device to be connected.

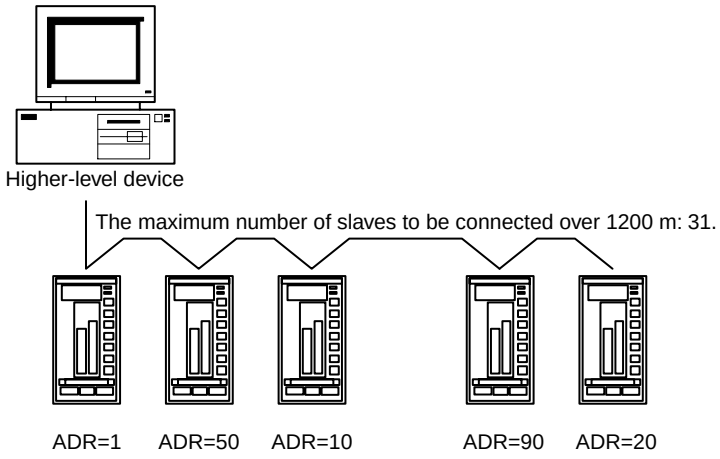
● **Data length (DLN)**

Set the same stop bit as that of the higher-level device to be connected. When MODBUS communication (PSL: 0 or 1) is chosen in protocol selection, the data length is fixed.

### ● Address number (ADR)

Set the address number of the US1000 itself. An address number of 1 to 99 may be assigned in any order. There is however one limitation — the number of US1000s to be connected to a single communication port is limited to 31.

Example of connecting five US1000s to a higher-level device by setting address numbers of 1, 50, 10, 90, and 20




### ● Minimum response time (RSP.T)

Set the time taken to respond to the higher-level device when US1000 receives transmission data from it.

A figure of 0 to 10 may be set. The unit of minimum response time is 10 ms. Response time will be "communication processing time + the set value of RSP.T × 10" milliseconds.

### ● Protocol-by-Protocol Default Parameter Settings

| Communication Protocol \ Parameter | PSL | BPS | PARI | STP | DLN |
|---|---|---|---|---|---|
| MODBUS (ASCII mode) | 0 | 9600 | E | 1 | ⑦ |
| MODBUS (RTU mode) | 1 | 9600 | E | 1 | ⑧ |
| PC-link communication without sum check | 2 | 9600 | E | 1 | 8 |
| PC-link communication with sum check | 3 | 9600 | E | 1 | 8 |

Note: Circled numbers denote fixed values (i.e., parameters can neither be shown nor changed).

# 2. Communication Specifications

The RS-485 communication interface has both the MODBUS communication protocol, and the PC link communication protocol.

**Table 2-1 US1000 Communication Protocol**

| | |
|---|---|
| Communication Hardware | 4-wire or 2-wire RS-485 communication system |
| Terminal | Terminal numbers: 21 to 25 |
| Communication Protocol Specifications | MODBUS communication (RTU mode)<br>MODBUS communication (ASCII mode)<br>PC link communication without sum check<br>PC link communication with sum check |
| Maximum Communication Rate | 38400 bps<br>(up to 9600 bps for MODBUS communication (RTU mode)) |

**Table 2-2 Types of Devices to be Connected**

| Device to be Connected | Communication Protocol | Example of Connected Devices |
|---|---|---|
| PC | MODBUS communication | General-purpose PCs |
| | PC link communication | General-purpose PCs |
| Graphic panels | MODBUS communication | General-purpose graphic panels |
| | PC link communication | See Section 4.2. |
| PLCs (sequencers) | MODBUS communication | General-purpose PLCs (sequencers) |
| | PC link communication | General-purpose PLCs (sequencers) |

## 2.1 RS-485 Communication Specifications

**Table 2-3 RS-485 Communication Interface**

| Item | Specifications |
|---|---|
| Standard | EIA RS-485 compliant |
| Maximum number of devices to be connected | 31 |
| Communication system | 2-wire, half duplex |
| Synchronization | Asynchronous (start-stop) |
| Communication protocol | No-protocol |
| Maximum communication distance | 1200 m |
| Communication rate | 600, 1200, 2400, 4800, 9600, 19200, 38400 |

∗ For the RTU mode of MODBUS communication, the highest communication rate is 9600 bps.

# 3. MODBUS Communication

## 3.1 Overview

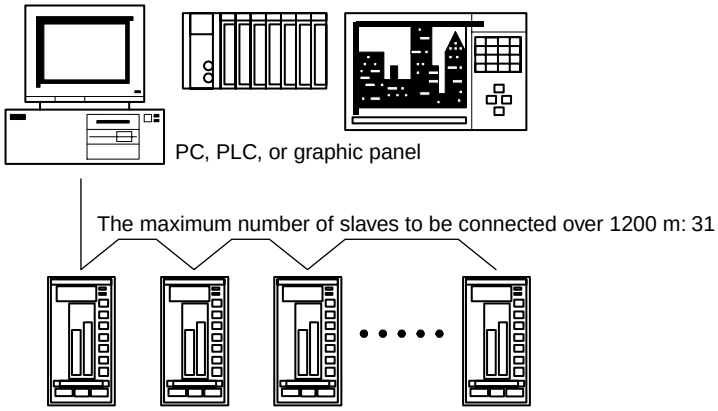



**Figure 3-1 Connection of Slaves in MODBUS Communication**

Use of the MODBUS communication enables US1000s to communicate with a wide variety of devices such as PCs, PLCs (sequencers), and graphic panels. In this communication, you use such device to read/write data from/into D registers, (internal registers) of the US1000.

Hereafter, PCs, PLCs (sequencers), and graphic panels are generally called “higher-level devices.”

**See Also**

Chapter 5 for information on the D registers.

For the MODBUS communication of the US1000, we provide the ASCII mode (ASCII system) and RTU mode (binary system) for the communication mode.

**Table 3-1 ASCII and RTU Modes**

| Item | ASCII Mode | RTU Mode |
|---|---|---|
| Number of data bits | 7 bits (ASCII) | 8 bits (binary) |
| Message start mark | : (colon) | Not necessary |
| Message end mark | CR + LF | Not necessary |
| Length of message (Note 1) | 2N + 1 | N |
| Data time intervals | 1 second or less | 24 bit time or less (Note 2) |
| Error detection | Longitudinal redundancy check: LRC | Cyclic redundancy check: CRC-16 |

Note 1: When the length of a message in the RTU mode, it is assumed to be “N.”
Note 2: When the communication rate is 9600 bps, 1 ÷ 9600 × 24 sec or less.

In the MODBUS communication, a higher-level device identifies each US1000 with a communication address of 1 to 99. Some of the commands used let you specify broadcast that requires no address numbers. For more information on broadcast specifications, see subsection 3.2.1.

### 3.1.1 Configuration of Message

Messages sent from a higher-level device to US1000s, consists of the following elements.

| Element | Start of Message Mark | Address Number (ADR) | Function Code | Data | Error Check | End of Message Mark |
|---|---|---|---|---|---|---|
| Number of bytes in RTU mode | None | 1 | 1 | 2n | 2 | None |
| Number of bytes in ASCII mode | 1 | 2 | 2 | 4n | 2 | 2 |
| | (1) | (2) | (3) | (4) | (5) | (6) |

**(1) Start of Message Mark**
This mark indicates the start of a message. Note that only ASCII mode requires the colon.

**(2) Address Number (1 to 99)**
Address numbers are used by higher-level devices to identify the US1000s at the communication destination. (These numbers are identification numbers specific to individual US1000s.)

**(3) Function Code (See subsection 3.2.1, List of Function Codes)**
The function code specifies a command (function code) from the higher-level device.

**(4) Data**
This element specifies D register numbers, the number of D registers, parameter values, and so on in accordance with the function code.

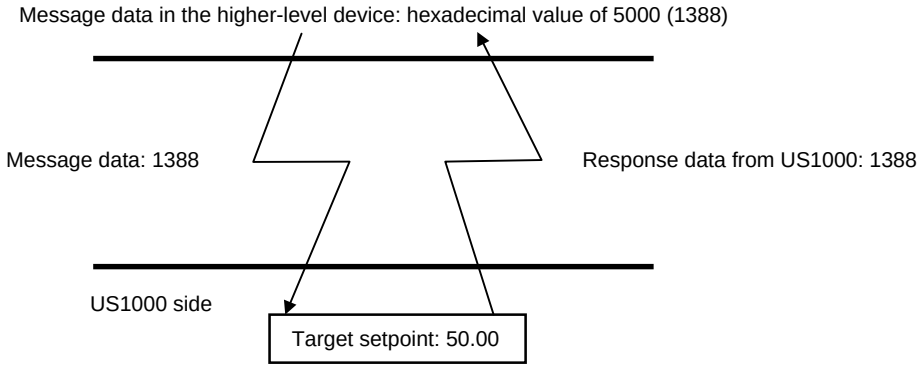
**(5) Error Check**
In RTU mode Carried out by the cyclic redundancy check (CRC-16) system.

In ASCII mode Carried out by the longitudinal redundancy check (LRC) system.

**(6) End of Message Mark**
This mark indicates the end of a message.

Note that only ASCII mode requires CR + LF

● **Message format for communication**
Example: When setting the target setpoint “50.00” to a US1000, the higher-level device sends message data (1388) into a value of “5000” converted into hexadecimals not including the decimal point (thus, this is true for sending both 5.000 or 500.0).




∗ The position of the decimal point for “5000” is determined by the DP (position of decimal point) parameter of the US1000.

# 3.2 Communication with Higher-level Device

The specification of D registers for a message using commercially available SCADA or the like and specification of D registers for a message in customer-created communication programs are different from simple specification of D register numbers. Thus, care should be taken.

(1) When using commercially available SCADA or the like, specify the D register numbers by changing them into reference numbers. D register numbers whose “D” leading character is replaced with “4,” are treated as reference numbers. (When using a DDE server or others, specify these reference numbers.)
(2) For communication programs created by the customer, specify registers using the hexadecimal numbers of values that are obtained by subtracting “40001” from the reference numbers. (Thus, hexadecimal numbers are those to be specified.)

Example: To specify target setpoint “D0301”:

(1) For a message using commercially available SCADA or the like, specify reference number “40301.”
(2) For a message in a customer-created communication program, specify the hexadecimal number, or 012C, of a value (0300) obtained by subtracting 40001 from the reference number.

## 3.2.1 List of Function Codes

Function codes are command words used by the higher-level device to obtain the D register information of US1000s.

**Table 3-2 List of Function Codes**

| Code Number | Function | Description |
|---|---|---|
| 03 | Reads data from multiple D registers. | Capable of reading data from a maximum of 64 successive D registers between D0001 and D1700. |
| 06 | Writes data into D register. | Capable of writing data to one D register between D0201 and D1700. |
| 08 | Performs loop back test. | See subsection 3.2.3, “Function Codes. |
| 16 | Writes data into multiple D registers. | Capable of writing data into a maximum of 32 successive D registers between D0201 and D1700. |

- A write using the function code is not possible for read-only or disabled D registers.
- Broadcast can be specified for function codes 06 and 16 only.

### 3.2.2 Specifying Broadcast

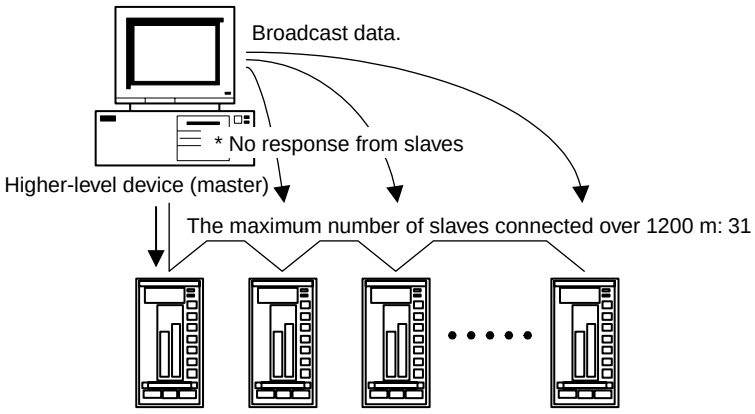



**Figure 3-2 Specifying Broadcast**

Broadcast is a feature in which all connected US1000s can receive the command concerned. Specifying the number in Table 3-3 at the location of the address number in a message enables the higher-level device to write data into the D registers of all US1000s.

**Table 3-3 Broadcast Specification Number**

| Number to be Specified in ADR | Applicable Devices |
|---|---|
| 00 | US1000 |

## 3.2.3 Function Codes

### 03 Reads data from multiple D registers.

● **Function**

This function code reads the contents of successive D registers by the specified number of them starting at a specified D register number.

• The maximum number of D registers to be read at a time is 64.

• For the format of responses in the event of failure, see subsection 3.2.4.

● **Message (for normal operation)**

| Element | Start of Message Mark (:) | Address Number (ADR) | Function Code (03) | D-Register Start Number (Upper Digit) | D-Register Start Number (Lower Digit) |
|---|---|---|---|---|---|
| Number of bytes in RTU mode | None | 1 | 1 | 1 | 1 |
| Number of bytes in ASCII mode | 1 | 2 | 2 | 2 | 2 |

Message (continued)

| Number of D Registers (Upper Digit) | Number of D Registers (Lower Digit) | Error Check | End of Message Mark (CR + LF) |
|---|---|---|---|
| 1 | 1 | 2 | None |
| 2 | 2 | 2 | 2 |

● **Response (for normal operation)**

| Element | Start of Message Mark (:) | Address Number (ADR) | Function Code (03) | Byte Count | Contents of D-Register (Upper Digit) | Contents of D-Register (Lower Digit) | … |
|---|---|---|---|---|---|---|---|
| Number of bytes in RTU mode | None | 1 | 1 | 1 | 1 | 1 | … |
| Number of bytes in ASCII mode | 1 | 2 | 2 | 2 | 2 | 2 | … |

Response (continued)

| Contents of D Registers (Upper Digit) | Contents of D Registers (Lower Digit) | Error Check | End of Message Mark (CR + LF) |
|---|---|---|---|
| 1 | 1 | 2 | None |
| 2 | 2 | 2 | 2 |

● **Example:** Reading the statuses of alarms 1 to 4 from the US1000 with address number 17.

The following message reads four successive D registers starting at alarm 1 (D0915) and address number 17 in the ASCII mode.

**[Message]** **[ : ]11030392000453[CR][LF]**

Start of message mark

"11": address number 17, "03": function code 03, "0392": D register address 0915, "0004": number of D registers 4, and "53": error check

* Numbers in quotation marks are hexadecimal.

The following response is returned with respect to the above message.

**[Response]** **[ : ]11030800000001000100000E2[CR][LF]**

Statuses of alarm1, alarm2, alarm3, alarm4

"08": byte count, "0001": alarm ON, "0000": alarm OFF

## 16 Writes data into D registers.

● **Function**

This function code writes data into successive D registers by the number of specified D registers from a specified D register number.

- The maximum number of D registers into which data is written at a time is 32.
- For the format of response in the event of failure, see subsection 3.2.4.
- Lets you specify broadcast (by setting “00” to the address number).

● **Message (for normal operation)**

| Element | Start of Message Mark (:) | Address Number (ADR) | Function Code (10) | D-Register Start Number (Upper Digit) | D-Register Start Number (Lower Digit) |
|---|---|---|---|---|---|
| Number of bytes in RTU mode | None | 1 | 1 | 1 | 1 |
| Number of bytes in ASCII mode | 1 | 2 | 2 | 2 | 2 |

Massage (continued)

| Number of D Registers (Upper Digit) | Number of D Registers (Lower Digit) | Byte Count | Data (Upper Digit) | Data (Lower Digit) | … | Error Check | End of Message Mark (CR + LF) |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | … | 2 | None |
| 2 | 2 | 2 | 2 | 2 | … | 2 | 2 |

● **Response (for normal operation)**

| Element | Start of Message Mark (:) | Address Number (ADR) | Function Code (10) | D-Register Start Number (Upper Digit) | D-Register Start Number (Lower Digit) |
|---|---|---|---|---|---|
| Number of bytes in RTU mode | None | 1 | 1 | 1 | 1 |
| Number of bytes in ASCII mode | 1 | 2 | 2 | 2 | 2 |

Response (continued)

| Number of D Registers (Upper Digit) | Number of D Registers (Lower Digit) | Error Check | End of Message Mark (CR + LF) |
|---|---|---|---|
| 1 | 1 | 2 | None |
| 2 | 2 | 2 | 2 |

● **Example:** Setting a proportional band of 200, an integral time of 10, and a derivative time of 3 to the US1000 with address number 02.

The following message writes values 200, 10, and 3 in this order in the ASCII mode, starting at the proportional band (D0331) of address number 02.

**[Message]** **[ : ]0210014A00030600C8000A0003C5[CR][LF]**

Start of message mark

“02”: address number 02, “10”: function code 16, “014A”: starts register address 0331, “0003”: number of D registers 3, “06”: byte count, “00C8”: proportional band’s value 200, “000A”: integral time 10, “0003”: derivative time 3, and “C5”: error check

* Numbers in quotation marks are hexadecimal.

The following response is returned with respect to the above message.

**[Response]** **[ : ]0210014A0003A0[CR][LF]**

Number of D registers: 3

## 06 Writes data into D register.

### ● Function

This function code writes data into a specified D register number.

- The maximum number of D registers into which data is written at a time is 1.
- For the format of response in the event of failure, see subsection 3.2.4.
- Lets you specify broadcast (by setting “00” to the address number).

### ● Message (for normal operation)

| Element | Start of Message Mark (:) | Address Number (ADR) | Function Code (06) | D-Register Number (Upper Digit) | D-Register Number (Lower Digit) |
|---|---|---|---|---|---|
| Number of bytes in RTU mode | None | 1 | 1 | 1 | 1 |
| Number of bytes in ASCII mode | 1 | 2 | 2 | 2 | 2 |

Message (continued)

| Write Data (Upper Digit) | Write Data (Lower Digit) | Error Check | End of Message Mark (CR + LF) |
|---|---|---|---|
| 1 | 1 | 2 | None |
| 2 | 2 | 2 | 2 |

### ● Response (for normal operation)

| Element | Start of Message Mark (:) | Address Number (ADR) | Function Code (06) | D-Register Number (Upper Digit) | D-Register Number (Lower Digit) |
|---|---|---|---|---|---|
| Number of bytes in RTU mode | None | 1 | 1 | 1 | 1 |
| Number of bytes in ASCII mode | 1 | 2 | 2 | 2 | 2 |

Response (continued)

| Write Data (Upper Digit) | Write Data (Lower Digit) | Error Check | End of Message Mark (CR + LF) |
|---|---|---|---|
| 1 | 1 | 2 | None |
| 2 | 2 | 2 | 2 |

### ● Example: Setting 70.00 to the target setpoint of the US1000 with address number 01.

The following message writes “7000” to the target setpoint (D0326) at address number 01 in the ASCII mode.

**[Message]** **[ : ]010601451B5840[CR][LF]**

Start of message mark

“01”: address number 01, “06”: function code 06, “0145”: D-register address 0326, “1B58”: target setpoint 70.00, and “40”: error check

* Numbers in quotation marks are hexadecimal.

The response of the same contents is returned with respect to the above message.

**[Response]** **[ : ]010601451B5840[CR][LF]**

Target setpoint: 70.00

## 08 Performs a loop back test.

● **Function**

This function code is used to check connection for communication.

- For the format of response in the event of failure, see subsection 3.2.4.
- The specification of a D register number (marked with an asterisk below) for a loop back test is "00" (fixed).
- Any value can be selected for send data.

● **Message (for normal operation)**

| Element | Start of Message Mark (:) | Address Number (ADR) | Function Code (08) | ✳00 (Upper Digit) | ✳00 (Lower Digit) |
|---|---|---|---|---|---|
| Number of bytes in RTU mode | None | 1 | 1 | 1 | 1 |
| Number of bytes in ASCII mode | 1 | 2 | 2 | 2 | 2 |

Message (continued)

| Send Data (Upper Digit) | Send Data (Lower Digit) | Error Check | End of Message Mark (CR + LF) |
|---|---|---|---|
| 1 | 1 | 2 | None |
| 2 | 2 | 2 | 2 |

● **Response (for normal operation)**

| Element | Start of Message Mark (:) | Address Number (ADR) | Function Code (08) | 00 (Upper Digit) | 00 (Lower Digit) |
|---|---|---|---|---|---|
| Number of bytes in RTU mode | None | 1 | 1 | 1 | 1 |
| Number of bytes in ASCII mode | 1 | 2 | 2 | 2 | 2 |

Response (continued)

| Send Data (Upper Digit) | Send Data (Lower Digit) | Error Check | End of Message Mark (CR + LF) |
|---|---|---|---|
| 1 | 1 | 2 | None |
| 2 | 2 | 2 | 2 |

● **Example:** Sending data 1234h to the US1000 with address number 05 to check connection for communication.

The following message sends "1234" (hexadecimal) to address number 05 in the ASCII mode.

**[Message]** **[ : ]050800001234AD[CR][LF]**

Start of message mark

"05": address number 05, "08": function code 08, "0000": fixed, "1234": send data, and "AD": error check

* Numbers in quotation marks are hexadecimal.

When connection for communication is normal, the following response is returned with respect to the above message.

**[Response]** **[ : ]050800001234AD[CR][LF]**

"1234": send data

## 3.2.4 Response Error Codes

### ● Message Format in the Event of Error

If there is any inconsistency other then communication errors in a message, the US1000 does nothing, but returns the following message.

| Element | Address Number (ADR) | Function Code* | Error Code | Error Check |
|---|---|---|---|---|
| Number of bytes in RTU mode | 1 | 1 | 1 | 2 |
| Number of bytes in ASCII mode | 2 | 2 | 2 | 2 |

∗ The function code contains a function code (hexadecimal number) + 80 (hexadecimal number).

### ● Error Codes in Response

**Table 3-5 List of Error Codes**

| Error Code | Meaning | Description |
|---|---|---|
| 01 | Function code error | No function code exists. |
| 02 | D-register address error | Address out of the range has been specified. |
| 03 | D-register count error | Number of D registers has been specified, being out of the range. |

### ● Even when a message is sent, no response returns if:

- Retransmission error (overrun, framing, parity, LRC, or CRC-16 error) was detected.
- Address in an instructed message is incorrect.
- Interval between data composing a message was 1 second or more.
- Broadcast is specified (address number: 00).

* As a measure against those, provide a timeout process in the communication functions of a higher-level device or in communication programs.

# 4. PC Link Communication

## 4.1 Overview

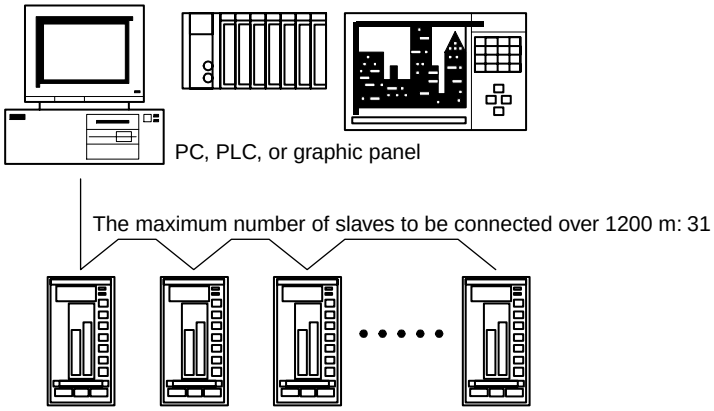



**Figure 4-1 Connection of Slaves in PC Link Communication**

The use of PC link communication enables US1000s to communicate with a device such as a PC, PLC (sequencer), and graphic panel easily. In this communication, you can use such device to read/write data from/into D registers or read data from I relays, both of which are internal registers of the US1000.

