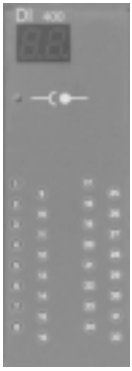
7.2 DI400

7.2.1 Technical Data

Module ID	DI400
Model Number	2DI400.6
Description	2010 Digital Input Module, 32 inputs 24 VDC, 10 msec, Sink/Source, 8 electrically isolated input groups , 8 Change-of-State inputs, 4 counter inputs, 100 kHz, gate or period measurement, order terminal blocks separately!
C-UL-US Listed	Yes
B&R ID Code	$01
Base plate Module	BP200, BP201, BP210
Number of Modules per System	1
Number of Inputs Total in 8 Groups of	 32 4
Electrical Isolation Input - PCC Group - Group Input - Input (same group)	 Yes (optocoupler) Yes (optocoupler) No
Wiring Sink Source	Sink or source GND to COM 24 VDC to COM
Input Voltage Nominal Maximum	 24 VDC 30 VDC
Input Resistance	Approx. 4 kΩ

Module ID	DI400
Switching Threshold LOW Range Switching Range HIGH Range	 <5 V 5 to 15 V >15 V
Switching Delay Typ. Max.	 10 msec 12 msec
Input Current at Nominal Voltage	Approx. 6 mA
Maximum Peak Voltage	500 V for 50 µsec max. every 100 msec
CSI Inputs	
Amount	8
Delay	5 µsec
Interrupt Trigger	Change-of-state
Counter Inputs	
Amount	4
Input Frequency	Max. 100 kHz
Resolution	16 bit
Used for	Event counter, gate / period measurement
Power Consumption	Max. 6 W
Dimensions (H, W, D) [mm]	285, 40, 185

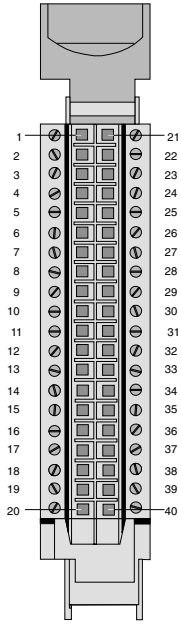
7.2.2 Status LEDs



—< ●— Displays the status of the terminal block, i.e. if this LED is lit, either no terminal block is connected to the module or the terminal block is not properly connected.

1 ... **32** These Status LEDs indicate the logical state of the respective input. The LED is lit, independent of the type of connection (Sink or Source), if the input is log. 1, i.e. if current is flowing through the optocoupler.

7.2.3 Terminal Assignments



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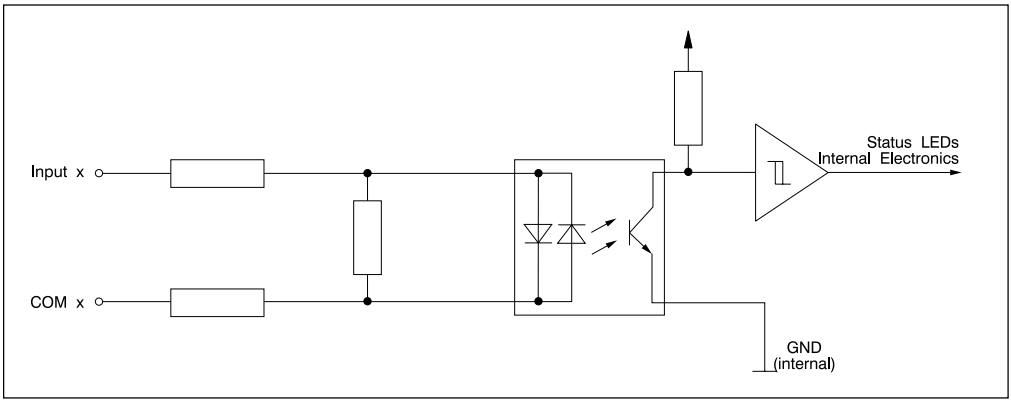
Termination	Name			
1	Input 1	Change-of-State Input	CSI 1	Group 1
2	Input 2	Change-of-State Input	CSI 2	
3	Input 3	Change-of-State Input	CSI 3	
4	Input 4	Change-of-State Input	CSI 4	
5	COM (1-4)			
6	Input 5	Change-of-State Input	CSI 5	Group 2
7	Input 6	Change-of-State Input	CSI 6	
8	Input 7	Change-of-State Input	CSI 7	
9	Input 8	Change-of-State Input	CSI 8	
10	COM (5-8)			
11	Input 9	Counter 1 / Gate 1 / Period 1	16 Bit	Group 3
12	Input 10			
13	Input 11	Counter 2 / Gate 2 / Period 2	16 Bit	
14	Input 12			
15	COM (9-12)			
16	Input 13	Counter 3 / Gate 3 / Period 3	16 Bit	Group 4
17	Input 14			
18	Input 15	Counter 4 / Gate 4 / Period 4	16 Bit	
19	Input 16			
20	COM (13-16)			
21	Input 17			Group 5
22	Input 18			
23	Input 19			
24	Input 20			
25	COM (17-20)			
26	Input 21			Group 6
27	Input 22			
28	Input 23			
29	Input 24			
30	COM (21-24)			
31	Input 25			Group 7
32	Input 26			
33	Input 27			
34	Input 28			
35	COM (25-28)			
36	Input 29			Group 8
37	Input 30			
38	Input 31			
39	Input 32			
40	COM (29-32)			

