



TYPE V Controller

Communication Reference Codes

Instruction Manual

First Edition

For proper equipment operation, please read this instruction manual and main unit instruction manual before use. Also read external communications terminal instruction manual carefully when ordering optional external communication function. Always keep equipment documentation safe and close at hand for convenient future reference.

Yamato Scientific America Inc.
Santa Clara, CA

Printed on recycled paper

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1. COMMUNICATION SETTING PROCEDURES

1.1: Communication setting

Make appropriate settings to master device (workstation PC etc.) and to TYPE V controller on main unit (hereafter, "main unit")

The following table shows the communication setting items for TYPE V controller.

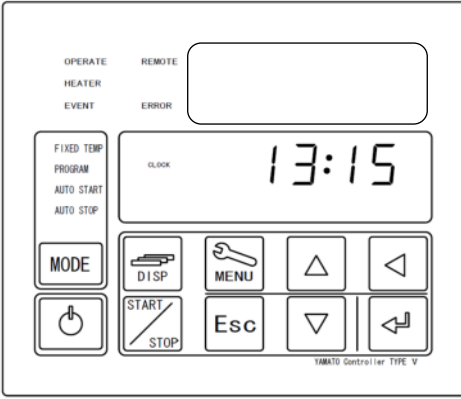

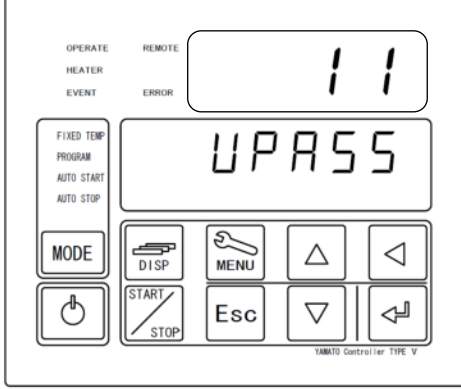





Set values on master device to match items 1-6 below on main unit

The following settings can be made by key operation.

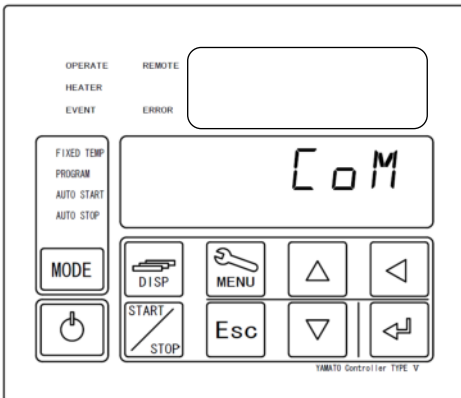


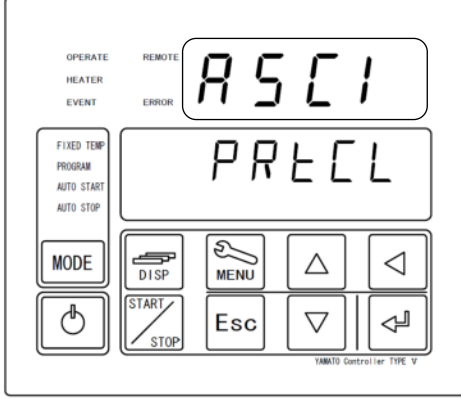




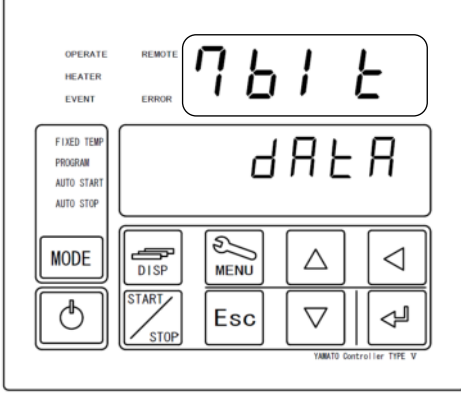





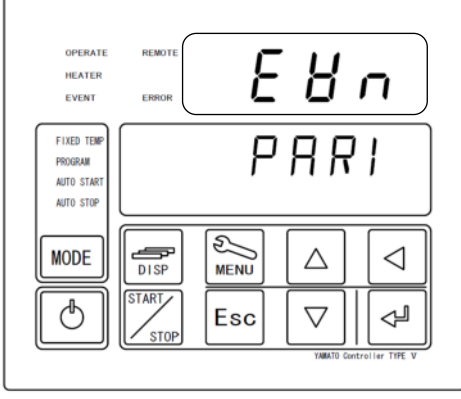





	Item	Item display name	Communication settings
1	Communication protocol	PRTCL	MODBUS- ASCII /RTU
2	Data length	DATA	7 /8 bit
3	Parity	PARI	Non/odd/ evn
4	Stop bit length	STOPB	1 /2 bit
5	Communication rate	BPS	9600 /19200/38400bps
6	Response delay time	DELAY	0 , 10, 20-250 msec
7	Communication address	ADDRS	1 -99
8	Communication mode	CMODE	RW /R

 : Factory defaults

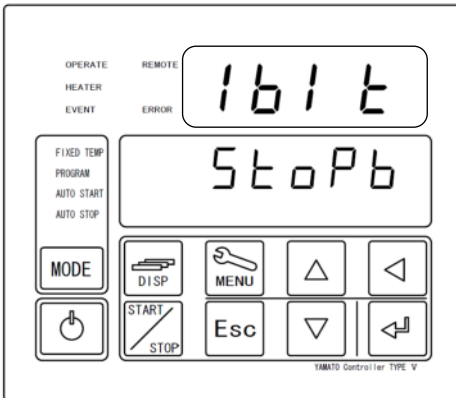





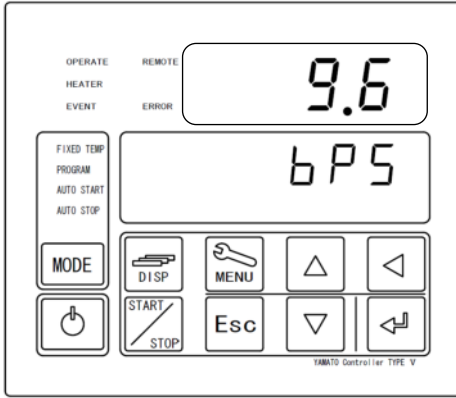





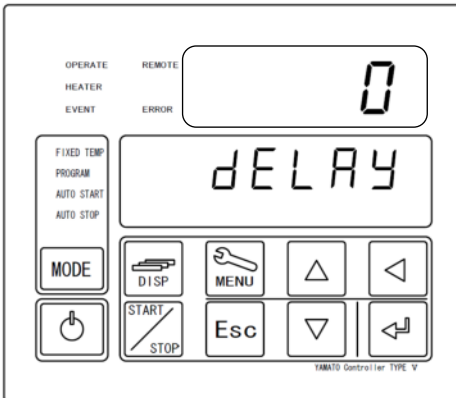





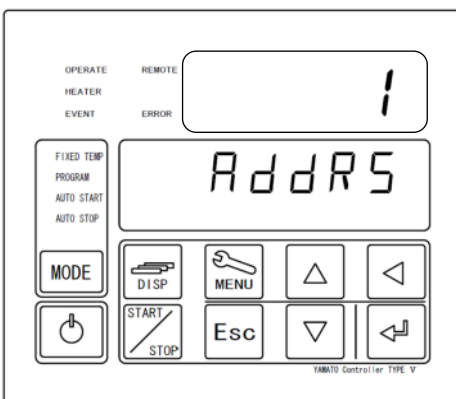





Communication settings by key operation

1		<p>Controller power should be turned off, showing only the time.</p> <p>If control panel shows anything other than time in the sub (lower) display, press & hold  to turn off the controller</p> <p>So it only shows the time.</p>
2		<p>Press & hold  until "UPASS" shows in the sub display and "00" shows in the main (upper) display.</p> <p>Enter "11" using    and press .</p> <p>* Password is fixed at 11 and cannot be changed.</p>

