

VB - 4DA

Analog Output Module

User Manual

Foreword

- This manual contains text, diagrams and explanations which will guide the reader in the correct installation, safe use and operation of the VB-4DA analog output module. It should be read and understood before attempting to install or use the unit.
- Further information can be found in the VIGOR M, VB and VH series PLC PROGRAMMING MANUAL.
- If in doubt at any stage during the installation of the VB-4DA analog output module always consult a professional electrical engineer who is qualified and trained to the local and national standards.
- If in doubt about the operation or use of the VB-4DA analog output module please consult the nearest VIGOR ELECTRIC CORP. distributor.
- This manual is subject to change without notice.

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1. Introduction

- The VB-4DA analog output module has four output channels. The output channels take in a digital value and output an equivalent analog (voltage or current) signal. This is called a D/A conversion. The VB-4DA has maximum resolution of 8 bits.
- The selection of voltage or current based output is by user wiring. Analog ranges of 0 ~ 10 V DC and/or 0 ~ 20 mA maybe selected independently for each channel.
- The VB-4DA analog output module is attached as an extension to the VB series Programmable Logical Controller (hereinafter referred to as “PLC”), and the VB-4DA is attached as an extension to the VB series PLC Main Unit. Each VB-4DA functions as a special module which transfers data with the PLC using the FROM / TO instructions, and would not occupy any input or output point. Up to 8 special modules can be connected to single VB2 series PLC; a single VB0 series PLC can connect with two special modules.

2. Specifications

<< Power Requirement >>

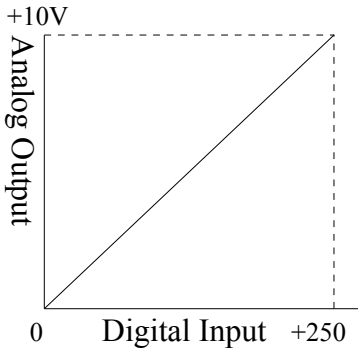
- 5 V DC, 30 mA (for internal control)
Supplied from PLC Main Unit (or Expansion Unit / VB-PWR) via its extension cable.
 - From a Main Unit:
[(The amount of Expansion Modules) + (The amount of Special Modules) X 2] ≤ 4
 - From an Expansion Unit or VB-PWR:
[(The amount of Expansion Modules) + (The amount of Special Modules) X 2] ≤ 12
- 24 V DC (+20% / -15%), 120 mA Max. (for analog signal output)
Supplied from external power supply or 24 V DC output of PLC.

<< Analog Output Performance Specifications >>

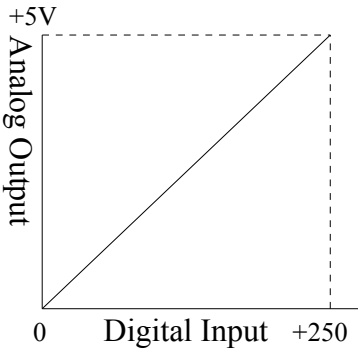
Item	Voltage Output			Current Output	
	Voltage or Current outputs are selected by BFM #0 & different terminals				
Mode	0	1	2	4	5
Analog Output Range (DC)	0 ~ +10 V	0 ~ +5 V	+1 ~ +5 V	0 ~ +20 mA	+4 ~ +20 mA
Digital Input Range	0 ~ +250			0 ~ +250	
External Load Resistance	500 Ω ~ 1 MΩ			500 Ω or less	
Resolution	40 mV	20 mV	16 mV	80 μA	64 μA
Overall Accuracy	± 1% (full scale)				
Conversion Speed	0.8 ms / 4 points				
Isolation	Photocoupler isolation between analog and digital circuits. DC/DC converter isolates of power from its power source. No isolation between analog channels.				

