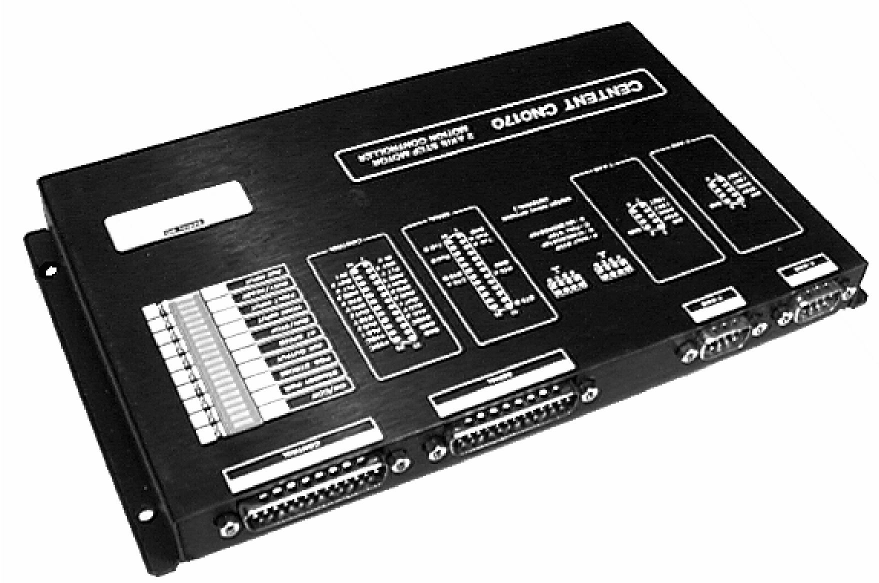
HARDWARE MANUAL
CN0170



TWO AXIS
MOTION CONTROLLER

CENTENT COMPANY
3879 SOUTH MAIN STREET 714-979-6491
SANTA ANA, CALIFORNIA 92707-5710 U.S.A.

This manual contains information for installing and operating the following Centent Company product:

- CN0170 Motion Controller

CONTENTS

CONNECTORS:

All inputs, outputs and power supply connections pass through four "D" type connectors located on the top edge of the CN0170. These connectors are arranged according to function, consisting of two motor drive connectors, a serial interface connector and a machine control/power supply connector. Centent Company can provide an optional serial interface cable to connect the CN0170 to an IBM compatible personal computer. The customer must supply the mating socket connectors and cables for motor and control connections, and serial connections if more than one CN0170 is "daisy-chained" together. The connector locations are shown in Figure 1.

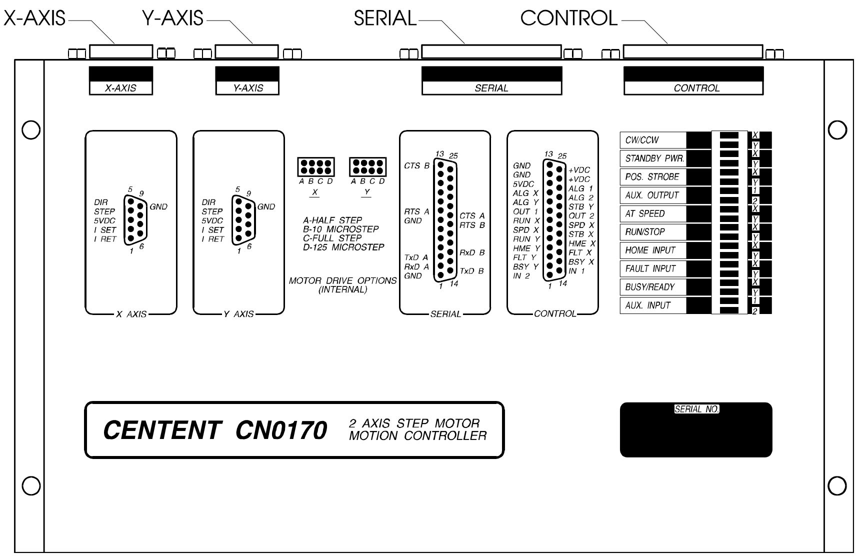


Figure 1

X-AXIS, Y-AXIS CONNECTOR:
The motor drive connectors are D9 plug connectors labeled "X-AXIS" and "Y-AXIS". They form the interface between the CN0170 and the motor drives. The output signals from the axis connectors are STEP, DIR and ISET. IRET is the ground reference and is required only if ISET is used.

STEP: (pin 4)
The STEP output connects to the step motor drive's STEP or PULSE input. The output is 5 volts for a logical '1' and zero volts for a logical '0'. The output can sink a maximum current of 50 milliamps at a logical '0' state. The output is TTL and 5V CMOS compatible. In most instances it is also directly compatible with opto-isolated step motor drive inputs. The STEP pulse rate is user selectable to x1, x2, x10 and x125 of the CN0170's programmed full-step rate. This maintains the same programmed motor shaft speed when using full-step, half-step, 10 microstep and 125 microstep drives respectively. Drives with other resolutions may be used, however the motor parameters must be reprogrammed accordingly. The

STEP output circuit is shown in Figure *2*. The Motor Drive Option jumper block is used to select the appropriate step rate resolution. Each axis has its own 4-position jumper block.

The CN0170's cover must be removed to access these option jumper blocks. To accomplish this, remove the four screws located on the bottom of the control, then lift the cover up at the LED Indicator side.

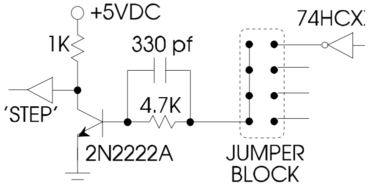


Figure 2,
Step Resolution Jumper

See Figure 3 for jumper block location.

