User Guide

for

DIGITAL PEAK PROGRAMME METER

477-430A

477-460A

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General Description.

The 477-460 is a Digital Peak Level Meter with phase meter in a table top housing. The input connects directly to the Serial Digital Audio Signal such as it is described in the EBU 3250 and IEC 958 standards.

The scale on this instrument is of the "absolute" type, meaning that the scale maximum (marked "0") corresponds to maximum digital code level. Consequently the integration time for the Bargraph read-out is "FAST" and not switchable to 5 ms (10 ms). However, a number of alternative display modes can selected, one of these providing an additional spot indication for "Normal" (5/10 ms integration time) read-out.

Generally, the digital technique pose some problems unknown in analog designs. For instance at 48 kHz sampling frequency, the number of samples at high audio frequencies is insufficient to obtain an accurate measurement of the true <u>audio</u> peak level. (Not the digital coding level). Also the ability of the digital signal chain to convey a dc offset (introduced by the A/D converter) is a problem as the measurement of low level audio signals will be concealed by the dc. Both these problems have been dealt with by digital signal processing in the instrument.

Operation and Indications:

Programming switch, rear side of instrument.

Switch No.	Description
1 and 2	The number of samples needed to activate the overload indication can be programmed by means of SW 1 and 2. The binary codes 0 thru 3 corresponds to 1,4,8 and 16 samples to activate overload LED. SW no. 1 is the least significant bit.
3	Without affecting the integration time of the <u>measurements</u> the <u>display ballistics</u> can be changed to obtain a more steady display. The "slow" ballistics is selected when SW 3 is on.
4,5,6,7 and 8	The display provides a marker which can be set to indicate the corresponding analg "Reference Level". The level can be set on the code switch on the rear side.

The code range is 0 to 31 dB, binary code, with SW 4 being the least and SW 8 the most significant bit. The factory default setting is 10 dB.
Alternatively, the level can be coded on the connector. If coded through the connector, all code switches should be in off position.

Factory Default
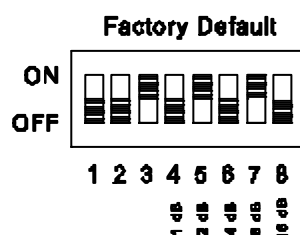
Front Layout.
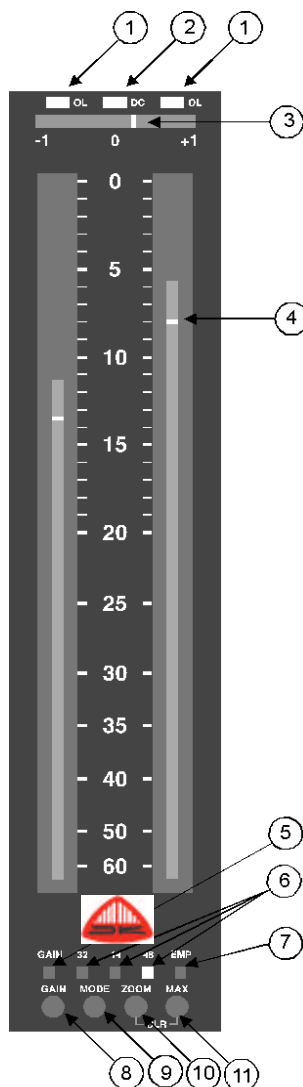
1) Overload indication.

Above each channel display is an overload LED which is triggered whenever a preselected number of contiguous samples equals maximum digital code level.

2) DC-warning.

Because of the dc-blocking in the measuring system, dc will not be displayed as part of the signal level. The dc-warning LED will indicate if such high dc levels are encoded in the digital signal that full utilisation of the dynamic range (for audio signals) is endangered.

3) Phase indication.

The phase meter indicates the stereo to mono compatibility of a stereo signal. The reading will be +1 for (mono-) signals in phase and -1 for signals out of phase. Centre indication is obtained from stereo signals with random L/R phase relationship.

4) Spot indication.

Depending on the actual display mode being used a spot indication is provided showing the "familiar" quasi peak indication (5/10 ms integration time).

5 & 8) Gain.

The scale range can be offset by 20 dB to extend the measuring range down to - 80 dB. The push-button (8) has alternating action and the LED will be lit when "GAIN" is selected.

6) Sample rate indicator.

The sample rate indication is based on a measurement of the actual sample rate rather than on the channel status bit information.

7) Emphasis indicator.

The LED will be lit if the emphasis bit is set in the received digital signal. No frequency compensation will be introduced to the measured audio level whether the emphasis bit is set or not.

9) Mode.

