Raymarine®

AUTOPILOT SYSTEM GUIDE

SMARTPILOT X-SERIES TECHNOLOGY

From the invention of the Autohelm® tiller pilot almost 30 years ago to the SmartPilot™ gyro enhanced Advance Steering Technology of today, Raymarine autopilots lead the way in autopilot technology and innovation and set a new benchmark in autopilot performance and reliability. From our tiller pilots and wheel-mounted Sportdrive to our fully integrated inboard systems, Raymarine SmartPilot X-Series (SPX) autopilots are powerful but simple to use with clear, easy-to-read LCD displays and a wide variety of options for any vessel.

Sailing, fishing or cruising, SmartPilot X-Series (SPX Series) autopilots offer the sophisticated performance and innovative features that demanding skippers appreciate. At the core of the SmartPilot X-Series autopilots are newly engineered course computers and the ST70 Series color autopilot control heads. This powerful combination of SmartPilot X-Series course computer technology and the elegant simplicity of the ST70 Series control heads offer captains innovative new features, precise course keeping and reliable performance.

Advanced Networking

All Raymarine SmartPilot systems support standard NMEA 0183 and SeaTalk interfaces. In addition the ST70 Series control head and X-Series course computers utilize SeaTalk**ng** data bus technology. SeaTalk**ng** is a super fast data network that features rugged color coded connectors and cables for hassle free installation.

Dodge
A single press the Dodge key facilitates manual course changes with options to resume the current track or start a new course

Smart Rudder Sense™
Smart Rudder Sense technology enables precision steering without the use of a rudder feedback sensor.

Vane Mode
Utilizing wind information from SeaTalk wind instruments SmartPilot steers to wind angle and sets the boat up so that the sails are at full trim (balanced)

AutoTack
Tack the boat through a user-programmable turn. Perfect for sailing with a shorthanded crew

Wind Trim
9 trim levels filter out unwanted autopilot movement due to wind gusts, conserving power while maintaining a straighter track

Auto Speed Gain
Adjusts the amount of helm applied at different boat speeds for a smooth safe ride

AutoLearn
AST technology and SPX course computers enable SmartPilot to AutoLearn your vessel's steering characteristics, simplifying calibration and allowing the autopilot to constantly adapt to changing sea conditions

AutoSeastate and AutoTrim
Automatically adjusts for wind and sea conditions to hold the best course

Smartpilot X-30

ST70

COCKPIT PILOTS

Cockpit pilots are easy-to-install autopilot systems that mount directly to your boat's helm, wheel or tiller. Raymarine offers several different cockpit pilot options engineered for vessels up to 30 feet in length.

BELOW DECK PILOTS

Typically recommended for boats larger than 30 feet, below deck autopilots generally consist of three main components: the drive unit, the corepack, and a control head. Raymarine SmartPilot systems accommodate a wide range of steering systems including hydraulic, mechanical, and power assisted stern drive steering systems.

Step One: Choose a Control Head

The control head is your interface to the autopilot system. Add additional control heads wherever you need to interact with the autopilot system.

Step Two: Select a Drive Unit

Under the control of the course computer Raymarine autopilot drive units interface with your vessels steering system for reliable and straight course keeping. A broad range of drive units are available to match almost any type of steering system.

Step Three: Select a Corepack

The brain of the autopilot system, SmartPilot X-Series corepacks consist of a course computer and fluxgate compass.

SELECTING AN AUTOPILOT CONTROL HEAD

Raymarine control heads offer the same level of autopilot performance but vary in size and feature-sets. To take full advantage of the SmartPilot X-Series Autopilot capabilities and performance, choose the ST70 Series Autopilot Control Heads.

ST70

ST70 Plus

ST70 Plus Autopilot Keypad

ST70 AUTOPILOT CONTROL HEAD

The color ST70 offers crisp sunlight viewability in a feature packed control head. Calibration is simple with the intuitive start-up wizard. The ST70 features an all new dodge function, 3-D isometric autopilot view, and extensive fishing patterns.

