

AIRCRAFT PARTS CORP.

GENERATOR CONTROL UNIT

TECHNICAL MANUAL



ENGINEER'S OF THE INDUSTRY'S FINEST
STARTER-GENERATORS AND GENERATOR CONTROL UNITS
TRUSTED BY PROFESSIONALS, POWERED BY APC

For Reference Only

OUR PASSION FOR QUALITY COMES STANDARD IN GCU MANUFACTURING

For over forty years, APC has been committed to being the leader and industry standard in the design and manufacture of aircraft electrical systems. Today this goal and pledge has not changed, neither has our commitment to serving our customers, the quality of our products, or company ownership. In fact, while most other manufacturers are changing hands, consolidating and changing their manufacturing location, APC has continued to operate under the same name, ownership and manufacturing base.

Far more advances in generator control unit design and performance are being made every day. Even while industry practices and standards are rapidly changing, APC has welcomed these challenges and continuously evolves along with industry trends in today's market. With the most up-to-date technologies and product knowledge close at hand, APC has stepped into the forefront of GCU design. APC's product line of Generator Control Units covers all industry requirements.

APC designs and manufactures generator control units that are far superior in architecture and performance. Our GCU's are designed for high reliability while the price to our customers is extremely competitive. Adding to that, APC technical support engineers are always readily available to assist our customers.

APC has long been recognized for its outstanding product achievements in the aircraft industry. The successful performance of our generator control units in the field is the culmination of our many tried and true design attributes, and advanced manufacturing techniques. Our GCU's are manufactured at our ISO9001 certified facility and assembled with only the highest quality components. The workmanship that goes into our products is second to none.

The generator control unit incorporates all the control and protective functions required for a single or multi-engine powered aircrafts 28 volt DC electric power system. APC generator control units are compact, lightweight and are designed to operate with our 28V D.C. starter-generators and other compatible machines manufactured to the requirements of MIL-G-6162.

Our generator control units can operate at ambient temperatures of between -55° C to $+71^{\circ}$ C and at altitudes of up to 70,000 feet. APC's generator control units also contain many desirable features such as: self-cooling, lightweight, no scheduled maintenance or vibration isolation is required. APC's patented "Torque Limiting" system can be integrated as an optional addition to our high quality generator control units. Custom features can also be added to



our generator control units, if any customization is requested. APC Generator Control Units feature a robust electronic and mechanical design to provide optimum functionality in the most demanding aircraft application environments.

Complementing our extensive product line of Generator Control Units is the recent introduction of our Digital Generator Control Units (DGCU); the GCSG 550 series. APC's Digital GCU uses a highly integrated, state-of-the-art microcontroller to implement the control and protective functions for improved reliability, reduced parts count and lower manufacturing costs. Its design also makes use of benchmark components for increased drive capability for field excitation, and contactors control with lower power dissipation and operating temperatures for improved component reliability. The digital GCU's also feature an automatic Built-in-Test with fault isolation to the LRU level for ease of maintenance of the electrical power system.

At APC our motto is, "the Customer is the Focus of Everything We Do", and every effort is made to place the customer's needs in the forefront. We continuously strive to meet and exceed our customer's expectations. We do this through the most technologically-advanced product designs for superior performing products, practicing lean manufacturing techniques to keep costs down and passing on the savings to our customers. Our customer service staff is number one in the business, and combined with the entire staff at APC, our business goals have been achieved overall in terms of Quality, Price and Delivery. If you haven't already, call us toll-free at I-877-4APCMFG, (I-877-427-2634), or visit us on the web at www.apcmfg.com and discover first hand why APC continues to be the most trusted OEM for aircraft electrical systems in the industry today.



APC GENERATOR CONTROL UNITS: SUMMARY CHARACTERISTICS

ELECTRICAL

Regulated Voltage	28.5 V DC Nominal
Voltage Regulation	+0.3/-0.7V, all conditions of environment, generator load and speed rating.
Generator Voltage Adjustment Range	26 to 30 VDC
Recovery Time	30 msec max., full load to no load and no load to full load.
Field Current	I 5 amps maximum
Paralleling Control	Load equalization within 10% of Gen. Rating
Generator Line Contactor Control	5 amps maximum
Start Contactor Control	5 amps maximum
Overvoltage Protection	MIL-STD-704/D0-160
Reverse Current Protection	10% of generator rating opens line contactor.
Self Test	Protective functions
Dielectric Strength	600 Vrms, 60 Hz.

MECHANICAL

Weight: 1.2 lbs. to 2.7 lbs. (0.54 kg to 1.22 kg)

Dimensions: As per oulline Drawing

Connector: Military Standard

Cooling: Self Cooled.

Installation: Solid Mounting; Capable of operation in any position

ENVIRONMENTAL

Operating Temp. Range: -55°C to +71°C

Vibration: MIL-STD-8 I OC, Method 5 I 4.2 Shock: MIL-STD-8 I OC, Method 5 I 6.2 Acceleration: MIL-STD-8 I OC, Method 5 I 3.1

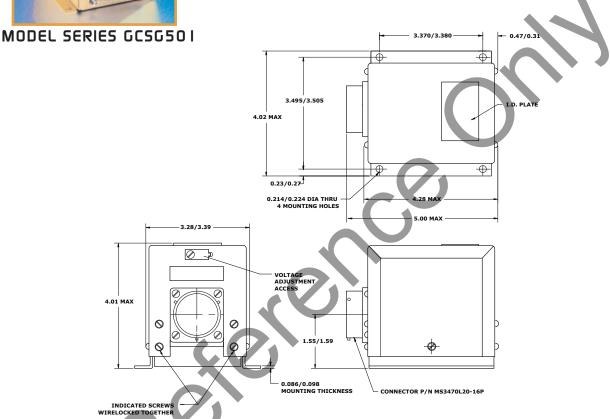
Altitude: Sea Level to 70,000 Ft.

NO SCHEDULED MAINTENANCE REQUIRED.

ALL APC GENERATOR CONTROL UNITS ARE DESIGNED TO MEET THE REQUIREMENTS OF MIL-R-2376 I B [AS]



THE GCSG501 SERIES GCU'S ARE DESIGNED FOR OPERATION WITH SERIES-TYPE STARTER-GENERATORS AND INCLUDE OVERLOAD PROTECTION.



TYPICAL AIRCRAFT INSTALLATIONS:

DESIGN FEATURES AND FUNCTIONS:

CONTROL FUNCTIONS:

- ♦ VOLTAGE REGULATOR WITH VOLTAGE ADJUSTMENT
- LINE CONTACTOR CONTROL
- DIFFERENTIAL VOLTAGE SENSING
- REMOTE ELECTRICAL RESET
- REMOTE ELECTRICAL TRIP

PROTECTION FUNCTIONS:

- OVERVOLTAGE PROTECTION
- OVERLOAD PROTECTION
- UNDERVOLTAGE PROTECTION
- ♦ REVERSE CURRENT PROTECTION
- REVERSE POLARITY BUILDUP PROTECTION
- OPEN GROUND PROTECTION
- ANTI CYCLE PROTECTION

SIKORSKY: 576 SERIES HELICOPTERS

- REMOTE OVERVOLTAGE AND OVERLOAD SELF TEST
- ♦ INTERNAL FIELD RELAY AND FLASH START RELAY



THE GCSG502 AND 503 SERIES GCU'S ARE DESIGNED FOR OPERATION WITH SERIES-TYPE STARTER-GENERATORS AND INCLUDE GENERATOR PARALLELING CONTROL.

MODEL SERIES GCSG502/GCSG503

TYPICAL AIRCRAFT INSTALLATIONS: GCU MODEL GCSG502:

DEHAVILLAND: DASH 7 APU
 BELL: 206L AUX. SYSTEM
 MYASISHCHEV: MIOIT
 AERO VODOCHODY: AE270

CESSNA P2 I O TURBO CONVERSION

TYPICAL AIRCRAFT INSTALLATIONS: GCU MODEL GCSG503:

SCHWEIZER: 330TDORNIER: DO-228

U.S. ARMY: "LITTLE BIRD" HELICOPTER
 NORTHROP GRUMMAN: UAV-FIRE SCOUT

NEW PIPER MALIBU CONVERSION

PZL: SW3

PAC: CRESCO 750

DESIGN FEATURES AND FUNCTIONS:

CONTROL FUNCTIONS:

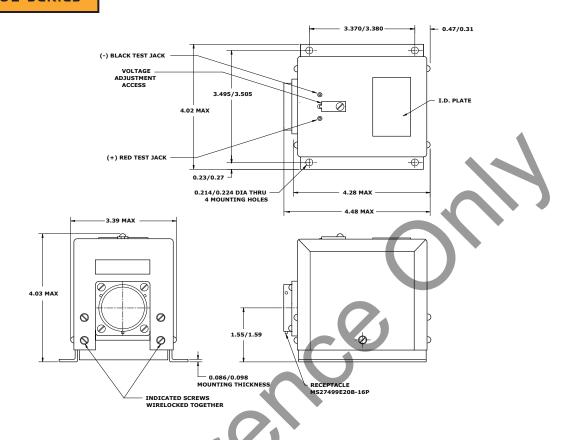
- VOLTAGE REGULATOR WITH VOLTAGE ADJUSTMENT
- GENERATOR CURRENT LIMIT
- AUTOMATIC PARALLELING CONTROL
- LINE CONTACTOR CONTROL
- DIFFERENTIAL VOLTAGE SENSING
- REMOTE ELECTRICAL RESET
- REMOTE ELECTRICAL TRIP

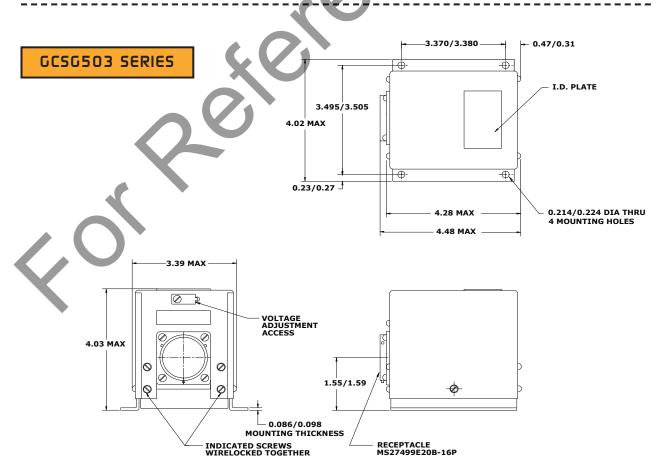
PROTECTION FUNCTIONS:

- OVERVOLTAGE PROTECTION
- OVER EXCITATION PROTECTION
- REVERSE CURRENT PROTECTION
- OPEN GROUND PROTECTION
- REVERSE POLARITY BUILDUP PROTECTION
- ANTI CYCLE PROTECTION
- LINE CONTACTOR CONTROL OUTPUT PROTECTION

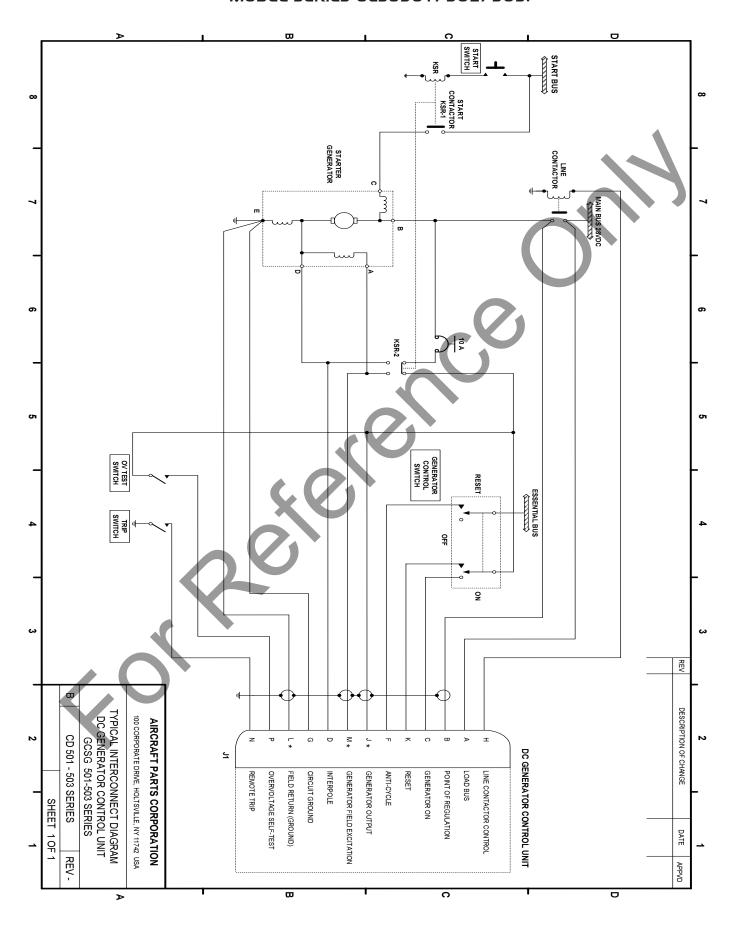
- REMOTE OVERVOLTAGE SELF TEST
- INTERNAL FIELD RELAY, FLASH START RELAY
 AND EQUALIZER RELAY

GCSG502 SERIES





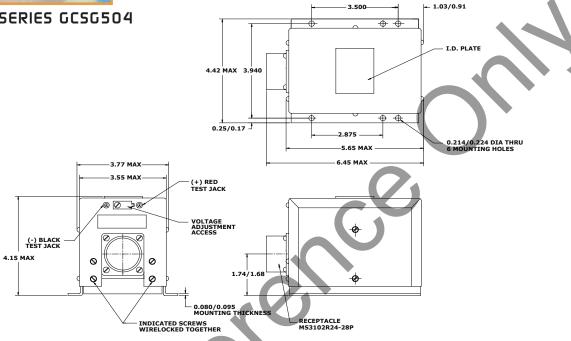
GENERATOR CONTROL UNIT SYSTEM INTERCONNECT DIAGRAM MODEL SERIES GCSG501/502/503.





THE GCSG504 SERIES GCU'S ARE DESIGNED FOR OPERATION WITH SERIES-TYPE STARTER-GENERATORS AND INCORPORATE **GROUND FAULT PROTECTION.**





TYPICAL AIRCRAFT INSTALLATIONS:

- FAIRCHILD: METRO SERIES II, III, IV
- MARSH AVIATION: 52 TRACKER, OVIDA
- GENERAL ATOMICS: UAV-PREDATOR B
- HAFEI: Y I 2 IV

DESIGN FEATURES AND FUNCTIONS:

CONTROL FUNCTIONS:

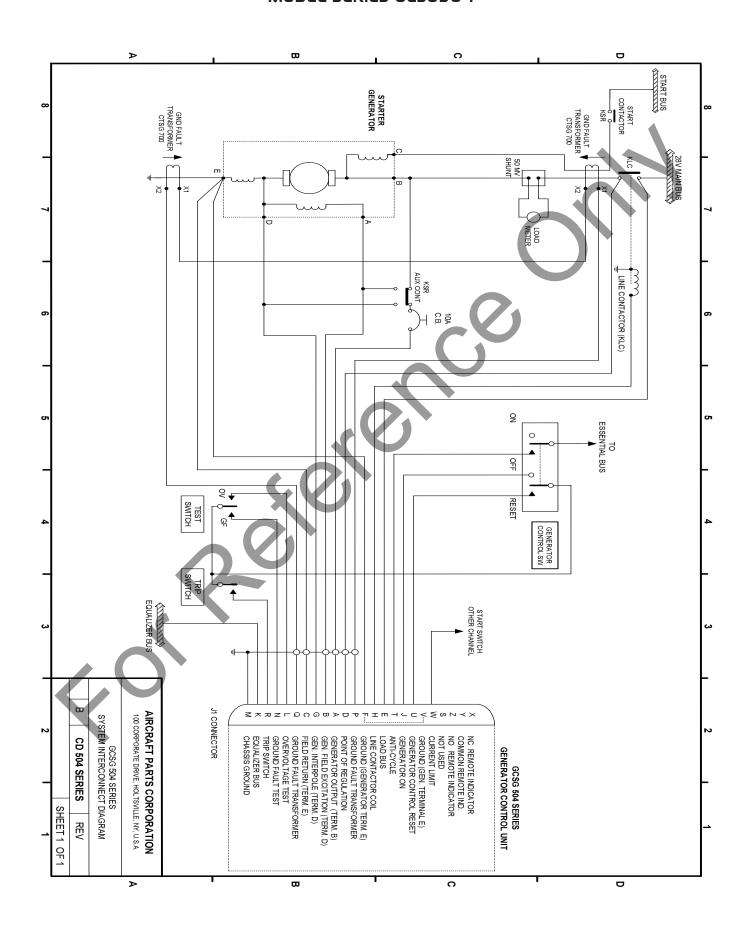
- VOLTAGE REGULATOR WITH LOCAL OR REMOTE VOLTAGE ADJUSTMENT
 - GENERATOR CURRENT LIMIT
- AUTOMATIC PARALLELING CONTROL GENERATOR LINE CONTACTOR CONTROL
 - DIFFERENTIAL VOLTAGE SENSING
 - REMOTE ELECTRICAL RESET
 - REMOTE ELECTRICAL TRIP
 - REMOTE INDICATOR CONTROL

PROTECTION FUNCTIONS:

- OVERVOLTAGE PROTECTION
- OVEREXCITATION PROTECTION
- REVERSE CURRENT PROTECTION
- OPEN GROUND PROTECTION
- GROUND FAULT PROTECTION
- ANTI-CYCLE PROTECTION
- LINE CONTACTOR CONTROL OUTPUT PROTECTION

- REMOTE OVERVOLTAGE AND **GROUND FAULT SELF TEST**
- INTERNAL FIELD, FLASH START AND **EQUALIZER RELAY**

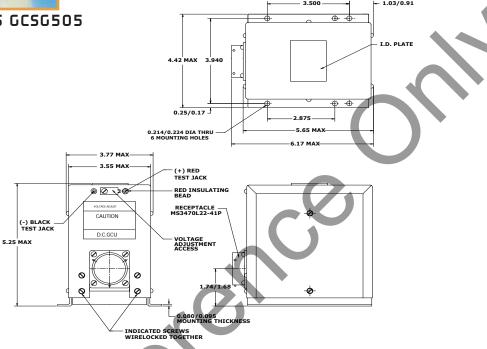
GENERATOR CONTROL UNIT SYSTEM INTERCONNECT DIAGRAM MODEL SERIES GCSG504





THE GCSG505 SERIES ARE FIELD WEAKENING GCU'S DESIGNED FOR OPERATION WITH SHUNT-TYPE STARTER-GENERATORS. THESE UNITS INCORPORATE THE START CONTROL FUNCTIONS, OVERLOAD AND GROUND FAULT PROTECTION.

MODEL SERIES GCSG505



TYPICAL AIRCRAFT INSTALLATIONS:

- ♦ BOMBARDIER CANADAIR: CL-415, CL-215 T
- ♦ AGUSTA: A I 09 SERIES HELICOPTERS

CCADD: SARAS

DESIGN FEATURES AND FUNCTIONS:

CONTROL FUNCTIONS:

- VOLTAGE REGULATOR WITH VOLTAGE ADJUSTMENT
- AUTOMATIC PARALLELING CONTROL
- GENERATOR CURRENT LIMIT
- GENERATOR LINE CONTACTOR CONTROL
- DIFFERENTIAL VOLTAGE SENSING
- START CONTACTOR CONTROL
 - 48 V START CONTROL
- STARTER FIELD CURRENT CONTROL (FIELD WEAKENING)
- AUTOMATIC STARTER CUT-OFF
- TORQUE LIMITING, START CYCLE (PATENTED)
- BUS TIE CONTROL
- REMOTE ELECTRICAL RESET
- ♦ REMOTE ELECTRICAL TRIP

FEATURES:

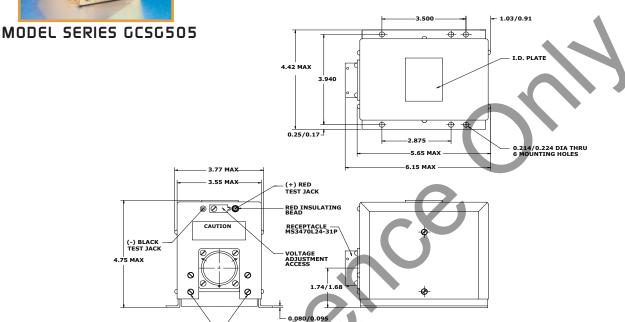
- REMOTE OVERVOLTAGE, UNDERVOLTAGE, GROUND FAULT AND OVERLOAD SELF TEST
- INTERNAL FIELD RELAY, FLASH START RELAY AND EQUALIZER RELAY

PROTECTION FUNCTIONS:

- OVERVOLTAGE PROTECTION
- OVEREXCITATION PROTECTION
 - REVERSE CURRENT PROTECTION
- ♦ GROUND FAULT PROTECTION
- OVERLOAD PROTECTION
- UNDERVOLTAGE PROTECTION
- OVERSPEED PROTECTION
- ANTI- CYCLE PROTECTION
- START/LINE CONTACTOR CONTROL OUTPUT PROTECTION
- OPEN GROUND PROTECTION



THE GCSG505 SERIES ARE FIELD WEAKENING GCU'S DESIGNED FOR OPERATION WITH SHUNT-TYPE STARTER-GENERATORS. THESE UNITS INCORPORATE START CONTROL FUNCTIONS.



INDICATED SCREWS WIRELOCKED TOGETHER

TYPICAL AIRCRAFT INSTALLATIONS:

- ♦ BOMBARDIER: LEARJET 60
- BELL: 412 AUX. SYSTEM.
- ♦ DEHAVILLAND: DASH 7 AGES APU
- ♦ AERMACCHI: 5211 TRAINER
- ♦ BASLER: TURBO DC-3 TURBINE CONVERSION
- ♦ PAC: CRESCO 750 XL

- ♦ BRITTEN NORMAN: DEFENDER & ISLANDER
- VALMET: L-90TP
- PZL: KANIA, SW4
- ◆ DASSAULT: FALCON 20 APU
- GROB: G140
- EXTRA FLUGZ: EA500

DESIGN FEATURES AND FUNCTIONS:

CONTROL FUNCTIONS:

- VOLTAGE REGULATOR WITH VOLTAGE ADJUSTMENT
 - AUTOMATIC PARALLELING CONTROL
 - GENERATOR CURRENT LIMIT (CROSS START)
 - GENERATOR LINE CONTACTOR CONTROL
- DIFFERENTIAL VOLTAGE SENSING
 - START CONTACTOR CONTROL
- 48 V START CONTROL
- STARTER FIELD CURRENT CONTROL: (FIELD WEAKENING)
- ♦ AUTOMATIC STARTER CUT-OFF
- TORQUE LIMITING, START CYCLE: (PATENTED)
- REMOTE ELECTRICAL RESET
- REMOTE ELECTRICAL TRIP

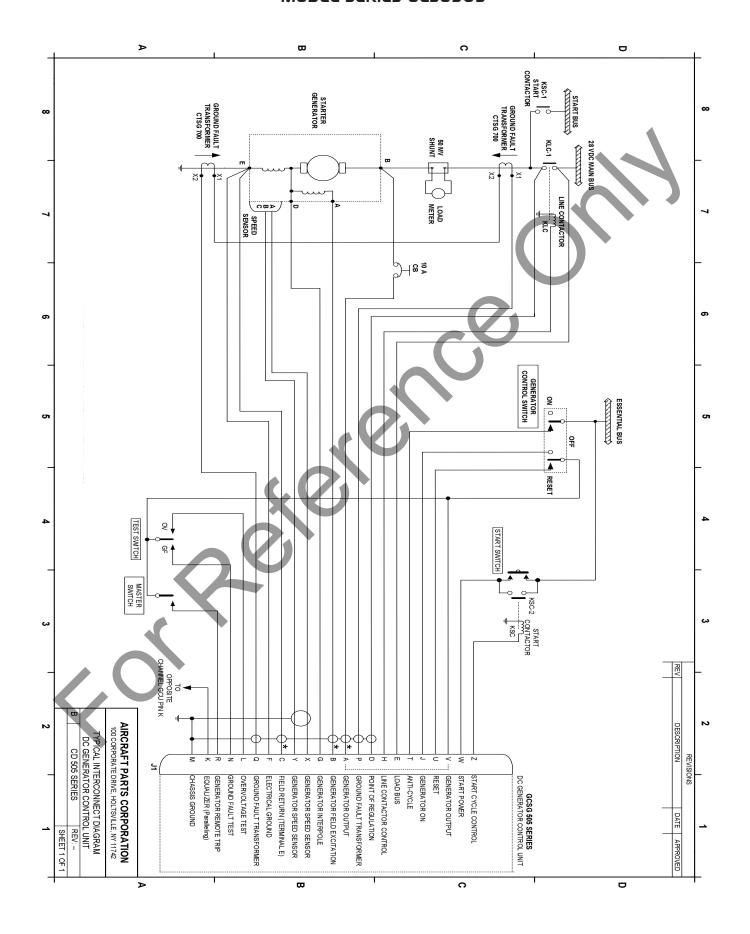
PROTECTION FUNCTIONS:

- OVERVOLTAGE PROTECTION
 - OVEREXCITATION PROTECTION
- REVERSE CURRENT PROTECTION
 - GROUND FAULT PROTECTION
- OVERSPEED PROTECTION
 - START LINE CONTACTOR CONTROL-OUTPUT PROTECTION
- OPEN GROUND PROTECTION
- ANTI CYCLE PROTECTION

- REMOTE OVERVOLTAGE,

 AND GROUND FAULT SELF TEST
- ♦ INTERNAL FIELD RELAY, FLASH START RELAY AND EQUALIZER RELAY

GENERATOR CONTROL UNIT SYSTEM INTERCONNECT DIAGRAM MODEL SERIES GCSG505



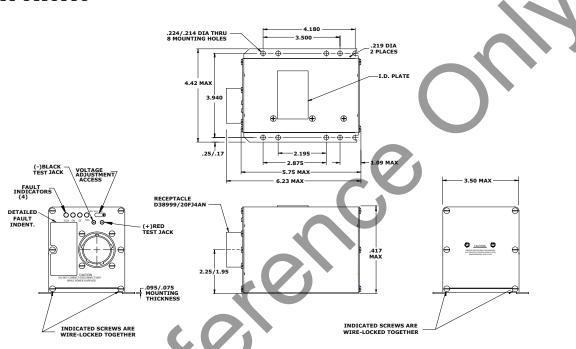
MODEL GCSG550 DIGITAL GCU



MODEL GCSG550

FEATURES:

- AUTOMATIC BIT & MONITORING
 - FAULT DIAGNOSTICS INDICATION
- THRESHOLD SELECTION
- SERIAL COMMUNICATION
- INTEGRAL FIELD RELAY
- FLASH START RELAY
 - EQUALIZER RELAY



DESIGN FEATURES AND FUNCTIONS:

CONTROL FUNCTIONS

- ♦ VOLTAGE REGULATOR WITH VOLTAGE ADJUSTMENT
- AUTOMATIC PARALLELING CONTROL
- GENERATOR CURRENT LIMIT
- START/LINE CONTACTOR CONTROL
- DIFFERENTIAL VOLTAGE SENSING
- FIELD WEAKENING CONTROL
- TORQUE LIMITING, START CYCLE
- AUTOMATIC STARTER CUT-OFF
- REMOTE ELECTRICAL RESET
- REMOTE ELECTRICAL TRIP

TEMPERATURE RANGE: -40°c TO +71°c
ENVIRONMENTAL - EMI: DO-160 D
SOFTWARE CERTIFICATION: DO-178B

CONNECTOR: MIL-C-38999 SERIES III

 WEIGHT:
 2.0 LBS.

 LENGTH:
 5.75 IN.

 WIDTH:
 3.50 IN.

 HEIGHT:
 4.15 IN.

CERTIFICATION PENDING

PROTECTION FUNCTIONS:

- OVERVOLTAGE PROTECTION
- OVEREXCITATION PROTECTION
- REVERSE CURRENT PROTECTION
- ♦ GROUND FAULT PROTECTION
- OVERLOAD PROTECTION
- OPEN SHUNT PROTECTION
- UNDERVOLTAGE PROTECTION
- OVERSPEED PROTECTION
- OPEN GROUND PROTECTION
- CONTACTORS OUTPUT PROTECTION
- OPEN P.O.R.
- SHUNT FIELD CIRCUIT MONITORING
- REVERSE POLARITY PROTECTION
 - ANTI CYCLE PROTECTION

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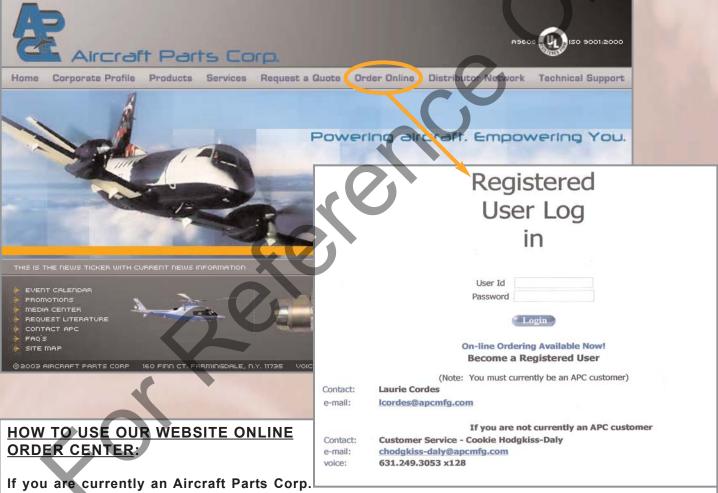
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