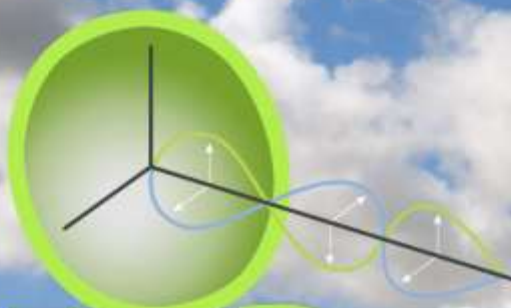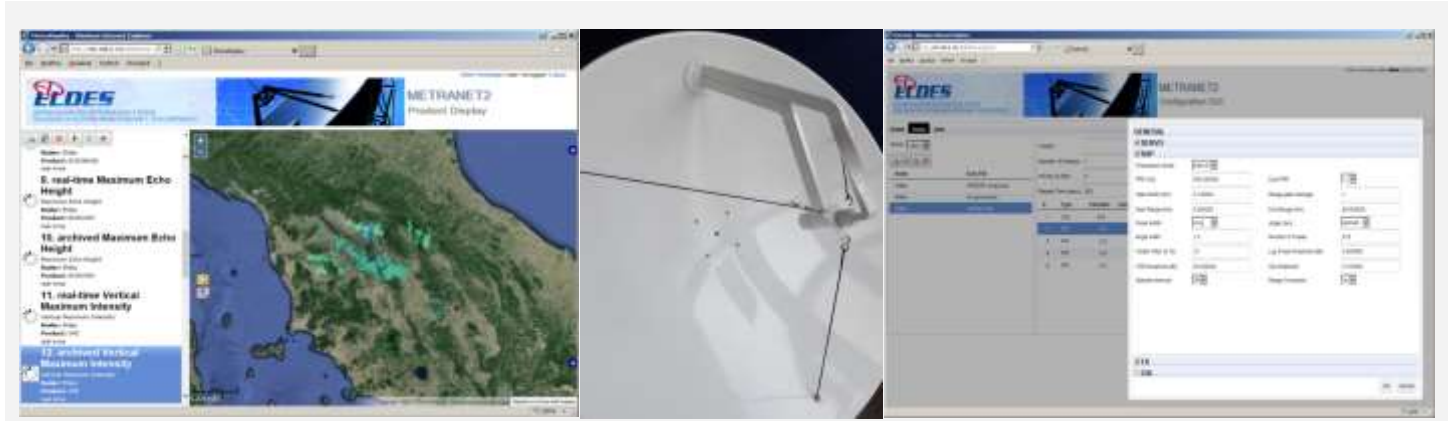weather radar

WR25XP

The high performance mini weather radar system that meets the most modern and sophisticated weather radar requirements applied to many different fields.

It combines the advantages of the most inexpensive models such as: portability, low consumption, small size and weight, with the performance typical of much more expensive systems. Think, for example, of the Doppler processing and the simultaneous dual-polarization, which make it a powerful instrument for most demanding users. A professional tool at an "amateur" price.

ELDES
RADAR SYSTEMS FOR METEOROLOGY AND DEFENCE
1993 25° 2018

Weather Radar WR-25XP
General description

The WR-25XP radar is the flagship product of ELDES' X-band mini radar family characterized by a price/performance ratio that is unique on the market. The capacity to operate in **simultaneous dual-polarization** and the **doppler** capabilities make WR-25XP an ideal instrument for the most advanced radar hydro-meteorological applications and for medium scale civil protection uses, as well as for monitoring rainfall fields and the convective phenomena associated with those severe atmospheric events that are particularly dangerous for air navigation.

The use of dual polarization technology makes it possible to partially compensate the path attenuation that typically penalizes X-band radars and whose effect can be further mitigated by the use of a network of interconnected mini radars with partially overlapped coverage sectors. Furthermore, by means of the differential parameters measured thanks to the dual polarization, a realiable classification of the hydrometeors is possible using sophisticated analysis software and quickly recognizing with a very high probability whether it is rain, hail or snow.

Doppler processing allows efficient filtering of undesirable echoes (clutter) and the instantaneous estimation of the velocity vectors and of the turbulence of the rainfield, in this way classifying its dangerousness.

Given its small size and weight, the WR-25XP can even be installed on a light trailer for quick relocation to areas sensitive to hydrogeological risk, or to areas with a high concentration of people for civil protection needs.

The reflectometric coverage of the sensor is 120 Km of radius on weak perturbations (i.e. light rain).

