OUTOKUMPU | Technology

CARPCO MODEL
MIH(13)111-5 LABORATORY
HIGH-INTENSITY INDUCED-ROLL
MAGNETIC SEPARATOR

Revision: 03-2

SERIAL NUMBER

221-06

University Of Vermont

USA

June 2006

OUTOKUMPU TECHNOLOGY, INC.
Physical Separation Division
6100 Phillips HighwayJacksonville, Florida U.S.A. 32216
telephone (904)353-3681 fax (904)353-8705

TABLE OF CONTENTS

1.0 SAFETY WARNINGS

SAFETY WARNINGS MUST BE READ BEFORE INSTALLING AND OPERATING THIS MACHINE!

- Have a qualified electrical maintenance technician install, adjust, and service this equipment. Follow the National Electrical Code and all other applicable electrical and safety codes, including the provisions of the Occupational Safety and Health Act (OSHA) when installing and operating equipment.

1) LIFTING

- Caution: Lift with care using hoist bar inside cabinet, which is attached to magnet blocks.

- Attention: Remove the hoist bar before operating the separator.

- Caution: Move and locate this machine with caution. This machine weighs approximately 425 pounds (193 kilograms). Proper care should be taken in mounting this unit to avoid unstable and potentially dangerous situations.

2) ELECTRICAL

- Reduce the chance of an electrical fire, shock, or explosion by proper grounding, over current protection, and thermal protection.

- Connect an adequate external grounding strap between the separator and a water pipe or similar earthing. This external grounding strap may be omitted in installations where reliable, tested earth or ground connection is made via a proper three-pin plug or permanent wiring in accordance with local electrical codes.

- Check to insure that all electrical connections and voltage requirements are in agreement with the electrical schematic shown in Appendix F prior to energizing the separator.

- Warning: Voltages encountered within this separator/controller are dangerous and can be fatal. This separator/controller is designed to prevent accidental shock when properly used. However, no engineering design can render safe a device, which is used carelessly. Therefore, the instructions contained in the operating manual must be followed whenever this separator/controller is used.

3) GENERAL

- Caution: When working with any dusty materials, care should be taken to provide operator(s) of laboratory or industrial separating devices with protective masks. Particular care should be taken when the materials are known to be hazardous or toxic, i.e., positive draft ventilation should be considered.

Warning/cautions tags are attached to the separator prior to shipment and precaution should be taken as specified to insure the safety of the personnel installing and operating this machinery.

2.0 INSTALLATION

2.1 Drawings

Refer to the general arrangement drawing and electrical schematic included in Appendix F of this operating manual before installing and operating this equipment.

2.2 General

A carbon steel lifting handle is bolted to two eye bolts on the magnet blocks inside the separator cabinet. This handle should be used when moving the separator in conjunction with proper lifting equipment. Total static load: 425 pounds (193 kilograms).

Note: This handle should be removed (unbolted) once the separator has been permanently installed to eliminate magnetic flux leakage which can occur through the carbon steel lift assembly.

2.3 Electrical Connections

Input Voltage: 115 VAC, 60 Hz, Single Phase

Caution: Check to insure that all electrical connections and voltage requirements are in agreement with the electrical schematic included in Appendix F prior to energizing separator.

Grounding: Connect an adequate external grounding strap between the separator and a water pipe or similar earthing. This external grounding strap may be omitted in installations where reliable, tested earth or ground connection is made via a proper three-pin plug or permanent wiring in accordance with local electrical codes.

3.0 SPECIFICATIONS

Carpco Model MIH(13)111-5 Laboratory High-Intensity Induced-Roll Magnetic Separator is a top-fed laboratory/pilot-plant dry high-intensity electromagnetic separator designed to separate paramagnetic (weakly magnetic) materials from non-magnetic materials. This compact model is used extensively for bench and pilot-scale testing of granular materials, production control in plants using industrial high-intensity magnetic separators and for applied mineral research.

3.1 Principle of Operation

This separator places all materials in contact with the highest magnetic field at the zones of steepest magnetic gradient and utilizes magnetic force and gravity to capture weakly magnetic materials. A turning magnetic roll used to transport materials through the active area provides an opposing centrifugal force for separation of magnetic and nonmagnetic materials. An illustration of the principle of operation is shown in Figure 1.

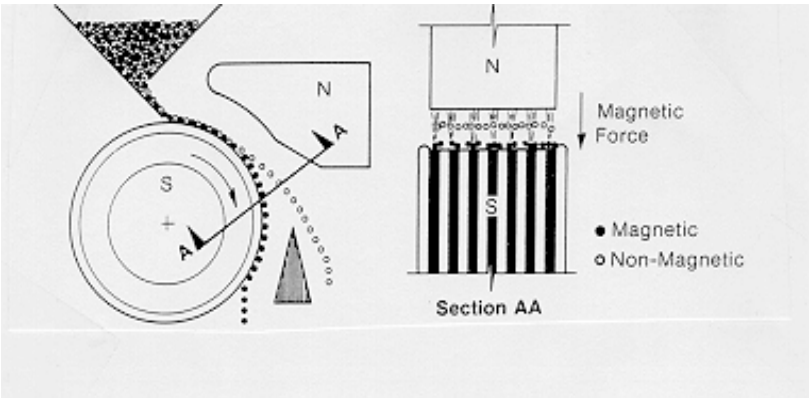


Figure 1: Principle of Operation

3.2 Standard Equipment Features

- *Components and controls* are built into a compact console so that the operator can easily observe and control separation simultaneously.

- A 62 in^3 (1016 cm^3) polished stainless steel *velocity feed hopper* equipped with vibratory assist is used to control the rate of material being separated.

- A *three-way product hopper* of polished stainless steel construction permits collection of magnetic, middling and nonmagnetic products.

- A 1/4-horsepower *D.C. motor drive* permits continuously variable roll speeds from 0 to 300 rpm.

- The *separating roll* is 5 inches (127 mm) in diameter by 2 inches (50 mm) wide employing laminated magnetic/nonmagnetic materials of construction.

- Continuously variable *input coil current* (0-3 amperes) using solid-state D.C. rectification to an air-cooled magnet coil permits the magnetic field intensity of the separator to be adjustable as indicated in Figure 2 for varying gap settings.

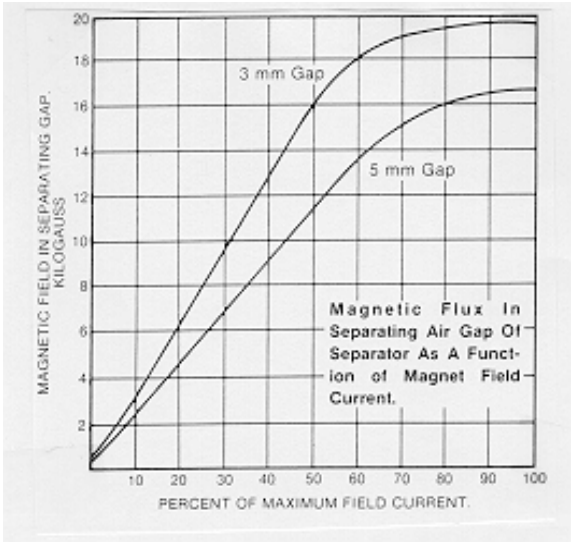


Figure 2: Magnetic Field vs Field Current in Magnet Gap

- Both chrome-plated *nose and tail pole pieces* are adjustable to accommodate a wide range of particle sizes and magnetic field requirements.

- Fuses are installed in the major power circuits of the separator for the protection of the associated components. They are easily accessible on the front panel and may be replaced by hand if an over current condition should occur.

3.3 Optional Equipment Features (only if applicable)

A Carpco Model *MIH(13)111-5CX* incorporates other optional features not included in the standard design of induced-roll separator.

- This variation of the standard design incorporates a *modified magnet coil*, which provides for cooling via a heat exchanger (provided separately) to reduce magnetic field variation that occurs due to changes in electrical resistance as heat builds up in the magnet coil.

- A *constant current controller* is provided to maintain a constant magnetic field during prolonged operation. Additional details about this controller are included in the Other Manufacturer's Information section of this operating manual.

- A *heat exchanger* is provided separately to provide the liquid cooling required to properly operate the modified magnet coil and constant current features. Additional details about this heat exchanger are included in the Other Manufacturer's Information section of this operating manual.

4.0 OPERATING INSTRUCTIONS

4.1 Suggested First Trial

Before operating the separator, the operator must determine what settings are needed to effectively separate the material based on particle size, shape and density. Table 1 shows some suggested first-trial settings for paramagnetic and ferromagnetic materials. The settings shown correlate with the industrial scale-up of this model [Carpco Models MIH(13)221-100 and MIH(13)231-100]. A sample test data sheet is included in Appendix B for recording the operating conditions and test results.

4.2 Establish Settings

4.2.1 Tail and Nose Gap Adjustment

A set of 1 mm (red) and 0.5 mm (white) feeler gauges is supplied to aid in setting the pole gaps.

Nose Gap: Loosen the two ½-inch hex-head bolts holding the nose block. Insert the appropriate number of feeler gauges into the pole gap to measure the distance. Set the gap to its desired position and firmly retighten the ½-inch hex-head bolts. Re-check the gap after tightening the bolts to ensure the block did not slip.

Tail Gap: Loosen the two ½-inch hex-head bolts holding the bearing support plate. Insert the appropriate number of feeler gauges into the pole gap to measure the distance. The factory setting is a 2 mm gap. Set the tail gap to the desired distance. Firmly retighten the ½" hex-head bolts. Re-check the gap after tightening the bolts to ensure the block did not slip.

4.2.2 Roll-Speed

Rotations per minute (rpm) are controlled by the variable roll speed control knob in the upper left-hand corner. RPM is displayed on the front panel meter, if the switch below is moved to the extreme right-hand side. Higher roll speeds must be used with fine materials to reduce fines entrapment of the roll. Lower speeds are generally used with coarser material to help reduce scattering and bounce.

Table 1: Suggested First-Trial Settings

Expected Response of Magnetic Particle	Particle Size	Tail Block Gap (mm)	Nose Block Gap (mm)	Roll Speed (rpm)	Feed Rate (lbs/hr/in) (kg/hr/cm)	Magnet Current (amps)
Paramagnetic (Weakly Magnetic)	Coarse Particles -6+28 mesh (-3+0.6 mm)	2	4-9	70-140	50-150 12-27	Up to 3.0
	Fine Particles -28+200 mesh (-0.6+0.074 mm)	2	3-9	100-180	100-220 24-40	Up to 3.0
Ferromagnetic (Highly Magnetic)	Coarse Particles -6+28 mesh (-3+0.6 mm)	2	9	70-140	50-150 12-27	0.1-0.3
	Fine Particles -28+200 mesh (-0.6+0.074 mm)	2	9	100-180	100-220 24-40	0.1-0.3

Notes: (1) Refer to Carpco's Electrostatic and Magnetic Separation Characteristics of Selected Mineral Chart for a guide as to paramagnetic or ferromagnetic characteristics of minerals (Appendix A).
(2) Feed rate of laboratory separator is based on 1-1/2 inches (38.1 mm) effective feed width

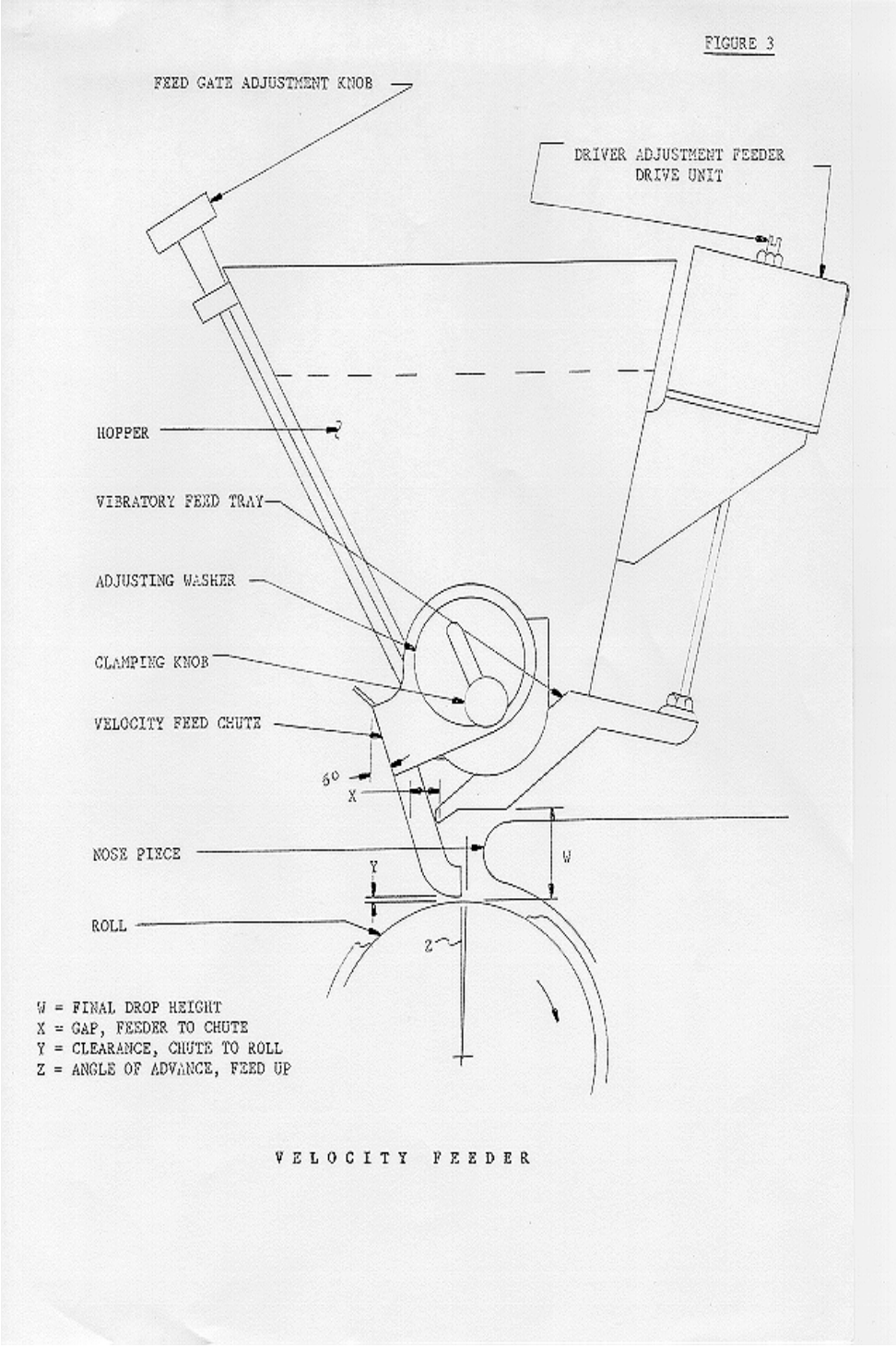


Figure 3 Velocity Feeder

4.2.3 Feeding the Separator

4.2.3.1 Setting Feeder Position/Drop Height: Before setting the feed rate, the total drop height of the velocity feed chute should be adjusted. For fine material, the longest drop height is required. A shorter drop height is appropriate for coarser materials. The following guidelines describe checking and adjusting the drop height and feeder position.

The first dimension to establish is the total drop height W (Figure 3). Once this has been decided, loosen the two thumbscrews on the sides of the hopper and move the hopper to the dimension desired. If necessary, swing the feed chute out of the way. The drop height may be measured easier with the help of a pair of calipers or dividers.

Next, the dimensions X and Y are both adjusted by means of the slotted clamp and thumbscrew shown in Figure 3. The dimension X (Figure 3) should be 1/4" - 3/8" (6-10mm) or at least large enough to pass the feed at the maximum rate desired without material piling up. The dimension Y (Figure 3) should be about 1/16" - 1/8" (1.5 - 3.0mm). It is very important when setting the feed chute that the back of the chute is set at an angle of 6 degrees from the vertical. This angle is built into the chute so that the falling stream of feed material is properly diverted and presented to the roll at the correct angle. Setting the chute at any other angle will upset the operation of the chute and defeat the advantages gained by its rise. Loosen the thumbscrew while holding the feed chute. The position of the chute may be moved in any direction horizontally or vertically by moving the thumbscrew along the slot provided and/or turning the slotted clamp (Figure 3) with the hand to enable movement in the direction desired. Always maintain the 6-degree angle of tilt on the back of the chute. The chute is clamped in its new position by tightening up the thumbscrew. Re-check dimensions X and Y and the 6 degree tilt after clamping. Turn on the roll momentarily to check adequate clearance Y.

The final adjustment allows movement of the whole hopper and feeder assembly horizontally so that the feeder lip is positioned at the correct point on top of the roll. Usually a setting with the lip directly on top of the roll is used (at TDC; Top Dead Center). Any other setting is measured as an angle from TDC which is called BTDC (Before Top Dead Center); thus, positive angles BTDC shows a lip position in advance of the top of the roll (feeder lip to the left of top), and negative angles show a lip position after top dead center. The actual position may be selected while feed is flowing from the feeder by observing the degree of scattering and bounce produced by each position, then

doing a trial separation. Angles too negative (after top dead center) may throw the feed over the roll without ever contacting it properly. Angles too far positive (before top dead center) may cause excessive impact with the roll.

