The pilot operated proportional directional valves D*1FC with position feedback are available in 4 sizes:

D31FC - NG10 (CETOP 05)
D41FC - NG16 (CETOP 07)
D91FC - NG25 (CETOP 08)
D111FC - NG32 (CETOP 10)

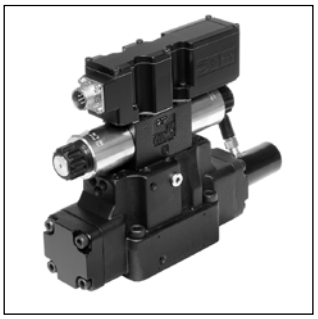
The digital onboard electronics is situated in a robust metal housing, which allows the usage under rough environmental conditions.

The nominal values are factory set. The parametrizing cable to connect to a serial RS232 interface is available as accessory.

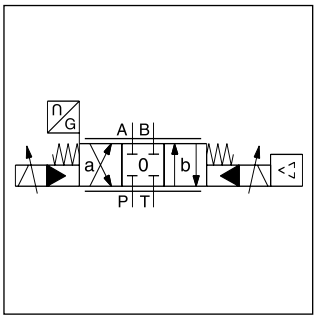
The innovative integrated regenerative function into the A-line (optional) allows energy saving circuits for differential cylinders. The hybrid version can be switched between regenerative mode and standard mode at any time.

**Features**

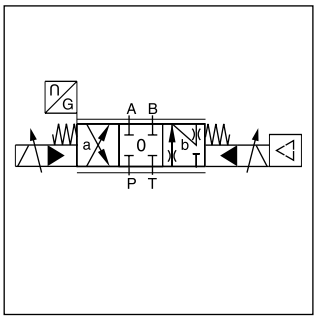
- Progressive flow characteristics for sensitive adjustment
- Low hysteresis
- High dynamics
- High flow capacity
- Centre position monitoring optional
- Energy saving A-regeneration optional
- Switchable hybrid version optional



