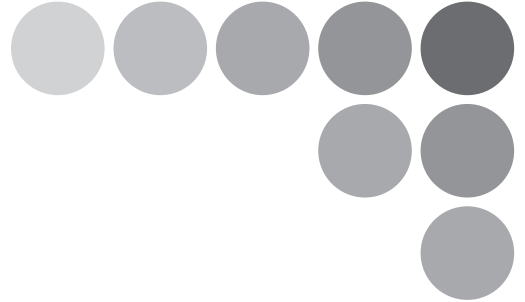# OMRON

Smart Sensors

ZS-HL-N Series

Non-procedual Communication Command Reference

Introduction

Thank you for purchasing the ZS-HL-N Series.
This manual provides reference information on non-procedural communication commands for ZS-HL-N Series.

When using the ZS-HL-N Series, be sure to observe the following:
- The ZS-HL-N Series must be operated by personnel knowledgeable in electrical engineering.
- To ensure correct use, please read this manual thoroughly to deepen your understanding of the product.
- Please keep this manual in a safe place so that it can be referred to whenever necessary.

Contents

Setting the Communication Specifications

Change the settings of the controller communication specifications for non-procedural communication with the external device.

CHECK! Use USB cable or RS-232C cable to connect ZS-HL-N Series controllers to external devices. For USB cable connection, install Smart Monitor ZS and USB driver beforehand. After installing Smart Monitor ZS, USB ports are recognized as standard COM ports, and communication is achieved as with the RS-232C. (Setting the communication specifications including baud rate is not necessary.) For details on how to connect cable, refer to the User's Manual for each controller.

1. Set the mode switch to "FUN".

2. Select [System] - [Communication] - [Mode] menu.

3. Select [non-procedural].

4. For RS-232C cable connection, select [System] - [Communication] - [RS-232C] menu to set the appropriate communication specifications for the external device.

5. Save the settings.

Format

The format of non-procedural commands are as follows:

Example: A command to acquire a measured value MEASURE command
* Each character is output as an ASCII code (except for FLOWDATA response).

| M	E	A	S	U	R	E		O	CR

Space   Delimiter
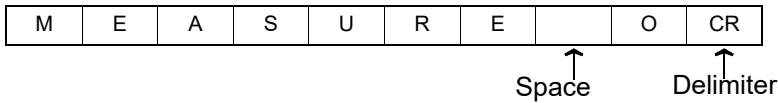
The format of returned values changes depending on the command.
For the description of each command, refer to "List of Non-procedural Commands" section.

•MEASURE / M / DATAGET
The returned value consists of right aligned 11 characters and a delimiter. The unit is nm for a displacement value. Shortfalls of the characters are filled with spaces from the left.

Example: The returned value is -30.719923 mm.

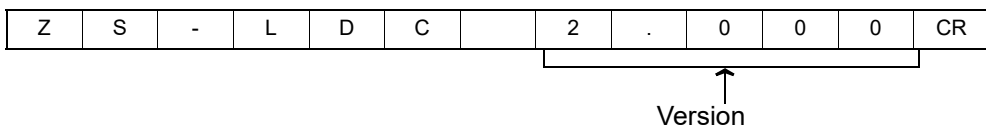|		-	3	0	7	1	9	9	2	3	CR
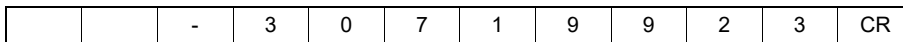
•BANKGET command
The returned value is output as 1 character bank No.

Example: The bank No. is 2.

1	CR

•VERGET command
The returned value is output in the following format:

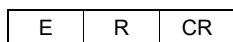| Z	S	-	L	D	C		2	.	0	0	0	CR

Version

•Other commands
Either OK or ER is returned according to the result of the command. The command was executed properly:

O	K	CR
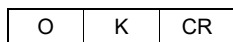
The command was not executed properly or the setting was NG:

