STUDER

PROFESSIONAL AUDIO EQUIPMENT

Service Information

SOFTWARE 20/89 UP-DATE KIT
FOR A820 MCH
20.100.820.70

SI 128/89   E   10.85.7040

1. Application

The A820 MCH software 20/89 contained in the present update kit
(Order No. 20.100.820.70) replaces the software versions listed
below and any test software version that was issued in the past.

You are requested to report the execution of the present software
modification by utilizing the enclosed report form, which has to
be returned to STUDER INTERNATIONAL AG, Attn. Service Dept.

The EPROMs (50.14.0125) that are to be exchanged can be recycled
and are expected to be received back at STUDER INTERNATIONAL AG
after the modification has been carried out.

In case these components are not returned they will be invoiced.

We thank you for your co-operation in this matter.

Software versions to be replaced:

Tape Deck software	14/10/87 or 06/88 or 35/88
Master software	10/10/87 or 35/88
Capstan software	17/87
Audio software	14/10/87 or 35/88
VU-Panel software	41/87 or 35/88
Audio Remote software	41/87 or 35/88
(for Audio Remote 8CH 21.328.501.00 and Audio Remote 24CH 21.328.503.00)	
Audio Remote Interface software	41/87
(for Parallel Channel Control IF 21.328.500.00)	

Software versions that remain unchanged:

Note: For completeness' sake, this software is also part of
         the present update kit. If you do not need this soft-
         ware because it is already fitted on the machines you
         are going to update, simply send the corresponding
         EPROMs back to STUDER INTERNATIONAL, together with
         the other EPROMs you have exchanged. Thank you.

Capstan software   35/88   (Order No. 1.820.994.25)
Parallel Channel Ctrl IF software 22/88   (Order No. 1.820.984.23)
(for the Parallel Channel Control Interface 21.328.500.00)

Important:

- The previous hardware updates described in the Service
Informations SI 110/87 (Order No. 10.85.5950) and SI 120/88
(Order No. 10.85.6061) must have been performed on the machines
to be equipped with the new software 20/89.

- The A820 MCH software 20/89 should be fitted on all existing
machines. It is absolutely necessary for all machines equipped
with the DOLBY Cat.300 Interface.

- The present software set works only in this combination, i.e.
MASTER 20/89, AUDIO 20/89, TAPE DECK 20/89, VU-PANEL 20/89,
CAPSTAN 35/88, PAR. CH. CTRL. IF 22/88. Do not fit any
combinations consisting of this release mixed with older
releases.

Control sheet for SW Update Kit

A820 MCH 1" & 2"   20.100.820.70

Please fill in this control sheet after the software update has been completed and send it back to :

STUDER INTERNATIONAL AG
Secretary Engineering Dept.
CH-8105 REGENSDORF
SWITZERLAND

Representative/Company :....................................

A820 MCH Serial Nr(s)   :....................................

                        :....................................

                        :....................................

Date   :....................................

Engineer
Name / Signature   :....................../...................

2. Summary of software changes

- Drop In/Out performance has been improved in terms of timing (seamless Drop In / Drop Out).

- The equalization (EQ) standard values for NAB/CCIR RECORD EQ at 7.5 ips (for 24-CH heads only !) have been changed in the present Audio SW 20/89 from   D3 to AA   (CCIR Record 7.5 ips)
                        DE to B8   (NAB Record 7.5 ips)
to adapt to the head characteristics.
Make sure that the old values (D3 for CCIR, DE for NAB) are kept in the RAM of the Audio MPU on the machines that you update with SW 20/89. (Refer to section 4.4.7 of the manual)
Attached is a list of the standard EQ values for A820 MCH.

- Operation with the TIME LINE LINX synchronizer system is now reliable.

- Improved software monitoring of hardware and supply voltage break downs around the different tacho signals (spooling motor tachos, move sensor tacho), coupled with preciser error messages. See attached list of error messages.

- Headblock identification improved with error message "HEAD NOT IDENTIFIED" in case of wrong Identification code coming from the Head Assembly Identifier PCB 1.820.795.00 on the head block assembly.

- Transport stop is issued in AUTOREC ALIGNMENT as soon as the alignment is completed.

- When the Parallel Channel Control IF (21.328.500.00) is activated, the message in the LC-display on the panel has been changed to "CONSOLE REMOTE IF ENABLED" to avoid confusion with the Audio remote control.

- The bargraph resolution at low levels has been improved (-20 dB indication).

- The NRS status of the different channels is stored in the channel setting memory as well.

- The REMOTE function (F 345 & F 346) for the activation of the tape deck remote controls and the RS 232 interface can now be switched also when no tape is threaded.

- Suppressing the TAPE GUARD function (F 201 & F 202) by holding down the fast forward or rewind key continuously is no longer possible from the tape deck remote controls.

- Autolocator: programming of PREROLL and POSTROLL parameters works now correctly, as described in the Autolocator operating instructions (No. 10.27.1070).

- Revised display messages and instructions for manual and automatic alignment of internal noise reduction systems. See attached alignment instructions.

- The exactitude of the Dolby Noise display on the bargraphs has been improved.

- Software adaptation for the control of the new Dolby Cat. 300/350/450 interface.
Attached are signal flow diagrams for the different operating modes of the A820 MCH with Dolby Cat. 300/350/450 .

- Automatic recognition of Dolby Cat. 300/350/450 circuits with the Dolby Cat.300/350/450 interface.

Newly implemented functions:

- <u>F 059   GROUP SELECT Y/N</u>
  not functional yet

- <u>F 061   DROP OUT DELAY Y/N</u>
  Drop Out delay activated ("YES") or not activated ("NO") in DELAY INHIBIT mode.

- <u>F 203   TIMER RESOLUTION A/B</u>
  Tape counter indicates with a resolution of seconds ("B") or tenths of seconds ("A"). Works also with transport remote controls.

3. Contents of the update kit

- 1 SI 128/89   10.85.7040
- 1 Label index .22   1.101.002.22
- 3 Label index .23   1.101.002.23
- 2 Label index .24   1.101.002.24
- 1 Label index .26   1.101.002.26

- TD software   20/89   1.820.985.23
  consisting of 2 EPROMs IC 16 (8000) checksum: 7122
                          IC 18 (C000) checksum: 99AF

- Master software   20/89   1.820.986.22
  consisting of 3 EPROMs IC 15 (4000) checksum: B437
  ATTENTION:
  this EPROM is of the type 27513 (paged EPROM) No. 50.14.2001 !
                          IC 16 (8000) checksum: 2E03
                          IC 18 (C000) checksum: D36C

- Audio software   20/89   1.820.987.23
  consisting of 3 EPROMs IC 15 (4000) checksum: 3D5B
                          IC 16 (8000) checksum: B135
                          IC 18 (C000) checksum: B39E

- VU-panel software   20/89   1.820.988.24
  consisting of 1 EPROM IC 18 (C000) checksum: 9FBF

- Audio Remote software   20/89   1.820.988.24
  consisting of 1 EPROM IC 18 (C000) checksum: 9FBF

- Capstan software   35/88   1.820.994.25
* consisting of 1 EPROM IC 17 (C000) checksum: D71A

- Parallel Channel Ctrl. IF software   22/88   1.820.984.23
* consisting of 1 EPROM IC 18 (C000) checksum: C4A2

All EPROMs are of the type 27128 (16k)   50.14.0125
except IC 15 of the Master software 1.820.986.22,
which is of the type 27513 (16k x 4 pages)   50.14.2001

*: see note page 1.

4. Modification instructions

Preparatory Steps

- Carry out an audio parameter back up (see manual A820 MCH Section 4.8).

- Write down tape deck alignment data:

```
. SET LIBR. WIND SPEED    A:              B:
. SET MAX.  WIND SPEED     A:              B:
. SET ROLLBACK TIME        :
. SET MAX. REEL            :
. SET PLAY TENSION         A: Left:       Right:
                           B: Left:       Right:
. SET WIND TENSION         A:              B:
. SET EDIT TENSION         A:              B:
. SET REV PLAY TENSION     A: Left:       Right:
                           B: Left:       Right:
. SET ES-BUS ADDRESS      MSB:            LSB:
. BIN RS 232/422 FORMAT    :
. ASCII RS 232 BAUD RATE   :
. ASCII RS 232 MODE        :
. TRIM NOMINAL SPEED       :
  (Default value)
```

- Write down Audio Keys/Mode data:

```
. 009 L RANGE 0/6          :
. 010 L RANGE 4/10         :
. 011 L RANGE 8/14         :
. 012 L RANGE 10/16        :
. 052 AUTO INPUT          A:    B:
. 053 METERING  VU/PPM     :
. 054 NRS DOLBY/TELCOM     :
. 055 DOLBY A/SR           :
. 056 TELCOM c4D/c4E       :
```

– Write down Tape Deck Keys/Mode data:

- 201 TAPE GUARD A   :
- 202 TAPE GUARD B   :
- 212 7.5 IPS   :
- 213 15 IPS   :
- 214 30 IPS   :
- 216 7.5/15 IPS   :
- 217 15/30 IPS   :
- 219 7.5/15/30 IPS   :
- 230 FADER MASTER ENABLE :
- 231 FADER A   :
- 232 FADER B   :
- 233 FADER C   :
- 234 FADER D   :
- 241 VARISPEED %   :
- 242 VARISPEED HT   :
- 243 VARISPEED IPS   :
- 244 –"– %/IPS/HT   :
- 245 –"– IND. ENHANCED   :
- 246 SAVE KEY SETTING   :
- 247 PROGRAM DISABLE   :
- 252 SHUTTLE MODE   :
- 253 WIND MODE   :
- 254 EDIT MODE   :
- 255 REC. INDIC. MODE   :
- 257 LIFTER REMOTE   :
- 258 LIFTER LOCAL   :

MPU-Audio 1.820.782.xx

- Remove RAM IC 8 and erase its contents by short circuiting the pins with each other. All variable parameters will now be lost Insert RAM again.
Note: This device is electrostatically sensitive.

- Remove EPROMs IC 15 (4000), IC 16 (8000) IC 18 (C000) and replace by new Audio software 1.820.987.23 IC 15 (4000), IC 16 (8000), IC 18 (C000).

- MPU-Audio 1.820.782.xx changes to index .23 .
Attach Label .23 (1.101.002.23).

MPU-Master 1.820.784.xx

- Remove RAM IC 8 and erase its contents by short circuiting the pins with each other. All variable parameters will now be lost. Insert RAM again.
Note: This device is electrostatically sensitive.

- Remove EPROMs IC 15 (4000), IC 16 (8000), IC 18 (C000) and replace by new Master software 1.820.986.22 IC 15 (4000), IC 16 (8000), IC 18 (C000).
Note: IC 15 must be of the type 27513 (50.14.2001) !

- MPU-Master 1.820.784.xx changes to index .22 .
Attach Label .22 (1.101.002.22).

MPU-TD Control 1.820.781.xx

- Remove EPROMs IC 16 (8000), IC 18 (C000) and replace by new Tape Deck software 1.820.985.23 IC 16 (8000) and IC 18 (C000).

- MPU-TD Control 1.820.781.xx changes to index .23 .
Attach Label .23 (1.101.002.23).

MPU-VU-Panel 1.820.783.xx

- Remove RAM IC 8 and erase its contents by short circuiting the pins with each other. All variable parameters will now be lost. Insert RAM again.
Note: This device is electrostatically sensitive.

- Remove EPROM IC 18 (C000) and replace by new VU-Panel software 1.820.988.24 IC 18 (C000).

- MPU-VU-Panel 1.820.783.xx changes to index .24.
Attach label .24 (1.101.002.24).

