Broadcasting FM

LINEAR DENKI

E-Compact

Less energy. More power.

FM Series

DDS Broadband FM Transmitters

76 to108 MHz

1.200 to 40.000 Watts RMS

English

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

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**
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**
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**
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**
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**
MPX Encoder Embedded MPX digital synthesis encoder. Digital inputs: AES/EBU, S/PDIF. Analog inputs: Left / Right balanced XLR. Output: MPX sample.	**OPTIONAL**
5-Band Audio Processor Integrated audio processor with 5-band parametric equalizer, consisting of a 30Hz high-pass filter, shelf filters for low and high frequencies, and three peak filters with adjustable bandwidth. It also has complete dynamics control, including noise gate, compressor with makeup gain and hard clipper, ensuring clean, consistent audio protected against peaks and distortions. All parameters are fully configurable.	**OPTIONAL**
10-Band Audio Processor High-precision audio processor, with 10-band parametric equalizer, including a 30Hz high-pass filter, shelf filters at the frequency ends and eight peak filters with frequency, gain, bandwidth and slope control. The dynamics control system is complete, incorporating a noise gate, compressor with makeup gain and hard clipper, optimizing the content for intelligibility, power and transmission safety. All parameters offer fine adjustment according to the needs of the broadcaster.	**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 playlist 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**
MPX over AES Input Enables digital transmission of the composite FM (MPX) signal — including stereo, pilot, and RDS — via AES3 (AES/EBU) interface at 192 kHz. Ensures superior audio quality, eliminates analog conversions, and keeps the signal 100% digital from the processor to the transmitter. Ideal for modern, high-fidelity broadcast systems.	**OPTIONAL**

Audio over IP input (AoIP) Allows the two STREAMING ports on the modulator to operate independently as audio inputs over IP. Supports AAC, MP3 and MPX audio standards. Includes onboard MPX digital encoder for L/R audio over IP or MPX audio to the modulator. Supports RTP/UDP (real-time streaming) and SRTP (real-time streaming protocol) transport protocols.	**OPTIONAL**
IP Input - MicroMPX Decoder [1] MicroMPX is an STL (Studio-to-Transmitter Link) codec. It carries a complete FM composite MPX signal, including pilot and RDS, at a bit rate of only 320 kbit/s, with perfect peak control. Using MicroMPX, you can generate your signal completely in your studio and easily distribute it to all your transmitters. The MicroMPX[1] Decoder will accurately recover the composite audio signal according to the settings defined on your broadcast source.	**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 [6] 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 for SFN High-precision time base synchronization via GPS. High performance for SFN (Single Frequency Network) operation. Includes an external GPS antenna and surge protector.	**OPTIONAL**
SFN (Single Frequency Network) [8] Allows delay adjustments for synchronization between one or more FM transmitters operating on the same frequency.	**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, minimizing damage caused by instabilities and ensuring reliable protection for the transmitter.	**OPTIONAL**
Energy Backup Emergency power supply system designed to ensure continuous operation in the event of a power failure. Equipped with fast switching technology and high-efficiency batteries, it offers reliable support for critical applications. Available in different capacities to suit all transmitter	**OPTIONAL**

General Characteristics

Digital synthesis modulator (DDS) built with SoC (System on Chip) technology. Hardware with several system elements integrated into a single chip that allows for high-power processing software. High-precision audio processing and digital modulation;
Assembled in a standard 19” Rack cabinet;
Fully solid-state. Power amplifiers built with LDMOS transistors;
Air-cooled;
Automatic fan rotation speed control;
Automatic restart in case of power failure;
Operates in SFN (Single Frequency Network) and MFN (Multiple Frequency Network);
Software for controlling and managing the entire equipment;
Access to settings and parameter management via display interface on the Exciter front panel or remotely via Ethernet[1] (WEB server or SNMP);
Alarm signaling LEDs present on the front panel of the Exciter, Power Drawer and Unbalance Load Drawer;
Access to the current and past alarm log via the display interface on the Exciter front panel or remotely via the WEB interface;
VSWR and Overpower protection via hardware and software, with automatic power reduction;
Software protection against module temperature rise, with alarm signaling and power reduction;
Automatic input switching, programmable with input priorities and in hold on and hold off modes;
Power supply with PFC (Power Factor Correction) and soft start with In-Rush limitation;
Emergency stop button;
Power drawers are combined with isolated progressive combiners. RF connections are made with quick-connect and rigid lines, eliminating failure-prone connectors and coaxial cables. This ensures a clean and highly reliable transmitter construction.