E	R	CR

The delimiter can be selected from the following three types.
CR/LF/CR+LF

List of Non-procedural Commands

Command name	Format	Returned value	Description
MEASURE	MEASURE <Task No.> <delimiter>	<measured value> <delimiter>	Acquires a measured value. If <Task No.> is omitted, it aqcuires the displayed measured value.
M	M <Task No.> <delimiter>	<measured value> <delimiter>	Same as MEASURE command.
DATAGET	DATAGET <Unit No.> <Data No.> <delimiter>	<Data> <delimiter>	Acquires measurement data or setting data of the processing unit. * For details of numbers, refer to "List of Parameters." p.6
DATASET	DATAGET <Unit No.> <Data No.> <Setting value> <delimiter>	OK <delimiter> ER <delimiter>	Changes setting data of the processing unit. * For details of numbers, refer to "List of Parameters." p.6
BANKGET	BANKGET<delimiter>	<Bank No.> <delimiter>	Acquires the current bank No.
BANKSET	BANKSET<Bank No.> <delimiter>	OK <delimiter> ER <delimiter>	Switches to the designated bank No.
ZERORST	ZERORST <Task No.> <delimiter>	OK <delimiter> ER <delimiter>	Executes a zero-reset. If <Task No.> is omitted, it executes on the task currently displayed as a result. If <Task No.> is set to 4, it executes on all the tasks.
ZEROCLR	ZEROCLR <Task No.> <delimiter>	OK <delimiter> ER <delimiter>	Cancels a zero-reset. If <Task No.> is omitted, it executes on the task currently displayed as a result. If <Task No.> is set to 4, it executes on all the tasks.
DATASAVE	DATASAVE <delimiter>	OK <delimiter> ER <delimiter>	Saves all the bank data on the flash memory of the controller.
VERGET	VERGET<delimiter>	<Type/Version> <delimiter>	Acquires version information of the system. Example: ZS-LDC 1.100<delimiter>
FLOWDATA	FLOWDATA <delimiter>	OK <delimiter> ER <delimiter>	Used to acquire measurement data at the shortest intervals possible. For details, refer to "FLOWDATA Reference." p.14

* Specifying the node

Specify @xx at the beginning of the command.

If the node No. is 1, specify @01. (Be sure to note double digits.)

If the node No. is omitted, the command operates on the node that received it.

* Format of a returned value
    A returned value for MEASURE,M,DATAGET,CFLOGGET,CFDATGET is the right aligned 11 characters.
* Upper case and lower case characters
    For alphabetic, only upper case characters are accepted.
* Task No.
    Omit <Task No.> when issuing a command for ZS-LDC.
    Task Nos are assigned as follows: 0: TASK1   1: TASK2   2: TASK3   3: TASK4.

List of Parameters

The following parameters can be obtained or set by DATASET or DATAGET command:

Unit No.	Data No.	Parameter	Setting range/Output range	Others
0	0	Measurement mode	0: STANDARD 1: HI-RESO 2: HI-SPEED 3: HI-SENS 4: CUSTOM	When multi-task mode is OFF.
		Measurement mode	1: STANDARD 2: HI-RESO 3: HI-SENS 4: CUSTOM	When multi-task mode is ON.
	12	Start position of area 1	0 to 639 (pix)	
	14	End position of area 1	0 to 639 (pix)	
	13	Start line of area 1	0 to (No. of additional lines - 1)	
	15	End line of area 1	0 to (No. of additional lines - 1)	
	24	Start position of area 2	0 to 639 (pix)	
	26	End position of area 2	0 to 639 (pix)	
	25	Start line of area 2	0 to (No. of additional lines - 1)	
	27	End line of area 2	0 to (No. of additional lines - 1)	
	18	Exposure time	2 to 200 (1 div: 0.1ms) When multi-task mode is OFF. 5 to 200 (1 div: 0.1ms) When multi-task mode is ON.	Parameters for CUSTOM mode
	19	Number of additional lines	1 to 200 When multi-task mode is OFF. 8 to 200 When multi-task mode is ON.	
	20	Line skipping	0: OFF 1: ON	
	22	2-area mode	0: OFF 1: ON	
	23	Compensation mode	0: OFF 1: Start position compensation 2: End position compensation 3: Start/End position compensation	
	32	Measurement cycle	112 to 20000 (us)	
	192	Reference point teach for compensation mode	1: Execute teach	
	193	2-area teach	1: Execute teach	
1	0	Head installation	0: Diffuse 1: Regular	

Unit No.	Data No.	Parameter	Setting range/Output range	Others
2	0	LD power mode	0: Auto 1: Auto-scale 2: Fixed	
	2	Surface to be controlled for light amount	0: Peak 1: First surface 2: Second surface 3: Third surface	
	6	LD power when fixed	0 to 800 (1 div: 0.1%)	
	13	Lower limit of LD power	0 to 800 (1 div: 0.1%)	
	14	Upper limit of LD power	0 to 800 (1 div: 0.1%)	
	32	Incident level	0 to 4095	
	36	LD power	0 to 800 (1 div: 0.1%)	
	37	Incident level (First surface)	0 to 4095	
	38	Incident level (Second surface)	0 to 4095	
	39	Incident level (Third surface)	0 to 4095	
3	0	Measurement object	When multi-task mode is OFF. 0: STANDARD 1: PCB 2: Mirror 3: Glass surface 4: Glass thickness When multi-task mode is ON. 0: STANDARD 1: PCB 2: Mirror 3: Glass surface	
	2	GLASS/GLASS THICKNESS mode	0: Mode 1 1: Mode 2	
	3	Image smoothing level	0: No filter 1: Filter size 2 2: Filter size 4 3: Filter size 8 4: Filter size 16	When the measurement object is changed, the settings are initialized according to the selected object.
	4	Background removing level before addition	0 to 255 (tone)	
	6	Edge threshold	0: 0% 1: 12.5% 2: 25% 3: 37.5% 4: 50% 5: 62.5% 6: 75% 7: 87.5%	

