

DECCA YACHT NAVIGATOR

MK III

OPERATING MANUAL

The copyright to the operating manual belongs to ap radiotelefon a/s, Denmark  
No reproduction in part or in whole may be made unless permission has been  
given in writing.

The purpose of the manual is to provide users with general information on how  
to operate and utilize the instrument.

The manual can under no circumstances be regarded as a document which places  
responsibility, liability, contractual obligations or other commitment on ap  
radiotelefon a/s, Denmark.



NOTE

The Decca Yacht Navigator III (DYN III) is an extremely useful navigation aid (Navaid), giving accurate positional information from received radio signals. Like any other radio navigation aid, its performance is dependent on the received radio signals which can be affected during propagation from transmitter to receiver. Users can obtain increased benefits from their receivers by familiarising themselves with these characteristics. DYN III should not be relied upon as a sole source of position fixing and the prudent mariner will always maintain a separate dead reckoning calculation and method of position observation.





<u>PAGE</u>	<u>CONTENTS:</u>	<u>PAGE</u>	<u>CONTENTS:</u>
7	Introduction	64	CENTRE
8	Survey of displayed information	65	POSITION STORE
11	Keyboard index	66	ANCHOR
12	The Decca Navigator System	67	HELP
15	Description of the equipment	68	COMPASS CORRECTION
15	Keyboard	69	COURSE & SPEED
16	Display	69	AVERAGING TIME
17	'Traffic lights'	70	TRIM
18	Beeper	73	CLOCK and Alarm Clock
19	Start up of the DYN	74	TIMER
20	Functions	76	ALERT system
24	Summary of functions	76	ALERT types
29	POSITION	78	ALERT programming
30	Accuracy	79	DISPLAY SHIFT
31	'Traffic lights'	80	LIGHT
32	Acceptance level	80	BLEEP
33	Position search	81	KEYLOCK
34	Position correction	82	SIGNALS
36	Position Filter	83	SPECIAL functions
39	CHAIN AND SLAVE SELECTION	84	TEST
40	Chain status display	87	Specification
42	European Decca Navigator chains	90	Block diagram
44	Two slave operation	92	Installation
45	Slave selection	93	Electrical connections
46	NAVIGATE functions	94	Installation hints
49	Introduction	99	List of General Agents
50	Definitions		
52	WAYPOINTS		
54	NAVIGATE display		
57	TRACKS		
58	ETA & DISTANCE		
60	ROUTEPLAN		





### INTRODUCTION

Based upon radio signals transmitted from Decca Navigator (R) stations the DYN calculates position in latitude and longitude every 20 seconds.

Backed by substantial computing power (50 Kbytes) the DYN III has many additional functions simplifying navigation on board.

A total of 25 chains of Decca Navigator transmitters enables the Yachtsman to operate in the waters around the Atlantic coast of Europe and the Baltic.

The DYN III has a comprehensive test programme built in which on request verifies the overall performance of the set.

## SURVEY OF DISPLAY INFORMATION

The main function of the DYN III is to calculate present position from the received signals, but many additional functions are included.

Position	Own position updated every 20 seconds displayed as latitude and longitude.
Course and Speed	a) True course and speed averaged over a period of from 2 to 99 minutes.
	b) Course and speed relative to the wind direction for optimizing speed when beating to windward.
Navigate	Information to follow a predetermined track between two positions. Up to 20 sequential tracks may be preprogrammed by the NAVIGATE function.
Tracks	For checking a planned route. Each track is displayed as heading and distance.
ETA Distance	Display of estimated time of arrival with distance to go.
Center	Display of the bearing and distance to a centre position, being either a point to reach or avoid.



Chain	Display of actual chain number together with predicted positional uncertainty in nautical miles.
Clock	Display of time and date. Clock operates independently of external power.
Timer	Special stop watch for racing. Count down to start and thereafter elapsed time including lap time display.
Fuel	Option to be included later.
Alerts	Up to 10 different parameters can be monitored automatically; in the event of a fault an audible signal is given and the cause displayed.
Signals	Displays the strength of received signals and noise level.
Man Over Board	By means of a remotely placed switch the DYN is instantaneously programmed with position when the switch is activated and provides bearing and distance to that point.
Voltage	(SPECIAL 11 ENT). Display of voltage for check of battery status.

These primary functions as well as several secondary functions are easily accessed from the keyboard which itself has been designed to be almost self explanatory.





# SURVEY WITH CROSS REFERENCES (page numbers)

Use of keyboard, see page 15.  
Use of functions, see page 20.

NORTH	55 : 41 . 62		EAST	12 : 36 . 07		Traffic light
SOUTH			WEST			
INPUT P 16 & 21	FILTER P 36		OFFSET P 34	ALARM P 76		P 31

P 15	U	P 19 & 29 LAT LON	1	P 69 & 70 CRS SPEED	2	P 49 & 54 NAVIGATE	3	P 58 ETA DIST	4	P 64 & 67 CENTER	5	P 82 SIGNALS	+/-	P 80 LIGHT	CLR
		EST POS P 19, 22, 32 & 33		AVER TIME P 69 & 36		WAYPOINTS P 52		TRACKS P 57		POS STORE P 65		TEST P 84		BEEP P 80	
P 15	L	P 39 CHAIN	6	P 73 CLOCK	7	P 74 TIMER	8	FUEL	9	P 76 ALARM	0	P 15 ROLL	:	P 81 KEY LOCK	ENT
		POS CORR P 34		CPS CORR P 68		SAILPLAN P 60		TRIM P 70		ANCHOR P 66		DISPL SHIFT P 79		SPECIAL P 83	

Battery voltage : Special 11 )  
Sailplan : Special 8 ) P 83  
Restart or delete: Special 10 )

