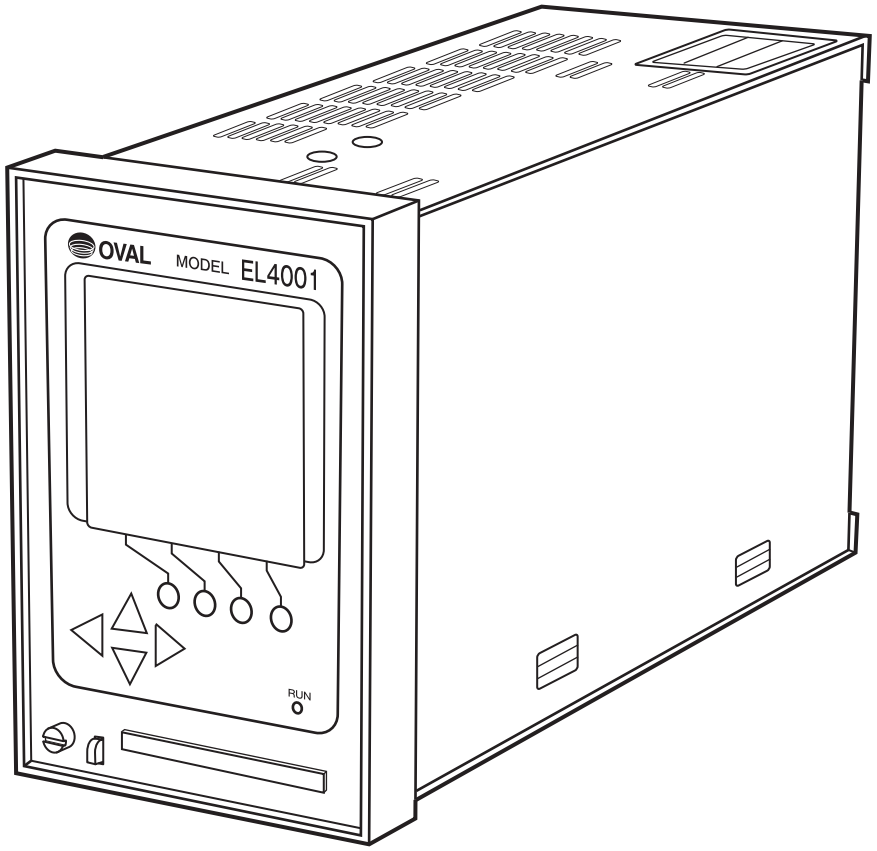
OVAL INSTRUCTIONS

Ins. No. E-880CM-3-E

FLOW COMPUTER EL4001 SERIES
COMMUNICATION MANUAL



Every OVAL Flow Computer is fabricated and shipped from our factory under stringent quality control. To derive maximum benefit from the computer, we recommend that you become familiar with this instruction manual before you place it in service and retain a copy at the field location for ready reference.

BEFORE YOU BEGIN

This manual has been prepared for OVAL flow computers of the EL4001 series. Making sure of your model number and understanding well about the input/output and calculation process according to the instruction manual for the model, and reference only the specific topic of interest.
In the EL4001 series, mode selection is simple with keystrokes on the front-panel keypad. However, we recommend you to become thoroughly familiar with the procedure described in this manual before you reconfigure parameters.
If you have something to inquire, contact the sales office from which you purchased the product, or the nearest OVAL representative in our customer service network.
(When you inquire, please supply us with the product name, model No., serial No., and other pertinent information.)

This communication manual applies to the following models:

- EL4101 Steam Flow Computer (saturated steam service)
- EL4111 Steam Flow Computer (superheated steam service)
- EL4121 Temperature/Pressure Compensated Flow Computer (gas service)
- EL4131 Temperature Compensated Flow Computer (liquid service)
- EL4201 Temperature/Pressure Compensated Gas Flow Computer (mass units)
- EL4211 Temperature Compensated Liquid Flow Computer (mass units)
- EL4301 Density Computer for Mass Flowmeter
- EL4311 Density Computer for Mass Flowmeter (with solids proportion calculation feature)
- EL4321 Density Computer for Spool Densitometer (gas service)
- EL4401 Blend Oil Temperature Compensated Flow Computer
- EL4501 Multipoint Temperature Compensated Flow Computer (liquid service)

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1. COMMUNICATION CAPABILITY OVERVIEW

With EL4001, communication between EL4001 and the host system (personal computer, sequencer, etc.) is available via RS-485. By communication, you can read the information displayed in the RUN mode, read/write the setup parameters in the SET and/or SYS mode, or by popping the key card into the drive, you can read/write the viscosity, density, and liquid kind you want to set up.

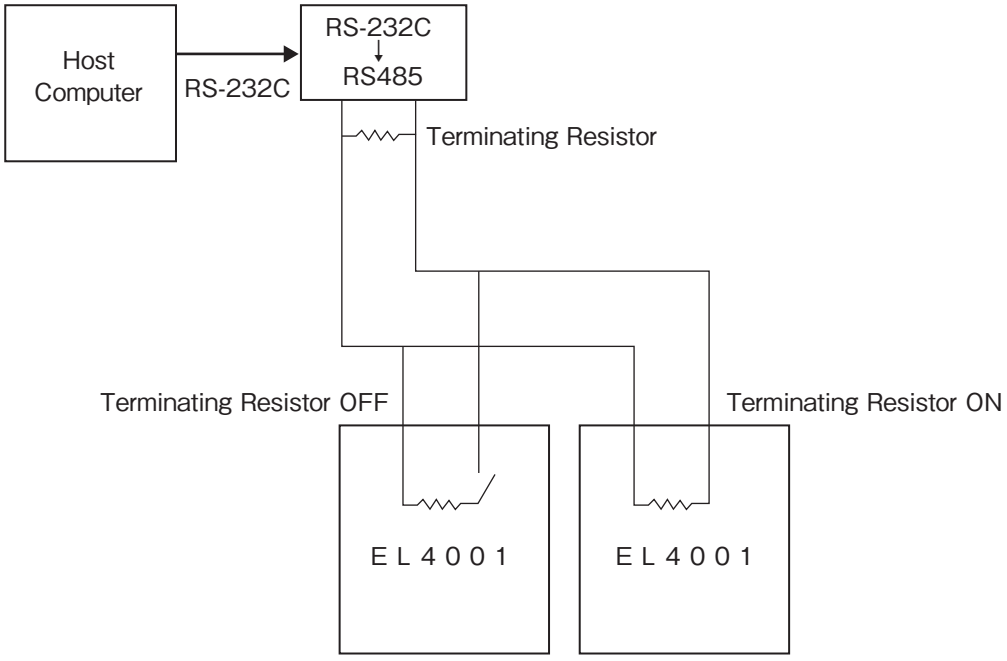
- No handshake: Nonprocedural
- One master to n slaves: n-multipoint communication (n: a maximum of 16 units)
- Compatible with local/remote selection : Shown on the LCD screen

※ We do not offer software support for higher-level systems.

2. NETWORK CONFIGURATION

A higher-level (host) system (PC, sequencer, etc.) and lower-level systems (EL4001) are connected in a network shown below.

※ Be sure to connect a terminating resistance (100Ω approx.) at both ends of the cable. EL4001 has a 100Ω terminating resistor internally. At the end of communication channel, place the DIP switch at the rear in the ON position; at an intermediate point in the channel, place it in the OFF position.



2.1 About Write Protect

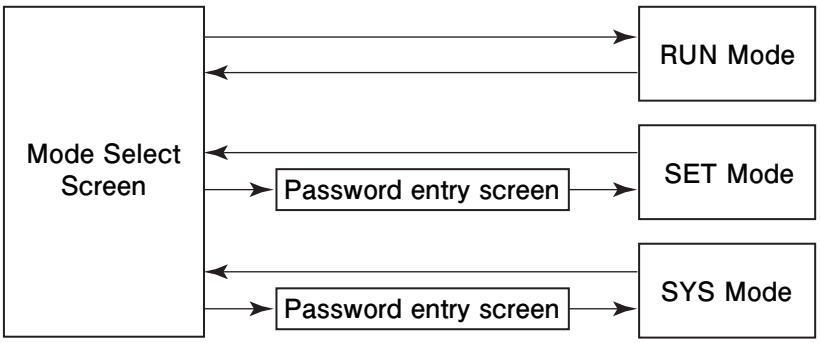
2.1.1 Write Protect with a Password

(1) Functions of Basic EL4001

Parameter write protect can be selectably enabled or disabled at the password setup menu in the SYS mode. While the password setup is "ON", the computer prompts you to enter the password when changing the RUN mode to other mode. When the password entered is identical with the registered password, a switch to another mode is permissible. If not, a reminder message appears, prompting you to enter the correct once again.

With the parameter setup cared inserted in the drive, on the other hand, entering a new parameter into the card while the password setup is "ON", the registered password is also written in the card.

Inserting the card with the password setup in the "ON" while a transfer from the RUN mode to another mode takes place, you can change modes to another mode without the need of keying in a password if the password that has been written in the card is identical with the registered password. If not, a reminder message appears, prompting you to enter the correct password again. In this case, you need to key in the password.



(2) Operation in Communication

In communication, you can change modes with the mode select command. By including a password in the message at this time, write protect is enabled. With the password setup placed in "ON", a change to another mode is permitted if the password in the message is identical with the registered one, similar to the mode selection with keystrokes. If not, a reminder message is sent out. However, when the password setup is in "OFF", the computer will override the password in the message.

(3) How to Reset a Password

In the password setup in the SYS mode, if "OFF" is your option for the setup, the computer will no longer prompt you to enter the password.

(4) Where unable to Reset a Password

If you have forgotten your password and are unable to reset it, there is no way to reset it by communication. In such a case, you can place the DIP switch inside the computer in the password setup "OFF".

This resets the password, but it requires you to open up the computer front panel.

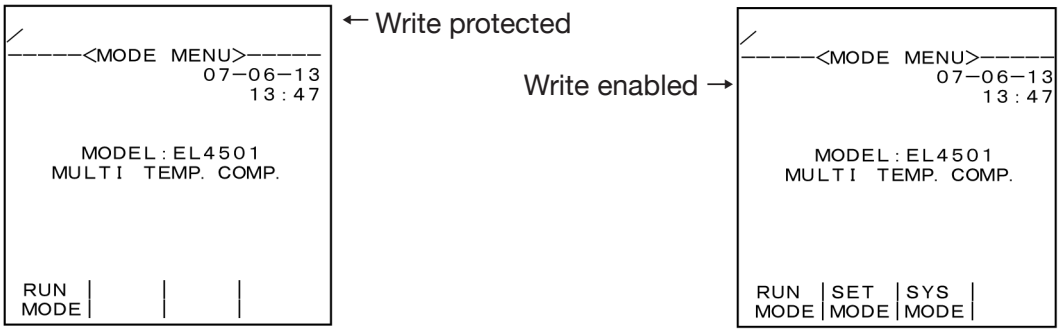
※ CAUTION: For details of DIP switch setup, see EL4001 Key Operation Manual.

2.1.2 Write Protect with DIP Switch

(1) Functions of Basic EL4001

By setting up the DIP switch on the basic EL4001 side, you can inhibit mode changes to the SET and SYS mode. When protected, in function keys, "SET MODE" and "SYS MODE" will no longer appear on the screen.

※ For details of DIP switch setup, see EL4001 Key Operation Manual.



(2) Operation in Communication

In data communication, when you attempt to change modes with the mode select command, a message will tell you with a response code that settings are write protected if so configured.

3. LOCAL/REMOTE SELECTION

The communication modes in the EL4001 are defined as AUTO/MANUAL statuses.
AUTO allows reconfiguration of settings through communication or keystrokes (local/remote).
In MANUAL, control through communication is disabled.

MANUAL: Only data entry through keystrokes is valid. Communication is unconditionally disabled.
Set up at the communication setup menu in the SYS mode.

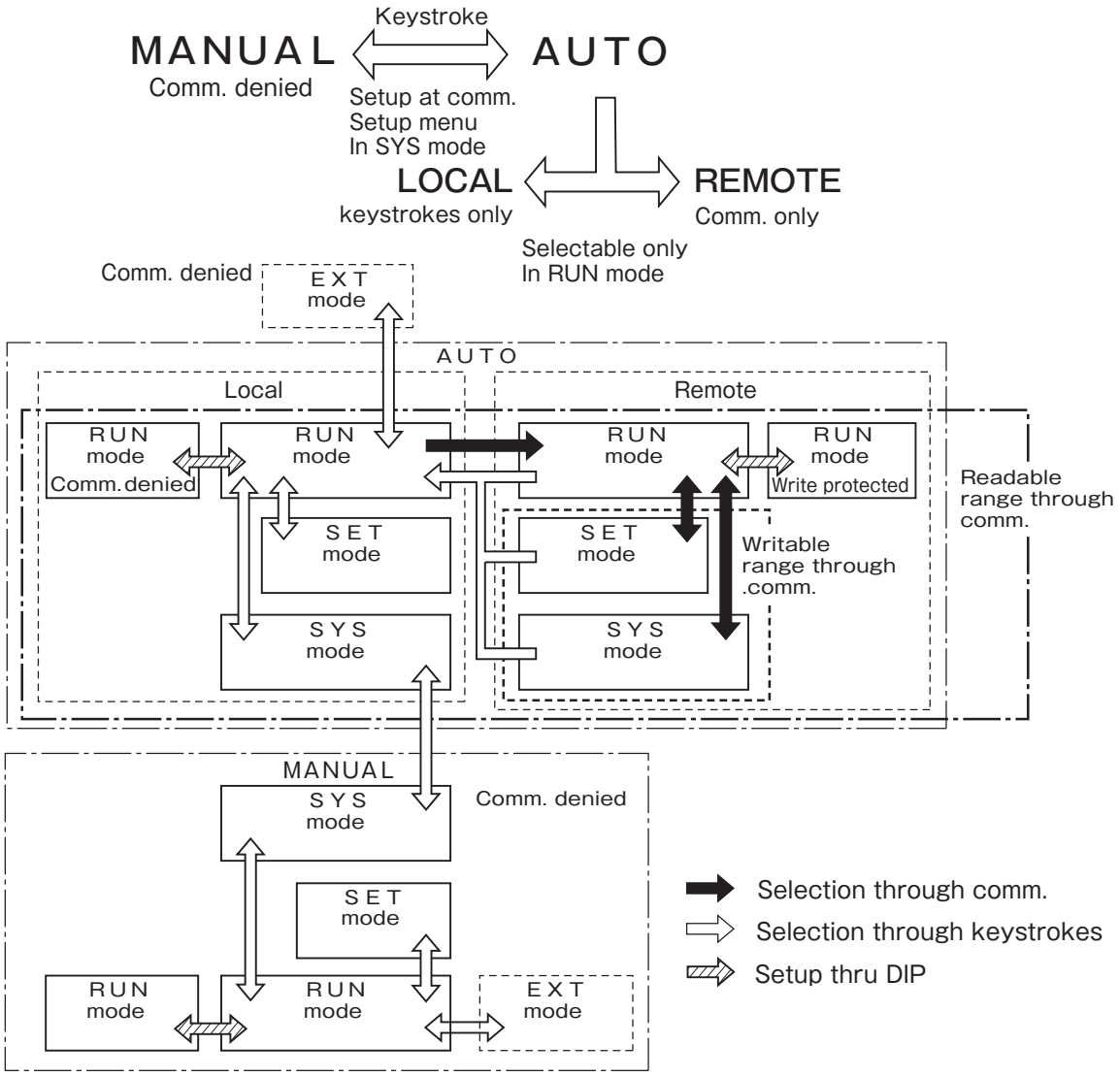
AUTO: Changes in settings by keystrokes or communication are acceptable.
Set up at the communication setup menu in the SYS mode.

Local: Only keystrokes are acceptable. In the RUN mode, switching from one mode to another made through communication brings up a message telling you of the switchover, and goes into the remote mode.

