

DANCER CONTROL DRIVE

by

SELECTRONICS

Innovative Solutions Through Electronic Technology



Model DCD-1

**DC Motor Controller & Drive for Dancer-Controlled
Strand, Sheet or Web Winding Applications**

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DANCER CONTROL DRIVE

Model DCD-1 series

The DCD-1 is designed to provide drive power to a DC motor in **winding** or **un-winding** applications for **media** (*strand* such as yarn, tape, wire, etc. or *web* such as fabric, sheeting, etc.). The motor speed and torque are very accurately and intuitively controlled by the position of a “dancer” compensator arm to keep constant or controlled tension on the media throughout the package build. Conventional drives for this application suffer from a number of drawbacks that have been eliminated by the DCD-1 such as: dancer arm hunting, the need for re-adjustment when tension or process speed is changed, expensive and trouble-prone position transducers, mechanical linkages, dash-pots, etc.

The DCD-1 provides the best dancer-controlled drive available because it was designed to be hassle-free.

NOTE: The DCD-1 as shown in the cover photo, is designed as a “drop-in” replacement for Leeson drives and transducers. The installation and operation information given in this manual applies to that application as example. However, many other configurations and ratings for a multitude of strand and web winding and unwinding applications are available including: remote-mounted angle sensors, precision wind ratio and tension control, etc. And, we custom design for your application. ... Call Selectronics !

Features:

- ◆ **Non-contact** dancer arm position sensing... no transducers, linkages, or damping to wear out or require adjustment
- ◆ Perfect dancer arm **dynamics** ... no hunting, and **no adjustments** necessary after install
- ◆ Will drive **any DC motor**, either permanent-magnet or field-type, up to 200 volt armature and 10 amperes
- ◆ May be powered from **60 to 277 VAC** with no adjustments or setting changes necessary
- ◆ Extremely quick and **easy installation** / conversion
- ◆ **No adjustment** necessary after installation
- ◆ Easy setting of **preset** or “thread-up” speed by ten-turn potentiometer on compensator panel
- ◆ **“Auto Preset”** option available for adjustment-free, automatic “thread-up speed” setting

- ◆ **Over-current limiting** prevents overload damage even if motor is stalled indefinitely
- ◆ Latest **high-tech design** makes circuitry fully automatic, self-adjusting, and trouble-free
- ◆ Proprietary arm position **sensing technology** and our patented **Regulated Setpoint Convergence**” circuitry (enhanced PID) were developed by Selectronics exclusively for the winding industry!
- ◆ **One minute** “swap out” of the entire controller should servicing be necessary
- ◆ **Small and compact** ... only 6 ¼ inches x 3 ¾ inches x 2 inches
- ◆ Available as either **“self-contained”** version with sensor, intelligent controller and motor drive all in one unit (as shown in photo above) or as **“remote-sensor”** version when space is limited in the area of the dancer shaft.
- ◆ **Two-year** warranty

INSTALLATION AND OPERATION

The DCD-1 provides controlled power to a DC permanent-magnet or field-type motor to drive the take-up winder at the correct regulated speed and torque to maintain the tension compensator (dancer) arm at a constant position.

There are two operation modes available in a single unit: the **“Preset Start”** and the **“Demand Start”**.

PRESET START

This mode is for string-up-on-the-fly strand applications. When the dancer arm is all the way down against the stop the strand-break limit switch is activated disabling the DCD-1’s armature voltage output so the motor is stopped. When the dancer arm is raised slightly or put on the “step” the switch is closed enabling power to the motor. (An optional “non-step” start feature is available for push-button start.) In this “arm-lower-than-normal” position the power is ramped up quickly to the maximum motor voltage limit (preset speed) as set by the 10-turn potentiometer on the winder panel (or the optional Auto-Preset module). This is usually set so the spindle surface speed is a few percent faster than the strand feed rate.

