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CLIF MOCK™

CD-20SFA Sample Probe Controller User Manual

c UL us LISTED

Class I Groups C and D
Hazardous Locations

Manual No. 2350754-01, 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-20SFA Sample Probe Controller is engineered to provide pulse input (flow proportional) control of the True-Cut C-Series sample probe. When a "start" pulse is received, the probe is rotated to capture and discharge an 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.

A failure alarm relay provides an output to alert users to a loss of power, loss of input signal, or motor failure. The relay contact remains open (inactive) for as long as a sample is being taken within the alarm delay period configured with the control card potentiometer. Alarm delays can range from 5 seconds to 6 minutes.

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-20SFA controller consists of the following:

- a motor control assembly (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 mounted in the hub assembly opposite the cam

When a high point on the cam is opposite the proximity switch, the PROX ("Hold") LED is illuminated. This signal indicates the sample probe is at the "stop and hold" position.

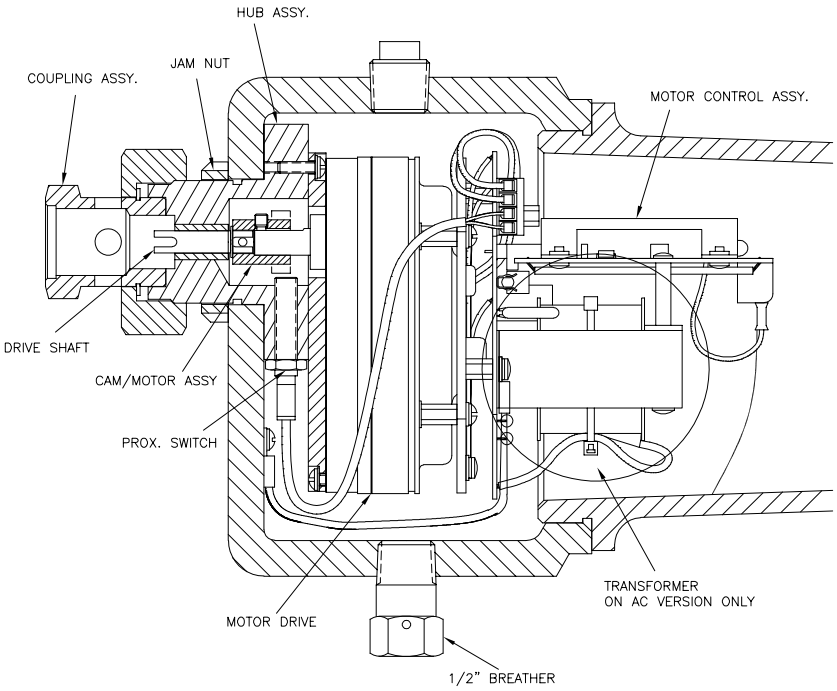

Figure 1.1—CD-20SFA controller components

The CD-20SFA 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-20SFA 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.

