

DIA1, DIA2

General

Usually, a galvanic isolation approach is taken, in order to precisely measure the voltages of on-board power supplies. The expensive galvanic isolation can be avoided if the measurements are done for valid common-mode difference voltages of an amplifier. The 1-channel differential input amplifier DIA1, and the 2-channel differential input amplifier DIA2 are such amplifiers.



Figure 1: Differential Input Amplifier DIA1.

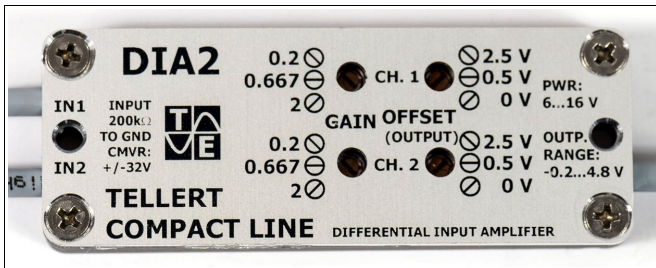


Figure 2: Differential Input Amplifier DIA2.

Output Voltage

The output voltage is given as:

$$U_o = a_p \cdot a \cdot (U_{positive} - U_{negative}) + U_{offset}$$

with output voltage U_o ,

additional prescaler's gain a_p (= 1 if no prescaler is used),

gain a according to the setting (= 0.2, $\frac{2}{3}$ or 2),

voltage $U_{positive}$ of the positive input signal,

voltage $U_{negative}$ of the negative input signal,

voltage U_{offset} according to the setting (= 0 V, 0.5 V or 2.5 V).

The measurement range without prescaler is given as:

$a_p = 1$	$U_{offset} = 0 V$	$U_{offset} = 0.5 V$	$U_{offset} = 2.5 V$
$a = 0.2$	0...24 V	-2.5...21.5 V	-12.5...11.5 V
$a = \frac{2}{3}$	0...7.2 V	-0.75...6.45 V	-3.75...3.45 V
$a = 2$	0...2.4 V	-0.25...2.15 V	-1.25...1.15 V

Internal Operations

Each of the inputs IN1/IN2 has two input signals which

both can lie within the range from -32 V to 32 V (= common-mode voltage range). Each of the input signals has a single input resistance against ground of 200 kΩ.

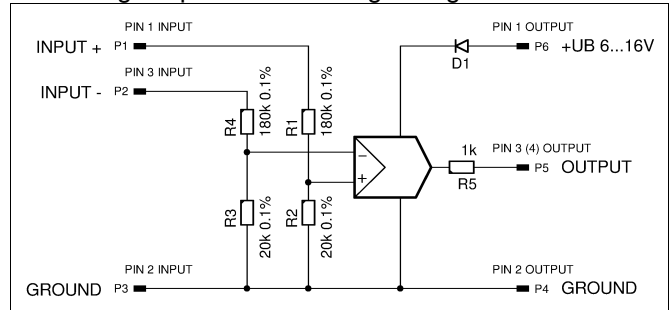


Figure 3: Sketch of DIA1.

Optional DIA1/DIA2 Prescalers

In order to enlarge the measuring range, the DIA1/DIA2 can be run with optionally available prescalers which are connected to the IN1/IN2 connectors.

List of optionally available adapter cables:

Scale	Additional Gain a_p	Pre-resistance (each input)	Total single input resistance against ground
BNC socket:			
1 : 1	1	0 kΩ	200 kΩ
4 mm banana sockets:			
1 : 1	1	0 kΩ	200 kΩ
2 : 1	$\frac{1}{2}$	200 kΩ	400 kΩ
3 : 1	$\frac{1}{3}$	400 kΩ	600 kΩ
4 : 1	$\frac{1}{4}$	600 kΩ	800 kΩ
5 : 1	$\frac{1}{5}$	800 kΩ	1 MΩ
10 : 1	$\frac{1}{10}$	1.8 MΩ	2 MΩ

The allowed input voltage of the prescalers for valid measurements lies within the range from U_{min} to U_{max} . The input voltage can temporarily lie within the range from $U_{spike,min}$ to $U_{spike,max}$ without destructing the amplifier but can yield an invalid output voltage.

	U_{min}	U_{max}	$(U_{spike,min})$	$(U_{spike,max})$
$a_p = 1$	-32 V	32 V	(-100 V)	(100 V)
$a_p = \frac{1}{2}$	-64 V	64 V	(-200 V)	(200 V)
$a_p = \frac{1}{3}$	-96 V	96 V	(-300 V)	(300 V)
$a_p = \frac{1}{4}$	-128 V	128 V	(-320 V)	(320 V)
$a_p = \frac{1}{5}$	-160 V	160 V	(-320 V)	(320 V)
$a_p = \frac{1}{10}$	-320 V	320 V	(-320 V)	(320 V)

The measurement ranges are given as:

$a_p = \frac{1}{2}$	$U_{\text{offset}} = 0 \text{ V}$	$U_{\text{offset}} = 0.5 \text{ V}$	$U_{\text{offset}} = 2.5 \text{ V}$
$a = 0.2$	0...48 V	-5...43 V	-25...23 V
$a = \frac{2}{3}$	0...14.4 V	-1.5...12.9 V	-7.5...6.9 V
$a = 2$	0...4.8 V	-0.5...4.3 V	-2.5...2.3 V

