

**INSTRUCTION MANUAL
FOR
PC LINK UNIT
CLT-20S**

Shinko

PREFACE

Thank you for your purchase of our PC link unit **CLT-20S**.

This manual contains instructions for the mounting, functions, operations and notes when operating the **CLT-20S**.

For the confirmation of model and specifications, please read this manual carefully before starting operation.

To prevent accidents arising from the use of this unit, please ensure the operator using it receives this manual.


Notes

- This instrument should be used according to the specifications described in the manual.
If it is not used according to the specifications, it may malfunction or cause fire.
- Be sure to follow the warnings, cautions and notices. If not, it could cause serious injury or malfunction.
- Do not apply a commercial power source to the sensor connected to the input terminal nor allow the power source to come into contact with the sensor.
- Specifications of the CLT-20S and the contents of this instruction manual are subject to change without notice.
- Care has been taken to assure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform us or the shop where you purchased the unit.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- Shinko Technos is not responsible for any damages or secondary damages incurred as a result of using this manual, including any indirect damages.

SAFETY PRECAUTIONS

(Be sure to read these precautions before using our products.)

The safety precautions are classified into two categories: "Warning" and "Caution".

Depending on circumstances, procedures indicated by  Caution may be linked to serious results and make sure to follow the directions for usage.



Warning

Procedures which may lead to a dangerous condition and cause death or serious injury, if not carried out properly.



Caution

Procedures which may lead to a dangerous condition and cause superficial to medium injury or physical damage or may degrade or damage the product, if not carried out properly.

1. Installation precautions



Caution

This instrument is intended to be used under the following environmental conditions (IEC61010-1):
Overvoltage category II, Pollution degree 2

Mount the unit in a place with:

- (1) A minimum of dust, and an absence of corrosive gases
- (2) No flammable, explosive gases
- (3) No mechanical vibrations or shocks
- (4) No exposure to direct sunlight, an ambient temperature of 0 to 50°C (32 to 122°F) that does not change suddenly
- (5) An ambient non-condensing humidity of 35 to 85%RH
- (6) The instrument away from large capacity electromagnetic switches or cables through which large current is flowing
- (7) No water, oil or chemicals or where the vapors of these substances can come into direct contact with the unit

Note: Although the case of this instrument is made of flame-resistant resin, do not install this instrument near flammable material.

Avoid setting this instrument directly on flammable material.

2. Wiring precautions



Caution

- Do not leave wire chips in the instrument, because they could cause fire, malfunction or inconvenience.
- Insert the connecting cable into the designated connector securely to prevent malfunction.
- Connect the wire for AC power source with its exclusive terminal as described in this instruction manual. The CLT-20S will be damaged if the AC power source wire is connected to a different terminal.
- For the ground terminal of the CPT-20A, use 2mm² or greater of thick wire. However, avoid grounding in conjunction with the power line.
- Use the solderless terminal with an insulation sleeve that fits to the M3 screw when wiring the CLT-20S terminals.
- The terminal block of the CPT-20A and CCT-235 are designed to be wired from the left side. The lead wire must be inserted from the left side of the terminal, and fastened with the terminal screw.
- Tighten the terminal screw with the specified torque.
If excessive force is given to the screw when tightening, the screw or case may be damaged.
- Do not apply a commercial power source to the sensor connected to the input terminal nor allow the power source to come into contact with the sensor, as the input circuit may be burnt out.
- With the relay contact output type, externally use an auxiliary electromagnetic switch according to the capacity of the load to protect the built-in relay contact.
- To prevent the unit from harmful effects of unexpected level noise, it is recommended that a surge absorber be installed between the electromagnetic switch coils.
- This unit has neither built-in power switch nor fuse. Therefore, it is necessary to install them in the circuit near the external unit.
(Recommended fuse: Time-lag fuse, rated voltage 250V, rated current 3.15A)

3. Running and maintenance precautions



Warning

- Do not touch live terminals. It may cause electric shock or problems in operation.
- Be sure to turn the power supplied to the instrument OFF before cleaning the module or retightening the screws.

Doing this work while the power is on may result in an electric shock which could cause severe injury or death.

- Wipe the instrument using a soft dry cloth.
(If paint thinner is used for wiping, the instrument may be deformed or discolored.)

Revisions

The manual number is noted at the lower right of the back cover.

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1. Overview

1.1 Overview of CLT-20S

When the PC Link unit (CLT-20S) is applied to the C series linked with the Power source host link unit (CPT-20A), the C series and personal computer (PC) on the market can be linked via the CLT-20S, and C series data can be transmitted to and from the PC.

1.2 Units and structure of CLT-20S

(1) PC Link unit, CLT-20S

A link unit to connect the PC

(2) Power source host link unit, CPT-20A

A link unit to supply the power to the CCT-235 and CLT-20S, and to communicate with the host unit.

(3) 2-channel temperature control unit, CCT-235-2 □ / □

Independent temperature control unit with 2 channels

Both the input and output of the 2 channels need to be identical.

(4) Heating/cooling temperature control unit, CCT-235- □ / □, D □

Temperature control unit

Heating/cooling control can be carried out with 1 channel input.

(5) Base unit

CBT-205 : Base unit for mounting the CPT-20A, CCT-235 and CLT-20S.

One CPT-20A and one CLT-20S are required for 1 base unit.

A maximum of four CCT-235 units can be mounted.

CBT-210 : Base unit for mounting the CPT-20A, CCT-235 and CLT-20S.

One CPT-20A and one CLT-20S are required for 1 base unit.

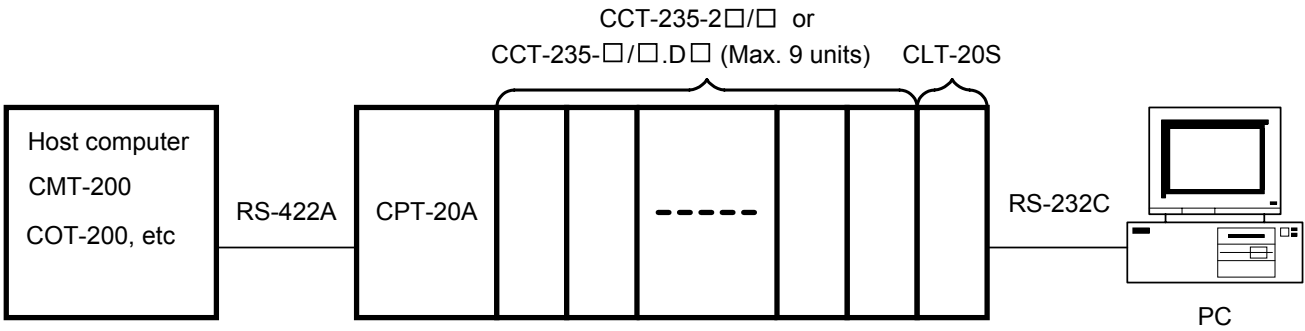
A maximum of nine CCT-235 units can be mounted.

Note:

- 2-channel temperature control unit and Heating/cooling temperature control unit can be used together.
- If the Monitoring software for the C series “SWM-CC001” (sold separately) is installed to the PC, the C series can be monitored without creating the communication program between the CLT-20S and the PC.