7.2.4 Input Circuit



7.2.5 Special Functions

Inputs 1 to 16 are special function inputs:

Inputs	Function
Input 1 - 8	8 Change-of-State Inputs (CSI 1 ... CSI 8)
Input 9 / 10	Counter 1 / Gate 1
Input 11 / 12	Counter 2 / Gate 2
Input 13 / 14	Counter 3 / Gate 3
Input 15 / 16	Counter 4 / Gate 4

7.2.6 Change-of-State Inputs

Inputs 1 to 8 can be selectively enabled for interrupt generation. If the state of a defined (enabled) input changes, an interrupt (IRQ) is created in the CPU and a respective IRQ task is started.
The normal input function is not influenced by active CSI inputs. Each input can be read normally regardless of if the input is enabled as CSI input or not.

7.2.7 Counter (16 Bit)

The user is provided 4 with independent 16 bit counters using the input pairs 9/10, 11/12, 13/14 and 15/16. The counters can be reset at any time by the application program to provide a defined start-point (reference value). Overflows are not registered.

Each counter can be configured individually for:

- Event Counting
- Gate Time Measurement
- Period Measurement

For the gate time and period measurement, an input signal (gate input) is either measured with an internal or external frequency. The external frequency is connected on the counter input. When using an internal frequency, you can select between 1 MHz and 4 MHz.

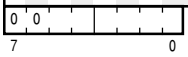
Each input can be read as a normal digital input regardless of if it is being used as a counter or gate input (10 msec input delay).

