X25 30

SEPARATELY EXCITED MOTOR CONTROLLER

The PG Drives Technology X25 and X30 motor controllers provide a tough, intelligent and cost-effective control solution for electric vehicles using separately excited traction motors. Suitable applications include golf cars, industrial tow tractors, aerial work platforms, personnel carriers, utility trucks and pallet trucks.

Model	Armature Current	Field Current	Supply Voltage
X25	250A	30A	48Vdc
X30	300A	30A	24-36Vdc

PG DRIVES TECHNOLOGY

Designed to Survive

Heavy duty, individual connections for battery and armature cables with integrated strain relief for control wiring

Detachable terminal cover protects against water jets and prevents accidental shorting by wrenches or other hand tools during servicing

Substantial, finned heatsink provides ample cooling by both convection and radiation

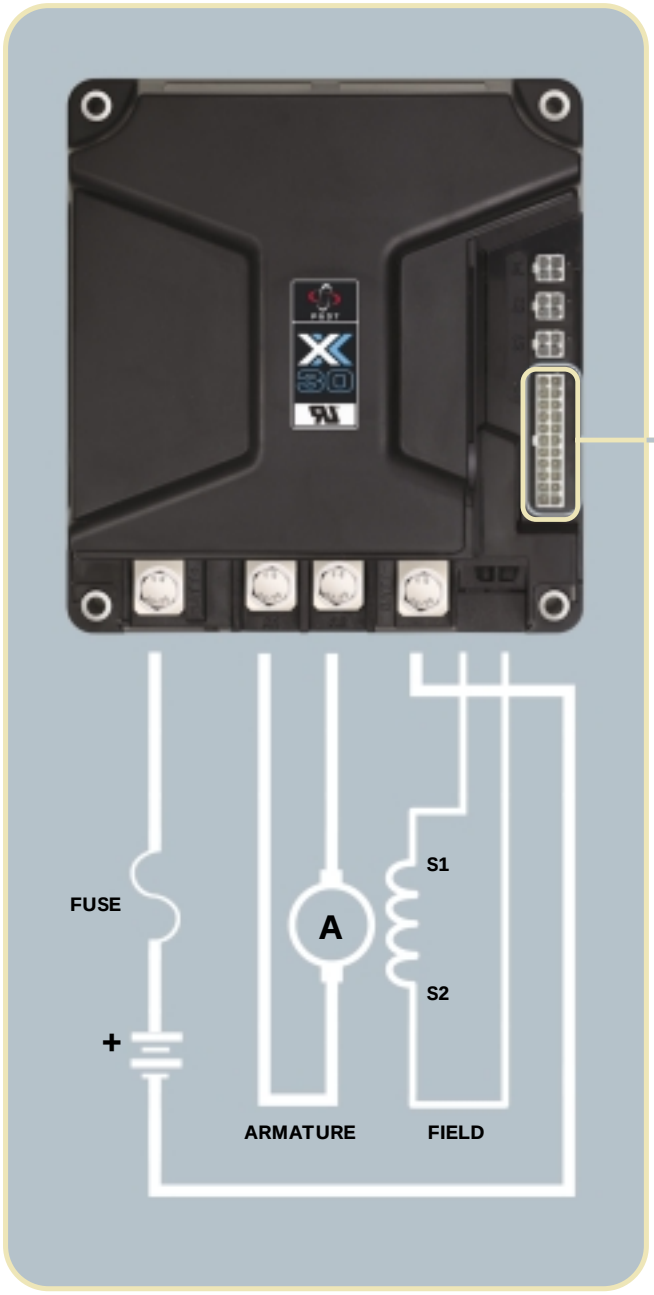
PG Drives Technology's X25 and X30 separately excited controllers are designed for use in a wide variety of small battery-powered vehicle applications such as golf cars, personnel carriers, stackers, pallet trucks, mobile aerial work platforms and floorcare vehicles. These controllers are tough, easy to install, highly efficient and very cost effective. Great emphasis has been placed on the survivability of the X25 and X30. Rugged packaging, thoughtful circuit design and state-of-the-art microprocessors, MOSFETS and surface mount components result in high levels of protection against condensation, shock, vibration, extremes of temperature, electrostatic discharges and the ingress of liquids. This 'designed to survive' philosophy allows the controllers to operate safely and reliably in the harshest environmental conditions.

