



TH-EC/LO

Radio Remote Controls for Locomotives



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The Application

The TH-EC/LO remote control system is the first remote control in the world specifically designed in compliance with the European safety standard for locomotives EN 50239. The modular concept with multiple options opens up new possibilities for streamlining in the railway industry. At the same time, improvements in safety features minimize the risk of accidents.

The TH-EC/LO is the result of consistent software and hardware engineering incorporating the latest European standards, especially EN 50126, EN 50128, EN 50129 as well as the requirements of the VDV 211. This guarantees the safe operation of a remotely controlled locomotive.

Thus, the radio remote control has become a major and important component to increase availability and efficiency in a modern shunting operation.

The EBA (Federal Railway Authority) certified TH-EC/LO system can be used on all types of locomotives. It fulfills the highest safety requirements for shunting, helper and multiple unit operation.

The modular design allows the standard version of the TH-EC/LO to be upgraded by modifying or adding modules in order to handle particular tasks such as a pitch and catch operation which allows the control of very long trains with either one or two transmitters.

The use of TH-EC/LO guarantees maximum safety, improvement of shunting operations and reduced walking distances for the switchman. Another option allows the remote control of electric switch points.

The System

Both transmitter and receiver electronics consist of a modern dual microprocessor system.

By using special multiplex systems on the carrier frequency, Cattron-Theimeg remote controls ensure the highest flexibility which allows the system to be used by multiple users in all applications, despite the ever-decreasing number of available frequencies.

The Cattron-Theimeg multiplex system enables the independent and simultaneous operation of a virtually arbitrary number of locomotives.

Radio remote controls of the TH-EC/LO series can be operated at the same place, time and frequency with nearly all Cattron-Theimeg locomotive remote control systems.

The radio remote control is easily adapted to the locomotive or application by a configuration plug in the transmitter and receiver. This feature results in simple and quick service, easy standardization and reduction of spare parts inventory which is especially important for companies operating a variety of locomotives.

Our Strength Lies in Solving Individual Problems:

- Radio systems with stationary control panels for trains in loading stations
- Radio remote controls with additional controls for remote selection and operation of electric switch points and tracks
- Radio remote controls for shunting and road locomotives in multiple unit operation
- Radio remote control systems using repeaters to increase range and for use in extremely difficult high frequency radio environments (e.g. tunnels)
- Remote control of a train from a control vehicle
- Radio remote control for locomotives with electronic speed control
- Feedback from locomotive to mobile transmitter, e.g. of status data, error, brake pressure, speed
- Safety related interface monitoring on the locomotive to attain the required safety integrity level





The Transmitter

Three basic transmitter housings are available which differ in the type of operating device and thus in execution of commands.

The first version uses the well-known x-y joystick. The brake and throttle commands are activated by moving the joystick in the appropriate direction.

The second version uses a lever control. Up to five brake and throttle command positions are available on its lever. The first and the last step can selectively be set up as a momentary or fixed step. Both transmitter versions are designed for single hand use, since the main control functions are located in the center of the transmitter.

In the third version, all functions are actuated by push buttons and toggle switches.

All housing versions are light and comfortable using state-of-the-art ergonomics; for example, the controls are recessed in order to avoid unintentional activation of commands. Each system is delivered with a lightweight, weatherproof, sailcloth harness. Specifically designed for this application, the harness has easily adjustable straps with quick disconnects to fit to the body for maximum comfort.

The transmitter, with its slightly curved front, allows the operator to move even in the most restricted area, e.g. between wagons, during coupling and uncoupling.



A limitation of mobility is almost impossible with this modern and ergonomically shaped housing.

The transmitter is simply slipped into the harness and secured with a snap fastener. This prevents the transmitter from falling out of the harness in any type of movement and inclination.

Additional Advantages of the Transmitter

The battery is secured in the rear transmitter by using a simple and reliable lock mechanism and can easily be changed, even during operation. State-of-the-art battery charger technology extends the battery life by shortening the charging time.

An electronic key with system-specific configuration and address information is located on the rear side of the transmitter. This key controls the correct allocation of the transmitter to the corresponding receiver i.e. locomotive. This configuration plug can be accessed either externally or internally by using special tools.

The screw connections on the transmitter guarantee an absolute seal according to IP65. System functions such as battery power, transmitter OK, and error messages are shown on LEDs as standard features.



Distinctive Transmitter Features

- Integrated internal antenna, external antenna as option
- Very loud electronic buzzer for acoustical indication of low battery power, premonition of tilt alert or errors
- Front plate in scratch resistant aluminum finish
- Solely proven and reliable controls with maximum life cycle
- Impact resistant plastic housing
- Service friendly electronics using plug in components
- Software determined digital parameters, e.g. tilt alert, vigilance
- Encapsulation of all components in RF-protected housings for EMC protection of electronics
- Optional LED's and/or LC Display for feedback information from locomotive
- Additional controls as option to operate electric switch points remotely



The Receiver

Two basic versions of the receiver are available which differ in the type of housing. Both versions have a modular design with plugin cards for easy access and a quick exchange of damaged components.