7.2.8 Variable Declaration

Function	Variable Declaration				
	Scope	Data Type	Length	Module Type	Channel
Read digital inputs individually (channel x)	tc_global	BIT	1	Digit. In	1 ... 32
Read digital inputs I01 - I08 Bit 0 ... I01 Bit 7 ... I08	tc_global	BYTE	1	Transp. In	0
Read digital inputs I09 - I16 Bit 0 ... I09 Bit 7 ... I16	tc_global	BYTE	1	Transp. In	1
Read digital inputs I17 - I24 Bit 0 ... I17 Bit 7 ... I24	tc_global	BYTE	1	Transp. In	2
Read digital inputs I25 - I32 Bit 0 ... I25 Bit 7 ... I32	tc_global	BYTE	1	Transp. In	3
Read fast CSI INPUTS I01 - I08 (for SW-compare) In order to determine which input triggered the interrupt, the compare with the fast CSI inputs must be made in the interrupt task. Then the new state is linked with the old state using EXOR. Bit 0 ... I01 Bit 7 ... I08	tc_global	BYTE	1	Transp. In	4
Read information byte "Interrupt Triggerer" The information byte indicates which input triggered the interrupt. In order to prevent a interrupt from being when several interrupts occur, the compare with the fast CSI inputs must be made in the interrupt task. Bit 0 ... I01: 0 - Interrupt not triggered, 1 - Interrupt triggered Bit 7 ... I08: 0 - Interrupt not triggered, 1 - Interrupt triggered	tc_global	BYTE	1	Transp. In	6
Read state of counter 1 (pulse, gate or period duration measurement)	tc_global	INT16	1	Transp. In	8
Read state of counter 2 (pulse, gate or period duration measurement)	tc_global	INT16	1	Transp. In	10
Read state of counter 3 (pulse, gate or period duration measurement)	tc_global	INT16	1	Transp. In	12
Read state of counter 4 (pulse, gate or period duration measurement)	tc_global	INT16	1	Transp. In	14
Read terminal status Bit 0 = 1: terminal not inserted Bit 0 = 0: terminal inserted on module	tc_global	BYTE	1	Status In	0
Interrupt enable - Enable Bit 7 (e.g. with 128)	tc_global	BYTE	1	Status Out	0
Enable the individual CSI inputs, each bit corresponds to an input Bit 0 = I01: 0 - disabled, 1 - enabled Bit 7 = I08: 0 - disabled, 1 - enabled	tc_global	BYTE	1	Status Out	1
Reset counter 1 with bit 7 = 0	tc_global	BYTE	1	Status Out	8
Configure counter 1 (see section "Register Configuration")	tc_global	BYTE	1	Status Out	9
Reset counter 2 with bit 7 = 0	tc_global	BYTE	1	Status Out	10
Configure counter 2 (see section "Register Configuration")	tc_global	BYTE	1	Status Out	11
Reset counter 3 with bit 7 = 0	tc_global	BYTE	1	Status Out	12
Configure counter 3 (see section "Register Configuration")	tc_global	BYTE	1	Status Out	13
Reset counter 4 with bit 7 = 0	tc_global	BYTE	1	Status Out	14
Configure counter 4 (see section "Register Configuration")	tc_global	BYTE	1	Status Out	15

Configuration Register

REGISTER WRITTEN	Bit	Description
	7	0
	6	0
	5	FITor - Negative ↔ positive on gate input
	4	FICount - Negative edge on counter input
	3	Gate - Gate measurement
	2	Peri - Period measurement
	1	Ext - External frequency
	0	1 MHz - Internal 1 MHz



FITor 0 .... Positive↔negative edge on gate input
1 .... Negative↔positive edge on gate input

FICount 0 .... Positive edge on counter input
1 .... Negative edge on counter input

Gate 0 .... Pulse measurement
1 .... Gate measurement

Peri 0 .... Gate measurement
1 .... Period measurement

Ext 0 .... Internal frequency
1 .... External frequency

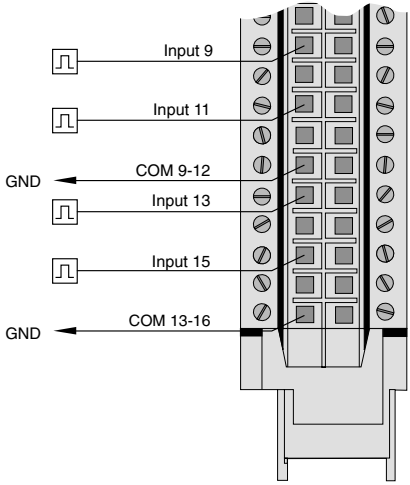
1 MHz 0 .... Internal 4 MHz
1 .... Internal 1 MHz

7.2.9 Connection Example for Pulse Measurement

Four 16 Bit counter, positive edge (default)

Configuration register: $00

Pin Assignments:



