Scotland Electronics (International) Ltd.

Motor Drive Products For Demanding Motion Control in Harsh Environments

Located in Forres, Scotland, Scotland Electronics (International) Limited (SEIL) has established an enviable reputation as a provider of innovative, high performance, electronic solutions, and has extensive experience in the development and management of major programs. Since 1995, the SEIL design and manufacturing facility has been providing quality electronic products to high-profile clients in a wide range of industries and applications.

SEIL's high performance motor drives have been developed for harsh environment and other specialist markets. The motor drive products are designed, manufactured and tested by a dedicated, multi-disciplined team who provide unmatched customer application support.

SEIL Motor Drive products have the performance and capability to be the best in market solutions for harsh environment motion control applications, coupled with competitive pricing.

Inherent in the SEIL motor drive products design is technical excellence, performance, ruggedness and reliability. In order to achieve this, the motor drive products employ a modular building block philosophy, which allows maximum reuse of qualified product design. This allows prototype SEIL motor drive products to be developed for specific applications and rapidly introduced to production in order to support client program requirements.

If required, the SEIL Motor Drive Products group can call on established motor manufacturer relationships, which allows the supply of a proven motor and drive sub-system package for specific applications. This can remove the customer's need for sub-contract management and engineering support associated with integration of the sub-system 'components'.

As with all SEIL products, the motor drive products are covered by a comprehensive warranty and after-sales consultative service.

For assistance with applications contact the SEIL Motor Drive Products team direct or any of our world-wide agents and representatives who are available for discussion, customer visits and demonstrations.

- Fast Track
- Turnkey solutions
- Competitive pricing
- Skilled motion control engineers
- Proven track record and heritage
- Airborne, naval and space qualified products
- Compact size and power density
- Smallest currently available

SEIL

DEMANDING MOTION CONTROL

servo amplifiers, motor drives and motion control systems

demanding motion control...

Some of SEIL's Clients

Alliance Space Systems	(USA)	Space demonstrator
BAE Systems	(UK)	Anti Missile dual Servo Motor Amplifier
Badger Explorer	(Norway)	Autonomous drilling bit
Boston University	(USA)	Space demonstrator
CERN	(France/Switzerland)	RF Piston stepper motor controllers
Claverham /FHL	(UK)	Missile demonstrator
CONAE	(Argentina)	Space demonstrator & qualified satellite antenna
Flight Refuelling Ltd	(UK)	Airbus A330 & A400M Refuelling Pod
FR Hi-Temp	(UK)	Airbus 380 consultancy fuel pumps
JF Rumic	(UK)	Rescue submarine thrusters
Lockheed Martin	(USA)	Naval ROV pump
Maritime Well Services/Aker Kvaerner	(Norway)	Downhole motor pump controllers
MSI Defence Systems Ltd	(UK)	Naval Gun stabilization system
NASA	(USA)	Space demonstrator
Northrop Grumman	(US).	Space demonstrator
NRC National Research Defence Council	Canada	Wind tunnel robotic arm
Read Well Services/Calidus Engineering	(UK)	Downhole motor pump
Remotec/Northrop Grumman	(Europe)	Unmanned vehicle
Smiths Aerospace	(UK)	Space demonstrator
Selex Sensor and Airborne Systems	(UK)	Fighter jet Radar Targeting system
Star Oil Tools	(Canada)	Down hole jarring tool
Terma A/S	(Denmark)	Saab JAS-39 Gripen Fighter jet
Thales Airborne Radar	(UK)	UAV Radar motion sub system
Thales Underwater Systems	(UK)	Submarine emergency periscope
Ultra Electronics	(UK)	Naval T45 Radar mast stabilization

demanding motion control...

Product Range

Series 50	Stepper Drives
Series 100	Brushed Servo Amplifiers - Single and Dual
Series 200	Brushless Three Phase - Trapezoidal Commutation
Series 300	Three Phase Brushless - Sinusoidal Commutation
Series 400	Two Phase Brushless - Sinusoidal Commutation
Series 500	Three Phase Sensorless Motor Drive
Series 600	Brushless 3 phase Transconductance Servo Amplifier Module
Series 1000	Motion Control Servo System Drives

Please contact SEIL or any of our agents for semi-custom or custom drive requirements

series 50

Stepper Motor Drives

The drive provides step and direction control and additionally has an internal pulse system that allows a run and direction control scheme. The internal voltage controlled oscillator allows the speed to be controlled via an external dc voltage 0 -10V. Two ranges are available, so that the speed can easily be controlled via the dc voltage. The Hi range gives inputs pulses in the range of 100 to 16000 pulses per second and a Lo range which gives pulses in the range of 10 to 1600 pulses per second.

The unit uses H - bridge pulse width modulated re-circulating current drive outputs with typical frequencies in the region of 20 to 30 kHz. Configuration of the current loops allows the current to be selected for the particular stepper motor. The raw dc power is used to generate the internal supplies required by the unit.

Various power levels can be supplied but the smallest unit is capable of around 50 Watts at voltages up to 100V. Lower power drive is possible by reconfiguring the internal current sensing. Various step options can be selected: Full step, half step and a sinusoidal mode for smoother operation.

