Electronic & Marine Research Industries

EMRI Autopilot

SEM300

Excellence in Ship Control

- Heading
- Course
- Track

Design

SEM300 is based on EMRI´s many years of experience in cost efficient and safe Autopilot design. It is designed with a tiller on the control panel, where the navigator can directly change set-point, both heading and radius. The panel is designed with pushbuttons that have LED backlight and an LED lightbar above each button. The lightbar clearly indicates which mode is in use, so operation can be done safely. The navigator is never in doubt, when an order is given due to the required actuation force of both tiller and pushbuttons.

To ensure the best experience and readability on the display at all times, the navigator can choose between day, dusk and night view.

Key Design Features ☑

- Track control if certified with ECDIS
- Course Mode – automatic drift compensation
- NAUT AW compliant with a standby unit
- Curved EBL – shown on ECDIS
- Adaptive Autopilot modes
- Alarm interface for BAM
- Intuitive operation
- 6.5 inch TFT display with high luminance

Adaptive Autopilot modes

SEM300 has two sets of adaptive modes to help with *fuel efficiency* and *steering optimization*. The Autopilot adapts its performance based on the choice made by the navigator.

Precise, Medium and Economy
Three options are available, depending on how tight the vessel needs to follow the set heading. Economy mode provides the most relaxed, fuel saving heading control by minimizing use of rudder movements.

Loaded, Medium and Light
Three options are available, depending on the vessel´s loaded condition. The Autopilot will automatically optimize the steering based on the chosen condition.

Key information displayed on the panel
- *Speed information, water and ground speed*
- *Rudder order*
- *Actual rudder (if feedback is provided)*
- *Clear indication of rudder limits*
- *Heading, Set Heading*
- *Actual Gyro in use*
- *Chosen performance mode*
- *Course mode (when course mode is used)*

SEM300 offers an improved steering experience compared to its predecessor SEM200 by displaying more relevant information.

Setup

SEM300 is preset from factory, where parameters are loaded into the Autopilot based on known ship data. This makes setup and sea trial simple. The preset is done with decades of experience in the field, and acknowledged steering performance.

If requested, additional finetuning can be performed by a service engineer. Useful setup wizards are available, and provides extensive opportunities for adjusting to specific individual preferences and vessel steering capabilities.

SEM300 consists of:

1 Autopilot Control Panel (MIP211)

1 Autopilot Cable (CE2MM)

1 Autopilot Electronic Unit (AEU611)

Measurements, generic connection overview and specifications shown on the next pages

Flexible design options

The Autopilot can have up to 4 control panels connected to the same AEU in case more panels are requested. An Armrest panel is also available for SEM300 allowing easy control from the navigator´s armrest.

- New setup feature –

In SEM300 new parameter settings can be uploaded directly to the Autopilot via USB key. It makes it quick and easy to make adjustments if needed.

Retrofit

SEM300 offers an improved human machine interface with extensive opportunities in its design and functionality. Retrofitting from SEM200 to SEM300 does not require any console work, as the equipment is designed to fit into the existing cut-outs onboard. EMRI can identify and deliver the correct Autopilot setup based on known ship data, making it as simple as possible for the crew onboard. This makes it cost efficient, while also minimizing the time needed to perform the retrofit.

Older/other Autopilots can be retrofitted to SEM300 by performing an observation of the existing system.

What is needed?

- Heading sensor input must be serial.
- Course mode needs GPS signal.

Advantages of retrofitting

- Improved display
- More relevant information provided
- Course Mode*
- Improved Programming Mode*
- Rudder Toe angle – better fuel economy for dual rudder vessels*
- Product life time considerations
- More bridge design options
- Improved service tools

**See next page for more information.*

EMRI Autopilots are known for high reliability and precise steering.

Course Mode

Besides Heading and Track control, SEM300 can be used in Course Mode which is a drift compensated heading control. No manual corrections are necessary, as the Autopilot automatically compensates for any drift by using the Gyro as dynamic reference and GPS signal as static reference to stay on course. See illustrative example.