MPU-VU-Panel 1.820.783.xx   in
<u>Audio Remote Control 21.328.501.00 (8CH) / 21.328.503.00 (24CH)</u>

- Remove RAM IC 8 and erase its contents by short circuiting the
pins with each other. All variable parameters will now be lost
Insert RAM again.
<u>Note:</u> This device is electrostatically sensitive.

- Remove EPROM IC 18 (C000) and replace by new VU-Panel software
1.820.988.24 IC 18 (C000).

- MPU-VU-Panel 1.820.783.xx changes to index <u>.24</u>.
Attach label <u>.24</u> (1.101.002.24).

*   <u>MPU-Capstan Control 1.820.764.xx</u>

- Remove EPROM IC 17 (C000) and replace by new Capstan software
1.820.994.25 35/88 IC 17 (C000).

- MPU-Capstan Control 1.820.764.xx changes to index <u>.26</u> .
Attach Label <u>.26</u> (1.101.002.26).

*   MPU-Audio Remote IF 1.820.787.xx
     <u>Parallel Channel Control Interface 21.328.500.00</u>

- Remove EPROM IC 18 (C000) and replace by new software
1.820.984.23 22/88 IC 18 (C000).

- MPU-Audio Remote IF 1.820.787.xx changes to index <u>.23</u> .
Attach Label <u>.23</u> (1.101.002.23).

*: see note page 1.

5. Putting into operation

- Switch tape recorder ON. After a short time the error message
"DATA LOST" will appear on the LC-display and the message
"ERROR" will appear on the counter display. Switch the recorder
OFF and ON again. The recorder is now ready for operation. Press
both STORE buttons to clear the error messages.

- Load the Audio parameter again.

- Load and check tape deck alignment:

      . SET LIBRABY WIND A / B
      . SET MAX. WIND SPEED A / B
      . SET ROLLBACK TIME
      . SET MAX. REEL SIZE
      . SET PLAY TENSION A: LEFT/RIGHT   B: LEFT/RIGHT
      . SET WIND TENSION A / B
      . SET EDIT TENSION A / B
      . SET REV PLAY TENSION A: LEFT/RIGHT   B: LEFT/RIGHT
      . SET ES BUS ADDRESS
      . BIN RS 232/422 FORMAT
      . ASCII RS 232 BAUD RATE
      . ASCII RS 232 MODE
      . TRIM NOMINAL SPEED

- Check programming of soft keys:

      . F 009 to F 056
      . F 102 to F 104
      . F 201 to F 258
      . F 301 to F 351

- Reprogram one key. This action deletes the error message
  "Default keys loaded".

STANDARD EQ VALUES FOR STUDER A820 MCH   (Tape A & B)

			8/16 CH	24 CH		
CCIR	7.5 ips	Repro	7C	7C		
		Record	A2	D3 —> AA	(with Audio SW 20/89)
		Sync	7C	97		
CCIR	15 ips	Repro	44	4F		
		Record	BA	C0		
		Sync	44	58		
CCIR	30 ips	Repro	26	2C		
		Record	D3	D3		
		Sync	26	2C		
NAB	7.5 ips	Repro	69	69		
		Record	A9	DE —> B8	(with Audio SW 20/89)
		Sync	69	85		
NAB	15 ips	Repro	61	69		
		Record	99	AA		
		Sync	61	79		
NAB	30 ips	Repro	26	2C		
		Record	D3	D3		
		Sync	26	2C		

ADDENDUM TO A820 MCH – MANUAL, SECT. 2.6.1:
"Error Messages of the Service Display"

DISPLAY	CAUSE
category 1:	
SPOOLING MOTOR TACHO LEFT	Left Spooling Motor tacho 1.820.771 shows too frequent direction changes or no tacho signals. Remedy: replace, repair or realign (if possible)
SPOOLING MOTOR TACHO RIGHT	Right Spooling Motor tacho 1.820.771 shows too frequent direction changes or no tacho signals. Remedy: replace, repair or realign (if possible)
SPOOLING MOTOR SERVO HARDWARE	Fault in the analog control circuit of the spooling motors or Voltage missing or Current feedback open. Remedy: check voltages and signals on the following PCBs: – Move Sensor 1.820.770 – Sp. Motor Drive Amp 1.820.875
category 3:	
HEAD NOT IDENTIFIED	Machine switched on with no head block mounted or wrong identification code coming from the Head Assembly Identifier PCB 1.820.795.00 (on the head block) Remedy: put head block on the machine or check Head Assembly ID PCB.

Note :   the following error messages have been placed in
          category 1:
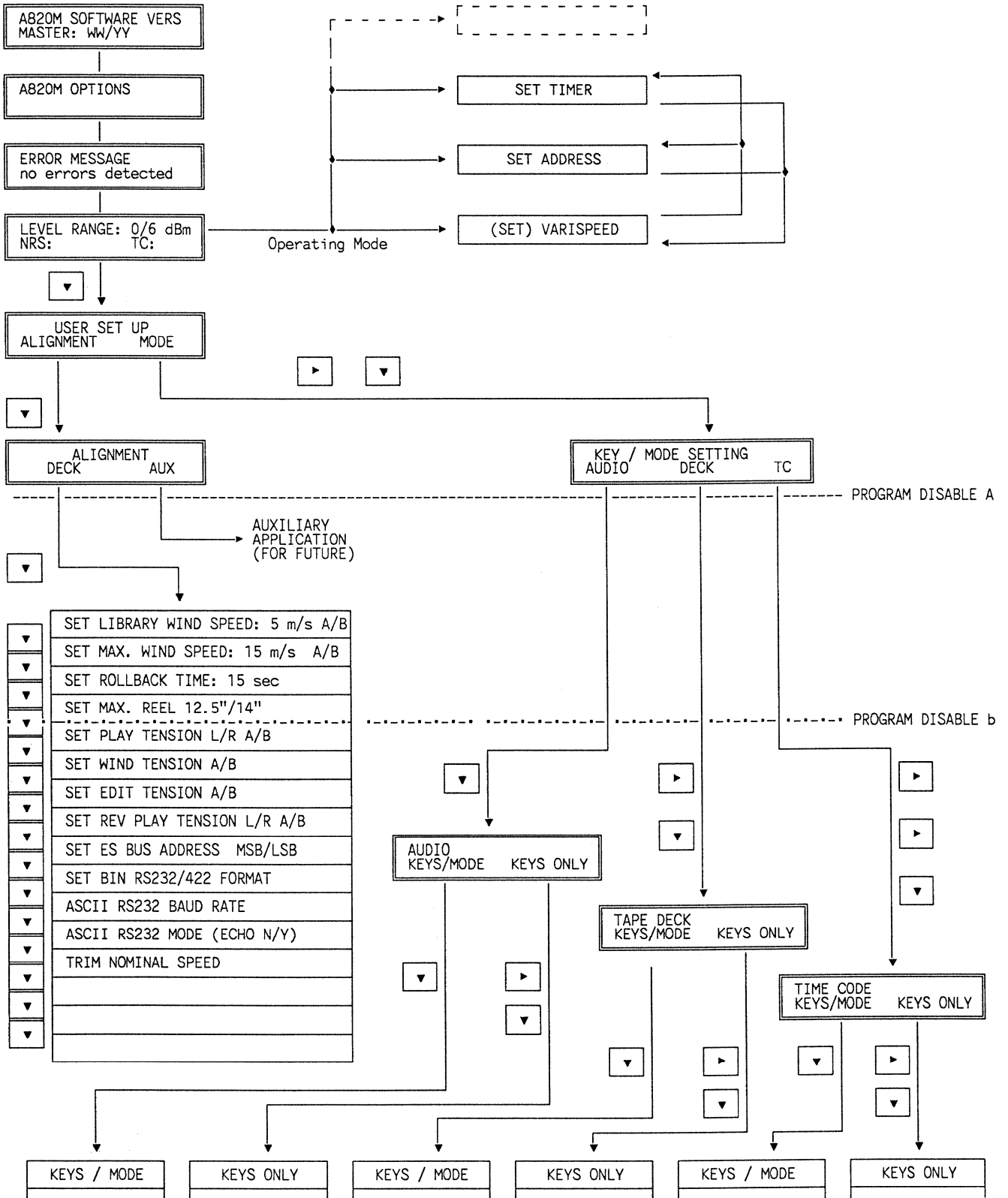
          "TACHO SENSOR"
          "TAPE TENSION CONTROL"
          "MOVE SENSOR HARDWARE"
          "NO COMMUNICATION MASTER - TAPE DECK"
          "NO COM. MASTER - AUDIO"
          "NO COM. CAPSTAN - TAPE DECK"

Status tree diagram

```
┌──────────────────────┐              ┌ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┐
│ A820M SOFTWARE VERS  │              
│ MASTER: WW/YY        │              └ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘
└──────────────────────┘
          │
┌──────────────────────┐              ┌──────────────────────┐
│ A820M OPTIONS        │              │      SET TIMER       │
└──────────────────────┘              └──────────────────────┘
          │
┌──────────────────────┐              ┌──────────────────────┐
│ ERROR MESSAGE        │              │     SET ADDRESS      │
│ no errors detected   │              └──────────────────────┘
└──────────────────────┘
          │
┌──────────────────────┐              ┌──────────────────────┐
│ LEVEL RANGE: 0/6 dBm │   Operating  │   (SET) VARISPEED    │
│ NRS:        TC:      │     Mode     └──────────────────────┘
└──────────────────────┘
     [▼]  │
┌──────────────────────┐
│ USER SET UP          │      [►]  [▼]
│ ALIGNMENT     MODE   │
└──────────────────────┘
  [▼]     │                                    ┌──────────────────────┐
┌──────────────────────┐                       │ KEY / MODE SETTING   │
│     ALIGNMENT        │                       │ AUDIO    DECK    TC  │
│ DECK           AUX   │                       └──────────────────────┘
└──────────────────────┘
```
--- PROGRAM DISABLE A

```
                AUXILIARY
                APPLICATION
                (FOR FUTURE)
  [▼]
┌──────────────────────────────────────────┐
│ SET LIBRARY WIND SPEED: 5 m/s A/B        │
├──────────────────────────────────────────┤
│ SET MAX. WIND SPEED: 15 m/s   A/B        │
├──────────────────────────────────────────┤
│ SET ROLLBACK TIME: 15 sec                │
├──────────────────────────────────────────┤
│ SET MAX. REEL 12.5"/14"                  │
├──────────────────────────────────────────┤
│ SET PLAY TENSION L/R A/B                 │
├──────────────────────────────────────────┤
│ SET WIND TENSION A/B                     │
├──────────────────────────────────────────┤
│ SET EDIT TENSION A/B                     │
├──────────────────────────────────────────┤
│ SET REV PLAY TENSION L/R A/B             │
├──────────────────────────────────────────┤
│ SET ES BUS ADDRESS   MSB/LSB             │
├──────────────────────────────────────────┤
│ SET BIN RS232/422 FORMAT                 │
├──────────────────────────────────────────┤
│ ASCII RS232 BAUD RATE                    │
├──────────────────────────────────────────┤
│ ASCII RS232 MODE (ECHO N/Y)              │
├──────────────────────────────────────────┤
│ TRIM NOMINAL SPEED                       │
├──────────────────────────────────────────┤
│                                          │
│                                          │
│                                          │
└──────────────────────────────────────────┘
```
·─· PROGRAM DISABLE b

```
                    ┌──────────────────────┐
                    │ AUDIO                │
                    │ KEYS/MODE   KEYS ONLY│
                    └──────────────────────┘

                              ┌──────────────────────┐
                              │ TAPE DECK            │
                              │ KEYS/MODE   KEYS ONLY│
                              └──────────────────────┘

                                        ┌──────────────────────┐
                                        │ TIME CODE            │
                                        │ KEYS/MODE   KEYS ONLY│
                                        └──────────────────────┘
```

