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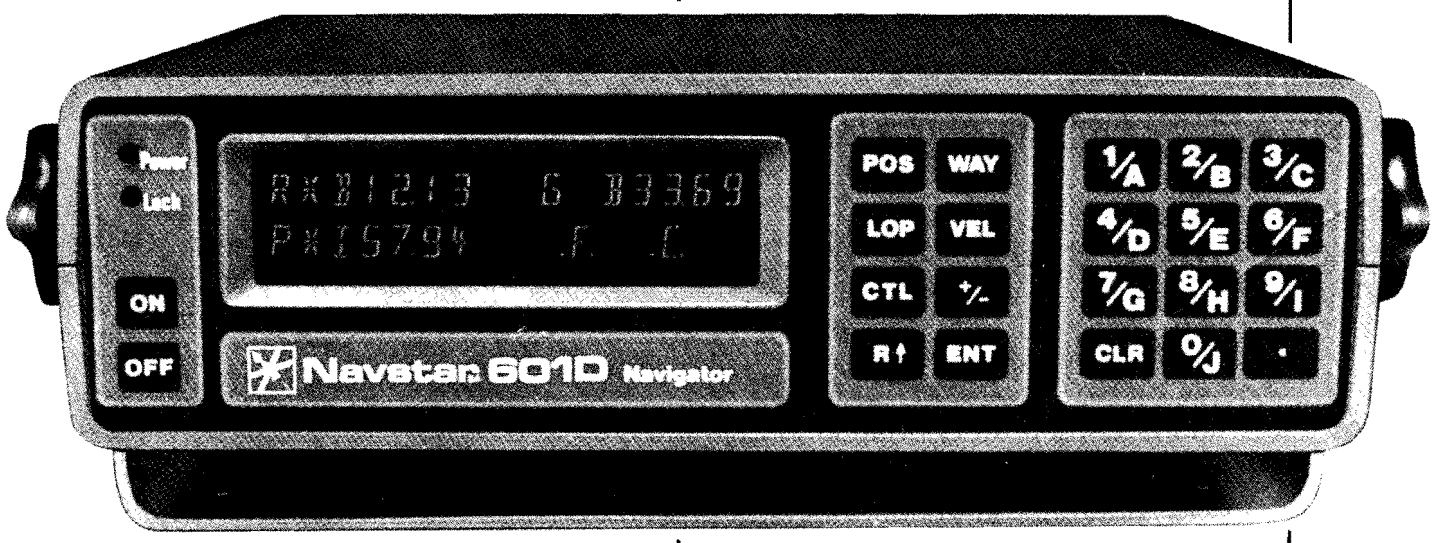
Navstar SA

601D
NAVIGATOR

INSTRUKTIONSBOK



Now that you are the owner of a NAVSTAR SA 601 D Navigator, we hope that these instructions and advisory notes will help you to operate the equipment smoothly.

This sophisticated, but easy-to-use navigation aid has been designed to assist you in the making of navigatorn decisions and to provide you with a variety of navigation options.

Remember: The equipment is at all times under your control.

Navstar SA

601D

NAVIGATOR

OPERATING INSTRUCTIONS

Note: NAVSTAR SA reserve the right to —

1. Alter any detail or part of these instructions without prior notice.

2. Supply equipment which may differ in detail from that described in this publication, within the Company's policy of constantly developing and improvning the design of its products.

USING THE MANUAL

This manual is sectionalised to cover the basic user requirements from a brief explanation of hyperbolic navigation, and the NAVSTAR SA 601 D Navigator through Installation (which includes Test and Initialisation to Operation).

A Glossary of Terms used appears at the front of the manual and it is recommended that the reader examines these in some detail before proceeding.

The Appendices Section provides a wealth of user information in depth.

CONTENTS

GLOSSARY OF TERMS

BRG	—	Bearing
CMG	—	Course-Made-Good
COM	—	Compass
CPA	—	Closest-Point-of-Approach
CTL	—	Control
CTS	—	Course-to-Steer
DEG	—	Degrees
DIRN (OR DIR)	—	Direction
DR	—	Dead Reckoning
EP	—	Estimated Position
ETA	—	Estimated-Time-of-Arrival
GC	—	Great Circle
GMT	—	Greenwich Mean Time
HDG	—	Heading
LAT	—	Latitude
LI	—	Lane Identification
LONG	—	Longitude
LON	—	Longitude
LOP	—	Line of Position
LMT	—	Local Mean Time
LOR	—	LORAN — Hyperbolic System
KN	—	Knots
MAGVAR	—	Magentic Variation
MAN	—	Manual
NM	—	Nautical Miles
POS	—	Position
RL	—	Rhumb Line
RNG	—	Range
SAT	—	Satellite
SMG	—	Speed-Made-Good
SPD	—	Speed
UMT	—	Universal Mean Time
UPD	—	Update
VEL	—	Velocity
WAY	—	Waypoint
WPT	—	Waypoint

TERMS — DEFINED

Course	The intended heading.
Course-to-Steer ..	(CTS) The course related to the Compass used by the Helmsman.
Dateline	The International Dateline is the 180th meridian modified to pass between Asia and America and bring islands belonging to the same group into the same time zone.
DR	(Dead Reckoning) The process of maintaining of predicting an approximate record of progress by projecting course and distance from a known position.
Drift	The distance covered in a given time due solely to the movement of a current and/or tidal stream.
Estimated Position ..	(EP) A best possible approximation of a present or future position. It is based on course and distance since the last known position with an estimation made for Leeway, Set & Drift, or by extrapolation from earlier fixes.
GMT	Greenwich Mean Time — The selected Standard Time of Reference for Local Mean Time at Greenwich, England.
Great Circle	Circles drawn on a sphere so that their planes pass through the centre of the sphere.
Heading	(Ship's Head) The horizontal direction of the Ship's Head at a given moment. (This term does not necessarily require movement of the vessel.)
Heading Reference ..	(HDG Ref.) A compass unit with log-interface facility that interfaces with a 600 Series Sat-Nav.
Latitude	The Angular Distance measured North to South from the Equator, from which it increases to a maximum of 90° at either Pole.
Leeway	The effect of wind in moving a vessel bodily to Windward.
LMT	Local Mean Time — Your Local Time Zone with reference to GMT. i.e. the time on your watch for example. Time Zone is to be found form a chart or suitable almanac.
Longitude	Arc of the Equator measured from the prime meridian East or West to a maximum of 180°.
Magnetic Variation ..	The horizontal angle between the geograhical meridian and the magnetic meridian.
Metre	Distance Measurement (1ft = 0.3468m).
Most Probable Position	The navigators assessment of the vessel's position based on information derived from all available sources.
Rhumb Line	Lines drawn on the Earth's surface to cross successive meridians at the same angle.
Sea Polition	The point at the termination of the water track.

Serial Link	Data Transmission between Equipments.
Set	The direction towards which a current and/or tidal stream flows.
Waypoint	This can be a final destinatin or some intermediate destination or turning point.
UMT	Universal Mean Time.
LOP (Line of Position)	Line of Constant Phase Difference between signals from Master and Slave transmitter.
Lane Boundary	LOP with zero phase difference.
Pattern	The set of lanes defined by one Master/Slave pair.
LI (Lane Identification)	Check provided by part of the signs to verify the course as it is conted through the lanes.

SUFFIX LETTERS USED

E — East (of Longitude)

M — Magnetic North (inc. Magnetic Variation)

N — North (of Latitude)

S — South (of Latitude)

T — True if relative to True North

W — West (of Longitude)

The NAVSTAR SA 601 D
Equipment comprises:

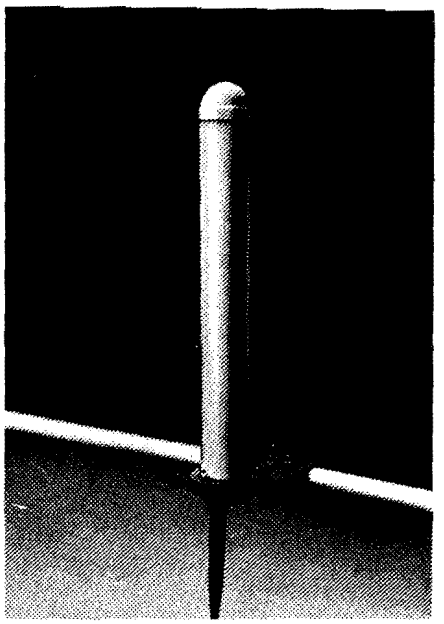
Computer

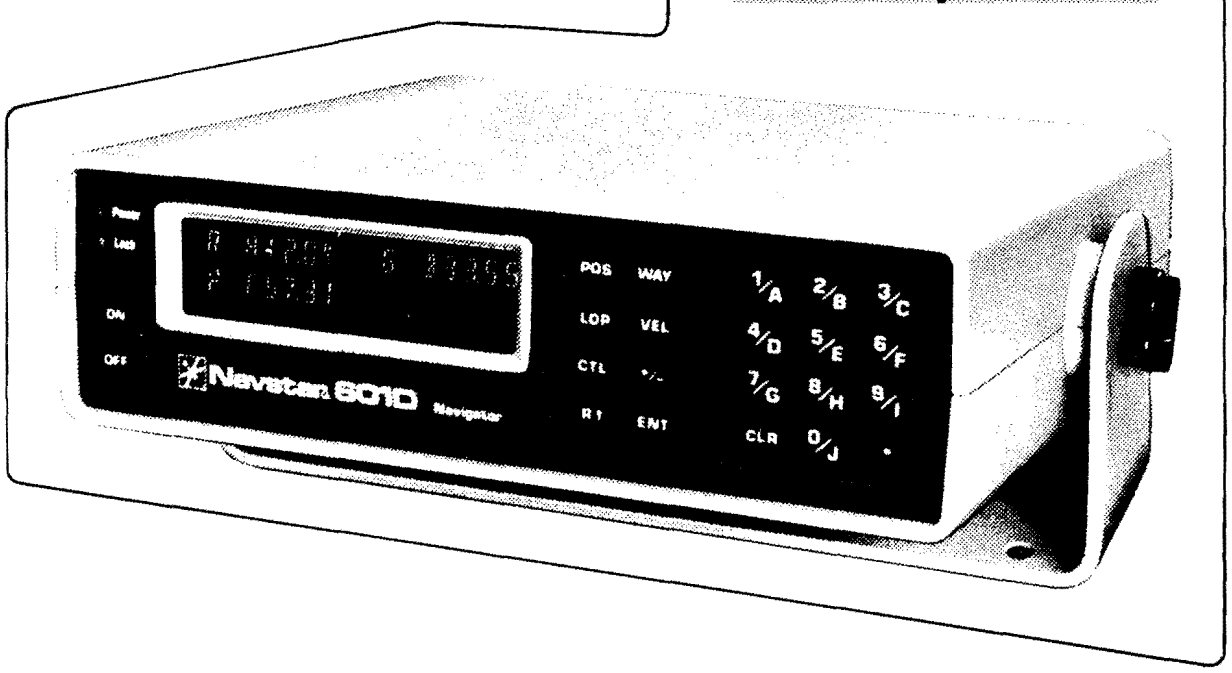
Power Supply

Display

Manual Controls

Small 'Stick' Antenna





HYPERBOLIC NAVIGATION — A Broad Outline

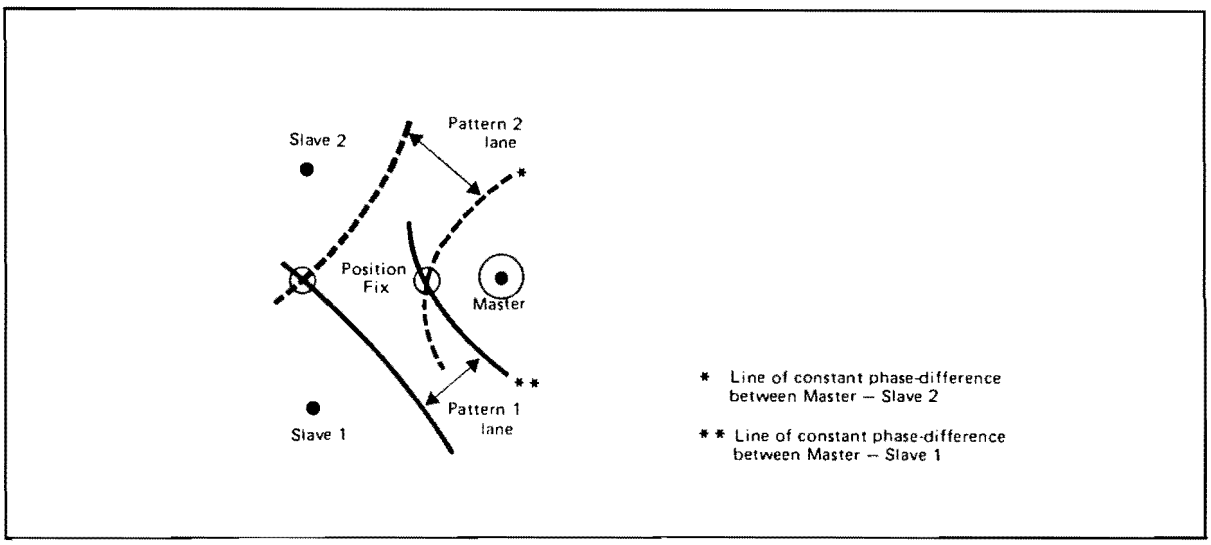
Hyperbolic navigation systems are so-called because the line of position (LOP) derived from a master and slave station froms a hyperbola on a chart. A complete position fix may be obtained from the intersection of two such lines, and if they share the same master station then a minimum of one master and two slave transmitters in required.