Features

- Temperature: standard -40 to 85°C, Designs can exceed these parameters
- Designed to Mil standards
- Nominal: 0-10V
- Dims: 95x75x23mm
- Weight: typical 250g (9oz)

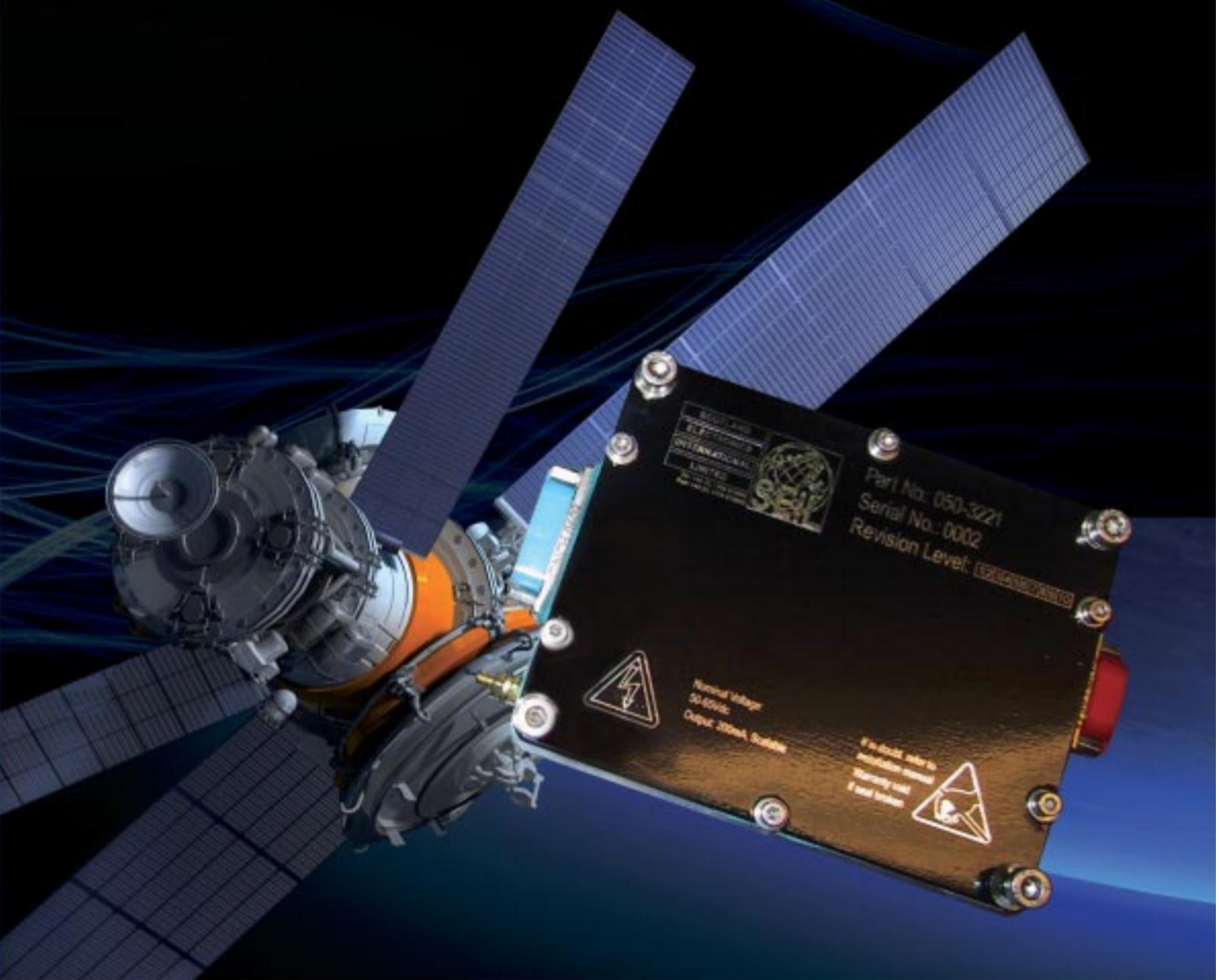
series 50

Stepper Bipolar Motor Drives

For Deployment & Positioning Systems in Space Applications

Industrial and Military temperature ranges available

Series 50 drives are Bipolar Stepper motor drives for aerospace and military applications. They are usually supplied in a semi-customised format for the particular program, including options for power levels and voltages. A range of packaging styles and connector options are also available. Please contact SEIL or any of our agents or representatives



series 100

Servo Amplifier

This drive is a transconductance amplifier scaled to give a current out for a demand voltage in. Input can be either ± 10V via a differential input for ± maximum current; alternatively the demand can be via a serial link.

Circuitry is provided for the inclusion of basic tacho and position loops that makes this amplifier suitable for simple servo loops without additional circuitry.

The module is available with a variety of output connector options for normal chassis mounting or with pins for PCB mounting The small size of the module and high efficiency permits easy mounting on a single Eurocard or alternative. Normally a heat ladder and wedge lock scheme would be advised to conduct the heat to the LRU case or rack structure, this allows the module case to be isolated from all internal circuitry and can be connected directly to the system chassis. These card-mounted modules can be supplied as semi-custom options. Contact SEIL for details and availability.