KEYS / MODE	KEYS ONLY	KEYS / MODE	KEYS ONLY	KEYS / MODE	KEYS ONLY

CONTINUE

AUDIO   TAPE DECK

KEYS / MODE	KEYS ONLY	KEYS / MODE
009 L RANGE 0/6 dBm	102 SPOT ERASE	201 TAPE GUARD A Y/N
010 L RANGE 4/10 dBm	104 AUDIO REMOTE IF	202 TAPE GUARD B Y/N
011 L RANGE 8/14 dBm		203 TIMER RESOLUTION A/B
012 L RANGE 10/16 dBm		212 7.5 IPS
052 AUTO INPUT A/B		213 15 IPS
053 METERING VU/PPM		214 30 IPS
054 NRS DOLBY/TELCOM		216 7.5/15 IPS
055 DOLBY A/SR		217 15/30 IPS
056 TELCOM c4D/c4E		219 7.5/15/30 IPS
059 GROUP SELECT Y/N		230 FADER MASTER ENABLE
061 DROP OUT DELAY Y/N		231 FADER A
		232 FADER B
		233 FADER C
		234 FADER D
		241 VARISPEED %
		242 VARISPEED HT
		243 VARISPEED IPS
		244 –"– %/IPS/HT
		245 –"– IND. ENHANCED
		246 SAVE KEY SETTING
		247 PROGRAMM DISABLE A/B
		252 SHUTTLE A/B
		253 WIND A/B
		254 EDIT A/B
		255 REC. INDIC. MODE A/B
		257 LIFTER REMOTE A/B
		258 LIFTER LOCAL A/B

TIME CODE

CONTINUE

TAPE DECK | | TIME CODE |

KEYS ONLY
301   REWIND
302   FORWARD
303   LIBRARY WIND
304   PLAY
305   REVERSE PLAY
306   STOP
307   RECORD A
308   RECORD B
309   EDIT
311   TRANSFER
312   HOLD
313   LOCATE 1
314   LOCATE 2
315   LOCATE 3
316   LOCATE 4
317   LOCATE 5
318   LOCATE ZERO
319   LOC START PLAY
320   LOC START STOP
321   LOC START REC
322   ROLLBACK PLAY
323   ROLLBACK STOP
324   ROLLBACK REC
325   BACKSPACE STOP
327   TAPE DUMP A
328   TAPE DUMP B
329   TAPE DUMP C
330   TAPE DUMP D
332   LIFTER
334   LAP/WATCH DISPLAY
335   RESET TIMER
336   SET TIMER
337   SET ADDRESS
338   SET VARISPEED
339   VARISPEED ON/OFF
345   REMOTE A R CTL ONLY
346   REMOTE B REM+LOCAL
347   SHUTTLE BAR
348   UNLOAD
351   NO FUNCTION

KEYS / MODE
401   FUTURE USE

KEYS ONLY
501   FUTURE USE

4.5.5
A820 MCH Dolby/Telcom Alignment Instructions

Instructions for the use of:
- Dolby A
- Dolby SR (Spectral Recording)
- Telcom c4

Noise Reduction modules with STUDER A820 MCH starting with the following combination of software versions:

TD software	20 / 89
Master software	20 / 89
Audio software	20 / 89
Capstan software	35 / 88
VU-Panel/Audio Remote software	20 / 89

Remarks:
- The TELCOM system is related to peak recording level. The DOLBY systems are related to operating level.
- Channels with activated NR system will switch automatically from REPRO to INPUT at drop-in, and back to REPRO at drop-out. It is possible, however, to select REPRO manually during recording.
- In "NRS TONE" and "NRS ALIGN" modes, the NR system will automatically switch to "BYPASS" for alignment and measuring purposes (Audio Alignment). The Record- and Reproduce adjustments of the machine are not influenced by the Noise Reduction System.
- The function "UNCAL MODE (ON/OFF)" allows in position "UNCAL MODE" (LED shines) an individual level setting for each channel. In position "CAL MODE" the same level setting is used for all channels. Both level settings are totally independent and do not influence each other.
  The CAL MODE may be used as the "In-House Standard" whereas the UNCAL MODE is used for incoming customer tapes which need individual channel setting.

Attention: The key "UNCAL MODE (ON/OFF)" is also an <u>operating key</u>. This means that it must be selected according to the desired mode (CAL/UNCAL MODE) in normal operation mode (NRS ALIGN = OFF).

Level Standardisation with Dolby systems

Dolby A-type and Dolby SR are complementary systems: that is, the processing applied during playback is a mirror image of that applied when recording. In addition, the process is dependant on both level and frequency of the signal being recorded. This gives great flexibility in the way that the processing adapts to the incoming signal, but it means that for correct operation the levels in the playback processor must be the same as those in the record processor when the recording was made. In most studios all this really means is that the recorder should be at unity gain which is the normal situation.
To ensure that the play processor gets this same signal level as the original record processor (which may be in a different studio) it is necessary to record a test signal onto the tape to indicate how the Dolby processing was set when the recording was made. To facilitate this, reference signals unique to Dolby systems are used to indicate Dolby level.

Dolby Reference Signals

Dolby tone (for A-type recordings) is 850 Hz, with a short (30 milliseconds) upward frequency modulation to 935 Hz roughly every three-quarters of a second. This produces a characteristic warble sound which is quite unmistakable. Dolby tone is recorded at Dolby level.
Dolby noise (for SR recordings) is pink noise with a 20 millisecond pause ("nick") every 2 seconds. This too produces an easily-identifiable "signature". Dolby noise is recorded on tape at 15 dB below Dolby level, but this difference is accounted for when Dolby noise is replayed in the calibration mode.
A further use of Dolby noise is called Auto Compare. On playback the signal sent to the monitor alternates automatically between 4 seconds of the Dolby noise from tape and four seconds of pink noise. The nicks identify the tape section, and two lights on the module provide a confirming indication. It is remarkably easy to listen and compare the

levels and frequency response of the complete recording chain in a very sensitive manner. While the SR process is less sensitive to any errors than the A-type system, it is extremely easy to detect small errors which the operator may wish to correct.

The Dolby reference signals will also identify which tracks have been recorded with Dolby processing, as the Dolby tone/noise can only be recorded on tracks where the relevant Dolby processing is switched on.

Dolby Level

On analogue audio tape, Dolby level will typically be between 185 nWb/m and 320 nWb/m. The choice of which level to adopt will depend on operating levels and local tape interchange standards. As a guide, most studios use Dolby level that corresponds to "0" VU or -6 dB peak on their recorder meters.

It is an extremely good practice to lay down a few seconds of Dolby tone/noise at the beginning of a new reel or recording so that a future recipient of the tape (maybe in a different country, for example) knows what Dolby level was used. Provided he adjusts his machine so that this section plays back at Dolby level on his meters, decoding will be correct.

NRS Level Indication

Stand-alone noise reduction units manufactured by Dolby Laboratories all have a meter specifically for indicating Dolby level, and a push-button labelled "Set Up" ("Dolby Tone/Cal" on older units) which is used when aligning the system.

The Set up button does the following:
- The factory calibrated Dolby processing is switched out, allowing the alignment of the interface to be observed
- Dolby tone/noise as appropriate is sent to the tape in the Record mode
- The Dolby level meter always reads signal returned from tape. In the case of Dolby SR, where the reference Dolby noise is recorded 15 dB below Dolby level, 15 dB of gain is inserted into the meter circuit and possibly misleading information from the frequency extremes is filtered out.
- Where SR is being used, and Dolby noise is being returned from tape, Auto Compare is initiated.

Exactly the same facilities are implemented on the STUDER A820 MCH. The "Set Up" ("Dolby Tone/Cal") button is replaced by the "NRS TONE" and "NRS ALIGN" buttons. When "NRS TONE" is pressed, Dolby Tone/Noise is sent to the tape. The "NRS ALIGN" button switches the A820 MCH metering to the calibration mode, and the LEDs at the zero point flash to show that this point now indicates Dolby level. The Dolby interface may then be aligned or adjusted via the associated software control.

NRS Interface Circuit

The NRS Interface circuitry of the A820 MCH contains two digitally controlled gain stages, one before the NR module and one after.

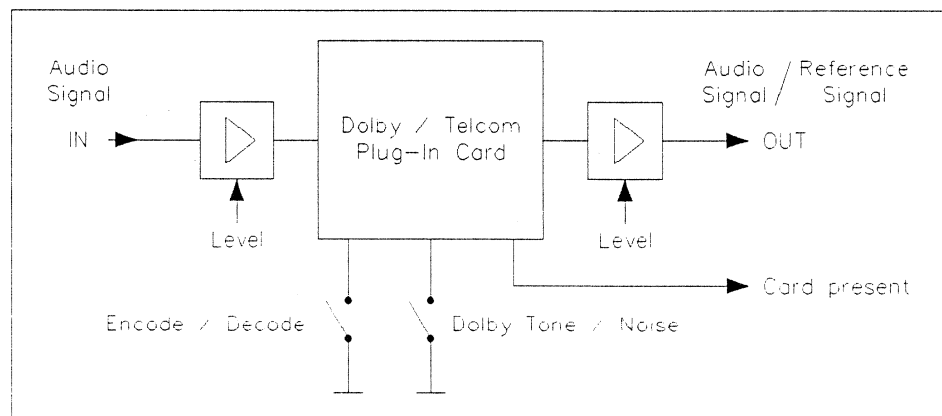
Fig. 4.5.5-1   Blockdiagram 1, default for:
Dolby SR Cat. 280
Dolby A Cat. 22
Telcom c4D
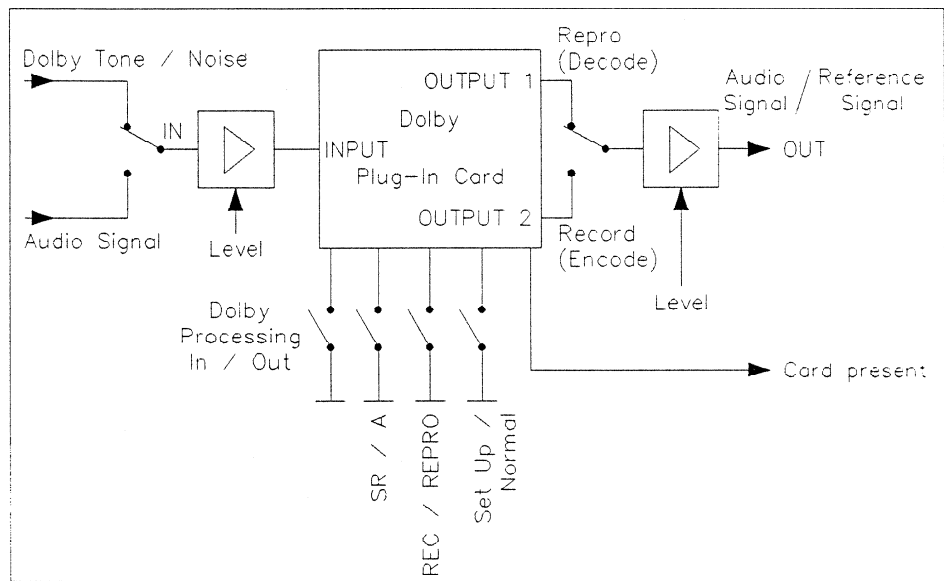
Fig. 4.5.5-2   Blockdiagram 2, default for:
                          Dolby SR/A Cat. 300
                          Dolby SR Cat. 350
                          Dolby A Cat. 450

The A820 MCH software sets the gain of these stages in such a way that the overall gain of the NRS Interface is always unity. The advantage of this arrangement is that the programme levels are independent of the setting of the NRS Interface. The only disadvantage is that any changes to "NRS LEVEL" are not reflected on either the recorder or console meters. However the current settings of the "NRS LEVEL" are precisely shown on the A820 MCH display, and may be adjusted if necessary.

