

Engine Governing and System Controls

GOVERNORS
AMERICA
CORP.



誥鑫企業有限公司
ARITH COMPANY LTD.
地 址：台北市復興北路427巷30號
電 話：(02)2717-5038
傳 真：(02)2717-5039
e-mail: taipei@arith.com.tw
網 址： <http://www.arith.com.tw>



Governors America Corp. is a leading provider of innovative engine control products to a World Wide list of customers.

Our dedication and focus on

our World market has resulted in a vertically integrated company with complete design, development, production, and marketing capabilities for its family of electromechanical and electronic devices for precise engine control and system integration. These market focused efforts have resulted in innovative engine control products that are being used in all parts of the world. GAC product solutions can be found in every imaginable application and in the harshest environments. Some typical applications are generator sets, material handling, marine propulsion, mining, locomotive and off-highway applications.

GAC has developed a broad, technically advanced line of Electronic Governing and Fuel Control Systems, complete with accessories. Engine control systems range in cost and complexity from single speed isochronous governors to sophisticated multi-engine load sharing / power control systems, full authority drive-by-wire systems, locomotive diesel electric controls, full engine generator military control systems and a great variety of complementing governing and control system accessories.



To maintain our leadership position in the engine control field, GAC has incorporated advanced technologies into its latest product developments. These technologies range from enhanced analog controls

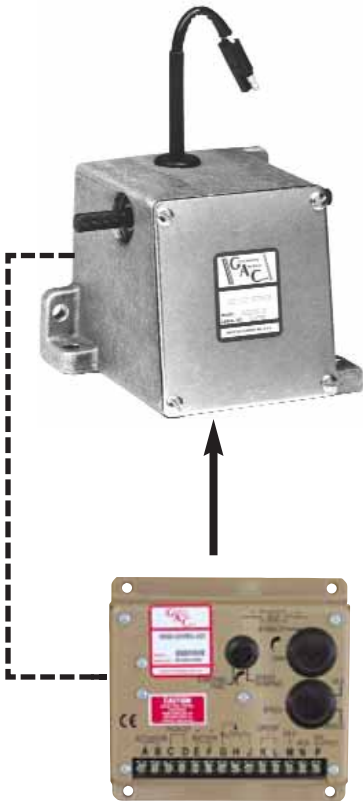
to advanced 32 bit microprocessor controlled systems. While all of GAC's technologies provide the Best Value available in the marketplace, with our analog controls targeting the simpler cost sensitive application and our digital controls targeting the more complex applications. GAC offers digital controls, which not only incorporate most of the features of our analog controls, but also comprehensive digital engine requirements. Features like user defined torque, boost, and starting maps with CANBus link for our digital engine controllers and full system metering, protection, start/stop control. GAC also offers system integration solutions for the many markets we serve, for example our Inteli family of generator set controllers. The Inteli family of controllers integrates all aspects of the genset from start/stop control to full system metering, protection and communication for both stand alone and paralleled systems. GAC also designs and manufactures custom electromechanical integral actuators. These high performance linear, rotary, and throttle body actuators are designed to optimally control a specific engine's fuel system. Some units include GAC's own high accuracy position sensing system.



GAC complements its innovative designs with a vertically integrated state of the art manufacturing facility. GAC manufacturing combines the latest in technology, capital equipment and computer operating systems with an experienced workforce to produce products that exceed our customers demands for high quality and on time deliveries.

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Product Overview



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External Electric Actuators

GAC Proportional Electromagnetic Actuators position the engine fuel control mechanism. The highly reliable rotary design of the environmentally sealed actuators have no sliding parts, require no maintenance, and can accommodate any linkage configuration. The multiple voltage feature of the ACB and ADB types offer application convenience. Exceptional response times result in superior performance. For fail safe operation, an internal spring returns the actuator to minimum fuel when de-energized. For fuel management applications, position feedback transducers are available within various actuator series.

Typical Applications



I20 Series

- 1.0 lb-ft of torque, 25° rotation, < 32 msec. response
- Small, low cost, low friction model
- Ideal for small fuel systems on engines up to 150 hp
- Suitable for rotary or small inline fuel pumps or small carburetors



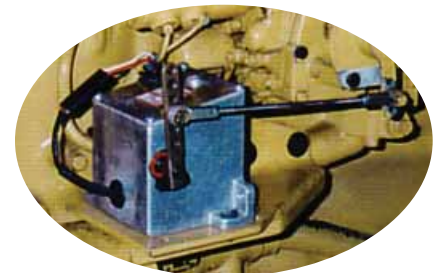
ADB I20E4 HT

- *New Improved design* - meters fuel to Cummins engines with PT fuel systems
- Fuel delivery capability up to V16 engines
- Relieves fuel rail pressure to ensure fastest governor response
- Field proven - best long life design for PT fuel systems



225 Series

- 2.2 lb-ft of torque, 25° rotation, < 45 msec. response
- Low cost, versatile model
- Suitable for multi-plunger fuel pumps and medium sized carburetors
- Various models offer a variety of connectors and wiring harnesses, including feedback sensors
- outstanding reliability and performance
- Feedback sensor available



