

The Centurion 7 Control

The centurion 7 control is an open architecture PC based control system. The functions of the control are divided between two main portions. The CNC portion is located behind the operators panel. This portion operates the front panel, runs the cnc software, and processes all of the motion control commands. The interface panel is located inside the electrical cabinet. It is responsible for communications between the CNC and the “outside world”. The control and the interface are connected by a fiber optic cable that carries the communications between the two.

Centurion 7 Control Components

Below is an overview of the cards found in a typical Centurion 7 control. Diagrams of the cards follow the descriptions.

CNC Control

Single Board Computer

The Centurion 7 is built around a single board computer, or SBC. The SBC board contains the processor, video control, I/O interface for floppies and other devices, memory simms, and a network controller. The SBC board also contains a PC/104 slot that allows for connection to other boards in the control. The power for the card comes from a power supply plugged directly into it. The PC/104 expansion slot will provide power to any other cards connected there.

Machine software, parameters, and part programs are stored on a flash ram storage card. The capacity of the flash ram card is 64 meg (standard) or 256 meg (option). The flash ram card is inserted into a socket on the back side of the SBC board, parallel to the board itself. If the card is moved to another control all machine software, parameters, and programs will go with it. On early Centurion 7 controls the storage is located on a Disk-on-Chip. This is a solid state chip that acts like a hard drive. Storage capacity of the chip is 8meg (standard) or 144meg (option).

The NCB2 board

The NCB2 board is responsible for all motion control calculation in the Centurion 7 control. It processes the axes moves and responds to the encoder feed back..

There are three main components on the card:

- A processor chip is mounted on the card to calculate the axes moves and respond to feed back.
- An Xilinx CPLD (complex programmable logic device) is mounted to the back side of the card and provides the bulk of the circuitry logic. This chip replaces many electronic components used

on the previous version of the NCB card. This chip is programmed at the factory through the CN2 port on the board.

- A third chip contains the NCB firmware that runs the board. This chip is flash programmed with a floppy disk and can be flash programmed in the field to update the NCB firmware, if necessary. Current machine software upgrades also include an NCB firmware update.

The NCB firmware and NCB PLD software versions can be displayed on the control under [F10]Utilities-[F8]Info-[F9].

Keypad Encoder Card

The Centurion 7 keypad encoder board processes the keyboard and switch input signals from the control and sends them to the SBC.

There are three main components to this board:

- A Keypad firmware chip that holds the keypad software. This software controls the interpretation of the keyboard matrix and the switch inputs.
- An Xilinx CPLD (complex programmable logic device) is mounted to the card and provides the bulk of the circuitry logic. This chip replaces many electronic components used on the previous versions of the keypad card.
- 2 ULN2803A lamp driver chips in sockets are used to power the 12vdc front panel lamps used in the switches of a discrete key front panel.

The Keypad firmware and Keypad PLD software version can be displayed on the control under [F10]Utilities-[F8]Info-[F9]. The Keypad firmware version should be 3.XX for discrete key panels and 4.XX for membrane panels.

The Membrane Panel Interface Card

The membrane interface card is used on the tactile front panel only. This card routes the keyboard signals between the membrane panel, the keypad encoder card, and the interface panel. It contains very few components. This board also contains the LED's for the various lighted function buttons.

The Front Panel Switch Card

The front panel switch card serves the same function as the membrane card, for the discrete key (individual letter and number keys) front panel.

Interface Panels

The Centurion 7 control can make use of either of two models of interface panels. The current model is the Active High or “Sourcing” interface. This interface provides or is triggered by +24 VDC signals. The previous model that is still be used in retrofit applications for older controls is the Active Low or “Sinking Interface”. This interface provides or is triggered by 0 VDC (ground) signals. The interface will be located in the machine electrical cabinet.

Sourcing Interface Assembly

This assembly acts as the translator between the NCB card and the outside world. This board brings the signals from the plugs to the motion control. It receives the signals from the various input switches, encoders, and drive devices. It contains the outputs and analog signals to fire relays, solenoids and command other external devices.

This assembly will always be accompanied by a safety relay to complete the machine enable circuit.

The Assembly contains two boards with separate power inputs and grounds. The first board is powered by +5VDC. There are several main components of this board:

- A processor chip on the board is used to manage the fiber optic communication between the interface board and the NCB card.
- Two Xilinx CPLDs (complex programmable logic devices) are mounted to the card and provides the bulk of the circuitry logic. These chips are programmed at the factory.
- A large eprom on the board contains the Interface board firmware. Its function is to run the interface board devices. The software is burnt onto it at the factory.
- Connectors for 5 axes of motion control. Each axis contains two styles of connector. One for a Yaskawa type connector and another generic connector for use with any other type of drive or device.
- Connectors for spindle, handwheel, and thermal compensation inputs.
- The watchdog relay. The watchdog relay is the o.k. signal for the motion control. If everything in the interface and NCB portion of the motion control is working correctly this relay is energized. A surface mount LED on the board indicates that the watchdog relay is on. It is labeled on the plastic cover of the interface assembly. The relay will come on only after the CNC software has booted up. If a failure occurs in the NCB, the interface, or the connection between them, the watchdog coil will de-energize and the machine will emergency stop. In addition, a set of normally closed contacts on the watchdog relay will put the analog signals to ground so that no command signals may be sent to the axis or spindle.
- Various LED status indicators.

- A DAC (digital to analog converter) chip produces the analog command signals for the axes and the spindle drive.
- An Offset and a Gain adjustment on the front edge of the card adjust the magnitude and balance of the analog signals. All analog signals are affected by this adjustment.

The second board is powered by +24VDC and contains all of the connections and components for the inputs and outputs. The physical connections to outside devices are made through I/O modules that are connected to the J1 through J4 connectors via ribbon cables.

Both boards have fuses near the DC power connectors.

The Interface logic board has a 2 amp fuse protecting the 5VDC circuit on the board.

The Interface IO board has 2 fuses:

- A 5 amp fuse in position F1 protects the 24VDC line that provides power to the IO board.
- A 2 amp fuse in position F2 protects a line into the logic board so that it may provide 24VDC through the axis connectors.

Any failure of the interface assembly is cause to check these three fuses.

Sinking Interface Daughter (IFD) Board

This board acts as the translator between the NCB card and the outside world. This board brings the signals from the plugs to the motion control. It receives the signals from the various input switches, encoders, and drive devices. It contains the outputs and analog signals to fire relays, solenoids and command other external devices.

There are several main components of the board:

- A processor chip on the board is used to manage the fiber optic communication between the interface board and the NCB card.
- Two Xilinx CPLDs (complex programmable logic devices) are mounted to the card and provides the bulk of the circuitry logic. These chips replace many electronic components located on the previous version of the Interface Daughter Board. These chips are programmed at the factory through the CN10 and CN33 ports on the board. One chip is labeled as the Interface Logic PLD (ifdlog) and the other as the Interface Encoder PLD (ifdpld).
- A large eeprom on the board contains the Interface board firmware. Its function is to run the interface board devices. The software is burnt onto it at the factory.
- The watchdog relay is the o.k. signal for the motion control. If everything in the interface and NCB portion of the motion control is working correctly this relay is activated. A surface mount LED near the base of the power connection indicates that the watchdog relay is active. The relay will come on only after the CNC software has booted up (this is a change from the centurion 6

interface, where the watchdog comes on soon after power up). If a failure occurs in the NCB, the interface, or the connection between them, the watchdog coil will de-energize and the machine will emergency stop. In addition, a set of normally closed contacts on the watchdog relay will put the analog signals to ground so that no command signals may be sent to the axis or spindle.

- A DAC (digital to analog converter) chip produces the analog command signals for the axes and the spindle drive.
- An Offset and a Gain adjustment on the front edge of the card adjust the magnitude and balance of the analog signals. All analog signals are affected by this adjustment.
- The ULN 2802 output chips are located in sockets near the leading edge of the card. These “Sinking” outputs provide 0VDC output signals for the control to trigger external devices. They are capable of sinking .3 amps of current at 24vdc. They are replaceable if damaged.
- The input chips are soldered to the card nearby. They are used to signal the card with a proximity switch or another external device. They are triggered by a 0 volt (ground) signal. They are not easily replaceable but are seldom damaged.

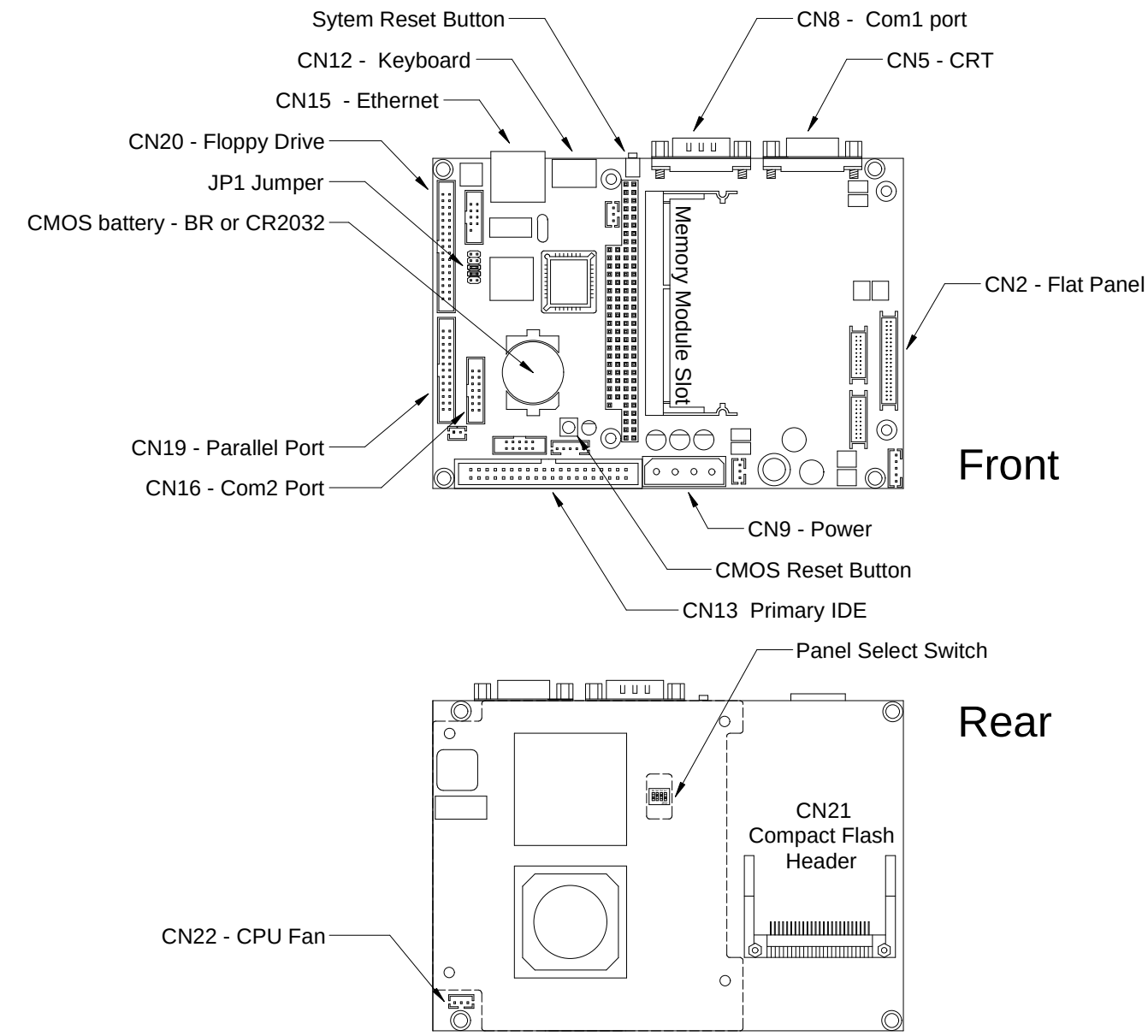
The Sinking Interface Panel

The interface panel contains the connectors that the peripheral devices (Axis Drives, Spindle Drives, Tool Changers, Ect.) connect to and transmits the signaling going into and out of the connected Interface Daughter Board. The plugs that are on the panel are dependent on the machine type and/or drive configuration. The interface panel also contains the LED indicators for the CR1A, CR1C, and CR2 relays.

The interface panel includes several sets of jumpers that route the inputs and outputs, and allow the control to be configured to replace a wide variety of previous applications. The jumper settings of a given interface are denoted by the letter suffix of the interface serial number.