The modules can provide full four quadrant or a two quadrant switching scheme. The best choice is always dependent on application and motor selection. SEIL can advise about the best switching scheme for your application.

These servo amplifiers are capable of operation in harsh environments for industrial and military applications.

The amplifier derives internal supplies from the raw power supply and they are available in a range of voltages and respective currents. All modules in this range are designed to supply 1kW maximum. Single and dual amplifiers are available in the same package.

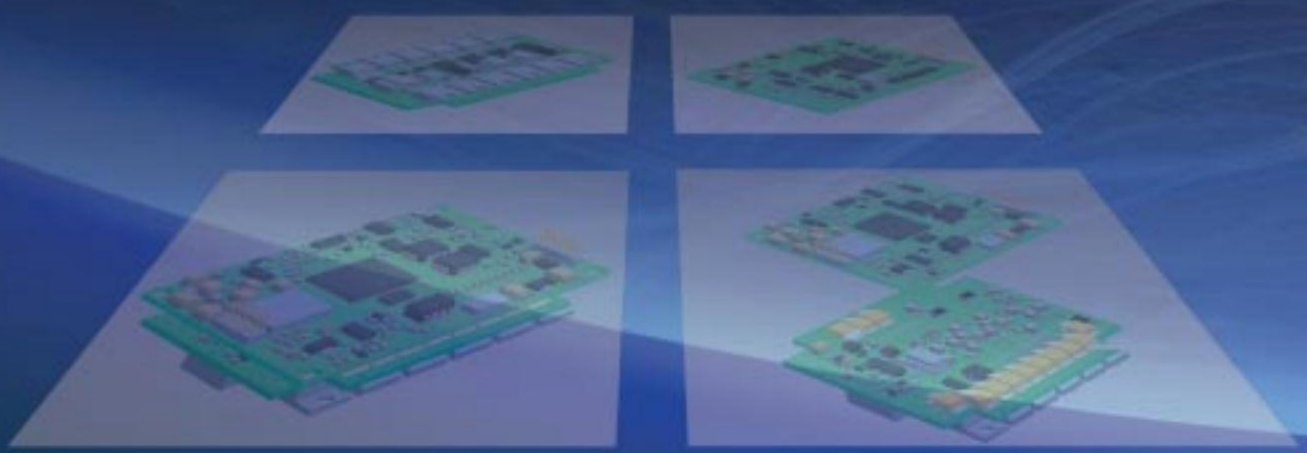
Standard voltage and current ranges include:

100 to 300 VDC nominal @ 5 Amps
50 to 99 VDC nominal @ 15 Amps
16 to 49 VDC @ 25 Amps

Contact SEIL for semi-custom options outside these ranges.

Features

- Temperature: -40 to + 85°C ambient
- Designed to Mil standards
- Nominal 270V, 100V & 50V Bus variants
- Dims: 95mm (L) x 75mm (B) x 23mm (H)
- Weight: 250gm (9oz)
- 1kW drive power
- Transconductance operation
- Internal generated supplies
- Fully isolated bridge



series 100

Brushed DC Motor Servo Amplifiers

For General Servo Applications Using Brushed Motors

Industrial and Military temperature ranges available

Transconductance operation and a range of voltage options allows the unit to drive most brushed motors up to a power level of 1kW. Single or Dual Servo Amplifiers are available in the same package, and limited angle torquers (LAT) can also be driven.

Applications include all servo position and velocity systems. For detailed information on applications, specifications etc. for Brushed Motor Drives or for any custom or semi custom requirements please contact SEIL or any of our agents or representatives.

series 200

Brushless 3 phase Transconductance Servo Amplifier

The Series 200 drives have trapezoidal commutation schemes for driving Brushless Three Phase PM motors. Drives for aerospace and military applications are usually supplied in a semi-customised format including options for packaging form factor, power levels and voltages, but the basic circuit blocks are standard. A basic unit of up to 1KW peak is available in a number of voltage ranges so that applications can be tested prior to any customisation requirement.

Data sheets covering all Trapezoidal amplifiers in the series are available on request from SEIL.

The Brushless 3 phase servo amplifier operates in a transconductance mode scaled to give a current out for a demand voltage in. Input is either ± 10V via a differential input for ± maximum current, or as an alternative the demand can be via a serial link. To commutate the Brushless motor, feedback of the relative rotor to stator position is required by the brushless servo amplifier. Both Hall Effect and Field Director schemes are catered for as standard. Versions are available that will operate with syncros, resolvers or optical encoder devices.

The module is available with a variety of output connectors options for normal chassis mounting or with pins for PCB mounting.

The small size of the module and high efficiency permits the easy mounting of a module on a single Eurocard or any alternative. Normally a heat ladder and wedge lock scheme would be advised to conduct the heat to the LRU case or rack structure. The module case is isolated from all internal circuitry and can be connected directly to the system chassis. These card-mounted modules can be supplied as semi-custom options. Contact SEIL to discuss applications, details and availability.

Modules can be supplied in a variety of switching schemes, either full four quadrant, two quadrant, or an alternative adaptive switching scheme. The best choice is always dependent on application and motor selection. SEIL can advise about the best switching scheme for your application.

