AD-4402 OP-21

INSTRUCTION MANUAL

DeviceNet™ Interface

WM : PD4000301

A&D Company, Limited

This is a hazard alert mark.

This mark informs you about the operation of the product.

Note This manual is subject to change without notice at any time to improve the product. No part of this manual may be photocopied, reproduced, or translated into another language without the prior written consent of the A&D Company.

Product specifications are subject to change without any obligation on the part of the manufacture.

Contents

1. Compliance

1.1.1. Compliance with FCC rules

- Please note that this equipment generates, uses and can radiate radio frequency energy. This equipment has been tested and has been found to comply with the limits of a Class A computing device pursuant to Subpart J of Part 15 of FCC rules. These rules are designed to provide reasonable protection against interference when this equipment is operated in a commercial environment. If this unit is operated in a residential area it may cause some interference and under these circumstances the user would be required to take, at his own expense, whatever measures are necessary to eliminate the interference.
  (FCC = Federal Communications Commission in the U.S.A.)

1.1.2. Compliance with Council Directives

CE This appliance complies with the statutory EMC (Electromagnetic Compatibility) directive 89/336/EEC and the Low Voltage Directive 73/23/EEC for safety of electrical equipment designed for certain voltages.

Note: The displayed value may be adversely affected under extreme electromagnetic influences.

2. Outline and Features

- The option (OP-21) is a special interface for the AD-4402 weighing indicator. The indicator, with the interface installed, is used for a slave device in the predefined Master/Slave Connection Set of the DeviceNet.

- With the option installed in the indicator, the master (PLC scanner) can control the operation mode, the I/O settings and can read weighing data into the memory of the master.
  PLC: Programmable Controller or Process Controller

- There are two operation methods for the indicator. "Command without handshake (Command Bit)" and "Command with handshake (Command)".

- The specification of the option is confirmed by the self-test program of the ODVA conformance test software ver.A-14. The indicator, with the interface installed, complies with the DeviceNet specifications.
  ODVA: Open DeviceNet Vender Association Inc.

Advice

- Knowledge of the weighing indicator and DeviceNet specifications is required for proper understanding of this instruction manual.

- Refer to the special references for DeviceNet specifications, basic term, wiring, setting, operation and control of the DeviceNet.

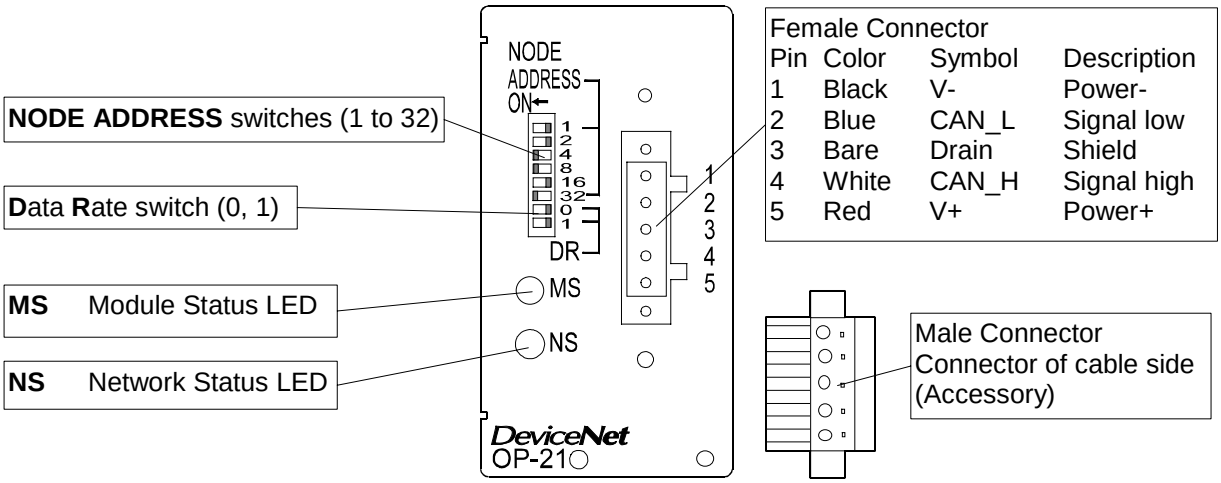
- Use authorized cables, tap (connector) and power tap, network power supply unit and other units for the DeviceNet.

Caution

- **The interface occupies 8 data 8 bytes for OUT DATA and 16 data bytes for IN DATA in the memory area of the PLC. Avoid crossing the memory area of other slave devices.**

- **The IN DATA will be all zeroes, when the AD-4402 is in the calibration mode or the function mode.**

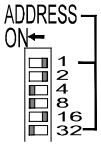
3. Panel and Names



3.1.1. Node Address and Data Rate

Node Address

Set a node address for this slave device using binary switches (2^0 to 2^5).
The node address range is 0 to 64.



Example: If address is 44, turn on the swithes of 32, 8, 4 (2^5, 2^3, 2^2).

Data Rate (Baud Rate)

Set a data rate using switch DR0 and DR1.

Data rate	125 kbps	250 kbps	500 kbps	Not used
DR0	OFF	ON	OFF	ON
DR1	OFF	OFF	ON	ON
				

Status LED

These LEDs indicate situation of the interface.

	MS (Module Status)	NS (Network Status)
Green ON	Device operational	On-line
Flashing Green		Not connected
Red ON	Unrecoverable fault	Critical link fault
Flashing Red	Recoverable fault	Connection time-out

3.1.2. Connector (Terminal)

The connector style is the pluggable open connector. This connector consists of a male connector and a female connector.

4. Installation

4.1.1. Installing the Option Board

- This option is the built-in type into the AD-4402.
- This option is installed into the AD-4402 option slot 1 or 2.

⚠Caution

- **Disconnect the power supply before the installation.**
- **Do not touch the wiring or internal portions of this device immediately after removing the power.**

Step 1 Remove the power cord and other cables from the AD-4402.

Step 2 Remove screws A and B to remove the cover.

Step 3 Remove screws C and D to remove the blank panels.

Step 4 Open the board cross bar.

