LINEAR DENKI

E-Compact
Less energy. More power.
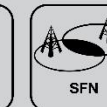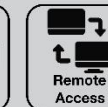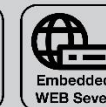
FM Series
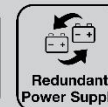## DDS Broadband FM Transmitters
76 to108 MHz
1.200 to 40.000 Watts RMS

- **SoC Technology**
- **High Efficiency**
- **Smart Fan Control**
- **Redundant Power Supply**
- **Embedded WEB Sever**
- **Remote Access**
- **SFN**
- **Surge Protector**
- **RoHS** Compliant
- **iso 9001** Certified

KOKUSAI DENKI Electric Linear S/A

English

FM Series

The E-Compact line of FM transmitters with DDS (Direct Digital Synthesizer) technology offers superior transmission quality and a wide range of technological advantages, distinguishing it from traditional transmitters modulated directly at the VCO (Voltage-Controlled Oscillator).

■ **PLL UNLOCKED NEVER AGAIN!** Transmitters modulated directly at the VCO are susceptible to ng synchronization loss (PLL UNLOCKED), especially with low-frequency audio, which can take the station off the air. The E-COMPACT FM DDS transmitter, with a digitally synthesized carrier, is not affected by audio variations, ensuring continuous and stable transmission, keeping your station always on the air.

■ **EffiMax TECHNOLOGY!**: The EffiMax technology present in the E-Compact FM DDS line performs automatic and intelligent corrections of the transmitter efficiency when there are changes in the operating frequency and power. This advanced feature dynamically optimizes performance, taking into account critical parameters such as power supply voltage and exciter signal level. In this way, EffiMax technology ensures more efficient and stable operation, maximizing component durability and energy efficiency, all automatically, without the need for manual intervention.

■ **HIGH GAIN HPA – ONE EXCITER MODEL**: The E-Compact FM DDS transmitters are built with high-gain power modules, allowing the use of low-power exciters, which are more robust compared to the high-power exciters commonly used in transmitters with low-gain modules. The whole E-Compact FM DDS transmitter line, from 1,000 watts to 40,000 watts, uses the same FM9001 exciter, warranting a stable and secure operation and providing parts uniformity and reliability.

■ **RF POWER COMBINERS, CABLELESS**: E-COMPACT FM DDS transmitters use isolated progressive combiners to combine power modules. RF connections are made with quick-connect terminations and rigid lines, eliminating connectors and coaxial cables prone to failure. This ensures a clean and highly reliable construction for the transmitter.

■ **EMBEDDED WEB INTERFACE**: The E-COMPACT FM DDS is developed with SoC (System on Chip) technology, allowing integration with web servers. This provides a graphical and intuitive web interface, accessible from tablets, smartphones, and other devices without the need for additional applications. It facilitates remote monitoring and control of all transmitter functions, offering operational convenience and flexibility.

■ **PARAMETRIZABLE SOFT LIMITER**: E-Compact FM DDS transmitters feature an advanced soft limiter that protects the audio signal from distortion and excessive peaks, ensuring modulation limits are within established standards. This feature is user-configurable, allowing precise control over audio dynamics. It ensures consistent quality within the modulation channel, without noticeable clipping or compression in the demodulated audio.

■ **INTEGRATED RDS**: The E-COMPACT FM DDS transmitter includes an integrated RDS (Radio Data System) generator, which transmits information such as the station name and program identification. For more advanced functionalities, we offer the optional RDS ENHANCED, enabling remote interactivity with information-generating devices, along with all other RDS system features.

■ **DIGITAL AUDIO PROCESSOR**: An optional state-of-the-art digital audio processor is available, with multiband processing. Available in 5 or 10 band options, it features precise equalization, and audio level control, providing dynamic and consistent sound, eliminating the need for additional equipment.

■ **AUDIO SERVER (AUTOMATIC AUDIO PLAYER)**: An optional audio server is embedded in the web interface, allowing for the upload of audio files in various formats. In the event of an interruption in the transmitter's input signal, the server is automatically activated as a backup, keeping the station on air with preloaded programming. This eliminates the need for USB drives, memory cards, or other external devices.

