

IStart Partners, Ltd
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INSTALLATION INSTRUCTIONS

These are the primary instructions for installing the IStart-1 System

Document No. A-02, Revision D

List of Effective Pages

The list of effective pages shown below contains all current pages with the page version date. This list should be used to verify this document contains all of the applicable and required pages. When inserting revised pages into this document, the List of Effective Pages should be updated, as well, to the corresponding new list.

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Revision:	Date:	By:	Changes:
IR	12/10/2015	L.E.S.	Initial Release
-	12/14/2015	L.E.S.	Updated to correct wiring
A	12/15/2015	L.E.S.	Added switch, fuse holder & fuse to kit. Changed dwg.
B	12/21/2015	G. Barnes	<p>Title page; Added doc number and revision level.</p> <p>Page 2; Edited and added information contained in the following section - Applicability, Objectives, Technical Document Reference, Airworthiness Limitations.</p> <p>Page 3; Edited and added information contained in the following section - IStart General Description and Operation, IStart Installation.</p> <p>Page 6; Component List section - added switch Assy and fuse assy p/n.</p> <p>Page 6; Fuel Hoses section - added requirement for Type D hose and Type C aft of the engine cooling baffle..</p> <p>Page 10; Hoses section - added directions to install Type D or equivalent high temperature hose forward of engine rear cooling baffle.</p>
C	6/ 17/ 2016	DRB	<p>Title page; Added doc number and revision level.</p> <p>Page ii; List of effective pages.</p> <p>Page iii; Revision History.</p> <p>Page 4; Installation drawing A-01 revised.</p> <p>Page 7; Updated picture.</p> <p>Page 9; Updated picture.</p> <p>Page 10; Updated picture.</p>
D	4/18/2017	DRB	<p>Title Page; Changed revision level.</p> <p>Page ii; List of effective pages.</p> <p>Page iii; Revision history.</p> <p>Page 10; Added text, hose purging</p> <p>Page 15; Improved display screen, accompanying text.</p>

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Applicability:

Aircraft powered by Lycoming and Continental Motors fuel injected engines to be modified by the installation of the IStart-1 Starting Fuel system.

Objectives:

This document provides detailed instructions for the installer of the IStart-1 Starting Fuel System. The installation must be accomplished in accordance with the instructions contained herein. The applicable Maintenance (Shop) Manual and Wiring Diagrams for the aircraft must be followed when disassembling and assembling original equipment components and systems.

Technical Document Reference:

Current versions of the IStart Installation Manual, Instruction for Continuing Airworthiness, and Flight Manual Supplement were included with the product. Current versions of these documents and additional technical documents may be found at www.istartair.com.

Airworthiness Limitations:

Airworthiness Limitations are FAA approved and specify maintenance required under 14 CFR §§ 43.16 and 91.403 of the Federal Aviation Regulations unless an alternative program has been FAA approved.

There are no (or additional) airworthiness limitations pertinent to the IStart1 Starting Fuel system.

IStart General Description and Operation

IStart is a fuel-injection control system which provides digitally controlled fuel for starting and establishing smooth idling under most environmental and operational conditions.

