

EMGS transmitter system Shelf Xpress

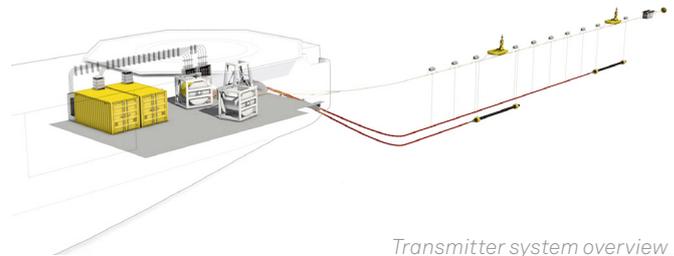
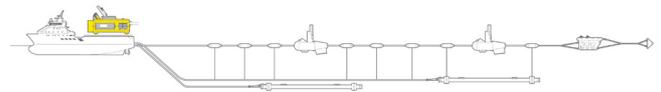
The new generation of CSEM transmitters from EMGS is based on proven technology with a capacity and accuracy superior to any commercial CSEM source.

Shelf Xpress is designed to further increase depth penetration and imaging in shallow water. This system is ideal for continental-shelf operations in water depths from 10 m down to 700 m.

Through eight years of operation with our conventional transmitter systems we have gained competence and confidence in using power electronics from Siemens in the signal source components. EMGS continued the cooperation with Siemens when the Shelf Xpress was developed. Using proven industrial power electronic modules and control system hardware has enhanced the quality and reliability of the Shelf Xpress.

With the Shelf Xpress EMGS has designed the current source to be mounted on the vessel instead of using a subsea encapsulation. In this way we have been able to radically increase the output power. The horizontal electric dipole (HED) antenna is towed 10 m below the sea surface. In cases with extreme shallow water the depth of the HED can be reduced.

Based on pulse-width modulation (PWM) and power transistor technology, the Shelf Xpress delivers unsurpassed resolution and accuracy. Combined with its high output power, Shelf Xpress provides the best data quality commercially available for EM transmitter systems.

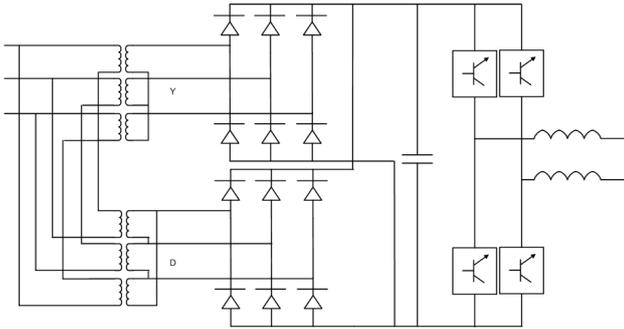


Transmitter system overview

Highlights

- 7200 A output current
- 6 times greater dipole moment than conventional transmitter, improved imaging of prospects
- Increased bandwidth (0 to 12 Hz), increased energy on high frequencies
- Increased accuracy – improved data quality
- No zero crossing wait state – full flexibility in waveform design

PWM with 12 pulse feeding



Current source

The ShelfXpress transmitter system is powered from a vessel's 690 V supply. Based on industrial frequency converter modules, the current source regulates the output waveform by using power transistors and PWM technology.

The components are qualified and incorporated in a number of Siemens products, ensuring high reliability and low technical downtime. Components have been selected to match the dipole antenna and the desired output amplitude and bandwidth.

Control system

The PWM-regulator of the transmitted signal is optimized for high bandwidth, and is located as closely as possible to the power electronics. A LabVIEW™-based control unit transmits the current reference at 2 kHz sampling rate for high resolution and accurate control. The transmitted signal is measured by precision current sensors. These sensors are regularly calibrated to achieve the best possible accuracy in current measurements. The control system is synchronized to GPS time using IEEE 1588 (Precision Time Protocol). Data is presented to the operator in real time, improving the quality control (QC). The control system also includes a large number of surveillance functions for system monitoring and protection.

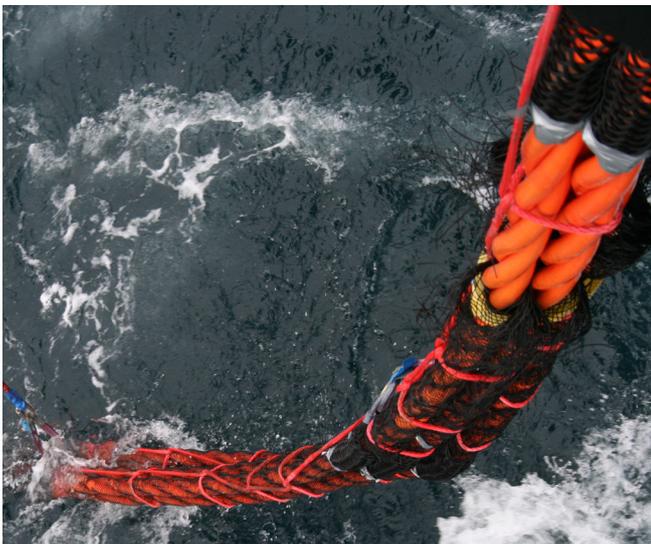
Antenna

The antenna system is a horizontal electric dipole (HED) connected directly to the on-board current source. The HED is towed at 10 m depth, suspended from the surface by 120 inflatable buoys. To reduce the vessel impact on the transmitted signal, the HED is towed 100 m behind the vessel. Navigation buoys over each electrode measure the dipole position with GPS precision. The impedance and temperature of the HED are also monitored real time and used for QC. The antenna system is a modular and very flexible solution for high reliability and high operability worldwide.

