Bulletin 2583-M1/USA
Installation Guide
Series D1FX
30 Design

Effective: December 11, 1995
FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

WARNING

The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated in the "Offer of Sale".

© Copyright 1995, Parker Hannifin Corporation, All Rights Reserved
Contents

Technical Information ............................................................................................................................... 1
  General Description ............................................................................................................................ 1
  Features ......................................................................................................................................... 1
  Operation ..................................................................................................................................... 1
  Specifications ................................................................................................................................. 1

Functional Description (Version AJ) .................................................................................................. 2
  Configuration Definition ............................................................................................................... 2
  Installation ................................................................................................................................... 2
  Standard Driver — Version AJ ........................................................................................................... 2
    Figure 1: Version AJ Functional Block Diagram ........................................................................... 2

Wiring & Initial Startup (Version AJ) .................................................................................................. 3
  Initial Startup ................................................................................................................................ 3
  Interface Wiring, 6 Pin I/O Connector ............................................................................................. 3
    Figure 2: Version AJ Board Setup ................................................................................................. 3
    Figure 3: Interface Wiring Diagram, Version AJ ........................................................................... 3

Functional Description (Version BJ) .................................................................................................. 4
  European Version BJ ....................................................................................................................... 4
    Figure 4: Version BJ Functional Block Diagram ........................................................................... 4

Wiring & Initial Startup (Version BJ) .................................................................................................. 5
  Initial Startup ................................................................................................................................ 5
  Interface Wiring, 7 Pin I/O Connector ............................................................................................. 5
    Figure 5: Version BJ Board Setup ................................................................................................. 5
    Figure 6: Interface Wiring Diagram, Version BJ ........................................................................... 5

Functional Description (Versions CJ & CK) ...................................................................................... 6
  External Closed Loop Feedback — Versions CJ & CK ................................................................... 6
    Figure 7: Version CJ Functional Block Diagram ........................................................................... 6
Bulletin 2583-M/USA
Technical Information

Parker Hannifin Corporation
Hydraulic Valve Division
Elyria, Ohio  44035  USA

Bulletin 2583-M1/USA Proportional Directional Control Valves
Series D1FX, 30 Design

General Description

The D1FX Series of proportional directional control valves provide variable output flow in response to voltage or current command signals. The valves are fully integrated units with on-board electronics and a spool position feedback device.

Features

- **Integral Electronics** ¾ Eliminates the time consuming and often costly electrical wiring between valve and driver card. Provides a fully factory tested valve/driver package.
- **LVDT** ¾ The spool position feedback is located between the valve body and coil thus allowing access to the manual overrides.
- **Electronic LVDT Null** ¾ Factory preset. No nulling required.
- **Diagnostic Indicator** ¾ Bi-color LED indicates the spool position.
- **Rugged Construction** ¾ Integral electronics packaged in a rugged die cast aluminum enclosure for protection from the harsh environments typical in many industrial applications.
- **Electrical Interface** ¾ Standard MS style connector for interface to computers and PLC’s.

Operation

The D1FX spool shifts proportionally in either direction in response to variable command signals; thus providing the desired output flow. Once the spool reaches the desired position, the internal LVDT sends a feedback signal to the drive amplifier to maintain that position. The closing of the inner control loop in this manner results in lower hysteresis and improved repeatability of the valve. The high dynamic amplifier gives this valve a frequency response of greater than 20 Hz.

Installation note: Valve should be mounted horizontally. (See Installation Information.)

