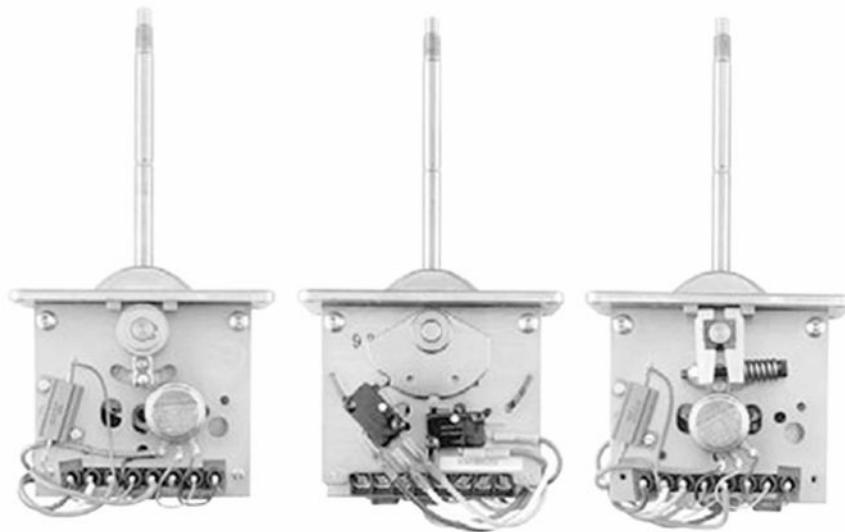


Installation Guide

# MCH

## Customizing the Basic Control Handle



**Revision history***Table of revisions*

<b>Date</b>	<b>Changed</b>	<b>Rev</b>
March 2020	Corrected release number	0204
March 2020	Removed life statement	0103
	Changed document number from 'AN00000203' to 'AN152886484817'	XX
July 2017	Removed part numbers of obsolete product	0102
August 2016	Replaces BLN 95-9051	0101

**Contents**

**MCHXXX Control Handle**

Introduction.....4  
 Theory of operation.....4  
 Custom options.....6  
 Technical data.....6

**Ordering information**

Models.....9  
 Product identification chart.....9  
 Nameplate part numbers list.....10  
 Assembly parts list.....10  
 Accessories.....11

**Installation**

Dimensions.....12  
     Panel cutout and mounting plate.....12  
     Surface mount.....13  
     Panel mount.....14  
 Assembly.....15  
     Option 1: Assemble non-locking control knob.....15  
     Option 2: Assemble center lock control knob.....15  
 Mounting.....15  
     Option 1: Surface mount.....15  
     Option 2 and 3: Top mount with case.....15  
     Option 4 and 5: Panel mount with case.....16  
 Wiring.....16  
     Wiring diagram.....16  
 Connection diagram.....17

**Adding and replacing parts**

Cam assembly drawing.....18  
 Switches drawing.....18  
 Single potentiometer drawing.....18  
 Warnings.....19  
 Install new center switch.....19  
 Install new auxiliary switch.....19  
 Replace existing switches.....20  
 Replace spur gear.....20  
 Replace potentiometer.....20  
 Replace centering spring.....21  
 Replacing breaks.....21

**Customer support**

Contact information.....22

## MCHXXX Control Handle

### Introduction

From left to right: MCH00AD1252; Common back view; MCH00BD1252



The MCHXXX Control Handle is intended for use in open loop systems controlling Danfoss hydrostatic pumps with an Electrical Displacement Control (EDC). These control handles are shipped without a knob or case. This allows the Danfoss distributor to stock one model which can be completed to satisfy customer requirement. The basic control handles are factory wired and calibrated. Two models have been set up, one spring and one friction held, that can be used on 12 or 24 volt systems.

The Control Handle is designed to provide man-machine interface. In addition to proportional operation of electrically controlled hydrostatics, switches may be incorporated to operate backup alarm, brake, and neutral interlock circuits.

### Theory of operation

Single potentiometer control handles are generally used with a fixed output power supply. The power supply may be either an automotive-type battery for mobile equipment or an AC to DC convertor for industrial applications. Single potentiometer control handles are designed for both 12 and 24 volt power supply by terminal selection.

Single potentiometer control handles have two advantages:

- Simplified electrical circuit
- Lower cost

The only disadvantage is the limited output power that makes it unsuitable for applications with the MCE101 or driving more than one EDC simultaneously.

A single coil or one coil of a dual coil EDC is connected as shown in the [Connection diagram](#) on page 17 and . The coil terminal connected to the common point of R2 and R3 (terminal 3) will all remain at or near half the supply (with R1 = 0 ohm) voltage as measured with respect to ground. The other side of the valve coil is connected to the potentiometer wiper (terminal 2). With the handle centered and the center switch actuated, it will also be at or near half the supply voltage.

With the control handle centered, the voltage on each EDC terminal is the same and there is no current flow through the valve coil. Since it is current flow which causes the pump output flow to change, the pump will be at zero stroke.

When the control handle is moved forward (as indicated by the forward arrow in the [Wiring diagram](#) on page 16), the voltage at terminal 2 increases proportionally with distance traveled. At full handle stroke, the voltage at terminal 2 will be approximately 8.6 volts with respect to ground. The terminal 3 remains at half supply; thus a 2.6 volt differential will result (for 12 volt system and single coil valves). This differential voltage is sufficient to fully stroke any Danfoss pump. When the Control Handle is moved in the reverse direction, the voltage at the terminal 2 decreases to approximately 3.4 volts, the terminal 3 becomes more positive so current flows through the coil in the opposite direction resulting in flow out the other pump port.

