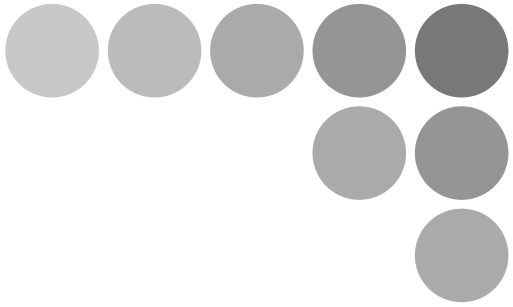
OMRON

Smart Sensor

ZFV-C



CompoWay/F Communication Command Reference

Cat. No. Z243-E1-01

Introduction

Thank you for purchasing the ZFV-C.
This manual provides information regarding operations and input/output format that are required for communication between ZFC-V controllers and external devices using the OMRON proprietary communication protocol, Compoway/F.

When using the ZFV-C, be sure to observe the following:

- The ZFV-C 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.

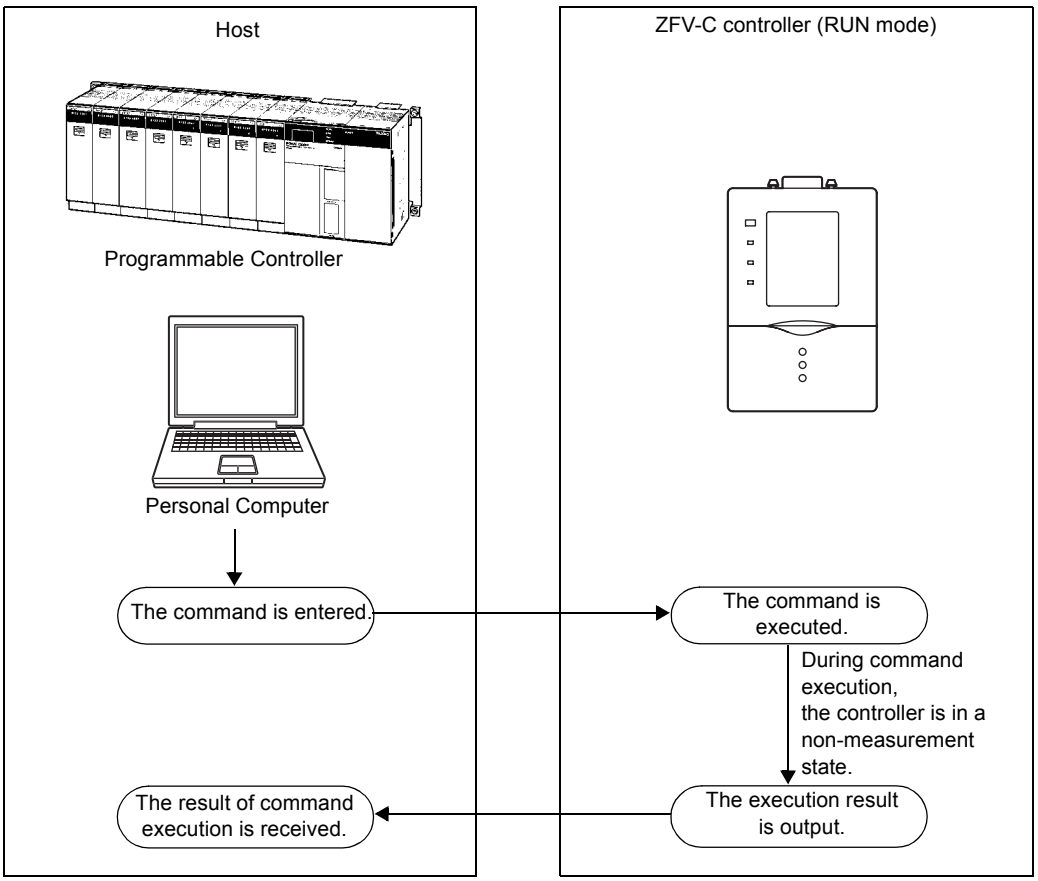
Contents

MEMO

Section 1
About Communication Commands

How Communication Works

ZFV-C controllers have a function for communicating with external devices. Use this function to read the data in ZFV-C controllers from the host and to write the setting data. Communication is achieved via the Command and Response Method based on CompoWay/F, OMRON's proprietary communication protocol. Controllers execute processing according to the command sent from the host, and then return the result as a response to the host that sent the command.



