



**PX-A Series:
Start-up Guide
Specifications and Installation**

POWERTEC
INDUSTRIAL MOTORS

Thank you for choosing this PowerTec product.

We will be glad to receive any possible information which could help us improving this manual. The e-mail address is the following: **sales@powertecmotors.com**

Before using the product, read the safety instruction section carefully.

Keep the manual in a safe place and available to engineering and installation personnel during the product functioning period.

Powertec Industrial Motors has the right to modify products, data and dimensions without notice.

The data can only be used for the product description and they can not be understood as legally stated properties.

All rights reserved.

This manual is updated according to software version 3.3

NOTE!

The identification number of the software version can be read on the drive nameplate or on the label on the FLASH memories mounted on the regulation card.

Tables of Contents

Safety Symbol Legend	1
Chapter 0 - Safety Precautions.....	2
Chapter 1 Functions and General Features	7
Chapter 2 Inspection procedures, Components Identification and Standard Specifications	9
2.1. Delivery Inspection Procedures	9
2.1.1. General	9
2.1.2. Drive type designation	9
2.1.3. Nameplate	10
2.2. Component identification	11
2.3. Standard specifications	13
2.3.1. Permissible environmental conditions	13
Disposal of the Device	14
2.3.2. AC Input/Output Connection	14
2.3.1. I x T Algorithm	16
Chapter 3 Installation Guidelines	19
3.1. Mechanical Specification	19
3.2. Watts Loss, Heat Dissipation, Internal Fans and Minimum Cabinet Opening Suggested for the Cooling	21
3.2.1 Cooling Fans Power Supply	22
3.3. Installation Mounting Clearance	23
3.4. Motors and Encoders	24
3.4.1. Motors	24
3.4.2 Feedback Devices	24
Chapter 4 - Wiring Procedure	27
4.1 Accessing the Connectors	27
4.1.1 Removing the Covers	27
4.1.2. Wiring Suggestion	28
4.2 Power Section	29
4.2.1 Terminal Assignment on Power Section / Cable Cross-Section	29
4.3 Regulation Section	31
4.3.1 R-XVy Regulation Card	31
4.3.2 Terminal Assignments on Regulation Section	33
4.3.3 XE Encoder Connector Assignments	36
4.3.4 XER Encoder Connector Assignments	36
4.3.5 Feedback /Drive Connections	36
4.3.5.1 Resolver Connections (RES).....	37
4.3.5.2 Digital Encoder with Hall Effect Sensors Connections (DEHS).....	37
4.3.5.3 Original Powertec Hall Effect Encoder (DEHS)	37
4.3.5.4 Encoder /Resolver Specifications (XE connector).....	38
4.3.5.5 Encoder Simulation / Repetition, Auxiliary Encoder Input (XER Connector)	38
4.3.5.6 Encoder Cable Length.....	39
4.3.5.7 Checking Encoder / Drive Connections	40
4.3.6 CANopen Connection	40

4.3.7 Fast Link Connections	41
4.3.7.1 Fast Link Data	41
4.4 Serial Interface	42
4.4.1 Serial Interface Description	42
4.4.2 RS 485 Serial Interface Connector Description	43
4.5 Standard Connection Diagram	44
4.5.1 FlexMax Connections	44
4.5.2 Parallel Connection on the AC (Input) and DC (Intermediate Circuit) Side of Several Drives	45
4.6 Circuit Protection	46
4.6.1 External Fuses for the Power Section	46
4.6.2 External Fuses for the Power Section DC Input Side	47
4.6.3 Internal Fuses	47
4.7 Chokes / Filters	48
4.7.1 AC Input Chokes	48
4.7.2 Output Chokes	48
4.7.3 Interference Suppression Filters	49
4.8 Braking Units	50
4.8.1 Internal Braking Unit	50
4.8.2 Internal and External Braking Resistors	50
4.8.3 Control of the External Braking Power	54
4.8.4 External Resistance Interaction with the System Parameters	55
4.8.5 Choice of the Thermal Relay for Brake Resistor	55
4.9 Buffering the Regulator Supply	56
4.10 Discharge Time of the DC-Link	58
Chapter 5 - Sizing Criteria	59
5.1 Motor Check	60
5.2 Check of the Drive Size	61
5.3 Application Example: Flying Cut	61
Chapter 6 - Maintenance	65
6.1 Care	65
6.2 Service	65
6.3 Repairs	65
6.4 Customer Service	65
Chapter 7 - Settings and Commissioning	67
7.1 PC Configurator	67
7.2 Commissioning	67
7.2.1 Connection with the PC	67
7.2.2 Essential Parameters Set up	68
7.2.3 Speed Mode Configuration Example	69
7.2.4 Position Mode Configuration Example	70
7.2.5 Electrical line Shaft Mode Configuration Example	71
7.3 Download Firmware	72
7.4 Automatic Electric Phasing Procedure for Encoder/Resolver	72