Normally the step rate resolution should match the step motor drive being used. This means the motor's rate of acceleration, speed and steps moved matches the programmed values. However, it is permissible to intentionally mismatch the step rate resolution with the drive in order to extend the operating range of the CN0170.

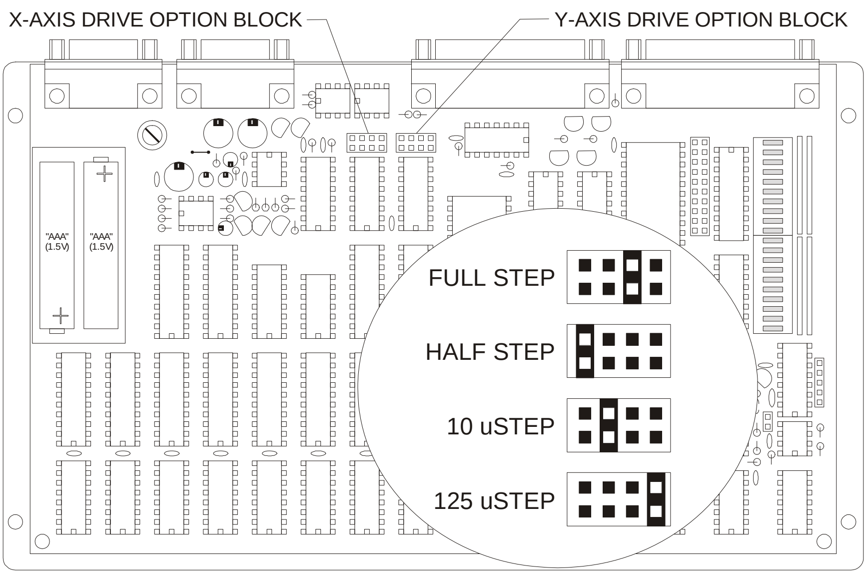


Figure 3, Step Resolution Jumper Block location

To set the step rate resolution, remove the shorting bar from the jumper block and replace it as shown in Figure 3. Do not jumper the pins in any other manner except as shown. Do not operate without a jumper, as no output on STEP will occur.

The axis jumper blocks may be set to the same or different step rate resolutions. For instance, the X-AXIS may be set to 125 microsteps while the Y-AXIS is set to the full-step resolution.

The STEP output pulse timing is shown in Figure 4.

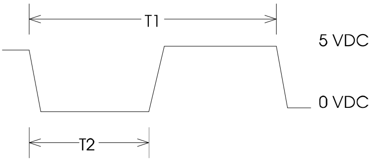


Figure 4

The CN0170 uses a step rate generator circuit to generate a frequency proportional to a 16-bit command. Consequently, all 65,536 possible speeds are evenly distributed over the speed range. An incremental change in speed command word produces the same speed change on either ends of the speed range.

	FULL-STEP	HALF-STEP	10 µSTEP	125 µSTEP
MAX STEP (KHz)	16.38375	32.7675	163.8375	2047.9688
MIN STEP (Hz)	0.25	0.50	2.50	31.25
DUTY CYCLE (T2/T1)	0.50	0.20	0.20	0.50
MIN ACCEL. (Hz/SEC.)	64	128	640	8000
TOTAL STEPS (MEG)	4.194304	8.388608	41.94304	524.288

The step rate generator circuit is digital and uses a 4.096 MHz crystal oscillator reference from which all step rates are derived. For those step rates that are not exact integer dividends of the reference oscillator, the step pulses will not be evenly distributed although the step rate will be exact. This uneven pulse distribution, or phase jitter, is limited to less than 244 nano-seconds from optimum step pulse placement.

The rate at which speed changes can be made is 256 times a second. During acceleration or deceleration, the relationship between speed and time is a staircase function rather than a continuous or monotonic function. This means speed changes are made at the beginning of each 1/256 of a second and then speed remains constant for the remainder of the period; approximately 0.0039 seconds (1/256 sec.).

DIR: (pin 5)

The DIR output connects to the step motor drive's direction input. This output provides a 5 volt output logical '1' that the drive interprets as a counter-clockwise command. A zero volt output constitutes a logical '0' and represents a clockwise command. The "CW/CCW" indicator LED (light emitting diode) lights for a clockwise direction.

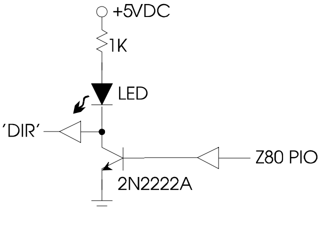


Figure 5, DIR output

The step motor drive should run the motor in the direction indicated by the "CW/CCW" indicator LED. If the direction is the opposite of this, it can be reversed by switching the step motor's phase leads.

The DIR output can sink 50 milliamps when in the logical '0' state. It is compatible with TTL and 5 volt CMOS logic. It is also directly compatible with opto-isolated step motor drive inputs. The DIR output driver is shown in Figure 5.

ISET: (pin 2)

The ISET output, in conjunction with the IRET (pin 1), is used as an option to set the step motor current to a lower, stand-by level while the motor is at rest. This is possible only if the step motor drive has provisions for a current set input. In many applications the torque required from the motor is substantially less when the motor is stationary. By reducing the motor current during idle, a dramatic decrease in motor and drive heating can be achieved.

The CN0170 waits a programmed period after a motor has stopped to activate the ISET output. If the motor is commanded to move before this time delay elapses, the timer is reset and the ISET output does not activate.

