

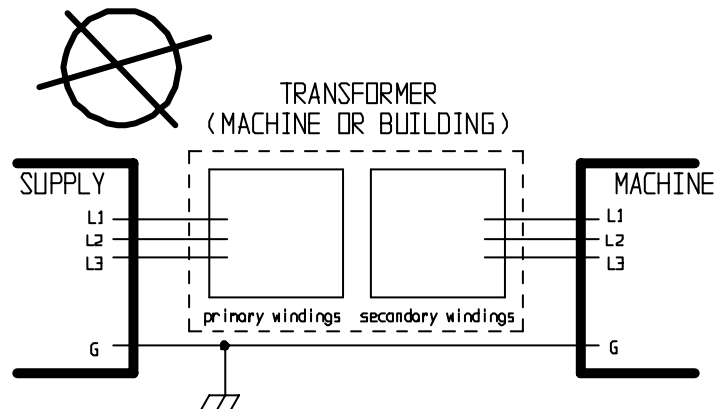
Electrical Manual

RW30B

Rev 4
3-16-04

***** 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.

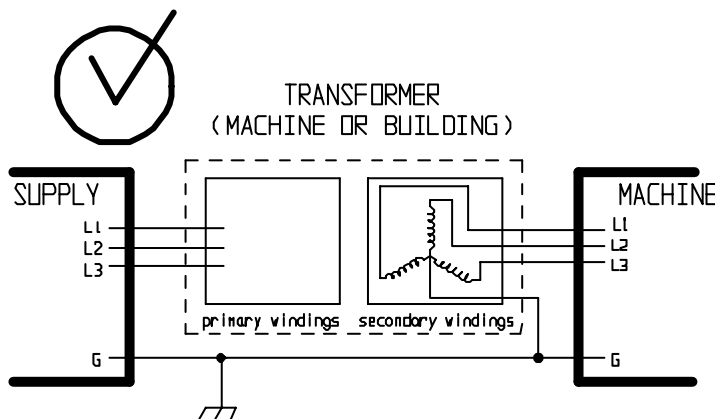
Remove transformer cover and follow transformer ground wire to determine if it is merely a case ground or if it actually goes to a neutral point within the secondary windings.

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.

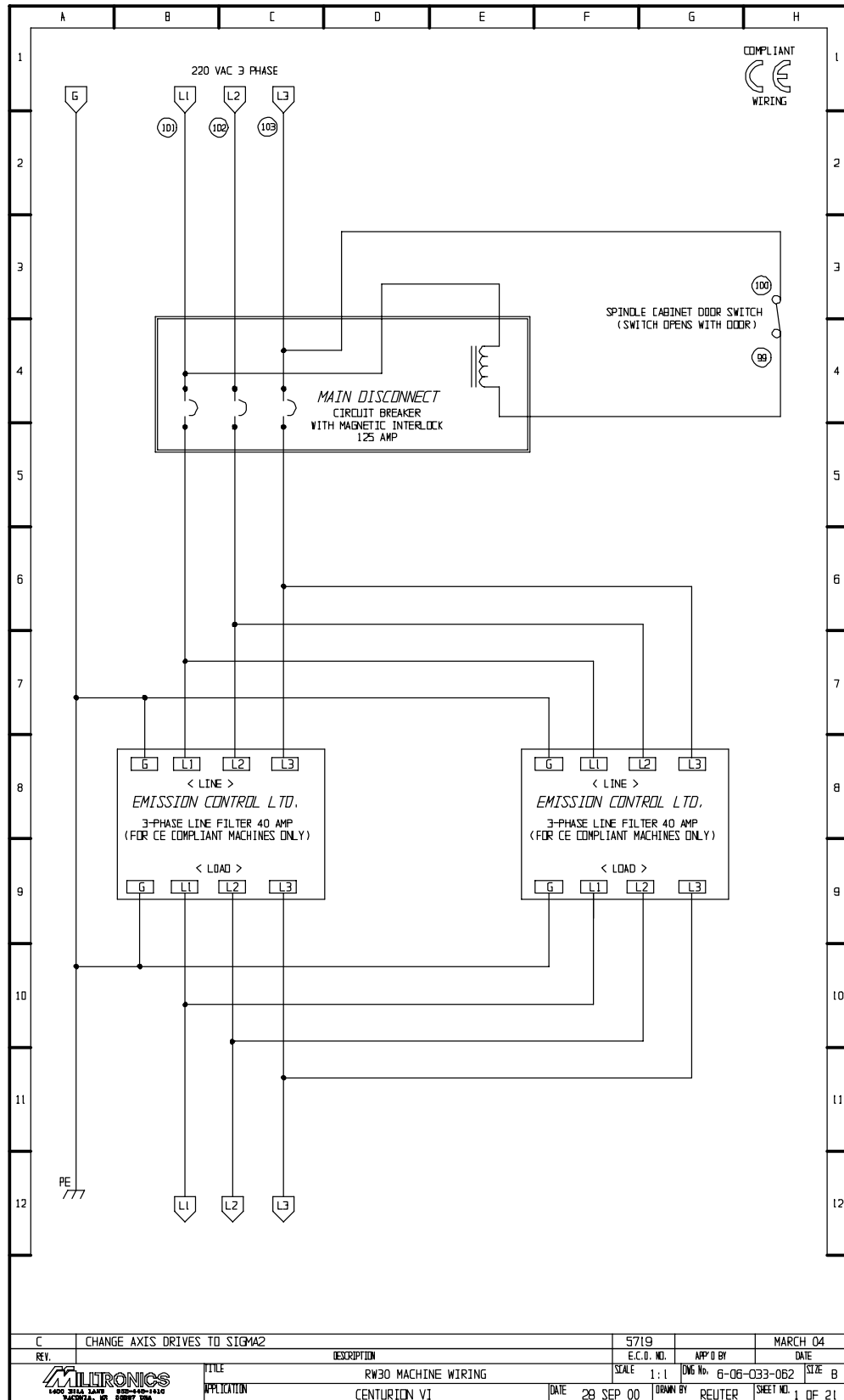
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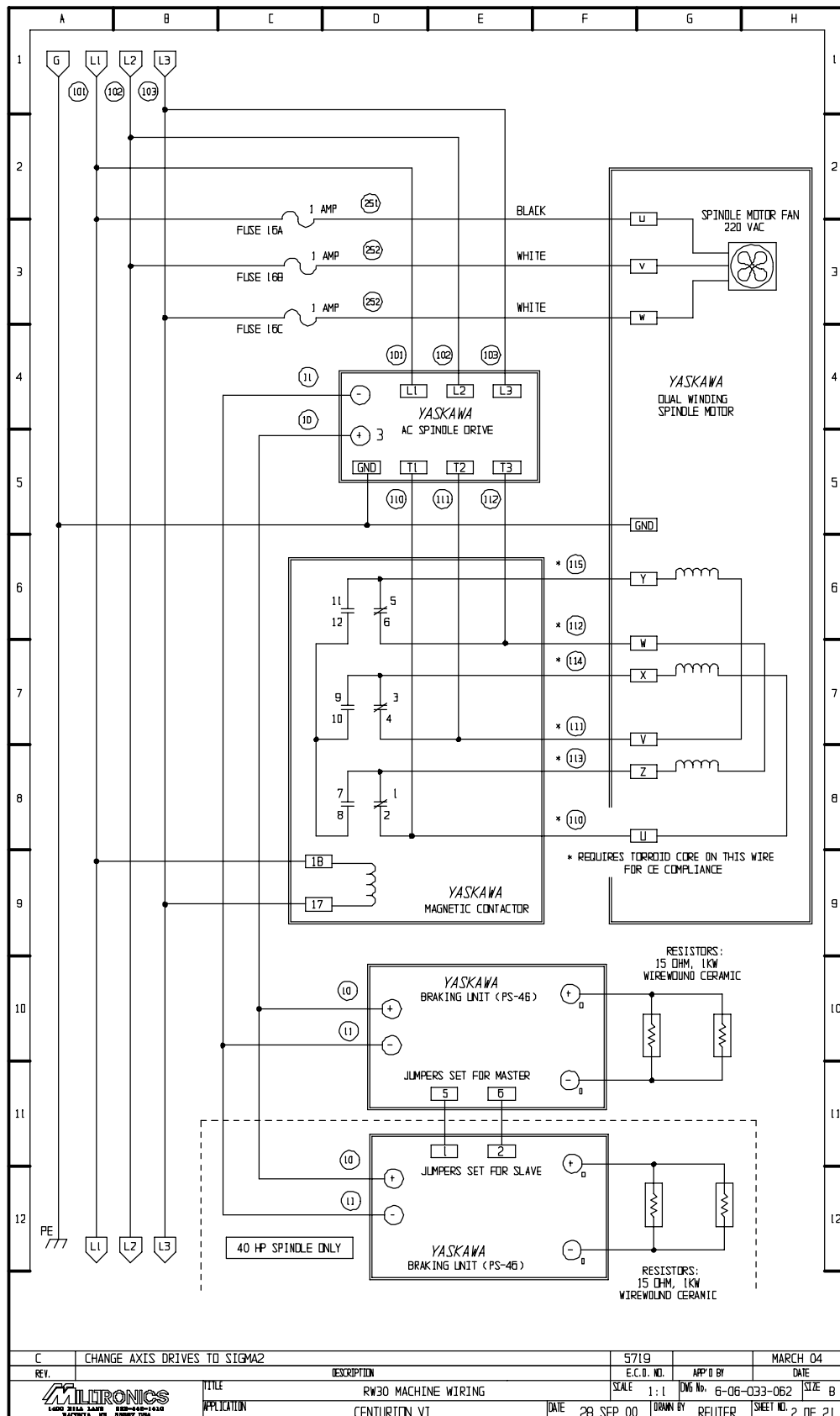
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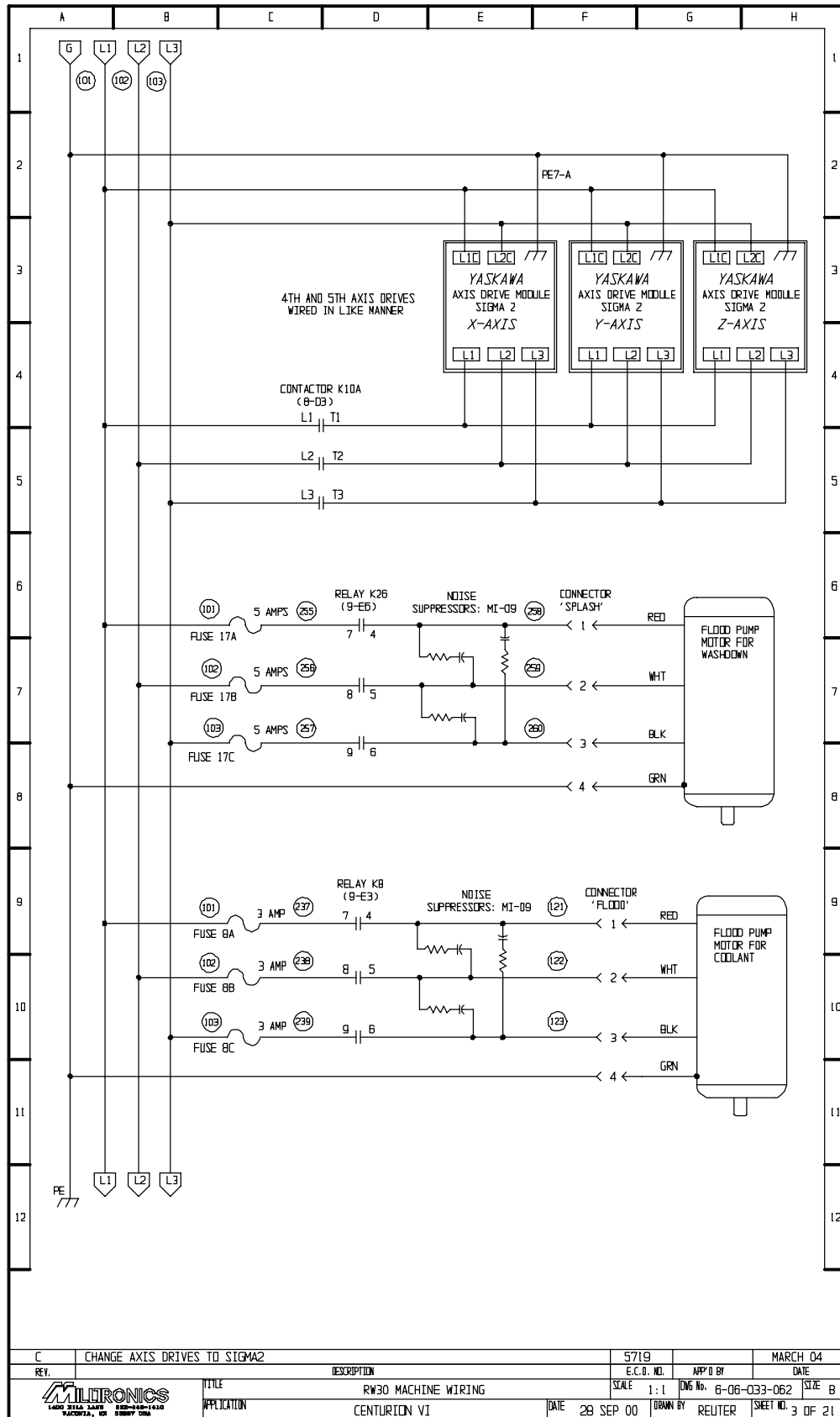
History

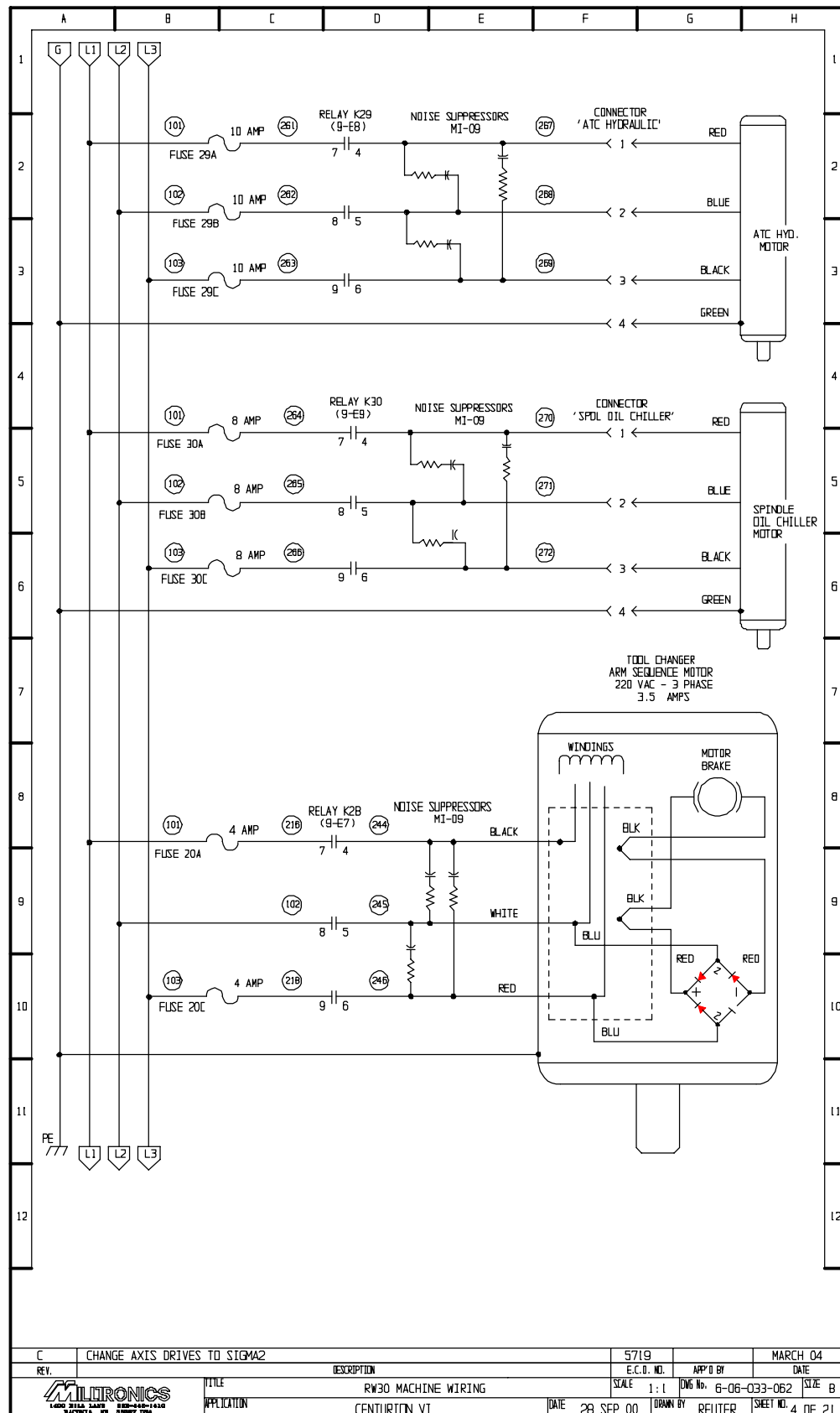
4-21-99	Original Version (RW20)
6-3-99	Update electrical drawings to rev D (reactors added).
7-12-99 Rev2	Added front panel drawings and SGDB15 drive parameters
7-28-99 Rev3	Added Auger / Flush circuit and updated panel drawing, new "RW20 only" schematic.
10-29-99	Added remote hand controller
2-8-01 Rev1	Convert to RW30A (from RW20) schematics and parameters
4-16-01 Rev2	Updated MC5 parameter listings
5-31-01 Rev3	Added new MC5 listing and prints for gearbox option, changed to m-rev B
3-16-04 Rev4	Change axis drives to Sigma2

