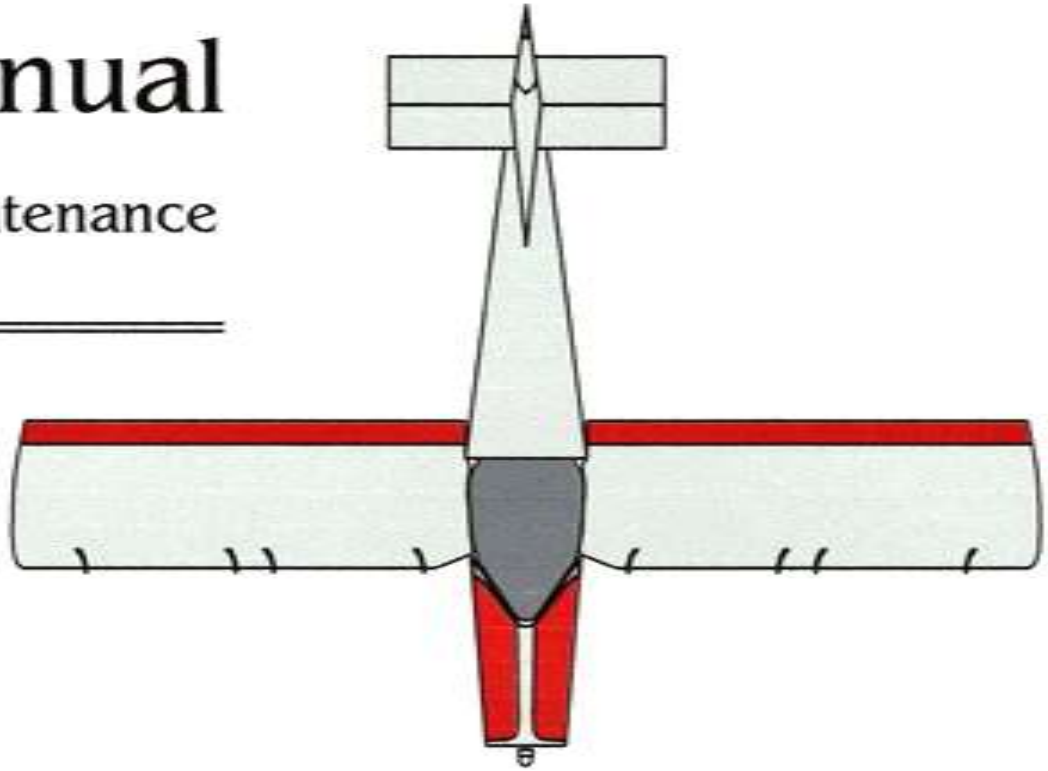
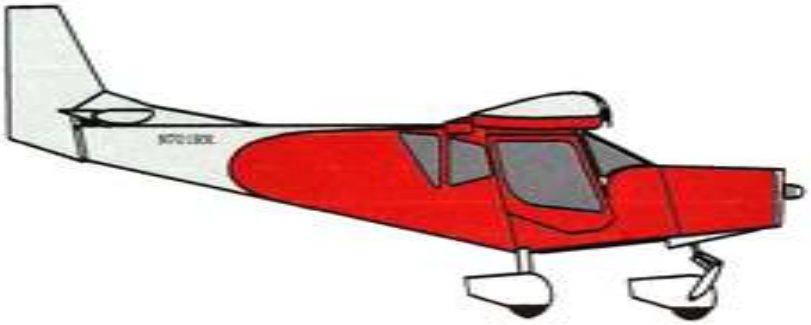
ELIXIR Pilots Manual

Specifications - Operation - Maintenance

N701RX



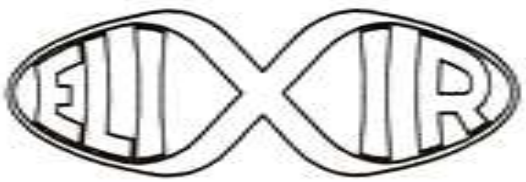
Built by Mark Phillips
Completed May 2018
Model 701.1
Serial # 1
Based on Zenith CH701



Features:

>Jabiru Generation 4 3300 6-cylinder engine
>Garmin G3X avionics with 2-axis autopilot
>ADS-B in/out by GTX35R and GDL39R
>Redundant instrumentation by UMA gauges
>Modified all-pushrod elevator contol (no cables)
>Re-engineered flaperon system with elect. adjust
>Widened firewall and rudder pedals
>All-aluminum cowling and cooling ducts
>Modified Jabiru trailing-link nosegear
>Removale all-aluminum "bubble" doors
>Doors latch under wing for start/taxi
>Baggage compartment "hatch" for doors-off ops
>All-aluminum wing and control suface tips
>Fuselage skins wrap around top & bottom
>Longerons internal to fuselage skins
>Modified internal horizontal stab attach
>Straight-loaded dual-bushed flaperon pivots
>Welded struts- steel jury struts
>Polished aluminum strut fairings
>Double-round solid rivets all trailing edges
>Solid and flush rivets wherever practical
>Spring-loaded laminated wood/brass tailskid
>Sheathed 1/8" brake lines on gear legs
>Easy engine access without cowl removal
>Added baggage compartment windows
>Large wood-paneled baggage compartment
>Fully-finished interior with flannel headliner
>Hidden, retractable 2-position LED landing lights
>All placards/labels permanently engraved
>"EXPERIMENTAL" placards velvet-backed stencils
>"Elixir" logo adjustable cabin vents each side
>Minimal exposed wiring interior and FWF
>Switch panel swings down for behind-panel access
>White/red overhead lights for cockpit & baggage area
>Minimum painted surfaces or visible fasteners
>Swaged rudder cables
>All interior structural components joggled
>Rear-view camera & screen (check six!)

Out of " X RI E L" comes:



Passenger Welcome: In the pursuit of recreation and education this aircraft celebrates aviation. Enjoy the ride!

From:

The Possum Works

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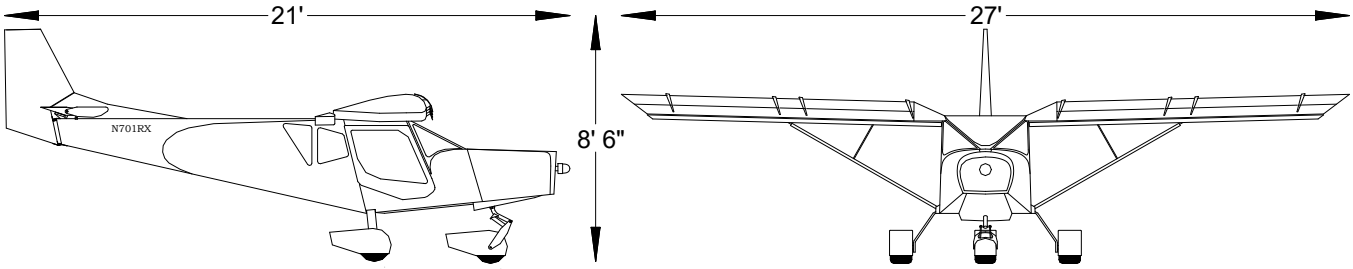
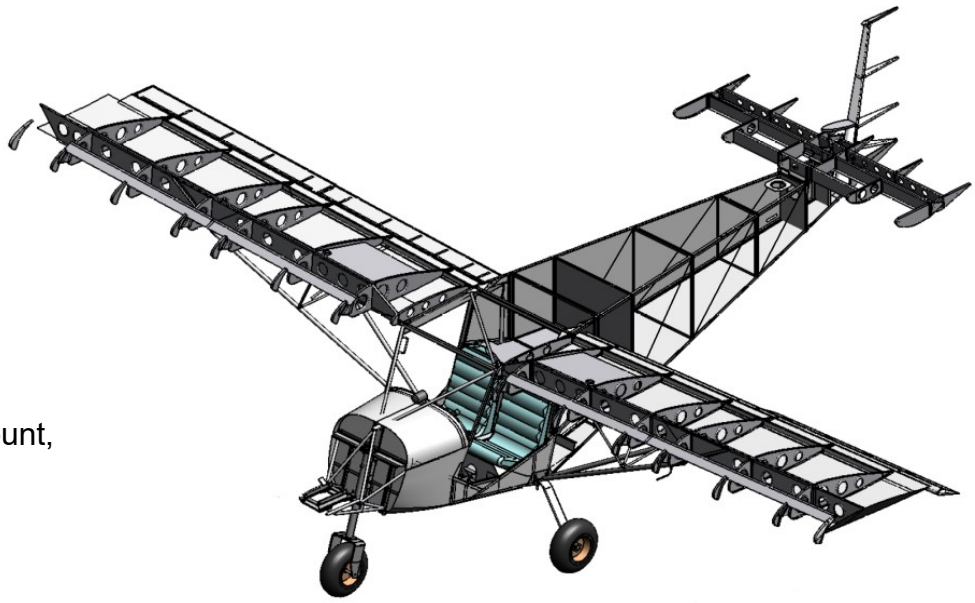
Basic Dimensions