To adapt to various applications the bargraph display can be operated in various modes. By holding the Gain Switch while pushing the Fast Switch the various modes (designated "a" to "e" below) are selected sequentially

a) The mode "a" is easy to distinguish from the rest by the blend-in scale markings. An illuminated background to the peak indicating bar-graph extends to the scale mark "0" to provide the user with clear scale markings, even in dimmed light.

b) In mode "b" there is no scale markings an no background ilumination.

c) In mode "c" a spot within the bar indicates peak audio level measured with 5/10 ms integration time (IEC 298-10).

d) In mode "d" the illuminated background extends to the top of the scale and the spot operates as an peak hold indication "riding" on the top of the bar.

e) In mode "e" the spot "holds" the maximum reading until it has been cleared by pressing the buttons "ZOOM" and "MAX" simultaneously.

10) Zoom.
The zoom function will increase the display resolution by a factor of ten thus for the shown scale the bottom (-60) mark will represent - 6 dB. The GAIN LED will flash while Zoom is active.

11) Max. memory function.
The meter incorporates a peak memory function that continuously monitors and stores the highest peak. The memory content can be displayed by pushing the MAX-button. The memory can be cleared by pushing the ZOOM and MAX buttons simultaneously.

Circuit Description.

The following description refers to the schematic block diagram no. 477-5019 and to the detailed schematic diagrams no. 477-5030, 477-5036 and 477-5038.

Digital receiver.

The digital receiver (IC9) recovers the original audio data from the AES/EBU digital interface signal. Connection to the input is isolated by the transformer TR1.

Digital Signal Processor.

The receiver feeds the audio data to the DSP (IC5) via a serial interface. The DSP performs filtering, intermediate sample reconstruction, rectification and it also integrates the sampled values to obtain correct integration time.

Controller.

The controller (IC6) performs a number of tasks:
a.   - further data processing and communication with the DSP.
b.   - scanning and control of Gas Discharge Bar-graph Display.
c.   - control of LED indicators (phase meter, if present).
d.   - handling inputs from push-button and programming switches.

a.   The controller (IC6) fetches the measurement values from the DSP via the DSP's "Host Interface".At this stage the measurement values are represented in linear form, thus the controller makes a linear to logarithmic conversion to suit the presentation on a (nearly) linear dB-scale. The DSP-program code is stored in the common E-prom (IC8) and during upstart transferred to the DSP under control of the controller.

b.   The Bar-graph display requires a 3-phase cathode drive signal and an anode control signal for each of the two anodes. These signals are generated by the controller and latched by IC13. On the display board the IC1 and Q14-Q17 constitutes the cathode drivers, while Q1-Q13 controls the anode voltages.

c.   The controller controls via a 3-wire serial interface the three LED-drivers (IC2,4 and 5) on the display board.

d.   Push-button and programming inputs are transferred to the controller via IC3 on the display board and via IC1 and IC2 on the back-panel board.

Power supply.

The power supply, placed on the main board, is a PWM-type switched mode supply. It consists of the PWM regulator (IC2) a MOSFET switch (Q1) and the transformer TR1. To achieve sufficient stability on the 5 volt supply this also employs a linear regulator (IC1).

Technical Specifications:

Supply voltage .... 20 V AC or 20 - 32 V dc (Power adaptor for 230 V included).

Current consumption, @ 24V supply .... 140 mA typ. (max. 200 mA)

Signal input:

Input type.. Serial digital audio interface (IEC 958)

Input impedance.. High impedance, floating, ($Z_i > 1$ kO) 1)

Minimum input signal.. $V_{min} = 200$ mV, $T_{min} = 0.5$ x T_{nom} (IEC 958)

Sampling rates .... 48 kHz, 44.1 kHz and 32 kHz

Measuring characteristics:

Main reading (bargraph):

Integration time .... "0" ms

Return time .... 1.7 s (0 to - 20 dB) (IEC 268-10, 1991-03)

Reference level.. Scale max. corresponds to maximum digital code level.

Overload indication .... The bar intensity is increased within overload range.

Low frequency cut-off.. DC-blocking; Cut-off frequency <0.3 Hz

"Analg Reference Level" marker.................................... selectable 0 to 31 dB below max. digital code.

Secondary reading (spot):

Integration time .... 5 ms @ -2 dB (10ms @ -1dB) IEC 298-10, 1991-03

Return time .... 1.7 s (0 to - 20 dB) (IEC 268-10, 1991-03)

Phase indication.. 0 to 180?. - Resolution 18?

Additional functions:

Gain: Additional 20 dB gain selectable on front.

Mode: The Bar-Graph display can be operated in various modes.
              For more details see "Front Layout" , § 9 Mode.

Memory: A peak memory is provided. Read-out and memory clear is push-button controlled on the front.

Zoom: To enable extremely accurate reading around "0 dB" the scale may be expanded by a factor of ten.

Indicators:
Flashing LEDs on top of each bar indicates (instantaneously) digital overload.
Excessive DC-content in either channel is indicated on LED
Gain is indicated on LED when selected.
Sampling rate and possible pre emphasis is indicated on LEDs

Notes:
1)   The 477-460 has been designed with high input impedance to allow for paralleled (daisy-chain) connection. If used without other line termination a termination resistor (75 O or 110 O) must be mounted on the mating connector.

Weight approx 0,6kg