Hereafter, PCs, PLCs (sequencers), and graphic panels are generally called “higher-level devices.”

**See Also**

Chapters 5 and 6 for information on the D registers and I relays.

In the PC link communication, a higher-level device identifies each US1000 with a communication address of 1 to 99. Some of commands to use let you to specify broadcast that requires no address numbers. For more information on broadcast specification, see subsection 4.2.2.

### 4.1.1 Configuration of Command

Commands sent from a higher-level device to the US1000, consist of the following elements.

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | Variable length | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|
| Element | STX | Address number (ADR) | CPU number 01 | Time to wait for response 0 | Command | Data corresponding to command | Checksum | ETX | CR |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |

**(1) STX (Start of Text)**
This control code indicates the start of a command. The character code is CHR$(2).

**(2) Address Number (01 to 99)**
Address numbers are used by the higher-level device to identify the US1000s at the communication destination. (They are identification numbers specific to the US1000.)

**(3) CPU Number**
This number is fixed to 01.

**(4) Time to Wait for Response**
This is fixed to 0.

**(5) Command (See subsection 4.2.1, List of Commands)**
Specify a command to be issued from the higher-level device.

**(6) Data Corresponding to Command**
Specify an internal register (D register or I relay), number of data pieces, US1000's parameter value, and others.

**(7) Checksum**
This converts the ASCII codes of texts between the character next to STX and the character immediately before the checksum into hexadecimal values and adds them byte by byte. It then fetches the single lowermost byte of the added results as the checksum.

This column is only required for PC link communication with checksum. PC link communication without checksum does not require this 2-byte space of ASCII code.

**(8) ETX (End of Text)**
This control code indicates the end of a command string. The character code is CHR$(3).

**(9) CR (Carriage Return)**
This control code indicates the end of a command. The character code is CHR$(13).

## NOTE

The control codes STX, ETX, and CR are essential for commands when you create a communication program for PC link communication. Omission of any of them or incorrect order of them results in communication failure.

● **Data Form of Commands**

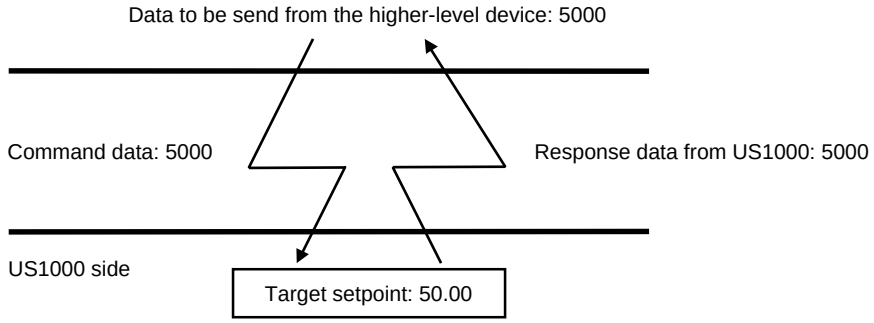
The table below shows the data forms of commands for D registers and I relays.

**Table 4-1 Data Forms of Commands for D Registers and I Relays**

| Type of Data | Contents of Data | Specified Form |
|---|---|---|
| PV high and low limits, target setpoints, and others | Measuring range (EU) data | Numeric data not including the decimal point |
| Bias, deviation alarms, and other | Measuring range width (EUS) data | Numeric data not including the decimal point |
| Proportional bands, upper and lower limits of output, and others | % data (0.0 to 100.0%) | 0 to 1000 |
| Various modes, alarm types, and others | Seconds, absolute values, and data without unit | Absolute values not including the decimal point |

● **Command Format for Communication**

Example: When setting a target setpoint “50.00” to a US1000, the higher-level device sends the value “5000” as command data without the decimal point (this is true for both setting 5.000 or 500.0).




∗ The position of the decimal point for “5000” is determined by the DP (position of decimal point) parameter of the US1000.

## 4.1.2 Configuration of Response

Responses from US1000 with respect to a command sent from the higher-level device consists of the elements shown below, which differ depending on the condition of communication; normal or failure.

**1) Normal Communication**

When communication is complete normally, the US1000s return a character string “OK” and when the read commands, return read-out data.

| Number of Bytes | 1 | 2 | 2 | 2 | Variable length | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|
| Element | STX | Address number (ADR) | CPU number 01 | OK | Parameter data | Checksum | ETX | CR |

**2) In the Event of Failure**

If communication is complete abnormally, the US1000s return a character string “ER” and error code (EC1 and EC2). (See subsection 4.2.4, Response Error Codes.)

- No response is made in case of an error in address number specification or CPU number specification.
- If a US1000 cannot receive ETX in a command, response may not be made.

∗ As a measure against those, provide a timeout process in the communication functions of the higher-level device or in communication programs.

| Number of Bytes | 1 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Element | STX | Address number (ADR) | CPU number 01 | ER | EC1 | EC2 | Command | Checksum | ETX | CR |

# 4.2 Communication with Higher-level Device

In PC link communication, when specifying D registers or I relays, the internal registers of US1000, you can use their numbers as is. The specifications of the number of each internal register are:

- D registers: D**** (****: numeric value)
- I relays: I**** (****: numeric value)

Higher-level devices to be connected to US1000s are those capable of handling the PC link communication protocol. The table below shows connectable graphic panels.

**Table 4-2 List of Graphic Panels Connectable**

| | Product | Name | Remarks |
|---|---|---|---|
| Pro-face by Digital Electronics Corporation | GP70 series | Graphic control panel | Note |
| | GP-J series | High-speed graphic control panel | |
| | GP-230 series | Medium-size graphic control panel | |
| | GP-430 series | Advanced, high-speed graphic control panels | |
| | GP-530 series | | |

For Digital's graphic panels, contact Digital Electronics Corporation directly.
Note: Display devices differ with the model.

For more information, see the documentation of each graphic panel to be connected.

As an example of communication program, Section 4.3 shows an example of BASIC program created using Microsoft Quick BASIC.

### 4.2.1 List of Commands

The following shows the lists of commands available in PC link communication. The details of them are explained in the description of each command.

**(1) Bit-basis Access Commands Dedicated to I Relays**

| Command | Description | Number of Bits to be Handled |
|---|---|---|
| BRD | Bit-basis read | 1 to 256 bits |
| BWR | Bit-basis write | 1 to 256 bits |
| BRR | Bit-basis, random read | 1 to 32 bits |
| BRW | Bit-basis, random write | 1 to 32 bits |
| BRS | Specifies I relays to be monitored on a bit-by-bit basis. | 1 to 32 bits |
| BRM | Bit-basis monitoring | — |

**(2) Word-basis Access Commands**

| Command | Description | Number of Bits to be Handled |
|---|---|---|
| WRD | Word-basis read | 1 to 64 words |
| WWR | Word-basis write | 1 to 64 words |
| WRR | Word-basis, random read | 1 to 32 words |
| WRW | Word-basis, random write | 1 to 32 words |
| WRS | Specified internal registers to be monitored on a word basis | 1 to 32 words |
| WRM | Word-basis monitoring | — |

**(3) Information Command**

| Command | Description | Number of Devices to be Handled |
|---|---|---|
| INF | Reads model, presence/absence of option, and revision. | 1 |

**(4) Broadcast Command (available only when “BS” is set to the address number)**

| Command | Description | Number of Devices to be Handled |
|---|---|---|
| BCR | Reads the identical registers of multiple US1000s collectively. | 1 to 15 |
| BCW | Writes different values into the identical registers of multiple US1000s collectively. | 1 to 15 |

### 4.2.2 Specifying Broadcast

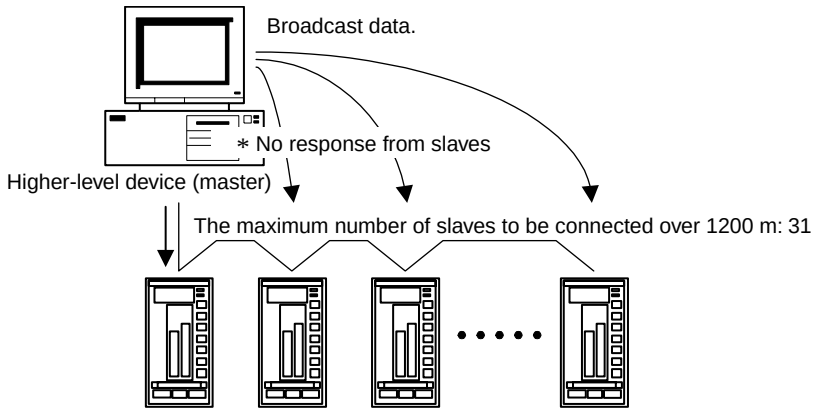



**Figure 4-2 Specifying Broadcast**

The broadcast function enables all of the connected US1000s or other devices to receive a command. Specifying an address number in Table 4-3 for the address number column in a command enables the higher-level device to read/write data from/into the internal registers of all US1000s or other devices.

For US1000s, internal registers (D registers and I relays) are assigned with numbers for management. (See chapters 5 and 6 for details.) For the internal registers of other models, see the documentation of the relevant model.

**Table 4-3 Address Numbers**

| ADR | Applicable Devices |
|---|---|
| BA | All Green series controllers (including US1000s) |
| BS | All US1000s |
| 00 | All devices that can handle PC link communication (including US1000s) |

## 4.2.3 Commands

### BRD Reads I relays on a bit-by-bit basis.

● **Function**

Reads a sequence of contiguous ON/OFF statuses by the specified number of bits starting at a specified I relay number.

- The number of bits to be read at a time is 1 to 256.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without checksum, do not include the 2-byte checksum command element in the command.

● **Command/Response (for normal operation)**

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 5 | 1 | 3 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | BRD | I relay number | Comma or space | Number of bits (n) | Checksum | ETX | CR |

| Number of Bytes | 1 | 2 | 2 | 2 | 1 | 1 | 1 | … | 1 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | d1 | d2 | d3 | … | dn | Checksum | ETX | CR |

The response is “0” when the status is OFF or “1” when ON.

dn: read data to the extent of the specified number of bits (n = 1 to 256)
dn = 0 (OFF)
dn = 1 (ON)

● **Example: Reading the status of alarm 1 of the US1000 with address number 01**

The following command reads the status of alarm 1 (I0097) at address number 01.

**[Command] STX$+ “01010BRDI0097, 001A0” +ETX$+CR$**

The following response is returned with respect to the above command. (Alarm 1 is ON.)

**[Response] STX$+ “0101OK18D” +ETX$+CR$**

Alarm has been ON since 1 was returned.

**BWR Writes data into I relays on a bit-by-bit basis.**

● **Function**

Writes ON/OFF data into a sequence of contiguous I relays at intervals of the specified number of bits and starting at a specified I relay number.

- The number of bits to be written at a time is 1 to 256.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes a checksum function. When performing communication without checksum, do not include the 2-byte checksum command element in the command.

● **Command/Response (for normal operation)**

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 5 | 1 | 3 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | BWR | I relay number | Comma or space | Number of bits (n) | Comma or space | d1 | d2 |

Command (continued)

| … | 1 | 2 | 1 | 1 |
|---|---|---|---|---|
| … | dn | Checksum | ETX | CR |

Write information is “0” when it is OFF or “1” when it is ON.

(dn: write data to the extent of the specified number of bits (n = 1 to 256)
dn = 0 (OFF)
dn = 1 (ON))

| Number of Bytes | 1 | 2 | 2 | 2 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | Checksum | ETX | CR |

● **Example:** Setting the user-defined flag of the US1000 with address number 01 to ON.

The following command writes ON into the user-defined flag (I0865) at address number 01.

**[Command] STX$+ “01010BWRI0865, 001, 1B3” +ETX$+CR$**

Note: The user-defined flag is a flag the user can read/write without restraint. For areas available to the user, see Chapter 6, Functions and Applications of I Relays.

“OK” is returned as the response to the above command.

**[Response] STX$+ “0101OK5C” +ETX$+CR$**

## BRR Reads I relays on a bit-by-bit basis in a random order.

● **Function**

Reads the ON/OFF statuses of I relays at intervals of the specified number of bits in a random order.

- The number of bits to be read at a time is 1 to 32.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes a checksum function. When performing communication without a checksum, do not include the 2-byte checksum command element in the command.

● **Command/Response (for normal operation)**

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 2 | 5 | 1 | 5 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | BRR | Number of bits (n) | I relay number 1 | Comma or space | I relay number 2 | Comma or space |

Command (continued)

| … | 5 | 2 | 1 | 1 |
|---|---|---|---|---|
| … | I relay number n | Checksum | ETX | CR |

| Number of Bytes | 1 | 2 | 2 | 2 | 1 | 1 | … | 1 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | d1 | d2 | … | dn | Checksum | ETX | CR |

The response is “0” when the status is OFF or “1” when ON.

dn: read data to the extent of the specified number of bits (n = 1 to 32)
dn = 0 (OFF)
dn = 1 (ON)

● **Example:** Reading the statuses of alarms 1 and 4 of the US1000 with address number 05

The following command reads the statuses of alarm 1 (I0097) and alarm 4 (I0101) at address number 05.

**[Command] STX$+ “05010BRR04I0097, I010190” +ETX$+CR$**

With respect to the above command, the ON and OFF responses are returned for alarms 1 and 4 respectively.

**[Response] STX$+ “0501OK10C1” +ETX$+CR$**

Alarm 1 has been ON.

**BRW Writes data into I relays on a bit-by-bit basis in a random order.**

● **Function**

Writes ON/OFF statuses into I relays at intervals of the specified number of bits on a per-I relay basis and in random order.

- The number of bits to be written at a time is 1 to 32.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without a checksum, do not include the 2-byte checksum command element in the command.

● **Command/Response (for normal operation)**

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 2 | 5 | 1 | 1 | 1 | 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | BRW | Number of bits (n) | I relay number 1 | Comma or space | d1 | Comma or space | I relay number 2 |

Command (continued)

| 1 | 1 | 1 | … | 5 | 1 | 1 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|
| Comma or space | d2 | Comma or space | … | I relay number n | Comma or space | dn | Checksum | ETX | CR |

Write information is “0” when it is OFF or “1” when it is ON.

dn: write data to the extent of the specified number of bits (n = 1 to 32)
dn = 0 (OFF)
dn = 1 (ON)

| Number of Bytes | 1 | 2 | 2 | 2 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | Checksum | ETX | CR |

● **Example:** Setting four user-defined flags of the US1000 with address number 05 to ON, OFF, OFF, and ON.

The following command sets the four user-defined flags (I0721, I0722, I0723, and I0724) at address number 05 to ON, OFF, OFF, and ON respectively.

**[Command] STX$+ “05010BRW04I0721, 1, I0722, 0, I0723, 0, I0724, 18D” +ETX$+CR$**

Note: The user-defined flags (I relays) are flags that the user can freely read/write. For areas available to the user, see Chapter 6, Functions and Applications of I Relays.

“OK” is returned as the response to the above command.

**[Response] STX$+ “0501OK60” +ETX$+CR$**

## BRS Specifies I relays to be monitored on a bit-by-bit basis.

● **Function**

Specifies the numbers of I relays to be monitored on a bit-by-bit basis. Note that this command simply specifies I relays. Actual monitoring is performed by the BRM command after the I relay numbers are specified.

When the volume of data is large and you wish to increase the communication rate, it is effective to use a combination of the BRS and BRM commands rather than the BRD command.

- The number of registers to be specified at a time is 1 to 32.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without a checksum, do not include the 2-byte checksum command element in the command.

● **Command/Response (for normal operation)**

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 2 | 5 | 1 | 5 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | BRS | Number of bits (n) | I relay number 1 | Comma or space | I relay number 2 | Comma or space |

Command (continued)

| … | 5 | 2 | 1 | 1 |
|---|---|---|---|---|
| … | I relay number n | Checksum | ETX | CR |

| Number of Bytes | 1 | 2 | 2 | 2 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | Checksum | ETX | CR |

● **Example:** Monitoring the stop status of the US1000 with address number 05

The following command monitors the stop status (I0067) at address number 05.

(This command is used for simply specifying registers.)

**[Command] STX$+ “05010BRS01I006754” +ETX$+CR$**

“OK” is returned as the response to the above command.

**[Response] STX$+ “0501OK60” +ETX$+CR$**

## BRM Monitors I relays on a bit-by-bit basis.

● **Function**

Reads the ON/OFF statuses of I relays that have been specified in advance by the BRS command.

- Before executing this command, the BRS command must always be executed to specify which I relays are to be monitored. If no relay has been specified, error code 06 is generated. This error also occurs if the power supply is turned off.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum command element in the command.

● **Command/Response (for normal operation)**

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | BRM | Checksum | ETX | CR |

| Number of Bytes | 1 | 2 | 2 | 2 | 1 | 1 | 1 | … | 1 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | d1 | d2 | d3 | … | dn | Checksum | ETX | CR |

The response is “0” when the status is OFF or “1” when ON.

dn: read data to the extent of the number of bits specified by the BRS command (n = 1 to 32)
dn = 0 (OFF)
dn = 1 (ON)

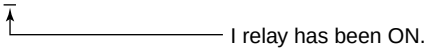
● **Example:** Monitoring the stop status of the US1000 with address number 05

The following command monitors the stop status (I0067) at address number 05.
(This command reads the statuses of the I relays specified by the BRS command.)

**[Command] STX$+ “05010BRMD7” +ETX$+CR$**

The ON/OFF status of the I relay is returned as the response to the above command.

**[Response] STX$+ “0501OK191” +ETX$+CR$**



## WRD Reads D registers and I relays on a word-by-word basis.

### ● Function

Reads a sequence of contiguous register information on a word-by-word basis, by the specified number of words, and starting at the specified register number.

- The number of words to be read at a time is 1 to 64.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum command element in the command.

### ● Command/Response (for normal operation)

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 5 | 1 | 2 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | WRD | Register number | Comma or space | Number of words (n) | Checksum | ETX | CR |

| Number of Bytes | 1 | 2 | 2 | 2 | 4 | 4 | … | 4 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | dddd1 | dddd2 | … | ddddn | Checksum | ETX | CR |

The response is returned in a 4-digit character string (0000 to FFFF) in a hexadecimal pattern.

Read data of the specified number of words
ddddn = character string in a hexadecimal pattern
n = 1 to 64

● **Example:** Reading a measured input value of the US1000 with address number 03
The following command reads the measured input value (D0003) at address number 03.

**[Command] STX$+ “03010WRDD0003, 01A5” +ETX$+CR$**

The measured input value 200 (00C8 (HEX)) is returned as the response to the above command.

**[Response] STX$+ “0301OK00C839” +ETX$+CR$**

**WWR Writes data into D registers and I relays on a word-by-word basis.**

● **Function**

Writes information into a sequence of contiguous registers on a word-by-word basis, by the specified number of words, and starting at the specified register number.

- The number of words to be written at a time is 1 to 64.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum command element in the command.

● **Command/Response (for normal operation)**

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 5 | 1 | 2 | 1 | 4 |
|---|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | WWR | Register number | Comma or space | Number of words (n) | Comma or space | dddd1 |

Command (continued)

| 4 | … | 4 | 2 | 1 | 1 |
|---|---|---|---|---|---|
| dddd2 | … | ddddn | Checksum | ETX | CR |

Write information is specified in a 4-digit character string (0000 to FFFF) in a hexadecimal pattern.

( Write data of the specified number of words
ddddn = character string in a hexadecimal pattern
n = 1 to 64 )

| Number of Bytes | 1 | 2 | 2 | 2 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | Checksum | ETX | CR |

● **Example:** Writing “200” into target setpoint 1 of the US1000 with address number 03.

The following command writes data 200 (00C8 (HEX)) into the target setpoint 1 (D0301) at address number 03.

**[Command] STX$+ “03010WWRD0301, 01, 00C8C0” +ETX$+CR$**

**“**OK**”** is returned as the response to the above command.

**[Response] STX$+ “0301OK5E” +ETX$+CR$**

## WRR Reads D registers and I relays on a word-by-word basis in random order.

### ● Function

Reads the statuses of registers on a word-by-word basis, by the specified number of words and in a random order.

- The number of words to be read at a time is 1 to 32.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum command element in the command.

### ● Command/Response (for normal operation)

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 2 | 5 | 1 | 5 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | WRR | Number of words (n) | Register number 1 | Comma or space | Register number 2 | Comma or space |

Command (continued)

| … | 5 | 2 | 1 | 1 |
|---|---|---|---|---|
| … | Register number (n) | Checksum | ETX | CR |

| Number of Bytes | 1 | 2 | 2 | 2 | 4 | 4 | … | 4 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | dddd1 | dddd2 | … | ddddn | Checksum | ETX | CR |

The response is returned in a 4-digit character string (0000 to FFFF) in a hexadecimal pattern.

( ddddn = character string in a hexadecimal pattern (n = 1 to 32) )

● **Example:** Reading the measured input and output values of the US1000 with address number 10.
The following command reads the measured input value (D0003) and output value (D0005) at address number 10.

**[Command] STX$+ “10010WRR02D0003, D000558” +ETX$+CR$**

The measured input value 200 (00C8 (HEX)) and output value 50 (0032 (HEX)) are returned as the response to the above command.

**[Response] STX$+ “1001OK00C80032FC” +ETX$+CR$**

## WRW Writes data into D registers and I relays on a word-by-word basis in random order.

### ● Function

Writes register information specified for each register into registers of the specified number of words in a random order.

- The number of words to be written at a time is 1 to 32.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum command element in the command.

### ● Command/Response (for normal operation)

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 2 | 5 | 1 | 4 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | WRW | Number of words (n) | Register number 1 | Comma or space | dddd1 | Comma or space |

Command (continued)

| 5 | 1 | 4 | … | 5 | 1 | 4 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|
| Register number 2 | Comma or space | dddd2 | … | Register number n | Comma or space | ddddn | Checksum | ETX | CR |

Write information is specified in a 4-digit character string (0000 to FFFF) in a hexadecimal pattern.

( Repetition of register numbers and write information by the specified number of words
ddddn = character string in a hexadecimal pattern
n = 1 to 32 )

| Number of Bytes | 1 | 2 | 2 | 2 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | Checksum | ETX | CR |

● **Example:** Writing “20.0” into target setpoint 1 of the US1000 with address number 10 and “15.0” into the alarm-1 setpoint.

The following command writes
“20.0” into target setpoint 1 (D0301) and “15.0” into the alarm-1 setpoint (D0231) at address number 10.

**[Command] STX$+ “10010WRW02D0301, 00C8, D0231, 009694” +ETX$+CR$**

Target setpoint: 200 — Alarm setpoint: 150

“OK” is returned as the response to the above command.

**[Response] STX$+ “1001OK5C” +ETX$+CR$**

## WRS Specifies the D registers and I relays to be monitored on a word-by-word basis.

### ● Function

Specifies the numbers of the registers to be monitored on a word-by-word basis. Note that this command simply specifies the registers. Actual monitoring is performed by the WRM command after the register numbers are specified by this command.

If the volume of data is large and you wish to increase the communication rate, it is useful to use a combination of the WRS and WRM commands rather than the WRD command. If the power supply is turned off, the register numbers specified will be erased.

- The number of words to be specified at a time is 1 to 32.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum command element in the command.

