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## WJ-9040 DDF102 DIRECTION FINDER



### FEATURES

- Microprocessor Controlled
- Full Local and Remote Control
- Built-In Test (BIT)
- Internal IF Demodulator With Four IF Filters
- RS-232, IEEE-488 Direct Interfaces (Optional)
- One-Half Rack, Modular Construction
- Low Power Consumption
- Ability to DF on Pulse Signals (0% 150 msec)

### DESCRIPTION

The WJ-9040 DDF102 Direction Finder provides the WJ-9040 System with direction finding capability. The DDF102, when used with a WJ-8628-X VHF/UHF Receiver and a WJ-98XX Series DF Antenna, forms a DF system as

shown in Figure 1. Frequency coverage of 20 to 1000 MHz is possible with the proper selection of receiver and DF antenna.

In addition to DF processing, the DDF102 serves as the DF system controller. It switches the DF antenna and accepts the prefiltered 21.4 MHz output of the WJ-8628-X Receiver for a line of bearing (LOB) generation. The DDF102 has its own internal IF demodulator with four selectable IF bandwidth filters. This feature permits the interchange of receivers without the need for calibrating the DF to the receiver. The IF demodulator is similar to that of the WJ-8628-X Receiver and uses the same IF filters. There are four standard IF filters installed: 10, 20, 50 and 200 kHz. If desired, the user can specify alternate IF filters.

All controls and displays needed for local operation of the WJ-9040 DDF102 are located on the front panel. Local control is through the front panel keypad which allows data/control entries. Remote control is through the WJ-9040 System I/O connector on the rear of the unit. A front panel

LCD display shows the current operating status of the unit in both local and remote control. A front panel DF display provides the LOB information in both a numerical readout and a compass-like circular display.

The DDF102 Direction Finder is configured in a half-rack module designed to mate with the WJ-8628-X VHF/UHF Series Receivers in a single rack assembly (Figure 2). The DDF102 communicates to the receiver via the WJ-9040 IOM108 module in the WJ-9040 EFR100 Equipment Frame. Receiver operating status data, such as tuned frequency, IF bandwidth, squelch threshold level, etc., can be passed to the DDF102 for increased DF system accuracy. This also reduces the operating overhead required of an operator or a system controller.

The DDF102 has an internal RF switch which can select one of five RF signals to the receiver which has only a single RF input. This switch is useful in systems which require multiple antenna inputs.

## CONTROL FUNCTIONS

The control functions are the same for both local and remote control. In the local mode, the operator controls the DDF102 through the front panel. In the remote mode, an external controller asserts control through RS-232 or IEEE-488 interface formats. For remote control, the DDF102 requires an IOM108. The control functions offered by the DDF102 are:

1. **BW:** The BW command selects 1 of 4 bandwidths present in the IF demodulator.
2. **OFFSET:** The OFFSET command adds a heading correction between 0 and 359 to the LOB to allow the DF to display true north reference.
3. **R/LCL:** The R/LCL (remote/local) control allows the operator to place the DF into remote or local control. The current operating status is shown in the LCD display. When in remote control, all front panel switches are inactive except for R/LCL.
4. **CLR:** The CLR control is used to clear out wrong data entries and is also used as a termination key in some TEST and AUX operations.
5. **LOB:** The LOB command causes the DF to take a single line of bearing based on data taken over one integration time period.
6. **INT TIME:** The INT TIME control selects an integration time period from a set of values 0.5, 1, 2, 3, 4, 5, 6, 7, 8, or 9 seconds.
7. **GATE:** The GATE command offers three LOB generation modes:
  - **OFF:** The GATE mode is off. LOBs are generated by the LOB key.
  - **ON:** The GATE mode is on. The DF generates continuous LOBs as long as the signal exceeds the COS threshold setting. The integration time period is forced to 0.5 second for quick reaction. When the signal becomes inactive, LOB generation stops and the display shows the last LOB.
  - **CON:** The GATE—CONTINUOUS mode is on. The DF generates continuous LOBs regardless of signal activity. Integration times can be selected to any value desired.

8. **AUX:** This key is used for a variety of auxiliary functions such as real-time clock.
9. **TEST:** This key activates BIT (built-in test). The TEST, when preceded by a valid number (1 to 11) activates a chosen BIT.