Unit No.	Data No.	Parameter	Setting range/Output range	Others
4	0	Mutual interference prevention mode	0: OFF 1: ON	
	1	Mutual interference prevention timing	0: Timing A 1: Timing B	
5	0	Gain setting	1 to 5	
40	0	Measurement mode	0: OFF 1: Average 2: Peak 3: Bottom 4: Thickness 5: Gap 6: K+mX; +nY	TASK1 settings. The settings in Unit Number 40 are valid only for multi-task mode.
	3	Parameter X	0: None 1: TASK 1 2: TASK 2 3: TASK 3 4: TASK 4	
	4	Parameter Y	0: None 1: TASK 1 2: TASK 2 3: TASK 3 4: TASK 4	
	5	Parameter K	-999999999 to 999999999 (nm)	
	8	Parameter M	-100 to 100 (1div: 0.1)	
	9	Parameter N	-100 to 100 (1div: 0.1)	
	1	Surface for measurement (Area 1)	0: First surface 1: Second surface 2: Third surface 3: Peak	
	10	Surface for measurement (Area 2)	0: First surface 1: Second surface 2: Third surface 3: Peak	
	11	Measurement position 1 (for thickness measurement)	0: None 1: Average 2: Peak 3: Bottom	
	12	Measurement position 2 (for thickness measurement)	0: None 1: Average 2: Peak 3: Bottom	
	13	Measurement area	0: Area 1 1: Area 2	
	14	Width of peak bottom	0 to 255	
	32	Measurement value (First surface)	- (nm)	
	33	Measurement value (Second surface)	- (nm)	

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Non-procedural Communication Command Reference

Unit No.	Data No.	Parameter	Setting range/Output range	Others
40	34	Measurement value (Third surface)	- (nm)	TASK1 settings. The settings in Unit Number 40 are valid only for multi-task mode.
41	0	Scaling mode	0: OFF 1: ON	
	1	Span value	-20000 to 20000 (1 div: 0.0001)	
	2	Offset value	-999999999 to 999999999 (nm)	
42	2	Smooth	0: OFF 1: ON	
43	2	Average	0: 1 time 1: 2 times 2: 4 times 3: 8 times 4: 16 times 5: 32 times 6: 64 times 7: 128 times 8: 256 times 9: 512 times 10: 1024 times 11: 2048 times 12: 4096 times	
44	2	Differential type	0: OFF 1: ON	
	3	Differentiation cycles	1 to 5000 (ms)	
45	2	Hold type	0: Through 1: Peak 2: Bottom 3: Peak to peak 4: Average 5: Sampling	
	3	Trigger method	0: External input 1: Self up 2: Self down	
	4	Trigger level	-999999999 to 999999999 (nm)	
	5	Trigger hysteresis	0 to 999999999 (nm)	
	6	Trigger delay (ms)	0 to 5000 (ms)	
	7	Sampling period (ms)	1 to 5000 (ms)	
	8	Trigger delay mode	0: OFF 1: ON	
46	5	Offset at zero reset	-999999999 to 999999999 (nm)	
	7	Zero reset mode	0: REAL 1: HOLD	
	64	Status	0: OFF 1: ON	

(*)

If GLASS/MODE 2 or GLASS THICKNESS/MODE 2 is selected, a process using multiple tasks will be performed, as in the multi-task mode.

The following processes are assigned to the respective tasks:

TASK 1	Calculates Area 1 displacement value.
TASK 2	Calculates Area 2 displacement value.
TASK 3	GLASS: Calculates the result of the NEAR side of TASK 1 and TASK 2.
	GLASS THICKNESS: Calculates the difference value between TASK1 and TASK2.
TASK 4	Unused

The measurement conditions can be set for each task in this mode.

• Configuration of Task

The ZS-HLDC-N performs task processing.

The processing units for each task are grouped into 20 units.

To refer to the processing unit of TASK N, therefore, add 20×(N-1) to the above processing unit No.

