DIRECTION FINDING (DF) SYSTEM

DF ACCURACY

Self-Calibrating, Wide Aperture VHF and UHF Antennas providing bearing accuracy of better than 1° RMS (typically 0.3°) to allow operators precise air traffic direction with minimum effort.

SAFETY

All equipment's constantly use Built-In Test Equipment (BITE) initiating alarms (visual and audible [configurable]) to identify faults to Line Replaceable Units (LRUs)

REMOTE CONFIGURATION

All aspects of the equipment can be remotely configured and interrogated. The EDF, Test Oscillator and the Communications Receiver can be controlled via the same Display position.

FLEXIBLE INSTALLATION

Setup and Installation of all equipment is bespoke. All installations are planned around the specific site requirements.

MODULAR DESIGN

Compact and modular design allows configurable systems setup to suit the customer's requirements. Up to 32 Channels per band and up to 50 display positions available per system.

TEST OSCILLATOR

System checking and bearing accuracy can be checked using the configurable Test Oscillator.



The HAYSYS Doppler-based DF system solution incorporates a high degree of functionality in a system that has been designed and integrated into relatively simple system architecture. The core elements of the system use standard interfaces to communicate with each other and provide ease of integration with other systems, such as RADAR displays.

Installation of a typical system is illustrated above in Figure
Concurrent frequencies can be monitored using a single antenna and multiple receivers and EDF Processors (up to 32 channels per band).

The EDF Processor is a 1U high standard 19" sub-rack unit with all connections being made at the rear panel. The EDF Processor is normally installed at the Antenna site and connected to the DF Server via Ethernet connectivity.

The EDF Processor uses Digital Signal Processing (DSP) algorithms in an embedded processor. These algorithms provide superior signal detection and bearing angle measurement.

The Communication Receiver is controlled by the Display Software via the DF server and local DF Site network connectivity. The receiver provides the input to the EDF Processor from the DF antenna. Multiple arrangements and configurations are possible with this modularised system solution.

- VHF and/or UHF Wide Aperture, 16-element Antennas, providing additional resilience to reflections
- Tailored installation to suit customer requirements
- Full monitoring of all aspects of the equipment from remote sites and display terminals
- Continuous monitoring and alarm functions at the display units and equipment
- Full Multi-Channel DF System with channel changes from the Display Terminals
- System based on modularised equipment providing increased flexibility and future proofing.

Communication from the Display Site to the DF Site is achieved via a cross-site link. Depending on installation, this link is either a 2/4 wire link or a fibre connection. Other methods of communication are available.

Testing of the DF System is achieved by a dedicated Test Oscillator (TO) and in addition, the system can be configured to check its self each time a tower transmission is made through the Tx bar facility.

The HAYSYS DF system allows the surveillance of multiple frequencies simultaneously (up to 32 frequencies per band).



Specifications

GENERAL

Site Error

Bearing Accuracy Instrument Error System Error System Calibration

Polarisation Error Operating Band

System Sensitivity DF Range (LOS)

Environment Operating Temperature Range

Storage temperature Range Relative Humidity

EMI/EMC

Safety

EQUIPMENT MOUNTING

Cooling

ANTENNA SYSTEM Antenna Gain Signal Polarisation Antenna Factor Impedance

Operating Temperature Range Storage temperature Range Relative Humidity Cone of Silence (Vertical Response) Wind speeds

Power Control Overall diameter Weight Wide-aperture, 16-element dipole array, continuous duty cycle $<\pm 2^{\circ}$ (ICAO Class A) Typically <1° maximum across the 360° Azimuth, 0.4° RMS. $< 0.1^{\circ}$ $< 0.1^{\circ}$ $< 0.1^{\circ}$ Can be calibrated via internal Antenna oscillator (recommended), Test Oscillator or external source <1° VHF – 108 MHz to 137 MHz UHF – 225.000 MHz to 406.000 MHz $<3\mu$ V/m >200NM (with sufficient transmitter power)

Outdoor equipment -50°C to +100°C, Indoor Equipment 0°C to +55°C -40°C to +75°C 0 to 95%, non-condensing

