Datong Electronics Limited

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Contents

APPENDICES

1 Introduction

This manual deals with the installation and operation of the Datong DF6B radio direction finder system, which incorporates an ICOM R8500 communications receiver.

For operating the ICOM receiver, refer to the ICOM manual supplied with the DF6B.

This manual also deals with the installation and operation of the standard and optional equipment associated with the DF6B, which includes:

- Head Units
- Antenna Selector Unit (ASU)
- Hand-held controller (DFC2)
- Antenna arrays. For more detailed installation instructions for antenna arrays, it may be necessary to refer to the instructions supplied with the arrays.

2 Description of Equipment

2.1 Function (Figure 2.1)

The DF6B is a radio direction finder designed for applications from amateur radio leisure activities to professional RF monitoring and control.

At present the unit covers the range from 1.5MHz to 1GHz, which will be extended as other head units become available.

A typical system consists of a number of antenna arrays, each with its associated head unit, an antenna selector unit (ASU), and a DF6B. If a single array is used, no ASU is requred.

With the DF6B tuned to the required frequency, the processor software instructs the ASU to select the appropriate antenna array. The incoming signals are processed by the head unit, the receiver, and the DF processor, and the signal bearing is shown on the front panel in both polar and digital form.

If required, the DF6B can be controlled remotely by a DFC2 hand-held controller.

2.2 Principle of DF Operation

The DF6B employs a modern computerised version of the classic Watson-Watt technique using four-element Adcock antenna arrays. Outputs from the north-south and east-west antenna pairs are amplitude modulated at two different low audio frequencies and combined with a ‘sense’ signal. The result is that all signals picked up by the antenna array are amplitude modulated in a way which depends on their direction of arrival.

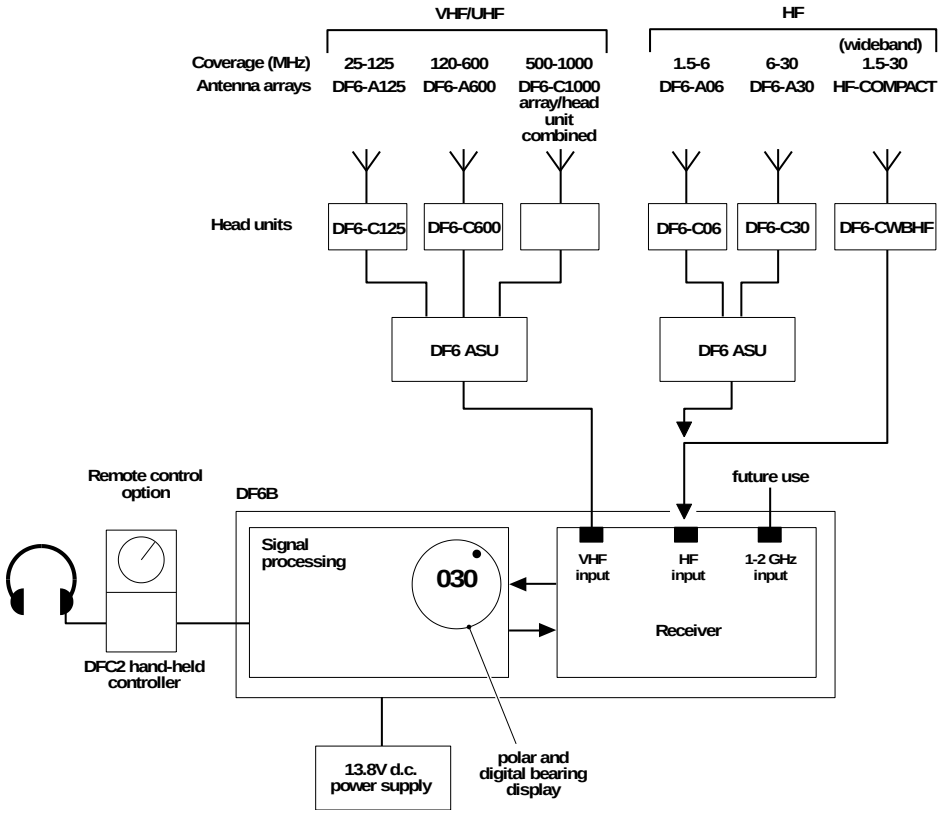


Figure 2.1 Typical DF6B Systems

2.3 DF6B (Figure 2.2)

The unit consists of a modified ICOM R8500 communications receiver and a DF processor mounted in a 19in rack, and is powered by a nominal 13.8V d.c. power source.

Receiver

In the receiver the chosen radio signal is demodulated, any normal modulation waveforms are filtered off, and the special modulation waveforms are recovered and digitised. A microprocessor corrects the data to allow for any gain, phase, or offset errors, applies various calibrations, and calculates and displays the bearing.

The ICOM R8500 receiver combines wide frequency coverage with good sensitivity and versatile mode selection. The receiver works with continuous and pulsed transmissions and with most modulation modes.

Digital Signal Processing

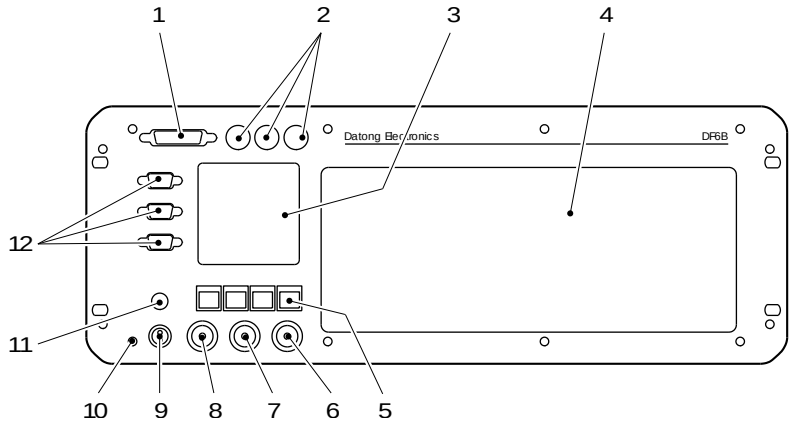
Early in the signal path the DF information is digitised and all subsequent processing is carried out in software. All data received during the previous five seconds is stored in memory and analysed statistically. In this way the processor is able to detect the presence or absence of a genuine received signal whether it is from a pulsed or continuous transmission.

Between pulses, or when the signal stops, the display holds the last valid reading. No manual threshold adjustments are required.

A two-way data link between the receiver and the DF processor enables the processor to select automatically the most appropriate antenna array for the frequency of the incoming transmission. For example using the optional Antenna Selector Unit (ASU) with three arrays for coverage from 30MHz to 1GHZ, the processor will command the ASU to select the correct array for VHF or

UHF operation, and select the HF input when operating below 30MHz.

The processor is pre-programmed with dimensional information about the antenna arrays, and calculates the displayed bearing to allow for the so-called ‘spacing error’ normally associated with Adcock antennas. This error-correction extends the upper frequency limit for a given antenna array.



1 AUXILIARY connector (for future expansion)
2 Fuses
3 Bearing display (polar and digital indication)
4 ICOM R8500 receiver
5 AV pushbuttons
6 Antenna connector (1-2GHz)
7 Antenna connector (VHF)
8 Antenna connector (HF)
9 Power supply connector (12V D.C. (IN))
10 Headphone connector
11 Brilliance control
12 Serial connectors for remote control

Figure 2.2 DF6B

Self-calibration

Analogue circuits in the DF processor are automatically calibrated for amplitude and phase response every thirty seconds, giving system accuracy that is essentially independent of drift in component values.

Self-test Routine (BITE)

The BITE (**B**uilt-**I**n **TE**st) facility is a test routine which can be activated to exercise all the hardware and software of the DF processor. In the event of faults the routine generates error messages to simplify fault diagnosis and to identify faulty components.

For further technical details of the DF6B, see ***Appendix A***.

2.4 D.C. Supply Lead (Figure 2.3)

1-metre lead for connecting a 13.8V d.c. supply to the 12V D.C. (IN) socket on the DF6B. Terminated at one end with a LEMO plug and at the other end with 150mm tails.

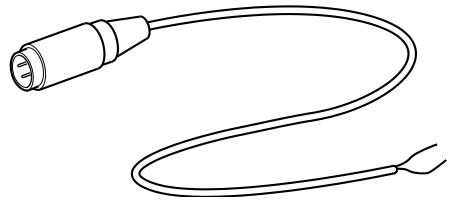


Figure 2.3 D.C. Supply Lead

2.5 Antenna Arrays

Datong offer a range of self-contained antenna systems for both mobile vehicle-mounted and high-sensitivity fixed station applications, and can also supply customised arrays for special purposes.

Up to five antenna arrays can be connected to DF6B at the same time via the optional Antenna Selector Unit (ASU).

The DF6B can provide coverage from 1.5MHz to over 1GHz using five arrays, either fixed or mobile.

Only a single normal coaxial feeder cable is required for each array. No other power or data cables are necessary, as power and data supplies are multiplexed with the incoming RF signal in the single cable.

For further technical details of antenna arrays see ***Appendix B***.

2.6 Head Units (Figure 2.4)

Each head unit connects an antenna array to the DF6B, or if more than one array is in use to the ASU, via a coaxial feeder cable.

Datong offer a range of head units, each one typically covering a 5-1 frequency band.

The head unit behaves as an electronic goniometer. It combines the inputs from the four antennas with an internally-generated sense signal that is amplitude modulated in a way that depends on the direction of the incoming radio signal.

For further technical details of standard and special head units, see ***Appendix C***.

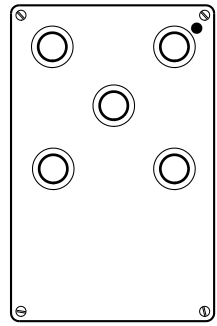


Figure 2.4 Standard Datong Head Unit

2.7 ASU (Antenna Selector Unit) - optional (Figure 2.5)

If more than one array is used, an ASU is required to interface the inputs from the arrays with the single input of the DF6B. The DF6B then commands the ASU to select the array required to suit the operating frequency as the tuning is adjusted.

The ASU can select from up to five arrays. Like the antenna arrays it does not need separate power or data cables, and is inserted at a suitable point in the coaxial RF feeder cable.

The LEDs next to the PORT (input) connectors show which array is currently in use; the LED next to the OUTPUT connector is provided for a future enhancement. Currently it flashes briefly when the ASU is switched, to show the presence of the input selection data signals.

For further technical details of the ASU, see ***Appendix D***.

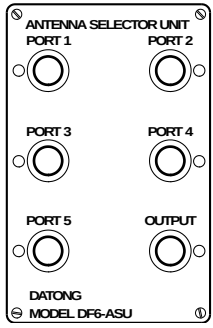


Figure 2.4 Antenna Selector Unit (ASU)

2.8 DFC2 Hand-held Controller - optional (Figure 2.5)

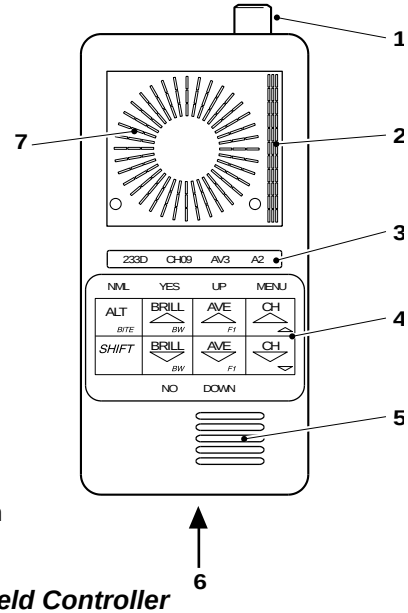
The hand-held controller provides remote control of the DF6B, with enhanced display and control functions. In use it is connected to the DFC2 serial connector on the front panel of the DF6B.

It is useful in mobile applications, providing a compact secondary display or acting as the sole control unit without requiring access to the DF6B.

The bearing display shows the direction of the incoming signal and indicates the signal quality, and signal strength indication is also provided.

The alphanumeric display shows the unit's main control settings, and is used in conjunction with the keypad to change operating parameters if required.

For installing and operating the DFC2, refer to ***Section 6 - Using the DFC2 Hand-held Controller***. For further technical details of the DFC2, see ***Appendix E***.



1 Volume control
2 Signal strength indicator
3 Alphanumeric display
4 Keypad
5 Speaker
6 Headphone connector, DF6B connector, and On/Off switch
7 Bearing display

Figure E.1 DFC2 Hand-Held Controller

3 Installation

3.1 Interconnections (Figure 3.1)

Figure 3.1 shows the components and interconnections for typical installations with multiple arrays, and a mobile installation using the HF-COMPACT array for wideband coverage. An ASU is required for multiple arrays.

CAUTION

The centre pins of the antenna connectors on the DF6B front panel carry a supply of 8V d.c. at up to 1A. Make sure that there is no short circuit between inner and outer conductors of any antenna, head unit or ASU feeder cable, and that any antenna to be connected to the system does not present a d.c. short to its signal cable. No Datong arrays present such a short. The 8V supply is short-circuit protected, but a prolonged short circuit could damage internal components of the DF6B through overheating.