Although useful for understanding how the single potentiometer Control Handle functions, it is not normally necessary to measure the voltages with respect to ground. The voltage measured across the 2 and 3 terminals is more useful, since this is the actual differential voltage applied to the valve coil. The difference between 12 and 24 volt version is a resistor (R1) installed to limit the current through the bridge circuit. The value for R1 for 24 Vdc operation is 40 ohm, 25 W. A center-off switch is recommended

**MCHXXX Control Handle**

for all single potentiometer type Control Handles. If one of the wires between the Control Handle and the pump control becomes shorted to ground (through worn insulation or broken wire), there would be sufficient electrical signal to fully stroke the pump. The center-off switch cuts the electrical power to the bridge circuit when the handle is in mechanical center of travel.

**MCHXXX Control Handle**

**Custom options**

- Choice of mounting styles with or without water tight case
- Mechanical options include center lock, spring return, friction held, and center detents
- 12 or 24 volt operation
- Environmentally hardened components designed for off-road construction equipment
- Optional cam operated switches

*Mounting*

<b>0</b>	No case	
<b>1</b>	Base or surface mount	Connection is through four screws to the flanges on the bottom of the metal case.
<b>2</b>	Top mount with case	The case is made of black nylon plastic.
<b>3</b>	Top mount without case	Connection is through two screws to an enlarged mounting plate. Top mounting allows the entire handle to be removed from above the panel.
<b>4</b>	Panel mount with case	The case is made of black nylon plastic.
<b>5</b>	Panel mount without case	Connection is via four screws to the top plate that holds the boot in place.

*Type of control knob*

<b>0</b>	No knob, non-locking	
<b>1</b>	Non-locking	The non-locking handle has a standard ball knob. The friction-held handle detents with a spring-loaded ball to indicate null, while the spring-return handle has a springpreload indicating null.
<b>2</b>	Center-lock	The center-lock handle has a cylindrical knob and provides a positive center-lock that unlatches when the operator pulls up on the knob.

*Handle actuation*

<b>A</b>	Spring-return, bidirectional	This handle uses a torsion spring to return to the mechanical center position and has 30° of handle throw on either side of center.
<b>B</b>	Friction held, bidirectional	This handle will maintain handle angle. Friction drag is adjustable.

*Connector*

<b>1</b>	Terminal strip, internal	Electrical connectors are made to a set of eight internal screw terminals.
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**Technical data**

*Operating voltage range*

<b>11 to 15 Vdc</b>	12 volt models	Wired to terminal 4
<b>22 to 30 Vdc</b>	24 volt models	Wired to terminal 5

**MCHXXX Control Handle**

*Load resistance*

<b>15 to 30 ohm</b>	When used with Danfoss single and dual-coil EDC
---------------------	---

*Auxiliary switch current capability (cam-actuated v3l microswitch)*

<b>3 amp</b>	Inductive at 28 Vdc
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**Mechanical**

<b>Handle stroke</b>	total travel	±30°, 60°
<b>Spring torque</b>	at center breakaway	11 ± 4 in·lb (1.2 ± 0.4 N·m)
	at full stroke	18 ± 6 in·lb (2.0 ± 0.7 N·m)
<b>Detent torque</b>	over & above friction drag	10 in·lb (1.1 N·m)
<b>Friction drag</b>	Friction is adjusted at brake assembly with dTs" English Allen wrench and #k" open-ended wrench	13.5 ± 3 in·lb (1.5 ± 0.3 N·m)

**Environmental**

<b>Temperature</b>	Operating	-40 °F to 170 °F (-40 °C to 77 °C)
	Storage	-30 °F to 150 °F (-34 °C to 66 °C)
<b>Humidity</b>	After being placed in a controlled atmosphere of 95% humidity at 100°F (38°C) for 10 days, the Control Handle will perform within specification limits.	
<b>Rain</b>	NEMA 4 for units with aluminum case only. After being showered from all directions by a high-pressure hosedown, the Control Handle will perform within specification limits.	
<b>Vibration</b>	Withstands a vibration test designed for mobile equipment control consisting of two parts:	Cycling from 5 to 2000 Hz in each of the 3 axes.
		Resonance dwell for one million cycles for each resonance point in each of the 3 axes.
<b>Shock</b>	50 g's for 11 ms	Three shocks in both directions of the 3 mutually perpendicular axes for a total of 18 shocks.

**Performance**

*Null current*

<b>±5 mA maximum</b>	12 Vdc operation	Control Handle is centered and center-off switch is closed.
<b>±8 mA maximum</b>	24 Vdc operation	

*Center dead zone*

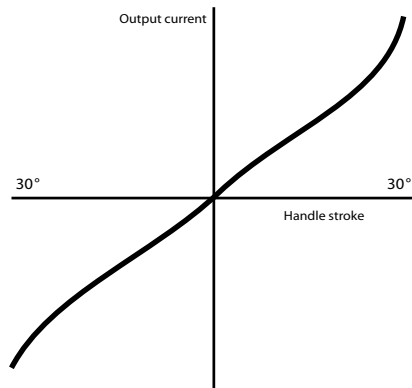
<b>±3° nominal</b>	Handle travel required to actuate center-off switch.
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*Full stroke output current*

<b>120 mA into 22 ohm load</b>	Factory test current	Other full stroke currents optional.
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### MCHXXX Control Handle

*Performance curve*





## Ordering information

### Models

#### Models

<b>MCH00AD1252</b>	Spring return model with two switches, one center off, one neutral start. Single potentiometer circuit for controlling Danfoss EDC from 12 or 24 volt supply
<b>MCH00BD1252</b>	Friction held model with two switches, one center off, one neutral start. Single potentiometer circuit for controlling Danfoss EDC from 12 or 24 volt supply.

