INTEGRA EFIS&EMS TL-6660 CONFIGURATION MANUAL

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RECORD OF REVISION

Revision	Revision Date	Description	ECO#	Insertion date	By
PrA	14.04.2013	Initial version			Hovorka

⚡ **WARNING:** If setup or calibration data is inadvertently or improperly changed, there could be inaccurate readings that may lead to improper operation of the aircraft or engine. This could result in engine damage and/or an emergency situation.

⚠ **CAUTION:** Use the INTEGRA at your own risk. To reduce the risk of unsafe operation, carefully review and understand all aspects of this Configuration Manual and the Flight Manual Supplement, and thoroughly practice basic operation prior to actual use. When in actual use, carefully compare indications from the INTEGRA to all available navigation sources, including the information from other NAVAIDS, visual sightings, charts, etc. For safety, always resolve any discrepancies before continuing navigation.

ⓘ **NOTE:** It is the pilot's responsibility for initial missed approach guidance in accordance with published procedure. The unit may not provide correct guidance until established on a defined leg.

ⓘ **NOTE:** GPS level of service annunciations are not applicable to the external CDI (or HSI) when VLOC is active.

TL elektronic is fully committed to your satisfaction as a customer. If you have any questions regarding the INTEGRA, please contact our customer service department.

EFIS Setup Menu

ⓘ **NOTE:** **This manual assumes that you have read User Manual and you've mastered operation of the Integra.**

In this menu you can set up many parameters mainly for flight settings.

Access to this menu:

Press the **right-hand** knob, select Enter Setup in menu. When prompt "Are you sure you want to enter to setup" appears, press "Yes". There in Setup mode switch screen to EFIS. Press the **right-hand** knob again, you should see Menu EFIS Setup now.

- **Menu EFIS Setup**
  - *Units*
  - *Configuration & Sensors*
  - *Range and Limits*
  - *Other Settings & Calibration*
  - *External Devices*
  - *EFIS Data Sharing*
  - *Autopilot Setup*
  - *Language*
  - *Demo Mode*
  - *Exit Menu*

EFIS UNITS

You can choose between metric and imperial units or you can define your own unit settings.

- **Menu UNITS**
  - *Metric*
  - *Imperial (UK)*
  - *Imperial (US)*
  - *Custom*

Metric	INTEGRA display units in metric system	km/h	m	mBar	km	m/s
Imperial (UK)	INTEGRA display units in metric and imperial system	kts	ft	mBar	nm	ft/min
Imperial (US)	INTEGRA display units in imperial system	kts	ft	inHg	nm	ft/min
Custom	you can choose individual units for each measure					

- **Menu Custom**
  - *Airspeed*
  - *Altitude*
  - *Baro pressure*
  - *Distance*
  - *VSI*

You can choose between metric and imperial units or you can define your own unit settings.
You can try changing some units. Take note EFIS screen is changed by how you modified values to metric or imperial.

Available units for measured quantities Quantities	Selectable units		
Digital speed indicator	km/h	kts	mph
Airspeed strip	km/h	kts	mph
Baro pressure	inHg	mBar	
Altitude strip	feet	metre	
Digital altitude indicator	feet	metre	
Vertical speed indicator	ft/min	kts	m/s

EFIS Configuration & Sensors

This menu contains settings for sensors of temperature.
- **Menu** Configuration & Sensors
  - *IAT*
  - *OAT*
  - *AUXT*

IAT   Internal Air Temperature
OAT   Outside Air Temperature
AUXT   Auxiliary Temperature

After you choose option for setting (IAT, OAT or AUXT) from the menu, you'll get list of available sensors. You can assign one of them to selected temperature or disable displaying of selected temperature by option Not Connected.

EFIS RANGE and LIMITS

In this menu you can set airspeed values
- **Menu Range and Limits**
  - *Airspeed*
    - *Vne – never exceed*
    - *Vno – maximum structural cruising*
    - *Vfe – maximum flap extended*
    - *Vs – stall speed*
    - *Vso – minimum flight speed in landing configuration*

Airspeed limits	kts
Vne - Never exceed	210
Vno - Maximum structural cruising	170
Vfe - Maximum flap extended	70
Vs - Stall speed	50
Vso - Min. speed in landing config.	30

ⓘ **NOTE:**   The limits of one each Vne, Vno, Vfe,Vs or Vso can´t overlap each other. If you try decrease for example Vne and it is impossible so you need to decrease Vno at first and than you can set Vne to lower value.

Vne   Never exceed speed.
Change the underlined by rotating the right-hand knob.
After you get required number, just press the knob and the underscore skips on to the next number. Press "Set" to enter the value. Press "Cancel" to skip previous menu.
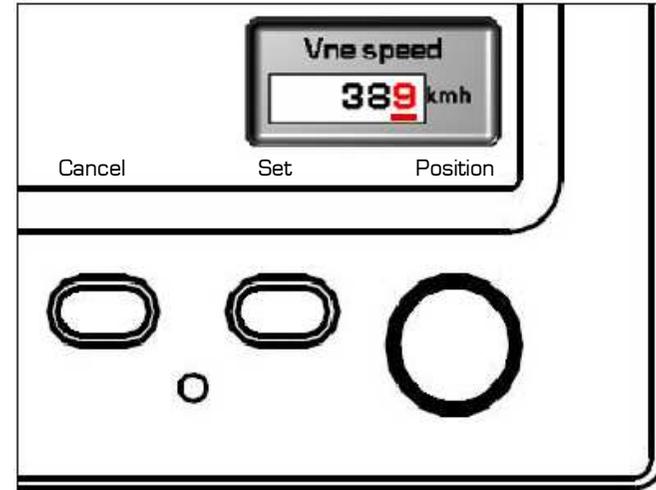
Vno   Maximum structural cruising speed or maximum speed for normal operations.
Change the underlined by rotating the right-hand knob.
After you get required number, just press the knob and the underscore skips on to the next number. Press "Set" to enter the value. Press "Cancel" to skip previous menu.
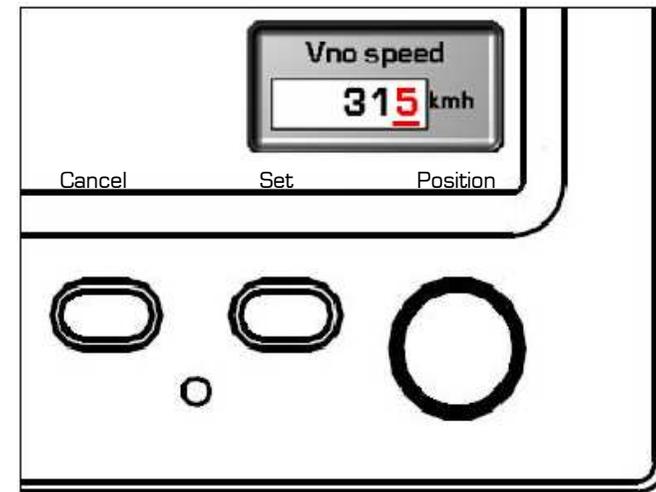
Vfe   Maximum flaps extended speed.
Change the underlined by rotating the right-hand knob.
After you get required number, just press the knob and the underscore skips on to the next number. Press "Set" to enter the value. Press "Cancel" to skip previous menu.