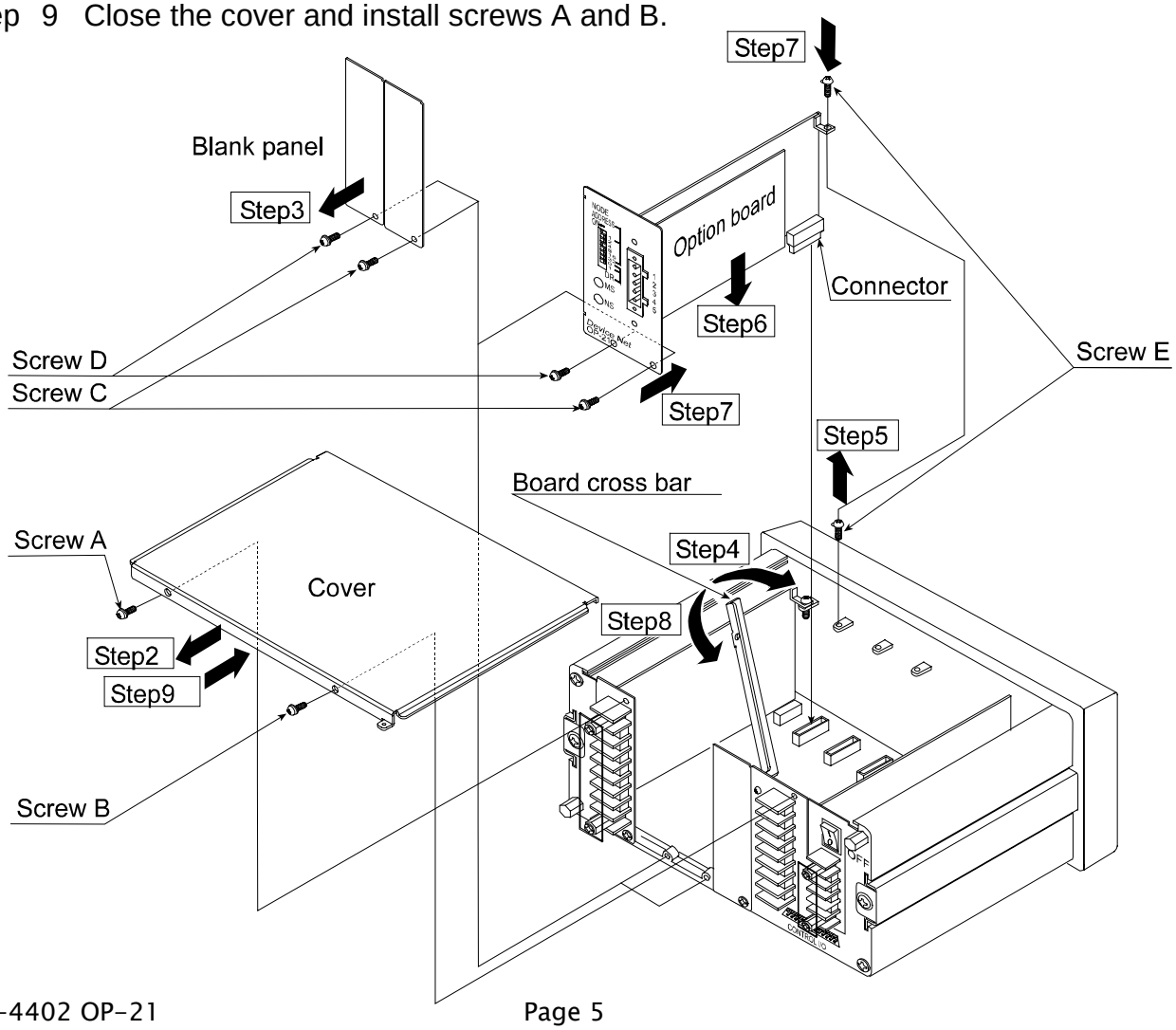
Step 5 Remove screw E.

Step 6 Install the option board into the slot.

Step 7 Attach the option board with screws C, D and E.

Step 8 Close the board cross bar.

Step 9 Close the cover and install screws A and B.

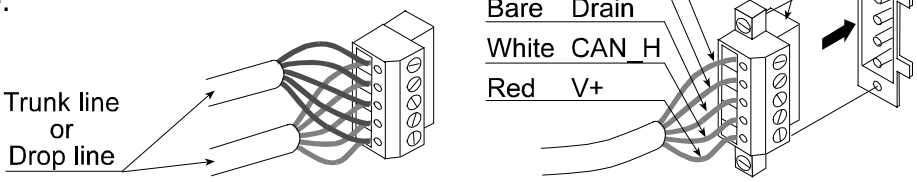


4.1.2. Wiring and Specifying Address and Data Rate

Caution

- **Turn off the network power supply before making any changes.**
- **It is recommend that you use compression terminal parts.**

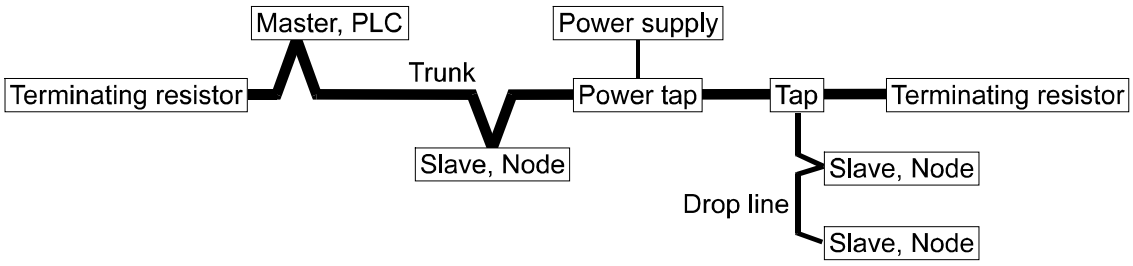
- Connect V+ and V- of the network power wires to the male connector.
- Connect CAN_H and CAN_L of signal wires to the male connector.
- Connect Drain (shield) to male connector.
- Insert and fix the connector.
- Specify a node address.
- Specify a baud rate.



4.1.3. Outline of Physical Connection for DeviceNet

- This slave device consumes maximum 55 mA from the network.

- Install terminating resistor at both ends of the trunk.
- When thin cable is used, the maximum cable distance of the trunk is less than 100 m. When thick cable is used, the maximum cable distance relates to the data rate
- The length of the drop line should be less than 6 m. The total length of the drop lines relates to the data rate.
- Connect the drain line to the ground terminal of the power tap, and ground them.



- Data rate and Cable Distance

Data Rate	Maximum Cable Distance			
	Trunk Line		Dorp Line	
	Thin Cable	Thick Cable	A Drop Length	Cumulative Length
125 kbps	100 m	500 m	156 m	6 m
250 kbps		250 m	78 m	
500 kbps		100 m	39 m	

5. Memory of PLC

5.1. Address Map

- The **OUT DATA** (4ch) is used for storing commands and parameters to the AD-4402.
- The **IN DATA** (8ch) is used for storing reply data from AD-4402.

Caution

- **The interface needs 8 bytes for OUT DATA and 16 bytes for IN DATA in the memory area of the PLC. Avoid crossing memory area of other slave devices. These use BCD code.**

5.1.1. OUT DATA (4ch), PLC to AD-4402

	bit15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1st ch	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1
	Output data (10^3)				Output data (10^2)				Output data (10^1)				Output data (10^0)			

	bit15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
2nd ch					8	4	2	1	8	4	2	1	8	4	2	1
	Output data				Output data (10^6)				Output data (10^5)				Output data (10^4)			

Polarity of output data. 0: positive, 1: negative

	bit15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
3rd ch									8	7	6	5	4	3	2	1
	Int. res.		Internal reservation						Command bit							

Flag R/$\overline{W}$ 0: Write, 1: Read

	bit15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Last ch					8	4	2	1	8	4	2	1	8	4	2	1
	Int. res.				Command No. (10^2)				Command No. (10^1)				Command No. (10^0)			

Command No. (10^3)

