

# SCHWARZBECK MESS - ELEKTRONIK

An der Klinge 29 D-69250 Schönau Tel.: 06228/1001 Fax.: (49)6228/1003

## Helmholtz-Spulenpaar HHS 5230-100 Helmholtz Coil Pair HHS 5230-100



### Technische Daten:

Kantenlänge:	3 m
Windungszahl (pro Spule):	100
Maximaler Spulenstrom:	16 A / 5 min.
Spulenstrom, nominell:	8 A cont.
Spulenabstand einstellbar:	$D > 1.13$ m
Spulenabstand für beste Feldhomogenität:	$D = 1.8$ m
Max. Magn. Feldstärke:	650 A/m @ $D=1.8$ m
Magn. Nennfeldstärke:	325 A/m @ $D=1.8$ m
Magn. Feldstärke bei 1 A Spulenstrom:	50.8 A/m @ $D=1.13$ m 37.6 A/m @ $D=2$ m 10.3 A/m @ $D=5$ m

Erforderlicher Strom für 1 A/m:	19.7 mA @ $D=1.13$ m 26.6 mA @ $D=2$ m 97.1 mA @ $D=5$ m
Abmessungen:	W: 2.0 x H: 3.10 x B: 3.18
Bodenabstand:	0.12 m
Anschlüsse: Laborbuchsen mit kombinierter Flügelklemme	4 mm
Nutzbarer Frequenzbereich:	DC - 5 kHz
Induktivität (pro Spule):	100 mH
Wirkwiderstand (pro Spule):	6 $\Omega$
Windungskapazität (pro Spule):	1.4 nF
Resonanzfrequenz (pro Spule):	> 10 kHz, typ. 13 kHz
Gewicht: (pro Spule):	190 kg

### Specifications:

Square Side Length:	3 m
Number of turns (per Coil):	100
Maximum Coil Current:	16 A / 5 min.
Nominal Coil Current:	8 A cont.
Coil Spacings:	$D > 1.13$ m
Coil Spacing for best Field Uniformity:	$D = 1.8$ m
Maximum Magnetic Field Strength:	650 A/m @ $D=1.8$ m
Nominal Magnetic Field Strength:	325 A/m @ $D=1.8$ m
Magnetic Fieldstrength, 1 A Coil Current:	50.8 A/m @ $D=1.13$ m 37.6 A/m @ $D=2$ m 10.3 A/m @ $D=5$ m

Current required for 1 A/m:

Mechanical Dimensions:	W: 2.0 x H: 3.10 x B: 3.18
Ground Clearance:	0.12 m
Terminals: 4 mm female with universal wing terminal	4 mm
Usable Frequency Range:	DC - 5 kHz
Inductance (per Coil):	100 mH
Resistance (per Coil):	6 $\Omega$
Coil Capacitance (per Coil):	1.4 nF
Resonant Frequency (per Coil):	> 10 kHz, typ. 13 kHz
Weight (per Coil):	190 kg

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### **Anwendung:**

Das Helmholtz-Spulenpaar eignet sich zur Erzeugung exakt definierter magnetischer Felder von DC bis etwa 5 kHz z.B. nach SAE J551-17. Die erzeugte Feldstärke steht in streng linearem Zusammenhang zum Spulenstrom. Aus der Spulengeometrie, dem Strom und der Windungszahl lässt sich die resultierende Feldstärke exakt analytisch (oder auch numerisch) berechnen. Die HHS 5230-100 ist aufgrund ihrer Größe ideal für Störfestigkeitsprüfungen gegen Magnetfelder im Automotive Bereich einsetzbar. Aufgrund der großzügig dimensionierten Bewicklung lassen sich (kurzzeitig) magnetische Felder über 800 A/m erzeugen. Typische Anwendungsfälle sind Immunitätsprüfungen an ganzen Fahrzeugen nach SAEJ551-17 (Vehicle Electromagnetic Immunity – Power Line Magnetic Fields). Bei der Felderzeugung mit Helmholtzspulen ist die magnetische Feldstärke streng proportional zum Spulenstrom. Letztendlich lässt sich die Kalibrierung der Magnetfeldstärke auf eine Strommessung (oder z.B. auf den Spannungsabfall an einem bekannten Vorwiderstand) zurückführen. Die Helmholtzspule selbst muss nicht kalibriert werden. Alternativ kann die Feldstärke auch mit Hilfe einer kleinen Feld-Sensorspule bestimmt werden.

### **Inbetriebnahme:**

Der Aufbau der Spule erfolgt nach der Anleitung „Montageanleitung Helmholtz-Spulenpaar HHS 5230“  
Die Helmholtzspule sollte in ausreichendem Abstand von möglichen Magnetfeldquellen (z.B. Transformatoren in Netzteilen von Messgeräten, stromdurchflossene Leiter, Bildschirme, Oszillografenröhren, Elektromotore, Lautsprecher uvm...) auf einem glatten tragfähigen Boden positioniert werden. Alle magnetischen Metallteile (d.h. Eisen / Stahl, Kobalt und Nickel) sollten aus der unmittelbaren Spulumgebung entfernt werden. Die Anschlussleitungen vom Generator zur Helmholtzspule sollten verdreht werden, um unerwünschte Einkopplungen magnetischer Flüsse zu vermeiden. Die Klemmen der Spule 1 sind mit Kennbuchstaben A und B, die Klemmen der Spule 2 mit C und D gekennzeichnet. Beim Betrieb der Spulen ist darauf zu achten, dass alle 4 Klemmen in eine Richtung zeigen, andernfalls entsteht in Spulenmitte eine Magnetfeld-Auslöschung.

### **Application:**

*The Helmholtz-Coils are especially designed to generate precisely defined magnetic fields from DC to ca. 5 kHz, e.g. according to SAE J551-17. The generated fields are in a strongly linear relation to the coil current. The field strength can be calculated exactly by analytical (or numerical) methods, based on the coils' geometry, the number of turns and the coil current. Therefore the HHS 5230-100 is ideally suited for immunity testing against magnetic fields in the automotive sector. Due to the generously dimensioned winding packets it is possible to generate magnetic fields up to approx. 800 A/m for short times. Typical applications are magnetic immunity testing to whole vehicles according to SAEJ551-17 (Vehicle Electromagnetic Immunity – Power Line Magnetic Fields). When generating magnetic fields with Helmholtz coils the coil current is directly proportional to the magnetic field strength. The calibration of the magnetic field is finally traceable to a current measurement (or to a voltage drop across a known resistor). The Helmholtz Coil itself does not require a calibration. Alternatively a small loop sensor can be used to determine the actual field strength.*