Vs   Stall speed or minimum steady flight speed in which the aircraft is still controllable.
Change the underlined by rotating the right-hand knob.
After you get required number, just press the knob and the underscore skips on to the next number. Press "Set" to enter the value. Press "Cancel" to skip previous menu.
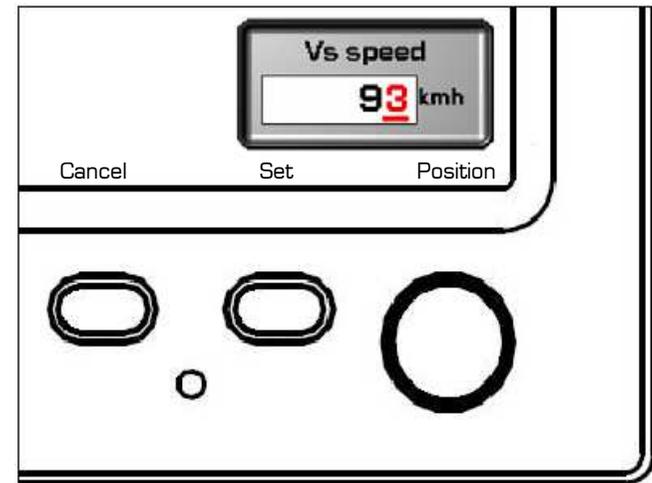
Vso Minimum flight speed in landing configuration.
Change the underlined by rotating the right-hand knob.
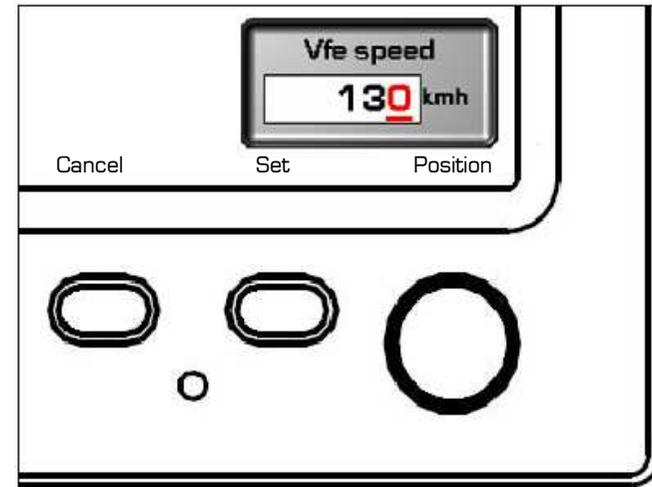After you get required number, just press the knob and the underscore skips on to the next number. Press "Set" to enter the value. Press "Cancel" to skip previous menu.
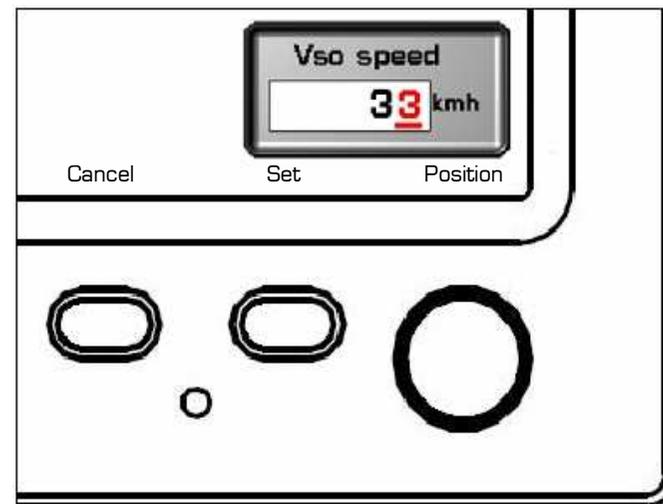
EFIS OTHER SETTINGS & CALIBRATION

This menu allows you to modify settings and calibrations

- **Menu OTHER SETTINGS & CALIBRATION**
  - *Aircraft Identification*
  - *Time*
  - *Date*
  - *Pitch Setting*
  - *Backlight control*
  - *AUX Input/Output*
  - *Main Switch Control*

Aircraft identification

The Aircraft ID Box has Letters A-Z, numbers 0-9 blanks and - symbol. The ID can also be shortened to fewer than 8 digits.

The underlined letter you can change just rotate with the right-hand knob. If you get required letter, just press the knob and the underscore will skip on to the next letter. Then press "Set" to enter the new value. Press "Cancel" to skip previous menu.
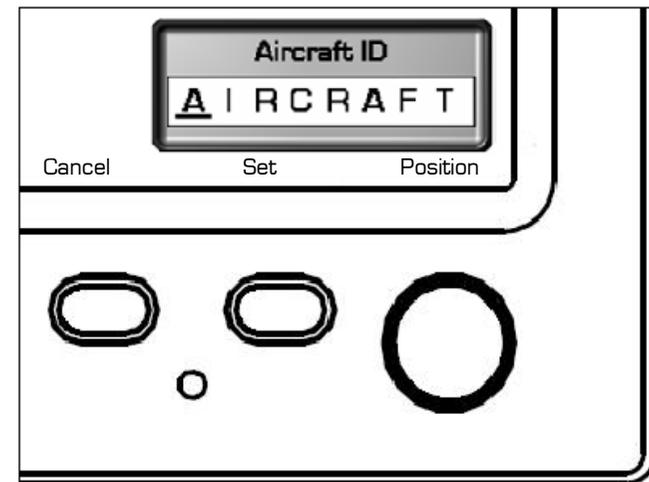
Time

You can set the time. The underlined numbers you can change just rotate with the right-hand knob. If you get required time, just press the knob and the underscore will skip on to the next number. Then press "Set" to enter the new value. Press "Cancel" to skip previous menu.
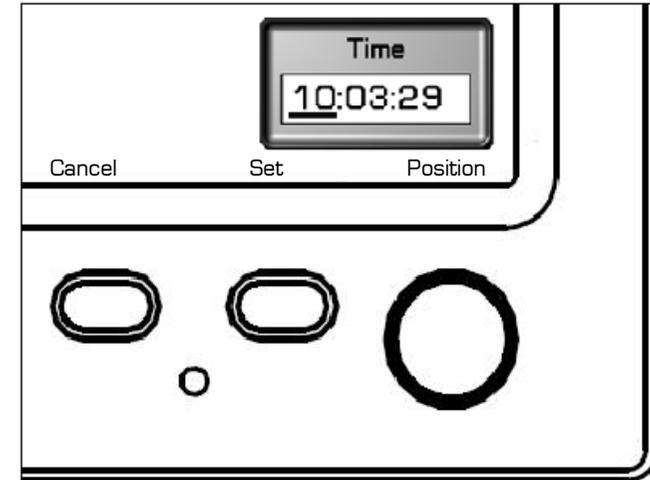
ⓘ **NOTE:**   It is necessary to set UTC (Zulu time) on the INTEGRA Clock.

Date

You can set the date. The underlined numbers you can change just rotate with the right-hand knob. If you get required time, just press the knob and the underscore will skip on to the next number. Then press "Set" to enter the date. Please insert date in the form of DD/MM/YY or day/month/year. Press "Cancel" to skip previous menu.
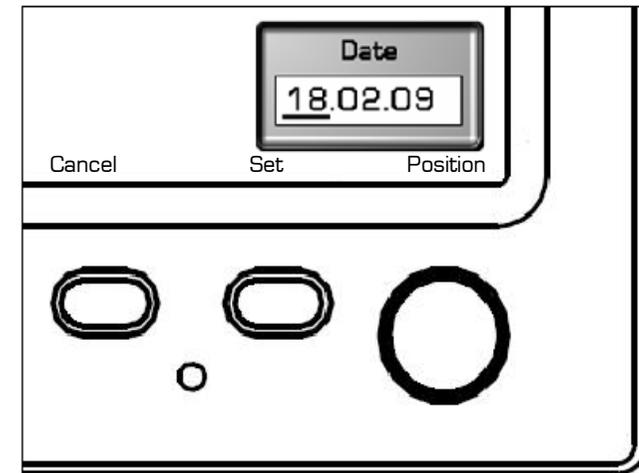
Pitch Setting   If the INTEGRA is not mounted at a right angle in relation to the pitch of the aircraft this function can be used to compensate for this variation.

⚡ **WARNING:**   If you are unfamiliar with pitch calibration please obtain qualified assistance. An incorrect calibration of horizon may result in death or serious injury.

Backlight Control   This menu has 2 submenus – Dimmer Source Control and Button Color

- **Dimmer Source Control**

  - *Manual*   You can set brightness manually
  - *External*   You can set external dimmer
    - *Max 5V*
    - *Max 12V*
    - *Max 24V*
  - *Auto*   You can set brightness automatically

- **Button Color**

  - *Green*   You can set green backlighting
  - *Red*   You can set red backlighting
  - *Orange*   You can set orange backlighting

AUX INPUT/OUTPUT   This menu contains other external inputs and outputs.

In every menu you can choose if you want to NOT CONNECT or YES – HI or YES – LO.

CNPY   Canopy status (open/close)

Gear UP   Undercarriage is retracted

Gear DOWN   Undercarriage is extended

Main Switch Control   If you have Integra connected via external main switch, set in this menu "CONNECTED". So you can power on or power off integra via main switch. If you have Integra connected directly to battery power,

- **Menu Main Switch Control**   choose "NOT CONNECTED" in this menu.
  - *Not Connected*
  - *Connected*

EFIS EXTERNAL DEVICES

You can add any external device, such as GPS, SL30 nav com, Remote Compass and CO Guardian.

- **Menu EXTERNAL DEVICES**
  - *GPS*
  - *SL30 nav com*
  - *Remote compass*
  - *CO Guardian*

```
                    External devices

GPS:  Port: COM1; Baud rate: 19200; Protocol: NMEA
SL30: Port: COM2
Remote compass:  Connected
CO Guardian:      Not connected
```

GPS

In this menu you can set access point, baud rate and protocol. First you can choose between COM1 or COM2. Now you can set baud rate from 4800 to 115200. And now you can choose protocol between NMEA and ARNAV.