※ **Note … When you want to make this operation in the local state with IC card (a key card for EL4501, an adjust card for maintenance, and a model setting card) inserted, do it from the PC of higher level with communication stopped.**

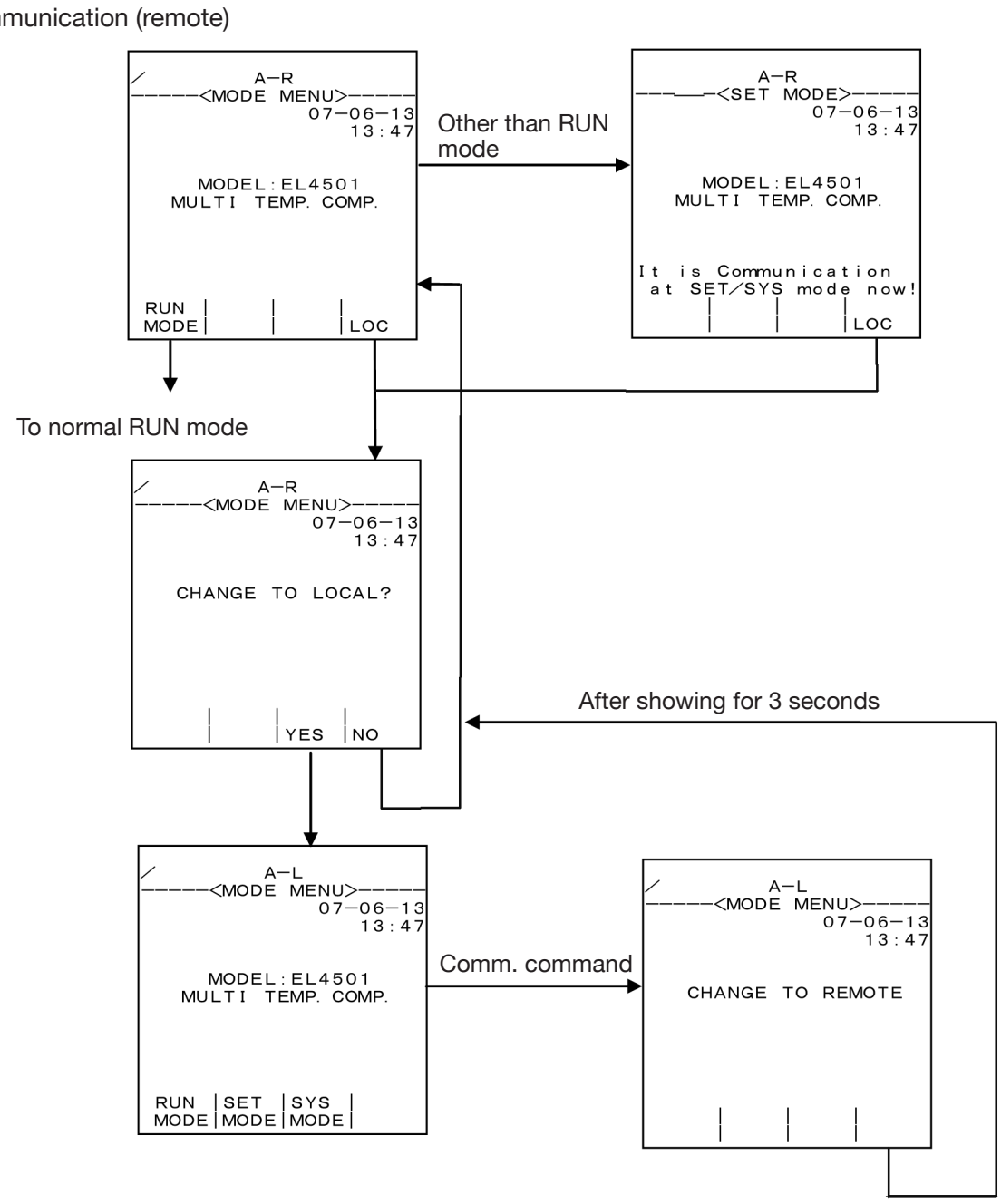
Remote: Only communication is acceptable. In the RUN mode, keying in brings up a message prompting you whether to switch into local, and goes into local if option is YES.

Local/remote and mode relationship



3.1 Mode Select Map

Shown below is the mode transition diagram.



4. SETUP ITEMS FOR COMMUNICATION

You can access communication-related menu items in the SYS mode.

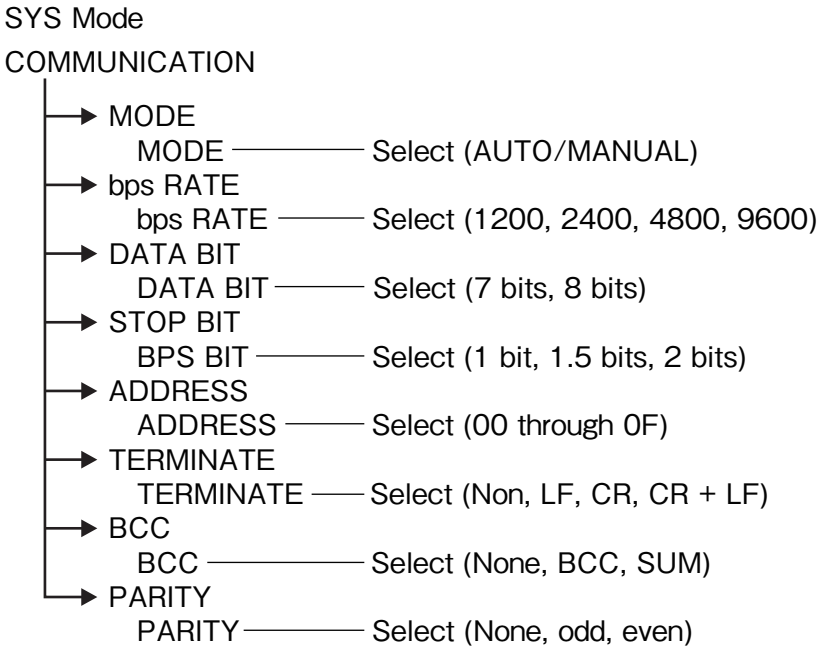
4.1 Menu Items

Communication-related menu items include

Communication modes : AUTO/MANUAL
Transfer rate : 1200, 2400, 4800, and 9600
Data bit number : 7 bits and 8 bits
Stop bit : 1 bit, 1.5 bits, and 2 bits
Home address : 2-digits hexadecimal: 00 to 0F
Terminate : None, LF, CR, and CR + LF
BCC : None, BCC, SUM
Parity : None, odd or even

4.2 Menu Trees

SYS mode-related setup menus are given below.

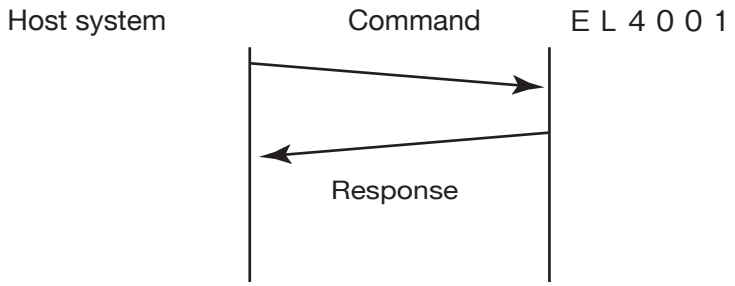


※ For details about menu items, see EL4001 Key Operation Manual.

5. COMMUNICATION PROCEDURE

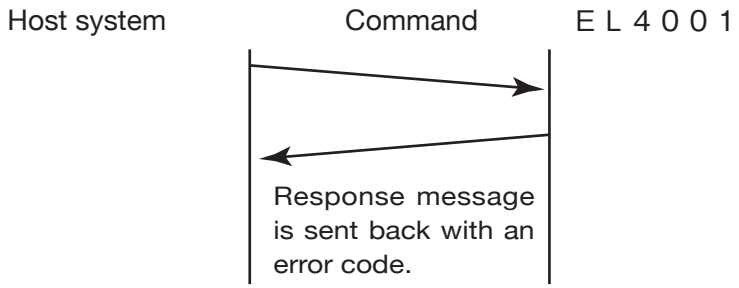
The host system (PC, for example) sends an R/W command to a client or secondary system (EL4001). The secondary equipment (EL4001) in turn sends a response only when the home address is in agreement; if not, it abandons the message without sending any response. In the meantime, the host system (PC, for example) awaits a response from a client (EL4001) after command transmission for a predetermined time period (5 seconds or so). If no response is received within this time duration, it is necessary for the host system (PC, etc.) to retry or other processing.

・**Normal send/receive:**



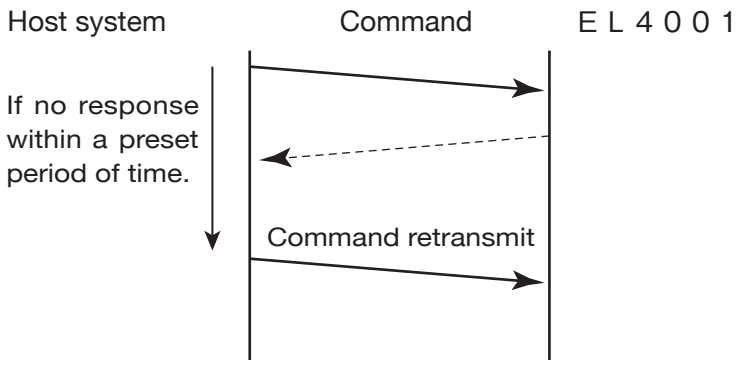
・**Reception error with EL4001:**

Upon detection of an error, such as command error or functional error on the EL side, a response message with an error code is sent back to the host.



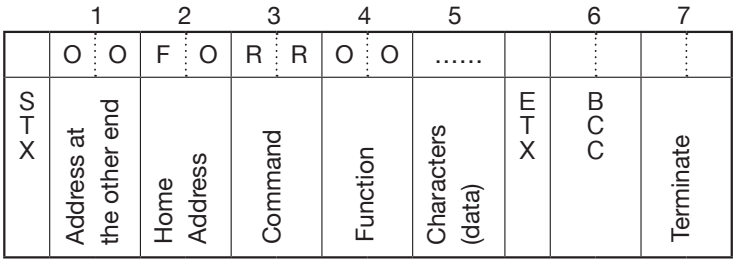
・**If communication failure occurs on the EL side or the host fails to receive a response:**

Following a command transmission, the host goes into wait state. If it fails to receive a response within a preset period of time, it retries the transmission.



6. COMMUNICATION FORMAT

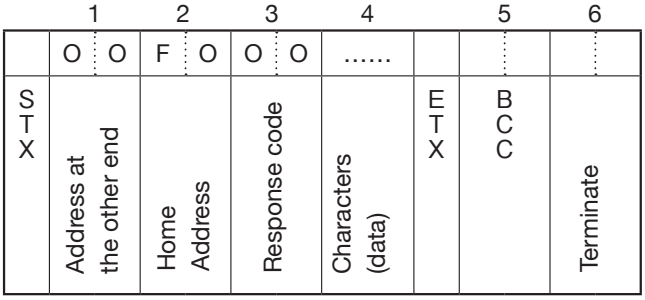
6.1 Command Format



No.	Item	Description	Bytes
1	Client system No.	Client system (EL4501) address 00 through 0F in 16 ways	2
2	Host system No.	Host system (PC, etc.) address F0 through FF in 16 ways	2
3	Command	Defined by two upper case English characters	2
4	Function code	Defined by two upper case English characters for each command	2
5	Characters	Defined for each command	Indefinite
6	B C C	Setup is optional. (1) None (2) S U M (3) B C C (XOR)	0 2 2
7	Terminate	Setup is optional. (1) None (2) L F (3) C R (4) C R + L F	0 1 1 2

All character strings are in ASCII code.

6.2 Response Format



No.	Item	Description	Bytes
1	Client system No.	Client system (EL4501) address 00 through 0F in 16 ways	2
2	Host system No.	Host system (PC, etc.) address F0 through FF in 16 ways	2
3	Response code	Defined by two upper case English characters	2
4	Characters	Defined for each command	Indefinite
5	B C C	Setup is optional. (1) None (2) S U M (3) B C C (XOR)	0 2 2
6	Terminate	Setup is optional. (1) None (2) L F (3) C R (4) C R + L F	0 1 1 2

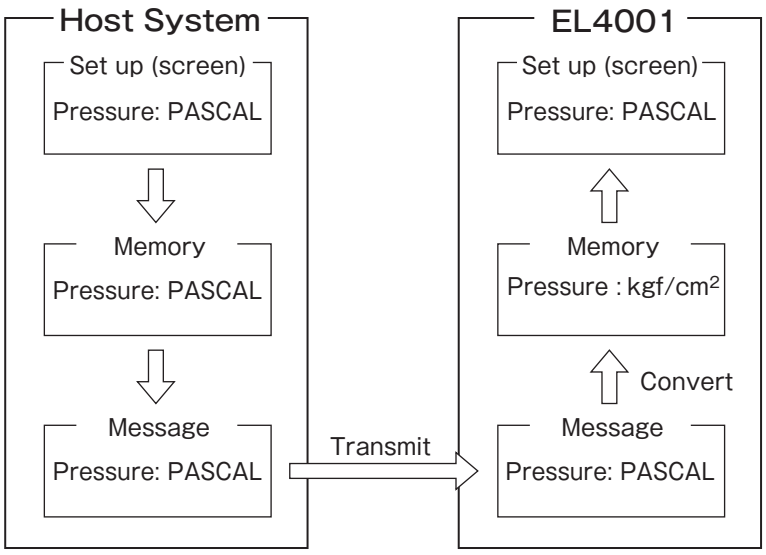
6.3 Communication Commands

Each command is represented in a two-byte code. Commands come under three major groups - READ,WRITE, and special.

R R：Read the information in the RUN mode.
R S：Read the information in the SET mode.
W S：Write the information in the SET mode.
R Y：Read the information in the SYS mode.
W Y：Write the information in the SYS mode.
R E：Read an error status.
R L：Read/reset the error logging.
R I：Read the model setup information.
S M：Local/remote select
M C：Mode select command
R C：Read the computer status.
R D：Read the calendar.
W D：Write the calendar.
S T：Total counter reset
S A：Simulated analog output
S C：Special command
In the case of EL4501
Batch write/read of settings
Data: Liquid kind, viscosity, viscosity unit, density, density unit.
Read/write liquid kind.
Read/write viscosity and viscosity unit.
Read/write density and density unit.

6.4 About the Numerical Data Units in the message

Any units can be chosen for numerical data in data communication with the host system (PC, etc.). Take a pressure unit Pa, for example, when Pa ("PASCAL") is your setup option pressure unit on the host system (PC, etc.) side, then the pressure-related numerical values in data communication will read in Pa across the board.
For this reason, all unit-dependent numerical values (temperature, pressure, instant flowrate, etc.) are paired with corresponding unit codes before they are transmitted.



6.5 About the Numerical Data Format in Data Transmission

Numerical data format in data transmission basically come under the following two styles where all characters use the ASCII code with decimal point eliminated.

① Standard format

Numerical data format generally uses an "exponential representation".

- Mantissa sign 1 digit
- Numerical value in mantissa 6 digits
- Exponent part sign 1 digit
- Numerical value in exponent part 2 digits

② Special (accumulated total) format

Total counter pulse uses the following format.

- Integer part 10 digits (effective data 8 digits)

6.6 Response Codes

Code	Name	Description
0 0	Normal data reception	Normal reception
0 1	Communication error	Undefined
0 2	Parity error	Parity check error (hardware)
0 3	Data length error	Data received has an illegal length (buffer overflow)
0 4	Data error	Data received is invalid.
0 5	BCC check error	BCC (block check character) check error (software)
1 0	Command error	An undefined command has been received.
1 1	Function code error	Data received is an error.
1 2	Local select	An undefined function code has been received.
1 3	Forced remote termination	A switchover from remote to local has taken place by operating a key. (A switchover was made properly in the RUN mode.)
2 0	Local error	A switchover from remote to local has taken place by operating a key. (A forced switchover was made in a mode other than RUN mode.)
2 1	Mode lock error	Mode select remains locked by DIP switch.
2 2	Mode setup error	Command received is invalid to implement in the current mode.
2 3	Password error	Invalid password
2 4	Parameter error	Parameter (data format) is invalid.
2 5	Setting out of range	Setting is invalid.
3 0	Model-specific command	Commands incompatible with this model

6.7 Procedure to Change Parameters in the SET Mode

If it is desired to change parameters in the SET mode in communication, follow the steps given below:

① With computer status read command (RC), make sure of the mode.
（1） If the response is local, select the remote with mode select command.
（2） If the response is remote, go to ③ .
（3） If write protected by DIP switch, cancel the DIP setting in the computer.

② With local/remote select command (SM), switch to the remote.
・At this point, a message telling you of a switch from local to remote appears on the EL4001 screen.

③ With computer status read command (RC), make sure of the mode.
（1） If the response is in the SYS mode, select the RUN mode with mode select command (MC).
（2） If the response is in the SET mode, go to ⑤ .

④ Switch from RUN to SET with mode select command (MC).
・At this point, the data in the EEPROM is copied to the RAM workarea.
・The EL4001 display shows the SET mode main menu screen.

⑤ To view the data you want to modify, read the parameters with SET mode data read command (RS).

⑥ With SET mode data write command (WS), change the parameters of interest.

