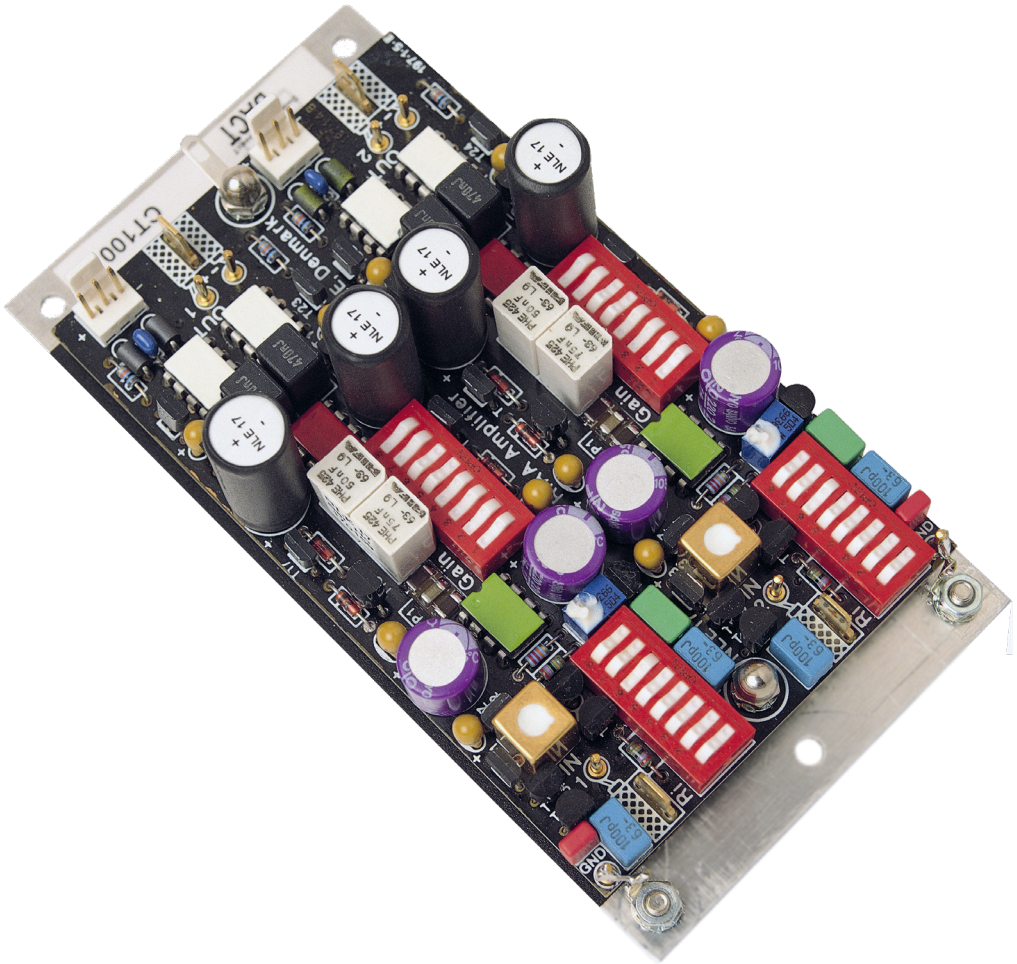
DACT

DANISH AUDIO CONNECT



User Manual

CT100 2-channel phono stage / RIAA preamplifier module

CT100 2-channel phono stage / RIAA preamplifier module

CONTENT

Please make sure to read through all of this Manual before connecting your CT100.

Warning

Connecting power supplies with wrong polarities will damage your CT100

Shorting any of the outputs (+ or - outputs) to ground, or connecting + and - outputs together will damage your CT100

UNPACKING

Thank you for purchasing this Danish Audio ConnecT product.
CT100 is a ready-made 2-channel RIAA preamplifier module built on a compact PCB. Connecting CT100 to input/output sockets and an external power supply will provide you with a high quality, no-nonsense, active phono preamplifier.
Your CT100 purchase includes

1 pc. CT100 2-channel RIAA preamplifier module
1 pc. aluminium Screen Plate (the CT100 PCB is pre-attached to the screen plate)
2 pcs. power supply connectors including colour coded wires

We recommend that you make sure to keep all of the above items after unpacking your CT100, as everything will prove useful when mounting and connecting your CT100.
Please observe that CT100 is shipped without power supply.

CONNECTIONS

Definitions

'Marking' refers to the text printed on the CT100 Printed Circuit Board:

Marking	Definition
IN 1	Signal input, channel 1
IN 2	Signal input, channel 2
OUT 1	Signal output, channel 1
OUT 2	Signal output, channel 2
+/-	Power supply to each of the 3-way connectors
GND	Chassis ground

Please also refer to Fig. 1 below.