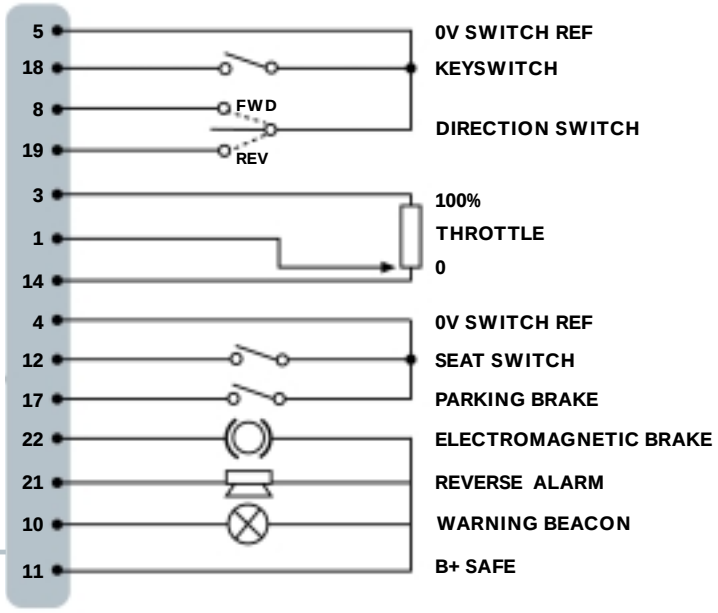
The controllers benefit from full-bridge field and half-bridge armature outputs, allied to a highly advanced drive algorithm to provide smooth, accurate and predictable control of speed and torque during drive and regenerative braking in both forward and reverse directions. This topology eliminates the need for direction contactors or relays, and the integral isolation feature means that the line contactor required by other controllers is also redundant. The control algorithm calculates the optimum combination of field current and armature current required to produce the desired speed and torque during driving and braking. This approach, together with the low-loss components used in the controller results in the highest possible efficiency, minimum motor losses and the maximum possible runtime per battery charge.

Robust IPX4 packaging with an integrated terminal cover protects the connectors from foreign objects, water jets and other contamination. The controllers also benefit from a cable tie anchor point for strain relief of the control connections. Fully protected inputs and outputs, and the integrated isolation contactor minimize the possibility of damage to the controller due to wiring errors, short circuits and overloads. Reverse polarity protection is built into the X25 and X30, eliminating another possible cause of failure. Three auxiliary outputs rated at 2A each can be configured to function in a wide variety of modes, and can be programmed to behave differently in the event of a fault, dependent on the importance of the connected device. The heavy duty, finned heatsink provides ample heat dissipation by either convection or radiation. This allows the controller to be mounted on the vehicle chassis without compromising anti-corrosion treatments such as powder coating or stove enamelling. The X25 and X30 are fully programmable via PGDT PC Programming software and the PGDT HHP hand-held programmer. The controllers feature powerful diagnostic and data logging capabilities. Information logged includes all system trips, controller trips and battery data, allowing battery condition and charging behavior to be monitored. Hours run counters and timers record the total number of key switch and traction hours elapsed, plus hours elapsed since the last service.

PGDT has a proven record of reliability and safety that is second to none amongst electronic motor controller manufacturers. Our background as the world's leading manufacturer of control systems for the mobility market - power wheelchairs for the disabled and scooters for the elderly or infirm - ensures that all of our products easily comply with the most stringent safety legislation. PGDT has a solid reputation of providing superb customer services. First class pre- and post-sales service and support is provided to OEMs throughout the entire process of vehicle design, approvals testing and production start-up, backed up by excellent, confidence inspiring warranty schemes. The X25 and X30 controllers, allied to PGDT's customer services offer vehicle OEMs of all sizes an outstanding combination of performance, functionality, cost effectiveness and support that is very difficult to match.