### **Installation:**

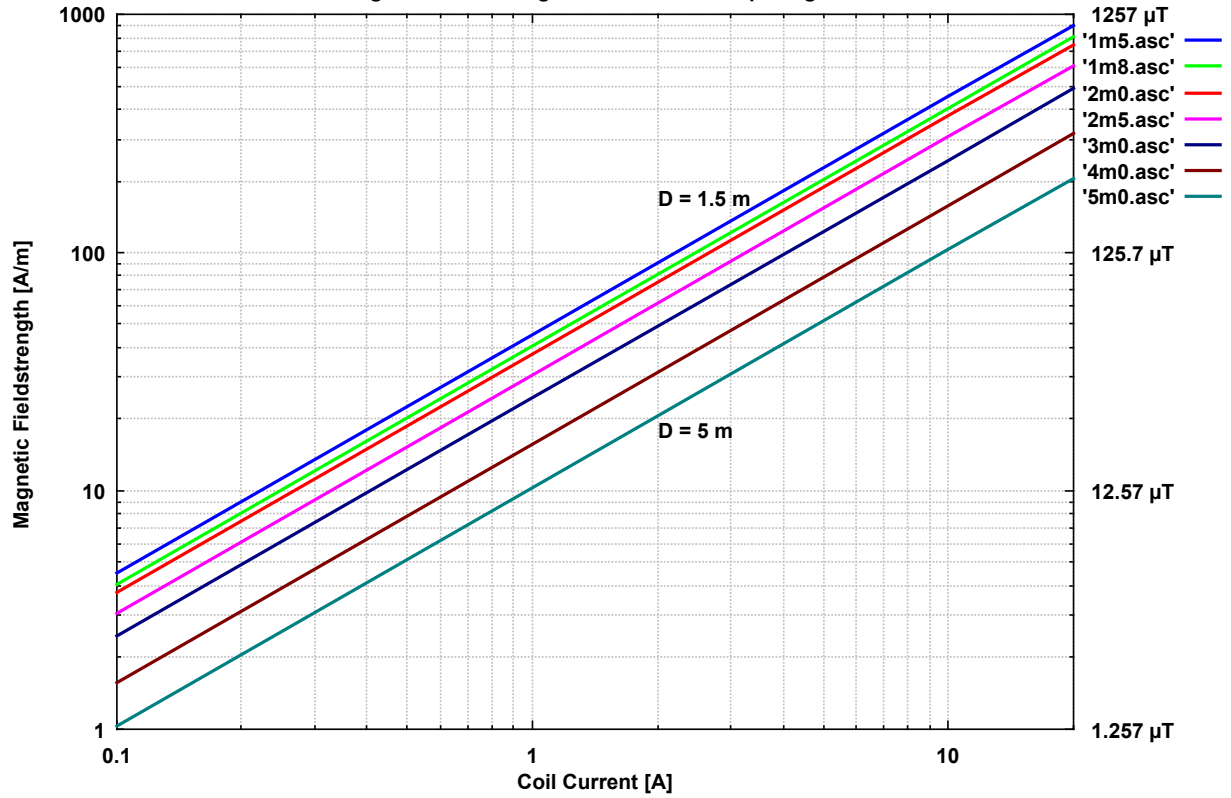
*The setup of the coils is described in the following part of the manual: "Assembly Instructions for Helmholtz Coil Pair HHS 5230"  
The Helmholtz-Coils should be installed on the floor in a sufficiently large separation from sources of unintentional magnetic fields, e.g. transformers in power supplies, conductors carrying high currents, computer monitors, loudspeakers, cathode ray tubes (CRT) and more.... All kind of magnetic material (e.g. steel, Nickel, Cobalt) should be removed from the near surrounding of the coil. The wires which are used to connect the current source with the Helmholtz-Coil should be twisted to avoid an unwanted injection of magnetic flux. The coil terminals are assigned with the characters A, B, C and D. During operation of the coils the terminals must show in one direction. Otherwise there will be a deletion of the magnetic field in the middle between the coils.*

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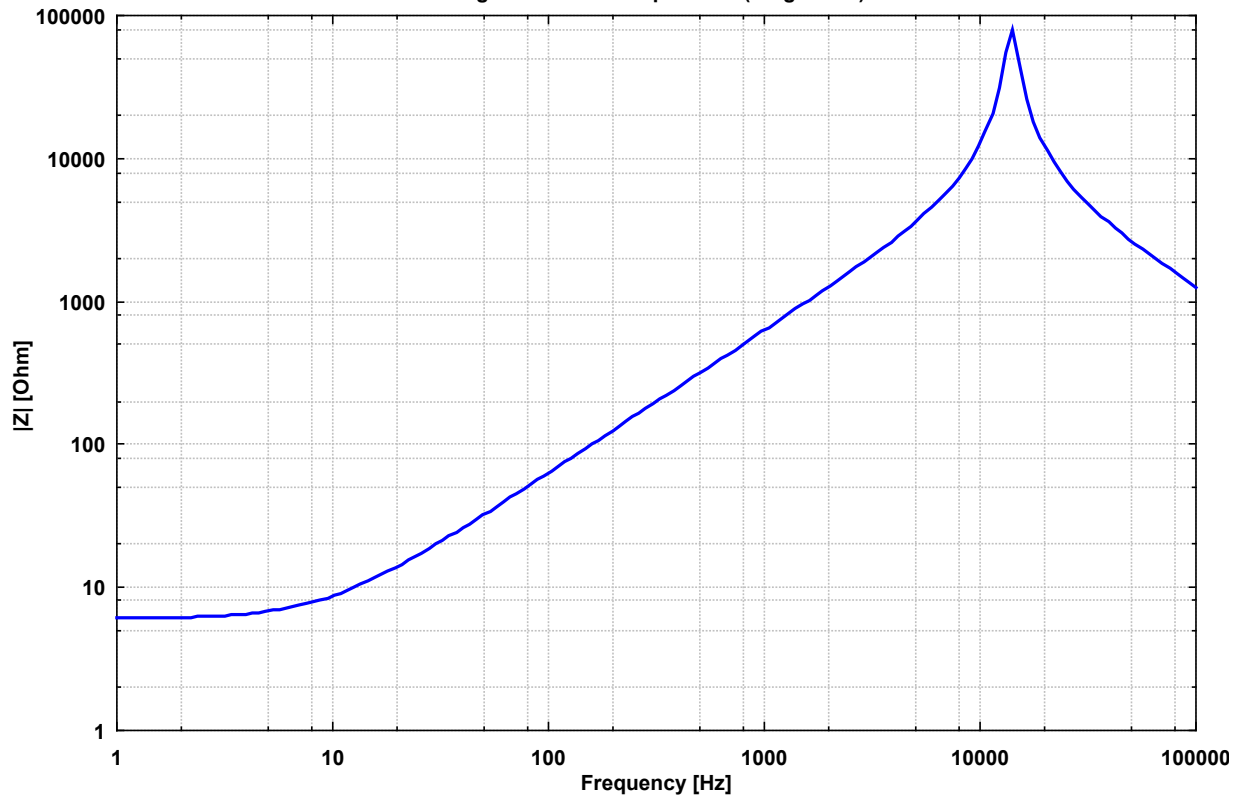
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## Helmholtz-Spulenpaar HHS 5230-100 Helmholtz Coil Pair HHS 5230-100

Magnetische Feldstärke und Spulenstrom  
Magnetic Fieldstrength at different Coil Spacings D



Betrag der Impedanz (Einzelspule)  
Magnitude of Coil Impedance (Single Coil)



