

OPERATIONS MANUAL

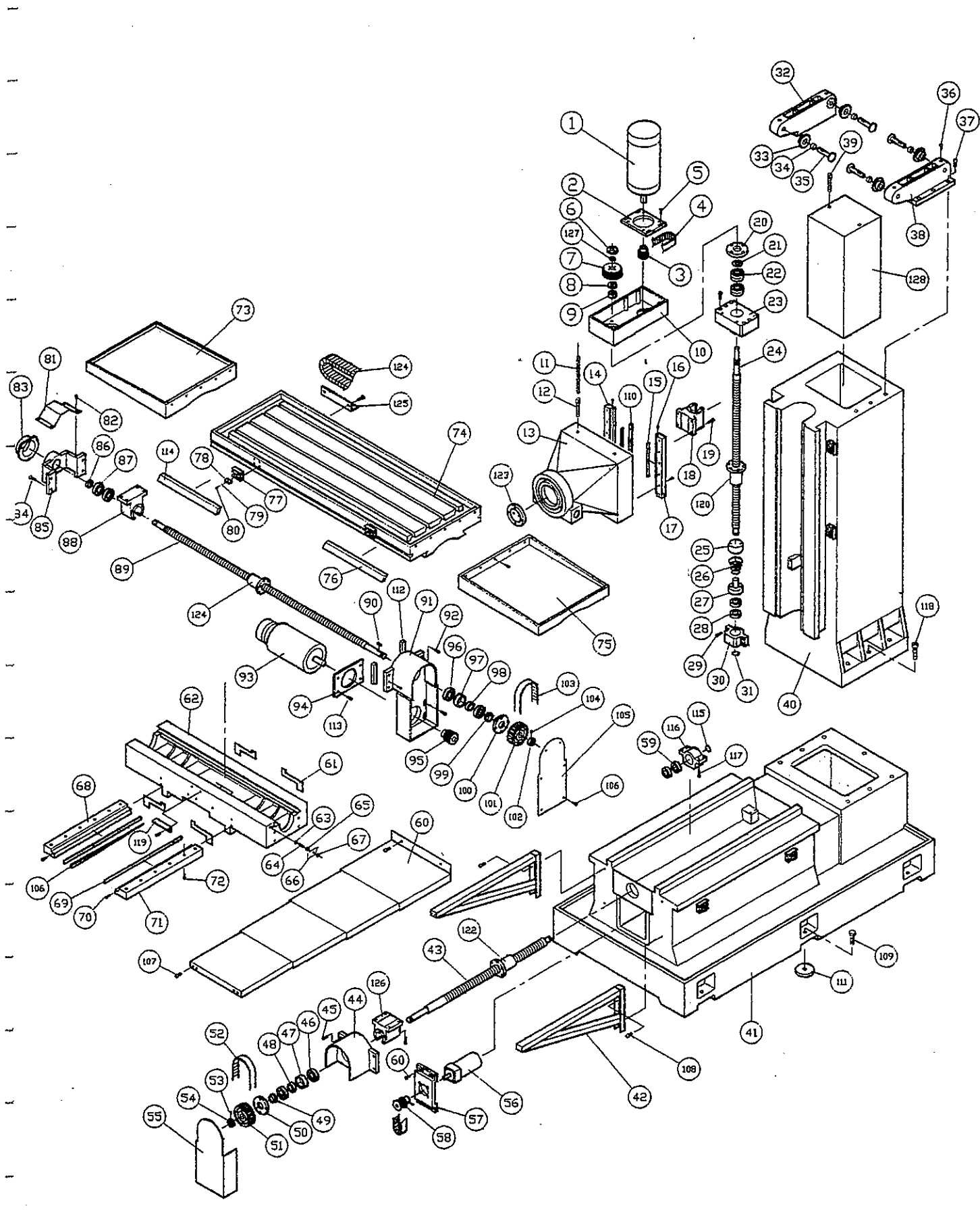
Mechanical and Electrical Drawings and Instructions
For

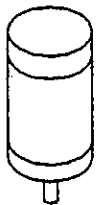
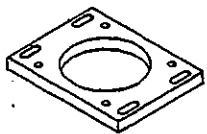
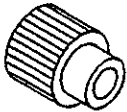
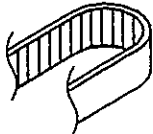
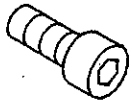
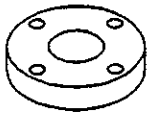
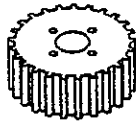
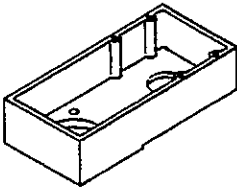


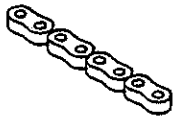
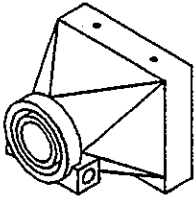
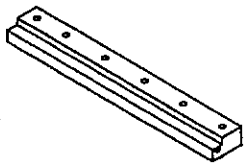
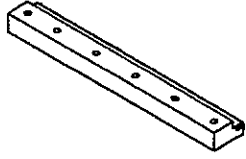
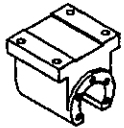
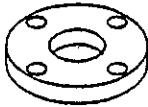
AUTOMATIC SPINDLE CNC MACHINE

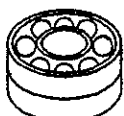
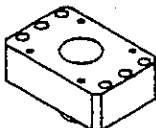
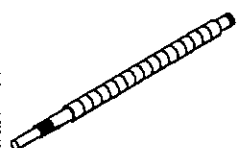
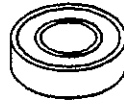
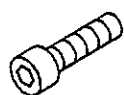
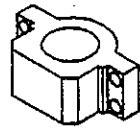
Milltronics Manufacturing Company
1400 Mill Lane
Waconia, Minnesota 55387 USA

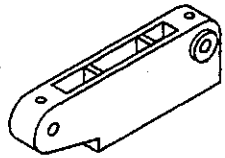
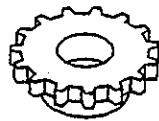
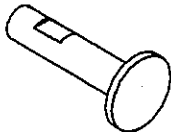
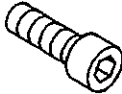
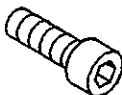
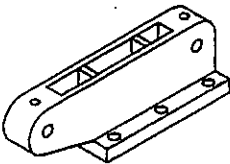
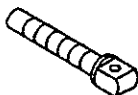
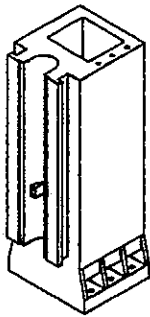
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TEL (Service): 952-442-1401
TEL (Parts): 952-442-1418
FAX: 952-442-1407

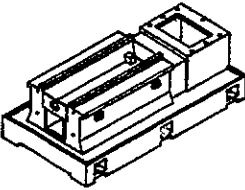
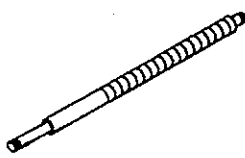
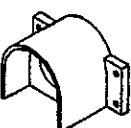
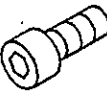
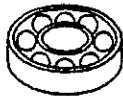
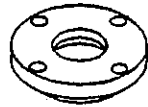


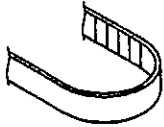
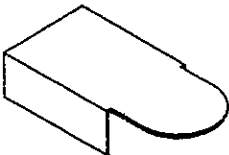
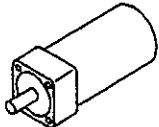
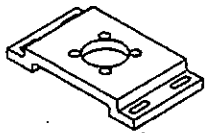
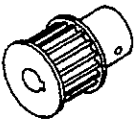
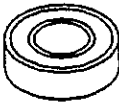
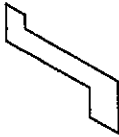
機型	WB-3V	零 件 表			頁 數	1 / P
項次	零 件	圖 號	名 稱	每 台 量	規 格 (備 註)	
1		WB3Z12	DC 馬達	1		
2		WB3Z11	馬達固定板	1		
3		WB3Z13	馬達皮帶輪	1		
4			HTD皮帶	1	M8*760*30	
5			螺 絲	4	M10*35L	
6		WB3Z08	迫緊圈	1		
7		WB3Z10	螺桿皮帶輪	1		
8		WB3Z10	隔 環	1		
9		WB3Z05	鎖緊螺帽	1	YSF M25*P1.5	
10		WB3Z07	傳動箱	1		

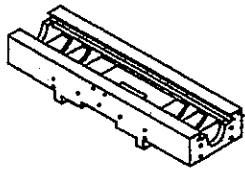
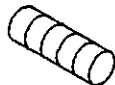
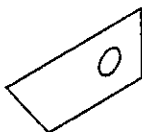
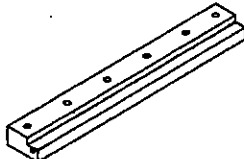
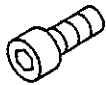
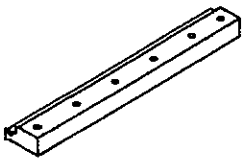
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項次	零 件	圖 號	名 稱	每 台 量	規 格 (備 註)	
11		WB3B08	鏈 條	2	5/8" * 86P	
12		WB3B07	配重螺栓		M14 * P2.0 (車, 銑, 鑽, 染)	
13		WB31101	主軸機座	1	(鑄, 銑, 鑽)	
14		WB31103	機頭承板左	1	(鑄, 銑, 鑽)	
15		WB31104	機頭承板底斜楔	2	(鑄, 銑, 貼 T/B)	
16		WB31106	調整螺絲		3/8" * 24牙	
17		WB31102	機頭承板右	1	(鑄, 銑, 鑽)	
18						
19			螺 絲			
20		WB3Z03	軸承座	1		

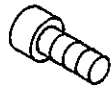
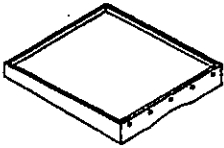
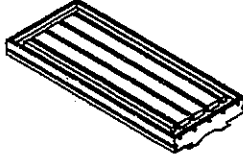
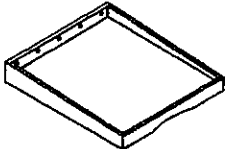
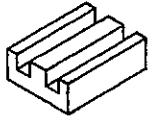
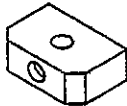
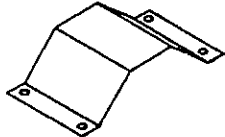
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頁次	零 件	圖 號	名 稱	每 台 量	規 格 (備 註)	
21			墊 片	1		
22		WB3Z06	軸 承	2	RHP BSB025062	
23		WB3Z07	軸承座	1	FC25	
24		WB5Z01-L	滾珠螺桿	1組	Ø40*P10*2B	
25		WB3Z34	滾珠護套托架	1		
26		WB3Z36	滾珠護套	1		
27		WB3Z35	滾珠護套托架	1		
28		WB3Y16	軸 承	2	6205ZZ (X,Y共用)	
29			螺 絲	4	M8*25L	
30		WB3Y17	尾端軸承座	1	FC25 (Z,Y共用)	
31			C型扣環	1片	S25	

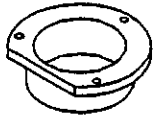
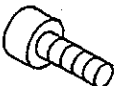
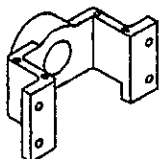
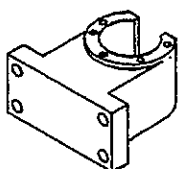
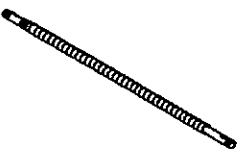
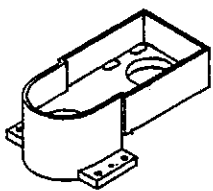
機型	WB-3V	零 件 表			頁 數	4 / P
項次	零 件	圖 號	名 稱	每 台 量	規 格 (備 註)	
32		WB3B01	左 擔 架	1	(銑, 搪, 鑽, 鑄)	
33		WB3B03	鏈 輪	4	5/8" * 13 齒 (車, 熱, 染)	
34		WB3B05	滾針軸承	4	RNA 4902	
35		WB3B04	鏈輪軸	4	(車, 銑, 染)	
36			螺 絲	4	M8 * 18	
37			螺 絲	10	M12 * 50L	
38		WB3B02	右 擔 架	1	(銑, 搪, 鑽, 鑄)	
39		WB3B07	配重螺栓	4	M14 * P2.0 (車, 銑, 鑽, 染)	
40		WV5C01	立 柱	1	(鑄, 銑, 熱, 鑽, 研)	

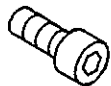
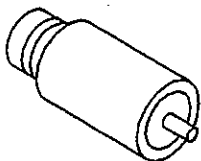
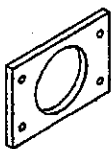
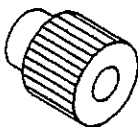
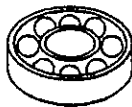
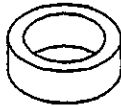
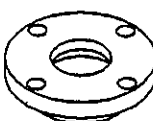
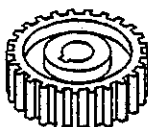
機型	WB-3V	零 件 表			頁 數	5 / P
項次	零 件	圖 號	名 稱	每 台 量	規 格 (備 註)	
41		WC5B01	底 座	1	(鑄, 銑, 鑽, 熱, 研)	
42		WC5Y05	Y軸伸縮板金支架	2		
43		WC5Y01	滾珠螺桿	1組	Ø40*P10*2B	
44		WC5Y02-1	傳動箱	1	(鑄, 銑, 搪, 鑽)	
45						
46		WB3X04	軸 承	1組	RHP BSB025062	
47		WB3X05	外隔環	1	(車, 研)	
48		WB3X06	內隔環	1	(車, 研)	
49		WB3X07	隔 環	1	(車)	
50		WB3X08	軸承蓋	1	(車, 鑽, 染)	

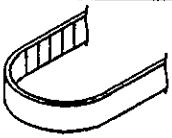
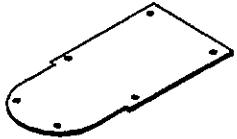
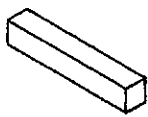
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項次	零 件	圖 號	名 稱	每 台 量	規 格(備 註)	
51		WB3X09	螺桿皮帶輪	1	(車,滾齒,拉串,染)	
52			HTD皮帶	1	M8*600	
53			螺 絲			
54		WB3X10	鎖緊螺帽	1	YSR M25*P1.5	
55		WV5Y03	蓋 板	1		
56		WV5Y04	DC馬達			
57			馬達固定板			
58		WB3Z13	馬達皮帶輪	1	(車,滾齒,拉串,染)	
59		WB3Y16	軸 承	1組	6205ZZ	
60			螺 絲			
61			括屑片	2組		

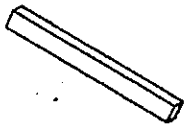
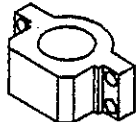
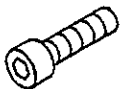
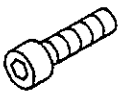
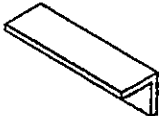
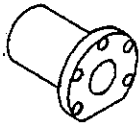
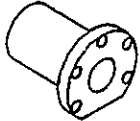
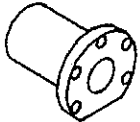
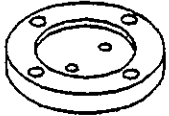
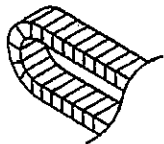
機型	WB-3V	零 件 表			頁 數	7 / P
項次	零 件	圖 號	名 稱	每 台 量	規 格 (備 註)	
62		WB31401	鞍 座	1		
63			螺 帽	2	M10*P1.5	
64			螺絲全牙	2	M10*P1.5*100L	
65			螺 帽	2	M10*P1.5	
66			斜楔端板	2		
67			螺 帽	2	M10*P1.5	
68		WB31403	鞍座承板左	1		
69		WB31404	鞍座承板斜楔	2		
70			調整螺絲	6	3/8*24牙	
71		WB31402	鞍座承板右	1		

機型	WB-3V	零 件 表			頁 數	8 / P
項次	零 件	圖 號	名 稱	每 台 量	規 格 (備 註)	
72			承高螺絲	8	M12*P1.75	
73		WB31504	工作台護架	1	鋁	
74		WB31501-L	工作台	1	FC30	
75		WB31504	工作台護架	1	鋁	
76		WB31503	工作台斜楔左	1	FC25	
77		WB3X36	極限開關座	6		
78		WB3X37	極限碰塊	6		
79		WB3X38	鋼 珠	6	ø4	
80			螺 絲		M5*P0.8	
81		WB3X39	蓋 板	1		

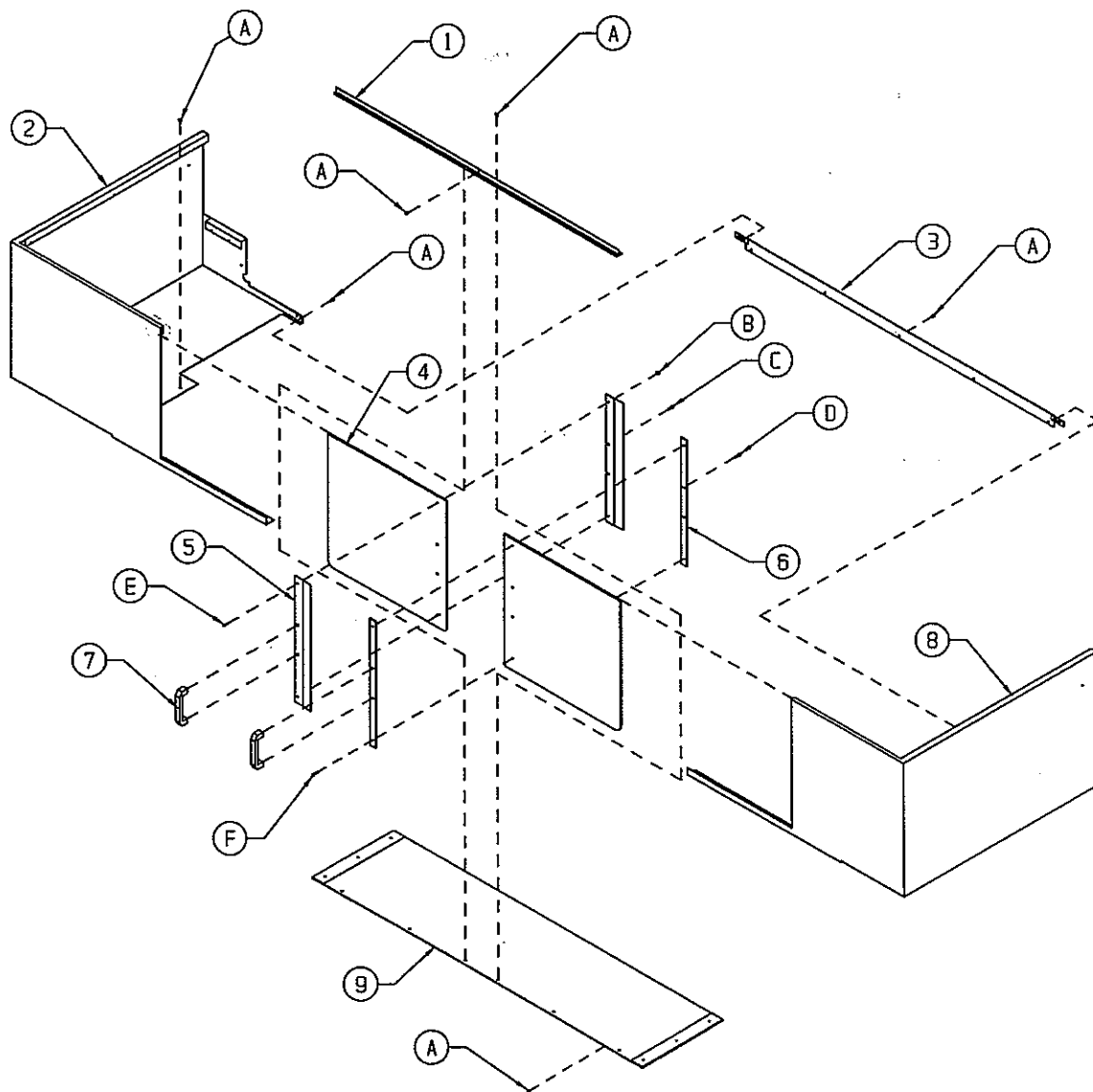
機型	WB-3V	零 件 表			頁 數	9 / P
項次	零 件	圖 號	名 稱	每 台 量	規 格 (備 註)	
82			螺 絲			
83		WB3X35	軸 承 蓋	1		
84			承窩螺絲	4		
85		WB3X33	軸 承 拖 架	1		
86		WB3X10	鎖緊螺帽	1	M25*P1.5	
87			鎖緊螺帽		6205ZZ	
88			傳動螺帽座			
89		WB5X01B	X軸滾珠螺桿	1		
90			平行雙圓鍵	1	8*7*30 (X,Y共用)	
91		WB3X03	X軸傳動箱	1		