Specifications

<table>
<thead>
<tr>
<th>Interface</th>
<th>NFPA D03, CETOP 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Pressure</td>
<td>315 Bar (4500 PSI)</td>
</tr>
<tr>
<td>Max. Tank Line Pressure</td>
<td>35 Bar (500 PSI)</td>
</tr>
<tr>
<td>Flow</td>
<td>Up to 38 LPM (10 GPM)</td>
</tr>
<tr>
<td>Frequency Response</td>
<td>&gt; 20 Hz with 10% CMD at 50% spool stroke</td>
</tr>
<tr>
<td>Step Response</td>
<td>Versions AJ, BJ, CJ, DJ: Full Shift, &lt;60 mS Versions CK, DK: Full Shift, &lt;70 mS</td>
</tr>
<tr>
<td>Repeatability</td>
<td>&lt; 0.5% of spool stroke</td>
</tr>
<tr>
<td>Hysteresis</td>
<td>&lt; 1.5%</td>
</tr>
<tr>
<td>Nominal Deadband</td>
<td>10%</td>
</tr>
<tr>
<td>Operating Temp. Range (Ambient)</td>
<td>24 volt model: -20° to 60°C (-4° to 140°F) 12 volt model: -29° to 60°C (-20° to 140°F)</td>
</tr>
<tr>
<td>Power Requirements</td>
<td>24 VDC @ 3 amps nom. (AJ, BJ, CJ, DJ) Range 21 to 30 VDC regulated 12 VDC @ 3 amps nom. (CK, DK) Range 11.5 to 15 VDC regulated **4 amp regulated power supply recommended</td>
</tr>
</tbody>
</table>

Command Signal

<table>
<thead>
<tr>
<th>Version</th>
<th>Command</th>
<th>Impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>AJ, BJ, CJK, DJ</td>
<td>0 to ± 10 VDC Dbl. Coil</td>
<td>100 k ohms</td>
</tr>
<tr>
<td>Version CK, DK</td>
<td>0 to ± 5 VDC Dbl. Coil</td>
<td>100 k ohms</td>
</tr>
<tr>
<td>Version AJ, BJ, CJ, DJ</td>
<td>4 to 20 mA Command</td>
<td>499 ohms</td>
</tr>
<tr>
<td>Version CK, DK</td>
<td>4 to 20 mA Command</td>
<td>249 ohms</td>
</tr>
</tbody>
</table>

Input Impedance

<table>
<thead>
<tr>
<th>Version</th>
<th>Impedance</th>
</tr>
</thead>
<tbody>
<tr>
<td>AJ, BJ, CJK, DJ</td>
<td>100 k ohms</td>
</tr>
<tr>
<td>CK, DK</td>
<td>100 k ohms</td>
</tr>
</tbody>
</table>

Reference Supply

<table>
<thead>
<tr>
<th>Version</th>
<th>Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>AJ, BJ, CJ, DJ</td>
<td>±10 VDC @ 10 mA (CK, DK)</td>
</tr>
<tr>
<td>CK, DK</td>
<td>±5 VDC @ 10 mA (CK, DK)</td>
</tr>
</tbody>
</table>

Low Power Fault Protection

<table>
<thead>
<tr>
<th>Version</th>
<th>Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>AJ, BJ, CJ, DJ</td>
<td>20 VDC (CK, DK)</td>
</tr>
<tr>
<td>CK, DK</td>
<td>11 VDC (CK, DK)</td>
</tr>
</tbody>
</table>

Diagnostics

Red/Green LEDs for spool position

Viscosity Range

75 - 600 SSU

Fluid Cleanliness

ISO Class 16/13, SAE Class 4 or better

Protection Class

Nema 4 (IP65)
Configuration Definition

The D1FX is supplied in two basic configurations — non-feedback and feedback. Non-feedback refers to valves having only a command input with any feedback loop closures made external to the valve. Feedback refers to valves having input terminals for both command and feedback and electronics for proportional loop closure. All the D1FX versions incorporate an internal spool position feedback.

The non-feedback versions include the Standard driver (AJ), a European version (BJ), and deadband versions (DJ & DK).

Feedback versions (CJ & CK) provide for external proportional feedback.

Detailed setup instructions can be found in the Options and Adjustments section. Not all jumpers and potentiometers are functional on every version.

Installation

Refer to the back of the manual for fluid recommendations, mounting restrictions, and other general installation instructions.

Standard Driver — Version AJ

Refer to the Functional Block diagram in figure 1. This is the standard 24 VDC version which accepts either a voltage or current command input. Output flow is proportional to the spool position which follows the Adjusted Command signal. ± 10 V reference voltages are available on Pins A and F of the I/O connector for a command potentiometer.