The most popular systems utilize a master and three slaves to avoid the use of areas where lines cut at shallow angels and lead to poor fix information.

The comparison between master and slave signals may be done by measuring a time-difference for a pulsed waveform, or a phase-difference using continuous wave (C.W.) signals.

In the case of C.W. signals, as a receiver moves away from a master and towards a slave (but no necessarily on a direct path) the master signal suffers increasing phase delay whilst the slave signal exhibits a reducing phase delay. The absolute phases are not available, but a phase-comparison can be made which repeats in a distance known as a "lane". The phase comparison determines the receiver position within a lane to a high degree of accuracy. In order to resolve the remaining ambiguity between the various lanes, a similar phase comparison may be done at a much lower frequency, generating very much wider "zones" at a reduced accuracy. Combining the two results gives a highly accurate fix with no ambigiuty over the area of a wide lane.

In order for the receiver to be able to make a distinction between the master and slave signals, they are transmitted in different frequency bands; but to preserve the phase-relationship, the frequencies are all exact harmonics of a common source. The much lower frequency is not transmitted directly, but derived from the difference between two in-band signals transmitted simultaneously, and this part of the transmission is interleaved with the normal part on a time-sharing basis.



THE NAVSTAR SA 601 D NAVIGATOR

The Navstar SA 601 D Navigator with its associated antenna is designed to receive and process radio navigation signals in the 100 KHz frequency and that have a format corresponding to Decca Navigator transmissions.

The 601 D Navigator automatically selects the correct chain and frequency for the location, locks-on to the transmissions from the master and slave stations, and using a phase-comparison technique, provides a continuous navigational fix expressed in Latitude/Longitude and Line-of-Position.

Small, simple to operate and economical, the 601 D uses low power to give high performance. It accepts 9—36 volts D.C. without a separate voltage regulator and is therefore suitable for most types of craft. Using only 10 watts of power, it takes only 0.8 amps from a 12 volt battery and 0.4 amps from 24 volts, and thus minimises the drain on the power source.

"Swith-ON" initialisation is simple. The automatic prompt quides the operator step-by-step requesting information.

The design concept embodied in the 601 D allows immediate direct access to information without the operator being required to memorise or refer to confusing codes. After initialisation the operator simply reads off the information displayed in the mode selected for as long as the power is applied.

Without operator intervention, the 601 D indicates exactly what the operator needs to know' The vessel's position, the time and date, the course-to-make-good to reach the destination and the distance to travel, item-by-item at four-second intervals.

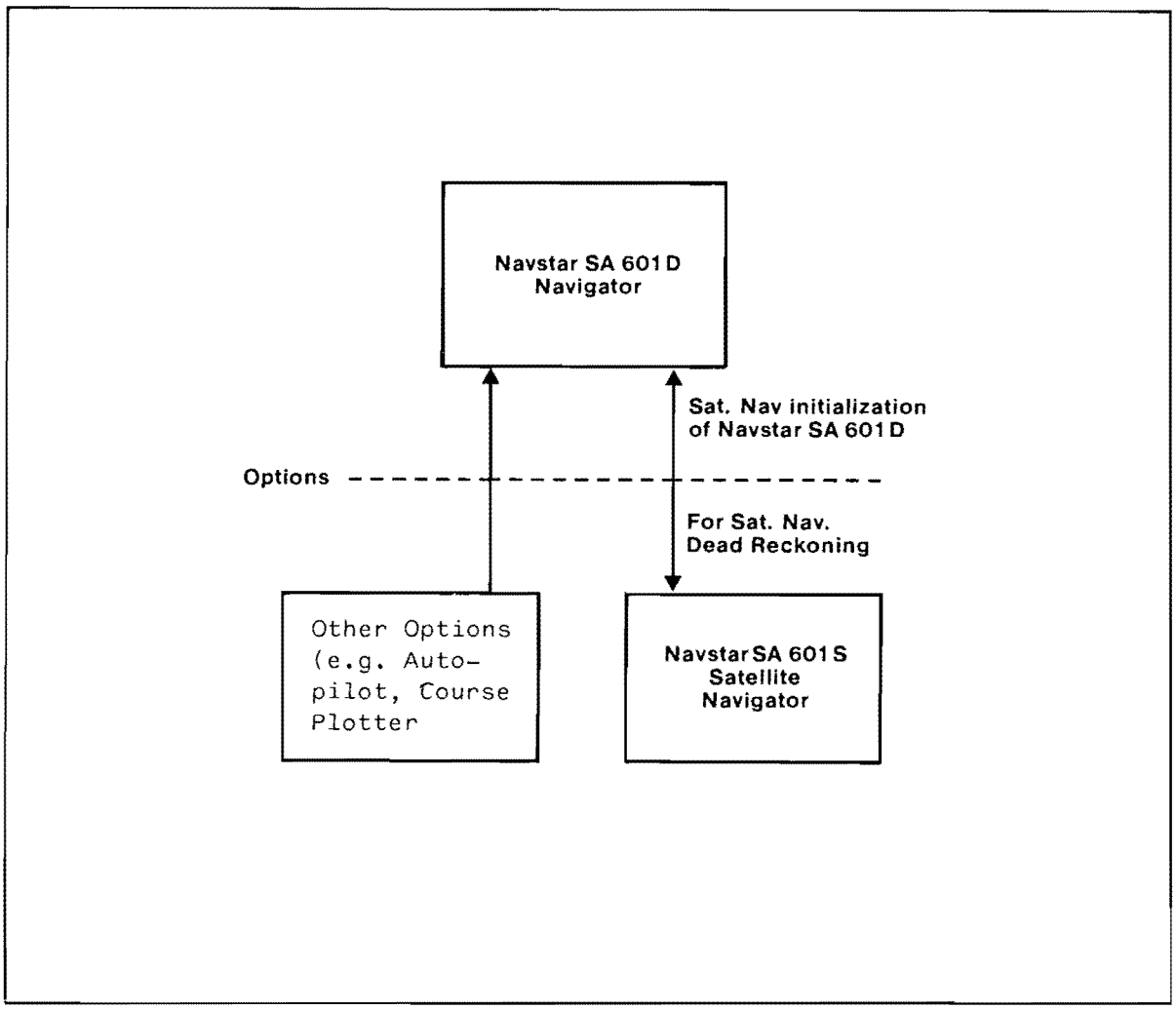
The 601 D automatically tests itself on command, indicating failures and identifying faulty modules, thus simplifying maintenance by PCB replacement.

The stick-type antenna provided with the set comprises a monopole matched to a pre-amp/filter unit in a ventilated, splashproof ABS tubular housing. Power to the pre-amplifier is supplied through the antenna cells.

Simple to install, the 601 D receiver is fitted with a swivel bracket for mounting on a table-top, bulkhead, or deck-head surface. The antenna is also easily mounted at a suitable above-deck location.

The 1983 version of the 601 D will operate either stand-alone or interfaced with the Navstar SA 601 S Satellite Navigator fitted with the interface option. From 1984, the 601 D will be a stand-alone device not fitted with the link facility which many mariners do not need. For those mariners who do require this extra facility, it is available on the 602 D.

The 601 S enhances the 601 D Navigator by providing initialising Latitude and Longitude and Zone Identification when entering areas of DECCA transmissions, thereby effectively extending the area of coverage; whilst the 601 D complements the 601 S by providing speed and heading information for dead reckoning purposes. The choice of the operating mode is at all times left within the operator's control. Warning indicators and an alarm inform the operator as to the state of the equipment during opertion.



The Navstar SA 601 D Navigator is one of the range of Navstar SA's 600 Series Navigation instruments, presenting the mariner with a wide variety of navigational options. The 601 D embodies the very latest in microprocessor technology, LSI/VLSI circiutry and rigorous testing. It is one of the latest in a range of products to be developed by a company that has, with its affiliated manufacturer, supplied over 10,000 electronic navigation receivers to civil, marine, naval and military users worldwide.

The Navstar SA 600 Series of navigation instruments is supported by more than a decade of expertise and experience in the design and manufacture of electronic navigation equipment.

NAVSTAR 601 D SPECIFICATION

System Accuracy	30—300 metres repeatability within coverage areas according to position.
Receiver Frequency	70—130 KHz (4 bands: 70—72 KHz; 84—86 KHz; 112—115 KHz? 126—129 KHz).
Computer	Z80 microprocessor with 4K of RAM and 24K of EPROM and 3 months' memory retention.
Data Interface	Serial TTL — compatible (see Appendix III)
Display	Dual 16-character × 15-segment flicker-free vacuum fluorescent tube.
Power Supply	Switched-mode overload and short circuit-protected power supply consuming 10 watts at 20°C from 9—36 volts D.C.
Antenna	Monopole matched to pre-amplified/filter unit in a ventilated splashproof ABS tubular housing. Power to the pre-amplifier is supplied through the antenna cable. Overall Gain: 20 db at 77 KHz and 120 KHz Bandwidth: 70—130 KHz Cable: 18 metres of UR43 supplied.
Environmental	Receiver 0°C to 55°C operating and storage Antenna -25°C to + 85°C operating and storage.

GENERAL PRINCIPLES

TIME

The NAVSTAR SA 601 D is not tied to any fixed time standard, and the user therefore may utilize Local Mean Time (LMT) or Greenwich Mean Time (GMT) or any other, as convenient.

ALARMS

The 601 D has an audible alarm which is controllable by the operator (See Display Page 5, Group 5).

It sounds for a period of about 2 minutes when any of the following conditions occurs:

— Closest Point-of-Approach to a Waypoint

— LI Error-a discrepancy arising between LOPs and LI

— Antenna has failed open-circuit or short-circuit

— Receiver has failed

— Memory has failed

— System has lost Lock

— Signal is SUSPECT i.e. decoding is not providing satisfactory repeatability

— 3 LOPs do no converge satisfactorily — Refer to Display Page 3, Group 3

— Patterna Selection is invalid (2 slave patterns)

— Position calls for a Change of Chain

— Position correction time limit has run out.

Display Page 3, Group 5, shows the time of, and the reason for, the last Alarm, even if the Audible Alarm is switched off.

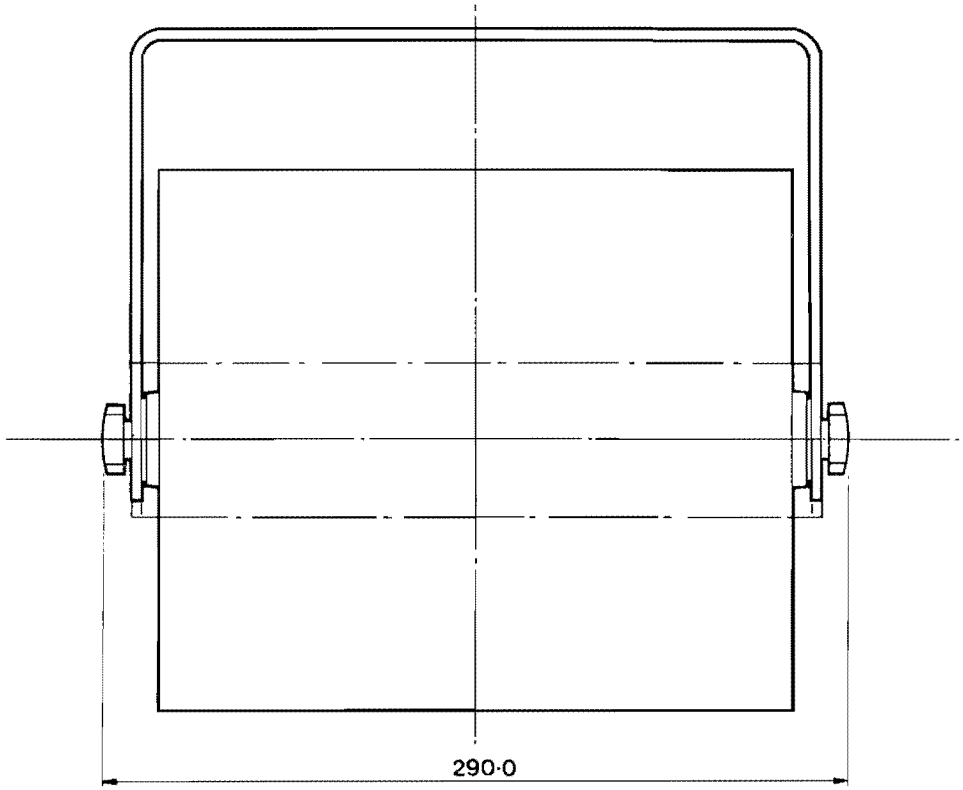
The Audible Alarm is stopped by pressing the [CLR] key.