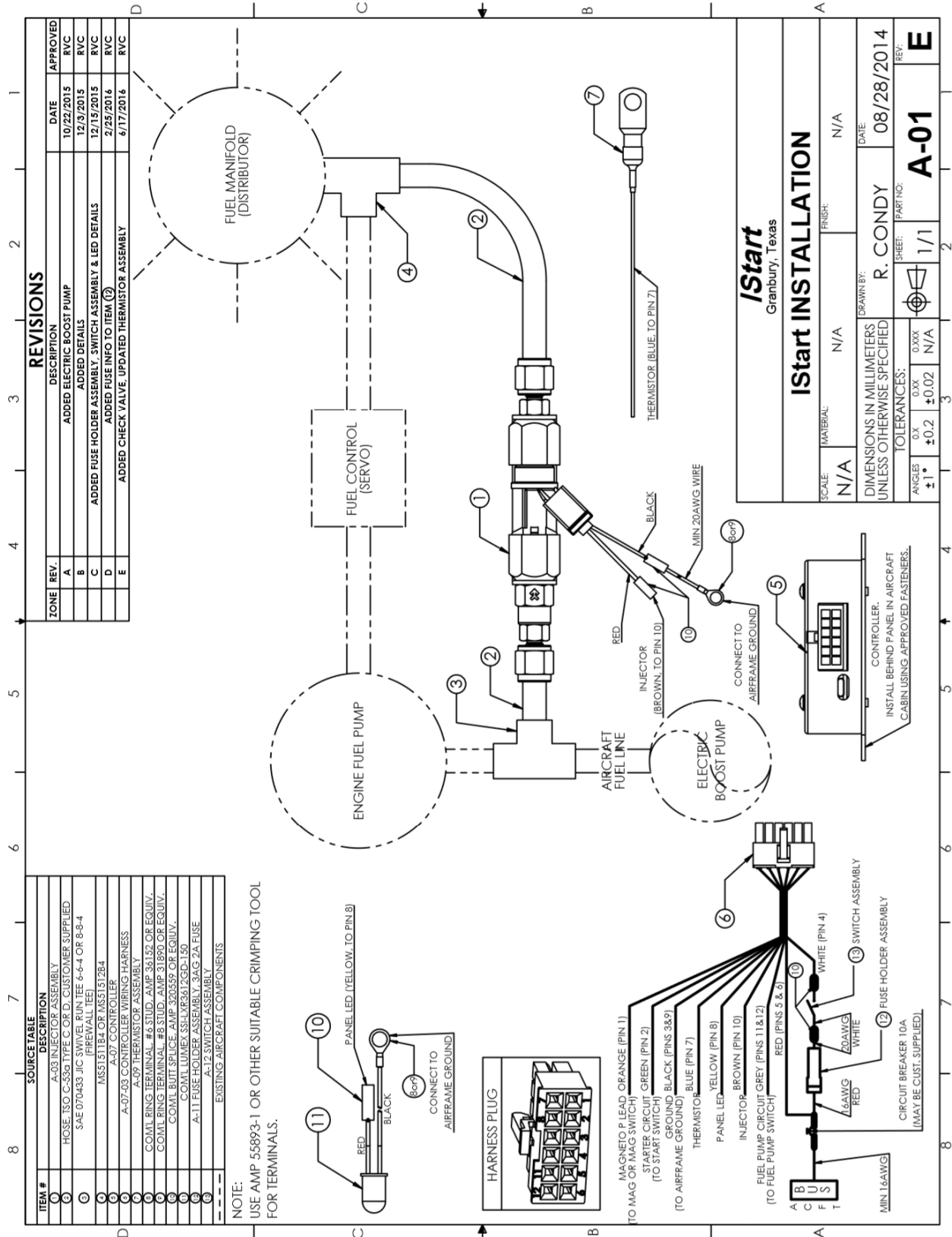
See the IStartAirplaneFlight Manual Supplement for operating instructions.

IStart Installation

TheIStart1 system Installation Drawing, A-01, is presented on the next page. The system installation is shown schematically to illustrate the design details and requirements that must be duplicated when installing the system.

A list of the parts required for installation is found in the upper left corner of the drawing. Please note that not all of the parts in this list are included in the kit. Included are the injector assembly, controller, controller wiring harness, thermistor assembly, fuse holder assembly, and toggle switch assembly. Common items such as TSO C-53a(Type D) hoses, fuel line Tees, ring terminals, and butt splices are user supplied. Also, wire supplied by the installer must be MIL W22759/16 (600V / 150C rating) wire. Wire sizes are specified farther along intheseinstructions.

iStart Installation Drawing



STEP-BY-STEP INSTALLATION INSTRUCTIONS

READ AND UNDERSTAND ALL OF THE INSTRUCTIONS BEFORE BEGINNING INSTALLATION.

FUTURE REVISIONS TO THE INSTALLATION INSTRUCTIONS WILL BE POSTED at WWW.IStartair.com.

This manual describes the installation of the IStart in five steps: (1) Determining Eligibility, (2) Selection of components, (3) Choosing mounting locations for the components, (4) Mounting the components, (5) Completing the wiring. This is followed by post-installation inspections.