Setting the Communication Specifications

Change the settings of the controller communication specifications for communicating with the external device by CompoWay/F protocol.


CHECK!

Use a USB cable or RS-232C cable to connect ZFV-C controllers to external devices.
For the USB cable connection, download and install the USB driver beforehand.
For the USB driver, please contact your OMRON representative.

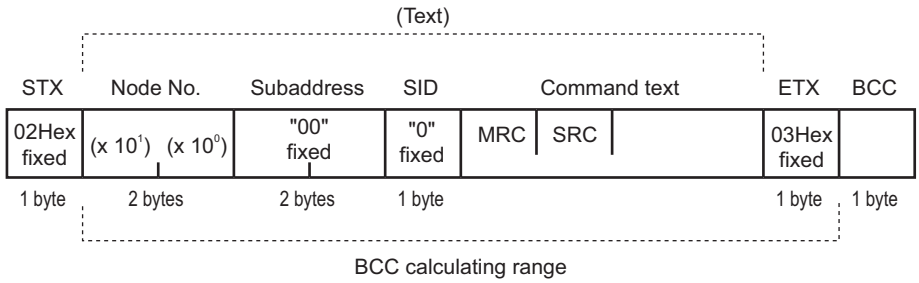
1. Switch the controller to [MENU].

2. Select [System2] - [Communication] to set the appropriate communication specifications for the external device.

3. Switch the controller to [RUN]. (This executes the save.)

Command Formats

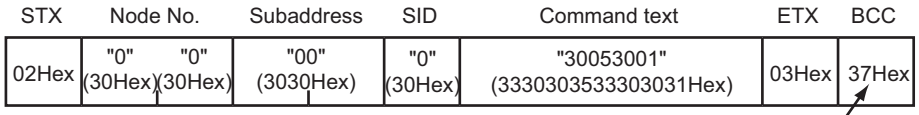
The command format of the communication commands is shown below.
In the following section, numerical values appended with "Hex" (e.g. 02Hex) indicate hexadecimal numbers. Those annotated by " " or only numeral values indicate ASCII characters.



* In the example format, 1 byte = 1 ASCII character.

Element	Description
STX	This code indicates the start of a communication frame (02Hex). Be sure to set the first byte to 02Hex. When a controller receives STX while receiving a command, it receives the command again starting from where it received STX.
Node No.	This is the node No. for identifying the destination. It should be fixed to "00." * About node No. This node No. indicates the connection group No. as seen from the host device (PLC). Not only ZFV-C but also two or more devices can be connected to the programmable controller. The No. assigned to devices connected to a PLC such as this is referred to as a node No.
Subaddress	This should be fixed to "00."
SID (service ID)	This should be fixed to "0."
Command text	This is the text section of the command. "Section 2 - Details of Commands" describes these sections by each individual command.
ETX	This code indicates the end of the text (03Hex).
BCC	This is the block check character. The exclusive OR (XOR) of values from node No. to ETX per single byte is BCC.

■ Example of BCC calculation



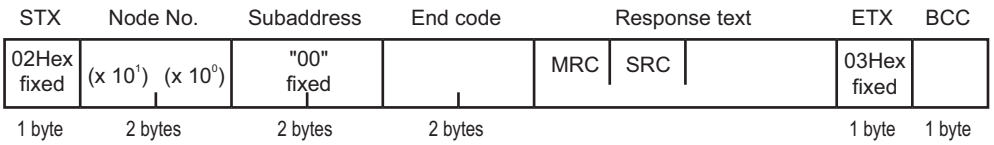
Set the result of calculation, "37Hex," to the BCC section.

<Calculation>
BCC=30Hex+30Hex+30Hex+30Hex+30Hex+33Hex+30Hex+30Hex+35Hex+33Hex+
30Hex+30Hex+31Hex+03Hex=37Hex

"+" indicates the exclusive OR (XOR) operation.

Response Formats

The response format of the communication commands is shown below.
In the following section, numerical values appended with "Hex" (e.g. 02Hex) indicate hexadecimal numbers. Those annotated by " " or only numeral values indicate ASCII characters.