ST70 PLUS AUTOPILOT CONTROL HEAD

The ST70 Plus system is an innovative instrumentation and autopilot display and control system engineered for premium yachts. ST70 Plus is the perfect partner for Raymarine E-Series and G-Series navigation systems. The ultra bright 6.5" color display is ideal for installations where information is viewed at a distance. The ergonomic remote autopilot keypad provides complete control of the intuitive menu and icon user interface. ST70 Plus is fully customizable, with high quality graphics, multiple color palettes and unique screen layout options.

Automatic Fishing Patterns

| Circle | Figure 8 | Box pattern search | Spiral | Lazy S Turn | Box | Clover Leaf | Zig Zag | 180° & 360° turn |

ST6002/ST7002/ST8002 CONTROL HEADS

The ideal solution for a secondary autopilot control head, the ST6002, ST7002 and ST8002 can also be used as a primary autopilot control head with an X-Series Corepack; however advanced features like fishing patterns and simplified calibaration are only available with the ST70 Series control heads.

ST8002

The large LCD display and rotary control knob make the ST8002 control head an excellent choice for precise course changes. The ST8002 offers 15 SeaTalk data pages and Power Steer mode (utilizing the rotary control knob).

ST7002

The ST7002 control head offers a large LCD display and dedicated controls for response, resume, and set course. A unique feature of the ST7002 is the capability to control your ST60+ instruments remotely from the ST7002 keypad. The ST7002 also features AutoTack control.

ST6002

Sized to match our ST60+ instruments, the ST6002 is the perfect control head when dash space is limited. Featuring AutoTack control and the ability to display up to 15 SeaTalk data pages.

ORDERING INFORMATION

PART #	DESCRIPTION
E12119-P	ST8002+ Surface Mount
E12183	ST8002+ Flush Mount
E12099-P	ST7002+ Surface Mount
E12182	ST7002+ Flush Mount
E12098-P	ST6002+ Surface Mount
E12100	ST6002+ Flush Mount

PART #	DESCRIPTION
E12196	ST70 Control Head*
E22115	ST70 Plus Display*
E22117	Sail Keypad for ST70 Plus*
E22118	Power Keypad for ST70 Plus*

*SeaTalk*ng* Autopilot Backbone Kit required for installation

Smartpilot X-5

Tiller Pilot

ST6002

SMARTPILOT X-5 TILLER PILOT SYSTEMS

The SmartPIlot X-5 Tiller or the high performance SmartPilot X-5 Tiller GP feature a remotely mounted course computer, fluxgate compass and ST6002 control head. The GP Tiller drive is used by the world's top single handed race skippers.

• Built-in rate gyro sensor enables Raymarine's AST (Advanced Steering Technology) software to intelligently monitor vessel yaw and actually anticipate course changes.

• AutoLearn simplifies the calibration procedure enabling the SmartPilot X-5 to automatically adjust calibration settings based on the vessels steering characteristics

ST1000 AND ST2000 TILLER PILOTS

The ST1000 and ST2000 feature a NMEA0183 and SeaTalk interface for GPS waypoint steering

Raymarine tiller pilots set the standard for performance, reliability and ease of use. A valuable member of your crew, the ST1000 and ST2000 feature powerful and efficient drives, housed in rugged waterproof enclosures. For larger boats the X-5 Tiller Pilot offers below deck pilot features and performance.

ORDERING INFORMATION & FIT GUIDE

PART #	DESCRIPTION
A12004	ST1000+ Tiller Pilot, for sailing vessels up to 6,600 lbs (3,000 kg)
A12005	ST2000+ Tiller Pilot, for sailing vessels up to 10,000 lbs (4,500 kg)
E12203	SmartPilot X-5 Tiller for sailing vessels up to 13,000 lbs (6,000 kg) displacement
E12204	SmartPilot X-5 Tiller GP for sailing vessels up to 16,500 lbs (7,500 kg) displacement
E12137	SmartPilot X-5 Tiller Core Pack (Course computer, fluxgate compass and drive unit only - no control head included)
E12138	SmartPilot X-5 Tiller GP Core Pack (Course computer, fluxgate compass and drive unit only - no control head included)