Figure 1 — Version AJ Functional Block Diagram

<table>
<thead>
<tr>
<th>CMD</th>
<th>TP2 Adj Cmd</th>
<th>FLOW</th>
<th>LED</th>
<th>TP1 Spool</th>
</tr>
</thead>
<tbody>
<tr>
<td>+10V</td>
<td>+10V</td>
<td>P Ô B</td>
<td>Grn</td>
<td>+10V</td>
</tr>
<tr>
<td>-10V</td>
<td>-10V</td>
<td>P Ô A</td>
<td>Red</td>
<td>-10V</td>
</tr>
</tbody>
</table>

Diagnostic Chart
Initial Startup

Factory Settings:
- LVDT hydraulically nulled (R3)
- Max A and Max B adjusted fully CW
- JP3 inserted: X1 Cmd gain
- Bias set for 0 V (R1)

Initial Startup:
- Turn on the DC power supply.
- Apply the Command input.
- Slowly increase the system pressure.
- Cycle the command and verify that the flow is proportional to the input.

Options: (Refer to Options/Adjustments section)
- Spool position monitoring (TP1 or Pin C)
- Max flow adjustments
- Reference voltages
- Current Cmd
- Bias

Interface Wiring, 6 Pin I/O Connector

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>EHC** 8 Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply</td>
<td>24VDC Nom. + Power Supply Common</td>
<td>E Red, D Grn &amp; Yel</td>
</tr>
<tr>
<td>Command</td>
<td>±10 VDC signal 4-20 mA, ±20 mA</td>
<td>B Blue</td>
</tr>
<tr>
<td>Reference Voltages</td>
<td>+10 VDC, -10 VDC</td>
<td>A Orn, F Wht</td>
</tr>
<tr>
<td>Spool</td>
<td>±10 VDC</td>
<td>C Blk</td>
</tr>
</tbody>
</table>

* Factory set – Do not adjust
** Min pots present but not functional on AJ

** Signal Common for an externally generated command should be separate from power supply ground.

Figure 2 — Version AJ Board Setup

Figure 3 — Interface Wiring Diagram, Version AJ
European Version BJ

Refer to the Functional Block diagram in Figure 4. The basic logic is the same as version AJ.

The power supply requirement is still +24 VDC but a separate wire has been added for chassis grounding. Pin E of the 7 pin connector is connected internally to the valve body but isolated from the electronics. An Enable signal is required at Pin C or the solenoids will remain de-energized.

The command input accepts either voltage or current inputs and has differential input capability for noise immunity and easy reversal of phasing. Output flow is proportional to the spool position which follows the adjusted command signal. The spool position may be observed at TP1 or at Pin F. Reference voltages are not available.

Figure 4 — Version BJ Functional Block Diagram

Diagnostic Chart

<table>
<thead>
<tr>
<th>-CMD/ +CMD</th>
<th>TP2 Adj Cmd</th>
<th>FLOW</th>
<th>LED</th>
<th>TP1 Spool</th>
</tr>
</thead>
<tbody>
<tr>
<td>+/-10V</td>
<td>+10V</td>
<td>P Ô B</td>
<td>Grn</td>
<td>+10V</td>
</tr>
<tr>
<td>+/-10V</td>
<td>-10V</td>
<td>P Ô A</td>
<td>Red</td>
<td>-10V</td>
</tr>
</tbody>
</table>
Initial Startup

Factory Settings:
- LVDT hydraulically nulled (R3)
- Max A and Max B adjusted fully CW
- Min A and Min B adjusted fully CCW
- JP3 inserted: X1 Cmd gain
- Bias set for 0 V (R1)

Initial Startup:
- Turn on the DC power supply
- Adjust Min A and Min B
- Apply the command input
- Slowly increase the system pressure
- Cycle the command and verify that the flow is proportional to the input
- Adjust Max A and Max B

Options: (Refer to Options/Adjustments section)
- Spool position monitoring (TP1 or Pin F)
- Min adjustments
- Max flow adjustments
- Current Cmd
- Bias

Interface Wiring, 7 Pin I/O Connector

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>EHC** 8G Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply</td>
<td>+ Power Supply Common</td>
<td>A</td>
</tr>
<tr>
<td>Enable</td>
<td>5 to 30 VDC</td>
<td>C</td>
</tr>
<tr>
<td>Command</td>
<td>±10 VDC signal</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>4-20 mA, ±20mA</td>
<td>E</td>
</tr>
<tr>
<td>Spool</td>
<td>±10 VDC</td>
<td>F</td>
</tr>
<tr>
<td>Chassis Ground</td>
<td>To valve body</td>
<td>G</td>
</tr>
</tbody>
</table>

