

APPLICATION NOTE ANVAU12540601

How to optimise a CD application based on the CD-Pro2LF module (VAU1254/31LF)

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	Product :	VAU1254/31LF
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Who is this application note intended for ?

This application note is intended for high-end audio and jukebox manufacturers who are using Philips CD-Pro2LF modules (VAU1254/31LF). Some articles concern also previous users of CD-Pro2M (VAU1254/31), CD-Pro2 (VAU1254/11), CD-Pro (VAU1252) and CDM12 Industrial modules, who have now switched to the CD-Pro2LF module.

What product is involved ?

The product involved is the Philips CD-Pro2LF module VAU1254/31LF. This module has replaced the CD-Pro2M module which was itself the successor of the former CD-Pro2M, CD-Pro2 and CDM12 Industrial modules.

What are the subjects discussed in this application note ?

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From CD-Pro2 to CD-Pro2LF :

The CD-Pro2LF is the successor of the CD-Pro2M module which is not produced any more. The CD-Pro2LF is of course pin-to-pin compatible with the CD-Pro2M and CD-Pro2 modules.

The CD-Pro2LF has recently showed up, because of the RoHS directive introduced on the 1st of July, 2006. This directive concerns the restriction of hazardous substances in all electronic products sold in the European community, as well as in several other countries worldwide.

The module has been modified to comply with this directive, and has consequently been renamed CD-Pro2LF ("LF" stands for "Lead Free").

The CD-Pro2LF includes all improvements brought with the CD-Pro2M module, and it continues to offer an excellent reliability and an unmatched playability (including with copy-protected discs), in accordance with the reputation of the CD-Pro family in the high-end and professional markets.

These improvements were indeed brought when switching from the CD-Pro2 to the CD-Pro2M module.

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Thus, the main difference between the CD-Pro2LF and the CD-Pro2 lies in the new laser unit in the module's optical pick-up unit. The flex assembly and the mounting and cover frames have been modified for this new laser. However, the CD-Pro2LF remains mechanically compatible with its predecessors.

Another difference is the new sledge motor, which is now a low noise, cadmium free version in order to meet all environmental requirements.

Regarding the audio section, the old TDA1305T D/A Converter has now been replaced by a 192kHz 24-bit Delta-Sigma Converter : the AK4384 will provide a better audio quality while reducing any jitter which would appear during digital audio processing.

Finally, the CD-Pro2LF provides excellent playability with CD-DA, CD-R and CD-RW discs. Like for the CD-Pro2M, the new module includes the decoding chip SAA7324 (CD10), which shows better performances, especially with its improved error correction system. Experience has also underline that CD10 is less sensitive to ESD.

Besides, the new firmware of the CD-Pro2LF module has been improved as regard to playback of copy-protected discs. Thus, the CD-Pro2LF module will equally accept most of the copy-protected discs, whatever the protection system involved with those discs.

Of course, the CD-Pro2LF module is based on the same DSA interface as in CD-Pro2M, CD-Pro2, CD-Pro and CDM12 Industrial modules : as a consequence, the same user software can be used for all these modules. For more information concerning the DSA interface, please refer to the Premium 10501 DSA Specifications.

Power supply recommendations :

Most of these recommendations appear in the Premium 10502 User Manual.

To prevent unregulated movements of the motor and actuators, the following recommendations should be followed :

- 1) +5V should be supplied first with a preferred timing of 150ms prior to the +9V to avoid movements of the actuators during power-up.
- 2) +9V has to be switched off first
- 3) Minimal time between power off and power on is 1s.

More information on this subject are provided below :

- 1) If the +9V power comes up faster than the +5V, you may notice spurious movements of the actuator upon power up. In this situation, the drivers are indeed powered up first by the +9V supply. After the drivers are powered up, the +5V is still rising. The drivers will consequently follow the power up pattern of the +5V and put this waveform in an amplified way on the actuators. This will cause movements of the actuators. If the +5V and +9V have the same rise times, the actuator movements are reasonable. In the case you do not want any movement at all, the +5V supply should come up a little faster (150ms) at start-up than the +9V supply. 150ms is enough here; increasing this figure is not

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necessary for normal supplies. Only when the rise time of the +5V is very slow, the 150ms have to be increased.