### ● Command/Response (for normal operation)

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 2 | 5 | 1 | 5 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | WRS | Number of words (n) | Register number 1 | Comma or space | Register number 2 | Comma or space |

Command (continued)

| … | 5 | 2 | 1 | 1 |
|---|---|---|---|---|
| … | Register number n | Checksum | ETX | CR |

| Number of Bytes | 1 | 2 | 2 | 2 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | Checksum | ETX | CR |

● **Example:** Monitoring the measured input value of the US1000 with address number 01
The following command monitors the measured input value (D0003) at address number 01. (This command simply specifies the registers.)

**[Command]** **STX$+ “01010WRS01D000356” +ETX$+CR$**

CPU number: 01 — D register number: D0003

“OK” is returned as the response to the above command.

**[Response]** **STX$+ “0101OK5C” +ETX$+CR$**

## WRM Monitors the D register and I relays on a word-by-word basis.

● **Function**

Reads register information that has been specified in advance by the WRS command.

- Before executing this command, the WRS command must always be executed to specify which registers are to be monitored. If no register has been specified, error code 06 is generated. This error also occurs if the power supply is turned off.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum command element in the command.

● **Command/Response (for normal operation)**

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | WRM | Checksum | ETX | CR |

| Number of Bytes | 1 | 2 | 2 | 2 | 4 | 4 | … | 4 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | dddd1 | dddd2 | … | ddddn | Checksum | ETX | CR |

The response is returned in a 4-digit character string (0000 to FFFF) in a hexadecimal pattern.

( Read data of the number of words specified by the WRS command
ddddn = character string in a hexadecimal pattern
n = 1 to 32 )

● **Example:** Monitoring the measured input value of the US1000 with address number 01

The following command monitors the measured input value (D0003) at address number 01.

(This command reads the statuses of the registers specified by the WRS command.)

**[Command]** **STX$+ “01010WRME8” +ETX$+CR$**

CPU number: 01

The measured input value 200 (00C8 (HEX)) is returned as the response to the above command.

**[Response]** **STX$+ “0101OK00C837” +ETX$+CR$**

Measured input value: 200

## INF Reads the model, presence or absence of options, and revisions.

### ● Function

Returns the model number of the US1000, whether any options are included, and the version number and revision number are read.

- For the format of response in the event of failure, see subsection 4.1.2.

### ● Command/Response (for normal operation)

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 1 | 2 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (ADR) | CPU number 01 | 0 | INF | 6 | Checksum | ETX | CR |

| Number of Bytes | 1 | 2 | 2 | 2 | 8 | 7 | 1 | 4 | 4 |
|---|---|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | US10□□-□ (Note 1) | V01.R00 (Note 2) | Space | Readout start register for special device | Number of readout registers for special device |

Response (continued)

| 4 | 4 | 2 | 1 | 1 |
|---|---|---|---|---|
| Write start register for special device | Number of write registers for special device | Checksum | ETX | CR |

**Note 1: Model and option of US1000**

**US10□□-□**

0: without communication (A10) option
1: with communication (A10) option

00: basic type
11: enhanced type (with custom computation)
21: position proportional type (with custom computation)

Example: US1000-1 → US1000-00/A10 (basic type with communication option)
US1011-1 → US1000-11/A10 (enhanced type with communication option)
US1021-0 → US1000-21 (position proportional type without communication option)

**Note 2: version number and revision number**

**V01. R00**

Revision number
Version number

## NOTE

The BCR command is available only if the communication wiring is configured using the two-wire method (i.e., the command is not available with the four-wire configuration).

● **Function**

Reads the identical registers of multiple US1000s collectively.

- For the format of response in the event of failure, see subsection 4.1.2.
- The number of US1000s to be read at a time is 1 to 15 and address numbers must be cousecutive.

● **Command/Response (for normal operation)**

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 1 | 4 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (BS) | CPU number 01 | 0 | BCR | First address number | Last address number | Comma or space | D Register number | ETX | CR |

| Number of Bytes | 1 | 2 | 2 | 2 | 4 | 1 | 1 | 1 | … | 2 | 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | data | ETX | Temporary delimiter (&) | Temporary STX (%) | … | Address number (ADR) | CPU number 01 |

Response (continued)

| 2 | 4 | 1 | 1 |
|---|---|---|---|
| OK | data | ETX | CR |

● **Example:** Reading the target setpoint 1 from US1000s with address numbers 02 to 04.

The following command reads the target setpoint 1 (D0301) at address numbers 02 to 04.

**[Command]** **STX$+ “BS010BCR0204, D0301” +ETX$+CR$**

CPU number: 01 — Address number: 02 to 04

The target setpoint 1 at addresses 02 to 04 are returned in response to the above command.

**[Response]** **STX$+ “0201OK00C8” +ETX$+ “&”+“%0301OK0096” +ETX$ + “&”+“%04010K0064”+ ETX$+CR$**

(Address no.: 02, target setpoint: 200)

(Address no.: 03, target setpoint: 150)

(Address no.: 04, target setpoint: 100)

## BCW Writes different values into identical registers collectively.

## NOTE

The BCW command is available only if the communication wiring is configured using the two-wire method (i.e., the command is not available with the four-wire configuration).

### ● Function

Writes different values into the identical registers of multiple US1000s collectively.

- For the format of response in the event of failure, see subsection 4.1.2.
- The number of US1000s to be written at a time is 1 to 15 and address numbers must be cousecutive.

### ● Command/Response (for normal operation)

| Number of Bytes | 1 | 2 | 2 | 1 | 3 | 2 | 2 | 1 | 4 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|
| Command element | STX | Address number (BS) | CPU number 01 | 0 | BCW | First address number | Last address number | Comma or space | Register number | Comma or space |

Command (continued)

| 4 | … | 1 | 4 | 1 | 1 |
|---|---|---|---|---|---|
| data | … | Comma or space | data | ETX | CR |

| Number of Bytes | 1 | 2 | 2 | 2 | 1 | 1 | 1 | … | 2 | 2 |
|---|---|---|---|---|---|---|---|---|---|---|
| Response element | STX | Address number (ADR) | CPU number 01 | OK | ETX | Temporary delimiter (&) | Temporary STX (%) | … | Address number (ADR) | CPU number 01 |

Response (continued)

| 2 | 1 | 1 |
|---|---|---|
| OK | ETX | CR |

● **Example:** Writing different values into target setpoint 1 of US1000s with address numbers 02 to 04. (Setting target setpoint 200 to address number 02, target setpoint 150 to address number 03, and target setpoint 100 to address number 04)

The following command writes different values into target setpoint 1 (D0301) at address numbers 02 to 04.

**[Command]** **STX$+ “BS010BCW0204, D0301, 00C8, 0096, 0064” +ETX$+CR$**

(Target setpoints 200, 150, and 100)

“OK” is returned as the response to the above command.

**[Response]** **STX$+ “0201OK” +ETX$+ “&”+“%0301OK” +ETX$ + “&”+“%0401OK”+ ETX$+CR$**

### 4.2.4 Response Error Codes

**See Also**

Subsection 4.1.2, Configuration of Response, for the structure of the response in the event of error.

The error codes (EC1) and detailed error codes (EC2) of response are as follows.

**Table 4-4 List of Error Codes EC1**

| Error Code | Meaning | Causes |
|---|---|---|
| 02 | Command error | • No command exists.<br>• Command not executable |
| 03 | Internal register specification error | • No register number exists.<br>• If a bit register (I relay) is used on a word-by-word basis, its specification is not correct. |
| 04 | Out of setpoint range | • A character other than 0 or 1 has been used for the bit setting.<br>• A value other than 0000 to FFFF has been specified in the word specification.<br>• The position of a start for a data load, save, or other command, is out of the address range. |
| 05 | Out of data number range | • The specification of the number of bits or words is out of the range of use.<br>• The number of data specified and the number of parameters for registers, etc. are not consistent. |
| 06 | Monitor error | • An attempt was made to execute monitoring without specifying the monitor (BRS or WRS). |
| 08 | Comma (,)/EXT-related Error | • No comma (,) or EXT exists in the command. |
| 41 | Communication error | • Error occurred during communication. |
| 42 | Sum Error | • The sum does not match the expected value. |
| 44 | Timeout between received characters | • No terminal character or ETX has been received. |

**Table 4-5 List of Detailed Error Codes EC2**

| Error Code (EC1) | Meaning | Detailed Error Code (EC2) |
|---|---|---|
| 03 | Device specification error | Parameter number where error occurred (HEX)<br>This is the number of a parameter in sequence that first resulted in error when counted from the leading parameter.<br>**Example:**<br>Error in device name specification<br>↓<br>**STX 01010BRW 30 I0721, 1, I0722, 0, A00502**<br>Parameter numbers 1 2 3 4 5 6<br><br>In this case, EC1 = 03 and EC2 = 06 |
| 04 | Out of setpoint range | |
| 05 | Out of data number range | |
| 41 | Communication error | b7 b6 b5 b4 b3 b2 b1 b0<br>Each bit has the following meaning:<br>b5: framing error<br>b4: overrun error<br>b3: parity error<br>b7, b6, b2, b1, and b0: reserved for system |

For error codes other than those noted as EC1, there is no EC2 meaning.

# 4.3 Example of BASIC Program for Send and Receive

This section shows an example of a command sending and response receiving program created with Microsoft Quick BASIC*2 for PC/AT*1 (or compatible machines).

The communication conditions of the US1000 and those of the PC (e.g., communication rate) must agree with each other. Set the communication rate (baud rate) of the PC using the SWITCH command of MS-DOS*3. For how to use the SWITCH command, refer to the User's Reference Manual of MS-DOS. Moreover, set the parity, character bit length, stop bit length, and so on using the OPEN statement.

*1 PC/AT is the product of IBM Corporation.
*2 Microsoft Quick BASIC is a registered trademark of Microsoft Corporation.
*3 MS-DOS is a registered trademark of Microsoft Corporation.

**Example of the Program Created Using Microsoft Quick BASIC Version 7.1 (Read the values in three D registers from register 0003)**

```
1000  '  === Main routine ===
1010  STX$=CHR$(2)                                  ' Define
1020  ETX$=CHR$(3)                                  ' Define
1030  CR$=CHR$(13)                                  ' Define
1040  RCVCHR$= ""                                   ' Initialize receive character string
1050  fRCVEND=0                                     ' Initialize flag
1060  fTIMEOUT=0                                    ' Initialize flag
1070  '
1080  SEND$=STX$+"01010WRDD0003,03"+ETX$            ' Create character string for send
1090  '
1100  OPEN "COM1:9600,N,8,1,ASC"  FOR RANDOM AS #1  ' Open a port
1110     ON COM(1) GOSUB receivechr                 ' Specify interruption processing during
                                                      receiving
1120     ON TIME(5) GOSUB timeout                   ' Specify interruption processing at timeout
1130  '
1140     PRINT #1,SEND$                             ' Send
1150     COM(1) ON                                  ' Permit interruption during receive
1160     TIMER ON                                   ' Start timer
1170  '
1180     DO                                         ' Wait for receive end or timeout
1190     LOOP WHILE fRCVEND=0 AND fTIMEOUT=0        '
1200  '
1210     TIMER OFF                                  ' Stop timer
1220     COM(1) OFF                                 ' Prohibit interruption during receiving
1230     CLOSE #1                                   ' Close the port
1240  '
1250     PRINT ">"+SEND$                            ' Display sent character string on screen
1260     PRINT "<"+RCVCHR$                          ' Display received character string on
                                                      screen
1270     END                                        ' END
1280  '
1290  '  === Subroutine ===
1300  receivechr:                                   ' Interruption processing during receiving
1310     CHR1$=INPUT\(1,#1)                         ' Fetch characters from receive buffer
                                                      one by one
1320     IF CHR1$=CR$   THEN                        ' If received character string is "CR,"
1330     IF RCVCHR$=SEND$ THEN                      ' If received character string is the same
                                                      served command,
1340     RCVCHR$= ""                                ' Initialize receive character string. (Echo
                                                      Back Processing)
1350     fRCVEND=0                                  ' receiving flag remains initialised at 0.
1360     ELSE                                       ' If received character string is different
                                                      from served command,
1370        fRCVEND=1                               ' receiving end flag is set.
1380     END IF                                     '
1390     ELSE                                       ' If it is a character other than CR,
1400        fRCVEND=0                               ' receiving end flag remains initialized at 0.
1410     RCVCHR$=RCVCHR$+CHR1$                      ' Create received character string
1420     END IF                                     '
1430  RETURN
1440  '
```

```
1450   timeout:                                    ‘ Timeout processing
1460      fTIMEOUT=1                               ‘ Set timeout flag
1470      RCVCHR$=″Time out !  (5 sec)″+CR$        ‘ Character string for display on screen
                                                     “Time out! (5 sec)”
1480   RETURN
  ↑
```

* The line numbers are not required. (They are simply provided for checking the number of program steps.)

# 5. Functions and Usage of D Registers

## 5.1 Overview of D Registers

This section explains the functions and usage of D registers.

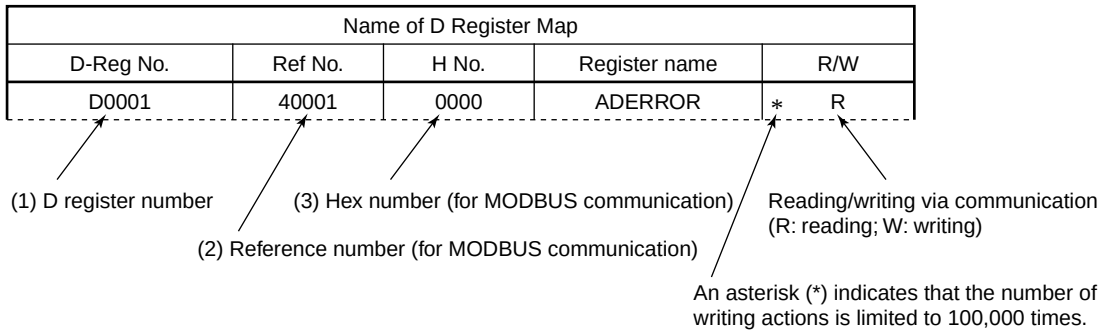
The D registers store the parameter data, flag data and process data that are handled by the US1000 controller. By connecting the US1000 controller to higher-order equipment capable of MODBUS communication or PC link communication, you can readily use these internal data items by reading from or writing to the D registers.

Using the D registers, you can perform:

- Centralized control using higher-order equipment
- Data exchange by reading/writing using higher-order equipment

## 5.2 Interpretation of Lists of D Registers (D Register Map Tables)

This section explains how to read the “D Register Map” tables in this chapter. In the example shown below, the number in the leftmost column denotes a register number “1”. The five-digit number in the column on the immediate right of the leftmost column represents a reference number for MODBUS communication “2”. The number in the column third from left is a register number (hexadecimal) for the MODBUS communication program “3”. Each register code name in the D Register Map tables represents a specific process data item, operation parameter, setup parameter or other data items such as flags. For details on the operation and setup parameters, see the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E).




### ■ Names of D Registers

The base names of some D registers are preceded by a combination of a number and then a period, and/or followed by a combination of a period and then a number, as shown in the format Y.□□□.X. In this format, Y represents the group number and X denotes the loop number.

Examples:

- The name 3.SV.1 means the SV in group 3 and for loop 1.
- The name MV.2 means the MV in loop 2.

# 5.3 Classification of D Registers

## ■ Classification of D Register Map Tables

The table below outlines how the D registers are classified by their numbers in the D Register Map tables.

**Table 5-1 Classification of D Registers**

| Register No. | Area and Data Categories | | Description | Reference |
|---|---|---|---|---|
| D0001 to 0049 | Process data area (Note 1) | Operating data | PV, SV, MV and other values | Section 5.4 |
| D0050 to 0100 | User area (Note 2), represented by shaded section in the table | — | Used for communication with the Graphic Panel. | Section 5.4 |
| D0101 to 0200 | Must not be used. | | | |
| D0201 to 0230 | Operation parameters *1 | Mode parameter data area | CAM, MMV, etc. | Section 5.5 |
| D0231 to 0300 | | Loop-1 and -2 computation parameter area | AT, SC, BS, FL, etc. | Sections 5.6 and 5.7 |
| D0301 to 0800 | | Loop-1 and -2 PID parameter area; user parameter area; and area for ten-segment linearizer parameters | P, I, D, etc. | Sections 5.6 to 5.8 |
| D0801 to 0900 | Messages | Message area | On-screen messages (each comprising up to 33 alphanumeric characters) | Section 5.8 |
| D0901 to 1000 | Setup parameters *1 | Loop-1 and 2 control parameter area | SV, ALM, CTL | Section 5.9 |
| D1001 to 1100 | | Loop common control function parameter area | AIN, RET, TRND, LOCK | Section 5.9 |
| D1101 to 1200 | | I/O configuration parameter area | CSEL, DO, DI, C.PYS | Section 5.9 |
| D1201 to 1300 | | Controller mode parameter area; analog input parameter area; and MV-output parameter area | USMD, IN, OUT, R485, INIT | Section 5.10 |

Note 1: Data for process values, operation parameters and setup parameters are stored as the types (EU, EUS, % and ABS without the decimal point) indicated in the "List of Operation Parameters" in Appendix 3 and the "List of Setup Parameters" in Appendix 4 of the *US1000 Digital Indicating Controller-Functions* instruction manual. The OFF and ON states are represented by 0 and 1, respectively. The D registers D0001 to 0049 are read-only.

Note 2: The user area (register numbers D0050 to 0100) is reserved for 16-bit register data used in the Graphic Panel or other software programs. When working with the Graphic Panel, do not write to or read from this area as usually done.

### See Also

Section 5.4, “Process Data Area and User Area.”

## NOTE

No data may be written to or read from data storage areas with blank fields in the tables that follow. If you attempt to do so, the US1000 controller may fail to operate correctly.

# 5.4 Process Data and User

| Area for Process Data | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D-Reg No. | Ref No. | H No . | Register Name | R/W | D-Reg No. | Ref No. | H No . | Register Name | R/W |
| D0001 | 40001 | 0000 | ADERROR | R | D0051 | 40051 | 0032 | | R/W |
| D0002 | 40002 | 0001 | EROOR.1 | R | D0052 | 40052 | 0033 | | R/W |
| D0003 | 40003 | 0002 | PV.1 | R | D0053 | 40053 | 0034 | | R/W |
| D0004 | 40004 | 0003 | CSV.1 | R | D0054 | 40054 | 0035 | | R/W |
| D0005 | 40005 | 0004 | MV.1 | R | D0055 | 40055 | 0036 | | R/W |
| D0006 | 40006 | 0005 | HMV.1 | R | D0056 | 40056 | 0037 | | R/W |
| D0007 | 40007 | 0006 | CMV.1 | R | D0057 | 40057 | 0038 | | R/W |
| D0008 | 40008 | 0007 | MOD.1 | R | D0058 | 40058 | 0039 | | R/W |
| D0009 | 40009 | 0008 | PIDNO.1 | R | D0059 | 40059 | 003A | | R/W |
| D0010 | 40010 | 0009 | CSVNO | R | D0060 | 40060 | 003B | | R/W |
| D0011 | 40011 | 000A | ALM | R | D0061 | 40061 | 003C | | R/W |
| D0012 | | | | | D0062 | 40062 | 003D | | R/W |
| D0013 | | | | | D0063 | 40063 | 003E | | R/W |
| D0014 | | | | | D0064 | 40064 | 003F | | R/W |
| D0015 | | | | | D0065 | 40065 | 0040 | | R/W |
| D0016 | | | | | D0066 | 40066 | 0041 | | R/W |
| D0017 | | | | | D0067 | 40067 | 0042 | | R/W |
| D0018 | 40018 | 0011 | ERROR.2 | R | D0068 | 40068 | 0043 | | R/W |
| D0019 | 40019 | 0012 | PV.2 | R | D0069 | 40069 | 0044 | | R/W |
| D0020 | 40020 | 0013 | CSV.2 | R | D0070 | 40070 | 0045 | | R/W |
| D0021 | 40021 | 0014 | MV.2 | R | D0071 | 40071 | 0046 | | R/W |
| D0022 | 40022 | 0015 | HMV.2 | R | D0072 | 40072 | 0047 | | R/W |
| D0023 | 40023 | 0016 | CMV.2 | R | D0073 | 40073 | 0048 | | R/W |
| D0024 | 40024 | 0017 | MOD.2 | R | D0074 | 40074 | 0049 | | R/W |
| D0025 | 40025 | 0018 | PIDNO.2 | R | D0075 | 40075 | 004A | | R/W |
| D0026 | 40026 | 0019 | DEV.1 | R | D0076 | 40076 | 004B | | R/W |
| D0027 | | | | | D0077 | 40077 | 004C | | R/W |
| D0028 | | | | | D0078 | 40078 | 004D | | R/W |
| D0029 | | | | | D0079 | 40079 | 004E | | R/W |
| D0030 | 40030 | 001D | DEV.2 | R | D0080 | 40080 | 004F | | R/W |
| D0031 | | | | | D0081 | 40081 | 0050 | | R/W |
| D0032 | 40032 | 001F | SMEC | R | D0082 | 40082 | 0051 | | R/W |
| D0033 | 40033 | 0020 | DISTS | R | D0083 | 40083 | 0052 | | R/W |
| D0034 | | | | | D0084 | 40084 | 0053 | | R/W |
| D0035 | 40035 | 0022 | PARAERR | R | D0085 | 40085 | 0054 | | R/W |
| D0036 | 40036 | 0023 | ALOSTS | R | D0086 | 40086 | 0055 | | R/W |
| D0037 | | | | | D0087 | 40087 | 0056 | | R/W |
| D0038 | | | | | D0088 | 40088 | 0057 | | R/W |
| D0039 | 40039 | 0026 | DISP1 | R | D0089 | 40089 | 0058 | | R/W |
| D0040 | 40040 | 0027 | DISP2 | R | D0090 | 40090 | 0059 | | R/W |
| D0041 | | | | | D0091 | 40091 | 005A | | R/W |
| D0042 | | | | | D0092 | 40092 | 005B | | R/W |
| D0043 | | | | | D0093 | 40093 | 005C | | R/W |
| D0044 | | | | | D0094 | 40094 | 005D | | R/W |
| D0045 | | | | | D0095 | 40095 | 005E | | R/W |
| D0046 | | | | | D0096 | 40096 | 005F | | R/W |
| D0047 | | | | | D0097 | 40097 | 0060 | | R/W |
| D0048 | | | | | D0098 | 40098 | 0061 | | R/W |
| D0049 | | | | | D0099 | 40099 | 0062 | | R/W |
| D0050 | 40050 | 0031 | | R/W | D0100 | 40100 | 0063 | | R/W |

Shaded areas ▭ indicate a user area (D-register numbers D0050 to D0100). These registers are not available if the Graphic Panel is in use.

### 5.4.1 Process Data Area (Read-only Data)

Some of the registers D0001 to D0049 (read-only) are designed to indicate two or more events, such as errors and abnormal statuses, using combinations of bits within them. If any of the events shown in the following tables occurs, the corresponding bit is set to 1. The bit remains set to 0 if the event has not occurred yet. Note that bits in blank fields are not in use.