CT100 2-channel phono stage / RIAA preamplifier module

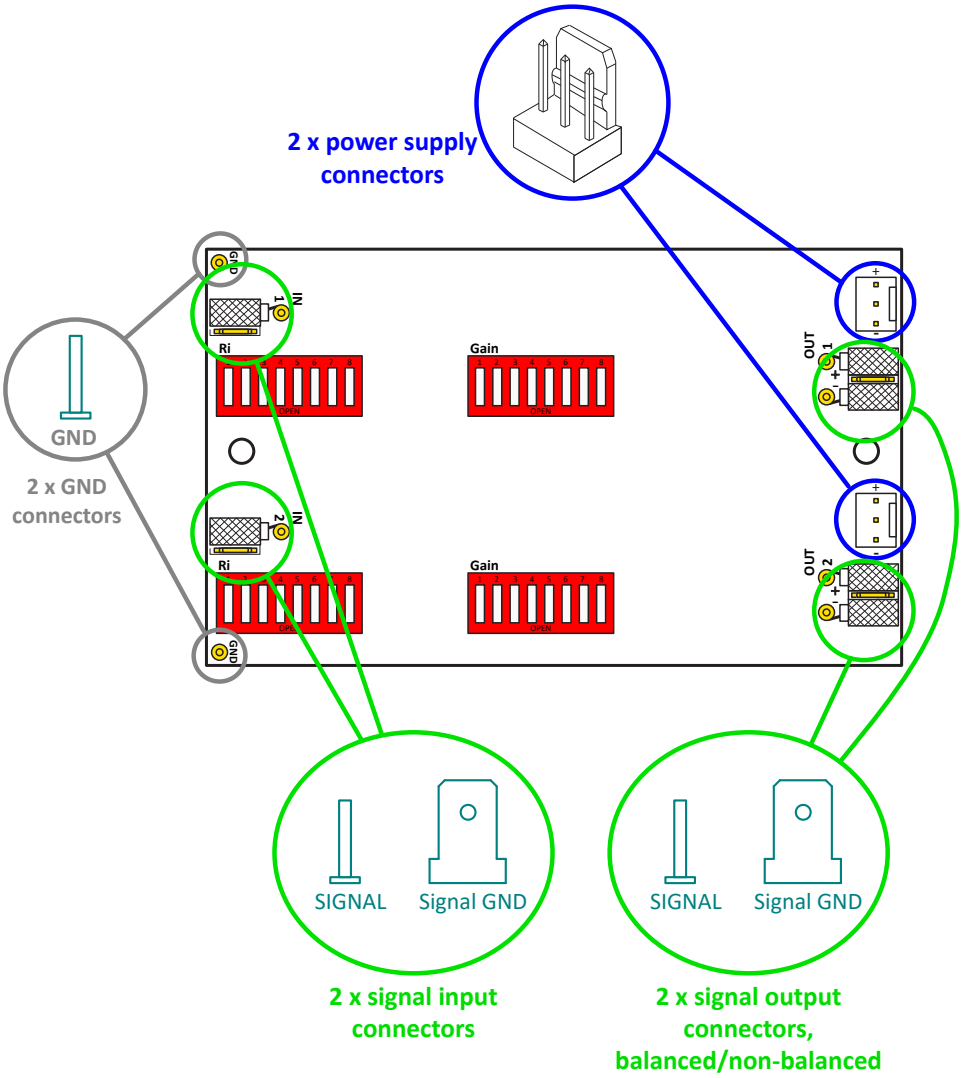


Fig. 1. CT100 connections

Power supply (not included)
CT100 is designed for using with either one +/- power supply common for both channels, or with a +/- power supply for each channel. The two channels of CT100 are completely separated on the PC Board. Therefore, when a power supply for each channel is used, the operation is true dual-mono.
The power supplies must be connected to the 3-way square pin headers as shown in fig. 1 and fig. 2 (exact connector dimensions specified in the CT100 Datasheet).
The colour codes (RED, BLACK, BLUE) in fig. 2 refer to the colours of the wires attached to the two separate power supply connector assemblies, which are included when purchasing a CT100.
⚠ External power supply must be connected to both CT100 channels, regardless of using one or two power supplies.
For more details please refer to the POWER SUPPLY chapter on the following pages.

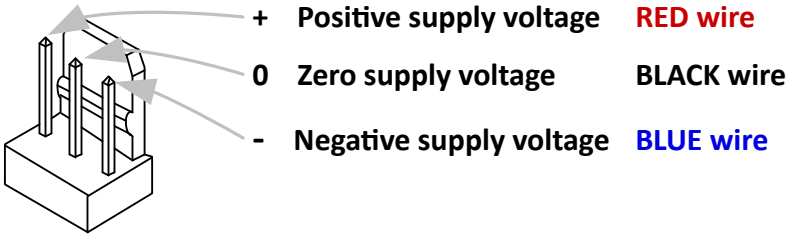


Fig. 2. CT100 power supply connections

Signal input

The input terminals are marked IN 1 and IN 2 on the CT100 PCB, and consist each of a round pin terminal and a flat tab terminal (specified in the CT100 Datasheet). This is where the phono transducer/cartridge is connected.
Generally, we recommend connecting the inputs with screened cables. The longer the input cables are, the more important is the screening. If the distance between the input sockets and the CT100 PCB is short, non-screened cables may be used. For non-screened signal cables, we recommend twisting the signal and the signal-ground wires.
For each channel, the signal-ground wire (the cable outer conductor/screen/braid/foil for screened cables) must be soldered to the flat tab connector. The signal wire (the cable centre conductor/core for screened cables) must be soldered to the round pin terminal. See fig. 3 below.