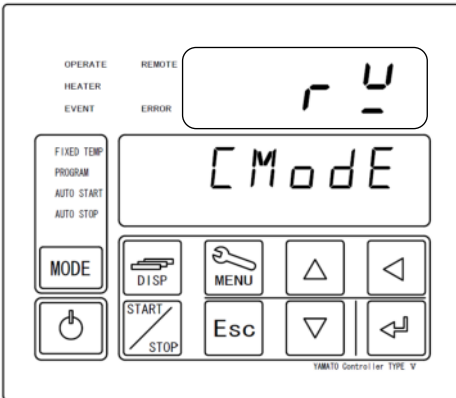





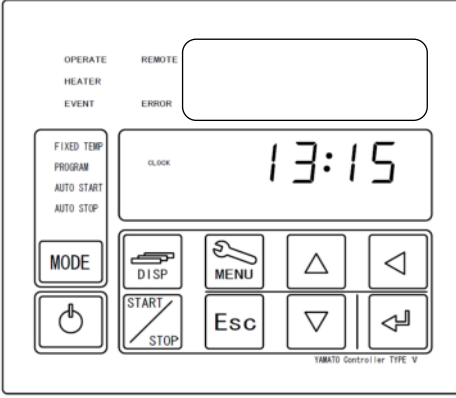

1. COMMUNICATION SETTING PROCEDURES





3		<p>Press  repeatedly until "COM" shows in the sub display.</p> <p>Press .</p>
4		<p>Communication protocol setting; default is "ASCII". "PRTCL" shows in the sub display and "ASCII" in the main display.</p> <p>Press . Main display content flashes.</p> <p>  can now be used to select "ASCII" or "rtU". Select either one and press .</p>
5		<p>Data length setting; default is "7BIT"</p> <p>Press  to show "DATA" in the sub display and "7BIT" in the main display.</p> <p>Press . Main display content flashes.   can now be used to select "7BIT" or "8BIT". Select either one and press .</p>
6		<p>Parity setting; default is "EVN"</p> <p>Press  to show "PARI" in the sub display and "EVN" in the main display.</p> <p>Press . Main display content flashes.   can now be used to select "NON", "ODD", or "EVN".</p> <p>Select one and press .</p>

1. COMMUNICATION SETTING PROCEDURES

7		<p>Stop bit length setting; default is "1BIT"</p> <p>Press  to show "STOPB" in the sub display and "1BIT" in the main display.</p> <p>Press . Main display content flashes.</p> <p>  can now be used to select "1BIT" or "2BIT"</p> <p>Select either one and press .</p>
8		<p>Communication rate setting; default is "9.6".</p> <p>Press  to show "BPS" in the sub display and "9.6" in the main display.</p> <p>Press . Main display content flashes.   can now be used to select "9.6 (kbps)", "19.2 (kbps)", or "38.4 (kbps)". Select one and press .</p>
9		<p>Response delay time setting; default is "0".</p> <p>Press  to show "DELAY" in the sub display and "0 (msec)" in the main display.</p> <p>Press . Main display content flashes.   can now be used to select "0 (msec)", "10 (msec)", or "20-250 (msec)" Select one and press .</p>
10		<p>Communication address setting; default is "1".</p> <p>Press  to show "ADDRS" in the sub display and "1" in the main display.</p> <p>Press . Main display content flashes.   can now be used to set address from 1-99. Select one and press .</p>

1. COMMUNICATION SETTING PROCEDURES

11		<p>Communication mode setting; default is "RW".</p> <p>Press  to show "CMODE" in the sub display and "RW" in the main display.</p> <p>Press . Main display content flashes.   can now be used to select "RW" or "R". Select either one and press .</p>
12		<p>When all settings are completed, press & hold  to turn TYPE V controller "OFF".</p> <p>Sub display shows current time, which completes the communication settings.</p>

- ❖ Change value can be recovered by using  during setting change. (Effective before pressing )
- ❖ With the controller turned "OFF", operation mode can be switched to remote mode by external communication.
- ❖ "REMOTE" LED illuminates while in remote mode. All keys except  are disabled. Pressing the other keys shows "REMOT" in the sub display.
- ❖ By holding  down during remote operation, main unit will quit remote mode and revert to idle with the controller "OFF".

1. COMMUNICATION SETTING PROCEDURES

1.2: Connection

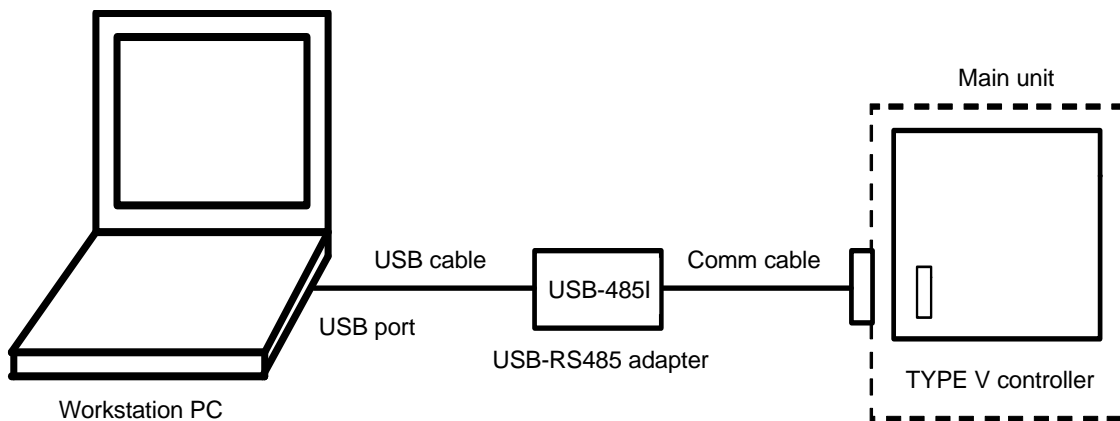
■ Workstation PC

- A USB interface is used.

■ USB-RS485 converter unit

- For the converter, System Sacom's "USB-RS485I RJ45-T4P" is recommended.
- By purchasing optional "external communication adapter USB-RS485I RJ45-T4P" (product code 211880), the following connection can be made (workstation not included).

