TOHO ELECTRONICS INC.

Operation Manual (Communication Edition)

(MODBUS RTU/ASCII)

Model: TTX-800

Name: 2ch Module-type Controller

4D-6607-C

Thank you very much for purchasing TTX-800.

Kindly read this operation manual for proper usage.

Table of Contents

1. Before Using the Product

1.1 About the Operation Manual

This manual explains the communication function of the TTX-800 (hereinafter referred to as the “Product”).

1.2 Things the Communication Function Can Do

The unit is equipped with RS-485 for data communication with the host computer, which allows users to write and read to items of this product that are described in “6 . List of Identifiers (Codes),” such as “To change, start, or stop items that can be operated through front keys” and “To read the information that can be displayed on the display section.”
Provided, however, that since the RAM of this product is used during the reading/writing of data through ordinary command, data that was written will be replaced by the previous data (data that is saved in EEPROM) if the power is turned OFF and then turned ON.
To save the written data into EEPROM of this product, execute the save request message.
（See “3.3.4” and “3.4.4,” Things to be Noted During Communication)
Furthermore, unnecessary setting items, such as items that are related to the unattached option, will not be read and written.

1.3 Position (Priority) of Communication

This product allows the user to change data and parameters through the key even during operation under communication mode.
Change of settings of data and parameters via communication will be disabled while the product is operated under RO (Read Only).
(Provided, however, that switching of communication mode is possible.)

1.4 Settings to Be Made Prior to Communication

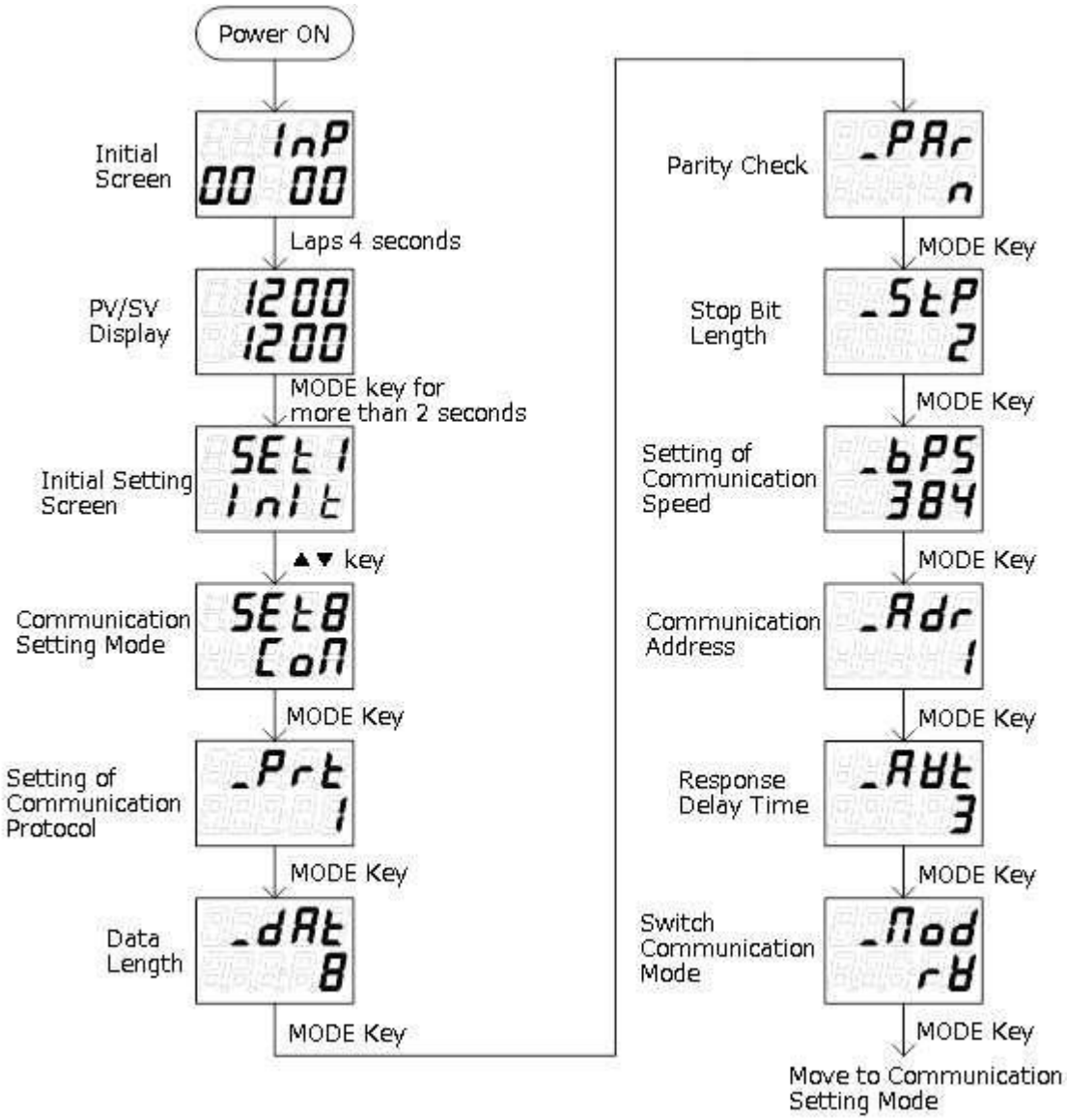
Several settings need to be made to this product for it to perform a communication function. See “2. Setting the MODBUS Communication.”

2. Setting the MODBUS Communication

2.1 Outline

Initial settings need to be made to the product for it to perform a communication function. Setting shall be done by keys at the front side.

Follow the procedure shown below to navigate between setting screens. See the User's Manual of the product for details.



When the setting is done, press the MODE key for more than two seconds to return to operation mode.

Communication setting mode is a setting mode that is common for channels. It can change the communication setting with the following operation regardless of the selection of CH:

Each parameter shown above is the initial value.