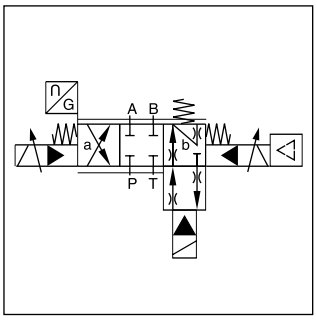
D41FC




Standard D*1FC

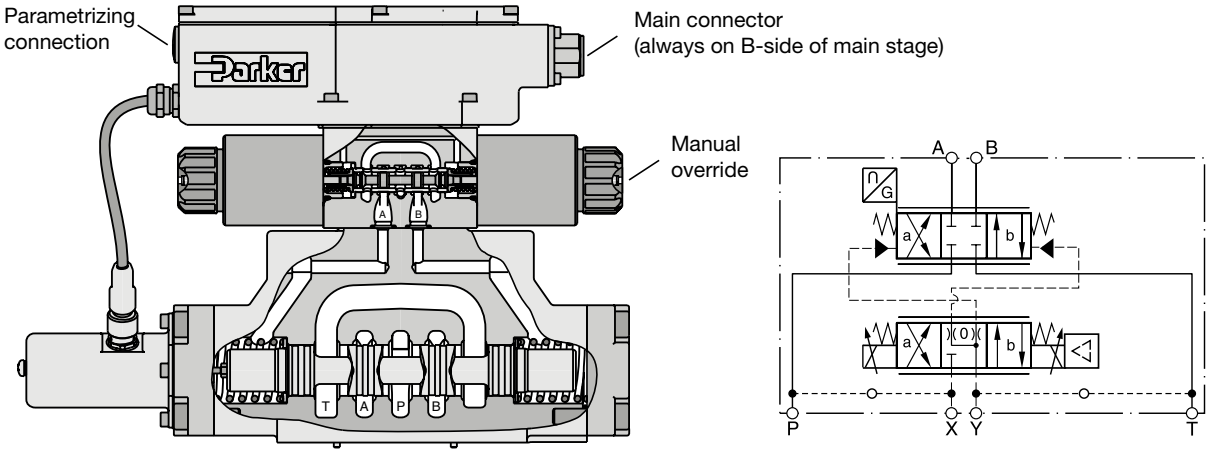



A-regeneration D*1FCR



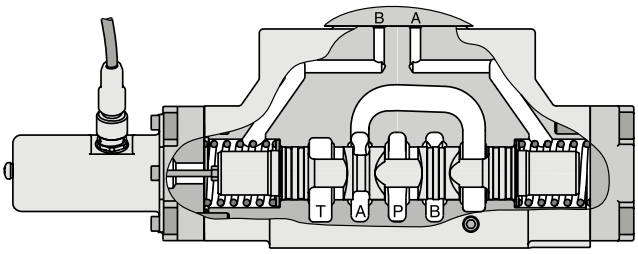

Hybrid D*1FCZ

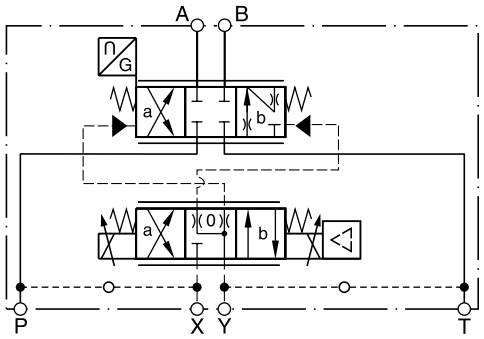
**D41FC**



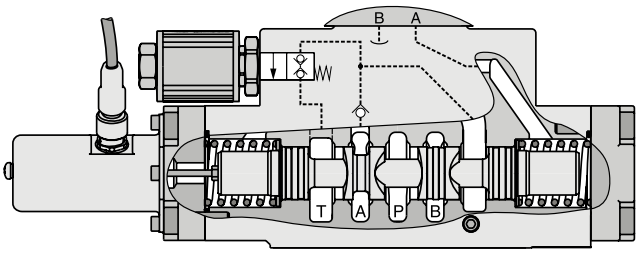
### D*1FCR and D*1FCZ

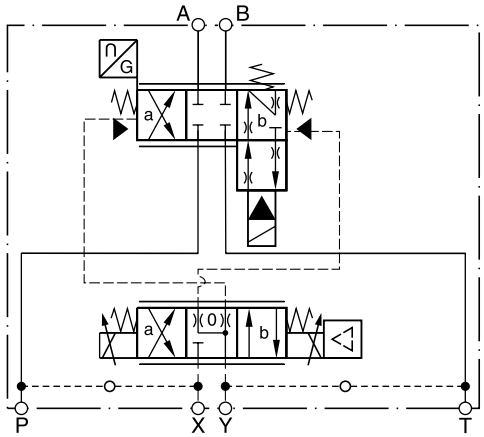
**Regenerative valve D*1FCR**



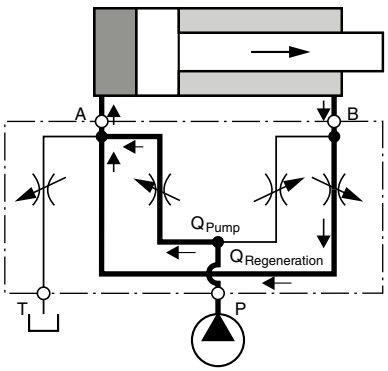




**Hybrid valve D*1FCZ**

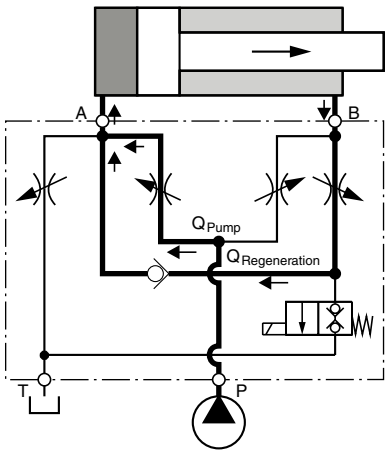


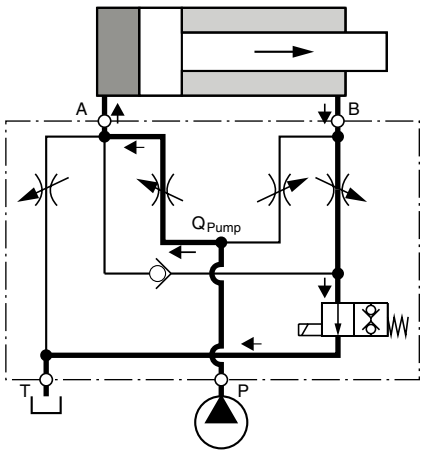

**D*1FCR (regenerative valve)**
**Cylinder extending**
**(high speed)**




**D*1FCZ (hybrid valve)**
**Cylinder extending**
**regenerative mode**
**(high speed)**




**Cylinder extending**
**standard mode**
**(high force)**



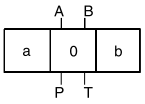

**Flow rate in % of nominal flow**

| Size | Spool | Port | | | | | |
|---|---|---|---|---|---|---|---|
| | | A-T | P-A | P-B | B-A (R-valve) | B-A (hybrid) | B-T (hybrid) |
| D41FCR/Z | 31/32 | 100 % | 50 % | 100 % | 50 % | 45 % | 20 % |
| D91FCR/Z | 31/32 | 100 % | 50 % | 100 % | 50 % | 50 % | 25 % |
| D111FCR/Z | 31/32 | 100 % | 50 % | 100 % | 50 % | 50 % | 20 % |

3

| D | | 1 | F | C | | | C | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Directional control valve | Size | NG06 pilot | Proportional control | Integrated electronics with position feedback | Function | Flow | Spool position on power down | Pilot connection | Seal | Command signal | Electronic option | Valve option | Design series (not required for ordering) |

| Code | Nominal size |
|---|---|
| 3 | NG10 / CETOP 05 |
| 4 | NG16 / CETOP 07 |
| 9 [1] | NG25 / CETOP 08 |
| 11 | NG32 / CETOP 10 |



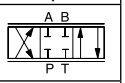
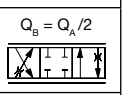
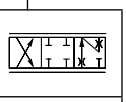
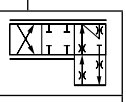
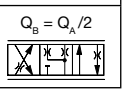
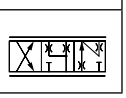
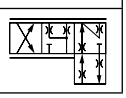

| Code | Valve option |
|---|---|
| 0 | Standard for spool type B, E R |
| 8 [6][7][8] | Monitor switch |
| L [5] | Hybrid valve 24V normally closed for spool type Z |

| Code | Electronic option [4] |
|---|---|
| 0 | 6+PE acc. EN175201-804 |
| 5 | 11+PE acc. EN175201-804 |
| 7 | 6+PE + enable acc. EN175201-804 |

| Code | Command signal | Function |
|---|---|---|
| B | 0...±10 V | 0...+10 V P -> B |
| E | 0...±20 mA | 0...+20 mA P -> B |
| K | 0...±10 V | 0...+10 V P -> A |
| S | 4...20 mA | 12...20 mA P -> A |

| Code | Seal |
|---|---|
| N | NBR |
| V | FPM |

| Code | Inlet | Drain |
|---|---|---|
| 1 | Internal | External |
| 2 | External | External |
| 4 | Internal | Internal |
| 5 | External | Internal |

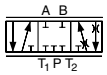
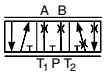
| Standard | | Regenerative function [2] | Hybrid function [2][3] |
|---|---|---|---|
| Code | Spool type | Code Spool type | Code Spool type |
| Overlap | | Overlap | Overlap |
| E01 |  | | |
| E02 |  | | |
| B31 |  | R31  | Z31  |
| B32 |  | R32  | Z32  |

| Code | Flow [l/min] at Δp = 5 bar per metering edge | | | |
|---|---|---|---|---|
| | D31 | D41 | D91 | D111 |
| D | 90 | — | — | — |
| E | 120 | — | — | — |
| F | — | 200 | — | — |
| H | — | — | 450 | — |
| L | — | — | — | 1000 |

Short delivery time for all variations

Parametrizing cable OBE → RS232, item no. 40982923

[1] With enlarged connections Ø 32 mm.
[2] For regenerative and hybrid function at D31FC (NG10) please refer solutions with sandwich- and adaptor plates "A10-1664 / A10-1665L / H10-1662 / H10-1666L" in chapter 12.

D31FC spool type: R31  R32 

[3] Not for D31FC.
[4] Please order plugs separately, see accessories .
[5] See page "regenerative and hybrid function" (not for D31FC).
[6] Not for D111FCZ*.
[7] Monitor switch for hybrid valves: code 8 includes options of code L (24 V normally closed).
[8] Please order female connector M12x1 separately (see accessories, female connector M12x1 (order no.: 5004109).

| | | | | | |
|---|---|---|---|---|---|
| **General** | | | | | |
| Design | | Pilot operated DC valve | | | |
| Actuation | | Proportional solenoid | | | |
| Size | | **NG10 (CETOP 05)** | **NG16 (CETOP 07)** | **NG25 (CETOP 08)** | **NG32 (CETOP 10)** |
| | | **D31** | **D41** | **D91** | **D111** |
| Mounting interface | | DIN 24340 / ISO 4401 / CETOP RP121 / NFPA | | | |
| Mounting position | | unrestricted | | | |
| Ambient temperature | [°C] | -20...+60 | | | |
| $MTTF_D$ value [1] | [years] | 75 | | | |
| Weight | [kg] | 9.0 | 12.5 | 21.0 | 68.5 |
| Vibration resistance | [g] | 10 Sinus 5...2000 Hz acc. IEC 68-2-6<br>10 (RMS) Random noise 20...2000 Hz acc. IEC 68-2-36<br>15 Shock acc. IEC 68-2-27 | | | |
| **Hydraulic** | | | | | |
| Max. operating pressure | [bar] | Pilot drain internal: P, A, B, X 350; T, Y 210 | | | |
| | [bar] | Pilot drain external: P, A, B, T, X 350; Y 210 | | | |
| Fluid | | Hydraulic oil according to DIN 51524...535, other on request | | | |
| Fluid temperature | [°C] | -20...+60 (NBR: -25...+60) | | | |
| Viscosity permitted | [cSt] / [mm²/s] | 20...400 | | | |
| recommended | [cSt] / [mm²/s] | 30...80 | | | |
| Filtration | | ISO 4406; 18/16/13 | | | |
| Nominal flow at Δp=5 bar per control edge [2] | [l/min] | 90 / 120 | 200 | 450 | 1000 |
| Leakage at 100 bar, main stage | [ml/min] | 200 | 200 | 600 | 1000 |
| pilot stage | [ml/min] | <100 | | | |
| Opening point | [%] | set to 10 command signal (see flow characteristics) | | | |
| Pilot supply pressure | [bar] | 20 - 350 | | | |
| Pilot flow, step response | [l/min] | 2.9 | 4.1 | 6.7 | 15 |
| **Static / Dynamic** | | | | | |
| Step response at 100 % step [3] | [ms] | 35 | 37 | 66 | 120 |
| Hysteresis | [%] | ≤ 0.1 | | | |
| Temperature drift | [%/K] | < 0.005 | | | |
| Sensitivity | [%] | ≤ 0.05 | | | |