Note:

If no ASU is to be used, (i.e. if only one array and head unit is to be connected to the VHF antenna connector), it will be necessary to enter the array type number before operating the system, as detailed in ***Section 5 – Operation From the Front Panel, 5.8.2 Entering the Array Type Number****.*

3.2 Selecting Signal Cables

The choice of signal cables depends on the length of cable needed and the upper operating frequency required. Small diameter coaxial cable such as UR-43 has a loss per 10m of about 1.5dB at 100MHz and 5dB at 1GHz. This order of loss is unlikely to be a problem in a mobile installation where the cables will be quite short, but can be significant in a fixed VHF or UHF installation.

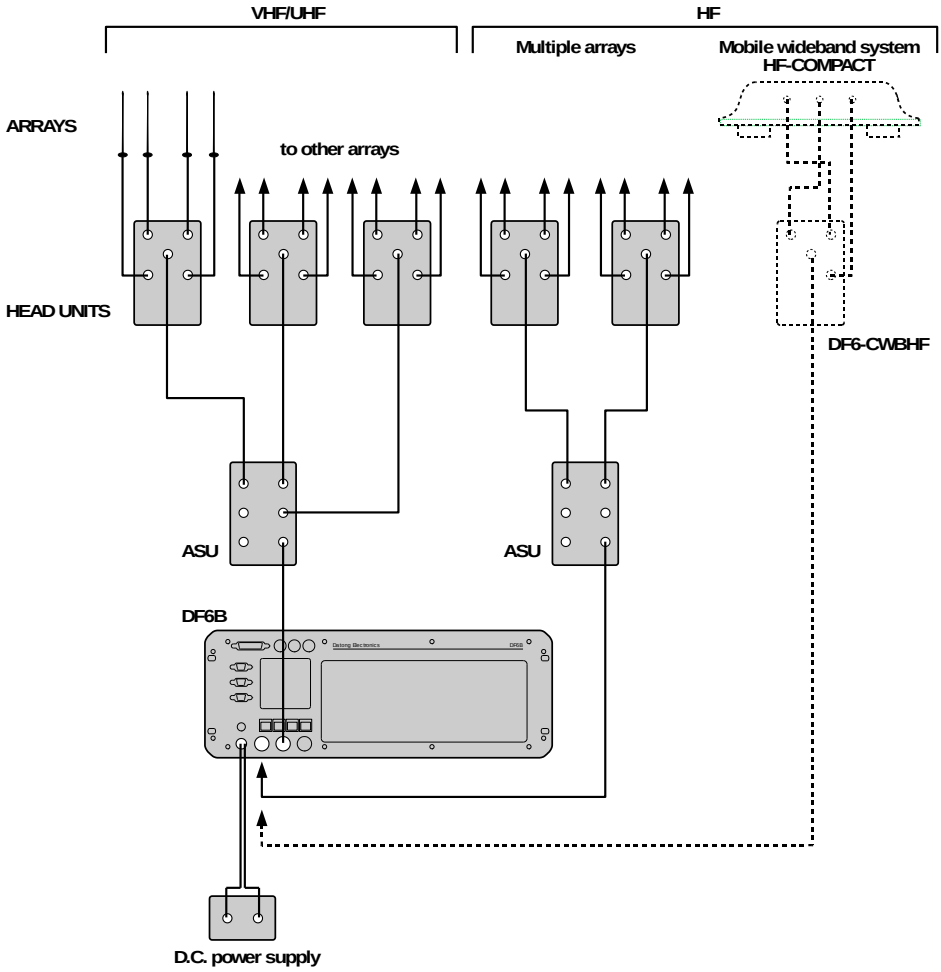


Figure 3.1 Typical Installations

Any loss in the cable will reduce the system sensitivity in the same proportion. A possible solution for long cable runs is to use large diameter low-loss cable and a masthead amplifier; (consult Datong for further details).

3.3 Mobile Antenna Systems

For details of types of antenna arrays and their application, see ***Appendix B***.

3.3.1 Whip Arrays

Whip antennas are fitted with magnetic bases for vehicle roof mounting.

Single Arrays (Figure 3.2)

Mount the antennas centrally on the vehicle roof at the corners of a square of side **a**, with a clear area around the antennas of at least side **b** to act as a ground plane.

The values of **a** and **b** depend on highest frequency (i.e. the shortest wavelength) covered by the array as follows:

$$\mathbf{a} = \frac{\lambda}{2\sqrt{2}} \qquad \text{and} \qquad \mathbf{b} > 1.5\,\mathbf{a}$$

- where λ is the wavelength at the highest frequency at which the array is to work.

For example, with a DF6-C125 array which is designed to work from 25 - 125MHz (i.e. down to 2.4m), **a** should be

$$\frac{2.4}{2\sqrt{2}} = 0.85\text{m} = 85\text{ cm}$$

and **b** should be > 1.3m

If it is not possible to mount the array with the 'North' antenna towards to front of the vehicle as shown, (for example if opposing sides of the square must be aligned with the sides of the vehicle), a correction for the alignment of the array can be made after installation as detailed in **Section 5 - Operation from the Front Panel, 5.8.3 Adding an Offset**.

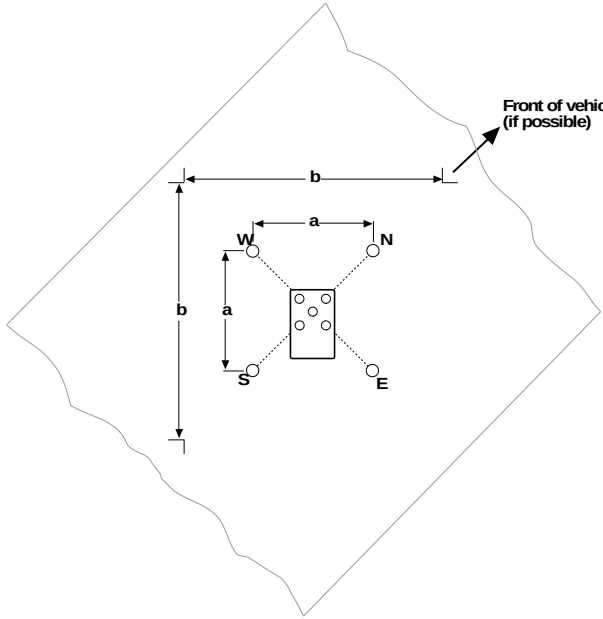


Figure 3.2 Single Mobile Array

Multiple Arrays (Figure 3.3)

For mounting three arrays on the vehicle roof, Datong recommend that they are mounted in concentric squares as shown, at 30° to each other. For two arrays, mount the arrays concentrically at 45° to each other. This arrangement will minimise the interaction between the arrays and minimise system degradation.

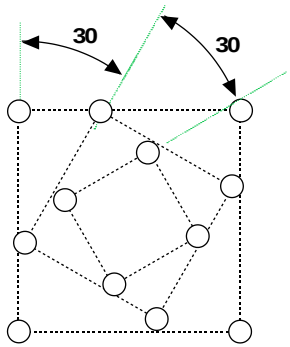


Figure 3.3 Multiple Mobile Arrays

3.3.2 HF Wideband Compact Array (Figure 3.4)

The array is used with the DF6-CWBHF head unit, and both units are fitted with mounting magnets.

1. Mount the array centrally on the vehicle roof with the connectors facing the rear of the vehicle.
2. Mount the head unit at a convenient point behind the array, and connect the two units with the three cables supplied.
3. Connect the head unit to the HF antenna connector on the DF6B.

   Make sure that the coaxial feeder is securely fastened as movement of the cable has been found to cause bearing instability.

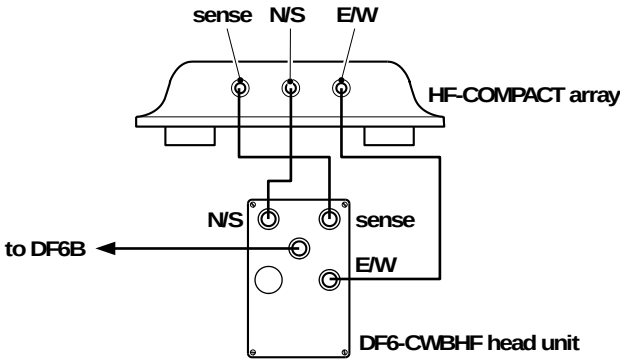


Figure 3.4 Wideband HF Array Connections

3.4 Fixed Arrays

For details of types of antenna arrays and their application, see ***Appendix B***.

Mounting details for the Datong range of dipole-based arrays are supplied with each array.

Mount each array as high as possible, and as far away as possible from other metallic objects.

3.5 Head Units

Mobile Systems

For larger arrays it is usually best to mount the head unit in the centre of the square of whip antennas, by means of the mounting magnets, as shown in Figure 3.2.

For smaller arrays, or where mounting the head unit in the centre of the vehicle roof is not possible, mount the head units as far away from the arrays as the length of the supplied cables will allow, ideally below the roof of the vehicle.

CAUTION

Datong do not recommend extending the supplied cables or replacing them with longer ones.

For a permanent installation, the head unit can be mounted beneath the vehicle roof and the cables taken through holes in the roof close to the bases of the antennas.

Connections (Figure 3.4)

The whip antennas in a mobile array are fitted with integral cables.

With each fixed dipole array four cables are supplied to connect the array to its head unit; all cables are the same length and any cable can be used to connect any antenna with its corresponding connector on the head unit.

Connect the 'North' antenna to the connector with the red dot (N). (For a mobile system the 'North' antenna is the one at or near the front of the vehicle). Connect the 'East', 'South' and 'West' antennas to connectors E, S and W accordingly.

In a mobile system, make sure that the cables lie flat on the vehicle roof so that they do not pick up stray signals. If necessary stick them down with conductive tape.

Repeat the connections for each additional array and head unit.

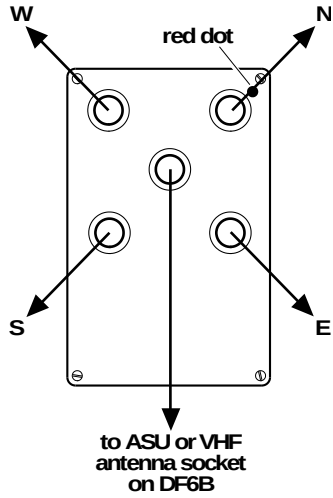


Figure 3.4 Head Unit Connections

3.6 Siting and Connecting an ASU (Figure 3.5)

Mount the ASU in any convenient location, probably near the DF6B in a mobile installation.

Ports 1-5 on the ASU correspond to Datong array and head unit types 1-5, as shown. Connect the head units to the ports.

CAUTION

It is important to connect each array to the correct port on the ASU. The ASU senses whether an array is connected to a port, but does not discriminate between types of array; if an array is connected it will be assumed that it is of the correct type.

Connect the OUTPUT port to the VHF antenna connector on the DF6B front panel using a suitable 50Ω signal cable. Make sure that the cable is securely fastened as movement of the cable has been found to cause bearing instability.

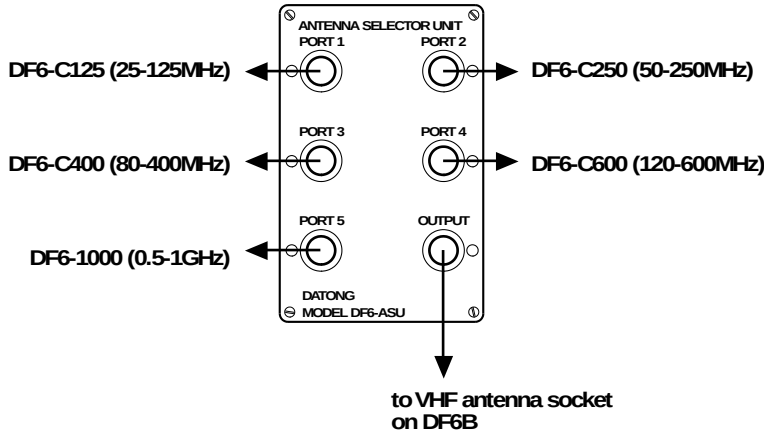


Figure 3.5 ASU Connections

3.7 Power Supply

The DF6B requires a d.c. supply of 13.8V ± 15% at up to approximately 4.5A. The system was designed for use with a 12V vehicle battery, but a regulated mains supply may be used.

Note:

An unregulated supply may also be used, for example from a portable generator or unregulated mains unit. If this is done Datong recommend that a 12V vehicle battery is incorporated to provide smoothing. The battery will absorb surges in the supply voltage and provide a back-up supply in the event of power failure.

Connect the supply to the 12V D.C. (IN) connector on the DF6B front panel using the 1m lead supplied.

3.8 Hand-held Controller DFC2 - optional

If a DFC2 hand-held controller is to be used, it is recommended that the system is first set up using the front panel controls as detailed in ***Section 4 - Setting Up and Basic Procedures***. The DFC2 can then be installed and operated as detailed in ***Section 5 -Using the DFC2 Hand-held Controller***.

4 Setting Up and Basic Procedures

Refer to the ICOM manual for operating the receiver.

4.1 Switching On

Switch on the system using the ON/OFF switch on the ICOM R8500 receiver. After a delay of about six seconds the system will be ready for operation.

Note:

*During the delay the processor performs 'ASU polling' (see **Section 5 - Operation from the Front Panel, 5.1 Switching On and Off**), and internal calibration checks.*

4.2 Voltage Check

After switching on, it is recommended that voltmeter is used to check the input voltage on load. There should be less than 0.5V drop along the d.c.input cable supplied. Components of the system can draw the following currents:

DF6B	: up to 2.5A
DFC2 hand-held controller	: 1A
Each head unit	: 80mA
ASU	: 20mA

This can make a total of up to 4A for a full DF6B system. A 12V vehicle battery in a low state of charge can have an output voltage of less than 11.7V on a 4A load.