Selected Board Illustrations

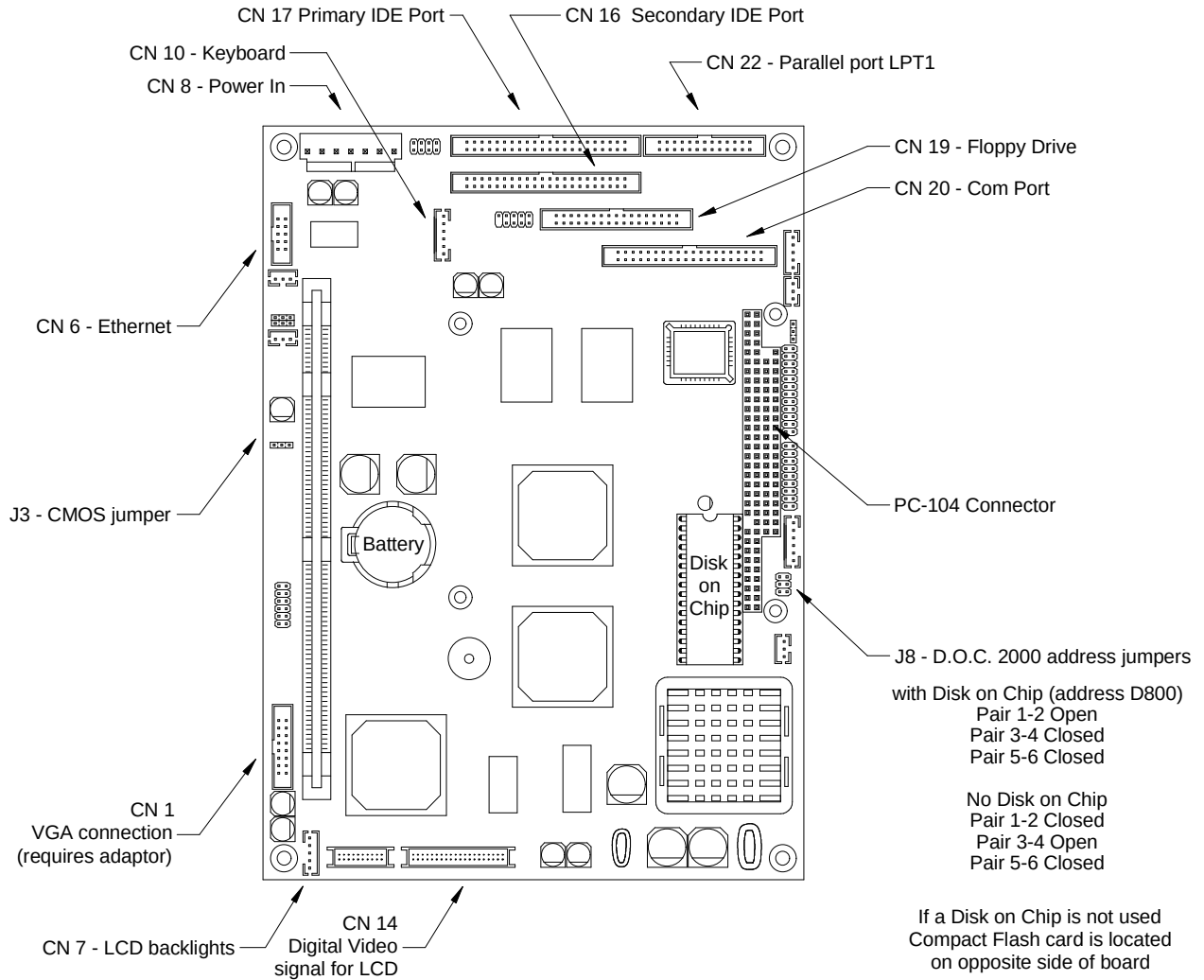
Single Board Computer PCM 9372 (current product) (BD-130)



CMOS battery is a BR or CR 2032 (PS-65).

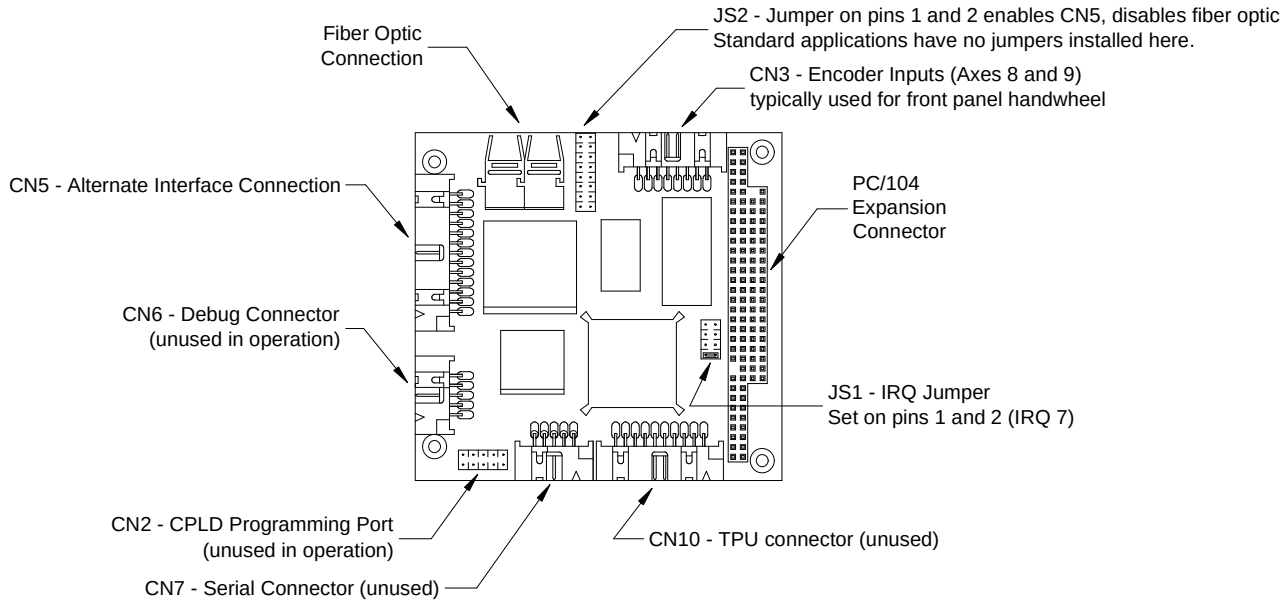
Single Board Computer

PCM 9550 (Original Cent 7 motherboard) (BD-125)

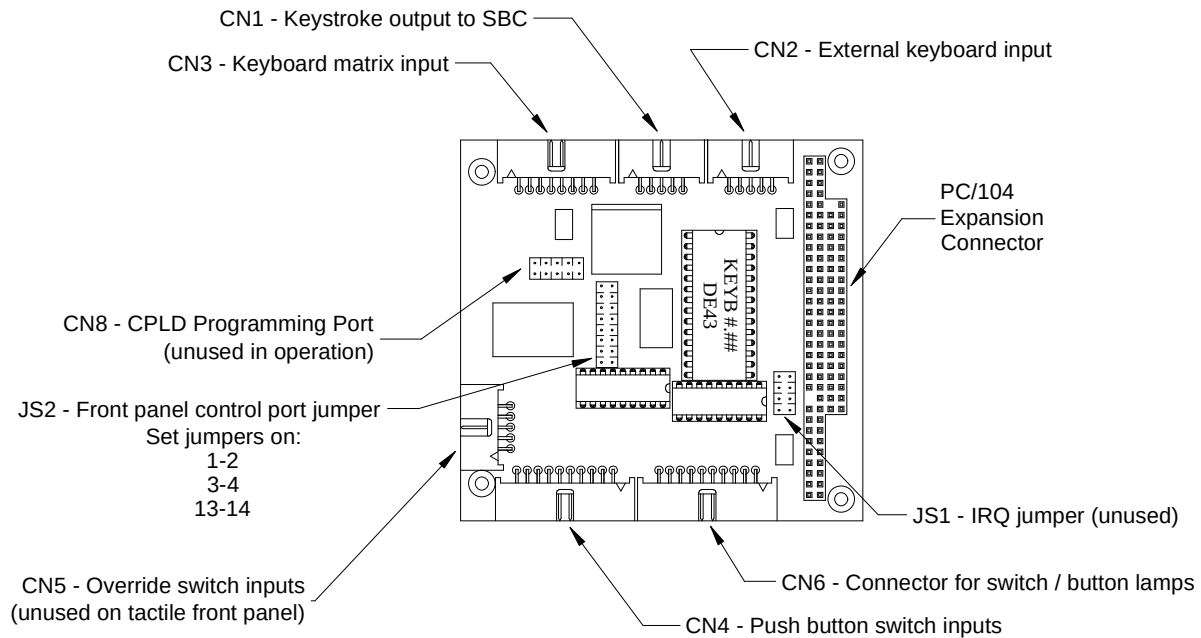


CMOS battery is a BR or CR 2032 (PS-65). Same battery as used on PCM 9372.

NCB Card (BD-100)

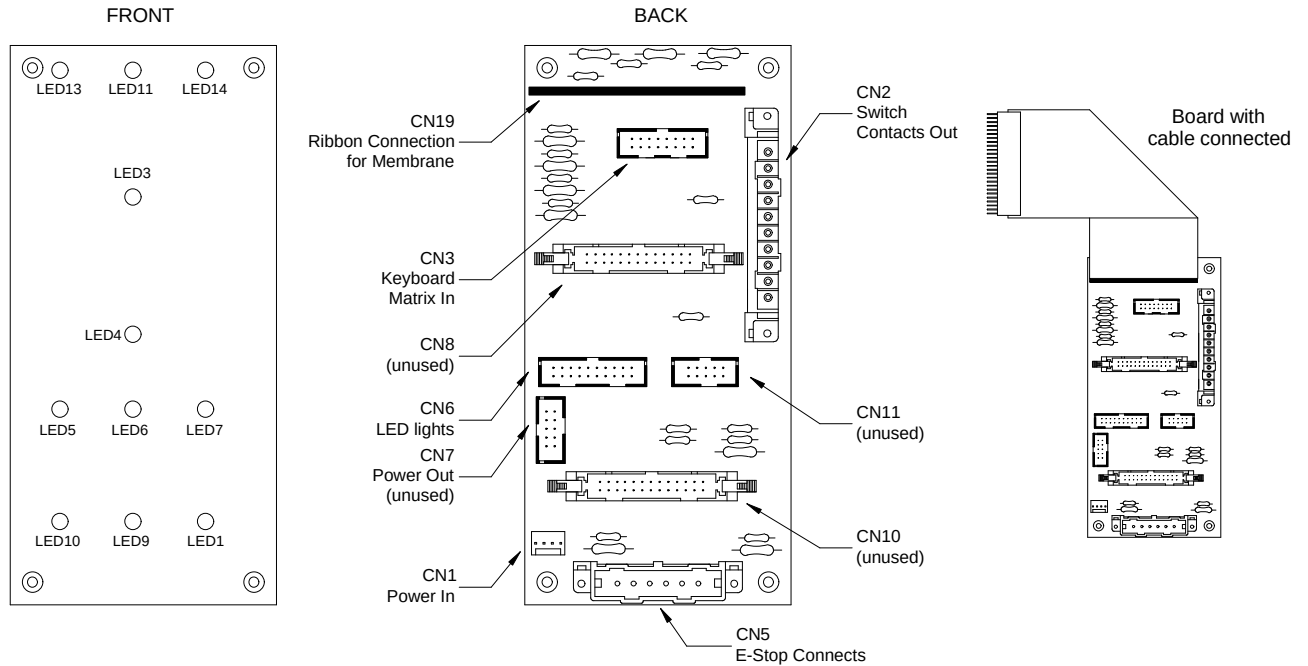


Keypad Encoder Card (BD-101)



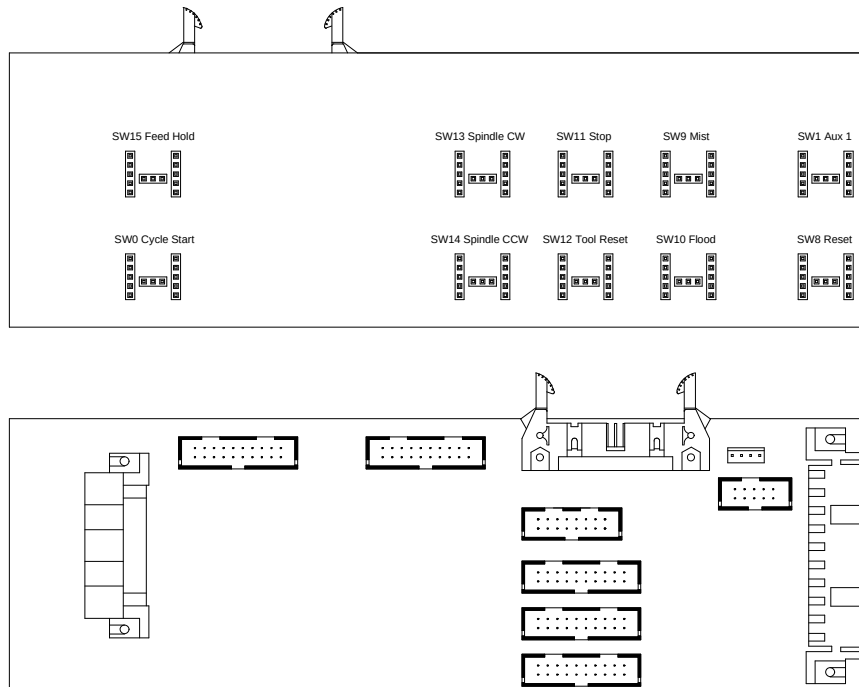
Membrane Panel Interface Card (BD 126)