Element	Description
STX	Command Format, page 1-4
Node No.	
Subaddress	
End code	Refer to the next page.
Command text	This is the response text section of the command. "Section 2 - Details of Commands" describes these sections by each individual command.
ETX	Command Format, page 1-4
BCC	

End codes of responses are shown below.

End code	Name	Description
"00"	Normal end	Command execution ended successfully.
"0F"	Command error	The specified command could not be executed. For details on non-execution, refer to the response code.
"10"	Parity error	A parity error occurred on one of the characters during command reception.
"11"	Framing error	A framing error occurred on one of the characters during command reception.
"12"	Overrun error	An overrun error occurred on one of the characters during command reception.
"13"	BCC error	An illegal BCC was received.
"14"	Format error	• This response is returned when characters other than 0 to 9 or A to F are used in command text sections. (except during echo back tests) • No SID and command text exist. Or, no command text exists. • Either MRC or SRC is missing in the command text.
"16"	Subaddress error	• The subaddress of the receive frame is illegal (not supported). • No subaddress, SID, and command text exist. • The subaddress is shorter than two characters, and no SID and command texts exist.
"18"	Frame length error	The receive frame exceeds the specified (supported) number of bytes.

An end code is returned after receiving one complete command frame addressed to the node.

No response is made when ETX or BCC characters are missing from the command frame.


CHECK!

Noise may cause response errors or no response. Be sure to retry from the host.

It may take three seconds at longest from sending a command to receiving a response. If no response is returned, be sure to send another command after waiting for at least three seconds.

Examples of Abnormal End

This section shows examples of end codes for abnormal ends that occur for received commands.

● Invalid subaddress, and no SID and command text exist

Command

STX	Node No.		Subaddress		ETX	BCC
02Hex			"0"	"A"	03Hex	

Response

STX	Node No.		Subaddress		End code		ETX	BCC
02Hex			"0"	"A"	"1"	"6"	03Hex	

The end code is "16" (subaddress error).

- This response occurred because a subaddress was received and subaddress errors have higher priority than format errors.

● No command text exists in the command

Command

STX	Node No.		Subaddress		SID	ETX	BCC
02Hex			"0"	"0"	"0"	03Hex	

Response

STX	Node No.		Subaddress		End code		ETX	BCC
02Hex			"0"	"0"	"1"	"4"	03Hex	

The end code is "14" (format error).

● Node No. is missing

Command

STX		ETX	BCC
02Hex		03Hex	

One character is missing in the node No.

Response

No response is returned.

● No subaddress exists, and an invalid BCC is used

Command

STX	Node No.		ETX	BCC
02Hex			03Hex	Err

Response

STX	Node No.		Subaddress		End code		ETX	BCC
02Hex			"0"	"0"	"1"	"3"	03Hex	

The subaddress is "00" and the end code is "13" (BCC error).

Section 2
Details of Commands

About General Information of Communication Commands

Communication commands are categorized into the groups and meanings shown in the following table:

Group	Meaning	Pages for Reference
Reading of parameter areas	Reading of setting values or measurement results on the target channel For measurement-related parameters, data is read by specifying unit No. and data No.	p.2-3 (For details on unit No. and data No., refer to Section 3.)
Writing of parameter areas	Writing of setting values or measurement results on the target channel For measurement-related parameters, data is written by specifying unit No. and data No.	p.2-6 (For details on unit No. and data No., refer to Section 3.)
Reading of controller information	Reading of information on models connected by cable	p.2-11
Operation instructions	Data operations are executed on individual or all banks.	p.2-12

[Notes on communication data transactions]

- The number of elements indicates the size of data to be exchanged. The ASCII character length per element is determined according to parameter type code. Specifically, this means
  8000h to BFFFh: 4 characters per element
  C000h onwards: 8 characters per element
  The Number of elements is "1" for all commands in this manual. Therefore, enter "8001h" to specify the number of elements.
- Machine No. indicates the channel No. of the destination controller.
- All data is exchanged using hexadecimal numbers. Therefore, "15" in decimal annotation, for example, should be expressed as "0000000Eh." (*1)
- Negative values are expressed as 2's complement. For example, "-100" should be expressed as "FFFFFF9Ch." (*1)
- When measured values are abnormal values, the data section is expressed as "7FFFFFFXh" ("X" varies depending on the case). (*1)

*1: This is an example of eight characters per element.