● **Bit Configuration of D0001 Register-ADERROR (Input Error)**

| Bit | Code | Event |
|---|---|---|
| 0 | AD1ERR.st | Error in A/D converter for input 1 |
| 1 | AD2ERR.st | Error in A/D converter for input 2 (US1000-11 or US1000 -21 only) |
| 2 | AD3ERR.st | Error in A/D converter for input 3 |
| 3 | | |
| 4 | AD1BO.st | Burn-out error in input 1 |
| 5 | AD2BO.st | Burn-out error in input 2 (US1000-11 or US1000 -21 only) |
| 6 | AD3BO.st | Burn-out error in input 3 |
| 7 | | |
| 8 | RJC1ERR.st | RJC error in input 1 |
| 9 | RJC2ERR.st | RJC error in input 2 (US1000-11 or US1000 -21 only) |
| 10 | | |
| 11 | VLERR.st | Failure in automatic adjustment of valve position |
| 12 | VLBO.st | Burnout in valve position feedback input |
| 13 to 15 | | |

● **Bit Configuration of D0002 Register-ERROR.1 (PV1 Error)**

| Bit | Code | Event |
|---|---|---|
| 0 | PV1ADC.st | Error in A/D converter for PV1 |
| 1 | PV1BO.st | Burn-out error in PV1 |
| 2 | RJC1ERR.st | RJC error in PV1 |
| 3 | | |
| 4 | PV1+over.st | PV1 above the upper limit of scale |
| 5 | PV1-over.st | PV1 below the lower limit of scale |
| 6, 7 | | |
| 8 | CSV1ADC.st | Error in A/D converter for CSV1 |
| 9 | CSV1BO.st | Burn-out error in CSV1 |
| 10, 11 | | |
| 12 | C.CSV1ADC.st | Error in A/D converter for CSV1 when CSV1 is used for control |
| 13 | C.CSV1BO.st | Burn-out error when CSV1 is used for control |
| 14 | AT1ERR.st | Auto-tuning error |
| 15 | | |

● **D0003 Register-PV.1 (Process Variable [PV] for Loop 1)**

● **D0004 Register-CSV.1 (Target Setpoint [SV] Used with Loop 1)**

● **D0005 Register-MV.1 (Manipulated Output Value [MV] for Loop 1)**

- For PID computations, this register allows the result of PID computation (readout (without the decimal point)) to be read as is. For example, the register contains an MV of 750 (without the decimal point) for a 75.0% readout.
- For on-off computations, the register contains a reading of 0 (0.0%) (without the decimal point) for the OFF state or 1000 (100.0%) for the ON state (without the decimal point).
- For heating/cooling computations, this register contains a value (without the decimal point) half that of the resulting PID computation (not a readout).

● **D0006 Register-HMV.1 (Heating-side MV for Loop-1 Heating/Cooling Computation)**

- For on-off computations, the register contains a reading of 0 (0.0%) (without the decimal point) for the OFF state or 1000 (100.0%) for the ON state (without the decimal point).
- For heating/cooling computations, this register contains the readout (without the decimal point) of the heating-side MV as is.

● **D0007 Register-CMV.1 (Cooling-side MV for Loop-1 Heating/Cooling Computation)**

- For on-off computations, the register contains a reading of 0 (0.0%) (without the decimal point) for the OFF state or 1000 (100.0%) for the ON state (without the decimal point).
- For heating/cooling computations, this register contains the readout (without the decimal point) of the cooling-side MV as is.

● **Bit Configuration of D0008 Register-MOD.1 (Mode of Loop 1)**

| Bit | Code | Event |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | R/S.st | 0: Run; 1: Stop |
| 3 | | |
| 4 | CAS1..st | 1: CAS mode |
| 5 | AUT1.st | 1: AUTO mode |
| 6 | MAN1.st | 1: MAN mode |
| 7 to 13 | | |
| 14 | AT1.st | 0: Auto-tuning disabled; 1: Auto-tuning enabled |
| 15 | | |

● **D0009 Register-PIDNO.1 (PID Number Used with Loop 1)**

| Bit | Code | Event |
|---|---|---|
| 0 | PIDNO.0 | Bit 0 for selecting PID number |
| 1 | PIDNO.1 | Bit 1 for selecting PID number |
| 2 | PIDNO.2 | Bit 2 for selecting PID number |
| 3 | PIDNO.3 | Bit 3 for selecting PID number |
| 4 to 15 | | |

This register allows the PID number, which is in use, to be read in the form of a binary bit string. The configuration of “bit 3 = off; bit 2 = on; bit 1 = off; bit 0 = on”, which is represented as “0101” in the binary system and as “5” in the decimal system, selects the PID number 5.

● **D0010 Register-CSVNO (Target-setpoint Number Currently in Use)**

| Bit | Code | Event |
|---|---|---|
| 0 | CSVNO1.0 | Bit 0 for selecting CSV number |
| 1 | CSVNO1.1 | Bit 1 for selecting CSV number |
| 2 | CSVNO1.2 | Bit 2 for selecting CSV number |
| 3 | CSVNO1.3 | Bit 3 for selecting CSV number |
| 4 to 15 | | |

This register allows the CSV number, which is currently in use, to be read in the form of a binary bit string. The configuration of “bit 3 = off; bit 2 = on; bit 1 = off; bit 0 = on”, which is represented as “0101” in the binary system and as “5” in the decimal system, selects the CSV number 5.

● **Bit Configuration of D0011 Register-ALM (Alarm Status)**

| Bit | Code | Event |
|---|---|---|
| 0 | ALM11.st | '1' if alarm 1 for loop 1 is on, or '0' if off |
| 1 | ALM12.st | '1' if alarm 2 for loop 1 is on, or '0' if off |
| 2 | ALM13.st | '1' if alarm 3 for loop 1 is on, or '0' if off |
| 3 | | |
| 4 | ALM14.st | '1' if alarm 4 for loop 1 is on, or '0' if off |
| 5 | | |
| 6, 7 | | |
| 8 | ALM21.st | '1' if alarm 1 for loop 2 is on, or '0' if off |
| 9 | ALM22.st | '1' if alarm 2 for loop 2 is on, or '0' if off |
| 10 | AIM23.st | '1' if alarm 3 for loop 2 is on, or '0' if off |
| 11 | | |
| 12 | ALM24.st | '1' if alarm 4 for loop 2 is on, or '0' if off |
| 13 | | |
| 14, 15 | | |

ALM21 to ALM24 for loop 2 are used as alarms 5 to 8 for loop 1 if, when the controller mode (US mode) is other than "cascade control," the 8-alarm mode is selected using the AMD alarm-related setup parameter.

**See Also**

The section on the eight-alarm mode in the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E)

● **Bit Configuration of D0018 Register-ERROR.2 (PV2 Error)**

| Bit | Code | Event |
|---|---|---|
| 0 | PV2ADC.st | Error in A/D converter for PV2 |
| 1 | PV2BO.st | Burn-out error in PV2 |
| 2 | PJC2ERR.st | RJC error in PV2 (US1000-11 or US1000 -21 only) |
| 3 | | |
| 4 | PV2+over.st | PV2 above the upper limit of scale |
| 5 | PV2-over.st | PV2 below the lower limit of scale |
| 6, 7 | | |
| 8 | CSV2ADC.st | Error in A/D converter for CSV2 (US1000-11 or US1000 -21 only) |
| 9 | CSV2BO.st | Burn-out error in CSV2 (US1000-11 or US1000 -21 only) |
| 10, 11 | | |
| 12 | C.CSV2ADC.st | Error in A/D converter for CSV2 when CSV2 is used for control (US1000-11 or US1000 -21 only) |
| 13 | C.CSV2BO.st | Burn-out error when CSV2 is used for control (US1000-11 or US1000 -21 only) |
| 14 | AT2ERR.st | Auto-tuning error |
| 15 | | |

● **D0019 Register-PV.2 (Process Variable for Loop 2)**

● **D0020 Register-CSV.2 (Target Setpoint Used with Loop 2)**

● **D0021 Register-MV.2 (Manipulated Output Value for Loop 2)**

- For PID computations, this register allows the result of PID computation (readout (without the decimal point)) to be read as is. For example, the register contains an MV of 750 (without the decimal point) for a 75.0% readout.
- For on-off computations, the register contains a reading of 0 (0.0%) (without the decimal point) for the OFF state or 1000 (100.0%) for the ON state (without the decimal point).
- For heating/cooling computations, this register contains a value (without the decimal point) half that of the result PID computation (not a readout).

● **D0022 Register-HMV.2 (Heating-side MV for Loop-2 Heating/Cooling Computation)**

- For on-off computations, the register contains a reading of 0 (0.0%) (without the decimal point) for the OFF state or 1000 (100.0%) for the ON state (without the decimal point).
- For heating/cooling computations, this register contains the readout (without the decimal point) of the heating-side MV as is.

● **D0023 Register-CMV.2 (Cooling-side MV for Loop-2 Heating/Cooling Computation)**

- For on-off computations, the register contains a reading of 0 (0.0%) (without the decimal point) for the OFF state or 1000 (100.0%) for the ON state (without the decimal point).
- For heating/cooling computations, this register contains the readout (without the decimal point) of the cooling-side MV as is.

● **Bit Configuration of D0024 Register-MOD.2 (Mode of Loop 2)**

| Bit | Code | Event |
|---|---|---|
| 0 | | |
| 1 | O/C.st | 0: Close; 1: Open |
| 2 | | |
| 3 | CAS2.st | 1: CAS mode |
| 4 | AUT2.st | 1: AUTO mode |
| 5 | MAN2.st | 1: MAN mode |
| 6 to 13 | | |
| 14 | AT2 | 0: Auto-tuning disabled; 1: Auto-tuning enabled |
| 15 | | |

● **D0025 Register-PIDNO.2 (PID Number Used with Loop 2)**

| Bit | Code | Event |
|---|---|---|
| 0 | PIDNO2.0 | Bit 0 for selecting PID number |
| 1 | PIDNO2.1 | Bit 1 for selecting PID number |
| 2 | PIDNO2.2 | Bit 2 for selecting PID number |
| 3 | PIDNO2.3 | Bit 3 for selecting PID number |
| 4 to 15 | | |

This register allows the PID number, which is in use, to be read in the form of a binary bit string. The configuration of “bit 3 = off; bit 2 = on; bit 1 = off; bit 0 = on”, which is represented as “0101” in the binary system and as “5” in the decimal system, selects the PID number 5.

● **D0026 Register-DEV.1 (Deviation for Loop 1)**

● **D0030 Register-DEV.2 (Deviation for Loop 2)**

● **D0032 Register-SMEC (Counter for Errors in Sampling Period)**

● **Bit Configuration of D0033 Register-DISTS (Statuses of External Contact Inputs)**

| Bit | Code | Event |
|---|---|---|
| 0 | DI1.st | Status of external contact input terminal 1<br>(the contact is on if the bit is 1, and off if 0) |
| 1 | DI2.st | Status of external contact input terminal 2<br>(the contact is on if the bit is 1, and off if 0) |
| 2 | DI3.st | Status of external contact input terminal 3<br>(the contact is on if the bit is 1, and off if 0) |
| 3 | DI4.st | Status of external contact input terminal 4<br>(the contact is on if the bit is 1, and off if 0) |
| 4 | DI5.st | Status of external contact input terminal 5<br>(the contact is on if the bit is 1, and off if 0) |
| 5 | DI6.st | Status of external contact input terminal 6<br>(the contact is on if the bit is 1, and off if 0) |
| 6 | DI7.st | Status of external contact input terminal 7<br>(the contact is on if the bit is 1, and off if 0) |
| 7 | | |
| 8 | DP1 | Status of interruption for readout parameter 1<br>(the display is shown if the bit is 1, and hidden if 0) |
| 9 | DP2 | Status of interruption for readout parameter 2<br>(the display is shown if the bit is 1, and hidden if 0) |
| 10 | MG1 | Status of interruption for message 1<br>(the message is shown if the bit is 1, and hidden if 0) |
| 11 | MG2 | Status of interruption for message 2<br>(the message is shown if the bit is 1, and hidden if 0) |
| 12 | MG3 | Status of interruption for message 3<br>(the message is shown if the bit is 1, and hidden if 0) |
| 13 | MG4 | Status of interruption for message 4<br>(the message is shown if the bit is 1, and hidden if 0) |
| 14, 15 | | |

Functions assigned to external contact inputs vary depending on the settings of the controller mode (US mode) and whether or not the functions of contact inputs are registered.

**See Also**

Chapter 2, “Controller Modes (US Modes),” in the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E), for the statuses of external contact inputs.

● **Bit Configuration of D0035 Register-PARAERR (Error in Calibrated Values or Parameters)**

| Bit | Code | Event |
|---|---|---|
| 0 | CALB.E.st | Error in calibrated values |
| 1 | | |
| 2 | USER.E.st | Error in data generated with the custom computation building tool |
| 3 | | |
| 4 | USMD.st | US-mode error |
| 5 | RANGE.st | Error in data for input range |
| 6 | SETUP.st | Error in setup parameters |
| 7 | | |
| 8 | PARA.E.st | Error in operation parameters |
| 9 | MODE.E.st | Error in backup data generated upon power failure |
| 10, 11 | | |
| 12 | EEP.E.st | Error in EEPROM |
| 13 | | |
| 14 | SYSTEM.E.st | Error in system data |
| 15 | | |

● **Bit Configuration of D0036 Register-ALOSTS (Status of Alarm Output)**

| Bit | Code | Event |
|---|---|---|
| 0 | ALO11 | Output status when alarm 1 for loop 1 is assigned<br>• 0: If the alarm is off for the “energized” alarm type, or on for the “deenergized” alarm type (i.e., the relay contact is open)<br>• 1: If the alarm is on for the “energized” alarm type, or off for the “deenergized” alarm type (i.e., the relay contact is closed) |
| 1 | ALO12 | Output status when alarm 2 for loop 1 is assigned<br>Same as bit 0 in regard to information on the bit status |
| 2 | ALO13 | Output status when alarm 3 for loop 1 is assigned<br>Same as bit 0 in regard to information on the bit status |
| 3 | | |
| 4 | ALO14 | Output status when alarm 4 for loop 1 is assigned<br>Same as bit 0 in regard to information on the bit status |
| 5 to 7 | | |
| 8 | ALO21 | Output status when alarm 1 for loop 2 is assigned<br>Same as bit 0 in regard to information on the bit status |
| 9 | ALO22 | Output status when alarm 2 for loop 2 is assigned<br>Same as bit 0 in regard to information on the bit status |
| 10 | ALO23 | Output status when alarm 3 for loop 2 is assigned<br>Same as bit 0 in regard to information on the bit status |
| 11 | | |
| 12 | ALO24 | Output status when alarm 4 for loop 2 is assigned<br>Same as bit 0 in regard to information on the bit status |
| 13 to 15 | | |

● **D0039 Register-DISP1 (Input Value for DISP1 Module Registered Using the Custom Computation Building Tool)**

This register stores the value fed to input 1 (IN1) of the Data Display 1 (DISP1) module.

● **D0040 Register-DISP2 (Input Value for DISP2 Module Registered Using the Custom Computation Building Tool)**

This register stores the value fed to input 1 (IN1) of the Data Display 2 (DISP2) module.

## 5.4.2 User Area

| Register No. | Data Category | Description |
|---|---|---|
| D0050 to 0100 | User area | Data can be written to or read from the range of D registers numbered 0050 to 0100. However, the area is reserved for communication with the Graphic Panel; it is not available if the Graphic Panel is used in the system. |

# 5.5 Modes and Computation Parameters

| Area for Modes and Computation Parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D-Reg No. | Ref No. | H No . | Register Name | R/W | D-Reg No. | Ref No. | H No . | Register Name | R/W |
| D0201 | 40201 | 00C8 | CAM.1 | R/W | D0251 | 40251 | 00FA | FBI.1 | * R/W |
| D0202 | 40202 | 00C9 | CAM.2 | R/W | D0252 | 40252 | 00FB | FBO.1 | * R/W |
| D0203 | | | | | D0253 | 40253 | 00FC | FFL.1 | * R/W |
| D0204 | | | | | D0254 | | | | |
| D0205 | 40205 | 00CC | R/S | R/W | D0255 | | | | |
| D0206 | 40206 | 00CD | O/C | R/W | D0256 | | | | |
| D0207 | 40207 | 00CE | SVNO | R/W | D0257 | | | | |
| D0208 | 40208 | 00CF | C.CSV.1 | R/W | D0258 | | | | |
| D0209 | 40209 | 00D0 | C.CSV.2 | R/W | D0259 | | | | |
| D0210 | 40210 | 00D1 | MMV.1 | R/W | D0260 | | | | |
| D0211 | 40211 | 00D2 | MMVc.1 | R/W | D0261 | | | | |
| D0212 | 40212 | 00D3 | MMV.2 | R/W | D0262 | | | | |
| D0213 | 40213 | 00D4 | MMVc.2 | R/W | D0263 | | | | |
| D0214 | | | | | D0264 | | | | |
| D0215 | | | | | D0265 | | | | |
| D0216 | | | | | D0266 | | | | |
| D0217 | | | | | D0267 | | | | |
| D0218 | | | | | D0268 | | | | |
| D0219 | | | | | D0269 | | | | |
| D0220 | | | | | D0270 | | | | |
| D0221 | | | | | D0271 | 40271 | 010E | AT.2 | * R/W |
| D0222 | | | | | D0272 | 40272 | 010F | SC.2 | * R/W |
| D0223 | | | | | D0273 | 40273 | 0110 | BS.2 | * R/W |
| D0224 | | | | | D0274 | 40274 | 0111 | FL.2 | * R/W |
| D0225 | | | | | D0275 | 40275 | 0112 | UPR.2 | * R/W |
| D0226 | | | | | D0276 | 40276 | 0113 | DNR.2 | * R/W |
| D0227 | | | | | D0277 | 40277 | 0114 | CRT.2 | * R/W |
| D0228 | | | | | D0278 | 40278 | 0115 | CBS.2 | * R/W |
| D0229 | | | | | D0279 | 40279 | 0116 | CFL.2 | * R/W |
| D0230 | | | | | D0280 | | | | |
| D0231 | | | | | D0281 | | | | |
| D0232 | | | | | D0282 | | | | |
| D0233 | | | | | D0283 | | | | |
| D0234 | | | | | D0284 | | | | |
| D0235 | | | | | D0285 | | | | |
| D0236 | | | | | D0286 | | | | |
| D0237 | | | | | D0287 | | | | |
| D0238 | | | | | D0288 | | | | |
| D0239 | | | | | D0289 | | | | |
| D0240 | | | | | D0290 | | | | |
| D0241 | 40241 | 00F0 | AT.1 | * R/W | D0291 | | | | |
| D0242 | 40242 | 00F1 | SC.1 | * R/W | D0292 | | | | |
| D0243 | 40243 | 00F2 | BS.1 | * R/W | D0293 | | | | |
| D0244 | 40244 | 00F3 | FL.1 | * R/W | D0294 | | | | |
| D0245 | 40245 | 00F4 | UPR.1 | * R/W | D0295 | | | | |
| D0246 | 40246 | 00F5 | DNR.1 | * R/W | D0296 | | | | |
| D0247 | 40247 | 00F6 | CRT.1 | * R/W | D0297 | | | | |
| D0248 | 40248 | 00F7 | CBS.1 | * R/W | D0298 | | | | |
| D0249 | 40249 | 00F8 | CFL.1 | * R/W | D0299 | | | | |
| D0250 | 40250 | 00F9 | FGN.1 | * R/W | D0300 | | | | |

An asterisk (*) indicates that the number of writing actions is limited to 100,000 times.

## 5.5.1 Mode Data

The mode registers listed below are designed to show, by the value contained, which mode is selected. You can change the mode by writing a different mode into the register via communication.

● **D0201 Register-CAM.1 (CAS, AUTO and MAN Modes for Loop 1)**
If defined as D0201 = 0, the register is in the AUTO mode.
If defined as D0201 = 1, the register is in the MAN mode.
If defined as D0201 = 2, the register is in the CAS mode.

● **D0202 Register-CAM.2 (CAS, AUTO and MAN Modes for Loop 2)**
If defined as D0202 = 0, the register is in the AUTO mode.
If defined as D0202 = 1, the register is in the MAN mode.
If defined as D0202 = 2, the register is in the CAS mode.

● **D0205 Register-R/S (RUN and STOP Modes)**
If defined as D0205 = 0, the register is in the RUN mode.
If defined as D0205 = 1, the register is in the STOP mode.

● **D0206 Register-O/C (OPEN and CLOSE Modes)**
If defined as D0206 = 0, the register is in the CLOSE mode.
If defined as D0206 = 1, the register is in the OPEN mode.

## 5.5.2 Write-only Data Area

The registers listed below are write-only registers that are accessed by higher-order equipment.
For example, to set 150.0°C in the C.CSV.1 register, write 1500 in the register.

| Register No. | Code Name | Description |
|---|---|---|
| 207 | SVNO | Used to set an SV number.<br>For example, if you set the SVNO to 5, the parameter 5.5V, ....., 5.PMc are used. |
| 208 | C.CSV.1 | Used to set an SV value for loop 1. |
| 209 | C.CSV.2 | Used to set an SV value for loop 2. |
| 210 | MMV.1 | Used to set an MV value when loop 1 is in the MAN mode. |
| 211 | MMVc.1 | Used to set a cooling-side MV value when loop 1 is in the MAN mode. |
| 212 | MMV.2 | Used to set an MV value when loop 2 is in the MAN mode. |
| 213 | MMVc.2 | Used to set a cooling-side MV value when loop 2 is in the MAN mode. |

### ■ Writing an SV Value

An SV value can be written via communication only when the loop is set to the CAS mode.

(1) Write an SV value into the C.CSV1 or C.CSV2 register.
(2) Set “CPT” in the CMS cascade input selection parameter.
(3) Set the loop to the CAS mode.

Now, you can operate the controller with the SV value you set via communication.

### ■ Writing an MV Value in the MAN Mode

You can write an MV value via communication only when the operation mode is set to the MAN mode.

(1) Set the operating mode of the US1000 controller to the MAN mode.
(2) Write MV values into the MMV.1, MMV.2, MMVc.1 and MMVc.2 registers.

Now, you can operate the controller with the MV values you set via communication in the MAN mode.

### ■ Manipulating Valves

In the MAN mode for position-proportional PID computation, write a valve position into the MMV.1 register.