4.3 Setting Up

Carry out the following procedures as necessary, referring to ***Section 5 - Operation from the Front Panel*** - ***5.8 Setup Mode Adjustments*** as indicated:

Condition	*Procedure*
System with single antenna array - (no ASU fitted)	***5.8.2 - Entering the Array Type***
'North' antenna of array or arrays not aligned with north (fixed installation), or not aligned with front of vehicle (mobile installation)	***5.8.3 - Adding an Offset***
After system repair, or RAM backup battery failure	***5.8.4 - Phase Trim Adjustment***

4.4 Locking Out Setup Mode

When the system has been set up, Datong recommend that Setup mode is locked out to prevent the settings from accidental alteration.

Setup mode can be locked out by means of the keys on the front panel, or by internal switches. If access is locked out by means of the internal switches, it can only be regained by removing the cover from the DF6B.

4.4.1 Locking Out by Front Panel Keys

This procedure toggles the system between ‘locked out' and ‘unlocked’ - repeat the procedure to restore access.

1. Switch the system off.
2. Press and hold down the AV1 and AV2 keys.
3. While holding down the keys, switch the system on, continuing to hold down the keys.
4. After about two seconds, release the keys.

Note:

If a DFC2 hand-held controller is in use, this procedure has no effect on the controls of the DFC2.

4.4.2 Locking Out by Internal Switches (Figure 4.1)

1. Switch the system off.
2. Remove the securing screws from the top cover of the DF6B, take off the cover, and identify switch bank S6.
3. Set switch 3 to ON to lock out Setup mode.

   Note:

   *If a DFC2 hand-held controller is in use, setting switch 5 to ON locks out the SHIFT and Alternative keypad functions, (see **Section 6 - Using the DFC2 Hand-held Controller**).*

   CAUTION

   Take care not to disturb the settings of the other switches. The functions of these are detailed in *Appendix A*.
4. Refit the cover and secure it with the screws.

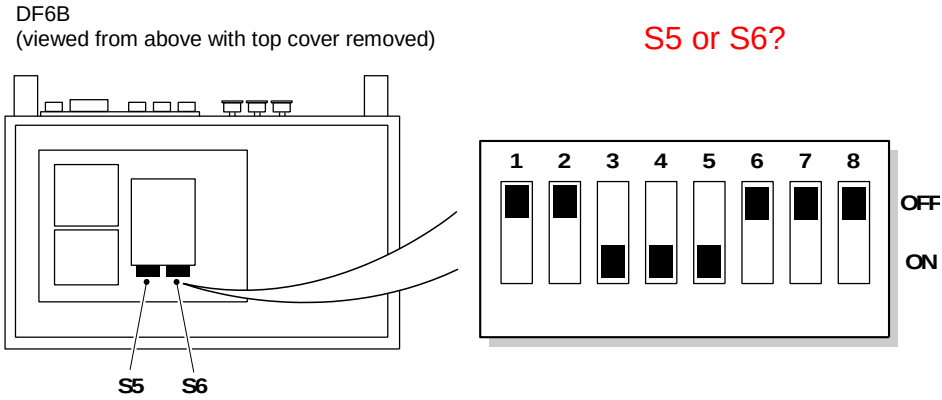


Figure 4.1 Internal Switches

4.5 Operation (Figure 4.2)

When the system is tuned to a useable signal, the display shows the bearing and the station can be heard on the internal speaker.

Tuning Refer to the ICOM manual, and tune the system to the required frequency.

Display The display will show the bearing in digital form, and the LEDs on the display will show the bearing in polar form to the nearest 10°. If the display blanks, the signal is too poor to give a useful reading.

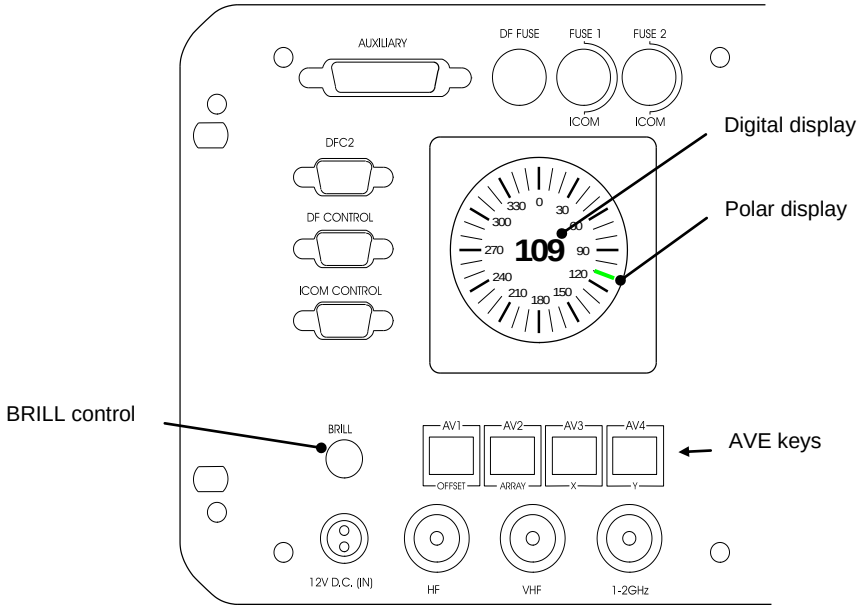


Figure 4.2 DF6B Front Panel

BRILL control Use this control to set the brilliance of the display.

AV keys These control the averaging time applied to the bearing reading, and affect the 'liveliness' of the display. AV1 gives the shortest time (the liveliest display), and AV4 the longest time. As a general guide, Datong recommend AV2 or AV3 for fixed installations and AV3 or AV4 for mobile systems.

With AM, CW and FM signals, useful bearings can be expected even when the signal is barely audible. For an SSB signal with a steady carrier, the display will normally blank out momentarily before the BFO note becomes inaudible.

For details of more advanced operating procedures, see ***Section 5 - Operation from the Front Panel***.

5 Operation from the Front Panel

Refer to the ICOM manual for operating the receiver.

Figure 5.1 shows the DF6B front panel.

5.1 Switching On and Off

When the ON/OFF switch on the ICOM receiver is set to ON, the system performs ASU polling and internal calibration checks.

ASU Polling The processor checks whether an ASU is connected. If an ASU is connected the processor then checks which input ports are occupied. The processor then stores this information to enable it to select the most appropriate array for the frequency in use.

During polling, the LEDs near the input ports on the ASU light up in turn as each port is checked. The LED near the OUTPUT connector is fitted for future enhancement. On existing systems it flashes briefly to indicate that input port selection signals are present.

CAUTION

If the occupied input ports on the ASU are changed while the system is switched on, the stored data will be incorrect. Switch the system on and off again to repeat the polling procedure.

5.2 Tuning

The receiver can be tuned through its full range, however the system will only operate efficiently at frequencies within the ranges of the antennas installed.

5.3 Audio Signal Monitoring

In some conditions the DF processor will add faintly audible low frequency tones to the audio output, most markedly with AM signals, and may also add a slight

'burbly' sound to SSB and CW signals at HF. This effect will not normally spoil the intelligibility of a signal unduly, and will not degrade DF performance.

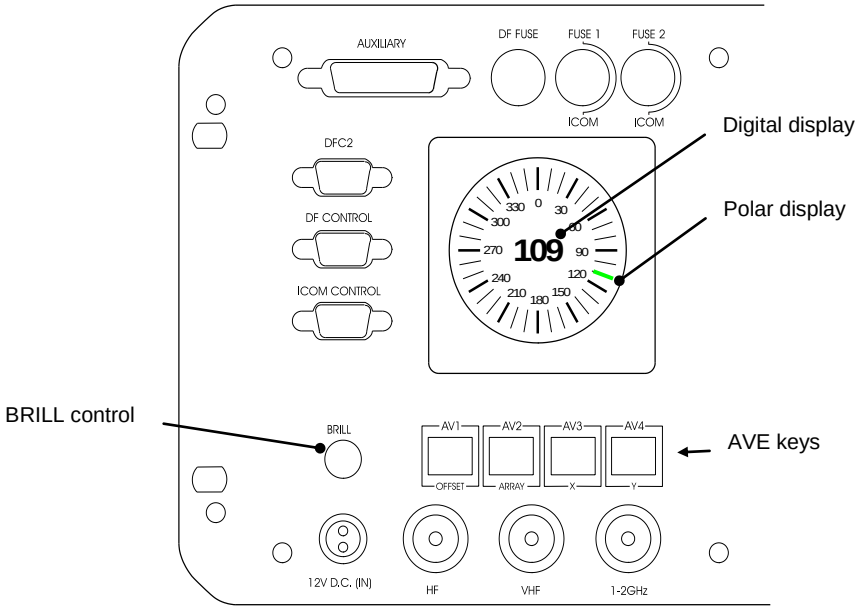


Figure 5.1 DF6B Front Panel

5.4 Display and Controls

The display is activated as soon as a useable signal is tuned, and shows the bearing of the signal relative to the heading of the antenna in use.

Digital display The digital display shows bearings, and other data as detailed in this section. When showing a bearing the display has a resolution of 1°, providing accuracy for logging a signal with a steady bearing.

Polar display The polar display consists of 36 LEDs, giving a resolution of 10°, and is useful for tracking changes in the bearing of a signal.

When a transmission stops, or the signal strength falls below a useable level, the display hold the last valid reading for a period equal to the averaging time and then blanks. The averaging time is selected by means of the AV keys as detailed below.

Note:

If a DFC2 hand-held controller is in use, the persistence of the bearing display can be increased beyond the averaging time by setting the Hang time as detailed in ***Section 6 – Using the DFC2 Hand-held Controller****,* ***6.9.2 Additional Functions, SET HANG TIME****.*

BRILL control Use this control to adjust the brightness of the bearing display. This control is also used in conjunction with the AV keys to adjust operating settings as detailed later in this section.

AV keys These keys are used to change the averaging time, and in addition have other functions as detailed at the appropriate points elsewhere in this Guide.

5.5 Checking the Display LEDs

To check the LEDs in the polar display, press and hold down the AV3 and AV4 keys. The LEDS will flash so that faulty LEDs can be identified.

5.6 Checking Which Array is in Use

Press and hold down the AV1 and AV2 keys. The digital display will show the array number, for example Ar2.

If an ASU is connected, this indicates which port is active (port 2 in the example).

This function is useful if multiple arrays are connected and are being selected by the ASU.

Note:

The selected array is also indicated by the LEDs on the ASU.

If no ASU is connected, (i.e. if only one array is connected), the display indicates which array type has been manually entered.

5.7 Changing the Averaging Time

The AV1, AV2, AV3 and AV4 keys select the period of time over which the incoming data is averaged before being displayed, as follows:

Key	***Averaging time (sec)***
AV1	0.62
AV2	1.25
AV3	2.5
AV4	5

The higher the key number, the longer the averaging time. Note that the averaging time doubles at each increment.

To change the averaging time, press the appropriate key.

The following is a guide to selecting a suitable averaging time:

Short Averaging Times – AV1 and AV2

Use short averaging times:

- To respond to fast ‘push to talk’ signals, where several stations are sharing a common frequency.
- To respond to rapid bearing changes in mobile ‘hunting DF’ operations.

Long Averaging Times - AV3 and AV4

Use long averaging times:

- To smooth out the effects of multipath fluctuations in mobile operations.
- If heavy signal modulation causes excessive fluctuation in the bearing display.
- To hold short signals on the display. The display holds signals for the full averaging time (5 seconds for AV4).
- If the transmitter is pulsed. The display will be a true average of the signals falling within the averaging time and will remain steady between pulses. Do not be tempted to use a short averaging time because the transmitter is pulsed, otherwise you will lose the benefit of signal averaging. The software will include only true signal pulses into the averaging and discard the noise between pulses. The display will be steadier and more indicative of the true bearing if the averaging time is long enough to allow several pulses to be averaged into the display rather than having the display respond separately to each pulse.

5.8 Setup Mode Adjustments

CAUTION

These adjustments can affect bearing accuracy and should only be performed by technically competent people.

5.8.1 Using Setup Mode (Figure 5.2)

Setup mode adjustments are made by using the setup functions of the four AV keys (OFFSET, ARRAY, X and Y), the BRILL control, and the digital display.

Entering Setup Mode

Press and hold down all four AV keys together until the LEDs in the keys light up to show that the unit is in setup mode, then release the keys.

Note:

If the LEDs do not light up, Setup mode has probably been locked out. Refer to ***Section 4 - Setting Up and Basic Procedures****,* ***4.4 Locking Out Setup Mode*** *to unlock access.*

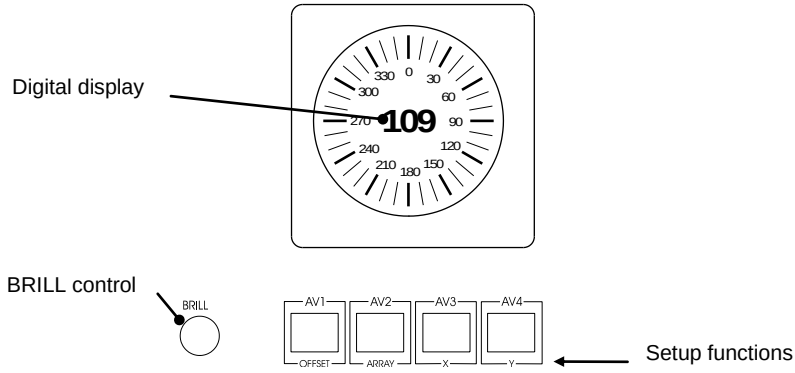


Figure 5.2 Setup Mode Controls

Selecting and Viewing Parameters

Press and hold down an AV key to select the required parameter. The LED in the key will go out to show that the parameter has been selected and the digital display will show the current setting of the selected parameter.