Tighten the four thumbscrews involved in this adjustment after each setting.

4.2.3.2 Setting Feed Rate: Once the feeder position and drop height have been set, the feed rate should be set as follows:

Equipment Needed: Stopwatch, sample of feed, collection pans and gram scale.

Note that the feed rate is controlled by both the feed gate adjustment and the variable vibrator control setting on the front panel. The feed gate adjustment is used for initial adjustment and the variable vibrator control is used to fine-tune the settings.

The feed gate must be opened further than the largest dimension of the material in the feeder to allow free flow. If part of the flow is blocked during feed tests, then increase the gate opening. Be aware of the possibility of other contaminants such as brush hairs, trash or oversize pieces of material present in the feed. Screening prior to separating may be used to deal with these problems.

To set the feed rate, follow the steps below:

1) Move the feed gate adjustment knob so that there is the correct gap between the feed gate and the vibratory feed tray as follows:

   Free Running Sand: 1/8"(3mm)
   Coarse Material: 1/4"(6mm)
   Ultra-fine Powders: 3/8"(9.5mm)

   This is a starting point. Further adjustment may be made later while running to insure smooth feeding. Place pans under the product hoppers. Place the sample into the hopper, starting very gently so that sand does not spill from the feeder. Adjust the front panel feed rate control to about 50% (or other setting depending on previous tests or experience)

2) With stopwatch in hand, switch on the feeder for 10 seconds and collect the sample.

3) Weigh the sample in grams and multiply this figure by 0.529 (0.0945) to obtain pounds/hour/inch (kg/hr/cm); or refer to Appendix C, Feed Rate Conversion Chart.

4) Repeat procedures 2 and 3, adjusting the feed rate controls for each test until the desired rate is achieved. It is important to set the feed rate as high as possible to realize the full capacity of the industrial machine, while also being consistent with requirements of separation quality.

5) Once all adjustments have been set, feeding may be stopped and started at will by the front panel toggle switch. This will enable timed runs to be accurately made, also when changing pans, without upsetting any of the rate adjustments mentioned above.

6) To simulate full-scale production units, feed rates should be 100-200 lb/hr/in (22.3-35.7 kg/hr/cm). Do not exceed 225 lb/hr/in (40 kg/hr/cm).

4.2.4 Splitters

After establishing all the previous settings, reload the material into the feed hopper. While the material is flowing, and with the magnet coil current off, set the right-hand splitter so that all material will just pass over this splitter into the nonmagnetic product bin. This setting is made using the locking adjustment knob on the front of the hopper.

4.2.5 Magnet Coil Current

Turn the magnet coil current on slowly and increase to the desired setting.

Note: The magnetic circuit is saturated at 3.0 amps and the current need not be set higher than this. The roll speed may vary when setting the magnet coil current; be sure to re-check this setting.

After establishing all the above settings, the separator should be allowed to warm up a few minutes prior to test work.

4.2.6 Roll Brush

It is good practice to empty the entrained particles from the roll brush after every test run. Lift the brush lever and slide the brush out of its holder. Tap the brush on the side of the pan holding the magnetics fraction. Use a 1" (2.5 cm) natural fiber (Chinese bristle) paintbrush to clean all three compartments of the product hoppers and brush holder assembly between tests.

4.2.7 Adjustable Splitters

The splitters are fitted with adjustable height blades. To adjust for initial setup, loosen the thumbscrew on the nearest edge of the splitter and adjust to new height; retighten the thumbscrew. Measure the height of the top edge of the blade above the top of the splitter pivot bushing. To be equivalent to the industrial machine, this height should be 3-1/2" (89 mm) for both splitters. Operators may find, however, that better results may be obtained if the left-hand splitter (between middlings and magnetics) is lowered to 2-3/4" (70 mm). This will enable better performance where a middlings stream is desired while separating either coarse or extra fine material. This length splitter will also enable it to meet the roll at a lower position than would otherwise be obtained. Be aware that where only one splitter is used (e.g. after scalping or after first high-intensity separation) that the middlings and magnetics products are combined as a magnetics fraction and the only splitter used is the right-hand one. For convenience, the left-hand splitter may be parked up against the right-hand splitter thus shutting off the middlings fraction.

5.0 MAINTENANCE

5.1 Belts

Caution: Before any maintenance on the belts is performed, be sure to disconnect all power from the machine.

Belts are accessed from the back of the separator. The motor-to-jackshaft belt can be adjusted by loosening the two bolts on the vertical of the jackshaft assembly. The jackshaft-to-roll belt is adjusted by loosening the two bolts on the horizontal of the jackshaft assembly. Be sure to firmly retighten all bolts after adjusting the belts.

5.2 Brush

The roll brush should be properly spring-loaded against the roll by the brush holder mechanism. Do not operate without a brush, as this will not only damage the roll but will also give poor separation. The brush should be cleaned after every test run. Worn brushes should be replaced with genuine Carpco bristle roll stock.

5.3 Ventilation (applicable on standard MIH(13)111-5 only)

A fan is provided to remove heat from inside the separator. After extended continuous use, the separator will get rather hot and this may result in reduced magnet current and possibly a tripped circuit breaker. If this occurs, turn the machine off and open the top door of the cabinet. Allow the machine to cool this way for ½ to 1 hour. Operation may then be resumed.

5.4 Spare Parts

The recommended spare parts listing for this separator is included in Appendix D.

5.5 Motor Maintenance

Lubrication and maintenance of the motor should follow guidelines given in Appendix E, Component Manufacturer's Data.

5.6 Other Components

Appendix E contains the manufacturer's data for various components that are included in this separator.

APPENDIX A

Separation Characteristics of Selected Minerals

APPENDIX B

Laboratory Worksheet

APPENDIX B

INDUCED-ROLL MAGNETIC SEPARATOR DATA SHEET

TECHNICIAN:_____ **DATES TESTED:_____**

PROJECT NAME:_____ **PROJECT NO._____**

TEST #	STREAM NAME	WT (G)	% WT. CIR	% WT. HF	SAMPLE NO.
	MAGNETICS				
	NONMAGNETICS				
	FEED				
	MAGNETICS				
	NONMAGNETICS				
	FEED				
	MAGNETICS				
	NONMAGNETICS				
	FEED				
	MAGNETICS				
	NONMAGNETICS				
	FEED				
OBSERVATIONS/ COMMENTS:					

OPERATING CONDITIONS					
		TEST	TEST	TEST	TEST
FEED RATE (LBS/HR/IN)					
ROLL SPEED (RPM)					
FEED SPEED, oF (oC)					
INNER SPLITTER (INS)					
OUTER SPLITTER (INS)					
NOSE GAP (MM)					
TAIL GAP (MM)					

APPENDIX C

Feed Rate Conversion Chart

APPENDIX C

FEED RATE CONVERSION CHART
MODEL MIH(13)111-5

SAMPLE WEIGHT	FEED RATE		SAMPLE WEIGHT	FEED RATE	
(g/10 sec)	(lbs/hr/in)	(kg/hr/cm)	(g/10 sec)	(lbs/hr/in)	(kg/hr/cm)
50.4	20	4.8	236	125	22.3
63.0	25	6.0	246	130	23.2
75.6	30	7.1	255	135	24.1
88.2	35	8.3	265	140	25.0
100.8	40	9.5	274	145	25.9
113.4	45	10.7	284	150	26.8
125.9	50	11.9	293	155	27.6
138.5	55	13.1	302	160	28.6
151.1	60	14.3	312	165	29.4
163.7	65	15.5	321	170	30.3
176.3	70	16.7	331	175	31.2
188.9	75	17.9	340	180	32.1
201.5	80	19.0	350	185	33.0
214.1	85	20.2	359	190	33.9
226.7	90	21.4	369	195	34.8
239.3	95	22.6	378	200	35.7
251.9	100	23.8	388	205	36.6
264.5	105	25.0	397	210	37.5
277.1	110	26.2	406	215	38.4
289.7	115	27.4	416	220	39.3
302.3	120	28.6	425	225	40.1

CONVERSION FACTORS
1) To convert g/10 sec to lbs/hr/in, multiply by 0.529.
2) To convert g/10 sec to kg/hr/cm = multiply by 0.0945.

APPENDIX D

Spare Parts Listing

APPENDIX D

RECOMMENDED SPARE PARTS FOR 1-2 YEARS' OPERATION
MODEL MIH(13)111-5

SP PART NO.	QUANTITY	DESCRIPTION
ELECTRICAL PARTS		
2954	2	PILOT LIGHT
CONTROL-DC-1001	1	MM23001C CONTROLLER DC MOTOR
MECHANICAL PARTS		
2958	2	ROLL BEARINGS, SEALED
2959	1	MOTOR-JACKSHAFT BELT
3029	1	JACKSHAFT BELT
2961	2	ROLL BRUSH
3026	6	RUBBER BUSHINGS
3002	1	VIBRATOR DRIVE UNIT
3027	2	KNOB
3028	1	FEEDER CONTROL COMPLETE

APPENDIX E

COMPONENT MANUFACTURER'S DATA

- Vibrator (FMC)
- Digital Panel Meter (Datel)
- D.C. Motor and Speed Control (Minarik)
- D.C. Tach Generator (Madison)
- Optional Constant Current Controller
(applicable on Model MIH(13)111-5CX only)
- Optional Heat Exchanger
(applicable on Model MIH(13)111-5CX only)

Syntron®
V-2-B Vibrator

■■■■■■■■■■■■ INSTALLATION ■ OPERATION ■ MAINTENANCE

Thank you for buying your equipment from FMC. This service instruction manual will help you to understand how your equipment operates and what is required to maintain peak performance. Please read it thoroughly and keep it on file for reference.

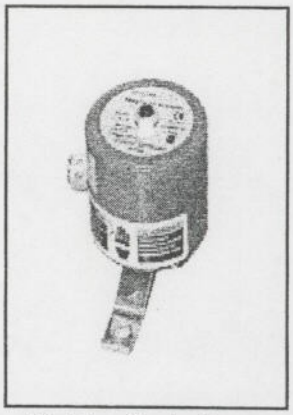
Your satisfaction is very important to us. Please direct any comments, questions or concerns to our Marketing Communications Department.

Date Purchased: _____

Serial No.: _____

Factory Order No.: _____

■ INTRODUCTION



The Syntron® Electromagnetic Vibrator, Model V-2-B applies vibration to bulk material, keeping the particles agitated and in a free flowing condition. The vibrator can be operated directly from an AC power supply with or without a standard control.

■ INSTALLATION

The Syntron V-2-B vibrator may be installed in any position, horizontal or vertical. The mounting bar is provided with a 13/32-inch diameter mounting hole. Tighten the bolt securely with the locknut and lockwasher provided. Check frequently to see that this bolt remains tight. The current supply must be the same as the rating designated on the nameplate.

■ OPERATION

NOTE: If the vibrator is installed on a hopper, do not operate the vibrator while the hopper is closed; vibratory action will compact hopper contents.

To operate the vibrator, simply connect the leads to the power supply. If a control is furnished, connect the vibrator to the control terminals and the control to the power supply. Use of a control permits the output to be

controlled by turning the rheostat knob. Turn the knob clockwise to increase output, and counterclockwise to decrease output.

■ AIR GAP ADJUSTMENT

Caution: If current draw is excessive (higher than nameplate 115V/.3 amps, 230V/.18 amps), adjust the air gap.

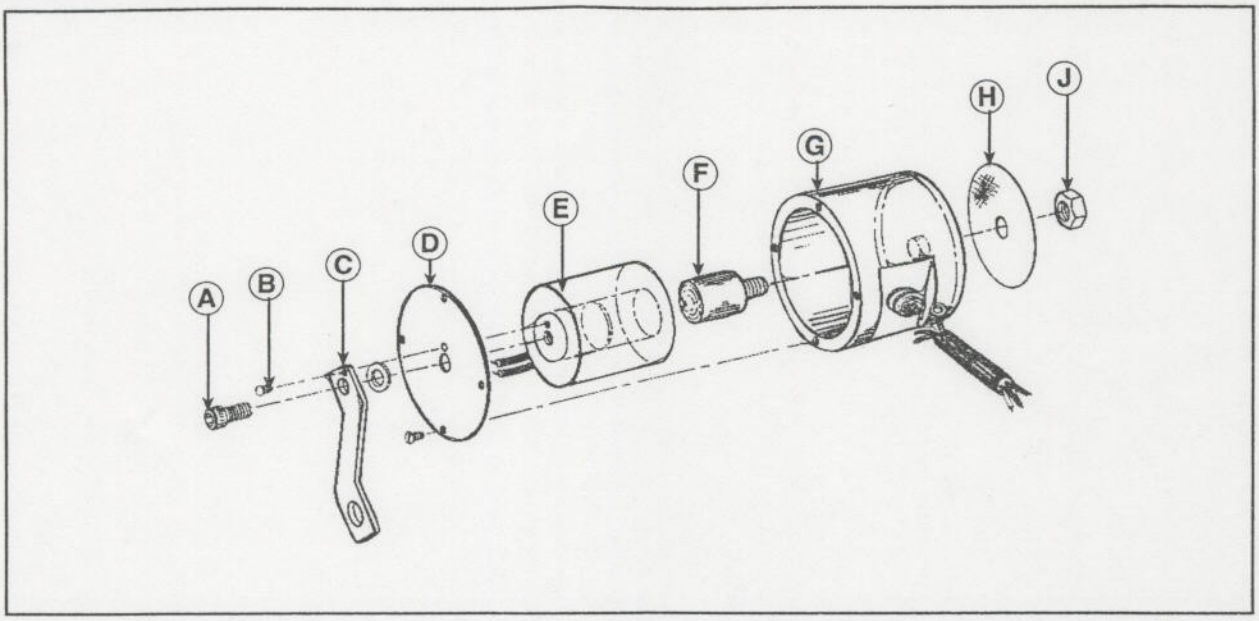
If the armature assembly strikes the core assembly (indicated by loud rapping noise) an adjustment of the air gap is necessary. Too narrow of an air gap will cause an excessive current draw. Loosen the locknut on top of the vibrator and adjust the armature by turning the adjustment screw until the striking stops. Tighten the locknut. Check the current draw of the vibrator; it must not exceed current requirements as designated on the vibrator nameplate.

■ TROUBLESHOOTING

Problem	Cause	Correction
Vibrator Operates Below Capacity	Loose Hardware	Repair
	Defective Magnet	Replace*
Vibrator Does Not Run	Loose Connections in Control	Repair
	Defective Rheostat	Replace*

*Replace only with parts supplied or recommended by FMC

■ PARTS LIST



■ PARTS

ITEM	QTY	DESCRIPTION	PART NO.
A		Cap Screw. Soc.	H0416500
	1	(1/4"-20x1/2")	
	1	Plainwasher (1/4")	H0112845
B	1	DriveScrew, (#6x1/4")	H0438400
C	1	Mounting Bar	A-161019-1
D	1	Disc	A-161018-1
		Mach. Screw, Rd. Hd	H0200501
	4	(#6-32x3/16")	
E		Core, Coil and Cable	C-172844-A
	1	Assembly (115V/50-60 Cy)	
		Core, Coil and Cable	C-172844-B
	1	Assembly (only 230V/60 Cy)	
F	1	Armature Assembly	A-62757
G	1	Cap Assembly	A-161201-A
	1	Compression Nut	102X040
	1	Grommet	102X041
	1	Washer	102X042
	1	Lockwasher #10	H0112404
	1	Mach. Scr. Pan Hd, Br	H0215602
		(10-32 x 3/16")	
	1	■ Caution Label	A-125694
H	1	Nameplate	A-164432-1
J	1	Hex Nut (5/16"-24)	H0102601

■ Do not remove or paint over safety labels. Should safety labels require replacement, contact FMC Corporation, Material Handling Equipment Division, Homer City, PA 15748 (724) 479-4500 for additional supply free of charge.

FMC Corporation
Material Handling Equipment
Homer City, Pennsylvania 15748
Phone (724) 479-4500 / (800) 362-8999
FAX: (724) 479-3400
www.fmcsyntron.com

SM0349A1299500
Printed in USA

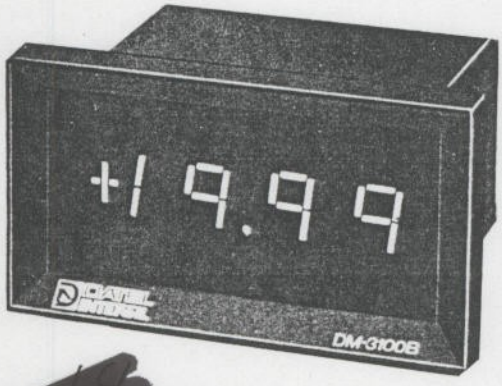
DM-3100B
AC-Powered, 3½ Digit LED Digital Panel Meter

FEATURES

- **Dual Voltage Power - 115/230 VAC, pin-selected**
- **Low Cost —**
- **Balanced Differential Inputs, 80 dB CMR Noise Rejection**
- **Autozeroing, Ratiometric Reference for Drift Correction**
- **1000 MΩ CMOS High Impedance Inputs**
- **Display - .56" High Numerals Red LED**
- **Compact, Short Depth Case - 3.00"W x 2.15"D x 1.76"H (76,2 x 54,6 x 44,7 mm)**

APPLICATIONS

- **Ammeter** - Accepts user-supplied shunts for ±20 μA to ±2A Full Scale Ranges
- **Voltmeter** - Accepts user-supplied attenuators for ±2V to ±1 kV Full Scale Ranges
- **Ohmmeter** - 200Ω to 10MΩ Full Scale Range



DESCRIPTION

The DM-3100B is a very low cost, dual AC-powered Digital Panel Meter. Analog voltages over the range of ±1.999 Vdc are displayed with 3½ digits of resolution. The DM-3100B is powered from the AC line; 115 or 230 VAC is pin-selectable. The unit can provide +5V and −5 Vdc (@ 100 milliamps and 5 milliamps respectively) to power customer-supplied external circuitry.