In the first version, the receiver electronics are housed in an aluminum pressure-mold housing with protection class IP 65. The receiver interface is wired to a multi-pole quick-disconnect plug.

In the second version, the receiver electronics are housed in a 19" / 3 RU rack.

Both housing designs are service-friendly. In the aluminum pressure-mold housing this is realized by an integrated tilting rack for easy access to the PCBs.

Three LED displays show all received commands as well as the system status information, enabling the locomotive operator or service technician to be informed about the status of all functions at any time.

Options:

- Flexible output of all commands, including safety:
 - Relay (standard)
 - Optocoupler (option)
 - CANopen (option)
- Processing of feedback signals and monitoring on the locomotive
- Antenna diversity
- Analog outputs (0-10V or 4-20mA)

Layout of the receiver

- Clear separation of RF module, microprocessor board and command output boards
- Very service-friendly construction using interlocked connectors
- LED displays for all received commands and system status information
- Output of emergency stop and time-out commands via positively driven relays



The System Safety

For safety reasons, both transmitter and receiver are based on dual microprocessors technique. Fail-safe monitoring electronics verify all received telegrams and execute the received signals only in case of consistent evaluation of both processors.

The entire system has been developed to be compliant with certified processes of EN 50126. The software has been designed according to the requirements for safety-related software and is suitable for applications which demand SIL3 under the terms of EN50129.

Furthermore, the system meets all requirements of EN50239 –especially for safety-relevant functions– for all command output options.

Cattron-Theimeg Europe has been recognized as an authorized development entity for safety-related applications; confirming the high engineering level and technical expertise of Cattron-Theimeg engineers regarding the safety of locomotive remote controls.



Additional Safety-Related Features

- Cyclic self-testing of the intelligent monitoring system
- Highest safety integrity class I3 for transmission protocols of remote control systems according to EN 608705-1
- Tested and certified by the Federal Railway Authority (EBA)
- High redundancy of hardware and software compliant with European Standards, in particular EN 50126, EN 50128, EN 50129 and EN 50155.
- All Cattron-Theimeg radio remote controls are manufactured with state-of-the-art production techniques according to ISO 9001 and EN 29001 standards



Options

Feedback

In addition to the transmission of control signals from the transmitter to the receiver, data such as speed, current brake pressure, and selected direction of travel, can be reported back to the transmitter and displayed on an LCD.

The needed information is shown to the operator on LEDs and/or LCD. The display can be customized with up to three lines with 3 x 12 characters displayed on the graphic-enabled, back-lit LCD.

LED Flash Lights

Two LED bars with up to 5 white, very bright LEDs can be mounted on the front of the transmitter. These LED bars are alternately triggered in a fast rhythm which generates a warning signal.

LED flash lights are used for shunting operations of pushed trains at night to alert people at ungated railroad crossings of approaching unlighted trains.



TransLoop

This feature is based on state-of-the-art RFID technology. Control commands can be launched contactless, without the need for a switch or mechanical connector.

Cross-Border Feature

Radio remote controls on locomotives in international use require different frequencies according to the national rules.

The cross-border feature allows the operation of four transmitters with different frequencies on just one receiver.

While the use of a single receiver saves both cost and space, the biggest benefit is the fail-safe operation. The choice of the wrong transmitter is impossible, as the transmitter/receiver combination can only be activated in the same frequency range.

Dual Transmitter Operation (Pitch and Catch)

In addition to the normal 1 to 1 alignment between transmitter and receiver, the receiver can also be controlled alternately by two different transmitters.

For this purpose, each transmitter features a release-upon-request button to pass the control for a defined period of time to a second operator. The transfer must take place at the locomotive holdup.

At any given time the locomotive can only be controlled by one operator.

Realtime Data Logging

The transmitter can be equipped with a GPS-based realtime data logger. The last 11,000 events are recorded in the data logger.

Operating Cycle Counter

The operating cycle counter is a memory device for both transmitter and receiver. The limit value of each actuator is programmed in this memory.

The storage comprises any activity on the actuator and its relevant output relay in the receiver.

The operator is informed by a LED signal when an actuator reaches the preset limit value of operating cycles. Simultaneously this 'limit reached' information is transmitted to the receiver and then forwarded to the diagnostic memory circuit of the locomotive.

This feature, as a part of a preventive maintenance program, reduces the annual service costs by up to 50%.

External Transmitter Antenna

External antennas may be necessary when the portable transmitter is operated at a fixed place, e.g. inside a control room of a loading station.

When the transmitter is put into the cradle for fixed operation the receiver signal is automatically switched to the external antenna connection.



All Options at a Glance

- Operator vigilance device
- Feedback of engine status data
- External transmitter antenna
- TransLoop
- LED flash lights
- GPS based data logger in the transmitter
- Operating cycle counter
- Throttle / brake counter
- Software function of the transmitter which allows a simple adjustment of a time-dependent input to position-dependent throttle and brake commands
- Cross-border feature
- Dual transmitter operation (Pitch and Catch)
- Intrinsically safe



EX Protection

While it is widely acknowledged that the radio remote control of locomotives and shunting vehicles contributes considerably to improved safety and greater productivity, where hazardous areas are involved there are many other considerations for users such as the possibility of explosions and the high cost of approvals.

For these applications Cattron-Theimeg has developed the TH-EC/LO ATEX transmitter certified for use in explosion-prone areas to the protection class of "II 2G EEx ib IIC T4".

These modified transmitters are powered by 'energy-reduced' batteries and are enclosed in a special leather case.

They belong within the device group II to the device category 2 and are suitable for use in zone 1, where all types of combustible gas may be present; however, they are unsuitable in carbon disulfide areas.

Combustible substances with an igniting temperature above 135°C (278°F), i.e. Temperature Class T4, may be present in these areas with high explosion inclination (explosion group IIC).



The receiver/decoder can also be designed for use within an Ex atmosphere. For this purpose the electronics are housed in a pressure-resistant enclosure with the required protection class.

ATEX Version Product Description

- The transmitter is powered by a special 'energy-reduced' battery
- The electronics of the transmitter are adapted to be fully compliant with the required directives
- To be fully compliant the transmitter must be used with the leather bag which is included in the scope of delivery
- The rear plate of the transmitter is made of aluminum



TH-EC/LO - Explanation of the Protection Class

II	2	G	E	Ex	ib	IIC	T4	T4	= Temperature class up to 135°C/278°F
								IIC	= All kinds of gas - except for carbon disulfide
								ib	= Ignition protection type intrinsic, category b
								Ex	= Explosion-proof
								E	= Compliant with ATEX-Norms
								G	= Gas
								2	= Ex-atmosphere is rarely in place
								II	= Group II "over ground"-Areas (e.g. Chemical, Petrochemical)

TH-EC/LO



Over 40 years of experience in development and production of quality remote controls using the most modern electric components and manufacturing techniques.

Over 10,000 delivered remote controls for locomotives in Europe, USA, Asia, Australia and New Zealand.

Over 3,000 remote controls delivered to European national railways and their successors.

TECHNICAL DATA

Frequency range	400 - 500 MHz (70 cm Band)
Radio standards	certified compliant with EN300113 and EN300220
Data transmission	according to EN 50159-2 and EN60870-5-1 Integrity Class I3
Multiple use of one frequency	System Mod Misch (Standard) System MX (Option) System Vario (Option)
Modulation	FM (frequency modulation)
Channel separation	12,5/20/25 KHz
Transmitted RF power	500 mW (standard), optional up to 2 W
Receiver sensitivity	< 0,6 μ Volt
Transmission rate	3100 bit/sek / RF transmission (12,5 KHz) 4800 bit/sek / RF transmission (0/25 KHz)
Response time	ca. 50 ms (typical)
Error detection	diverse redundancy in hardware
Telegram security	CRC (Cyclic Redundancy Check), $d \geq 6$
Telegram structure	PPM, HDB3, VWC

Address coding	16 bit
Operating temperature	-20° C up to +70° C
Protection class	IP65
Tranmitter Weight	about 1.9 kg, depending on model
Receiver Dimensions	
Die-cast housing	600 x 250 x 120 mm (L x W x H), IP65
19" rack	3 HE, 483 x 132 x 235 mm (L x W x H) IP20, provided for mounting in switch cabinet
Supply voltage	24 VDC (16.8 - 30.0VDC)
Command output	parallel relay output (Standard) parallel optocoupler (Option) CANopen (Option)
Output interlocks	available for all locomotive types
Operator monitor	tilt switch, vigilance
Certifications	EBA & R&TTE (Europa), PTT approval for many non-european countries



USA
Cattron-Theimeg International Inc.
58 West Shenango Street
US Sharpsville, Pennsylvania 16150
Phone: +1-724-962-3571
Fax: +1-724-962-4310
mail@cattron-theimeg.com

SOUTH-AFRICA
Cattron-Theimeg Africa (Pty.) Ltd.
24 O'Reilly Merry Road
ZA 1518 Rynfield
Benoni, Gauteng
Phone: +27-11-425-1123
Fax: +27-11-849-5717
cattron@cattronsa.com

CANADA
Cattron-Theimeg Canada Ltd.
150 Armstrong Avenue, Units 5 - 6
CA Georgetown, Ontario L7G 5G8
Phone: +1-905-873-9440
Fax: +1-905-873-9449
salescdn@cattron-theimeg.com

BRAZIL
Cattron-Theimeg Américas Ltda.
Rua Antonio Rodrigues de Carvalho 435
BR Campinas
SP CEP 13033-220
Phone: +55-19-3243-7803
Fax: +55-19-3243-9258
cattronamericas@cattron-theimeg.com

EUROPE
Cattron-Theimeg Europe GmbH & Co. KG
Krefelder Straße 423-425
DE 41066 Mönchengladbach
Phone: +49-2161-6363-0
Fax: +49-2161-6363-100
info@theimeg.de

GREAT BRITAIN
Cattron-Theimeg UK Ltd.
Riverdene Industrial Estate, Molesey Road
GB Hersham
Surrey KT12 4RY
Phone: +44-1932-247511
Fax: +44-1932-220937
sales@cattronuk.com