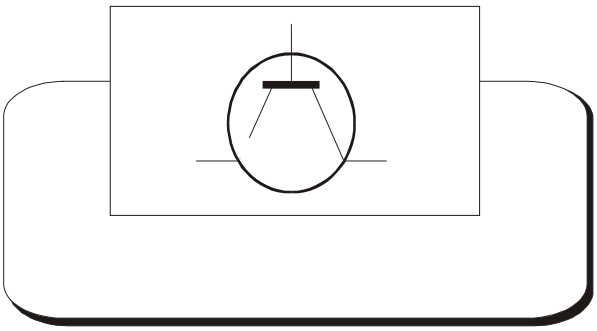
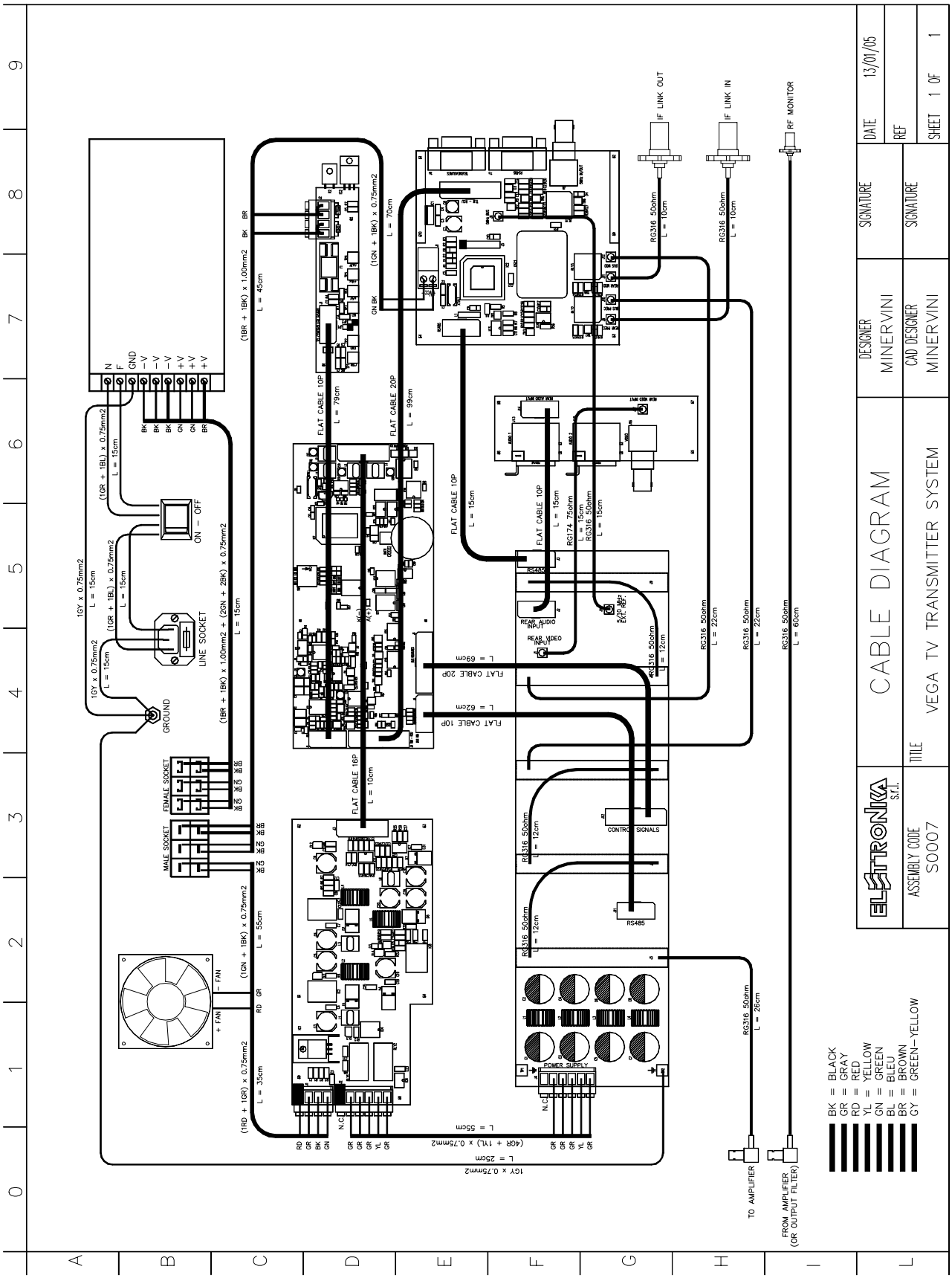


Section 3 - Diagram

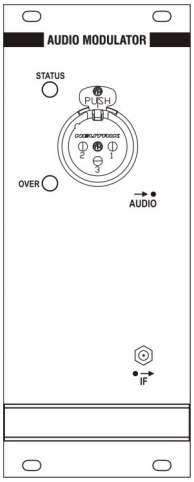
Contents:


CABLE DIAGRAM
VEGA TV TRANSMITTER SYSTEM
ELETTRONIKA S.r.l.
ASSEMBLY CODE S0007
TITLE
DESIGNER MINERVINI
CAD DESIGNER MINERVINI
SIGNATURE
SIGNATURE
DATE 13/01/05
REF
SHEET 1 OF 1
BK = BLACK
GR = GRAY
RD = RED
YL = YELLOW
GN = GREEN
BL = BLEU
BR = BROWN
GY = GREEN-YELLOW
IF LINK OUT
IF LINK IN
RF MONITOR
TO AMPLIFIER
FROM AMPLIFIER (OR OUTPUT FILTER)
ON - OFF
LINE SOCKET
GROUND
FEMALE SOCKET
MALE SOCKET
+ FAN
- FAN
FLAT CABLE 10P
FLAT CABLE 20P
FLAT CABLE 16P
FLAT CABLE 20P
REAR AUDIO INPUT
REAR VIDEO INPUT
CONTROL SIGNALS
RS485
POWER SUPPLY
RG316 50ohm
RG174 75ohm

Part Name Code	Description	Qty
S0007	MODULAR STRUCTURE	1
MTG0077AR0	POWER SUPPLY MODULE	1
MTG0076AR0	EXTERNAL REFEREMENT MODULE	1
MTG0078AR0	MULT. AUDIO STEREO MODULATOR - OPT.	1
MTG0072AR0	MULT. VIDEO MODULATOR MODULE	1
MTG0073AR0	MULT. IF PRECORRECTOR MODULE	1
MTG0084AR0	MULT. LOCAL OSCILLATOR MODULE	1
MTG0075AR0	MULT. CHANNEL FILTER MODULE	1
MTG0079AR0	DISPLAY AND POWER SUPPLY MODULE	1
MTF0088BR0	15W UHF AMPLIFIER MODULE	1
05352	SAW FILTER SF0036BA01033T (EX 523) B/G	1
OPT016	OPTION NOTCH FILTER UHF VEGA	1

S0007 VEGA Structure

Part Name Code	Description	Qty
05627	BOARD GUIDE cod. 010Z000	10
05616	FRONT METAL SIDE M 2.5 cod. 000EA084	2
05552B	3-4U HANDLE KIT cod. 235.012	2
DET1010	DET1010R1 DOWN DIN GUIDE FOR VEGA	1
05611A	FRONT METAL SIDE cod. 000DA084	2
05611B	REAR METAL SIDE cod. 000DA085	2
CON0256	CON0256R0 LEFT SIDE FOR VEGA	1
05609A	ANGULAR FOR HANDLE cod. 116ZF001	2
05617	REAR METAL SIDE M 2.5 cod. 000EA085	2
SCH0194AR1	BUS STRUCTURE	1
05636A	PERFORATED COVER RACK cod. 405MB084	2
02699	10 WAYS FEMALE CONNECTOR cod. IDS10FSR1	4
02867	20 CONT. FEMALE CONNECTOR cod. IDS20FSR1	4
02884	6 WAYS MALE KSC 6 EXTR. CLAMP-HOLDER	2
02881	4 WAYS MALE KSC 4 EXTR. CLAMP-HOLDER	2
02897	2 WAYS MALE 90° KSCO2 EXTR. CLAMP-HOLDER	1
VEN00004	PAPST FAN mod. 4184NXH 24V	1
07596	FAN GRID LZ 201	1
DET0875I	DET0875R1 CONVEYER FAN FOR VEHA INOX P.2678	1
CON0239	CON0239R0 RIGHT SIDE FOR VEGA	1
08878	RG316 50Ω 41626-SMB 90° 260mm DIN CABLE	1
08879	RG316 50Ω 41626-SMB 220mm DIN CABLE	2
08880	RG316 50Ω 41626-41626 120mm CABLE	3
DET1056	DET1056R1 UP DIN GUIDE FOR VEGA	1
02513	SMB 90° R114186000 SOCKET	1
02515	SMB R114313000 SOCKET	1
08502	RG316 50Ω CABLE	1



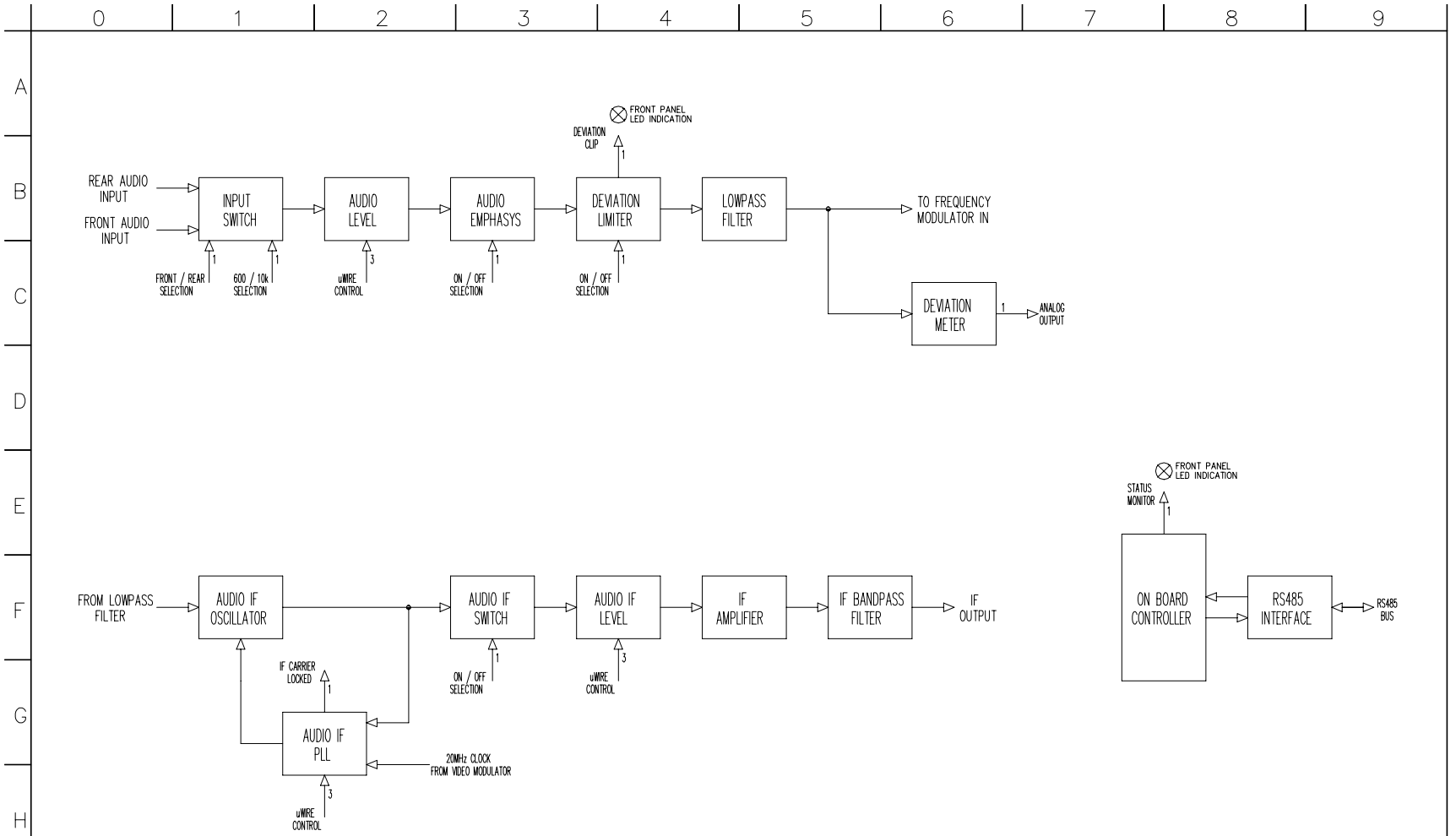
DESCRIPTION

The audio signal enters the module through one 600Ω balanced or 10kΩ unbalanced XLR connection, which may be placed either on the front or rear panel and software-selected. It is conditioned by a digital power-meter with a ±8dB 0.5dB-step dynamic and muting. Then there are the emphasis and clipping stages (which can be inserted via software), before the frequency modulation of the audio carrier.
The control system of the audio subcarrier is a PLL which locking frequency can be selected via software depending to the transmission standard, while the reference frequency comes from the video module.
The control frequency comes from a VCTCXO inside the module to foresee the possibility of a separated-audio system, for which the 20MHz may be locked to a more precise system coming from the 5/10MHz bus.
The carrier obtained this way is modulated in frequency and level-conditioned by an IF gain stage trough a digital power-meter with a ±3dB dynamic in fine tuning before being added to the video carrier.
The following control signal for the modulator operation are present on the board: PLL lock status of the audio subcarrier, Overload on the audio input, Peak level of the deviation of the audio subcarrier.

All of the operating parameters of the board are managed by the built-in micro-processor. Communication to outside are performed trough RS485 bus.

TECHNICAL CHARACTERISTICS

Input impedance	600Ω - 10kΩ selectable
Nominal level	2Vpp -∞/+8dB
Input	Front and back XLR selectable
Emphasis	FLAT-50μsec (FLAT-75usec)
Deviation limiter	Selectable
Low-pass filter	15kHz excludible
Frequency response	< ±0.5dB
THD	< 0.5%
Intermodulation	< 60dB (d2,d3)
Synchronous AM S/N	> 50dB
Asynchronous AM S/N	> 70dB
FM S/N CCIR	> 72dB
Analog measures	Carrier FM deviation
Carrier frequency synthesis	PLL
Audio carrier characteristics	On/Off selection and level adjustment > ±3dB
Frequency reference	Internal TCXO externally lockable
External interface	Microprocessor with RS485 protocol
Firmware	Re-configurable through RS485



ELETTRONIKA S.r.l.	ELECTRIC DIAGRAM	DESIGNER MINERVINI	SIGNATURE	DATE 10/12/2004
ASSEMBLY CODE MTG0071A	TITLE MULTISTANDARD AUDIO MODULATOR	PCB DESIGNER TULLO	SIGNATURE	PCB REF PN1022A
				SHEET 1 OF 1

The module contains the following blocks:

1. **Input relay** – chooses the audio source between the XLR on the front panel of the module and the one on the back of the apparatus and selects the input impedance to 600Ω or 10kΩ; both switching are managed by the software.
2. **Audio level regulation stage** – regulates the level of the audio signal by means of a digital potentiometer which can be programmed trough a uWIRE interface (with 0.5dB step between -8dB and +8dB).
3. **Emphasis stage** – inserts an emphasis curve on the audio signal with a time constant depending on the standard (50,75us); the choice can be selected via software.
4. **Deviation limiter** – cuts the audio level to limit the FM deviation; its intervention is handled by the software and the intervention of the clipper, if any, is signalled by a red LED on the front panel.
5. **Low-pass filter** – filters the audio signal before the modulation to suppress external residues from the audio band (20Hz-15kHz); the filter can be inserted by means of jumpers on the board.
6. **Audio signal level measurement** – this stage detects the peak level of the audio signal providing a conditioned analog voltage for the A/D conversion; the voltage will be processed by the microcontroller of the display board (see MTG0079) to be shown as VU-METER.
7. **Frequency modulator** – converts to intermediate frequency the audio signal as FM modulation of a carrier.
8. **Carrier level regulation stage** – switches on and off the audio carrier and the regulation within at least ±3dB of the level referring to the video carrier.
9. **IF amplifier** – amplifies the audio carrier to obtain an output level of -6dBm.
10. **Output low-pass filter** – filters the harmonics of the audio carrier.
11. **Audio IF oscillator** – generates the audio carrier performing the PLL frequency synthesis; the selectable standards and the lock indication are handled by the software.
12. **20MHz reference** – the frequency reference for the PLL synthesis of the carrier is generated by a TCXO which may be locked to a more precise 5/10MHz external reference (see MTG0076).
13. **Controller** – all of the described operations are managed by a microcontroller communicating to the user interface board (see MTG0079) by RS485 protocol; the local controller stores the status of the module and a reprogramming of the firmware (possible via RS485 from the display board) does not alter its contents.