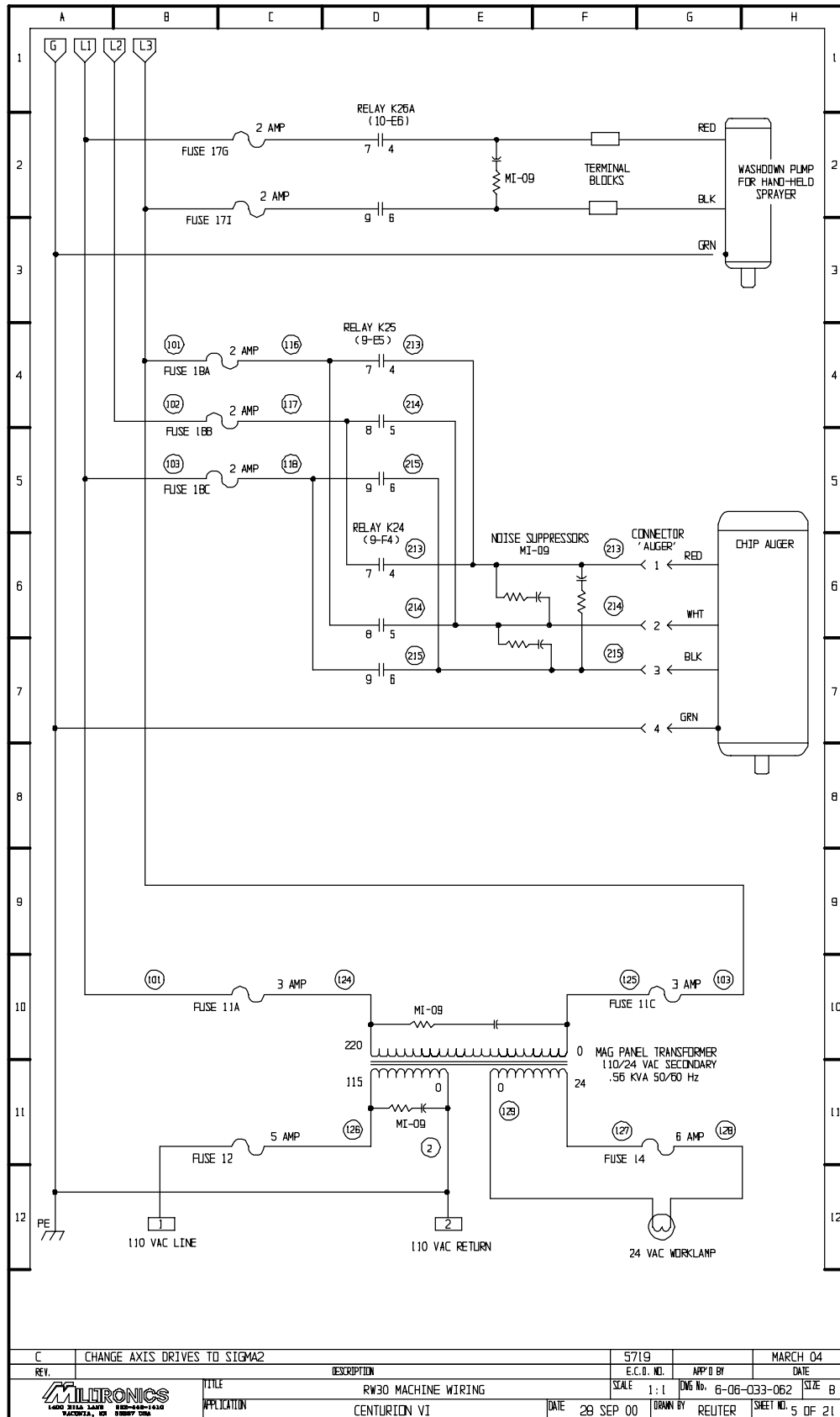
Machine Schematic

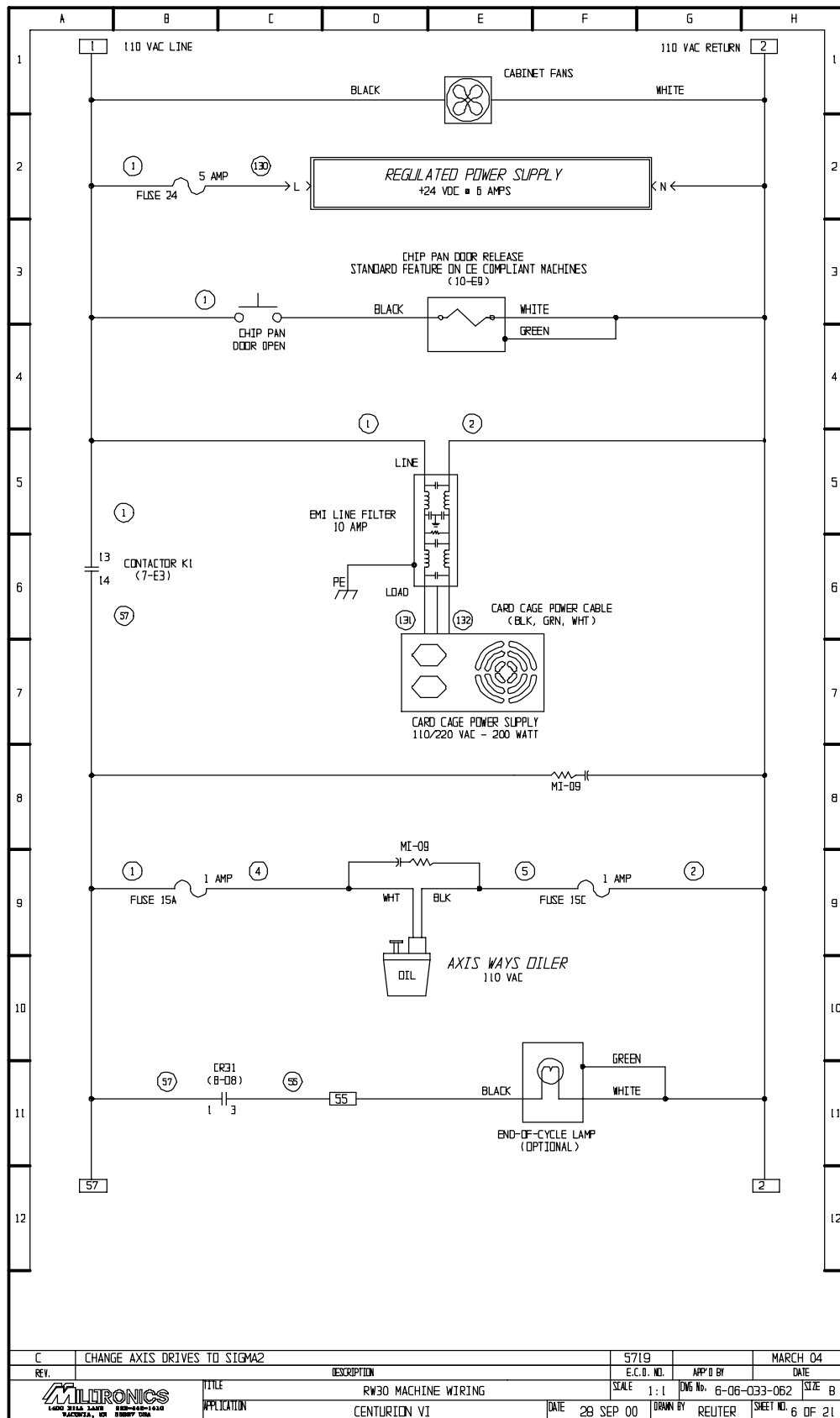


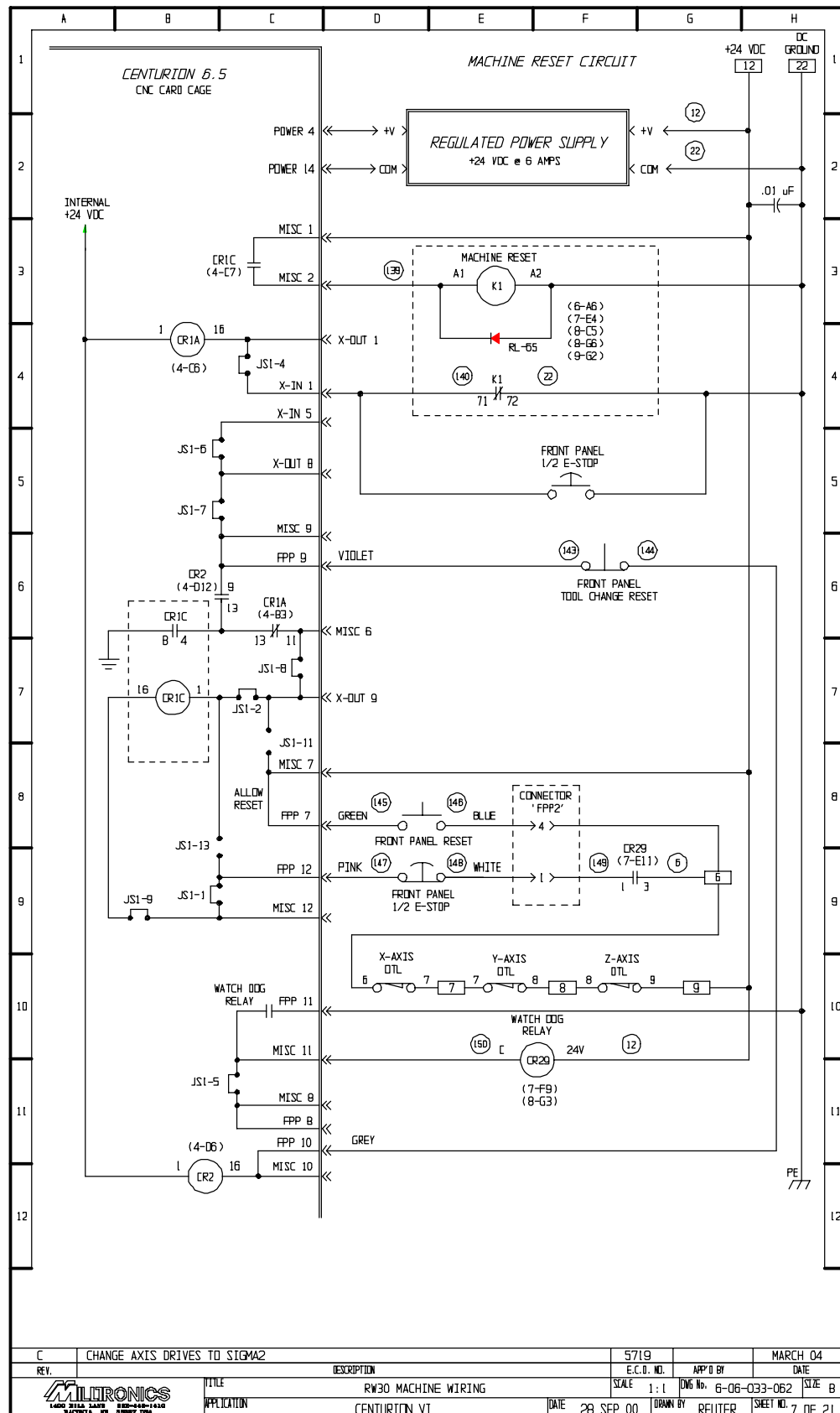


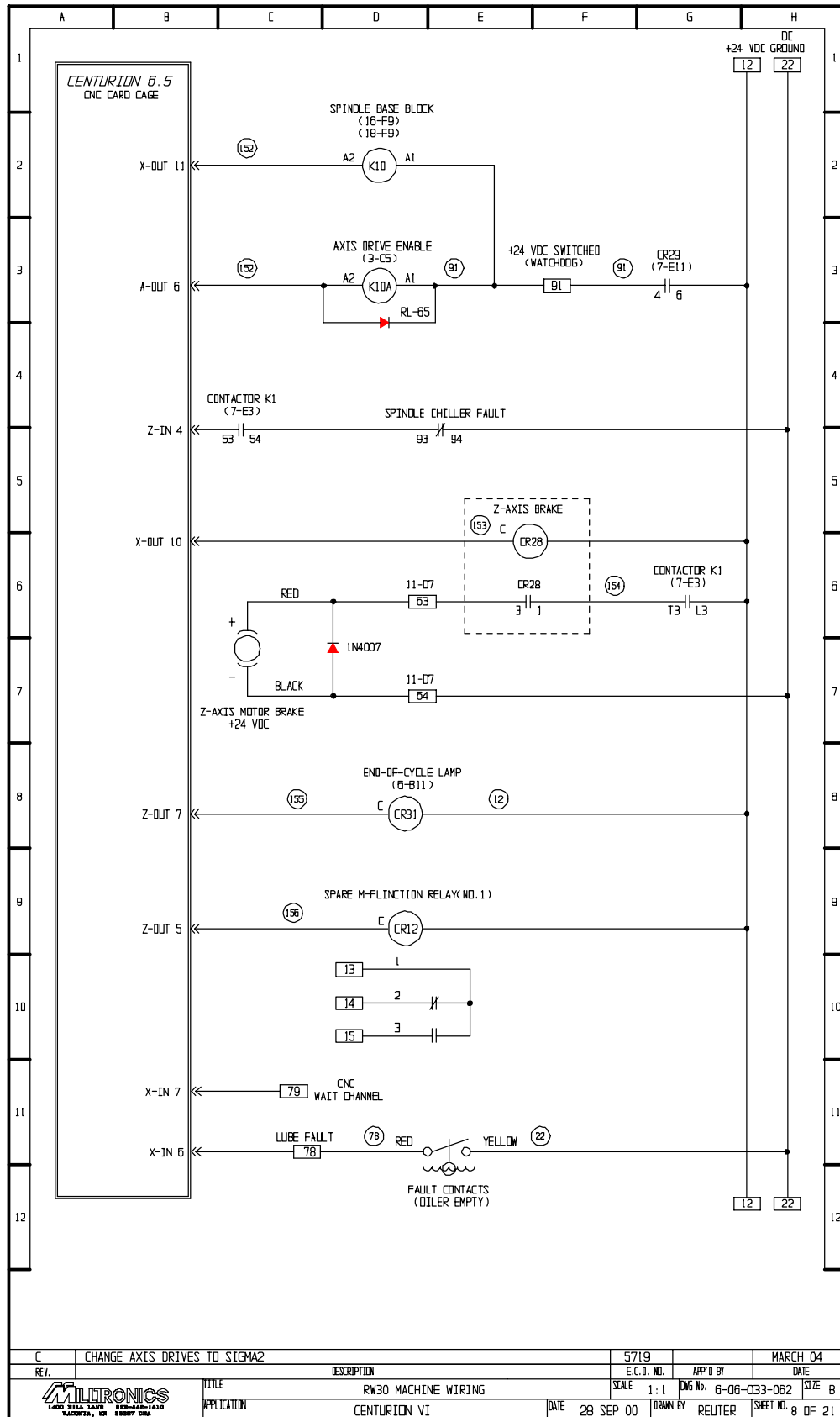


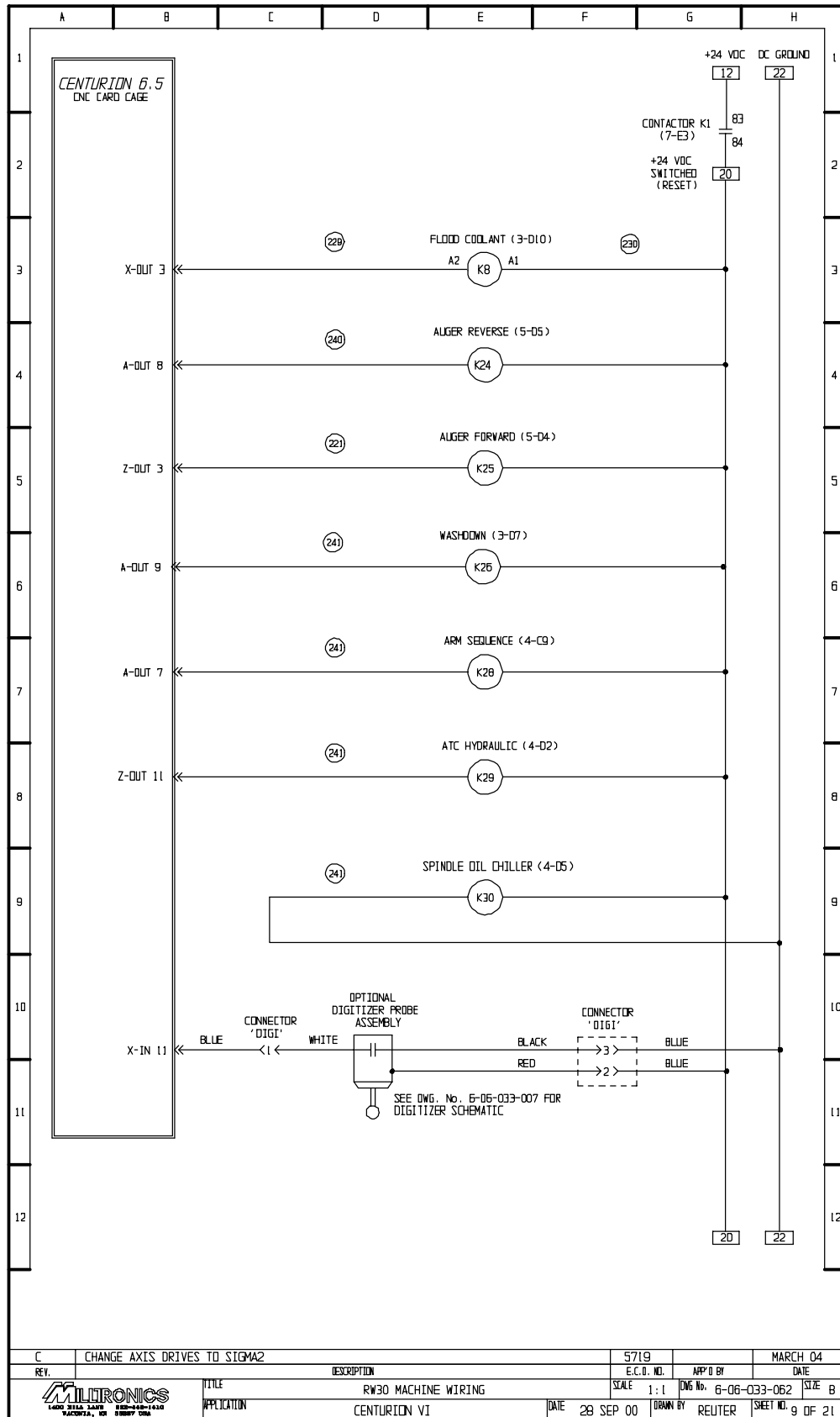




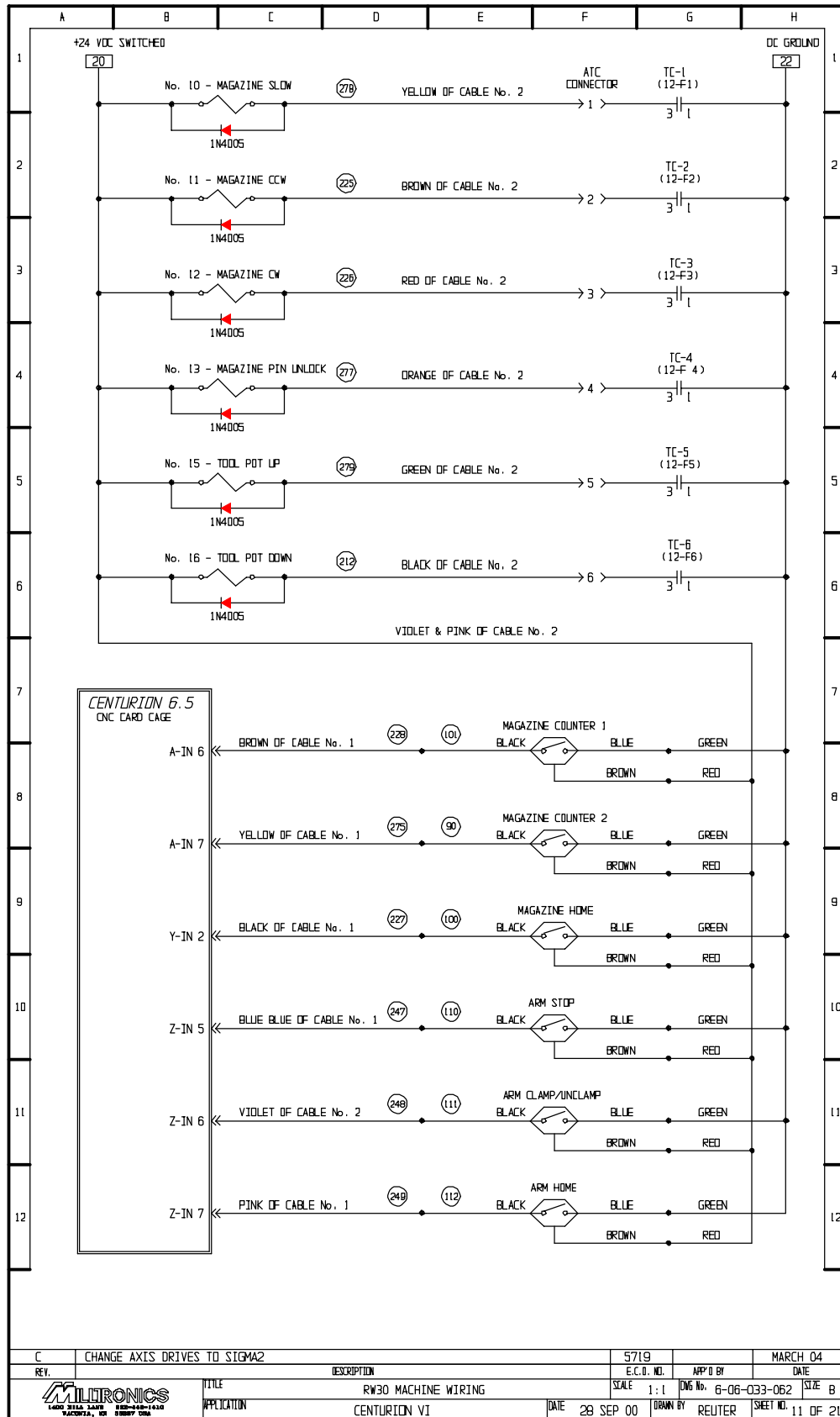


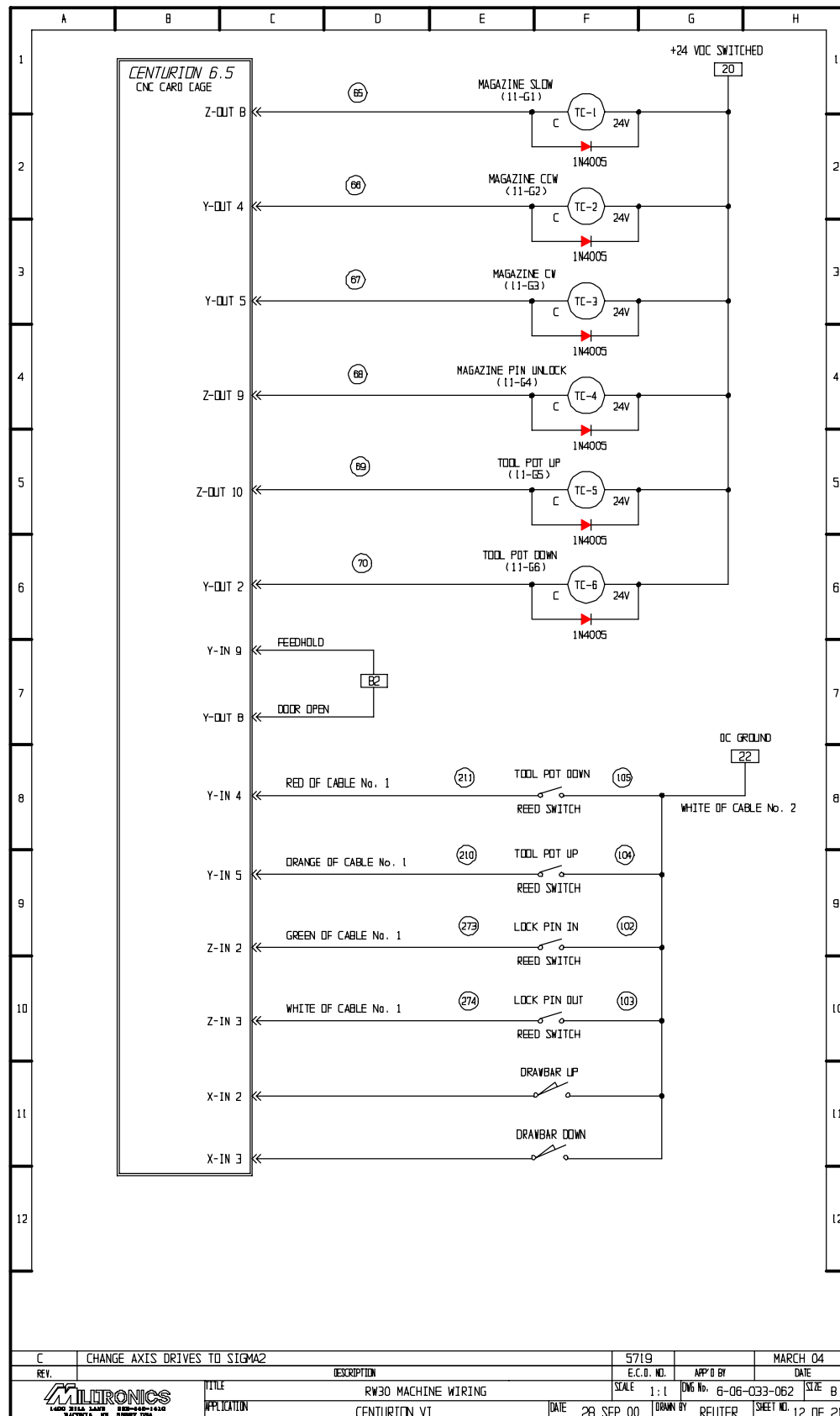


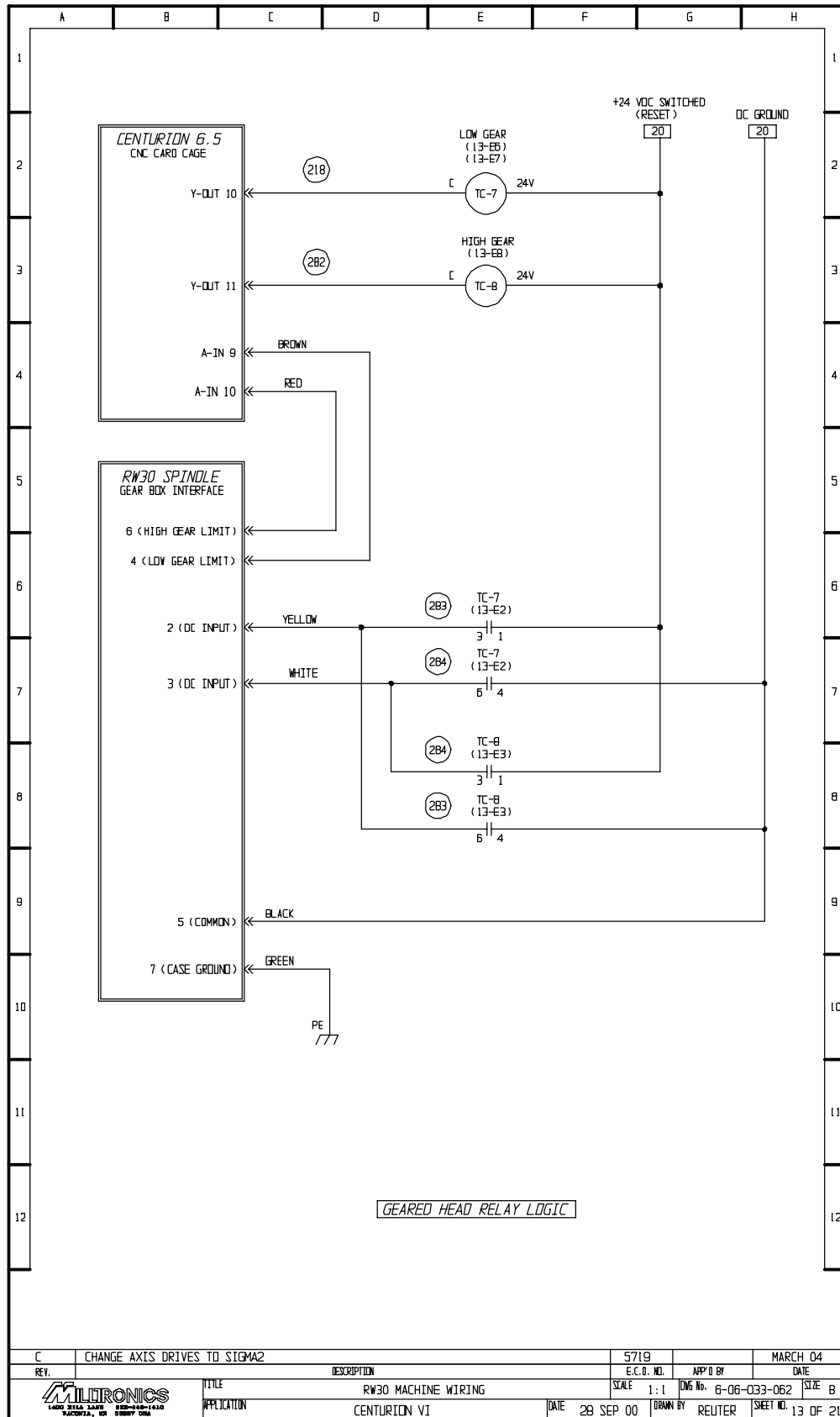


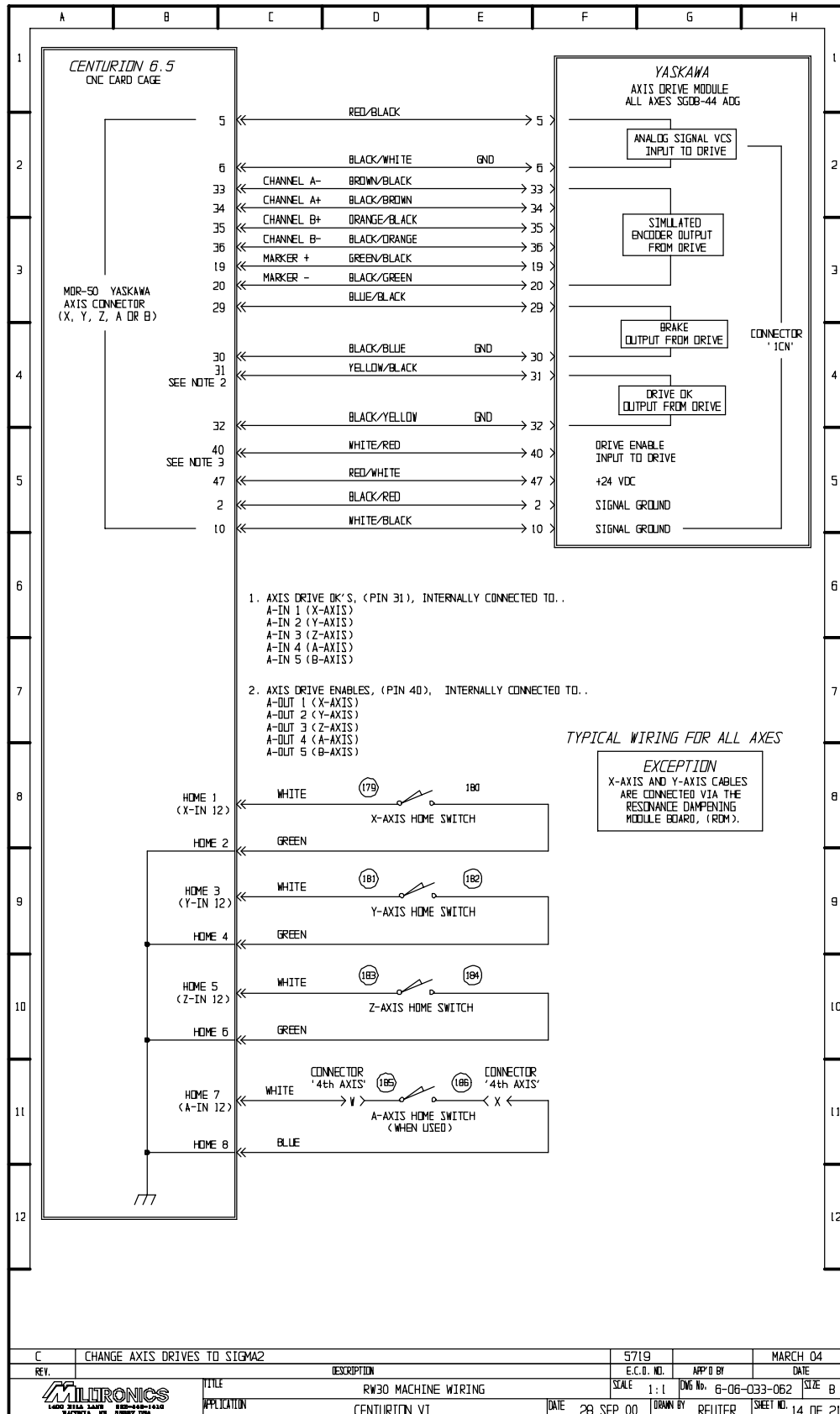


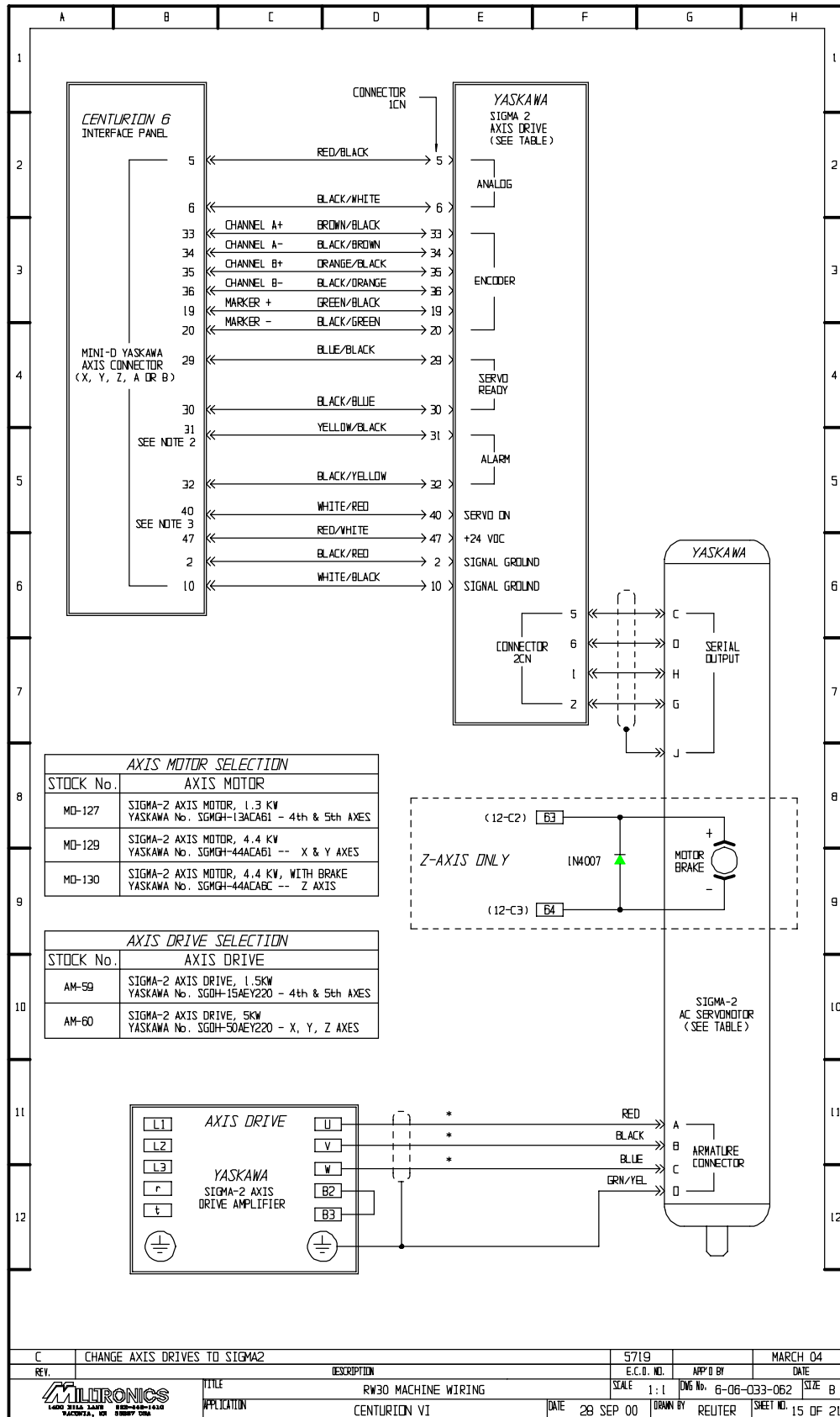


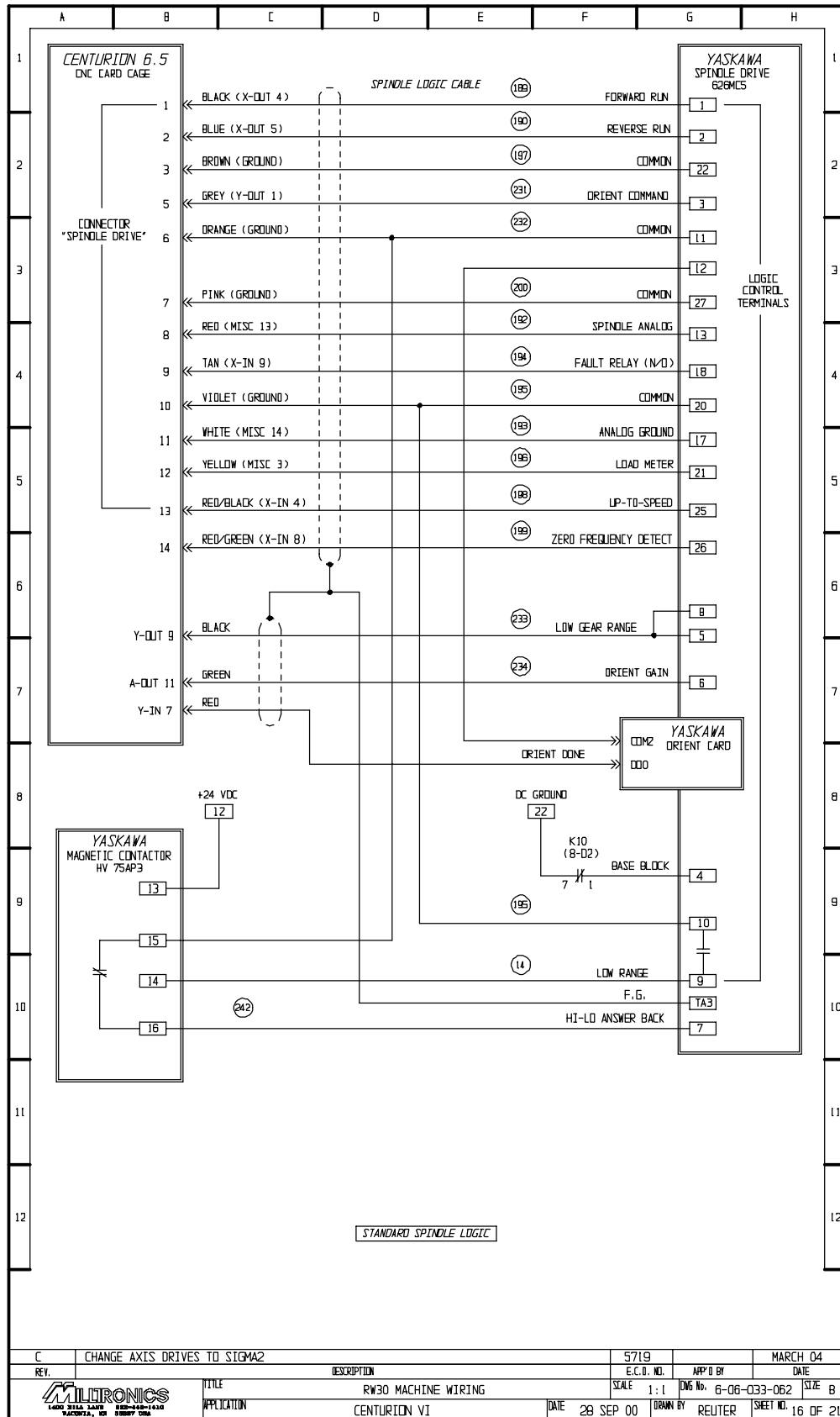


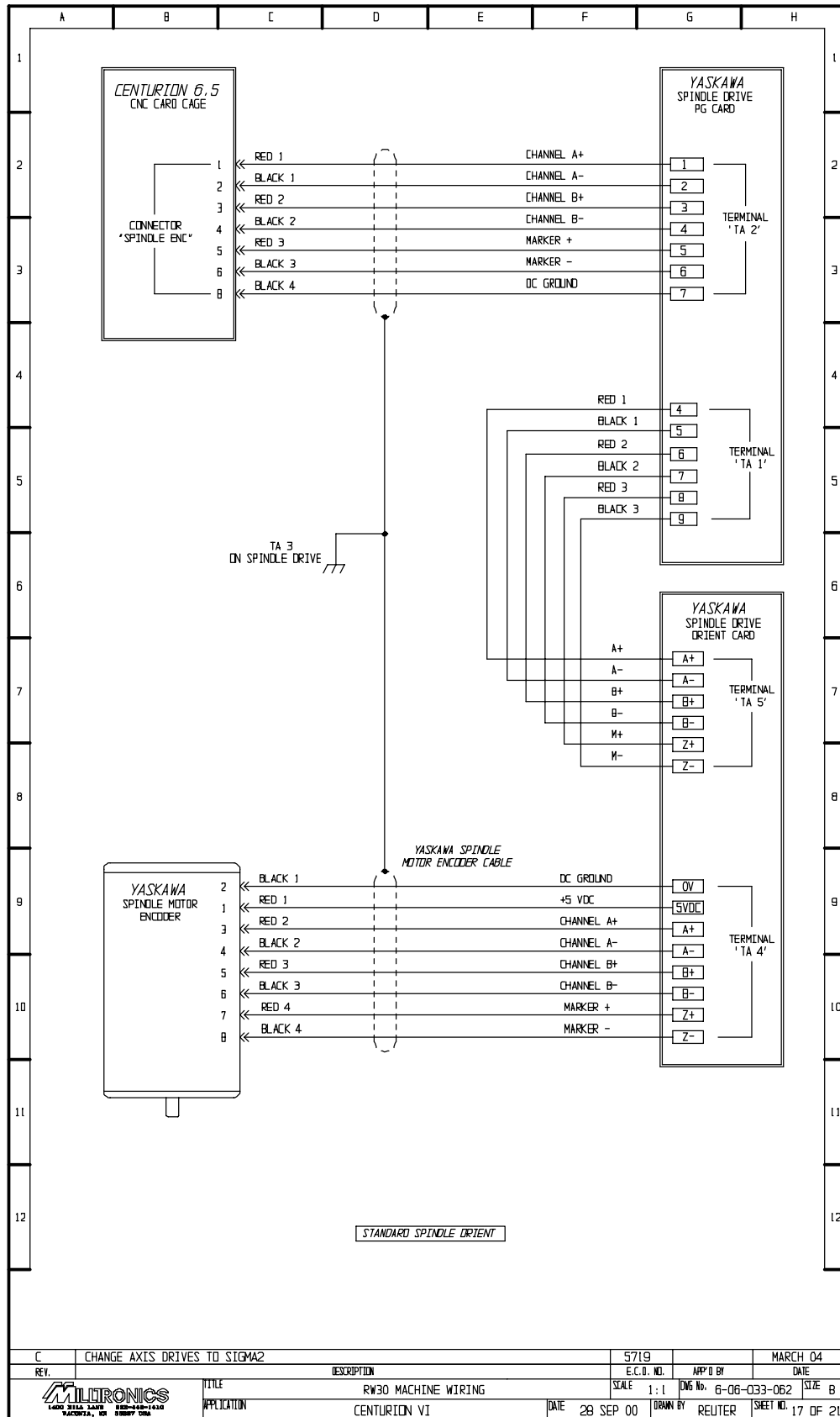


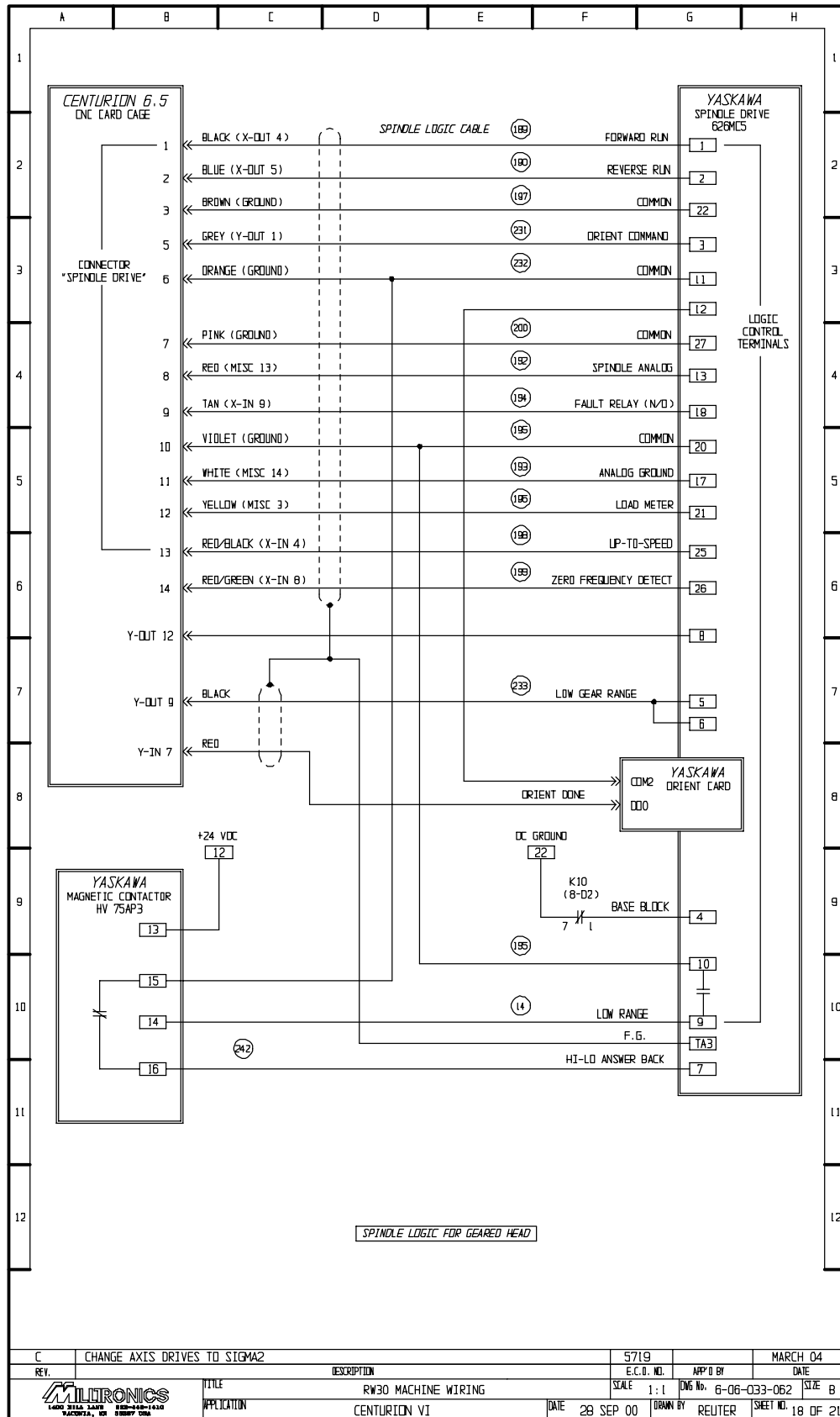


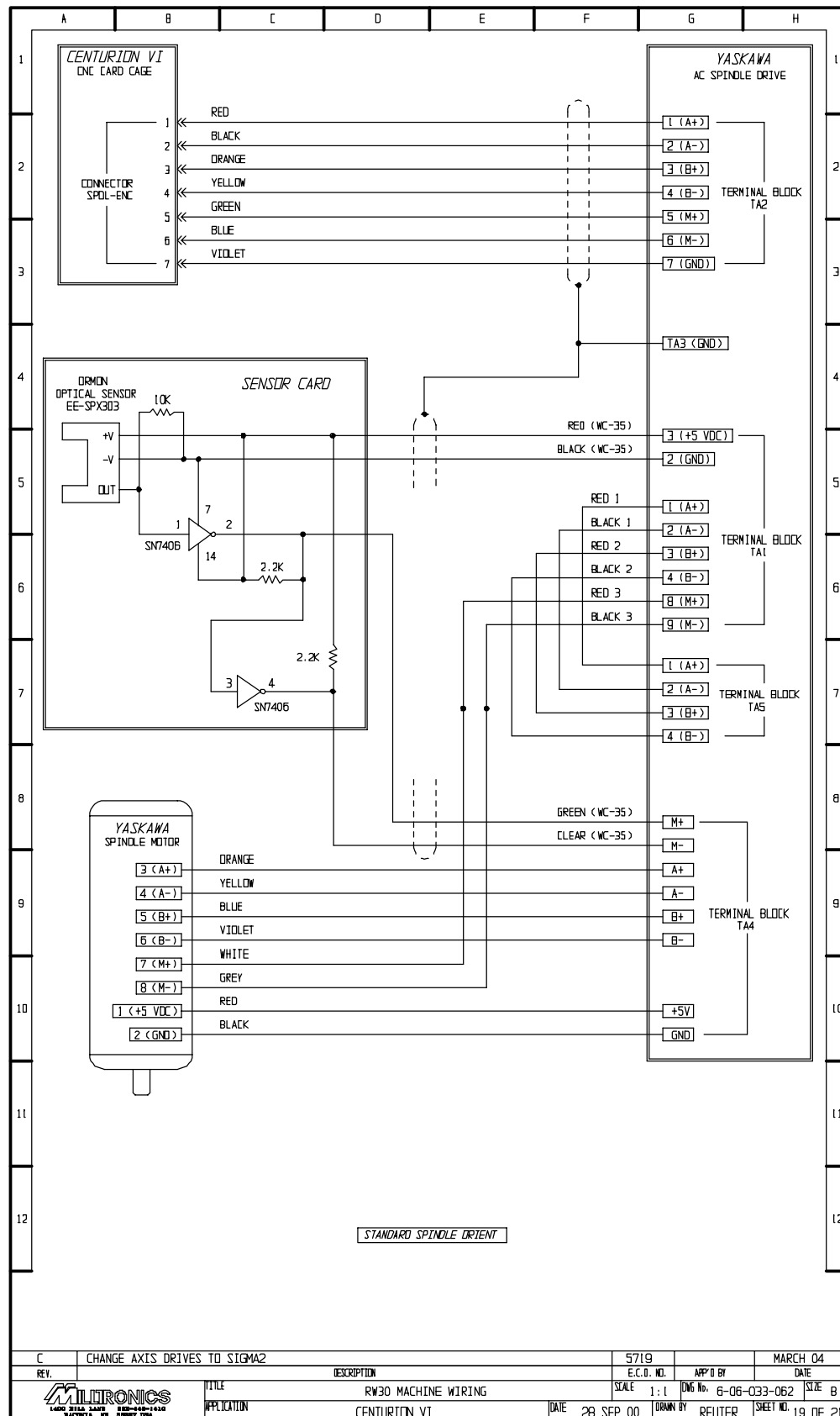


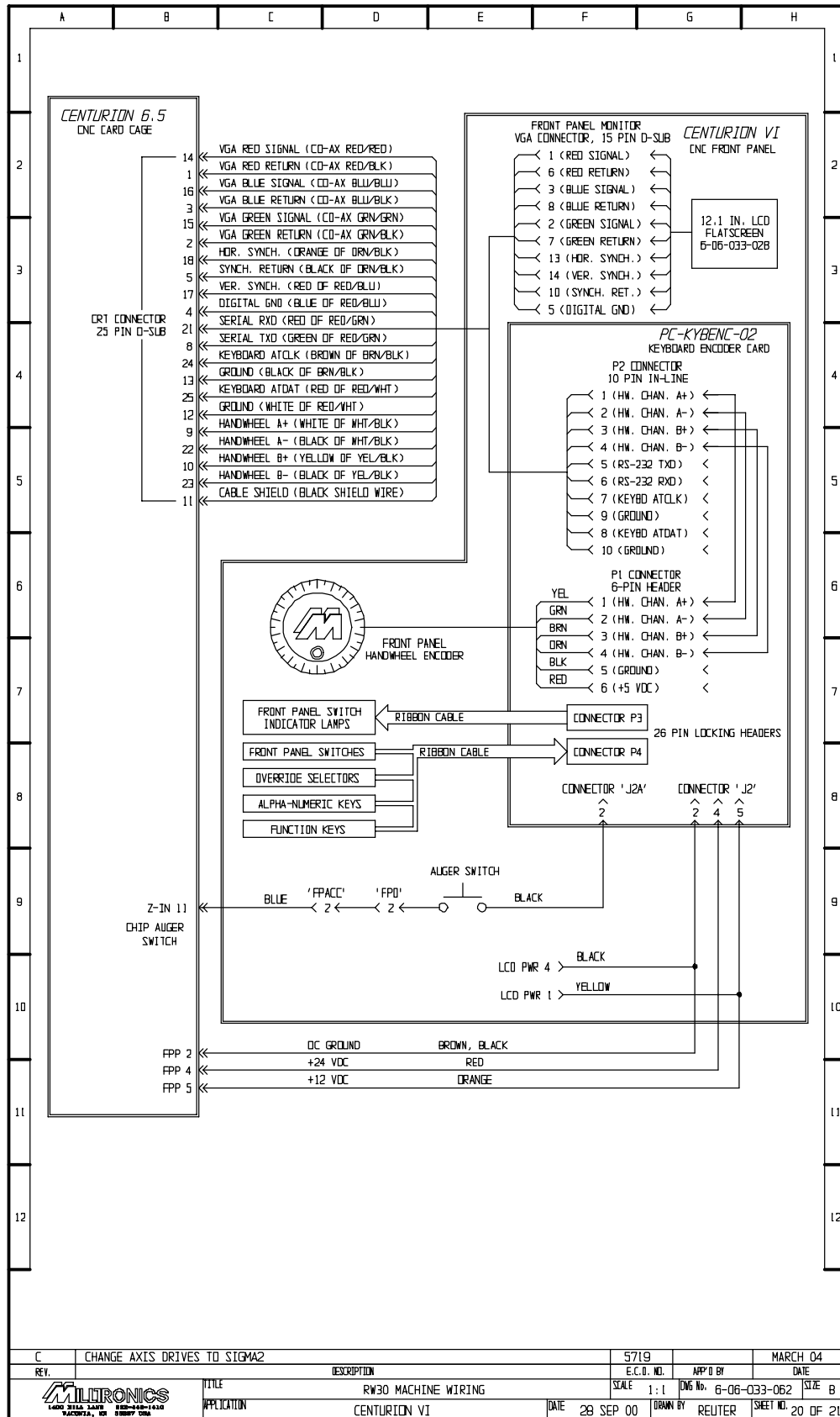


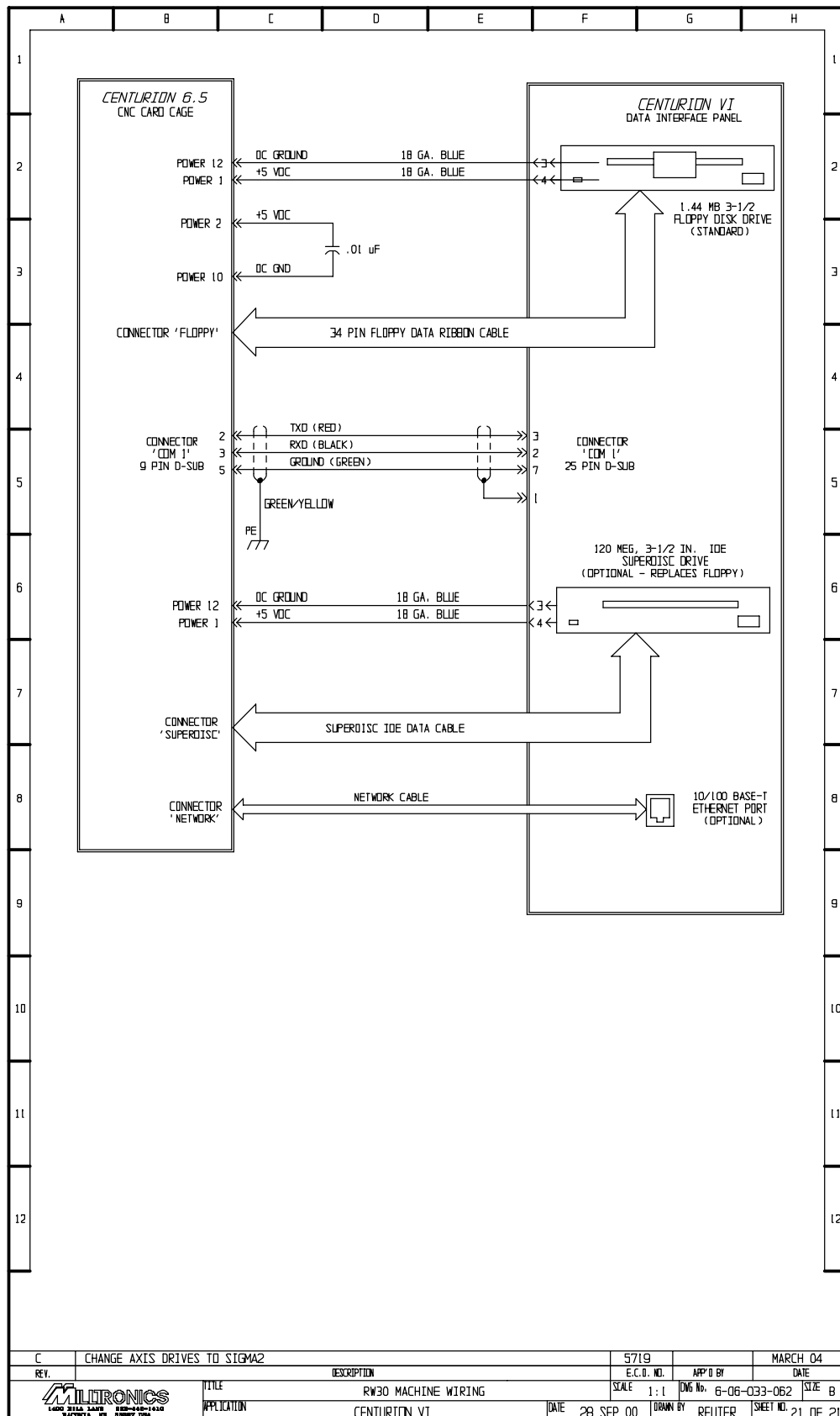




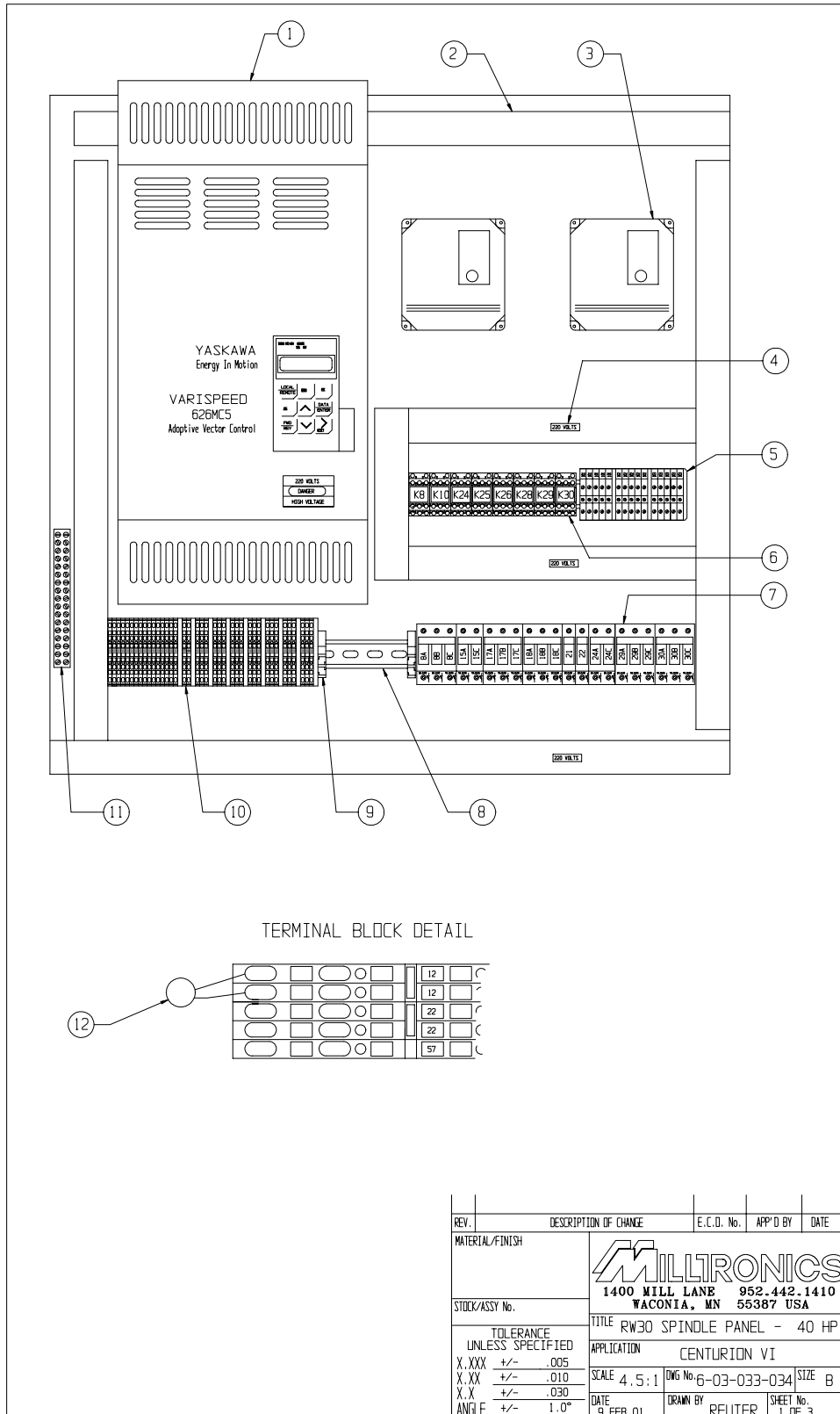


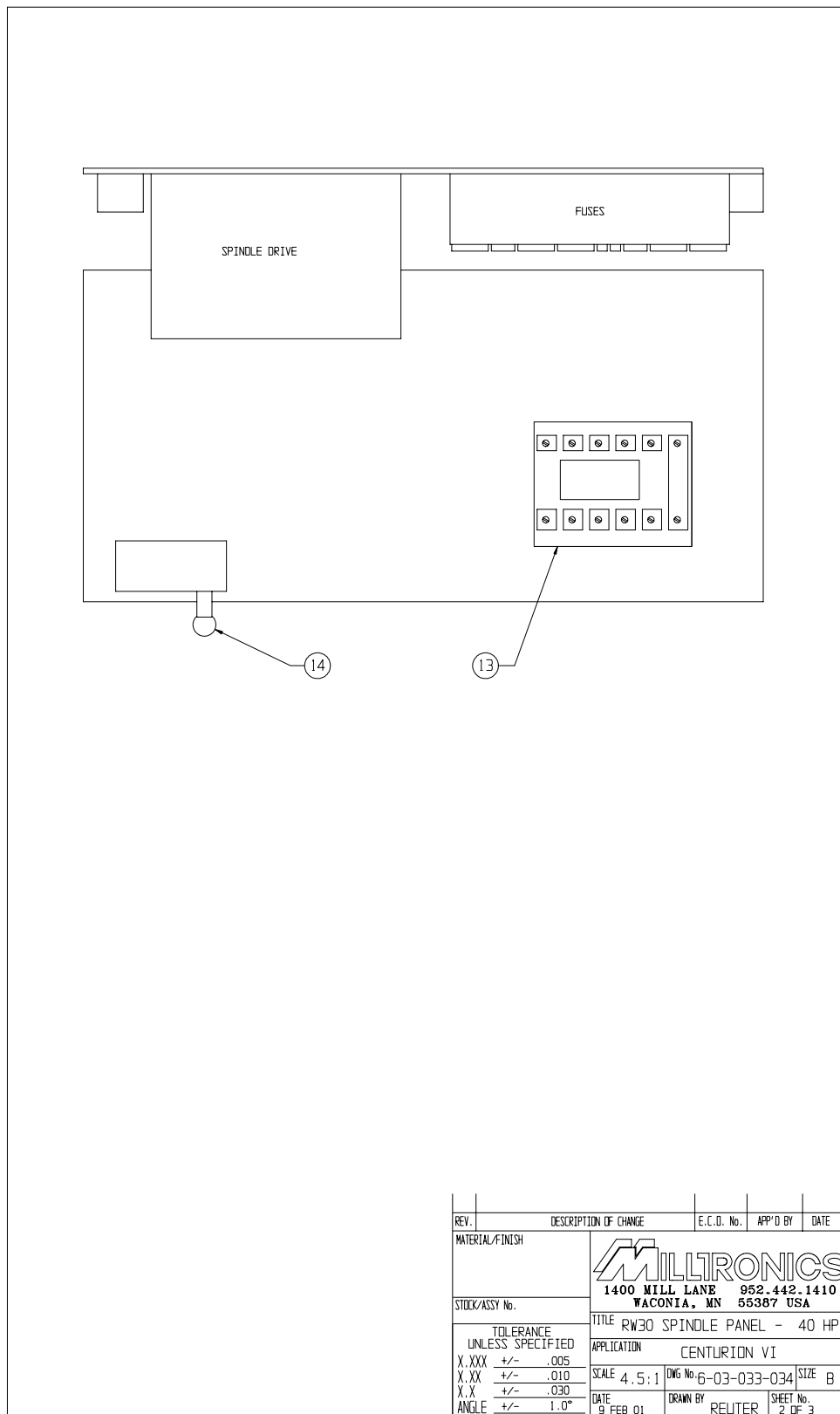






Drive Panel Layout





- PARTS LIST -

ITEM	STOCK No.	DESCRIPTION	QTY	REMARKS