In conventional multitrack operation, track monitoring is fed from the Repro or Sync signal when the recorder is in Play; in Record, track monitoring is fed from the input signal. (This is essential with synchronous overdubbing.) However with a tape recorder it is also possible to monitor from Repro while in Record. In the STUDER A820 MCH the same Dolby module is used for both record and play and its mode and position in the signal path are switched appropriately by the record/play logic in the A820. This is identical to the implementation in all stand-alone multitrack units manufactured by Dolby Laboratories. On such units a "Check Tape" facility is provided: this switches the off tape signal directly to the track monitoring. The signal is still Dolby encoded, but the quality of the recording channel can be checked. The same facility is available on the A820MCH, by switching to Repro when in the Record mode when Dolby processing is selected.

Note: All Dolby alignment is always carried out with the processing switched out, so that the interface levels can be correctly set. The Dolby processing itself is factory set and can not be adjusted. Due to its "intelligent" nature, different frequencies and levels are treated differently by Dolby processing. For this reason it is standard practice to switch out Dolby processing when aligning the recorder. This is automatically carried out both during the A820 software alignment procedures and whenever the "NRS TONE" button is pressed; however sending tone to tape subsequently, with processing on, may result in level change on tape. For example if tone at Dolby level is sent to any recorder via Dolby processing the following signal level changes may be observed on the recorder meters:

	Dolby-A	Dolby-SR
1 kHz	- ½ dB	≥ + ¼ dB
10 kHz	+ ¼ dB	-5½ dB
50 Hz	+ ¼ dB	-3 dB

Exactly the opposite will be seen on replay. (In fact this can be checked by playing back encoded tones through the Dolby processing - the signal returned to the console will be the same as that sent originally, provided recorder and NRS interface have been aligned.)

When recording studio reference tones therefore, care should be taken to ensure that the Dolby processing is switched out.

Using Dolby A-type modules:

Set functions No. 053 to "METERING VU", No. 054 to "NRS DOLBY", and No. 055 to "DOLBY A".

Using TELCOM c4D/c4E-type modules:

Set functions No. 053 to "METERING PPM", No. 054 to "NRS Telcom", and No. 056 to "TELCOM c4D or c4E".

Note: The following alignment instructions are written for Dolby NR-Systems. They also apply for TELCOM NR-Systems but Dolby Level is replaced by TELCOM Level and the LC-Display indicates in "dB"instead of "VU".

RECORD:

- Dolby Level = 0 VU: This is the default setting.

  Set "Dolby A CAL/UNCAL CH1-XY" to +0.0 VU on the LCD:
  - Press "NRS ON" and "ALL SAFE" to switch all NR-Systems on.
  - Press "NRS ALIGN".
  - Press "MANUAL ALIGN"; "UNCAL MODE" is automatically switched ON.
  - Switch the "UNCAL MODE" ON or OFF depending on whether the NR system has to be aligned for all channels (CAL MODE, In-house Standard) or for individual channels (UNCAL MODE, adjusting to a tape coming in from outside).
  - Set for +0.0 VU with the "PARAM UP/PARAM DOWN" buttons.
  - Press "STORE" if the level is reached.
  - Repeat the alignment for the remaining channels if "UNCAL MODE" is selected.
  - Press "NRS ALIGN" again to return to normal operating mode.
  To double check the level setting, press the "NRS TONE" button and record a section of tone on blank tape. The tone should read 0 VU when played back (either with the "NRS TONE" button still pressed or NR switched off).

- Dolby Level not at 0 VU:
  Example: 0 VU might correspond to a flux level of 320 nWb/m and the Dolby Level in use might be at 200 nWb/m. Playing a 200 nWb/m test tape on a machine which has been aligned for 320 nWb/m would give a reading of -4 VU.

  Set "Dolby A CAL/UNCAL CH1-XY" to -4.0 VU on the LCD:
  - Press "NRS ON" and "ALL SAFE" to switch all NR-Systems on.
  - Press "NRS ALIGN".
  - Press "MANUAL ALIGN"; "UNCAL MODE" is automatically switched ON.
  - Switch the "UNCAL MODE" ON or OFF depending on whether the NR system has to be aligned for all channels (CAL MODE), or for individual channels (UNCAL MODE).
  - Set for -4.0 VU with the "PARAM↑/PARAM↓" buttons.
  - Press "STORE" if the level is reached.
  - Repeat the alignment for the remaining channels if "UNCAL MODE = ON" is selected.
  - Press "NRS ALIGN" again to return to normal operating mode.
  To double check the level setting, press the "NRS TONE" button and record a section of tone on blank tape. The tone should read-4 VU when played back (either with the "NRS TONE" button still pressed or NR switched off).

REPRODUCE:

- Dolby Level = 0 VU;
  Press "NRS ON" and "ALL SAFE" to switch all NR-Systems on.
  With the "NRS ALIGN" button pressed, Dolby Tone reproduced from tape should read "0" (on channels with flashing middle LED).
  If this is the case then all is well.

- Dolby Level does not match 0 VU; If Dolby Tone from tape does not read "0" then the machine can be adjusted in 2 different ways:

A Manual Alignment
- Press "NRS ON" and "ALL SAFE" to switch all NR-Systems on.
- Press "NRS ALIGN".
- Press "MANUAL ALIGN"; "UNCAL MODE" is automatically switched ON.
- Switch the "UNCAL MODE" ON or OFF depending on whether the NR system has to be aligned for all channels (CAL MODE), or for individual channels (UNCAL MODE).
- Play the Dolby Tone section of the tape.
- Set for "0" (flashing middle LED) with the "PARAM UP/PARAM DOWN" buttons.
- Press "STORE" if the level is reached.
- Repeat the alignment for the remaining channels if "UNCAL MODE" is selected.
- Press "NRS ALIGN" again to return to normal operating mode.

B Automatic Alignment
- Press "NRS ON" and "ALL SAFE" to switch all NR-Systems on.
- Press "NRS ALIGN".
- Press "AUTO ALIGN"

Attention: switches automatically to UNCAL MODE!
- Play the Dolby Tone section of the tape.
- Press "STORE START"
- Press "NRS ALIGN" again to return to normal operating mode.

Remarks:
■ If the Dolby Tone section on the tape is too short to complete the automatic alignment process in one cycle, then press "LOC START" (LOC START PLAY must be programmed) before the end of the Dolby Tone in order to rewind and automatically continue the alignment process.
■ If one (or more) of the active channels cannot be aligned by the "AUTO ALIGN" routine, then the NR-System on the concerned channel(s) will be switched OFF and the error message "failed" appears.
■ If the machine has been adjusted to a pre-recorded tape with the automatic alignment procedure in UNCAL MODE, then the key "UNCAL MODE" must remain active (i.e. LED must shine) in normal operating mode!

Using Dolby Spectral Recording modules:
Set functions No. 053 to "METERING VU", No. 054 to "NRS DOLBY", and No. 055 to "DOLBY SR".
The alignment of SR differs from A-type in two aspects.
■ The alignment signal is pink noise rather than the familiar Dolby Tone. This noise signal known as "Dolby Noise" has short "gaps" every two seconds, similar to the warble in the DolbyTone.
■ Dolby Noise serves not only as a level reference but can be used to <u>check frequency response</u> as well. To facilitate frequency response checks, all SR processors include a facility known as AUTO COMPARE.

AUTO COMPARE works as follows:
■ In AUTO COMPARE, the module will output the following sequence:
4 seconds of noise from the tape followed by 4 seconds of noise from the internal generator. This sequence reveals audibly any level or response errors in the recorder including any Dolby Level misalignment.
The "tape" section of the noise has a 20 ms gap after 2 seconds; the "ref." section from the internal generator is continuous. Lights on the front of each Cat. No. 280 indicate which signal is being heard at any time.

On the rear of each Cat No 280 is a frame configuration switch used to configure the AUTO COMPARE system as appropriate for different types of interfaces. The switch is labeled "360", "361", and "M" for use with Dolby Laboratories models 360, 361, and M series. For use in the STUDER A820 MCH the switch should be set to the "360" position (to the edge).
On any of the units manufactured by Dolby Laboratories the meter gain of the unit is changed so that when the Dolby Tone button is pressed the meter will read on the

Dolby Level dot for noise recorded 15 dB below Dolby Level. The same feature is provided by the A820 MCH software, when "NRS ALIGN" is pressed and the NR-Systems are switched ON: the VU-Meter will read on the flashing middle LED for noise recorded at 15 dB below Dolby Level.

RECORD:

■ Dolby Level = 0 VU (Dolby Noise at -15 dB): This is the default setting.

Set "Dolby SR CAL/UNCAL CH 1-XY" to 0.0 VU if VU metering mode is selected, or to -6.0 dB if PEAK metering mode is selected.
-   Press "NRS ON" and "ALL SAFE" to switch all NR-Systems on.
-   Press "NRS ALIGN".
-   Press "MANUAL ALIGN"; "UNCAL MODE" is automatically switched ON.
-   Switch the "UNCAL MODE" ON or OFF depending on whether the NR system has to be aligned for all channels (CAL MODE, In-house Standard) or for individual channels (UNCAL MODE, adjusting to a tape coming in from outside).
-   Set for 0.0 VU (in VU metering mode), or -6.0 dB (in PEAK metering mode) with the "PARAM↑ /PARAM↓" buttons.
-   Press "STORE" if the level is reached.
-   Repeat the alignment for the remaining channels if "UNCAL MODE" is selected.
-   Press "NRS ALIGN" again to return to normal operating mode.
To double check the level setting, press the "NRS TONE" button and record a section of Dolby Noise on blank tape. The Dolby Noise will be recorded at a level of -15 dB below 0 VU. Rewind the tape. With the "NRS ALIGN" button pressed, Dolby Tone reproduced from tape should read "0" (on channels with flashing middle LED).
If this is the case then all is well.

■ Dolby Level not at 0 VU:
Example: 0 VU might correspond to a flux of 320 nWb/m and the Dolby Level in use might be at to 200 nWb/m. Playing a 200 nWb/m test tape on a machine which has been aligned for 320 nWb/m would give a reading of -4 VU.

Set "Dolby SR CAL/UNCAL CH 1-XY" to -4.0 VU on the LCD (or -10.0 dB PEAK):
-   Press "NRS ON" and "ALL SAFE" to switch all NR-Systems on.
-   Press "NRS ALIGN".
-   Press "MANUAL ALIGN"; "UNCAL MODE" is automatically switched ON.
-   Switch the "UNCAL MODE" ON or OFF depending on whether the NR system has to be aligned for all channels (CAL MODE), or for individual channels (UNCAL MODE).
-   Set for -4.0 VU (in VU metering mode), or -10.0 dB (in PEAK metering mode) with the "PARAM↑ /PARAM↓" buttons.
-   Press "STORE" if the level is reached.
-   Repeat the alignment for the remaining channels if "UNCAL MODE" is selected.
-   Press "NRS ALIGN" again to return to normal operating mode.
To double check the level setting, press the "NRS TONE" button and record a section of Dolby Noise on blank tape. The Dolby Noise will be recorded at -4 dB below -15dB, i.e. -19 dB below 0 VU in this case.
With the "NRS ALIGN" button pressed, Dolby Tone reproduced from tape should read "0" (on channels with flashing middle LED).
If this is the case then all is well.

REPRODUCE:

- Dolby Level = 0 VU (Dolby Noise at -15 dB):
  Press "NRS ON" and "ALL SAFE" to switch all NR-Systems on.
  With the "NRS ALIGN" button pressed, Dolby Tone reproduced from tape should read "0" (on channels with flashing middle LED).
  If this is the case then all is well.

