



## MCW102B

### Proportional Rotary Position Controller

BLN-95-8970-4

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## DESCRIPTION

The MCW102B Proportional Rotary Position Controller provides automatic grade and steering control on paving, curbing and planing machines. It uses a follower arm riding on a stringline or a ski riding on the prepared surface as a grade reference. In steering applications, the MCW102B uses a vertical follower arm riding against a stringline reference. The MCW102B controls servovalves to position a screed, form cutting drum, or steer cylinder.



## FEATURES

- Non-contacting sensing element for long life
- Fully burned-in components for added reliability
- Bright up/down lights for easy nulling
- Adjustable sensitivity
- Run/Standby switch for manual or automatic control
- Remote setpoint or steering feedback connections available
- Reverse polarity and short circuit protection
- Rugged aluminum housing
- Withstands high vibration and shock
- Moisture and corrosion resistant
- Easy to mount
- Adjustable tracking force

## TECHNICAL DATA

### ELECTRICAL

#### SUPPLY VOLTAGE

12 or 24 Vdc  
0.5 amps Does not include output current to load.

#### MAXIMUM OUTPUT CURRENT @ 14 VDC SUPPLY

170 ± 20 mA with 23 ohm load  
The MCW102B drives a number of Danfoss servovalves.

#### MAXIMUM REVERSED POLARITY VOLTAGE

50 Vdc for 5 minutes

#### SHORT CIRCUIT PROTECTION

The controllers are protected against short circuits across the valve coil as well as shorts between the outputs and ground. A short circuit is defined as 1 ohm maximum resistance for 5 minutes maximum.

#### LOAD DUMP

Protected against load dump per SAE J2.20.97

### MECHANICAL

Physical stops limit the rotation to approximately ± 23° from null.

### ENVIRONMENTAL

#### OPERATING TEMPERATURE

-18° to 77° C (0° to 170° F)

#### STORAGE TEMPERATURE

-30° to 65° C (-22° to 150° F)

#### HUMIDITY

After being placed in a controlled atmosphere of 95% humidity at 38° C for 10 days, the controller will perform within specification limits.

#### RAIN

The controller will withstand exposure to a 15 minute shower with cold water after reaching the maximum storage temperature.

## TECHNICAL DATA (continued)

### VIBRATION

Withstands a vibration test designed for mobile equipment controls consisting of two parts:

1. Cycling from 5 to 2000 Hz in each of the three axes.
2. Resonance dwell for one million cycles for each resonant point in each of the three axes.

Run from 1 g to 8 g's. Acceleration level varies with frequency.

