

**1. General**

ECO-SL MKII is a self-contained CD Module derived from CD-SL with the emphasis on cost reduction. It is the direct successor of ECO-SL (CD6/DSIC2), now equipped with CD7 signal processor LSI, which incorporates the functions of CD6 and DSIC2 in only one chip. ECO-SL MKII is almost 100% hardware-, but not software-compatible to ECO-SL. The module includes following functions :

- CD Mechanism
- CD Tray Loader Mechanism
- CD Electronics (HF Preamplifier, CD Servo & Decoder, DAC, tray driver)

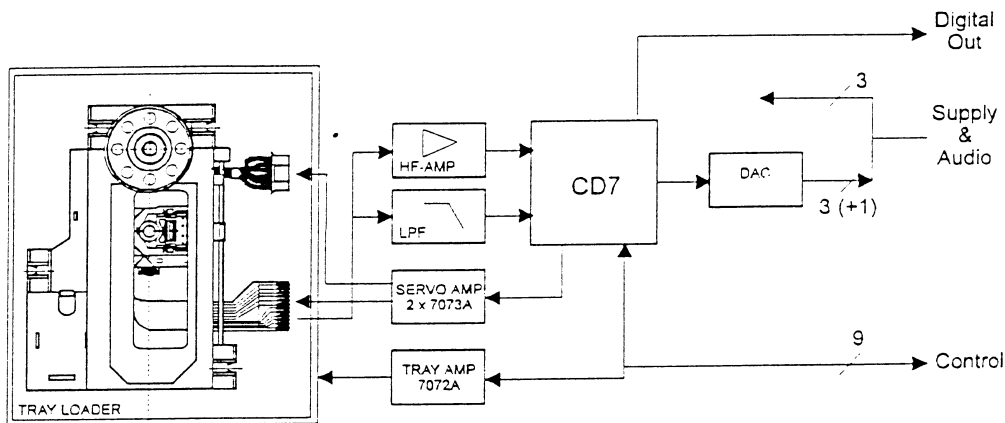
The CD Electronics can be used with CD Mechanism, but without Tray Loader Mechanism; this setup is called the "flap version" of ECO-SL MKII. The design of the flap loading mechanism is set-related and thus not treated in this specification.

NOT included are:

- Control function (microprocessor): has to be handled by external (set)-microprocessor
- Ornamental CD Tray cover: styling and set-related

**2. Key Components**

- CD Mechanism : CDM12.1 (3104 147 02170)
- CD Loader : Mechanical part of CD-SL (3103 308 51170) or new HK tool (3103 309 04770)
- CD Decoder & Servo: SAA7378 (low cost CD7)
- DAC: TDA1311, Continuous Calibration ("*non bitstream*")



**3. Version Overview**

An overview of available versions can be found in annex I.

**4. PCB Design**

- double sided, one side ground plane with hand soldered vias (may be changed to single sided once EMC evaluation is positive; see chapter 8, EMC)
- Axial / Radial / Manual Insertion (CD7, HCU04, (DAC in case of *bitstream*) as SMD's)
- Design Rules : D1732\_92, minimal pitch 5 millimeters (retro fit, double masking).

**5. Interfaces**

**5.1 Mechanical**

Tray loading mechanism: dimensions same as CD-SL, see CD-SL, sheet 112-01 (Shortloader 1 Assy, 3103 308 5117).

Flap loading mechanism: stuffing height 15mm. Design of flap loader is set-related. See MC170 for ref.

Shielding plate for improved performance on passive radiation: Sheet-Screening\_1, 3103 301 4362.

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	1		<b>3103 308 51410</b>		96-08-27	
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96-08-27	3					
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This shielding plate requires 4.6mm clearance and is mounted on the bottom of the PCB. Decision whether shielding plate is needed or not remains in the responsibility of set designer. For more information see chapter 8, EMC.

### 5.2 Electrical

Interface connections used for all applications of ECO - SL MKII:

#### 5.2.1 Supply and Audio Interface

Conn. 1802, "Supply & Audio", 6 (7) pol JST XH horizontal, linked to combi board of set

1802			
□	1	+A	servo supply voltage, 6 - 13.5V, see chapters 6,10.3
□	2	GND	servo and dig. ground
□	3	+5	5V switchable for digital IC's, ±5%
□	4	ANA-R	analogue output right
□	5	AGND	analogue ground
□	6	ANA-L	analogue output left, same spec. as ANA-L
□	7		