- Dolby Level does not match 0 VU:
  If Dolby Noise from tape does not read "0" (with the "NRS ALIGN" button pressed) then the machine can be adjusted in 2 different ways:

A   Manual Alignment
  - Press "NRS ON" and "ALL SAFE" to switch all NR-Systems on.
  - Press "NRS ALIGN".
  - Press "MANUAL ALIGN"; "UNCAL MODE" is automatically switched ON.
  - Switch the "UNCAL MODE" ON or OFF depending on whether the NR system has to be aligned for all channels (CAL MODE), or for individual channels (UNCAL MODE).
  - Play the Dolby Noise section of the tape.
  - Set for "0" (flashing middle LED) with the "PARAM UP/PARAM DOWN" buttons.
  - Press "STORE" if the level is reached.
  - Repeat the alignment for the remaining channels if "UNCAL MODE" is selected.
  - Press "NRS ALIGN" again to return to normal operating mode.

B   Automatic Alignment
  - Press "NRS ON" and "ALL SAFE" to switch all NR-Systems on.
  - Press "NRS ALIGN".
  - Press "AUTO ALIGN".

Attention: switches automatically to UNCAL MODE!
  - Play the Dolby Noise section of the tape.
  - Press "STORE START".
  - Press "NRS ALIGN" again to return to normal operating mode.

Remarks:
- If the Dolby Noise section on the tape is too short to complete the alignment process in one cycle, then press "LOC START" (LOC START PLAY must be programmed) before the end of the Dolby Noise in order to rewind and automatically continue the alignment process.
- If one (or more) of the active channels cannot be aligned with the "AUTO ALIGN" routine, then the NR-System on the corresponding channel(s) will be switched OFF and the error message "failed" appears.
- If the machine has been adjusted to a pre-recorded tape with the automatic alignment procedure in UNCAL MODE, then the key "UNCAL MODE" must remain active (i.e. LED must shine) in normal operating mode!

AUTO COMPARE MODE: In either of the above cases you can check the level of the Dolby Noise on tape by pressing first "NRS ALIGN" and then "NRS TONE" ("AUTO COMPARE" mode) during reproduction of the Dolby Noise and "soloing" each monitor channel in turn. Both the "tape" and "ref." sections of Dolby Noise should be at the same level. The recorder meters will also alternate between "tape" and "ref.".
You can see this on the Dolby cartridges in the machine.
Differences between the two sections will show up as periodic changes in level. Set for minimum difference for each channel either by using the above AUTO ALIGN process or by using the Manual Alignment process described below.

Manual Alignment during   ■ Press "NRS ON" and "ALL SAFE" to switch all NR-Systems on.
AUTO COMPARE MODE   ■ Press "NRS ALIGN" and "NRS TONE"

■ Press "MANUAL ALIGN"; "UNCAL MODE" is automatically switched ON.

■ Play the Dolby Noise section of the tape.

■ "Soloing" each monitor channel in turn. Both the "tape" and the "ref." sections of the Dolby Noise should be at the same level. This may be done by ear or by using the meters.

■ Set for minimum level difference for each channel with the "PARAM UP/PARAM DOWN" buttons.

■ Press "STORE" if the level is reached.

■ Repeat the alignment for the remaining channels.

■ Press "NRS ALIGN" again to return to normal operating mode.
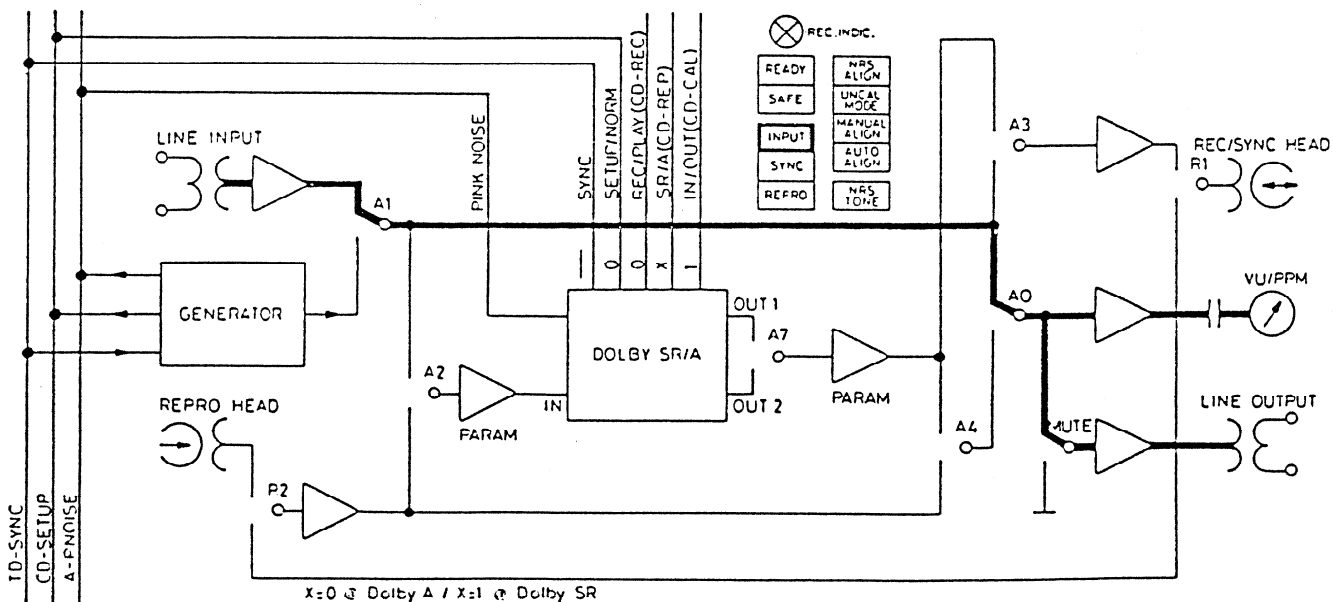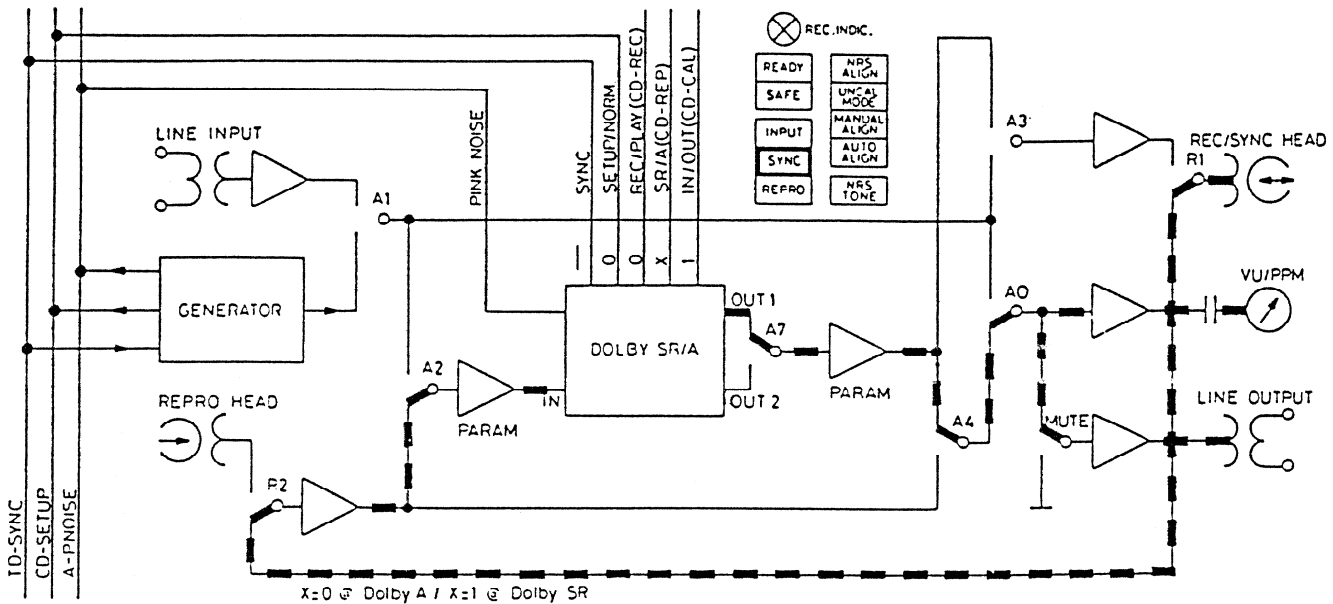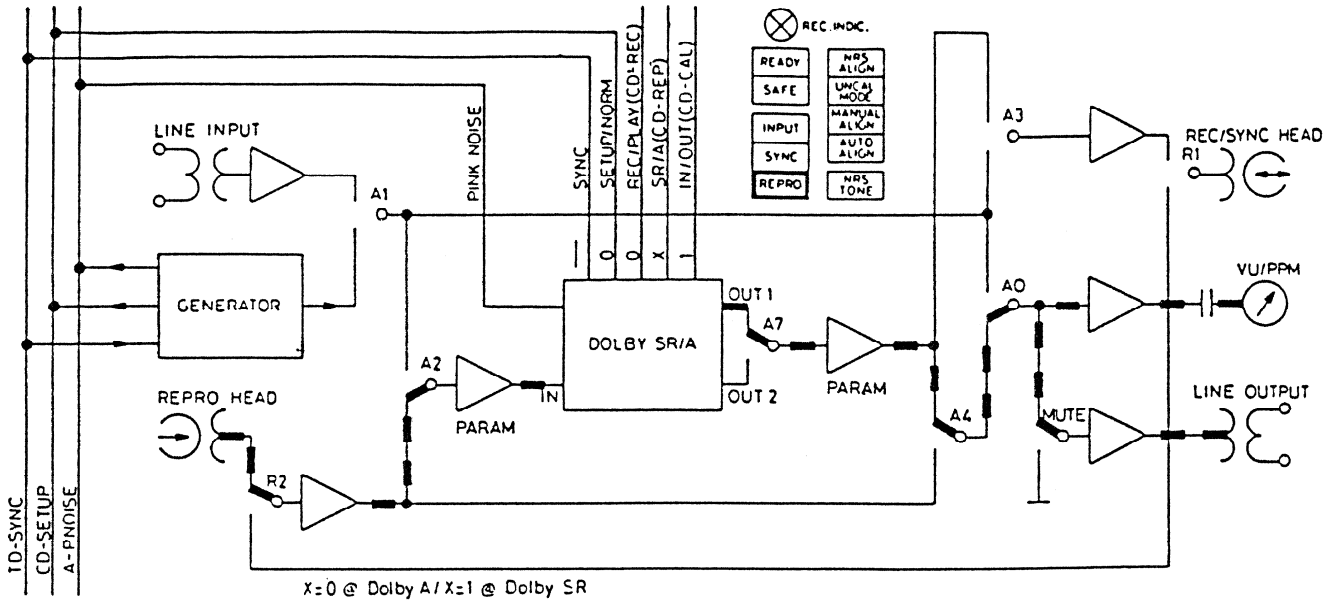
X=0 @ Dolby A / X=1 @ Dolby SR

