

USER'S MANUAL

MODEL: 5201

PROJECTED FIELD ELECTROMAGNET

Date Sold: _____

Serial number: _____

PROPRIETARY

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Section 1

SPECIFICATIONS

Model: 5201 Electromagnet Specifications

Projected Field: (at max current of 20A)

$B_x = \pm 0.3T$ (3000G)
(X,Y,Z = 0, 0, 4mm)
 $B_z = \pm 0.2T$ (2000G)
(X,Y,Z = 14, 0, 4mm)

Projected Field Region (for B_x)

X = 0mm
Y = -5 to + 5mm
Z = 0 to 12mm

(for B_z)

X = ± 14 mm
Y = 0mm
Z = 0 to 12mm

Coil:

coil resistance (20°C)

0.85 Ohm

max resistance (hot)*

1.02 Ohm

max power (water cooling)

20A/20V (400W)

max power (ambient air cooling)

5A/5V (25W)

Self Inductance:

Approx 40mH at 1 Hz

(The apparent inductance reduces with frequency due to eddy currents in the solid poles)

Cooling: (measured at water I/O manifold)

1.0 Liter/min, 2.0 bar [0.26 USG/min, 28 psid]

Thermal Interlock:

Open circuit above 75° C (167° F)

Dimensions:

Drawing 11901860
70.0 mm W x 60.0 mm D x 120 mm H
2.8 inch W x 2.4 inch D x 4.7 inch H

Mass:

2.1 kg (4.6 lb)

***CAUTION - The value of maximum coil resistance given should not be exceeded.**

At this resistance the coils are at maximum safe temperature for continuous operation.

Section 2

WARNINGS

REFER TO WARNINGS BELOW BEFORE OPERATING ELECTROMAGNET SYSTEM

1 Personnel Safety

In operation the magnet fringing field in the vicinity of the pole gap is in excess of 0.5m T (5G). This can cause malfunctioning of sensitive electronic and magnetic components. We recommend that warning signs are posted indicating that a magnetic field may be present.

2 Ferromagnetic Objects

During operation the magnet exerts magnetic attraction towards ferromagnetic objects in the near vicinity of its pole faces. Keep ferromagnetic items clear!

3 Arcing

This magnet stores energy in its field during operation. Do not disconnect any current lead while under load or the magnetic field energy will be discharged across the interruption causing arcing and possible damage to electronic circuits.

4 Coil Hot Resistance

Do not exceed the maximum coil hot resistance given in the specifications or coil overheating and possible damage may occur

5 Watches, Credit Cards, and Magnetic Disks

Do not move magnetically sensitive items into the close vicinity of the magnet pole gap. Even some anti-magnetic watches can be damaged when placed in close proximity to the pole gaps during operation. Credit cards, and magnetic disks are affected by magnetic fields as low as 0.5m T (5G). Depending on the previous operating field and the pole gap, the remanent field in the gap can be in excess of 0.5mT (5G) with the magnet power supply off or disconnected.

6 Power Supply

Refer to the power supply manufacturers manual for additional important safety information.

Section 3

INSTALLATION

Mounting Position (Refer to drawing 11902050)

The magnet system can be mounting in any orientation, including being completely inverted. Four M3 clearance holes are provided on the magnet transition plate for mounting the magnet.

Electrical Connections

The magnet system comes with integrated wiring for the magnet. Never connect or remove cables from the magnet system with the DC power energized otherwise damage to the magnet power supply may occur. Follow instruction below for making electrical connections.

Power Supply (Refer to drawing 11902000 & 13900420)

1. Firstly ensure the power supply is turned off and the AC power cable is disconnected.
2. Plug in the magnet cable plug into the back of Kepco BOP power supply.
3. Secure the connecting plug with the two securing thumbscrews.
4. Connect the three sleeved wires to the output connector block on the rear of the Kepco BOP power supply as detailed below.
 - Black Wire with Red sleeve to Output
 - Black Wire with Blue sleeve to Common
 - Green wire to Ground

Note: Reconnect AC power cable to power supply . The magnet system is now ready to use. Do not power up the magnet unless the cooling water is turned on and flowing at 1.0 liters/min.

Electrical Interlocks

The Model 5201 has two thermostats, Selco part no 802L-075. They are located on the pole/coil assembly heatsinks and wired in series. The thermostats are normally closed, opening when the coil heatsink temperature exceeds 75° C, +/- 5° C.

Water Cooling (Refer to drawing 11902000)

The Model 5201 can be operated to an average coil temperature of 70° C. Assuming an ambient laboratory temperature of 20° C and a temperature coefficient of resistivity for copper of 0.0039/° C, the hot resistance of the coil should not exceed 20% more than the ambient temperature "cold" resistance. The coil thermostat will open when either pole/coil heatsink temperature exceeds approximately 75° C. If either temperature switch opens then the Magnet power supply circuit breaker will trip to the off position. Clean, cool (16° C - 20° C) water at 1.0l/min at 1.0 bar (28 psid) should be used to cool the 5201 magnet.

The cooling copper tubes are electrically isolated from the coils to avoid electrochemical corrosion. A 50 micron filter should be placed before the input to the magnet to trap particulates and avoid blockage of the cooling circuits.

Water Cooling Connections

The magnet is supplied with two 3.0m m (1/8") I.D. 1 meter long flexible hoses that connected the water cooling circuit to the hose couplings on the rear of the Water I/O Manifold. On the front of the Water I/O Manifold are two barbed "push on" hose couplings to suit 6 m m (1/4") I.D. rubber hose.

- Water Inlet: Connect to a clean water source fitted with a suitable metering valve (to control water flow).
- Water Outlet: Connect to drain.

Inlet Water Metering Valve Kit.

Metering Valve (brass)
required)

SWAGELOCK Cat No: B-4MG4-MH (1

Hex Nipple (brass) 1/8" NPT female

SWAGELOCK Cat No: B-2-CN (1 required)

Hose Push on (black) 1/4" I.D.
required)

SWAGELOCK Cat No: PB-4-BK (as

Water Control Panel, Part 11902480.

GMW offers an optional Water Control Panel for users that have a suitable supply of cooling water. The 11902480 includes a water filter, flow control, flow indicator and flow interlock in one package. Since the thermal capacity of the Model 5201 Electromagnet is small it is particularly important to have the correct water flow to avoid overheating. A water flow interlock ensures that the Power Supply for the 5201 will not provide current unless both the water flow and coil temperature interlocks are in the closed (safe) position.

Section 4

OPERATION

Electromagnet System (Kepco Power Supply operating in Current Control)

1. Set Voltage and Current toggle switches to off before turning on power main circuit breaker.
2. Set Current control potentiometer to fully counterclockwise position. Turn the potentiometer clockwise five turns. This position is approximately equal to a zero current setting.
3. Select Mode switch to Current.
4. Turn on power supply main circuit breaker.
5. Turn on Current control toggle switch
6. Turn the Current control potentiometer clockwise for positive current or counterclockwise for negative current as required.

Section 5

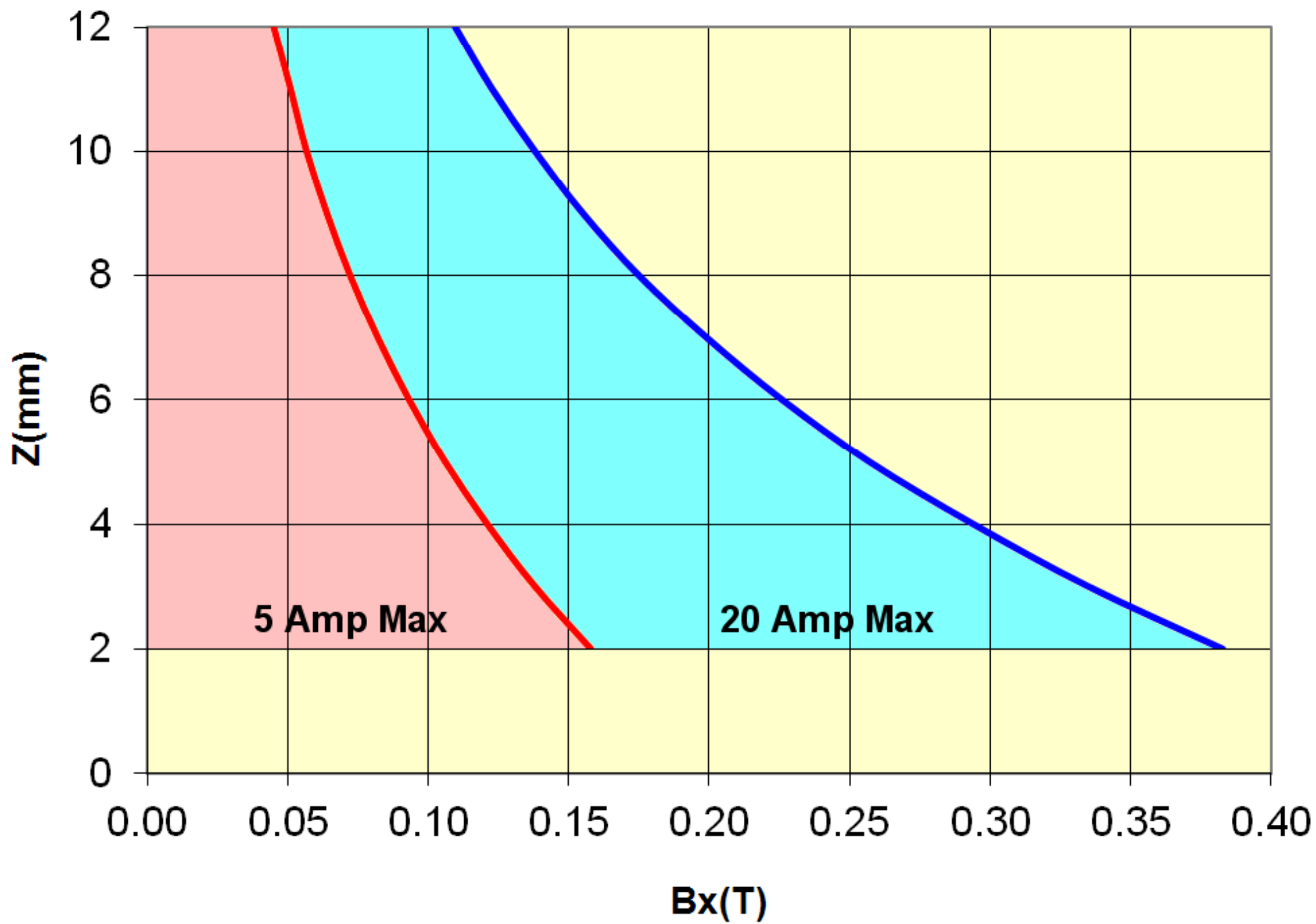
MAINTENANCE

Electrical Connections on the magnet terminal block should be checked annually. The electrical connections should be clean and tight. Discoloration is a sign that the connection is overheating and must be rectified before further use of the magnet.

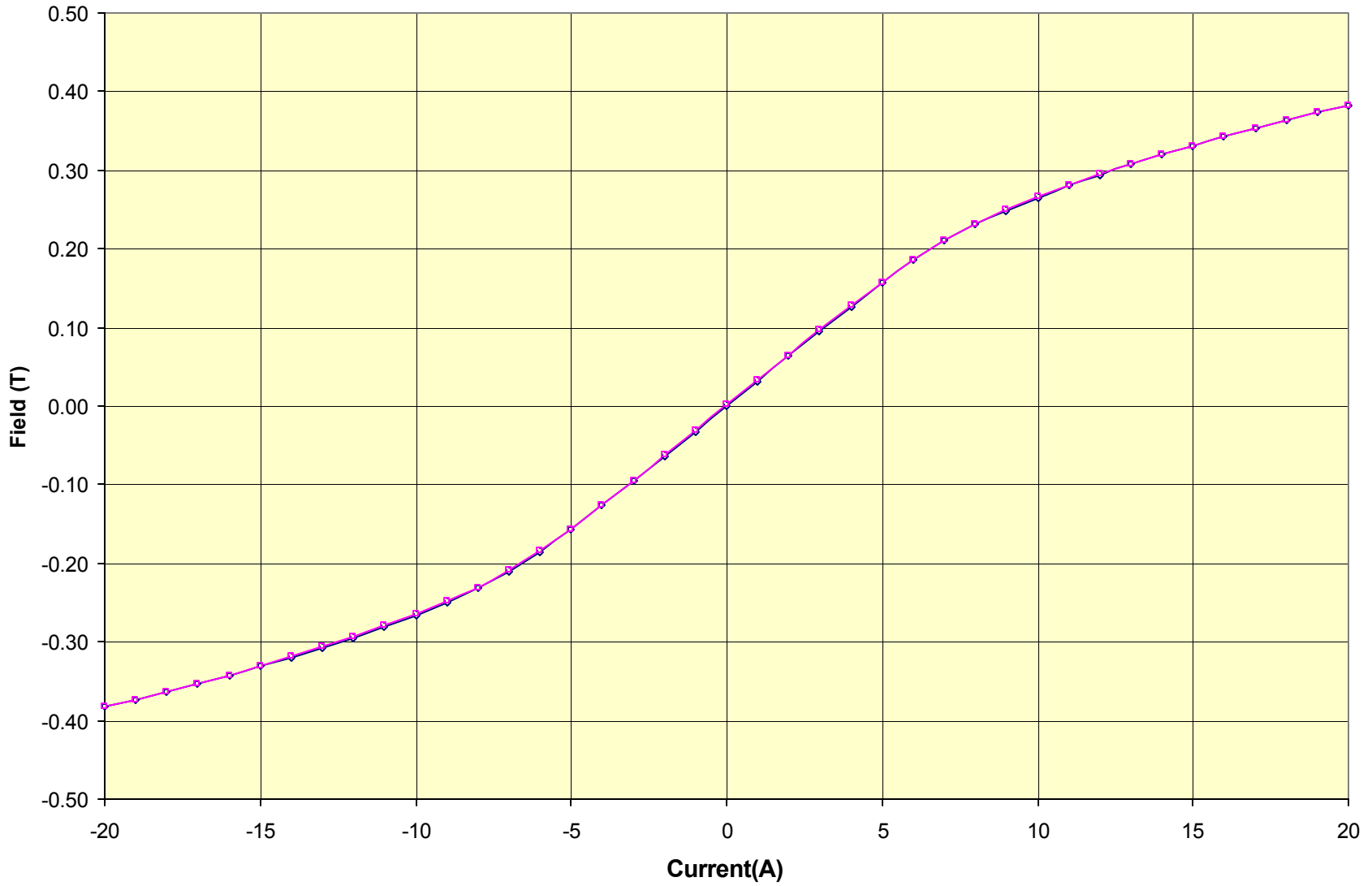
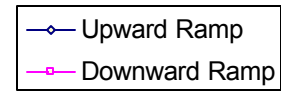
Water Hoses should be checked regularly for water leaks. Any leaks should be rectified before further use of the magnet.

Section 6

EXCITATION CURVES

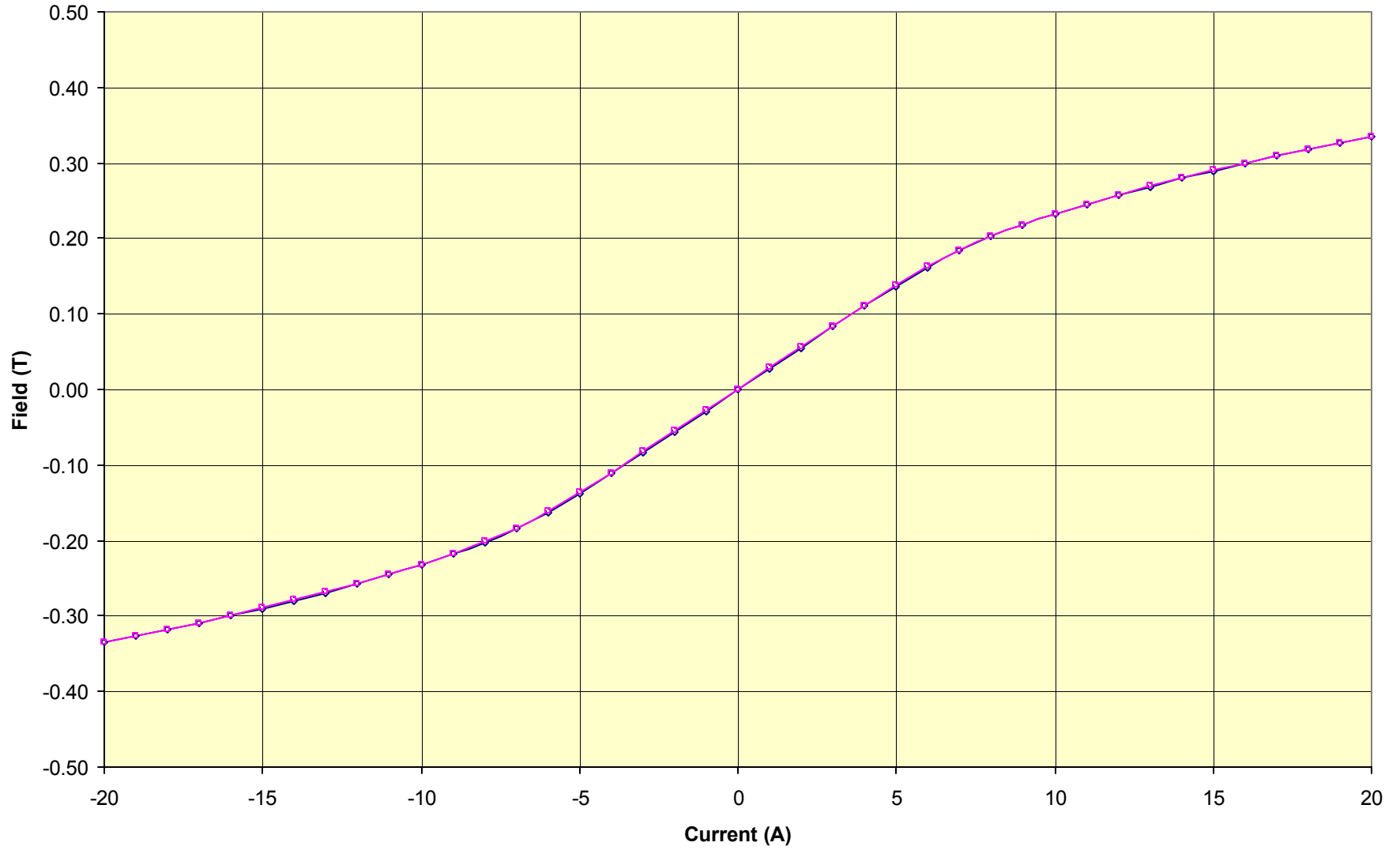


Projected Field Magnet SN:001
Bx vs. Current (X=Y=0mm, Z=2mm)

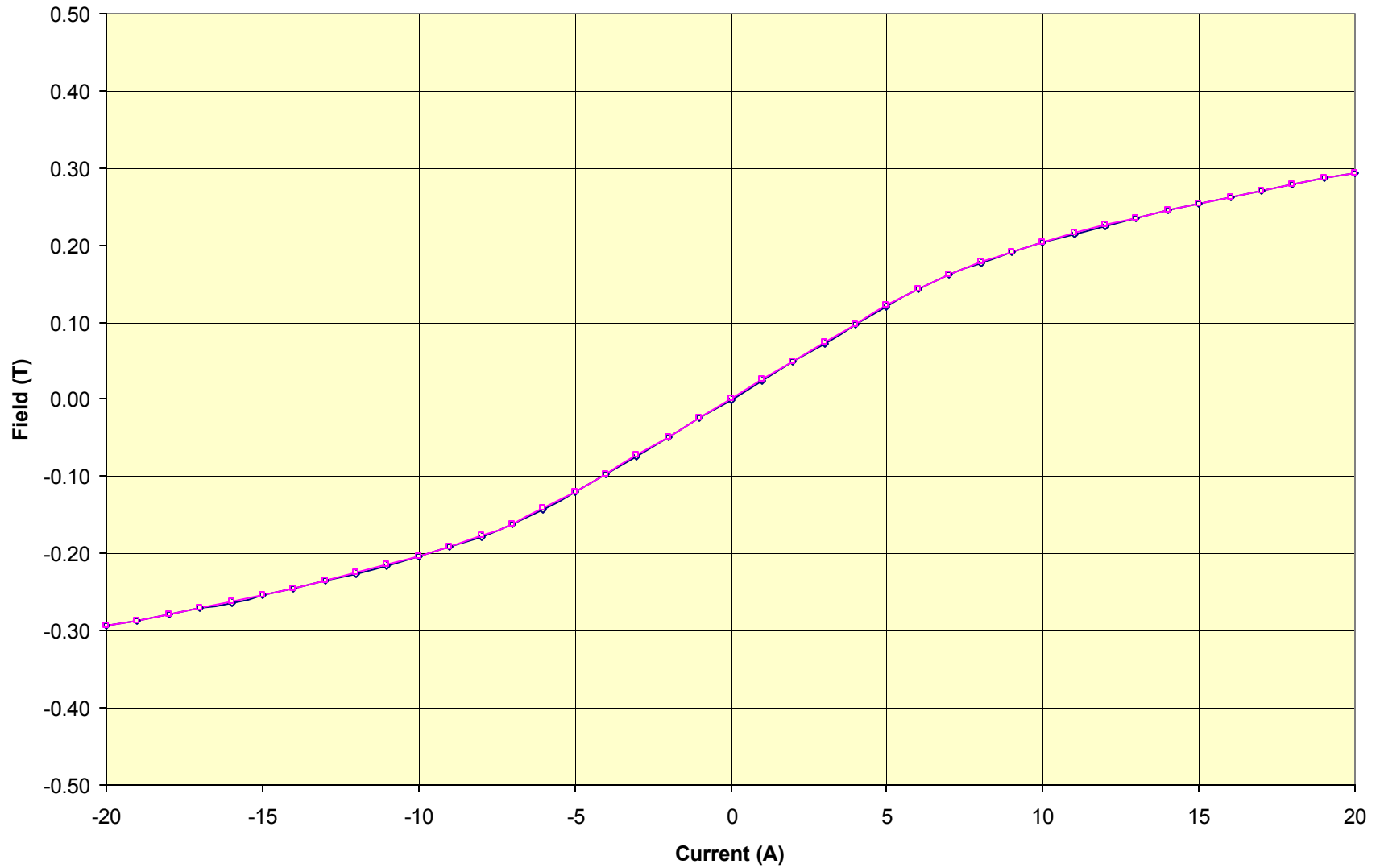
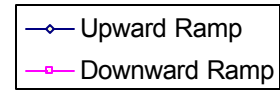


