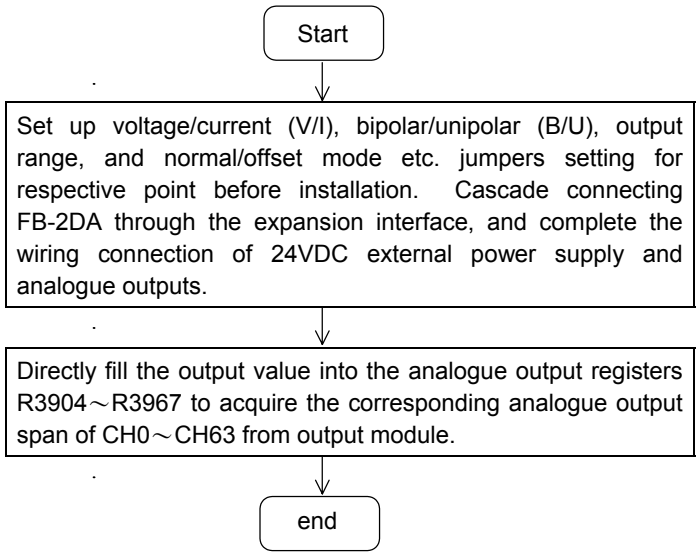
Chapter 19 FB-2DA Analog Output Module

The resolution of FB-PLC analogue output (or called as D/A output) is 12 bits. The OS version of main unit before V3.2x has only 8 points of total analogue output. Starting from OS version V3.30, the analogue output can reach as many as 64 points, and the output module changes to FB-2DA new style model with slim shape. Each module has two outputs and can expand to connect as many as 32 modules.

19.1 Specifications of FB-2DA Functions

Item			Specifications		Remark
Output point			2 points (channels)		
Digital output value			−2048～+2047		
Kind of analog output signal	Normal Mode	Bipolar*	1*.Voltage: −10～10V 2.Voltage: −5～5V	3.Current: −20～20mA 4.Current: −10～10mA	● There are 16 kinds of output signal in total, user may set by himself. * : It means the default setting.
		Uni-polar	5.Voltage: 0～10V 6.Voltage: 0～5V	7.Current: 0～20mA 8.Current: 0～10mA	
	Offset mode	Bipolar	9.Voltage: −6～10V 10.Voltage: −3～5V	11.Current: −12～20mA 12.Current: −6～10mA	
		Uni-polar	13.Voltage: 2～10V 14.Voltage: 1～5V	15.Current: 4～20mA 16.Current: 2～10mA	
Finest resolution l	Normal mode		Voltage: 1.22mV (while 0～5V output) Current: 2.44μA (while 0～10mA output)		
	Offset mode		Voltage: 0.98mV (while 1～5V output) Current: 1.95μA (while 2～10mA output)		
Accuracy			Within ±1% of full scale		
Conversion rate			Update all outputs every scan		
Maximum accommodation for resistance loading			Voltage: 500Ω～1MΩ Current: 0Ω～500Ω		The deviation will be enlarged if exceeding this range
Insulation			Photocouple isolation		No isolation between channels.
External power supply			24VDC±20%, Current < 200mA/@24VDC		

19.2 The Procedure of Using FB-2DA Analogue Output Module



------- Please refer to section 19.4 for hardware explanation.

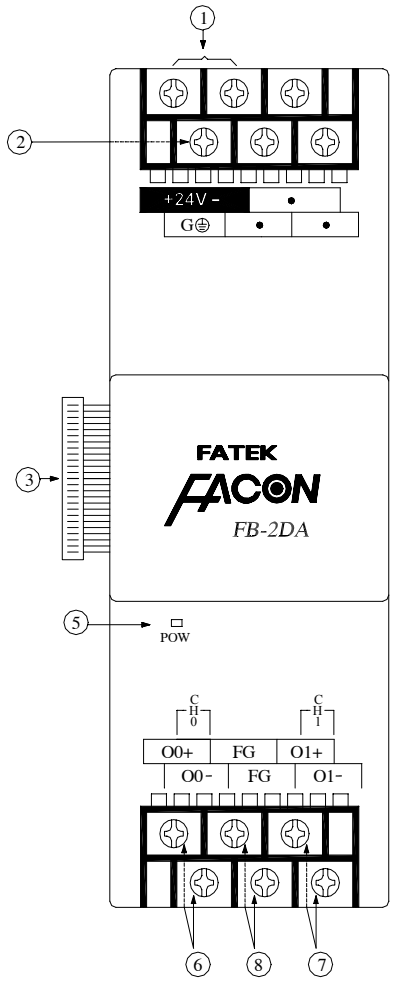
19.3 Address Allocation of FB-PLC Analogue Outputs

