CLIF MOCK™

CD-20 Sample Probe Controller User Manual

c UL us LISTED
Class I Groups C and D
Hazardous Locations

Manual No. 2350752-01, Rev. 02

Important Safety Information

Symbols and Terms Used in this Manual

WARNING: This symbol identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

CAUTION: Indicates actions or procedures which if not performed correctly may lead to personal injury or incorrect function of the instrument or connected equipment.

Important: Indicates actions or procedures which may affect instrument operation or may lead to an instrument response which is not planned.

This product must be operated within the parameters stated in this manual and in conjunction with the ratings printed on the product serial tag.

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Section 1—Overview

The CD-20 Sample Probe Controller is engineered for use with the True-Cut C-Series sample probe. It provides both pulse input (flow proportional) and repeat (time proportional) control of the sample probe. When a "start" pulse is received, the probe is rotated to capture and discharge a 1.5-ml isokinetic sample. When installed in a horizontal line, the probe is stopped in the closed position, while on a vertical line the probe is stopped in the open position.

The C21 probe collects one 1.5 cc sample per 360-degree rotation.

The C22 probe collects two 1.5 cc samples per 360-degree rotation.

An explosion-proof housing encloses the complete assembly, and two ¾-in. NPT holes allow connection of the line power and input pulse (for flow-proportional sampling). A ½-in. breather plug and a ½-in. conduit plug are installed on opposite sides of the enclosure.

A coupling, jam nut, and hub allow the assembly to be mounted directly to the C-Series sample probe. No brackets or supports are required; however, they are recommended for piping with significant vibration.

The CD-20 controller (Figure 1.1) consists of the following:

- a motor control assembly (12VDC, 24VDC, 115VAC, or 230VAC)
- a DC gear motor with a gear ratio of 150:1
- a cam with two high points mounted on the gear motor output shaft
- a proximity switch

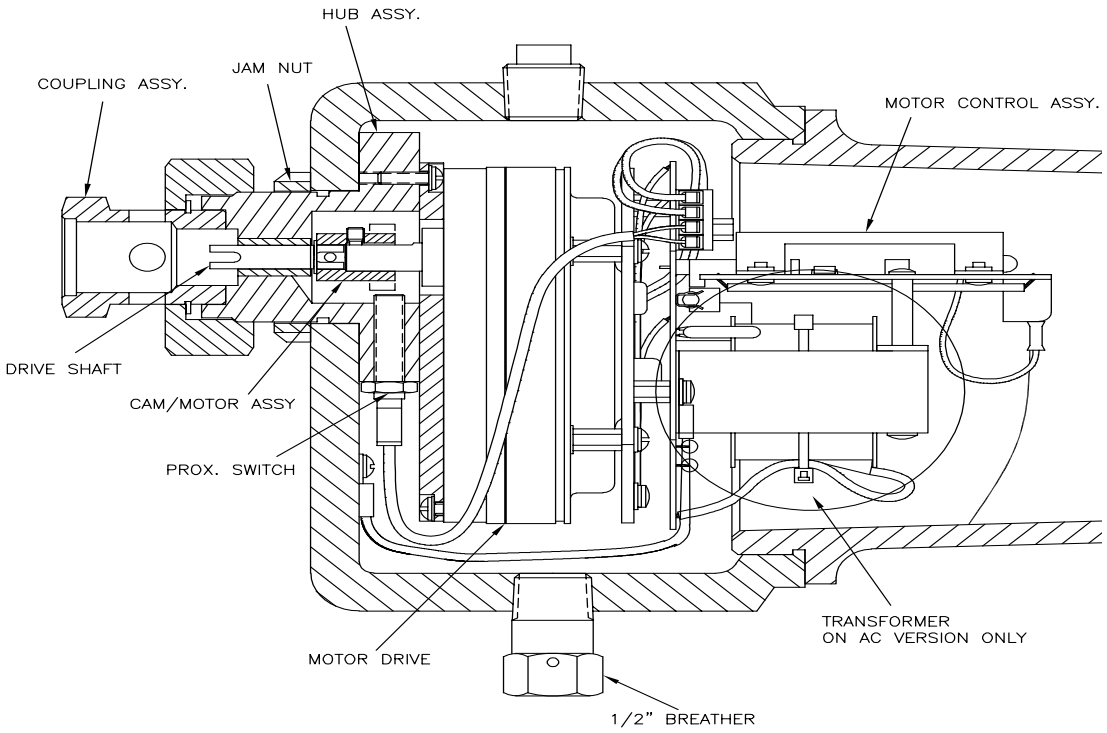

Figure 1.1—CD-20 controller components

The motor control assembly (Figure 1.2) consists of a control card and power board mounted to a ring, which in turn, is mounted to the back of the CD-20 gear motor. All field connections are to terminal block 1TB on the control card. The motor and proximity switch connections are made at the factory to terminal block 2TB on the power board.