Figure 5 — Version BJ Board Setup

Figure 6 — Interface Wiring Diagram, Version BJ
External Closed Loop Feedback — Versions CJ and CK

Special Note: The successful design and startup of either a closed loop positioning or velocity control system requires considerable forethought and a good understanding of the dynamics of the system and the load one is attempting to control. Closed loop feedback control is a broad topic and far exceeds the scope of this instruction set. It is the intention of the following instruction sheet to provide the necessary information to set-up the D1FX for use in typical closed loop applications. It is the responsibility of the user to understand the limitations, hazards, and implications of closed loop feedback control systems, as well as detailed tuning procedures required by some control schemes.

The feedback version is available in both a 24 VDC and 12 VDC nominal power supply. It has the option of either a voltage or current command signal. The feedback signal must be a voltage signal and can not exceed ±10 VDC (±5 VDC for CK). The feedback signal may have the same or opposite polarity to the command signal but must be the same magnitude as the command signal as there are no scaling adjustments provided. Reference voltages are available on pins A & F of the I/O connector for the command or feedback potentiometer.

The outer loop has proportional feedback. There are adjustable gains for both flow directions. Minimum threshold adjustments are available to optimally tune closed loop positioning systems.

Figure 7 — Version CJ Functional Block Diagram

<table>
<thead>
<tr>
<th>INPUTS</th>
<th>TP2 Error</th>
<th>FLOW</th>
<th>LED</th>
<th>TP1 Spool</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMD&gt;FBK</td>
<td>-V</td>
<td>P Ô A</td>
<td>Red</td>
<td>-V</td>
</tr>
<tr>
<td>CMD&lt;FBK</td>
<td>+V</td>
<td>P Ô B</td>
<td>Grn</td>
<td>+V</td>
</tr>
</tbody>
</table>
Initial Startup

Factory Settings:
- LVDT hydraulically nulled (R3)
- Max A and Max B adjusted approx half way
- Min A and Min B adjusted fully CCW
- JP3 inserted-proportional gain
- JP4 inserted-(Invert Fdbk)
- Bias set for 0 V (R1)

Initial Startup:
- Turn on the DC power supply
- Adjust Min A and Min B
- Connect the command input
- Connect the feedback input (Insert JP4 if the Fdbk and Cmd have the same polarity. Remove JP4 and insert JP5 for opposite polarity.)
- Slowly increase the system pressure
- Cycle the command and verify that the Fdbk follows the Cmd
- Adjust Max A and Max B

Options: (Refer to Options/Adjustments section)
- Spool position monitoring (TP1)
- Min adjustments
- Max gain adjustments
- Reference voltages
- Current Cmd
- Bias

Interface Wiring, 6 Pin I/O Connector

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Pin</th>
<th>Wire Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Power Supply</td>
<td>24VDC Nom.</td>
<td>E</td>
<td>Red</td>
</tr>
<tr>
<td></td>
<td>+Power Supply</td>
<td>D</td>
<td>Grn &amp; Yel</td>
</tr>
<tr>
<td></td>
<td>Common</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Command</td>
<td>±10 VDC signal 0 to 20 mA</td>
<td>B</td>
<td>Blue</td>
</tr>
<tr>
<td>Reference Voltages</td>
<td>+10 VDC</td>
<td>A</td>
<td>Orn</td>
</tr>
<tr>
<td></td>
<td>-10 VDC</td>
<td>F</td>
<td>Wht</td>
</tr>
<tr>
<td>*FDBK</td>
<td>±10 VDC</td>
<td>C</td>
<td>Blk</td>
</tr>
</tbody>
</table>

* "CK" version requires 12 VDC power supply and ±5 VDC input signals. Reference voltages are ±5 VDC.

Figure 8 — Version CJ Board Setup

* Factory set – Do not adjust

Figure 9 — Interface Wiring Diagram, Version CJ

** Signal Common for CMD or FDBK should be separate from power supply ground.
Standard Driver with Deadband Eliminators — Versions DJ and DK

The standard D1FX valve may not, depending on the load, be electrically symmetrical about the no-flow condition. Occasionally, (such as when using a PLC generated signal) it is desirable to equalize the signal needed for similar flow from P to A and P to B. Deadband or minimum threshold adjustments are designed to make the D1FX electrically symmetrical about the no-flow condition. This is a means of more easily hydraulically nulling and reducing the no-flow deadband at the same time.