- **Menu GPS**
  - *Not connected*
  - *Com 1*
  - *Com 2*
  - *Baud: 115200*
  - *Baud: 57600*
  - *Baud: 38400*
  - *Baud: 19200*
  - *Baud: 9600*
  - *Baud: 4800*
  - *Protocol: NMEA*
  - *Protocol: ARNAV*

ⓘ **NOTE:** If you select baud rate, which is not supported by your GPS receiver, baud rate 4800 will be automatically set.

SL30 nav com

The SL30 is a VHF Navigation/Communications Transceiver. You can connect SL30 with INTEGRA via COM1 or COM2.

- **Menu SL30 nav com**
  - *Not connected*
  - *Com 1*
  - *Com 2*

Remote compass

TL elektronic Remote Compass is exclusive source of magnetic heading information for the Integra. The connection to Integra is via CAN BUS.

- **Menu Remote compass**
  - *Not connected*
  - *Connected*
  - *Settings*
    - *Declination*
    - *Inclination*
    - *Total Mag. Field*
    - *Build In*
  - *Calibration*

If Remote Compass is not connected you will not have Heading data.

If Remote Compass is "connected" on Integra, but Remote Compass is missing or there is a problem with communication, heading data display ERROR.

If Remote Compass is connected properly you will have correct Heading data.

Menu Settings

To calibrate your Remote Compass, you must input your location's current magnetic inclination angle and intensity. Before doing this, you must obtain these two values for the geographic location where you will be performing the calibration. Note that this procedure only needs to be done once, prior to magnetic calibration. Moving the aircraft to another location does not require repeating this procedure.

Obtaining Magnetic Inclination and Intensity

1. TL elektronic recommends The National Geophysical Data Centre (NGDC) of the National Oceanic & Atmospheric Administration website at http://www.ngdc.noaa.gov/geomag-web/#igrfwmm to obtain inclination and intensity.
2. Select your country and your city.
3. Click on Get Location button to obtain coordinates or enter coordinates for your location directly.
4. Click on Calculate button at the bottom of the page to obtain values needed for the INTEGRA.

5. Set up Declination, Inclination and Total Field in the INTEGRA in agreement with the website. Obtained values from the website must be rounded for inserting to the INTEGRA: Round seconds (sign ") to minutes (sign ') for Declination and Inclination: 0"-29"-> +0', 30"-59"-> +1'. Round hundredth to integers for Total Field: 0,00 - 0,49 -> 0; 0,50 – 0,99 -> 1

   e.g.:
   Declination 3° 29' 55" rounded to 3° 30'
   Inclination 66° 8' 9" rounded to 66° 8'
   Total Field 49,007.81 nT rounded to 49,008 nT
   (note: sign **,** in value for Total Field means separator for thousands)

6. Set up in the INTEGRA position of Remote Compass ("Build In") according to its placing in the aircraft.

Menu Calibration
In this menu you can calibrate your Remote Compass.
Orient your plane in a known direction, preferably on a compass rose at the airport. Turn aircraft to the north direction. Stabilize the aircraft at horizontal position and keep the aircraft in this position during all calibration. Press OK. Integra start with calibration.

Turn aircraft in agreement with instruction on Integra. You will turn aircraft to the west, south and east.

After calibration will be displayed information about status of calibration.

There can be some mistake during calibration. Integra show you error message with error description.

CO Guardian

- **Menu CO Guardian**
  - *Not connected*
  - *Com 1*
  - *Com 2*

You can connect and disconnect the external CO Guardian device on port COM 1or COM 2.
CO guardian monitors the quantity of CO_2 in the cockpit. If the quantity of CO_2 exceeds the safety limit the INTEGRA will show you an alert message.

EFIS Data Sharing
If you have multiple TL elektronic products in your aircraft, they can be networked together via the TL elektronic **iFamily®** CanBUS. Units networked via **iFamily®** have the ability to share information with each other. Any product's data can then be viewed on any other screen in the **iFamily®** network. For example, an EFIS INTEGRA has the ability to display engine monitor information if it is connected to an EMS INTEGRA.
The **iFamily®** systems allows you to connect autopilot servos and remote compass.

ⓘ **NOTE:** See Integra **iFamily®** Connection part and Explanation of Possible Connections in User Manual for more information and explanation.

- **Menu EFIS Data Sharing**
    - *Off*
    - *Low Priority*
    - *High Priority*

Off

The Integra doesn't send EFIS data to bus. The Integra is not source of EFIS data for other Integra units connected to bus. The Integra only receives EFIS data from bus.

Low Priority

The Integra is set as data source with low priority for EFIS data shared by bus.

High Priority

The Integra is set as data source with high priority for EFIS data shared by bus.

Language

You can switch between languages; the Integra will display button labels, menus, prompts etc. in selected language. Options are: English, Czech, German, French, Russian.

Demo Mode

ⓘ   **NOTE: Run of Demo Mode during flight is strictly prohibited because the Integra is not displaying actual flight parameters, but values from internal memory loop.**

This option provides opportunity for trying out features of other versions of the INTEGRA. Of course the opportunity for trying out features of other versions is also available in Integra Demo PC application, which you could obtain from TL-elektronic web site.
 After you'll start-up Demo Mode by selecting Demo On, the Integra will be reading input data of sensors from loop in internal memory. After time of loop is up, loop will be automatically start-up again.

- **Menu Demo Mode**
  - *Demo ON*
  - *Demo OFF*
  - *Integra Type*
  - *Reset Time*
  - *Save Setting*

Demo ON / Demo OFF

These two options switch between on-state and off-state of Demo Mode.

Integra Type

In this submenu you can choose simulated INTEGRA unit of specific version. Options are EMS, EFIS, EFIS+EMS and Remote Display.

ⓘ **NOTE: To exit the Remote Display Demo Mode, you'll have to press the right-hand knob and then immediately the left-hand knob. This is only way, because Menu Enter Setup is not available for INTEGRA Remote Display.**

Reset Time

This submenu serves for setting reset time of loop. Range is from 30 seconds to 10 minutes.

Save Setting

If you select Save Setting, complete settings of the Integra will be saved. That includes the settings in standard screens (e.g. set of Towing Menu, Highway, Baro Pressure, Nav Source) and in Setup Mode (sensors setting, units etc.).

After count down of Reset Time reaches zero, all settings (that you've made after the Save Setting option selection) will be lost. In other words, settings will revert to state in moment, that you've select Save Setting option.

ⓘ **NOTE:** Running of Demo Mode is indicated by changing of color of the Integra buttons(sequence red-orange-green) and red displayed message Demo Mode.

AUTOPILOT (OPTIONAL FUNCTION)

The Integra Autopilot (referenced below as the AP) offers roll(aileron), pitch(elevator) and yaw(rudder) axis control. The number of axes, which can be controlled by AP, is depending on your purchased Activation Key; as well as variety of navigation abilities of AP. See Price list for available AP Activation keys and their features.

Available features of the Integra Autopilot includes: control of the aircraft axes with the aid of Altitude and Heading Bug or dynamic control supported by VOR or GPS, comfortable Autopilot setting via your chosen external button, settings of Autopilot servos including sensitivity setting, slip setting, adjustment of monitored limits as maximum bank angle, turn rate control, maximum climb/descent speed etc.

Access to Autopilot Setup:
Select option Autopilot Setup in Menu EFIS Setup.

- **Menu Autopilot Setup**
  - *Servo Setup*
  - *Servo Deflection Calibration*
  - *External Button*
  - *Roll Axis Setup*
  - *Pitch Axis Setup*
  - *Enter Activation / Enter Reactivation*

On following pages you'll find description of each option(listed above) of menu Autopilot Setup.

Servo Setup

This submenu provides options for determining connected servos by user and its automatic detection.

- **Menu Servo Setup**
  - *Servo Roll*
    - *Installed-YES*
    - *Installed-NO*
    - *Slip*
  - *Servo Pitch*
    - *Installed-YES*
    - *Installed-NO*
    - *Slip*
  - *Servo Yaw*
    - *Installed-YES*
    - *Installed-NO*
    - *Slip*
  - *Servo Detection*

Servo Roll / Servo Pitch / Servo Yaw

You can see above that adjustable options for all servos are same. Therefore these options are collectively described below and apply to all servos.

Installed-YES / Installed-NO

You can choose just one of these options: Installed-YES or Installed-NO. That determines, whether the appropriate servo is installed or not.