When the winder is threaded the spindle pulls the strand slightly faster than the feed rate. This quickly takes up slack and pulls the dancer arm upward. The DCD-1 responds to this and reduces the motor torque so the spindle slows to the exact speed necessary to maintain the dancer arm at its desired running position. Due to the spring or air tension on the dancer arm this maintains constant tension on the strand winding process to assure uniform package build. (Tension “profiling” is available as an option. **Contact Selectronics at 704-694-3441.**)

DEMAND START

This mode is for string-up-while-stopped media applications. When the arm is all the way down the media and the spindle are stopped. The media is manually wrapped onto the empty take-up tube until the dancer arm is pulled up to the top. Now, the run circuit is closed and the delivery to the winder is started. As the media motion causes the dancer arm to drop the spindle accelerates to the correct rate to keep the arm at its desired winding position. Due to the spring or air tension on the dancer arm this maintains constant tension on the media throughout the winding process to assure uniform package build. (Tension “profiling” is available as an option. **Contact Selectronics at 704-694-3441.**)

The DCD-1 limits the maximum current delivered to the motor to less than twelve (12) amps in any condition so even mechanical failure and total motor stall poses no immediate danger to the DCD-1 or the motor.

INSTALLATION

NOTE: The DCD-1 as shown in the cover photo, is designed as a drop-in replacement for Leeson drives and transducers, to which these instructions apply. Many other configurations are available. Call Selectronics.

The first step in the conversion from a Leeson drive to the Selectronics DCD-1 is to remove the old transducer and its bracket, the bellcrank tensioning and the transducer linkage. Disconnect the media-break switch wires and remove the old potentiometer and its harness. Now remove the end cap and pins from the bellcrank. Slide the provided magnet collar assembly over the end of the bellcrank but do not tighten yet. Replace the tension string with its screw.

The DCD-1 enclosure must be mounted on the compensator panel with the provided bracket so its end is centered directly over the center axis of the magnet holder that is affixed to the dancer arm shaft bellcrank. The universal hole pattern in the provided mounting bracket matches existing holes in all Leeson compensator panels, so no drilling is necessary. Size #10 screws and washers may be used to attach DCD-1 bracket to the panel. The size of the holes in the bracket and panel will allow some latitude in the positioning of the enclosure. Install the provided MAX SPEED (Preset) potentiometer in the compensator panel hole where the old one was. Connect its harness wires to the strand-break switch (circuit should close when arm is lifted).

ALIGNMENT

The DCD-1 responds to the angle of the magnet with respect to the centerline of the enclosure. The magnet holding collar is secured to the dancer shaft with a setscrew so the RED TIP end of the magnet points directly away from, and is perpendicular to, the end of the enclosure when the dancer arm is in its desired “winding” position. This is usually “arm-level” but may be higher or lower than level if the application requires. A slight gap should exist between the magnet and the DCD-1 enclosure so that it is close but not touching. The exact width of the air-gap is not critical.

Temporarily position the magnet collar so it is almost touching the bottom of the DCD-1 enclosure and the red tip of the magnet is pointing away from the bracket. Tighten the Allen setscrew just snug not tight. Remove the four corner screws from the cover of the DCD-1 and take out the circuit assembly. A sticker is provided on the inside bottom of the enclosure that covers the alignment sight-hole. Move this sticker aside and, with the bracket-to-panel screws loose, position the enclosure so the locator dot on the center of the magnet collar aligns with the center of the sight-hole. Tighten the mounting screws.

Now, fix the compensator arm in the desired winding position. Loosen the magnet collar setscrew. Place a standard index or business card between the magnet collar and the bottom of the enclosure as a “thickness gauge”. Position the magnet collar just touching the card and with the red tip of the magnet pointing away from the mounting bracket and perpendicular to the end of the enclosure. Tighten the setscrew securely. Confirm that the locator dot is still in the center of the sight-hole. Replace the sticker over the hole to keep out debris. Re-install the circuit assembly.

ELECTRICAL CONNECTIONS

The DCD-1 will accept any supply input of 60-277 VAC and deliver to the armature of the motor whatever voltage is necessary to keep the compensator arm in the desired winding position as long as what is needed is not greater than supply input. The DCD-1 will pass from 0 to 100% of the available input power through to the motor.

Usually the supply is 120 VAC or 240 VAC. Usually the motor armature rating is 90 VDC (if used with 120 VAC supply) or 180 VDC (if used with 240 VAC supply). It is possible to use a 240 VAC supply with a 90 VDC armature rating without any modifications. However, a 120 VAC supply will only provide 80% of rated speed on a 180 VDC armature motor which may not provide needed speed.

If a permanent-magnet type motor is used then simply insulate the DCD-1's field output wires. **If a field-type motor is used then take note of the following:** The field voltage output of the DCD-1 is unregulated and is function of the supply voltage. Thus, 120 VAC will power a 100 VDC field; and 240 VAC will power a 200 VDC field.