Projected Field Magnet SN:001
Bx vs. Current (X=Y=0mm, Z=3mm)

Upward Ramp
Downward Ramp

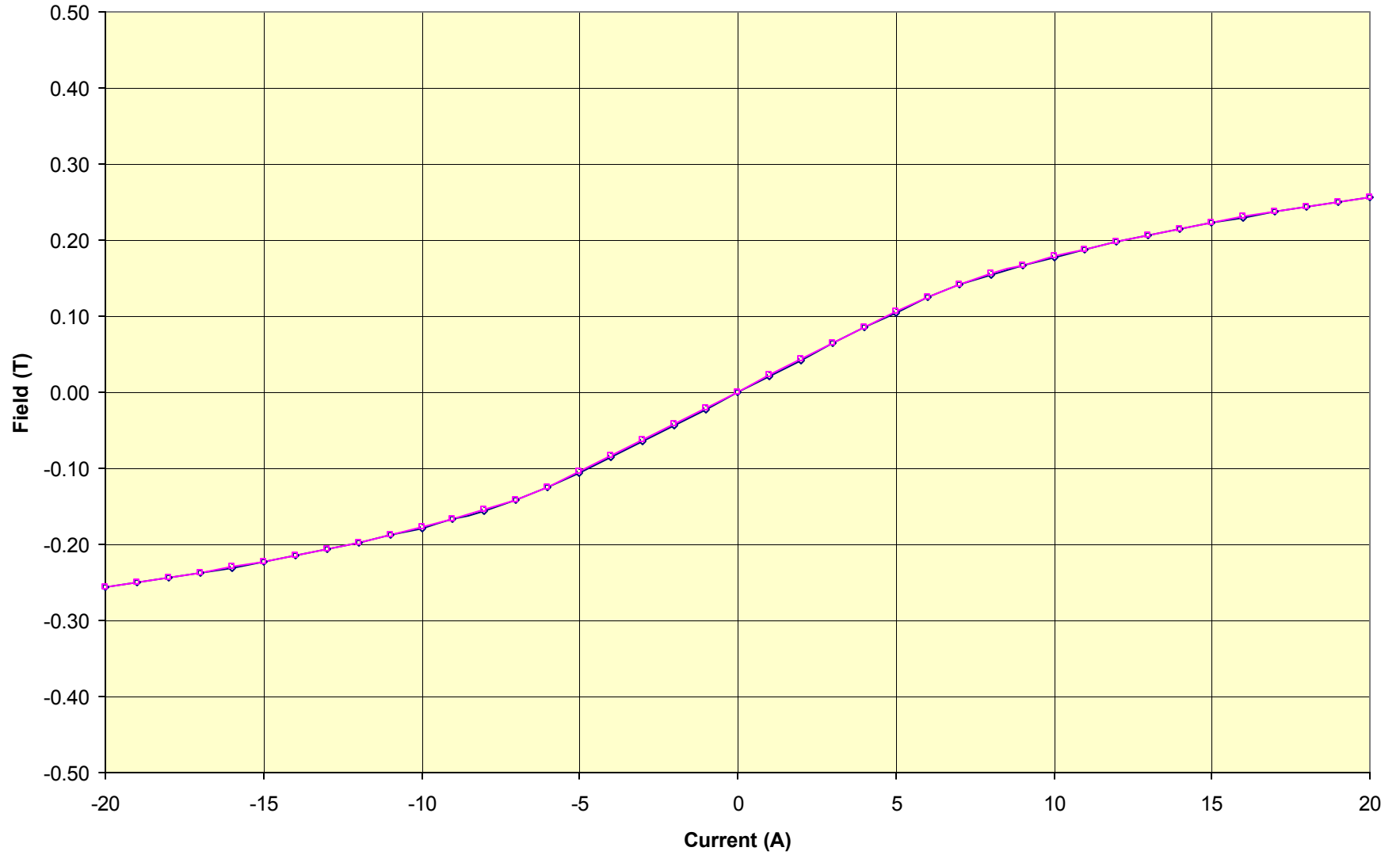


Projected Field Magnet SN:001
Bx vs. Current (X=Y=0mm, Z=4mm)

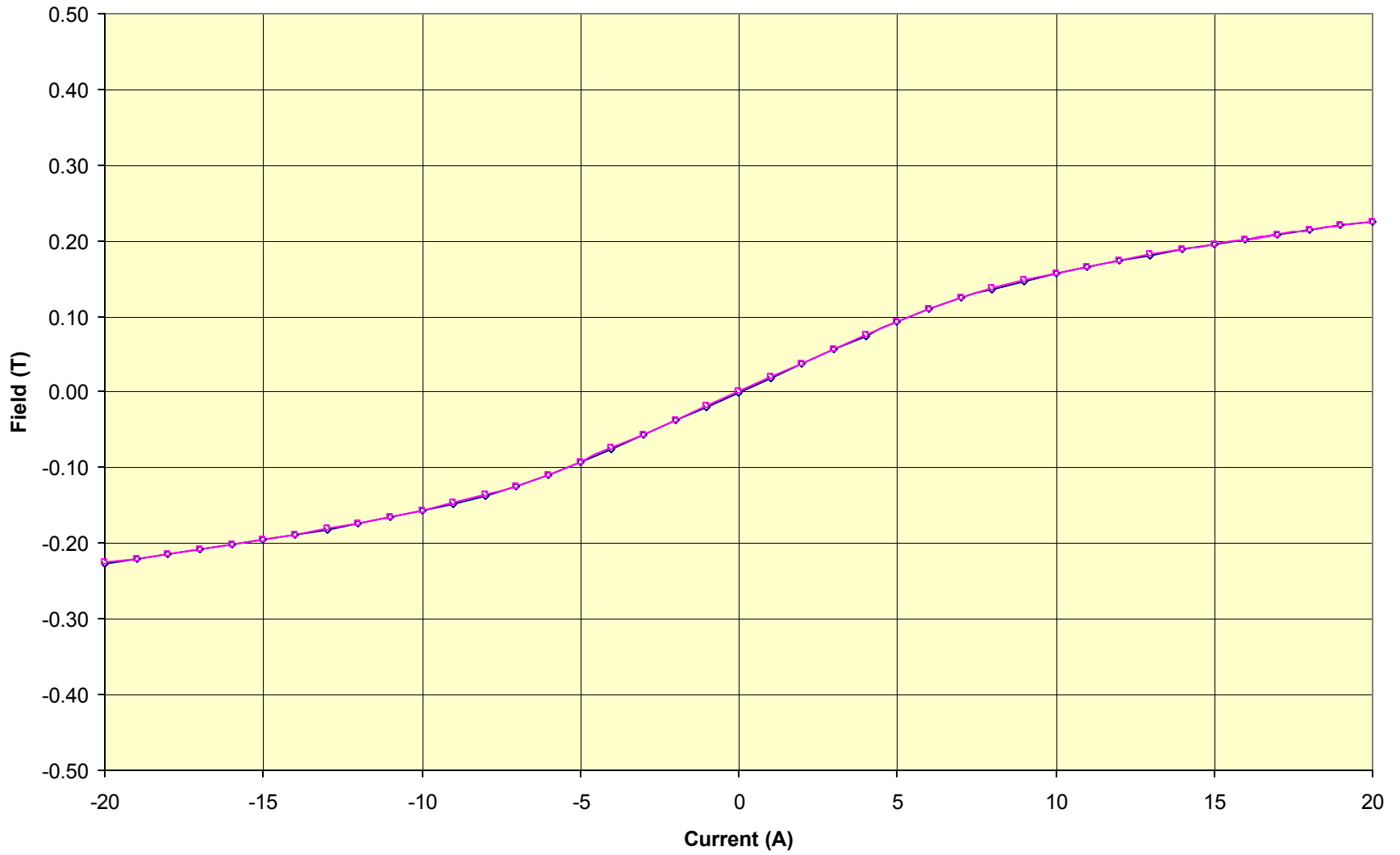
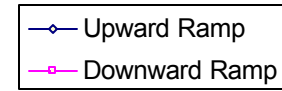


Projected Field Magnet SN:001
Bx vs. Current (X=Y=0mm, Z=5mm)

Upward Ramp
Downward Ramp

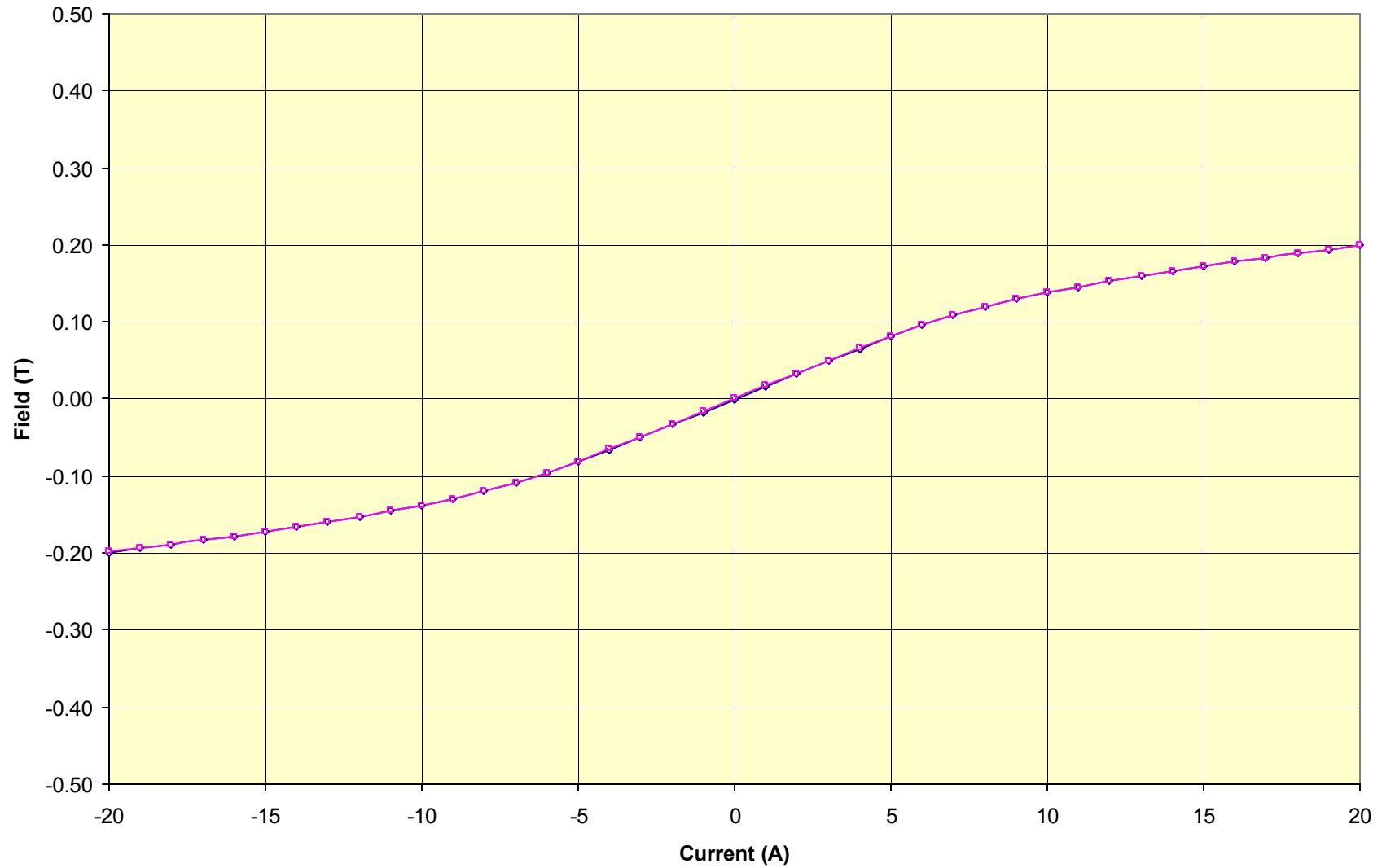


Projected Field Magnet SN:001
Bx vs. Current (X=Y=0mm, Z=6mm)



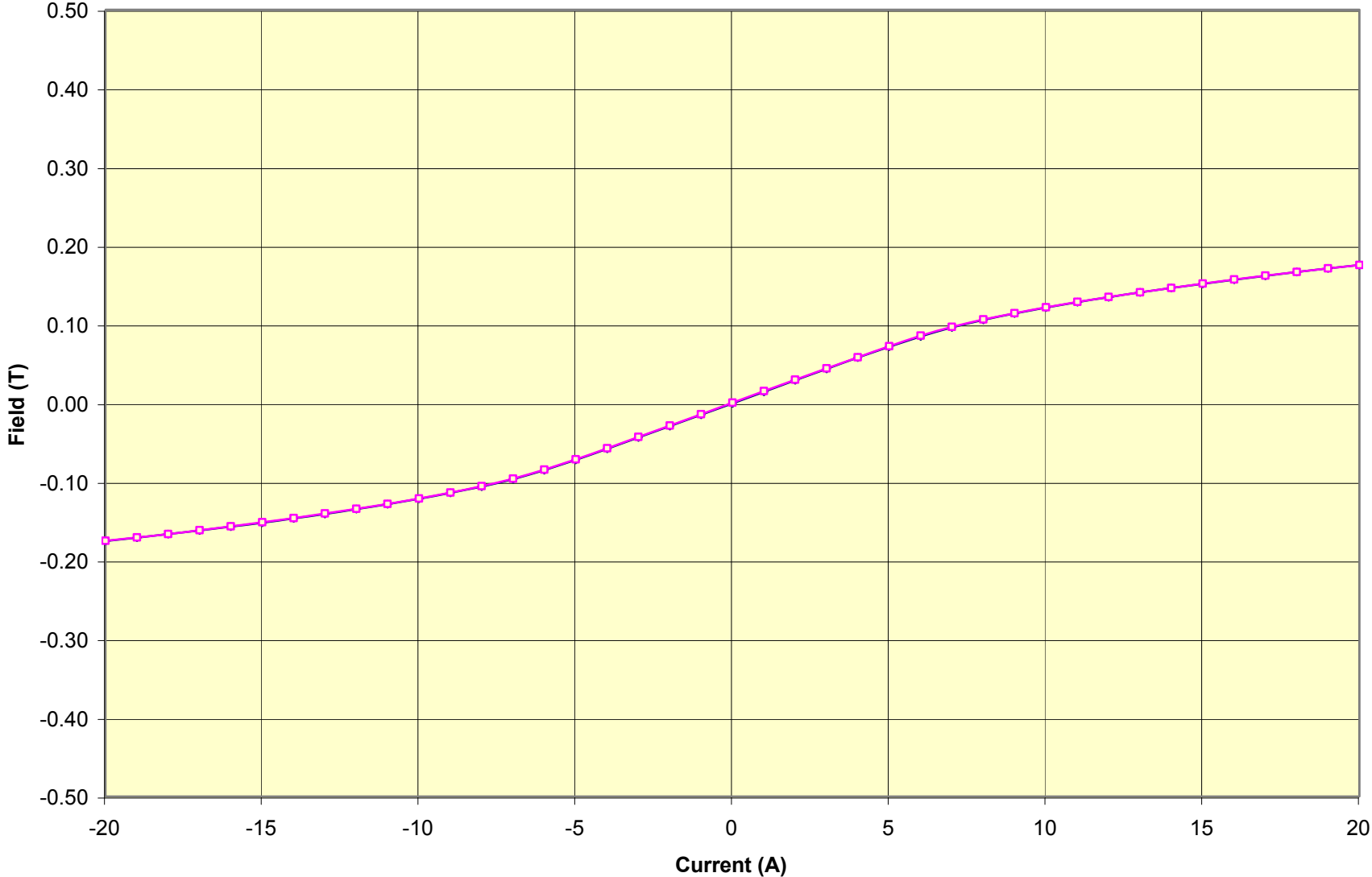
Projected Field Magnet SN:001
Bx vs. Current (X=Y=0mm, Z=7mm)

Upward Ramp
Downward Ramp



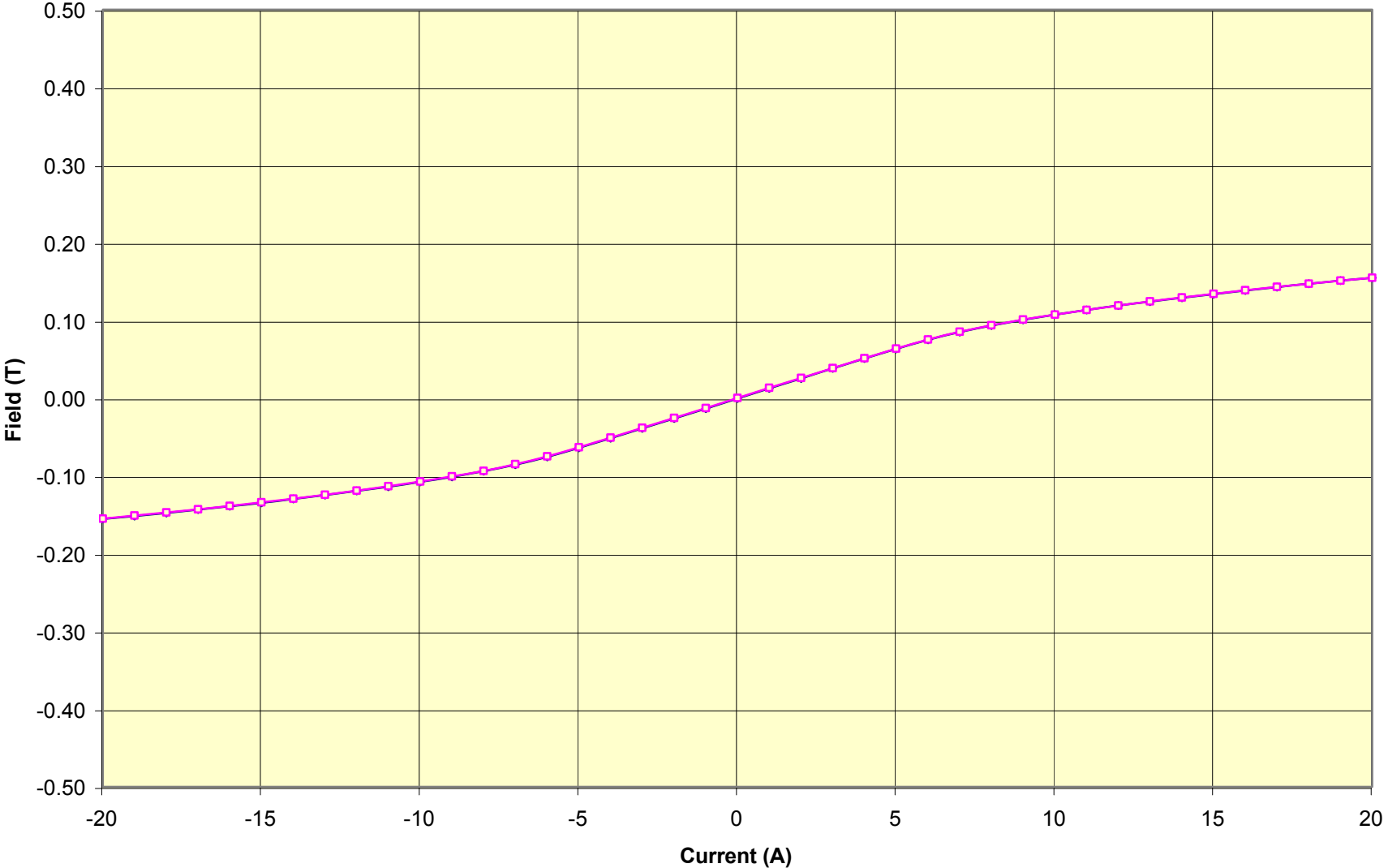
Projected Field Magnet SN:001
Bx vs. Current (X=Y=0mm, Z=8mm)

Upward Ramp
Downward Ramp

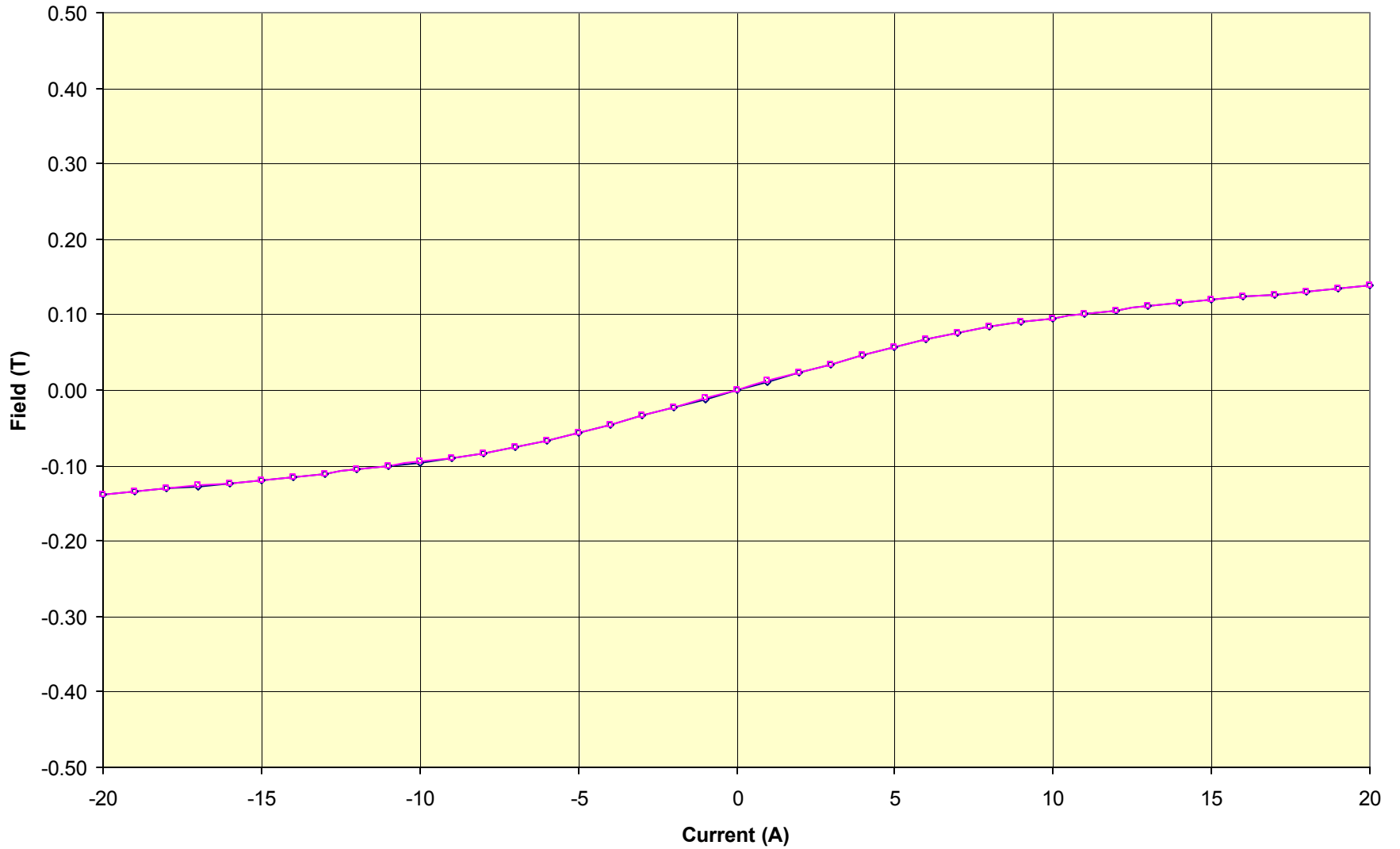
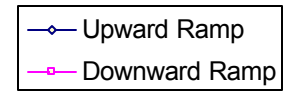