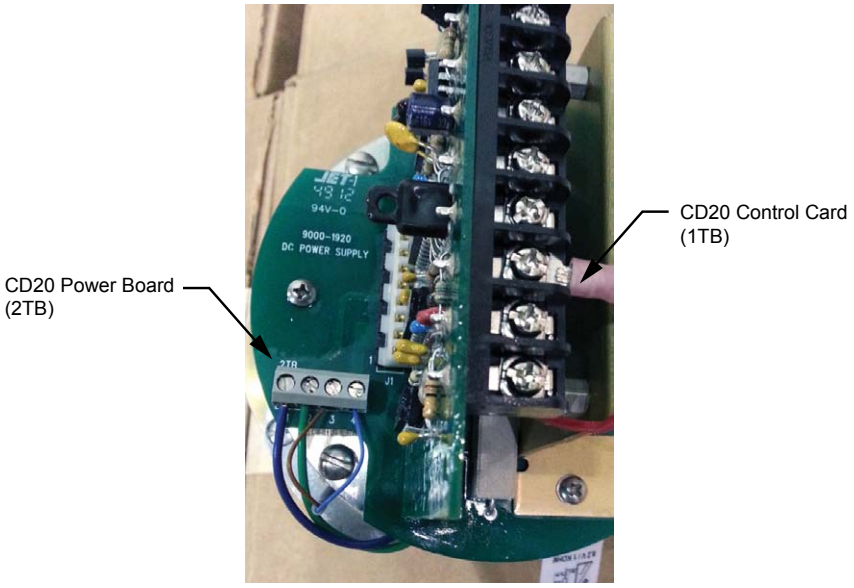

Figure 1.2—CD-20 motor control assembly

How It Works

When an input pulse from either the repeat-mode timer or an external pulse source is received, a command is output to rotate the motor. Armature feedback controls the speed of the motor at about 12 rpm and current feedback limits motor current to 3 amperes.

Time-proportional sampling may be configured for a sampling frequency of 3 seconds to 3 minutes.

Flow-proportional sampling requires that the pulse input be closed for at least 5 msec to produce a “start” pulse. An electronic square wave input must have an amplitude of 12VDC.

The proximity switch input amplifier provides the signal to stop the motor. Two LEDs installed on the controller card allow the user to test the controller’s operation. The I-LIMIT LED is on when the drive is in current limit, which is normal during acceleration.The PROX (“Hold”) LED is on when the motor is stopped.

Field wiring instructions are provided in Section 2—Installation and Wiring, page 7. A signal verifying the 180-degree rotation of the motor can be transmitted to a control room if desired.

Hazardous Location Safety Compliance

Assemblies designed for 24VDC, 115VAC and 230VAC input power are UL-listed in the US and Canada for Class I Groups C and D Hazardous Locations.

A 12VDC controller is available without the UL listing.

Table 1.1—CD-20 Specifications

	24 VDC	115/230 VAC
Temperature	-40ºC to 55ºC	-40ºC to 55ºC
Voltage	24VDC @2A max	115 / 230 VAC @ 1A max
Pulse Input	12VDC	12VDC
Transistor Output	12VDC max @ 100mA max	12VDC max @ 100mA max
Current Draw (Controller)		
Stop Mode	30 mA	60 mA
Running Mode	0.5 Amp	150 mA
Peak Motor (Turn On) Current	1 Amp	300 mA
Current Draw (Motor)		
Motor (Turn On) Current	320 mA	850 mA

Section 2—Installation and Wiring

WARNING: This module is designed for connection to hazardous electric voltages. Ignoring this warning can result in severe personal injury or mechanical damage. This product must be reliably earthed and installed by qualified personnel in accordance with the prevailing local electrical wiring regulations and safety standards.

The CD-20 controller mounts directly to the C-Series sample probe via the DC-2 coupling (Figure 2.1). The DC-2 coupling should be hand-tightened to ensure that the internal retaining ring is not pushed out of its groove. If the DC-2 coupling is over-tightened at the CD-20 hub, the motor shaft will not engage the DC-1 coupling on the probe.