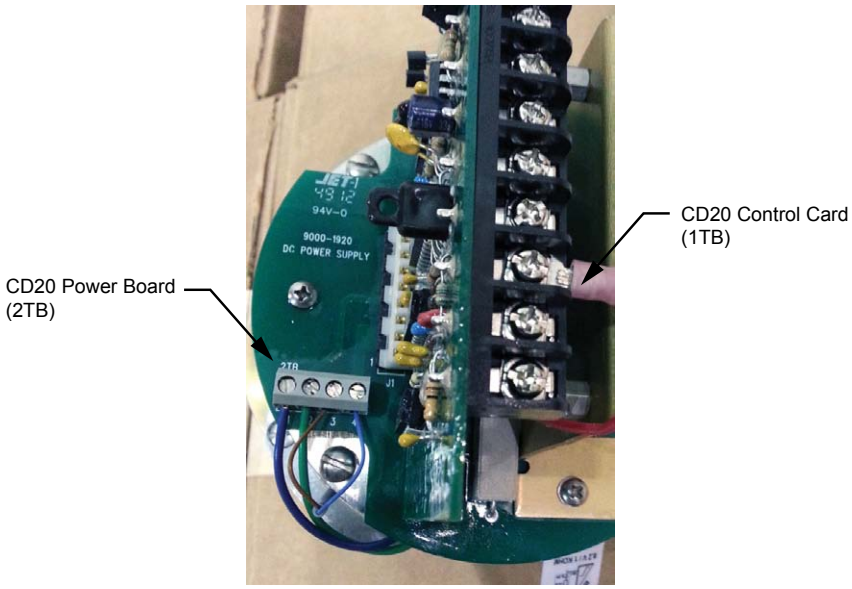

Figure 1.2—CD-20SFA motor control assembly

How It Works

When an input pulse from 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.

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.

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.

Table 1.1—CD-20SFA 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-20SFA 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-20SFA 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, page 8). 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.

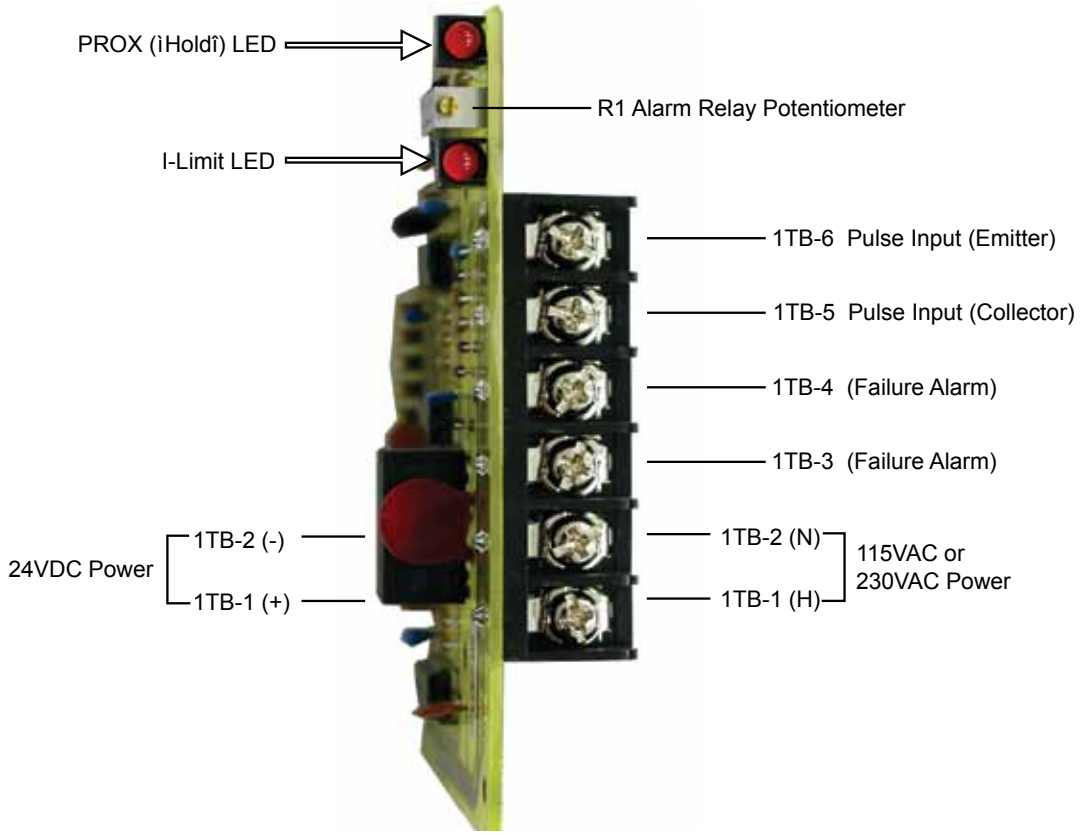

Figure 2.2—Field wiring of CD-20SFA controller

3. Connect the sample failure alarm relay contact to 1TB-3 and 1TB-4. The contact will remain open for as long as sampling occurs within the alarm delay period. This contact is rated for 90 VA resistive and 30 VA inductive loads. It is suitable for use with 115VAC low current.
4. Adjust the alarm delay time by turning the R1 potentiometer screw clockwise. Alarm delays ranging from 5 seconds to 6 minutes can be selected via this adjustment.