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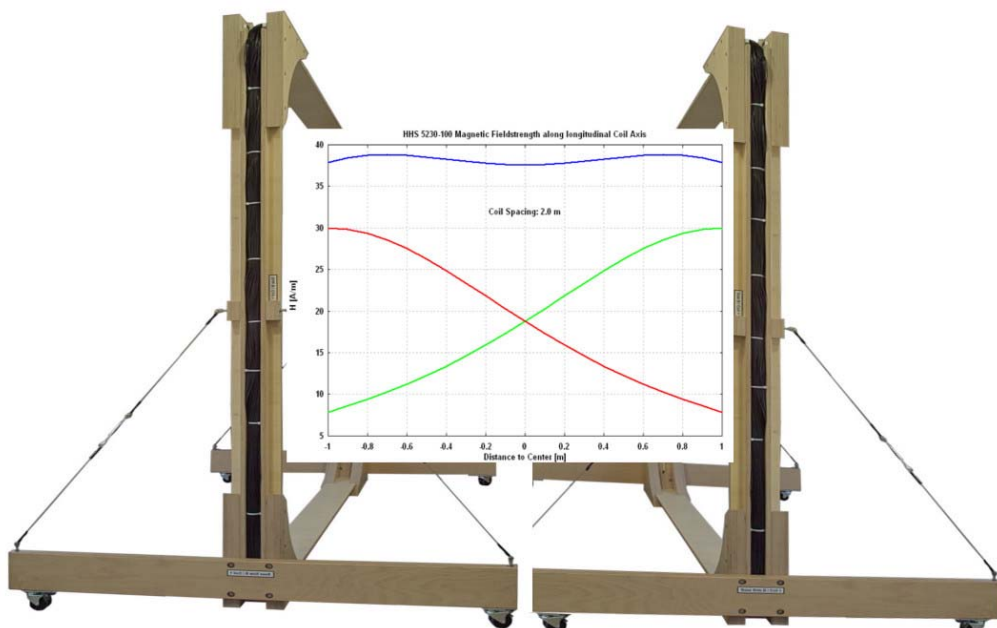
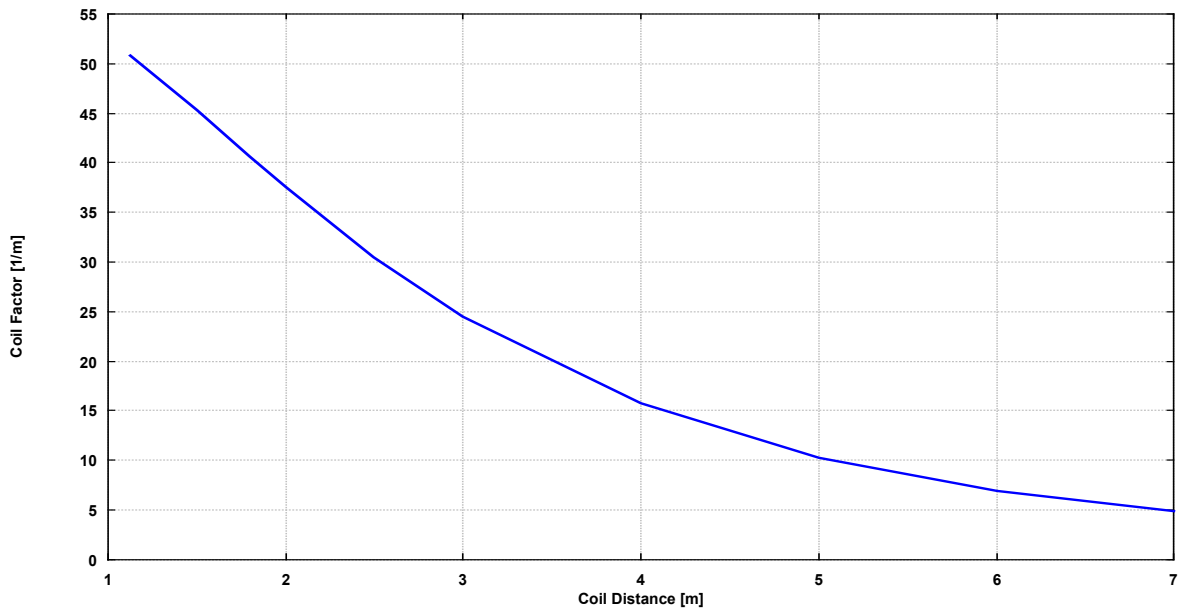
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## Helmholtz-Spulenpaar HHS 5230-100 Helmholtz Coil Pair HHS 5230-100

Coil factors for different coil separations:

Coil Separation [m]	Coil Factor <sup>1</sup> [1/m]	Coil Factor <sup>1</sup> [dB 1/m]
1.13	50.79	34.1
1.5	45.27	33.1
1.8	40.63	32.2
2.0	37.59	31.5
2.5	30.52	29.7
3.0	24.50	27.8
4.0	15.72	23.9
5.0	10.28	20.2
6.0	6.93	16.8
7.0	4.83	13.7

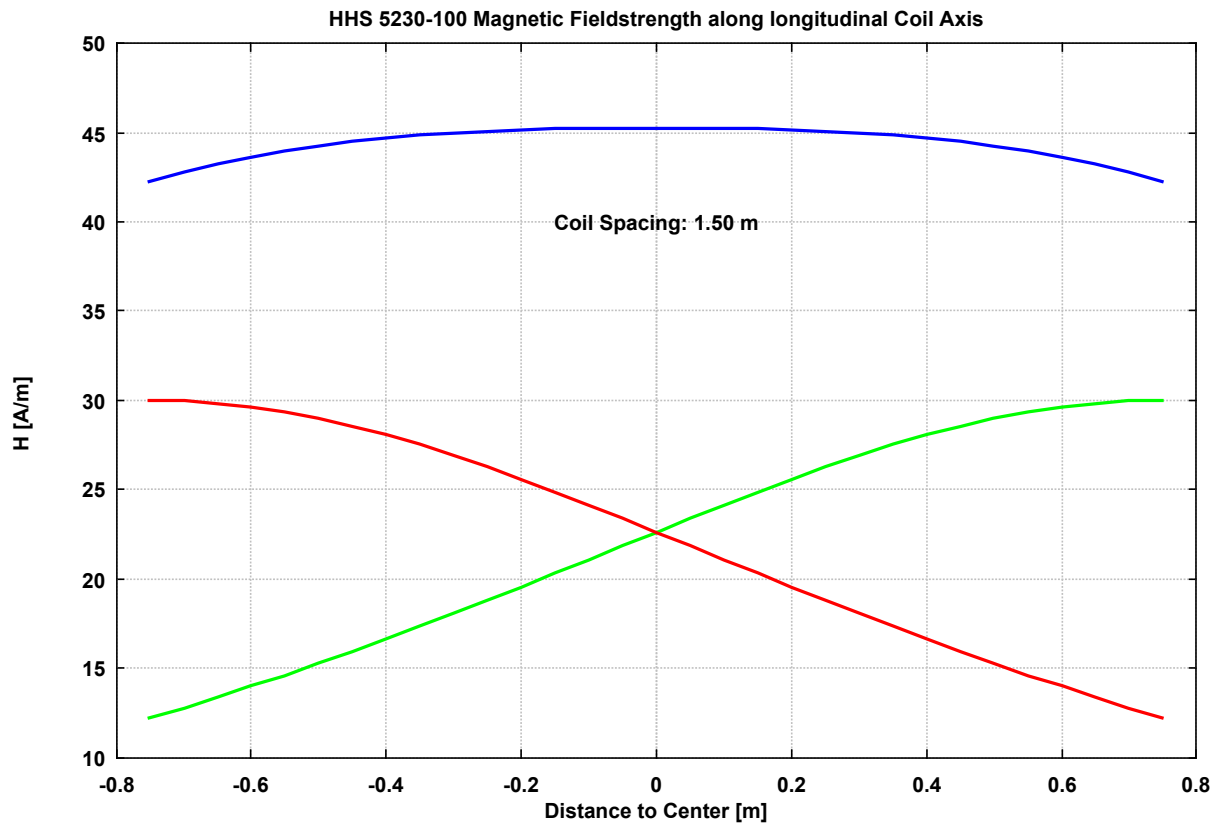
<sup>1</sup> The magnetic field strength is measured in the middle between the Helmholtz coils.



