User's
Manual

Model UT350L
Limit Controller
Communication Functions
User's Manual

GREEN SERIES

IM 05D01D21-10E

YOKOGAWA
Yokogawa Electric Corporation

IM 05D01D21-10E
2nd Edition

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Introduction

This user's manual describes the communication functions of the UT350L controller and provides information on how to create communication programs.

The UT350L controller use the following communication protocols:

1) PC link communication protocol
2) Ladder communication protocol

The UT350L controller cannot communicate with a host device that uses a communication protocol other than the above.

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

* Host devices: PCs, PLCs (sequencers), graphic panels, and others

■ Intended Readers

This manual is intended for people familiar with the functions of the UT350L controller such as control engineers and personnel in charge of the maintenance of instrumentation and control equipment.

■ Related Documents

The following user's manuals all relate to the communication functions of the UT350L controller. Read them as necessary. The codes enclosed in parentheses are the document numbers.

- *UT350L User's Manual -Installation, Initial Setting, and so on.*
  (IM 05D01D21-01E to 03E)

Explains the basic operation of the UT350L controller.

■ Regarding This User's Manual

(1) This manual should be provided to the end user. Keep an extra copy or copies of the manual in a safe place.

(2) Read this manual carefully to gain a thorough understanding of how to operate this product before starting operation.

(3) This manual describes the functions of this product. Yokogawa Electric Corporation (hereinafter simply referred to as Yokogawa) does not guarantee the application of these functions for any particular purpose.

(4) Under absolutely no circumstances may the contents of this manual, in part or in whole, be transcribed or copied without permission.

(5) The contents of this manual are subject to change without prior notice.

(6) Every effort has been made to ensure that the details of this manual are accurate. However, should any errors be found or important information be omitted, please contact your nearest Yokogawa representative or our sales office.

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■ Safety Precautions

The following symbol is indicated on the controller to ensure safe use.

CAUTION

This symbol on the controller indicates that the operator must refer to an explanation in the user's 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 electric shock or other dangers that may result in injury or loss of life.

The following symbols are used in the hardcopy user's manuals and in the user's manual supplied on the CD-ROM.

NOTE

Indicates that operating the hardware or software in a particular manner may damage it or result in a system failure.

IMPORTANT

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

■ Force Majeure

(1) Yokogawa assumes no liability to any party for any loss or damage, direct or indirect, caused by the use or any unpredictable defect of the product.

(2) No portion of the software supplied by Yokogawa may be transferred, exchanged, leased or sublet for use by any third party without the prior permission of Yokogawa.

(3) Be sure to use the spare parts approved by Yokogawa when replacing parts or consumables.

(4) Use this software with one specified computer only. You must purchase another copy of the software for use on each additional computer.

(5) Copying this software for purposes other than backup is strictly prohibited.

(6) Store the floppy disk(s) (original medium or media) containing this software in a secure place.

■ Regarding Protection, Safety, and Prohibition Against Unauthorized Modification

(1) In order to protect the product and the system controlled by it against damage and ensure its safe use, make certain that all of the instructions and precautions relating to safety contained in this document are strictly adhered to. Yokogawa does not guarantee safety if products are not handled according to these instructions.

(2) Modification of the product is strictly prohibited.

(3) Reverse engineering such as the disassembly or decompilation of software is strictly prohibited.

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Model UT350L
Limit Controller
User's Manual

IM 05D01D21-10E 2nd Edition

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1. Communications Overview

The UT350L controllers have an RS-485 serial communication interface, through which data exchange is performed with a device such as a personal computer, PLC (sequencer), and graphic panel.

The following five communication protocols are supported.

Table 1.1 Communication Protocols

Communication protocol	Protocol specification
PC link communication	Without sum check
	With sum check
Ladder communication	Handshaking

Table 1.2 Connectable Devices

Communication protocol	Connectable device	Requirements
PC link communication	Personal computer	RS-232C/RS-485 converter
	Graphic panel	-
	PLC (sequencer)	With serial communication module
Ladder communication	PLC (sequencer)	With ladder communication module

1.1 Interface Specifications

Table 1.3 RS-485 Interface

Interface	Communication system	Baud rate	Other specifications	Protocols available
Standard RS-485	4-wire, half-duplex	600, 1200 2400, 4800 9600bps	- Asynchronous (start-stop) - Handshaking - Maximum communication distance: 1200 m - Maximum number of connectable devices: 31 - Start bit: 1 - Data length: 8 or 7 bits - Parity: No parity, even, odd - Stop bit: 1 or 2	PC link communication Ladder communication
	2-wire, half-duplex			

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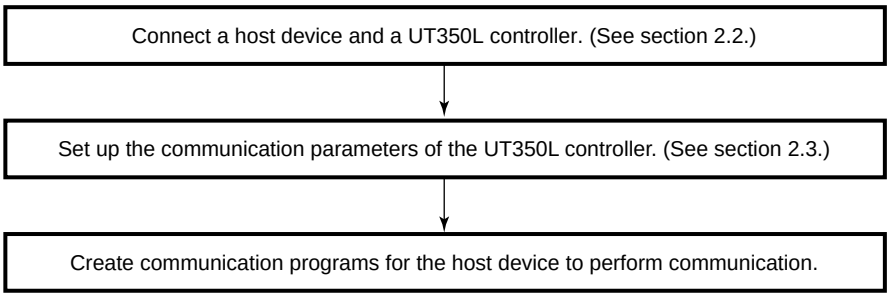
2. Setup

This chapter describes the procedure to set up the communication functions and also refers to some notes on wiring and communication parameters.

2.1 Setup Procedure

Set up the communication functions of the UT350L controller as follows:



∗ Create communication programs referring to the documentation of each host device.
∗ In this manual, “host devices” generically denotes PCs, PLCs (sequencers), and graphic panels.

2.2 Wiring for Communication

Connect the UT350L controller and the host device for communication. The wiring procedures and precautionary notes are as follows.

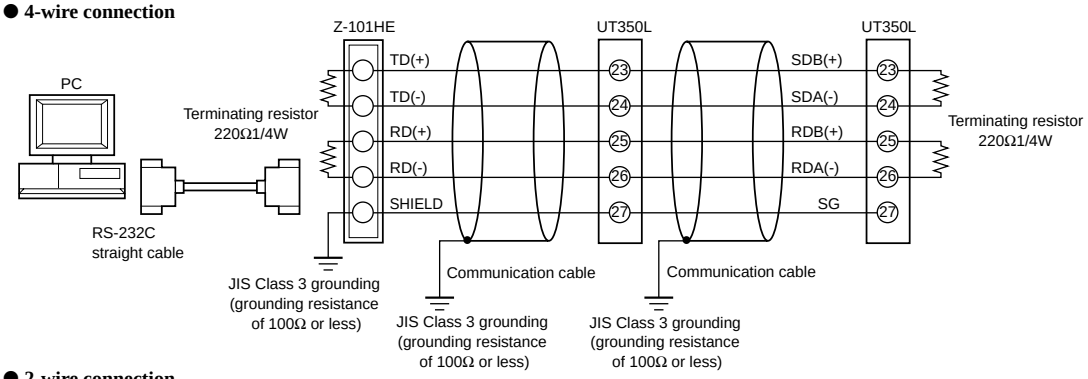
NOTE

- To avoid an electrical shock, be sure to turn off the power supply source to the equipment involved before you start wiring.
- Use crimp terminals at cable ends.
- Before you start wiring, read the user's manual of each device.