- 7.5 Integrated CANopen Interface 74
 - 7.5.1 CANopen Functions 74
 - 7.5.1.1 Pre-defined Master/Slave Connection 74
 - 7.5.1.2 NMT Services (Network Management) 74
 - 7.5.1.3 Initialization 75
 - 7.5.1.4 Communication Object 75
 - 7.5.1.5 Object Dictionary Elements 76
 - 7.5.1.6 Rx PDO Entries 76
 - 7.5.1.7 Tx PDO Entries 76
 - 7.5.1.8 SDO Entries 77
 - 7.5.1.9 COB-ID SYNC Entries 77
 - 7.5.1.10 COB-ID Emergency 77
 - 7.5.2 CANopen Management 77
 - 7.5.3 Process Data Channel Control 78
 - 7.5.3.1 PDC Input Configuration (FB XXX MS Parameter) 79
 - 7.5.3.2 PDC Output Configuration (FB XXX SM Parameter) 80
 - 7.5.3.3 Use of the PDC in MDPIc Applications 80
 - 7.5.4 SDO Management 80
 - 7.5.5 Alarms 81
- 7.6 Modbus 82
 - 7.6.1 Modbus Protocol and Message Format 82
 - 7.6.2 Modbus Functions 82
 - 7.6.3 Error Management 82
 - 7.6.3.1 Exception codes 82
 - 7.6.4 System Configuration 83
 - 7.6.5 Appendix - Register and Coil Modbus Tables 83
- 7.7 DeviceNet Interface (XVy-DN) 83
 - 7.7.1 DeviceNet General Description 83
 - 7.7.2 Connection 83
 - 7.7.3 Leds 83
 - 7.7.4 Interface 84
 - 7.7.5 DeviceNet Function 84
 - 7.7.6 Object description 85
 - 7.7.6.1 Object Model 85
 - 7.7.6.2 How Objects Affect Behavior 85
 - 7.7.6.3 Defining Object Interface 86
 - 7.7.7 Data transfert via Explicit Messaging 86
 - 7.7.7.1 Drive Parameter Access 86
 - 7.7.7.1.1 Class Code 86
 - 7.7.7.1.2 Class attributes 86
 - 7.7.7.1.3 Instance Attributes 86
 - 7.7.7.1.4 Common Services 86
 - 7.7.7.1.5 Object Specific Services 86
 - 7.7.7.1.6 Behavior 87
 - 7.7.8 Polling Function 90
 - 7.7.9 XVy-DN Interface configuration 90
 - 7.7.9.1 Fieldbus Menu 90
 - 7.7.9.2 Error Codes 91