1	PS-50	AC SPINDLE DRIVE, DUAL WINDING, 22 KW YASKAWA CIMR 626MCSU2022	1	
4	WC-65	WIRE DUCT, 2 INCH	6.5 FT.	
	WC-66	WIRE DUCT COVER, 2 IN.	6.5 FT.	
3	PS-50	DYNAMIC SPINDLE BRAKING UNIT YASKAWA CDBR-2022	2	
4	LB-52	220 VOLTS LABEL	3	
5	TB-37	DISTRIBUTION TERMINAL BLOCKS	12	
6	RL-74	CONTROL RELAY, 24 VDC COIL, 3PDT 10 AMP TYCO/SCHRACK PT370024	8	
	RL-75	RELAY SOCKET BASE, DIN RAIL TYCO/SCHRACK PT70703	8	RELAYS: K8, K10, K24, K25, K26, K28, K29, K30
7	FU-77	IEC FUSE HOLDER, 10 x 38, SINGLE SQUARE D No. DF6-AB10	2	HOLDERS FOR FUSES 21 & 22
	FU-83	IEC FUSE HOLDER, 10 x 38, DUAL SQUARE D No. GK10D	2	HOLDERS FOR FUSES 15A/C & 24A/C
	FU-82	IEC FUSE HOLDER, 10 x 38, TRIPLE SQUARE D No. GK10F	5	HOLDER FOR FUSES 11A & 11C
	FU-72	CERAMIC FUSE, 1/2 AMP, DF No. 44000.5 CLASS AM BUSS EQUIVALENT: FNG-1/2	2	FUSES 24A & 24C
	FU-73	CERAMIC FUSE, 1 AMP, DF No. 420001 CLASS g/G BUSS EQUIVALENT: FNG-1	2	FUSES 15A & 15C