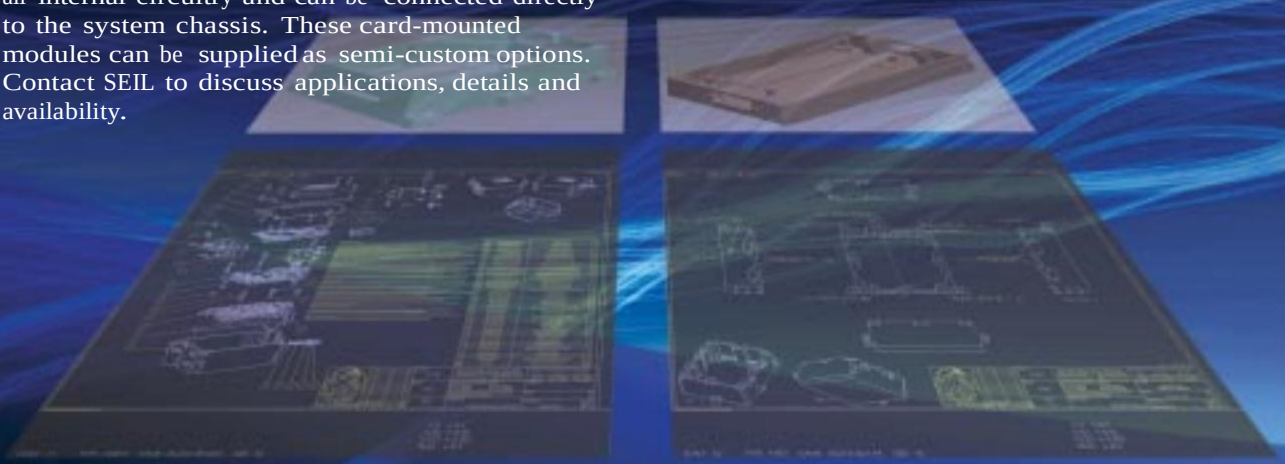
These servo amplifiers are designed for harsh environments and industrial and military applications. They derive their internal supplies from the raw power supply and are available in a range of voltages and respective currents. All modules in this range are designed to supply 1 kW maximum power to the motor.

Standard voltage and current ranges include:
100 to 300 VDC nominal @ 5 Amps
50 to 99 VDC nominal @ 15 Amps
16 to 49 VDC @ 25 Amps

Contact SEIL for semi-custom options outside these ranges.

Features

- Temperature: -40 to + 175°C ambient
- Designed to Mil standards
- 270VDC Bus operation (Mil 704 voltage levels from 115V 3 ph 400Hz)
- Dims: 95mm (L) x 75mm (B) x 23mm (H)
- Weight: 250gm (9oz)
- 1kW drive power
- Transconductance operation
- Internal generated supplies
- Fully isolated bridge
- Analogue ± 10V demand or Serial RS422



series 200

Brushless 3 phase Motor Servo Amplifier Trapezoidal Commutation

Designed for Servo Applications in Harsh Environments

Industrial and Military temperature ranges available

The standard servo amplifier module is designed and optimised to drive the CDA Intercorp range of high performance motors, however other brushless motors can also be driven.

The CDA Intercorp motors are typically used in harsh environments, military and space applications and this module provides a matching drive capability.

Applications include all servo position and velocity systems such as driving aircraft pod and turret rotating window assemblies or roll sections, or any other higher power rotary, linear and pointing mechanisms.

For more information on typical applications of SEIL Brushless Motor Drives or for details of our complete range of standard Servo amplifiers and Motor Drives, or for any custom or semi custom requirements please contact SEIL or any of our agents and representatives.

series 300

Brushless 3 phase Sinusoidal Servo Amplifier

This brushless 3 phase sinusoidal servo amplifier operates in a transconductance mode scaled to give a current out for a demand voltage in. Input is either ± 10V via a differential input for ± maximum current, or the demand can be via a serial link. The motor is sinusoidally commutated to give low torque ripple and maximum motor efficiency. To commutate the motor, feedback of the relative rotor to stator position is required to calculate the respective current in each of the phases. Field Director, synchro and resolver schemes are catered for as standard. It is also possible to obtain versions that will work with syncros, resolvers or optical encoder devices.

The module is available with a variety of output connectors, options for normal chassis mounting or with pins for PCB mounting.

The small size of the module and high efficiency permits the easy mounting of a module on a single Eurocard or any alternative. A heat ladder and wedge lock scheme would normally be used to conduct the heat to the LRU case or rack structure. The module case is isolated from all internal circuitry and can be connected directly to the system chassis. Card-mounted modules can be supplied as semi-custom options. Contact SEIL to discuss applications, details and availability.

These modules use a full four quadrant switching scheme on each of the motor phase current loops and hence can be back driven in high inertia systems.

The modules are designed for harsh environments and for industrial and military applications. They derive their internal supplies from the raw power supply and are available in a range of voltages and respective currents. All modules in this range are designed to supply 1 kW maximum power to the motor.

Standard voltage and current ranges include:
100 to 300 VDC nominal @ 5 Amps
50 to 99 VDC nominal @ 15 Amps
16 to 49 VDC @ 25 Amps

Contact SEIL for semi-custom options outside these ranges.

