16.2 DS100

16.2.1 General Information

The DS100 module is a programmable I/O module with 3 differential outputs and 16 digital inputs. This module is mainly used for **Electronic Drum Sequencers**.

The drum sequencer gets its name from the mechanical drum sequencers which works by means of cam on a shaft. Every disc represents a certain output which is active in certain positions during the rotation of the shaft.
The electronic functionality of the drum sequencer has the following advantages over the mechanical camshaft.:

     ❍ Higher switching precision
     ❍ Switching cycle does not cause wear
     ❍ Easier adjustment
     ❍ Pre-stop times

The DS100 I/O processor is used as a drum sequencer can calculate the output states of up to 128 outputs according to the actual angular position. In addition, a time can be calculated to compensate for switching times. The output states are stored in the DPR (Dual Port RAM) and can be read cyclically by the PCC CPU and recopied to any digital output modules.

To read the actual angular position, the following encoders can be hooked up to the differential inputs or outputs of the DS100 module:

        ❍ Absolute encoder with synchronous serial interface (SSI)
        ❍ Absolute encoder with parallel interface
        ❍ Incremental encoder

The method of coding (gray or dual) as well as the encoder resolution can be defined by the user with software (function block).
The encoder supply comes from the module as well. It is electrically isolated from the PCC, short circuit protected and current limited and is available on the terminal block.

The electronic drum sequencer can be configured by the user using function blocks. The respective software can be obtained from B&R (including documentation).

16.2.2 Technical Data

Module ID	DS100	
Model Number	2DS100.60-1	
Description	2010 Electronic Drum Sequencer, absolute encoder, SSI/parallel, 16 Bit, 3 differential inputs, RS422 level, 100 kHz, 3 differential outputs, RS422 level, 100 kHz, 16 digital inputs 24 VDC, 5 µsec, Sink, Order terminal blocks separately!	
C-UL-US Listed	Yes	
B&R ID Code	$1A	
Module Type	B&R 2010 I/O module	
Base Plate Module	BP200, BP201, BP210	
Communication	RISC processor	
Instruction Cycle Time	0.8 µsec	
Dual Ported RAM (DPR)	384 Byte SRAM (not buffered)	
System RAM	256 KByte SRAM (not buffered)	
Encoder Supply (internal)	Electrical isolation, short circuit protection and current limitation	
Encoder Supply Voltage	24 V ±10%	4.6 V ±10%
Load	Max. 120 mA	Max. 120 mA
Encoders Used		

Absolute Encoder (Single Turn)
      Coding
      Resolution
	Synchronous serial interface (SSI)
	Gray or dual
	Max. 16 Bit (range: 4096 steps)
		Parallel interface
		Gray or dual
		Max. 12 Bit

Differential Outputs		
Number of Differential Outputs	3	

Electrical Isolation
      Output - PCC
      Output - Output
	Yes (optocoupler)
	No	

Module ID	DS100
Differential Outputs	
Output Level	RS422
Output Frequency	Max. 100 kHz
Differential Inputs	
Number of Differential Inputs	3

Electrical Isolation
    Input - PCC
    Input - Input
	Yes (optocoupler)
	No

Input Level	RS422
Input Frequency	Max. 100 kHz
Digital Inputs	

Number of Inputs
    Total 16
    in Groups of
	4

Connection	Sink connection required (COM connections are to be connected to GND)

Electrical Isolation
    Input - PCC
    Group - Group
    Input - Input
	Yes (optocoupler)
	Yes (optocoupler)
	No

Input Voltage
    Nominal
    Maximal
	24 VDC
	30 VDC

Input Resistance	4,4 kΩ

Switching Threshold
    LOW Range
    Switching Range
    HIGH Range
	<5 V
	5 to 15 V
	>15 V

Switching Delay
    log. 0 - log. 1
    log. 1 - log. 0
	(max. and typ.)
	5 µsec (pulse width $\geq$ 20 µsec)
	5 µsec (pulse width $\geq$ 20 µsec)

Count Frequency	Max. 25 kHz (ratio 1:1)

Power Consumption
   24 V Encoder Supply Voltage
   4.6 V Encoder Supply Voltage
	9 W + 1.5 x encoder power
	9 W + 2.5 x encoder power

Dimensions (H, W, D) [mm]	285, 40, 185

16.2.3 Differential Outputs

If the DS100 module is used as an electronic drum sequencer, the differential outputs are to be used to connect an absolute encoder via a synchronous serial interface.
By installing the proper software, other functions (e.g. frequency inputs or pulse width modulation outputs) can also be can also be used. If digital inputs 9 to 16 are used, differential output 3 is no longer available for use.

16.2.4 Differential Inputs

If the DS100 module is used as an electronic drum sequencer, the differential inputs are to be used to connect an absolute encoder via a synchronous serial interface.
By installing the proper software, the differential inputs can be used as pulse inputs or for gate time measurement for example.

16.2.5 Digital Inputs

If the DS100 module is used as an electronic drum sequencer, the digital inputs are to be used to connect
an absolute encoder via a parallel interface.
By installing the proper software, channels 1 to 8 can also be used as normal digital inputs, pulse inputs or
for gate time measurement. However, channels 9 to 16 are only used as normal digital inputs.