	FU-86	CERAMIC FUSE, 4 AMP, DF No. 420004 CLASS g/G BUSS EQUIVALENT: FNG-4	3	FUSES 17A, 17B & 17C
	FU-87	CERAMIC FUSE, 6 AMP, DF No. 440006 CLASS AM BUSS EQUIVALENT: FNG-6	5	FUSES 21, 22, 30A, 30B & 30C
	FU-	CERAMIC FUSE, 10 AMP, DF No. 440010 CLASS AM BUSS EQUIVALENT: FNG-10	3	FUSES 29A, 29B & 29C
8	WX-167	DIN RAIL, 35 x 7.5 mm	1	
9	TB-35	DIN RAIL ANCHOR BLOCK	2	
	TB-30	TERMINAL BLOCK, 4-POSN., TOP ENTRY	39	
	TB-32	TERMINAL BLOCK JUMPER, 10 POSN.	1	
	TB-33	TERMINAL BLOCK LABEL TAB, SHEET OF 100	39	
	TB-31	TERMINAL BLOCK END PIECE/DIVIDER	9	
11	BU-04	GROUNDING BUS BAR	1	
12	CA-16	CAPACITOR, CERAMIC DISC, .01 uF	2	ALSO ON CARD CAGE
13	RL-77	SPINDLE SPEED RANGE MAGNETIC CONTACTOR YASKAWA HV-150AP	1	ON FLOOR OF MAG BOX
14	SW-	LIMIT SWITCH, ROLLER ACTUATED	1	MAIN POWER SAFETY LOCKOUT

-TERMINAL BLOCK DIRECTORY-

- 1. - 110 VAC LINE (JUMPERED x3)
- 2. - 110 VAC RETURN (JUMPERED x2)
- 12. - +24 VDC (JUMPERED x2)