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## Helmholtz-Spulenpaar HHS 5230-100 Helmholtz Coil Pair HHS 5230-100



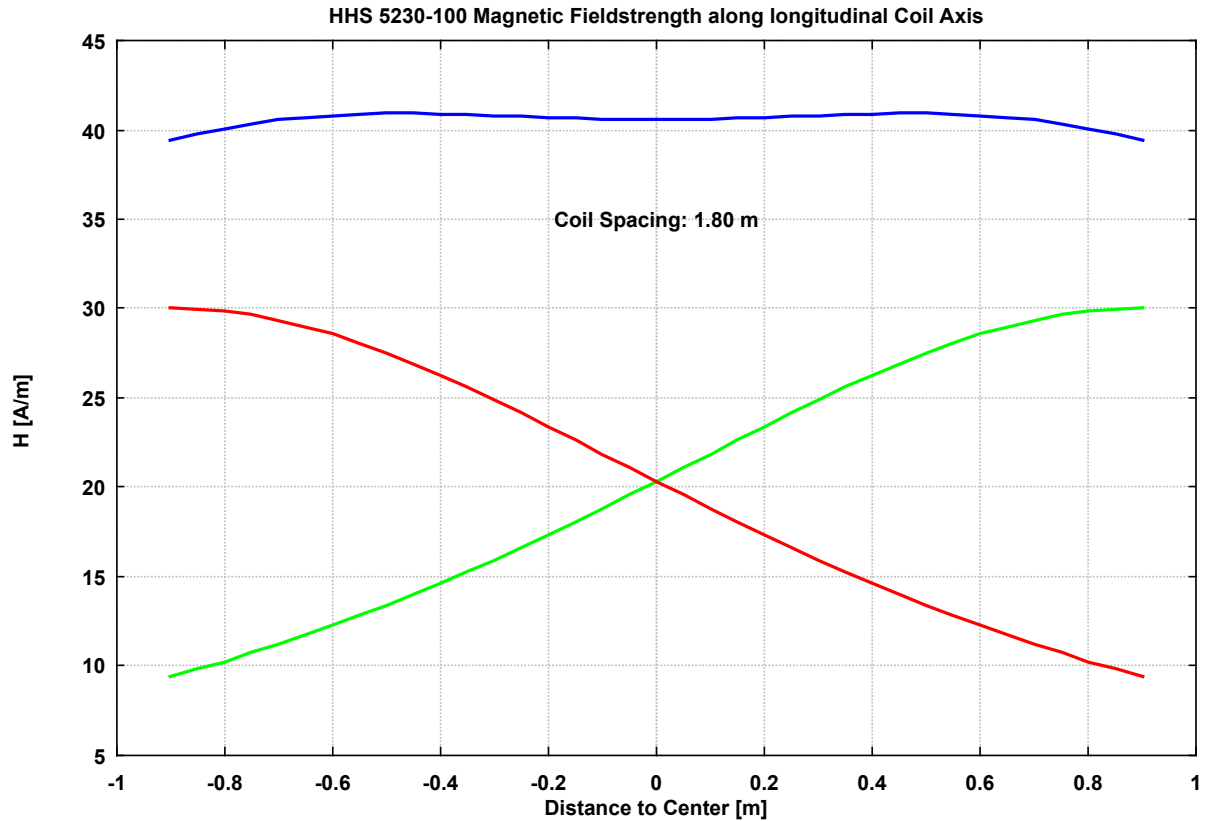
Längskomponente der magnetischen Feldstärke entlang der Spulenlängsachse <i>Magnet. Fieldstrength, longitudinal component along rotational axis</i>						
Distance to Center	H1 A/m	H2 A/m	Htot A/m	H1 dB $\mu$ A/m	H2 dB $\mu$ A/m	Htot dB $\mu$ A/m
0.00	22.6354	22.6354	<b>45.2707</b>	147.10	147.10	<b>153.12</b>
0.05	23.4025	21.8617	<b>45.2641</b>	147.39	146.79	<b>153.12</b>
0.10	24.1575	21.0863	<b>45.2439</b>	147.66	146.48	<b>153.11</b>
0.15	24.8945	20.3139	<b>45.2085</b>	147.92	146.16	<b>153.10</b>
0.20	25.6073	19.5483	<b>45.1556</b>	148.17	145.82	<b>153.09</b>
0.25	26.2891	18.7931	<b>45.0822</b>	148.40	145.48	<b>153.08</b>
0.30	26.9333	18.0511	<b>44.9843</b>	148.61	145.13	<b>153.06</b>
0.35	27.5329	17.3248	<b>44.8577</b>	148.80	144.77	<b>153.04</b>
0.40	28.0813	16.6163	<b>44.6977</b>	148.97	144.41	<b>153.01</b>
0.45	28.5720	15.9273	<b>44.4993</b>	149.12	144.04	<b>152.97</b>
0.50	28.9988	15.2590	<b>44.2578</b>	149.25	143.67	<b>152.92</b>
0.55	29.3562	14.6124	<b>43.9685</b>	149.35	143.29	<b>152.86</b>
0.60	29.6394	13.9880	<b>43.6274</b>	149.44	142.92	<b>152.80</b>
0.65	29.8446	13.3864	<b>43.2310</b>	149.50	142.53	<b>152.72</b>
0.70	29.9689	12.8077	<b>42.7766</b>	149.53	142.15	<b>152.62</b>
0.75	30.0105	12.2517	<b>42.2623</b>	149.55	141.76	<b>152.52</b>

Spulenstrom: 1 A, Spulenabstand: 1.5 m  
Coil Current: 1 A, Coil Separation: 1.5 m