■ Communication cable connection



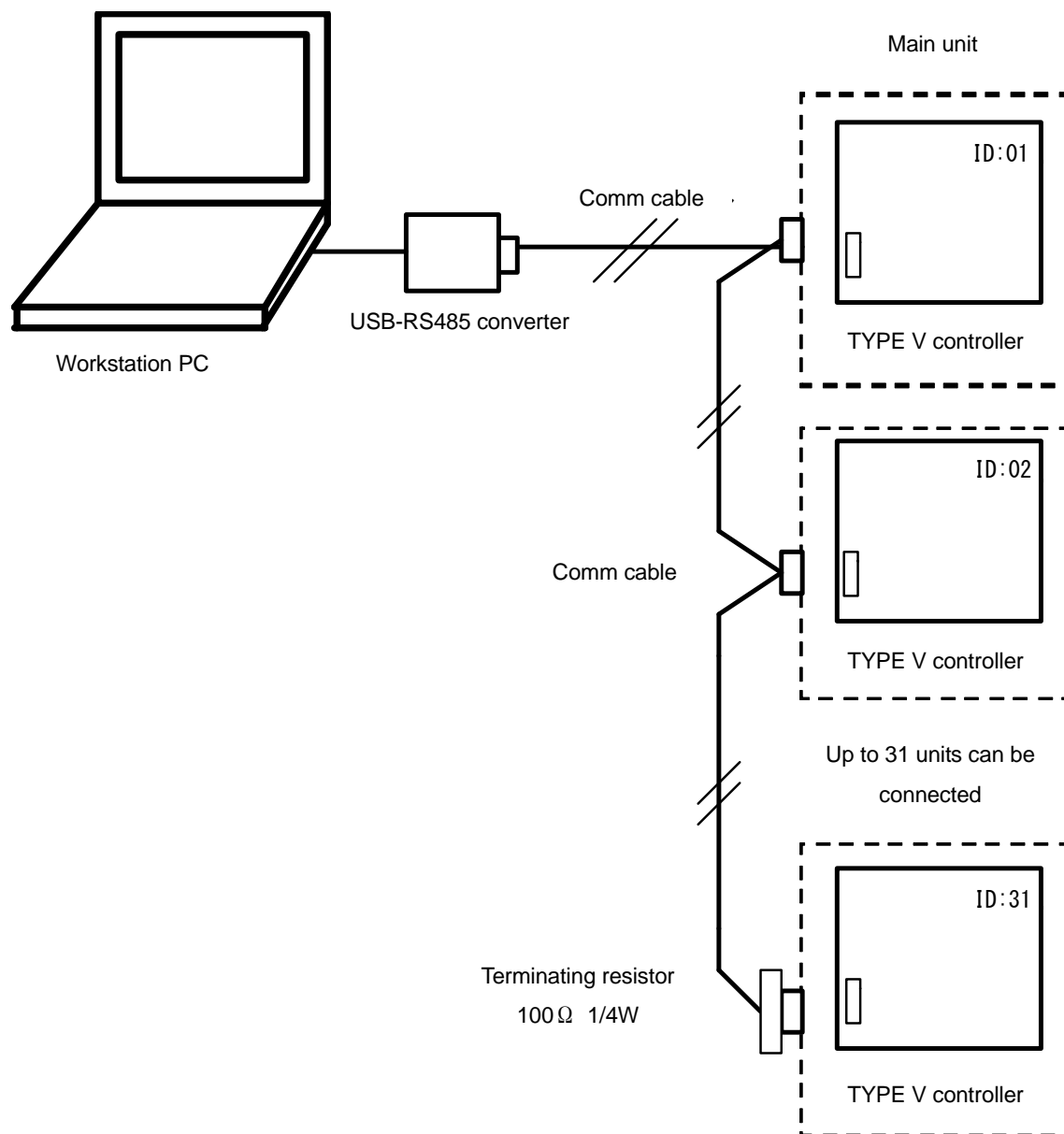
Note: "External communication adapter kit" (product code 211880) includes the following:

1. USB cable: connects workstation and USB-RS485 converter unit. 1.8 m.
2. Comm cable: connects USB-RS485 converter unit to main unit terminal block. UL2464TASB 2-lead AWG20 cable.
3. USB-RS485 converter unit: System Sacom USB-485I RJ45-T4P.

1. COMMUNICATION SETTING PROCEDURES

1.3: Multiple connection procedure

Shown below is an example of multi-drop wire connection.



Note: Terminating resistor: custom-made item.

If you prepare a terminating resistor yourself, connect a fixed resistor of 100 Ω and 1/4 W or over in parallel to the last cable appliance terminal block.

2. COMMUNICATION INTERFACE

- Communication protocol conforms to MODBUS and the protocol can be selected from RTU and ASCII.

Refer to MODBUS standard specification and commercial reference manuals for details on MODBUS.

2.1: Data transmission system

Transmission system: half-duplex asynchronous data transfer (polling/selecting)

Transmission distance: Max 500m (results may vary depending on environment)

Connection method: Multi-drop system (max 31 units)

Start bit: 1 bit

Transmission code: ASCII (ASCII mode)

Binary (RTU mode)

Error check: LRC (ASCII mode)

CRC-16 (RTU mode)

2.2: Frame configuration

In RTU mode, frame is composed of message portion only.

In ASCII mode, frame consists of start character "(": (colon, 3AH)", message and end character "CR (carriage return, 0DH) + LF (line feed, 0AH)".

RTU mode:

message

ASCII mode:

:	message	CR	LF
---	---------	----	----

2.3: Message configuration

MODBUS messages are composed of the following in both RTU and ASCII modes.

Slave address

Function code

Data

Error check

2.4: Slave address

Slave address can be set from 1-99. Master normally communicates with one slave device. All slave devices receive any message sent from the master in common, however, only the device with slave address corresponding to the directive message responds.

2. COMMUNICATION INTERFACE

2.5: Function code

The function code communicates to the slave device what to execute. Function code data is classified by type below.

Analog setting: each setting information type. Numerical value within 16 bits:

-32768 to 32767

Analog input data: measurement, status and other data. Numerical value within 16 bits.

Code	Function	Unit	MODBUS original function (reference)
03	Read analog settings	16 bit	Read content of maintenance register
04	Read analog input data	16 bit	Read content of input register
06	Write analog settings	16 bit	Write to single maintenance register

2.6: Data

Data configuration varies according to function code.

At the time of request from the master, data is composed of code number, data count, etc. of target data to be read and written.

Response from the slave consists of data in relation to the request.

Basic MODBUS data is all integers of 16-bit, and the presence or absence of a sign is defined for each data. Accordingly, by assigning a decimal to another address to convert into an integer or fixing the decimal position, it is normalized and expressed on scale upper/lower limits.

2.7: Reference number

A reference number is assigned to data and it is necessary for reading and writing the data.

Reference number range is categorized as "analog input data" and "analog setting value" according to data type.

Data type	Reference number	Relative number
Analog input data	30001-40000	Reference number -30001
Analog setting value	40001-50000	Reference number -40001

Relative number is the address number used during actual communication.

2. COMMUNICATION INTERFACE

2.8: Error check

Transmission frame error check differs by mode.

RTU: CRC-16

ASCII: LRC

2.8.1 CRC-16 calculation

CRC divides the information to be sent with the generating polynomial, adds the remainder behind the information to send.

