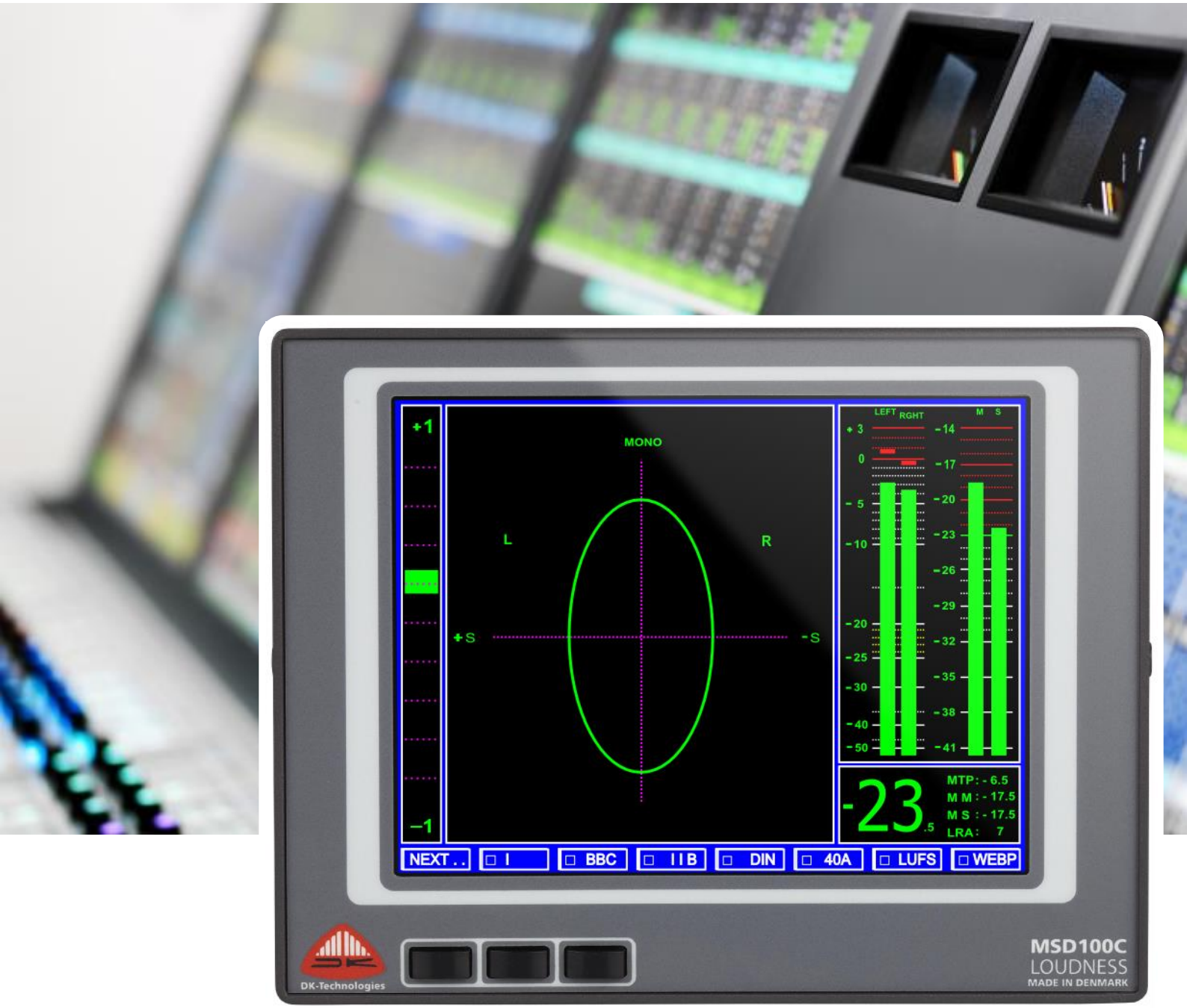
MSD100C Loudness

User Manual



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About this manual

This manual will provide you with a quick overview of the MSD100C Loudness functions .
Happy reading!

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Important Notes

Disclaimer

Purpose

Any fitness for purpose legislation or other determination that may be applied in the area where this equipment is installed must take due cognizance that it is designed for use in professional broadcast, audio and video systems by appropriately trained personnel. The equipment is not intended for use in a domestic environment and regulations designed for such situations are not applicable.

