Doppler Weather Radar System

Solution for meteorological monitoring and analysis

One of the smallest and lightest

Compact Dual Polarimetric X-band Doppler Weather Radar
Model: WR-2100

Compact X-band Doppler Weather Radar
Model: WR-50

www.furuno.com
Soaring needs for Weather Radar that stem from intensifying extreme weather

A number of arguments on the global scale as to how to tackle problems arising from extreme weather, such as short localised rainstorms, tornados and other adverse phenomena, have been taking place recently. Subsequently, urgent needs have been recognised for the solution of localised weather forecasting as part of social infrastructure so as to protect human lives and assets from unexpected natural disasters, i.e., river floods, landslides, etc., hence delivering better safety and peace of mind to society.

Dual Polarimetric Doppler Weather Radar to contribute to prediction of occurrence of rainstorms

Dual Polarimetric Doppler Weather Radar simultaneously transmits and receives horizontally- and vertically-polarised radio waves. It is capable of computing the movement velocity of nimbus, as can be obtained from Single Polarimetric Doppler Weather Radar using horizontally-polarised radio waves, as well as precise precipitation intensity.

Shape of precipitation particles is horizontally-long oval, due to the effect from atmosphere and gravity. Using these characteristics, Dual Polarimetric Doppler Weather Radar obtains diameters of precipitation particles to compute precise precipitation intensity.
Classified as one of the smallest and lightest Weather Radar available in the market*

FURUNO, which has earned the leading market share in marine Radar, provides Dual Polarimetric X-band Doppler Weather Radar WR-2100 and Doppler Weather Radar WR-50.

With ultra high definition spatiotemporal resolution capability, the WR-2100 Dual Polarimetric Doppler Weather Radar grasps omni-directional precipitation intensity in 50-metre-mesh in six-second-intervals. By conducting high spatiotemporal resolution monitoring of the development process, three-dimensional structure as well as movement of a cumulonimbus, which causes precipitation, the development of short localised rainstorms can be predicted. Moreover, the WR-2100 has been downsized during the development phase to the extent that can be classified as one of the smallest and lightest Dual Polarimetric Doppler Weather Radar available in the market.

Combining the two types of Weather Radar, FURUNO delivers “Multi-Radar System” capable of conducting real-time 3D monitoring of meteorological phenomena at a modest investment.

* as of June 2013 (Dual Polarimetric Doppler Weather Radar)
In order to predict the development of short localized rainstorms, following the abrupt development of a cumulonimbus, high spatiotemporal resolution monitoring of meteorological phenomena is required. By downsizing both Dual Polarimetric Doppler Weather Radar and Single Polarimetric Doppler Weather Radar, FURUNO makes remarkable reduction on the deployment cost a possibility. Also, it has become easier to create “Multi-Radar System” by combining both Radar units.

High spatiotemporal resolution 3D monitoring of meteorological phenomena by “Multi-Radar System” makes possible the provision of precautionary information about prospective sediment disasters as well as information about evacuation routes, shelter location, etc., in case of foreseen rainstorms in real-time.

*The map data used in this page has been provided through Digital Japan Web System of Geospatial Information Authority of Japan.
*The terrain elevation data of the background has been obtained from “Shuttle Radar Topography Mission (SRTM)”, conducted by Jet Propulsion Laboratory, the US.

**System Configuration**

**WF-2100**

- Antenna Unit
- Signal Processing Unit
- Display Unit
- PC

**WF-50**

- Radar Unit
- Display Unit

**Image of “Multi-Radar System”**

Approximately 30km
CAPPI (Constant Altitude Plan Position Indicator) observation

by the WR-2100

Data from the identical altitude is to be extracted and monitored, suitable for observing the development of a cumulonimbus. (Altitude: 1-9 km)

On CAPPI observation, horizontal cross-section scans of a cumulonimbus are conducted at the equal altitudes. The altitude of a developed cumulonimbus top may exceed 10 km. Precipitation can be observed at higher altitude in a greatly developed cumulonimbus.

RHI (Range Height Indicator) observation

by the WR-2100

Vertical cross-section scan on a cumulonimbus is conducted, suitable for observing the development of a cumulonimbus.

On RHI observation, vertical cross-section scans of a cumulonimbus are conducted, hence easily grasping development status of a cumulonimbus. This case example clearly shows the active up-and-down movement of nimbus.

Doppler velocity observation

by the WR-2100 and the WR-50

Suitable for monitoring nimbus movement velocity and wind field.