## BUILT-IN TEST

The DDF102 has extensive built-in test (BIT) which isolates faults to the module level. The TEST ALL command is initiated on power up. Individual BIT can be activated by the TEST key on the front panel keypad. Some of the available tests are:

1. **TEST ALL:** All tests are performed. Those tests which fail are displayed on the LCD display. This test is activated upon power up. It can also be activated by the TEST key.
2. **DISPLAY TESTS:** Both the LCD and the DF display are tested for missing characters.
3. **KEYPAD TEST:** The keypad is tested for proper key action.
4. **MICROPROCESSOR TEST:** The microprocessor tests its onboard components.
5. **DF PROCESSOR TEST:** The DF circuit is checked with an internal angle simulator.
6. **IF DEMOD/IOM108 COMMUNICATION TEST:** The data paths between the IF demodulator and the external IOM108 modules are tested.
7. **RF SWITCH TEST:** The individual RF inputs of the RF switch can be selected to verify proper operation of the switch.

In addition to the above tests, there are two other tests which allow the operator to turn on individual elements of the DF antenna to verify that the DF antenna, receiver, and DF processor are all working together properly. These tests, which originate with the DDF102, can be considered as system BIT.

## QUALITY FACTOR

A quality factor indicator is calculated with each LOB. The quality factor, which is a number value between 0 and 9, can be regarded as a confidence factor that the calculated LOB is accurate. The indicator is based on a statistical calculation with the DF processing algorithm and is modified according to signal level and COS status.

## CORRECTION TABLES

The basic system accuracy can be improved through use of correction tables. The DDF102 has a large surplus memory space for the inclusion of these tables. Contact factory for details.

## PULSED SIGNAL OPERATION

The DDF102 is capable of operating against pulsed signals of 150 msec minimum duration when placed in GATED—ON mode. The integration time period is set to 0.5 second. A signal presence circuit within the DDF102 will allow the

collection of data only when the signal is active. This ensures that the LOB calculation will not include noise. A minimum active period of 150 msec is required for an LOB calculation. When signals are less than 0.5 second, the system accuracy will experience a gradual degradation.

## IF FILTERS

The DDF102 comes with a standard set of four IF filters: 10 kHz, 20 kHz, 50 kHz and 200 kHz. Other filters are available. The user can select up to four values from the following set of filters: 3 kHz, 10 kHz, 20 kHz, 50 kHz, 100 kHz, 200 kHz and 300 kHz.

## SPECIFICATIONS

Minimum DF System .....

System Type .....

System Performance

IF Input Frequency .....

Sensitivity .....

Frequency Range .....

Instrument Resolution .....

Typical System Accuracy .....

Azimuth Coverage .....

Elevation Coverage .....

Bearing Presentation .....

Integration Times .....

Front Panel Controls:

BACK LIGHT .....

DISPLAY ADJUST .....

Keypad:

Numerics .....

CLR .....

IF BW .....

OFFSET .....

TEST .....

LOB .....

INT TIME .....

GATE .....

AUX .....

R/LCL .....

Temperature:

Operating .....

Storage .....

Size .....

Weight .....

Power .....

## REMOTE I/O CAPABILITY (MULTIPLE DF STATION NETTING)

For special applications which require the DDF102 to interface directly to external devices such as printer or communication equipment, the following interface formats are available: RS-232, IEEE-488, or audio FSK. With a special software application package and one of the remote I/O formats installed, it is possible to create a basic nettable DF system with DF subsystems and external communication equipment. An external computer can be attached to one of the DF subsystems to enhance the system capabilities.

WJ-9040 DDF102 Direction Finder, WJ-8628-X VHF/UHF Receiver, WJ-98XX Series DF Antenna. WJ-9040 EFR100, IOM108, EPS100, SRM105  
Single channel interferometer

21.4 MHz  
10 dB S/N ratio for 3 degrees RMS accuracy  
20 to 1000 MHz nominal (depends on receiver/antenna)  
1 degree  
3 degrees RMS, 2 degrees RMS with correction tables  
360 degrees  
± 30 degrees  
3-digit numerical line of bearing in 1 degree increments complemented by a compass-like LED circular display  
Signal integration times of: 0.5, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0 seconds

Turns on LCD back light  
Controls viewing angle of LCD

Used for data entry  
Clears numeric entry  
Selects one of four IF bandwidths  
Permits offset of LOB to correct antenna misalignment  
Initiates self-test routines  
Displays line of bearing based on data taken over integration period  
Selects one of ten available integration times  
Sets LOB function to operate when carrier signal is present from receiver  
Auxiliary functions  
Reads all data on front panel and allows all parameters set by front panel to be done remotely via IEEE-488 or RS-232 Bus (located in WJ-9040 IOM108 Module). Return to local is accomplished by pressing "R/LCL" button. Remote is accomplished by the proper computer command (RMT)