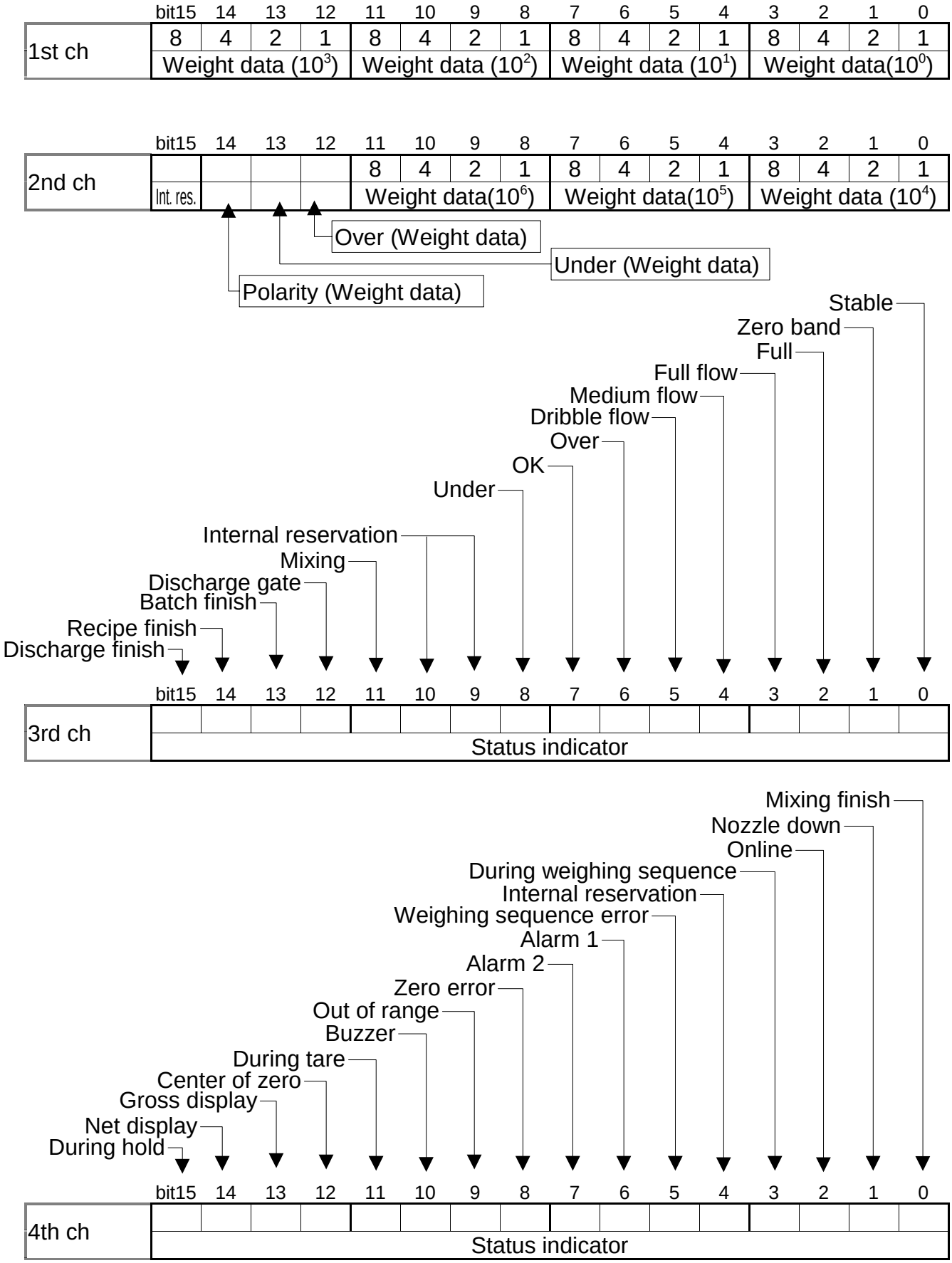
Flag G/$\overline{N}$ 0: Net, 1: Gross

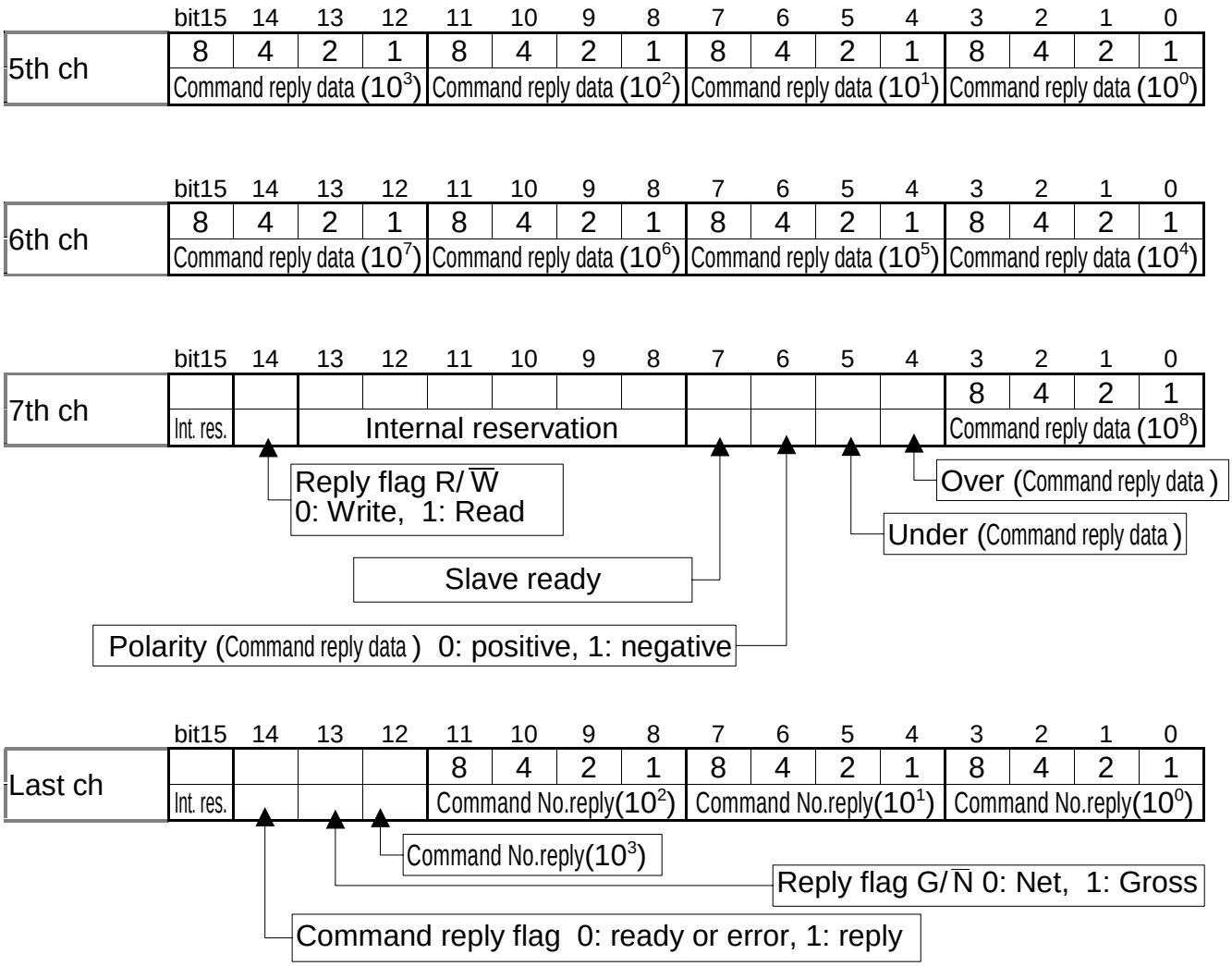
Command request flag. 0: No request, 1: Request

Explanation of the OUT DATA

Output data	The bits to be used for the output command. Refer to "5.3.Command"
Command bit	The bits to assign function and use to each command bit. Refer to "5.2.Command Bit"
Command No.	The bits to specify the "command No.". Refer to "5.3.Command"
Flag R/$\overline{W}$	The bit to select the "read command" or write command".
Flag G/$\overline{N}$	The bit to select the "gross value" or "net value".
Int. res.(Internal reservation)	Write zero.