⑦ Repeat steps ⑤ and ⑥ until all changes are made. Then, with mode select command (MC), calculate the minimum scaling factor for pulse output (SET → scaling setup).
・A response with the minimum scaling factor for pulse output is sent back.
・With mode select command (MC), you can cancel the modification and return to the RUN mode at this point.

⑧ With mode select command (MC), switch the scaling setup to the RUN. At this point, the scaling factor for pulse output you set up is added to the command message.
・By this process, the contents modified in the RAM workarea is copied to the EEPROM, and the scaling factor for pulse output is set up.
（1） If the response is acceptable, a switchover to the RUN mode takes place.
（2） If the response is unacceptable, the state ⑦ remains unchanged.
・In this case, with mode select command (MC), you are to cancel or set up the right value again, and switch from the scaling setup to the RUN once again.

6.8 RUN Mode Data Read Command (RR)

6.8.1 Description

With this command, the information shown in the RUN mode can be read in batch or individually. Function codes are assigned to individual items to be read.

Function No. 00 : Batch read
01… : Read individually

※ CAUTION: You can read in RUN, SET, or SYS mode. In the SYS mode, however, the contents to be read are those last calculated because calculation does not take place in the SYS mode

Functions of Read Command in the RUN Mode by Model

Function	EL4101	EL4111	EL4121	EL4131
0 0	Batch read	Batch read	Batch read	Batch read
0 1	Total count 1, unit	Total count 1, unit	Uncorrected total, unit	Uncorrected total, unit
0 2	Total count 2, unit	Total count 2, unit	Corrected total, unit	Corrected total, unit
0 3	———	Instant flowrate, unit	———	———
0 4	Instant flowrate, unit	Temperature, unit	Uncorrected instant flowrate, unit	Uncorrected instant flowrate, unit
0 5	Pressure, unit	Pressure, unit	Corrected instant flowrate, unit	Corrected instant flowrate, unit
0 6	———	———	———	———
0 7	Corr. factor 1, unit	Corr. factor 1, unit	Temperature, unit	Temperature, unit
0 8	Corr. factor 2, unit	Corr. factor 2, unit	Pressure, unit	———
0 9	Meter error corr. factor, unit	Meter error corr. factor, unit	———	———
0 A	Meter correction factor, unit	Meter correction factor, unit	Correction factor, unit	Meter error correction factor, unit
0 B	Specific weight, unit	Specific weight, unit	Meter error correction factor, unit	Temperature correction coeff., unit
0 C	Specific enthalpy, unit	Specific enthalpy, unit	3 α corr. factor, unit	———
0 D	———	———	T/P corr. factor, unit	———
0 E	———	———	Quadratic correction factor, unit	———

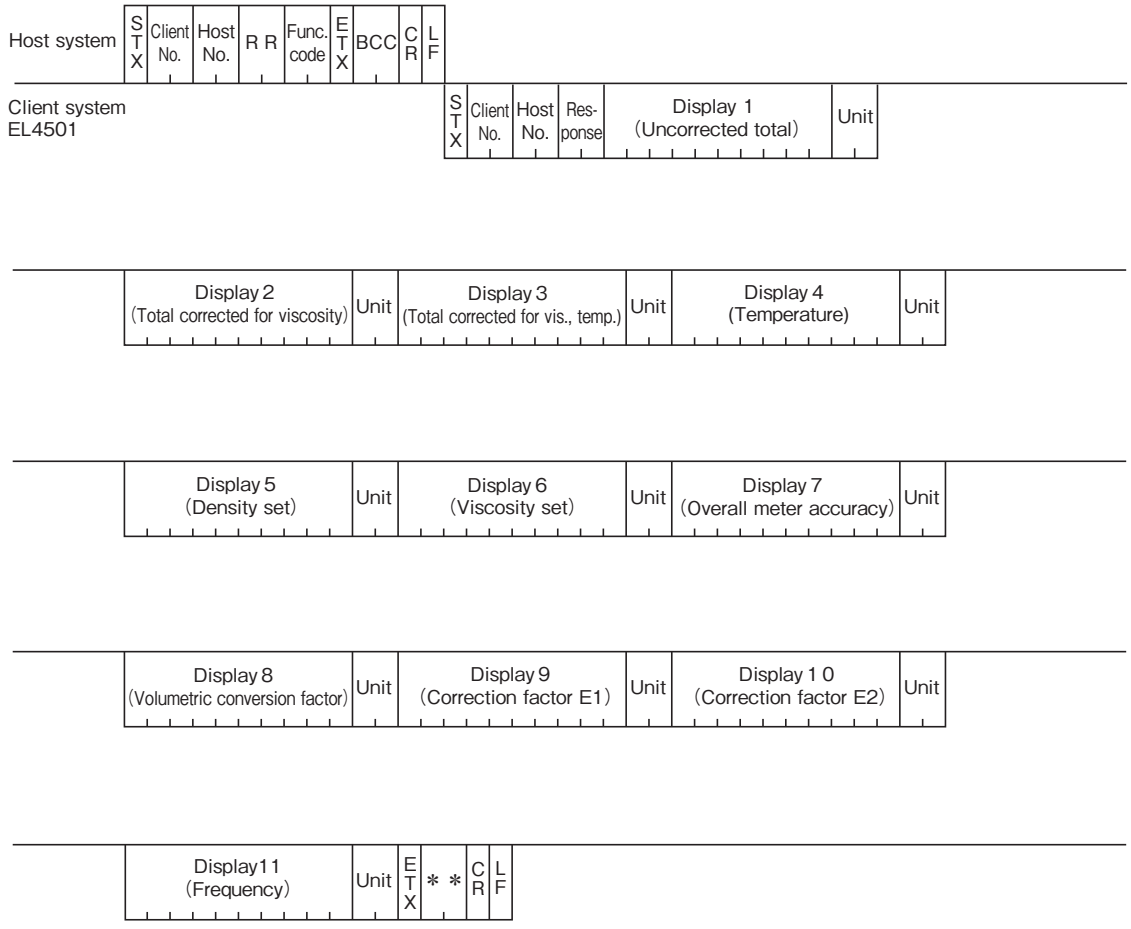
Function	EL4201	EL4211	EL4301	EL4311
0 0	Batch read	Batch read	Batch read	Batch read
0 1	Uncorrected total, unit	Uncorrected total, unit	Uncorrected density, unit	Uncorrected density, unit
0 2	Corrected total, unit	Corrected total, unit	Corrected density, unit	Corrected density, unit
0 3	———	———	———	———
0 4	Uncorrected instant flowrate, unit	Uncorrected instant flowrate, unit	Temperature, unit	Uncorrected total, unit
0 5	Corrected instant flowrate, unit	Corrected instant flowrate, unit	Density period, unit	Corrected solids content total, unit
0 6	———	Temperature, unit	———	———
0 7	Temperature, unit	Meter error correction factor, unit	Solids content weight ratio, unit	Uncorrected instant flowrate, unit
0 8	Pressure, unit	Temperature correction coefficient, unit	———	Corrected solids content instant flowrate, unit
0 9	———	Density, unit	———	———
0 A	Correction factor, unit	———	———	Temperature, unit
0 B	Meter error correction factor, unit	———	———	Density period, unit
0 C	3 α corr. factor, unit	———	———	———
0 D	T/P corr. factor, unit	———	———	Meter error correction factor, unit
0 E	Quadratic correction factor, unit	———	———	Solids content weight ratio, unit
0 F	Density, unit	———	———	———

Functions of Read Command in the RUN Mode by Model

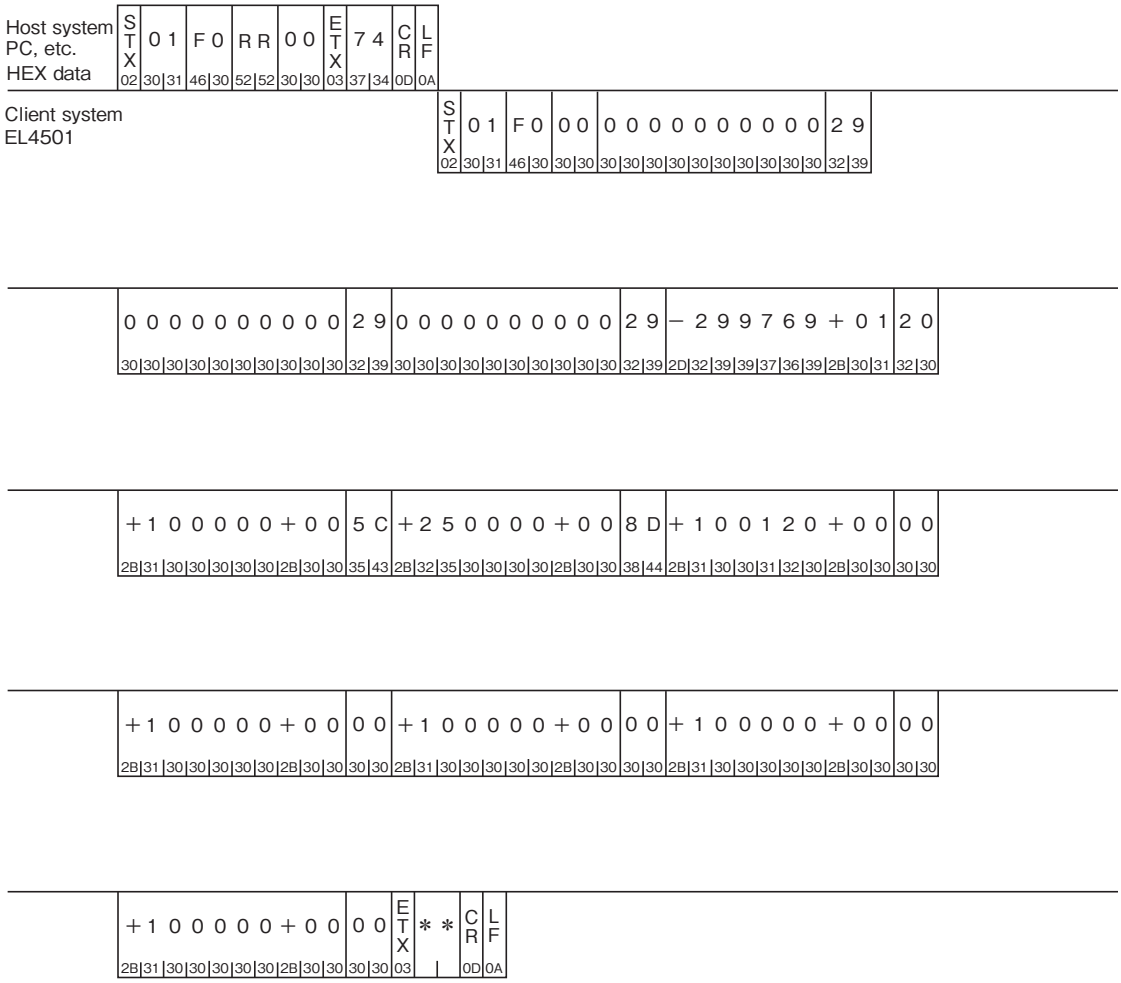
Function	EL4321	EL4401	EL4501
0 0	Batch read	Batch read	Batch read
0 1	Uncorrected density, unit	Total count 1, unit	Uncorrected total, unit
0 2	Corrected density, unit	Total count 2, unit	Total corrected for viscosity, unit
0 3	———	Instant flowrate, unit	Total corrected for viscosity and temperature, unit
0 4	Temperature, unit	Temperature, unit	Temperature, unit
0 5	Pressure, unit	Blend rate, unit	Density set, unit
0 6	———	———	Viscosity set, unit
0 7	Molecular weight, unit	Overall meter error, unit	Overall meter error, unit
0 8	Specific weight, unit	Volumetric conversion factor, unit	Volumetric conversion factor, unit
0 9	———	———	———
0 A	———	———	Correction factor E1
0 B	———	———	Correction factor E2
0 C	———	———	Frequency

6.8.2 Command/Response

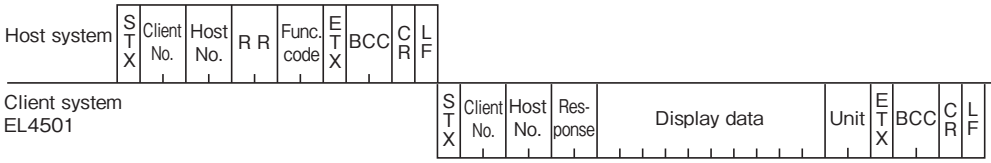
① Batch read [with 8 items to be displayed in the RUN mode (EL4501)]



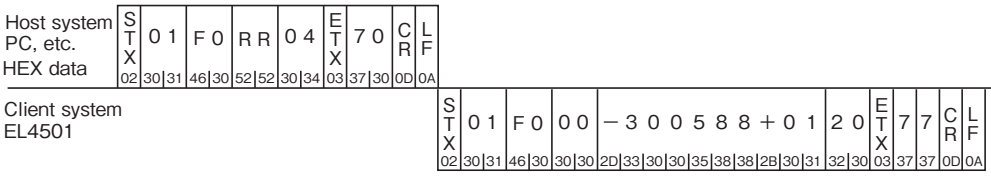
Example: To read in batch (EL4501)



② To read individually (EL4501)



Example: 4th tem (temperature) in RUN mode (EL4501)



6.9 SET Mode Data Read Command (RS)

6.9.1 Data

With this command, you can read the data set up in the SET mode individually. The function codes are assigned to individual items to be read.

Functions of SET Mode Command and Contents

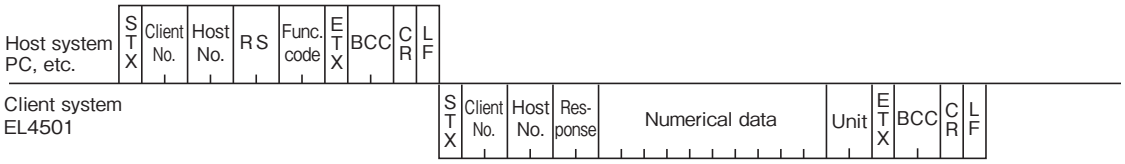
Func.	Bracket	Item	Data format	4101	4111	4121	4131	4201	4211	4301	4311	4321	4401	4501
0 0	Temp. input	Unit	XX		○	○	○	○	○	○	○	○	○	○
0 1		Fixed value	+XXXXXX+XX		○	○	○	○	○	○	○	○	○	○
0 2		Baseline	+XXXXXX+XX		○	○	○	○	○	○	○	○	○	○
0 3		Full scale	+XXXXXX+XX		○	○	○	○	○	○	○	○	○	○
0 4		Under alarm point	+XXXXXX+XX		○	○	○	○	○	○	○	○	○	○
0 5		Over alarm point	+XXXXXX+XX		○	○	○	○	○	○	○	○	○	○
0 6		Under fallback value	+XXXXXX+XX		○	○	○	○	○	○	○	○	○	○
0 7		Over fallback value	+XXXXXX+XX		○	○	○	○	○	○	○	○	○	○
0 8		Smoothing factor	+XXXXXX+XX		○	○	○	○	○	○	○	○	○	○
1 0	Press. input	Unit	XX	○	○	○		○				○	○	
1 1		Fixed value	+XXXXXX+XX	○	○	○		○				○	○	
1 2		Baseline	+XXXXXX+XX	○	○	○		○				○	○	
1 3		Full scale	+XXXXXX+XX	○	○	○		○				○	○	
1 4		Under alarm point	+XXXXXX+XX	○	○	○		○				○	○	
1 5		Over alarm point	+XXXXXX+XX	○	○	○		○				○	○	
1 6		Under fallback value	+XXXXXX+XX	○	○	○		○				○	○	
1 7		Over fallback value	+XXXXXX+XX	○	○	○		○				○	○	
1 8		Smoothing factor	+XXXXXX+XX		○	○		○				○	○	
2 0	Pulse input	Meter factor	+XXXXXX+XX	○	○	○	○	○	○		○		○	○
2 1		Max. frequency	+XXXXXX+XX	○	○	○	○	○	○		○		○	○
2 2	Total count 1	Unit	XX	○	○	○	○	○	○		○		○	○
2 3	Total count 2	Unit	XX	○	○	○	○	○	○		○		○	○
2 4	Total count 3	Unit	XX											○
2 5	Instant measure	Instant flowrate measuring system	XX	○	○	○	○	○	○		○		○	○
2 6		Low cutoff frequency	+XXXXXX+XX	○	○	○	○	○	○		○		○	○
2 7		Low cutoff count stop	XX	○	○	○	○	○	○		○		○	○
2 8		Smoothing factor	+XXXXXX+XX	○	○	○	○	○	○		○		○	○
2 9		Max. wait time, instant rate measuring	+XXXXXX+XX	○	○	○	○	○	○		○		○	○
2 A		No. of cycles, instant rate metering	+XXXXXX+XX	○	○	○	○	○	○		○		○	○
2 B		Interpolation	XX	○	○	○	○	○	○		○		○	○
2 C		Ref. clock correction factor	+XXXXXX+XX	○	○	○	○	○	○		○		○	○
3 0	Analog output	Unit	XX	○	○	○	○	○	○	○	○	○	○	○
3 1		Baseline	+XXXXXX+XX	○	○	○	○	○	○	○	○	○	○	○
3 2		Full scale	+XXXXXX+XX	○	○	○	○	○	○	○	○	○	○	○
3 3		Upper limit of output	+XXXXXX+XX	○	○	○	○	○	○	○	○	○	○	○
3 4		Lower limit of output	+XXXXXX+XX	○	○	○	○	○	○	○	○	○	○	○
3 5		Low cutoff	+XXXXXX+XX										○	
3 6	Instant flow 1	Unit	XX	○	○	○	○	○	○		○		○	
3 7	Instant flow 2	Unit	XX			○	○	○	○		○			
3 8	Analog output	Smoothing factor	+XXXXXX+XX	○	○	○	○	○	○	○	○	○	○	○
3 9														
4 0	3 α corr. factor	Correction system	XX		○	○		○					○	○
4 1		α factor	+XXXXXX+XX		○	○		○					○	○
4 2		β factor	+XXXXXX+XX		○	○		○					○	○
4 3		Ref. temperature	+XXXXXX+XX		○	○		○					○	○
4 4	T/P corr. factor	Ref. temperature	+XXXXXX+XX			○		○				○		
4 5		Ref. pressure	+XXXXXX+XX			○		○				○		