ST6002   Compass   Smartpilot X-5

SMARTPILOT X-5 WHEEL PILOT FOR SAILBOATS

The SmartPilot X-5 Wheel Pilot is the successor to the popular ST4000 and S1 Wheel drive systems. Equipped with the advanced X-5 course computer this rugged wheel pilot system features Raymarine's Advanced Steering Technology (AST). The SPX-5's integral rate gyro sensor and AST offers smarter performance and enables the SPX-5 to "AutoLearn" the vessel's steering characteristics for improved course keeping and simplified calibration.

Wheel Pilot Features:

• Advanced wheel mounted cockpit autopilot system for sailing vessels

• All new SmartPilot X-5 rate gyro equipped course computer

• Fully enclosed MkII wheel-drive delivers below deck autopilot performance

• Simple clutch engagement mechanism

• Easy-to-install, no rudder reference sensor required

• Available bundled with the ST6002 control head

ORDERING INFORMATION & FIT GUIDE

PART #	DESCRIPTION
E12201	SmartPilot X-5 Wheel Pilot for wheel steered sailing vessels up to 16,500lbs (7,500kg) displacement. (Course computer, ST6002 control head, compass and drive unit)
E12133	SmartPilot X-5 Wheel Corepack (Course computer, fluxgate compass and drive unit only - no control head included) for wheel steered vessels up to 16,500lbs (7,500kg) displacement

Smartpilot X-5

Sport Drive
(Wheel not included)

ST6002

SMARTPILOT X-5 SPORT

The perfect crew member for power and sport boats, the SmartPilot X-5 Sport is an innovative helm mounted autopilot system that is easy-to-use and easy-to-install. The rugged Sportdrive system simply mounts to an existing fixed or tilt steering helm. No cutting hydraulic lines or complicated rudder sensors are required. Behind the scenes the intelligent X-5 course computer provides precise steering, while the proven ST6002 control head offers intuitive autopilot control.

• Helm mounted autopilot system

• Easy-to-install autopilot for power boats typically up to 30' (9m)

• Built-in rate gyro sensor with Raymarine AST (Advanced Steering Technology)

• AutoLearn technology simplifies calibration and enables the autopilot to automatically adapt to changing sea conditions

• Smart Rudder Sense technology eliminates the need for a rudder reference® sensor

• SeaTalk®, SeaTalk*ng* and NMEA 0183 compatible

Modular system includes X-5 course computer, fluxgate compass, Sport Drive and ST6002 control head

ORDERING INFORMATION

PART #	DESCRIPTION
E12206	SmartPilot X-5 Sport autopilot system with ST6002 control head
E12132	SportDrive without a control head

FIT GUIDE

Cable steered powerboats with a laden displacement of up to 2,000 kg (4,400 lbs) or powerboats with manual hydraulic and servo hydraulic steered vessels up to 3,500 kg (7,700lbs).

Steering Helm Requirements

2.5 to 5.0 turns lock to lock - 15Nm (11 lbs) torque

S100   S1000

S1000 WIRELESS AUTOPILOT SYSTEM

No wires, no plugs. The S1000 utilizes the latest in wireless technology for reliable and convenient autopilot control. Everything you need for installation is included in the SmartPilot S1000 box, including fittings, hoses and tools. (For most applications. In some instances, additional fittings, hardware or tools may be required.)

Key features of the S1000 Autopilot system include:

• Smooth course changes regardless of boat speed

• The anglers' copilot with automatic fishing patterns

• Intuitive, menu driven interface

• No rudder reference is required

Minimum trolling speed 1.5knts

ORDERING INFORMATION

PART #	DESCRIPTION
E12169	S1000 Wireless Autopilot System

FIT GUIDE

For hydraulically steered vessels typically up to 25 feet in length. The S1000 is designed for hydraulic steering systems with a capacity of 5 to 8 cubic inches (80 to 130 cubic centimeters). See Raymarine.com for list of compatible balanced hydraulic steering systems.

