3. PROMUX MODULES

3.1 PM16DI - DIGITAL INPUTS WITH COUNTERS

3.1.1 Description

The PM16DI module is a 16 channel digital input module. The inputs are isolated from the logic by bi-directional opto-couplers. The inputs are divided into 2 isolated groups of 8 inputs each. This allows for many configurations in which the input module may be used. One such configuration could be where one group is connected as common positive and the second group connected as common negative.

The counters operate in three modes:
In **mode 0:** All the counters are disabled.

In **mode 1:** The counters are 32 bit counters allowing a count value from 0 to 4294967295. The count value can be cleared by writing a zero to the associated registers or preset to any other value using the same method.

In **mode 2:** The inputs are connected as up/down counters. Input 1 will increment counter 1 whilst input 2 decrements counter1. In the same way, inputs 3&4 operate counter 2, inputs 5&6 operate counter 3 and inputs 7&8 operate counter 4, etc.

When the input filter is configured for > 10ms (Input Filter > 1), the 16 counters are saved in non-volatile memory and the count value will be saved when power fails.

The format of the registers allows the status of the inputs to be read as either single bits or all at once as a single register on the Modbus network.

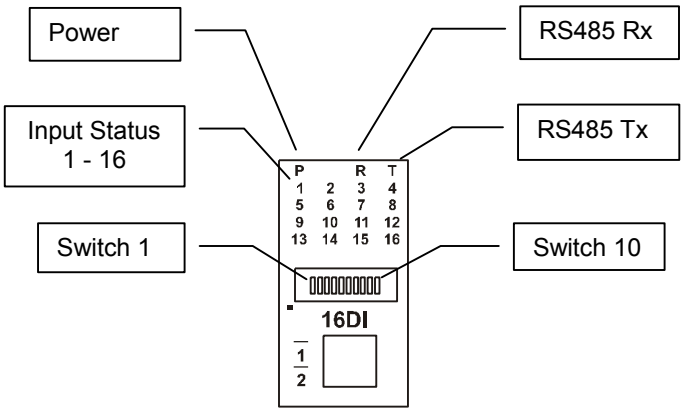
3.1.2 Technical Specification of PM16DI

Power Supply	Logic Supply Voltage	12 -24 Vdc
	Logic Supply Current	30mA @ 12V / 17mA @ 24V
Digital Inputs	Input Points	16
	Input Voltage Range	12 - 24 Vdc
	Input Current per input	5mA @ 12Vdc / 11mA @ 24Vdc
	Isolation	1500Vrms between field and logic
Counters (Filter disabled)	Inputs	1 to 16
	Resolution	32 Bits
	Frequency	1KHz (max)
	Pulse Width	500us (min)
Counters (Filter > 1)	Inputs	1 to 16
	Resolution	32 Bits
	Frequency	25Hz (max)
	Pulse Width	20ms (min)
Temperature	Operating Temperature.	-40°C to + 80°C
	Storage Temperature	-40°C to + 85°C
Connectors	Logic Power and Comms.	4 Pin Connector on underside of unit
	Inputs	18 Way screw connector on front

Note: Inputs 1 to 16 are used as both digital inputs and counter inputs.