Features

- Temperature: -50 to +85°C ambient
- Designed to Mil standards
- 270Vdc Bus operation (Mil 704 voltage levels from 115V 3 ph 400Hz)
- Dims: 95mm (L) x 75mm (B) x 23mm (H)
- Weight: 250gm (9oz)
- 1kW drive power
- Transconductance operation
- Internal generated supplies
- Fully isolated bridge
- Analogue ± 10V demand or Serial RS422

series 300

Brushless 3 phase Sinusoidal Servo Amplifier with Sinusoidal Commutation

Smooth Torque for Servo Applications in Harsh Environments

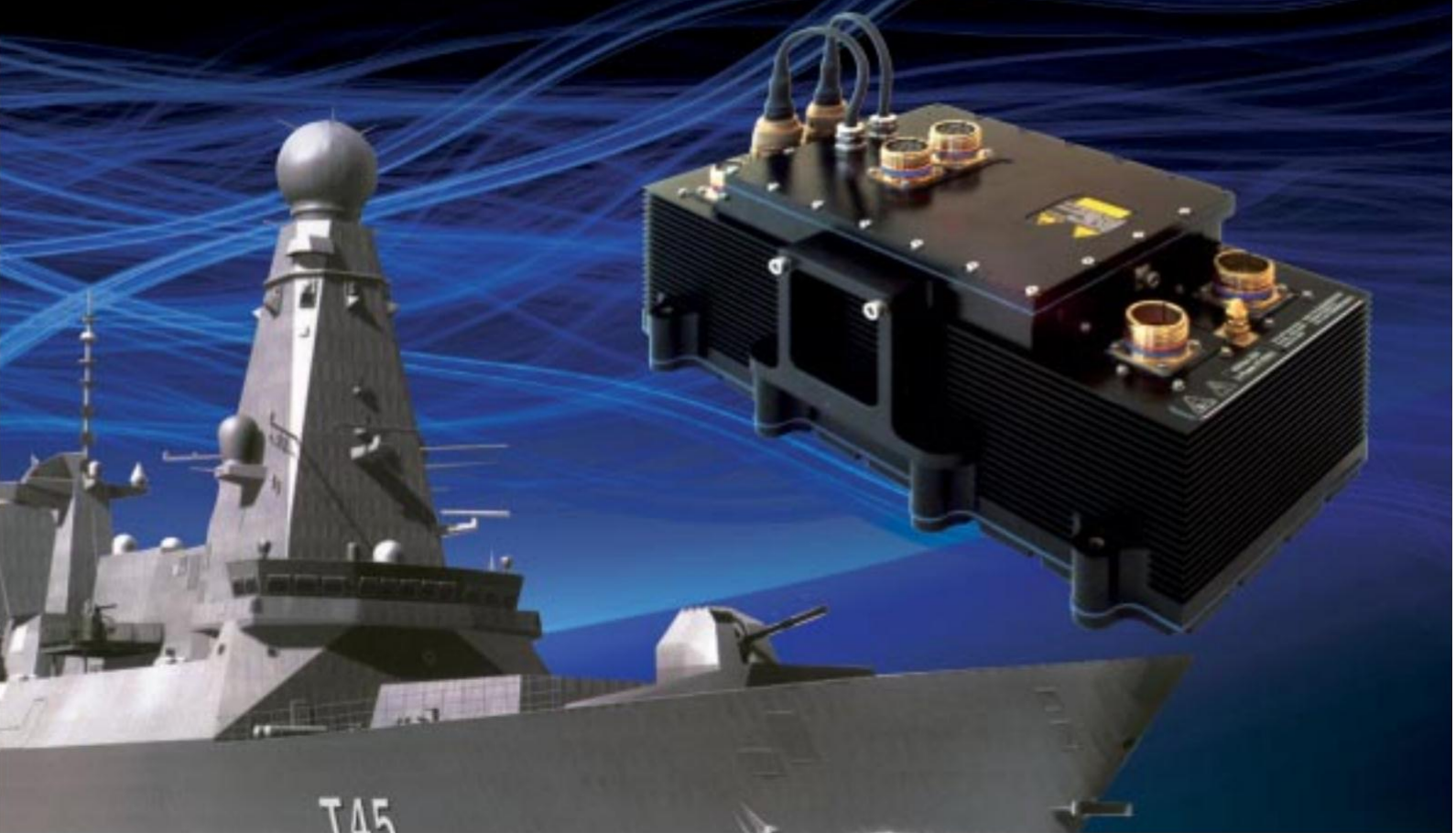
Industrial and Military temperature ranges available

This sinusoidal servo amplifier module is designed and optimised to drive the CDA Intercorp range of high performance brushless 3 phase motors; in addition, other brushless motors can also be driven.

The CDA motors are typically used in harsh environments, military and space applications, and this module provides a matching drive capability.

Applications include all servo position and velocity systems, especially where smooth torque production is required. Typically used in tracking and stabilisation systems, and the units are ideally suited for pedestals, gimbals and all high precision drives.