- 20. - +24 VDC GROUND (JUMPERED x2)
- 22. - DC GROUND (JUMPERED x2)
- 57. - 110 VAC SWITCHED (JUMPERED x2)
- 78. - LUBE FAULT
- 91. - +24 VDC SWITCHED/WATCHDOG
- <DIVIDER>
- 4. - AXIS WAYS OILER
- 5. - AXIS WAYS OILER
- <DIVIDER>
- 116. - WIRING AUGER CHIP , L1
- 117. - WIRING AUGER CHIP , L2
- 118. - WIRING AUGER CHIP , L3
- <DIVIDER>
- 121. - FLOOD PUMP , L1
- 122. - FLOOD PUMP , L2
- 123. - FLOOD PUMP , L3
- <DIVIDER>
- 213. - CHIP CONVEYOUR, L1
- 214. - CHIP CONVEYOUR, L2
- 215. - CHIP CONVEYOUR, L3
- <DIVIDER>
- 244. - ATC CW
- 245. - ATC COMMON
- 246. - ATC CCW
- <DIVIDER>
- 258. - CHIP WASHDOWN, L1
- 259. - CHIP FLUSH , L2
- 260. - CHIP FLUSH , L3
- <DIVIDER>
- 267. - ATC HYDRAULIC PUMP , L1
- 268. - ATC HYDRAULIC PUMP , L2
- 269. - ATC HYDRAULIC PUMP , L3
- <DIVIDER>
- 270. - SPINDLE CHILLER PUMP , L1
- 271. - SPINDLE CHILLER PUMP , L2
- 272. - SPINDLE CHILLER PUMP , L3