Should this valve be used in a closed loop positioning system, deadband adjustments are an effective method of achieving higher repeatability and accuracy with a relatively low position loop gain.

This valve is available in both a 24 VDC and 12 VDC nominal power supply. It has the option of either voltage or current command signal. Reference voltages are available on the MS connector for the command or feedback potentiometer.

---

**Figure 10 — Version DJ Functional Block Diagram**

**Diagnostic Chart**

<table>
<thead>
<tr>
<th>CMD</th>
<th>TP2 Adj Cmd</th>
<th>FLOW</th>
<th>LED</th>
<th>TP1 Spool</th>
</tr>
</thead>
<tbody>
<tr>
<td>+10V</td>
<td>-10V</td>
<td>P Ø A</td>
<td>Red</td>
<td>-10V</td>
</tr>
<tr>
<td>-10V</td>
<td>+10V</td>
<td>P Ø B</td>
<td>Grn</td>
<td>+10V</td>
</tr>
</tbody>
</table>
Initial Startup

Factory Settings:
- LVDT hydraulically nulled (R3)
- Max A and Max B adjusted fully CW
- Min A and Min B adjusted fully CCW
- JP3 inserted: X 1 Cmd gain
- Bias set for 0 V (R1)

Initial Startup:
- Turn on the DC power supply
- Adjust Min A and Min B
- Connect the command input
- Slowly increase the system pressure
- Cycle the command and verify that the flow is proportional to the input
- Adjust Max A and Max B

Options: (Refer to Options/Adjustments section)
- Spool position monitoring (TP1 or PIN C)
- Min adjustments
- Max flow adjustments
- Reference voltages
- Current Cmd
- Bias

Interface Wiring, 6 Pin I/O Connector

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>EHC** 8 Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply</td>
<td>24VDC Nom.</td>
<td>E</td>
</tr>
<tr>
<td>+Power Supply</td>
<td>Common</td>
<td>D</td>
</tr>
<tr>
<td>Command</td>
<td>±10 VDC signal</td>
<td>B</td>
</tr>
<tr>
<td>4-20 mA, ±20 mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference Voltages</td>
<td>+10 VDC</td>
<td>A</td>
</tr>
<tr>
<td>-10 VDC</td>
<td></td>
<td>F</td>
</tr>
<tr>
<td>Spool</td>
<td>±10 VDC</td>
<td>C</td>
</tr>
</tbody>
</table>

- **Signal Common for CMD or FDBK should be separate from power supply ground.

Figure 11 — Version DJ Board Setup

Figure 12 — Interface Wiring Diagram, Version DJ
Spool Position Monitoring

The spool position relative to its zero starting point can be observed at TP1.

The spool voltage follows the command input after all adjustments have been made.

LVDT Null

The D1FX valves are hydraulically nulled to a double rod cylinder. The null should not need adjustment.

If it appears necessary to null the valve:

- Adjust Min A and Min B fully CCW.
- On the C version Max A and Max B should be adjusted approx halfway with the fdbk input disconnected.
- With pressure at 500 psi, set command input to approximately 0 volts.
- Slowly increase the command until flow just begins. Record this setting (+Cmd).
- Slowly decrease the command until flow just begins with a negative input (-Cmd).
- Add the magnitude of the two values and then divide by 2. This is the value at which flow should start in either direction (Start).
- If the magnitude of -Cmd was less than +Cmd, set the input to -Start. Otherwise set the input to +Start.
- Slowly adjust R3 (NULL) until flow just begins.

Reference Voltages (AJ,CJ,CK,DJ,DK)

Reference voltages are available for wiring to potentiometers for Cmd or Fdbk inputs. Up to 10 mA current is available but a 10 K ohm pot is recommended. The potentiometer can be wired for either a ± voltage or for a single polarity as shown below. Check wiring before applying power. Incorrect wiring can result in damage to the electronics.

Manual Overrides

Manual overrides are a design feature which allow the user to shift the valve in a system without electrical power. In the center of each coil there is a brass pin. Pushing on one of these pins with an allen wrench will result in flow.