The DM-3100B uses a self-illuminated red LED display with .56" high numerals. It is clearly visible from many feet away in normal or dim light.

Inputs to the DM-3100B are balanced differential (80 dB Common Mode Rejection) so the meter will accurately display small signals even in electrically noisy industrial environments. CMOS circuitry results in an extremely high input impedance (1000 Megohms, typically) and a very low bias current of 5 picoamps - inputs with a source impedance as high as 100 kilohms can be displayed with accuracy. The input circuitry will also safely tolerate overvoltages up to ±250 Vdc (155 VRMS). Inputs are sampled and displayed about four times per second.

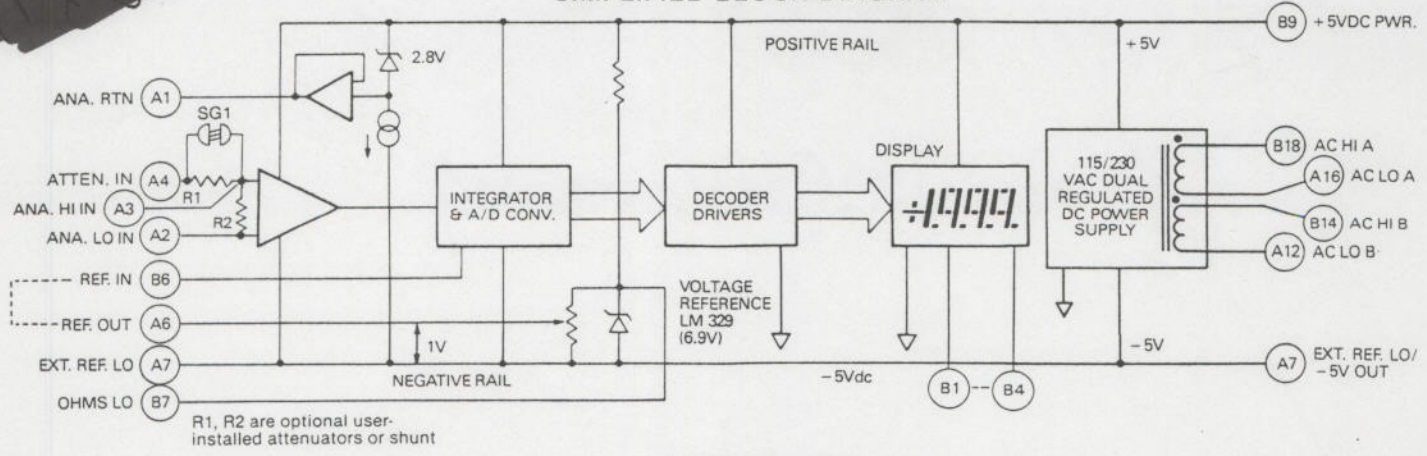
Autozeroing and a ratiometric reference in-out loop permit the DM-3100B to be used for drift correction in bridge-type measurement systems. Meter accuracy is adjustable to ±1/10% (±1 count). Temperature drift of zero is ±1 count from 0 to 50°C, while temperature drift of gain runs typically ±50 ppm of Reading/°C.

The AC-powered DM-3100B was designed for installations where existing dc supplies are noisy, inaccessible, or overloaded. This meter may be used wherever a voltage, or a unit which can be made proportional to voltage, must be displayed with accuracy and clarity. The basic input range of ±1.999 Vdc can be expanded with a simple voltage divider to display voltages up to ±1kV or up to ±2A using current shunts. Blank pads on the meter's circuit board can accept user-supplied voltage attenuator resistors, current shunts, or digital ohmmeter components.

The DM-3100B is supplied in Datel's standard short depth black polycarbonate case, measuring only 3.00"W x 2.15"D x 1.76"H. All connections are made on the back panel to an optional 18-pin edge connector. Cutout dimensions are 1.812"H x 3.062"W (46,0 x 77,8 mm), minimum.

Note: DPM's are supplied without bezel labels and logos.

SIMPLIFIED BLOCK DIAGRAM



MODEL DM-3100B

DATEL-INTERSIL

SPECIFICATIONS, DM-3100B
(Typical @ +25°C, unless noted)

ANALOG INPUT

Configuration	True, balanced differential bipolar −1.999 Vdc to +1.999 Vdc Input pad area will accept user-installed range change
Input Bias Current	5 pA typical, 50 pA maximum
Displayed Accuracy @ +25°C	Adjustable to ±0.1% reading, ±1 count
Resolution	1 mV
Temperature Drift of Zero	Autozeroed ±1 count over 0 to +50°C
Temperature Drift of Gain	±50 ppm of Reading/°C typ. ±100 ppm of Reading/°C max.
Input Impedance	100 Megohms, minimum
Input Overvoltage	±250 Volts dc,155 VRMS continuous max. ±300 Volts intermittent max.
Common Mode Rejection	80 dB, DC to 60 Hz, 1 Kilohm unbalance
Common Mode Voltage Range	Within +Vs − .5V and −Vs +1V where +Vs is the positive rail (Pin B9) and −Vs is the negative rail (Pin A7)). −Vs is approximately equal to −5V below PWR. COM. (Pin A9)
Warm-Up Time	Within 10 minutes
Reference	Internal, referred to the negative rail (−Vs). External, user-supplied reference optional for ratiometric operation.
External Ref. Range	+100 mV to 2V, referred to −Vs
Ramp-up Time (Integration Period)	83.3 mS

DISPLAY

Number of Digits	3 decimal digits and most significant "1" digit (3½ digits)
Decimal Points	Selectable decimal points are included for scale multipliers.
Display Type	Red, light-emitting diode (LED) self illuminated.
Display Height	0.56 inches (14,2 mm)
Overscale	Inputs exceeding the full scale range blank the display, leaving a "1" MSD and sign.
Autopolarity	A minus sign is automatically displayed for negative inputs, and may also be blanked
Sampling Rate	Factory set at 3 conversions per second. May be rewired up to 20 conversions/second.

I/O CONNECTIONS

Analog HI Input (Pin A3) **Analog LO Input (Pin A2)**	Differential input voltages are connected between these inputs. A bias current path to POWER COMMON (if ±5V-powered) or ANALOG RETURN from both these inputs must be externally provided. External circuits must constrain these inputs to be within the common mode voltage range.
Attenuator IN (Pin A4)	Connected in series through R1 (Optional attenuator resistor) to Ana. HI In (Pin A3). Supplied with a jumper in place of R1.
Analog Return (Pin A1)	This pin may be used as a low-noise bias current return for some floating inputs. If not possible, inputs may be referenced to POWER COMMON (if ±5V-powered). Analog Return is approximately −2.8V below +Vs and can sink 30 mA to −Vs.
Reference In/Out (Pins B6/A6)	Normally, REF. IN and REF. OUT should be jumpered together. An external floating source referred to EXT. REF. LO (Pin A7) may be substituted for ratiometric operation.
Decimal Points	Connect selected pin to DECIMAL POINT COMMON (Pin B5)
Display Test (Pin A5)	Connect this input to +5 Vdc (Pin B9) to light all display segments.
$\overline{\text{Polarity}}$ $\overline{\text{Enable}}$ (Pin A8)	Ground this input to Pin A9 to automatically display a minus sign for negative inputs.
Ohms Lo (Pin B7)	This connection is used in the ohmmeter configuration, otherwise do not use.

POWER CONNECTIONS

For 115 VAC input: (parallel both windings)

1. Connect AC LINE HI A (Pin B18) to AC LINE HI B (Pin B14). Connect both to the hot side of the AC line (mains).
2. Connect AC LINE LO A (Pin A16) to AC LINE LO B (Pin A12). Connect both to the neutral side of the AC line (mains).

For 230 VAC input: (Series both windings)

1. Connect AC LINE HI B (Pin B14) to AC LINE LO A (Pin A16). Make no other connections to these two leads.
2. Connect AC LINE HI A (Pin B18) to the the hot side of the AC line (mains).
3. Connect AC LINE LO B (Pin A12) to the neutral side of the AC line (mains).

DC Power Ground (Pin A9) may be connected to earth ground if input circuits permit.

For DC-Power Only:
A bipolar ±5V power supply or two isolated single supplies are required.

Connect +5V to Pin B9, −5V to Pin A7 and Power Ground to Pin A9

POWER REQUIREMENTS

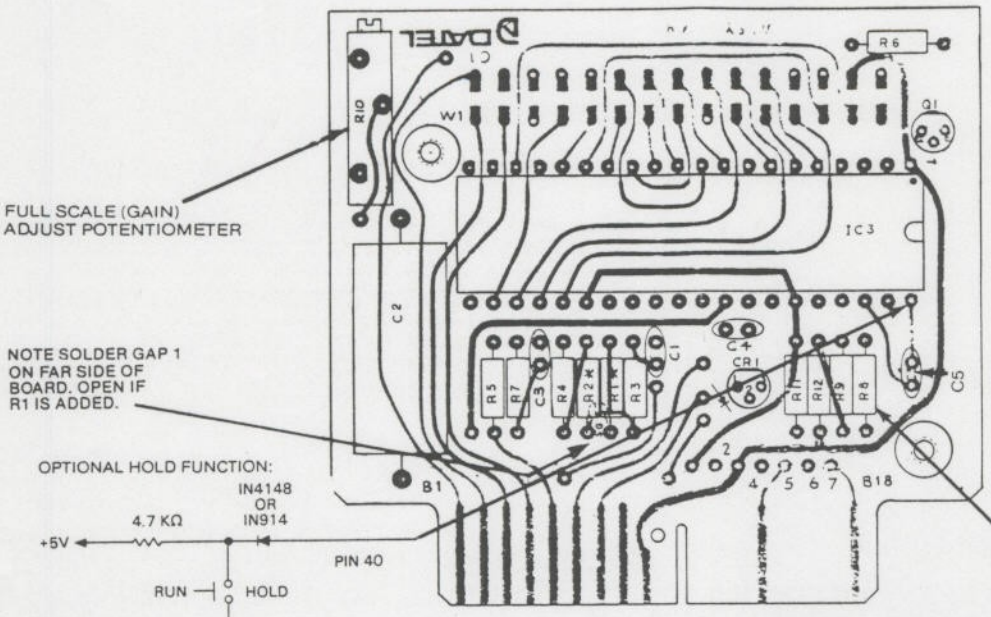
AC Power	115 or 230 VAC, ±10%, 47 to 440 Hz, 4 watts typical
DC Power (Users will normally power from AC-only. DC-only power is optional.)	+5V ±0.25 Vdc @ 250 mA typical, 400 mA max. and −5V Vdc @ 5 mA typ, 25 mA max. Logic spikes must be less than 50 mV. Bypass supplies externally if necessary.
Calibration	A multiturn screwdriver pot adjusts the full scale reading (gain). Zero is automatic (autozeroing). Suggested recalibration in stable conditions is 90 days.

PHYSICAL-ENVIRONMENTAL

Short-Depth Case	Interchangeable with other Datel cases.
Outline Dimensions	3.00"W x 2.15"D x 1.76"H (76,2 x 54,6 x 44,7 mm)
Cutout Dimensions	1.812"H x 3.062"W (46,0 x 77,7 mm)
Mounting Method	Through a front panel cutout secured by (4) 4-40 front access screws which are concealed by the bezel.
Weight	Approximately 5 ounces (142g)
Connector	Double-sided edgeboard PC type, solder tab, gold-plated fingers, Dual 18-pin, 0.100" centers, Datel #58-2075010, (not included)
Mounting Position	Any
Operating Temperature Range	0 to +50°C
Storage Temperature Range	−25 to +85°C
Altitude	0 to 15,000 feet (4600m)
Relative Humidity	20% to 80% non-condensing

DATEL-INTERSIL

DM-3100B COMPONENT LOCATIONS



RC OSCILLATOR

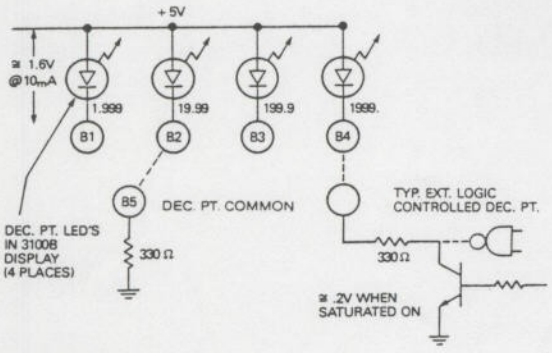
R8 (100KΩ)

$$R8\ (K\Omega) = \frac{3 \times 10^4}{\text{SAMPLE RATE}} \times C5(pF)$$

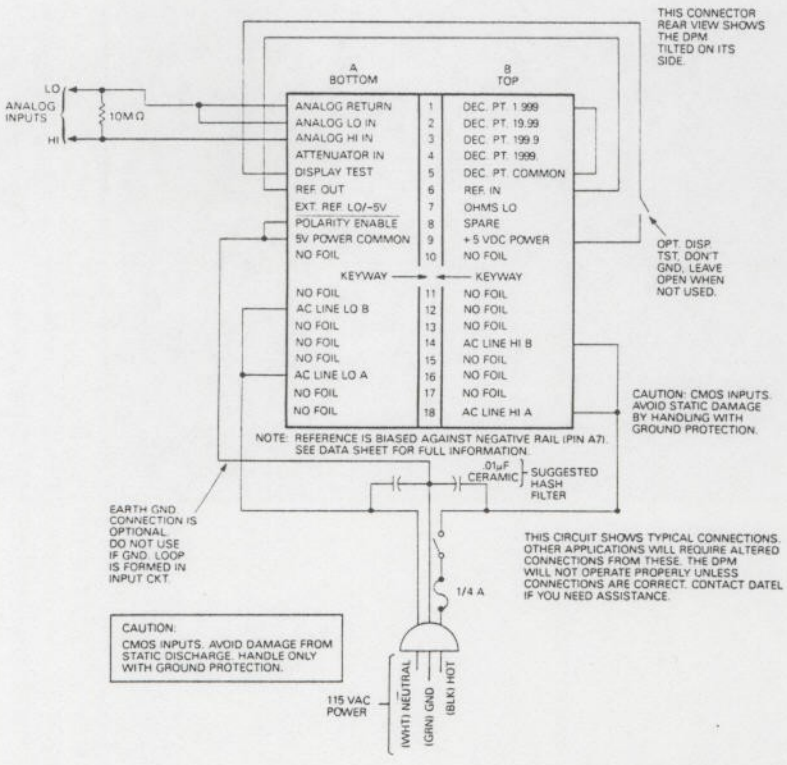
R8 MAY BE TRIMMED FOR EXACTLY 48 kHZ on IC PIN 38 (MEASURE WITH LOW CAPACITY PROBE) FOR BEST 60 HZ NOISE REJECTION. FOR 50 HZ, USE 120 pF AT C5 RETRIM. REDUCE R8 FOR FASTER SAMPLING.

Some versions of the DM-3100B have solder gaps on the bottom of the converter board, rather than a jumper at R1. Before attenuating resistors can be added to the DM-3100B, this solder gap must be opened with a soldering iron.

