COMMUNICATION INSTRUCTION MANUAL

PC-935, PC-955

(OPTION CODES: C, C5, SVTC)

Shinko

--- CONTENTS ---

To prevent accidents arising from the misuse of this controller, please ensure the operator using it receives this manual.
Please read this Communication instruction manual along with the Insruction manual for PC-900.

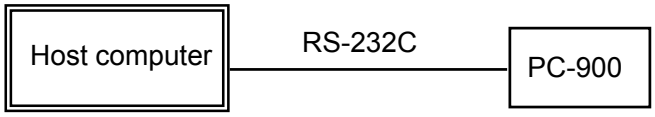
⚠ Warning

Turn the power supply to the instrument off before wiring or checking.
Working or touching the terminal with the power switched on may result in severe injury or death due to Electric Shock.

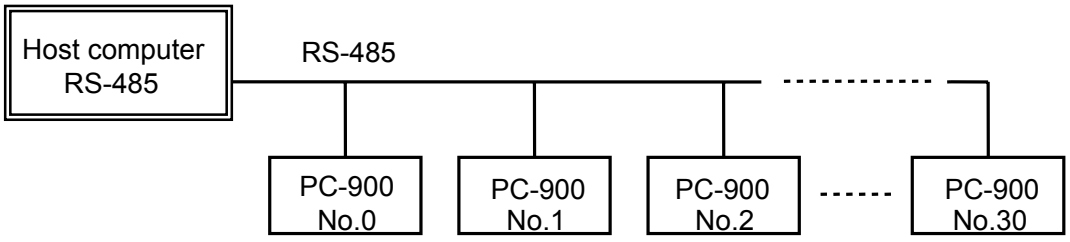
1. System configuration

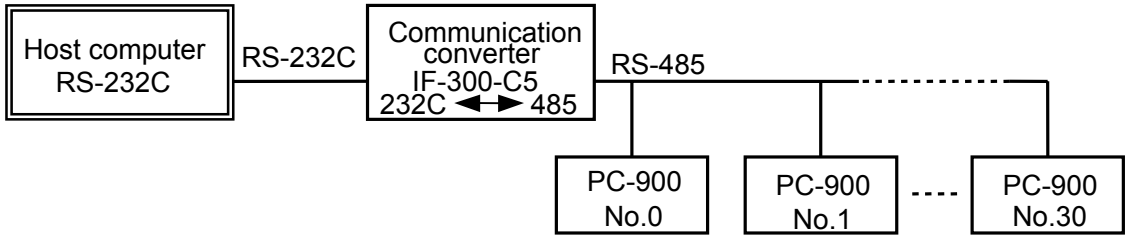
1.1 System configuration

(1) RS-232C (option C)



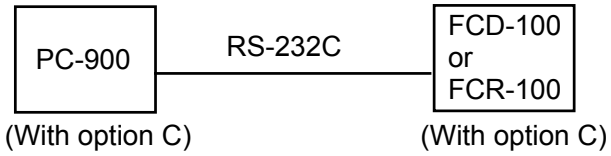
(2) RS-485 multi-drop connection (option C5)



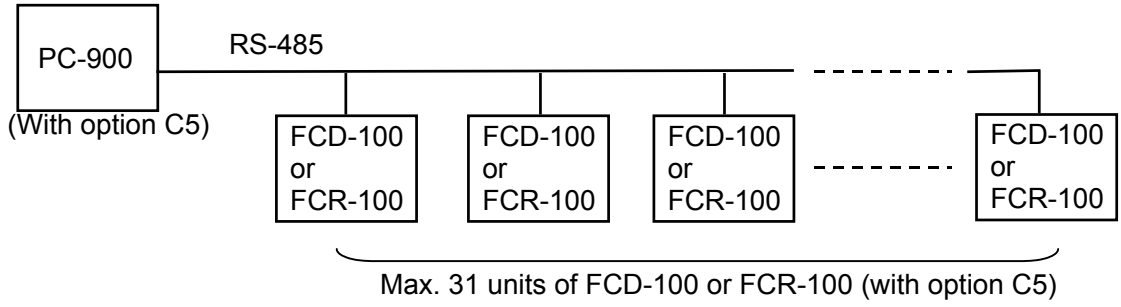


(3) Setting value digital transmission (option SVTC)

• When executing Setting value digital transmission with option C



• When executing Setting value digital transmission with option C5



● Setting value digital transmission (SVTC)
• When the option C is applied to the PC-900, and if the Setting value digital transmission is selected during Communication mode by the front keypad, the main setting value of the PC-900 can be digitally transmitted to the FCD-100 or FCR-100 units that have option C.
(Refer to the instruction manual for PC-900 on page 65)
Only one FCD-100 or FCR-100 can be connected to the PC-900 at a time.

• When the option C5 is applied to the PC-900, and the Setting value digital transmission is selected during Communication mode by the front keypad, the main setting value of the PC-900 can be digitally transmitted to those FCD-100 or FCR-100 units that have option C5.
(Refer to the instruction manual for PC-900 on page 65)
A maximum of 31 units of FCD-100 or FCR-100 can be connected to one PC-900.

● Notices when using the option SVTC
• The memory can store up to 10,000,000 (ten million) entries.
If the number of setting times exceeds the limit, the data will not be memorized.
Be sure to select Lock 3 for the FCD-100 or FCR-100 when changing the setting value frequently via communication function to make memory use more efficient.
• When using the Setting value digital transmission function, **set the Setting value memory number of the FCD-100 or FCR-100 to 1**. If it is not set to 1, malfunctions may occur.
• Match the transfer rate of the FCD-100 or FCR-100 to that of the PC-900.
• It is not necessary to set the instrument number for FCD-100 or FCR-100.
• When using the Setting value digital transmission function, the communication function (C, C5) is not available.

1.2 Communication interface

(1) RS-232C (option C)

● Characteristic (based on EIA RS-232C)

Connection

Signal	Code	Signal direction	Terminal No.
Transmitting data	TX	Output	11
Receiving data	RX	Input	12
Signal ground or Common return	COM	———	16

Cable length: Max. 10m

Adaptable connector and cable (Parts listed in the table below or their equivalents can be used)

Parts name	Manufacturer	Model
D sub-connector	Japan Aviation Electronics Ind. Ltd.	DB-25PFT-N
Connector cover		DB-C2-J9
Cable	Onamba Co., Ltd.	OTSC-2PVB-7/0.32TA

(2) RS-485 (option C5)

● Characteristic (based on EIA RS-485)

Connection

Signal	Code	Signal direction	Terminal No.
Inverted output	YA	Input, Output	11
Non-inverted output	YB	Input, Output	12
Signal ground or Common return	COM	———	16

Cable length: Max. 1km

Adaptable connector and cable (Parts listed in the table below or their equivalents can be used)

Parts name	Manufacturer	Model
D sub-connector	Japan Aviation Electronics Ind. Ltd.	DB-25PFT-N
Connector cover		DB-C2-J9
Cable	Onamba Co., Ltd.	OTSC-2PVB-7/0.32TA

(3) Setting value digital transmission (option SVTC)

● Characteristic (option C) (based on EIA RS-232C)
Connection, Cable length, adaptable connector and cable are the same as item (1) above.
● Characteristic (option C5) (based on EIA RS-485)
Connection, Cable length, adaptable connector and cable are the same as item (2) above.

2. Wiring connection

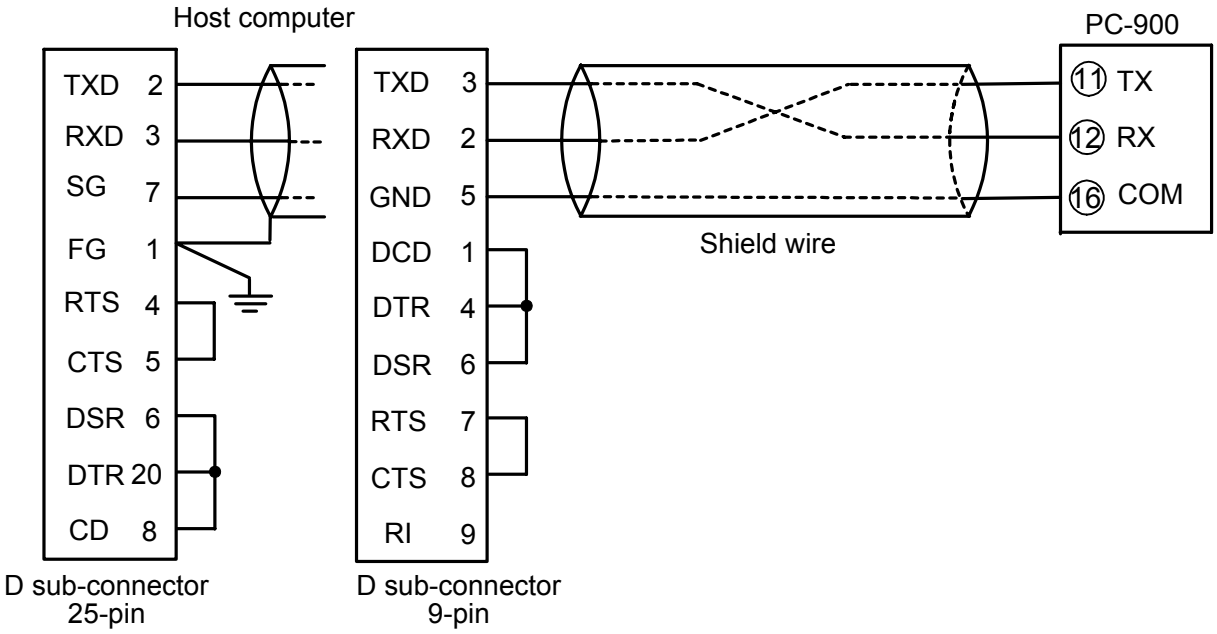
⚠ Warning

Turn the power supply to the instrument off before wiring or checking it.
Working or touching the terminal with the power switched on may result in severe injury or death due to Electric Shock.
Moreover, the instrument must be grounded before the power supply to the instrument is turned on.

