

**FADEC electronic**  
**Oct 16, 2011**

Covers engines with analog throttle signal (23 02 21) or PWM signal (23 02 22) and electrically controlled (hydraulically operated) gear boxes with or without trolling valve

Software Version  
cwt11.05, mth11.35  
mot11.14, dis11.03

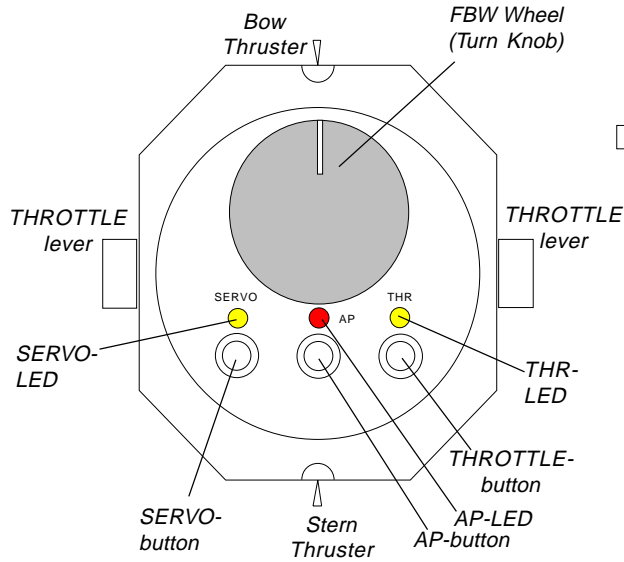
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# Turn Knob Functions of the Fly-By-Wire unit

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



## Turn-Rate Mode

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

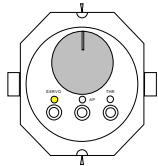
In Turn-Rate-Mode heading changes can be made either with the Turn Knob or with the push buttons on an autopilot or heading display.

**Note:** the Turn Rate mode is only available when the heading gyro has completed its alignment (normally 5 minutes after power up, but can take longer with no compass in the system). An operational gyro is also indicated by a dot behind the "H." on the heading display. The Turn Rate Mode is always used while moving forward.

In DOCKING MODE, it should even be used while halted or moving astern, when vectored thrust is available from the propulsion system (as with two individually steered rudders or stern drives, or with bow and stern thrusters, or with jet drives). Use the FBW-wheel to change the heading.

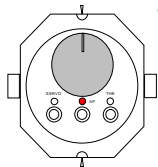
## Servo Mode

Press the "SERVO" button briefly to toggle between the *SERVO* Mode and *Turn Rate* Mode. An inactive Turn Knob would be activated by the SERVO button, taking over an eventually 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 used when the Heading Gyro is not yet aligned, otherwise use the Turn Rate Mode.



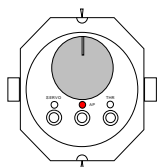
## Heading Mode

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

<b>SERVO LED</b> blinking fast and a double beep sounds every two seconds	Rudder not following the Turn Knob position
<b>SERVO LED</b> glowing slowly (On and Off)	STANDBY-mode: continuous pumps are kept running
<b>red AP LED</b> glowing slowly (On and Off)	No communication with DRIVE Box or FADEC-Box
<b>red AP LED</b> 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.
<b>red AP LED</b> flashing fast	The FBW-unit is locked (see Setup)

## "Moving" your remote control

When disconnecting the cable of an active FBW-unit while 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 at the same time, then the system will resume normal operation as soon as power has been reestablished. No user action is required. This also makes a good point for use of two separate power sources for the CAN-Bus and the FADEC-Boxes, when installing the system.

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

## Speed Mode

In SPEED Mode either water speed (or ground speed in the absence of a log) are controlled by the FADEC system.

Throttle levers are inactive in Speed Mode. Selected speed can be modified with the rear toggle switch or Joystick and will be displayed briefly on the AP-Display, when speed is modified.

Throttles can be engaged again anytime by pressing the THR-Button, which cancels the Speed Mode.

**Throttle Station:** to activate the SPEED Mode, hold down the THR-Button, quickly followed by pressing the AP-Button. The THR-LED will then change to a periodic double flash.

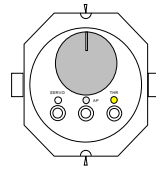
**Note:** when selected speed is lower than 5 kt, the system will automatically switch into Docking Mode. Selecting a speed of 5 kt or above will cancel the Docking Mode.

The SPEED Mode is activated automatically on the **Joystick**, when applying the SERVO button or selecting the LAND mode with a double click on the AP button.



# Throttle Lever Functions

## Engaging the Throttle Station



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



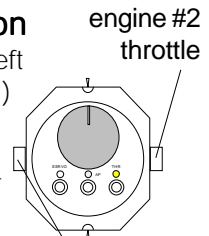
The throttle function is activated independently from the Turn Knob Function at each station.