7.7.10 Alarms	91
7.7.10.1 X _{Vy} -DN Alarms	91
7.7.10.2 Drive alarm handling	91
7.7.10.3 Alarm reset	91
7.7.11 Process Data Channel Control	92
7.7.11.1 PDC Input Configuration (SYS_FB_XXX_MS parameter)	92
7.7.11.2 PDC Output Configuration (SYS_FB_XXX_SM Parameter)	92
7.7.11.3 Configuration of the Virtual Digital I/Os	92
7.7.11.4 Use of the PDC in MDPlc Applications	93
Chapter 8 - Keypad Operation	95
8.1 Keypad Description	95
8.1.1 LED	95
8.1.2 Display	95
8.1.3 Function Keys	96
8.1.4 Using the Keypad	96
8.2 Keypad Operations	97
8.2.1 Errors	97
8.3 Alarms and Errors Handling	98
8.3.1 Alarms (Failure register)	98
8.3.2 Alarm description	99
Chapter 9 - Block Diagrams	103
Chapter 10 - Parameters	107
10.1 Main Menu Index	107
10.2 Legend	108
10.3 Parameters Description and Functions from PC Configurator	108
Chapter 11 - EMC Directive - Declaration of Conformity	167
Chapter 12 - Parameters Index	171

List of Figures and Tables

Figure 2.1.3.1: Identification nameplate	10
Figure 2.1.3.2: Firmware & Card revision level nameplate	10
Figure 2.1.3.3: Nameplates position	10
Figure 2.2.1: Basic Setup of drive	11
Figure 2.2.2: Drive view & components	12
Table 2.3.2.1: AC Input/Output specifications	15
Table 2.3.3.1: PX Overload Currents and I x T Algorithm - 460Vac	16
Figure 3.1.1: Drive Dimensions (sizes PX-3 ... PX-30)	19
Table 3.1.1: Drive dimensions and Weights (sizes PX-3 ... PX-30)	19
Figure 3.1.2: Mounting methods (sizes PX-3 ... PX-30)	19
Figure 3.1.1: Drive dimensions (sizes PX-40 ... PX-300)	20
Figure 3.1.4: Mounting methods (sizes PX-40 ... PX-300)	20
Table 3.1.2: Drive dimensions and Weights (sizes PX-40 ... PX-300)	20
Table 3.2.1: Heat dissipation and Required Air Flow	21
Table 3.2.2: Minimum cabinet opening suggested for the cooling	21
Figure 3.2.1: UL type fans connections on PX-160, PX-190 and PX-230 sizes	22
Figure 3.2.2: UL type fans connections on PX-125 and PX-300 sizes	22
Figure 3.2.3: Example for external connection	22
Figure 3.3.1: Max. Angle of Inclination	23
Figure 3.3.2: Mounting Clearance	23
Table 3.4.2.1: Feedback devices	25
Table 3.4.2.1: Recommended cable section	25
Figure 4.1.1: Removing the covers (sizes PX-3 to PX-30)	27
Figure 4.1.2: Removing the covers (sizes PX-40 to PX-300)	28
Table 4.2.1.1: Power Section Terminals from PX-3 to PX-30	29
Table 4.2.1.2: Power Section Terminals from PX-40 to PX-100	29
Table 4.2.1.3: Power Section Terminals from PX-125 to PX-300	30
Table 4.2.2.2: Maximum cable cross section for power terminals	30
Figure 4.3.1: Connectors Location	32
Table 4.3.1.1: Jumpers on Regulation Card	32
Table 4.3.2.1: Plug-in Terminal Strip Assignments on Regulation Card	33
Table 4.3.2.3: Maximum permissible cable cross-section on the plug-in terminals of the regulator section	34
Table 4.3.2.4: Maximum Control Cable Lengths	34
Figure 4.3.2.1: Potentials of the control section	35
Table 4.3.3.1: XE Connector Assignments	36
Table 4.3.4.1: XER Connector Assignments	36
Table 4.3.5.1: Resolver/Encoder jumpers settings	36
Figure 4.3.7.1: XFL-OUT Connector (FAST LINK Output)	41
Figure 4.3.7.2: XFL-IN Connector (FAST LINK Input)	41
Figure 4.4.1.1: RS485 Serial Interface	42
Table 4.4.2.1: Assignment of the plug XS connector for the RS 485 serial interface	43