2000 Series

- 7.5 lb-ft of torque, 25° rotation, < 80 msec. response
- Wide angular travel
- Large bearing system
- Substantial reserve torque (up to 10 lb-ft) to move linkage systems with high inertia and moderate friction loads
- Through-shaft design and universal mounting to simplify installation
- Sized for engines from 400-1800 hp
- Suitable for large carburetors, large fuel pumps, and multiple-injector systems
- Feedback sensor available



5000 Series ~ 70 NM Torque

- In Preparation

CAT 3516

Integral Electric Actuators

No external Linkage - Directly coupled to fuel pump
Top Performance

Typical Applications



ALN025 Linear Actuator

- 1/4 ft-lb, 22mm stroke, fast response
- Designed with high quality anti-friction bearings
- Cost effective design
- Replaces competitive models



100/I07 Series

- Mounts directly to Stanadyne "D" series pumps to eliminate brackets and external linkage
- Automotive electrical connector
- Actuator replaces fuel shutoff solenoid function
- Sealed design prevents contamination of fuel
- Faster response than competitive designs

* 100 Series for Stanadyne "D" Series pumps



103 Series

- Easy installation requiring minimal time
- Low cost engine governing solution
- Fast response < 45 msec.
- High reliability and proven electromechanical design

* 103 Series for DELPHI DPG/DP210G pumps



110 Series

- Directly replaces engine stop solenoid
- Unique linear electromechanical technology
- Mating half connector consistent with type used by engine manufacturer

* 110 Series for 2, 3, and 4 cyl. DEUTZ 1011 / 2011 engines



Integral Electric Actuators

Typical Applications



I 50 Series

- Compact, low cost design
- 25° rotation
- Designed for YANMAR and other small engine applications
- Unique rope start provision
- Magnetic assist shut-off feature to assure engine shutdown

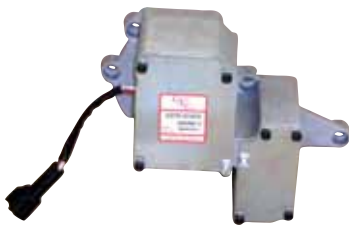


I 75 Series

- Mounts on the pump in place of mechanical governor
- Capable of controlling pumps on engines up to 8-cyl.
- Sealed to protect linkage and electromagnetic components from environment
- Connects directly to fuel rack without bellows
- Includes manual shut-off mechanism
- Compact size, fast response
- Cost effective design
- Feedback position available



- * I 75 Series for "P" size Bosch style pumps
- * I 76 Series for "A" size Bosch style pumps / left hand racks
- * KT275 / Field installation kit required for 3000 Series "P" pumps
- * KT276 / Field installation kit required for 7000 Series "P" pumps



I 80 Series

- Replaces existing mechanical governor
- Proven electromechanical design
- Spring balanced system that allows the fuel rack to return to minimum fuel

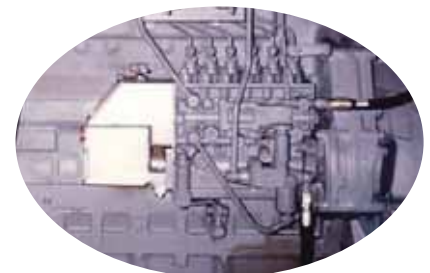


- * I 80 Series for DEUTZ 1013 / 2012 and VOLVO 520 / 720 engines



275 Series

- Mounts on the pump in place of mechanical governor
- Capable of controlling pumps on engines up to 12-cyl.
- Sealed to protect linkage and electromagnetic components from contamination
- Connects directly to fuel rack without bellows
- Includes manual shut-off mechanism
- No external lubrication drain lines required
- Position feedback transducer is available
- Optimum performance for inline pumps
- MW pump adapter kit available



- * 275 Series for "P" size Bosch style pumps
- * KT275 / Field installation kit required for 3000 Series "P" pumps
- * KT276 / Field installation kit required for 7000 Series "P" pumps

Electric Throttle Actuator for Gasengines

GAC Proportional Electromagnetic Actuators position the engine fuel control mechanism. The highly reliable rotary design of the environmentally sealed actuators have no sliding parts, require no maintenance, and can accommodate any linkage configuration. The multiple voltage feature of the **ACB** and **ADB** types offer application convenience. Exceptional response times result in superior performance. For fail safe operation, an internal spring returns the actuator to minimum fuel when de-energized. For fuel management applications, position feedback transducers are available within various actuator series.



ATB250 / 350 / 400

- Available in 25mm, 35mm, and 40 mm bore sizes



ATB450 / 550 / 650

- Available in 45mm, 55mm and 65mm bore sizes



ATB650 / 750 / 850 / 950

- Available in 65mm, 75mm, 85mm, and 95mm bore sizes

Throttle Body Actuators

- All metal, environmentally sealed design
- Compatible with most fuel mixers and fuel intake manifolds
- Suitable for NG, LP, and CNG fuels
- Low cost option compared to conventional external actuators
- Ideal for drive-by wire and dual fuel applications
- throttle plate supported by ball bearings
- High reliability
- Fast response
- Easy installation
- Feedback sensor available

Typical Applications



Electronic Speed Controls

GAC Speed Control Units are designed and manufactured in various configurations to meet application requirements using the latest analog and digital control technologies. Reverse battery polarity protection and fail-safe protection in the event of loss of speed sensor signal or battery voltage, is incorporated into every **GAC Speed Control Unit**.