CALIBRATION PROCEDURE

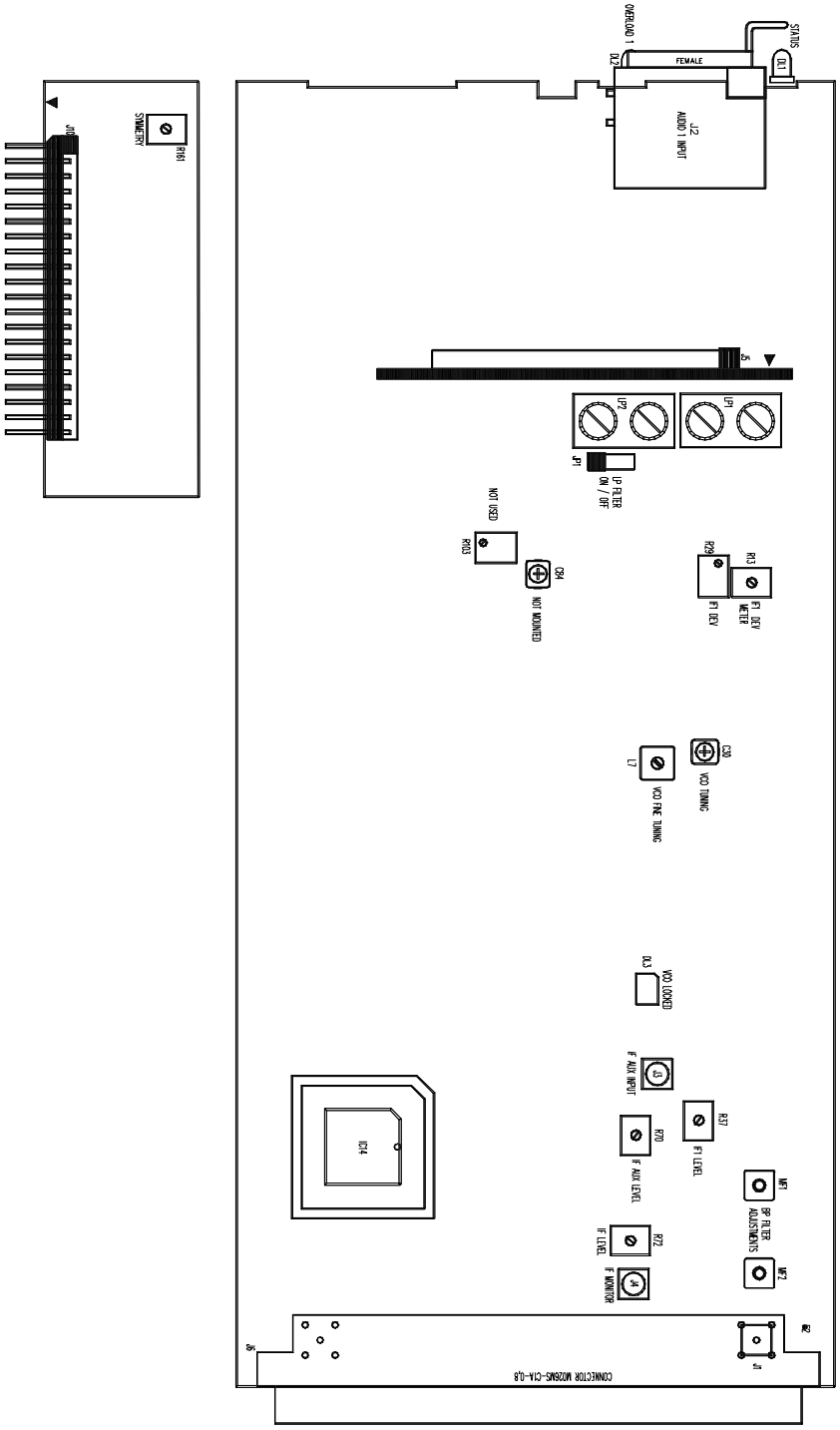
- Instrument list

MEASURE	INSTRUMENT
Lock of the carriers and reference	*- Spectrum analyser* *- Oscilloscope* *- Tester*
Calibration of the audio parameters after the FM modulation	*- Audio generator* *- FM Audio receiver* *- Audio parameters analyser*

Description of the adjustment points

COMPONENT	DESCRIPTION
R6	FM deviation level
R36	Unused
R37	Audio carrier level (-6dBm)
R99	VU-METER deviation
C17	Tuning of the local oscillator of the audio carrier
L5	Fine tuning of the local oscillator of the audio carrier
J7	IF video testpoint (50kHz)
J10	Unused
J3	VCO control voltage testpoint (7...8V)
J6	TCXO testpoint (50kHz)
J11	Unused
J12	External reference testpoint (100kHz)
J2	Audio input (panel)
J5	IF Monitor (panel)

Component layout for adjustment points



The calibration procedure of the module requires a complete structure of display board (see MTG0079) and extension module (see MTG0095) in order to perform the software selection which will be referred to later and power the module itself.

Menu of the Multistandard Mono Audio Modulator Module

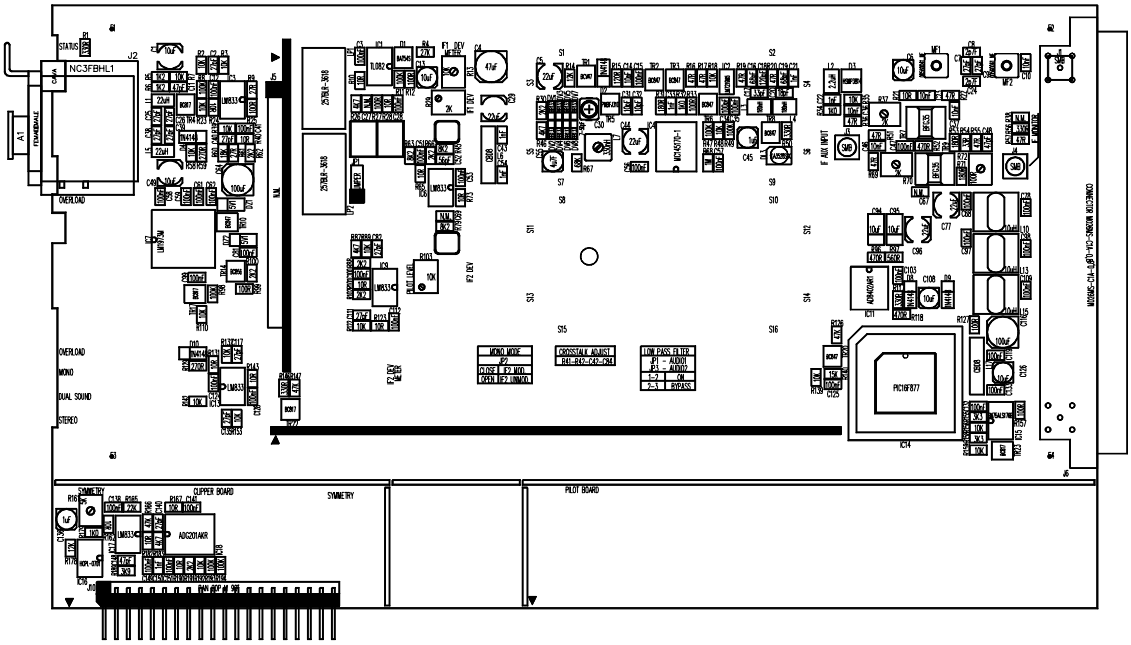
Verification of the IF oscillator section – connect a spectrum analyser to the monitor of the **J5** module and check the sections in it:

- ❑ Configure the module with ***IF On*** and ***IF Level*** at ½ of the scale and calibrate **C17**, **L5** to lock the audio carrier to the intermediate frequency of the set standard (to change the standard refer to the standard change procedure) and obtain a lock voltage between *7V* and *8V* on **J3,** checking that ***SC*** is on *Lock* in the menu of the display.
- ❑ In case of problems in obtaining the lock, check that on **J6**, **J7** and **J12** there are the frequencies listed in the table of the description of the adjustment points.

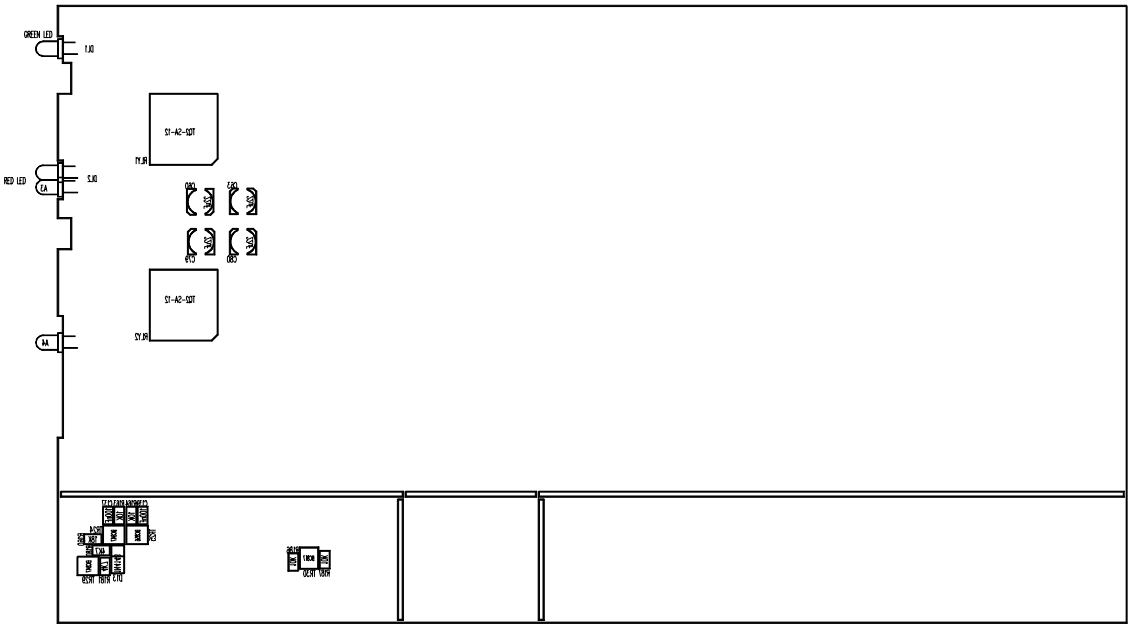
Verification of the audio base-band section – connect an audio source to **J2** and an FM demodulator with audio parameters measurement capability to the IF monitor of **J5** and check the sections in it:

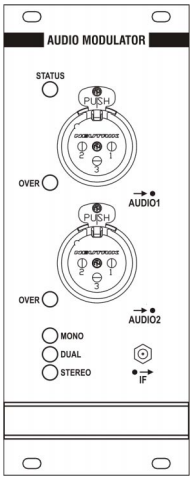
- ❑ Configure the module with ***Audio Lvl*** at *0dB*, ***Zin*** on *600*Ω, ***Limiter*** *off*, ***Emph*** *present* and ***Source*** *front*.
- ❑ Calibrate **R6** to obtain the correct level of audio deviation.
- ❑ Increase ***Audio Lvl*** to *+6dB* and set ***Limiter*** *on*, chect that the over LED lighted up and that ***Overload*** indicates *Pres*, restore ***Audio Lvl*** to *0dB* and check that the LED becomes unlit and ***Overload*** indicates *Trig*, if needed reset this indication with ***Reset Trig*** and check that it goes to *Abst*.
- ❑ Calibrate **R99** for the correct indication of the VU-METER.

Component layout SCH0198AR3 - Bot layer



Component layout SCH0198AR3 - Top layer





DESCRIPTION

This modulator allows the Mono, Stereo and Dual Sound coding of TV audio signal.
The boards accept two input audio channels with a nominal amplitude of 2Vpp ±8dB on a selectable impedance of either 600Ω balanced or 10kΩ unbalanced. The selection of the input impedance is made by means of a relay, the adjustment of the input level is made by means of a digital power-meter. The audio inputs are trough balanced XLRF audio connectors on the front panel or trough the bus connector. The audio source, either from front or back, is switched by a relay.
The modulator allows to add a pre-emphasis circuit, which time constant can be set in factory to either 50 or 75 microseconds.
It is possible to add a deviation circuit to prevent an overdrive of the modulator by an excessive-level base-band signal.
The base-band audio signals are limited in frequency through low-pass filters which suppress frequencies higher than 15kHz.
The deviation level is monitored by two peak detectors, one for each audio channel.
The Mono, Stereo or Dual Sound coding is analog. The pilot tone identifying the codification is overlapped to the audio signal which modulates the secondary audio subcarrier. This tone is represented by a 54.6875kHz pilot frequency, synthesised locally and locked by a PLL to the line frequency of the video signal in base band.
The coding requires this pilot frequency to be non-modulated for monophonic audio. The pilot frequency is AM modulated with a frequency equal to 117.5Hz, 50% modulation depth, for Stereo. It is AM modulated with a frequency of 274.1Hz, 50% modulation depth, for Dual Sound audio.
The coded audio signal modulates the two subcarriers generated by the VCO, PLL locked to a reference frequency of 20MHz. Each of the subcarriers can be disabled, and the nominal level can be changed by ±3dB. On the board there is an IF input for the 38.9MHz video carrier. The latter is added to the two audio subcarriers and sent to the output.

The following control signal for the modulator operation are present on the board:

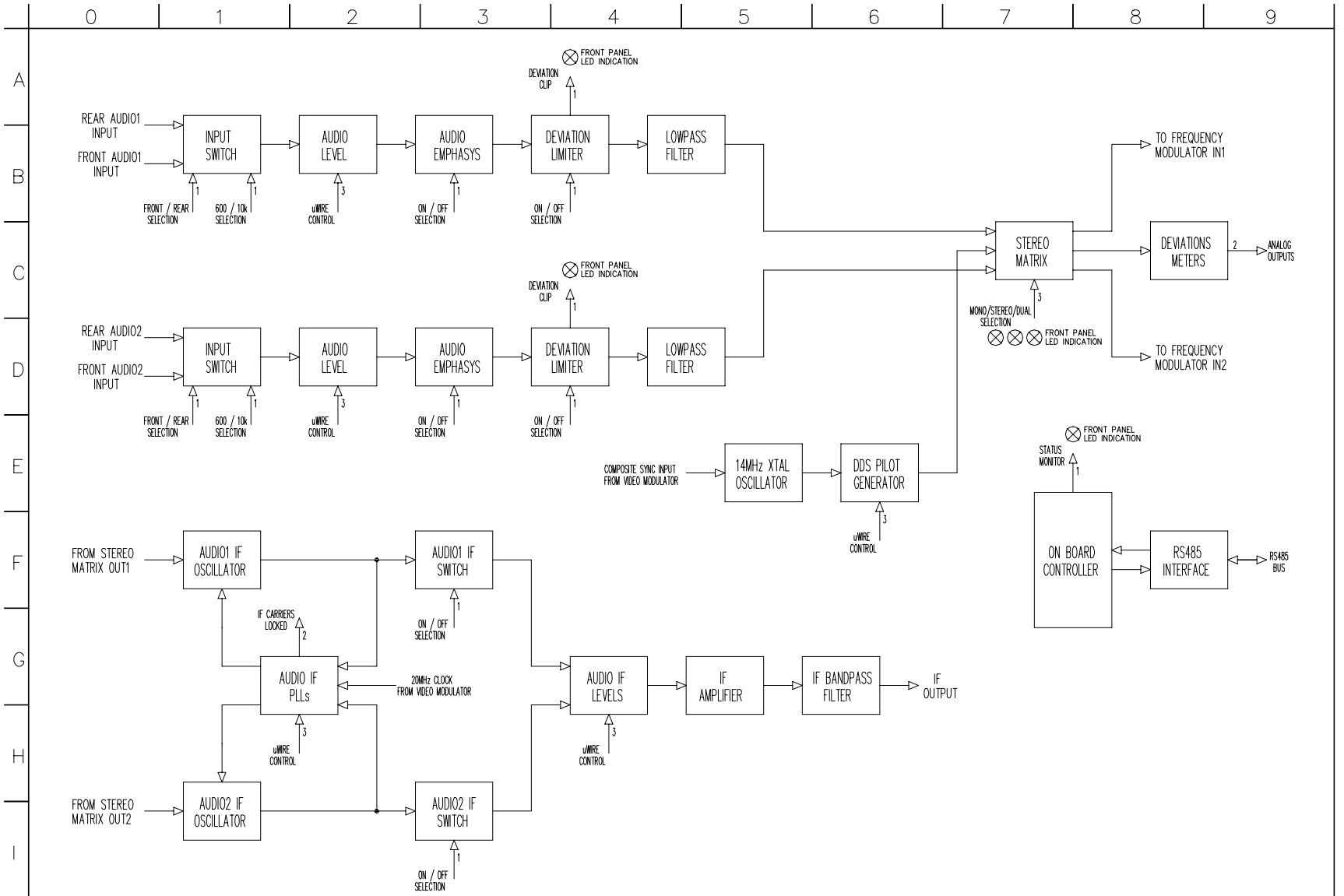
- PLL lock status of the primary audio subcarrier.
- PLL lock status of the secondary audio subcarrier.
- PLL lock status of the pilot tone.
- Overload on the main audio input.
- Overload on the secondary audio input.
- Peak level of the deviation of the primary audio subcarrier.