When the ISET output is active, the "STANDBY PWR" indicator LED lights. The ISET output and "STANDBY PWR" indicator turn off 4 milliseconds before step pulses are sent to the drive. This delay permits the motor current to rise to its normal operating level before a move begins. The ISET output circuit is shown in Figure 6.

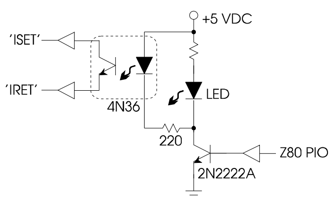


Figure 6, ISET output

5 VDC: (pin 3)

The 5 VDC output is provided to act as a power supply for STEP and DIR opto-isolators on step motor drives that feature isolated inputs. The 5 VDC line should connect to the opto-isolator LED anodes. Depending on the step motor drive, these may be individual inputs, or they may be tied in common to a single input. Current then flows from the 5 VDC output, through the opto-isolator LED and current limit resistor, and into the STEP or DIR output on the CN0170.

GND: (pins 6-9)

The ground pins on the connector outputs are arranged so they alternate with the signal pins if a ribbon cable is used to connect the CN0170 to the step motor drives. This attenuates cross-talk and provides shielding for the signal lines. It is also useful if the motor drives are a substantial distance from the CN0170.

For best noise immunity and reliable operation, the step motor drives should be opto-isolated. To maintain this isolation, do not terminate the GND lines to the motor drive or power supply.

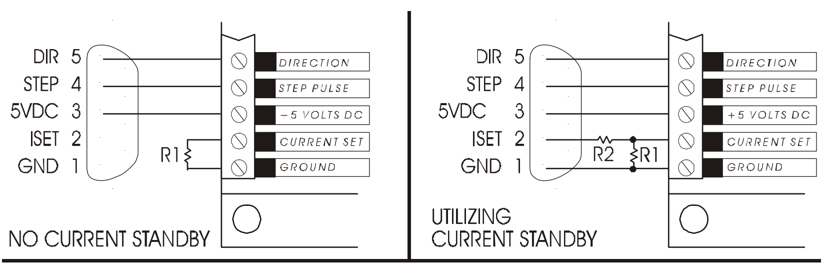
When the CN0170 is used with motor drives that do not have opto-isolated inputs, the GND outputs are the signal return lines for the CN0170 STEP and DIR outputs.

CONNECTING CENTENT DRIVES TO THE CN0170:

The CN0170 interfaces directly to Centent CN0124, CN0142, CN0143, CN0152, CN0153, CN0162 and CN0165 step motor drives. The CN0170 also interfaces directly to the Centent CN0182 servo drive.

Figure 7

Figure 7 provides connection diagrams for CN0142, CN0143, CN0152 and CN0153 step motor drives with and without the STANDBY function. R1 is



the current set resistor and R2 is the STANDBY resistor. R2 may be replaced with a wire jumper if motor current is off during standby. This allows the motor to "freewheel" with no holding torque evident. R2 is not used and ISET or IRET are not connected if current standby is not required.

Please refer to the Operating Manual, CN0140 & CN0150 Series Step Motor Drives for a detailed discussion of motor current setting and the method of calculating the values for R1 and R2.

Figure 8, Current Standby - CN0162

The CN0162 Step Motor Drive has an automatic standby output that may be used in place of or in addition to the CN0170 STANDBY.

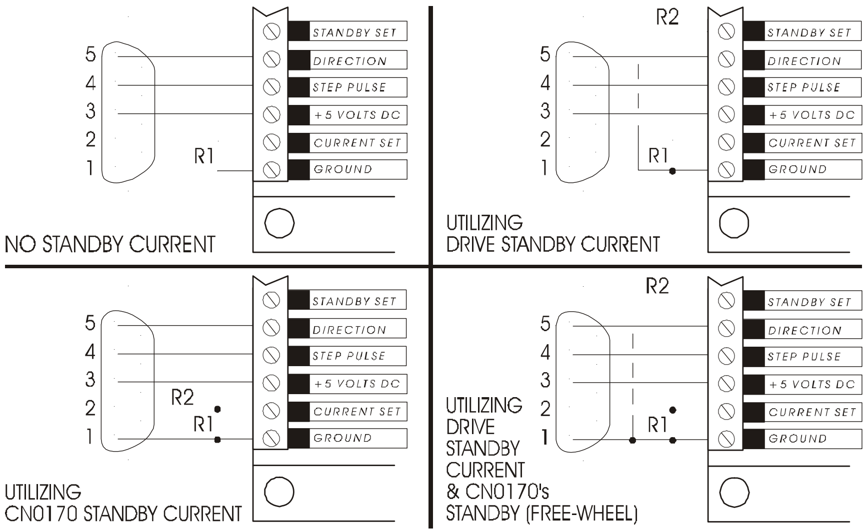


Figure 8 shows the possible configurations for connecting the CN0162 to the CN0170. R1 is the current set resistor and R2 is the STANDBY resistor. Refer to the Operating Manual, CN0162 Microstep Drive to determine the values for R1 and R2.

If no standby is required or the CN0162's standby is used, it is not necessary to connect ISET and IRET to the CN0162 (Figure 8, upper left & right). Use the CN0162 drive's standby (Figure 8, upper right) if a simple, fixed time delay is sufficient. If the programmable time delay feature of the CN0170 STANDBY is required, use the configuration in Figure 8, lower left. The CN0162's standby may be combined with the CN0170's STANDBY to provide three operating current levels. As shown in Figure 8, lower right, the CN0162 provides the normal motor standby while the STANDBY from the CN0170 allows a zero torque, "free-wheel" condition, under program control.