A wide variety of application needs can be satisfied with **GAC's** constant or variable speed governing , in isochronous or droop operation. All circuit boards are hard potted or conformally coated to be vibration and moisture resistant.

Fixed speeds within a range of 8 : 1

Typical for single Genset applications



ESD 1000 Series

- Simple, isochronous operation
- Lowest cost speed control
- Rugged, hard potted design



ESD 2100 Series

- Single engine isochronous operation
- Precise speed control
- Easy installation and adjustment
- Adjustable PID functions



ESD 2200 Series

- All the features of the ESD 2100
- Extremely rugged hard potted
- Single engine isochronous operation
- High performance design

Wide range variable speed control

For single or parallel Gensets or offroad vehicles - pumps



ESD 2300 Series

- All the features of the ESD 2200
- Single element speed switch
- Wide range variable speed operation



ESD 5100 Series

- All the features of the ESD 2100
- Selectable droop operation
- Adjustable idle speed
- Interfaces with accessories
- Multi-voltage unit
- Soft coupling option



ESD 5200 Series

- All the features of the ESD 5100
- Includes independent single element speed switch with Test/Reset switches
- Integral speed switch with 10 amp relay output

Specially for ATB Electric Throttles on Gas engines



ESD 2400 Series

- Designed for non-feedback ATB actuators
- All the features of the ESD 2200
- Idle speed adjust
- Utilizes actuator current for control enhancement

Note: For ATB's with position sensor use ESD 5403

Electronic Speed Controls

with extended features



ESD5500E Series

- All the features of the ESD5100
- Starting fuel ramping to minimize exhaust smoke
- Starting fuel limiting / adjustment
- Soft coupling feature



ESD5300 Series

- Comprehensive full featured speed control
- Two element speed switch included
- Built-in ramp generator
- Starting fuel limiting for engine emissions control
- Dual gain
- High current output



ESD5400 Series

- All the features of the ESD5100
- Start fuel limiting
- Designed for feedback actuator operation
- Single element speed switch
- Closed loop control utilizing requested and actual fuel position control
- Speed ramping

Digital Engine Management Systems

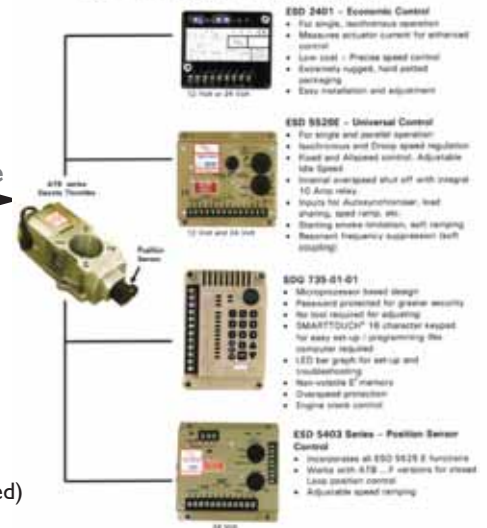


SDG700/SDG800 Series

- Microprocessor based design with CANBus operation
- Highly customizable performance to match each application
- SMARTTOUCH® 16 character keypad for easy set-up / programming (No computer required)
- Password protected for greater security
- LED bar graph for set-up and troubleshooting
- Non-volatile E² memory
- 3 fixed speeds, plus a variable speed range
- Configurable fuel limit control
- Overspeed protection
- Engine crank control
- Plus many other great features

Application range

Selection of suitable GAC Control Units for ATB series Electric Throttles



DSC 1002 / 1004

- NEW Generation, microprocessor based engine control for use with EDC or GAC actuator
- Modular software can be customized to the application with a standard PC
- Applications include: gen sets, marine, mining and various other industrial applications
- Total fuel management, i.e. multiple torque maps, multiple droop/isochronous options
- End of line programming and field configurable design
- Engine emission controlled with: starting fuel, boost pressure fuel limiting, ramping functions and temperature sensing
- CANBus data transfer (J1939) for total system integration
- Fault indication and logging with reduced power modes
- Designed for high reliability

Typical Applications



Dump Truck



Catamaran Ferry

Locomotive Controls

GAC Locomotive Engine Controls provide both variable and eight notch speed control functions. For diesel electric applications, a complete speed and excitation control is available. Smooth speed and load changes are achieved with the built-in speed ramping function. Additional functions such as wheel slip, auto reset and speed switches are included.