Each FB-2DA module provides 2 point of outputs. The memory mapping of outputs is beginning from the module closest to main unit; it is orderly numbered as CH0～CH1 (1st module), CH2～CH3 (2nd module), CH4～CH5 (3rd module)……. and increased with occurring order number, which reaches 64 points in total (32 modules), and they are corresponding to the respective internal analogue output registers (so called OR register) R3904～R3967. User needs only to expand connecting FB-2DA through expansion interface, and main unit will automatically detect the quantity of the outputs and send out the register value to corresponding output of each FB-2DA. The following table is detailed OR registers (R3904～R3967) corresponding to the expansion analogue outputs (CH0～CH63). The relationship between the register value and output span, please refer to the explanation of section 19.6.

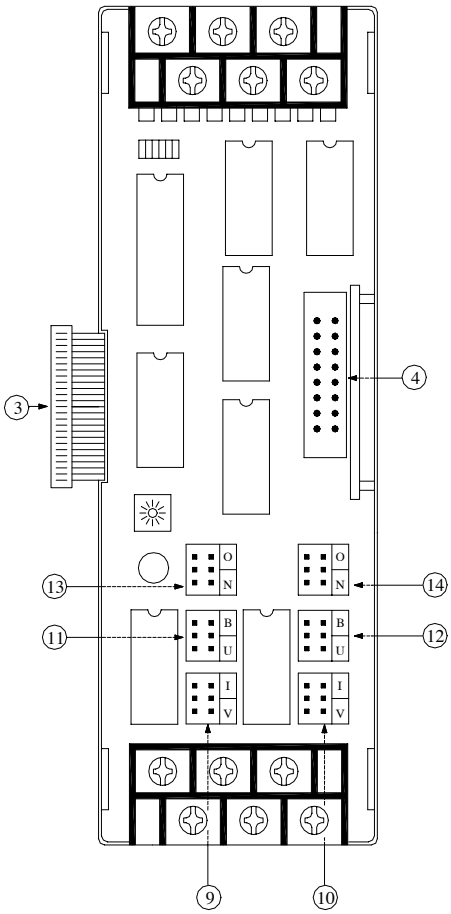
Analogue output register (OR)	Content of OR		Output label of FB-2DA	
	B15 B14 B13 B12	B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 B0		
R3904	– – – –	B11 Output value of CH0 B0	CH0	1st module
R3905	– – – –	Output value of CH1	CH1	
R3906	– – – –	Output value of CH2	CH0	2nd module
R3907	– – – –	Output value of CH3	CH1	
R3906	– – – –	Output value of CH4	CH0	3rd module
R3907	– – – –	Output value of CH5	CH1	
≈ . . . . . ≈	≈	≈ . . . . . ≈	≈ . . . . . ≈	. . . . .
R3966	– – – –	Output value of CH62	CH0	32th module
R3967	– – – –	B11 Output value of CH63 B0	CH1	

(Sign extended of B11)

19.4 Explanation of FB-2DA Hardware



A: Outlook of top view



B: PCB top view (uncovered)

① External power input terminal: Power supply for analogue circuit of FB-2DA module, the voltage can be 24VDC±20% and should be supplied with 4W of power at least.

② Protecting ground terminal: To connect to the safety Earth Ground of power system.

③ Expansion input cable: It should be connected to the front expansion unit, or the expansion output of main unit.

④ Expansion output connector : Provides the connection for next expansion unit.

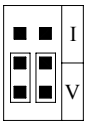
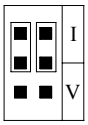
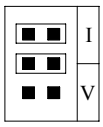
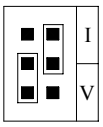
⑤ Power indicator: It indicates whether the power supply of analogue circuit and external input power source are normal.