5.1.2. IN DATA (8ch), AD-4402 to PLC





Explanation of the IN DATA

Slave ready	When AD-4402 is in weighing mode or a status that can weigh, it is "ON". When this bit is "ON", it can read the command reply data and write output data.
Command No. reply	it is reply data of the command No. .
Command reply data	It is reply data of the command.
Reply flag G/$\overline{N}$	It is reply data of gross or net.
Reply flag R/$\overline{W}$	It is reply data of read or write.
Int. res.(Internal reservation)	Do not use these bits.

5.2. Command Bit

5.2.1. How to Use Command Bit

- Assign the function to eight bits of the "**command bit**" in the function mode. Refer to the instruction manual.
- When executing the function assigned to a bit, turn on the bit.
- The function has effect at the leading edge (rising edge) of the bit.
- Keep the signal level at least 30 msec.

5.2.2. Execution Procedure of Command Bit

Step 1 Assign a "**command bit**" function to each bit in the function mode of AD-4402.
Turn off all bits of the "**command bit**" in the PLC memory.
Step 2 Turn on the bit in the PLC memory, to execute the function.
Step 3 Then the AD-4402 executes the function.
Step 4 Turn off all bits of the "**command bit**" in the PLC memory.

5.2.3. Function List of Command Bit

Assign the following function to each command bit. [Function setting]-[Option]-[OP-21]

Category Address symbol	Name	Parameter	Initial Value
21F-1	Command bit 1	Refer to the next list.	1 Zero
21F-2	Command bit 2		3 Tare
21F-3	Command bit 3		4 Clearing Tare
21F-4	Command bit 4		5 Batch start
21F-5	Command bit 5		13 Emergency stop
21F-6	Command bit 6		22 Pause
21F-7	Command bit 7		23 Re-start
21F-8	Command bit 8		44 Error reset

Function list for command bit

Parameter	Description	Parameter	Description
0	Not used	23	Re-start
1	Zero	24	Clear accumulation data of active material code
2	Zero clear (to be zero)		
3	Tare	25	Clear all totals of material code
4	Tare clear (to be zero)	26	Clear total of active recipe code
5	Batch start	27	Clear all totals of recipe code
6	Recipe start	36	Forced batch finish
7	Discharge start	37	Forced recipe finish
8	Mixing start	38	Forced discharge finish
10	Manual free fall compensation	44	Reset error
11	Total	45	Leading edge (Up) Hold Trailing edge (down) Clearing hold
12	Cancel the last result		
13	Emergency stop	47	Manual print command
22	Pause		

5.3. Commands

5.3.1. How to Use Command

- BCD code is used for numerical data. When data is negative, the polarity bit is turned on. ASCII code is used for each character data (in the unit of 8 bits).
  Character output area is [OUT data] - [2nd ch] (Bit 12 ~ 15 of "**Output data**" is used).
  Example for BCD: "3" = "0011".
  Example for ASCII code: "A" = "0100 0001".
  Space code = "0010 0000".

- Flag "**R/$\overline{W}$**" specifies the "read command" or "write command".
  0: write command, 1: read command
- Specify an executed command for the "**Command No.**"
- Specify the data of an executed command for the "**Output data**".
- Command has effect at the leading edge of "**Command request flag**".
  Keep the signal level more than 30 msec.
- The result of the command is input to "**Command reply flag**" and "**Command No. reply**".
- When the read command is output, the result is input to "**Command reply data**".
- When the data is positive over, flag "**Over**" is ON.
  When the data is negative over, flag "**Under**" is ON.
  When the data is negative value, polarity flag is ON.

5.3.2. Execution Procedure of Command

Ready

Step 1 Turn off the "**Command request flag**".
Step 2 Specify the flag "**R/$\overline{W}$**". 0: write command, 1: read command
Step 3 Specify an executed command for "**Command No.**"
Step 4 If output data is needed, specify data for "**Output data**".

Execution

Step 5 Confirm that the flag "**Slave ready**" is ON.

Step 6 Turn on the "**Command request flag**". It has effect at the leading edge.

Step 7 The AD-4402 replies.
The result is input into "**Command reply flag**", flag "**R/$\overline{W}$**", "**Command No. reply**".

Step 8 If it is a read command, data is input into "**Command reply data**".

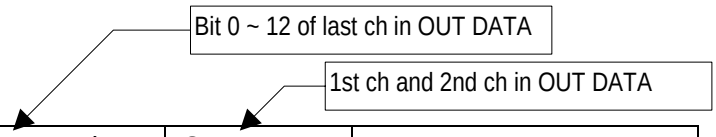
Finish

Step 9 Turn off the "**Command request flag**".

5.3.3. Read Command List

Command Name	Command No.	Note
Material name 1 (1st to 4th character)	1	Bit 0 ~ 12 of last ch in OUT DATA This data is stored in each material code. Specify a material code No. before the input. A material code No. specified at "**Material code to store** (33)" of "**Write command**". During setting, material code No. can check by "**Material code to store**(33)" of "**Read command**".
Material name 2 (5th to 8th character)	2	
Material name 3 (9th to 12th character)	3	
Material hopper	5	
Final	6	
Free fall	7	
Preliminary	8	
Optional preliminary	9	
Over	10	
Under	11	
Zero band	12	
Full	13	
Tare	14	
Supplementary flow open timer	15	
Supplementary flow close timer	16	
Manual free fall compensation	17	
Initial dribble supply	18	
Initial medium supply	19	
Total weight	20	
Total count	21	
Current material code	32	
Material code to store	33	
Weighing result	36	Last result is read.
Recipe name 1 (1st to 4th character)	40	This data is stored in each recipe codes. Specify a recipe code No. before the input. A recipe code No. specified at "**Recipe codeto to store** (57)" of "**Write command**". During setting, recipe code can check by "**Recipe code to store**" of "**Read command**".
Recipe name 2 (5th to 8th character)	41	
Recipe name 3 (9th to 12th character)	42	
Material 1	44	
Material 2	45	
Material 3	46	
Material 4	47	
Material 5	48	
Material 6	49	
Material 7	50	
Material 8	51	
Material 9	52	
Material 10	53	
Total weight	54	
Total count	55	
Current recipe code	56	
Recipe code to store	57	
Error information	60	Refer to 5.4.Error information
Decimal point	61	
Current tare	64	Tare = Gross - Net

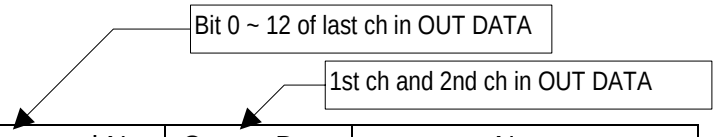
5.3.4. Write Command List



Command Name	Command No.	Output Data	Note
Material name 1 (1st to 4th character)	1	Characters data #	This data is stored in each material code. Specify a material code No. before the input. A material code No. specified at "**Material code to store** (33)" of "**Write command**".
Material name 2 (5th to 8th character)	2		
Material name 3 (9th to 12th character)	3		
Material hopper	5	Numerical data	
Final	6		
Free fall	7		
Preliminary	8		
Optional preliminary	9		
Over	10		
Under	11		
Zero band	12		
Full	13		
Tare	14		
Supplementary flow open timer	15		
Supplementary flow close timer	16		
Automatic free fall range	17		
Initial dribble supply	18		
Initial medium supply	19		
Recall material code	32	Code No. 0 to 99	
Material code to store	33		
Recipe name 1 (1st to 4th character)	40	Characters data #	This data is stored in each recipe codes. Specify a recipe code No. before the input. A recipe code No. specified at "**Recipe code to store** (57)" of "**Write command**". Use "**Material 1**" at first and in order. Set "FFFFFFFF" to unused codes.
Recipe name 2 (5th to 8th character)	41		
Recipe name 3 (9th to 12th character)	42		
Material 1	44	Code No. 0 to 99	
Material 2	45		
Material 3	46		
Material 4	47		
Material 5	48		
Material 6	49		
Material 7	51		
Material 8	50		
Material 9	52		
Material 10	53		
Recall recipe code	56	Code No. 0 to 99	
Recipe code to store	57		

Material and recipe names are alphanumeric data, and are ASCII code in unit of 8 bits. If it is not used, then put in space code (20h).

Control Command List



Command Name	Commnad No.	Output Data	Note
Zero	0	1	
Zero clear	0	2	
Tare	0	3	
Tare clear	0	4	
Batch start	0	5	
Recipe start	0	6	
Discharge start	0	7	
Mixing start	0	8	
Manual free fall compensation	0	10	
Total	0	11	
Cancel the last result	0	12	
Emergency stop	0	13	
Clear total of each material code	0	14	Specify material code No. at "**Material code to store** (33)" of "**Write command**".
Clear total of each recipe code	0	15	Specify a recipe code No. at "**Recipe code to store**(57)" of "**Write command**".
Pause	0	22	
Re-start	0	23	
Clear accumulation data of active material code	0	24	
Clear all totals of material code	0	25	
Clear total of active recipe code	0	26	
Clear all totals of recipe code	0	27	
Forced batch finish	0	36	
Forced recipe finish	0	67	
Forced discharge finish	0	68	
Reset error	0	44	
Manual print command	0	47	
Net display	0	49	
Gross display	0	50	

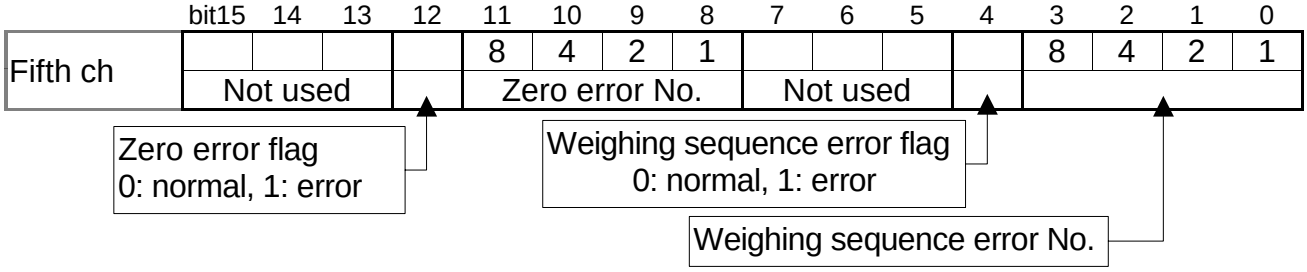
5.4. Error Information

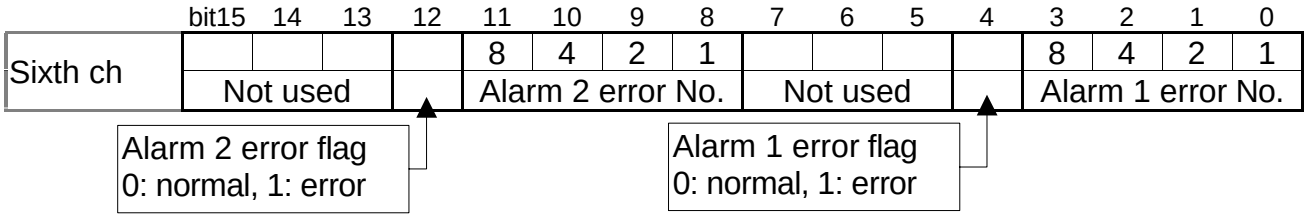
- When an error has occurred, the information can be input from the AD-4402 to PLC memory with "**Error information** (60)" of the "**Read command**".
- There are the "**Error No.**" and the "**Error flag**" in an error code. There are four error code types in the "**Command reply data**".

Caution

- **Data of "unused bit" is an undefined value.**
- **Refer to AD-4402 instruction for the detail of the error code, too.**

Error Information in IN DATA





Error No.

Type	No.	Cause and Treatment
Weighing sequence error No. SQ.ERR	0	The weighing sequence stoped. Cope with cause and restart the sequence.
	1	Safety check can not be completed. Check the safety.
	2	Under weight or over weight. Compensate weight and restart.
	3	There is a conflict in setpoint Check setpoint
	4	Time over of batch weighing. Check the gate and hopper remains.
	5	Time over of discharge. Check the discharge gate.
	6	The remains are not enough to weigh. Add material.
	7	When the batch is started, the weight is full already.
	8	Nozzle is touching the hopper. Check the nozzle.
	9	There is no tare (vessel) on the weighing pan.

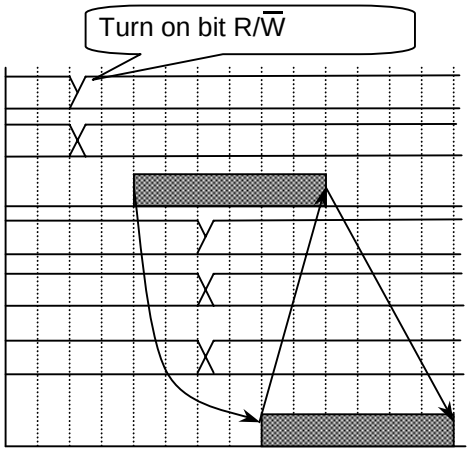
Type	No.	Cause and Treatment
Zero error ZR.ERR	0	Weighing value is out of zero band. Display can not be zeroed by zero compensation.
	1	Weighing value is out of tare condition. Display can not be zeroed by tare operation.
	2	Weighing value is not stable. Automatic zeroing or automatic tare can not performed at power on
Alarm 1 **ALARM 1**	1	Weighing value is out of range.
	9	Emergency stop is executed. Emergency stop is executed by external input.
Alarm 2 **ALARM 2**	1	A/D converter is positive over count. Check the loadcell cable.
	2	A/D converter is negative over count. Check the loadcell cable.
	4	RAM error. Check the backup battery

6. Timing Chart

6.1. Read Command

- Specify data to be read at "**Command No.**" Reply data is input to "**Command reply data**".