■ **ONBOARD FM SIGNAL ANALYZER**: Optional feature available at the front panel and web interface, providing a Modulation Monitor that samples the signal radiated by the transmitter and uses advanced processing resources to offer real-time measurements such as modulation analysis, which evaluates the signal's quality and fidelity, modulation level indicators, which monitor the intensity of the transmitted signal, and an alarm function that alerts about modulation problems outside specified parameters. All this is available in an intuitive and easy-to-use interface for convenient and efficient operation.

■ **GPS SYNCHRONISM TO OPERATE IN SFN**: An option to embed a GPS-based time synchronization mechanism for operation in SFN (Single Frequency Network). High-precision digital synchronization adjustment with sub-microsecond delay or advance resolution.

Available Resources

MCCB (Molded Case Circuit Breaker)[4]
AC distribution module with load capacity from 16 kW to 64 kW composed of circuit breaker and contactor, with operating range of 200Vac to 250Vac (Typ 230Vac). It has 02 safety interlocks to cut the equipment's power.
DEFAULT

SPD (Surge Protection Devices)
Extra protection integrated into the MCCB acting against overvoltage surges from the electrical network, optional for EC801HP and default for other HP models.
DEFAULT

Easy Maintenance" Concept
Power supplies with plug-in connections, eliminating the need for cables and wiring, allowing quick and safe replacement. All fans and air filters of the transmitter are easily accessible from the front panel, allowing for easy cleaning and replacement maneuvers
DEFAULT

Embedded WEB Server
Remote access to all configurations and management of the transmitter via web browser on PC or Smartphone through the Ethernet port[1], without the need for driver or application installation.
DEFAULT

Remote Software / Firmware Update
Remote and secure software updates via the WEB interface, eliminating the need for USB drives, memory cards, or other external devices.
DEFAULT

Embedded Soft Limiter
Ensures modulation limits are within established standards, preventing distortions and excessive peaks. Configurable according to user preferences, it offers precise control over audio dynamics, ensuring consistent quality within the modulation channel without clipping or compression in the demodulated audio.
DEFAULT

Tone Generator
Tone generator with adjustable audible frequencies, to assist in installation and maintenance maneuvers. This feature allows quick and precise identification of the transmitted signal during technical checks and adjustments. Configurable frequencies range from 50 Hz to 15 kHz, with adjustable power levels.
DEFAULT

Embedded Basic RDS
Embedded RDS generator in the WEB interface, providing group 0A/0B functions: PI (Program Identification), unique station identification code, and PS (Program Service Name), radio station name.
DEFAULT

Modulator Interfaces
Inputs: MPX, SCA, Reference
Outputs: Reference
DEFAULT

Isolated RF Combiners[4]
Isolated progressive combiners in the power modules. High-power RF output connections done with rigid lines, eliminating coaxial cables prone to connector failures.
DEFAULT

2,700 W Power Supply
The HPA operates with 2,700 W PSU(s) in share mode, with front access and plug-in connection. The quantities of line PSU(s) and the total power supply slot capacity are described in the "Models and their specific characteristics" table.
DEFAULT

FM Signal Analyzer
Evaluates the performance of the transmitted audio by sampling the signal captured from the air.
Allows real-time management of measurements such as total modulation, 19kHz pilot subcarrier, positive and negative peaks, right and left channels, main channel (L+R), stereophonic channel (L-R), AM noise, and subcarriers at 38kHz, 57kHz, 67kHz, and 92kHz, the presence of the 19kHz pilot subcarrier, and stereo or mono operation mode.
DEFAULT

Digital Manuals
DEFAULT

Audio Encoder
Embedded MPX digital synthesis encoder
Digital inputs: AES/EBU, S/PDIF
Analog inputs: Left / Right balanced XLR
Output: MPX sample
OPTIONAL

5-Bands Audio Processor
Embedded 5-bands digital audio processor. AGC control, equalization, stereo enhancer, clipping control, and configurable compression.
OPTIONAL