Figure 4.5.1.1: Typical connection 44

Figure 4.5.2.1: Parallel Connection on the AC and DC Side of Several Drives 45

Table 4.6.1.1: External Fuse Types for AC input side 46

Table 4.6.2.1: External fuses type for DC input side 47

Table 4.6.3.1: Internal fuses 47

Table 4.7.1.1: 3-Phase AC Input Chokes 48

Table 4.7.2.1: Recommended values for output chokes 49

Table 4.7.3.1: Recommended EMI filters 49

Figure 4.8.1: Operation with Braking Unit (Principle) 50

Figure 4.8.1.1: Connection with internal Braking Unit and external braking resistor ... 51

Table 4.8.2.1: Lists and technical data of the external standard resistors 51

Figure 4.8.2.2: Limit operating braking cycle with typical triangular power profile 52

Figure 4.8.2.3: Braking cycle with $TBR / TC = 20\%$ 53

Table 4.8.2.2: Technical data of the internal braking units 54

Table 4.9.1: DC Link Buffer Time 57

Figure 4.9.1: Buffering the Regulator Supply by Means of Additional Intermediate Circuit Capacitors 57

Table 4.10.1: DC Link Discharge Time 58

Table 7.5.1: Communication Objects 75

Table 7.5.2: Objects used by the CANopen communication profile 76

Table 7.7.3.1: AL-OP leds status codification 84

Table 7.7.7.1: Error codes for the parameter access 90

Table 7.7.7.2: Parameter format 90

Table 8.3.2.1: Errors list 97

Figure 8.3.1: Led Status and Keypad 98

Table 8.3.1.1: Alarms list 98

Safety Symbol Legend



Indicates a procedure, condition, or statement that, if not strictly observed, could result in personal injury or death.



Indicates a procedure, condition, or statement that, if not strictly observed, could result in damage to or destruction of equipment.



Indicates a procedure, condition, or statement that should be strictly followed in order to optimize these applications.

NOTE!

Indicates an essential or important procedure, condition, or statement.

Chapter 0 - Safety Precautions

According to the EEC standards the FlexMax and accessories must be used only after checking that the machine has been produced using those safety devices required by the 89/392/EEC set of rules, as far as the machine industry is concerned. These standards do not apply in the Americas, but may need to be considered in equipment being shipped to Europe.

Drive systems cause mechanical motion. It is the responsibility of the user to insure that any such motion does not result in an unsafe condition. Factory provided interlocks and operating limits should not be bypassed or modified.

Electrical Shock and Burn Hazard:

When using instruments such as oscilloscopes to work on live equipment, the oscilloscope's chassis should be grounded and a differential amplifier input should be used. Care should be used in the selection of probes and leads and in the adjustment of the oscilloscope so that accurate readings may be made. See instrument manufacturer's instruction book for proper operation and adjustments to the instrument.



Fire and Explosion Hazard:

Fires or explosions might result from mounting Drives in hazardous areas such as locations where flammable or combustible vapors or dusts are present. Drives should be installed away from hazardous areas, even if used with motors suitable for use in these locations.

Strain Hazard:

Improper lifting practices can cause serious or fatal injury. Lift only with adequate equipment and trained personnel.

Drives and motors must be ground connected according to the NEC.

Replace all covers before applying power to the Drive. Failure to do so may result in death or serious injury.

Adjustable frequency drives are electrical apparatus for use in industrial installations. Parts of the Drives are energized during operation. The electrical installation and the opening of the device should therefore only be carried out by qualified personnel. Improper installation of motors or Drives may therefore cause the failure of the device as well as serious injury to persons or material damage.

Drive is not equipped with motor overspeed protection logic other than that controlled by software. Follow the instructions given in this manual and observe the local and national safety regulations applicable.