Used on tactile front panel only

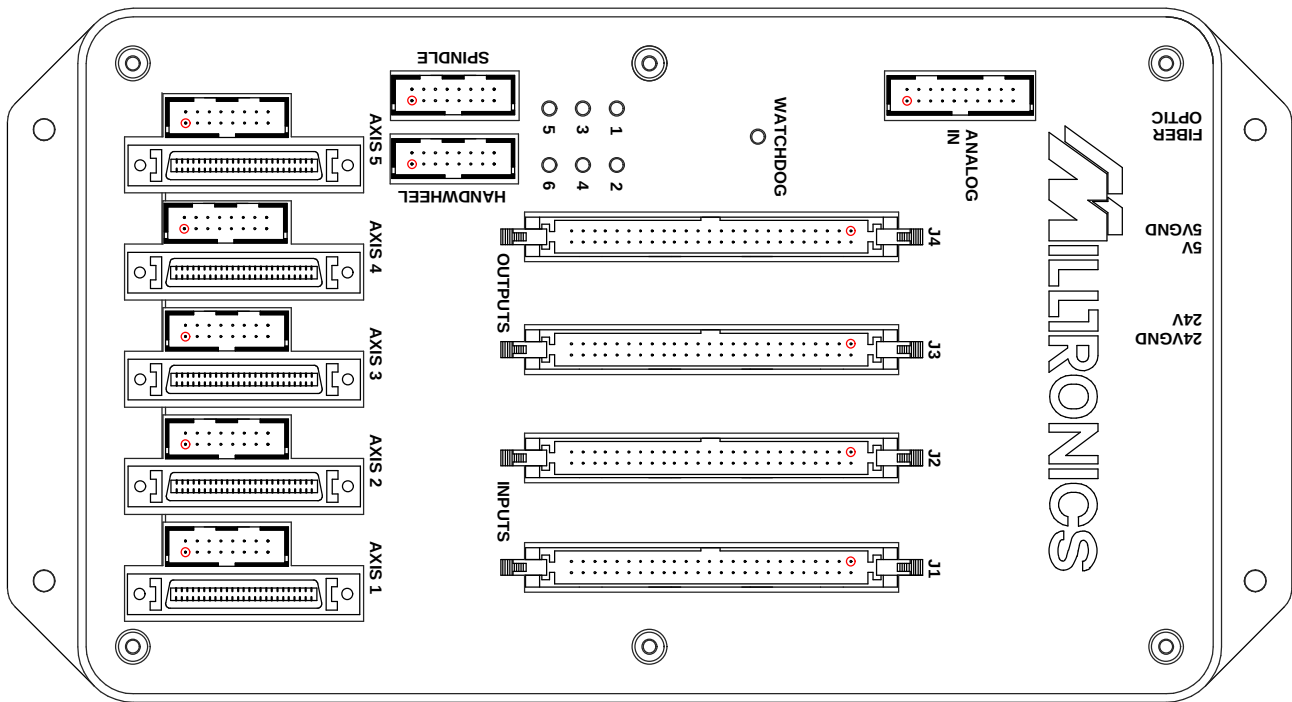


Front panel Switch Card (7300-2)

Used on discrete key front panel only

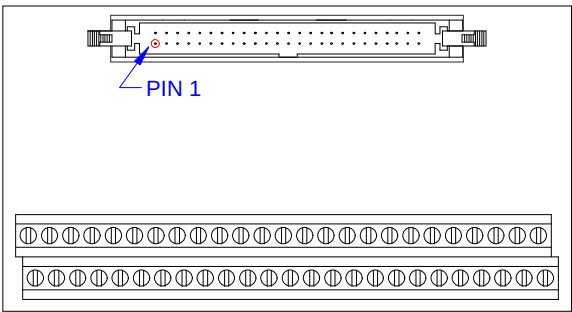


Active High or “Sourcing” Interface Panel Assembly (7534)



◉ = PIN 1

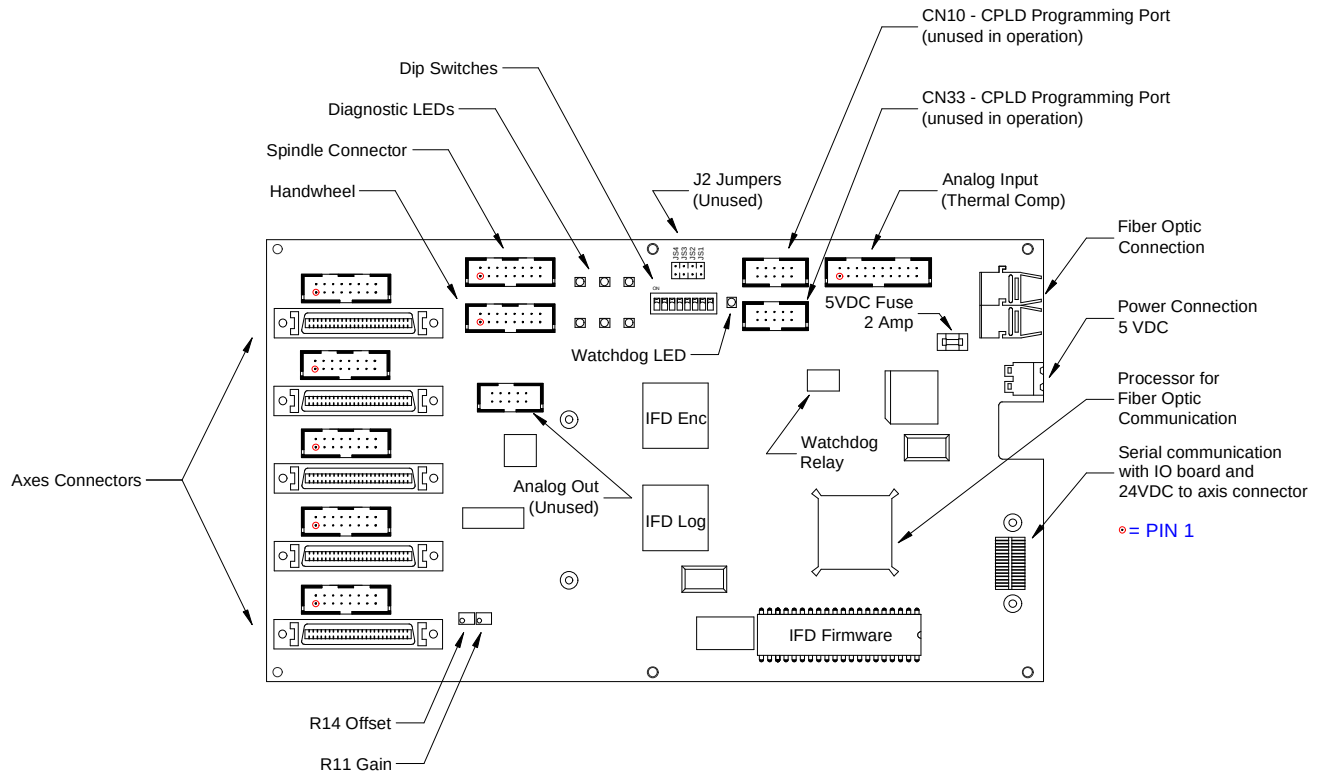
Active High or “Sourcing” Input/Output Module (PR-38)



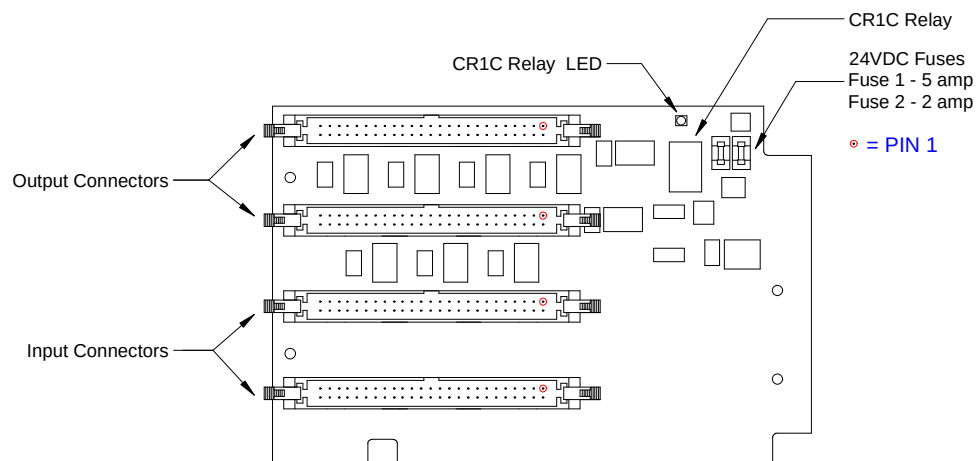
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49

Active High or “Sourcing” Interface Boards

Logic Board (BD-143)

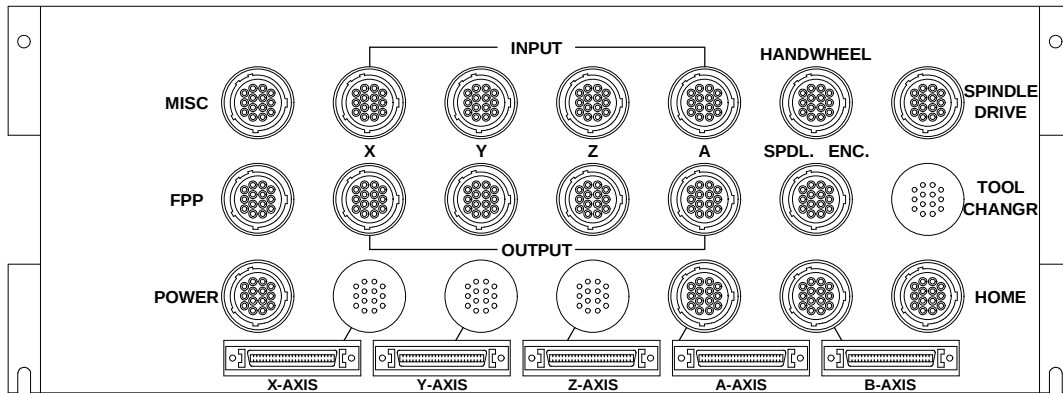


IO Board (BD-144)

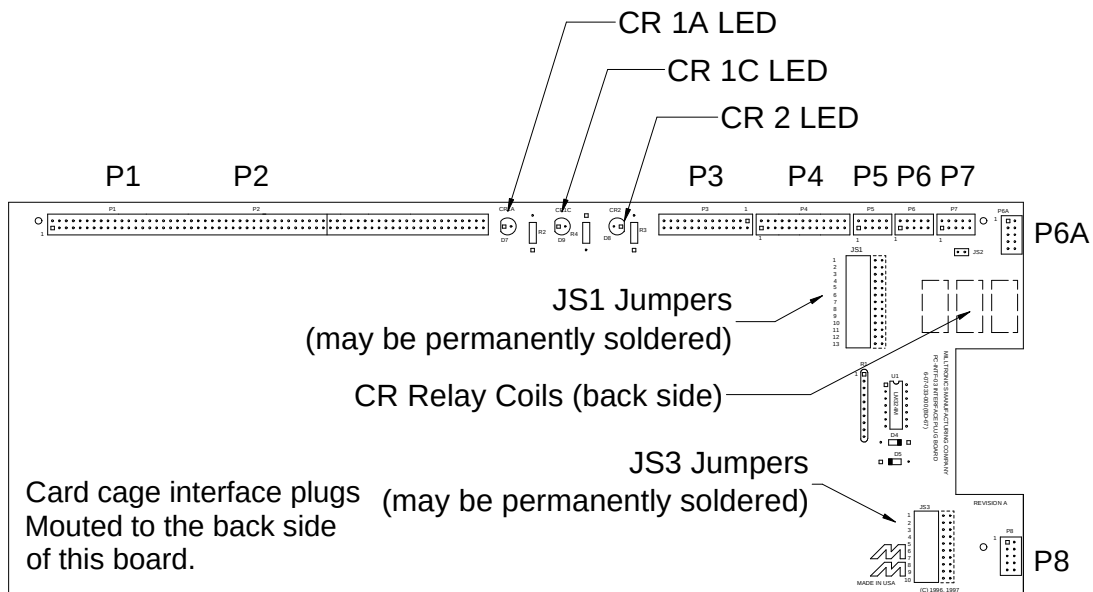


Active Low or “Sinking” Interface Panel (7535)

Front Side - Mill (Lathe will vary slightly)