2.2 Detailed Settings of the Communication Setting Mode

2.2.1 Setting of the Communication Protocol

_Prt	PV	Please set the communication protocol.
1	SV	Initial Value

Settings

1 : Modbus(RTU)

2 : Modbus(ASCII)

2.2.2 Data Length

_dAt	PV	Please set the data length.
8	SV	Initial Value

Settings

7 : 7 bits

8 : 8 bits

2. 2. 1. This can be set only if the setting of the communication protocol is “2”

2.2.3 Parity Check

_PAr	PV	Please set the parity check.
n	SV	Initial Value

Settings

n : OFF

o : Odd

E : Even

2.2.4 Stop Bit Length

_StP	PV	Please set the stop bit length.
2	SV	Initial Value

Settings

1 : 1 bit

2 : 2 bits

2.2.5 Setting of the Communication Speed

_bPS	PV	Please set the communication speed.
384	SV	Initial Value

Settings

12 : 1200bps
24 : 2400bps
48 : 4800bps
96 : 9600bps
192 : 19200bps
384 : 38400bps

2.2.6 Communication Address

_Adr	PV	Please set the communication address.
1	SV	Initial Value

Settings

Setting Range : 1～247
The communication address of CH2 is “Communication Address + 1”
If it is set to “247,” the address of CH2 is “1.”

2.2.7 Response Delay Time

_AbE	PV	Please set the response delay time.
3	SV	Initial Value

Settings

Setting Range : 0～250 ms

Set the time to take for the upper computer to complete the receiving of the “request message,” open the line, and get ready for the next input.

* Communication may not be performed properly if the response delay time is too short.
* In actual operation, the processing time of the product will be added to the response delay time.

2.2.8 Switching of the Communication Mode

_Mod	PV	Please set the switching of the communication mode.
rW	SV	Initial Value

Settings

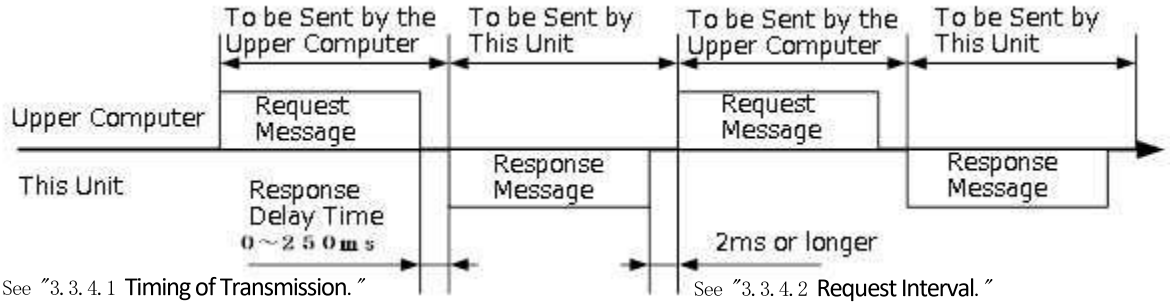
rO : Communication R is available
rW : Communication RW is available

Only this setting will allow R/W of communication even during “RO.”

3. MODBUS Communication Control

3.1 Communication Procedures

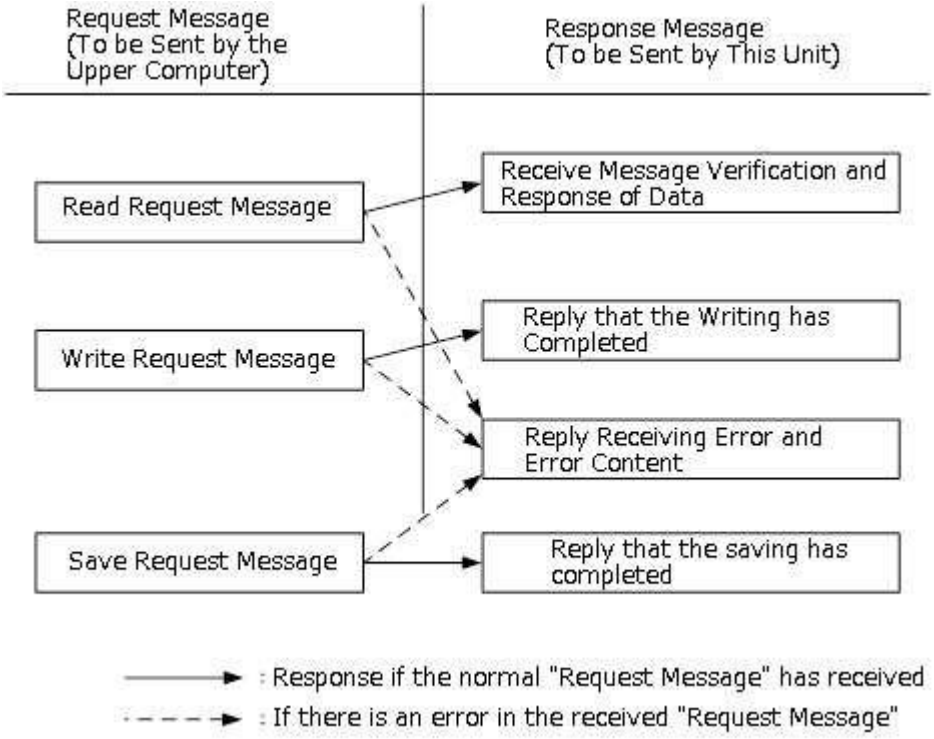
This product returns the “response message” as a reply to the “request message” that will be sent by the upper computer. Therefore, the transmission will never be initiated by this product.



See ″3.3.4.1 Timing of Transmission.″ See ″3.3.4.2 Request Interval.″

3.2 Kinds of Message

■ Kinds of message can be briefly classified into the following:



■ Data is in binary during MODBUS RTU mode.

■ In the case of the MODBUS ASCII mode, all codes will be expressed in ASCII code.

■ To code the program for the upper computer, see “6. List of Identifier (Codes)” and “7. List of ASCII Codes.”

■ This product will not save the data unless the save request message is received.
To keep the data for the next power ON, send the save request message.

3.3 Explanation of MODBUS RTU Communication

3.3.1 Structure of MODBUS RTU Request Message (Data Transmission from the Upper Computer to This Product)

■ See "3.3.3 Explanation of MODBUS RTU Codes" for codes a) to g).