- Peak level of the deviation of the secondary audio subcarrier.

All of the operating parameters of the board are managed by the built-in micro-processor. Communication to outside are performed trough RS485 bus.

TECHNICAL CHARACTERISTICS

Input impedance	600Ω - 10kΩ selectable
Nominal level	2Vpp -∞/+8dB
Input	Front and rear XLR selectable
Emphasis	FLAT-50μsec (FLAT-75usec)
Deviation limiter	Selectable
Low-pass filter	15kHz excludable
Frequency response	< ±0.5dB
THD	< 0.5%
Stereo crosstalk	< -40dB
Intermodulation	< 60dB (d2,d3)
Synchronous AM S/N	> 50dB
Asynchronous AM S/N	> 70dB
FM S/N CCIR	> 72dB
Analog measures	FM deviation of the carriers
Carrier frequency synthesis	A PLL
Audio carrier characteristics	On/Off selection and level adjustment > ±3dB
Pilot tone characteristics	54687.5Hz (3/2fs) ±10Hz
Pilot tone modulation	AM 50%
Modulation frequency	274.12Hz (1/57fs) 117.48Hz(1/133fs)
Frequency reference	Internal TCXO externally lockable
External interface	Microprocessor withRS485 protocol
Firmware	Re-configurable via RS485



ELETTRONIKA s.r.l.	ELECTRIC DIAGRAM	DESIGNER MINERVINI	SIGNATURE	DATE 10/12/2004
ASSEMBLY CODE MTG0078A	TITLE MULTISTANDARD AUDIO STEREO MODULATOR	PCB DESIGNER TULLO	SIGNATURE	PCB REF PN1022A
				SHEET 1 OF 1

The module contains the following blocks:

1. **Input relays (2)** – chooses the audio source between the XLR on the front panel of the module and the one on the back of the apparatus and selects the input impedance to 600Ω or 10kΩ; both switching are managed by the software.
2. **Audio level regulation stages (2)** – regulates the level of the audio signal by means of a digital potentiometer which can be programmed trough a uWIRE interface (with 0.5dB step between –8dB and +8dB).
3. **Emphasis stages (2)** – inserts an emphasis curve on the audio signal with a time constant depending on the standard (50,75us); the choice can be selected via software.
4. **Deviation limiters (2)** – cuts the audio level to limit the FM deviation; its intervention is handled by the software and the intervention of the clipper, if any, is signalled by a red LED on the front panel.
5. **Low-pass filters (2)** – filters the audio signal before the modulation to suppress external residues from the audio band (20Hz-15kHz); the filter can be inserted by means of jumpers on the board.
6. **Stereo matrix** – encodes the two audio signals depending on the transmission mode set and adds the modulated pilot tone to define the transmission standard as either mono, stereo or dual sound; the selection can be made via software and is indicated by three yellow LEDs on the frontal panel.
7. **14MHz quartz oscillator** – generates the clock needed to synthesise the pilot tone locked to the line-synchronism frequency of the video signal coming from the video modulator module (see MTG0072).
8. **Synthesised pilot tone generator** – synthesises the pilot tone by means of DDS programmed trough an uWire interface.
9. **Audio signal level measurement** – this stage detects the peak level of the audio signal providing two conditioned analog voltages for the A/D conversion; the voltages will be processed by the microcontroller of the display board (see MTG0079) to be displayed as VU-METERS.
10. **Frequency modulators (2)** – converts to intermediate frequency the audio signal as FM modulation of a carrier.
11. **Carrier level regulation stages (2)** – switches on and off the audio carrier and the regulation within at least ±3dB of the level referring to the video carrier.
12. **IF amplifier** – amplifies the audio carrier to obtain an output level of -6dBm.
13. **Output low-pass filter** – filters the harmonics of the audio carrier.
14. **Audio IF oscillators (2)** – generates the audio carrier performing the PLL frequency synthesis; the selectable standards and the lock indication are handled by the software.
15. **20MHz reference** – the frequency reference for the PLL-synthesis of the audio carrier is obtained from the video module (see MTG0072) to keep a perfect intercarrier lining.
16. **Controller** – all of the described operations are managed by a microcontroller communicating to the user interface board (see MTG0079) by RS485 protocol; the local controller stores the status of the module and a reprogramming of the firmware (possible via RS485 from the display board) does not alter its contents.

CALIBRATION PROCEDURE

- Instrument list

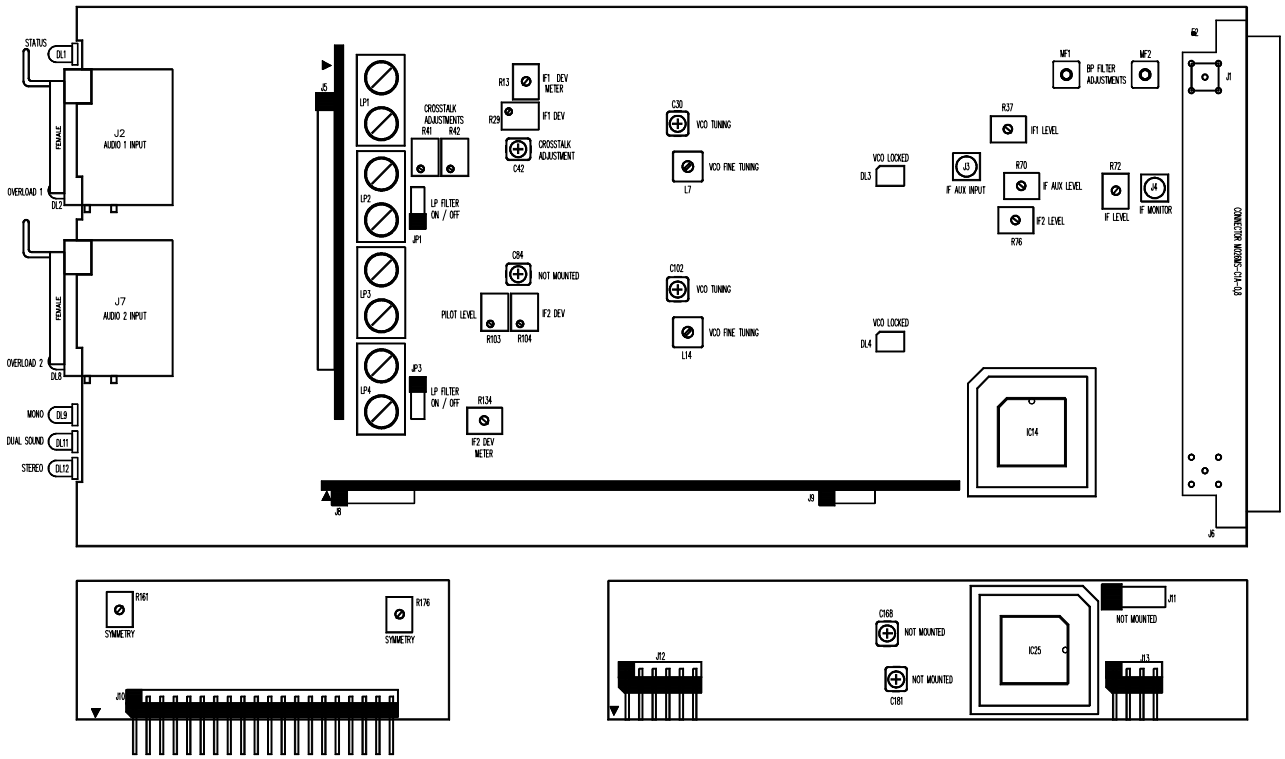
MEASURE	INSTRUMENT
Lock of the carriers and reference	*- Spectrum analyser* *- Oscilloscope* *- Tester*
Calibration of the audio parameters after the FM modulation	*- Audio generator* *- FM Audio receiver* *- Audio spectrum analyser*

- Description of the adjustment points

COMPONENT	DESCRIPTION
R161	Clipper symmetry, left channel
R176	Clipper symmetry, right channel
R13	Indication of the main carrier deviation
R134	Indication of the secondary carrier deviation
LP1, LP2, LP3, LP4	Frequency response adjustment
R41, R42, C42	Crosstalk adjustment
R103	Pilot tone level adjustment
R29	Adjustment of the main carrier deviation
R104	Adjustment of the secondary carrier deviation
C30, L7	Adjustment of the main carrier frequency
C102, L14	Adjustment of the secondary carrier frequency
R37	Adjustment of the main carrier output level
R76	Adjustment of the secondary carrier output level
R70	Adjustment of the video carrier (Unused)
R72	Adjustment of the carriers output level

COMPONENT	DESCRIPTION
MF1, MF2	Adjustment of the output filter
J2, J7	Audio inputs (panel)
J4	IF monitor (panel)

Component layout for adjustment points



The calibration procedure of the module requires a complete structure of display board (see MTG0079) and extension module (see MTG0095) in order to perform the software selection which will be referred to later and power the module itself.

- Menu of the Multistandard Stereo Audio Modulator Module

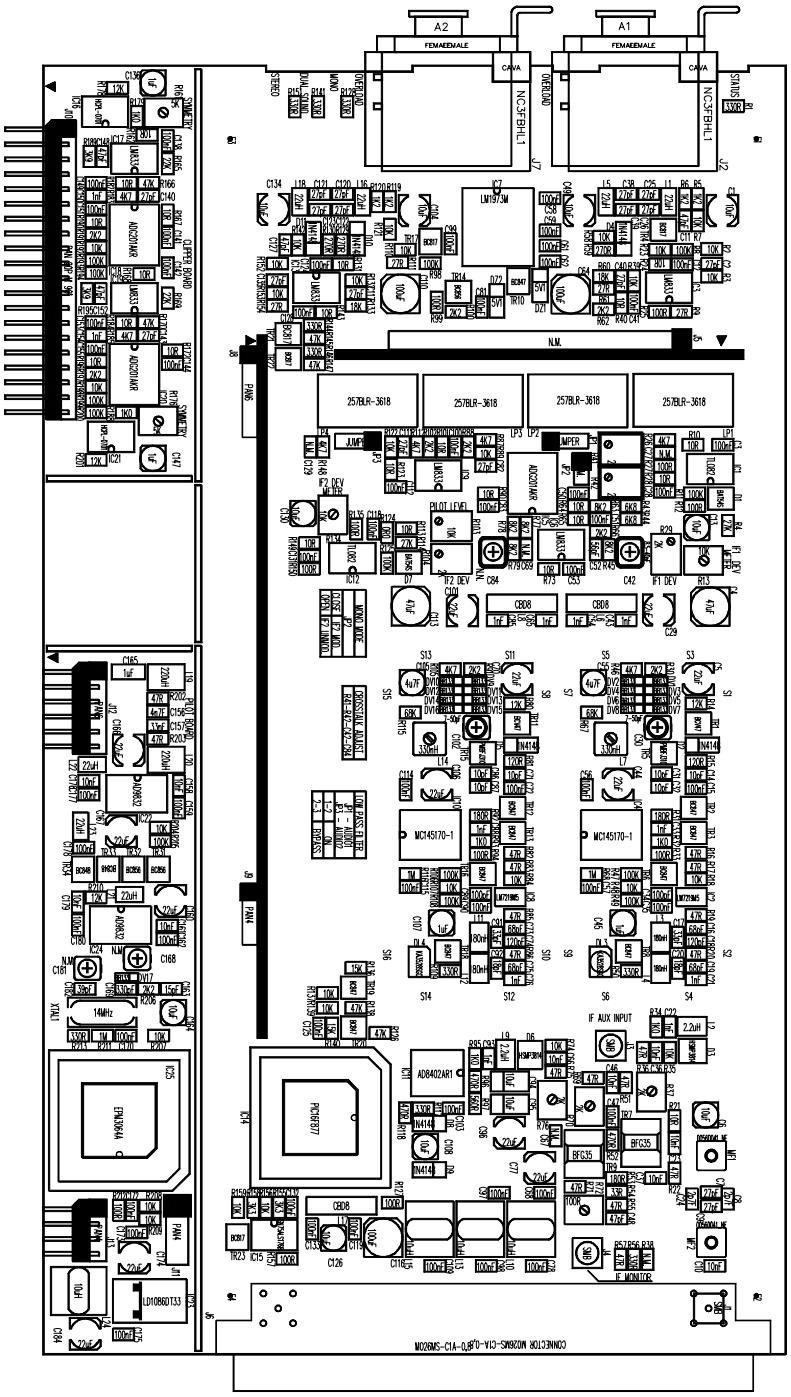
Verifica sezione oscillatore a IF – collegare un analizzatore di spettro sulla monitoria del cassetto **J5** e controllare la funzionalità delle sezioni in esso presenti:

- ❑ Configure the module with ***IF1** and **IF2** On* and ***IF1 Level*** and ***IF2 Level*** at ½ of the scale and calibrate **C30** and **L7 (C102** and **L14)** to lock the audio carriers to the intermediate frequency of the set standard (to change the standard refer to the standard change procedure) and obtain a lock voltage between *2V* and *3V* on **C4 (C113),** checking that ***SC1*** and ***SC2*** are on *Lock* in the menu of the display.
- ❑ Connect a spectrum analyser in tracking mode between **J3** and the output of the **J1** module and check the response of the filter calibrating **MF1** and **MF**2 to the minimum ripple.
- ❑ Calibrate the **R37** trimmer to obtain on **J1** the maximum level of the main carrier in output and calibrate **R76** for a level of the secondary carrier -*7dBc* compared to the main, then calibrate **R72** to obtain a level of the main carrier of -*6dBm*.