Back Side



P1/P2 - Input/Output

P3 - Analog Outputs

P4 - Axis Encoder Connection 1-4

P5 - Axis Encoder Connection 5

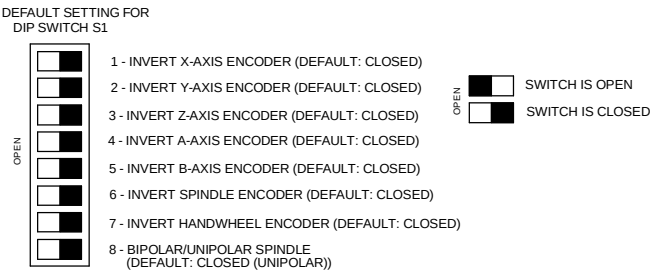
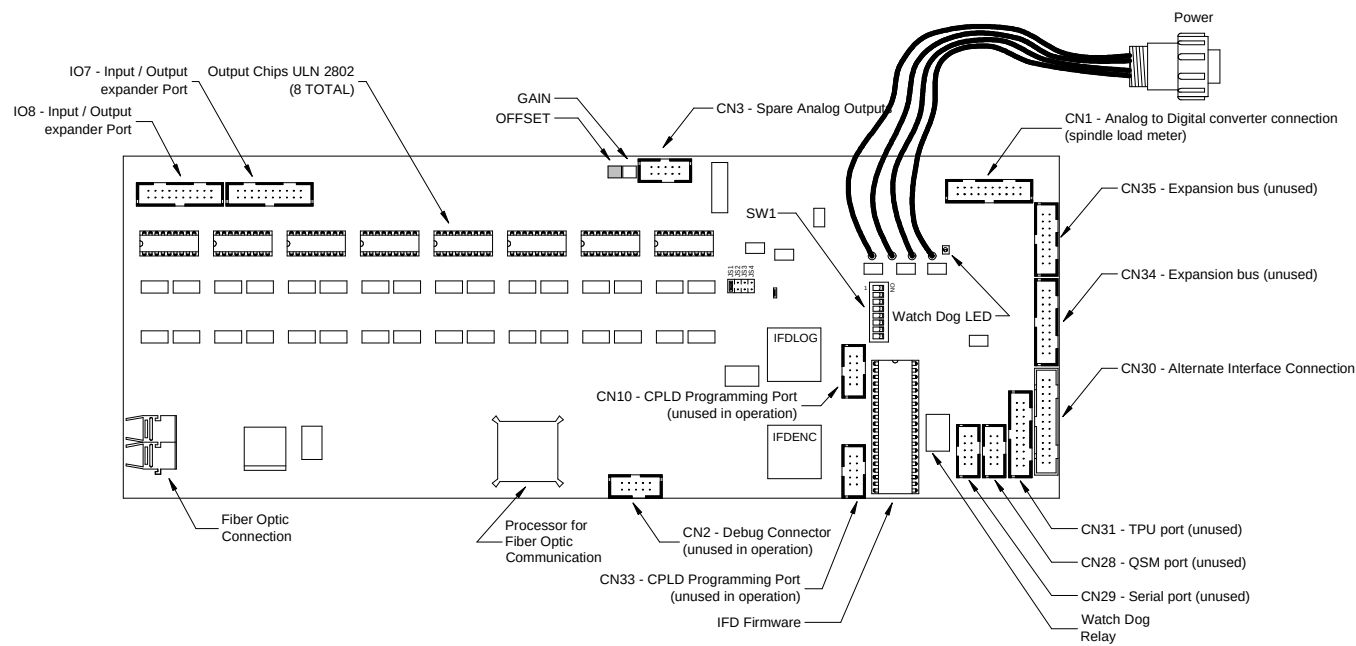
P6 - Spindle Encoder (In/Out of Interface Daughter Board)

P6A - Spindle Encoder In

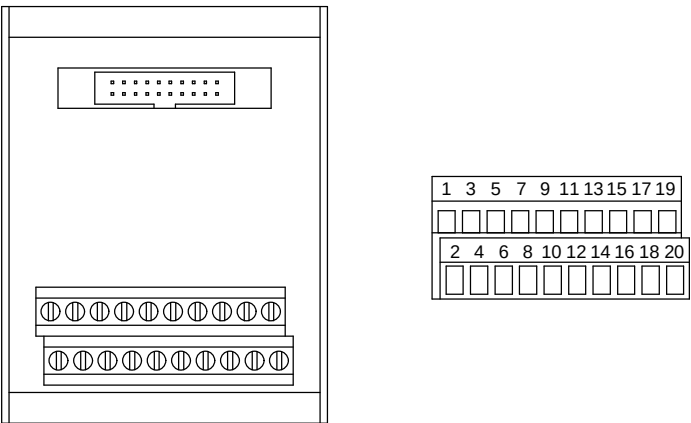
P7 - Handwheel encoder, Watchdog, Spindle Load Meter

P8 - Hand Wheel Encoder In

Active Low or “Sinking” Interface Daughter Board (BD-120)

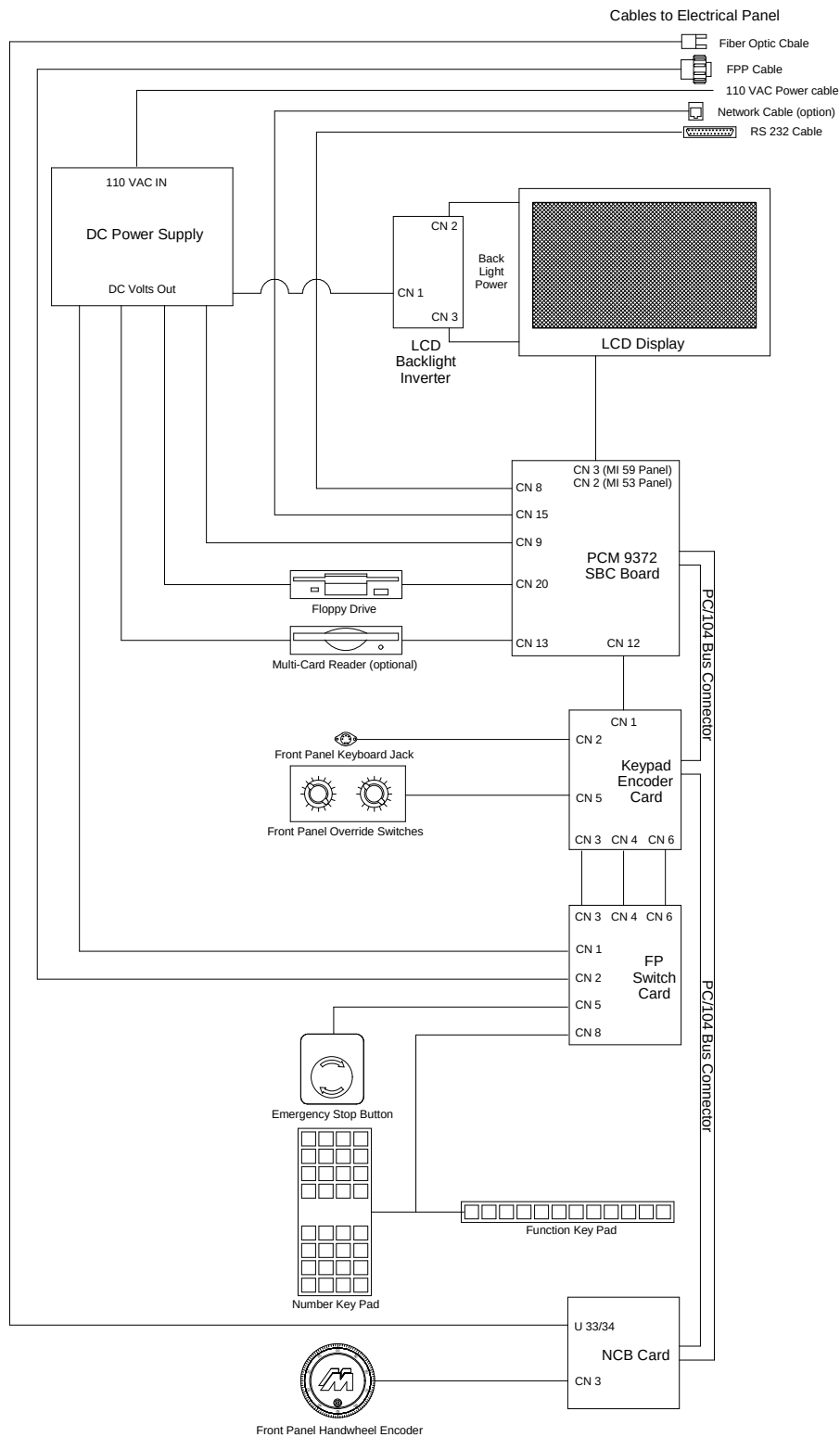


Active Low or “Sinking” Input/Output Expansion Module (PR37)



Centurion 7 Control Connections Diagram

Discrete Key Front Panel



Keypad Encoder Signals

The keypad encoder card translates the front panel switch inputs, override knobs, and keypad inputs into keyboard signals. Because the switch functions are translated into keyboard commands it is possible to run the machine directly from an external keyboard. The keyboard commands are as follows:

FP switch commands- ALT +	Feed rate over ride- ALT+	Spindle over ride ALT +
F1 = STOP	A = 0%	1 = 0%
F2 = E STOP	S = 10%	2 = 10%
F3 = CW	D = 20%	3 = 20%
F4 = FEED HOLD	F = 30%	4 = 30%
F5 = CCW	G = 40%	5 = 40%
F6 = CYCLE START	H = 50%	6 = 50%
F7 = MIST	J = 60%	7 = 60%
F8 = TOOL RESET	K = 70%	8 = 70%
F9 = FLOOD	Z = 80%	Q = 80%
F10 = RESET	X = 90%	W = 90%
	C = 100%	E = 100%
	V = 110%	R = 110%
	B = 120%	T = 120%
	N = 130%	Y = 130%
	M = 140%	U = 140%
	< = 150%	I = 150%

Keypad Diagnostics

Centurion 7 controls have a diagnostic screen to indicate whether the push buttons on the front panel are being read by the keypad encoder card. To access these diagnostics from the main menu enter [F6] Display, [F5] Panel. The screen will show the push button name, followed by a “0” character. The character will change to a “1” when the appropriate button is pressed. There will also be a status display following the activity bit that will show the expected function of the switch light; on, off, or blink.

Override Switch Functions and Settings

The feed rate and Spindle over ride switches on the discrete key front panel are four channel rotary switches. These switches send a binary signal that will indicate to the keypad encoder card the position that the switch is in. The keypad encoder then converts this into a keyboard signal and passes it to the control.

The OVR parameters in the software (Params-Setup-OVRs) determine the percentage value at each position for feed and spindle override. The machine software has entries for 24 switch positions to accommodate the new molded front panel (to be released mid 2008). Current override switches have 16 positions and will use only those positions in the parameters.

RunTime 000:00:00		Main-Parms-Setup-OVRs-FdOvr-Edit		Active :00002																																			
Current		Next		Distance																																			
X	+00.0000	+00.0000	+00.0000	+00.0000																																			
Y	+00.0000	+00.0000	+00.0000	+00.0000																																			
Z	+00.0000	+00.0000	+00.0000	+00.0000																																			
<table border="1"> <thead> <tr> <th colspan="4">Feedrate Override Settings</th> </tr> </thead> <tbody> <tr> <td>1 - 000</td> <td>7 - 060</td> <td>13 - 120</td> <td>19 - 000</td> </tr> <tr> <td>2 - 010</td> <td>8 - 070</td> <td>14 - 130</td> <td>20 - 000</td> </tr> <tr> <td>3 - 020</td> <td>9 - 080</td> <td>15 - 140</td> <td>21 - 000</td> </tr> <tr> <td>4 - 030</td> <td>10 - 090</td> <td>16 - 150</td> <td>22 - 000</td> </tr> <tr> <td>5 - 040</td> <td>11 - 100</td> <td>17 - 000</td> <td>23 - 000</td> </tr> <tr> <td>6 - 050</td> <td>12 - 110</td> <td>18 - 000</td> <td>24 - 000</td> </tr> </tbody> </table>						Feedrate Override Settings				1 - 000	7 - 060	13 - 120	19 - 000	2 - 010	8 - 070	14 - 130	20 - 000	3 - 020	9 - 080	15 - 140	21 - 000	4 - 030	10 - 090	16 - 150	22 - 000	5 - 040	11 - 100	17 - 000	23 - 000	6 - 050	12 - 110	18 - 000	24 - 000						
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F7 F8 F9 F10 ESC Exit																																							

Membrane panels do not have override switches. They have Up/Down arrows that select the percentage of feed and speed. They use position 11 as the base value and adjust in 5% increments from that point.

The over ride switch signals can be found in the CN5 connector plugged into the keypad encoder card. The pin numbers are:

Feed Rate override

- 5 LSB
- 6
- 7
- 8 MSB
- 10 Common

Spindle override

- 1 LSB (Least significant bit)
- 2
- 3
- 4 MSB (Most significant bit)
- 9 Common

By checking continuity between the common lead and the different switch channels it is possible to determine if the switch is working properly. The combination of outputs at each switch position should match the table below:

Switch Pos	Spindle %	Feed Rate %	Binary Code
1	0	0	0000
2	10	10	0001
3	20	20	0010
4	30	30	0011
5	40	40	0100
6	50	50	0101
7	60	60	0110
8	70	70	0111
9	80	80	1000
10	90	90	1001
11	100	100	1010
12	110	110	1011
13	120	120	1100
14	135	130	1101
15	175	140	1110

The front panel hand wheel override settings are determined in the HDW section. The table shows the axis movement distance represented in encoder pulses that will result from each pulse (represented by a physical “click”) of the hand wheel. Remote hand wheels have separate override settings in the POWER section of the setup parameters.