[1] If valves with onboard electronics are used in safety-related parts of control systems, in case the safety function is requested, the valve electronics voltage supply is to be switched off by a suitable switching element with sufficient reliability.

[2] Flow rate for different Δp per control edge: $Q_x = Q_{Nom.} \cdot \sqrt{\frac{\Delta p_x}{\Delta p_{Nom.}}}$

[3] Measured with load (210 bar pressure drop / two control edges)

3

| **Electrical characteristics** | | | |
|---|---|---|---|
| Duty ratio | | [%] | 100 |
| Protection class | | | IP65 in accordance with EN 60529 (with correctly mounted plug-in connector) |
| Supply voltage/ripple DC | | [V] | 18...30, electric shut-off at < 17, ripple < 5 % eff., surge free |
| Current consumption max. | | [A] | 2.0 |
| Pre fusing medium lag | | [A] | 2.5 |
| Command signal | | | |
| Code K (B) | Voltage | [V] | 10...0...-10, ripple <0.01 % eff., surge free, 0...+10 V P—>A (P—>B) |
| | Impedance | [kOhm] | 100 |
| Code E | Current | [mA] | 20...0...-20, ripple <0.01 % eff., surge free, 0...+20 mA P—>B |
| | Impedance | [Ohm] | < 250 |
| Code S | Current | [mA] | 4...12...20, ripple <0.01 % eff., surge free, 12...20 mA P—>A<br>< 3.6 mA = enable off, > 3.8 mA = enable on acc. to NAMUR NE43 |
| | Impedance | [Ohm] | < 250 |
| Differential input max. | | [V] | |
| Code 0/7 | | | 30 for terminal D and E against PE (terminal G)<br>11 for terminal D and E against 0 V (terminal B) |
| Code 5 | | | 30 for terminal 4 and 5 against PE (terminal ⏚)<br>11 for terminal 4 and 5 against 0 V (terminal 2) |
| Adjustment ranges | Min | [%] | 0...50 |
| | Max | [%] | 50...100 |
| | Ramp | [s] | 0...32.5 |
| Interface | | | RS 232, parametrizing connection 5pole |
| Enable signal (code 5/7) | | [V] | 5...30 |
| Diagnostic signal | | [V] | +10...0...-10 / +12.5 error detection, rated max. 5 mA |
| EMC | | | EN 61000-6-2, EN 61000-6-4 |
| Electrical connection | Code 0/7 | | 6 + PE acc. to EN 175201-804 |
| | Code 5 | | 11 + PE acc. to EN 175201-804 |
| Wiring min. | Code 0/7 | [mm²] | 7 x 1.0 (AWG20) overall braid shield |
| | Code 5 | [mm²] | 8 x 1.0 (AWG20) overall braid shield |
| Wiring length max. | | [m] | 50 |

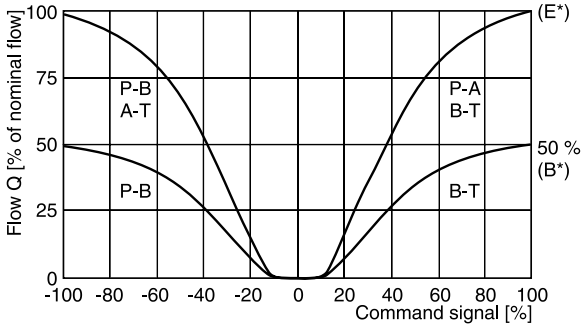
| **Electrical characteristics hybrid option** | | |
|---|---|---|
| Duty ratio | [%] | 100 |
| Protection class | | IP 65 in accordance with EN 60529 (with correctly mounted plug-in connector) |
| Supply voltage | [V] | 24 |
| Tolerance supply voltage | [%] | ±10 |
| Current consumption | [A] | 1.21 |
| Power consumption | [W] | 29 |
| Solenoid connection | | Connector as per EN 175301-803 |
| Wiring min. | [mm²] | 3 x 1.5 recommended |
| Wiring length max. | [m] | 50 recommended |

With electrical connections the protective conductor (PE ⏚) must be connected according to the relevant regulations.

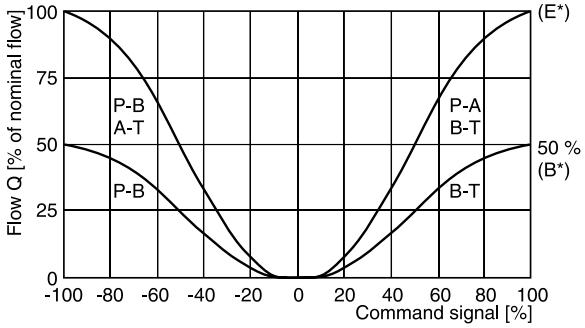
### D*1FC B/E Flow characteristics

(set to opening point 10 %) at Δp = 5 bar per metering edge

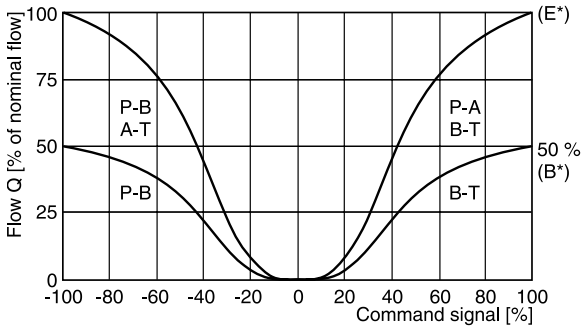
**D31FC,** Spool code E01, E02, B31, B32