⑥、⑦: CH0～CH1 output terminal

⑧ Framing Ground.

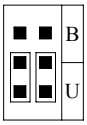
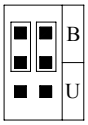
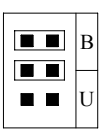
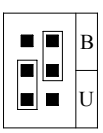
⑨、⑩: The voltage(V) / current (I) output selection of CH0～CH1

Since the voltage output and current output are sharing to use a pair of terminal, it must depend on the jumper to select voltage output or current output. Both of the jumpers must be placed according to the text label direction (vertically) and in pair to be placed on V or I position, as illustrated in following diagram.

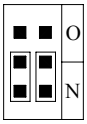
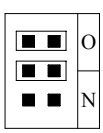
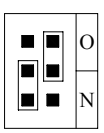
○		×
Voltage output（V）	Current output（I）	JP5、JP6 or JP5、JP6
JP5、JP6 	JP5、JP6 	  Jumper horizontally placed or separated to be up/down placed are all incorrect.

⑪、⑫: The selection of unipolar(U) / bipolar(B) of CH0～CH1.

The two jumpers must be placed as the text label direction (vertical) to insert to B or U position in pair.

○		×
Unipolar output（U）	Bipolar output（B）	JP3、JP4 or JP3、JP4
JP3、JP4 	JP3、JP4 	  Jumper horizontally placed or separated to be up/down placed are all incorrect.

⑬、⑭: The Offset(O) / Normal(N) mode selection of CH0～CH1; the two jumpers must be placed as text label direction (vertical) to insert to O or N position in pair.

○		×
Normal mode（N）	Offset（O）	JP1、JP2 or JP1、JP2
JP1、JP2 	JP1、JP2 	  Jumper horizontally placed or separated to be up/down placed are all incorrect.

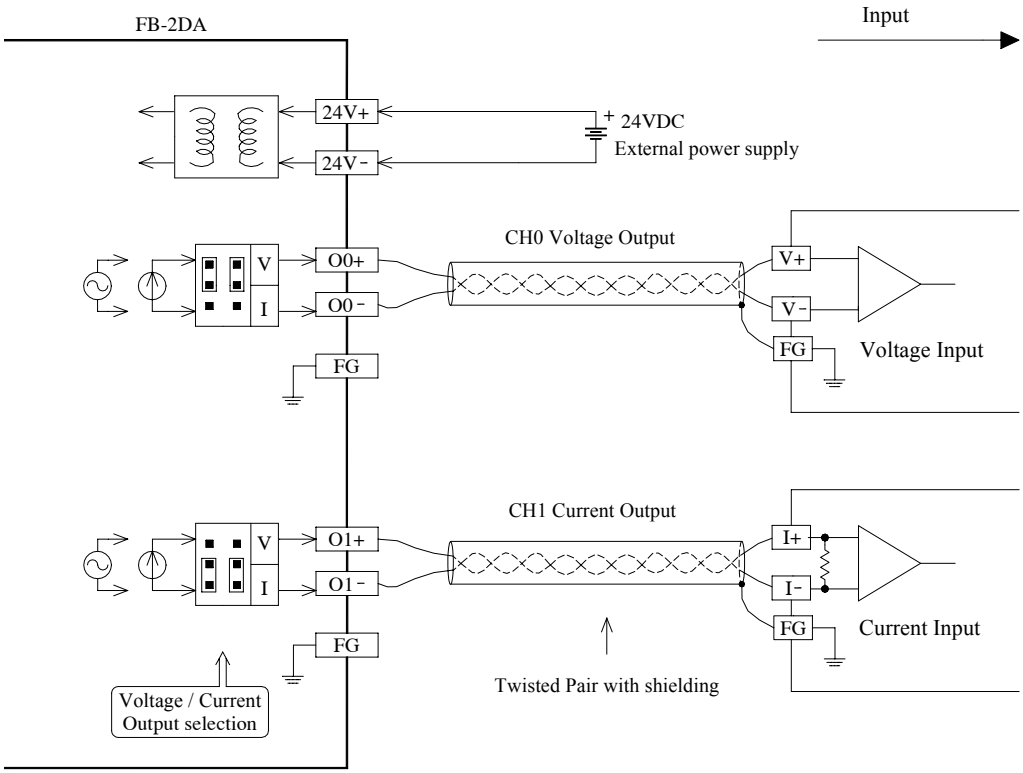
⑮ selection of the maximum output span: 5V/10mA or 10V/20mA.