Rudder Toe angle

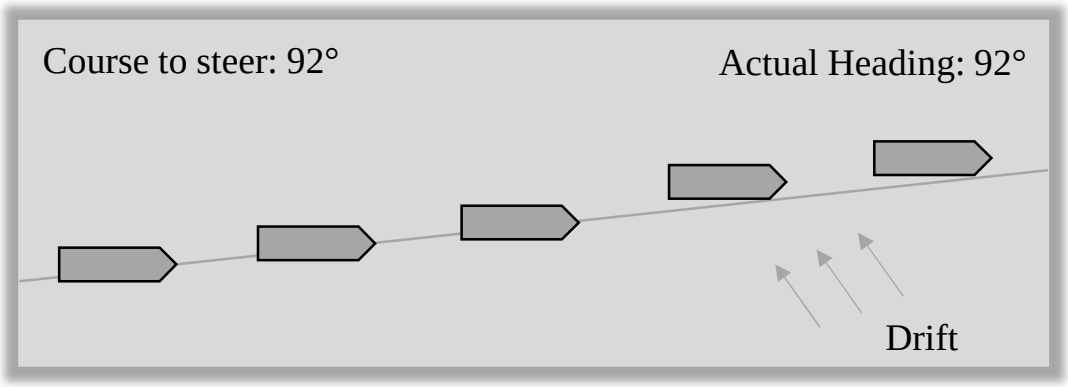
For dual rudder vessels, SEM300 can display the Toe angle on the control panel. When using Toe angle control of the rudders, it is possible to optimize the fuel consumption by avoiding loss of propulsion.

Improved Programming Mode

The navigator can plan changes ahead by programming next heading, next course or next radius which is stored in the Autopilot and ready to be executed. It is especially useful when navigating in narrow waters such as the archipelagoes.

When programming the next settings, the navigator can keep the actual settings available in the background and thereby be able to make an easy swap between modification of ongoing maneuvers and programming mode. The Autopilot control panel clearly and logically displays the step by step programming using the terminology “next” to avoid any possible confusion.

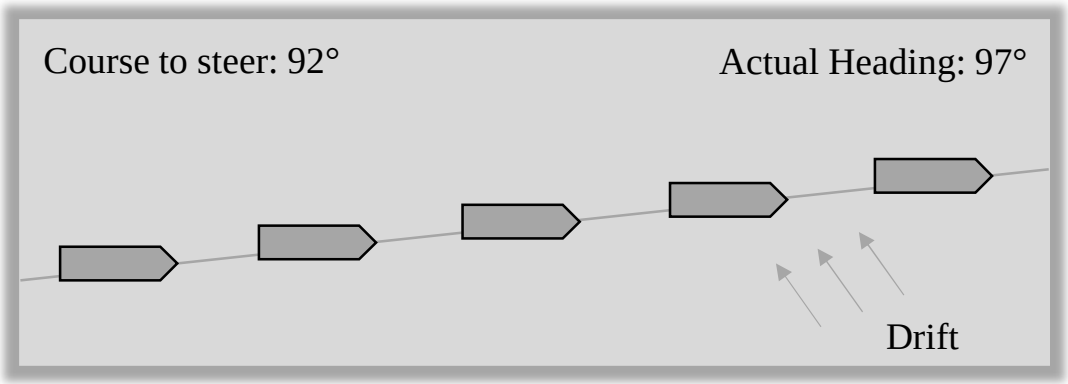
Illustrative example of drift compensated heading control



Heading control

Classic heading control will maintain the set heading making it necessary for the navigator to manually compensate for any drift to stay on course.

Course Mode



When operating in Course Mode the Autopilot will compensate for any drift by automatically adjusting the actual heading to stay on course.

ARP - Armrest Panel

The Armrest Panel for Autopilot is designed to allow for easy control of the essential Autopilot functions from the navigators´s armchair. The idea is to add more functionality and better ergonomics for the navigator, when operating the SEM300.

Safety in use

The Armrest Panel has similar layout and functional style as the Autopilot Control Panel to avoid any possible confusion by the navigator. It is operated by the use of pushbuttons and a rocker tiller, that are designed to avoid unwarranted actions.

Pushbutton actuation

- The actuation force of 5.5N requires a firmly and determined pressure to actuate the pushbuttons.

Tiller actuation

- Any order confirmation in normal operation mode requires at least 2 clicks. Any changes made by the tiller must be confirmed by an EXECUTE to activate the set order.

- A feature is added clearly indicating when the tiller is in immediate mode.

Installation

The Armrest Panel is installed directly to the Autopilot Electronic Unit via CAN-bus terminals or through a junction box.