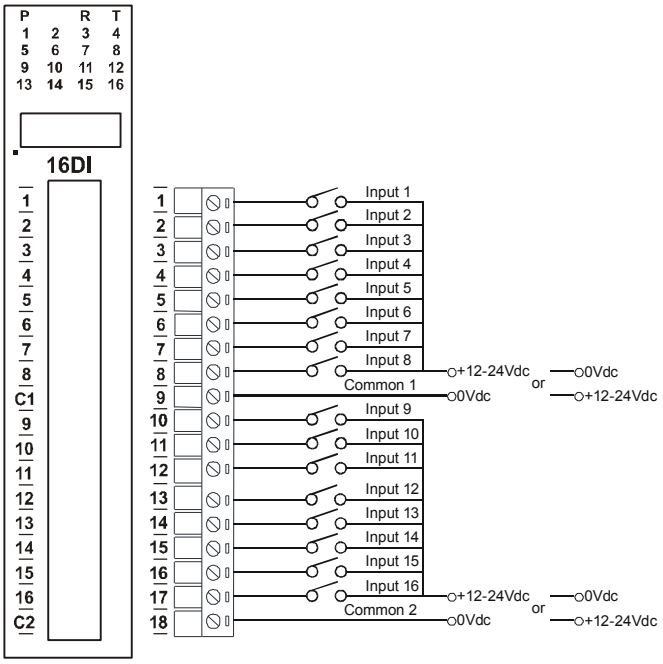
3.1.3 Status Indicators

Power: Flashes to indicate the CPU is running.
RS485 Rx: Flashes to indicate the unit has received a valid Modbus message.
RS485 Tx: Flashes to indicate the unit has sent a Modbus message.
Input Status: "OFF" when the input is off.
"ON" when the input is on.

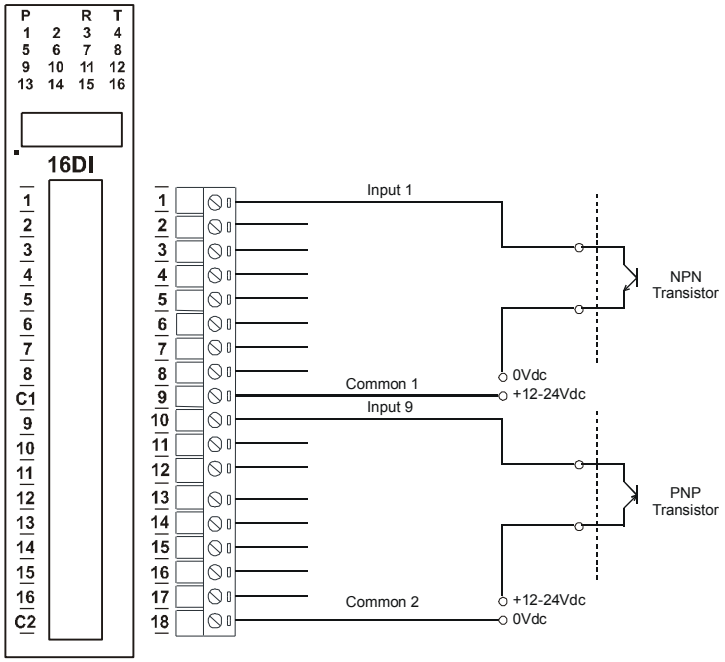


3.1.4 Wiring

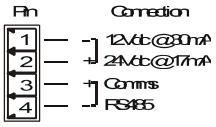
The following diagram shows how the digital inputs are connected to potential free switches. The common can be connected to positive or negative as indicated.



The following diagram shows how the digital inputs are connected a NPN transistor or a PNP transistor.



The following diagram shows the wiring for the power and RS485 communications.



3.1.5 Switch Settings

SWITCH	FUNCTION	DESCRIPTION
1	NODE ID +1	Node ID's from 0 to 127 are set up using switches 1 to 7
2	NODE ID +2	"
3	NODE ID +4	"
4	NODE ID +8	"
5	NODE ID +16	"
6	NODE ID +32	"
7	NODE ID +64	"
8	INVERT	When switched ON the status of the inputs are inverted in the Modbus status register (30002).
9	-	Not Used.
10	BAUD RATE	Selects 9600 (off) or Programmed Baud Rate (on)