This selection defines the output span both of CH0 and CH1, and labeled with only 5V/10V character.

The jumper is located at the vertical board under PCB top view B, which is labeled as JP8 jumper. It has to take off the shell of FB-2DA to see it. The labeling and setting method are illustrated as following diagram:

10V 5V JP8	10V 5V JP8
Span of 10V or 20mA	Span of 5V or 10mA
● −10～10V　● −20～20mA	● −5～5V　● −10～10mA
● 0～10V　● 0～20mA	● 0～5V　● 0～10mA
● − 6～10V　● −12～20mA	● −3～5V　● − 6～10mA
● 2～10V　● 4～20mA	● 1～5V　● 2～10mA

19.5 The Output Circuit of FB-2DA



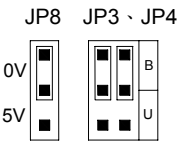
19.6 The Output Characteristic and Jumper Setting of D/A

As previously mentioned, the FB-2DA can yield 16 kind of outputs by the jumpers setting of V/I, B/U, O/N and 10V/5V. Hereby it tackles on the bipolar/unipolar (B/U) and span (10V/5V) two kinds of jumper setting to make 4 output conversion curves and are illustrated as following diagrams. These 4 conversion curves incorporating V/I and O/N setting can make the above mention 16 kind of outputs. For the selection of V/I and O/N, please refer to section 19.4.

Diagram 1: Bipolar 10V (20mA) Output Span

O/N mode / V/I type	Normal mode (N)	Offset mode (O)
Voltage output (V)	−10～10V	−6～10V
Current output (I)	−20～20mA	−12～20mA

Jumper setting



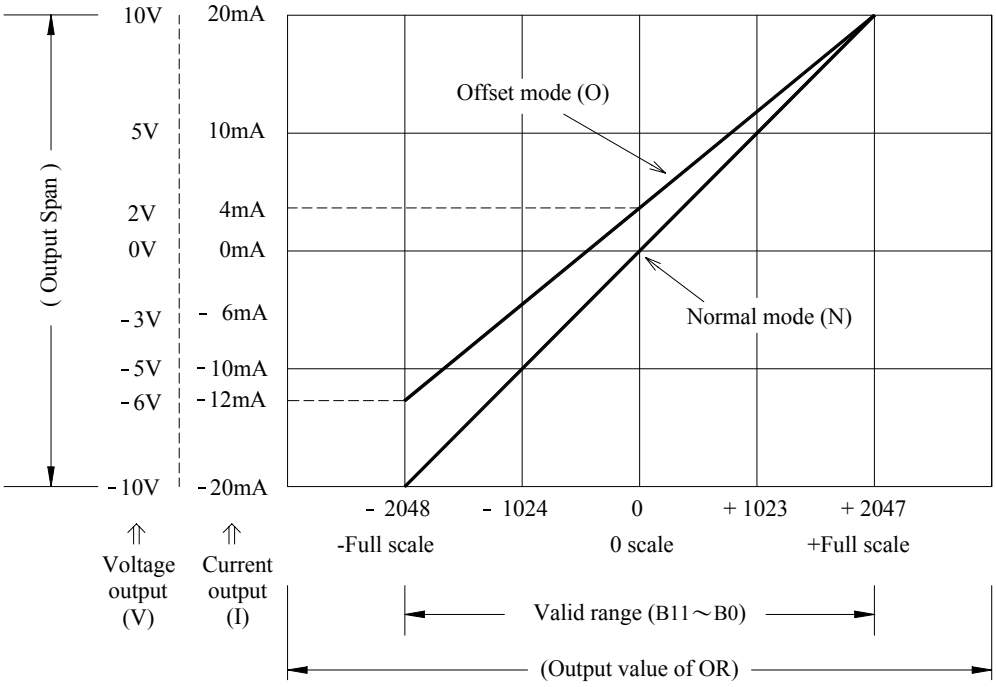
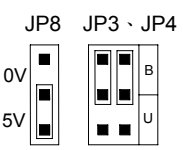