### Product identification chart

Name	X	X	X	X	X	XXX
MCH	Mounting	Type of control knob	Handle actuation	Electrical characteristics	Connector	Factory assigned

#### Mounting

- 0** No knob, no case
- 1** Base (surface) mount aluminum case
- 2** Top mount (drop-in) with plastic case
- 3** Top mount (drop-in) without plastic case
- 4** Panel mount with plastic case
- 5** Panel mount without plastic case

#### Type of control knob

- 0** No knob, non-locking
- 1** Non-locking
- 2** Center lock

#### Handle actuation

- A** Spring-return, bidirectional
- B** Friction held, bidirectional

#### Electrical characteristics

- D** Proportional, center-off and neutral start switch

#### Connector

- 1** Terminal strip internal

**Ordering information**

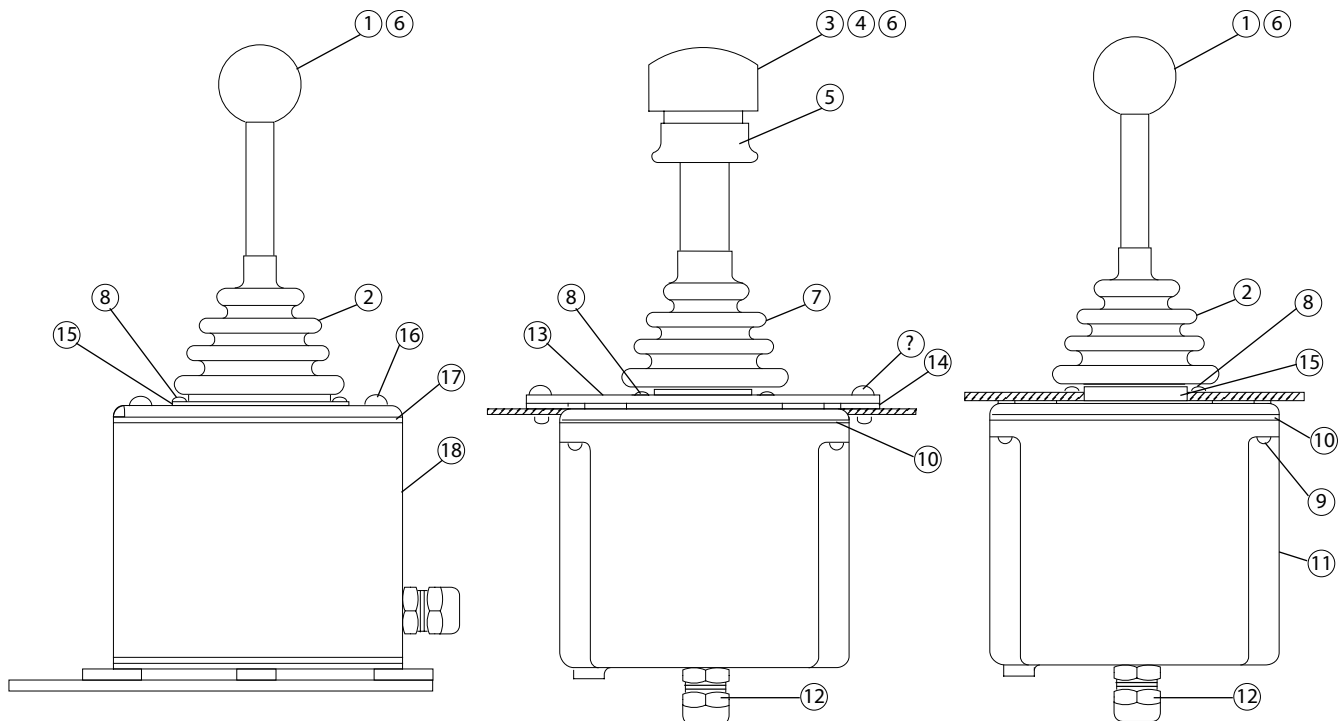
**Nameplate part numbers list**

Nameplate part numbers	Spring actuation control handle type
K16375	MCH11AD1252
K16376	MCH21AD1252
K16377	MCH31AD1252
K16378	MCH41AD1252
K16379	MCH51AD1252
K16380	MCH12AD1252
K16381	MCH22AD1252
K16382	MCH32AD1252
K16383	MCH42AD1252
K16384	MCH52AD1252

Nameplate part numbers	Friction held control handle type
K16385	MCH11BD1252
K16386	MCH21BD1252
K16387	MCH31BD1252
K16388	MCH41BD1252
K16389	MCH51BD1252
K16390	MCH12BD1252
K16391	MCH22BD1252
K16392	MCH32BD1252
K16393	MCH42BD1252
K16394	MCH52BD1252

**Assembly parts list**

*Assembly parts item numbers*



**Ordering information**

*Parts required to complete knob and case assemblies*

Item number	Part number	Quantity	Name	Type								
				Non-locking	Center lock	Surface	Top/case	Top/no case	Panel/case	Panel/no case	Friction	Spring
1	K00566	1	Knob	X								
2	11146334	1	Boot	X								
3	K00617	1	Knob top		X							
4	K00616	1	Spring		X							
5	K03545	1	Handle centerlock		X							
6	K00024	As required	Loctite 277		X							
7	11146335	1	Boot		X							
8	K27328	4	Screw M5-13	X		X	X	X	X	X		
9	K00776	4	Case fastner				X		X			
10	K00559	1	Gasket case seal				X		X			
11	K00754	1	Case plastic				X		X			
12	K00557	1	Leadwire strain relief				X		X			
13	K00636	1	Top mount plate				X	X				
14	K00653	1	Gasket top mounting				X	X				
15	K00562	1	Collar boot retainer			X			X	X		
16	K24329	4	Screw M5x16			X						
	K27328	4	Screw M5x16 for aluminum case			X						
17	K00558	1	Gasket			X						
18	K02992	1	Aluminum case assembly			X						
19	K00578	4	Seal collar			X						
20	MCH00A	1	Handle spring							X		
21	MCH00B	1	Handle friction								X	
22	K03734	1	Cam*									
23	K07194	1	Set screw*									
24	K16308	1	Wiring diagram									

\* These parts are required to change from one N/S switch and one center off switch to one center off switch and one forward or reverse switch.