3.3.1.1 Structure of Read Request Message

a)	Slave Address		**01H**	
b)	Function Code		**03H**	
c)	Register Address	Upper	**00H**	First register address
		Lower	**00H**	
d)	Number of Registers	Upper	**00H**	2 (fixed)
		Lower	**02H**	※ Except for communication monitor register address
e)	CRC-16	Lower	**C4H**	
		Upper	**0BH**	

3.3.1.2 Structure of Write Request Message

a)	Slave Address		**01H**	
b)	Function Code		**10H**	
c)	Register Address	Upper	**01H**	First register address
		Lower	**00H**	
d)	Number of Registers	Upper	**00H**	2 (fixed)
		Lower	**02H**	
f)	Number of Bytes		**04H**	Number of Registers x 2
g)	Data for the First Register (Lower Word)	Upper	**00H**	③
		Lower	**00H**	④ Data structure is ①②③④H.
	Data for the First Register (Upper Word)	Upper	**00H**	① (① represents 1 byte)
		Lower	**00H**	②
e)	CRC-16	Lower	**FEH**	
		Upper	**3FH**	

3.3.1.3 Structure of Save Request Message

a)	Slave Address		**01H**	
b)	Function Code		**10H**	
c)	Register Address	Upper	**09H**	First register address
		Lower	**0CH**	
d)	Number of Registers	Upper	**00H**	2 (fixed)
		Lower	**02H**	
f)	Number of Bytes		**04H**	Number of Registers x 2
g)	Data for the First Register (Lower Word)	Upper	**00H**	Data for saving the setting is optional.
		Lower	**00H**	
	Data for the First Register (Upper Word)	Upper	**00H**	
		Lower	**00H**	
e)	CRC-16	Lower	**E8H**	
		Upper	**E2H**	

3.3.2 Structure of the MODBUS RTU Response Message (Data Transmission from This Product to Upper Computer)

■ See "3.3.3 Explanation of MODBUS RTU Codes" for codes a) to h).

3.3.2.1 Response Message for Read Request Message

a)	Slave Address		**01H**	
b)	Function Code		**03H**	
f)	Number of Bytes		**04H**	Number of Registers x 2
g)	Data for the First Register (Lower Word)	Upper	**0AH**	③
		Lower	**A1H**	④ Data structure is ①②③④H.
	Data for the First Register (Upper Word)	Upper	**00H**	① (① represents 1 byte)
		Lower	**00H**	②
e)	CRC-16	Lower	**A8H**	
		Upper	**09H**	

3.3.2.2 Response Message for Write/Save Request Message

a)	Slave Address		**01H**	
b)	Function Code		**10H**	
c)	Register Address	Upper	**01H**	First register address
		Lower	**00H**	
d)	Number of Registers	Upper	**00H**	2 (fixed)
		Lower	**02H**	
e)	CRC-16	Lower	**40H**	
		Upper	**34H**	

3.3.2.3 Response Message for the Error

a)	Slave Address		**01H**	
b)	Function Code		**83H**	← In case of error, the value that consists of the function code of request message +80H will be set.
h)	Error Number		**03H**	
e)	CRC-16	Lower	**01H**	
		Upper	**31H**	

3.3.3 Explanation of MODBUS RTU Codes

■ The following codes from a) Slave Address, b) Function Code up to h) Error Code will be expressed in 8-bit binary:

a) Slave Address

This is the address of the device that will be communicated by the upper computer (this product).

The address in the response message from this product indicates the source of the response message.

b) Function Code

Enter the code 03H or 10H.

- 03H: If the data is to be read from this product
- 10H: If the data is to be written or saved into this product

c) Register Address

Specifies the position of data to be read or written with two bytes.

See "6. List of Identifiers (Codes)" for the address of each command.

d) Number of Registers

Specifies the number of registers that write.

Since the number of registers of this product is fixed to 2, set it to "0002H."

e) CRC-16

This is an error checking code for the detection of a possible error in the message. It sends CRC-16 (Cyclic Redundancy Code).

The generating polynomial of CRC-16 that is used in this product is $X^{16} + X^{15} + X^2 + 1$.

The lower byte before the upper byte is to be attached at the end of the message.

f) Number of Bytes

Specifies the number of registers that read and write x 2.

Since the number of registers of this product is 2 (fixed), set "04H."

g) Data Section

Specifies the data to be written into the register. Data is four bytes (fixed).

If the data contains a decimal point, set the numeric value that ignores the decimal point.

Data that is enclosed in parentheses is the value that will be used in the actual message to be sent. See "3.3.1 Structure of the MODBUS RTU Request Message (Data Transmission from Upper Computer to This Product)" for details.

■ In case of numerical data

Contents of Communication	HEX Data
PV = 1200.0 (°C)	**00002EE0h (2EE00000)**
SV = -10.00(°C)	**FFFFFC18h (FC18FFFF)**

■ ASCII code will be written in case of character data (□ means space).

Contents of Communication	HEX Data
Priority Screen 0-1 = □INP	**20494E50h (4E502049)**
Priority Screen 0-2 = □□P1	**20205031h (50312020)**

h) Error Number

If there is an error in the message that was sent by the upper computer, the error number will be included in the "response message" of this product for the reply.

Contents and classification of errors are the following:

Error Number	Description of errors in the "Request Message" that was received by this product
01	Received an unsupported function code
02	Received an unspecified address
03	Numerical value data is out of the "setting range that is specified individually by the setting item"

3.3.4 Things to Be Noted During MODBUS RTU Communication

3.3.4.1 Timing of Transmission

Upon using RS-485, set enough response delay time to ensure communication (sending/receiving) with the upper computer.

See the figure “3.1 Communication Procedures.”

3.3.4.2 Request Interval

If “request message” is to be sent continuously by the upper computer, wait for at least 2 msecs. from the arrival of the “response message” from this product before sending the next request message.

3.3.4.3 Conditions for Response

This product will not return the “response message” if there is a time interval of more than 3.5 characters between data that comprise the “request message” since it cannot identify these data as one whole “request message.”

Therefore, although there is an error in the “request message,” a “response message” with the error number (response for the error) will not be returned unless the above condition is met.

Therefore, the upper computer should resend the necessary “request message” if the “response message” is not returned within the reasonable time.

At a time interval of more than 3.5 characters, this product clears all characters that were received prior to the said interval.

3.3.4.4 Address Specification Error

This product will not respond to any “request message” that specifies an address other than the one that has been set to itself.

Therefore, if there is an error in the address section of the “request message,” none of the slave stations will return the “response message.”

Therefore, the upper computer should resend the necessary “request message” if the “response message” is not returned within the reasonable time.

At a time interval of more than 3.5 characters, this product clears all characters that were received prior to the said interval.

3.3.4.5 Number of Digits of Data and Position of Decimal Point

See “3.3.3 Explanation of MODBUS RTU Codes g) Data Section.”

3.3.4.6 Operation After Receiving the Save Request Message

This product starts saving data once it receives the save request message correctly from the upper computer.

Data will be saved within six seconds.

The product sends a response when the saving of data is completed.

Some data may be lost if the product is turned OFF while the saving process is in progress.