Example: To change the averaging process of TASK2, refer to or set to a parameter with:

Process unit No.=43+20×(2-1)=63 and

Data No.=2

Unit No.	Data No.	Parameter	Setting range/Output range	Others
120	0	Hysteresis width	0 to 999999999 (nm)	Setting judgment process
	1	Timer mode	0: OFF 1: OFF-Delay 2: ON-Delay 3: One shot	
	2	Delay time	1 to 5000 (ms)	
	3	Judgment output TASK	0: TASK 1 1: TASK 2 2: TASK 3 3: TASK 4	
121	0	Non-measurement settings	0: Keep 1: Clamp	
122	2	Monitor focus mode	0: OFF 1: ON	
	3	Monitor focus distance value 1	-999999999 to 999999999 (nm)	
	4	Monitor focus distance value 2	-999999999 to 999999999 (nm)	
	5	Monitor focus current value 1	4 to 20 (mA)	
	6	Monitor focus current value 2	4 to 20 (mA)	
	7	Monitor focus voltage value 1	-10 to 10 (V)	
	8	Monitor focus voltage value 2	-10 to 10 (V)	

Unit No.	Data No.	Parameter	Setting range/Output range	Others
122	21	Output mode TASK	When multi-task mode is OFF. 0: OFF 1: ON	
			When multi-task mode is ON. 0: OFF 1: TASK 1 2: TASK 2 3: TASK3 4: TASK4	
	23	Output at CLAMP	Voltage output 0: MAX 1: 10 V 2: 9 V 3: 8 V 4: 7 V 5: 6 V 6: 5 V 7: 4 V 8: 3 V 9: 2 V 10: 1 V 11: 0 V 12: -1 V 13: -2 V 14: -3 V 15: -4 V 16: -5 V 17: -6 V 18: -7 V 19: -8 V 20: -9 V 21: -10 V 22: MIN	
			Current output 0: MAX 1: 20 mA 2: 19 mA 3: 18 mA 4: 17 mA 5: 16 mA 6: 15 mA 7: 14 mA 8: 13 mA 9: 12 mA 10: 11 mA 11: 10 mA 12: 9 mA 13: 8 mA 14: 7 mA 15: 6 mA 16: 5 mA 17: 4 mA	

Unit No.	Data No.	Parameter	Setting range/Output range	Others
123 Digital output	2	Monitor focus mode	0: OFF 1: ON	
	3	Monitor focus distance value 1	-999999999 to 999999999 (nm)	
	4	Monitor focus distance value 2	-999999999 to 999999999 (nm)	
	5	Monitor focus current value 1	0 to 65535	
	6	Monitor focus current value 2	0 to 65535	
	7	Clear monitor focus	1: Clear	
123	8	Output at CLAMP	0 to 65535	
	10	Output TASK (When the measurement value is output)	0: TASK 1 1: TASK 2 2: TASK 3 3: TASK 4 4: Consecutively	
	11	Output mode	0: OFF 1: Measurement value 2: Judgment	
	12	Update cycle	0 to 100	
124 Logging	2	Mode	0: OFF 1: ON	
	3	Buffering period	1 to 65535	
	4	Buffer size per item of data	1 to 1000	
	14	TASK 1	0: OFF 1: ON	When multi-task mode is ON.
	15	TASK 2	0: OFF 1: ON	
	16	TASK 3	0: OFF 1: ON	
	17	TASK 4	0: OFF 1: ON	
240 Parallel input	4	Input 0	0: Low Active 1: High Active	
	5	Input 1		
	6	Input 2		
	7	Input 3		
	8	External input mode	0: Normal mode 1: Bank switching mode	
	9	Control TASK setting	0: TASK1 1: TASK2 2: TASK3 3: TASK4	

Setting Threshold Value

When multi-task mode is OFF
• When selecting a mode other than "GLASS/MODE 2" and "GLASS THICKNESS/MODE 2".

Unit No.	Data No.	Parameter	Setting range/Output range	Others
48	2	Lower limit of threshold	-999999999 to 999999999 (nm)	
	3	Upper limit of threshold	-999999999 to 999999999 (nm)	
	4	Hysteresis width	0 to 999999999 (nm)	
	5	Timer mode	0:OFF 1:OFF DELAY 2:ON DELAY 3:ONE SHOT	
	6	Delay time	1 to 5000 (ms)	

• When selecting "GLASS/MODE 2" or "GLASS THICKNESS/MODE 2" mode.