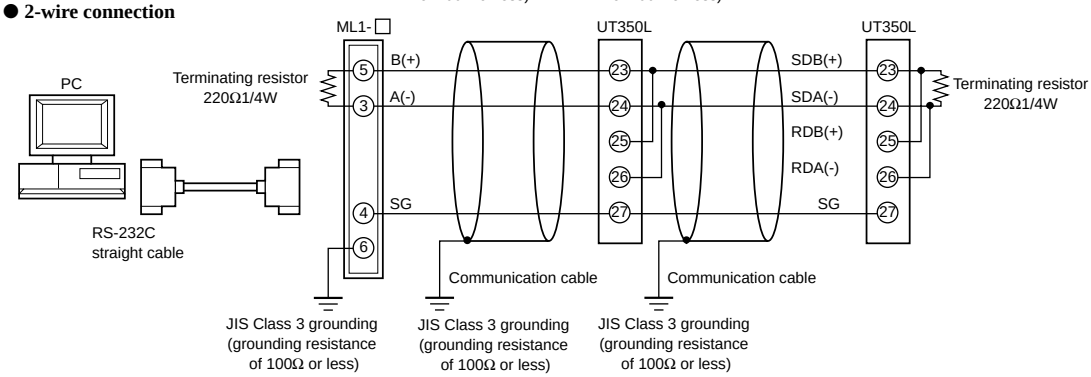
2.2.1 Wiring to a Personal Computer

Since general personal computers cannot directly be connected to the RS-485 interface, wiring must be provided via an RS-232C/RS-485 converter. The following figures show the wiring for 4-wire connection and 2-wire connection.

● **4-wire connection**



● **2-wire connection**

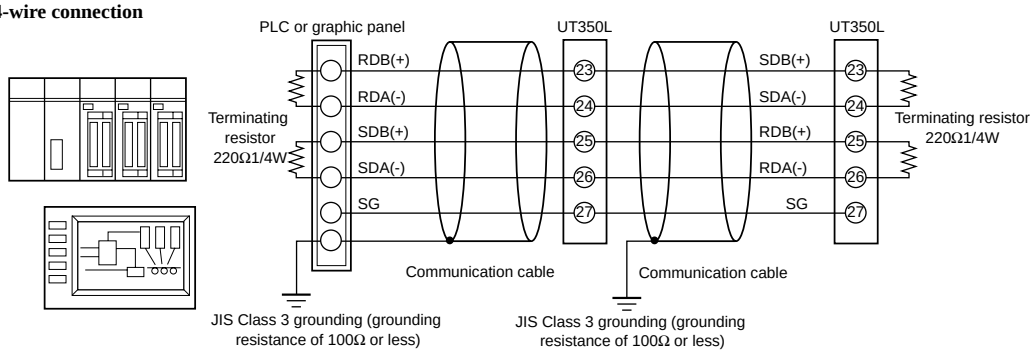


Note: Z-101HE and ML1-□ are the converters of Sharp Corporation and Yokogawa Electric Corporation, respectively. You can also use other RS-232C/RS-485 converters. Before you use another converter, check its electrical specifications.

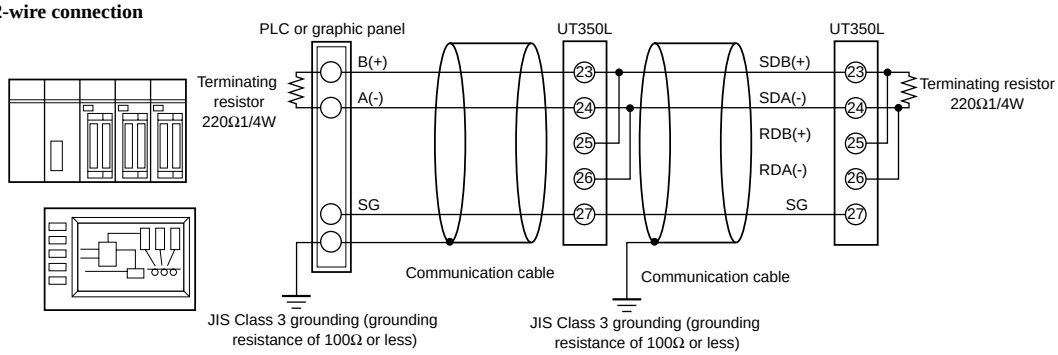
2.2.2 Wiring to a PLC (Sequencer) or Graphic Panel

Since general PLCs (sequencers) and graphic panels have an RS-485 interface, they can be directly connected to a UT350L controller. If your PLC (sequencer) or graphic panel has an RS-232C interface, see subsection 2.2.1.

● **4-wire connection**



● **2-wire connection**



2.3 Notes on Setting Communication Parameters

This section describes the parameters that set up the communication functions and their setting ranges.

NOTE

The communication specifications of both the UT350L controller and the host device must be the same. Check the communication specifications of the host device first, then set up the communication parameters of the UT350L controller.

2.3.1 Procedure to Set Communication Parameters

For the operation procedure, see the User's Manual of UT350L controller.

The UT350L are shipped from the factory with the following communication specifications.

Table 2.3.1 Protocol-by-Protocol Default Parameter Settings

Communication protocol	PSL	BPS	PRI	STP	DLN
PC link communication (without sum check)	0	9600	EVEN	1	8
PC link communication (with sum check)	1	9600	EVEN	1	8
Ladder communication	2	9600	EVEN	1	⑧

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

2.3.2 Description of Communication Parameters

Table 2.3.2 Communication Parameters of UT350L controller

Parameter name	Parameter code	Setting range		Default
Protocol selection	PSL	PC link communication	0: Without sum check 1: With sum check	0
		Ladder communication	2: Ladder communication	
Address	ADR	1 to 99		1
Baud rate	BPS	600, 1200, 2400, 4800, 9600 (bps)		9600
Parity	PRI	NONE (no parity), EVEN, ODD		EVEN
Stop bit	STP	1, 2 (bit)		1
Data length	DLN	7, 8 (bit)*1		8
Minimum response time	RP.T	0 to 10 (×10 ms)		0

*1: Data length is fixed at 8 bits for ladder communication is selected.

1) Protocol selection (PSL)

Set the same communication protocol as that of the host device to be connected to. The UT350L controller supports PC link and ladder communication protocols, which are specific to UT350L controller.

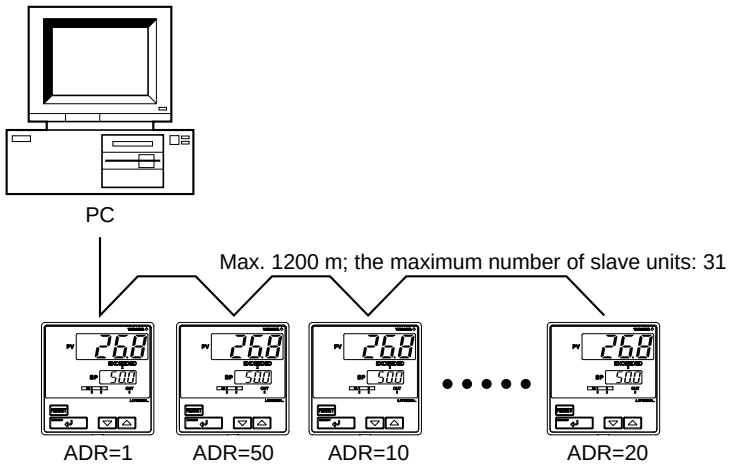
2) Baud rate (BPS)

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

3) Address number (ADR)

Set the address number of the UT350L controller to one that is not being used by another controller. An address number of 1 to 99 can be assigned in any order. Note that the number of UT350L controllers that can be connected to a single communication port is limited to 31.

Example of connecting four UT350L controllers to a host device with address numbers of 1, 50, 10, and 20:



4) 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 host device to be connected.

5) Stop bit (STP)

Set the same stop bit as that of the host device to be connected.

6) Data length (DLN)

Set the same data length as that of the host device to be connected. (When ladder communication is selected, the data length is fixed.)

7) Minimum response time (RP.T)

Set the time taken to respond to the host device after the UT350L controller receives transmission data from it. The unit is 10 ms. The response time will be “communication processing time + the set value of RP.T X 10” milliseconds.

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3. PC Link Communication

3.1 Overview

PC link communication protocol is one of the protocols used to communicate with devices such as PCs, PLCs (sequencers), and graphic panels. Via this communication protocol, these devices can exchange data with a UT350L controller by reading/writing the controller's internal registers (D registers and I relays).

Hereafter, PCs, PLCs (sequencers), and graphic panels shall be referred to as "host devices."

In PC link communication, a host device identifies UT350L controller with a communication address, which ranges from 1 to 99. However, broadcasting, which requires no address number, is possible with some of the commands. For more information, see subsection 3.2.2.