Do not turn the power of this product OFF for at least six seconds after the sending of the save request message.

3.3.4.7 Upon Turning the Power ON

This product will not perform any communication while performing an initial process after turning its power ON (no response).

Set the adequate time of delay from power ON to the start of communication.

3.3.4.8 Saving the Data Other Than Save Request Message

This product saves the parameter into the memory element even without receiving the save request message in case of the following:

① When the parameter has changed by the key operation and when the limiter of other parameters has become active because of the changed parameter

② When auto tuning/self-tuning has ended successfully

3.4 Explanation of MODBUS ASCII Communication

3.4.1 Structure of MODBUS ASCII Request Message (Data Transmission from the Upper Computer to This Product)

■ See "3.4.3Explanation of MODBUS ASCII Codes" for codes a) to j).

3.4.1.1 Structure of Read Request Message

a)	Start Code		**':'**	
b)	Slave Address		**'0','1'**	
c)	Function Code		**'0','3'**	
d)	Register Address	Upper	**'0','0'**	First register address
		Lower	**'0','0'**	
e)	Number of Registers	Upper	**'0','0'**	2 (fixed)
		Lower	**'0','2'**	※ Except for communication monitor register address
f)	LRC		**'F','A'**	
g)	End Code		**CR,LF**	

3.4.1.2 Structure of Write Request Message

a)	Start Code		**':'**	
b)	Slave Address		**'0','1'**	
c)	Function Code		**'1','0'**	
d)	Register Address	Upper	**'0','1'**	First register address
		Lower	**'0','0'**	
e)	Number of Registers	Upper	**'0','0'**	2 (fixed)
		Lower	**'0','2'**	
h)	Number of Bytes		**'0','4'**	Number of Registers x 2
i)	Data for the First Register (Lower Word)	Upper	**'0','0'**	③
		Lower	**'0','0'**	④ Data structure is ①②③④H.
	Data for the First Register (Upper Word)	Upper	**'0','0'**	① (① represents 1 byte)
		Lower	**'0','0'**	②
f)	LRC		**'E','8'**	
g)	End Code		**CR,LF**	

3.4.1.3 Structure of Save Request Message

a)	Start Code		**':'**	
b)	Slave Address		**'0','1'**	
c)	Function Code		**'1','0'**	
d)	Register Address	Upper	**'0','9'**	First register address
		Lower	**'0','C'**	
e)	Number of Registers	Upper	**'0','0'**	2 (fixed)
		Lower	**'0','2'**	
h)	Number of Bytes		**'0','4'**	Number of Registers x 2
i)	Data for the First Register (Lower Word)	Upper	**'0','0'**	Data for saving the setting is optional.
		Lower	**'0','0'**	
	Data for the First Register (Upper Word)	Upper	**'0','0'**	
		Lower	**'0','0'**	
f)	LRC		**'B','B'**	
g)	End Code		**CR,LF**	

3.4.2 Structure of MODBUS ASCII Response Message (Data Transmission from This Product to the Upper Computer)

■ See “3.4.3Explanation of MODBUS ASCII Codes” for codes a) to j).

3.4.2.1 Response Message for Read Request Message

a)	Start Code		**‘:’**	
b)	Slave Address		**‘0’,’1’**	
c)	Function Code		**‘0’,’3’**	
h)	Number of Bytes		**‘0’,’4’**	Number of Registers x 2
i)	Data for the First Register (Lower Word)	Upper	**‘0’,’0’**	③
		Lower	**‘0’,’0’**	④ Data structure is ①②③④H.
	Data for the First Register (Upper Word)	Upper	**‘0’,’0’**	① (① represents 1 byte)
		Lower	**‘0’,’0’**	②
f)	LRC		**‘F’,’8’**	
g)	End Code		**CR,LF**	

3.4.2.2 Response Message for Write/Save Request Message

a)	Start Code		**‘:’**	
b)	Slave Address		**‘0’,’1’**	
c)	Function Code		**‘1’,’0’**	
d)	Register Address	Upper	**‘0’,’1’**	First register address
		Lower	**‘0’,’0’**	
e)	Number of Registers	Upper	**‘0’,’0’**	2 (fixed)
		Lower	**‘0’,’2’**	
f)	LRC		**‘E’,’C’**	
g)	End Code		**CR,LF**	

3.4.2.3 Response message for the error

a)	Start Code	**‘:’**	
b)	Slave Address	**‘0’,’1’**	
c)	Function Code	**‘8’,’3’**	← In case of error, the value that consists of the function code of request message +80H will be set.
j)	Error Number	**‘0’,’3’**	
f)	LRC	**‘7’,’9’**	
g)	End Code	**CR,LF**	

3.4.3 Explanation of MODBUS ASCII Codes

■ The following codes from a) Start Code, b) Slave Address up to j) Error Number will be expressed in ASCII code:

■ See "7. List of ASCII Codes" for details about ASCII codes.

■ See "3.4.1 Structure of MODBUS ASCII Request Message (Data Transmission from the Upper Computer to This Product)" for the conversion to ASCII codes.

a) Start Code

This is a code that is necessary for the receiving side to detect the start of the message. It shall be attached to the start of the character string to be sent.

b) Slave Address

This is the address of the device that will be communicated by the upper computer (this product).
The address in the response message from this product indicates the source of the response message.

c) Function Code

Enter the code 03H or 10H.

- 03H: If the data is to be read from this product
- 10H: If the data is to be written or saved into this product

d) Register Address

Specifies the position of data to be read or written with two bytes.
See "6. List of Identifiers (Codes)" for the address of each command.

e) Number of Registers

Specifies the number of registers that write.
Since the number of registers of this product is fixed to 2, set it to "0002H."

f) LRC

This is an error checking code for the detection of possible errors in the message. It sends LRC.
LRC that is used in this product is a value where all data in the message, except for start code and end code, are summed up without performing a carryover and treat the sum total as a complement of 2.
Any portion that is expressed as "1" and "B" shall be considered as "1BH."
If 12H was computed as an error number, attach "1" and "2" at the end of the message.

g) End Code

This is a code that is necessary for the receiving side to detect the end of the message.
CR(0DH) and LF(0AH) shall be attached at the end of the character string to be sent.

h) Number of Bytes

Specifies the number of registers that read and write x 2.
Since the number of registers of this product is 2 (fixed), set "04H."

i) Data Section

Specifies the data to be written into the register. Data is four bytes (fixed).

If the data contains a decimal point, set the numeric value that ignores the decimal point.