Adjusting Parameters

Use the BRILL control to adjust the selected parameter: turn it clockwise to increase and anticlockwise to decrease the value.

After setting a parameter, release the AV key; the LED will light up again.

If the BRILL control reaches the end of its travel before the required value is displayed:

1. Release the AV key.

2. Turn the BRILL control to the opposite end of its travel.
3. Press the AV key again and continue turning the BRILL control. Repeat this procedure as necessary until the require value has been set.

Leaving Setup Mode

Press and hold down all four AV keys until the LEDs in the keys go out.

5.8.2 Entering the Array Type

If no ASU is installed, the array type must be entered manually so that the processor can:

- Apply the appropriate correction tables for array spacing errors, and
- Select the correct bearing offset value, (see ***5.8.3*** below).

This data must be entered when the array and head unit are first installed, and if they are changed after initial installation.

Note:

If an ASU is installed, array selection is automatic and the processor will not use the array type entered. If required, the array type can be entered for future use without an ASU installed.

To enter the array type:

Press the ARRAY key and turn the BRILL control to select the required type (types 1 - 5, or type 0).

Details of arrays types 1 - 5 are given in ***Appendix C – B.6 – Head Units and Antenna Arrays***.

Array type 0 is included for applications with non-standard head units and where no ASU is installed. With this setting no corrections for spacing errors are applied, and a bearing offset of zero is used.

5.8.3 Adding an Offset (Figure 5.3)

A bearing of 0° (360°) should indicate a signal coming from true north in a fixed installation, and from 'dead ahead' in a mobile installation. If it is not possible to align an array with true north, an offset can be applied to allow for the misalignment, for example Figure 5.3 shows an offset of 45°. A typical example would be where the ‘square’ of the antenna array on a vehicle is mounted so that opposite sides of the square are parallel to the side of the vehicle roof, with the ‘marked’ antenna (connected to the connector on the head unit with the red dot) at the front right hand corner. The array is therefore rotated clockwise by 45°, and a signal from straight ahead will show a bearing of 360° - 45°, i.e. 315°. An offset of +45° must then be added to give the correct bearing of 0° (360°).

If the array is rotated ***clockwise***, a ***positive*** offset is required.

If it is rotated ***anticlockwise***, a ***negative*** offset is required.

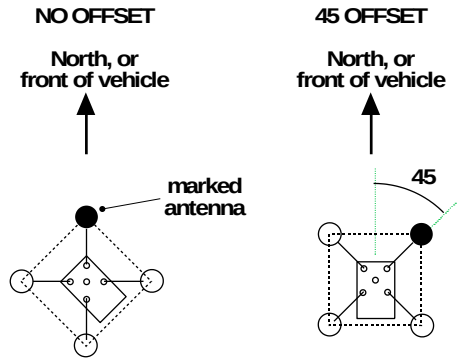


Figure 5.3 Bearing Offset

The system can store six offset values: one for each antenna connected to ports 1-5 on the ASU, and one for an array type 0 (see ***5.8.2*** above). When the system is delivered, all the offsets are set to zero.

An offset must be entered for each array connected to the ASU. To enter an offset for an array, that array must be the current array so the receiver must be tuned to an appropriate frequency for entering each offset, as detailed in the procedure below.

Notes:

1. *For the most accurate results, use transmissions with known bearings.*
2. *Offsets can also be entered using the hand-held controller, (see **Section 6 - Using the DFC2 Hand-held Controller**, **6.9.3 – 'Front Panel' Settings**).*

To enter an offset:

1. Tune the receiver to an appropriate frequency so that the required array is selected.

   Note:

   To check which array is selected, press and hold down the AV1 and AV2 keys.

2. Select Setup mode by pressing and holding down all four AV keys.
3. Press and hold down the AV1 (OFFSET) key.

   The digital display will show an angle of between -190º and +190º, which is the bearing offset associated with the currently selected array.

4. Adjust the offset by means of the BRILL control, to set the bearing on the polar display to 0° (360º).

   Notes:

1. *The bearing shown on the polar display always includes the bearing offset, and in setup mode the digital display*

will show the value of a parameter when an AV key is pressed. Therefore if the system is tuned to a signal with a known bearing, the value of the offset can be adjusted while observing the polar display.

2. *To obtain an accuracy of 1º when using a known transmission, periodically release the AV1 key to show the bearing of the signal on the digital display.*

5. Repeat the procedure for the remaining arrays.

5.8.4 Phase Trim (X and Y) Adjustment

Two modulation frequencies (X and Y frequencies) are added to the incoming signals in the antenna head unit to carry the signals from the four antennas in the array. The DF5 signal processor uses two trim values to correct for the phase delay (in degrees) experienced by these two frequencies as they pass through the circuitry of the receiver. The delay is caused mainly by the main IF filter in the receiver, and the system stores and uses a separate pair of X and Y values for each of the receiver modes.

The X and Y trim values are entered during manufacture when the processor is first matched to the receiver. They will normally only require adjustment if repairs have been carried out on the DF6B or if the RAM backup battery has failed.

If is it necessary to adjust the values, the procedure given below must be repeated for each of the receiver modes.

A strong steady signal in each mode is required for the adjustment.

To adjust the trim:

1. Enter setup mode by pressing and holding down all four AV keys.

2. Tune to a strong steady transmission and select the required receiver mode, for example FM.

3. Press and hold down the AV3 (X) key.

   The digital display will show the value of the X trim, and the polar display will show the error value.

4. Adjust the X trim using the BRILL control until the polar display reads either 0º or 180º.

   The choice of 0º or 180º depends on the bearing of the test signal. The trim value should not exceed approximately 50º, so select whichever gives a trim value less than this.

   Note:

   If the display is unsteady while you are making the adjustment, repeat the adjustment using a signal with a different bearing, preferably one which is an odd multiple of 45º. If possible, avoid signals from the cardinal directions (N, E, S, and W).

5. Press and hold down the A4 (Y) key, and repeat the adjustment for the Y trim.

6. Repeat the X and Y adjustments for the remaining receiver modes.

5.9 Self-Test Routine (BITE)

To activate the BITE routine, press the AV2 and AV3 keys together.

The routine will run for about 10 seconds and if no faults are detected normal operation will resume.

If the system fails a test, the digital display will show an error code and the routine will pause at that test.

To move to the next test, press AV2 and AV3 together.

To abort the test routine at any time, press AV1 or AV4.

Note:

If the system fails a test, it may still be useable.

For further use of the test routine in identifying faults, see ***Section 7 – Troubleshooting***.

5.10 Changing ASU Connections

If you change the antenna connections to the ASU while the system is switched on, no antenna polling will be performed and the system will not select the appropriate arrays.

After changing the connections, switch the system off and then on again so that the system carries out the antenna polling process.

6 Using the DFC2 Hand-held Controller

6.1 Function (Figure 6.1)

The hand-held controller enables the DF6B to be remotely controlled, for example when a second control point is required or the DF6B is installed away from the operating position in a mobile installation.

The controller gives access to all the functions available from the front panel, in addition to other functions detailed in this section.

The system can be controlled from either the DFC2 or from the front panel; control selections made at one point are reflected at the other.

6.2 Installation and Disconnection (Figure 6.1)

Connecting

1. Make sure that the DFC2 is switched off.
2. Connect the DFC2 to the DFC2 connector on the front panel with the lead supplied.

Switching On and Off

The On/Off switch on the DFC2 works in parallel with the On/Off switch on the receiver. If both switches are off, the system can be switched on from either point.

To switch the system off, both switches must be set to ‘Off’

Disconnecting

Switch off the DFC2 before disconnecting it from the DF6B.

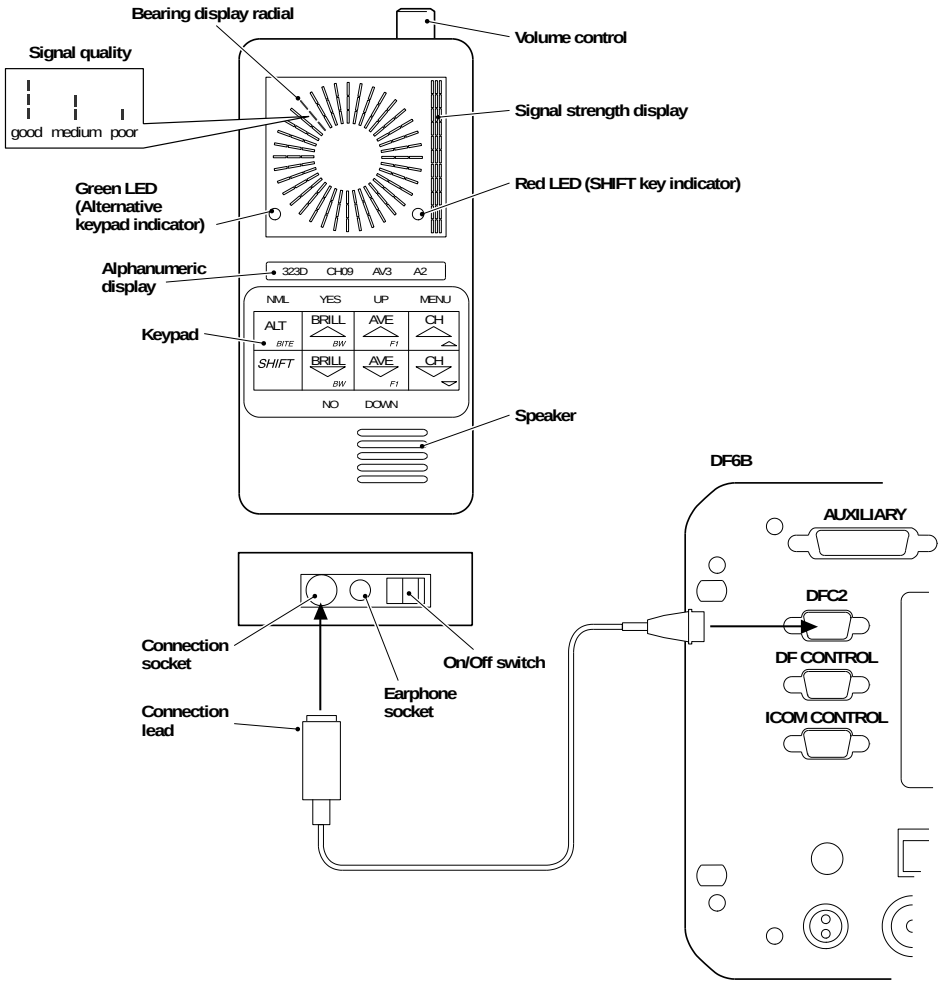


Figure 6.1 The DFC2 Hand-held Controller

CAUTION

The bandwidth cannot be adjusted from the front panel of the DF6B. Before disconnecting the DFC2, check that the bandwidth is set to maximum.

6.3 Locking Out the Alternative Keypad

The Alternative keypad gives access to the menu functions of the DFC2 as detailed in ***6.7 – Keypad***. When the system has been set up, Datong recommend that the Alternative keypad is locked out to prevent the settings from accidental alteration.

The Alternative keypad can be locked out by means of the controls on the DFC2, or by internal switches in the DF6B. If access is locked out by means of the internal switches, it can only be regained by removing the cover from the DF6B.

6.3.1 Locking Out by DFC2 Controls

This procedure toggles the system between 'locked out' and 'unlocked' - repeat the procedure to restore access.

1. Switch the system off.
2. Press and hold down the SHIFT key on the DFC2.
3. While holding down the SHIFT key, switch the system on, continuing to hold down the key.
4. After about two seconds, release the key.

Note:

This procedure has no effect on the controls of the DF6B.

6.3.2 Locking Out by Internal Switches

Refer to ***Section 4 – Setting Up and Basic Procedures, 4.4.2 – Locking Out by Internal Switches***.

Note:

Setting switch 5 to ON also locks out the SHIFT keypad functions.

6.4 Displays

Bearing

The bearing is shown as a radial whose length gives a guide to the quality and reliability of the signal. For example if the bearing signal fluctuates owing to multipath reception or reflections, the radial shortens to indicate that the bearing is less reliable.

When a transmission stops, the display holds the last valid bearing for a period equal to the averaging time. The radial then shortens to minimum length and moves randomly around the display in response to the received background noise.

Signal Strength

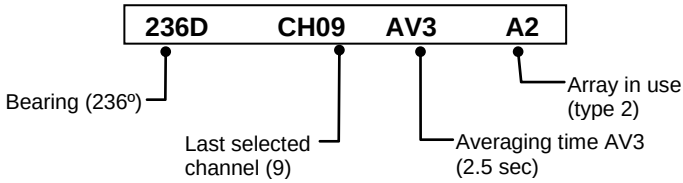
The signal strength display consists of three columns of LEDs. The left-hand column (green LEDs) indicates the weakest signals, the centre column (yellow LEDs) signals of medium strength, and the right-hand column (red LEDs) the strongest signals. The dynamic range of the display is approximately 100dB.

For pulsed transmissions, the display holds the signal strength reading at the 'pulse on' level during 'pulse off'.

When a transmission stops, the display holds the last valid indication for a period equal to the averaging time.