10-Bands Audio Processor
Embedded state-of-the-art 10-bands digital audio processor. Dynamic span control for each of the 10 bands, equalization, clipping control, and configurable compression.
OPTIONAL

Audio Server
Integrated audio server in the WEB interface, allowing for the upload of files in various formats. The configurable player can activate predetermined playlists in case of loss of the main audio link, without the need for USB drives, memory cards, or other external hardware.
OPTIONAL

Enhanced RDS
Fully parameterized RDS generator with all advanced functionalities, such as unique station identification, station name transmission, program type classification, dynamic text message sending, precise time and date information provision, alternative frequency list, traffic bulletin indication, and other station transmission information. It also allows remote interactivity with information-generating devices via ASCII over IP or UECP over IP protocols, all in compliance with international RDS standards.
OPTIONAL

Audio Input via IP
Allows the two STREAMING ports on the modulator to operate independently as audio input via IP. Supports AAC, MP3, and MPX audio standards. Includes an embedded MPX digital encoder for L/R audio via IP or MPX audio for the modulator.
OPTIONAL

MPX OUTPUT VIA IP
Provides the MPX signal generated by the transmitter's audio encoder or processor via STREAMING output.
OPTIONAL

Certified Company
ISO 9001
certification since 2002

SRT PROTOCOL VIA IP Supports the SRT (Secure Reliable Transport) protocol for secure and reliable audio transmission over the Internet. Compatible with the latest streaming technologies, the transmitter allows connection to online broadcast servers and platforms, expanding content distribution possibilities and audience reach. Includes support for SRT Caller and Listener for bidirectional communication, integrated encryption and authentication for advanced security, and ultra-low latency for real-time transmission.	**OPTIONAL**
Dual Drive[5] Backup modulator/exciter that enables automatic redundancy without the need of a separate control module.	**OPTIONAL**
Extra 2,700 W Power Supply for Redundant Operation The power drawer allows for the addition of an extra power supply in share mode for redundant power operation across all models of the E-Compact FM Line.With frontal access and plug-in connection.	**OPTIONAL**
GPS Time Base High-precision time base synchronization via GPS. High performance for SFN (Single Frequency Network) operation. Includes an external GPS antenna and surge protector.	**OPTIONAL**
Remote Telemetry Device via 4G Remote monitoring of the transmitter using GPRS / 3G / 4G cellular network, compatible with SNMP management software and email alerts for alarms and status. (Telemetry service contracted separately.)	**OPTIONAL**
SPD (Surge Protection Devices) Extra protection module against electrical network overvoltage surges, optional for models up to 5,000 Watts and standard for models above 5,000 Watts.	**OPTIONAL**
S-Guardian Isolating Transformer Protection device against electrical variations, including voltage spikes, noise, and interference. Equipped with an electrostatic shield transformer and surge suppression devices, it provides superior electrical isolation from the power grid,	**OPTIONAL**

General features

Standard 19" Rack;
Fully solid-state;
Air-cooled;
Automatic restart in case of power failure;
Operates in SFN (Single Frequency Network) and MFN (Multiple Frequency Network);
Control and management firmware for the entire equipment;
Access to settings and management of parameters via display interface on the front panel of the Exciter or remotely via Ethernet (WEB server or SNMP);
Alarm indication LEDs present on the front panel of the Exciter (FM9001), the Power Module (HPA) and the Dummy Load Module (DL);
Access to the list of current or past alarms via display interface on the front panel of the Exciter or remotely via WEB interface;
VSWR and Overpower protection via hardware and software, with automatic power reduction;
Software protection against module temperature increase, with alarm signaling and power reduction;
Automatic fan rotation speed control;
Power supply with PFC (Power Factor Correction) and soft start with In-Rush limitation.