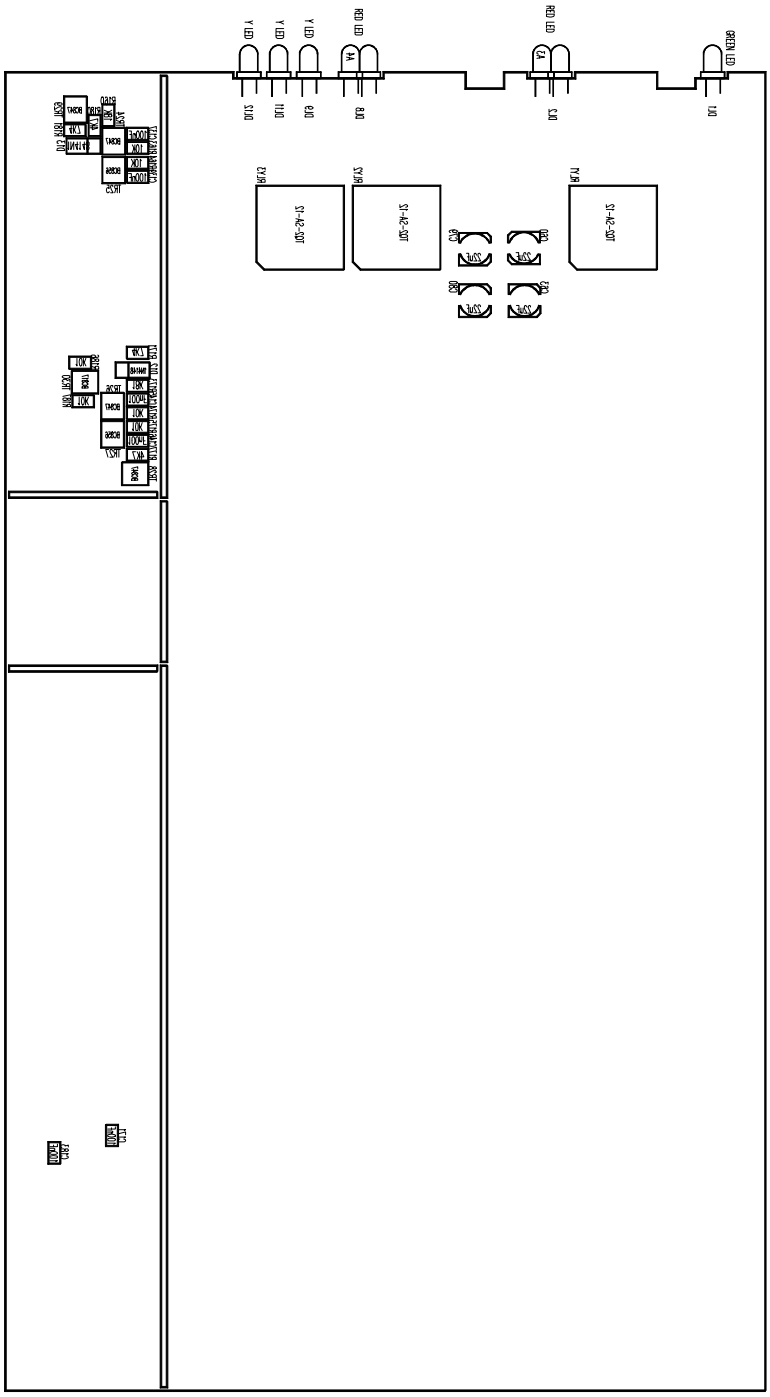
Verification of the audio base-band section – connect an audio source to **J2** and **J7** and an FM demodulator with audio parameters measurement capability to the IF monitor of **J4** and check the sections in it:

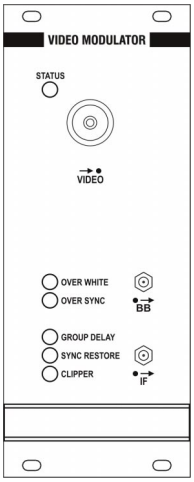
- ❑ Configure the module with ***Mode** DualSound*, ***Audio1 Lvl** 0dB*, ***Audio2 Lvl** 0dB*, ***Zin** 600*Ω, ***Limiter** off*, ***Emph** present* and ***Source** front*.
- ❑ Calibrate **R29** and **R104** to obtain the correct level of audio deviation for both subcarriers.
- ❑ Increase ***Audio1(2) Lvl*** to *+6dB* set ***Limiter** on*, chect that the over LED lighted up and that ***OverloadL(R)*** indicates *Pres*, and that the limitation circtuit acts symmetrically on both polarities of the audio signal, using an oscilloscope on pin3 of **JP1** (**JP3**), and retouch if needed **R161** (**R176**), restore ***Audio1(2) Lvl*** to *0dB* and check that the LEDs become unlit and ***OverloadL(R)*** indicates *Trig*, if needed reset this indication with ***Reset Trig*** and check that it goes to *Abst*.
- ❑ Calibrate **R13** and **R134** for the correct indication of the VU-METERS.
- ❑ Configure the module with ***Mode** Mono* and calibrate **R103** to a *2.5kHz* deviation of the pilot tone with no audio sources connected on **J2** and **J7**.
- ❑ Configure the module with ***Mode** Stereo* and connect an audio signal to **J7**, calibrate **R41**, **R42** and **C42** to maximise the crosstalk of the right channel over the left channel.

Component layout SCH0210AR1 - Bot layer



Component layout SCH0210AR1 - Top layer





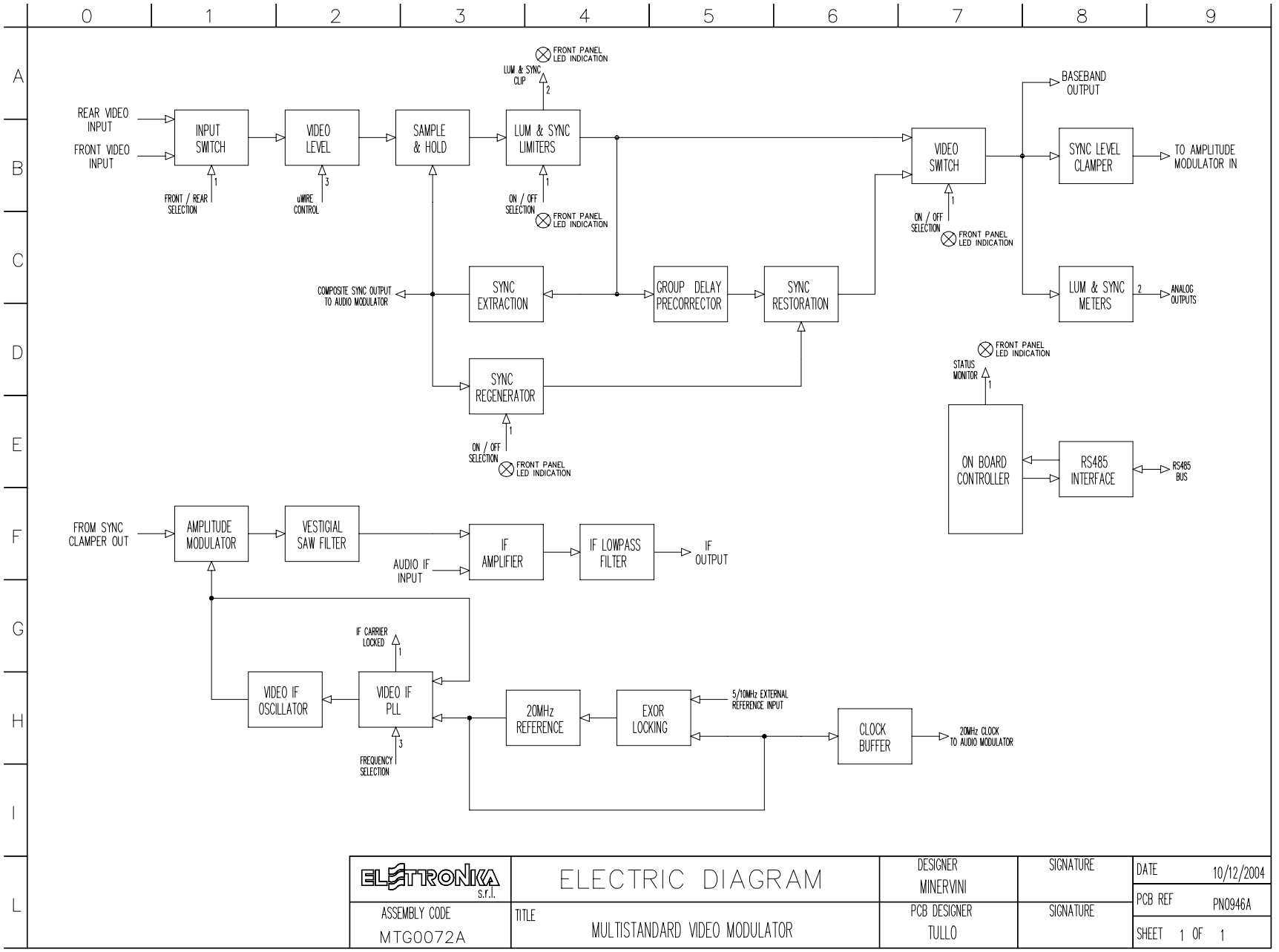
DESCRIPTION

The video signal enters the module trough a 75Ω BNC connection which can be selected via software on either the front or rear panel of the apparatus, and is conditioned to the standard value of 1Vpp by a digital power-meter with a maximum dynamic of +/-6dB. A sample&hold system allows to set the black level independently from the video information in order to perform clipping operations of the synchronism and luminance levels (which can be disabled via software).
An electronic switch (selectable via software) allows to add the video pre-correction stage, made up by the synchronism regenerator and the video group delay pre-corrector. The former allows to regenerate a normal synchronism level for remarkably degraded video signals, while the latter allows to correct the shape of the audio trap contained in the TV receivers. If the synchronism regenerator is not needed, it can be disabled even if the video pre-correction stage is enabled, but it cannot be used without the latter. The processed video signal modulates the amplitude of the audio carrier generated by an internal local oscillator and controlled by a PLL which locking frequency can be selected via software in accordance with the transmission standard.
The amplitude modulation of the carrier is performed by a Gilbert dell controlled in current to obtain an effective modulation linearity. After this, there are the vestigial filter and an UF gain stage which also sums the audio subcarriers, if any. The whole modulation system is locked to an internal 20MHz reference made up by a VCTCXO, which may in turn be locked to an external 5/10MHz reference present on the control bus, in case the precision offset support is needed.
This 20MHz reference is also used in the audio modulation module in order to obtain the perfect distance between the audio and video carriers even without the external precision reference.

TECHNICAL CHARACTERISTICS

Input impedance	75Ω - ROS>25dB
Nominal level	1Vpp ±6dB
Input	Front and back selectable BNC
Group delay	< 50nsecpp
Frequency response	<±0.5dB
Differential gain	<±1%
Differential phase	<±2°
Luminance non-linearity	<±2%
k-Factor	< 1%
Tilt	< 1%
ICPM	<2°
S/HUM	>48dB
S/Nunwgt	>60dB
S/Nwgt	>68dB
Clamping	S/H to backporch

Clipper intervention	On synchronism and luminance
Synchronism regenerator	Effective within ±6dB
Group delay pre-corrector	8-celle, excludible
Analog measures	Synchronism and luminance level
Carrier frequency synthesis	PLL
Frequency reference	Internal TCXO externally lockable
External interface	Microprocessor with RS485 protocol
Firmware	Riconfigurabile tramite RS485


REAR VIDEO INPUT
FRONT VIDEO INPUT
INPUT SWITCH
FRONT / REAR SELECTION
VIDEO LEVEL
uWIRE CONTROL
SAMPLE & HOLD
LUM & SYNC LIMITERS
LUM & SYNC CLIP
FRONT PANEL LED INDICATION
ON / OFF SELECTION
FRONT PANEL LED INDICATION
VIDEO SWITCH
ON / OFF SELECTION
FRONT PANEL LED INDICATION
BASEBAND OUTPUT
SYNC LEVEL CLAMPER
TO AMPLITUDE MODULATOR IN
LUM & SYNC METERS
ANALOG OUTPUTS
COMPOSITE SYNC OUTPUT TO AUDIO MODULATOR
SYNC EXTRACTION
GROUP DELAY PRECORRECTOR
SYNC RESTORATION
SYNC REGENERATOR
ON / OFF SELECTION
FRONT PANEL LED INDICATION
FRONT PANEL LED INDICATION
STATUS MONITOR
ON BOARD CONTROLLER
RS485 INTERFACE
RS485 BUS
FROM SYNC CLAMPER OUT
AMPLITUDE MODULATOR
VESTIGIAL SAW FILTER
AUDIO IF INPUT
IF AMPLIFIER
IF LOWPASS FILTER
IF OUTPUT
IF CARRIER LOCKED
VIDEO IF OSCILLATOR
VIDEO IF PLL
FREQUENCY SELECTION
20MHz REFERENCE
EXOR LOCKING
5/10MHz EXTERNAL REFERENCE INPUT
CLOCK BUFFER
20MHz CLOCK TO AUDIO MODULATOR
ELETTRONIKA s.r.l.
ELECTRIC DIAGRAM
DESIGNER MINERVINI
SIGNATURE
DATE 10/12/2004
ASSEMBLY CODE MTG0072A
TITLE MULTISTANDARD VIDEO MODULATOR
PCB DESIGNER TULLO
SIGNATURE
PCB REF PN0946A
SHEET 1 OF 1

The module contains the following blocks:

1. **Input relay** – chooses the video source between the BNC on the front panel of the module and the one on the back of the apparatus; the switching is managed by the software.
2. **Video level regulation stage** – regulates the level of the video signal by means of a digital potentiometer which can be programmed trough a uWIRE interface.
3. **Clamping stage** – uses the timing information of the synchronism extraction stage (see below) to perform the sample & hold of the black level at backporch.
4. **Synchronism and luminance limitation** – clips the synchronism and luminance levels without distorting the crominance signal; the intervention is handled by the software and shown by a yellow LED on the frontal panel, the intervention of the clipper, if any, is shown by two red LEDs (one for synchronism and one for luminance) on the front panel.
5. **Synchronism extraction stage** – extracts from the video signal the synchronism timing to perform the clamping, the regeneration and the lock of the pilot tone of the stereo audio modulator (see MTG0078).
6. **Synchronism regeneration stage** – starting from the timing information extracted by the previous stage, this processes a new synchronism pulse corrected both in level, timing and shape (rising and lowering times); the intervention is handled by the software and signalled by a yellow LED on the frontal panel.
7. **Group delay pre-corrector** – performs the pre-correction of the notch filter on the audio carrier in the demodulator of the receiver in order to equalise its group delay.
8. **Synchronism insertion stage** – 'cuts' the existing synchronism of the video signal and superimposes the regenerated one; due to the need of a delay in the video signal to perform the cut compared to the extraction timing of the synchronism, this stage is related to the insertion of the group delay pre-corrector which inserts this delay.
9. **Video switch** – this stage chooses between the processed video signal (pre-corrected and regenerated in synchronism if needed) and the non-processed one, at this stage there is the monitor for the video base band with 75Ω output with SMB connector on the frontal panel; the choice is handled by the software and signalled by a yellow LED on the front panel.
10. **Video signal level measurement** – this stage detects the peak of the synchronism and luminance levels providing two analog voltages for the A/D conversion; the voltages will be processed by the microcontroller of the display board (see MTG0079) to be displayed as VU-METERS.
11. **Synchronism level clamper** – once all needed processing have been performed with the clamping at black level, a new clamping operation at the synchronism level is made in order to perform the subsequent negative AM modulation.
12. **Amplitude modulator** – converts to the intermediate frequency the video signal referring to the synchronism

peak with a modulation depth of 90% at white level.

13. **Vestigial SAW filter** – filters the double side-band to the broadcast carrier in order to obtain a vestigial modulation (the upper side-band is partially broadcast).
14. **IF Amplifier** – performs the amplification after the vestigial filtering and sums the audio subcarrier(s) coming from the audio modulator module (see MTG0071/78).
15. **Output low pass filter** – filters the presence of harmonics of the audio and video carriers.
16. **IF video oscillator** – generates the video carrier by performing the PLL frequency synthesis; the selectable standards and the lock indication are handled by the software.
17. **Riferimento a 20MHz** – the frequency reference for the PLL synthesis of the video carrier is generated by a TCXO which may be locked to a more precise 5/10MHz external reference (see MTG0076), this reference is buffered and used as reference by the audio modulator (see MTG0071 /78) to synthesise the frequency of the audio carrier so that there are no frequency offsets between the two carriers, even when there is no common external reference.
18. **Controller** – all of the described operations are managed by a microcontroller communicating to the user interface board (see MTG0079) by RS485 protocol; the local controller stores the status of the module and a reprogramming of the firmware (possible via RS485 from the display board) does not alter its contents.