**Accessories**

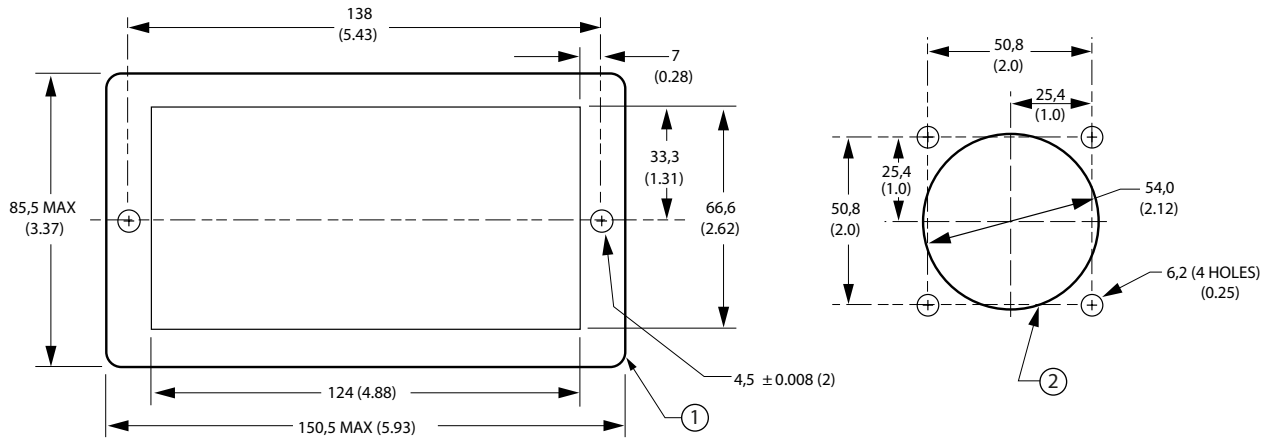
*EDC mating connectors*

<b>K03383</b>	Single-coil Packard Weather Pack 2-wire
<b>K03384</b>	Dual-coil Packard Weather Pack 4-wire
<b>K08106</b>	MS connector

## Installation

### Dimensions

Panel cutout and mounting plate

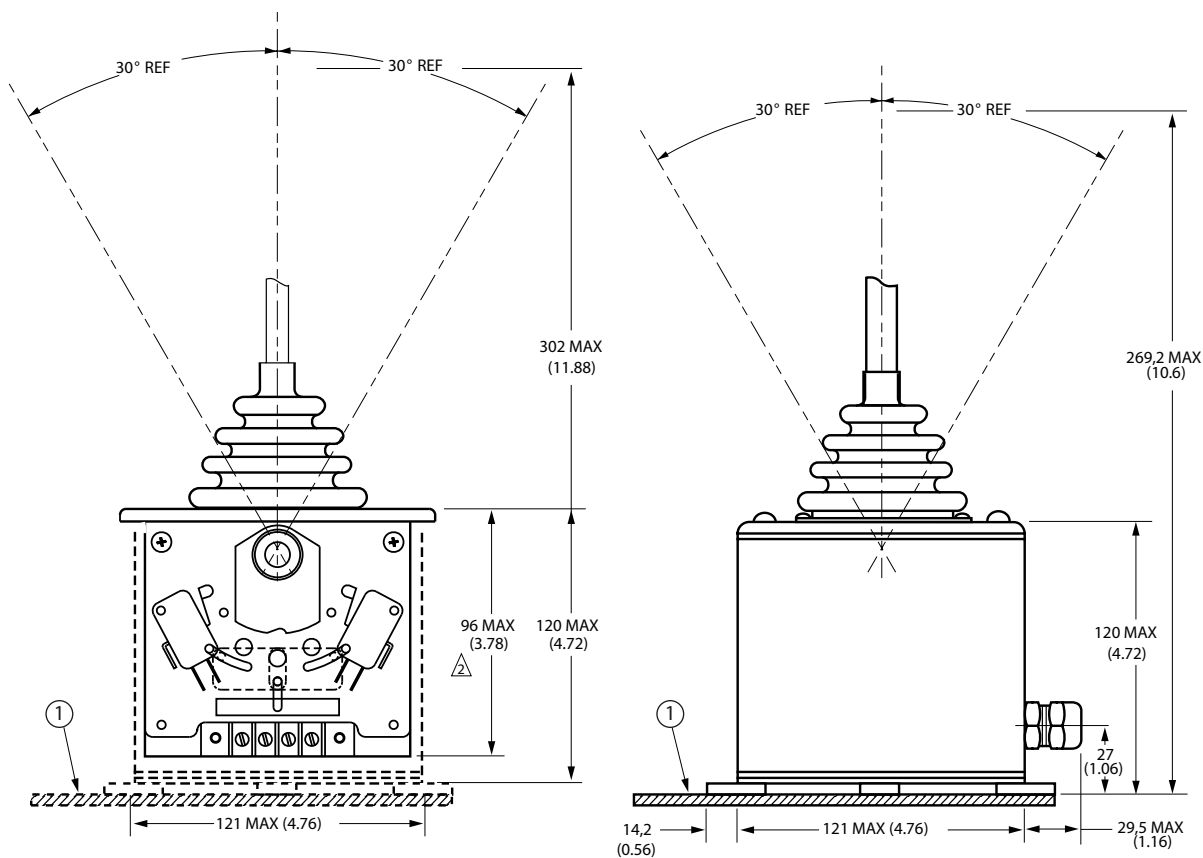
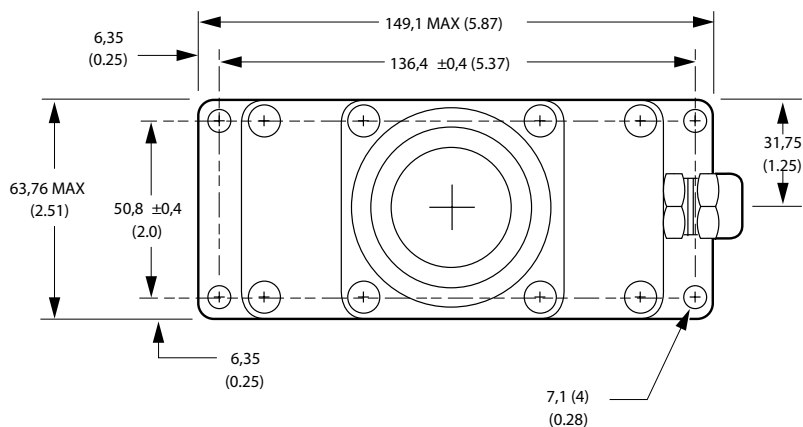