Func.	Bracket	Item	Data format	4101	4111	4121	4131	4201	4211	4301	4311	4321	4401	4501
5 0	Temp. input	Correction system	XX	○	○	○	○	○	○		○		○	
5 1		Fixed value	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 2		Frequency 1	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 3		Frequency 2	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 4		Frequency 3	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 5		Frequency 4	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 6		Frequency 5	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 7		Frequency 6	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 8		Frequency 7	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 9		Frequency 8	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 A		Frequency 9	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 B		Meter error 1	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 C		Meter error 2	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 D		Meter error 3	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 E		Meter error 4	+XXXXXX+XX	○	○	○	○	○	○		○		○	
5 F		Meter error 5	+XXXXXX+XX	○	○	○	○	○	○		○		○	
6 0		Meter error 6	+XXXXXX+XX	○	○	○	○	○	○		○		○	
6 1		Meter error 7	+XXXXXX+XX	○	○	○	○	○	○		○		○	
6 2		Meter error 8	+XXXXXX+XX	○	○	○	○	○	○		○		○	
6 3		Meter error 9	+XXXXXX+XX	○	○	○	○	○	○		○		○	
6 8	Density	Unit	XX					○	○					
6 9		Density	+XXXXXX+XX					○	○					
7 0	Quad. corr. factor	Factor Pa	+XXXXXX+XX			○		○				○		
7 1		Factor Pb	+XXXXXX+XX			○		○				○		
7 2		Factor Pc	+XXXXXX+XX			○		○				○		
7 3		Factor Ta	+XXXXXX+XX			○		○				○		
7 4		Factor Tb	+XXXXXX+XX			○		○				○		
7 5		Factor Tc	+XXXXXX+XX			○		○				○		
7 6	Solids cont. calc.	Factor Da	+XXXXXX+XX								○			
7 7		Factor Db	+XXXXXX+XX								○			
7 8		Factor Dc	+XXXXXX+XX								○			
7 9		Factor Ta	+XXXXXX+XX								○			
7 A		Factor Tb	+XXXXXX+XX								○			
7 B		Factor Tc	+XXXXXX+XX								○			
7 C	Compression deviation factor.	Factor Z	+XXXXX+XX			○		○				○		
7 D		Factor B	+XXXXX+XX			○		○				○		
7 E		Factor C	+XXXXX+XX			○		○				○		
8 0	Superheated steam relative dens.	Unit	XX		○									
8 1	Superheated steam sp. enthalpy	Unit	XX		○									
8 2	Saturated steam relative dens.	Unit	XX	○										
8 3	Saturated steam sp. enthalpy	Unit	XX	○										
8 8	Temp. corr. coeff. (EL4131) (EL4211)	Ref. temperature	+XXXXXX+XX				○		○					
8 9		Coeff. A	+XXXXXX+XX				○		○					
8 A		Coeff. B	+XXXXXX+XX				○		○					
8 B		Coeff. C	+XXXXXX+XX				○		○					
8 C		Max. corr. coeff.	+XXXXXX+XX				○		○					
9 0	Density calculation (EL4401) (EL4501)	Unit	XX										○	○
9 1		Under fallback value	+XXXXXX+XX										○	○
9 2		Over fallback value	+XXXXXX+XX										○	○
9 3	Density calculation	Unit	XX							○	○	○		
9 4		Fixed value	+XXXXXX+XX							○	○	○		
9 5		Under alarm point	+XXXXXX+XX							○	○	○		
9 6		Over alarm point	+XXXXXX+XX							○	○	○		
9 7		Under fallback value	+XXXXXX+XX							○	○	○		
9 8		Over fallback value	+XXXXXX+XX							○	○	○		
9 9		Ref. temperature	+XXXXXX+XX							○	○			
9 A		Density with air	+XXXXXX+XX							○	○			
9 B		Temp., air calibration	+XXXXXX+XX							○	○			

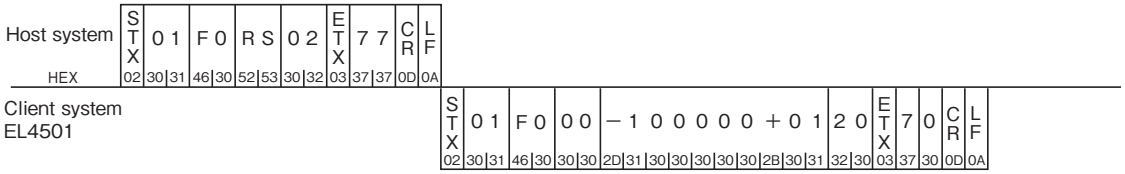
Func.	Bracket	Item	Data format	4101	4111	4121	4131	4201	4211	4301	4311	4321	4401	4501
9 C	Dens. calc.	Density period with air	+XXXXXX+XX							○	○			
9 D		Density with water	+XXXXXX+XX							○	○			
9 E		Density during calibration with water	+XXXXXX+XX							○	○			
9 F		Density period with water	+XXXXXX+XX							○	○			
A 0		Temp. corr. coeff. of tube spring const.	+XXXXXX+XX							○	○			
A 1		Reference temperature conversion factor of density	+XXXXXX+XX							○				
A 2		Density of carrier fluid	+XXXXXX+XX							○				
A 3		Density of target fluid	+XXXXXX+XX							○				
A 4		Selection of measuring system	XX									○		
A 5		Period (time)	+XXXXXX+XX									○		
A 6		Constant do	+XXXXXX+XX									○		
A 7		Constant K	+XXXXXX+XX									○		
A 8		Temperature during calibration, tcal	+XXXXXX+XX									○		
A 9		Temperature coeff. α	+XXXXXX+XX									○		
B 0	Density input	Unit	XX							○	○	○		
B 1		Corr. factor of internal ref. oscillator	+XXXXXX+XX							○	○	○		
C 0	Visc. corr. setup (EL4501)	Viscosity unit	XX											○
C 1		Under alarm point	+XXXXXX+XX											○
C 2		Over alarm point	+XXXXXX+XX											○
C 3		Meter error corr. visc.μ1	+XXXXXX+XX											○
C 4		Meter error corr. visc.μ2	+XXXXXX+XX											○
C 5		Meter error corr. visc.μ3	+XXXXXX+XX											○
C 6		Meter insp. Velocity (freq. 1)	+XXXXXX+XX											○
C 7		Meter error 11	+XXXXXX+XX											○
C 8		Meter error 21	+XXXXXX+XX											○
C 9		Meter error 31	+XXXXXX+XX											○
C A		Meter insp. Velocity (freq. 2)	+XXXXXX+XX											○
C B		Meter error 12	+XXXXXX+XX											○
C C		Meter error 22	+XXXXXX+XX											○
C D		Meter error 32	+XXXXXX+XX											○
C E		Meter insp. Velocity (freq. 3)	+XXXXXX+XX											○
C F		Meter error 13	+XXXXXX+XX											○
D 0		Meter error 23	+XXXXXX+XX											○
D 1		Meter error 33	+XXXXXX+XX											○
D 2		Meter insp. Velocity (freq. 4)	+XXXXXX+XX											○
D 3		Meter error 14	+XXXXXX+XX											○
D 4		Meter error 24	+XXXXXX+XX											○
D 5		Meter error 34	+XXXXXX+XX											○
D 6		Meter insp. Velocity (freq. 5)	+XXXXXX+XX											○
D 7		Meter error 15	+XXXXXX+XX											○
D 8		Meter error 25	+XXXXXX+XX											○
D 9		Meter error 35	+XXXXXX+XX											○
D A		Meter insp. Velocity (freq. 6)	+XXXXXX+XX											○
D B		Meter error 16	+XXXXXX+XX											○
D C		Meter error 26	+XXXXXX+XX											○
D D		Meter error 36	+XXXXXX+XX											○
D E		Meter insp. Velocity (freq. 7)	+XXXXXX+XX											○
D F		Meter error 17	+XXXXXX+XX											○
E 0		Meter error 27	+XXXXXX+XX											○
E 1		Meter error 37	+XXXXXX+XX											○
E 2		Meter insp. Velocity (freq. 8)	+XXXXXX+XX											○
E 3		Meter error 18	+XXXXXX+XX											○
E 4		Meter error 28	+XXXXXX+XX											○
E 5		Meter error 38	+XXXXXX+XX											○
E 6		Meter insp. Velocity (freq. 9)	+XXXXXX+XX											○
E 7		Meter error 19	+XXXXXX+XX											○
E 8		Meter error 29	+XXXXXX+XX											○
E 9		Meter error 39	+XXXXXX+XX											○

6.9.2 Command/Response

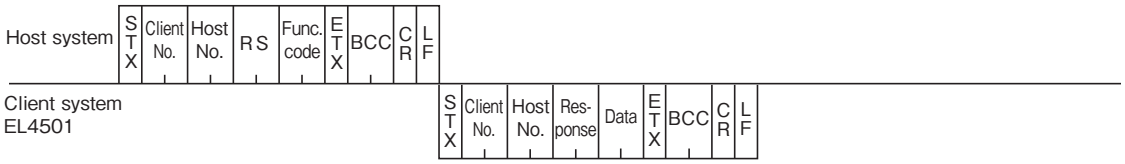
① To read numerical data



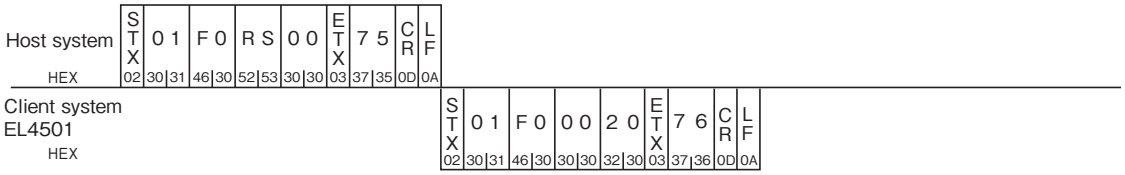
Example: Temperature baseline



② To read numerical data



Example: Temperature unit



6.10 SET Write Command (WS)

6.10.1 Data Contents

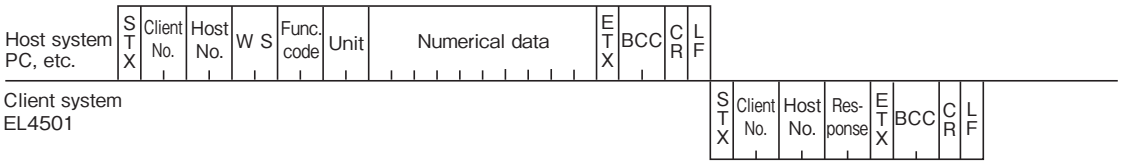
With this command, you can write the data in the SET mode individually.
Function codes are assigned to individual contents to be read. Modes other than SET mode are invalid.

Numerical data and their units are set up individually in pairs. These units however differ from those set up in the SET mode in that they are used in data transmission.

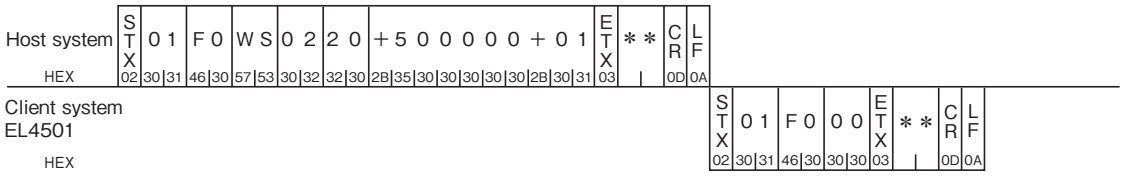
Example: Where ℃ is selected at the temperature unit setup menu in the SET mode, setting up "K" in messages over the communication network by no means alters SET-mode temperature related items to read in ℃.

6.10. 2 Command/Response

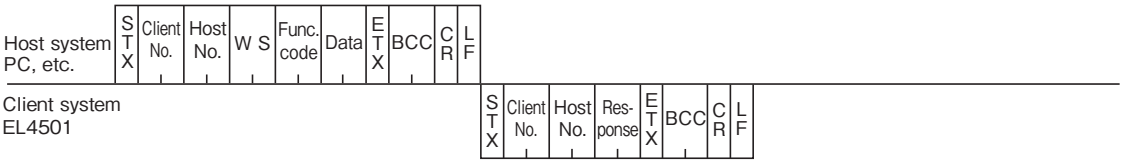
① To write numerical data



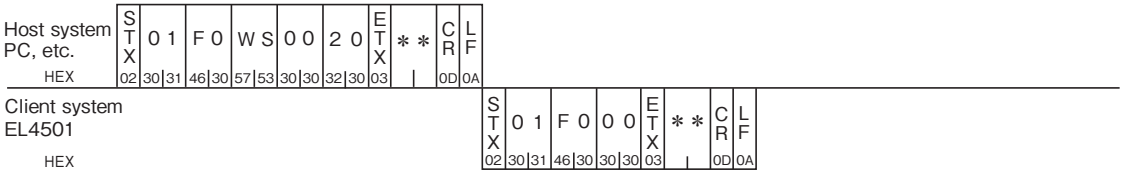
Example: Temperature baseline



② To write data



Example: Temperature unit



6.11 SYS Mode Data Read Command (RY)

6.11.1 Description

This command reads the contents data shown in the SYS mode individually. (See the list of SYS Mode Command Functions.)
Modes other than SYS mode are invalid.