Data that is enclosed in parentheses is the value that will be used in the actual message to be sent. See "3.4.1 Structure of MODBUS ASCII Request Message (Data Transmission from the Upper Computer to This Product)" for details.

■ In Case of Numerical Data

Contents of Communication	HEX Data
PV = 1200.0 (℃)	**00002EE0h (2EE00000)**
SV = -10.00(℃)	**FFFFFC18h (FC18FFFF)**

■ ASCII code will be written in case of the character data (□ means space).

Contents of Communication	HEX Data
Priority Screen 0-1 = □INP	**20494E50h (4E502049)**
Priority Screen 0-2 = □□P1	**20205031h (50312020)**

j) Error Number

If there is an error in the message that was sent by the upper computer, the error number will be included in the "response message" of this product for the reply.

For multiple errors, the largest error number will be included.

Contents and classification of error are the following:

Error Number	Description of errors in the "Request Message" that was received by this product
01	Received an unsupported function code
02	Received an unspecified address
03	Numerical value data is out of the "setting range that is specified individually by the setting item"

3.4.4 Things to Be Noted During MODBUS ASCII Communication

3.4.4.1 Timing of Transmission

Upon using RS-485, set enough response delay time to ensure communication (sending/receiving) with the host computer.

See the figure “3.1 Communication Procedures.”

3.4.4.2 Request Interval

If the “request message” is to be sent continuously by the upper computer, wait for at least 2 msecs. from the arrival of the “response message” from this product before sending the next request message.

3.4.4.3 Conditions for Response

This product will not return the “response message” if the start code and end code are not included in the “request message.”

Therefore, although there is an error in the “request message,” the “response message” with the error number (response for the error) will not be returned unless the above condition is met.

Therefore, the upper computer should resend the necessary “request message” if the “response message” is not returned within the reasonable time.

Once the start code is received, this product clears all codes that were received prior to the said start code.

3.4.4.4 Address Specification Error

This product will not respond to any “request message” that specifies an address other than the one that has been set to itself.

Therefore, if there is an error in the address section of the “request message,” none of the slave stations will return the “response message.”

Therefore, the upper computer should resend the necessary “request message” if the “response message” is not returned within the reasonable time.

Once the start code is received, this product clears all codes that were received prior to the said start code.

3.4.4.5 Number of Digits of Data and Position of the Decimal Point

See “3.4.3 Explanation of MODBUS ASCII Codes i) Data Section.”

3.4.4.6 Operation After Receiving the Save Request Message

This product starts saving data once it receives the save request message correctly from the upper computer.

Only data that is different from the one stored in EEPROM (changed data) shall be saved.

Data will be saved within six seconds.

The product sends a response when the saving of data is completed.

Some data may be lost if the product is turned OFF while the saving process is in progress.

Do not turn the power of this product OFF for at least six seconds after sending the save request message.

3.4.4.7 Upon Turning the Power ON

This product will not perform any communication while performing an initial process after turning its power ON (no response).

Set the adequate time of delay from power ON to the start of communication.

3.4.4.8 Saving Data Other than Save Request Message

This product saves the parameter into memory element even without receiving the save request message in case of the following:

① When the parameter is changed by the key operation and when the limiter of other parameters become active because of the changed parameter

② When auto tuning/self-tuning has ended successfully

4. Specifications

4.1 Type of Communication Standard : EIA Standard based on RS-485

4.2 Communication Specifications

4.2.1 Communication Method

: Network·····Multidrop System (Maximum of 1 to 31 stations)

: Direction of Information·····Half-Duplex

: Synchronization System·····Start-Stop Synchronization

: Transmission Code·····ASCII 7-bit code except for BCC data

(For 8-bit code, top bit = 0)

4.2.2 Interface System

: Signal Wire·····Two wires for sending and receiving

: Communication Speed····· Select and set 1200, 2400, 4800, 9600, 19200, and 38400BPS.

: Communication Distance·····Up to 500m

Provided, however, that the distance may vary depending on the surrounding environment, such as cables.