LCC200 Series

- 8 notch speed control
- Wheel slip control
- Built-in 2 element speed switch
- Speed ramping accel/deceleration
- Adjustable starting fuel
- Starting fuel ramping to minimize exhaust smoke

Typical Applications



LCC300 Series

- Wide range seamless speed control
- 0-10 V dc or 0-20 mA speed set inputs
- Speed ramping accel/deceleration
- Integral 2 element speed switch
- Adjustable starting fuel
- Starting fuel ramping to minimize exhaust smoke

*Peak Performance from GAC to climb the Peak
with
GAC Diesel-Electric Locomotive Control
LCC 109 / ACE 275*



LCC100B Series

- 8 notch speed control with ramping
- Dual wheel slip control inputs
- Generator excitation control up to 110 V @ 12 amps
- Built-in 2 element speed switch
- Isolated circuits for governor and excitation
- Generator voltage and current limiting circuits
- False code protection



Accessory Control Modules

For automatic parallel operation and power control



LSM100 Load Sharing Module

All electronic power sensing, accurately measures true power, load anticipation and droop adjustments included, small, compact size



LSM672 Load Sharing Module

Precise isochronous load sharing, forward and reverse power monitors with relay outputs, load anticipation function



LSM 201 Load Sharing Module

All the features of the LSM100, forward power monitor w/ adjustable delay, reverse power monitor w/ adjustable delay, mains power control with ramp, load ramping (soft loading and unloading), power monitor with LED bar graph, built-in parallel cable relay simplifies installation



SYC6714 Synchronizer

Fast, automatic phasing synchronizer, isolated high voltage / low power consumption AC inputs, adjustable dynamics and breaker closure window, LEDs provide status information



PRC100A Power Ramp Control

Controls an entire group of engines, bumpless loading and unloading, zero power indicator, high and low load limit adjustments



VMA100 Voltage Matching

Voltage matching within selectable triple tolerance bands, out of voltage range - auto shut-off, transient protected and internal shielding of AC/DC circuits, provides enable signal to synchronizer to form total voltage and phase control system, internal raise / lower relays interface to external voltage adjusting circuits

Interface Modules

Interface Modules are available to facilitate the use of GAC products with other manufacturer's governor control systems.



EAM 100 - EFC Interface Module
 EAM 101 - DYNAL & 8000 (24v)
 EAM 103 - BARBER COLMAN SYN/L.S.
 EAM 104 - DDEC Interface Module
 EAM 105 - HEINZMANN Interface Module
 EAM 106 - EFC Interface - Digital Control
 EAM 107 - CIL Interface
 EAM 108 - WOODWARD EPG Interface
 EAM 110 - CUMMINS QST30 Interface
 EAM 111 - MTU Interface Module
 EAM 112 - EFC Interface Module

EAM 113 - CAT HUEI
 EAM 114 - DEUTZ Interface Module
 EAM 115 - PERKINS Interface Module
 EAM 116 - UNIVERSAL Interface
 EAM 120 - GAC to WOODWARD Interface
 EAM 121 - WOODWARD to GAC Interface
 EAM 122 - VOLVO Interface
 EAM 124 - CAT Interface
 EAM 125 - For FB actuators
 EAM 126 - IGC Interface Module
 EAM 127 - SCANIA S6 Interface Module

Speed Switches



SSW674 (one element)

High or low selectable speed ranges to suit most control requirements, selectable latching or non-latching relay output, tachometer output voltage signal, loss of speed sensor protection, small, compact, low cost



SSW675 / SSW676 (two or three element)

Crank termination, overspeed sensing, SSW676 has third element for paralleling under frequency or any intermediate speed monitoring, convenient overspeed test and reset functions, 10 amp relay outputs with LED indicators, analog tachometer output voltage signal

For wide range speed control

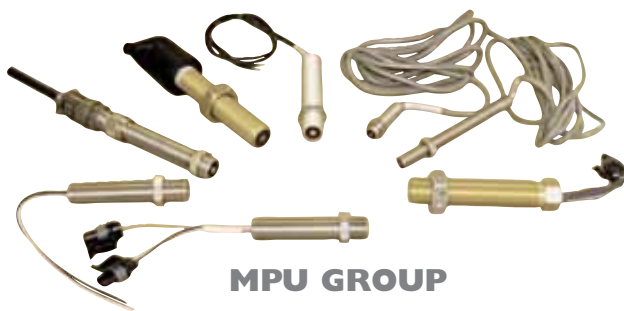


RSC671 Ramp Generator

For applications requiring smooth variable speed operation, accepts process control 4-20mA input or voltage ranges from 0-10 V, wide range, infinite resolution, adjustable, up / down engine speed ramping

Accessories

Magnetic Speed Sensors



MPU GROUP

The Magnetic Speed Sensor detects when ring gear teeth, or other ferrous projections, pass the tip of the sensor. Electrical impulses are produced by the sensor's internal coil and sent to the speed control unit. The signal from the magnetic speed sensor, teeth per second (Hz.), is directly proportional to engine speed. Speed sensors are available in various lengths in both U.S. and metric threads. Wire leads, military connectors, automotive connectors or stud terminals are available. Over 15 styles are currently available.