Min Adjustments (BJ,CJ,CK,DJ,DK)

Min A and Min B can be adjusted to reduce the mechanical deadband in the valve.
Min Adjustments (cont.)

To adjust:
- Remove Cmd and Fdbk inputs. Bias should be set for 0 V.
- Apply low hydraulic pressure
- Move the switch down to A
- Adjust Min A CW until flow just begins
- Turn back CCW until flow ceases
- Move the switch up to B and repeat with Min B
- Move switch to center for Run

Max Flow Adjustments (AJ,BJ,DJ,DK)

Max A and Max B can be used to limit or scale flow on the open loop versions. Potentiometers fully CW results in maximum spool travel. Fully CCW reduces spool travel by 30% with JP3 gain and 10% with JP2 gain.
- Set the Cmd for maximum input
- Adjust the Max pot for the desired flow
- Repeat for the opposite flow direction

Adjust Min A and Min B before Max A and Max B.

**Flow Diagram**

- **1**: Max A-CW (MIN A-CCW)
- **2**: Max A-CW (MIN A-CW)
- **3**: Max A-CCW (MIN A-CW)

Bias (All versions)

The command bias is factory set to 0 VDC. It can be used with a current input or PLC to provide bidirectional flow.

To reset the bias to zero:
- Disconnect any inputs.
- Adjust Max A and Max B about midpoint.
- Adjust bias (R1) until TP2 reads zero volts.

Current or PLC Command (All versions)

The 24 V versions have a 499 ohm current resistor which converts 0 to 20 mA to 0 to 10 V signal.

\[(4 \text{ to } 20 \text{ mA} \Rightarrow 0 \text{ to } 10 \text{ V})\]

The 12 V versions have a 249 ohm resistor which converts 0 to 20 mA to 0 to 5 V signal.

\[(4 \text{ to } 20 \text{ mA} \Rightarrow 0 \text{ to } 5 \text{ V})\]

4-20 mA or 0-10V inputs can be biased and amplified for full range on non-feedback versions.
- Adjust Max A and B fully CW. Connect Cmd required for “no flow” (5 volts for 0-10V input, 12 mA for 4-20 mA input)
- Adjust bias pot R1 until TP2 equals 0 V.
- For a gain of X2.5 insert jumper JP2
  - 0-10 V \(\Rightarrow\) ±12.5V
  - 4-20 mA \(\Rightarrow\) ±10V on 24 V versions
  - 4-20 mA \(\Rightarrow\) ±5V on 12 V versions
- For a gain of X1 insert JP3
  - 0-10 V \(\Rightarrow\) ±5V

**Warning:** Adding bias will result in flow when the command signal is removed. Use the Enable to remove the drive signal.

Max Gain Adjustments (CJ,CK)

The CJ & CK versions provide for proportional feedback with adjustable gains for the A and B solenoids.
- Adjust Max A and Max B to approx center (15 out of 30 turns).
- Connect the inputs. Apply low pressure and verify phasing is correct.
- Disconnect the inputs. Add the Min thresholds.
- Once the basic system is operational, the gain can be adjusted for optimum performance. When the error signal at TP2 is positive (green LED), adjust Max B (R101). When the error signal is negative (red LED), adjust Max A (R102).
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instability</td>
<td>Power supply?</td>
<td>Select a power supply not current limited below 4.0 Amps. Use a separate power supply for each valve. The power supply should be chassis grounded.</td>
</tr>
<tr>
<td></td>
<td>Noise on inputs?</td>
<td>To verify, disconnect input signals to D1FX. Jumper Cmd and Fdbk terminals to common. For best results use a separate ground wire for signal inputs and power supply.</td>
</tr>
<tr>
<td>Actuator Drifting</td>
<td>Min adjustments?</td>
<td>Min adjustments can be adjusted such that the spool cannot stop flow and there will be no stable operating point. Remove the Min adjustments and start over.</td>
</tr>
<tr>
<td></td>
<td>System variations?</td>
<td>The valve was hydraulically nulled for a double rod cylinder. In a closed loop system drift may occur with no inputs connected. Connect the feedback and make external loop gain adjustment.</td>
</tr>
<tr>
<td>Low Flow</td>
<td>Flow limited?</td>
<td>Adjust Max CW for more flow on versions A, B, and D. Correct gain jumper inserted (JP2 or JP3)? Verify that the command input is correct.</td>
</tr>
<tr>
<td></td>
<td>Floating input?</td>
<td>Both inputs must be connected on B versions.</td>
</tr>
<tr>
<td></td>
<td>System pressure?</td>
<td>Verify that the system pressure is set as required and there are no other flow paths.</td>
</tr>
<tr>
<td>No Flow</td>
<td>Power?</td>
<td>Verify there is power to the board and it is wired with the correct polarity. Verify that the ENABLE signal is present on Version B. Verify that the connections to the valve subplate are correct. Verify the hydraulic pump is on.</td>
</tr>
<tr>
<td>No Proportional Control</td>
<td>Phasing?</td>
<td>If Version A, B, or D is connected to an external feedback system, verify open loop operation of valve with a potentiometer. If Version C, make sure proper feedback jumper (JP4 or JP5) is installed. Improper system phasing would result in maximum flow output.</td>
</tr>
</tbody>
</table>
Fluid Recommendations