3.1.6 PM16DI Data Registers (MODULE TYPE = 100)

Modbus Address	Register Name	Low Limit	High Limit	Access	Description
10001	Digital Input 1	0	1	R	Status of Digital Inputs.
10002	Digital Input 2	0	1	R	"
10003	Digital Input 3	0	1	R	"
10004	Digital Input 4	0	1	R	"
10005	Digital Input 5	0	1	R	"
10006	Digital Input 6	0	1	R	"
10007	Digital Input 7	0	1	R	"
10008	Digital Input 8	0	1	R	"
10009	Digital Input 9	0	1	R	"
10010	Digital Input 10	0	1	R	"
10011	Digital Input 11	0	1	R	"
10012	Digital Input 12	0	1	R	"
10013	Digital Input 13	0	1	R	"
10014	Digital Input 14	0	1	R	"
10015	Digital Input 15	0	1	R	"
10016	Digital Input 16	0	1	R	"
30001	S/W Version / Module Type	N/A	N/A	R	High Byte = Software Version Low Byte = 100
30002	Digital Inputs	N/A	N/A	R	Digital Inputs in 16 bits. 16 - 1.
40003	Counter 1 MSB	0	65535	R/W	Counter MSB and LSB combine to give a 32 bit
40004	Counter 1 LSB	0	65535	R/W	Counter with range 0 to 4294967295.
40005	Counter 2 MSB	0	65535	R/W	"
40006	Counter 2 LSB	0	65535	R/W	"
40007	Counter 3 MSB	0	65535	R/W	"
40008	Counter 3 LSB	0	65535	R/W	"
40009	Counter 4 LSB	0	65535	R/W	"
40010	Counter 4 LSB	0	65535	R/W	"
40011	Counter 5 MSB	0	65535	R/W	"
40012	Counter 5 LSB	0	65535	R/W	"
40013	Counter 6 MSB	0	65535	R/W	"
40014	Counter 6 LSB	0	65535	R/W	"
40015	Counter 7 MSB	0	65535	R/W	"
40016	Counter 7 LSB	0	65535	R/W	"
40017	Counter 8 MSB	0	65535	R/W	"
40018	Counter 8 LSB	0	65535	R/W	"
40019	Counter 9 MSB	0	65535	R/W	"
40020	Counter 9 LSB	0	65535	R/W	"
40021	Counter 10MSB	0	65535	R/W	"
40022	Counter 10LSB	0	65535	R/W	"

Modbus Address	Register Name	Low Limit	High Limit	Access	Description
40023	Counter 11MSB	0	65535	R/W	Counter MSB and LSB combine to give a 32 bit
40024	Counter 11LSB	0	65535	R/W	Counter with range 0 to 4294967295.
40025	Counter 12MSB	0	65535	R/W	"
40026	Counter 12LSB	0	65535	R/W	"
40027	Counter 13MSB	0	65535	R/W	"
40028	Counter 13LSB	0	65535	R/W	"
40029	Counter 14MSB	0	65535	R/W	"
40030	Counter 14LSB	0	65535	R/W	"
40031	Counter 15MSB	0	65535	R/W	"
40032	Counter 15LSB	0	65535	R/W	"
40033	Counter 16MSB	0	65535	R/W	"
40034	Counter 16LSB	0	65535	R/W	"
40035	Counter Capture	0	65535	R/W	Bit1 = 1 to Capture Counter1, Bit2 = 1 to Capture Counter2, etc.
40036	CCounter 1 MSB	0	65535	R/W	Capture Counter Registers. MSB and LSB
40037	CCounter 1 LSB	0	65535	R/W	combine to give a 32 bit Value.
40038	CCounter 2 MSB	0	65535	R/W	Counter with range 0 to 4294967295.
40039	CCounter 2 LSB	0	65535	R/W	
40040	CCounter 3 MSB	0	65535	R/W	"
40041	CCounter 3 LSB	0	65535	R/W	"
40042	CCounter 4 LSB	0	65535	R/W	"
40043	CCounter 4 LSB	0	65535	R/W	"
40044	CCounter 5 MSB	0	65535	R/W	"
40045	CCounter 5 LSB	0	65535	R/W	"
40046	CCounter 6 MSB	0	65535	R/W	"
40047	CCounter 6 LSB	0	65535	R/W	"
40048	CCounter 7 MSB	0	65535	R/W	"
40049	CCounter 7 LSB	0	65535	R/W	"
40050	CCounter 8 MSB	0	65535	R/W	"
40051	CCounter 8 LSB	0	65535	R/W	"
40052	CCounter 9 MSB	0	65535	R/W	"
40053	CCounter 9 LSB	0	65535	R/W	"
40054	CCounter 10MSB	0	65535	R/W	"
40055	CCounter 10LSB	0	65535	R/W	"
40056	CCounter 11MSB	0	65535	R/W	"
40057	CCounter 11LSB	0	65535	R/W	"
40058	CCounter 12MSB	0	65535	R/W	"
40059	CCounter 12LSB	0	65535	R/W	"
40060	CCounter 13MSB	0	65535	R/W	"
40061	CCounter 13LSB	0	65535	R/W	"
40062	CCounter 14MSB	0	65535	R/W	"
40063	CCounter 14LSB	0	65535	R/W	"