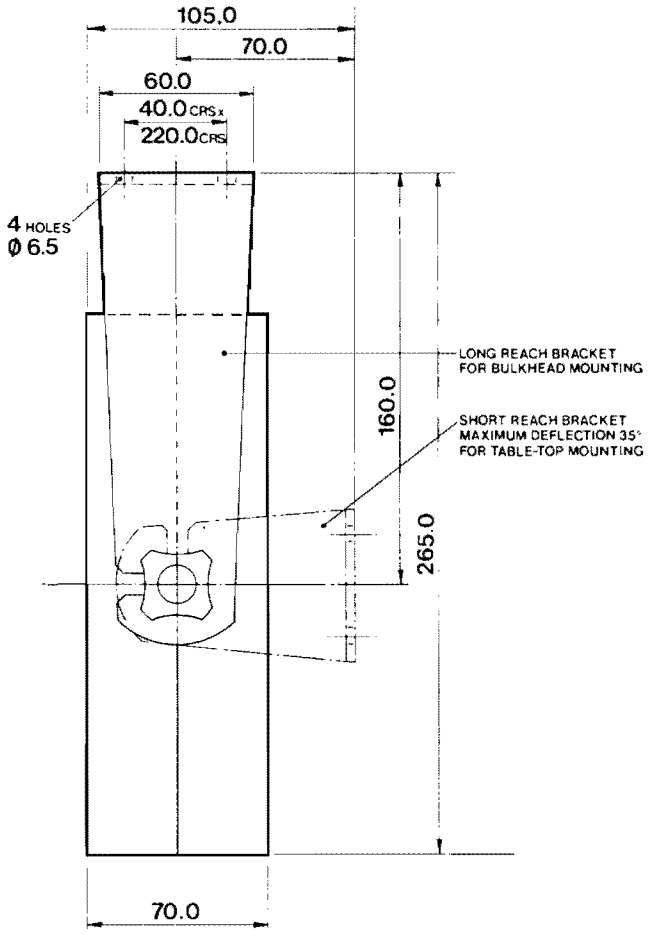
INSTALLATION KIT — NAVSTAR SA 601 D

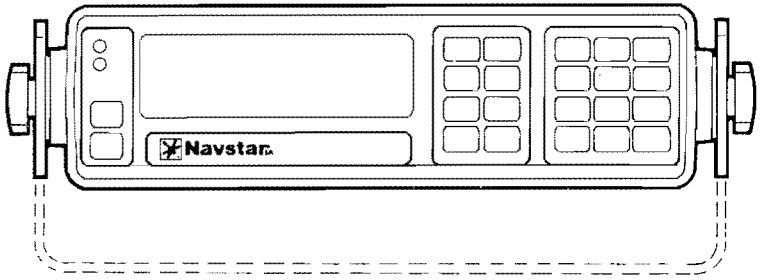
Standard	Optional
One STICK ANTENNA with Mounting Flange & Screws One POWER SUPPLY LEAD (1 metre) fitted plus 3-pin Plug 60 ft UR43 COAXIAL CABLE with fitted TNC Connectin for the Antenna and a BNC Connector Kit supplied loose One TNC BOOT for waterproofing the TNC Connector One SYSTEM NAVSTAR SA 601 D equipped with Mounting Bracket, Washers, Inserts and Knobs One Manual	One LONG-REACH MOUNTING BRACKET One ADAPTOR for existing 'Decca Navigator' Wire Antenna Installations

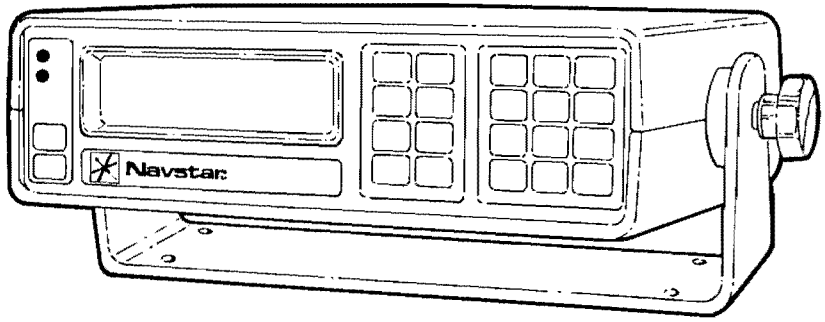
601D – Dimensions and Mounting

All dimensions in millimetres









INSTALLATION

The Navstar SA 601 D Navigator comprises an integrated Receiver/Computer/Display together with a swivel-type Mounting Bracket, Power Cable and an Antenna/Pre-amplifier complete with 18 metres of 50 ohms Co-axial Cable. The Antenna Plug for the receiver is supplied loose.

RECEIVER Installation

The Receiver itself must be mounted in a dry place, probably adjacent to the Chart Table. The mounting bracket is designed to fit either under or over the Receiver to facilitate angular adjustment for convenient operation, and is suitable for table-top, bulkhead, or deck-head surface mounting.

For deck-head mounting or for low-level mounting against a bulkhead, where the operator will look down upon the Receiver front panel, the bracket will be inverted over the top of the unit. The bracket may also be used to enable the Receiver to be let-in flush with an instrument panel or bulkhead.

The Receiver should not be sited in direct sunlight as this will make clear viewing of the display difficult.

Earthing- See this Section.

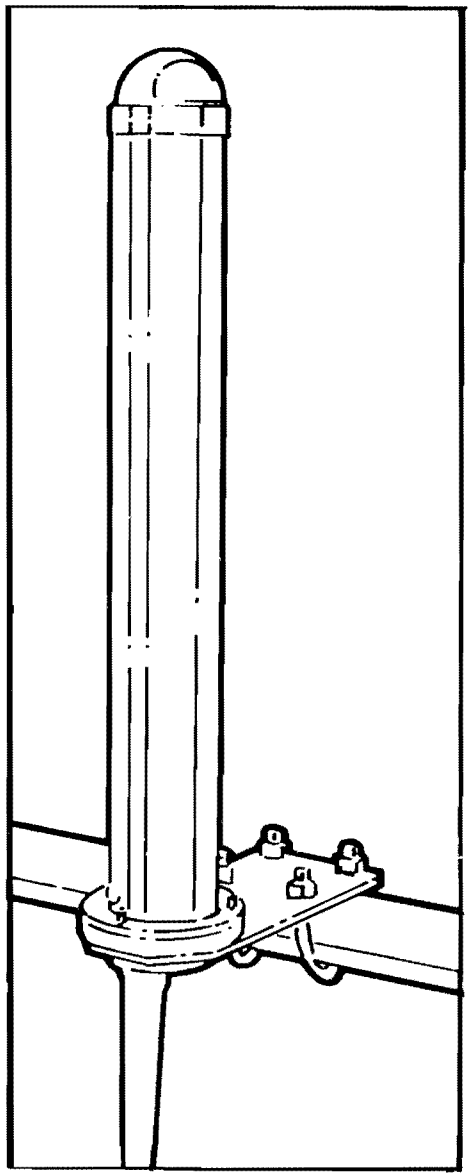
POWER SUPPLY Installation

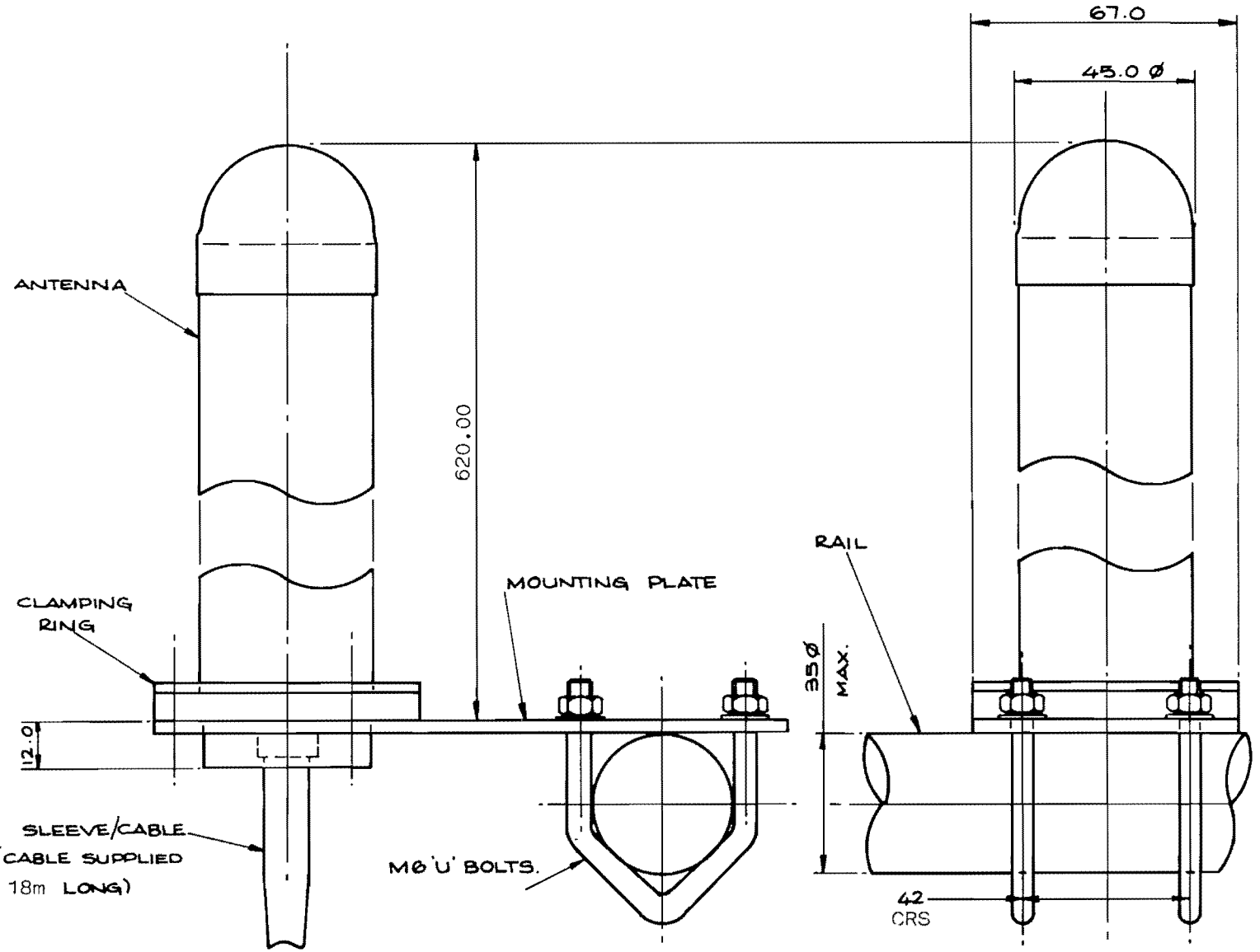
The 601 D requires 9—36 volts D.C. with the supply being as free as possible from any surges, voltage drop or interference of any kind. It is essential that no interruption of this supply should occur whilst the equipment is in use.

The current consumend is approximately 0.8 amps at 12 volts and 0.4 amps at 24 volts, but it is advisable to use as large a cross-section of cable as possible to minimise the voltage drop.

The Receiver is supplied with a 1.5 metre power cable terminated with a plug.

NOTE: The Brown wire is + ve. The 601 D Receiver is protected against reverse polarity and a fuse is fitted to the supply (2A × 20 mm). The fuseholder is located internally and to gain access, it is necesry to carefully (and only partially) remove the top half of the case.