FIRST: The Owner / Installer must determine:

- a. Permission has been obtained to use the IStart STC in the form of a letter from IStartPartners, Ltd.
- b. The AML for the IStart STC lists the aircraft on which IStart is to be installed.
- c. The records of the aircraft on which IStart is to be installed do not show any other STCs installed which would conflict with the IStart installation. Such might include:
 - a. Installation of an engine which is carbureted.
 - b. Installation of an electrical system with a nominal voltage greater than 28V.
 - c. Installation of a FADEC or similar fuel controller.

SECOND: The Owner / Installer must carefully consider the selection of the user-provided components for the installation.

Due to the many configurations of aircraft and many years of addition and removal of equipment it is impossible to designate a single installation location even within a specific aircraft year and model. Therefore, IStart does not supply certain components that may not meet individual requirements. A list of installer supplied parts is below:

- a. Additional angled fittings may be needed. Select MS or AN approved fittings.
- b. Hoses. There must be a flexible hose in and out of the Injector assembly. The hoses must meet TSO-C53a Type D FAA standards. A hose installed in the engine accessory compartment (i.e., aft of the engine rear cooling baffle) where it is not subject to heating from the engine cylinders can be TSO-C53a Type C.
- c. 10 amp current limiting device Klixon 7274-2-10 or Tyco W58XC4C12A10. See Circuit Breaker instructions on next page.
- d. Wire terminations (ring-lugs and butt-splices) must be aircraft-quality, such as AMP PIDG. Use AMP 48387 crimping tool or equivalent to install on wire.
- e. Wire - use only MIL W22759/16 (600V / 150C rating) wire.

IStart Component List

The components in the list below in **Bold** are supplied with the IStart kit. Other components listed are supplied by the installer.

Qty	P/N	Description	Mounting Location
1	A-07	Controller	Cabin, behind panel
1	NA	Panel Indicator	Cabin, on panel in view of pilot
1	A-12	Switch Assembly	Cabin, on panel near LED Indicator
1	A-10	Panel Placard	Cabin, on panel near ON/OFF Switch
1	NA	10ACkt. Breaker	Cabin, on panel near original breakers or LED Indicator (may not be needed, see instructions below)
1	A-11	Fuse Assembly	Cabin, behind panel near ON/OFF Switch
1	NA	Swivel Run T	2 supplied. Forward of Firewall in Main Fuel Line.
1	NA	Straight T	2 supplied. Top of engine in inlet to fuel distributor
1	A-03	Injector Assembly	Engine area, preferably on top near fuel distributor
1	NA	Fuel Hose	Routed from Swivel Run T to Injector Assembly
1	NA	Fuel Hose	Routed from Injector Assembly to T in fuel distributor
1	A09	ThermistorAssy	Secured under a convenient valve-cover screw.

Circuit breaker: If the aircraft has a circuit breaker for the fuel pump connected to the aircraft bus with a fuel pump switch in series, a new breaker will not be needed as IStart can be powered from the existing fuel pump circuit breaker. If such is not available, or if the installer desires, a 10 Amp thermal circuit breaker for the IStart circuit may be installed. The new circuit breaker should be push-to-reset and may be of the pull-off type. Klaxon 7274-2-10 and Tyco W58XC4C12A10 are acceptable.

Fuel Hoses: The installer must purchase or fabricate flexible hoses to convey fuel into and out of the Injector assembly. The hoses must meet TSO-C53a Type D FAA standards. Hoses installed aft of the engine rear cooling baffle that are not subject to heating from the engine cylinders must meet either TSO-53a Type D or Type C. The installer must determine the length of the hoses after installation of the T-fittings.

Third: Choose IStart Component Mounting Locations:

Controller: The Controller should be mounted in the cabin in a location behind the instrument panel in which there will be no interference with flight or engine controls. It is advisable to locate the Controller in a position in which the Harness plug and the micro-USB diagnostic plug can be easily accessed. Secure the Controller with AN or MS fasteners.

Circuit Breaker: If a new circuit breaker is to be installed, a location in the instrument panel (or circuit breaker panel, if the aircraft is so equipped) should be chosen.

Switch and Indicator: The A-12 Switch Assembly and Indicator (Lumex SSI-LXR3612GD-150) should be adjacent and located on the panel in plain view of the pilot. The switch is supplied with two White 20AWG wires attached to allow installation with butt-splices. This location will vary with aircraft installation. Make sure that there is adequate space to install the Panel Placard next to the Switch. Ensure that the installation of these components does not interfere with or obstruct the view of other panel mounted controls and indicators.