Slip

Option Slip provides adjusting of servo slipping. That means that you can set amount of transmitted torque via magnetic clutch before slipping. If you set higher number, more torque could be transmitted and you will have to exert much more force in case of manual adjustment when the AP is active. There is no drag, which could be exerted by turned off AP on yoke and rudder pedals. Range of maximum transmitted torque is from 0 to 100% with 5% step.

Servo Detection

You will have to execute this procedure because it's necessary to assign servos to appropriate controlled axes. Follow the instructions which will appear on screen.

Servo Deflection Calibration

This submenu serves for calibration of deflections of servos and their subsequent test.

- **Menu Servo Deflection Calibration**
  - *Deflection Calibration*
  - *Deflection Test*

Deflection Calibration

This procedure identifies range of motion of each servo and it should be executed before servo Deflection Test. Just follow the instructions on the screen for successful completion of calibration.

Deflection Test

By using this option you can test servos assignment to controlled axes and verify correctness of direction of movement for flight control surfaces.
Select Deflection Test option and avoid touch the yoke during the test. Follow the instructions on the screen.

External Button

This option enables extension of the ways for activation and deactivation of the AP. Moreover it simplifies the setting of Altitude bug and Heading bug and makes setting of bugs more comfortable. Of course, external button with appropriate and handy position is needed. Recommended place for external button is on yoke (control column) or on central panel.

- **Menu External Button**
  - *Autopilot Activation-Deact. Only*
  - *Autopilot Activation-Prev. Act. & Deact.*
  - *Autopilot Activation-Stab. Act. & Deact.*
  - *Hold On Function-Enable*
  - *Hold On Function-Disable*

option of Menu External Button		action of the button (note: Before any deactivation[temporary or permanent] of the AP performed by the external button, the AP has to be activated by the AP buttons on the Integra at first.)	
		press **(press and immediate release)**	**holding down**
Hold On Function Enable			
	Deact. Only is set	The AP is deactivated. Activation of the AP must be performed by the AP buttons on the Integra.	The AP is temporarily deactivated. After release of the button, the AP will follow the last configuration.
	Prev.Act. & Deact is set	The AP is activated with the last configuration. Next pressing will deactivate the AP.	The AP is temporarily deactivated. After release of the button, the AP will follow the last configuration.
	Stab.Act & Deact. is set	The AP is activated and the AP will hold current altitude and heading.	The AP is temporarily deactivated. After release of the button, the AP will hold current altitude and heading.
Hold On Function Disable			
	Deact. Only is set	The AP is deactivated. Activation of the AP must be performed by the Integra buttons.	*no reaction*
	Prev.Act. & Deact is set	The AP is activated with the last configuration. Next pressing will deactivate the AP.	*no reaction*
	Stab.Act & Deact. is set	The AP is activated and the AP will hold current altitude and heading.	*no reaction*

Roll Axis Setup

This submenu provides settings of the AP performance during a roll of the aircraft.

- **Menu Roll Axis Setup**
  - *Control Sensitivity*
  - *Mode-Turn Rate*
  - *Mode-Bank Angle*
  - *Max. Bank Angle*
  - *Turn Rate Target*

Control Sensitivity

This parameter specifies how fast the AP reacts to deviations between target heading and actual heading. If the parameter is adjusted too high, the aircraft will be itchy. Fast, hardline adjustments of heading will appear. If the parameter is adjusted too low, the aircraft will leisurely responds to heading deviations. Range of values of the parameter is from 1 to 24. Value 1 refers to low sensitivity, value 24 refers to high sensitivity. Default value is 10.

Mode-Turn Rate/Mode-Bank Angle

These options are entitled here together because they are two options of one switch (metaphorically told). That means that you can choose Mode-Turn Rate or Mode-Bank Angle.

Mode-Turn Rate

If you select this mode, the AP will control the aircraft according to parameter Turn Rate Target (described below) and Max. Bank Angle(described below).

Mode-Bank Angle

If you select this mode, the AP will control the aircraft according to parameter Max. Bank Angle.

Max. Bank Angle

The parameter determines maximum bank angle of the aircraft during AP's controlled turns. Range of adjustable values of the parameter is from 5 to 45 degrees. Default value is 15 degrees and it is adjustable in 1 degree increments.

Turn Rate Target

The parameter determines average target turn rate of the aircraft. Turn Rate target is specified in angular degrees per second. That means, for example when Turn Rate Target is 1 degree per sec., then aircraft's turn of 90 degrees will be performed in 90 seconds. Remember that adjustable value of the parameter is only average value, which could be exceed due flight dynamics and the time for turn initialization. Range of adjustable values is from 0.5 degree to 3 degrees per sec. Default value is 1.5 degree per sec. and it is adjustable in 0.1 degree per sec. increments.

Pitch Axis Setup

This submenu provides settings of the AP performance during controlled change of altitude.

- **Menu Pitch Axis Setup**
  - *Control Sensitivity*
  - *Mode-Vertical Speed*
  - *Mode-Longitudinal Angle*
  - *Max. Longitudinal Angle*
  - *Max. Climb Speed*
  - *Max. Descent Speed*
  - *Min. Air Speed*
  - *Max. Air Speed*

Control Sensitivity

This parameter specifies how fast the AP reacts to deviations between target altitude and actual altitude. If the parameter is adjusted too high, the aircraft will be itchy. Fast, hardline adjustments of altitude will appear. If the parameter is adjusted too low, the aircraft will leisurely responds to altitude deviations. Range of values of the parameter is from 1 to 24. Value 1 refers to low sensitivity, value 24 refers to high sensitivity. Default value is 10.Mode-Vertical Speed/Mode-Longitudinal Angle
These options are entitled here together because they are two options of one switch (metaphorically told). That means that you can choose Mode-Vertical Speed or Mode-Longitudinal Angle.

Mode-Vertical Speed

If you select this mode, the AP will control the aircraft according to parameters Max. Climb Speed and Max. Descent Speed(both described below).

Mode-Longitudinal Angle

If you select this mode, the AP will control the aircraft according to parameter Max. Longitudinal Angle(described below).

Max. Longitudinal Angle

The parameter determines angle between longitudinal axis of the aircraft in horizontal flight and longitudinal axis of the aircraft when the AP pitches the aircraft up or down during controlled altitude change. If Mode-Longitudinal Angle is set, parameter Max. Longitudinal Angle is activated.

Max. Climb Speed/Max. Descent Speed

If Mode-Vertical Speed is selected, Max. Climb Speed and Max. Descent Speed will be used for reduction of Vertical Speed during climb or descent of the aircraft.

Min. Air Speed

Min. Air Speed is minimum airspeed at which you can activated the AP.
If actual airspeed is lower than set Min. Air Speed , the AP will pitch the aircraft down to increase actual airspeed.
If aircraft's altitude is lower than altitude determined by Altitude Bug or Navigation source(VOR or GPS) and the AP can't pitch the aircraft up without dropping below Min. Air. Speed , the Integra will display message "ADD POWER".
The Min. Air Speed must be set to (at least) 30% above Vs. This is default setting of Min. Air Speed value.

Max. Air Speed

Max. Air Speed is maximum airspeed at which you can activated the AP.
If actual airspeed is higher than set Max. Air Speed , the AP will pitch the aircraft up to decrease actual airspeed.
If aircraft's altitude is higher than altitude determined by Altitude Bug or Navigation source(VOR or GPS) and the AP can't pitch the aircraft down without Max. Air. Speed get exceed , the Integra will display message "REDUCE POWER".
The Max. Air Speed must be set to (at most) 95% of Vne. This is default setting of Max. Air Speed value.

⚡   **WARNING:**   Default values of Min. Air Speed and Max. Air Speed are set according to Vs (Stall Speed) and Vne (never exceed speed) values which are set in menu EFIS Range and Limits (see on page 10). **Proper readjustment from default values of Min. Air Speed and Max. Air Speed is not watched by the INTEGRA. So, make sure that you know, what you are doing.**

Enter Activation/Enter Reactivation

The last option in menu Autopilot Setup is Enter Activation or Enter Reactivation. Enter Activation is displayed, when Activation Key hasn't been entered. In that case the Autopilot function isn't enable. When you've already entered Activation Key, option Enter Reactivation is displayed. If you want to upgrade your Activation Key (e.g. Premium Activation Key to Gold Activation Key), just select Enter Reactivation and enter your new Activation Key.

EMS Setup Menu

Access to this menu:
Press the right-hand knob, select Enter Setup in menu. When prompt "Are you sure you want to enter to setup" appears, press "Yes". There in Setup mode switch screen to EMS. You should see Menu EMS Setup.

In this menu you can set up many parameters mainly for engine and sensor settings.