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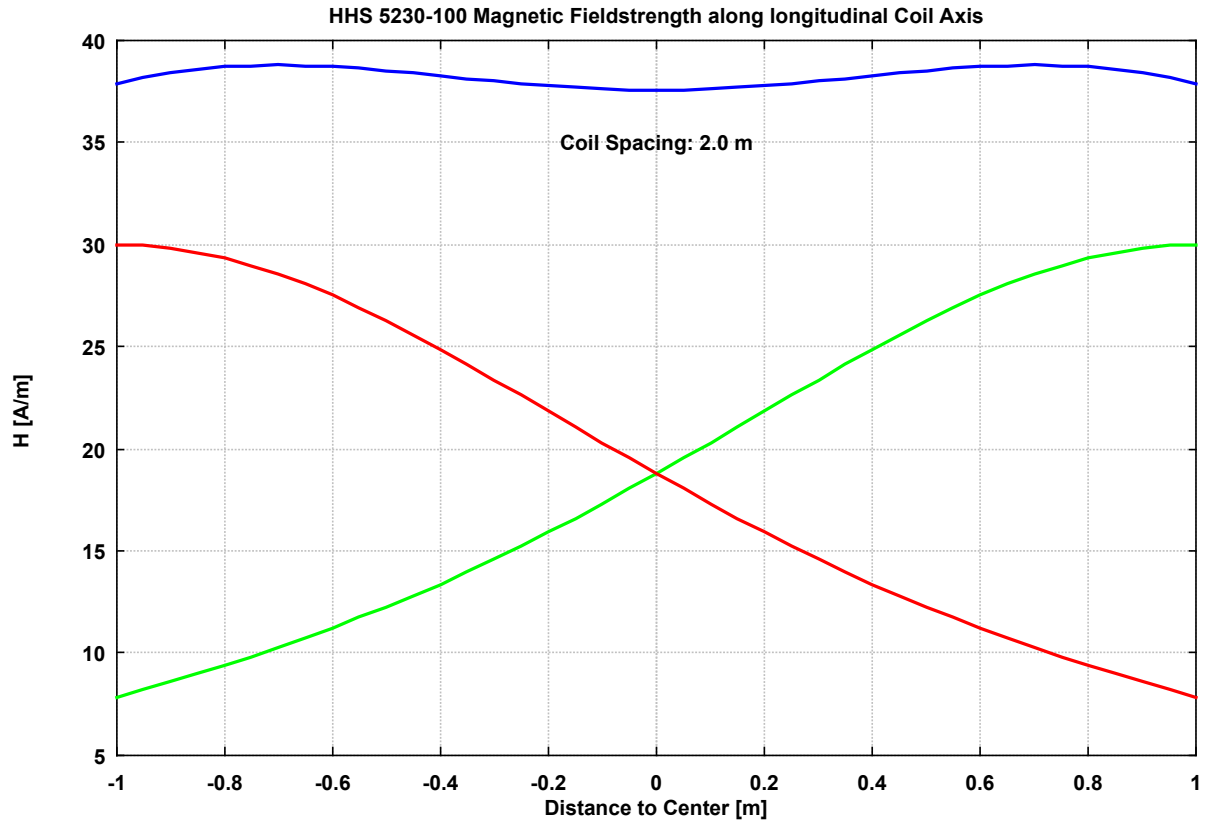
Längskomponente der magnetischen Feldstärke entlang der Spulenlängsachse <i>Magnet. Fieldstrength, longitudinal component along rotational axis</i>						
Distance to Center	H1 A/m	H2 A/m	Htot A/m	H1 dB $\mu$ A/m	H2 dB $\mu$ A/m	Htot dB $\mu$ A/m
0.00	20.3139	20.3139	<b>40.6278</b>	146.16	146.16	<b>152.18</b>
0.05	21.0864	19.5483	<b>40.6347</b>	146.48	145.82	<b>152.18</b>
0.10	21.8617	18.7931	<b>40.6547</b>	146.79	145.48	<b>152.18</b>
0.15	22.6354	18.0511	<b>40.6864</b>	147.10	145.13	<b>152.19</b>
0.20	23.4025	17.3248	<b>40.7273</b>	147.39	144.77	<b>152.20</b>
0.25	24.1575	16.6163	<b>40.7738</b>	147.66	144.41	<b>152.21</b>
0.30	24.8945	15.9273	<b>40.8219</b>	147.92	144.04	<b>152.22</b>
0.35	25.6073	15.2590	<b>40.8663</b>	148.17	143.67	<b>152.23</b>
0.40	26.2891	14.6124	<b>40.9015</b>	148.40	143.29	<b>152.23</b>
0.45	26.9333	13.9880	<b>40.9213</b>	148.61	142.92	<b>152.24</b>
0.50	27.5329	13.3864	<b>40.9193</b>	148.80	142.53	<b>152.24</b>
0.55	28.0813	12.8077	<b>40.8890</b>	148.97	142.15	<b>152.23</b>
0.60	28.5720	12.2517	<b>40.8237</b>	149.12	141.76	<b>152.22</b>
0.65	28.9988	11.7185	<b>40.7173</b>	149.25	141.38	<b>152.20</b>
0.70	29.3562	11.2077	<b>40.5638</b>	149.35	140.99	<b>152.16</b>
0.75	29.6394	10.7187	<b>40.3581</b>	149.44	140.60	<b>152.12</b>
0.80	29.8446	10.2513	<b>40.0959</b>	149.50	140.22	<b>152.06</b>
0.85	29.9689	9.8046	<b>39.7735</b>	149.53	139.83	<b>151.99</b>
0.90	30.0105	9.3782	<b>39.3887</b>	149.55	139.44	<b>151.91</b>

Spulenstrom: 1 A, Spulenabstand: 1.8 m  
Coil Current: 1 A, Coil Separation: 1.8 m

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## Helmholtz-Spulenpaar HHS 5230-100 Helmholtz Coil Pair HHS 5230-100



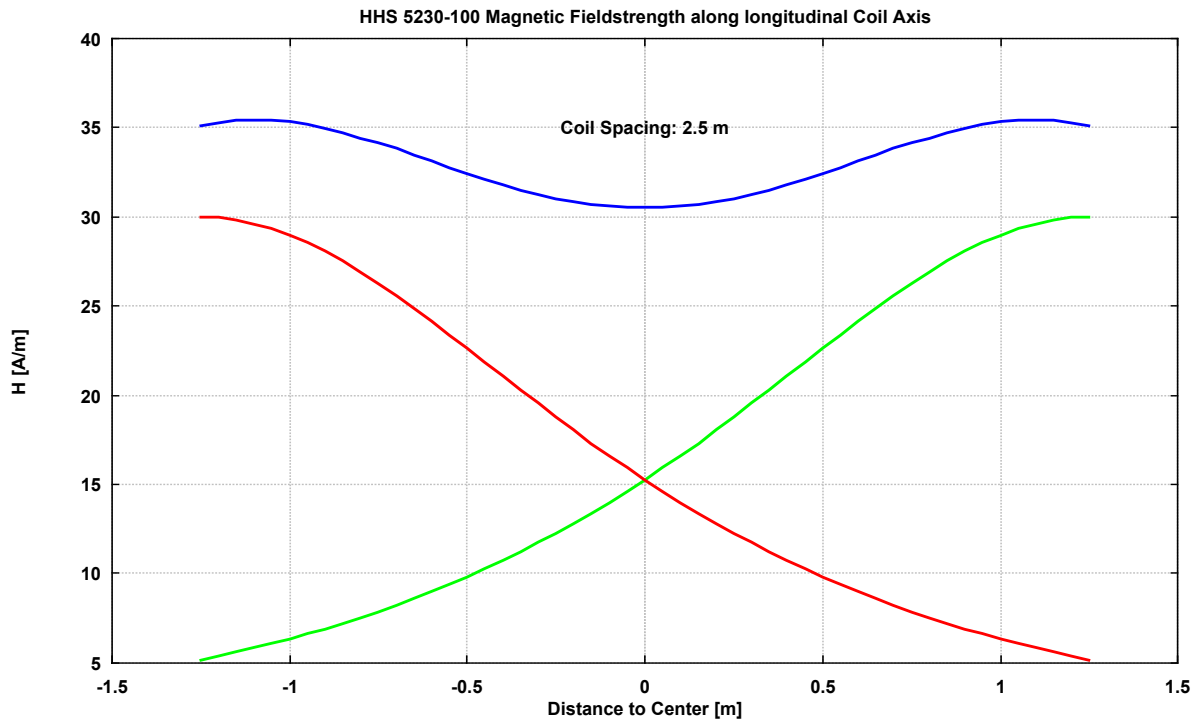
Längskomponente der magnetischen Feldstärke entlang der Spulenlängsachse <i>Magnet. Fieldstrength, longitudinal component along rotational axis</i>						
Distance to Center	H1 A/m	H2 A/m	Htot A/m	H1 dB $\mu$ A/m	H2 dB $\mu$ A/m	Htot dB $\mu$ A/m
0.00	18.7931	18.7931	37.5861	145.48	145.48	151.50
0.05	19.5483	18.0511	37.5994	145.82	145.13	151.50
0.10	20.3139	17.3248	37.6387	146.16	144.77	151.51
0.15	21.0864	16.6163	37.7027	146.48	144.41	151.53
0.20	21.8617	15.9273	37.7890	146.79	144.04	151.55
0.25	22.6354	15.2590	37.8944	147.10	143.67	151.57
0.30	23.4025	14.6124	38.0149	147.39	143.29	151.60
0.35	24.1575	13.9880	38.1455	147.66	142.92	151.63
0.40	24.8945	13.3864	38.2809	147.92	142.53	151.66
0.45	25.6073	12.8077	38.4149	148.17	142.15	151.69
0.50	26.2891	12.2517	38.5409	148.40	141.76	151.72
0.55	26.9333	11.7185	38.6518	148.61	141.38	151.74
0.60	27.5329	11.2077	38.7406	148.80	140.99	151.76
0.65	28.0813	10.7187	38.8001	148.97	140.60	151.78
0.70	28.5720	10.2513	38.8232	149.12	140.22	151.78
0.75	28.9988	9.8046	38.8034	149.25	139.83	151.78
0.80	29.3562	9.3782	38.7344	149.35	139.44	151.76
0.85	29.6394	8.9713	38.6107	149.44	139.06	151.73
0.90	29.8446	8.5833	38.4279	149.50	138.67	151.69
0.95	29.9689	8.2134	38.1823	149.53	138.29	151.64
1.00	30.0105	7.8609	37.8714	149.55	137.91	151.57