Alphanumeric

During normal operation, the alphanumeric display shows bearing and status information; a typical display might be:



It is also used with the keypad for displaying and changing system settings.

6.5 Audio Signal Monitoring

The DFC2 is equipped with an internal speaker and a 3.5mm headphone jack; connecting a headphone disconnects the speaker. The volume control acts on the speaker or the headphone and is independent of the volume control on the DF6B.

6.6 Basic Procedures

Setting Up

Connect the DFC2 to the DF6B and switch the system on.

Setting Display Brightness

Press to increase brightness

Press to decrease brightness

There are seven brightness levels. Briefly pressing a BRILL key changes the level by one; holding down a key causes the change to auto-repeat. If you try to increase

the brightness above its upper limit the speaker will bleep. Changing the brightness of the DFC2 display has no effect on the DF6B display.

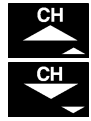
Selecting the Averaging Time

Use the AV keys to select one of the AV1, AV2, AV3 and AV4 options that are available from the DF6B front panel keys. When you select an averaging time it will be shown on the alphanumeric display, for example: AV2

When you change the averaging time, the LED in the corresponding AV key on the DF6B front panel will light up. Similarly, the DFC2 display will reflect changes made using the AV keys on the DF6B front panel.

Selecting the Receiver Channel

When channels have been programmed into the ICOM receiver, they can be selected by means of the CH keys.



Press once to increase channel number by one

Press once to decrease channel number by one

Hold down SHIFT and press CH key once to change channel number by 10.

Hold down SHIFT and CH key to auto-repeat channel number change in steps of 10.

The alphanumeric display will show the selected channel (for example CH12), and the receiver's display will also show the selected channel.

Notes:

1. *It is possible to select the number for a channel which has not been programmed into the receiver. The receiver will only change to channels for which the frequency and mode have been programmed.*

2. *The channel number shown on the DFC2 alphanumeric display will only remain valid provided that no changes have been made to the channel details programmed into the receiver. The display will not reflect changes made at the receiver. (This is a limitation of the software in the receiver).*

3. *It is not possible to select channel 0 on the receiver from the DFC2.*

6.7 Keypad (Figure 6.2)

The keypad consists of eight keys which are colour-coded for ease of access to the following functions:

Normal Keypad – white and gold keys:

The white keys provide routine functions as detailed in ***6.6 Basic Procedures***. Press the 'up arrow' key to increase and the 'down arrow' key to decrease the associated setting. Hold down the key to auto-repeat, i.e. to change the setting rapidly.

SHIFT

For the gold key functions, hold down SHIFT while pressing the required key. For example SHIFT + CH key changes the channel number in steps of 10. When the SHIFT key is pressed, the red LED beneath the bearing display lights up. For further details see ***6.8 SHIFT Keypad Functions***.

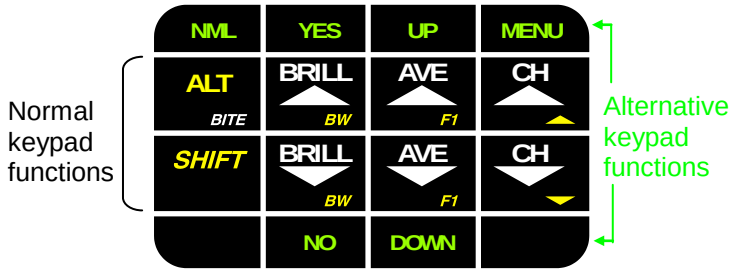


Figure 6.2 The DFC2 Keypad

Alternative Keypad – 'green keys'

The alternative keypad gives access to a menu system for making and changing system settings as detailed in ***6.9 Alternative Keypad Functions***.

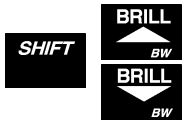
6.8 SHIFT Keypad Functions

Notes:

1. *If the SHIFT functions cannot be accessed, they may have been locked out.* ***Refer to Section 4 - Setting Up and Basic Procedures****,* ***4.4.2 - Locking Out by Internal Switches****.*
2. *The F1 and F2 functions on the AVE keys are not implemented.*

BW (Audio Bandwidth)

The audio monitor signal which is fed to the loudspeaker in the receiver and the loudspeaker in the DFC2 passes through a bandpass filter in the DF processor, centred on a frequency of 800Hz. The filter has four pre-set bandwidths, and the required bandwidth can be selected by means of the BW keys.



Increase bandwidth

Decrease bandwidth

The selected bandwidth is displayed for a few seconds in place of the digital bearing, (for example 236D might change to BW0).

The bandwidths which correspond to the numbers on the display are as follows:

Number	***Bandwidth (Hz)***
BW0	400
BW1	560
BW2	1200
BW3	2500

The widest setting (BW3) is the default setting and is suitable for most applications. Narrower bandwidths may give clearer reception of SSB or weak CW signals, or may help to reduce the DF modulation tones on AM signals.

CAUTION

The bandwidth cannot be adjusted from the front panel of the DF6B. Before disconnecting the DFC2, check that the bandwidth is set to maximum.

6.9 Alternative Keypad Functions

CAUTION

These functions must only be used by technically competent persons as their use may affect bearing accuracy.

Note:

If the alternative keypad functions cannot be accessed they may have been locked out by the internal switches in the DF6B or by means of the controls on the DFC2. ***Refer to Section 4 - Setting Up and Basic Procedures****,* ***4.4.1 - Locking Out by Internal Switches****, and* ***6.3.1 - Locking Out by DFC2 Controls****.*

The alternative keypad provides the same facilities as Setup mode on the DF6B (using the front panel controls), and some additional functions.

Accessing the Alternative Keypad Menu

ALT BITE

1. Press the ALT key; the green LED beneath the bearing display will light up and the keys will perform the functions indicated by the adjacent green key labels. To restore the normal keypad functions, press the ALT key again.

MENU

2. Press MENU. The alphanumeric display will show a menu option, for example:

BEARING TRIM <Y?>

(This means: Do you want to adjust the bearing trim?)

Selecting and Changing Settings

Use the green keys to select and change settings, and to navigate through the menu system, as follows:

UP DOWN To scroll through the other menu options.

YES To select the displayed option (i.e. to reply 'yes' in response to the **<Y?>** prompt).

When you select an option the display will show the selected parameter and its current setting. The display will also show the keys that may be used to respond to the display, for example:

<UDYN> = UP DOWN YES NO

Use the UP and DOWN keys to change the setting, or to increase or decrease the value of the parameter as follows:

UP DOWN Increase/decrease by one

SHIFT UP DOWN Increase/decrease by 10

For larger changes, use the CH keys as follows:

CH CH Increase/decrease by 100

SHIFT CH CH Increase/decrease by 1000

When the setting is correct:

YES Confirm the setting

NO Return to the menu (unless the display indicates otherwise)

ALT BITE To deactivate the alternative keypad and return to normal operation.

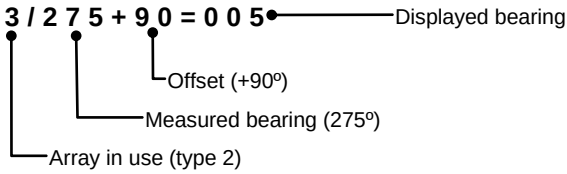
6.9.1 'Front Panel' Functions

These provide the same functions as those performed with the front panel controls of the DF6B. For full details of the functions, refer to the equivalent settings in ***Section 5 – Operation From the Front Panel*** as indicated:

BEARING TRIM <Y?>

(***5.8.3 - Adding an Offset***)

Pressing YES will display a message in the format shown in this example:



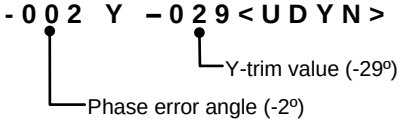
Change the value of the offset so that the displayed bearing is correct and the offset lies between –190º and +190º.

ADJ MOD PHASE <Y?>

(***5.8.4 – Phase Trim (X and Y) Adjustment***)

This adjustment must be repeated for each of the receiver modes (AM normal and narrow bandwidth, USB and LSB, CW, FM normal and narrow bandwidth, and WFM). Access to the receiver will therefore be required as the mode cannot be selected from the DFC2.

Pressing YES will display a message in the format shown in this example:



Adjust the Y-trim value to set the phase error angle to zero or 180º. The Y-trim value must not exceed 50º; if you cannot obtain an error angle of zero or 180º with a value less than 50º, trim the Y-value in the opposite direction.

When the Y-trim value is correct, press YES; the display will show the X-value. Set the X-trim value in the same way as for the Y-trim

SELECT ARRAY <Y?>

(***5.8.2 – Entering the Array Type***)

Note:

This setting is only required if no ASU is connected. If you enter a setting with an ASU connected it will be ignored until the ASU is disconnected.

The display will show which type of array is currently selected, for example:

A R R A Y 4 < U D N >

Change the number of the array type as required.

6.9.1 'Front Panel' Functions

CAUTION

Some of these functions affect the front panel display of the DF6B. They will remain in force if the DFC2 is disconnected from the system and cannot be restored until the DFC2 is reconnected.

A N T I N V / N M L < Y ? >

This function enables the east-west sense of the bearing display to be reversed to allow for an antenna array to be installed upside down (for example underneath an aircraft). When the sense has been reversed, all displayed bearings are affected irrespective of which array is in use.

Note:

The same effect can be achieved by reversing the connections of the east and west antennas at the head unit, unless a packaged unit such as the HF-COMPACT wideband array is in use.

Pressing YES will produce either of these displays, depending on the current setting:

N O R M A L O K ? < Y / N >

or

I N V E R T O K ? < Y / N >

To change the setting press NO; (repeatedly pressing NO will toggle between the settings), then YES to accept the setting and return to the menu.

RESTORE DFLT <Y?>

This function cancels any changes made to the system settings since its delivery from the factory, and restores the factory default settings.

To prevent accidental selection, two key presses are required to activate the option. Pressing YES displays the message:

R E S E T ? < Y / N >

To abort the function and return to the menu, press NO.

To continue, press YES. The display will show:

S U R E ? < Y / N >

The function can still be aborted by pressing NO.

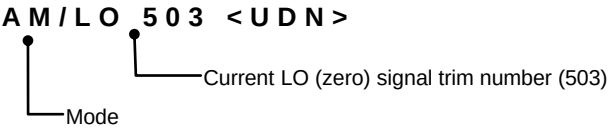
To reset the defaults, press YES.

SET ZERO SIG <Y?>

This function enables the zero-signal indication of the signal strength indicator to be set.

The adjustment must be repeated for each of the receiver modes (AM normal and narrow bandwidth, USB and LSB, CW, FM normal and narrow bandwidth, and WFM). Access to the receiver will therefore be required as the mode cannot be selected from the DFC2.

1. Select a mode on the receiver (for example AM), and press YES on the DFC2. The display will show:



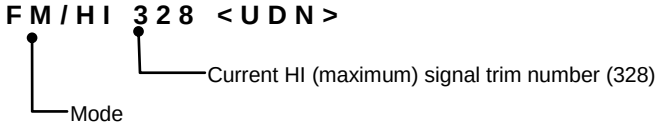
2. Disconnect the antenna or ASU from the DF6B to produce zero-signal conditions.
3. On the DFC2, adjust the signal trim number so that the signal strength indicator shows zero signal strength, (i.e. so that none of the green LEDs are lit except for the lowest one which flickers on and off.
4. Repeat the setting for the remaining receiver modes.
5. Reconnect the antenna or ASU.

SET MAX SIG <Y?>

This function enables the maximum-signal indication of the signal strength indicator to be set.

The adjustment must be repeated for each of the receiver modes (AM normal and narrow bandwidth, USB and LSB, CW, FM normal and narrow bandwidth, and WFM). Access to the receiver will therefore be required as the mode cannot be selected from the DFC2.

1. Select a mode on the receiver (for example FM), and press YES on the DFC2. The display will show:



2. Using either an RF generator connected to the antenna connector on the DF6B, or a powerful transmission, apply a signal of any frequency within the DF6B's range to the receiver so that the receiver's S-meter shows its maximum reading.
3. On the DFC2 adjust the signal trim number so that the signal strength indicator shows maximum signal strength (i.e. all the red LEDs are lit, with the top LED occasionally flicking off).
4. Repeat the setting for the remaining receiver modes.

   Note:

   *The trim number for **maximum** signal strength is **smaller** than the number for **minimum** signal strength.*

SET ANT RANGE <Y?>

CAUTION

Use this function only if Datong have issued you with specific instructions to do so. Incorrect settings may cause the system to select the wrong antenna if an ASU is connected, or to apply the wrong corrections for antenna spacing error.

The function enables the following three parameters associated with each of the five types of antenna array to be adjusted:

- Upper frequency limit (MHz)
- Lower frequency limit (MHz)
- Effective diagonal distance between array elements (cm)

1. Press YES. The display will show a message indicating which array type is currently selected for changing parameters, for example:

   A N T E N N A 5 < U D Y >

   If required, use the UP and DOWN keys to change to a different array type.

2. When the required array type is displayed, press YES. The display will show the current upper frequency limit for the selected array, for example:

   3 / M X = 1 0 5 0 < U D N >

   Current upper (Max) frequency limit (1050MHz)

   Array type

3. Change the limit as required and press YES. The display will show the current lower frequency limit for the selected array, for example:

   3 / M N = 5 5 0 < U D N >

   Current lower (Min) frequency limit (550MHz)

   Array type

4. Change the limit as required and press YES. The display will show the diagonal distance for the square of four antennas in the array, for example:

   3 / D = 1 6 < U D N >

   Diagonal distance (16cm)

   Array type

5. Change the distance as required and press YES. The display will show:

   G O A H E A D ? < Y N >

6. To save the new values and return to the menu press YES.

   (To abort the procedure leaving the values unchanged and return to the menu, press NO).