All dimensions in millimetres

ANTENNA INSTALLATION

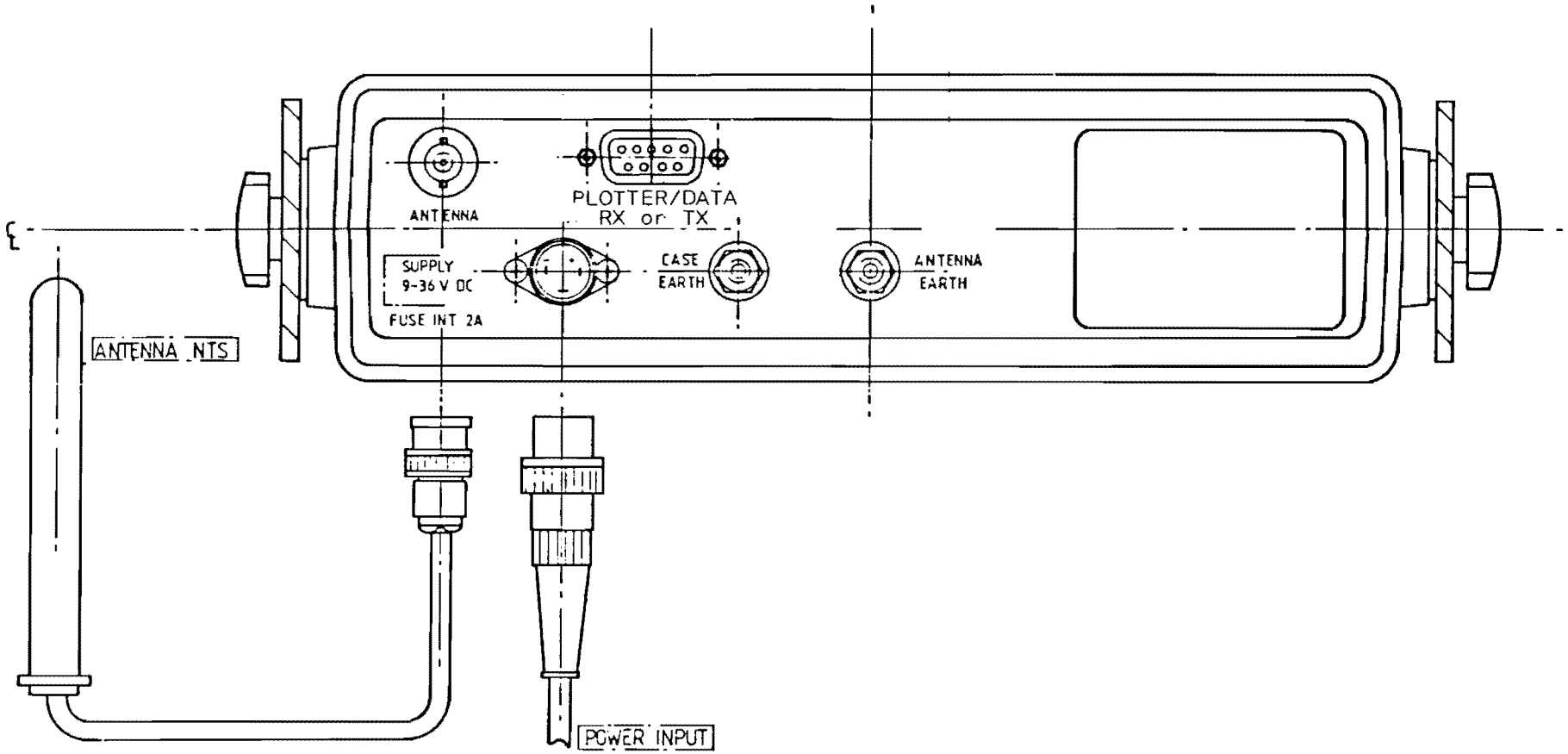
The NAVSTAR SA 601 D Navigator Antenna/Preamplifier must be positioned outside any superstructure, wires, sails and other radio equipment antenna, to facilitate a clear "view" at any heading over 360° of azimuth. This is to ensure that radio transmission reception is not screened at any heading by obstructions "opaque" to the radio waves. The Antenna should also be positioned as high as is practicable in order that the maximum working range and the mimimum screening for reliable operation are attained. Reliable operation is dependent upon the height of the Antenna above the water line. For sailing vessels it is desirable for the Antenna to be mounted from the mizzen mast, and for yawl or ketch rigs, the Antenna's mounting bracket should be attached directly to the mast top. Where only a single mast exists, the Antenna should again be fixed to the mast top, but it is appreciated that other radio aerials, wind equipment and lights may cause a mounting problem.

Note: Electrical discharge (or corona) often occurs at sharp points in upper stays, rigging and associated fixtures. If the Antenna can possibly be mounted above such "noise" sources, the effect of electrical discharge upon signal reception is minimised. The Antenna/Preamplifier is designed to prevent any local static discharge.

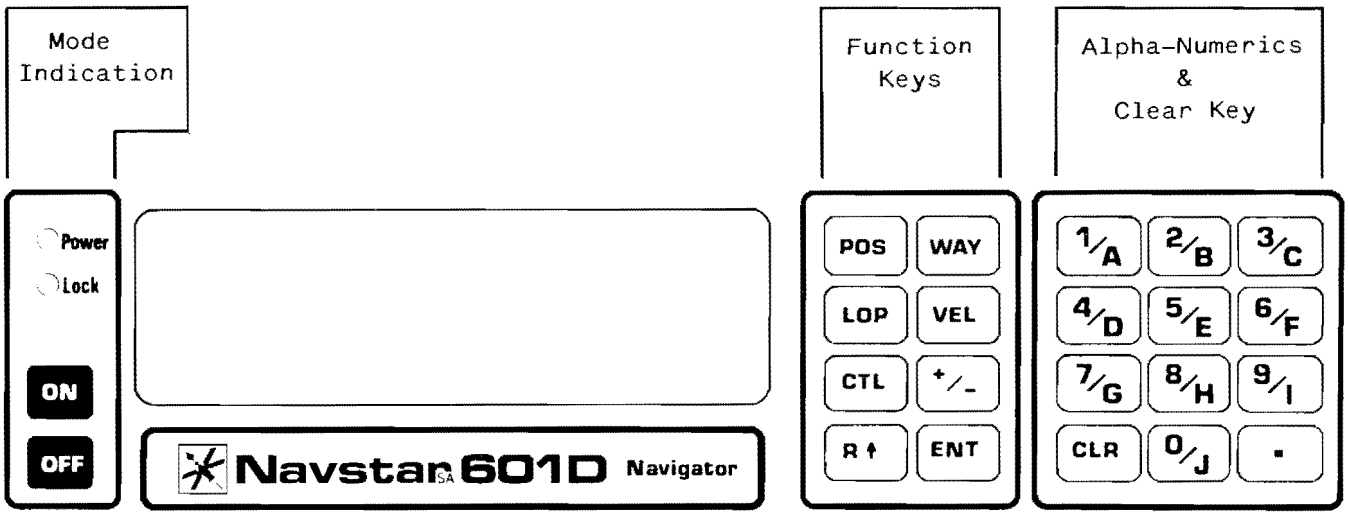
IMPORTANT: It is essential that the base of the Antenna adjacent to the Antenna mounting bracket MUST be veritcally above, or level with, any metalwork so that, electrically, the Antenna has an uninterrupted "view" over 360° azimuth.

For power boats, less screening problems arise and providing that the height of the Antenna above the water-line is adequate, location of the Antenna upon the cabin roof may be found to be acceptable. However the Antenna should be kept well clear of VHF aerials, rigging, or other equipment. When radar is fitted a position upon the masthead, above the scanner plane, is recommended to avoid possible radar interference.

If, upon Installation, a persistent disagreement of nearly 0.5 lane occurs between LI and Lane Count (even when using a good signal) then such antenna screening should be suspected. For the same reason, it is advisable, whenever possible, to complete the Installation and Checking clear of crowded harbour conditions.



NAVSTAR SA 601D BACK PANEL CONNECTIONS



Control:

ON OFF

Hold OFF for longer than 5 secs.

Mode Indication:

O Power (LED)
Lights up when set is switched ON

O Lock (LED)
Continuous light for satisfactory lock.
Flashing lock light indicates that the system is in Lock but there is an alarm active which affects the integrity of the Position Fix.

5 Groups of information Displays called up by Keys:

POS
POSITION

WAY
WAYPOINT

LOP
LINE OF POSITION

VEL
VELOCITY

CTL
CONTROL

+/-
To change state either/or for display, having multiple states eg YES/NO, Bright & Dim display, Keyboard lock & N to S

R
To roll forward to next display page

ENT
Enter Data

1/A to 0/J
Alpha-Numeric Character Input

.
Decimal point key facility for use in conjunction with numeric characters

CLR
Clear Key:
Cancel/Erase unconfirmed data

HANDHAVANDE REGLER

Användandet av NAVSTAR 601 D och den information som den kan lämna är uppdelad i 5 olika grupper för enklare handhavande enligt följande:

[POS] — Position
[WAY] — Girpunkter
[LOP] — Positionslinjer (decca värden)
[VEL] — Fart och kurs
[CTL] — Kontroll och allmän information

Under var och en av dessa rubriker finns ett antal sidor med information.

Varje grupp väljs med motsvarande tangent [POS] [WAY] [LOP] [VEL] eller [CTL] , inom gruppen "rullas" sedan önskad sida fram med [R↑] tangenten.

I denna bok refereras till gruppen med tangentens första bokstav och sidan med sidnummer, tex. W3 är tredje sidan i girpunktsgruppen, tryck [WAY] [R↑] [R↑] för att komma dit.

På varje sida kan det vara flera olika värden vilka kan ändras av användaren. Det som kan ändras är understruket av en blinkande linje (cursor).

OBS: Cursor linjen kommer fram under den del av texten som navigatorn önskar information om:

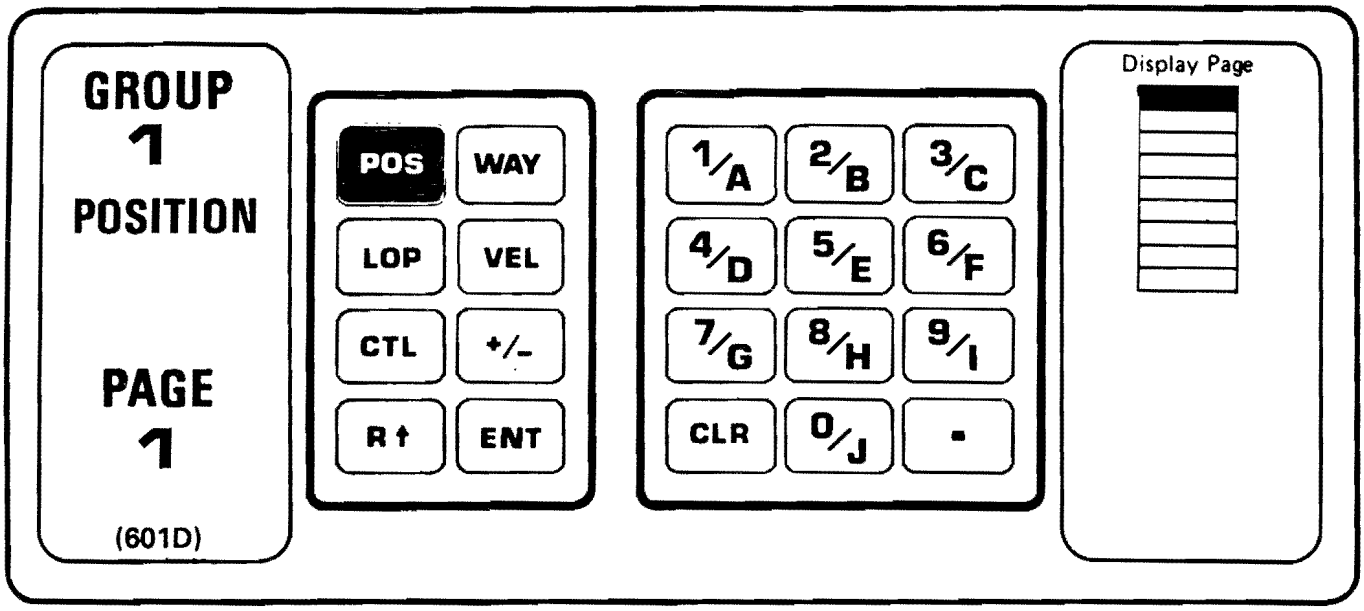
a) När ett ord är understruket så används [+/-] tangenten för att bläddra fram önskad ord/funktion, ingen annan tangent behövs.

b) När ett tal är understruket så betyder detta att nytt tal kan matas in. Efter att talet matas in så måste man trycka på [ENT] för att datorn skall acceptera det nya värdet.

c) [+/-] tangenten används även vid negativa tal samt för ändring till sydlig latitud och västlig longitud.

[ENT]
Varje siffra visas direkt vid inmatning, när sedan hela talet är inmatat så måste man trycka på ENT för att datorn skall acceptera värdet. Samtidigt flyttas cursor linjen till nästa position eller efter sista positionen så försvinner den för att åter komma fram vid första positionen om man trycker på ENT ytterligare en gång.

[CLR]
Denna tangent används om man vill ändra ett inmatat tal innan man tryckt på [ENT]



FUNKTION: POSITION — LAT/LONG

```
LAT   58  53.13 N
LON    2  10.22 E
```

INFORMATIV SIDA

Väljes med POS tangent

Denna sida visar den nuvarande positionen baserad på de mottagna radiosignalerna. Positionen är bestämd med hjälp av 2 av de 3 LOP (decca) värdena som är uppmätta. Positionen kan även innehålla en manuellt inlagd korrektoinsfaktor.

Vid automatiskt kedjeval så används de två bästa signal (LOP) värderna. Vid manuellt kedjeval så startar navigatorn på de bästa slavarna, men önskade slavar kan väljas av operatören. Se vidare grupp 3 LOP sid 9.

VIKTIGT!