SeaTalk or NMEA0183 GPS input required

SELECTING A DRIVE: HYDRAULIC STEERING SYSTEMS

Raymarine SmartPilots connect to hydraulic steering systems using a rugged hydraulic pump matched to the capacity of the vessel's hydraulic steering system. To properly match a Raymarine hydraulic pump to a specific vessel and steering system, the actual size (in cubic inches) of the hydraulic cylinder ram (or rams) needs to be determined. Your steering system documentation will have this information. Alternatively, you can look on the actual cylinder ram itself for the brand and model number. Once you have learned the model number of your cylinder ram(s), visit our website www.raymarine.com to access our hydraulic cylinder ram cross-reference guide to learn which Raymarine hydraulic autopilot pump type is compatible with your hydraulic steering system.

Raymarine autopilot hydraulic pumps are available in several sizes to accommodate a broad range of hydraulic steering cylinder capacities. The table below illustrates the capacity of each type of Raymarine hydraulic autopilot pump when used with the corresponding SmartPilot corepack.
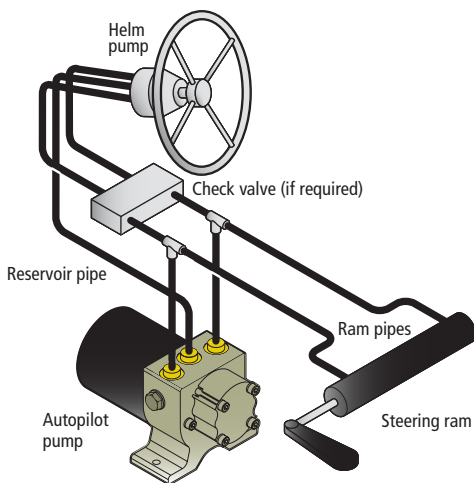
SMARTPILOT HYDRAULIC DRIVE SELECTION CHART

Ram Capacity	Drive Needed	Corepack Needed
$3.1in^3 - 6.7in^3$ (50-110cc)	Type 0.5 ☐ E12139 (12v only)	X-10
$4.9in^3 - 14in^3$ (80 – 230cc)	Type 1 ☐ M81120 (12v) ☐ M81119 (24v)	X-10
$14in^3 - 21in^3$ (230- 350cc)	Type 2 ☐ M81121 (12v) ☐ M81123 (24v)	X-30
$21in^3$-$30.5in^3$ (350-500cc)	Type 3 ☐ M81122 (12v) ☐ M81124 (24v)	X-30
$21in^3$-$73in^3$ (350-1200cc)	Constant Running ☐ E12171 (12v) ☐ E12172 (24v)	X-SOL

- In some systems with dual steering rams, cylinder capacity is total of the two rams. Visit www.raymarine.com to learn more about selecting a hydraulic drive for dual steering ram systems.

- A Certified Raymarine Dealer is best suited for installing a hydraulic autopilot system.

SELECTING A DRIVE: MECHANICAL STEERING SYSTEMS

When selecting an autopilot drive unit for a mechanical steering system, the vessel displacement is the determining factor for selecting the properly sized drive. When determining your vessel displacement always add 20% to the dry weight of your vessel to account for the added weight of fuel, gear, provisions and people. Next select the type of autopilot drive that is right for your mechanical steering system. Raymarine SmartPilot drive units for mechanical steering systems are available in linear, hydraulic linear, sterndrive and rotary drive configurations. Below are images of each type of mechanical steering drive.