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

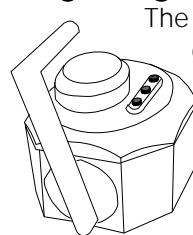


The status of the left engine (number 1) is indicated by the left (SERVO) LED, the status of the right engine (number 2) is indicated by the red (AP) LED.

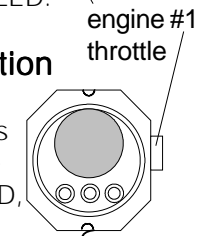


engine #2 throttle

## 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.



engine #1 throttle

## NEUTRAL, AHEAD and ASTERN

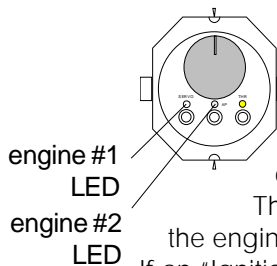
The throttle levers have a distinct detent at Neutral (zero thrust) and also at forward idle and at astern idle. If in NORMAL mode (as opposed to Docking Mode), advancing the throttle further than the forward or astern idle detent will accelerate the engine.

Shifting of the gear is displayed by a flickering LED and a short beep of the respective engine.

In Docking Mode and with a Trolling Valve installed, only clutch pressure is increasing during the first 25% of throttle range.

### Warm-Up Mode (Zero Thrust)

Put the throttle lever into NEUTRAL, then press and hold the THR-button. Now move the throttle lever to AHEAD idle (or more), and release the THR-button. Repeat that for the second engine, if desired. The WARM-UP Mode is indicated by a periodic double flash of the respective LED.



The throttle lever is used to control the engine speed as needed.

If an "Ignition Switch" is installed in the model of your FADEC-Box, it will be turned ON when the WARM-UP Mode is selected.

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

### Engine Stop Mode

If an "Ignition Switch" is installed in the model of your FADEC-Box, it will be turned off when the STOP-Mode is selected from any throttle station.

When in NEUTRAL gear, press and hold down the THR-button, then pull back the respective throttle lever into REVERSE.

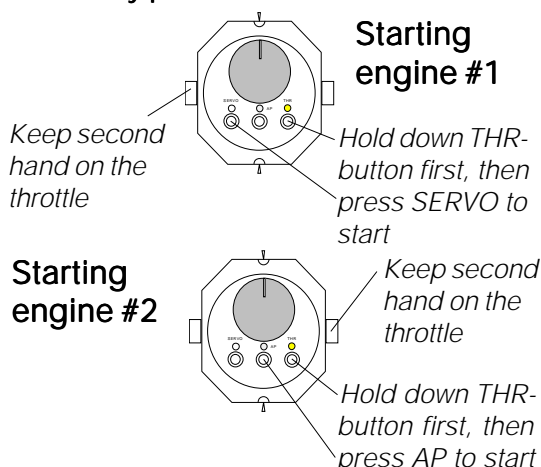
To cancel the STOP Mode, move the throttle to NEUTRAL on any active throttle station. The ignition switch remains off until entering the WARM-UP mode again.

### Engine Start Mode

The FADEC-Box permits to duplicate the engine start button. The starter motor can therefore be activated from any throttle station. The throttle of the *respective engine* 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.

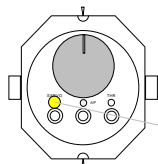
You will probably have one hand on the throttle lever and the other hand on those two buttons. When the engine fires, release the buttons and adjust the throttle as needed.

**Engine Start from the Fly-By-Wire Station is only possible in WARM-UP Mode!**

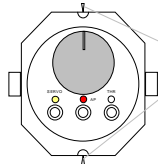


## Manual Bow and Stern Thrusters

### With Toggle Switches



1. The **SERVO-Mode** must be active **at this station** (or **THR-Mode** active, if the Drivebox is in OFF-Mode).

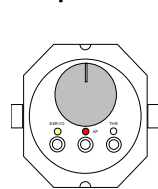


2. Press and hold the respective toggle towards the desired side. With proportional thrusters the thruster speed can be increased or decreased in 10 steps with every toggle application.

Activation of the Thrusters is indicated by flickering LEDs.

Activation of the Thrusters is indicated by flickering LEDs.

### Proportional Thruster-Joysticks



(P3=5)

1. The **SERVO-Mode** must be active **at this station** (or **THR-Mode** active, if the Drivebox is in OFF-Mode).

2. Move the respective joystick towards the desired side. With proportional thrusters, thruster speed is proportional to joystick deflection.

Thruster activation is indicated by flickering LEDs.