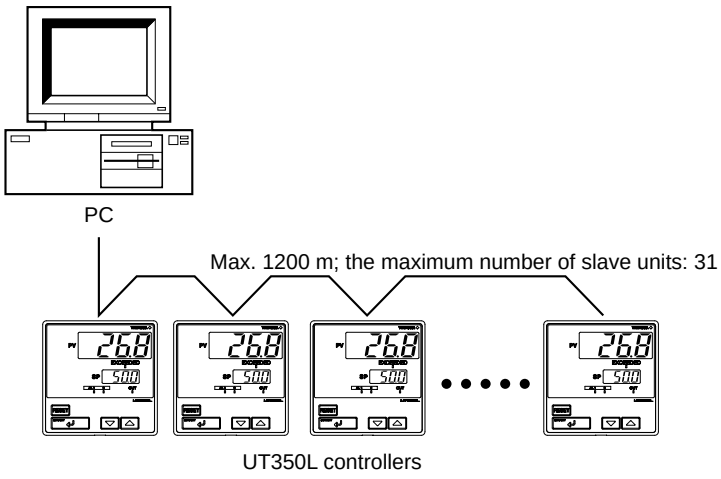


Figure 3.1 Connection of PC Link Communication

The next section will discuss the configuration of commands and responses.

3.1.1 Configuration of Commands

Commands sent from a host device to a UT350L controller 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 a host device to identify which UT350L controller to communicate with. (ID number of the UT350L)

Adress Number = UT350L parameter (ADR) value

(3) CPU Number

This number is fixed to 01.

(4) Time to Wait for Response

This is fixed to 0.

(5) Command (See subsection 3.2.1.)

Specify a command to be issued from the host device.

(6) Data Corresponding to Command

Specify an internal register (D register or I relay), number of data items, UT350L parameter values, or others.

(7) Checksum

In PC link communication with sum check, the ASCII codes of the text between STX and the checksum are converted into hexadecimal values and added on a byte basis. Then the lowermost byte of the added results is turned into ASCII code, and its lower byte is used as the checksum.

This 2-byte space is unnecessary for PC link communication without sum check.

(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 marks the end of a command. The character code is CHR$(13).

NOTE

The control codes STX, ETX, and CR in commands are indispensable. Do not miss any of them when you create a communication program for PC link communication. A communication failure will result if any of them are omitted or if the order is incorrect.

● Data Forms of Commands

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

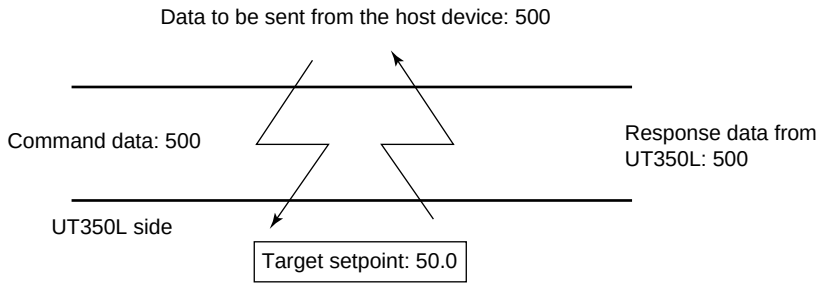
Table 3.1 Data Forms

Data type	Data content	Data form
PV high and low limits, target setpoints, and others	Measuring range (EU) data	Numeric data excluding the decimal point
Bias, deviation alarms, and others	Measuring range span (EUS) data	Numeric data excluding the decimal point
Limit control types, alarm types, and others	Seconds, absolute values, and data without unit*	Absolute value excluding the decimal point

* Parameter list of UT350L controller User's Manual for information about data form.

● Command Format for Communication

Example: When setting a target setpoint "50.0" to a UT350L controller, the host device sends the value "500" as command data without the decimal point (this is true for both settings 5.00 or 500).



* The position of the decimal point for "500" is determined by the DP (decimal point position) parameter of the UT350L controller.

3.1.2 Configuration of Response

Responses from a UT350L controller with respect to a command sent from the host device consist of the elements shown below, which differ depending on the condition of communication - normal or failure.

1) With Normal Communication

When communication is carried out normally, the UT350L controller returns the character string “OK” and, in response to read commands, also returns 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 carried out abnormally, the UT350L controller returns the character string “ER” and error codes (EC1 and EC2). (See subsection 3.2.4, Response Error Codes.)

- No response is made in case of an error in address number specification or CPU number specification.
- If a UT350L controller cannot receive an ETX contained in a command, a response may not be made.

* As a measure against these situations, provide a timeout processing in the communication functions or communication programs of the host device.

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

3.2 Communication with Host Device

In PC link communication, when specifying D registers or I relays (internal registers of UT350L controller), you can use the numbers as is. The numbers of these internal registers are in the following format:

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

Host devices to be connected to a UT350L controller are those capable of handling the PC link communication protocol.

(1) Connectable graphic panels

Graphic panels that can be connected to a UT350L controller are listed below. However, it may be possible to connect graphic panels other than the ones listed below.

Table 3.2 List of Graphic Panels Connectable

Product	Name	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		

Note: For more information about Digital's graphic panels, contact Digital Electronics Corporation. (Be careful because the display device differs depending on the model.)

(2) Communication with FA-M3 with UT-link module

No ladder communication program is required to communicate with FA-M3 with UT-link module (Yokogawa PLC). The UT-link module's function offers 2 modes, in which users can exchange data without paying attention to the communication procedure. (For more information, see the user's manual of UT-link module "IM 34M6H25-01E.")

- User-specifiable mode: Always reads/writes the user-specified devices* of the UT350L controller.
- Command mode: Accesses the devices* of the UT350L controller only when necessary.

*:"Device" here denotes the internal registers of the UT350L controller (D registers and I relays).

3.2.1 List of Commands

The following are 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 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 words 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	Specifies internal registers to be monitored on a word-by-word basis.	1 to 32 words
WRM	Word-basis monitoring	—

(3) Information Commands

Command	Description	Number of controllers handled
INF	Reads model, version, and revision	1

3.2.2 Specifying Broadcast

Broadcast addressing allows the corresponding multiple UT350L controller to receive the command.

(1) In the command, specify the broadcast address in Table 3.3 and execute it.

(2) Broadcast addressing works independently of the communication address of the controller.

(3) Broadcast addressing is only applicable to write commands.

(4) No response is returned when broadcast addressing is used.

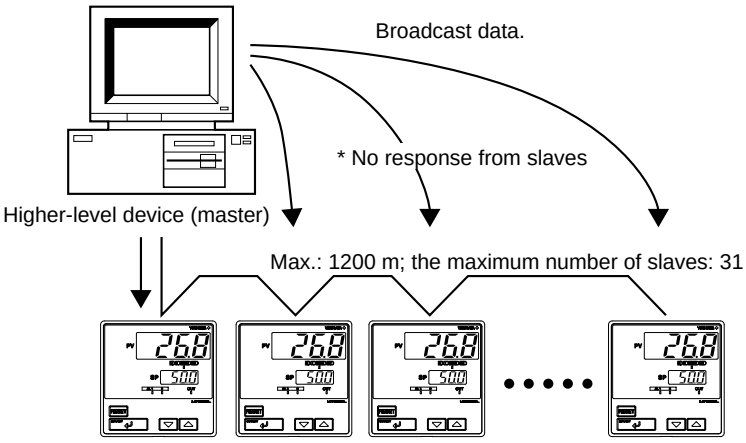


Figure 3.2 Broadcasting

Table 3.3 Address Numbers

Address No.	Corresponding devices
BA	All models of GREEN Series
01 to 99	Device with a corresponding address number

3.2.3 Commands

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

● Function

Reads the ON/OFF statuses of a sequence of contiguous I relays 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 3.1.2.
- The command shown below includes the checksum function. When performing communication without checksum, do not include the 2-byte checksum 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 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 UT350L controller 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 by the specified number of bits, 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 3.1.2.
- The command shown below includes a checksum function. When performing communication without checksum, do not include the 2-byte checksum 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” to set OFF or “1” to set ON.

dn: write data 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 UT350L controller with address number 01 to ON.