Spulenstrom: 1 A, Spulenabstand: 2.0 m  
Coil Current: 1 A, Coil Separation: 2.0 m

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## Helmholtz-Spulenpaar HHS 5230-100 Helmholtz Coil Pair HHS 5230-100



Längskomponente der magnetischen Feldstärke entlang der Spulenlängsachse <i>Magnet. Fieldstrength, longitudinal component along rotational axis</i>						
Distance to Center	H1 A/m	H2 A/m	Htot A/m	H1 dB $\mu$ A/m	H2 dB $\mu$ A/m	Htot dB $\mu$ A/m
0.00	15.2590	15.2590	30.5181	143.67	143.67	149.69
0.05	15.9273	14.6124	30.5397	144.04	143.29	149.70
0.10	16.6163	13.9880	30.6044	144.41	142.92	149.72
0.15	17.3248	13.3864	30.7112	144.77	142.53	149.75
0.20	18.0511	12.8077	30.8587	145.13	142.15	149.79
0.25	18.7931	12.2518	31.0448	145.48	141.76	149.84
0.30	19.5483	11.7185	31.2669	145.82	141.38	149.90
0.35	20.3139	11.2077	31.5216	146.16	140.99	149.97
0.40	21.0863	10.7187	31.8051	146.48	140.60	150.05
0.45	21.8617	10.2513	32.1129	146.79	140.22	150.13
0.50	22.6354	9.8046	32.4400	147.10	139.83	150.22
0.55	23.4025	9.3782	32.7807	147.39	139.44	150.31
0.60	24.1575	8.9713	33.1288	147.66	139.06	150.40
0.65	24.8945	8.5833	33.4778	147.92	138.67	150.50
0.70	25.6073	8.2134	33.8207	148.17	138.29	150.58
0.75	26.2891	7.8609	34.1500	148.40	137.91	150.67
0.80	26.9333	7.5251	34.4584	148.61	137.53	150.75
0.85	27.5329	7.2053	34.7382	148.80	137.15	150.82
0.90	28.0813	6.9007	34.9820	148.97	136.78	150.88
0.95	28.5720	6.6106	35.1826	149.12	136.40	150.93
1.00	28.9988	6.3345	35.3332	149.25	136.03	150.96
1.05	29.3562	6.0716	35.4277	149.35	135.67	150.99
1.10	29.6394	5.8212	35.4606	149.44	135.30	150.99
1.15	29.8446	5.5829	35.4275	149.50	134.94	150.99
1.20	29.9689	5.3559	35.3248	149.53	134.58	150.96
1.25	30.0105	5.1397	35.1503	149.55	134.22	150.92

Spulenstrom: 1 A, Spulenabstand: 2.5 m  
Coil Current: 1 A, Coil Separation: 2.5 m

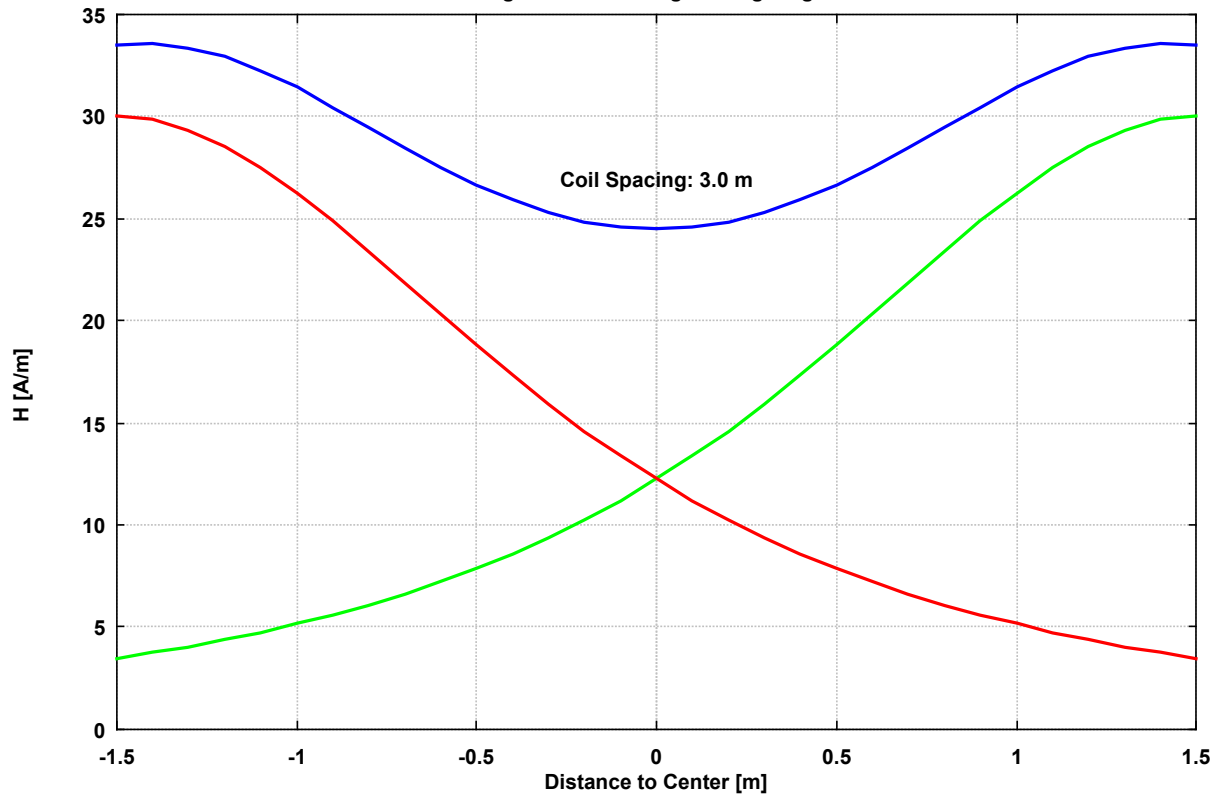


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## Helmholtz-Spulenpaar HHS 5230-100 Helmholtz Coil Pair HHS 5230-100