Fuse Assembly: The A-11 Fuse Assembly is supplied with one Red 16AWG wire and a White 20AWG wire preinstalled to allow installation with butt-splices and a 3AG2A fuse. Locate the Inline Fuse Holder behind the panel near the switch. Secure to structure or cable bundle.



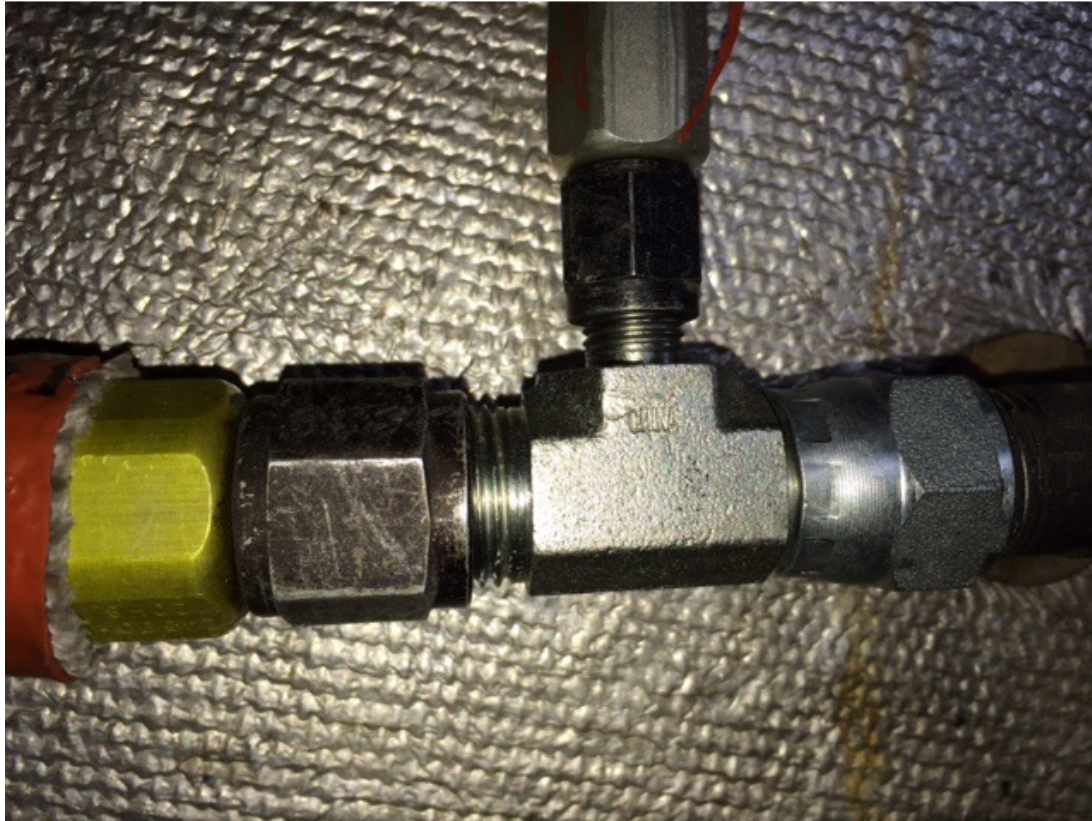
The picture above shows the installation of the Controller, Circuit Breaker, Switch and Panel Indicator in a Bellanca 17-30A in the lower center of the Instrument Panel. A blank-plate, removed for this picture, covers the Controller which is mounted in a former ash-tray location. The fasteners holding the Controller are not shown in this picture but go through the holes that can be seen in the Controller's baseplate. The Switch is immediately to the left of the Controller and the Circuit Breaker and Panel Indicator are left of the Switch.

Straight T-fitting: Fuel from the IStart Injector Assembly is injected into the engine through this T-fitting which is installed in main fuel line going into the Fuel Distributor on top of the engine.