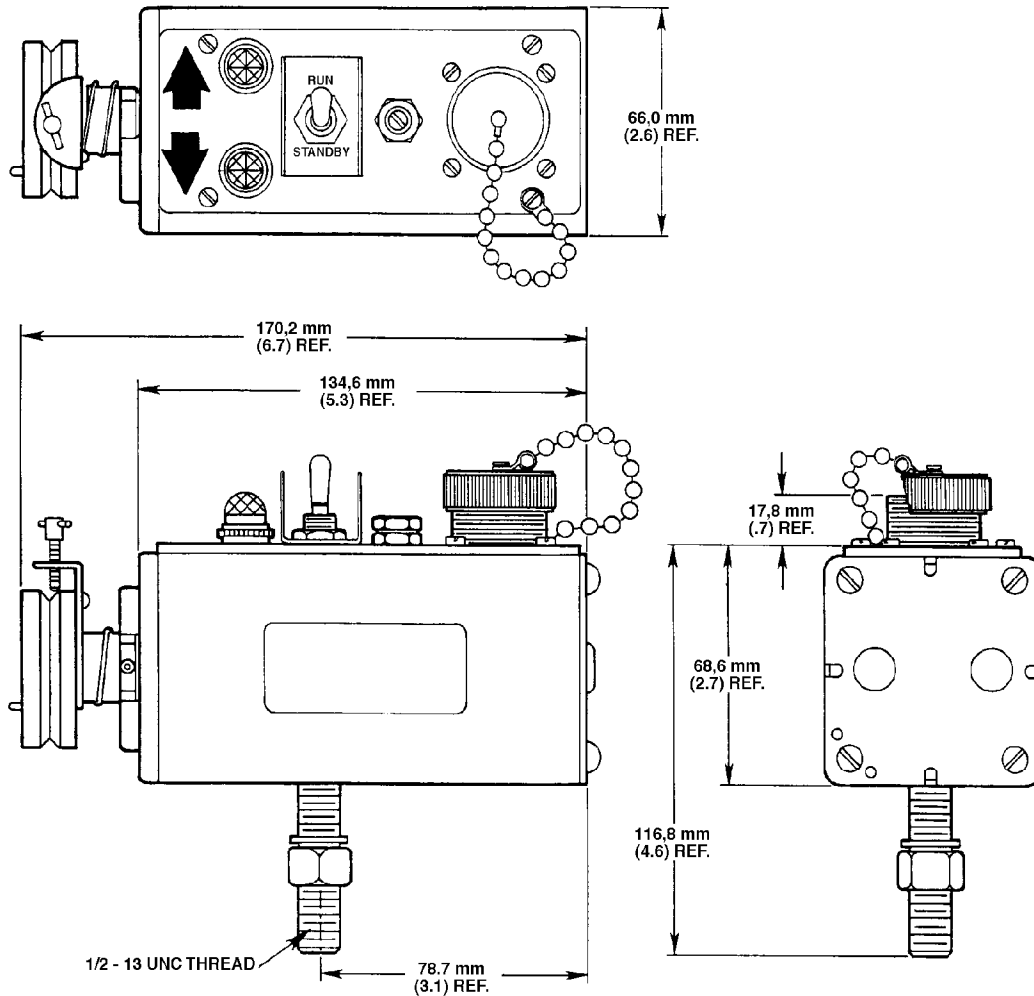
### SHOCK

50 g for 11 milliseconds. Three shocks in both directions of the three mutually perpendicular axes for a total of 18 shocks.

### DIMENSIONS

See the Dimensions Drawing.

## DIMENSIONS



1304

Dimensions of the MCW102B in Millimeters (inches).

# TECNICAL DATA *(continued)*

## PERFORMANCE

### TEST CONDITIONS

SUPPLY: 14 Vdc or 24 Vdc  
 GAIN: Maximum (full cw)  
 RUN/STANDBY SWITCH: Run  
 TEMPERATURE: 25° C  
 Shaft rotation measured at end of 4.25 inch long horizontal arm. (Equivalent to a standard 6 inch long sensing arm trailing at 45°).

### MAXIMUM TORQUE

6.0 in-gms required to rotate the shaft from either side of null to the stop.

### NULL CENTERING

With the shaft roll pin centered between the stops, electrical null will occur within  $\pm .37$  inches.

### GAIN SETTING

Electrical null will vary .01 inch maximum from maximum to minimum gain.

### MAXIMUM TEMPERATURE NULL SHIFT

.15 inch vertical deflection over the range from 0° to 50° C (32° to 122° F). A larger null shift may occur over a greater temperature span. It is recommended that the user re-null the MCW102B each morning before using. See the Adjustment section.

### PHASING

Facing the hub with the lamps up, a clockwise shaft rotation will make pin F positive with respect to pin E. The right lamp will come on. If desirable, this phasing can be reversed. Model MCW102B1020 has reverse phasing.

### PROPORTIONAL BAND

$.30 \pm .10$  inches

### INDICATOR LAMPS DEADBAND (MCW102B)

.05 inches maximum

### GAIN SETTING EFFECT ON INDICATOR NULL

.01 maximum from maximum to minimum gain. Indicator and valve null track within less than .01 inches equivalent at the grade sensing point.

### CENTERING

Lamps will come on within .04 inches of each other.

### NULL POINT STABILITY

Changes in supply voltage from 11 to 15 Vdc will not change the null point more than .02 inches.

### REMOTE SETPOINT/STEERING FEEDBACK PHASING

With the feedback potentiometer turned fully clockwise (toward the positive end of the potentiometer), the MCW102B shaft must rotate clockwise to null facing the hub.