Figure 2.1—DC-2 coupling

All field connections are made to terminal block 1TB on the control card (Figure 2.2). Install wiring as follows:

1. Connect power to 1TB-1 and 1TB-2.
2. Connect the flow pulse input contact to 1TB-5 and 1TB-6. If an open collector transistor driver is used, connect the collector to 1TB-5 and connect the emitter to 1TB-6 (common).

Note The input pulse contact must be closed for at least 5 msec to produce a start pulse. An electronic square wave input must have a pulse amplitude of 12VDC. A 5VDC square wave will not work.

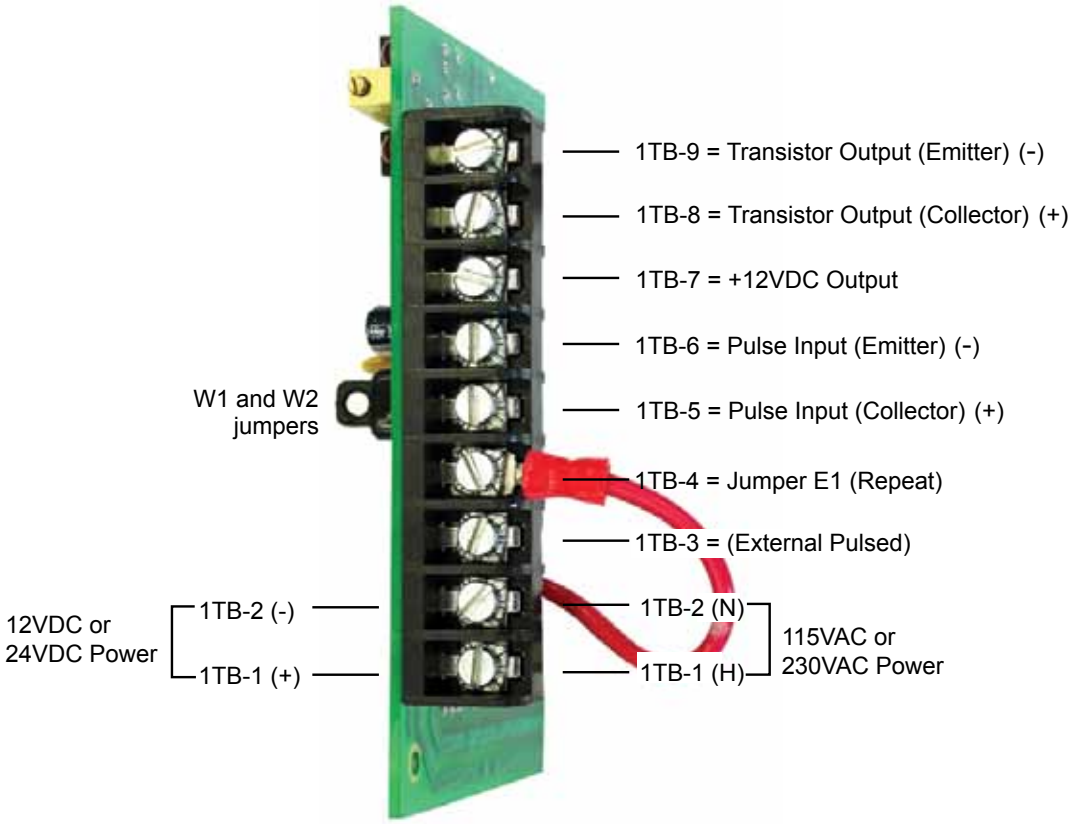

Figure 2.2—Field wiring of CD-20 controller

3. Configure the on-board jumper E1 to select the source of "start" pulses for the CD-20 control logic.
   - For external pulsed mode, connect jumper E1 to 1TB-3.
   - For the repeat mode (time-proportional sampling), connect jumper E1 to 1TB-4, as shown in Figure 2.2.
4. To power an external flow pulse circuit such as a turbine meter pre-amplifier, connect the instrument to the +12VDC output at 1TB-7. Maximum current from this supply is 50 mA.
5. If a signal verifying the rotation of the motor is desired in a control room, connect the transistor output contact to 1TB-8 (collector) and 1TB-9 (emitter). Check the position of jumpers W1 and W2 to designate whether the transistor will turn on or off when the proximity switch is opposite the high point on the cam (Figure 2.3, page 9).