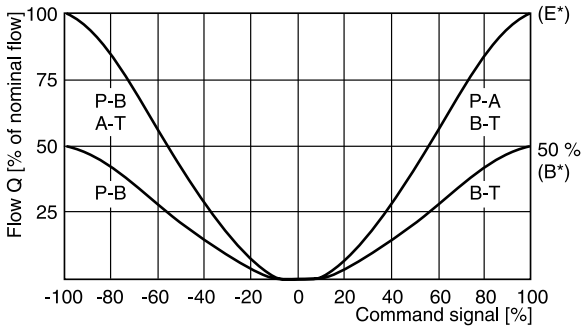

**D41FC**, Spool code E01, E02, B31, B32




**D91FC,** Spool type E01, E02, B31, B32



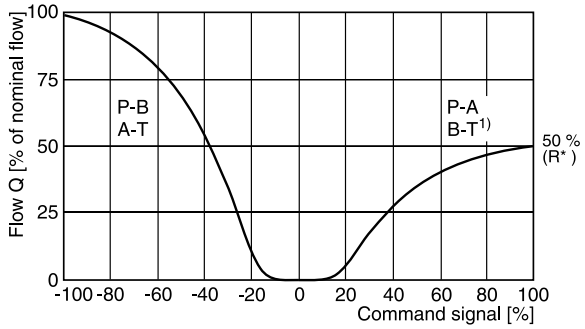

**D111FC,** Spool type E01, E02, B31, B32



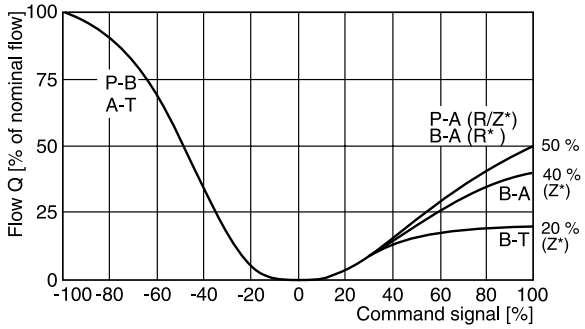

### Flow characteristics D*1FCR/Z

(set to opening point 10 %) at Δp = 5 bar per metering edge

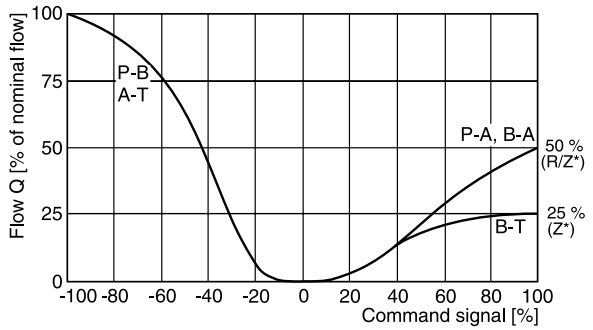
**D31FC,** Spool type R31, R32




**D41FC,** Spool type R31, R32, Z31, Z32




**D91FC**, Spool type R31, R32, Z31, Z32




**D111FC**, spool type R/Z* on request

[1] With 2 tank ports.

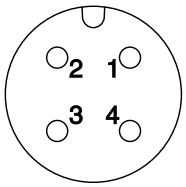
All characteristic curves measured with HLP46 at 50 °C.

3

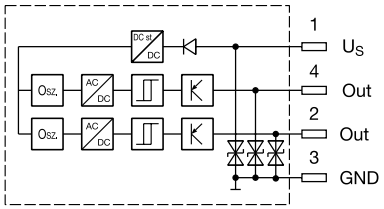
## Electrical characteristics of position control M12x1 as per IEC 61076-2-101

| | | |
|---|---|---|
| Supply voltage | [VDC] | 24 |
| Tolernace supply voltage | [%] | ±20 |
| Ripple supply voltage | [%] | ≤10 |
| Polarity protection | [V] | 300 |
| Current consumption without load | [mA] | ≤20 |
| Switching hysteresis | [mm] | <0.06 |
| Max. output current per channel, ohmic | [mA] | 250 |
| Ambient temperature | [°C] | -20 … +60 |
| Protection | | IP65 acc. EN 60529 |
| CE conform | | EN 61000-4-2 / EN 61000-4-4 / EN 61000-4-6 [1] / ENV 50140 / ENV 50204 |
| Min. distance to next AC solenoid | [m] | 0.1 |
| Interface | | M12x1 acc. to IEC 61076-2-101 |

## M12x1 connector pin assignment




1 + US 19.2...28.8 V
2 Output B (normally closed)
3 0 V
4 Output A (normally closed)




Outputs: Open collector

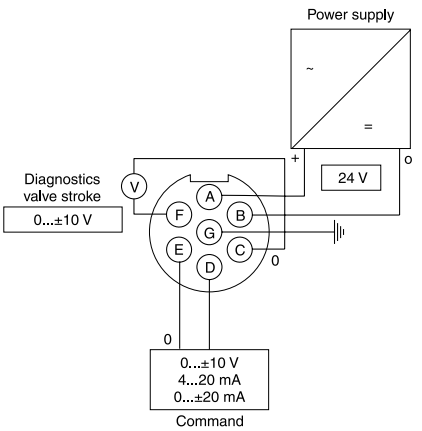
| Signal | Output A (pin 4) | Output B (pin 2) |
|---|---|---|
| neutral | closed | closed |
|  | open | closed |
|  | closed | open |

The neutral position is monitored. The signal changes after less than 10 % of the spool stroke.

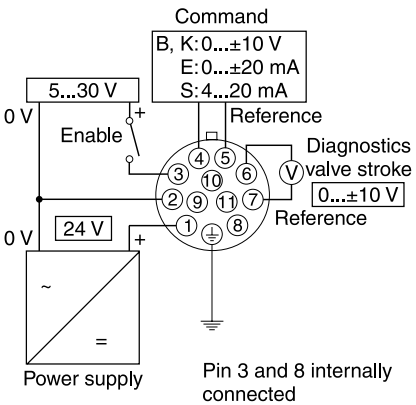
Please order female connector M12x1 separately (see accessories, female connector M12x1 (order no.: 5004109).

## Wiring according EN 175201-804

### Code 0/3, 6+PE




### Code 5, 11+PE

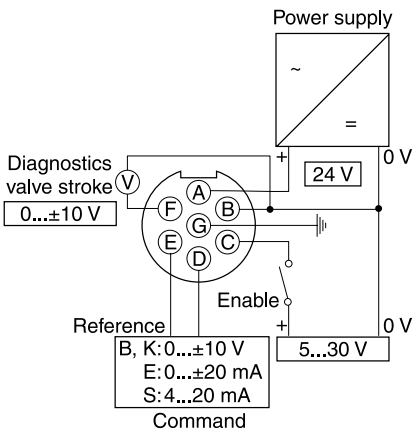



Pin 3 and 8 internally connected

Pin 9 and 11 internally connected

Pin 10 not connected

### Code 1/7, 6+PE + enable




[1] Only guaranted with screened cable and female connector

### ProPxD interface program

The ProPxD software allows quick and easy setting of the digital valve electronics. Individual parameters as well as complete settings can be viewed, changed and saved via the comfortable user interface. Parameter sets saved in the non-volatile memory can be loaded to other valves of the same type or printed out for documentation purposes.

The PC software can be downloaded free of charge at www.parker.com/isde – see page “Support" or directly at www.parker.com/propxd.