For more information on typical applications of SEIL Brushless Motor Drives or for details of our complete range of standard servo amplifiers and motor drives, or for any custom or semi custom requirements please contact SEIL or any of our agents or representatives.



series 400

Sinusoidal Servo Amplifier - 2 phase Brushless

This sinusoidal servo amplifier is designed to drive brushless 2 phase motors. It operates in a transconductance mode and gives a current out for a demand voltage in. Input is either ± 10V via a differential input for ± maximum current, or as an alternative the demand can be via a serial link. The 2 phase motor is sinusoidally commutated to give low torque ripple and maximum motor efficiency. Feedback of the relative rotor to stator position is required to calculate the respective sine and cosine current in each of the two motor phases. Two phase Field Director or Resolvers schemes are catered for as standard. It is also possible to obtain versions that will operate with optical encoder devices.

Contact SEIL to discuss your application.

The module is available with a variety of output connectors, options for normal chassis mounting or with pins for PCB mounting.

The small size of the module and high efficiency will allow easy mounting of a module on a single Eurocard or any alternative. Normally a heat ladder and wedge lock scheme would be advised to conduct the heat to the LRU case or rack structure. To this effect the module case is isolated from all internal circuitry and can be connected directly to the system chassis. These card-mounted modules can be supplied as semi-custom options.

Contact SEIL to discuss applications, details and availability.

These modules use a full four quadrant switching scheme on each of the motor phase current loops and hence can be back driven in high inertia systems.

These servo amplifiers are designed for harsh environments and for industrial and military applications. They derive their internal supplies from the raw power supply and are available in a range of voltages and respective currents. All modules in this range are designed to supply 1 kW maximum power to the motor.

Standard voltage and current ranges include:
100 to 300 VDC nominal @ 5 Amps
50 to 99 VDC nominal @ 15 Amps
16 to 49 VDC @ 25 Amps

Contact SEIL for semi-custom options outside these ranges.

Features

- Temperature: -40 to + 85°C ambient
- Designed to Mil standards
- 270Vdc Bus operation (Mil 704 voltage levels from 115V 3 ph 400Hz)
- Dims: 95mm (L) x 75mm (B) x 23mm (H)
- Weight: 290gm (10oz)
- 1kW drive power
- Transconductance operation
- Internal generated supplies
- Fully isolated bridge
- Analogue ± 10V demand or Serial RS422

series 400

Sinusoidal Servo Amplifier for 2 phase Brushless Motors

2 phase Sinusoidal Commutation

Smooth Torque Applications in Harsh Environments

Industrial and Military temperature ranges available

This 2 phase sinusoidal servo amplifier is designed and optimised to drive the CDA Intercorp range of high performance brushless 2 phase motors, however other 2 phase brushless motors can also be driven.

The CDA Intercorp motors are typically used in harsh environments, military and space applications and this module provides a matching drive capability.

Applications include all servo position and velocity systems, especially where smooth torque production is required. Typical usage is in tracking and stabilisation systems, and tension control. The units are ideally suited for all high precision drive systems.

For more information on typical applications for SEIL Brushless Motor Drives or details of our complete range of standard servo amplifiers and motor drives, or for any custom or semi custom requirements please contact SEIL or any of our agents or representatives

series 500

Sensorless Motor Drive - 3 phase Brushless DC

The sensorless configuration gives the advantage of minimised connections to the motor. Only the three motor phases need be connected to the brushless motor. No feedback wires are required. This eases the connection problem when the electronics are situated in a chamber at atmospheric pressure and are connected by high-pressure electrical feed-through terminals to the motor, working in a high-temperature, high-pressure environment typical of down-hole type installations.

By careful control of the power dissipation in the semiconductor devices the unit is able to operate almost to the limit of the maximum junction temperatures with good reliability.

A variety of control schemes can be provided, from simple ON/OFF control by a logic signal or contact closure to full speed control over an isolated serial link. Direction control CW/CCW can be under control of a logic signal or contact closure. This can also be controlled from a serial link. Please note that with a sensorless drive it is normal to stop rotation prior to commanding the reverse direction; logic is built into the drive to ensure that a stop signal is provided before the unit will accept a change in direction.

Sensorless drives normally require to be started off load, but techniques have been employed which may allow motor starting under load in certain conditions.

Power to the unit is used to derive the internal power supplies. Dependent upon application, raw power can be fed directly to the bridge or it can be fed via an external inductor, which will then allow the internal circuitry to provide a controlled soft start-up.

The unit is provided in a modular anodised aluminium enclosure whose dimensions have been selected so that it can be fitted into standard 52mm coiled tubing within a normal atmospheric pressure container. The base plate is the cold wall interface, which allows easy mounting to a low thermal impedance heat-sinking path. External solder pins are used for ease of system connections but alternative connection schemes can be provided. Construction techniques used are designed to withstand high vibration and shock.