Premium quality mineral based hydraulic oil with a viscosity range between 150-250 SSU (32-54 cst.) at 38°C (100°F) is recommended. The absolute operation viscosity range is from 75-600 SSU (15-130 cst.). Oil should have maximum anti-wear properties and rust and oxidation treatment.

Filtration

For maximum valve and system component life, the system should be protected from contamination at a level not to exceed 125 particles greater than 10 microns per milliliter of fluid. (SAE Class 4 or better / ISO Code 16/13).

Silting

Silting can cause any sliding spool valve to stick, and not spring return, if held shifted under pressure for long periods of time. The valve should be cycled periodically to prevent sticking.

Special Installations

Consult your Parker representative for any application requiring the following:

- Pressure above rated.
- Fluid other than those specified.
- Synthetic or fire-resistant fluids.
- Oil temperature above 71.1°C (160°F).
- Flow path other than normal.
- Non-standard power supply grounding.

Torque Specifications

The recommended torque values are for the bolts which mount the valve to the manifold or subplate are as follows:

<table>
<thead>
<tr>
<th>NFPA Size</th>
<th>Bolt Thread Size Metric</th>
<th>English</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>D03</td>
<td>M5 x 0.8</td>
<td>10-24 UNC</td>
<td>5.6 N.m. (50 in.-lbs.)</td>
</tr>
</tbody>
</table>

Mounting Restriction

In order to ensure proper operation, the D1FX must be mounted horizontally. If the valve is mounted vertically, a check valve with a minimum rating of 1.4 Bar (20 PSI) should be placed in the tank line to maintain back pressure to the valve.

Tank Line Surges

If several valves are piped with a common tank line, flow surges in the line may cause an unexpected spool shift. Separate tank lines should be used when line surges are expected.

Subplate Specifications

<table>
<thead>
<tr>
<th>Subplate</th>
<th>Port Size</th>
<th>Location</th>
<th>Max. Pressure PSI</th>
<th>Max. Pressure Bar</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPD23</td>
<td>3/8&quot; NPTF</td>
<td>Bottom</td>
<td>3,000</td>
<td>210</td>
</tr>
<tr>
<td>SPD233D</td>
<td>3/8&quot; NPTF</td>
<td>Bottom</td>
<td>5,000</td>
<td>345</td>
</tr>
<tr>
<td>SPD23S</td>
<td>9/16-18 NPTF</td>
<td>Bottom</td>
<td>3,000</td>
<td>210</td>
</tr>
<tr>
<td>SPD23SA</td>
<td>9/16-18 NPTF</td>
<td>Side</td>
<td>3,000</td>
<td>210</td>
</tr>
</tbody>
</table>
Bulletin 2583-M1/USA

Ordering Information

Proportional Directional Control Valves
Series D1FX, 30 Design

D1F  X  E  0  0  30

Electrohydraulic Directional Flow Control Valve

Integral LVDT & Control Electronics

Code Nominal Flow @ ΔP=10 Bar (145 PSI)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>7.5 LPM (2.0 GPM)</th>
<th>15 LPM (4.0 GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Standard Driver w/ 6 pin MS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Euro Driver (7 pin MS) w/ external shutdown</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>External Close Loop Pos. Driver w/ 6 pin MS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Standard Driver w/ deadband eliminator &amp; 6 pin MS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Weight: Single Solenoid 3.2 kg (7.0 lbs.); Double Solenoid 3.4 kg (7.5 lbs.)