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

[Command] STX$+ “01010BWRI0865, 001, 113” +ETX$+CR$

Note: The user-defined flags (I relays) are flags that the user can freely read/write. For user’s read/write-accessible areas, see subsection 3.4.2.

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

[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 the individual I relays specified in a random order by the specified number of bits.

- 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 3.1.2.
- The command shown below includes a checksum function. When performing communication without the checksum, do not include the 2-byte checksum 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 of the specified number of bits (n = 1 to 32)
dn = 0 (OFF)
dn = 1 (ON)

● **Example:** Reading the statuses of alarms 1 and 2 of the UT350L with address number 05

The following command reads the statuses of alarm 1 (I0097) and alarm 2 (I0098) at address number 05.

[Command] **STX$+ “05010BRR02I0097, I00989D” +ETX$+CR$**

In response to the command above, the ON and OFF responses are returned for alarms 1 and 2.

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

Alarm 1 is ON, and alarm 2 is OFF.

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

● Function

Writes ON/OFF statuses in the individual I relays specified in a random order by the specified number of bits.

- 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 3.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum 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” to set OFF or “1” to set ON.

dn: write data 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 UT350L controller 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 user’s read/write-accessible areas, see subsection 3.4.2.

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

[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 with this command.

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. If the power supply is turned off, the specified I relay numbers will be erased.

- 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 3.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum 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 UT350L controller with address number 05

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

(This command is used simply for specifying registers.)

[Command] STX$+ "05010BRS01I006754" +ETX$+CR$

"OK" is returned in response to the command above.

[Response] STX$+ "0501OK60" +ETX$+CR$

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

● Function

Reads the ON/OFF statuses of the 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 returned. This error also occurs if the power supply is turned off.
- For the format of response in the event of failure, see subsection 3.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum 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 and “1” when ON.

dn: read data 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 UT350L controller with 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 in response to the command above.

[Response] **STX$+ “0501OK160” +ETX$+CR$**

The I relay is ON.

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, 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 3.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum 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.

(dddn: 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 UT350L controller with address number 03

The following command reads the measured input value (D0003) at address number 03.

[Command] STX$+ "03010WRDD0003, 0175" +ETX$+CR$

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

[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, 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 3.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum 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.

(dddn: 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 the target setpoint of the UT350L controller with address number 03.

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

[Command] STX$+ “03010WWRD0301, 01, 00C890” +ETX$+CR$

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

[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 the individual registers, on a word-by-word basis, specified in a random order by the specified number of words.

- 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 3.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum 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 control output values of the UT350L controller with address number 10.

The following command reads the measured input value (D0003) and control output value (D0005) at address number 10.

[Command] **STX$+ "10010WRR02D0003, D00058B" +ETX$+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 the registers specified in a random order by the specified number of words.

- 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 3.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum 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.

ddddn: Repetition of register numbers and write information of 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 the target setpoint and “15.0” into the alarm-1 setpoint of the UT350L controller with address number 10.

The following command writes
“20.0” into the target setpoint (D0301) and “15.0” into the alarm-1 setpoint (D0915) at address number 10.

[Command] **STX$+ “10010WRW02D0301, 00C8, D0915, 00969D” +ETX$+CR$**

Target setpoint: 200 — Alarm setpoint: 150

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

[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 effective 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 3.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum 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 UT350L controller 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 in response to the command above.

[Response] STX$+ “0101OK5C” +ETX$+CR$

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

● Function

Reads the information of the registers that have 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 returned. This error also occurs if the power supply is turned off.
- For the format of response in the event of failure, see subsection 3.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum 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.

ddddn: 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 a UT350L controller with address number 01

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

(This command reads the status of the register specified by the WRS command.)

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

CPU number: 01

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

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

Measured input value: 200

INF Reads the model, version, and revision information.

● Function

Reads the model code, version number, and revision number of the UT350L controller.

- For the format of response in the event of failure, see subsection 3.1.2.

● 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	Response time: 0	INF	6	Checksum	ETX	CR

Number of Bytes	1	2	2	2	8	8	4	4
Response element	STX	Address number (ADR)	CPU number 01	OK	Model code: LC350-0□ (Note 1)	Version and revision numbers (Note 2)	0001 (Note 3)	(Note 4)

Response (continued)

4	4	2	1	1
(Note 5)	0000 (Note 6)	Checksum	ETX	CR

Note 1: Model name and options of UT350L Controller

● Model code of UT350L **LC350-0□**

0: No option
1: With communication

Note 2: Version and revision numbers

V01. R00 (Space)

Space (blank)
Revision number
Version number

Note 3:Valid in Non-user-specifiable mode.
* The value in this field is the first read register number, which is “0001” for all models.
Note 4:Valid in Non-user-specifiable mode.
* The value in this field is the number of registers read in Non-user-specifiable mode: “0008” for UT350L.
Note 5:Valid in Non-user-specifiable mode.
* The value in this field is the first write register number: “0001” for UT350L.
Note 6:Valid in Non-user-specifiable mode.
* The value in this field is the number of registers written in Non-user-specifiable mode, which is “0000” for all models.
*: One of the convenient modes used when communicating with FA-M3 with UT-link module. (See section 3.2.)

3.2.4 Response Error Codes

See Also

Subsection 3.1.2, Configuration of Response, for the structure of the response in the event of an error.

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

Table 3.4 Error Codes (EC1)

Error code	Meaning	Causes
02	Command error	• The command does not exist. • Command not executable
03	Internal register specification error	• Specified register number does not exist. • In handling bit registers (I relays) on a word-by-word basis, its specification is not correct.
04	Out of setting range	• A character other than 0 and 1 was used for bit setting. • A value other than 0000 to FFFF was specified in the word specification. • The start address specified for data loading/saving is out of the address range.
05	Number of data error	• Specified number of bits or words is too large. • The number of data or registers specified and the number of parameters for them are inconsistent.
06	Monitor error	• An attempt was made to execute monitoring without specifying any device to be monitored (BRS or WRS).
08	Parameter error	• Wrong parameter.
42	Sum error	• The sum does not match.
43	Internal buffer overflow	• Too much data was received.
44	Timeout between received characters	• No terminal character or ETX is received.

Table 3.5 Detailed Error Codes (EC2)

Error code (EC1)	Meaning	Detailed error code (EC2)
03	Internal register specification error	Indicates the parameter number where an error occurred (HEX). This is the number of a parameter in sequence that first resulted in an error when counted from the leading parameter. **Example:** Error in internal register specification ↓ **STX 01010BRW 03 I0097, 1, I0098, 0, A00502, 0** Parameter number 1 2 3 4 5 6 In this case, EC1 = 03 and EC2 = 06
04	Out of setting range	
05	Number of data error	
08	Parameter error	

For EC1 error codes other than those noted above, EC2 has no meaning.

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4. Ladder Communication

4.1 Overview

By using ladder communication, you can easily perform communication between a PLC (sequencer) and a UT350L controller. This kind of communication allows for the reading/ writing of D registers (internal registers of UT350L controller).

In ladder communication, a PLC identifies each instrument by its station number, which ranges from 1 to 99.

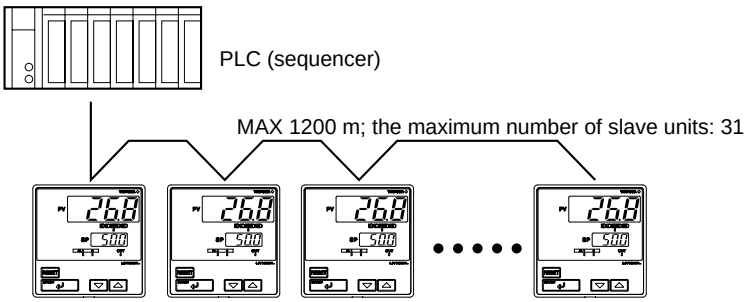


Figure 4.1 Connecting with Ladder Communication

4.1.1 Configuration of Commands

Commands sent from a PLC consist of the following elements.

Number of Bytes	1	1	2	1		1		2	1	1
Number of BCD digits	2	2	4	1	1	1	1	4	2	2
Element	Station number	CPU number 01	Parameter number	0	0	R/W	+/–	Read/write data	CR	LF
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	

(1) Station Number (01 to 99)

The station number is used by the PLC to identify which instrument to communicate with. (ID number of UT350L controller)

(2) CPU Number

This number is fixed to 01.