7. Repeat the procedure as required for the remaining types of array.

SET HANG TIME <Y?>

This function enables the DF6B and DFC2 displays to hold their reading for a time additional to the averaging time (the Hang Time).

The function is useful for bridging breaks in a signal. If a signal stops, the displays will freeze for a time equal to the averaging time plus the hang time. If the signal resumes before these times elapse, the displays return to their normal active state. If the times elapse before the signal resumes, the displays blank out and then show random indications due to noise.

During the hang time, three decimal points are included in the digital bearing displays of the DF6B and the DFC2, for example:

a bearing display of **039**

will show **.0.3.9**

Pressing YES will show a message indicating the current setting of the hang time, for example:

H A N G 0 1 0 S < U D N >

Current Hang Time (10 seconds)

The time can be set in the range 0 - 99 seconds.

Set the time as required and press NO to return to the menu.

Note:

*If switch 6 of the internal switch bank in the DF6B is set to ON, the Hang time is set to infinity and the value entered using the SET HANG TIME function is ignored. (For details of the switches see **Section 4 - Setting Up and Basic Procedures**, **4.4.2 -Locking Out by Internal Switches**).*

SOFTWARE DATE <Y?>

This function displays the date or version number of the software in the DF processor of the DF6B, for example:

2 9 / 0 4 / 9 9 D F 6 0 8

Datong reference code

Date (dd/mm/yy)

POLL ANTENNAS <Y?>

This function activates ASU polling, (the routine which is performed automatically each time the system is switched on, as detailed in ***Section 5 - Operation from the Front Panel***, ***5.1 - Switching On and Off***).

Press YES to activate the routine which takes about six seconds, during which time DF functions are suspended. At the end of the routine the display will again show:

POLL ANTENNAS <Y?>

Press NO. The DFC2 will exit from the menu functions. To return to the menu, press MENU.

TEST RADIALS <Y?>

This function tests the LEDs which form the radials in the DFC2's polar bearing display.

When the function is selected, DF operation continues; the DF6B's front panel displays operate normally and audio signals can be monitored from the DF6B and the DFC2.

Press YES. The display will show:

R - T E S T 0 0 0 < U D N >

Displayed radial (0°)

- and the DFC2's radial display will show a bearing of 0° with maximum radial length, (i.e. will activate all three LEDs of the radial).

Use the UP and DOWN keys to change the displayed bearing as required; the display will activate the LEDs in the radial nearest to each selected bearing.

Press NO to exit from the test and restore full DF operation.

TEST S-METER <Y?>

This function tests the LEDs in the DFC2's signal strength display.

When the function is selected, DF operation continues; the DF6B's front panel displays operate normally and audio signals can be monitored from the DF6B and the DFC2.

Press YES. The display will show:

S-TEST 000 <UDN>

Signal strength (0)

The signal strength meter will have been forced to its minimum reading (zero signal strength), and no LEDs will be lit.

Use the UP and DOWN keys to increase the displayed signal strength as required. The reading should increase by one LED for every three units of signal strength, so for example with a signal strength of 39 all 11 green LEDs and the bottom two yellow LEDs should light up - (39 = 3 x 13, i.e.13 LEDS should be lit). The third yellow LED should light up when the signal strength increases to 42.

Press NO to exit from the test and restore full DF operation.

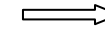
7 Troubleshooting

7.1 Troubleshooting Guide

The DF6B is a reliable unit and many problems encountered are usually due to causes external to the DF6B. If a fault occurs:

- First check the antenna arrays and connections.
- If this does not reveal the cause, refer ***to 7.2 General Symptoms*** and ***7.3 Symptoms Associated with the DFC2*** as appropriate, which deal mainly with faults due to incorrect settings and operation conditions.
- If the fault can still not be identified, use the self-test routine (BITE) as detailed in ***7.3*** to diagnose hardware or software faults in the DF6B.

7.2 General Symptoms

SYMPTOM	***CAUSE and REMEDY***
Nothing happens at switch-on	• Check that the power supply is connected. • Check the power supply polarity; (it is safe to try reversing the polarity). • If a DFC2 is in use, make sure that its cable is securely connected at both ends. (See ***Appendix E*** for details of the cable pin-outs) • Check and if necessary renew the DF fuse on the DF6B front panel. This is a 5A quick-blow 1¼ in fuse which protects the d.c. supply to the whole system. • Check and if necessary renew the ICOM Fuses 1 and 2 on the DF6B front panel, These are 5A quick-blow 1¼ in fuses protecting the positive and negative feeds to the Icom receiver. 

SYMPTOM	*CAUSE and REMEDY*
(Nothing happens at switch-on)	• Check that the power supply is adequate; (***see Section 4 – Setting Up and Basic Procedures***, ***4.2 – Voltage Check***).
System will not switch off	• If a DFC2 hand-held controller is connected, the On/Off switches on both the DF6B and the receiver must be set to 'off' to turn off the system.
No access to Setup mode – **OFFSET, ARRAY X and Y keys inactive**	• These keys are active only when Setup mode has been selected and the LEDs in the keys are lit. Check that Setup mode has not been locked out, (***See Section 4 – Setting Up and Basic Procedures, 4.4 - Locking Out Setup Mode***).
Display responds too slowly (or too quickly)	• Reduce (or increase) the averaging time.
Displays do not remain steady between transmitter pulses	• Increase the averaging time, (and if necessary the Hang time if a DFC2 hand-held controller is in use).
System loses operating settings	• Receiver RAM back-up battery failed. Refer to the receiver manual for renewing the battery. • DF6B DF settings back-up battery failed. (This lithuim cell is mounted on the Analogue PCB and should last for many years. It should be renewed by qualified service personnel).
No signals detected when receiver is tuned	• Check that antenna array is correctly connected. • Connect a conventional antenna in place of DF array. If receiver picks up signals, cables or connections associated with the array may be faulty.

⇨

SYMPTOM	*CAUSE and REMEDY*
(No signals detected when receiver is tuned)	**CAUTION** **Make sure that the conventional antenna has no d.c. path between inner and outer feeders. Long-term short circuits could damage internal components of the DF6B through overheating.**
Incorrect or unexpected bearings	• Most cases of incorrect bearings are caused by problems with the antenna connections, usually through incorrect connections between a head unit and its antennas. Check connections between antennas, head unit(s), ASU (if fitted), and DF6B.
Bearings steady but incorrect	• Check that antennas are correctly connected and that cables between head unit and antennas have not been interchanged. • Check that the ASU connections have not been altered since the system was switched on. If they have, switch the system off and after ten seconds switch on again to allow the ASU polling routine to check which antennas are connected. • Check that any necessary bearing offset has been correctly set for all arrays in the system. See ***Section 5 – Operation from the Front Panel, 5.8.3 - Adding an Offset***, and ***Section 6 – Using the DFC2 Hand-held Controller***, ***6.9.1 - ' Front Panel' Functions***, ***BEARING TRIM***. • Check that the phase trim procedure has been correctly carried out. A separate trim is required four each of the receiver modes. See ***Section 5 – Operation from the Front Panel***, ***5.8.4 – Phase Trim (X and Y) Adjustments***, and ***Section 6 – Using the DFC2 Hand-held Controller, 6.9.1 – 'Front Panel' Functions***, ***ADJ MOD PHASE***. ⇨

SYMPTOM	*CAUSE and REMEDY*
(Bearings steady but incorrect)	• If a DF array is used far above its specified operating frequency the system may appear to work but with an antenna offset of 180°. See ***Appendix B*** for details of the frequency ranges of Datong antenna arrays.
Signal strength reading depends on receiver mode selection	• The sensitivity of the signal strength meter on the Icom receiver depends to some extent on the modulation mode selected. • If the effect occurs on the signal strength indicator of the DFC2, check that the zero and maximum signal strength settings have been made correctly for each receiver mode, (see ***Section 6 – Using the DFC2 Hand-held Controller, 6.9.2 - Additional Functions***, ***SET ZERO SIG*** and ***SET MAX SIG.*** • Note that even with correct trimming some discrepancy is inherent in the design of the receiver.
Bearings are very unsteady even with a strong signal	• If this happens while travelling through built-up areas but not in open areas, use a longer averaging time. • Check connections between antennas, heed unit(s), ASU (if fitted), and DF6B. • Check that the phase trim settings have not been disturbed, (see ***Section 5 – Operation from the Front Panel***, ***5.8.4 – Phase Trim (X and Y) Adjustments***, and ***Section 6 – Using the DFC2 Hand-held Controller, 6.9.1 – 'Front Panel' Functions***, ***ADJ MOD PHASE***. • Unsteady bearings can result from an antenna array being used far below its specified operating frequency. See ***Appendix B*** for details of the frequency ranges of Datong antenna arrays. ⇨

SYMPTOM	*CAUSE and REMEDY*
No bearings in certain quadrants	• If the bearing tends to stay in one quadrant of the display even when the signal is strong, check that all four antennas in the array are correctly connected. • If the required signal is very weak or absent, the system may be responding to interference. In mobile installations, if the indication varies as the vehicle turns the interference is likely to be external, for example a telephone or computer installation in a nearby building. If the indication is independent of vehicle orientation the interference could be generated by equipment in the vehicle.
Bearing errors in some quadrants	• See **No bearings in certain quadrants** above. • A large antenna near the DF array will cause a distortion of the bearing pattern, especially for signals coming from behind the antenna. If possible, check by removing the offending antenna. The effect may also change if the antenna is connected or short-circuited. Pattern distortions will be greatest if the antenna is resonant at the operating frequency.

7.3 Symptoms Associated with the DFC2

SYMPTOM	*CAUSE and REMEDY*
Alphanumeric display shows: CALLING MASTER	• The controller is not receiving data from the DF6B. Check that the controller cable is correctly connected and free from damage. See ***Appendix E*** for details of the cable pin-outs. • Check that the supply voltage is within acceptable limits; it should be 13.8V ± 15% at the 12VD.C. IN connector on the DF6B front panel. (See ***Section 4 – Setting Up and Basic Procedures, 4.2 – Voltage Check***). ⟹

SYMPTOM	*CAUSE and REMEDY*
Display flickers ar low brightness settings	• This is a characteristic of the display chips. The flicker is much less noticeable when the eye is night-adapted, as it should be when low brightness settings are normally used.
Controller beeps when DF vehicle's engine is started	• This results from the momentary drop in supply voltage when the starter motor operates; (with some batteries the heavy starting current can momentarily reduce the battery voltage below the minimum operating voltage for the system). The beep occurs when the DFC2's microprocessor resets as the voltage returns to normal. Make sure that the voltage drop along the supply cable is not excessive by measuring the voltage at the 12V D.C. IN connector on the DF6B's front panel while the DF6B and the DFC2 are operating at full display brightness.
Controller beeps when keys are pressed	• An 'illegal' key press can cause a beep, especially if two keys are pressed at the same time. • The controller also beeps when the brightness settings have reached the limits of their range.
Alternative keypad functions not available	• Check that the alternative keypad has not been locked out, (see ***Section 6 – Using the DFC2 Hand-held Controller***, ***6.3 – Locking Out the Alternative Keypad***).
No audio, displays frozen	• An unprogrammed channel has been selected. Channels to be used must be programmed into the receiver; refer to the Icom receiver manual for programming channels.

7.4 Self-test Routine (BITE)

Start the routine by using the DF6B or the DFC2 controls as follows:

DF6B Press AV2 and AV3 together.

(To abort the routine press either AV1 or AV4)

DFC2 Press the ALT *BITE* key.

(To abort the routine press either of the two AVE keys)

While the routine is running the alphanumeric display will show TESTING.

The routine takes about ten seconds to run, after which the system returns to normal operation if no faults are found.

If the system fails a test, the routine pauses and the display shows an error message. If a service engineer is not available, make a note of the error message and contact Datong.

DF6B: Press AV2 and AV3 together to step to the next test.

DFC2: Press the ALT *BITE* key to resume the routine.

Note:

If the system fails a test it may still be useable.