X=0 @ Dolby A / X=1 @ Dolby SR

X=0 @ Dolby A / X=1 @ Dolby SR

X=0 @ Dolby A / X=1 @ Dolby SR

X=0 @ Dolby A / X=1 @ Dolby SR

Dolby A : Record Mode

Dolby SR : Noise sync Mode
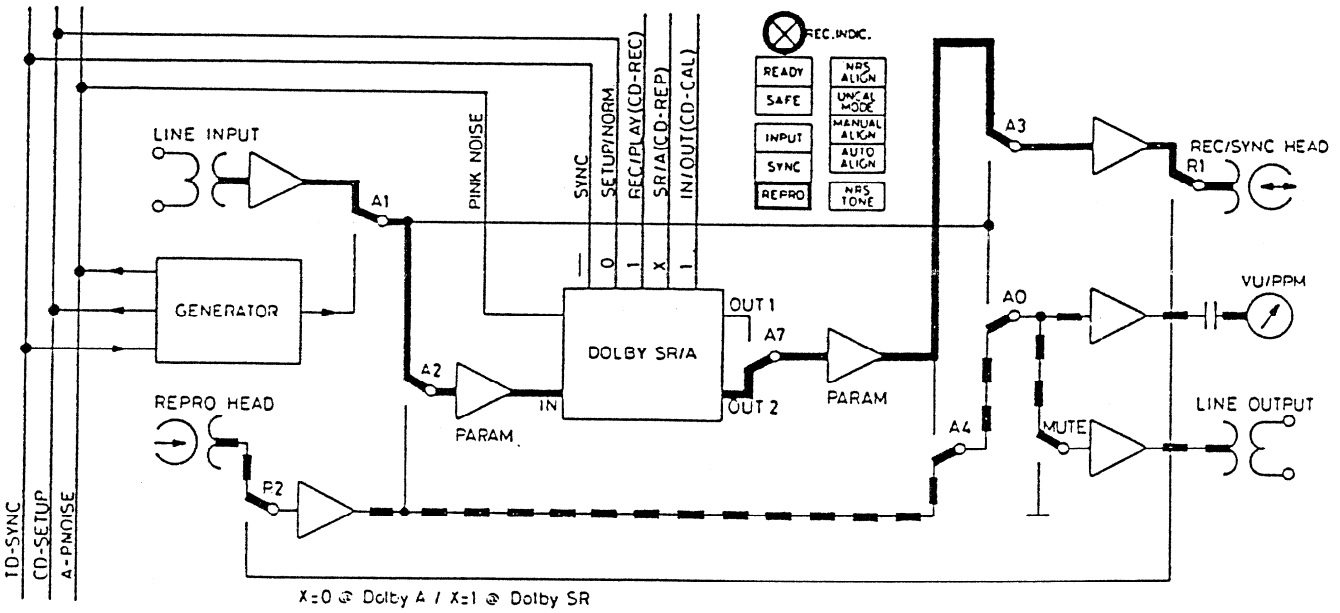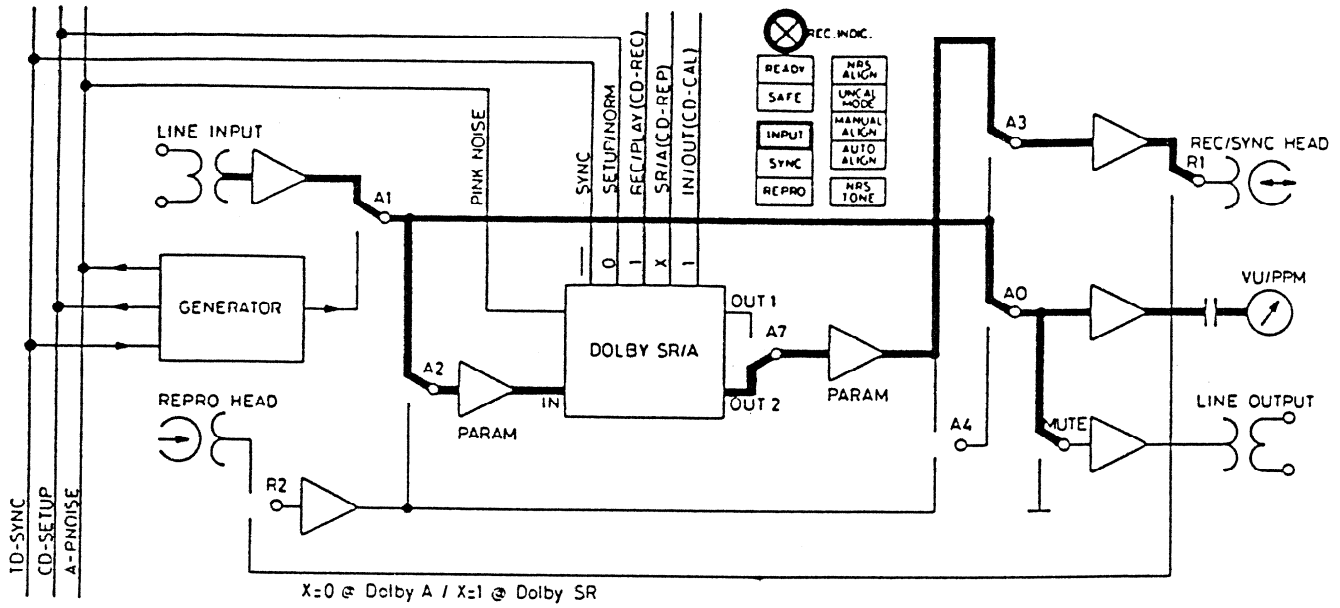
Dolby SR : Noise record Mode
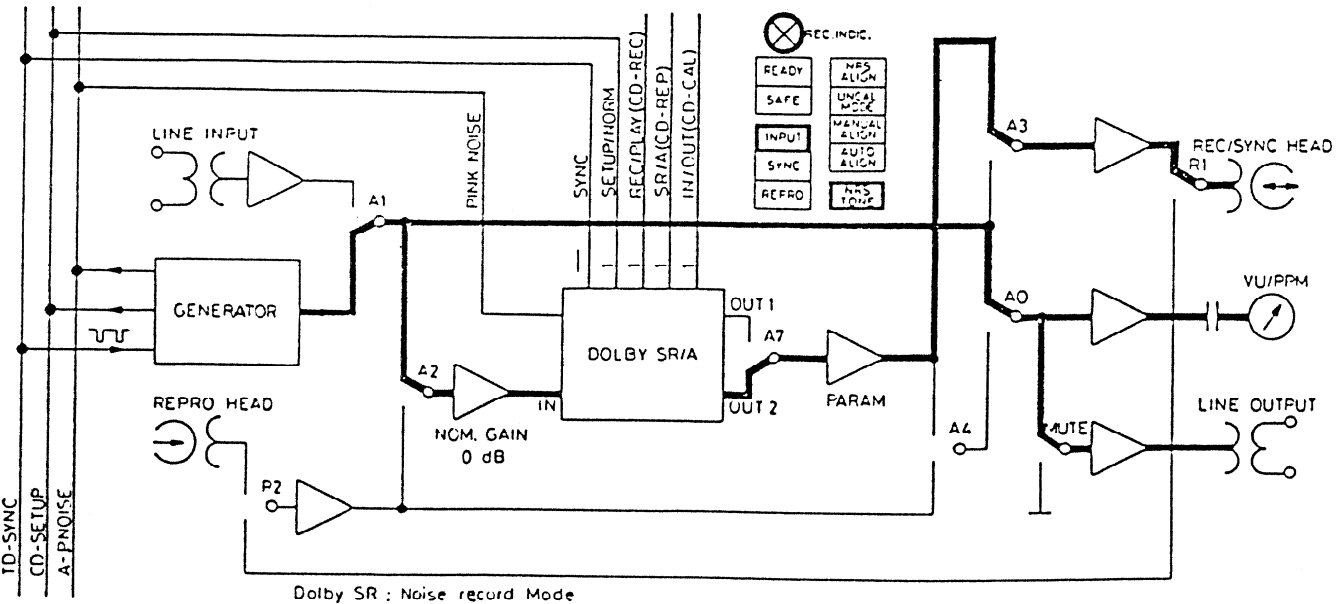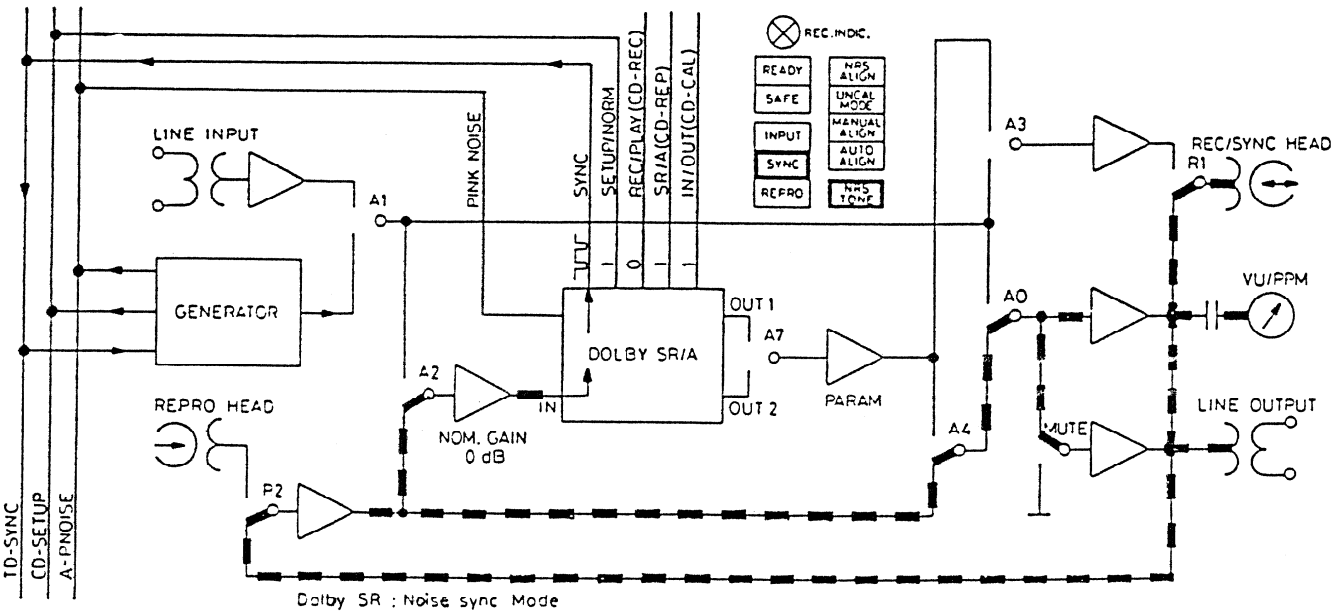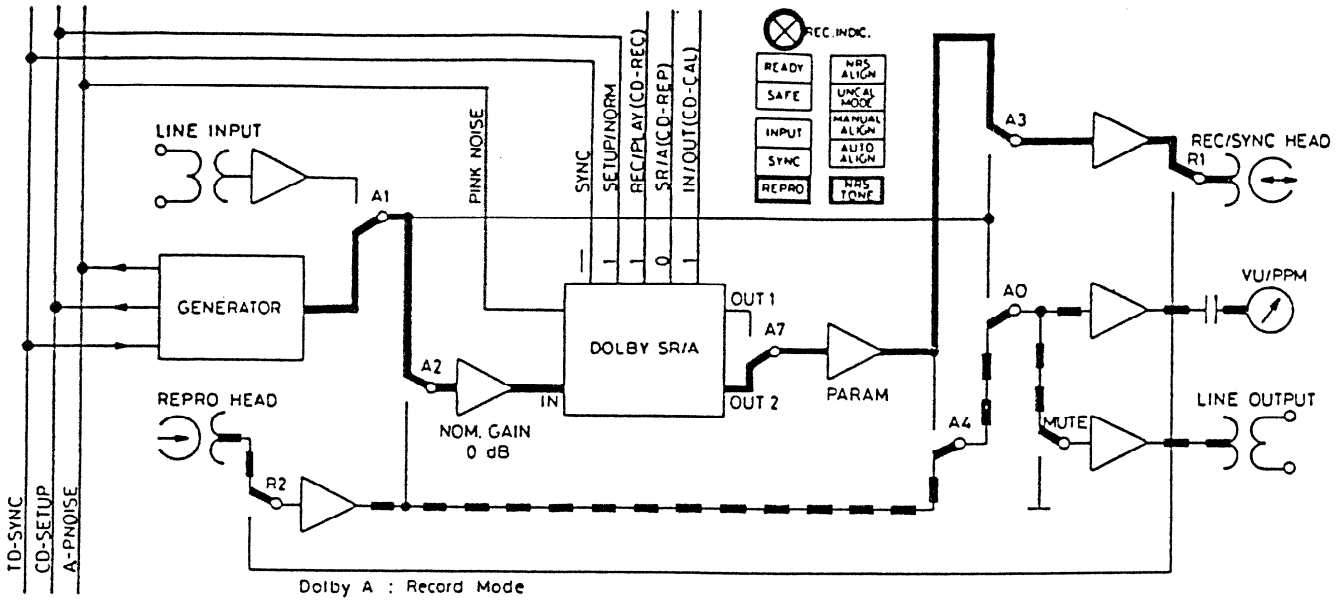
Alignment Mode/Autocompare (SR only)