Bolt Kit No. — BK209
Mounting Bolt Torque: 5.6 N.m. (50 in.-lbs.)

Cables

Electrohydraulic Cable for D1FX Valve

Note: For D1FX connector only, order part #697561 (6-pin)
For D1FX, Variation “B” connector only, order part #697323 (7-pin)

Use Power Supply #PS24, 24 VDC
The terms described in this document and other documents or descriptions provided by Parker Hannifin Corporation, its subsidiaries and its authorized distributors are hereby offered for sale at prices to be established by Parker Hannifin Corporation, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer (“Buyer”) shall be governed by all of the following Terms and Conditions. Buyer’s order for any such items, when communicated to Parker Hannifin Corporation, its subsidiary or an authorized distributor (“Seller”) verbally or in writing, shall constitute acceptance of this offer.

1. Terms and Conditions of Sale: All descriptions, quotations, proposals, offers, acknowledgments, acceptances and sales of Seller’s products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer’s acceptance of any offer to sell is limited to these terms and conditions. Any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance of an offer by Seller, or any other items which become Buyer’s property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed with no Buyer objection. All items which are manufactured using such property, shall not be responsible for any loss or damage to such property while it is in Seller’s possession or control.

2. Payment: Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for any taxes imposed or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer’s receipt of the shipment.

3. Delivery: Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller’s plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller’s delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

4. Warranty: Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from date of shipment from Parker Hannifin Corporation. This WAR RANTY IS EXPRESSLY LIMITED TO THE SOLE AND EXCLUSIVE WARRANTY PER TAINING TO ITEMS PROVIDED HEREBY. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING UNDER LAW, TRADITIONAL USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED.

5. Limitation Of Remedy: SELLER’S LIABILITY ARISING FROM OR IN ANY WAY CONNECTED WITH THE ITEMS SOLD OR THIS CONTRACT SHALL BE LIMITED EXCLUSIVELY TO REPAIR OR REPLACEMENT OF THE ITEMS SOLD OR REFUND OF THE PURCHASE PRICE PAID BY BUYER. AT SELLER’S SOLE OPTION, NO OTHER REMEDY SHALL BE LIABLE FOR ANY INCIDENT, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, INC. LUDING BUT NOT LIMITED TO LOST PROFITS ARISING FROM OR IN ANY WAY CONNECTED WITH THIS AGREEMENT OR ITEMS SOLD HEREBY, WHETHER ALLEGED TO ARISE FROM BREACH OF CONTRACT, EXPRESS OR IMPLIED WARRANTY, OR IN TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, FAILURE TO WARN OR STRICT LIABILITY.

6. Changes, Reschedules and Cancellations: Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller’s discretion, and shall be upon such terms and conditions as Seller may require.

7. Special Tooling: A tooling charge may be imposed for any special tooling, including without limitation, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller’s property notwithstanding payment of tooling charges by Buyer. In the event Buyer acquires any interest in apparatus belonging to Seller which is utilized in the notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

8. Buyer’s Property: Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer or any other items which become Buyer’s property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed with no Buyer objection. All items which are manufactured using such property, Buyer shall be held harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

9. Indemnity For Infringement of Intellectual Property Rights: Seller shall have the right for infringement of any patent, trademark, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against all claims of infringement of U.S. Patents, U.S. Trademarks, copyrights, trade dress and trade secrets (hereinafter ‘Intellectual Property Rights’). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller’s obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any actions or actions settlements or damages awarded in connection with such infringement. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwith standing the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller’s sole and exclusive liability and Buyer’s sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgments resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

10. Force Majeure: Seller does not assume the risk of and shall not be liable for delay or failure to perform any of its obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter ‘Events of Force Majeure’). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller’s control.

11. Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain therein.

12. Agreement/Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain therein. This Agreement shall be governed by the laws of the State of Ohio. No actions arising out of the sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.