DECIMAL POINT WIRING



INPUT/OUTPUT CONNECTIONS WITH SINGLE-ENDED INPUT

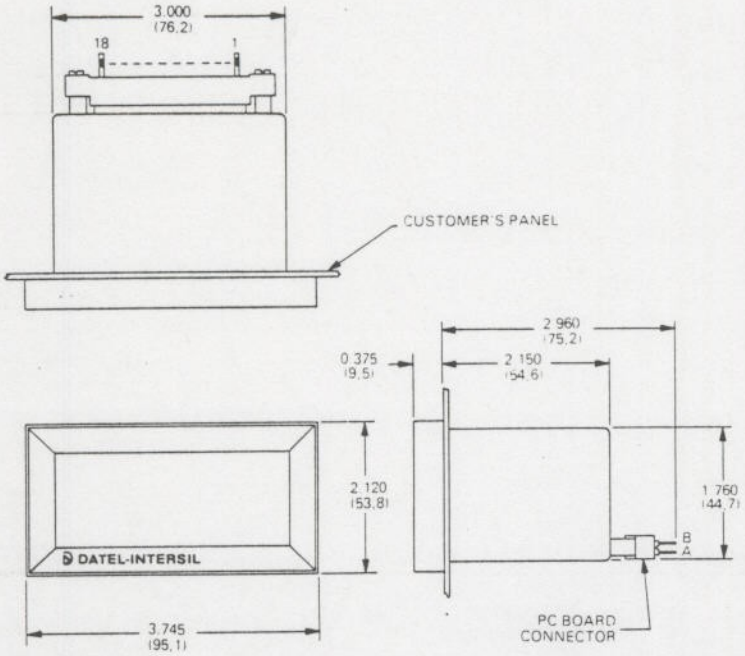


ORDERING INFORMATION

MODEL	DESCRIPTION	QUANTITY (1-9)
DM-3100B	DPM, AC-Powered	
58-2075010	Dual 18-pin connector, .100" ctrs., solder-tabs (not included)	

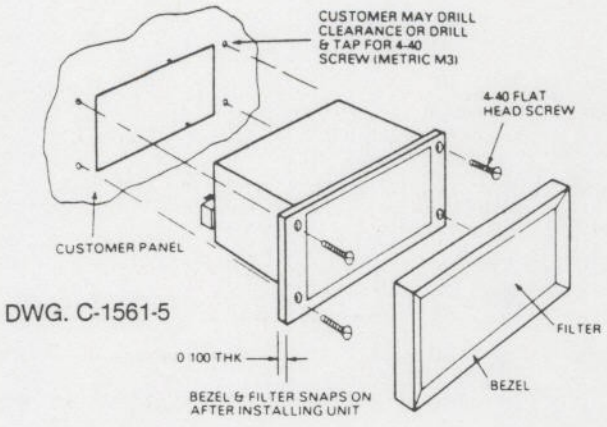
DATEL-INTERSIL

MECHANICAL DIMENSIONS
INCHES (MM)



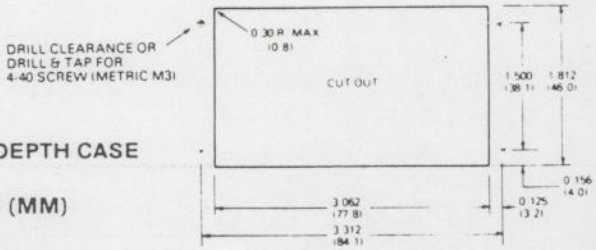
DWG. C-1561-4

PANEL MOUNTING



DWG. C-1561-5

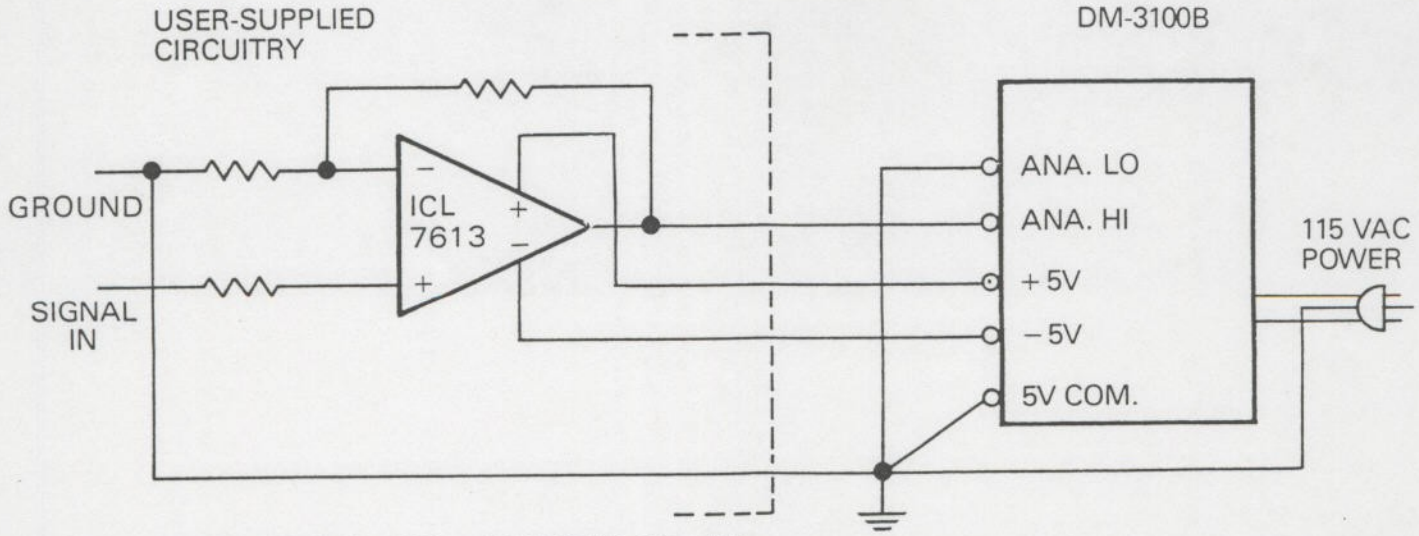
SHORT DEPTH CASE
INCHES (MM)



DWG. C-1561-3

SINGLE-ENDED INPUT WITH GAIN

The internal power supply of the DM-3100B can be used to power external circuitry. The drawing below shows an op amp—user-supplied—in a single-ended configuration to provide gain for a low level input. Power is from the +5V and −5V power in connections (B9 and A7, respectively) on the DM-3100B. Where low level signals will be amplified, it is important to pay attention to ground routing. A single common ("Mecca") ground point, as indicated in the diagram, is recommended.



LOW-CURRENT, ±5V – POWERED OP AMP.

APPLICATIONS

RATIOMETRIC CONNECTIONS WITH BRIDGE INPUTS

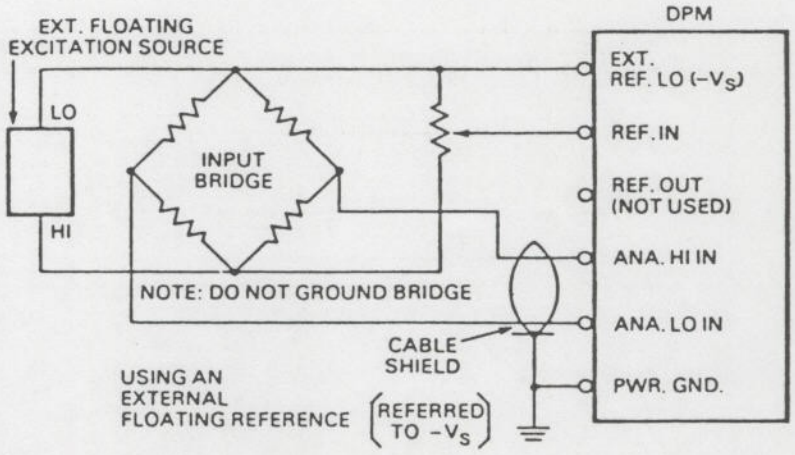
The DM-3100B has a reference in-out loop which makes possible ratiometric measurements. Representative connections are illustrated below. Ratiometric operation eliminates changes in the DPM reading due to voltage variations in the Bridge's external excitation source. The input gain on the DM-3100B varies inversely with voltage at Reference In — as REF IN voltage increases, meter gain decreases. Meter input gain thus can be made to compensate for variations in the bridge excitation source voltage. (The DPM is set for unity gain when REF IN V equals +1V as referred to $-V_S$).

For all applications, $V_{IN} = 2\ V_{REF}$ at full scale (1999 counts). For small values of V_{REF} (100 mV or lower), increased display noise, nonlinearity, rollover and CMR errors will be apparent. Avoid V_{REF} inputs beyond about 2V to prevent integrator saturation with full scale inputs. Variable V_{REF} is not intended for wide gain changes as in multimeter applications. Instead, it should be used for drift correction, scaling to engineering units, or for modest amounts of gain.

A note on grounding: The DM-3100B's internal voltage reference source is biased against the internal negative supply rail ($-V_S$). Note that this is *not* the same electrical connection as the 5V Power Common connection. Refer to the Simplified Block Diagram.

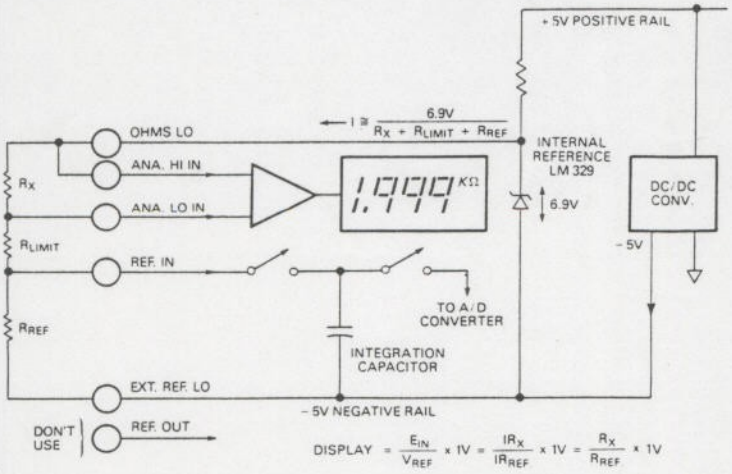
Because of this configuration, external reference sources should be isolated from the 5V Power Common and should have the Reference Lo Output from the external source connected to the negative supply rail.

$$\text{DISPLAY} = \frac{1\ \text{VOLT}}{(\text{REF. IN}) - \begin{pmatrix}\text{EXT.}\\ \text{REF.}\\ \text{LO}\end{pmatrix}} \times \begin{pmatrix}\text{ANA}\\ \text{HI}\\ \text{IN}\end{pmatrix} - \begin{pmatrix}\text{ANA}\\ \text{LO}\\ \text{IN}\end{pmatrix}$$



DIGITAL OHMMETER CONNECTIONS

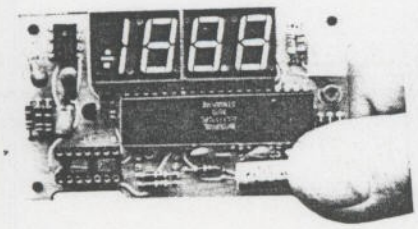
The digital ohmmeter circuit uses the DM-3100B's ratiometric capability. An external reference resistor of known resistance, accuracy, and temperature drift is connected in series with the unknown resistance. A constant, stable voltage from the DPM's internal reference diode is applied to the resistor pair to produce a constant current. This current develops two voltage drops across the resistors which are proportional only to the ratio of the resistances since the current through them is identical.



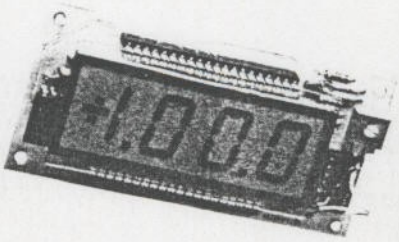
The chart below lists recommended R_{REF} and R_{LIMIT} resistance values corresponding to different ohmmeter ranges. Values of R_{LIMIT} were selected to limit the current through R_{REF} and Rx to 1 milliampere maximum.

RANGE	RESOLUTION	R_{LIMIT}	R_{REF}	DECIMAL POINT
19.99 MΩ	10 kΩ	22 MΩ	10 MΩ	B2 to B5
1.999 MΩ	1 kΩ	3.6 MΩ	1 MΩ	B1 to B5
199.9 kΩ	100 Ω	360 kΩ	100 kΩ	B3 to B5
19.99 kΩ	10 Ω	36 kΩ	10 kΩ	B2 to B5
1.999 kΩ	1 Ω	6.2 kΩ	1 kΩ	B1 to B5

THE FORCE IN DPM'S.



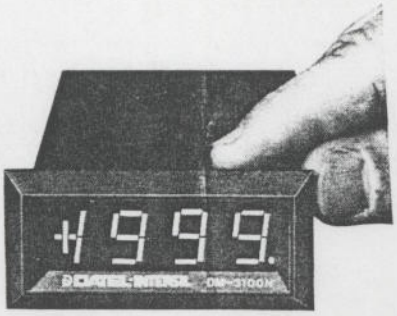
ULTRA-LOW COST OEM
Tiny 2" x 3.5" single-board with .62" panel depth
Accepts components for 2 to 200V, 20 μA to 2A, and digital ohmmeter ranges
Noise-rejecting balanced differential inputs
5 Vdc power @ 280 mA
DM-31, Stock to 2 weeks



MICROPOWERED .75"-HIGH LCD
2" x 4" single-board with .56" panel depth
Battery-powered 5 Vdc @ 3.5 mA
Large, easy-to-read .75" digits
Balanced differential, low noise input
Autozeroing, ratiometric for drift correction
DM-LX3, Stock to 4 weeks

LOW-COST 4½ DIGITS
1000 Megohms input impedance, 5 pA bias current
Autozeroing, ratiometric for drift-correction
4½ digits for large-scale indications Example: 15,000 pounds full scale
Accepts components for 2V to 200V, 20 μA to 2A ranges
DM-4100L, Stock to 4 weeks

MINIATURE AC-POWERED
Dual Power 115/230 VAC, pin-selected
Low-noise Balanced Differential Inputs
Autozeroed, ratiometric drift-correction
3½ LED Digits, ±2V basic range
1000 Megohm input impedance, 5 pA bias current
DM-3100B, Stock to 4 weeks



LOW-COST MULTIRANGE
Accepts user-installed components for:
1. Any voltage range ±2V to ±200V
2. Any current range ±20 μA to ±2A
3. Digital Ohmmeter 200Ω to 10 MΩ FS
4. Offset pot for 4-20 mA and others Noise-rejecting balanced differential input

+5 Vdc power @ 280 mA
DM-3100N, Stock to 4 weeks

MICROBUSSABLE 3-STATE BCD
4½ digit data gated out in 4-bit nibbles, full parallel selectable
Connects directly to shared microprocessor busses
1000 Megohm input impedance, 5 pA bias current
Autozeroed, ratiometric to correct drift
5 Vdc power @ 500 mA
DM-4100D, Stock to 4 weeks

Datel-Intersil has a dozen DPM's for instrument makers. All prices are 1 to 9 quantity.
Contact Datel-Intersil for generous OEM quantity discounts.

DATEL INTERSIL
11 CABOT BOULEVARD, MANSFIELD, MA 02048/TEL. (617)339-9341/TWX 710-346-1953/TLX 951340
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• Los Angeles, CA (213)933-7256 • Houston, TX (713)939-7271 • Dallas, TX (214)241-0651
OVERSEAS: INTERSIL DATEL (UK) LTD-TEL. BASINGSTOKE (0256) 57361 • INTERSIL DATEL SARL-TEL. 602 57 11 •
INTERSIL DATEL GmbH-TEL. (89)530741 • DATEL KK TOKYO-TEL. 793-1031

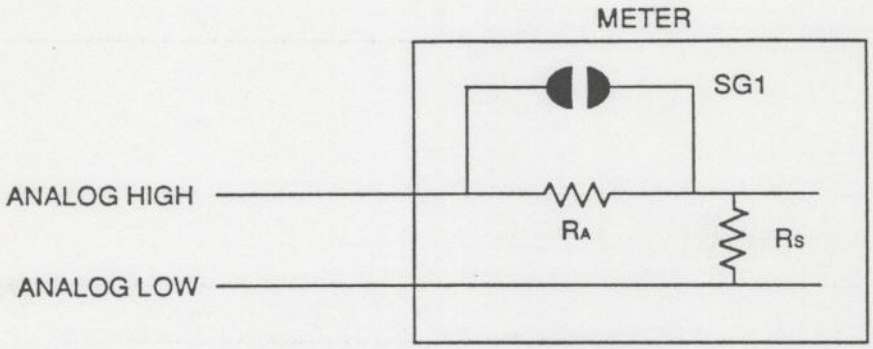
PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

11/81 BULLETIN DMBBJ05111

MODIFYING THE METER'S INPUT RANGE

All DATEL DPM's are shipped with a standard input range configuration of ±2V dc. It is quite easy to change the input range by installing an attenuation resistor and shunt resistor. DATEL DPM's have pads on the circuit board for the installation of these two resistors. Install an attenuation resistor (R_A) in series with the ANALOG HIGH input, and a shunt resistor (Rs) across ANALOG HIGH and ANALOG LOW. For higher voltage input ranges, a solder gap (SG1) must be opened in conjunction with the installation of R_A.

The figure below shows the resistor and solder gap configuration. For most meters, the exact locations of the resistor pads and solder gap are shown in the meter's Data Sheet. In some cases this information is missing or incorrect. See the reverse of this page for updated information.