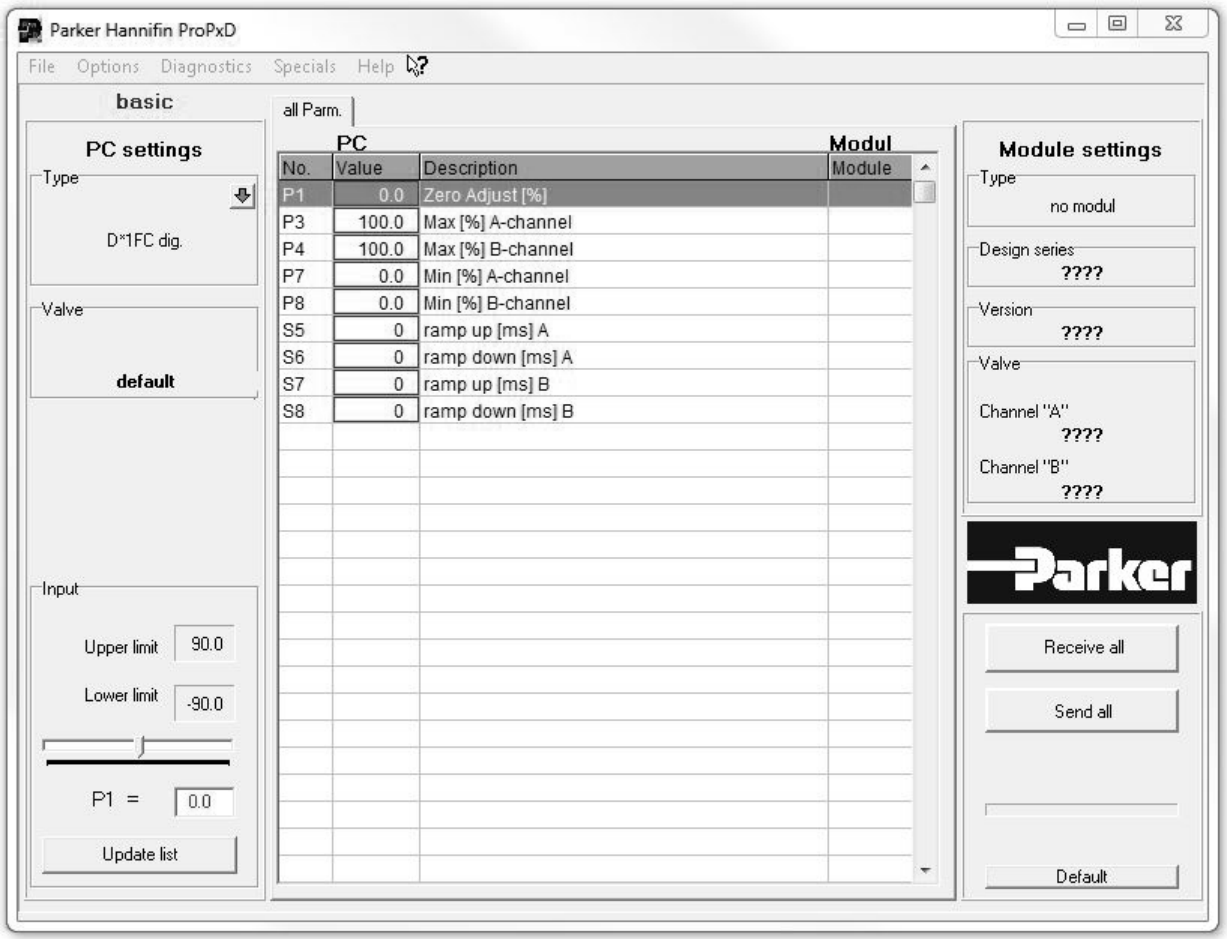
### Features

- Comfortable editing of valve parameters
- Saving and loading of customized parameter sets
- Executable with all Windows® operating systems from Windows® XP upwards
- Simple communication between PC and valve electronics via serial interface RS232C

The valve electronics cannot be connected to a PC with a standard USB cable – this can result in damages of PC and/or valve electronics.

**The parametrizing cable may be ordered under item no. 40982923.**

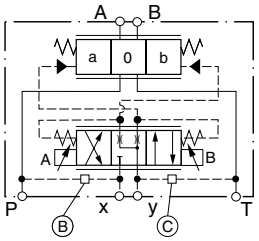




### Pilot oil inlet (supply) and outlet (drain)

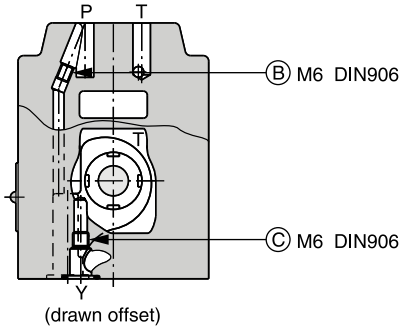
○ **open,** ● **closed**

| Pilot oil Inlet | Pilot oil Drain | B | C |
|---|---|---|---|
| internal | external | ○ | ● |
| external | external | ● | ● |
| internal | internal | ○ | ○ |
| external | internal | ● | ○ |



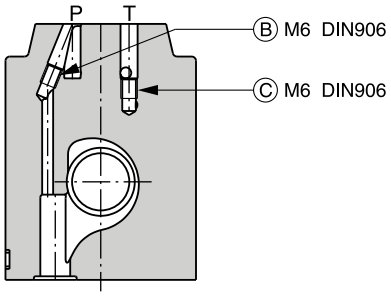

3

### D31FCB/E

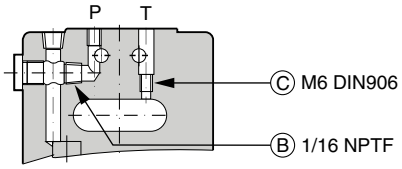



(drawn offset)

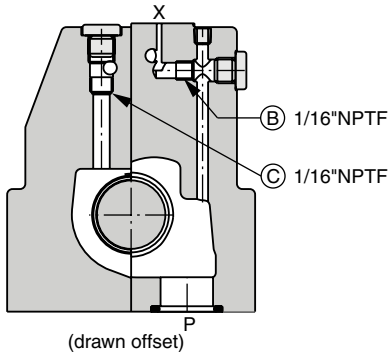
### D31FCR




### D41FCB/E

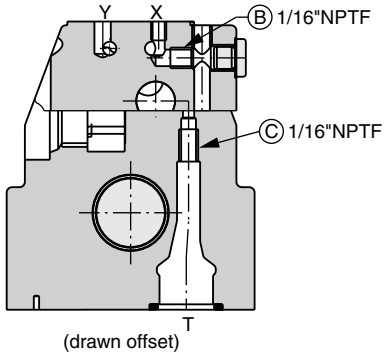



### D41FCR



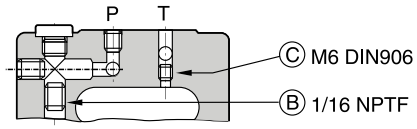

(drawn offset)

### D41FCZ

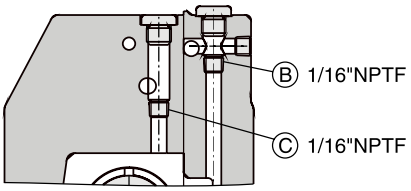



(drawn offset)