Appendix A Receiver and DF Processor Unit

A.1 Specifications

Physical

Dimensions	470mm wide x 147mm high x 365mm deep,
Case	Standard 19 x 5 ¾ in rack-mounting steel case, finished in black passivated stove enamel.
Weight	25kg
Storage and working temperature	-10 to +50° C

Receiver

Type	Icom R8500
Frequency coverage	1.5MHz – 1GHz
Modulation modes	AM (normal and narrow) SSB (LSB and USB) CW FM (normal and narrow) WFM (wide and narrow)
For further details of the receiver, refer to the ICOM R8500 manual	

Notes:

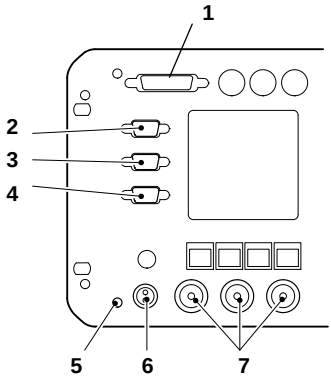
1. *Head units are available for use at frequencies down to 1.5MHz and up to 1GHz. The Icom R8500 will operate down to 100kHz and up to 1.999999GHz*
2. *If the DF6B is used with the HF-COMPACT mobile antenna array, the lowest frequency of DF working is set by the reduced sensitivity of the HF-COMPACT below about 5MHz.*

` **DF6B**

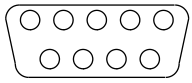
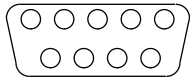
Type	Dual modulated electronic
DF display ***Numerical*** ***Polar***	 3-digit numeric, 1° resolution 36 LEDS, 10° resolution
Main controls	Four momentary-action pushbuttons with integral LEDs, for selecting averaging times of 5, 2.5, 1.25 and 0.62 seconds, and for selecting Setup mode and other functions. Rotary knob for adjusting display brightness and for adjusting system values when Setup mode selected.
DF modulation modes	AM (normal and narrow) SSB (LSB and USB) CW FM (normal and narrow) WFM (wide and narrow)
DF sensitivity	Gives bearings of barely audible signals
Accuracy	Main instrument accuracy ± 1% Overall accuracy depends also on antenna arrays.
Correction for spacing error	Automatic up to 0.5λ antenna separation
Max integration time	5 sec
Shortest useable signal	20msec
Threshold adjustments	Automatic
Array selection	Automatic selection among up to five arrays with ASU (Antenna Selector Unit) ⇨

Antenna feeder	Standard 50Ω co-axial cable
Antenna power and control cables	Power and control share coaxial feeder cable
Remote control facilities	9600 Baud link to optional DFC2 hand-held controller 1200 Baud link for optional system control via RS232 port (DF CONTROL). DF and receiver control can be separate with RS232 link used for receiver control (ICOM CONTROL)
Self-test facilities	Display test Built-in test routine (BITE) software

A.2 Connectors



1 AUXILIARY	For future expansion
2 DFC2 Control DFC2 5 4 3 2 1 9 8 7 6 View into socket on front panel	DFC2 control via 9-pin D-type socket for 9600 Baud RS232 serial protocol: 1. +12V d.c. supply to controller; each leg of supply fused on DF6B front panel by 5A quick-blow fuse 2. Serial control output from DF6B to DFC2 3. Not used 4. Power ON/Off; connected to system power rail, to be connected to pin 1 on this socket via On/Off switch which is in parallel with On/Off switch on receiver, requiring both switches to be set to Off to switch system off. 5. AREM: carries audio signal for DFC2's loudspeaker and earphone 6. Digital ground, for serial link 7. Serial control input to DF6B from DFC2 8. Not used

3 DF CONTROL 5 4 3 2 1  9 8 7 6 View into socket on front panel	DF control via 9-pin D-type socket for 1200 Baud serial protocol. (***Contact Datong for further details***): 1 Not used 2 Serial control input 3 Serial control output 4 Not used 5 Signal ground 6 Not used 7 Not used 8 Not used 9 AFREM: carries audio signal
4 ICOM CONTROL 5 4 3 2 1  9 8 7 6 View into socket on front panel	Icom receiver control via 9-pin D-type socket for 1200 Baud RS232 serial protocol. (***Contact Datong for further details***): 1 Not used 2 Serial control input 3 Serial control output 4 Not used 5 Signal ground 6 Not used 7 Not used 8 Not used 9 Not used This port controls the receiver, provided that switch 6 of the internal switchbank is set to ON, (see ***A.4 Internal DIP Switch Settings*** below).
5 Earphone	¼ in socket for 8Ω (minimum) headphones ⇨

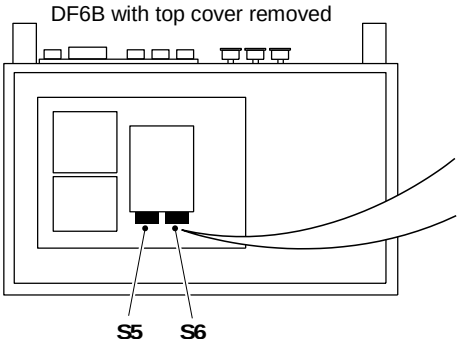
6 Power 12V D.C. IN	LEMO connector, requires LEMO plug (part no FGG1B 302 CNAD 622) and lead supplied with system.
7 Antennas HF, VHF, 1-2GHz	TNC coaxial sockets, take RF input to receiver and supply control data and d.c. power to head unit(s) and optional antenna selector unit (ASU). **CAUTION:** **+8V d.c. is present on the centre connector of the antenna sockets. Do not connect any cable to the sockets which might present a d.c. short circuit.**

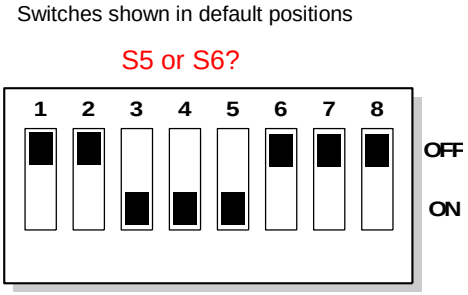
A.3 Logic Levels on Serial Ports

The DF6B system's digital interface uses a full implementation of the RS232 ± 12V interface.

A.4 Internal DIP Switch Settings

The bank of eight DIP switches inside the case of the DF6B control parameters which are not set by software. To gain access to the switches, remove the top cover of the DF6B.



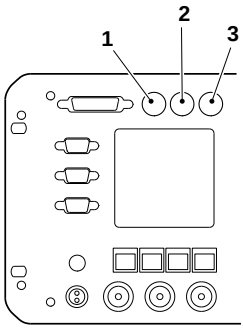


Switch functions:

Switch	*ON*	*OFF*	*Details*
1	Old processing method	New (current) processing method	If set to ON allows backward compatibility with the earlier (pre-1995) DF6. For Datong engineering purposes - do not alter setting.
2	DF-Icom bus disabled, ICOM CONTROL port enabled	DF-Icom bus enabled, ICOM CONTROL port disabled	To use the DF CONTROL port for control of the DF unit and the Icom receiver from a single port on a remote PC, set this switch to OFF (the default). To use the ICOM CONTROL port to control the Icom receiver independently, set the switch to ON; a PC with two serial ports will be required.
3	Setup mode for front panel AV keys disabled	Setup mode for front panel keys enabled	If set to ON, software cannot unlock Setup mode. See ***Section 4 - Setting Up and Basic Procedures***, ***4.4 - Locking Out Setup Mode***.
4	Auxiliary (engineering) menu for DFC2 disabled	Auxiliary (engineering) menu for DFC2 enabled	Do not alter setting.
5	DFC2's alternative keypad disabled	DFC2's alternative keypad enabled	If set to ON, software cannot enable the alternative keypad. For further details see ***Section 6 - Using the DFC2 Hand-held Controller***, ***6.3 - Locking Out the Alternative Keypad.***
6	Freeze DF6B display	Normal DF6B display	During normal operation, if a signal stops the DF6B displays the last registered bearing for the averaging time set by the AV keys. Setting this switch to ON overrides the effect of the SET HANG TIME function of the DFC2, effectively setting the Hang time to infinity. When a signal stops, the display freezes until the DF6B again detects a signal on the current channel and frequency. For details of Hang time, see ***Section 6 - Using the DFC2 Hand-held Controller***, ***6.9.2 - Additional Functions, SET HANG TIME***.
7	Internal defaults reset	Normal operation	If set to ON, resets the DF6B's operating parameters to their default values and holds them indefinitely. To reset the defaults, set the switch to ON momentarily, then to OFF again, so that the DF6B will accept further changes to the parameters. ⇨

Switch	*ON*	*OFF*	*Details*
8	Auto-correction of array spacing errors disabled	Normal operation	With the switch in the OFF position (the default setting) the DF6B automatically calculates correction values for errors in array spacing. The ON position is normally only used for test purposes.

A.5 Power Supply

Voltage	Nominally 13.8V d.c. ± 15%, negative earth
Current	DF processor and receiver only: up to 2.5A Total system maximum (DF processor, receiver, ASU, three head units, DFC2 hand-held controller): up to 3.8A
Fuses  	1 DF6B supply: positive leg protected by 5A quick-blow fuse. 2 and 3 Receiver: positive and negative legs each protected by 5A quick-blow fuse.

A.6 Accessories

- Antenna arrays (see ***Appendix B*** for details).
- Head units (see ***Appendix C*** for details).
- ASU (Antenna Selector Unit) model F6-ASU (see ***Appendix D*** for details).
- DFC2 hand-held controller (see ***Appendix E*** for details).

Appendix B Antenna Arrays

Datong offer the following range of antenna arrays for use with the DF6B system. Some of these are bundled with the appropriate head unit as indicated.

Array Type No.	***Frequency range (MHz)***	***Matching Head Unit***	***Details***
DF6B-A06	1.5 – 6	DF6B-C06	Fixed HF ground array system
DF6B-A30	6 – 30	DF6B-C30	Fixed HF ground array system
HF-COMPACT	1.5 – 30	DF6B-WBHF	Portable wideband HF array: works at reduced sensitivity in the range 1.5 – 5MHz, (see ***Appendix C***).
DF6B-A125	25 – 125	DF6B-C125	Set of 4 magnetically-mounting whip antennas: bundled with the DF6B-C125
DF6B-A250	50 – 250	DF6B-C250	Set of 4 magnetically-mounting whip antennas: bundled with the DF6-C250
DF6B-A400	80-400	DFCB-C400	Set of 4 magnetically-mounting whip antennas: bundled with the DF6B-C400
DF6B-A600	120 – 600	DF6B-C600	Set of 4 magnetically-mounting whip antennas; bundled with the DF6B-C600
DF6B-AD125	25 - 125	DF6B-C125	4-dipole high gain mast-mounting array
DF6B-AD250	50 – 250	DF6B-C250	4-dipole high gain mast-mounting array
DF6-AD400	80 – 400	DFCB-C400	4-dipole high gain mast-mounting array
DF6-AD600	120 – 600	DF6B-C600	4-dipole high gain mast-mounting array

Note:

Coverage from 1.5 – 30 MHz is obtainable using the DF6-WBHF Head Unit and HF COMPACT mobile array. However if required coverage from either 1.5 – 6 MHz or 6 – 30 MHz can be provided using fixed HF ground arrays DF6-A06 and DF6-A30 respectively with suitable head units.

Datong will be happy to quote for non-standard arrays to meet users' requirements.

Appendix C Head Units

C.1 Function

A head unit acts as electronic goniometer, combining the inputs from the four antennas of the DF array with an internally-generated sense signal that is amplitude modulated in a way that depends on the direction of the incoming radio signal. It is connected by a single standard 50 Ω feeder cable to the DF processor in the DF6B. The feeder cable supplies power and control data to the head unit, as well carrying the output from the head unit to the DF6B's front panel antenna socket, or to an ASU if the system has more than one array.

C.2 Housing and Connectors (Figure C.1)

Each unit is housed in a die-cast aluminium box with TNC coaxial connectors mounted on its lid. The cables from the four antennas go to the four corner connectors, the 'north' antenna going to the connector top-right on the lid, marked with a red dot. The output to the DF6B (or to the ASU, if more than one antenna array is used) is taken from the central connector.

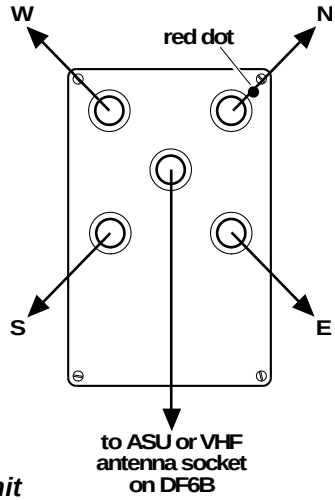


Figure C.1
Standard Head Unit

C.3 Specifications

Dimensions Including magnetic mounting assembly Without magnetic mounting assembly	 215 x 93 x 77*mm, * plus height of TNC connectors 215 x 80 x 60mm
Housing	Diecast aluminium with matt black finish. Case and lid sealed with rubber gasket rendering the unit waterproof to a depth of 10m
Weight	0.85kg
Storage and working temperature	-20 to +60° C
Input and output connectors	TNC
Power requirement	8V d.c. at 80mA, plus any current drawn from the input connectors

C.4 Power Supplies

CAUTION

8V d.c. is present on each of the input connectors of the head unit; make sure that no antenna that is plugged into an input connector presents a d.c. short to that connector. The DF6B to which the head unit is connected (possibly via an ASU) will tolerate short-term short circuits across its antenna socket, but a long-term short might cause damage through overheating to some of the internal components of the DF6B.

Any head units and ASU connected to a DF6B's antenna sockets take their power from the DF6B. There is no firm limit to the direct current that can be drawn by an individual head unit or ASU, but the DF6B itself is fused at 5A on its front panel. Since the DF6B draws up to 2.5A from its power source, it is recommended not to draw more than 0.25A from the antenna socket a hand-held controller is in use, or 0.75A if no controller is used. An ASU draws 20mA. The two front panel fuses protect the positive and negative legs of the incoming d.c. power supply, and should always be replaced by fuses or the same type and rating.

C.5 Mounting Arrangements (Figure C.2)

For magnetic mounting, two rubber-enclosed magnet assemblies are fitted symmetrically to the underside of the head unit case. Figure C.2 shows the spacing and size of the assemblies.

Alternatively, you can remove the magnet assemblies and make your own mounting arrangements. The four cross-headed screws hold the magnet plate to the mounting plate. If the four screws are removed, you can then secure the head unit and its mounting plate either via the four screw holes now vacant, or via the four 10mm holes, designed to accept U-clamps for mast mounting and for use with the DF6B-AD range of dipole arrays.