Features

- Temperature: -40 to +125°C. An extended high temperature range is available
- Vibration capability 20-2000 Hz to 25G rms
- Designed to Mil standards
- DC input Voltage range 100 - 300V.
- Up to 5 Amps peak current
- Dims: 150mm (L) x 45mm (B) x 20mm (H) 5.9in (L) x 1.8in (B) x 0.8in (H)
- Weight: 225gm (8oz)
- 1kW drive power
- Voltage mode operation with current limit
- Internally generated power supplies
- Customised options providing motor speed, motor current and temperature measurement are available
- Simple system interface or serial link control

series 500

Brushed DC Motor Servo Amplifiers

for General Servo Applications using Brushed Motors

Industrial and Military temperature ranges available

Transconductance operation and a range of voltage options allows the unit to drive most brushed motors up to a power level of 1kW. Single or Dual Servo Amplifiers are available in the same package, and limited angle torquers (LAT) can also be driven.

Applications include all servo position and velocity systems.

For detailed information on applications, specifications etc. for Brushed Motor Drives or for any custom or semi custom requirements please contact SEIL or any of our agents or representatives.

series 600

Brushless 3 phase Transconductance Servo Amplifier Module

This Brushless 3 phase servo amplifier operates in a transconductance mode scaled to give a current out for a demand voltage in. Input is either ± 10V via a differential input for ± maximum current, or the demand can be via a serial link. To commutate the Brushless motor, feedback of the relative rotor to stator position is required by the brushless servo amplifier. Both Hall Effect and Field Director schemes are catered for as standard. It is also possible to obtain versions that will operate with syncros, resolvers or optical encoder devices.

The module is available with a variety of output connectors options for normal chassis mounting or with pins for PCB mounting.

The small size of the module and high efficiency will allow easy mounting of a module on a single Eurocard or any alternative. Normally a heat ladder and wedge lock scheme would be advised to conduct the heat to the LRU case or rack structure. To this effect the module case is isolated from all internal circuitry and can be connected directly to the system chassis. These card-mounted modules can be supplied as semi-custom options.

These modules can be provided in a variety of switching schemes, either full four quadrant, two quadrant, or an alternative adaptive switching scheme. The best choice is always dependent on application and motor selection. SEIL can advise about the best switching scheme for your application.

These servo amplifiers are designed for harsh environments and industrial and military applications. They derive the internal supplies from the raw power supply and are available in a range of voltages and respective currents. All modules in this range are designed to supply 1 kW maximum power to the motor.

Standard voltage and current ranges include:
100 to 300 VDC nominal @ 5 Amps
50 to 99 VDC nominal @ 15 Amps
16 to 49 VDC @ 25 Amps

Contact SEIL for semi-custom options outside these ranges.

Features

- Temperature: -40 to + 85°C ambient
- Designed to Mil standards
- 270VDC Bus operation (Mil 704 voltage levels from 115V 3 ph 400Hz)
- Dims: 95mm (L) x 75mm (B) x 23mm (H)
- Weight: 250gm (9oz)
- 1kW drive power
- Transconductance operation
- Internal generated supplies
- Fully isolated bridge
- Analog ± 10V demand or Serial RS422

series 600


SCOTLAND
ELECTRONICS
INTERNATIONAL
LIMITED
SEIL
Linear Amplifier


SEIL
Linear Amplifier


AIRBUS A380
A380

series 1000

Motion Control System for Brushless Motor Servo Applications

Industrial and Military temperature ranges available

The Motion Control System is designed to drive Brushless servo motors such as those supplied by CDA Intercorp, in a complete servo system with control of acceleration, velocity and position.

The unit combines Digital Signal Processing servo control with either a Sinusoidal or Trapezoidal commutated Amplifier.

Control over the servo system is by simple serial link allowing interactive loop set-up on a PC. Non-volatile memory locks the control variables into the unit for normal stand-alone operation.

Applications include servo position and velocity systems that require a stand-alone system or control via a serial or parallel computer interface.

Contact us for information on complete motion control applications, servo systems for harsh environments, and details of our range of standard servo amplifiers and motor drives. Also contact SEIL for any custom or semi-custom requirements.

series 1000

Motion Control System for Brushless Motors

The Motion Control system combines one of the SEIL standard transconductance amplifier units with a SEIL DSP control unit. The DSP control unit provides interfaces for resolvers, optical encoders etc. for position, acceleration and velocity measurement and control.

Serial and Parallel interfaces are also provided for connection to a control PC for set-up and debugging. Interfaces are also provided to the system interface for ease of control. RS232, RS485, RS422 and 8 Bit Parallel etc are available as standard. Other semi-custom options can be supplied if required.

Motion Control electronic units (EU) are available with a variety of output connector options and are usually chassis mounted. EUs of the correct size are available for rack mounting with connector wedge lock schemes suitable for PCB form factor standards. The module case is then isolated from all internal circuitry and can be connected directly to the system chassis. These card-mounted EUs can be supplied as semi-custom or custom options.

Software is provided for setting-up servo loops and tuning the servo system via a PC and serial link. The configuration can then be saved within the unit for stand-alone operation. The PC can monitor the servo variables, and plots can be obtained of the systems performance during normal stand-alone operation.

Robust construction to military standards allows operation within harsh environments. The Motion System generates its own isolated supplies.

