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***CD20 (115VAC)  
Sampler Drive***

***User Manual***

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## Description

The CD20-115VAC Control and Drive Assembly is engineered specifically for use with the True-Cut C-Series sample probe. It comprises the following components:

- a motor speed control that provides both pulse input (flow-proportional) and repeat (time-proportional) control of the sample probe. When a “start” pulse is received at the CD20 control card input, the probe is driven 180 degrees to capture and discharge a single 1.5-ml isokinetic sample. On a horizontal line, the probe is stopped in the closed position, while on a vertical line, the probe is stopped in the open position.
- a DC gear motor with a gear ratio of 150:1
- a cam with two high points located opposite each other, 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, a signal is output to the CD20 motor control electronics that indicates the sample probe is at the stop and "Hold" position.
- the coupling, jam nut, and hub which allow the CD20 Control and Drive Assembly to be mounted directly to the C-Series sample probe. No brackets or supports are required; however, they are recommended on pipelines with significant vibration.
- an explosion-proof housing which encloses the complete assembly. Two ¾-in.-in. NPT holes allow connection of the 115VAC 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.
- rotation acknowledgement or verification that the motor has rotated at least 180 degrees.

## Installation and Wiring

The CD20 mounts directly to the C-Series sample probe via the DC-2 coupling. 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 CD20 hub, the motor shaft will not engage the DC-1 coupling on the probe.

Use the following steps to install field wiring to the CD20-115VAC (Figure 1):

1. Connect 115VAC 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. If an electronic square wave input is used, it must have a pulse amplitude of 12VDC. A 5VDC square wave will not work.

3. The on-board jumper E1 selects the source of “start” pulses for the CD20 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 1.
4. 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).

**Note**— A +12VDC output is available at 1TB-7 for powering external flow pulse circuits such as a turbine meter pre-amplifier. Maximum current from this supply is 50 mA.