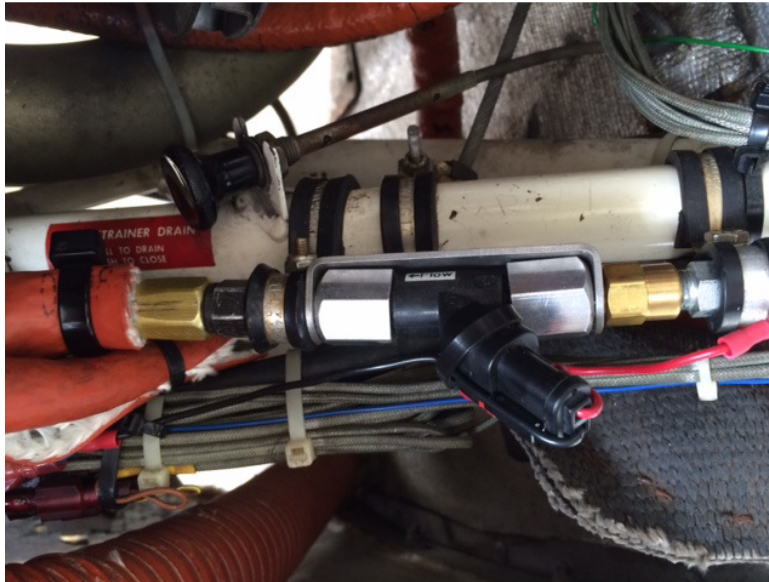
The picture above shows the Straight T-Fitting installed in the fuel distributor on the top of the Bellanca 17-30A Engine (Continental IO-520-K). The main fuel hose is in the center of the picture, shown attached to the left-hand port of the T-Fitting. The fuel hose on the top is the output hose from the IStart Fuel Injector Assembly, shown attached to the other port of the T-Fitting.

Swivel-Run T-fitting: Fuel for the IStart system is obtained by installing the Swivel-Run T-fitting at the firewall fitting of the fuel line from the aircraft's fuel system.



The picture above shows the Swivel-Run T-fitting installed at the firewall of the Bellanca 17-30A. The elbow fitting coming through the firewall at the right and the fuel hose attached to the T-Fitting at the left are original. The new Swivel-Run T-fitting is shown installed between these with the inlet fuel hose to the IStart Injector Assembly attached to the center (top) port of the T-fitting.

Injector Assembly: The Injector Assembly controls the delivery of fuel from the pressurized source (aircraft boost pump) to the Fuel Distributer. Choose a convenient and accessible location to install the Injector Assembly. One good location is on top of the engine near the Fuel Distributer. In the installation shown below, the Injector Assembly is mounted near the firewall and secured to part of the engine mount.



Bellanca 17-30A Injector Assembly Installation

Hoses: One hose will connect the Swivel-run T-fitting to the Injector Assembly and the other will connect the Injector Assembly to the Straight T-fitting at the Fuel Distributer. Carefully consider the routing of these hoses when determining where the Injector Assembly is going to be located. Install only TSO C53a Type D hose(s), or equivalent fire resistant, high temperature environment hose(s), in front of the engine rear cooling baffle (over engine cylinders). When the injector is mounted in the engine accessory compartment (i.e., aft of the engine rear cooling baffle), a TSO-C53a Type C hose can be used to connect the injector to the Swivel-run T-fitting. When installing the hoses, ensure that they are clean and free of debris by flowing a minimum of 2 qts. of fuel through each hose. Collect and discard that fuel.

Thermistor Assembly: The Thermistor Assembly will be mounted under, and secured by, one of the engine valve cover screws. Choose a rear cylinder and a screw under which to mount the Thermistor Assembly which will allow convenient routing of the wire.

Fourth: Mount the Components:

Controller: Place the Controller in the chosen position in the cabin behind the instrument panel secure with AN or MS fasteners. Plug the A-07 Wiring Harness into the mating connector of the Controller.

Circuit Breaker, Switch and Indicator: Drill the mounting panel as required to fit the circuit breaker (if you are installing one). Drill a 0.250" D hole for the indicator and switch. Mount these components using the hardware that accompany the component.