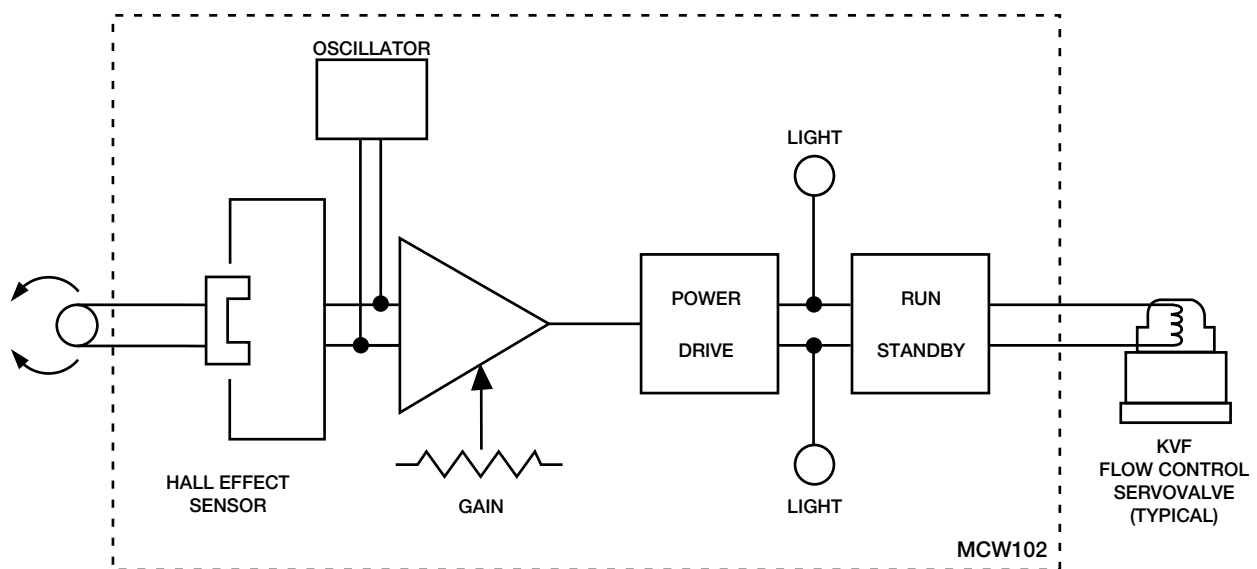
### NULL SETTING WITH REMOTE SETPOINT/STEERING FEEDBACK

With the feedback potentiometer at either end, the MCW102B will null within 15° of the null point without remote input.

### RUN/STANDBY SWITCH

On Standby, output will be  $0 \pm 1$  mA.

## BLOCK DIAGRAM



1740

## THEORY OF OPERATION

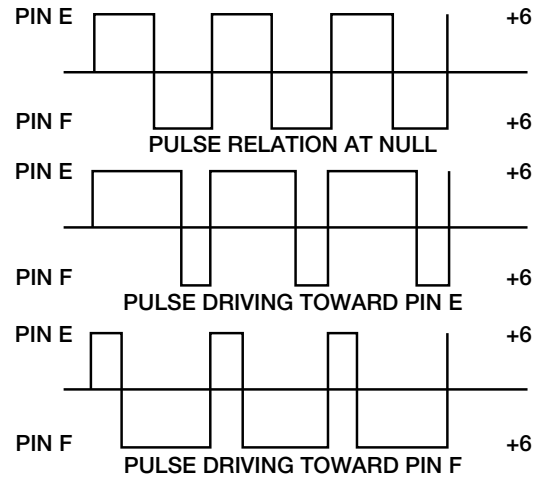
The MCW102B Proportional Rotary Position Controller consists of two stages: a sensor input and an amplifying/controlling section. See the MCW102B Block Diagram. The sensor input section accepts steering or grade information through either a right angle or straight tube follower. Right angle followers are used to sense grade and are either tubular (for stringlines) or skate and ski (for firm reference surfaces). Straight followers are used to sense a steering path and are tubular. As the reference is raised or lowered - left or right for steering - the hub shaft is rotated so that the follower maintains contact.