### 5.5.3 Data Area for Computation Parameters

| Register No. | Data Category | Description | Remarks |
|---|---|---|---|
| D0241 to 0253 | Loop-1 computation parameters | AT.1: Loop-1 auto-tuning selection<br>SC.1: Loop-1 SUPER function selection<br>BS.1: Loop-1 PV bias<br>FL.1: Loop-1 PV filter<br>UPR.1: Loop-1 setpoint ramp-up<br>DNR.1: Loop-1 setpoint ramp-down<br>CRT.1: Loop-1 cascade ratio<br>CBS.1: Loop-1 cascade bias<br>CFL.1: Loop-1 cascade input filter<br>FGN.1: Loop-1 feedforward gain<br>FBI.1: Loop-1 feedfoward input bias<br>FBO.1: Loop-1 feedfoward output bias<br>FFL.1: Loop-1 feedfoward input filter | For details on the parameters, see the US1000 Digital Indicating Controller-Functions instruction manual (IM 5D1A01-02E). |
| D0271 to 0279 | Loop-2 computation parameters | The loop-2 computation parameters, i.e., AT.2, …, CFL.2, are functionally the same as their corresponding loop-1 computation parameters listed above, i.e., AT.1, …, CFL.1. | |

# 5.6 Loop-1 PID Parameters

| Area for Loop-1 PID Parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D-Reg No. | Ref No. | H No . | Register Name | R/W | D-Reg No. | Ref No. | H No . | Register Name | R/W |
| D0301 | 40301 | 012C | 1.SV.1 | * R/W | D0351 | 40351 | 015E | 3.SV.1 | * R/W |
| D0302 | 40302 | 012D | 1.A1.1 | * R/W | D0352 | 40352 | 015F | 3.A1.1 | * R/W |
| D0303 | 40303 | 012E | 1.A2.1 | * R/W | D0353 | 40353 | 0160 | 3.A2.1 | * R/W |
| D0304 | 40304 | 012F | 1.A3.1 | * R/W | D0354 | 40354 | 0161 | 3.A3.1 | * R/W |
| D0305 | 40305 | 0130 | 1.A4.1 | * R/W | D0355 | 40355 | 0162 | 3.A4.1 | * R/W |
| D0306 | 40306 | 0131 | 1.P.1 | * R/W | D0356 | 40356 | 0163 | 3.P.1 | * R/W |
| D0307 | 40307 | 0132 | 1.I.1 | * R/W | D0357 | 40357 | 0164 | 3.I.1 | * R/W |
| D0308 | 40308 | 0133 | 1.D.1 | * R/W | D0358 | 40358 | 0165 | 3.D.1 | * R/W |
| D0309 | 40309 | 0134 | 1.MH.1 | * R/W | D0359 | 40359 | 0166 | 3.MH.1 | * R/W |
| D0310 | 40310 | 0135 | 1.ML.1 | * R/W | D0360 | 40360 | 0167 | 3.ML.1 | * R/W |
| D0311 | 40311 | 0136 | 1.MR.1 | * R/W | D0361 | 40361 | 0168 | 3.MR.1 | * R/W |
| D0312 | 40312 | 0137 | 1.H.1 | * R/W | D0362 | 40362 | 0169 | 3.H.1 | * R/W |
| D0313 | 40313 | 0138 | 1.DR.1 | * R/W | D0363 | 40363 | 016A | 3.DR.1 | * R/W |
| D0314 | 40314 | 0139 | 1.Pc.1 | * R/W | D0364 | 40364 | 016B | 3.Pc.1 | * R/W |
| D0315 | 40315 | 013A | 1.Ic.1 | * R/W | D0365 | 40365 | 016C | 3.Ic.1 | * R/W |
| D0316 | 40316 | 013B | 1.Dc.1 | * R/W | D0366 | 40366 | 016D | 3.Dc.1 | * R/W |
| D0317 | 40317 | 013C | 1.Hc.1 | * R/W | D0367 | 40367 | 016E | 3.Hc.1 | * R/W |
| D0318 | 40318 | 013D | 1.DB.1 | * R/W | D0368 | 40368 | 016F | 3.DB.1 | * R/W |
| D0319 | 40319 | 013E | 1.RP.1 | * R/W | D0369 | 40369 | 0170 | 3.RP.1 | * R/W |
| D0320 | 40320 | 013F | 1.PM.1 | * R/W | D0370 | 40370 | 0171 | 3.PM.1 | * R/W |
| D0321 | 40321 | 0140 | 1.PMc.1 | * R/W | D0371 | 40371 | 0172 | 3.PMc.1 | * R/W |
| D0322 | | | | | D0372 | | | | |
| D0323 | | | | | D0373 | | | | |
| D0324 | | | | | D0374 | | | | |
| D0325 | | | | | D0375 | | | | |
| D0326 | 40326 | 0145 | 2.SV.1 | * R/W | D0376 | 40376 | 0177 | 4.SV.1 | * R/W |
| D0327 | 40327 | 0146 | 2.A1.1 | * R/W | D0377 | 40377 | 0178 | 4.A1.1 | * R/W |
| D0328 | 40328 | 0147 | 2.A2.1 | * R/W | D0378 | 40378 | 0179 | 4.A2.1 | * R/W |
| D0329 | 40329 | 0148 | 2.A3.1 | * R/W | D0379 | 40379 | 017A | 4.A3.1 | * R/W |
| D0330 | 40330 | 0149 | 2.A4.1 | * R/W | D0380 | 40380 | 017B | 4.A4.1 | * R/W |
| D0331 | 40331 | 014A | 2.P.1 | * R/W | D0381 | 40381 | 017C | 4.P.1 | * R/W |
| D0332 | 40332 | 014B | 2.I.1 | * R/W | D0382 | 40382 | 017D | 4.I.1 | * R/W |
| D0333 | 40333 | 014C | 2.D.1 | * R/W | D0383 | 40383 | 017E | 4.D.1 | * R/W |
| D0334 | 40334 | 014D | 2.MH.1 | * R/W | D0384 | 40384 | 017F | 4.MH.1 | * R/W |
| D0335 | 40335 | 014E | 2.ML.1 | * R/W | D0385 | 40385 | 0180 | 4.ML.1 | * R/W |
| D0336 | 40336 | 014F | 2.MR.1 | * R/W | D0386 | 40386 | 0181 | 4.MR.1 | * R/W |
| D0337 | 40337 | 0150 | 2.H.1 | * R/W | D0387 | 40387 | 0182 | 4.H.1 | * R/W |
| D0338 | 40338 | 0151 | 2.DR.1 | * R/W | D0388 | 40388 | 0183 | 4.DR.1 | * R/W |
| D0339 | 40339 | 0152 | 2.Pc.1 | * R/W | D0389 | 40389 | 0184 | 4.Pc.1 | * R/W |
| D0340 | 40340 | 0153 | 2.Ic.1 | * R/W | D0390 | 40390 | 0185 | 4.Ic.1 | * R/W |
| D0341 | 40341 | 0154 | 2.Dc.1 | * R/W | D0391 | 40391 | 0186 | 4.Dc.1 | * R/W |
| D0342 | 40342 | 0155 | 2.Hc.1 | * R/W | D0392 | 40392 | 0187 | 4.Hc.1 | * R/W |
| D0343 | 40343 | 0156 | 2.DB.1 | * R/W | D0393 | 40393 | 0188 | 4.DB.1 | * R/W |
| D0344 | 40344 | 0157 | 2.RP.1 | * R/W | D0394 | 40394 | 0189 | 4.RP.1 | * R/W |
| D0345 | 40345 | 0158 | 2.PM.1 | * R/W | D0395 | 40395 | 018A | 4.PM.1 | * R/W |
| D0346 | 40346 | 0159 | 2.PMc.1 | * R/W | D0396 | 40396 | 018B | 4.PMc.1 | * R/W |
| D0347 | | | | | D0397 | | | | |
| D0348 | | | | | D0398 | | | | |
| D0349 | | | | | D0399 | | | | |
| D0350 | | | | | D0400 | | | | |

An asterisk (*) indicates that the number of writing actions is limited to 100,000 times.

| Area for Loop-1 PID Parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D-Reg No. | Ref No. | H No . | Register Name | R/W | D-Reg No. | Ref No. | H No . | Register Name | R/W |
| D0401 | 40401 | 0190 | 5.SV.1 | * R/W | D0451 | 40451 | 01C2 | 7.SV.1 | * R/W |
| D0402 | 40402 | 0191 | 5.A1.1 | * R/W | D0452 | 40452 | 01C3 | 7.A1.1 | * R/W |
| D0403 | 40403 | 0192 | 5.A2.1 | * R/W | D0453 | 40453 | 01C4 | 7.A2.1 | * R/W |
| D0404 | 40404 | 0193 | 5.A3.1 | * R/W | D0454 | 40454 | 01C5 | 7.A3.1 | * R/W |
| D0405 | 40405 | 0194 | 5.A4.1 | * R/W | D0455 | 40455 | 01C6 | 7.A4.1 | * R/W |
| D0406 | 40406 | 0195 | 5.P.1 | * R/W | D0456 | 40456 | 01C7 | 7.P.1 | * R/W |
| D0407 | 40407 | 0196 | 5.I.1 | * R/W | D0457 | 40457 | 01C8 | 7.I.1 | * R/W |
| D0408 | 40408 | 0197 | 5.D.1 | * R/W | D0458 | 40458 | 01C9 | 7.D.1 | * R/W |
| D0409 | 40409 | 0198 | 5.MH.1 | * R/W | D0459 | 40459 | 01CA | 7.MH.1 | * R/W |
| D0410 | 40410 | 0199 | 5.ML.1 | * R/W | D0460 | 40460 | 01CB | 7.ML.1 | * R/W |
| D0411 | 40411 | 019A | 5.MR.1 | * R/W | D0461 | 40461 | 01CC | 7.MR.1 | * R/W |
| D0412 | 40412 | 019B | 5.H.1 | * R/W | D0462 | 40462 | 01CD | 7.H.1 | * R/W |
| D0413 | 40413 | 019C | 5.DR.1 | * R/W | D0463 | 40463 | 01CE | 7.DR.1 | * R/W |
| D0414 | 40414 | 019D | 5.Pc.1 | * R/W | D0464 | 40464 | 01CF | 7.Pc.1 | * R/W |
| D0415 | 40415 | 019E | 5.Ic.1 | * R/W | D0465 | 40465 | 01D0 | 7.Ic.1 | * R/W |
| D0416 | 40416 | 019F | 5.Dc.1 | * R/W | D0466 | 40466 | 01D1 | 7.Dc.1 | * R/W |
| D0417 | 40417 | 01A0 | 5.Hc.1 | * R/W | D0467 | 40467 | 01D2 | 7.Hc.1 | * R/W |
| D0418 | 40418 | 01A1 | 5.DB.1 | * R/W | D0468 | 40468 | 01D3 | 7.DB.1 | * R/W |
| D0419 | 40419 | 01A2 | 5.RP.1 | * R/W | D0469 | 40469 | 01D4 | 7.RP.1 | * R/W |
| D0420 | 40420 | 01A3 | 5.PM.1 | * R/W | D0470 | 40470 | 01D5 | 7.PM.1 | * R/W |
| D0421 | 40421 | 01A4 | 5.PMc.1 | * R/W | D0471 | 40471 | 01D6 | 7.PMc.1 | * R/W |
| D0422 | | | | | D0472 | | | | |
| D0423 | | | | | D0473 | | | | |
| D0424 | | | | | D0474 | | | | |
| D0425 | | | | | D0475 | | | | |
| D0426 | 40426 | 01A9 | 6.SV.1 | * R/W | D0476 | 40476 | 01DB | 8.SV.1 | * R/W |
| D0427 | 40427 | 01AA | 6.A1.1 | * R/W | D0477 | 40477 | 01DC | 8.A1.1 | * R/W |
| D0428 | 40428 | 01AB | 6.A2.1 | * R/W | D0478 | 40478 | 01DD | 8.A2.1 | * R/W |
| D0429 | 40429 | 01AC | 6.A3.1 | * R/W | D0479 | 40479 | 01DE | 8.A3.1 | * R/W |
| D0430 | 40430 | 01AD | 6.A4.1 | * R/W | D0480 | 40480 | 01DF | 8.A4.1 | * R/W |
| D0431 | 40431 | 01AE | 6.P.1 | * R/W | D0481 | 40481 | 01E0 | 8.P.1 | * R/W |
| D0432 | 40432 | 01AF | 6.I.1 | * R/W | D0482 | 40482 | 01E1 | 8.I.1 | * R/W |
| D0433 | 40433 | 01B0 | 6.D.1 | * R/W | D0483 | 40483 | 01E2 | 8.D.1 | * R/W |
| D0434 | 40434 | 01B1 | 6.MH.1 | * R/W | D0484 | 40484 | 01E3 | 8.MH.1 | * R/W |
| D0435 | 40435 | 01B2 | 6.ML.1 | * R/W | D0485 | 40485 | 01E4 | 8.ML.1 | * R/W |
| D0436 | 40436 | 01B3 | 6.MR.1 | * R/W | D0486 | 40486 | 01E5 | 8.MR.1 | * R/W |
| D0437 | 40437 | 01B4 | 6.H.1 | * R/W | D0487 | 40487 | 01E6 | 8.H.1 | * R/W |
| D0438 | 40438 | 01B5 | 6.DR.1 | * R/W | D0488 | 40488 | 01E7 | 8.DR.1 | * R/W |
| D0439 | 40439 | 01B6 | 6.Pc.1 | * R/W | D0489 | 40489 | 01E8 | 8.Pc.1 | * R/W |
| D0440 | 40440 | 01B7 | 6.Ic.1 | * R/W | D0490 | 40490 | 01E9 | 8.Ic.1 | * R/W |
| D0441 | 40441 | 01B8 | 6.Dc.1 | * R/W | D0491 | 40491 | 01EA | 8.Dc.1 | * R/W |
| D0442 | 40442 | 01B9 | 6.Hc.1 | * R/W | D0492 | 40492 | 01EB | 8.Hc.1 | * R/W |
| D0443 | 40443 | 01BA | 6.DB.1 | * R/W | D0493 | 40493 | 01EC | 8.DB.1 | * R/W |
| D0444 | 40444 | 01BB | 6.RP.1 | * R/W | D0494 | 40494 | 01ED | 8.RP.1 | * R/W |
| D0445 | 40445 | 01BC | 6.PM.1 | * R/W | D0495 | 40495 | 01EE | 8.PM.1 | * R/W |
| D0446 | 40446 | 01BD | 6.PMc.1 | * R/W | D0496 | 40496 | 01EF | 8.PMc.1 | * R/W |
| D0447 | | | | | D0497 | | | | |
| D0448 | | | | | D0498 | | | | |
| D0449 | | | | | D0499 | | | | |
| D0450 | | | | | D0500 | | | | |

An asterisk (*) indicates that the number of writing actions is limited to 100,000 times.

## 5.6.1 Data Area for Loop-1 PID Parameters

| Register No. | Data Category | Description | Remarks |
|---|---|---|---|
| D0301 to 0321 | Group-1 parameters for loop 1 | 1.SV.1: Target setpoint<br>1.A1.1: Alarm 1 setpoint<br>1.A2.1: Alarm 2 setpoint<br>1.A3.1: Alarm 3 setpoint<br>1.A4.1: Alarm 4 setpoint<br>1.P.1: Proportional band<br>1.I.1: Integral time<br>1.D.1: Derivative time<br>1.MH.1: Upper limit of output<br>1.ML.1: Lower limit of output<br>1.MR.1: Manual reset<br>1.H.1: Hysteresis<br>1.DR.1: Direct/reverse action switchover<br>1.Pc.1: Cooling-side proportional band<br>1.Ic.1: Cooling-side integral time<br>1.Dc.1: Cooling-side derivative time<br>1.Hc.1: Cooling-side relay hysteresis<br>1.DB.1: Deadband<br>1.RP.1: Zone PID reference point<br>1.PM.1: Preset output value<br>1.PMc.1: Cooling-side preset output value | Selecting an SV number by means of communication enables the parameter group of the same number to be used.<br><br>Thus, switches in the parameter group occur simultaneously in both loop 1 and loop 2.<br><br>For example, if you set the SVNO parameter to 5, the parameters 5.SV.1, . . ., 5.PMc.1 are used.<br><br>For details on the parameters, see the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E). |
| D0326 to 0346 | Group-2 parameters for loop 1 | The group-2 parameters for loop 1, i.e., 2.SV.1, . . ., 2.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1. | |
| D0351 to 0371 | Group-3 parameters for loop 1 | The group-3 parameters for loop 1, i.e., 3.SV.1, . . ., 3.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1. | |
| D0376 to 0396 | Group-4 parameters for loop 1 | The group-4 parameters for loop 1, i.e., 4.SV.1, . . ., 4.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1. | |
| D0401 to 0421 | Group-5 parameters for loop 1 | The group-5 parameters for loop 1, i.e., 5.SV.1, . . ., 5.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1. | |
| D0426 to 0446 | Group-6 parameters for loop 1 | The group-6 parameters for loop 1, i.e., 6.SV.1, . . ., 6.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1. | |
| D0451 to 0471 | Group-7 parameters for loop 1 | The group-7 parameters for loop 1, i.e., 7.SV.1, . . ., 7.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1, where<br>RHY.1, which corresponds to 1.RP.1, denotes the zone PID hysteresis. | |
| D0476 to 0496 | Group-8 parameters for loop 1 | The group-8 parameters for loop 1, i.e., 8.SV.1, . . ., 8.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1, where<br>RDV.1, which corresponds to 1.RP.1, denotes the zone PID reference deviation. | |

# 5.7 Loop-2 PID Parameters

| Area for Loop-2 PID Parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D-Reg No. | Ref No. | H No . | Register Name | R/W | D-Reg No. | Ref No. | H No . | Register Name | R/W |
| D0501 | 40501 | 01F4 | 1.SV.2 | * R/W | D0551 | 40551 | 0226 | 3.SV.2 | * R/W |
| D0502 | 40502 | 01F5 | 1.A1.2 | * R/W | D0552 | 40552 | 0227 | 3.A1.2 | * R/W |
| D0503 | 40503 | 01F6 | 1.A2.2 | * R/W | D0553 | 40553 | 0228 | 3.A2.2 | * R/W |
| D0504 | 40504 | 01F7 | 1.A3.2 | * R/W | D0554 | 40554 | 0229 | 3.A3.2 | * R/W |
| D0505 | 40505 | 01F8 | 1.A4.2 | * R/W | D0555 | 40555 | 022A | 3.A4.2 | * R/W |
| D0506 | 40506 | 01F9 | 1.P.2 | * R/W | D0556 | 40556 | 022B | 3.P.2 | * R/W |
| D0507 | 40507 | 01FA | 1.I.2 | * R/W | D0557 | 40557 | 022C | 3.I.2 | * R/W |
| D0508 | 40508 | 01FB | 1.D.2 | * R/W | D0558 | 40558 | 022D | 3.D.2 | * R/W |
| D0509 | 40509 | 01FC | 1.MH.2 | * R/W | D0559 | 40559 | 022E | 3.MH.2 | * R/W |
| D0510 | 40510 | 01FD | 1.ML.2 | * R/W | D0560 | 40560 | 022F | 3.ML.2 | * R/W |
| D0511 | 40511 | 01FE | 1.MR.2 | * R/W | D0561 | 40561 | 0230 | 3.MR.2 | * R/W |
| D0512 | 40512 | 01FF | 1.H.2 | * R/W | D0562 | 40562 | 0231 | 3.H.2 | * R/W |
| D0513 | 40513 | 0200 | 1.DR.2 | * R/W | D0563 | 40563 | 0232 | 3.DR.2 | * R/W |
| D0514 | 40514 | 0201 | 1.Pc.2 | * R/W | D0564 | 40564 | 0233 | 3.Pc.2 | * R/W |
| D0515 | 40515 | 0202 | 1.Ic.2 | * R/W | D0565 | 40565 | 0234 | 3.Ic.2 | * R/W |
| D0516 | 40516 | 0203 | 1.Dc.2 | * R/W | D0566 | 40566 | 0235 | 3.Dc.2 | * R/W |
| D0517 | 40517 | 0204 | 1.Hc.2 | * R/W | D0567 | 40567 | 0236 | 3.Hc.2 | * R/W |
| D0518 | 40518 | 0205 | 1.DB.2 | * R/W | D0568 | 40568 | 0237 | 3.DB.2 | * R/W |
| D0519 | 40519 | 0206 | 1.RP.2 | * R/W | D0569 | 40569 | 0238 | 3.RP.2 | * R/W |
| D0520 | 40520 | 0207 | 1.PM.2 | * R/W | D0570 | 40570 | 0239 | 3.PM.2 | * R/W |
| D0521 | 40521 | 0208 | 1.PMc.2 | * R/W | D0571 | 40571 | 023A | 3.PMc.2 | * R/W |
| D0522 | | | | | D0572 | | | | |
| D0523 | | | | | D0573 | | | | |
| D0524 | | | | | D0574 | | | | |
| D0525 | | | | | D0575 | | | | |
| D0526 | 40526 | 020D | 2.SV.2 | * R/W | D0576 | 40576 | 023F | 4.SV.2 | * R/W |
| D0527 | 40527 | 020E | 2.A1.2 | * R/W | D0577 | 40577 | 0240 | 4.A1.2 | * R/W |
| D0528 | 40528 | 020F | 2.A2.2 | * R/W | D0578 | 40578 | 0241 | 4.A2.2 | * R/W |
| D0529 | 40529 | 0210 | 2.A3.2 | * R/W | D0579 | 40579 | 0242 | 4.A3.2 | * R/W |
| D0530 | 40530 | 0211 | 2.A4.2 | * R/W | D0580 | 40580 | 0243 | 4.A4.2 | * R/W |
| D0531 | 40531 | 0212 | 2.P.2 | * R/W | D0581 | 40581 | 0244 | 4.P.2 | * R/W |
| D0532 | 40532 | 0213 | 2.I.2 | * R/W | D0582 | 40582 | 0245 | 4.I.2 | * R/W |
| D0533 | 40533 | 0214 | 2.D.2 | * R/W | D0583 | 40583 | 0246 | 4.D.2 | * R/W |
| D0534 | 40534 | 0215 | 2.MH.2 | * R/W | D0584 | 40584 | 0247 | 4.MH.2 | * R/W |
| D0535 | 40535 | 0216 | 2.ML.2 | * R/W | D0585 | 40585 | 0248 | 4.ML.2 | * R/W |
| D0536 | 40536 | 0217 | 2.MR.2 | * R/W | D0586 | 40586 | 0249 | 4.MR.2 | * R/W |
| D0537 | 40537 | 0218 | 2.H.2 | * R/W | D0587 | 40587 | 024A | 4.H.2 | * R/W |
| D0538 | 40538 | 0219 | 2.DR.2 | * R/W | D0588 | 40588 | 024B | 4.DR.2 | * R/W |
| D0539 | 40539 | 021A | 2.Pc.2 | * R/W | D0589 | 40589 | 024C | 4.Pc.2 | * R/W |
| D0540 | 40540 | 021B | 2.Ic.2 | * R/W | D0590 | 40590 | 024D | 4.Ic.2 | * R/W |
| D0541 | 40541 | 021C | 2.Dc.2 | * R/W | D0591 | 40591 | 024E | 4.Dc.2 | * R/W |
| D0542 | 40542 | 021D | 2.Hc.2 | * R/W | D0592 | 40592 | 024F | 4.Hc.2 | * R/W |
| D0543 | 40543 | 021E | 2.DB.2 | * R/W | D0593 | 40593 | 0250 | 4.DB.2 | * R/W |
| D0544 | 40544 | 021F | 2.RP.2 | * R/W | D0594 | 40594 | 0251 | 4.RP.2 | * R/W |
| D0545 | 40545 | 0220 | 2.PM.2 | * R/W | D0595 | 40595 | 0252 | 4.PM.2 | * R/W |
| D0546 | 40546 | 0221 | 2.PMc.2 | * R/W | D0596 | 40596 | 0253 | 4.PMc.2 | * R/W |
| D0547 | | | | | D0597 | | | | |
| D0548 | | | | | D0598 | | | | |
| D0549 | | | | | D0599 | | | | |
| D0550 | | | | | D0600 | | | | |

An asterisk (*) indicates that the number of writing actions is limited to 100,000 times.