- 2) The same story counts for switching off the power supply , only now it is the other way around : the +9V has to be switched off first.
- 3) Between switching off the power of the module and switching it back again, you should wait for 1 second (just like in any other audio application). This is to make sure that the microprocessor is properly reset during power-up. The maximum reset time is 1s after the +5V has been switched on. After this time, commands (e.g. spin up) may be sent. If the sledge is not yet at its inner position, the command will only be executed after the sledge is home.

In order to avoid wrong reset of the microprocessor on successive power on/power off cycling without waits, an external reset pulse can be given to the microprocessor via the DSA interface, which will guarantee a proper reset.

Playability of the CD-Pro2LF module depends on the power supply too. Experience has shown that playability can be improved by using +10V supply instead of +9V for the motor and actuator drivers (TDA7073). It is however not advised to go beyond +10V, because this extra power will only be translated into extra heat which in turn will decrease the lifetime of the product. Hence, ventilation holes (or a fan) would be required in the cabinet in the neighbourhood of the two TDA7073 drivers (especially during spin up, spin down, and access of a new track).

Grounding recommendations :

In the power supply connector of the CD-Pro2LF module (Connector 1214 / JST PH 4), pin 2 is used for the actuator drivers (+9 or +10V). Pin 1 is the related ground.

Pin 4 is used as power supply for the rest of the circuitry (+5V). Pin 3 is the related ground.

In contrary to the CDM12 Industrial module, both grounds are not connected in the CD-Pro2LF module ! Ground signal on pin 1 and ground signal on pin 3 have to be connected together in your power supply section in order to prevent unwanted disturbance signals !

Besides, if a metal shielding is used with a distance of less than 5mm to the PCB, the shielding has to be connected to the PCB ground.

16 MHz clock output :

A 16 MHz clock output is available from the CD-Pro2LF. It can be used for instance with MPEG boards which require a clock synchronous with the CD decoder.

The connector which should include this 16MHz clock signal is actually not stuffed on the CD-Pro2LF PCB. However the clock can be retrieved from the middle print of this 3-pin connector (connector 1702 / JST PH 3), which is located at the back of the CD-Pro2LF, on the component side of the PCB.

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Magnetic clamper recommendations :

A magnetic clamper has to be used in order to keep the disc in position. Such a clamper has been especially designed for the CD-Pro2LF module and we advise to use it in order to get the best performances out of your application (playability, disc acceptance,...).

However, the clamper is a visible part in your application and you may want to design it yourself, so that it matches the line of your products. In this case, the following recommendations have to be taken into account (for instance, a too strong clamping force would brake the spinning motor and have serious consequences on the playability and the disc acceptance of the application) :

- 1) The minimum clamping force is 135 gram force. Below 135 grf, the radial noise increases. Below 85 grf, the radial noise reaches unacceptable level. Besides, an extra thick disc will decrease the clamping force.
- 2) The maximum clamping force is 200 gram force
- 3) The original magnet is equipped with a metal ring to act as a shortcut for magnetic stray fields. In this way, the magnetic stray fields do not reach the opto-magnetic control system. This should also be taken into account when designing a new clamper.
- 4) The inertia of the system should not be increased by means of a heavy disc clamp puck. Best is to keep the puck weight below 150 grams.
- 5) The shape of the clamper should have a low inertia profile.
- 6) The actual clamping area is the edge of the turn-table. The clamper should only clamp in the area close to the edge of the disc (some discs may be wrongly shaped).

If you design a clamper which does not fulfil the above recommendations, performances of the application may be seriously affected : it would be consequently better to use the original clamp device.

Getting the best audio performances :

The usual audio software on CD-DA discs has a SNR of 98dB max. The output of CD10 (SAA7324) is already de-emphasised, and then quantized to 16 bits again. At this stage, the theoretical max. attainable SNR which can be expected from the D/A Converter of the CD-Pro2M module (AK4384) will be 98dB. Measured operational values are about 97dB. THD at 0dB input signal will be -85dB, and -35dB at -60dB input signal.

