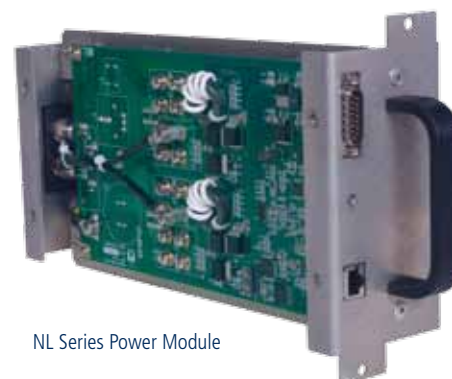


SPACE & POWER EFFICIENCY

Powerful Building Blocks

The building block of the NL Series is a Class D RF amplifier with Nautel's patent pending pulse power recovery technique which utilizes power that, using current technology, is normally dissipated in the antenna. The result is an RF module with outstanding efficiency regardless of antenna height.

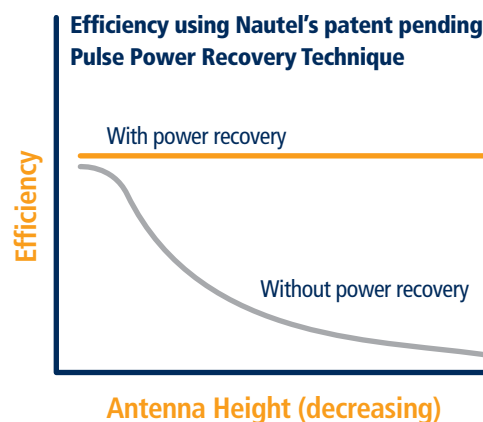


NL Series Power Module

These lightweight, hot-pluggable power modules slide into the front of the transmitter for easy servicing. Advances in amplifier technology make this amplifier extremely efficient and capable of operating at high power continuously while generating minimal waste heat. The result is very low transistor junction temperatures assuring reliable operation even in the highest ambient temperatures.

Robust Design

Nautel next generation LORAN transmitters are designed to withstand harsh environments all over the world. Tens of millions of hours of



real-world operational experience have gone into the design and construction of the NL Series. The result is unparalleled performance and reliability. In fact Nautel field experience indicates an MTBF in excess of one million hours for Nautel's navigation solutions.

Outstanding Efficiency Lowers Ownership Cost

Exceptional efficiency and low maintenance overhead make the NL series transmitters extremely cost effective to own and operate with overall efficiency typically reaching 70% or better. High efficiency means less energy is wasted as heat which reduces cooling and ventilation costs.

Class Leading Space Efficiency

NL Series transmitters are typically one half the size of competing solid state high power LORAN transmitters. Yet even with

its compact footprint, the NL Series offers easy and spacious access to all major serviceable components and modules. Energy efficiency also translates into additional space efficiency since less space needs to be allotted to HVAC services.

Lightning Protection

Nautel is recognized in the navigation and broadcast fields as experts in the proper transmitter design and site layout necessary to protect equipment from damage due to lightning strikes. Nautel has taken the same approach in designing the NL Series transmitters to ensure that, even in the harshest environments, your transmitters remain on air.

Redundant Architecture

Key components in the NL Series transmitters are hot-swappable, making service as easy as pulling and replacing a module. The NL Series features fully parallel redundant architecture on all active components assuring no single point of failure. The NL Series offers:

- Redundant Power Amplifiers
- Redundant Exciters
- Multiple parallel/redundant fans in each cabinet
- Redundant low voltage power supplies
- Failsafe manual and remote control
- Redundant switch mode power supplies
- 10% PA overhead