Diagram 2: Bipolar 5V (10mA) Output Span

O/N mode / V/I type	Normal mode (N)	Offset mode (O)
Voltage output (V)	−5～5V	−3～5V
Current output (I)	−10～10mA	−6～10mA

Jumper setting



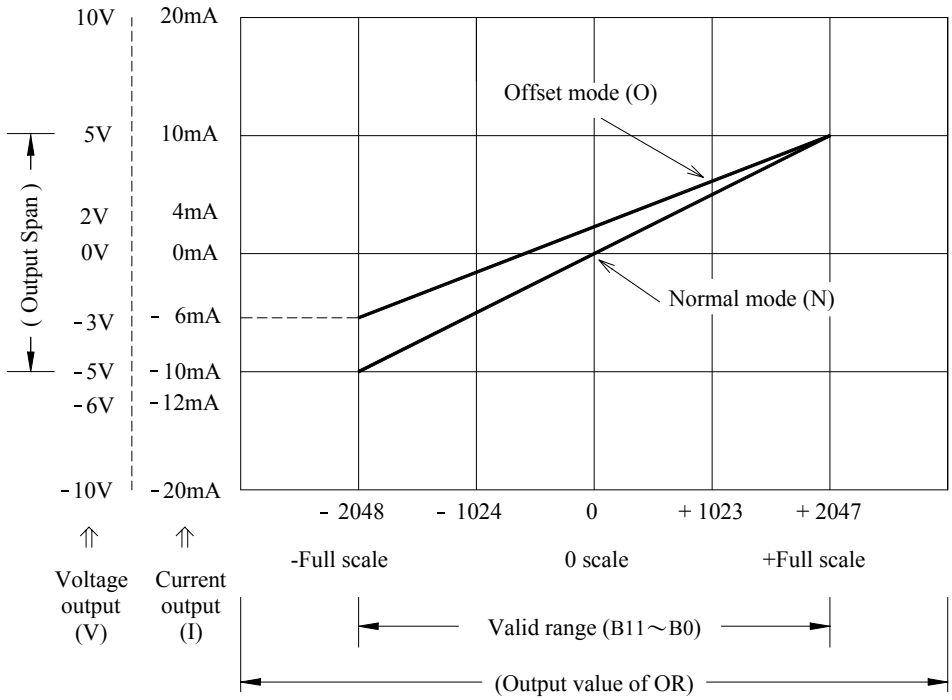


Diagram 3: Unipolar 10V (20mA) Output Span

O/N mode / V/I type	Normal mode (N)	Offset mode (O)
Voltage output (V)	0～10V	2～10V
Current output (I)	0～20mA	4～20mA