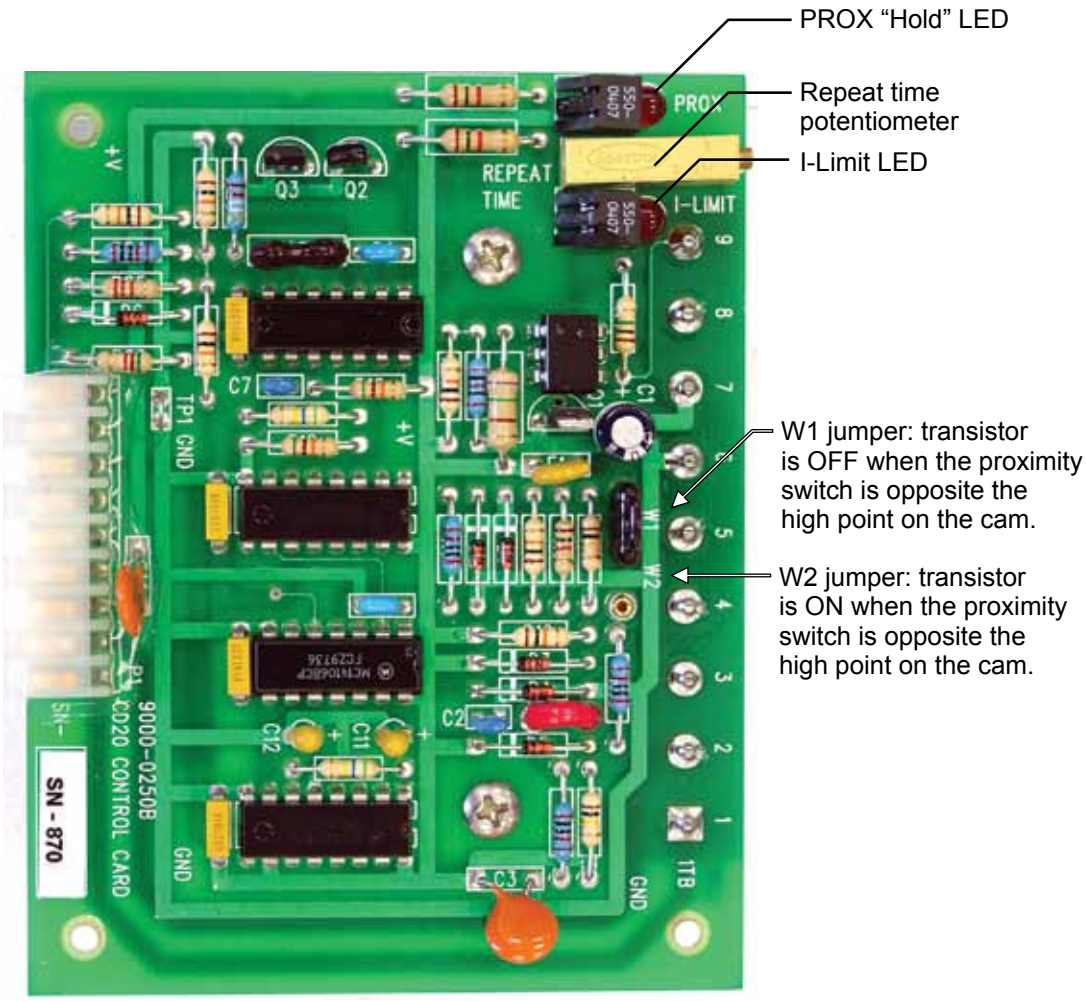

Figure 2.3—CD-20 control card, full view

Section 3—Maintenance

Operational Test

The start-up procedure consists of three steps: a repeat-mode checkout, an external input pulse mode checkout, and a sample probe/control drive checkout. The following user-supplied equipment is required to complete these tests:

- push-button switch
- power supply
- a 100-ml graduated beaker or other applicable measuring device

Note If the CD20A controller is connected to a sample probe, disconnect it before performing the following procedures.

Repeat Mode (Time-Proportional) Check-Out

The repeat time potentiometer (Figure 2.3), which determines the rate of sampling when the controller is connected to a probe, is typically set at the factory at 15 seconds. However, it can be adjusted over a range of 3 seconds to 3 minutes.

To perform the repeat mode check-out,

1. Connect jumper E1 to terminal 1TB-4 (Figure 2.2, page 8).
2. Apply input power to the CD-20 control card. Input power will be 12VDC, 24VDC, 115VAC or 230VAC, depending on the controller model purchased.
3. Verify that the motor rotates 180 degrees and stops. This should take approximately 2.5 seconds. The process should repeat at regular intervals as determined by the potentiometer (off delay) setting.