Note slats,
bed-style engine mount,
standard nose gear
and tires

Original CH-701 Airframe Structure

The CH-701 was introduced in 1986 by Zenith Aircraft founder and designer Chris Heintz as a simple to build affordable STOL aircraft. (note that “ZENITH” is an anagram of “HEINTZ”) According to the Zenith website, as of 2022 more than 500 examples are in operation around the world. Typical of Experimental Aircraft, many exhibit custom features and modifications to suit the builder- all in the interest of “Recreation and Education”- *ELIXIR* is certainly no exception to this concept…

Specifications & Performance

WINGSPAN ……..……...27’
LENGTH: ……..……21’
HEIGHT: ……..……..8’ 6”
MAXIMUM GROSS WEIGHT: ……..……1220 lbs
MAX WEIGHT @ G-LOAD +6/-3G ……..……. 1100 lbs
EMPTY WEIGHT ……..…..…...755 lbs
MAXIMUM USEFUL LOAD: ……..…..…..…465 lbs
BAGGAGE ALLOWANCE ……..……. 65 lbs
WING AREA.……..… 122 sq ft
WING LOADING (1015 lbs, solo wt.) ……..... 8.3 lbs/sq ft
POWER LOADING (1015 lbs, solo wt.) ……..…. 8.4 lbs/hp
FUEL:
Capacity ……..……11 Gallons each wing, 22 Gallons Total
Type ……..…… 100LL or 92 octane (minimum) automotive gasoline
OIL CAPACITY ……..……3.7 qts

SPEED: Maximum at Sea Level ……..……110 mph*
Cruise, 75% Power at 8,000 Ft ……..……...110 mph

RANGE (approximate - includes 3 gal. for taxi, takeoff & climb):
75% @ 8000’ , no reserve ……..…… 3.4 hrs
55% @ 8000’ no reserve ……..…… 4.25 hrs
75% @ 8000’, one hour (5 gal) reserve …… 2.5 hrs
55% @ 8000’, one hour (5 gal) reserve …… 3.1 hrs

RATE OF CLIMB AT SEA LEVEL (solo)……..……1000 - 1250 fpm

SERVICE CEILING (w/o Oxygen)……...……14,000’

TAKEOFF PERFORMANCE: Solo with slats installed/removed ….....…..……150’/225’

LANDING PERFORMANCE: Solo with slats installed/removed ….....…..……..150’/225’

STALL SPEED (CAS):
Flaps Up, Power Off ……..……..…… undetermined
Flaps Down, Power Off ……..…… undetermined

* (IAS) AS ESTABLISHED FOR ORIGINAL DESIGN BY KIT MANUFACTURER

Airspeed Limitations

	SPEED	MPH	REMARKS
V_{NE}	Never Exceed Speed	**110***	Do not exceed this speed in any operations.
V_{NO}	Maximum Structural Cruising Speed	**90***	Exceed this speed only in smooth air.
V_A	Maneuvering Speed	**71***	Do not make full control movements above this speed. Full elevator deflection will result in a 6g load at this speed.
V_{FE}	Maximum Flap Extended Speed	**63** @ Full	Do not exceed this speed with flaps down
Vy	Best Rate of Climb	**?**	
Vx	Best Angle of Climb	**?**	
Vs	Stall Speed Clean	**?**	Power off, no airspeed indication, gentle mush

***** (IAS) AS ESTABLISHED FOR ORIGINAL DESIGN BY KIT MANUFACTURER

Airspeed Indicator Markings

MARKING	MPH	SIGNIFICANCE
White Arc	**35 – 63**	Full Flap Operating Range. Lower limit is Vso. Upper limit is maximum speed with flaps extended
Green Arc	**39 – 90**	Normal Operating Range. Lower limit is Vs. Upper limit is maximum structural cruising speed
Yellow Arc	**71 – 110**	Operations must be conducted with caution and only in smooth air.
Red Line	**110**	Maximum speed for all Operations*****

***** (IAS) AS ESTABLISHED FOR ORIGINAL DESIGN BY KIT MANUFACTURER

Weight and Balance Data (original-current empty weight=755)

N701RX Weight & Balance Phillips, Mark A 701.1 Serial # 1

Empty Aircraft, No Fuel — **As Weighed**

	Weight (lbs)	Arm (in.)	Moment
Right Main	282.00	27.75	7,825.50
Left Main	280.00	27.75	7,770.00
Nose	185.00	(21.00)	(3,885.00)
Fuel	0.00	23.62	0.00
Crew	0.00	23.62	0.00
Baggage	0.00	41.33	0.00
	747.00	**15.68**	11,710.50

Full Fuel, Solo w/ Full Baggage

	Weight (lbs)	Arm (in.)	Moment
Airplane	747.0	15.68	11,710.50
Fuel	132.0	23.62	3,117.84
Crew	220.0	23.62	5,196.40
Baggage	65.0	41.33	2,686.45
	1164.0	**19.51**	22,711.19

Forward CG Limit = 11.0 inches / Rear CG Limit = 20 inches
Datum: Leading edge of the wing slat
Level Points:
Lateral--Main door sills / Longitudinal – Upper Longeron
MAX T.O. Weight 1220 Lbs
Date 7/15/2018 (Update after paint and interior complete)

Low Fuel, Solo w/ Full Baggage

	Weight (lbs)	Arm (in.)	Moment
Airplane	747.0	13.82	11,710.50
Fuel	36.0	23.62	850.32
Crew	120.0	23.62	2,834.40
Baggage	65.0	41.33	2,686.45
	968.0	**18.68**	18,081.67

Zero Fuel, Max Crew Weight

	Weight (lbs)	Arm (in.)	Moment
Airplane	747.00	13.82	11,710.50
Fuel	18.00	23.62	425.16
Crew	340.00	23.62	8,030.80
Baggage	0.00	41.33	0.00
	1,105.00	**18.25**	20,166.46

Light Pilot, Full Fuel / Baggage

	Weight (lbs)	Arm (in.)	Moment
Airplane	747.0	13.82	11,710.50
Fuel	220.0	23.62	5,196.40
Crew	120.0	23.62	2,834.40
Baggage	65.0	41.33	2,686.45
	1152.0	**19.47**	22,427.75

Full Fuel, Max Crew Weight

	Weight (lbs)	Arm (in.)	Moment
Airplane	747.00	13.82	11,710.50
Fuel	132.00	23.62	3,117.84
Crew	340.00	23.62	8,030.80
Baggage	0.00	41.33	0.00
	1,219.00	**18.75**	22,859.14

Two Bubbas, Half Fuel, No Baggage

	Weight (lbs)	Arm (in.)	Moment
Airplane	747.0	13.82	10,323.54
Fuel	66.0	23.62	1,558.92
Crew	400.0	23.62	9,448.00
Baggage	0.0	41.33	0.00
	1213.0	**17.58**	21,330.46

Engine Information

Model …….. Jabiru Generation 4 3300cc ser.# 33A 2933
HP ……120 @ 3300 rpm @ Sea Level
Bore / Stroke / Compression ratio ……..…….. 97.5mm/74mm/8:1
Engine Ramp Weight (incl. exhaust, carb, start motor, alt. & ignition syst …..178 lbs.
Firing Order ……..…...1-4-5-2-3-6
Fuel ……..….AVGAS or 90 Octane AKI (R+M/2) min. (10% Ethanol max)
(Refer to Jabiru Service Letter JSL 007-7 for full information)
Carburetor …… Bing Constant Velocity 94/40
Air Filter ……..…. K&N RA-0760
Fuel Pump……..Camshaft- driven diaphragm type
Magneto Spark Advance (fixed) …… 23 degrees BTDC
Ignition …….... Jabiru dual breakerless transistorized (battery independent)

Coil to flywheel gap ……..…. 0.01”
Sparkplugs ……. NGK D9EA / .022-.024” Gap
Alternator ……. Jabiru 12-pole perm. magnet (flywheel integral) 17amp continuous
Battery ……..… Odyssey Extreme ODS-AGM16L (PC680) VSLA
Voltage Regulator ……..…….. Kubota RP201-53710
Oil Filter ……..…… NAPA 1394 or equiv.
Oil Cooler ……..…… Setrab 50-610-7612
Oil ……. W100, W100Plus, 15W-50 multigrade complying with SAE-J-1899
Fixed grade recommended under normal operating conditions:

Ambient Air Temp	Mineral Grades	Ashless Dispersant Grades
Above 95F	SAE 60	SAE 60
59-96F	SAE 50	SAE 50
01-77F	SAE 40	SAE 40

Oil Sump Capacity ……..……..3.7 U.S. Quarts

Operating Limits (ground)

Idle Speed ……..……..…….800-850rpm
Oil Pressure @ idle ……..……..……11-58 psi, 44 psi optimal
Oil Temp ……..…… maximum 212 F

Operating Limits (in-flight)

Maximum / maximum continuous engine speed ……..……..…3300 rpm
Recommended cruise engine speed ……..……..……..… 2800 - 3000 rpm
Fuel pressure ……..……..…….. .75 - 5 psi
Oil Pressure ……...11 psi min @ idle , normal ops 31-58 psi, optimal 44 psi
Oil Temp ……..…….. 59F min., 244F max., continuous ops. 176-212F
Cylinder Head Temperature (CHT) …….392F max (climb), 356F max (cruise)
Cylinder Head Temperature (CHT) ……..... Maximum 5 minutes above 356F
Exhaust Gas Temperature (EGT) range (cruise) ……..…… 1112-1328F
Exhaust Gas Temperature (EGT) range (above 70% power) ……..…… 1112-1292F

(Refer to Jabiru doc. JEM0005-5 dated 30/05/2020 available from www.jabiru.net.au for full engine information)

Propeller

Sensenich ……..……..……W64ZK45 AF5190

Wheels - Tires

Matco ……..……..……6” E-series- PH-1A Z calipers
Carlisle ……..……15x6.00x6 NHS – 25 psi (30 psi max) inflation

Electrical System

(See battery/alternator/regulator info in Engine Information section above)

Aircraft electrics employ a Main Bus/E-bus (Endurance bus) architecture with power distributed via 3 fuse blocks. The forward and E-bus fuse blocks are located on a drop-down panel under the center of the instrument panel accessed by removing a hinge pin on the forward edge of the panel. Also located here is the GEA24 Engine monitor, security switch and other components. The rear fuse block is located above the main battery inside the rear fuselage along with the Master and Start contactors, autopilot servos, ACK E-04 ELT, GTX35 transponder, flap linear actuator and other components, accessible through the hatch on the fuselage bottom. An auxiliary full-current receptacle connected directly to the battery is located in the rear half of the baggage compartment floor.

Under normal operations, the entire system is powered from the battery via the Master contactor. Under alternator-out operations, the proper procedure is to confirm failure by noting a reduced voltage level as indicated by the GEA24 engine monitor and displayed on the GDU450 display. A reading of less than 12.5 volts when the engine is operating above approximately 1200 rpm indicates charging system failure. If this condition is noted, turn ON the E-bus switch located at the right end of the switch panel, THEN turn off the Master switch. This sequence assures uninterrupted power to devices powered by the E-bus. See electrical diagram for details. This feature is provided for extended endurance (reduced battery drain) in the event of an in-flight charging system failure- the Master contactor is a significant consumer of available battery capacity which under E-bus operation (Master OFF) is no longer engaged. Remaining power-consuming items should be carefully utilized to preserve remaining battery capacity.

Items powered by E-bus:

1- UMA Tachometer and Oil Temp gauges located in center panel
2- GEA24 Engine Monitor
3- Avionics (G3X system excluding autopilot servos)
4- Wingtip strobe lights
5- Center panel warning lights
6- Comm radio

Items NOT powered by E-bus:

1- Front 12V accessory receptacle behind right panel door
2- Engine Starter motor
3- Wingtip Navigation lights
4- Horn
5- Landing Lights
6- Elevator trim
7- Dome lights
8- ELT continuous power (main lithium battery charging)
9- Flaps (flaperon angle adjust)

Note that if operation of the items listed above is required, switching the Master back on will restore function but at a significantly higher current draw (Master contactor now ON). An example would be a need to adjust elevator trim- turn on Master, adjust trim, and switch Master back off. Also note that transmitting on Comm will draw up to 3 amps during transmission- transmit only as necessary while operating on E-bus alone.

The 12V receptacle located on the starboard side of the baggage compartment is connected directly to the battery at all times and can be used for battery trickle-charging or operating items such as phone chargers etc. without Master or E-bus engaged.

Control System

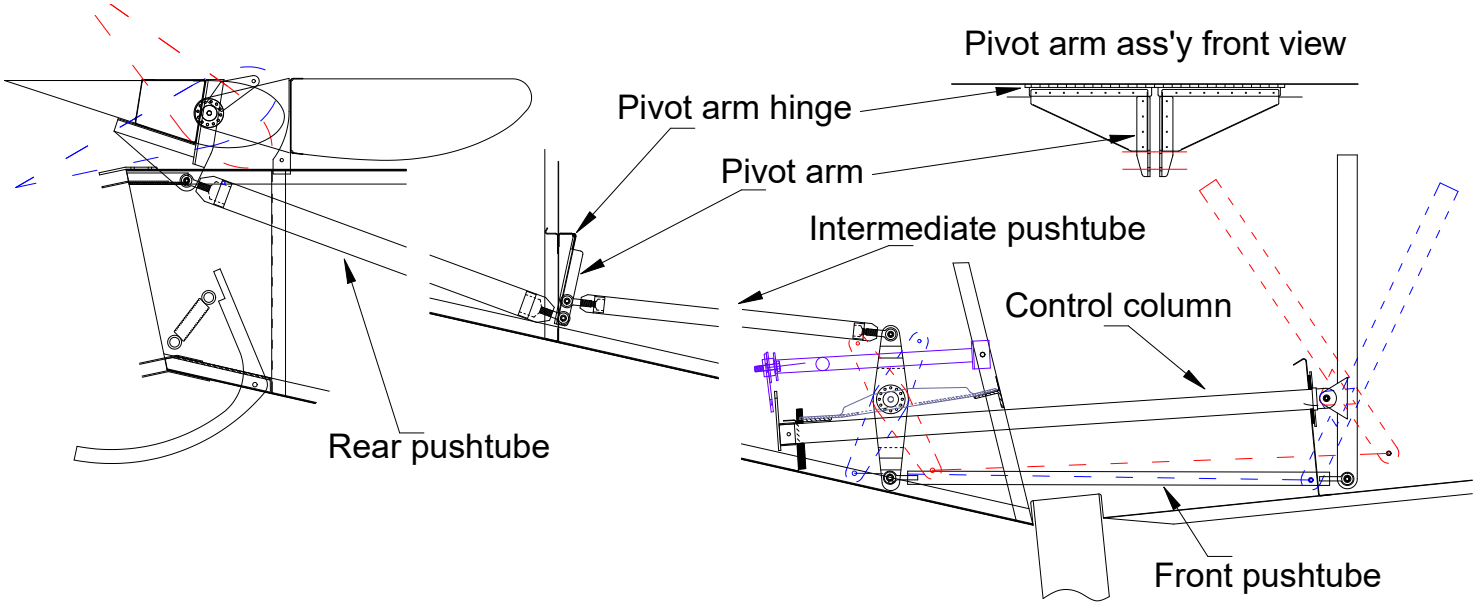
Elixir features a control system significantly different from the original design for a variety of reasons. These include the ability to provide a significantly larger baggage compartment, precise elevator operation utilizing push/pull tubes instead of cables, precise control of flaperon position (“flap” function), improved structural and load geometry for many components as well as aesthetic considerations. These changes in no way are a critique of the original design, but merely modifications desired by the builder. All components have exhibited excellent functionality and reliability through extensive initial testing/inspection and as of May 2022 more than 200 hours of flight operation.

Elevator

The original design employs a front pushtube connected to the bottom of the center-mounted control stick and runs to a bellcrank mounted to the rear of the control column. Cables connected to the top and bottom of this bellcrank cross over mid-fuselage and connect to horns located on the elevator top and bottom.

Elixir utilizes a modified original control column with the front pushtube operating a bellcrank mounted to the fuselage structure with a double-row flanged bearing. An intermediate pushtube connects from the top of this bellcrank to a pivot arm located mid-fuselage. A third rear pushtube is connected at an adjacent location on the pivot arm and aft to a horn on the elevator bottom. The elevator pivots on double-row flanged bearings at the center and on each end.