-FUSE DURECTORY-

- FUSES 8A,8B,8C FLOOD PUMP (2 AMP)
- FUSES 15A,15C AXIS WAYS OILER (1 AMP)
- FUSES 17A,17B&17C CHIP FLUSH (4 AMP)
- FUSES 18A,18B&18C CHIP CONVEYOUR (2 AMP)
- FUSES 21&22 ATC MOTOR (6 AMP)
- FUSES 24A &24C SPINDLE MOTOR FAN (1/2 AMP)
- FUSES 29A,29B&29C ATC HYDRAULIC PUMP (10 AMP)
- FUSES 30A,30B&30C SPINDLE OILER CHILLER PUMP (6 AMP)

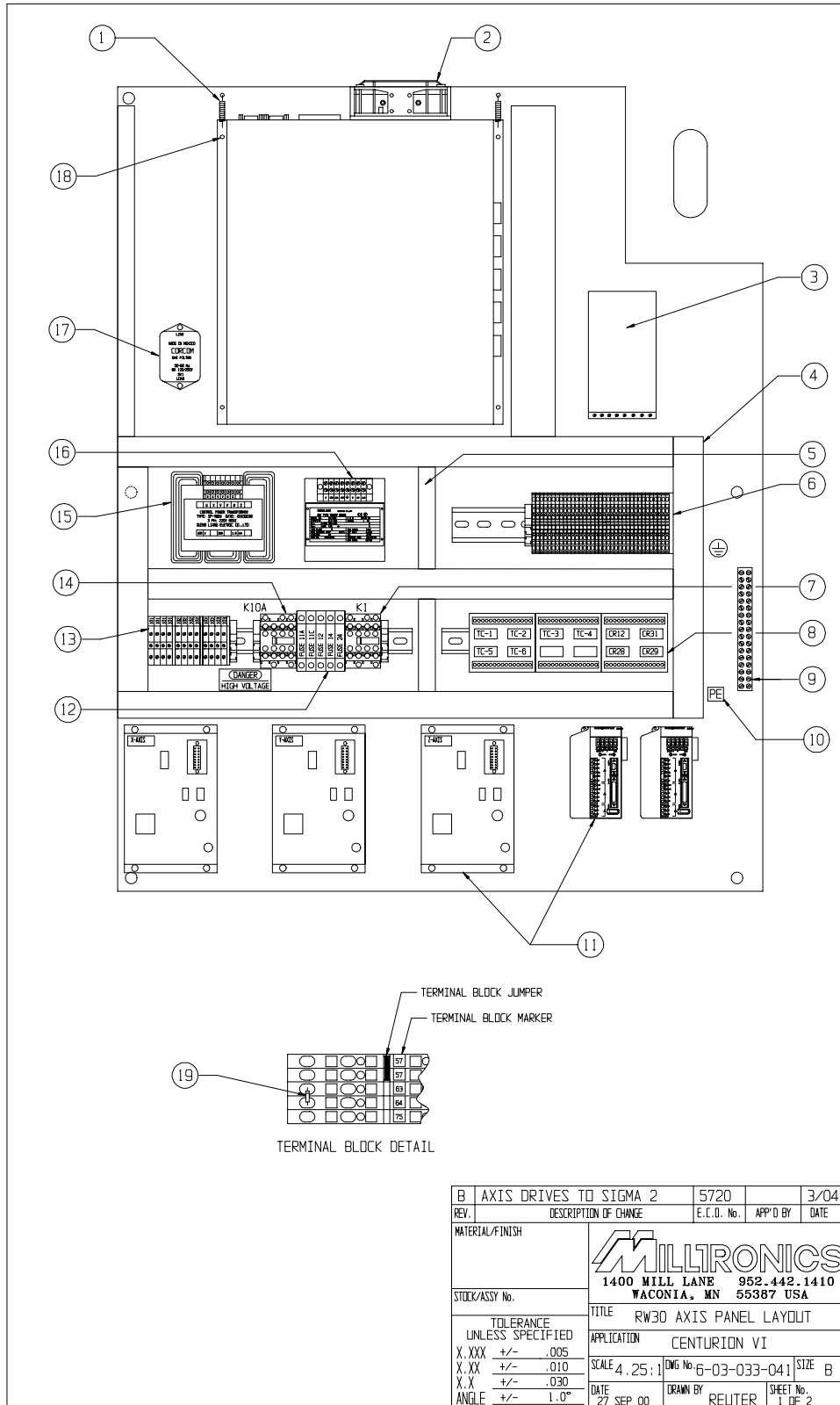
-RELAY & CONTACTOR DIRECTORY-

- K8 FLOOD COOLANT
- K10 SPINDLE ENABLE
- K24 AUGER REVERSE
- K25 AUGER FORWARD
- K26 CHIP FLUSH PUMP
- K28 ATC HYDRAULIC MOTOR
- K30 SPINDLE CHILLER PUMP

REV.	DESCRIPTION OF CHANGE	E.C.O. No.	APP'D BY	DATE
 1400 MILL LANE 952.442.1410 WACONIA, MN 55387 USA				
MATERIAL/FINISH		TITLE RW30 SPINDLE PANEL - 40 HP		
STOCK/ASSY No.		APPLICATION CENTURION VI		
TOLERANCE UNLESS SPECIFIED X.XXX +/- .005 X.XX +/- .010 X.X +/- .030 ANGLE +/- 1.0°		SCALE 1:1	DWG No. 6-03-033-034	SIZE B
DATE 9 FEB 01		DRAWN BY REUTER	SHEET No. 3 OF 3	

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Logic Panel Layout



- PARTS LIST -

ITEM	STOCK No.	DESCRIPTION	QTY	REMARKS
1	HD-63	CARD CAGE SPRING HANGER	2	
2	6130-1	CENTURION 6.5 SBC CNC CARD CAGE	1	
3	PS-52	SWITCHING POWER SUPPLY, +24 VDC, 150 WATT	1	
4	WC-104	WIRE DUCT, 1 INCH	6.5 FT.	
	WC-105	WIRE DUCT COVER, 1 IN.	6.5 FT.	
5	WC-67	WIRE DUCT, 1-1/2 INCH	26 IN.	
	WC-68	WIRE DUCT COVER, 1-1/2 INCH	26 IN.	
6	TB-30	TERMINAL BLOCK, 4-POSN., TOP ENTRY	37	
	TB-32	TERMINAL BLOCK JUMPER, 10 POSN.	2	
	TB-33	TERMINAL BLOCK LABEL TAB, SHEET OF 100	0.37	
	TB-31	TERMINAL BLOCK END PIECE/DIVIDER	1	
	TB-35	TERMINAL BLOCK DIN RAIL END STOP	4	
7	RL-68	CONTACTOR RELAY, DC COIL, 3HP SQUARE D/TELEMECANIQUE LP101210	1	
	RL-61	CONTACTOR AUXILIARY, 2-N/O, 2-N/C SQUARE D/TELEMECANIQUE LA10N22	1	CONTACTOR K1
	RL-65	CONTACTOR NOISE SUPPRESSOR DIODE SQUARE D/TELEMECANIQUE LA40CIU	1	
8	9107	M-FUNCTION QUAD RELAY BOARD MILLTRONICS PC-REL-02	3	DC RELAYS: TC-1, TC-2, TC-3, TC-4, TC-5, TC-6, CR12, CR28, CR29, CR31
9	BU-04	GROUNDING BUS BAR	1	
10	LB-81	ELECTRICAL SAFETY LABELS	1	
11	AM-60	AXIS DRIVE MODULE YASKAWA SG0H-50AEY220	3 X,Y,Z	
	AM-59	AXIS DRIVE MODULE YASKAWA SG0H-15AEY220	2 A, B	
12	FU-77	IEC FUSE HOLDER, 10 x 38, SINGLE SQUARE D No. DFG-AB10	3	HOLDERS FOR FUSES 12, 14, 24
	FU-83	IEC FUSE HOLDER, 10 x 38, DUAL SQUARE D No. GK100	1	HOLDER FOR FUSES 11A & 11C
	FU-74	CERAMIC FUSE, 2 AMP, DF No. 420002 CLASS g/G BUSS EQUIVALENT: FNG-2	3	FUSES 11A, 11C, 24
	FU-75	CERAMIC FUSE, 4 AMP, DF No. 420004 CLASS g/G BUSS EQUIVALENT: FNG-4	2	FUSES 12, 14
13	TB-37	DISTRIBUTION TERMINAL BLOCKS	12	
14	RL-64	CONTACTOR RELAY DC COIL, 3HP SQUARE D/TELEMECANIQUE LP101810	1	CONTACTOR K10A
	RL-65	CONTACTOR NOISE SUPPRESSOR DIODE SQUARE D/TELEMECANIQUE LA40CIU	1	
15	JA-19	3-PHASE LINE REACTOR, 25 AMP, 1.8H	1	FOR NON-CE MACHINES ONLY
16	TR-46	TRANSFORMER, 0.56 VKA, 50/60Hz	1	
17	MT-10	LINE FILTER, 110 VAC, 10 AMP	1	
18	WX-129	CARD CAGE RUBBER SHOCK MOUNT, 8-32 UNC M/F	4	
19	DI-20	DIODE, 1N4007	1	

- TERMINAL BLOCK DIRECTORY -

TERMINAL BLOCKS LISTED LEFT TO RIGHT

<TERMINAL BLOCK END STOP>
 <TERMINAL BLOCK END PIECE>
 1. 110 VAC LINE (x3 JUMPERED)
 2. 110 VAC RETURN (x3 JUMPERED)
 6. X-AXIS LIMIT SWITCHES
 7. X & Y AXIS LIMIT SWITCHES
 8. Y & Z AXIS LIMIT SWITCHES
 9. Z LIMIT SWITCHES
 12. +24 VDC (x3 JUMPERED)
 13. SPARE M-FUNCTION, COMMON
 14. SPARE M-FUNCTION, N/C
 15. SPARE M-FUNCTION, N/O
 20. +24 VDC SWITCHED (x4 JUMPERED)
 22. DC GROUND (x7 JUMPERED)
 55. END-OF-CYCLE LAMP
 57. 110 VAC SWITCHED (x2 JUMPERED)
 63. Z-AXIS BRAKE +
 64. Z-AXIS BRAKE -
 78. AXIS LUBE FAULT
 79. CNC WATT CHANNEL
 82. CHIP PAN OODR SWITCH N/O
 83. SETUP BUTTON
 91. WATCHDOG-SWITCHED +24 VDC
 327. TOOL OUT REQUESTED
 <TERMINAL BLOCK END STOP>

FUSES

FUSE 11A & 11C - TRANSFORMER PRIMARY, 2 AMP
 FUSE 12 - 110 VAC, 4 AMP
 FUSE 14 - WORKLAMP TRANSFORMER, 4 AMP
 FUSE 24 - 24 VDC POWER SUPPLY, 2 AMP

- RELAY & CONTACTOR DIRECTORY -

RELAYS
 CR12. SPARE M-FUNCTION
 CR29. WATCHDOG
 CR28. RELAYS AXIS BRAKE
 CR31. END-OF-CYCLE LAMP
 TC- 1. MAGAZINE SLOW
 TC- 2. MAGAZINE C/W
 TC- 3. MAGAZINE C/W
 TC- 4. MAGAZINE PIN UNLOCK
 TC- 5. TOOL POT UP
 TC- 6. TOOL POT DOWN
 CONTACTORS
 K1. MACHINE RESET
 K10A. AXIS DRIVES ENABLE

B	AXIS DRIVES TO SIGMA 2	5720		3/04
REV.	DESCRIPTION OF CHANGE	E.C.O. No.	APP'D BY	DATE
MATERIAL/FINISH				
STOCK/ASSY No.	1400 MILL LANE 952.442.1410 WACONIA, MN 55387 USA			
TOLERANCE UNLESS SPECIFIED	TITLE RW30 AXIS PANEL LAYOUT			
X .XXX +/- .005	APPLICATION CENTURION VI			
X .XX +/- .010	SCALE 1:1 DWG No 6-03-033-041 SIZE B			
X .X +/- .030	DATE 27 SEP 00 DRAWN BY REUTER SHEET No. 2 OF 2			
ANGLE +/- 1.0°				

MC5 Spindle Drive Parameters

for

RW-20, RW-30 Models

5-31-01 (Added geared head RW30)

Parameter	Name	MC5 2011 20/15HP	MC5 2015 30/22 HP	MC5 2015 40/30 HP	MC5 2015 40/30 HP	Unit
		6422	6422	6422	6422	
		Electronic Orient	Electronic Orient	Electronic Orient	Electronic Orient	
		19 KVA	24 KVA	37 KVA	37 KVA	
INITIALIZE CONSTANTS		Belted Head	Belted Head	Belted Head	Geared Head	
A1-01	Access Level	4	4	4	4	
A1-02	Control Method	3	3	3	3	
PROGRAM CONSTANTS						
B1-01	Reference Selection	1	1	2.5	2.5	
B1-07	LOC/REM RUN Sel	1	1	1	1	
B1-02	Operation Method	5	5	5	5	
B2-03	D/C Injection Braking	.25	.25	.25	.25	
AUTO TUNING CONSTANTS						
C1-01*	Accel Time 1	2.0	2.0	3.5	3.5	sec
C1-02*	Decel Time 1	5.0	5.0	5.5	5.5	sec
C1-03*	Accel Time 2	0.4	0.4	.5	.5	sec
C1-04*	Decel Time 2	0.4	0.4	.2	.2	sec
C1-07*	Accel Time 4	1.0	1.0	2.0	2.0	sec
C1-08*	Decel Time 4	2.0	2.0	4.5	4.5	sec
C1-11	Acc/Dec SW Freq	133.0	133.0	135.	135.	Hz
C2-01	SCrv Acc @ Start	.20	.20	.1	.1	
C2-02	SCrv Acc @ End	.20	.20	.25	.25	
C2-03	SCrv Dec @ Start	.4	.4	.4	.4	
C2-04	SCrv Dec @ End	.3	.3	.2	.2	
C5-01*	ASR P Gain	20	20	10	55	
C5-02*	ASR I Gain	.5	.5	.25	.25	
C5-03*	ASR P Gain 2	30.00	30.00	65.	65.	
C5-04*	ASR I Time 2	0.300	0.300	.25	.25	sec
C5-06	ASR Delay Time	0	0	0	0	
C6-01	Carrier Freq Max	4.0	4.0	4.0	4.0	KHz
C8-02	Special	0.10	0.10	0.10	0.10	
C8-03	Special	0.0	0.0	0.0	0.0	
C8-04	Special	5	5	5	5	%
C8-06	Special	0.0	0.0	0.0	0.0	Ms
C8-07	Special	5	5	5	5	%
C8-27	Inverse rate current	49.0	49.0	49.0	49.0	A
C8-28	DCCT Gain	1.154	1.154	1.154	1.154	
D1-09	Jog Reference	1.00	1.00	1.00	5.5	Hz
MOTOR CONSTANTS						
E1-02	Motor Selection	1	1	1	1	
E1-04*	Max Frequency	200.	200.	266.7	266.7	Hz
E1-05	Max Voltage	157.1	122.4	160	160	V
E1-06	Base Frequency	67.3	40.0	50.	50.	Hz
E1-13	Base Voltage	145.3	118.7	160.	160.	V
E2-01	Motor Rated FLA	50.	67.4	91.	91.	A

		MC5 2011	MC5 2015	MC5 2015	MC5 2015	
Parameter	Name	20/15HP	30/22 HP	40/30 HP	40/30 HP	Unit
		6422	6422	6422	6422	
E2-02	Motor Rated Slip	.83	0.62	.68	.68	Hz
E2-03	No-load Current	11.9	32.4	50.9	50.9	A
E2-04	Number of Poles	4	4	4	4	
E2-05	Term Resistance	.171	0.156	.065	.065	Oh m
E2-06	Leak Inductance	11.0	9.4	9.4	9.4	%
E2-07	Saturation Comp1	.49	0.40	.41	.41	
E2-08	Saturation Comp2	.72	0.69	0.69	0.69	
E3-01	Control Method	3	3	3	3	
E4-01	Max Frequency 2	50.0	50.0	50.0	50.0	Hz
E4-02	Max Voltage 2	112.9	115.3	139.8	139.8	VAC
E4-03	Base Frequency 2	16.7	20.0	25	25	Hz
E5-01	Motor Rated FLA2	58	64.7	88.5	45	A
E5-02	Mot Rated Slip2	1.11	0.86	1.35	1.35	Hz
E5-03	No-load Current 2	17.9	23.5	30.8	30.8	A
E5-05	Term Resistance2	.555	0.290	.170	.170	Oh m
E5-06	Leak Inductance2	13.0	14.2	14.2	14.2	%
OPTION CONSTANTS						
F1-01	FG Constant	1024	1024	1024	1024	
F1-02	PG Fdbk Loss Sel	1	1	1	1	
F1-03	PG Overspeed Sel	1	1	1	1	
F1-04	PG Deviation Sel	3	3	3	3	
F1-05	PG Rotation Sel	1	1	1	1	
F1-06	PG Output Ratio	1	1	1	1	
F1-08	PG Overspd Level	150%	150%	115%	115%	
F1-11	PG Deviate Time	.5	.5	.5	.5	
F1-14	PGO Time	2	2	2	2	
F4-03	A0 Ch2 Select	5	5	5	5	
INPUTS						
H1-01	Terminal 3 Sel	2	2	2	2	
H1-02	Terminal 4 Sel	8	8	8	8	
H1-03	Terminal 5 Sel	80	80	80	80	
H1-04	Terminal 6 Sel	77	77	77	7	
H1-05	Terminal 7 Sel	82	82	82	82	
H1-06	Terminal 8 Sel	7	7	7	6	
OUTPUTS						
H2-01	Terminal 9 and10 Sel	1C	1C	1C	1C	
H2-02	Terminal 25 Sel	13	13	13	13	
H2-03	Terminal 26 Sel	1	1	1	1	
H3-01	Terminal 13 Sel	0	0	0	0	
H3-02	Terminal 13 Sel	100%	100%	100%	100%	
H3-05	Terminal 16 Sel	0	0	0	0	
H4-01	Terminal 21 Sel	3	3	3	3	
RS 232						
H5-01	Serial Comm Adr	1F	1F	1F	1F	
H5-02	Serial Comm Sel	3	3	3	3	
H5-03	Serial Corn Sel	0	0	0	0	
H5-04	Serial Fault Sel	3	3	3	3	
H5-05	Serial Flt Dtct	1	1	1	1	

		MC5 2011	MC5 2015	MC5 2015	MC5 2015	
Parameter	Name	20/15HP	30/22 HP	40/30 HP	40/30 HP	Unit
		6422	6422	6422	6422	
L1-01	Motor Protect OFF	0	0	0	0	
L3-04	Stall P Decel Sel	0	0	0	0	
L8-05	Ph Loss In Sel	0	0	0	0	
L8-07	Ph Loss Out Sel	1	1	1	1	
WINDING CHANGE CONSTANTS						
P1-02	Frequency Width	6.0	6.0	6.0	6.0	Hz
P1-03	Ansback Det Time	0.50	0.50	0.50	0.50	Sec
P1-04	Wye Winding Sel	1	1	1	1	
P1-05	CASE Param 5	.01	.01	.01	.01	
ELECTRONIC ORIENT CONSTANTS						
P3-01**	Orient Position	0 to 4095	0 to 4095	0 to 4095	0 to 4095	
P3-02	Position Gain H	20	20	20	20	
P3-05	Ore Set Pulse	10	10	10	10	
P3-06	Ore Reset Pulse	10	10	10	10	
P3-07*	Orient Speed	150	150	150	150	
P3-08	Gear Ratio	1	1	1	1	
P3-11	Gear Direction	0	0	0	0	
P3-12	Dither Level	0	0	0	0	

***Parameters will vary depending on RPM option of machine**

**** Orient Position will vary on every machine.**

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 from Yaskawa.