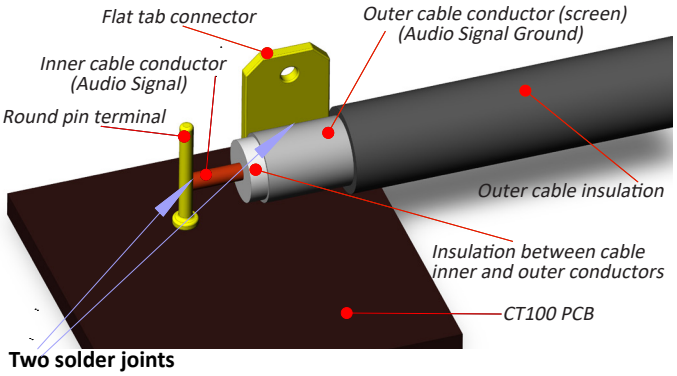


Fig. 3. CT100 audio signal input connections

Signal output

The output terminals are marked OUT 1 and OUT 2 on the CT100 PCB, and consist each of a two round pin terminals and one flat tab terminal (dimensions specified in the CT100 Datasheet).
Generally, we recommend connecting the outputs with screened cables. The longer the output cables are, the more important is the screening. If the distance between the output sockets and the CT100 PCB is short, non-screened cables may be used. For non-screened signal cables, we recommend twisting the signal and the signal ground wires.

Signal output - non-balanced

For each channel, the signal-ground wire (the cable outer conductor/screen/braid/foil for screened cables) must be soldered to the flat tab connector. The signal wire (the cable centre conductor/core for screened cables) must be soldered to the round pin terminal *marked +*. See fig. 4 below. The terminal marked + is the non-inverted signal output.
⚠ The round pin terminal *marked –* is the inverted signal output and may **NOT** be connected to ground (or to anything else), but shall be left without any connections.

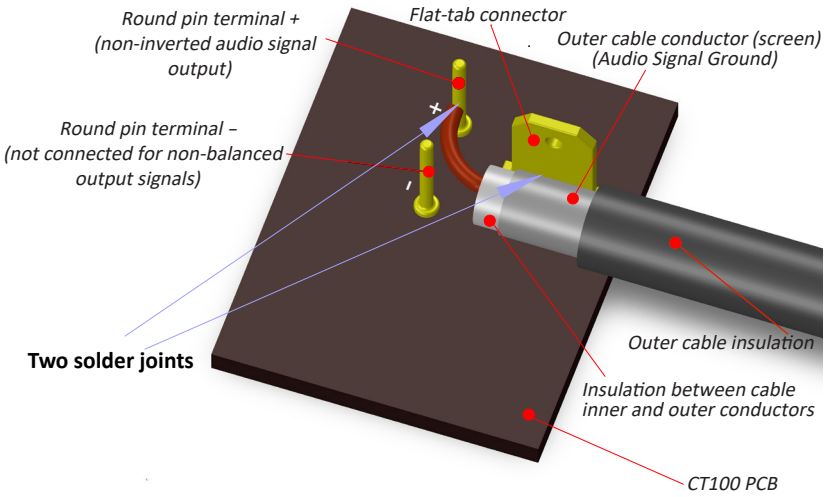


Fig. 4. CT100 audio signal output connections, non-balanced

Signal output - balanced
For each channel, the signal-ground wire (the cable outer conductor/screen/braid/foil for screened cables) must be soldered to the flat tab connector. The non-inverted signal wire must be soldered to the round pin terminal *marked +*, the inverted signal wire must be soldered to the round pin terminal *marked –*. See fig. 5 below.

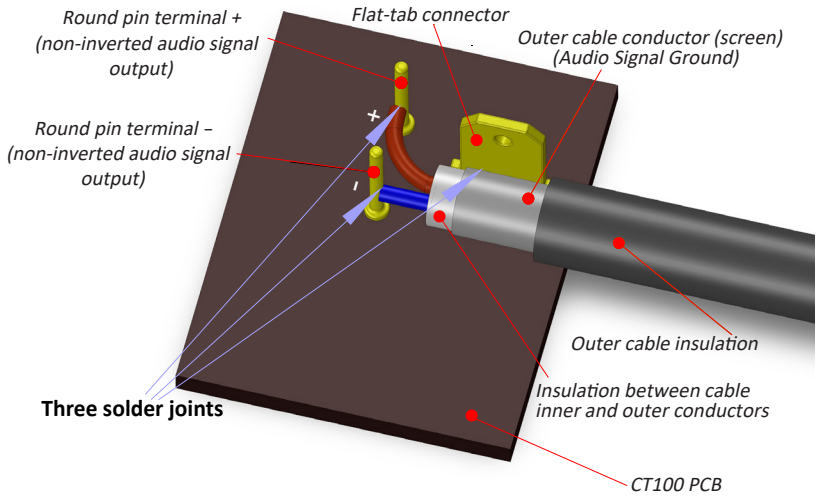


Fig. 5. CT100 audio signal output connections, non-balanced

GND
The two round GND pin terminals (see fig. 1 above) must be connected with short wires to the solder tags on the attached Screen Plate. This is normally done by the manufacturer before shipping. Please observe that no conductor tracks on the PC board unintended connect to the Screen Plate or other external circuits. See also MOUNTING below.

POWER SUPPLY

Definitions
See CONNECTIONS fig. 1 above.

Power requirements
CT100 must be powered by a ±DC voltage, which is a positive voltage with reference to 0 Volts (Common) as well as a negative voltage with reference to the same 0 Volts. The positive and negative voltages are usually of equal magnitude. Although equal magnitude is not required it is recommended.
Each channel of CT100 provides local positive and negative voltage regulation of ±16 Volts when CT100 is power supplied with ±17 Volts up to ±35 Volts. CT100 can operate with minimum ±9 Volts. When CT100 is connected to a preamplifier or a loading impedance higher than 5 kOhms, the power supply requirement is:

±9 to ±35 Volts. Optimum ±17 to ±35 Volts

When CT100 is connected to a loading impedance lower than 5 kOhms, the power supply requirement is:

±7 to ±24 Volts

The supply current is approx. ±22mA per channel, but possibly higher when the loading impedance is less than 5 kOhms, depending on the audio signal level.