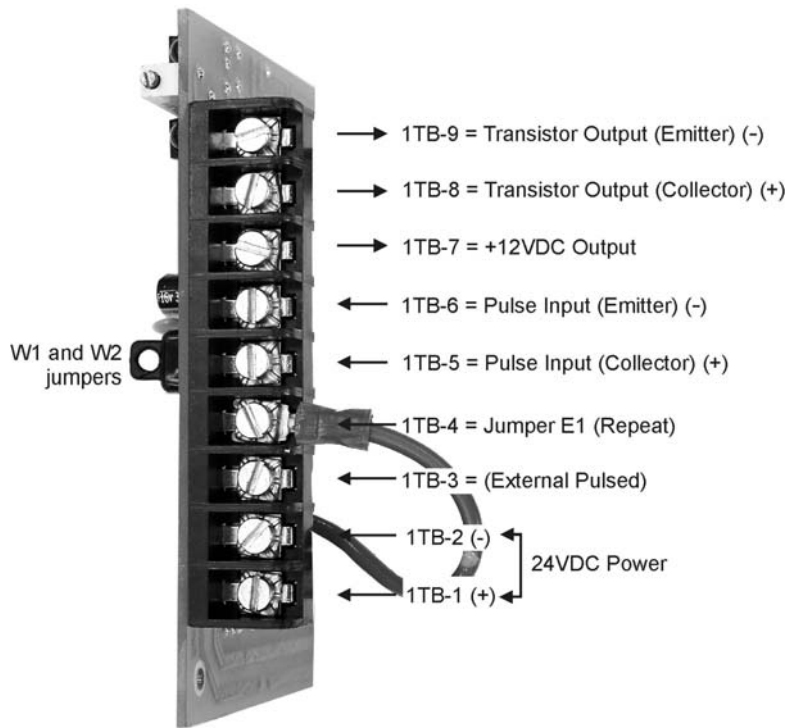


Figure 1—Field wiring of CD20 (115VAC) assembly

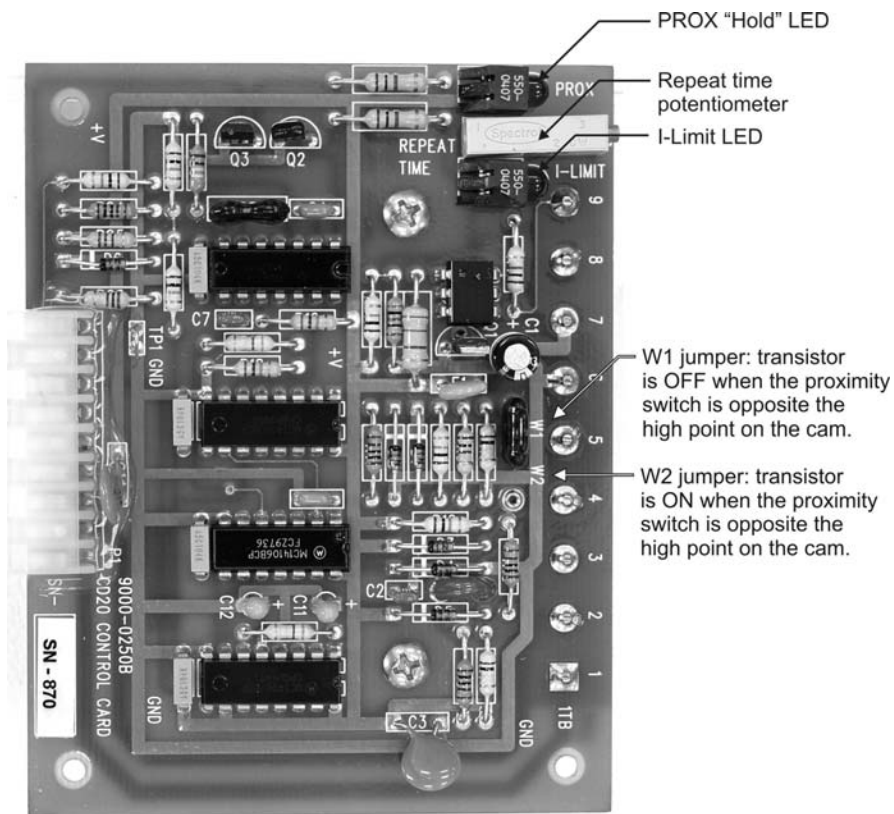


Figure 2—CD20 (115VAC) control card (full view)

## Start-up Procedure

The start-up procedure consists of four steps: a pretest, a repeat-mode checkout, an external input pulse mode checkout, and a sample probe/control drive checkout. Each of these is described below.

### Pre-Test Procedure

1. Disconnect the CD20 control and drive assembly from the sample probe.
2. Connect a push button switch across 1TB-5 and 1TB-6 for test purposes.

### Repeat Mode Check-Out

1. Connect jumper E1 to terminal 1TB-4.
2. Apply 115VAC input power to the CD20-115VAC control card.
3. The repeat time potentiometer can be adjusted for off-delay times of 3 seconds to 3 minutes. Verify that the motor rotates 180 degrees and stops for each repeat pulse. Also verify that the PROX (“Hold”) LED is on while the motor is stopped.
4. Verify that the CD20 output shaft rotates in a clockwise direction as you look at the shaft. The sample probe will be rotated counterclockwise (CCW) when the CD20 drive is connected to it. If the direction of motor rotation is wrong, swap the motor armature leads at 2TB-1 and 2TB-2.
5. Verify that the I-LIMIT LED blinks on momentarily during acceleration of the CD20 motor. After the motor reaches the 12-rpm running speed, the I-LIMIT LED should turn off.

The PROX (“Hold”) LED should be off while the motor is running and should turn on when the motor stops. It should take about 2.5 seconds for the motor to rotate 180 degrees and stop.

### External Input Pulse Mode Check-Out

1. Disconnect the 115VAC input power from the CD20.
2. Move the E1 jumper to 1TB-3 to select the external pulse input mode.
3. Connect a pulse input or switch to 1TB-5 and 1TB-6.
4. Apply 115VAC power to the CD20 control card.
5. Verify that the CD20 output shaft rotates 180 degrees for each external input pulse.

Note—Any input pulses that occur when the CD20 is running are disregarded by the control logic. 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 CD20 motor is stopped and the PROX (“Hold”) LED is on.

### Sample Probe and CD20 Check-Out

1. Disconnect power from the CD20.
2. Mount the CD20 to the sample probe and hand-tighten the DC-2 coupling.
3. Verify that the product line is full and pressurized.
4. Hold a 100-ml graduated beaker (or other applicable measuring device) under the probe’s discharge and collect 10 samples. Each sample should be 1.5 ml in size; therefore, the total volume for 10 samples should be 15 ml.