I sifferfönstrets högra kant kan följande varningstecken visas:

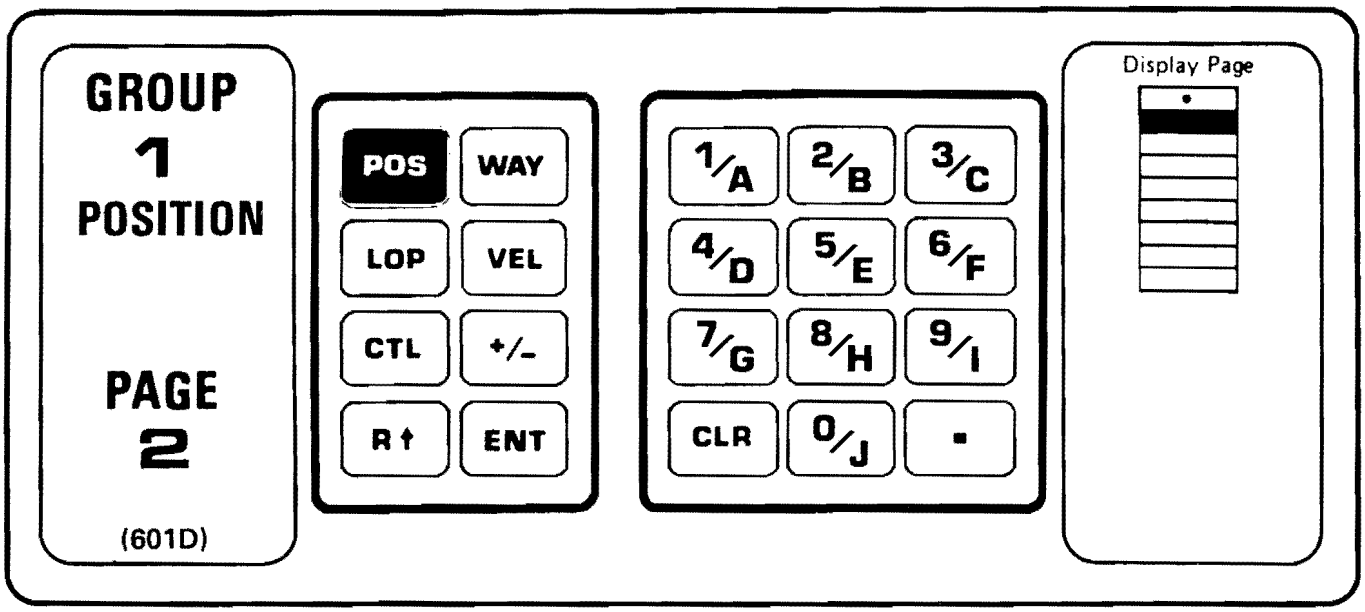
a." C " visar att, till den uppmätta råpositionen har adderats en korrektionsfaktor.

```
LAT   58  53.13 N
LON    2  10.22 E.C.
```

b." F " visar att operatören har valt en filtreringstid som avviker från normala 5 sekunder. Se grupp i POS sid 4.

```
LAT   58  53.13 N.F
LON    2  10.22 E.C.
```

Press R↑



FUNKTION: OSÄKERHETSRUTA

DMD 0.8NM 012°T
P-R 1.2NM 063°T

INFORMATIV SIDA

Denna sida visar en "osäkerhetsruta" i avstånd och bäring motsvarande 1 lane mellan linjerna på de två slavar som används för lat/long beräkningen.

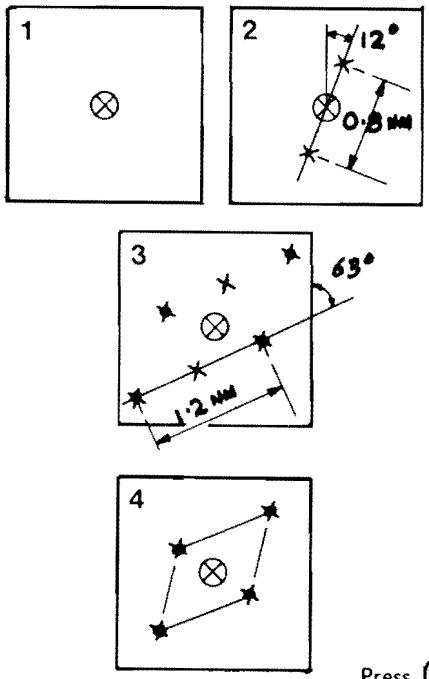
För att rita upp rutan runt din positin i ett sjökort, förfar enligt nedan:

1. Markera i kortet din position som den står enligt föregående sida

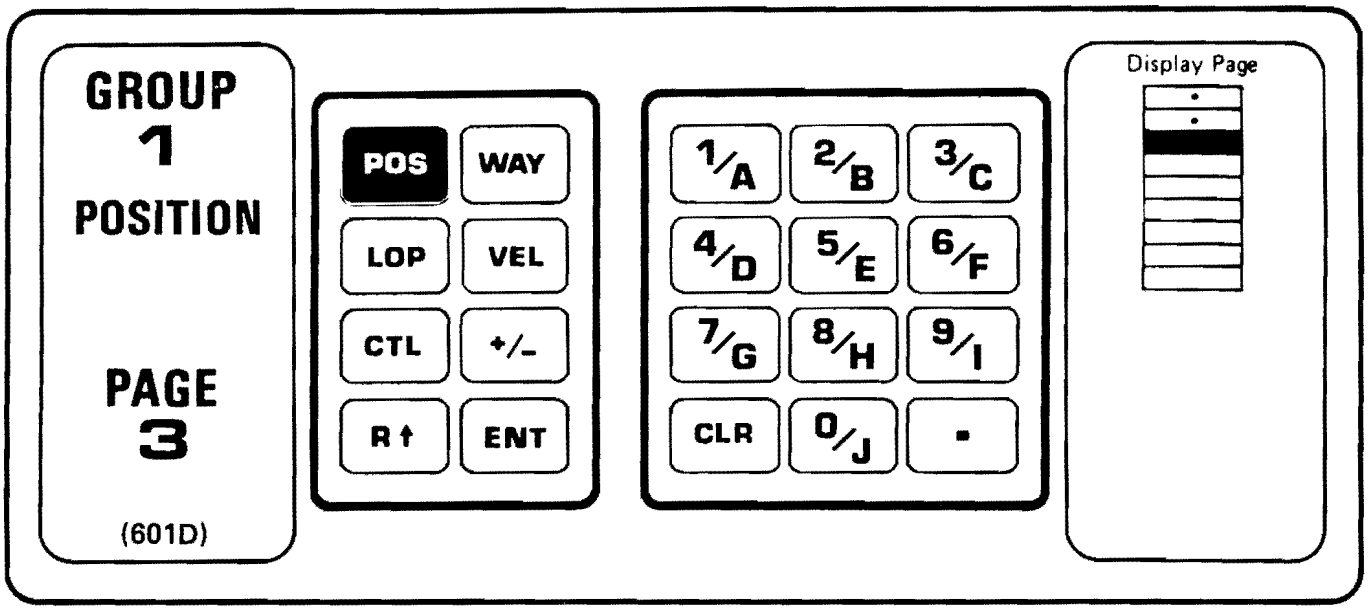
2. Markera två punkter symmetriskt runt din position med bäring och avstånd enligt övre raden (0,8 NM 012)

3. På var sida om dessa punkter markeras nu två nya punkter placerades med avstånd och bäring enligt den nedre raden.

4. Sammanbind de fyra senare punkterna med linjer så att de bildar en romb. Denna ruta representerar en osäkerhet av 1 lane (+/— 0,5 lane). I de flesta fall så är noggrannheten större än så. För fler detaljer se bilaga 1 och publicerade datablad över decca nätets tillförlitlighet under olika tider på dygn och år.



Press R↑



FUNKTION: STÖRNIVÅ MÄTARE

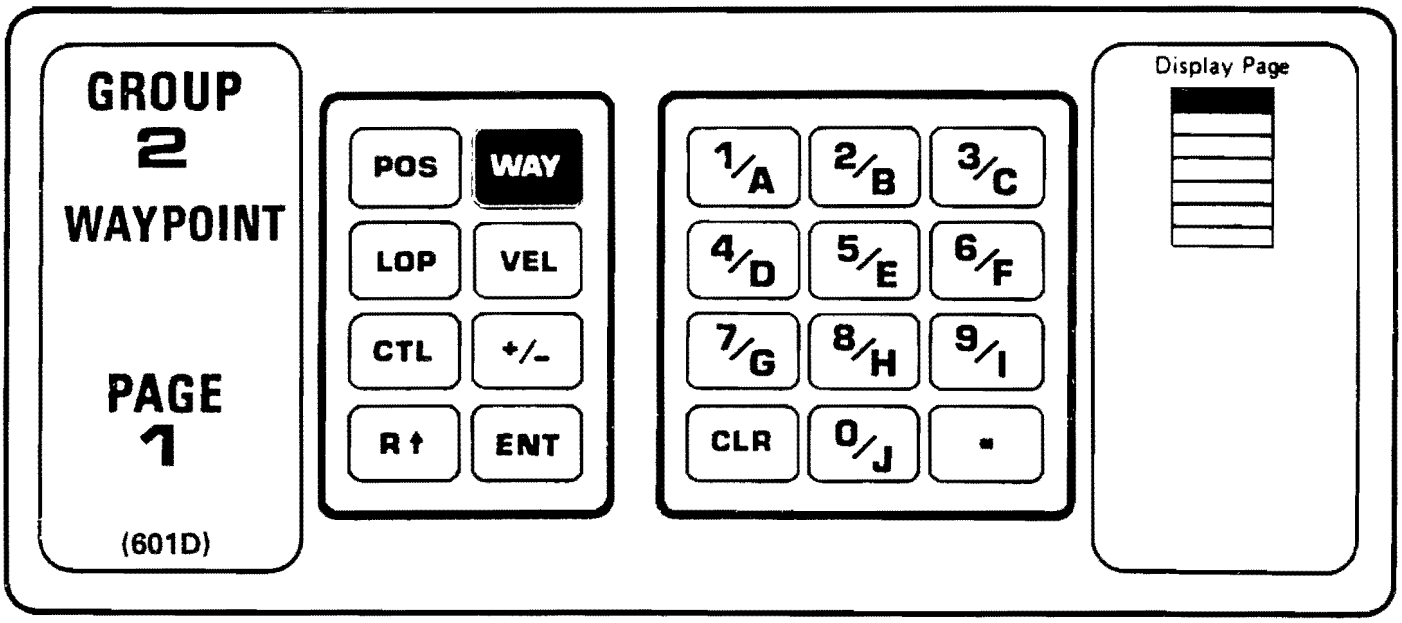
INFORMATIV SIDA

R betyder röd, G betyder grön, och P betyder violett.

Denna sida visar att siffervärde på störnivån av signalerna från mastern och de tre slavarna från 0—99. Värden lägre än 25 är önskvärda speciellt på mastern för att få tillförlitliga värden. Detta gäller speciellt lane identifieringspulserna (LI).

Asterisken " * " visar vilka slavar som används för att beräkna LAT/LONG positionen. När asterisken blinkar så indikerar detta att man har ett LI fel på det värdet.

Press R↑



FUNKTION: AVSTÅND, BÄRING OCH KURS ATT STYRA TILL EN GIRPUNKT

```
W1   RL    RNG    0.0
BRG045T   CTS   045T
```

INFORMATIV SIDA

DEFINITION: GIRPUNKT — Girpunkt (WP) kan vara slutmål eller en plats på vägen där du skall ändra kurs. NAVSTAR 601 D kan lagra upp till 25 olika girpunkter (WayPoints). När girpunkternas position i latitud och longitud har matats in i navigatorns minne så visar navigatorn avstånd och bäring till valfri girpunkt från din nuvarande position. Girpunktsdata är beräknat efter storcirkel (GC) eller loxodrom (RL) (konstant kompasskurs). Värdena beräknas kontinuerligt av navigatornsdatorn så att de hela tiden skall gälla från den senast beräknade positionen (EP). Val av WP nummer samt loxodrom alternativt storcirkel göres på denna sida.