MSD100C Loudness

About the MSD100C Loudness

Congratulations! By purchasing a Master Stereo Display (MSD) from DK-Technologies, you have decided to actually "see what you hear!" We are certain that your Master Stereo Display will prove an invaluable tool in your daily work.
The MSD100C-LOUDNESS is a dedicated Loudness meter that measures loudness according to the ITU BS.1770 recommendation. The meter has 1 AES-3 input and 1 stereo pair of analogue inputs. It also has 1

About the ITU BS.1770 Loudness Measurement

The ITU Recommendation BS.1770 specifies the algorithms to measure audio programme loudness. The RLB-LU application implements these algorithms to display the loudness of a Stereo signal as well as for a Surround Sound Signal. (The MSD100C-LOUDNESS can only measure Loudness for a stereo signal).

Applications

There are many applications, where it is necessary to measure and control the perceived loudness of audio signals.
Examples of this includes television and radio broadcast applications, where the nature and content of the programme material changes frequently. In these applications the audio content can continually switch between music, speech and sound effects. Such changes in the content of the programme material can result in significant changes in subjective loudness. Moreover, various forms of dynamic processing are frequently applied to the signals, which can have significant effect on the perceived loudness of the signal.
The matter of subjective loudness is also of great importance to the music industry and in the production of commercials, where dynamic range processing is commonly used to maximize the perceived loudness.

The Main Screen

The main MSD100C screen features a number of audio display tools:

- Phase correlation meter
- Goniometer Phase and amplitude
- Left/Right PPM bargraphs (selectable scale)
- (M) Momentary Loudness bargraph
- (S) Shortterm Loudness bargraph
- Integrated Loudness Text readout
- (MTP) Maximum True Peak Text readout
- (MM) Maximum Momentary Loudness Text readout
- (MS) Maximum Shortterm Loudness Text readout
- (LRA) Loudness Range Text readout

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Operation

The MSD100C has three hardware buttons used to operate and setup the different functions of the MSD100C Loudness. There are three levels of operation:

- **Top level**: Start | Stop | Clear
- **Input Selection level**: Restart | Setup | AES
- **Setup level:** Peak Level | Gate On | RLB-LU-Ref | Ref Freq | Window size | LU Scale | PPM scale

Top Level

The top level operation allows you to start, stop and clear the loudness readings.
Any loudness measurement needs a start and stopping point in order to calculate the Integrated Loudness results (please see the Loudness & Terminology section later in this manual).

Input Selection Level

The Input selection level is reached by pressing and holding the 'Clear' button in the Top Level for approximately 1 second.
The 'AES' or 'Analog' buttons allow you to switch to the desired input source.
Exit the Input Selection level by hitting 'Restart'.

Setup level

The Setup Level is reach by pressing and holding the 'Clear' button in the Top Level for approximately 1 second and then pressing 'Setup'.
The Setup menu is step-through list of parameters, meaning that you have pass every parameter from start to end before being able to exit.
The actual parameters and functions are explained here:

Peak Level

The Peak level parameter sets the True Peak level for the MSD100C Loudness.
Use the arrow up/down keys to set the desired True Peak Max level.
Hit 'Next' to move onto the next Setup parameter.

Gate On

The ITU BS1770-2 specifies that a relative gate must be applied at -10dB below the integrated gated loudness level.
The gate is added to remove low level signals with minimum influence on the final loudness measurement result. See more in the Loudness and Terminology section.
Use the arrow up/down keys to set the desired Gate On relative threshold

RLB-LU Ref

The RLB-LU Reference is the target loudness reference point, also known as the Integrated Loudness level.
EBU R128 specifies -23LUFS as the target reference, while SMPTE A/85 has defined -24LKFS as the target.
See more in the Loudness and Terminology section.
Use the arrow up/down keys to set the desired RLB-LU Ref level.
Hit 'Next' to move onto the next Setup parameter.

Reference Frequency

This is the frequency chosen for the calibration alignment and is either 400 or 1000 Hz.
Use the arrow up/down keys to select the appropriate ref. frequency.
Hit 'Next' to move onto the next Setup parameter.

Window (Sliding / Shortterm Loudness)

The 'Window' parameters allows you to set the sliding measurement window used to define the Shortterm Loudness measurement.
EBU R128 defines a 3 second window as the shorterm loudness sliding window, while SMPTE A/85 defines 10 seconds.
See more in the Loudness and Terminology section.
Use the arrow up/down keys to set the sliding window time span.
Hit 'Next' to move onto the next Setup parameter.