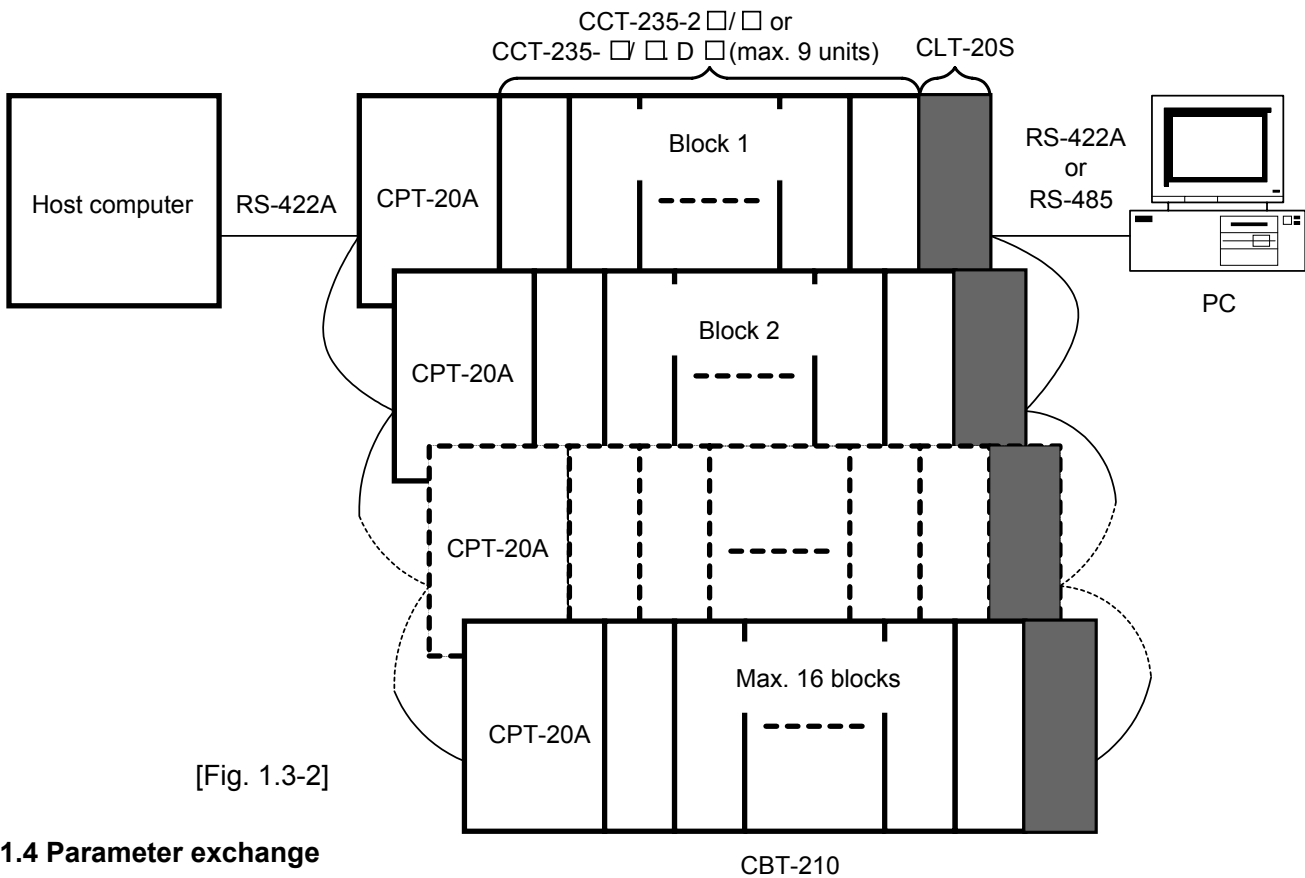
1.3 System configuration

- When one CLT-20S is connected to the PC



[Fig. 1.3-1] CBT-210

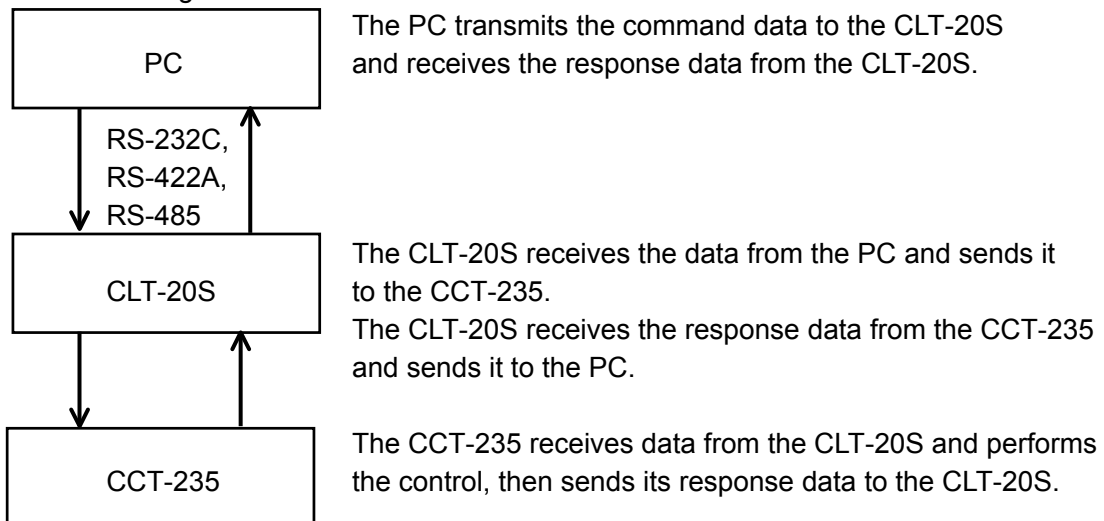
- When multiple CLT-20S (max. 16 units) are connected to the PC



[Fig. 1.3-2]

1.4 Parameter exchange

Parameter exchange is shown as follows.




2. Model names

2.1 Model names

CLT-20S: PC link unit

2.2 How to indicate the model nameplate



Warning

Turn the power supply to the instrument OFF before confirming the model nameplate. Working with the power switched ON may result in an Electric Shock which could cause severe injury or death.

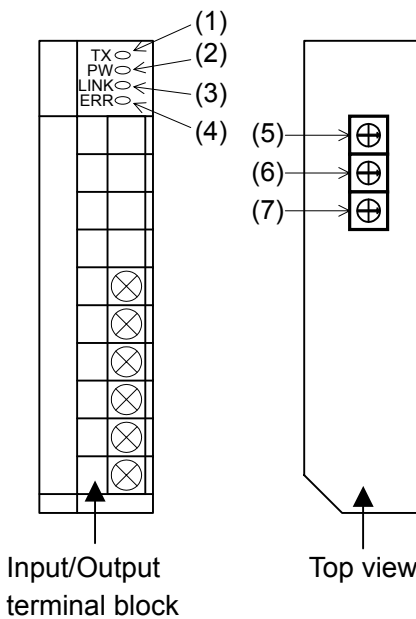
Model name labels are put on the case and inner assembly. See [Fig. 2.2-1].

[Example]

CLT-20S	Model name: CLT-20S
TC	Option: Terminal cover
No. x x x x x x	Instrument number (indicated only on the inner assembly.)

[Fig. 2.2-1]

3. Name and functions of the sections



[Fig. 3-1]

- (1) Communication indicator
Yellow LED (TX) lights up while communicating between the CCT-235 and CLT-20S.
- (2) Power indicator
Green LED (PW) lights up when the power to the instrument is supplied.
- (3) PC communication indicator
Yellow LED (LINK) lights up while communicating between the CLT-20S and the PC.
- (4) PC communication error indicator
Red LED (ERR) lights up when an error occurs during the PC communication.
- (5) Rotary switch for transfer rate setting
This sets the data transfer rate when communicating with the PC.
- (6) Rotary switch for instrument number setting
This sets the instrument number of this unit.
Setting range: 0 to F (Hexadecimal number)
- (7) Rotary switch for communication protocol setting
This sets the communication protocol of this unit.
Setting range: 0 to F (Hexadecimal number)

4. Setup



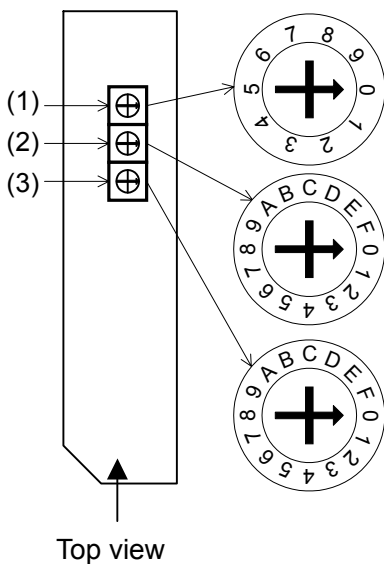
Warning

Turn the power supply to the instrument OFF before performing the setup. Working with the power switched ON may result in an Electric Shock which could cause severe injury or death.

Note: Set up each Rotary switch first before inserting the CLT-20S into the CBT-200 socket.

• **Switch setup**

Using a small slotted screwdriver or tweezers, set up the rotary switches of CLT-20S. See [Fig. 4-1].



[Fig. 4-1]

(1) Rotary switch for transfer rate setting

Rotary Sw. No.	0	1	2	3
Transfer rate	2400bps	4800bps	9600bps	19200bps

Note: Do not set the Rotary switch No. 4 to 9.

When connecting multiple CLT-20S, set the same transfer rate to all the CLT-20S.

(2) Rotary switch for unit number setting

This sets the instrument number of this unit. Setting range: 0 to F (Hexadecimal number)

Note: when connecting multiple CLT-20S, the unit number should not be duplicated. If duplicated, the communication with the PC cannot be carried out.

(3) Rotary switch for communication protocol setting

This sets the communication protocol of this unit.

Setting range: 0 to F (Hexadecimal number)

0: Shinko protocol

1: Modbus protocol

Note: Do not set the communication protocol to the range from 2 to F.

5. Mounting

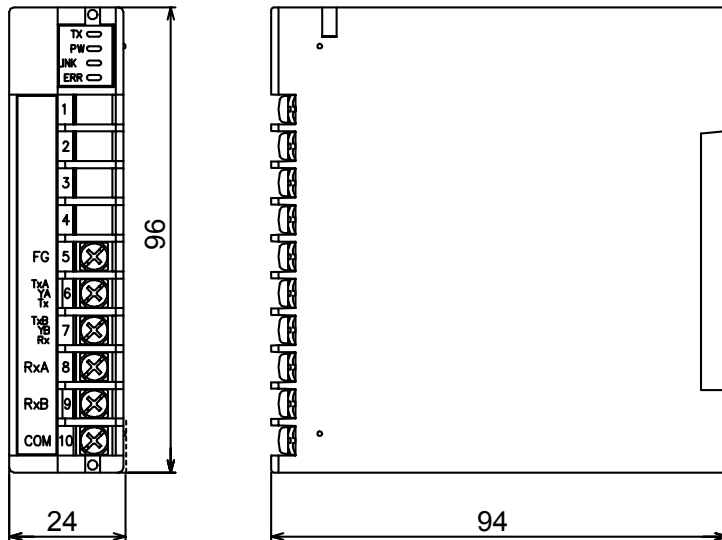
5.1 Site selection

This instrument is intended to be used under the following environmental conditions (IEC61010-1):
 Overvoltage category II, Pollution degree 2

Mount the unit in a place with:

- (1) A minimum of dust, and an absence of corrosive gases
- (2) No flammable, explosive gases
- (3) No mechanical vibrations or shocks
- (4) No exposure to direct sunlight, an ambient temperature of 0 to 50°C (32 to 122°F) that does not change suddenly
- (5) An ambient non-condensing humidity of 35 to 85%RH
- (6) The instrument away from large capacity electromagnetic switches or cables through which large current is flowing
- (7) No water, oil or chemicals or where the vapors of these substances can come into direct contact with the unit

5.2 External dimension drawing



[Fig. 5.2-1]

5.3 Mounting to the DIN rail (CBT-200)

Refer to the C series Instruction manual Section 4.2 “Mounting” for mounting the CLT-20S to the DIN rail.

5.4 Mounting to the CBT-200 (CLT-20S)

Mount the CLT-20S at the right end of the CBT-200 when mounting the CLT-20S to the CBT-200. Refer to the C series Instruction manual Section 4.2 “Mounting” for mounting the CLT-20S to the CBT-200.