Unit No.	Data No.	Parameter	Setting range/Output range	Others
88	2	Lower limit of threshold	-999999999 to 999999999 (nm)	
	3	Upper limit of threshold	-999999999 to 999999999 (nm)	
	4	Hysteresis width	0 to 999999999 (nm)	
	5	Timer mode	0:OFF 1:OFF DELAY 2:ON DELAY 3:ONE SHOT	
	6	Delay time	1 to 5000 (ms)	

When multi-task mode is ON
• Can be set for each TASK.

Unit No.	Data No.	Parameter	Setting range/Output range	Others
48	2	Lower limit of threshold	-999999999 to 999999999 (nm)	TASK1 settings. For TASK2 to TASK4, the unit numbers are as follows:
	3	Upper limit of threshold	-999999999 to 999999999 (nm)	
	4	Hysteresis width	0 to 999999999 (nm)	
	5	Timer mode	0:OFF 1:OFF DELAY 2:ON DELAY 3:ONE SHOT	TASK2: 68 TASK3: 88 TASK4: 108
	6	Delay time	1 to 5000 (ms)	

FLOWDATA Reference

What is FLOWDATA?

The ZS-HL-N series implements high speed sampling measurement up to 110us.

Handling these measurement data with an external device requires reading in a large amount of data.

The ZS-HL-N series are provided with a mechanism which enables to handle and acquire measurement data by a given bundle.

This bundle of data is called a FLOWDATA.

■ How to acquire FLOWDATA

FLOWDATA is batch output if the controller has accepted the command for acquiring a FLOWDATA when data is accumulated for the specified buffer size (max. 1000 data).

A device receiving data (such as PC) needs to issue the command before the ZS controller accumulates measurement data for the buffer size.
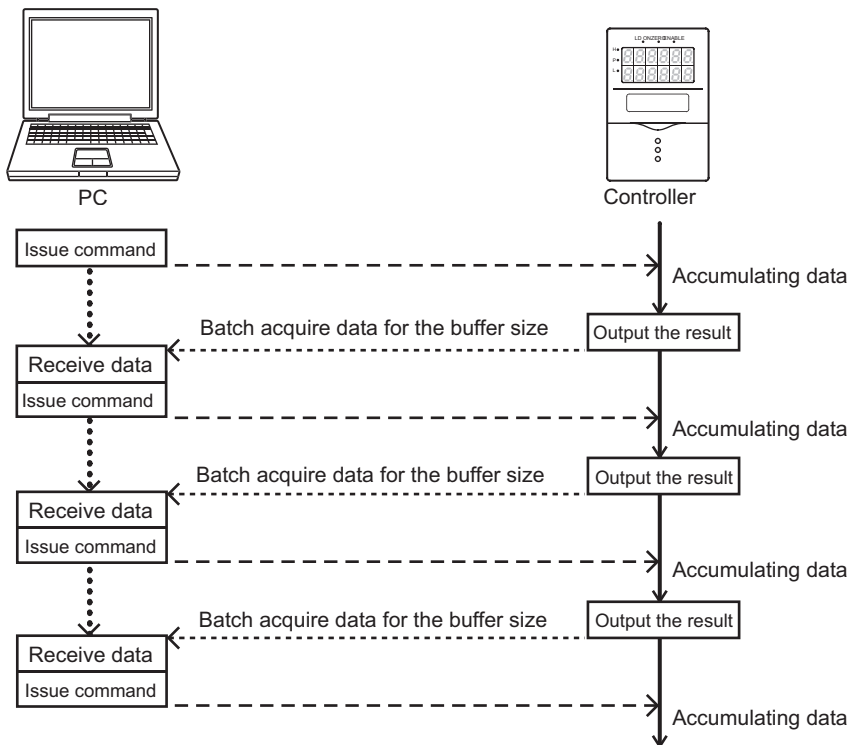
If the controller has not received the command when measurement data for the buffer size is accumulated in the controller, the past data is overwritten:

In this case, it raises an error flag for buffer overflow. A device receiving data (such as PC) needs to check this flag to see if the commands have been issued in time.

Format

After outputting the command for acquiring FLOWDATA, the binary data is output in the following format:

Header division (4bytes)	Data division (4bytes)

Configuration of FLOWDATA p.17

> Binary data is used for response data of FLOWDATA to give the highest priority to the speed. Therefore, general purpose communication tools such as HyperTerminal may not be used to receive the data.

CHECK!

■ Buffer size and buffer intervals

The buffer size of measurement data to be accumulated in the ZS controller and its buffer intervals can be changed.
Change the following parameters:
* DATAGET and DATASET commands are used to change and refer to the parameters.