Digital Input Circuit
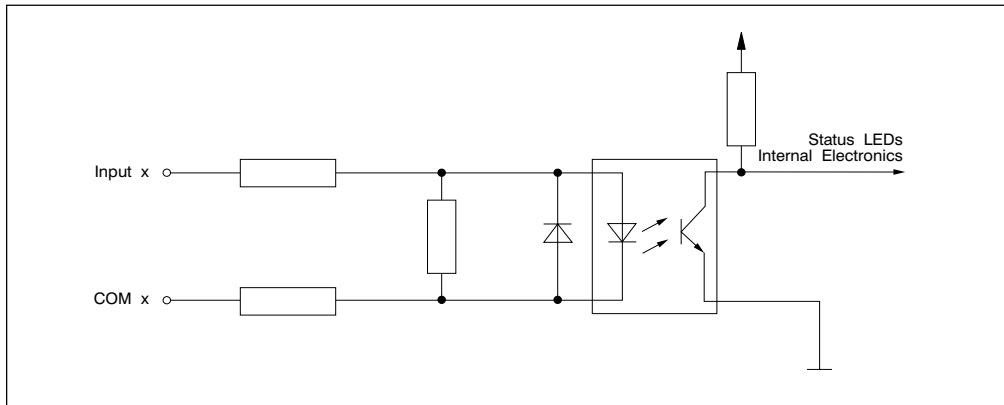
16.2.6 Status LEDs

⎯⊂ ●⎯   Indicates the terminal block status, i.e. if this LED is lit, the terminal block is not
connected properly or there isn't one.

RUN   LED "RUN" light, if the intelligent I/O processor is in operation.

FORCE   EEPROM is used or original TPU code overload

SSI   This LED lights if an absolute encoder is connected with a synchronous serial
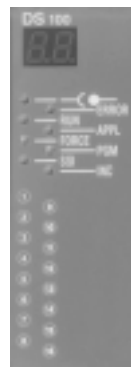interface (SSI) and delivers a signal.

ERROR   Error or undefined state.

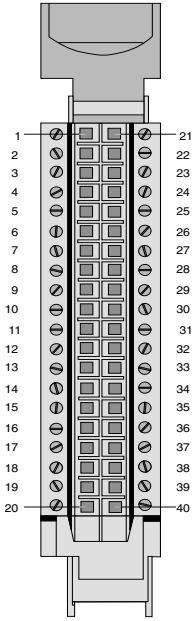**APPL**   The "APPL" LED lights if the application software is running.

PGM   The LED is lit if data is being exchanged between the PCC CPU and the intelligent I/O processor
program.

INC   This LED has no function at this time (reserved for incremental encoders).

1 ... 16   LEDs 1 to 16 indicates the logical state of the respective digital input.

16.2.7 Terminal Assignments

Terminal	Description	Group	Terminal	Description	Group
1	RXD[1]		21	TXD[1]	
2	Shield		22	GND[1]	
3	24V ENCODER		23	GND ENCODER	
4	4.6V ENCODER		24	GND ENCODER	
5	Differential Output 1 +		25	Differential Output 1 -	
6	Differential Output 2 +		26	Differential Output 2 -	
7	Differential Output 3 +		27	Differential Output 3 -	
8	Differential Input 1 + / A[2]		28	Differential Input 1 - / $\overline{A}$[2]	
9	Differential Input 2 + / B[2]		29	Differential Input 2 - / $\overline{B}$[2]	
10	Differential Input 3 + / R[2]		30	Differential Input 3 - / $\overline{R}$[2]	
11	Digital Input 1		31	Digital Input 9	
12	Digital Input 2		32	Digital Input 10	
13	Digital Input 3	1	33	Digital Input 11	3
14	Digital Input 4		34	Digital Input 12	
15	COM (1-4)		35	COM (9-12)	
16	Digital Input 5		36	Digital Input 13	
17	Digital Input 6		37	Digital Input 14	
18	Digital Input 7	2	38	Digital Input 15	4
19	Digital Input 8		39	Digital Input 16	
20	COM (5-8)		40	COM (13-16)	

TB140

[1] RS232 connection for VT100 terminal (in order to be able to work with IP Monitor). If terminals are not connected, connections 1 and 21 are to be jumped by the user.

[2] Incremental encoder

16.2.8 Encoder Connection

The following encoders can be connected to the DS100 module:

- ❍ Absolute encoder with synchronous serial interface (SSI)
- ❍ Absolute encoder with parallel interface
- ❍ Incremental encoder

Terminal	Absolute encoder with syn. serial interface		Absolute encoder with parallel interface		Incremental encoder		Encoder supply	
	Desc.	Definition	Desc.	Definition	Desc.	Definition	Desc.	Definition
1								
2								
3							24V	+24 V enc. supply
4							4.6V	+4.6 V enc. supply
5	T	Clock output						
6								
7								
8	D	Data input			A	Channel A		
9					B	Channel B		
10					R	Reference pulse		
11			D1	Data input bit 0				
12			D2	Data input bit 1				
13			D3	Data input bit 2				
14			D4	Data input bit 3				
15								
16			D5	Data input bit 4				
17			D6	Data input bit 5				
18			D7	Data input bit 6				
19			D8	Data input bit 7				
20								
21								
22								
23							GND	GND enc. supply
24							GND	GND enc. supply
25	$\overline{T}$	T inverted						
26								
27								
28	$\overline{D}$	D inverted			$\overline{A}$	A inverted		
29					$\overline{B}$	B inverted		
30					$\overline{R}$	R inverted		
31			D9	Data input bit 8				
32			D10	Data input bit 9				
33			D11	Data input bit 10				
34			D12	Data input bit 11				
35								
36								
37								
38								
39								
40								

Signal Cable Shielding

Twisted pair cable must be used for the connections for absolute encoders with synchronous serial interfaces. The shielding is done through the specially built shield connection on the terminal block. The shield connections are linked directly to ground (⏚,i.e.: with the mounting rail).

Shielded connection cables are also recommended for absolute encoders with parallel interfaces.

16.2.9 Variable Declaration

The variable declaration for intelligent I/O processors is described in chapter "PG2000 Programming System" of the "B&R 2000 Software User's Manual".