## Customizing the Basic Control Handle

### Installation

1. Mounting plate
2. Remove burrs from both sides of panel to avoid damaging boot

#### Surface mount

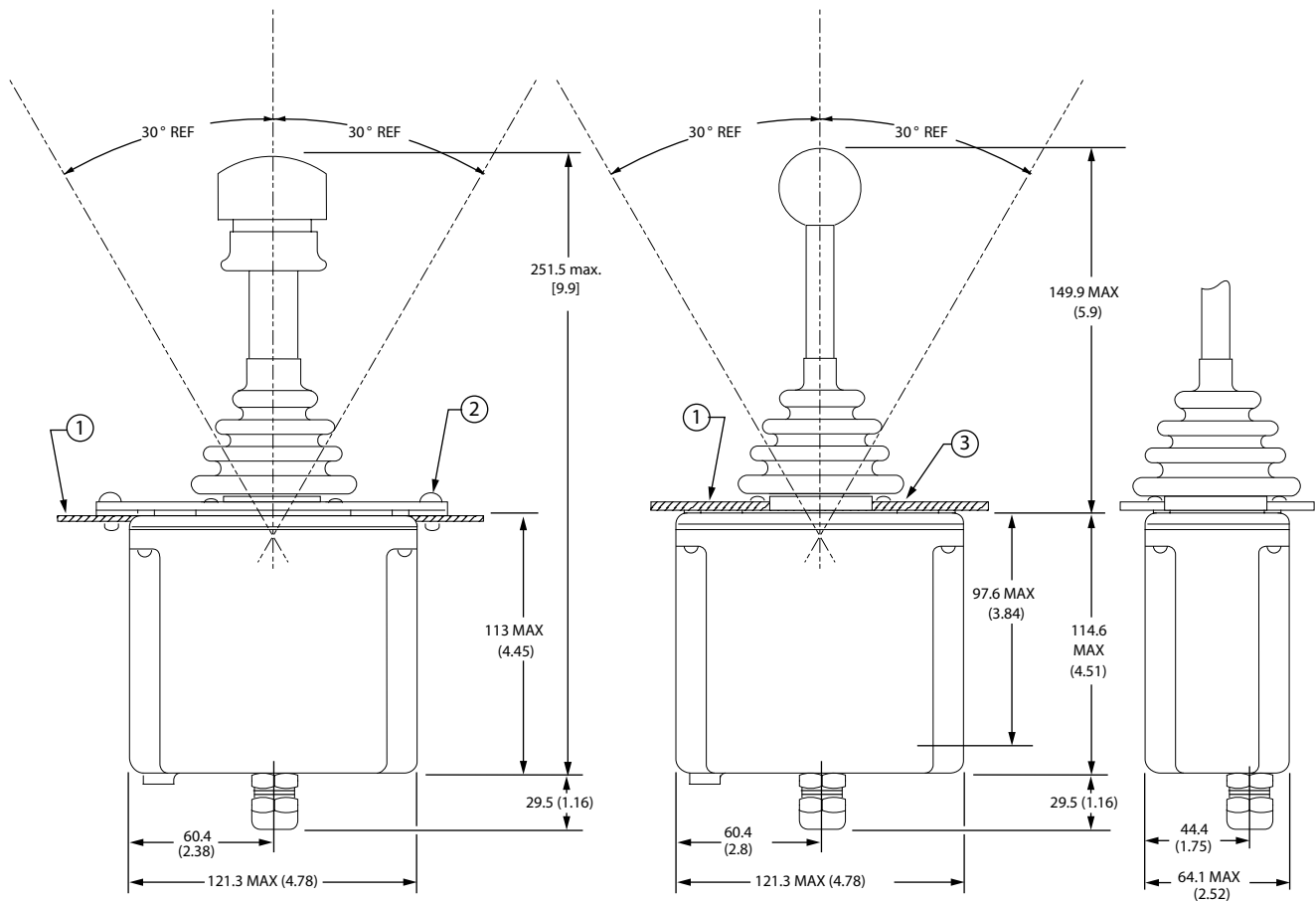


**Installation**

**1. Customer panel**

**Panel mount**

*Left to right: Panel mount (drop in); Panel mount; Panel mount side view*



1. Customer panel
2. Tapping screws (2)
3. Remove collar that retains boot and discard

## Installation

### Assembly

#### **Option 1: Assemble non-locking control knob**

Reference items in [Assembly parts list](#) on page 10.

1. Assemble boot (K22078 Item 2) over handle shaft so that ring inside of boot is in radius on handle shaft. Mold seams of boot should be 90° to handle axis.
2. Apply bead of Loctite (K00024 Item 6) three quarters of the length of internal threads in knob (K00566 Item1).
3. Screw knob onto handle shaft and hand tighten.

#### **Option 2: Assemble center lock control knob**

Reference items in [Assembly parts list](#) on page 10.