## Motor Control Operation

The CD20 motor control assembly consists of a control card and power board mounted to a ring, which in turn, is mounted to the back of the CD20 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.

### 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 mode, which is normal during acceleration.

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

### Power Board Functions

The CD20 power board provides the following functions:

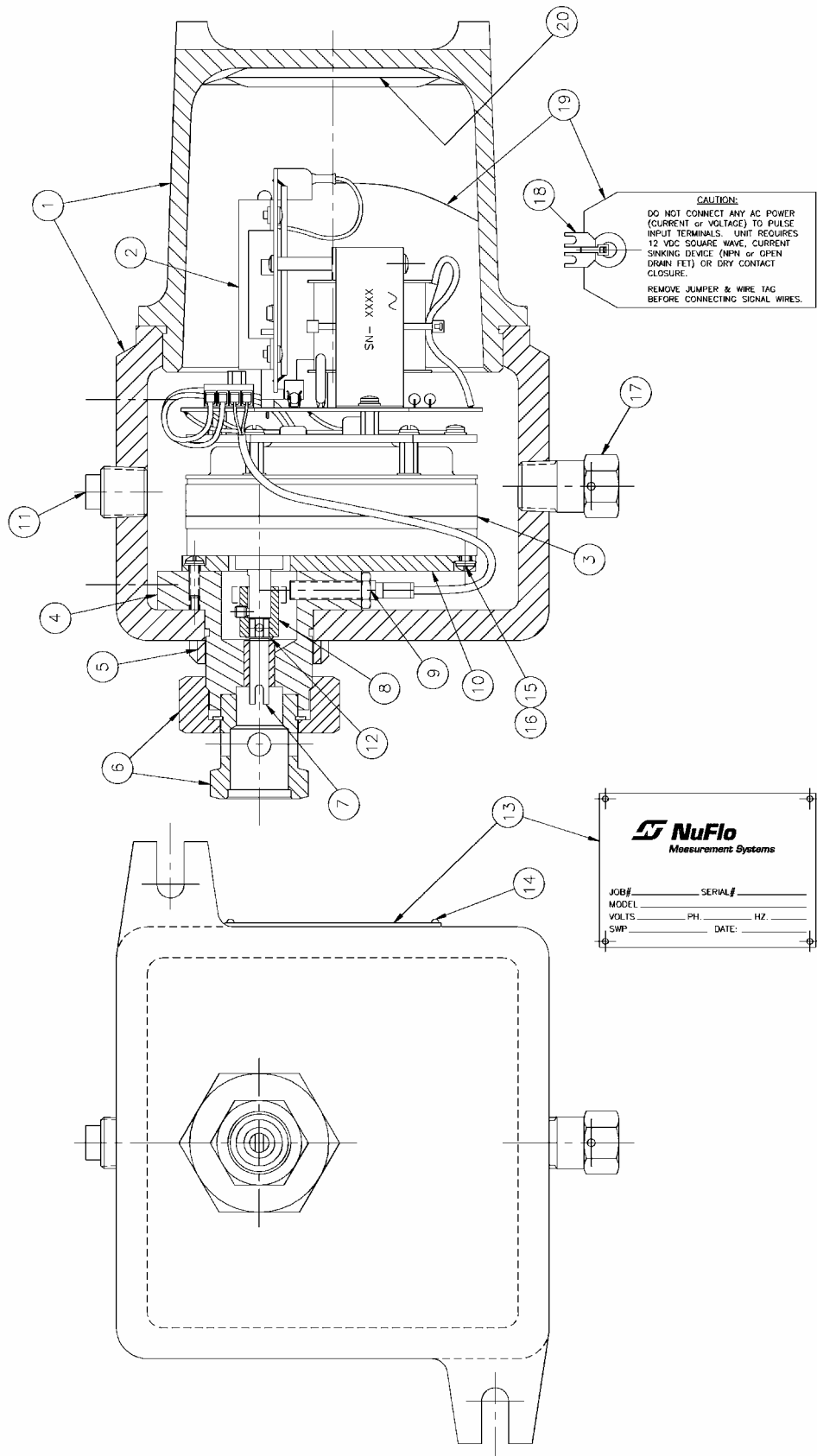
- Fuse F1 (1-amp, type AGC) provides short circuit protection. It will open if there is a short in the primary or secondary of transformer T1.
- Transformer T1 converts the 115VAC input to 14 VRMS secondary power when primary jumpers W1 and W2 are installed. (These jumpers are specific to the power board; they are not the control card jumpers shown in Figures 1 and 2.)
- 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 CD20 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.