POWER ON/OFF  
at rear of the set

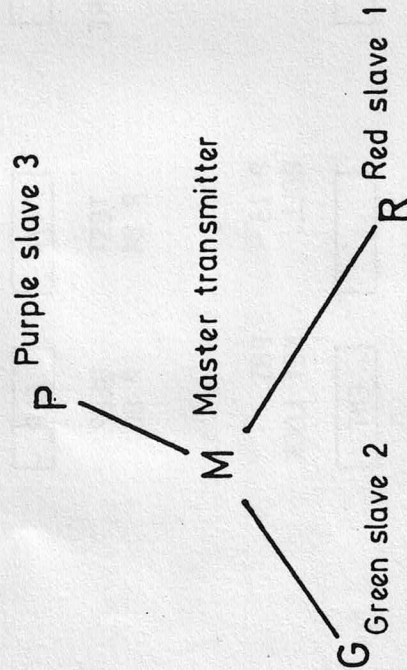
## THE DECCA NAVIGATOR SYSTEM

A Decca Navigator chain normally consists of four transmitters, a MASTER and three slaves placed at a distance of 50 to 150 nautical miles from the master. The slaves are identified by colour RED, GREEN and PURPLE, corresponding to 1, 2 and 3 in the DYN III.

A single chain will for instance cover all the waters around Denmark as far out as the middle of the North Sea. The accuracy of the position obtained depends on the ship's position relative to the transmitters in the chain; in the immediate chain area (50 to 100 n m from the MASTER) the accuracy typically is 0.1 to 0.2 n m increasing gradually to 1 to 2 n m at longer distances. The DYN III calculates and displays the predicted uncertainty.

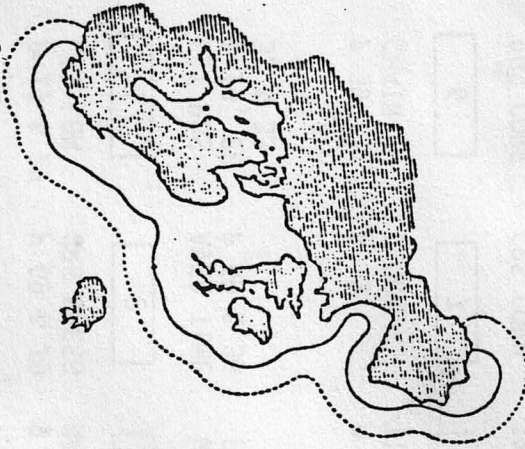
As the Decca Stations are monitored 24 hours a day, the stability of transmissions is assured, giving you the best radio navigation system for Western European waters.

### Decca Transmitter Chain



A Decca chain may be used at least 250 n m from the MASTER station.

### Coverage



A total of 25 transmitter chains cover Europe as shown. For more details see Admiralty List of Radio Signals, volume 5, chart appendix NP 285 a. Please also see page 42.



The received signals from the master and one of the slaves form a line of position in the DYN III. Thus, using the master together with two slaves, a position can be determined as the crossing point of two lines of position. When all three slaves are used, the position with a cocked hat (error triangle) is determined from the three lines of position.

As the wavelength of the transmitted signals is much shorter than the distance between the transmitters, the master/slave pair creates multiple lines of position repeated at a distance of 2-5 n.m. In order to choose the correct line of position the navigator must know its approximate position (estimated position) within 1 to 2 n.m. when switched on for the first time. After this the DYN III continuously updates its position when under way. When switched off in harbour the last position is memorized to give an automatic start next time.

# DECCA YACHT NAVIGATOR III

RACAL

LATITUDE

LONGITUDE

N

E

S

W

49:48.18  
4:00.89

INPUT

FILTER

OFFSET

ALARM

U

L

LAT LON	CRS SPEED	NAVIGATE	ETA DIST	CENTER	SIGNALS	LIGHT
1	2	3	4	5	+/-	CLR
EST POS	AVR TIME	WAY POINTS	TRACKS	POS STORE	TEST	BEEP
CHAIN	CLOCK	TIMER	FUEL	ALARM	ROLL	KEYLOCK
6	7	8	9	0	:	ENT

POS CORR	CPSS CORR	SAILPLAN	TRIM	ANCHOR	DISPL SHIFT	SPECIAL
----------	-----------	----------	------	--------	-------------	---------



## DESCRIPTION OF THE EQUIPMENT

### Keyboard

The keyboard gives access to the various functions in accordance with the wording by each key as well as the numerals used for input of waypoint positions etc.

For instance key no. 2 has the upper text CRS SPEED and the lower text AVER TIME. This key is used either to select the course and speed display, or to select the function where averaging time for course and speed can be chosen (2 to 99 minutes). The key is used as the digit 2 when numerals are being keyed in.

U/L To distinguish between upper and lower key function the U or L key is used before the function key. Thus U2 selects CRS SPEED and L2 selects AVER TIME.

+/- The "+/-" key changes direction; North to South or East to West when a position is being entered. To alter various settings the "+/-" key will change ON to OFF and vice versa. (When editing the route plan, the +/- key makes space for insertion of an extra waypoint number).

CLR The "CLR" key alters the display backlight from ON to OFF when used directly, and during input of numerals the CLR key is used to clear previously stored values in favour of new ones when changes are necessary, for instance changing of waypoint positions in the memory. When editing the route plan the CLR key removes a waypoint number from the route plan. If a stored value is cleared and the blank display is ENTERed, then the old value will be retained in the memory.

ROLL : The ":" key has two functions; either to separate degrees from minutes when a LAT/LON position is keyed in, or to shift (ROLL) from one function stage to the next. This is also the case when entering a series of data (waypoints etc). The ":" key both enters the data keyed in and also ROLLS (shifts) to the next input stage in a function. (When editing the route plan, the ":" key shifts the route plan to the left to give access to any part of it).

ENT The "ENT" key enters and completes a data input and returns the DYN to the last selected main display. (A main display is one of the upper key functions no. 1 to 9 but excluding 6).

## DISPLAY

The display consists of two identical display windows each containing 8 digits, a colon and a decimal point for numeric displays.

The display can also provide an alphabetical read out.