As the hub shaft turns, it rotates a U-shaped magnet that is attached inside the device housing. A Hall Effect sensor is mounted to the housing between the poles of the magnet, and as the angle of the flux lines passing through the Hall sensor changes with the follower, the voltage from the sensor varies. The output voltage is approximately proportional to the angle of rotation over the sensing range.

The amplifying/controlling section of the MCW102B compares the voltage output of the Hall sensor against the midpoint of a 200 Hz square wave that alternately puts a high voltage on one side and then the other of the output pins to a proportional valve. See the Typical Output Signal diagram. In steering applications, the square wave midpoint varies up and down in response to the ACX104C Feedback Sensor signal. When the midpoint of the square wave equals the Hall null output voltage, the duration of the signals alternately placed on pins E and F is equal, and the valve remains

centered due to the high frequency of the cycling. But if the two voltages become non-symmetrical the voltage duration becomes biased towards the appropriate side of the valve. The appropriate incandescent light will fire when the vertical deviation from the sensor exceeds  $\pm .025$  inches vertical deflection from null.

## TYPICAL OUTPUT SIGNAL



966

## MOUNTING

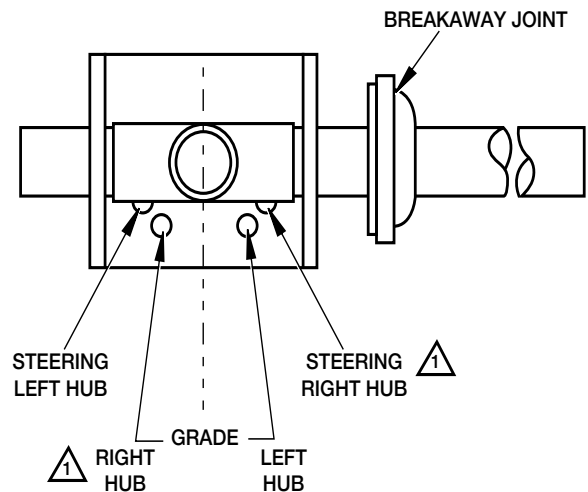
Determine the mounting location, and drill a 9/16-inch (14 mm) hole for the mounting stud. Remove the nut and lockwasher. Mount the MCW102B with the shaft horizontal. Tighten the nut against the lockwasher, but not too tightly, since it must be loosened in the adjustment procedure.

Attach the appropriate follower to the hub. Note the guide hole location and direction of travel. Guide holes in the mounting bracket for the grade/steering followers, part number KG07002, are located as shown in the Guide Hole Identification diagram. Part number KG07002 is only used for steering applications.

After the follower has been installed, adjust the spring on the hub so the follower exerts a very light pressure on the stringline or reference surface.

A skate assembly, part number KG06001, and ski assembly, part number KG02001, may be used with the right angle follower, part number KG04003 when a firm reference surface is used. When using these devices, hub spring tension is comparatively unimportant.