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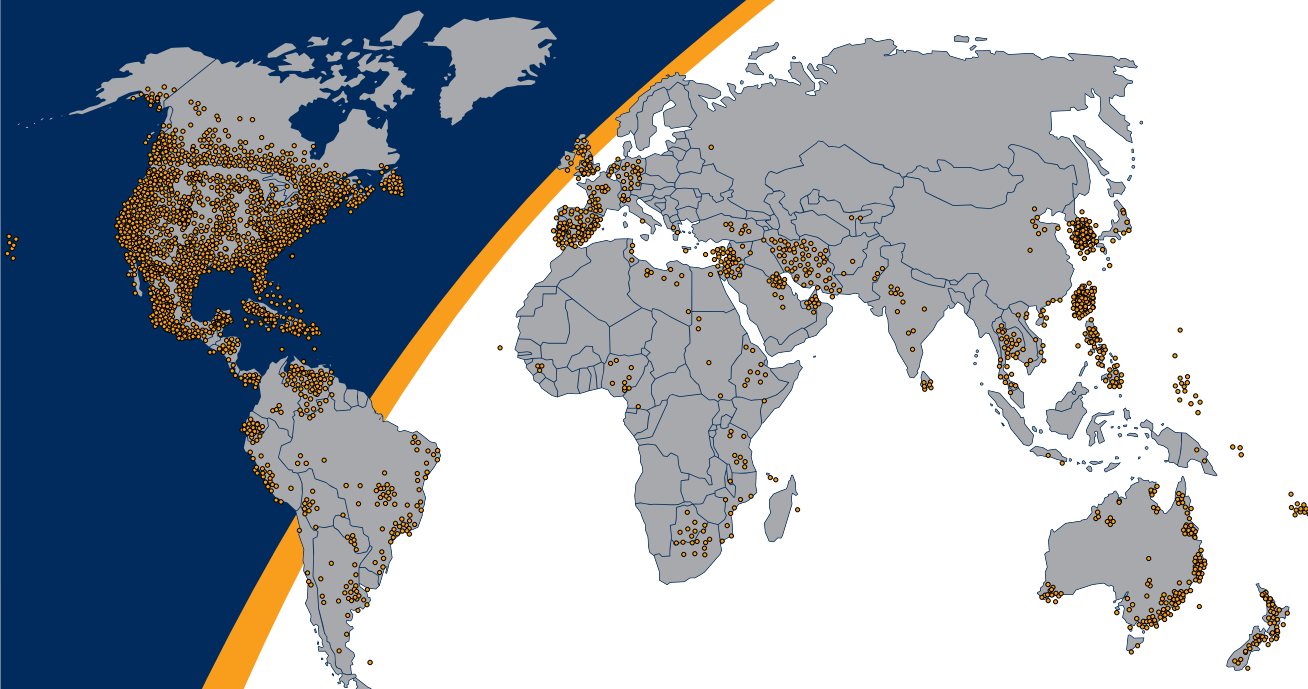
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Nautel installed transmitters Over 7700 in 170 countries



WHY CHOOSE NAUTEL?

Nautel designers and engineers have the experience to support our products, old or new. Our customer service staff is available 24 hours a day, 7 days a week to answer your questions and provide experienced technical support. We provide extensive training and on-site support for all our products along with extended warranties and a ready supply of parts that can be shipped at a moment's notice.

Nautel products include extensive documentation, manuals and schematics to guide you through everything from installation to troubleshooting. We build value into every piece of equipment that leaves our facilities; in terms of technical features, innovation and cost effectiveness, Nautel is always one step ahead of the pack.



