United Kingdom Maritime
Pilot's Association

Piloting Vessels Fitted With Azimuthing Control Devices (ACD's)

Azimuth Controlled Device (ACD) Vessel MPX

The purpose of this booklet is to assist the pilot in a practical sense when conducting the MPX and conning the navigation on an azimuthing vessel. For further information and technical explanations refer to the (EU) Azipilot Project. http://pilot.ncl.ac.uk/index.htm and click on here for all the project reports.

This booklet will not make you an expert however, it does assume a degree of competence in general shiphandling and is therefore intended to supplement this knowledge in understanding what the Master is doing when manoeuvring his vessel. We strongly recommend that pilots should attend a training course specific to ACD's. Bear in mind that the Master may not have been on an ACD course and therefore may not be operating the ACDs in the correct manner.

There are many different configurations of azimuthing propulsion. For the sake of simplicity, this booklet will focus on the most popular – **2 units at the stern**.

Specific questions to ask in addition to standard MPX:

- **What type of ACD -**

There are a variety of manufacturers - Aquamaster, Azipod (ABB), Azipull/Mermaid (Rolls Royce) and Schottel for example who all produce their own version.

They are all slightly different from each other as you can imagine, some are pushing pods, others are pulling pods, there are types with 2 propellers on each pod and there are some which are shrouded with a Kort nozzle - you can clarify the exact type during the MPX and by consulting the Pilot Card. This will also confirm what other features are present - fins, skegs, etc. What you want to know is where are you squirting the water and maybe what at?

Fundamentally, from a Pilot's point of view, is that actually operating the pod to manoeuvre the vessel follows the same principle for whatever type of azimuthing system is installed.

- **Are the units fixed pitch, variable pitch or combinator?**

  Most fixed pitch units have to be rotated through 360 degrees to the desired angle so forward planning is needed, however some fixed pitch units can be stopped and put astern – **always enquire during the MPX**

  Variable pitch units allow the user to apply a percentage of forward propulsion astern without having to rotate the whole unit through 180 degrees – you should confirm how much "astern" power is available. When berthing/unberthing you can therefore use the units much like a standard propeller/thruster combination, with the outboard unit used as an athwartship thruster and the inboard unit used as a fore/aft propeller.

- **Rotation speed**

  The faster the better of course, 20 secs rotation is good, over 30 secs is quite slow and therefore manoeuvres require more forward planning.

- **Clutch or not**

  Some systems have, generally older ones, a clutch system. You can compare it to a stop/start engine vs CPP. There is a lot less finesse and control with a clutch system. Power curves tend to be exponential, where for lower power response is slugglish/minimal and then when you reach a certain level can be aggressive, even vicious with little warning. Equally fixed pitch ACD's don't offer quite as much finesse as CPP units.

- **Size of propellers**

  Small propellers mean less manoeuvrability and therefore more speed/revs/pitch required to keep a course.

- **General**

  Azimuth propelled vessels require more speed than a comparable conventional vessel to keep a steady course, particularly when experiencing a following sea/current. Due to the stern construction which is often of a 'pram stern' design so the vessel has less directional stability. Acceleration and deceleration tends to be much quicker than on a similar conventional vessel. All of the power of the ME can be applied in any direction.

Helm Orders

A number of azimuthing vessels are fitted with a standard wheel, if so, then if you are inexperienced in using ACD's, it is recommended to use the wheel and give standard helm orders. When berthing/unberthing the units will have to be switched into individual mode.

When a wheel is not available then helm orders used are:

Steer a course of…
Alter course to…when only a few degrees are needed
Steady on…

When a larger course alteration is required, the following procedure is used:

Commence turning vessel to port/starboard (check ACD's are put the correct way)
During the turn – increase/maintain/decrease ROT as required.

(It is helpful to know the ROT required for a particular turn at a given speed. See ROT table on following page.)