Reading Parameter Areas

The following describes reading of parameter areas.

List of Parameter Area Read Commands

Data name	MRC	SRC	Parameter type	Read start address	Specification of number of elements	Data to be read	Data length *1
Current bank No.	02h	01h	8000h	<Machine No.>	8001h	Bank No.	16
Reading processing unit data	02h	01h	C000h+ <Parameter No.>	XXYYh (XX: <unit No.>, YY: <machine No.>)	8001h	Data to be read	32

*1 This refers to the ASCII character length. For details, refer to p.2-2.

For details on the unit No. and parameter No. of each processing unit, refer to "Section 3 - Unit Nos. and Parameter Nos."

Example 1: To read the current bank No. from a 2CH controller, assign a command as follows:
[Machine No.]=0002h

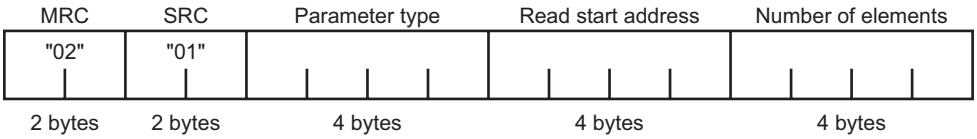
MRC	SRC	Parameter type	Read start address	Number of elements
02h	01h	8000h	0002h	8001h

Example 2: To read the judgment result from a 1CH controller, assign a command as follows:
[Data No.]=00h, [Unit No.]=02h, [Machine No.]=0001h

MRC	SRC	Parameter type	Read start address	Number of elements
02h	01h	C000h	0201h	8001h

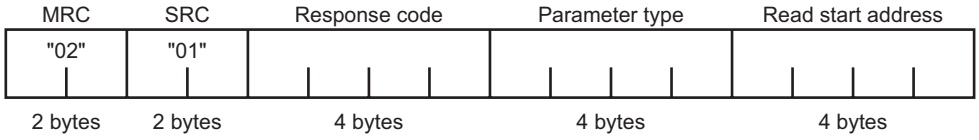
Commands and Responses

● Command



Element	Description
Parameter type	Specify parameters corresponding to the data to be acquired. List of Parameter Area Read Commands, p.2-3
Read start address	Specify the machine No. (i.e. CH No.) of the controller to read data from by using an ASCII code expressed in hexadecimal. Note that the format in the case of a "processing unit data read" command is XXYYh (where, XX: unit No., YY: machine No.) Unit Nos. and Parameter Nos., p.3-4
Number of elements	Specify the number of elements corresponding to the parameter type. List of Parameter Area Read Commands, p.2-3

● Response



Element	Description
Response code	Indicates the controller status for the command. Data to be read is not returned when an error occurs.
Data to be read	Data to be read is expressed by using an ASCII code annotated in hexadecimal. The data length varies depending on commands. List of Parameter Area Read Commands, p.2-3

Response code for a normal end

Response code	Name	Description
Response code	Normal end	No errors occurred.

Response codes when an error occurs

Response code	Error name	Cause
"1001"	Long command length	The command is too long.
"1002"	Short command length	The command is too short.
"1003"	Inconsistent number of elements/data	The number of elements and data do not match.
"1101"	Area type error	The parameter type is wrong.
"1103"	Start address outside of range error	The read start address is out of range. The read start address specifies the sensor of the unconnected Machine No. The bit position is other than "00."
"1104"	End address outside of range error	The specified number of elements is out of range.
"2203"	Operating error	This is a read error.
"2204"	Operating error	The sensor's operating mode is other than RUN.
"2205"	Operating error	This is an invalid command.

Writing Parameter Areas

The following describes writing of parameter areas.

List of Parameter Area Writing Commands

Data name	MRC	SRC	Parameter type	Write start address	Specification of number of elements	Data to be written	Data length *1
Bank switching	02h	02h	8000h	<Machine No.>	8001h	bank No. (1 to 8)	16
Writing processing unit data	02h	02h	C000h+ <Parameter No.>	XXYYh (XX: <unit No.>, YY: <machine No.>)	8000h + <Number of elements>	Data to be written	32

*1 This refers to the ASCII character length. For details, refer to p.2-2.