- 92x92mm. panel cutout and 96x96mm. front plate according to DIN norm
- Total depth of 55mm.
- Bottom mounted panel avoiding visible screw mounts

- Coming Soon –

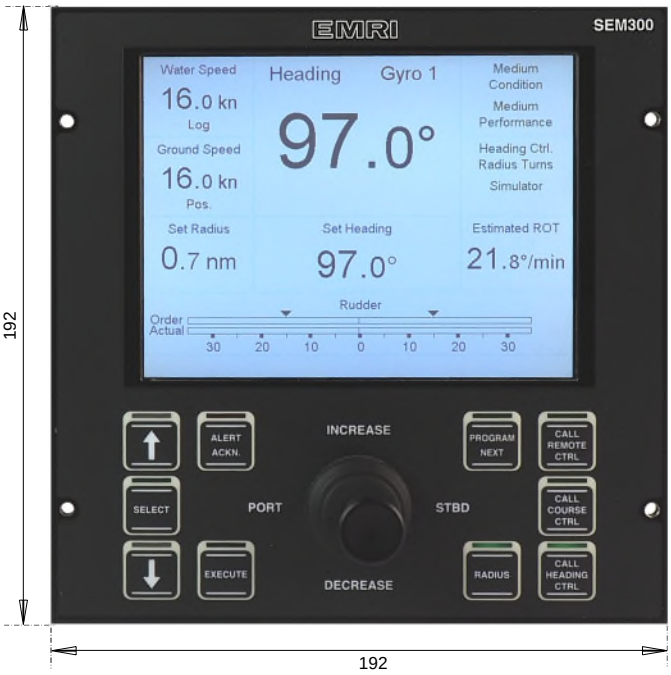
A 5 inch vertical Armrest display (ARD) that can be built into the same front plate for a slim line control panel.

ARD

ARP

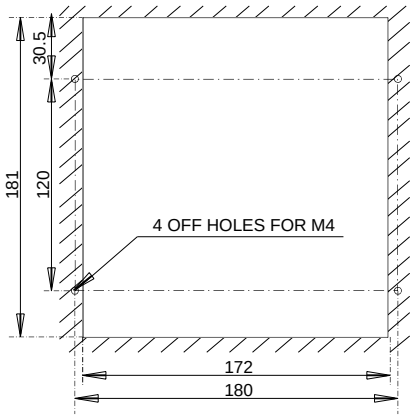
MIP211 front and side view

All measurements in mm.

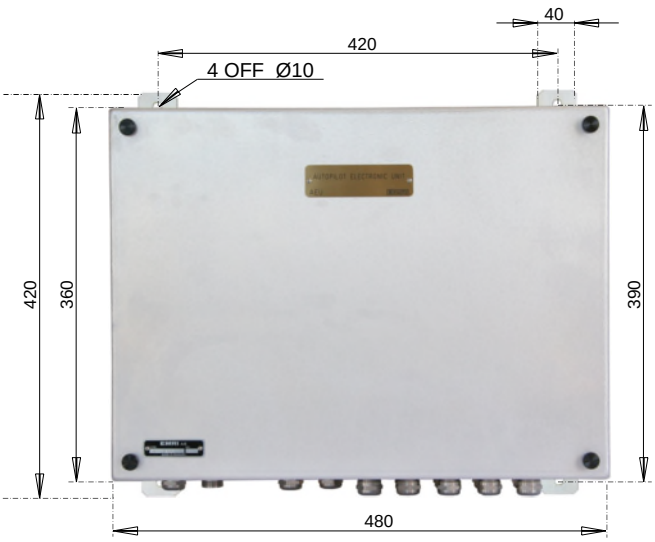


Type: MIP211
Micropilot Control Panel
Weight: 1.6 kg.

PANEL CUT OUT



AEU611 front and side view



Type: AEU611
Autopilot Electronic Unit
Weight: 11 kg.

CE2MM Autopilot Cable

Type: CE2MM
Autopilot Cable, 3–10 m.
Weight: 0.6 – 1.6 kg.

Specifications

Product Name

SEM300

Autopilot Control Panel (MIP211)

Power supply
24 VDC Supply from the Autopilot Electronic Unit(AEU611)
Power: Max 17W

Display
6.5” TFT display
LED backlight
Luminance 800 cd/m^2
Presentation of information according to IEC62288
Actuation of pushbuttons: 5.5 Newton

Mode selections
Heading
Course
Track
Radius

Interface
CAN bus: 2 ports
Ethernet: 1 port 100 base-T
USB: 1 port (1x device USB 2.0 type B)

Autopilot Electronic Unit (AEU611)

Power supply
Ship Supply 24 VDC +30/-25%
Power: Max 48W

Interface
CAN bus: 2 ports
Ethernet: 1 port 100 Base-T
USB: 2 ports (1x HOST USB1.1 type A, 1x DEVICE USB1.1 type B)
Serial I/O: 6 ports RS422
Digital input: 17 (opto isolated)
Digital output: 15
Analog output: 2 ports +/- 10V with possibility to convert to 4-20mA using an optional isolation amplifier
Analog input: 4 ports +/- 10V with possibility to convert to 4-20mA using an optional isolation amplifier
Isolated outputs: 3 opto isolated FET outputs

Applicable for both MIP211 and AEU611

Environmental conditions
Ambient temperature range (operating): -15°C/55°C
Ambient temperature range (storage): -15°C/55°C
Humidity: Tested up to 93%RH at 40°C
Vibration: 0.7g acc. to IEC60945:2008
Immunity radiated radio frequencies: 80-2000MHz acc. to IEC60945:2008
Immunity conducted radio frequencies: 0.15-80MHz acc. to IEC60945:2008
Radiated emission: 0.15MHz – 2000 MHz acc. to IEC60945:2008
Enclosure degree of protection: IP22

Standards conformity
Functional testing: ISO 11674:2008
Environmental testing: IEC60945:2008
Serial interface: IEC 61162-1:2016
Presentation of navigation information: IEC 62288:2014
Bridge Alert Management: MSC.302(87)

Armrest Panel (ARP)

Power supply
24 VDC Supply from the Autopilot Electronic Unit(AEU611)
Power: Max 17W

Environmental conditions
Ambient temperatur range (operating): -25°C /70 °C
Ambient temperatur range (storage): -15°C /70°C
Humidity: Tested up to 95%RH at 25-55°C
Vibration: 0.7g acc. to IEC60945
Immunity radiated radio frequencies: 80-2000MHz acc. to IEC60945
Immunity conducted radio frequencies: 0.15-80MHz acc. to IEC60945
Radiated emission: 0.15MHz – 2000 MHz acc. to IEC60945

Standards conformity
Environmental testing: IEC60945/E10

Interface
CAN bus : 2 ports (1 port is isolated up to 2 kV)
Ethernet: 1 port 100 Base-T

Mode selections
Heading
Radius
Track

NMEA sentences

The autopilot can receive the following list of Standard NMEA sentences:
Generally the sentences must follow the IEC 61162-1 Edition 5, but old sentences are also received.

NMEA Sentence	Signal input	Remarks
$xxTHS	Heading True from Gyro	
$xxHCR	Heading Correction report from Gyro	Coming before related THS
$XXHDT	Heading True from Gyro.	Old standard
$XXHDG	Heading from Magnetic Compass	
$XXHDM	Heading from Magnetic Compass	Specified not recommended in NMEA ver. 2.0
$XXVBW	Speed from Doppler LOG	Both IEC61162 & earlier NMEA standard is received.
$XXVTG	Ground Speed from GPS	
$XXVHW	Water speed and ships Heading	
$PESSA $PESSD $PESSX	ECDIS	Proprietary EMRI NMEA sentence
$XXROT	Rate Of Turn	
$XXACK	Acknowledged Alerts	
$XXACN	Alert Command	Advanced alert communication