Notice: The terminal block of this instrument is designed to be wired from the left side.
The lead wire must be inserted from the left side of the terminal, and fastened by the terminal screw.

(1) RS-232C (option C)

Notice: For wiring, connect TXD (Host computer) with RX (PC-900), and RXD (Host computer) with TX (PC-900) as shown below.

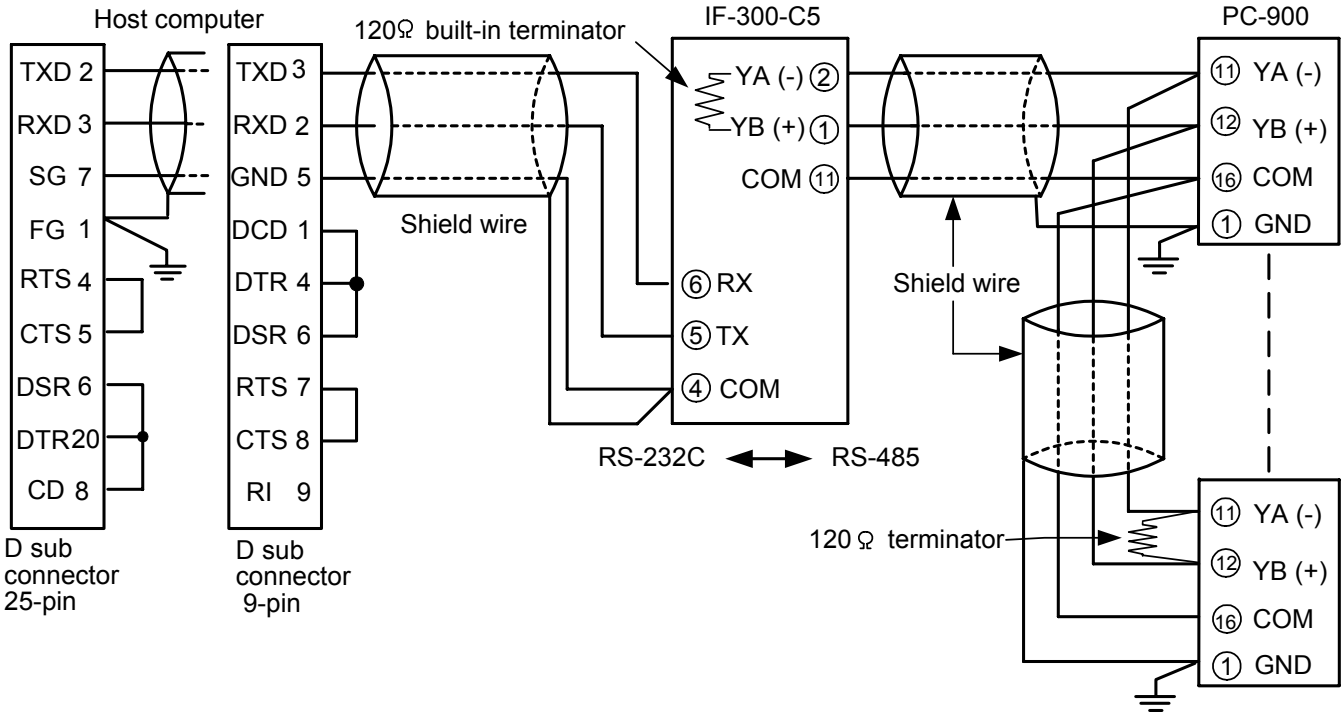


(Fig. 2-1)

(2) RS-485 (option C5)

When using communication converter IF-300-C5

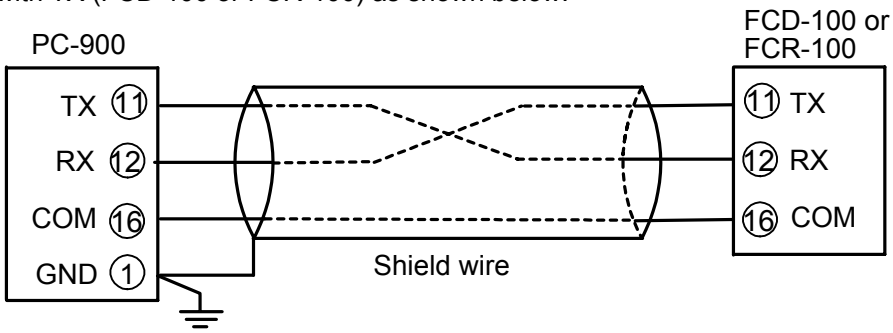
• Connector: D sub 9-pin, D sub 25-pin
Connection: RS-232C ◀⟷▶ RS-485 (Data transfer rate: 2400, 4800, 9600, 19200bps)



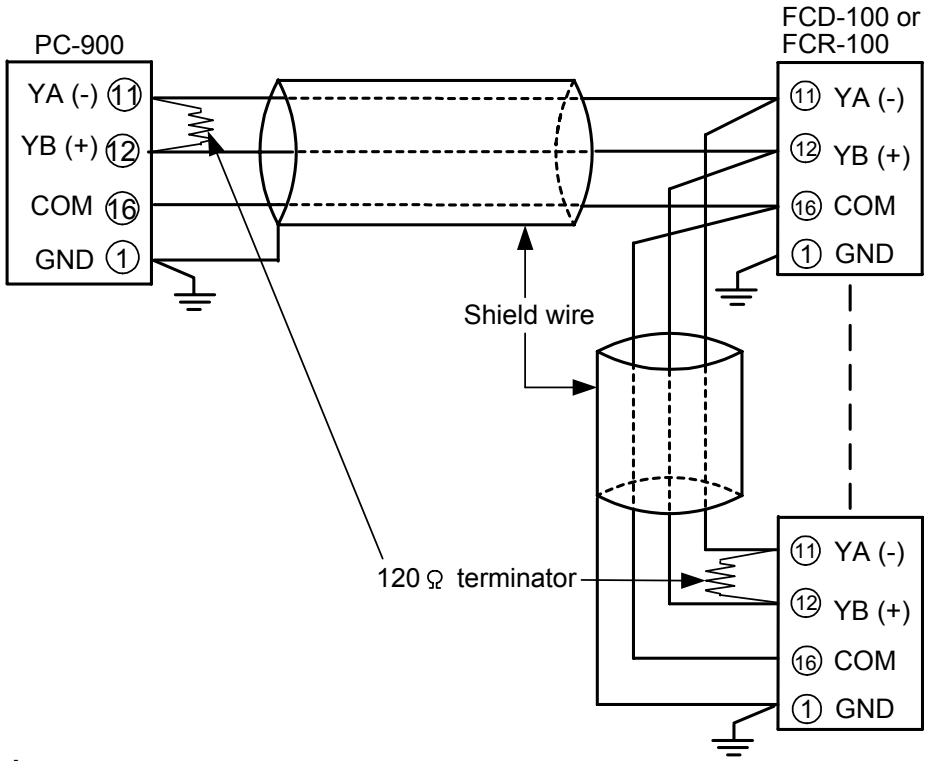
(3) Setting value digital transmission (option SVTC)

When option C is applied (Connection: RS-232C)

Notice: For wiring, connect TX (PC-900) with RX (FCD-100 or FCR-100), and RX (PC-900) with TX (FCD-100 or FCR-100) as shown below.



When option C5 is applied (Connection: RS-485)



Shield wire

Connect only one side of the shield wire to the FG or GND terminal so that current cannot flow to the shield wire.

Notice: If both sides of the shield wire are connected to the FG or GND terminal, the circuit will be closed between the shield wire and the ground. As a result, current will run through the shield wire and this may cause noise.

Never fail to ground FG and GND terminals.

Terminator (Terminal resistor)

Communication converter IF-300-C5 (sold separately) has a built-in terminator.

The terminator is mounted at the end of the wire when connecting a personal computer with multiple peripheral devices. The terminator prevents signal reflection and disturbance.

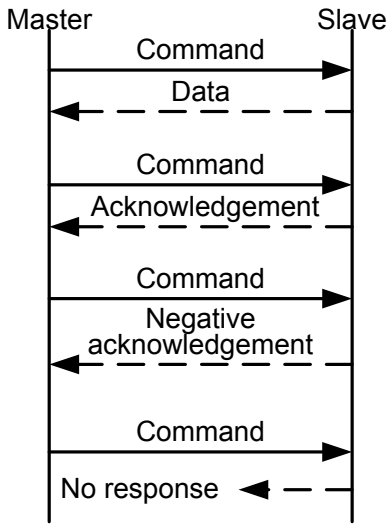
3. Setup of the PC-900

- It is necessary to set an instrument number to each of the PC-900 units individually when communicating by connecting plural units.
- Select a data transfer rate for the PC-900 according to that of the host computer.
  For the Setting value digital transmission, the data transfer rate must be the same between the PC-900 and FCD-100 or FCR-100.
- For the instrument number setting, data transfer rate setting and communication mode selection,
  Refer to the instruction manual for PC-900 on pages 64, 65.

4. Communication procedure

• RS-232C (option C), RS-485 (option C5)

Communication starts with command transmission from the host computer (hereafter Master) and ends with the response of the PC-900 (hereafter Slave).



(Fig.4-1)

- **Response with data**
  When the master sends the reading command, the slave responds with the corresponding setting value or current status.
- **Acknowledgement**
  When the master sends the setting command, the slave responds by sending an acknowledgement after the processing is terminated.
- **Negative acknowledgement**
  When the master sends non-existent command or value out of the setting range, the slave returns a negative acknowledgement.
- **No response**
  The slave will not respond to the master when there is a framing error or checksum error.

Communication timing of the RS-485 (option C5)

Slave side

When the slave starts transmission to RS-485 communication line, the slave is arranged so as to provide an idle status (mark status) **transmission period of 1 or more characters** before sending the response to ensure the synchronization on the receiving side.

The slave is arranged so as to disconnect the transmitter from the communication line **within a 1 character transmission period** after sending the response.