Various supply options are available including:

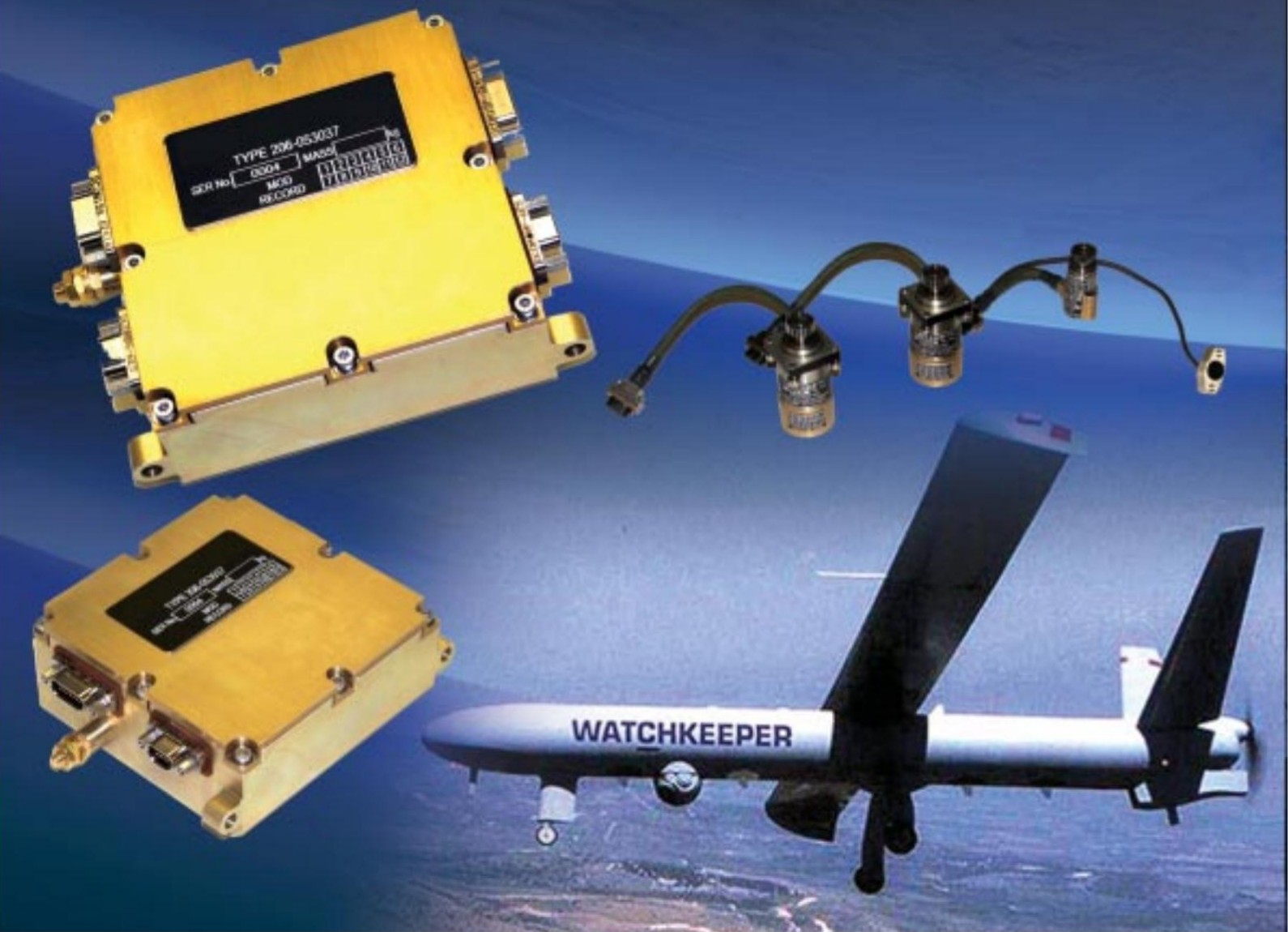
100 to 300 VDC nominal @ 5 Amps
50 to 99 VDC nominal @ 15 Amps
16 to 49 VDC @ 25 Amps

The normal power level to the motor is approximately 1kW. Higher powers are available. Contact SEIL or any of our agents or representatives for further details and availability, and semi-custom options outside these ranges.

series 1000

FEATURES

- Temperature: -50 to + 85°C ambient
- Designed to Mil standards
- 270V, 100V and 50V variants
- Dimensions (chassis mounting) 175mm (L) x 125mm (B) x 50mm (H)
- Weight approx: 750gm
- 1kW drive power
- Serial and Parallel interfaces
- Internal generated supplies with Mil-Std-461 EMC
- Fully isolated
- Configurable servo loops



series 1000


SEIL
DEMANDING
MOTION CONTROL

demanding motion control...

SEIL is a niche market specialist in motion control systems design, manufacture and implementation, taking responsibility for the motor and controller sub-system. SEIL's main objective is to provide world-class electronic designs, reinforced by unmatched manufacturing quality.

To achieve this objective our company culture embraces:

- teamwork
- the development of people
- a deep understanding of our client's business and industry
- strong capitalisation and a clear indentification of our core business.

We adopt a partnership approach with our clients for mutual benfit, understanding each other's businesses and becoming more productive as a team; enabling us to match our services and products to the needs of our customers. This philosophy enables us to create state-of-the-art electronics solutions for individual requirements.

Mike Ramsay BSc.
Chairman & Principal Stakeholder

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