Circuit Breaker / Fuse Assembly Wiring: If you are installing a circuit breaker, connect one terminal of the circuit breaker to the aircraft bus using the existing bus-bar, if possible, or using 16AWG or larger wire and ring terminals. Whether using a circuit breaker you have installed or if you are using the aircraft's fuel pump breaker, route the **Red** wire in the A-07 wiring harness to the output terminal of the circuit breaker, cut to length and crimp a ring lug onto the wire. Route the **Red** 16AWG wire of the A-11 Fuse Assembly to the same output terminal of the circuit breaker, cut to length and crimp a ring lug onto the wire. Connect both ring lugs to the output terminal of the circuit breaker and tighten the screw.

Switch Assembly Wiring: Connect the white 20AWG wire from the A-11 Fuse Assembly to one of the 20AWG wires from the switch with a butt-splice. Route the **White** wire in the A-07 wiring harness to the other 20AWG wire of the Switch Assembly, cut to length and connect with a butt-splice.

Panel Indicator Wiring: Route the Black wire of the Panel Indicator to a convenient airframe ground such as an existing screw or a new screw in an existing or newly drilled hole. Cut the wire to length and crimp a ring-lug onto the wire. Secure the lug to airframe ground using existing or new aircraft-quality hardware. Route the **Yellow** wire in the A-07 Harness to the Panel Indicator, cut to length and crimp the red wire of the Panel Indicator to the **Yellow** wire using a butt-splice.

Straight T-fitting: Select one of the two supplied Straight T-fittings which has the orientation that best suits the desired hose routing. Remove the main fuel line to the distributor and the fitting onto which it was attached. Inspect the threads in the distributor and ensure no sealant from the original fitting remains. Install the chosen T-fitting into this distributor port, applying Loctite Hydraulic Sealant or equivalent to the 1/8" NPT threads. Do not apply sealant to the first two lead threads. Do not use Teflon tape. Screw the main fuel line onto the open port of the T-fitting that matches the size of the B-nut on the main fuel line and tighten.

Injector Assembly: Place the Injector Assembly in the chosen location with the fuel hoses attached. Secure the Injector Assembly using Adel clamps or other approved fastening means. Attach the clamps within 4" of each end of the Injector Assembly. Route the output hose from the Injector Assembly to the open port of the Straight T-fitting or the new fitting installed in the Fuel Distributer and tighten.

Swivel-Run T-fitting: Install the Swivel-Run T-fitting in series with the fuel supply line to the engine-driven fuel pump in the location chosen. Route the inlet hose from the Injector Assembly to the small port of the T-fitting and tighten.

Injector Assembly Wiring: Route the **Brown** wire in the A-07 Harness through the firewall to the area where the Injector Assembly is installed. Cut to length and splice to the Injector Assembly's Red wire with a butt-connector. Route the Injector Assembly's Black wire to a convenient aircraft ground. If necessary, extend the Injector Assembly's Black wire with minimum AWG20 wire using a butt-splice. Install a ring-lug on the wire and connect to aircraft ground. Secure the wire against vibration and chafing.

Thermistor Assembly: Remove the valve cover screw at the chosen location, place the ring terminal of the Thermistor Assembly over the screw and reinstall the screw.

Thermistor Wiring: Route the **Blue** wire in the A-07 Harness through the firewall to the area where the Thermistor Assembly is installed. Cut to length and splice to the Thermistor Assembly's wire with a butt-splice. Secure the wire against vibration and chafing.

Fifth: Complete the wiring:

P-Lead wiring: The Controller requires a P-Lead signal from a magneto that is active during cranking. Route the **Orange** wire in the A-07 Harness to the point from which this signal is to be obtained. Possible connections are the Ignition switch or the P-Lead on the magneto. If the P-Lead on the magneto is to be used the **Orange** wire must be routed through the firewall in a safe manner. Cut the wire to length and install a ring lug on the wire. Complete the connection to the P-Lead terminal on the magneto or the ignition switch, tightening the screw or nut.

Start signal wiring: The Controller requires a signal that is positive when the engine starter is energized. Route the **Green** wire in the A-07 Harness to the point from which this signal is to be obtained. Possible connections are the Start switch or the S-Terminal of the aircraft's starter relay (solenoid). If the S-Terminal of the aircraft's starter relay is to be used the Green wire must be routed through the firewall in a safe manner. Cut the wire to length and install a ring lug on the wire. Complete the connection to the S-terminal on the relay or the Start switch, tightening the screw or nut.

