Parker
Automation

PDFX ministep indexer-drive

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Introducing the PDFX ministepping indexer-drive from Parker - a winning combination of state-of-the-art technology and third-generation software to take on the toughest applications.

Two versions of the drive, rated at 2.5A and 5A peak, cater for general-purpose stepper motors up to frame size 34. As the performance data shows, this equates to low-speed torque outputs up to 3Nm and maximum speeds up to 50 rps. The internal bus voltage is 75V DC. There is a choice of four resolution settings up to 4000 steps/rev, and all the usual short-circuit and overvoltage protection is incorporated as well as ambient temperature monitoring.

The totally-new switch mode power supply operates from all AC supply voltages between 110V and 240V without any adjustment. This means it can be used anywhere in the world without having to worry about setting it up for the local supply. The drive is fully EMC compliant with the addition of an external filter unit.

The indexer itself is also an entirely new design; the command language is based on the well-proven X-Code, and is therefore very easy to learn, but it incoporates many powerful new features including event-driven functions. The indexer is more fully described on the next page.

A requested feature incorporated into the PDFX is a precision analogue input for speed control. This allows the velocity in continuous run mode to be determined by an external 0-10V analogue signal. The maximum velocity will be the value programmed in software, and speed changes will follow the programmed acceleration and deceleration rates. An alternative bi-directional mode allows a ±10V signal to control speed in either direction. There is a velocity deadband determined by the programmed start-stop speed, and the analogue input has 10-bit resolution.

The PDFX may be used in applications in which positional integrity must be guaranteed. The drive will accept signals from an incremental encoder in order to carry out position maintenance and/or stall detection. In position maintenance mode, the motor will if necessary make a correction at the end of the move until the encoder position is within a progammable deadband of its target.

An auxiliary output from the indexer section is available to control a separate drive. This is available as a step-direction signal, a CW/CCW step signal or an encoder-style quadrature signal (selected by software).

The PDFX offers both RS232 and RS485 communication as standard, with a selectable baud rate of 9600 or 19200. CANbus communication will become available later as an option. Device addressing is via a bit switch, with provision for up to 63 axes; when using RS232 communication, addresses can be allocated automatically via the daisy chain up to 255 axes.

Sufficient I/O has been provided to meet the needs of a wide range of applications. There is a dedicated high-speed input for registration, together with inputs for limit and home position switches. Six further multi-purpose inputs are fully programmable as event triggers or user-defined functions. The eight PNP-style outputs can each source 60mA which is available from the internal 24V supply.

- Universal AC input 110 - 240V
- Fully EMC compliant using external filter
- Fieldbus communication option using CANbus protocol
- Independently-programmable acceleration & deceleration rates
- Programmable start-stop speed to minimise move times
- Accepts encoder feedback for position tracking and stall detection
- Dedicated fast-response input for accurate registration
- Indexer output available to control a slave drive, configurable as step/direction, CW/CCW step or quadrature
- Robust 24V I/O for improved noise immunity
- Flash memory for rapid programming of custom software or upgrades
- Precision ±10V analogue velocity control input with 10-bit resolution
- Optional external +24V feed to maintain communication when main power removed
- Designed to operate with general-purpose stepper motors
- Extended diagnostic reporting functions
- Command language based on standard X-Code
- Powerful event-driven program functions
- Labelled program blocks simplify programming
- Device addressing by software or bit switch
- RS232 & RS485 communication as standard

The PDFX is equipped with a totally new indexer designed to meet the needs of a wide range of applications. Priority has been given to ease of programming, flexibility and robustness of the I/O.

Considerable effort has gone into the design of the PDFX indexer to ensure that its functionality is appropriate for typical PDFX applications. A very basic controller is too limited in its range of application, whereas unnecessary complexity not only imposes a cost penalty but can also complicate the programming process.

