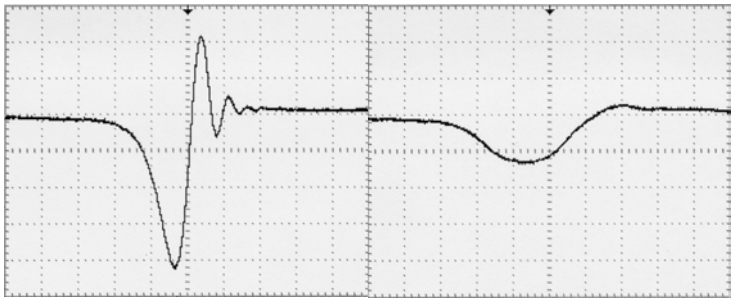
METROLAB Instruments SA
the world leader in NMR measurement

Gradient Compensation Coils
1100-20 / 1100-40
ACC-1060

10/03

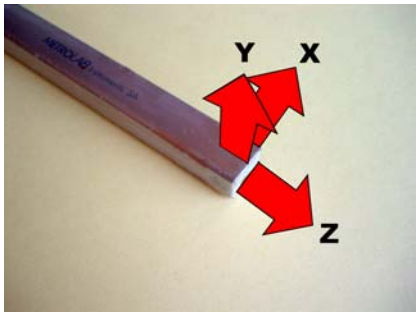
NMR magnetic field strength measurements in inhomogeneous fields

The Metrolab family of gradient compensation coils offset linear field gradients. As shown in the figure to the right, even a small gradient can render an NMR field strength measurement difficult or impossible.

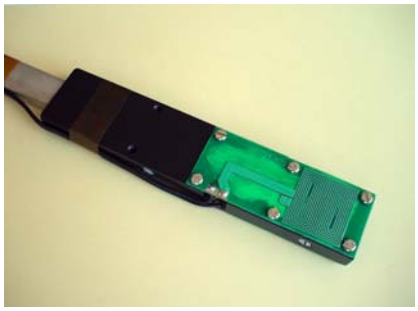


Effect of a field gradient on the NMR signal: zero gradient (left) and 1.5 G/cm linear gradient (right). B_0 = 1T = 10^4G.

The coils are designed to precisely offset only the gradient, leaving the zero-order field strength B_0 unchanged. A common application of the gradient compensation coils is the measurement or regulation of a magnet with the Metrolab PT 2025 NMR Precision Teslameter when only the fringe field is accessible, for example because the gap is too small or filled with a vacuum chamber.

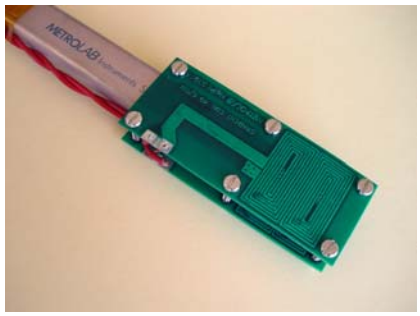


Axis conventions, relative to probe.

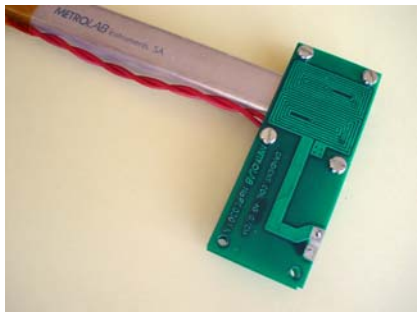


1100-40, for $\delta B_y/\delta z$ correction.

Metrolab offers a total of four configurations of gradient compensation coils. The 1100-20 consists of two printed circuit boards mounted directly on the Metrolab 1060 or 1062 NMR probe. Parallel or transverse mounting will correct a gradient $\delta B_y/\delta z$ or $\delta B_y/\delta x$, respectively. The 1100-20 can compensate a maximum gradient of 20 G/cm, using only the probe's copper housing as a heatsink.



1100-20 mounted for $\delta B_y/\delta z$ correction.



1100-20 mounted for $\delta B_y/\delta x$ correction.

The 1100-40 uses the same printed circuit boards as the 1100-20, but includes a separate copper heatsink that is affixed to the probe. The 1100-40 can compensate a maximum of 40 G/cm in the $\delta B_y/\delta z$ direction. With proper cooling, two or three coils can be stacked to achieve even higher gradients.

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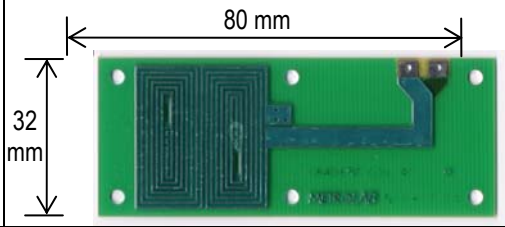
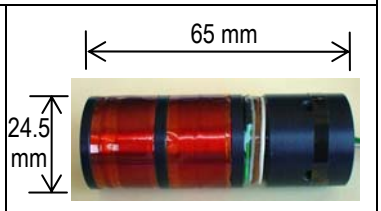
ACC-1060, for $\delta B_z/\delta z$ correction.

Finally, the ACC-1060 consists of a pair of cylindrically wound coils that fit around the Metrolab 1060 or 1062 NMR probe. It corrects an axial gradient $\delta B_z/\delta z$ of up to 100 G/cm.

Specifications:

	1100-20 (parallel)	**1100-20** (transverse)	**1100-40**	**ACC-1060**
Measured field	B_y			B_z
Gradient direction	$\delta B_y/\delta z$	$\delta B_y/\delta x$	$\delta B_y/\delta z$	$\delta B_z/\delta z$
Maximum gradient	20 G/cm		40 G/cm	100 G/cm
Maximum current	1.5 A		2.9 A	0.29 A
Coil resistance	0.74 Ω (25° C, coils in series)			26 Ω per coil (25° C)
Power supply	The gradient compensation coils generally require a small separate power supply. In order to track a varying main field, it may be possible to drive the gradient coil with the primary power supply, using an appropriately sized resistor to step down the power supply voltage. Note that this approach requires the main power supply to be field-regulated rather than current-regulated, and that iron-core magnets not be driven into saturation.			
Coil dimensions				
Clearance required:				
• **Width (Δx)**	33 mm	81 mm	33 mm	25 mm
• **Height (Δy)**	18 mm	18 mm	19 mm	25 mm
• **Length (Δz)**	81 mm	33 mm	160 mm	66 mm
• **Length beyond probe tip**	15 mm	15 mm	15 mm	12 mm

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