Gaskets, mounting kits, speed trim controls, and more



KT276



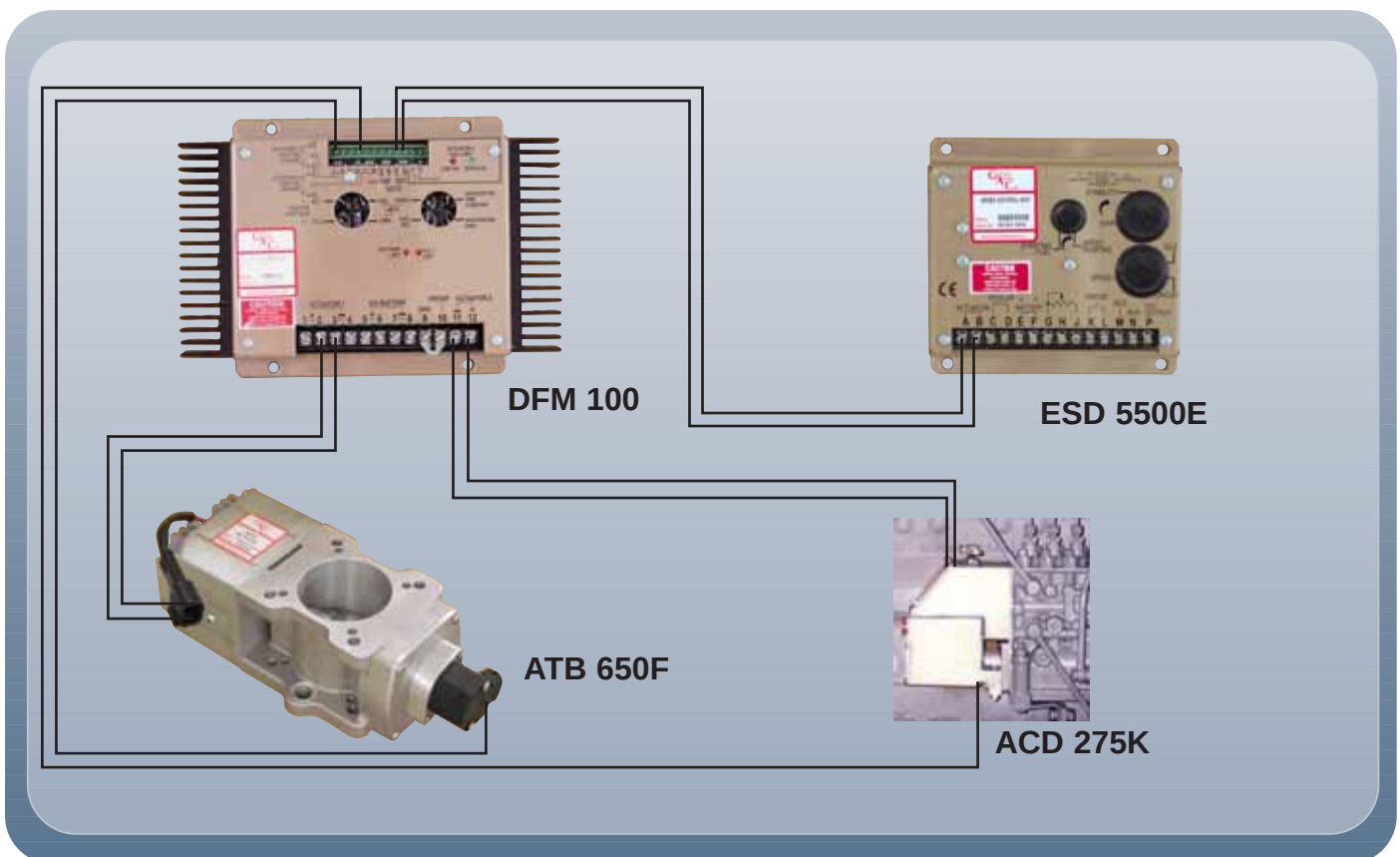
KT176A



TP502

Dual Fuel Control Systems

In the Dual Fuel mode, two different actuator systems are typically used. One can be a standard diesel fuel pump actuator with feedback, and the other a gaseous fuel control valve with feedback. When in Dual Fuel operation, the diesel function is usually limited to a specific level of fuel to start combustion in the engine. The lower the diesel fuel level limit, the more gaseous fuel can be put into the engine. The **FUEL BALANCE** adjustment is then used to set equal engine cylinder power at near 100% engine load.



Typical Application

Converted CAT 3306T

Combination Controls

Governor + Engine Protection in one unit



Typical Application



IGC700 Series

- Integrated engine governor and protection control for constant or variable speed applications
- 3 contacts for starter motor, fuel valve, or solenoid output and alarm or preheat output
- 10 discrete user configurable signal sensor inputs
- Remote starting with battery system monitor
- Small size for in-panel mounting (96mm x 96mm)
- Integrated 'start' and 'stop' buttons provide manual control and shutdown supervision with additional security

Special Controls

Typical Applications



EGS 1016

Drive-by-wire control
Multifunction control of Engine & Road speed,
with communication to gearbox.



Smoke



No Smoke



ESD 5524



SLM 100

Smoke Limiting Module
Reduces smoke during dynamic load changes.
Can be retrofitted.
Works in conjunction with the ESD 5524 Speed control.

From Turbo charger



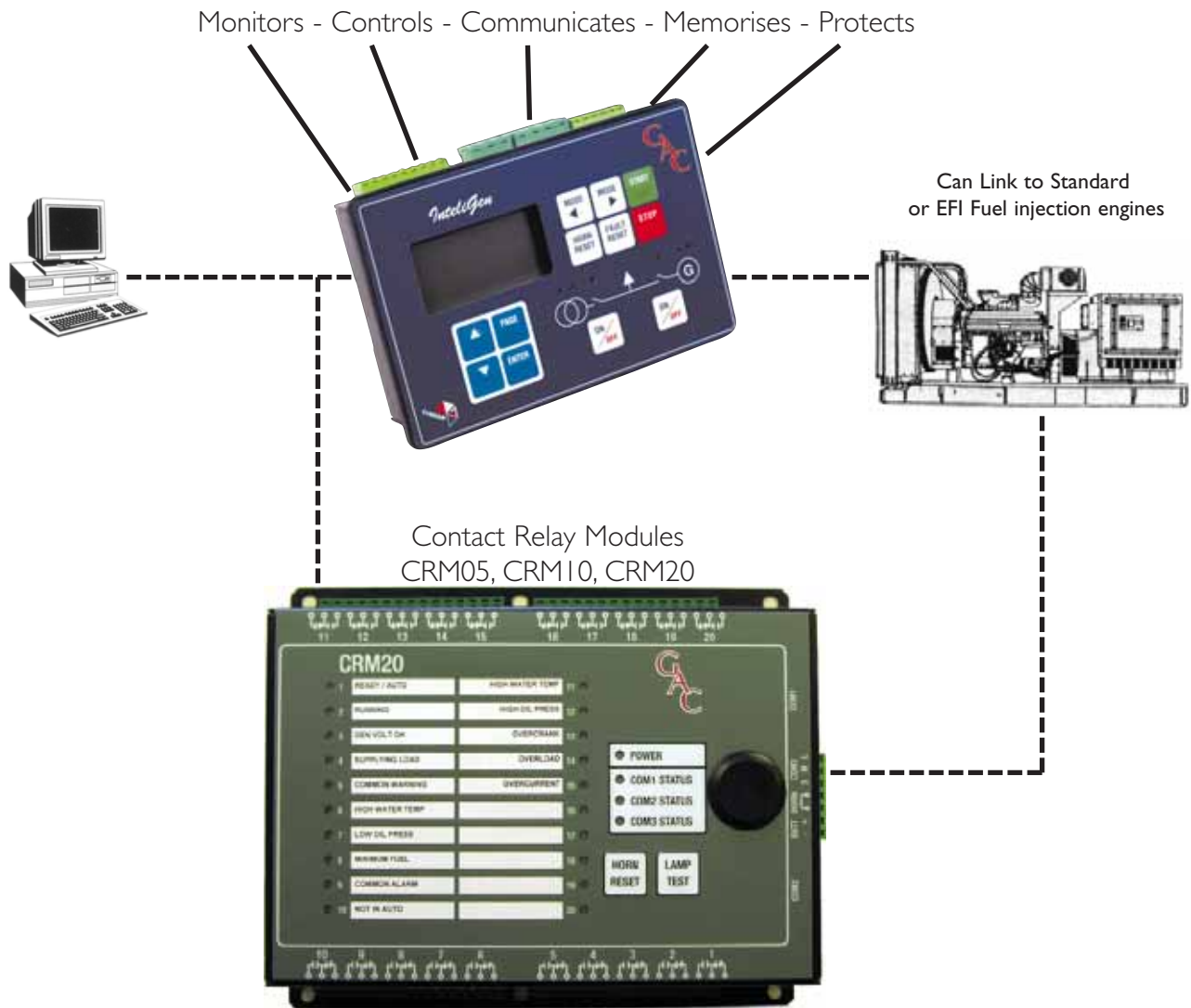
EGS 1020 Series

Twin/Triple Engines to one Gearbox (Shaft)
Control.
Continuous proportional load sharing with
remote wide range speed control.



Genset Control Technology

Comprehensive Costeffective Solutions

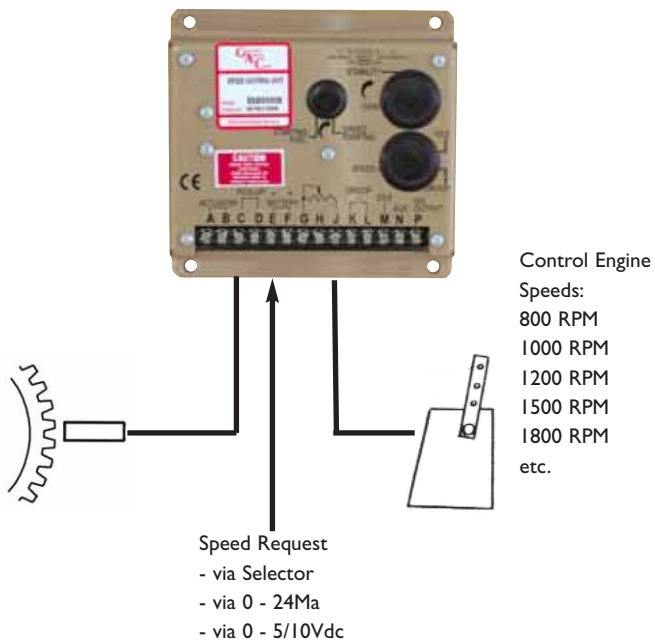


Governors America Corp. introduces an accessory module that will complement any generator system. Our contact relay modules can offer a dry contact for any information on ModBus, J1939, CAN, and some specialized standard protocols. The modules are offered in 5, 10, and 20 relay units. The units are configurable through GAC's SmartView software. With the offered software the unit can react on all controller states as well as comparisons made internally to the CRM itself. Each CRM has at least ten available "virtual" blocks (CRM20 has ten, CRM10 has twenty, and the CRM05 has twenty five). These blocks can be used to read data out of the controller and perform some logical function on it. You can and, or, add, subtract, divide, and inverse any of these blocks. It is possible to apply only one operation to some data in a particular block additional blocks would have to be used until the desired logic formula is complete. The CRM has 20 normally open / normally closed contacts with a corresponding three color LED (configurable in SmartView) and a Function label for each. It also has four status lights, three of which notify the user of whether or not the corresponding communications port is operating correctly. The other LED is used for power supply status. The unit is also equipped with a horn relay output and a horn silence button. The Horn duration is configurable through SmartView. It can be configured to be 0 - 190 seconds with one second steps; any value over 190 will sound the horn until Horn Reset is depressed. The module can accept 8-36V DC power supplies. The Lamp test button serves two purposes, the first is a quick check of how each LED is configured (hold Lamp Test for less than 2 seconds), it will also run through and color check on each LED if the button is depressed for longer than 2 seconds. Holding both Horn Reset and Lamp Test for three seconds will place communications port number two into configuration mode. Keyed connectors allow the user to connect each connector to its corresponding socket. There is an eight position Dipswitch for unit hard coding. Switches one, two and three are used for introducing the CAN terminating resistors into communications port one, two, and three. Switches four, five, six, seven, and eight are used to select various modes of operation. Below is the layout for labeling the lights that correspond to the relays. The layout is intended for 8 1/2" x 11" sheet of paper.

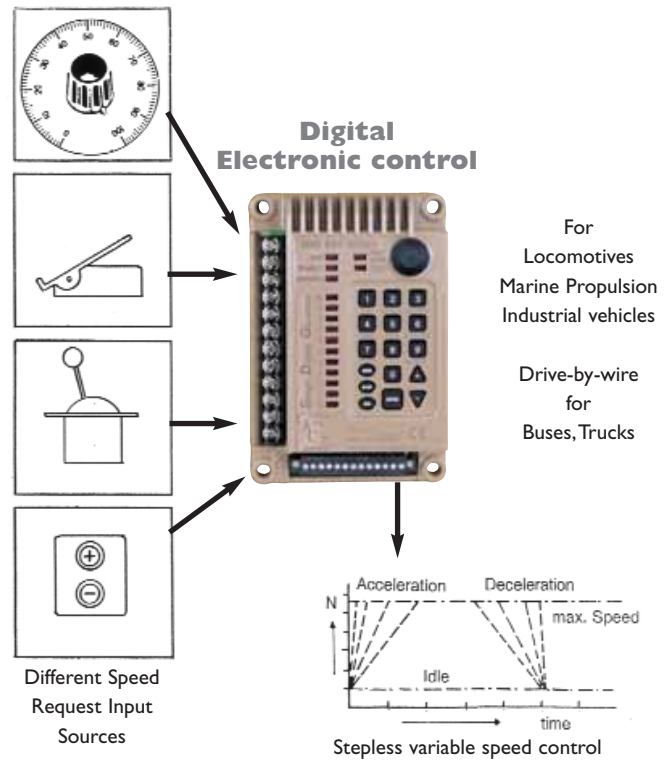
Governor Applications

Various Speed controlling Modes

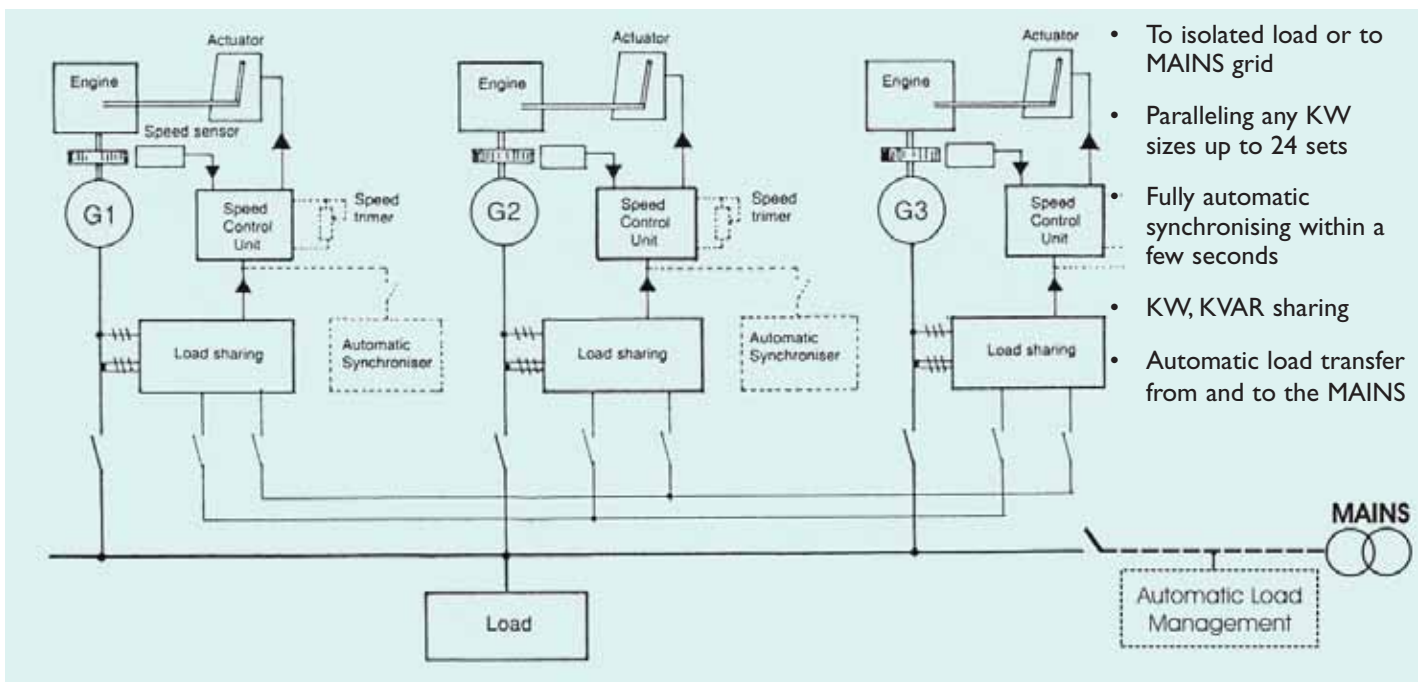
Fixed Speeds



Wide Range Speed Control



Parallel operation of Generating sets



GAC is committed to manufacturing in the USA and is currently producing 95% of our products in both the electronic and mechanical product families with this philosophy. The ability to manufacture GAC's

products internally allows for stringent quality monitoring and faster response times to our customer's requirements.

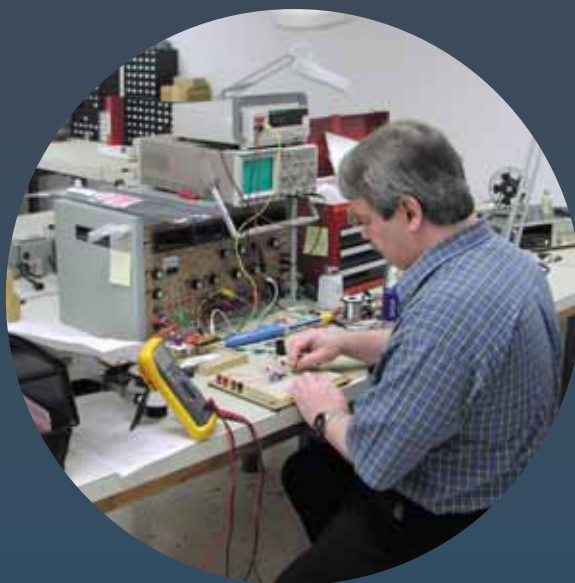


GAC manufacturing is driven by a comprehensive "ERP" system that allows for the full integration of new products, forecasted sales, manufacturing capacity, job/product tracking, electronic procurement and bar coding with customer service, quality, accounting and sales. This total system allows for the efficient and comprehensive method of operation that maintains GAC in the forefront of providing the customer with what they need, when they need it, at a competitive price.

The latest in electronic surface mount and through hole manufacturing methods and equipment combine for an efficient and high quality operation. GAC has implemented a process that allows for maximum flexibility in producing products in either high or low volume to satisfy the customer's ever changing requirements. The mechanical assembly process has the latest in automatic and semi-automatic production methods and tools that are augmented by GAC's full array of in-house CNC equipment that insures high standards of quality and "just in time" manufacturing methods. Behind all of this are GAC's employees and our commitment to Quality. These dedicated individuals are committed to continuous improvements in their areas of

discipline. These areas of discipline are engineering, marketing, customer service, production, and quality assurance. Quality at GAC starts at the very beginning, with the design of our products.

All of our designs start with the premise that we must provide our customers with the Highest Quality product providing the Best Value available in the World. To do this we design our product to the latest World standards, including ISO 9001, compliant with EMC standards, UL recognition, CSA approval, NFPA compliance, CE approval, and Marine Agency classification. GAC has its own EMC lab to insure our product performance, but always uses an independent test laboratory for third party certifications.



誥鑫企業有限公司
ARITH COMPANY LTD.

地址：台北市 105 復興北路 427 巷 30 號
電話：(02)2717-5038 (代表號)
傳真：(02)2717-5039
郵件：taipei@arith.com.tw
網址：www.arith.com.tw