The display has in total four markers with explanatory text below. The markers may be described as follows:

- INPUT: When on, the displayed information (number or ON/OFF setting) may be changed from the keyboard.
- FILTER: Indicates filtering (smoothing) of the lat/lon position; the position becomes a mean value of the measured positions over a period of time, each updated with course and speed to give present mean position. (The filtering is switched ON/OFF in the AVER TIME function POS FILT ON/OFF). See page 36.
- OFFSET: Indicates that the lat/lon position is corrected with an offset added to the measured position. The offset is used to compensate for small errors in the received signals. (The offset is initiated in the POS CORR function where either the true position or offsets can be keyed in). See page 34.
- ALARM: The marker becomes visible if any of the alert parameters are outside the alert limits. See page 76.



## TRAFFIC LIGHT DISPLAY

The traffic lights next to the display are for monitoring reception conditions, and operate in three main modes. First to indicate whether three or two slaves are used for position calculation, second to indicate whether the calculated position is accepted or rejected, and thirdly to indicate whether locking to the signals from the chain in use is taking place.

Three slave operation is indicated by a single light, normally green, occasionally amber.

Two slave operation is indicated by two lights, amber and green simultaneously.

The red light comes on when the calculated position is rejected due to distortion or noise in the signals received.

Finally, the red light will start flashing slowly if the DYN III cannot lock to the signals from the chain in use. (This also happens for a short period while the DYN III is locking to a chain after switching on or when a new chain has been selected).

In three slave operation when three lines of position are used, which light is on is determined by the size of the cocked hat relative to the selected acceptance level (controlled within the EST POS function). If for instance acceptance level 1 has been chosen, a green light indicates that the position lines coincide or almost. On the other hand the amber light with acceptance level 3 indicates substantial displacement of a position line. (Large cocked hat).

## BLEEPER

Inside the DYN III there is a small bleeper.

The bleeper is used to draw attention to the following conditions:

1. When a key operation is incorrect or outside the given limit, the DYN III rejects the key operation and gives a short beep.
2. From the keyboard (BLEEP function) the bleeper can be switched ON/OFF to sound once every 20 seconds when a new position has been calculated, and all the displayed information has been updated.
3. Passing a waypoint in the route plan the bleeper sounds 15 times.
4. During the last ten minutes of TIMER count down the bleeper gives five beeps at one minute intervals, and during the last five seconds a beep each second: finally fifteen beeps to indicate starting time.
5. When an alert comes on the system also triggers the bleeper. In this case the audible alarm continues until stopped with the Alarm key. Alert beeps are groups of three every five seconds.
6. When shifting the display of the route plan or tracks using the ROLL key, the bleeper is triggered every time the display has been rotated back to the start.
7. When a new chain or slave pair has been selected automatically, the bleeper sounds three times.



36 36  
03 30  
38° 15' 00" N 00° 30' 00" E

START UP

When power is switched on (at rear of set) first time, the DYN III will preset all the functions to a standard setting and then ask for an estimated position. This must be within 1 to 2 nautical miles of actual position.

First the display will ask for estimated latitude, EST LAT.

Key in first whole degrees (52), then ":",

followed by minutes of arc and decimals (06.90)

(an erroneous key entry is simply corrected with the CLR key).

When latitude has been keyed in, the ENT key enters latitude.

The DYN then asks for estimated longitude, EST LON, which is keyed in as for

latitude. The DYN III assumes eastern longitude, but if in western longitude,

changes east to west with the +/- key before longitude is ENTERED.

EST LAT  
EST LAT 52:  
EST LAT 52:063  
EST LAT  
EST LAT 52:069 ENT  
EST LON  
EST LON 4:18  
EST LON 4:18 +/- ENT

Then the DYN III searches for the optimum chain and starts receiving the radio signals to determine position. After approximately 2 minutes the green lamp in the traffic light next to the display shows that the DYN III has made a satisfactory position measurement. After this the position is updated every 20 seconds as long as power is on, thus the DYN III keeps track of the change of position when under way, independent of selected display functions.

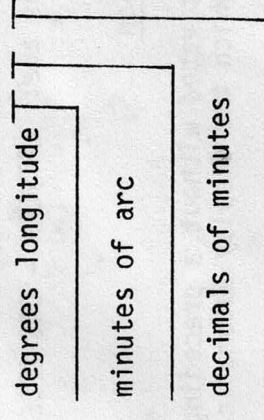
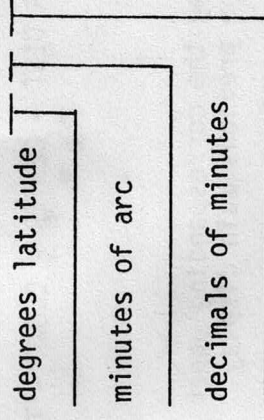
LAT LON position display:

NORTH

' 52:07.21

WEST

' 4:17.73



To Clear 10 ENT +/-  
Roll 19  
ENT

## FUNCTIONS

Some functions will display the result of internal computations whereas other functions are used to enter (or just check) numerals or settings to be used for computations in the DYN III.

Basically any function is called up in the display by using two keys, the first being the U or L key, and the second in accordance with the function as stated in abbreviated form above (Upper) or below (Lower) each of the remaining 14 keys. (See page 24; function survey).

### Function Stages

Most of the functions are split into several sub-functions (function stages), but all the stages are related to the selected function. Access to the different stages of a function is obtained by the ":" key which is known as "ROLL" when used after a function has been called.

### Main functions

A main function will remain in the display until a new main display is selected. All other displays vanish in favour of a main display if left unattended for more than one minute.

The main functions are: LAT/LON - CRS SPEED - NAVIGATE - ETA DIST - CENTER - CLOCK - TIMER - FUEL

### Single key function

Each key when activated without a preceding U or L will bring the corresponding upper key function into the display for 3 seconds after which the display automatically reverts to the previous main display.

This is to give a quick check of other functions.



### Input

To guide you in the key operations the left display has an input marker (bottom lefthand corner). When this input marker is on, it is possible from the keyboard to change the displayed numeral or setting (numerals are, for instance, latitude/longitude; settings are for instance ON/OFF control of various functions).