Generating polynomial is as follows:

$$1 + x^2 + x^{15} + x^{16}$$

Use the following procedure to calculate from slave address to final data.

1. CRC-16 data (if x) initialization (= FFFFH)
2. Exclusive OR (EX-OR) of data 1 and x. $\rightarrow x$
3. Shift x 1 bit to the right. $\rightarrow x$
4. If carrier appears, take A001H and EX-OR. Otherwise, go to step 5. $\rightarrow x$
5. Repeat steps 3 and 4 until shifted 8 times
6. EX-OR of x and following data. $\rightarrow x$
7. Same as steps 3-5
8. Repeat final data
9. Create a message of the calculated 16-bit data, ordering low to high

Example: if data is [02H] [07H], CRC-16 is 1241H; so error check data will be [41H] [12H].

2.8.2 LRC calculation

Use the following procedure to calculate from slave address to final data.

1. Create message using RTU mode
2. Add up data from heading to end. $\rightarrow x$
3. Take the complement of x. $\rightarrow x$
4. Add 1. ($x = x+1$)
5. Add x to end of message as LRC.
6. Convert in entirety to ASCII characters.

Example: if data is [02H] [07H], LRC is [F7H]; so binary message will be [02H] [07H] [F7H] and ASCII message will be [30H] [32H] [30H] [37H] [46H] [37H].

2. COMMUNICATION INTERFACE

2.9: Function code details

The following is a function code exclusive response:

2.9.1 Analog setting value reading

[Function code: 03 (03H)]

Only a specific quantity from the specified number "continuous number analog setting value (2-byte: 16-bit) data" is read. The data is split into high 8-bit and low 8-bit, arranged in numerical order and composed into response message data.

Example: readout for fixed temp operation SV setting, fixed temp auto start SV setting, fixed temp auto start time/timer select setting for slave 1.

(slave 1 analog setting value reference numbers are 40001 to 40003 in above cases.)

Reference number (Relative number)	40001 (0000H)	40002 (0001H)	40003 (0002H)
Data	650 (028AH)	-50 (FFCEH)	0 (0000H)

<RTU mode>

Master → device

Slave address	01H
Function code	03H
Start number (H)	00H
Start number (L)	00H
Quantity (H)	00H
Quantity (L)	03H
CRC (L)	05H
CRC (H)	CBH

Device → master (normal)

Slave address	01H
Function code	03H
Number of data	06H
Fixed temp SV (H)	02H
Fixed temp SV (L)	8AH
Fixed temp AT STA SV (H)	FFH
Fixed temp AT STA SV (L)	CEH
Fixed temp timer select (H)	00H
Fixed temp timer select (L)	00H
CRC (L)	E8H
CRC (H)	A3H

<ASCII mode error check>

LRC	F9H	LRC	9DH
-----	-----	-----	-----

Note: start number (relative number) is "reference number minus 40001".

Note: the number of data is the number of bytes in data; the number of requests is 3 and the number of data is 6 in the example above.

2. COMMUNICATION INTERFACE

2.9.2 Analog input data read-out

[Function Code: 04(04 H)]

Only a specific quantity from the specified number "continuous number analog input (2 byte : 16-bit) data" is read.

The data is split into high 8-bit and low 8-bit, arranged in numerical order and composed into response message data.

Response example: Same as "function code 03", only the start number (relative number) is "reference number minus 30001".

2.9.3 Analog setting value write

[Function code: 06(06 H)]

Assign analog setting value for given number to specified value.

Example: set fixed temp operation temp setting to 100 for slave 1.

<RTU mode>

Master → device

Slave address	01H
Function code	06H
Setting value No. (L)	00H
Setting value No. (L)	00H
Setting data (H)	00H
Setting data (L)	64H
CRC (L)	88H
CRC (H)	21H

Device → master (normal)

Slave address	01H
Function code	06H
Setting value No. (L)	00H
Setting value No. (L)	00H
Setting data (H)	00H
Setting data (L)	64H
CRC(L)	88H
CRC(H)	21H

<ASCII mode error check>

LRC	95H
-----	-----

LRC	95H
-----	-----

Note: setting value number (relative number) is "reference number minus 40001".

Note: Response will be the same as master message under normal response.

2. COMMUNICATION INTERFACE

2.10: Error processing

No response error

In the following cases, message is ignored and no response is sent.

1. When message transmission error (overrun, framing, parity, CRC or LRC) is detected.
2. When slave address in message is not for receiving device.
3. When message data interval is too long.

RTU...When less than 9600bps: 20msec or more

When over 9600bps: 5msec or more

ASCII...1sec or more

4. When transmission parameters are not in agreement.
5. When receiving message exceeds maximum allowable bytes.

Response error

When master message contains no error, but the following problems (see table below) occur, a code signifying error content is sent in response as an "error message".

Slave address
Function code + 80H
Error codes
CRC (L)
CRC (H)

Function code	Function code + 80H
03	83H
04	84H
06	86H

2.11: Transmission error codes

Transmission error codes are as follows:

Error Codes	Description
01H	Function code error Irregular/incorrect function code is received
02H	Relative number (reference number) error Irregular/incorrect start number or setting value number is received
03H	Incorrect number of data pieces · Number of data exceeds the specified number for data to be transmitted in response to received message · The number of request is 0 · Number of specified data received and actual number of data are not in agreement
11H	Setting value out of range Setting value is outside the range defined in the reference table
12H	Setting not available

3. REMOTE OPERATION VIA COMMUNICATION

3.1: Start remote mode

- Remote mode can start only when the controller is OFF state.
- Start remote mode by specifying operation mode (fixed temp operation, program operation, auto start, auto stop, or program auto start). However, when program operation or program auto start is selected, remote mode cannot be started unless the following condition is satisfied.

Operation mode	Remote mode start conditions
Program operation	Program patterns for the operation are specified.
Program auto start	Program pattern for auto start is specified.

3.2: End remote mode

- When remote mode ends, regardless of the remote operation state (standby/running/end) main unit terminates operation and set remote operation state in standby, then quit remote mode. After remote mode ends, the controller will be turned OFF (shows power OFF screen).

3.3: Remote operation start/stop

- When starting remote operation during standby or at the end of operation, main unit starts remote operation with operation mode and setting value set at that point.
- Remote operation is stopped by transmitting remote operation stop command during remote operation.

3.4: Operation mode change in remote mode

- The operation mode can be changed to another during standby or at the end of operation. However, when changing the operation mode to program operation or program auto-start, the mode change cannot be completed unless the following condition is satisfied.

Operation mode	Operating mode change conditions
Program operation	Program patterns for the operation are specified.
Program auto start	Program pattern for auto start is specified.

3. REMOTE OPERATION VIA COMMUNICATION

3.5: Key operation in remote mode

- All key operations on the controller are disabled in remote mode except power OFF operation by holding down the POWER key. When pressing any keys other than the POWER key, display indicates that main unit is in remote mode and buzzer sounds. This indication will show for one second, and then the display returns to the previous screen.

3.6: Recovery from power outage in remote mode

- The power recovery operation in remote mode is the same as that in local mode.