| Area for Loop-2 PID Parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D-Reg No. | Ref No. | H No . | Register Name | R/W | D-Reg No. | Ref No. | H No . | Register Name | R/W |
| D0601 | 40601 | 0258 | 5.SV.2 | * R/W | D0651 | 40651 | 028A | 7.SV.2 | * R/W |
| D0602 | 40602 | 0259 | 5.A1.2 | * R/W | D0652 | 40652 | 028B | 7.A1.2 | * R/W |
| D0603 | 40603 | 025A | 5.A2.2 | * R/W | D0653 | 40653 | 028C | 7.A2.2 | * R/W |
| D0604 | 40604 | 025B | 5.A3.2 | * R/W | D0654 | 40654 | 028D | 7.A3.2 | * R/W |
| D0605 | 40605 | 025C | 5.A4.2 | * R/W | D0655 | 40655 | 028E | 7.A4.2 | * R/W |
| D0606 | 40606 | 025D | 5.P.2 | * R/W | D0656 | 40656 | 028F | 7.P.2 | * R/W |
| D0607 | 40607 | 025E | 5.I.2 | * R/W | D0657 | 40657 | 0290 | 7.I.2 | * R/W |
| D0608 | 40608 | 025F | 5.D.2 | * R/W | D0658 | 40658 | 0291 | 7.D.2 | * R/W |
| D0609 | 40609 | 0260 | 5.MH.2 | * R/W | D0659 | 40659 | 0292 | 7.MH.2 | * R/W |
| D0610 | 40610 | 0261 | 5.ML.2 | * R/W | D0660 | 40660 | 0293 | 7.ML.2 | * R/W |
| D0611 | 40611 | 0262 | 5.MR.2 | * R/W | D0661 | 40661 | 0294 | 7.MR.2 | * R/W |
| D0612 | 40612 | 0263 | 5.H.2 | * R/W | D0662 | 40662 | 0295 | 7.H.2 | * R/W |
| D0613 | 40613 | 0264 | 5.DR.2 | * R/W | D0663 | 40663 | 0296 | 7.DR.2 | * R/W |
| D0614 | 40614 | 0265 | 5.Pc.2 | * R/W | D0664 | 40664 | 0297 | 7.Pc.2 | * R/W |
| D0615 | 40615 | 0266 | 5.Ic.2 | * R/W | D0665 | 40665 | 0298 | 7.Ic.2 | * R/W |
| D0616 | 40616 | 0267 | 5.Dc.2 | * R/W | D0666 | 40666 | 0299 | 7.Dc.2 | * R/W |
| D0617 | 40617 | 0268 | 5.Hc.2 | * R/W | D0667 | 40667 | 029A | 7.Hc.2 | * R/W |
| D0618 | 40618 | 0269 | 5.DB.2 | * R/W | D0668 | 40668 | 029B | 7.DB.2 | * R/W |
| D0619 | 40619 | 026A | 5.RP.2 | * R/W | D0669 | 40669 | 029C | 7.RP.2 | * R/W |
| D0620 | 40620 | 026B | 5.PM.2 | * R/W | D0670 | 40670 | 029D | 7.PM.2 | * R/W |
| D0621 | 40621 | 026C | 5.PMc.2 | * R/W | D0671 | 40671 | 029E | 7.PMc.2 | * R/W |
| D0622 | | | | | D0672 | | | | |
| D0623 | | | | | D0673 | | | | |
| D0624 | | | | | D0674 | | | | |
| D0625 | | | | | D0675 | | | | |
| D0626 | 40626 | 0271 | 6.SV.2 | * R/W | D0676 | 40676 | 02A3 | 8.SV.2 | * R/W |
| D0627 | 40627 | 0272 | 6.A1.2 | * R/W | D0677 | 40677 | 02A4 | 8.A1.2 | * R/W |
| D0628 | 40628 | 0273 | 6.A2.2 | * R/W | D0678 | 40678 | 02A5 | 8.A2.2 | * R/W |
| D0629 | 40629 | 0274 | 6.A3.2 | * R/W | D0679 | 40679 | 02A6 | 8.A3.2 | * R/W |
| D0630 | 40630 | 0275 | 6.A4.2 | * R/W | D0680 | 40680 | 02A7 | 8.A4.2 | * R/W |
| D0631 | 40631 | 0276 | 6.P.2 | * R/W | D0681 | 40681 | 02A8 | 8.P.2 | * R/W |
| D0632 | 40632 | 0277 | 6.I.2 | * R/W | D0682 | 40682 | 02A9 | 8.I.2 | * R/W |
| D0633 | 40633 | 0278 | 6.D.2 | * R/W | D0683 | 40683 | 02AA | 8.D.2 | * R/W |
| D0634 | 40634 | 0279 | 6.MH.2 | * R/W | D0684 | 40684 | 02AB | 8.MH.2 | * R/W |
| D0635 | 40635 | 027A | 6.ML.2 | * R/W | D0685 | 40685 | 02AC | 8.ML.2 | * R/W |
| D0636 | 40636 | 027B | 6.MR.2 | * R/W | D0686 | 40686 | 02AD | 8.MR.2 | * R/W |
| D0637 | 40637 | 027C | 6.H.2 | * R/W | D0687 | 40687 | 02AE | 8.H.2 | * R/W |
| D0638 | 40638 | 027D | 6.DR.2 | * R/W | D0688 | 40688 | 02AF | 8.DR.2 | * R/W |
| D0639 | 40639 | 027E | 6.Pc.2 | * R/W | D0689 | 40689 | 02B0 | 8.Pc.2 | * R/W |
| D0640 | 40640 | 027F | 6.Ic.2 | * R/W | D0690 | 40690 | 02B1 | 8.Ic.2 | * R/W |
| D0641 | 40641 | 0280 | 6.Dc.2 | * R/W | D0691 | 40691 | 02B2 | 8.Dc.2 | * R/W |
| D0642 | 40642 | 0281 | 6.Hc.2 | * R/W | D0692 | 40692 | 02B3 | 8.Hc.2 | * R/W |
| D0643 | 40643 | 0282 | 6.DB.2 | * R/W | D0693 | 40693 | 02B4 | 8.DB.2 | * R/W |
| D0644 | 40644 | 0283 | 6.RP.2 | * R/W | D0694 | 40694 | 02B5 | 8.RP.2 | * R/W |
| D0645 | 40645 | 0284 | 6.PM.2 | * R/W | D0695 | 40695 | 02B6 | 8.PM.2 | * R/W |
| D0646 | 40646 | 0285 | 6.PMc.2 | * R/W | D0696 | 40696 | 02B7 | 8.PMc.2 | * R/W |
| D0647 | | | | | D0697 | | | | |
| D0648 | | | | | D0698 | | | | |
| D0649 | | | | | D0699 | | | | |
| D0650 | | | | | D0700 | | | | |

An asterisk (*) indicates that the number of writing actions is limited to 100,000 times.

### 5.7.1 Data Area for Loop-2 PID Parameters

| Register No. | Data Category | Description | Remarks |
|---|---|---|---|
| D0501 to 0521 | Group-1 parameters for loop 2 | 1.SV.2: Target setpoint<br>1.A1.2: Alarm 1 setpoint<br>1.A2.2: Alarm 2 setpoint<br>1.A3.2: Alarm 3 setpoint<br>1.A4.2: Alarm 4 setpoint<br>1.P.2: Proportional band<br>1.I.2: Integral time<br>1.D.2: Derivative time<br>1.MH.2: Upper limit of output<br>1.ML.2: Lower limit of output<br>1.MR.2: Manual reset<br>1.H.2: Hysteresis<br>1.DR.2: Direct/reverse action switchover<br>1.Pc.2: Cooling-side proportional band<br>1.Ic.2: Cooling-side integral time<br>1.Dc.2: Cooling-side derivative time<br>1.Hc.2: Cooling-side relay hysteresis<br>1.DB.2: Deadband<br>1.RP.2: Zone PID reference point<br>1.PM.2: Preset output value<br>1.PMc.2: Cooling-side preset output value | Selecting an SV number by means of communication enables the parameter group of the same number to be used.<br><br>Thus, switches in the parameter group occur simultaneously in both loop 1 and loop 2.<br><br>For example, if you set the SVNO parameter to 5, the parameters 5.SV.2, . . ., 5.PMc.2 are used.<br><br>For details on the parameters, see the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E). |
| D0526 to 0546 | Group-2 parameters for loop 2 | The group-2 parameters for loop 2, i.e., 2.SV.2, . . ., 2.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2. | |
| D0551 to 0571 | Group-3 parameters for loop 2 | The group-3 parameters for loop 2, i.e., 3.SV.2, . . ., 3.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2. | |
| D0576 to 0596 | Group-4 parameters for loop 2 | The group-4 parameters for loop 2, i.e., 4.SV.2, . . ., 4.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2. | |
| D0601 to 0621 | Group-5 parameters for loop 2 | The group-5 parameters for loop 2, i.e., 5.SV.2, . . ., 5.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2. | |
| D0626 to 0646 | Group-6 parameters for loop 2 | The group-6 parameters for loop 2, i.e., 6.SV.2, . . ., 6.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2. | |
| D0651 to 0671 | Group-7 parameters for loop 2 | The group-7 parameters for loop 2, i.e., 7.SV.2, . . ., 7.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2, where RHY.2, which corresponds to 1.RP.2, denotes the zone PID hysteresis. | |
| D0676 to 0696 | Group-8 parameters for loop 2 | The group-8 parameters for loop 2, i.e., 8.SV.2, . . ., 8.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2, where RDV.2, which corresponds to 1.RP.2, denotes the zone PID reference deviation. | |

# 5.8 USER Parameters and the Ten-segment Linearizers Parameters and Messages

| Area for User Parameters and Ten-segment Linearizer Parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D-Reg No. | Ref No. | H No . | Register Name | R/W | D-Reg No. | Ref No. | H No . | Register Name | R/W |
| D0701 | 40701 | 02BC | U1 | * R/W | D0751 | 40751 | 02EE | 2.X1 | * R/W |
| D0702 | 40702 | 02BD | U2 | * R/W | D0752 | 40752 | 02EF | 2.Y1 | * R/W |
| D0703 | 40703 | 02BE | U3 | * R/W | D0753 | 40753 | 02F0 | 2.X2 | * R/W |
| D0704 | 40704 | 02BF | U4 | * R/W | D0754 | 40754 | 02F1 | 2.Y2 | * R/W |
| D0705 | 40705 | 02C0 | U5 | * R/W | D0755 | 40755 | 02F2 | 2.X3 | * R/W |
| D0706 | 40706 | 02C1 | U6 | * R/W | D0756 | 40756 | 02F3 | 2.Y3 | * R/W |
| D0707 | 40707 | 02C2 | U7 | * R/W | D0757 | 40757 | 02F4 | 2.X4 | * R/W |
| D0708 | 40708 | 02C3 | U8 | * R/W | D0758 | 40758 | 02F5 | 2.Y4 | * R/W |
| D0709 | 40709 | 02C4 | UD1 | R | D0759 | 40759 | 02F6 | 2.X5 | * R/W |
| D0710 | 40710 | 02C5 | UD2 | R | D0760 | 40760 | 02F7 | 2.Y5 | * R/W |
| D0711 | 40711 | 02C6 | UD3 | R | D0761 | 40761 | 02F8 | 2.X6 | * R/W |
| D0712 | 40712 | 02C7 | UD4 | R | D0762 | 40762 | 02F9 | 2.Y6 | * R/W |
| D0713 | 40713 | 02C8 | UD5 | R | D0763 | 40763 | 02FA | 2.X7 | * R/W |
| D0714 | 40714 | 02C9 | UD6 | R | D0764 | 40764 | 02FB | 2.Y7 | * R/W |
| D0715 | 40715 | 02CA | UD7 | R | D0765 | 40765 | 02FC | 2.X8 | * R/W |
| D0716 | 40716 | 02CB | UD8 | R | D0766 | 40766 | 02FD | 2.Y8 | * R/W |
| D0717 | 40717 | 02CC | UD9 | R | D0767 | 40767 | 02FE | 2.X9 | * R/W |
| D0718 | 40718 | 02CD | UD10 | R | D0768 | 40768 | 02FF | 2.Y9 | * R/W |
| D0719 | 40719 | 02CE | UD11 | R | D0769 | 40769 | 0300 | 2.X10 | * R/W |
| D0720 | 40720 | 02CF | UD12 | R | D0770 | 40770 | 0301 | 2.Y10 | * R/W |
| D0721 | 40721 | 02D0 | UD13 | R | D0771 | 40771 | 0302 | 2.X11 | * R/W |
| D0722 | 40722 | 02D1 | UD14 | R | D0772 | 40772 | 0303 | 2.Y11 | * R/W |
| D0723 | 40723 | 02D2 | UD15 | R | D0773 | 70773 | 0304 | 2.PMD | * R/W |
| D0724 | 40724 | 02D3 | UD16 | R | D0774 | | | | |
| D0725 | 40725 | 02D4 | UD17 | R | D0775 | | | | |
| D0726 | 40726 | 02D5 | 1.X1 | * R/W | D0776 | | | | |
| D0727 | 40727 | 02D6 | 1.Y1 | * R/W | D0777 | | | | |
| D0728 | 40728 | 02D7 | 1.X2 | * R/W | D0778 | | | | |
| D0729 | 40729 | 02D8 | 1.Y2 | * R/W | D0779 | | | | |
| D0730 | 40730 | 02D9 | 1.X3 | * R/W | D0780 | | | | |
| D0731 | 40731 | 02DA | 1.Y3 | * R/W | D0781 | | | | |
| D0732 | 40732 | 02DB | 1.X4 | * R/W | D0782 | | | | |
| D0733 | 40733 | 02DC | 1.Y4 | * R/W | D0783 | | | | |
| D0734 | 40734 | 02DD | 1.X5 | * R/W | D0784 | | | | |
| D0735 | 40735 | 02DE | 1.Y5 | * R/W | D0785 | | | | |
| D0736 | 40736 | 02DF | 1.X6 | * R/W | D0786 | | | | |
| D0737 | 40737 | 02E0 | 1.Y6 | * R/W | D0787 | | | | |
| D0738 | 40738 | 02E1 | 1.X7 | * R/W | D0788 | | | | |
| D0739 | 40739 | 02E2 | 1.Y7 | * R/W | D0789 | | | | |
| D0740 | 40740 | 02E3 | 1.X8 | * R/W | D0790 | | | | |
| D0741 | 40741 | 02E4 | 1.Y8 | * R/W | D0791 | | | | |
| D0742 | 40742 | 02E5 | 1.X9 | * R/W | D0792 | | | | |
| D0743 | 40743 | 02E6 | 1.Y9 | * R/W | D0793 | | | | |
| D0744 | 40744 | 02E7 | 1.X10 | * R/W | D0794 | | | | |
| D0745 | 40745 | 02E8 | 1.Y10 | * R/W | D0795 | | | | |
| D0746 | 40746 | 02E9 | 1.X11 | * R/W | D0796 | | | | |
| D0747 | 40747 | 02EA | 1.X11 | * R/W | D0797 | | | | |
| D0748 | 40748 | 02EB | 1.PMD | * R/W | D0798 | | | | |
| D0749 | | | | | D0799 | | | | |
| D0750 | | | | | D0800 | | | | |

An asterisk (*) indicates that the number of writing actions is limited to 100,000 times.

| Area for Messages | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D-Reg No. | Ref No. | H No . | Register Name | R/W | D-Reg No. | Ref No. | H No . | Register Name | R/W |
| D0801 | 40801 | 0320 | MSG101 | R | D0851 | 40851 | 0352 | MSG311 | R |
| D0802 | 40802 | 0321 | MSG102 | R | D0852 | 40852 | 0353 | MSG312 | R |
| D0803 | 40803 | 0322 | MSG103 | R | D0853 | 40853 | 0354 | MSG313 | R |
| D0804 | 40804 | 0323 | MSG104 | R | D0854 | 40854 | 0355 | MSG314 | R |
| D0805 | 40805 | 0324 | MSG105 | R | D0855 | 40855 | 0356 | MSG315 | R |
| D0806 | 40806 | 0325 | MSG106 | R | D0856 | 40856 | 0357 | MSG316 | R |
| D0807 | 40807 | 0326 | MSG107 | R | D0857 | 40857 | 0358 | MSG317 | R |
| D0808 | 40808 | 0327 | MSG108 | R | D0858 | 40858 | 0359 | MSG318 | R |
| D0809 | 40809 | 0328 | MSG109 | R | D0859 | 40859 | 035A | MSG319 | R |
| D0810 | 40810 | 0329 | MSG110 | R | D0860 | 40860 | 035B | MSG320 | R |
| D0811 | 40811 | 032A | MSG111 | R | D0861 | 40861 | 035C | MSG401 | R |
| D0812 | 40812 | 032B | MSG112 | R | D0862 | 40862 | 035D | MSG402 | R |
| D0813 | 40813 | 032C | MSG113 | R | D0863 | 40863 | 035E | MSG403 | R |
| D0814 | 40814 | 032D | MSG114 | R | D0864 | 40864 | 035F | MSG404 | R |
| D0815 | 40815 | 032E | MSG115 | R | D0865 | 40865 | 0360 | MSG405 | R |
| D0816 | 40816 | 032F | MSG116 | R | D0866 | 40866 | 0361 | MSG406 | R |
| D0817 | 40817 | 0330 | MSG117 | R | D0867 | 40867 | 0362 | MSG407 | R |
| D0818 | 40818 | 0331 | MSG118 | R | D0868 | 40868 | 0363 | MSG408 | R |
| D0819 | 40819 | 0332 | MSG119 | R | D0869 | 40869 | 0364 | MSG409 | R |
| D0820 | 40820 | 0333 | MSG120 | R | D0870 | 40870 | 0365 | MSG410 | R |
| D0821 | 40821 | 0334 | MSG201 | R | D0871 | 40871 | 0366 | MSG411 | R |
| D0822 | 40822 | 0335 | MSG202 | R | D0872 | 40872 | 0367 | MSG412 | R |
| D0823 | 40823 | 0336 | MSG203 | R | D0873 | 70873 | 0368 | MSG413 | R |
| D0824 | 40824 | 0337 | MSG204 | R | D0874 | 70874 | 0369 | MSG414 | R |
| D0825 | 40825 | 0338 | MSG205 | R | D0875 | 70875 | 036A | MSG415 | R |
| D0826 | 40826 | 0339 | MSG206 | R | D0876 | 70876 | 036B | MSG416 | R |
| D0827 | 40827 | 033A | MSG207 | R | D0877 | 70877 | 036C | MSG417 | R |
| D0828 | 40828 | 033B | MSG208 | R | D0878 | 70878 | 036D | MSG418 | R |
| D0829 | 40829 | 033C | MSG209 | R | D0879 | 70879 | 036E | MSG419 | R |
| D0830 | 40830 | 033D | MSG210 | R | D0880 | 70880 | 036F | MSG420 | R |
| D0831 | 40831 | 033E | MSG211 | R | D0881 | | | | |
| D0832 | 40832 | 033F | MSG212 | R | D0882 | | | | |
| D0833 | 40833 | 0340 | MSG213 | R | D0883 | | | | |
| D0834 | 40834 | 0341 | MSG214 | R | D0884 | | | | |
| D0835 | 40835 | 0342 | MSG215 | R | D0885 | | | | |
| D0836 | 40836 | 0343 | MSG216 | R | D0886 | | | | |
| D0837 | 40837 | 0344 | MSG217 | R | D0887 | | | | |
| D0838 | 40838 | 0345 | MSG218 | R | D0888 | | | | |
| D0839 | 40839 | 0346 | MSG219 | R | D0889 | | | | |
| D0840 | 40840 | 0347 | MSG220 | R | D0890 | | | | |
| D0841 | 40841 | 0348 | MSG301 | R | D0891 | | | | |
| D0842 | 40842 | 0349 | MSG302 | R | D0892 | | | | |
| D0843 | 40843 | 034A | MSG303 | R | D0893 | | | | |
| D0844 | 40844 | 034B | MSG304 | R | D0894 | | | | |
| D0845 | 40845 | 034C | MSG305 | R | D0895 | | | | |
| D0846 | 40846 | 034D | MSG306 | R | D0896 | | | | |
| D0847 | 40847 | 034E | MSG307 | R | D0897 | | | | |
| D0848 | 40848 | 034F | MSG308 | R | D0898 | | | | |
| D0849 | 40849 | 0350 | MSG309 | R | D0899 | | | | |
| D0850 | 40850 | 0351 | MSG310 | R | D0900 | | | | |

## 5.8.1 Data Area for USER Parameters

| Register No. | Data Category | Description | Remarks |
|---|---|---|---|
| D0701 to 0708 | USER parameters | U1 to U8 | Parameters U1 to U3 are used when the controller mode (US mode) is loop control with PV switching, loop control with PV auto-selector, loop control with PV switching and two universal inputs, or loop control with PV auto-selector and two universal inputs.<br>**See Also**<br>*US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E) |

## 5.8.2 User Area

| Register No. | Data Category | Description | Remarks |
|---|---|---|---|
| D0709 to 0725 | User area | UD1 to UD17 | Data can be read from the area of D registers 0709 to 0725. |

## 5.8.3 Data Area for Parameters of Ten-segment Linearizers 1 and 2

| Register No. | Data Category | Description | Remarks |
|---|---|---|---|
| D0726 to 0748 | Ten-segment linearizer-1 parameters | 1.X1: Ten-segment linearizer-1 input 1<br>1.Y1: Ten-segment linearizer-1 output 1<br>1.X2: Ten-segment linearizer-1 input 2<br>1.Y2: Ten-segment linearizer-1 output 2<br>1.X3: Ten-segment linearizer-1 input 3<br>1.Y3: Ten-segment linearizer-1 output 3<br>1.X4: Ten-segment linearizer-1 input 4<br>1.Y4: Ten-segment linearizer-1 output 4<br>1.X5: Ten-segment linearizer-1 input 5<br>1.Y5: Ten-segment linearizer-1 output 5<br>1.X6: Ten-segment linearizer-1 input 6<br>1.Y6: Ten-segment linearizer-1 output 6<br>1.X7: Ten-segment linearizer-1 input 7<br>1.Y7: Ten-segment linearizer-1 output 7<br>1.X8: Ten-segment linearizer-1 input 8<br>1.Y8: Ten-segment linearizer-1 output 8<br>1.X9: Ten-segment linearizer-1 input 9<br>1.Y9: Ten-segment linearizer-1 output 9<br>1.X10: Ten-segment linearizer-1 input 10<br>1.Y10: Ten-segment linearizer-1 output 10<br>1.X11: Ten-segment linearizer-1 input 11<br>1.Y11: Ten-segment linearizer 1 output 11<br>1.PMD: Ten-segment linearizer 1 mode | For details on the parameters, see the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E). |
| D0751 to 0773 | Ten-segment linearizer-2 parameters | The parameters of ten-segment linearizer 2, i.e., 2.X1, . . ., 2.PMD, are functionally the same as the corresponding parameters of ten-segment linearizer 1 listed above, i.e., 1.X1, . . ., 1.PMD. | |

## 5.8.4 Area for Setting Message Text

| Register No. | Data Category | Description | Remarks |
|---|---|---|---|
| D0801 to 0820 | Message 1 text setting | MSG101 to MSG120 | These registers contain the messages registered using the LL1100 PC-based Parameters Setting Tool. The message text should include no more than 33 single-byte alphanumeric characters.<br>You can register a maximum of four messages. |
| D0821 to 0840 | Message 2 text setting | MSG201 to MSG220 | |
| D0841 to 0860 | Message 3 text setting | MSG301 to MSG320 | |
| D0861 to 0880 | Message 4 text setting | MSG401 to MSG420 | |

