Chapter 6   Digital Input (DI) Circuit

The FBs-PLC provides the ultra high speed differential double end 5VDC inputs (i.e., single input with two terminals without common) and the single-end 24VDC inputs which use the common terminal to save terminals. The response speeds of single-end common input circuits are available in high, medium and low. Because the double end input circuit has two independent terminals, it can be connected either in SINK or SOURCE for input or in differential input wiring for line driver source. The single-end input circuit can be set to SINK or SOURCE type by varying the wiring of the common terminals S/S inside PLC and external common wire of input circuits (see Sec. 6.3 for details).

6.1   Specifications of Digital Input (DI) Circuit

Item / Specifications	5VDC Differential Input — Ultra High Speed(HSC)	24VDC Single-end Input — High Speed (HSC)	Medium Speed(HSC)		Mid/Low Speed	Low Speed	Note
Maximum input frequency*/ accumulated time	920KHz	200KHz	20KHz (HHSC)	Total 5KHz (SHSC)	0.47 mS^{*1}	4.7 mS	*: Half of maximum frequency while A/B phase input
Input Signal Voltage	5VDC±10%	24VDC±10%					
Input Current Threshold — ON Current	＞11 mA	＞8 mA	＞4mA			＞2.3mA	
Input Current Threshold — OFF Current	＜2 mA		＜1.5mA			＜0.9mA	
Maximum Input current	20mA	10.5mA	7.6mA			4.5 mA	
Input Status Indication	Displayed by LED: Lit when "ON", dark when "OFF"						
Isolation Type	Photocoupler signal isolation						
SINK/SOURCE Wiring	Independent Wiring	Via variation of internal common terminal S/S and external common wiring					
List of Input Response Speed for Various Models — FBS-20MNR/T/J	X0,1	X4, 5, 8, 9	X2,3,6,7,10,11				
FBS-32MNR/T/J	X0,1,4,5	X8, 9, 12, 13	X2,3,6,7,10,11,14,15		X16~19		
FBS-44MNR/T/J	X0,1,4,5,8,9,12,13		X2,3,6,7,10,11,14,15		X16~27		
FBS-10MCR/T/J		X0,1	X4,5	X2,3			
FBS-14MCR/T/J		X0,1	X4,5	X2,3,6,7			
FBS-20MCR/T/J		X0,1,4,5	X8,9	X2,3,6,7,10,11			
FBS-24MCR/T/J		X0,1,4,5	X8,9.12,13	X2,3,6,7,10,11			
FBS-32MCR/T/J		X0,1,4,5,8,9	X12,13	X2,3,6,7,10,11,14,15	X16~19		^{*1} : Limit of input speed in MA model is 10KHz
FBS-40MCR/T/J		X0,1,4,5,8,9	X12,13	X2,3,6,7,10,11,14,15	X16~23		
FBS-60MCR/T/J		X0,1,4,5,8,9,12,13		X2,3,6,7,10,11,14,15	X16~35		
FBS-10MAR/T/J			X0,1,4,5	X2,3			
FBS-14MAR/T/J			X0,1,4,5	X2,3,6,7			
FBS-20MAR/T/J			X0,1,4,5,8,9	X2,3,6,7,10,11			
FBS-24MAR/T/J			X0,1,4,5,8,9,12,13	X2,3,6,7,10,11			
FBS-32MAR/T/J			X0,1,4,5,8,9,12,13	X2,3,6,7,10,11,14,15	X16~19		
FBS-40MAR/T/J			X0,1,4,5,8,9,12,13	X2,3,6,7,10,11,14,15	X16~23		
FBS-60MAR/T/J			X0,1,4,5,8,9,12,13	X2,3,6,7,10,11,14,15	X16~35		
Expansion Unit/Module R/T/J						All Input Points	
Noise Filtering Time Constant^{*3}	DHF(0 ~ 15mS) ＋AHF(0.47μs)		DHF(0 ~ 15mS) ＋AHF(4.7μs)		DHF(0 ~ 15mS) ＋AHF(0.47μs)	AHF(4.7ms)	DHF：Digital Hardware Filter AHF：Analog Hardware Filter