4. COMMUNICATION REFERENCE TABLE

External communication



When using external communication option on any unit, access by anything other than the following reference addresses, may cause equipment malfunction. Do not attempt to use any reference address, code or utility other than those given below or as recommended by Yamato Scientific Co., Ltd. Do not access functions that are not mentioned in the controller keys operation (see main unit instruction manual). Unit may malfunction or become out of control.

4.1: Function code 03/06

TYPE V Controller Communication Reference table; items with “*” are not applicable by model

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)	Initial value	Remarks
40001	03 06	R W	Fixed temp operation SV setting	SLL-SLH	0.0°C	◆Corrected within the range between SLL and SLH
40002	03 06	R W	Fixed temp auto start SV setting	SLL-SLH	0.0°C	◆Corrected within the range between SLL and SLH
40003	03 06	R W	Fixed temp auto start time/timer select	Timer/time (0/1)	Timer	
40004	03 06	R W	Fixed temp auto start time setting (H)	00-99 (0-99)	00	H: hour
40005	03 06	R W	Fixed temp auto start timer setting (L)	00-59 (0-59)	00	L: minute
40006	03 06	R W	Fixed temp auto start time setting (H)	00-23 (0-23)	00	H: hour
40007	03 06	R W	Fixed temp auto start time setting (L)	00-59 (0-59)	00	L: minute
40008	03 06	R W	Fixed temp auto stop SV setting	SLL-SLH	0.0°C	◆Corrected within the range between SLL and SLH
40009	03 06	R W	Fixed temp auto stop timer/time select	Timer/time (0/1)	Timer	
40010	03 06	R W	Fixed temp auto stop timer setting (H)	00-99 (0-99)	00	H: hour

4. COMMUNICATION REFERENCE TABLE

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)	Initial value	Remarks
40011	03 06	R W	Fixed temp auto stop timer setting (L)	00-59 (0-59)	00	L: minute
40012	03 06	R W	Fixed temp auto stop time setting (H)	00-23 (0-23)	00	H: hour
40013	03 06	R W	Fixed temp auto stop time setting (L)	00-59 (0-59)	00	L: minute
40014	03 06	R W	Fixed temp quick auto stop timer/time select	Timer/time (0/1)	Timer	
40015	03 06	R W	Fixed temp quick auto stop timer setting (H)	00-99 (0-99)	00	H: hour
40016	03 06	R W	Fixed temp quick auto stop timer setting (L)	00-59 (0-59)	00	L: minute
40017	03 06	R W	Fixed temp quick auto stop time setting (H)	00-23 (0-23)	00	H: hour
40018	03 06	R W	Fixed temp quick auto stop time setting (L)	00-59 (0-59)	00	L: minute
40019	03 06	R W	Program operation pattern no. setting	0-99 (0-99)	0	◆Setting not available while program operation is running
40020	03 06	R W	Program operation auto start pattern no. setting	0-99 (0-99)	0	◆Setting not available while auto start timer is counting
40021	03 06	R W	Program auto start timer/time select	Timer/time (0/1)	Timer	
40022	03 06	R W	Program auto start timer setting (H)	00-99 (0-99)	00	H: hour
40023	03 06	R W	Program auto start timer setting (L)	00-59 (0-59)	00	L: minute

4. COMMUNICATION REFERENCE TABLE

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)	Initial value	Remarks
40024	03 06	R W	Program auto start time setting (H)	00-23 (0-23)	00	H: hour
40025	03 06	R W	Program auto start time setting (L)	00-59 (0-59)	00	L: minute
40027	03	R	Accumulated power consumption (KW/h)	0-999KW/h (0-999)	0 KW/h	
40028	03	R	Accumulated power consumption (MW/h)	0-999MW/h (0-999)	0 MW/h	
40029	03	R	Accumulated CO2 emissions (Kg)	0-999Kg (0-999)	0 Kg	
40030	03	R	Accumulated CO2 emissions (t)	0-999t (0-999)	0 t	
40031	03	R	Output MV	0.0-100.0% (0-1000)	0.0%	
40032	03	R	Accumulated time: total power-on time	Max: 65535h (0-65535)	0h	
40033	03	R	Accumulated time: total operation time	Max: 65535h (0-65535)	0h	
40034	03	R	Present power consumption	0.0-999.9KW/h (0-9999)	0 KW/h	

4. COMMUNICATION REFERENCE TABLE

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)	Initial value	Remarks
41001	03 06	R W	Keypad lock setting	OFF/MLOC/ FLOC/ON (0/1/2/3)	OFF	
41002	03 06	R W	Buzzer sound setting	ON/ CLK (click off)/ OFF (0/1/2)	ON	
41003	03 06	R W	Calendar setting (Year)	2010-2099 (10-99)	2010	
41004	03 06	R W	Calendar setting (Month)	1-12 (1-12)	1	
41005	03 06	R W	Calendar setting (day)	1-31 (1-31)	1	
41006	03 06	R W	Calendar setting (Hour)	0-23 (0-23)	0	
41007	03 06	R W	Calendar setting (minute)	0-59 (0-59)	0	◆Seconds are fixed at 0
41008	03 06	R W	Refrigerator control function select	NON/2P/ CYC/CNT (0/1/2/3)	2P	*
41009	03 06	R W	Refrigerator cycle operation ON-time setting	0-120min (0-120)	30min	*
41010	03 06	R W	Refrigerator cycle operation OFF-time setting	0-120min (0-120)	10min	Restart protective time \leq OFF-time*
41011	03 06	R W	Defrost operation mode setting	NON (none)/ CLK (time)/ TIME (time) (0/1/2)	NON	Auto setting*
41012	03 06	R W	Defrost operation start time setting (H)	00-23 (0-23)	00	H: hour*
41013	03 06	R W	Defrost operation start time setting (L)	00-59 (0-59)	00	L: minute*

4. COMMUNICATION REFERENCE TABLE

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)	Initial value	Remarks
41014	03 06	R W	Defrost operation cycle setting	1-96h (1-96)	24h	Automatic operation only*
41015	03 06	R W	Defrost operation time setting	0-59min (0-59)	5min	Common to automatic & manual operation*
41016	03 06	R W	Fan speed setting: during standby	0-10 (0-10)	10	*
41017	03 06	R W	Fan speed setting: during operation	0-10 (0-10)	10	*
41018	03 06	R W	Fan speed setting: at the end of operation	0-10 (0-10)	10	*
41019	03 06	R W	Auto damper setting: damper aperture during standby	0/25/50/75/100 % (0/1/2/3/4)	0%	*
41020	03 06	R W	Auto damper setting: damper aperture during operation	0/25/50/75/100 % (0/1/2/3/4)	0%	*
41021	03 06	R W	Auto damper setting: damper aperture at the end of operation	0/25/50/75/100 % (0/1/2/3/4)	0%	*
41022	03 06	R W	Event output setting: event 1 output during standby	OFF/ON (0/1)	OFF	*
41023	03 06	R W	Event output setting: event 1 output during operation	OFF/ON (0/1)	OFF	*
41024	03 06	R W	Event output setting: event 1 output at the end of operation	OFF/ON (0/1)	OFF	*
41025	03 06	R W	Event output setting: event 2 output during standby	OFF/ON (0/1)	OFF	*
41026	03 06	R W	Event output setting: event 2 output during operation	OFF/ON (0/1)	OFF	*