# 5.9 Control Function Parameters, Loop Common Control Function Parameters, and I/O Configuration Parameters

| Area for Control Function Parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D-Reg No. | Ref No. | H No . | Register Name | R/W | D-Reg No. | Ref No. | H No . | Register Name | R/W |
| D0901 | 40901 | 0384 | CMS.1 | * R/W | D0951 | | | | |
| D0902 | | | | | D0952 | | | | |
| D0903 | 40903 | 0386 | PVT.1 | * R/W | D0953 | | | | |
| D0904 | 40904 | 0387 | TMU.1 | * R/W | D0954 | | | | |
| D0905 | 40905 | 0388 | DVB.1 | * R/W | D0955 | 40955 | 03BA | AL1.2 | * R/W |
| D0906 | | | | | D0956 | 40956 | 03BB | AL2.2 | * R/W |
| D0907 | | | | | D0957 | 40957 | 03BC | AL3.2 | * R/W |
| D0908 | | | | | D0958 | 40958 | 03BD | AL4.2 | * R/W |
| D0909 | | | | | D0959 | 40959 | 03BE | HY1.2 | * R/W |
| D0910 | | | | | D0960 | 40960 | 03BF | HY2.2 | * R/W |
| D0911 | | | | | D0961 | 40961 | 03C0 | HY3.2 | * R/W |
| D0912 | | | | | D0962 | 40962 | 03C1 | HY4.2 | * R/W |
| D0913 | | | | | D0963 | 40963 | 03C2 | PVR.T.2 | * R/W |
| D0914 | | | | | D0964 | 40964 | 03C3 | AMD.2 | * R/W |
| D0915 | 40915 | 0392 | AL1.1 | * R/W | D0965 | | | | |
| D0916 | 40916 | 0393 | AL2.1 | * R/W | D0966 | 40966 | 03C5 | MVR.2 | * R/W |
| D0917 | 40917 | 0394 | AL3.1 | * R/W | D0967 | 40967 | 03C6 | MOD.2 | * R/W |
| D0918 | 40918 | 0395 | AL4.1 | * R/W | D0968 | 40968 | 03C7 | AR.2 | * R/W |
| D0919 | 40919 | 0396 | HY1.1 | * R/W | D0969 | | | | |
| D0920 | 40920 | 0397 | HY2.1 | * R/W | D0970 | | | | |
| D0921 | 40921 | 0398 | HY3.1 | * R/W | D0971 | | | | |
| D0922 | 40922 | 0399 | HY4.1 | * R/W | D0972 | | | | |
| D0923 | 40923 | 039A | PVR.T.1 | * R/W | D0973 | | | | |
| D0924 | 40924 | 039B | AMD.1 | * R/W | D0974 | | | | |
| D0925 | | | | | D0975 | | | | |
| D0926 | 40926 | 0339 | MVR.1 | * R/W | D0976 | | | | |
| D0927 | 40927 | 033A | MOD.1 | * R/W | D0977 | | | | |
| D0928 | 40928 | 033B | AR.1 | * R/W | D0978 | | | | |
| D0929 | 40929 | 033C | FFS | * R/W | D0979 | | | | |
| D0930 | | | | | D0980 | | | | |
| D0931 | | | | | D0981 | | | | |
| D0932 | | | | | D0982 | | | | |
| D0933 | | | | | D0983 | | | | |
| D0934 | | | | | D0984 | | | | |
| D0935 | | | | | D0985 | | | | |
| D0936 | | | | | D0986 | | | | |
| D0937 | | | | | D0987 | | | | |
| D0938 | | | | | D0988 | | | | |
| D0939 | | | | | D0989 | | | | |
| D0940 | | | | | D0990 | | | | |
| D0941 | 40941 | 0348 | CMS.2 | * R/W | D0991 | | | | |
| D0942 | | | | | D0992 | | | | |
| D0943 | 40943 | 034A | PVT.2 | * R/W | D0993 | | | | |
| D0944 | 40944 | 034B | TMU.2 | * R/W | D0994 | | | | |
| D0945 | 40945 | 034C | DVB.2 | * R/W | D0995 | | | | |
| D0946 | | | | | D0996 | | | | |
| D0947 | | | | | D0997 | | | | |
| D0948 | | | | | D0998 | | | | |
| D0949 | | | | | D0999 | | | | |
| D0950 | | | | | D1000 | | | | |

An asterisk (*) indicates that the number of writing actions is limited to 100,000 times.

| Area for Loop Common Control Function Parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D-Reg No. | Ref No. | H No . | Register Name | R/W | D-Reg No. | Ref No. | H No . | Register Name | R/W |
| D1001 | 41001 | 03E8 | A.BS1 | * R/W | D1051 | 41051 | 041A | RET1 | * R/W |
| D1002 | 41002 | 03E9 | A.FL1 | * R/W | D1052 | 41052 | 041B | RTH1 | * R/W |
| D1003 | 41003 | 03EA | A.SR1 | * R/W | D1053 | 41053 | 041C | RTL1 | * R/W |
| D1004 | 41004 | 03EB | A.LC1 | * R/W | D1054 | 41054 | 041D | RET2 | * R/W |
| D1005 | 41005 | 03EC | A.BO1 | * R/W | D1055 | 41055 | 041E | RTH2 | * R/W |
| D1006 | 41006 | 03ED | A.RJ1 | * R/W | D1056 | 41056 | 041F | RTL2 | * R/W |
| D1007 | | | | | D1057 | 41057 | 0420 | RET3 | * R/W |
| D1008 | | | | | D1058 | 41058 | 0421 | RTH3 | * R/W |
| D1009 | | | | | D1059 | 41059 | 0422 | RTL3 | * R/W |
| D1010 | | | | | D1060 | | | | |
| D1011 | 41011 | 03F2 | A.BS2 | * R/W | D1061 | 41061 | 0424 | SVC | * R/W |
| D1012 | 41012 | 03F3 | A.FL2 | * R/W | D1062 | 41062 | 0425 | ▽/△ | * R/W |
| D1013 | 41013 | 03F4 | A.SR2 | * R/W | D1063 | 41063 | 0426 | < / > | * R/W |
| D1014 | 41014 | 03F5 | A.LC2 | * R/W | D1064 | 41064 | 0427 | C | * R/W |
| D1015 | 41015 | 03F6 | A.BO2 | * R/W | D1065 | 41065 | 0428 | A | * R/W |
| D1016 | 41016 | 03F7 | A.RJ2 | * R/W | D1066 | 41066 | 0429 | M | * R/W |
| D1017 | | | | | D1067 | 41067 | 042A | MODE | * R/W |
| D1018 | | | | | D1068 | 41068 | 042B | O.LP1 | * R/W |
| D1019 | | | | | D1069 | 41069 | 042C | O.LP2 | * R/W |
| D1020 | | | | | D1070 | 41070 | 042D | PID | * R/W |
| D1021 | 41021 | 03FC | A.BS3 | * R/W | D1071 | 41071 | 042E | USR | * R/W |
| D1022 | 41022 | 03FD | A.FL3 | * R/W | D1072 | 41072 | 042F | PYS1 | * R/W |
| D1023 | 41023 | 03FE | A.SR3 | * R/W | D1073 | 41073 | 0430 | PYS2 | * R/W |
| D1024 | 41024 | 03FF | A.LC3 | * R/W | D1074 | 41074 | 0431 | PWD | * R/W |
| D1025 | 41025 | 0400 | A.BO3 | * R/W | D1075 | | | | |
| D1026 | | | | | D1076 | | | | |
| D1027 | | | | | D1077 | | | | |
| D1028 | | | | | D1078 | | | | |
| D1029 | | | | | D1079 | | | | |
| D1030 | | | | | D1080 | | | | |
| D1031 | | | | | D1081 | 41081 | 0438 | PSL | * R/W |
| D1032 | | | | | D1082 | 41082 | 0439 | BPS | * R/W |
| D1033 | | | | | D1083 | 41083 | 043A | PARI | * R/W |
| D1034 | | | | | D1084 | 41084 | 043B | STP | * R/W |
| D1035 | | | | | D1085 | 41085 | 043C | DLN | * R/W |
| D1036 | | | | | D1086 | 41086 | 043D | ADR | * R/W |
| D1037 | | | | | D1087 | 41087 | 043E | RSP.T | * R/W |
| D1038 | | | | | D1088 | | | | |
| D1039 | | | | | D1089 | | | | |
| D1040 | | | | | D1090 | | | | |
| D1041 | 41041 | 0410 | PPID | * R/W | D1091 | | | | |
| D1042 | 41042 | 0411 | R.MD | * R/W | D1092 | | | | |
| D1043 | 41043 | 0412 | R.TM | * R/W | D1093 | | | | |
| D1044 | 41044 | 0413 | CT.1 | * R/W | D1094 | | | | |
| D1045 | 41045 | 0414 | CT.2 | * R/W | D1095 | | | | |
| D1046 | 41046 | 0415 | CTc.1 | * R/W | D1096 | | | | |
| D1047 | 41047 | 0416 | CTc.2 | * R/W | D1097 | | | | |
| D1048 | | | | | D1098 | | | | |
| D1049 | | | | | D1099 | | | | |
| D1050 | | | | | D1100 | | | | |

An asterisk (*) indicates that the number of writing actions is limited to 100,000 times.

| Area for I/O Registration Parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D-Reg No. | Ref No. | H No . | Register Name | R/W | D-Reg No. | Ref No. | H No . | Register Name | R/W |
| D1101 | 41101 | 044C | C.S1 | * R/W | D1151 | 41151 | 047E | U.1AL | * R/W |
| D1102 | 41102 | 044D | C.S2 | * R/W | D1152 | 41152 | 047F | U.2AL | * R/W |
| D1103 | 41103 | 044E | C.S3 | * R/W | D1153 | 41153 | 0480 | U.SVN | * R/W |
| D1104 | 41104 | 044F | C.S4 | * R/W | D1154 | 41154 | 0481 | U.1PI | * R/W |
| D1105 | 41105 | 0450 | C.S5 | * R/W | D1155 | 41155 | 0482 | U.2PI | * R/W |
| D1106 | 41106 | 0451 | DO1 | * R/W | D1156 | 41156 | 0483 | U.AI1 | * R/W |
| D1107 | 41107 | 0452 | DO2 | * R/W | D1157 | 41157 | 0484 | U.AI2 | * R/W |
| D1108 | 41108 | 0453 | DO3 | * R/W | D1158 | 41158 | 0485 | U.AI3 | * R/W |
| D1109 | 41109 | 0454 | DO4 | * R/W | D1159 | 41159 | 0486 | U.PV1 | * R/W |
| D1110 | 41110 | 0455 | DO5 | * R/W | D1160 | 41160 | 0487 | U.PV2 | * R/W |
| D1111 | 41111 | 0456 | DO6 | * R/W | D1161 | 41161 | 0488 | U.SMP | * R/W |
| D1112 | 41112 | 0457 | DO7 | * R/W | D1162 | | | | |
| D1113 | | | | | D1163 | | | | |
| D1114 | | | | | D1164 | | | | |
| D1115 | | | | | D1165 | | | | |
| D1116 | | | | | D1166 | | | | |
| D1117 | | | | | D1167 | | | | |
| D1118 | | | | | D1168 | | | | |
| D1119 | | | | | D1169 | | | | |
| D1120 | | | | | D1170 | | | | |
| D1121 | | | | | D1171 | 41171 | 0492 | PY1X | * R/W |
| D1122 | | | | | D1172 | 41172 | 0493 | PY1Y | * R/W |
| D1123 | | | | | D1173 | 41173 | 0494 | PY2X | * R/W |
| D1124 | | | | | D1174 | 41174 | 0495 | PY2Y | * R/W |
| D1125 | | | | | D1175 | | | | |
| D1126 | | | | | D1176 | | | | |
| D1127 | | | | | D1177 | | | | |
| D1128 | | | | | D1178 | | | | |
| D1129 | 41129 | 0468 | CAS.1 | * R/W | D1179 | | | | |
| D1130 | 41130 | 0469 | AUT.1 | * R/W | D1180 | | | | |
| D1131 | 41131 | 046A | MAN.1 | * R/W | D1181 | | | | |
| D1132 | 41132 | 046B | CAS.2 | * R/W | D1182 | | | | |
| D1133 | 41133 | 046C | AUT.2 | * R/W | D1183 | | | | |
| D1134 | 41134 | 046D | MAN.2 | * R/W | D1184 | | | | |
| D1135 | 41135 | 046E | O/C | * R/W | D1185 | | | | |
| D1136 | 41136 | 046F | R/S | * R/W | D1186 | | | | |
| D1137 | 41137 | 0470 | TRF.1 | * R/W | D1187 | | | | |
| D1138 | 41138 | 0471 | TRF.2 | * R/W | D1188 | | | | |
| D1139 | | | | | D1189 | | | | |
| D1140 | 41140 | 0473 | SV.B0 | * R/W | D1190 | | | | |
| D1141 | 41141 | 0474 | SV.B1 | * R/W | D1191 | | | | |
| D1142 | 41142 | 0475 | SV.B2 | * R/W | D1192 | | | | |
| D1143 | 41143 | 0476 | SV.B3 | * R/W | D1193 | | | | |
| D1144 | 41144 | 0477 | DP1 | * R/W | D1194 | | | | |
| D1145 | 41145 | 0478 | DP2 | * R/W | D1195 | | | | |
| D1146 | 41146 | 0479 | MG1 | * R/W | D1196 | | | | |
| D1147 | 41147 | 047A | MG2 | * R/W | D1197 | | | | |
| D1148 | 41148 | 047B | MG3 | * R/W | D1198 | | | | |
| D1149 | 41149 | 047C | MG4 | * R/W | D1199 | | | | |
| D1150 | | | | | D1200 | | | | |

An asterisk (*) indicates that the number of writing actions is limited to 100,000 times.

### 5.9.1 Data Area for Control Function Parameters

| Register No. | Data Category | Description | Remarks |
|---|---|---|---|
| D0901 to 0905 | Loop-1, SV-related parameters | CMS.1, . . ., DVB.1 | For details on the parameters, see the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E). |
| D0915 to 0924 | Loop-1, alarm setting parameters | AL1.1, . . ., PMD.1 | |
| D0926 to 0929 | Loop-1, control function setting parameters | MVR.1, . . ., FFS | |
| D0941 to 0945 | Loop-2, SV-related parameters | CMS.2, . . ., DVB.2 | |
| D0955 to 0964 | Loop-2, alarm setting parameters | AL1.2, . . ., PMD.2 | |
| D0966 to 0968 | Loop-2, control function setting parameters | MVR.2, . . ., AR.2 | |

### 5.9.2 Data Area for Loop Common Control Function Parameters

| Register No. | Data Category | Description | Remarks |
|---|---|---|---|
| D1001 to 1006 | Input computation setting parameters | A.BS1, . . ., A.RJ1 | For details on the parameters, see the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E). |
| D1011 to 1016 | | A.BS2, . . ., A.RJ2 | |
| D1021 to 1025 | | A.BS3, . . ., A.BO3 | |
| D1041 to 1047 | Loop common control function setting parameters | PPID, . . ., CTc.2 | |
| D1051 to 1059 | Retransmission output setting parameters | RET1, . . ., RTL3 | |
| D1061 to 1066 | Keylock setting parameters | SVC, . . ., M | |
| D1067 to 1074 | Menu lock setting parameters | MODE, . . ., PWD | |
| D1081 to 1087 | RS-485 setting parameters | PSL, . . ., RSP.T | |

### 5.9.3 Data Area for I/O Configuration Parameters

| Register No. | Data Category | Description | Remarks |
|---|---|---|---|
| D1101 to 1105 | SELECT display configuration parameters | C.S1, . . ., C.S5 | For details on the parameters, see the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E). |
| D1151 to 1161 | USER display configuration parameters | U.AL1, . . ., U.SMP | |
| D1106 to 1112 | Contact output configuration parameters | DO1, . . ., DO7 | |
| D1129 to 1149 | Contact input configuration parameters | CAS.1, . . ., MG4 | |
| D1171 to 1174 | Ten-segment linearizer unit setting parameters | PY1X, . . ., PY2Y | |

# 5.10 Controller-mode, Analog-input and MV-output Parameters

| Area for Controller-mode, Analog-input and MV-output Parameters | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| D-Reg No. | Ref No. | H No . | Register Name | R/W | D-Reg No. | Ref No. | H No . | Register Name | R/W |
| D1201 | 41201 | 04B0 | TYP1 | * R/W | D1251 | | | | |
| D1202 | 41202 | 04B1 | UNI1 | * R/W | D1252 | | | | |
| D1203 | 41203 | 04B2 | DP1 | R | D1253 | | | | |
| D1204 | 41204 | 04B3 | RH1 | * R/W | D1254 | | | | |
| D1205 | 41205 | 04B4 | RL1 | * R/W | D1255 | | | | |
| D1206 | 41206 | 04B5 | SDP1 | * R/W | D1256 | | | | |
| D1207 | 41207 | 04B6 | SH1 | * R/W | D1257 | | | | |
| D1208 | 41208 | 04B7 | SL1 | * R/W | D1258 | | | | |
| D1209 | | | | | D1259 | | | | |
| D1210 | | | | | D1260 | | | | |
| D1211 | 41211 | 04BA | TYP2 | * R/W | D1261 | 41261 | 04EC | V.RS | * R/W |
| D1212 | 41212 | 04BB | UNI2 | * R/W | D1262 | 41262 | 04ED | V.L | * R/W |
| D1213 | 41213 | 04BC | DP2 | R | D1263 | 41263 | 04EE | V.H | * R/W |
| D1214 | 41214 | 04BD | RH2 | * R/W | D1264 | 41264 | 04EF | V.AT | * R/W |
| D1215 | 41215 | 04BE | RL2 | * R/W | D1265 | 41265 | 05F0 | INIT | * R/W |
| D1216 | 41216 | 04BF | SDP2 | * R/W | D1266 | | | | |
| D1217 | 41217 | 04C0 | SH2 | * R/W | D1267 | | | | |
| D1218 | 41218 | 04C1 | SL2 | * R/W | D1268 | | | | |
| D1219 | | | | | D1269 | | | | |
| D1220 | | | | | D1270 | | | | |
| D1221 | 41221 | 04C4 | TYP3 | * R/W | D1271 | | | | |
| D1222 | | | | | D1272 | | | | |
| D1223 | 41223 | 04C6 | DP3 | R | D1273 | | | | |
| D1224 | 41224 | 04C7 | RH3 | * R/W | D1274 | | | | |
| D1225 | 41225 | 04C8 | RL3 | * R/W | D1275 | | | | |
| D1226 | 41226 | 04C9 | SDP3 | * R/W | D1276 | | | | |
| D1227 | 41227 | 04CA | SH3 | * R/W | D1277 | | | | |
| D1228 | 41228 | 04CB | SL3 | * R/W | D1278 | | | | |
| D1229 | | | | | D1279 | | | | |
| D1230 | | | | | D1280 | 41280 | 04FF | USM | * R/W |
| D1231 | 41231 | 04CE | P.DP1 | * R/W | D1281 | 41281 | 0500 | SMP | * R/W |
| D1232 | 41232 | 04CF | P.RH1 | * R/W | D1282 | | | | |
| D1233 | 41233 | 04D0 | P.RL1 | * R/W | D1283 | | | | |
| D1234 | | | | | D1284 | | | | |
| D1235 | 41235 | 04D2 | P.DP2 | * R/W | D1285 | | | | |
| D1236 | 41236 | 04D3 | P.RH2 | * R/W | D1286 | | | | |
| D1237 | 41237 | 04D4 | P.RL2 | * R/W | D1287 | | | | |
| D1238 | | | | | D1288 | | | | |
| D1239 | | | | | D1289 | | | | |
| D1240 | | | | | D1290 | | | | |
| D1241 | 41241 | 04D8 | MVS.1 | * R/W | D1291 | | | | |
| D1242 | 41242 | 04D9 | MVS.2 | * R/W | D1292 | | | | |
| D1243 | 41243 | 04DA | AO1 | * R/W | D1293 | | | | |
| D1244 | 41244 | 04DB | AO2 | * R/W | D1294 | | | | |
| D1245 | 41245 | 04DC | AO3 | * R/W | D1295 | | | | |
| D1246 | 41246 | 04DD | RVOP | * R/W | D1296 | | | | |
| D1247 | | | | | D1297 | | | | |
| D1248 | | | | | D1298 | | | | |
| D1249 | | | | | D1299 | | | | |
| D1250 | | | | | D1300 | | | | |

An asterisk (*) indicates that the number of writing actions is limited to 100,000 times.

### 5.10.1 Data Area for Storing the Controller-mode, Analog-input and MV-output Parameters

| Register No. | Data Category | Description | Remarks |
|---|---|---|---|
| D1201 to 1208 | Analog input 1 parameters | TYP1, . . ., SL1 | The DP1 (D register numbered 1203) is not a parameter register but a read-only register.<br>For details on the parameters, see the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E). |
| D1211 to 1218 | Analog input 2 parameters | TYP2, . . ., SL2 | The DP2 (D register numbered 1213) is not a parameter register but a read-only register.<br>For details on the parameters, see the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E). |
| D1221 to 1228 | Analog input 3 parameters | TYP3, . . ., SL3 | The DP3 (D register numbered 1223) is not a parameter register but a read-only register.<br>For details on the parameters, see the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E). |
| D1231 to 1233 | PV input 1 parameters | P.DP1, . . ., P.RL1 | For details on the parameters, see the *US1000 Digital Indicating Controller-Functions* instruction manual (IM 5D1A01-02E). |
| D1235 to 1237 | PV input 2 parameters | P.DP2, . . ., P.RL2 | |
| D1241 to 1246 | MV-output parameters | MVS.1, . . ., RVOP | |
| D1261 to 1264 | Valve calibration parameters | V.RS, . . ., V.H | |
| D1265 | Parameter initialization | INIT | |
| D1280 | US-mode parameter | USM | |
| D1281 | Control period parameter | SMP | |

# 6. Functions and Usage of I Relays

This chapter explains the functions and usage of the I relays.

The I relays contain information on errors in the US1000 controller, as well as the controller's operating and alarm statuses. By connecting the US1000 controller to higher-order equipment (via PC communication link only), you can read these internal data items from the I relays to use for your own particular purpose. (Note that most of the I relays have the same functions as the D registers.)

## 6.1 On-Off Status I Relays

The following table summarizes how the on-off status I relays are classified.

| I Relay No. | Data Category | Description | Remarks |
|---|---|---|---|
| 1 to 16 | On-off statuses | Input error (same as data in the D0001 register) | Information stored in each group of these I relays is represented by the four sets of binary codes, from 0000 (0 in the decimal system) to 1000 (8 in the decimal system), which are formed by each combination of four I relays. The lowest-numbered I relay in each set signifies the LSB of the four bits. |
| 17 to 32 | | PV1 error (same as data in the D0002 register) | |
| 33 to 48 | | PV2 error (same as data in the D0018 register) | |
| 49 to 64 | | Error in calibrated values or parameters (same as data in the D0035 register) | |
| 65 to 80 | | Loop 1's mode (same as data in the D0008 register) | |
| 81 to 96 | | Loop 2's mode (same as data in the D0024 register) | |
| 97 to 112 | | Alarm status (same as data in the D0011 register) | |
| 113 to 160 | | Do not use | |
| 161 to 176 | | Status of external contact input (same as data in the D0033 register) | |
| 177 to 192 | | Do not use | |

### NOTE

The on-off status I relays numbered 1 to 192 store on-off status information. In normal operation, this area can be accessed to read the on-off status.
When specifying an I relay number via communication, begin the number with an upper-case letter I. For example, type I0009 to specify the RJC1ERR.st relay (I relay numbered 9).