LU Scale

The LU scale allows you define if you want to see the absolute 'LUFS scale' or the 'LU scale' relative to the RLB-LU reference described earlier.
Please note that the EBU absolute loudness scale definition 'LUFS' is identical to the SMPTE label 'LKFS' meaning that they are interchangeable. The MSD100C Loudness therefor only offers the choice of 'LUFS' as the absolute scale labelling.
See more in the Loudness and Terminology section.
Use the arrow up/down keys to set absolute or relative loudness scale.
Hit 'Next' to move onto the next Setup parameter.

PPM Scale

The PPM scale allows you to choose the specific scale and ballistics of the PPM bargraphs.
The following scales are available:

- 'I' aka PPM Nordic: Test level -18dBFS
- BBC – VU integration time, reference point '4' = -18dBFS
- IIB – used for transmission lines +/-12 range
- DIN – 0 point sits at +6dBu (-12dBFS)
- 40A – an emulation of the 40A Dorrough meter scale and ballistics
- LUFS – identical to the LUFS loudness scale.
- WebP –A digital scale with headroom for showing +3dB True Peaks, meaning that the 0 point is in fact the 0dBFS point and +3dBFS is essentially digital overshoots or True Peaks.

Applying the new settings

Hit the 'Restart' button to apply the new settings, this will restart the meter and exit to Top level.

Loudness & Terminology

About Loudness

Loudness measurements differ from conventional signal amplitude measurements in that they are also influenced by the frequency content of the signal and the duration of transient components. The way these various elements are handled to give a value for display has been defined by the International Telecommunications Union in their standard ITU BS1770 which is the only loudness standard to have achieve any degree of international acceptance.
The DK Meter allows a number of parameters to be adjusted to suit whatever options your organisation and perhaps regulatory body has decided to mandate.
Two organisations leading the way in the standardisation of loudness measurements are the Advanced Television Systems Committee (ATSC) in the USA and the European Broadcasting Union (EBU) in Europe. The background information to the measurement norms is contained in the ATSC document "Techniques for establishing and maintaining audio loudness for digital television", document A/85:2011. The EBU document R128 is supplemented by EBU Tech 3341, 3342, 3343 and 3344 between them they define a number of terms and set out the reasons behind many of the objectives of loudness measurements.

Terminology

The Loudness world includes a number of terms and abbreviations worth noting:

Loudness Range (LRA)
Loudness range is a statistic calculation of the material's dynamic range based on the short term (sliding) loudness (3 secs). Loudness Range is abbreviated 'LRA'.

Momentary Loudness (M)

Momentary loudness is the sum of the RLB weighted audio channels and integrated over 400ms. Momentary loudness is used to calculate short term and integrated loudness Momentary Loudness is abbreviated 'M'.

Short Term Loudness (S)

Short term loudness is a 3 seconds integration of the momentary loudness. (10 and 30 seconds are also used in some standards/regions). Short Term Loudness is abbreviated 'S'

Absolute Gated Integrated Loudness

The absolute integrated loudness is a long term measurement (an integration over the entire material) based on the momentary loudness. It uses an absolute gate at -70LUFS/LKFS (M) which means that if the momentary loudness is getting under -70LUFS/LKFS then the measurement holds until the momentary loudness goes above. The absolute loudness is not used directly by the user, but is used to calculate the dynamic gate. The dynamic gate is, according to ITU-R BS.1770-2, -10 LU below the absolute gated loudness.

Dynamic Gated Integrated Loudness (I)

The dynamic gated loudness is a long term measurement (an integration over the entire material) based on the momentary loudness.
It uses a dynamic gate at -10 LU under (dB relative to) the absolute gated loudness which means that the measurement is on hold if the momentary loudness gets under the dynamic gate.
It is always the last value of the dynamic gate which is used on the material. This means that it is necessary to include or exclude any material from the "past" if the dynamic gate is changing. This means that the dynamic gate is always -10 LU under (dB relative to) the end result of the dynamic gated loudness.
The dynamic gate level may vary with local requirements. Dynamic Gated Integrated Loudness is abbreviated 'I'

True Peak (TP)

True peak measurements, not only looks at the actual samples, but also inter-sample peaks.
This means that True Peak metering will indicate peaks that would potentially cause distortion when converter in e.g. digital-analogue converters, sample rate converters and data compression codecs.
True peak is therefore a highly relevant tool when performing normalization of source material.

LUFS, LKFS and LU

The three LU, LUFS and LKFS are essentially addressing the same issue, which sometimes cause some confusion.
LKFS is the K-weighted loudness scale and one unit on this scale is equal to one dB. LUFS is identical to LKFS. ITU-R BS.1770-2 and ATSC are using the terms LKFS, while EBU R128 are using LUFS – both are expressing the identical scale. 0 LUFS/LKFS is equal to 0 dBFS @ 1KHz according to ITU-R BS.1770-2 and EBU R128 (some recommendations may use 400Hz).