Consult Milltronics Manufacturing for current parameters.

Sigma 2 Axis Drive Parameters For RW Series

The following table lists the axis drive parameters changed by Milltronics. All other parameters remain set to the Yaskawa factory default settings. RW20 not implemented as of this date.

P#	RW30				
	X	Y	Z	A	B
000	0000H	0000H	0001H	0000H	0001H
100	96	90	93	50	50
101	285	285	327	650	650
201	1181	1181	1476	500	500
300	433	436	543	218	231
401	30	32	44	100	100
408	0101H	0101H	0100H	0000H	0000H
409	330	350	2000	350	350
40A	170	160	70	N/A	N/A
40B	700	700	2000	N/A	N/A
40C	150	150	70	N/A	N/A

Card Cage Gain Setting Procedure

The motion control cards are pre-adjusted in the assembly area by commanding a move of 0.2048" and adjusting the gain pot so the analog is **5** volts. This adjustment can be made on the machine as well, but some parameters should be noted before making the adjustments.

Note 1: Before making any adjustments on the Centurion 6 make sure that the AXIS parameters "Velocity Gain" are set to zero and the machine is re-homed.

Note 2: The offset pots should be adjusted to show zero following error when the machine is at rest before making gain adjustments.

The gain adjustments done in the assembly area are done for moves on axes that have 10,000 pulses/inch. If the PPU on the machine is something other than 10,000 you must move a different distance. The 5 volts should be tuned in for a 2,048 pulse move.

Example 1:

A rotary axis has 500 pulses/degree. You should see 5 volts after a move of 4,096 degrees, (I.E. $10,000/500 \times 0.2048$)

Example 2:

A machine has a PPU of 10,160. You should see **5** volts after moving 0.2016 inches (I.E. $10,000/10,160 \times 0.2048$). In most cases this small difference is not significant.

Note 3: The encoder multiplier parameter will have no affect on the above adjustments.

Drive Setting Procedure

After the motion control cards have been adjusted, the drives are tuned.

In AXIS parameters, check once again that Velocity Gain values are 0 (see above); check that Excess Error is set to 0.500; re-home the machine.

Use the hand-held digital operator to set CN-03 on Yaskawa axis **drives**. The correct value on all VM machines is 328. CN-03 is the equivalent of a gain pot. Move an axis at 100 ipm and observe the following error. It should be 0.050 for all axes on all machines, except rotary axes. Tweak the motion control card gain pot for final adjustment, to get as close to 0.050 as necessary.

If the machine has analog drives, then adjust the drive gain pot to set the following error at 100 ipm to 0.050 for all axes on all machines. Once again, the final adjustment may be made by tweaking the motion control card gain pot, if necessary.

If the axis PPU is something other than 10,000 you must tune the drives accordingly.

Example: A rotary axis has a PPU of 500. You should move the axis at 2,000 degrees per minutes (I.E. $10,000/500 \times 100$) and tune the drive so you see a following error of 1.000 degree (I.E. $10,000/500 \times 0.050$).

Test that you can achieve max rapid and that the following error at max rapid is correct. Check in AXIS parameters to see the value for max rapid, then use the following formula:

Following error at max rapid = max rapid/100 x 0.050.

Example: A VM24 has max rapids of 800 ipm. You should see a following error of .400 at full rapid (I.E. $800/100 \times 0.050 = .400$).

Go back into AXIS parameters and set Velocity Gain to 100. Re-home machine.

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

Connector Y-Output

Pin 1 - Creep speed	Pin 8 - Blowoff/Drumdoor/FeedHold (jumped to TCH-Yin9)
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Centurion 6 CNC Connector Signal Listing

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 TlChngr)	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
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

Centurion 6 CNC Connector Signal Listing

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	

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)

Centurion 6 CNC Connector Signal Listing

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
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