Function of SYS Mode Command

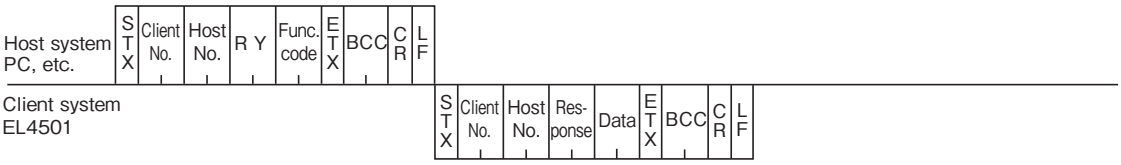
Func-tion	Bracket	Item	Data format	Data				
				0 0	0 1	0 2	0 3	0 4
0 0	Temperature input	Input type	XX	NONE	Rt100Ω	4-20mA	1-5V	—
0 1	Pressure input	Input type	XX	NONE	4-20mA	1-5V		
0 2	Analog output	Output type	XX					
0 3	Density input	Input type	XX	NONE	PULSE INPUT			
0 4	Pulse output 1	Output type	XX	NONE	TOTAL COUNT1	TOTAL COUNT2	TOTAL COUNT3	ALARM
0 5		Pulse out width	XX	1mS	50mS	—	—	—
0 6	Pulse output 2	Output type	XX	NONE	TOTAL COUNT1	TOTAL COUNT2	TOTAL COUNT3	ALARM
0 7		Pulse out width	XX	1mS	50mS	—	—	—
0 8	Pulse output 3	Output type	XX	NONE	TOTAL COUNT1	TOTAL COUNT2	TOTAL COUNT3	ALARM
0 9	Backlight	AUTO/Manual	XX	AUTO	MANUAL			
0 A		ON/OFF	XX	ON	OFF			
0 B	Power ON reset	ON/OFF	XX	ON	OFF			
0 C	RUN page save	ON/OFF	XX	ON	OFF			

Func.	Bracket	Item	4101	4111	4121	4131	4201	4211	4301	4311	4401	4401	4501
0 0	Temperature input	Input type		○	○	○	○	○	○	○	○	○	○
0 1	Pressure input	Input type	○	○	○	○	○				○	○	
0 2	Analog output	Output type			○	○	○	○	○	○			
0 3	Density input	Input type							○	○	○		
0 4	Pulse output 1	Output type	○	○	○	○	○	○		○	○	○	○
0 5		Pulse out width	○	○	○	○	○	○		○		○	○
0 6	Pulse output 2	Output type	○	○	○	○	○	○		○	○	○	○
0 7		Pulse out width	○	○	○	○	○	○		○		○	○
0 8	Pulse output 3	Output type	○	○	○	○	○	○	○	○	○	○	○
0 9	Backlight	AUTO/Manual	○	○	○	○	○	○	○	○	○	○	○
0 A		ON/OFF	○	○	○	○	○	○	○	○	○	○	○
0 B	Power ON reset	ON/OFF	○	○	○	○	○	○		○		○	○
0 C	RUN page save	ON/OFF	○	○	○	○	○	○	○	○	○	○	○

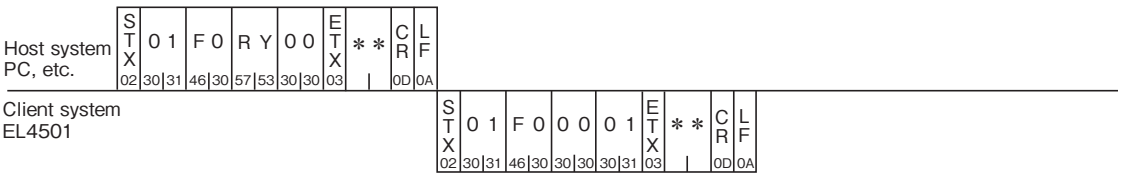
Function of Analog output (Function 02)

Model	Code			
	0 0	0 2	0 4	0 5
EL4121	FLOW RATE	FLOW RATE（C）	—	—
EL4131	FLOW RATE	FLOW RATE（C）	—	—
EL4201	FLOW RATE	FLOW RATE（C）	—	—
EL4211	FLOW RATE	FLOW RATE（C）	—	—
EL4301	—	—	DENSITY	% MASS
EL4311	FLOW RATE	FLOW RATE（SOLID）	SOLID RATIO	DENSITY(C)

6.11.2 Command/Response



Example: Temperature input format

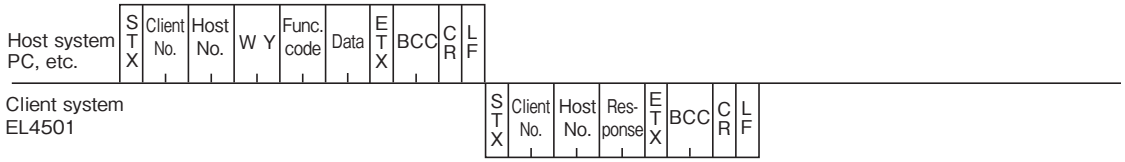


6.12 Write Command in SYS Mode (WY)

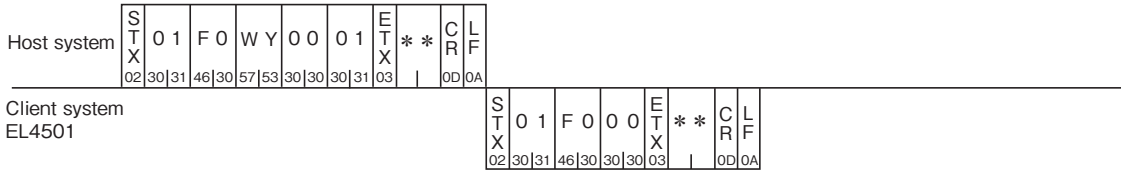
6.12.1 Description

This command writes contents in the SYS mode individually (See Functions of SYS Mode Command). Command is invalid unless in the local or SYS mode.

6.12.2 Command/Response



Example: Temperature input format



6.13 Error Status Read Command (RE)

6.13.1 Description

With this command, you can read the error count of the basic EL4001 and error flags (status). One error is represented by one byte; 0 (30H) = normal status as opposed to 1 (31H) = error status. (See the List of Functions.)

In reading individually, a response data is always sent in 2-bytes (specified location and 1-byte data that follows).

Function codes

00: Error count and listing

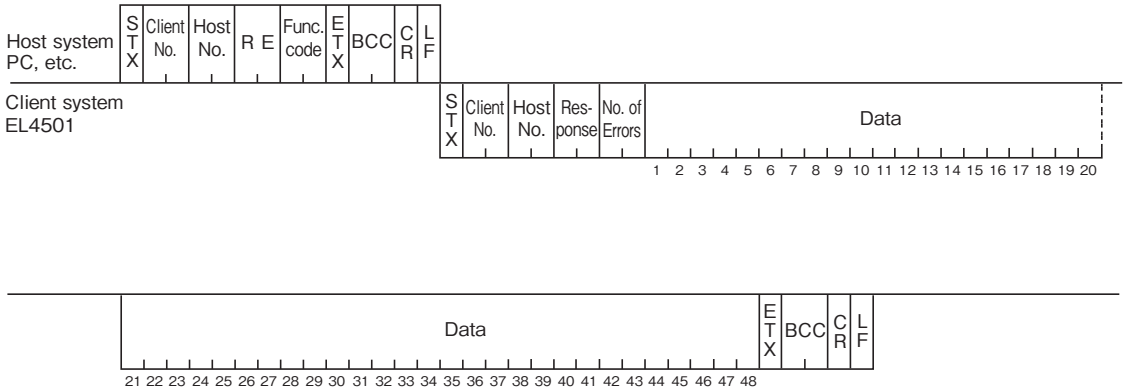
01… : Individual error status

A List of Error Status Read Commands Functions Generated by the Basic EL4501

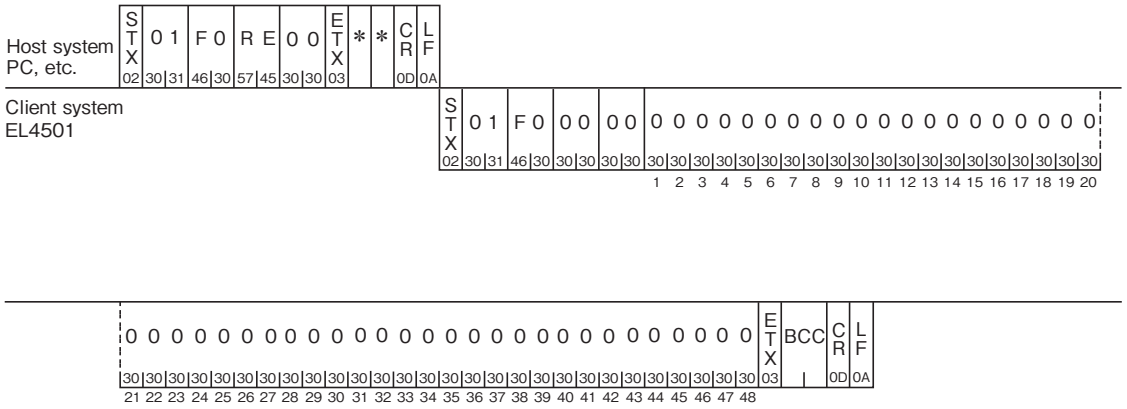
Func. byte	Func. code	Display	Description
1	01	ADJUST DATA ERROR	Adjust data error : Sumcheck mismatch
2	02	ADJUST DATA LIMIT ERR	Adjust data out of range : Adjustment data is out of acceptable range.
3	03	ADJUST DATA NONE	Adjustment not yet set : Adjustment has not been made.
4	04	MODEL PROGRAM ERROR	Model setup program error : Sumcheck mismatch
5	05	MODEL PROGRAM NONE	Model setup program not yet set : Model setup program has not been set.
6	06	SET PARAMETER ERROR	Setup parameter error : Sumcheck mismatch
7	07	SET PARAMETER NONE	Setup parameter not yet set : Setup parameters are set to defaults.
8	08	RAM CHECK ERROR	RAM check error : RAM check ended in error.
9	09	EEPROM CHECK ERROR	EEPROM check error : EEPROM check ended in error.
10	0A	PARAMETER PROTECT ERR	Parameter write protect error : Parameter write protect in error
11	0B	PROGRAM PROTECT ERR	Model setup program write protect error
12	0C	CALENDER ERROR	Calendar setup error : Calendar setup is in error.
13	0D	IC CARD WRITE ERROR	IC card write error : Fails to write the IC card.
14	0E	IC CARD READ ERROR	IC card read error : Fails to read the IC card.
15	0F	IC CARD ACCESS ERROR	IC card access error : Card removed while accessing the IC card.
16	10	POWER ON	Power ON : Power is turned ON.
17	11	A/D CONVERT ERROR	A/D conversion error : Density converter circuit has a fault.
18	12	DENSITY CONVERT ERROR	Density conversion error : Density converter circuit has a fault.
19	13	UNDEFINED	
20	14	TEMP1. (PT) OVER	Temp. input 1 Pt over flow : Temp. input 1 Pt level exceeded over alarm point.
21	15	TEMP1. (PT) UNDER	Temp. input 1 Pt under flow : Temp. input 1 Pt level exceeded under alarm point.
22	16	TEMP2. (PT) OVER	Temp. input 2 Pt over flow : Temp. input 2 Pt level exceeded over alarm point.
23	17	TEMP2. (PT) UNDER	Temp. input 2 Pt under flow : Temp. input 2 Pt level exceeded under alarm point.
24	18	TEMP1. (ANA) OVER	Temp. input 1 ANA over flow : Temp, input 1 ANA level exceeded over alarm point.
25	19	TEMP1. (ANA) UNDER	Temp. input 1 ANA under flow : Temp. input 1 ANA level exceeded under alarm point.
26	1A	TEMP2. (ANA) OVER	Temp. input 2 ANA over flow : Temp. input 2 ANA level exceeded over alarm point.
27	1B	TEMP2. (ANA) UNDER	Temp, input 2 ANA under flow : Temp. input 2 ANA level exceeded under alarm point.
28	1C	PRESS1. OVER	Press. input 1 over flow : Press. input 1 level exceeded over alarm point.
29	1D	PRESS1. UNDER	Press, input 1 under flow : Press. input 1 level fell below under alarm point.
30	1E	PRESS2. OVER	Press. input 2 over flow : Press. input 2 level exceeded over alarm point.
31	1F	PRESS2. UNDER	Press. input 2 under flow : Press. input 2 level fell below under alarm point.
32	20	DENSITY OVER	Density input 1 over flow : Density input 1 level exceeded over alarm point.
33	21	DENSITY UNDER	Density input 1 under flow : Density input 1 level fell below under alarm point.
34	22	4mA SCALER 1 UNDER	Analog output 1 under flow : Analog output 1 level fell below under alarm point.
35	23	20mA SCALER 1 OVER	Analog output 1 over flow : Analog output 1 level exceeded over alarm point.
36	24	4mA SCALER 2 UNDER	Analog output 2 under flow : Analog output 2 level fell below under alarm point.
37	25	20mA SCALER 2 OVER	Analog output 2 over flow : Analog output 2 level exceeded over alarm point.
38	26	UNDEFINED	
39	27	CALCULATION	Calculation start / end : Keeps start and end time of calculation for error logging.
40	28	UNDEFINED	
41	29	UNDEFINED	
42	2A	UNDEFINED	
43	2B	UNDEFINED	
44	2C	UNDEFINED	
45	2D	UNDEFINED	
46	2E	UNDEFINED	
47	2F	UNDEFINED	
48	30	UNDEFINED	

6.13.2 Command/Response

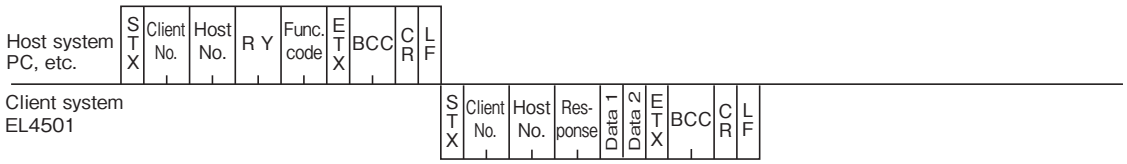
① A list of error status



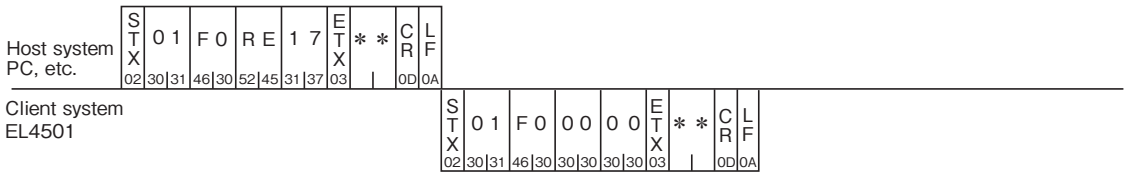
Example: A list of status



② Individual



Example: A/D conversion error



6.14 Error Logging Read Command (RL)

6.14.1 Description

With this command, you can read the logging record of error events in batch or individually.

Function No. 00: Batch read

01… : Read error events individually.

Error No. is the same as the byte number of error status read command. (00: "None")

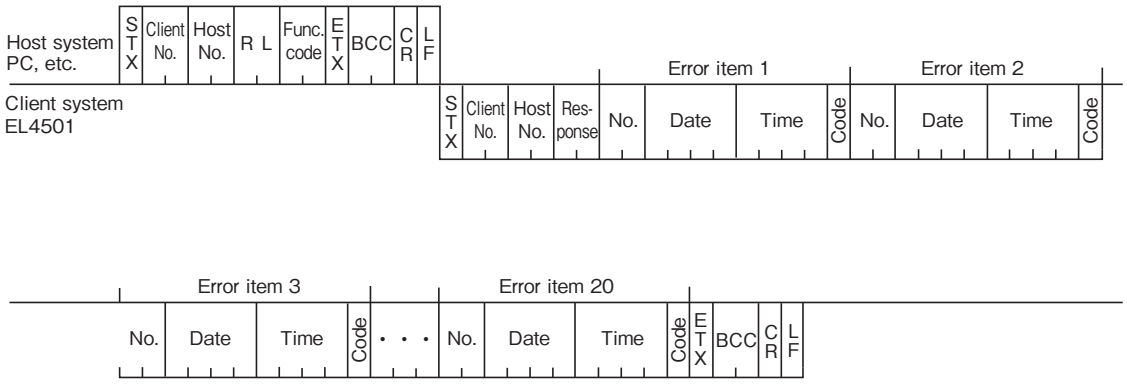
※ A total of 20 events can be stored in error record logging, error start/end discriminated. If error start/end count exceeds 20 in the course of logging, overwriting takes place at the first data. Accordingly, data stored in the first area of logging data is not necessarily the oldest one. It follows that you specify the data area No., rather than the sequential order of data, when you specify the contents to be read with this command.

※ "Year" is not included in the date to be read in error logging.