Jumper setting	JP8	JP3、JP4
	10V 5V	B U

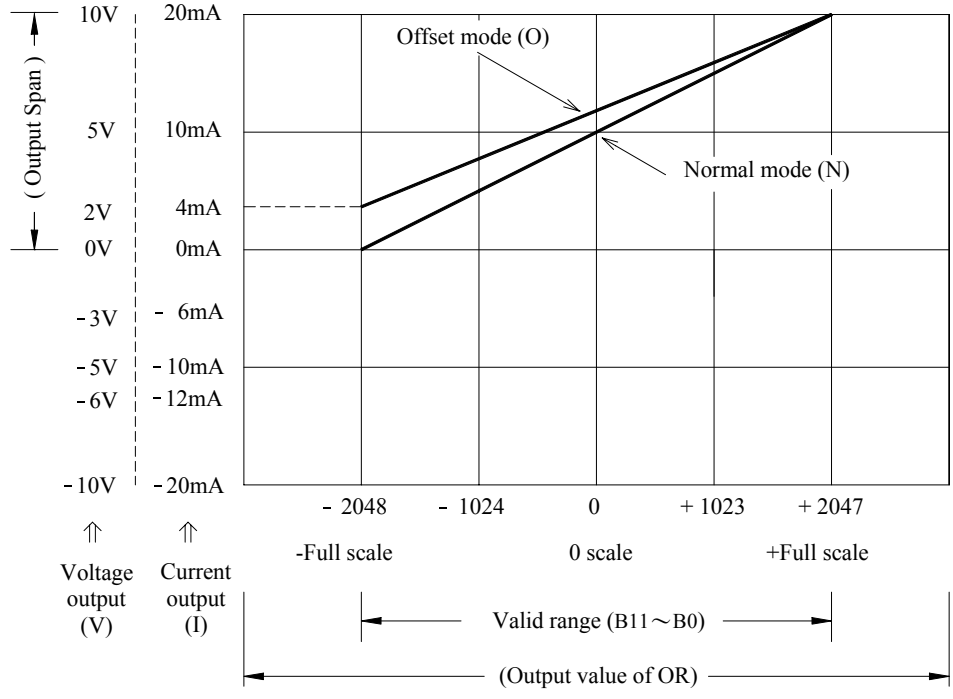
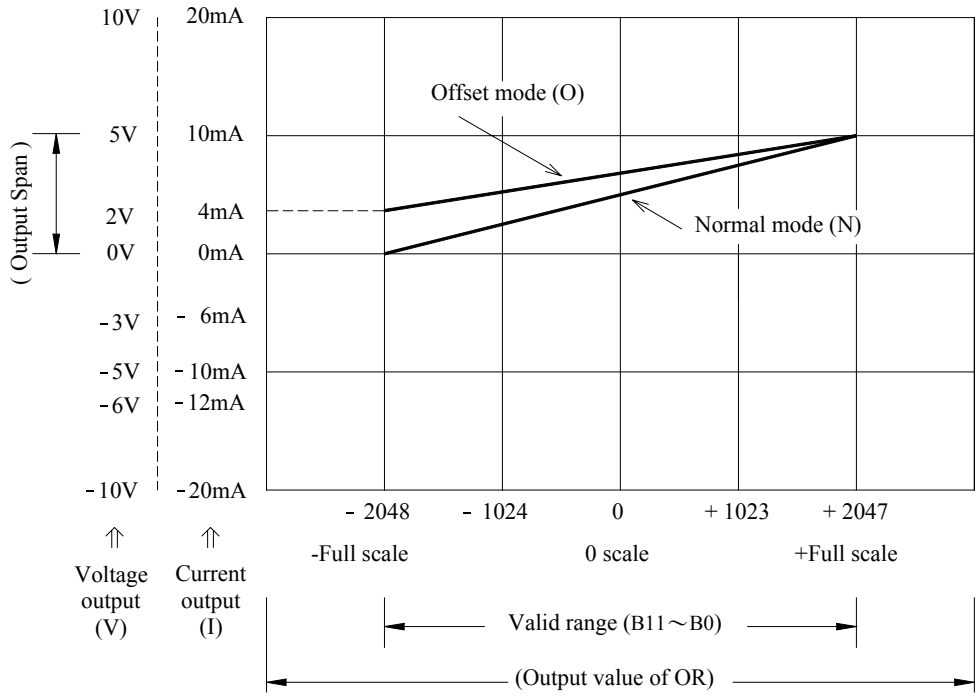


Diagram 4: Unipolar 5V (10mA) Output Span

O/N mode / V/I type	Normal mode (N)	Offset mode (O)
Voltage output (V)	0～5V	1～5V
Current (I)	0～10mA	2～10mA

Jumper setting	JP8	JP3、JP4
	10V / 5V	B / U



19.7 Notifications for the operation of FB-2DA

A FB-2DA Matching with the OS Version of Main Unit

FB-2DA can be installed to reach 64 points of D/A outputs (it must be the main unit with V3.30 and later version). If the OS version of main unit before version V3.30, it can cascade to connect 4 modules at the most, hence get a total analogue output of 8 points only.

B The Processing of Unipolar output

FB-2DA expressed with –2048 as the minimum output value for 0V or 0mA and 2047 as the maximum output value for selected maximum output span while in unipolar output; the ladder program operation is used 0～4095 as the minimum and maximum output value for calculation; therefore, before filling the calculated output value to analogue output register OR (R3904～R3967), it must first convert the 0～4095 value to corresponding value of –2048～2047 to get a correct output span. The treatment is quite simple; just make the calculated output value (0～4095) deducts 2048 and stores it to analogue output register OR (R3904～R3967) and that's done.