6.2 Structure and Wiring of 5VDC Ultra High Speed Differential Input Circuit

Only the MN main unit of FBs provides the 5VDC ultra high speed differential input circuit, which is mainly used for the input of hardware high speed counter (HHSC) with a maximum working frequency up to 920 KHz. In practice, to ensure the high speed and high noise immunity, please use Line-Driver for differential line driving. In environments with small noise and medium working frequency (＜200KHz), however, it can be changed to the 5VDC single-end SINK or SOURCE input or to the 24VDC single-end SINK or SOURCE input by connecting a 3KΩ/0.5W resistor in series, as shown in the figure below.

(A) Wiring of 5VDC differential input for Line-Driver driving（with frequency up to 920KHz for high speed and environments with large noise）
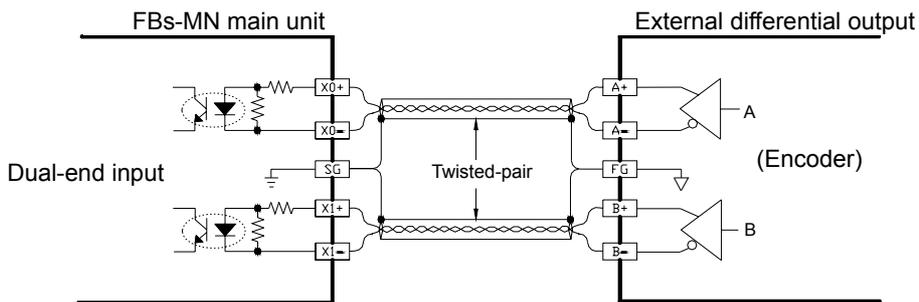
(B) Wiring of 5VDC differential input to 5VDC single SINK or SOURCE input
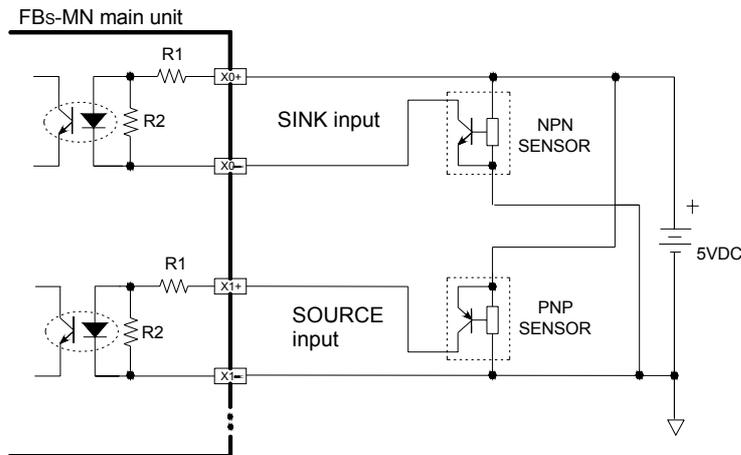
(C) Method of converting 5VDC differential input to 24VDC single-end SOURCE input
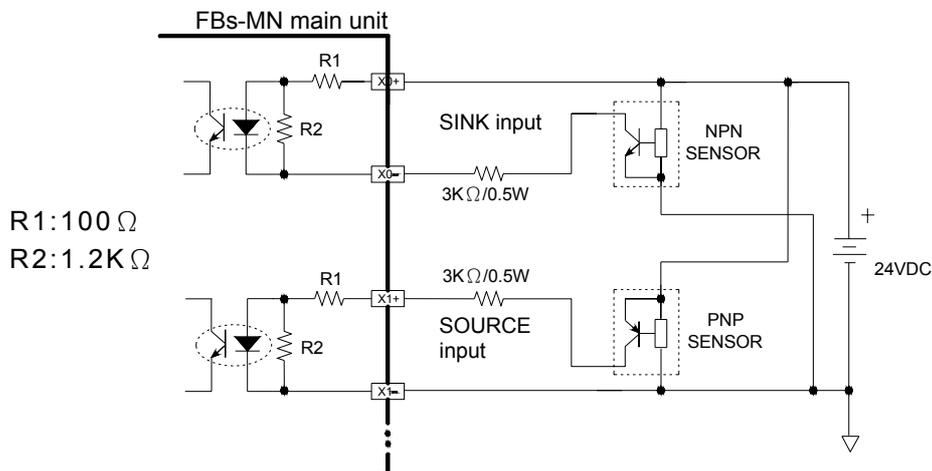
6.3 24VDC Single-End Input Circuit and Wiring for SINK/SOURCE Input