Range	R_A	Rs	SG1
±2V dc	–	–	–
±20V dc	10 MΩ	1.1 MΩ	OPEN
±200V dc	10 MΩ	100 KΩ	OPEN
±200 mA	–	10Ω, 1W	CLOSE
±20 mA	–	100Ω	CLOSE
±2 mA	–	1 KΩ	CLOSE
±200 µA	–	10 KΩ	CLOSE
±20 µA	–	100 KΩ	CLOSE

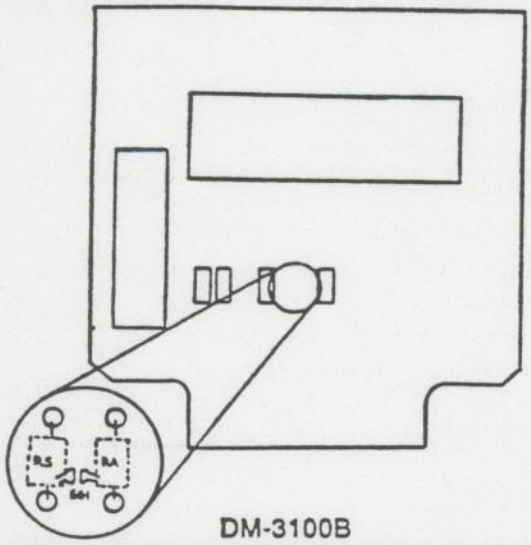
For input ranges not shown, use the general equation: Where: $50\ K\Omega < R_A + Rs < 10\ M\Omega$

$$\frac{Rs}{R_A + Rs} \quad \text{Multiplied by Range} = 2.0$$

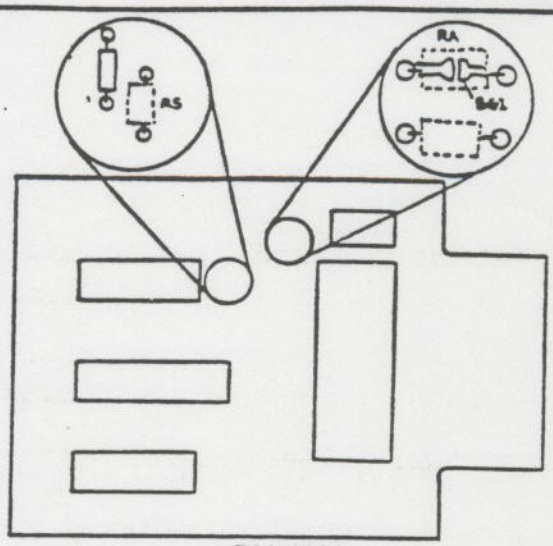
IMPORTANT:

1. Use 1%, 1/4W metal-film resistors (except where noted).
2. RA and RS values may be different, as long as the proportions shown in the table above are maintained.
3. With a few exceptions, RA is designated as R1 on component layouts and RS as R2. The solder gap is generally labled "SG1" and is located on the wiring side of the printed circuit board. Consult individual product Data Sheets.
4. Change the decimal point location for correct readout of nonstandard input ranges. Consult the meter's Data Sheet.
5. After installing resistors, recalibrate the meter according to the procedures described in the meter's Data Sheet.

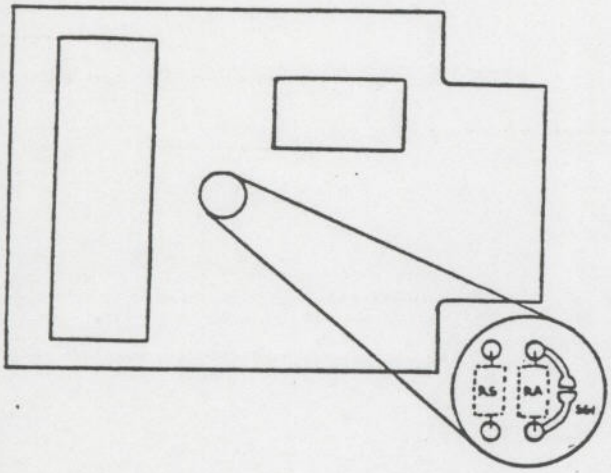
RESISTOR AND SOLDER GAP LOCATIONS
(If your meter is not pictured, consult Data Sheet)



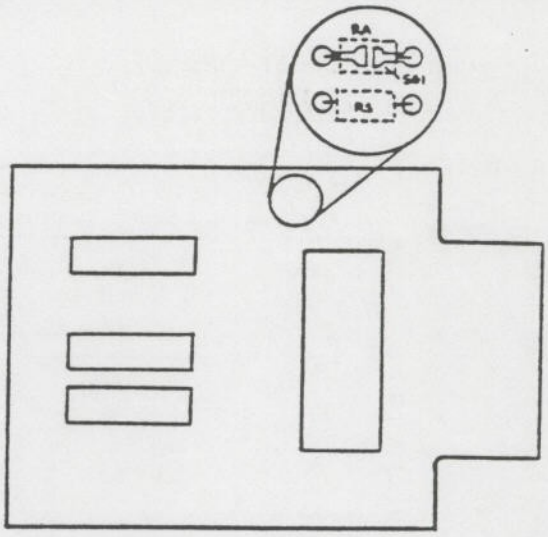
DM-3100B



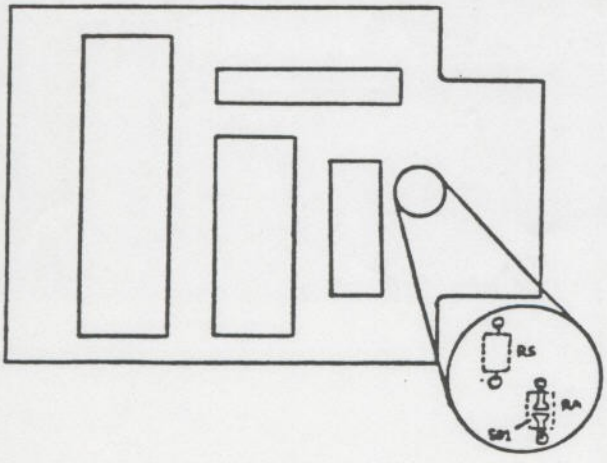
DM-4200



DM-3100U2/U3



DM-4101D



DM-4105

WARNING: DATEL panel meters contain sensitive CMOS devices which are easily damaged. Meter modifications should only be attempted by skilled technicians.

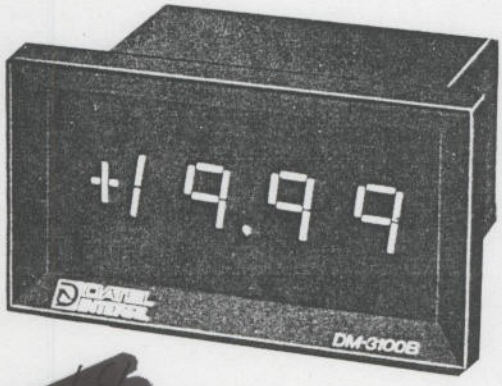
DM-3100B
AC-Powered, 3½ Digit LED Digital Panel Meter

FEATURES

- **Dual Voltage Power - 115/230 VAC, pin-selected**
- **Low Cost —**
- **Balanced Differential Inputs, 80 dB CMR Noise Rejection**
- **Autozeroing, Ratiometric Reference for Drift Correction**
- **1000 MΩ CMOS High Impedance Inputs**
- **Display - .56" High Numerals Red LED**
- **Compact, Short Depth Case - 3.00"W x 2.15"D x 1.76"H (76,2 x 54,6 x 44,7 mm)**

APPLICATIONS

- **Ammeter** - Accepts user-supplied shunts for ±20 μA to ±2A Full Scale Ranges
- **Voltmeter** - Accepts user-supplied attenuators for ±2V to ±1 kV Full Scale Ranges
- **Ohmmeter** - 200Ω to 10MΩ Full Scale Range



DESCRIPTION

The DM-3100B is a very low cost, dual AC-powered Digital Panel Meter. Analog voltages over the range of ±1.999 Vdc are displayed with 3½ digits of resolution. The DM-3100B is powered from the AC line; 115 or 230 VAC is pin-selectable. The unit can provide +5V and −5 Vdc (@ 100 milliamps and 5 milliamps respectively) to power customer-supplied external circuitry.

The DM-3100B uses a self-illuminated red LED display with .56" high numerals. It is clearly visible from many feet away in normal or dim light.

Inputs to the DM-3100B are balanced differential (80 dB Common Mode Rejection) so the meter will accurately display small signals even in electrically noisy industrial environments. CMOS circuitry results in an extremely high input impedance (1000 Megohms, typically) and a very low bias current of 5 picoamps - inputs with a source impedance as high as 100 kilohms can be displayed with accuracy. The input circuitry will also safely tolerate overvoltages up to ±250 Vdc (155 VRMS). Inputs are sampled and displayed about four times per second.

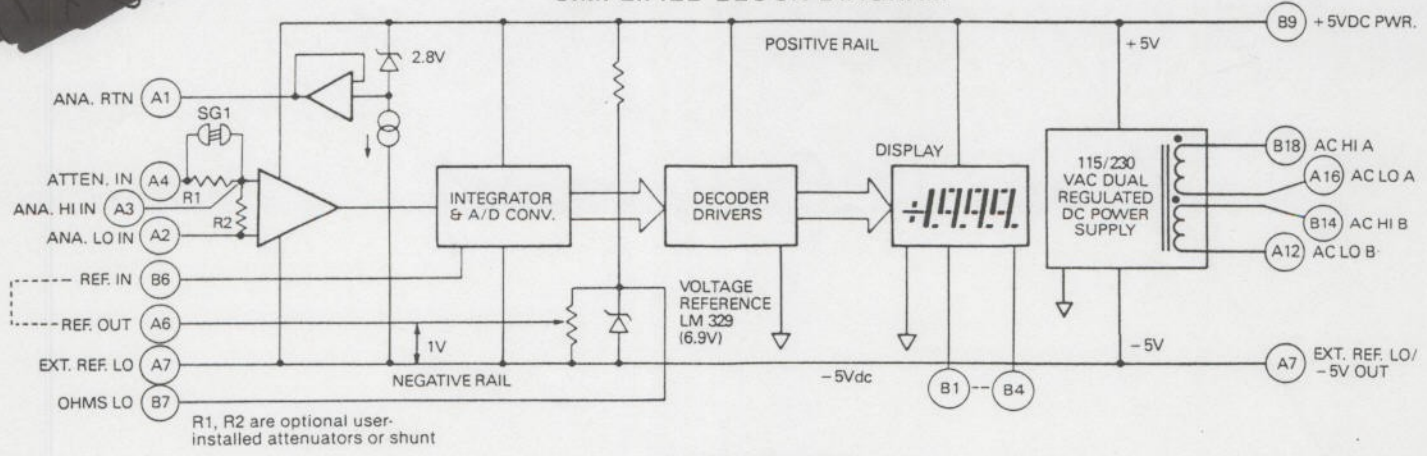
Autozeroing and a ratiometric reference in-out loop permit the DM-3100B to be used for drift correction in bridge-type measurement systems. Meter accuracy is adjustable to ±1/10% (±1 count). Temperature drift of zero is ±1 count from 0 to 50°C, while temperature drift of gain runs typically ±50 ppm of Reading/°C.

The AC-powered DM-3100B was designed for installations where existing dc supplies are noisy, inaccessible, or overloaded. This meter may be used wherever a voltage, or a unit which can be made proportional to voltage, must be displayed with accuracy and clarity. The basic input range of ±1.999 Vdc can be expanded with a simple voltage divider to display voltages up to ±1kV or up to ±2A using current shunts. Blank pads on the meter's circuit board can accept user-supplied voltage attenuator resistors, current shunts, or digital ohmmeter components.

The DM-3100B is supplied in Datel's standard short depth black polycarbonate case, measuring only 3.00"W x 2.15"D x 1.76"H. All connections are made on the back panel to an optional 18-pin edge connector. Cutout dimensions are 1.812"H x 3.062"W (46,0 x 77,8 mm), minimum.

Note: DPM's are supplied without bezel labels and logos.

SIMPLIFIED BLOCK DIAGRAM



MODEL DM-3100B

DATEL-INTERSIL

SPECIFICATIONS, DM-3100B
(Typical @ +25°C, unless noted)

ANALOG INPUT

Configuration	True, balanced differential bipolar −1.999 Vdc to +1.999 Vdc Input pad area will accept user-installed range change
Input Bias Current	5 pA typical, 50 pA maximum
Displayed Accuracy @ +25°C	Adjustable to ±0.1% reading, ±1 count
Resolution	1 mV
Temperature Drift of Zero	Autozeroed ±1 count over 0 to +50°C
Temperature Drift of Gain	±50 ppm of Reading/°C typ. ±100 ppm of Reading/°C max.
Input Impedance	100 Megohms, minimum
Input Overvoltage	±250 Volts dc,155 VRMS continuous max. ±300 Volts intermittent max.
Common Mode Rejection	80 dB, DC to 60 Hz, 1 Kilohm unbalance
Common Mode Voltage Range	Within +Vs − .5V and −Vs +1V where +Vs is the positive rail (Pin B9) and −Vs is the negative rail (Pin A7)). −Vs is approximately equal to −5V below PWR. COM. (Pin A9)
Warm-Up Time	Within 10 minutes
Reference	Internal, referred to the negative rail (−Vs). External, user-supplied reference optional for ratiometric operation.
External Ref. Range	+100 mV to 2V, referred to −Vs
Ramp-up Time (Integration Period)	83.3 mS

DISPLAY

Number of Digits	3 decimal digits and most significant "1" digit (3½ digits)
Decimal Points	Selectable decimal points are included for scale multipliers.
Display Type	Red, light-emitting diode (LED) self illuminated.
Display Height	0.56 inches (14,2 mm)
Overscale	Inputs exceeding the full scale range blank the display, leaving a "1" MSD and sign.
Autopolarity	A minus sign is automatically displayed for negative inputs, and may also be blanked
Sampling Rate	Factory set at 3 conversions per second. May be rewired up to 20 conversions/second.

I/O CONNECTIONS

Analog HI Input (Pin A3) **Analog LO Input (Pin A2)**	Differential input voltages are connected between these inputs. A bias current path to POWER COMMON (if ±5V-powered) or ANALOG RETURN from both these inputs must be externally provided. External circuits must constrain these inputs to be within the common mode voltage range.
Attenuator IN (Pin A4)	Connected in series through R1 (Optional attenuator resistor) to Ana. HI In (Pin A3). Supplied with a jumper in place of R1.
Analog Return (Pin A1)	This pin may be used as a low-noise bias current return for some floating inputs. If not possible, inputs may be referenced to POWER COMMON (if ±5V-powered). Analog Return is approximately −2.8V below +Vs and can sink 30 mA to −Vs.
Reference In/Out (Pins B6/A6)	Normally, REF. IN and REF. OUT should be jumpered together. An external floating source referred to EXT. REF. LO (Pin A7) may be substituted for ratiometric operation.
Decimal Points	Connect selected pin to DECIMAL POINT COMMON (Pin B5)
Display Test (Pin A5)	Connect this input to +5 Vdc (Pin B9) to light all display segments.
$\overline{\text{Polarity}}$ $\overline{\text{Enable}}$ (Pin A8)	Ground this input to Pin A9 to automatically display a minus sign for negative inputs.
Ohms Lo (Pin B7)	This connection is used in the ohmmeter configuration, otherwise do not use.

POWER CONNECTIONS

For 115 VAC input: (parallel both windings)

1. Connect AC LINE HI A (Pin B18) to AC LINE HI B (Pin B14). Connect both to the hot side of the AC line (mains).
2. Connect AC LINE LO A (Pin A16) to AC LINE LO B (Pin A12). Connect both to the neutral side of the AC line (mains).

For 230 VAC input: (Series both windings)

1. Connect AC LINE HI B (Pin B14) to AC LINE LO A (Pin A16). Make no other connections to these two leads.
2. Connect AC LINE HI A (Pin B18) to the the hot side of the AC line (mains).
3. Connect AC LINE LO B (Pin A12) to the neutral side of the AC line (mains).

DC Power Ground (Pin A9) may be connected to earth ground if input circuits permit.

For DC-Power Only:
A bipolar ±5V power supply or two isolated single supplies are required.

Connect +5V to Pin B9, −5V to Pin A7 and Power Ground to Pin A9

POWER REQUIREMENTS

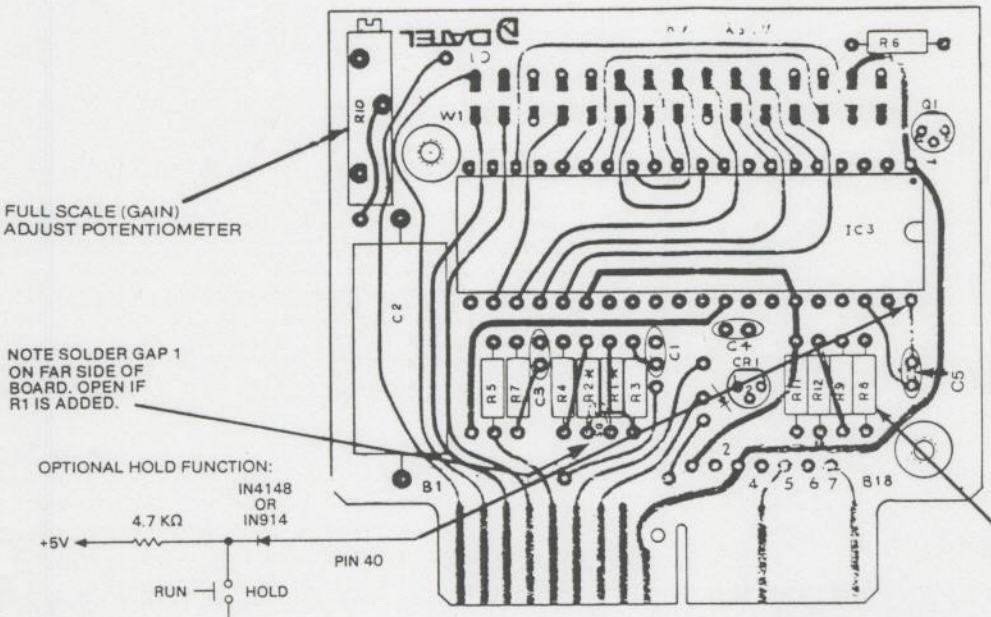
AC Power	115 or 230 VAC, ±10%, 47 to 440 Hz, 4 watts typical
DC Power (Users will normally power from AC-only. DC-only power is optional.)	+5V ±0.25 Vdc @ 250 mA typical, 400 mA max. and −5V Vdc @ 5 mA typ, 25 mA max. Logic spikes must be less than 50 mV. Bypass supplies externally if necessary.
Calibration	A multiturn screwdriver pot adjusts the full scale reading (gain). Zero is automatic (autozeroing). Suggested recalibration in stable conditions is 90 days.