CALIBRATION PROCEDURE

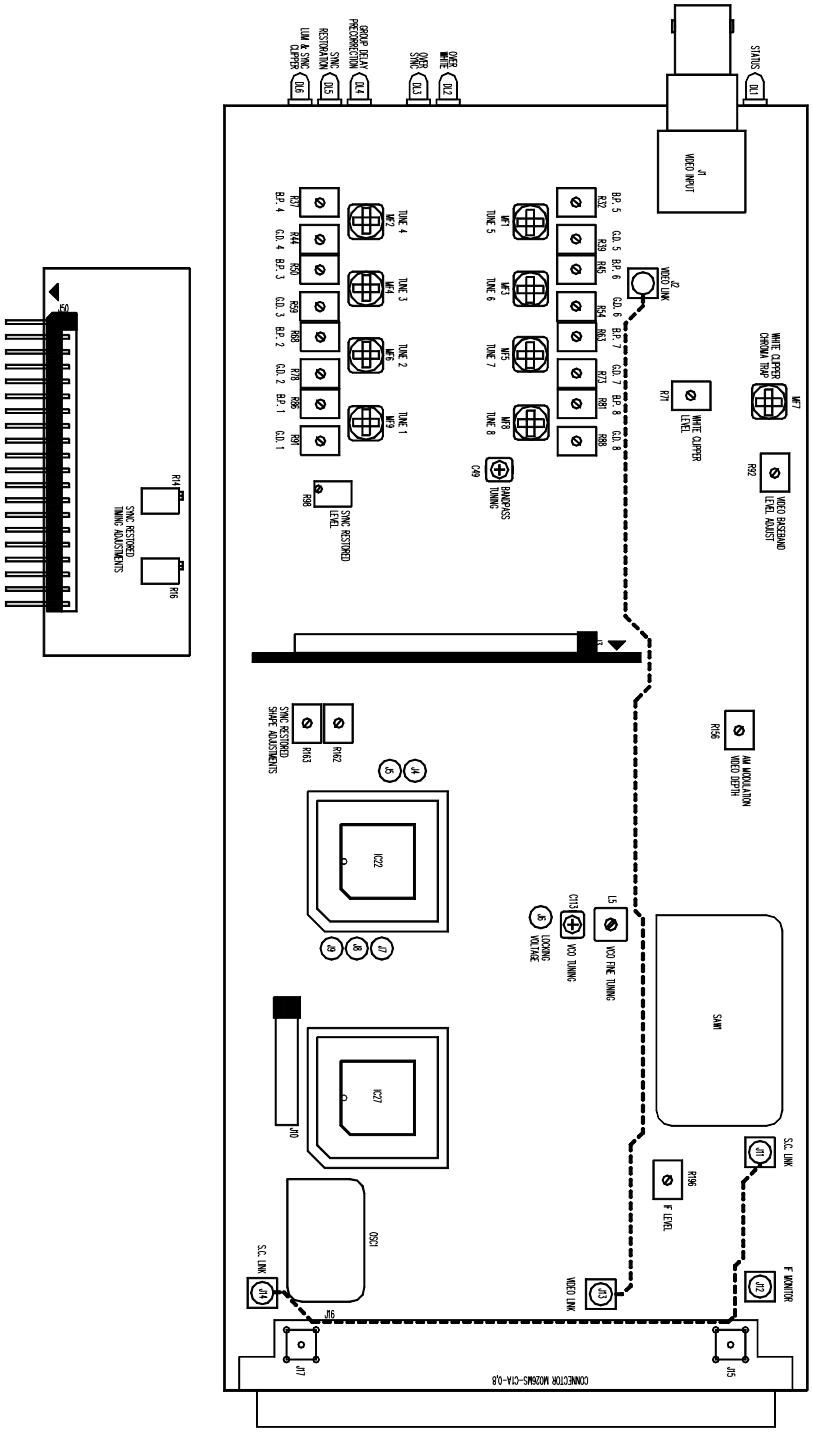
- Instrument list

MEASURE	INSTRUMENT
Lock of the carriers and reference	*- Spectrum analyser* *- Oscilloscope* *- Tester*
Calibration of the video parameters in base band and after the AM modulation	*- Video generator with VITS* *- AM Video receiver* *- Video parameters analyser*

- Description of the adjustment points

COMPONENT	DESCRIPTION
R71	White clipper level
R92	Level of the video signal in base band (0dB on dig. pot.)
R156	AM modulation depth (90%)
R196	Video carrier level (-6dBm)
R32, R45, R63, R81, R37, R50, R68, R86	Control of the passing band of the pre-corrector cells
R39, R54, R73, R88, R44, R59, R78, R91	Control of the group delay of the pre-corrector cells
R98	Level of the regenerated synchronism
R14, R16	Timing of the cut window of the synchronism
R162, R163	Shape adjustment of the synchronism
C49	Control of the passing band of the pre-corrector
C113	Tuning of the local oscillator of the video carrier
MF1, MF3, MF5, MF8, MF2, MF4, MF6, MF9	Tuning of the group delay pre-corrector cells
MF7	Tuning of the filter on the chrome carrier of the white limiter
L5	Fine tuning of the local oscillator of the video carrier
J4	IF video testpoint (50kHz)
J5	Unused
J6	VCO control voltage testpoint (7...8V)
J7	TCXO testpoint (50kHz)
J8	Unused
J9	External reference testpoint (100kHz)
J1	Video input (panel)
J2-J13	Video link for rear input
J11-J14	IF link for audio carrier input
J12	IF monitor (panel)

Component layout for adjustment points



The calibration procedure of the module requires a complete structure of display board (see MTG0079) and extension module (see MTG0095) in order to perform the software selection which will be referred to later and power the module itself.

- Menu of the Multistandard Video Modulator Module

Verification of the video base-band section – connect a video source with VITS to **J1** and a video parameter measurer to the video base-band output and check the sections included:

- ❑ Configure the module with ***Video Level*** at ½ of the scale, ***Clipper*** *off*, ***Precorr*** *off*, ***Sync.Restore*** *off* and ***Source*** *front*.
- ❑ Calibrate **R92** to obtain the correct levels of synchronism (Fig.1), luminance (Fig.2) and color burst (Fig.3).
- ❑ Increase ***Video Level*** to ¾ of the scale and set ***Clipper*** to *on*, calibrate R71 for the intervention of the white limitation circuit, check that the over LEDs light up and that ***White Clip*** and ***Sync Clip*** are on *Pres*, restore ***Video Level*** to ½ of the scale and check that the LEDs become unlit and that ***White Clip*** and ***Sync Clip*** are on *Trig*, if needed reset this indication by means of ***Reset Trig*** anc check that ***White Clip*** and ***Sync Clip*** are on *Abst*.
- ❑ Configure the module with ***Precorr*** *on* and calibrate **R39**, **R54**, **R73**, **R88**, **R44**, **R59**, **R78** and **R91** to obtain the desired group delay mask, if needed calibrate **R32**, **R45**, **R63**, **R81**, **R37**, **R50**, **R68**, **R86** and **C49** to make the passing band flat; in case this cannot be done in the base band (the video parameters analyser has no group delay mask for the required standard) the calibration of the IF pre-corrector can be made using the AM receiver set with the trap on the audio carrier enabled, equalising the group delay in order to make it flat as in Fig.10 (thus automatically compensating the trap on the audio carrier of the receiver).
- ❑ Configure the module with ***Sync.Restore*** *on* and calibrate **R14** and **R16** for the correct timing of the synchronism pulse (Fig.5) and color burst (Fig.6) and **R98** for the correct level of the synchronism (Fig.1); only if needed, calibrate **R16**2 and **R163** to equalise the rising and lowering time of the synchronism pulse.

Verification of the IF oscillator section – connect a spectrum analyser on the monitor of the **J12** module and check the sections within:

- ❑ Calibrate **C113** and **L5** to lock the video carrier to the intermediate frequency of the set standard (to change the standard refer to the standard change procedure) and obtain a lock voltage between *7V* and *8V* on **J6** checking that ***Video*** is on *Lock* in the display menu.
- ❑ In case of problems in obtaining the lock, check that on **J4**, **J7** and **J9** there are the frequencies listed in the table of the description of the adjustment points.

Verification of the AM modulation section – connect a video source with VITS to **J1,** a spectrum analyser to the monitor of the **J12** module and an AM video receiver with video parameters analyser to the output of the **J15** module, anc check the sections within:

- ❑ Calibrate **R196** for a level of *–6dBm* of the video carrier and check that the video parameters described in the technical specifications table are obtained (see Fig.1 to Fig.14).

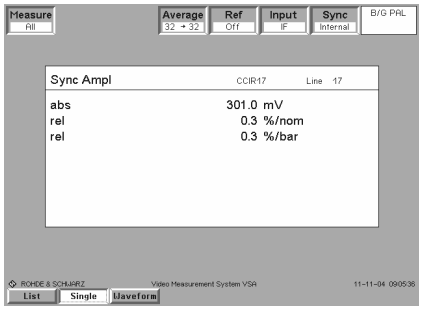


Fig. 1

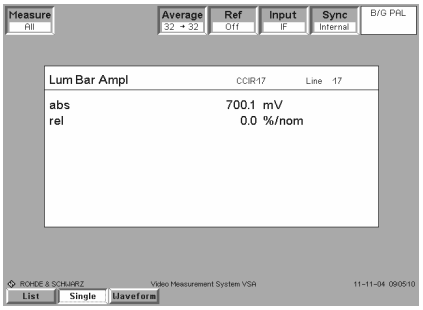


Fig. 2

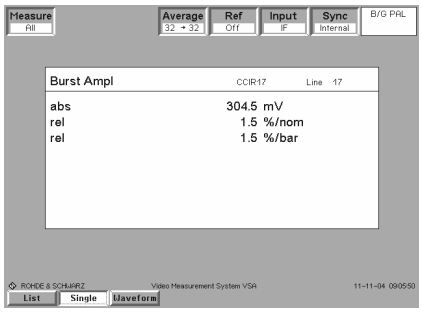


Fig. 3

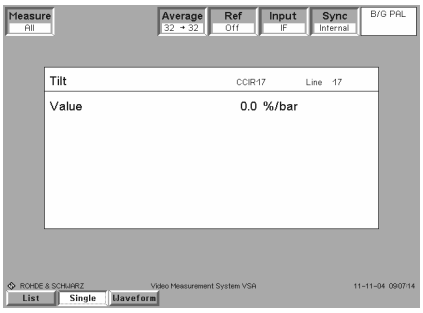


Fig. 4

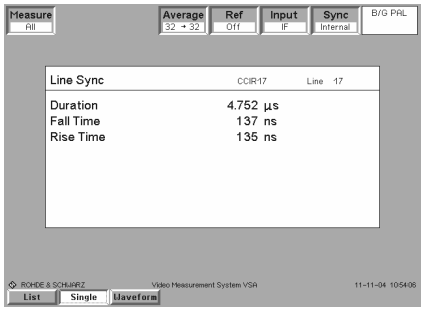


Fig. 5

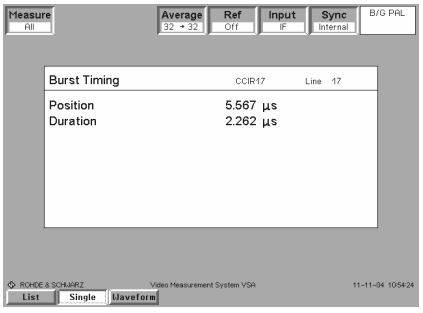


Fig. 6

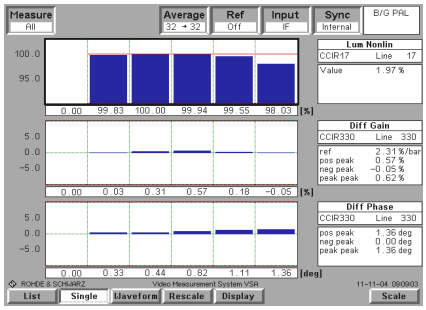


Fig. 7

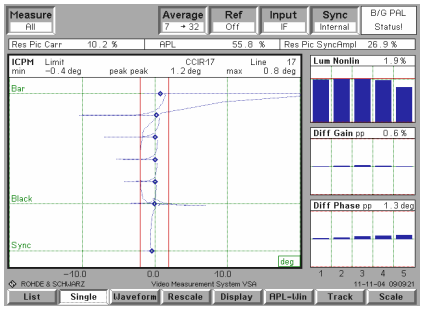


Fig. 8

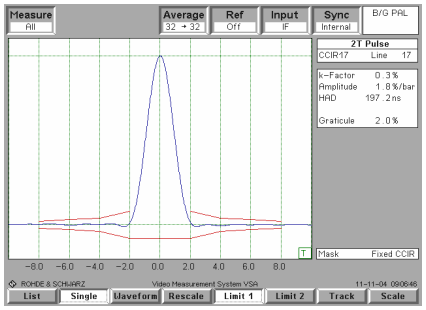


Fig. 9

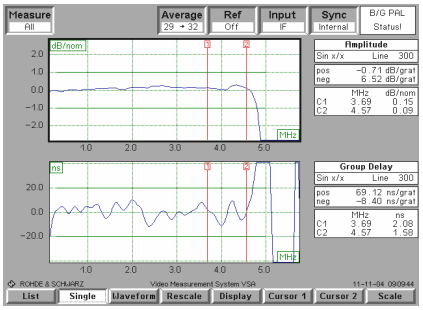


Fig. 10

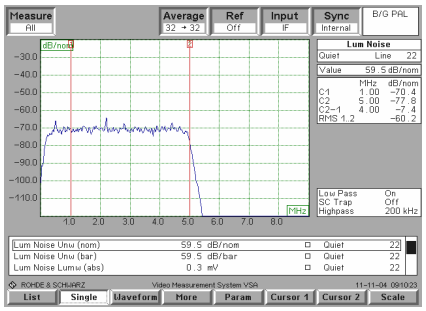


Fig. 11

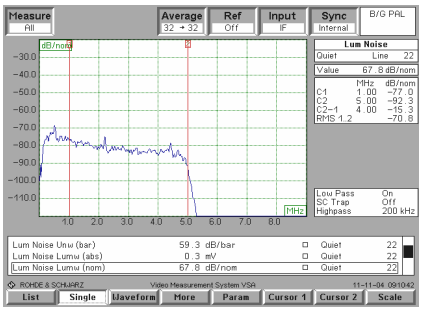


Fig. 12

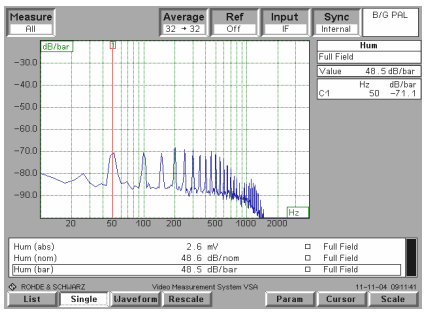


Fig. 13

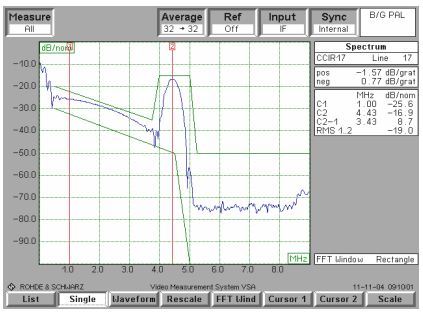
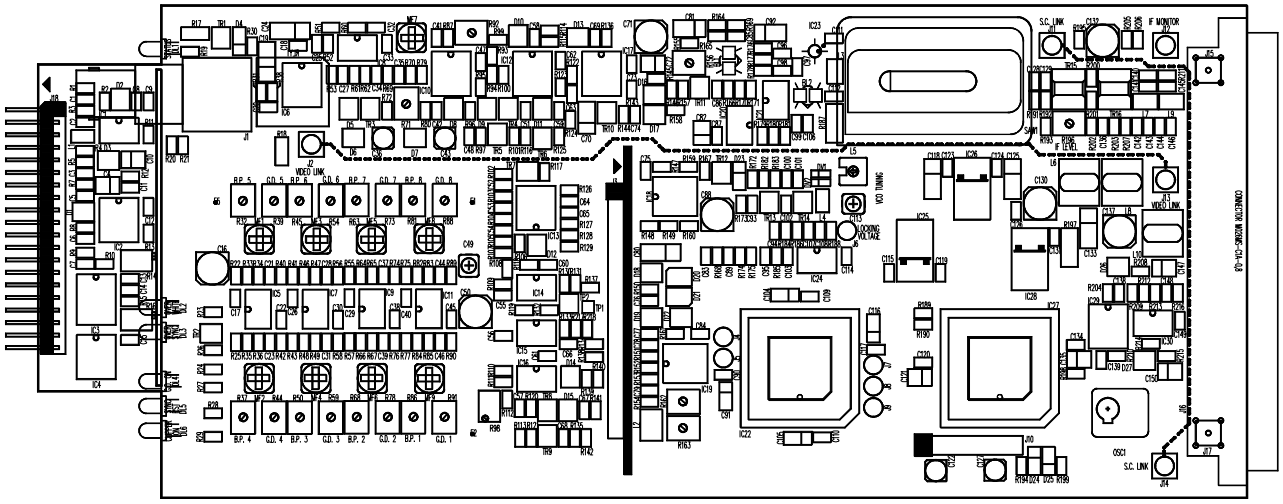
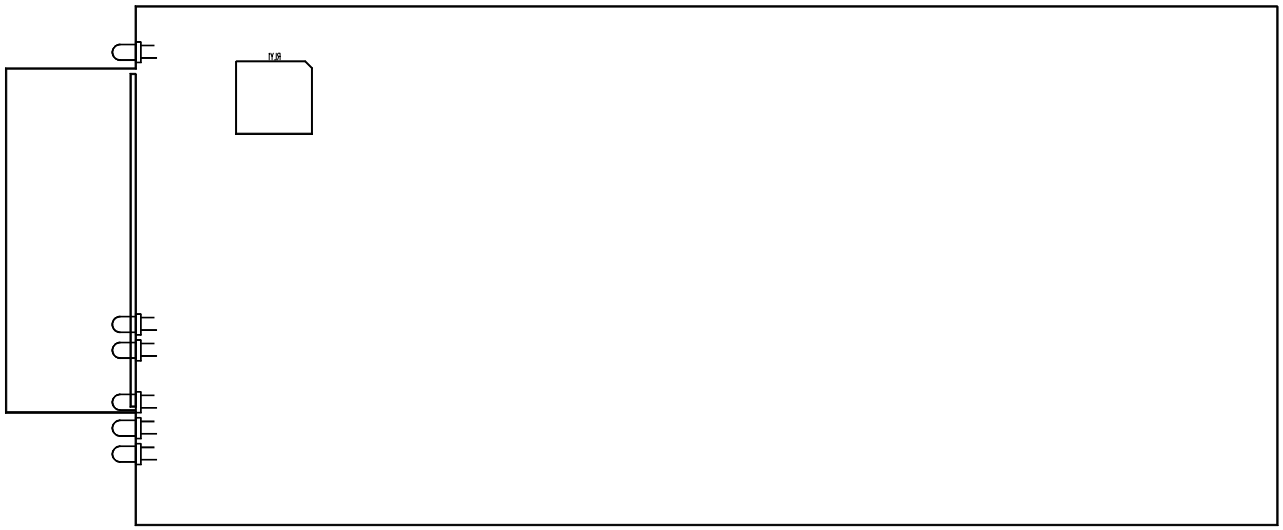