SPEED IN KNOTS	RADIUS OF TURN IN NAUTICAL MILES															
	0.1	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.85**	**0.9**	**1**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**
3	28.6	14.3	9.5	7.2	5.7	4.8	4.1	3.6	3.4	3.2	2.9	2.6	2.4	2.2	2.0	1.9
4	38.2	19.1	12.7	9.5	7.6	6.4	5.5	4.8	4.5	4.2	3.8	3.5	3.2	2.9	2.7	2.5
5	47.7	23.9	15.9	11.9	9.5	8.0	6.8	6.0	5.6	5.3	4.8	4.3	4.0	3.7	3.4	3.2
6	57.3	28.6	19.1	14.3	11.5	9.5	8.2	7.2	6.7	6.4	5.7	5.2	4.8	4.4	4.1	3.8
7	66.8	33.4	22.3	16.7	13.4	11.1	9.5	8.4	7.9	7.4	6.7	6.1	5.6	5.1	4.8	4.5
8	76.4	38.2	25.5	19.1	15.3	12.7	10.9	9.5	9.0	8.5	7.6	6.9	6.4	5.9	5.5	5.1
9	85.9	43.0	28.6	21.5	17.2	14.3	12.3	10.7	10.1	9.5	8.6	7.8	7.2	6.6	6.1	5.7
10	95.5	47.7	31.8	23.9	19.1	15.9	13.6	11.9	11.2	10.6	9.5	8.7	8.0	7.3	6.8	6.4
11	105.0	52.5	35.0	26.3	21.0	17.5	15.0	13.1	12.4	11.7	10.5	9.5	8.8	8.1	7.5	7.0
12	114.6	57.3	38.2	28.6	22.9	19.1	16.4	14.3	13.5	12.7	11.5	10.4	9.5	8.8	8.2	7.6
13	124.1	62.1	41.4	31.0	24.8	20.7	17.7	15.5	14.6	13.8	12.4	11.3	10.3	9.5	8.9	8.3
14	133.7	66.8	44.6	33.4	26.7	22.3	19.1	16.7	15.7	14.9	13.4	12.2	11.1	10.3	9.5	8.9
15	143.2	71.6	47.7	35.8	28.6	23.9	20.5	17.9	16.9	15.9	14.3	13.0	11.9	11.0	10.2	9.5
16	152.8	76.4	50.9	38.2	30.6	25.5	21.8	19.1	18.0	17.0	15.3	13.9	12.7	11.8	10.9	10.2
17	162.3	81.2	54.1	40.6	32.5	27.1	23.2	20.3	19.1	18.0	16.2	14.8	13.5	12.5	11.6	10.8
18	171.9	85.9	57.3	43.0	34.4	28.6	24.6	21.5	20.2	19.1	17.2	15.6	14.3	13.2	12.3	11.5
19	181.4	90.7	60.5	45.4	36.3	30.2	25.9	22.7	21.3	20.2	18.1	16.5	15.1	14.0	13.0	12.1
20	191.0	95.5	63.7	47.7	38.2	31.8	27.3	23.9	22.5	21.2	19.1	17.4	15.9	14.7	13.6	12.7

RATE OF TURN (DEGREES PER MINUTE)

Always confirm which mode the ACD's are set to - synchronous or individual (individual is recommended for berthing and narrow channels due to quicker response time when checking a manoeuvre) and that the bridge team have put the system into a suitable mode for pilotage waters/berthing. Most ACD vessels have several operating modes depending on the stage of the passage and the type of work the vessel performs.

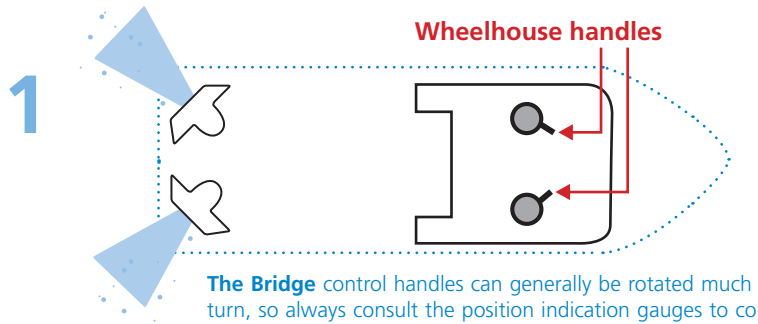
Speed - There are no dead slow, slow, half orders etc on an ACD vessel – just order the speed in knots over the ground that you require – you can ask the Master what settings give what speed of course during the MPX.

When swinging the ACD unit 180 degrees, in normal circumstances it is common practice to set the unit to zero revs/pitch before swinging and when in the desired position, then apply the power. However, On most larger vessels the ACDs aren't fitted with pitch control propellers and so most manufacturers recommend maintaining a small positive thrust rather than stopping because there can be lubrication / cooling problems if the ACDs are stopped for any length of time. If the ACDs aren't required for a period during a manoeuvre then the recommendation is to have them clutched in on minimum revs in the neutral (face to face) mode.

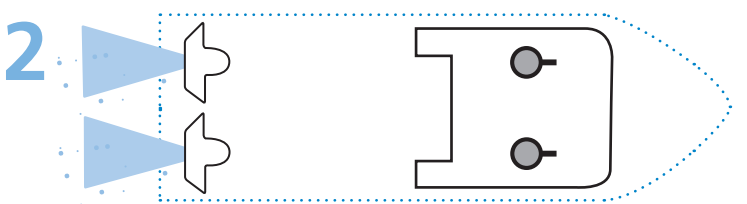
Units are nearly always swung so that the wash goes outboard to avoid the potential of damage to the other pod – particularly when swinging while they are under load.