(3) Parameter number

For D registers, 4-digit BCD data of a D register number with its leading character “D” removed.

(4) 0

This is fixed to 0.

(5) 0

This is fixed to 0.

(6) R/W

0: Read

1: Write

(7) +/-

0: Positive data (+)

1: Negative data (-)

(8) Read/write data

For read operation, the number of data items to be read. (64 at maximum)

For write operation, setting data with a 4-digit BCD value excluding the decimal point.

(9) CR, LF

These control codes mark the end of a command. The character codes for CR and LF are CHR$(13) and CHR$(10), respectively.

● Data Forms of Commands

The table below shows the data forms of D registers.

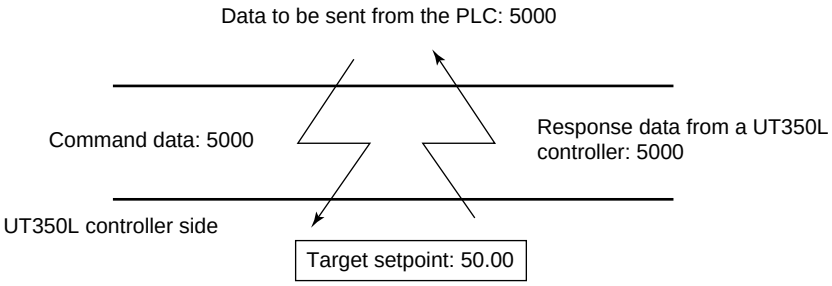
Table 4.1 Data Forms

Data type	Data content	Data 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 others	Measuring range span (EUS) data	Numeric data not including the decimal point
Limit control types, alarm types, and others	Seconds, absolute values, and data without unit*	Absolute value not including the decimal point

* Parameter list of UT350L controller User's Manual for information about data form.

● Command Format for Communication

Example: When setting the target setpoint 50.00 to a UT350L controller, the PLC sends the value 5000 as command data without the decimal point (this is also true for both settings 5.000 or 500.0).



* The position of the decimal point for 5000 is determined by the DP (decimal point position) parameter of the UT350L controller.

4.1.2 Configuration of Response

Response from a UT350L controller with respect to a command sent from the PLC consists of the elements shown below.

Number of Bytes	1	1	2	1		1		2	1	1
Number of BCD digits	2	2	4	1	1	1	1	4	2	2
Element	Station number	CPU number 01	Parameter number	0	0	R/W	+/–	Read/write data	CR	LF

When responding to a data read command, the length of this part varies: 64 data items at maximum.

4.2 Communication with PLC

With ladder communication you cannot specify D registers (internal registers of UT350L controller) by using their numbers as is. Set register numbers as shown below.

- D register: 4-digit BCD value of the register number (with “D” removed)

PLCs that can communicate with UT350L controllers are those capable of using the ladder communication protocol.

PLCs that can be connected to a UT350L controller are listed below.

Table 4.2 List of PLCs that can be connected

Supplier	Product	Requirement	Remarks
Yokogawa Electric Corporation	FA500	With communication module (RZ91-ON)	(Note)
	FA-M3	With communication module (F3RZ91-ON)	
Mitsubishi Electric Corporation, or others	MELSEC-A series and others	With computer link unit	
	PLCs that can communicate in handshaking mode.	With computer link unit	

Note: For more information about the PLCs listed above, contact the supplier.

For details, see the instruction manual of the PCL to be connected.

4.2.1 Reading Data

Shown below are the configurations of commands and responses when data in a UT350L controller is read by the PLC.

● Commands

Number of bytes	1	1	2	1		1		2	1	1
Number of BCD digits	2	2	4	1	1	1	1	4	2	2
Element	Station number	CPU number 01	Parameter number	0	0	0	0	Number of data items to read (n)	CR	LF

● Responses

Number of bytes	1	1	2	1		1		2	1	1	2
Number of BCD digits	2	2	4	1	1	1	1	4	1	1	1	1	4
Element	Station number	CPU number 01	Parameter number	0	0	0	+/–	dddd1	0	0	0	+/–	dddd2

Data of the parameter number (first data) — Second data

…	1		1		2	1	1
	1	1	1	1	4	2	2
…	0	0	0	+/–	ddddn	CR	LF

nth data

● **Example:** Reading a measured input value of a UT350L controller with station number 01

The following command reads the measured input value (D0003) at station number 01.

[Command] **“01010003000000010D0A”**

In response to the command above, the measured input value “200” is returned.

[Response] **“0101000300002000D0A”**

“0200” has been returned.

4.2.2 Writing Data

Shown below are the configurations of commands and responses when data is written to a UT350L controller from the PLC.

● Commands

Number of bytes	1	1	2	1		1		2	1	1
Number of BCD digits	2	2	4	1	1	1	1	4	2	2
Element	Station number	CPU number 01	Parameter number	0	0	1	+/–	dddd	CR	LF

● Responses

Number of bytes	1	1	2	1		1		2	1	1
Number of BCD digits	2	2	4	1	1	1	1	4	2	2
Element	Station number	CPU number 01	Parameter number	0	0	1	+/–	dddd	CR	LF

● **Example:** Writing “200” to the target setpoint 1 value of a UT350L controller with station number 01.

The following command writes “200” to the target setpoint 1 (D0301) at station number 01.

[Command] “01010301001002000D0A”

In response to the command above, the following response is returned. (Target setpoint 1 value is 200.)

[Response] “0101030100100200D0A”

“0200” has been returned.

4.2.3 Response Error Codes

The PLC may receive the following responses in the event of error.

Table 4.4 Response in the Event of Error

Error condition	Data sent from PLC	Data PLC receives
A non-existing parameter number was sent.	0101 **0000** 0000 0001 CRLF "0000" is the wrong parameter number.	0101 0000 0000 **FFFF** CRLF "FFFF" is returned.
Characters other than BCD codes were used in an element other than a station number.	0101 0123 0000 **000B** CRLF 0101 0123 **000B** 0000 CRLF 0101 0123 **0B00** 0000 CRLF 0101 **012B** 0000 0000 CRLF	0101 **FFFF FFFF FFFF** CRLF
An LF code (0A) was used in an element other than a station number.	0101 0123 0000 00**0A** CRLF 0101 0123 00**0A** 0000 CRLF 0101 0123 **0A**00 0000 CRLF 0101 01**0A** 0000 0000 CRLF	No response
Specified station number does not match any of the controllers connected.	01**03** 0123 0000 0000 CRLF **00**01 0123 0000 0000 CRLF **33**01 0123 0000 0000 CRLF	No response
The write data was outside the range.	0101 0123 0011 **9999** CRLF "9999" is the data outside the range.	0101 0123 0011 **0050** CRLF "0050" is the current setting of the parameter.
Wrong command length. (Command length is 10 bytes including CR and LF codes.)	0101 0123 0000 **00** CRLF 0101 0123 **00** 0000 CRLF 0101 **0** 0000 0000 CRLF	No response
A timeout occurred when sending data. (Timeout: 5 seconds)	—	No response
Send buffer overflowed. (The buffer capacity is 199 bytes.)	—	No response
A framing error or a parity error occurred.	—	No response

NOTE

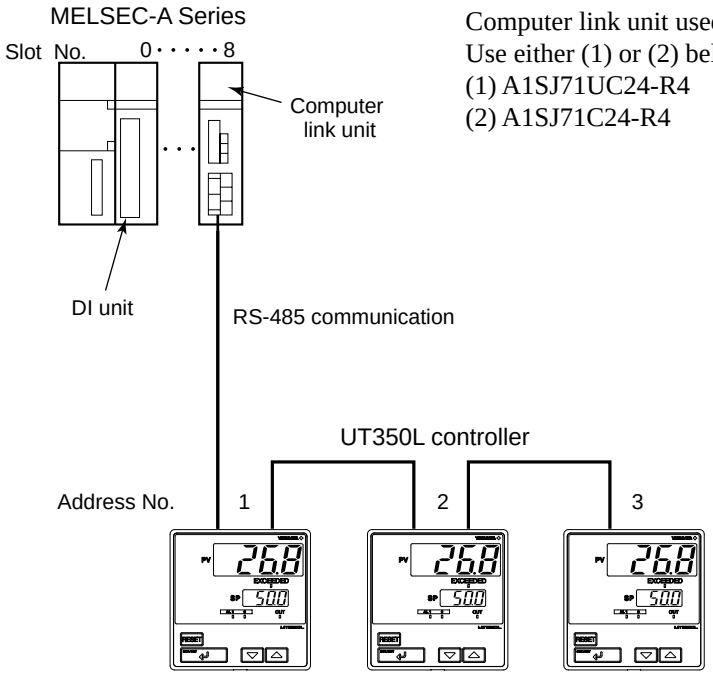
If you try to read data of a parameter number that is not in the D register table, or that corresponds to a vacant cell in that table, no error occurs and 0 is returned.

