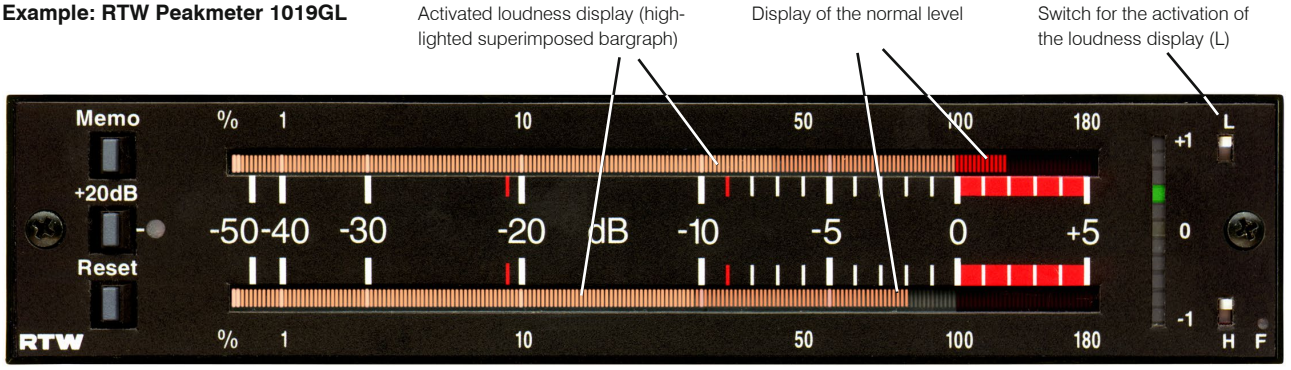
# The Loudness Display of the RTW Peak Program Meter

**(1019, 1034G, 1039G, 11528G, 11529G, 11529G-DIN, 1204A, 1205D)**

**Example: RTW Peakmeter 1019GL**




## The Frequency Response Curve

The loudness display of the RTW peak program meters (peak-meter or PPM) is generated by analyzing the two predominant audio signal parameters, frequency and impulse. This is done by applying physiological principles analog to the processes which take place in the human ear.

The signals are run through a filter circuit which uses a special filter curve developed and optimised in comprehensive experiments carried out at the Funkhaus Berlin.

## The Optimisation Process

The loudness meter design is based on data generated in a number of empirical listening tests.These tests were carried out with a large group of pro audio people - tonmeisters and sound engineers - each of whom participated in a series of listening sessions.

A selection of speech and music samples of different types were chosen from the sound archives and assembled in pairs of short takes of between 10 and 30 seconds duration. The takes in each pair were chosen to be as technically and artistically opposite as possible, particularly as regards impulse content and frequency distribution. The total of thirty pairs included both music (organ, chamber, orchestral, choral and pop) and a broad selection of speech (male and female).

In each session the test listeners were asked to adjust the level until both takes in the pair had the same subjective volume. The fader adjustments made by each test listener were recorded as separate dB values for each take. These values were then collated and the mean aggregate value was used to adjust the level of the corresponding samples in each take and to produce a test tape in which the individual takes had the same subjective loudness. The listening volume of the sample of chamber music, symphonic music, pop music and so on had a dynamic range from 66 dB to 99 dB.

The next phase of the optimisation process used a loudness peakmeter programmed with the ISO/R26 frequency response curve (80 dB curve, see figure on the rear side below). The differences between the displayed loudness values were then minimised with the help of a one-third octave filter upstream from the meter. In doing this, itwas necessary to take into account the effect of each filter adjustment on every test take. Because of the large number of test series this was a very time-consuming process. The final result of all this work was the optimised, comprehensive frequency response curve.

### Review of the Optimised Frequency Response Curve

A follow-up test of the optimised frequency response curve was then carried otu with a group of test listeners.

For this test, all sample program pairs were adjusted with a loudness peakmeter so that the loudness display levels were as close to identical as possible and recorded twice, using two different methods. In the first recording pass the meter was programmed with the ISO/R26 curve (see figure below), and in the second with the optimised frequency evaluation curve developed in the preceding tests. A further series of listening sessions was then carried out, in which the test candidates classified their subjective listening impressions and recorded them in tables. The mean deviations calculated from these tables were as shown in the table below.

Because of the great complexity of both the signal and the physiological processes involved in human hearing, the remaining approx. 2 % of sample programs that were subjectively classified as having clear difference in loudness cannot be reduced further with reasonable technical means.

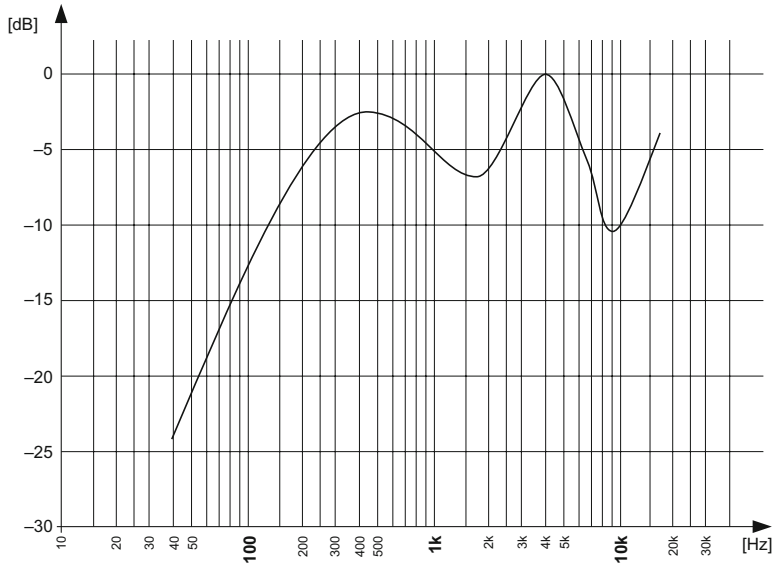
### The Energy Content of Audio Programs

The type of audio signal rectification is also an important factor for the correlation of the visual loudness display with the subjective loudness of the audio program. The good test results described above were achieved using RMS rectification, which converts the energy content of the audio program for the loudness display. RMS signal rectification is thus also used in the RTW peak program meters with loudness display.

**Mean Deviations**

| Subjective impression: | same loudness | slight difference | clear difference |
|---|---|---|---|
| Meter with ISO/R26 curve: | 36,3 % | 55 % | 8,7 % |
| Meter with optimised evaluation curve (as used in RTW peak program meters) | 58,8 % | 39 % | 2,2 % |

**ISO Recommendation R26 (80 dB Curve)**




*Subject to technical changes without prior notice. 10/2005*

RTW RADIO-TECHNISCHE WERKSTÄTTEN GmbH & Co. KG
Elbeallee 19 • 50765 Köln • Germany
Telefon: +49(0)221 - 7 09 13-33 • FAX: +49(0)221 - 7 09 13-32
Internet: www.rtw.de • E-Mail: rtw@rtw.de