Practical Manoeuvring Guide - The diagrams and text that follow show how to set the azimuthing units in order to achieve a desired manoeuvre/direction. Additionally, the position to set the handles on the bridge is also shown. Bear in mind responses will vary from vessel to vessel and in general the larger/heavier/deeper the vessel the less responsive they will be, particularly to the "walking" type manoeuvres. Particularly very long vessels.

NB: a bow thrust unit has been omitted in order to demonstrate what manoeuvres can be achieved without the aid of a bow thruster. In reality, most vessels are fitted with a BTU which can therefore be used in conjunction with the azimuthing units at the stern.



The Bridge control handles can generally be rotated much quicker than the ACD's turn, so always consult the position indication gauges to confirm actual position of the ACD, as these mimic the actual rotation speed of the unit.



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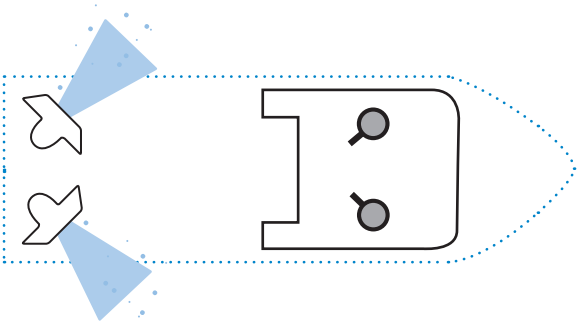

Sailing slow astern

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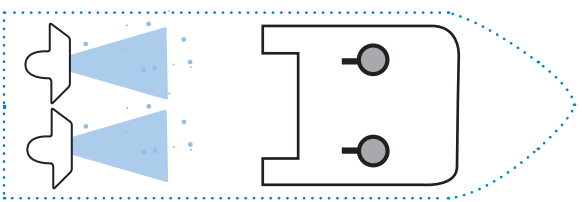
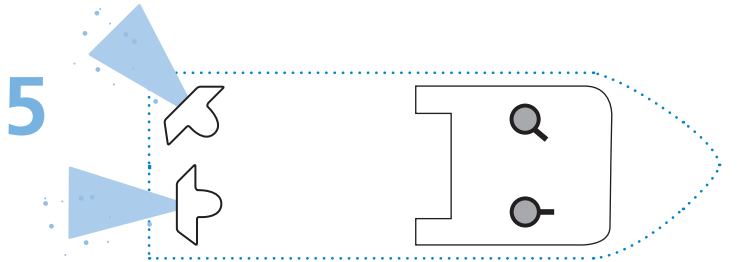


Sailing full astern



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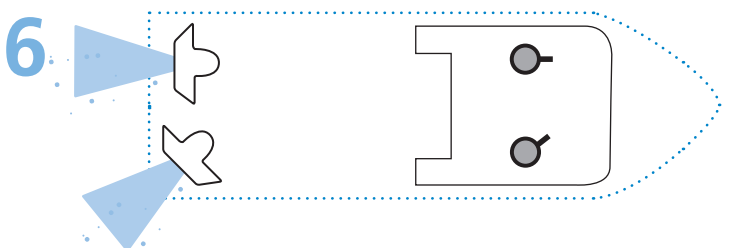
Turning to port

Always start with turning the unit inwards on the side you wish to turn towards. The other unit can also be used in the same direction to supplement the turn.



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Turning to starboard

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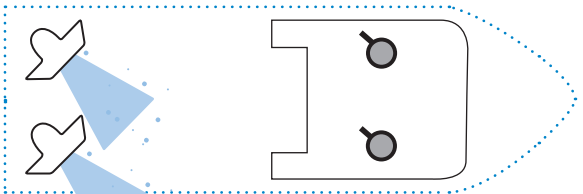

Turning the stern to port

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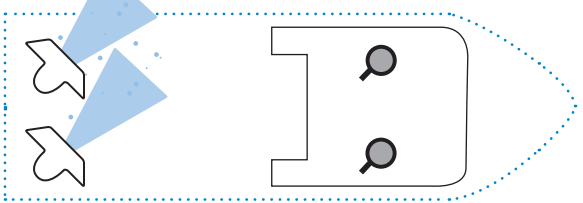

Turning the stern to starboard

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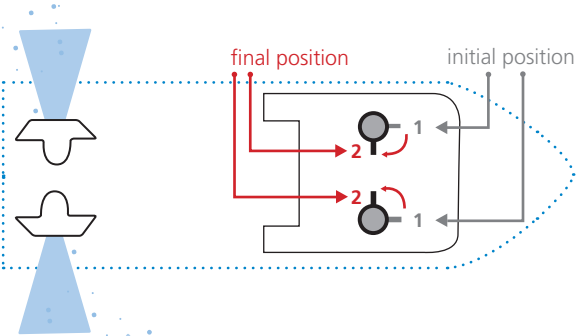