For the best audio performances, the power supply wires should be of AWG24 type. As mentioned above (power supply and grounding recommendations), the PCB of the module should be connected to 2 independent power supplies : one for +5V, the other for +9V or +10V. Again, the ground terminals of the two power supplies must be connected at the supply side to reduce voltage drop or ripple over the power wiring. The ground terminals of the supply connector are indeed not connected on the PCB of the CD-Pro2LF !

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Another important note concerns the absolute audio phase : one of the properties of the CD-Pro2LF D/A Converter (AK4384) is that the phase of the audio output has turned 180 degrees. If you want to get the absolute phase in your design, an inverting amplifier should be used between the CD-Pro2LF module and speaker/headphone output.

Remaining time information :

In the user section of your design based on the CD-Pro2LF module, you may propose different possibilities to display time information. In the case you want to display the remaining time of a track, you can use the DSA command 'Get title length'. By subtracting the relative time from the title length, you can easily display this remaining time information.

However, the 'Get title length' command is limited by the memory size of the CD-Pro2LF microprocessor. As a consequence, you can only retrieve this information for tracks 1 to 20. In case you would like to display remaining time information for tracks above 20, the following alternatives can be used :

- 1) You can use the 'Read Long TOC' command instead of the usual 'Read TOC' command. The 'Read Long TOC' command successively returns information for all tracks of a disc, i.e. a continuous stream of 5 bytes for each track. You can then store the title length information for each track in the memory of your user microprocessor. The same calculation as above will give you the remaining time information. In case you are also limited with the memory size of the user microcontroller, you can use this work-around only for tracks above 20.
- 2) Another alternative is based on the way the title length is calculated :
$$\text{title-length} = \text{Start-time}(\text{track } X+1) - \text{Start-time}(\text{track } X)$$
As a consequence, you can get the title length of the track X by sending the following sequence of DSA commands :
SET MODE with ATTI = 01 (Absolute time)
Wait for response
PAUSE
Wait for response
PLAY TITLE with track number (X + 1)
in the response, the absolute time represents the start-time of title (X+1)
PLAY TITLE with track number (X)
in the response, the absolute time represents the start-time of title (X)
The title length can now be calculated
If the setting of ATTI is wrong, then you can send a new ATTI value with the SET MODE command
Wait for response
Any other command

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Handling instructions :

The mechanism of the CD-Pro2LF module (VAM1254/21) consists of delicate optical, mechanical and electrical components. Excessive mechanical forces on any part shall be avoided and proper ESD measures shall be taken.

The PCB does not require any adjustments.

Storage in dusty, high temperature and high humidity environments should be avoided.

To avoid damage to the laser by ESD (ElectroStatic Discharges), measuring equipment and operators should be grounded during handling. The user of this unit must take all necessary precautions to avoid ESD failures during handling of this unit.

Contamination of the objective lens will influence the performance. Never touch the lens with your fingers, and avoid that grease from the mechanical parts is spoiled on the lens. Handle the mechanism in a clean environment.

The Optical Pick Up unit has been carefully adjusted during manufacturing. Avoid touching this part. Do not disassemble. Do not readjust.

Warning : Invisible Laser Radiation. The laser beam may damage the human eye. Avoid direct exposure to laser beam.

Fast heating up (e.g. by bringing the mechanism from a cold place into a warm and humid room) can result in moisture condensing on the lens, thus influencing the playability for a certain time. Before checking the performances, the mechanism should stabilise to climatic conditions for at least 4 hours.

Literature concerning CD-Pro2LF module

The following documents provide complete technical information on the CD-Pro2LF module (mechanism, application, software,...) :

- VAM1254/21 Data Sheet : CD mechanism for professional audio/video applications
- VAU1254/31 Data Sheet : CD player module for professional audio/video applications
- Premium 10502 User Manual
- Maintenance Instruction Premium 10501
- DSA Interface bus protocol & DSA Command set for Premium 10501
- DSA Application notes for Premium 10501

A few of the above articles actually come from these documents. If you would like to receive some of these documents, you can make a written request to our technical service (Fax : +33 2 51 85 92 94). A copy of the requested documents will be mailed in return to your company.

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