4.3 Communication with MELSEC

By way of ladder communication, a UT350L controller can exchange data, via its internal registers, with PLCs of suppliers other than Yokogawa. Sections 4.2 and 4.3 explain how to implement ladder communication with a MELSEC-A Series instrument (product of Mitsubishi Electric Corp.), which is often used in ladder communication.

Example

- System configuration:



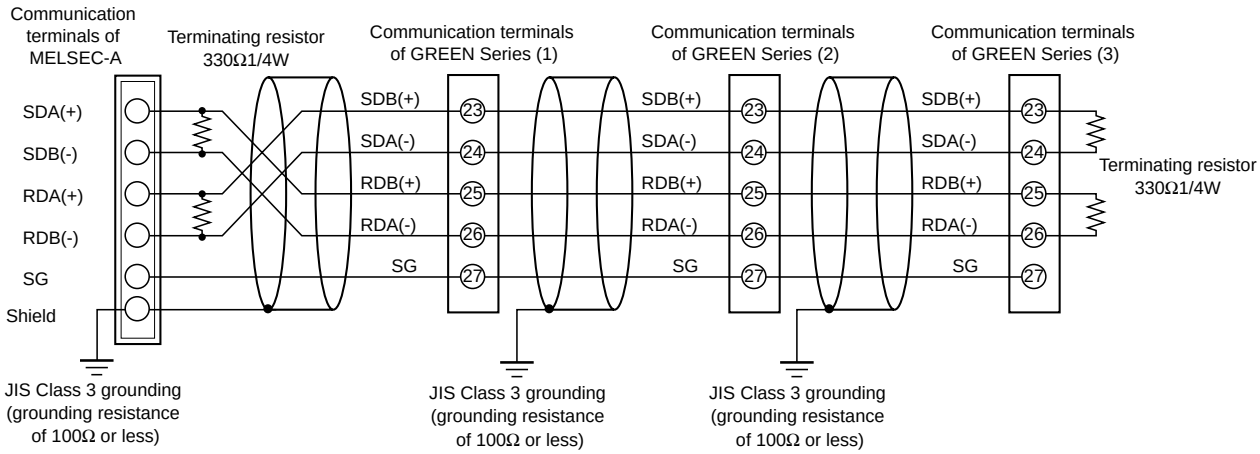
Computer link unit used at MELSEC-A:
Use either (1) or (2) below.
(1) A1SJ71UC24-R4
(2) A1SJ71C24-R4

4.3.1 Preparing for Communication

Provide wiring and set communication specifications.

4.3.2 Wiring

Connect the computer link unit of MELSEC-A to the UT350L controller's communication terminals.



The terminating resistor ratings are 220 W, 1/4W for UT350L controllers and 330 W, 1/4W for MELSEC-A instruments. The largest terminating resistor which is 330 W, 1/4W, should be provided.

4.3.3 Setting Communication Specifications

After wiring is finished, set the same communication specifications at both the UT350L and MELSEC-A's computer link unit.

● Communication settings of UT350L

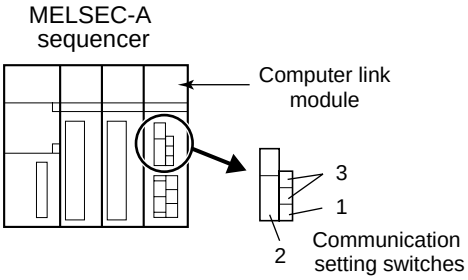
Communication settings are made to the software. Call up the setup parameters under the R485 menu, and set them up.

Code	Parameter name	Setting	Remarks
PSL	Protocol selection	2 (ladder communication)	Must be set to 2 to perform ladder communication.
BPS	Communication rate *1	4 (9600)	0 : 600, 1 : 1200, 2 : 2400, 3 : 4800, 4 : 9600 (bps)
PRI	Parity	1 (EVEN)	0 : NONE, 1 : EVEN, 2 : ODD
STP	Stop bit	1	1, 2
DLN	Data length	8	7, 8
RP.T	Minimum response time	0	0 to 10 (x10 ms)

For the operation procedure, see the User's Manual of each UT350L controller.

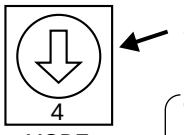
● Transmission settings of MELSEC-A

Set the switches of the computer link unit as shown below in steps (1) to (3).



(1) Mode switch
(2) Transmission spec. switches
(3) Station number switches

(1) Mode switch

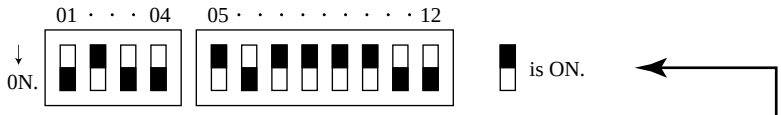


Set to “4.”

Mode 4 sets the following.
Communication rate: 9600 bps
Parity: even
Stop bit: 1
Data length: 1

MODE	Description
0 to 3	Disabled
4	Handshaking mode
:	:
8	Format-4 protocol mode
9 to E	Disabled
F	MELSEC test mode

(2) Transmission specification switches (: Not used for communication with a UT350L controller.)

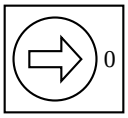


Switch No.	Item	Setting	
		ON	OFF
01	Not used.		
02	Link selection	Computer link	Multi-link
03	Not used.		
04	Write in RUN mode	Enabled	Disabled
	Communication rate (bps)		

	300	600	2400	4800	9800	19200	Disabled
05	OFF	ON	OFF	OFF	ON	OFF	ON
06	OFF	OFF	ON	OFF	OFF	ON	ON
07	OFF	OFF	OFF	ON	ON	ON	ON

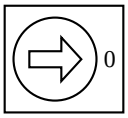
08	Data bit length	8 bits	7 bits
09	Parity bit	Yes	No
10	Parity bit type	Even	Odd
11	Stop bit selection	2 bits	1 bit
12	Sum check	Yes	No

(3) Station number switches



x10: Sets the 10th digit.

x10: Set to “0.”
x1: Set to “0.”



x1: Sets the 1st digit.

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5. Functions and Use of D Registers

5.1 Overview

This section explains the functions and use of D registers.

D registers store parameter data, flag data and process data of the UT350L controller. You can readily use these internal data items by reading from or writing to the D registers.

You can use D registers to perform:

- Centralized control using a host device
- Data exchange by reading/writing data from/to a host device

5.2 Interpretation of D Register Tables

This section explains how to read the D Register Map tables in this chapter. The numbers listed in the leftmost column are D register numbers ((1) below). Each register code name in the D Register Map tables represents a specific process data item, operating parameter, setup parameter or other data items such as a flag. For details on the operating parameters and setup parameters, see the user's manual of UT350L.

Name of D Register Map		
D-Reg No.	Register name	R/W
D0001	ADERROR	R

(1) D register number

Permission of read/write by communication
An asterisk (*) in this column indicates that the number of writing actions is limited to 100,000.