RunTime 000:00:00		Main-Parms-Setup-OVRs-HwOvr		Active :00002																									
Current		Next		Distance																									
X +00.0000	+00.0000	+00.0000	+00.0000	+00.0000	+00.0000																								
Y +00.0000	+00.0000	+00.0000	+00.0000	+00.0000	+00.0000																								
Z +00.0000	+00.0000	+00.0000	+00.0000	+00.0000	+00.0000																								
Handwheel Override Settings <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px 10px;">1 - 000</td> <td style="padding: 2px 10px;">7 - 102</td> <td style="padding: 2px 10px;">13 - 381</td> <td style="padding: 2px 10px;">19 - 000</td> </tr> <tr> <td style="padding: 2px 10px;">2 - 003</td> <td style="padding: 2px 10px;">8 - 127</td> <td style="padding: 2px 10px;">14 - 444</td> <td style="padding: 2px 10px;">20 - 000</td> </tr> <tr> <td style="padding: 2px 10px;">3 - 013</td> <td style="padding: 2px 10px;">9 - 152</td> <td style="padding: 2px 10px;">15 - 508</td> <td style="padding: 2px 10px;">21 - 000</td> </tr> <tr> <td style="padding: 2px 10px;">4 - 025</td> <td style="padding: 2px 10px;">10 - 203</td> <td style="padding: 2px 10px;">16 - 000</td> <td style="padding: 2px 10px;">22 - 000</td> </tr> <tr> <td style="padding: 2px 10px;">5 - 051</td> <td style="padding: 2px 10px;">11 - 254</td> <td style="padding: 2px 10px;">17 - 000</td> <td style="padding: 2px 10px;">23 - 000</td> </tr> <tr> <td style="padding: 2px 10px;">6 - 076</td> <td style="padding: 2px 10px;">12 - 305</td> <td style="padding: 2px 10px;">18 - 000</td> <td style="padding: 2px 10px;">24 - 000</td> </tr> </table> Comp : Cancelled Tool : T03(03) Length : 00.0000 Diam. : 00.0000 Plane : XY (G54)0 Clearnce: 00.1000 Interp : Linear (Feed) Feed : F050.0 ipm (100%) 050.0 ipm Units : Abs/English Cycle : Cancelled Dwell : 0000.00 sec Spindle : S0000 rpm (100%) : 0000 rpm (OFF) 020 Coolant : Off Part # : 0000						1 - 000	7 - 102	13 - 381	19 - 000	2 - 003	8 - 127	14 - 444	20 - 000	3 - 013	9 - 152	15 - 508	21 - 000	4 - 025	10 - 203	16 - 000	22 - 000	5 - 051	11 - 254	17 - 000	23 - 000	6 - 076	12 - 305	18 - 000	24 - 000
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5 - 051	11 - 254	17 - 000	23 - 000																										
6 - 076	12 - 305	18 - 000	24 - 000																										
F1 Edit F4 FdOvr F5 HwOvr F6 SpOvr ESC Back																													

Control Outputs and Inputs

The Centurion 7 achieves most of the interfacing to connected devices through the outputs and inputs of the control. An output provides a signal to a device such as a relay or solenoid, servo drive, indexer or other device. An input is triggered by an external signal provided by a prox switch, limit switch, or other device and is used to signal the control that a certain event is taking place or a condition met. Often a failure of the machine to perform a task, such as completing a tool change or turning on the spindle, can be traced to a failure of the input / output of the given function. It then becomes important to be able to verify the outputs and inputs associated with the machine operation.

Sourcing Logic

The state of the input and output signals depend upon which interface panel is used with the CNC. All current products use the Active High or “Sourcing” interface panel. This panel uses +24vdc logic; The outputs provide +24vdc at 250mA and the inputs are triggered by +24vdc. The outputs are protected against shorts or over amperage.

The inputs and outputs groups on a “Sourcing” interface are identified by the IO module that they are connected to, J1 through J4. J1 and J2 are inputs, while J3 and J4 are outputs. The sourcing interface has 72 inputs and 72 outputs, using pins 1 through 36 on each module for the connections.

The status of the outputs and inputs of the control can be viewed by entering the diagnostic display of the control. This can be done from the main menu by entering [F6] Display, [F4] Diagnostic. The [F1] through [F4] keys will access the J1-J4 groups. The inputs and outputs will be listed by their STO/CLO number (see “Setting and Clearing Outputs Manually” later in this section). The diagnostic screens will show a black dot next to the input or output to indicate that it is not active. The dot will change to white if the input or output is activated. SLS software will require the setup parameters to be open for the diagnostic option to be viewed under display.

The software also has an option for static diagnostics. The static diagnostic page captures the status of the inputs and outputs at the time of the last control E-stop, providing a snapshot of the control I/O at the time of failure. The static diagnostic page can be viewed by going into the [F10] Utilities, [F8] Info, [F7] Diagnostic menu.

Centurion 7 software also has provisions in the software for time out messages that will advise the operator if the machine has hung up waiting for a specific input signal. This allows the control to tell the user which signal may be missing without having to examine the diagnostic pages. A timeout will take approximately 15 seconds from a non-receipt of signal to an emergency stop condition. The red message box will display, in addition to the usual emergency stop information, “Time out waiting for _____”. This will indicate the lost signal. Sometimes this is not the first message displayed, so the escape key must be pressed once to clear the first message box and bring up the next one to view the time out message.

Sourcing outputs

Sourcing output chips are soldered directly to the IO board in the interface assembly. They are protected against over amperage or direct shorts, so are not easily damaged. If they are damaged the IO board must be replaced.

Outputs can be checked to see if they are providing the correct signal provided they are hooked to a device. If the output is not connected to a device the voltage measurement will not be correct.

A voltage measurement of an output should show:

- 0 VDC when the output is off (Black dot on the diagnostic page)
- +24 VDC when the output is on (White dot on the diagnostic page)

Sourcing Inputs

The input chips on the Centurion 7 control are optically isolated and are triggered by a signal to the corresponding pin. Triggering an input will cause its entry to show a white dot in the diagnostic page. It will show a black dot when it is not. Each input is brought into the control through the corresponding pin on the axis input plug (for instance J1-23 will be found in the J1 input connector, terminal number 23).

There is no way to set an input through the control. To test an input it must be connected to a voltage source.

On a “Sourcing” interface the input needs to be pulled up to +24vdc. This can be done by connecting a wire from the appropriate J1 or J2 terminal to terminal block 12 (+24vdc) on the terminal strip on the electrical panel. The input should show a white dot when connected to 24vdc. If it is not there is a problem in the control that may require board replacement or factory repair. The input chips are not in sockets and are not easily replaceable, however they are seldom damaged.

Sinking Interface Logic

The Active Low or “Sinking” interface panel uses ground state logic; The outputs provide a ground capable of sinking 300mA of current and the inputs are triggered by a 0vdc signal.

The inputs and outputs groups on a “Sinking” interface are identified by axis group, 1 through 6. Each group has 12 inputs and 12 outputs, except for group 6 which has only 4. Physical access to the inputs and outputs in the first four groups is achieved through the 14 pin AMP connectors on the interface panel. They will be labeled Axis 1 – In, Axis 1 – Out, Axis 2 – In, ect. Access to the 5 and 6 input/output groups must be done using IO expansion modules plugged into the interface.

The status of the outputs and inputs of the control can be viewed by entering the diagnostic display of the control. This can be done from the main menu by entering [F6] Display, [F4] Diagnostic. The diagnostic screens will show a black dot next to the input or output to indicate that it is not active. The dot will change to white if the input or output is activated. In older software a “0” character may be seen in place of a black dot, and a “1” in place of a white dot. SLS software will require the setup parameters to be open for the diagnostic option to be viewed under display.

The software also has an option for static diagnostics. The static diagnostic page captures the status of the inputs and outputs at the time of the last control E-stop, providing a snapshot of the control I/O at the time of failure. The static diagnostic page can be viewed by going into the [F10] Utilities, [F8] Info, [F7] Diagnostic menu. This must be done prior to resetting the machine.

Centurion 7 software also has provisions in the software for time out messages that will advise the operator if the machine has hung up waiting for a specific input signal. This allows the control to tell the user which signal may be missing without having to examine the diagnostic pages. A timeout will take approximately 15 seconds from a non-receipt of signal to an emergency stop condition. The red message box will display, in addition to the usual emergency stop information, “Time out waiting for _____”. This will indicate the lost signal. Sometimes this is not the first message displayed, so the escape key must be pressed once to clear the first message box and bring up the next one to view the time out message.

Sinking Outputs

Socketed ULN 2802 driver chips on the “Sinking” interface daughterboard provide the outputs. There are eight chips total and can be replaced if damaged. The outputs are distributed on the chips as such:

U-53	Axis 1 outputs 1-8	U-53 is closest to the gain adjustment pots
U-59	Axis 1 outputs 9-12, Axis 2 outputs 1-4	
U-56	Axis 2 outputs 5-12	
U-65	Axis 3 outputs 1-8	
U-71	Axis 3 outputs 9-12, Axis 4 outputs 1-4	
U-68	Axis 4 outputs 5-12	
U-77	Axis 5 outputs 1-8	
U-80	Axis 5 outputs 9-12, Axis 6 outputs 1-4	U-80 is closest to the end of the card

Each output is brought out of the control through the corresponding pin on the axis output plug (for instance Axis 1 out 7 will be found in the Axis 1 output plug, pin number 7).

Outputs can be checked to see if they are providing the correct signal provided they are hooked to a device. If the output is not connected to a device the voltage measurement will not be correct.

A voltage measurement of a sinking output should show:

- +24 VDC when the output is off (Black dot or “0” on the diagnostic page)
- 0 VDC (approximately) when the output is on (White dot or “1” on the diagnostic page)

Sinking Inputs

The input chips on the Centurion 7 control are optically isolated and are triggered by a signal to the corresponding pin. Triggering an input will cause its entry to show a white dot in the diagnostic page. It will show a black dot when it is not. Each input is brought into the control through the corresponding pin on the axis input plug (for instance Axis1 - In7 will be found in the Axis 1 Input plug, pin number 7).

There is no way to set an input through the control. To test an input it must be connected to ground.

The easiest way to accomplish this is to obtain a wire with a pin crimped on the end of it. Remove the pin from the suspected input and replace it with the pinned wire. Touch the other end of the wire to terminal block 22 (D.C. ground) or to bare metal on the electrical panel. When the input is grounded its entry in the diagnostic display show a white dot. If it is not there is a problem in the control that may require board replacement or factory repair. The input chips are not in sockets and are not easily replaceable, however they are seldom damaged.

Setting and Clearing Outputs Manually

Outputs are usually activated during the course of an M code function on the machine, but can also be set individually through the STO and CLO commands. This can be done in a program, as in the case of a custom M-code, or through the MDI mode. The command STO 6 will cause the 6th output to activate and the associated diagnostic to change to a white dot. CLO 6 will turn the output off and cause it to go back to a black dot. The machine's logic files may block some outputs from being set.

The chart below lists the physical location of the output connection, followed by the STO/CLO number used to activate or deactivate it.

Sinking Interface Pin #	Sourcing Pin #	STO #	Sinking Interface Pin #	Sourcing Pin #	STO #
Axis 1 – Out 1	J3-1	1	Axis 4 – Out 1	J4-1	37
Axis 1 – Out 2	J3-2	2	Axis 4 – Out 2	J4-2	38
Axis 1 – Out 3	J3-3	3	Axis 4 – Out 3	J4-3	39
Axis 1 – Out 4	J3-4	4	Axis 4 – Out 4	J4-4	40
Axis 1 – Out 5	J3-5	5	Axis 4 – Out 5	J4-5	41
Axis 1 – Out 6	J3-6	6	Axis 4 – Out 6	J4-6	42
Axis 1 – Out 7	J3-7	7	Axis 4 – Out 7	J4-7	43
Axis 1 – Out 8	J3-8	8	Axis 4 – Out 8	J4-8	44
Axis 1 – Out 9	J3-9	9	Axis 4 – Out 9	J4-9	45
Axis 1 – Out 10	J3-10	10	Axis 4 – Out 10	J4-10	46
Axis 1 – Out 11	J3-11	11	Axis 4 – Out 11	J4-11	47
Axis 1 – Out 12	J3-12	12	Axis 4 – Out 12	J4-12	48
Axis 2 – Out 1	J3-13	13	Axis 5 – Out 1	J4-13	49
Axis 2 – Out 2	J3-14	14	Axis 5 – Out 2	J4-14	50
Axis 2 – Out 3	J3-15	15	Axis 5 – Out 3	J4-15	51
Axis 2 – Out 4	J3-16	16	Axis 5 – Out 4	J4-16	52
Axis 2 – Out 5	J3-17	17	Axis 5 – Out 5	J4-17	53
Axis 2 – Out 6	J3-18	18	Axis 5 – Out 6	J4-18	54
Axis 2 – Out 7	J3-19	19	Axis 5 – Out 7	J4-19	55
Axis 2 – Out 8	J3-20	20	Axis 5 – Out 8	J4-20	56
Axis 2 – Out 9	J3-21	21	Axis 5 – Out 9	J4-21	57
Axis 2 – Out 10	J3-22	22	Axis 5 – Out 10	J4-22	58
Axis 2 – Out 11	J3-23	23	Axis 5 – Out 11	J4-23	59
Axis 2 – Out 12	J3-24	24	Axis 5 – Out 12	J4-24	60
Axis 3 – Out 1	J3-25	25	Axis 6 – Out 1	J4-25	61
Axis 3 – Out 2	J3-26	26	Axis 6 – Out 2	J4-26	62
Axis 3 – Out 3	J3-27	27	Axis 6 – Out 3	J4-27	63
Axis 3 – Out 4	J3-28	28	Axis 6 – Out 4	J4-28	64
Axis 3 – Out 5	J3-29	29		J4-29	65
Axis 3 – Out 6	J3-30	30		J4-30	66
Axis 3 – Out 7	J3-31	31		J4-31	67
Axis 3 – Out 8	J3-32	32		J4-32	68
Axis 3 – Out 9	J3-33	33		J4-33	69
Axis 3 – Out 10	J3-34	34		J4-34	70
Axis 3 – Out 11	J3-35	35		J4-35	71
Axis 3 – Out 12	J3-36	36		J4-36	72

Feedback Channels

The Centurion 7 control is capable of 5 axes of simultaneous motion control. The (up to 5) axes of machine motion are connected to the “Live” motion connectors. These connections provide both command signal in the form of a 0-10VDC analog and inputs for A, B, and Marker signals from an encoder. They also provide 5 and 24 VDC and a drive enable signal.