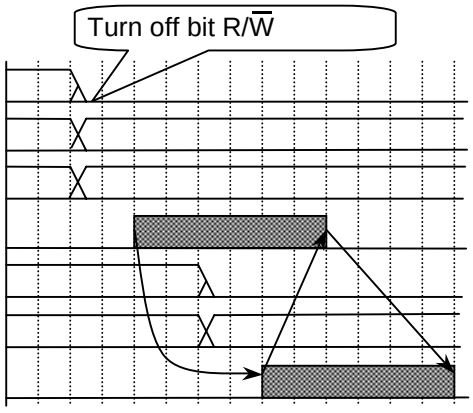
Flag R/$\overline{W}$ ..... OUT DATA , 3rd ch, bit14
Command No. .....OUT DATA, Last ch, bit0～12
Command request flag..... OUT DATA, Last ch, bit14
Reply flag R/$\overline{W}$ .....IN DATA, 7th ch, bit14
Command reply No......IN DATA, Last ch, bit0～12
Command reply data .....
.....IN DATA, 5th ch, 6th ch, 7th ch, bit0～6
Command replay flag ..... IN DATA, Last ch, bit14



6.2. Write Command

- Specify data to write at "**Command No.**" Send the output data of "**OUT DATA**".

Flag R/$\overline{W}$ ..... OUT DATA , 3rd ch, bit14
Command No. .....OUT DATA, Last ch, bit0～12
Output data..... OUT DATA, 1st ch Second ch
Command No. .....OUT DATA, Last ch, bit0～12
Reply flag R/$\overline{W}$.....IN DATA, 7th ch, bit14
Command reply No......IN DATA, Last ch, bit0～12
Command replay flag ..... IN DATA, Last ch, bit14



7. Monitor Mode

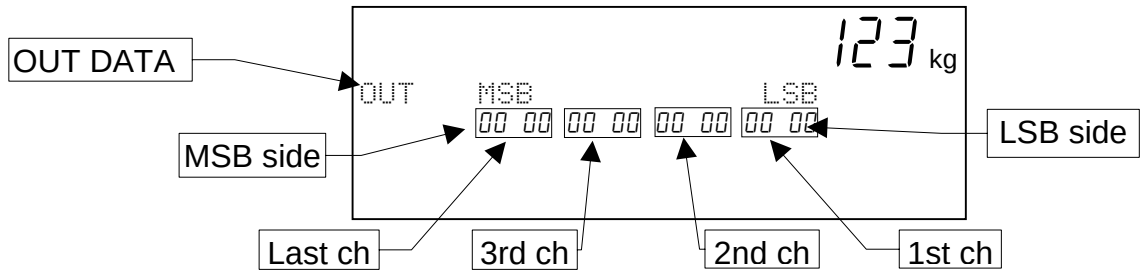
7.1. Operation and Indication

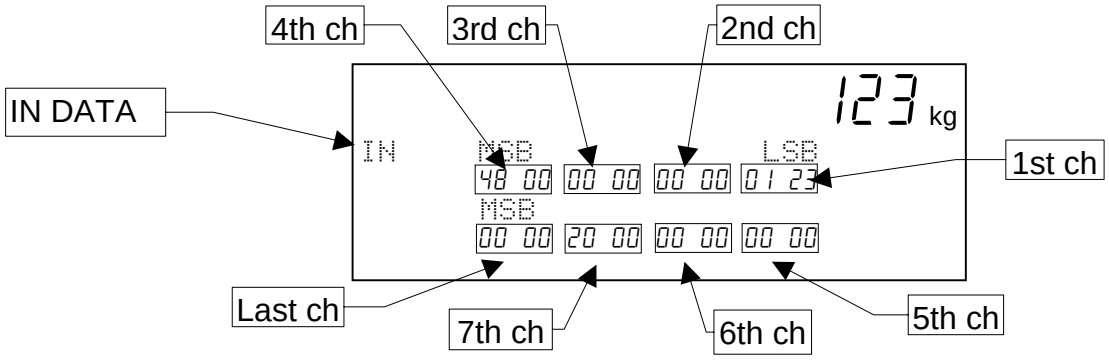
- This mode is uses to monitor the condition of the indicator.
  The mode does not stop a current communication and weighing sequence. OUT DATA, IN DATA and STATUS can be monitored.
- Data can not be writen.
- The monitor format is hexadecimal numbers.

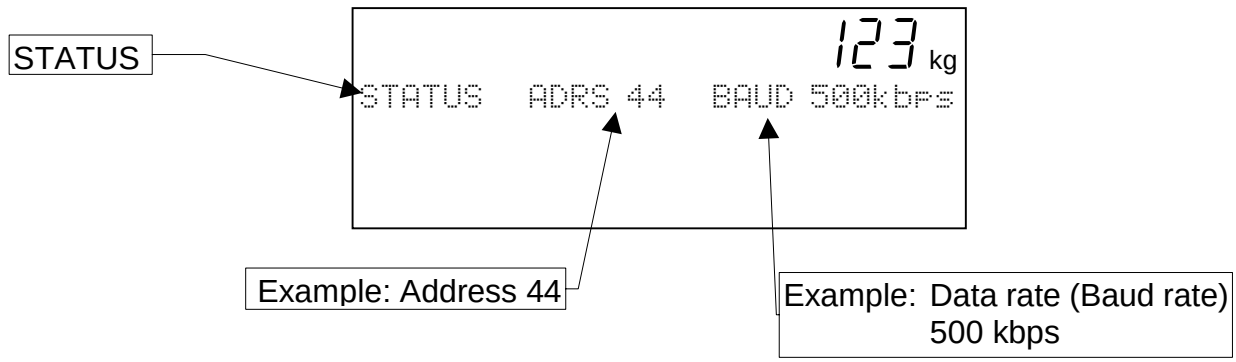
- Use the following keys to operate the monitor mode.
- Entering the monitor mode..... When displaying weighing value, press and hold the **ENTER** key and press the ↓ key. Enter menu Check using the **ENTER** key and the ↓ key.
  Menu: [Check] - [Monitor] - [Option] - [OP-21]

- Selecting a data..... The 1 key (Order of OUT →IN →STATUS)
  The 2 key (Order of OUT →STATUS →IN)

- End key (Exit key)..... **ESC** key







7.2. Interface Status Monitor

Monitor Symbols	Descriptions
ADRS	Node address
BAUD	Baud rate
TIME_OUT	Time out
ERR:ROM	Hardware error
ERR:RAM	Hardware error
ERR:CAN	Hardware error
ERR:PARAMETER	Baud rate is out of setting range. #
ERR:NODE_ADDRESS	Duplicated node address #
ERR:BUSOFF	BUSOFF error #
ERR:POWER	Network power supply error #

These errors are reset after turning the indicator on again.