- **Menu EMS Setup**
  - *Units*
  - *Configuration & Sensors*
  - *Range and Limits*
  - *Other Setting & Calibration*
  - *External Devices*
  - *EMS Data Sharing*
  - *Autopilot Setup*
  - *Language*
  - *Demo Mode*
  - *Exit Menu*

EMS UNITS

You can choose between metric and imperial units or you can define your own unit settings.

- **Menu UNITS**
  - *Metric*
  - *Imperial (UK)*
  - *Imperial (US)*
  - *Custom*

Metric – INTEGRA display units in metric system – (Bar, °C, Pa, litre)
Imperial (US) – INTEGRA display units in metric and imperial system (Bar, °C, Pa, gallons)
Imperial (UK) – INTEGRA display units in imperial system (inHg, F, psi, gallons)
Custom – you can choose individual units for each measure.

- **Menu Custom**
  - *MAN pressure*
  - *Temperature*
  - *Pressure*
  - *Quantity*

Available units for measured quantities

Quantities	Selectable Units		
Indicator press of oil	bar		psi
Indicator oil temperature	Celsius		Fahrenheit
Internal air temperature	Celsius		Fahrenheit
Outsider air temperature	Celsius		Fahrenheit
Temperature of cylinders	Celsius		Fahrenheit
Information about fuel, fuel pressure	bar	kg/cm2	psi
Consumption fuel flow and fuel quantity	Litre		GAL
Manifold air pressure	mBar	torr	inHg

.

EMS CONFIGURATION & SENSORS

In this menu you can properly set all connected sensors.

- **Menu CONFIGURATIONS & SENSORS**
  - *RPM*
  - *MAP*
  - *Rotor RPM*
  - *Oil pressure*
  - *Oil Temperature*
  - *Water CHT Temperature*
  - *Water Aux Temperature*
  - *Left / Total Tank*
  - *Right Tank*
  - *Fuel Pressure*
  - *Fuel Flow*
  - *EGT, CHT number*
  - *EGT, CHT setting*
  - *IAT*
  - *OAT*
  - *Voltage*
  - *Current*

In every menu you can choose if you want to CONNECT or NOT CONNECT a sensor and in some menus you will have a list of sensors in which to choose the appropriate sensor.

RPM	This sensor monitors RPM
MAP	This sensor monitors manifold pressure
Rotor RPM	This sensor monitors Rotor RPM
Oil Pressure	This sensor monitors oil pressure
Oil Temperature	This sensor monitors oil temperature
Water CHT Temperature	This sensor monitors CHT Temperature(in meaning used by ROTAX, technically the sensor is placed on engine block). To enable displaying of this info, see section Other Setting & Calibration-Water CHT Temperature Label.
Water Aux Temperature	This sensor monitors water temperature. To enable displaying of this info, see section Other Setting & Calibration-Water CHT Temperature Label.
Left / Total tank	This sensor monitors fuel level in left tank
Right tank	This sensor monitors fuel level in right tank	You can disconnect this tank, so the left tank will be the only one and the main tank.

⚠ **CAUTION:** After left or right tank is chosen a warning message is displayed: "**After change sensor you have to recalibrate fuel tank, do you want to continue?**" and two labels are displayed "YES or NO". If you press YES, a list will be shown with possible sensors choices.

Fuel Pressure	This sensor monitors fuel pressure
Fuel flow	This sensor monitors Fuel Flow
EGT, CHT Number	You can set the Cylinder Number to 2, 4 or 6.
IAT	This sensor monitors internal air temperature
OAT	This sensor monitors outside air temperature

Voltage	You can choose where (battery, pump, avionics etc.) you want gauge voltage monitoring. Menu for Voltage is the same as for Current.	• **Menu Voltage** • *Voltage1 – Yes* • *Voltage1 – No* • *Voltage1 – Label* • *Voltage2 – Yes* • *Voltage2 – No* • *Voltage2 – Label* • *Voltage3 – Yes* • *Voltage3 – No* • *Voltage3 – Label*	*VoltageX –Yes* *-Select when Voltage(1,2 or 3) is used* *VoltageX –No* *-Select when Voltage(1,2 or 3) is not used* *VoltageX –Yes* *-Select when you want to set label of Voltage(1,2 or 3). See next page for description.*
Current	You can choose where (battery, pump, avionics etc.) you want gauge current monitoring. Menu for Current is the same as for Voltage.	• **Menu Current** • *Current1 – Yes* • *Current1 – No* • *Current1 – Label* • *Current2 – Yes* • *Current2 – No* • *Current2 – Label* • *Current3 – Yes* • *Current3 – No* • *Current3 – Label*	*CurrentX –Yes* *-Select when Current(1,2 or 3) is used* *CurrentX –No* *-Select when Current(1,2 or 3) is not used* *CurrentX –Yes* *-Select when you want to set label of Current(1,2 or 3). See page 44 for description.*

Setting Voltage label

```
                        Sensors
RPM:           used        Fuel flow:      used
MAP:           6624-33     EGT, CHT:       2x
Rotor RPM:     not used    IAT:            6624-39
Oil press:     6624-40     OAT:            6624-39
Oil temp:      6624-05     Voltage 1:      "BATTERY   ", used
Water CHT:     6624-05     Voltage 2:      "PUMP", used
Water Aux:     6624-17     Voltage 3:      "AVIONICS", used
Left tank:     6624-21     Current 1:      "BATTERY", used
Right tank:    6624-22     Current 2:      "PUMP", used
Fuel press:    6624-37     Current 3:      "AVIONICS", used
```

```
                              Voltage 1 label
                              B A T T E R Y
```

Default   Cancel   Set   Position

The underlined letter you can change by rotating the right-hand knob. If you get the required letter, just press the knob and the underscore will skip on to the next letter. Press "Set" to accept the new label. Press "Cancel" to skip to previous menu. Press "Default" to reset to default label. For Voltage 1 is default label "BATTERY", for Voltage 2 – "PUMP", for Voltage 3 – "AVIONICS".

Setting Current label

```
                          Sensors
RPM:          used        Fuel flow:    used
MAP:          6624-33     EGT, CHT:     2x
Rotor RPM:    not used    IAT:          6624-39
Oil press:    6624-40     OAT:          6624-39
Oil temp:     6624-05     Voltage 1:    "BATTERY  ", used
Water CHT:    6624-05     Voltage 2:    "PUMP", used
Water Aux:    6624-17     Voltage 3:    "AVIONICS", used
Left tank:    6624-21     Current 1:    "BATTERY", used
Right tank:   6624-22     Current 2:    "PUMP", used
Fuel press:   6624-37     Current 3:    "AVIONICS", used
```

```
                    Current 1 label
                    B A T T E R Y
```

Default   Cancel   Set   Position

The underlined letter you can change by rotating the right-hand knob. If you get the required letter, just press the knob and the underscore will skip on to the next letter. Press "Set" to accept the new label. Press "Cancel" to skip to previous menu. Press "Default" to reset to default label. For Current 1 is default label "BATTERY", for Current 2 – "PUMP", for Current 3 – "AVIONICS".

You can choose and assign Thermocouple and Sensors to EGT and CHT. In this menu choose one EGT or one of CHT. Press the knob and discovers next menu. Now select Input. In this menu select desired thermocouple. Now selected EGT or CHT is associated with this thermocouple. You can do it the same way for every EGT and CHT.

EGT, CHT setting
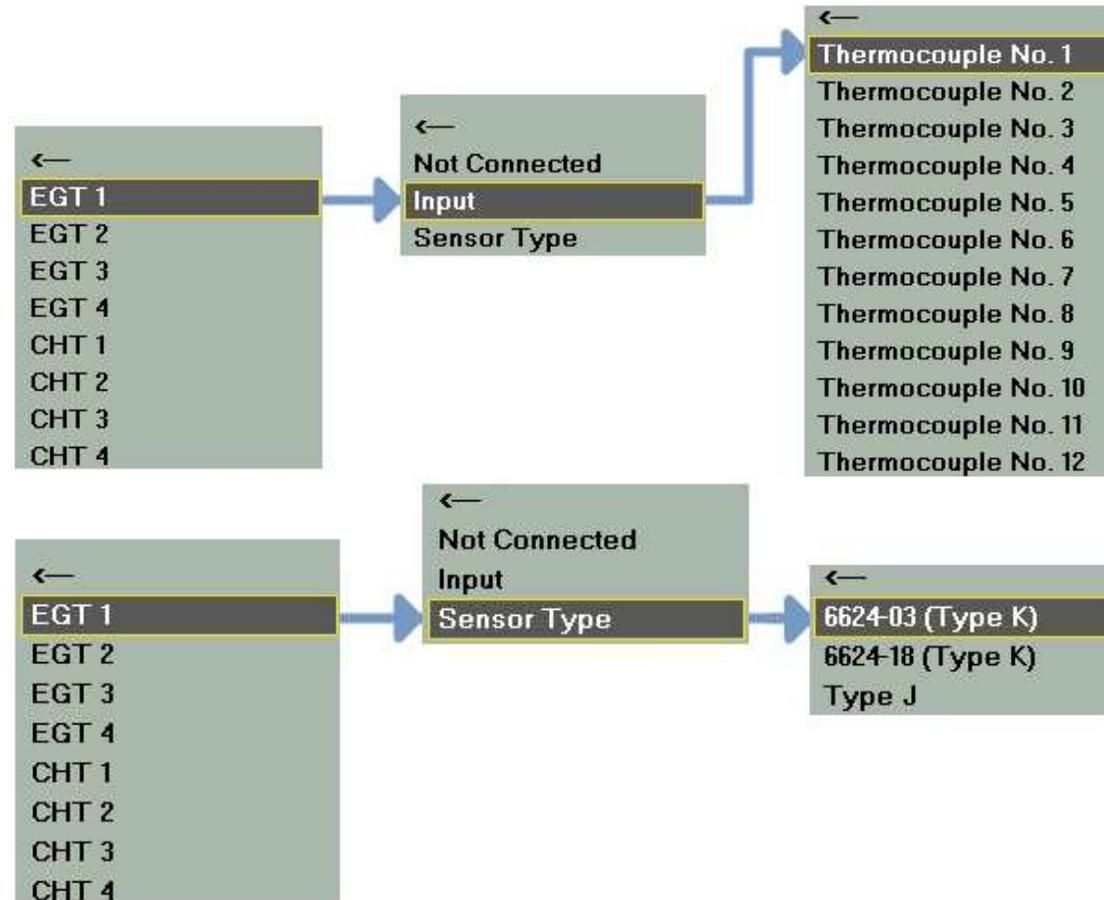
CHT described here means Cylinder Head Temperature(measured by thermocouples under spark plugs not in meaning used by ROTAX).

EMS RANGE AND LIMITS

In this menu you can set minimum and maximum critical values, minimum and maximum warning values and normal values.

- **Menu RANGE AND LIMITS**
  - *RPM*
  - *MAP*
  - *ROTOR RPM*
  - *Oil Pressure*
  - *Oil Temperature*
  - *Water CHT Temperature**
  - *Water Aux Temperature*
  - *Left / Total tank*
  - *Right tank*
  - *Fuel pressure*
  - *Fuel flow*
  - *EGT*
  - *CHT***
  - *Voltage 1*
  - *Current 1*
  - *Voltage 2*
  - *Current 2*
  - *Voltage 3*
  - *Current 3*

	Range	Min Alarm	Min Warn	Norm	Warn	Alarm
RPM [rpm]:	3000			500	2700	2800
MAP [mBar]:	1300		500		1100	
Rotor RPM [rpm]:	1000				700	850
Oil Press [bar]:	8.0			1.0	5.0	6.0
Oil Temp [°C]:	140			60	110	130
Water CHT [°C]:	150			0	110	130
Water Aux [°C]:	160			50	135	145
Left/Total tank [gal]:	11.0	2.2				
Right tank [gal]:	11.0	2.2				
Fuel Press [bar]:	5.00	0.40	0.90		3.50	4.50
Fuel flow [gal/h]:	5.5					4.4
EGT [°C]:	1200				1000	1100
CHT [°C]:	300				250	280
Voltage 1 [V]:	40.0				0.0	0.0
Current 1 [A]:	50.0				0.0	0.0
Voltage 2 [V]:	40.0				0.0	0.0
Current 2 [A]:	50.0				0.0	0.0
Voltage 3 [V]:	40.0				0.0	0.0
Current 3 [A]:	50.0				0.0	0.0

* Range and Limits for Water Temperature and CHT are same, This CHT refers to temperature measured on engine block-ROTAX meaning of the word CHT

**refers to temperatures measured by thermocouples under spark candles

ⓘ **NOTE:**   The limits of one each values can´t overlap each other. If you try decrease for example ALARM and it is impossible so you need to decrease WARN at first and than you can set ALARM to lower value.

Available Limits Configuration Table

Indicator	You can set					
	Range	Min. Alarm	Min. Warn	Norm	Warn	Alarm
RPM	X			X	X	X
MAP	X		X		X	
Rotor RPM	X	X	X		X	X
Oil Pressure	X	X	X		X	X
Oil Temperature	X	X	X	X	X	X
Water CHT Temperature	X			X	X	X
Water Aux Temperature	X			X	X	X
Left tank / Total Tank	X	X				

Available Limits Configuration Table

Indicator	You can set					
	Range	Min. Alarm	Min. Warn	Norm	Warn	Alarm
Right tank	X	X				
Fuel pressure	X	X	X		X	X
Fuel flow	X					X
EGT	X				X	X
CHT	X				X	X
Voltage 1	X	X	X		X	X
Current 1	X	X	X		X	X
Voltage 2	X	X	X		X	X
Current 2	X	X	X		X	X
Voltage 3	X	X	X		X	X
Current 3	X	X	X		X	X

Example of differences between set values.

Default values are defined

RANGE	MIN ALARM	MIN WARN	NORM	WARN	ALARM
3000	-	-	500	2700	2800

New values are defined:

RANGE	MIN ALARM	MIN WARN	NORM	WARN	ALARM
5000	-	-	1000	3000	4000

Indicator	Function	Recommendation
Warning Oil Pressure	Warning Limit. Useful as a reminder to reduce RPM when warming a cold engine, especially in winter conditions, to avoid excessive oil pressure.	As recommended by engine manufacturer
Alarm Minimum Oil Pressure	Minimum Oil Pressure – This Warns of loss of oil pressure. This is serious. Consider you situation carefully. This may lead to complete engine seizure or it may only be instrument or sensor failure. It requires immediate action but not over-reaction.	As recommended by engine manufacturer
Oil Temperature Warning	Yellow indicator	As recommended by engine manufacturer
Maximum Oil Temp.	Consider setting this limit lower than the maximum to get early warning of abnormal oil temp.	As recommended by engine manufacturer
Normal Oil Temperature	Intended for troubleshooting. Can also indicate reminder that the engine is not warm enough.	Set according to engine manufacturer's recommendation or set based on experience
RPM Alarm Max	Red Line -Warns when the engine has reached maximum RPM	Set according to engine manufacturer's recommendation.
RPM Warning	Yellow Indicator	Set Based on experience
RPM Normal	Green indicator	Set according to engine manufacturer's recommendation.

Fuel Right and Left Tank Alarm	Minimum Fuel Quantity	Set for at least enough useable fuel to provide for 30-60 minutes of flight at cruise power.
Fuel Right and Left Tank range	Indicates each tanks capacity	Setting Fuel Tank Range requires Fuel Tank Calibration
Fuel Flow	Generates a warning when the fuel flow (rate of fuel burn) exceeds this limit. Useful for detecting badly leaking fuel lines, loose connections to fuel injectors, etc. Very useful safety feature for all engines, but especially fuel injected engines. Be sure to use it!	Account for max fuel flow rate at full takeoff set max 10%-20% above max rate
EGT Warning	Maximum Exhaust Gas Temp. – Not all engines have published limits, nor do all engines require a maximum EGT limit.	Set limit according to engine manufacturer recommendation, or based on experience.
CHT Warning	Warning Cylinder Head Temperature. Often engines will normally operate significantly lower than the engine manufacturer's limit.	Set according to engine manufacturer's recommendation
CHT Alarm	Consider setting this limit lower than the maximum to get early warning of abnormal CHTs	Set according to engine manufacturer's recommendation

EMS OTHER SETTING & CALIBRATION

- **Menu OTHER SETTING & CALIBRATION**
  - *Aircraft Identification*
  - *Time*
  - *Date*
  - *Backlight Control*
  - *AUX Input/Output*
  - *Fuel Flow*
  - *Fuel Press – set zero pressure*
  - *Fuel Calibration*
  - *Set Unexhaustible Fuel*
  - *RPM Setting*
  - *Rotor RPM Setting*
  - *Engine Time Threshold*
  - *Water CHT Temperature Label*
  - *Main Switch Control*

Aircraft identification   It is the same as in EFIS.
Time   It is the same as in EFIS.
Date   It is the same as in EFIS.
Backlight Control   It is the same as in EFIS.
AUX INPUT/OUTPUT   It is the same as in EFIS.

Fuel flow

You can set K-factor and Time of aver flow.