Dolby A (linear)

Dolby SR (linear)

Dolby SR (autocompare)
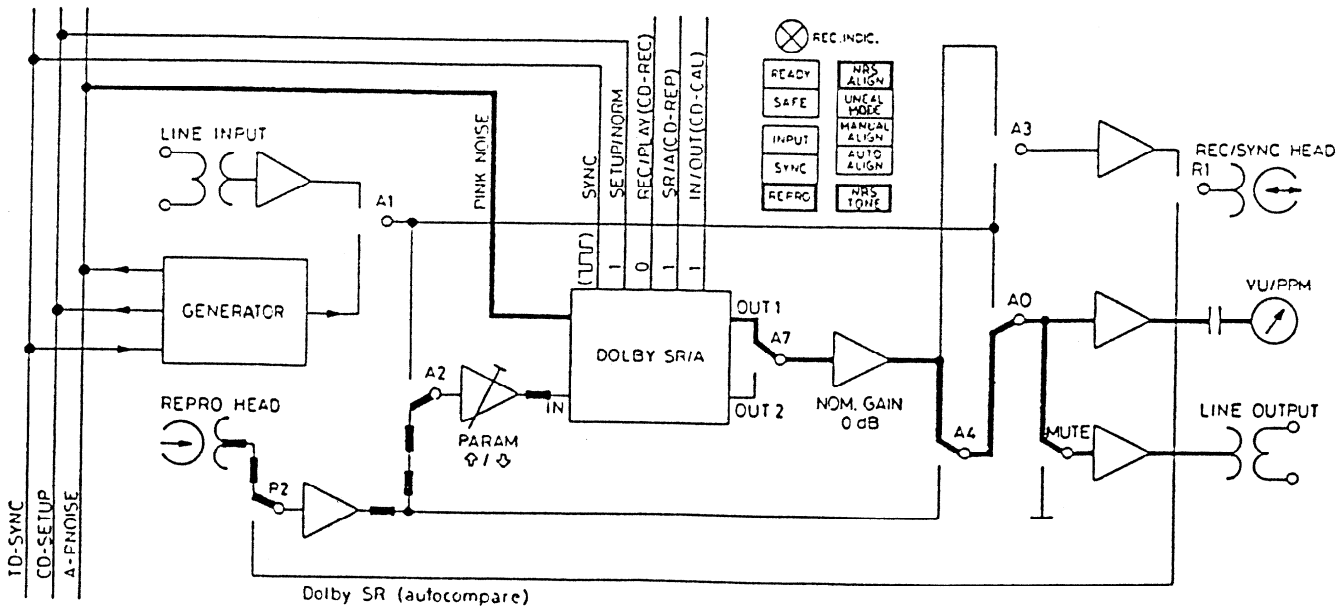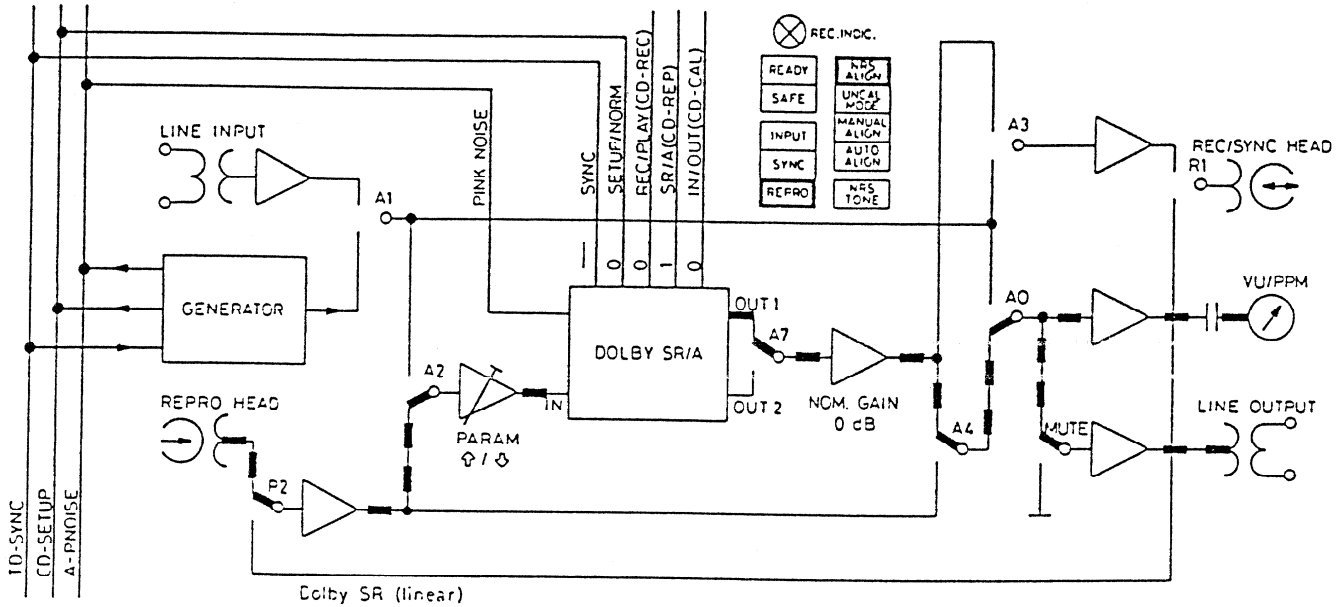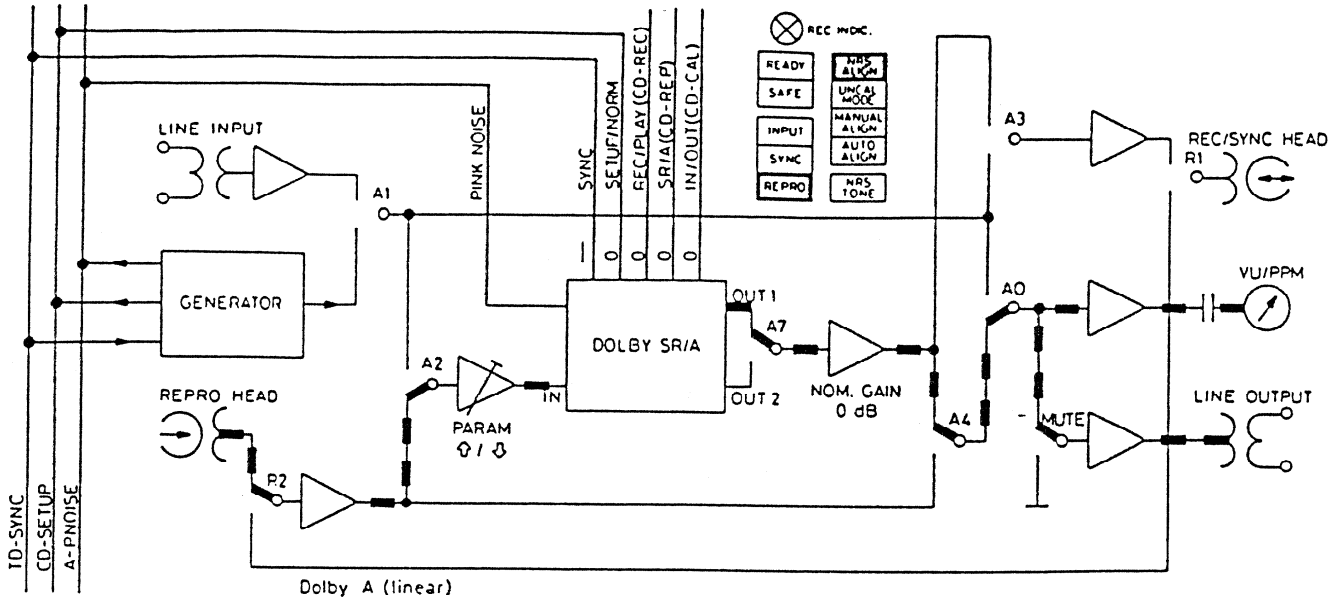
ASCII Protokoll der seriellen Schnittstelle A820MCH/A827MCH
****

Last update   : 11.04.89
Original date : 16.12.86

Changes:

SYNTAX:
[-,A,B,C] means input/output - or A or B or C is definitively expected
(-,A,B,C) means input/output - or A or B or C is possibly expected

MACHINE PROPERTIES:
"-" not implemented
"1" implemented
"x" optionally implemented in future

ERROR MESSAGES:

"?" CR LF: input is unknown command or has wrong format (no echo mode)
"INPUT FORMAT ERROR" CR LF: input has wrong format (echo mode)

USE OF CNTRL X: (without space or CR)
cntrl x cancels last input section (output CR LF)

USE OF CNTRL W: (without space or CR)
cntrl w is a flip-flop with the same function as x-on/off)

XON,XOFF:
XOFF means: stop sending new commands (else overrun)
XON means: continue sending commands (ready again)
     (see normal X-ON/OFF protocol)

TLS 4000 synchronizer supposes no XON/XOFF !

Important Note: This release of the ASCII-protocol of the serial RS 232
                   Interface is implemented in the A820 MCH Master software
                   20/89 (Order No. 1.820.986.22).

                   The ASCII-protocol implemented in other Master software
                   releases may deviate from the present one. It is therefore
                   strongly recommended that you specify the version of the
                   Master software that corresponds to your application.

Specifications by TLS controller demands

----

1. Data transfer, data save

Each transfer is initiated by controller and responsed by tape recorder
within maximal 100 ms:

Exceptions: - After power on the slave machine may announce itself
                with a welcome message of any length.

              - The commands "F" and "R" of A810 are not
                quitted (increases transfer rate for toggling) !

If a transfer initiated by controller isn't quitted by slave within
demanded time or is responsed with an error message, including a '?',
the command is cleared by CX (18H) and after receipt of a LF once
repeated. If also this command won't be quitted in requested time,
the connection is considered as interrupted and is restarted newly.

2. Command sequences for special consideration

Status Request

The first status request after a command must receive already an
updated status. Before a message from tape deck is available, status
'not achieved' can be shown.

If e.g. a tape out occured on a machine, it can answer with
'play not achieved' for a short time after reception of command 'PLY'.
If a status request doesn't receive at least the last requested status
as 'not achieved', the controller can assume, that the command cannot
be executed or that a command on slave machine has been initiated by
pressing a key.

Locate / Play Locate commands

While a locate is executed, the machine may answer with status 'locate
achieved/not achieved' or 'stop not achieved'. Locating is finished
by sending status 'stop'.