No data may be written to or read from data storage areas with blank fields in the tables that follow. If you attempt to do so, the US1000 controller may fail to operate correctly.

| Area for On-Off Status | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code |
| 1 | AD1ERR.st | 33 | PV2ADC.st | 65 | | 97 | ALM11.st | 129 | | 161 | DI1.st |
| 2 | AD2ERR.st | 34 | PV2BO.st | 66 | | 98 | ALM12.st | 130 | | 162 | DI2.st |
| 3 | AD3ERR.st | 35 | RJC2ERR.st | 67 | R/S.st | 99 | ALM13.st | 131 | | 163 | DI3.st |
| 4 | | 36 | | 68 | | 100 | | 132 | | 164 | DI4.st |
| 5 | AD1BO.st | 37 | PV2+over.st | 69 | CAS1.st | 101 | ALM14.st | 133 | | 165 | DI5.st |
| 6 | AD2BO.st | 38 | PV2-over.st | 70 | AUT1.st | 102 | | 134 | | 166 | DI6.st |
| 7 | AD3BO.st | 39 | | 71 | MAN1.st | 103 | | 135 | | 167 | DI7.st |
| 8 | | 40 | | 72 | | 104 | | 136 | | 168 | |
| 9 | RJC1ERR.st | 41 | CSV2ADC.st | 73 | | 105 | ALM21.st | 137 | | 169 | DP1.st |
| 10 | RJC2ERR.st | 42 | CSV2BO.st | 74 | | 106 | ALM22.st | 138 | | 170 | DP2.st |
| 11 | | 43 | | 75 | | 107 | ALM23.st | 139 | | 171 | MG1.st |
| 12 | VLERR.st | 44 | | 76 | | 108 | | 140 | | 172 | MG2.st |
| 13 | VLBO.st | 45 | C.CSV2ADC.st | 77 | | 109 | ALM24.st | 141 | | 173 | MG3.st |
| 14 | | 46 | C.CSV2BO.st | 78 | | 110 | | 142 | | 174 | MG4.st |
| 15 | | 47 | AT2ERR.st | 79 | AT1.st | 111 | | 143 | | 175 | |
| 16 | | 48 | | 80 | | 112 | | 144 | | 176 | |
| 17 | PV1ADC.st | 49 | CALB.E.st | 81 | | 113 | | 145 | | 177 | |
| 18 | PV1BO.st | 50 | | 82 | | 114 | | 146 | | 178 | |
| 19 | RJC1ERR.st | 51 | USER.E.st | 83 | O/C.st | 115 | | 147 | | 179 | |
| 20 | | 52 | | 84 | | 116 | | 148 | | 180 | |
| 21 | PV1+over.st | 53 | USMD.st | 85 | CAS2.st | 117 | | 149 | | 181 | |
| 22 | PV1-over.st | 54 | RANGE.st | 86 | AUT2.st | 118 | | 150 | | 182 | |
| 23 | | 55 | SETUP.st | 87 | MAN2.st | 119 | | 151 | | 183 | |
| 24 | | 56 | | 88 | | 120 | | 152 | | 184 | |
| 25 | CSV1ADC.st | 57 | PARA.E.st | 89 | | 121 | | 153 | | 185 | |
| 26 | CSV1BO.st | 58 | MODE.E.st | 90 | | 122 | | 154 | | 186 | |
| 27 | | 59 | | 91 | | 123 | | 155 | | 187 | |
| 28 | | 60 | | 92 | | 124 | | 156 | | 188 | |
| 29 | C.CSV1ADC.st | 61 | EEP.E.st | 93 | | 125 | | 157 | | 189 | |
| 30 | C.CSV1BO.st | 62 | | 94 | | 126 | | 158 | | 190 | |
| 31 | AT1ERR.st | 63 | SYSTEM.E.st | 95 | AT2.st | 127 | | 159 | | 191 | |
| 32 | | 64 | | 96 | | 128 | | 160 | | 192 | |

# 6.2 On-Status I Relays

The following table summarizes how the on-status I relays are classified.

| I Relay No. | Data Category | Description | Remarks |
|---|---|---|---|
| 193 to 208 | On-statuses | Input error (same as data in the D0001 register) | Information stored in each group of these I relays is represented by the four sets of binary codes, from 0000 (0 in the decimal system) to 1000 (8 in the decimal system), which are formed by each combination of four I relays. The lowest-numbered I relay in each set signifies the LSB of the four bits. |
| 209 to 224 | | PV1 error (same as data in the D0002 register) | |
| 225 to 240 | | PV2 error (same as data in the D0018 register) | |
| 241 to 256 | | Error in calibrated values or parameters (same as data in the D0035 register) | |
| 257 to 272 | | Loop 1's mode (same as data in the D0008 register) | |
| 273 to 288 | | Loop 2's mode (same as data in the D0024 register) | |
| 289 to 304 | | Alarm status (same as data in the D0011 register) | |
| 305 to 352 | | Do not use | |
| 353 to 368 | | Status of external contact input | |
| 369 to 384 | | Do not use | |

## NOTE

The on-status I relays numbered 193 to 384 remain turned on for one control period only when the status changes from “off” to “on.”
When specifying an I relay number via communication, begin the number with an upper-case letter I. For example, type I0201 to specify the RJC1ERR.on relay (I relay numbered 201).

| Area for On-Status | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code |
| 193 | AD1ERR.on | 225 | PV2ADC.on | 257 | | 289 | ALM11.on | 321 | | 353 | DI1.on |
| 194 | AD2ERR.on | 226 | PV2BO.on | 258 | | 290 | ALM12.on | 322 | | 354 | DI2.on |
| 195 | AD3ERR.on | 227 | RJC2ERR.on | 259 | R/S.on | 291 | ALM13.on | 323 | | 355 | DI3.on |
| 196 | | 228 | | 260 | | 292 | | 324 | | 356 | DI4.on |
| 197 | AD1BO.on | 229 | PV2+over.on | 261 | CAS1.on | 293 | ALM14.on | 325 | | 357 | DI5.on |
| 198 | AD2BO.on | 230 | PV2-over.on | 262 | AUT1.on | 294 | | 326 | | 358 | DI6.on |
| 199 | AD3BO.on | 231 | | 263 | MAN1.on | 295 | | 327 | | 359 | DI7.on |
| 200 | | 232 | | 264 | | 296 | | 328 | | 360 | |
| 201 | RJC1ERR.on | 233 | CSV2ADC.on | 265 | | 297 | ALM21.on | 329 | | 361 | DP1.on |
| 202 | RJC2ERR.on | 234 | CSV2BO.on | 266 | | 298 | ALM22.on | 330 | | 362 | DP2.on |
| 203 | | 235 | | 267 | | 299 | ALM23.on | 331 | | 363 | MG1.on |
| 204 | VLERR.on | 236 | | 268 | | 300 | | 332 | | 364 | MG2.on |
| 205 | VLBO.on | 237 | C.CSV2ADC.on | 269 | | 301 | ALM24.on | 333 | | 365 | MG3.on |
| 206 | | 238 | C.CSV2BO.on | 270 | | 302 | | 334 | | 366 | MG4.on |
| 207 | | 239 | AT2ERR.on | 271 | AT1.on | 303 | | 335 | | 367 | |
| 208 | | 240 | | 272 | | 304 | | 336 | | 368 | |
| 209 | PV1ADC.on | 241 | CALB.E.on | 273 | | 305 | | 337 | | 369 | |
| 210 | PV1BO.on | 242 | | 274 | | 306 | | 338 | | 370 | |
| 211 | RJC1ERR.on | 243 | USER.E.on | 275 | O/C.on | 307 | | 339 | | 371 | |
| 212 | | 244 | | 276 | | 308 | | 340 | | 372 | |
| 213 | PV1+over.on | 245 | USMD.on | 277 | CAS2.on | 309 | | 341 | | 373 | |
| 214 | PV1-over.on | 246 | RANGE.on | 278 | AUT2.on | 310 | | 342 | | 374 | |
| 215 | | 247 | SETUP.on | 279 | MAN2.on | 311 | | 343 | | 375 | |
| 216 | | 248 | | 280 | | 312 | | 344 | | 376 | |
| 217 | CSV1ADC.on | 249 | PARA.E.on | 281 | | 313 | | 345 | | 377 | |
| 218 | CSV1BO.on | 250 | MODE.E.on | 282 | | 314 | | 346 | | 378 | |
| 219 | | 251 | | 283 | | 315 | | 347 | | 379 | |
| 220 | | 252 | | 284 | | 316 | | 348 | | 380 | |
| 221 | C.CSV1ADC.on | 253 | EEP.E.on | 285 | | 317 | | 349 | | 381 | |
| 222 | C.CSV1BO.on | 254 | | 286 | | 318 | | 350 | | 382 | |
| 223 | AT1ERR.on | 255 | SYSTEM.E.on | 287 | AT2.on | 319 | | 351 | | 383 | |
| 224 | | 256 | | 288 | | 320 | | 352 | | 384 | |

# 6.3 Off-Status I Relays

The following table summarizes how the off-status I relays are classified.

| I Relay No. | Data Category | Description | Remarks |
|---|---|---|---|
| 385 to 400 | Off-statuses | Input error (same as data in the D0001 register) | Information stored in each group of these I relays is represented by the four sets of binary codes, from 0000 (0 in the decimal system) to 1000 (8 in the decimal system), which are formed by each combination of four I relays. The lowest-numbered I relay in each set signifies the LSB of the four bits. |
| 401 to 416 | | PV1 error (same as data in the D0002 register) | |
| 417 to 432 | | PV2 error (same as data in the D0018 register) | |
| 433 to 448 | | Error in calibrated values or parameters (same as data in the D0035 register) | |
| 449 to 464 | | Loop 1's mode (same as data in the D0008) | |
| 465 to 480 | | Loop 2's mode (same as data in the D0024) | |
| 481 to 496 | | Alarm status (same as data in the D0011) | |
| 497 to 544 | | Do not use. | |
| 545 to 560 | | Status of external contact input | |
| 561 to 576 | | Do not use. | |

## NOTE

The off-status I relays numbered 385 to 576 remain turned on for one control period only when the status changes from “on” to “off.”
When specifying an I relay number via communication, begin the number with an upper-case letter I. For example, type I0393 to specify the RJC1ERR.off relay (I relay numbered 393).

| Area for On-Status | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code |
| 385 | AD1ERR.off | 417 | PV2ADC.off | 449 | | 481 | ALM11.off | 513 | | 545 | DI1.off |
| 386 | AD2ERR.off | 418 | PV2BO.off | 450 | | 482 | ALM12.off | 513 | | 546 | DI2.off |
| 387 | AD3ERR.off | 419 | RJC2ERR.off | 451 | R/S.off | 483 | ALM13.off | 515 | | 547 | DI3.off |
| 388 | | 420 | | 452 | | 484 | | 516 | | 548 | DI4.off |
| 389 | AD1BO.off | 421 | PV2+over.off | 453 | CAS1.off | 485 | ALM14.off | 517 | | 549 | DI5.off |
| 390 | AD2BO.off | 422 | PV2-over.off | 454 | AUT1.off | 486 | | 518 | | 550 | DI6.off |
| 391 | AD3BO.off | 423 | | 455 | MAN1.off | 487 | | 519 | | 551 | DI7.off |
| 392 | | 424 | | 456 | | 488 | | 520 | | 552 | |
| 393 | RJC1ERR.off | 425 | CSV2ADC.off | 457 | | 489 | ALM21.off | 521 | | 553 | DP1.off |
| 394 | RJC2ERR.off | 426 | CSV2BO.off | 458 | | 490 | ALM22.off | 522 | | 554 | DP2.off |
| 395 | | 427 | | 459 | | 491 | ALM23.off | 523 | | 555 | MG1.off |
| 396 | VLERR.off | 428 | | 460 | | 492 | | 524 | | 556 | MG2.off |
| 397 | VLBO.off | 429 | C.CSV2ADC.off | 461 | | 493 | ALM24.off | 525 | | 557 | MG3.off |
| 398 | | 430 | C.CSV2BO.off | 462 | | 494 | | 526 | | 558 | MG4.off |
| 399 | | 431 | AT2ERR.off | 463 | AT1.off | 495 | | 527 | | 559 | |
| 400 | | 432 | | 464 | | 496 | | 528 | | 560 | |
| 401 | PV1ADC.off | 433 | CALB.E.off | 465 | | 497 | | 529 | | 561 | |
| 402 | PV1BO.off | 434 | | 466 | | 498 | | 530 | | 562 | |
| 403 | RJC1ERR.off | 435 | USER.E.off | 467 | O/C.off | 499 | | 531 | | 563 | |
| 404 | | 436 | | 468 | | 500 | | 532 | | 564 | |
| 405 | PV1+over.off | 437 | USMD.off | 469 | CAS2.off | 501 | | 533 | | 565 | |
| 406 | PV1-over.off | 438 | RANGE.off | 470 | AUT2.off | 505 | | 534 | | 566 | |
| 407 | | 439 | SETUP.off | 471 | MAN2.off | 503 | | 535 | | 567 | |
| 408 | | 440 | | 472 | | 504 | | 536 | | 568 | |
| 409 | CSV1ADC.off | 441 | PARA.E.off | 473 | | 315 | | 537 | | 569 | |
| 410 | CSV1BO.off | 442 | MODE.E.off | 474 | | 506 | | 538 | | 570 | |
| 411 | | 443 | | 475 | | 507 | | 539 | | 571 | |
| 412 | | 444 | | 476 | | 508 | | 540 | | 572 | |
| 413 | C.CSV1ADC.off | 445 | EEP.E.off | 477 | | 509 | | 541 | | 573 | |
| 414 | C.CSV1BO.off | 446 | | 478 | | 510 | | 542 | | 574 | |
| 415 | AT1ERR.off | 447 | SYSTEM.E.off | 479 | AT2.off | 511 | | 543 | | 575 | |
| 416 | | 448 | | 480 | | 512 | | 544 | | 576 | |

# 6.4 Alarm Flag, Timer Flag, Power-on Flag Status I Relays

The following table summarizes how the status I relays for flags, including alarm, timer and power-on flags, are classified.

| I Relay No. | Data Category | Description |
|---|---|---|
| 577 to 592 | Statuses | Currently cascade SV number (Note 1) (same as data in the D0010 register) |
| 593 to 608 | | Currently selected loop-1 PID number (Note 1) (same as data in the D0009 register) |
| 609 to 624 | | Currently selected loop-2 PID number (Note 1) (same as data in the D0025 register) |
| 625 to 656 | | Do not use. |
| 657 to 672 | | One-second, five-second, ten-second and one-minute timers (Note 2) |
| 673 to 688 | | Status of PV2, LP2 and DV (deviation) lamps (Note 3) |
| 689 to 704 | | Status of alarm output (same as data in the D0036 register) |
| 705 to 720 | Do not use. | Do not use |
| 721 to 2048 | User area (Note 4) | An area where you can freely write or read status data |

Note 1: Information stored in each group of these I relays is represented by the four sets of binary codes, from 0000 (0 in the decimal system) to 1000 (8 in the decimal system), which are formed by each combination of four I relays. The lowest-numbered I relay in each set signifies the LSB of the four bits.

Note 2: The one-second, five-second, ten-second and one-minute timers are available with I relays only.

Note 3: Information stored in these relays represent the status of the instrument's front-panel lamps. The relay turns on (flag "1") when the lamp comes on.

Note 4: The "I Relay Map Overview" tables do not contain the range of I relays numbered from 769 to 2048 within the user area. You can write to or read from this range of I relays, however, by means of communication.

## NOTE

In the “I Relay Map Overview” tables, those I relays in the 1 to 720 range that have no code names in their fields, are not in use. Do not write to or read from these unused I relays; doing so may destroy the data in the US1000 controller.

The code name of each I relay, except the I relays listed below, is the same as that of its corresponding D register in terms of bit configuration.

| I Relay No. | Data Category | Description |
|---|---|---|
| 0577 to 0580 | CSVNO.0 to CSVNO.3 | SV numbers |
| 0593 to 0596 | PIDNO1.0 to PIDNO1.3 | Loop-1 PID numbers |
| 0609 to 0612 | PIDNO2.0 to PIDNO2.3 | Loop-2 PID numbers |
| 0657 to 0661 | TIM.1S, . . ., TIM.1M | One-second timer, . . ., one-minute timer |
| 0672 to 0674 | PON, . . ., LP2 | Statuses of power-on, PV2 and LP2 lamps on the instrument's front panel |
| 0681 to 0687 | DEV1-, . . ., DEV2+ | Statuses of deviations in loop 1 and loop 2 |

## TIP

Each bit represented by any of the I relays numbered 1 to 576 and 689 to 701, is the same as that in each read-only D register in terms of the code name and assigned function.

Cross-check the assigned functions of these I relays with the information provided in subsection 5.4.1, “Process Data Area (Read-only Data).”

The status I relays numbered 577 to 2049 store SV and PID numbers, as well as the on-off statuses of flags such as the timer and power-on flags.

## NOTE

When specifying an I relay number via communication, begin the number with an upper-case letter I. For example, type I0657 to specify the TIM.1S relay (I relay numbered 657).

| Area for SV and PID Numbers and the Statuses of Timer, Power-on and Alarm Flags, plus User Area | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code | No. | I Relay Name Code |
| 577 | CSVNO.0 | 609 | PIDNO2.0 | 641 | | 673 | | 705 | | 737 | UR17 |
| 578 | CSVNO.1 | 610 | PIDNO2.1 | 642 | | 674 | LP2 | 706 | | 738 | UR18 |
| 579 | CSVNO.2 | 611 | PIDNO2.2 | 643 | | 675 | MV | 707 | | 739 | UR19 |
| 580 | CSVNO.3 | 612 | PIDNO2.3 | 644 | | 676 | ALM | 708 | | 740 | UR20 |
| 581 | | 613 | | 645 | | 677 | | 709 | | 741 | UR21 |
| 582 | | 614 | | 646 | | 678 | | 710 | | 742 | UR22 |
| 583 | | 615 | | 647 | | 679 | | 711 | | 743 | UR23 |
| 584 | | 616 | | 648 | | 680 | | 712 | | 744 | UR24 |
| 585 | | 617 | | 649 | | 681 | DEV1- | 713 | | 745 | UR25 |
| 586 | | 618 | | 650 | | 682 | DEV1Z | 714 | | 746 | UR26 |
| 587 | | 619 | | 651 | | 683 | DEV1+ | 715 | | 747 | UR27 |
| 588 | | 620 | | 652 | | 684 | | 716 | | 748 | UR28 |
| 589 | | 621 | | 653 | | 685 | DEV2- | 717 | | 749 | UR29 |
| 590 | | 622 | | 654 | | 686 | DEV2Z | 718 | | 750 | UR30 |
| 591 | | 623 | | 655 | | 687 | DEV2+ | 719 | | 751 | UR31 |
| 592 | | 624 | | 656 | | 688 | | 720 | | 752 | UR32 |
| 593 | PIDNO1.0 | 625 | | 657 | TIM.1S | 689 | ALO11 | 721 | UR1 | 753 | UR33 |
| 594 | PIDNO1.1 | 626 | | 658 | TIM.5S | 690 | ALO12 | 722 | UR2 | 754 | UR34 |
| 595 | PIDNO1.2 | 627 | | 659 | TIM.10S | 691 | ALO13 | 723 | UR3 | 755 | UR35 |
| 596 | PIDNO1.3 | 628 | | 660 | | 692 | | 724 | UR4 | 756 | UR36 |
| 597 | | 629 | | 661 | TIM.1M | 693 | ALO14 | 725 | UR5 | 757 | UR37 |
| 598 | | 630 | | 662 | | 694 | | 726 | UR6 | 758 | UR38 |
| 599 | | 631 | | 663 | | 695 | | 727 | UR7 | 759 | UR39 |
| 600 | | 632 | | 664 | | 696 | | 728 | UR8 | 760 | UR40 |
| 601 | | 633 | | 665 | | 697 | ALO21 | 729 | UR9 | 761 | UR41 |
| 602 | | 634 | | 666 | | 698 | ALO22 | 730 | UR10 | 762 | UR42 |
| 603 | | 635 | | 667 | | 699 | ALO23 | 731 | UR11 | 763 | UR43 |
| 604 | | 636 | | 668 | | 700 | | 732 | UR12 | 764 | UR44 |
| 605 | | 637 | | 669 | | 701 | ALO24 | 733 | UR13 | 765 | UR45 |
| 606 | | 638 | | 670 | | 702 | | 734 | UR14 | 766 | UR46 |
| 607 | | 639 | | 671 | | 703 | | 735 | UR15 | 767 | UR47 |
| 608 | | 640 | | 672 | PON | 704 | | 736 | UR16 | 768 | UR48 |

You can freely write to or read from the range of I relays numbered 769 to 2048.

### 6.4.1 User Area

| I Relay No. | Data Category | Description |
|---|---|---|
| 721 to 2048 | User area | Data can be written to or read from the range of I relays 721 to 2048 via communication. That is, you can use the area freely no matter which type of control is performed by the US1000 controller. |

# Appendix
## Table of ASCII Codes (Alphanumeric Codes)

In order to implement PC link communication, create a transmission/receiving program by referring to the following table of ASCII codes.

| b8 | b7 | b6 | b5 | b4 | b3 | b2 | b1 | | 0 (000) | 1 (001) | 2 (010) | 3 (011) | 4 (100) | 5 (101) | 6 (110) | 7 (111) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0 | 0 | 0 | 0 | **0** | NUL | DLE | SP | 0 | @ | P | ` | p |
| | | | | 0 | 0 | 0 | 1 | **1** | SOH | DC1 | ! | 1 | A | Q | a | q |
| | | | | 0 | 0 | 1 | 0 | **2** | STX | DC2 | “ | 2 | B | R | b | r |
| | | | | 0 | 0 | 1 | 1 | **3** | ETX | DC3 | # | 3 | C | S | c | s |
| | | | | 0 | 1 | 0 | 0 | **4** | EOT | DC4 | $ | 4 | D | T | d | t |
| | | | | 0 | 1 | 0 | 1 | **5** | ENQ | NAK | % | 5 | E | U | e | u |
| | | | | 0 | 1 | 1 | 0 | **6** | ACK | SYN | & | 6 | F | V | f | v |
| | | | | 0 | 1 | 1 | 1 | **7** | BEL | ETB | ‘ | 7 | G | W | g | w |
| | | | | 1 | 0 | 0 | 0 | **8** | BS | CAN | ( | 8 | H | X | h | x |
| | | | | 1 | 0 | 0 | 1 | **9** | HT | EM | ) | 9 | I | Y | i | y |
| | | | | 1 | 0 | 1 | 0 | **A** | LF | SUB | * | : | J | Z | j | z |
| | | | | 1 | 0 | 1 | 1 | **B** | VT | ESC | + | ; | K | [ | k | { |
| | | | | 1 | 1 | 0 | 0 | **C** | FF | FS | , | < | L | ¥ | l | \| |
| | | | | 1 | 1 | 0 | 1 | **D** | CR | GS | – | = | M | ] | m | } |
| | | | | 1 | 1 | 1 | 0 | **E** | SO | RS | . | > | N | • | n | ¯ |
| | | | | 1 | 1 | 1 | 1 | **F** | SI | US | / | ? | O | _ | o | DEL |

Control codes — Character codes

Note:
SP ($20): space
DEL ($7F): control code

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