<< Charts of D/A Converter Characteristic >>

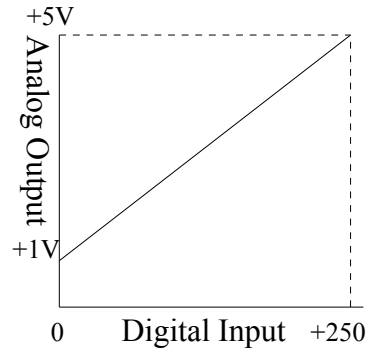
Mode: 0
(0 ~ +10 V DC, voltage output)



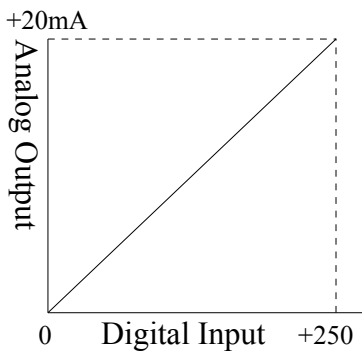
Mode: 1
(0 ~ +5 V DC, voltage output)



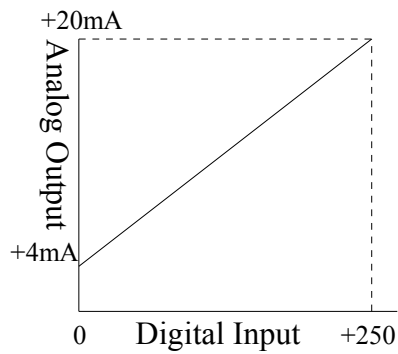
Mode: 2
(+1 ~ +5 V DC, voltage output)



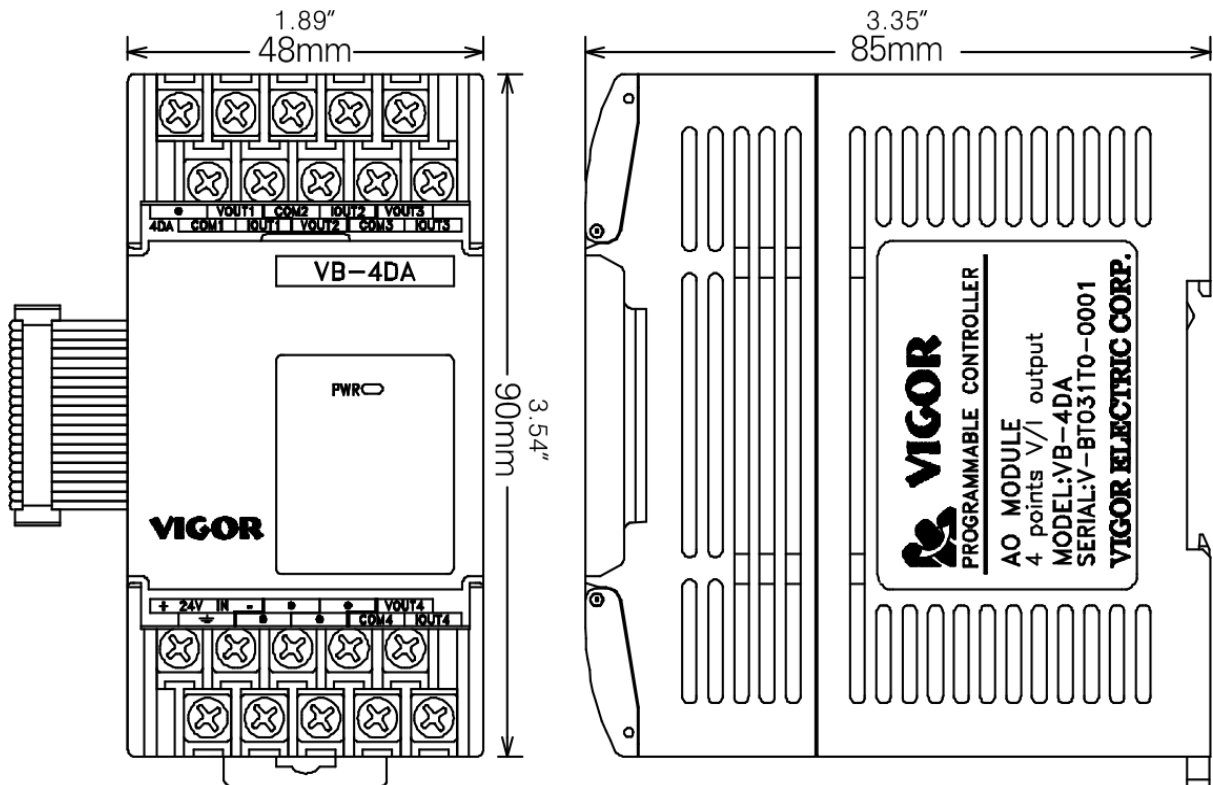
Mode: 4
(0 ~ +20 mA DC, current output)