PHYSICAL-ENVIRONMENTAL

Short-Depth Case	Interchangeable with other Datel cases.
Outline Dimensions	3.00"W x 2.15"D x 1.76"H (76,2 x 54,6 x 44,7 mm)
Cutout Dimensions	1.812"H x 3.062"W (46,0 x 77,7 mm)
Mounting Method	Through a front panel cutout secured by (4) 4-40 front access screws which are concealed by the bezel.
Weight	Approximately 5 ounces (142g)
Connector	Double-sided edgeboard PC type, solder tab, gold-plated fingers, Dual 18-pin, 0.100" centers, Datel #58-2075010, (not included)
Mounting Position	Any
Operating Temperature Range	0 to +50°C
Storage Temperature Range	−25 to +85°C
Altitude	0 to 15,000 feet (4600m)
Relative Humidity	20% to 80% non-condensing

DATEL-INTERSIL

DM-3100B COMPONENT LOCATIONS



RC OSCILLATOR

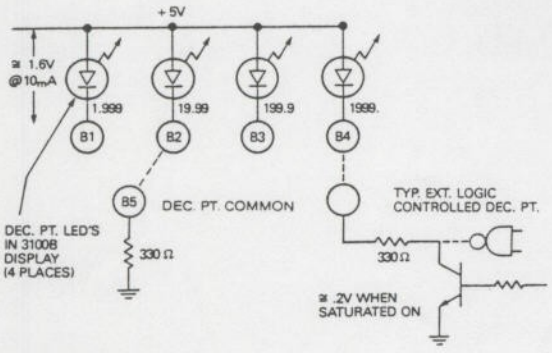
R8 (100KΩ)

$$R8\ (K\Omega) = \frac{3 \times 10^4}{\text{SAMPLE RATE}} \times C5(pF)$$

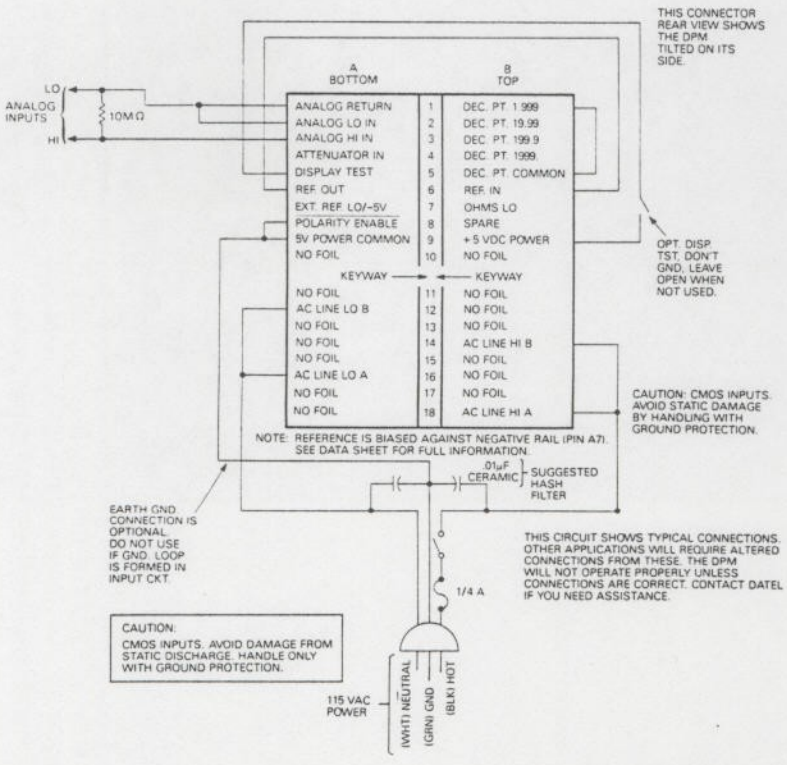
R8 MAY BE TRIMMED FOR EXACTLY 48 kHZ on IC PIN 38 (MEASURE WITH LOW CAPACITY PROBE) FOR BEST 60 HZ NOISE REJECTION. FOR 50 HZ, USE 120 pF AT C5 RETRIM. REDUCE R8 FOR FASTER SAMPLING.

Some versions of the DM-3100B have solder gaps on the bottom of the converter board, rather than a jumper at R1. Before attenuating resistors can be added to the DM-3100B, this solder gap must be opened with a soldering iron.

DECIMAL POINT WIRING



INPUT/OUTPUT CONNECTIONS WITH SINGLE-ENDED INPUT

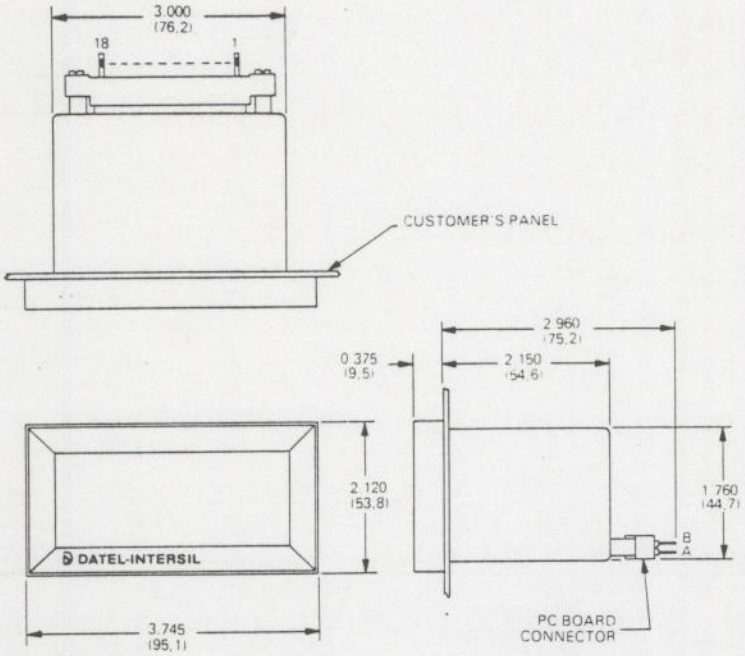


ORDERING INFORMATION

MODEL	DESCRIPTION	QUANTITY (1-9)
DM-3100B	DPM, AC-Powered	
58-2075010	Dual 18-pin connector, .100" ctrs., solder-tabs (not included)	

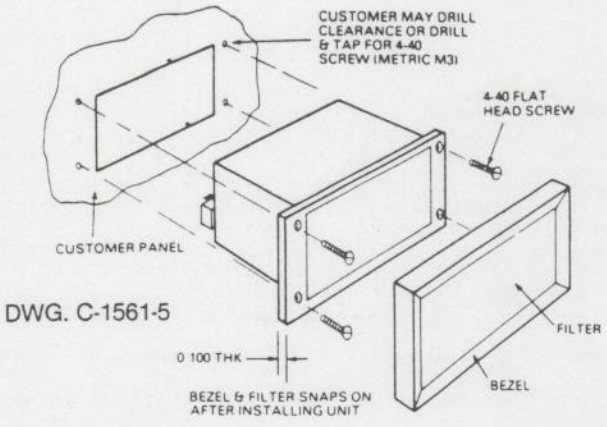
DATEL-INTERSIL

MECHANICAL DIMENSIONS
INCHES (MM)



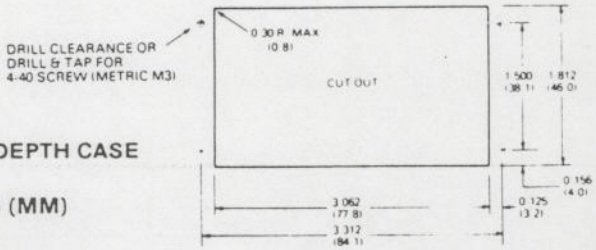
DWG. C-1561-4

PANEL MOUNTING



DWG. C-1561-5

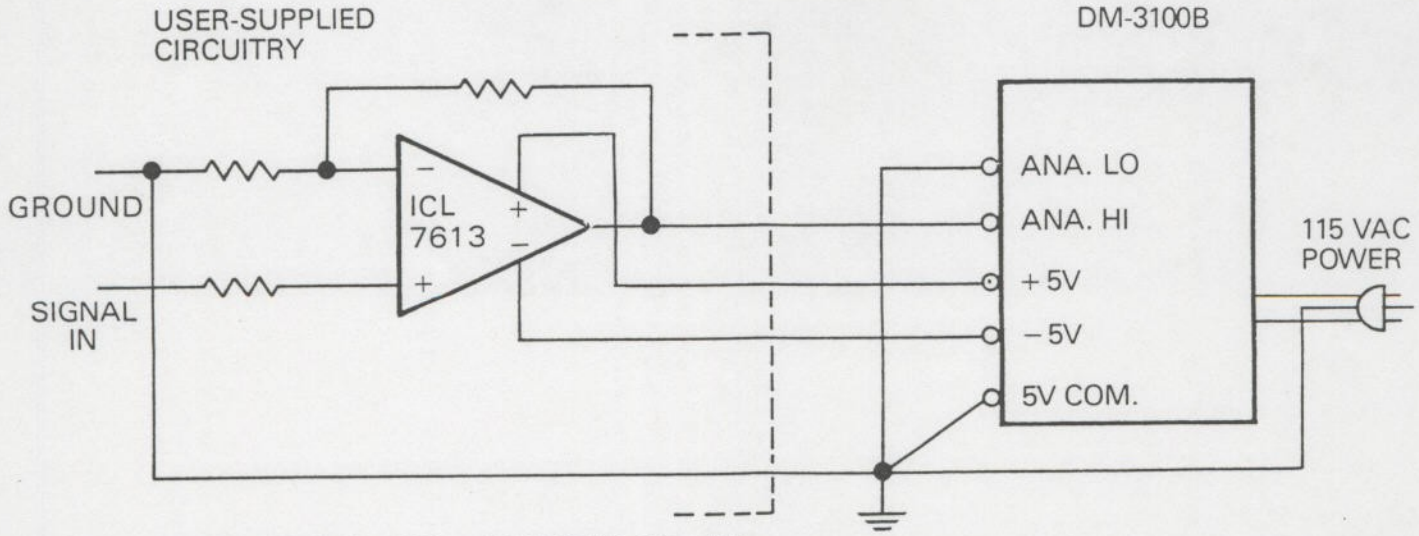
SHORT DEPTH CASE
INCHES (MM)



DWG. C-1561-3

SINGLE-ENDED INPUT WITH GAIN

The internal power supply of the DM-3100B can be used to power external circuitry. The drawing below shows an op amp—user-supplied—in a single-ended configuration to provide gain for a low level input. Power is from the +5V and −5V power in connections (B9 and A7, respectively) on the DM-3100B. Where low level signals will be amplified, it is important to pay attention to ground routing. A single common ("Mecca") ground point, as indicated in the diagram, is recommended.



LOW-CURRENT, ±5V – POWERED OP AMP.

APPLICATIONS

RATIOMETRIC CONNECTIONS WITH BRIDGE INPUTS

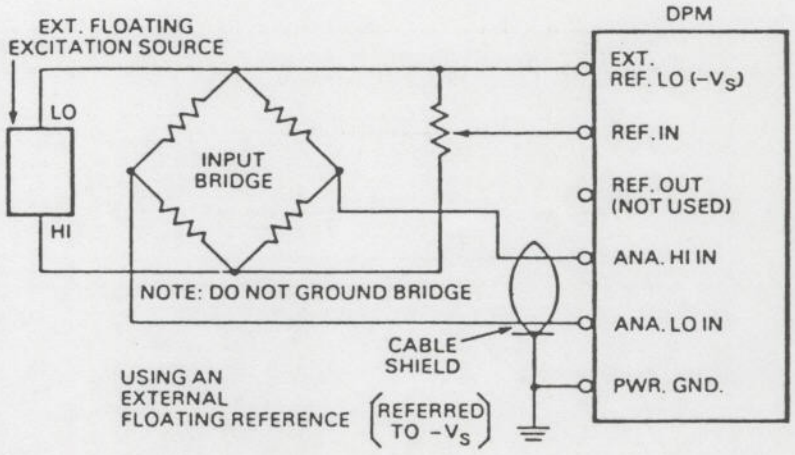
The DM-3100B has a reference in-out loop which makes possible ratiometric measurements. Representative connections are illustrated below. Ratiometric operation eliminates changes in the DPM reading due to voltage variations in the Bridge's external excitation source. The input gain on the DM-3100B varies inversely with voltage at Reference In — as REF IN voltage increases, meter gain decreases. Meter input gain thus can be made to compensate for variations in the bridge excitation source voltage. (The DPM is set for unity gain when REF IN V equals +1V as referred to $-V_S$).

For all applications, $V_{IN} = 2\ V_{REF}$ at full scale (1999 counts). For small values of V_{REF} (100 mV or lower), increased display noise, nonlinearity, rollover and CMR errors will be apparent. Avoid V_{REF} inputs beyond about 2V to prevent integrator saturation with full scale inputs. Variable V_{REF} is not intended for wide gain changes as in multimeter applications. Instead, it should be used for drift correction, scaling to engineering units, or for modest amounts of gain.

A note on grounding: The DM-3100B's internal voltage reference source is biased against the internal negative supply rail ($-V_S$). Note that this is *not* the same electrical connection as the 5V Power Common connection. Refer to the Simplified Block Diagram.

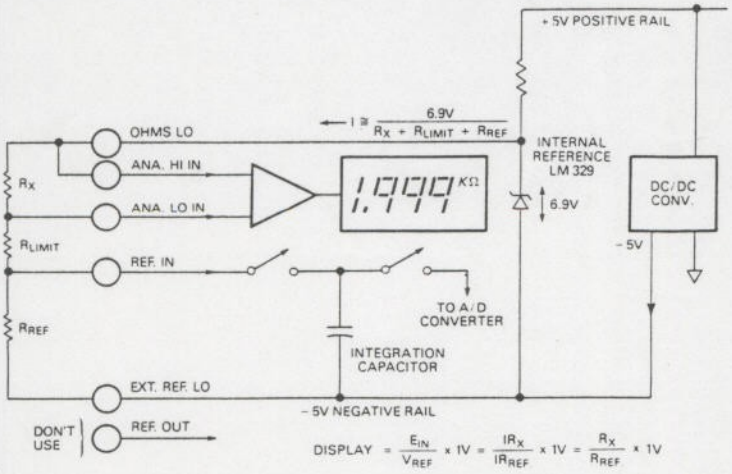
Because of this configuration, external reference sources should be isolated from the 5V Power Common and should have the Reference Lo Output from the external source connected to the negative supply rail.

$$\text{DISPLAY} = \frac{1\ \text{VOLT}}{(\text{REF. IN}) - \begin{pmatrix}\text{EXT.}\\ \text{REF.}\\ \text{LO}\end{pmatrix}} \times \begin{pmatrix}\text{ANA}\\ \text{HI}\\ \text{IN}\end{pmatrix} - \begin{pmatrix}\text{ANA}\\ \text{LO}\\ \text{IN}\end{pmatrix}$$



DIGITAL OHMMETER CONNECTIONS

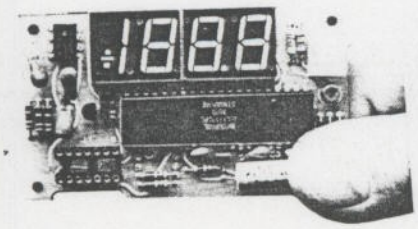
The digital ohmmeter circuit uses the DM-3100B's ratiometric capability. An external reference resistor of known resistance, accuracy, and temperature drift is connected in series with the unknown resistance. A constant, stable voltage from the DPM's internal reference diode is applied to the resistor pair to produce a constant current. This current develops two voltage drops across the resistors which are proportional only to the ratio of the resistances since the current through them is identical.



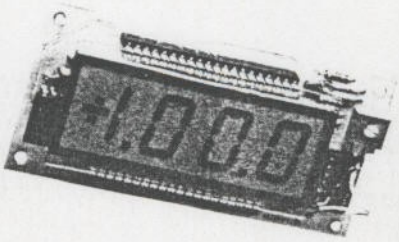
The chart below lists recommended R_{REF} and R_{LIMIT} resistance values corresponding to different ohmmeter ranges. Values of R_{LIMIT} were selected to limit the current through R_{REF} and Rx to 1 milliampere maximum.

RANGE	RESOLUTION	R_{LIMIT}	R_{REF}	DECIMAL POINT
19.99 MΩ	10 kΩ	22 MΩ	10 MΩ	B2 to B5
1.999 MΩ	1 kΩ	3.6 MΩ	1 MΩ	B1 to B5
199.9 kΩ	100 Ω	360 kΩ	100 kΩ	B3 to B5
19.99 kΩ	10 Ω	36 kΩ	10 kΩ	B2 to B5
1.999 kΩ	1 Ω	6.2 kΩ	1 kΩ	B1 to B5

THE FORCE IN DPM'S.