4. COMMUNICATION REFERENCE TABLE

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)	Initial value	Remarks
41027	03 06	R W	Event output setting: event 2 output at the end of operation	OFF/ON (0/1)	OFF	*
41028	03 06	R W	Event output setting: event 3 output during standby	OFF/ON (0/1)	OFF	*
41029	03 06	R W	Event output setting: event 3 output during operation	OFF/ON (0/1)	OFF	*
41030	03 06	R W	Event output setting: event 3 output at the end of operation	OFF/ON (0/1)	OFF	*
41043	03 06	R W	CO2 emission conversion factor	0.001-9.999 (1-9999)	0.550	
41045	03 06	R W	Calibration offset	-CAL.L to CAL.L	0.0	◆ Corrected within the range between -CAL.L and CAL.L.
42012	03 06	R W	Power recovery mode setting	CNT/STP (0/1)	CNT	

4. COMMUNICATION REFERENCE TABLE

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)
46001	03 06	R W	Operation mode: Remote/local	0: Fixed temp operation 1: Fixed temp auto start 2: Fixed temp auto stop 3: Program operation 4: Program auto start 5: Local (at the time of writing, and the end of mode) ◆ Remote mode start setting is not available when local control is ON. ◆ Remote mode can only be cancelled while in remote mode. ◆ Program operation For program auto start: Setting not available unless program patterns are set.
46002	03 06	R W	Operation mode: STOP/RUN	STOP/RUN (0/1) ◆ No processing in local mode.
46003	03 06	R W	Communication protocol select	ASCII/RTU (0/1) ◆ It does not depend on communication impossibility conditions.
46004	03 06	R W	Data length setting	7BIT/8BIT(0/1) ◆ It does not depend on communication impossibility conditions. ◆ 7BIT cannot be set while RTU is being set.
46005	03 06	R W	Parity setting	NON/ODD/EVN (0/1/2) ◆ It does not depend on communication impossibility conditions.
46006	03 06	R W	Stop bit setting	1BIT/2BIT (0/1) ◆ It does not depend on communication impossibility conditions.
46007	03 06	R W	Communication rate setting	9.6k/19.2k/38.4kbps (3/4/5) ◆ It does not depend on communication impossibility conditions.
46008	03 06	R W	Response delay time setting	0/10/20-240/250ms (10 increments) (0/1/2-24/25) ◆ It does not depend on communication impossibility conditions.
46009	03 06	R W	Address setting	1-99 (1-99) ◆ It does not depend on communication impossibility conditions.
46010	03 06	R W	Communication mode setting	R/RW (0/1) ◆ It does not depend on communication impossibility conditions.

4. COMMUNICATION REFERENCE TABLE

4.2: Function code 04

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)
30101	04	R	Current temp monitor (PV)	K: -30°C to 610°C R: -30°C to 1210°C T: -200°C to 210°C PT1: -110°C to 110°C PT2: -200°C to 410°C ◆Refer to main unit instruction manual for above sensors. +over-range: 32767 -over-range: -32768 PV decimal point
30102	04	R	PV decimal position	DP.0/DP.1 (0/1)
30103	04	R	In-operation target temp (SV)	RUN SV (target temp in program operation) -1999 to 9999°C 0°C when READY PV decimal point
30104	04	R	In-operation execute temp (SV)	Execute temp (SV) in program operation -1999 to 9999°C 0°C when READY PV decimal point
30105	04	R	Output MV (MV)	-10.0 to 110.0%
30107	04	R	RUN/READY status monitor	High order byte 0: Fixed temp operation 1: Fixed temp auto start 2: Fixed temp auto stop 3: Program operation 4: Program auto start Low order byte 0 = READY (standby) 1 = RUN (running) 2 = END (end)

4. COMMUNICATION REFERENCE TABLE

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)																
30108	04	R	Error status	<div>BIT0 = temp sensor error</div> <div>BIT1 = triac (SSR) short circuit</div> <div>BIT2 = Heater disconnection</div> <div>BIT3 = Fan error</div> <div>BIT4 = Automatic damper error*</div> <div>BIT5 = Independent overheat prevention device error</div> <div>BIT6 = Three-phase power supply error*</div> <div>BIT7 = Main relay contact failure</div> <div>BIT8 = Refrigerator error*</div> <div>BIT9 = RAM error</div> <div>BIT10 = EEPROM error</div> <div>BIT11 = Auto tune error*</div> <div>BIT12 = External Error*</div> <div>BIT13 = Inverter error*</div> <div>BIT14 = High pressure error*</div> <div>BIT15 = Overload error*</div> <div><div>Low order</div><table><tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr></table><div>High order</div><table><tr><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td></tr></table><div>0 = No error</div><div>1 = Error occurs</div></div> <div>◆Refer to main unit instruction manual for above errors.</div>	7	6	5	4	3	2	1	0	15	14	13	12	11	10	9	8
7	6	5	4	3	2	1	0													
15	14	13	12	11	10	9	8													
30109	04	R	Alert status	<div>BIT0 = Water level error*</div> <div>BIT1 = Door open*</div> <div>BIT2 = Software overheat error</div> <div><table><tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr></table><div>0 = Alert OFF</div><div>1 = Alert ON</div></div>	7	6	5	4	3	2	1	0								
7	6	5	4	3	2	1	0													
30110	04	R	Running pattern/step No.	<div>High order byte</div> <div>Pattern No.</div> <div>0-99 (0 = standby)</div> <div>Low order byte</div> <div>Step No.</div> <div>0-99 (0 = standby)</div>																

4. COMMUNICATION REFERENCE TABLE

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)
30111	04	R	Running step repeat destination No./ remaining number of step repeats	[High order byte] Repeat destination No. 0-99 [Low order byte] Remaining number of repeats 0-99/255 (INF = 255)
30112	04	R	Fixed temp auto start remaining time	[High order byte] Hour: 0-99 [Low order byte] Minute: 0-59
30113	04	R	Fixed temp auto stop remaining time	[High order byte] Hour: 0-99 [Low order byte] Minute: 0-59
30114	04	R	Fixed temp quick auto stop remaining time	[High order byte] Hour: 0-99 [Low order byte] Minute: 0-59
30115	04	R	Program auto start remaining time	[High order byte] Hour: 0-99 [Low order byte] Minute: 0-59
30116	04	R	Running step remaining time	[High order byte] Hour: 0-99/255 (INF = 255) [Low order byte] Minute: 0-59/255 (INF = 255)

4. COMMUNICATION REFERENCE TABLE

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)
30117	04	R	Device status monitor	Bit0: fixed temp auto start remaining time (0 = count stop, 1 = counting) Bit1: fixed temp auto stop remaining time (0 = count stop, 1 = counting) Bit2: quick auto stop remaining time (0 = count stop, 1 = counting) Bit3: program auto start remaining time (0 = count stop, 1 = counting) Bit4: program op remaining time in current step (0 = count stop, 1 = counting) Bit5: remote/local status (0 = local ,1 = remote) Bit6: defrost status (0 = defrost stop, 1 = defrosting)* Bit7: program operation repeat status (0 = No repeat, 1 = repeating) Bit8: quick auto stop status (0 = auto stop OFF, 1 = auto stop ON) Bit9: power key status (0 = OFF, 1 = ON)
30131	04	R	Accumulated power-on time	Max: 65535h
30132	04	R	Accumulated operation time	Max: 65535h
30133	04	R	Power consumption (KW/h)	0-999KW/h
30134	04	R	Power consumption (MW/h)	0-999MW/h
30135	04	R	CO2 consumption (Kg)	0-999Kg
30136	04	R	CO2 consumption (t)	0-999t
30137	04	R	Present power consumption display (KW/h)	0-999KW/h