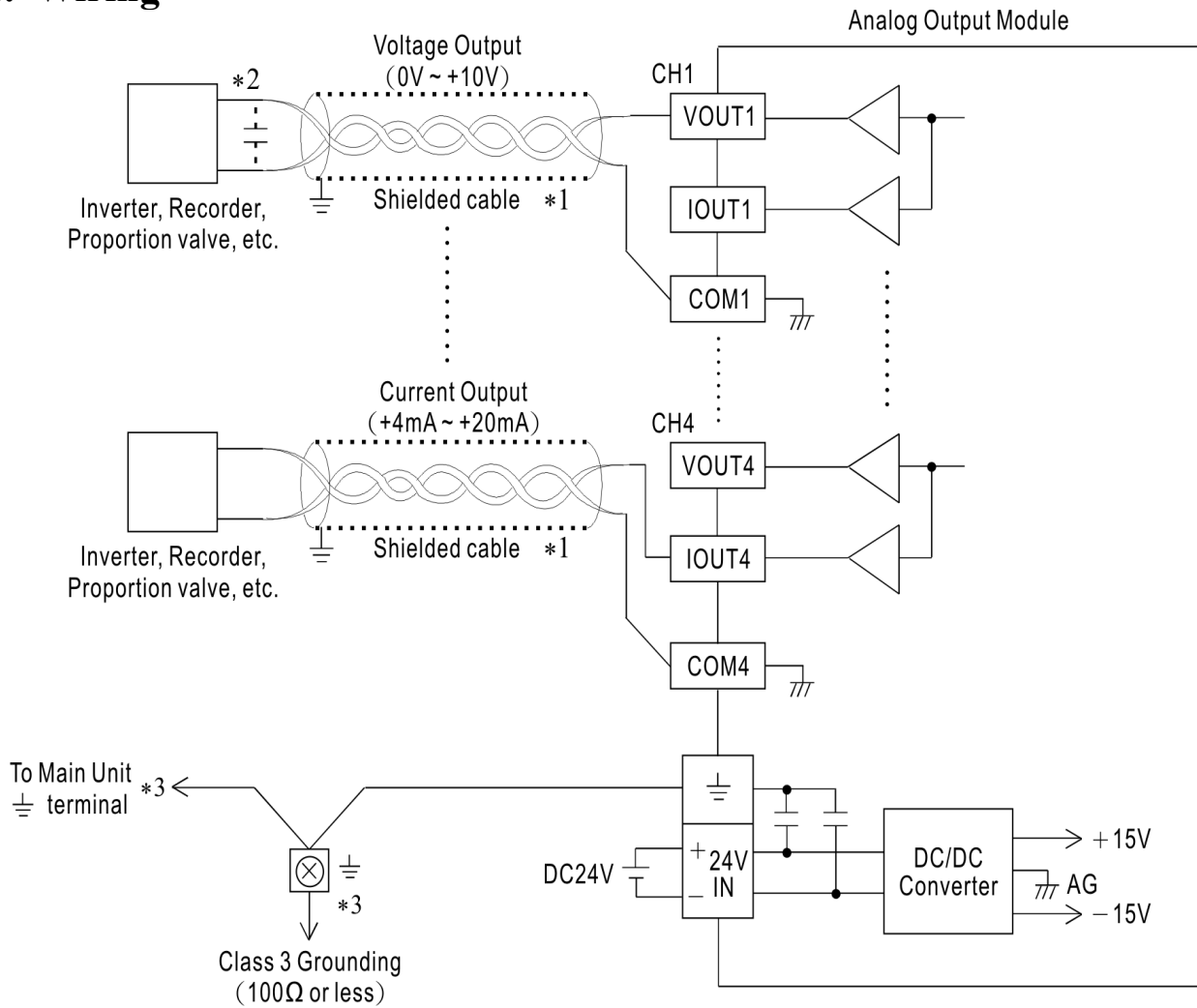
Mode: 5
(+4 ~ +20 mA DC, current output)