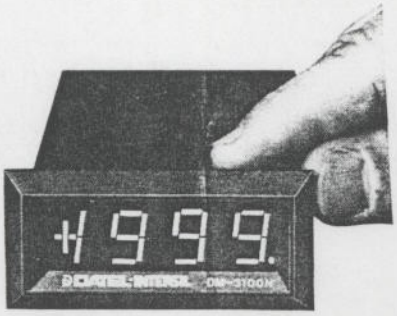
ULTRA-LOW COST OEM
Tiny 2" x 3.5" single-board with .62" panel depth
Accepts components for 2 to 200V, 20 μA to 2A, and digital ohmmeter ranges
Noise-rejecting balanced differential inputs
5 Vdc power @ 280 mA
DM-31, Stock to 2 weeks



MICROPOWERED .75"-HIGH LCD
2" x 4" single-board with .56" panel depth
Battery-powered 5 Vdc @ 3.5 mA
Large, easy-to-read .75" digits
Balanced differential, low noise input
Autozeroing, ratiometric for drift correction
DM-LX3, Stock to 4 weeks

LOW-COST 4½ DIGITS
1000 Megohms input impedance, 5 pA bias current
Autozeroing, ratiometric for drift-correction
4½ digits for large-scale indications Example: 15,000 pounds full scale
Accepts components for 2V to 200V, 20 μA to 2A ranges
DM-4100L, Stock to 4 weeks

MINIATURE AC-POWERED
Dual Power 115/230 VAC, pin-selected
Low-noise Balanced Differential Inputs
Autozeroed, ratiometric drift-correction
3½ LED Digits, ±2V basic range
1000 Megohm input impedance, 5 pA bias current
DM-3100B, Stock to 4 weeks



LOW-COST MULTIRANGE
Accepts user-installed components for:
1. Any voltage range ±2V to ±200V
2. Any current range ±20 μA to ±2A
3. Digital Ohmmeter 200Ω to 10 MΩ FS
4. Offset pot for 4-20 mA and others Noise-rejecting balanced differential input

+5 Vdc power @ 280 mA
DM-3100N, Stock to 4 weeks

MICROBUSSABLE 3-STATE BCD
4½ digit data gated out in 4-bit nibbles, full parallel selectable
Connects directly to shared microprocessor busses
1000 Megohm input impedance, 5 pA bias current
Autozeroed, ratiometric to correct drift
5 Vdc power @ 500 mA
DM-4100D, Stock to 4 weeks

Datel-Intersil has a dozen DPM's for instrument makers. All prices are 1 to 9 quantity.
Contact Datel-Intersil for generous OEM quantity discounts.

DATEL INTERSIL
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INTERSIL DATEL GmbH-TEL. (89)530741 • DATEL KK TOKYO-TEL. 793-1031

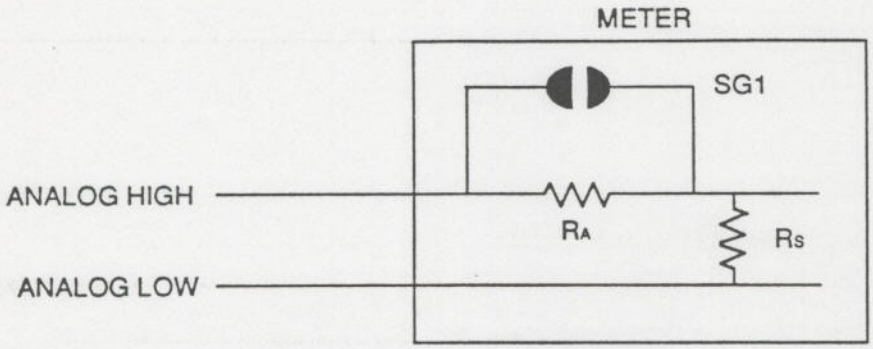
PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

11/81 BULLETIN DMBBJ05111

MODIFYING THE METER'S INPUT RANGE

All DATEL DPM's are shipped with a standard input range configuration of ±2V dc. It is quite easy to change the input range by installing an attenuation resistor and shunt resistor. DATEL DPM's have pads on the circuit board for the installation of these two resistors. Install an attenuation resistor (R_A) in series with the ANALOG HIGH input, and a shunt resistor (Rs) across ANALOG HIGH and ANALOG LOW. For higher voltage input ranges, a solder gap (SG1) must be opened in conjunction with the installation of R_A.

The figure below shows the resistor and solder gap configuration. For most meters, the exact locations of the resistor pads and solder gap are shown in the meter's Data Sheet. In some cases this information is missing or incorrect. See the reverse of this page for updated information.



Range	R_A	Rs	SG1
±2V dc	–	–	–
±20V dc	10 MΩ	1.1 MΩ	OPEN
±200V dc	10 MΩ	100 KΩ	OPEN
±200 mA	–	10Ω, 1W	CLOSE
±20 mA	–	100Ω	CLOSE
±2 mA	–	1 KΩ	CLOSE
±200 µA	–	10 KΩ	CLOSE
±20 µA	–	100 KΩ	CLOSE

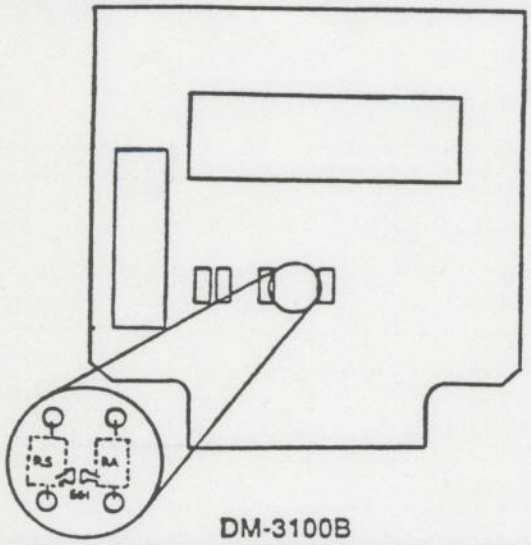
For input ranges not shown, use the general equation: Where: $50\ K\Omega < R_A + Rs < 10\ M\Omega$

$$\frac{Rs}{R_A + Rs} \quad \text{Multiplied by Range} = 2.0$$

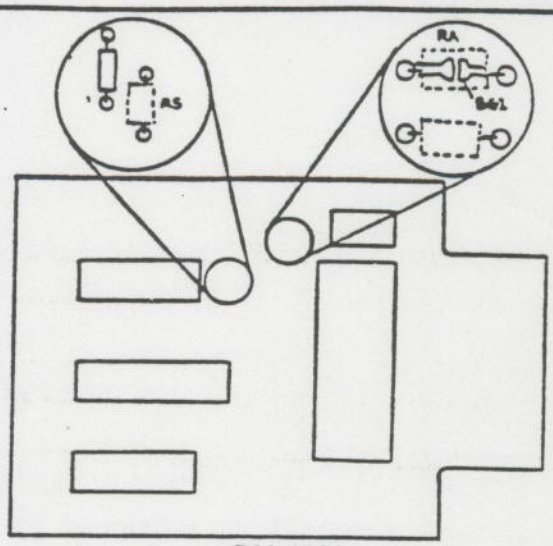
IMPORTANT:

1. Use 1%, 1/4W metal-film resistors (except where noted).
2. RA and RS values may be different, as long as the proportions shown in the table above are maintained.
3. With a few exceptions, RA is designated as R1 on component layouts and RS as R2. The solder gap is generally labled "SG1" and is located on the wiring side of the printed circuit board. Consult individual product Data Sheets.
4. Change the decimal point location for correct readout of nonstandard input ranges. Consult the meter's Data Sheet.
5. After installing resistors, recalibrate the meter according to the procedures described in the meter's Data Sheet.

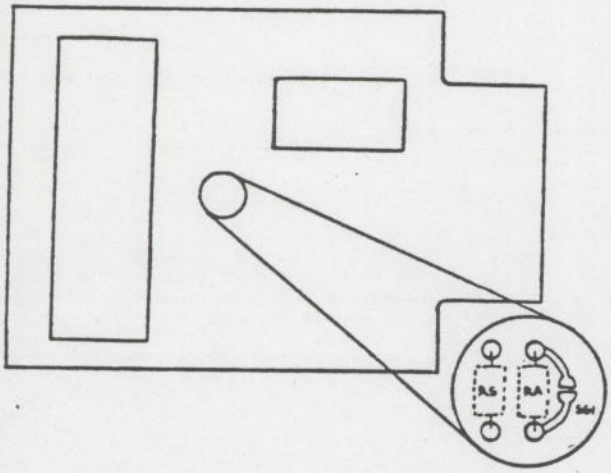
RESISTOR AND SOLDER GAP LOCATIONS
(If your meter is not pictured, consult Data Sheet)



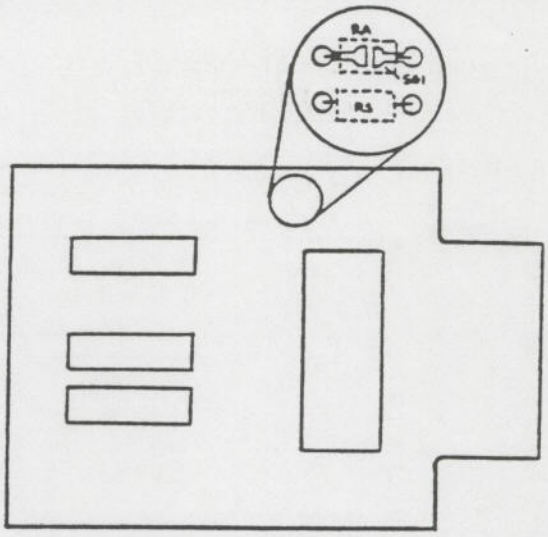
DM-3100B



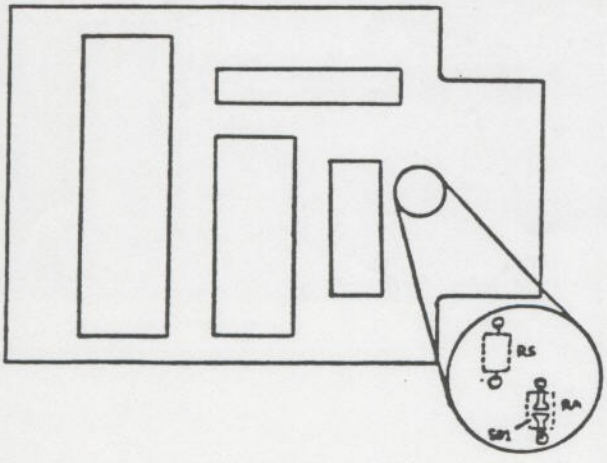
DM-4200



DM-3100U2/U3



DM-4101D



DM-4105

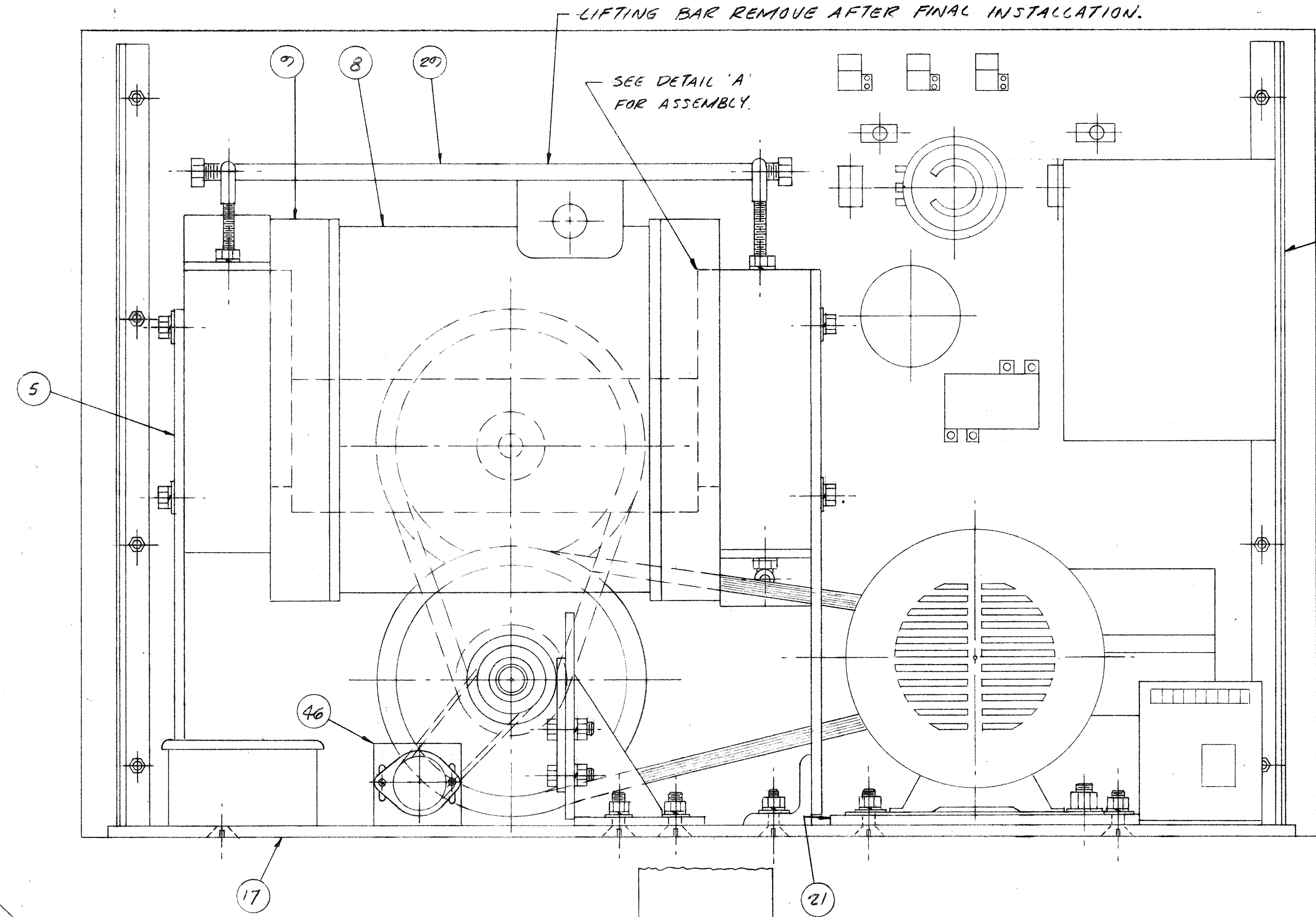
WARNING: DATEL panel meters contain sensitive CMOS devices which are easily damaged. Meter modifications should only be attempted by skilled technicians.