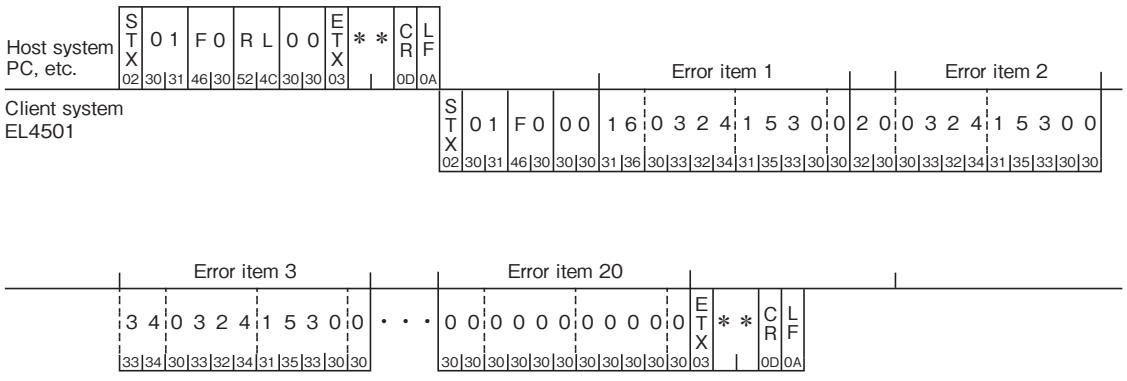
Start/end code 0 : Start 1 : End

6.14.2 Command/Response

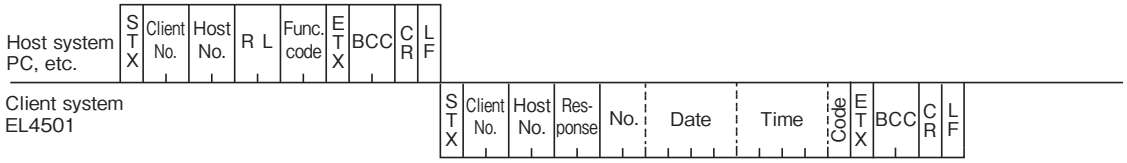
① Batch read



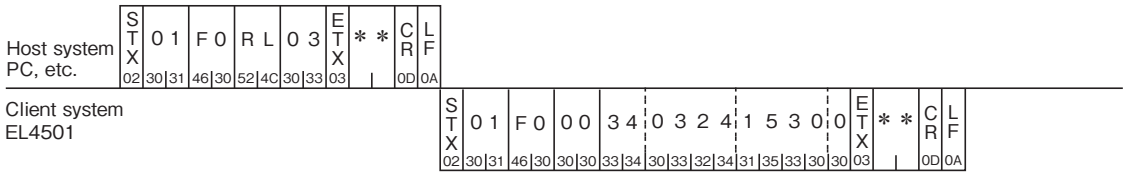
Example : Batch read



② Read individually



Example: Read individually (3rd item)



6.15 Model Setup Information Read Command (RI)

6.15.1 Description

This command allows you to read the model setup-related information in batch or individually.

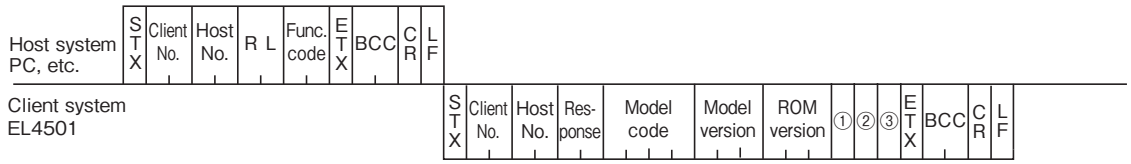
00 : Read in batch (model code, model setup version, common ROM version, parameter status, adjustment made or not yet made, password set or not yet set)
01… : Read individually

Function	Description	Data format
0 1	Model code	XXXX
0 2	Model setup version	XXX
0 3	Common ROM version	XXX
0 4	Parameter status	X
0 5	Calibration yes or no	X
0 6	Password setup yes or no	X

Description	0	1	2	3
Parameter status		D E F	S E T	End of setup
Calibration yes or no	N O	O K		
Password setup yes or no	Invalid	Valid		

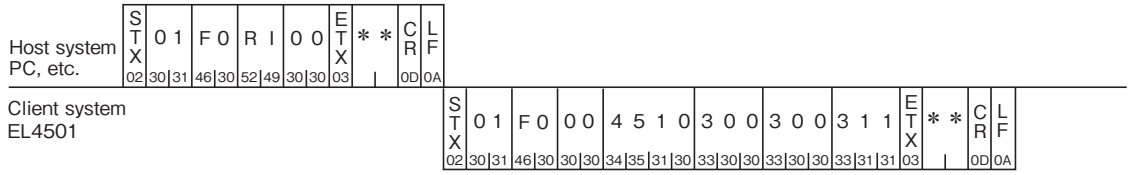
6.15.2 Command/Response

① Batch read

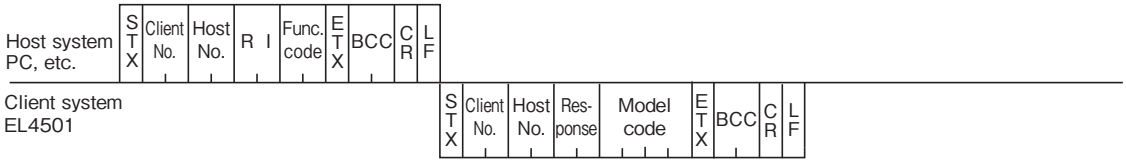


① Parameter status, ② Calibration yes or no, ③ Password yes or no

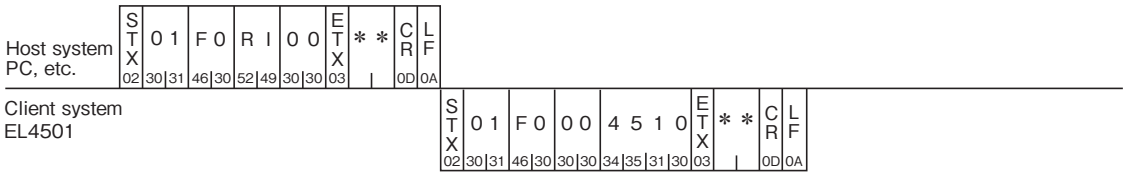
Example: Batch read



② Read individually (model code)



Example: Read individually (model code)



6.16 Local/Remote Select Command (SM)

6.16.1 Description

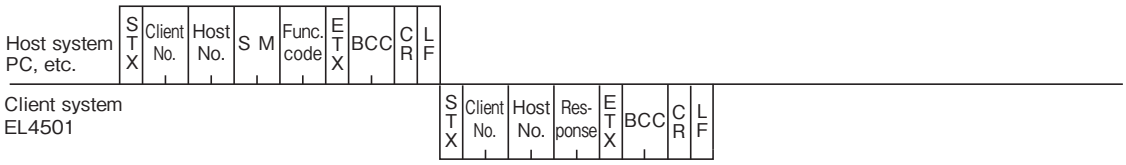
This command switches local/remote communication status.

With this command, switching is enabled when the communication setup in the SYS mode is in "AUTO".

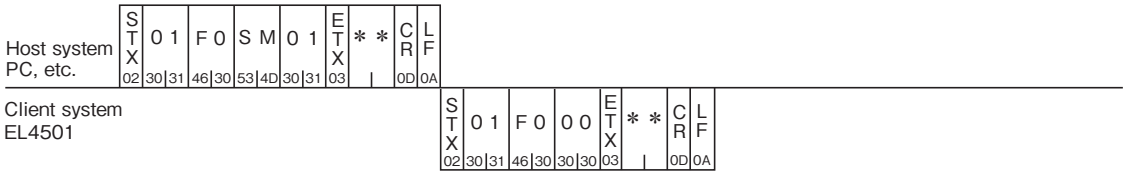
00: Local (keystrokes acceptable)

01: Remote (keystrokes unacceptable)

6.16.2 Command/Response



Example: Remote (keystrokes unacceptable)



6.17 Mode Select Command (MC)

6.17.1 Description

With this command, you can select RUN, SET, or SYS mode, similar to the way you operate the basic EL4501 with keys.

A password is included in a message. It is ignored if the password function is set in the "OFF". If the password is invalid with the password setup in the "ON", then the current mode remains unchanged.
In response, always the code of the current mode is returned.

Functions of Mode Select Command

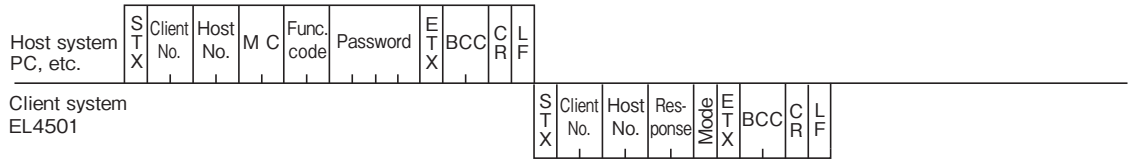
Function	Mode select	Description
0 0	R U N → S E T	EEPROM → RAM Copied to workarea
0 1	S E T → Scaling	Min. pulse output scaling calculation Min. output scaling factor to the response
0 2	Scaling → R U N	Add scale factor to the command message. Resultant to response code. If OK, go to RUN mode.
0 3	R U N → S Y S	Alter the end of calculation, go to SYS mode.
0 4	S Y S → R U N	Alter the end of calculation, go to RUN mode.
0 9	S E T mode cancel	Cancel all setup changes and return to RUN mode.

Mode Status Definitions

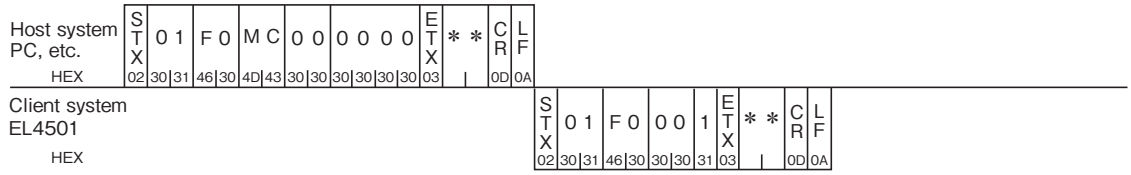
No.	Mode
0	R U N mode
1	S E T mode
2	S Y S mode
3	Scaling setup

6.17.2 Command/Response

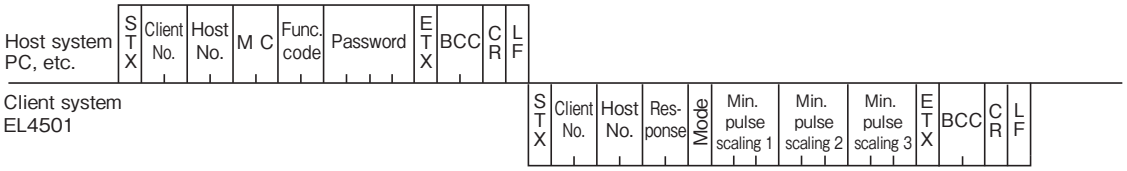
① RUN → SET



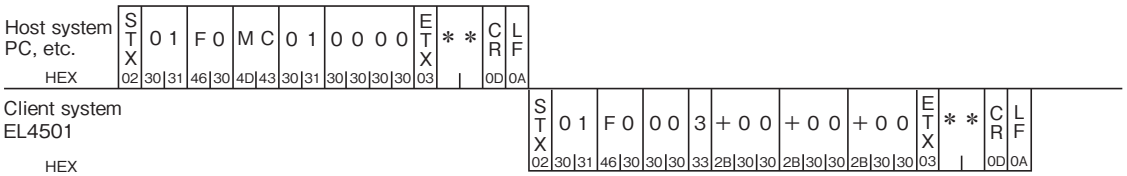
Example



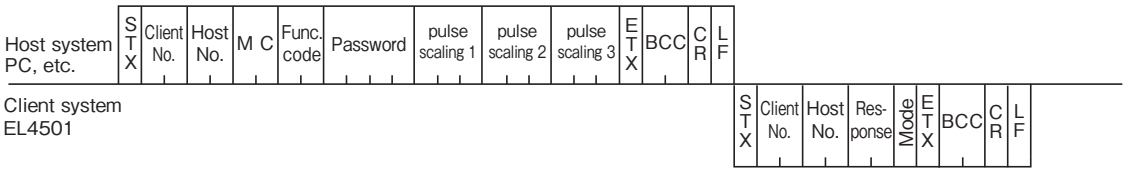
② SET → Scaling



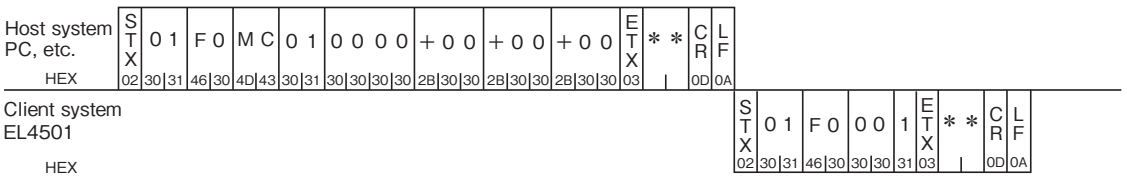
Example:



③ Scaling → RUN



Example:



6.18 Computer Status Read Command (RC)

6.18.1 Description

This command allows you to read in batch or individually the data indicating the operating status of the of the EL4501.

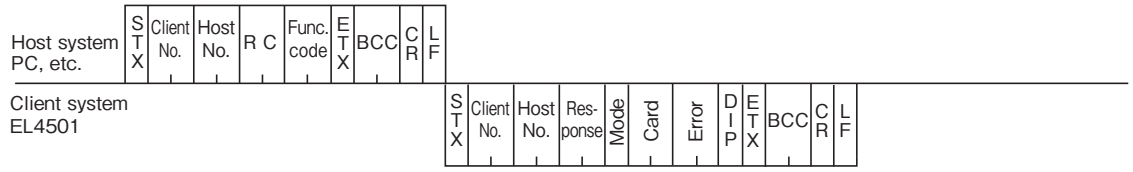
00 : Batch read
01… : Read respective items individually

Function	Description	Data format
0 1	Modes (RUN, SET, SYS, scaling setup)	X
0 2	Card insertion (model, calibration, maintenance, parameters, logging)	XX
0 3	Error count	XX
0 4	DIP setup enabled, disabled	X

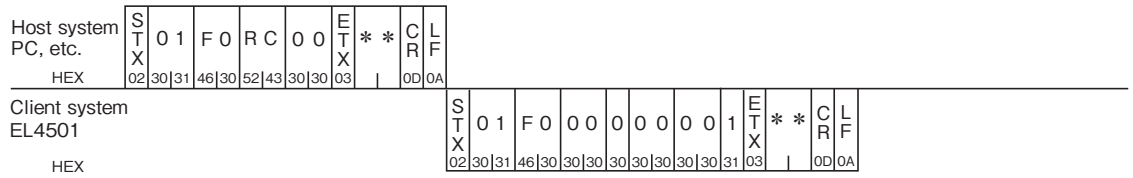
Description	0	1	2	3
Mode	R U N	S E T	S Y S	Scaling setup
D I P	Disabled	Enabled		

Description	0 0	1 0	2 0	4 0
Card insertion	None	Model	Calibration	Maintenance

6.18.2 Command/Response



Example :



6.19 SYS Mode Calendar Read Command (RD)

6.19.1 Description

With this command, you can read the calendar setting, or the date and hour displayed on the mode select menu screen.

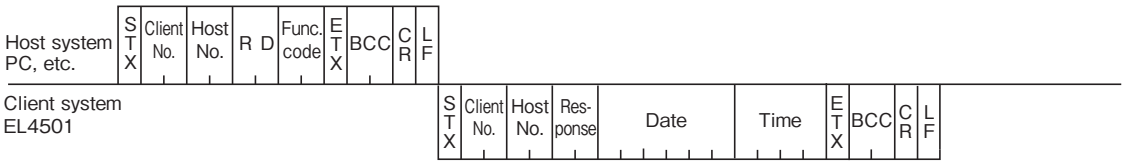
Any mode, including SYS mode, is valid for this command.

00: Batch read

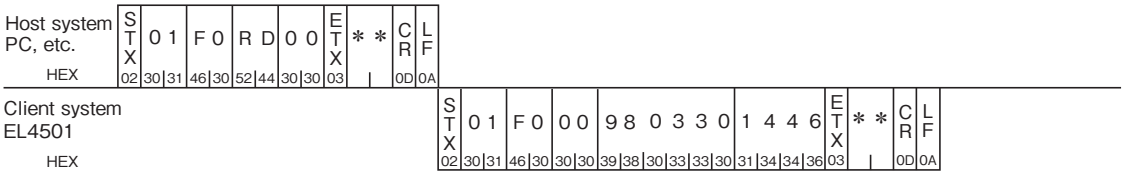
01: Date	02: Year	03: Month	04: Day
05: Time	06: Hour	07: Minute	

6.19.2 Command/Response

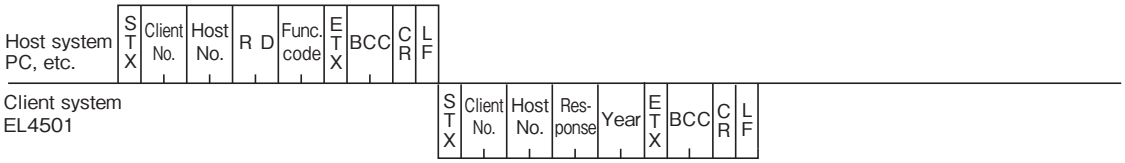
① Batch read



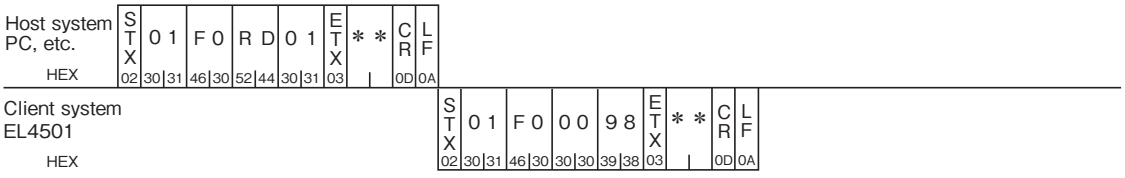
Example: Batch read



② Read individually



Example: Read individually (year)



6.20 SYS Mode Calendar Write Command (WD)

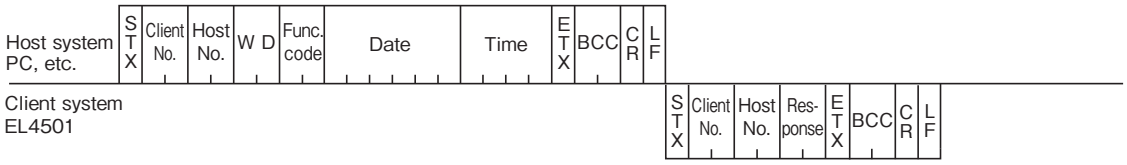
6.20.1 Description

With this command, you can write the date and time of calendar setting in the SYS mode.
Modes other than SYS mode are invalid.