Projected Field Magnet SN:001
Bx vs. Current (X=Y=0mm, Z=9mm)

Upward Ramp
Downward Ramp

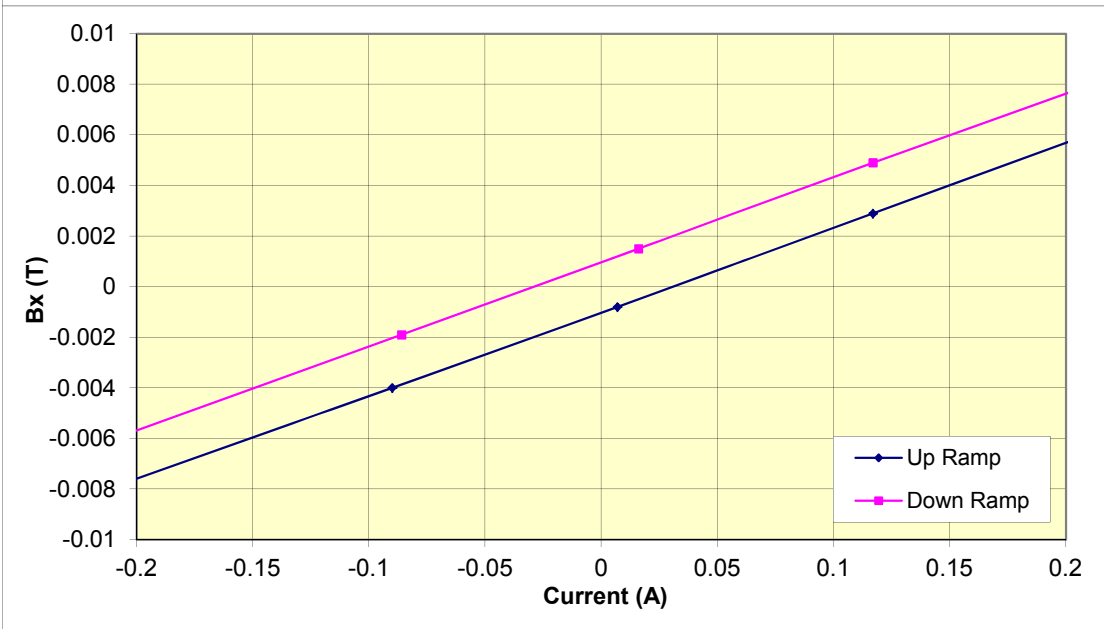
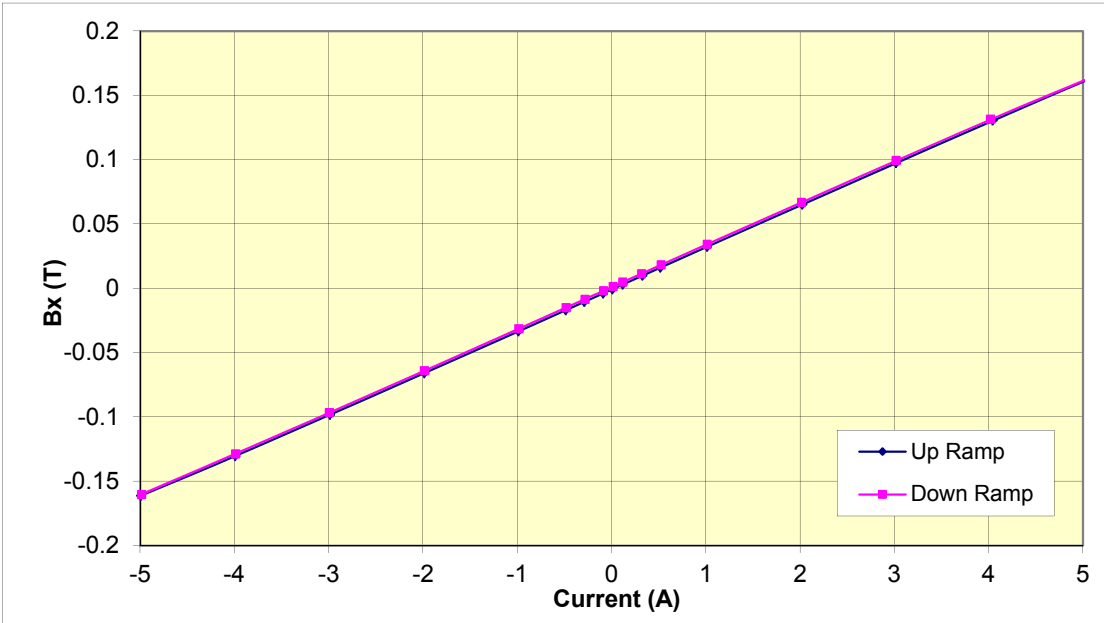


Projected Field Magnet SN:001
Bx vs. Current (X=Y=0mm, Z=10mm)



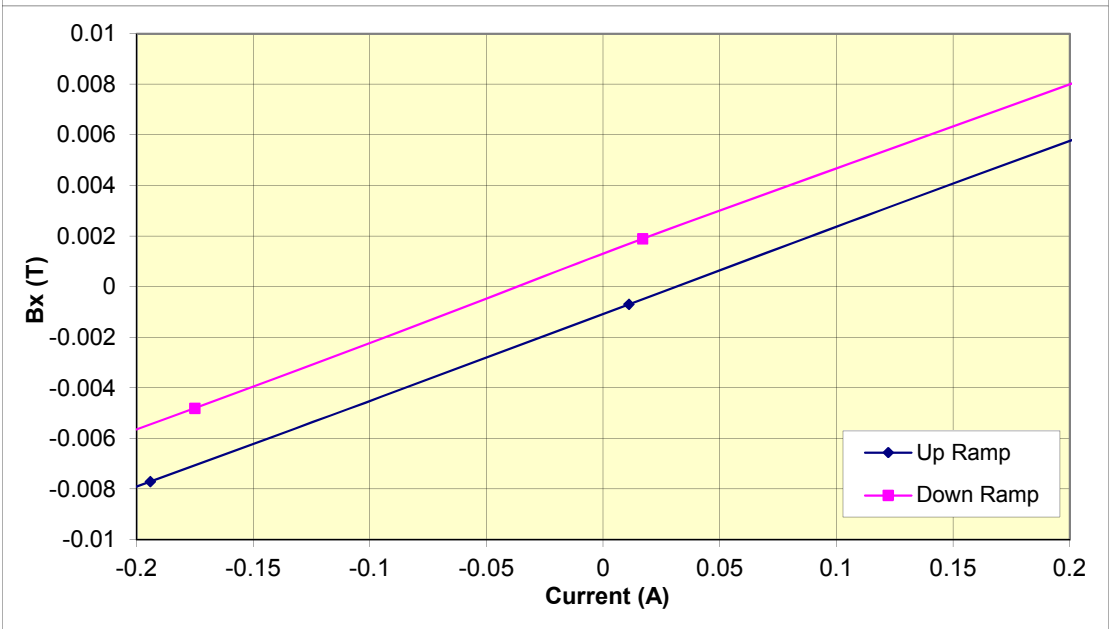
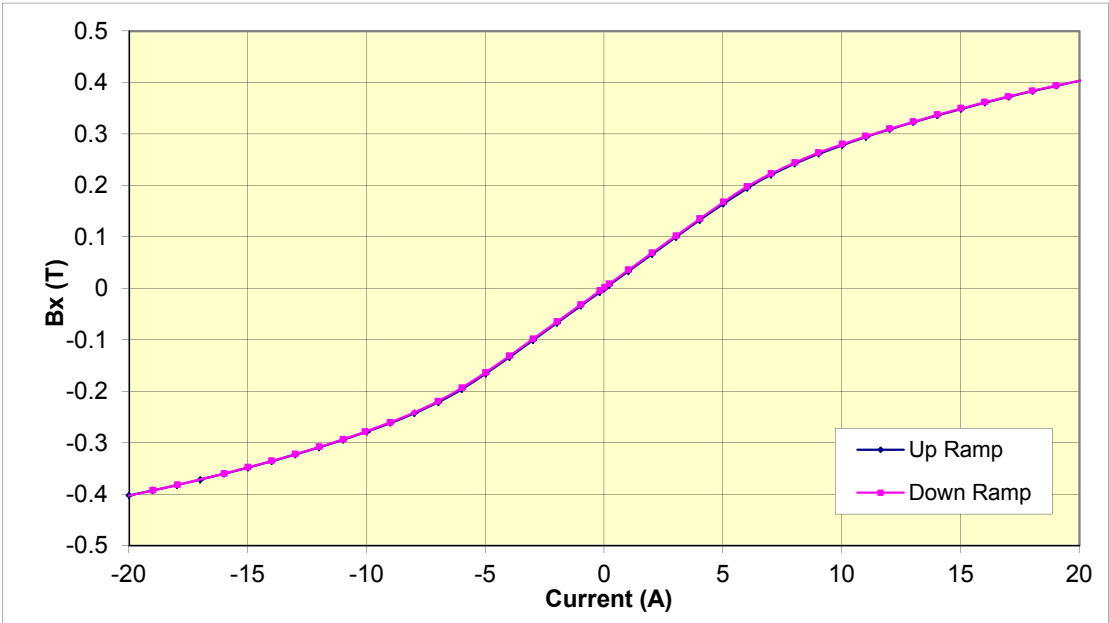
GMW ASSOCIATES
Electromagnet Hysteresis Plot

Model:	5201	Engr:	Y.Q.
Serial No:	15	Date:	12/16/2005
Pole Face:		Page:	2 of 2
Pole gap:	N/A		
Power Supply:	Kepeco 20-5		
PS SN:	147743 R15		
Position:	X=Y=0mm, Z= 2mm above pole		
Current:	-5A~+5A		



GMW ASSOCIATES
Electromagnet Hysteresis Plot

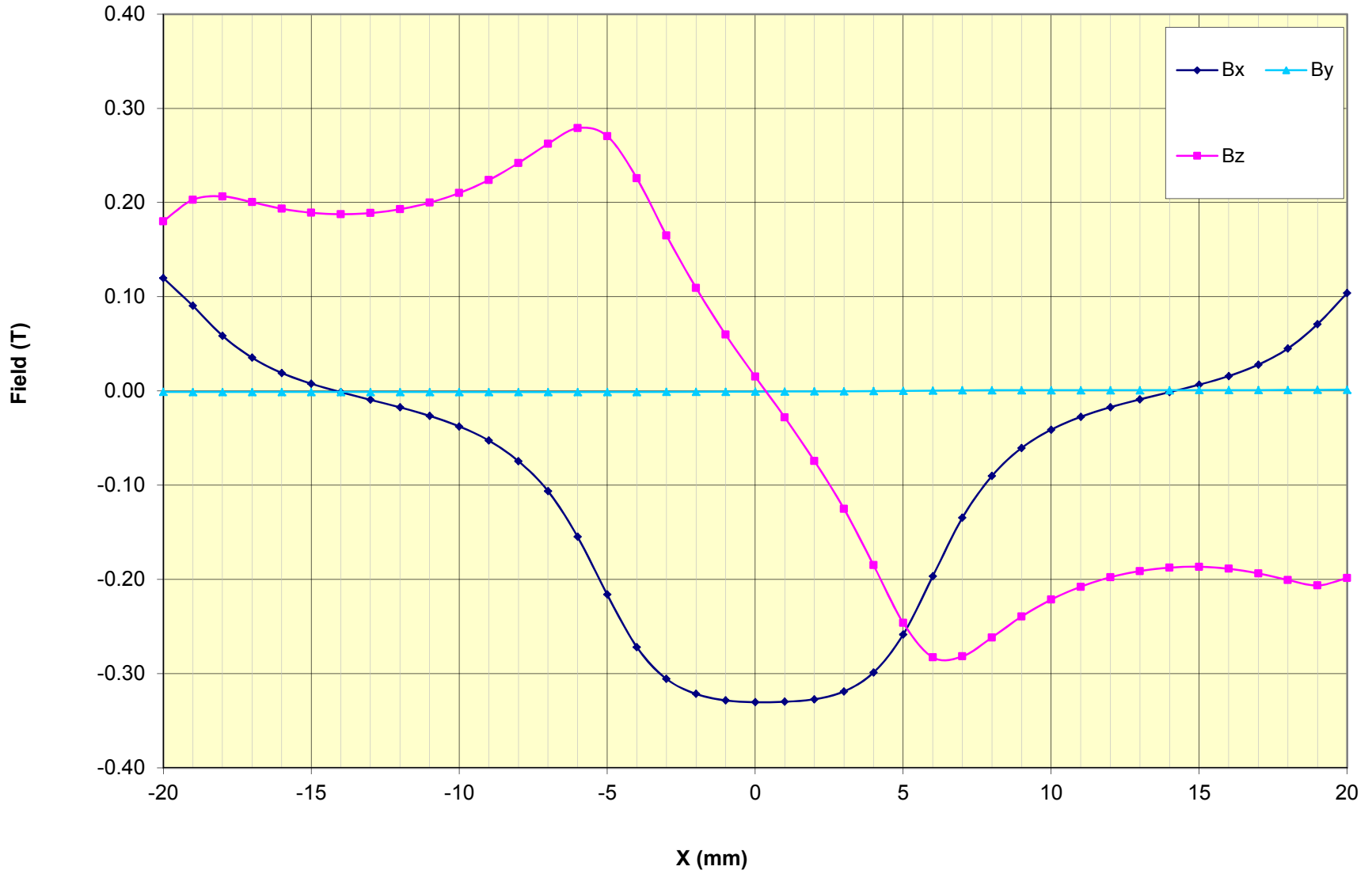
Model:	5201	Engr:	Y.Q.
Serial No:	15	Date:	12/16/2005
Pole Face:		Page:	1 of 2
Pole gap:	N/A		
Power Supply:	Kepco 20-20		
PS SN:	155399 R31		
Position:	X=Y=0mm, Z= 2mm above pole		
Current:	-20A~+20A		



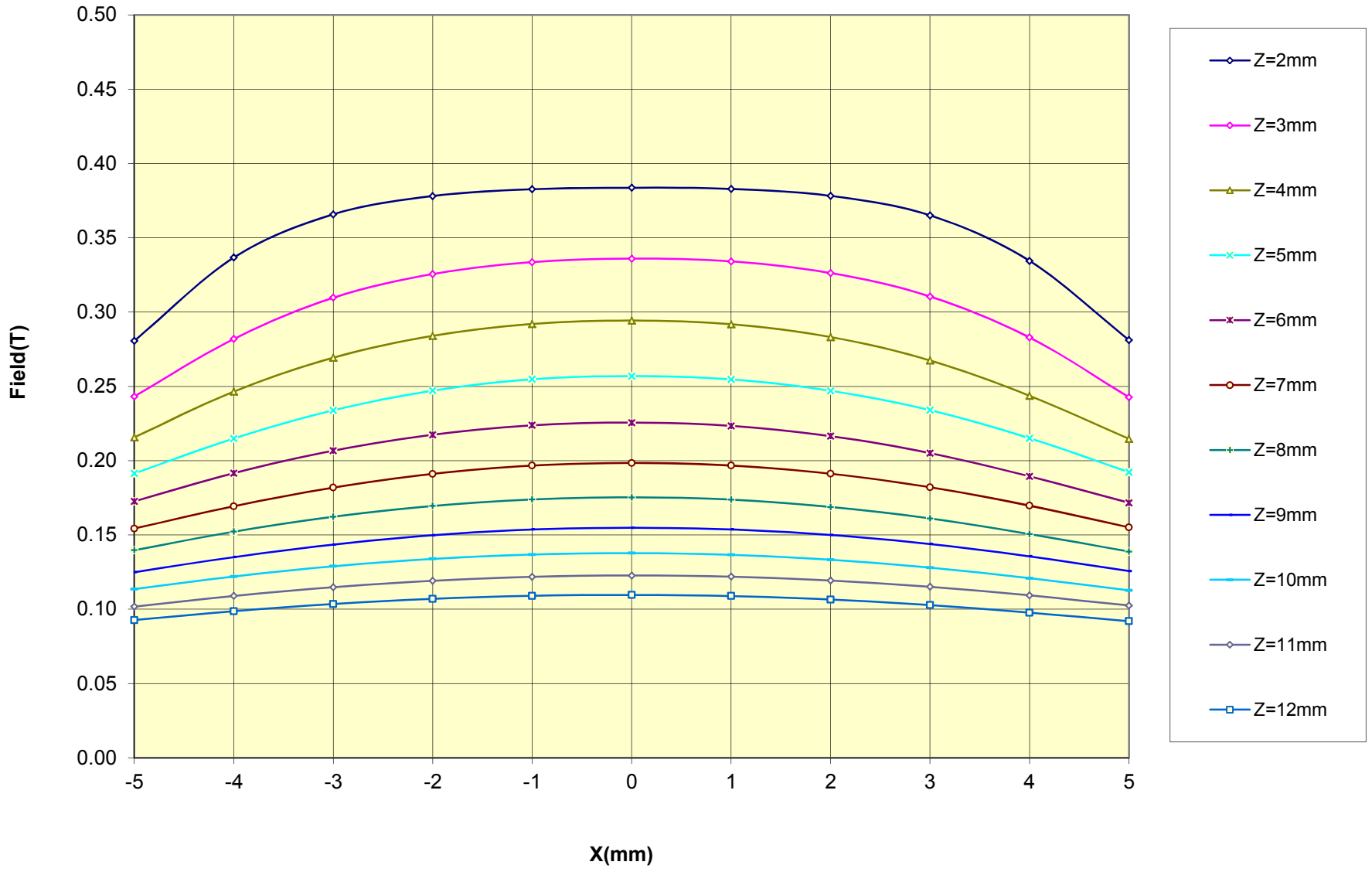
Section 7

TEST DATA

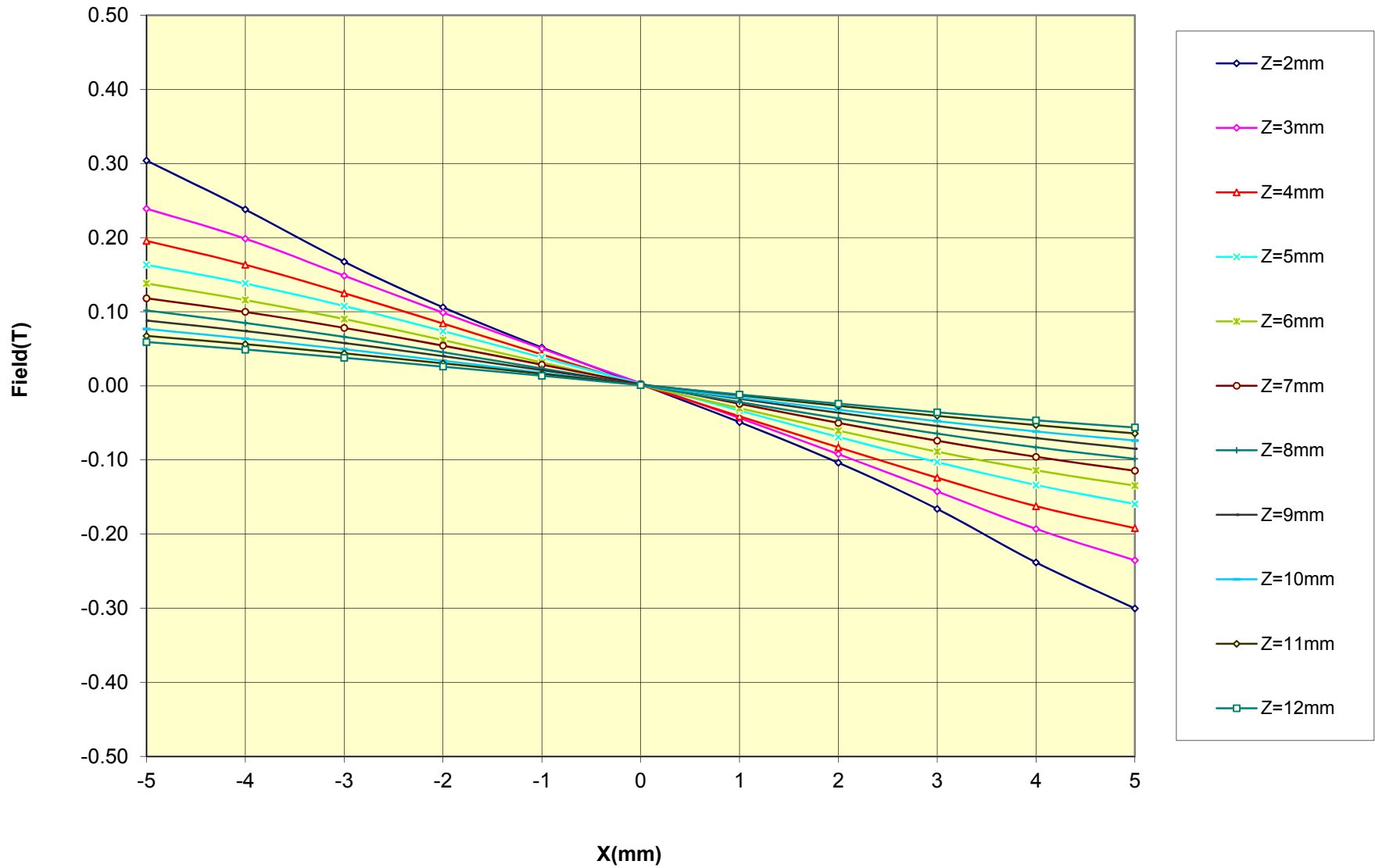
GMW 5201 Project Field Magnet SN:004
-Bx, By, Bz vs. X (Y=0mm, Z=2mm, I=15A)