Note—Any input pulses that occur when the CD-20SFA is rotating are disregarded by the control logic.

4. Verify that the PROX (“Hold”) LED is on while the motor is stopped.The PROX (“Hold”) LED should be off while the motor is running and turn on when the motor stops.
5. Verify the I-LIMIT LED blinks on momentarily during acceleration of the CD-20 motor. After the motor reaches the 12 RPM running speed, the I-LIMIT LED should turn off.
6. Verify the CD-20 output shaft rotates in a *clockwise* direction as you look at the shaft from the bottom of the CD20. The sample probe will rotate *counterclockwise* when the CD-20 controller is connected. If the direction of motor rotation is wrong, swap the motor armature leads at 2TB-1 and 2TB-2.

External Pulse Mode (Flow-Proportional) Check-Out

1. Disconnect the input power from the CD-20.
2. Move the E1 jumper to 1TB-3 to select the external pulse input mode (Figure 2.2, page 8).
3. Connect a push-button switch to 1TB-5 and 1TB-6.
4. Apply power to the CD-20 control card.
5. Activate the switch to generate a pulse input to the motor control assembly. To be registered by the control logic, the input pulse must have a duration of 5 msec or longer and it must occur when the CD-20 motor is stopped and the PROX (“Hold”) LED is on.
6. Verify the CD-20 output shaft rotates 180 degrees for each external pulse.

Note—Any input pulses that occur when the CD-20 is rotating are disregarded by the control logic.

Sample Probe and CD-20 Check-Out

1. Disconnect input power from the CD-20.
2. Mount the CD-20 to the sample probe and hand-tighten the DC-2 coupling.
3. Make sure the push-button switch is still connected to 1TB-5 and 1TB-6.
4. Verify that the product line is full and pressurized.

5. Reconnect input power to the CD-20.
6. Hold a 100-ml graduated beaker (or other applicable measuring device) under the probe's discharge.
7. Activate the switch repeatedly to collect 10 samples, 1.5 cc each.

Motor Control Assembly

The CD-20 motor control assembly (Figure 1.2, page 6) consists of a control card and power board mounted to a ring, which in turn, is mounted to the back of the CD-20 gear motor.

Control Card Functions

When an input pulse from either the repeat-mode timer or an external pulse source is received, a speed command is output to rotate the motor. Armature feedback controls the speed of the motor at about 12 rpm and current feedback limits motor current to 3 amperes.

The proximity switch input amplifier provides the signal to stop the motor.

The I-LIMIT LED is on when the drive is in current limit, which is normal during acceleration.

The PROX ("Hold") LED is on when the motor is stopped.

Power Board Functions—12VDC and 24VDC Controllers

The 12VDC and 24VDC power boards provide the following functions:

- Fuse F1 (2-amp, fast-acting) provides short circuit protection. ZD1, a 33V "crowbar" zener diode, provides over voltage protection for the rest of the circuit.
- Diode D2 prevents current flow if +12/24VDC power is connected to the common terminal and a ground is connected to the +12/24VDC terminal.
- Q4, an LT1074CT switching regulator and associated circuitry efficiently convert the +12/24VDC into a regulated +6.3VDC motor supply voltage.
- The control card uses motor armature feedback to set the speed command to the motor driver power FET Q2.
- A stop command from the control card to Q1 provides motor braking which prevents the motor from coasting past the stopping point.
- R6 is the motor current feedback resistor. The motor current is limited to 3.0 amps.
- Fuse F2 (2-amp, slow blow) will open in less than 1 minute if the motor is stalled (locked rotor).

Table 3.1—Troubleshooting Tips for 12VDC/24VDC Controllers

Problem	Probable Cause	
Input power fuse F1 open.	Input power surge above 33VDC.	Check fuse F1. Replace as required.
	Short circuit on the power board.	Return to factory for replacement of power board.
Motor Fuse F2 open.	Motor stall (locked rotor).	Check fuse F2. Replace as required.
	Short circuit in motor armature circuit.	Return to factory for replacement of control card.
Motor does not run and the current limit LED is off.	Input power not on or connected backwards.	Check wiring of 1TB-1 and 1TB-2 on control card.
	Fuse F1 or F2 open.	Check fuse continuity. Replace fuses as required.
	Open circuit to motor armature.	Check wiring of 2TB-1 and 2TB-2 on power board.
	CD-20 control failure.	Return to factory for replacement of control card.
	Jumper E1 not connected to 1TB-3 or 1TB-4.	Check jumper position.
	Pulsed mode selected but no pulses of proper amplitude at 1TB-5 to 1TB-6.	Verify the pulse input signal is present.
Motor continues to run. The PROX (“Hold”) LED never comes on or blinks on and off.	Broken or open proximity switch wire.	Check wiring of 2TB-3 and 2TB-4.
	The proximity switch is not sensing the high points of the cam.	Check proximity switch and cam alignment.
	CD-20 control failure (power supply board).	Return to factory for replacement of CD-20 motor control assembly.