Next Generation LORAN Transmitters



NL Series

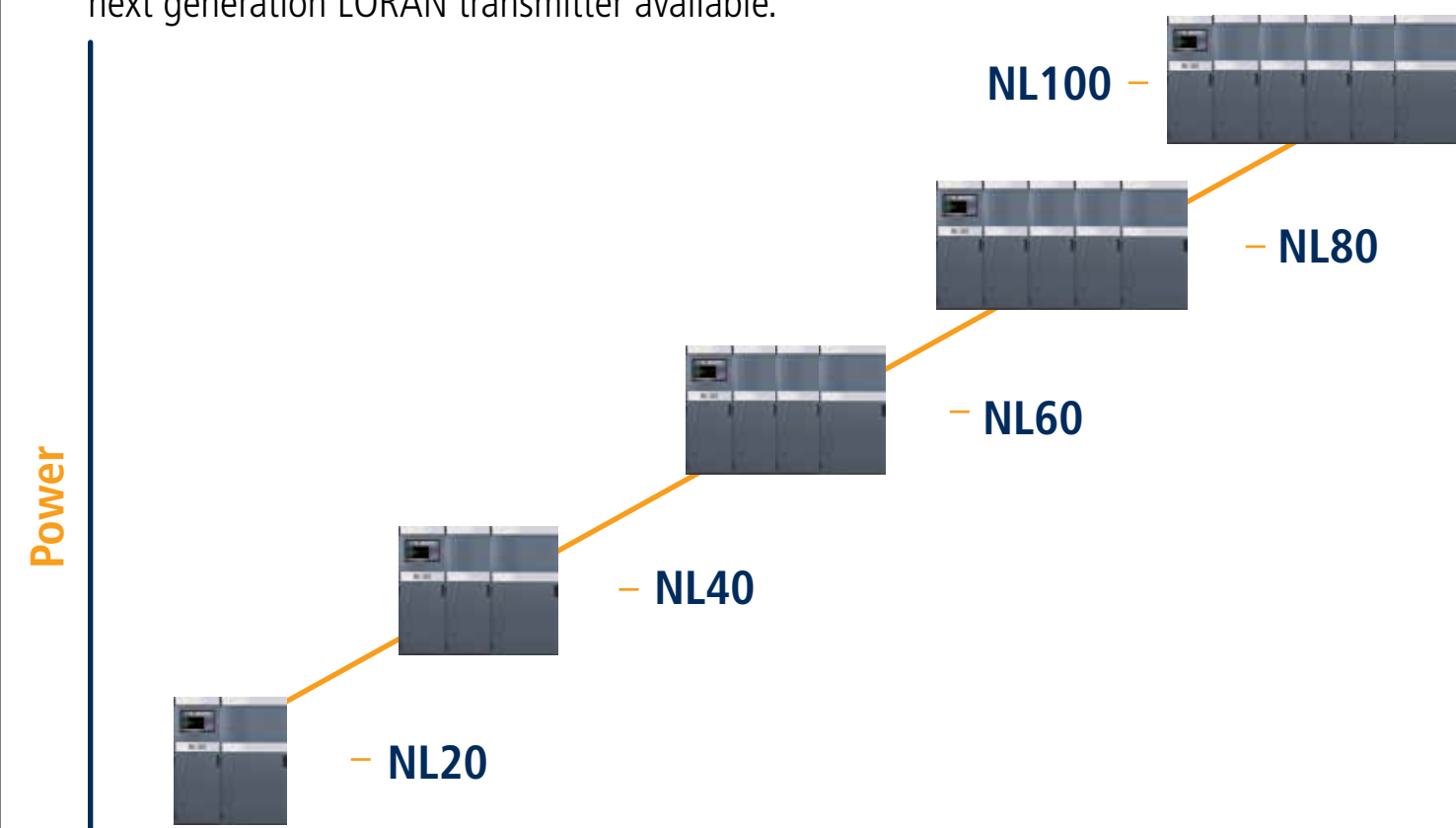
NL Series

The next generation of LORAN transmitters

The NL Series sets a new standard for a next generation LORAN transmitter with outstanding performance, rugged design and operational ease in the industry's most compact enclosure. The NL Series also features a software configurable pulse shape ensuring the ability to meet the demands of future modulation techniques. Add exceptional pulse stability, 70% efficiency, unmatched levels of redundancy plus an intuitive touch screen interface and the result is the most advanced next generation LORAN transmitter available.

NAUTEL INNOVATION

- Industry's top efficiency: 70%
- Patent pending pulse power recovery technique
- Precise pulse control
- Lightweight hot-swap redundant power modules
- Intuitive touch screen interface
- Web based remote control and monitoring
- Ultra compact design



The NL Series naming convention is based on the total number of active modules in a given transmitter (ex. NL40 – 40 power modules)

Preliminary

1.5MW

THE NL SERIES OFFERS SCALABILITY FROM TENS OF WATTS TO MORE THAN 1.5 MW

Power Scalability

The NL Series platform is extremely scalable utilizing Nautel combining techniques that have been proven reliable in the field for over 25 years at peak power levels of more than 1.5 MW. In addition, the unique low-power scalability of the NL Series opens up a whole new set of cost effective in-fill coverage applications.

The NL Series also supports increased average power capability allowing higher pulse rates and future or alternate modulation techniques. No matter what size transmitter you deploy, the NL Series' redundant architecture ensures extreme reliability.

NL Series

MODULAR NEXT GENERATION LORAN ARCHITECTURE

NEXT GENERATION CONTROL & MONITORING



OUTSTANDING RELIABILITY / SERVICEABILITY

Inherent Reliability

NL Series transmitters are ruggedly engineered to provide easy on-air service and maintenance. The NL Series combines 24 hot-swappable modules in each power cabinet with front panel access. At all power levels, all modules contribute equally to the final output. The NL series can experience significant RF amplifier failure with no change in pulse shape or timing. Further losses reduce amplitude while maintaining the integrity of pulse shape and timing.

Less Maintenance/Fewer Site Visits

The NL Series ability to stay on the air all but eliminates the need for emergency site visits. Repairs or module replacement can be performed whenever it is convenient.

Automatic Standby Exciter

A critical component of any transmitter is the exciter which provides coherent drive to the power modules. These signal processing and control circuits generate RF carrier and control signals necessary for pulse generation. A unique feature of Nautel transmitters is the complete duplication of these circuits. Should a failure occur in the RF drive or modulator drive, the transmitter automatically switches to the built-in standby exciter. This dramatically enhances the already high operational reliability inherent in the modular solid-state design.