The DCD-1 can be used to power a 100 VDC field from a 240 VAC supply with a simple wiring change. Simply connect the positive field wire from the motor to one of the incoming AC power leads instead of its usual YELLOW wire.

CAUTION: It is essential to remove power from the power harness before plugging and unplugging the DCD-1 connector to avoid arcing when used with a field-type motor. Also, do not allow any of the four motor leads to contact machine ground or AC supply leads. **Damage to the DCD-1 will result!**

NOTE: It is a normal characteristic of a field-type DC motor for the “preset” speed to vary over time since the resistance of the field increases as the motor heats up which reduces field current causing “field-weakening” speed increase. Also, the field voltage is a function of supply voltage, which can vary due to loading or normal utility variations. Selectronics offers “precision preset” options for the DCD-1 to eliminate this drift. **Contact Selectronics at 704-694-3441.**

The DCD-1 contains an internal **15 AMP** fuse for motor and circuit protection. This fuse size is chosen since the armature current limit output of the DCD-1 is 12 amps. However, the field **supply output of the DCD-1 is capable of only 1 AMP output**. If this rating is exceeded circuit damage will result. This could occur if a motor field short-circuits or the field wires contact machine ground. It is therefore highly recommended that both field output wires be protected with **1 AMP** fuses connected in-line between the DCD-1 and the motor.

The connections of the DCD-1 leads are as follows:

POWER HARNESS (6-pin, large connector)

WHITE/GREY	120 Neutral	or 240 line AC input
WHITE/BLACK	120 Active (hot)	or 240 line AC input

BROWN	Armature Negative output
RED	Armature Positive output
BLACK	Field Negative output (for field-type motors, disregard for PM motors)
YELLOW	Field Positive output (for field-type motors, disregard for PM motors)

CONTROL HARNESS (4-conductor, small connector)

GRAY	STOP Limit Switch (open circuit
BLUE	STOP Limit Switch (disables motor)

ORANGE	PRESET Speed Potentiometer CW
VIOLET	PRESET Speed Potentiometer WIPER

OPERATION

The magnet collar position determines the normal winding position of the compensator arm. If the arm's winding position is not as desired when put into operation the magnet collar may be re-positioned as necessary to correct the arm position. There is no electrical adjustment of the arm position. This assures that any DCD-1 circuit assembly will run in the same arm position in a given panel. If servicing is necessary then just remove the circuit assembly only which will not disturb the alignment and will allow quick substitution without the need for re-adjustment.

NOTE:

The DCD-1's operation does not behave like a potentiometer. That is, the arm's instantaneous position does not determine the actual speed or torque of the motor. Instead, arm position determines speed and torque "trend". Arm-lower-than-normal-winding-position gives speed and torque trend upward. Arm-higher-than-normal-winding-position gives speed and torque trend downward. Normal winding position gives no trend, regardless of present speed. Rapid arm movement gives rapid torque change. In this way the DCD-1 maintains the arm position no matter what the media speed.

WINDER SET-UP FOR OPTIMUM PERFORMANCE

The gear ratio between the motor and take-up spindle on the winder determines its performance under specific conditions. If the spindle is geared too high then it will be operating at a disadvantage near full package where maximum horsepower is needed. Insufficient spindle torque will result causing motor heating and unstable operation.

Ideally, the winder should be set-up so the surface speed of the empty core, when the motor is running at its maximum, is 115-125% of the fastest speed that the media will ever be delivered to the spindle. (If this speed is not known then it can be determined by placing a surface-wheel tachometer against the package surface or the roller bail while winding the product with the highest process speed.)

To determine if gearing is acceptable put an empty tube on the spindle, place the compensator arm at its fastest position and start the winder. Place a surface-wheel-type tachometer against the empty tube, turn the PRESET speed pot to maximum (fully-clockwise) and record the yards or meters-per-minute.

If this speed is greater than 125% of the fastest process speed previously determined then a gearing **decrease** is warranted. If this speed is less than 115% then a gearing **increase** is necessary.

Although the Dancer Control Drive DCD-1 was designed specifically for the yarn winding industry, many other models are available for other a multitude or winding and un-winding applications. Many thousands are in use throughout the world since 1993. This product will give many years of reliable service under normal operating conditions. Selectronics guarantees it free from defects in materials and workmanship for a period of two years from the date of purchase.

Thank you for your purchase! We welcome your questions and comments. We stand ready to assist you with special applications. And, we have a broad line of other products for the winding industry. Please let us know if we can help you in any way!

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