6. Wiring connection

6.1 Terminal arrangement



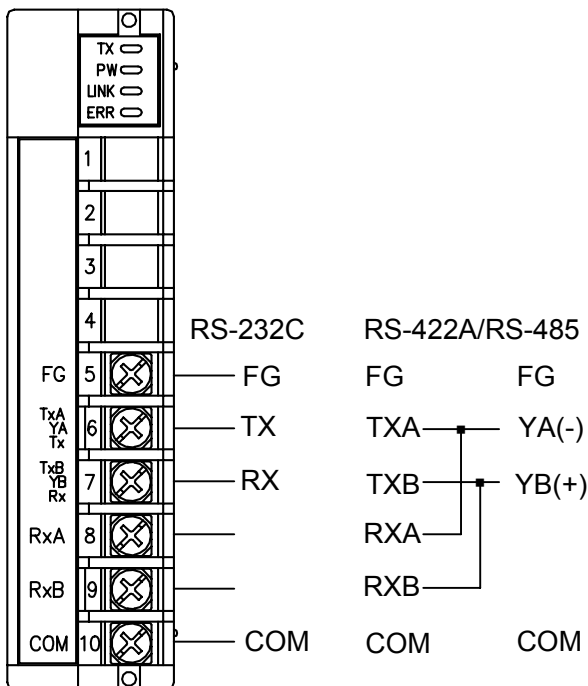
Warning

Turn the power supply to the instrument OFF before wiring or checking.
 Working with the power switched ON may result in an Electric Shock which could cause severe injury or death.
 Moreover, the instrument must be grounded before the power supply to the instrument is turned on.



Caution

- Do not leave wire chips in the instrument, because they could cause fire, malfunction or inconvenience.
- Use the solderless terminal with an insulation sleeve that fits to the M3 screw when wiring the CLT-20S terminal.
- The terminal block of the CLT-20S is designed to be wired from the left side. The lead wire must be inserted from the left side of the terminal, and fastened with the terminal screw.
- Tighten the terminal screw with the specified torque.
 If excessive force is given to the screw when tightening, the screw or case may be damaged.



[Fig. 6.1-1]

6.2 Wiring connection example



Caution

- As to the cable, connector and terminals between the PC and CLT-20S, use the designated products as noted in this manual. (See page 16.)
- For the ground terminal of the CLT-20S, use a thick wire (1.25 to 2.0mm²).

• Terminal arrangement of the connector (PC)

D-sub 9-pin connector

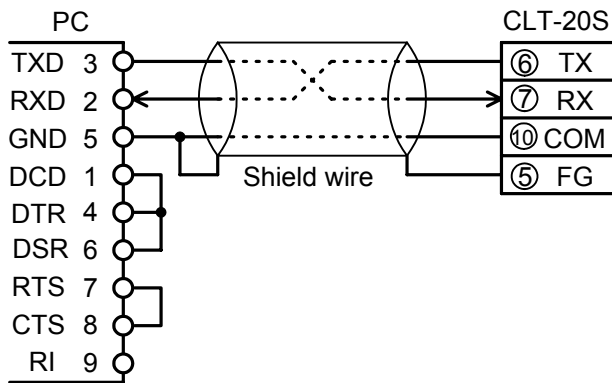
Pin No.	Code
1	DCD
2	RXD
3	TXD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

D-sub 25-pin connector

Pin No.	Code
1	FG
2	TXD
3	RXD
4	RTS
5	CTS
6	DSR
7	GND
8	DCD
20	DTR
22	RI

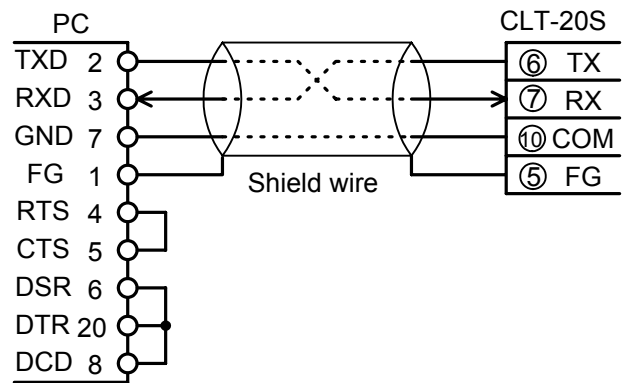
(1) RS-232C

[D-sub 9-pin connector]



[Fig. 6.2-1]

[D-sub 25-pin connector]

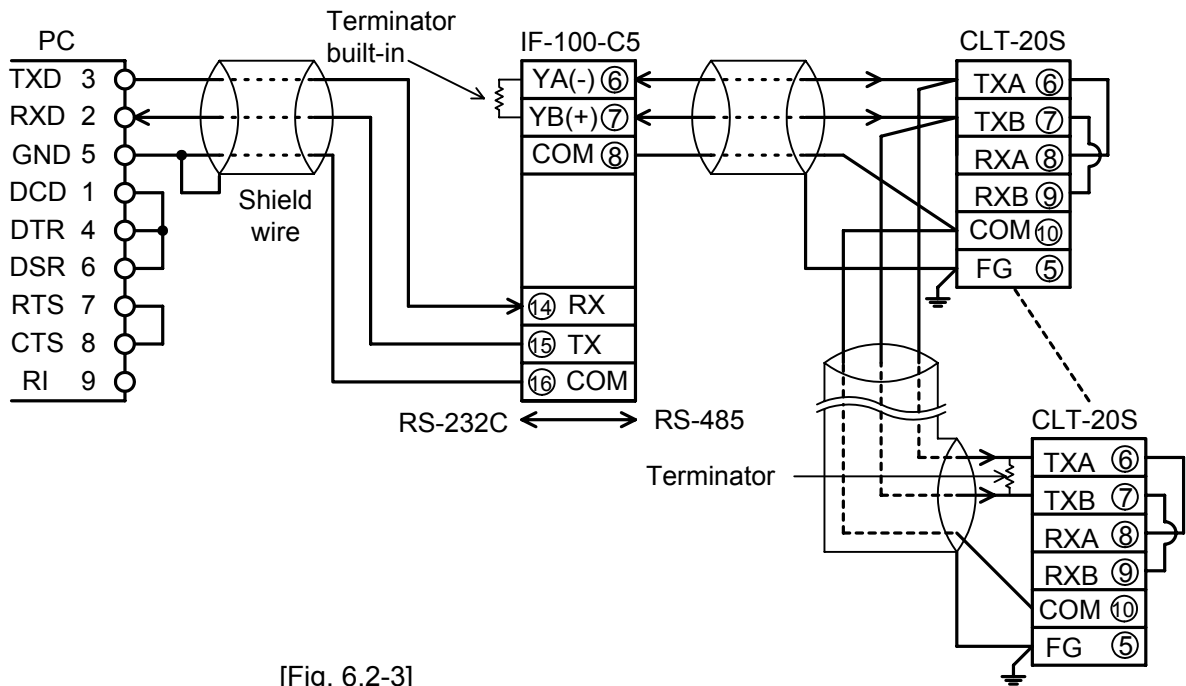


[Fig. 6.2-2]

(2) RS-485

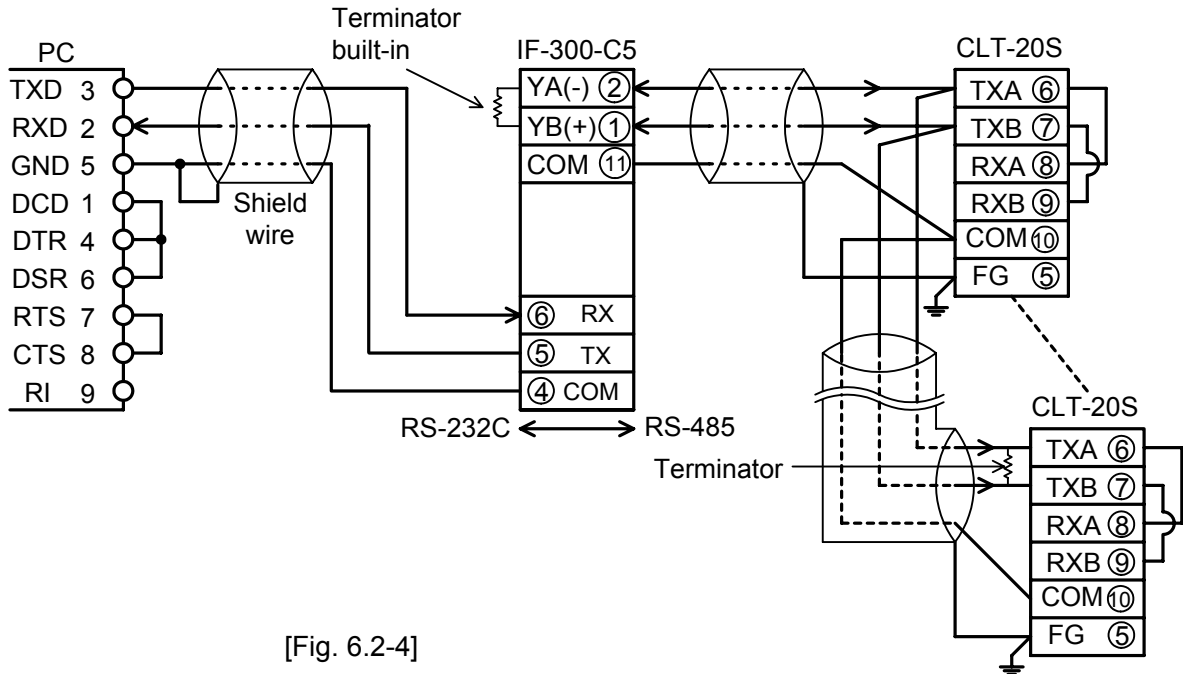
[D-sub 9-pin connector]

- When using communication converter IF-100-C5 (only available for Shinko protocol)



[Fig. 6.2-3]