The CN0165 drive has an automatic Standby output that requires no external resistor for Standby current. A trimpot located on the rear face of the drive sets the standby current as a percentage of normal operating current.
As with the CN0162, the user has the option of employing the standby feature of the drive, the CN0170 Motion Controller, or both.

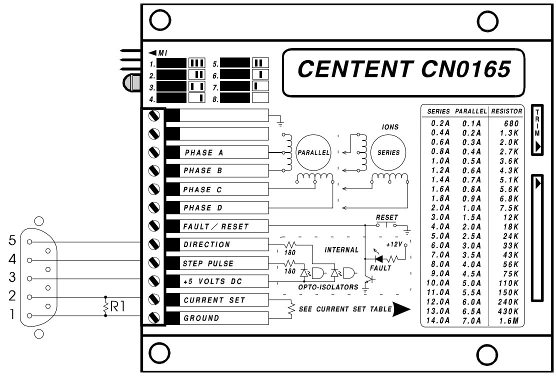


Figure 9, Free-wheel Current Standby - CN0165

Figure *9* shows the CN0170's STANDBY used for the "free-wheel" option. This is equivalent to the CN0162 configuration shown in the lower right example in Figure 8. The Standby trimpot on the CN0165 sets current standby. Refer to the Operating Manual, CN0165 Step Motor Drive to determine motor current settings and values for the R1 current set resistor.

The Centent CN0182 Servo Drive is compatible with the CN0170 controller.

STEP, DIR and 5VDC are the only connections required between the CN0170 and the CN0182.

The Current Limit Trimpot on the CN0182 adjusts current set for the drive.

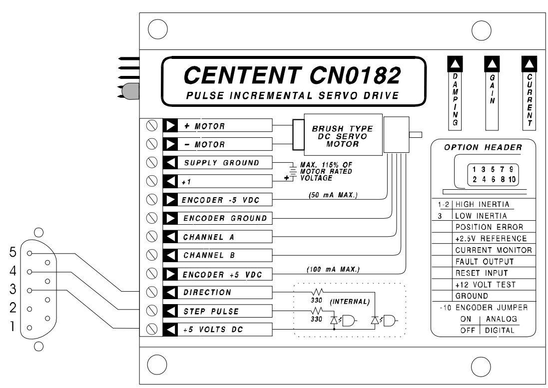


Figure 10, CN0182 connections

CONTROL CONNECTOR:

The machine control functions are channeled through a D25 plug connector labeled "CONTROL". This connector contains all inputs and outputs. The power supply also passes through this connector. There are eight digital TTL compatible outputs, eight digital TTL compatible inputs and four analog inputs. The analog inputs are converted to 8-bit precision. Two of each group of input/outputs are reserved for user defined functions; the remaining have dedicated functions.

The input/outputs within each group are electrically identical. The digital inputs are sampled 256 times a second, the digital outputs are updated 256 times a second and the analog inputs are sampled 32 times a second.

OUTPUTS:

The outputs are TTL and 5 Volt CMOS compatible, with a status indicator LED for each output. The outputs are active low, with the status indicators lighted in the low or logical '0' state. The labeled function on the cover next to each indicator is active while that indicator is lit. Where the label is dual function, the first function is active while the indicator is illuminated. The second function is active when the indicator is off.

The circuit for a typical output is shown in Figure 11. The output driver is a 74LS374 octal D-flop. The D inputs connect to the CN0170 data buss while the Q outputs go to the control connector. The 2.2K resistor pulls the outputs up to the 5 volt supply during a logical '1' output. This enhances 5 Volt CMOS compatibility.

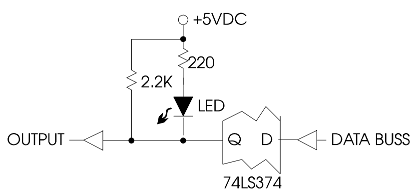


Figure 11, digital outputs

The 220 ohm resistor limits the status indicator LED current to 12 milliamps during the logical '0' or output active state. The 74LS374 has a minimum logical '0' current sink capability of 24 milliamps, leaving 12 milliamps of driving capability.

STB X, Y: (pin 18, pin19)

The STB output goes active (low) when the motor completes a positioning move. This output, when used in conjunction with the BSY input, is a used to synchronize an external process to the CN0170 motion controller. The STB output may be used to trigger or initiate an external process that has to be performed once the motor has completed a move. The external process provides the BSY input to the CN0170. While the external process is in progress, the BSY input is held active (low). When the process has completed the BSY input to the CN0170 goes inactive (high). If another move is pending, it may now begin.

An example would be a printed circuit board drilling application. The CN0170 would operate an X/Y table that would carry the printed circuit board under a stationary drill. Once the board was at the desired location, the drill would move down, drill a hole and then retract. During this time the X/Y table must remain stationary. After the drill has retracted, the table would move the board to the next location. In this instance, the external process is the board drilling sequence that would be triggered by the STB output. The BSY input would be held active by the external process for the duration of the sequence.

The STB output can be programmed for one of two responses. The Busy/Ready instruction turns hardware handshake on or off. If XB- (or YB-) instruction is sent to the CN0170, hardware handshaking is turned off. The STB output goes active for 3.9 milliseconds upon completion of a commanded move. If the BSY input is not taken low before STB output goes inactive, then a pending move will begin. The BSY input will not go active (low) if it is not used, the normal situation with handshake turned off.

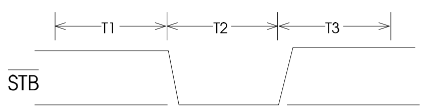


Figure 12, Busy/Ready

If the BSY input is low when the STB output goes inactive, the pending move will be held off while the BSY input remains active. The timing diagram for the STB output is shown in Figure 12.