Ground: The controller requires Aircraft Ground. Route the **Black** wire in the A-07 Harness to a convenient airframe ground such as an existing screw or a new screw in an existing or newly drilled hole. Cut the wire to length and crimp a ring-lug onto the wire. Secure the lug to airframe ground using existing or new aircraft-quality hardware.

This completes the IStart hardware installation.

Post-installation Inspection

Inspect the new hose routing. Ensure that the hoses are routed and secured to prevent chafing or contact with hot (exhaust) components. Check the security of all fittings.

Inspect the new wiring. Ensure that the wires are routed and secured to prevent chafing or contact with hot (exhaust) components.

Purge the system. IT IS ESSENTIAL that the entire IStart system is free of contaminants. In addition to flushing all hoses (even new hose assemblies may have debris) you must purge the system before IStart is powered up the first time.

Disconnect the hose from the inlet side of the Injector Assembly (A-03). Be prepared to collect a quantity of fuel from that hose. Turn on the boost pump and collect enough fuel to ensure a clean hose. Reconnect that hose and discard the fuel.

Disconnect the hose from the outlet side of the IStart injector assembly where it connects to the fuel distributor. Turn the Master switch ON, turn the IStart power switch ON, the pump will run and a small amount of fuel will flow. When the Status light flashes, cycle the IStart power switch on and off. Repeat the cycle until you have collected a minimum of 1/2 cup of fuel. Reconnect the fuel hose and discard the fuel.

Check for leaks. With the IStart Switch OFF, turn on the aircraft's Battery (Master) switch. Turn the boost pump on. Verify that you can hear the boost pump running. Inspect the hose connections to the Swivel-run T-fitting for leaks. Turn the boost pump off.

Check again for leaks. Turn the IStart Switch ON. Verify that you can hear the boost pump running for a short time. Inspect the hose connections to the Injector Assembly and to the Fuel Distributer for leaks. Verify that the Panel Indicator is blinking. Turn the IStart Switch off. Verify that the boost pump stops and the Panel Indicator is not illuminated.

If the preceding inspection indicates no problems, or if the problems found are corrected, IStart is ready for the first start! Consult the Airplane Flight Manual Supplement to proceed.

Settings and Adjustments

Objectives: The IStart startingsystem, as delivered from the factory, is designed to operate in a satisfactory manner for the engine specified. However, there are small differences in engine operation not only between models but between engines supposedly identical. Occasionally the operation of the IStart System may be optimized by the adjustment of some fuel delivery rates or duration. These adjustments are simple, easy to do and require no specialized tools or knowledge.

Adjustments are intended to be done with assistance from the IStart technical help personnel.

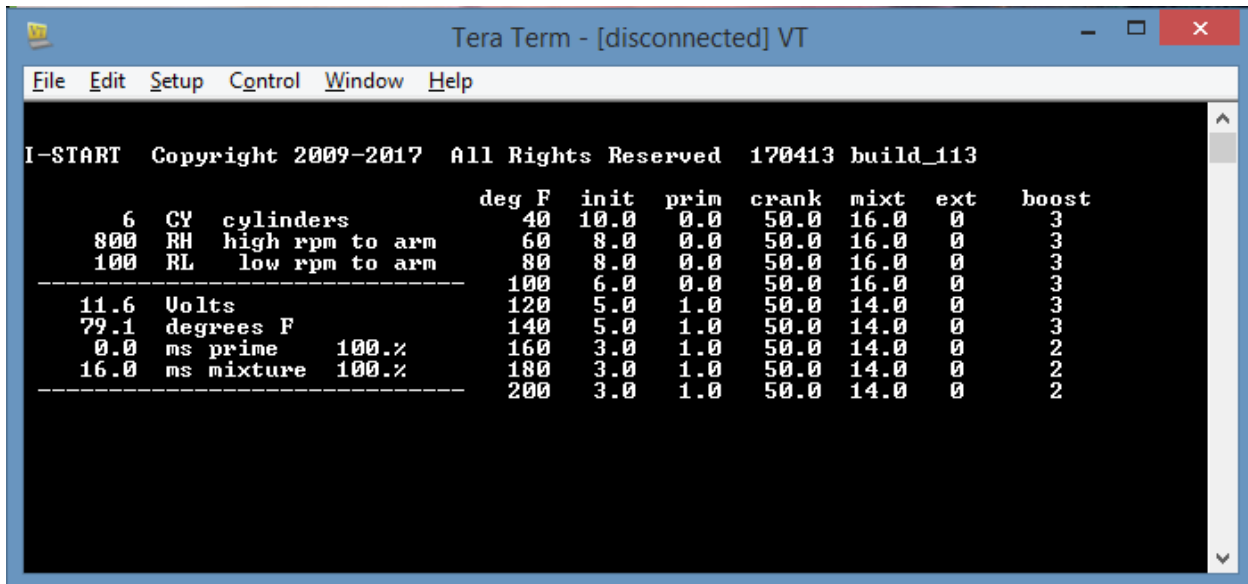
The adjustments available are intentionally limited in scope. There is no access to any programming feature available to the installer. Changing the settings does not affect the basic programming of the IStart Controller. IStart's internal safeguards are in no way compromised and are not accessible except at the factory.