The traditional pre-calculation approach to trajectory generation has been abandoned in the PDFX. All trajectory calculations are now carried out 'on the fly', which means that the generator is always able to accept updates to parameters whilst maintaining positional accuracy.

Combining the best features

Parker has taken two well-established programming languages - X-Code and COMPAX language - each of which has its own particular advantages. We have combined the user-friendliness and flexibility of X-Code with the outstanding power of parameter-driven programming, and the result is a language having the familiar 'look and feel' of X-Code but which supports both sequential and event-driven code. More importantly, many programming operations may be carried out with far fewer commands.

Event-driven code reduces programming effort

In certain applications, individual external events must trigger specific motion programs. The event-driven functions of the PDFX language greatly simplify this type of programming. A typical program to execute two alternative move profiles in response to two trigger inputs takes only 10 commands, resulting in a dramatic reduction in program creation time and support costs.

Independent acceleration & deceleration

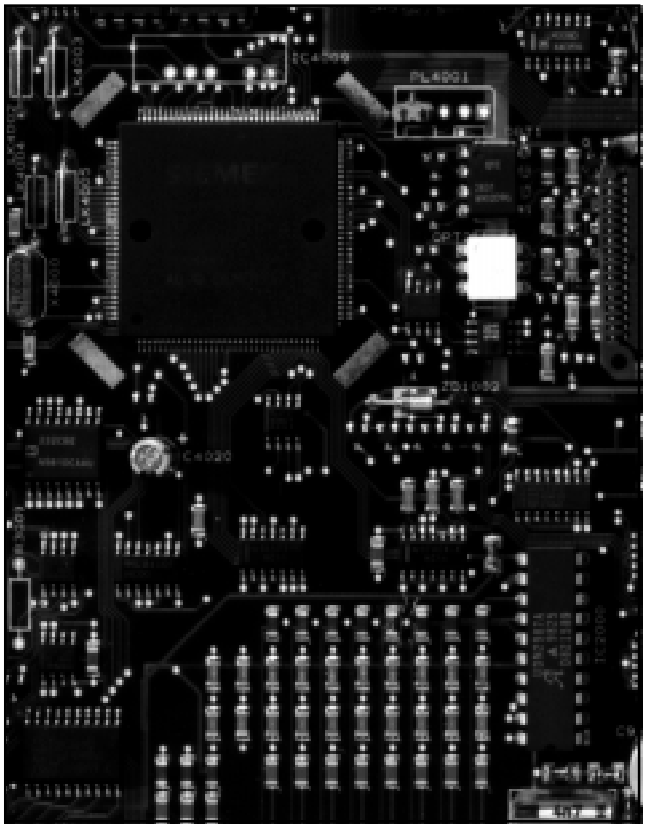
Acceleration and deceleration rates may be programmed with a single command, an approach which serves the majority of applications. However, in the PDFX the acceleration and deceleration rates are also programmable independently. This can improve throughput rates in vertical axes and in applications where the friction component is significant. The ability to pre-define a set of move profiles makes this a practical proposition in vertical axes without the need to continuously re-program accel/decel slopes.

Programmable start-stop speed

A further performance-enhancing feature is the provision of a programmable start-stop speed. Rather than accelerating to and from rest, this takes advantage of a stepper motor's start-stop range and inserts a pedestal underneath the conventional velocity profile. This helps to minimise the move time and is most effective where short moves are involved.

Pre-defined move profiles

The PDFX can hold up to 8 pre-defined move profiles which can then be accessed by a single program command. This allows for more efficient programming, and improves the response of the indexer by reducing the execution time. It is a particularly useful feature where changes must be made to multiple parameters between moves.



Labelled program blocks

Blocks of program code can be allocated a label comprising up to 5 characters which uniquely identifies the block. This code may then be called from the main routine, or it may be commanded to run from an external event via one of the inputs.