機型	WB-3V	零 件 表			頁 數	10 /P
項次	零 件	圖 號	名 稱	每 台 量	規 格(備 註)	
92			調整螺絲			
93		WB3Z12	DC馬達	1		
94		WB3X11	馬達固定板	1	(X,Y軸共用)	
95		WB3Z13	馬達皮帶輪	1	(X,Y軸共用)	
96		WB3X04	軸 承	1	RHP BSB025062 (X,Y軸共用)	
97		WB3X05	外 隔 環	1	(X,Y軸共用)	
98		WB3X06	內 隔 環	1	(X,Y軸共用)	
99		WB3X07	中 隔 環	1	(X,Y軸共用)	
100		WB3X08	軸 承 蓋	1	(X,Y軸共用)	
101		WB3X09	螺桿皮帶輪	1	(X,Y軸共用)	
102		WB3X10	鎖緊螺帽	1	YSF 25*P1.5 (X,Y軸共用)	

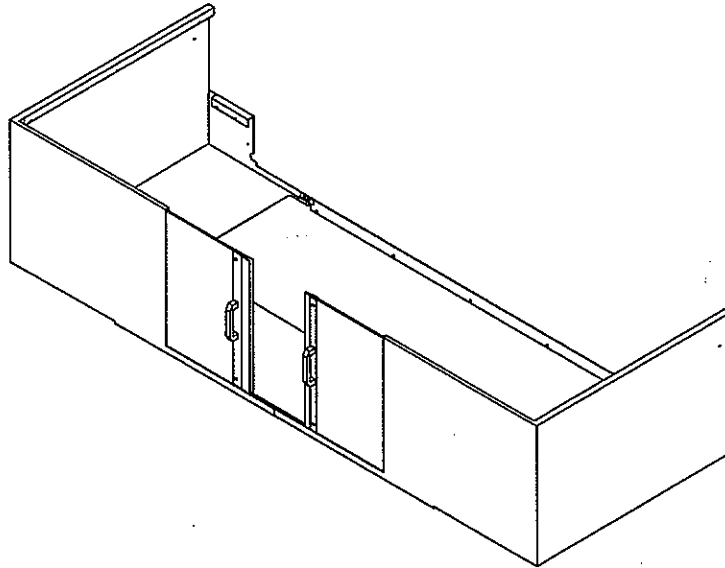
機型	WB-3V	零 件 表			頁 數	11 /P
項次	零 件	圖 號	名 稱	每 台 量	規 格 (備 註)	
103			HTD皮帶	1	8M-760-30	
104			螺絲全牙			
105		WB3X28	蓋 板	1		
106			螺 絲	6		
107			螺 絲			
108			調整螺絲	4	M8*P1.25	
109			地基螺絲	6		
110			機頭中斜楔	1		
111		WB31302	墊 塊	6	鑄,銑,貼T/B	
112		WB3X32	墊 塊	1組		
113			調整螺絲	4	M10*P1.5	

機型	WB-3V	零 件 表			頁 數	12 /P
項次	零 件	圖 號	名 稱	每 台 量	規 格 (備 註)	
114		WB31502	工作台斜楔右	1	FC25	
115			C型扣環	1	S25	
116		WB3Y17	尾端軸承座	1	FC25 (X,Y軸共用)	
117			螺 絲	4	M8*P1.25	
118			螺 絲	7	M20*100L	
119			X軸極限座	3	S45	
120			螺桿螺帽			
121			螺桿螺帽			
122			螺桿螺帽			
123		WB2Z41	旋轉蝸輪座	1只	S45C	
124		WB31111	油管護管	1	900L	

[illegible]



REV.	DESCRIPTION	E.C.D. NO.	APP'D BY	DATE
MATERIAL/FINISH		 MILLTRONICS MANUFACTURING 1400 MILL LANE (612) 442-1410 WACONIA, MN 55387		
STOCK/ASSY No.				
TOLERANCE UNLESS SPECIFIED		TITLE CE MB24 TABLE GUARD ASSEMBLY		
X.XXX	±	APPLICATION SOLID WAYS BED MILL		
X.XX	±	SCALE 15:1	DWG No. 6-10-032-010	SIZE B
X.X	±	DATE 14 DEC 98	DRAWN BY DAHLKE	SHEET NO. 1 OF 2
ANGLE	±			



PARTS LIST

No.	QTY	STOCK No.	DESCRIPTION
1	1	MPS-26	MB20 TABLE GUARD DOOR RAIL
2	1	MPS-123	CE MB24 TABLE GUARD - LEFT
3	1	MPS-126	MB24 TABLE GUARD - REAR
4	2	MPS-89	CE TABLE GUARD LEXAN DOOR
5	2	MPS-87	CE LEFT DOOR HANDLE PLATE
6	2	MPS-88	CE RIGHT DOOR HANDLE PLATE
7	2	WX-142	HANDLE
8	1	MPS-124	CE MB24 TABLE GUARD - RIGHT
9	1	MPS-64	MB25 TABLE GUARD FRONT

HARDWARE LIST

No.	QTY	DESCRIPTION
A	24	1/4-20 x 3/8 BHCS
B	4	10-32 NUT
C	2	1/4-20 x 5/8 BHCS
D	2	1/4-20 x 3/4 BHCS
E	2	10-32 x 5/8 BHCS
F	2	10-32 x 3/4 BHCS

REV.	DESCRIPTION	E.C.O. NO.	APP'D BY	DATE
MATERIAL/FINISH		 MILLTRONICS MANUFACTURING 1400 MILL LANE (612) 442-1410 WACONIA, MN 55387		
STOCK/ASSY No.				
TOLERANCE UNLESS SPECIFIED		TITLE CE MB24 TABLE GUARD ASSEMBLY		
X.XXX	±	APPLICATION SOLID WAYS BED MILL		
X.XX	±	SCALE 15:1	DWG No. 6-10-032-010	SIZE B
X.X	±	DATE 14 DEC 98	DRAWN BY DAHLKE	SHEET NO. 2 OF 2
ANGLE	±			

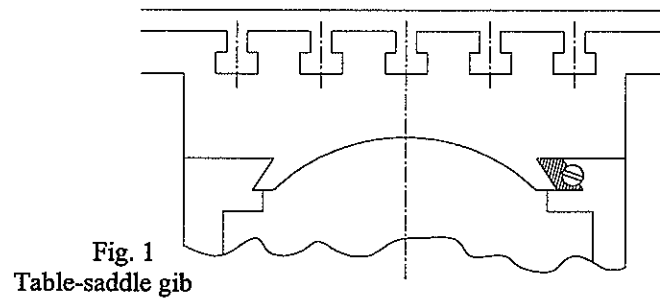
Machine Maintenance

- **Adjusting Gibs**
- **Checking and Adjusting Backlash**
- **Machine Lubrication**
- **Machine Lifting Instructions**

Adjusting Gibs

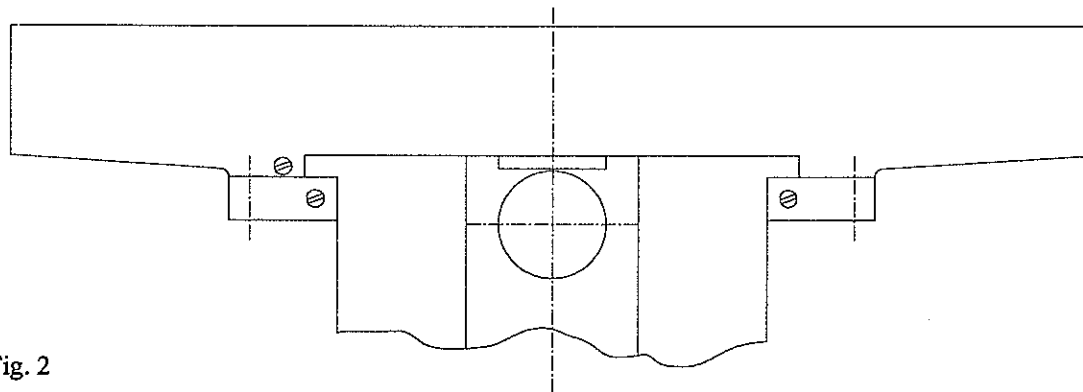
Adjusting Table Gib

The table gibs adjusting screw is on the left side. To take up the gib, tighten the large screw slightly until a slight drag is felt when moving the table by hand. (Fig. 1)



Adjustment of Saddle Gib

Tighten gib using the same method as above however, the chip wiper must be removed first. (Fig. 2)



Saddle-Base Gib

Adjustment of head Bolster gib.

Remove Chip wiper and adjust screw until smooth movement is attained. (Fig. 3)

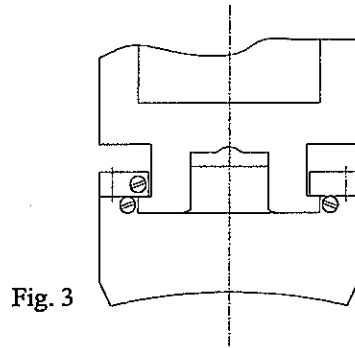


Fig. 3

Bolster Gib

Checking and Adjusting Backlash

Use a good solid magnetic base and a .0005 Inch indicator. Install the magnetic base on the machine table in close proximity to the spindle. Clean the area that the indicator will be in contact with.

Go into PARAMETERS/AXIS arrow down to BACKLASH press F1 EDIT and set X, Y and Z to zero. *(Before setting them to zero note original settings)*

Find the high spot on the spindle by moving the indicator back and forth and set indicator to zero. *(See point A on Fig. 4)*

The next step is easiest if done in jog mode. *(Select distance and 1 inch increments)*
You may have to press the jog key several times for the desired direction to clear the spindle.

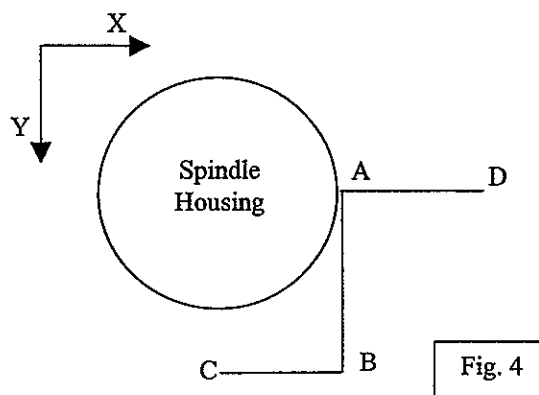
Press the jog key for the desired direction for A to move towards D *(see Fig. 4)* and then back to A, the indicator may have moved, adjust it back to zero and repeat this step until it stays at zero.

Jog the desired axis or tool *(see Fig. 4)* from point A to B to C back to B then back to the start point A. The reading on the indicator is backlash and should be put into the backlash parameter under PARAMS-SETUP-AXIS.

After putting the backlash into the table, repeat the procedure to ensure the numbers took affect. If the indicated error seems to increase this is addlash, and you may have to subtract the indicated number from the backlash chart.

*The X axis procedure is shown, repeat procedure for Y and Z.
Remember to save these new changes to your parameter disk.*

(The diagram below is an example of checking your backlash in the X-axis.)



Lubricating MB Machines:

Head:

Using Mobillex EP lubricant grease the head monthly. There is a grease fitting on the right side of the head near the High/Low gear and on the left side of the head near the quill feed selector. The *oil cups* can be filled periodically. One oil cup can be found on the front of the head, the other cup is near the High/Low gear.

AUTO LUBRICATOR:

The auto oiler should be checked weekly. Make sure the oiler is filled and is working properly.

DISCHARGE VOLUME PER CYCLE:

Adjustable from 2.5 CC minimum to 5.0 CC maximum. To reduce oil delivery remove the lock screw, measure A (Fig. 5), turn Adjusting screw clockwise increasing dimension A in the increment

(corresponding to the desired discharge) as shown. (Table 1)

IN.	DISCHARGE	NOTES:
.400	2.5 c.c.	
.320	3.0 c.c.	
.240	3.5 c.c.	
.160	4.0 c.c.	
.080	4.5 c.c.	
0.00	5.0 c.c.	Break in setting

Table 1

DISCHARGE PRESSURE: 60 psi Maximum.

Peak system Pressure will decrease when:

- (a) discharge volume decreases,
- (b) number of Meter-Units in system increases,
- (c) oil viscosity decreases.

OIL VISCOSITY RANGE: See specification sheet

RECOMMENDED OIL: Mobil Vactra Oil No. 2

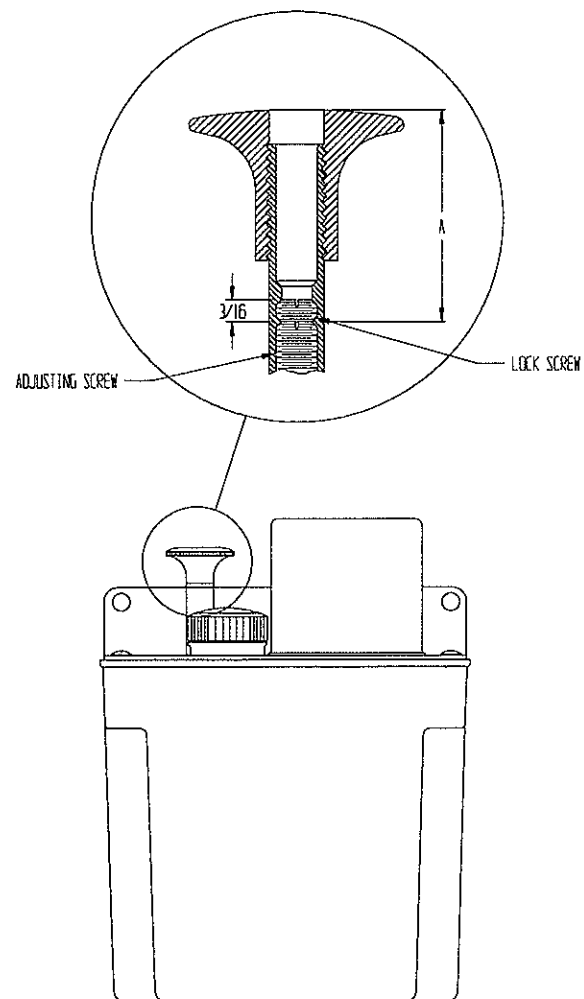
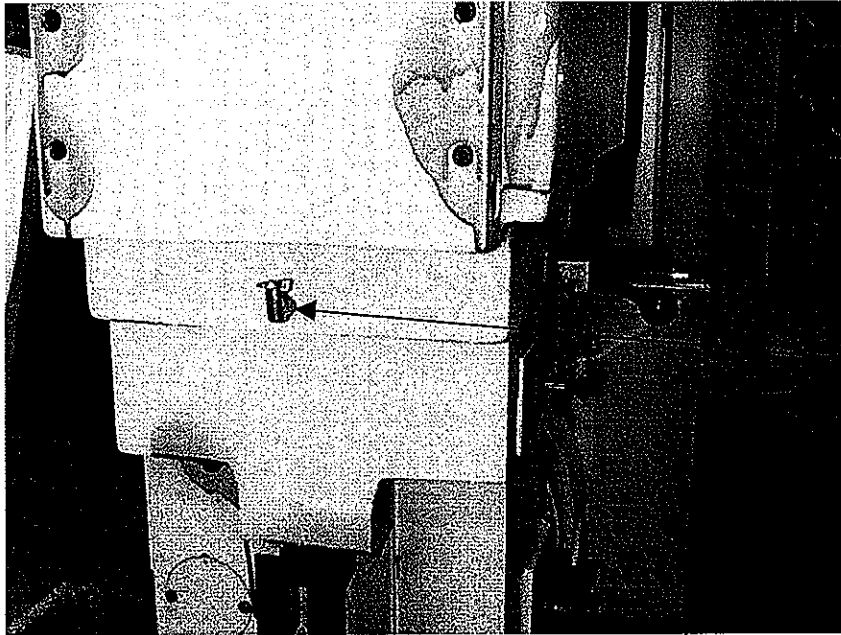
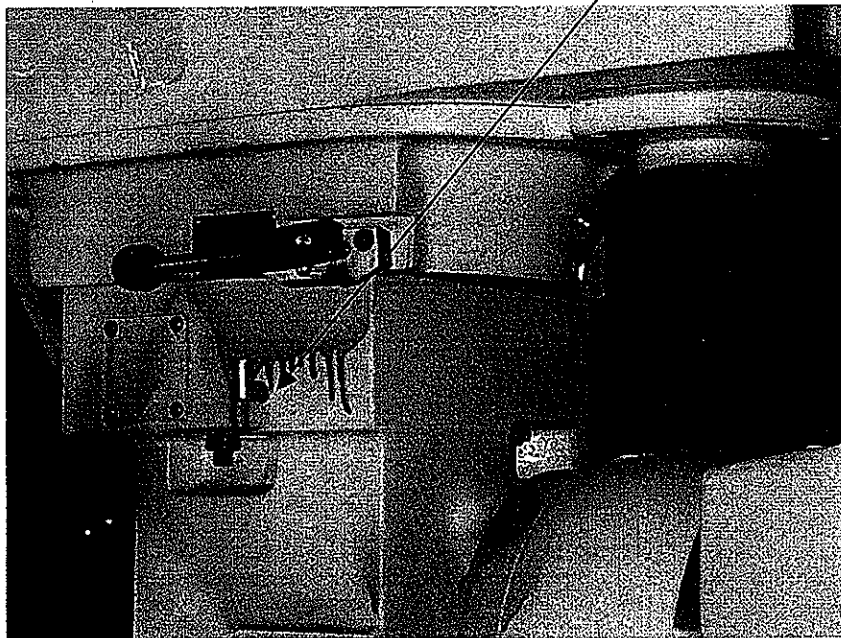


Fig. 5

MB24/25 Automatic Spindle Head Lubrication



Oil Cups (A few drops weekly)

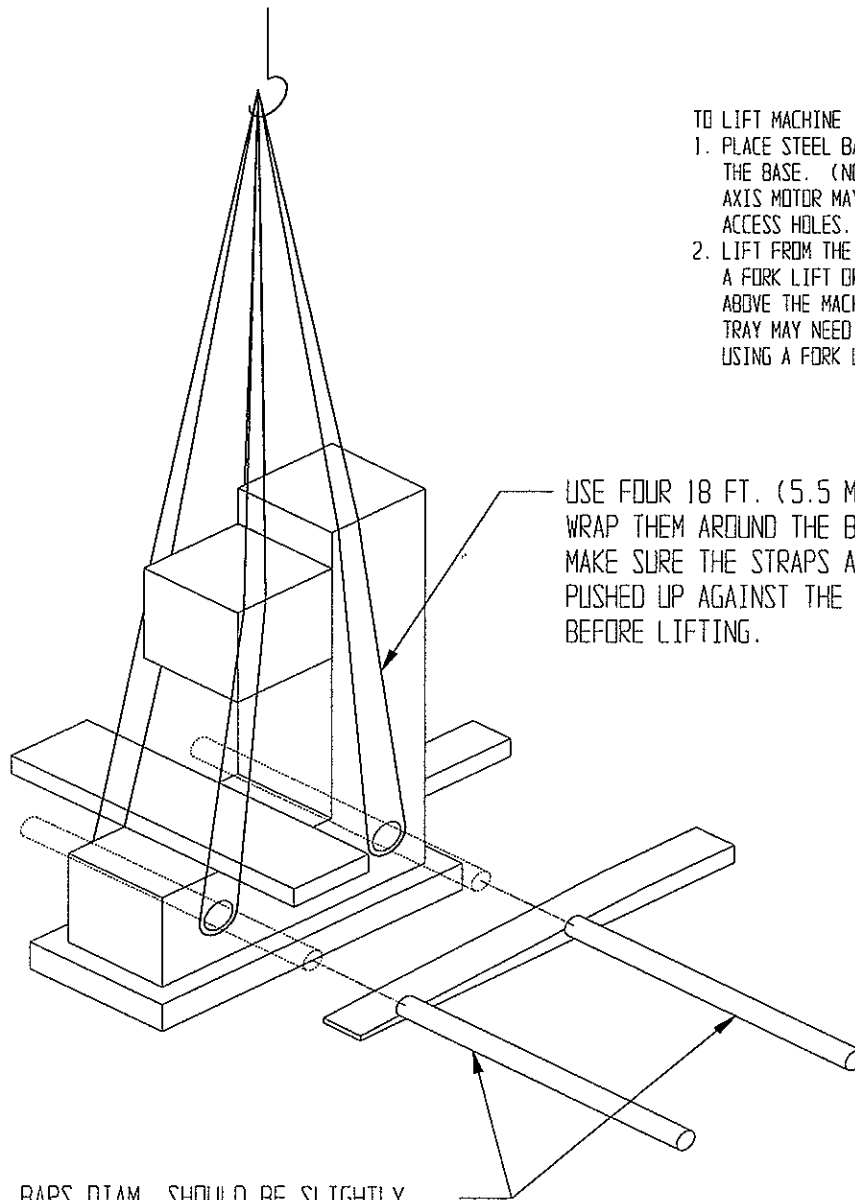


Grease Fitting for Head
(Use Multipurpose EP Monthly)

MOBILITH AW SERIES, MULTIPURPOSE EP GREASE	
PRODUCT NUMBER	64352-8
NLGI GRADE	1
COLOR	GREEN
STRUCTURE	SMOOTH/TACKY
SOAP TYPE	LITHIUM COMPLEX
MINERAL OIL VISCOSITY	
cST AT 40°C	150
cST AT 100°C	13
SUS AT 100°F	750
SUS AT 210°F	70
ISO VISCOSITY GRADE	150
PENETRATION AT 23°C (77°F), WORKED	325
DROPPING POINT, ASTM D 2265, F°	475
TIMKEN OK LOAD, ASTM D 2509, lb	40
FOUR-BALL EP TEST, ASTM D 2596, WELD LOAD, kg	250
LOAD WEAR INDEX	40
FOUR-BALL WEAR TEST, ASTM D 2266, SCAR DIAMETER, mm, MAX	0.5
CORROSION PREVENTION, ASTM D 1743	PASS
WHEEL BEARING TEST, ASTM D 4290 MODIFIED, LEAKAGE, GRAM	5

MOBIL VACTRA OIL No. 2	
PRODUCT NUMBER	60049-4
SPECIFIC GRAVITY, 60/60F	0.88
POUR POINT, °C (°F), max.	-9 (16)
FLASH POINT, °C(°F), min.	244 (472)
VISCOSITY	
cST AT 40°C	68
cST AT 100°C	8.6
SUS AT 100°F	356
SUS AT 210°F	55
VISCOSITY INDEX	97
ISO VG	68
COLOR, ASTM D 1500	4
FZG, PASS STAGES	11
4 BALL WELD, kg, ASTM D 2783	160
4 BALL WEAR, mm, ASTM D 4172	0.22
COPPER CORROSION, ASTM D 130	1B
RUST, D665A	PASS
VICKERS V-104C, mg D 2882 (MOD)	-
CMCO, P-SPEC, APPROVAL	P-47
BIJUR PT 37-1 APPROVAL	PASS
OKUMA APPROVAL	PASS

LIFTING INSTRUCTIONS:



TO LIFT MACHINE

1. PLACE STEEL BARS THROUGH THE HOLES IN THE BASE. (NOTE: FLOOD PUMP AND/OR AXIS MOTOR MAY NEED TO BE REMOVED TO ACCESS HOLES.)
2. LIFT FROM THE BACK OF THE MACHINE WITH A FORK LIFT OR LIFT WITH 4 STRAPS FROM ABOVE THE MACHINE. (NOTE: METAL CHIP TRAY MAY NEED TO BE REMOVED WHEN USING A FORK LIFT.)