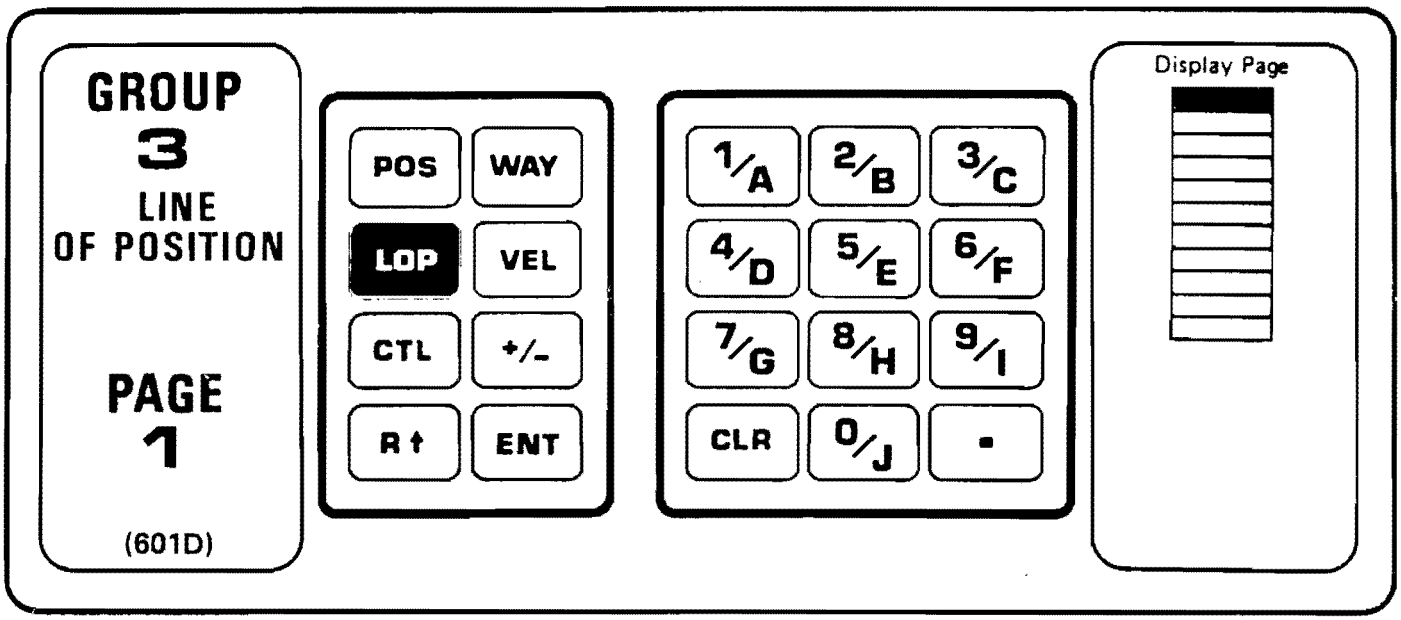
En verklig storcirkelkurs kan hållas genom att kontinuerligt följa kurs-att-styra (CTS) informationen, eller automatiskt via en lämplig autopilot.

OBS! I navigatorsprogrammet finns även en WP O, den enda position du kan lägga in här är din aktuella position (EP) via RESET CROSSTRACK (se sid W3). Denna funktion används normalt för att justera startpunkten när man kommit ut på fritt vatten och kan hålla rak kurs till nästa girpunkt (WP). Den kan även användas för att "frysa" den aktuella positionen så att den senare kan avläsas på sid W5/W6 (man-över-bord funktion).

1. BRG är bäringen till nästa girpunkt från nuvarande position (EP).

2. CTS är den kompasskurs som rorgängaren skall hålla för att komma till girpunkten (kompenserad för eventuell ströminformation inmatad på sid V3). T efter kursen visar att det är kursen till den sanna nordpolen, M visar att navigatorn justerat för magnetisk missvisning (matas in på sid W4).

Press R↑



FUNKTION: LOP (DECCA) VÄRDEN

INFORMATIV SIDA

Exempel

Denna sida visar positionen i form av LOP (decca) värden. Värdet skrivs ut med en zonbokstav samt lanevärdet med heltalssiffror och två decimaler. På övre raden visas röd och grön slav, på undre raden finns violett samt information om vissa larm.

De två stjärnorna visar vilka värden som används för beräkning av latitud och longitud.

Om .F. eller .C. visas så varnar detta för att man lagt in en filtreringstid (.F.) som avviker från de normala fem sekunderna eller att LOP värdena är justerade med en korrektionsfaktor (.C.) Se sid L5 & L6.

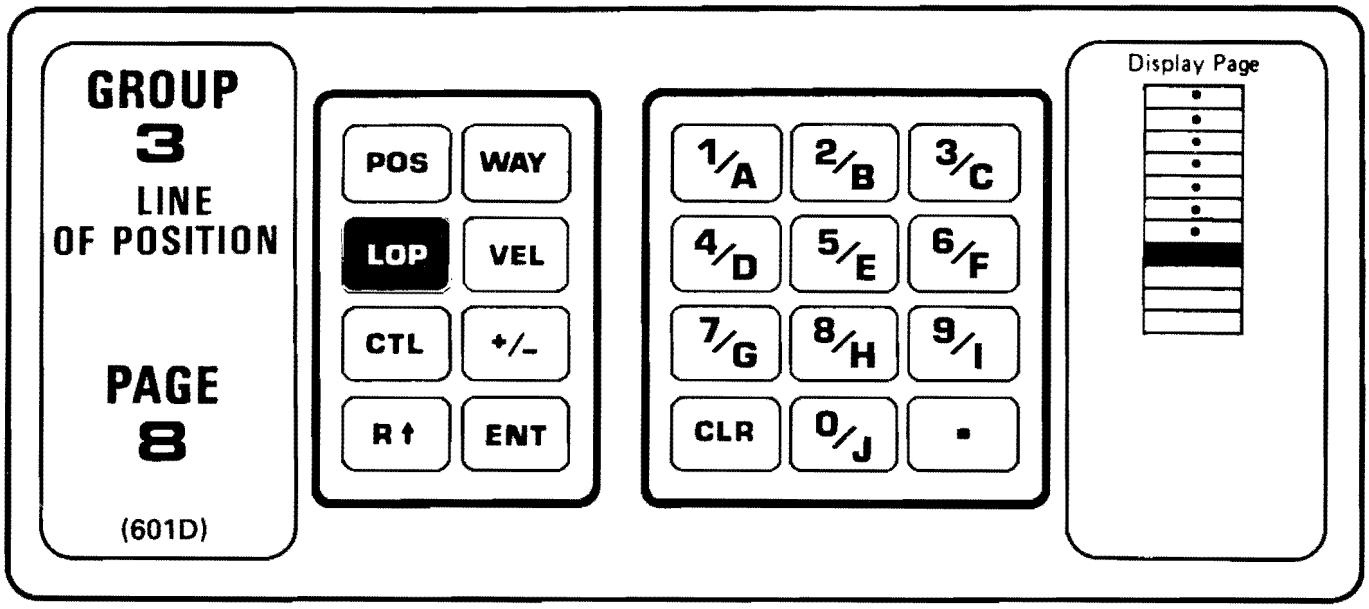
Vidare visas L.I. ALARM (lane identifieringsfel) om det visade lanevärdet skulle avvika från de mottagna LI pulserna (se vidare sid L2). Ofullständig låsning på signalerna och eventuell avvikelse mellan de tre värdena (3-LOP).

OBS! Vid byte av kedja (automatiskt eller manuellt), så kommer en eventuell korrektion att nollställas automatiskt.

Följande larm visas på denna sida:

NO LOCK	— navigatorn har ej hittat signalerna.
PHASE LOCK	— signalen funnen men ej helt låst.
(SLÄKT)	— navigatorn klar för användning.
3-LOP	— de tre värdena ger ej samma position.

Press R↑



FUNKTION: BÄSTA KEDJA OCH SLAVAR

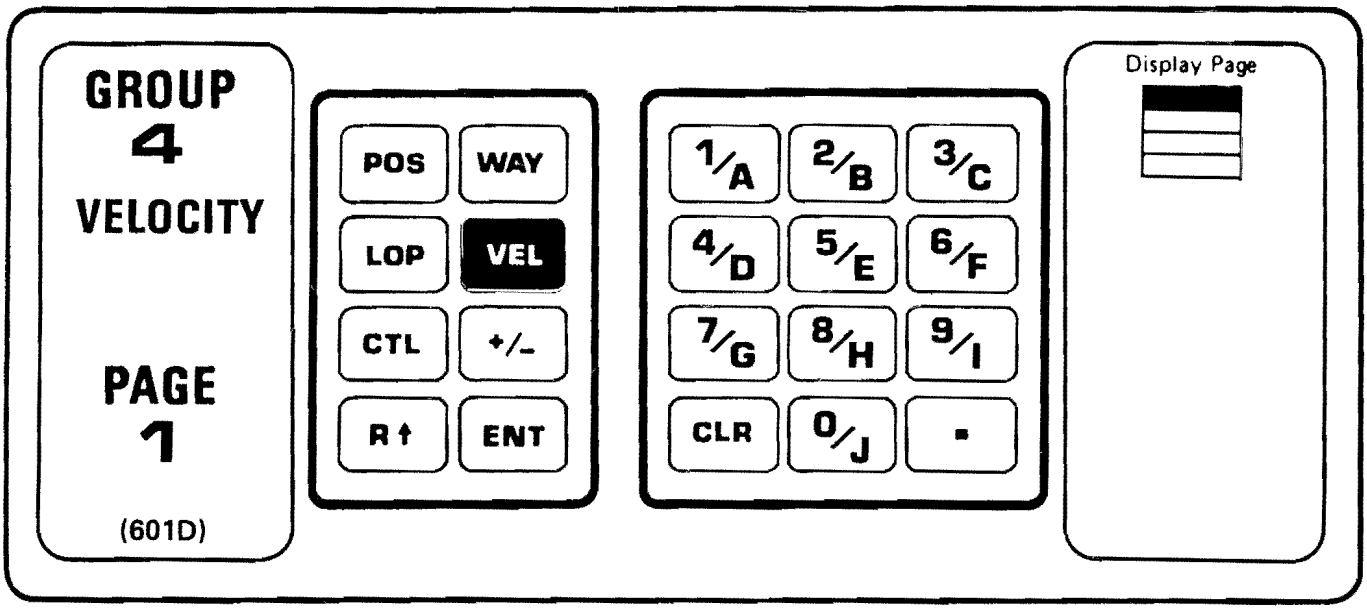
```
BEST CHAIN      8 F
BEST PAT.       P-R
```

INFORMATIV SIDA

Med hjälp av given lat/lon position visar Navigatorn här den kedja och det par av slavar som bör ge den bästa positionsbestämningen i området.

OBS: Val av kedja och slavar göres enbart med hjälp av position och hänsyn tas ej till eventuellt dåliga signalvärden.

Press R↑



FUNKTION: FART OCH KURS

INFORMATIV SIDA

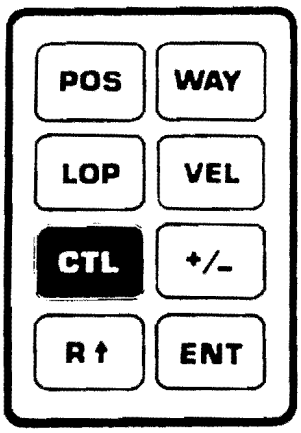
Denna sida visar fart och kurs baserat på den förflyttning som navigatorn mätt upp under de sista 4 minuterna. På grund av den långa integreringstiden (föranledd av variationer i signalerna) så får man en viss eftersläpning vid kurs och fartändringar. Vid plötslig positionsändring t.e.x. vid upprättning av LI-fel så kan orimliga värden visas, dessa går dock tillbaka efter några minuter. Vid stor osäkerhetsruta (sid P2) så får man räkna med ostabil fartinformation.

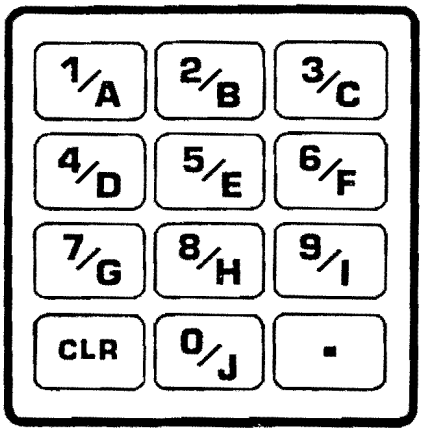
Press R↑

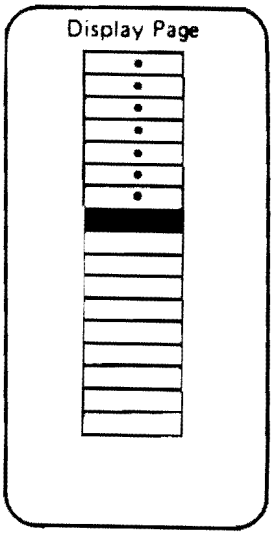
GROUP
5
CONTROL

PAGE
8

(601D)







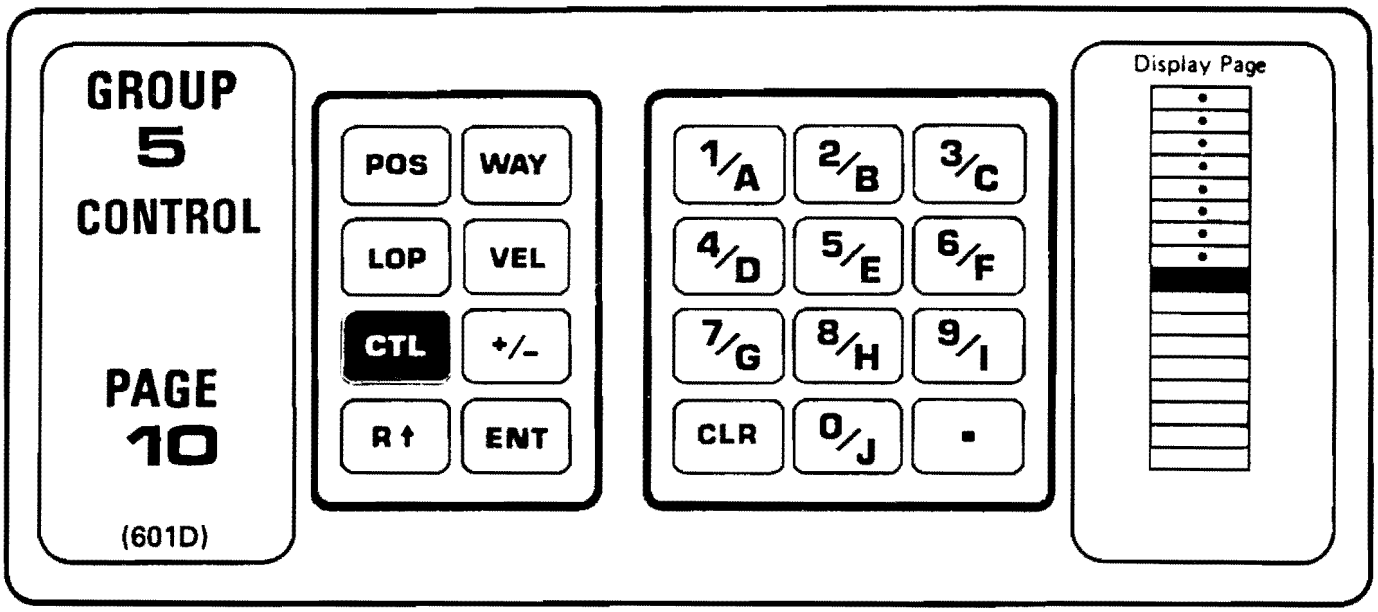
FUNKTION: STARTPOS. FRÅN SAT-NAV

POSN. FROM 601S ?
NO

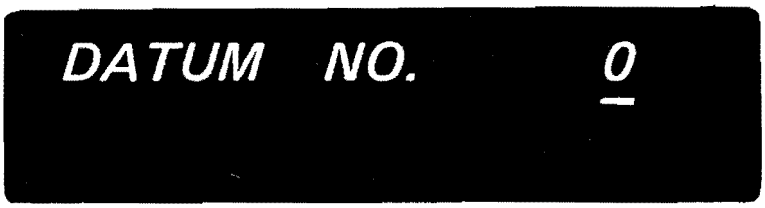
AKTIV SIDA
Att ändra:
NO till YES med
tangenten [+/-]

NAVSTAR 601 D kan här instrueras att ta en ny LAT/LON position från en ansluten satellitnavigator.
Används när man kommer till område med decca täckning eller när man av någon anledning fått felaktig position på 601 D.

Press [R↑]



FUNKTION: "DATUM" NUMMER



AKTIV SIDA
Att ändra: Valfri siffra samt enl. nedan
Datum nummer 0—9

Kartor i olika delar av värden stämmer ej överens helt och hållet då de är ritade med utgångspunkt från olika lokala referenspunkter. Detta beror huvudsakligen på att det är först på senare år med hjälp av moderna satellitbaserade mätsystem, som man lyckats att bestämma hur olika delar av vår värd ligger i förhållande till varandra. I din NAVSTAR Navigator finns korrektionsformler för omvandling till de 9 största lokala "datum" systemen. Navigatorn själv arbetar med ett internationellt system som kallas WGS 72 (World Geodetic System). Positioner enligt WGS erhålles när navigatorn är inställd på datum O.

DATUM NUMMER I NAVSTAR

0. WGS 72 (använd detta om du ej är säker på vad som gäller.)

1. U.K.	4. S.AMERIKA	7. HAWAII
2. EUROPA	5. S. AFRIKA	8. JAPAN
3. N. AMERIKA	6. AUSTRALIEN	9. INDIEN

I Sverige används ett eget system som ej finns med i navigatorn. Det datum som ger bäst resultat i svenska vatten (tillsammans med svenska sjökort) är datum 1 (och ej datum 2 som används fast i de flesta andra navigatorer). Har du däremot danska sjökort så är datum 2 det korrekta.

För att få optimal noggrannhet i svenska kort så skall du använda datum 0 och sedan addera de korrektionstal för WGS 72 som finns tryckt på alla nytryckta svenska sjökort (tryckta 84 och senare).
E.x. i Skagerrak kort 93 gäller korrektion lat +0,03 lon +0,15. Om navigatorn visar (datum 0) 57 43.83 11 59.65 så motsvarar det i kortet 57 43.86 11 59.80.

För normal navigering så ger datum 1 en överensstämmelse som räcker. Glöm ej att **Decca systemet är avsett för utomskärsnavigering och kan ge flera hundra meter fel inne i skärgården.**

Press R↑

NAVIGATION WITH THE NAVSTAR SA 601 D

APPENDIX 1

Manual Operation

There are occasions when it can be useful to override automatic operation, for instance to avoid unnecessary chain chaning when briefly crossing a "NEW CHAIN SELECT" boundary, or when bad signal strength is observed on the signal/noise monitor page.

If this involves a change of chain then the new designation must be entered. The 601 D will obtain the rest of the data required from the last Lat-Long position fix. However data my be overwritten, and patterns selected by the user. This gives a great flexibility to the system but should be used with care and an understanding of the hyperbolic navigation system. S/N, diamond, 3-LOP displays enable the user to make good choices with minimal chart and table data. It should however be understood that a very poor useage of this feature can result in very poor fixes, perhaps exceeding the zone tolerance of closer chain/pattern, and that these poor fixes may be used as the initialising data when making, for example a better selection or re-assigning "automatic" operation. Carrying forward such errors will normally be detected by an alarm, and is best avoides by re-entering a good Lat-Long on the "CTL" roll in such cases.

Lane Identification

The basic signals from the Master and slave transmitters are phase compared to provide accurate positional information within small "lanes". These basic units are however too fine for initial positioning purposes and dead reckoning across the "lane boundaries" is not completely immune to noise. Additional coding is therefore imprinted on the signals, defining much wider "zones". This is decoded and presented in the LI itself and is only presented briefly followed by the discrepancy between LI and lanecount. When everything is correct the discrepancy is low, less than 0.5 lane on all patterns.

If there is a discrepancy due to interference (and hence a "lane slip", or most probably on initialisation where the input is not known to an accuracy of half a lane) it will show on this display. In "automatic" mode the initialisatoin error will be monitored by the 601 D, and if found to be consistent will automatically be up-dated to produce the correct position fix. In other cases updating will not be carried out automatically, but an alarm will be generated to call the attention of the user. The 601 D continues to navigate, and so in the event of there being a real error, it produces a parallel course and therefore permitts the discrepancy to be checked and corrected at will. Under adverse conditions occasional corrupt LIs can be received, hence automatic updating is undesirable and so the user should observe a consistent error, through a few cycles, before updating to correct the position. In exceptinally bad conditions, repeated false alarms might occur and the nuisance can be avoided by the switching off the alarm function associated with L.I., residual warnings (such as the flashing "LOCK" light) of the condition will remain visible.

Fixed Errors

The speed of radio waves varies over different types of land and sea. As a result the phase differencies in practice differ slightly from the predicted values at a given location. These discrepancies remain fixed and so do not affect the repeatability of a position fix but do affect its absolute accuracy. O.1 lane discrepancies are common and larger figures sometimes occur which should be borne in mind by the mariner. Charts do not usually include these corrections, but tables are published for areas which have been extensively surveyed. The 601 D is able to accept these figures through its keyboard if available and will correct accordingly. It is also able to compute a correction factor from a corrected Lat-Long input.

Even the fixed errors may vary considerably over short distances and therefore the 601 D calls for a confirmation of any correction data every hour to remind the user of this fact.

Variable Errors

Propagation of the radio waves is affected by weather and seasonal factors and this too injects discrepancies into the lanecounts. More particularly at night a skywave is propagated, taking a different path to the ground-wave and interfering with it. Noise and variability are thus more marked at night, and the effect is larger when working a long way from the centre of coverage of a chain. Table 1 gives an indication of the variability of the system accuracy with time of day, range and season. Charts of accuracy contours, together with time and season tables are published for the various chains.

The fixed and variable errors are naturally different on different chains, and so it should be appreciated that a small discrepancy in apparent positions derived from different chains will occur, of the same order as the system accuracy.

Table 1 Repeatability (centilanes)

Range from baseline	100	200	300
Time:	Nm	Nm	Nm
Daylight	5	5	5
Dawn/Dusk	8	6	10
Night	12	15	35

Note:

1. Repeatability expectation is limited to 4 centilanes even at very short distance from baselines.
2. Accuracy over much of the coverage area is limited by the fixed and variable errors resulting from propation variations, and is therefore poorer than repeatability. Even under optimum conditoins, absolute accuracy should not be expected better than 0.1 Nm.
3. Winter conditins generally give poorer results than summer. The above table is very much simplified and considerable data on repeatability/accuracy has been published for the various chains.

Diamond of Error

As noted in the preceding paragraphs, the lines of position (LOPs) are subject to various disturbances. In full daylight conditions this may be only a few centilanes, but at the worst time, season and range it may amount to whole lanes. Using a chart overprinted with the LOPs it is quite easy to see the effect, as in Figure 1.

It can be seen that the unknows associated with the two LOPs define a "diamond-shaped" area, representing the uncertainty of the position fix. Very shallow crossing angles produce very elongated "diamonds", and position fixes which may be good in one direction but poor in the other.

The 601 D operating in "automatic" mode chooses the best pair of LOPs to minimise the uncertainty, in "Manual" the user is in control of this feature. When overprinted charts are not in use, the user will find the "DMD" information very useful for understanding the accuracy of fixing. The "DMD" display gives the distances and bearings of two sides of the diamond, which can be sketched out around the nominal position on any chart.

According to the time, season, and range, the actual accuracy will be a scaled version of the same diamond, and if a very long thin shape is defined then it warns of a poor fix accuracy in that direction. The derived displays (Lat-Long, velocity etc) can only reflect the accuarcy of this basic data.

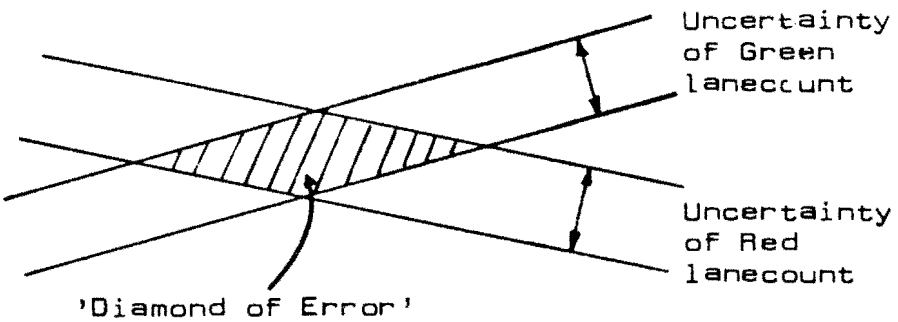


Fig. 1

3-LOP

Most chains feature 3 slaves, and there are therefore 3 LOPs available to use in position fixing. One of these may be very poor (on a baseline extension lanes are extremely wide, or the crossing angle may be shallow). However the wise mariner checks the third LOP on the chart if possible. Som inaccuracy is inevitable and so instead of exactly aligning in the main crossing point it is likely to cross formning a small triangle (commonly referred to as a "cocked hat") — Figure 2:

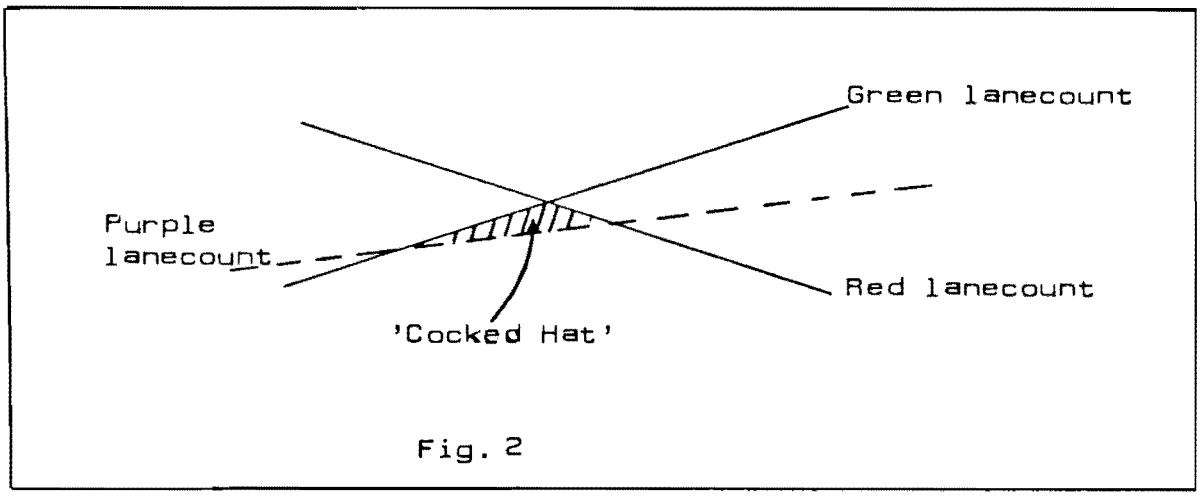


Fig. 2

The 601 D presents a form of this check on the LOP roll as the '3-LOP DIFF'. The differences between Lat-Long and 3-LOPs are presented, two of which are zero since they have defined the Lat-Long fix. Only a small discrepancy should occur on the third. A large value (many lanes) suggests an incorrect fix, perhaps because of inadequate signal strength, or probably because of an incorrect initialisation position which has defined a wrong "zone" where the lay of lanes from 3 patterns is different. A warning is generated for a discrepancy exceeding 1 lane.