- **Menu Fuel flow**
  - *K-Factor*
  - *Time of Average Flow*

K-factor

You can manually adjust the K-Factor. The K-Factor is a measurement of the pulses per gallon that the flow transducer outputs. Due to variations in the installation of the flow transducer, it may be necessary to adjust the K-Factor for the first few flights in order to get an accurate fuel remaining, fuel used and flow reading. The K-Factor should be changed only when the fuel tanks have been filled accurately on level ground. After a few adjustments of the K-Factor, the fuel remaining and the fuel used as calculated by the INTEGRA should be within a few gallons (or less) of actual and should not need further adjustment. Use the following fields, as necessary, to correct the K-Factor.

The underlined numbers you can change by rotating the right-hand knob. If you get the required number, just press the knob and the underscore will skip on to the next number. Press "Set" to enter the new value. Press "Cancel" to skip previous menu.
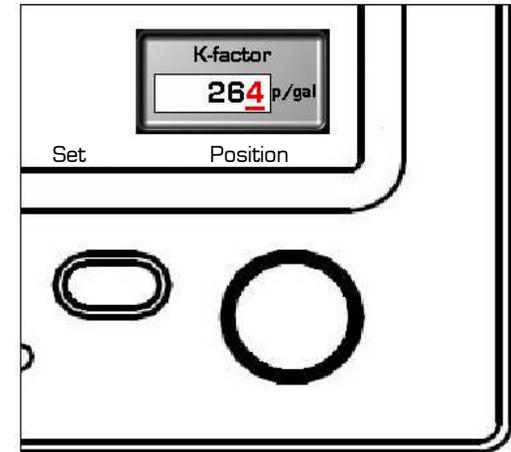
$$K\text{-}FACTOR = \text{Last K-FACTOR} + \frac{(\text{Shown value} - \text{Real value}) \times \text{Last K-FACTOR}}{\text{Real value}}$$

Time of Average Flow
You can set time duration for how long you want average flow of fuel. After this time the INTEGRA will show you average fuel flow.

The numbers of seconds you can change just rotate with the right-hand knob. If you get required number, just press "Set". Press "Cancel" to skip previous menu.

Time of aver
4 sec

Set   Position
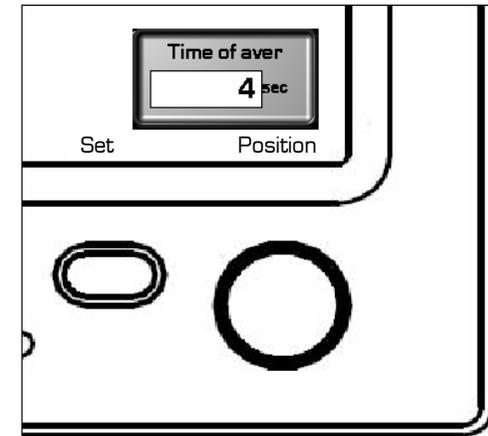
(i) **NOTE:** Maximum displaying time which you can set is 10 seconds.

Fuel press zero calibration

Offset value: 2.67

Press Set to store new value

Fuel pressure – set zero
This is function for correction of variance between pressure sensors.

Back   Set
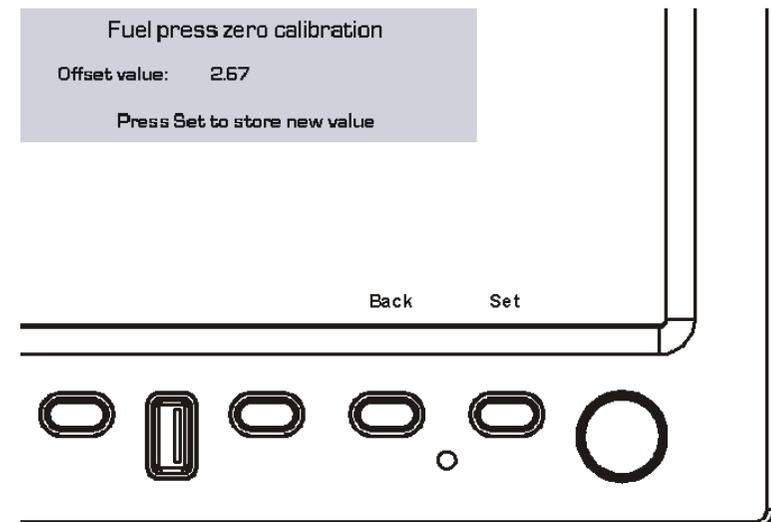
Fuel calibration

Because the shape of the tank can be asymmetric therefore petrol in fuel tanks may not be level. You can set up to 15 steps of fuel calibration.
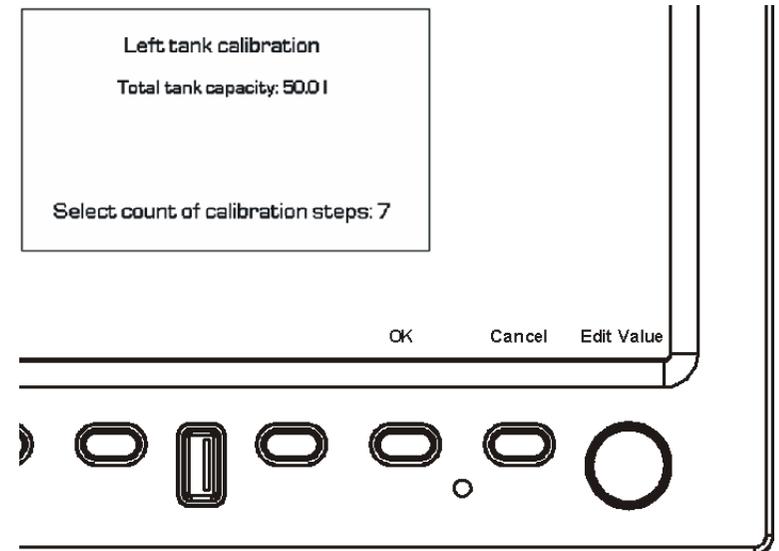
- **Menu Fuel calibration**
  - *Left tank*
  - *Right tank*

  (Right tank is enable)

  Or

  - *Total tank*

  (Right tank is disable)

First you choose left or right tank for calibration and press the knob. Now is displayed label and you can choose number of steps merely rotate the knob. When you have set number of steps, press "OK". You can cancel this operation if you press the "Cancel" button.

Left tank calibration

Total tank capacity: 50,0 l

Select count of calibration steps: 7

OK   Cancel   Edit Value

ⓘ **NOTE:** You can set count of calibration steps in range from 3 to 15.

ⓘ **NOTE:**   If you want to change the capacity of the tank:
Enter to Setup – Range and Limits – Left / Total Tank and set the RANGE.

If you press "OK" button the next label with "Start calibration" is displayed. Be sure before starting the calibration that your fuel tank is full.

Left tank calibration

Total tank capacity: 50,0 l
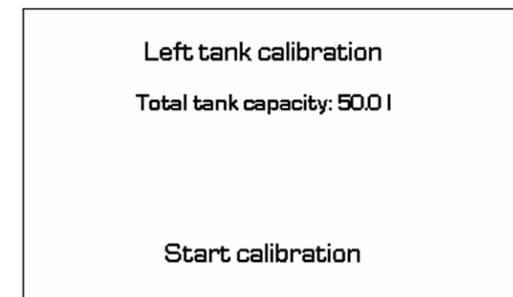
Start calibration

⚠ **CAUTION:** The INTEGRA must be calibrated to the aircraft fuel system and the INTEGRA's accuracy must be verified before flying the aircraft. The accuracy and proper operation of each function displayed on the INTEGRA should be verified before the aircraft is released for flight.

**Set unexhaustible fuel**

- **Menu Set Unexhaustible Fuel**
  - *Left tank*
  - *Right tank*
  (Right tank is enable)

  Or

  - *Total tank*
  (Right tank is disable)

Your fuel tank may contain fuel that cannot be consumed. In this step you may set the quantity of this fuel.