USE FOUR 18 FT. (5.5 M) STRAPS.
WRAP THEM AROUND THE BAR.
MAKE SURE THE STRAPS ARE
PUSHED UP AGAINST THE BASE
BEFORE LIFTING.

STEEL BARS DIAM. SHOULD BE SLIGHTLY
SMALLER THEN THE DIAM. OF THE HOLES
IN THE BASE. MIN DIAM. OF THE BARS IS
1.5 IN. (3.81 CM)

REV.	DESCRIPTION OF CHANGE	E.C.O. No.	APP'D BY	DATE
MATERIAL/FINISH	 1400 MILL LANE 612.442.1410 WACONIA, MN 55387 USA			
FIN:				
STOCK/ASSY No. MP--	TITLE MB LIFTING INSTRUCTIONS			
TOLERANCE UNLESS SPECIFIED	APPLICATION GENERAL PRODUCTS			
X.XXX +/- .005	SCALE 1:1 DWG No. 6-11-032-022 SIZE B			
X.XX +/- .010	DATE 13 JAN 99 DRAWN BY HEURING SHEET No. 1 OF 1			
X.X +/- .030				
ANGLE +/- 1.0°				

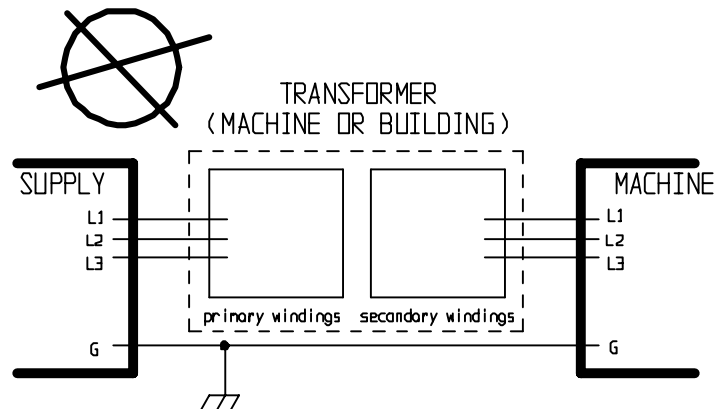
Electrical Manual

***MB/VK
Auto Spindle***

*Rev. 2
7-12-99*

***** CAUTION *****

DRIVES WILL BE DAMAGED BY INCORRECT POWER CONNECTION



Disconnect transformer entirely from power supply.

Check resistance between transformer ground wire and each secondary leg.

If resistance is more than 1 or 2 ohms, then the transformer ground wire is not connected to a neutral point within the secondary windings.

or

Disconnect transformer entirely from power supply.

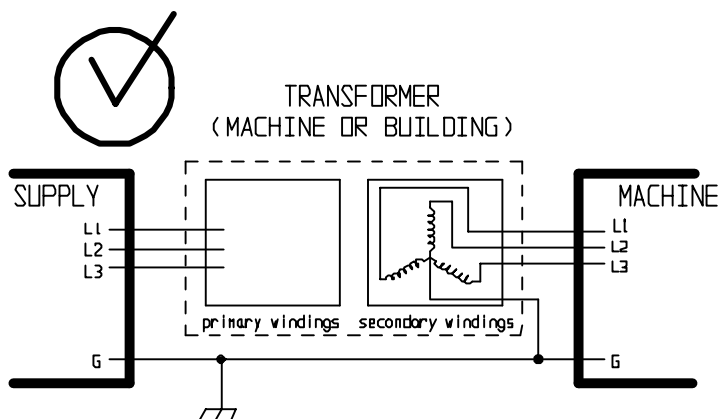
Remove transformer cover and follow transformer ground wire to determine if it is merely a case ground or if it actually goes to a neutral point within the secondary windings.

or

Check voltages between each secondary leg and ground.

If they are not equal, the secondary windings are "floating" with respect to ground.

THE GROUND WIRE GOING INTO THE MACHINE MUST BE CONNECTED
TO A NEUTRAL POINT WITHIN THE SECONDARY WINDINGS
AND TO EARTH GROUND.



The secondary windings must be grounded.

Voltages between each secondary leg and ground should be equal, half the voltage between secondary legs.

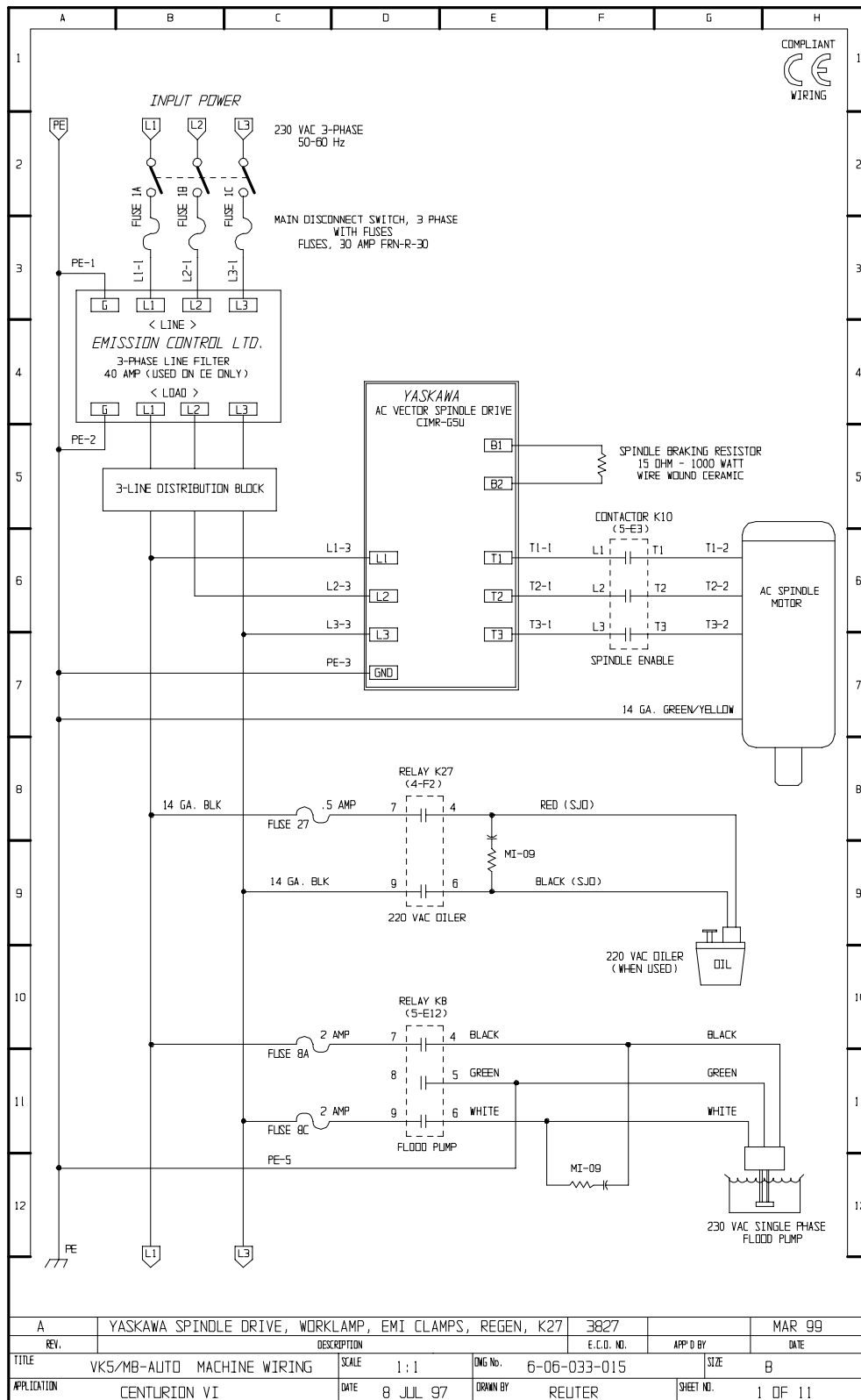
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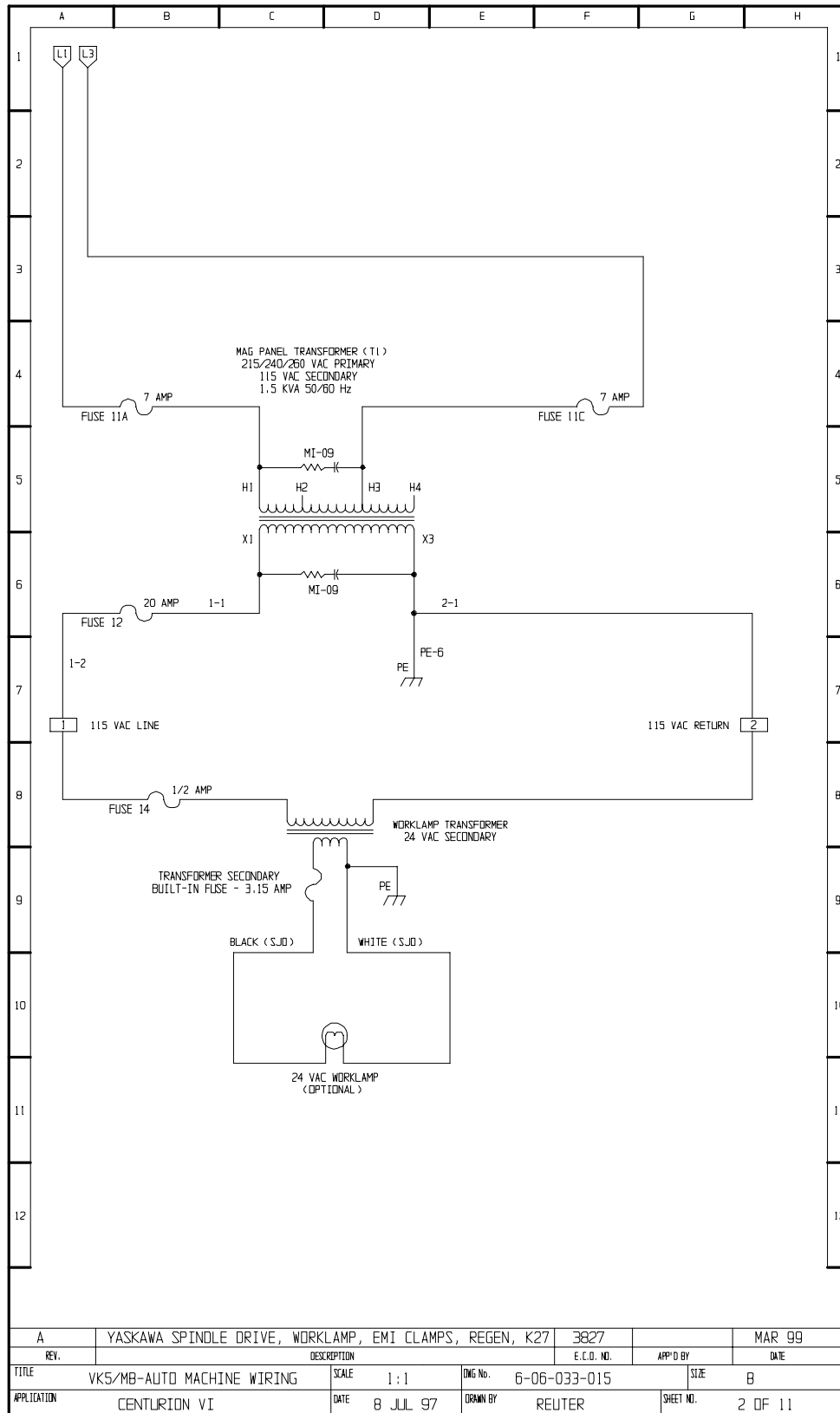
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History

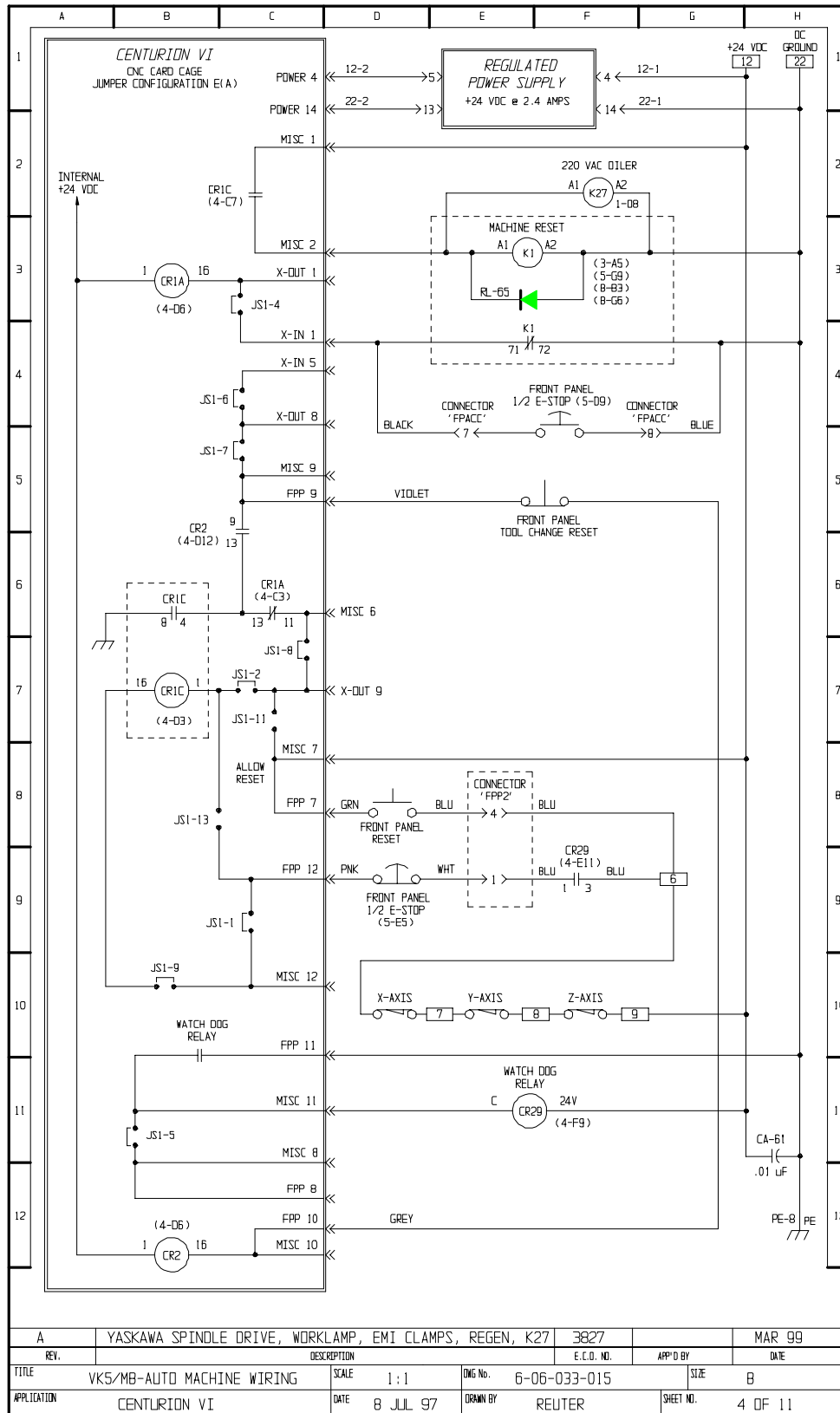
4-21-99 Original revision
7-12-99 Rev 2 Added LCD front panel drawings