LU stands for Loudness Unit, and is a scale relative to the chosen Reference level. 0 LU is equal to the reference level. The reference level will vary between the different Recommendations e.g. EBU R128 has 0 LU = -23 LUFS.One LU is equal to one dB

Appendix A – Specifications

The loudness specification

The MSD100C-LOUDNESS is conforms with the ITU BS-1770 and ITU BS-1771 recommendations on how to measure loudness.

Inputs

The MSD100C-LOUDNESS is equipped with 1 AES3 and 1 stereo pair of analogue inputs.

Digital input

The digital input is equipped with a sample rate converter to synchronize the input to the internal clock.

Sample rate range:	30 Hz to 100 kHz.
Internal sample rate:	48 kHz.
Bit resolution:	24 bits.
Group delay:	maximum 1.75 msec.
Passband ripple:	±0.008 dB.
Thd+N:	typical –103 dB at 1 kHz.
Dynamic range:	>120 dB.
Nominal input impedance:	110 ohm.

Analogue input

The analogue input is a true transformer balanced input.

Maximum input level:	+24 dBu.
Frequency range ±0.3 dB:	30 Hz to 20 kHz.
Passband ripple:	±0,002 dB.
Group delay:	<0.82 msec.
Dynamic range, A-weighted:	>103 dB.
Crosstalk at 1 kHz:	<–96 dB.
Signal-to-noise ratio:	typical 93 dB.
Nominal input impedance:	>20 kohm.

Mechanical Specifications

The MSD100C-LOUDNESS is as standard delivered with an U-bracket and a Base Plate for easy table mount.

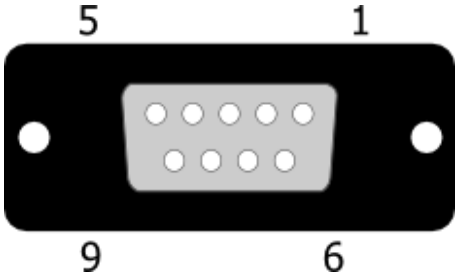
Dimensions

Height:	144 mm
Width:	186 mm (Mounting holes 190 mm)
Depth:	41 mm

Appendix B – Pin-out

Utility Connector with RS232 communication

Utility connector with RS232 communication.
Connector type: 9 Pin Female D-Sub.

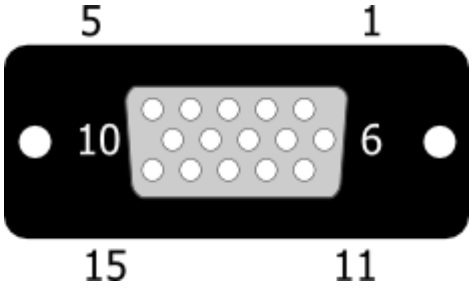


Signal Name		Pin number
RS232	TX	2
RS232	RX	3
Ground		5

If connecting to a 9 pin serial port (D-Dub) then pin 2, 3 and 5 must be connected to the same pin numbers on the PC.

VGA Connector

The MSD100C-LOUDNESS if fitted with a VGA connector for an external display.
Connector type: 15 Pin Female High Density D-Sub.

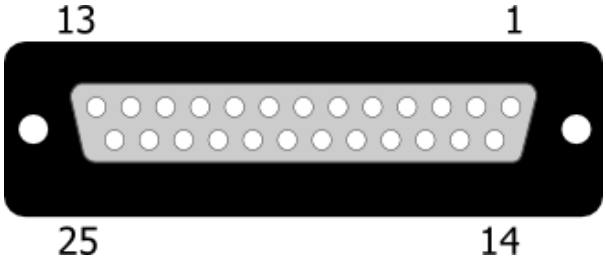


Signal Name		Pin number
Red		1
Green		2
Blue		3
Ground		4
Ground		5
Ground		6
Ground		7
Ground		8
Ground		9
Ground		10
H-Sync		13
V-Sync		14

Audio and Power Connector

The MSD100C-LOUDNESS is fitted with a 25 pin D-Sub connector for the audio and power connections A breakout cable to XLR connectors and the power supply are supplied as standard.

Connector type: 25 Pin Female D-Sub.



Signal Name		**Pin number**
Analogue ch.1	Hot	14
-	Cold	1
-	Ground	2
Analogue ch.2	Hot	15
-	Cold	3
-	Ground	16
AES3	Hot	9
-	Cold	21
-	Ground	22
Power	+Vcc (15VDC)	25
-	Ground	12