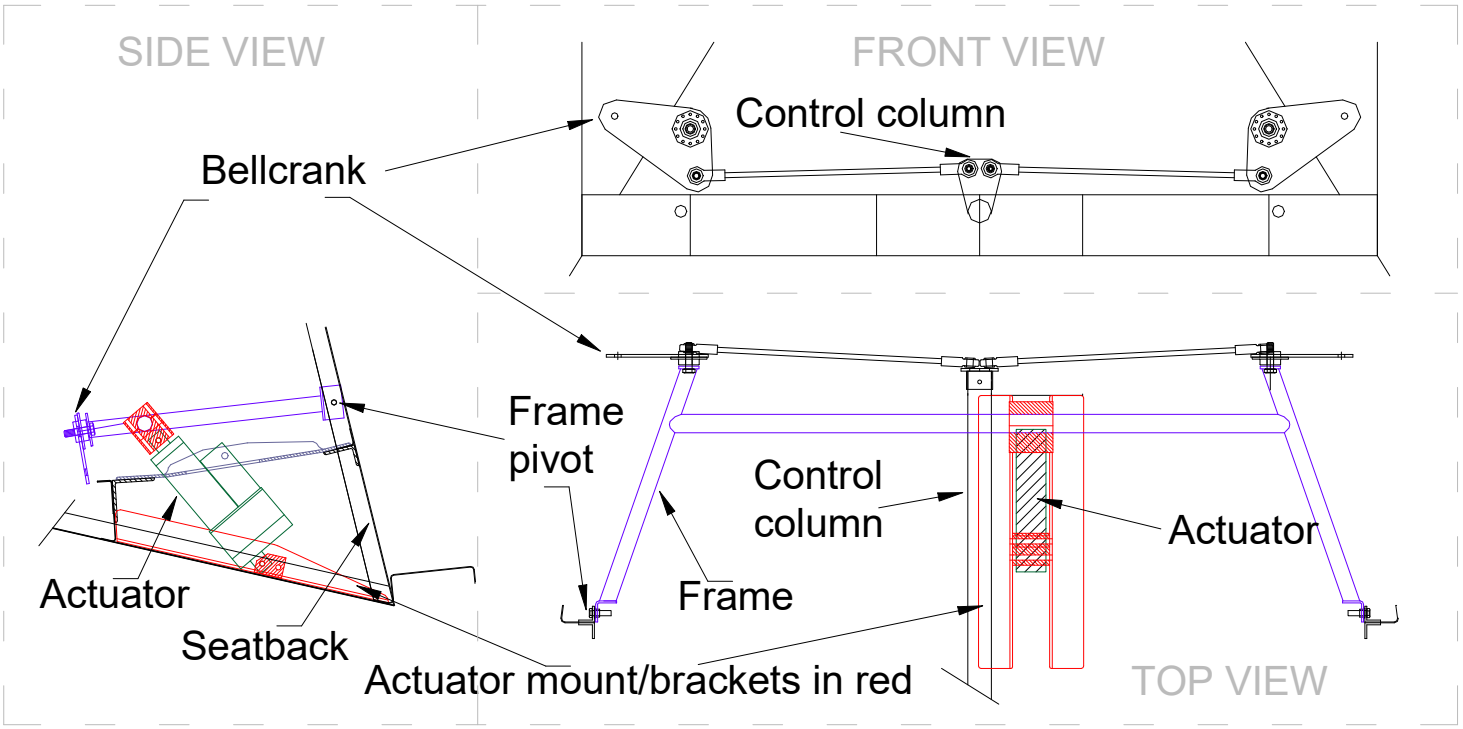
The front and rear bearing blocks (pivot bushings) on the control column are modified from the original to eliminate metal-to-metal contact. Up/down positive control stops are provided on the top and bottom of the elevator.



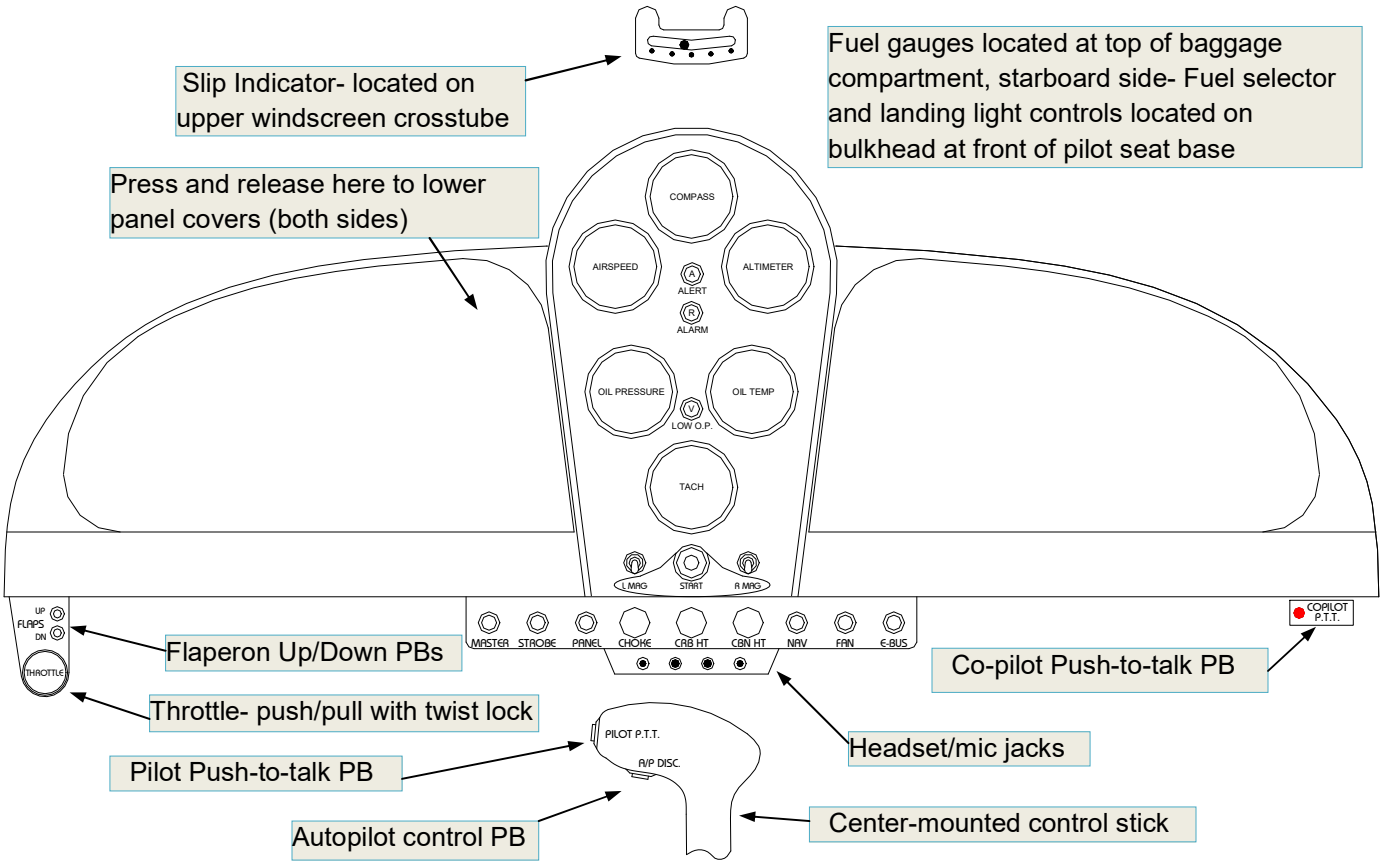
Flaperons

The original design uses a system of bellcranks attached at the rear of the control column, a welded-tube mixer frame aft of the seat and pushrods connected to the flaperons through slots in the side skin of the fuselage. The system in *Elixir* is designed for three objectives (1) increase baggage capacity (2) eliminate the open slots in the skin which are difficult to seal from air/water intrusion and (3) improve flaperon "flap" positioning.