Master side (Notice on programming)

Set the program so that the master can disconnect the transmitter from the communication line **within a 1 character transmission period** after sending the command in preparation for reception of the response from the slave.

To avoid the collision of transmissions between the master and the slave, send the next command after carefully checking that the master received the response.

Note:

When the master communicates with the slave through the line converter (IF-300-C5), it is not required to manage the transmission timing described above, because the converter automatically sets the transmission timing while interpreting the protocol.

(See pages 5 and 6 for RS-485 connection.)

5. Command configuration

5.1 Command configuration

All commands are composed of ASCII. The data (setting value, decimal number) is represented by hexadecimal figures, and ASCII code is used.

The negative numbers are represented by 2's complement.

(Example)

Decimal number	Hexadecimal figure
9999	270FH
1000	03E8H
100	0064H
1	0001H
0	0000H
-1	FFFFH
-100	FF9CH
-1000	FC18H
-1999	F831H

● **2's complement**

Find the 1's complements first.

1's complements: Reverse each binary bit. 0 will become 1 and vice versa.

(Example) If 1000 is converted to binary, it is written as follows.

0000 0011 1110 1000

0 3 E 8 (Hexadecimal)

If the converted value is reversed, it is written as follows.

1111 1100 0001 0111

This is the 1's complements of 1000.

2's complements: Add 1 to the 1's complements.

If 1 is added to the 1's complements of 1000. it is written as follows.

1111 1100 0001 0111

F C 1 8 (Hexadecimal)

This is the 2's complements of 1000, that is -1000.

● Step time and Time signal are converted to the minimum unit selected during Step time unit selection (PC-900 manual p.68), then the values are converted to Hexadecimal figures. ASCII codes are used for the command.

(Example: Time is represented with Hexadecimal figures as follows)

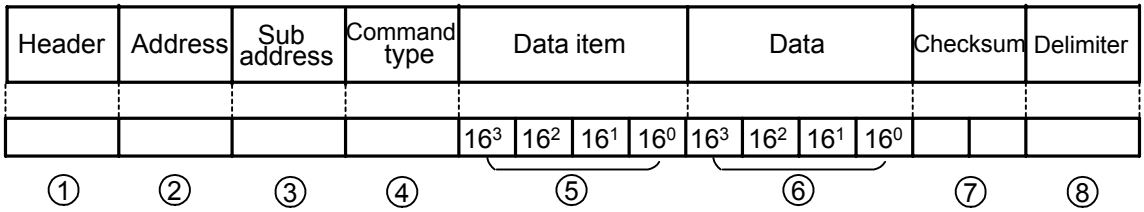
(Minute:Second)

Time	Decimal number	Hexadecimal figure
15 min. 30 sec.	930 seconds	03A2H
50 min. 40 sec.	3040 seconds	0BE0H

(Hour:Minute)

Time	Decimal number	Hexadecimal figure
1 hour 30 sec.	90 minutes	005AH
15 hours 50 sec.	950 minutes	03B6H

(1) Command



① **Header** : STX (02H) fixed, Start of text
Control code to represent the beginning of the command (text)
ASCII codes are used.

② **Address** : Numbers by which the master discerns each slave.
Instrument number 0 to 94 (00H to 5EH) and Global address 95 (5FH)
The numbers (20H to 7EH) are used by giving 20H of bias.
95 (7FH) is called **Global address**, which is used when the same command is sent to all the slaves connected. However, a response is not returned.

③ **Sub address**: (20H) fixed

④ **Command type**: Code to discern Setting command (50H) and Reading command (20H)

⑤ **Data item** : Data classification of the command object
Composed of hexadecimal 4 digits (See pages 13 to 20.)

16^3 In the case of 0: Represents setting items such as Fixed value control parameter, PID Auto-tuning performance, Attached function and Auto/Manual control change.
In the case of 1: Represents the Program pattern setting item
In the case of 2: Represents the PID block setting group setting item
In the case of 3: Represents the Wait block setting item
In the case of 4: Represents the Alarm block setting item
In the case of 5: Represents the Output block setting item
In the case of 6: Represents the Time signal block setting item
In the case of 7: Represents the setting items for Number of repeat and Pattern link designation of program control.

16^2 Represents the setting items for Pattern number (0 to 9) and Block number (0 to F).

16^1 Represents the Step number (0 to 9) setting item

16^0 Represents the setting items in the step or block.

Data item example (See pages 13 to 20)

• Control output (OUT1) proportional band setting in Fixed value control ---	0 0 0 2
• Alarm 3 setting in Fixed value control ----------	0 0 0 9
• Temperature setting for Pattern 5, Step 3 in program control ----------	1 5 3 0
• Alarm 3 setting for Block 5 in Program control ----------	4 5 0 2
• Number of repeat setting for Pattern 8 in Program control ----------	7 8 0 0
• Reading of current process variable ----------	0 0 8 0

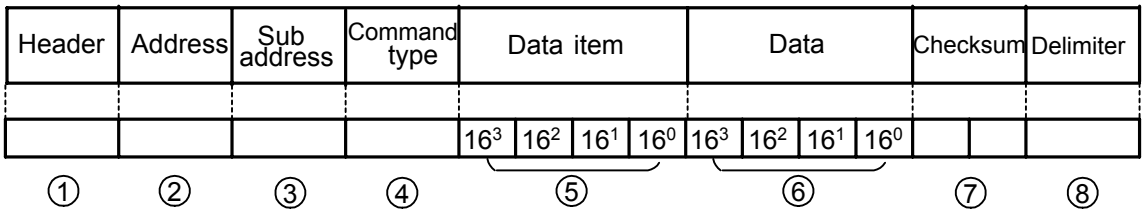
⑥ **Data** : The contents of data (setting value) differ depending on the setting command.
Composed of hexadecimal 4 digits (See pages 13 to 20.)
Reading command has no data.

⑦ **Checksum** : 2-character data to detect communication errors (See page 10 for the calculation.)

⑧ **Delimiter** : ETX (03H) fixed, End of text
Control code to represent the end of command (text)

(2) Response to the command

● **Response with data (Response to the reading command)**



① **Header** : ACK (06H) fixed, [Acknowledgement]
Control code to represent the beginning of the response

② **Address** : Instrument number 0 to 95 (20H to 7FH) to which the response is transmitted.
The same code with the received command is used for the response.

③ **Sub address**: (20H) fixed

④ **Command type**: Code to discern Setting command (50H) and Reading command (20H)
The same code with the received command is used for the response.

⑤ **Data item** : Data classification of the command object
Composed of hexadecimal 4 digits (See pages 13 to 20.)
The same code with the received command is used for the response.

16^3 In the case of 0: Represents setting items such as Fixed value control parameter, PID Auto-tuning performance, Attached function and Auto/Manual control change.
In the case of 1: Represents the Program pattern setting item
In the case of 2: Represents the PID block setting group setting item
In the case of 3: Represents the Wait block setting item
In the case of 4: Represents the Alarm block setting item
In the case of 5: Represents the Output block setting item
In the case of 6: Represents the Time signal block setting item
In the case of 7: Represents the setting items for Number of repeat and Pattern link designation of program control.

16^2 Represents the setting items for Pattern number (0 to 9) and Block number (0 to F).

16^1 Represents the Step number (0 to 9) setting item

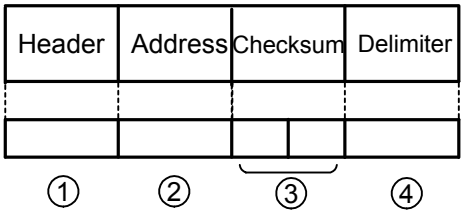
16^0 Represents the setting items in the step or block.

Reading data item example (See pages 13 to 20)

• Control output (OUT2) proportional band setting in Fixed value control ---	0 0 0 6
• Alarm 3 setting in Fixed value control ----------	0 0 0 9
• Temperature setting for Pattern 7, Step 1 in program control ----------	1 7 1 0
• Alarm 3 setting for Block 7 in Program control ----------	4 7 0 2
• Number of repeat setting for Pattern 2 in Program control ----------	7 2 0 0
• Reading of current process variable ----------	0 0 8 0

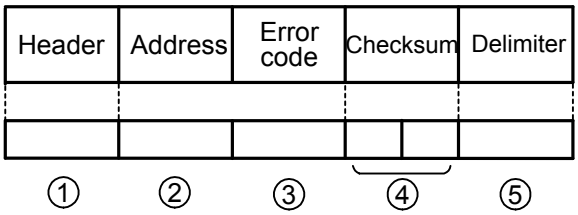
⑥ **Data** : The contents of data differ depending on the reading command.
Composed of hexadecimal 4 digits (See pages 13 to 20.)
⑦ **Checksum** : 2-character data to detect communication errors (See page 10 for the calculation.)
⑧ **Delimiter** : ETX (03H) fixed, End of text
Control code to represent the end of response

● **Acknowledgement**



① **Header** : ACK (06H) fixed, [Acknowledgement]
Control code to represent the beginning of the response
② **Address** : Instrument number 0 to 95 (20H to 7FH) to which the response is transmitted.
The same code with the received command is used for the response.
③ **Checksum** : 2-character data to detect communication errors (See page 10 for the calculation.)
④ **Delimiter** : ETX (03H) fixed, End of text
Control code to represent the end of response

● **Negative acknowledgement**



① **Header** : NAK (06H) fixed, [Negative acknowledgement]
Control code to represent the beginning of the response
② **Address** : Instrument number 0 to 95 (20H to 7FH) to which the response is transmitted.
The same code with the received command is used for the response.
③ **Error code** : Represents an error type. Composed of hexadecimal 1 digit.
1 (31H)-----Non-existent command
2 (32H)-----Not used
3 (33H)-----Setting value outside the setting range
4 (34H)-----Status unable to set (e.g. AT is performing)
5 (35H)-----During setting mode by keypad operation
④ **Checksum** : 2-character data to detect communication errors (See page 10 for the calculation.)
⑤ **Delimiter** : ETX (03H), fixed, End of text
Control code to represent the end of response