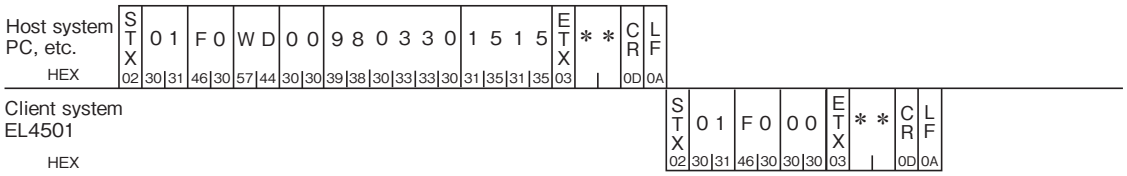
00: Batch read
01: Date 02: Year 03: Month 04: Day
05: Time 06: Hour 07: Minute

6.20.2 Command/Response

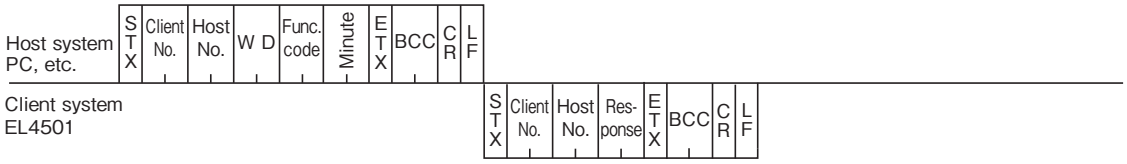
① Batch write



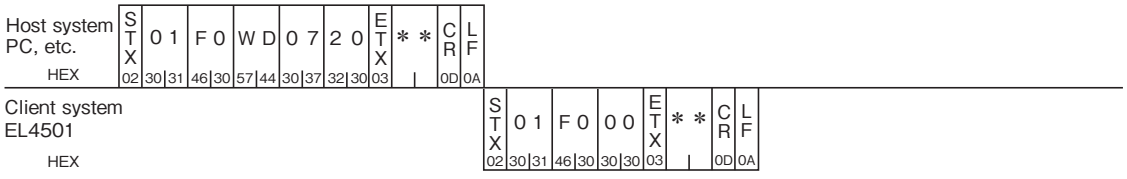
Example: Batch write



② Write individually



Example: Write individually (minute)



6.21 SYS Mode Total Counter Reset Command (ST)

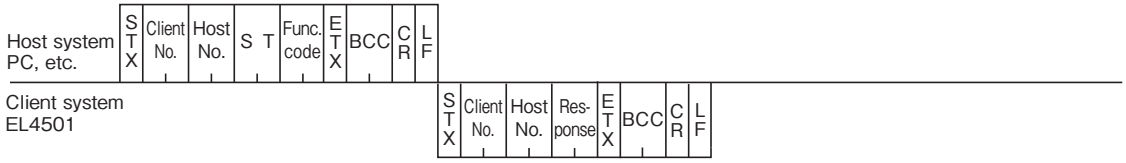
6.21.1 Description

With this command, you can reset the total counter readings in the SYS mode, either in batch or individually.
Modes other than SYS mode are invalid.

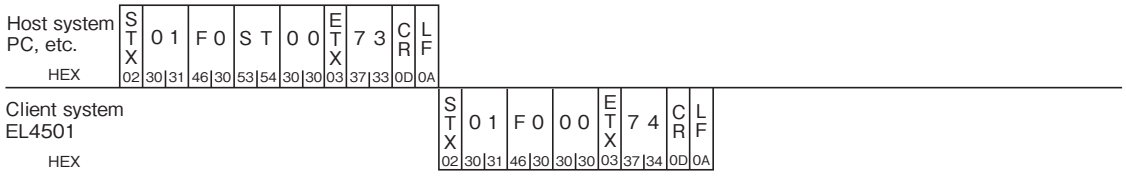
00: Batch 01: Total 1 02: Total 2 03: Total 3

With a model having no more than two total counters, an attempt to implement code 03: Total 3 will result in an error. Also, with a model not provided with total counters, always an error message will be emitted.

6.21.2 Command/Response



Example: Batch reset



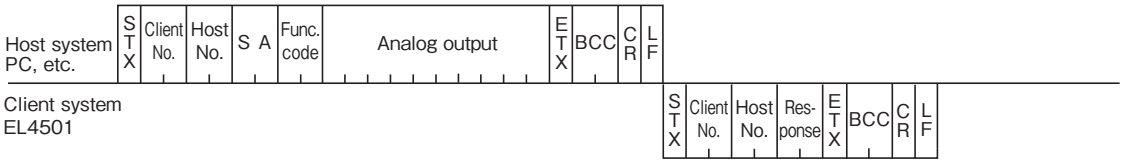
6.22 Simulated Analog Output SYS Mode Analog Output Command (SA)

6.22.1 Description

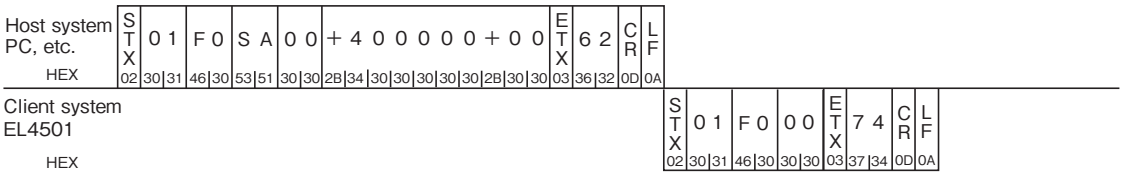
With this command, a simulated analog output can be produced by setting up the value for simulated analog output available in the SYS mode.
Modes other than SYS mode are invalid.
Following a command reception and sending its response, the analog output is updated.
The measuring unit to be set up is "mA".

00: Analog output 1 01: Analog output 2

6.22.2 Command/Response



Example: Analog output 1



6.23 Special Commands (SC) with EL4401

6.23.1 Function Codes 00 through 04

(1) Description

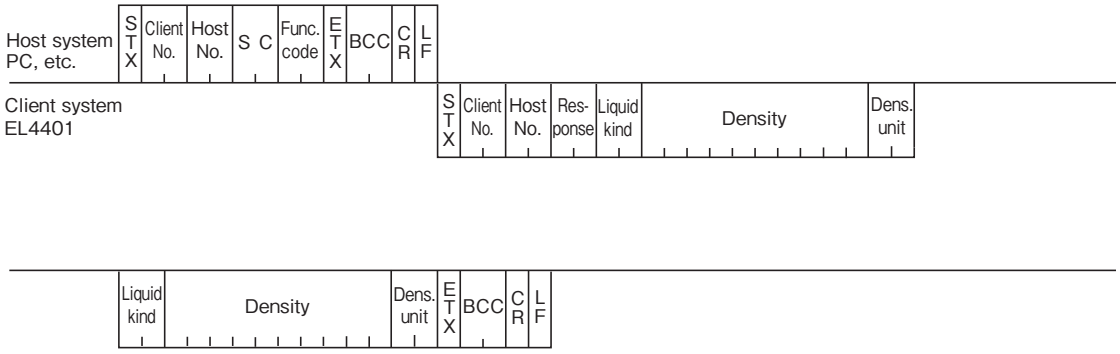
This command allows you to batch read the settings in the parameter setup mode (data: liquid kind, density, and density unit).

00: Batch read
01: Read liquid kind of liquid A 02: Read density and density unit of liquid A
03: Read liquid kind of liquid B 04: Read density and density unit of liquid B

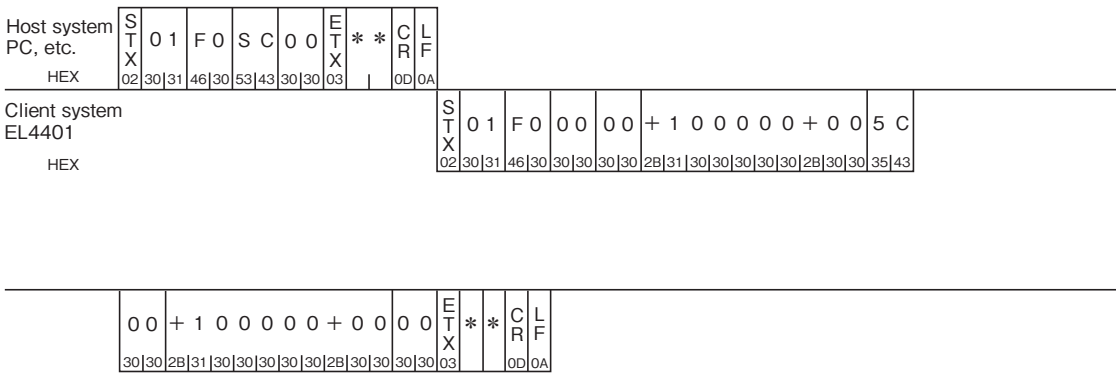
Code	Liquid kind
0	Crude
1	Fuel
2	Lube

(2) Command/Response

Batch read



Example: Batch read



6.23.2 Function Codes 05 through 07

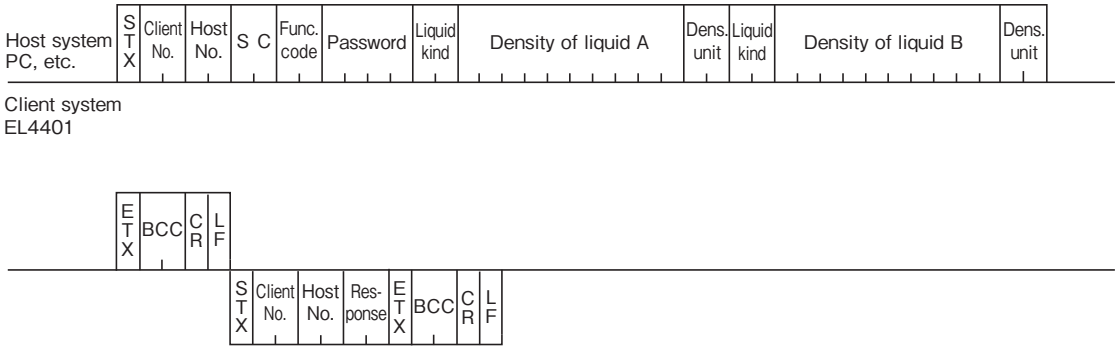
(1) Description

This command allows you to batch write the settings in the parameter setup mode (data: liquid kind, viscosity, viscosity unit, density, and density unit).
(For codes assigned to units, see Section 10. CODES ASSIGNED TO UNITS.)

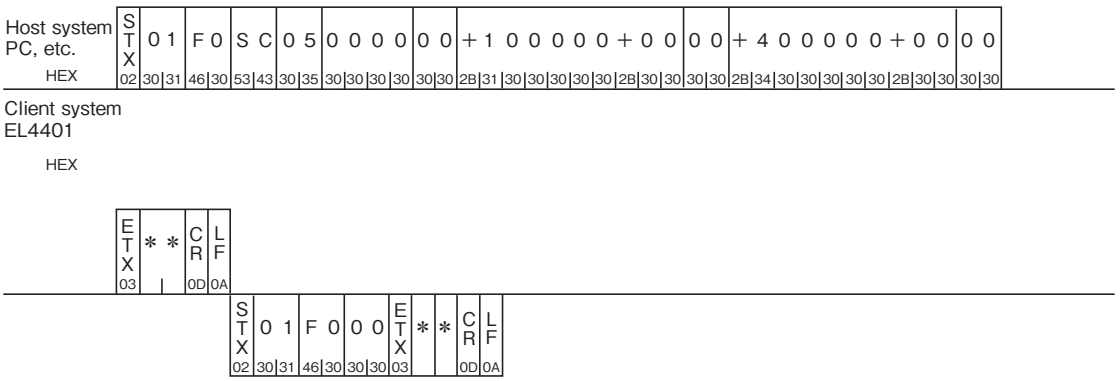
05: Batch write
06: Write liquid kind of liquid A
07: Write density and density unit of liquid A
08: Write liquid kind of liquid B
09: Write density and density unit of liquid B

6.23.3 Command/Response

Batch write



Example: Batch write



6.24 Special Commands (SC) with EL4501

6.24.1 Function Codes 00 through 03

(1) Description

This command allows you to batch read the settings in the KEY card (data: liquid kind, viscosity, viscosity unit, density, and density unit).

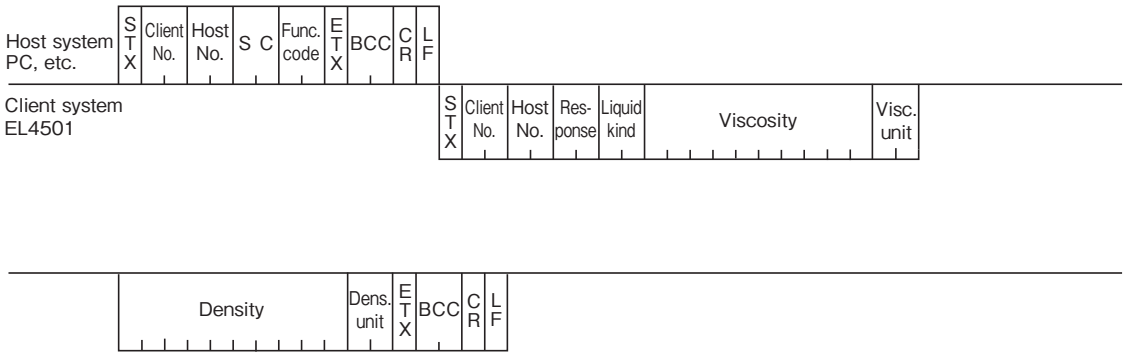
00: Batch read

01: Read liquid kind　　02: Read viscosity and viscosity unit　　03: Read density and density unit

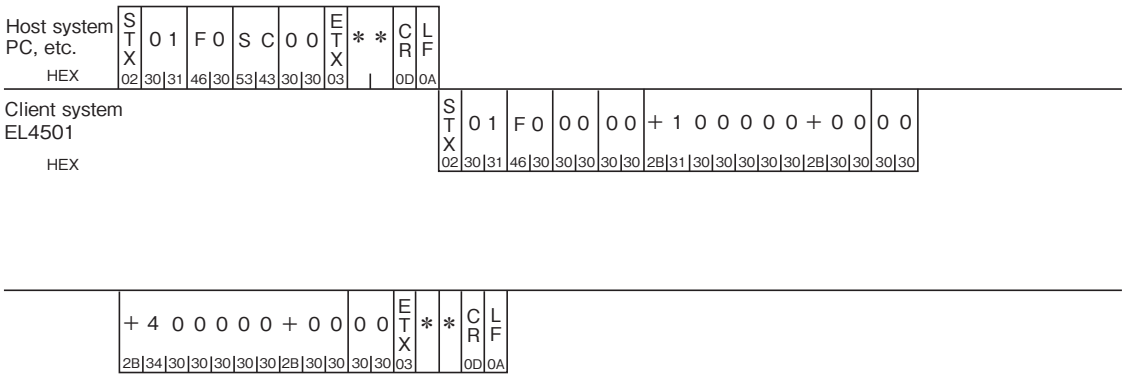
Code	Liquid kind
0	Crude
1	Fuel
2	Lube

(2) Command/Response

Batch read



Example: Batch read



6.24.2 Function Codes 04 through 07

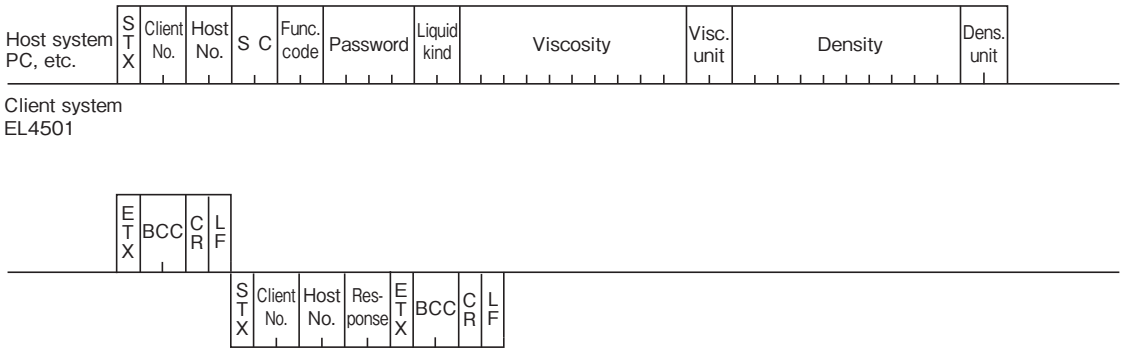
(1) Description

This command allows you to batch write the settings in the KEY card (data: liquid kind, viscosity, viscosity unit, density, and density unit).
The KEY card is primarily intended for use as substitute for the key. However, since it cannot play this role in data communication, a write lock with a password is made to serve as substitute for the key.
(For more complete information about the codes for units, see Chapter 12, CODES ASSIGNED TO UNITS.)