Unit No.	Data No.	Parameter	Description
124	2	FLOWDATA accumulation mode	0: OFF 1: ON
	3	Buffer intervals	1 to 65535 (pcs)
	4	Buffer size	1 to 1000 (pcs)

■ Logging data

Data to be accumulated in the ZS controller can be selected.

• When multi-task mode is OFF
• When GLASS/MODE 2 or GLASS THICKNESSS/MODE 2 is selected for the measurement object

Unit No.	Data No.	Value	Description
124	5	0	No accumulation
		1	Accumulation of result of area 1
		2	Accumulation of result of area 2
		3	Accumulation of result of glass surface or glass thickness

• When a mode other than the above is selected for the measurement object

Unit No.	Data No.	Value	Description
124	5	0	No accumulation
		1	Accumulation

• When multi-task mode is ON

Unit No.	Data No.	Value	Description
124	14	0	Does not accumulate the result of TASK 1
		1	Accumulate the result of TASK 1
	15	0	Does not accumulate the result of TASK 2
		1	Accumulate the result of TASK 2
	16	0	Does not accumulate the result of TASK 3
		1	Accumulate the result of TASK 3
	17	0	Does not accumulate the result of TASK 4
		1	Accumulate the result of TASK 4

Configuration of FLOWDATA Response

1 packet of FLAWDATA														
Header division													Data division	
1st byte	2nd byte				3rd byte			4th byte				–		
A	B	C	D	E	F	G	H	I	J	K	L	Data	Meaning of data	
8	1	1	2	4	5	1	2	1	1	1	5	32	Number of bits	=Total 64 bits

Details of header division

Data	Name	Description
A	Unused	Reserved bit
B	FLOWDATA overflow bit	Normally set to 0.Set to 1 when there is an overflow in FLOWDATA accumulation.
C	Decimal information	Normally set to 0.0: nm order, 1: mm order
D	TASK No.	TASK1 to TASK4 (*1)
E	Unused	Always 0
F	Unit states (Input)	Indicates ON/OFF states of various input lines. (*2)
G	FLOWDATA stop bit	• All data are set to 1 if FLOWDATA does not flow over subsequently. (Always set to 1 for one-shot requests) • All data are set to 0 if FLOWDATA continues to flow over. (Until FLOWDATA is stopped after requested (in succession)
H	TASK judgment result bit	Indicates the TASK judgment result of data source. (*3)
I	Disabled	Reserved bit
J		
K		
L	Unit states (Output)	Indicates output states (states of measurement results). (*4)
Data	Measurement data	Signed 32 bit data When the decimal info division is 0, the unit of the data is nm. When the decimal info division is 1, the unit of the data is mm

*1 TASK No.=bit data+1
Example: bit data=10B=2 (dec)
        indicates TASK3 data.

*2 The input lines are, from the lower bit, assigned to:
In case of ZS
• Input terminal 4 (Unused. Always set to 0.)
• Input terminal 3
• Input terminal 2
• Input terminal 1
• Input terminal 0 (5 inputs in total.)

*3 Data to be received and their states are as follows:

00b=Not executed

01b=LOW

10b=PASS

11b=HIGH

*4 The output states are, from the lower bit, assigned to:
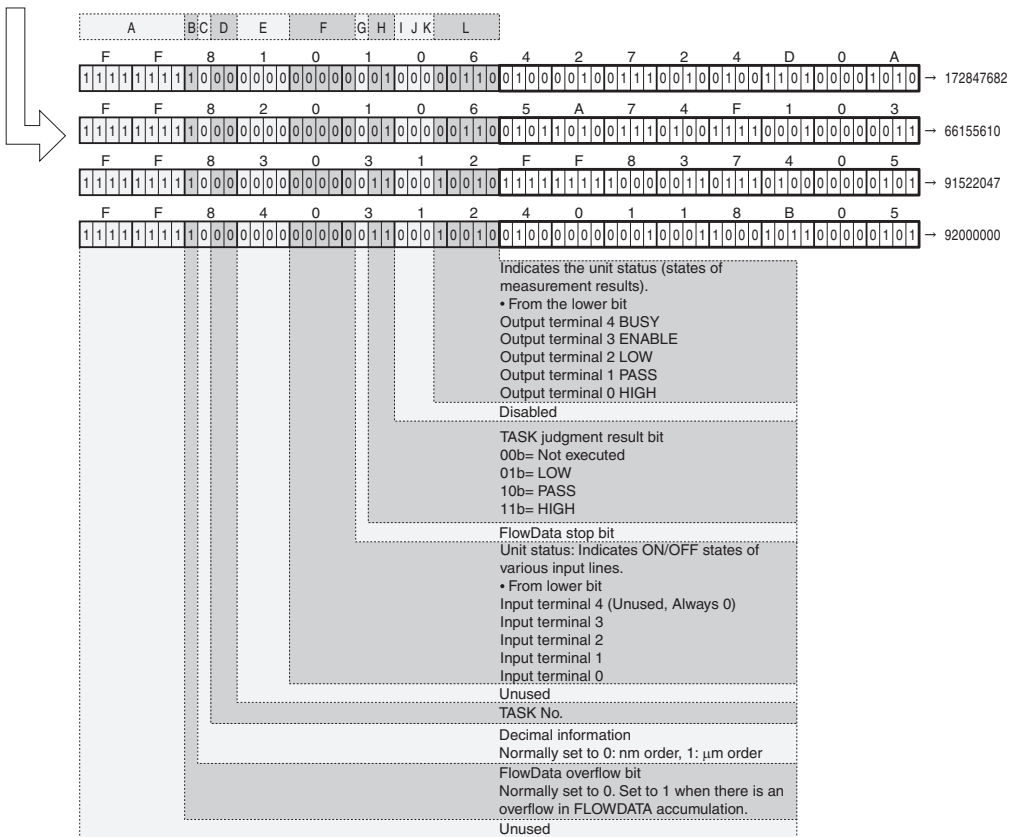
In case of ZS