There are four additional connections that receive encoder feedback and provide 5 VDC only. These connections are used for devices that will be included in a position loop with one of the existing axes. These devices include pulse generators, spindle encoders, and quill scales.

Devices in the second group will be assigned to a feedback channel through the machine parameters. The assignment is based upon where they are plugged in. They may make use of a “live” feedback channel if none of the others are available. The channels are identified as follows:

Location	Connector	Axis #
Interface Panel	Axis 1	1
Interface Panel	Axis 2	2
Interface Panel	Axis 3	3
Interface Panel	Axis 4	4
Interface Panel	Axis 5	5
Interface Panel	Spindle	6
Interface Panel	Handwheel	7
NCB card	CN3	8
NCB card	CN3	9

Parameter Files

The Ram Directory

A Centurion control's "parameters" actually consist of many files beyond the setup parameters contained in the Pfile.dat. These files are all located inside of a directory called "ram" on the C: drive. When parameters are saved it copies all of these files onto a floppy disk inside of another "ram" directory. When parameters are loaded the machine copies all of the files contained in a "ram" directory on a floppy disk into the C:\ram on the machine.

This is a listing of many of the files that may be seen in the ram directory:

Active.dat:	Contains the number of the current active program, as well as the current edit program.
Path.dat:	Contains the DOS paths to the various components of the machine software.
Pfile.dat:	Contains the machine setup parameters. A list of these parameters should appear in the "Red Book" of machine information shipped with each machine.
BPfile.dat:	A backup of the machine setup parameters. Used by the machine as a restore file in case of parameter corruption.
Bscrew1:	The X axis ball screw compensation file.
Bscrew2:	The Y axis ball screw compensation file.
Bscrew3:	The Z axis ball screw compensation file.
Ncb1.hex:	This is a file found in a Centurion 6 control that deals with the function of the M-codes. Ncb1 deals mainly with spindle control and coolant commands.
Ncb2.hex:	This is a file found in a Centurion 6 control that deals with the function of the M-codes. Ncb2 deals mainly with the tool changer and spindle gear shifting.
Ncb3.hex:	This is a file found in a Centurion 6 control that deals with the function of the M-codes. Ncb3 deals mainly with spare M-codes.
Ncb4.hex:	This is a file found in a Centurion 6 control that deals with the function of the M-codes. Ncb4 deals mainly with special functions. It may not always be present.
Inp(3):	A text file that provides the labels for the inputs in the diagnostic display. Must be of the correct foreign extension to function. Not necessary for machine operation.

Out(3):	A text file that provides the labels for the outputs in the diagnostic display. Must be of the correct foreign extension to function. Not necessary for machine operation.
Mcodes(3):	A text file that provides the labels for the M-codes in the MDI page. Must be of the correct foreign extension to function. Not necessary for machine operation.
Gcodes(3):	A text file that provides the labels for the G-codes in the MDI page. Must be of the correct foreign extension to function. Not necessary for machine operation.
Soft.ver:	A text file showing the versions of software the machine contained for keyboard, CNC, firmware, and the NCB files when the machine left Milltronics. Not necessary for machine operation.
Pfile.ref:	A reference file of the pfile as it was when the control was built. Not necessary for machine operation.
O901*:	A custom G-code program
O902*:	A custom M-code program
Special.dat:	A program file that serves as the tool setting macro accessed through the run menu.
Q****:	A file used to store and reload a specific group of parameters. Q0 through Q9 are used to store the work coordinate subsets.

In addition to these files there may also be a macro to operate the tool changer. Files with .DAT, .LAT, or .SLS will be English language files. Other extensions could be other languages. See programming and operation manual for extensions of various languages.

Saving and Loading Parameters

Because the Centurion control software can be subject to corruption in the software due to various causes it is always advisable to have a backup copy of the machine parameters on a floppy disk. This is easily done on most Centurion controls. To save the machine parameters:

Centurion 7 CNC and Lathe

With a floppy disk in the drive and the control at the main menu press:

[F7] Params

[F6] Save

[F1] Ok

The parameters will be saved on a floppy drive in a directory called "ram".

Centurion 7 SLS

With a floppy disk in the drive and the control at the main menu press:

[F10] Utilities

[F3] Files

[F2] Save

This will bring up a menu of the programs in the control.

[F8] down arrow key to move the pointer until it points at "Parameters"

[F2] Set

[F1] Start

The parameters will be saved on a floppy drive in a directory called "ram".

To load parameters back into the machine:

Centurion 7 CNC and Lathe

With the parameter disk in the drive and the control at the main menu press:

[F7] Params

[F7] Load

[F1] Ok

The parameters will be loaded into the ram directory. Escape to the main menu and E-stop the machine. Power the machine down for approximately 30 seconds and power back up for the parameters to take effect.

Centurion 7 SLS

With the parameter disk in the drive and the control at the main menu press:

[F10] Utilities

[F3] Files

[F1] Load

This will bring up a menu of the programs in the control.

[F8] down arrow key to move the pointer until it points at "Parameters"

[F2] Set

[F1] Start

The parameters will be loaded into the ram directory. Escape to the main menu and E-stop the machine. Power the machine down for approximately 30 seconds and power back up for the parameters to take effect.

The PFILE.DAT File

The Pfile.dat file is the file that contains the setup parameters of the machine. This file is not a text file and cannot be viewed by itself. The setup parameters can be viewed within the machine by entering the setup parameter section.

To enter the setup parameters enter the parameter menu on the control and press:

[F1] Setup

[F1] Level

This will prompt the user for the access code. Type “**PROTO3**” for the access code and press enter.

The user will now be asked for the access level. Type “**3**” for access level.

The setup parameters will now be open and the operator will see several parameter section choices that can be made. The main sections are:

[F2] Precision

[F3] Power

[F4] Axis

[F5] Miscellaneous

[F6] Over rides

[F7] Ball screw tables

[F8] Thermal Comp

[F9] Dos

The parameters are arranged in these sections depending upon what they are related to. A full list of these parameters appear at the end of this section.

Power parameters include info about the default modes of the machine and the tool changer. Any change in this section will require the machine to be powered down and back up again to take effect. Axis parameters include information about the axis movement of the machine. Most of these parameters must have the machine re-homed to take effect. The miscellaneous group contains the spindle ranges and other software defaults. The over ride section contains the values that control the feed rate and spindle over ride knobs. The ball screw tables section controls the ball screw compensation. The thermal comp section has info related to the optional thermal comp sensors.

The DOS key will make the CNC software shut down and the DOS prompt come up on the screen. The Machine must be E-stopped before going into DOS. The machine must be shut down and powered up again to restore it to operation.

Any of these parameters can be changed by simply scrolling the cursor to it and using the [F1] edit key. Any parameter that requires the machine to have power cycled to take effect will also require that the operator escape back to the main menu before E-stopping the machine and powering it down. If the control is not set back to the main menu before power down the change may not remain in the parameter file.

The Path.dat File

The Path.dat file is a text file that determines where the different resident elements of the machine software are located. There are six different areas of concern.

They are:

- Rom: Location of the CNC software and other main parts of the software
- Ram: Location of the machine parameter files
- Parts: Machine storage location of parts programs
- Display: Location that the tool path graphic file will be held when it is generated. (The screen display in graph mode).
- Floppy: Drive location of floppy disk drive or other device for machine parameters to load from/save to.

Remote Files: The load from/ store to path for part programs.

The Path.dat file can be viewed by entering [F10] Utilities, [F8] Info, [F5] Paths.

Centurion 7 software has the ability to enable a drive switching key during the files-load and files-save functions (enabled by the “drive key on menus” parameter in Params-Ctrl). This key allows the user to change the drives that are being loaded from/stored to as they go. This will alter the current parts and floppy or remote storage paths in the control. It will not change the path.dat file. The default paths can be reset in the control by either cycling power on the machine, or by viewing the path.dat file as stated in the above previously.

The Path.dat file can be edited like a text file either through the CNC (program-text-any) or the DOS editor.

Centurion 7 control with the compact flash (current standard):

Rom	C:\ROM\
Ram	C:\RAM\
Parts	C:\PARTS\
Display	D:\
Floppy	A:\
Remote Files	A:\ if floppy only
	E:\ if Zip drive or Multi-Card reader installed
	_: \ or any other letter if networking is installed

NCB Hex Files

The NCB.Hex files configure the inputs and outputs and provide the sequencing for the various M-codes used on the machine. Because of differences in machine design and features, different machines require different NCB files to operate correctly. If the files are lost the control will not be able to process M-codes. The files can be restored by loading the backup parameters.

Software Upgrades

Software for mills and lathes is updated on a continuous basis. Upgrades are sought either to fix a problem in a previous version of software or to add features to an older machine. The process and difficulty level of a software upgrade is dependent upon the age of the machine and the type of software in it. If there are any questions on compatibility of a software upgrade contact the factory before the upgrade is attempted

Installing a Software Update

1. Power the machine down
2. Insert the software update diskette labeled into the disk drive on the machine.
3. Power the machine up. The software will load automatically
4. When software loading is complete the machine software will boot as normal
5. Check for any new parameters and adjust as required. Power down as needed.
6. Create a new parameter disk

A new parameter disk should be created so the original disk may be preserved for future reference. Label a blank diskette, put it into the disk drive then press PARAMS-SAVE.

Converting from SLS to CNC Software

With the advent of disk upgradeable software it has become more popular than ever to switch an SLS software machine over to CNC software. This is easy to accomplish, although it does require some changes to the ram files. Note that the mechanical hand wheels of many SLS machines will be lost in the change to CNC.

Before loading the new software some parameter changes should be made.

1. Change the Foreign Extension parameter from SLS to DAT
Save a copy of the parameters.

2. Load the parameter disk into the computer or into the machine and edit the file names
Rename Inp3.sls to Inp.dat
Rename Out3.sls to Out.dat
Rename Mcodes3.sls to Mcodes.dat
Note: If the machine is French or German you have to rename Inp3.grm to Inp.grm,
Out3.grm to Out.grm and Mcodes3.grm to Mcodes.grm (or .FRN)
3. There are some files you can delete if the machine will use English extensions:
Mcodes3.frn
Mcodes3.grn
Inp3.frn
Inp.grm
Out3.frn
Out3.grm
Init.bat
4. Flash the CNC software into the control.
5. Load the new parameter disk that was created.
6. There may be more parameters to change. Two of them to check are:
Slow Jog Velocity to 50.
Multiple Block Display to YES
7. Save new parameters back up disk.

Note: If the foreign extension parameter was not changed from SLS to DAT before the old software was replaced the new software will not boot correctly. To overcome this problem use the following procedure:

Press the F8 key on machine power up. This will prompt the user to confirm Yes or No to all lines of the autoexec.

Answer yes to all commands until reaching the **C:\CNC\CNC** line. Answer no to this line, then yes to the rest. This will leave the control at a **C:\RAM** prompt.

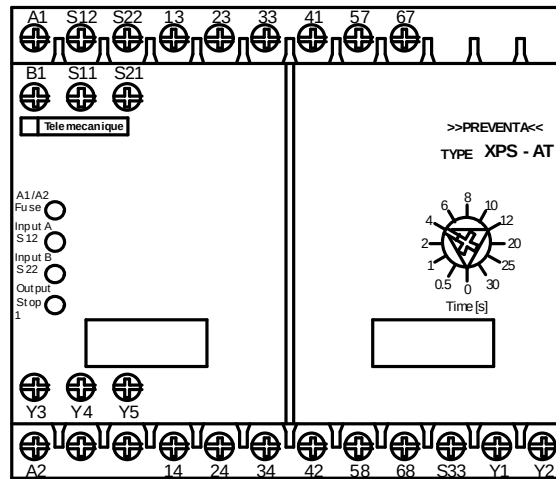
At the C:\RAM prompt type **C:\CNC\CNC N DAT** (caps not required)

This should allow the control to boot up and then the foreign extension parameter can be changed. Reboot the control normally.

The Centurion 7 “Sourcing” Reset Circuit

Featuring the Telemecanique Preventa XPS-AT Safety relay

In 2006 Milltronics changed from a “Sinking” interface panel which used 0VDC inputs and outputs to a “Sourcing” interface which uses 24VDC inputs and outputs. The machine enable or “reset” circuit was changed at this time to make use of the Telemecanique Preventa XPS-AT Safety Relay. The following information describes this Safety Relay and its use in a typical Milltronics machine.