5.2 Checksum calculation

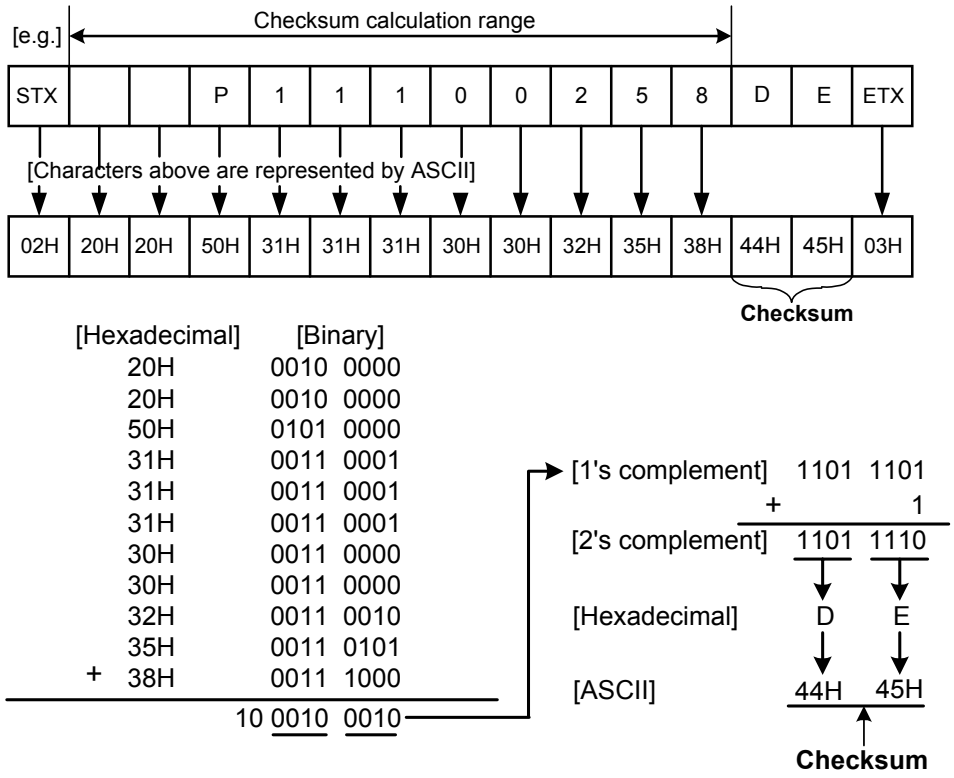
Checksum is used to detect receiving errors in the command or data.
Set the program for the master side as well to calculate the checksum of the response data from the slaves so that the communication errors can be checked.

The ASCII code (hexadecimal) corresponding to the characters which range from the address to that before the checksum is converted to binary notation, and the total value is calculated. The lower 2-digits of the total value are converted to 2's complements and then to hexadecimal figures, that is, ASCII code for the checksum.

Checksum calculation example

Main setting value: 600℃ (Fixed value control)
Address (instrument number): 0 (20H)

- 1's complement: Reverse each binary bit. 0 will become 1 and vice versa.
- 2's complement: Add 1 to 1's complement.



6. Contents of the command

6.1 Notes on the setting command and reading command

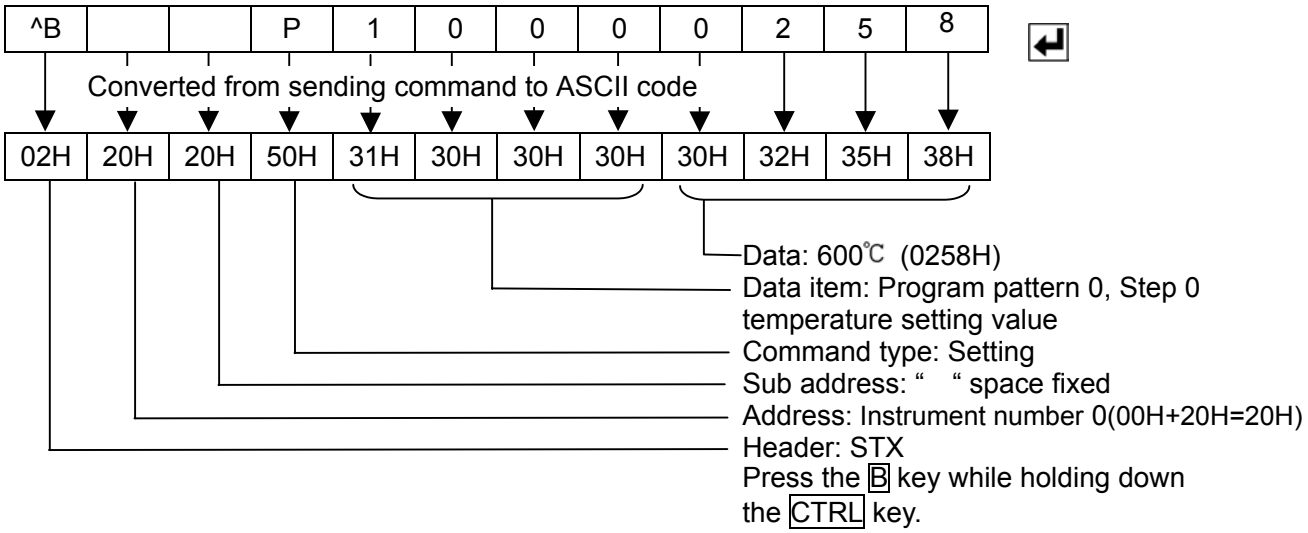
- It is possible to set the setting value by the setting command of the communication function even if the setting value is locked.
- Although the options are not applied, setting optional items is possible by the setting command. However, they will not function.
- The memory can store up to 10,000,000 (ten million) entries.
  If the number of setting times exceeds the limit, it cannot memorize the data. So frequent transmission via communication is not recommended.
- When connecting plural slaves, the address (instrument number) must not be duplicated.
- When sending a command by Global address [95 (7FH)], the same command is sent to all the slaves connected. However, a response will not be returned.
- The instrument number and data transfer rate of the slave cannot be set by communication. Set them by the PC-900 front keypad.

Setting command

- The settable range is the same as the one that can be set with the keypad.
  (Refer to the instruction manual for PC-900)
  For communication command, refer to the Command table of this manual.
- All commands are composed of ASCII.
- The data (setting value, decimal) is converted to hexadecimal figures, and ASCII is used. Negative numbers are represented by 2's complement. When the data (setting value) has a decimal point, a whole number without a decimal point is used.

(Example)

If the sample program (pp.20, 21) is used, and when Program pattern 0 Step 0 temperature setting value is set to 600℃ (Instrument number : 0)

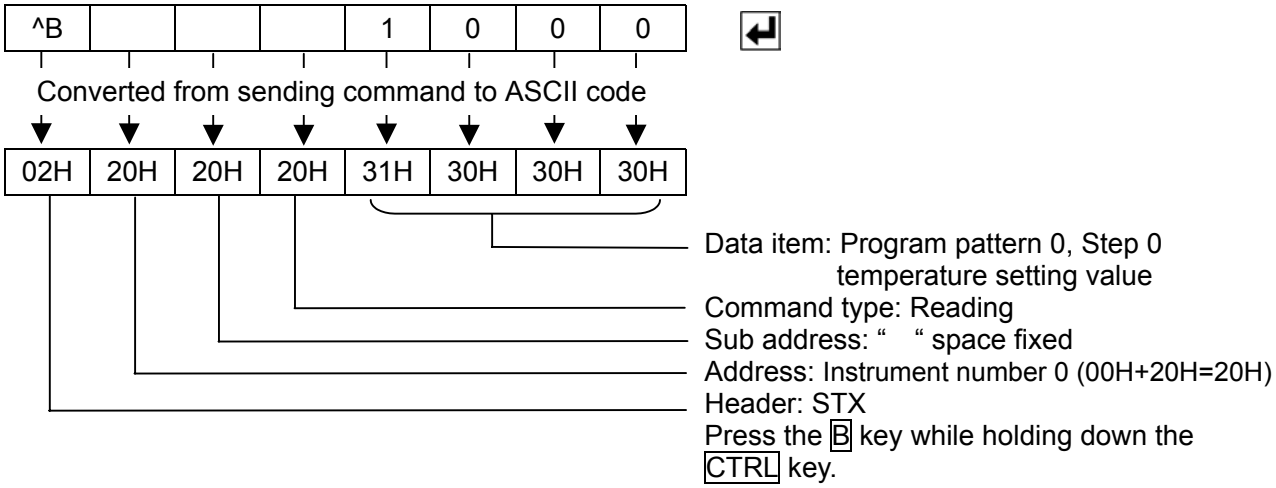


Reading command

- All commands are composed of ASCII.
- The data (setting value, decimal) is converted to hexadecimal figures, and ASCII is used. Negative numbers are represented by 2's complement. When the data (setting value) has a decimal point, the response is returned as a whole number without a decimal point.

(Example)

If the sample program is used (P.20, 21), and when Program pattern 0, Step 0 temperature setting value is read by the reading command (Instrument number : 0)



6.2 Command table

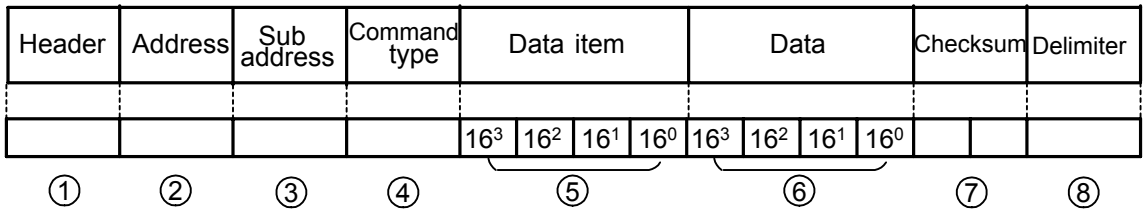


Table below describes ④ Command type, ⑤ Data item and ⑥ Data.
If the setting value of the data has a decimal point, the decimal point is ignored and it is converted to a hexadecimal figure.