Equipment required:

1. A laptop using Windows XP or later or any serial data terminal with USB output configured for 57,600bps.
2. USB to Micro-USB data cable.
3. Free Tera Term software package at <https://tssh2.osdn.jp/>.

Computer set up:

1. Attach the cable from the laptop USB port to USB Micro port adjacent to the IStart harness plug on the Controller
2. Retrieve the free Tera Term program online and download it to your computer.
 - a. Open Tera Term
 - b. Select Setup pull down menu
 - c. Select Serial Port
 - d. Change Baud rate to 57,600
 - e. OK
3. Turn IStart power switch ON
4. Press Enter. The IStart settings page will now be displayed on the Tera Term screen and adjustments can be made as follows:



```

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      6 CY cylinders          deg F  init  prim  crank  mixt  ext  boost
      800 RH high rpm to arm    40  10.0  0.0   50.0  16.0  0    3
      100 RL low rpm to arm     60   8.0  0.0   50.0  16.0  0    3
-----
      100                               80   8.0  0.0   50.0  16.0  0    3
      100                               100  6.0  0.0   50.0  16.0  0    3
      11.6 Volts                    120  5.0  1.0   50.0  14.0  0    3
      79.1 degrees F                140  5.0  1.0   50.0  14.0  0    3
      0.0 ms prime 100.%            160  3.0  1.0   50.0  14.0  0    2
      16.0 ms mixture 100.%         180  3.0  1.0   50.0  14.0  0    2
-----
      200                               200  3.0  1.0   50.0  14.0  0    2

```

Tera Term IStart Screen Display

Setting Adjustments available: Number of Cylinders and Initial, Prime, Cranking, Idle Mixture, Extended and Boost at temperatures from 40F to 200F.

The keys to making adjustments are:

CY<sp>**n**<enter> where n is 4 for 4 cylinder engine and 6 is for 6 cylinder engine.

I<temp><sp>**nn**<enter> where temp is 40, 60, 80, 100, 120, 140, 160, 180, 200 (degrees F)
and nn is tenths of seconds of fuel flow at power ON.

P<temp><sp>**nn**<enter> where temp is 40, 60, 80, 100, 120, 140, 160, 180, 200 (degrees F)
and nn is tenths of seconds of fuel flow at START.

C<temp><sp>**nnn**<enter> where temp is 40, 60, 80, 100, 120, 140, 160, 180, 200 (degrees F)
and nn is tenths of seconds of fuel pulse during cranking.

M<temp><sp>**nnn**<enter> where temp is 40, 60, 80, 100, 120, 140, 160, 180, 200 (degrees F)
and nn is tenths of fuel pulse during engine idle.

Each time an adjustment is made, the terminal will re-display the screen. Verify that the display shows the change made.

Adjustment procedures for any column at any temp:

This example will adjust the Prime fuel delivery at an engine temperature of 80F to 6 seconds.

1. Type: **P80**<sp>**60**<enter>

2. Verify that the screen shows a setting of 6.0 under the Prime column at 80F

This example will adjust the Cranking fuel delivery at an engine temperature of 160F to 35.

1.Type: **C160**<sp>**350**<enter>

2. Verify that the screen shows a setting of 35.0 under the Crank column for 160F.