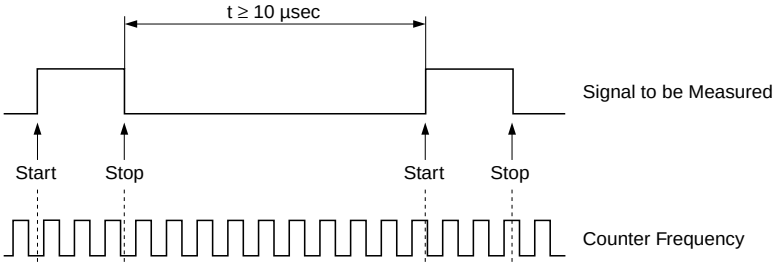
7.2.10 Gate Measurement

A signal connected to channel 10, 12, 14 or 16 can be measured using gate measurement. The pause between two gate measurements must be ≥10 µsec.
A internal and an external counter frequency can be selected for the measurement. The setting is made with the configuration register.

- ❍ Internal counter frequency (1 MHz or 4 MHz)
- ❍ External counter frequency (Rev. ≤36.00 max. 15 kHz / Rev. ≥46.00 max. 100 kHz)

The external counter frequency is connected to channel 9 (for gate measurement on channel 10), channel 11 (measurement on channel 12), 13 (measurement on channel 14) or 15 (measurement on channel 16). The external frequency can be selected separately for all channels.

Principles of Gate Measurement



Pulse counting is started with the rising edge of the gate and stopped with the falling edge. At the falling edge, the counter value is placed in a buffer register. At the next rising edge, the counter begins to run again.
During gate time measurement, the last counter value saved (gate time) can be read by the application program. The value in the buffer register is only updated at the end of the current measurement (falling edge).

The DI400 offers another possibility for gate measurement. Pulse counting is started at the negative edge and stopped at the positive edge for this type of measurement. The setting is made with configuration register.

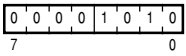
Connection Example for Gate Time Measurement

Gate time measurement on all four channels (positive to negative edge).

An external frequency is used for the measurement:

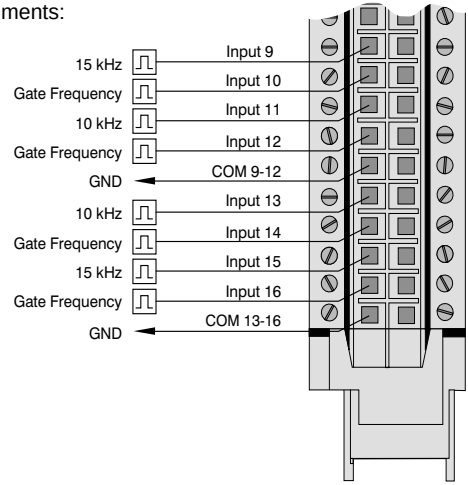
Channel 9 and 15: 15 kHz
Channel 11 and 13: 10 kHz

Configuration Register:

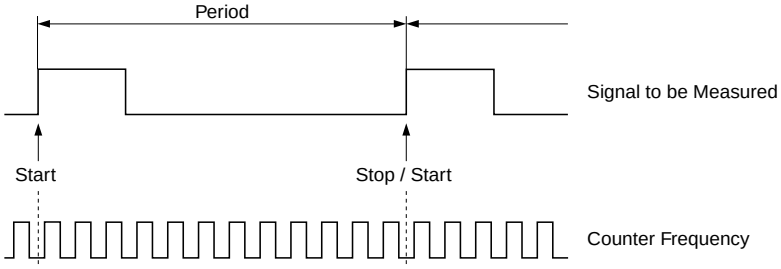


= $0A

Terminal assignments:



7.2.11 Period Measurement



Pulse counting is started with the rising edge on the input and stopped with the next rising edge. The counter value is placed in a buffer register. The counter starts to run again with the same rising edge.
During a period measurement, the last counter value saved (period) can be read by the application program. The value in the buffer register is only updated at the end of the current measurement.

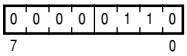
Connection Example for Period Measurement

Gate time measurement on all four channels.

An external frequency is used for the measurement:

Channel 9 and 15: 15 kHz
Channel 11 and 13: 10 kHz

Configuration Register:



= $06

Terminal assignments: