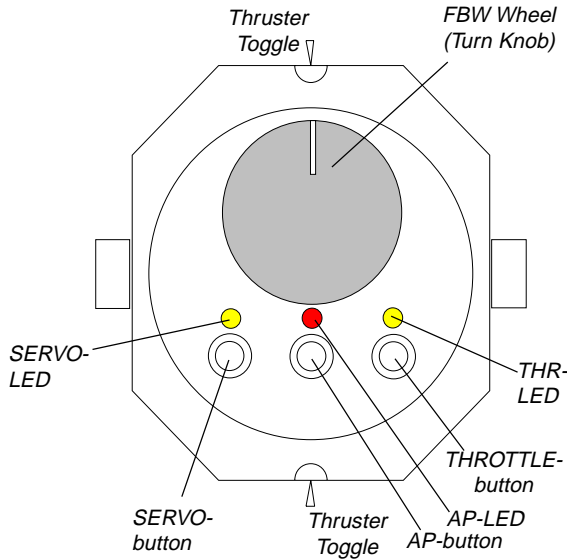


Index

Turn Knob Functions of the Fly-By-Wire unit	2
Thruster Functions	3
Throttle Lever Functions	4
Installing the Engine Actuators and Cables	6
FADEC Actuator Connection	9
FADEC-Box Setup	10
Initial Operation	10
Setup Parameters	11
Throttle Station Setup	12
FADEC fail codes	13

Turn Knob Functions of the Fly-By-Wire unit

The actual operating mode is indicated by yellow and red mode LED's, the Turn Knob and Throttle position and a beeper.



Turn-Rate Mode

The **Turn-Rate Mode** is the normal operating mode of the Fly-By-Wire Wheel. It is engaged by a click on the SERVO button and indicated by a lit SERVO and AP LED. The Wheel position determines the vessels' rate of turn. With a centered wheel in the detent, the heading will be maintained. Use the SERVO button to toggle between the SERVO and Turn-Rate Mode.

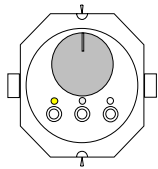
The rudder is controlled by the autopilot. Heading changes can be made through the FBW-wheel or on an autopilot or heading display.

Note: the Turn-Rate Mode is only available after the heading gyro has completed its alignment (5 minutes after power up). An operational gyro is indicated by a dot behind the "H." on the heading display.

The Turn-Rate Mode must be used only while going forward, but not when stopping or going backwards, except when the Docking-Mode has been activated with the THR-button and a thruster (or Jet Drives, or two individually controlled Stern-Drives) have been installed.

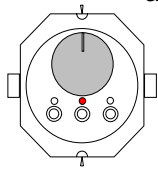
Servo Mode

Press the "SERVO" button briefly to toggle between the *SERVO* Mode and *Turn Rate* Mode. An inactive unit would be activated by the SERVO button, taking over any existing mode of another FBW-unit. The rudder follows directly the steering wheel position, when only the yellow SERVO-LED is ON. The *SERVO* Mode is only used for maneuvering or when going backwards.



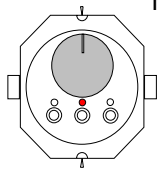
Heading Mode

Press the AP-button briefly to engage the autopilot in **HDG** Mode. The red AP-LED comes on on all FBW-units and the FBW wheel will be "disconnected". Heading changes can now be made on any AP or heading display.



NAV Mode

Double click the AP button to engage the **NAV** Mode. The red AP-LED comes on on all units and the FBW wheel will be "disconnected". An active route must be available (from a GPS or plotter). The route will be intercepted and followed automatically, the intercept angle is 30 degrees on the active leg of the programmed ground track.

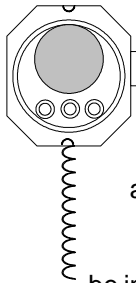


Turn Knob Warning Functions

SERVO LED blinking fast and a double beep sounds every two seconds	Rudder not following the Turn Knob position
SERVO LED glowing slowly (On and Off)	STANDBY-mode: continuous pumps are kept running
red AP LED glowing slowly (On and Off)	No communication with DRIVE Box or FADEC-Box
red AP LED flashing slowly and a beep sounds every two seconds.	The temperature of the Drive Box is within 8 C (15 F) of the cut-off limit.
red AP LED flashing fast	The FBW-unit is locked (see Setup)

"Moving" your remote control

When disconnecting the cable of an active FBW-unit in SERVO- or TurnRate-Mode, the autopilot will switch into HEADING-Mode and maintain the present heading.



After reconnecting the unit to the CAN-Bus, the TurnRate-Mode or SERVO-Mode can be selected again.

The throttle mode however will not be interrupted by disconnecting the unit. After reconnecting it (at the same or any other bus-connector), the throttle continues to function, as if it had not been disconnected.

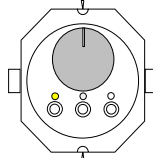
Activation of Throttle Station after Power Interruption

Should a power interruption occur either on the CAN-Bus (which powers the throttle stations), or at the FADEC-Box (which drives the actuators), but not at both of them, then the system resumes normal operation as soon as power has been reestablished. No user action is required. This is also a good reason, to use two separate power sources, when installing the system.

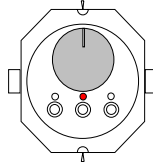
When both the throttle stations and the FADEC-Boxes have been unpowered, none of the throttle stations will be active, before the THR-button has been pressed at the desired station.

Thruster Functions

Bow and Stern Thruster, manual operation

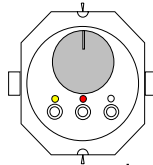


Press and hold the toggle towards the desired side (the SERVO Mode must be active at that station).



The **yellow** SERVO-LED will flicker, when the thruster is pushing to port. The **red** AP-LED will flicker, when the thruster is pushing to starboard.

A bow thruster overheat condition is indicated by a combined flashing of the SERVO and AP-LED. If thruster use is continued in an overheat condition, an intermittent warning tone will sound from the unit. The thruster will **not** be shut

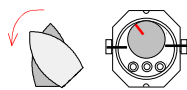


down automatically. 

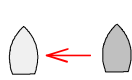
Docking-Mode with Bow and Stern Thrusters

After switching the throttle station into Docking-Mode (by pressing the THR-button, so as to get a flashing THR-Diode), mainly the **thrusters** will be used for steering, instead of the rudder. This is valid for all autopilot modes, except in pure SERVO Mode, where thrusters have to be commanded manually by toggle switches and the rudder will follow directly the FBW-Wheel.

With the FBW-Wheel in *Turn-Rate Mode*, the boat can be turned even at stand still or while going backwards, when the Docking-Mode is on as well. The Rate of Turn is determined by the position of the FBW-Wheel. The heading is held when the wheel is centered.

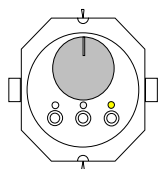


When both Bow **and** Stern Thrusters are installed (or with Jet-Drives or two individually controlled Stern-Drives), the boat can be shifted sideways without changing the heading or altering the selected rate of turn, by using one of the toggle switches.



Throttle Lever Functions

Engaging the Throttle Station



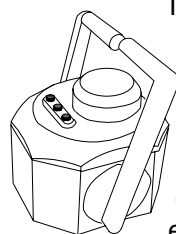
Press the THR-button briefly, to activate the throttle(s) of the unit. The engine(s) will immediately respond to the existing lever position(s) and the THR-LED of the unit will be lit, to indicate the active throttle station.



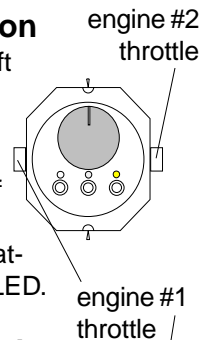
The throttle function is activated independently of the Turn Knob Function at each station.

The existing throttle mode(s) at the previously active throttle station will be continued on the newly activated station. For example with the left engine in WARM UP Mode and the right engine in FWD gear, this will be copied to the newly activated station, when the THR button is pressed.

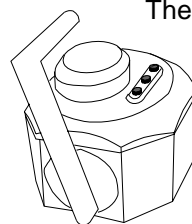
Twin Engine Throttle Station



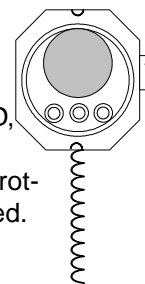
The status of the left engine (number 1) is indicated by the left (SERVO) LED, the status of the right engine (number 2) is indicated by the red (AP) LED.



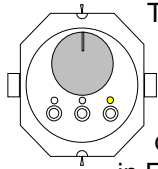
Single Engine Throttle Station



The status of the engine (number 1) is indicated by the left (SERVO) LED, no matter on which side the throttle lever is mounted.



Neutral - Forward - Reverse (Astern)



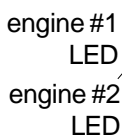
The throttle levers have a distinctive detent at Neutral, at FWD idle and at REV idle. Advancing the throttle further than these detents will accelerate the engine in FWD or REV gear respectively.

Shifting of the gear is displayed by a flickering LED of the respective engine. After the shift actuator has reached the new position (or hydraulic clutch pressure has built up), the flickering LED will stop with a short beep.

There is a built in delay for engaging gear out of NEUTRAL. The delay is a function of the measured or assumed engine speed.

Warm-Up Mode (gear neutral)

Put the engine into NEUTRAL gear, then press and hold the THR-button. Move the respective throttle lever to FWD (idle or above), and release the THR-button. Repeat that for the second engine, if desired. The WARM-UP Mode is now indicated by a continuous double flash of the left LED for engine # 1, or the middle LED for engine # 2. The throttle lever is controlling the governor position as needed.

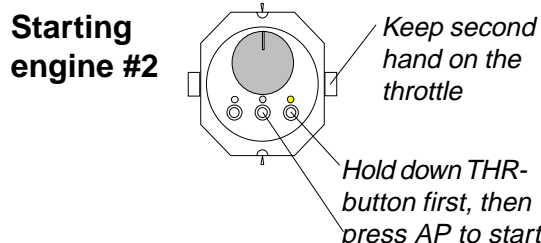
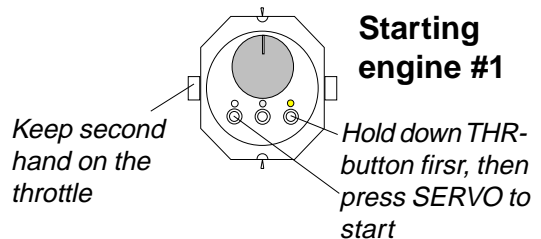


WARM-UP Mode is cancelled by pulling the respective throttle lever back to NEUTRAL. It can be reentered anytime as above (with a running or stopped engine).

Engine Start Mode

The FADEC-Box permits to duplicate the engine starter button. The Starter Button can therefore be activated from any throttle station. The throttle of the engine to start has to be in WARM-UP Mode. Then press and hold down the THR-button, and also press the SERVO-button to start engine #1, or the AP-button to start engine #2.

You will probably have one hand on the throttle lever and the other hand on those two buttons. The throttle station will sound a beep as long as the starter is engaged. When the engine fires, release the buttons and adjust the throttle as needed.



Docking Mode

If enabled in the FADEC setup (page 11, item A4*), a Docking-Mode can be turned on or off, by briefly pressing the THR-button of the active station. Condition is, that the engines are in NEUTRAL or in WARM-UP mode.

The Docking-Mode is indicated by a *flashing* THR-LED instead of the *steady-on* THR-LED of the active station.

Engine power or clutch pressure are restricted by the FADEC in Docking-Mode, while full throttle throw can be used, to make subtle power changes or clutch pressure changes.

Beside of its effect on the engines, the Docking-Mode affects steering as described on page 3.

Engine Stop Mode

If enabled in the FADEC setup, the engine can be shut down from any throttle station.

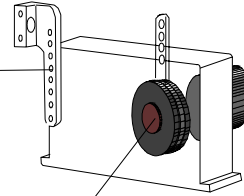
When in NEUTRAL gear, press and hold down the THR-button, then pull back the respective throttle lever into REVERSE. This will retard the governor crank below idle position and stall the engine.

When you want the FADEC out from STOP Mode, simply move the throttle back to NEUTRAL.

Installing the Engine Actuators and Cables

Unpacking the Actuators

Install the actuator-cable support bracket as shown. Use a higher bracket position, when expecting to use an outer hole of the actuator crank.



Warning 1:

Stay clear from the actuator crank with hands and feet, whenever it is powered. The crank has the potential to cause severe injury. The installer is responsible to prevent anyone from coming close to a working actuator.



Warning 2:

Do not connect the actuators directly to power (for testing them). This would misalign their internal position sensor and possibly complicate the installation.

Warning 3:

Never connect the actuators directly to a higher than a 12 Volts source, this could damage the motors.

Warning 4:

During the whole installation process, keep the red disconnect nut open, to permit the crank to move freely.

Warning 5:

Only trained and qualified professionals should take responsibility to install the FADEC system on any kind of vessel. Only they know about the potential risks for life and property, involved with a potential failure of the system and loss of control of the vessel, as well as applicable laws.

Mounting the Actuators

Although the actuators are sealed, it is imperative to have them at a dry location which will not be flooded or sprayed eventually.

A working temperature below 45 degrees Celsius (113 F) is recommended.

The FADEC-Box should be mounted as close as possible to the actuators, to minimize radio frequency emissions. Special attention should be paid to route the electrical cables at a safe distance from hot engine parts.

Actuator Crank Radius:		
Outer hole	56,7 mm	2.23 in.
2nd hole	49,7 mm	1.96 in.
3rd hole	42,7 mm	1.68 in.
Inner hole	35,7 mm	1.40 in.

Quick Disconnect: keep it open (counter clockwise) during the installation and initial setup, except for measuring the required cable length!

Throttle and shift actuators are marked differently. They have different internal sensor wiring. The shift actuator is shipped in NEUTRAL-gear position. The throttle actuator comes in IDLE-power (retracted) position. These zero-positions can be adjusted later, if necessary.

Mounting the Shift Actuator cable

Make sure the actuator is not connected electrically to the FADEC-Box, or at least the FADEC should not be powered.

Move the mechanically disconnected actuator crank to the upright position and engage the crank by tightening gently the red disconnect nut. Make sure the crank sits neatly in the groove of the actuator flange, when it stands up vertically.

The actuator flange has been marked with a black marker pen on the top side, when the flange was in NEUTRAL-GEAR position. If the pen marking is found at a different angle, it means the actuator has been moved out from its NEUTRAL-GEAR position. In this case disengage the cranks (open the red nut) of **both** actuators, connect **both** actuators electrically, put the throttle to NEUTRAL and press THR for one second. The actuator flanges should move to IDLE and NEUTRAL. If they don't, you will have to execute an alignment cycle by setting "Ac" = 01, as described later in this manual. Thereafter turn off power and continue mounting the cables.

Connect the shift cable at the actuator crank. Use the outermost hole for now.

The outer hole of the shift actuator crank will move approximately 35 mm (1.5 in.) out of neutral, either to FORWARD or to REVERSE, with a setting of A5=15 (forward throw), respectively A6=15 (reverse throw).

Next connect the cable to the gear box shift crank, while the crank rests in NEUTRAL position. Adjust the fork length on either cable end as required. Use an appropriate hole on the crank, that will engage the gear, when the

FADEC mechanical

cable moves by 35 mm (1.5 in.) approximately. When the cable has been mounted on both ends, disengage the QUICK DISCONNECT at the actuator. Then move the actuator crank by hand to FORWARD gear and to REVERSE gear, and verify the gear box is shifting properly, with no interference of the forks at the cable ends.

Standard setting: selecting FWD gear will pull on the shift cable, selecting REVERSE will push (red actuator wire = terminal 7, black actuator wire = terminal 8; FADEC-Setup A1=00).

Non-Standard setting: selecting FWD gear will push the shift cable, selecting REVERSE will pull on it (red actuator wire = terminal 8, black actuator wire = terminal 7; FADEC-Setup A1=01).

Throw adjustment: the FWD and REV shift throw can be adjusted separately in the FADEC-Setup by A5 and A6 at a later stage:

A5, A6 (5...17)	throw [mm] outer hole	throw [inches] outer hole
5	23	0.9
10	28,5	1.12
15	35	1.38
17	38	1.5

Numbers above 17 are not recommended for A5 and A6, to limit bending of the cable end.

Mounting the Throttle Cable

Make sure the actuator is not connected electrically to the FADEC-Box, or at least the FADEC-Box should not be powered.

Move the mechanically disconnected actuator crank to a retracted cable position, which is about 30 degrees from upright towards the cable support bracket. Then engage the crank by gently tightening the red QUICK-DISCONNECT nut. Make sure the crank sits neatly in the groove of the actuator flange.

The actuator flange has been marked with a black marker pen on the top side, when the flange was in IDLE POWER position. If the pen marking is found at a different angle, you should move the flanges electrically to their IDLE and NEUTRAL position first, as described already for the Shift Cable.

Now connect the throttle cable at the actuator crank. Use the outermost hole for now.

The outer hole of the throttle actuator crank will pull the cable approximately 68 mm (2.67 in.) out of IDLE, with a Setup setting of A7=64.

Next connect the cable to the governor crank, while the crank rests in IDLE position. Adjust the fork length at either cable end as required.

Use an appropriate hole on the governor crank, that will apply full power, when the cable moves by 68 mm (2.67 in.) approximately. After the cable has been mounted on both ends, disengage the QUICK DISCONNECT at the actuator. Move the actuator crank by hand to FULL power, and verify that the engine will accelerate properly, with no interference of the fork at either cable end.

Standard setting: advancing the throttle will pull on the cable (red actuator wire = terminal 3, black actuator wire = terminal 4; FADEC-Setup A0=01).

Non-Standard setting: advancing the throttle will push the cable (red actuator wire = terminal 4, black actuator wire = terminal 3; FADEC-Setup A0=00).

Governor Throw adjustment: the governor throw should normally not be reduced in the FADEC-Setup, to guarantee the highest throttle precision. Use a more inward hole on the throttle actuator, if a smaller throw is needed. It is not recommended to reduce the throttle throw electrically in the setup, by lowering A7 from its standard value of 64. The lowest number is 32, giving only half of the standard angular throw.

A7= (32...64)	throw [mm] outer hole	throw [inches] outer hole
32	37	1.46
64 (standard)	68	2.68

New Cables First Electric Operation

Disconnect the red QUICK DISCONNECT screw of the **throttle and shift** actuator. Make sure the motor wires and the sensor cables of both actuators are connected correctly to the FADEC-Box.

Disconnect all Autopilot-Boxes and an eventual second FADEC-Box from the CAN-Bus. Call up the AP-ConFig-Mode on a Display-Unit and select "A5".

[If a second display is available, display "FL" (fail codes) on it. This might be useful later]

At the desired throttle station press THR for one second. The THR-LED should illuminate steady. Move the throttle lever to the IDLE-FWD detent. Watch the shift actuator flange turning into FWD-gear position. The throttle servo flange should stay at IDLE-power. Then exercise the throttle through forward and reverse, from idle to full power.

Verify the actuator cranks could be connected (cranks in the groove) with the red QUICK DISCONNECT, after moving the cables manually to the corresponding position.

Adjusting the idle and neutral crank-position

Both the throttle and the shift actuator's "zero"-position can be set mechanically.

Remove the potentiometer lid of the actuator by unscrewing its three holding screws. A 2.5 mm Allen key (0.1 inches) is needed. Pay attention not to loose the O-ring seal of the lid. The adjustment screws of the potentiometer become visible under the lid.

Open the QUICK DISCONNECT on both actuators.

Operate the throttle and shift actuator by using a throttle station.

The throttle IDLE position can now be adjusted by first moving the throttle lever to the NEUTRAL detent.

Then loosen the three adjustment screws of the potentiometer-holder, just enough to rotate the holder as desired. The throttle motor will instantly rotate the actuator flange by the same angle as the holder has been shifted. When finished, tighten the three holder-screws and mount the sensor lid. Make sure the O-ring sits correctly under the lid.

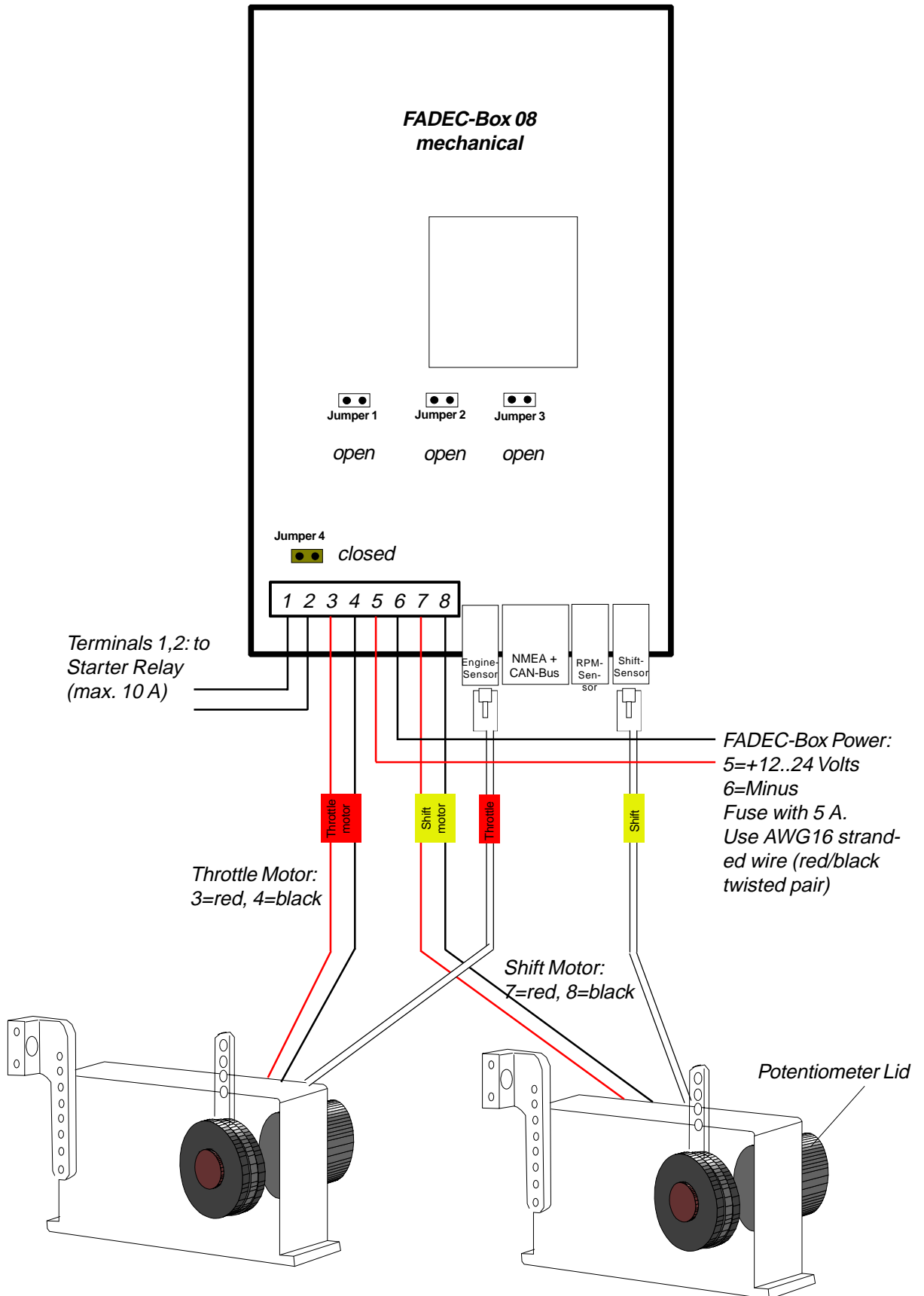
WARNING: the "New Cables First Operation" procedure must be repeated, to ensure there will be the correct actuator throw, after setting a new idle point.

The Shift NEUTRAL position is adjusted much like the throttle-IDLE position, except that the Shift Actuator will not move to a different position, before the throttle lever has been taken out from NEUTRAL and back to NEUTRAL.

WARNING: the "New Cables First Operation" procedure must be repeated, to ensure there will be the correct actuator throw, after setting the new neutral point.

FADEC Actuator Connection

Throttle and Shift Actuator and Starter Button



FADEC-Box Setup

Initial Operation

Possible Problems

The actuator flanges are not moving as expected and seem to be locked, with their zero position mark near the bottom. Fail code 03 (throttle servo extreme) or 08 (shift servo extreme) are displayed.

Reason: at least one of the actuators has reached an extreme position, possibly due to wrong wiring of the motor at the FADEC-Box or wrong setup data (A0 or A1).

Action: verify connections and setup data, then start an alignment cycle by setting "Ac" to 01. This should bring both servos to their zero position. If necessary, repeat that after cutting power to the FADEC-Box for a few seconds.

Opposite way moving shift actuator: (FWD instead REVERSE).

Reason: incorrect connection and setup of Shift Actuator.

Action: Interchange Shift Motor wires and switch setup parameter "A1".

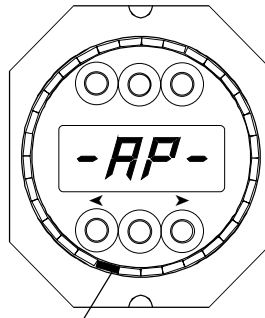
Shift Actuator has incorrect throw:

Action: adjust FWD shift throw by altering "A5" in the setup, REVERSE shift throw by "A6". Avoid numbers above 17. Use different crank holes (at the actuator or at the gear-box), if needed.

Throttle actuator has incorrect throw:

Action: use different crank holes at the actuator or at the governor. Only if still needed, lower "A7" in the setup. The standard value of A7=64 should be kept as close as possible to 64, to improve throttle accuracy.

FADEC-Setup is done on any of the Autopilot-Displays in the System, and **only** after the Autopilot-Driveboxes and an eventual second FADEC-Box have been disconnected from the CAN-bus.



Throttle-Servo LED

The FADEC-BOX must be powered and connected to the bus to permit its configuration.

1. Select the AP-Configuration Mode on an Autopilot Display (or set "di=01" on any other Tecnautic Display and select >ConFig>AP). Verify that an LED is lit in the lower half of the perimeter, as shown in the picture above. If none of the LEDs is lit, there is no communication with the FADEC-Box and the setup cannot start.

- 1) Press and hold the lower outer buttons
- 2) Press the lower middle button 4 times
- 3) Release all buttons (Con-FiG is shown)
- 4) Use the lower middle button to scroll forward until "-AP-" is displayed.

2. Press the lower left button once. The parameter "**A0:**" will be displayed (A0=00 or A0=01). Be careful not to alter A0 unintentionally by pressing (again) the left or right button.

3. Use the lower middle button to scroll forward to the next parameter **A1, A2** etc. Each parameter can be altered if needed, with the left or right lower button.

Setup Parameters

There are two sets of parameters. The proper selection is made with A9.

- A0:01** (00 or 01) Rotation sense of the throttle actuator. A0=01 is the standard setting. It requires the red throttle-motor wire on terminal 3, black on 4. The throttle actuator will *pull* the governor cable for increasing power.
- A1:00** (00 or 01) Rotation sense of the shift actuator. A1=00 is the standard setting. It requires the red shift-motor wire on terminal 7, black on 8. The actuator will *pull* the shift cable for shifting to FORWARD.
- A2:01** 01 is compulsory for mechanical throttle and shift (other setting is not permitted with the mechanical FADEC-Box).
- A3:01** (01...02) Engine selection. Set A3=01 for the left engine or a single engine (engine #1) and A3=02 for the right engine (engine #2).
- A4:01** (01...31) Throttle actuator "Retard"-throw. The throttle cable will be moved back below IDLE, to stop the engine, when the STOP-Mode is selected at the throttle station.
- A5:17** (05 ...17) Shift actuator FORWARD shift throw.
- A6:17** (05 ...17) Shift actuator REVERSE shift throw.
- A7:64** (32...64) Throttle actuator throw. Keep A7 as high as possible, select suitable inward crank hole first, before reducing A7.
- A8:00** A8=00 .. automatic shift delay (protection) before shifting into gear after high power settings.
- A8=01..31 .. Engine RPM increase (Spin Up) before shifting into gear. The spin up will fade out there after. No shift delay (protection) if A8 not zero.

A9:01 (00 or 01) This is a switch between selected parameters. A9=00 shows parameters A0* ... A4*. However A9 other than zero displays parameters A0 ... A4.

AA:00 (0...31) Reserved
A_:00 (0...64) Reserved

Ac:00 **Caution:** open the QUICK DISCONNECT on both actuators. Set Ac=01 to start a sensor alignment cycle of the actuators, if needed. After an alignment cycle verify movements and throw of both actuators, before reconnecting the QUICK DISCONNECTs.



A-:00 NMEA output from the FADEC-box:
 A- =00 .. Test data out (ASCII terminal)
 A- =01 .. Set up flux gate HS8000
 A- =02 .. HDM and VHW out (8 Hz)
 A- =03 .. VHW out (8 Hz)
 A- =04 .. Test heading instead fluxgate

Second group of parameters A0* .. A4*:
 The parameters A0* .. A4* are displayed, whenever A9 has been set to zero previously. A0 .. A4 however will be displayed only when A9 is not zero. Note that the asterisk is not shown on the display unit.

A0*:00 Reserved

A1*:00 Reserved

A2*:00 Reserved

A3*:00 Reserved

A4*:00 The Docking-Mode is enabled when setting A4*=01.

Throttle Station Setup

Entering the SETUP mode: press and hold the left and right button. Then, while holding the left and right button, press the middle button four times briefly and release all buttons. This procedure would also unlock a locked unit.

The red LED (only) will come on, indicating setup step 1 (P1) of the station.

Step P1: (reserved function) Press SERVO briefly to advance to step 2, or press THR to exit the setup mode.

Step P2: (reserved function) Press SERVO briefly to advance to step 3, or press THR to exit the setup mode.

Step P3: Press AP (the middle button) briefly and listen to the number of beeps. Press AP again to increase the number of beeps. P3 selects the connected equipment (toggles or gyro).

When finished, press SERVO briefly to advance to step 4, or press THR to exit the setup mode.

Step P4: P4 calibrates the throttle potentiometer after connecting it for the first time to this FBW-unit or after reinstalling it.

When finished, **press and hold** SERVO to advance to step 5a, or press and release the SERVO button to advance to step 5b, or press THR to exit the setup mode.

Step P5a: P5a locks the FBW unit, when the AP button is pressed before the SERVO button has been released.

Step P5b: (no function) press SERVO briefly to advance to step 6, or press THR to exit the setup mode.

Step P6: P6 sets the illumination group number for the unit. Press the middle button repeatedly to select the desired number. Standard setting is P6=1 (one beep), for group number 1.