Models and their specific characteristics

	EC801MP	EC802MP	EC803MP	EC801HP	EC802HP	EC803HP	EC804HP	EC805HP	EC806HP	EC808HP
RMS Power:	**1.200 W**	**2.400 W**	**3.200 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**
PSU(s) per HPA (Default):	1	2	3								
Redundant PSU per HPA (Optional):	1			0	1						
Typical AC consumption [2]:	1.710 W	3.430 W	4.570 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 heat dissipation [2]:	1.760 BTU/h	3.510 BTU/h	4.680 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%										
Mains	M220 ● B220 ● T220 ● T380						T220 ● T380				
Power Amplifier Model:	PA801MP	PA802MP	PA803MP	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	
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:	RACK 19" ● DESKTOP				RACK 19"						
Height:	3 RU	4 RU		8 RU	20 RU	24 RU	32 RU	36 RU	44 RU ● (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
REF IN	BNC-FEMALE Connector Impedance: 50 Ω @10 MHZ Level: -10 dBm to +10 dBm 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

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);
Ethernet interface[1] 10/100 Streaming/Management	01 port RJ45 IEEE 802.3i (10Base-T) IEEE 802.3u (100Base-TX) 10/100 Mbps (Half/Full Duplex)
Ethernet interface[1] GbE0 Streaming/Management	02 ports RJ45 IEEE 802.3i (10Base-T) IEEE 802.3u (100Base-TX) IEEE 802.3ab (1000Base-T) 10/100/1000 Mbps (Auto-Negotiation, Half/Full Duplex)

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

Audio Server (OPTIONAL)

Audio Decoders	MPEG (Layer 1/2/3), AAC, AC3 (Dolby Digital), Vorbis, FLAC, PCM.

Electrical Characteristics

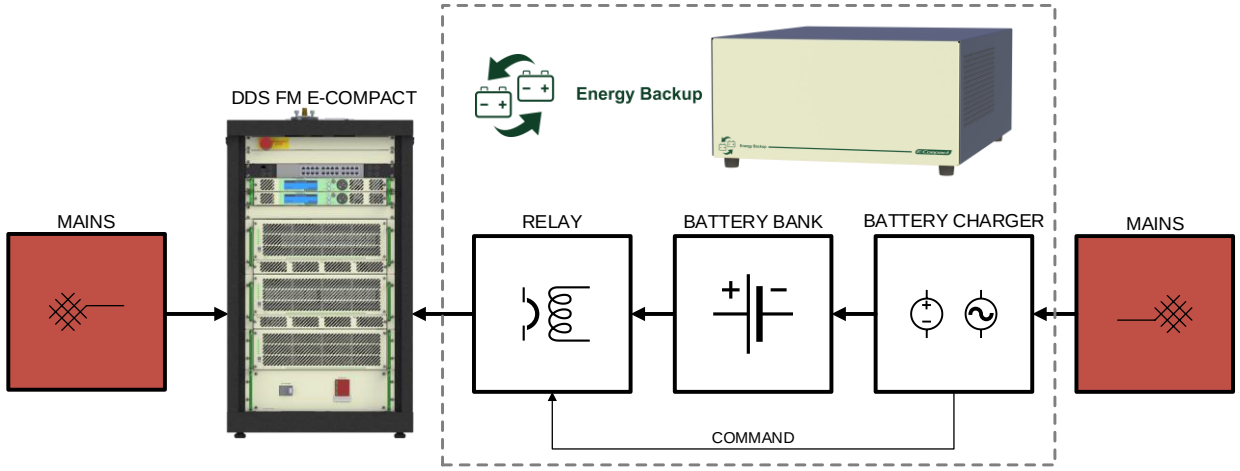
AC Input Voltage	198~250 VAC220 VAC ±10% (Typical)
AC Frequency	47~66 Hz
PFC	0,98 (Typical), 0,96 (>20% Load)

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

Energy Backup (OPTIONAL)

Keeps the transmitter on air in the event of a power outage, operating as a DC UPS.
DC backup power bank composed of 12 Volt stationary batteries from 115 to 240 A. High durability and greater number of charge and discharge cycles
Dedicated battery charger (NPB-1700-48) of 1,680 Watts, ideal for lithium, lead-acid and other technologies. It has 3-stage charging curve control (BMS - Battery Management System).
Adjustable transmitter power reduction according to programming, considering the battery bank and the equipment power.
Automatic connection and disconnection of batteries to the system.
It operates in float mode when fully charged.
Prevention against “deep discharge” for longer battery life



	EC801MP	EC802MP	EC803MP	EC801HP	EC802HP	EC803HP	EC804HP	EC805HP	EC806HP	EC808HP
Battery Bank (Quantity / Model) ***Minimum recommendation***	(4x) DF500 C100 40A	(4x) DF1000 C100 70A	(4x) DF2000 C100 115A	(4x) DF2000 C100 115A	(4x) DF3000 C100 185A	(4x) DF4100 C100 240A	(8x) DF3000 C100 185A	(4x) DF3000 C100 185A (4x) DF4100 C100 240A	(8x) DF4100 C100 240A	(12x) DF3000 C100 185A
Transmitter Power Reduction in Energy Backup Mode	40% to 70% da potência nominal									
Time in Energy Backup mode [7]	20 to 30 minutos			10 to 20 minutos						

Notes:
[1] They are trademarks owned or registered (trademark) or developed by: Ethernet (Xerox Corporation); MicroMPX (Thimeo Audio Technology B.V.);
[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);
[6] For the EC803MP model, the 3rd source works as redundant for maximum RF output power of up to 3,200 Watts;
[7] The Energy Backup mode time may vary depending on the transmitter power settings. Values considered with the Battery Banks at full charge. For higher Energy Backup load capacities, consult the factory.
[8] Requires GPS Time Base, which can be internal or external.

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