Warning ⚠

If the CT100 is powered incorrectly with only a positive voltage or only a negative voltage, a DC voltage of several Volts will occur on the output terminals OUT 1 and OUT 2.

In other words: If only one (+ or -) supply voltage is connected to the CT100, a DC voltage and/or an AC voltage of unacceptable magnitude will occur on the outputs of CT100. Probably harmless to CT100, but connected hi-fl equipment etc. could be damaged. Especially if this equipment can amplify DC voltage and thereby destroy loudspeaker voice coils and set them on fire. The user is solely responsible that the power requirements are observed and followed correctly.

CT100 voltage regulators
CT100 has 4 voltage regulators on board. Each of the two channels has one positive and one negative voltage regulator. All voltage regulators consist of two independent sections in series. Four ferrite bead filters provide effective RFI suppression. (Mobile phones etc.). Decoupling capacitors are selected to ensure optimum wideband working conditions for audio signals.

Power supplies
If CT100 is installed in units having their own ±DC voltage power supply, CT100 can be connected to the units DC voltage if all above-mentioned power requirements are met, including the ability to supply extra at least ±22mA per channel. The optimum power source for CT100 is the DACT CT102 Audio Power Supply.
Powering with batteries or rechargeable batteries is an option for CT100 and it usually leads to good audible results.
All above mentioned power requirements are valid for battery powering as well. Rechargeable batteries may be used as well, but a mains powered charging circuit will induce mains leakage into the ground circuit of the hi-fl system. Such charging circuits should be disconnected from the mains when the charging is ended in order to assure all advantages of battery powering. Each CT100 is supplied with two cables terminated with locking connectors intended for connecting CT100 to batteries or other power sources. The three wires are colour coded in accordance with fig. 2 above. (See CONNECTIONS). See also fig. 6 below. Fig. 6 shows an example of battery powering, where a dual pole on/off switch is used, and where two low-ESR reservoir capacitors are added to reduce supply impedance and to stabilize the supply voltage.
⚠ A dual-pole on/off switch is always required.

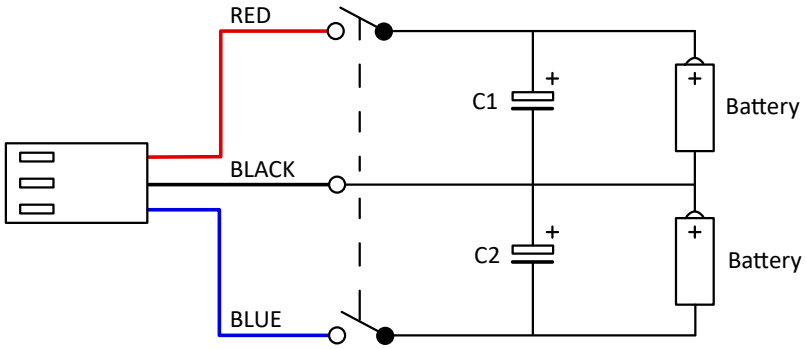


Fig. 6. CT100 power supply example

MOUNTING

Noise sources

Phono amplifiers are very sensitive and mostly screening is required. When CT100 is installed, it is advisable to make experiments with wiring and screening if noise interference occurs. The following directions are guidelines. They mainly apply for dual-mono and balanced output unless otherwise specified.

Common noise sources to consider

- Transformers
- Electrical motors
- Mobile phones
- Relays
- Electrical appliances
- Etc.

Screen Plate

CT100 is shipped mounted on an aluminium Screen Plate (shown Fig. 7). The Screen Plate must always be used even if CT100 is built into a metal enclosure. It provides RF shielding, protects the SMD components on the rear side of the PCB, and avoids that PCB tracks are short-circuited accidentally. For Screen Plate dimensions please see the CT100 Datasheet.

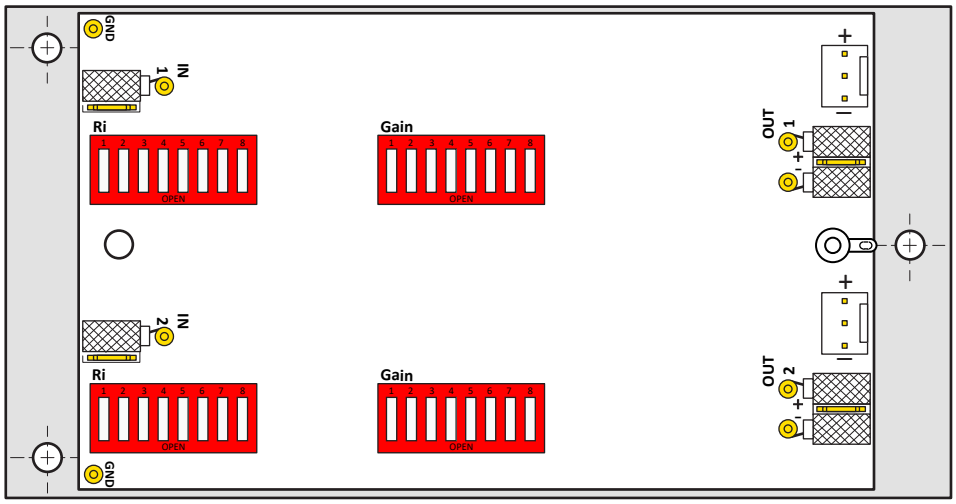


Fig. 7. CT100 with screen plate

Mounting CT100 into a non-metal enclosure or into a turntable

CT100 can be built into a turntable so that the sensitive audio signal from the cartridge can be wired to CT100 with short wires or screened cables in order to protect the original audio signal from noise interference. This configuration enables the turntable to deliver a balanced (2 Volts) or unbalanced (1 Volt) audio signal directly to preamplifiers etc. Fig. 8 shows installation into a non-metal enclosure/turntable.

Follow 1-9 below:

1. If mounting into a turntable: Draw the complete circuit diagram of the turntable. Keep it.
2. Fix CT100 near the signal from the cartridge and far away from motor, mains transformer etc.
3. Connect (solder) GND on both channels to the Screen Plate P117-02 with two short wires. (These connections are normally already made by the manufacturer before shipping).
4. Connect (solder) the wires from the cartridge to CT100 IN 1 / IN 2. See “Signal Input” and Fig. 3 above.
5. Connect (solder) the turntable’s “Earth” wire to one of the CT100 GND pins. See Fig. 8 below.(“Earth” is connected to the tonearm and/or the turntables metal chassis).
6. Connect (solder) OUT 1/2 to XLR or RCA sockets. See “Signal output” and Fig. 4/5 above.
7. Connect (solder) P1 from the solder tag to “Channel 1” screen. In the same way, P2 is connected to “Channel 2” screen, but only if “Channel 2” channel is noisy. If both P1 and P2 are connected to the solder tab, the two channels share the same common (0 Volt), which is not true dual-mono, even if two separate power supplies are used.
8. Connect the power supply. See CONNECTIONS fig. 1 and POWER SUPPLY above.
9. Earth connection is not required, but if desired connect earth to one GND.

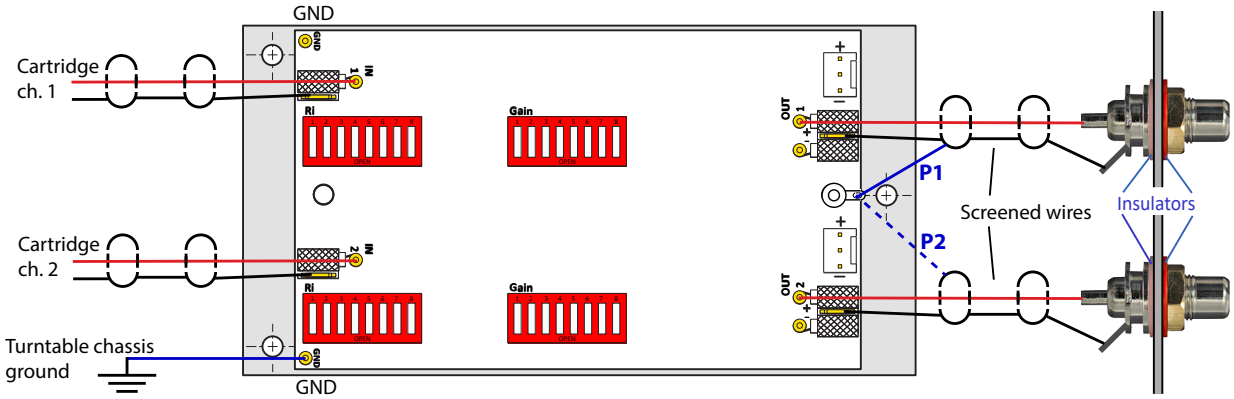


Fig. 8. Mounting CT100 into a non-metal enclosure/turntable.
This example uses non-balanced output connections (RCA output sockets).

Mounting CT100 into a metal enclosure

If noise interference is a problem, a metal box can provide screening.

Fig. 9 shows an example. The above 1-9 are still valid except for:

4a. Connect (solder) IN 1 and IN 2 to two insulated phono chassis sockets.

5a . Connect (solder) a wire from GND to a non-insulated binding post, which is electrically connected, to the metal enclosure.

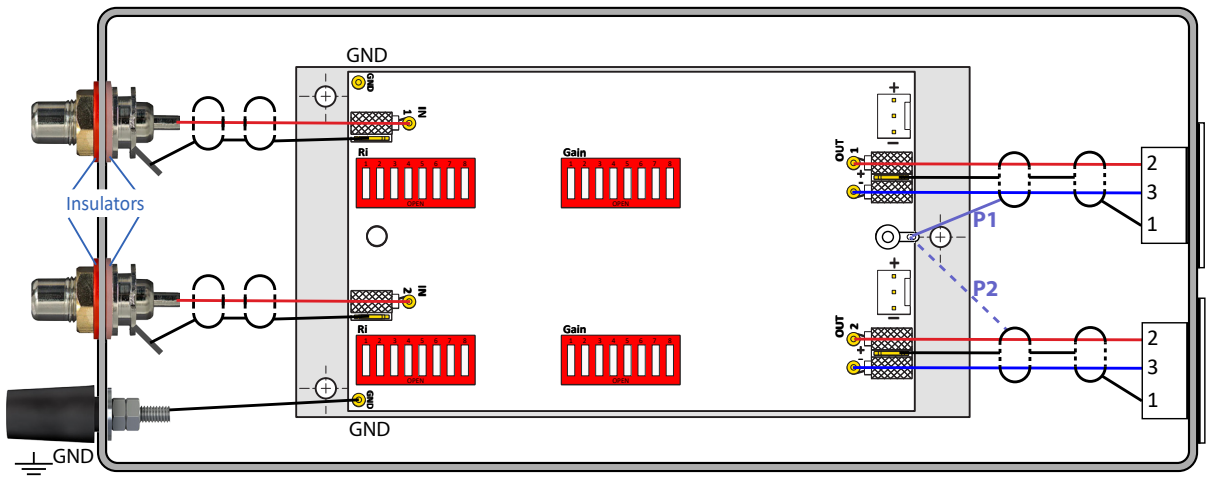


Fig. 9. Mounting CT100 into a metal enclosure.
This example uses balanced output connections (XLR output connectors).

SETTINGS

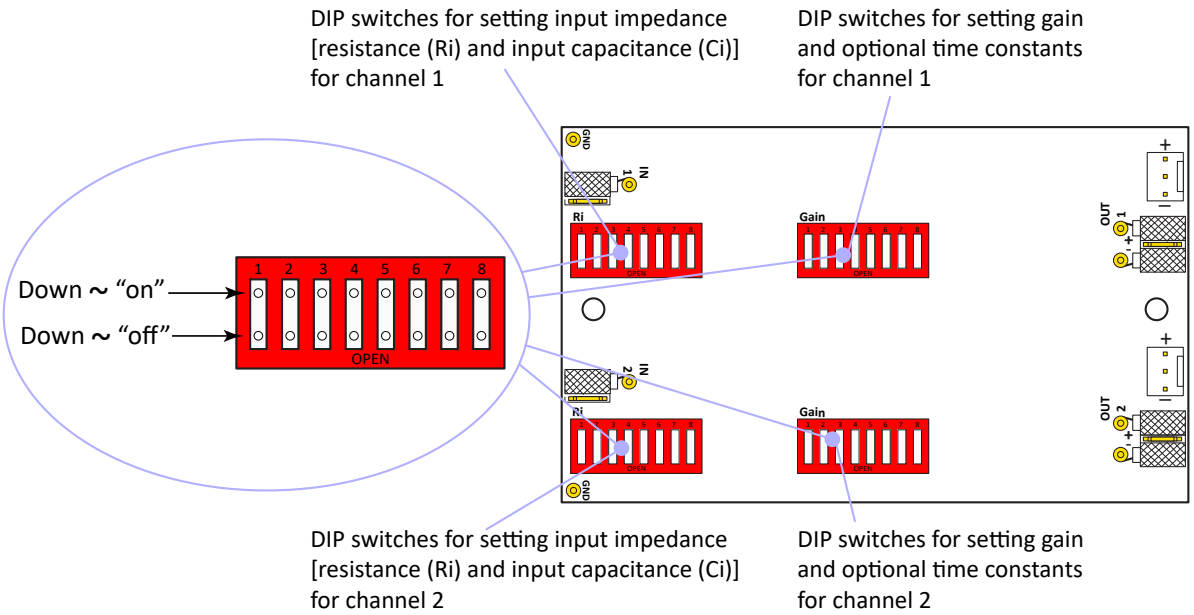


Fig. 10. CT100 settings via DIP switches.

CT100 2-channel phono stage / RIAA preamplifier module

CT100 adaptability
CT100 will adapt to practically any MC and MM cartridge on the market through a wide range of gain, input resistance, and input capacitance settings. No step-up transformer required for most MC cartridges.
Operation is described in fig. 10 above and in the following.

Warning

Turn the volume control completely down, or power off, when the DIP-switches are operated. Otherwise your hi-fi equipment may be damaged by noise transients.

Input resistance Ri
The resistive input loading for MC/MM cartridges can be set in accordance with the cartridge manufacturer's recommendation, or experimentally. Both channels must be set identically. Select only Ri settings specified in table 1. (For resistive values not specified, see OTHER INFORMATION below).

TABLE 1. Input resistance settings.

Resistance, Ri	"Input impedance"-DIP switch settings on/off (fig. 10).							
Ohm	Switch **1**	Switch **2**	Switch **3**	Switch **4**	Switch **5**	Switch **6**	Switch **7**	Switch **8**
10	on	on	on	on	on	on	-	-
15	on	off	on	on	off	on	-	-
18	on	off	off	on	off	on	-	-
20	on	off	off	off	off	off	-	-
25	off	on	on	on	on	on	-	-
30	off	on	on	off	on	on	-	-
40	off	on	off	on	off	on	-	-
50	off	on	off	off	off	off	-	-
60	off	off	on	on	on	on	-	-
70	off	off	on	on	off	off	-	-
80	off	off	on	off	on	on	-	-
90	off	off	on	off	off	on	-	-
100	off	off	on	off	off	off	-	-
150	off	off	off	on	on	on	-	-
180	off	off	off	on	on	off	-	-
200	off	off	off	on	off	on	-	-
250	off	off	off	on	off	off	-	-
400	off	off	off	off	on	on	-	-
600	off	off	off	off	on	off	-	-
1k	off	off	off	off	off	on	-	-
47k	off	off	off	off	off	off	-	-

Input Capacitance Ci

The capacitive input loading for MC/MM cartridges can be set in accordance with the cartridge manufacturer's recommendation, or experimentally. Both channels must be set identically. See table 2. (For capacitive values not specified, see OTHER INFORMATION below).

Example: If your cartridge requires a load resistance of 40 Ohms and a load capacitance of 200 pF, the Ri/Ci DIP switch settings (1-8) should be off, on, off, on, off, on, on, off.

TABLE 2. Input capacitance settings.

Capacitance, Ci	**"Input impedance"-DIP switch settings on/off (fig. 10).**							
pF	Switch **1**	Switch **2**	Switch **3**	Switch **4**	Switch **5**	Switch **6**	Switch **7**	Switch **8**
100	-	-	-	-	-	-	off	off
200	-	-	-	-	-	-	on	off
300	-	-	-	-	-	-	off	on
400	-	-	-	-	-	-	on	on

Gain

The gain required for MC/MM cartridges can be set in accordance with the manufacturer's specification for MC/MM nominal output level, or experimentally. (For MC/MM nominal output levels below 0.10mV (=100uV), gain is set at 0.10mV. For MC/MM nominal output levels above 10mV, gain is set at 10mV).

Both channels must be set identically unless balance adjustment is necessary. Select only gain settings specified in table 4.

Gain settings

Settings specified in table 4 apply for a CT100 nominal output level of 1 Volt (Vo=1V) unbalanced and 2 Volts balanced. (For other CT100 output levels, see OTHER INFORMATION below).

Balance adjusting

The high resolution gain setting (table 4) allows for channel balance control if necessary. Even expensive MC/MM cartridges very often have considerable unequal output levels "Right" to "Left". (Channel difference). CT100 can equalize channel difference by setting different gain for the two channels. Most easily by alternate listening and adjusting. Remember to turn the volume fully down when the DIP-switches are operated. Otherwise your audio equipment may be damaged by noise transients.

Time constants 3.18uS and 7950uS

CT100 feature the option of activating either a 20Hz high pass filter (7950uS) and/or and 50kHz low pass filter (3.18uS). It can be most advantageous to activate the time constant 7950uS (20Hz) as a high pass filter (RIAA/IEC) to minimize warp and infrasonic signal interference. The time constant 3.18uS (50kHz) is only activated if the phonograph disc is cut with this time constant. Otherwise the high frequencies will be affected. In most cases the 3.18uS time constant DIP switch (7) should be left in its default "on" position (meaning filter off"). Both channels must be set identically.

TABLE 3. Time constant settings.

Time constant	**"Gain"-DIP switch settings on/off (fig. 10).**							
uS	Switch **1**	Switch **2**	Switch **3**	Switch **4**	Switch **5**	Switch **6**	Switch **7**	Switch **8**
3.18 off / 7950 off	-	-	-	-	-	-	on	on
3.18 off / 7950 on	-	-	-	-	-	-	on	off
3.18 on / 7950 off	-	-	-	-	-	-	off	on
3.18 on / 7950 on	-	-	-	-	-	-	off	off

TABLE 4. Gain settings.								
MC/MM nom. output level	**"Gain"-DIP switch settings on/off (fig. 10).**							
mV	Switch **1**	Switch **2**	Switch **3**	Switch **4**	Switch **5**	Switch **6**	Switch **7**	Switch **8**
0.10	off	off	off	off	on	on	-	-
0.12	off	off	off	off	off	on	-	-
0.15	on	off	off	off	on	on	-	-
0.18	on	off	off	off	off	on	-	-
0.20	off	on	off	off	on	on	-	-
0.25	off	on	off	off	off	on	-	-
0.30	on	on	off	off	off	on	-	-
0.40	off	off	on	off	on	on	-	-
0.45	on	off	on	off	on	on	-	-
0.50	off	off	on	off	off	on	-	-
0.55	on	on	on	off	on	on	-	-
0.60	off	on	on	off	off	on	-	-
0.70	on	on	on	off	off	on	-	-
0.80	off	off	off	on	on	on	-	-
0.90	off	on	off	on	on	on	-	-
1.0	off	off	off	on	off	on	-	-
1.1	off	off	on	on	on	on	-	-
1.2	off	on	on	on	on	on	-	-
1.3	off	off	on	on	off	on	-	-
1.4	on	off	on	on	off	on	-	-
1.5	off	on	on	on	off	on	-	-
1.6	off	on	on	off	on	off	-	-
1.8	on	on	on	off	on	off	-	-
2.0	off	on	off	off	off	off	-	-
2.5	off	off	off	on	on	off	-	-
3.0	on	on	off	on	on	off	-	-
3.5	off	off	on	on	on	off	-	-
4.0	on	on	on	on	on	off	-	-
4.5	off	on	on	off	off	off	-	-
5.0	on	on	on	off	off	off	-	-
7.0	off	off	off	on	off	off	-	-
8.0	on	on	off	on	off	off	-	-
9.0	off	off	on	on	off	off	-	-
10.0	on	on	on	on	off	off	-	-

OTHER INFORMATION

Dual-mono
CT100 is only operating in true dual-mono when the two channels are connected to two individual power supplies. This is recommended. (It is possible to power supply both channels with only one power supply, but this is not true dual-mono. See also POWER SUPPLY above).

Headphones
If headphones are connected directly to CT100, there is a risk of overloading the output devices and thereby affecting the reliability of CT100. Headphones are normally not connected directly to CT100. (OUT 1 and OUT 2 are intended to be connected to a preamplifier). If headphones are experimentally connected to CT100, the volume can be adjusted with "Gain". (See also SETTINGS). We recommend to use dynamic headphones with an impedance of 600 Ohms or higher. Use terminals marked OUT 1 and OUT 2. Take care that the phase is correct and that "Right" and "Left" channels are not interchanged.

Recommended cartridges
Practically any MC/MM cartridges will work well with CT100. Ask for the cartridge manufacturer's specifications for nominal resistive and capacitive input loading and nominal output level for your MC/MM cartridge so the CT100 DIP-switches can be set correctly.

Other values of Ri and Ci
Other values of Ri and Ci than specified in table 1 and 2 can be obtained. Additional resistors and/or capacitors can be mounted (soldered) directly onto the CT100 input terminals, in parallel with the input signal. Keep the leads short. (Remember to include the resistance and capacitance set by the CT100 DIP switches when calculating the resulting input impedance). See fig. 13.

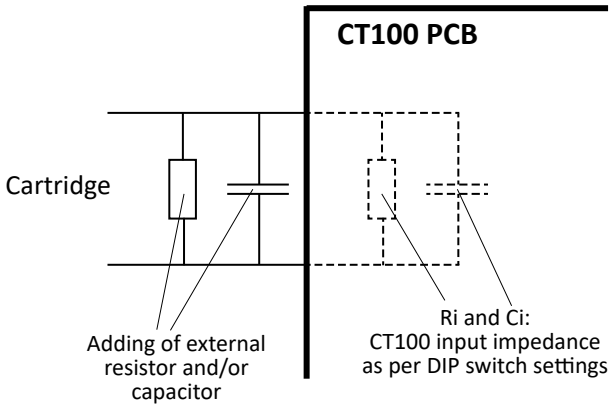


Fig. 11. CT100, adding of external resistor/capacitor.

Other gain settings
The gain setting need not provide a CT100 nominal output level of 1 Volt (Vo=1V). Gain can be adjusted so the CT100 output level matches the required input signal level of preamplifiers etc. Select only gain settings specified in table 3. Gain should not be set so the CT100 output level at OUT1 and OUT 2 is unnecessarily high, as this will reduce the signal to noise ratio. (For example, if gain is set at 0.10mV and the cartridge nominal output level is 1.0mV, the signal to noise ratio is reduced by 20dB = 10 times).

Output DC offset
Normally a low DC output offset will occur on the output terminals OUT 1 and OUT 2. Typically 1 mV to 3mV. The magnitude of the output offset depends on whether the CT100 servo amplifier has settled. Therefore, the output offset cannot be measured until 10-20 seconds after CT100 has been switched on. If CT100 is connected to a preamplifier and a power amplifier which both can amplify DC voltages, it must be estimated whether the resulting DC output offset voltage applied to the loudspeakers is too high. If necessary, a capacitor can be inserted in the signal path to block the DC offset voltage. (The capacitor value is calculated in each individual case to match source/load impedance values and the desired low frequency roll-off. Make sure only to use high quality audio-grade capacitors). If a totally steady DC output offset voltage is most important, it is recommended that the high pass filter 7950uS (20Hz), table 3, is activated.

Oscillation
There is always a risk that hi-fl equipment and its interconnect cables can cause oscillation when connected. The reason is that inevitable capacitance and inductance (capacitors and inductors) may force high frequency signals into phase shift so the amplifier acts as an oscillator. CT100 is designed with special Integrated Circuits, which are stable with any load connected to OUT 1, and OUT 2 as long as proper wiring is made. Screened cables from the CT100 outputs are required, and it is strongly recommended to use screened cables on the inputs as well.

Modifications
It is strongly discouraged to make any alterations to CT100. Circuitry is already optimized.

Maintenance
None. (The two multi-turn trimmers for “input bias current cancellation are adjusted by DACT. Readjustment is unnecessary).

Service
CT100 is a highly complicated piece of electronics that can only be serviced by the most skillful technicians and should always be returned to DACT in case or any defects.
Repair time may be significant due to the complexity and sensitivity of the CT100 circuitry, and in the end around 10% of returned CT100 boards may never be repaired successfully. Before shipping, a repaired CT100 will be exposed to the same tests as a new board and must meet the same specifications.
Due to the anticipated repair times of CT100, DACT do not offer a CT100 repair service as such. Instead we offer to replace your CT100 board by another used board that was repaired previously but 100% checked and confirmed to meet the original specifications. Please contact us to check the current fee schedule for this replacement service.

Hints
1. Power “on”/ “off’ must be switched by a double-pole switch to ensure that both the positive and the negative voltage are switched simultaneously as required. See fig. 6.
2. DIP-switches must be operated full “Down” (fig. 10). If contact changeover is incomplete with insufficient make or break action, random noise transients will occur.
3. Do not touch the two gold-plated screening houses close to IN 1/IN 2 when CT100 is switched “on”. (Temperature fluctuations may disturb the CT100 servo amplifier stability, which causes an unsteady DC output offset).
4. Power amplifiers, which can amplify DC voltage, should be avoided. They represent a potential risk.
5. Never clean or lubricate the DIP-switches. It may affect the sonic performance seriously and even produce noise transients.
6. Do not flex the CT100 PC board. This will damage the SMD components by cracking and/or breaking their solder joints.
7. Do not remove CT100 from the metal screening plate.
8. Never remove the sealing on the two trimmers.
9. When powering with batteries or rechargeable batteries, the leads connecting to CT100 should be short. Otherwise the effect of the capacitors C1/C2 is reduced. See fig. 6.
10. When turning CT100 on for the very first time make sure to connect its outputs to an amplifier that has a volume control. Turn the volume fully down and turn it up slowly in order to prevent wrong wiring etc. from damaging your other audio equipment.

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