Centurion 6 CNC Connector Signal Listing

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

Pin 7 - Tool carousel at pocket prox

open signal

Pin 8 - Tool changer arm in prox

Pin 14 - Tool changer arm & door solenoids common

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

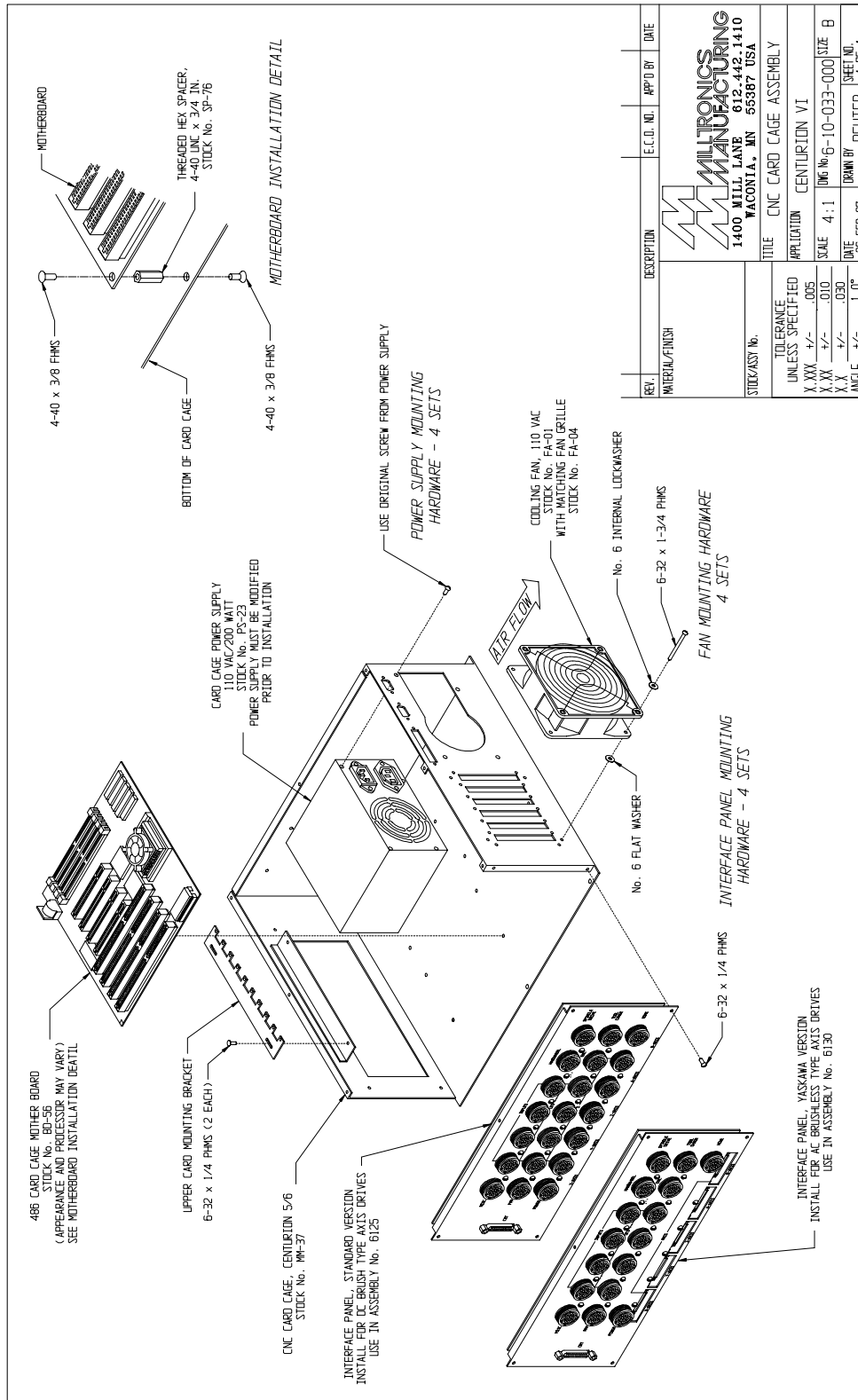
Pin 3 - TXD

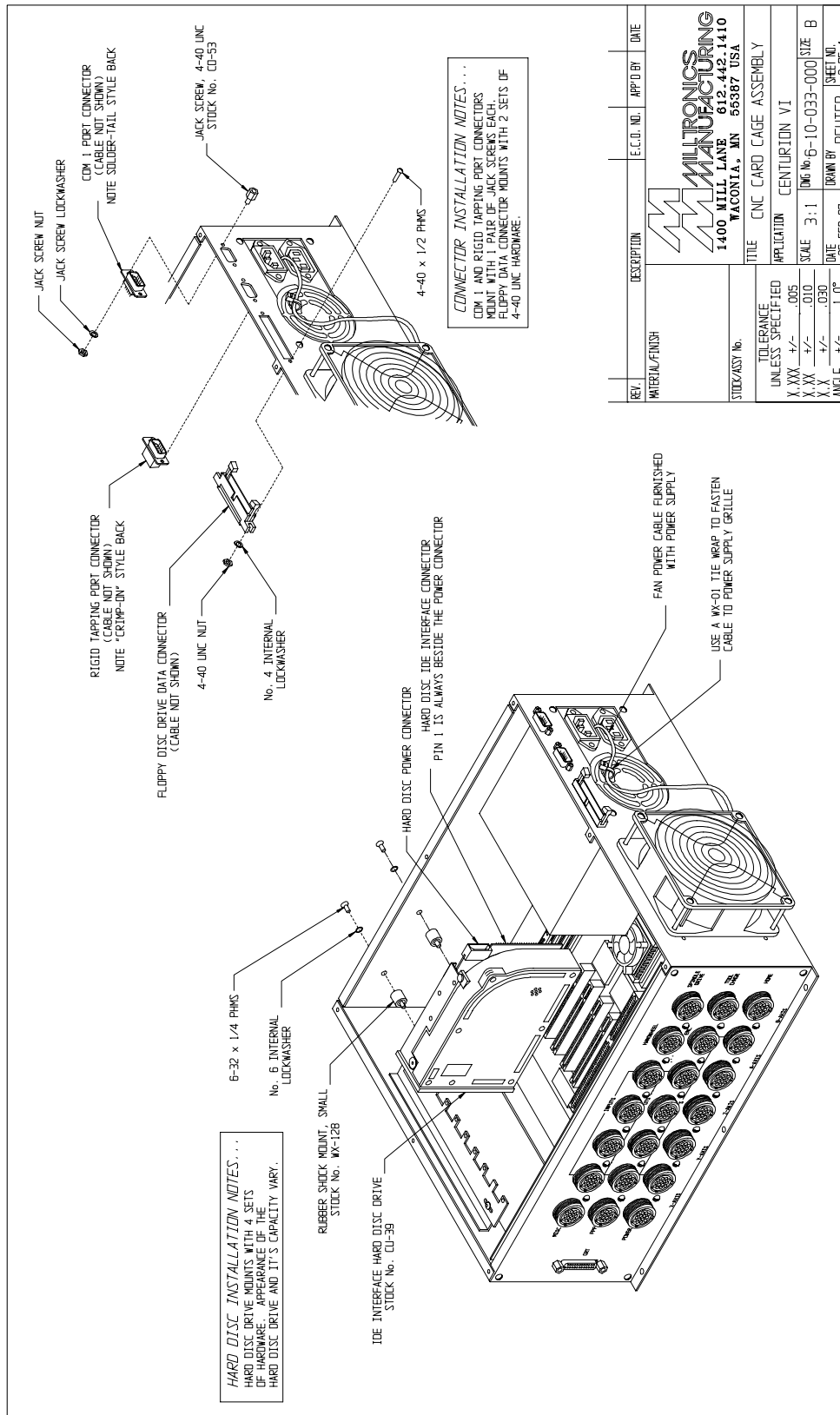
Pin 7 - Ground

All other pins no connect

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Card Cage Assembly

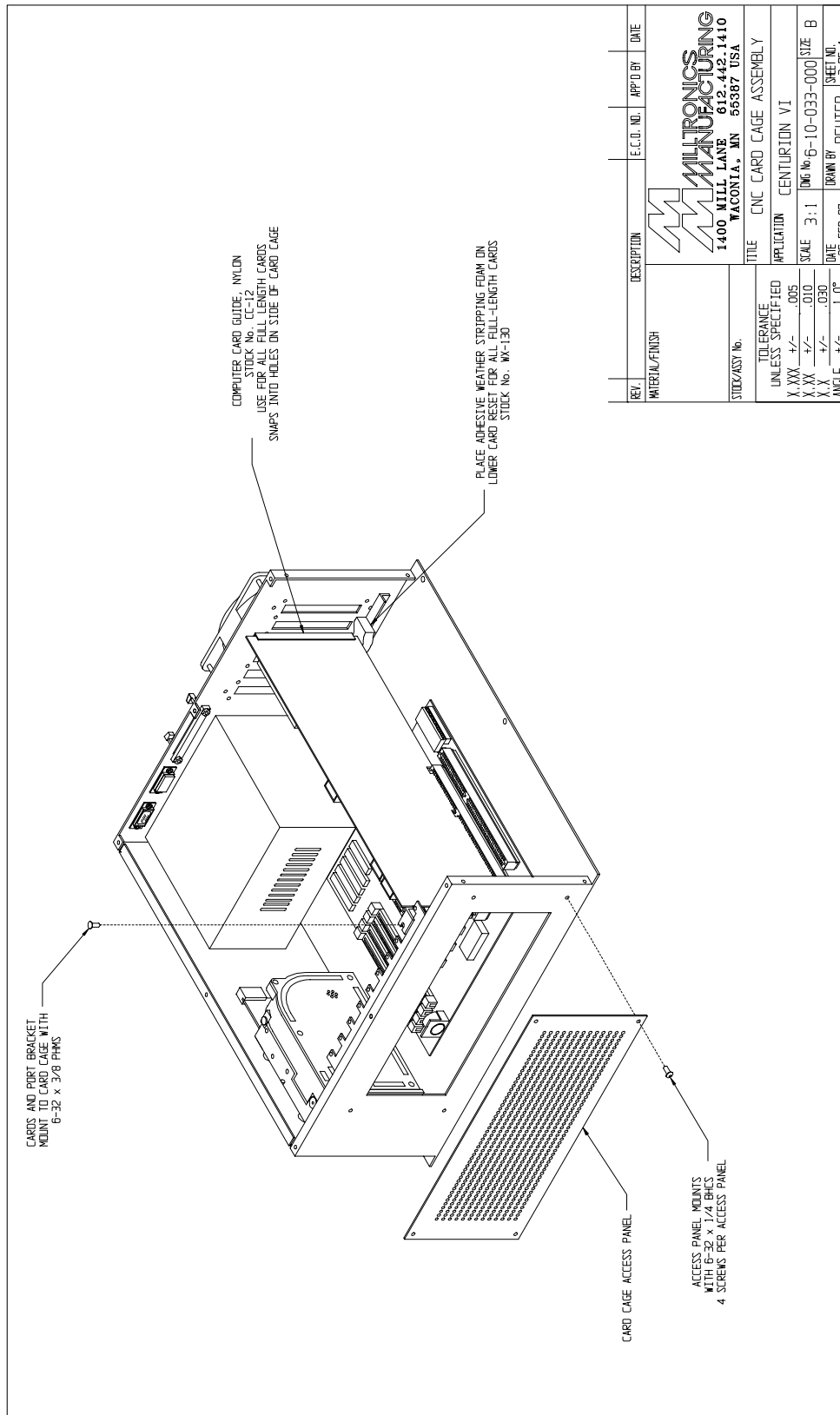


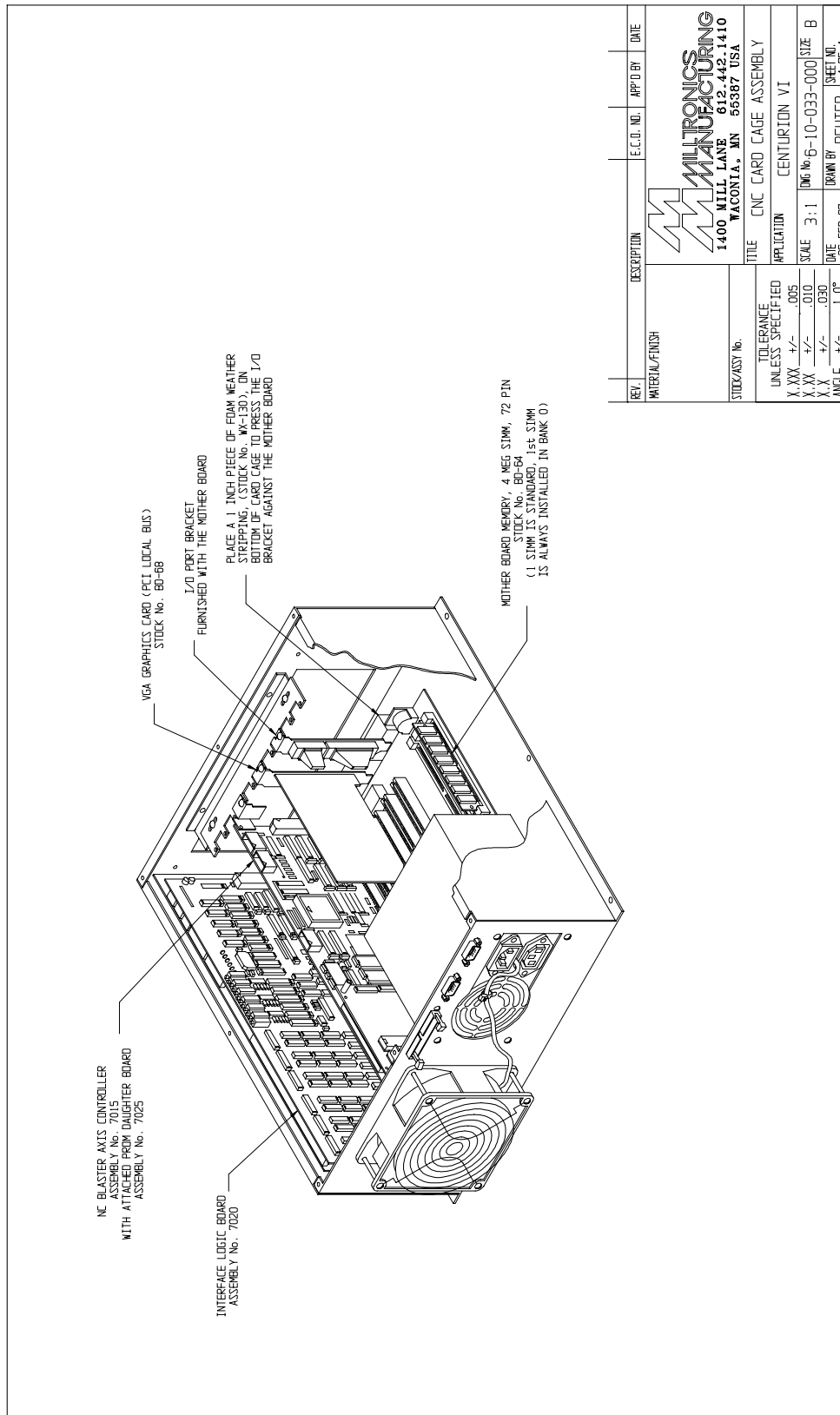


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	TOLERANCE UNLESS SPECIFIED			
	X.XXX +/- .005			
	X.XX +/- .010			
	X.X +/- .030			
	ANGLE +/- 1.0°			
	TITLE			
	APPLICATION			
	SCALE			
	DATE			
	DRAWN BY			
	REVIEWER			



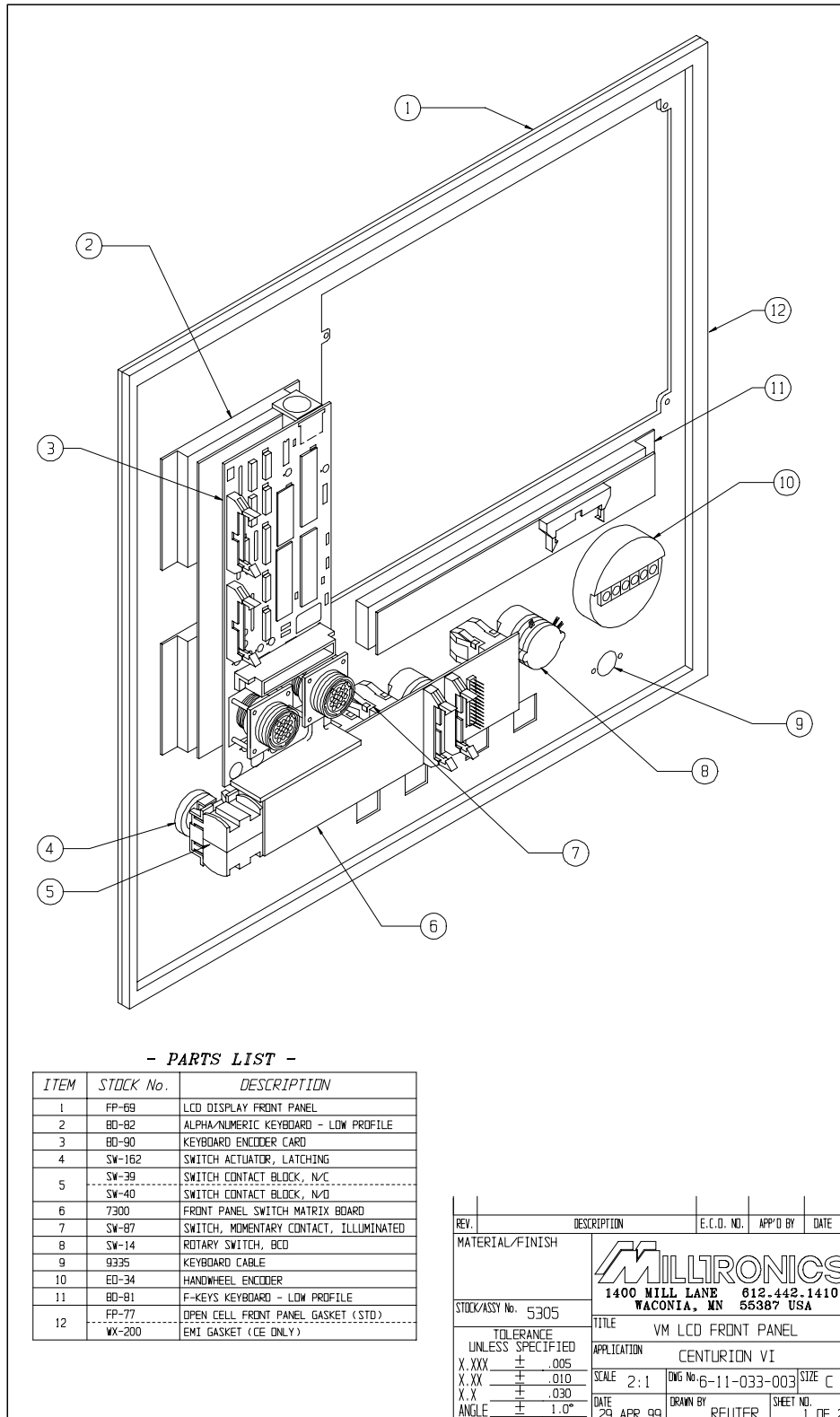
CNC CARD CAGE ASSEMBLY
CENTURION VI
3:1
Dwg No. 6-10-033-000
SIZE B
26 FEB 97
REUTER
2 OF 4

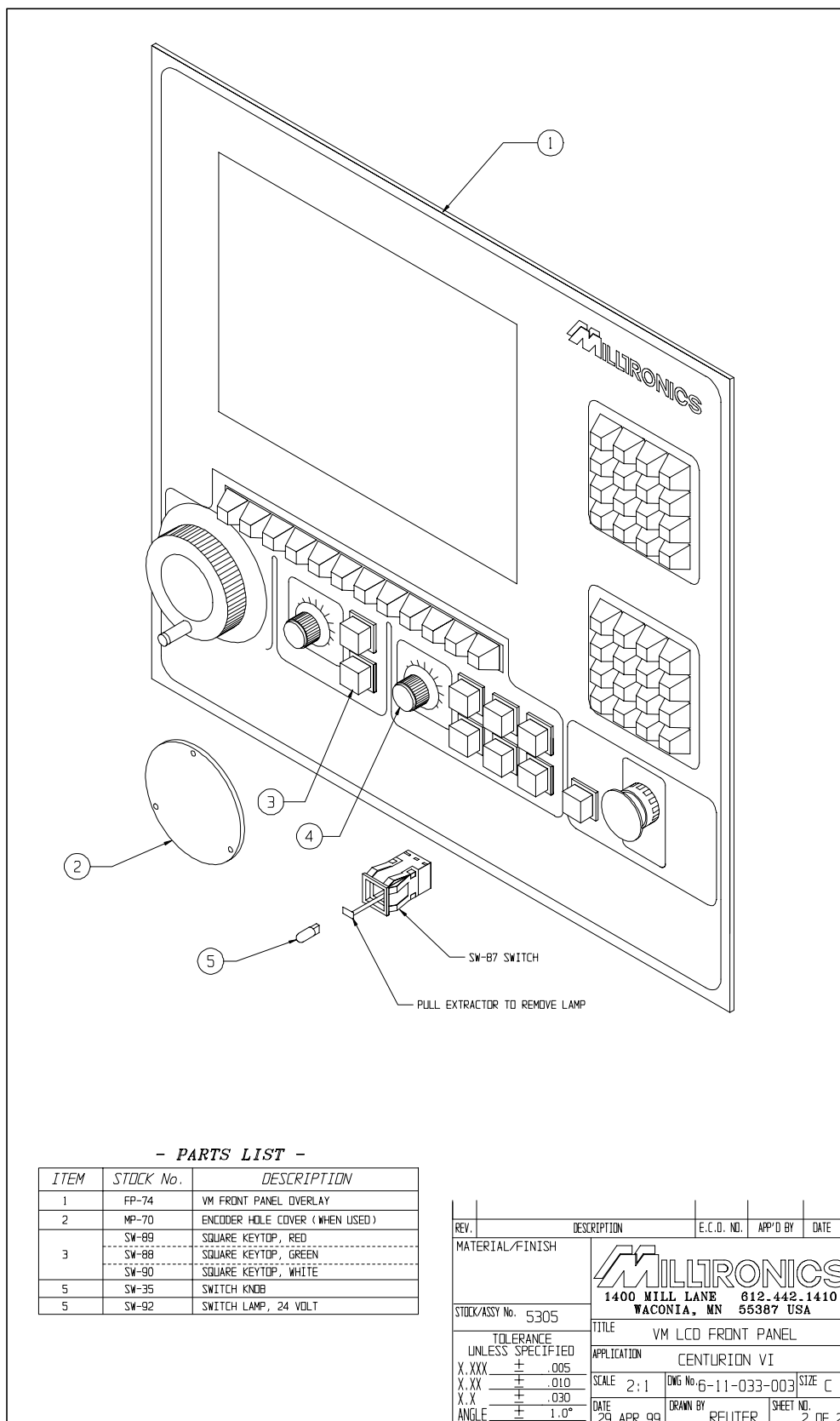




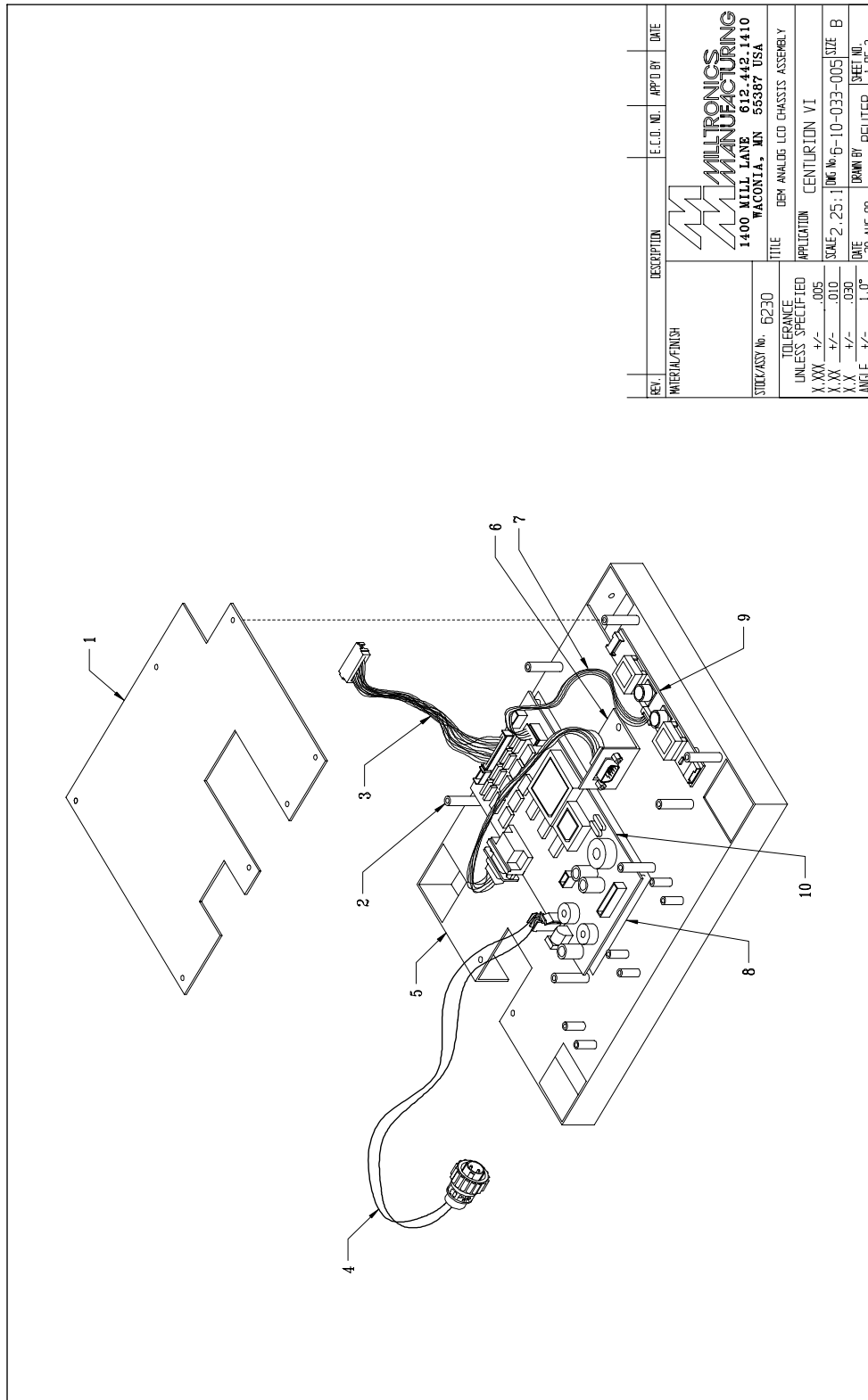
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MATERIAL/FINISH				
 MILLIRONICS MANUFACTURING 1400 WILL LANE 612-442-1410 WACONIA, MN 55387 USA				
STOCK/AST No.	TITLE	CNC CARD CAGE ASSEMBLY		
UNLESS SPECIFIED	APPLICATION	CENTURION VI		
X.XXX +/- .005	SCALE	3:1	DWG No. 6-10-033-000	SIZE B
X.XX +/- .010				
X.X +/- .030	DATE	26 FEB 97	DRAWN BY	REUTER
ANGLE +/- 1.0°				SHEET NO. 4 OF 4

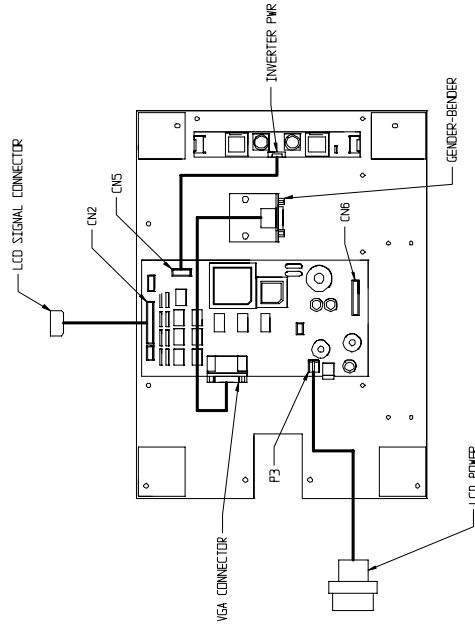
LCD Front Panel Assembly





LCD Chassis Assembly





-INSTRUCTIONS-

1. MOUNT THE VGA GENDER-BENDER TO THE CHASSIS WITH 8-32 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 LOCKWASHERS SHOULD BE USED TO SECURE THE BOARD ON TOP OF THE CONVERSION BOARD. USE 4-40 1/4 RHMS AND LOCKWASHERS TO MOUNT THE BOARD. ATTACH 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. (LARGER PLUG). THESE CABLES 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 INLINE 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-98 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-98	6-32 x 1-1/4 FEMALE/FEMALE HEX SPACER
3	CB-42	DV/SHARP LCD SIGNAL CABLE DIGITAL VIEW No. 23430
4	9486	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	9487	ANALOG VGA GENDER-BENDER ASSEMBLY DNG No. 6-04-033-080
7	CB-41	14.014034.5520 POWER CABLE DIGITAL VIEW No. 420680170
8	WX-242	DIGITAL VIEW PCB 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-9511 v.3

REV	DESCRIPTION	E.C.D. NO.	APP'D BY	DATE
	MATERIAL/FINISH			
	STOCK/ASSY No. 6230			
	TOLERANCE UNLESS SPECIFIED			
	X.XX ±.005			
	X.XX ±.010			
	X.XX ±.030			
	ANGLE ±.1°			
	TITLE	DEM ANALOG LCD CHASSIS ASSEMBLY		
	APPLICATION	CENTURION VI		
	SCALE	2.25:1 DNG No. 6-10-033-005		
	SIZE	B		
	DATE	24 JUN 98		
	DRAWN BY	REUTER		
	SHEET NO.	2 OF 2		