Safety Relay Terminal Designations

A1 - 24 volts DC power

A2 – DC ground

Y3,Y4,Y5 – Jumper to indicate the nature of the reset signal. Y3 and Y5 are tied together in a Milltronics machine indicating that the Safety Relay will reset on the trailing edge of the reset pulse. This means that reset occurs upon button release, not when it is first pressed.

S11 to S12 – Input Circuit A

S21 to S22 – Input circuit B

Input circuits that indicate the machine status outside of the Safety Relay is OK. Circuits must be unbroken to allow the machine to reset. A break in either circuit will signal the Safety Relay to stop the machine. If the relay is faulted both circuits must be broken (an e-stop button pressed) before they can be restored.

B1 to S11 – These terminals are jumped to indicate the presence of two separate input circuits (A and B). When this jumper is in place the two circuits are operated at different voltages (one at 24vdc and the other at 0vdc). This allows the Safety Relay to detect shorts between the two circuits or to ground.

S33 to Y2 – A momentary connection between these two terminals initiates the reset of the Safety Relay. The connection can be broken down into two parts:

S33 to Y1 – The reset pulse. This includes a contact in the reset button and a relay contact in the interface panel tied to the “ALLOW RESET” signal (J3-9). There should be continuity between these two terminals when the reset button is pressed.

Y1 to Y2 – Pre-existing conditions. These are normally closed contacts on any number of relays activated by the Safety Relay that should be OFF before the machine is allowed to reset. In most Milltronics machines this includes the relays that provide power to the axes and spindle controllers. Other relay contacts could be present as well (see specific machine print for details).

The Y1 terminal does not have an internal connection to the Safety Relay and is used only as a convenient terminal to separate the wiring between the reset pulse and NC contact circuits.

41 to 42 – This is an NC contact that is used to alert the CNC that the Safety Relay is in a stopped condition. This signal is connected to the E-stop input (J1-1) of the CNC.

13 to 14

23 to 24

33 to 34 – These normally open contacts close when the Safety Relay is enabled. They open immediately when the relay is stopped.

57 to 58

67 to 68 - These normally open contacts close when the Safety Relay is enabled. They open a delayed time after the relay is stopped. The duration of the delay (in seconds) is set by the dial on the front of the Safety Relay.

Safety Relay Conditions at Start

The following conditions should exist on the Safety Relay once the CNC control has booted up and the emergency stop buttons are released. The machine will not be prepared to reset if these conditions are not met.

Power on A1 and A2. Indicated by top light “A1/A2 Fuse” being lit.

Continuity in the circuit between S11 and S12 terminals indicated by “Input A” light being on

Continuity in the circuit between S21 and S22 terminals indicated by “Input B” light being on

Stop 1 time delay circuits are open indicated by the “Output Stop 1” light being off.

Any problems in the initial startup of the relay could be due to any of the following causes.

If the “A1/A2 Fuse” light is not on:

- The relay is not getting 24vdc to the A1 terminal.
- It is not connected to DC ground at terminal A2.
- The Safety Relay is defective.

If the “Input A” and “Input B” lights are both out:

- One of the e-stop buttons is depressed.
- An external device with an emergency stop button on it is not connected, i.e. remote hand wheel or chip conveyor.

If the “Input B” light is on, but the “Input A” light is not. There is a break between S11 and S12 caused by:

- The Watchdog relay in the interface panel not being on (check interface).
- The CR1A “Software E-Stop” relay being on or contacts stuck open (check output J3-1 or the CR1A relay).
- A break in E-stop wiring between S11 and S12. Check for continuity thru the circuit.

The “Input A” light is on, but the “Input B” light is not. There is a break between S21 and S22 caused by:

- A break in E-stop wiring between S21 and S22. Check for continuity thru the circuit.
- On initial applications where CR1A contacts and watchdog contacts were wired between terminal B1 and S11 on the Safety Relay (Disregard if there is a jumper directly from B1 to S11)
 - Watchdog relay in the interface panel not being on (check interface)
 - CR1A “Software E-Stop” relay being on or contacts stuck open (check output J3-1)

If the “Output Stop 1” light is on:

- The machine is already reset.
- The relay is in the time delay period after e-stop.
- The relay is defective.

Resetting the Machine

How to reset the machine:

- Release all of the emergency stop switches on the machine. A1/A2 Fuse, Input A, and Input B lights should now all be lit.
- Wait approximately 5 seconds.
- Press and RELEASE the RESET button on the machine. Machine should reset after the release of the reset button.

How to reset the machine after a software emergency stop (drive fault, excess error, air pressure alarm):

- Clear the cause of the machine fault.
- Press any one of the emergency stop buttons (to clear both A and B emergency stop channels).
- Release all of the emergency stop switches on the machine. A1/A2 Fuse, Input A, and Input B lights should now all be lit.
- Wait approximately 5 seconds.
- Press and RELEASE the reset button on the machine.
- Machine should reset after the release of the e-stop button.

The Reset Sequence Explained

When the machine is powered on the A1/A2 Fuse light should come on. The input B light will come on as well.

As the interface panel initializes and the watchdog relay turns on, the Input A light will come on.

The relay should now be in its starting condition and prepared to be enabled. If it is not see the above section “Safety Relay conditions at start” to determine why.

To enable the machine, press the reset button. A signal is sent from terminal S33 on the Safety Relay through a “reset allow” relay contact in the interface assembly, then through an NO contact on the reset button itself to terminal Y1 on the Safety Relay. This signal then travels from The Y1 terminal through various NC contacts (see appropriate machine schematic for details) to the Y2 terminal. The button is then released, stopping the signal. It is this “trailing edge” when the signal stops that is an indication that the Safety Relay is to enable. If the relay is enabled the fourth light “Output Stop 1” should come on.

Things to check if the Safety Relay does not enable:

Make sure that the lights show that the relay is in the starting condition.

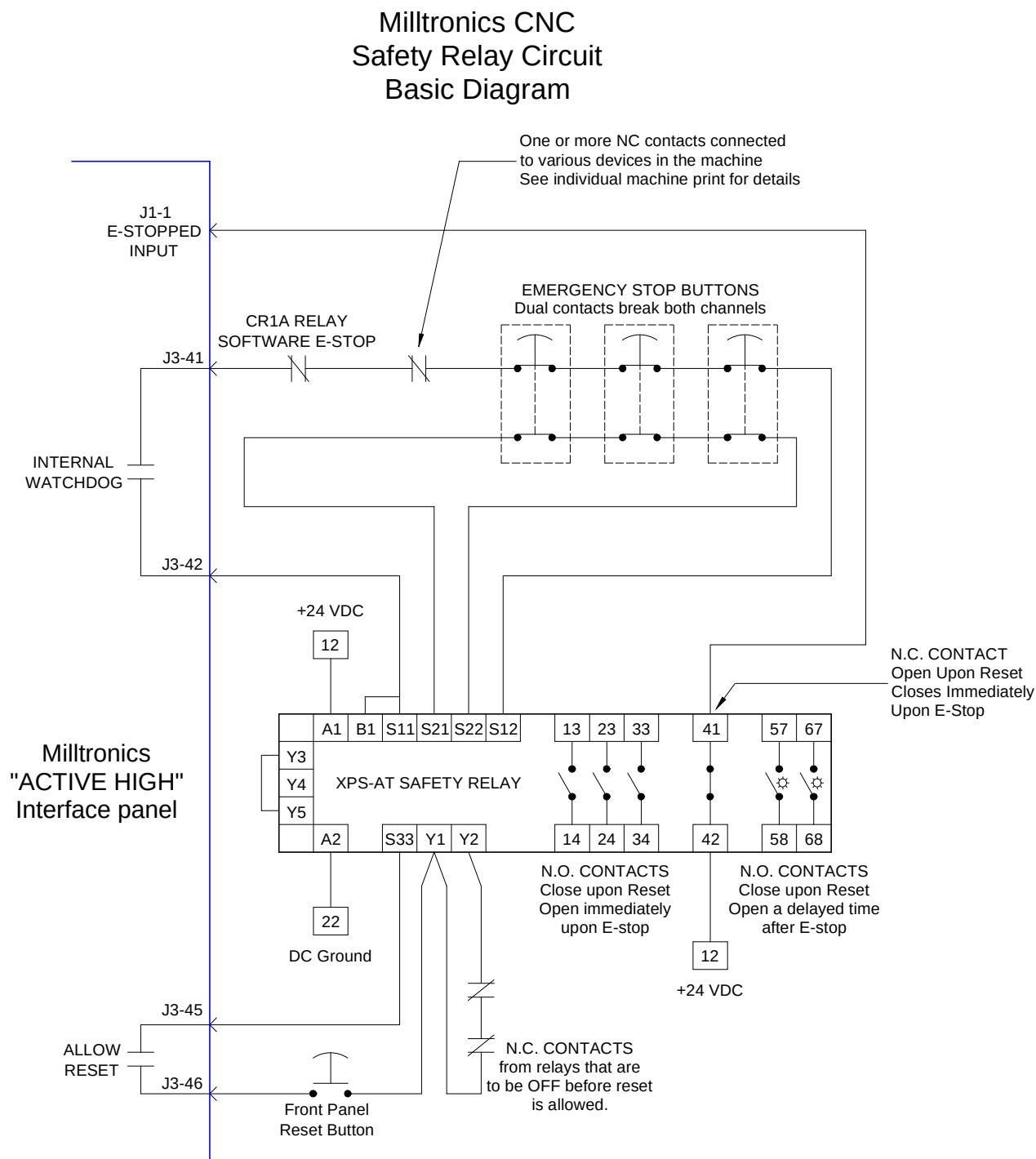
Check that the signal is traveling between S33 and Y1.

- The “Allow reset” contact may not be closing in the interface when the reset button is pressed. Check in the diagnostic screen for J3-9 to be changing to a white dot when the reset button is pressed. If it does not the CNC does not want the machine to reset. Things that inhibit the “Allow Reset”:
 - o J1-1 “E-stopped” is a black dot. This input is triggered through the NC contact at terminals 41 and 42 of the Safety Relay. If the machine does not know it is e-stopped, then it will not try to reset.
 - o Spindle drive fault.
 - o Watchdog failure in the interface assembly (Input A light should not be lit).
- Check that there is continuity through the allow reset contact between J3-45 and J3-46 on the interface terminals when reset is pressed. If the diagnostic dot changes color, but there is no continuity between the two terminals, the interface panel may be bad.
- Check that there is continuity through the reset button contacts when reset is pressed. If there is no continuity through it when pressed then the button or wiring may be bad.
- **Check that the signal is traveling between Y1 and Y2.**
Prior to the Safety Relay being enabled the relay contacts should be closed between Y1 and Y2. Check for continuity between Y1 and Y2 terminals. If there is no continuity a relay or contact may be stuck open.
- **Check if there is always continuity between S33 and Y2**
This would require a multi-level failure, however if the cycle start was stuck on there could be continuity between S33 and Y2 all of the time. In that case there would be no “trailing edge” signal when the button was released and the Safety Relay will not enable.
- **The Safety Relay is bad.**

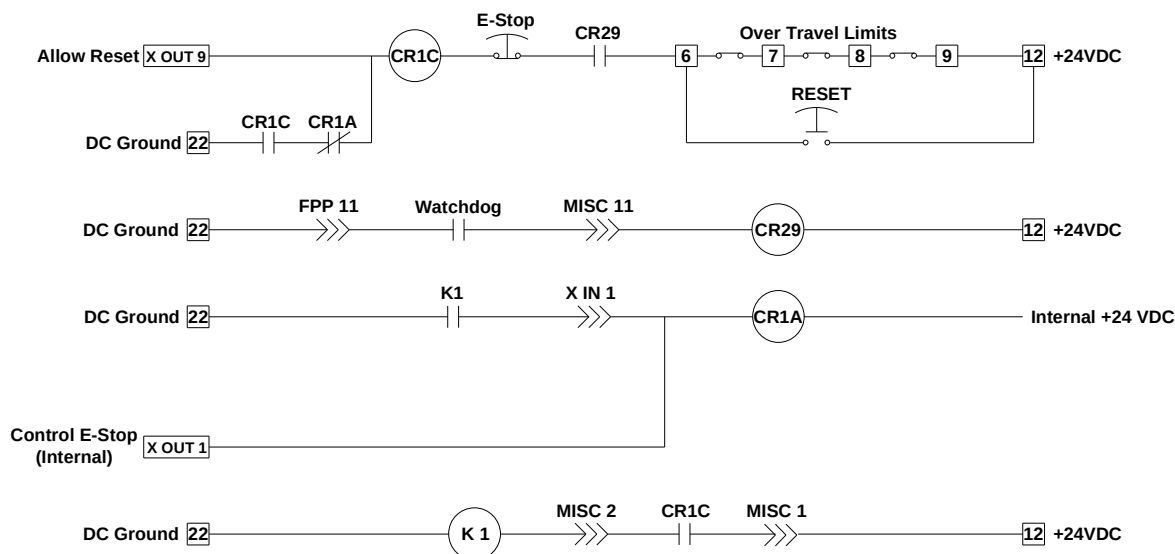
If the Safety Relay energizes for a second, but drops out immediately then one of the “Drive OK” signals may be missing which would indicate a drive fault. Check for A 449 alarm on the control or look for fault indications on the axis drives.