When a numeric value is to be changed, the old value must be cleared before a new one can be keyed in. The ON/OFF settings are operated by the "+/-" key, and need not to be cleared first.

### Display shift

The upper key functions nos. 1 to 9 may be selected for the DISPLAY SHIFT function in any combination. The display shift function divides the 20 second update period into four times 5 second, and shifts the display every 5 seconds in accordance with the selected sequence. See page 79.

Example of a function:

EST POS - estimated position - is used for keying in a new approximate position (within 1 to 2 n m). This function is used if for instance the DYN III has been switched off while moving. The stored position in the memory then has to be corrected before the navigator is able to compute the position from the Decca signals.

The function EST POS contains four stages; input of new latitude, input of new longitude, position search ON/OFF and "accept" level setting for the traffic lights.

Call of the function EST POS

to key in the actual latitude, e.g. 55° 21' North

with the ":" key the latitude is then entered and the next function stage appears

and the actual longitude is keyed in, e.g. 10° 57' West, the "+/-" key changes East to West

with the ":" key the longitude is also entered and the next function level appears

the "+/-" key will change OFF to ON, but only keying the ":" key once more leaves it off and rolls to the last stage of the EST POS function

To complete the EST POS function, the ENT key must be used

A further ROLL instead of ENT would revert back to the beginning of the EST POS function once more.

Key operation	Reply in display
L 1	EST LAT '55:41.62
CLR 55:21	EST LAT '55:21
ROLL	EST LON '12:36.07
CLR 10:57 +/-	EST LON ,10:57
ROLL	SEARCH POS OFF
ROLL	ACCEPT LEVEL 2
ENT	'55:21.00 ,10:57.00



As seen from the example, a specific function stage is obtained by first calling the main function (L1) and then ROLL (: ) through the stages until the required one appears.

As a general rule all the displays have a mnemonic text as a guide to the correct function stage. Furthermore the input marker in the left hand display tells you if you can alter the displayed numeral or setting. The operation will be almost self-explanatory after a short period of use.

Finally it may be mentioned that in order to get used to the DYN III for practical navigation, the best way to learn its capabilities is to run through the keyboard and functions. It is not possible to harm the set with any key operation, but you may lose own position. Therefore such use should be at a known position - home or mooring. If the DYN III gets totally "confused", the following key operation erases all entries and restarts it:- "L ENT 10 ENT : +/- ENT" (SPECIAL 10; DELETE). After this you need to re-enter your EST POS as well as resetting the clock.

NOTE: All the waypoints will also disappear from the memory after the DELETE function.

# SUMMARY OF FUNCTIONS AND STAGES (W CORRESPONDS TO THE NUMBER OF WAYPOINTS)

KEYS	FUNCTION (key text)	INPUT POSSIBLE	ROLL STAGES	DESCRIPTION
U 1	LAT LON	no	1	Display of present position in latitude and longitude.
L 1	EST POS	yes	4	Entry of estimated position, position search ON/OFF, accept level for maximum allowable cocked hat error.
U 2	CRS SPEED	no	1	Display of true course and speed, or - if the "TRIM" function is ON - course relative to the wind direction keyed in and speed up wind.
L 2	AVER TIME	yes	2	Determines averaging time (2 to 99 minutes) for course and speed and ON/OFF for position filtering.
U 3	NAVIGATE	no	1	Display of information required to follow a predetermined track between two positions.
L 3	WAYPOINTS	yes	3+W	Input of a series of waypoint positions; starting at a preselected waypoint number. ON/OFF control of automatic route plan generation during input of waypoints.
U 4	ETA DIST	yes	2	Display of Estimated Time of Arrival, and distance to final destination E, or to any previous point in the route plan.
L 4	TRACKS	no	1+W	Display of heading and distance along individual tracks between waypoints in route plan.



KEYS	FUNCTION (key text)	INPUT POSSIBLE	ROLL STAGES	DESCRIPTION
U 5	CENTER	yes	5	Display of bearing and distance to a "centre" position C, or any waypoint.
L 5	POS STORE	yes	3	Storing present position as "centre" position, or as any waypoint. The stored LAT/LON is displayed.
U 6	CHAIN	yes	2	Display of chain in use; actual slaves selected together with predicted positional uncertainty. Chain and slave selection.
L 6	POS CORR	yes	5	Input of true chart position or position offset. ON/OFF control of the application of offset to the displayed position.
U 7	CLOCK	yes	5	Display of time and date, alarm clock settings, time and date setting.
L 7	CPSS CORR	yes	2	ON/OFF of compass correction, input of correction (900W to 900E).
U 8	TIMER	yes	4	Stop watch with count down to zero and totalling of elapsed time.
L 8	SAILPLAN	yes	1+W	Display of waypoint numbers in the sequence they are to be used. The plan may be edited if necessary.
U 9	FUEL			To be included later.
L 9	TRIM	yes	2	ON/OFF of TRIM function and input of true wind direction, (0-359 degrees).

KEYS	FUNCTION (key text)	INPUT POSSIBLE	ROLL STAGES	DESCRIPTION
U 0	ALARM	yes	10(17)	ON/OFF of 10 alerts and 7 alert limits. Monitors essential parameters for safety of navigation.
L 0	ANCHOR	yes	2	ON/OFF for anchor watch alert including dragging limit.
U +/-	SIGNALS	no	3	Reception conditions, display of signal strength from the four transmitters of the Decca chain in use, noise level and oscillator offset.
L +/-	TEST	no	5	Test of the DYN III itself, i.e. keyboard, display, traffic lights, receiver and CPU (Central Processing Unit/calculator).
U CLR	LIGHT	yes	1	Display backlight ON/OFF. The preceding U key is not necessary when a main function is displayed.
L CLR	BEEP	yes	1	Changes between ON and OFF of the 20 second bleep on each new position updating.
(U):	ROLL	no	0	The Upper key is never used when Rolling. The ":" key rolls the display from one to the next level of a function. Also the ":" key will separate degrees from minutes when a lat/long position is keyed in.