Modbus Address	Register Name	Low Limit	High Limit	Access	Description
40064	CCounter 15MSB	0	65535	R/W	"
40065	CCounter 15LSB	0	65535	R/W	"
40066	CCounter 16MSB	0	65535	R/W	"
40067	CCounter 16LSB	0	65535	R/W	"
30100	DIP Switch	0	65535	R	Status of DIP Switch on Front Panel
40101	Counter Mode	0	2	R/W	0=Disable, 1=Up Counting, 2=Up/Down Count
40102	Input Filter	0	65535	R/W	0 = Disable, >0 = Enable. (x10ms)
40103	Capture Zero	0	65535	R/W	0 = Disabled, bit1 = auto zero counter 1.
40121	Baud Rate	2400	18750	R/W	2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500
40122	Parity	0	2	R/W	0 = none, 1 = even, 2 = odd
40123	Stop Bits	1	2	R/W	1 = 1 stop bit, 2 = 2 stop bits
40124	Reply Delay	0	255	R/W	0 = Disable, >0 = Enable. (x10ms)

3.1.6.1 Digital Input Register.

The digital inputs can be read in a single register as follows:

MSB					**PM16DI DIGITAL INPUTS**										LSB	ADDRESS
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1	30002

16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

Digital Input Number

3.1.6.2 Counter Registers.

The counters are stored as two 16 bit registers. The first register is the High Register and the second register is the Low Register. To get the actual 32 bit count value the registers must be combined as follows:

Counter High Value = Register 40003.
Counter Low Value = Register 40004.

Counter Value = (Counter High Value X 65535) + Counter Low Value.

3.1.6.3 Counter Capture.

To capture a counter a 1 must be written to the corresponding bit position in the Counter Capture Register 40035. For example:

1. Writing 1 to Register 40035 results in Counter 1 value being captured to Counter Capture 1.
2. Writing 2 to Register 40035 results in Counter 2 value being captured to Counter Capture 2.
3. Writing 3 to Register 40035 results in Counter 1 value being captured to Counter Capture 1 and Counter 2 value being captured to Counter Capture 2.

Once the module has Captured the counters, the Counter Capture Register 40035 is cleared to zero. It is possible to read this register to get confirmation that the capture is complete before reading the captured counter values.

3.1.6.4 Counter Auto Zero.

The counter being captured can be auto zeroed. The purpose of this function is to let the module zero the counter so that no counts get lost due to delays from communication latency, etc.

To ensure that a counter is auto zeroed, a 1 must be written to the corresponding bit position in the Capture Zero Register 40103. For example:

Writing 1 to Register 40103 results in Counter 1 value being zeroed when the Counter Capture bit is 1.

The value in the Capture Zero Register 40103 is permanently stored in memory and only has to be configured once.