1. Assemble boot (K00635 Item 7) over handle center lock (K03454 Item 5) so that ring inside of boot is in radius of handle center lock and assemble over handle shaft.
2. Assemble spring (K00616 Item 4) to handle center lock.
3. Apply bead of Loctite (K00024 Item 6) three quarters of the length of internal threads in knob (K00617 Item3).
4. Screw knob onto handle shaft aligning center lock (K03545 Item 5) with D in knob and hand tighten.
5. Rotate boot so that mold seams of boot are 90° to handle axis. Check center lock for operation.

### Mounting

#### **Option 1: Surface mount**

Reference items in [Assembly parts list](#) on page 10.

1. Assemble gasket (K00558 Item 18) to handle (MCH00B Item 21 or K03734 Item 22).
2. Assemble handle to case (K02992 Item 19) so that notch on handle die cast cover is on same side as cable strain relief of case.
3. Assemble 4 seal collars (K00578 Item 9) to screw (K27329 Item 17) closed end of collars toward screw heads.
4. Assemble 4 screws to case and tighten to  $25 \pm 3$  in•lb.
5. Assemble boot retainer collar (K00562 Item 16) to boot.
6. Assemble 4 seal collars (K00578 Item 9) to screw (K27328 Item 8) closed end of collars toward screw heads.
7. Assemble 4 screws to retain boot and tighten to  $25 \pm 3$  in•lb. Make sure mold seams in boot are 90° to handle axis.
8. Assemble appropriate nameplate on case opposite side of leadwire strain relief.

#### **Option 2 and 3: Top mount with case**

Reference items in [Assembly parts list](#) on page 10.

1. Assemble strain relief (K00557 Item 13) to case (K00754 Item 12) and tighten.
2. Assemble gasket (K00559 Item 11) to handle (Item 21 or 22).
3. Assemble 4 case fasteners (K00776 Item 10) to handle.
4. Assemble top mounting plate (K00636 Item 14) to handle making sure mold seams on boot are 90° to handle axis.
5. Assemble 4 seal collars (K00578 Item 9) to screws (K27328 Item 8). Closed end of collars toward screw heads.
6. Assemble 4 screws to retain top mounting plate to handle and tighten to  $25 \pm 3$  in•lb.

**Installation**

7. Assemble gasket (K00653 Item 15) to top mounting plate.
8. Assemble appropriate nameplate to case on drain hole end of case.
9. Assemble case to handle with drain hole on opposite end of notch on die cast cover.
10. For top mount models with no case, omit steps 1, 2, 3, 8, and 9 above, and assemble nameplate to one of the handle side plates.

**Option 4 and 5: Panel mount with case**

Reference items in [Assembly parts list](#) on page 10.

1. Assemble strain relief (K00557 Item 13) to case (K00754 Item 12) and tighten.
2. Assemble gasket (K00559 Item 11) to handle (Item 21 or 22).
3. Assemble 4 case fasteners (K00776 Item 10) to handle.
4. Assemble collar (K00562 Item 16) to handle making sure mold seams on boot are 90° to handle axis.
5. Assemble 4 seal collars (K00578 Item 9) to screws (K27328 Item 8) with closed end of collars toward screw heads.
6. Assemble 4 screws to retain collar to handle and tighten to  $25 \pm 3$  in·lb.
7. Assemble appropriate nameplate to case on drain hole end of case.
8. Assemble case to handle with drain hole on opposite end of notch on die cast cover.
9. For top mount models with no case, omit steps 1, 2, 3, 7 and 8, and assemble nameplate to one of the handle side plates.

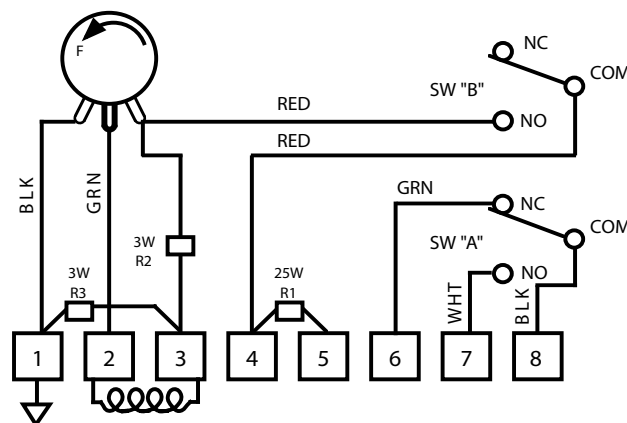
**Wiring**

Basic control handles access to power, ground, and the output is gained through the barrier terminal strip inside the handle case (see [Connection diagram](#) on page 17). A cable should run from the terminal strip through the connector/strain relief on the side or bottom of the case. For most applications, #18 AWG wire should be used.

The auxiliary switch is factory wired. The switch terminals are aEh" quick-connected for control handles with one or two switches. A clockwise handle movement generally causes a current flow from terminal 3 to terminal 2, if the terminal strip is facing you.

In order to avoid damaging the Basic control handle, a 1-amp fuse wired in series with the power wire is recommended.