HHS 5230-100 Magnetic Fieldstrength along longitudinal Coil Axis



Längskomponente der magnetischen Feldstärke entlang der Spulenlängsachse <i>Magnet. Fieldstrength, longitudinal component along rotational axis</i>						
Distance to Center	H1 A/m	H2 A/m	Htot A/m	H1 dB $\mu$ A/m	H2 dB $\mu$ A/m	Htot dB $\mu$ A/m
0.00	12.2518	12.2517	<b>24.5035</b>	141.76	141.76	<b>147.78</b>
0.10	13.3864	11.2077	<b>24.5941</b>	142.53	140.99	<b>147.82</b>
0.20	14.6124	10.2513	<b>24.8636</b>	143.29	140.22	<b>147.91</b>
0.30	15.9273	9.3782	<b>25.3055</b>	144.04	139.44	<b>148.06</b>
0.40	17.3248	8.5833	<b>25.9081</b>	144.77	138.67	<b>148.27</b>
0.50	18.7931	7.8609	<b>26.6540</b>	145.48	137.91	<b>148.52</b>
0.60	20.3139	7.2053	<b>27.5192</b>	146.16	137.15	<b>148.79</b>
0.70	21.8617	6.6106	<b>28.4723</b>	146.79	136.40	<b>149.09</b>
0.80	23.4025	6.0716	<b>29.4740</b>	147.39	135.67	<b>149.39</b>
0.90	24.8945	5.5829	<b>30.4774</b>	147.92	134.94	<b>149.68</b>
1.00	26.2891	5.1397	<b>31.4288</b>	148.40	134.22	<b>149.95</b>
1.10	27.5329	4.7377	<b>32.2706</b>	148.80	133.51	<b>150.18</b>
1.20	28.5720	4.3728	<b>32.9448</b>	149.12	132.82	<b>150.36</b>
1.30	29.3562	4.0412	<b>33.3974</b>	149.35	132.13	<b>150.47</b>
1.40	29.8446	3.7397	<b>33.5844</b>	149.50	131.46	<b>150.52</b>
1.50	30.0105	3.4653	<b>33.4759</b>	149.55	130.79	<b>150.49</b>

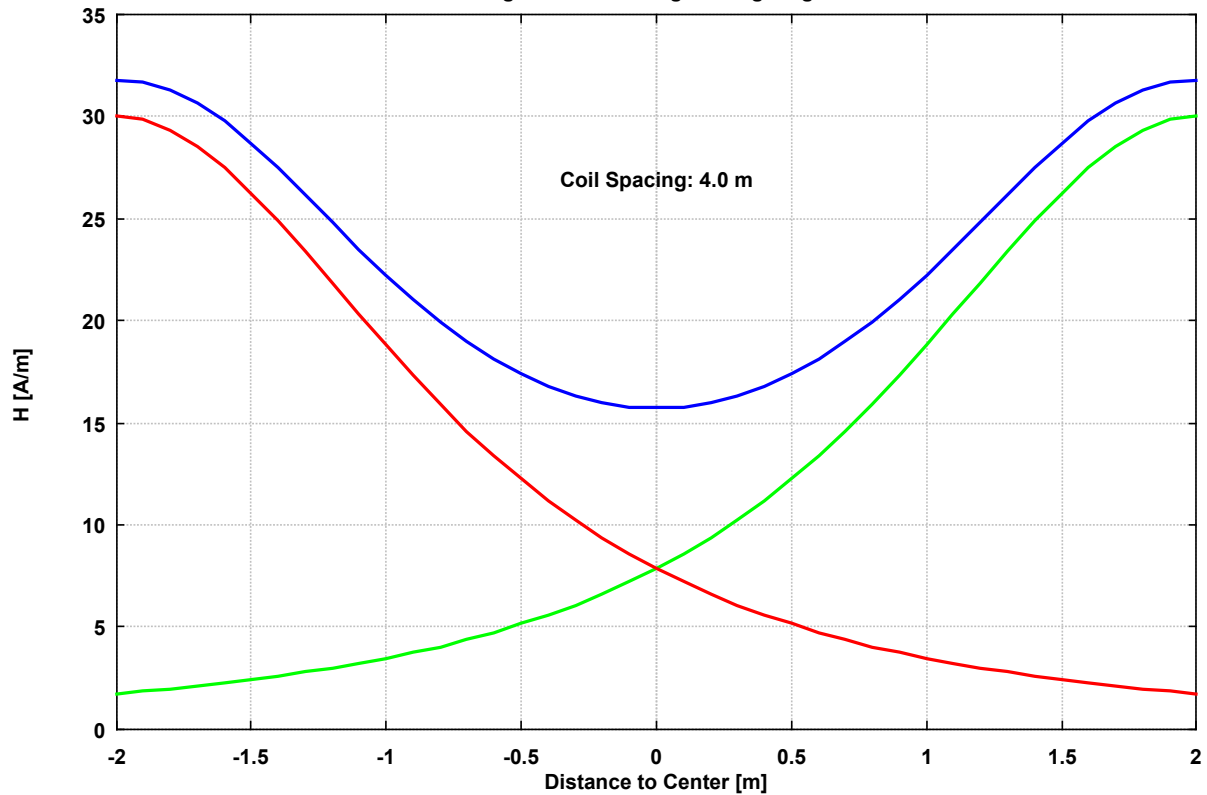
Spulenstrom: 1 A, Spulenabstand: 3.0 m  
*Coil Current: 1 A, Coil Separation: 3.0 m*