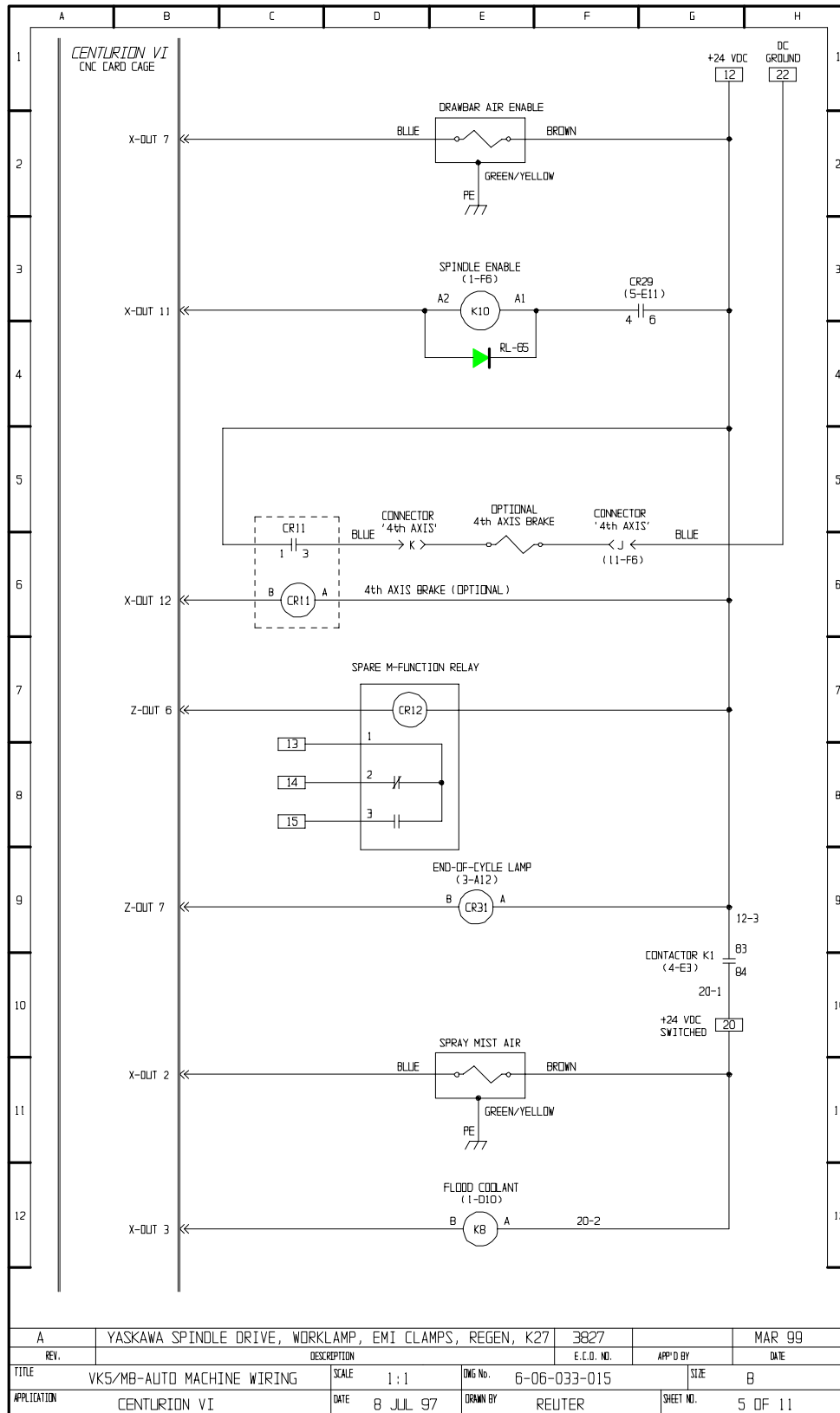
Machine Schematic

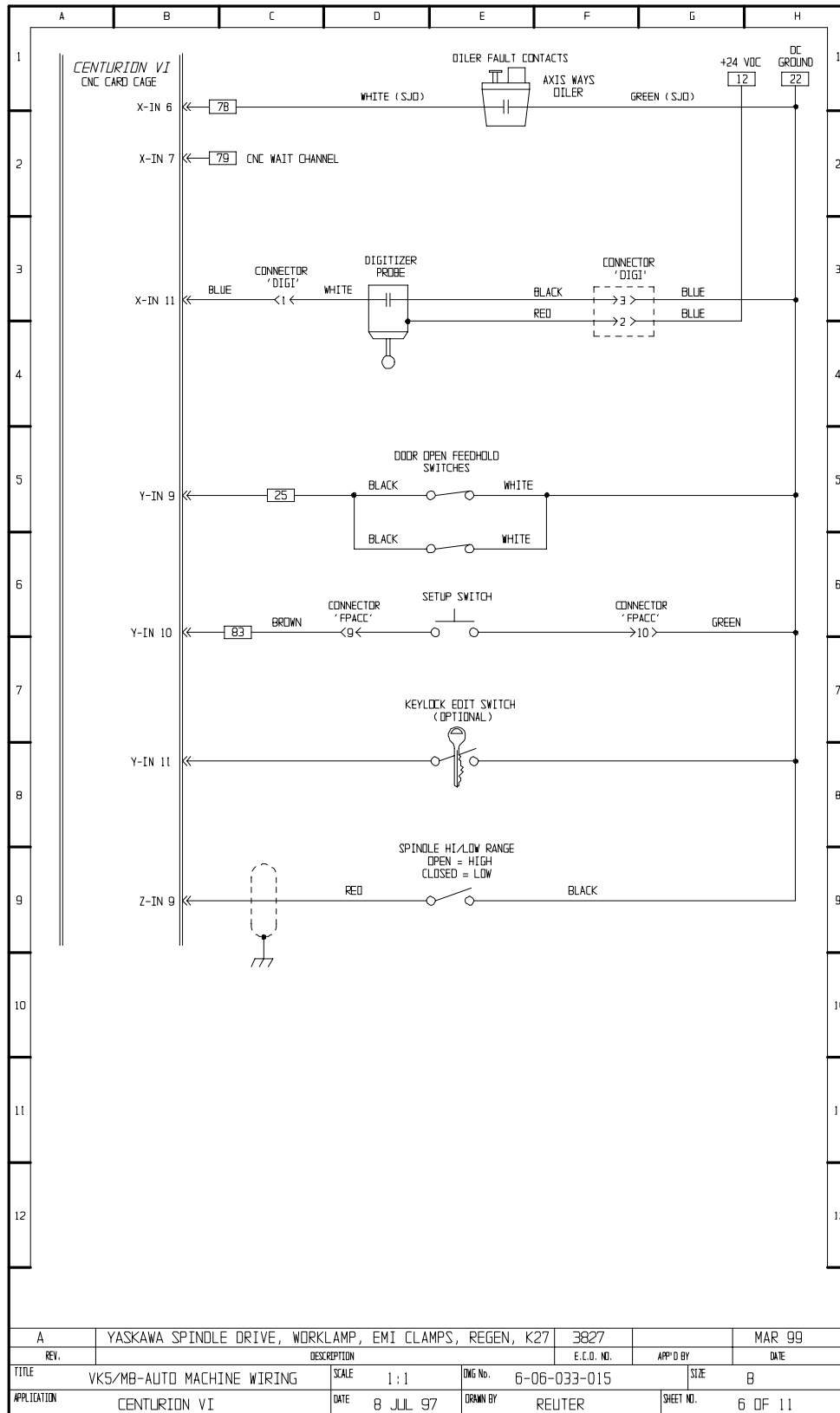


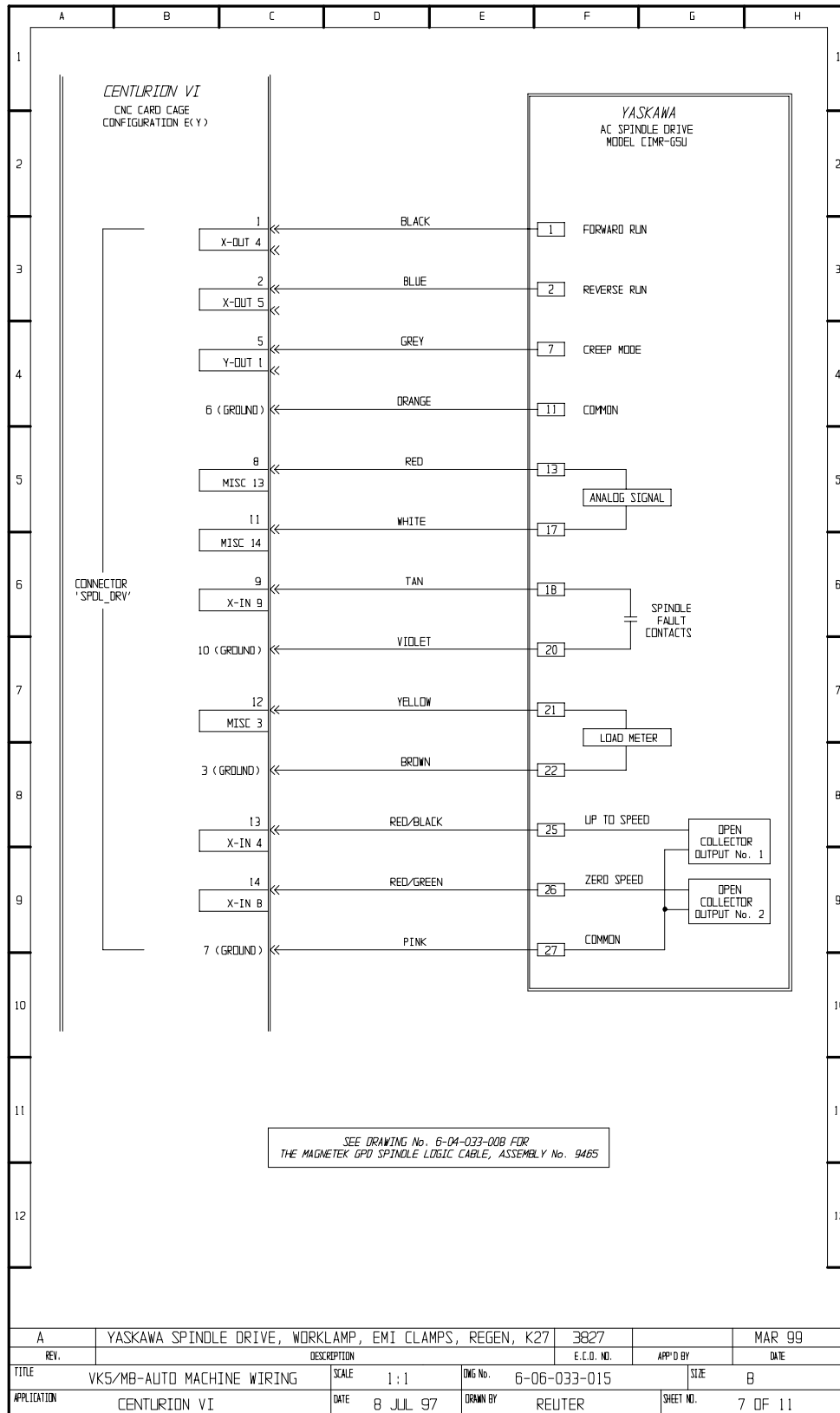


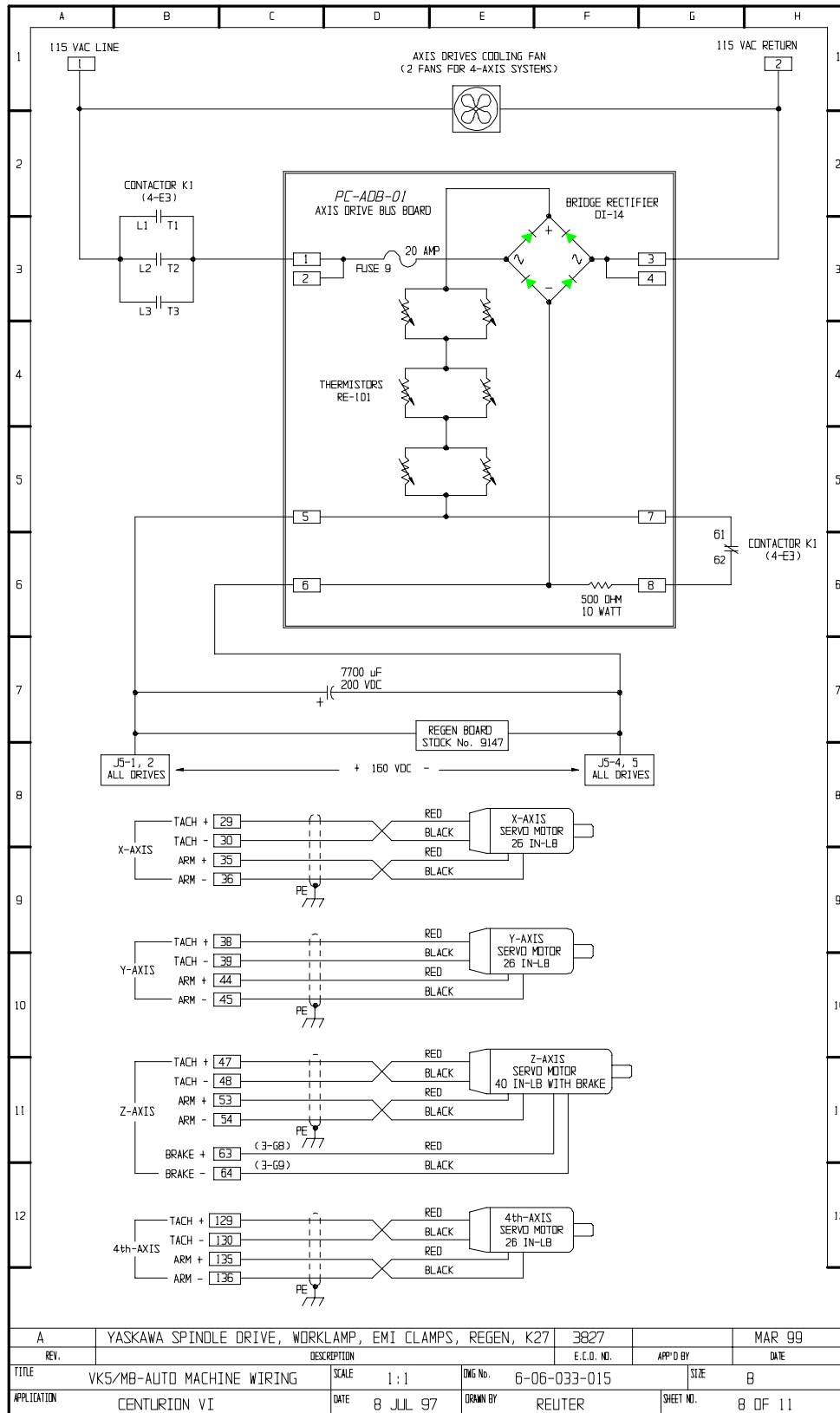


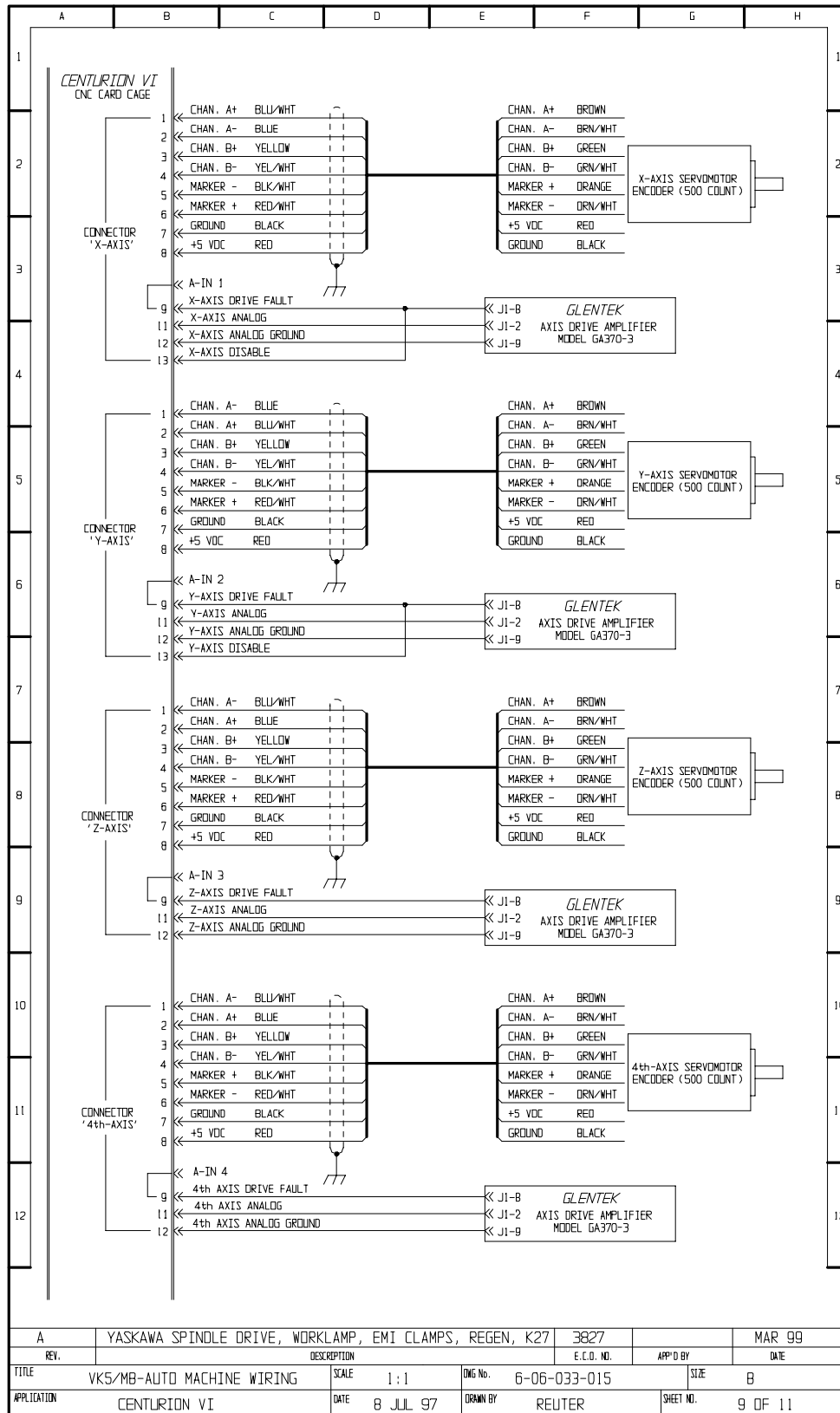


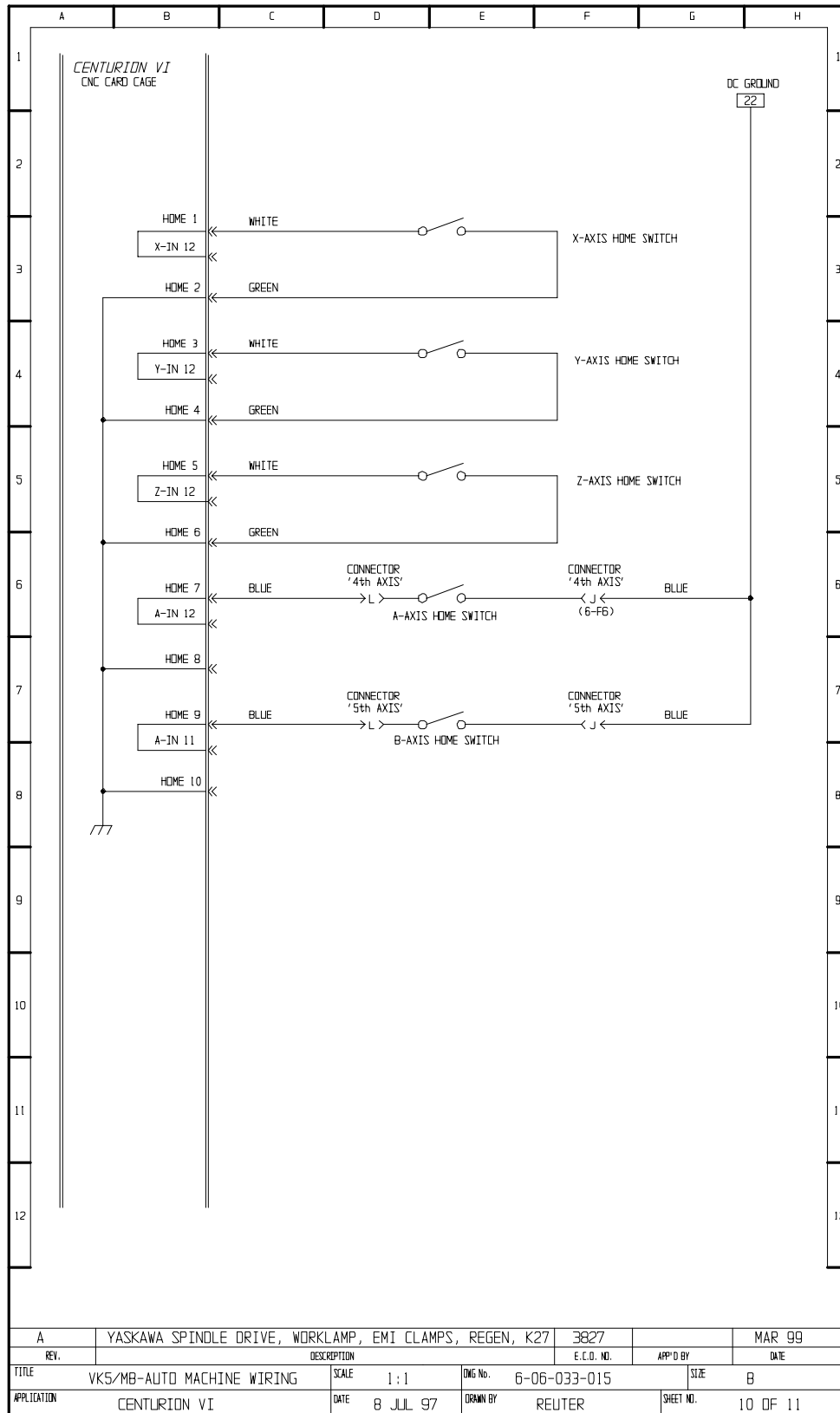


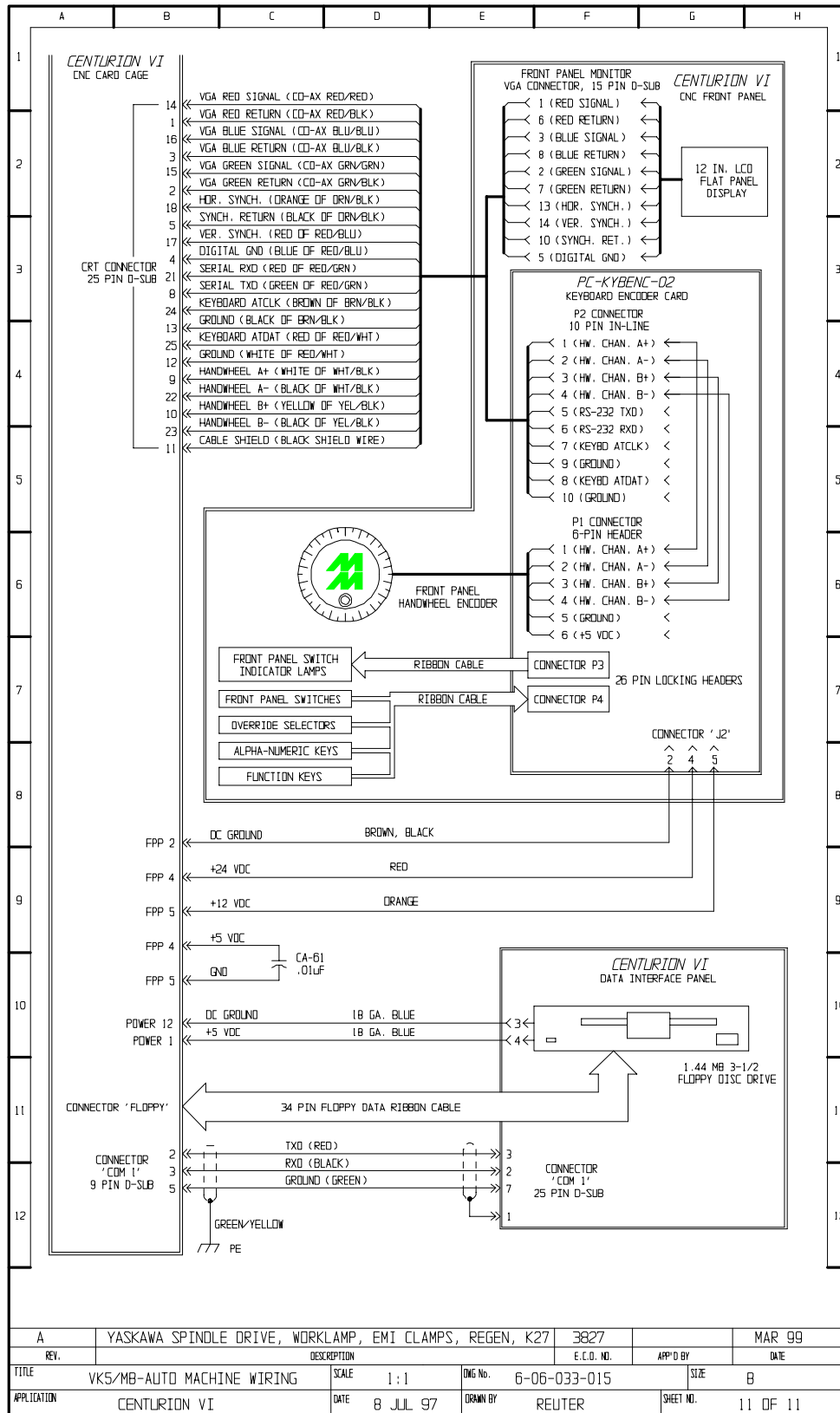












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- PARTS LIST -

ITEM	STOCK No.	DESCRIPTION	QTY	HARDWARE	REMARKS
1	PL-55	39 x 33 ZINC CHROMATE PLATED MAG PANEL, DWG. No. 6-01-033-008	1	G	
2	FU-04 FU-62	FUSE BLOCK, DOUBLE FRN-R FUSE, 7 AMP, FRN-R-7, (FUSES 11A & 11C)	1 2	C	
3	TB-20	3-LINE DISTRIBUTION BLOCK	1	C	
4	MP-347 MP-259	VM16 MAIN LEXAN COVER, DWG. No. 6-01-033-014 LEXAN STANDOFF, LONG, DWG. No. 6-01-018-300	0 or 1 0 or 4	F	USED ON CE COMPLIANT MACHINES ONLY
5	WX-186	GROUNDING LUG	1	N	
6	SW-42 FU-35 FU-30	MAIN DISCONNECT SWITCH, THC31 (GE) FUSE CLIP KIT FUSE, 30 AMP, FRN-R-30, (FUSES 1A, 1B & 1C)	1 1 3	C G	
7	FU-09 FU-28 FU-46	FUSE CLIP, SINGLE MDL/MDA FUSE, 2 AMP MDL, (FUSES 8A, 8C) FUSE, 1 AMP MDL, (FUSE 24)	3 2 1	A	
8	TR-26	MAG PANEL TRANSFORMER, 1.5 KVA, 9T58B3396 (GE)	1	E	
9	M1-09	NOISE SUPPRESSOR, 600 VOLT	4	I	
10	FU-51 NONE	FUSE, 30 AMP MDL, (FUSE 12) TRANSFORMER FUSE CLIP KIT	1 1	G	
11	RL-48 RL-06	+24 VDC CONTROL RELAY, 10 AMP, 3PDT RELAY SOCKET BASE	1 1	H	
12	RE-65	RESISTOR, WIRE WOUND CERAMIC, 15 OHM/1000 WATT	1	E	
13	PS-17	PC3 AC SPINDLE DRIVE, 220 VAC SAFTRONICS No. C1MR-PCU23P7	1	D	
14	MP-346 MP-259	VM16 BRAKE RESISTOR LEXAN COVER DWG No. 6-01-033-020 LEXAN STANDOFF, LONG, DWG. No. 6-01-018-300	0 or 1 0 or 3	F	USED ON CE COMPLIANT MACHINES ONLY
15	BLU-04	GROUNDING BUS BAR - 23 POST, SQUARE-D PK23GTA	1	G	
16	RL-64 RL-61 RL-65	DC CONTACTOR RELAY, 18 AMP TELEMECANIQUE LP10D1810 CONTACTOR AUXILIARY RELAY, 2 N/O & 2 N/C TELEMECANIQUE LA1DN22 CONTACTOR NOISE SUPPRESSOR DIODE TELEMECANIQUE LA4DC1U	2 1 2	H J J	ATTACH AUX TO CONTACTOR K1
17	9107	M-FUNCTION QUAD RELAY BOARD	1	H	
18	8177	REGULATED POWER SUPPLY, +24 VDC @ 2.4 AMPS	1	C	
19	WX-167	DIN RAIL MOUNTING CHANNEL, 35 x 7.5 mm, 3 IN. PIECE	10	B	
20	TB-30 TB-31 TB-32 TB-33	DIN RAIL TERMINAL BLOCK, 4-POST, TOP ENTRY DIN RAIL TERMINAL BLOCK END PIECE DIN RAIL TERMINAL BLOCK JUMPER, 10 POS'N TERMINAL BLOCK MARKING TAB, SHEET OF 100	47 1 1.9 0.47	H K K K	
21	FA-01 FA-04 FA-03 BR-09	COOLING FAN, 110 VAC FAN GRILLE FAN POWER CABLE, 24 IN. FAN MOUNTING BRACKET	1 or 2 1 or 2 1 or 2 1 or 2	C	USE 2 FANS FOR 4-AXIS SYSTEMS
22	AM-25	AXIS DRIVE AMPLIFIER, 160 VDC GLENTEK GA-370	3 or 4	D	4 DRIVES FOR 4-AXIS SYSTEMS
23	MP-348 MP-259	VM16 AXIS DRIVES LEXAN COVER DWG No. 6-01-033-013 LEXAN STANDOFF, LONG, DWG. No. 6-01-018-300	0 or 1 0 or 4	F	USED ON CE COMPLIANT MACHINES ONLY
24	7335	AXIS DRIVE BUS BOARD	1	H	
25	M1-10	LINE FILTER, 110 VAC, 10 AMP	1	B	
26	CA-51 CA-30 LB-70	CAPACITOR, ELECTROLYTIC, 7700 uF/200 WVDC CAPACITOR MOUNTING RING, VR-12 CAPACITOR WARNING LABEL	2 2 2	B	STICKS TO SIDE OF CAPACITOR
27	LB-81	ELECTRICAL HAZARD WARNING LABEL SET	1		STICKS TO MAG PANEL AND CAPACITORS
28	WC-65 WC-66	2 INCH WIRE TRACK 2 INCH WIRE TRACK COVER	48 IN. 48 IN.	B	
29	WX-129	RUBBER SHOCK MOUNT	4	M	
30	SP-74	STEEL CARD CAGE STANDOFF MOUNT	2	L	
31	LB-20	UNITED STATES FLAG LABEL	1		STICKS TO CARD CAGE COVER
32	6125	CENTURION VI CNC CARD CAGE	1		SEE ITEMS 29, 30 & 33
33	HD-63	CARD CAGE SPRING HANGER	2	P	
34	DI-16	BRIDGE RECTIFIER	1	K	
35	DI-20	DIODE, 1N4007	1	K	

HARDWARE SPECIFICATION

- A - 8-32 x 3/8 RHMS
- B - 8-32 x 5/16 RHMS WITH NO. 8 INTERNAL LOCKWASHER
- C - 8-32 x 1/2 RHMS WITH NO. 8 INTERNAL LOCKWASHER
- D - 10-32 x 1/2 RHMS WITH NO. 10 INTERNAL LOCKWASHER
- E - 1/4-28 x 3/4 RHMS WITH 1/4 LOCKWASHER FROM BOTTOM AND 1/4 LOCKWASHER AND 1/4-28 NUT ON TOP
- F - 1/4-28 x 1 RHMS WITH 1/4 LOCKWASHER FROM BOTTOM AND 1/4 LOCKWASHER AND 1/4-28 NUT ON TOP
- G - HARDWARE INCLUDED WITH PART
- H - DIN RAIL MOUNTED COMPONENT
- I - USE CYANOACRYLATE ADHESIVE, (SUPER GLUE)
- J - ATTACHES TO CONTACTOR
- K - ATTACHES TO TERMINAL BLOCK
- L - 8-32 x 3/4 SHCS AND NO. 8 INTERNAL LOCKWASHER FROM BOTTOM AND NO. 8 INTERNAL LOCKWASHER & NUT ON TOP
- M - NO. 8 INTERNAL LOCKWASHER AND 8-32 NUT ON BOTTOM
- N - 10-32 x 5/8 SHCS WITH NO. 10 INTERNAL LOCKWASHER FROM BOTTOM AND TWO 10-32 NUTS WITH THREE NO. 10 INTERNAL LOCKWASHERS ON TOP
- O - 1/4-20 x 3/4 SHCS WITH 1/4 LOCKWASHER FROM BOTTOM
- P - 10-32 x 1 SHCS WITH NO. 10 INTERNAL LOCKWASHER AND 10-32 NUT FROM TOP, AND 10-32 NUT WITH NO. 10 INTERNAL LOCKWASHER FROM BOTTOM.

A	REMOVE TB51, 75, 327	3151		6/97
REV.	DESCRIPTION	E.C.D. NO.	APP'D BY	DATE
MATERIAL/FINISH				
STOCK/ASSY No.	5035	TITLE	VK5 & MB-AUTO MAG PANEL LAYOUT	
TOLERANCE UNLESS SPECIFIED	X.XXX +/- .005 X.XX +/- .010 X.X +/- .030 ANGLE +/- 1.0°	APPLICATION	CENTURION VI	
		SCALE	1.25:1	DWG No. 6-03-033-021 SIZE C
		DATE	23 MAY 97	DRAWN BY REUTER SHEET NO. 2 OF 2

Yaskawa Varispeed 616G5 Spindle Drive Parameters

MB19-MB24, VK4 & 5, and VM15 & 16 Auto Machines

Set parameter A1-01 to 4 (parameter access level = advanced) to give you access to all the parameters.

PARAMETER	DESCRIPTION	VALUE	
B2-01	DC Injection Braking start frequency	10 Hz	
B2-02	DC Injection Brake Current	100 %	
B2-04	DC injection Brake at Stop	.25 sec	
C1-01*	Acceleration Time 1	2.0 sec	
C1-02*	Deceleration Time 1	2.0 sec	
D1-09	Jog Frequency Reference (Creep)	1.50 Hz	
E1-04	Maximum Output Frequency	140 Hz	
E1-09	Minimum Output Frequency	1 Hz	
E2-01	Full Load Current (FLA)	26.6 Amps	
E2-02	Rated Slip	.8 Hz	
E2-03	No Load Current	11.9 Amps	
E2-05	Line-to-line Resistance	.36 Ohms	
E2-06	Inductance Leakage	15.5 %	
E2-07	Saturation Coefficient 1	.38	
E2-08	Saturation Coefficient 2	.58	
H2-02	Terminal 25 Select	2 (up-to-speed)	
H2-03	Terminal 26 Select	1 (zero speed)	5.25
H4-01	Terminal 21 Select	3 (load meter)	5.23
L1-01	Motor OL Protection	0 (disabled)	
L3-04	Deceleration Stall Prevent	0 (disabled)	
L8-05	Input Open Phase Detection	1 (enabled)	

* For single-phase operation, set both C1-01 and C1-02 to 6 seconds.

This listing contains the spindle drive parameters that have been changed by Milltronics Manufacturing. All other parameters remain unchanged and are the factory default settings by Yaskawa.

Spindle Drive Parameter List
For Yaskawa 616G5

Parameter	Function	Default
A1-00	Language Selection	0
A1-01	Parameter Access Level	2
A1-02	Control Method Selection	2
A1-03	Initialize Parameters	0000
A1-04	Enter Password	0000
B1-01	Reference Selection	1
B1-02	Operation Method Selection	1
B1-03	Stopping Method Selection	0
B1-04	Reverse Operation Prohibit	0
B1-05	Zero Speed Operation	0
B1-06	Logic Input Scan Rate	1
B1-07	Local/Remote Run Selection	0