**Wiring diagram**

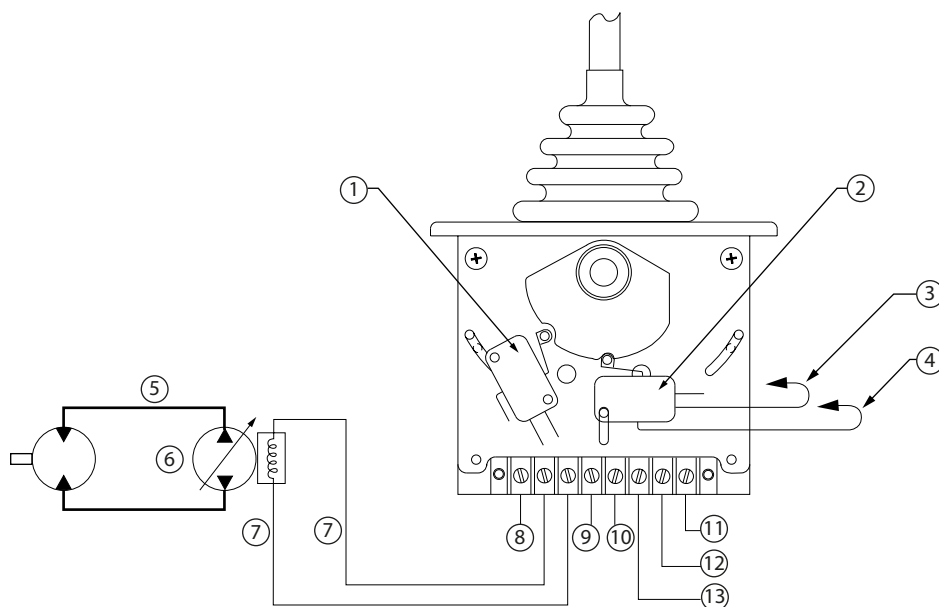


- |                                |                         |                                  |
|--------------------------------|-------------------------|----------------------------------|
| 1. Ground                      | 2. EDC coil             | 3. EDC coil                      |
| 4. +12 Vdc                     | 5. +24 Vdc              | 6. Neutral start normally closed |
| 7. Neutral start normally open | 8. Neutral start common |                                  |



## Installation

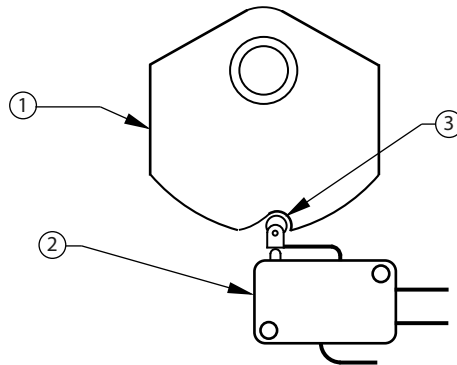
### Connection diagram



- |     |                               |     |                             |
|-----|-------------------------------|-----|-----------------------------|
| 1.  | Neutral start switch          | 2.  | Center off switch           |
| 3.  | From potentiometer            | 4.  | From terminal               |
| 5.  | Hydrostatic transmission      | 6.  | PV                          |
| 7.  | EDC coil                      | 8.  | GND                         |
| 9.  | 12 Vdc                        | 10. | 24 Vdc                      |
| 11. | Neutral start common          | 12. | Neutral start normally open |
| 13. | Neutral start normally closed |     |                             |

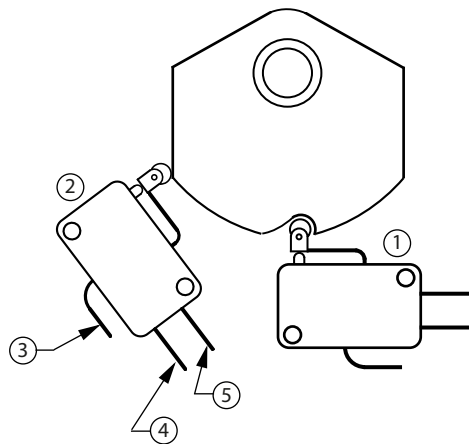
**Adding and replacing parts**

**Cam assembly drawing**



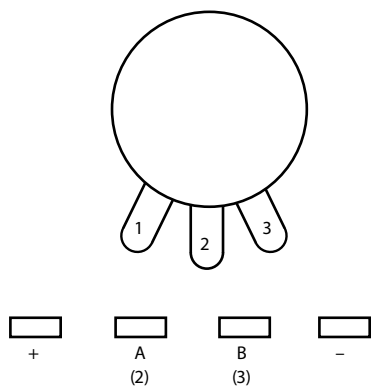
- 1. Cam assembly
- 2. Switch body
- 3. Radius

**Switches drawing**



- 1. #1 switch
- 2. #2 switch
- 3. Common
- 4. Normally open
- 5. Normally closed

**Single potentiometer drawing**



## Adding and replacing parts

### Warnings

1.  **Warning**

Failure to calibrate switches within the specified angles may result in the switch being activated when the handle is not in the proper position. (Example: If the switch is a center off switch, and is not calibrated per specifications, the machine function controlled by that handle may be activated when the handle is in the neutral position.)

2.  **Warning**

Failure to replace wires or electrical components to their original positions may result in an electrical failure which could burn out the handle or valve, or cause the function to be reversed from its original action, or in the elimination or bypassing of a function.

3.  **Warning**

Failure to calibrate the center lock function may result in the handle passing through the center position without locking.

4.  **Warning**

Failure to ensure free handle movement in both directions may result in limited movement in one direction, or (if spring returned) may cause the handle to stick in one direction.

5.  **Warning**

Failure to null potentiometer may result in an uneven output in each direction. The machine function controlled by the handle may be faster in one direction than in the other.

### Install new center switch

1. Install cam assembly with hub to the outside.  
Do not tighten setscrew.
2. Install switch body toward the radius side of the notch in the cam assembly.  
Reference [Cam assembly drawing](#) on page 18.
3. Move cam assembly and switch body until roller is in notch of cam assembly.
4. Tighten switch mounting screws to fasten switch body.
5. See [Warning 1](#). Adjust cam to ensure switch is actuated when the handle is within  $3^\circ \pm 1^\circ$  of neutral or detented position.
6. Tighten setscrew on cam.
7. See [Warning 1](#). Recheck actuating angle of cam. If not within  $3^\circ \pm 1^\circ$  of neutral or detented position, loosen cam setscrew and readjust.
8. Wire as desired.

### Install new auxiliary switch

1. Determine desired switching angle and mount switch.
2. See [Warning 1](#). Adjust switch to within  $\pm 1^\circ$  of desired switching angle.
3. Tighten switch mounting screws.  
Do not adjust auxiliary switches by moving cam, as this will destroy center switch adjustment.
4. Wire as desired.