For details on the unit No. and parameter No. of each processing unit, refer to "Section 3 - Unit Nos. and Parameter Nos."

Example 1: To switch the bank of a 2CH controller to "2", assign a command as follows:
[Machine No.]=0002h, [Data to be written]=0002h

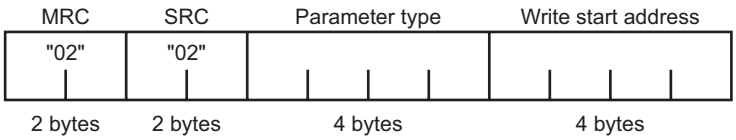
MRC	SRC	Parameter type	Read start address	Number of elements	Data to be written
02h	02h	8000h	0002h	8001h	0002h

Example 2: To set the threshold value of a 1CH controller (ITEM=match), assign a command as follows:
[Data No.]=28h, [Unit No.]=02h, [Machine No.]=01h, [Data to be written]=00000050h

MRC	SRC	Parameter type	Read start address	Number of elements	Data to be written
02h	02h	C028h	0201h	8001h	00000050h

Commands and Responses

● Command



Element	Description
Parameter type	Specify parameters corresponding to the data to be written. List of Parameter Area Write Commands, p.2-6
Write start address	Specify the machine No. (=CH No.) of the controller to write data to using an ASCII code expressed in hexadecimal. Note that the format in the case of a "processing unit data write" command is XXYYh (where, XX: unit No., YY: machine No.) Unit Nos. and Parameter Nos., p.3-4
Number of elements	Specify the number of elements corresponding to the parameter type. List of Parameter Area Write Commands, p.2-3
Data to be written	Data to be written is specified by using an ASCII code expressed in hexadecimal. The data length varies depending on commands. • List of Parameter Area Write Commands, p.2-6 • Do not issue commands other than specified parameter types. Issuing wrong commands may rewrite internal parameters. If the internal parameters of connected sensors are rewritten, execute the operation instruction command "EEPROM initialization."

Reading Controller Information

The following describes reading of ZFC-V model, for example.

● Command

● Response

Element	Description
Response code	Indicates the controller status for the command. Data to be read is not returned when an error occurs.
Model	The model is expressed by 20 ASCII characters.
Version	The version is expressed by 20 ASCII characters.

Response code for a normal end

Response code	Name	Description
"0000"	Normal end	No errors occurred.

Response codes when an error occurs

Response code	Error name	Cause
"1001"	Long command length	The command is too long.
"1002"	Short command length	The command is too short.

Operation Instructions

The following describes execution of operation instructions that are issued to controllers.

List of Operation Instruction Commands

Instruction Name	MRC	SRC	Instruction code	Related information 1	Related information 2
Initialization of controller settings (Flash)	30h	05h	55h	<Machine No.>	
Save controller settings (Flash)	30h	05h	57h	<Machine No.>	
Measurement execution	30h	05h	90h	<Machine No.>	Measurement method (one shot measurement/continuous measurement/end continuous measurement=0/1/2)
Key lock status setting	30h	05h	CAh	<Machine No.>	Lock status (0: unlocked 1: locked)
Clear password	30h	05h	CCh	<Machine No.>	0000h
Clear measurement values	30h	05h	CDh	<Machine No.>	0000h

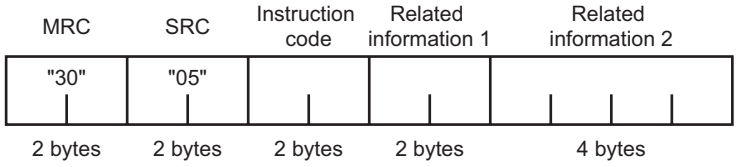
Complete INIT initializes all settings (settings of all banks and system settings).