4.2.3 Character

1) MODBUS (RTU) Communication Protocol

: Start Bit Length·····1 bit fixed

: Stop Bit Length: Select and set from 1 bit and 2 bits

: Data Length·····8 bits fixed

: Parity·····Select and set from none, odd, and even

: CRC-16 Check···ON fixed

: Communication Address·····1—247

2) MODBUS (ASCII) Communication Protocol

: Start Bit Length·····1 bit fixed

: Stop Bit Length: Select and set from 1 bit and 2 bits

: Data Length: Select and set from 7 bits and 8 bits

: Parity·····Select and set from none, odd, and even

: LRC Check····· ON fixed

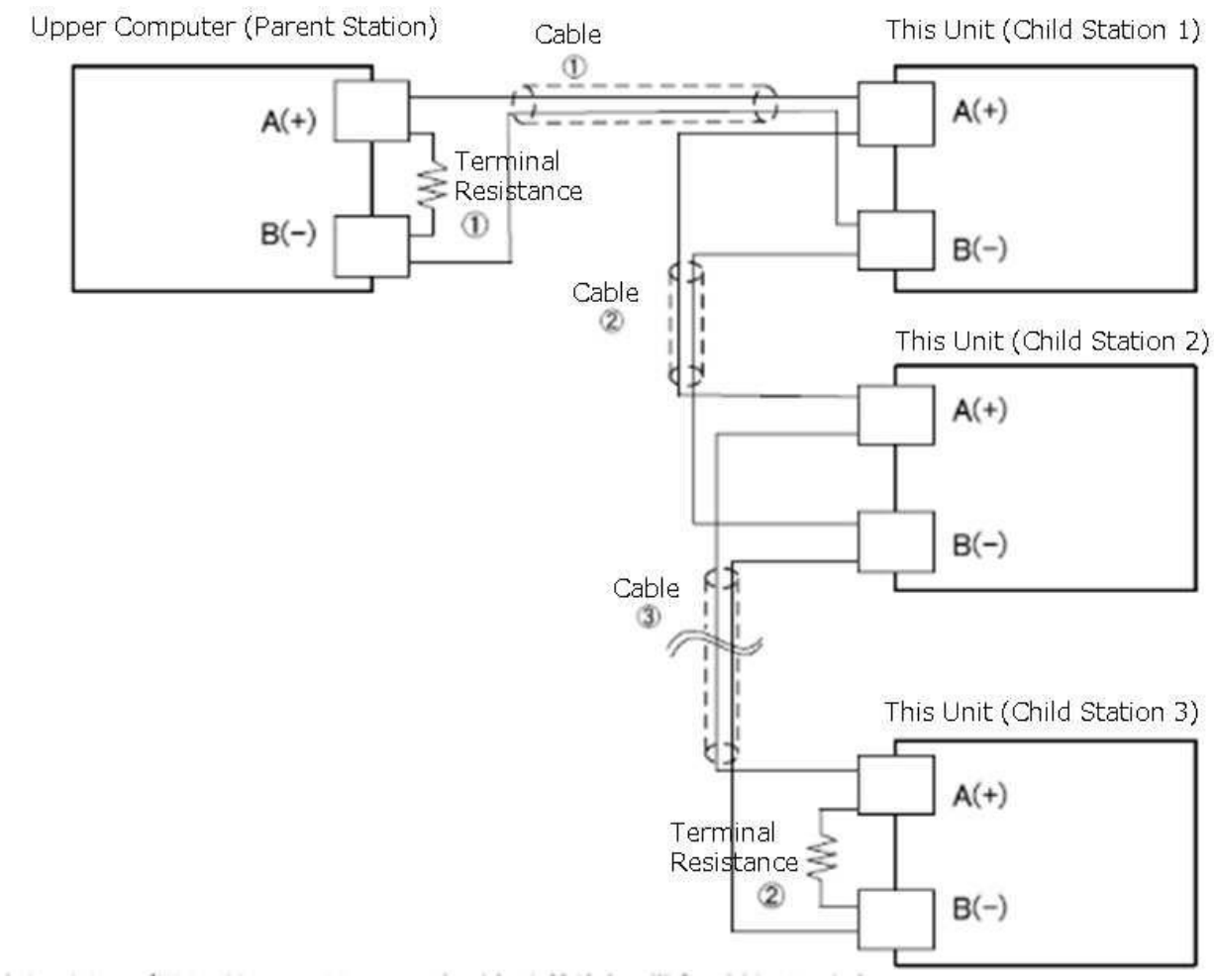
: Communication Address·····1—247

3) MODBUS (RTU/ASCII) Communication Function Code

: 03H (Read the content of the holding register)

:10H (Write the content of multiple holding registers)

5. Wiring



○ The figure below shows a case where secondary stations 1—3 (3 stations) will be connected to the primary station.

◇ For cables ①—③, use the cable with the same characteristic impedance.

- Connect secondary stations 1—3 as slave as shown in the figure.
  Use the cable with the same characteristic impedance for the connection between secondary stations as well.

◇ Attach the terminator to both the primary station ① and the farthest secondary station ② (secondary station 3).

◇ Choose the terminator of which [Characteristic impedance of cables ①—③] ＝ [Resistance of ①] ＝ [Resistance of ②].

- Also, use a cable with characteristic impedance where [Resistance of ①]//[Resistance of ②] (parallel combined resistance) is 75Ω or higher.
- Use the twisted pair wire with a shield for the cable.

6. List of Identifiers (Codes)

■ See the User's Manual of this product for setting range, selection items, initial value, and other related information.

6.1.1 Initial Setting Mode

Modbus		Name	Command	Remark
Absolute (DEC)	Relative (HEX)			
40257	0100	Setting of the Input Type	RW	
40259	0102	Setting of the Decimal Point	RW	
40261	0104	Setting of the Maximum Limit of Scaling	RW	
40263	0106	Setting of the Minimum Limit of Scaling	RW	
40265	0108	Setting of the PV Correction Function	RW	
40267	010A	Setting of the Gain of the PV Correction	RW	
40269	010C	Setting of the Zero Point of the PV Correction	RW	
40271	010E	Setting of the Minimum Limit Before PV Correction	RW	
40273	0110	Setting of the Maximum Limit Before PV Correction	RW	
40275	0112	Setting of the Minimum Limit After PV Correction	RW	
40277	0114	Setting of the Maximum Limit After PV Correction	RW	
40279	0116	Setting of 0 Before PV Multipoint Correction	RW	
40281	0118	Setting of 1 Before PV Multipoint Correction	RW	
40283	011A	Setting of 2 Before PV Multipoint Correction	RW	
40285	011C	Setting of 3 Before PV Multipoint Correction	RW	
40287	011E	Setting of 4 Before PV Multipoint Correction	RW	
40289	0120	Setting of 5 Before PV Multipoint Correction	RW	
40291	0122	Setting of 6 Before PV Multipoint Correction	RW	
40293	0124	Setting of 7 Before PV Multipoint Correction	RW	
40295	0126	Setting of 8 Before PV Multipoint Correction	RW	
40297	0128	Setting of 9 Before PV Multipoint Correction	RW	
40299	012A	Setting of 10 Before PV Multipoint Correction	RW	
40301	012C	Setting of 0 After PV Multipoint Correction	RW	
40303	012E	Setting of 1 After PV Multipoint Correction	RW	
40305	0130	Setting of 2 After PV Multipoint Correction	RW	
40307	0132	Setting of 3 After PV Multipoint Correction	RW	
40309	0134	Setting of 4 After PV Multipoint Correction	RW	
40311	0136	Setting of 5 After PV Multipoint Correction	RW	
40313	0138	Setting of 6 After PV Multipoint Correction	RW	
40315	013A	Setting of 7 After PV Multipoint Correction	RW	
40317	013C	Setting of 8 After PV Multipoint Correction	RW	
40319	013E	Setting of 9 After PV Multipoint Correction	RW	
40321	0140	Setting of 10 After PV Multipoint Correction	RW	
40323	0142	Setting of the Input Filter	RW	
40325	0144	Setting of PV Difference/Addition	RW	
40327	0146	Setting of the Maximum Limit of Difference/Addition Display	RW	
40329	0148	Setting of the Minimum Limit of Difference/Addition Display	RW	
40331	014A	Setting of the PV Abnormality Display	RW	
40333	014C	Setting of the PV Abnormality Addition Function	RW	
40335	014E	Setting of the FUNC Key Function	RW	
40337	0150	Setting of the Key Lock	RW	