Fix Accuracy in Harbour

Because the 601 D offers a Lat-Long correction facility, for use when an exact Lat-Long may be established, it is necessary to appreciate that the fixing accuracy of a phase-comparison system is not at its best in a crowded harbour. There may be small phase distortions introduced by adjacent cranes, or multitudes of masts. It is advisable therefore not to use the anchorage as a "TRUE LAT-LONG" for small correction purposes but to reserve this facility for open water.

APPENDIX II

WAYPOINTS

A Waypoint can be either a final destination or some intermediate destination, or turning point. The 601 D will accept up to nine waypoints. By defining each waypoint in terms of latitude and longitude, the distance and bearing of any waypoint, or series of waypoints, from the user's present position may be displayed.

The waypoint distances and bearings etc., are based upon either Rhumb Lines or Great Circles.
The use of waypoints on a volyage is illustrated in the diagram (Fig. 3).

Note: The words "Page W4" etc. in this section are references to pages in the 601 D computer program. (See under OPERATION-Group 2).

Single Waypoints:

With reference to the voyage diagram: suppose that upon leaving the Needles on the Isle of Wight, the user wishes to proceed westward along the south coast of England; if the visibility is likely to be poor, the mariner may enter a position South of Anvil Point as the first waypoint. The lat and long of this position, 1 mile south of Anvil Point, would be entered on Page W6 as 'Waypoint 1'. If Waypoint 1 is selected as the next waypoint of the intended course, Page W1 indicates to the user the distance and bearing of that waypoint from the present position.

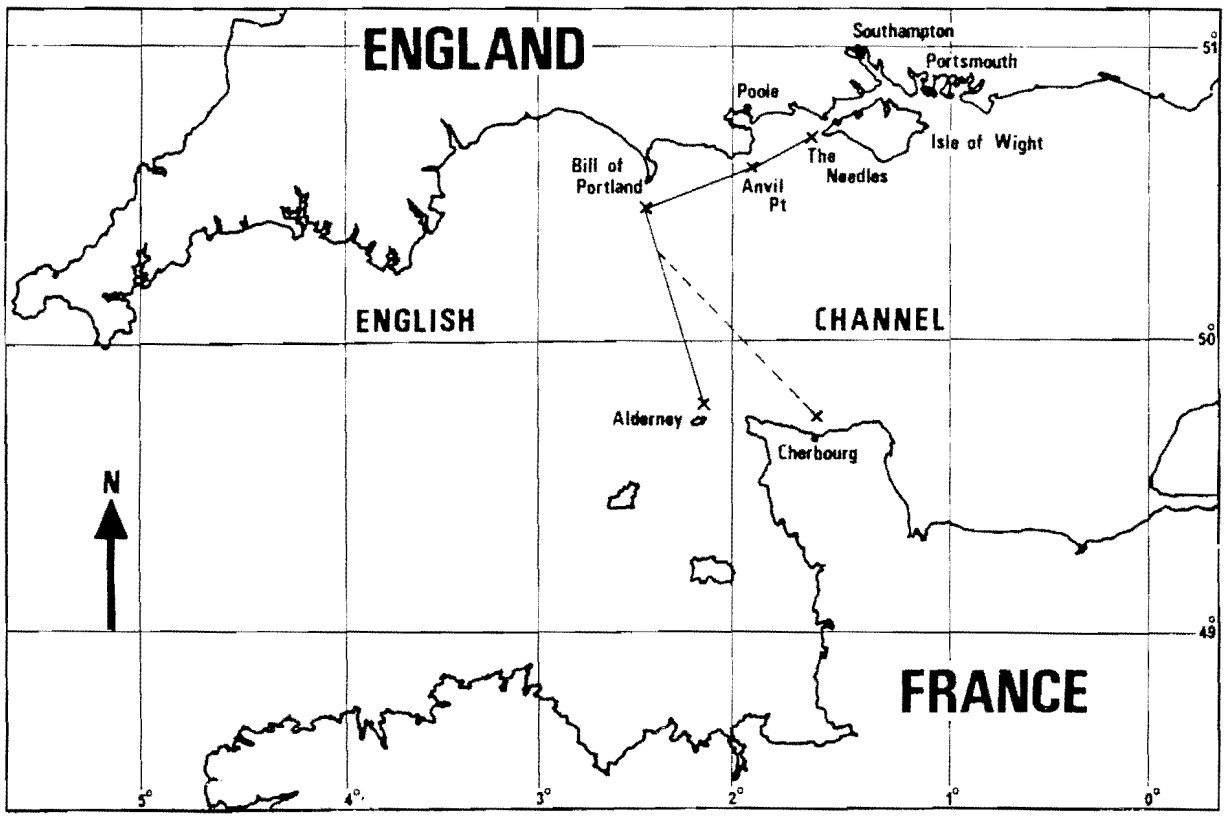


Fig. 3

When the mariner reaches Anvil Point, he would probably alter course slightly in order to clear the tide race off Portland Bill. Again he may choose a position in this case perhaps four mile off the Bill. This now becomes the new becomes the new waypoint and would have been entered as Waypoint 2. The data relating to this position should be displayed by selecting "FROM WPT. 1 TO WPT. 2" as the intended course on Page W4. Any changes in the tidal data should already have been entered as they occur, in order that the displayed course-to-steer is as accurate as possible.

If the mariner now decides to change the proposed voyage and cross the channel to Alderney a position just north of Alderney might be selected as a third waypoint. Again, on the way across the channel, wind conditions (if under sail) might make it preferable to make for Cherbourg, and a alternative track is shown as a dotted line to illustrate such a change of plan.

It is only necessary to select "TO WPT4" on Page W4 in order to have the new bearing and distance of that fourth waypoint from the user's present position, not forgetting of course, to re-enter into the 601 D changes in tidal conditions as they occur.

Series of Waypoints ("String-of-Beads") (1983 versions only)

When using this form of the waypoint feature, the initial position would be entered as Waypoint 0, using Page W3 (if that was the user's present Lat/Long) or Pages W5 and W6 as Waypoint 1,2,3 and 4.

The initial course would be entered on Page W4 as "FROM WPT O to WPT 1, 2, 3". The range and ETA would refer to the total distance to Waypoint 3. The bearing, course-to-steer, and cross-track distance would refer to the first leg of the voyage from Waypoint O to Waypoint 1. Then upon reaching Waypoint 1, it would be necessary only to alter Page W4 in order to obtain all the details for the next leg of the volyage.

APPENDIX III

INTERCONNECTION OF THE 600 SERIES LINK

For full details of this option consult NAVSTAR SA.

SERIAL LINK PORT D-TYPE 9-WAY CONNECTION

The 601 D serial port (TX/RX) is currently programmed for NMEA-type format modified to transmit 'Decca Navigator' (Hyperbolic) type information.

This connection facility offers the user the standard TTL NMEA output requirement or an RS 232 level output.

The interconnection is made with a screened lead fitted with a 9-way, D-type connector.

See the range of NAVSTAR SA Hyperbolic-compatible systems.

WARNING! DO NOT INTERCONNECT SYSTEMS WITH THE SETS SWITHED **ON**
— THIS MAY CAUSE SYSTEM CORRUPTION.

Note: Byte 35 in NMEA 0182 gives LORAN status information. The 601 D operates on the similar, but different, 'Decca Navigator' type of hyperbolic signals. The various components of Byte 35 are therefore transmitted giving similar indications of the status within this system.

The two BNC rear panel connectors are not utilized on 1983 models, and not fitted to 1984 Models.

COMPLEX DATA FORMAT

A Study Group for NMEA 0180 Complex Data Format was organized and the following proposal was presented at the October 21st 1980 meeting by Peter Cunningham of Metal Marine Pilot.

In order to make the NMEA 0182 standard more universal, expandable and efficient, this proposal recommends replacing the paired byte format with a block-structured format. Information to be transmitted would be in the form of a variable-length block of data. The length of the block would be application dependent.

For the Loran-C Autopilot interface requirements, the data block would have the following charcteristics:—

1) All bytes in the data block will be sequentially transmitted, one at a time, using serial bit system as follows:—

1. Start Bit D0-D6:	Logical 0 Vout 4.0V 7-bit ASCII code or 7-bit statis information (D0 = LSB)
D7:	Logical 1 to identify the complex data format
Parity Bit:	Parity shall be odd
Stop Bit(s):	At least one stop bit

2. All bytes included in the block structure will have a logical 1 in bit 7 of the byte being transmitted. This distinguishes the complex data format from the simple data format.

3. To signify the beginning of a data block, the ASCII character "$" will be sent.

4. The "$" character (hex 24) will be followed by 2 ASCII characters which will be a nmemonic for a device-specific address.

5. The 2 nmemonic characters will be followed by a variable-length data block, which consists of device-specific data.

6. The ASCII character "ETX" (hex 03) will be sent to denote end of the data block.

7. All ASCII characters will be in 7-bit code.

8. Any data that can't be provided in some parts of the data block will be filled by the ASCII "NULL" character.

NOTE: Bytes of simple format data may be interspersed on same transmission line with bytes of complex format data.

The Data Block bytes will be the following:—

Byte		ASCII Character		Hex Value
1		$		<24>
2		M	!Device	<4D>
3		P	!Address	<50>
4		K = kilometers	!Represents	
		N = nautical miles	!Cross Track	
		U = microseconds	!Error Units	
		Resolution on Cross Track Error Units:		
		0.02 for kilometers		
		0.01 for nautical miles		
		0.10 for microseconds		
5	MSD	0—9 or " "	!Cross	
6		0—9 or " "	!Track	
7		0—9 or " "	!Error	
8	LSD	0—9 or " "	!and	
9		L or R	!Error Position	
10		T = True	!Represents	
		M = Magnetic	!Bearing Units	
		Transmit magnetic bearing info if available		
11	MSD	0—3	!Bearing from	
12		0—9	!Present Position	
13	LSD	0—9	!to Next Waypoint	
14—23		XXDXX'XX"P or XXDDXX.XX'P	!Latitude	
		WHERE:		
		X can be any numerical digit		
		D represents "degrees"		
		' represents "minutes"		
		. is a decimal point (for fractions of minutes)		
		" represents "seconds"		
		P represents direction can be "S" for South, or "N" for North		

For example: 57 degrees 34'19"N would be sent as:

ASCII Char	Hex value
5	35
7	37
D	44
3	33
4	34
'	27
1	31
9	39
"	22
N	4E

24—34	XXDXX'XX"P or XXXDXX.XX'P	!Longitude
	WHERE:	
	P represents direction can be "E" for East or "W" for West	
35	NON-ASCII byte that contains status onfo	
	BIT 0 = 1 for man. cycle lock	
	BIT 1 = 1 for low SNR	
	BIT 2 = 1 for Cycle Jump	
	BIT 3 = 1 for Blink	
	BIT 4 = 1 for Arrival at Waypoint	
	(goes to 1 when abeam of new course line,	
	stays high for 4 data updates)	
	BIT 5 = 1 for discontinuity of TD's (stays high for	
	4 data updates)	
	BIT 6 = 1 (always)	
	NOTE: Bits 1—3 each represent an ORed value of the status of	
	the stations you are using for tracking	
36	"NULL" character	!Reserved status byte
37	"ETX" character	!End of data <03>
		!block

NOTE: Uppdate block of data one every 2—8 seconds. This need not be done in a single burst.

These details are subject to change without notice.

APPENDIX IV

CURRENT DESIGNATED CHAIN CODES

EURPOPE

OA	South Baltic
0E	Vestlandet (Norway)
1B	South West British
2A	Northumbrian
2E	Holland
3B	North British
3E	Lofoten (Norway)
3F	German
4B	North Baltic
4C	North Spanish
4E	Trondelag (Norway)
5B	English
5F	North Bothnian
6A	South Spanish
6C	North Scottish
6E	Gulf of Finland
7B	Danish
7D	Irish
7E	Finmark (Norway)
8B	French
8C	South Bothnian
8E	Hebridean
9B	Frisian
9E	Helgeland (Norway)
10B	Skagerrak

AUSTRIALIA

4A	Australia Port Hedland
8E	Australia Dampier

INDIAN OCEAN/PERSIAN GULF

1C	South Persian
2F	Salaya (India)
6C	Banladesh
7B	Bombay
8B	Calcutta

JAPAN

4C	Shirkoku
6C	Tohoku
7C	Kyushu
8C	Japan Kanto
9C	Hokkaido Japan

CANADA

2C	Newfoundland
6B	Cabot Strait
9C	Anitcosti

AFRICA

4A	S. Africa Namaqua
6A	Cape
8A	E. Province
8F	Lagos
9C	S.W. Africa
10C	S. Africa Natal