KEYS	FUNCTION (key text)	INPUT POSSIBLE	ROLL STAGES	DESCRIPTION
L :	DISPL SHIFT	yes	2	Programming of four displays (selected from the Upper functions no. 1 to 9) to be shown sequentially during a 20 second update period.
U ENT	KEY LOCK	yes	1	ON to OFF of keyboard lock in HELP mode using the "+/-" key, and input of key lock code (four digits) preceded by the CLR key to lock or unlock the keyboard.
L ENT	SPECIAL	yes	multiple	Access to special functions specified by a numeral 1 to 20 which is entered first.

#### SPECIAL FUNCTIONS:

L ENT 8 ENT	yes	1	Delete Route plan; will stop the NAVIGATE function at once.
L ENT 9 ENT	yes	1	To be used in the fuel state monitoring option in due course.
L ENT 10 ENT	yes	2	Reset of navigator or delete all memory content.
L ENT 11 ENT	no	1	Voltage of external supply line (accuracy 5%).
L ENT 12 ENT	no	1	Display of software type.





## POSITION

Determination of present position is the most important function of the DYN III. For you own safety at sea we recommend that you first of all familiarise yourself with this basic function. Especially when reception conditions degrade and manual control becomes necessary, it is important to know the capabilities of the DYN III.

### Accuracy of a Position Fix (predicted value displayed in the CHAIN function)

Generally accuracy will be better than 0.1 to 0.2 nautical miles within the immediate chain area (50 to 100 n m from the master), but locally that accuracy may deteriorate.

The DYN III itself contributes only partly to any inaccuracy. Other factors are the signal propagation conditions, distance from the centre of the chain used and its geometry relative to own position.

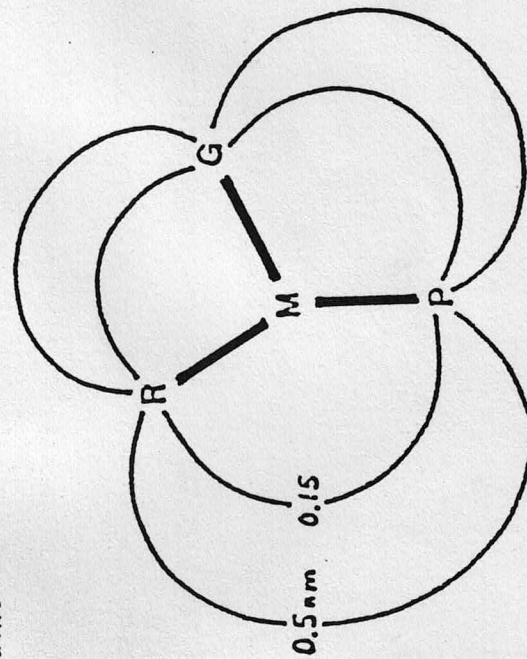
Propagation conditions vary according to weather and time of day and year, best result being achieved on a clear summer day.

Position calculation presumes reception of ground wave only, and if part of the signal received has been reflected from the ionosphere (skywave), then accuracy decreases. Skywave increases as distances from the chain increase and at night.

When the groundwave is propagated over dry land (e.g. rock) or over high ground, position uncertainty will also become larger than normal.

The DYN III itself calculates a predicted uncertainty in nautical miles. This figure is based upon normal reception conditions. The predicted uncertainty may be exceeded if conditions deteriorate.

Typical accuracy contours for a chain.





### Traffic Lights

The traffic lights next to the display indicate position updating conditions in three different modes. Firstly to indicate 3 or 2 slave operation, secondly to indicate whether the calculated position is accepted or rejected, and finally to indicate whether locking to the signals from the chain in use is taking place.

3 slave operation is indicated by a single light, normally green, occasionally amber.

2 slave operation is indicated by two lights, amber and green simultaneously.

The red light comes on when the calculated position is rejected due to distortion or noise in the signals received.

Finally, the red light will start flashing slowly if the DYN III cannot lock on to the signals from the chain in use. (This also happens for a short period while the DYN III is locking onto a chain after switching on, or when a new chain has been selected).

In 3 slave operation, the light that is on is determined by the size of the cocked hat relative to the selected acceptance level (within the EST POS function). If for instance acceptance level 2 has been chosen:

- (i) a green light indicates that the received signals are satisfactory.
- (ii) the amber light indicates that the cocked hat is large, but still within acceptable limits.
- (iii) the red light comes on if discrepancy is outside acceptable limits (cocked hat too large).

Within the EST POS function the acceptance limit can be modified; either to small cocked hat (ACCEPT LEVEL 1) or to a very tolerant limit (ACCEPT LEVEL 3).

### Acceptance level (within the EST POS function)

When all three slaves in a transmitter chain are used, the position calculation is based upon three lines of position, forming a cocked hat of a certain size. Acceptance level determines the maximum size of the cocked hat which can be accepted for position updating.

The size of the cocked hat is indicated by the traffic lights: (a) Red - unacceptable,

(b) Amber or green-acceptable to a lesser or greater degree.

If the traffic lights turn red for one or more 20 second update periods, the DYN III maintains the last updated position. As soon as the signals becomes acceptable again, updating proceeds. This could for instance happen during a thunder storm. If updating has stopped for a prolonged period (more than 15 minutes), the updating alert (UPd) will sound.

The acceptance level can be changed within the EST POS function, where three levels are possible: 1-2-3.

1 allows only a small cocked hat, whereas the 3 allows quite large errors in the signals received.

Normally acceptance level 3 should be avoided, but in some exceptional areas the received signals may be distorted to such an extent that position updating is only possible using the least critical level, i.e. 3.

In such cases it may be better to use two slaves only, but then the advantages of three lines of position are lost, and the position could be in error by one or more zone widths (3 to 5 nautical miles). This might for instance happen if the DYN III were switched on with a wrong estimated position. In this case the third slave alert (3rd) monitors discrepancies of the third slave signal. If the alert comes on, it could be due to a wrong position provided that the signal level from the unused slave is acceptable (higher than 5-6). Otherwise the alert has less significance.



### Position search (within the EST POS function)

If the DYN III is switched on at sea and the position in the memory is some way from the actual position, a new estimated position must be entered.

This function combines input of a new estimated position with the ON/OFF control of the Position Search function as well as the acceptance level setting.

With a reasonably accurate estimated position, the Position Search function may be left off at first. If the traffic light stays at red, but the update bleep (when switched on) sound every 20 seconds, this indicates that the estimated position may be too far from the correct position. In this case the Position Search function should be switched ON.

After a position has been found with the Position Search function it is wise to check the position with a neighbouring chain, if possible.

A position search should always be started with the lowest acceptance level (accept level 1). If no position can be found, the acceptance level may be increased before a new attempt.

When a position has been found, the Position Search function is automatically switched off.

Position Searching is only possible when 3 slaves are used for position calculation. If the optimum chain has only two slaves, a neighbouring chain with three slaves should be selected (CHAIN function). Refer to chain Data, page 42.

Also if your estimated position is very inaccurate (more than 5 to 10 nautical miles), a remote chain having adequate signals and all 3 slaves can be very useful to give a first position search to correct the estimated position: after that the optimum chain should be used.

The Position Search function assumes reasonably good signals, i.e. signal levels higher than 6-7 and a noise figure less than 2-3.

The ability of the Position Search function to correct an inaccurate position depends on the relative chain geometry (your position relative to the positions of the four transmitters). Performance will be degraded if you are close to a base line extension. (A base line is the line joining a master and a slave station).

Position correction (POS CORR function)

If the actual position is known exactly, and the DYN III shows a small deviation in latitude and longitude due to imperfection in the signals received, the displayed position may be corrected with the POS CORR function.

Switch the POS CORR ON; CLR the displayed LAT/LON readings and enter the true position (OBS LAT/LON); the DYN III then calculates the difference in latitude and longitude from the measured position, and stores this difference (OFFSET as displayed when Rolling further through the POS CORR function). This constant position offset is then added to the measured position to display the corrected position. Thus it is possible to navigate with greater accuracy within a small area (the errors in the signals received are only constant within a limited area).

If for instance the position measured is:

560 23.41N 110 04.31E

and the exact chart position by other means is known to be:

560 23.86N 110 04.17E

the following key sequence is used:

<u>Key Operations</u>	<u>Displays</u>
L6	OFFSET POS OFF
+/-	OFFSET POS ON
Roll	OBS LAT 56:23.41
CLR 5 6 : 2 3 8 6	OBS LAT 56:23.86
Roll	OBS LON 11:04.31
CLR 1 1 : 0 4 1 7	OBS LON 11:04.17
Roll	OFFS LAT '0:00.45
Roll	OFFS LON 0:00.14
ENT	



After this the DYN III shows the corrected position and the Offset marker comes on to indicate that the position includes an offset.

In the example the true position was keyed in, and the DYN III then calculated the resulting offsets as displayed.

It is possible to key in the offsets directly, if they are known from a previous occasion. Thus when true position is keyed in, it will be helpful to note down the resulting offsets for use when approaching the same area again.

Due to the nature of the radio signals the offsets will be more accurate if they are measured in the daytime when random skywave interference is minimal.

All position calculations in the DYN III (position store - waypoint calculation etc) will use the position as displayed in the LAT LON function, i.e. including position offset, when applied.

As the position correction depends on the radio signals used for position calculation, the correction is switched off if the chain or slaves in use are changed (automatically or manually from the keyboard).

Position filter (within the AVER TIME function)

If reception conditions are poor but useable, or if present position is in a fringe area of the transmitter chain in use (large predicted uncertainty in the CHAIN function), then the position may be unstable and move around a mean value, partly because of radio noise and partly because of poor geometry of the lines of position.

The position stability may be improved if the position filter is switched ON:

AVER TIME function	L 2	<input type="text" value="FILTER"/>	<input type="text" value="CONST 5"/>
ROLL	:	<input type="text" value="FILTER"/>	<input type="text" value="POS OFF"/>
Switch to ON	+/-	<input type="text" value="FILTER"/>	<input type="text" value="POS ON"/> ENT

The averaging time corresponding to the filter constant 5 is 5 minutes, and may be changed or just entered as it is.

To change the FILTER CONST use the key sequence CLR 10 ENT if for instance the averaging time is to be changed from 5 to 10 minutes.

With an averaging time of for instance 10 minutes the resulting position in the display is a mean value of the positions measured in the last 10 minutes, each being updated with course and speed to give a mean value of the boat's position.



When the position is "filtered", the reaction to a change of course and/or speed becomes accordingly slower, therefore a warning is given with the FILTER marker in the left hand display.

As the filter constant is common for position, course and speed, the course and speed is also stabilized more by choosing a higher value for the filter constant, provided a steady course and speed is maintained.

The averaging time may be chosen between 2 and 99 minutes.

At a fixed position, when the position correction for the area is to be found, position filtering is useful, giving a stable reading when the OBS LAT/LON is keyed in. Thereby the calculated OFFSETS become more precise.

The filtered position is always updated and is thus immediately available when the filter is switched on.

The course and speed calculation takes into account the selected filter constant, but is independent of the ON/OFF setting of the position filter.





### Chain and Slave Selection (within the CHAIN function)

Initially the DYN III will operate on all the existing slaves (normally 3 - occasionally only 2) belonging to the selected chain. Automatic chain selection will choose the chain which gives the minimum predicted positional uncertainty. This initial setting of the DYN III will give the best result in most cases.