Section 3—Maintenance

Operational Test

If the operation of the instrument is in question, the following procedures can help isolate the problem. The following user-supplied equipment is required:

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

Basic CD-20SFA Check-Out

1. Disconnect the probe from the CD-20SFA.
2. Disconnect the input power from the CD-20SFA.
3. Connect a push-button switch to 1TB-5 and 1TB-6 on the control card.
4. Reconnect input power to the CD-20SFA.
5. Activate the switch and verify the CD-20SFA output shaft rotates 180 degrees with each pulse. Wait for the shaft to stop rotating before repeating the switch activation.

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

6. Connect the multimeter to 1TB-3 and 1TB-4 on the control card.
7. Wait for the configured alarm period to expire (factory default period is 5 seconds) and verify that the alarm relay contact closes.
8. Activate the push-button switch to send a pulse and verify that the alarm relay contact opens.
9. Repeat steps 7 and 8 as required.

Sample Probe and CD-20SFA Check-Out

1. Disconnect input power from the CD-20SFA. The push-button switch should still be connected to 1TB-5 and 1TB-6.
2. Mount the CD-20SFA to the sample probe and hand-tighten the DC-2 coupling.
3. Verify that the product line is full and pressurized.
4. Reconnect input power to the CD-20SFA.
5. Hold a 100-ml graduated beaker (or other applicable measuring device) under the probe's discharge.
6. Activate the switch repeatedly to collect 10 samples, 1.5 cc each.

Motor Control Assembly

The 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-20A gear motor.

Control Card Functions

The CD20-SFA control card performs the following functions:

- Components C7, R12, CR5, and a U4 gate provide a 100-msec power-up reset.
- An alarm delay timer circuit is implemented with U3, C6, C10, R4, R1 and a U4 gate. This circuit is reset every time a sample is taken and on initial power-up. U3 counts oscillator pulses and de-energizes relay 1CR after counting 2048 clock pulses from U4 pin 6.
- An input filter circuit connected to 1TB-5 buffers incoming pulses from an external flow measuring device. The filter has a 2msec time constant, and the input pulse duration must be at least 5 msec to assure a start pulse output.

- When set by a start pulse, the RUN/STOP latch U5A outputs the speed command voltage to the summing point control amplifier U2A.
- Amplifier U2B provides current feedback to the summing point control amplifier U2A.
- Resistor R19 provides armature voltage feedback to the summing point control amplifier U2A.
- DS2 is the current limit LED indicator.
- DS1 is the PROX ("Hold") LED indicator.
- U2C is the proximity switch amplifier. The voltage across the proximity switch (2TB-3 to 2TB-4 on the power board) will be nominally +8VDC when the proximity switch is sensing metal and +4VDC when the proximity switch is sensing an absence of metal.
- Latch U5B outputs a single 20-msec one-shot pulse to reset the RUN/STOP latch U5A when the proximity switch first senses a high point on the cam.

Power Board Functions

The power board provides 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 +VDC power is connected to the common terminal and a ground is connected to the +VDC terminal.
- Q4, an LT1074CT switching regulator and associated circuitry efficiently convert the +VDC 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

Problem	Probable Cause	Recommended Action
Input power fuse F1 open.	Input power surge above 33VDC.	Check fuse F1.
	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.
	Short circuit in motor armature circuit.	Return to factory for replacement of control card.

Problem	Probable Cause	Recommended Action
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.
	Open circuit to motor armature.	Check wiring of 2TB-1 and 2TB-2 on power board.
	CD-20SFA control failure.	Return to factory for replacement of control card.
	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-20SFA control failure (power supply board).	Return to factory for replacement of CD-20SFA motor control assembly.

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

Return shipments should be addressed to:

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