$a_p = \frac{1}{3}$	$U_{\text{offset}} = 0 \text{ V}$	$U_{\text{offset}} = 0.5 \text{ V}$	$U_{\text{offset}} = 2.5 \text{ V}$
$a = 0.2$	0...72 V	-7.5...64.5 V	-37.5...34.5 V
$a = \frac{2}{3}$	0...21.6 V	-2.25...19.35 V	-11.25...10.35 V
$a = 2$	0...7.2 V	-0.75...6.45 V	-3.75...3.45 V

$a_p = \frac{1}{4}$	$U_{\text{offset}} = 0 \text{ V}$	$U_{\text{offset}} = 0.5 \text{ V}$	$U_{\text{offset}} = 2.5 \text{ V}$
$a = 0.2$	0...96 V	-10...86 V	-50...46 V
$a = \frac{2}{3}$	0...28.8 V	-3...25.8 V	-15...13.8 V
$a = 2$	0...9.6 V	-1...8.6 V	-5...4.6 V

$a_p = \frac{1}{5}$	$U_{\text{offset}} = 0 \text{ V}$	$U_{\text{offset}} = 0.5 \text{ V}$	$U_{\text{offset}} = 2.5 \text{ V}$
$a = 0.2$	0...120 V	-12.5...107.5 V	-62.5...57.5 V
$a = \frac{2}{3}$	0...36 V	-3.75...32.25 V	-18.75...17.25 V
$a = 2$	0...12 V	-1.25...10.75 V	-6.25...5.75 V

$a_p = \frac{1}{10}$	$U_{\text{offset}} = 0 \text{ V}$	$U_{\text{offset}} = 0.5 \text{ V}$	$U_{\text{offset}} = 2.5 \text{ V}$
$a = 0.2$	0...240 V	-25...215 V	-125...115 V
$a = \frac{2}{3}$	0...72 V	-7.5...64.5 V	-37.5...34.5 V
$a = 2$	0...24 V	-2.5...21.5 V	-12.5...11.5 V

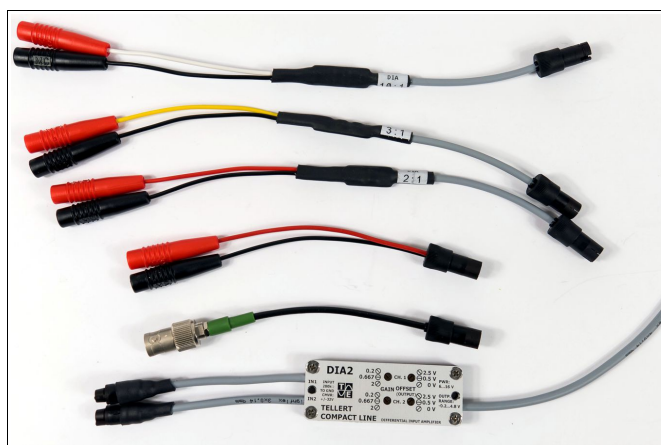


Figure 4: DIA2 with prescalers.

TEMES Settings

	$U_{\text{offset}} = 0 \text{ V}$	$U_{\text{offset}} = 0.5 \text{ V}$	$U_{\text{offset}} = 2.5 \text{ V}$
Phys. Value	Measurement range	Measurement range	Measurement range
Voltage	0...4.8 V	0...4.8 V	0...4.8 V

Pin Assignment

PWR: This plug is manufactured by Binder (Binder Series 719). It supplies the amplifier with voltage and outputs the difference voltages.

Pin	Assignment [Wire color]
1	Supplying voltage (6 V to 16 V DC) [white]
2	Ground (0 V) [brown]
3	Output signal 1 [green]
4	[DIA2 only:] Output signal 2 [yellow]
5	(unused)

IN1/IN2: This socket is manufactured by Binder (Binder Series 719). The socket IN1 refers to channel CH1, and the socket IN2 refers to channel CH2 and is only available for DIA2.

Pin	Assignment
1	Positive input signal
2	Supply's ground (typically unconnected)
3	Negative input signal

Electrical Specification

Supplying voltage range: 6 V to 16 V DC; inverse-polarity protected;

Current consumption: about 1 mA per channel

Single input resistance against ground:
200 k Ω \pm 0.1 %

Single input voltage range (without prescaler):
-32 V to 32 V (= common-mode voltage range).

Range for a temporary spike of a single input voltage without destruction but with a possibly invalid output signal (without prescaler):
-100 V to 100 V.

Output voltage range: 0 V to 4.8 V (Non-linear range from -0.3 V to 5.05 V); input resistance $R_i = 1 \text{ k}\Omega$;

Mechanical Specification

Box Dimensions:	DIA1: 68 mm x 14 mm x 8 mm DIA2: 64 mm x 24 mm x 8 mm
Weight:	DIA1: 23 g DIA2: 34 g
Cable IN1/IN2:	Length: about 6 cm
Cable OUT:	Length: about 46 cm
Box Protection:	Splash-proof
Switches:	Slot width: 1.8 mm

The boxes are stackable with M3 screws.