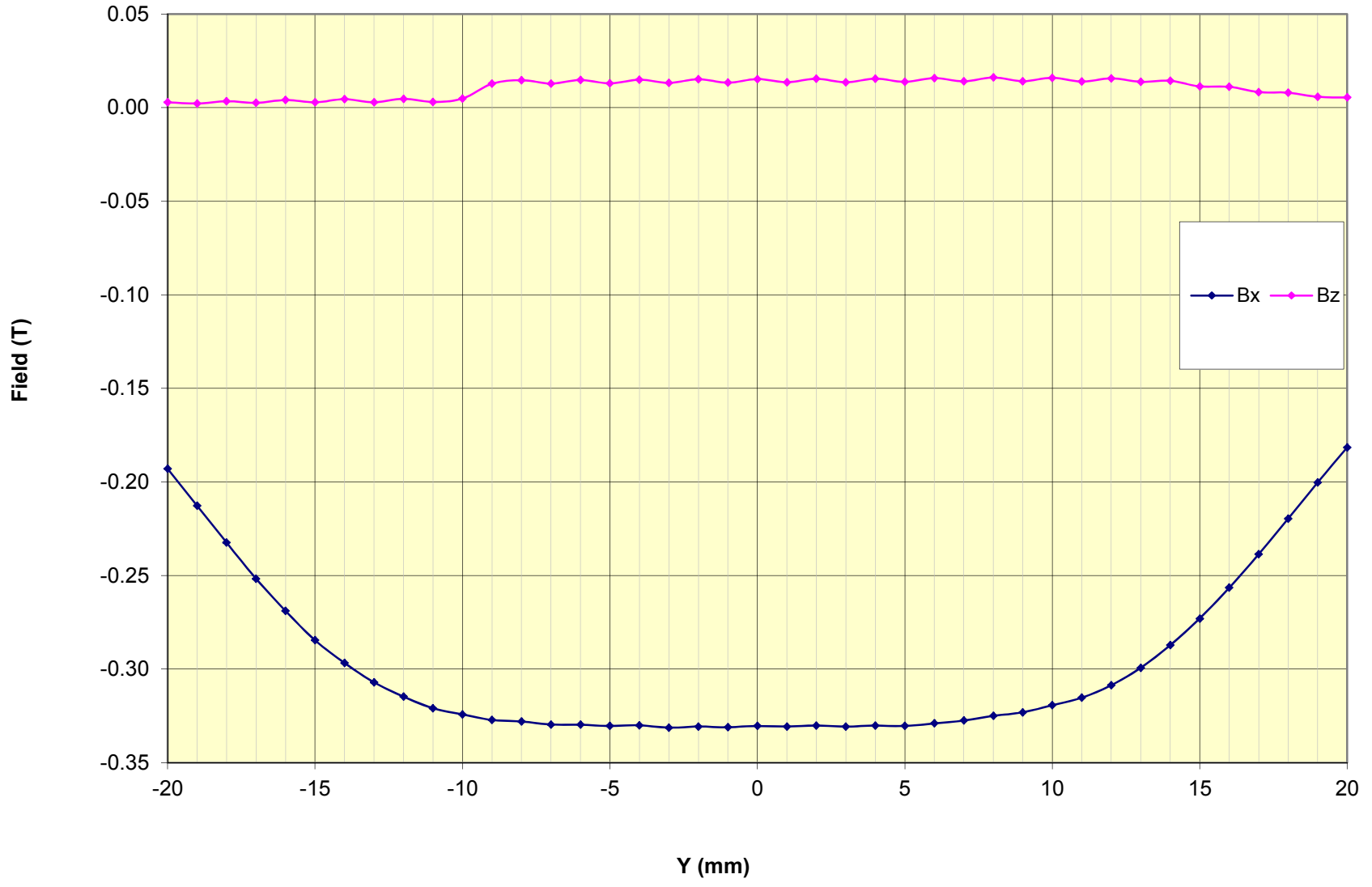
Projected Field Magnet SN: 001
Bx vs. X (Y=0mm)
Current = 20A



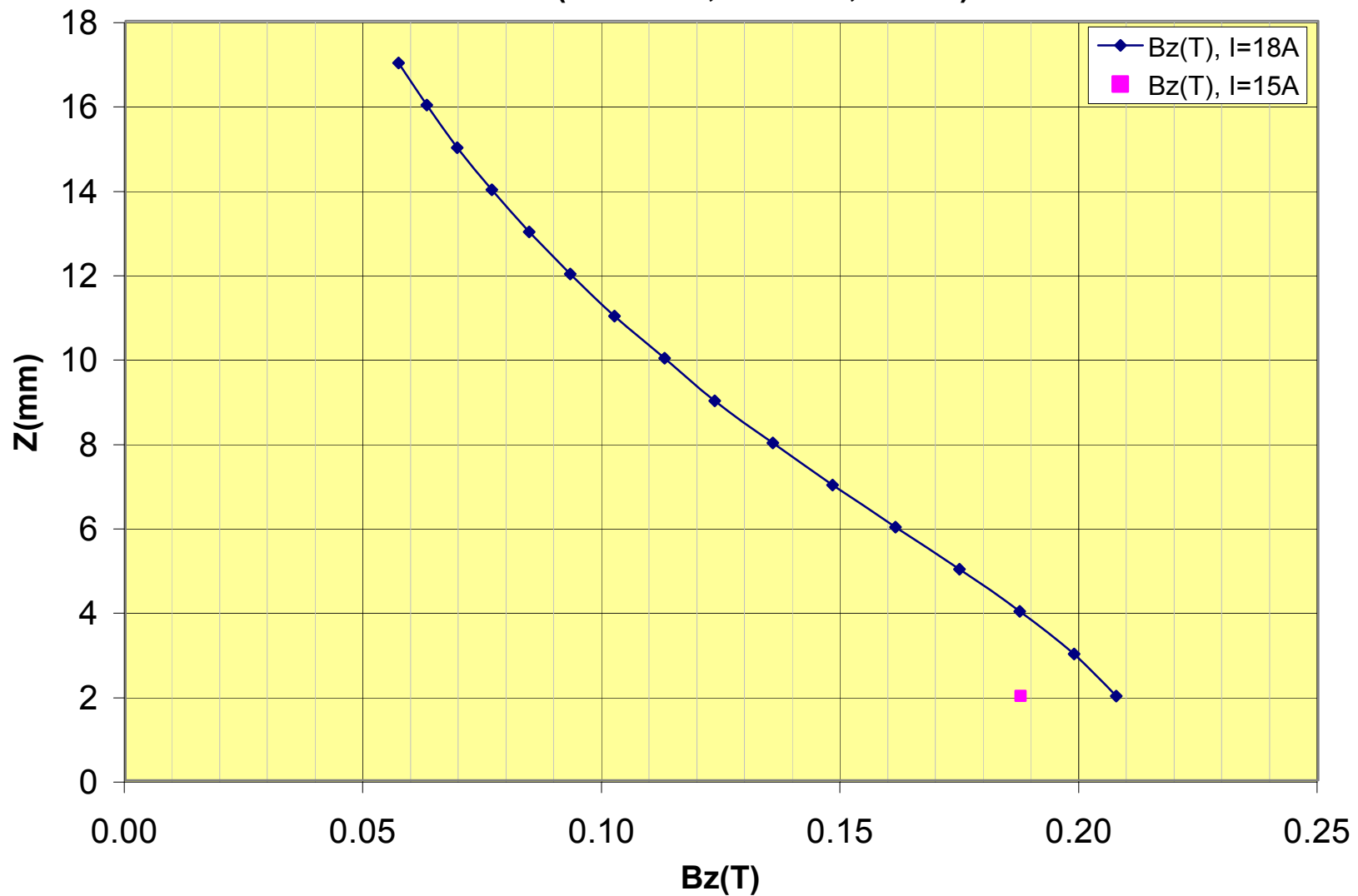
Projected Field Magnet SN: 001
Bz vs. X (Y=0mm)
Current = 20A



GMW 5201 Project Field Magnet SN:004
-Bx, Bz vs. Y (X=0mm, Z=2mm)
Current = 15A



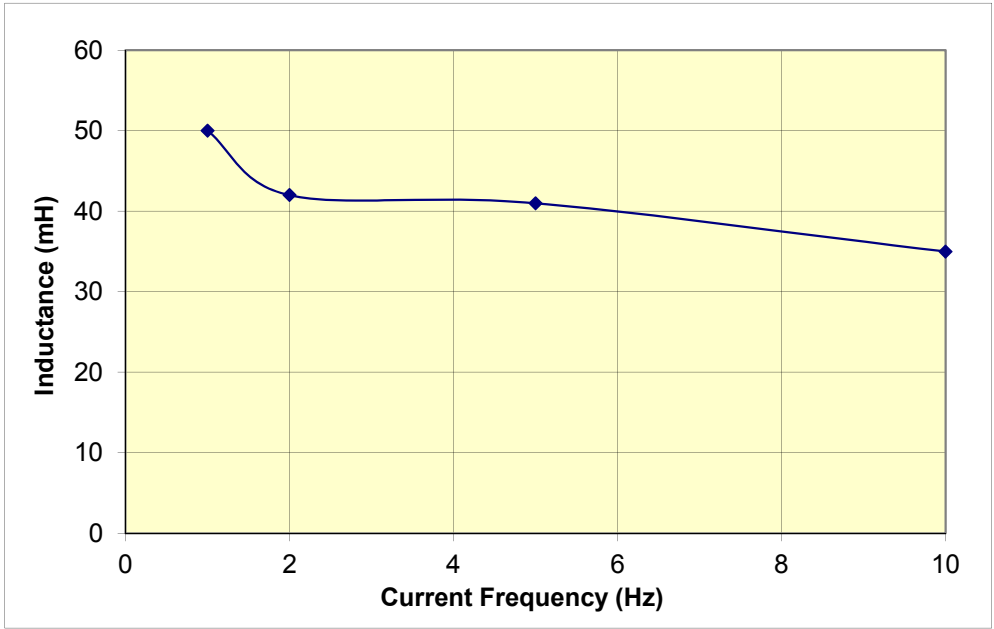
Projected Field Magnet SN:004
Bz vs. Z (X=14mm, Y=0mm, I=18A)



GMW ASSOCIATES
5201 Electromagnet Inductance

Model:	5201	Engr:	Y.Q.
Serial No:	15	Date:	12/16/2005
Pole Face:		Page:	1 of 1
Pole gap:	N/A		
Power Supply:			
PS SN:			
Position:	X=Y=0mm, Z= 2mm above pole		
Current:	1Hz, 2Hz, 5Hz, 10Hz, sine		

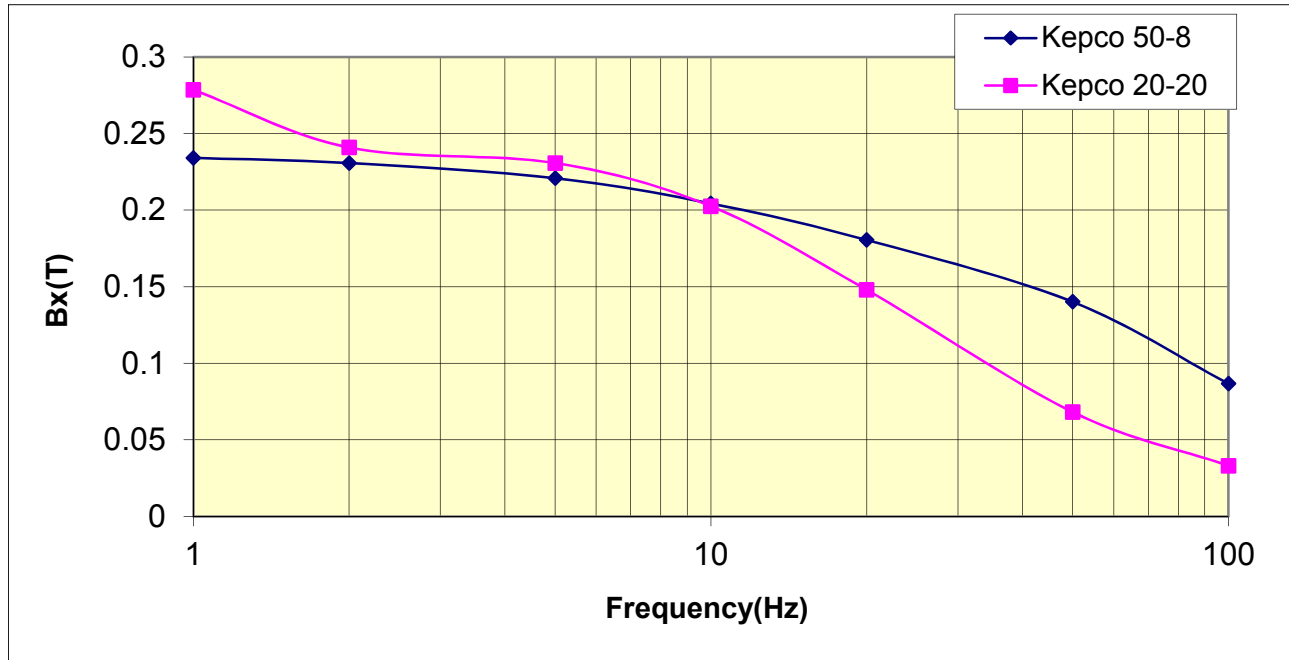
Current Frequency (Hz)	Inductance(mH)
1	50
2	42
5	41
10	35



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Electromagnet Bx vs Frequency (sine wave) Plot

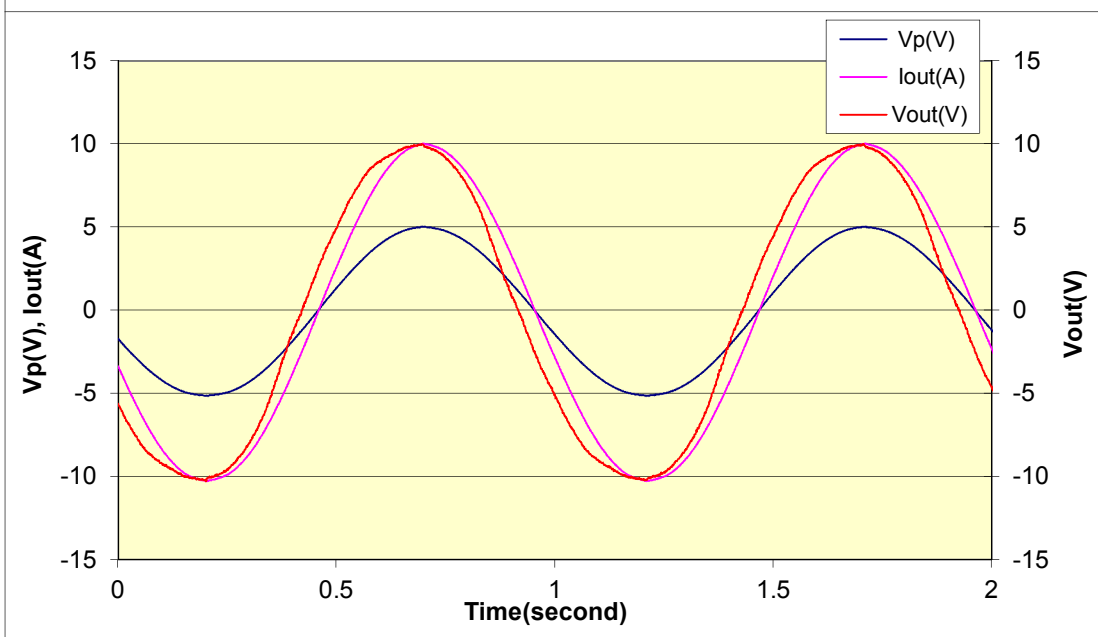
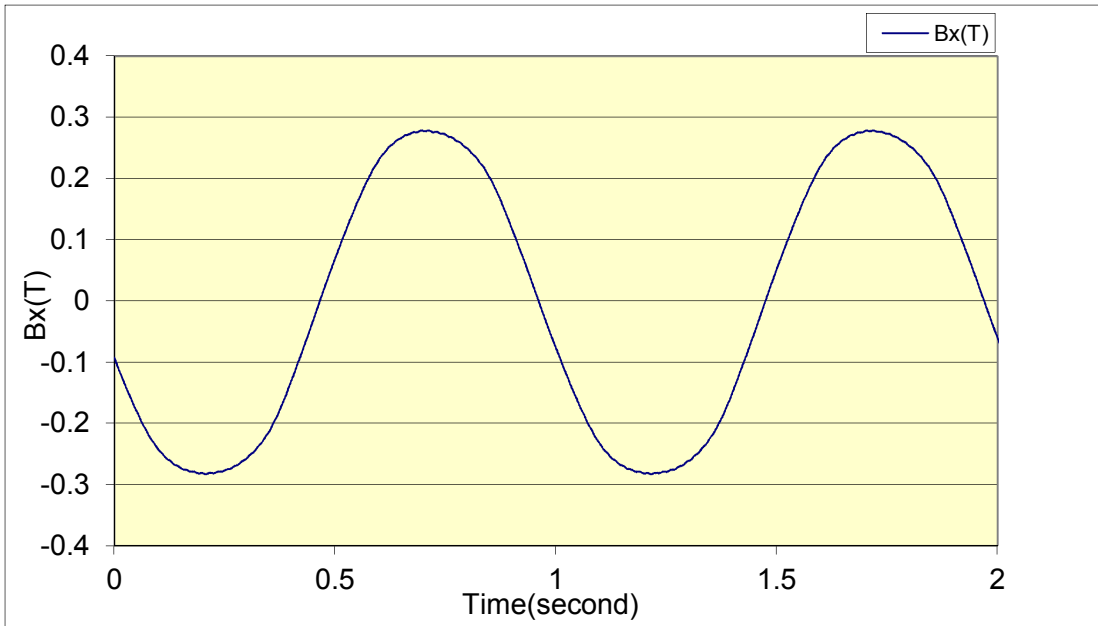
Model:	5201	Engr:	Y.Q.
Serial No:	15	Date:	12/16/2005
Pole Face:		Page:	1 of 1
Pole gap:	N/A		
Power Supply:	Kepeco 20-20	PS SN:	155399 R31
Power Supply:	Kepeco 50-8	PS SN:	154897 R24
Position:	X=Y=0mm, Z= 2mm above pole		
Current:	Sine, before visual distortion of sine waveform		

Frequency(Hz)	Kepeco 50-8	Kepeco 20-20
1	0.2341	0.2785
2	0.2307	0.2408
5	0.2208	0.2307
10	0.2043	0.2025
20	0.1805	0.1479
50	0.1401	0.0681
100	0.0867	0.0331