6.1.2 Control Setting Mode

modbus		Name	Command	Remark
Absolute (DEC)	Relative (HEX)			
40513	0200	Control Setting (SV)	RW	
40515	0202	Control Mode	RW	
40517	0204	Setting of the Control Type	RW	
40519	0206	Setting of the Minimum Limit of SV Limiter	RW	
40521	0208	Setting of the Minimum Limit of SV Limiter	RW	
40523	020A	Maximum Limit of Cascade Scaling	RW	
40525	020C	Minimum Limit of Cascade Scaling	RW	
40527	020E	SV for the Cascade AT	RW	
40529	0210	SV for the Remote AT	RW	
40531	0212	PID Type	RW	
40533	0214	Switching of Direct Action/Reverse Action	RW	
40535	0216	Setting of the Maximum Limit of MV Limiter	RW	
40537	0218	Setting of the Minimum Limit of MV Limiter	RW	
40539	021A	Manipulated Variable of Output 1	RW	
40541	021C	AT Coefficient	RW	
40543	021E	AT Sensitivity	RW	
40545	0220	Setting of the Tuning Type	RW	See “Other Settings Mode” for the start of AT
40547	0222	Setting of the Proportional Band	RW	
40549	0224	Setting of the Integral Time	RW	
40551	0226	Setting of the Derivative Time	RW	
40553	0228	Setting of the Proportional Cycle	RW	
40555	022A	Antireset Windup	RW	
40557	022C	Setting of the Control Sensitivity	RW	
40559	022E	Setting of the OFF Point	RW	
40561	0230	Setting of the Maximum Limit of Manipulated Variable (MV) Limiter of Subcontrol	RW	
40563	0232	Setting of the Minimum Limit of Manipulated Variable (MV) Limiter of Subcontrol	RW	
40565	0234	Manipulated Variable of Subcontrol	RW	
40567	0236	Setting of the Proportional Band of Subcontrol	RW	
40569	0238	Setting of the Proportional Cycle of Subcontrol	RW	
40571	023A	Setting of the Sensitivity of Subcontrol	RW	
40573	023C	Setting of the OFF Point of Subcontrol	RW	
40575	023E	Manual Reset	RW	
40577	0240	Setting of the Dead Band	RW	
40579	0242	Setting of the Loop Abnormality PV Threshold of the Main Control	RW	
40581	0244	Setting of the Loop Abnormality Controlled Variable Threshold of the Main Control	RW	
40583	0246	Setting of the Loop Abnormality PV Variation of the Main Control	RW	
40585	0248	Setting of the Loop Abnormal Time of the Main Control	RW	
40587	024A	Setting of the Loop Abnormality PV Threshold of the Subcontrol	RW	
40589	024C	Setting of the Loop Abnormality Controlled Variable Threshold of the Subcontrol	RW	

40591	024E	Setting of the Loop Abnormality PV Variation of the Subcontrol	RW	
40593	0250	Setting of the Loop Abnormal Time of the Subcontrol	RW	
40595	0252	Setting of the Loop Abnormality Display	RW	
40597	0254	Setting of the Valve Motor Stroke Time	RW	
40599	0256	Setting of the Valve Motor Dead Band	RW	
40601	0258	Initial Open Angle After the End of AT	RW	

6.1.3 OUT1 Setting Mode

modbus		Name	Command	Remark
Absolute (DEC)	Relative (HEX)			
40769	0300	Setting of the Access Point	RW	
40771	0302	Event 1 Function Setting	RW	
40773	0304	Event 1 Additional Function	RW	
40775	0306	Event 1 Judgment Timing	RW	
40777	0308	Setting of the Maximum Limit of Event 1	RW	
40779	030A	Setting of the Minimum Limit of Event 1	RW	
40781	030C	Setting of the Sensitivity of Event 1	RW	
40783	030E	Setting of the Delay Timer of Event 1	RW	
40785	0310	Setting of Event 1 Output	RW	
40787	0312	Setting of Event 2 (PV Abnormality) Output	RW	
40789	0314	Setting of Event 3 (AT Abnormality) Output	RW	
40791	0316	Setting of Event 4 (Loop Abnormality) Output	RW	
40793	0318	Setting of Event 5 (Timer Output) Output	RW	
40795	031A	Setting of Event 6 (Interlock) Output	RW	
40797	031C	Setting of Event Display	RW	
40799	031E	Setting of Event Polarity	RW	
40801	0320	Setting of the Transmission Output Function	RW	
40803	0322	Setting of the Transmission Output Polarity	RW	
40805	0324	Setting of the Transmission Scaling Maximum Limit	RW	
40807	0326	Setting of the Transmission Scaling Minimum Limit	RW	
40809	0328	Switching of the Ratio Conversion	RW	
40811	032A	Setting of the Pitch of Ratio Conversion	RW	
40813	032C	Setting of the Ratio of Ratio Conversion	RW	
40815	032E	Setting of the Bias of Ratio Conversion	RW	

6.1.4 OUT2 Setting Mode

modbus		Name	Command	Remark
Absolute (DEC)	Relative (HEX)			
41025	0400	Setting of the Access Point	RW	
41027	0402	Event 1 Function Setting	RW	
41029	0404	Event 1 Additional Function	RW	
41031	0406	Event 1 Judgment Timing	RW	
41033	0408	Setting of the Maximum Limit of Event 1	RW	
41035	040A	Setting of the Minimum Limit of Event 1	RW	
41037	040C	Setting of the Sensitivity of Event 1	RW	
41039	040E	Setting of the Delay Timer of Event 1	RW	
41041	0410	Setting of Event 1 Output	RW	
41043	0412	Setting of Event 2 (PV Abnormality) Output	RW	
41045	0414	Setting of Event 3 (AT Abnormality) Output	RW	
41047	0416	Setting of Event 4 (Loop Abnormality) Output	RW	
41049	0418	Setting of Event 5 (Timer Output) Output	RW	
41051	041A	Setting of Event 6 (Interlock) Output	RW	
41053	041C	Setting of Event Display	RW	
41055	041E	Setting of Event Polarity	RW	

6.1.5 OUT3 Setting Mode

modbus		Name	Command	Remark
Absolute (DEC)	Relative (HEX)			
41281	0500	Setting of the Access Point	RW	
41283	0502	Event 1 Function Setting	RW	
41285	0504	Event 1 Additional Function	RW	
41287	0506	Event 1 Judgment Timing	RW	
41289	0508	Setting of the Maximum Limit of Event 1	RW	
41291	050A	Setting of the Minimum Limit of Event 1	RW	
41293	050C	Setting of the Sensitivity of Event 1	RW	
41295	050E	Setting of the Delay Timer of Event 1	RW	
41297	0510	Setting of Event 1 Output	RW	
41299	0512	Setting of Event 2 (PV Abnormality) Output	RW	
41301	0514	Setting of Event 3 (AT Abnormality) Output	RW	
41303	0516	Setting of Event 4 (Loop Abnormality) Output	RW	
41305	0518	Setting of Event 5 (Timer Output) Output	RW	
41307	051A	Setting of Event 6 (Interlock) Output	RW	
41309	051C	Setting of Event Display	RW	
41311	051E	Setting of Event Polarity	RW	