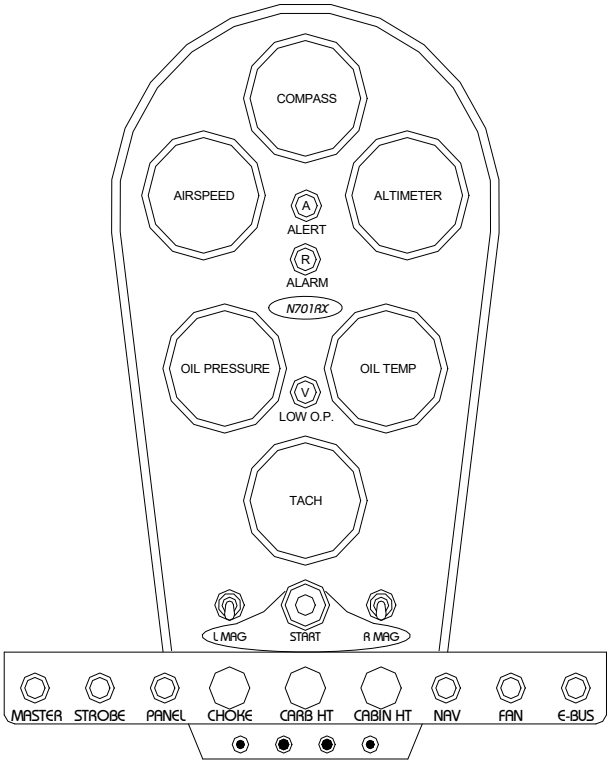
The modified system is functionally similar to the one used in the factory Zenith 750 models but is significantly different. In *Elixir*, a horn welded to the rear of the control column connects via pushrods to bellcranks on each side of the fuselage. These bellcranks are mounted with double-row flanged bearings to a movable frame that pivots on bushings just aft of the seats and is positioned by an electrically operated linear actuator to raise/lower the bellcranks providing "flap" function. Pushrods also mounted to these bellcranks extend up to arms connected to the flaperons. These arms are inside the fuselage and bolt to the flaperons through a sealed hole in the side skins. All eight flaperon pivots at the wing rear spar are modified to use low-friction double-flanged bushings on the attach fingers. These are located between double parallel brackets on the flaperons to eliminate side-loading of the attach bolts.



Instrument Panel / Controls Overview, Basic Panel



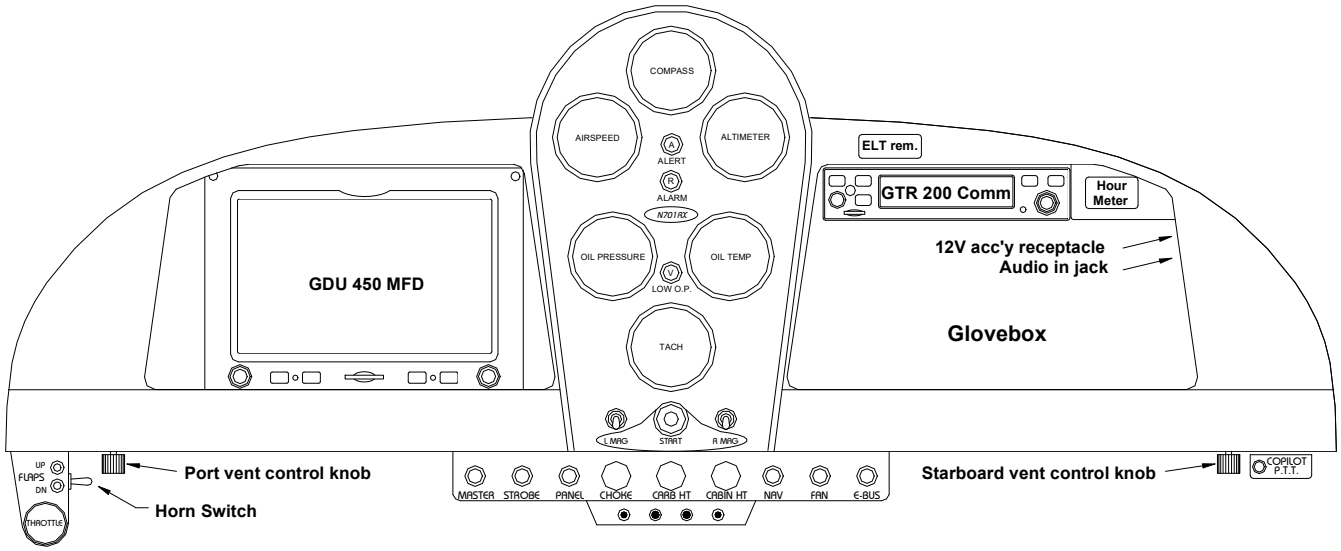
Center Panel Detail



Notes:

- All instruments operate independently of G3X with separate power supply for oil temp and tachometer
- Oil pressure is direct-connect mechanical gauge with external vent
- Start button operates regardless of mag switch position (does NOT operated on e-bus)
- Fan switch is spare (not currently used)
- E-bus is for alternator-out ops- refer to electrical diagram & description for more information
- Headset/microphone jacks are: Pilot on left & Co-pilot on right- headsets are stereo with intercom internal to radio

Panel - Side Covers Open

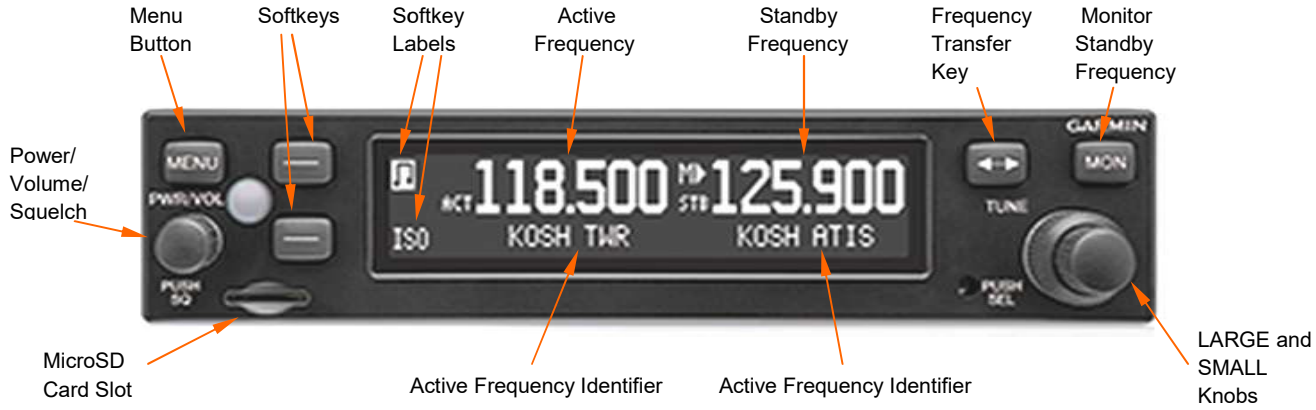


Garmin G3X GDU450 Multi Function Display (EFIS)

(Refer to Garmin User Manuals for detailed functions and operation)

G3X Sample Screenshots

GTR200 Comm Radio Overview



(Refer to Garmin User Manuals for detailed functions and operation)

PREFLIGHT INSPECTION

CABIN

a) Documentation present (in glovebox, rear baggage wall)
b) Aeronautical Charts / databases current and as required
c) Check contents and security of baggage area
d) Check Mag switches off
e) Master ON
f) Check fuel levels on gauges
g) Master OFF
h) Carb Heat verify COLD

LEFT WING

a) Check fuel quantity with stick- double check fuel cap security
b) Pitot- remove cover & inspect for blockage
c) Check BS Generators/struts/fairings for security
d) Grab wingtip and shake to check security
e) Flaperon- inspect pivots & freedom of movement
f) Check rear of left wheel pant- grab and manipulate
g) Sump left fuel tank if desired

EMPENNAGE

a) Shake left horizontal stab to ensure mounting security
b) Remove elevator pin- rotate elevator- inspect left attach bolt
c) Inspect trim tab and servo rod
d) Inspect left rudder cable and attachment
e) Manipulate rudder to check bearings and freedom of movement
f) Inspect tail skid
g) Raise elevator and check rear pushrod attach
h) Inspect right rudder cable and attachment
i) Shake right horizontal stab to ensure mounting security
j) Observe top of fuselage for anomalies

RIGHT WING & OIL LEVEL CHECK

a) Sump right fuel tank if desired
b) Check rear of right wheel pant- grab and manipulate
c) Flaperon- inspect pivots & freedom of movement
d) Grab wingtip and shake to check security
e) Check struts/fairings/BS generators for security
f) Check fuel quantity with stick- double check fuel cap
g) Stow pitot cover/elevator pin/fuel stick in glove compartment
h) Pull right cowl door pin- secure cowl door
i) Check oil level & re-secure dip stick
j) Examine engine compartment for leaks, unusual odors
k) Replace cowl door pin
l) Set right vent as desired- check right door is fully latched