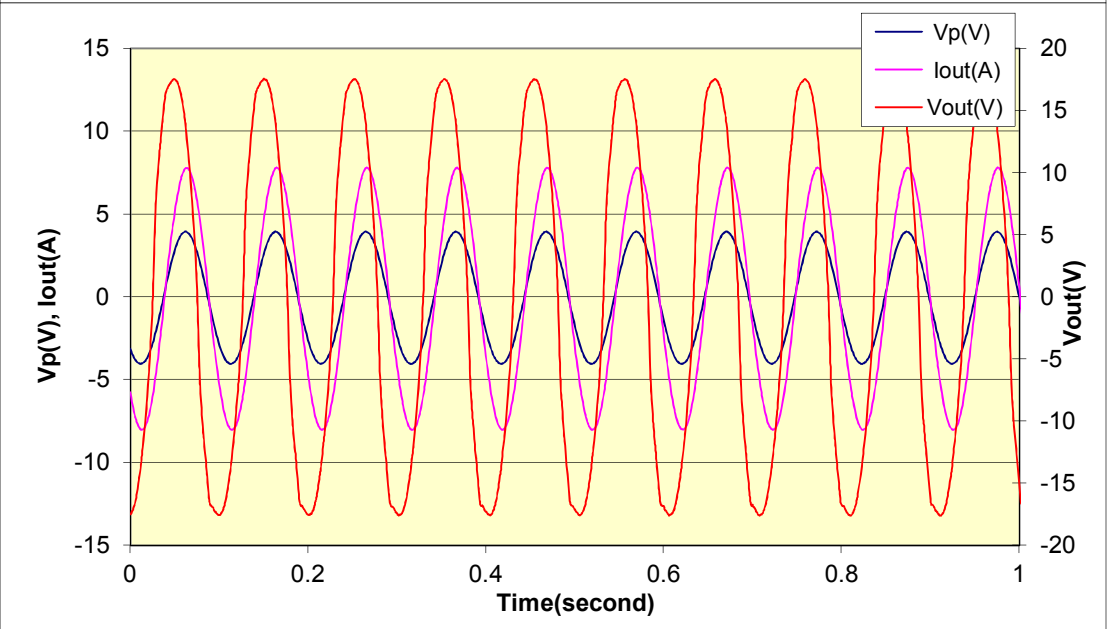
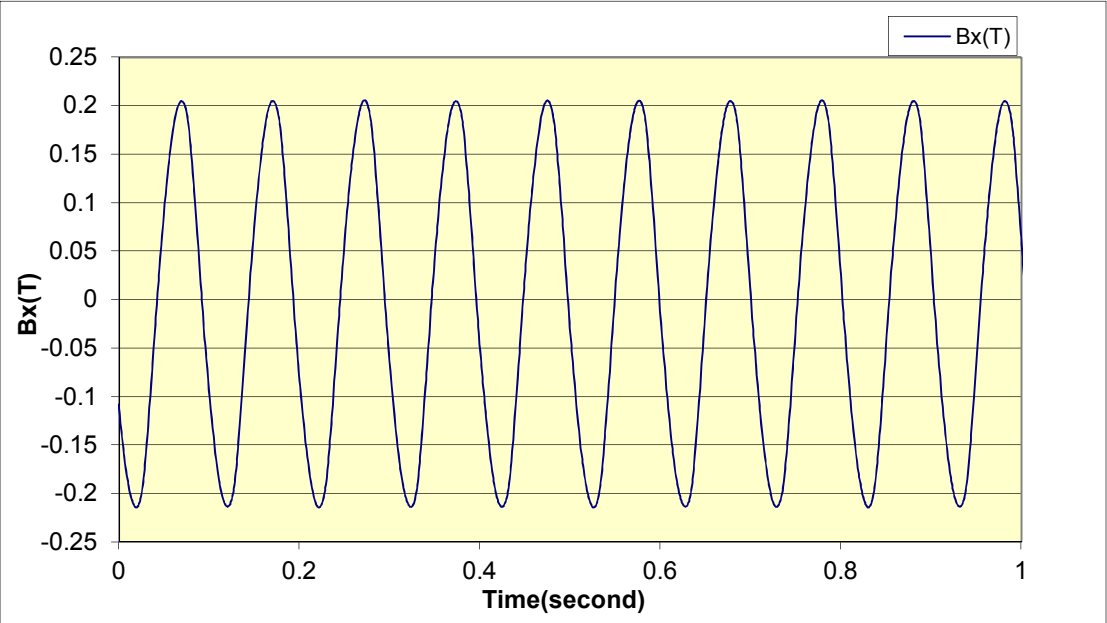
GMW ASSOCIATES
5201 Electromagnet 1Hz sine wave waveform

Model:	5201	Engr:	Y.Q.
Serial No:	15	Date:	12/2/2005
Pole Face:		Page:	1 of 1
Pole gap:	N/A		
Power Supply:	Kepeco 20-20		
PS SN:	155399 R31		
Position:	X=Y=0mm, Z= 2mm above pole		
Current:	1Hz sine, -10A~+10A		



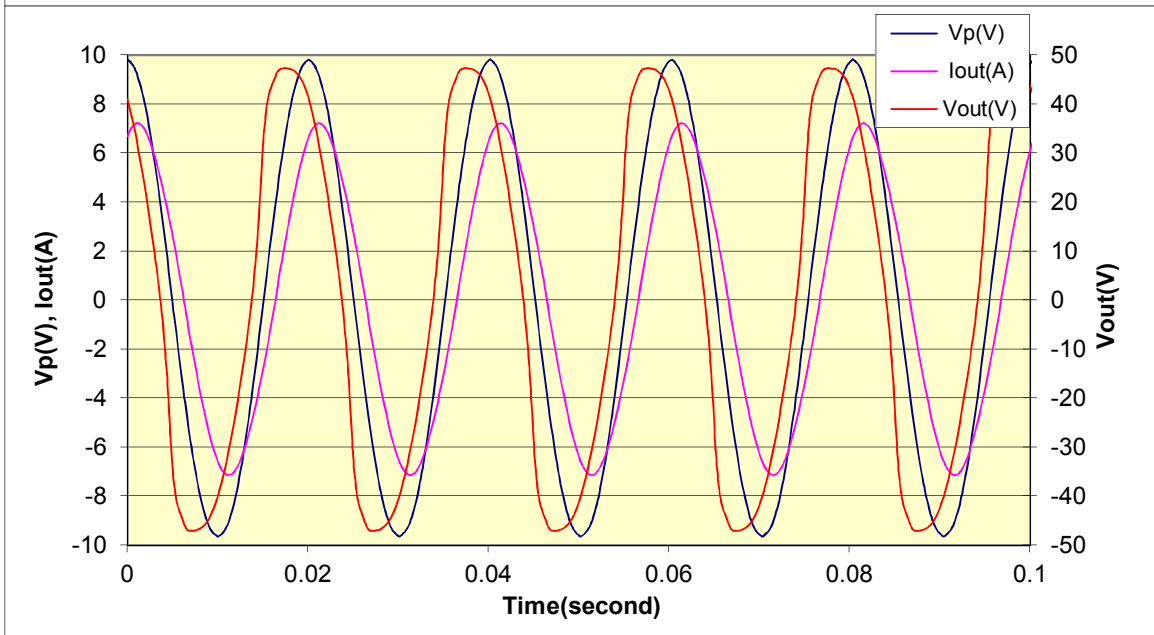
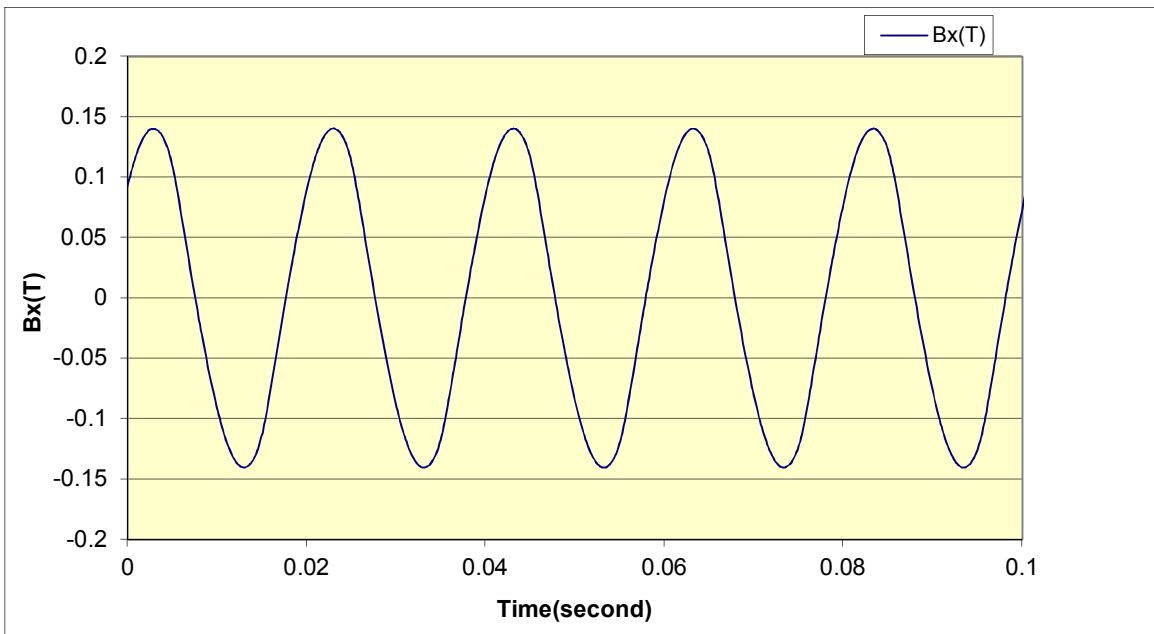
GMW ASSOCIATES
5201 Electromagnet 10Hz sine wave waveform

Model:	5201	Engr:	Y.Q.
Serial No:	15	Date:	12/2/2005
Pole Face:		Page:	1 of 1
Pole gap:	N/A		
Power Supply:	Kepeco 20-20		
PS SN:	155399 R31		
Position:	X=Y=0mm, Z= 2mm above pole		
Current:	10Hz sine, -8A~+8A		



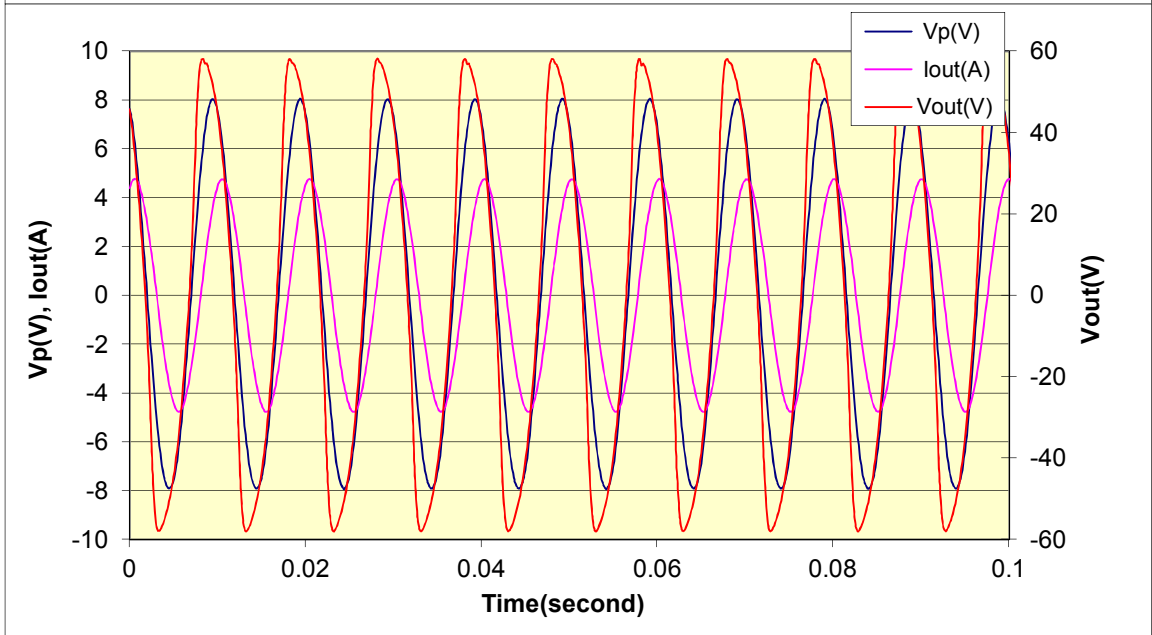
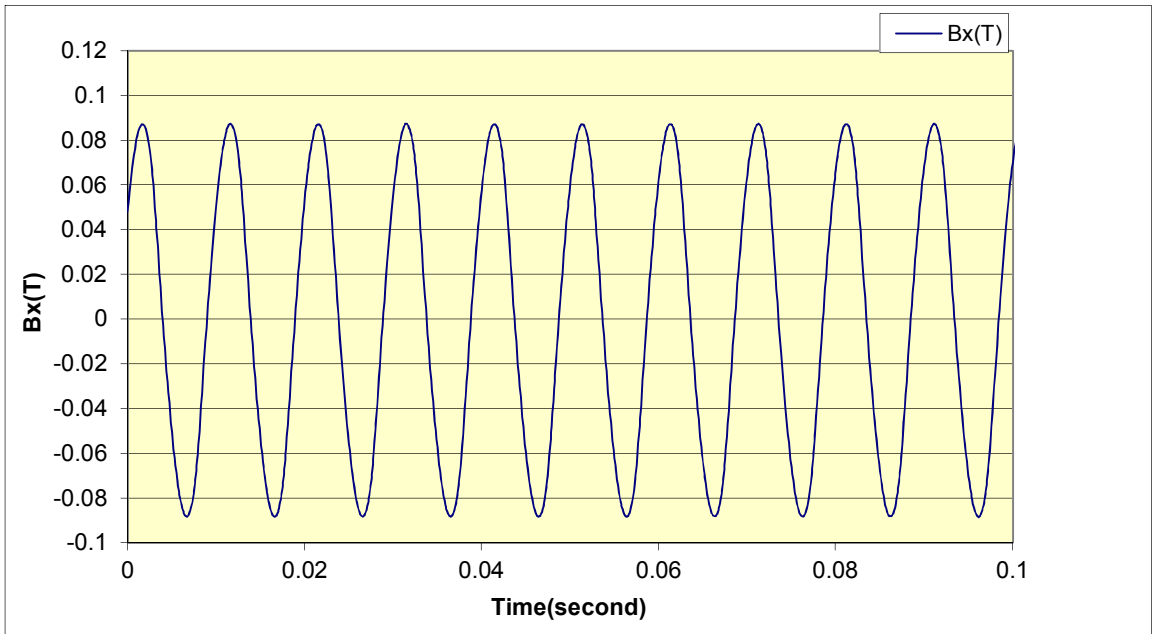
GMW ASSOCIATES
5201 Electromagnet 50Hz sine wave waveform

Model:	5201	Engr:	Y.Q.
Serial No:	15	Date:	12/13/2005
Pole Face:		Page:	1 of 1
Pole gap:	N/A		
Power Supply:	Kepeco 50-8		
PS SN:	154897 R24		
Position:	X=Y=0mm, Z= 2mm above pole		
Current:	50Hz, sine wave, -7A~+7A		



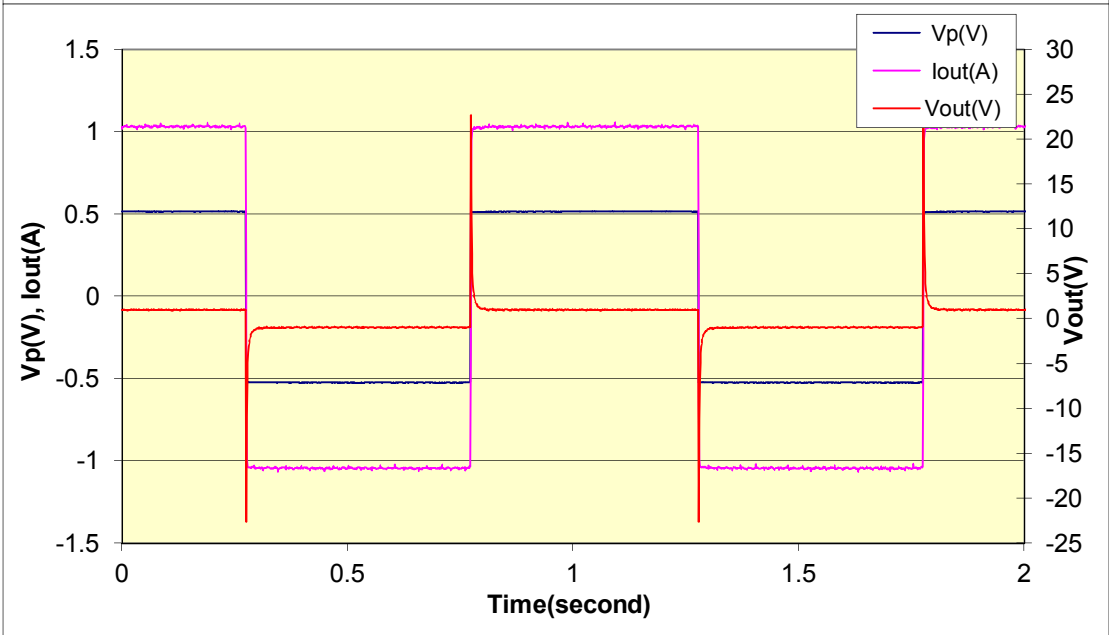
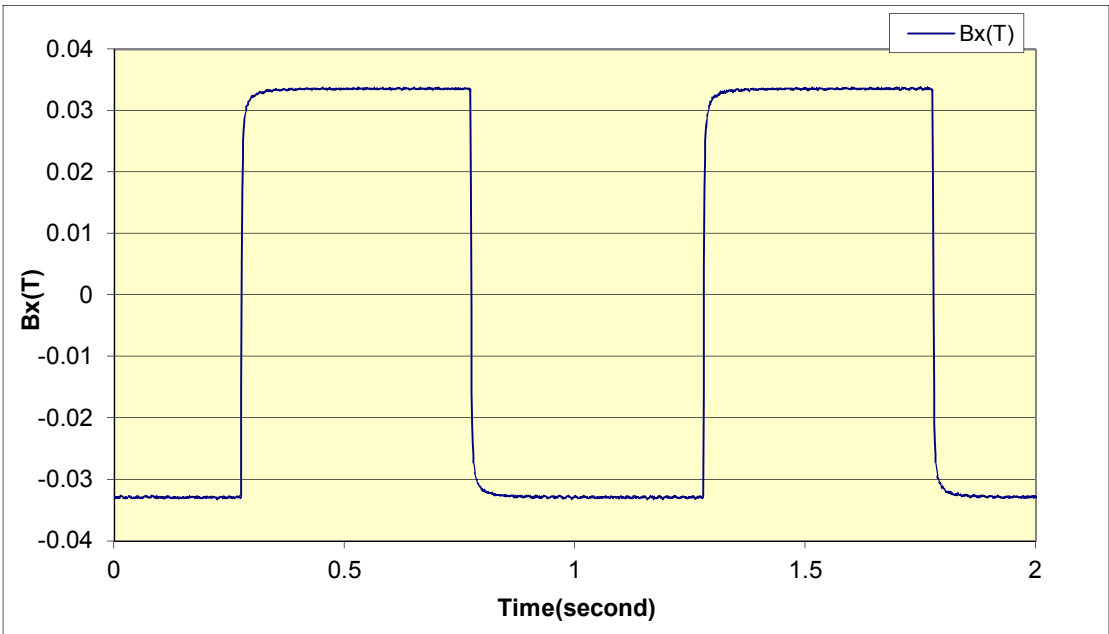
GMW ASSOCIATES
5201 Electromagnet 100Hz sine wave waveform

Model:	5201	Engr:	Y.Q.
Serial No:	15	Date:	12/13/2005
Pole Face:		Page:	1 of 1
Pole gap:	N/A		
Power Supply:	Kepeco 50-8		
PS SN:	154897 R24		
Position:	X=Y=0mm, Z= 2mm above pole		
Current:	100Hz, sine wave, -5A~+5A		



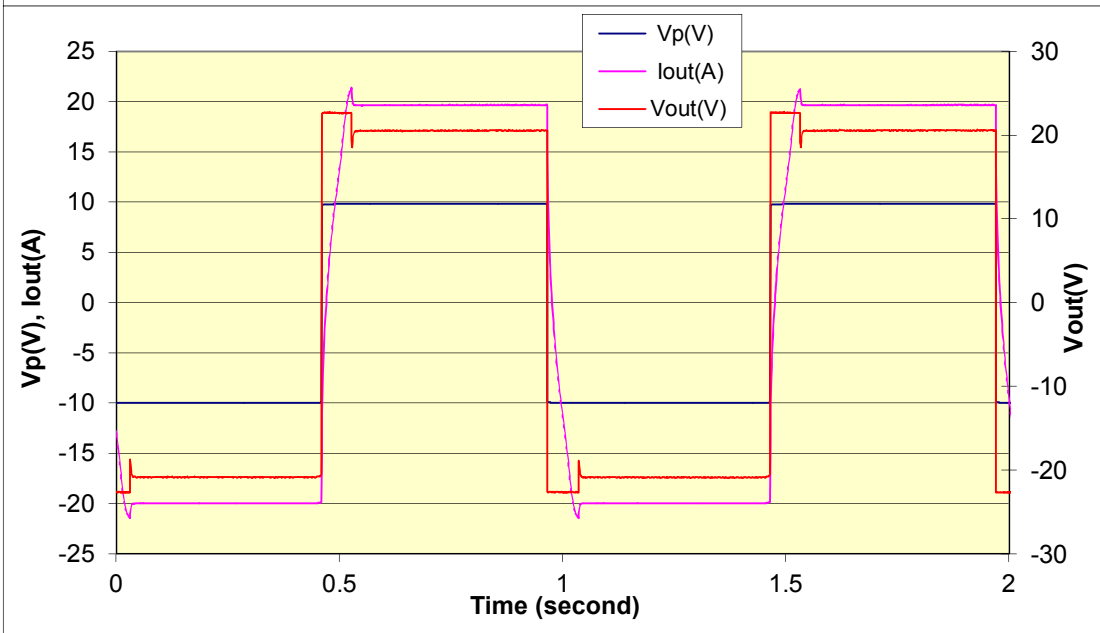
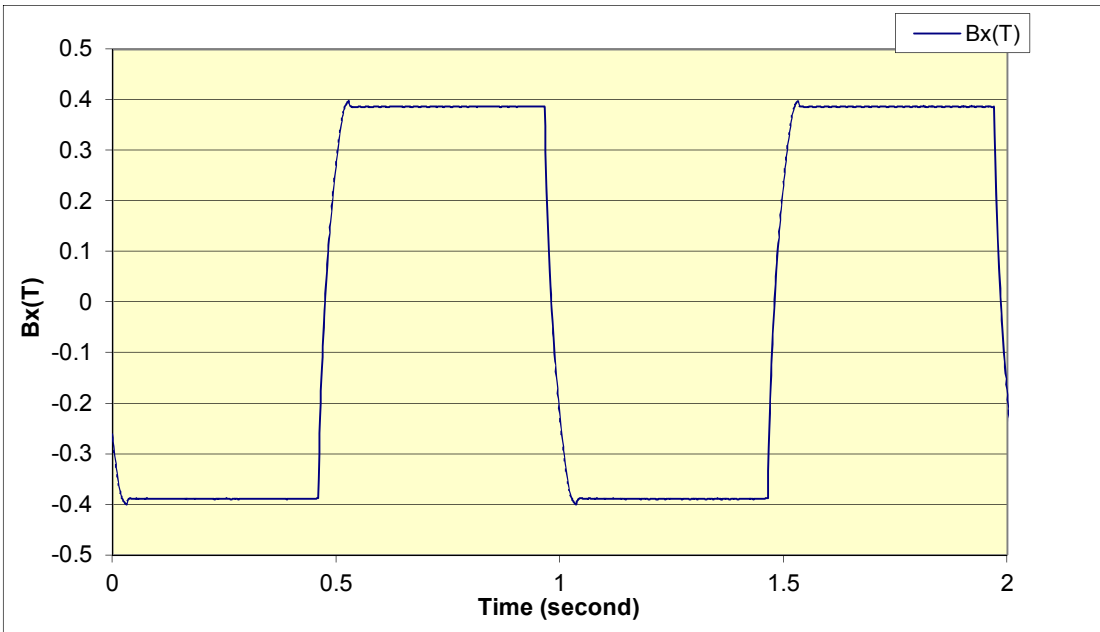
GMW ASSOCIATES
5201 Electromagnet 1Hz square wave waveform