Extensive Remote Diagnostics

Maintenance is further simplified thanks to the advanced remote control and monitoring capability of the NL Series. Faults can be diagnosed remotely to the Lowest Replaceable Unit level so staff traveling to the transmitter site can take only the specific spares required.

Fewer Smaller Spares

Nautel's redundant architecture with built in spare modules not only maximizes on-air continuity, it greatly minimizes spares requirements. Should you choose to keep spares on hand Nautel has designed compact Lowest Replaceable Units for easy and economical storage. As an example the NL Series power module weighs less than 5 lbs or 2.5 kg. No special tools or lifts are required.

Unattended Operation

The NL Series is ideally suited for unattended, automatic or remote controlled operation. After an AC power loss, over voltage or RF overload, prior operating status is automatically restored. The NL Series also features automatic antenna tuning for reactance changes in the antenna and pulse optimization for changes in antenna resistance.

This block diagram shows Nautel's highly redundant RF drive chain and pulse generation stage for Next Generation Loran transmitters

Exciter/Transmitter Controller

Two exciters, in main/standby configuration, generate the required pulse sequence to drive the PAs. The exciters also monitor the output pulse and if a fault occurs, initiate a changeover to the standby side.

Rack Controller

Dual main/standby rack controller boards interpret the pulse sequence information from the exciters and generate the control signals for the individual power amplifiers.

Power Amplifiers (PAs)

Redundant, hot-swappable PAs make up the pulse generation stage, switching on and off in sequence to generate the Loran pulse. An additional number of redundant PAs, which are in the "off" mode, are supplied as active spares further increasing the robustness of the system

Passive Series/Parallel Combiner

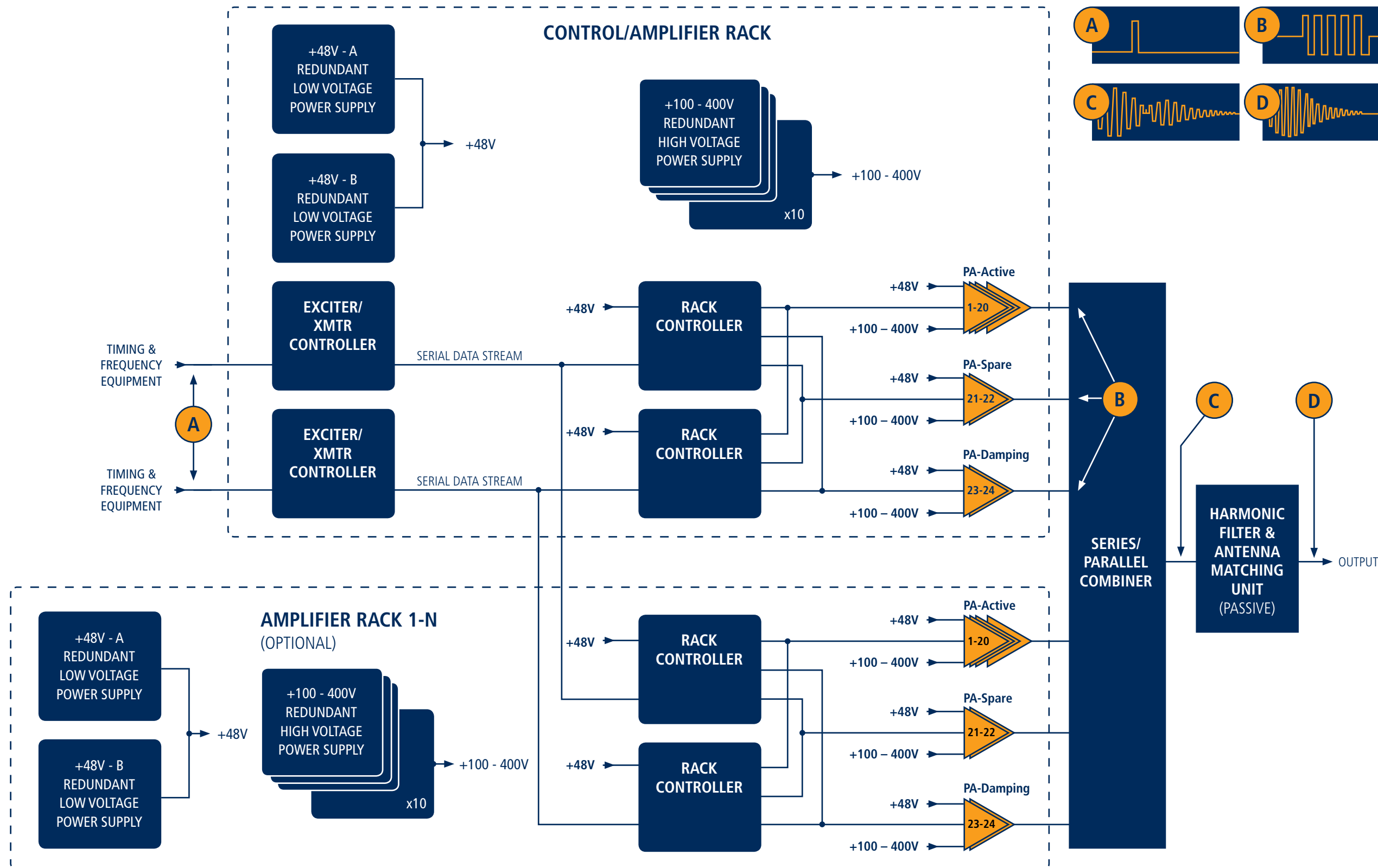
The series/parallel combiner combines the output of each individual PA to generate the required output.