A powerful Linux Workstation, typically installed in the Radar Control Center or near the radar itself, process the polar data of the three-dimensional volumes, containing the "moments" acquired by one or more radars.

The result is the generation of a large number of reflectivity and doppler products usually available only in the much more expensive weather radars and airport doppler radar systems.

The products can be displayed through a simple graphic user interface (GUI) for immediate use, even by non-experts. The data and weather maps produced can be exported and published according to the most common interchange formats and thus displayed through WEB Clients supplied by ELDES or by third parties.

The WR-25XP can be installed in unattended stations as it can be remotely controlled and transmit pre-processed data.

In line with the tradition of the weather radar manufactured by ELDES, this time also we paid close attention to the aspects of reliability and maintainability for use 24 hours a day, 365 days a year with need for minimum interruptions for preventive maintenance and a very low percentage of failure thanks to the use of professional high reliability and well tested hardware basic components. In this way even running costs are reduced to negligible figures.

Technical description

The WR-25XP radar operates in X-Band, using a small Prime focus parabolic antenna, which provides good angular resolution characteristics and low secondary lobes compared to the dish diameter of 90 cm. The antenna can be moved in an automatic and programmable way, both in azimuth and in elevation, in order to acquire the entire polar volume desired and to allow acquisition in **RHI mode**. All the radio frequency components, the Transmitter and the digital Receiver for the two polarization channels (Vertical and Horizontal) are contained in the radome together with the control electronic, the drivers and the azimuth and elevation motors. This unit is called Scanner. An Ethernet connection line allow connecting the Scanner to a Linux Workstation, which is dedicated to the radar management, the local diagnostics and real time moments display. This PC also deals with processing the acquired signals, generating a complete set of meteorological "moments", tied to reflectivity (uZ and cZ), to the doppler velocities (V, W) and to the derived polarimetric parameters (Φ_{dp}, K_{dp}, Z_{dr}, $RhoHV$). Despite using a Magnetron transmitter, the system is "coherentized" on receive, guaranteeing the necessary phase and amplitude stability of the received signals. The coherentization is performed through a dedicated channel which samples each emitted radar pulse and uses it as a reference for the received echoes, correcting the phase of all samples in order to filter the clutter and extract the doppler and differential phase information.

Each radar covers a maximum radius of 120 Km which may be significantly increased by installing a network of interconnected mini radars.

Using this configuration, which also offers intrinsic system redundancy, it is possible to partially correct the "attenuation and masking effect" which, typically, constitute a well known limit to the use of the X-band in weather radar. Locally the radar control PC is equipped with the appropriate tools for diagnostics, maintenance and real-time display of the "moments" and with the powerful RDP software **METRANET2** that generate in real time the numerous radar products available, listed hereinafter. The standard and optional Products represent in graphic and numerical form the various parameters measured and calculated by the instrument to be used for different purposes and by different users.

Communication between the radar sites and the eventual Radar Control Center may take place through Ethernet TCP/IP. The generated products are easily transferable or exportable into the most common representation formats like Opera BUFR, HDF5, MDV (Titan). In addition, the format of the raw data is provided on request and allows its use even directly by particularly advanced users.

The display and control of the radar can take place directly at the local workstation or on remote Web clients. The user interface is simple and functional to allow full use of the system, after a short training course, even by non-specialist users.

The Radar Data Processor (RDP) software allows: configuration of the scans and of the operating parameters (even remotely); generation of the weather "products"; display of the data and their export in standard formats; local storage management; monitoring of the operating status of the local radar and possibly of the other ones connected to the network; local and remote diagnostics and maintenance activities.

Typical applications

- ☑ Gap filling
- ☑ Observation and classification of weather phenomena on both local and extra-urban scale
- ☑ Support for hydrometeorological models and integration of existing pluviometric networks on medium-small basins
- ☑ Monitoring of urban area weather conditions for the creation of services for local authorities and users
- ☑ Protection of sporting events, concerts and public performances
- ☑ Protection of professional outdoor activities such as drilling, construction, harbor and airport activities, etc.
- ☑ Support for traffic and mobility management in the presence of adverse weather conditions
- ☑ Monitoring of events potentially harmful for agriculture and stock farming
- ☑ Insurance appraisals on damage caused by bad weather