- (T1) The motor is in motion, moving to a location. The STB output is inactive. While the motor is in motion, repeat (T1).

- (T2) The motor has reached the position and has stopped. The STB output goes active. The external process should activate the STB input at this time if a pending move is to be held off.

- (T3) The STB output goes inactive. If the BSY input is inactive, the next motor move begins, if one is pending.

If the XB+ (or YB+) instruction is sent to the CN0170, the STB output goes active immediately upon the completion of a command move. The BSY input is sampled 350 microseconds later.

If the BSY input is inactive it is sampled every 3.9 milliseconds. The STB output remains active while this is going on. The CN0170 will wait indefinitely in this state, waiting for acknowledgment that the external process has begun.

When the BSY input goes active, the STB output goes inactive 3.9 milliseconds later. The CN0170 will wait indefinitely in this state, waiting for the BSY input to go inactive. The BSY input is taken inactive again when the external process has completed. If a move has been pending, it will begin after the BSY input goes inactive again.

This method insures synchronization between a user's process and the CN0170 regardless of the speed of the process response time. The timing relationship between STB and BSY is shown in Figure 13.

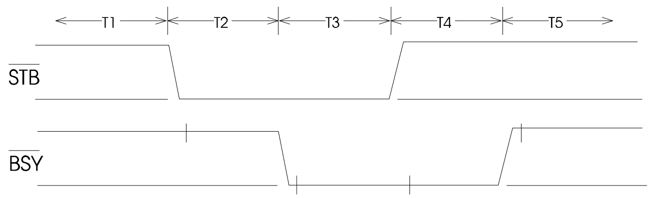


Figure 13, Hardware Handshake timing diagram

- (T1) The motor is moving, STB is inactive and BSY is inactive.
- (T2) The motor is stopped, STB is active and BSY is sampled. If BSY is inactive, repeat (T2).
- (T3) The BSY input is active, the STB output goes inactive at the end of (T3).
- (T4) The STB output is inactive and the BSY input is sampled. If BSY is active, repeat (T4).
- (T5) The BSY input is inactive; the motor will begin to move if another move is pending.

SPD X, Y: (pin 6, pin 19)
The SPD output goes active whenever the motor has reached its programmed maximum velocity. This output is useful for a process that may begin only after the motor speed has stabilized.

The SPD output is inactive while the motor is accelerating to maximum velocity. The SPD output goes active coincident with the motor ceasing to accelerate. The SPD output goes inactive again when the motor begins to decelerate to a stop or a lower velocity.

When the axis is in a Joystick or Speed Mode, the SPD output will also be active while the motor is stopped. This is because a stopped axis is considered having a command speed of zero. When the axis is in the Ratio Mode, the SPD output will mirror the SPD output of the other axis.

RUN X, Y: (pin 7, pin5)
The RUN output goes active anytime the motor is at a non-zero speed. This output is useful for applications requiring the motor be stopped before a process may occur. The RUN indicator LED lights when the motor is turning; when the motor is stopped the LED is off, indicating a STOP condition.

OUT 1,2: (pin 8, pin20)
The OUT outputs are user defined, meaning the user may turn the outputs on or off as needed, independent of what the motor output is doing. An OUT output is 'on' when it is at zero volts and 'off' when it is at 5 volts. When it is 'on', the output has a current sink capability of 12 milliamps. The OUT indicator LED is illuminated when the output is on and off when the output is off.

The OUT output is updated 256 times a second. The minimum on or off times for the output is 3.9 milliseconds. All on or off times are integer multiples of 3.9 milliseconds.

INPUTS, DIGITAL:
The eight digital inputs consist of six dedicated machine control inputs and two user-defined inputs. The inputs are active low, meaning the input has to be at a logical '0' or grounded for activation. Each digital input has an indicator LED associated with it. The LED lights when the input is grounded. The labeled function on the cover next to each LED is active when that LED is illuminated.

The inputs may be driven by a variety of devices. Suitable devices include SPST switches, open collector transistors, opto-isolators, Hall-effect sensors, TTL drivers or any type of device capable of sinking 14 milliamps of current.

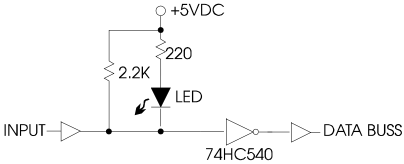


Figure 14, Input circuit

The circuit diagram for a typical input is shown in Figure 14. The input device is a 74HC540 octal inverting buffer. Its outputs go to the CN0170 data buss while its inputs go to the Control Connector.

The 2.2K resistor provides input pull-up to the 5 volt supply. This insures good noise immunity if the inputs are left open, or in the inactive, logical '1' state. The 220 ohm resistor limits the indicator LED current to 12 milliamps while the input is grounded, or in the active, logical '0' state.

Suitable input devices must be capable of shorting at least 12 milliamps of current to ground. This includes SPST switches, open collector NPN transistor circuits, Hall-effect sensors, reed relays, optical isolators and other devices. More than one switch may be wired to an input. For example, it may be useful to wire multiple switches to a FLT (fault) input, permitting the detection of a number of malfunctions.

HME X, Y: (pin 17, pin 4)

The HME input is used in conjunction with the "XH" or "YH" instruction to calibrate the motor to a known, physical location. Most step motor applications are open loop; the motor's position is inferred by adding or subtracting step pulses to the internal position register. It is assumed the motor will take the steps sent to it.