3. External Dimensions



4. Wiring



- *1: Please use a twisted pair shielded isolation cable for each analog output channel and keep the cable away from the electromagnetic interference source (ex. power lines or any other lines which may induce electrical noise). Apply 1-point grounding at the load side of the output cable (class 3 grounding: 100 Ω or less).
- *2: If electrical noise or a voltage ripple exists at the output, must connect a smoothing capacitor of 0.1 ~ 0.47 μF, 25 V.
- *3: Connect the ≡ terminal on the VB-4DA with the ≡ terminal on the Main Unit of the programmable controller.

- Mixed (voltage and current) output from the same channel is not possible.
- Shorting the voltage output terminal or connecting the current output load to the voltage output terminal may damage the VB-4DA.
- The 24 V DC service power of the programmable controller can also be used.
- Do not connect any unit to the unused terminal.

5. Outline of FROM/TO Instruction

D	FNC 78 FROM	P		Read special module BFM												
Device																
	X	Y	M	S	KnX	KnY	KnM	KnS	T	C	D	SD	P	V,Z	K,H	VZ index
m1															○	
m2															○	
D							○	○	○	○	○					○
n															○	
<ul style="list-style-type: none"> • m1 = 1~8 • m2 = 0~32767 • n = 1~32767 																
X0			<p>(m1): The position number of the specified special module (m2): Initial serial number of the BFM(s) to be read (D): The initial device of storage(s) for collect the picked up data (n): Number of data group(s) to be read</p> <ul style="list-style-type: none"> • The Main Unit of VB Series PLC use the instruction to read BFM data of the special module. • When X0="ON", 1 group (it will be the BFM #30, because (n)= K1 and (m2)= K30) data in the specified special module (which is installed in the (m1)= K1 = 1st. position) will be read and stored in (D)= D10. • To assign the (m1) in a VB Series, each special module is consecutively assigned from K1 to K8 (in a VB0 Series, (m1)= K1 or K2), it begins with the closest one to the Main Unit. • When X0="OFF", the instruction will not be performed but the data (which was read previously) will still remain. 													
D	FNC 79 TO	P		Special module BFM write in												
Device																
	X	Y	M	S	KnX	KnY	KnM	KnS	T	C	D	SD	P	V,Z	K,H	VZ index
m1															○	
m2															○	
S					○	○	○	○	○	○	○				○	○
n															○	
<ul style="list-style-type: none"> • m1 = 1~8 • m2 = 0~32767 • n = 1~32767 																
X0			<p>(m1): The position number of the specified special module (m2): Initial serial number of the BFM(s), which will be written (S): The initial source device, which stores the data is for the BFM (n): Number of data group(s) to be write</p> <ul style="list-style-type: none"> • The Main Unit of VB series PLC use this instruction to write data to the special module BFM. • When X0="ON", the content value of (S) (K0) will be written into the BMFs which are started form BFM #1 ((m2) = K1) in the special module and it is installed in the 1st. ((m1)= K1) position. Since (n) = K4, there are 4 BMFs will be written sequentially. • To assign the (m1) in a VB Series, each special module is consecutively assigned from K1 to K8 (in a VB0 Series, (m1)= K1 or K2), it begins with the closest one to the Main Unit. • When X0="OFF", the instruction will not be performed but the data (which was written previously) will still remain. 													