NOSE

a) Step back from aircraft and visually check tires for inflation
b) Check rear of nose pant for security- grab and manipulate
c) Inspect cooling inlets, carb air inlet & plenums
d) Inspect oil cooler for obstructions and leakage
e) Check propeller and spinner for condition and security
f) Inspect windscreen- clean if required
g) Position pilot seatbelt on door bracket- adjust air vent as needed
h) Check left cowl door pin for full insertion
i) Set fuel selector to desired position
j) Inspect rudder pedals & brakes for obstructions or leaks
k) Arrange seat belts, headsets as needed

Perform one-lap walkaround at a distance to verify general condition of airplane prior to boarding

ENGINE START

a) Preflight Inspection – COMPLETE
b) Brief passenger (if equipped- check for “bag” if desired!)
c) Chocks
d) Pitot Cover
e) Elevator Pin (check full stick range of motion)
f) Seat belts
g) Doors
h) Headsets, hats, glasses
i) Fuel select
j) Throttle OUT/locked
k) Choke (if needed- check throttle FULLY closed if using choke)
l) Master ON
m) Strobes ON
n) Brakes ON
o) Mags ON
p) Start (1-2-3 Count) –adjust throttle/close choke
q) Check Oil Pressure, tach
r) Panel ON
s) Radio ON
t) Check XPNDR frequency
u) Monitor AWOS/Unicom- set baro on PFD, adjust altimeter

TAXI

a) Monitor Unicom & announce as appropriate
b) Set lights for operation
c) Observe wind sock
d) Enter waypoint if desired
e) Monitor traffic- taxi to runway

RUNUP

a) CHT 200+, EGT 1000+
b) Oil temp 90+
c) Oil press 32-60
d) 1800 rpm, oil pressure steady, EGTs rising
e) Left mag check
f) Right mag check
g) Carb heat- check EGTs drop
h) Check doors
i) Check flaperon position
j) Set trim as desired
k) Re-check fuel selector
l) Verify departure frequency and XPNDR code
m) Verify runway in use
n) Re-check windsock
o) Re-check passenger (if equipped)
p) Re-check for full stick movement
q) Announce and depart

DEPARTURE

If you have made it this far, what happens next is entirely your responsibility. DON'T EVER FORGET:

"It is better to be on the ground wishing you were up there than to be up there wishing you were on the ground".

In other words, use this machine carefully, responsibly, respectfully and intelligently, and you will tell amazing stories to your grandchildren.

ENJOY!

The Possum Works

ATC light signals

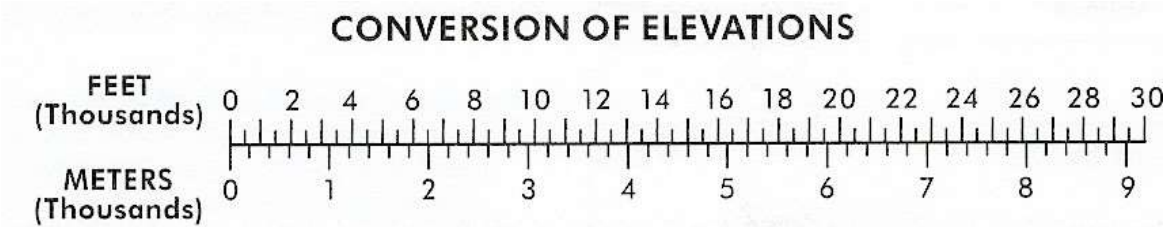
Color and type of signal	Meaning with respect to aircraft on the surface	Meaning with respect to aircraft in flight
Steady **green**	Cleared for takeoff	Cleared to land
Flashing **green**	Cleared to taxi	Return for landing
Steady **red**	Stop	Give way to other aircraft and continue circling.
Flashing **red**	Taxi clear of runway in use	Airport unsafe—do not use
Flashing **white**	Return to starting point on airport	N/A
Alternating **red** and **green**	Exercise extreme caution	Exercise extreme caution

Compass Headings, VFR under 18,000ft

Course	Altitude
0 – 179 degrees	Odd thousand +500
180 – 360 degrees	Even thousand + 500

Special Transponder Codes

0000 – General Purpose code subject to regional agreement
1200 – Civil VFR, General Aviation code
7500 – Unlawful Interference code (Hijack)
7600 – Radio Communications Failure code
7700 – Emergency code
7777 – Military Intercept code (NEVER USE!)
(Code 2100 is a test code for servicing unit)



Conversion table: Temperature

C	F	C	F	C	F	C	F	C	F	C	F
-40	*-40*	**10**	*50*	**60**	*140*	**110**	*230*	**160**	*320*	**210**	*410*
-34	*-30*	**16**	*60*	**66**	*150*	**116**	*240*	**166**	*330*	**216**	*420*
-29	*-20*	**21**	*70*	**71**	*160*	**121**	*250*	**171**	*340*	**221**	*430*
-23	*-10*	**27**	*80*	**77**	*170*	**127**	*260*	**177**	*350*	**227**	*440*
-18	*0*	**32**	*90*	**82**	*180*	**132**	*270*	**182**	*360*	**232**	*450*
-12	*10*	**38**	*100*	**88**	*190*	**138**	*280*	**188**	*370*	**238**	*460*
-7	*20*	**43**	*110*	**93**	*200*	**143**	*290*	**193**	*380*	**243**	*470*
-1	*30*	**49**	*120*	**99**	*210*	**149**	*300*	**199**	*390*	**249**	*480*
4	*40*	**54**	*130*	**104**	*220*	**154**	*310*	**204**	*400*	**254**	*490*

Conversion Table: MPH/Knots

MPH	*Knots*	MPH	*Knots*	MPH	*Knots*	MPH	*Knots*	MPH	*Knots*
50	*43*	**70**	*60.8*	**90**	*78.2*	**110**	*95.6*	**130**	*113.0*
51	*44*	**71**	*61.7*	**91**	*79.1*	**111**	*96.5*	**131**	*113.8*
52	*45*	**72**	*62.6*	**92**	*79.9*	**112**	*97.3*	**132**	*114.7*
53	*46*	**73**	*63.4*	**93**	*80.8*	**113**	*98.2*	**133**	*115.6*
54	*47*	**74**	*64.3*	**94**	*81.7*	**114**	*99.1*	**134**	*116.4*
55	*48*	**75**	*65.2*	**95**	*82.6*	**115**	*99.9*	**135**	*117.3*
56	*49*	**76**	*66.0*	**96**	*83.4*	**116**	*100.8*	**136**	*118.2*
57	*50*	**77**	*66.9*	**97**	*84.3*	**117**	*101.7*	**137**	*119.0*
58	*50*	**78**	*67.8*	**98**	*85.2*	**118**	*102.5*	**138**	*119.9*
59	*51*	**79**	*68.6*	**99**	*86.0*	**119**	*103.4*	**139**	*120.8*
60	*52*	**80**	*69.5*	**100**	*86.9*	**120**	*104.3*	**140**	*121.7*
61	*53*	**81**	*70.4*	**101**	*87.8*	**121**	*105.1*	**141**	*122.5*
62	*54*	**82**	*71.3*	**102**	*88.6*	**122**	*106.0*	**142**	*123.4*
63	*55*	**83**	*72.1*	**103**	*89.5*	**123**	*106.9*	**143**	*124.3*
64	*56*	**84**	*73.0*	**104**	*90.4*	**124**	*107.8*	**144**	*125.1*
65	*56*	**85**	*73.9*	**105**	*91.2*	**125**	*108.6*	**145**	*126.0*
66	*57*	**86**	*74.7*	**106**	*92.1*	**126**	*109.5*	**146**	*126.9*
67	*58*	**87**	*75.6*	**107**	*93.0*	**127**	*110.4*	**147**	*127.7*
68	*59*	**88**	*76.5*	**108**	*93.8*	**128**	*111.2*	**148**	*128.6*
69	*60*	**89**	*77.3*	**109**	*94.7*	**129**	*112.1*	**149**	*129.5*

Standard Torque Tables

Nuts & Bolts (AC 43.13-1B) / (inch-pounds)	Std. Aircraft Handbook	
Fine Thread	MS20365 & AN310 nuts	MS20364 & AN320
8-36	12-15	7-9
10-32	20-25	12-15
1/4-28	50-70	30-40
5/16-24	100-140	60-85
3/8-24	160-190	95-110
7/16-20	450-500	270-300
Coarse Thread		
8-32	12-15	7-9
10-24	20-25	12-15
1/4-20	40-50	25-30
5/16-18	80-90	48-55
3/8-16	160-185	95-100
7/16-14	235-255	140-155

AN818 flared fitting (AC 43.13-1B)

Fitting dash number size	Tubing OD	Al tubing	Steel tubing
-2	1/8	20-30	75-85
-3	3/16	25-35	95-105
-4	1/4	50-65	135-150
-5	5/16	70-90	170-200
-6	3/8	110-130	270-300
-8	1/2	230-260	450-500

Hoses (Sacramento Sky Ranch)

Fitting dash number size	Tubing OD	Thread	Inch-lbs
-3	3/16	3/8-24	25-35
-4	1/4	7/16-20	50-65
-5	5/16	1/2-20	70-90
-6	3/8	9/16-18	110-130
-8	1/2	3/4-16	230-260

Pipe thread engine plugs (Lycoming SSP1776)

NPT	Steel
1/8-27	40-44
1/4-18	85-94
3/8-18	110-121
1/2-14	160-176

Wire Sizing (AC 43.13-1B)

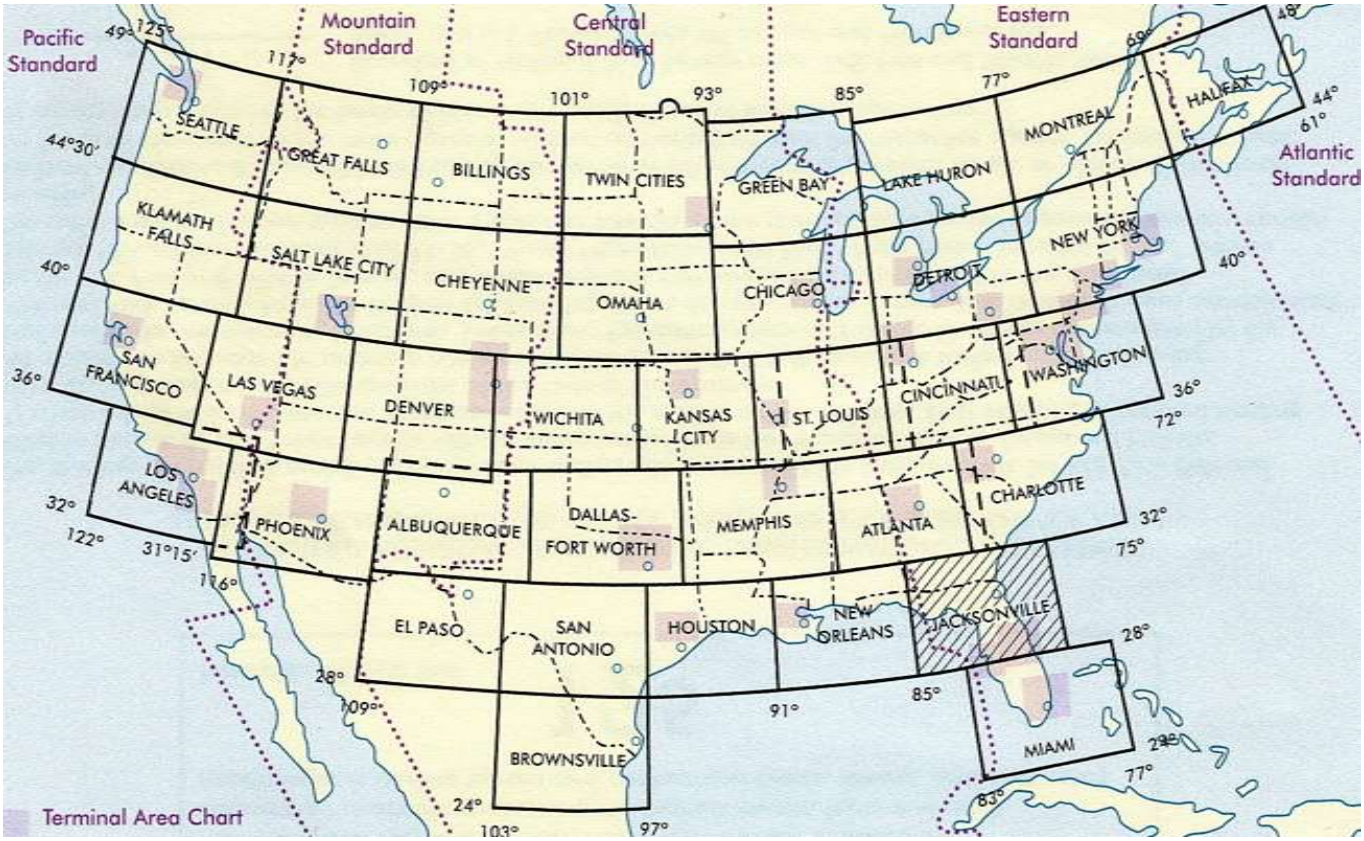
TABLE 11-9. Current carrying capacity and resistance of copper wire.

Wire Size	Continuous duty current (amps)-Wires in bundles, groups, harnesses, or conduits. (See Note #1) Wire Conductor Temperature Rating			Max. resistance ohms/1000ft@20 °C tin plated conductor (See Note #2)	Nominal conductor area - circ.mils
	105 °C	150 °C	200 °C		
24	2.5	4	5	28.40	475
22	3	5	6	16.20	755
20	4	7	9	9.88	1,216
18	6	9	12	6.23	1,900
16	7	11	14	4.81	2,426
14	10	14	18	3.06	3,831
12	13	19	25	2.02	5,874
10	17	26	32	1.26	9,354
8	38	57	71	0.70	16,983
6	50	76	97	0.44	26,818
4	68	103	133	0.28	42,615
2	95	141	179	0.18	66,500
1	113	166	210	0.15	81,700
0	128	192	243	0.12	104,500
00	147	222	285	0.09	133,000
000	172	262	335	0.07	166,500
0000	204	310	395	0.06	210,900

Note #1: Rating is for 70°C ambient, 33 or more wires in the bundle for sizes 24 through 10, and 9 wires for size 8 and larger, with no more than 20 percent of harness current carrying capacity being used, at an operating altitude of 60,000 feet. For rating of wires under other conditions or configurations see paragraph 11-69.

Note #2: For resistance of silver or nickel-plated conductors see wire specifications.

VFR Sectional Chart Guide



Decimal Equivalents Table / Drill Size

DRILL SIZE	DEC.	DRILL SIZE	DEC.	DRILL SIZE	DEC.	DRILL SIZE	DEC.
0.1mm	.0039	41	.0960	**15/64**	**.2344**	**33/64**	**.5156**
0.2mm	.0079	40	.0980	6mm	.2362	**17/32**	**.5313**
0.3mm	.0118	2.5mm	.0984	B	.2380	13.5mm	.5315
80	.0135	39	.0995	C	.2420	**35/64**	**.5469**
79	.0145	38	.1015	D	.2460	14mm	.5512
1/64	**.0156**	37	.1040	**1/4 & E**	**.2500**	**9/16**	**.5625**
0.4mm	.0157	36	.1065	6.5mm	.2559	14.5mm	.5709
78	.0160	**7/64**	**.1094**	F	.2570	**37/64**	**.5781**
77	.0180	35	.1100	G	.2610	15mm	.5906
0.5mm	.0197	34	.1110	**17/64**	**.2656**	**19/32**	**.5938**
76	.0200	33	.1130	H	.2660	**39/64**	**.6094**
75	.0210	32	.1160	I	.2720	15.5mm	.6102
74	.0225	3mm	.1181	7mm	.2756	**5/8**	**.6250**
0.6mm	.0236	31	.1200	J	.2770	16mm	.6299
73	.0240	**1/8**	**.1250**	K	.2810	**41/64**	**.6406**
72	.0250	30	.1285	**9/32**	**.2812**	16.5mm	.6496
71	.0260	29	.1360	L	.2900	**21/32**	**.6562**
0.7mm	.0276	3.5mm	.1378	M	.2950	17mm	.6693
70	.0280	28	.1405	7.5mm	.2953	**43/64**	**.6719**
69	.0292	**9/64**	**.1406**	**19/64**	**.2969**	**11/16**	**.6875**
68	.0310	27	.1440	N	.3020	17.5mm	.6890
1/32	**.0312**	26	.1470	**5/16**	**.3125**	**45/64**	**.7031**
0.8mm	.0315	25	.1495	8mm	.3150	18mm	.7087
67	.0320	24	.1520	O	.3160	**23/32**	**.7188**
66	.0330	23	.1540	P	.3230	18.5mm	.7283
65	.0350	**5/32**	**.1562**	**21/64**	**.3281**	**47/64**	**.7344**
0.9mm	.0354	22	.1570	Q	.3320	19mm	.7480
64	.0360	4mm	.1575	8.5mm	.3346	**3/4**	**.7500**
63	.0370	21	.1590	R	.3390	**49/64**	**.7656**
62	.0380	20	.1610	**11/32**	**.3438**	19.5mm	.7677
61	.0390	19	.1660	S	.3480	**25/32**	**.7812**
1mm	.0394	18	.1695	9mm	.3543	20mm	.7874
60	.0400	**11/64**	**.1719**	T	.3580	**51/64**	**.7969**
59	.0410	17	.1730	**23/64**	**.3594**	20.5mm	.8071
58	.0420	16	.1770	U	.3680	**13/16**	**.8125**
57	.0430	4.5mm	.1772	9.5mm	.3740	21mm	.8268
56	.0465	15	.1800	**3/8**	**.3750**	**53/64**	**.8281**
3/64	**.0469**	14	.1820	V	.3770	**27/32**	**.8438**
55	.0520	13	.1850	W	.3860	21.5mm	.8465
54	.0550	**3/16**	**.1875**	**25/64**	**.3906**	**55/64**	**.8594**
1.5mm	.0591	12	.1890	10mm	.3937	22mm	.8661
53	.0595	11	.1910	X	.3970	**7/8**	**.8750**
1/16	**.0625**	10	.1935	Y	.4040	22.5mm	.8858
52	.0635	9	.1960	**13/32**	**.4062**	**57/64**	**.8906**
51	.0670	5mm	.1969	Z	.4130	23mm	.9055
50	.0700	8	.1990	10.5mm	.4134	**29/32**	**.9062**
49	.0730	7	.2010	**27/64**	**.4219**	**59/64**	**.9219**
48	.0760	**13/64**	**.2031**	11mm	.4331	23.5mm	.9252
5/64	**.0781**	6	.2040	**7/16**	**.4375**	**15/16**	**.9375**
47	.0785	5	.2055	11.5mm	.4528	24mm	.9449
2mm	.0787	4	.2090	**29/64**	**.4531**	**61/64**	**.9531**
46	.0810	3	.2130	**15/32**	**.4688**	24.5mm	.9646
45	.0820	5.5mm	.2165	12mm	.4724	**31/32**	**.9688**
44	.0860	**7/32**	**.2188**	**31/64**	**.4844**	25mm	.9843
43	.0890	2	.2210	12.5mm	.4921	**63/64**	**.9844**
42	.0935	1	.2280	**1/2**	**.5000**	**1**	**1.000**
3/32	**.0938**	A	.2340	13mm	.5118	–	–

…from the walls of The PossumWorks:

“Any idiot can design an airplane, but it takes a genius to design an airplane any idiot can build.”

James “Dutch” Kindelberger
North American Aviation engineer, President, CEO 1935-1960

“Five percent of the people think. Ten percent of the people think they think. Eighty-five percent of the people would rather die than think.”

Thomas A. Edison

“The difference between stupidity and genius is that genius has its limits.”

Albert Einstein

“Am I a test pilot? Every flight is a test”

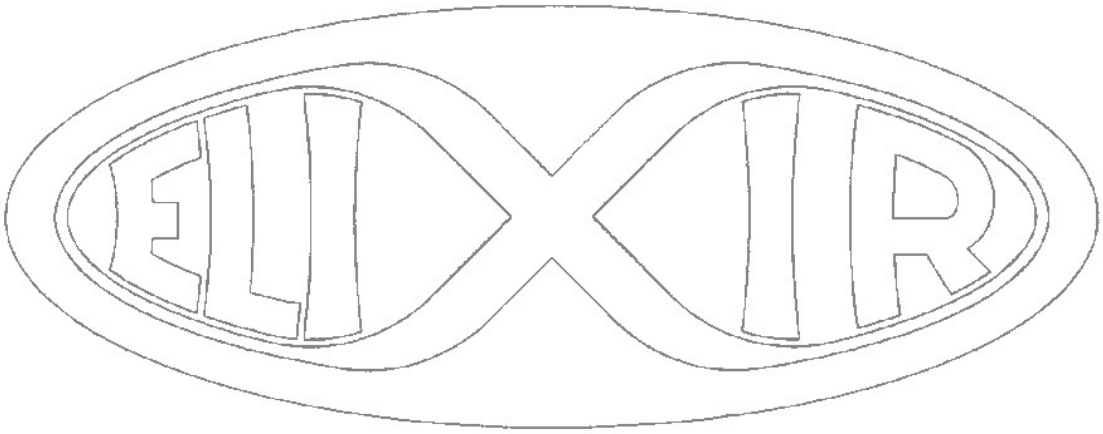
Possum

“I’m impatient with stupidity”

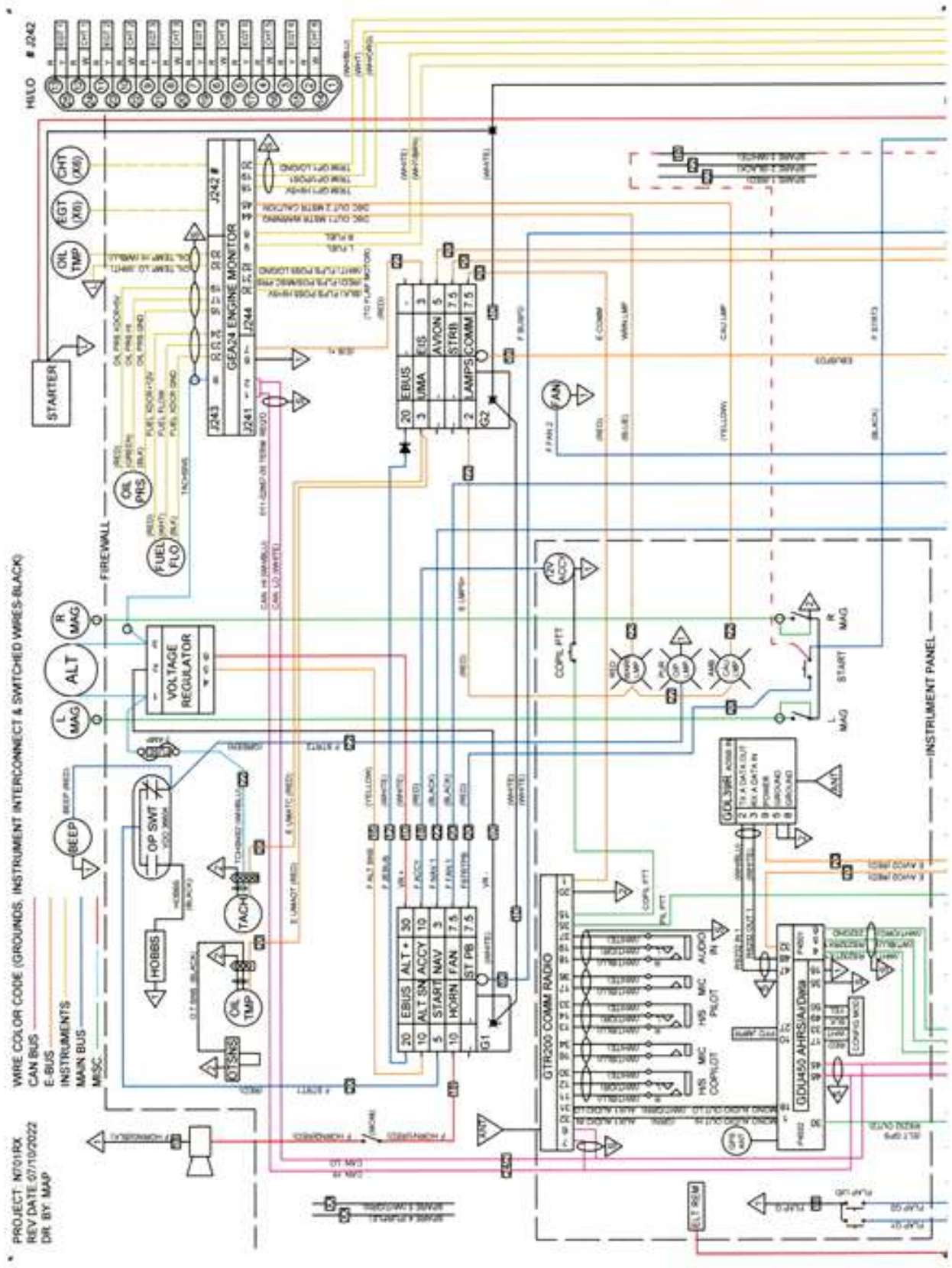
Klaatu (from The Day the Earth Stood Still, 1951)

“Rules have all the appearances of good intention but in fact, they tend to relieve rule-writers from having to be teachers and rule-followers from having to understand real risks. I prefer to understand.

Bob Nuckolls



Electrical System Drawing, Upper half



Electrical System Drawing, Lower half