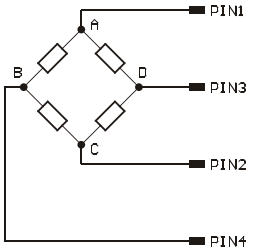
SONDERENTWICKLUNGEN
MESSTECHNIK

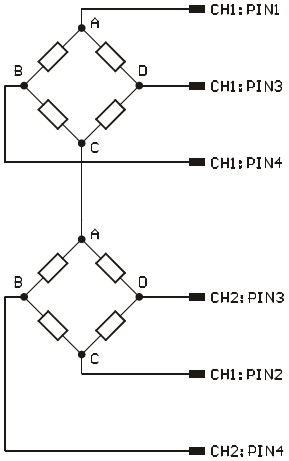
DCBA2, DCBA8

General

The DCBA amplifies the voltage difference of a full resistor bridge. The DCBA2 supports two bridges whereas the DCBA8 supports eight bridges.



Usually, point A of the bridge above is connected with the bridge supply (5 V DC) and point C is connected with ground (0 V). Then, one of the points B and D is connected with the inverting sensor input and the other point is connected with the noninverting sensor input. Using this configuration, the signal to be amplified is given by the voltage difference between noninverting and inverting sensor input.



To reduce loss currents, two strain gauges may be connected in series. This is done by connecting point C of the first bridge with point A of the second bridge. Since the resistance between point A and point C changes just slightly (< 1 ‰) within the complete working range, it is assumed to be constant. Furthermore, if both bridges are of the same type, the corresponding resistances are equal and the voltage between point A and point C is just half of the bridge supply in both cases.

Output Signal

The output voltage U_o is defined as

$$U_o = a \cdot r \cdot U_r + U_z$$
$$r = (U_n - U_i)/U_r$$

where a is the sensor amplification, r is an auxiliary ratio, U_r is the voltage between point A and point C, U_z is the sensor's offset voltage, U_n is the noninverting input voltage and U_i is the inverting input voltage.
If a force sensor with a ratio r_{max} = 2 mV/V at a force F_{max} = 500 N is connected to the DCBA, the output voltage U_o is defined as

$$U_o(F) = (a \cdot U_r \cdot r_{max} / F_{max}) \cdot F + U_z$$

The sensor's output voltage range is from 0.1 V to 4.9 V. To use the complete output range, the amplification is set to

$$a = (4.9\ V - U_z)/(r_{max} \cdot U_r)$$

Setup of DCBA

The amplification a is defined by the position P of the switch. The switch positions are labelled clockwise, starting with P = 1 at 9 o'clock position.
Offset U_z is defined by the potentiometer and by the offset amplification a_z. Use a_z = 1 for a small but smoothly resolved offset, and a_z = 4 for a larger but roughly resolved offset.

Pos *P*	Ampl. *a*	Offset Ampl. a_z
1	500	1
2	1000	1
3	2000	1
4	2500	1
5	50	1
6	100	1
7	200	1
8	250	1
9	500	4
10	1000	4
11	2000	4
12	2500	4
13	50	4
14	100	4
15	200	4
16	250	4

TEMES Parameters (General)

The parameters which are used by TEMES to define a linear relationship between physical value p and input signal v are not (as commonly used) polynomial coefficients. Instead, TEMES uses two distinct points $P_0 = (v_0, p_0)$ and $P_1 = (v_1, p_1)$ of a two dimensional space, which is spanned by the input signal and the physical value. Then the relationship

is given by the line through these two points. The coordinates of the two points are given by the first physical value p_0, the corresponding input signal v_0, the second physical value p_1 and the corresponding input signal v_1. Note that p_1 must not equal p_0 and v_1 must not equal v_0.
Factor m and offset t are used to describe the linear relationship with polynomial coefficients. Thus, $p(v) = m \cdot v + t$.

Factor, Offset	Example for two points
$m = (p_1 - p_0) / (v_1 - v_0)$	P_0: $v_0 = 0$, $p_0 = t$
$t = p_0 - m \cdot v_0$	P_1: $v_1 = 1$, $p_1 = m + t$

TEMES Parameters (DCBA)

The following TEMES parameters may be used for a force sensor application:

Point P_0	Point P_1
$p_0 = 0$ N	$p_1 = F_{max}$
$v_0 = U_z$	$v_1 = a \cdot r_{max} \cdot U_r + U_z$

Pin Assignment

Input socket: This socket is manufactured by Binder (Binder Series 719).

Pin	Assignment [Cable colour]
1	Bridge supply (5 V DC; max. 25 mA) [red]
2	Bridge supply (0 V) [brown]
3	Inverting input [black]
4	Noninverting input [orange]

Note that the valid CMMR (common-mode input voltage range) is from 1 V to 4 V (Both, inverting and noninverting input voltages must be within this range).

Output plug: This plug is manufactured by Binder (Binder Series 719). It supplies the DCBA with voltage and puts out the amplified signals.

Pin	Assignment [Cable colour]
1	Supplying voltage (7 V to 16 V DC) [red]
2	Ground [brown]
3	Output Channel CH1 [black]
4	Output Channel CH2 [orange]
5	(unused)

Since the DCBA8 has 8 output channels, it also has additionally three output plugs. The pin assignment is the same as above, but pin 3 (CH3, CH5, CH7) and pin 4 (CH4, CH6, CH8) provide the further output signals.

Specifications

Input signal frequency range (typical):
$f_{-0.1\ dB}$ > 1 kHz; $f_{-3\ dB}$ > 4 kHz;
Gain Error (verified): e_g < 1.5 %
Max Input Offset Drift (typical): 2 µV/°C
Noise (typical): 35 nV/$\sqrt{Hz}$ RTI noise at 1 kHz

Mechanical Data

Type	Length × Width × Height
DCBA2	40 mm × 30 mm × 16 mm
DCBA8	108 mm × 43 mm × 18 mm