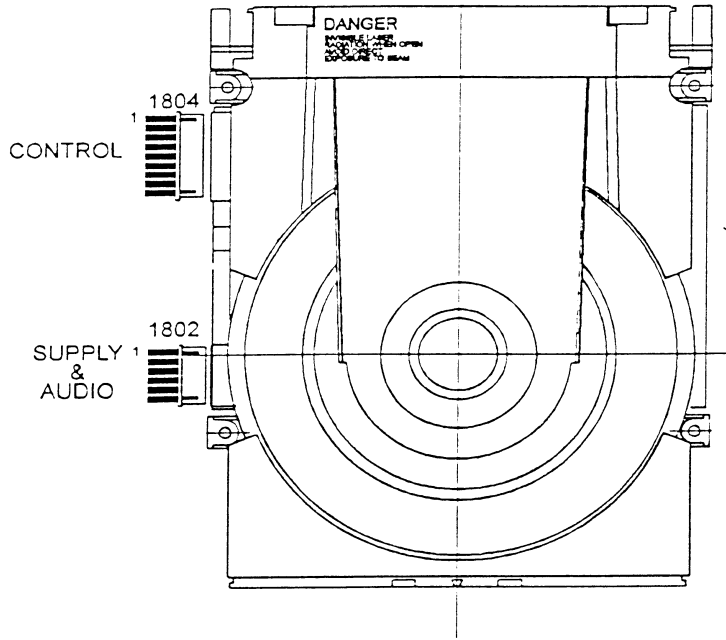
#### 5.2.2 Control Interface

Conn. 1804, "Control", 9 (7) pol JST XH horizontal, linked to control (front) PCB of set

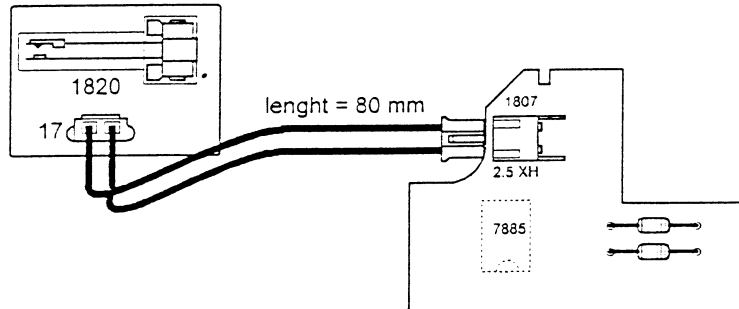
1804			
□	1	GND	- GND, connected to pin2 of 1802, for EMC improvement
□	2	SICL	I Clock line for CD7
□	3	GND	- GND, connected to pin2 of 1802, for EMC improvement
□	4	SILD	I Latch line for CD7
□	5	DATA	I/O bidirectional data line for CD7
□	6	RESET	I Reset for CD7
□	7	TRAY_SW	O tray switch (referred to GND).
□	8	TRAY+	I tray out if low (tray version only)
□	9	TRAY-	I tray in if low (tray version only)

Tray in/out controlled with 2 lines (TRAY+, TRAY-). For flap version, conn. 1804 is 7p and TRAY+, TRAY- are not existing, "TRAY\_SW" indicates the position of leaf switch.  
In future, pin 1 of 1804 can be deleted for the reason of cost saving.

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95-12-01	2		3103 308 51410
96-08-27	3		95-11-27
		File: 2sh190 2.doc	Cnt.Sh. 4 10 Sh. 190-3
WR	Check:	Date: 17.11.95	A4



5.2.4 Leaf Switch Connector (flap version only)  
 Conn. 1807, Leaf Switch, 2p JST XH horizontal



5.2.5 Correction Flag CFLG) Output  
 Conn. 1850, Leaf Switch, 2p JST PH horizontal

This output can be used for measuring the BLER (Block Error Rate) of the CD Decoder by means of an appropriate measuring equipment. Output needs an external 10k pull up to +5V.

1850			
□	1	GND	-
□	2	CFLG	O

## 6. Environment Conditions

Temperature: operating : -10 °C - 65 °C for +A= 6...12V (except CDM12.1)  
 -10 °C - 55 °C for +A= 6...13.5V (except CDM12.1)  
 storage : -25 °C - 70 °C (except CDM12.1)  
 (CDM12.1: see spec. 5.1, 17.02.95: operational temperature range: 5 - 55°C)

Climate : all climates acc. UAN-D1590

Shock : For specified shock performance, +A must be between +8 and 13.5V.  
 A +A=6...8V leads to degradation of shock performance.