Example: To execute Complete INIT of a 2CH controller, assign a command as follows:
[Related information 1]=02h

MRC	SRC	Instruction code	Related information 1	Related information 2
30h	05h	55h	02h	0001h

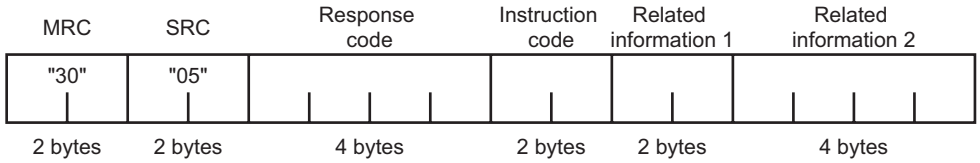
Commands and Responses

● Command



Element	Description
Instruction code	Specify commands corresponding to the instruction to be executed.
Related information 1	Specify the channel No. of the controller targeted by the command. Example: In the case of 2CH, specify "02."
Related information 2	Normally, a setting other than "0000" is not accepted.

● Response



Element	Description
Response code	Indicates the controller status for the command.
Instruction code	A code the same as the transmitted code is returned.
Related information 1	
Related information 2	

Response code for a normal end

Response code	Name	Description
"0000"	Normal end	No errors occurred.

Response codes when an error occurs

Response code	Error name	Cause
"1001"	Long command length	The command is too long.
"1002"	Short command length	The command is too short.
"1101"	Area type error	The instruction code is wrong.
"1103"	Start address outside of range error	The related information specifies the sensor of an unconnected machine No.
"2203"	Operating error	The setting is abnormal. For details on error conditions, refer to the ZFV-C User's Manual.
"2204"	Operating error	The sensor's operating mode is other than RUN.
"2205"	Operating error	This is an invalid command.

Section 3
Unit Nos. and Parameter Nos.

Setting Value Acquisition/Change Commands

■ Parameter List (ZFV-C)

"Common" parameters are common regardless of the currently selected item. Also, the parameters under "common" parameters differ according to the currently selected item.

● Common

Unit No.	Data No.	Parameter	Setting range/output range	Remarks
00h	24h	Light brightness (left)	0 to 5	Read/write
00h	25h	Light brightness (up)	0 to 5	
00h	26h	Light brightness (right)	0 to 5	
00h	27h	Light brightness (down)	0 to 5	

● Search (SEARCH)/Match (MATCH)

Unit No.	Data No.	Parameter	Setting range/output range	Remarks
02h	0h	Judgment	-2: measurement off -1: NG 0: OK	Read only
02h	01h	Measured value	0 to 100	
02h	02h	Measurement result maximum value	0 to 100	
02h	03h	Measurement result minimum value	0 to 100	
02h	04h	Measurement result average value	0 to 100	
02h	14h	Measurement count	0 to 9999999	
02h	15h	NG count	0 to 9999999	
02h	16h	NG occurrence ratio	0 to 99.999	
02h	28h	Threshold	0 to 100	Read/write

● Area 1 (AREA1)/Area 2 (AREA2)/Area 3 (AREA3)

Unit No.	Data No.		Parameter	Setting range/output range	Remarks
02h	00h		Judgment	-2: measurement off -1: NG 0: OK	Read only
02h	01h		Measured value	0 to 999	
02h	(Area 1/3) 04h	(Area 2) 0Ah	Measurement result maximum value	0 to 999	
02h	(Area 1/3) 05h	(Area 2) 0Bh	Measurement result minimum value	0 to 999	
02h	(Area 1/3) 06h	(Area 2) 0Ch	Measurement result average value	0 to 999	
02h	14h		Measurement count	0 to 9999999	
02h	15h		NG count	0 to 9999999	
02h	16h		Fault rate	0 to 99.999	
02h	(Area 1/2) 24h	(Area 3) 27h	Upper limit value	0 to 999	Read/write
02h	(Area 1/2) 25h	(Area 3) 28h	Lower limit value	0 to 999	

● Brightness (BRIGHT)