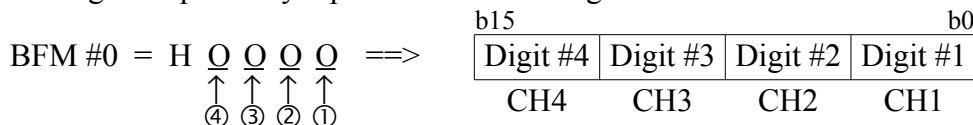
6. Allocation of Buffer Memory (BFM)

Data is transmitted between the VB-4DA and the Main Unit via buffer memories (BFM).

BFM	Description	
#0	Output mode select	Default value = H0000 (when the PLC power, OFF→ON)
#1	CH #1 Output data	Default value = 0 (when the PLC power, OFF→ON)
#2	CH #2 Output data	
#3	CH #3 Output data	
#4	CH #4 Output data	
#5	Data holding mode	Default value = H0000 (when the PLC power, OFF→ON)
#30	Model code: K106 (Read only)	

[BFM #0] Output mode select:

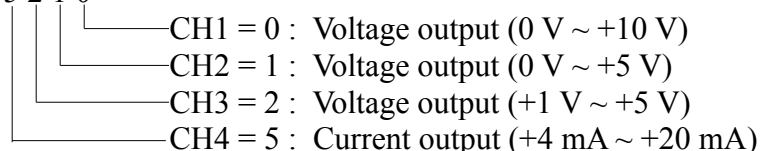
The value of BFM #0 switches the analog output between voltage and current on each channel. It takes the form of a 4-digit hexadecimal number. The first digit will be the command for the channel 1 (CH1), and the second digit is for the channel 2 (CH2), and so forth. The numeric values of these four digits respectively represent the following items:



- When: $\text{Q} = 0$: Sets the channel to voltage output mode (0 V ~ +10 V).
 $\text{Q} = 1$: Sets the channel to voltage output mode (0 V ~ +5 V).
 $\text{Q} = 2$: Sets the channel to voltage output mode (+1 V ~ +5 V).
 $\text{Q} = 4$: Sets the channel to current output mode (+4 mA ~ +20 mA).
 $\text{Q} = 5$: Sets the channel to current output mode (0 mA ~ +20 mA).

Switching the output mode resets the I/O characteristics to the factory-set characteristics. Refer to the section of [<< Charts of D/A Converter Characteristic >>](#).

Example: Let the BFM #0 = H 5 2 1 0

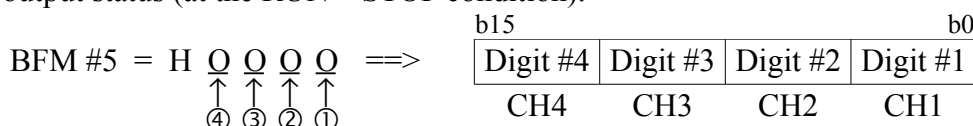


[BFM #1, #2, #3 and #4]: Output data channels CH1, CH2, CH3, and CH4

- BFM #1: Output data of CH1 (Initial value: 0)
 BFM #2: Output data of CH2 (Initial value: 0)
 BFM #3: Output data of CH3 (Initial value: 0)
 BFM #4: Output data of CH4 (Initial value: 0)

[BFM #5]: Data holding mode:

While the programmable controller is in the STOP mode, the last output value in the RUN mode could be hold. To write a 4-digit hexadecimal number in BFM #5 as follows can choose its analog output status (at the RUN→STOP condition).