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		File: 2sh190 2.doc	Cnt.Sh.	5	10	Sh. 190-4	A+
WR	Check:	Date: 17.11.95					

operating :  $\pm X$  direction (3ms)  $\geq 5$  g (ECO-SL MKII in AZ8640)  
 $\pm Y$  direction (3ms)  $\geq 5$  g ("")  
 $\pm Z$  direction (3ms)  $\geq 5$  g ("")

## 7. Safety

IEC 65/UL1492

Compliance to safety requirements at module level is defined at following supply conditions :

+A (Conn. 1802 pin 1) :  $12V/I_{max} = 2.5A$

Maximum voltage at +A supply: 16V (elcaps withstand 16V)

Maximum current when +A is connected to GND: 2.5A

Minimum required current when at minimum +A (6V):  $I_{min} = 1.25A$

+5 (Conn. 1802 pin 3) :  $5V/I_{max} = 1.25A$

Maximum voltage at +5: 6.3V

All elcaps are at least 16V types, except item 2866, which is 330 $\mu$ /6.3V.

For deviating supply conditions the safety requirements have to be re-evaluated by the applicant.

## 8. Electro Magnetic Compatibility (EMC)

EMC evaluation of set has to be repeated when changing over from ECO-SL to ECO-SL MKII.

EMC properties are optimized on module level using methods and limits as defined in PQR (XUW-0010EN, dated 1995-03-02) in order to create the basis for compliance with above mentioned norms at set level. As the specific situation in a set (eg. wiring) influences the EMC behaviour, the EMC performance has to be evaluated at set level by the applicant.

active radiation: acc. EN 55022, EN 55013, FCC15:

- Common mode interference currents on all module cables are  $\leq 10dB\mu A$   
in a frequency interval from 30MHz to 1000MHz.

passive radiation: acc. EN 55020, immunity to electrical fields, measured in PLAY mode with Burn-In testdisc on track 20.

ECO-SL measured in FW46 (metal bottom of set close to PCB):  $\geq 30$  V/m

ECO-SL measured in AZ8640 (no metal shielding at all):  $\geq 5$  V/m

ECO-SL with shielding plate in AZ8640: typ.  $\geq 7$  V/m

for improved passive radiation immunity, a shielding plate is available (SHEET SCREENING 1, 3103 301 4362). This shielding needs 4.6mm clearance, measured from the bottom of the PCB, and has to be soldered with 3 soldering joints to GND of ECO-SL PCB.

## 9. Quality

AQL : 0.4 maj.

0.65 min.

Field Quality:  $\leq 650h$ :  $< 1.5\%$  customer returns

$\leq 3300h$ :  $< 3\%$  customer returns



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95-12-01	2					95-11-27	
96-08-27	3						
		File: 2sh190 2.doc	Cnt.Sh.	6	10	Sh. 190-5	A4
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## 10. Technical Data

If not specified otherwise : PQR for Portables and MMM, Class II

### 10.1 Audio Performance

Measuring conditions: no ripple on +5V line. See also chapter 10.3.

Parameter	<i>non bitstream</i> TDA1311 CC-DAC
Output resistance	2k $\Omega$ $\pm$ 33%
Output voltage (unloaded) (0dB, 1kHz)	0.55V <sub>rms</sub> $\pm$ 1dB
Channel unbalance	< $\pm$ 1dB
Frequency response	< $\pm$ 1.5dB for 20Hz - 20kHz
SNR (bipolar zero, unweighted)	80dB limit
SNR (bipolar zero, A-weighted)	90dB typ (86dB limit)
THD+N / S (20Hz - 20kHz)	65dB typ (60dB limit)
THD+N / S (1kHz)	68dB typ (63 dB limit)
Dynamic Range (-60dB)	83 dB typ
Outband Attenuation	> 25dB for f > 24kHz
Crosstalk (20Hz - 20kHz)	40dB limit
Emphasis (switched automatically by CD7)	15/50 $\mu$ s

### 10.2 Playability

satisfies XUW0010-EN, 1995-03-02, p.112, chapter 25.3

### 10.3 Supply Voltage Range & Current Consumption

Supply Voltage: +5:  $\pm$ 5%

+A: 6...13.5V.

Restrictions: - for +A  $\leq$  8V decreased shock performance.