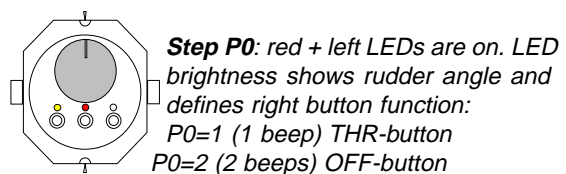
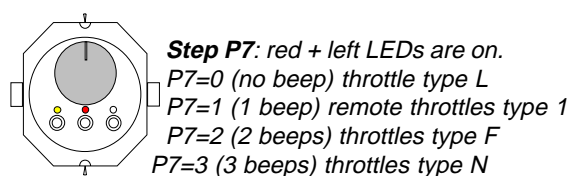
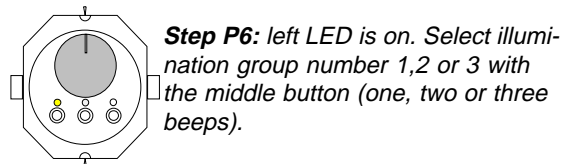
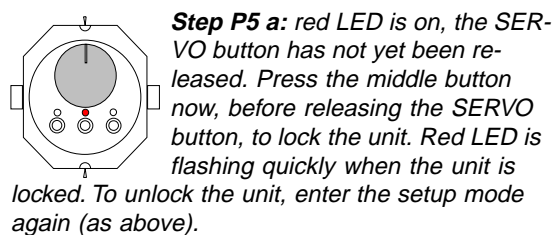
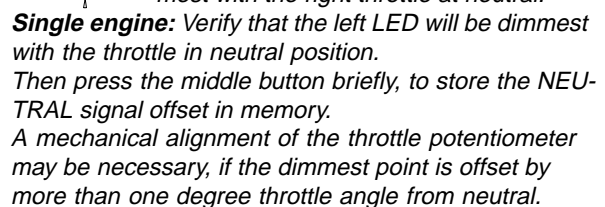
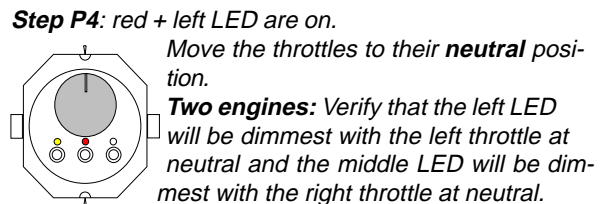
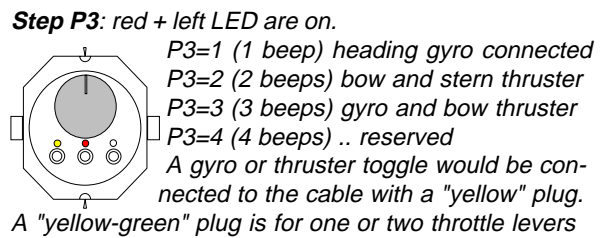
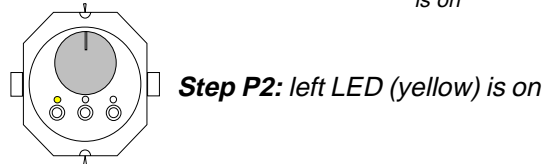
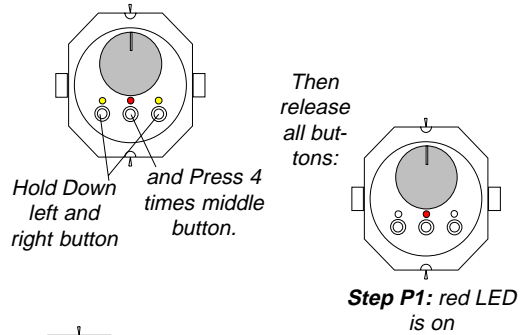
Press SERVO briefly to advance to step 7, or press THR to exit the setup mode.

Step P7: P7 sets the throttle lever type. Press the middle button to select the throttle lever type of this station. **Setting the wrong number is dangerous** and may cause unwanted switchings.

Press SERVO briefly to advance to step 0, or press THR to exit the setup mode. Step 1 follows again after step 0.

Step P0: P0 defines the right button function: P0=1: THR-button or P0=2: OFF-button (turns off the AP and SERVO-wheel).

Whenever unsure about the present step number, press THR to exit the setup mode.



FADEC fail codes

FADEC fail codes are produced by the FADEC-Box and sent to all display units, but only when no other Box is connected to the CAN-Bus. Therefore disconnect all autopilot and thruster boxes (and eventual second Fadec) from the bus temporarily when analyzing FADEC failures.

There are two ways to read the code:

A) select the FAIL code by reading it from a display unit (dF=F0 must be active).

B) select the "Config" mode on a display unit (any unit in the system) and press the right button to read out the last FAIL code of the box.

Note: when switching off bus power **and** FADEC power, any code stored inside the display units will be lost; a random number (e.g. 33) will be displayed after powering up the FADEC again, until a new fail code is transmitted by the box.

- 01 OFF due to over current
- 02 OFF due to box over temperature
- 03 OFF due throttle-servo extreme angle
- 04 OFF: CB on FADEC-BOX has dropped
- 05 Battery voltage low! (no throttle disconnect, only warning)
- 06 OFF due to low internal Gate Voltage
- 07 OFF due to 1/4-sec over current limit
- 08 OFF due to shift-servo extreme position
- 12 OFF due to shift-servo time-out
- 13 7474 OFF (65 A short circuit cut off)
- 14 OFF due to throttle fault
- 15 OFF due to 4-second over current limit
- 17 OFF due to servo current > 45A

NMEA Input at the throttle station (no NMEA-output is provided):

From the following NMEA 0183-sentences, specific data fields are read. The data are used for displaying certain functions and for guidance of the autopilot in NAV mode.

The NMEA input is not available on the remote throttle station.

- APB: a) Cross Track Error
b) Mag bearing between waypoints
- BOD: Mag bearing between waypoints
- BWC,BWR: MagBrg+Dist of pres.pos. to WP
- GLL: Lat / Long
- HDM, HDG: Magnetic Heading
- MWV: Apparent Wind Angle and Speed
- RMB: Cross Track Error,Bearing+Distance to WP
- RMC: Ground Track and Speed
- VHW: a) Magnetic Heading
b) Water Speed (knots)
- VTG: Ground Track and Speed
- VWR: Apparent Wind Angle and Speed
- WDC: Distance to Waypoint
- WDR: Distance to Waypoint
- XTE: Cross Track Error (NM)