Command type	Data item		Data
20H/50H	0001H	Fixed value control Main setting value setting	Setting value
20H/50H	0002H	Fixed value control Control output (OUT1) proportional band setting	Setting value
20H/50H	0003H	Fixed value control Integral time setting	Setting value
20H/50H	0004H	Fixed value control Derivative time setting	Setting value
20H/50H	0005H	Fixed value control Anti-reset windup setting	Setting value
20H/50H	0006H	Fixed value control Control output (OUT2) proportional band setting	Setting value (Multiplying factor to the control output (OUT1) proportional band)
20H/50H	0007H	Fixed value control Alarm 1 (A1) action point setting	Setting value
20H/50H	0008H	Fixed value control Alarm 2 (A2) action point setting	Setting value
20H/50H	0009H	Fixed value control Alarm 3 (A3) action point setting	Setting value
20H/50H	000AH	Fixed value control Alarm 4 (A4) action point setting	Setting value
20H/50H	000BH	Automatic/Manual control change mode	0000H: Automatic control 0001H: Manual control
20H/50H	000CH	Manual manipulating value setting (For automatic control, Negative acknowledgement is returned.)	Setting value
20H/50H	000DH	PID auto-tuning action selection	0000H: PID auto-tuning 0001H: Multi-mode PID auto-tuning
20H/50H	000EH	PID auto-tuning Performance/Cancellation (For standby mode or Manual mode, Negative acknowledgement is returned.)	0000H: Cancellation 0001H: Performance

20H/50H	000FH	Alarm 3 (A3) action form selection	0000H: No alarm action 0001H: High limit alarm 0002H: High limit alarm with standby 0003H: Low limit alarm 0004H: Low limit alarm with standby 0005H: High/Low limits alarm 0006H: High/Low limits alarm with standby 0007H: High/Low limit range alarm 0008H: High/Low limit range alarm with standby 0009H: Process high alarm 000AH: Process high alarm with standby 000BH: Process low alarm 000CH: Process low alarm with standby 000DH: Pattern end output
20H/50H	0010H	Alarm 4 (A4) action form selection	The same as Alarm 3 (A3) action form selection
20H/50H	0011H	Alarm 1 (A1) hysteresis setting	Setting value
20H/50H	0012H	Alarm 2 (A2) hysteresis setting	Setting value
20H/50H	0013H	Alarm 3 (A3) hysteresis setting	Setting value
20H/50H	0014H	Alarm 4 (A4) hysteresis setting	Setting value
20H/50H	0015H	Alarm 1 (A1) delayed timer setting	Setting value
20H/50H	0016H	Alarm 2 (A2) delayed timer setting	Setting value
20H/50H	0017H	Alarm 3 (A3) delayed timer setting	Setting value
20H/50H	0018H	Alarm 4 (A4) delayed timer setting	Setting value
20H/50H	0019H	Loop break alarm time setting	Setting value
20H/50H	001AH	Loop break alarm span setting	Setting value
20H/50H	001BH	Control output (OUT1) proportional cycle setting	Setting value
20H/50H	001CH	Control output (OUT1) high limit setting	Setting value
20H/50H	001DH	Control output (OUT1) low limit setting	Setting value
20H/50H	001EH	Control output (OUT1) ON/OFF hysteresis setting	Setting value
20H/50H	001FH	Control output (OUT1) rate of change limit setting	Setting value
20H/50H	0020H	Control output (OUT2) proportional cycle setting	Setting value
20H/50H	0021H	Control output (OUT2) action selection	0000H: Air cooling 0001H: Oil cooling 0002H: Water cooling
20H/50H	0022H	Control output (OUT2) high limit setting	Setting value
20H/50H	0023H	Control output (OUT2) low limit setting	Setting value
20H/50H	0024H	Control output (OUT2) ON/OFF hysteresis setting	
20H/50H	0025H	Overlap band/Dead band setting	Setting value
20H/50H	0026H	Open/Closed output dead band setting	Setting value
20H/50H	0027H	Main setting value (SV) high limit setting	Setting value
20H/50H	0028H	Main setting value (SV) low limit setting	Setting value
20H/50H	0029H	Transmission output mode selection	0000H: Process variable (PV) 0001H: Main setting value (SV) 0002H: Control output (OUT1) Manipulating value (MV)

20H/50H	002AH	Transmission output high limit setting	Setting value
20H/50H	002BH	Transmission output low limit setting	Setting value
20H/50H	002CH	Scaling high limit setting	Setting value
20H/50H	002DH	Scaling low limit setting	Setting value
20H/50H	002EH	Decimal point place selection	0000H: No decimal point 0001H: 1 digit after decimal point 0002H: 2 digits after decimal point 0003H: 3 digits after decimal point
20H/50H	002FH	Sensor correction setting	Setting value
20H/50H	0030H	PV filter time constant setting	Setting value
20H/50H	0031H	Setting value lock selection	0000H: Unlock 0001H: Lock
20H/50H	0032H	Step temperature setting value (SV) (when program control start) setting	Setting value
20H/50H	0033H	Program control start system selection	0000H: PV start 0001H: PVR start 0002H: SV start
20H/50H	0034H	Status after power failure restored selection	0000H: Stop 0001H: Continuation 0002H: Halt
20H/50H	0035H	Step time unit selection	0000H: Hour:Minute 0001H: Minute:Second
20H/50H	0036H	Step time indicating method selection	0000H: Step remaining time 0001H: Step time setting value
20H/50H	0037H	Step temperature indicating method selection	0000H: Current step temperature 0001H: Step temperature setting value
20H/50H	0038H	Pattern end output time setting	Setting value
20H/50H	0039H	Step temperature setting value (SV) when program end holding function selection	0000H: Hold function is not applied 0001H: Hold function is applied
20H/50H	003AH	Time signal 1 output/Status output (RUN) selection	0000H: Time signal 1 output 0001H: Status output (RUN)
20H/50H	003BH	Time signal 2 output/Status output (HOLD) selection	0000H: Time signal 2 output 0001H: Status output (HOLD)
20H/50H	003CH	Time signal 3 output/ Status output (WAIT) selection	0000H: Time signal 3 output 0001H: Status output (WAIT)
20H/50H	003DH	Time signal 4 output/ Status output (FAST) selection	0000H: Time signal 4 output 0001H: Status output (FAST)
20H/50H	003EH	Time signal 5 output/ Status output (STOP) selection	0000H: Time signal 5 output 0001H: Status output (STOP)
20H/50H	003FH	Running pattern number setting [Effective when 0 is selected by external Pattern number selection, and when the mode is in Program standby. (External selection has priority.)]	0000H: Running pattern number 0 0001H: Running pattern number 1 0002H: Running pattern number 2 0003H: Running pattern number 3 0004H: Running pattern number 4 0005H: Running pattern number 5 0006H: Running pattern number 6 0007H: Running pattern number 7 0008H: Running pattern number 8 0009H: Running pattern number 9
20H/50H	0040H	Pattern number selection to be set	0000H: Pattern number 0 0001H: Pattern number 1 0002H: Pattern number 2 0003H: Pattern number 3 0004H: Pattern number 4 0005H: Pattern number 5 0006H: Pattern number 6 0007H: Pattern number 7 0008H: Pattern number 8 0009H: Pattern number 9

50H	0041H	Control mode change	0000H: Fixed value control 0001H: Program control
50H	0042H	Program control Run/Stop (For Fixed value control, Negative acknowledgement is returned.)	0000H: Stop 0001H: Run (includes Hold cancellation)
50H	0043H	Holds the Progress time during Program control. (For Fixed value control or Program standby mode, Negative acknowledgement is returned.)	0001H: HOLD
50H	0044H	Advances the step to the next during Program control. (For Fixed value control or Program standby mode, Negative acknowledgement is returned.)	0001H: ADVANCE
50H	0045H	The step reverts to the previous step during Program control. (For Fixed value control or Program standby mode, Negative acknowledgement is returned.)	0001H: BACK ADVANCE
20H/50H	0046H	Open output time setting	Setting value
20H/50H	0047H	Closed output time setting	Setting value
20H/50H	1000H	Temperature setting value for Pattern 0, Step 0	Setting value
20H/50H	1001H	Time setting value for Pattern 0, Step 0	Setting value
20H/50H	1002H	PID block number selection to be used for Pattern 0, Step 0	0000H: Block number 0 0001H: Block number 1 0002H: Block number 2 0003H: Block number 3 0004H: Block number 4 0005H: Block number 5 0006H: Block number 6 0007H: Block number 7 0008H: Block number 8 0009H: Block number 9
20H/50H	1003H	Time signal 1 Block number selection to be used for Pattern 0, Step 0	0000H: Block number 0 0001H: Block number 1 0002H: Block number 2 0003H: Block number 3 0004H: Block number 4 0005H: Block number 5 0006H: Block number 6 0007H: Block number 7 0008H: Block number 8 0009H: Block number 9 000AH: Block number 10 000BH: Block number 11 000CH: Block number 12 000DH: Block number 13 000EH: Block number 14 000FH: Block number 15
20H/50H	1004H	Time signal 2 Block number selection for Pattern 0, Step 0	The same as Time signal 1
20H/50H	1005H	Time signal 3 Block number selection for Pattern 0, Step 0	The same as Time signal 1
20H/50H	1006H	Time signal 4 Block number selection for Pattern 0, Step 0	The same as Time signal 1
20H/50H	1007H	Time signal 5 Block number selection for Pattern 0, Step 0	The same as Time signal 1
20H/50H	1008H	Time signal 6 Block number selection for Pattern 0, Step 0	The same as Time signal 1