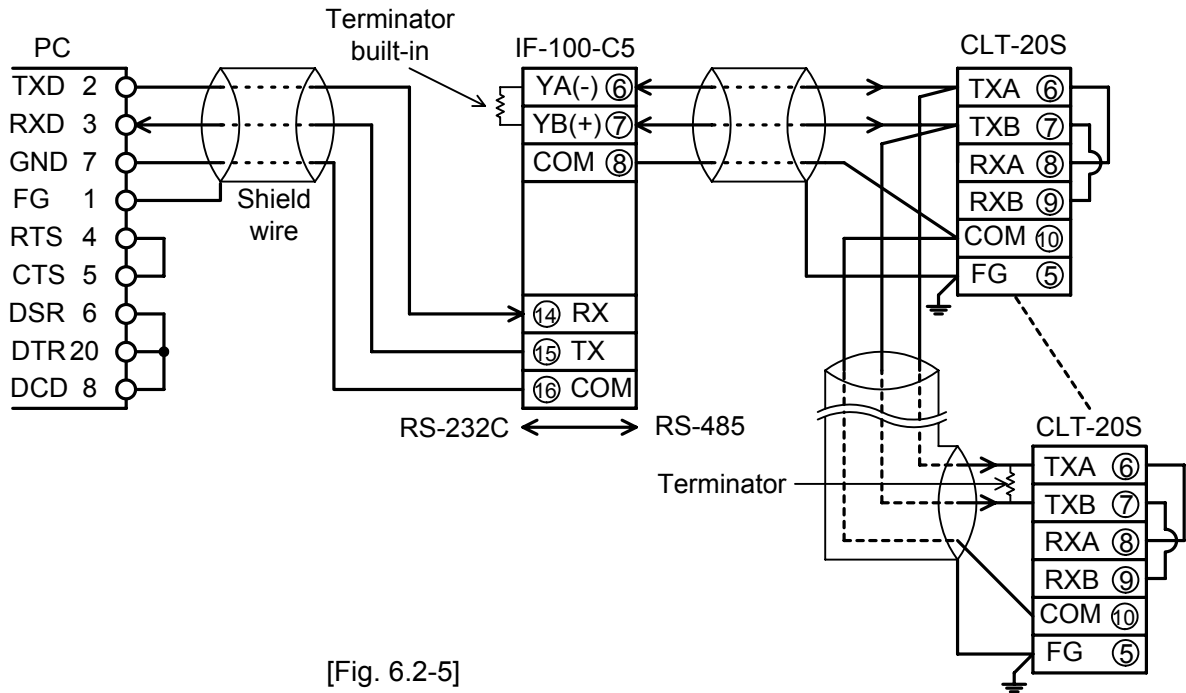
- When using communication converter IF-300-C5 (only available for Shinko protocol)



[Fig. 6.2-4]

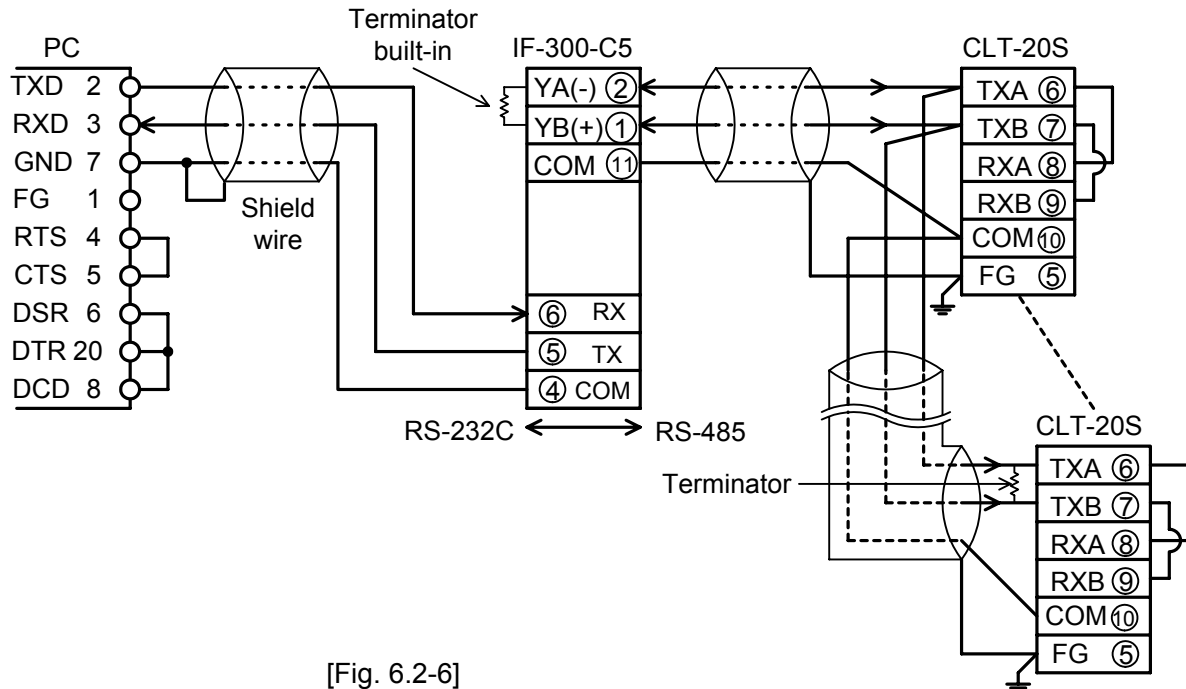
[D-sub 25-pin connector]

- When using communication converter IF-100-C5 (only available for Shinko protocol)



[Fig. 6.2-5]

- When using communication converter IF-300-C5 (only available for Shinko protocol)



[Fig. 6.2-6]

(3) RS-422A

When wiring, refer to the manual of the communication converter procured in the market.

Shield wire

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

If both sides of the shield wire are connected to the FG or GND terminal, the closed circuit is made between the shield wire and ground. As a result of this, the current will flow in the shield wire and noise may easily be caused by the current.

The FG or GND ground terminal must be grounded.

Terminator (Terminal resistor)

The longer the communication line becomes, the less the communication is performed because the transfer waveform deteriorates due to the echo.

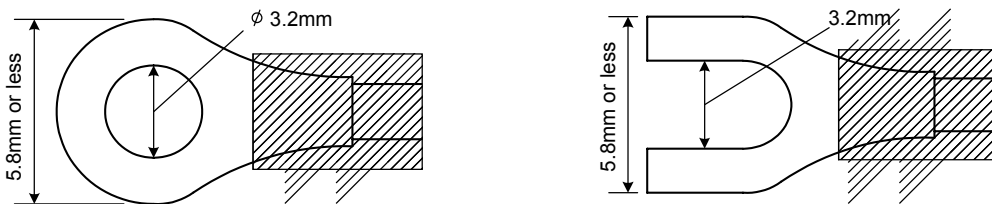
To prevent this, connect a terminator.

The terminator should be connected at the physical terminal of the communication cable.

Communication converter [IF-100-C5] or [IF-300-C5] is sold separately.

● **Solderless terminal**

Use a solderless terminal with an insulation sleeve that fits to the M3 screw as shown below.



[Fig. 6.2-7]

Solderless terminal	Manufacturer	Model name	Tightening torque
Y type	Nichifu Terminal Industries CO.,LTD.	1.25-Y3	0.6N·m Max. 1.0N·m
	Japan Solderless Terminal MFG CO.,LTD.	VD1.25-B3A	
Round type	Nichifu Terminal Industries CO.,LTD.	1.25-3	
	Japan Solderless Terminal MFG CO.,LTD.	V1.25-3	

Recommended cable

Cable	Model name	Manufacturer
Cable	OTSC-2PVB-7/0.32TA	Onamba Co.,Ltd.

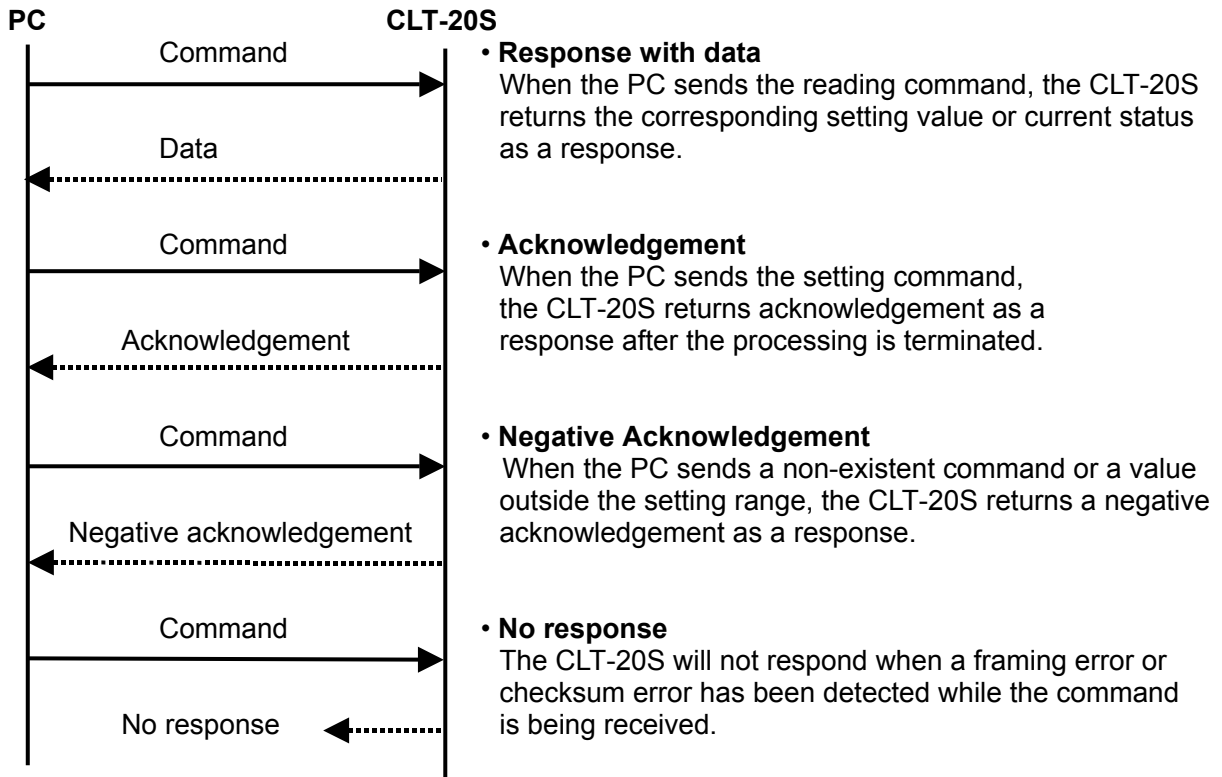
Recommended D sub connector

Connector and its cover	Model name	Manufacturer
D-sub 9-pin connector	DE-9SF-N	Japan Aviation Electronics Industry Limited
D-sub 9-pin connector cover	DE-C1-J6	Japan Aviation Electronics Industry Limited
D-sub 25-pin connector	DB-25PFT-N	Japan Aviation Electronics Industry Limited
D-sub 25-pin connector cover	DB-C2-J9	Japan Aviation Electronics Industry Limited

7. Communication procedure

● Between a host computer and the CLT-20S

Communications between the PC and the CLT-20S are started by transmitting the command from the PC, and terminated by receiving the response from the CLT-20S.