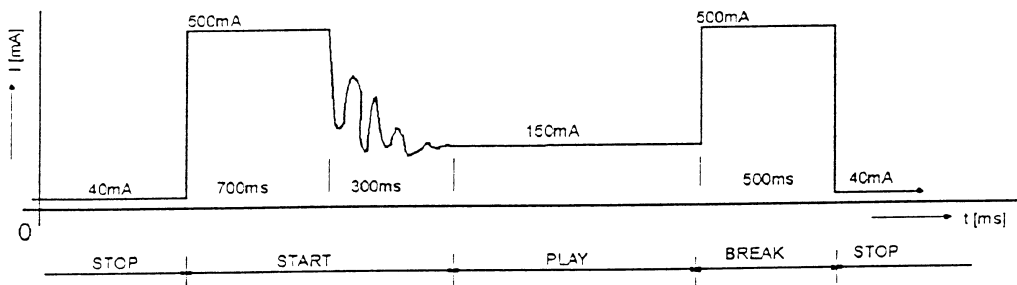
- for +A  $\geq$  12V temperature range -10...55°C

Version 3103 308 51310 needs a +5 supply voltage of 5.4V  $\pm$  5% (request Z7)

Mode	+5V	+A (12V)
Stop	35 mA <sub>typ</sub>	40mA <sub>typ</sub>
Play	100mA <sub>typ</sub>	150mA <sub>typ</sub>
Start Up	100mA	500mA <sub>max</sub>

For laser diode at end of lifetime add 30mA to +5V supply current.

Next figure shows typical current on +A line:



Maximum ripple: +5V: ripple determines audio performance. Measurement shows a dependency of  $\approx 0.3\text{dB/mV}_{\text{ripple}}$  (100Hz ripple on +5 line)

Line drops: +A: 1.5V<sub>pp</sub> with max. slope of 50 mV/s

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96-08-27	3						
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## 11. Application Notes

### 11.1 Supply / Supply switching Concept :

There are 2 supply inputs to the module :

+A Conn. 1802 (Supply) pin 1

This voltage supplies servo driver amp's etc. and can be applied continuously; there is however a current flow of 40mA<sub>typ</sub> (bias current of servo driver amp's, etc.) even if the 5V Supply (see below) is switched off. A zero power standby solution can be realized by switching +A line off externally.

+5 Conn. 1802 (Supply) pin 3

This voltage supplies the digital circuit (Servo Processor, Decoder, DAC) and shall be applied only if the CD part has to be active (e.g. mode selector in position CD) to prevent interference to other parts of the set (tuner) in non-CD modes.

The 5V line is also used to supply the DAC; for a good audio performance care has to be taken to keep the low frequency ripple as low as possible.

### 11.2 Ground Concept

There are 3 ground connections to the module.

GND Conn. 1802 (Supply) pin 2 'Supply Ground'

This is the ground connection to servo amplifiers, digital circuits. etc.

As this line carries high and 'noisy' currents it shall be connected directly to the central ground reference point of the set (main filter capacitor in the power supply)

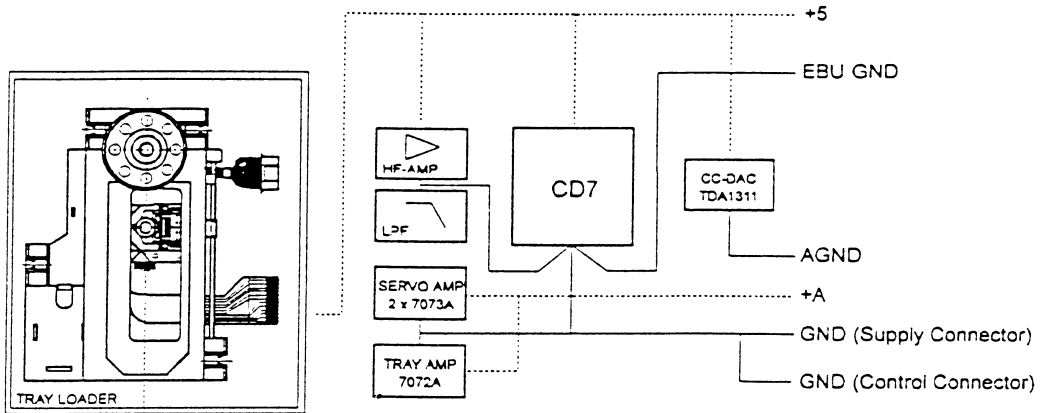
AGND Conn. 1802 (Audio) pin 5 'Audio Ground'

*Non bitstream* version: This is the ground connection for the audio output part (DAC TDA1311) and shall be routed in parallel to the audio signals. Ultimately it has to be connected to the same potential as the supply ground. GND and AGND are *not* connected inside the ECO-SL module.

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GND Conn 1804 (Control) pin 3 'Supply Ground'  
 Same ground as 1802, pin 2. Should be used to improve EMC. Please note that this line is only allowed to carry signal return currents.

The next figure shows supply and grounding concept of *non bitstream* ECO-SL MKII.



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