Passive Harmonic Filter and Antenna Matching Unit

The harmonic filter removes any unwanted harmonics from the Loran signal generated by the transmitter. The antenna matching unit matches and tunes the antenna impedance to that required at the output of the transmitter.

Low Voltage/High Voltage Power Supplies

A number of redundant, hot swappable, low voltage and high voltage power supplies provide the necessary dc voltage to power the transmitter and drive the RF power amplifiers.

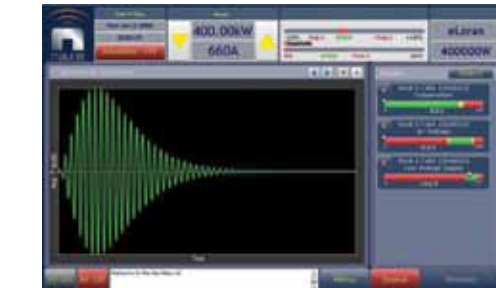


NL Advanced User Interface (AUI)

The NL Series features a 17 inch color LCD screen with a wide range of control, monitoring and diagnostic features. The AUI can be controlled by touch screen, or via a mouse and keyboard. Some of the features of the AUI include:

- LORAN data acquisition and diagnostic functionality.
- Comprehensive monitoring and control.
- Logging of all functions.

Screens are easy to set up and read, and clearly display the parameters you need to see. Administrators have the ability to set permissions to define user roles and password protection is available to safeguard against unauthorized access to the AUI.



Sophisticated Remote Control and Monitoring

No matter where you are, you're only moments away from ensuring your NL Series transmitter is operating optimally. Pull up a web browser, enter your transmitter's IP address, and you're connected. 100% of the local NL Series display functionality is available on any web-interfaced PC or handheld device via the internal NL Series web server. Users can access status, controls, alarms, logs and reports anywhere internet access is available.

Control Redundancy

The touch screen interface is implemented as a non-critical functional unit and may be completely removed from the system without affecting transmitter operation. A back-up control interface provides control in case of front panel computer system failure. In addition to web based access the NL Series also supports traditional direct wired contact closure capability for local or remote control.

NAUTEL NL SERIES QUICK SPECS

Specifications per control/power cabinet

24 RF power modules each with:

- Microcontroller for protection and monitoring
- Short circuit protection
- Hot pluggable

Module configuration (per control/power cabinet)

- 20 active
- 2 spare
- 2 damping

Pulse Timing Stability

- Extremely low jitter
- Highly accurate pulse timing
- 700 Pulse Per Second (PPS) capable

Antenna Tuning

- $\pm 5\%$ antenna tuning capability
- Control and Monitoring
- 17" / 436mm LCD touch screen
- Web based remote access/control
- Contact closure remote
- Redundant back-up control interface
- Module level monitoring

Dual exciters

- Automatic changeover
- Main/Standby signal chain

Efficiency

70% Typical

Voltage

208V 3 phase 50/60 Hz or to customer specifications

NL Series dimensions per cabinet

Control/Power cabinet(s)

1.84 m H x 0.71 m W x 1.02 m D
72.5" H x 28" W x 40" D

Filter cabinet

1.84 m H x 0.96 m W x 1.02 m D
72.5" H x 37.75" W x 40" D