B2-01	DC Injection Braking Start Frequency	0.5
B2-02	DC Injection Braking Current	50
B2-03	DC Injection Braking Time at Start	0.00
B2-04	DC Injection Braking Time at Stop	0.00
B3-01	Speed Search Selection	0
B3-02	Speed Search Current	150
B3-03	Speed Search Deceleration Time	2.0
B4-01	Timer Function Timer ON-delay Time	0.0
B4-02	Timer Function Timer OFF-delay Time	0.0
B5-01	PID Control Mode Selection	0
B5-02	PID Proportional Gain	1.00
B5-03	PID Integral Time	1.0
B5-04	PID Integral Limit	100.0
B5-05	PID Differential Time	0.00
B5-06	PID Output Limit	100.0
B5-07	PID Offset Adjustment	0.0
B5-08	PID Primary Delay Time Constant	0.00
B6-01	Dwell Frequency at Start	0.0
B6-02	Dwell Time at Start	0.0
B6-03	Dwell Frequency at Stop	0.0
B6-04	Dwell Time at Stop	0.0
B7-01	Droop Control Gain	0.0
B7-02	Droop Control Delay Time	0.05
B8-01	Energy-Saving Gain	80
B8-02	Energy-Saving Frequency	0.0
B9-01	Zero-Servo Gain	5
B9-02	Zero-Servo Completion Width	10
C1-01	Acceleration Time 1	10.0
C1-02	Deceleration Time 1	10.0
C1-03	Acceleration Time 2	10.0

Parameter	Function	Default
C1-04	Deceleration Time 2	10.0
C1-05	Acceleration Time 3	10.0
C1-06	Deceleration Time 3	10.0
C1-07	Acceleration Time 4	10.0
C1-08	Deceleration Time 4	10.0
C1-09	Fast Stop Deceleration Time	10.0
C1-10	Accel/Decel Time Setting Unit	1
C1-11	Accel/Decel Time Switching Frequency	0.0
C2-01	S-Curve Characteristic at Accel. Start	0.20
C2-02	S-Curve Characteristic at Accel. End	0.20
C2-03	S-Curve Characteristic at Decel. Start	0.20
C2-04	S-Curve Characteristic at Decel. End	0.20
C3-01	Slip Compensation Gain	1.0
C3-02	Slip Compensation Primary Delay Time	200
C3-03	Slip Compensation Limit	200
C3-04	Slip Comp. Selection During recognition	0
C4-01	Torque Compensation Gain	1.00
C4-02	Torque Compensation Time Constant	20
C5-01	ASR Proportional Gain 1	20.00
C5-02	ASR Integral time 1	0.500
C5-03	ASR Proportional Gain 2	20.00
C5-04	ASR Integral time 2	0.500
C5-05	Auto Speed Regulator, (ASR), Integral limit	5.0
C5-06	ASR Primary Delay Time	0.004
C5-07	ASR Switching Frequency	0.0
C6-01	Carrier Frequency Upper Limit	15.0
C6-02	Carrier Frequency Lower Limit	15.0
C6-03	Carrier Frequency Proportional Gain	0
C7-01	Hunting Prevention Selection	1
C7-02	Hunting Prevention Gain	1.00
C8-08	AFR Gain	1.00
C8-30	Carrier Frequency During Auto-tuning	0
D1-01	Frequency Reference 1	0.00
D1-02	Frequency Reference 2	0.00
D1-03	Frequency Reference 3	0.00
D1-04	Frequency Reference 4	0.00
D1-05	Frequency Reference 5	0.00
D1-06	Frequency Reference 6	0.00
D1-07	Frequency Reference 7	0.00
D1-08	Frequency Reference 8	0.00
D1-09	Jog Frequency Reference	6.00
D2-01	Frequency Reference Upper Limit	100.0
D2-02	Frequency Reference Lower Limit	0.0
D3-01	Critical Frequency Rejection 1	0.0
D3-02	Critical Frequency Rejection 2	0.0

Parameter	Function	Default
D3-03	Critical Frequency Rejection 3	0.0
D3-04	Critical Frequency Rejection Width	1.0
D4-01	Frequency Reference Hold Function Selection	0
D4-02	+/- Speed Limits	10
D5-01	Torque Control Selection	0
D5-02	Torque Reference Delay Time	0
D5-03	Speed Limit Selection	1
D5-04	Speed Limit	0
D5-05	Speed Limit Bias	10
D5-06	Speed/Torque Control Switching Timer	0
E1-01	Input Voltage Setting	230
E1-02	Motor Selection	0
E1-03	V/f Pattern Selection	F
E1-04	Maximum Output Frequency	60.0
E1-05	Maximum Voltage	230.0
E1-06	Base Frequency	60.0
E1-07	Mid. Output Frequency A	0.0
E1-08	Mid. Output Voltage A	0.0
E1-09	Minimum Output Frequency	0.5
E1-10	Minimum Output Voltage	0.0
E1-11	Mid. Output Frequency B	0.0
E1-12	Mid. Output Voltage B	0.0
E1-13	Base Voltage	0.0
E2-01	Motor Rated Current	19.60
E2-02	Motor Rated Slip	1.50
E2-03	Motor No-load Current	5.10
E2-04	Number of Motor Poles	4
E2-05	Motor Line-to-line Resistance	0.399
E2-06	Motor Leakage Inductance	18.2
E2-07	Motor Iron Core Saturation Coefficient 1	0.50
E2-08	Motor Iron Core Saturation Coefficient 2	0.75
E2-09	Motor Mechanical Loss	0.0
F1-01	Encoder (PG) Constant	1024
F1-02	Operation Selection at PG Open Circuit	1
F1-03	Operation Selection at Over speed	1
F1-04	Operation Selection at Speed Deviation	3
F1-05	PG Rotation	0
F1-06	PG Division Rate (PG Pulse Monitor)	1
F1-07	Integral Value During Accel/Decel Selection	0
F1-08	Over speed Detection Level	115
F1-09	Over speed Detection Delay Time	0.0
F1-10	Excessive Speed Deviation Detection Level	10
F1-11	Excess Speed Deviation Detection Delay Time	0.5
F1-12	Number of PG Gear Teeth 1	0
F1-13	Number of PG Gear Teeth 2	0
F1-14	PGo Detect Time	2.0
F2-01	AI-14 Bi-Polar or Uni-Polar Input Selection	0

Parameter	Function	Default
F3-01	DI-16 Digital Input Option	0
F4-01	AO-08 / AO-12 Channel 1 Monitor Selection	2
F4-02	AO-08 / AO-12 Channel 1 Gain	1.00
F4-03	AO-08 / AO-12 Channel 2 Monitor Selection	3
F4-04	AO-08 / AO-12 Channel 2 Gain	0.50
F5-01	DO-02 Channel 1 Output Selection	0
F5-02	DO-02 Channel 2 Output Selection	1
F6-01	DO-08 Output Mode Selection	0
F7-01	PO-36F Frequency Multiple Selection	1
H1-01	Multi-Function Input Terminal 3	24
H1-02	Multi-Function Input Terminal 4	14
H1-03	Multi-Function Input Terminal 5	3
H1-04	Multi-Function Input Terminal 6	4
H1-05	Multi-Function Input Terminal 7	6
H1-06	Multi-Function Input Terminal 8	8
H2-01	Multi-Function Output Terminal 9 & 10	0
H2-02	Multi-Function Output Terminal 25-27	1
H2-03	Multi-Function Output Terminal 26-27	2
H3-01	Auto Speed Reference Signal Level Selection Terminal 13	0
H3-02	Auto Speed Reference Signal Gain Terminal 13	100.0
H3-03	Auto Speed Reference Signal Bias Terminal 13	0.0
H3-04	Multi-Function Analog Input 1 Signal Level Selection Terminal 16	0
H3-05	Multi-Function Analog Input 1 Selection Terminal 16	0
H3-06	Multi-Function Analog Input 1 Gain Terminal 16	100.0
H3-07	Multi-Function Analog Input 1 Bias Terminal 16	0.0
H3-08	Multi-Function Analog Input 2 Signal Level Selection Terminal 14	2
H3-09	Multi-Function Analog Input 2 Selection Terminal 14	1F
H3-10	Multi-Function Analog Input 2 Gain Terminal 14	100.0
H3-11	Multi-Function Analog Input 2 Bias Terminal 14	0.0
H3-12	Analog Input Filter Time Constant	0.000
H4-01	Multi-Function Analog Monitor 1 Selection Terminal 21	2
H4-02	Multi-Function Analog Monitor 1 Gain Terminal 21	1.00
H4-03	Multi-Function Analog Monitor 1 Bias Terminal 21	0.0
H4-04	Multi-Function Analog Monitor 2 Selection Terminal 23	3
H4-05	Multi-Function Analog Monitor 2 Gain Terminal 23	0.50
H4-06	Multi-Function Analog Monitor 2 Bias Terminal 23	0.0
H4-07	Multi-Function Analog Monitor Signal Level Selection Terminal 21 & 23	0
H5-01	Serial Comm. Station Address	1F
H5-02	Serial Comm. Baud Rate	3
H5-03	Serial Comm. Parity Rate	0
H5-04	Stopping Method After Serial Comm. Error	3