0° to 50°C  
-40° to +70°C  
5.2" high × 8.9" wide × 14.4" deep (13.2 cm × 20.3 cm × 36.6 cm). Designed to fit in WJ-9040 EFR 100 Equipment Frame  
12 pounds (5.4 kg) approximately  
12 watts; power supplied by WJ-9040 EFR100 Equipment Frame

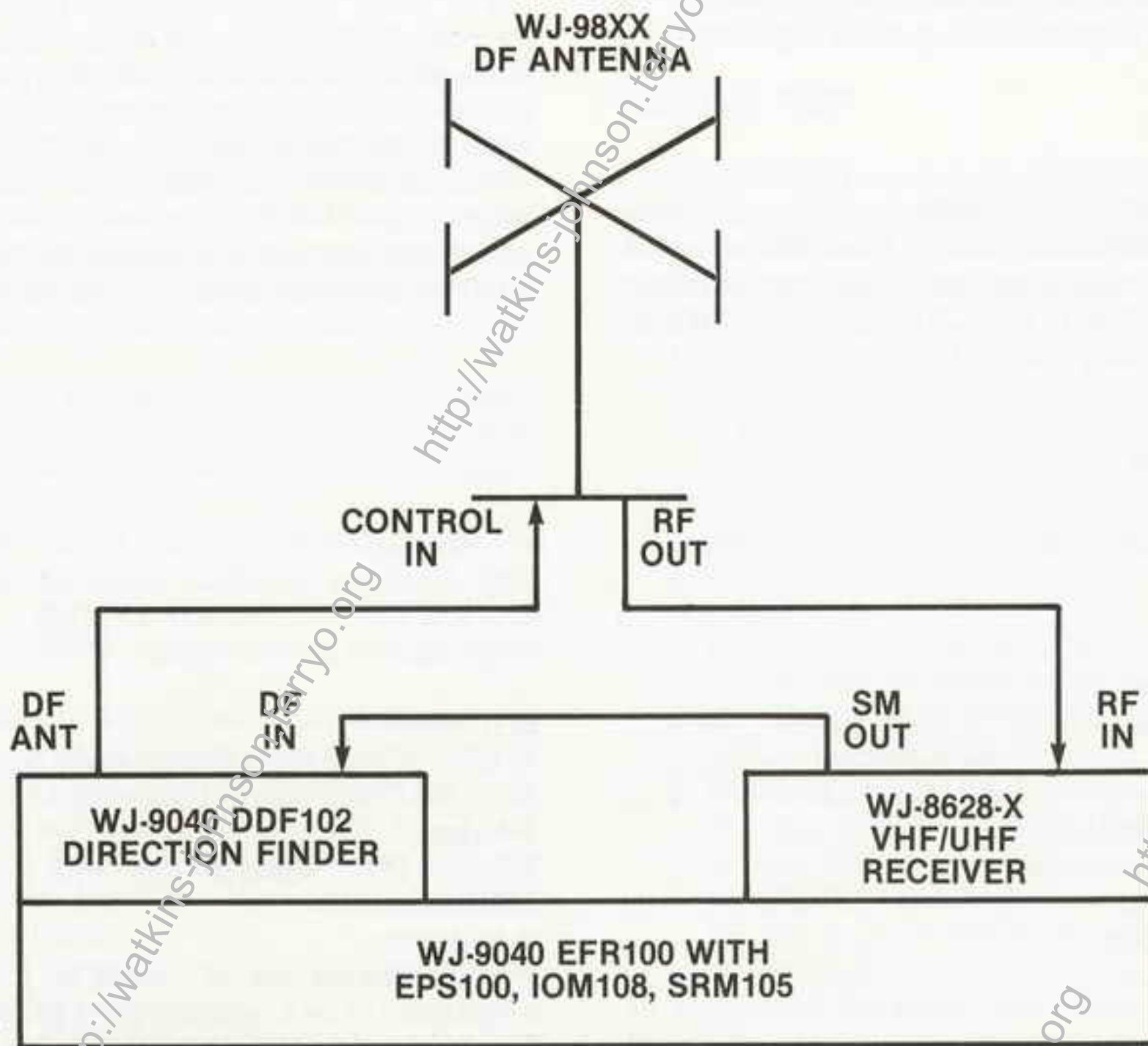


Figure 1: Minimum DF System



Figure 2: WJ-9040 DDF102 With WJ-8628-4 Receiver