## GUIDE HOLE IDENTIFICATION



△ THE RIGHT HUB IS DEFINED AS THE ONE WITH THE SPRING BIAS ADJUSTMENT THUMBSCREW

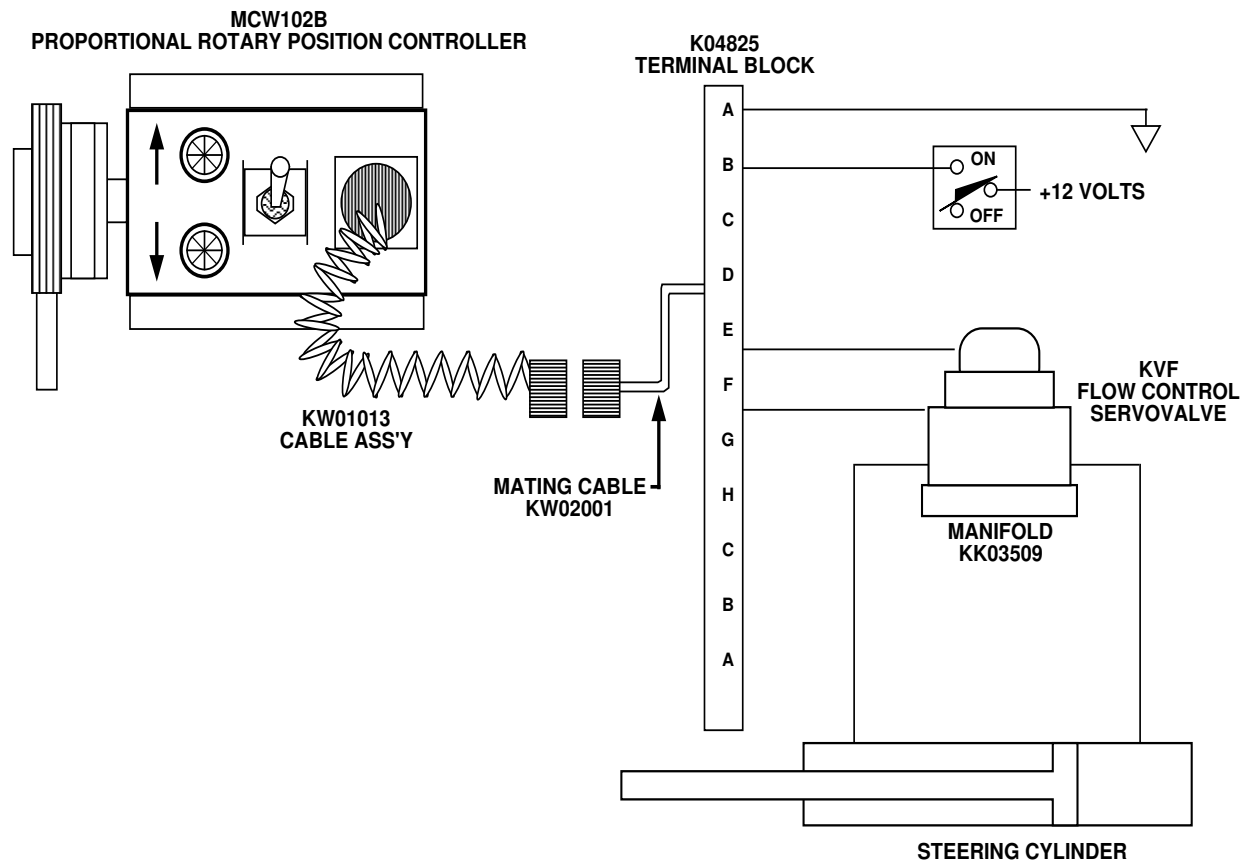
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## WIRING

All wiring connections are made through an MS Connector located on the end of the front panel of the device. A two-foot coiled cable that extends to ten feet is available with plugs for easy connection and removal. A straight plug is provided on one end and a right angle plug on the other (part number

KW01013), or two straight plugs (part number KW01014). Use an MS3102A18-1P connector (part number K03989) on the machine for cable connections. See the Connection diagram.

## CONNECTION DIAGRAM



1621A

## ADJUSTMENT

1. Place the Run/Standby switch on Standby.
2. Loosen the locknut on the front of the housing, which captures the gain adjustment potentiometer.
3. Turn the deadband potentiometer fully clockwise to maximum gain.
4. Apply electrical power to the system. Hydraulic power is not necessary at this time.
5. With the equipment at the correct grade position, adjust the vertical position of the MCW102B until an equivalent angular deflection causes the lamps to fire. Lock the controller in place.
6. Turn the potentiometer back approximately 1/4 turn.
7. Turn on the hydraulic power and place the Run/Standby switch on Run.
8. Observe the response of the machine. If it oscillates when returning to null, turn the potentiometer counter-clockwise. If the machine slowly approaches null but stops short, turn the potentiometer clockwise.
9. Tighten the locknut to hold the gain adjustment potentiometer.