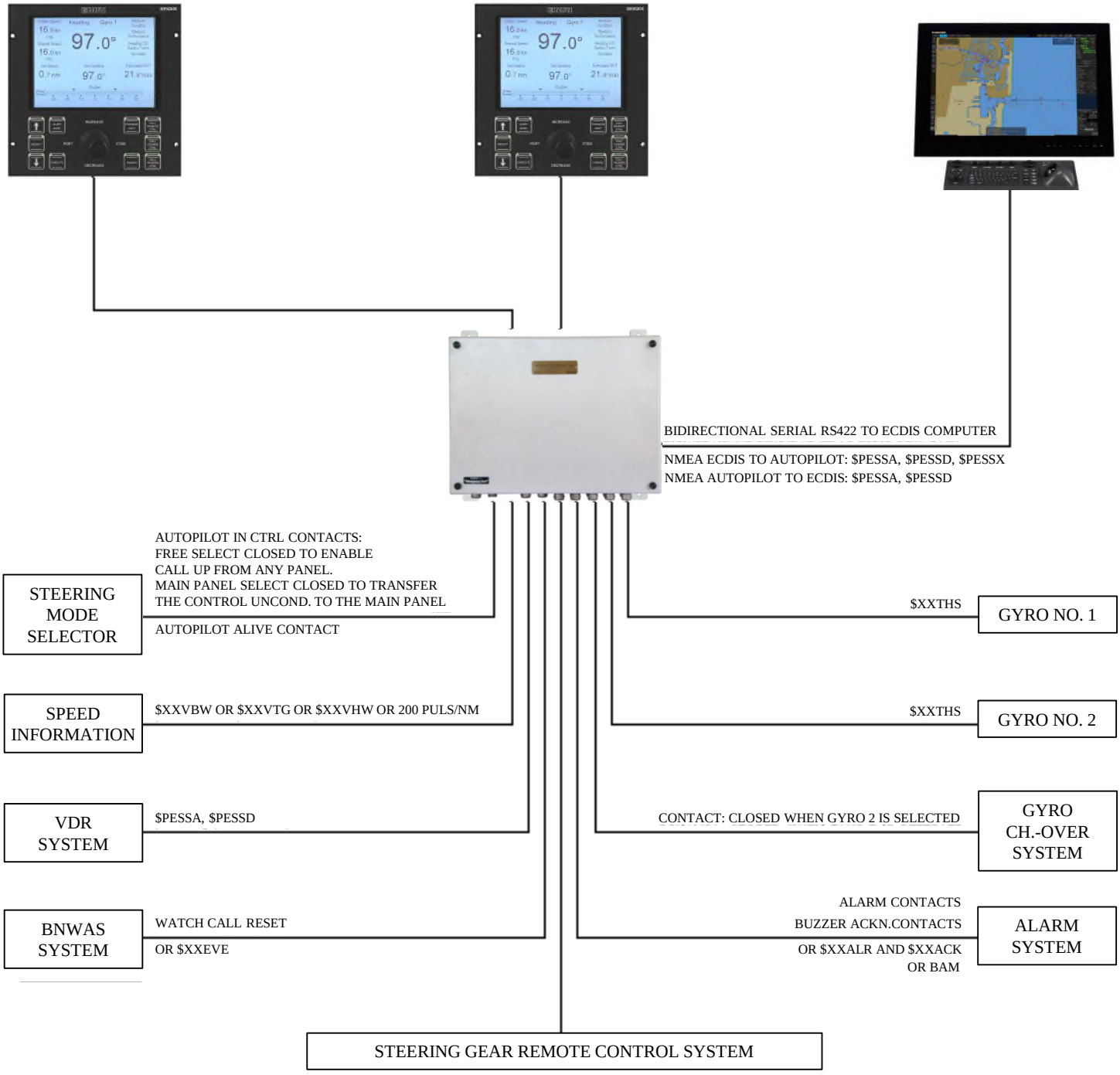
Further the Robertson STX sentence can be received as heading information. 9600 baud.

The autopilot can transmit the following list of Standard NMEA sentences:
Generally the sentences follows the IEC 61162-1 Edition 5.

NMEA Sentence	Signal Output	Remarks
$XXALR	Autopilot Alert sentence	
$XXALF, BAM	Alert sentence	Advanced Alert communication
$XXALC, BAM	Cyclic Alert List	Advanced Alert communication
$XXARC, BAM	Alert command refused, Not used.	Advanced Alert communication
$XXHBT, BAM	Heartbeat	To BAM, INS.
$XXEVE	Event sentence, BNWAS	
$PESSA $PESSD	ECDIS	Proprietary EMRI NMEA sentence

Principle block diagram of the SEM300 Autopilot system

Block diagram shown with two MIP211 Autopilot control panels.



Principle block diagram of the SEM300 Autopilot system

Block diagram shown with two MIP211 Autopilot control panels and two ARP Armrest panels.