APPENDIX F

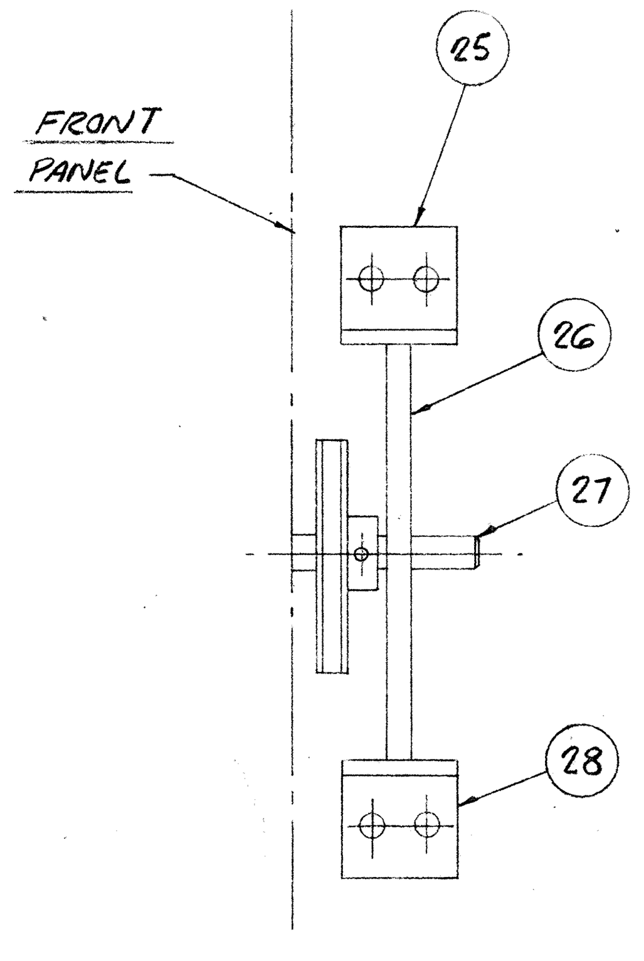
DRAWINGS

General Arrangement
Electrical Schematic

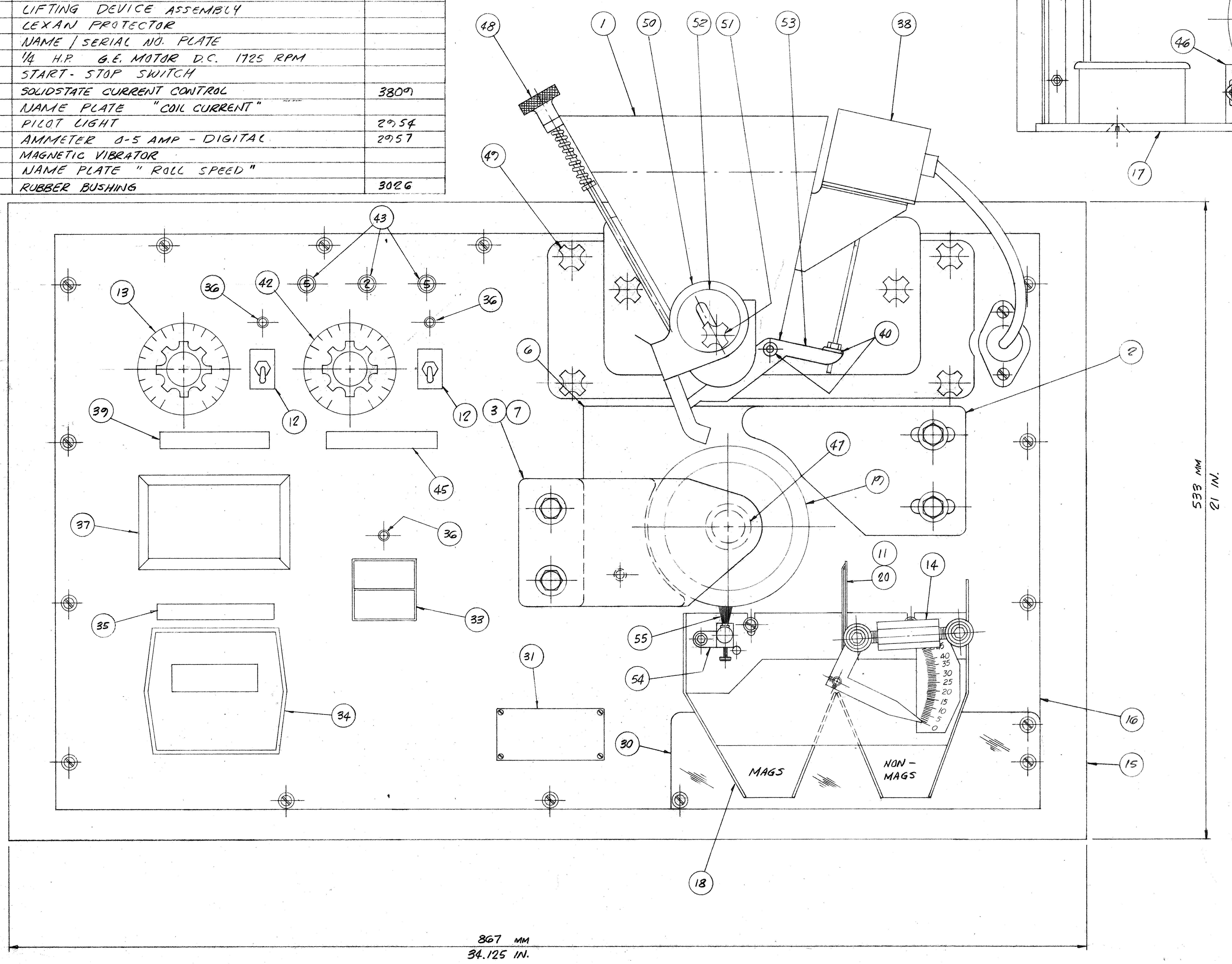
ITEM	QTY	DESCRIPTION	SP. NO.
1	1	VIBRATORY FEED HOPPER	
2	1	NOSE BLOCK	
3	1	TAIL BLOCK	
4	2	SIDE BLOCK	
5	2	SIDE BLOCK SUPPORT	
6	1	POLE PIECE BACK PLATE	
7	1	POLE PIECE CAP	
8	1	MAGNET COIL	
9	1	COIL SPACER	
10	1	CORE PIECE	
11	1	SPLITTER EDGE	
12	3	TOGGLE SWITCH ON / OFF	
13	1	SPEED CONTROL POTENTIOMETER	
14	1	SPLITTER ADJUSTMENT TURNBUCKLE	
15	1	CABINET	
16	1	FRONT PANEL	
17	1	BASE	
18	1	PRODUCT HOPPER	
19	1	SEPARATING ROLL	2962
20	2	THUMB KNOB - SPLITTER ADJM'T. - NOT SHOWN	
21	1	MOTOR BASE	
22	2	WATER COOLANT CONNECTIONS	
23	2	SUPPORT ANGLE	
24	1	JACK SHAFT	2975
25	1	INTERCHANGEABLE ROLL MOUNTING PLATE - LEFT	
26	1	" ROLL IDLER SHAFT SUPPORT	
27	1	" ROLL SHAFT	
28	1	" ROLL MOUNTING PLATE - RIGHT	
29	1	LIFTING DEVICE ASSEMBLY	
30	1	LEXAN PROTECTOR	
31	1	NAME / SERIAL NO. PLATE	
32	1	1/4 H.P. G.E. MOTOR D.C. 1725 RPM	
33	1	START - STOP SWITCH	
34	1	SOLIDSTATE CURRENT CONTROL	3809
35	1	NAME PLATE "COIL CURRENT"	
36	3	PILOT LIGHT	2954
37	1	AMMETER 0-5 AMP - DIGITAL	2957
38	1	MAGNETIC VIBRATOR	
39	1	NAME PLATE " ROLL SPEED "	
40	3	RUBBER BUSHING	3026
41	1	MOTOR JACKSHAFT BELT	2959
42	1	VARIABLE AUTOTRANSFORMER - FEEDER CONTROL	3028
43	3	CIRCUIT BREAKER	2956
44	1	JACKSHAFT ROLL BELT	3029
45	1	LEGEND STRIP " VIBRATOR CONTROL "	
46	1	TACHOMETER GENERATOR	
47	2	ROLL BEARING	2958
48	1	KNOB - FEED GATE ADJUSTMENT	
49	6	KNOB - FEED HOPPER ADJUSTMENT	3027
50	1	VELOCITY FEED CHUTE	
51	1	KNOB - VELOCITY FEED CHUTE ADJM'T	
52	1	ADJUTMENT WASHER	
53	1	VIBRATING FEED TRAY	
54	1	ROLL BRUSH HOLDER ASSEMBLY	3804
55	1	ROLL BRUSH (NYLON)	3805

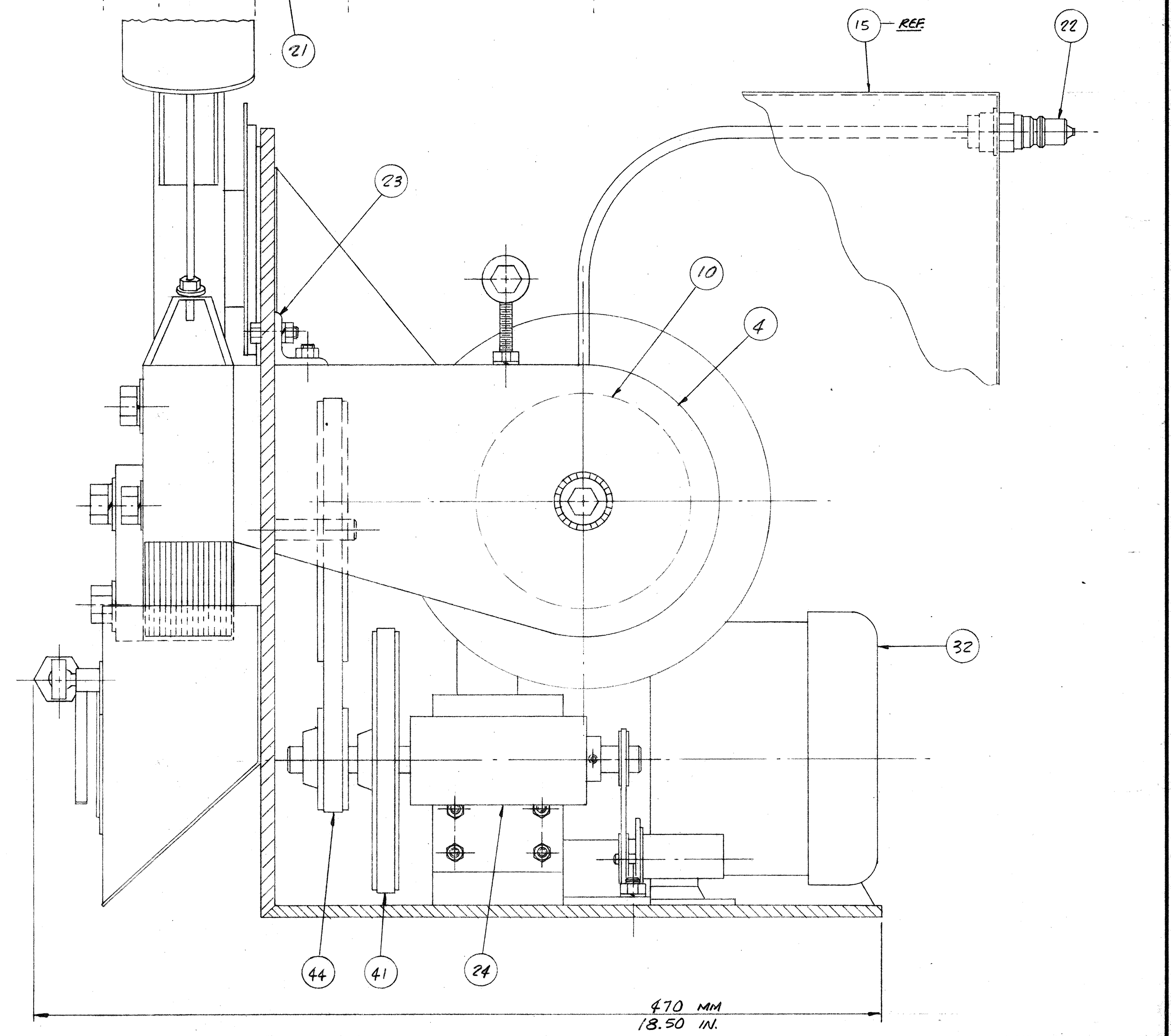


POWER
120 / 240 VAC
50 / 60 HZ
1 PHASE
7/4 AMPS FULL LOAD
WEIGHT
173 KGS / 392 LBS



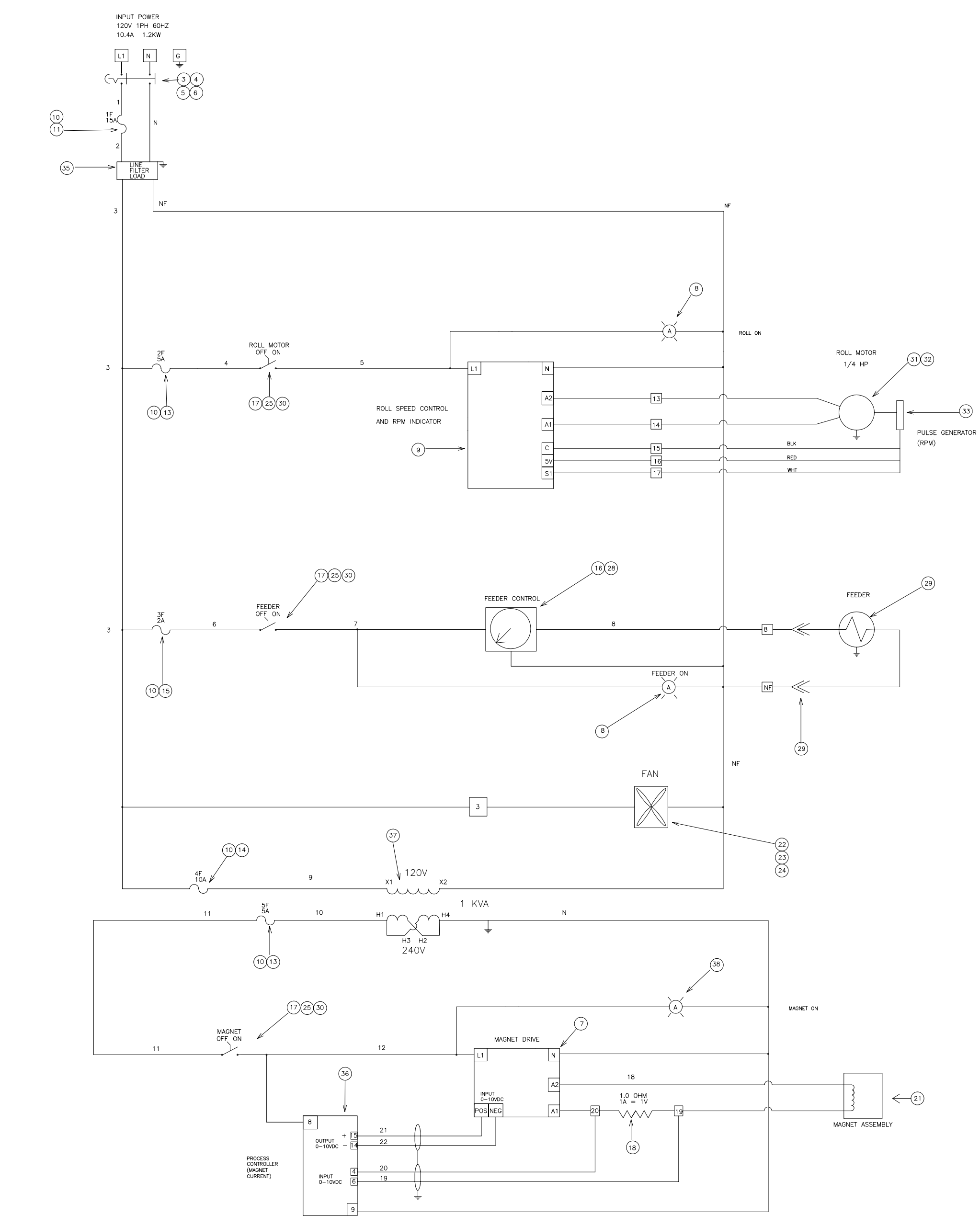
DETAIL 'A'





MATERIAL						FOR
	REQ'D	ASS'Y OR BILL	PT. NO.	SUBJECT		
	SCALE	NONE	PART	GENERAL ARRANGEMENT		
	DRAWN PJW	DATE 6.18.91	EQUIPMENT	MIH (13) 111-5		
	CHECKED	6/18/91	Carpco JACKSONVILLE, FLORIDA		DWG. NO.	4 - 2090
	APPROVED	6.18.91				
KEY / REVISIONS / INITIAL / DATE	WORK DONE BY		COMPLETED DATE		SHOP TIME	HRS.

REV	DESCRIPTION	DATE	REVISED	APPROVED



TERMINALS: L1-N-G-NF-NF-3-13-14-15-16-17-G-19-20-SP-G

REV	DESCRIPTION	DATE	BY	APPR

SURFACE FINISH | MATERIAL DIMENSION | MATERIAL SPECIFICATION

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DO NOT SCALE DRAWING

DRAWN L. TOMBERLIN 3-22-06
APPROVED

DIMENSIONS ARE IN INCHES (MM)
DIMENSIONAL TOLERANCES
0 PLACE ± 1
1 PLACE ± .1
2 PLACE ± .06
3 PLACE ± .01
ANGLE ± 1.5°
BREAK SHARP EDGES .01-.03
DEBURR ALL EDGES

outokumpu
Physical Separation Division
6100 Phillips Highway
Jacksonville, Florida 32216
Ph: 904-353-3681 Fax: 904-353-8705

ELECTRICAL SCHEMATIC
MIH(13)111-5 MK2 120V

SCALE NONE | DWG. NO. 3-4037 | REV
WEIGHT | SHEET OF

NOTES
1-WIRE COLORS
BLACK HOT AC
WHITE-NEUTRAL-AC
RED AND BLUE-DC POWER
GREEN/YELLOW-GROUND
OTHERS AS NOTED
2-LAST WIRE NUMBER 22
3-[3] -TERMINAL
(6) -PIN NUMBER
(6)↗ -ITEM NUMBER

BILL OF MATERIAL MIH(13)111-5

ITEM	QTY	MLH(13)111-5 120V 60HZ
3	1	SWITCH PUSH PULL
4	1	LEGEND PULL ON-PUSH OFF
5	2	CONTACT BLOCK N.C.L.B.
6		
7	1	DC DRIVE
8	2	PILOT LIGHT AMBER 120V
9	1	DC MOTOR CONTROL/DISPLAY
10	5	FUSEHOLDER
11	1	FUSE 15A 250V GSA-15
12		
13	2	FUSE 250V 5A GDL-5
14	1	FUSE 10A 250V GSA-10
15	1	FUSE 2A 250V GDL-2
16	1	DIAL PLATE
17	3	SWITCH PLATE
18	1	RESISTOR 1 OHM 25W
21	1	MAGNET ASS'Y
22	1	FAN
23	1	FAN CORD SET
24	1	FAN GUARD
25	3	TOGGLE SWITCH
28	1	FEEDER CONTROL
29	1	FEEDER
30	3	SWITCH SEAL BOOT
31	1	MOTOR 1/4 HP
32	1	BASE MOTOR
33	1	RPM SENSOR
35	1	NOISE FILTER
36	1	PROCESS CONTROL
37	1	TRANSFORMER 1KVA 120-240V
38	1	PILOT LIGHT AMBER 230V
39	1	FLANGED OUTLET
40	1	PLUG