In first step you choose left or right tank. Now the underlined number you can change just rotate with the right-hand knob. If you get the required number, just press the knob and the underscore will skip on to the next number. Press "Set" to enter the new value. Repeat the same procedure for the second tank.
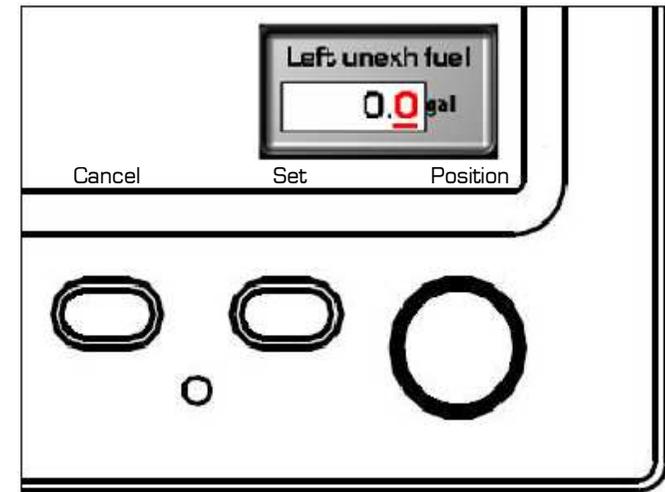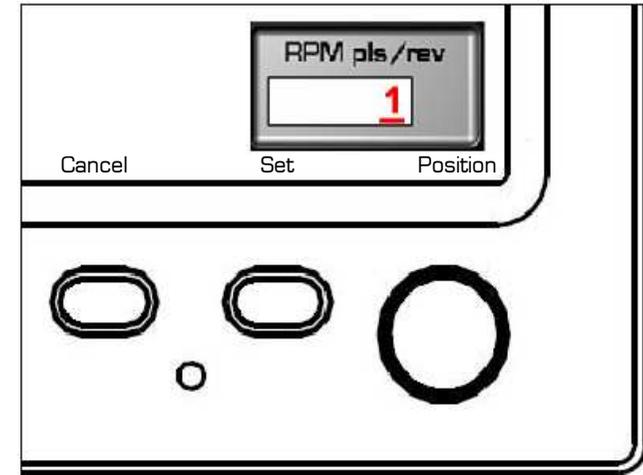
RPM setting

- **Menu RPM setting**
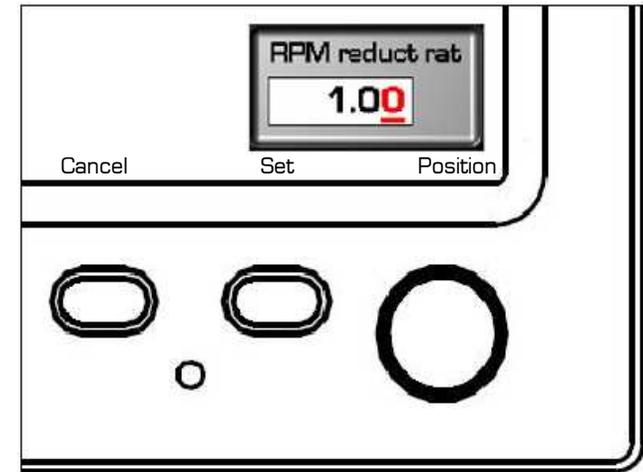 - *Pulses Per Rev*
  - *Reduction ratio*

You can set number of pulses per rev and you can set reduction ratio.

In both cases the underlined number you can change by rotating the right-hand knob. If you get the required number, just press the knob and the underscore will skip on to the next number. Press "Set" to enter the new value. Press "Cancel" to skip previous menu.

ⓘ **NOTE:** If you are unable to install a sensor directly on your engine and the location of your sensor is affected by a reduction ratio. It is then necessary to enter the correct reduction ratio. If this function is not used then preset reduction ratio to 1.00.
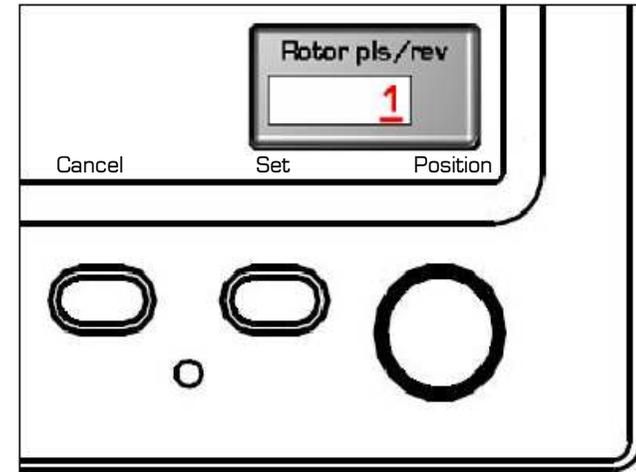
Rotor RPM setting You can set number of pulses.

- **Menu Rotor RPM setting**
  - *Pulses Per Rev*

The underlined number you can change by rotating the right-hand knob. If you get the required number, just press the knob and the underscore will skip on to the next number. Press "Set" to enter the new value. Press "Cancel" to skip previous menu.

Engine time Threshold

The underlined number you can change by rotating the right-hand knob. If you get the required number, just press the knob and the underscore will skip on to the next number. Press "Set" to enter the new value. Press "Cancel" to skip previous menu.

Page 58
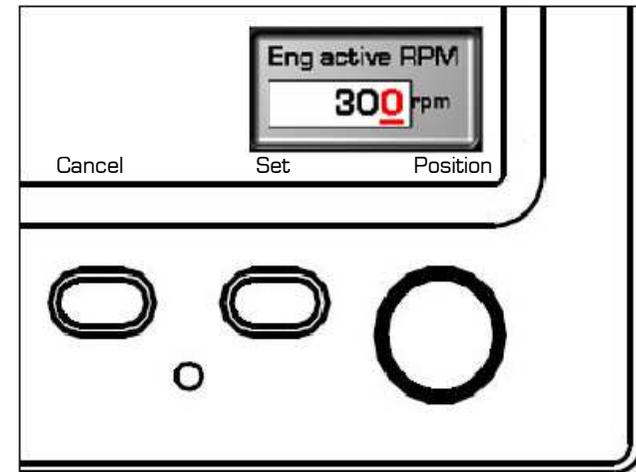
Water CHT Temperature Label

You can choose whether you want to display WATER TEMPERATURE and/or Cylinder Head Temperature (ROTAX meaning of the word) .

- **Menu Water CHT Temperature Label**
  - *WATER*
  - *CHT*

OR

AND
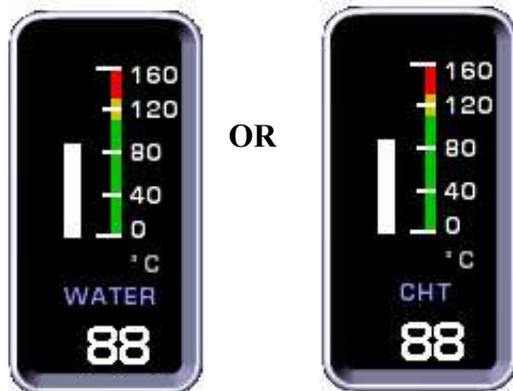
Water Temperature and CHT depiction as it is displayed on EMS screen when Towing Menu is OFF	Water Temperature and CHT depiction as it is displayed on EMS screen when Towing Menu is ON

The CHT described here represents value measured on engine block with resistance sensor. That's the meaning of CHT used by ROTAX. Don't confuse this CHT with CHT measured by thermocouples under spark plug.

Main Switch Control   It is the same as in EFIS

EMS EXTERNAL DEVICES

External devices are devices which you can connect on port COM1 or COM2.

- **Menu EXTERNAL DEVICES**
  - *CO Guardian*

CO Guardian

You can connect and disconnect the external CO Guardian device on port COM 1or COM 2.
CO guardian monitors the quantity of CO in the cockpit. If quantity of CO exceeds the preset safe limit the INTEGRA will show you an alert message.

EMS Data Sharing

If you have multiple TL elektronic products in your aircraft, they can be networked together via the TL elektronic iFamily® CanBUS. Units networked via iFamily® have the ability to share information with each other. Any product's data can then be viewed on any other screen in the iFamily® network. For example, EFIS INTEGRA has the ability to display engine monitor information if it is connected to EMS INTEGRA. The iFamily® systems allows you to connect autopilot servos and remote compass.

ⓘ   **NOTE:** See Integra **iFamily®** Connection part and Explanation of Possible Connections in User Manual for more information.

- **Menu EMS Data Sharing**
  - *Off*
  - *Low Priority*
  - *High Priority*

Off

The Integra doesn't send EMS data to bus. The Integra is not source of EMS data for other Integra units connected to bus. The Integra only receives EMS data from bus.

Low Priority

The Integra is set as data source with low priority for EMS data shared by bus.

High Priority

The Integra is set as data source with high priority for EMS data shared by bus.

Autopilot Setup

See separated Autopilot Section on page 25.

INTEGRA EFIS&EMS TL-6660 CONFIGURATION MANUAL

TL ELEKTRONIC Inc.

Part Number

TLX-6660X-DC-001-PrA

Europe

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