Parameter	Function	Default
H5-05	Serial Comm. Error Detection	1
L1-01	Motor Overload Protection Selection	0
L1-02	Motor Overload Protection Time constant	1.0
L2-01	Momentary Power Loss Detection Selection	0
L2-02	Momentary Power Loss Ride-Thru Time	2.0
L2-03	Momentary Power Loss Min. Base Block Time	0.7
L2-04	Momentary Power Loss Recovery Ramp Time	0.3
L2-05	Under voltage Detection Level	190
L2-06	KEB Frequency	0.0
L3-01	Stall Prevention Selection During Accel	1
L3-02	Stall Prevention Level During Accel	150
L3-03	Stall Prevention Limit During Accel (CHP)	100
L3-04	Stall Prevention Selection During Decel	1
L3-05	Stall Prevention Selection During Running	1
L3-06	Stall Prevention Level During Running	160
L4-01	Speed Coincidence Frequency	0.0
L4-02	Speed Coincidence Width	2.0
L4-03	Speed Coincidence Frequency (+/-)	0.0
L4-04	Speed Coincidence Width (+/-)	2.0
L4-05	Frequency Reference Loss Detection	0
L5-01	Number of Auto Restart Attempts	0
L5-02	Auto Restart Operation Selection	0
L6-01	Torque Detection Selection 1	0
L6-02	Torque Detection Level 1	150
L6-03	Torque Detection Time 1	0.1
L6-04	Torque Detection Selection 2	0
L6-05	Torque Detection Level 2	150
L6-06	Torque Detection Time 2	0.1
L7-01	Forward Torque Limit	200
L7-02	Reverse Torque Limit	200
L7-03	Forward Regenerative Torque Limit	200
L7-04	Reverse Regenerative Torque Limit	200
L8-01	Internal Dynamic Braking Resistor Protection	0
L8-02	Overheat Protection Alarm Level	95
L8-03	Operation Selection After Overheat Pre-alarm	3
L8-05	Input Open-phase Protection Selection	0
L8-07	Output Open-phase Protection Selection	
o1-01	Monitor Selection	6
o1-02	Monitor Selection After Power-up	1
o1-03	Digital Operator Display Selection	0
o1-04	Digital Operator Display Units	0
o1-05	Parameter Address Display Selection	0
o2-01	LOCAL/REMOTE Key Selection	1
o2-02	STOP Key Function During Remote Run	1
o2-03	User Parameter Default Value	0
o2-04	kVA Selection (Drive Model Number)	5

Parameter	Function	Default
o2-05	Digital Operator "Motor Operated Pot"	0
o2-06	Operation Selection When Digital Operator is Disconnected	1
o2-07	Elapsed Operating Hour Timer Set	0
o2-08	Elapsed Operating Hour Timer Selection	0
o2-09	Initial Mode Selection	1
U1-01	Frequency Reference	
U1-02	Output Frequency	
U1-03	Output Current	
U1-04	Control Method	
U1-05	Motor Speed	
U1-06	Output Voltage	
U1-07	DC Bus Voltage	
U1-08	Output Power	
U1-09	Torque Reference	
U1-10	Input Terminal Status	
U1-11	Output Terminal Status	
U1-12	Operation Status	
U1-13	Elapsed Operation Time	
U1-14	Software Version (Flash I.D. No.)	
U1-15	Control Circuit Terminal 13 Input Voltage	
U1-16	Control Circuit Terminal 14 Input Voltage	
U1-17	Control Circuit Terminal 16 Input Voltage	
U1-18	Motor Secondary Current (Iq)	
U1-19	Motor Exciting Current	
U1-20	Output Frequency After Soft-start	
U1-21	Automatic Speed Regulator Input	
U1-22	Automatic Speed Regulator Output	
U1-23	Speed Deviation Regulator Input	
U1-24	PID Feedback Amount	
U1-25	DI-16H Input Status	
U1-26	Output Voltage Reference (Vq)	
U1-27	Output Voltage Reference (Vd)	
U1-28	Software Number (CPU I.D. No.)	
U1-32	ACR (q-Axis) Output	
U1-33	ACR (d-Axis) Output	
U1-34	OPE Detected	
U2-01	Current Fault	
U2-02	Last Fault	
U2-03	Frequency Reference	
U2-04	Output Frequency	
U2-05	Output Current	
U2-06	Motor Speed	
U2-07	Output Voltage	
U2-08	DC Bus Voltage	
U2-09	Output Kilowatts	
U2-10	Torque Reference	
U2-11	Input Terminal Status	
U2-12	Output Terminal Status	
U2-13	Inverter Status	
U2-14	Elapsed Time	
U3-01	Last Fault	

Parameter	Function	Default
U3-02	Fault Message 2	
U3-03	Fault Message 3	
U3-04	Fault Message 4	
U3-05	Elapsed Time 1	
U3-06	Elapsed Time 2	
U3-07	Elapsed Time 3	
U3-08	Elapsed Time 4	

Glentek Axis Drive Amplifiers

The GA370 used on Milltronics DC machines are a modular, high power, high bandwidth PWM servo amplifier designed for use with DC permanent magnet servomotors. The GA370 utilizes today's latest technology in power semiconductors for high efficiency, which in turn makes the amplifier extremely reliable in today's and tomorrow's demanding applications.

Description of Features and Technical Information

SIGNAL INPUT:

The +/- 10 VDC analog signal is applied between J1 pins 2 and 9. Pin 9 is the signal ground.

LOCK OUT (TOTAL INHIBIT AND FAULT MONITOR):

The X and Y amplifiers can be locked out by the CNC control (SLS systems only) via the UNLOCK feature. Pressing UNLOCK causes the axis plug pin13 to ground the drive input, J1 pin 8. Pressing RESET on the front panel re-enables the amplifier.

PROTECTION CIRCUITS:

The following protection circuits are integral to the GA370 amplifier to prevent damage to the amplifier and your equipment. When activated these protection circuits will totally inhibit the amplifier and turn on the fault output.

OVER VOLTAGE INDICATOR (RED LED):

The indicator LED will turn ON and latch indicating the D.C. bus voltage has exceeded the maximum safe voltage for the system. This circuit protects the motor and amplifier from high D.C. bus voltages.

LOW SPEED ELECTRONIC CIRCUIT **BREAKERS (RED LED):**

The indicator LED will turn ON and latch indicating the Low Speed Electronic Circuit Breaker (LS/ECB) has fired. This circuit protects the motor, amplifier and mechanical system from damage due to excessive mechanical bind or possibly driving into a hard mechanical stop.

Circuit operation is as follows:

When the motor current exceeds the value set at TP9, typically 1.5 VDC (scale factor 1 VOLT = 10 AMPS), U1B-14 switches positive and voltage on C46 begins integrating up. If the current remains above the set point, typically for 1.5 seconds, the LS/ECB latch will trigger.

HIGH SPEED ELECTRONIC CIRCUIT BREAKER (RED LED):

The indicator LED will turn ON and latch indicating the High Speed Electronic Circuit Breaker (HS/ECB) has fired. This circuit protects the amplifier from dead shorts across the amplifier output terminals. The HS/ECB is always factory set and should not be adjusted. The typical factory setting is 45 Amps for 10 microseconds.

TEMP INDICATOR OPERATION (RED LED):

The Temp Indicator LED will Turn ON and latch when the transistor heatsink temperature exceeds 170°F.

SPECIFICATIONS:

OUTPUT POWER (For each GA370 amplifier module)	
OUTPUT CURRENT (Peak):	±25 AMPS
OUTPUT CURRENT (RMS):	±15 AMPS
OUTPUT VOLTAGE (typical)	±100 VDC
INPUT POWER:	
FANS:	120 VAC, 50/60 Hz @ 1 AMP
D.C. BUS VOLTAGE	
TYPICAL:	65 VDC TO 170 VDC
MAXIMUM:	200 VDC

Fault Indications and Possible Causes

FAULT SHUTDOWNS CAN ONLY BE CAUSED BY ABNORMAL CONDITIONS. THE CAUSE SHOULD BE INVESTIGATED BEFORE REPEATED RECYCLING OF THE MOTOR DRIVE TO PREVENT POSSIBLE DAMAGE TO THE AMPLIFIER.

OVER TEMPERATURE SHUTDOWN:

When the heatsink temperature has reached a level that, if exceeded would damage the output transistors, the Temp indicator LED is latched ON inhibiting the amplifier.

List of possible causes of excessive temperature rise:

1. Loss of cooling air – Fans are defective or airflow is blocked.
2. Excessive rise in cooling air temperature due to cabinet ports being blocked or excessive hot air being ingested.
3. Extended operational duty cycle due to mechanical overload of motor or defective motor.
4. Defective power output section due to component failure
5. Noisy Tachometer signal – A noisy tachometer causes a considerable amount of random switching of the power output transistors, thus increasing the amount of heat developed in the output section, The higher the bandwidth the more the heating due to a noisy tachometer. A noisy tachometer can be identified by a large amount of rumbling and twitching of the motor at low or zero shaft speeds.

OVER VOLTAGE SHUTDOWN:

When the D.C. bus voltage has exceeded the maximum safe voltage of 200 VDC, the Over voltage indicator LED turns ON inhibiting the amplifier. This circuit protects the motor and amplifier from high D.C. bus voltages.

List of possible causes of high D.C. bus voltage

1. AC main voltage too high.
2. Wrong transformer installed.
3. A spinning DC motor is basically a DC generator and it produces a voltage (BEMF) which is
4. Proportional to RPM. This BEMF voltage becomes additive to the DC bus voltage (Regen
5. Voltage) when the amplifier is commanded to decelerate a given motor inertial load. If the Regen Voltage is high enough to cause a OVER VOLTAGE SHUTDOWN consult with Milltronics for the addition of a REGEN CLAMP to you system.

LOW SPEED ELECTRONIC CIRCUIT BREAKER (LS/ECB) SHUTDOWN:

The LS/ECB is tripped when a preset current threshold is exceeded for a preset length of time, typically 15 Amps for 3 seconds. The time delay is typically set at the factory to your system requirements.

List of possible causes:

1. Binding or stalling of motor shaft.
2. Overload of amplifier output to motor.
3. Large reflected load inertia.

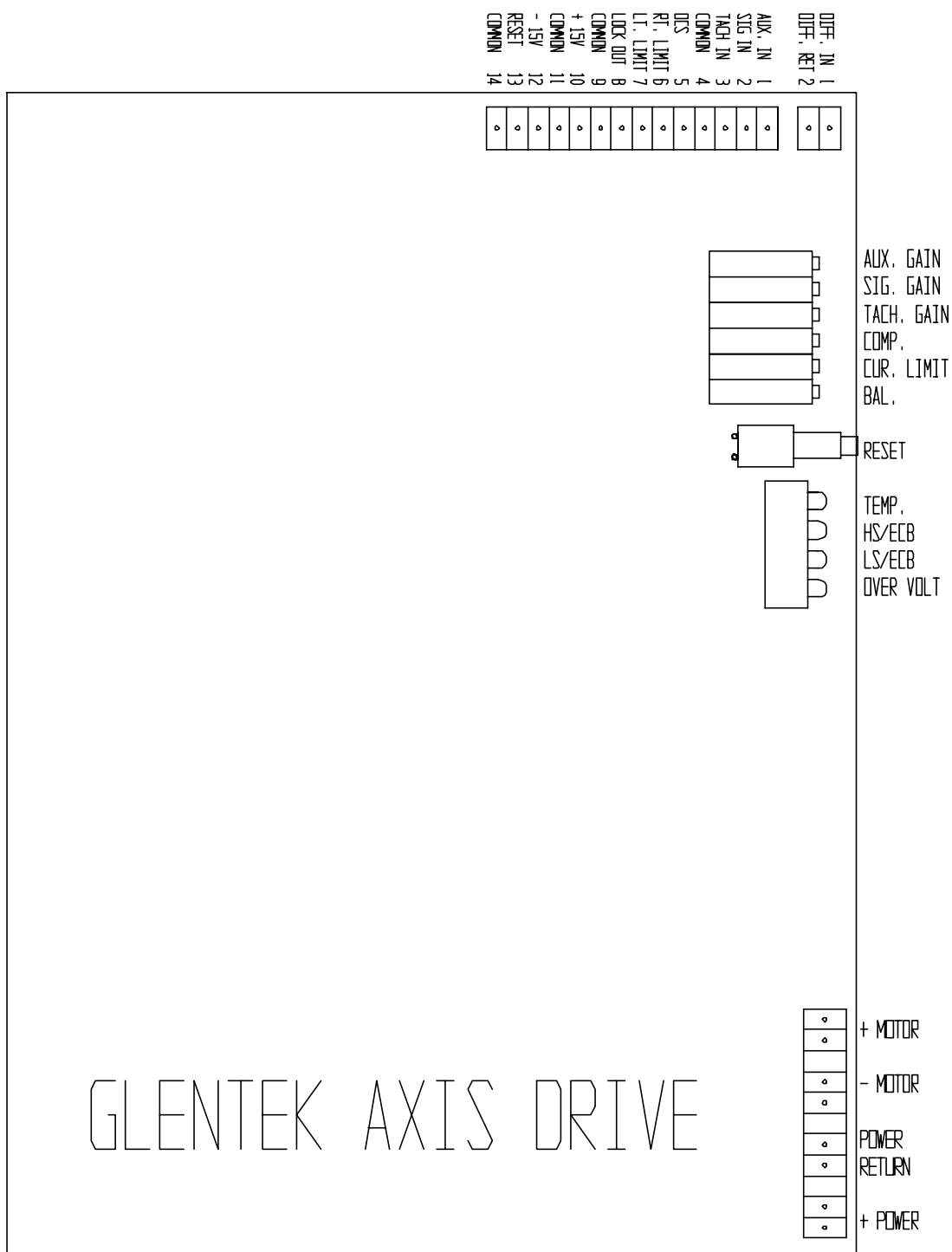
HIGH SPEED ELECTRONIC CIRCUIT BREAKER (HS/ECB) SHUTDOWN:

The HS/ECB is tripped by 45 or more Amps of output current for 10 micro seconds.

List of possible causes:

1. Shorted motor leads.
2. Motor inductance too low.
3. Intermittent motor short.
4. Motor commutator flash over.

Drive Card Layout



Centurion 6 CNC Connector Signal Listing

Connector X-Input

Pin 1 - Machine emergency stopped	Pin 8 - Spindle zero speed
Pin 2 - Spare	Pin 9 - Spindle drive fault
Pin 3 - Spare	Pin 10 - Spool Reverse
Pin 4 - Spindle up-to-speed	Pin 11 - Digitizing probe signal
Pin 5 - Tool Change	Pin 12 - Key (jumped to Home-1 and X-axis10)
Pin 6 - Lube Fault (oiler empty)	Pin 13 - No connect
Pin 7 - CNC wait channel	Pin 14 - No connect

Connector Y-Input

Pin 1 - Air pressure	Pin 8 - Tool out switch pushed – (requested)
Pin 2 - Tool carousel at home (jumped to TCH-8)	Pin 9 - Chip pan door is open (feedhold)
Pin 3 - Tool carousel at pocket (jumped to TCH-9)	Pin 10 - Set-up button
Pin 4 - Tool changer arm is in (jumped to TCH-10)	Pin 11 - Edit switch (keylock)
Pin 5 - Tool changer arm is out (jumped to TCH-11)	Pin 12 - Key (jumped to Home-3)
Pin 6 - Spare Y-axis 10)	Pin 13 - No connect
Pin 7 - Orient roller is in - prox signal (jumped to TCH-12)	Pin 14 - No connect

Connector Z-input

Pin 1 - Remote HW Enable	Pin 8 - Tool Setting
Pin 2 - Remote FOV1	Pin 9 - High/Low Gear
Pin 3 - Remote FOV2	Pin 10 - Arm Parked
Pin 4 - OverTemp	Pin 11 - Auger Switch
Pin 5 - Top (on arm tool changer)	Pin 12 - Key (jumped to home 5 and Z-axis 10)
Pin 6 - Middle (on arm tool changer)	Pin 13 - No connect
Pin 7 - Bottom (on arm tool changer)	Pin 14 - No connect

Connector A-Input

Pin 1 - X-axis Yaskawa drive OK/Fault (jumped through JS3 to X-axis 9)	Pin 8 - Remote HW Coord 1
Pin 2 - Y-axis Yaskawa drive OK/Fault (jumped through JS3 to Y-axis 9)	Pin 9 - Remote HW Coord 2
Pin 3 - Z-axis Yaskawa drive OK/Fault (jumped through JS3 to Z-axis 9)	Pin 10 - Remote HW Coord 3
Pin 4 - A-axis Yaskawa drive OK/Fault(jumped through JS3 to A-axis 9)	Pin 11 – Remote HW set Coord
Pin 5 - B-axis Yaskawa drive OK/Fault (jumped through JS3 to B-axis 9)	Pin 12 - Key (jumped to home 7 and A-axis 10)
Pin 6 - Remote HW Axis 1	Pin 13 - No connect
Pin 7 - Remote HW Axis 2	Pin 14 - No connect

Connector X-Output

Pin 1 - Excess Error	Pin 8 - Tool change
Pin 2 - Spray mist coolant	Pin 9 - Allow Reset
Pin 3 - Flood coolant	Pin 10 - Delayed reset
Pin 4 - Spindle clockwise	Pin 11 - Spindle latch
Pin 5 - Spindle counter clockwise	Pin 12 - Rotary clamp
Pin 6 - Spindle drive OK	Pin 13 - Key
Pin 7 - Drawbar Enable (VK5 & MB-Auto only)	Pin 14 - No connect

Centurion 6 CNC Connector Signal Listing

Connector Y-Output

Pin 1 - Creep speed	Pin 8 - Blowoff/Drumdoor/FeedHold (jumped to TCH-Yin9)
Pin 2 - Tool changer arm in/ pot down (jumped to TCH-1)	Pin 9 - Gear 1 of 4 Gear
Pin 3 - Power drawbar (jumped to TCH-2)	Pin 10 - Low range - Gear 2 of 4
Pin 4 - Tool carousel clockwise (jumped to TCH-3)	Pin 11 - Medium range – Gear 3 of 4
Pin 5 - Tool carousel counter clockwise (jumped to TCH-4)	Pin 12 - High range - Gear 4 of 4
Pin 6 - Spindle enable	Pin 13 - Key
Pin 7 - Orient roller (jumped to TCH-5)	Pin 14 - No connect

Connector Z-Output

Pin 1 - MC1G / Optical Probe On	Pin 8 - Miscellaneous M-code No. 2
Pin 2 - MC1D / Hard Tap (For no ramps on CSM)	Pin 9 - Miscellaneous M-code No. 3
Pin 3 - MC1C / Auger for Chip removal M38/M39	Pin 10 - Miscellaneous M-code No. 4
Pin 4 - MC1B	Pin 11 - Miscellaneous M-code No. 5
Pin 5 - MC1A	Pin 12 - Spindle reverse
Pin 6 - Miscellaneous M-code No. 1	Pin 13 - Key
Pin 7 - End-of-cycle lamp	Pin 14 - No connect

Connector A-Output

Pin 1 - X-Axis drive enable (jumped through JS3 to X-axis 13)	Pin 8 - Spare
Pin 2 - Y-Axis drive enable (jumped through JS3 to Y-axis 13)	Pin 9 - Spare
Pin 3 - Z-Axis drive enable (jumped through JS3 to Z-axis 13)	Pin 10 – Spindle Running
Pin 4 - A-Axis drive enable (jumped through JS3 to A-axis 13)	Pin 11 – Door Open
Pin 5 - B-Axis drive enable (jumped through JS3 to B-axis 13)	Pin 12 – Door Close
Pin 6 - Axis drives enable	Pin 13 - Key connect
Pin 7 - Arm (on Swing-Arm TICHngr)	Pin 14 - No

Connectors X, Y, Z, A and B Axis (DC Brush Drives)

Pin 1 - Channel A +	Pin 8 - +5 VDC
Pin 2 - Channel A -	Pin 9 - Axis fault/OK (jumped through JS3 to A-Input)
Pin 3 - Channel B +	Pin 10 - Axis home switch (also found on Home Connector)
Pin 4 - Channel B -	Pin 11 - Axis analog signal
Pin 5 - Marker -	Pin 12 - Axis analog ground
Pin 6 - Marker +	Pin 13 - Axis Enable/Disable (jumped through JS3 to A- Output)
Pin 7 - DC ground	Pin 14 - Key