If a motor fails to take a step, or takes some extra ones, the position register will be in error with respect to the actual motor position. This error is accumulative because open loop operation does not feed back to the controller any motor position information.

A home instruction is used to clear possible errors between where the CN0170 assumes the motor is and where it actually is. It is usually invoked before a series of positioning moves are made. This is accomplished by driving the motor towards a switch that activates the HME input. The HME input switch is usually activated by the mechanism driven by the motor.

The CN0170's homing algorithm causes the motor to stop within one increment of motion of the HME input edge transition. The internal motor position register is then set to zero; defining the motor's home location.

In execution of the homing instruction, the motor seeks out the closed to open transition of the Home input switch. This permits the Home position to be located anywhere in the travel range of the motor if a cam operated Home input switch is used.

If the Home position is located at one extreme of the permissible travel range, or the switch is not cam operated, the switch installation should permit over-travel during the homing sequence. The mechanism activating the Home input switch might have considerable velocity upon initial contact. The contact velocity is based on variables such as rate of acceleration, command speed and distance from the Home position when the HOME instruction is invoked.

In detail, the HOME instruction sequence is as follows:

(1) Is the motor on the HME switch? If YES, go to (5).
(2) Accelerate towards the HME switch.
(3) Is the motor on the HME switch? If NO go to (2).
(4) Decelerate to a stop, reverse direction.
(5) Accelerate away from the HME switch.
(6) Is the motor on the HME switch? If YES, go to (5).
(7) Decelerate to a stop, reverse direction.
(8) Move towards the HME switch at Base Velocity. (If Base Velocity is zero, the move will occur at a velocity of 0.25 steps per second; the slowest possible rate.)
(9) Is the motor on the HME switch? If no, go to (8).
(10) Stop, reverse direction.
(11) Move away from HME switch at:
    - 256 steps/second (FULL STEP)
    - 128 steps/second (HALF STEP)
    - 25 steps/second (10 MICROSTEPS)
    - 2 steps/second (125 MICROSTEPS)

    Or at Base Velocity, whichever is lower
(12) Is the motor on the HME switch? If YES, go to (11).
(13) Stop motor.

The four different final speeds based on the drive resolution in (11) are to guarantee that the motor will stop within one increment of motion of the Home input switch opening. Be sure to set the base velocity high enough to allow the motor to move off the switch in a reasonable time. For most applications, 256 steps per second should be adequate.

FLT X, Y (pin 16, pin 3)

An active FLT input stops the step motor immediately. Its purpose is to act as an emergency stop. When a Fault input is sensed, operation ceases immediately. In IMMEDIATE MODE (M1), all pending instructions are canceled. In OPERATE MODE (M3) the program is reset.

If the FLT input activates while the motor is running, the step pulses to the motor drive are abruptly terminated. Since there is no deceleration, it is likely that the motor will lose synchronization if the speed is sufficiently high.

To clear the Fault condition, the FLT input must go inactive and a new instruction issued. If the system employs a Home switch and motor position relative to the Home switch is important, the next instruction should be XH (or YH).

When a Fault is sensed a KILL command is issued on the 'B' serial port of the CN0170. This signals the next CN0170 (in a daisy-chained system) to stop. The command will be passed down the entire chain by the CN0170s, ensuring all operation ceases. To route the KILL command back to the host, connect Serial connector pin 14 to pin 16 and pin 13 to pin 19 on the last CN0170 unit in the chain. In this configuration, all commands issued to the CN0170s will echo back to the host.

BSY X, Y: (pin 15, pin 2)

The BSY input, when used in conjunction with the STB output, synchronizes the CN0170 Motion Controller to an external process. See the STB X, Y section for a complete description.

The BSY input, when active, prevents the execution of a pending HOME, Point to Point, Linear Interpolation or Circular Interpolation instruction. The BSY input is sampled every 3.9 milliseconds while it is active and a move is pending. Once it goes inactive, the move begins and the BSY input is ignored thereafter. The BSY input is ignored for all other motion instructions.

IN 1,2: (pin 14, pin 1)

The IN inputs are user-defined inputs. The user may read the state of the inputs via the user's computer, independent of the ongoing motion control process. The IN inputs are considered on if the input is at a logical '0' or grounded state. The indicator LED is illuminated for an 'on' input. The IN inputs are considered off if the input is left open or driven with a 5 volt signal. The indicator LED is unlit for the off state. The IN inputs are sampled 256 times a second. Input states lasting less than 3.9 milliseconds may go unrecorded.

The IN 1 input may be designated as a GO instruction for the program residing in the CN0170. See the SOFTWARE MANUAL, CN0170 TWO AXIS MOTION CONTROLLER for details.

INPUTS, ANALOG:

The CN0170 has four analog inputs. Two analog inputs are dedicated for use with the Joystick instructions while the remaining two are designated as general-purpose inputs.

The analog inputs are multiplexed into a sample and hold circuit. The output of the sample and hold circuit is converted by an 8-bit digital to analog converter and read into the CN0170 memory. The user may read this data over the RS-232A interface. The analog inputs are converted in sequence, with an A/D conversion occurring every 3.9 milliseconds. This means any particular analog input is sampled 32 times a second.

The analog input voltage range must be between zero and 5 VDC. Care must be taken not to exceed these limits or damage may result. The inputs appear as a 200 ohm resistor in series with a 0.01μf capacitor.

The user may select one of two analog conversion ranges. The A/D can have a zero to full range of 0-5 volts or a reduced range of 2-3 volts. The reduced range makes the analog inputs directly compatible with potentiometric joysticks.