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 D0049	Process data area (Note 1)	Data displayed for operation	PV, SP, and others	Section 5.4
D0050 to D0100	User area (Note 2), represented by shaded cells in the table	—	If a graphic panel is used, this area is used for communication with the graphic panel.	Section 5.4
D0101 to D0230	Cannot be used.			
D0231 to D0256	Operating parameters (Note 1)	SP and Alarm setpoint parameters	SP, A1, A2, BS, FL, H	Section 5.5 Section 5.6
D0257 to D0900		Cannot be used.		
D0901 to D0903	Setup parameters (Note 1)	Cannot be used.		
D0904 to D1253		PV input, alarm type, retransmission output, and communication parameters	IN, AL, HY, PSL, etc.	Section 5.7 Section 5.8

Note 1: Data for process values, operating parameters and setup parameters are stored in the types (EU, EUS, %, or ABS without the decimal point) indicated in the Operating Parameter Lists and Setup Parameter Lists of the user's manual of UT350L. The OFF and ON states are represented by 0 and 1, respectively. D registers D0001 to D0049 are read-only.

Note 2: When communicating with a graphic panel, do not write to or read from this area (D0050 to D0100) because this area is reserved for 16-bit register data used by graphic panels.

[See Also] Section 5.4, Process Data and User Area.

NOTE

It is prohibited to read/write data by communication from/to the registers of blank cells in the register map tables. If you attempt to do so, the UT350L may not operate properly.

5.4 Process Data and User Area

Area for process data					
D-Reg No.	Register name	R/W	D-Reg No.	Register name	R/W
D0001	ADERROR	R	D0051		R/W
D0002	ERROR	R	D0052		R/W
D0003	PV	R	D0053		R/W
D0004	CSP	R	D0054		R/W
D0005		R	D0055		R/W
D0006		R	D0056		R/W
D0007		R	D0057		R/W
D0008	MOD	R	D0058		R/W
D0009	TIME	R	D0059		R/W
D0010	MAX/MIN	R	D0060		R/W
D0011	ALM	R	D0061		R/W
D0012			D0062		R/W
D0013			D0063		R/W
D0014			D0064		R/W
D0015			D0065		R/W
D0016			D0066		R/W
D0017			D0067		R/W
D0018			D0068		R/W
D0019			D0069		R/W
D0020			D0070		R/W
D0021			D0071		R/W
D0022			D0072		R/W
D0023			D0073		R/W
D0024			D0074		R/W
D0025			D0075		R/W
D0026			D0076		R/W
D0027			D0077		R/W
D0028			D0078		R/W
D0029			D0079		R/W
D0030			D0080		R/W
D0031			D0081		R/W
D0032			D0082		R/W
D0033			D0083		R/W
D0034			D0084		R/W
D0035	PARAERR	R	D0085		R/W
D0036			D0086		R/W
D0037			D0087		R/W
D0038			D0088		R/W
D0039			D0089		R/W
D0040			D0090		R/W
D0041			D0091		R/W
D0042			D0092		R/W
D0043			D0093		R/W
D0044			D0094		R/W
D0045			D0095		R/W
D0046			D0096		R/W
D0047			D0097		R/W
D0048			D0098		R/W
D0049			D0099		R/W
D0050		R/W	D0100		R/W

Shaded area : User area (You cannot use these registers when a graphic panel is used.)

5.4.1 Process Data Area (Read-only)

Some of the registers in this area (D0001 to D0049, read-only) are designed to represent two or more events, such as errors and statuses, using combinations of bits within the register. If any of the events shown in the following tables occur, the corresponding bit is set to 1. The bit remains 0 if the event does not occur. Note that bits with blank fields in the tables are not in use.

● Bit Configuration of D0001: ADERROR (Input Error)

Bit	Code	Event
0	ADERR	Input A/D converter error
1 to 15		

● Bit Configuration of D0002: ERROR (PV Error)

Bit	Code	Event
0		
1	PVBO	PV burnout error
2	RJCERR	PV RJC error
3		
4	PV+over	PV over-scale
5	PV-over	PV under-scale
6 to 15		

● D0003: PV (Measured input value)

● D0004: CSP (Current target setpoint [SP])

● Bit Configuration of D0008: MOD (Operation mode)

Bit	Code	Event
0		
1	EXD	1:EXCEED
2	OUT	Output Relay; 1:on, 0:off
3 to 15		

● Bit Configuration of D0011: ALM (Alarm Status)

Bit	Code	Event
0	ALM1	‘1’ when alarm 1 is ON; ‘0’ when OFF
1	ALM2	‘1’ when alarm 2 is ON; ‘0’ when OFF
2 to 15		

[See Also] User’s Manual of UT350L

● Bit Configuration of D0035: PARAERR (Error in calibration values and parameters)

Bit	Code	Event
0	CALB.E	Calibration value error
1 to 5		
6	SETUP	Setup parameter error
7		
8	PARA.E	Operation parameter error
9 to 11		
12	EEP.E	EEPROM error
13		
14	SYSTEM.E	System data error
15		

5.4.2 User Area

Register No.	Category	Description
D0050 to D0100	User area	Users can read/write data from/to the registers in this area. However, if a graphic panel is used in the system, users cannot use this area because it is reserved for communication with the graphic panel.

5.5 Alarm Setpoint, Bias, and Filter Parameters

Area for Alarm Setpoint, Bias, and Filter Parameters					
D-Reg No.	Register name	R/W	D-Reg No.	Register name	R/W
D0201			D0251		
D0202			D0252		
D0203			D0253		
D0204			D0254		
D0205			D0255		
D0206			D0256	H	*R/W
D0207			D0257		
D0208			D0258		
D0209			D0259		
D0210			D0260		
D0211			D0261		
D0212			D0262		
D0213			D0263		
D0214			D0264		
D0215			D0265		
D0216			D0266		
D0217			D0267		
D0218			D0268		
D0219			D0269		
D0220			D0270		
D0221			D0271		
D0222			D0272		
D0223			D0273		
D0224			D0274		
D0225			D0275		
D0226			D0276		
D0227			D0277		
D0228			D0278		
D0229			D0279		
D0230			D0280		
D0231	A1	*R/W	D0281		
D0232	A2	*R/W	D0282		
D0233			D0283		
D0234			D0284		
D0235			D0285		
D0236			D0286		
D0237			D0287		
D0238			D0288		
D0239			D0289		
D0240			D0290		
D0241			D0291		
D0242			D0292		
D0243	BS	*R/W	D0293		
D0244	FL	*R/W	D0294		
D0245			D0295		
D0246			D0296		
D0247			D0297		
D0248			D0298		
D0249			D0299		
D0250			D0300		

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

5.5.1 Data Area for Alarm Setpoint, Bias, and Filter Parameters

Register No.	Category	Description	Remarks
D0231 to D0232	Alarm setpoint parameters	A1 to A2: Alarm setpoints for alarm 1 to 2	For details on the parameters, see the User's Manual of UT350L
D0243 to D0244	Computation parameters	BS: PV bias FL: PV filter	

5.6 SP Parameter

Area for SP Parameter					
D-Reg No.	Register name	R/W	D-Reg No.	Register name	R/W
D0301	SP	*R/W	D0351		
D0302			D0352		
D0303			D0353		
D0304			D0354		
D0305			D0355		
D0306			D0356		
D0307			D0357		
D0308			D0358		
D0309			D0359		
D0310			D0360		
D0311			D0361		
D0312			D0362		
D0313			D0363		
D0314			D0364		
D0315			D0365		
D0316			D0366		
D0317			D0367		
D0318			D0368		
D0319			D0369		
D0320			D0370		
D0321			D0371		
D0322			D0372		
D0323			D0373		
D0324			D0374		
D0325			D0375		
D0326			D0376		
D0327			D0377		
D0328			D0378		
D0329			D0379		
D0330			D0380		
D0331			D0381		
D0332			D0382		
D0333			D0383		
D0334			D0384		
D0335			D0385		
D0336			D0386		
D0337			D0387		
D0338			D0388		
D0339			D0389		
D0340			D0390		
D0341			D0391		
D0342			D0392		
D0343			D0393		
D0344			D0394		
D0345			D0395		
D0346			D0396		
D0347			D0397		
D0348			D0398		
D0349			D0399		
D0350			D0400		

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

5.6.1 Data Area for SP Parameter

Register No.	Category	Description	Remarks
D0301	Operating parameters	SP: Target setpoint	