Simple Wiring Arrangement





- Integrated line supply contactor
- Reverse polarity protection
- U_L recognised component*
- Dedicated charger connector
- Integrated battery data logging
- Four user selectable operating profiles
- Solid state motor reversal
- Highly efficient, advanced drive algorithm
- Continuous armature and field current control
- Regenerative braking down to zero speed
- Closed loop speed control
- Overtemperature, overvoltage and undervoltage protection
- Automatic restraint braking with audible alarm function
- Control connections fully protected against shorts to B+ or 0V
- Low impedance logic inputs
- Fully protected current limited outputs
- Three fully programmable 2A auxiliary drivers
- Programmable auxiliary fault detection behavior
- Supports electronic & wig-wag (type 4) throttles
- 14V power supply for electronic throttles or speed sensors
- Programmable electromagnetic brake function
- Audible reverse alarm function
- Hours run and service timers
- Comprehensive vehicle and controller trip logs
- Two serial links with dedicated connectors
- Simple diagnostics and BDI via optional PGDT TruCharge™ display
- Comprehensive diagnostics and BDI via PGDT iGauge™ display
- Field programming and diagnostics via rugged PGDT handheld programmer
- PGDT PC Programmer™ software

* Pending at time of print

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Integral Isolation

The X25 and X30 controllers feature integral physical disconnection of the battery positive supply. This means that no external isolation contactor is required, simplifying the high power wiring and thus eliminating a frequent cause of vehicle failure.

This approach has been approved by Underwriters Laboratories Inc, (U_L) who have granted the X25 and X30 controllers 'recognized component' status.*

Battery Data Logging

The dedicated battery charger connector of the X25 and X30 allows the direct connection of an off-board or on-board charger with a maximum charging current of 25Arms, which enables the controller to measure the charging current and voltage. The connector is provided with a third terminal for a safety interlock connection to prevent the vehicle from being driven during charging.

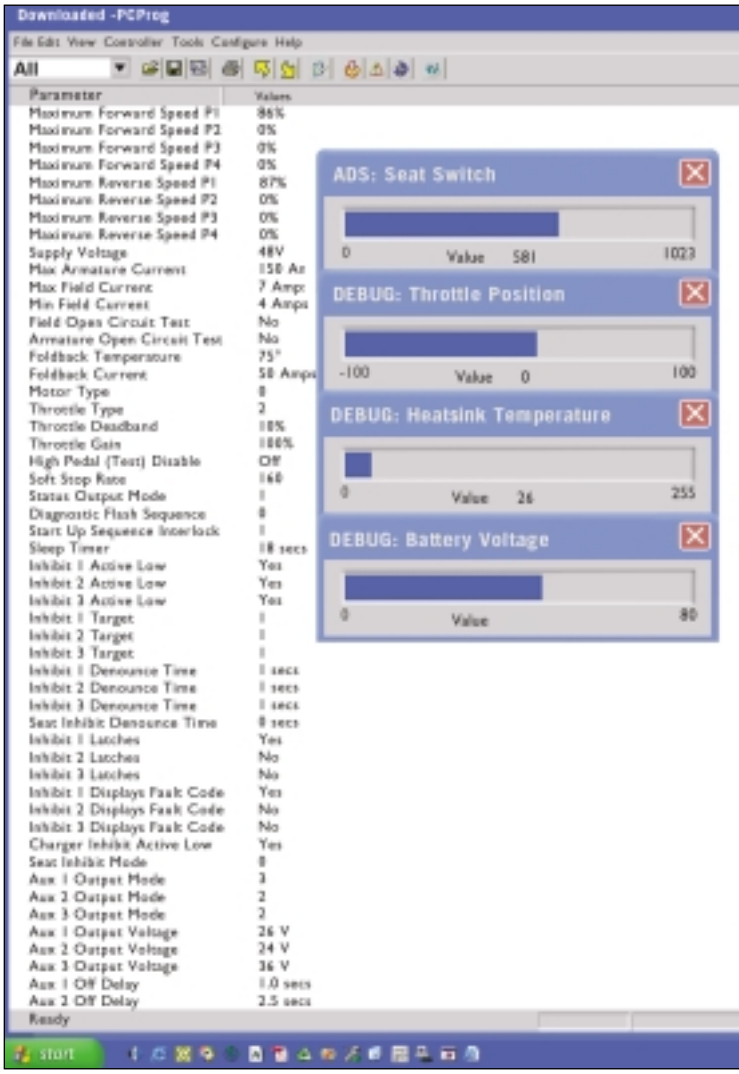
This measurement of charging voltage and current allows the controller to calculate and log valuable battery performance parameters such as:

- **Number of charge/discharge cycles**
- **Voltage at start and finish of each charge cycle**
- **Voltage at end of each discharge cycle**
- **Maximum current during discharge**
- **Current at end of charge**
- **Ampere hours used during each discharge cycle**
- **Ampere hours returned during each charge cycle**
- **Charge duration**

Intuitive Programming

PGDT's PC Programming software and interface cable allow the X25 and X30 to be programmed by any PC running Microsoft XP, NT and Windows 98 or later. PC Programmer allows individual parameters to be viewed and modified, or complete files to be saved and transferred for controller cloning. A restricted mode provides read-only access to the parameters but allows files to be loaded into the controller, ideal for factory floor programming. The diagnostics mode provides real-time measurement of controller values, and access to the trip logs, system timers and logged battery data.

The PGDT HHP hand-held programmer provides similar functionality to the PC Programming software, but in a portable, rugged tool intended for use by service engineers and dealers. The HHP can transfer complete files between controllers and provides powerful diagnostic functions. Like the PC programming software, several versions are available which restrict access to certain parameters and functions.



Powerful Diagnostics

The PGDT iGauge™ features a large graphical LCD to provide the vehicle operator with vital status information such as battery status, hour counters and comprehensive diagnostic information in an intuitive, logical manner.

Fits 52mm diameter cut out

Large backlit dot matrix LCD display

Field replaceable vandal resistant front lens

Additional high intensity red LED for fault indication

Battery status information

Charging status display

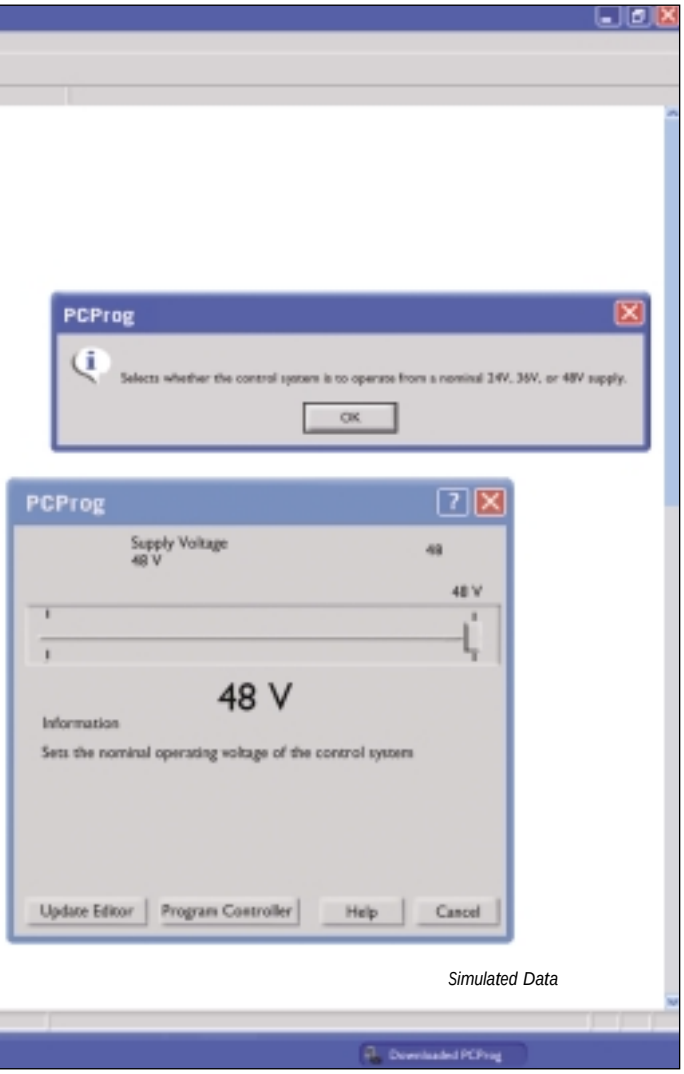
Hour counters and service timers

Diagnostic code display

All data received serially from X25/X30

Battery lockout relay output

Integral audible alarm



Simulated Data

The diagnostic display on the iGauge can be customized by OEM's using PGDT's PC programming software. A text description can be added to each system fault code so that a vehicle specific warning message is displayed on the LCD. For example, 'parking brake not released' or 'charger connected'. Furthermore, multiple programming files can be created to provide vehicles with the correct language diagnostic messages for the destined country of use.