Always connect the Drive to the protective ground (PE) via the marked connection terminals (PE2) and the housing (PE1). Brushless Drives and AC Input filters have ground discharge currents greater than 3.5 mA. EN 50178 specifies that with discharge currents greater than 3.5 mA the protective conductor ground connection (PE1) must be fixed type and doubled for redundancy.

The drive may cause accidental motion in the event of a failure, even if it is disabled, unless it has been disconnected from the AC input feeder.



Never open the device or covers while the AC Input power supply is switched on. Minimum time to wait before working on the terminals or inside the device is listed in section 4.10 on Instruction manual .

If the front plate has to be removed because of ambient temperature higher than 40 degrees, the user has to ensure that no occasional contact with live parts may occur.

Do not connect power supply voltage that exceeds the standard specification voltage fluctuation permissible. If excessive voltage is applied to the Drive, damage to the internal components will result.

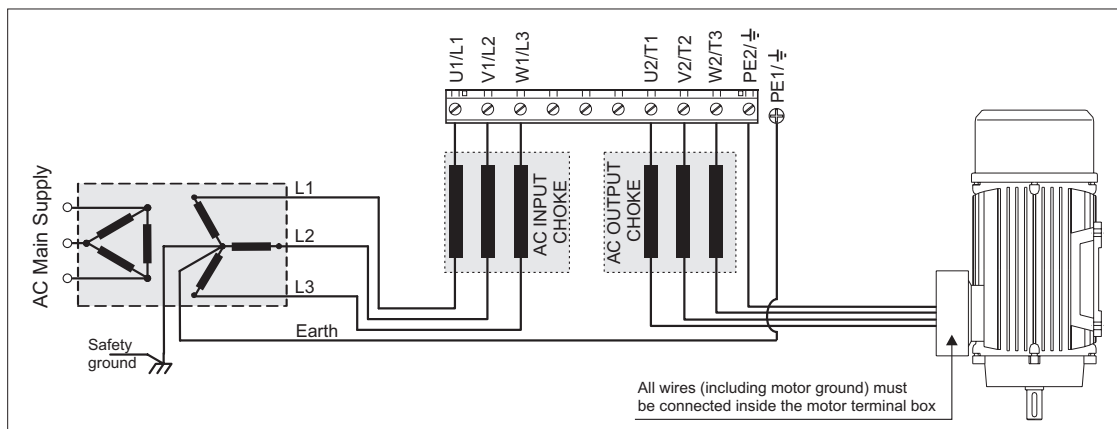
Power supply and grounding

In case of a three phase supply not symmetrical to ground, an insulation loss of one of the devices connected to the same network can cause functional problem to the drive, if the use of a wye / delta transformer is avoided.



- 1 PowerTec drives are designed to be powered from standard three phase lines that are electrically symmetrical with respect to ground (TN or TT network).
- 2 In case of supply with IT network, the use of delta/star transformer is mandatory, with a secondary three phase wiring referred to ground.

Please refer to the following connection sample.



Do not operate the Drive without the ground wire connected. The motor chassis should be grounded to earth through a ground lead separate from all other equipment ground leads to prevent noise coupling.

The grounding connector shall be sized in accordance with the NEC or Canadian Electrical Code. The connection shall be made by a UL listed or CSA certified closed-loop terminal connector sized for the wire gauge involved. The connector is to be fixed using the crimp tool specified by the connector manufacturer.

Do not perform a megger test between the Drive terminals or on the control circuit terminals.

Because the ambient temperature greatly affects Drive life and reliability, do not install the Drive in any location that exceeds the allowable temperature. Leave the ventilation cover attached for temperatures of 104° F (40° C) or below.



Caution

If the Drive's Fault Alarm is activated, consult the TROUBLESHOOTING section of this instruction book, and after correcting the problem, resume operation. Do not reset the alarm automatically by external sequence, etc.

Be sure to remove the desiccant dryer packet(s) when unpacking the Drive. (If not removed these packets may become lodged in the fan or air passages and cause the Drive to overheat).