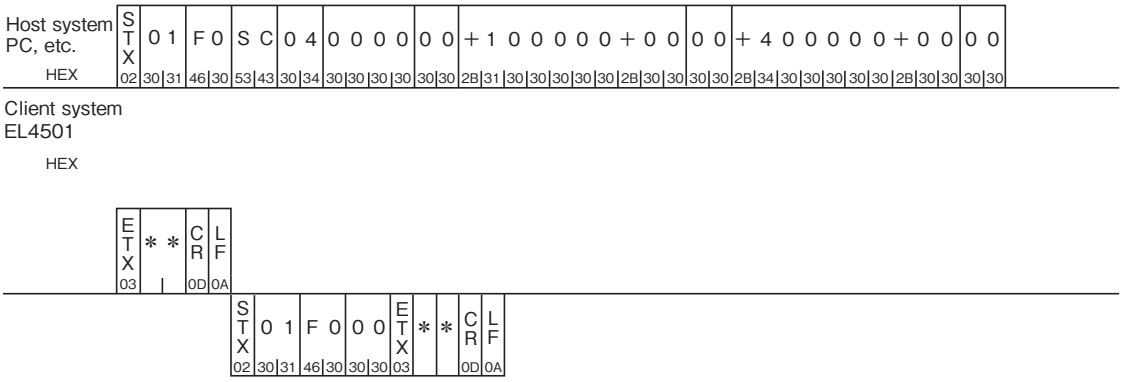
04: Batch read
05: Read liquid kind 06: Read viscosity and viscosity unit 07: Read density and density unit

6.24.3 Command/Response

Batch read



Example: Batch read

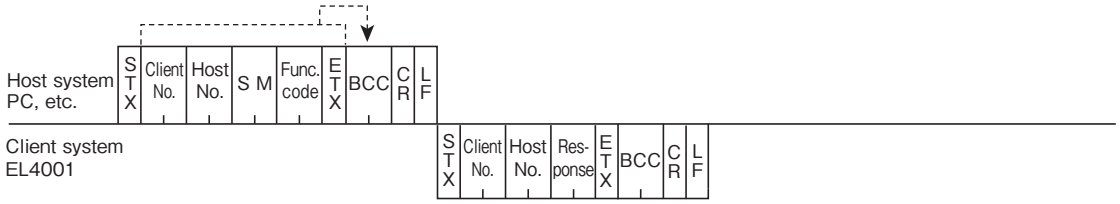


7. ABOUT BCC / SUMCHECK

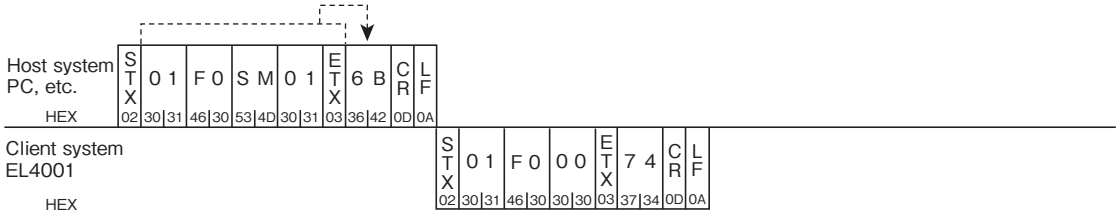
A check data may be added to the message at the communication setup menu in the SYS mode.

① BBC check

This data can be determined by exclusive OR (XOR) all characters from next "STX" through "ETX" in the message below.



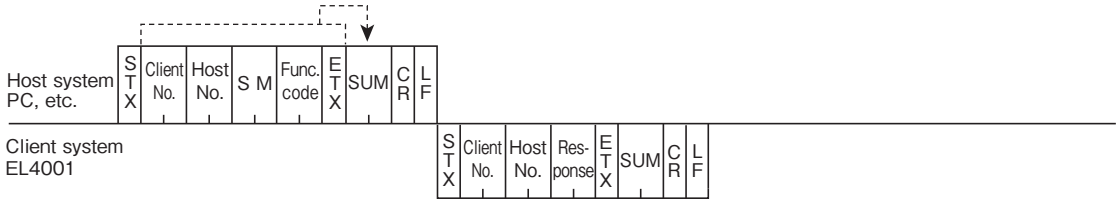
Example: Remote (keystrokes unacceptable)



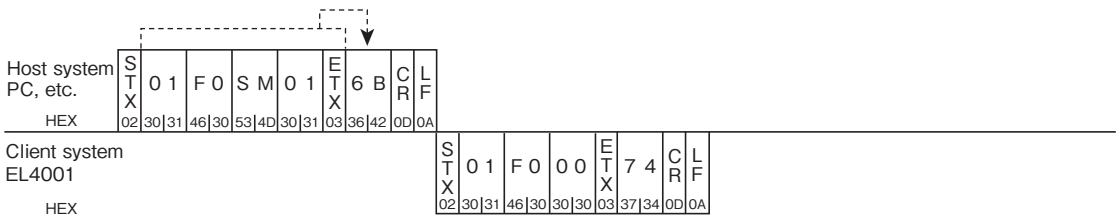
6BH = 30H XOR 31H XOR 46H XOR 30H XOR 53H XOR 4DH XOR 30H XOR 31H XOR 03H

② Sumcheck

This data can be determined by the last 8-bit data of the sum of bytes from next "STX" through "ETX" in the message below.



Example: Remote (keystrokes unacceptable)

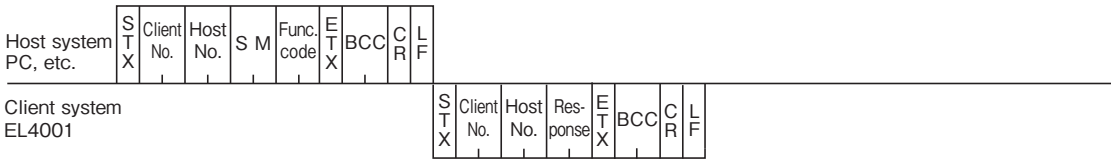


6BH = 30H XOR 31H XOR 46H XOR 30H XOR 53H XOR 4DH XOR 30H XOR 31H XOR 03H

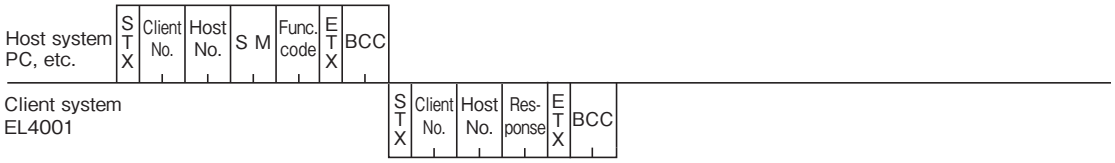
8. ABOUT CR / LF

CR or LF may be added to the end of a message in your SYS mode communication setup.

① C R + L F

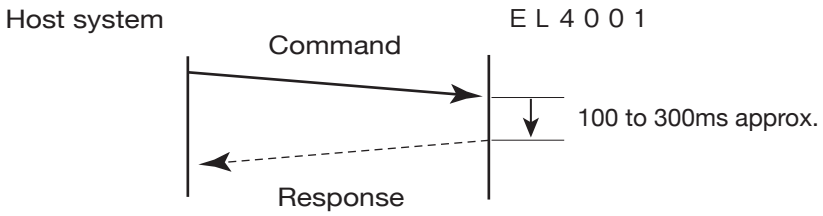


② None

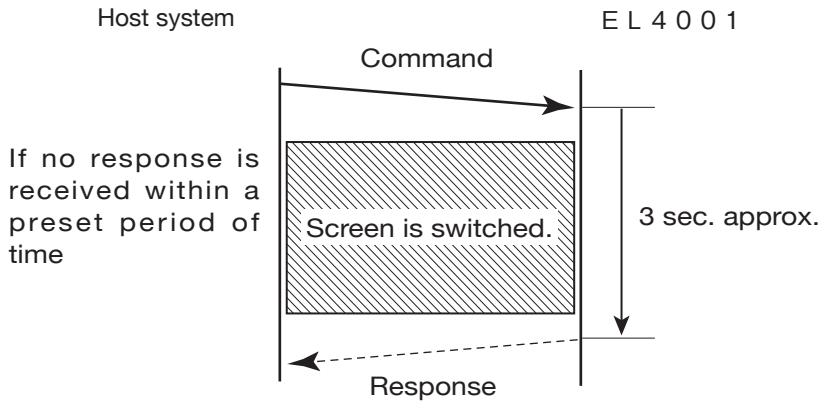


9. ABOUT DURATION BETWEEN MESSAGES

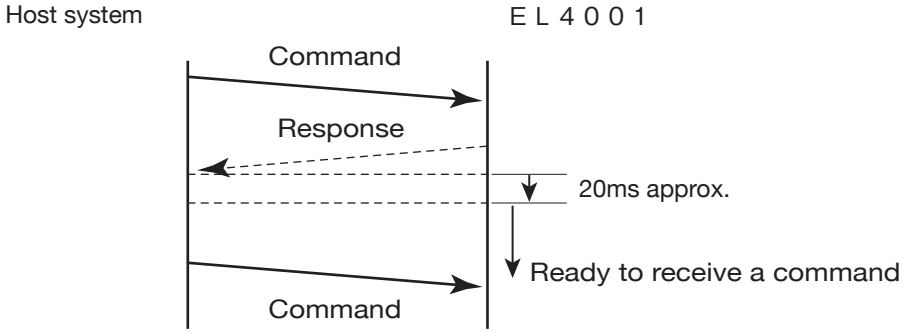
The duration required from the time the host system issues a command until the EL4001 issues a response data is about 100 to 300ms.



Execution of 01: Remote (keystrokes unacceptable) command in the local/remote select command (SM) involves sending a response data as a result of switching from one screen to another. Hence, a duration of about 3 seconds is required in this case.



It requires about 20ms for the EL4001 to issue a response until being ready to receive the next command. If it is desired to issue a series of commands from the host computer, provide this time duration before you issue subsequent command.



10. CODES ASSIGNED TO UNITS

CODE	Decimal Point	Measuring unit	Applica-tion	CODE	Decimal point	Measuring unit	Applica-tion	CODE	Decimal point	Measuring unit	Applica-tion
04	3	bar		4B	0	kg/h		A0	0	m^3/min (std)	
05	4	mHg		4D	0	t/min		A1	0	m^3/h (std)	
06	0	mmH20		4E	0	t/h		A2	0	ml/min (std)	
07	2	Psi		50	0	lb/min		A3	0	ml/h (std)	
08	4	MPa		51	0	lb/h		A4	0	kl/min (std)	
09	0	g/cm^2		54	0	ton (US) /min		A5	0	kl/h (std)	
0A	3	kgf/cm^2		55	0	ton (US) /h		A6	0	kl (std)	
0B	0	Pa		57	0	m^3/min (nor)		A7	0	l/min (std)	
0C	1	kPa		58	0	m^3/h (nor)		A8	0	l/h (std)	
0D	1	Torr		5A	0	l/p		A9	0	l (std)	
0E	3	atm		5C	4	g/cm^3	Liquid	AF	0	m^3 (C)	EL4131
10	0	gal (US) /min		5D	1	kg/m^3	Liquid	B0	0	m^3/min (C)	EL4131
11	0	l/min		5E	4	kg/l	Liquid	B1	0	m^3/h (C)	EL4131
12	0	gal (UK) /min		5F	4	g/ml	Liquid	B2	0	ml/min (C)	EL4131
13	0	m^3/h		60	1	g/l	Liquid	B3	0	ml/h (C)	EL4131
18	0	l/s		61	6	kg/ml	Liquid	B4	0	kl/min (C)	EL4131
20	2	C°		63	1	g/m^3	Liquid	B5	0	kl/h (C)	EL4131
21	2	F°		6C	2	kJ/kg		B6	0	kl (C)	EL4131
23	2	K		6D	2	J/g		B7	0	l/min (C)	EL4131
28	0	gal (US)		6E	3	kcal/kg		B8	0	l/h (C)	EL4131
29	0	l		6F	3	cal/g		B9	0	l (C)	EL4131
2A	0	gal (UK)		73	0	g/mol		C8	0	gal (US) /h	
2B	0	m^3		78	0	Hz		CA	0	l/h	
30	2	µs		79	0	kHz		CD	0	gal (UK) /h	
31	5	ms		7D	0	g/l/℃		CF	0	m^3/min	
32	0	min		7E	0	g/ml/℃		D0	0	ml/sec	
33	0	s		82	0	µsec/℃		D1	0	ml/min	
34	0	h		83	0	msec/℃		D2	0	ml/h	
35	0	d		84	0	sec/℃		D3	0	ml/min (nor)	
36	0	MJ		87	0	%		D4	0	ml/h (nor)	
37	0	cal		8C	3	P		D5	0	kl/min	
38	0	kcal		8D	1	cP		D6	0	kl/h	
39	0	Mcal		8E	4	Pa・s		D7	0	kl/min (nor)	
3A	0	J		8F	1	mPa・s		D8	0	kl/h (nor)	
3B	0	kJ		90	4	N・s/m^2		DE	0	ml	
3C	0	g		93	6	g/cm^3	Gas	DF	0	kl	
3D	0	kg		94	4	kg/m^3	Gas	E0	0	m^3 (nor)	
3E	0	t		95	6	kg/l	Gas	E1	0	l (nor)	
3F	0	lb		96	6	g/ml	Gas	E3	0	barrel	
40	0	ton (US)		97	4	g/l	Gas	E4	0	kl (nor)	
47	0	g/min		98	6	kg/ml	Gas	EA	0	l/min (nor)	
48	0	g/h		9A	4	g/m^3	Gas	EB	0	l/h (nor)	
4A	0	kg/min		9F	0	m^3 (std)		EB	0	l/h (nor)	

11. ASCII CODE

				B5	0	1	0	1	0	1	0	1
				B6	0	0	1	1	0	0	1	1
				B7	0	0	0	0	1	1	1	1
				B8	0	0	0	0	0	0	0	0
B4	B3	B2	B1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE		0	@	P		p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	“	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BE	ETB	‘	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	A	LF	SB	*	;	J	Z	j	z
1	0	1	1	B	HM	EC	+	;	K	[	k	{
1	1	0	0	C	CL	→	,	<	L	¥	l	|
1	1	0	1	D	CR	←	−	=	M	]	m	}
1	1	1	0	E	SO	↑	.	>	N	^	n	~
1	1	1	1	F	SI	↓	／	?	O	_	o	DEL

SOH：**Start of Heading**
STX：**Start of Text**
ETX：**End of Text**
EOT：**End of Transmission**
ENQ：**Enquiry**
ACK：**Acknowledge**
DLE：**Data Link Escape**
NAK：**Negative Acknowledge**
SYN：**Synchronous Idle**
ETB：**End of Transmission Block**

2022.05 Revised △
2008.09 Released
E-880CM-3-E (1)

All specifications are subject to change without notice for improvement.

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