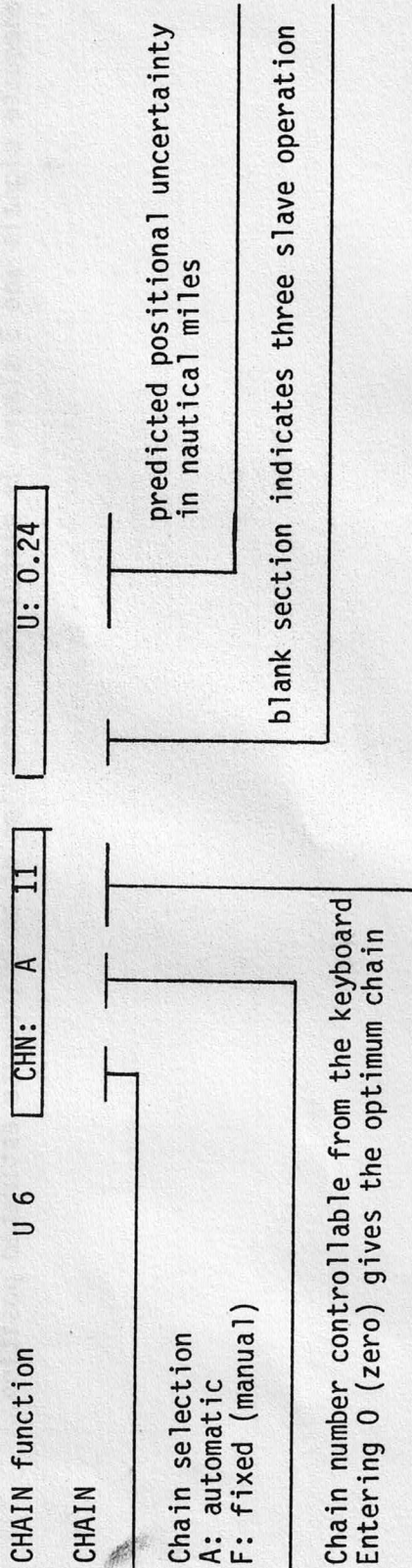
However, it is possible to make the chain and slave selection manually, in order to have constant 2 slave operation with automatic slave selection, giving the least positional uncertainty for two slaves only.

A remote chain with adequate signals and 3 slaves is useful for correction of an inaccurate estimated position.

Chain status display (within the CHAIN function)

The display of chain number and uncertainty (as seen in the first stage of the CHAIN function) includes an indication of the actual slave selection. Furthermore, the display shows whether the chain and slaves have been selected manually or automatically.

Display for 3 slave operation:





### Chain Selection

Normally chain selection is automatic, but with the CHAIN function it is possible to enter any chain identified by the number on the Decca Navigator chain coverage map, Page 42.

The mode of chain selection is seen in the chain status display as the prefix to the chain number: A for automatic chain selection, F for fixed (chain no. manually selected).

To revert from fixed to automatic chain selection, chain no. 0 (zero) must be entered in the CHAIN function.

U 6	CHN: F 6	U: 1.42
CLR 0	CHN: F 0	:
ENT	CHAIN	SEARCH
	CHN: A 7	U: 0.16

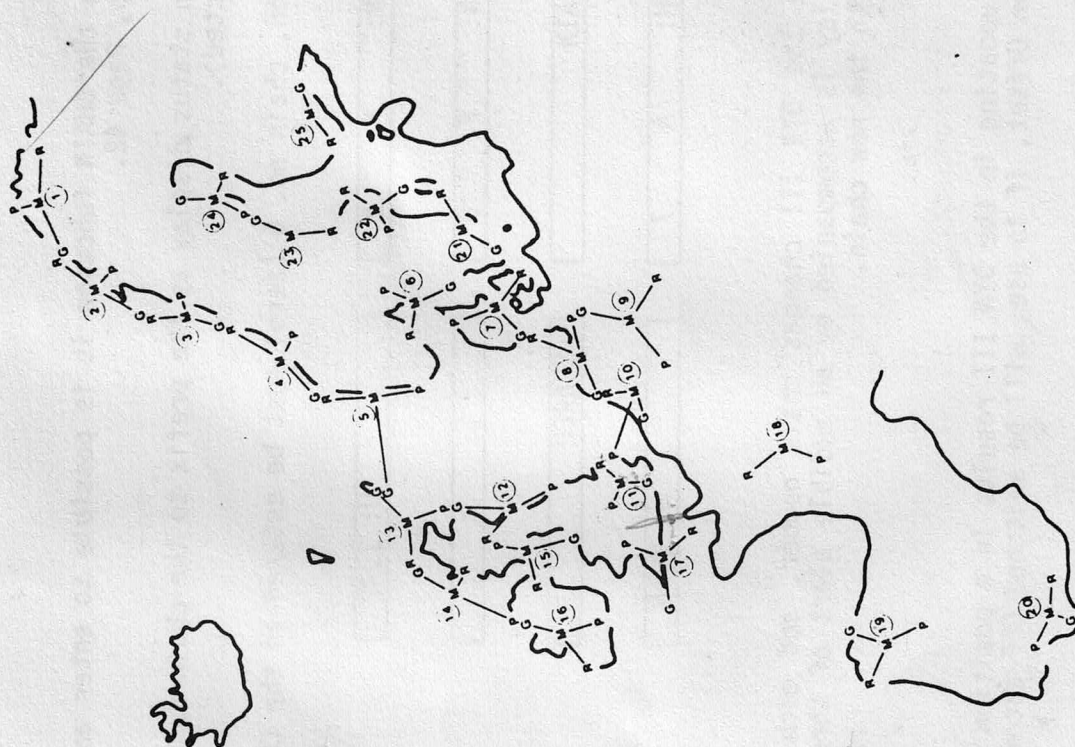
### Automatic display of chain status

The chain status will be displayed each time the DYN III changes chain number, and each time automatic two slave operation changes the slave in use. The display is accompanied by an audible alert of three bleeps, which continues until the DYN III has made a position update with the new chain.

### Position shift

A change of chain or slaves used for position updating in the DYN III results in a position shift due to the different propagation conditions of the signals. Position Offset, if in use, will be switched OFF automatically.

# DECCA NAVIGATOR SYSTEM EUROPEAN CHAINS



M: MASTER STATION  
R: RED SLAVE STATION (1)  
G: GREEN SLAVE STATION (2)  
P: PURPLE SLAVE STATION (3)

## NOTE:

More details are given in the Admiralty List of Radio Signals (ALR), Volume 5, chart appendix. The ALR is available at main chart agents.