Connectors X, Y, Z, A and B Axis (Yaskawa Brushless Drives)

Pin 1 - 0 VDC	Pin 20 - Marker -	Pin 34 - Channel A -
Pin 2 - 0 VDC	Pin 29 - Servo ready	Pin 35 - Channel B +
Pin 5 - Axis analog signal	Pin 30 - 0 VDC	Pin 36 - Channel B -
Pin 6 - 0 VDC	Pin 31 - Alarm output	Pin 40 - Servo ON
Pin 10 - 0 VDC	Pin 32 - 0 VDC	Pin 47 - +24 VDC
Pin 19 - Marker +	Pin 33 - Channel A +	All other pins are no connect

Axis Home Connector

Pin 1 - X-axis home switch signal (jumped to X-axis 10 & X-input 12)	Pin 8 - A-axis home switch ground
Pin 2 - X-axis home switch ground	Pin 9 - B-axis home switch signal (jumped to B-axis 10 & A-input 11)
Pin 3 - Y-axis home switch signal (jumped to Y-axis 10 & Y-input 12)	Pin 10 - B-axis home switch ground
Pin 4 - Y-axis home switch ground	Pin 11 - Key

Centurion 6 CNC Connector Signal Listing

Pin 5 - Z-axis home switch signal (jumped to Z-axis 10 & Z-input 12)	Pin 12 - No connect
Pin 6 - Z-axis home switch ground	Pin 13 - No connect
Pin 7 - A-axis home switch signal (jumped to A-axis 10 & A-input 12)	Pin 14 - No connect

Spindle Drive Connector

Pin 1 - Forward Run (jumped to X-out 4)	Pin 8 - Spindle analog signal (jumped to Misc-13)
Pin 2 - Reverse Run (jumped to X-out 5)	Pin 9 - Spindle fault contacts (jumped to X-in 9)
Pin 3 - Ground	Pin 10 - Ground
Pin 4 - Key	Pin 11 - Spindle analog signal ground (jumped to Misc-14)
Pin 5 - Creep speed (jumped to Y-out 1)	Pin 12 - Spindle load meter (jumped to Misc-3)
Pin 6 - Ground	Pin 13 - Up-to-speed (jumped to X-in 4)
Pin 7 - Ground	Pin 14 - Zero speed (jumped to X-in 8)

Spindle Encoder Connector

Pin 1 - Channel A +	Pin 6 - Marker +	Pin 11 - DC ground
Pin 2 - Channel A -	Pin 7 - DC ground	Pin 12 - DC ground
Pin 3 - Channel B +	Pin 8 - +5 VDC	Pin 13 - DC ground
Pin 4 - Channel B -	Pin 9 - DC ground	Pin 14 - Key
Pin 5 - Marker -	Pin 10 - No connect	

Miscellaneous Connector (Misc)

Pin 1 - Machine reset - CR1C (+24 VDC)	Pin 8 - Reset 2 (jumped to FPP-8)
Pin 2 - Machine reset - K1 coil	Pin 9 - Tool change 1
Pin 3 - Load meter analog	Pin 10 - Tool change 2
Pin 4 - DC ground	Pin 11 - E-stop 1
Pin 5 - Key	Pin 12 - E-stop 2
Pin 6 - Excess error latch	Pin 13 - Spindle analog
Pin 7 - Reset 1 (jumped to FPP-7)	Pin 14 - DC ground

Front Panel Connector (FPP) and J2 on keyboard encoder card

Pin 1 - No connect	Pin 8 - Front panel reset switch (jumped to Misc-8)
Pin 2 - Front panel DC ground	Pin 9 - Front panel tool change reset switch (jumped to Misc-9)
Pin 3 - Key	Pin 10 - Front panel tool change reset switch (jumped to Misc-10)
Pin 4 - Front panel +24 VDC	Pin 11 - Front panel emergency stop switch (jumped to Misc-11)
Pin 5 - Front panel +12 VDC	Pin 12 - Front panel emergency stop switch (jumped to Misc-12)
Pin 6 - No connect	Pin 13 - No connect
Pin 7 - Front panel reset switch (jumped to Misc-7)	Pin 14 - No connect

Power Connector

Pin 1 - +5 VDC	Pin 6 - +12 VDC	Pin 11 - DC ground
Pin 2 - +5 VDC	Pin 7 - -12 VDC	Pin 12 - DC ground
Pin 3 - +5 VDC	Pin 8 - No connect	Pin 13 - DC ground
Pin 4 - +24 VDC	Pin 9 - Key	Pin 14 - DC ground
Pin 5 - No connect	Pin 10 - DC ground	

Connector Handwheel for remote handwheel option

Pin 1 - Channel A +	Pin 6 - No connect	Pin 11 - DC ground
Pin 2 - Channel A -	Pin 7 - DC ground	Pin 12 - DC ground
Pin 3 - Channel B +	Pin 8 - +5 VDC	Pin 13 - DC ground
Pin 4 - Channel B -	Pin 9 - DC ground	Pin 14 - Key
Pin 5 - No connect	Pin 10 - No connect	

Centurion 6 CNC Connector Signal Listing

Connector Tool Changer

Pin 1 - Tool changer arm in (jumped to Y-out 2)	Pin 8 - Tool carousel at home prox (jumped to Y-in 2)
Pin 2 - Power drawbar (jumped to Y-out 3)	Pin 9 - Tool carousel at pocket (jumped to Y-in 3)
Pin 3 - Tool carousel clockwise (jumped to Y-out 4)	Pin 10 - Tool changer arm in (jumped to Y-in 4)
Pin 4 - Tool carousel counter clockwise (jumped to Y-out 5)	Pin 11 - Tool changer arm out (jumped to Y-in 5)
Pin 5 - Tool carousel orient roller cylinder (jumped to Y-out 7)	Pin 12 - Tool carousel orient prox (jumped to Y-in 7)
Pin 6 - 20 pocket tool changer door open (jumped to Y-out 8)	Pin 13 - No connect
Pin 7 - Key	Pin 14 - No connect

Connector COM1 (Card Cage)

Pin 2 -	TXD
Pin 3 -	RXD
Pin 5 -	DC ground
All other pins	no connect

Connector COM2 For rigid tapping option

Pin 1 - Channel A +	Pin 4 - Channel B -	Pin 7 - +5 VDC
Pin 2 - Channel A -	Pin 5 - Marker +	Pin 8 - DC Ground
Pin 3 - Channel B +	Pin 6 - Marker -	Pin 9 - No connect

Connector Floppy Disk

Standard IBM personal computer floppy disk drive data port

Connector CRT (Video)

Pin 1 - VGA red signal return	Pin 14 - VGA red signal
Pin 2 - VGA green signal return	Pin 15 - VGA green signal
Pin 3 - VGA blue signal return	Pin 16 - VGA blue signal
Pin 4 - Digital ground	Pin 17 - VGA vertical synch.
Pin 5 - VGA synch. Return	Pin 18 - VGA horizontal synch.
Pin 6 - No connect	Pin 19 - No connect
Pin 7 - No connect	Pin 20 - No connect
Pin 8 - Serial I/O TXD	Pin 21 - Serial I/O RXD
Pin 9 - Front panel handwheel channel A +	Pin 22 - Front panel handwheel channel A -
Pin 10 - Front panel handwheel channel B +	Pin 23 - Front panel handwheel channel B -
Pin 11 - Cable shield	Pin 24 - Keyboard ATCLK
Pin 12 - DC ground	Pin 25 - Keyboard ATDAT
Pin 13 - DC ground	

Connectors in the CNC control box

Connector CRT (Monitor Power)

Pin 1 -	Monitor power 110 VAC line
Pin 3 -	Monitor power 110 VAC return
Pin 14 -	Monitor chassis ground
(All other pins are no connect)	

Connector FPACC

Pin 1 - Front panel fan +24 VDC	Pin 8 - Front panel emergency stop common
Pin 2 - Front panel fan DC ground	Pin 9 - Setup switch signal
Pin 3 - Chip pan door open feedhold signal	Pin 10 - Setup switch common
Pin 4 - Chip pan door open ground	Pin 11 - Chip pan door open 110 VAC
Pin 5 - Tool out switch signal	Pin 12 - Chip pan door open 110 return

Centurion 6 CNC Connector Signal Listing

- | | |
|---|-----------------------------------|
| Pin 6 - Tool out switch common | Pin 13 - End-of-cycle lamp signal |
| Pin 7 - Front panel emergency stop signal | Pin 14 - End-of-cycle lamp common |

Connector P2

- | | |
|---|------------------------|
| Pin 1 - Front panel handwheel channel A + | Pin 6 - Serial I/O RXD |
| Pin 2 - Front panel handwheel channel A - | Pin 7 - Keyboard ATCLK |
| Pin 3 - Front panel handwheel channel B + | Pin 8 - Keyboard ATDAT |
| Pin 4 - Front panel handwheel channel B - | Pin 9 - DC ground |
| Pin 5 - Serial I/O TXD | Pin 10 - DC ground |

Keyboard DIN Connector (J1)

- | | |
|------------------------|-------------------|
| Pin 1 - Keyboard EXCLK | Pin 4 - DC ground |
| Pin 2 - Keyboard EXDAT | Pin 5 - +5 VDC |
| Pin 3 - No connect | |

Connectors in the Mag Box

Connectors ATC1 and 1-1E

- | | |
|---|---|
| Pin 1 - Tool changer carousel power – return | Pin 9 - Tool changer arm out prox |
| Pin 2 - Tool changer carousel power – clockwise | Pin 10 - Tool arm in/tool arm out prox |
| Pin 3 - Tool changer carousel power - counter clockwise | DC ground |
| Pin 4 - Home/at pocket prox DC ground | Pin 11 - Key |
| Pin 5 - Home/at pocket prox +24 VDC | Pin 12 - Tool changer arm in/out signal |
| Pin 6 - Tool carousel home prox | Pin 13 - 20 pocket tool changer door open signal |
| Pin 7 - Tool carousel at pocket prox | Pin 14 - Tool changer arm & door solenoids common |
| Pin 8 - Tool changer arm in prox | |

Connector ATC2

- | | |
|---|---|
| Pin 1 - Spindle orient solenoid signal | Pin 8 - Spindle orient prox chassis ground |
| Pin 2 - Power drawbar solenoid signal | Pin 9 - Drawbar solenoid chassis ground |
| Pin 3 - Spray mist air solenoid signal | Pin 10 - Key |
| Pin 4 - Spindle orient solenoid +24 VDC | Pin 11 - Spray mist solenoid chassis ground |
| Pin 5 - Power drawbar solenoid +24 VDC | Pin 12 - Spindle orient prox signal |
| Pin 6 - Tool Out switch | Pin 13 - Spindle orient prox +24 VDC |
| Pin 7 - Spray mist air solenoid +24 VDC | Pin 14 - Spindle orient prox DC ground |

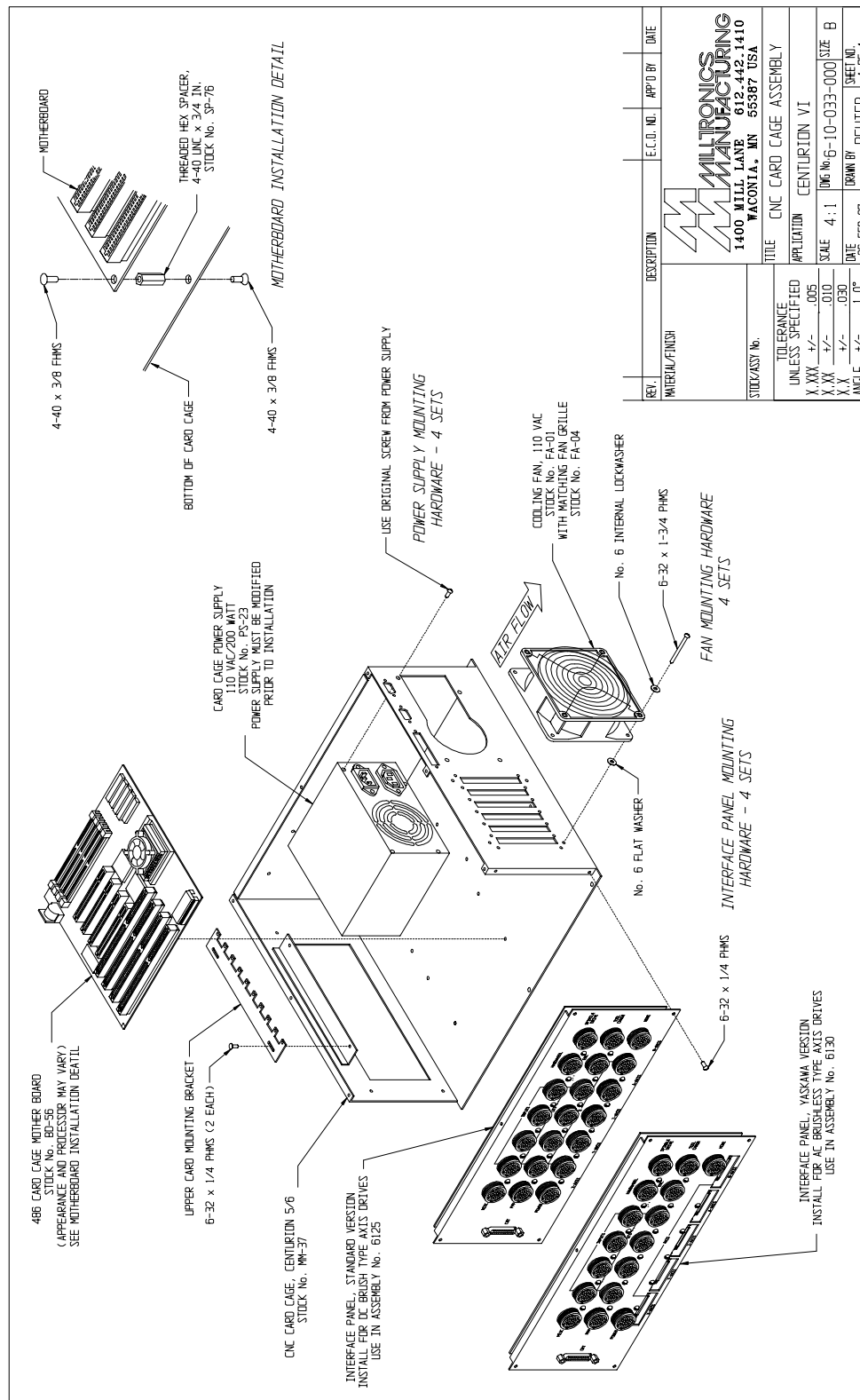
Connector on +24 VDC Regulated Power Supply

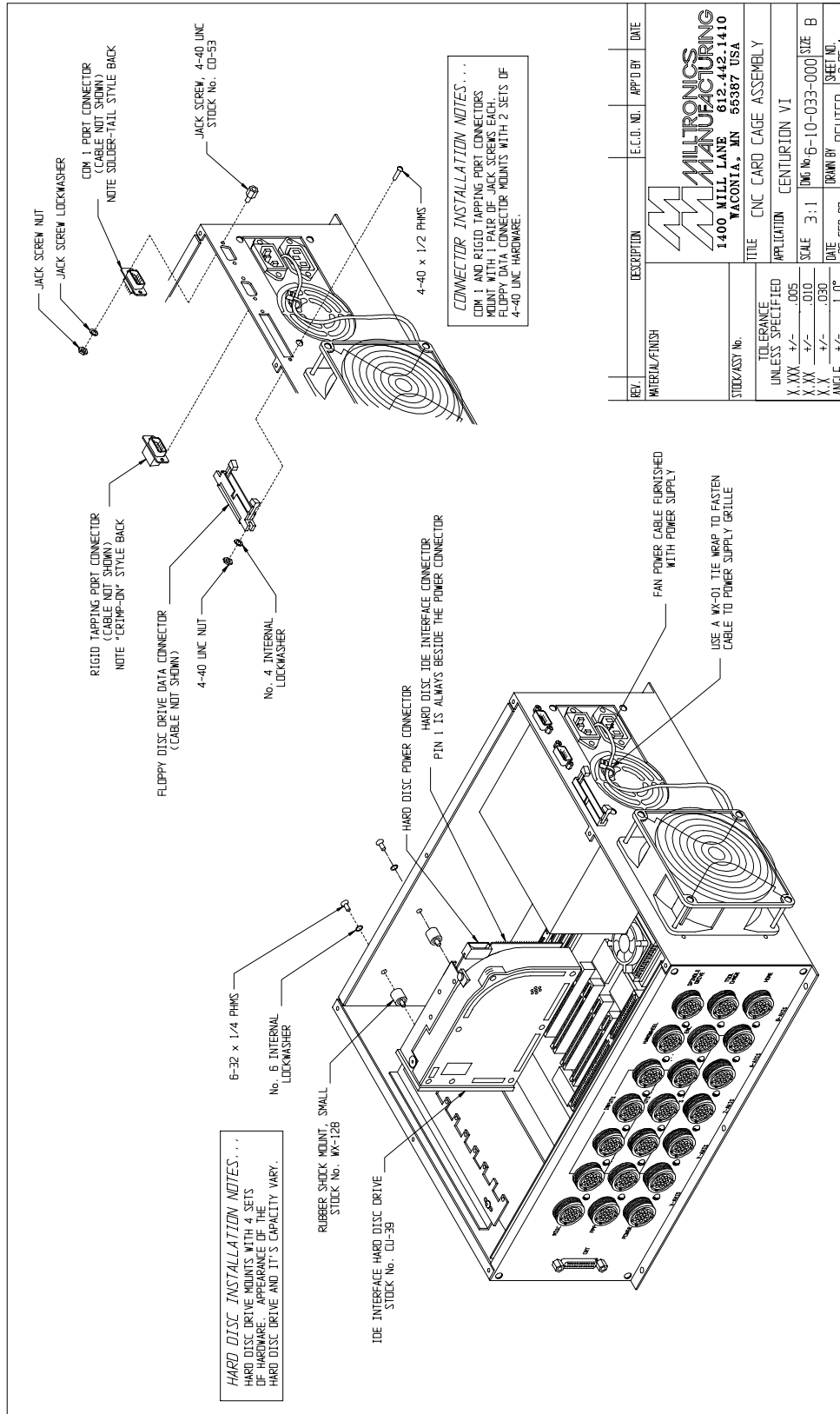
- | | |
|------------------------|---------------------|
| Pin 1 - 110 VAC line | Pin 8 - No connect |
| Pin 2 - 110 VAC return | Pin 9 - No connect |
| Pin 3 - No connect | Pin 10 - No connect |
| Pin 4 - +24 VDC | Pin 11 - DC ground |
| Pin 5 - +24 VDC | Pin 12 - DC ground |
| Pin 6 - Key | Pin 13 - DC ground |
| Pin 7 - No connect | Pin 14 - DC ground |

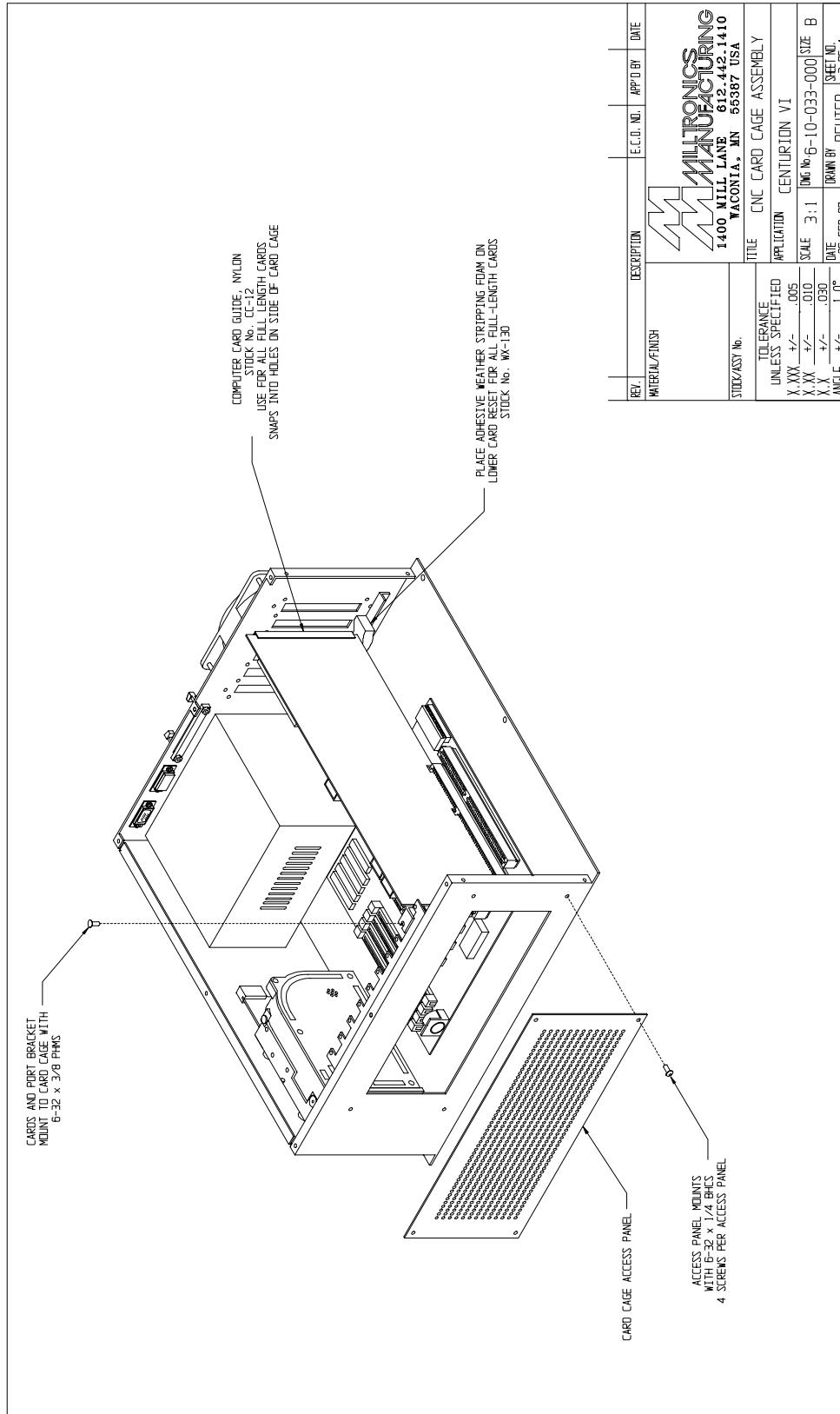
Connector COM1 (on Mag Panel)