Models and their specific characteristics

	EC801MP	EC802MP	EC803MP	EC801HP	EC802HP	EC803HP	EC804HP	EC805HP	EC806HP	EC808HP
RMS Power:	1.200 W	2.400 W	3.600 W	5.000 W	10.000 W	15.000 W	20.000 W	25.000 W	30.000 W	40.000 W
Typical AC Consumption [2]:	1.710 W	3.430 W	5.140 W	7.140 W	14.280 W	21.420 W	28.570 W	35.710 W	42.850 W	57.140 W
Typical Thermal Dissipation [2]:	1.760 BTU/h	3.510 BTU/h	5.260 BTU/h	7.310 BTU/h	14.620 BTU/h	21.930 BTU/h	29.240 BTU/h	36.550 BTU/h	43.870 BTU/h	58.490 BTU/h
Typical Efficiency [2]:	70%									
Supported Electrical Network:	M220 B220 T220 T380						T220 T380			

	EC801MP	EC802MP	EC803MP	EC801HP	EC802HP	EC803HP	EC804HP	EC805HP	EC806HP	EC808HP
Power Amplifier Model:	PA801MP	PA802MP	PA803MP	PA804HP	PA804HP	PA804HP	PA804HP	PA804HP	PA804HP	PA804HP
Power Amplifier Height:	2 RU		3 RU	4 RU						
Power Pallets per Power Amplifier:	1	2	3	4						
Power Amplifiers (HPA):	1				2	3	4	5	6	8
PSU per Power Amplifier:	1	2		3						
Capacity of PSU(s) per Power Amplifier (Redundancy):	2	3		4						
RF Output Connector (50Ω):	DIN 7/16" EIA 7/8" EIA 1 5/8"			EIA 7/8" EIA 1 5/8"		EIA 3 1/8"				
Mounting:	DESKTOP			RACK 19" or DESKTOP	RACK 19"					
Height:	3 RU		4 RU	8 RU	20 RU	24 RU	32 RU	36 RU	44 RU or (2x) 24 RU	(2x) 32 RU
Width:	483 mm	483 mm	483 mm	516 mm	602 mm	602 mm	602 mm	602 mm	602 mm	1,202 mm
Length:	590 mm	590 mm	590 mm	816 mm	1.032 mm	1.232 mm	1.232 mm	1.232 mm	1.232 mm	1.232 mm
Weight:	30 Kg	35 Kg	40 Kg	45 Kg	210 Kg	350 Kg	420 Kg	500 Kg	600 Kg	800 Kg

Technical Features

RF

Operating Frequency	76 MHz to 88 MHz 88 MHz to 108 MHz
Bandwidth	200 kHz
Minimum Operating Power	1% of the rated power
Power Stability	±10%
Carrier Generation	NCO-based synthesis
Frequency Stability	±50 ppb
Phase Noise	≤-95 dBc/Hz @ 1 kHz

Harmonic and Spurious Attenuation Away from the Main Carrier without Modulation

From 120 kHz to 240 kHz	>25 dB
From 240 kHz to 600 kHz	>35 dB
> 600 kHz	>74 dB @1.200 W RF Out >77 dB @2.400 W RF Out >79 dB @3.600 W RF Out >80 dB @ ≥5.000 W RF Out

Modulation

Modulation Type	FM DDS (Direct Digital Synthesis)
Modulation Percentage	100% @ ±75 kHz offset
Analog Input MPX IN	Frequency Response: 20 Hz to 100 kHz Adjustable level; 0 dBu nominal BNC-FEMALE Connector Impedance: 10 kΩ Level: +4 dBu nominal Adjustable: -7 to +7 dBu
Analog Input SCA IN	Resp. de Freq.: Frequency Response: 57 kHz to 100 kHz Level: 2Vpp @ ±7.5kHz deviation BNC-FEMALE Connector Impedance: 10 kΩ Level: -0.8 dBu @ ±7.5kHz deviation

Audio Frequency Response

Amplitude response for frequencies from 50 Hz to 15 kHz within the established limits of pre-emphasis	25 µs 50 µs 75 µs (Default) Maximum variation of ±1dB within the limits
Flat harmonic distortion from 40 Hz to 15 kHz	< 0,06%
FM Noise from 50 Hz to 15 kHz	< 70 dB @100% modulation
AM Noise from 50 Hz to 15 kHz	< 53 dB @100% modulation
Analog audio input and composite signal	20 Hz to 100 kHz +4 dBu @ 75 kHz modulation 75kHz @ 100% modulation