## Adding and replacing parts

### Replace existing switches

1. Identify and record wire positions.
2. Remove wires from switch.
3. Remove switch.  
Do not remove cam assembly.
4. See [Warning 1](#). Install switch, as described above.
5. [Warning 2](#). Install wires in the original positions.

### Replace spur gear

1. Identify and record wire positions of switches.
2. Remove wires from switches.
3. Remove cam assembly.
4. [On friction-held handles, take precautions to prevent the loss of the detent spring and ball.](#)  
Remove switch side plate.
5. Remove spur gear.
6. Install new spur gear by aligning teeth with gear segment.  
Do not tighten setscrew.
7. Electrically null potentiometer. See step regarding [Electrically null potentiometer](#).
8. Tighten spur gear setscrew.
9. Friction-held handles only: Replace detent spring and ball.
10. Replace switch side plate.  
See [Warning 3](#). If the handle has the center lock option, replace the side plate and check the center lock action. If it does not function, readjust the side plate and recheck until it works properly. See [Warning 4](#). Check for free handle movement in both directions. If it does not function, readjust the side plate and recheck until it works properly.
11. Adjust switches, reference [Install new center switch](#) on page 19, [Install new auxiliary switch](#) on page 19, and [Replace existing switches](#) on page 20.

### Replace potentiometer

1. Identify and record wire positions on switches and potentiometer.
2. Remove wires and switches from potentiometer.
3. Remove cam assembly.
4. [On friction-held handles, take precautions to prevent the loss of the detent spring and ball.](#)  
Remove switch side plate.
5. Remove spur gear.
6. Remove potentiometer.
7. Install new potentiometer. (Do not tighten).
8. Install spur gear. (Do not tighten).
9. Adjust gear mesh by sliding potentiometer toward segment to obtain minimum backlash.
10. Tighten potentiometer.
11. See [Warning 2](#). Rewire potentiometer and switches to original positions.
12. If the control handle has two switches and there is a resistor in line with the common terminal of the #2 switch, disconnect the common lead. (Reference [Switches drawing](#) on page 18).
13. See [Warning 5](#). Electrically null potentiometer.
  - If the handle is a bidirectional device with a single potentiometer, null the potentiometer using the following method. (Reference [Single potentiometer drawing](#) on page 18).

## Adding and replacing parts

- a. Place the handle in the center or detented position.
  - b. If the handle has a center off switch, connect a jumper wire from “+” on the terminal strip to potentiometer terminal #1.
  - c. Connect the power lead from the machine to “+” on the terminal strip and the ground lead from the machine to “-” on the terminal strip.
  - d. Using a voltmeter, connect the “+” on the meter to the “2” on the terminal strip, and the “-” on the meter to “3” on terminal strip.
  - e. Rotate the potentiometer until the meter reads  $0 \pm 0.1$  volt.
  - f. Tighten setscrew on spur gear.
  - g. Recheck the value at the center position. If not in specification, repeat the nulling procedure. If a jumper wire was used between potentiometer terminal 1 and “+”, remove it.
- If the handle is a unidirectional device, null the potentiometer using the following method. (Reference [Single potentiometer drawing](#) on page 18).
    - a. Rotate the handle full clockwise when viewed from the potentiometer side.
    - b. If the handle has an end off switch, connect a jumper from the “+” on the terminal strip to potentiometer terminal 3.
    - c. Connect the power lead from the machine to the “+” terminal, and the ground lead from the machine to the “-” terminal.
    - d. Using a voltmeter, connect the “+” from the meter to potentiometer terminal 2, and the “-” from the meter to the “-” on the terminal strip.
    - e. Rotate the potentiometer shaft slowly to decrease the voltage.
    - f. When the meter reads  $0 \pm 0.1$  volts, tighten setscrew on spur gear.
    - g. Recheck reading. Repeat procedure if necessary. If a jumper wire was used between “+” and potentiometer terminal 3, remove it.
14. If the common lead from switch #2 was removed, reconnect it. (See [Switches drawing](#) on page 18).
  15. Replace detent spring and ball.
  16. See [Warning 3](#) and [Warning 4](#). Replace switch side plate.
  17. Adjust switches, reference [Install new center switch](#) on page 19, [Install new auxiliary switch](#) on page 19, and [Replace existing switches](#) on page 20.

## Replace centering spring

1. Remove snap ring.
2. Remove washers.
3. Remove bushing.
4. Remove spring.
5. See [Warning 3](#). Install new spring.  
 Tabs on spring may require bending to ensure minimum handle movement and proper center lock function in the neutral position
6. Replace bushing.
7. Replace washers.  
 Nylon washer to the inside.
8. Replace snap ring.

## Replacing breaks

1. Remove snap ring.
2. Remove and discard brake assemblies. (Use existing spring, screw and nut).
3. Mount new brake assemblies.
4. Replace snap ring.
5. Tighten nut and screw two full turns after initial contact.

**Customer support****Contact information****Order from**

<b>Danfoss Power Solutions (US) Company</b>	Customer Service Department 3500 Annapolis Lane North Minneapolis, Minnesota 55447 Phone: (763) 509-2084 Fax: (763) 559-0108
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Include:

- Description of the problem
- Copy of the purchase order
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**Danfoss  
Power Solutions (US) Company**  
2800 East 13th Street  
Ames, IA 50010, USA  
Phone: +1 515 239 6000

**Danfoss  
Power Solutions GmbH & Co. OHG**  
Krokamp 35  
D-24539 Neumünster, Germany  
Phone: +49 4321 871 0

**Danfoss  
Power Solutions ApS**  
Nordborgvej 81  
DK-6430 Nordborg, Denmark  
Phone: +45 7488 2222

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