A Play Locate command is initiated by sending to slave machine one or
several 'PLY' after a locate command. The slave may answer while play
locating with status message 'play locate achieved/not achieved' or
with 'play not achieved'. Play locating is finished by sending status
'play achieved'.

| TAPE DECK COMMANDS

sign set	machine 820MCH	machine 827MCH	input	output	meaning
STP	1	1	STP [,CR]	CR LF	stop
EDI	1	1	EDI [,CR]	CR LF	edit
PLY	1	1	PLY [,CR]	CR LF	play
REC	1	1	REC [,CR]	CR LF	record
FWD	1	1	FWD [,CR]	CR LF	forward
RWD	1	1	RWD [,CR]	CR LF	rewind
WHR <SPEED>	1 1	1 1	WHR [ ] <xxxx> (0<=xxxx<=5FFF)	CR LF	contr. rewind
WHF <SPEED>	1 1	1 1	WHF [ ] <xxxx> (0<=xxxx<=5FFF)	CR LF	contr. wind forward
SSA	-	-	SSA [,CR]	CR LF	set play speed A (3,75 IPS)
SSB	1	1	SSB [,CR]	CR LF	set play speed B (7,50 IPS)
SSC	1	1	SSC [,CR]	CR LF	set play speed C (15 IPS)
SSD	1	1	SSD [,CR]	CR LF	set play speed D (30 IPS)
NS?	1	1	NS? [,CR]	text CR LF	nominal speed ?
SVS	-	-	SVS [,CR]	CR LF	varispeed on
CVS	-	-	CVS [,CR]	CR LF	varispeed off
VEN	1	1	VEN [,CR]	CR LF	external varispeed on
VEF	1	1	VEF [,CR]	CR LF	external varispeed off
FEN	1	1	FEN [,CR]	CR LF	fader enable on
FEF	1	1	FEF [,CR]	CR LF	fader enable off

sign set	machine 820MCH	827MCH	input	output	meaning
EDT	1	1	EDT [,CR]	CR LF	lifter mode on/audio on sync (tape on heads)
LFT	1	1	LFT [,CR]	CR LF	lifter mode off (tape not on heads)
LFN	1	1	LFN [,CR]	CR LF	lifter mode on/audio on input (tape on heads)
LOC \<address>	1	1	LOC [ ] \<(-)hh[,:,/]mm[,:,/] ss[,:,/] x> x=dsec	CR LF	locate to address \< >
LMV \<address>	1	1	LMV [ ] \<xxxxxxxx> 4 Byte (hex)	CR LF	locate move roll \< >
ZLO	1	1	ZLO [,CR]	CR LF	locate to zero
MV?	1	1	MV? [,CR]	xx[ ]xx[ ]xx[ ]xx CR LF	move roll counter ?
STM \<address>	1	1	STM [ ] \<(-)hh[,:]mm[,:] ss[,:]xxx> x= dsec	CR LF	set timer on address \< > -9:59:59:999\<ADDR\<23:59:59:999
RTI	1	1	RTI [,CR]	CR LF	reset timer
TM?	1	1	TM? [,CR]	[-,u,o,h] h:mm:ss:x CR LF u=under-, o=overflow, x=dsec	timer ? -9:59:59\<ADDR\<23:59:59
DST	1	1	DST [,CR]	CR LF hh:mm:ss:x nn ttt address,td_st. in numb.,text	display machine status (go out: ctrl x)

sign set	machine 820MCH	827MCH	input	output	meaning
ST?	1	1	ST? [,CR]	xx CR LF	status ?
	1	1		xx: 01 = tape out	
	1	1		81 = tape out achieved	
	1	1		02 = stop	
	1	1		82 = stop achieved	
	1	1		03 = rewind	
	1	1		83 = rewind achieved	
	1	1		04 = forward	
	1	1		84 = forward achieved	
	1	1		06 = play varispeed	
	1	1		86 = play vari achieved	
	1	1		07 = play internal ref	
	1	1		87 = play int ref ach	
	1	1		08 = play external ref	
	1	1		88 = play ext ref ach	
	1	1		09 = record	
	1	1		89 = record achieved	
	1	1		0A = play reverse	
	1	1		8A = play reverse ach.	
	1	1		0B = edit	
	1	1		8B = edit achieved	
	-	-		0C = play fader	
	-	-		8C = play fader achieved	
	1	1		40 = shuttle backward	
	1	1		C0 = shuttle backw ach	
	1	1		41 = shuttle forward	
	1	1		C1 = shuttle forw ach	
	1	1		42 = locate rewind	
	1	1		C2 = locate rewind ach	
	1	1		43 = locate forward	
	1	1		C3 = locate forward ach	
	-	-		44 = locate play reverse	
	-	-		C4 = loc play revers ach	
	-	-		45 = locate play forw	
	-	-		C5 = loc play forw ach	
	1	1		46 = cueing reverse	
	1	1		C6 = cueing reverse ach	
	1	1		47 = cueing forward	
	1	1		C7 = cueing forward ach	
	-	-		48 = position play rev	
	-	-		C8 = position ply rv ach	
	-	-		49 = position play forw	
	-	-		C9 = position ply fw ach	
	1	1		4A = rewind controlled	
	1	1		CA = rewind contrl ach	
	1	1		4B = wind forw contrl	
	1	1		CB = wind forw ctrl ach	
	1	1		59 = tape dump	
	1	1		D9 = tape dump achieved	
	1	1		5A = cut	
	1	1		DA = cut achieved	
	1	1		DD = burn in achieved	

sign set	machine 820MCH	827MCH	input	output	meaning
SD?	1	1	SD? [,CR]	dd:ww:yy CR LF	software date ?
MK?	1	1	MK? [,CR]	aa	mark nr of software version aa=mark number: 0,1,´?´=mark I, 2=mark II
MT?	1	1	MT? [,CR]	aa	machine type ? aa=machine type number 1=820,2=812,3=820MCH,4=827M 5=807

```
+-------------------------------------------------------------------------------------------------+
| AUDIO COMMANDS                                                                                   |
| all commands are used by master rs232                                                           |
|                                                                                                 |
+-------------+--------+--------+--------------------+--------------------------+------------------+
|             | machine         |                    |                          |                  |
| sign set    | 820MCH| 827MCH |       input        |        output            |     meaning      |
+-------------+--------+--------+--------------------+--------------------------+------------------+
|             |       |        |                    |                          |                  |
+-------------+--------+--------+--------------------+--------------------------+------------------+
|             |       |        |                    |                          |                  |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| SNB         |   1   |   1    | SNB [ ,CR]         | CR LF                    | set NAB equalization |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| SCR         |   1   |   1    | SCR [ ,CR]         | CR LF                    | set CCIR equalization |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| STA         |   1   |   1    | STA [ ,CR]         | CR LF                    | set tape sort A  |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| STB         |   1   |   1    | STB [ ,CR]         | CR LF                    | set tape sort B  |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| MSN         |   1   |   1    | MSN [ ,CR]         | CR LF                    | master safe on   |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| MSF         |   1   |   1    | MSF [ ,CR]         | CR LF                    | master safe off  |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| SRH         |   1   |   1    | SRH [ ,CR]         | CR LF                    | rehearsal mode on |
|             |   1   |   1    |                    |                          | only with dropin/out delay on |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| CRH         |   1   |   1    | CRH [ ,CR]         | CR LF                    | rehearsal mode off |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| DDN         |   1   |   1    | DDN [ ,CR]         | CR LF                    | drop in/out delay on |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| DDF         |   1   |   1    | DDF [ ,CR]         | CR LF                    | drop in/out delay off |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| AA?         |   1   |   1    | AA? [ ,CR]         | aabbccdd CR LF           | channel 1..8 status ? |
|             |       |        |                    | aa:   0 = safe           |                  |
|             |       |        |                    |       1 = ready/record   |                  |
|             |       |        |                    | bbcc: 00 = rep           | MSB(xx) : chnl 8 |
|             |       |        |                    |       01 = sync          | LSB(xx) : chnl 1 |
|             |       |        |                    |       1x = input         |                  |
|             |       |        |                    | dd:   0 = demute         | xx = aa .. dd    |
|             |       |        |                    |       1 = mute           |                  |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| AB?         |   1   |   1    | AB? [ ,CR]         | aabbccdd CR LF           | channel 9..16 status ? |
|             |       |        |                    | aa:   0 = safe           |                  |
|             |       |        |                    |       1 = ready/record   |                  |
|             |       |        |                    | bbcc: 00 = rep           | MSB(xx) : chnl 16 |
|             |       |        |                    |       01 = sync          | LSB(xx) : chnl 9 |
|             |       |        |                    |       1x = input         |                  |
|             |       |        |                    | dd:   0 = demute         | xx = aa .. dd    |
|             |       |        |                    |       1 = mute           |                  |
+-------------+--------+--------+--------------------+--------------------------+------------------+
| AC?         |   1   |   1    | AC? [ ,CR]         | aabbccdd CR LF           | channel 17..24 status ? |
|             |       |        |                    | aa:   0 = safe           |                  |
|             |       |        |                    |       1 = ready/record   |                  |
|             |       |        |                    | bbcc: 00 = rep           | MSB(xx) : chnl 24 |
|             |       |        |                    |       01 = sync          | LSB(xx) : chnl 17 |
|             |       |        |                    |       1x = input         |                  |
|             |       |        |                    | dd:   0 = demute         | xx = aa .. dd    |
|             |       |        |                    |       1 = mute           |                  |
+-------------+--------+--------+--------------------+--------------------------+------------------+
```

| sign set | machine | | input | output | meaning |
	820MCH	827MCH			
REA ⟨i⟩	1	1	REA [ ] ⟨i⟩ [,CR]	CR LF	set channel i to ready
	1	1	i=1..24 or OFFH for all		
SAF ⟨i⟩	1	1	SAF [ ] ⟨i⟩ [,CR]	CR LF	set channel i to safe
	1	1	i=1..24 or OFFH for all		
IMP ⟨i⟩	1	1	IMP [ ] ⟨i⟩ [,CR]	CR LF	set channel i to input
	1	1	i=1..24 or OFFH for all		
SYN ⟨i⟩	1	1	SYN [ ] ⟨i⟩ [,CR]	CR LF	set channel i to synch
	1	1	i=1..24 or OFFH for all		
REP ⟨i⟩	1	1	REP [ ] ⟨i⟩ [,CR]	CR LF	set channel i to repro
	1	1	i=1..24 or OFFH for all		
MTN ⟨i⟩	1	1	MTN [ ] ⟨i⟩ [,CR]	CR LF	mute channel i
	1	1	i=1..24 or OFFH for all		
MTF ⟨i⟩	1	1	MTF [ ] ⟨i⟩ [,CR]	CR LF	demute channel i
	1	1	i=1..24 or OFFH for all		
CHN ⟨i⟩	1	1	CHN [ ] ⟨i⟩ [,CR]	CR LF	channel i on
	1	1	i=1..24 or OFFH for all		
CHF ⟨i⟩	1	1	CHF [ ] ⟨i⟩ [,CR]	CR LF	channel i off
	1	1	i=1..24 or OFFH for all		

sign set	machine 820MCH	827MCH	input	output	meaning
TP?	1	1	TP? [,CR]	aabbccddeeff gghhiijjkkll mmnnooppqqrr CR LF tape width 1": aa: tape tension play left bb: tape tension play right cc: tape tension wind dd: tape tension edit ee: ttension rev play left ff: ttension rev play right tape width 2": gg: tape tension play left hh: tape tension play right ii: tape tension wind jj: tape tension edit kk: ttension rev play left ll: ttension rev play right tape width Unruest: mm: tape tension play left nn: tape tension play right oo: tape tension wind pp: tape tension edit qq: ttension rev play left rr: ttension rev play right	tape tension parameter ?
LCD	1	1	LCD [,CR]	CR LF	local keyboard disabled
LCE	1	1	LCE [,CR]	CR LF	local keyboard enabled
RMD	1	1	RMD [,CR]	CR LF	remote keyboard disabled
RME	1	1	RME [,CR]	CR LF	remote keyboard enabled
SBA <address>	1	1	SBA [ ]<xxxx>	CR LF	set bus address (8280-FFFF)
BA?	1	1	BA? [,CR]	xxxx CR LF	bus address ?