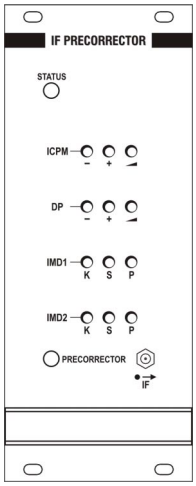
Fig. 14

Component layout SCH0172AR3 - Top Layer



Component layout SCH0172AR3 - Bot Layer



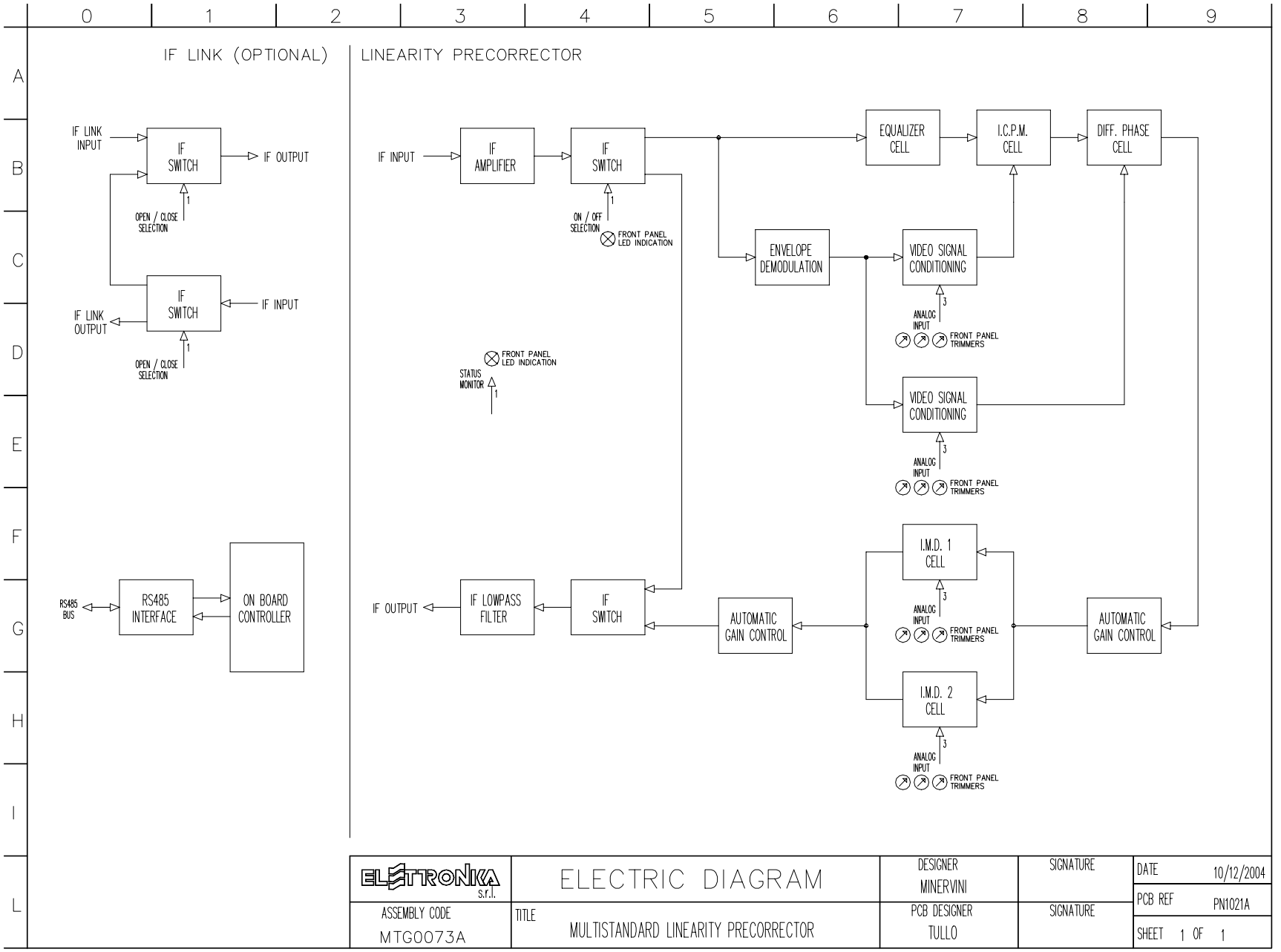


DESCRIPTION

The non-linearity IF pre-correction is performed by two distinct stages which act on different characteristics of the signal. The first stage works on ICPM and differential phase and gain (DGDP) of the video signal, which are small signal characteristics and thus need a pre-correction based on "adapted" filtering cells.
The second stage works on intermodulation, which is a large signal characteristic and needs a pre-correction based on the intervention on non-linear stages.
In consideration of this, the work of the second stage is assured by am automatic gain control system which comes before and after the correction cells, and which is needed to have the system work correctly for each type of pre-correction adopted.
The whole pre-correction stage can be enabled and disabled via software with a switching system which prevents the overshoot at IF-level, dangerous for the final stages.

TECHNICAL CHARACTERISTICS

Input impedance	50Ω - ROS > 25dB
Output impedance	50Ω - ROS > 25dB
Nominal level	-6dBm
Group delay	< 10nsecpp
Frequency response	<±0.2dB
I.C.P.M. pre-correction	3 cells: (-) (+) (level)
D.P. pre-correction	3 cells: (-) (+) (level)
IMD1 pre-correction	3 cells: (knee) (slope) (phase)
IMD2 pre-correction	3 cells: (knee) (slope) (phase)
Video signal for ICPM and DP	Internal envelopment demodulator
Automatic gain control	Before and after the IMD1 cells, 2
Pre-correction	Excludible via software
Pre-corrector intervention	Can be enabled even when powered, without overshoot
Analog measures	---


IF LINK (OPTIONAL)
LINEARITY PRECORRECTOR
IF LINK INPUT
IF SWITCH
IF OUTPUT
OPEN / CLOSE SELECTION
IF LINK OUTPUT
IF INPUT
RS485 BUS
RS485 INTERFACE
ON BOARD CONTROLLER
IF AMPLIFIER
ON / OFF SELECTION
FRONT PANEL LED INDICATION
STATUS MONITOR
EQUALIZER CELL
I.C.P.M. CELL
DIFF. PHASE CELL
ENVELOPE DEMODULATION
VIDEO SIGNAL CONDITIONING
ANALOG INPUT
FRONT PANEL TRIMMERS
IF LOWPASS FILTER
AUTOMATIC GAIN CONTROL
I.M.D. 1 CELL
I.M.D. 2 CELL
ELETTRONIKA S.r.l.
ELECTRIC DIAGRAM
DESIGNER
MINERVINI
SIGNATURE
DATE
10/12/2004
ASSEMBLY CODE
MTG0073A
TITLE
MULTISTANDARD LINEARITY PRECORRECTOR
PCB DESIGNER
TULLO
SIGNATURE
PCB REF
PN1021A
SHEET 1 OF 1

The module contains the following blocks:

1. **Input amplifier** – de-couples the input of the module from the internal pre-correction sections.
2. **Input/output relay** – inserts or excludes the pre-corrector from the IF chain with the timing needed to avoid power overshoot due to the internal AGC stages; the switch is handled by the software and signalled by a yellow LED on the frontal panel.
3. **Envelopment demodulation stage** – extracts the video information from the AM modulation in order to process the interventions on the pre-correction of ICPM and DP.
4. **Conditioning stages of the video signal (2)** – these use the information extracted by the demodulator and process it by inserting some deformation stages of the video signal which parameters (lower cut, upper cut and level) depend on the controls on the frontal panel.
5. **Equalisation cell** – equalises the passing band of the IF pre-corrector by inserting a band-pass filter cell between the ICPM (set on the video carrier) and DP (set on the audio carrier) pre-correction cells.
6. **ICPM pre-correction cell** – performs the intervention set by the ICPM conditioning stage on the band-pass filter cell set on the video carrier.
7. **DP pre-correction cell** – performs the intervention set by the DP conditioning stage on the band-pass filter cell set on the audio carrier.
8. **Automatic gain control stage (in)** – performs the gain control on the IF signal in order to have the IMD pre-correction cells always work on the optimal point.
9. **Intermodulation pre-correction cells (2)** – pre-correct the three-tones intermodulation by inserting two non-linearity stages which parameters (knee, slope and phase) depend on the controls on the frontal panel.
10. **Automatic gain control stage (out)** – performs the gain control on the IF signal in order to obtain an output signal which level does not depend on the inserted pre-correction.
11. **Output low-pass filter** – filters the presence of harmonics inserted by the linearity pre-corrector.

CALIBRATION PROCEDUE

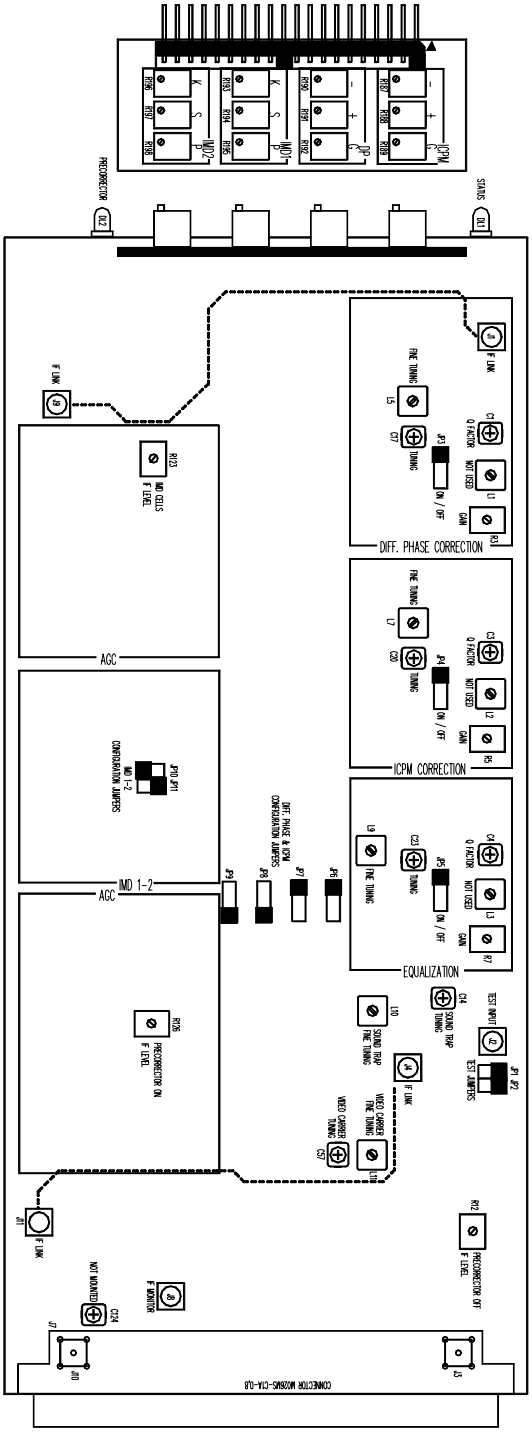
- List of instruments

MEASURE	INSTRUMENT
Calibration of the pre-correction cells and envelopment demodulator	*- Spectrum analyser with tracking* *- Oscilloscope*
Calibration of the video parameters after the pre-correction	*- Video generator with VITS* *- AM Video receiver* *- Video parameters analyser*

- Description of the adjustment points

COMPONENT	DESCRIPTION
R12	IF level without pre-correction (-6dBm)
R123	IF level before the IMD pre-corrector (0dBm)
R126	IF level after the IMD pre-corrector (-6dBm)
C57, L11	Band-pass filter on the video carrier of the envelopment demodulator
C14, L10	Notch filter on the audio carrier of the envelopment demodulator
C23, L9	Tuning of the equalisation band-pass filter
R7, C4	Merit and gain factor of the equalisation band-pass filter
C20, L7	Tuning of the ICPM band-pass filter
R5, C3	Merit and gain factor of the ICPM band-pass filter
C17, L5	Tuning of the DP band-pass filter
R3, C1	Merit and gain factor of the DP band-pass filter
L1, L2, L3	Need no calibration
R187, R188, R189	Calibration of the ICPM parameters
R190, R191, R192	Calibration of the DP parameters
R193, R194, R195	Calibration of the IMD1 parameters
R196, R197, R198	Calibration of the IMD2 parameters
JP1, JP2	Jumpers to calibrate the IF filter concerning the ICPM and DP cells
J2	IF input of the filter concerning the ICPM and DP cells
JP3, JP4, JP5	Jumpers to esclude the cells of the ICPM and DP IF filters
J1, J9	IF link (J1 is also the output of the ICPM and DP filter)
JP10, JP11	Configuration jumpers of the IMD cells (do not use)
J4, J11	IF link
J8	IF monitor (panel)
JP6, JP9	Configuration jumpers of the intervention of the DP pre-correction
JP7, JP8	Configuration jumpers of the intervention of the ICPM pre-correction

Component layout for adjustment points



The calibration procedure of the module requires a complete structure of display board (see MTG0079) and extension module (see MTG0095) in order to perform the software selection which will be referred to later and power the module itself. Besides a video modulator module (see MTG0072) and an audio modulator module (see MTG0071/78) already calibrated are needed to calibrate, if neededm the envelopment demodulator (only for the first calibration or to change the standard).

- Menu of the Multistandard IF Precorrector Module

Verification of the ICPM and DP pre-correction section – connect a spectrum analyser with tracking between **J2** and **J1** and check the sections therein:

- ❑ Calibrate **C20** and **L7** to tune the cell of I.C.P.M. to the frequency of the video carrier summing about *750kHz* (Fig.1) with **JP4** *on* and **JP3** and **JP5** *off*.
- ❑ Calibrate **C17** and **L5** to tune the cell of D.P. to the frequency of the audio carrier subtracting about *750kHz* (Fig.2) with **JP3** *on* and **JP4** and **JP5** *off*.
- ❑ Calibrate **C23, L9** to tune the equalisation cell to the middle of the intermediate frequency (Fig.3) with **JP5** *on* and **JP3** and **JP4** *off*.
- ❑ Set **JP3**, **JP4** and **JP5** *on* and check the response of the filter curve (Fig.4) to the desired passing band, if needed retouch **R3**, **R5** and **R7** to correct the ripple in band and **C1**, **C3** and **C4** to equalise the group delay of the filter obtaining a frequency response as in Fig.5.

Verification of the envelopment demodulator section – connect the module to the frame provided with video modulator by means of the extension board and check the sections therein:

- ❑ Calibrate **C57** and **L11** to obtain the best demodulation of the video signal by connecting an oscilloscope to **C44** (only if changing the IF standard).
- ❑ Calibrate **C14** and **L10** to obtain the best attenuation of the audio signal superimposed to the video signal connecting an oscilloscope to **C44** (only if changing the IF standard and with at least one audio module in the frame).

Verification of the IMD1, 2 pre-correction sections – connect a spectrum analyser with tracking between **J9** and **J10** and check the sections therein:

- ❑ Configure the module with ***Prec*** *enabled.*
- ❑ Calibrate **R123** to an IF level of *0dBm* on **R178** and calibrate **R126** to an IF level of *-6dBm* on **J10** with the tracking on *-6dBm*.
- ❑ Check that the passing band of the section is similar as the one in Fig.6 and able to cover the whole IF band from *30MHz* to *50MHz*.

Verification of the module without pre-correction – connect a spectrum analyser with tracking between **J3** and **J10** and check the sections therein:

- ❑ Configure the module with ***Prec*** *disabled.*
- ❑ Calibrate **R12** to an IF level of *-6dBm* on **J10** with the tracking on *-6dBm*.
- ❑ Check that the passing band of the section is flat within *0.2dB* on the whole IF from *30MHz* to *50MHz*.