# Troubleshooting

Problem	Probable Cause	Recommended Action
Input power fuse F1 is open.	Transformer T1 has an internal secondary winding or primary winding short.	Replace T1 or power board. To verify short in transformer, you must unsolder leads from the power board and measure winding resistance. Secondary resistance is 3 ohms. Primary windings are about 20 ohms each.
	Rectifier diode CR2, CR3, CR4, or CR5 shorted.	Check diodes with an ohmmeter and replace or change power board or CD20 motor control.
	Input power transformer jumper is installed incorrectly.	Check for jumper across 115VAC to Neutral.
Current limit LED is on, the motor is stopped.	Sample probe jammed or the motor armature is driving the probe backwards (CW) against the cam drop off point.	To isolate the problem, power down and remove the CD20 from the probe and verify CD20 output shaft turns CW as you look at it in repeat mode. Verify sample probe can be turned CCW with a screwdriver and proper discharge is obtained.
	Short across A1 to A2 of CD20 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, replace CD20 motor control assembly.
	Bind-up in gear box.	Replace 150:1 ratio gear motor.
	Bind-up due to alignment of adapter plate or hub.	Remove adapter plate and hub from gear motor. Turn on control and see if gear motor will run. If so, realign and reinstall adapter plate and hub.
	Transistor Q4 or Q2 has failed.	Replace CD20 assembly or CD20 power board.
Current limit LED is on, motor runs at a slow speed.	Motor overload.	Remove drive from sample probe and run. If the motor still runs slow, then remove motor from hub and adapter plate and run.
	CD20 current limit circuit failure.	Replace CD20 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.	Replace CD20 assembly or CD20 power board.

Problem	Probable Cause	Recommended Action
Motor does not run (cont'd).	<p>Input pulses are not present at 1TB-5 and 1TB-6.</p> <p>In the case of an electronic driver, the input pulses at 1TB-5 and 1TB-6 do not have a +12VDC pulse amplitude due to incorrect wiring.</p>	<p>Use a separate switch input to verify the CD20 is operating correctly in pulse mode. Use a portable oscilloscope to verify proper pulse input.</p> <p>Check for proper wiring (Figure 1).</p>
Motor continues to run. The PROX ("Hold") LED never comes on.	<p>Proximity switch is not sensing the high points on the cam.</p> <p>CD20 motor control failure.</p>	<p>Check proximity switch and cam alignment.</p> <p>Replace CD20 motor control assembly.</p>
Motor runs at full speed or faster continuously.	Output transistor Q4 has failed.	Replace Q4 with an MJE 3055 or replace the CD20 motor speed control.



### CD20-115VAC Parts List

ITEM	QTY	CONTROL NO.	DESCRIPTION
1	1	50142304856	ENCLOSURE
2	1	50142307662	SPEED CONTROL, 115VAC
3	1	50142307700	MOTOR, CS/CD DRIVE
4	1	50142382006	HUB ASSEMBLY, CD DRIVE
5	1	50142200170	JAM NUT, CS/CD DRIVE
6	1	50142150932	DRIVE COUPLING ASSY, DC-2
7	1	50142307695	DRIVE SHAFT
8	1	50142381667	COUPLING, CAM/MOTOR ASSEMBLY
9	1	50142309906	PROXIMITY SWITCH, EI-08-01-NACS
10	1	50142307686	ADAPTER PLATE
11	1	50142304632	PLUG, 1/2", CONDUIT
12	1	50142307696	SNAP RING
13	1	50142200101	TAG, ELECTRICAL, CD/DS DRIVE
14	4	50025400765	DRIVE SCREW, 2 x 3/16"
15	11	50142307693	BINDER HD SCREW, #8-32NC x 1/2" LG
16	11	50142307694	WASHER HUB SCREW, #8
17	1	50142304642	BREATHER, 1/2" PLUG
18	1	50142400194	JUMPER, RDI #J4-02
19	1	50142200109	CAUTION TAG, CD20, CD20A, CD30 DRIVES
20	1	50142304858	HUMISORB PACKET, #107HX 4 x 4

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