### Manual Throttles

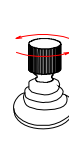
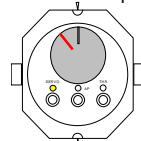
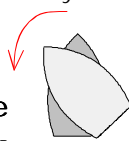
Even without a Joystick is it easy to move the boat purely sideways, with engines in Docking-Mode and the FBW-wheel in Turn-Rate-Mode. For moving to port, the port throttle will be pulled into reverse just above idle and the starboard throttle will be put into forward thrust, just above idle.

Use only one throttle for Forward/Aft boat movement.



### Turning in Docking-Mode

Using the FBW-Wheel **in Turn-Rate Mode** lets you turn the boat even at stand still or while moving astern, when the Docking-Mode is on. The **Rate of Turn** is selected by the Turn Knob position or the Joystick rotation, if there is one attached.

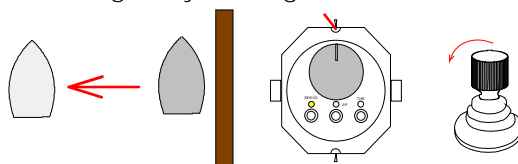


The boat is always turning in the sense of the knob, even when moving astern. With the Turn Knob centered in the detent, heading will be maintained by the heading gyro.

The autopilot can use thrusters or individually steered drives for turning the boat. One thruster or two independent rudders or drives are required. A single Water-Jet is also sufficient.

### Sideways motion in Docking Mode

Move sideways by use of the forward toggle or Joystick, while the **Turn-Rate Mode** is on. The heading is held automatically or may be changed by rotating the knob while moving sideways.



When side-thrust is produced with proportional thrusters or independent rudders or drives, it can be altered gradually with the Joystick.

Sideways thrust with *two sraight shafts* (without thrusters) requires very effective rudders, so as to deflect forward thrust enough sideways (since reverse thrust will remain merely straight).

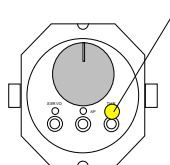
## Manual Docking-Mode

**Autopilot in Docking-Mode:** the vessel can be steered (turned) at standstill and also be shifted sideways. Bow and Stern Thrusters will be used automatically, if available. In the presence of two engines, these will be put into opposite gear (and steered individually to different rudder angles, if so selected in the setup during installation).

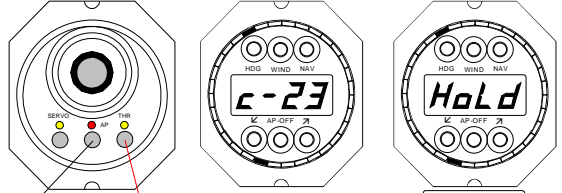
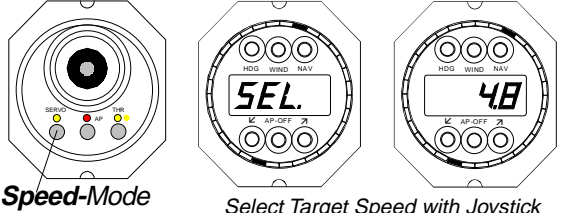
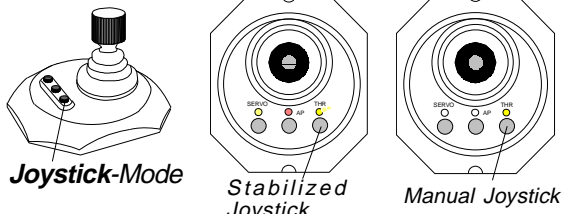
**FADEC in Docking-Mode:** the system may be configured to limit engine power in Docking-Mode, permitting large throttle movements for small thrust adjustments.

**Changing into and out of Docking-Mode:** The THR-button is used to select the Docking-Mode for the autopilot **and** for the FADEC. Switching in and out of Docking-Mode **requires the engines either in NEUTRAL** or in WARM-UP Mode. Hold the THR-button for 2 seconds until it sends a short beep. The Docking-Mode is indicated by a flashing Throttle-LED.

The steering functions of the Docking-Mode (rudders, drives and thrusters) will not become active if selected at high speed, until boat speed has dropped below 5 kt.



# Three-Axis Joystick



**In Hover Mode** use WIND button to switch into Wind- or Anchor-Mode. Thrusters may be disabled in Anchor-Mode with the OFF-button.

**Turn Rate or Servo**

Thrust

SERVO THR

THR-button for Turn-Rate or Servo Mode

**Turn Rate or Servo**

Speed Select

SERVO THR

SERVO-button for Turn-Rate or Servo Mode

**Turn Rate**

Anchor Point offset

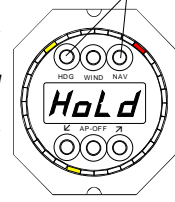
SERVO THR

Double click for LAND-Mode

To arm for waypoint capture press both buttons together, start with the NAV button

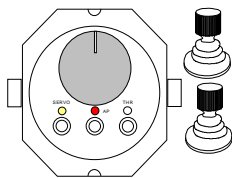
To connect your Anchor Point to a waypoint, the Hover Mode must be armed.

The armed state is shown with an intermittent red NAV-LED. It is cancelled with the NAV button or THR button. An armed waypoint is captured within 50m. Moving a captured waypoint in Anchor or Hover Mode will drag the vessel with it.



# Throttle Station Functions

Throttle Station with Proportional Thruster Joysticks



# Steering Functions

Rudder Bow Stern

SERVO THR

Servo + manual Thrusters

Throttle

Hold down THR button for Docking Mode (blinking)

Turn Rate Sideways

+Sideways motion in Docking Mode

Speed

Press THR+AP for Speed Mode (blink fast)

Speed Select

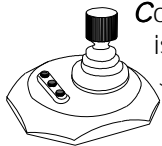
Autopilot

HDG-Mode (double click for NAV Mode)

THR-Functions are independent of Steering Functions and can be selected with any Steering Mode

Steering Functions are independent of THR-Functions and can be selected with any Throttle Mode

## Joystick Functions



Control of the manual **Joystick-Mode** is taken with the **THR-button** on the Joystick unit.

Heading can be changed by rotating the Joystick knob, whereas moving the stick in any direction will move the boat accordingly. By pressing the THR-button again, it is possible to allow heading control either in SERVO-Mode (not stabilized) or in Turn Rate Mode (gyro stabilized).

All available rudders, engines, propellers and thrusters are controlled by the Autopilot-FADEC system.

When a steady manual input is desired, the signal of the spring loaded Joystick may be frozen by holding the THR-button, until the handle has been released.

A new subsequent Joystick movement will unfreeze it again.

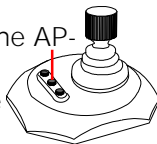
The Joystick-Mode has a very fast and continuous double flash of the THR-LED.

The **SERVO button** will activate the SERVO or Turn Rate Mode in the same manner as on a Throttle Station. In addition, the **Speed Mode** becomes active, permitting speed selection by forward or aft movement of the Joystick.

Lateral Joystick movement has no effect in Speed Mode.

### Hover Mode

The Hover Mode is engaged with the AP-button on the Joystick. The vessel then holds its present GPS-position, with the Joystick in Turn Rate Mode.



Heading control may be transferred to the Wind Mode or Heading Mode (on the AP-Display), or to the Turn Rate Mode on a Throttle Station.

To cancel Hover Mode, press any THR-button. The SERVO button will not terminate the Hover Mode.

An Anchor Point offset from the SatNav antenna (setup A8\*) can be altered by forward or aft Joystick movements, in one-meter steps, while in Hover or Anchor Mode. The offset will return to the stored value A8\* when the NAV mode is engaged.

### Anchor Mode

In Anchor Mode the vessel is pointed automatically towards a virtual buoy, while distance is maintained constant. Lateral motion is not required for this mode.

Anchor Mode can be selected out of Hover Mode with the WIND button on the Display.

Anchor Mode will be engaged automatically, if the vessel has no Hover capability, when Hover Mode is selected.

Line length to the virtual buoy can be fed with the Joystick (antenna offset). Negative numbers will attach the buoy to the stern.

## Plotter Operation

A hover point may be created by an active waypoint on the plotter screen: **press NAV (first) plus HDG (together), to arm that waypoint for hover capture** (NAV-LED blinking red).



When the vessel comes within close distance of the armed waypoint, it will capture the waypoint and enter hover mode.

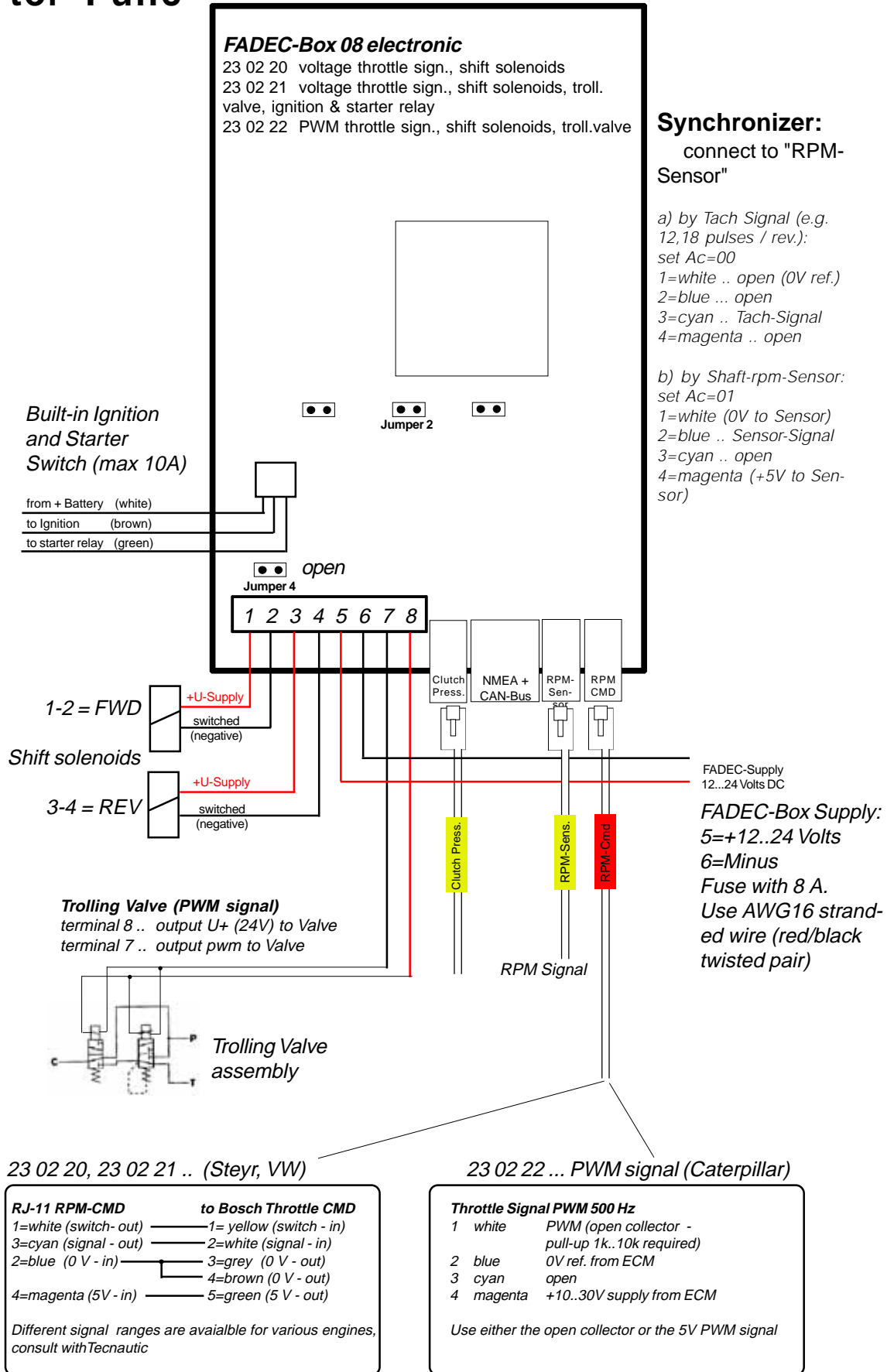
If the vessel has only Anchor Mode capability, it will automatically enter Anchor Mode when the capture occurs.

If the armed waypoint is moved on the plotter screen and the boat is already in Hover or Anchor mode, it will be dragged to the new position.

**To disarm hover point capture**, press the NAV button briefly or press the THR-button (the latter also cancels an actual hover mode).

# FADEC Connection

## Throttle Signal, Shift, Trolling Valve, Ignition and Starter Function



# Electrical Connection

## Warning:

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.

## Wiring the ECU

Connect the ECU (engine control unit, supplied by the engine manufacturer) according diagram on facing page.

### Throttle signal is Voltage:

- Pin 1 = Safety Switch Signal (0 Volt at idle RPM, open or 5 V when accelerating above 10% approximately)
- Pin 2 = 0 Volt (supplied from ECU)
- Pin 3 = RPM command voltage (throttle signal). At idle approx. 0,4 V ... at full throttle 3,3 to 5 V, depending on ECU model).
- Pin 4 = 3,3 to 5 V (supplied from ECU)

### Throttle by PWM signal:

- Pin 1 = PWM signal (open collector, 1k..10k pull-up required)
- Pin 2 = 0 Volt (supplied from ECU)
- Pin 3 = alternative PWM signal 0V-5V (1k Ohm source impedance)
- Pin 4 = 10 to 30 V (supply from ECU)

Leave the Shift Valves initially unconnected, for testing the throttle response of the engine.

## Trolling Valve Wiring and Setup

Connect the Trolling Valve as shown. Only trolling valves with a combined connection for ON-OFF and pressure regulation can be connected (e.g. ZF-type). Adjust settings if needed (see also page 8 and 9):

1. On the Display unit: select the FADEC setup parameter "A6" (make sure only one Box is connected to the CAN-Bus during setup, no other FADEC-Box or Drivebox present).
2. With running engine select the Docking-Mode and engage FORWARD IDLE. Adjust A6 for a slow shaft rotation (approx. 2 rev./sec). Verify switching between FWD and REV.
3. Select "A5" on the Display unit and switch from Trolling Mode to Normal Mode. Verify smoothness of clutch engagement when shifting quickly between FORWARD and REVERSE. Reduce A5 if clutch engagement is not gentle, but leave A5 as high as possible, for sufficiently firm shaft breaking during high speed shift reversal.

## Wiring the Gear Box

Connect the shift valve solenoids as shown on facing page.

## Installing a Shaft RPM Sensor

Mount the sensor at a suitable location, to pick up the shaft RPM.

Verify the sensor operation by reading out RPM 1 or RPM 2 respectively on the display unit.

Whenever two engines are installed, they will be synchronized automatically, when their throttle angles and engine speeds are similar.

# Possible Problems

## Engine stalls when shifting into gear

(Clutch is engaging normally. Throttle station shows no abnormal status)

**Action 1:** verify if engine responds to the throttle and can be accelerated in WARM-UP mode. Then ....

If **"YES" assume: (Reason 1)** not enough spin up before shifting into gear: increase amount of spin up (by increasing A8 in the setup) or increase the shift delay (by increasing A0), or both. It may be helpful to disconnect the clutch wires temporarily, to monitor the spin up without actually engaging the gear, when selecting FWD or REV.

If **"NO" assume: (Reason 2)** interrupted CMD signal line (command) from FADEC-Box to the ECU (electronic engine control unit).

**Action:** verify the CMD-cable connection and the CMD signal voltage (for analog throttle signal: pin-3: idle = 0.4 Volt, full power = between 3 and 4.5 Volt, depending on ECU and FADEC-Box setup parameter "A7").

## Engine RPM is fluctuating when synchronizing

The signal of either shaft RPM sensor is intermittent.

**Action:** disconnect one sensor, to disable synchronizing. Monitor the remaining shaft RPM display for stability. Repeat with second shaft RPM sensor.

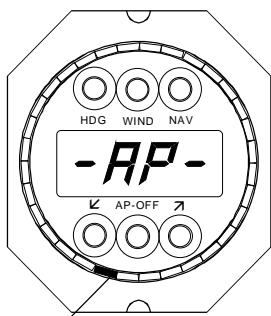
# FADEC-Box Setup

## Initial Operation

## Setup Parameters

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

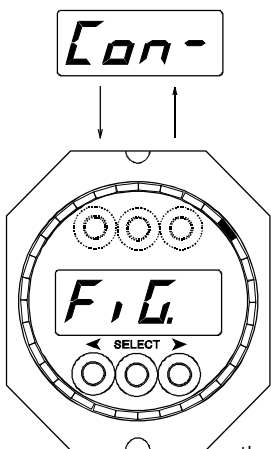
FADEC-Setup is done on an Autopilot-Display, but **only** after any Autopilot-Drivebox or Thruster-Box and eventual second FADEC-Box have been disconnected from the CAN-bus.



Throttle-Signal LED

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

### ConFig menu:



1. Select the **AP-Configuration Mode** on an Autopilot Display (or set "di=01" on any other Tecnausic 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) In addition 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.

**A0:00** A0=01 adds a break of 0,4 seconds after rev-up, before clutch engagement.

**A1:01** A1=01 is for automatic shift delay (protection) before shifting into gear after high power settings. Recommended when a Trolling Valve is **not** installed.

**A2:03/04/05..**Boxtype: A2=03..throttle signal is analog voltage (Steyr, VW); A2=04: signal is 500 Hz PWM (Caterpillar); A2=05: pwm-signal for hydraulic thruster by proportional valve.

**A3:01** (01...02) Engine selection. A3=01 for the left engine (engine #1) or A3=02 for the right engine (engine #2).

**A4:05** (01...31) Trolling Valve *Break-Off time* [1 unit = 125 ms]. Time starts from beginning of clutch engagement. Smaller number permits faster shifting. Should be long enough, to ensure sufficient propeller braking in a high speed shift reversal.

**A5:16** (01...31) Trolling Valve *Break-Off pressure*. Kicks off shaft rotation. Reduce setting when clutch engages hard, but keep it as high as possible, to allow for sufficient braking during high speed reversals from FULL AHEAD to FULL ASTERN.

**A6:12** (01 ... 31) Minimum trolling valve pressure in Docking-Mode, that keeps propeller spinning slowly in FWD or REV IDLE.

**A7:64** (32...64) Throttle Gain. Reduce A7, to decrease full throttle FADEC output signal (RPM command voltage or PWM-width) such as to achieve full power only short of the throttle stop.

**A8:00** (0...31) Sets Engine RPM increase (Spin Up), before shifting into gear. Consider function of A1\* and A2\* below!  
Note: there is no Spin Up when switching into WARM-UP mode.

**A9:10** a) Parameter set selection: A9=00 displays the second set of parameters, denoted as A0\*.. A7\* see below.  
 b) Limit Trolling Valve current [and clutch torque] as a function of throttle angle (a higher number A9 makes a lower torque)

**AA:00** (0..32) Minimum thrust in Hover- or Joystick-Mode  
 a) twin screw vessels without thrusters: set AA so as to have sufficient steering, while in opposite gear.  
 b) single screw vessels with bow and stern thruster: set AA to represent lowest idle thrust (FWD or reverse).

**A\_:20** a) A\_ is the throttle gain setting in Hover and Speed Mode  
 b) If A2=03, A\_ becomes a second Throttle gain setting, instead of A7, when an RPM-switch is installed and closed (for low power maneuver practicing). Also set A-=06, to enable it.

**Ac:00** Reserved

**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 instd. compass
- A- =06 .. RPM-switch enabled

**Second group of parameters A0\* .. A8\*:**

The parameters A0\* .. A8\* are displayed whenever A9 has been set to zero previously. A0 .. A8 however will be displayed only when A9 is not zero.

Note that the asterisk (\*) is not shown on the display unit. *Remember A9!*



**A0\*:00** Reserved Function

**A1\*:01** See table for Rev-Up on right side

**A2\*:01** With trolling valve installed set A2\*=01  
 See also table for Rev-Up on right side.

**A3\*:00** Must be 00

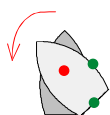
**A4\*:01** A4\*=01 enables the Docking-Mode

**A5\*:00** Must be 00

**A6\*:03** (00..03) Hover accuracy.

**A7\*:00** set A7\*=01 for *Twin screw* tractor (front) drive or with Bow Thruster only.

**A8\*:30** Anchor Point offset from Sat-Nav antenna. Anchor Point refers to Hover Mode Position. A8\*=30 means no offset. Numbers above 30 will move the Anchor Point towards the bow, below 30 towards the stern. Range +/-30 m.



**Rev-Up options:**

Engine spinup before clutch engagement. The parameters A8, A1\* and A2\* are used to set the desired Rev-Up:

**A1\*=01 and A2\*=01**

Rev-Up according A8, but only in Docking-Mode

**A1\*=00 and A2\*=01**

Rev-Up according A8, in Docking-Mode and Normal Mode

**A1\*=01 and A2\*=00**

No Rev-Up

**A1\*=00 and A2\*=00**

Rev-Up according A8. The RPM spin-up will fade away after clutch engagement

# 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 (gyro, toggles or joystick).

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.

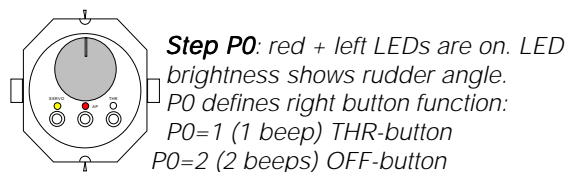
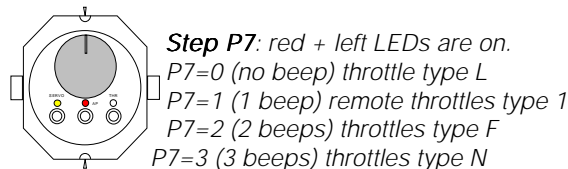
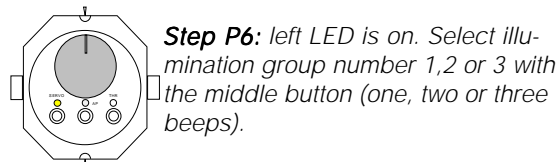
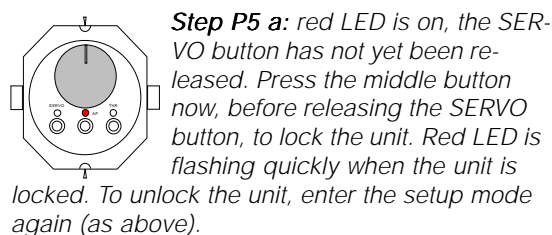
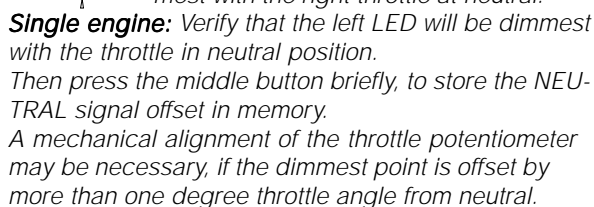
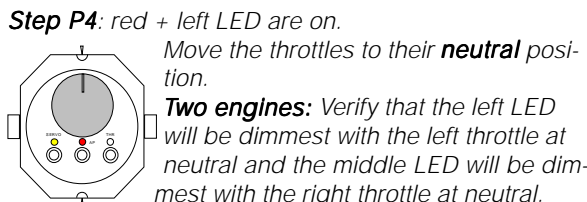
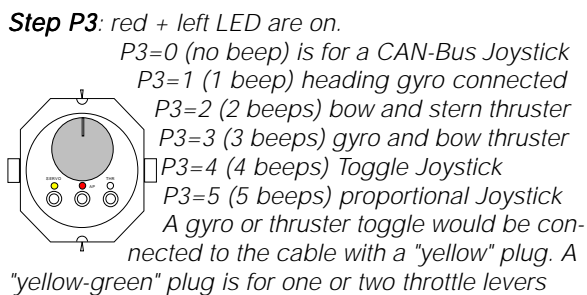
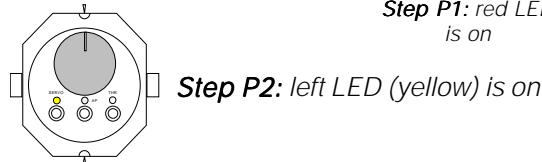
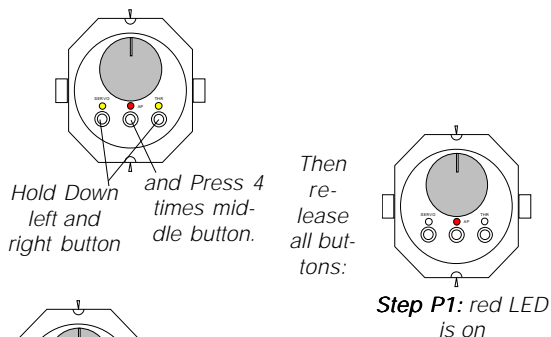
Press SERVO briefly to advance to step 7, or press THR to exit the setup mode.

**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. This is very useful during installation.

Reading FAIL codes from the display unit is done with function "F0", which is shown after holding the OFF-button (for about 3 seconds). The lower right button is then used to select the desired Box:

P.1=Drivebox1, P.2=Drivebox2,  
F.1=Fadeebox1, F.2=Fadeebox2.

For example F.2=08 points to a problem with the Shift Servo on the Starboard engine.

Note: when switching off bus power **and** FADEC power, any code stored inside the display units will be lost; a random number (e.g. 32) will be displayed after powering up the FADEC again, until a new fail code is transmitted by the box.

FADEC-Fail codes may be cleared with the THR-button.

"OFF" stands for automatic disconnect of the FADEC-Box:

Code	FADEC Failure Cause
01	OFF due to over current
02	OFF due to Fadec box over temperature
04	OFF: CB on Fadec box has dropped
05	INFO: Battery voltage low! (no throttle disconnect, only Info)
06	OFF due to low internal Gate Voltage
10	INFO: sensed late dblvlt (> 18 V)
13	OFF due to > 65A short circuit
14	OFF due to throttle or joystick fault
15	OFF due to 4-sec 15A over current limit
17	OFF due to over current > 30 A
20	OFF due to Drivebox fault in Joyst. mode
22	hover OFF due to WP shifted >0,1 NM
23	hover OFF due to missing GPS, compass or gyro data
24	Speed mode OFF due to missing SPD data
25	hover or joystick mode OFF due to fault in the slave FADEC-Box
26	INFO: unlock code required for joystick or hover mode

### Failure treatment

Reconnect any throttle station by pressing the THR-button. Continue with manual throttles. Remove failure cause if known.

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

From the following NMEA 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.

Sentence:	Data read from sentence:
APB:	a) Cross Track Error b) Mag and True bearing between waypoints
BOD, BWW:	Mag bearing between waypoints
BWC,BWR:	Mag.Brg+Dist of pres.pos. to WP and WP Long/Lat
GLL:	Lat / Long present position
HDM, HDG, HDT:	Magnetic or True Heading
MWV:	Apparent Wind Angle and Speed
RMB:	Cross Track Error, Bearing+Distance to WP
RMC:	Ground Track, Speed and variation
VHW:	a) Magnetic Heading b) Water Speed (knots)
VTG:	Ground Track (mag) and Speed
VWR:	Apparent Wind Angle and Speed
WDC:	Distance to Waypoint
WDR:	Distance to Waypoint
XTE:	Cross Track Error (NM)