Unit No.	Data No.	Parameter	Setting range/output range	Remarks
02h	00h	Judgment	-2: measurement off -1: NG 0: OK	Read only
02h	01h	Measured value (average density)	0 to 255	
02h	02h	Measured value (density deviation)	0 to 127	
02h	03h	Measured result (average density) maximum value	0 to 255	
02h	04h	Measured result (average density) minimum value	0 to 255	
02h	05h	Measured result (average density) average value	0 to 255	
02h	06h	Measured result (density deviation) maximum value	0 to 127	
02h	07h	Measured result (density deviation) minimum value	0 to 127	
02h	08h	Measured result (density deviation) average value	0 to 127	
02h	14h	Measurement count	0 to 9999999	
02h	15h	NG count	0 to 9999999	
02h	16h	Fault rate	0 to 99.999	
02h	25h	Average density upper limit value	0 to 255	Read/write
02h	26h	Average density lower limit value	0 to 255	
02h	27h	Density deviation upper limit value	0 to 127	
02h	28h	Density deviation lower limit value	0 to 127	

● Color inspection (HUE)

Unit No.	Data No.	Parameter	Setting range/output range	Remarks
02h	00h	Judgment	-2: measurement off -1: NG 0: OK	Read only
02h	01h	Measured value	0 to 509	
02h	05h	Measurement result maximum value	0 to 509	
02h	06h	Measurement result minimum value	0 to 509	
02h	07h	Measurement result average value	0 to 509	
02h	14h	Measurement count	0 to 9999999	
02h	15h	NG count	0 to 9999999	
02h	16h	Fault rate	0 to 99.999	
02h	27h	Threshold	0 to 509	Read/write

● Width (WIDTH)

Unit No.	Data No.	Parameter	Setting range/output range	Remarks
02h	00h	Judgment	-2: measurement off -1: NG 0: OK	Read only
02h	01h	Measured value	0 to 999	
02h	02h	Measurement result maximum value	0 to 999	
02h	03h	Measurement result minimum value	0 to 999	
02h	04h	Measurement result average value	0 to 999	
02h	14h	Measurement count	0 to 9999999	
02h	15h	NG count	0 to 9999999	
02h	16h	Fault rate	0 to 99.999	
02h	26h	Upper limit value	0 to 999	Read/write
02h	27h	Lower limit value	0 to 999	

● Position (POSITION)

Unit No.	Data No.	Parameter	Setting range/output range	Remarks
02h	00h	Judgment	-2: measurement off -1: NG 0: OK	Read only
02h	01h	Measured value	0 to 468	
02h	02h	Measurement result maximum value	0 to 468	
02h	03h	Measurement result minimum value	0 to 468	
02h	04h	Measurement result average value	0 to 468	
02h	14h	Measurement count	0 to 9999999	
02h	15h	NG count	0 to 9999999	
02h	16h	Fault rate	0 to 99.999	
02h	26h	Threshold	0 to 468	Read/write

● Count (COUNT)

Unit No.	Data No.	Parameter	Setting range/output range	Remarks
02h	00h	Judgment	-2: measurement off -1: NG 0: OK	Read only
02h	01h	Measured value	0 to 128	
02h	02h	Measurement result maximum value	0 to 128	
02h	03h	Measurement result minimum value	0 to 128	
02h	04h	Measurement result average value	0 to 128	
02h	14h	Measurement count	0 to 9999999	
02h	15h	NG count	0 to 9999999	
02h	16h	Fault rate	0 to 99.999	
02h	26h	Upper limit value	0 to 255	Read/write
02h	27h	Lower limit value	0 to 255	

● Character (CHARA1)/Character (CHARA2)

Unit No.	Data No.	Parameter	Setting range/output range	Remarks
02h	00h	Judgment	-2: measurement off -1: NG 0: OK	DATAGET compatible
02h	01h	Measured value	(CHARA1) 0 to 127 (CHARA2) 0 to 100	
02h	02h	Measurement result maximum value	(CHARA1) 0 to 127 (CHARA2) 0 to 100	
02h	03h	Measurement result minimum value	(CHARA1) 0 to 127 (CHARA2) 0 to 100	
02h	04h	Measurement result average value	(CHARA1) 0 to 127 (CHARA2) 0 to 100	
02h	14h	Measurement count	0 to 9999999	
02h	15h	NG count	0 to 9999999	
02h	16h	Fault rate	0 to 99.999	
02h	(CHARA1) 26h	Threshold	0 to 100	DATASET/DATAGET compatible
02h	(CHARA2) 35h	Threshold	0 to 100	

Revision History

Revision code	Date	Revised contents
01	January 2006	Original production
02	May 2006	Function added as per software version upgrade (Ver1.30)

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