- Output terminal 4 (Busy output)
- Output terminal 3 (Enable output)
- Output terminal 2 (Low output)
- Output terminal 1 (Pass output)
- Output terminal 0 (High output)

(5 outputs in total). States in parenthesis indicate the standard states.

[FLOWDATA setting example]

```
DATASET 124 2 1    FLOWDATA accumulation mode ON
DATASET 124 3 1    1 buffer interval
DATASET 124 4 1    1 buffer size
DATASAVE           Data save
FLOWDATA
```


Indicates the unit status (states of measurement results).
- From the lower bit
Output terminal 4 BUSY
Output terminal 3 ENABLE
Output terminal 2 LOW
Output terminal 1 PASS
Output terminal 0 HIGH

Disabled

TASK judgment result bit
00b= Not executed
01b= LOW
10b= PASS
11b= HIGH

FlowData stop bit

Unit status: Indicates ON/OFF states of various input lines.
- From lower bit
Input terminal 4 (Unused, Always 0)
Input terminal 3
Input terminal 2
Input terminal 1
Input terminal 0

Unused

TASK No.

Decimal information
Normally set to 0: nm order, 1: µm order

FlowData overflow bit
Normally set to 0. Set to 1 when there is an overflow in FLOWDATA accumulation.

Unused

Example of Usage

To give an example, provided below is a procedure to communicate by non-procedural commands using Windows standard tool HyperTerminal.

1. Start up HyperTerminal.

HyperTerminal is located under [Program]-[Accessory]-[Communication].
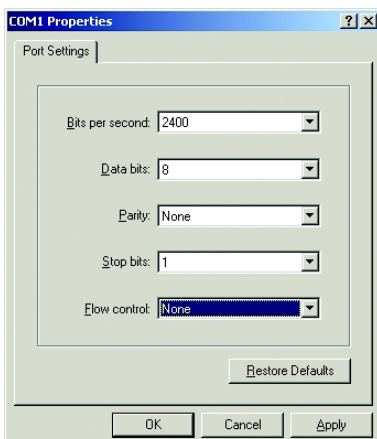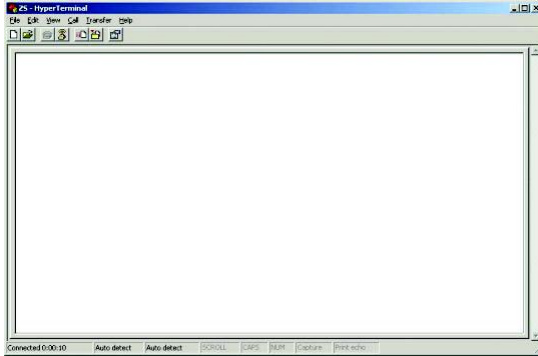
(1) Enter an appropriate project name.
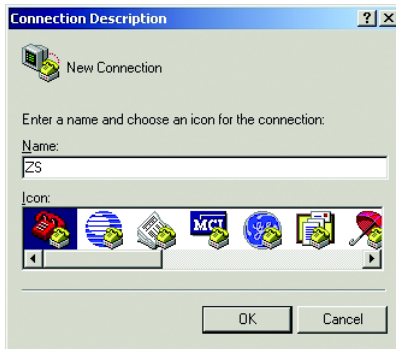
(2) Select the COM port connected to the ZS in the Connection Method section.
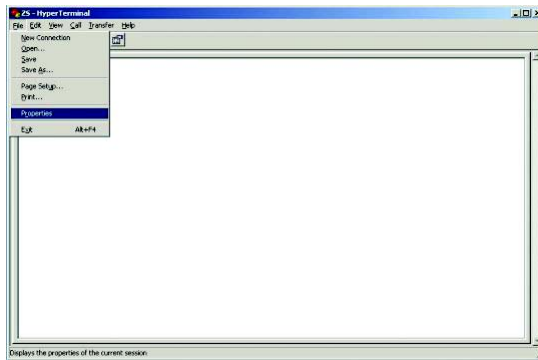