Rotary Drive   Linear Drive   Stern Drive

MECHANICAL ROTARY DRIVES

The rotary drive is designed for power and sailboat steering systems that can be driven from the helm position through a chain and sprocket (for example: cable and rod steering systems). The outstanding design of the Raymarine rotary drive unit provides smooth, powerful autopilot-controlled steering with quiet operation. Use the table below to select a rotary drive suitable for your vessel displacement.
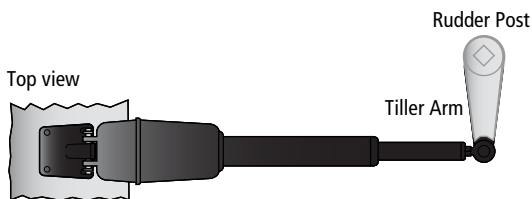
Steering sprocket

Rotary Drive   Drive Chain

Drive sprocket

Typical Rotary Drive System
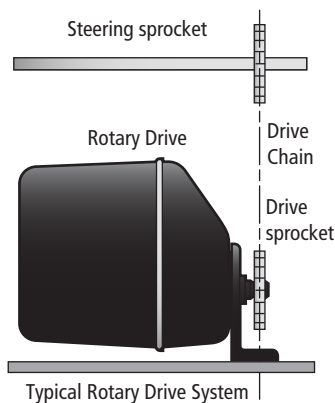
SMARTPILOT ROTARY DRIVE SELECTION CHART

Maximum Boat Displacement	Drive Needed	Corepack Needed
24,000 lb (11,000 kg)	Type 1 ☐ M81135 (12v only)	X-10
44,000 lb (20,000 kg)	Type 2 ☐ M81136 (12v) ☐ M81137 (24v)	X-30

- Optional drive sprockets and modification to the steering chain may be required.

- An authorized Raymarine Dealer is best suited for installing a rotary drive system.

MECHANICAL LINEAR DRIVES

Our most common drive type for sailing vessels, Raymarine mechanical linear drives provide powerful thrust, fast hard over times and quiet operation. Mounted below decks, the linear drive moves the rudder directly by pushing the tiller arm or rudder quadrant.
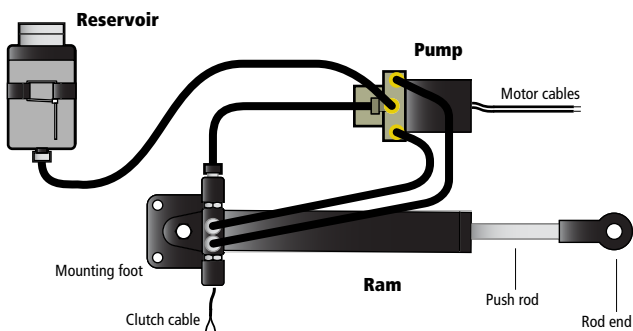

Top view

Rudder Post

Tiller Arm

Typical Linear Drive System

SMARTPILOT LINEAR DRIVE SELECTION CHART

Maximum Boat Displacement	Drive Needed	Corepack Needed
24,000 lb (11,000 kg)	Type 1 ❑ M81130 (12v only)	X-10
33,000 lb (15,000 kg)	Type 2 Short ❑ M81131 (12v) ❑ M81133 (24v)	X-30
44,000 lb (20,000 kg)	Type 2 Long ❑ M81132 (12v) ❑ M81134 (24v)	X-30

HYDRAULIC LINEAR DRIVES

Designed for larger mechanically steered vessels, our hydraulic linear drives are self-contained hydraulic steering systems consisting of a reversing pump, reservoir and hydraulic ram.

Reservoir

Pump

Motor cables

Mounting foot

Ram

Push rod

Rod end

Clutch cable

SMARTPILOT HYDRAULIC LINEAR DRIVE SELECTION CHART

Maximum Boat Displacement	Drive Needed	Corepack Needed
48,500 lb (22,000 kg)	☐ M81200 (12 Volts) ☐ M81201 (24 Volts)	X-30
77,000 lb (35,000 kg)	☐ M81202 (12 Volts) ☐ M81203 (24 Volts)	X-30

• The linear drive unit connects to the rudder stock via an independent tiller arm. Accessory fittings from your steering system manufacturer may be required.

• An authorized Raymarine Dealer is best suited for installing a linear drive system.

SELECTING A DRIVE: STERN DRIVES

Many boats equipped with inboard/outboard engines and power assisted cable steering can take advantage of our universal I/O drive unit. This innovative electromechanical drive unit operates the power steering valve in the same way as the steering cable.