# SCHWARZBECK MESS - ELEKTRONIK

An der Klinge 29 D-69250 Schönau Tel.: 06228/1001 Fax.: (49)6228/1003

## Helmholtz-Spulenpaar HHS 5230-100 Helmholtz Coil Pair HHS 5230-100

HHS 5230-100 Magnetic Fieldstrength along longitudinal Coil Axis



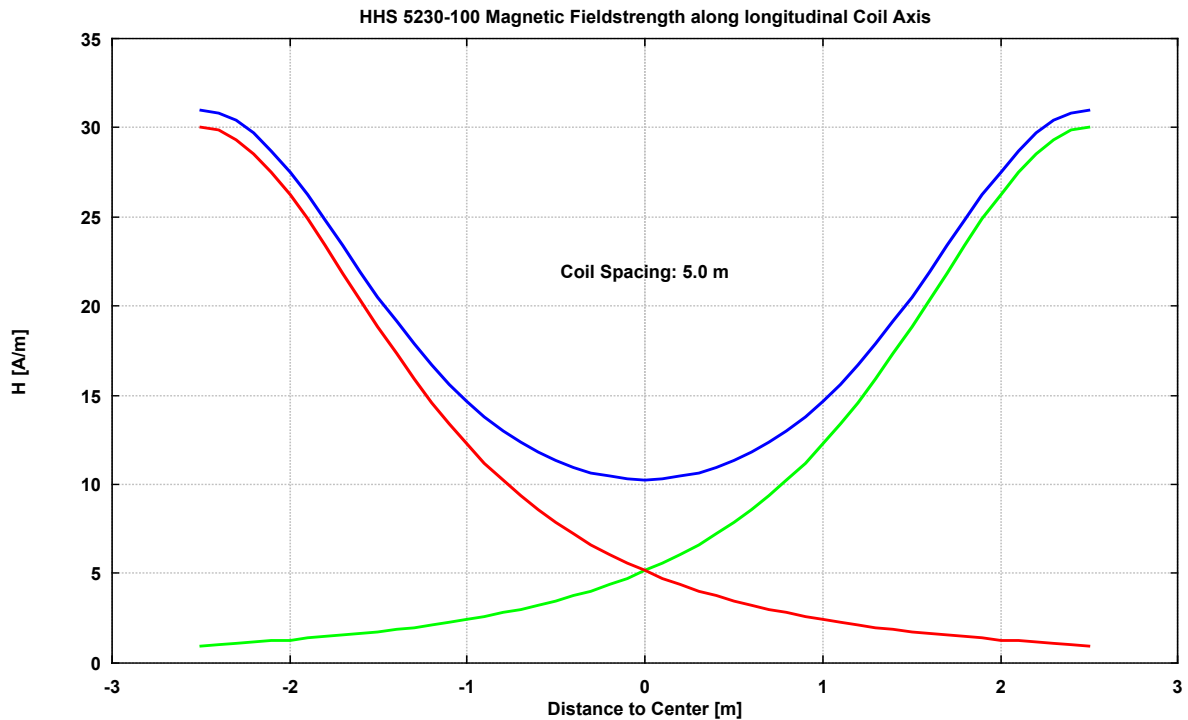
Längskomponente der magnetischen Feldstärke entlang der Spulenlängsachse <i>Magnet. Fieldstrength, longitudinal component along rotational axis</i>						
Distance to Center	H1 A/m	H2 A/m	Htot A/m	H1 dB $\mu$ A/m	H2 dB $\mu$ A/m	Htot dB $\mu$ A/m
0.00	7.8609	7.8609	<b>15.7218</b>	137.91	137.91	<b>143.93</b>
0.10	8.5833	7.2053	<b>15.7886</b>	138.67	137.15	<b>143.97</b>
0.20	9.3782	6.6106	<b>15.9888</b>	139.44	136.40	<b>144.08</b>
0.30	10.2513	6.0716	<b>16.3228</b>	140.22	135.67	<b>144.26</b>
0.40	11.2077	5.5829	<b>16.7905</b>	140.99	134.94	<b>144.50</b>
0.50	12.2518	5.1397	<b>17.3915</b>	141.76	134.22	<b>144.81</b>
0.60	13.3864	4.7377	<b>18.1241</b>	142.53	133.51	<b>145.17</b>
0.70	14.6124	4.3728	<b>18.9852</b>	143.29	132.82	<b>145.57</b>
0.80	15.9273	4.0412	<b>19.9686</b>	144.04	132.13	<b>146.01</b>
0.90	17.3248	3.7397	<b>21.0646</b>	144.77	131.46	<b>146.47</b>
1.00	18.7931	3.4653	<b>22.2584</b>	145.48	130.79	<b>146.95</b>
1.10	20.3139	3.2152	<b>23.5292</b>	146.16	130.14	<b>147.43</b>
1.20	21.8617	2.9871	<b>24.8488</b>	146.79	129.51	<b>147.91</b>
1.30	23.4025	2.7787	<b>26.1812</b>	147.39	128.88	<b>148.36</b>
1.40	24.8945	2.5882	<b>27.4827</b>	147.92	128.26	<b>148.78</b>
1.50	26.2891	2.4137	<b>28.7028</b>	148.40	127.65	<b>149.16</b>
1.60	27.5329	2.2538	<b>29.7867</b>	148.80	127.06	<b>149.48</b>
1.70	28.5720	2.1070	<b>30.6790</b>	149.12	126.47	<b>149.74</b>
1.80	29.3562	1.9720	<b>31.3282</b>	149.35	125.90	<b>149.92</b>
1.90	29.8446	1.8479	<b>31.6925</b>	149.50	125.33	<b>150.02</b>
2.00	30.0105	1.7335	<b>31.7440</b>	149.55	124.78	<b>150.03</b>

Spulenstrom: 1 A, Spulenabstand: 4.0 m  
Coil Current: 1 A, Coil Separation: 4.0 m

# SCHWARZBECK MESS - ELEKTRONIK

An der Klinge 29 D-69250 Schönau Tel.: 06228/1001 Fax.: (49)6228/1003

## Helmholtz-Spulenpaar HHS 5230-100 Helmholtz Coil Pair HHS 5230-100



Längskomponente der magnetischen Feldstärke entlang der Spulenlängsachse  
Magnet. Fieldstrength, longitudinal component along rotational axis

Distance to Center	H1 A/m	H2 A/m	Htot A/m	H1 dB $\mu$ A/m	H2 dB $\mu$ A/m	Htot dB $\mu$ A/m
0.00	5.1397	5.1397	10.2794	134.22	134.22	140.24
0.10	5.5829	4.7377	10.3206	134.94	133.51	140.27
0.20	6.0716	4.3728	10.4443	135.67	132.82	140.38
0.30	6.6106	4.0412	10.6519	136.40	132.13	140.55
0.40	7.2053	3.7397	10.9450	137.15	131.46	140.78
0.50	7.8609	3.4653	11.3262	137.91	130.79	141.08
0.60	8.5833	3.2152	11.7985	138.67	130.14	141.44
0.70	9.3782	2.9871	12.3653	139.44	129.51	141.84
0.80	10.2513	2.7787	13.0300	140.22	128.88	142.30
0.90	11.2077	2.5882	13.7959	140.99	128.26	142.79
1.00	12.2517	2.4137	14.6655	141.76	127.65	143.33
1.10	13.3864	2.2538	15.6402	142.53	127.06	143.88
1.20	14.6124	2.1070	16.7193	143.29	126.47	144.46
1.30	15.9273	1.9720	17.8994	144.04	125.90	145.06
1.40	17.3248	1.8479	19.1727	144.77	125.33	145.65
1.50	18.7931	1.7335	20.5266	145.48	124.78	146.25
1.60	20.3139	1.6280	21.9419	146.16	124.23	146.83
1.70	21.8617	1.5305	23.3922	146.79	123.70	147.38
1.80	23.4025	1.4404	24.8429	147.39	123.17	147.90
1.90	24.8945	1.3570	26.2515	147.92	122.65	148.38
2.00	26.2891	1.2797	27.5688	148.40	122.14	148.81
2.10	27.5329	1.2079	28.7408	148.80	121.64	149.17
2.20	28.5720	1.1413	29.7132	149.12	121.15	149.46
2.30	29.3561	1.0793	30.4354	149.35	120.66	149.67
2.40	29.8446	1.0216	30.8662	149.50	120.19	149.79
2.50	30.0105	0.9678	30.9783	149.55	119.72	149.82

Spulenstrom: 1 A, Spulenabstand: 5.0 m  
Coil Current: 1 A, Coil Separation: 5.0 m