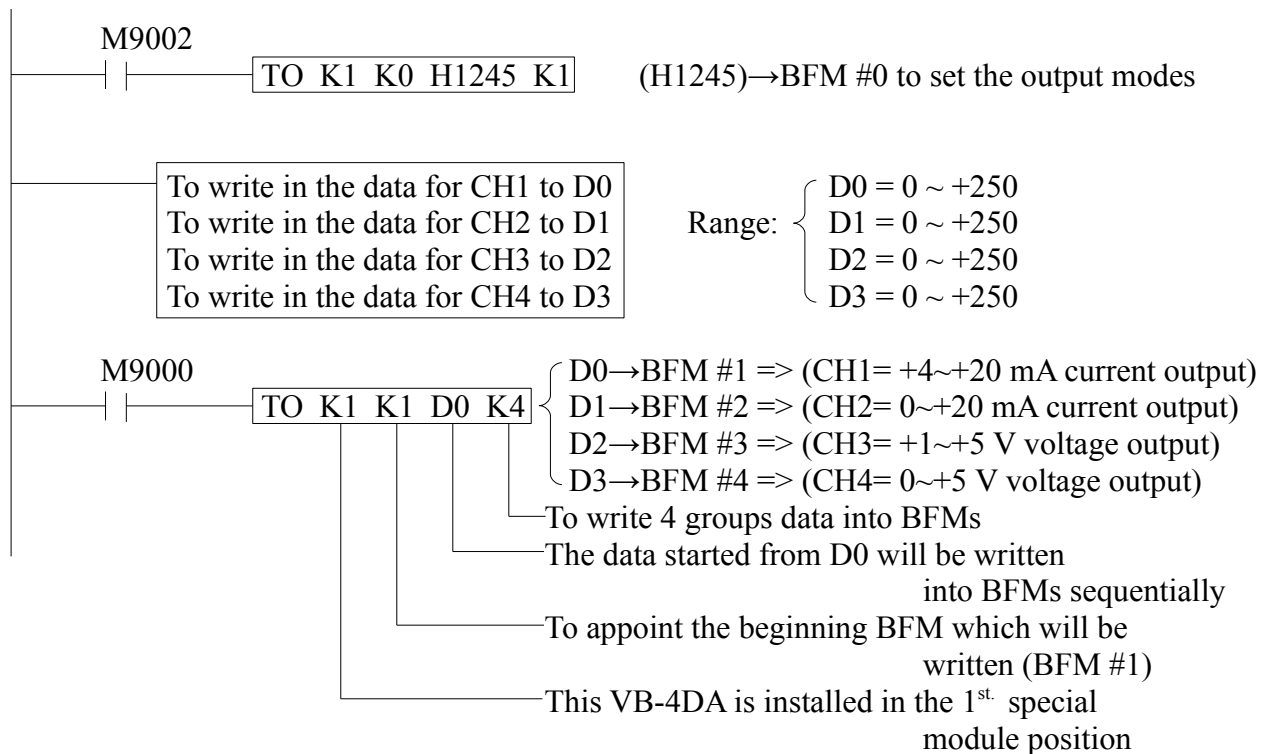


- When: $\text{Q} = 0$: Sets the channel to hold the output value. (If the PLC RUN→STOP)
 $\text{Q} = 1$: Sets the channel to the lowest output (OFFSET) value. (If the PLC RUN→STOP)

7. Operation and Program Example

To operate the VB-4DA can using the following simple example programs.

Example #1:



- In this program, the BFM #0 = H1245 :

The digit #1 = 5, CH1 will be a +4 mA ~ +20 mA current output.

The digit #2 = 4, CH2 will be a 0 mA ~ +20 mA current output.