Stern Drive

SMARTPILOT STERN DRIVE SELECTION CHART

Type	Universal I/O drive
Corepack Type	X-10
Drive method	Electromechanical
Maximum thrust	50 kg (110 lb)
Maximum stroke	214 mm (8.3 in)
Hard over to hard over time	8.8 sec
Part Number	☐ E12026

- **Always** verify compatibility before installing a drive unit by consulting with an authorized Raymarine dealer or Raymarine's Product Support Team.

- This drive is not compatible with 1997 or later Mercruiser power assist Inboard Outboard drives. Please see Smartpilot X-5 Sport.

- Cable steering systems using non feedback helms are not compatible with this drive.

- Additional stern drive units are available for specific engine configurations. Visit our website www.raymarine.com to learn more.

SELECTING A COREPACK

Once you have determined the appropriate Drive Unit, the next step is to select a SmartPilot Corepack. Corepacks contain the SmartPilot course computer and compass. The X-30 and X-SOL corepacks also include a rudder reference sensor. Corepacks are available in three levels of performance (X-10, X-30 or X-SOL). Based on the type of drive unit your vessel requires, use the chart below to select the appropriate level of SmartPilot Corepack.

**X-10 COREPACK**   **X-30 COREPACK**   **X-SOL COREPACK**

SMARTPILOT X-SERIES COREPACK SELECTION CHART

Core Packs	X-10	X-30	X-SOL
Compatible Drive Types	Type 1	Type 2 ,3	Solenoid Drive Systems
Supply voltage	12/24v	12/24v	12/24v
Solenoid drive interface	No	No	Yes
Supplied with Rudder Reference Sensor	No	Yes	Yes
Smart Rudder Sense technology	Yes	Yes	No
Fast 10Hz gyro stabilized heading output for MARPA and radar/chart overlay on Raymarine Multifunction Displays	Yes	Yes	Yes
Part Number	☐ E12198	☐ E12199	☐ E12205

SELECTING A COREPACK: X-CAN FOR STEER-BY-WIRE SYSTEMS

Designed to integrate with modern steer-by-wire system like the Volvo Penta IPS, the Raymarine SmartPilot X-CAN represents the convergence of autopilot and propulsion technology. Employing Raymarine's proven AST (Advanced Steering Technology), the SmartPilot X-CAN delivers razor sharp course keeping and smooth course changes. CAN Bus communication protocol provides the SmartPilot X-CAN with a single cable interface to today's modern propulsion systems.   SeaTalk and SeaTalk**ng** technology provides captains their choice of multiple SmartPilot or ST70 control heads as well as seamless integration with Raymarine's multifunction displays, instrument systems and NMEA2000 devices.
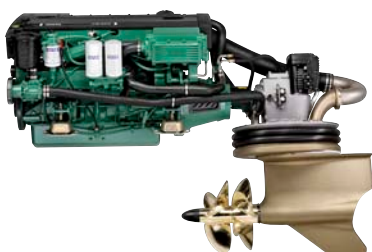
Features:

- Steer-By-Wire Technology
- Advanced Steering Technology (SmartPilot AST)
- Simplified CAN Bus interface*
- Compatible with the ST70 autopilot control heads

* Volvo Penta Autopilot Gateway required for some installations. Please consult your Raymarine dealer for more information.

ORDERING INFORMATION

PART #	DESCRIPTION
E12200	SmartPilot CAN Corepack

MERCURY VERADO SYSTEMS
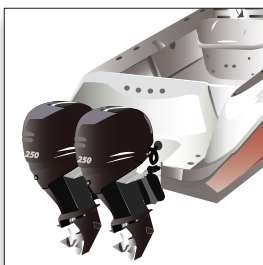
Choose the SmartPilot X-10 corepack, your choice of control head, the Type 1 hydraulic drive and the optional Verado hose kit (part # A18127) for vessels equipped with single or twin Mercury Verado outboard engines. Raymarine Smart Rudder Sense technology eliminates the need for a rudder feedback sensor, simplifying the autopilot installation with Verado propulsion systems.