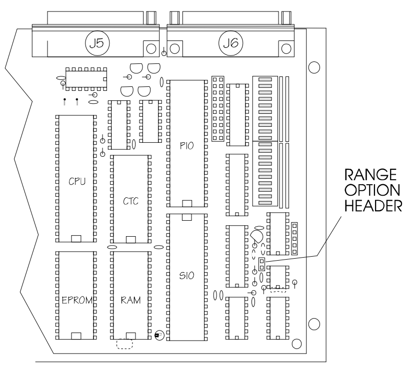


Figure 15, Range Option Header

The Range Option Header is used to select the appropriate A/D conversion range. The CN0170's cover must be removed for access to the header. Remove the four screws on the bottom of the CN0170 and lift the cover up at the LED indicator end.

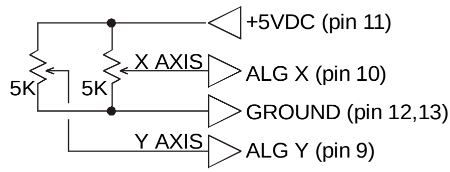
See Figure 15 for the location of the Range Option Header. For 0-5 VDC conversion range, connect the pins together with the jumper block provided.

For 2-3 VDC conversion range, remove the jumper block from the pins. The selected conversion range will apply to all four analog inputs.

ALG X, Y: (pin 10, pin 9)

The ALG analog inputs are used for joystick operation. The analog input is converted to an 8-bit value. This 8-bit value references to a look-up table in the CN0170. The table entry is multiplied by the programmed maximum velocity to form the command velocity for the motor. There are eight selectable look-up tables available to the programmer. They range from linear to logarithmic with various degrees of dead-band. The application determines which table is most suitable.

The ALG inputs may be used with a joystick or a potentiometer directly. A 5VDC supply is provided on the Control connector for powering the joystick or potentiometer.



F

igure 16, Joystick interface

The recommended minimum potentiometer resistance is 500 ohms and the maximum resistance is 5K ohms. The circuit diagram for connecting a joystick to the CN0170 is shown in
Figure 16.

The ALG input may also be driven by other electronic circuits such as op-amps. It is recommended that the source impedance not exceed 1000 ohms.

ALG 1, 2: (pin 23, pin 22)

The ALG 1 and ALG 2 inputs are general-purpose user inputs. The digital value of these inputs may read the over the serial interface. The input voltage range is from 0-5 VDC or 2-3 VDC. The input sample rate is 32 times a second.

POWER SUPPLY:

The CN0170 requires a single polarity power supply. All other circuit voltages are generated internally. An internal battery maintains stored parameters and programs in memory when the CN0170 is powered down. The input voltage may range from +8 VDC to +12 VDC. The power supply voltage does not have to be regulated if the ripple voltage lies between these limits.

+VDC: (pin 24, 25)

The +VDC pins are the main power supply input connections for the CN0170. Reverse polarity protection is provided by an internal series diode between the +VDC inputs and the CN0170 circuitry.

The +VDC current requirement depends on the number of status LEDs that are illuminated and how heavily the 'on' digital outputs are loaded. Worst case current draw is 400 milliamps; the minimum current is 80 milliamps. The actual current draw will be between these limits.

Maximum power dissipation is 3.2 watts. No special considerations for heat sinking are needed if the ambient temperature is less than 70 degrees Celsius.

The CN0170 has a power supply supervisor circuit on its internal 5 volt supply. This circuit monitors the supply voltage and operates the system reset and battery switchover functions. Because of hysteresis on its trip point voltages, there are no restrictions on power supply voltage rate of change.

GND: (pin 12,13)
The GND inputs are the power supply return lines. All inputs and outputs are referenced to this potential.

+5VDC: (pin 11)
The 5VDC output is provided to supply power to potentiometers or a joystick for use with the ALG inputs. This output may also be used as a power supply for a modest amount of external circuitry or devices. The maximum current draw is 300 milliamps for any external load.

Care must be taken not to short the 5VDC output to any output pin or ground. Failure to do so may result in damage to the CN0170.

AUXILIARY INPUT/OUTPUT CONNECTOR:
This connector is a 10x2 pin socket located inside the CN0170. It is necessary to remove the cover for access to this connector. The Auxiliary I/O Connector provides direct access to a Z80 PIO 'B' port. The port is TTL compatible. When programmed for output, each bit can drive Darlington transistors (1.5 mA @ 1.5 V). No buffering or isolation is provided. External circuitry may be required to prevent damage to the CN0170. The user is responsible to provide the appropriate interface to this port.

The Auxiliary I/O provides up to eight additional bits of digital input or output. See the SOFTWARE MANUAL, CN0170 TWO AXIS MOTION CONTROLLER for details on programming these channels.

An IDC (insulation displacement connector) Pin Connector may be used to facilitate access to the Aux. I/O channels. This implies operating the CN0170 with the cover removed. Care must be taken to keep foreign objects out of the controller to prevent contamination or circuit shorts. The location and pin assignments for the Auxiliary Input/Output Connector are shown in Figure 17.