Flash memory

The PDFX indexer software is held in Flash Memory. This makes it easy to customise products for specific applications, and in future will allow upgraded software to be downloaded on site via a modem or Internet connection. As a result, application problems in the field can be resolved very quickly with a minimum of down-time, if necessary by modification of the original software.

Robust, flexible I/O

Particular attention has been paid to the ruggedness of the I/O to achieve the highest possible noise immunity. The I/O operates at 24V levels only and is compatible with the vast majority of PLCs. Directional limit and home switch inputs are included, but may be reassigned as additional user inputs if these functions are not needed. All relevant homing parameters are quickly and easily configured within the single HOME command; there is provision for homing to either edge of the switch, as well as homing to the 'zero phase' signal from the drive for improved repeatability.

Power stage specification

Output current per phase	PDFX13 - 2.5A peak ±10% PDFX15 - 5A peak ±10%
Output current adjustment	50% - 100% of peak current, software-selectable in 10% increments
Automatic standby reduction	50% or 70% of programmed current
Standby reduction time	30mS from last step pulse
Motor bus voltage	75V DC ±10%
Drive resolution	400, 800, 2000 or 4000 steps/rev, software-selectable
Minimum motor inductance	0.7mH
Recommended motor inductance range	0.7mH - 10mH
Switching frequency	20kHz
AC supply voltage	110V - 240V RMS ±10%
AC input current	PDFX13 - 2A max. at 110V AC PDFX15 - 3A max. at 110V AC
Supply frequency	47 - 63Hz
Internal power supply rating	PDFX13 - 100W continuous, 200W peak (25% duty cycle) PDFX15 - 150W continuous, 300W peak (25% duty cycle)
Optional external logic supply input	24V DC ±10%
External logic supply current	500mA plus total current sourced by programmable outputs
Protection	Motor overcurrent/short circuit, over & under voltage, logic supply fault, over temperature, ext. 24V reverse supply
Optional power dump (PDFX15 only)	17W continuous rating, 170W peak
Ambient temperature range	0° - 50°C
Cooling	Natural convection with integral fan
Humidity	0% - 95%, non-condensing

Indexer specification

Positioning range	±2,147,483,647 steps
Velocity range	0.01 to 50 revs/sec
Acceleration range	0.1 to 1024 revs/sec^2
Positioning modes	Incremental, absolute, registration, continuous run
Communication:	
Data format	8 data bits, 1 start bit, 1 stop bit, no parity, optional echoback; Xon/Xoff supported
Baud rate	9,600 or 19,200 selectable by bit switch
Address setting range	1 - 63 by bit switch, 1-255 by software
RS232 connection	2 wire plus ground
RS485 connection	2 wire or 4 wire
Digital inputs:*	
User-programmable inputs	6 (home & limits can be used as additional user-programmable inputs but with limited functionality)
Dedicated inputs	Home, + limit, - limit, registration
Input levels	Logic high 12 - 30V, logic low 0 - 3.4V
Input impedance	2.3K to 0V
Analogue control inputs:	
Voltage range	±10V differential
Maximum input voltage	±20V, either input relative to 0V
Input impedance	200K
Resolution	10 bits (20mV)
Encoder inputs:	
Signal levels	Differential, TTL compatible; quadrature, step/direction or CW/CCW step (1µS min. pulse width)
Maximum frequency	100kHz pre-quadrature
Encoder power output	+5V DC, 150mA maximum
Digital outputs:	
User-programmable outputs	8, PNP current-sourcing
Output levels	0 - 0.4V (output off, with 2K load), 22 - 24V ±10% (output on)
Output current rating	60mA maximum per output (provided by internal +24V supply)
Indexer clock output	Differential TTL levels, configurable as step/dirn., CW/CCW step or quadrature, 1µS pulse width

*+24V is required to operate digital inputs including home and limits. If this is not available externally, one of the programmable outputs may be permanently enabled to provide +24V.

Abbreviated list of commands

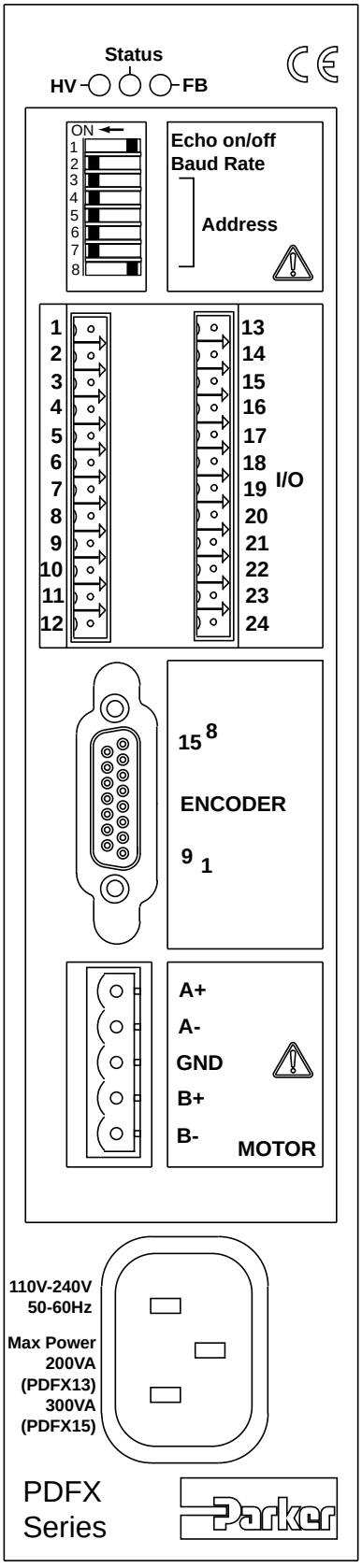
A	Combined acceleration & deceleration rate
AA	Acceleration rate
AD	Deceleration rate
ARM	Enable event triggered code
C	Continue
CLEAR	Clear user code
D	Distance
E	Enable command execution
EXIT	Exit from loop
G	Go
GH	Go Home
GOSUB	Go to subroutine & return
GOTO	Go to routine
H	Change direction
HOME	Configure homing parameters
S	Report Input Status
K	Kill
LIMITS	Configure limit inputs
LIST	List user program
LOOP	Repeat user code
M	Indexer operating Mode
O	Output
OFF	Turn off motor power
ON	Turn on motor power
POSMAIN	Position maintenance configuration
PROFILE	Define move profile
PS	Pause
R	Read system parameter
REG	Define Registration move parameters
RFS	Return to Factory Settings
STALL	Stall detect configuration
S	Stop
SV	Save current setup
T	Wait for Time delay
TR	Wait for Trigger
USE	Select move profile
V	Velocity
VS	Start-Stop Velocity
W	Write system parameter
Z	Reset
#	Set address remotely

Examples of event-driven program functions

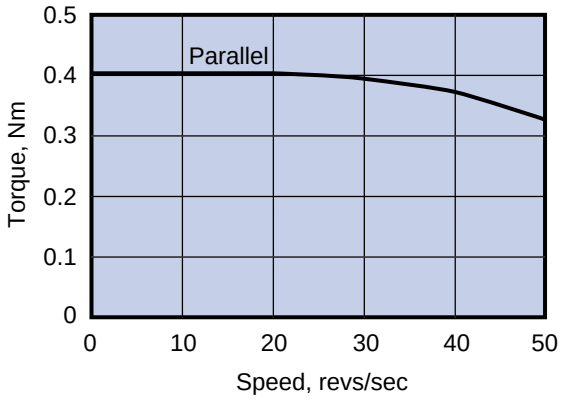
PROFILE1(20,20,12000,40,0)* define move profile 1
PROFILE2(10,15,-12000,5,0)* define move profile 2
INP3+: execute following code if input 3 goes high:
USE1 select pre-defined move profile 1
G go (i.e. perform the move)
END end of code block
INP4-: execute following code if input 4 goes low:
USE2 select pre-defined move profile 2
G go
END end of code block

* data in brackets represents acceleration, deceleration, distance plus direction, velocity & start-stop velocity

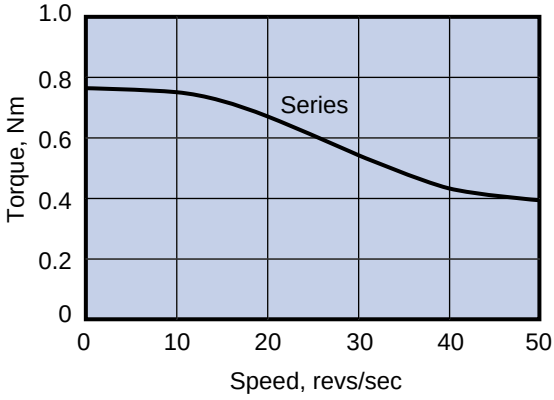
PDFX front panel



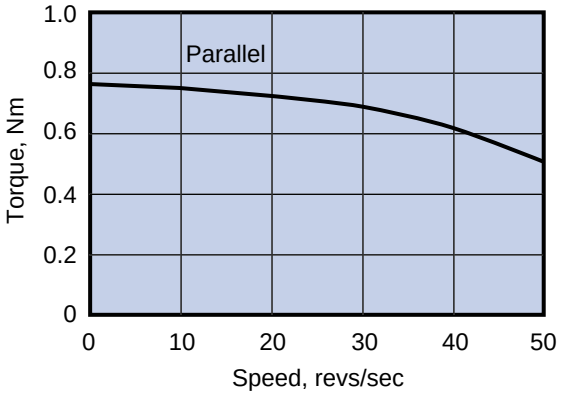
PDFX13 with ST57-51P motor



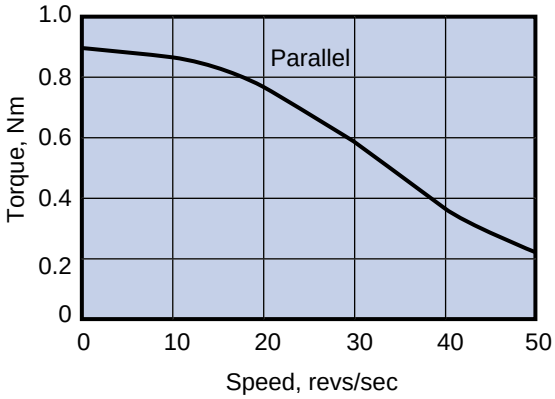
PDFX15 with ST57-83P motor



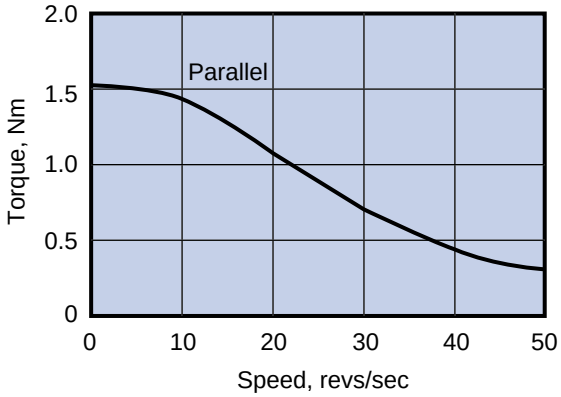
PDFX15 with ST57-102P motor



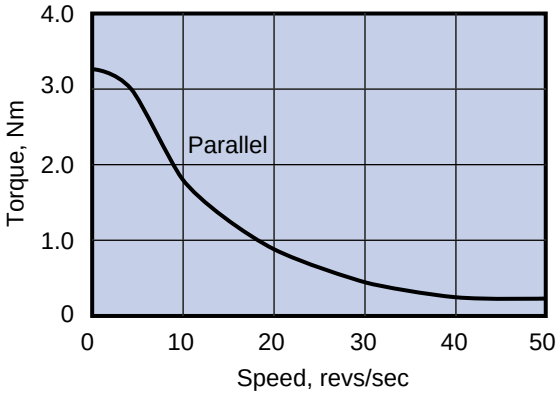
PDFX15 with ST83-62P motor



PDFX15 with ST83-93P motor

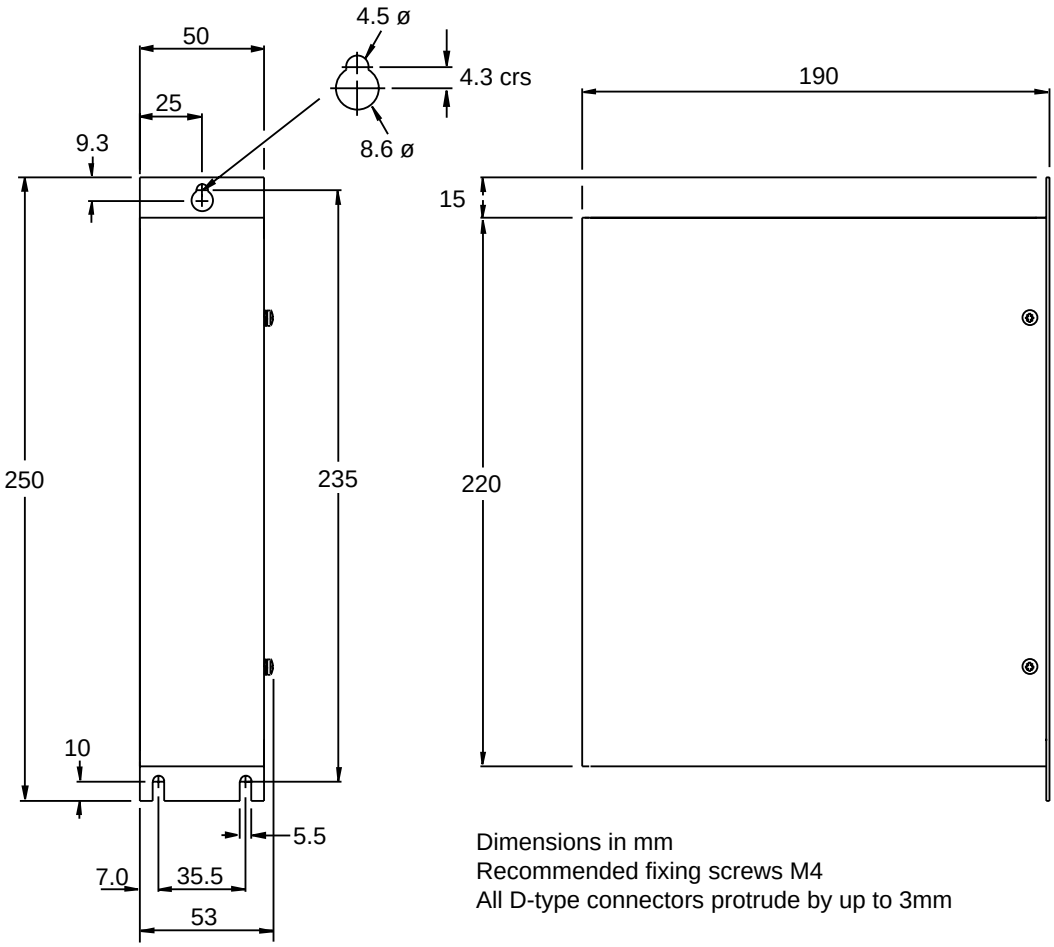


PDFX15 with ST83-135P motor



The torque-speed curves above indicate the performance achieved using Parker ST series stepper motors. Whilst they give an indication of the performance which may be expected from an alternative motor of equivalent frame size, this can only be confirmed by measurement. In particular, the choice of winding impedance has a significant effect on torque-speed characteristics.