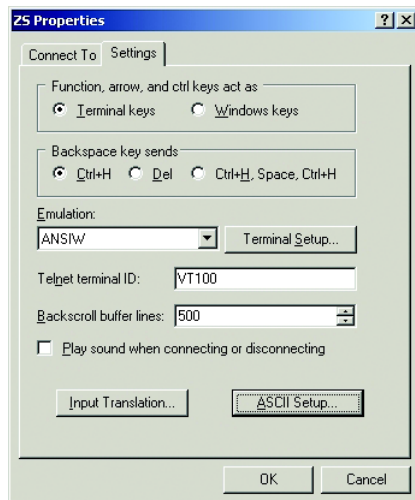(3) Set the communication conditions.

(4) HyperTerminal is started up.

2. **To make the interaction with commands easier, set echo and other functions.**
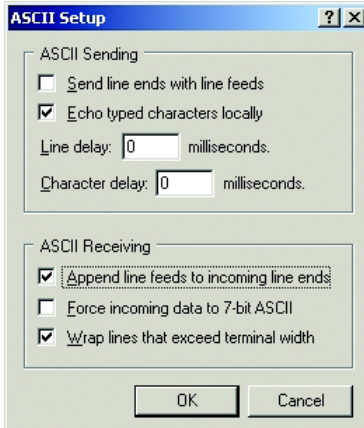
(1) Open [Property].

(2) Select the setting tag, and then ASCII settings.

ZS-HL-N Series
Non-procedural Communication Command Reference
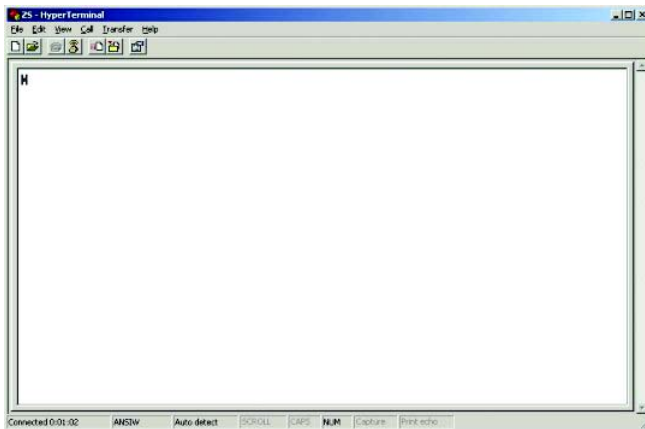
(3) Check the following items, and press OK to complete the setting.

3. Set the communication conditions for the ZS side.

(1) Set [System]-[Communication]-[RS-232C] as consistent with the above setting.
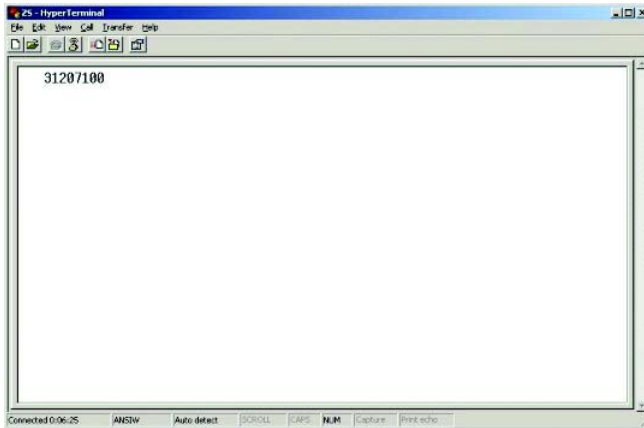(2) Set [System]-[Communication]-[Protocol] as non-procedural.

4. Change ZS into "RUN" mode.

5. Perform non-procedural communication.

(1) Input a command, and then press the return key.

(2) A returned value responding to the command is returned from the controller.

Revision History

A manual revision code appears as a suffix to the catalog number at the bottom of the front and back covers of this manual.

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Revision code

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