On Doppler observation, by monitoring Doppler velocity of the nimbus, moving velocity of the nimbus, namely, wind speed and direction, can be computed. In this example, warm colors indicate the winds that move away from the Radar antenna, while cold colours indicate the winds that move towards the Radar antenna. The arrow lengths and direction indicate the wind speed and direction, respectively.

PPI (Plan Position Indicator) observation

by the WR-2100 and the WR-50

Monitoring is to be conducted at a fixated elevation angle, suitable for rainfall amount on the ground and low-level wind shear observation.

The antenna is rotated while fixing its elevation angle. PPI observation at low elevation angle generates rainfall amount on the ground. Also, when the rainfall amount data is accumulated for the duration of 1 hour, accumulated rainfall amount for 1 hour can be calculated. Also, by analysing the Doppler velocity obtained by PPI observation at low elevation angle, low-level wind shear can be obtained.

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Compact Dual Polarimetric X-band Doppler Weather Radar  
**WR-2100**

- Classified as one of the smallest and lightest Dual Polarimetric Doppler Weather Radar available in the market (Radome diameter: 108 cm, Radome weight: 65 kg)
- High-precision, real-time monitoring of precipitation intensity (mm/h)
- Outputs moving velocity of nimbus
- Outputs dual polarimetric Doppler information (Zdr, Kdp) for computing diameter of precipitation particles as well as discriminating types of precipitation (rain, snow, etc.)
- 3D scan to observe the vertical structure of a cumulonimbus
- Suitable for localised meteorological monitoring as well as for monitoring of short localised rainstorm, when networked into “Multi-Radar System”

**Compact X-band Doppler Weather Radar  
WR-50**

- Compact, light-weight Radome antenna (Radome diameter: 60 cm, Radome weight: 28 kg)
- Outputs movement velocity of nimbus and detects horizontal movement of nimbus at a fast rate
- Straightforward interface with power supply cable and LAN cable for data communications

**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Model Name</th>
<th>WR-2100</th>
<th>WR-50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna Polarity</td>
<td>Dual polarimetric (Vertical and Horizontal), simultaneously transmitted/received</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Operating Frequency</td>
<td>9 GHz band</td>
<td>9 GHz band</td>
</tr>
<tr>
<td>Beam Width</td>
<td>2.7 degrees (both horizontal and vertical beams)</td>
<td>5.0 degrees</td>
</tr>
<tr>
<td>Peak Output Power</td>
<td>100 W (both horizontal and vertical beams)</td>
<td>50 W</td>
</tr>
<tr>
<td>Vertical Scan Angle</td>
<td>-2 to 90 degrees (adjustable)</td>
<td>-2 to 90 degrees (adjustable)</td>
</tr>
<tr>
<td>Antenna Rotation Speed</td>
<td>16 rpm max. (adjustable)</td>
<td>16 rpm max. (adjustable)</td>
</tr>
<tr>
<td>Maximum Range</td>
<td>Approx. 30 km</td>
<td>Approx. 30 km</td>
</tr>
<tr>
<td>Scan Modes</td>
<td>PPI, CAPPI, RHII (Sector Scan available)</td>
<td>PPI, CAPPI</td>
</tr>
<tr>
<td>Data Processing Unit</td>
<td>Externally arranged</td>
<td>Incorporated</td>
</tr>
<tr>
<td>Output Data</td>
<td>Reflectivity factor Zh (dBZ), Doppler velocity V (m/s), Doppler velocity width W (m/s), Cross polarization difference phase ϕp (deg), Specific differential phase KDP (deg/km), Correlation coefficient between two polarizations pHV, Differential reflectivity factor ZDR, Rainfall intensity R (mm/h)</td>
<td>Reflectivity factor Zh (dBZ), Doppler velocity V (m/s), Rainfall intensity R (mm/h)</td>
</tr>
<tr>
<td>Data Correction</td>
<td>Distance attenuation, Rain attenuation, Excessive Doppler velocity, Suppression of signal returns from land, Clutter suppression</td>
<td>Distance attenuation, Rain attenuation, Excessive Doppler velocity, Suppression of signal returns from land, Clutter suppression</td>
</tr>
<tr>
<td>Communication Port</td>
<td>– LAN 100Base-T×1port</td>
<td>– LAN 100Base-T×1port</td>
</tr>
<tr>
<td>Power Supply</td>
<td>100-240 VAC, Single Phase, 50/60 Hz</td>
<td>100-240 VAC, Single Phase, 50/60 Hz</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>650 W max</td>
<td>300 W max</td>
</tr>
</tbody>
</table>

**Compact Dual Polarimetric X-band Doppler Weather Radar**  
**WR-2100**  
65 kg 144 lb

**Compact X-band Doppler Weather Radar**  
**WR-50**  
28 kg 62 lb

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