### D91FCB/E

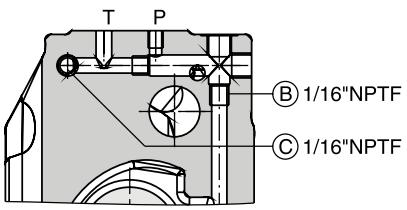



### D91FCR

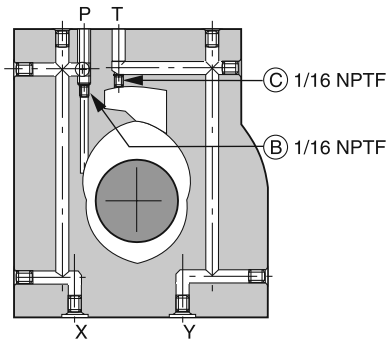



(drawn offset)

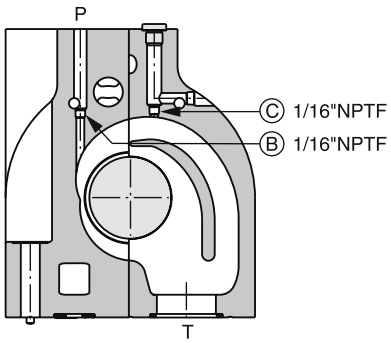
### D91FCZ




### D111FCB/E

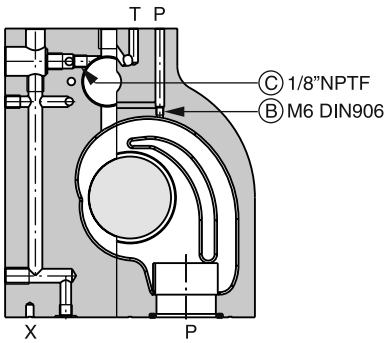



### D111FCR




(drawn offset)

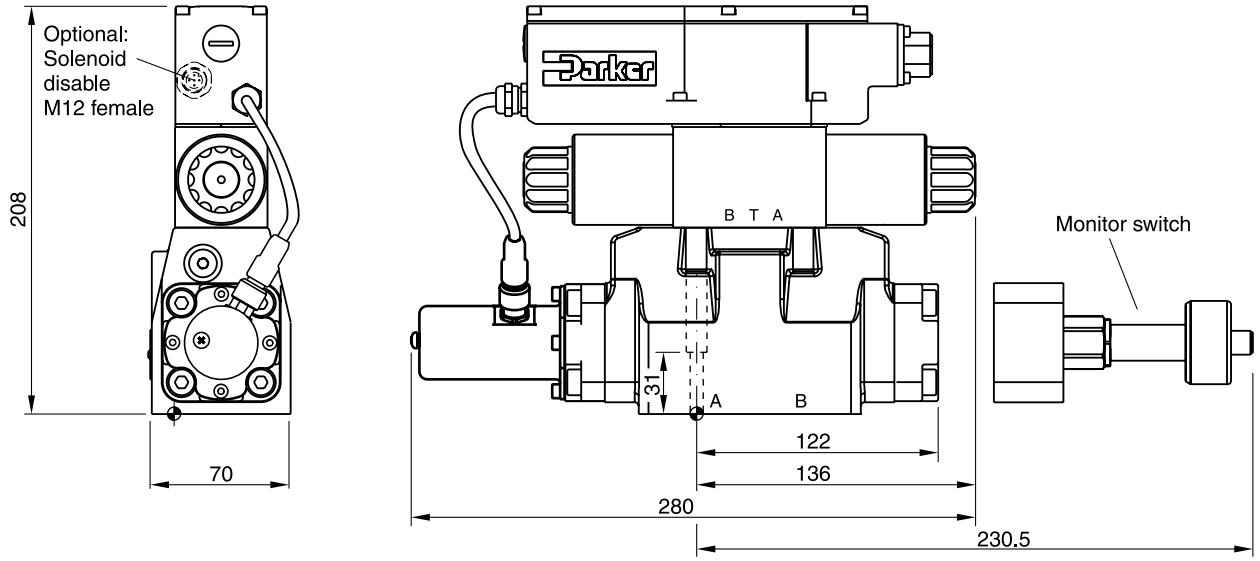
### D111FCZ




(drawn offset)

D_1FC UK.indd 16.04.21

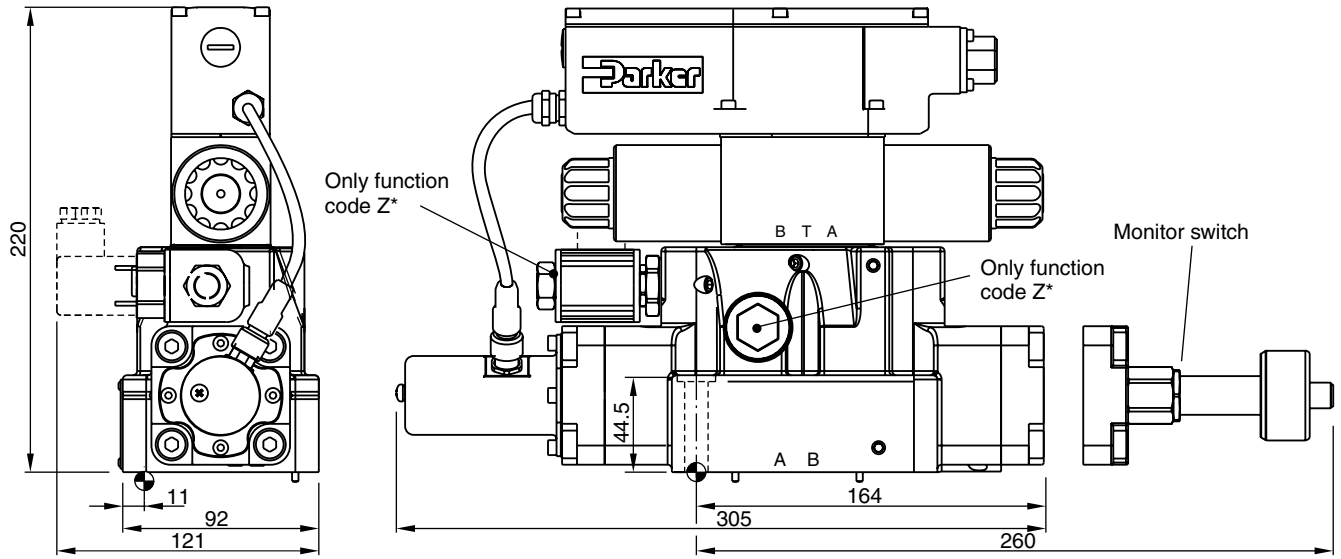
### D31FC




Regenerative and hybrid function with additional plate "H10-1666L / H10-1662 / A10-1664 / A10-1665L", see chapter 12.

| Surface finish | Kit | | | Kit |
|---|---|---|---|---|
| $R_{max}6.3$ 0.01/100 | BK385 | 4x M6x40<br>ISO 4762-12.9 | 13.2 Nm<br>±15 % | NBR: SK-D31FC<br>FPM: SK-D31FC-V |