Available weather products

Standard Products	Hydrology Products
PPI (Plan Position Indicator)	VPR (Vertical Profile)
RHI (Range Height Indicator)	SRI (Surface Rainfall Intensity)
CAPPI (Constant Altitude PPI)	SRISV (SRI with Side View)
VMI (Vertical Maximum Intensity)	SRT (Surface Rainfall Total accum.)
ECHO-VMI (Maximum Echo Height)	VIL (Vertical Integrated Liquid)
Advanced Products	CAPPI-SRI (CAPPI of SRI)
VCUT (Vertical Cross Section)	SRT-SUBC (Subcatchment Accumulat.)
VMISV (Vert. Max. Intens. Sideview)	**Turbulence / Wind Shear Products**
ECHO-TOP (Echo Top Height)	VAD (Velocity Azimuth Display)
ECHO-BASE (Echo Base Height)	VVP (Volume Vleocity Processing)
POH (Probability Of Hail Istant.)	SHEARA (Azimuthal Shear)
HYDRO-CLASS (Hydrometeor Class)	SHEARR (Radial Shear)
LBM (Lowest Beam Map)	SHEARH (Horizontal Shear)
HO-LBM (Height of LBM)	SHEARV (Vertical Shear)
...recasting Products	SHEARE (Elevation Shear)
...WCASTING (Nowcasting)	SHEAR2 (2D Shear rad.+elevat.)
...ORM (Storm Location and movement)	SHEAR3 (3D Shear rad.+azim.+elevat.)
...nverters	
CODER Bufr, Hdf5, MDV, GIF/BMP..	
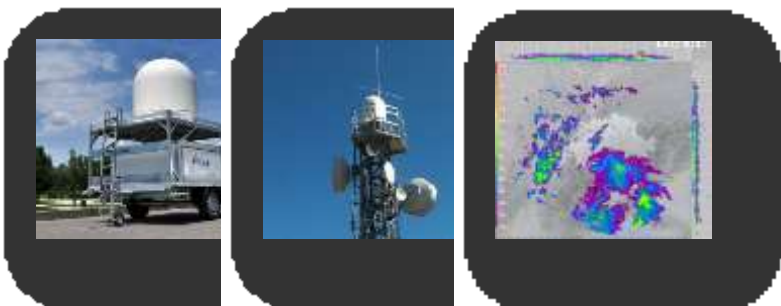
Technical specifications

Transceiver

Operating frequency	9410MHz ±30MHz
Peak power	25KW ± 20% (12.5 KW Horizontal Channel - 12.5 KW Vertical Channel)
Average power	5W, 7.5W, 10W (2.5W, 3.75W, 5W x channel)
Pulse width	0.2- 0.4 -0.8 uS (typ.) user selectable
Repetition frequency (PRF)	1000 – 750 – 500 Hz user selectable
Modulator	Solid State
Receiver	Linear Digital for simultaneous dual-polarization coherent on receive (Doppler)
Transmitter	Magnetron
Dynamic range	>90dB
Polarization	STAR
Noise figure	≤ 3.1 dB
Tuning	Automatic with AFC in real time

Antenna

Type	Parabolic prime focus reflector (ϕ 90cm)
Horizontal lobe width	≤2,5°
Vertical lobe width	≤2,5°
Sidelobes within ±10°	< -24 dB
Gain	≥ 36 dB
Scan Mode	• PPI: 0° to 360°, 1 deg/s to 45 deg/s • RHI: -10° to 120°, 1 deg/s to 14 deg/s • SECTOR: full sector scanning • POINT: fully programmable fixed-point acquisition
Sector Blanking	2 user programmable both in azimuth and elevation sectors

Signal processor

Type	Digital processing on PC			
Generated polar moments	uZ, cZ, W, V, Zdr, PhiDP, RhoHV, KDP, SNR, CCR, SQI, STAT1 and STAT2			
Clutter Correction	Doppler filtering (DFT) and Time-Domain filtering (IIR)			
Sensitivity	6 dBz @ 25Km			
Pulse integration	Configurable based on pulse number or antenna sync			
Calibration	Automatic (TX and noise correction)			
Range scale	30Km 40Km 60Km 120Km User selectable			
Range resolution	31.25m 62.5m 62.5m 125m Depending upon Range scale			

Radar Data Processing and Control (METRANET 2)

Web based real time display of products and mosaic
Local/remote real time display and control for maintenance
Open architecture for multi-radar networks (ELDES and third parts)

Dimensions

Dimensions (typical data)	Radome with base diameter 123.5 cm x height 143 cm
Weight	< 150 Kg excluding mast
Electrical Consumption	< 600 VA (PC Included)

Specifications are referred to the IC03 version and are subject to change without notice.

ISO 9001:2015