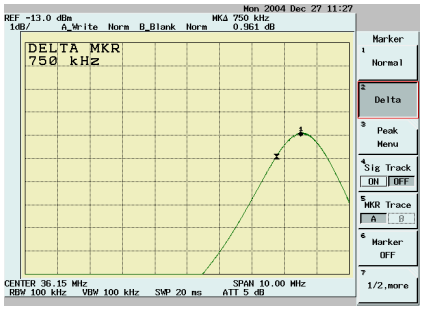


Fig. 1

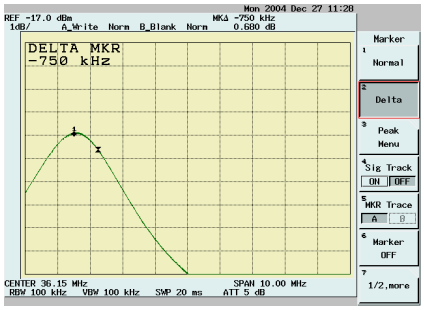


Fig. 2

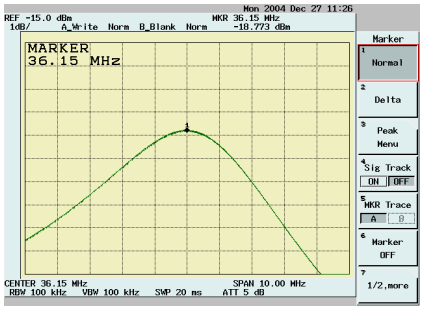


Fig. 3

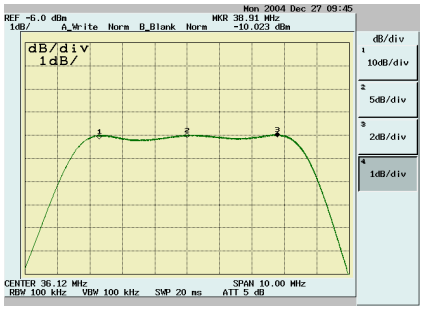


Fig. 4

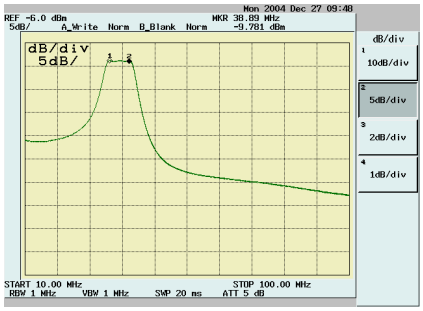


Fig. 5

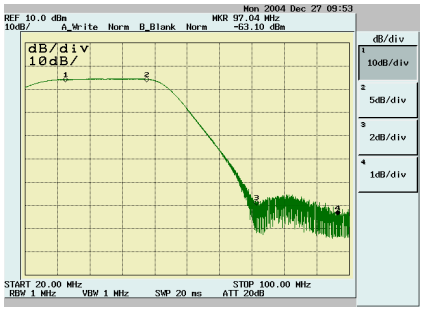
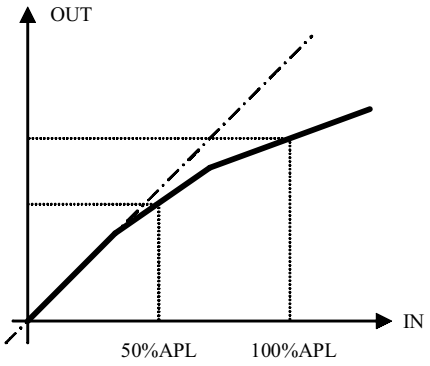


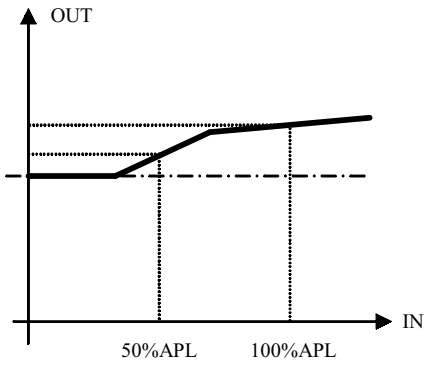
Fig. 6

The testing procedure of the linearity pre-corrector is the consequence of a series of subsequent interventions on the pre-corrector cells in order to achieve a good compromise of the video parameters of the amplifier at the working power.
A calibration technique for the cells allowing to satisfy these requirements is proposed below; the choice of the good compromise on the video parameters is anyway entrusted to the skill of the tester.

IMD1, 2 pre-correction - the intermodulation pre-correction inserts distortions in the negative Am modulation linear characteristic of the video signal in order to compensate the distortions due to the power amplifier.
These are characterised by three parameters: ***K****nee*, ***S****lope* and ***P****hase*, and introduce some deviations from the input/output linear characteristic of the pre-corrector.
For a more complete possibility of shaping the non-linearity characteristic, there are two pre-correction cells in two particular regions of the characteristic: **50% APL** (cell 1) and **100% APL** (cell 2).



AM-AM



AM-PM

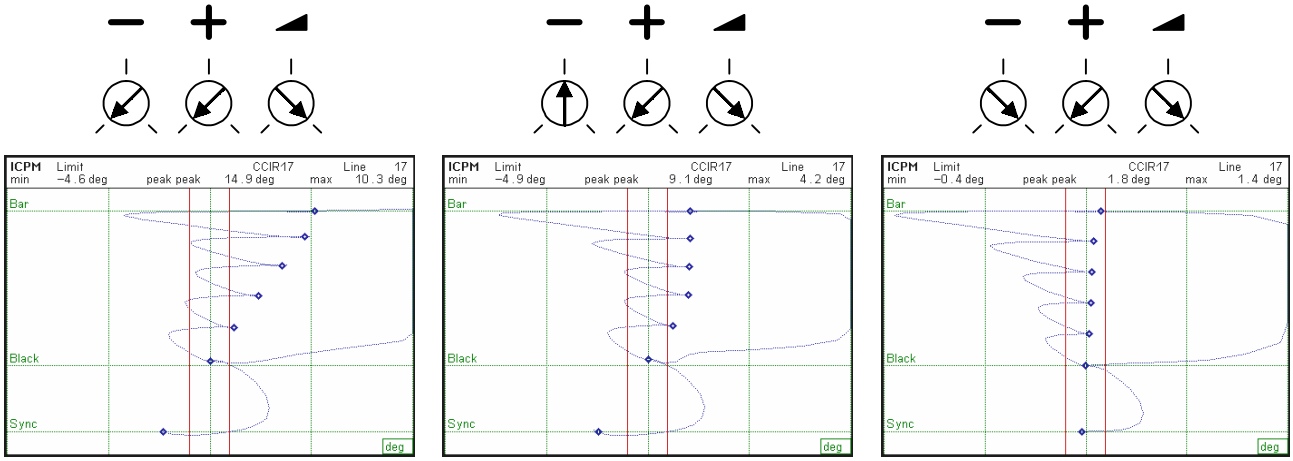
The suggested procedure to compensate the characteristic of the final power stage is to start 'positioning' cell 1 (by acting on the K and S trimmers) in order to find a minimum point for the intermodulation, then 'position' cell 2; retouch the P trimmer if needed to refine the pre-correction.
Usually cell 1 only is needed to pre-correct A-class final stages, while for AB-class ones both cells are needed.
In order to exclude one of the cells (or both at the beginning of the pre-correction procedure) it only takes decreasing the K, S and P trimmers to the minimum.
Perform the pre-correction procedure for the intermodulation with the *red bar* video signal and repeat it for the other colours if needed, refining the pre-correction.

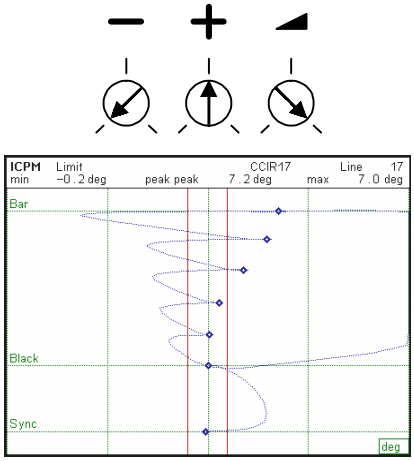
ICPM pre-correction – a catalogue of the different kinds of pre-correction which can be introduced on the ICPM parameter is given below. Once the measure has been taken, the situation which better approximates

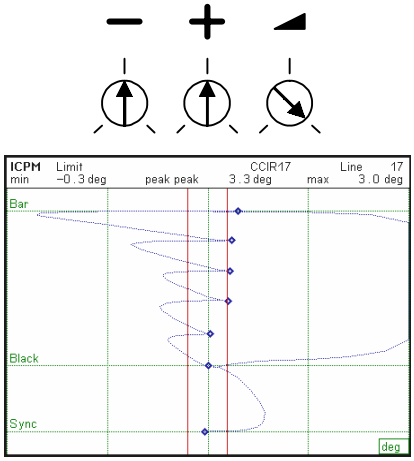
the compensation has to be found, then the figure reproducing the measure **in a 'specular' way** is to be considered.
In the catalogue there are also the positions of the trimmers and the jumpers to obtain all proposed configurations, of course intermediate solutions are possible and the intensity of all solutions may be scaled by means of the level trimmer which is considered to be at the maximum intervention in the catalogue.

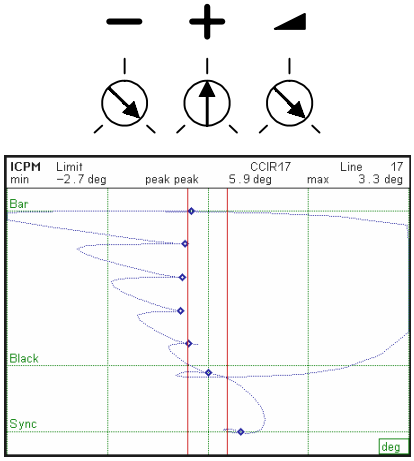
DP pre-correction – a catalogue of the different kinds of pre-correction which can be introduced on the DP parameter is given below. Once the measure has been taken, the situation which better approximates the compensation has to be found, then the figure reproducing the measure **in a 'specular' way** is to be considered.
In the catalogue there are also the positions of the trimmers and the jumpers to obtain all proposed configurations, of course intermediate solutions are possible and the intensity of all solutions may be scaled by means of the level trimmer which is considered to be at the maximum intervention in the catalogue.

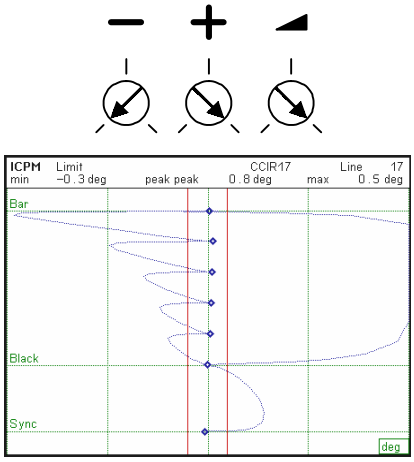
- ***I.C.P.M.*** Pre-correction catalogue with: JP7 → 1-2; JP8 → 1-2