4. COMMUNICATION REFERENCE TABLE

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)
31001	04	R	Pattern number	1-99
31002	04	R	Step number	1-99
31003	04	R	End step setting	OFF/ON
31004	04	R	Step temp setting	SLL-SLH
31005	04	R	Step time setting (H)	00-99/INF
31006	04	R	Step time setting (L)	00-59/INF
31007	04	R	Repeat setting: repeat destination	0-98
31008	04	R	Repeat setting: number of times to repeat	0-99/INF
31009	04	R	Wait setting	OFF/ON
31010	04	R	Event output setting: EV1-3	OFF/ON*
31011	04	R	Fan speed setting	0-10*
31012	04	R	Auto damper aperture setting	0/25/50/75/100%*
31013	04	R	Refrigerator operation setting	NON/2P/CYC/CNT*

* Steps 2 to 98 are omitted

* 1 step = 15 reference unit



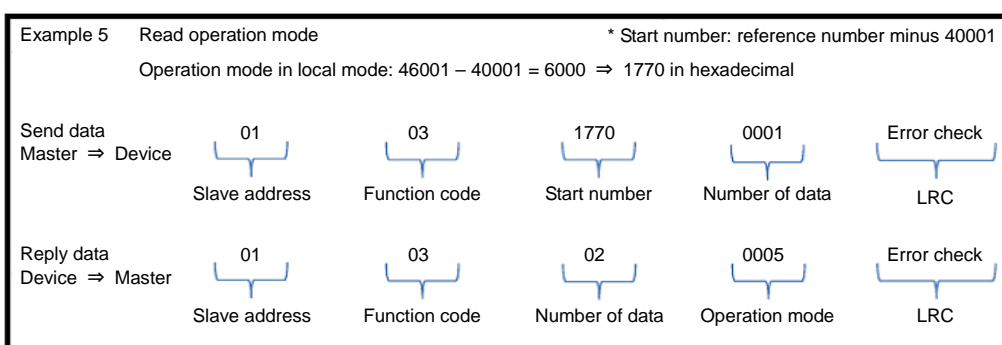
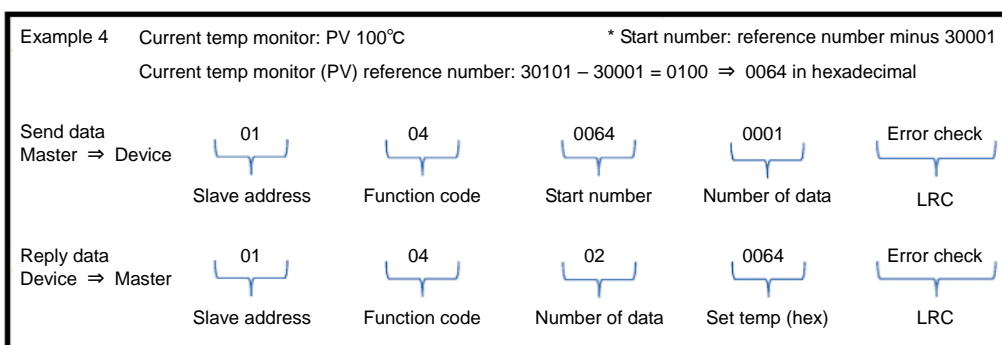
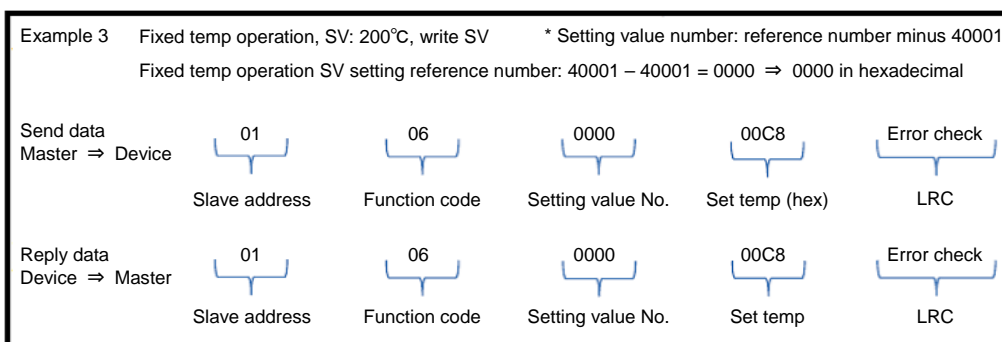
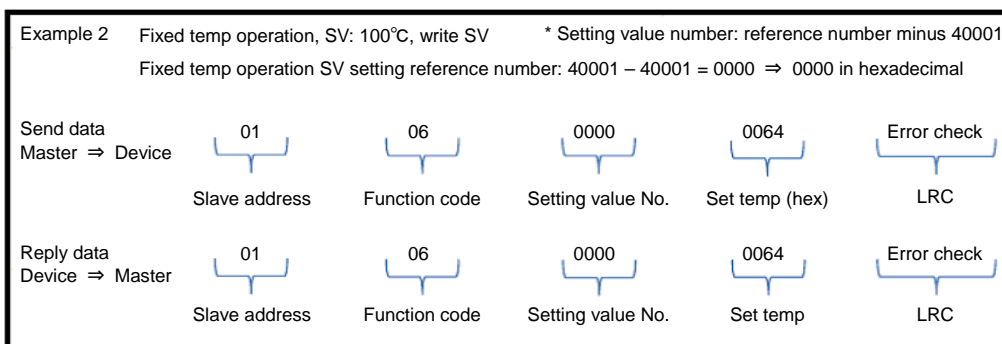
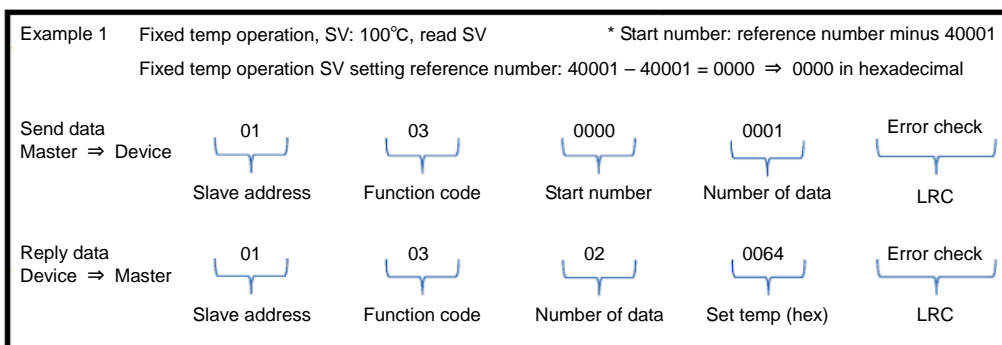
4. COMMUNICATION REFERENCE TABLE