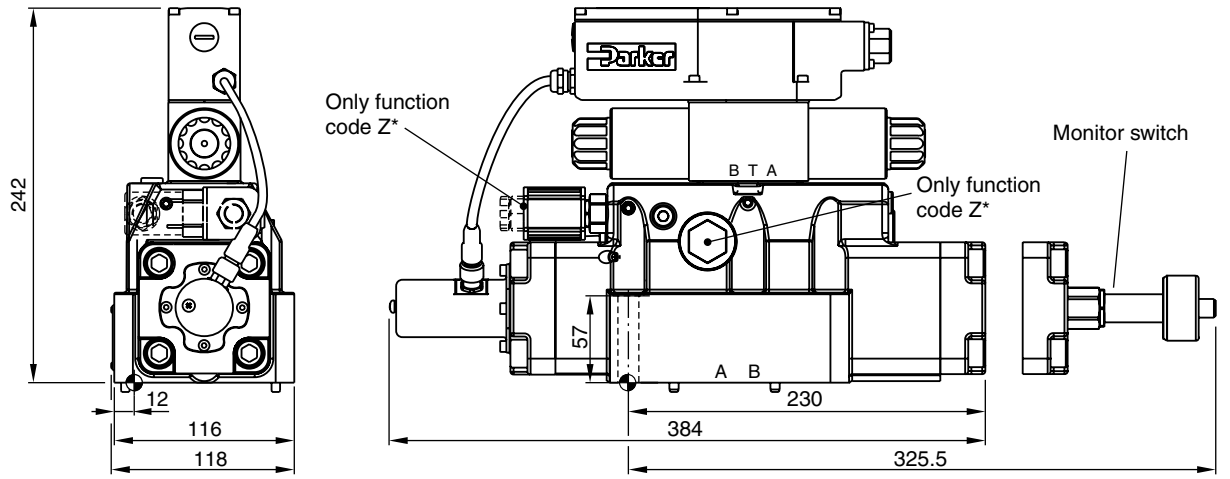
### D41FC




| Surface finish | Kit | | | Kit |
|---|---|---|---|---|
| $R_{max}6.3$ 0.01/100 | BK320 | 2x M6x55<br>4x M10x60<br>ISO 4762-12.9 | 13.2 Nm ±15 %<br>63 Nm ±15 % | NBR: SK-D41FC<br>FPM: SK-D41FC-V |

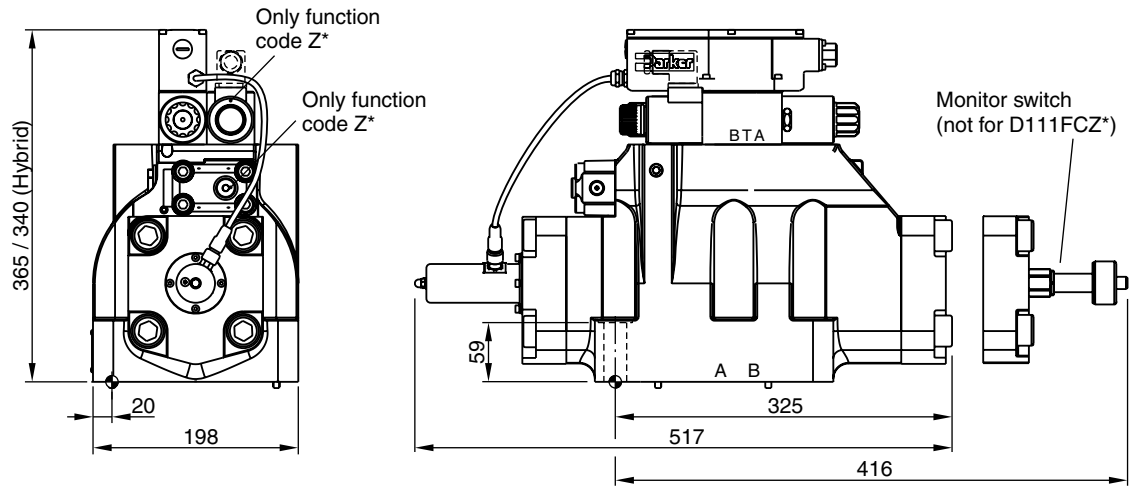
3

### D91FC




| Surface finish | Kit | | | Kit |
|---|---|---|---|---|
| $\sqrt{R_{max}6.3}$ 0.01/100 | BK360 | 6x M12x75<br>ISO 4762-12.9 | 108 Nm<br>±15 % | NBR: SK-D91FC<br>FPM: SK-D91FC-V |

### D111FC




| Surface finish | Kit | | | Kit |
|---|---|---|---|---|
| $\sqrt{R_{max}6.3}$ 0.01/100 | BK386 | 6x M20x90<br>ISO 4762-12.9 | 517 Nm<br>±15 % | NBR: SK-D111FC<br>FPM: SK-D111FC-V |

### Introduction

The new proportional valves with position feedback series D*FC (direct operated) and D*1FC (pilot operated) with EtherCAT interface fulfill the requirements of modern communication between valve and main control. Due to high data transmission speed and short cycle times, also demanding control functions can be realized within the fieldbus system.

The valve is actuated and monitored by the EtherCAT interface. Actual value (spool position), temperature, operating hours and different error messages are available as diagnostic signals. The valve parameters are factory set and can be adapted with the Parker ProPxD software via the parametrizing interface.

In addition to the fieldbus communication, the valves provide the range of functions of the standard version including analogue command signal and diagnostic spare stroke. Thus they can be operated independent of the fieldbus control, particularly during commissioning and maintenance.

The option with EtherCAT is available for the series:

- D1FC, D3FC
- D31FC, D41FC, D91FC, D111FC

D1FC with EtherCAT



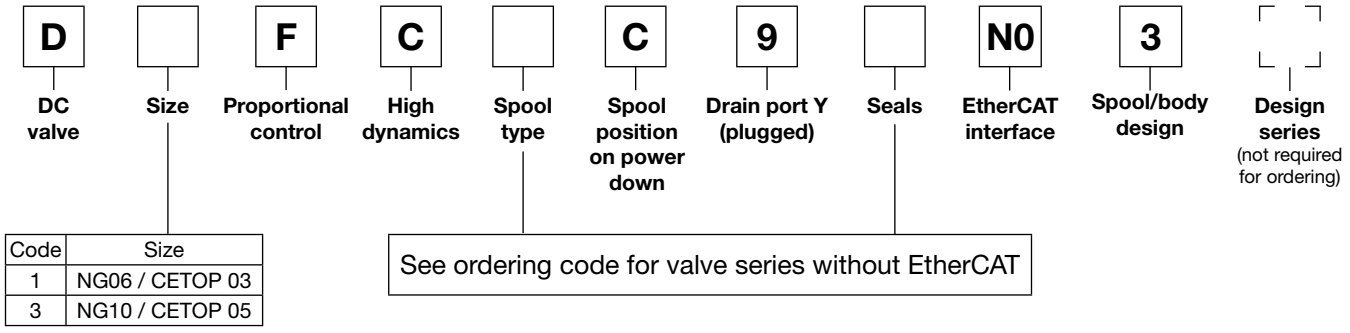
### Features EtherCAT interface

- EtherCAT interface, 2x M12x1 connector 4-Pin (EtherCAT In and EtherCAT Out)
- Progressive flow characteristics for sensitive adjustment
- Low hysteresis
- High dynamics
- High flow capacity
- Onboard electronics

### Technical Data

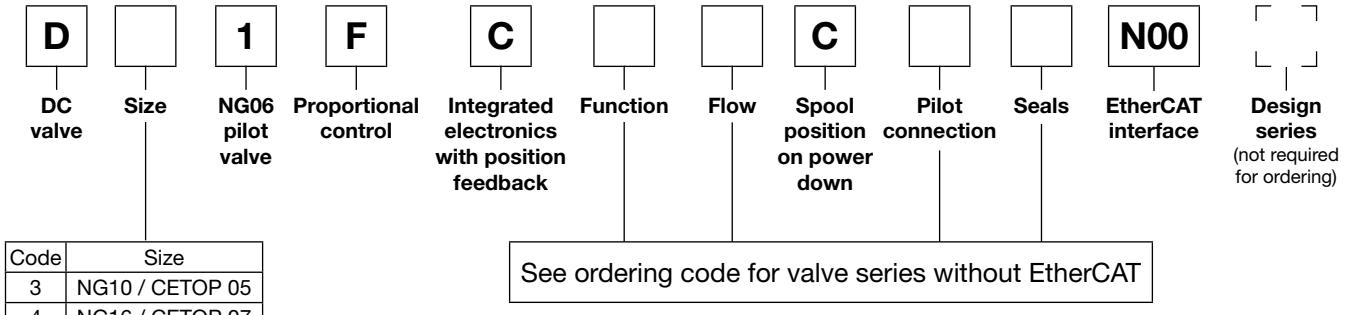
| | | | |
|---|---|---|---|
| **Electrical** | | | |
| Duty ratio | | [%] | 100 |
| Protection class | | | IP65 in accordance with EN 60529 (with correctly mounted plug-in connector) |
| Supply voltage/ripple | | [V] | 18...30, electric shut-off at < 17, ripple < 5 % eff., surge free |
| Current consumption max. | | [A] | 2.0 (D1FC, D*1FC), 3.5 (D3FC) |
| Pre fusing medium lag | | [A] | 2.5 (D1FC, D*1FC), 4.0 (D3FC) |
| Differential input | | [V] | 30 for terminal D and E against PE (terminal G) |
| Diagnostic signal | | [V] | +10...0...-10 / +12.5 error detection |
| EMC | | | EN 61000-6-2, EN 61000-6-4 |
| Electrical connection | | | 6 + PE acc. to EN 175201-804 |
| EtherCAT interface | | | 2 x socket M12x1: 5p acc. to IEC61076-2-101 |
| Wiring min. | | [mm²] | 3 x 1.0 (AWG16) overall braid shield |
| Wiring length max. | | [m] | 50 |
| Wiring EtherCAT | | | acc. to CiA DS-301 Version 4 / Twisted pair cable acc. to ISO11898 |
| EtherCAT profiles | | | Communication Layer IEC 61158-x-12, 301 Version 4<br>Device Profile in accordance with CIA DS - 408 Version 1.5.2<br>CANopen over EtherCAT (object dictionary) |
| Functionality | | | One PDO (Receive)<br>One PDO (Transmit)<br>BUS-cycle time down to 0.250 mSec. |
| **Parameterization** | | | |
| Interface | | | RS 232, parametrizing cable order code 40982923 |
| Interface program | | | ProPxD (see www.parker.com/propxd) |
| Adjustment ranges | Min | [%] | 0...50 |
| | Max | [%] | 50...100 |
| | Ramp | [%] | 0...32.5 |

### Direct Operated Proportional DC Valve




| Code | Size |
|---|---|
| 1 | NG06 / CETOP 03 |
| 3 | NG10 / CETOP 05 |

### Pilot Operated Proportional DC Valve

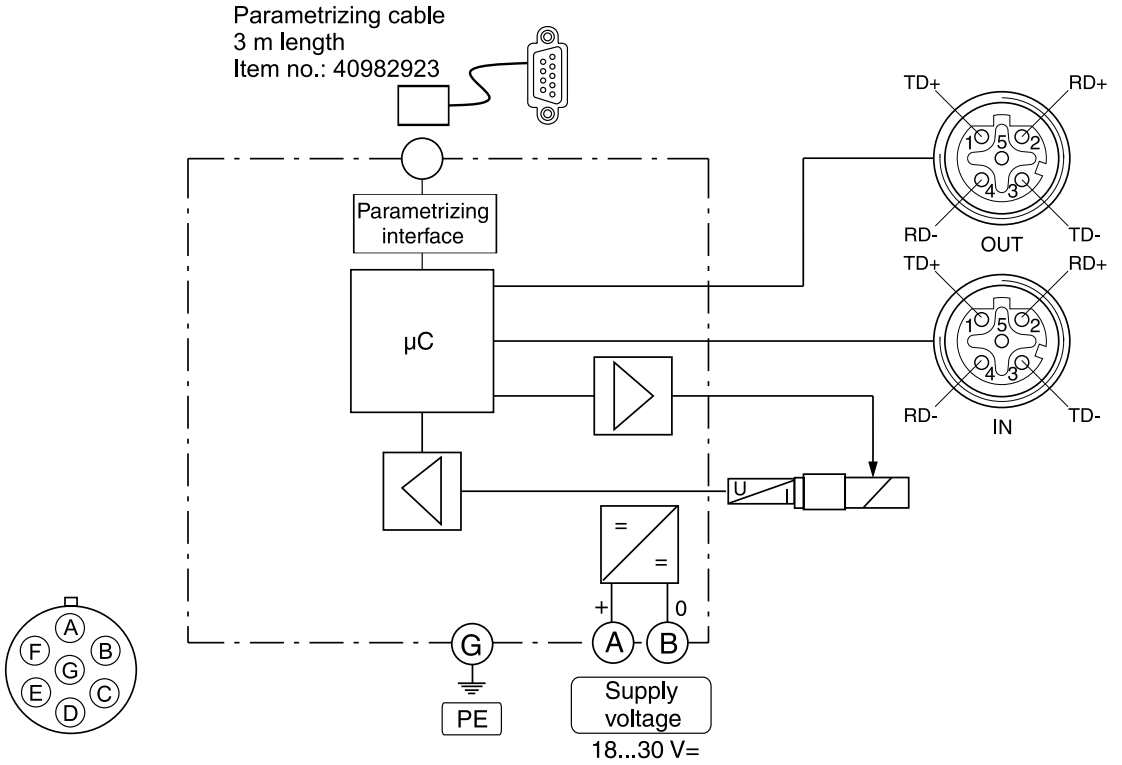



| Code | Size |
|---|---|
| 3 | NG10 / CETOP 05 |
| 4 | NG16 / CETOP 07 |
| 9 | NG25 / CETOP 08 |
| 11 | NG32 / CETOP 10 |

Please order connector separately, see chapter 3 accessories.
Parametrizing cable OBE → RS232, item no. 40982923

### Block diagram

EtherCAT




### Dimensions D1FC with EtherCAT

EtherCAT EtherCAT