Model:	5201	Engr:	Y.Q.
Serial No:	15	Date:	12/2/2005
Pole Face:		Page:	1 of 1
Pole gap:	N/A		
Power Supply:	Kepeco 20-20		
PS SN:	155399 R31		
Position:	X=Y=0mm, Z= 2mm above pole		
Current:	1Hz square, -1A~+1A		



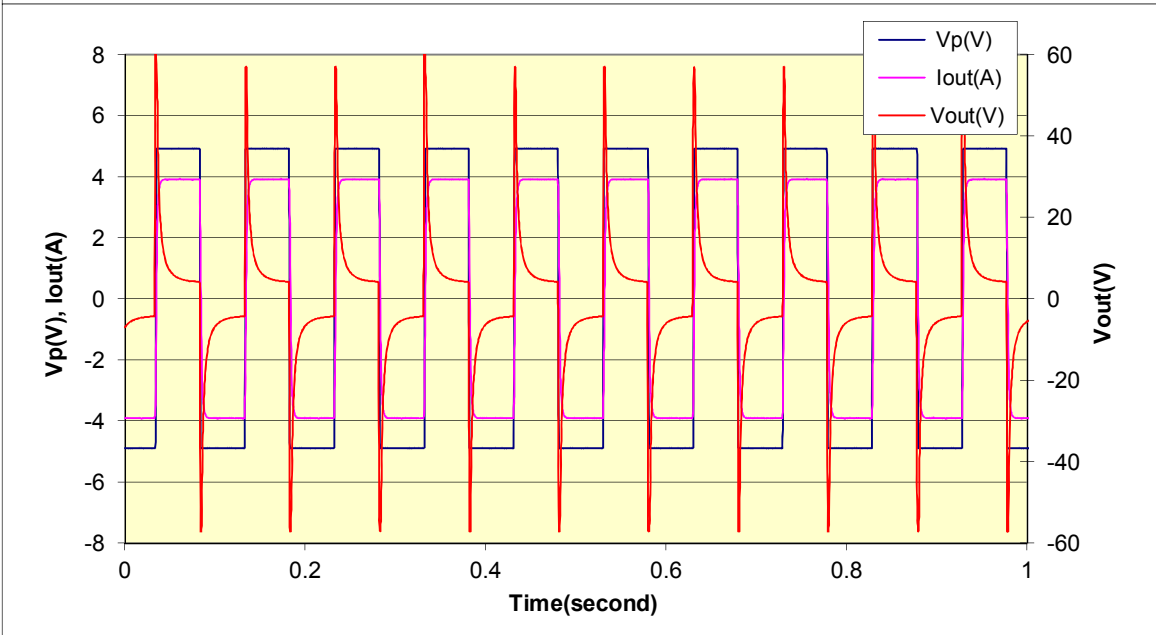
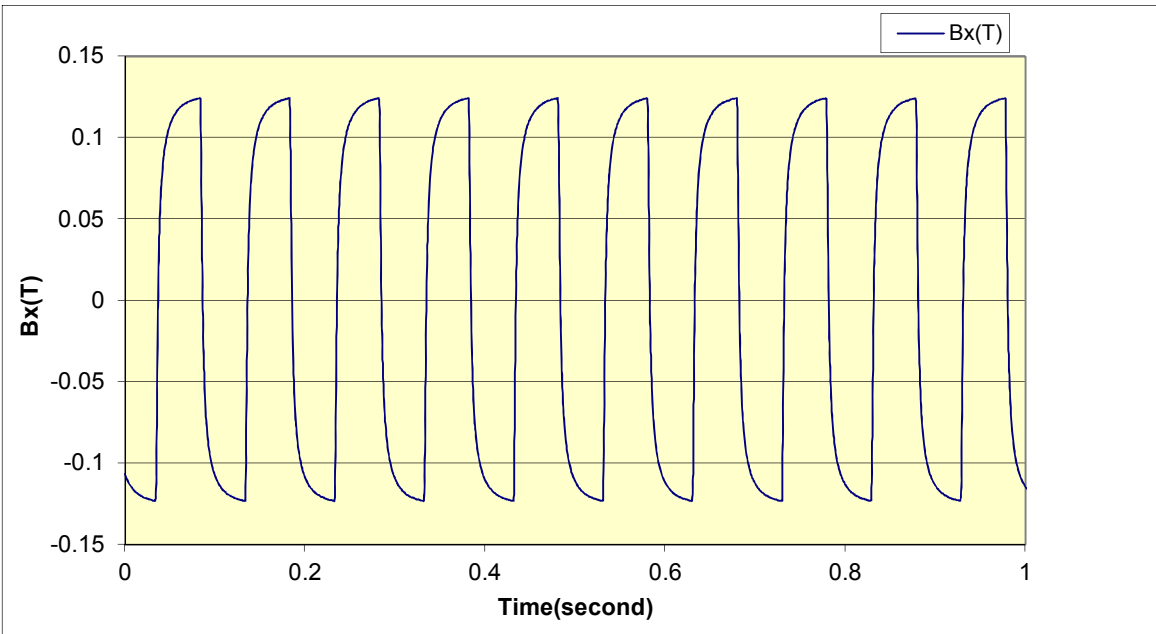
GMW ASSOCIATES
5201 Electromagnet 1Hz square wave waveform

Model:	5201	Engr:	Y.Q.
Serial No:	15	Date:	12/2/2005
Pole Face:		Page:	1 of 1
Pole gap:	N/A		
Power Supply:	Kepeco 20-20		
PS SN:	155399 R31		
Position:	X=Y=0mm, Z= 2mm above pole		
Current:	1Hz square, -20A~+20A		



GMW ASSOCIATES
5201 Electromagnet 10Hz square wave waveform

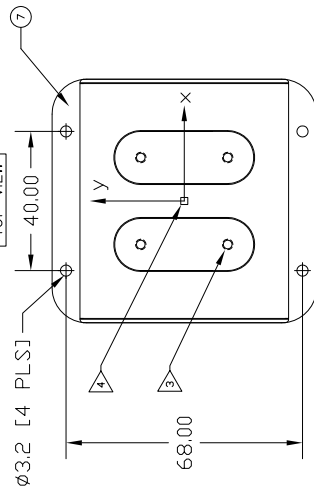
Model:	5201	Engr:	Y.Q.
Serial No:	15	Date:	12/13/2005
Pole Face:		Page:	1 of 1
Pole gap:	N/A		
Power Supply:	Kepeco 50-8		
PS SN:	154897 R24		
Position:	X=Y=0mm, Z= 2mm above pole		
Current:	10Hz, square wave, -4A~+4A		



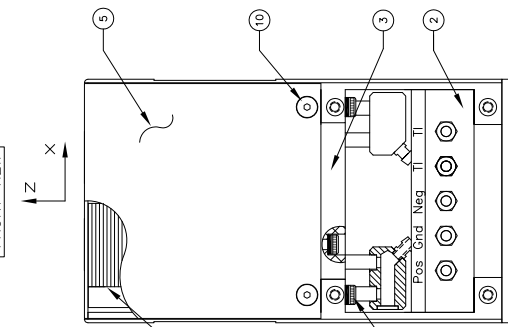
Section 8
DRAWINGS

PROPRIETARY
THIS DRAWING CONTAINS CONFIDENTIAL INFORMATION
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IN WRITING BY GMAW INC.

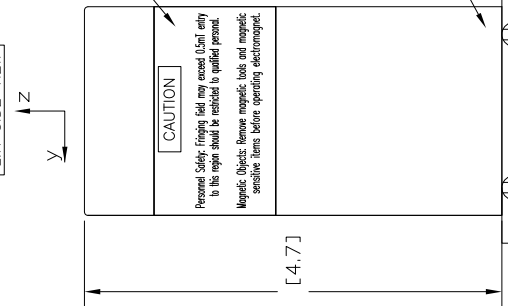
TOP VIEW



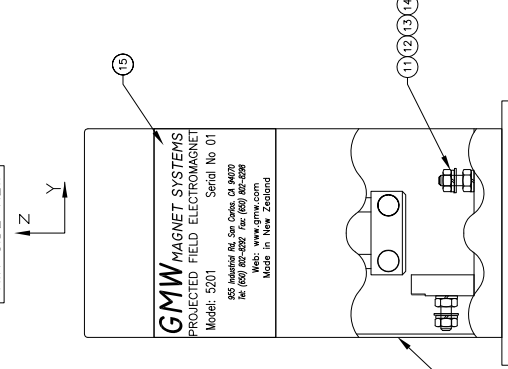
FRONT VIEW



L.H. SIDE VIEW



R.H. SIDE VIEW



REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		04/10/03	G.DOUGLAS
B	UPDATE MAGNET SPECIFICATIONS & NOTES		07/30/03	G.DOUGLAS
C	CORRECT ITEM 8 & 9, ADD ITEM 17, CHG NOTE 1 & 3		07/26/05	G.DOUGLAS
D	CHANGE FLOW RATE, DELETE NOTE 2		28 Nov, 11	M. Duffy

MAGNET SPECIFICATIONS

FIELD (Bx max): 0.3T [4 mm above pole face]
 COIL RESISTANCE (20 °C): 0.85 ohm
 RESISTANCE (Hot): 1.02 ohm
 MAX POWER: 20V/20A [400 W]
 COOLING: 1.0 liter/min 2.0 bar [14 psid]
 THERMAL INTERLOCK: OPEN CIRCUIT ABOVE 75° C [167° F]
 MASS: 2.1 kg [4.6 lbs]

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
17	4	DIN 7991	SHCS, M3 x 8 FLAT HD S/S	
16	1	10900670	LABEL, CAUTION	
15	1	10900660	LABEL, SPECIFICATION	
14	1	DIN 84A	SCREW, M3 X 10 CHEESE HD SLOTTED BRASS	
13	2	DIN 934	NUT, M3 BRASS	
12	1	DIN 433	WASHER, FLAT M3 x 6 x 0.5 BRASS	
11	12	BN 792	WASHER, RIBBED LOCK SPRING/STEEL	
10	8	DIN 7991	SHCS, M3 x 5 FLAT HD S/S	
9	8	DIN 912	SHCS, M3 x 12 S/S	
8	2	DIN 912	SHCS, M3 x 8 S/S	
7	1	17905190	TRANSITION PLATE	
6	2	17905130	COVER, BOTTOM	
5	1	17905120	COVER, TOP	
4	2	17905070	SHIELD POLE	
3	1	17905060	YOKE	
2	1	11901910	TERMINAL BLOCK ASSEMBLY	
1	2	11901870	POLE/COIL ASSEMBLY	

DO NOT SCALE FROM DRAWING (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	mm	TITLE
X.XXX	±.007	±0.03	
X.XX	±.01	±0.1	
X.X	±.05	±0.3	
X	±.06	±1	
DEC.	±.5	±0.5	

FINISH: 63° 1.6°
 THIRD ANGLE PROJECTION

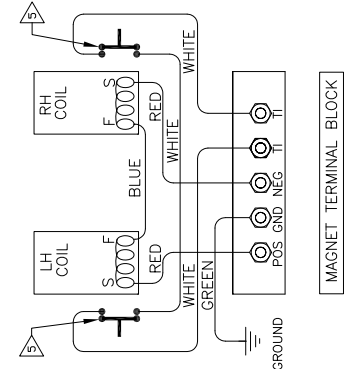
DATE: 08/13/02
 DRAWN: G.DOUGLAS
 CHECK: [blank]
 ENGINEERING: [blank]
 NEXT ASSY: C71280
 SYSTEM: [blank]
 SOFTWARE: AUTOCAD 2000

SCALE: 1:1 WT kg SHEET 1 OF 1

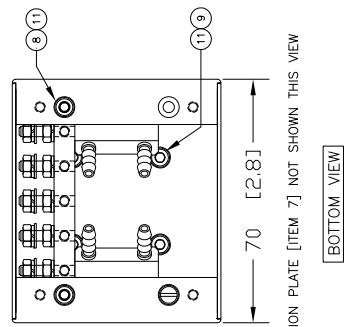
GMW
 955 Industrial Rd, San Carlos, CA 94070
 Tel: (650)802-8292. Fax: (650)802-8298.

PROJ FIELD MAGNET
 MODEL: 5201
 DRAWING NO. A2 11901860
 REV D

MAGNET SCHEMATIC



BOTTOM COVER [ITEM 6] NOT SHOWN THIS VIEW



TRANSITION PLATE [ITEM 7] NOT SHOWN THIS VIEW

BOTTOM VIEW

NOTE

- SEE DWG NO 11902010 FOR MAGNET WIRING DETAILS. WATER COOLING DETAILS SHOWN ON DWG NO: 11902040.
- FILL HOLES WITH NYLON SCREW, CUT FLUSH WITH POLE SURFACE, COLOR BLACK [x4]
- ROI [REGION OF INTEREST]
- TEMPERATURE SWITCHES SELCO 802L-075

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IN WRITING BY GMW INC.

NOTE
SHIELD POLE NOT
SHOWN THIS VIEW

COIL SERIAL
NUMBER LABEL

OVERTEMPERATURE
THERMOSTATS

NOTE
INTERNAL MAGNET
WIRING AND HOSES
NOT SHOWN THIS VIEW

TRANSITION PLATE

NOTE
TRANSITION PLATE
NOT SHOWN ON
BOTTOM VIEW

HOSE CLIP TAILS MUST FACE INWARDS AS SHOWN

WATER COOLING INTERCONNECT HOSE

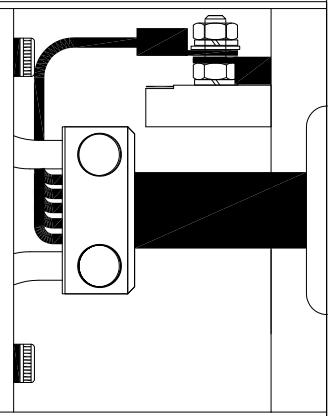
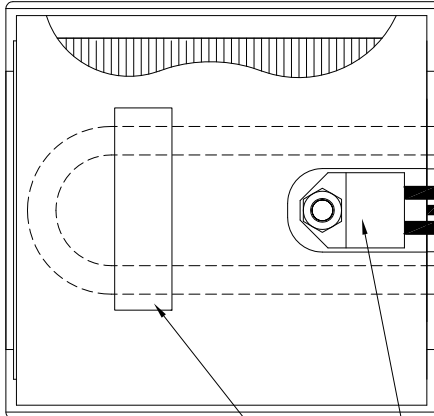
WATER COOLING INLET/OUTLET HOSES

GROUND CONNECTION

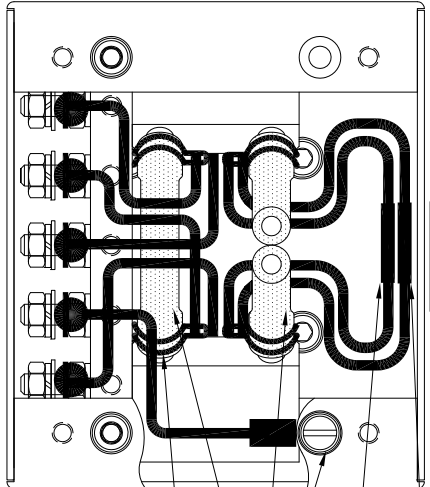
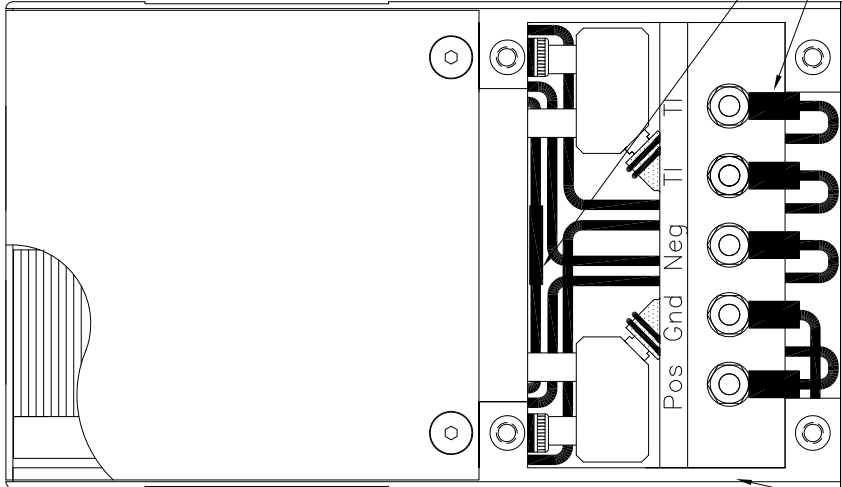
SOLDER WHITE THERMOSTAT WIRES TOGETHER
COVER WITH HEATSHRINK SLEEVING

SOLDER BLUE COIL WIRES TOGETHER
COVER WITH HEATSHRINK SLEEVING

SIDE VIEW



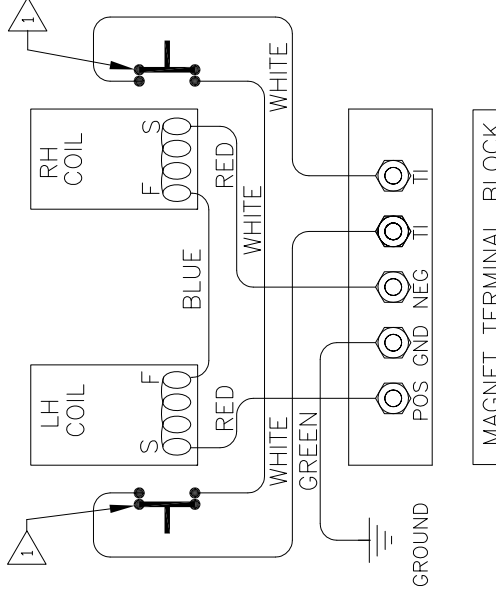
FRONT VIEW



REVISIONS

REV	RELEASE	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE			09/16/03	G.DOUGLAS
B	CHANGE ITEM 3, HOSE CLAMPS			28 Nov. 11	M. Duffy

MAGNET SCHEMATIC



MAGNET TERMINAL BLOCK

COIL/THERMOSTAT WIRE JOINTS

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
6	1	16900460	CURRENT/ INTERLOCK CABLE 20A [5M LONG]	
5	1		GROMMET, RUBBER 15 ID x 30 OD	
4	2	27041	HOSE, 2.8mm ID GATES [1 meter long]	
3	4	15400017	HOSE CLAMP, OETIKER	
2	A/R		HEATSHRINK SLEEVING, BLACK 5mm ID	
1	6		TERMINAL, RING TYPE 3mm HOLE	

PARTS LIST		DO NOT SCALE FROM DRAWING		DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	
DATE	08/16/03	DATE	08/16/03	LINEAR	INCHES / mm
CHECK	G.DOUGLAS	DATE		X.XXX	±.009 / ±0.03
ENGINEERING		DATE		X.XX	±.07 / ±0.1
		DATE		X.X	±.05 / ±0.3
		DATE		X	±.06 / ±1
		DATE		DEC.	±.5 / ±0.5
		DATE		FINISH	63 / 1.6
11901860	5201			THIRD ANGLE PROJECTION	
NEXT ASSY	SYSTEM				
	SOFTWARE				
	AUTOCAD 2000				

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MAGNET WIRING
MODEL: 5201

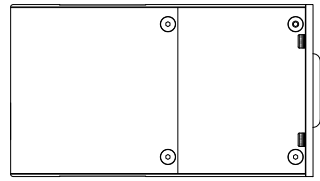
DRAWING NO. A2 11902010

SCALE: WT kg SHEET 1 OF 1

1 2 3 4 5 6 7 8

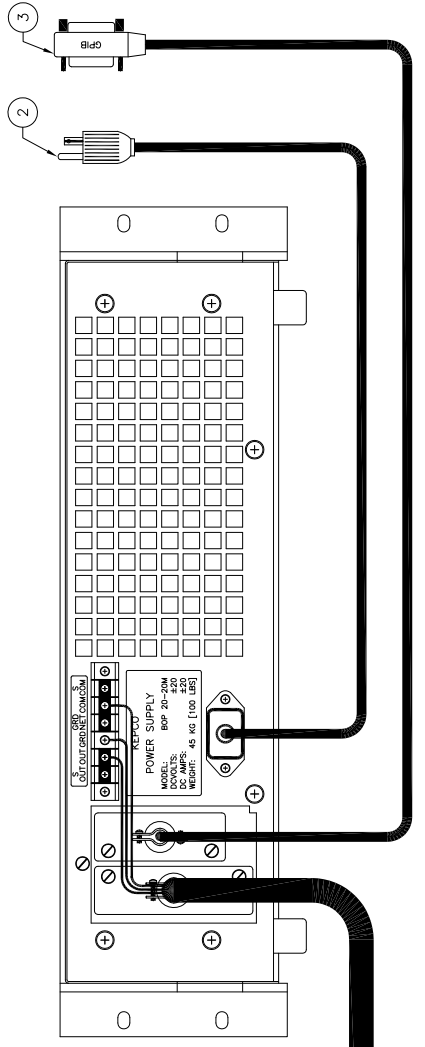
REV	RELEASE	DESCRIPTION	DRAWN	DATE	APPROVED
A			G.D.	09/17/03	G.D.

MODEL: 5201 MAGNET



MAGNET REAR VIEW

KEPCO MODEL: BOP 20-20M BIPOLAR POWER SUPPLY



POWER SUPPLY REAR VIEW

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 ELECTRIC COMPANY.