Normal stopping

transverse arrest

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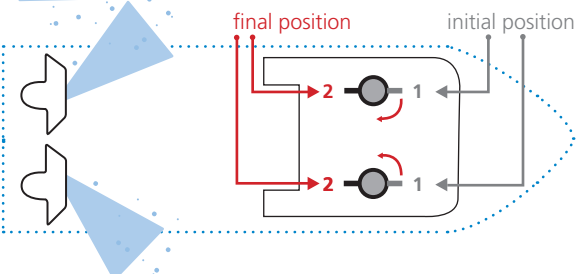

Emergency crash stop

***always** turn the units outwards to avoid wash passing over the other unit*

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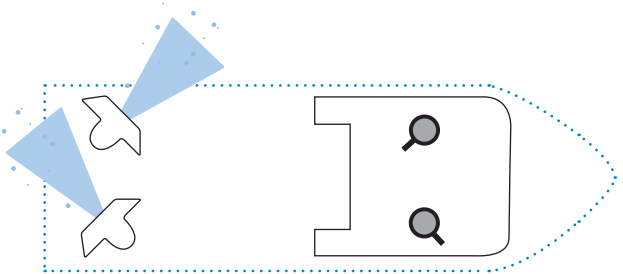

Turning on the spot to port

to prevent cavitation, avoid wash from one thruster entering the other thruster

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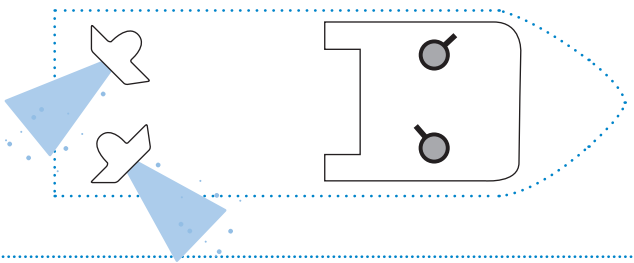
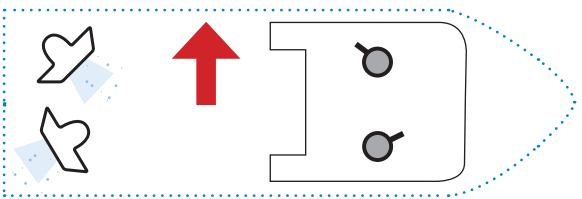


Turning on the spot to starboard

to prevent cavitation, avoid wash from one thruster entering the other thruster

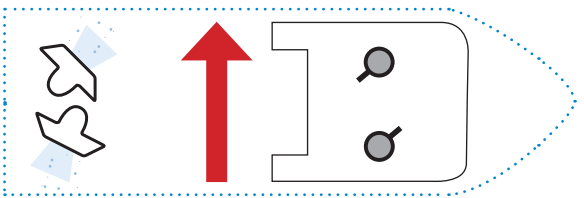
Walking the Vessel

Walking the Vessel Slowly to Port



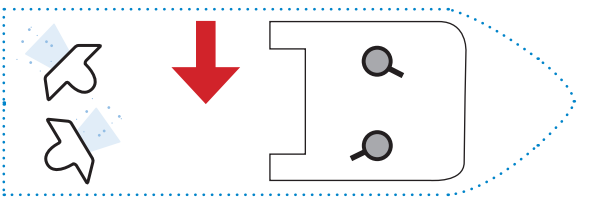
There should be slightly more power on the port unit to avoid forward momentum.

Walking the Vessel Fast to Port



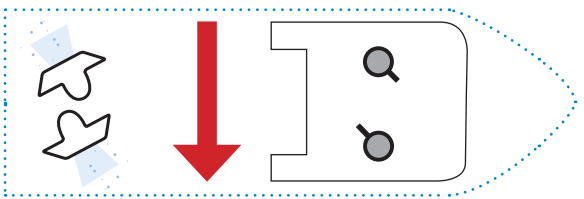
The port unit should be set at about 40° to 45° astern and the starboard about 20° to 30° ahead with more power on the starboard unit. Fore and aft movement is controlled by adjusting the starboard unit's angle and power rating.

Walking the Vessel Slowly to Starboard



There should be slightly more power on the starboard unit to avoid forward momentum.

Walking the Vessel Fast to Starboard



The starboard unit should be set at about 40° to 45° astern and the port about 20° to 30° ahead with more power on the starboard unit. Fore and aft movement is controlled by adjusting the port unit's angle and power rating.

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