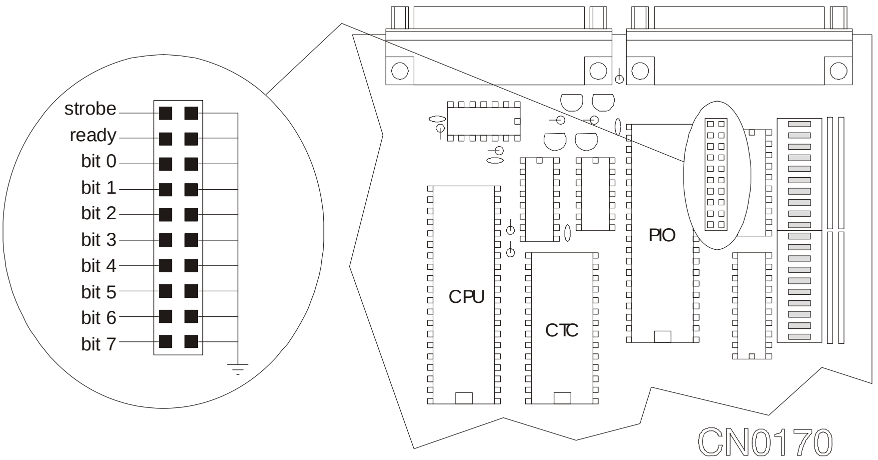


Figure 17, Auxiliary Input/Output Connector

SERIAL CONNECTOR:
The serial interface is a D25 plug connector labeled "SERIAL". It supports a primary channel 'A' as well as a secondary channel 'B'. The primary channel 'A' connects to the host computer.

The secondary channel may be connected to channel 'A of another CN0170, if desired. Up to 10 CN 0170 Motion Controllers may be connected in this daisy-chain configuration, providing a maximum of 20 axis' of motion control.

The secondary 'B' channel of the last CN0170 in the chain may pass data to other devices (printer, plotter, etc.). This means the host computer does not require an additional serial port for these devices.

The CN0170 features automatic baud rate selection, eliminating the need for baud rate switches. The CN0170 will automatically adjust to the host at the following baud rates: 300, 600, 1200, 2400, 4800, and 9600.

The baud rate is set by the host computer by sending a carriage return character (013 decimal) after power-up of the CN0170.

The secondary 'B' channel is set to the same baud rate as the primary channel.

SERIAL CABLE:
The user may order a serial cable from Centent if his system will require a single CN0170. This cable has the necessary jumpers built in for handshaking with an IBM PC compatible computer.

If more than one CN0170 is to be connected together, the user must fabricate his own serial cable. Figure 18 shows a typical connection diagram connecting a host computer with a 25-pin serial interface connector to two daisy-chained CN0170s.

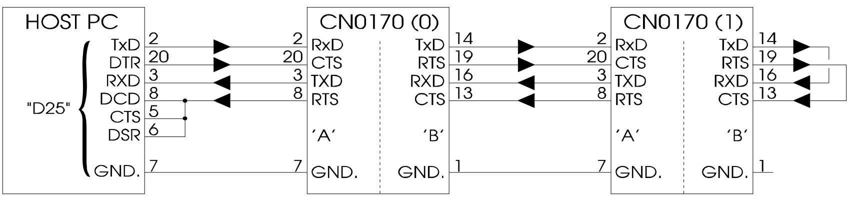


Figure 18, D25 RS232 connections

If the host computer has a 9 pin serial connector, refer to the diagram in Figure 19.

A D9 to D25 (female) cable must be fabricated to complete the serial interface.

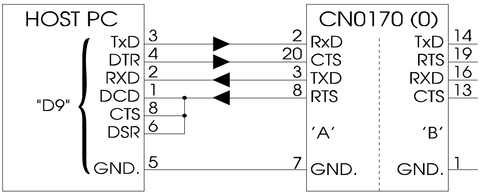


Figure 19, D9 RS232 connections

BATTERY REPLACEMENT:
The CN0170 uses two AAA alkaline batteries for data retention in the CMOS static memory. The current consumption is about 20 µA when the CN0170 is powered down. This equates to at least a year of battery life.

Battery replacement is indicated when battery voltage is less than 2.8 volts. Replacement is suggested on a yearly schedule regardless of battery voltage. Any evidence of battery leakage requires immediate replacement.

To replace the batteries, remove the four screws on the bottom of the CN0170. Lift the cover up at the Indicator LED side and remove it. The battery holder position is shown in Figure 20.

If possible, have power applied to the CN0170 during battery replacement. If it is not possible, the CN0170 will maintain the program and parameters for about 2 minutes.

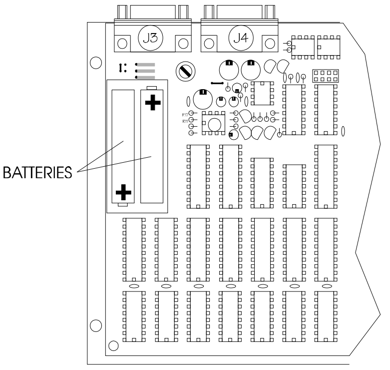


Figure 20, Batteries

Observe the correct polarity when inserting the new batteries in the battery holder.

CONNECTOR DIAGRAMS:

MOTOR INTERFACE	
PIN	FUNCTION
1	IRET
2	ISET
3	5VDC
4	STEP
5	DIR
6-9	GROUND

CONTROL INTERFACE	
PIN	FUNCTION
1	IN 2
2	BSY Y
3	FLT Y
4	HME Y
5	RUN Y
6	SPD X
7	RUN X
8	OUT 1
9	ALG Y
10	ALG X
11	5 VDC
12	GND
13	GND
14	IN 1
15	BSY X
16	FLT X
17	HME X
18	STB X
19	SPD Y
20	OUT 2
21	STB Y
22	ALG 2
23	ALG 1
24	+VDC
25	+VDC

SERIAL INTERFACE	
PIN	FUNCTION
1	SIGNAL GROUND
2	RxD (PORT A)
3	TxD (PORT A)
7	SIGNAL GROUND
8	RTS (PORT A)
13	CTS (PORT B)
14	TxD (PORT B)
16	RxD (PORT B)
19	RTS (PORT B)
20	CTS (PORT A)