● Communication timing of RS-422A and RS-485

• CLT-20S side

When the CLT-20S starts transmission to RS-422A/RS-485 communication line, the CLT-20S is arranged so as to provide 1 character transmission period or more of idle status (mark status) before sending the response to ensure the synchronization on the receiving side.

The CLT-20S is arranged so as to disconnect the transmitter from the communication line within a period of 1 character transmission after sending the response.

• PC side (Notice on programming)

Set the program so that the PC can provide 1 character transmission period or more of idle status (mark status) before sending the command to ensure the synchronization on the receiving side when the PC starts the transmission to RS-422A/RS-485 communication line.

Set the program so that the PC can cut the transmitter off from the communication line within a period of 1 character transmission after sending the command in preparation for reception of the response from the CLT-20S.

To avoid the collision of transmissions between the PC and the CLT-20S, send the next command after checking that the PC received the response.

Note:

When the PC communicates to the CLT-20S with Shinko protocol through the line converter (IF-100-C5, IF-300-C5, sold separately), it is not required to manage the transmission timing described above because the converter takes the timing interpreting the protocol automatically.

8. Shinko protocol

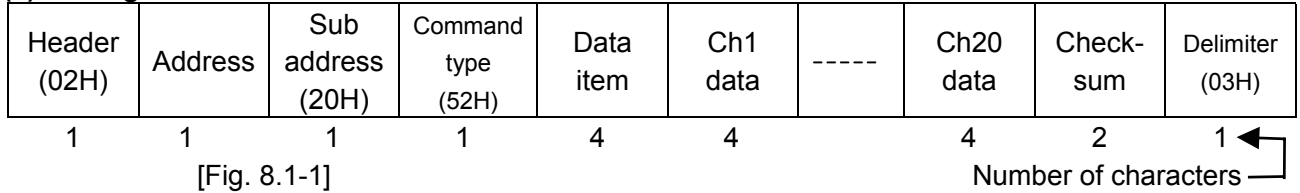
8.1 Command structure

All commands are composed of ASCII codes.

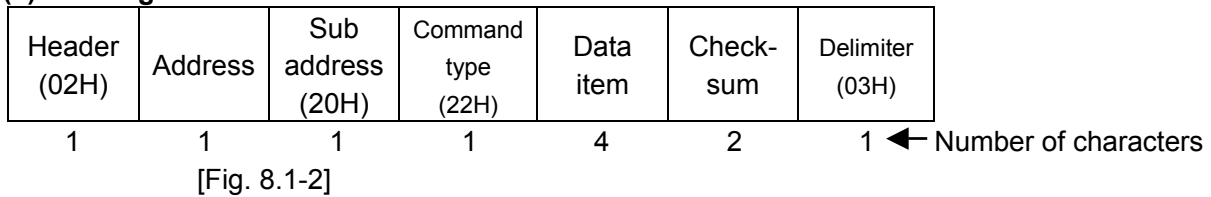
The data (setting value, decimal) is represented with hexadecimal number, and ASCII code is used.

The negative number is represented with 2's complement.

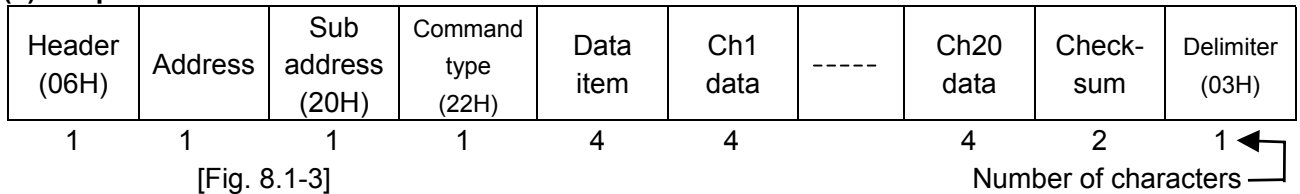
(1) Setting command



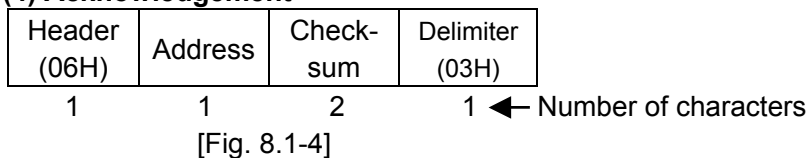
(2) Reading command



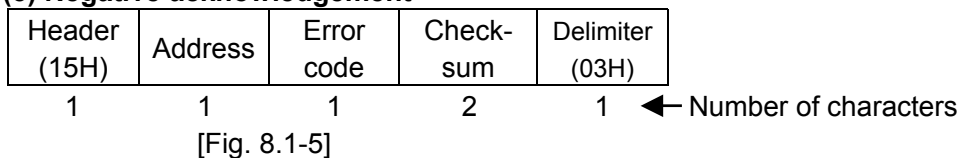
(3) Response with data



(4) Acknowledgement



(5) Negative acknowledgement



Header : Control code to represent the beginning of the command or the response.
ASCII codes are used.

Setting command, Reading command : 02H fixed

Response with data, Acknowledgement: 06H fixed

Negative acknowledgement : 15H fixed

Address (Instrument number):

Number by which the PC identifies each CLT-20S.

20H to 2FH [20H is added to the instrument number 0 to 15 (00H to 0FH)]

[The numbers are used by giving 20H of bias, because 00H to 0FH are used for control code.]

Sub address : 20H fixed

Command type : Code to identify the Setting command (52H) or Reading command (22H).

Data item : Data classification of the command object.

It is made up of 4 digits of hexadecimal number.

See the Command table. (Page.21 to 24)

Data : The contents of the data (setting value) depends on the setting command.

It is made up of 4 digits of hexadecimal number.

See the Command table. (Page. 21 to 24)

Checksum : 2-character of data to detect a communication error

- Delimiter** : Control code to represent the ending of the command.
03H fixed
- Error code** : Represents an error type.
It is made up of 1 digit of hexadecimal number.
 - 0 (30H) Unknown error
 - 1 (31H) Non existent command
 - 2 (32H) Not used
 - 3 (33H) Setting outside the setting range
 - 4 (34H) Status unable to set (during Auto-tuning)

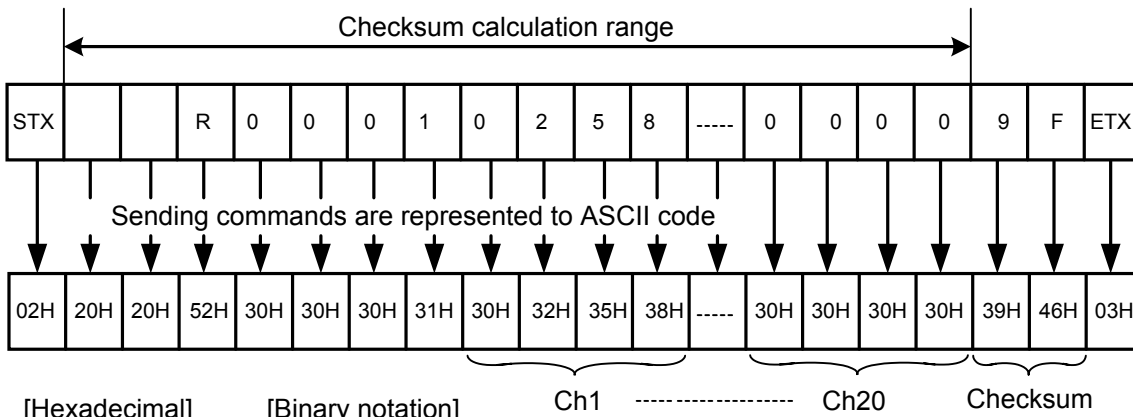
8.2 Checksum calculation

Checksum is used to detect receiving errors in the command or data.
Set the program for the PC side as well to calculate the checksum of the response data from the CLT-20S so that the communication error can be checked.

The ASCII code (hexadecimal) which corresponds to the characters ranging 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 number, that is, ASCII code for the checksum.

Checksum calculation example is shown as follows.

Main setting value: 600°C (0258H) for channels 1 to 18
However, data for the 20 channels is transmitted. (0 is sent to all data of Ch19 and Ch20.)
Address (instrument number): 0 (20H)



[Hexadecimal]	[Binary notation]
20H	0010 0000
20H	0010 0000
52H	0101 0010
30H	0011 0000
.	.
.	.
.	.
30H	0011 0000
30H	0011 0000
30H	0011 0000
+ 30H	0011 0000

1's complements:
Make each bit of binary 0 and 1 reverse.
2's complements:
Add 1 to 1's complements.

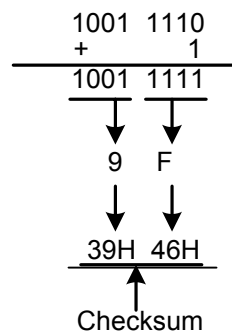
1 0001 0110 0001

(1's complements)

(2's complements)

(Hexadecimal)

(ASCII code)



8.3 Contents of the command

Notes on the setting command and reading command

- When the CLT-20S is applied to the C series, 9 units (18 channels) of the CCT-235 can be connected, and data for 20 channels can be transmitted. However, for Ch19 and Ch20 data, 0 is sent.
- Although options are not applied, setting the items for the options is possible by the setting command, however, they will not function.
- When connecting multiple CLT-20S, the address (instrument number) must not be duplicated.
- The instrument number and transfer rate of the CLT-20S cannot be set by the communication, but can be set by rotary switch.
- For the CCT-235 with Heating/cooling specification, only 1 channel is used, which means no data can be set to Ch2

With the reading command, control output MV (cooling output MV) reading, and b0 (Main output in Current status 1 and 2) can only be read among Ch2 data.