Emissions - EN55032: 2015 +AC: 2016-07 +A11: 2020 +A1:2020, ETSI EN 301 489-1 V2.2.3 (2019-11) & ETSI EN 301 489-22 V2.1.1 (2010-10). Immunity - EN 55035: 2017 +A11: 2020, ETSI EN 301 489-1 V2.2.3 (2019-11) & ETSI EN 301 489-22 V2.1.1 (2010-10). Certified to IEC 62368-1:2018, EN 62368-1:2020 + A11:2020 and IEC 62368-3:2017

Standard 19" sub-racks suitable for mounting in 19" rack cabinets up to 42U in height (600mm or 800mm deep). Self-cooled, no external fans required.

3.8 dBi (VHF), 2.2dBi (UHF) Vertical 8.53 dB/m (VHF), 17.92 dB/m (UHF) 62.7 Ω at 127.5 MHz (VHF) 61.1 Ω at 308 MHz (UHF) -50°C to +100°C -40°C to +75°C 0 to 95%, non-condensing ±5° from the vertical axis Resists speeds of up to 200 kms/h (up to 30mm ice) Power-over-Ethernet (PoE) 100Mb/s Ethernet - Standard TCP/IP 3.04m (VHF) 1.26m (UHF) 47 Kgs (VHF) 23Kgs (UHF)







UHF Polar

RECEIVER Frequency Range

Channel Spacing Operating Temperature Range Storage temperature Range Relative Humidity Frequency Error Sensitivity Selectivity Antenna Connector Impedance Display Display Indicators Indicators Size Weight

EDF PROCESSOR

Commutation Frequency Bearing Resolution DF Response time Display Display Indicators Indicators Operating Temperature Range Storage temperature Range Relative Humidity Size Weight

TEST OSCILLATOR Frequency Range

Interface Operating Temperature Range Storage temperature Range Relative Humidity Power Supply

SYSTEM INTERFACES Human Machine Interface (HMI)

Electrical Interfaces

Protocols

(Expandable to 108MHz to 406MHz on request) 8.33kHz and 25 kHz 0°C to +55°C -40°C to +75°C 0 to 95%, non-condensing $\leq \pm 2.5$ ppm (typically ± 1 ppm) -117 dBm (0.32µV) -60dB 50 Ω BNC 40 x 2 Character LCD Receiver Name, Frequency, Modulation, RSS, Audio Out and Alarm Standard 1U 19" Rack 3Kgs

118.000 MHz to 400.000 MHz

500 Hz 0.1° 250ms 40 x 2 Character LCD Channel Name, Bearing, Alarm, Menu Tx Bar (PTT Input) and Alarm 0°C to +55°C -40°C to +75°C 0 to 95%, non-condensing Standard 1U 19" Rack 2.7Kgs

118.000 MHz to 400 MHz (Expandable to 108MHz to 406MHz on request) RJ45 Standard Ethernet -50°C to +100°C -40°C to +75°C 0 to 95%, non-condensing Power Over Ethernet (PoE)

Microsoft Windows Applications for DF Services and Main Display application – used by Operator and Maintainer functionality. Display application displays up to 4-channels simultaneously per display in both 3-digit bearings and vector display. Provides for 32 programmable channels per band as well as GIS mapping and Compass Rose Display.

RJ45 Standard Ethernet – allowing remote operation from almost any distance (thousands of miles) Serial RS232 (Asynchronous) also available Asterix Part 31 Category 205 Radio Direction Finder Reports RDS 1600 RS232 (Asynchronous) Topsky DF Service Indra Nova 9000 Integration with ATCR 33S & Master -T available. Includes ATMS systems – (ICD Required)

SYSTEM POWER REQUIREMENTS Power Supply Power

Uninterruptible Power Supply (optional) External Battery Pack (optional) Surge Protection

Antenna Lightning Protection

85-264 VAC, 47-63 Hz 21 Watts per channel + 12W PoE Eaton 9X series on-line UPS (1.5kW or 3kW) Eaton EBM All cables entering building from outside are protected with Surge Protectors to IEC 62305 as standard. Lightning Air Terminal mounted on the top Antenna as standard.