MERCURY VERADO TECH TIP

For triple or quad Verado engine applications use X-30 Corepack, your choice of control head, a Type 2 hydraulic drive and the optional Verado hose kit (A18127).

WIRELESS AUTOPILOT CONTROLLERS

Add the freedom of a wireless remote to your Raymarine SmartPilot Autopilot. Choose from the compact S100 Wireless remote for full function autopilot control. The larger SmartController offers full autopilot control plus the ability to quickly monitor vital instrument and navigation data. The SmartController features a rechargeable battery that connects to any SeaTalk network and automatically recharges the batteries from the SeaTalk network power supply. Compatible with current and legacy SeaTalk instruments and SeaTalk autopilots.

S100 WIRELESS SEATALK AUTOPILOT REMOTE CONTROL

Compact and lightweight, the S100 remote delivers the freedom of wireless control to any Raymarine autopilot. The bright display is easy to read with two lines of text and a graphical autopilot mode indicator. The 5 button ergonomic keypad and intuitive menu structure provides simple operation and easy access to extended features. Rugged and waterproof, the S100 fits in your pocket or clips to your belt, keeping full function autopilot control always within reach.

ORDERING INFORMATION

PART #	DESCRIPTION
E15024	S100 Wireless Autopilot Control

Belt Clip   Lanyard

SMARTCONTROLLER WIRELESS SEATALK AUTOPILOT AND INSTRUMENT REMOTE CONTROL

Take control of your Raymarine SeaTalk® network with the powerful SmartController wireless handheld remote. Set a new course to steer or monitor vital instrument and navigation data in the palm of your hand. Big on features, the waterproof SmartController is lightweight and compact for easy handling. The SmartController features a rechargeable battery that recharges from the SeaTalk® network power supply. A convenient mounting cradle holds the SmartController firmly in place when recharging.

ORDERING INFORMATION

PART #	DESCRIPTION
E15023	SmartController Wireless Autopilot Control

SMARTPILOT AUTOPILOT JOYSTICK

Compatible with any Raymarine SmartPilot below-deck autopilot system, the SmartPilot Autopilot Joystick provides you with convenient auxiliary steering control anywhere on your boat using your autopilot's drive system. Multiple Joystick Controllers can be fitted anywhere you need to steer. Mount them at bridge-wing control stations, aft-decks or even in the arm of your Captain's chair. Easy SeaTalk network integration simplifies installation. The Raymarine SmartPilot Joystick Controller supports both proportional and bang-bang operation. Combine the Joystick Controller with an optional rudder angle instrument below for convenient full-function steering anywhere.

ORDERING INFORMATION

PART #	DESCRIPTION
E12136	Smartpilot Autopilot Joystick

RUDDER ANGLE INSTRUMENTS

ST60 Plus Rudder

ST70 Plus Rudder

The Raymarine ST60+ and ST70+ Analog Rudder Angle Instruments provide a clear indication of rudder angle position anywhere you need to see it. The perfect compliment to your Raymarine SmartPilot system, our rudder angle instruments can be mounted at the helm, in the pilot house, or at auxiliary control stations. SeaTalk networking makes installation easy. Multiple Rudder Angle Instruments can be mounted anywhere you need them. These instruments are backlit for night time operation, and are fully waterproof for mounting inside or out. Convenient surface mount or flush mount options match your other instruments, autopilot control head and multifunction displays perfectly.

ORDERING INFORMATION

PART #	DESCRIPTION
A22008-P	ST60 Plus Rudder Angle Indicator
E22122	ST70 Plus Rudder Angle Indicator

* Optional rudder reference unit required for operation (part number M81105)

CHOOSE AN AUTOPILOT ONLINE

Visit our website at www.raymarine.com and access our interactive online autopilot sysytem builder. The interactive system builder will help you select the best autopilot solution for your boat. While online you can also connect with our network of authorized dealers. Raymarine dealers offer expert installation and advise on Raymarine autopilot systems.

WWW.RAYMARINE.COM

• Extensive product information and video tutorials

• Expert Technical advice and FAQs

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Raymarine®