- Pin 2 - RXD
Pin 3 - TXD
Pin 7 - Ground
All other pins no connect

Card Cage Assembly



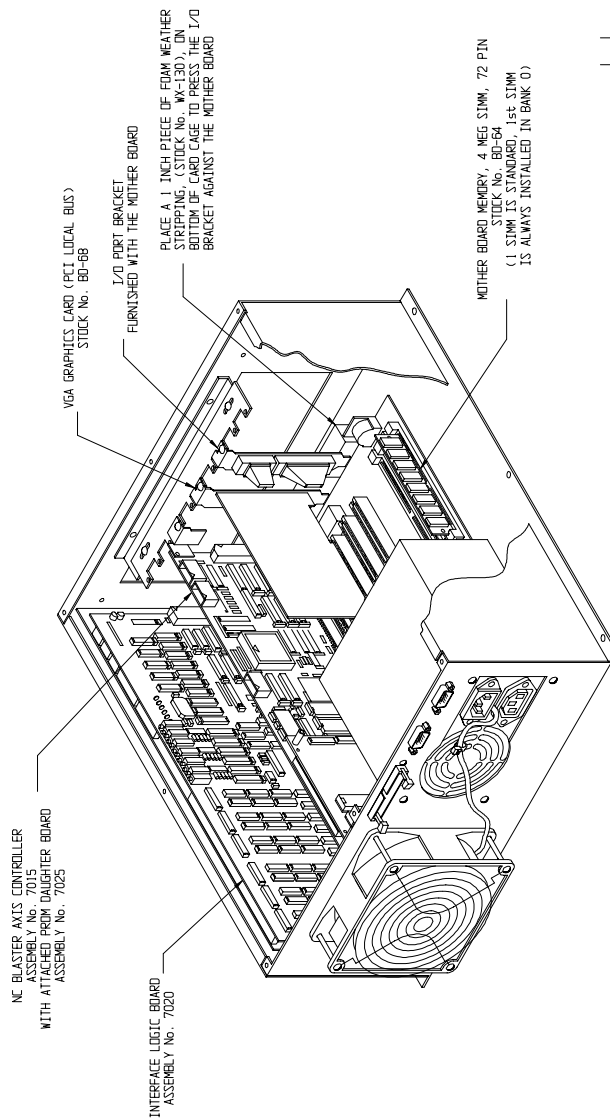




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	XX .XX +/- .010			
	XX .XX +/- .030			
	ANGLE +/- 1.0°			
	TITLE			
	APPLICATION			
	SCALE			
	DATE			
	DRAWN BY			
	REVIEWER			
	SHEET NO.			
	3 OF 4			



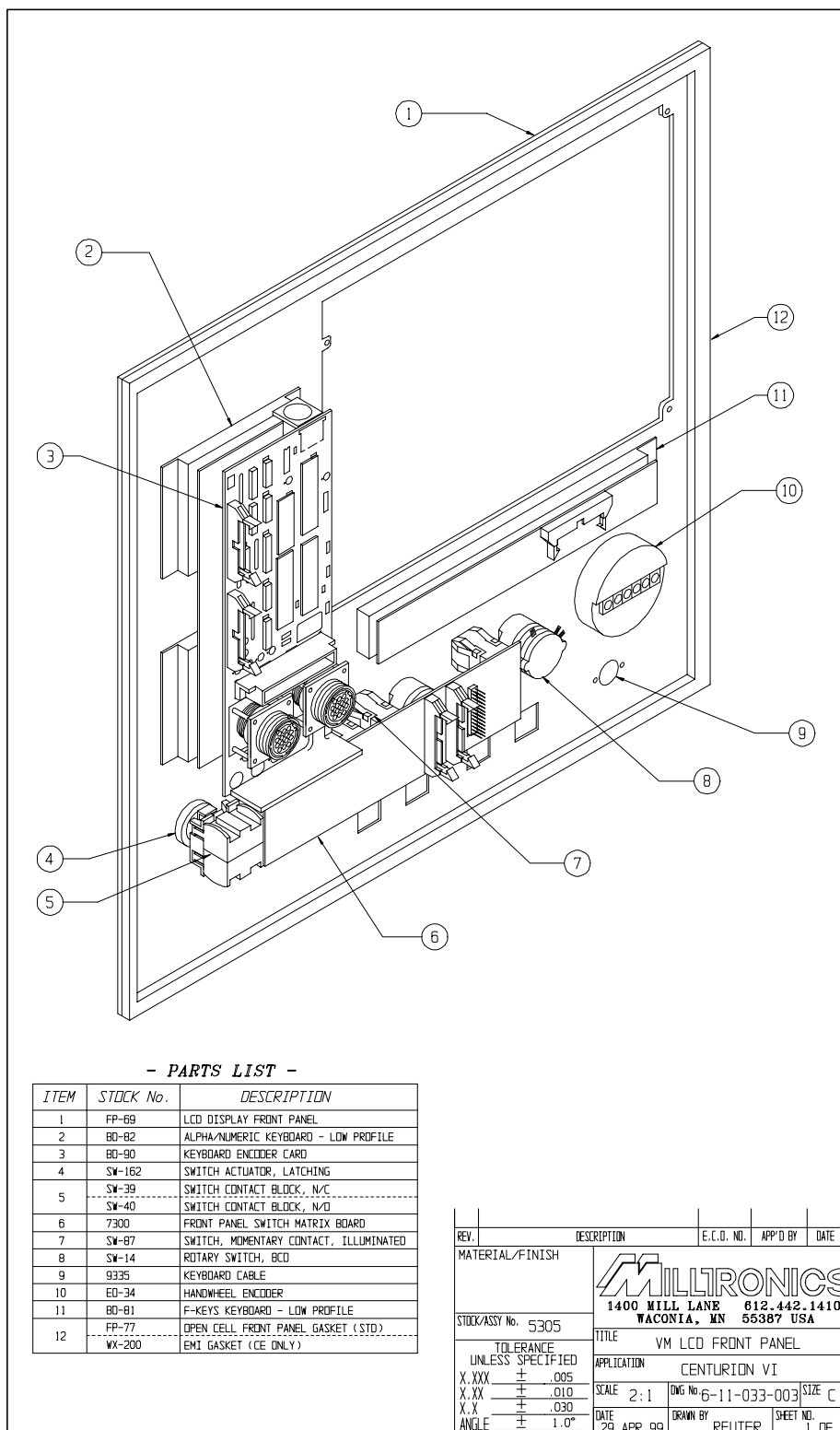
CNC CARD CAGE ASSEMBLY
CENTURION V1
Dwg No. 6-10-033-000
SIZE B
25 FEB 97
REITER

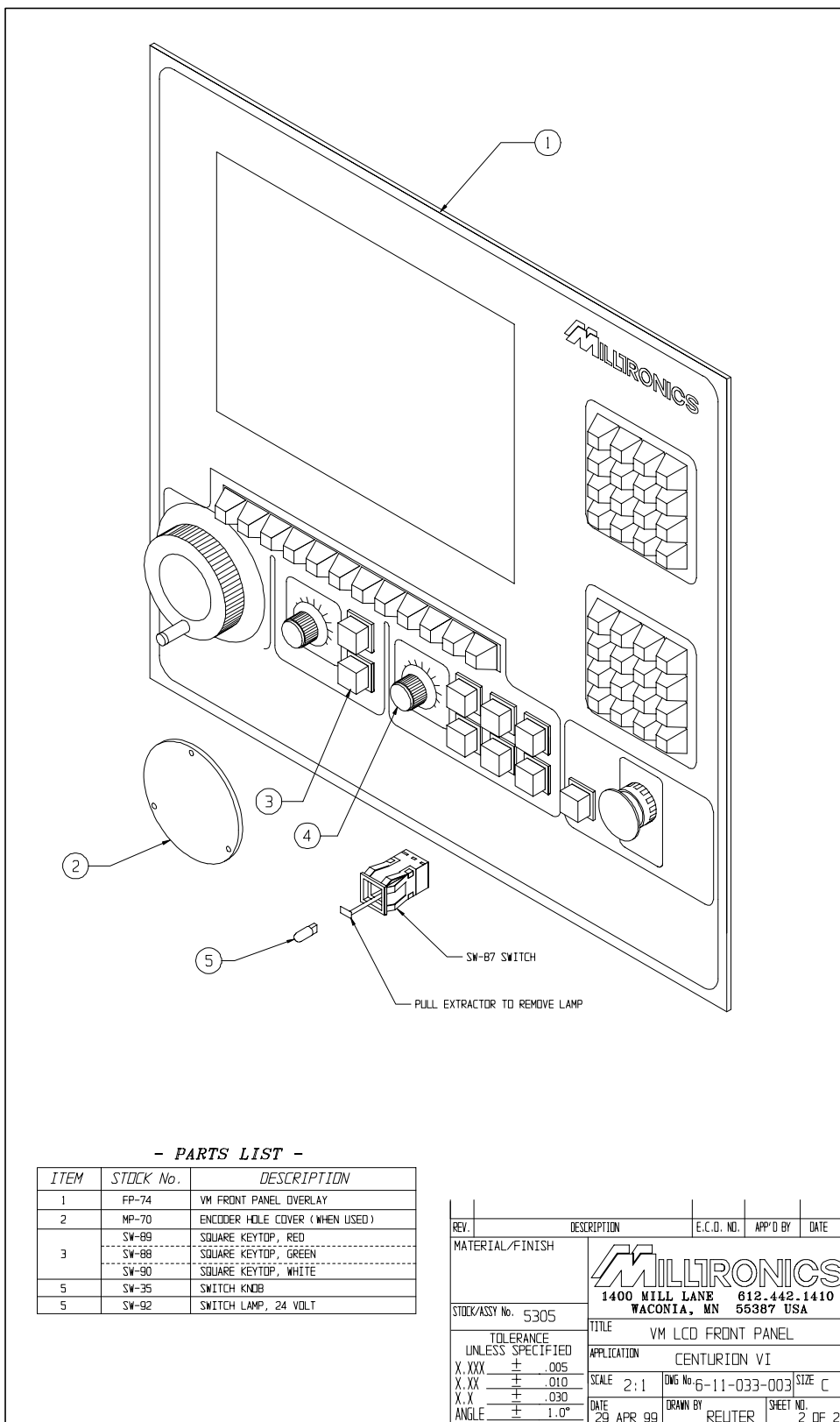


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	X-XX +/- .010			
	X-X +/- .030			
	ANGLE +/- 1.0°			
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	APPLICATION	CENTURION VI		
	SCALE	3:1		
	DATE	25 FEB 97		
	DRAWN BY	REUTER		
	CHECK NO.	4 OF 4		

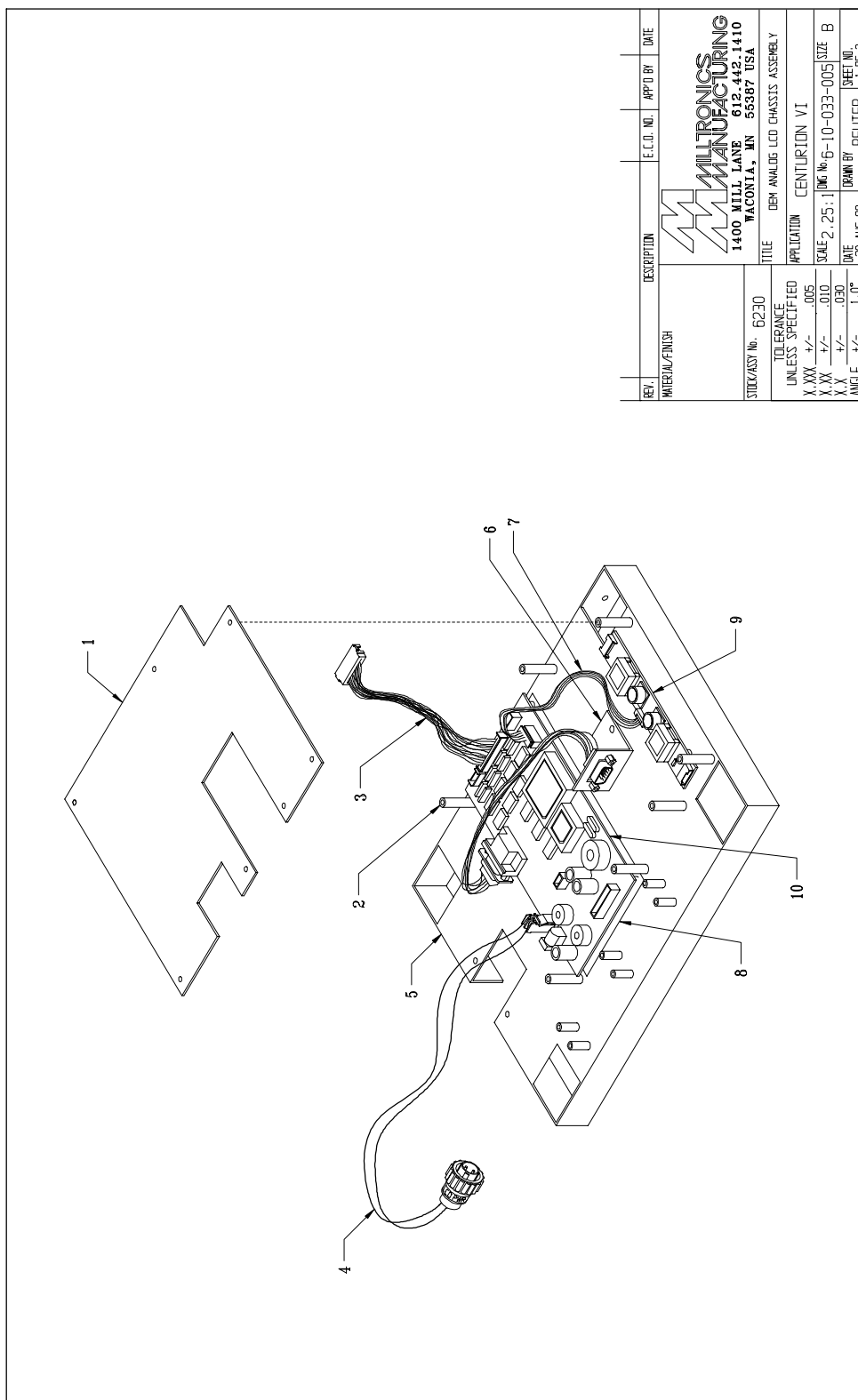
MILLIRONICS
MANUFACTURING
1400 WILL LANE
612-442-1410
WACONTA, MN 55387 USA

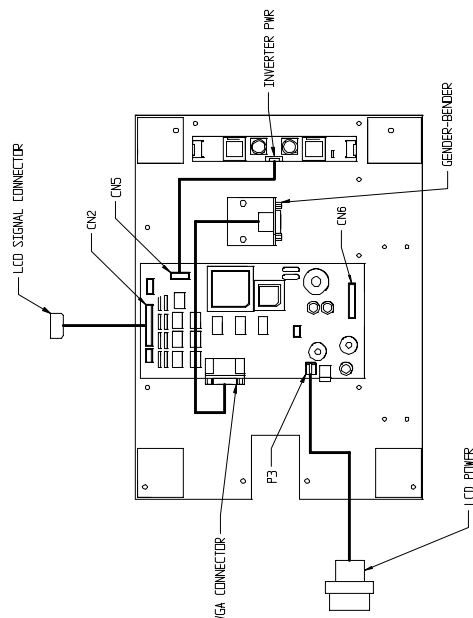
LCD Front Panel Assembly





LCD Panel Assembly





- INSTRUCTIONS -

1. MOUNT THE VGA GENDER-BENDER TO THE CHASSIS WITH 6-32 x 1/2 RHMS AND NO. 8 LOCKWASHERS.
2. PLACE THE WX-242 INSULATOR SO IT LIES UNDER THE DIGITAL VIEW BOARD. INDEX THE INSULATOR WITH THE MOUNTING STANDOFFS FOR THE PC BOARD.
3. INSTALL THE ANALOG-TO-DIGITAL CONVERSION BOARD. THE WIRES FROM THE VGA GENDER-BENDER MUST LIE UNDER THE INSULATOR BOARD. USE 4-40 x 1/4 RHMS AND LOCKWASHERS TO SECURE THE BOARD. THE OTHER END OF THE VGA GENDER-BENDER TO THE VGA CONNECTOR ON THE CONVERSION BOARD AND SECURE WITH THE CONNECTOR SCREWS.
4. MOUNT THE COFT INVERTER BOARD TO THE CHASSIS WITH 4-40 x 1/4 RHMS AND LOCKWASHERS. CONNECT THE INVERTER POWER CABLE TO THE INVERTER BOARD, (SMALLER PLUG). CONNECT THE OTHER END TO THE CONVERSION BOARD CONNECTOR CN5. THESE PULSES ARE KEPT TO FIT ONLY ONE WAY ON EITHER BOARD'S CONNECTORS.
5. PLUG THE ANALOG LCD POWER CABLE (12-PIN END) INTO THE 'P3' CONNECTOR ON THE CONVERSION BOARD.
6. CONNECT THE DUAL IN-LINE END OF THE LCD SIGNAL CABLE INTO 'CN2' CONNECTOR ON THE CONVERSION BOARD. THIS CONNECTOR IS KEPT AND WILL FIT ONLY ONE WAY. CONTAIN THE LOOSE WIRES OF THE CABLE WITH WX-01 TIE WRAPS.
7. PLACE NO. 6 INTERNAL LOCKWASHERS ON THE 6-32 STUDS. THESE ARE THE ONLY STUDS ON THE CHASSIS. THEN SCREW ON THE SP-99 SPACERS.
8. PLACE THE LCD CHASSIS COVER ON THE COMPLETED ASSEMBLY AND USE 6-32 x 1/4 RHMS AND LOCKWASHERS TO SECURE IT IN PLACE.

- PARTS LIST -

ITEM	STOCK No.	DESCRIPTION
1	PL-63	LCD CHASSIS BACK COVER DNG No. 6-01-033-042
2	SP-99	6-32 x 1-1/4 FEMALE/FEMALE HEX SPACER
3	CB-42	DV/SHARP LCD SIGNAL CABLE DIGITAL VIEW No. 23430
4	9406	ANALOG LCD POWER CABLE DNG No. 6-04-033-079
5	BR-95	12 IN. LCD DISPLAY CARRIER DNG No. 6-01-033-029
6	9497	ANALOG VGA GENDER-BENDER ASSEMBLY DNG No. 6-04-033-080
7	CB-41	HLD14034/SS20 POWER CABLE DIGITAL VIEW No. 420680170
8	WX-242	DIGITAL VIEW REQ INSULATOR DNG No. 6-01-033-047
9	PS-44	COFT BACKLIGHT INVERTER XENTER No. 13520
10	80-80	ANALOG LCD DISPLAY CONVERSION BOARD DIGITAL VIEW MODEL No. AC-5611 v.3

REV.	DESCRIPTION	E.C.D. NO.	APP'D BY	DATE
MATERIAL/FINISH				
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STOCK/ASST No. 6230	TITLE	DEM ANALOG LCD CHASSIS ASSEMBLY		
UNLESS SPECIFIED	APPLICATION	CENTURION V1		
X.XX +/- .005	SCALE	2, 25, 1/16	NO. 6-10-033-005	SIZE B
X.XX +/- .010				
X.XX +/- .030	DATE	24 JUN 98	BY REUTER	12 OF 2
ANGLE +/- 1.0°				