8. Sample Program

- This sample program uses the PLC C200HE made by the OMRON Corporation.
- Construction of network: Master: 1 unit, AD-4402: 1 unit. The scan list is stored in the scanner.
  IN DATA: 350 to 357 ch
  OUT DATA: 50 to 53 ch
  Input module is installed in the slot 4th.
- In this example, there are some unused data in IN DATA and OUT DATA.

Operation

- When pressing the start button, a final value (1000) is set to material code (No.5) and batch programming is performed.
- Procedure of command is as follows:
  1. Setting material code.
  2. Inputting a final value.
  3. Recalling program of material code.≅

Used Relays and Memory Map

Used Relays

Channel. No.	Relay Name	Function
253.15	Special relay	At start, it is scanned once.
253.13	Special relay	It is always ON.
255.06	Special relay	When result is "equal" or "0", it is tuned on.

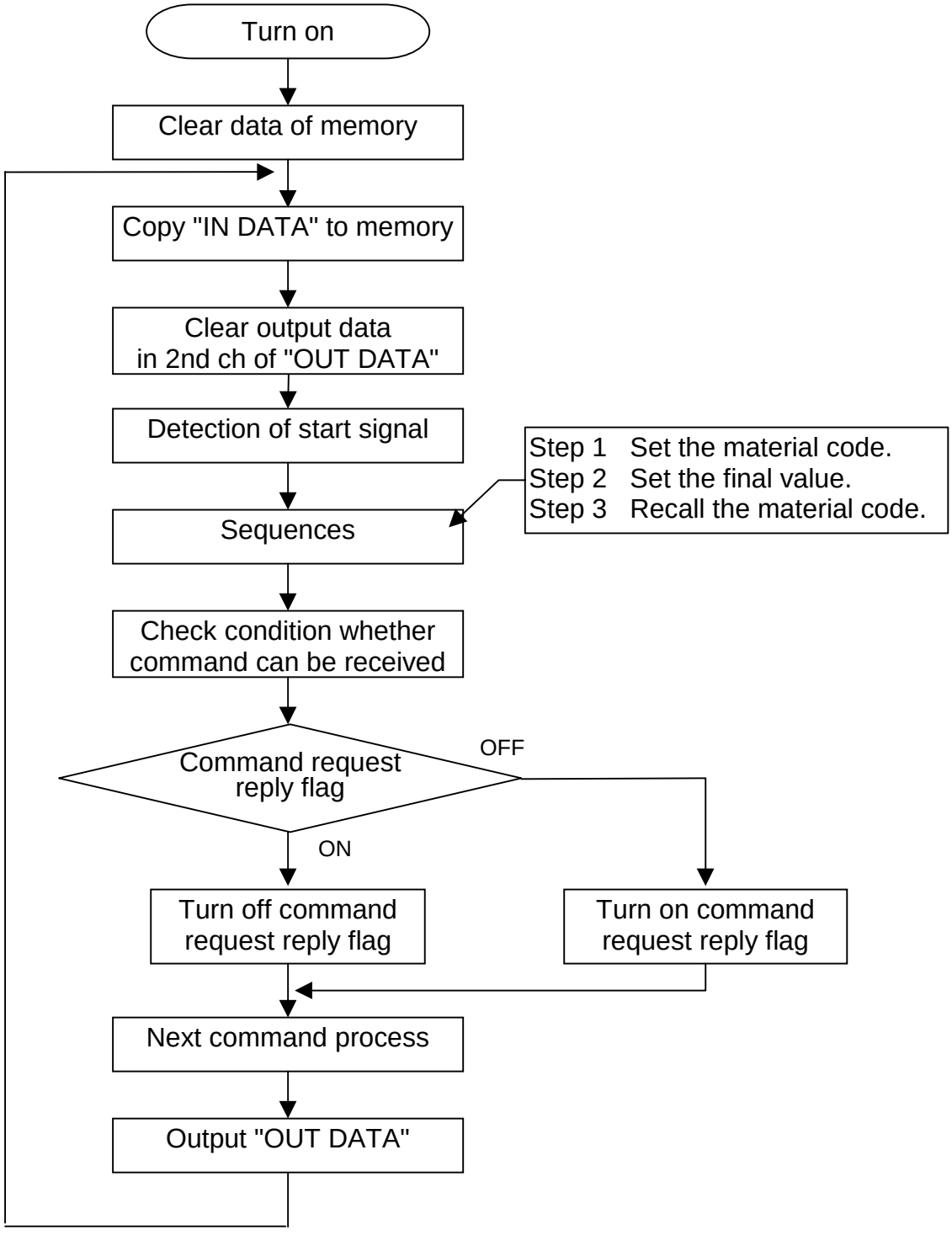
Channel. No.	Relay Name	Function
2.00	Internal relay	Control of command request flag
2.01	Internal relay	Check condition to receive a command
2.03	Internal relay	Control of start signal
2.04	Internal relay	Detection to turn on start signal
2.05	Internal relay	Detection to turn off command reply flag
4.00	I/O relay	Start