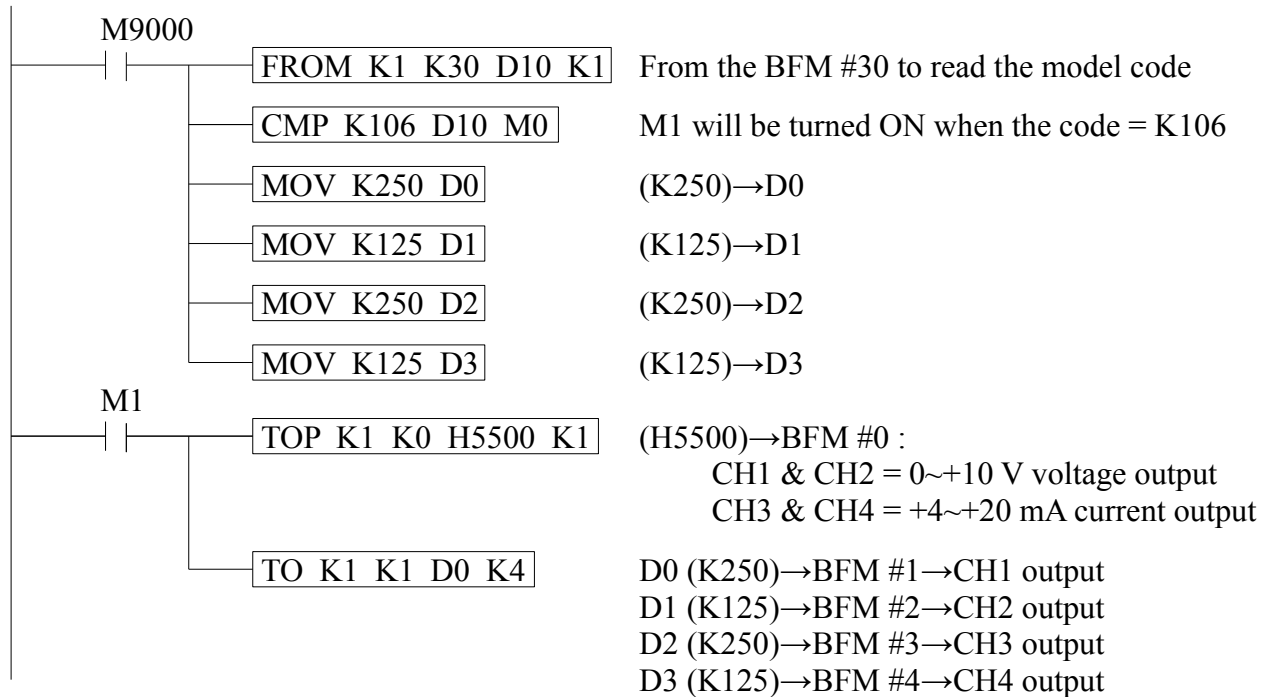
The digit #3 = 2, CH3 will be a +1 V ~ +5 V voltage output.

The digit #4 = 1, CH4 will be a 0 V ~ +5 V voltage output.

Operation procedure:

- ① Turn OFF the power of the Main Unit, and then connect the VB-4DA. After that, wire the I/O and power lines of the VB-4DA.
- ② Set the Main Unit to STOP, and turn ON the power. To download the above program then switch the Main Unit to RUN.
- ③ Analog values will be sent from D0 (BFM #1), D1 (BFM #2), D2 (BFM #3) and D3 (BFM #4) to the respective output channels of the VB-4DA. When the Main Unit is in STOP, the analog values has been set before stopping will not remain output.
- ④ When the Main Unit is in STOP, the lowest (OFFSET) values of the mode can also be output. For a detailed description, refer to [Chapter #6: Allocation of Buffer Memory \(BFM\)](#).
- ⑤ To set the values of D0, D1, D2 and D3, the analog outputs of VB-4AD will follow digital inputs.

Example #2:



- To execute the program above, on the VB-4DA terminals will be:
 Between VOUT1 and COM1 has 10 V output.
 Between VOUT2 and COM2 has 5 V output.
 Between IOUT3 and COM3 has 20 mA output.
 Between IOUT4 and COM4 has 12 mA output.

Cautions Regarding Operation

- ① Check whether the output wiring and/or expansion cables are properly connected on VB-4DA analog output module. (Refer to the [Chapter #4: Wiring](#))
- ② Check that the VB system configuration rules have not been broken, i.e. the number of modules does not exceed 8.
- ③ Ensure that the correct output mode has been selected for the application.
- ④ Check that there is no power overload on either the 5 V or 24 V [Power Requirement](#), remember the loading on the VB Main Unit or a powered extension unit varies according to the number of extension units or special function units connected.
- ⑤ Put the Main Unit into RUN.
- ⑥ After turning ON or OFF the 24 V DC power for analog signals, the analog output may fluctuate for approximately 1 second. This is due to time delays in the power supply from the Main Unit or differences in start time. For this reason, be sure to take preventive measures so that this output fluctuation will not affect the external units.

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