



Integrating HYPACK[®] Into Vessel Autopilot - An Introduction

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WHAT IS THE AUTOPILOT DRIVER?

Autopilot.dll outputs NMEA messages to the vessel's autopilot to steer planned lines.

WHAT IS THE AUTOPILOT DRIVER USEFUL FOR?

For some vessel operations, hand-steering survey lines can be a challenging, labor-intensive task. Some operators find using the vessel's autopilot helpful for maintaining vessel track while surveying. The HYPACK[®] Autopilot driver takes this capability one step further by sending navigation commands from HYPACK[®] to the boat's autopilot to correct for deviations from the planned line. This is similar to integrating a chartplotter (supplied by the autopilot manufacturer, or a third-party software such as Rose Point) into your autopilot.

WHAT ARE THE LIMITATIONS OF USING HYPACK[®] TO STEER LINES?

The capability of HYPACK[®]'s Autopilot driver is only as good as the autopilot itself. There are a multitude of settings within a vessel's autopilot that need to be fine-tuned for specific operations and environmental conditions. For example, most autopilots have different weather settings for varying sea states, and options for rudder gain (how much rudder to use and how aggressively to apply it) and counter rudder (how it responds to overshooting the desired course). When there is a lot of wind or current, especially perpendicular to the planned lines, the vessel's autopilot will have a more difficult time maintaining its track, especially if the settings aren't adjusted accordingly.

Additionally, some autopilots have "quirks": One vessel I worked aboard had an autopilot system that would make dramatic 180 degree turns if the line plan transitioned to a reciprocal line without the operator taking the vessel out of autopilot in between. That being said, **only test your autopilot when and where it's safe to do so**, preferably in open waters away from any other vessel traffic or dangers to navigation!

WHAT DO YOU NEED TO MAKE THIS WORK?

To use HYPACK[®] to control the vessel's autopilot, you need (at a minimum):

- HYPACK[®] with a GPS and the Autopilot.dll configured in HYPACK[®] Combined Hardware
- A Planned Line file (.lnw)
- An autopilot system capable of using NMEA messages from an external source for vessel navigation
- Appropriate connectors and converters

Before jumping too far into integrating HYPACK[®] into your autopilot, I recommend reaching out to the autopilot manufacturer and discussing the autopilot's capabilities, and what type of connectors and adapters you would need to make this type of integration work.

HOW DOES A BOAT'S AUTOPILOT WORK?

An autopilot typically has:

- A computer- the brain of the autopilot, usually installed under the helm stand or somewhere out of sight
- A controller- the user interface usually located near the helm stand
- A heading sensor and GPS
- A drive unit- integrated into the boat's steering system

Usually in the controller menu, you can select from different steering mode options such as heading hold (maintain an ordered heading), waypoint mode (steer to a specified lat/long), or navigation mode (steer by navigation commands from an external source). Additionally, somewhere in the controller settings you'll often find options for connecting to external devices for receiving data. With many modern autopilot systems, this transfer of data happens over something called a NMEA 2000 backbone.

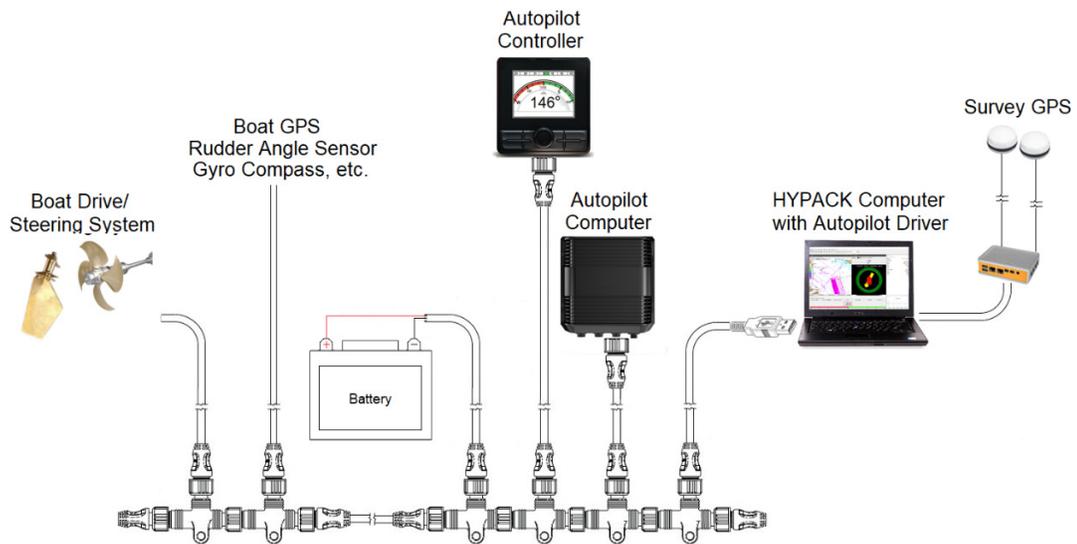
WHAT IS A NMEA 2000 BACKBONE?