The safety relay is highly reliable and its failure is unlikely. If relay failure is suspected, recheck the above conditions prior to replacing it.

Sourcing Machine Reset Basic Diagram



The Centurion 7 “Sinking” Reset Circuit



1. The front panel reset switch is pressed, sending a keyboard signal to the control
2. Axis 1-Output 9 “ALLOW RESET” will turn on while the button is pressed, providing a momentary ground to the circuit. This is indicated on the diagnostics screen ([F6] Display, [F4] Diag) by the dot next to axis 1-Out 9 turning from black to white

If Axis 1-Output 9 does not turn to a white dot while the reset button is pressed there are several possible problems:

- There may be a drive fault inhibiting the reset signal. This would be signified by a white dot at Axis 1-Input 9 if it is the spindle drive. An axis drive fault will show up in Axis 4 diagnostic group. Axis 4 inputs 1 through 5 could possibly be drive indicators, depending upon the number of axis. If the machine is equipped with D.C. drives, these will be drive faults and a white dot will indicate that a drive is faulted. If the machine has A.C. Yaskawa drives these will be drive O.K. indicators and a fault will be shown by a black dot (a white dot means the drive is o.k.)
- There must be a ground at Axis 1-Input 1 “E-Stopped” for the machine to be able to set the “ALLOW RESET”. If Axis 1-Input 1 is not a white dot, it is missing that ground. The +24vdc line may be low or shorted and its voltage should be checked. The ground comes through normally closed contacts on the K1 machine reset relay. There may be a problem with it.
- The reset switch itself may be malfunctioning. Plug in an external keyboard and press the F10 key while holding down the Alt key. This will simulate the keyboard signal that the reset switch sends when depressed. If the machine resets this way the switch needs to be replaced.

3. The internal ground at Axis 1-Output 9 energizes the coil of CR 1C through contacts on the CR 29 relay, the normally closed contacts of the E-Stop button and through the over travel limits or the normally open contacts of the reset button.

If CR 1C is not energized at this time there are again several possibilities:

- The CR 29 relay is not activated. Check the LED next to the CR 29 relay located on a quad relay card (the relay itself should be labeled). If the LED is unlit there may be a problem in the control. The CR 29 relay is powered through the control watchdog relay. Check LED 1 on the control's interface panel. If it is unlit there is a malfunction in the control and it may have to be sent in for repair.
- The E-Stop switch contact is malfunctioning such that it is open all of the time.
- The CR 1C relay has failed.
- There may be a problem in the jumper settings if the interface panel has just been replaced.

4. When the CR 1C relay energizes, the relay latches to ground through the over travel limits, through its own contacts, and through a set of normally closed contacts on the CR 1A relay. (The CR 1A is wired through normally closed contacts on K 1, and will shut off when K 1 comes on. It is also wired to the normally open E-Stop contacts and will come on when E-stop is latched or held in.) The reset switch is then released leaving the CR 1C on.

If CR 1C will not remain latched there are several possible problems:

- The machine is sitting on a limit switch or a limit wire is broke. Hold down the reset switch and jog the machine to the center of travel. Release the reset and observe if the machine stays in reset. If a break in the limits is suspected they may be jumped across by placing a jumper wire from terminal block 6 to block 9. If the machine stays reset the problem axis can be isolated by jumping across terminal blocks 6 to 7 (X axis), blocks 7 to 8 (Y axis), and blocks 8 to 9 (Z axis).
- The E-stop button may still be latched or the normally open contacts may be stuck shut leaving the CR 1A relay energized.
- The K 1 relay contacts may be stuck shut or K1 is not coming on, causing the same condition as above.
- There may be problems with the contacts on CR 1A or CR 1C.

DO NOT OPERATE MACHINE WITH ANY JUMPERS IN PLACE. Jumpers are for trouble shooting purposes only.

5. With CR 1C latched the K 1 machine reset relay should then come on and all machine devices will be energized.

CMOS Setting

The CMOS of the control, sometimes referred to as the Bios settings, is the memory on the motherboard where the configuration of the motherboard itself is set. It is here that the hardware devices such as floppy and hard disk drives are indicated. The BIOS also keeps the date and time, boot sequence, and many other settings. The addition of new hardware, or a battery failure on the motherboard will require entry and setting of the CMOS.

CMOS Setup for SBC 9732 board in a Centurion 7 Control

To access and make changes to the CMOS an external keyboard must be plugged into the machine. The proper keys will not be available without it.

To enter the CMOS:

Turn on the machine power and immediately begin pressing the DELETE key on the external keyboard. Do not hold the key down as it will cause a Keyboard error.

If successful a blue screen will appear labeled “CMOS Setup Utility – Copyright © 1984-2001 Award Software.” The following menu selections will appear:

Standard CMOS Features	PC Health Status
Advanced BIOS Features	Frequency/Voltage Control
Advanced Chipset Features	Load Optimized Defaults
Integrated Peripherals	Set Password
Power Management Setup	Save and Exit Setup
PnP/PCI Configurations	Exit without saving

The bottom of the screen will list the keys used to navigate the CMOS setup software.

To set the CMOS for a Centurion 7 Control:

Use the arrow keys to move the cursor to **Load Optimized Defaults**. Press ENTER.

A dialog box will appear that says “Load optimized defaults (Y/N)”. Enter Y for yes, then press ENTER. Default CMOS settings will be loaded.

Use the arrow keys to move the cursor to **Standard CMOS Features**. Press ENTER.

Move the cursor to “IDE Primary Slave”. Press ENTER.

Move the cursor to “IDE Primary Slave”. Change the setting to NONE using the PAGE UP key.

Press ESC to return to the **Standard CMOS Features** menu.

Press ESC to return to the Main CMOS menu.

Use the arrow keys to move the cursor to **Advanced Bios Features**. Press ENTER.

Move the cursor to “Boot Numlock Status”. Change the setting to OFF using the PAGE UP key.

Press ESC to return to the Main CMOS menu.

Use the arrow keys to move the cursor to **Advanced Chipset Features**. Press ENTER.

Move the cursor to "Panel Type". Change the setting to the appropriate value for the panel type.

Move the cursor to "On Chip USB". Change the setting to DISABLED using the PAGE UP key.

Press ESC to return to the Main CMOS menu.

Panel type - 12" - 800x600 18 bit - 10" - 800x600 LVDS.

Use the arrow keys to move the cursor to **Integrated Peripherals**. Press ENTER.

Move the cursor to "Onboard Parallel Port". Change the setting to DISABLED using the PAGE UP key.

Press the F10 SAVE Key. A dialog box will prompt "Save to CMOS and EXIT (Y/N)". Enter Y for yes, then press ENTER. The CMOS setting is complete.

The control will reboot and should come up as normal.

CMOS Setup for SBC 9550 board

If a Centurion 7 control with a PCM9550 single board shows a screen with only bands of gray, black, and blue color but the machine operates otherwise then the CMOS battery has failed. The battery must be replaced (see board illustrations for location) and the cmos settings restored.

Restoring the CMOS will require an external VGA monitor to be plugged into the motherboard. A ribbon cable should be plugged into the CN1 connector on the single board with a VGA video connector on the opposite end. If the ribbon cable is not present then one must be obtained from the parts department (Part number CB-75).

Connect the external monitor and an external keyboard and enter the CMOS in the same manner as for the PCM 9732 board.

Setting up custom codes on the Centurion Control

Often it is desirable or necessary to create a user defined M-code or G-Code for the machine to use. A custom code is one that is linked to a program such that when the M-code or G-code is commanded, the program will be run. The procedure to set up a custom code follows.

1. From the main menu, enter the setup parameters and go to the Power group.
2. Page down to the custom M and G code section. Select the custom code slot that is to be used and set it to the M or G Code number desired (if an M 77 is being created, set the custom M-code to 77). Escape back to the main menu.

RunTime 000:00:00		Main-Parms-Setup-Power		Active :00002	
Current		Next		Distance	
X	+00.0000	+00.0000		+00.0000	
Y	+00.0000	+00.0000		+00.0000	
Z	+00.0000	+00.0000		+00.0000	
*** Custom M and G code Tables *** Custom Gcode 09010.....000 Custom Gcode 09011.....000 Custom Gcode 09012.....000 Custom Gcode 09013.....000 Custom Gcode 09014.....000 Custom Gcode 09015.....000 Custom Gcode 09016.....000 Custom Gcode 09017.....000 Custom Gcode 09018.....000 Custom Gcode 09019.....000 Custom Mcode 09020.....000 Custom Mcode 09021.....000 Custom Mcode 09022.....000 ▶ Custom Mcode 09023.....000 Custom Mcode 09024.....000 Comp : Cancelled Tool : T03(03) Length : 00.0000 Diam. : 00.0000 Plane : XY (G54)0 Clearnce: 00.1000 Interp : Linear (Feed) Feed : F050.0 ipm (100%) : 050.0 ipm Units : Abs/English Cycle : Cancelled Dwell : 0000.00 sec Spindle : S0000 rpm (100%) : 0000 rpm (OFF) 020 ☐ Coolant : Off Part # : 0000					
F1		F7	F8	F9	F10
Edit		↑	↓	PgUp	PgDn
				Esc	

3. Write a program with the number of the custom M-code slot that was selected. If custom M-code 09020 was set, then the program written must be named 09020. Save the program.
4. Escape to the main menu, E-stop, and power down the machine. Wait approximately 30 seconds and power up.
5. When the machine is powered back up the M-code should be active.

Note: If an M-code number of an existing M-code is used, the custom code will replace the original. If the original code is called at the end of the custom code the original will be executed after the custom events are run. A custom M-code cannot call another custom M-code. Custom M-codes can be placed either in the parts storage or the B:/ram. If they are placed in ram they can be saved with the other parameters and are safe from being erased.

Sample Custom M-Code

Example: To make a lamp come on when an M30 is commanded.

1. Start a new text program o9024. In the program write:

```
SET Z8  
M30
```

2. Store the program.
3. Then set the Parameter Custom M code 9024 to 30. (see below)
4. After this has been done reboot the machine to load the program into main memory.

When the M30 command is commanded, 9024 gets run. The SET Z8 command will trigger Z output 8, which could turn on a relay wired to it. This in turn could power a light. The original M30 will then be executed and the command is complete.

Wait Channel

Input J1-7 (Axis 1-input 7) is the wait channel. It is wired to terminal block 79.

If an M32 is commanded in a program the control will look at this input. If the input is signaled, showing a white dot in diagnostics display, the machine will stop at this point and wait for the input to lose the signal before continuing the program. If the signal is not there at the time the M32 is issued the control will continue as if it did not receive the code at all. The signal must only be broken for an instant to allow the control to pass beyond this block of the program.

A popular use for the wait command is if the machine tool has an indexer installed. The indexer code will usually include a check of the wait channel. The indexer itself will have a channel wired to the wait channel that will signal while the indexer is turning. When the indexer move is completed it will break the signal and allow the program to continue.

RS 232 Communication

Another method of bringing information in from the outside world to the control's memory, other than the floppy drive, is the RS232 port. Centurion CNC controls use a standard RS232 interface just as that found on today's desktop personal computers.

The pinout of the 25 pin "D" style connector on the control box is as follows:

- Pin 2 Receive data
- Pin 3 Transmit data
- Pin 7 Signal Ground
- Pin 1 Frame Ground – (tied to cable shield on one computer end only)

Operation notes.

- The Milltronics end requires no jumpers such as 5,6,8, & 20. Only pins 2,3, & 7 are used.
- Hardware handshaking signals are NOT used.
- Software handshaking (Xon & Xoff) is used to control the data flow. This handshaking mode is employed by default and cannot be disabled.
- The required parameters for baud rate, data bits, stop bits, and parity are found under PARAMS-CTRL in the CNC menus. Before attempting any communication ensure that the devices on both ends are set up the same way as one another.
- When transferring data always prepare the receiving end first, then initiate the sender.
- Always make sure the type of file being received is the same type as that being sent. When transferring files from a CAD/CAM system the file type will always be TEXT.
- To receive a file, go into UTIL-RS232-RECV, select the type of the file TEXT or FCAM. Type the name or number of the new file being created, then press enter. The file name of the file being sent is not transferred with the data so the name must be specified when RECEIVE FILE is initiated.
- To send a file go into UTIL-RS232-SEND, select the type of file TEXT or CONV, & MENU. Then from the menu, select the file with the cursor arrow, hit enter, then F1 to begin.

RS232 Cables

There are two different cable configurations used for RS232 communications. The two drawings below show how these cables should be made for proper communication to the machine. The machine end of both cables requires a male 25-pin plug. The computer end of the cable is determined by the type of port used.

In making a 25 pin to 25-pin cable, connect pin 1 of the computer end only to the shield of the cable. Pin 2 on the computer end should connect to pin 3 of the machine end. Pin 3 of the computer end should connect to pin 2 of the machine end. Pin 7 of the computer end should connect to pin 7 on the machine end as a ground.

In making a 9 pin to 25-pin cable, as before pin 1 on the 9-pin computer end should be connected to the cable shield. Pin 2 on the computer end should connect to pin 2 on the machine end. Pin 3 on the computer end should connect to pin 3 on the machine end. And pin 5 on the computer end should connect to pin 7 on the machine end as signal ground.