Reference No.	FNC Code	R/W	Data name	Setting range (in-transmission)
32471	04	R	Pattern number	1-99
32472	04	R	Step number	1-99
32473	04	R	End step setting	OFF/ON
32474	04	R	Step temp setting	SLL-SLH
32475	04	R	Step time setting (H)	00-99/INF
32476	04	R	Step time setting (L)	00-59/INF
32477	04	R	Repeat setting: repeat destination	0-98
32478	04	R	Repeat setting: number of times to repeat	0-99/INF
32479	04	R	Wait setting	OFF/ON
32480	04	R	Event output setting: EV1-3	OFF/ON*
32481	04	R	Fan rotation level setting	0-10*
32482	04	R	Auto damper aperture setting	0/25/50/75/100%*
32483	04	R	Refrigerator operation setting	NON/2P/CYC/CNT

5. COMMUNICATION SAMPLE MESSAGE

5.1: ASCII

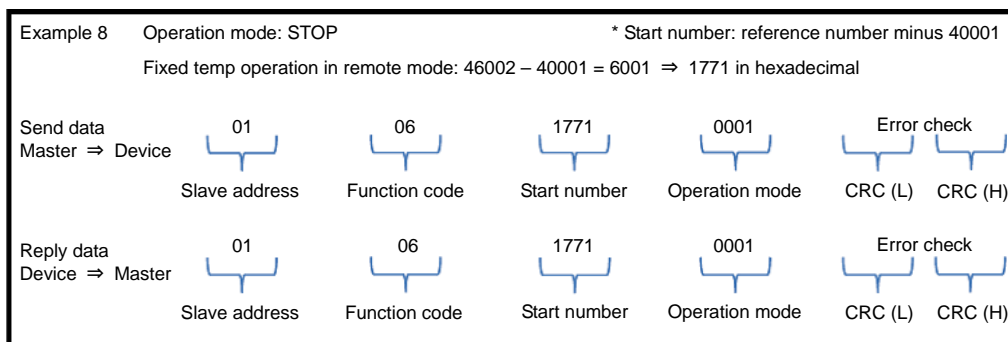
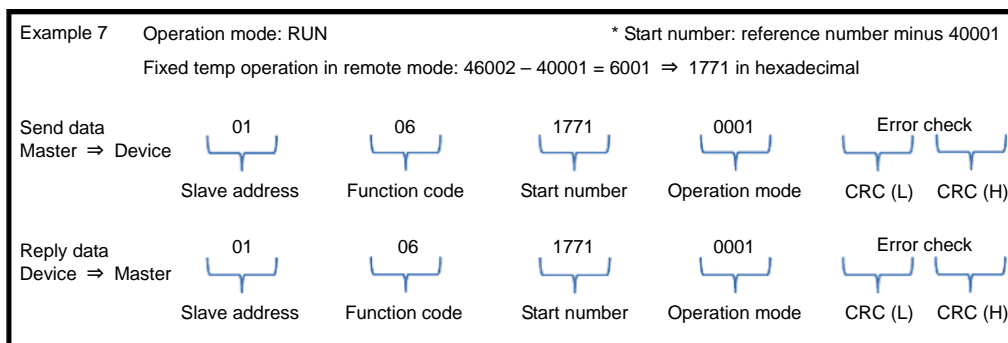
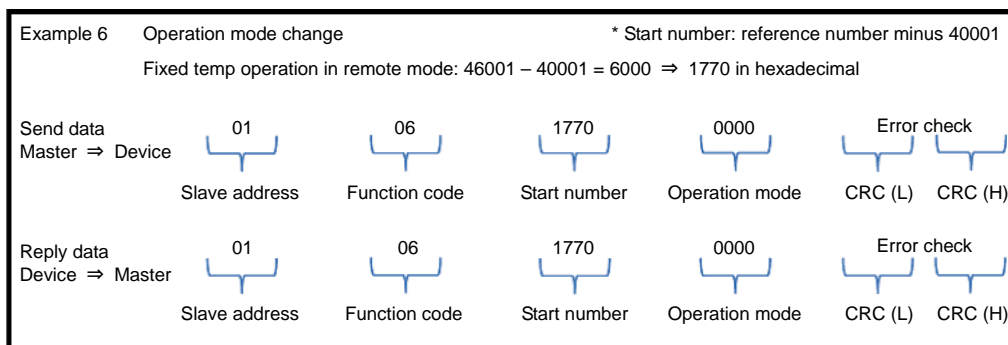
Sample message for ASCII



5. COMMUNICATION SAMPLE MESSAGE

5.2: RTU

Sample message for RTU



Operation mode

0000: Fixed temp operation (remote)
 0001: Fixed temp auto start (remote)
 0002: Fixed temp auto stop (remote)
 0003: Program operation (remote)
 0004: Program auto stop (remote)
 0005: Local

STOP/RUN

0000: STOP
 0001: RUN

6. PRECAUTIONS

- **Consider before resending the command.**

Unit employs two-wire RS-485 communication. Unlike RS-232C, communication is started by a direction from master device without confirming the status of main unit. In some cases, communication processing may become complicated for main unit, leading to communication failure (no response error, or other errors). Therefore, please pay sufficient attention when resending the command.

- **Do not connect/disconnect cables, or turn on/off power during communication.**

Doing so may cause errors and/or operation stop. When this happens, it is necessary to reset all devices and restart from the beginning.

- **Ensure that message is properly sent before sending the next.**

In RS-485, multiple devices are connected to the same communication line, and only one unit of the communication address specified by the master device occupies the communication line. In order to ensure that whole message arrives at the master device, unit waits for approximately 5 msec after the last character has been sent and then releases communication line. If the next communication is started by the master before the line is opened, the signals collide and communication cannot be properly carried out. Please be careful when using a high-speed device as a master

- **To ensure reliable communication, consider the following as far as possible for the communication specifications of the master device.**

Item	Specifications of the master device
Time to next transmission after receiving response from main unit	200 msec or more
Action when main unit did not respond	Retransmission
Time to determine that main unit is not responding	1 sec or more
Number of times of no-response monitoring to judge that the communication is abnormal	10 times (10 sec) or more

- **Note that the number of times of writing to main unit via external communication is limited**

When changing the setting parameter values of main unit, changed parameters are written to the EEPROM. Use caution not to change parameters more than needed.

If the maximum number of times of EEPROM writes (1,000,000 times) is exceeded, the controller will detect an error and will not operate. Be particularly careful when writing to main unit through communication with PLC.

Limited Liability

Always operate equipment in strict compliance to the handling and operation procedures set forth by this instruction manual.

Yamato Scientific Co., Ltd. assumes no responsibility for malfunction, damage, injury or death, resulting from negligent equipment use.

Never attempt to disassemble, repair or perform any procedure which are not expressly mandated by this manual. Doing so may result in equipment malfunction, serious personal injury or death.

Notice

- Instruction manual descriptions and specifications are subject to change without notice.
- Yamato Scientific Co., Ltd. will replace flawed instruction manuals (pages missing, pages out of order, etc.) upon request.