## TROUBLESHOOTING

### Keep the following facts in mind while troubleshooting the system:

- The lights will indicate deviations whenever power is applied to the MCW102B, regardless of the Run/Standby switch position.
- In the Run position, amplifier output is connected to the valve. In the Standby position, it is not.
- If the gain potentiometer is turned fully counterclockwise (minimum gain), a larger deviation will be needed to command an output to the proportional valve.
- Preliminary checks should include examination of the cables and leads for damaged or broken wire. Examine areas where shorting may occur. Check the power supply to be sure it is greater than 11 volts.

1. Check for free rotation, proper spring loading and tightness in all sensor grid parts.
2. Unhook the MCW102B cables and manually operate the valves to check for correct operations. Re-connect the cables.
3. Check the lights when the controller is in the Standby mode. Vary the machine position manually and note the indication. One light and then the other should glow as the conditions are reversed.
4. If another controller is available, set it on the same surface as the other and plug the MS connector into the replacement unit. Check system operation. If the problem disappears, the controller is defective. Substitute the replacement and return the old device as outlined in the Ordering Information.

## ORDERING INFORMATION

### SPECIFY

1. Time proportional or proportional output
2. Valve load to be driven
3. Accessories
4. Service parts

### ACCESSORIES

1. KG07002, Steering Follower  
Straight tubular follower, 20.1 inches long overall with breakaway joint. For steering only.
2. KG04003, Right Angle Grade Follower  
With breakaway joint. For grade applications only. Follows a stringline. Also used with skate assembly, or skate and ski assembly for following hard reference surface.
3. K09274, Right Angle Grade Follower Less Sensing Arm  
For grade applications utilizing the skate and/or skate and ski assembly. Same as part number KG04003 above, but without the sensing arm and breakaway joint.

4. KG06001, Skate Assembly  
For grade applications. Used with right angle grade follower (part number K09274) on hard reference surface.
5. KG02001, Ski Assembly  
For grade applications. Used with right angle grade follower (part number K09274), and skate assembly (part number KG06001) on hard reference surface.
6. KW01013, Cable Assembly  
Two foot coiled cable that extends to ten feet. Has right angle connector on one end and straight connector on the other to make connections between the MCW102B and Bendix Type No. MS3102A18-1P plug (part number K03989).
7. K00702 Lens (service part)
8. K03891 Lamp (service part)

ORDER NUMBER	INPUT	ELECTRICAL DESCRIPTION	DRIVES
MCW102B1004	12 Vdc	No Remote Setpoint/Steering Connections	KVF
MCW102B1020	12 Vdc	Pins C/D Common For Remote Setpoint or Steering Feedback	KVF
MCW102B1038	12 Vdc	Pins C/D Common For Remote Setpoint or Steering Feedback	V7509
MCW102B1046	12 Vdc	No Remote Setpoint/Steering Connections	V7509
MCW102B1053	24 Vdc	Lamp Phasing Reversed Requires $\pm 20^\circ$ Shaft Rotation To Re-null, Pins C/D Common For Remote Setpoint or Steering Feedback	KVF
MCW102B1061	12 Vdc	Pins C(+) and D(-) Are Separate Remote Setpoints or Steering Feedback Connections	KVF
MCW102B1085	24 Vdc	Pins C/D Common For Remote Setpoint or Steering Feedback	KVF

## **CUSTOMER SERVICE**

### **NORTH AMERICA**

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#### **ORDER FROM**

Danfoss (US) Company  
Customer Service Department  
3500 Annapolis Lane North  
Minneapolis, Minnesota 55447  
Phone: (763) 509-2084  
Fax: (763) 559-0108

#### **DEVICE REPAIR**

For devices in need of repair or evaluation, include a description of the problem and what work you believe needs to be done, along with your name, address and telephone number.

#### **RETURN TO**

Danfoss (US) Company  
Return Goods Department  
3500 Annapolis Lane North  
Minneapolis, Minnesota 55447

### **EUROPE**

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#### **ORDER FROM**

Danfoss (Neumünster) GmbH & Co.  
Order Entry Department  
Krokamp 35  
Postfach 2460  
D-24531 Neumünster  
Germany  
Phone: 49-4321-8710  
Fax: 49-4321-871-184