For other reading data, 0 is returned as a data.

- If power failure occurs during the communication, the data during communication cannot be guaranteed.

Setting command

- For the settable range of the data items, see the C series manual Section “3.8 Specifications”.
- For the communication command, see the “Command table” (pages 21 to 24).
- All commands are composed of ASCII code.
- Data (setting value, decimal) is converted to hexadecimal figures and ASCII codes are used.

The negative number is represented with 2's complement.

When data (setting value) has a decimal point, make the value 10 times higher than the setting value and convert to the hexadecimal figures to input.

	Decimal	Hexadecimal
[Example 1] Main setting value: 1000°C		
In the case of positive (+) number, convert the number to the hexadecimal number.	: 1000	→ 03E8H

[Example 2] Main setting value: -10°C		
In the case of negative (-) number, the number is represented with 2's complements, then converted to the hexadecimal figures.	: -10	→ FFF6H

[Example 3] Main control output proportional band: 2.5%		
When the number has a decimal point, ignore the decimal point and convert to the hexadecimal figures.	: 25	→ 0019H

Reading command

- For the communication command, see the “Command table” (pages 21 to 24).
 - All commands are composed of ASCII code.
 - Data (setting value, decimal) is converted to hexadecimal figures and ASCII code are used.
- The negative number is represented with 2's complement.
- When data (setting value) range has a decimal point, the response is returned as a whole number without a decimal point.

8.4 Command table (Shinko protocol)

Command Type	Data Item	Data
22H/52H	0001H: Main setting value (SV)	Setting value
22H/52H	0002H: Main proportional band	Setting value
22H/52H	0003H: Integral time	Setting value
22H/52H	0004H: Derivative time	Setting value
22H/52H	0005H: Alarm 1 (High limit alarm)	Setting value
22H/52H	0006H: Alarm 2 (Low limit alarm)	Setting value
22H/52H	0007H: Main output proportional cycle	Setting value
22H/52H	0008H: Heater burnout alarm	Setting value
22H/52H	0009H: Control action Perform/Stop	0: Control Stop 1: Control Perform
22H/52H	000AH: Auto-tuning Perform/ Cancel	0: AT Cancel 1: AT Perform
22H/52H	000BH: Alarm 1 (High limit) hysteresis	Setting value
22H/52H	000CH: Alarm 2 (Low limit) hysteresis	Setting value
22H/52H	000DH: Control output ON/OFF action hysteresis	Setting value
22H/52H	000EH: Control output high limit	Setting value
22H/52H	000FH: Control output low limit	Setting value
22H/52H	0010H: PV (input) filter time constant	Setting value
22H/52H	0011H: Temperature unit	0: °C 1: °F
22H/52H	0012H: Control action	0: Heating (Reverse action) 1: Cooling (Direct action)
22H/52H	0013H: Alarm 1 action	0: No alarm action 1: High limit alarm 2: High limit with standby 3: Low limit alarm 4: Low limit with standby 5: High/Low limits alarm 6: High/Low limits alarm with standby 7: H/L limit range alarm 8: H/L limit range w/standby 9: Process high alarm 10: Process high alarm with standby 11: Process low alarm 12: Process low alarm with standby
22H/52H	0014H: Alarm 2 action	The same as Alarm 1
22H/52H	0015H: Loop break alarm 1 action span	Setting value
22H/52H	0016H: Loop break alarm 1 action time	Setting value
22H/52H	0017H: Anti-reset windup	Setting value
22H/52H	0018H: PD (Manual) reset	Setting value
22H/52H	0019H: Sensor correction	Setting value
22H/52H	001AH: Loop break alarm 2 action span	Setting value
22H/52H	001BH: Loop break alarm 2 action time	Setting value
22H/52H	001CH: Cooling proportional band	Setting value
22H/52H	001DH: Cooling proportional cycle	Setting value
22H/52H	001EH: Overlap band/Dead band	Setting value
22H/52H	001FH: Cooling action mode selection	0: Air cooling 1: Oil cooling 2: Water cooling
22H/52H	0020H: Cooling output ON/OFF action hysteresis	Setting value

52H	0040H: Data initialization Perform/Cancel	0: Cancel 1: Perform (*1)
22H	0080H: Current PV (input value) reading	Current PV
22H	0081H: Current MV (control output manipulated variable) reading	Current MV
22H	0082H: Heater current (ampere) value reading	Heater current (ampere) value when control output is ON.
22H	0083H: Current status 1 reading	<p><u>0000</u> <u>0000</u> <u>0000</u> <u>0000</u> b^{15} to b^0</p> <p>b0 : Main output 0: OFF 1: ON</p> <p>b1 : Alarm 1 (High limit) 0: OFF 1: ON</p> <p>b2 : Alarm 2 (Low limit) 0: OFF 1: ON</p> <p>b3 : Heater burnout alarm 0: OFF 1: ON</p> <p>b4 : Over scale 0: Normal 1: Over</p> <p>b5 : Under scale 0: Normal 1: Under</p> <p>b6 : Ignored</p> <p>b7 : Auto-tuning 0: Cancel 1: Perform</p> <p>b8 : Initial communication 0: Communicated 1: Not communicated</p> <p>b9 : Control action 0: Heating (Reverse) 1: Cooling (Direct)</p> <p>b10: Control action status 0: Stop 1: Perform</p> <p>b11: Heater burnout alarm applied or not 0: Not applied 1: Applied</p> <p>b12: Data update request 0: Not requested 1: Requested (*2)</p> <p>b13: Loop break alarm 1 0: OFF 1: ON</p> <p>b14: Temperature 0: Normal 1: Abnormal (*3)</p> <p>b15: Instrument 0: Normal 1: Abnormal (*4)</p>

22H	0084H: Current status 2 reading	<div style="display: flex; justify-content: space-between; align-items: center;"> <u>0000</u> b¹⁵ to <u>0000</u> b⁰ </div> <p>b0 : Main output 0: OFF 1: ON</p> <p>b1 : Control action status 0: Stop 1: Perform</p> <p>b2 : Alarm 1 (High limit) 0: OFF 1: ON</p> <p>b3 : Alarm 2 (Low limit) 0: OFF 1: ON</p> <p>b4 : Over scale 0: Normal 1: Over</p> <p>b5 : Heater burnout alarm 0: OFF 1: ON</p> <p>b6 : Auto-tuning 0: Cancel 1: Perform</p> <p>b7 : Under scale 0: Normal 1: Under</p> <p>b8 : Loop break alarm 2 0: OFF 1: ON</p> <p>b9 : Temperature 0: Normal 1: Abnormal (*3)</p> <p>b10 to b15: Ignored</p>
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- (*1) When initializing the data, set the odd number channel of the unit (CCT-235) to be initialized to "0001". The data of the unit (CCT-235) to be set to "0001" will be initialized.
- (*2) When the setting value of the CCT-235 is changed via CPT-20A, bit12 [Data update request in Current status 1 reading] becomes 1 (Requested).
 Finding this status, the PC starts to read all setting values of the CLT-20S.
 After all data of the setting items are read, the CLT-20S sets bit12 [Data update request in Current status 1 reading] to 0 (Not requested).
- (*3) Bit14 [Temperature in Current status 1 reading] and bit9 [Temperature in Current status 2 reading] become 1 (Abnormal) on the condition that:
 $SV + 20^{\circ}C < PV$ and $PV > 80^{\circ}C$
 After that, if the PV falls as much as $5^{\circ}C$, they become 0 (Normal).
- (*4) If the CLT-20S cannot communicate with the CCT-235, bit15 [Instrument in Current status 1 reading] becomes 1 (Abnormal).
 If the instrument is abnormal, the CLT-20S sets other data to the initial value (0) and returns it to the PC.

Command Type	Data Item	Data
22H	00A0H: CPU version number reading	CPU version number of each CCT-235 is read from the channel of odd number (1, 3, 5...).
22H	00A1H: Instrument status reading	<p>The sensor range of each CCT-235 is read from the channel of odd number (1, 3, 5...).</p> <p>0: K -200 to 1370°C, -320 to 2500°F 1: J -200 to 1000°C, -320 to 1800°F 2: R 0 to 1760°C, 0 to 3200°F 3: B 0 to 1820°C, 0 to 3300°F 4: PL-II 0 to 1390°C, 0 to 2500°F 5: N 0 to 1300°C, 0 to 2300°F 6: K 0.0 to 600.0°C, 0.0 to 999.9°F 7: J 0.0 to 600.0°C, 0.0 to 999.9°F 8: Pt100 -199.9 to 850.0°C, -199.9 to 999.9°F 9: JPt100 -199.9 to 500.0°C, -199.9 to 900.0°F</p> <p>10: Vdc 0 to 10000 (Output OFF when input burnout)</p> <p>11: Adc 0 to 10000 (Output OFF when input burnout)</p> <p>12: Vdc 0 to 10000 (Output ON when input burnout)</p> <p>13: Adc 0 to 10000 (Output ON when input burnout)</p> <p>The option and output status of each CCT-235 are read from the channel of even number (2, 4, 6...).</p> <p>b0: Heater burnout alarm 0: Not applied 1: Applied</p> <p>b1: Heater burnout alarm rating 0: 20A 1: 50A</p> <p>b2: Ch1 control output (Current) b3: Ch1 control output (Relay contact) b4: Ch1 control output (Non-contact voltage) b5: Ch2 control output (Current) b6: Ch2 control output (Relay contact) b7: Ch2 control output (Non-contact voltage) b8: Ignored b9: Ignored</p> <p>b10: Cooling control output function 0: Not applied 1: Applied</p> <p>b11 to b15: Ignored</p>

9. Modbus protocol

9.1 Message structure

Modbus protocol has 2 transmission modes (ASCII mode and RTU mode).

The CLT-20S (slave) works in ASCII mode, and therefore all commands are composed of ASCII code.