ITEM	QTY.	PART NUMBER	DESCRIPTION	NOTE
3	1	SNQ 488-2	GP1B CABLE [2M LONG]	2
2	1	KEPCO	AC POWER CORD [115V US TYPE]	
1	1	16900460	CURRENT/ INTERLOCK CABLE 20A [5M LONG]	

DATE		DRAWN		TITLE	
DATE	BY	DATE	BY	SCALE	NTS
09/17/03	G.D.	03/10/03	G.D.	1:1	1
09/17/03	G.D.	03/10/03	G.D.	1:1	1
09/17/03	G.D.	03/10/03	G.D.	1:1	1
09/17/03	G.D.	03/10/03	G.D.	1:1	1
09/17/03	G.D.	03/10/03	G.D.	1:1	1
09/17/03	G.D.	03/10/03	G.D.	1:1	1

GMW
 955 Industrial Rd, San Carlos, CA 94070
 Tel: (650)802-8292 Fax: (650)802-8298

ELECTRICAL ASSY
 5201/BOP 20-20M
 SIZE: 1.5" X 4.5" X 3.5"
 REV: A111902000

NOTE

- 1. POWER SUPPLY SHOWN WITH 115V AC INPUT
- 2. GP1B INTERFACE IS OPTIONAL EQUIPMENT
- 3. REFER TO TABLE ON DWG 13900420 FOR AC INPUT RATINGS OTHER THAN 115V AC INPUT

***** WARNING *****

CHECK AC POWER VOLTAGE AND FREQUENCY MATCH POWER SUPPLY SPECIFIED REQUIREMENTS BEFORE APPLYING AC INPUT POWER

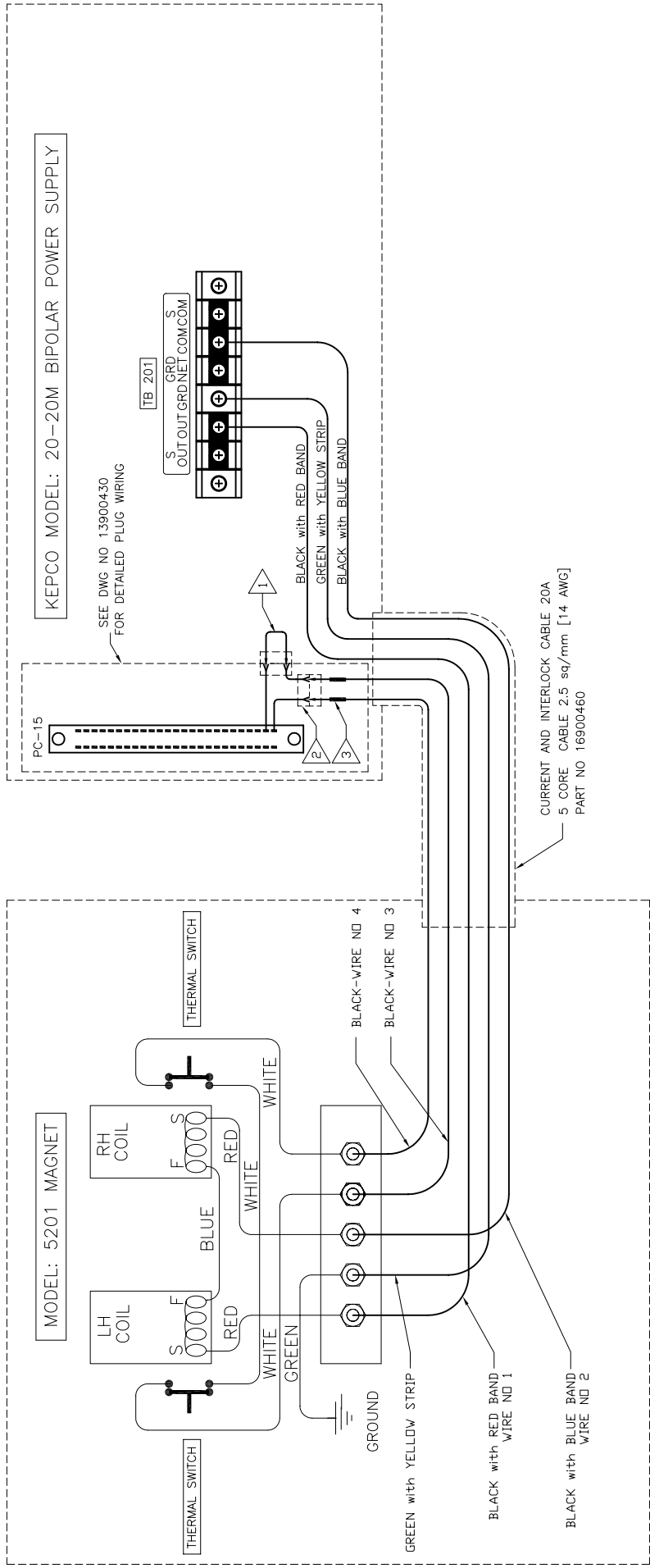
DATE	BY	DESCRIPTION
09/17/03	G.D.	DO NOT SCALE FROM DRAWING (UNLESS OTHERWISE SPECIFIED)
09/17/03	G.D.	DO NOT SCALE FROM DRAWING (UNLESS OTHERWISE SPECIFIED)
09/17/03	G.D.	DO NOT SCALE FROM DRAWING (UNLESS OTHERWISE SPECIFIED)

REV	DESCRIPTION
A	SOFTWARE AUTOCAD 2000

1 2 3 4 5 6 7 8

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REV	DESCRIPTION	DATE	APPROVED
A	RELEASE	04/17/03	G.DOOGLAS
B	ADD LINKS TO REFCO-7/B	09/29/03	G.DOOGLAS
C	ADD MOLEX CONNECTORS, AND NOTES 1 TO 3	12/02/04	G.DOOGLAS
D	UPDATE NOTES 1, 2, & 3	07/28/05	G.DOOGLAS



ELECTROMAGNET SYSTEM ELECTRICAL REQUIREMENTS			
AC INPUT POWER 1 PHASE, 50 to 60HZ	115V	208V	230V
AC INPUT FULL LOAD CURRENT	11.0	6.5	6.0
RECOMMENDED MAIN AC BREAKER	15	10	10
RECOMMENDED AC POWER OUTLET	5-15R	-	-
RECOMMENDED AC CABLE SIZE	1.5 SQ/MM	1.0 SQ/MM	1.0 SQ/MM

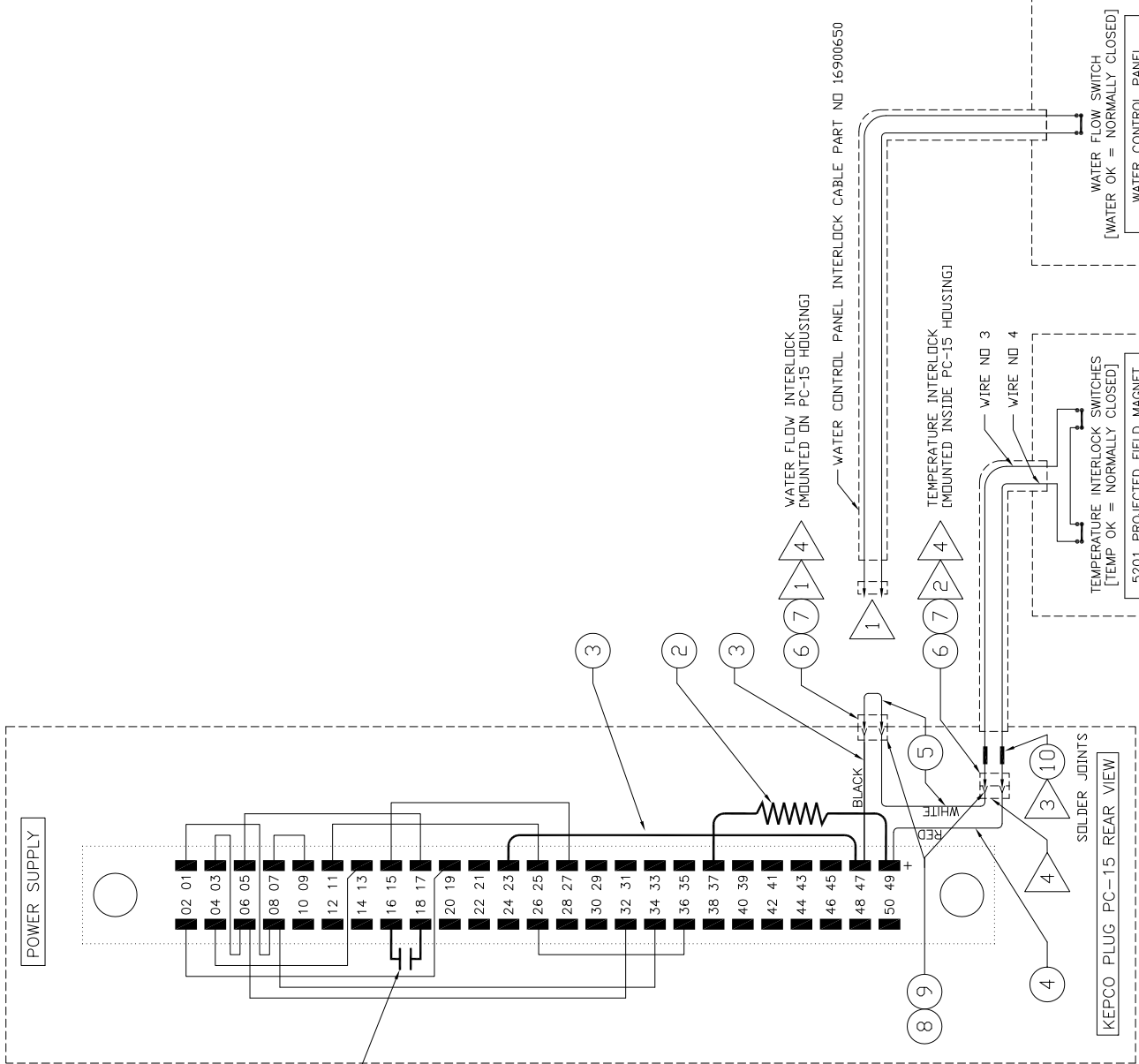
NOTE: DRAWING SHOWS POWER SUPPLY SETUP FOR 1 PHASE 115V AC POWER

- NOTE**
- WATER FLOW INTERLOCK CONNECTOR, TO USE REMOVE MOLEX PLUG/LINK AND FIT INCOMING WATER FLOW INTERLOCK PLUG/CABLE. [MOUNTED ON PC-15 HOUSING]
 - TEMPERATURE INTERLOCK CONNECTOR, THIS CONNECTION PROVIDES A CONVENIENT DISCONNECTION FOR THE TEMPERATURE INTERLOCK INCOMING CABLE. [MOUNTED INSIDE PC-15 HOUSING WHEN ASSEMBLED].
 - SOLDER AND HEATSHRINK JOINTS BETWEEN 2.5 Sq/mm WIRE NO 3 & 4 TO 0.2 Sq/mm [20 AWG] CONNECTING WIRES ONTO KEPCO PLUG TERMINALS NO 47 & 49.

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DO NOT SCALE FROM DRAWING UNLESS OTHERWISE SPECIFIED				
DATE	DATE	DATE	DATE	DATE
DRWN	CHKD	APP'D	DATE	DATE
G.DOOGLAS	G.DOOGLAS	G.DOOGLAS	04/17/03	04/17/03
ENGINEERING	ENGINEERING	ENGINEERING	ENGINEERING	ENGINEERING
5201	5201	5201	5201	5201
TITLE				
ELECTRICAL WIRING				
5201/BOP 20-20M				
SCALE NTS WT KG				
A113900420				
SHEET 1 OF 1				

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REV	DESCRIPTION	DATE	APPROVED
A	RELEASE	04/17/03	G.DOUGLAS
B	ADD ITEMS 4 TO 8, AND NOTES 1 TO 3	12/02/04	G.DOUGLAS
C	ADD INTERLOCK DIAGRAMS AND WIRING, NOTE 4	07/22/05	G.DOUGLAS
D	ADD 'L' TO TITLE	28 Nov. 11	M. Duffy



- NOTE**
- 1 WATER FLOW INTERLOCK CONNECTOR. TO USE REMOVE MOLEX PLUG/LINK AND FIT INCOMING WATER FLOW INTERLOCK PLUG/CABLE FROM WATER CONTROL PANEL PART NO 16900650.
 - 2 TEMPERATURE INTERLOCK CONNECTOR. THIS CONNECTION PROVIDES A CONVENIENT DISCONNECTION FOR THE TEMPERATURE INTERLOCK INCOMING WIRES.
 - 3 SOLDER AND HEATSHRINK JOINTS BETWEEN 2.5 Sq/mm WIRE NO 3 & 4 TO 0.5 Sq/mm [20 AWG] CONNECTING WIRES ONTO KEPKO PC-15 TERMINALS NO 47 & 49.
 - 4 REMOVE MOUNTING EARS FROM MOLEX PLUG AND RECEPTACLE AT LOCATIONS SHOWN.

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
10	A/R		HEATSHRINK SLEEVING, 3.0mm BLACK	
9	4	02-06-1103	TERMINAL, FEMALE [Tin Plated] MOLEX	
8	2	03-06-1022	RECEPTACLE HOUSING, 2 WAY MOLEX	
7	4	02-06-2103	TERMINAL, MALE [Tin Plated] MOLEX	
6	2	03-06-2022	PLUG HOUSING, 2 WAY MOLEX	
5	A/R	019036	WIRE, HOOK UP, 20 AWG [White] ALPHA	
4	A/R	019040	WIRE, HOOK UP, 20 AWG [Red] ALPHA	
3	A/R	019038	WIRE, HOOK UP, 20 AWG [Black] ALPHA	
2	1		RESISTOR, 680 OHM/0.25 W	
1	1		CAPACITOR, MYLAR 0.33uF	

DO NOT SCALE FROM DRAWING (UNLESS OTHERWISE SPECIFIED)

LINEAR	ANGULAR	SCALE
0.003	0.003	1:1
0.005	0.005	1:1
0.010	0.010	1:1
0.020	0.020	1:1
0.030	0.030	1:1
0.040	0.040	1:1
0.050	0.050	1:1
0.060	0.060	1:1
0.070	0.070	1:1
0.080	0.080	1:1
0.090	0.090	1:1
0.100	0.100	1:1
0.125	0.125	1:1
0.150	0.150	1:1
0.200	0.200	1:1
0.250	0.250	1:1
0.300	0.300	1:1
0.400	0.400	1:1
0.500	0.500	1:1
0.600	0.600	1:1
0.800	0.800	1:1
1.000	1.000	1:1
1.250	1.250	1:1
1.500	1.500	1:1
2.000	2.000	1:1
2.500	2.500	1:1
3.000	3.000	1:1
4.000	4.000	1:1
5.000	5.000	1:1
6.000	6.000	1:1
8.000	8.000	1:1
10.000	10.000	1:1

GMW
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ELECTRICAL WIRING
 BOP 20-20M/L

SCALE: NTS 1:1
 SHEET 1 OF 1

OPTIONAL - SEPARATE ORDER ITEM

TEMPERATURE INTERLOCK SWITCHES
 [TEMP OK = NORMALLY CLOSED]
 5201 PROJECTED FIELD MAGNET
 PART NO: 11901860

WATER FLOW SWITCH
 [WATER OK = NORMALLY CLOSED]
 WATER CONTROL PANEL
 PART NO: 11902480

TEMPERATURE INTERLOCK EMOUNTED INSIDE PC-15 HOUSING

WIRE NO 3
 WIRE NO 4

WATER FLOW INTERLOCK EMOUNTED ON PC-15 HOUSING

WATER CONTROL PANEL INTERLOCK CABLE PART NO 16900650

POWER SUPPLY

KEPKO PLUG PC-15 REAR VIEW

SOLDER JOINTS

BLACK

WHITE

RED

+

02 01

04 03

06 05

08 07

10 09

12 11

14 13

16 15

18 17

20 19

22 21

24 23

26 25

28 27

30 29

32 31

34 33

36 35

38 37

40 39

42 41

44 43

46 45

48 47

50 49

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LABEL PART NO: 10907-0020-0

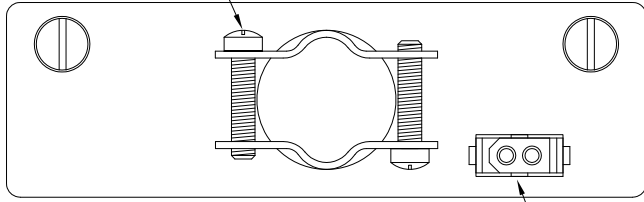
WATER FLOW INTERLOCK (Mounted on PC-15 Housing)
 TO USE: Remove Molex plug/link and fit incoming water flow interlock
 plug/cable.

TEMPERATURE INTERLOCK (Mounted inside PC-15 Housing)
 To access temperature interlock connector loosen cable clamp
 gently withdraw cable to expose connector. Reassemble in reverse
 order and tighten cable clamp.

10907-0020-0

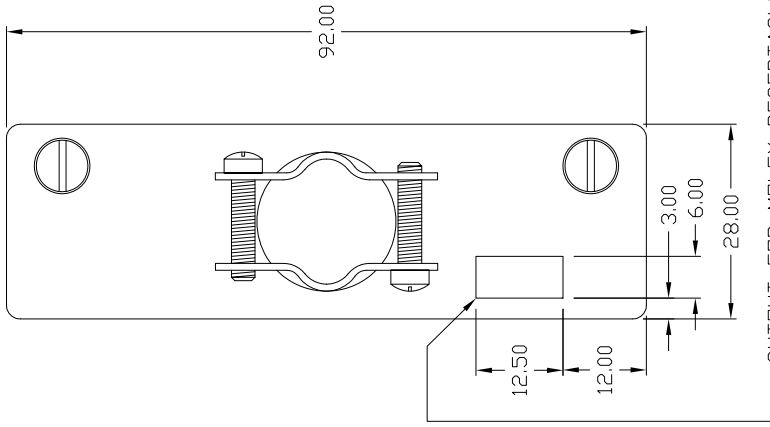
KEPCO PC-15 PROGRAMMING PLUG

CABLE CLAMP



WATER FLOW INTERLOCK
 MOLEX RECEPTACLE

2



CUTOUT FOR MOLEX RECEPTACLE

REV	RELEASE	DESCRIPTION	DRAFT	DATE	APPROVED
A				07/25/05	G.DOUGLAS

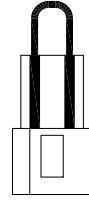
REVISIONS

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
PARTS LIST				
DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)				
DATE	07/25/05	GMW		
DRAWN	G.DOUGLAS	955 Industrial Rd, San Carlos, CA 94070		
CHECK		Tel: (650)802-8292. Fax: (650)802-8298.		
ENGINEERING		TITLE		
		LINEAR	INCHES	mm
		X.XXX	±.007	±0.03
		X.XX	±.01	±0.1
		X.X	±.03	±0.3
		X	±.06	±1
		DEC.	±.5	±0.5
		FINISH	63	1.6
		THIRD ANGLE PROJECTION		
NEXT ASSY	SYSTEM	DRAWING NO.		
SOFTWARE	AUTOCAD	2000	REV	
			A2	11907-0025-0
			SCALE	1:1
			WT Kg	
			SHEET	1 OF 1

NOTE:

1. FOR WIRING DETAILS AND PART DESCRIPTIONS
 SEE DWG NO: 13900430.

2. FIT MOLEX PLUG/LINK TO MOLEX RECEPTACLE
 WHEN WATER FLOW INTERLOCK IS NOT USED.

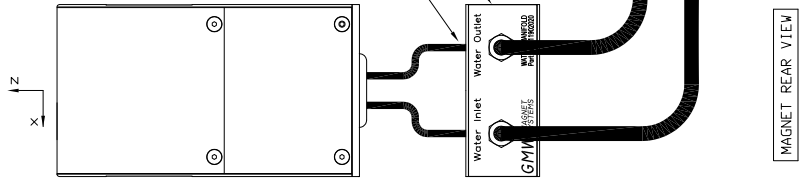


MOLEX PLUG/LINK

REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	RELEASE	10/7/04	G.DOUGLAS

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MODEL: 5201 MAGNET



*** OUTLET ***
 FACILITY WATER

*** INLET ***
 FACILITY WATER

SHUTOFF VALVES

METERING VALVE
 (TO SET MAGNET WATER FLOW)

FIT REDUCERS AS REQUIRED TO
 SUIT 1/8 NPT HOSE CONNECTOR

ALL EQUIPMENT ABOVE DOTTED LINE SUPPLY BY CUSTOMER

MAGNET REAR VIEW

1 2 3 4 5 6 7 8

D C B A

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
4	2	B704	HOSE, $\phi 6\text{mm}$ [0.25"] L.E. [5 Meter long]	
3	2	KA-04-02-MB	HOSE COUPLING, 1/4 HOSE 1/8 NPT I/E	
2	2	677	HOSE CLIP, DU-BRO	
1	1	11902020	WATER I/O MANIFOLD	

PARTS LIST		
DATE	DESCRIPTION	QUANTITY
	DO NOT SCALE FROM DRAWING (UNLESS OTHERWISE SPECIFIED)	
	LINEAR (INCHES)	±0.03
	XXX (MILLIMETERS)	±0.03
	XXX (INCHES)	±0.03
	XXX (MILLIMETERS)	±0.03
	XXX (INCHES)	±0.03
	XXX (MILLIMETERS)	±0.03
	XXX (INCHES)	±0.03
	XXX (MILLIMETERS)	±0.03
	XXX (INCHES)	±0.03
	XXX (MILLIMETERS)	±0.03
	XXX (INCHES)	±0.03
	XXX (MILLIMETERS)	±0.03
	XXX (INCHES)	±0.03
	XXX (MILLIMETERS)	±0.03
	XXX (INCHES)	±0.03
	XXX (MILLIMETERS)	±0.03
	XXX (INCHES)	±0.03
	XXX (MILLIMETERS)	±0.03
	XXX (INCHES)	±0.03
	XXX (MILLIMETERS)	±0.03

SOFTWARE	
SOFTWARE	VERSION
AUTOCAD	2000

GMW			
DATE	DESCRIPTION	QUANTITY	REVISIONS
	DO NOT SCALE FROM DRAWING (UNLESS OTHERWISE SPECIFIED)		
	LINEAR (INCHES)	±0.03	
	XXX (MILLIMETERS)	±0.03	
	XXX (INCHES)	±0.03	
	XXX (MILLIMETERS)	±0.03	
	XXX (INCHES)	±0.03	
	XXX (MILLIMETERS)	±0.03	
	XXX (INCHES)	±0.03	
	XXX (MILLIMETERS)	±0.03	
	XXX (INCHES)	±0.03	
	XXX (MILLIMETERS)	±0.03	
	XXX (INCHES)	±0.03	
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	XXX (INCHES)	±0.03	
	XXX (MILLIMETERS)	±0.03	
	XXX (INCHES)	±0.03	
	XXX (MILLIMETERS)	±0.03	

COOLING SYSTEM	
MODEL	REV
5201	A

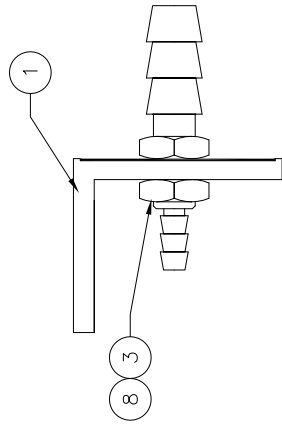
SCALE	
SCALE	SHEET 1 OF 1
A1	1

1 2 3 4 5 6 7 8

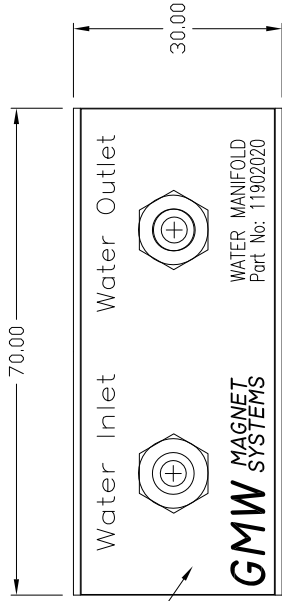
D C B A

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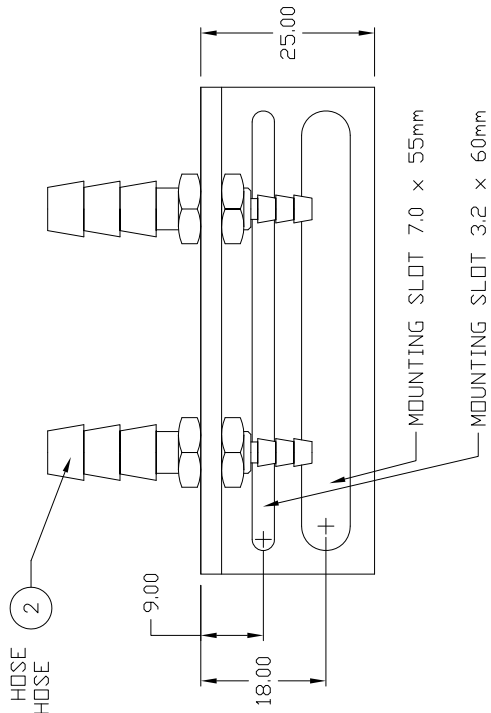
END VIEW



FRONT VIEW



BOTTOM VIEW



FRONT CONNECTION TO SUIT 6.0mm ID HOSE
 REAR CONNECTION TO SUIT 3.0mm ID HOSE

NOTE: 1 SUPPLY ITEMS 4 THRU 7 PACKED IN ZIP LOCK
 PLASTIC BAG. THESE ITEMS NOT SHOWN ON DRAWING.