External Synchronization References

Automatic reference signal input detector	10 MHz 1 PPS
	BNC-FEMALE Connector Impedance: 50 Ω @10 MHZ Level: -10 dBm to +10 dBm
REF IN	Impedance: 10 kΩ @1 PPS Level: 3V3TTL (2.2V minimum) Automatic impedance change on signal detection.
REF OUT	BNC-FEMALE Connector Selectable output signal: Impedance: 50 Ω @10 MHZ Level: +8 dBm Impedance: 10 kΩ @1 PPS Level: 3V3 TTL

Audio / Stereophony Encoder (OPTIONAL)

Analog Inputs LEFT IN RIGHT IN	Frequency Response: 20 Hz to 15 kHz Balanced XLR-FEMALE connector Impedance: 600 Ω Level: 0 dBu nominal Adjustable from -12 to +12 dBu)
Digital Input AES-EBU IN	Balanced XLR-FEMALE connector Impedance: 110 Ω Vpto: 192 kSps Level: -22 dBfs: Adjustable: -50 dBfs to 0 dBfs
Digital Input S/PDIF IN	BNC-FEMALE Connector Impedance: 75 Ω Vpto: 192 kSps Level: -22 dBfs: Adjustable: -50 dBfs to 0 dBfs
Analog Output MPX OUT	Frequency Response: 20 Hz to 100 kHz BNC-FEMALE Connector Impedance: 100 Ω Adjustable: 0 Vpp to 5 Vpp
Pilot Carrier Level	19 kHz ±2 Hz Level from 0 to 12% modulation 0.01% steps
Pilot Carrier Phase	Adjustable (Step <1°)
Suppression 19kHz/38kHz	< -63dB
Separation between stereo channels	> 57dB

GPS Antenna Input (OPTIONAL)

Connector	SMA Female
Impedance	50 Ω
Accessories	External antenna, cable, and surge protector

Interface Ethernet[1] (OPTIONAL)

Digital Audio Stream	RJ45 Connector (2 ports) RTP Receiver: Unicast RTP/UDP compatible receiver Decoder: HE-AAC (v.1 and v.2), MPEG-1 Layer 3 or raw PCM

Interfaces

Local equipment control interface	Graphic display 256x64 pixels Navigation cursor keys
Modulation Monitoring	Total modulation information on the graphic display or on the WEB Interface
Signal indication LEDs	Alarm LEDs on the Exciter (FM9001), the Power Module (HPA) and the Dummy Load Module (DL);
Management (MNGT)	RJ45 Connector IEEE802.3u 10 Base-T /100Base TX format Ethernet[1] access WEB server and SNMP (Telemetry)

Electrical Characteristics

AC Input Voltage	198~250 VAC 220 VAC ±10% (Typical)
AC Frequency	47~66 Hz
PFC	0,98 (Typical), 0,96 (>20% Load)

Operating Environment Characteristics

Operating Altitude	Up to 2,500 meters[3] above sea level
Ambient Temperature	0 °C to +50 °C (+25 °C recommended)
Relative Humidity	0 to 95% non-condensing
Cooling of Power Amplifiers	Forced ambient air, front-to-back flow through high-volume integral fans

Notes:

[1] Ethernet is a trademark of Xerox Corporation.

[2] Measurements in optimized channel and environment, may vary according to the operating frequency. Measured efficiency: AC/RF Out.

[3] Rated power up to 2,500m. Above 2,500m, consult the factory.

[4] MCCB and Isolated RF Combiners available only on EC802HP, EC803HP, EC804HP, EC805HP, EC806HP, EC808HP models.

[5] Dual Excitation option is available for 19" rack mount models (EC801HP-RACK, EC802HP through EC808HP).

KOKUSAI DENKI Electric Linear S/A

Avenida Frederico de Paula Cunha, 1001 – Maristela
Santa Rita do Sapucaí – MG – Brasil – CEP: 37536-162
Telephone: +55(35) 3473-3473
www.lineardenki.com.br
www.kokusai-denki.com.br

REV07 – JANUARY/2025

Certified Company
ISO 9001
certification since 2002