Memory Map

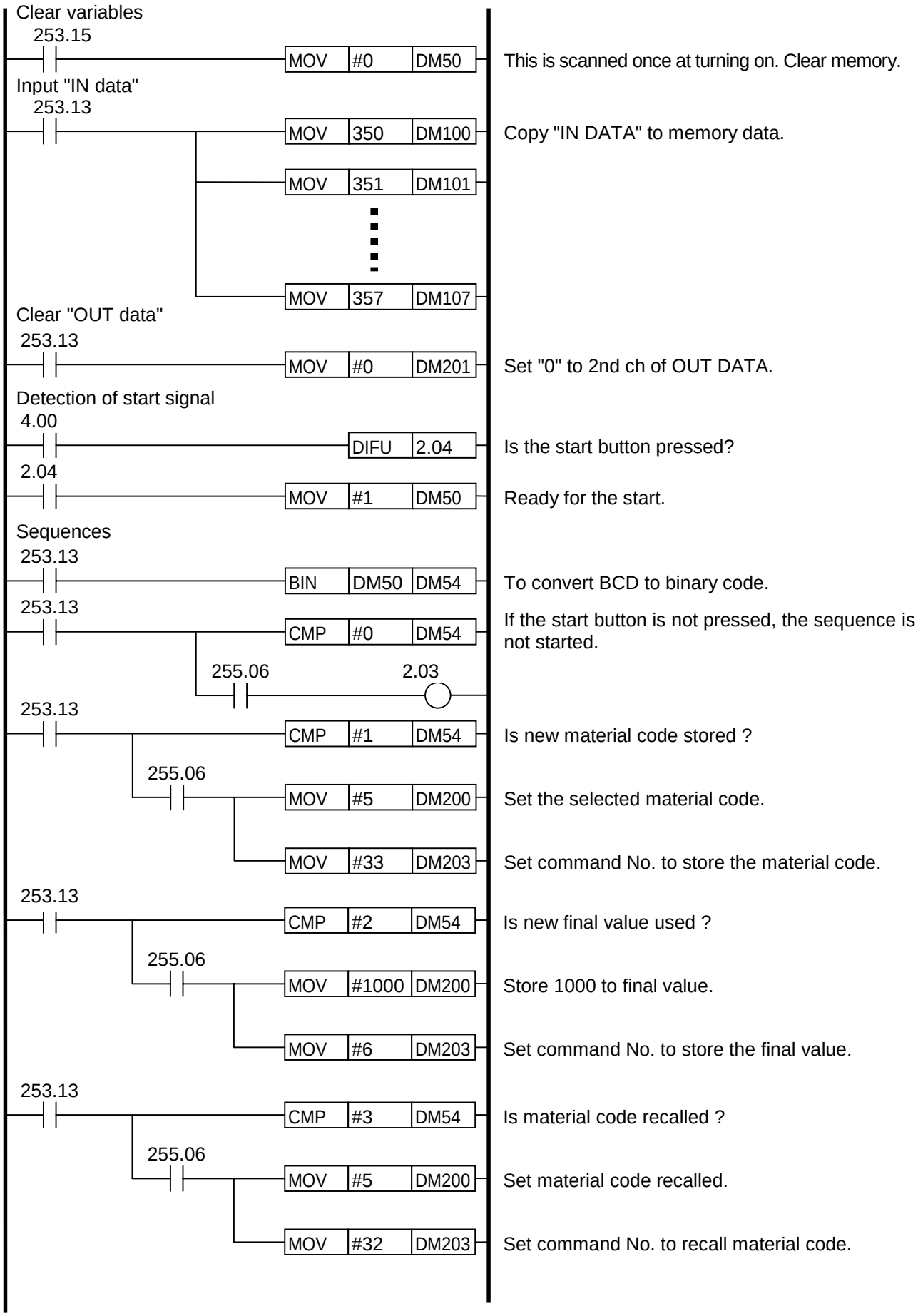
Data Memory No.	Function	Data Memory No.	Function
DM50	Sequence No. (BCD)	DM104	IN DATA at 5th ch #
DM51	Slave ready	DM105	IN DATA at 6th ch #
DM53	Dummy	DM106	IN DATA at 7th ch #
DM54	Sequence No. (Binary)	DM107	IN DATA at last ch
DM100	IN DATA at 1st ch #	DM200	OUT DATA at 1st ch
DM101	IN DATA at 2nd ch #	DM201	OUT DATA at 2nd ch
DM102	IN DATA at 3rd ch #	DM202	OUT DATA at 3rd ch #
DM103	IN DATA at 4th ch #	DM203	OUT DATA at last ch

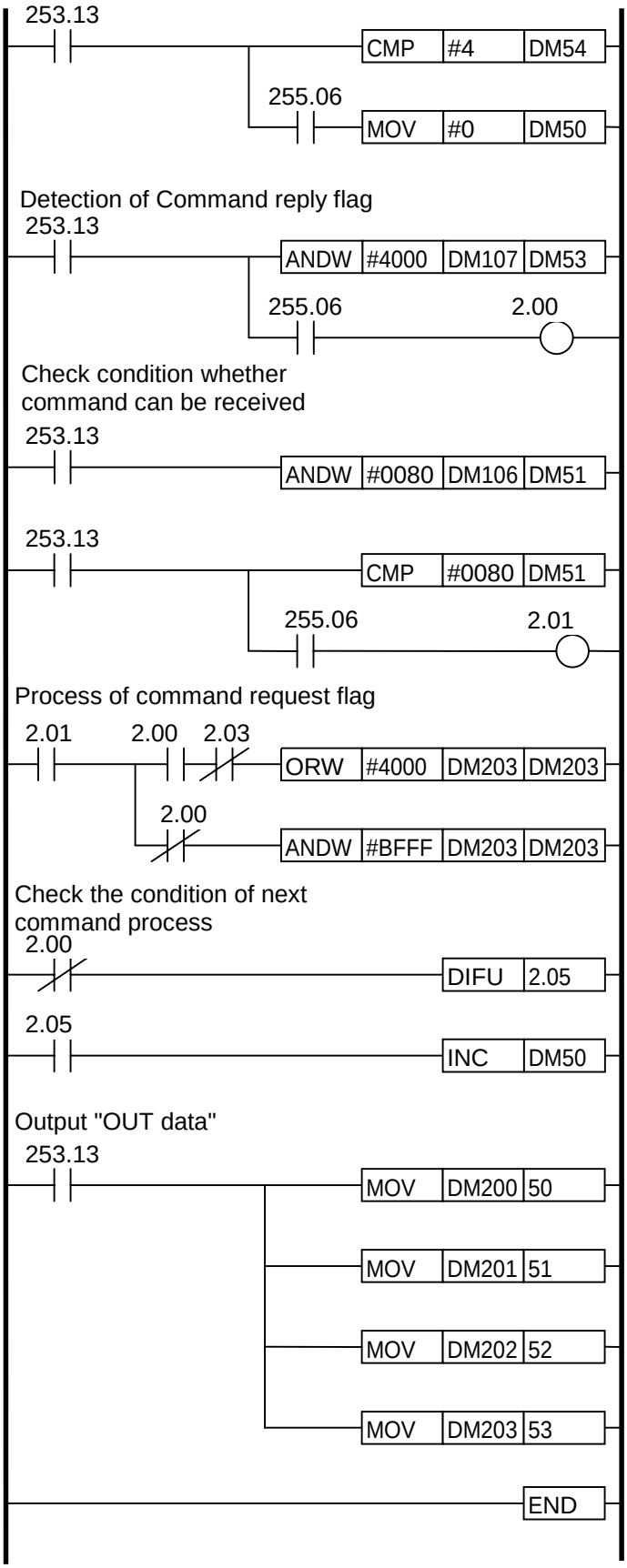
This sample program does not use the channel data.

Flow Chart


Turn on
Clear data of memory
Copy "IN DATA" to memory
Clear output data
in 2nd ch of "OUT DATA"
Detection of start signal
Step 1 Set the material code.
Step 2 Set the final value.
Step 3 Recall the material code.
Sequences
Check condition whether
command can be received
Command request
reply flag
OFF
ON
Turn off command
request reply flag
Turn on command
request reply flag
Next command process
Output "OUT DATA"

Ladder Diagram




253.13
CMP #4 DM54
Are all commands finished ?
255.06
MOV #0 DM50
Ready for next start signal.
Detection of Command reply flag
253.13
ANDW #4000 DM107 DM53
Check the command reply flag.
255.06
2.00
Check condition whether command can be received
253.13
ANDW #0080 DM106 DM51
Copy the slave ready flag to memory.
253.13
CMP #0080 DM51
Check the slave ready flag.
255.06
2.01
Process of command request flag
2.01
2.00
2.03
ORW #4000 DM203 DM203
Turn on the command request flag.
2.00
ANDW #BFFF DM203 DM203
Turn off the command request flag.
Check the condition of next command process
2.00
DIFU 2.05
Check the command reply flag.
2.05
INC DM50
If the command reply flag is off, proceed next command.
Output "OUT data"
253.13
MOV DM200 50
Output memory data to "OUT DATA"
MOV DM201 51
MOV DM202 52
MOV DM203 53
END

MEMO

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