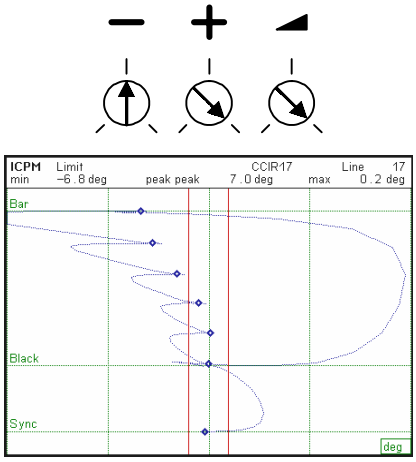


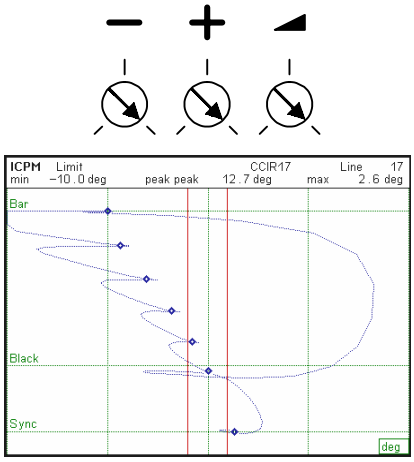




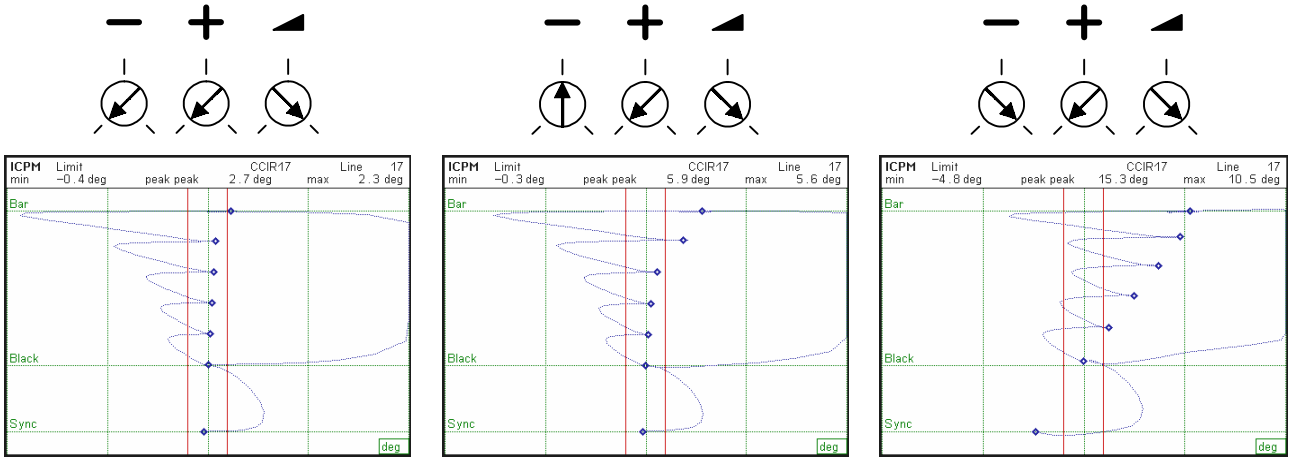


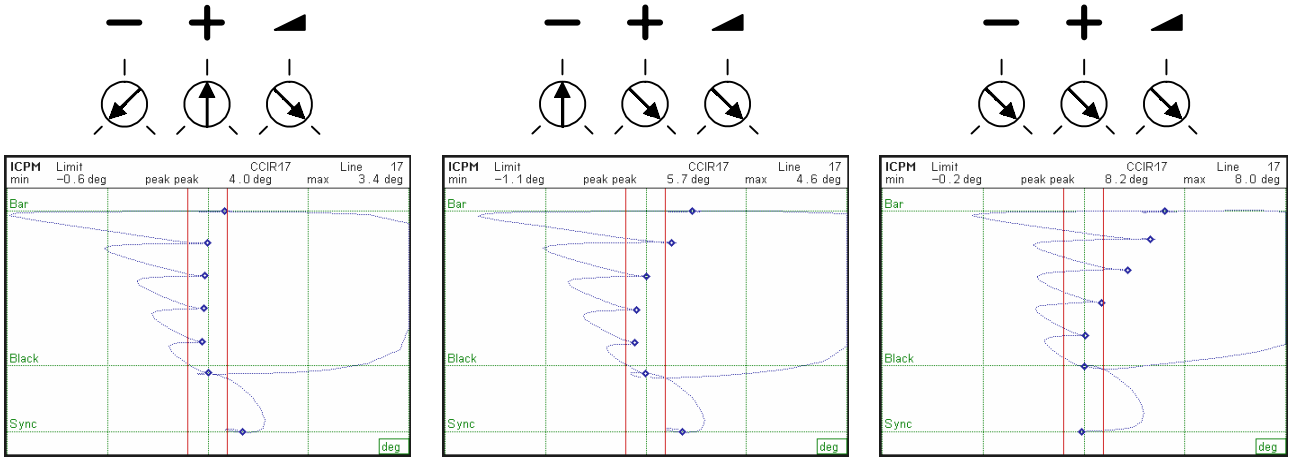


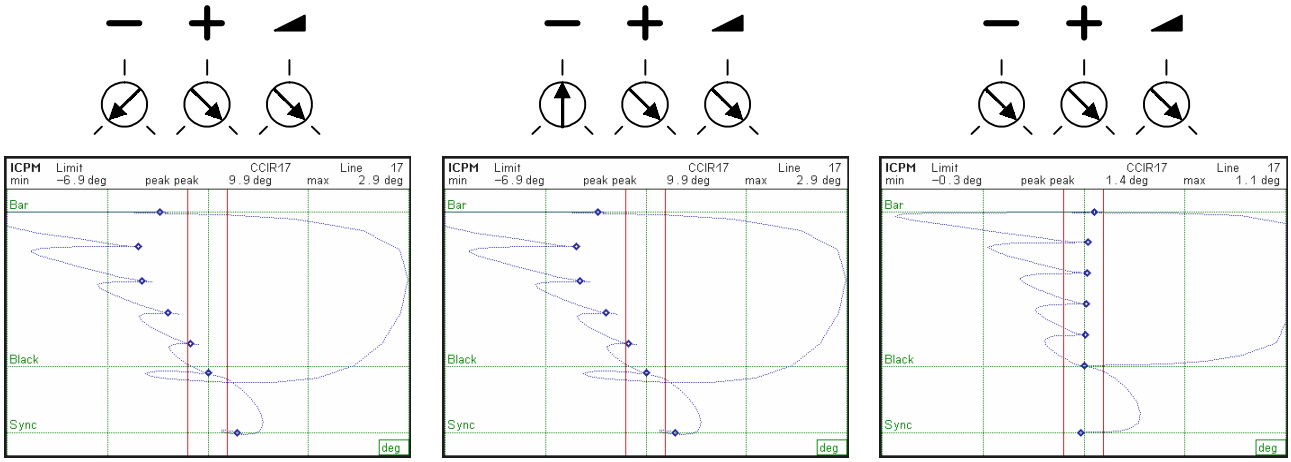




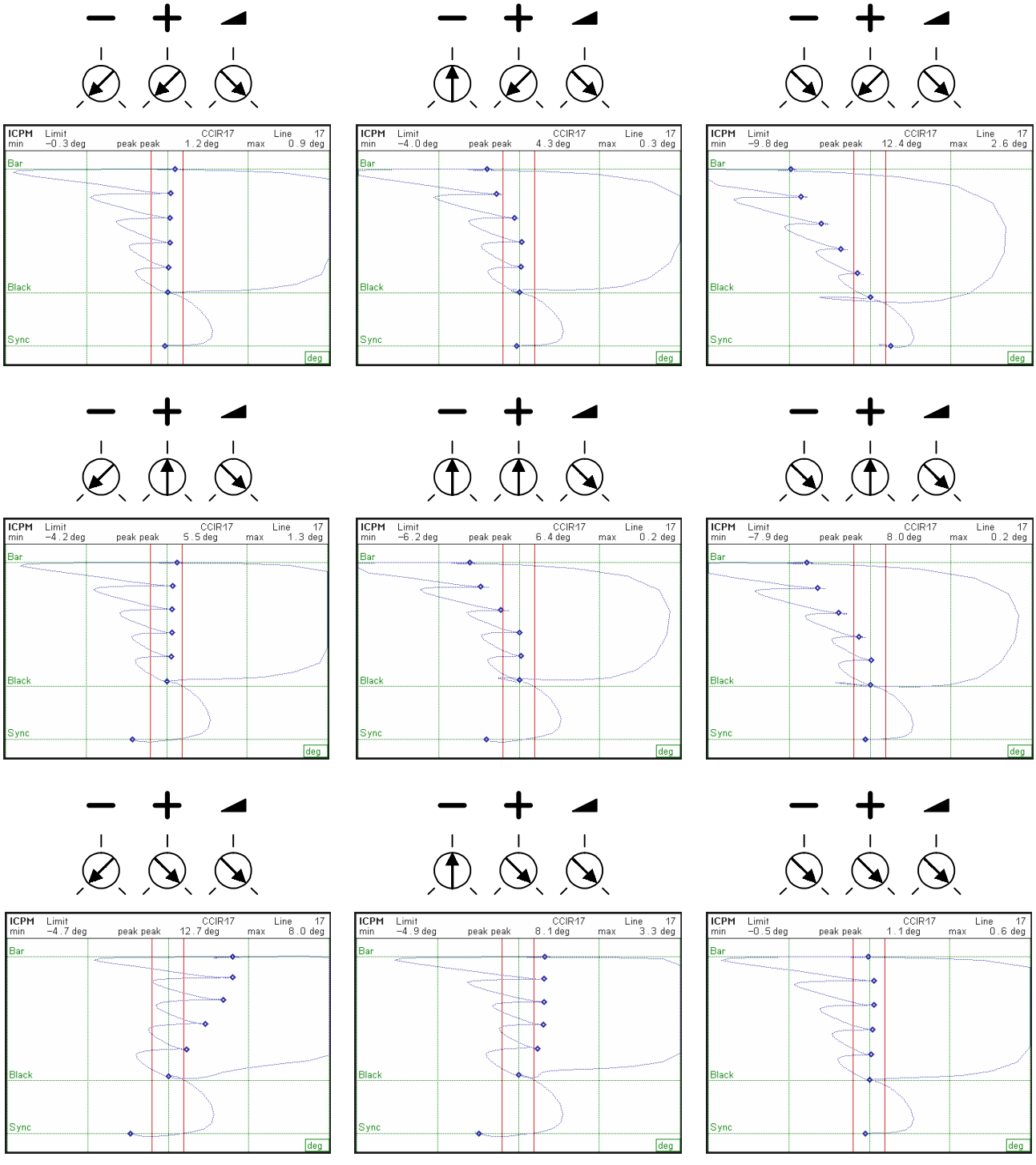
- ***I.C.P.M.*** Pre-correction catalogue with: JP7 → 2-3; JP8 → 1-2



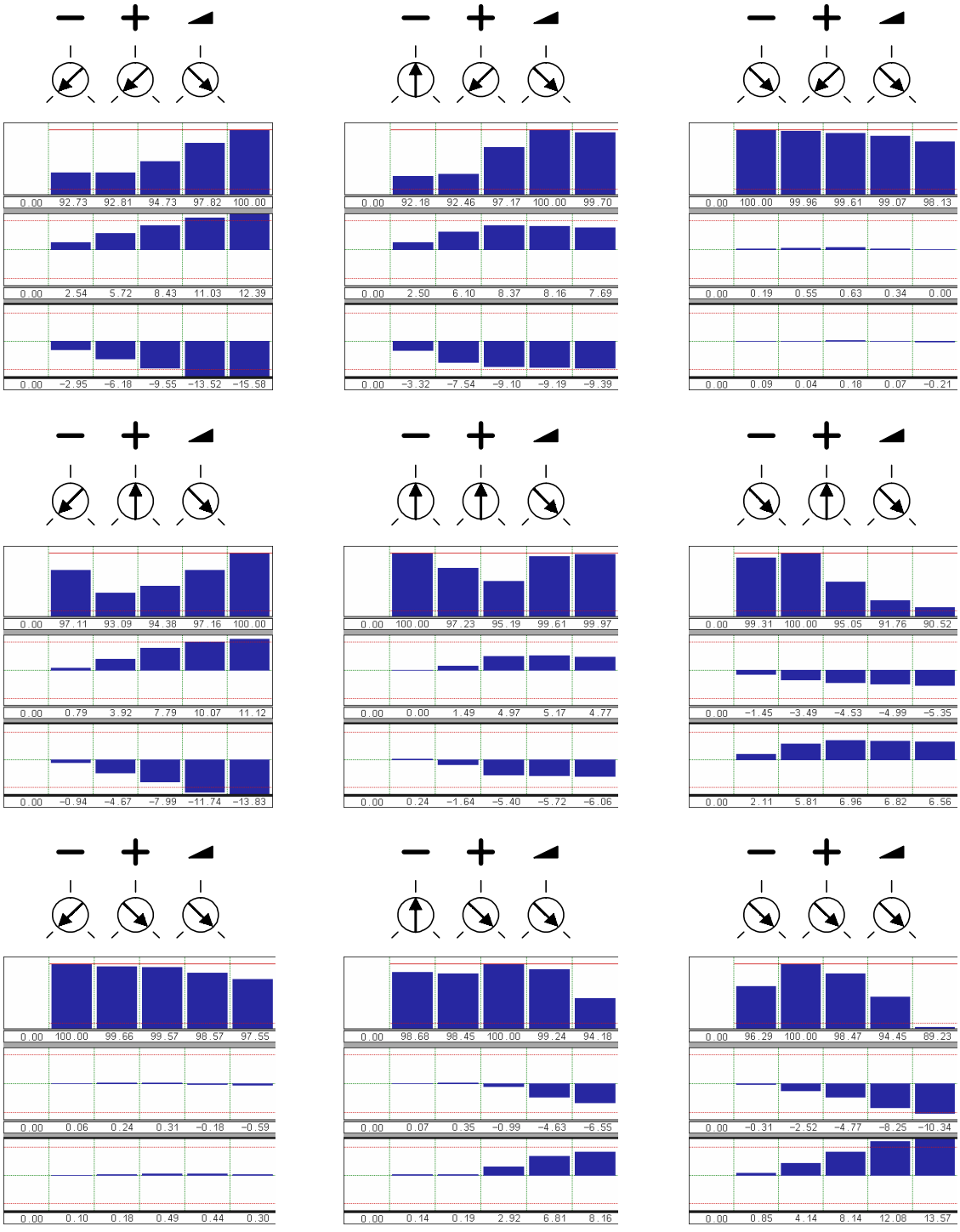




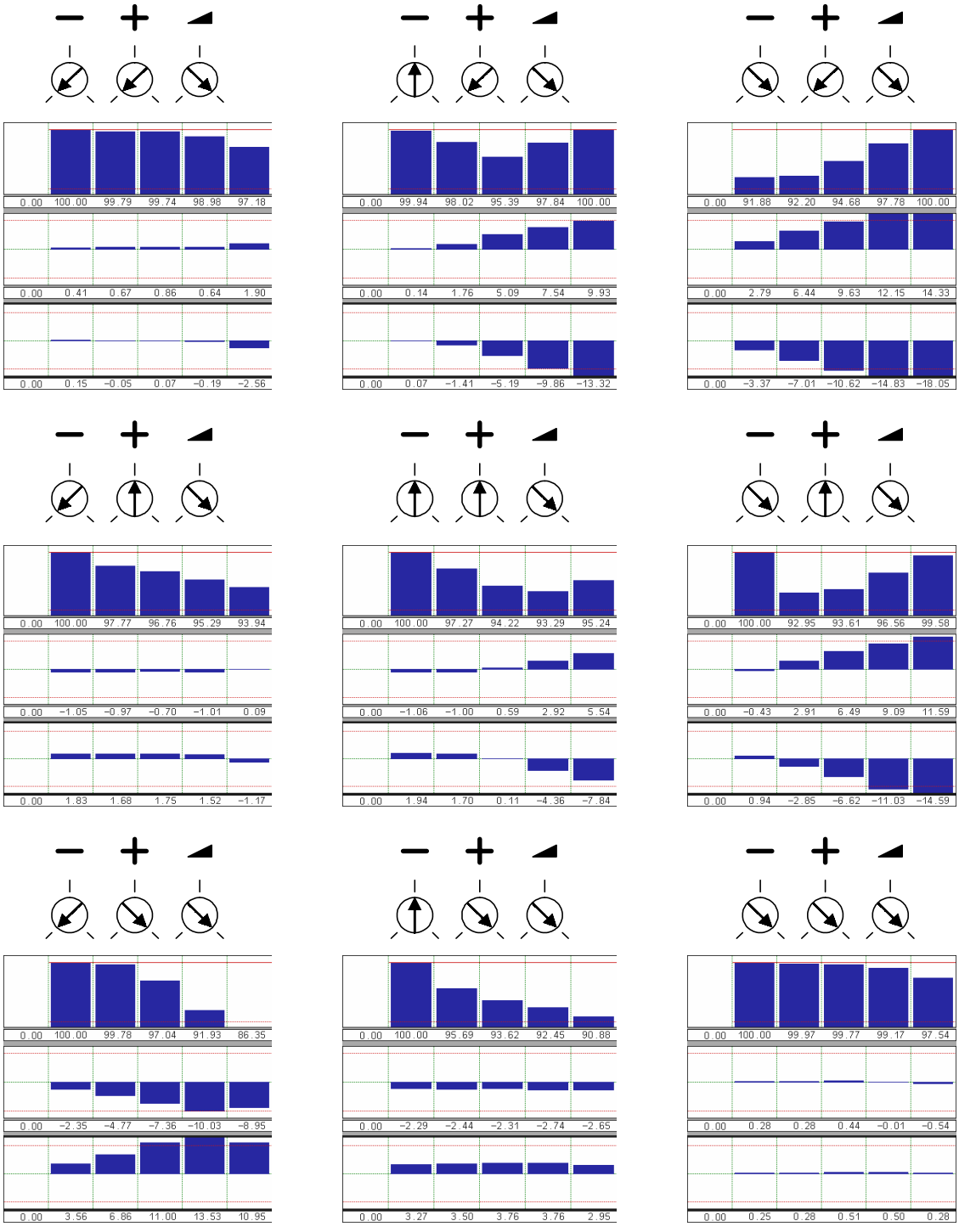
- ***I.C.P.M.*** Pre-correction catalogue with: JP7 → 1-2; JP8 → 2-3



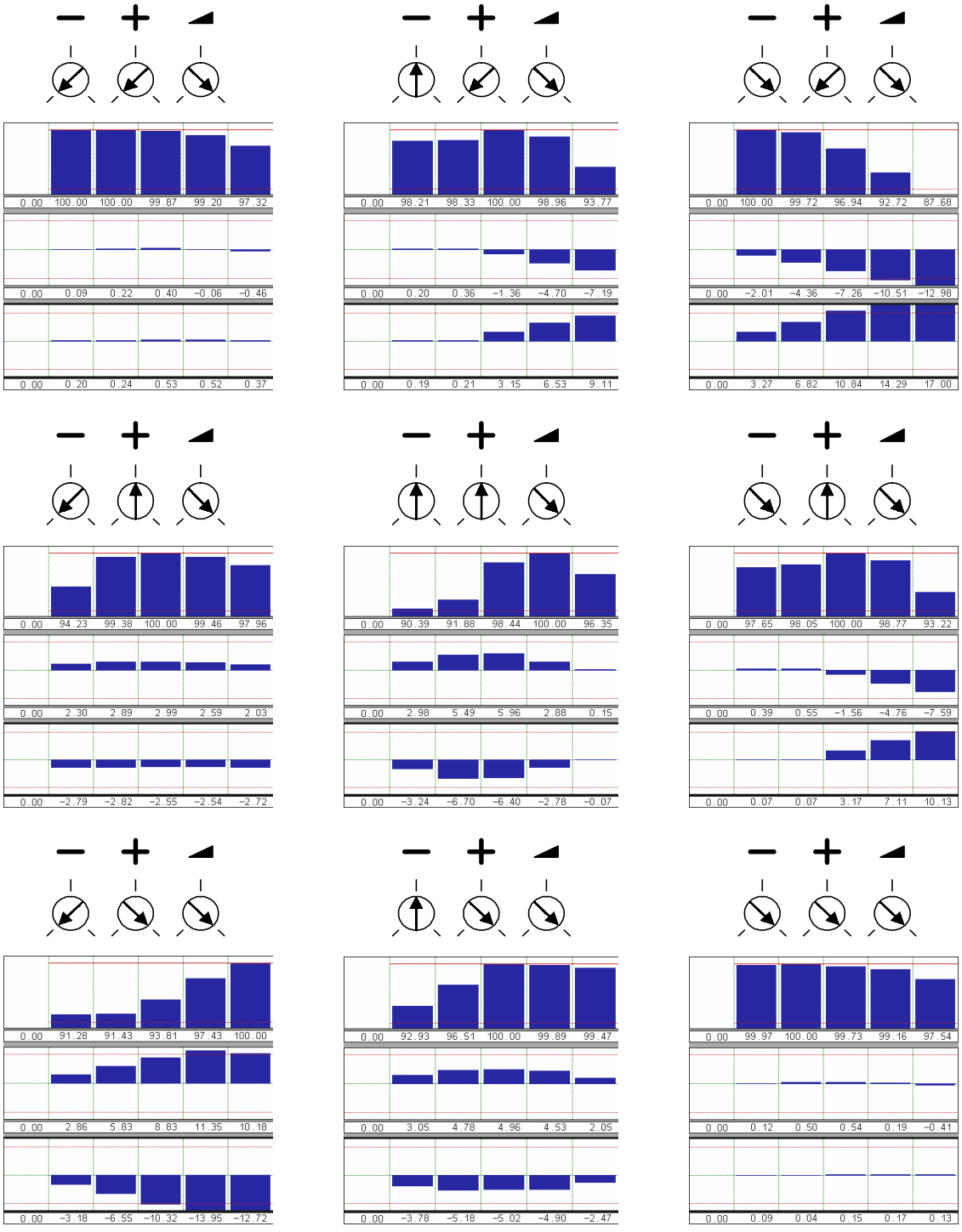
- ***D.P.*** Pre-correction catalogue with: JP6 → 1-2; JP9 → 1-2



- ***D.P.*** Pre-correction catalogue with: JP6 → 2-3; JP9 → 1-2



- ***D.P.*** Pre-correction catalogue with: JP6 → 1-2; JP9 → 2-3



Component layout SCH0209AR1