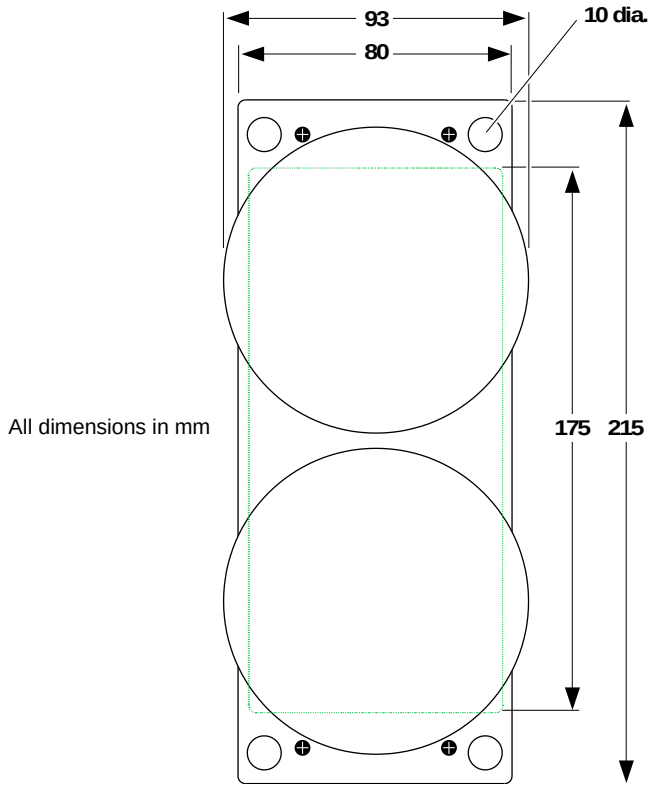


Figure C.2 Mounting Arrangements

C.6 Head Units and Antenna Arrays

VHF/UHF Systems

Datong head units for DF6B VHF/UHF systems are supplied with a set of magnetically-mounted 4-whip antennas. The DF6B itself is supplied as standard with one head unit and matching set of magnetically-mounted whip antennas of the buyer's choice. The DFC-C1000 head unit, for the 500-1,000 MHz range, is an optional extra, and comes as a combined head unit and antenna array system.

HF Systems

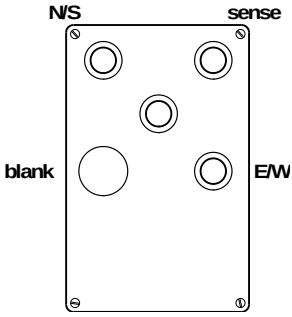
The head units for its DF6B-HF system are bundled with their matching antenna arrays – the DF6B-C06 and DF6B-C30 with ground antenna array systems, the DF6-CWBHF with the HF-COMPACT wideband mobile array. The DF6B-HF does not come as standard with any head units or arrays.

Although the range of standard head units should meet the great majority of needs, Datong will be pleased to design and manufacture special-purpose head units to meet a customer's exact requirements .

Model	*Datong type*	*Frequency range (MHz)*	*Arrays*
DF6-C06	1	1.5–6	Suitable ground antenna array: DF6-A06
DF6-C30	3	6–30	Suitable ground antenna array: DF6-A30
DF6-CWBHF	n/a	1.5–30	Designed for use with the HF-COMPACT mobile array, which has wide bandwidth but reduced sensitivity below 5MHz
DFC6-C125	1	25-125	Package includes a set of four 25-125MHz whip antennas. Higher gain mast-mounting dipole array type DF6-AD125 available as an option, including a DF6B-C15
DF6B-C250	2	50–250	Package includes a set of four 50-250 MHz whip antennas. Higher-gain mast-mounting dipole array type DF6-AD250 available as an option, including a DF6B-C250 ⇨

Model	*Datong type*	*Frequency range (MHz)*	*Arrays*
DF6B-C400	3	80–400	Package includes a set of four 80 – 400MHz whip antennas. Higher-gain mast-mounting dipole array type DF6B-AD400 available as an option, including a DF6B-C400.
DF6B-C600	4	120–600	Package includes a set of four 120-600MHz whip antennas; Higher-gain mast-mounting dipole array type DF6B-AD600 available as an option, including a DF6B-C600
DF6B-C1000	5	500-1000	Head unit and antenna array are an integral unit.
DF6B-C1000M	5	500-1000	Supplied as standard with mast-mounting 4-dipole array type DF6B-AD1000.

C.7 'Special' Head Units



DF6B-CWBHF

The wideband HF head unit type DF6-CWBHF is designed to work with Datong wideband portable HF array type HF-COMPACT, (see below).

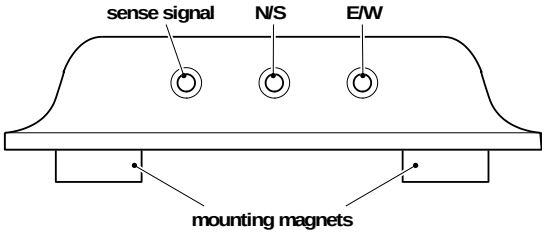
The 3 TNC connectors on the HF-COMPACT connect with the 3 input connectors on the DF6B-CWBHF head unit. The 'South' connector on the standard head unit is replaced by a polythene blanking plug in the DF6B-CWBHF.

The DF6B-CWBHF covers the range 5 - 30 MHz at full sensitivity, and the range 1.5 - 5 MHz at reduced sensitivity.

HF-COMPACT Portable HF Antenna Array

Designed for operation from 1.5 - 30 MHz with the DF6-CWBHF head unit, the HF-COMPACT works at reduced sensitivity in the range 1.5 - 5 MHz. The unit is installed on a vehicle roof with the connectors facing rearwards,

and connected to the head unit with the three cables supplied.

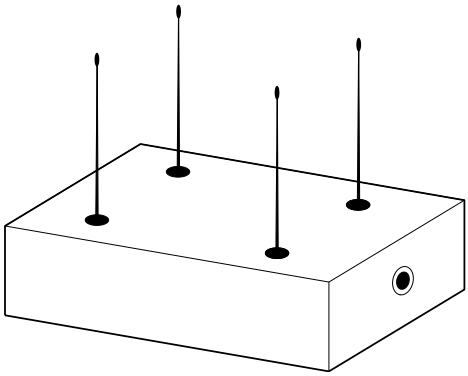


DF6B-C1000

Owing to the short operating wavelengths, the head unit is integrated with the array in the DF6B-C1000.

Dimensions	178 x 178 x 34*mm, excluding antennas 178 x 178 x 42*mm, including antennas
Weight	1 kg
Power requirements	8V d.c. at 80mA

**These dimensions include the small magnets attached to the base of the unit.*



Appendix D Antenna Selector Unit (ASU)

D.1 Function (Figure D.1)

In a system with more than one array, the ASU provides switching between arrays. The unit can select from up to five arrays; the DF processor uses the current operating frequency to command the ASU to switch to the correct head unit and array for that frequency.

The LEDs next to the input (PORT) connectors light up to show which array is in use. The LED next to the OUTPUT connector is fitted for a future enhancement; at present it flashes briefly to indicate the presence of the PORT selection data signals.

The unit is powered from the 8V d.c. supply carried by the RF feeder cable connecting the ASU to the DF6B's front panel. The feeder also carries the control signals for the ASU.

Figure D.1 also indicates the head units intended to be connected to the PORT connectors, together with their frequency ranges. The PORT numbers correspond to the Datong array type numbers, (see ***Appendix C***).

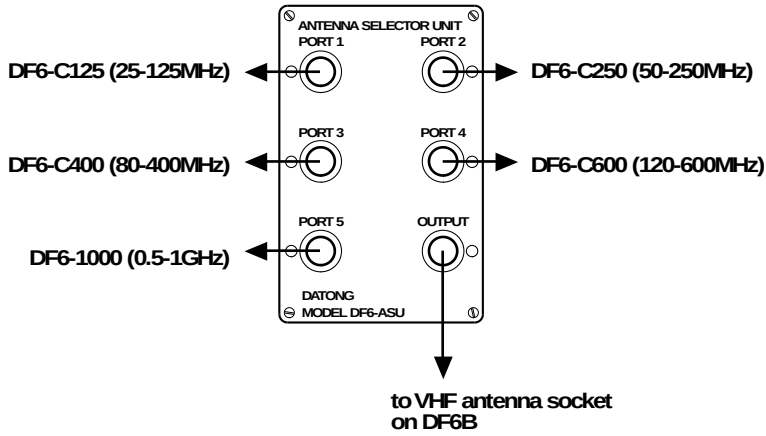


Figure D.1 Antenna Selector Unit (ASU)

D.2 Specification

Dimensions	178 x 80 x 57*mm * plus height of TNC connectors
Housing	Diecast aluminium with matt black finish. Case and lid sealed with rubber gasket rendering the unit waterproof to a depth of 10m
Weight	0.7kg
Storage and working temperature	-20 to +60° C
Frequency range	1.5 – 1000 MHz (Provides switching for up to five antenna arrays; only three arrays required for 25 – 1000 MHz coverage)
Signal, control data and power cable	Standard 50Ω coaxial cable, such as UR43
Power requirements	8V d.c. at 20mA

CAUTION

8V d.c. is present on the centre pins of the five PORT connectors. Do not connect any antenna array or head unit that presents a short circuit to the inputs.

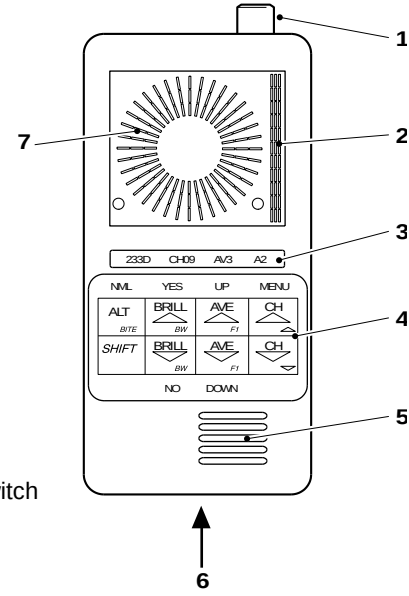
Appendix E Hand-held Controller (DFC2)

E.1 Function (Figure E.1)

The DFC2 provides remote control In installations where it is useful to be able to control the system from a point remote from the DF6B.

The DFC2 can be used in parallel with the DF6B, and provides more functions than are available from the DF6B's front panel.

The controller provides a polar display of bearing with 3-element LED signal quality indication, and a 33-element LED signal strength indicator. A digital display indicates bearing, channel, averaging time and array in use. The keypad provides normal operational control, with alternative keypad functions for changing operating parameters.



1 Volume control
2 Signal strength indicator
3 Alphanumeric display
4 Keypad
5 Speaker
6 Headphone connector, DFC2 connector, and On/Off switch
7 Bearing display

Figure E.1 DFC2 Hand-Held Controller

E.2 Specification

Dimensions	185 x 90 x 28 mm
Housing	Milled from solid aluminium, finished matt black, display and keypad sealed to case with epoxy resin
Weight	0.6 kg
Storage and working temperature	0 - 50° C
Polar display	36 radials, each comprising 3-element LED display giving approximate signal quality indication. Bearing resolution 10°.
Digital display	16-character alphanumeric, showing bearing, averaging time and antenna in use. With alternative keypad functions in use, shows menu functions and value of selected parameter. Bearing resolution 1°.
Signal strength display	Three 11-element LED displays (red, yellow, green) side-by-side. Displays dynamic range of over 100dB in roughly equal steps, (similar to range of receiver's signal strength meter).
Audio monitoring	Miniature speaker, and 3mm earphone socket
Controls	Keypad with eight dual-mode keys Volume control, for speaker and earphone On/Off switch (works in parallel with receiver's On/Off switch)
Data link to DF6B	RS232 at 9600 Baud
Internal microprocessor	8751 (8-bit single chip)
Power supply	9.5 – 16V d.c. via DF6B controller cable, at 250mA – 1A depending on volume and display brightness settings

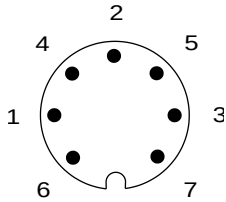
E.3 Cable, Connectors and Pin-outs

DFC2 connector 7-pin DIN female

DF6B connector 9-pin D-type female

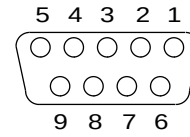
Cable 4m supplied, 7-pin DIN male to 9-pin D-type male

7-pin DIN at DFC2



View into socket from outside DFC2

9-pin D-type into DF6B



View into socket from outside DF6B

Pin	***Function at DF6B end***	***Pin***
1	Incoming data from DF6B	2
2	Audio signal from DF6B to DFC2 speaker/earphone	5
3	Outgoing data to DF6B	7
4	Switched 13.2V d.c.*	4
5	Analogue ground for audio signal on pins 2/5	9
6	Unswitched*	1
7	Cable screen, E	6
-	Not used	3
-	Not used	8

* Pins 6/1 carry a direct connection from the DF6B's power supply (via the two 5A fuses on the DF6B's front panel), and are connected to one side of the On/Off switches on the DFC2 and the ICOM receiver. Pins 4/4 are connected to the other side of both switches, and supply the DFC2, the DF6B, and any head units or ASU connected to the system. Both switches must be set to Off to switch off the system.