Power Board Functions—115VAC and 230VAC Controllers

The CD-20 power board provides the following functions:

- Fuse F1 (1-amp, type AGC) provides short circuit protection. It will open if there is a short in the primary or secondary of transformer T1.
  - ***For 115VAC units***, transformer T1 converts the input power to 14 VRMS secondary power when primary jumpers W1 and W2 are installed on the power board. ***Note: Do not confuse these jumpers with W1 and W2 on the control card.***
  - ***For 230VAC units***, transformer T1 converts the input power to 14 VRMS secondary power when primary jumper W3 is installed on the power board.
- Diodes CR2, CR3, CR4, and CR5 provide full-wave rectified DC voltage for use in driving the motor.
- Transistor circuits including Q1, Q2, and Q4 provide the basic speed control and drive for the CD-20 gear motor, which has a 9VDC armature and pm field.
- Power Fet Q3 is on when the RUN/STOP latch is commanding the motor to stop. Q3 provides electronic braking of the motor to minimize coast past the desired probe stopping point.
- Resistor R5 is the current-sensing resistor for the current limit switch.
- Regulator U1 provides +12VDC for the control card.

Table 3.2—Troubleshooting Tips for 115VAC/230VAC Controllers

Problem	Probable Cause	
Input power fuse F1 is open.	Input power surge above 250VAC.	Check fuse F1. Replace as required.
	Transformer T1 has an internal secondary winding or primary winding short.	Return to factory for replacement of T1 or power board.
	Rectifier diode CR2, CR3, CR4, or CR5 shorted.	Check diodes with an ohmmeter and return to factory for replacement of power board or CD-20 motor control.
	Input power transformer jumper is installed incorrectly.	Check for jumper across power input (115VAC or 230VAC) to Neutral.
Current limit LED is on, the motor is stopped.	Sample probe jammed or the motor armature is driving the probe backwards (clockwise) against the cam drop off point.	To isolate the problem, power down and remove the CD-20 from the probe and verify CD-20 output shaft turns clockwise as you look at it in repeat mode. Verify sample probe can be turned counterclockwise with a screwdriver and proper discharge is obtained.
	Short across A1 to A2 of CD-20 motor output due to a short in power FET Q3.	Power down, remove motor leads, and verify that when power is reapplied, the current limit light is off. Then check motor armature resistance to verify the short circuit. If motor circuit checks out, return to factory for replacement of CD-20 motor control assembly.
	Bind-up in gear box.	Return to factory for replacement of 150:1 ratio gear motor.
	Transistor Q4 or Q2 has failed.	Return to factory for replacement of CD-20 motor control assembly or power board.
Current limit LED is on, motor runs at a slow speed.	CD-20 current limit circuit failure.	Return to factory for replacement of CD-20 motor control.
Motor does not run.	Input power not on.	Check for proper input voltage at 1TB-1 and 1TB-2.
	Fuse clips corroded and F1 is not making contact or fuse F1 is open.	With power off, check fuse F1 continuity from 1TB-1 through the F1 fuse clips.
	Jumper E1 is not connected to 1TB-3 or 1TB-4.	Connect E1 to 1TB-3 for pulsed mode operation or 1TB-4 for repeat mode operation.
	Motor circuit open or leads not connected to 2TB-1 and 2TB-2.	Verify motor wiring. Verify motor impedance by disconnecting the motor leads and check for an open armature.
	Transistor Q4 or Q2 has failed.	Return to factory for replacement of CD-20 motor control assembly or power board.

Factory Repairs

Important **The UL Listing mark applies to the CD Series controller in its original factory condition. To maintain certification, repairs must be performed by a UL-authorized Cameron facility. Attempts to modify the product at any other location will make the certification invalid.**

To return a product for repair, contact Cameron to request an Return to Manufacturer Authorization (RMA) form and shipping instructions.

Phone: 1-800-654-3760; 281-582-9500
Fax: 281-582-9599
Email: SupportUSA.Jiskoot@c-a-m.com

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