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
9	1	10900650	LABEL, WATER MANIFOLD	
8	2	BN 792	WASHER, M6 LOCK SP/S	
7	2	DIN 934	NUT, M3 HEX S/S	1
6	2	DIN 433	WASHER, M3 FLAT S/S	1
5	2	BN 792	WASHER, M3 LOCK SP/S	1
4	2	DIN 912	SHCS, M3 x 12 S/S	1
3	2	DIN 439 B	NUT, M6 JAM BRASS	1
2	1	17905380	HOSE FEEDTHRU 6mm HOSE to 3mm HOSE	
1	1	17905210	MOUNTING BRACKET	

DRAWN		DATE	PARTS LIST	
G. DOUGLAS	10/22/03		DO NOT SCALE FROM DRAWING	
CHECK	DATE		DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)	
ENGINEERING	DATE		LINEAR	INCHES / mm
			X.XXX	±.002 / ±0.03
			X.XX	±.04 / ±0.1
			X.X	±.15 / ±0.3
			X	±.08 / ±1
			DEC.	±.5 / ±0.5
			FINISH	63 / 1.6
			THIRD ANGLE PROJECTION	
NEXT ASSY	SYSTEM		SCALE	2:1
SOFTWARE	AUTOCAD	2000	WT	kg
			SHEET	1 OF 1

GMW
 955 Industrial Rd, San Carlos, CA 94070
 Tel: (650)802-8292. Fax: (650)802-8298.

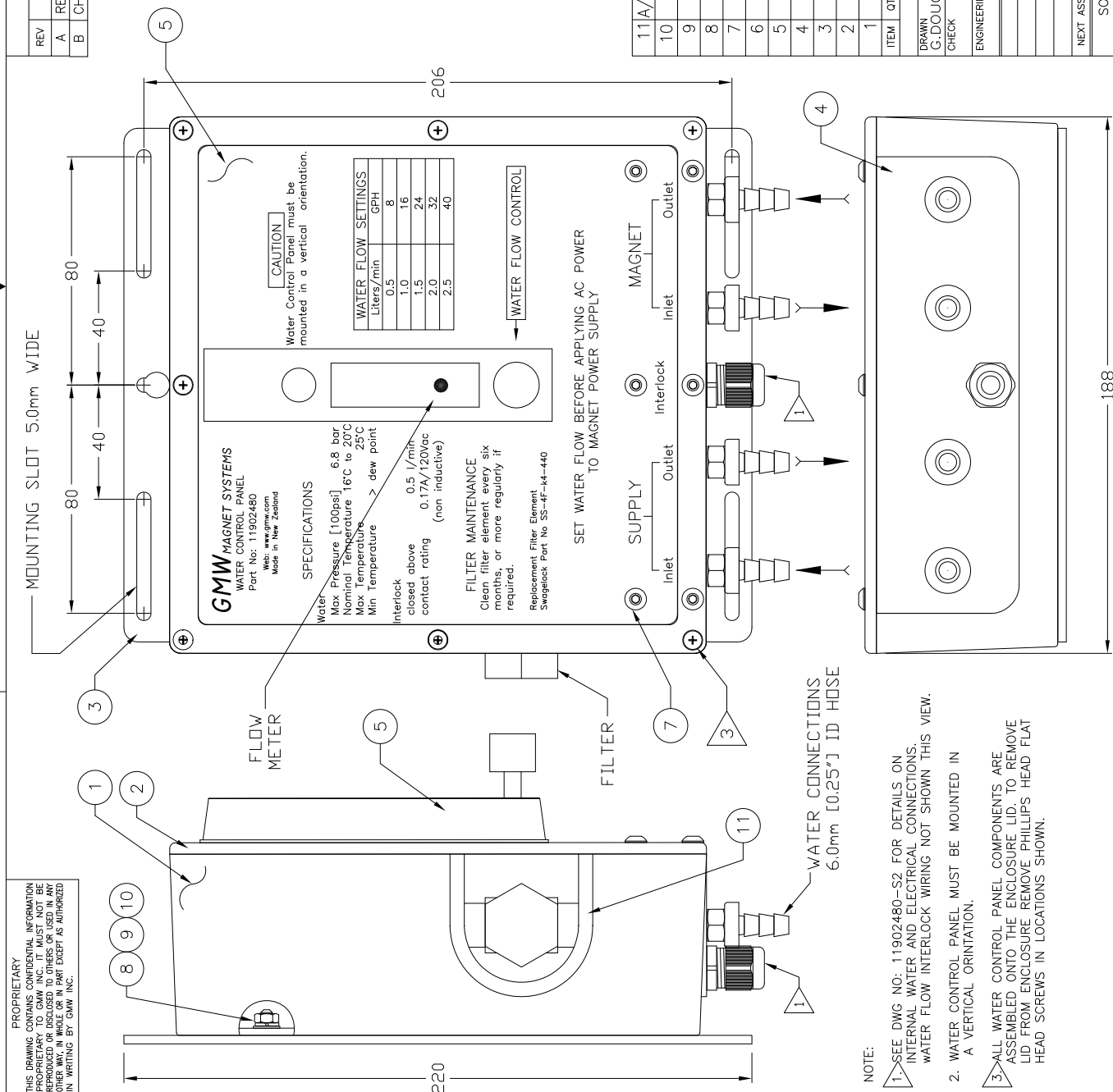
WATER I/O MANIFOLD
 MODEL: 5201
 DRAWING NO. A2 11902020
 REV A

REVISIONS

REV	RELEASE	DESCRIPTION	DRAFT	DATE	APPROVED
A				10/22/03	G. DOUGLAS

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MOUNTING SLOT 5.0mm WIDE



REV	RELEASE	DESCRIPTION	DRAFT	DATE	APPROVED
A				11/15/04	G.DOUGLAS
B		CHANGE FILTER ELEMENT TYPE		28 Nov. 11	M. Duffy

REVISIONS

NOTE: PARTS LIST CONTINUED ON SHEET 2 OF DWG NO: 11902480

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
11A/R	1	PCAO32	EDGING CHANNEL, 6 x 3mm RUBBER	
10	4	DIN 7980	WASHER, SPRING M4 S/S	
9	4	DIN 433	WASHER, FLAT M4 S/S	
8	4	DIN 934	NUT, HEX M4 S/S	
7	6	ISO 7380	SHCS, BUTTON HD M4 x 10 S/S	
6	1	FL-812-VSS	FLOW METER, OMEGA 0.1-1.6 L/MIN	
5	1	10901630	SPECIFICATION LABEL	
4	1	17906210	MANIFOLD	
3	1	17906200	MOUNTING PLATE	
2	1	12900310	ENCLOSURE LID	
1	1	12900300	ENCLOSURE	

DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)		PARTS LIST	
DATE	11/04/04	DATE	11/04/04
CHECK	G.DOUGLAS	DATE	
ENGINEERING		DATE	
NEXT ASSY	5201	FINISH	63
SOFTWARE	AUTOCAD 2000	THIRD ANGLE PROJECTION	
		SCALE	1:1
		WT	kg
		SHEET	1 OF 2

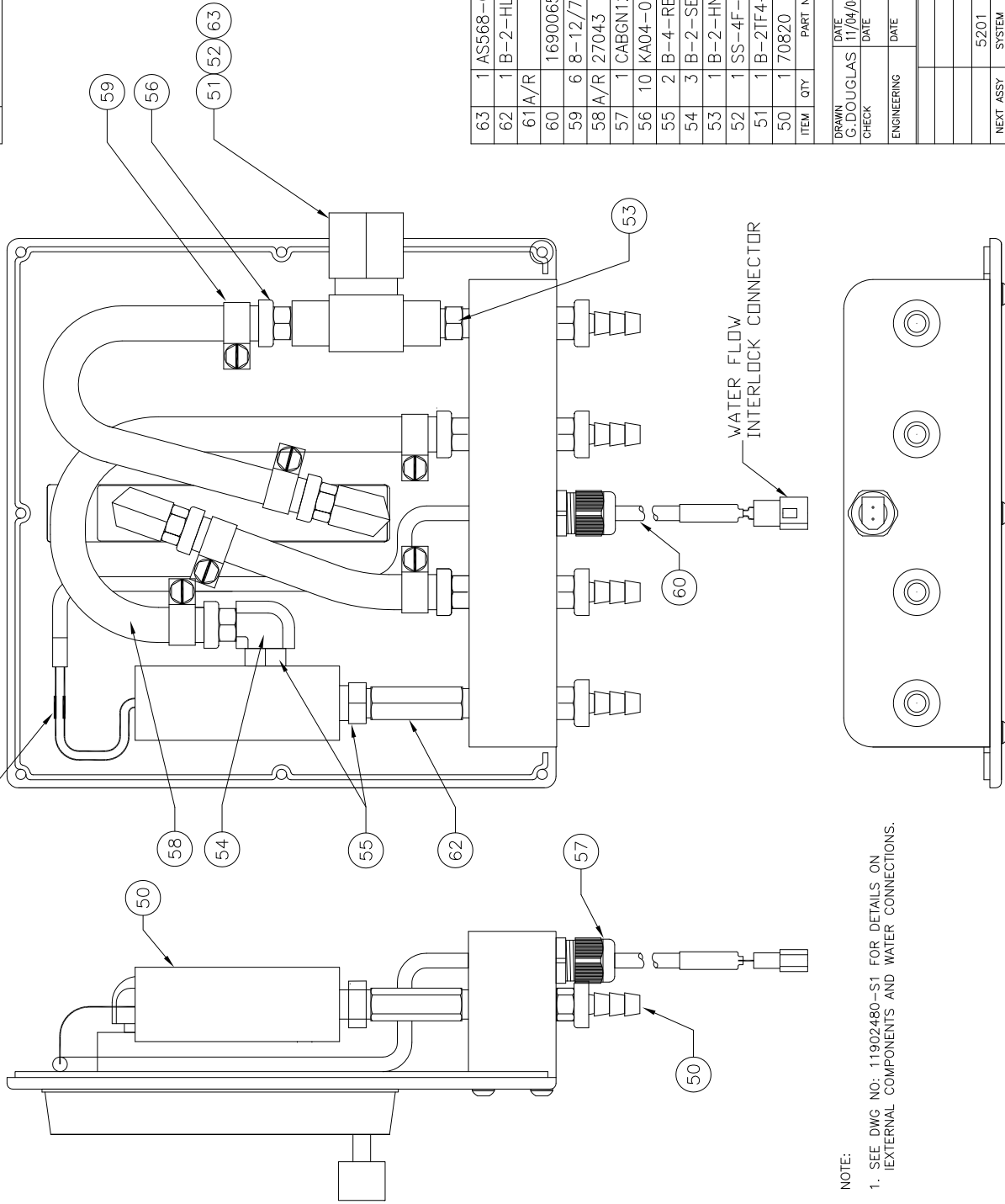
- NOTE:
- SEE DWG NO: 11902480-S2 FOR DETAILS ON INTERNAL WATER AND ELECTRICAL CONNECTIONS. WATER FLOW INTERLOCK WIRING NOT SHOWN THIS VIEW.
 - WATER CONTROL PANEL MUST BE MOUNTED IN A VERTICAL ORIENTATION.
 - ALL WATER CONTROL PANEL COMPONENTS ARE ASSEMBLED ONTO THE ENCLOSURE LID. TO REMOVE LID FROM ENCLOSURE REMOVE PHILLIPS HEAD FLAT HEAD SCREWS IN LOCATIONS SHOWN.

D C B A

D C B A

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SOLDER
JOINTS



REVISIONS

REV	DESCRIPTION	DRAFT	DATE	APPROVED
A	RELEASE		11/15/04	G. DOUGLAS
B	CHG ITEM 59, ADD ITEM 62		04/05/06	G. DOUGLAS
C	CHG ITEM 52, ADD ITEM 63		29 Apr. 11	M. Duffy

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
63	1	AS568-015	WTON O-RING, AS568A-015, ID: 9/16, Thickness: 1/16	
62	1	B-2-HLN-2.00	HEX NIPPLE 1/8 NPT, SWAGelok	
61 A/R		16900650	HEATSHRINK SLEEVING, 3.0mm BLACK	
60	1	8-12/7.5W3 P	CABLE, INTERLOCK	
59	6	8-12/7.5W3 P	HOSE CLAMP NORMA	
58 A/R		1 CABGN12	HOSE, WATER/VACUUM 6.0 ID GATES	
57	1	KA04-02MB	CABLE GLAND, CABAC	
56	10	B-4-RB-2	COUPLING, BRASS 1/4-1/8 NPT-1/4 HOSE I/E	
55	2	B-2-SE	REDUCER, BRASS 1/4-1/8 NPT SWAGelok	
54	3	B-2-HN	STREET ELBOW, 90° BRASS 1/8 NPT SWAGelok	
53	1	SS-4F-K4-440	HEX NIPPLE 1/8 NPT, SWAGelok	
52	1	B-2TF4-60	FILTER ELEMENT 440 micron, SWAGelok	
51	1	70820	FILTER BODY, BRASS, SWAGelok	
50	1		FLOW SWITCH, GEMS 0.5 l/min	

PARTS LIST

DATE	DATE	DATE	DATE	DATE	DATE
DRAWN G. DOUGLAS	11/04/04	CHECK DATE		ENGINEERING DATE	
LINEAR	X.XXX	X.XXX	X.X	X	DEC.
±.004	±.01	±.03	±.06	±.1	±.5
±0.03	±0.1	±0.3	±1	±0.5	±1.6
FINISH 63					
THIRD ANGLE PROJECTION					
NEXT ASSY SYSTEM 5201					
SOFTWARE AUTOCAD 2000					

DO NOT SCALE
FROM DRAWING
DIMENSIONS & TOLERANCES
(UNLESS OTHERWISE SPECIFIED)

GMW
955 Industrial Rd, San Carlos, CA 94070
Tel: (650)802-8292. Fax: (650)802-8298.

TITLE
WATER CONTROL PANEL
GENERAL ASSEMBLY

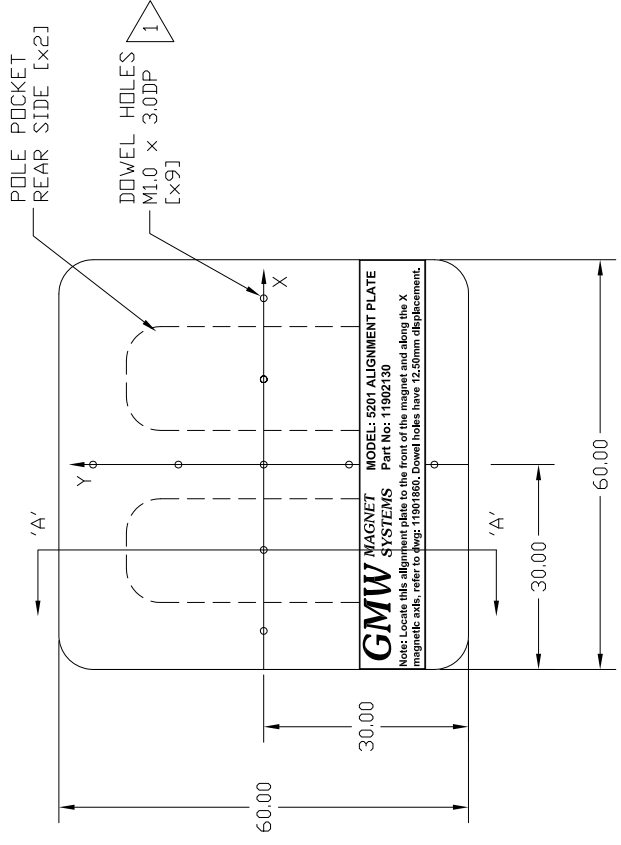
SCALE 1:1 WT kg

SHEET 2 OF 2

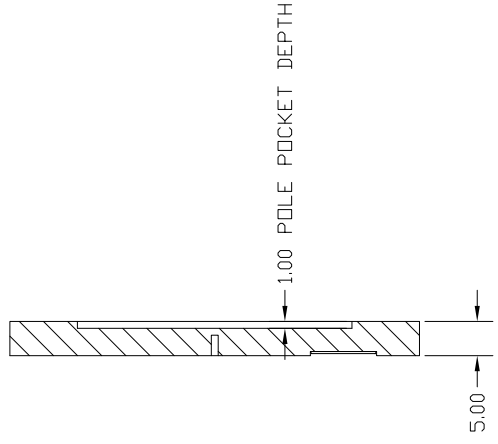
NOTE:
1. SEE DWG NO: 11902480-S1 FOR DETAILS ON
EXTERNAL COMPONENTS AND WATER CONNECTIONS.

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TOP VIEW



SECTION VIEW A'-A'



4 3 2 1

REV	RELEASE	DESCRIPTION	DRAFT	DATE	APPROVED
A				03/30/06	G.DOUGLAS
B		CHANGE NOTE 2		28 Nov, 11	M. Duffy

ITEM	QTY	PART NUMBER	DESCRIPTION	NOTE
3	3	DIN 6325	DOWEL PIN, ϕ 1.00mm x 5.0 LONG	C/S 4
4	6	VSM 12771B	DOWEL PIN, ϕ 1.00mm x 5.0 LONG	S/S 4
2	1	10901080	IDENTIFICATION LABEL	
1	1	17905220	ALIGNMENT PLATE [Aluminum]	

DO NOT SCALE FROM DRAWING DIMENSIONS & TOLERANCES (UNLESS OTHERWISE SPECIFIED)

LINEAR	INCHES	MILLIMETERS	TITLE
XXX	±0.04	±0.03	
XX	±0.1	±0.1	
X	±0.5	±0.3	
DEG.	±0.06	±1	
FINISH	AS- ∇	±0.5	
THIRD ANGLE PROJECTION	1:1		

11901860 5201

SOFTWARE AUTOCAD 2000

SCALE 2:1 WT kg

SHEET 1 of 1

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Tel: (650)802-8292. Fax: (650)802-8298.

PROJ FIELD MAGNET ALIGNMENT PLATE

DRAWING NO. A2 11902130

REV B

NOTE:

- DOWEL HOLES ARE PROVIDED ALONG THE X and Y MAGNETIC AXES HOLES ARE 12.5mm DISPLACEMENT. [9 PLACES TOTAL]. DOWEL HOLES ARE 1.00mm CLEARANCE HOLES TO SUIT 1.00mm DOWEL PINS.
- BEFORE FITTING THIS ALIGNMENT PLATE, THE TOP COVER (ITEM 5, P/N: 17905120 ON DRAWING 1190860) MUST BE REMOVED. CLEAN THE POLE POCKETS AND THE MAGNET POLE FACES. FIT ALIGNMENT PLATE WITH THE LABEL LOCATED TO THE MAGNET FRONT, REFER DWG NO: 11901860.
- MAGNETIC FIELD DIRECTIONS ARE SHOWN FOR POSITIVE MAGNET CURRENT.
- USE ITEM 4 FOR MAGNETIC ALIGNMENT [CARBON STEEL] DOWEL PIN. USE ITEM 3 FOR NON MAGNETIC LOCATION [STAINLESS STEEL] DOWEL PIN.