A NMEA 2000 backbone uses plug-and-play components to integrate your marine electronic devices over a common network. They are extendable, meaning you can easily incorporate additional devices by adding additional connectors to the network. Depending on the manufacturer of your autopilot, you can usually purchase connectors and adapters that are compatible with the NMEA 2000 backbone on your vessel. Most NMEA 2000 devices are interchangeable and vary only by connector type.

PHYSICAL CONNECTIONS FROM THE HYPACK[®] COMPUTER TO THE AUTOPILOT:

As I mentioned previously, often the easiest way to sort this out is to talk to the autopilot manufacturer. The HYPACK[®] Autopilot driver sends standard NMEA 0183 messages and will often require a converter to be readable to the autopilot if it isn't equipped to read them

natively. The cable you purchase to connect from the computer to the NMEA 2000 backbone might have built-in conversion capability. After everything is integrated, your setup might be something like this:



In some scenarios, you may have to build a custom cable to connect directly to the autopilot computer board, in which case you'd need some knowledge of basic electronics, serial conversion, and NMEA DB-9 connector pinout.

USING THE AUTOPILOT DRIVER:

Setup: Refer to the Common Driver Notes in your HYPACK® documentation folder. The messages you select will depend on what NMEA strings your autopilot needs. You also have some alarm and multiplier options that you can configure as needed.

Setup Dialog

Generated Messages

- APB - Auto Pilot B sentence
- BWW - Bearing, waypoint to waypoint
- XTE - Cross-track error, measured
- BOD - Bearing, origin to destination
- RMB + RMC - RMB Recommend minimum navigation information
RMC Recommend minimum specific GPS/TRANSIT data
- VTG - Track made good and speed over ground

Alarms

- Depth Min: 10 Max: 100 Time: 10
- Standard Deviation Work Units: 5
- Beams per Ping Max Bad Beam %: 5
- MRU
- SVP Min: 1440 Max: 1550
- GPS HDOP: 5 Sats: 3 Time: 10
- Border

XTE Decimal Precision

2 3 4

Multiplier

Apply

XTE Minimum 0.01

XTE Multiplier 1.01

XTE Maximum 1

OK Cancel

Connection: Connection information for the output to the autopilot.

Device Connection

Connection Type Serial

Serial Parameters

Port COM1 Speed 9600

Data bits 8 Stop bits 1

Parity None Flow control None

OK Cancel

A sample of what the output messages will look like:

Autopilot-COM1:9600,n,8,1

Course : 283.7 Heading: 190.75

```
$GPVTG,181.3,T,,2.2,N,4.2,K*20
$GPBOD,283.7,T,,M,L1P1,L1P0*66
$GPRMC,204625.424,A,4252.6232,N,07915.3438,W,2.2,190.7,051022,,D*75
$GPRMB,A,0.0087,L,L1P0,L1P1,4252.6142,N,07915.3440,W,0.01,179.9,2.2,V,D*7C
$GPBWw,283.7,T,,M,L1P1,L1P0*6D
$GPAPB,A,A,0.0087,L,N,,283.7,T,L1P0,179.9,T,179.9,T,D*56
$GPXTE,A,A,0.0087,L,N,D*09
```

TESTING YOUR SETUP:

Much of this setup and testing can (and should) be accomplished at the pier. Once you have the autopilot integrated and the driver set up, confirm that autopilot is receiving the messages. Make sure you're in the correct mode to navigate from an external source, and that you have the right source selected. Once the autopilot starts receiving commands, it might prompt you to confirm you want to proceed to the ordered course. Compare the information on the screen with the selected planned line to be sure what you're seeing makes sense. **Be careful- some autopilots might not send a prompt and may begin to turn without asking!** In the example below, you would probably not want to accept this course change as it will attempt to turn the boat 180 degrees in autopilot.



Once the integration is confirmed, it's time to do some operational tests in safe, open water.

SOME TIPS FOR SUCCESS:

- Set aside some time to fine tune the settings on your autopilot before attempting to run a survey using the Autopilot driver.
- Don't try to make big turns in autopilot. Put the vessel in hand steering to come about, then when you are steadied on your line azimuth with a small cross-track error (XTE), engage navigation mode on the autopilot.
- Give the vessel plenty of running room to line up before the start of the line. If you aren't steady or you're still far to the left or right of the line when you engage navigation mode, it will likely have a difficult time getting to the line.
- Having good communication between the vessel operator and the surveyor is crucial when using HYPACK[®] to drive lines. Unexpected changes to the selected line can be a big problem.

This article is not intended to be all-inclusive, but more to give some of you some general guidance if you're considering the integration of HYPACK[®] into your autopilot. If you decide to pursue this project, please reach out with any specific questions you may have to help@hypack.com!