The PGDT TruCharge™ gauge provides a simple, low cost means of displaying battery status and system diagnostics. The TruCharge™ gauge is a 10-segment, three colour LED display that normally displays the battery condition. In the event of a system trip, the display will flash a sequence of pulses to indicate the likely cause.

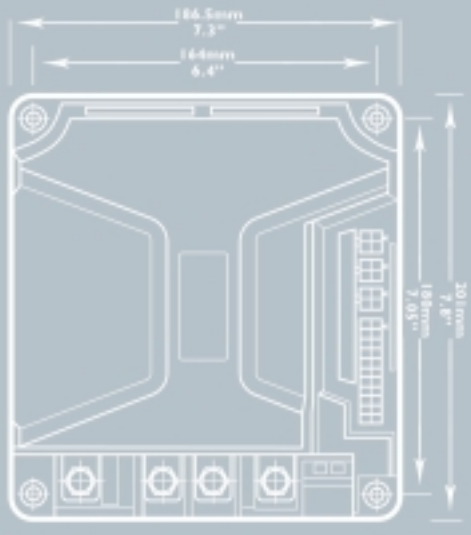
PGDT can supply, via our partners, a complete range of electric vehicle components such as contactors, battery connectors, tiller heads, hand control units, foot pedals and throttle units, beacons, horns and switches. PGDT's partners can also provide comprehensive services such as full vehicle electrical system design, together with the specification and supply of all major components. Custom panel sub-assemblies can also be supplied, together with a bespoke wiring harness design and supply service.

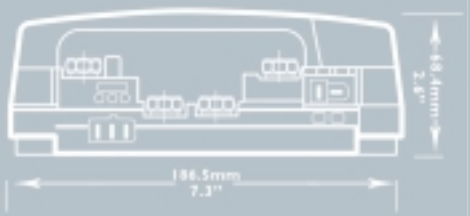
SPECIFICATIONS

Parameter	X30	X25
Nominal Input Voltage	24 - 36Vdc	48Vdc
Operating Voltage Range	16 - 44Vdc	32 - 60Vdc
Overvoltage Trip	50Vdc	70Vdc
Undervoltage Trip	14 - 20Vdc	26Vdc
PWM operating Frequency	20kHz	
Armature Current Rating, 2 Minute	300A	250A
Armature Current Rating, 1 Hour	125A	
Field Current Rating, 2 Minute	30A	
Field Current Rating, 1 Hour	15A	
Braking Current Limit	300A	250A
Battery Charging Current Rating	25 Arms	
Auxiliary 1 Output Current Rating	2A	
Auxiliary 1 Output Voltage	0 - 36Vdc	0 - 48 Vdc
Auxiliary 2 Output Current Rating	2A	
Auxiliary 2 Output Voltage	0 - 36Vdc	0 - 48 Vdc
Auxiliary 3 Output Current Rating	2A	
Auxiliary 3 Output Voltage	0 - 36Vdc	0 - 48 Vdc
Protected B+ Output Current Rating	6A	
Sensor Supply Output	14 Vdc, 10mA	
Operating Ambient Temperature Range	-25°C to 55°C	
Environmental Rating	IPX4	
Safety:	Meets or exceeds applicable sections of EN1175-1:1998	
EMC:	Exceeds EN12895:2000	
Approvals	U_L Recognized Component. *	

Notes: All outputs fully protected against short circuit & overload currents.
Current ratings quoted for an ambient temperature of 20°C.
Current ratings are continuous unless stated otherwise.
All specifications subject to change without notice.
* Pending at time of print

DIMENSIONS





Regulatory Compliance
The design will allow customers to meet the machinery directive 89/392/EEC, the low voltage directive and the essential requirements of:
ANSI /NGCMA Z130.1-1999. 'American National Standard for Golf Cars - Safety and performance Specifications'
EN60335-2-72 'Automatic machines for floor treatment, for industrial and commercial use'
EN1175-1: 1998 'Safety of industrial trucks - Electrical requirements - Part 1: General requirements for battery powered trucks'
EN12895: 2000 'Industrial trucks - Electromagnetic compatibility'
UL 583 'Standard for Safety for Electric-Battery-Powered Industrial Trucks'

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Certificate No FM 21061

SK78036/09/05
For further details refer to X25/X30 Technical Manual SK77893

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