Full electrical and mechanical details of ST series motors will be found in the Parker Stepper Products Catalogue No. 1600.232.



Dimensions in mm
Recommended fixing screws M4
All D-type connectors protrude by up to 3mm

Ordering codes

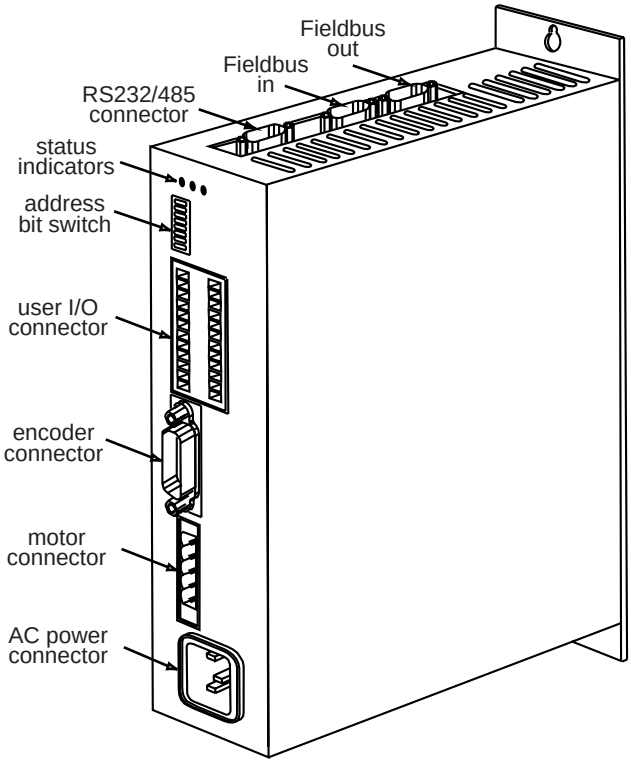
PDFX13 2.5A indexer-drive

PDFX15 5A indexer-drive

PDFX15-D 5A indexer-drive with power dump

Please consult Parker for details of suitable EMC filters for use with the PDFX range.

The -D power dump option may be needed when a high-inertia load is decelerated rapidly. It is recommended if the deceleration time in seconds from a maximum speed *v* revs/sec is less than (Jv^2 - 0.1), where J is the total system inertia (including the motor) in Kg-m^2. If the expression in brackets is negative, the power dump is not required.



Engineering solutions in motion control...

The performance requirements of today's automation tasks demand reliable, cost-effective solutions and the reassurance of competent technical backup. A comprehensive product range supported by highly-trained, experienced application engineers forms the basis of Parker's motion control capability.

With the combined resources of world-class companies like Digiplan, Compumotor, Hauser and Daedal, Parker can offer a range of automation products which is second to none. High-performance stepper and servo systems combined with powerful, flexible controllers are complemented by a wide selection of mechanical positioning systems. This equipment is supplied and supported through a worldwide network of Automation Technology Centres, each with factory-trained staff who specialise in the application of high-technology motion control systems.

Our aim is to give customers a competitive advantage by providing top-grade equipment and unrivalled technical support. Whether the application is in industrial automation, production machinery, instrumentation or research, you can be certain that your system will be precision-engineered and backed by the Parker guarantee of quality and reliability.

Parker - we engineer solutions in motion control

Machine Interfaces	Motion Controllers	Drives & Motors	Mechanical Positioners	Machine Structures
Remote panels Joysticks	Open loop Closed loop PC compatible Contouring Following	Stepper Microstepper Servo Analogue Digital	Linear tables Rotary tables Multi-axis stages Linear actuators	Structural framing Gantry systems Support hardware

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