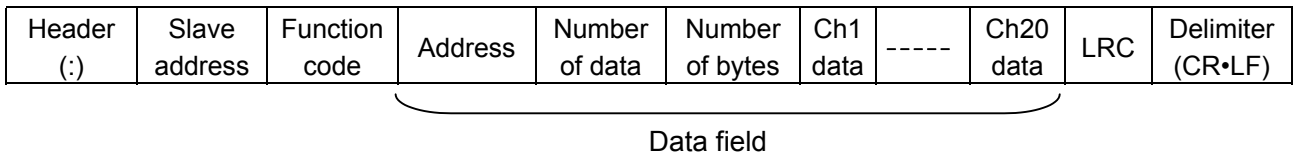
The data (setting value, decimal) is converted to the hexadecimal number and ASCII code is used.

The negative number is represented with 2's complement.

In ASCII mode, messages start with a colon (:) character (3AH) and ends with CR (carriage return,0DH) + LF (linefeed, 0AH).

An interval between characters is 1 second. If a greater interval occurs, the receiving device assumes an error has occurred.

A typical message frame is shown below [Fig. 9.1-1].



[Fig. 9.1-1]

9.2 Slave address

Slave address (instrument number) is 0 to 15 and is represented with 2 characters of ASCII code.

Slave address (instrument number) can be set by the rotary switch in the range of 0 to 15.

Master designates a slave by placing the slave address in the message.

When the slave is responding, the slave places its own address in the response message and informs the master which slave is responding at that time.

Since the slave is not available for the broadcast address, instrument number 0 slave receives the message and returns the response message.

9.3 Function code

Function code tells the slave what kind of action to perform and is represented with two ASCII characters.

Also when the master sends the message to the slave, the function code commands the slave to undertake the following action types.

Function code	Contents
03 (03H)	Reading the setting value and status of the slave (Max. 20 data can be read at a time)
16 (16H)	Setting to the slave (Only 1 data can be written.)

When the slave responds to the master, the function code is used to discern whether the response is normal or if any error is occurred. When the response is normal, the slave simply echoes the original function code.

When the response is abnormal, a value of 1 is added to the most significant bit of the function code and is returned as a response. At this time, the slave informs the master of the error cause by adding an error code to the response message.

Error code	Contents of the error
0 (00H)	Reserve (Not used)
1 (01H)	Illegal function (non-existent function)
2 (02H)	Illegal data address (non-existent data address)

9.4 Data field

Data field includes slave address, the number of data, the number of bytes as well as data.

The slave address, the number of data and data are represented with four ASCII characters (within the range of -32768 to 32767).

The number of bytes is represented with two ASCII characters.

The request from the master is composed of the slave address, the number of data, the number of bytes and data.

The response from the slave is composed of data requested by the master.

The message data sent from the master to the slave contains additional information which the slave must use to take the action defined by the function code.

9.5 Error check

Error check is represented with the two ASCII characters.

Error check characters are the result of a Longitudinal Redundancy Check (LRC) calculation that is performed on the message which starts with (:) and ends with (CR•LF).

The LRC characters are appended to the message as the last field preceding the CR•LF characters.

Error checking methods

LRC is applied to the entire message.

Both the character check and message frame check are generated in the master and applied to the message contents before transmission. (The slave checks each character and the entire message frame during receipt.)

The master is configured by the user to wait for a predetermined timeout interval before aborting the transaction. This interval is set to be long enough for any slave to respond normally. If the slave detects a transmission error, the message will not be acted upon. The slave will not respond to the master. (After time passes, the master handles the error.)

A message addressed to a non-existent slave device will also cause a timeout.

LRC check

The LRC character checks the message contents, exclusive of the beginning colon and terminating CR•LF characters.

The LRC character is 1 byte, containing an 8-bit binary value.

The LRC value is calculated by the slave, which appends the LRC to the message.

The slave calculates an LRC during receipt of the message, and compares the calculated value to the actual value it received in the LRC field. If the two values are not equal, an error results.

The LRC is calculated by adding together successive 8-bit bytes of the message, discarding any carries, and then two's complementing the result, excluding the beginning colon character and terminating CR•LF characters.

9.6 Transmission message example

(1) Setting value and status reading (instrument number 1, reading of main setting value of all channels)

Message (request) from the master

Header (:)	Slave address (01H)	Function code (03H)	Address (0000H)	Number of data (0014H)	LRC (B7H)	Delimiter (CR•LF)
1	2	2	4	4	2	2 ← Number of characters

Normal message (response) from the slave

Header (:)	Slave address (01H)	Function code (03H)	Number of response bytes (28H)	Ch1 data (0064H)	-----	Ch20 data (0000H)	LRC (1EH)	Delimiter (CR•LF)
1	2	2	2	4		4	2	2 ← Number of characters

This message is an example of main setting value 100 (0064H) reading from Ch1 to Ch20. However, 0 (0000H) is read as the main setting value for Ch19 and Ch20. The slave address, function code, the number of data, etc are represented with a hexadecimal number and placed in the message one character at a time.

One channel has 16 bits of data, therefore there are 2 response bytes. One character of ASCII is expressed by the message which consists of 4 bits, therefore 4 times the amount of characters are needed.

Error message (response) from the slave

Header (:)	Slave address (01H)	Function code (83H)	Error code (02H)	LRC (D2H)	Delimiter (CR•LF)
1	2	2	2	2	2 ← Number of characters

This message is an example occurred when the address of the item to be read is mistaken. The error contents is returned to the master by adding 1 to the most significant bit of the function code.

(2) Setting to the slave [instrument number 1, when the main setting value for all channels is set to 100 (0064H)]

Message (request) from the master

Header (:)	Slave address (01H)	Function code (10H)	Address (0000H)	Number of data (0014H)	Number of bytes (28H)	Ch1 data (0064H)	---	Ch20 data (0000H)	LRC (9BH)	Delimiter (CR•LF)
1	2	2	4	4	2	4		4	2	2 ← Number of characters

Normal message (response) of the slave

Header (:)	Slave address (01H)	Function code (10H)	Address (0000H)	Number of data (0014H)	LRC (B9H)	Delimiter (CR•LF)
1	2	2	4	4	2	2 ← Number of characters

This message is an example when set the main setting value to 100 (0064H) for instrument number 1. The slave address, function code, the number of data, etc are represented with a hexadecimal number and placed in the message one character at a time.

Error message (response) of the slave

Header (:)	Slave address (01H)	Function code (90H)	Exception code (02H)	LRC (D4H)	Delimiter (CR•LF)
1	2	2	2	2	2 ← Number of characters

This message is an example occurred when the address of the item to be set is mistaken. The error contents are returned to the master by adding 1 to the most significant bit of the function code.

9.7 Command table (Modbus protocol)

R: Read, W: Write (setting)

Address	Contents	Attribute	Data
0000H to 0013H	Main setting value (SV)	R/W	Setting value
0014H to 0027H	Main proportional band	R/W	Setting value
0028H to 003BH	Integral time	R/W	Setting value
003CH to 004FH	Derivative time	R/W	Setting value
0050H to 0063H	Alarm 1 (High limit)	R/W	Setting value
0064H to 0077H	Alarm 2 (Low limit)	R/W	Setting value
0078 H to 008BH	Main output proportional cycle	R/W	Setting value
008CH to 009FH	Heater burnout alarm	R/W	Setting value
00A0H to 00B3H	Control action Perform/Stop	R/W	0: Stop 1: Perform
00B4H to 00C7H	Auto-tuning Perform/Cancel	R/W	0: Cancel 1: Perform
00C8H to 00DBH	Alarm 1 (High limit) hysteresis	R/W	Setting value
00DCH to 00EFH	Alarm 2 (Low limit) hysteresis	R/W	Setting value
00F0H to 0103H	Control output ON/OFF action hysteresis	R/W	Setting value
0104H to 0117H	Control output high limit	R/W	Setting value
0118H to 012BH	Control output low limit	R/W	Setting value
012CH to 013FH	PV filter time constant	R/W	Setting value
0140H to 0153H	Temperature unit	R/W	0: °C 1: °F
0154H to 0167H	Control action	R/W	0: Heating (Reverse action) 1: Perform (Direct action)
0168H to 017BH	Alarm 1 action selection	R/W	0: No alarm action 1: High limit alarm 2: High limit alarm w/standby 3: Low limit alarm 4: Low limit alarm w/standby 5: High Low limits alarm 6: High Low limits w/standby 7: High Low limit range alarm 8: High Low limit range w/standby 9: Process high alarm 10: Process high alarm with standby 11: Process low alarm 12: Process low alarm with standby
017CH to 018FH	Alarm 2 action selection	R/W	The same as Alarm 1
0190H to 01A3H	Loop break alarm 1 action span	R/W	Setting value
01A4H to 01B7H	Loop break alarm 1 action time	R/W	Setting value
01B8H to 01CBH	Anti-reset windup	R/W	Setting value
01CCH to 01DFH	PD (manual) reset	R/W	Setting value
01E0H to 01F3H	Sensor correction	R/W	Setting value
01F4H to 0207H	Loop break alarm 2 action span	R/W	Setting value
0208H to 021BH	Loop break alarm 2 action time	R/W	Setting value
021CH to 022FH	Cooling proportional band	R/W	Setting value
0230H to 0243H	Cooling proportional cycle	R/W	Setting value
0244H to 0257H	Overlap band/Dead band	R/W	Setting value
0258H to 026BH	Cooling action mode selection	R/W	0: Air cooling 1: Oil cooling 2: Water cooling
026CH to 027FH	Cooling output ON/OFF action hysteresis	R/W	Setting value

0280H to 0293H	Data initialization Perform/Cancel	W	0: Cancel 1: Perform (*1)
0294H to 02A7H	Not used		
02A8H to 02BBH	Not used		
02BCH to 02CFH	Current PV (input value) reading	R	Current PV (input value)
02D0H to 02E3H	Current MV (control output manipulated variable) reading	R	Current MV
02E4H to 02F7H	Heater current (ampere) value reading	R	Heater current value when control output is on
02F8H to 030BH	Current status 1 reading	R	$\begin{array}{cccc} \underline{0000} & \underline{0000} & \underline{0000} & \underline{0000} \\ b^{15} & & \text{to} & b^0 \end{array}$ <ul style="list-style-type: none"> b0 : Main output 0: OFF 1: ON b1 : Alarm 1 (High limit) 0: OFF 1: ON b2 : Alarm 2 (Low limit) 0: OFF 1: ON b3 : Heater burnout alarm 0: OFF 1: ON b4 : Over scale 0: Normal 1: Over b5 : Under scale 0: Normal 1: Under b6 : Ignored b7 : Auto-tuning 0: Cancel 1: Perform b8 : Initial communication 0: Communicated 1: Not communicated b9 : Control action 0: Heating (Reverse) 1: Cooling (Direct) b10: Control action status 0: Stop 1: Perform b11: Heater burnout alarm applied or not 0: Not applied 1: Applied b12: Data update request 0: Not requested 1: Requested (*2) b13: Loop break alarm 1 0: OFF 1: ON b14: Temperature 0: Normal 1: Abnormal (*3) b15: Instrument 0: Normal 1: Abnormal (*4)