20H/50H	1009H	Time signal 7 Block number selection for Pattern 0, Step 0	The same as Time signal 1
20H/50H	100AH	Time signal 8 Block number selection for Pattern 0, Step 0	The same as Time signal 1
20H/50H	100BH	Wait block number selection to be used for Pattern 0, Step 0	0000H: Block number 0 0001H: Block number 1 0002H: Block number 2 0003H: Block number 3 0004H: Block number 4 0005H: Block number 5 0006H: Block number 6 0007H: Block number 7 0008H: Block number 8 0009H: Block number 9
20H/50H	100CH	Alarm block number selection to be used for Pattern 0, Step 0	0000H: Block number 0 0001H: Block number 1 0002H: Block number 2 0003H: Block number 3 0004H: Block number 4 0005H: Block number 5 0006H: Block number 6 0007H: Block number 7 0008H: Block number 8 0009H: Block number 9
20H/50H	100DH	Output block number selection to be used for Pattern 0, Step 0	0000H: Block number 0 0001H: Block number 1 0002H: Block number 2 0003H: Block number 3 0004H: Block number 4 0005H: Block number 5 0006H: Block number 6 0007H: Block number 7 0008H: Block number 8 0009H: Block number 9
20H/50H	1010H	Temperature setting value for Pattern 0, Step 1	Setting value
⋮	⋮	⋮	⋮
20H/50H	199DH	Output block number selection to be used for Pattern 9, Step 9	0000H: Block number 0 0001H: Block number 1 0002H: Block number 2 0003H: Block number 3 0004H: Block number 4 0005H: Block number 5 0006H: Block number 6 0007H: Block number 7 0008H: Block number 8 0009H: Block number 9
20H/50H	2000H	Control output (OUT1) proportional band setting for Block number 0	Setting value
20H/50H	2001H	Integral time setting for Block number 0	Setting value
20H/50H	2002H	Derivative time setting for Block number 0	Setting value
20H/50H	2003H	Anti-reset windup setting for Block number 0	Setting value

20H/50H	2004H	Control output (OUT2) proportional band setting for Block number 0	Setting value
20H/50H	2904H	Control output (OUT2) proportional band setting for Block number 9	Setting value
20H/50H	3000H	Wait value setting for Block number 0	Setting value
20H/50H	3900H	Wait value setting for Block number 9	Setting value
20H/50H	4000H	Alarm 1 action point setting for Block number 0	Setting value
20H/50H	4001H	Alarm 2 action point setting for Block number 0	Setting value
20H/50H	4002H	Alarm 3 action point setting for Block number 0	Setting value
20H/50H	4003H	Alarm 4 action point setting for Block number 0	Setting value
20H/50H	4903H	Alarm 4 action point setting for Block number 9	Setting value
20H/50H	5000H	Control output (OUT1) high limit setting for Block number 0	Setting value
20H/50H	5001H	Control output (OUT1) low limit setting for Block number 0	Setting value
20H/50H	5002H	Control output (OUT2) high limit setting for Block number 0	Setting value
20H/50H	5003H	Control output (OUT2) low limit setting for Block number 0	Setting value
20H/50H	5004H	Control output (OUT1) rate of change limit setting for Block number 0	Setting value
20H/50H	5904H	Control output (OUT1) rate of change limit setting for Block number 9	Setting value
20H/50H	6000H	Time signal output OFF time setting for Block number 0	Setting value
20H/50H	6001H	Time signal output ON time setting for Block number 0	Setting value
20H/50H	6F01H	Time signal output ON time setting for Block number 15	Setting value
20H/50H	7000H	Number of repeat setting for Pattern number 0	Setting value
20H/50H	7001H	Pattern link setting for Pattern number 0 and 1	0000H: No link 0001H: Link
20H/50H	7901H	Pattern link setting for Pattern number 9 and 0	0000H: No link 0001H: Link

Command type	Data item		Data
20H	0080H	Current process variable (PV) reading	Current process variable (PV)
20H	0081H	Current Control output (OUT1) Manipulating value (MV) reading	Current Control output (OUT1) Manipulating value (MV)
20H	0082H	Current Control output (OUT2) Manipulating value (MV) reading	Current Control output (OUT2) Manipulating value (MV)
20H	0083H	Current Setting value (SV) reading	Current Setting value (SV)
20H	0084H	Current Performing step remaining time reading	Current step remaining time
20H	0085H	Current Performing pattern and step reading	16^0 digit: Performing pattern 16^1 digit: Performing step 16^2, 16^3 digit: Not used, always 0
20H	0086H	Current output status reading [From control output (OUT1, Open) to Downscale]	2^0 digit: Control output (OUT1, OPEN) 0: OFF 1: ON (Always 0 for current output) 2^1 digit: Control output (OUT2, Closed) 0: OFF 1: ON (Always 0 for current output) 2^2 digit: Alarm 1 (Pattern end) output 0: OFF 1: ON 2^3 digit: Alarm 2 (Pattern end) output 0: OFF 1: ON 2^4 digit: Alarm 3 (Pattern end) output 0: OFF 1: ON 2^5 digit: Alarm 4 (Pattern end) output 0: OFF 1: ON 2^6 digit: Loop break alarm output 0: OFF 1: ON 2^7 digit: Upscale 0: OFF 1: ON 2^8 digit: Downscale 0: OFF 1: ON 2^9 to 2^{15} digit: Not used, Always 0
20H	0087H	Current output status reading [From Time signal 1 (RUN) to Time signal 8 output]	2^0 digit: Time signal 1 (RUN) output 0: OFF 1: ON 2^1 digit: Time signal 2 (HOLD) output 0: OFF 1: ON 2^2 digit: Time signal 3 (WAIT) output 0: OFF 1: ON 2^3 digit: Time signal 4 (FAST) output 0: OFF 1: ON 2^4 digit: Time signal 5 (STOP) output 0: OFF 1: ON 2^5 digit: Time signal 6 output 0: OFF 1: ON 2^6 digit: Time signal 7 output 0: OFF 1: ON 2^7 digit: Time signal 8 output 0: OFF 1: ON 2^8 to 2^{15} digit: Not used, Always 0
20H	0088H	Current output status reading [From Control mode to Program control (Wait)]	2^0 digit: Control mode 0: Fixed value 1: Program 2^1 digit: Automatic/Manual control 0: Automatic 1: Manual 2^2 digit: Auto-tuning 0: Cancellation 1: Performance

			2^3 digit: Program control 0: Stop 1: Performance 2^4 digit: Program control (Hold) 0: OFF 1: ON 2^5 digit: Program control (Wait) 0: OFF 1: ON 2^6 to 2^{15} digit: Not used, Always 0

7. Sample program

7.1 Sample program list

```
1000 '*************************************************************************************************
1010 ' <SAMPLE1A.BAS>
1020 ' • This program is a communication example for DCL-300, FCD-100, FCR-100,
1030 '    FCL-100, GCS-300, HCD-100, JCD-100, JCR-100, JCS-200, JCD-300,
1040 '    JCR-300, JCS-300, MCD-100, MCR-100, PC-800, PC-900 and PCD-300.
1050 ' • Runs on the IBM PC and compatible PC with GW-BASIC.
1060 '                                                    SHINKO TECHNOS CO., LTD.
1070 '*************************************************************************************************
1080 '
1090 '************************************************
1100 '*              Initial                         *
1110 '************************************************
1120 CRPMAX=25:                          'maximum row line number (vertical)
1130 CMAX=80:                            'maximum column number
1140 CRP=1:                              'row line pointer
1150 CCP=1:                              'column pointer
1160 DIM KD$(200):                       'key input buffer
1170 CLS: GOSUB 1690
1180 OPEN "COM1:9600,E,7,1" AS #1 :      '9600bps, even, data 7 bits data, 1 stop bit
1190 ON COM(1) GOSUB 1420
1200 COM(1) ON
1210 '************************************************
1220 '*              Main                            *
1230 '************************************************
1240 B=1
1250 KD$(B)=""
1260 WHILE KD$(B)="": KD$(B)=INKEY$: WEND
1270 IF KD$(B)=CHR$(2) THEN  KD$(1)=KD$(B):B=1
1280 IF KD$(B)=CHR$(&HD) THEN GOSUB 1340 ELSE GOSUB 1360: GOTO 1250
1290 FOR B=1 TO BMAX
1300    PRINT#1,KD$(B);
1310 NEXT B
1320 GOTO 1240
1330 '
1340 GOSUB 1750: KD$(B)=CHR$(3): BMAX=B:GOSUB 1620
1350 RETURN
1360 GOSUB 1620
1370 IF B<200 THEN B=B+1 ELSE PRINT "Over flow ... Key input buffer": STOP
1380 RETURN
1390 '************************************************
1400 '*              Receiver                        *
1410 '************************************************
1420 N=LOC(1):IF N=0 THEN RETURN
1430 D$=INPUT$(N,#1):CRPB=2
1440 FOR L=1 TO N
1450    RD$=MID$(D$,L,1)
1460    IF RD$ < " " THEN GOSUB 1520 ELSE GOSUB 1540
1470 NEXT L
1480 RETURN
1490 '************************************************
1500 '*              Display                         *
1510 '************************************************
1520 GOSUB 1560:PRINT "^";:GOSUB 1560:PRINT CHR$(ASC(RD$)+ASC("@"));
1530 RETURN
1540 GOSUB 1560:PRINT RD$;
```

```
1550 RETURN
1560 CCP=CCP+1:IF CCP=CMAX THEN CCP=1:GOSUB 1590
1570 LOCATE CRP+CRPB,CCP
1580 RETURN
1590 CRP=CRP+4:IF CRP=CRPMAX THEN CRP=1:CLS
1600 GOSUB 1690
1610 RETURN
1620 CRPB=0
1630 IF KD$(B) < " " THEN GOSUB 1650 ELSE GOSUB 1670
1640 RETURN
1650 GOSUB 1560:PRINT "^";:GOSUB 1560:PRINT CHR$(ASC(KD$(B))+ASC("@"));
1660 RETURN
1670 GOSUB 1560:PRINT KD$(B);
1680 RETURN
1690 LOCATE CRP+1,CCP:PRINT STRING$(CMAX,"-");
1700 LOCATE CRP+CRPB,CCP
1710 RETURN
1720 '************************************************
1730 '*              Make SUM                        *
1740 '************************************************
1750 SUM=0
1760 FOR LS=2 TO B-1
1770    SUM=SUM+ASC(KD$(LS))
1780 NEXT LS
1790 SUMC$=RIGHT$("0"+HEX$(((NOT SUM)+1) AND &HFF),2)
1800 KD$(B)=LEFT$(SUMC$,1):GOSUB 1620:B=B+1
1810 KD$(B)=RIGHT$(SUMC$,1):GOSUB 1620:B=B+1
1820 RETURN
1830 END
```

7.2 Operation method of the sample program

(1) Before executing the sample program, check the following.

- Settings such as data transfer rate, instrument number are correct (option C5 for RS-485). (See p.6.)
- Wiring connections are correct.

When checking is completed, turn the power on.

(2) Start up the GW-BASIC.

Prepare the GW-BASIC and input as BASIC by key operation, and then press the ↵ (Enter) key.

(3) Input the sample program and save the program as "SAMPLE1A. BAS".

```
OK
1000 '*************************************************************************************************↵
1010 ' <SAMPLE1A.BAS>↵
1020 ' •This program is a communication example for DCL-300, FCD-100, FCR-100, ↵
1030 '   FCL-100, GCS-300, HCD-100, JCD-100, JCR-100, JCS-200, JCD-300,↵
 :
 :
 :
1800 KD$(B)=LEFT$(SUMC$,1):GOSUB 1620:B=B+1↵
1810 KD$(B)=RIGHT$(SUMC$,1):GOSUB 1620:B=B+1↵
1820 RETURN↵
1830 END↵
SAVE "SAMPLE1A.BAS",A↵
OK
```

(4) Load the sample program.

Input as underlined by key, and press the ↵ (Enter) key.

```
OK
load "SAMPLE1A.BAS"↵
```

When the load is completed, the display will be as follows.

```
load "SAMPLE1A.BAS"
OK
```

(5) Execute the sample program.
Input as underlined by key, and press the ↵ (Enter) key.

```
OK
RUN ↵
```

When executed, the display appears as follows, it is the standby status for command input.
The transmitting data is displayed above the line [-------], and the receiving data is displayed below the line.

```
--------------------------------------------------------------------------------------------------------
```

(6) As Example 1 below, execute the setting command of the main setting value.
(When the main setting value for Program pattern 0, Step 0 is set to 600℃ [Address: 0])
To execute the command, input it from header (STX) "^B" to data with the key, and press the ↵ (Enter) key.

(Example 1)

^B			P	1	0	0	0	0	2	5	8	↵

- Data: 600℃ (0258H)
- Data item: (1000H)
- Command type [Setting]: (50H)
- Sub address: 0 (20H)
  [00H + 20H = 20H]: " " space
- Address : 0 (20H)
  [00H + 20H = 20H]: " " space
- Header: STX (02H)
  Press the <B> while the <CTRL> is being pressed.

The checksum is automatically calculated, and it is sent with the delimiter (ETX).

^B			P	1	0	0	0	0	2	5	8	E	0	^C

- Delimiter ETX (03H)
- Checksum

When the command finishes normally, it responds as follows.

^F		E	0	^C

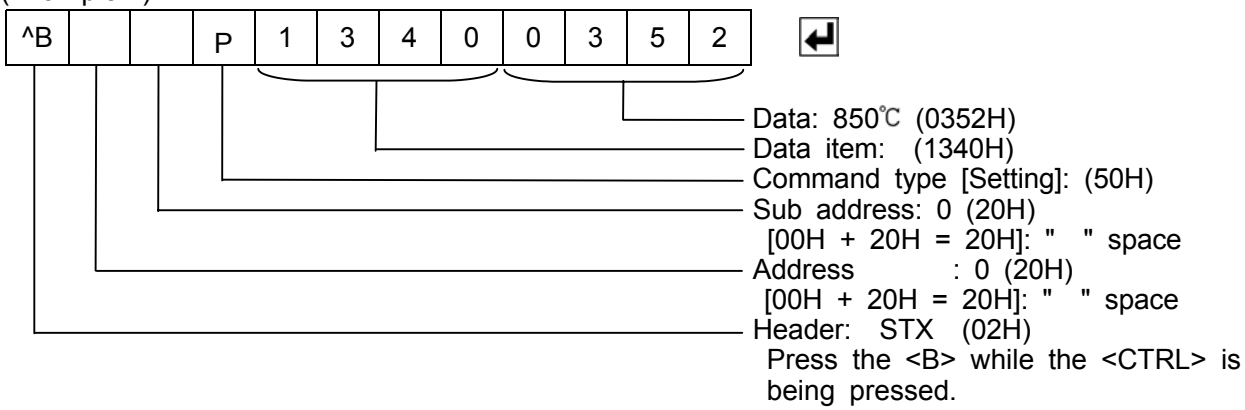
- Delimiter ETX (03H)
- Checksum
- Address
- Header ACK (06H) Acknowledgement

Check if the display is as follows.

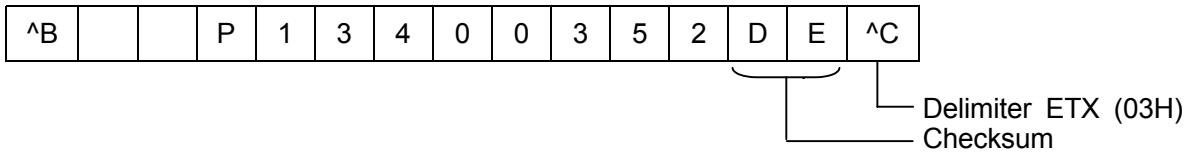
```
^B  P10000258E0^C
-------------------------------------------------------------------------------------------------------------------
                    ^F E0^C
```

As Example 2 below, execute the setting command of the main setting value.
(When the main setting value for Program pattern 3 Step 4 is set to 850℃ [Address: 0])
To execute the command, input it from Header (STX) "^B" to Data with the key, and press the ↵ (Enter) key.

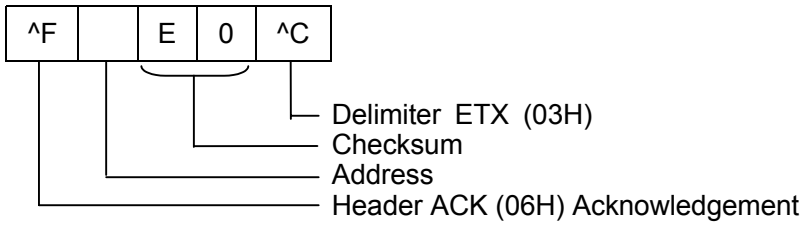
(Example 2)



The checksum is automatically calculated, and it is sent with the delimiter (ETX).



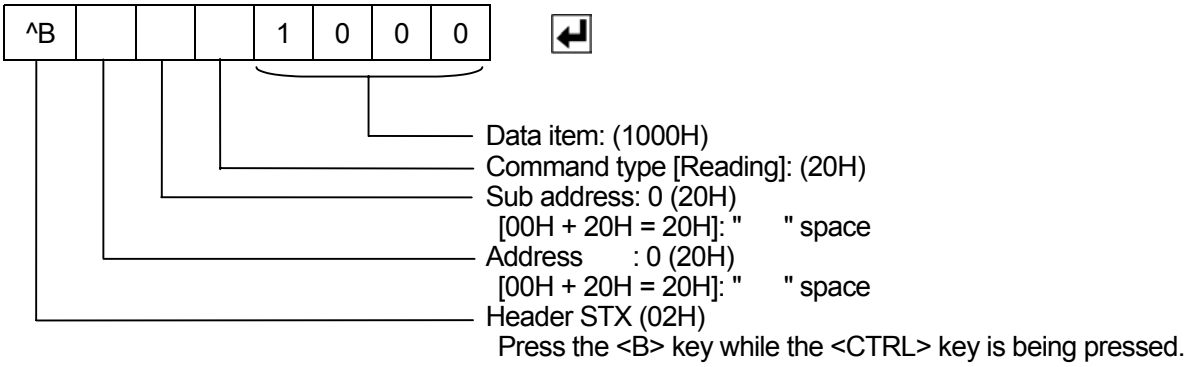
When the command finishes normally, it responds as follows.



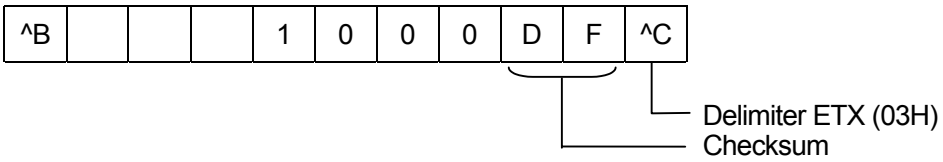
Check if the display is as follows.

```
^B  P13400352DE^C
-------------------------------------------------------------------------------------------------------------------
                    ^F E0^C
```

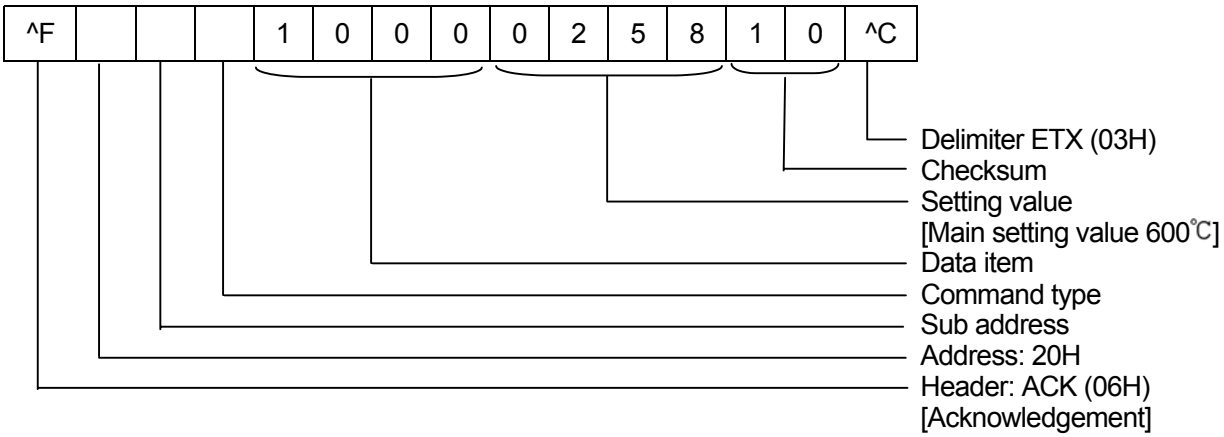
(7) Read the Main setting value (Example 1) set at item (6) by reading command. (Address: 0)
Input from header (STX) to Data item with the key, and press the ↵ (Enter) key.



The checksum is automatically calculated, and it is sent with the delimiter (ETX)



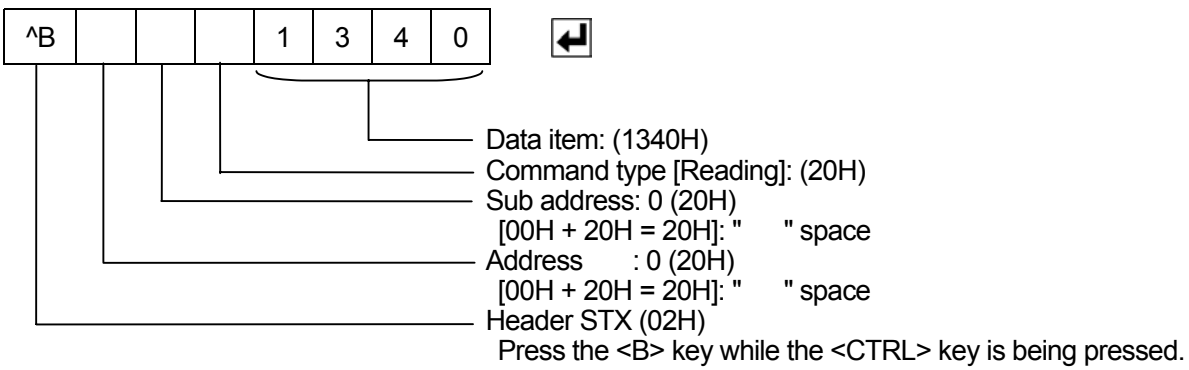
When the command finishes normally, it responds as follows.
In the case of Main setting value 600℃, Program pattern 0, Step 0.



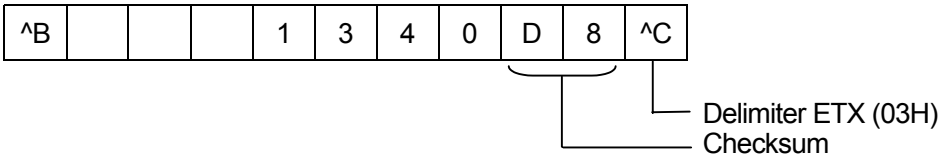
Check if the display is as follows.

^B P10000258E0^C	^B 1000DF^C
^F E0^C	^F 1000025810^C

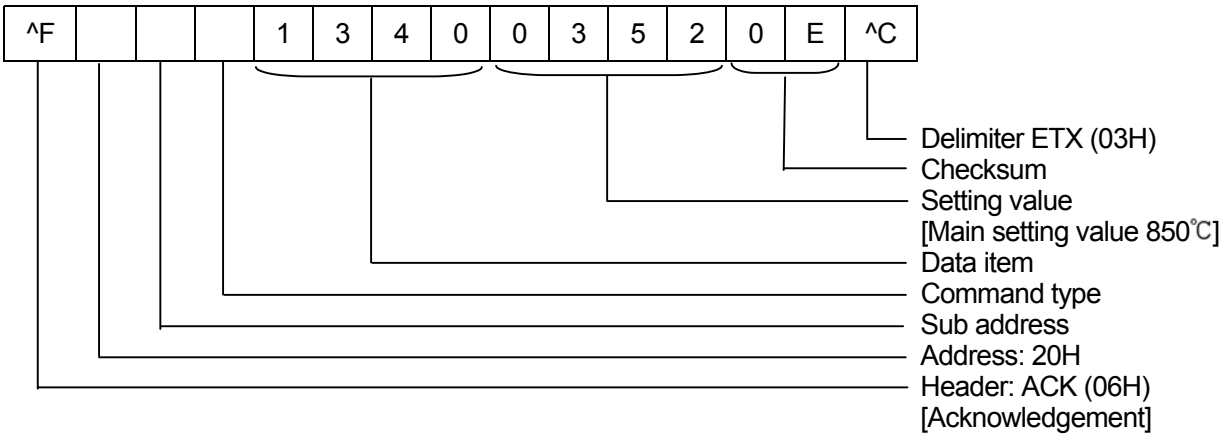
Read the Main setting value (Example 2) set at item (6) by reading command. (Address: 0)
Input from Header (STX) to Data item with the key , and press the ↵ (Enter) key.



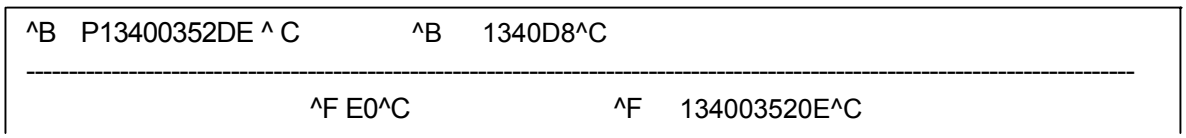
The checksum is automatically calculated, and it is sent with the delimiter (ETX)



When the command finishes normally, it responds as follows.
In the case of Main setting value 850℃, Program pattern 3, Step 4.



Check if the display is as follows.



(8) The communication test can be executed for other command in the same way.

7.3 Notice when inputting the command

- All commands are composed of ASCII codes.
- Data

  Positive number (+): Convert to hexadecimal figure.

  (Example) Main setting value 1000℃ in Fixed value control

  1000 ⟶ 03E8H

  Negative number (-): Convert to hexadecimal figure.

  (Example) Main setting value -10℃ in Fixed value control

  -10 ⟶ FFF6H

  Decimal point: Convert to hexadecimal figure, ignoring the decimal point.

  (Example) Control output (OUT1) proportional band 2.5%

  25 ⟶ 0019H
- If power failure occurs during communication, the data cannot be guaranteed.
- Control code

  Because the code cannot be indicated on the CRT display, the control code is indicated with the letters "^" and values to which 40H of bias are added.

  .

Control code	CRT display	Key operation
STX (02H)	^B ("^") and 02H + 40H")	Press the B key while holding down the CTRL key.
ETX (03H)	^C ("^") and 03H + 40H")	Press the C key while holding down the CTRL key.
ACK (06H)	^F ("^") and 06H + 40H")	Press the F key while holding down the CTRL key.
NAK (15H)	^U ("^") and 15H + 40H")	Press the U key while holding down the CTRL key.

8. Specifications

Communication system: Half-duplex

Data transfer rate	: 9600bps (2400, 4800, 9600, 19200bps) Selectable by keypad operation
Synchronous system	: Start-stop synchronous
Code form	: ASCII
Error detection	: Parity check, Checksum
Error correction	: Command request repeat system
Data format	Start bit : 1
	Data bit : 7
	Parity : Even parity
	Stop bit : 1

9. Troubleshooting

If any malfunctions occur, refer to the following items after checking the power supply to the master and the slave.

• **Problem: Communication failure**

Check the following
The connection or wiring of communication is not secure. (See pp.5, 6)
Burnout on the communication cable or imperfect contact with the connector.
Data transfer rate of the slave does not coincide with that of the master. (See p.6)
The data bit, parity and stop bit of the master do not accord with those of the slave. (See p.26)
The instrument number (address) of the slave does not coincide with that of the command.
The instrument number (address) is duplicated in multiple slaves. (See p.6)
When communicating without using Shinko communication converter (IF-300-C5), make sure that the program is appropriate for the transmission timing. (See p.7)
Check if the setting value memory number of FCD-100 or FCR-100 is set to 1 when using Setting value digital transmission (option: SVTC) function (See p.4)

•

Problem: Though it is able to communicate, the response is 'NAK'.

Check the following
Check whether a non-existent command code has been sent or not. (See pp.13 to 20)
The setting command data goes outside the setting range of the slave. (Refer to the instruction manual for PC-900)
The controller cannot be set when a function such as AT is performing.
The operation mode is under the front keypad operation setting mode.

If you have any inquiries, please consult our agency or the shop where you purchased the unit.

10. ASCII code

b7	0	0	0	0	1	1	1	1
b6	0	0	1	1	0	0	1	1
b5	0	1	0	1	0	1	0	1

b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE (TC7)	SP	0	@	P	`	p
0	0	0	1	1	SOH (TC1)	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX (TC2)	DC2	”	2	B	R	b	r
0	0	1	1	3	ETX (TC3)	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT (TC4)	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ (TC5)	NAK (TC8)	%	5	E	U	e	u
0	1	1	0	6	ACK (TC6)	SYN (TC9)	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB (TC10)	’	7	G	W	g	w
1	0	0	0	8	BS (FEO)	CAN	(	8	H	X	h	x
1	0	0	1	9	HT (FE1)	EM	)	9	I	Y	i	y
1	0	1	0	A	LF (FE2)	SUB	*	:	J	Z	j	z
1	0	1	1	B	VT (FE3)	ESC	+	;	K	[	k	{
1	1	0	0	C	FF (FE4)	FS (IS4)	,	<	L	\	l	|
1	1	0	1	D	CR (FE5)	GS (IS4)	–	=	M	]	m	}
1	1	1	0	E	SO	RS (IS4)	.	>	N	^	n	¯
1	1	1	1	F	SI	US (IS4)	/	?	O	-	o	DEL

SHINKO TECHNOS CO.,LTD.
OVERSEAS DIVISION

Reg. Office : 1-2-48, Ina, Minoo, Osaka, Japan
Mail Address : P.O.Box 17, Minoo, Osaka, Japan
URL : http://www.shinko-technos.co.jp
E-mail : overseas@shinko-technos.co.jp
Tel : 81-72-721-2781
Fax: 81-72-724-1760

PC9CE2 2003.09