6.1.6 Timer Setting Mode

modbus		Name	Command	Remark
Absolute (DEC)	Relative (HEX)			
41537	0600	Setting of the Timer Output Destination	RW	
41539	0602	Setting of the Timer Function	RW	
41541	0604	Switching of the Timer Unit	RW	
41543	0606	Setting of the Timer SV Start Permission Range	RW	
41545	0608	Setting of the Timer	RW	
41547	060A	Monitoring of the Remaining Time of Timer	R	

6.1.7 DI Setting Mode

modbus		Name	Command	Remark
Absolute (DEC)	Relative (HEX)			
41793	0700	DI Function Allocation	RW	
41795	0702	Interlock Occurrence Delay Timer	RW	
41799	0706	Setting of the Interlock Display	RW	
41801	0708	Interlock Additional Function	RW	
41803	070A	DI Polarity	RW	
41805	070C	Control Setting 2	RW	

6.1.8 Communication Setting Mode

modbus		Name	Command	Remark
Absolute (DEC)	Relative (HEX)			
42049	0800	Setting of Communication Protocol	RW	
42051	0802	Data Length	RW	
42053	0804	Parity Check	RW	
42055	0806	Stop Bit Length	RW	
42057	0808	Setting of Communication Speed	RW	
42059	080A	Communication Address	RW	
42061	080C	Response Delay Time	RW	
42063	080E	Switching of Communication Mode	RW	W of communication is possible even during the switching of communication mode [RO]

6.1.9 Other Settings Mode

modbus		Name	Command	Remark
Absolute (DEC)	Relative (HEX)			
42305	0900	Reset Alarm	W	
42307	0902	Switching of the Unit of Nonoperation Backlight Shutoff Time.	RW	
42309	0904	Nonoperation Backlight Shutoff Time	RW	
42311	0906	Backup Setting Values	W	
42313	0908	Setting of the Device Type	RW	
42315	090A	Initialization of Setting Values	W	
42317	090C	AT Start/Stop	RW	0: AT Stop/1: AT Start
42319	090E	Timer Start/Stop	RW	0: Stop/1: Start
42321	0910	Setting Value Save Request	RW	

6.1.10 Communication Monitor Register

- The communication monitor register is capable of continuous reading.
- Specify the number of registers you wish to read continuously to the "Number of Registers" of the read request message. Upon such, make sure that the specified value is within the register address shown on the table below.

modbus		Name	Command	Remark
Absolute (DEC)	Relative (HEX)			
40001	0000	Measuring Value	R	Over Scale: 0x7FFF Under Scale: 0x8000
40003	0002	Manipulated SV	R	
40005	0004	Manipulated Variable of Main Control	R	
40007	0006	Manipulated Variable of Subcontrol	R	
40009	0008	Operation State	R	0:READY 1:RUN 2:MANUAL
40011	000A	DO Monitor	R	Returns the state of DO with the bit information. OFF:0 ON:1 0000 0000 0000 0000 |||| |||| |||| |||+─ OUT1※ |||| |||| |||| ||+── OUT2 |||| |||| |||| |+─── OUT3 ++++ ++++ ++++ +──── Fixed to 0 ※OUT1 Fixed to 0 if the model is AO
40013	000C	AO Monitor	R	OUT1 DO Model…Fixed to 0.0% OUT1 AO Model…-10.0～110.0%
40015	000E	DI Model	R	Returns the state of DI Nonactive: 0 Active: 1
40017	0010	Information	R	Returns the state with the bit information. Normal State: 0 Condition has Occurred:1 0000 0000 0000 0000 |||| |||| |||| |||+─Err0 has occurred |||| |||| |||| ||+──Err1 has occurred |||| |||| |||| |+───Err2 has occurred |||| |||| |||| +──── Loop abnormality has occurred |||| |||| |||+─────Sensor abnormality has occurred |||| |||| ||+────── OUT1 EV1 has occurred |||| |||| |+──────OUT2 EV1 has occurred |||| |||| +──────OUT3 EV1 has occurred |||| |||+──────── Interlocked |||| ||+──────── Auto tuning ++++──────── Fixed to 0
40019	0012	Monitoring of the Remaining Time of the Timer	R	00:00…0x0000 99:59…0x26E7

7. List of ASCII Codes

Upper / Lower	00h	10h	20h	30h	40h	50h	60h	70h
00h	**NUL**	**DLE**	**Space**	**0**	**@**	**P**	**`**	**p**
01h	**SOH**	**DC1**	**!**	**1**	**A**	**Q**	**a**	**q**
02h	**STX**	**DC2**	**“**	**2**	**B**	**R**	**b**	**r**
03h	**ETX**	**DC3**	**#**	**3**	**C**	**S**	**c**	**s**
04h	**EOT**	**DC4**	**$**	**4**	**D**	**T**	**d**	**t**
05h	**ENQ**	**NAK**	**%**	**5**	**E**	**U**	**e**	**u**
06h	**ACK**	**SYN**	**&**	**6**	**F**	**V**	**f**	**v**
07h	**BEL**	**ETB**	**‘**	**7**	**G**	**W**	**g**	**w**
08h	**BS**	**CAN**	**(**	**8**	**H**	**X**	**h**	**x**
09h	**HT**	**EM**	**)**	**9**	**I**	**Y**	**i**	**y**
0Ah	**LF**	**SUB**	*****	**:**	**J**	**Z**	**j**	**z**
0Bh	**VT**	**ESC**	**+**	**;**	**K**	**[**	**k**	**{**
0Ch	**FF**	**FS**	**,**	**<**	**L**	**¥**	**l**	**|**
0Dh	**CR**	**GS**	**-**	**=**	**M**	**]**	**m**	**}**
0Eh	**SO**	**RS**	**.**	**>**	**N**	**^**	**n**	**~**
0Fh	**SI**	**US**	**/**	**?**	**O**	**_**	**o**	**DEL**

※How to Use the ASCII Code Table:
(ASCII Code) = (Upper) + (Lower)

Example 1: If “A”: (41h) = (40h) + (01h)
Example 2: If “m”: (6Dh) = (60h) + (0Dh)

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