The Drive must be mounted on a wall that is constructed of heat resistant material. While the Drive is operating, the temperature of the Drive's cooling fins can rise to a temperature of 194° F (90°C).

Do not touch or damage any components when handling the device. The changing of the isolation gaps or the removing of the isolation and covers is not permissible.

Protect the device from impermissible environmental conditions (temperature, humidity, shock etc.)

No voltage should be connected to the output of the drive (terminals U2, V2 W2). The parallel connection of several drives via the outputs and the direct connection of the inputs and outputs (bypass) are not permissible.

A capacitive load (e.g. Var compensation capacitors) should not be connected to the output of the drive (terminals U2, V2, W2).



Caution

The electrical commissioning should only be carried out by qualified personnel, who are also responsible for the provision of a suitable ground connection and a protected power supply feeder in accordance with the local and national regulations. The motor must be protected against overloads.

No dielectric tests should be carried out on parts of the drive. A suitable measuring instrument (internal resistance of at least 10 kW/V) should be used for measuring the signal voltages.

NOTE!

If the Drives have been stored for longer than two years, the operation of the DC link capacitors may be impaired and must be “reformed”.

Before commissioning devices that have been stored for long periods, connect them to a power supply for two hours with no load connected in order to regenerate the capacitors, (the input voltage has to be applied without enabling the drive).

NOTE!

The terms “Inverter”, “Controller” and “Drive” are sometimes used interchangeably throughout the industry. We will use the term “Drive” in this document.

Notes:

A large, empty rectangular box with a thin black border, intended for taking notes.

Chapter 1 Functions and General Features

FlexMax represents a new concept in motion control technology. This very fast servodrive, based on the DSP (digital signal processor) VECON™ and integrated with versatile and innovative power hardware, is aimed at providing real-time control of servosystems.

FlexMax is an IGBT servodrive particularly suitable for high bandwidth applications with brushless servomotors. Thanks to the innovative software installed on the flash eprom, it can be considered as a combination of a digital drive and a PLC using a special software tool called E@syDrivesPX.

FlexMax features full-digital regulation with a 16KHz cycle, a 5KHz current loop bandwidth, a position loop with zero tracking failure, an analog interface, some dedicated digital interface, and I/O expansion.

The drive position loop (PI type) is based on two symmetrical register circuits which store the desired and the actual information. The PID speed loop (a position loop derivative) and the PID2 acceleration control (a second position loop derivative) are added to increase the accuracy of the controlled axes, both in feedback and in a feedforward conditions.

The drive has the following features:

- Torque, Speed, Position, and Electrical Line Shaft (ELS) control
- Linear motor control
- Plc functions with MDPlc dedicated software environment
- “E@syDrivesPX” Windows ® configurator via Slink3 protocol
- 1 configurable main encoder / resolver input
- 1 configurable auxiliary encoder input / encoder repetition / simulation output
- 1 input for absolute encoder with SSi / EnDat protocols with EXP-ASE expansion card *
- 1 digital encoder output (+5V) (with optional EXP-FO expansion card *)
- 1 digital encoder output (+5V ... +15V / +24V) (with optional EXP-E expansion card *)
- 2 analog differential inputs (11 bits + sign)
- 2 analog outputs (11 bits + sign)
- 7 programmable digital inputs
- 6 programmable digital outputs
- 1 digital relay output 1A 250V
- 1 optional expansion board for 8 inputs + 4 outputs digital I/O (EXP-D8R4 *)
- RS485 asynchronous opto-isolated multi-drop serial port
- 2 fast synchronous serial ports for master-slave communications between drives (Fast Link connectors)
- Fiber optical communication adapters
- Standard Fieldbus communication: CANopen, Modbus, DeviceNet, and (only on PX- ...-PDP drive) Profibus-DP
- IP20 (NEMA 1) protection, book case, removable connectors, serial encoder interface brought out via 1/2 D-sub connectors, ground connection screws for shielded cables mounted on board.

*** NOTE!**

One expansion board (EXP) maximum per drive.

NOTES: