Volume 9 Issue 2 April 2004

Approach

www.s-tec.com

MEGGITT / S-TEC

Inside This Issue

Terry Flaishans joins the team as Vice President of Engineering

Please join us in welcoming Terry Flaishans as Meggitt/S-TEC's Vice President of Engineering. Terry is a systems/software engineer with executive level engineering and management experience in the design, development, and certification of highly complex electronic systems that include state-of-the-art integrated avionics and automotive systems, software, and processes. Terry has been with Honeywell International, Aerospace Electrical Systems Sector in Phoenix, Arizona since 1983, with his last position as their Director of Displays, Center of Excellence. Specific projects that Terry has worked on while with Honeywell include the PRIMUS Epic, P2000, P1000 & SPZ 8000 integrated avionics systems. Prior to Honeywell, Terry was an engineer at Ford Motor Company designing various automotive components.

Terry has a B. S. in Electrical Engineering from the University of Michigan; has been an FAA Company Designated Engineering Representative (DER) since 1994 with categories for approval in Electronic Equipment & Systems, Automatic Flight Controls, Flight Instruments, Navigation Systems, Warning Systems, Software Level A, B, C, D approvals, and Reliability Analysis for FAR 23, 25, 27, 29; and holds his Private Pilot license. Terry is currently in the process of obtaining his instrument rating.

Terry will have both the Engineering and Flight Engineering departments reporting to him. While Terry's background is strong in product development and engineering, his motivational leadership style will be an added benefit not only to our Engineering departments, but to our organization as a whole.

From the President's Desk

As we head into the second quarter of the year, there are strides being made here at Meggitt/S-TEC.

Firstly, you will notice a slight name change from Meggitt Avionics/S-TEC to Meggitt / S-TEC. It's a small amendment on paper, however huge in the industry. We hope to achieve greater name recognition and our own identity.

We would like to introduce to you our new Vice President of Engineering, Terry Flaishans. Terry will oversee both product development engineering and flight engineering. We are combining these two engineering disciplines in an effort to maximize the performance of our autopilot and display systems in each and every aircraft application. Terry brings with him vast knowledge and experience in aviation and engineering.

The website, www.s-tec.com, has taken on a new look. In addition, we are happy to announce that we have created a section for dealer's eyes only. You will find a wealth of information including a lot of technical data behind this firewall. To access this restricted area, see the article below. We hope that this restricted dealer area is helpful to you and your staff.

Our trade show schedule is in full swing. As this issue of the Approach newsletter is being delivered to your mail box, we are attending the Aircraft Electronics Association convention in Las Vegas. We hope to meet many of you at the convention, and would like to be able to spend time with each and every one of you to express our gratitude and to thank you for your business.

Sun 'n Fun follows AEA. This year, the show runs from Tuesday, April 13 through Monday, April 19. We participate in this event to represent you, our dealer. Discussions are held with S-TEC autopilot owners, along with potential customers to bring them knowledge and understanding of autopilots. Should you have an opportunity to visit Lakeland, Florida, please stop by and visit us in Hangar D, Booth 11 – 13.

This months training sessions contain Install Fundamentals in the Installation of S-TEC Autopilots section and Problem / Symptoms Evaluation in the Troubleshooting and Maintenance of an S-TEC Autopilot section. We have heard from quite a few avionics shops expressing their appreciation in the fact that we are publishing training articles. Please forward any ideas to the Editor, of what you would like to see in the future newsletters. This Approach newsletter is for you and your staff, so your ideas are welcomed.

As always, we thank you for your business.

DealerLink

We are excited to announce that our websites, www.S-TEC.com and www.MAGIC.aero, are being given a fresh look. Sometime within the next month both websites will have a more comprehensive and user friendly format and you and your customers will enjoy a visit even more than before.

During the same formatting change we will be initiating a restricted access area on each website exclusively for dealers, DealerLink.

Dedicated dealer areas have been created in both sites to provide information and resources of interest to our global dealer network. The dealer areas will initially include a library of service letters and bulletins, technical data, installation information and product support information that's for your eyes only.

Dealers will access the DealerLink area using their current Meggitt/S-TEC or MAGIC dealer number as your username and a password of your choice chosen during your initial visit to DealerLink. Within 24 hours of this first visit, we will validate your further access and advise by email. Full access will be allowed from that point forward. There will be a provision for changing passwords and retrieval of forgotten passwords included at the site.

The establishment of secure, restricted dealer areas in our web sites will be a valuable addition to our dealer support function and we're confident dealers will find the information of value and importance to assure repeated visits.

We will be continually adding and updating information in this area. If you have any comments on how we should make use of this restricted access area, please do not hesitate to share your thoughts with us.

Installation of S-TEC Autopilots

(A Continuing Series)

This training issue of the Approach is the third in the series. We hope that these are a useful tool for you and your avionics shop staff.

We will continue to write articles of interest to specific problems, how to detect and correct them, along with articles to keep you informed on S-TEC facts.

The articles will be written to aid and assist you in your routine autopilot sales and installation business. The articles will be general to cover our entire S-TEC product line, rather than specific systems.

Below is the list of articles that will appear in the Approach newsletters over the next several months:

Notes: Gray Text *indicates topics covered in Dec. 2003 and January 2004 Approach.*
Bold Text *indicates topics covered in this issue of the Approach.*
Normal Text ***indicates topics to be covered in future issues.***

Installation of S-TEC Autopilots:

A. Introduction
B. Airframe inspection (prior to install)
   a. Modifications installed (STC's)
   b. Repairs
C. Pre-installation preparation
   a. Inventory of parts
   b. Autopilot interface evaluation (existing NAV/COMs, FD/HSI/GPS/DG)
D. Install fundamentals
E. List of tools
F. Removal of old equipment
G. Cable routing
H. Servo installation
I. Transducer installation
J. Computer/Mode Selector installation

Troubleshooting & Maintenance of an S-TEC Autopilot:

A. Introduction
   a. ICA (Instructions for Continued Airworthiness)
B. System basics
   a. Electrical Systems
   b. Mechanical Systems
C. Flight Line Tester Manual
   a. List of test equipment
   b. Use of test equipment
D. Problem / Symptoms evaluation
E. Troubleshooting flow chart
F. Airframe inspection
G. Corrective actions
H. System Test / Flight Test / Return to Service

Installation Fundamentals

Two previous installation articles discussed the importance of inspecting the airframe for modifications (STC's) and repairs that might complicate the installation of an S-TEC autopilot and the importance of pre-installation inventory and autopilot interface evaluation. After the airframe inspection and pre-installation inventory is complete we can move on to the initial phase of the installation process.

The installation documentation provided with each S-TEC autopilot kit contains a wealth of information in the form of notes. These notes contain information that is critical to the proper operation of the autopilot. Some notes address regulatory requirements found in 14 CFR Part 43 which must be complied with.

S-TEC provides wiring harnesses for most of our autopilot and optional equipment kits. When field fabricated wiring is required, refer to the wiring interconnect drawings supplied. A common note on the wiring interconnect refers to the type of wire which must be used for field fabricated wiring. Any wiring used for field fabricated applications must meet or exceed the requirements of MIL-W-22759/16 and be 22 GA. minimum, unless otherwise noted.

Many aircraft have an HSI instead of a DG for the heading bug and course datum input to the autopilot. S-TEC wiring harnesses are provided that will accommodate the use of either an HSI or DG in full function autopilot systems such as the 60-1, 60-2, 65, and Fifty Five X. The wiring interconnect drawing associated with these systems incorporates a note regarding a jumper that must be removed when an HSI system is installed in lieu of a DG. Failure to remove this jumper will result in the inability to properly intercept and track a backcourse using the REV mode.

S-TEC basic autopilot systems such as the Twenty, Thirty, 40, and 50 do not require heading bug information. The HDG mode is optional in these systems. The S-TEC wiring harnesses are provided with a jumper installed that inhibits the operation of the HDG mode. The wiring interconnect drawings for these basic systems contain a note indicating that this jumper must be removed in order to activate the HDG mode.

Continued on Page 4

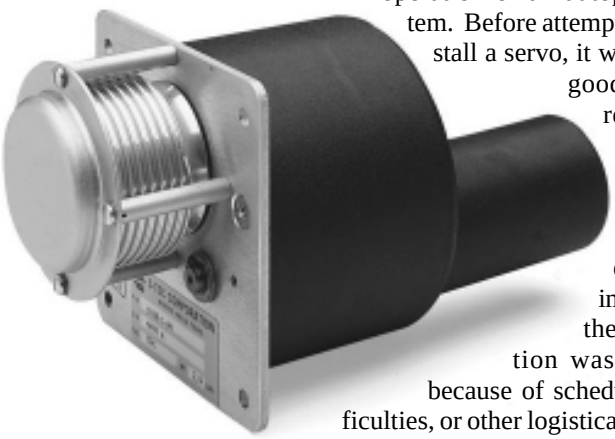
Installation Fundamentals

Continued From Page 3

The S-TEC 60 PSS, full function pitch axis only autopilot must have ILS Energize (LOC Switch) present when executing a coupled approach which includes the Glideslope. The wiring interconnect drawing for this system incorporates a note advising the installer of this requirement. This note is often overlooked during the course of the installation and interface. GS mode will not arm or engage without the presence of ILS Energize (LOC Switch).

All S-TEC systems with a pitch axis incorporate an accelerometer for sensing vertical acceleration. It is essential that the PFGC (Pitch Flight Guidance Computer, System 60-2, 65, and 60 PSS), Pitch Computer (System Thirty, Thirty ALT), and Programmer/Computer (System 50, Fifty Five X, 1500 DFCS, and 2100 DFCS) be mounted level. The related installation drawings contain a note which indicates the requirement that these components be mounted level with the aircraft's lateral and longitudinal axes, ± 10º. Failure to adhere to this note may result in a failure to initialize at power up (No RDY indication), a failure during the pre-flight checks required in the POH, and poor autopilot operation in turbulence. Shock mounted instrument panels should be examined to insure that the shock mounts are functional. Replace any shock mounts that are stiff or show physical sighs of deterioration. Stiff or deteriorated shock mounts can cause panel mounted components with an integral accelerometer to experience excessive vibration. This also leads to poor performance in all flight conditions.

There are several notes found on servo installation drawings which are very important to the proper installation, and subsequent operation of an autopilot system. Before attempting to install a servo, it would be a good time to revisit the issue of aircraft rigging. This is especially important if the installation was delayed because of scheduling difficulties, or other logistical reasons. The aircraft may have undergone an annual inspection or other maintenance which may have reconfigured the primary cable tensions. Aircraft primary cable tension, system friction, pulley and jackscrew lubrication should be verified. Control surface balance should also be addressed. Bridle cable wrap details are included on the servo installation drawing. An important point often over looked is the position of the bridle cable ball in relation to the servo as mounted in the aircraft. Pitch servo installation drawings usually show the position of the bridle cable ball when the elevator is in the "full down" position. Roll and yaw servo installation drawings typically show the position of the bridle cable ball in the aileron or rudder neutral position. Roll servo installation drawings may also reference a position with respect to the aircraft structure such as "forward". Trim servos usually do not require orientation of a bridle cable ball because, in most cases, there is none. An important note often overlooked on a trim servo installation drawing indicates that the installer should adjust the trim cable tension to that specified by the manufacturer. S-TEC never specifies trim servo cable tension when a single "vee" groove capstan is used.



All S-TEC autopilot systems with a pitch axis utilize an absolute pressure transducer for altitude reference. These transducers are extremely sensitive and require special consideration when installing. Transducer installation drawings contain a note requiring that the transducers must be mounted with the hose bib in a horizontal plane. A common mistake in the field is installing the transducer in accordance with the General Installation Bulletin supplied with the kit, instead of installing it in accordance with the specific installation instructions for the aircraft in question. The General Installation Bulletin is only to be used in the absence of specific instructions. The latest requirements for installing the 0111 Absolute Pressure Transducer appear on page 5.

Finishing Up The Installation

When the autopilot components have been installed and the cables laid out and wired, it's time to apply power, right? Wrong!

Even though much of the harness is factory prefabricated, there has still been a lot of installer performed wiring and many possibilities for one or more wrong connections. This could prevent proper operation of the system and possibly cause damage to the components.

Now is the time to "wring out the wiring". It takes some extra time and effort, but it can preclude wringing your hands or somebody's neck if the odor of smoke is detected, which almost always signals a delay in completion of the installation and delivery of the aircraft.

With components disconnected, all wires should be thoroughly tested, pin to pin, for continuity with an ohmmeter. Do not rely strictly on visual inspection for proper color codes which can be easily misread in poor lighting conditions. Connections should be tested electrically.

All interface connections to non-autopilot equipment such as heading systems and navigation receivers should be verified with both S-Tec provided drawings and the equipment manufacturer's wiring information. Also ensure that, as mentioned in the "Installation Fundamentals" section of this issue, that all notes on the wiring diagrams have been complied with.

Another important precaution is to verify presence and polarity of all grounds and applied voltages from switches and circuit breakers with a voltmeter.

Now you may, with a reasonable sense of confidence attach the cable connectors to the components and proceed with the post installation tests as outlined in the instructions provided.

Future columns will include troubleshooting tips for common problems encountered during installation. Many of those problems will not occur if the wiring checks above are properly performed.

Installation of S-TEC Autopilots

A Continuing Series

Transducer Installation

Protect the Unit from the elements

The unit shall not be mounted in any location where it will be subjected to falling water, driving rain, or where it will be subjected to a heavy aqueous stream, such as fluid de-icing. It shall not be mounted where it will be subjected to the destructive effects of fluid contaminants commonly encountered in and around an aircraft. It shall not be mounted where it will be subjected to blowing sand and dust in the course of normal aircraft operations. It shall not be mounted where it will see the destructive effects of severe fungus contamination or where it will be subjected to salt atmosphere in the course of normal aircraft operations. It shall not be mounted where external ice or frost can adhere, or where freezing of water condensation or by re-freezing of melting ice, or where ice build-up can occur by direct water exposure. These limitations mean the unit shall be mounted within the passenger compartment, baggage compartment, or other protected areas.

Protect the Unit from direct and indirect effects of lightning

Lightning induced transients vary with the location where the equipment is installed in the aircraft therefore; the units installed location shall consider lightning induced transients. The unit shall not be installed external to the airframe. This limitation means the unit shall be mounted within the passenger compartment, baggage compartment, or other protected areas.

Protect the Unit from electrostatic discharge

The unit shall not be installed in any location where an air discharged electrostatic pulse can be imparted by any passenger or the pilot. This limitation means the unit shall be mounted within the passenger compartment, baggage compartment, or other protected areas where it is unlikely that passengers or pilots will contact the unit.

Conclusion

The preceding instructions and limitations are for the benefit of authorized S-TEC installers to assure proper and accurate installation of the 0111 Absolute Pressure Transducer. In all installations the design data and subsequent aircraft installations shall strictly comply with the above instructions/limitations.

The unit has no periodic maintenance or adjustment, or any restrictions for continued airworthiness.

NOTE: The 0111 Absolute Pressure Transducer shall be limited to installations for altitudes between –1000 ft. to +35,000 ft.

In the last issue of the Approach, we made a typographical error in the DG & HSI Compatibility article. The error appeared in the Notes column of the Compatible HSI chart. A corrected HSI compatibility chart appears below. We apologize for any inconvenience this error may have caused.

COMPATIBLE HSI's

Manufacturer	System Model/Type	Output	Notes
Aeronetics	Model 8000	AC	
Bendix	HSD 880	DC	
Century	NSD 1000	DC	7
Cessna/ARC	IG-832A, IG-832C, IG-895A	DC	7
Collins	PN-101 P/N 331A-3G	AC	6
Collins	HSI P/N 331A-6P/6R	AC	
EDO	NSD 360/360A, DG 360	DC	
King	KCS 55/55A	DC	
King	KPI 550/550A	AC	
NARCO	HSI 100/100S	AC	
Sandel	SN 3308	DC	8
Sigma Tek	HSI IU445-004-9	DC	
S-TEC	ST 180	AC	

Notes:

1) Same as S-TEC Standard DG
2) Use only for Systems Twenty, Thirty, 40 & 50
3) Standard DG with bootstrap
4) Same as 52D54
5) Same as 52D254
6) Except -006
7) Interface same as NSD 360
8) Configure for KCS 55

Troubleshooting & Maintenance of S-TEC Autopilots

(A Continuing Series)

Problem/Symptom Evaluation

"My autopilot is not flying correctly; there is something wrong with my autopilot!"

How many times have you heard that from an upset customer? Well, the autopilot flies the airplane so if it is not flying as it should, there MUST be something wrong with the autopilot, right?

As they say in the TV commercials, Not exactly!

After twenty-plus years in the autopilot industry and literally hundreds of STC applications for our products, we have learned when an autopilot does not fly the airplane the way it should, it is often not the autopilot. Now this is not to be misunderstood to mean we do not have our problems. Everyone in this industry, from airframe manufacturers to aftermarket product producers, have exceptions to the rule. However, every effort was made with each STC to establish a system that optimized the equipment being installed in each model of aircraft.

A couple of things each owner must understand. (1) General aviation aircraft are hand-built and, therefore, each one a bit different than the last. (2) The majority of the general aviation fleet of aircraft is getting on in age…much like the rest of us.

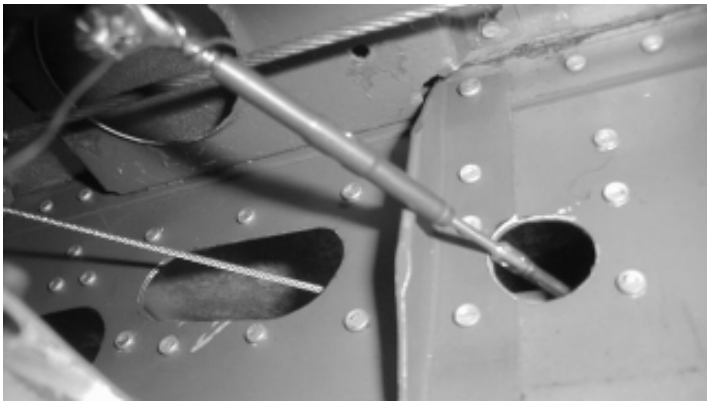
With regard to the first point, considerable effort was made to identify a "standard" aircraft of a particular model before the STC project began. What is a "standard" aircraft? We began each project with an aircraft that flew well before the autopilot was installed, an aircraft that represented the fleet in peripheral equipment and options. The autopilot was then optimized to fly this particular aircraft. History has proven this approach to be valid and has provided customers with a product that has made S-TEC the autopilot of choice.

The second point presents more of an issue. As aircraft age, things change. When the autopilot begins to show signs of not flying the aircraft as well as it did, it is often a sign that something on the aircraft has changed or just simply requires maintenance. In fact, if the autopilot installation is new and does not fly as expected, it could very well be the aircraft just needs a little TLC.

Control systems have certain standards. Cable tensions are called out in the manufacturer's specifications. If they were not important, the maintenance manual would just say tighten 'em up. With time, cable tensions change. It's a fact of life. They should be checked and adjusted annually.

Control systems generally have rod ends somewhere in the system and they wear out, introducing slack into the system. More importantly, if not properly maintained, they will begin to freeze up, introducing friction into the system. We will address control system friction as a whole a little later. All control surfaces are mounted on bearings of some type. Ball bearings will rust and freeze up, bushings will become dirty and gummed up, both adding friction into the system.

Another problem which comes up on a regular basis is improper installation of the control surfaces. Mounting bolts tightened to tight add system friction. Improper painting of the control surfaces, or their mounting points, contributes to this problem. At times we have disconnected the control system from the control surface to find the surface can be placed in any position and released, only to stay in a fixed position. All control surfaces should move freely and control systems maintained to ensure all components in the system are working properly. The autopilot was optimized to work with a system free of excessive friction.



Control system friction is an autopilots worst enemy, period. Everything the autopilot attempts to do is based on the ability to move the control surfaces. If the autopilot is burdened by the airframe system, it will not function as designed.

Control system friction limits are not normally established for most general aviation aircraft; however some do. If the aircraft you are troubleshooting does not have defined limits, common sense always works well. Disconnecting control surfaces one at a time will often identify a problem area. Every control system is a maze of cables, pulleys, rods, rod ends, bushings, and bearings. In some cases, identification of a single point problem is not possible. If all components in the system are in good shape, lubrication as identified by the manufacturer may be the only required effort. You should understand the problems we have encountered are not 1 or 2 extra pounds of friction, but rather, 2 or 3 TIMES the friction allowed, where these numbers were available.

Another system for close examination is the airframe static system. Items have usually been removed, added, or moved requiring the static system to be modified. All static systems have many connections and these connections must all be tight and the system

Continued on Page 7

Problem/Symptom Evaluation

Continued from Page 6

free from leaks. Autopilot systems with altitude hold have a pressure transducer in the system. Most, though not all, are tied into the airframe static system. A recent inspection of a customer airplane disclosed a number of leaks, and missing o-rings. The static buttons on the fuselage had been painted with a small "dime" patch placed over the opening. Removal of the patch after painting produced a ridge around the opening that disturbed the airflow over the opening. For the pressure transducer to function properly, the system must be free of leaks and the static ports free of paint. The same aircraft had a static line routed over the radar unit behind the instrument panel and the heat from this unit had melted a hole in the line. In a pressurized aircraft, this was a real problem. A simple leak check can tell you a lot about the system as a whole.

Proper installation of the system is another must. Inspection of another customer aircraft with flying problems revealed the fact that a simple strap on the back of the computer tray had not been installed on a System Fifty Five X computer/programmer. With an internal accelerometer in the computer, a harmonic vibration on the twin-engine aircraft was driving the computer/programmer nuts. Installation of the required strap eliminated the problems with the autopilot.

During a recent visit at our facility, We asked an owner how his yaw damper was working. "I turn it on but cannot tell if it is working or not", was his reply. Removal of the tail cone revealed the bridal cable, clamps, and a broken cable attach bracket all neatly placed in a zip-lock baggie, tied to the structure with a ty-rap. My guess was it wasn't working as advertised. Strange but true.

We at S-TEC have made every effort to provide an autopilot system that will perform as advertised. Experience has shown when a problem aircraft arrives and all the proper maintenance items corrected, most systems function very well. Those times when all efforts fall short, we are here to assist. It is up to you, our dealer, to educate the flying public of the effects of improper maintenance, or lack thereof, on their autopilot performance.

Additionally, it's up to you, our dealer, to troubleshoot all potential causes of an autopilot performance squawk, including the airframe areas that can impact the autopilot.

Come Visit Us at Sun 'n Fun

April 13 - 19, 2004

Booth D11 - D13

Meggitt / S-TEC is in a familiar location to many of you that have made a visit to Sun 'n Fun in past years. We are located in Booth D11-13.

Kevin King and Valerie Flanagan will be present the entire week. Come meet Wayne Arendsee, Neal O'Bannon, and Andy Byron Tuesday thru Friday. Ken Paul, Van Dardis and Dave Thomason will be in the booth Friday thru Monday.

Our participation at these events is for you. We represent you, our dealer. Dealer Directories are available for interested prospects, so we certainly hope that we send business your way.

We look forward to visiting with you at Sun 'n Fun.

S-TEC® WarrantyPLUS

Something New and Exciting on the Horizon!

We are in the final stages of a program to offer additional Warranty Coverage for S-TEC Systems and wanted to tell you to watch your mail and our internet site.

You will be able to sell, and MAKE ADDITIONAL PROFIT, offering **S-TEC® WarrantyPLUS** *to buyers of our autopilots in the very near future.*

STC UPDATE

APPROVALS SINCE DECEMBER 2003 APPROACH

KIT NO.	VOLT	SYSTEM	AIRCRAFT
ST-852	14V	55/55X	Lancair Models LC40-550FG

IN-PROCESS STC'S

KIT NO.	VOLT	SYSTEM	AIRCRAFT
ST-569	28V	55/55X	Cessna models R182 and TR182 and the above models when modified per STC SA950CE (Horton STOL) and/or STC SA2285CE (Horton flap gap seals); Reims-Cessna model FR182 and the above model when modified per STC SA2422CE (Horton STOL)
ST-536	28V	55/55X	Piper Aircraft Company Models: PA-32-301, PA-32-301T, PA-32R-301, PA-32R-301T, PA-32-301FT, and PA-32-301XTC
ST-226	14V	60-2	Cessna models 210G, T210G, 210H, T210H, 210J, and T210J and models T210G, T210H and T210J when modified per STC SA2689SW (RAM modification)
ST-829	14V	20/30	Cessna models 206, P206, U206, P206A, TP206A, U206A, TU206A, P206B, TP206B, U206B, TU206B, P206C, TP206C, U206C, TU206C, P206D, TP206D, U206D, TU206D, P206E, TP206E, U206E, TU206E, U206F, TU206F; and U206G AND TU206G (landplane, floatplane or amphibian configuration) and models U206G AND TU206G (landplane, floatplane or amphibian configuration) when modified by any of the following STCS: STC SA1513WE (Robertson STOL) or STC SA2353NM (Soloy engine conversion) and/or STC SA3634SW (extended range fuel tanks) and/or STC SA914NE (wing tip extensions)
ST-194	14V	40/50	Cessna models 210G, T210G, 210H, T210H, 210J, and T210J and models T210G, T210H and T210J when modified per STC SA2689SW (RAM modification)

New Fax Numbers

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325-8808

Customer Service

328-0753

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and

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Approach

Published and copyrighted by Meggitt /S-TEC, the *Approach* is intended to provide S-TEC dealers with information valuable in the everyday selling and servicing of S-TEC Autopilots and electronic instruments.

Comments and suggestions are encouraged and welcomed. For additional copies of the *Approach* for others in your organization or for distribution to your own mailing list, contact:

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