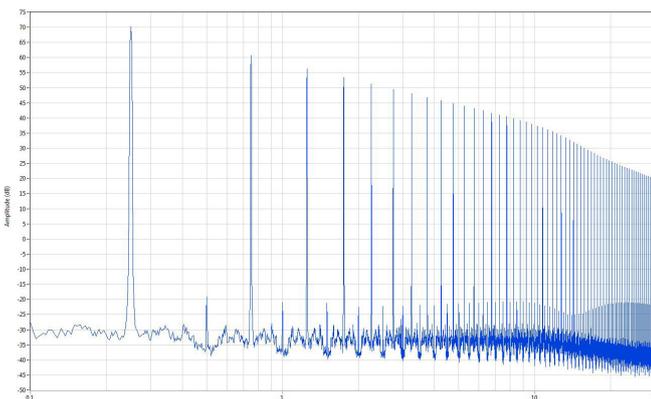
The dipole is 300 m long and consists of a total 1500 mm² copper cable. 7200 A output current results in a dipole moment of 2160 kAm. The dipole length can be extended if desirable. Deployment and recovery time for the antenna system is approximately three hours.



Current source output cables



Antenna cables from vessel to sea



7200A 0.25Hz square signal measured FFT

QHSE

EMGS has a very strong focus on personnel safety. All electrical work is performed onboard in accordance with procedures. To ensure that all parties are aware of and following the rules and regulations which apply for electrical safety, a detailed Safety Standard for Source Operation has been published. This is available for clients, vessel owners and EMGS employees.

EMGS has chosen to use Det Norske Veritas (DNV) as an external consultant to help us ensure that the safety level onboard our vessels is at the highest level. Furthermore, DNV audits our vessels annually.

Onboard electrical and operational safety in this context means:

- DNV audited and certified source installation
- DNV audited and certified operational handling procedures
- DNV audited and certified source and receiver deck handling
- Source winch and handling system designed and certified according to DNV standard for certification: Lifting appliances
- The transmitter system is audited and approved by Norwegian Radiation Protection Authority according to International Commission on Non-Ionizing Radiation Protection recommendations.

EMGS Transmitter System Specifications

	Conventional	Deep Xpress	Shelf Xpress
Dipole antenna current	1250A	1500A	7200A
Dipole moment (Dipole length)	350kAm (280m)	420kAm (280m)	2 160kAm (300m)
	Dipole antenna is modular and length is adjustable for all systems		
Current measurement precision	<2%	<1%	<1%
Current measurement sampling rate	200Hz	2kHz	2kHz
Output Bandwidth	0-10Hz	0 to 25Hz 0 to 50Hz (reduced output)	0 to 12Hz 0 to 50Hz (reduced output)
Power electronics	THYRISTOR	IGBT	IGBT
Zero crossing wait state	80ms	N/A	N/A
Timing accuracy	1000 μs	<100μs	<100μs
Timing distribution system	PPS/NMEA	IEEE 1588	IEEE 1588
Electric power consumption, vessel	160kW	160kW	1200kW
Umbilical voltage	3.5kV	3.5kV	N/A
Antenna output power	115kW	110kW	1100kW
Operational depth	10 to 3500m	10 to 4000m	10 to 700m (surface towed only)
Operational water temperature	<30°C	<30°C	<40°C
Towing speed (dependent on sea currents and depths)	<3.5knot	<5knot	<5 knot
Tow Array Positioning	USBL	USBL	RGPS

EMGS, the marine EM market leader, uses its proprietary electromagnetic (EM) technology to support oil and gas companies in their search for offshore hydrocarbons. EMGS supports each stage in the workflow, from survey design and data acquisition to processing and interpretation. The company's services enable integration of EM data with seismic and other geophysical and geological information to give explorationists a clearer and more complete understanding of the subsurface. This improves exploration efficiency, and reduces risks and the finding costs per barrel.

EMGS has conducted more than 650 surveys to improve drilling success rates across the world's mature and frontier offshore basins. The company operates on a worldwide basis with main offices in Trondheim and Oslo, Norway; Houston, USA; and Kuala Lumpur, Malaysia.

Please visit www.emgs.com for the latest news and in-depth information about EMGS and EM technology.

EMGS Headquarters

Stiklestadveien 1
N-7041 Trondheim, Norway
Telephone +47 73 56 88 10

North & South America

15021 Katy Freeway, Suite 500
Houston, TX 77094, USA
Telephone +1 281 920 5601

Asia Pacific

Unit E-15. 2-4, 15th Floor
East Wing, Rohas Perkasa
No. 8 Jalan Perak
50450 Kuala Lumpur, Malaysia
Telephone +603 21 66 06 13

www.emgs.com