5.7 Alarm Type, Limit Control Type Selection, and Retransmission Parameters

Area for Alarm Type and Limit Control Type Selection Parameters					
D-Reg No.	Register name	R/W	D-Reg No.	Register name	R/W
D0901			D0951		
D0902			D0952		
D0903			D0953		
D0904	TMU	*R/W	D0954		
D0905			D0955		
D0906			D0956		
D0907			D0957		
D0908			D0958		
D0909			D0959		
D0910			D0960		
D0911			D0961		
D0912			D0962		
D0913			D0963		
D0914			D0964		
D0915	AL1	*R/W	D0965		
D0916	AL2	*R/W	D0966		
D0917			D0967		
D0918			D0968		
D0919	HY1	*R/W	D0969		
D0920	HY2	*R/W	D0970		
D0921			D0971		
D0922			D0972		
D0923			D0973		
D0924			D0974		
D0925			D0975		
D0926			D0976		
D0927			D0977		
D0928			D0978		
D0929			D0979		
D0930	R.MD	*R/W	D0980		
D0931			D0981		
D0932	DIS	*R/W	D0982		
D0933	HI.LO	*R/W	D0983		
D0934	OP.SL	*R/W	D0984		
D0935			D0985		
D0936			D0986		
D0937			D0987		
D0938			D0988		
D0939			D0989		
D0940			D0990		
D0941			D0991		
D0942			D0992		
D0943			D0993		
D0944			D0994		
D0945			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.

Area for Retransmission Parameters					
D-Reg No.	Register name	R/W	D-Reg No.	Register name	R/W
D1001			D1051		
D1002			D1052		
D1003			D1053		
D1004			D1054		
D1005			D1055		
D1006			D1056		
D1007			D1057		
D1008			D1058		
D1009			D1059		
D1010			D1060		
D1011			D1061		
D1012			D1062		
D1013	RET	*R/W	D1063		
D1014	RTH	*R/W	D1064		
D1015	RTL	*R/W	D1065		
D1016			D1066		
D1017			D1067		
D1018			D1068		
D1019			D1069		
D1020			D1070		
D1021			D1071		
D1022			D1072		
D1023			D1073		
D1024			D1074		
D1025			D1075		
D1026			D1076		
D1027			D1077		
D1028			D1078		
D1029			D1079		
D1030			D1080		
D1031			D1081		
D1032			D1082		
D1033			D1083		
D1034			D1084		
D1035			D1085		
D1036	LOCK	*R/W	D1086		
D1037			D1087		
D1038			D1088		
D1039			D1089		
D1040			D1090		
D1041			D1091		
D1042			D1092		
D1043			D1093		
D1044			D1094		
D1045			D1095		
D1046			D1096		
D1047			D1097		
D1048			D1098		
D1049			D1099		
D1050			D1100		

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

5.7.1 Data Area for Alarm Type, Hysteresis, Limit Control Type Selection Parameters

Register No.	Category	Description	Remarks
D0904	Time unit for duration time	TMU	For alarm types, see the User's Manual of UT350L.
D0915 to D0916	Alarm setting parameters	AL1 to AL2	
D0919 to D0920	Alarm hysteresis	HY1 to HY2	0.0 to 100.0% of measured input range span
D0930	Restart mode	R.MD	For details on the parameters, see the User's Manual of UT350L.
D0932	The way of confirmation	DIS	
D0933	Limit control type selection	HI.LO	
D0934	Operating display selection	OP.SL	

5.7.2 Data Area for Retransmission and Key-lock Parameters

Register No.	Category	Description	Remarks
D1013 to D1015	Retransmission output setting parameters	RET to RTL	For details on the parameters, see the User's Manual of UT350L.
D1036	Key-lock setting parameters	LOCK	

5.8 PV Input, Control Output, and Communication Parameters

Area for PV Input and Communication Parameters					
D-Reg No.	Register name	R/W	D-Reg No.	Register name	R/W
D1201	IN	*R/W	D1251	DLN	R
D1202	UNI	*R/W	D1252	ADR	R
D1203			D1253	RP.T	R
D1204	RH	*R/W	D1254		
D1205	RL	*R/W	D1255		
D1206	SDP	*R/W	D1256		
D1207	SH	*R/W	D1257		
D1208	SL	*R/W	D1258		
D1209	BSL	*R/W	D1259		
D1210	RJC	*R/W	D1260		
D1211			D1261		
D1212			D1262		
D1213			D1263		
D1214			D1264		
D1215			D1265		
D1216			D1266		
D1217			D1267		
D1218			D1268		
D1219			D1269		
D1220			D1270		
D1221			D1271		
D1222			D1272		
D1223			D1273		
D1224			D1274		
D1225			D1275		
D1226			D1276		
D1227			D1277		
D1228			D1278		
D1229			D1279		
D1230			D1280		
D1231			D1281		
D1232			D1282		
D1233			D1283		
D1234			D1284		
D1235			D1285		
D1236			D1286		
D1237			D1287		
D1238			D1288		
D1239			D1289		
D1240			D1290		
D1241			D1291		
D1242			D1292		
D1243			D1293		
D1244			D1294		
D1245			D1295		
D1246			D1296		
D1247	PSL	R	D1297		
D1248	BPS	R	D1298		
D1249	PRI	R	D1299		
D1250	STP	R	D1300		

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

5.8.1 Data Area for PV Input, and Communication Parameters

Register No.	Category	Description	Remarks
D1201 to D1210	PV input parameters	IN to RJC	For details on the parameters, see the User's Manual of UT350L.
D1247 to D1253	RS-485 communication parameters	PSL to RP.T	

6. Functions and Use of I Relays

6.1 Overview

This chapter explains the functions and use of I relays.

I relays contain status information of errors, operation, and alarms. Contents of I relays can be read only by means of communication using a host device. (Note that the I relays have the same information as the D registers but with I relays some of the information is read-only.)

You can use I relays to perform:

- Centralized monitoring through a display created with a host device.

6.2 Status I Relays

The configuration of status I relay area is as shown below.

Table 6.1 Classification of I Relays

I relay No.	Category	Description	Remarks
1 to 16	Status	Input error (same as D0001)	
17 to 32		PV error (same as D0002)	
33 to 48		Do not use.	
49 to 64		Error in calibration values or parameters (same as D0035)	
65		Do not use.	
66 and 67		EXCEEDED flag and OUT lamp flag	
68 to 96		Alarm flag	
99 to 720	Do not use.		
721 to 784	User-definable area		

NOTE

- When specifying an I relay number for communication, begin the number with the character “I.” For example, set I0019 to specify the RJCERR relay (I relay No.: 0019).
- In the area for I relays 1 to 720, it is prohibited to write data to I relays with blank cells in I relay map tables. If you attempt to do so, the UT350L may not operate properly.

Status Area											
No.	I relay name	No.	I relay name	No.	I relay name	No.	I relay name	No.	I relay name	No.	I relay name
1	ADERROR	33		65		97	ALM1	129		161	
2		34		66	EXD	98	ALM2	130		162	
3		35		67	OUT	99		131		163	
4		36		68		100		132		164	
5		37		69		101		133		165	
6		38		70		102		134		166	
7		39		71		103		135		167	
8		40		72		104		136		168	
9		41		73		105		137		169	
10		42		74		106		138		170	
11		43		75		107		139		171	
12		44		76		108		140		172	
13		45		77		109		141		173	
14		46		78		110		142		174	
15		47		79		111		143		175	
16		48		80		112		144		176	
17		49	CALB.E	81		113		145		177	
18	PVBO	50		82		114		146		178	
19	RJCERR	51		83		115		147		179	
20		52		84		116		148		180	
21	PV+over	53		85		117		149		181	
22	PV-over	54		86		118		150		182	
23		55	SETUP	87		119		151		183	
24		56		88		120		152		184	
25		57	PARA.E	89		121		153		185	
26		58		90		122		154		186	
27		59		91		123		155		187	
28		60		92		124		156		188	
29		61	EEP.E	93		125		157		189	
30		62		94		126		158		190	
31		63	SYSTEM.E	95		127		159		191	
32		64		96		128		160		192	

6.3 User Area

I relay No.	Category	Description
721 to 784	User area	You can read/write data from/to the area for I relays 721 to 784 via communication. That is, you can use the area freely without affecting the control function of UT350L.

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