The 24VDC single-end digital input circuits of FBs-PLC are available for high, medium and low speed. They all have the similar circuit structures but with different response speeds. To save input terminals, the circuit of single-end input is implemented by connecting one end of all input points (photo coupler) inside the PLC to the same internal common point labeled as S/S. The other end of each input circuit is connected to corresponding terminals such as X0, X1, X2, etc. The S/S common terminal and N single-end inputs comprise of N digital inputs (i.e., only N+1 terminals are used for N terminals). Therefore, we call this type of input structure the single-end input. The user also needs to do the same thing when making the connection of external digital input devices. Namely, the one end of all input devices (e.g., buttons, switches) are connected together and called the external common wire, while the other ends of input circuits are connected to the input terminals X0, X1, X2, etc., of PLC. Then finish it by connecting the external common wiring and internal common terminal S/S to the positive/negative terminals of the 24VDC power. When connect the internal common terminal S/S to 24V+(positive) and the external common wire to 24V− (negative), then the circuit serve as SINK input. On the contrary, while exchange the wiring of the above internal and external common will serve as a SOURCE input. The above wiring schemes can illustrated below:

● Wiring of single-end common SINK input
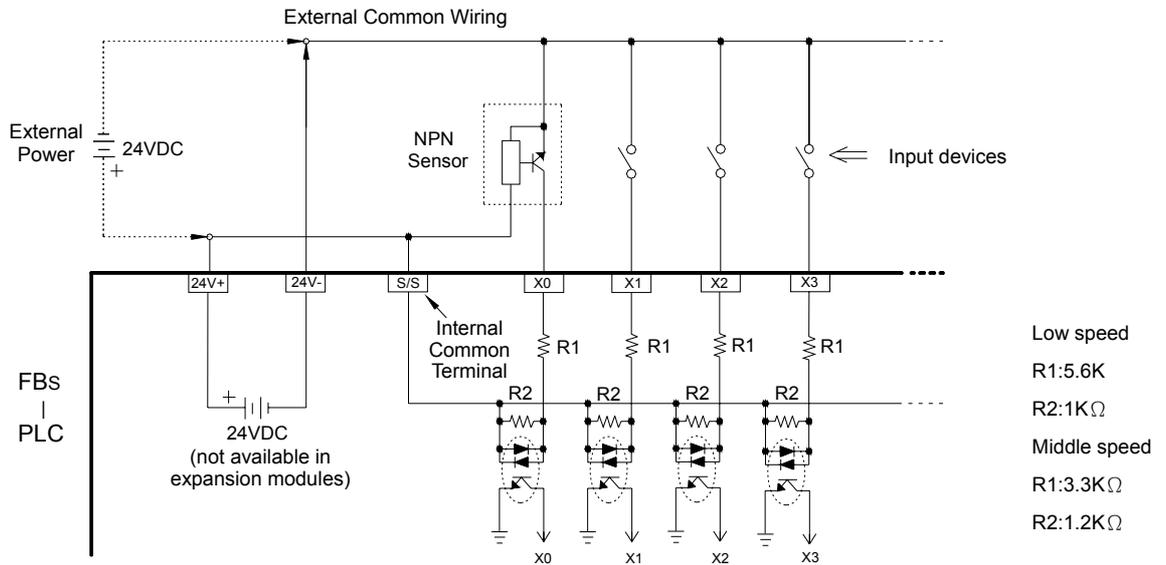
● Wiring of single-end common SOURCE input