030CH to 031FH	Current status 2 reading	R	<p>0000 0000 0000 0000 b^{15} to b^0</p> <p>b0 : Main output 0: OFF 1: ON</p> <p>b1 : Control action status 0: Stop 1: Perform</p> <p>b2 : Alarm 1 (High limit) 0: OFF 1: ON</p> <p>b3 : Alarm 2 (Low limit) 0: OFF 1: ON</p> <p>b3 : Heater burnout alarm 0: OFF 1: ON</p> <p>b4 : Over scale 0: Normal 1: Over</p> <p>b5 : Heater burnout alarm 0: OFF 1: ON</p> <p>b6 : Auto-tuning 0: Cancel 1: Perform</p> <p>b7 : Under scale 0: Normal 1: Under</p> <p>b8 : Loop break alarm 2 0: OFF 1: ON</p> <p>b9 : Temperature 0: Normal 1: Abnormal (*3)</p> <p>b10 to b15: Ignored</p>
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- (*1) When initializing the data, set the odd number channel of the unit (CCT-235) to be initialized to "0001". The data of the unit (CCT-235) to be set to "0001" will be initialized.
- (*2) When the setting value of the CCT-235 is changed via CPT-20A, bit12 [Data update request in Current status 1 reading] becomes 1 (Requested).
 Finding this status, the master starts to read all setting values of the CLT-20S.
 After all data of the setting items are read, the CLT-20S sets bit12 [Data update request in Current status 1 reading] to 0 (Not requested).
- (*3) Bit14 [Temperature in Current status 1 reading] and bit9 [Temperature in Current status 2 reading] become 1 (Abnormal) on the condition that:
 $SV + 20^{\circ}C < PV$ and $PV > 80^{\circ}C$
 After that, if the PV falls as much as $5^{\circ}C$, they become 0 (Normal).
- (*4) If the CLT-20S cannot communicate with the CCT-235, bit15 [Instrument in Current status 1 reading] becomes 1 (Abnormal).
 If the instrument is abnormal, the CLT-20S sets other data to the initial value (0) and returns them to the master.

0320H to 0333H	CPU version number reading	R	CPU version number of each CCT-235 is read from the channel of odd number (1, 3, 5...).
0334H to 0347H	Instrument status reading	R	<p>The sensor range of each CCT-235 is read from the channel of odd number (1, 3, 5...).</p> <p>0: K -200 to 1370°C, -320 to 2500°F 1: J -200 to 1000°C, -320 to 1800°F 2: R 0 to 1760°C, 0 to 3200°F 3: B 0 to 1820°C, 0 to 3300°F 4: PL-II 0 to 1390°C, 0 to 2500°F 5: N 0 to 1300°C, 0 to 2300°F 6: K 0.0 to 600.0°C, 0.0 to 999.9°F 7: J 0.0 to 600.0°C, 0.0 to 999.9°F 8: Pt100 -199.9 to 850.0°C, -199.9 to 999.9°F 9: JPt100 -199.9 to 500.0°C, -199.9 to 900.0°F</p> <p>10: Vdc 0 to 10000 (Output OFF when input burnout)</p> <p>11: Adc 0 to 10000 (Output OFF when input burnout)</p> <p>12: Vdc 0 to 10000 (Output ON when input burnout)</p> <p>13: Adc 0 to 10000 (Output ON when input burnout)</p> <p>The option and output status of each CCT-235 is read from the channel of even number (2, 4, 6...).</p> <p>b0: Heater burnout alarm applied or not 0: Not applied 1: Applied</p> <p>b1: Heater burnout alarm rating 0: 20A 1: 50A</p> <p>b2: Ch1 control output (Current) b3: Ch1 control output (Relay contact) b4: Ch1 control output (Non-contact voltage) b5: Ch2 control output (Current) b6: Ch2 control output (Relay contact) b7: Ch2 control output (Non-contact voltage) b8: Ignored b9: Ignored b10: Cooling control output function 0: Not applied 1: Applied</p> <p>b11 to b15: Ignored</p>

Note:

- Address 700 (02BCH) and above are for reading only.
 If the setting message is transmitted to these areas, Error code 2 is returned.
- Address 840 (0348H) and above are not used.
 If the setting or reading message is transmitted to these areas, Error code 2 is returned.
- If the designated address range is incorrect, then the setting or reading message is sent, Error code 2 is returned.

10. Specifications

(1) Standard specifications

Name	PC link unit
Model	CLT-20S
Supply voltage	5±0.2Vdc (supplied by the CPT-20A)
External dimensions	24 x 96 x 100mm (W x H x D)
Mounting method	Base unit (CBT-2 □ □) mounting
Case	Flame-resistant resin, Black
Action indicator	While the power supply to the instrument is turned ON, green LED (PW) lights up. While communicating between the CLT and CCT, yellow LED (TX) lights up. While communicating between the CLT and PC, yellow LED (LINK) lights up. If an error is occurred during the PC communication, red LED (ERR) lights up.

Setting

- PC transfer rate (0 to 3): Rotary switch (See page 10.)
- PC link unit (0 to 15): Rotary switch (See page 10.)
- PC communication protocol (0 to 1): Rotary switch (See page 10.)

Host communication function

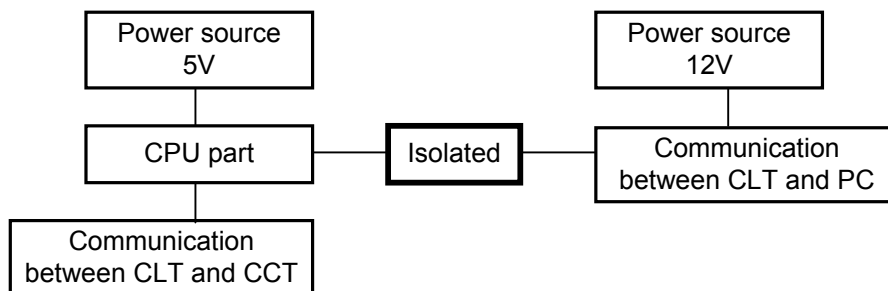
Communication circuit	Based on RS-232C (C), or RS-422A/RS-485 (C5)
Communication method	Half-duplex communication start-stop synchronous
Transfer rate	2400bps, 4800bps, 9600bps, 19200bps

Data format

Start bit	: 1
Data length	: 7
Parity	: Even
Stop bit	: 1

Insulation•Dielectric strength

Circuit insulation configuration



Power consumption	Approx. 1VA
Ambient temperature	0 to 50°C (non-condensing)
Weight	Approx. 90g
Accessories	Instruction manual 1 copy Terminal cover 1 piece (When the option [TC] is applied)

10.2 Optional specifications

Terminal cover [TC]

Electrical shock protecting terminal cover

11. Troubleshooting

If any malfunction occurs, refer to the following items after checking the power supply of the PC and the C series. If the power is supplied to the C series, green power (PW) indicator lights up.



Warning

Turn the power supply to the instrument OFF before wiring or checking. Checking with the power switched ON may result in an Electric Shock which could cause severe injury or death.

- Phenomenon: If it is unable to communicate.

Check the following	Solution
Burnout or imperfect contact of the communication cable or of the terminal part.	Change the communication cable or surely tighten the terminal screw.
The communication cable is not connected properly.	Wire the cable properly. (page 13-15)
The terminators are not connected at the both ends of the unit.	Connect the terminators. (page 14-15)
The setup of the PC, CLT-20S is not correct.	Set up the units properly. (page 10)

If any other problems arise, make inquiries at our agency or the shop where you purchased the unit.

12. 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	0	0	0
0	0	0	1
0	0	1	0
0	0	1	1
0	1	0	0
0	1	0	1
0	1	1	0
0	1	1	1
1	0	0	0
1	0	0	1
1	0	1	0
1	0	1	1
1	1	0	0
1	1	0	1
1	1	1	0
1	1	1	1

	0	1	2	3	4	5	6	7
0	NUL (TC7)	DLE (TC7)	SP	0	@	P	\	p
1	SOH (TC1)	DC1	!	1	A	Q	a	q
2	STX (TC2)	DC2	"	2	B	R	b	r
3	ETX (TC3)	DC3	#	3	C	S	c	s
4	EOT (TC4)	DC4	\$	4	D	T	d	t
5	ENQ (TC5)	NAK (TC8)	%	5	E	U	e	u
6	ACK (TC6)	SYN (TC9)	&	6	F	V	f	v
7	BEL	ETB (TC10)	'	7	G	W	g	w
8	BS (FE0)	CAN	(	8	H	X	h	x
9	HT (FE1)	EM	)	9	I	Y	i	y
A	LF (FE2)	SUB	*	:	J	Z	j	z
B	VT (FE3)	ESC	+	;	K	[	k	{
C	FF (FE4)	FS (IS4)	,	<	L	\	l	|
D	CR (FE5)	GS (IS4)	-	=	M	]	m	}
E	SO	RS (IS4)	.	>	N	^	n	~
F	SI	US (IS4)	/	?	O	_	o	DEL

******* Inquiry *******

For any inquiry about this unit, please contact the shop where you purchased the unit or our agency after checking the following.

- Model name ----- CLT-20S
- Option ----- TC
- Instrument number ----- No. xxxxxx

In addition to the above, please let us know the details of malfunction, if any, and the operating conditions.

**SHINKO TECHNOS CO.,LTD.
OVERSEAS DIVISION**

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