DYN III  
FD 271



Chain Name	Chain Number	Decca chain identity	Chain Name	Chain Number	Decca chain identity
Finnmark	1	7E	Not operational	27	
Lofoten	2	3E	Not operational	28	
Helgeland	3	9E	Not operational	29	
Trondelag	4	4E	SW Africa	30	9C
Vestlandet	5	0E	Namaqua	31	4A
Skagerrak	6	10B	Cape	32	6A
Danish	7	7B	E Province	33	8A
Frisian Islands	8	9B	Natal	34	10C
German	9	3F	Not operational	35	
Holland	10	2E	S Persian Gulf	36	1C
English	11	5B	N Persian Gulf	37	5C
Northumbrian	12	2A	Salaya	38	2F
N Scottish	13	6C	Bombay	39	7B
Hebridean	14	8E	Calcutta	40	8B
N British	15	3B	Bangladesh	41	6C
Irish	16	7D	Kyushu	42	7C
SW British	17	1B	Shikoku	43	4C
French	18	8B	Not operational	44	
NW Spanish	19	4C	Kanto	45	8C
S Spanish	20	6A	Tohoku	46	6C
S Baltic	21	0A	Hokkaido	47	9C
N Baltic	22	4B	Dampier	48	8E
S Bothnian	23	8C	Port Hedland	49	4A
N Bothnian	24	5F	E Newfoundland	50	2C
Gulf of Finland	25	6E			
Lagos	26	8F			
(Not operational)					

43

### Two Slave Operation

When only two slaves are used for position calculation in the DYN III this is indicated by the "traffic lights" which show amber and green simultaneously. A position is calculated as the intersection of two lines of position. As lines of position are repeated within a distance of about 3 to 4 nautical miles, the DYN III has to select the right ones using the estimated position.

Therefore, this must be correct within 1.5 to 2 nautical miles at start-up, otherwise the calculated position will be wrong. Using three slave operation this can be detected and corrected with the Position Search function, but with two slave operation, the Position Search function is not used. Therefore navigate with more care when only two slaves are used. If the chain has three slaves, but only two are selected then the 3rd slave alert indicates if the third position line has a large deviation. This may be due to a wrong position at start up. (The alert may also be triggered by noise only. This can be checked as the SIGNALS will show a low level for the third slave. In such a case the alert may be switched off).

### Display for 2 slave operation:

CHAIN function	U 6	CHN: A 11	F 3	U: 0.28
		slave selection A automatic F fixed (manual)		number indicating which slave has been excluded

The excluded slave is identified by 1, 2 or 3 for red, green or purple slaves.

The predicted uncertainty takes into account the number of slaves used for the position calculation.



Slave selection (second stage of the CHAIN function)

In the second stage of the CHAIN function the actual slave signals selected can be seen and slave selection changed. When the function has been activated by the keys U 6 :, the display will show:

U 6 ROLL      STATION      USE:      123

Blank indicates normal use of all slaves  
A indicates automatic two slave selection  
F indicates fixed two slave selection

The slaves have the numbers 1-2-3 for red-green-purple  
123 indicate that three slaves are in use  
23 indicate that red slave is excluded  
1 3 indicate that green slave is excluded  
12 indicate that purple slave is excluded

The possible input modes are:

0: automatic two slave selection (least predicted uncertainty)  
12: red and green slaves selected  
13: red and purple slaves selected  
23: green and purple slaves selected  
123: normal use of all slaves

The display shows the actual mode of operation. It can be changed by CLR and keying in the number for the new mode selected. When entered, the DYN III will briefly display the new chain status.

Decca chain layouts are shown in the Admiralty List of Radio Signals, volume 5, chart appendix.

Automatic two slave selection (input code = 0)

In this mode the DYN III will always exclude the least significant slave signal. This is checked continuously, and just like the automatic chain shift, the receiver will change to another slave to give the best cut of the lines of position.

Automatic two slave operation is independent of chain shift (manual or automatic).

Chain status will be displayed each time the DYN III changes slave.

As with chain shift, a change of slave may introduce a position discrepancy depending on any errors in the received signals.

Manual slave selection (input code = 12, 13 and 23)

If manual slave selection is chosen, the resulting positional accuracy may be less than optimum (in extreme cases useless). When another chain is selected (manually or automatically), the DYN will return to 3 slave operation.

Manual slave selection is obtained by CLR'ing the displayed slaves and then keying in appropriate number as follows:

- 12 ENT to select red and green signals (excludes purple)
- 13 ENT to select red and purple signals (excludes green)
- 23 ENT to select green and purple signals (excludes red)



NOTE:

When manual (Fixed) slave selection is used, positional uncertainty should always be checked regularly in order to avoid navigating with a combination of slaves which has become useless (too high a predicted uncertainty) due to changed position of the boat. The ALERT system in the DYN III, when in use, gives an automatic running check of positional uncertainty. The UNC alert should be switched on and the limiting uncertainty keyed in at all times.

If chain selection is in the automatic mode, but slave selection is fixed, then if the actual uncertainty becomes greater than that of another chain, that chain will be selected and the DYN reverts to three slave operation. After this, the optimum chain will automatically be selected, now using all three slaves.

Three Slave Operation (code = 123)

To return the DYN III to three slave operation, the number 123 for red, green and purple should be keyed in.

NOTE

When making a stop, after detection of a fault, the operator should immediately check the status of the system. If the fault is a minor one, it may be possible to continue operation for a short time. If the fault is a major one, the operator should stop the system immediately. The operator should also check the status of the system after the fault has been corrected. If the fault has been corrected, the operator should restart the system. If the fault has not been corrected, the operator should stop the system immediately. The operator should also check the status of the system after the fault has been corrected. If the fault has been corrected, the operator should restart the system. If the fault has not been corrected, the operator should stop the system immediately.

These are the instructions for the operator.

It is the responsibility of the operator to ensure that the system is operating correctly at all times.