ComNav® marine ltd

Sine-Cosine Interface Box

for ComNav 1000, 2000 & 14xx Series Autopilots and SI-TEX SP-70 & SP-80 Autopilots

Installation Instructions

Certified System ISO 9001

PN 29030044 V1.0

Welcome

Thank you for purchasing a ComNav Marine Sine-Cosine Interface Box!

At ComNav, we are dedicated to reliability & quality in all our products, and proud of our prominence as a leader in the design and manufacture of marine autopilot systems. We promise to do our best to ensure your satisfaction with all your ComNav products.

ComNav Marine Ltd.

General Notice

This document, ComNav part number 29030044 Version 1 Revision 0, contains the approved Installation Instructions for the Sine-Cosine Interface Box. Where versions of this document exist in other languages, the English version shall be considered authoritative.

Document History

Revision	Date	By	Description
1R0	06 August 2004	FW	First release
1R1	14 November 2008	FW, DTO	• Added info for K-INT4, Vector G2/G2B and 14xx/SP-70/80 • Formatted with current template

Introduction

These Installation Instructions are for the ComNav Sine-Cosine Interface Box, PN 21010004.

This document is mainly intended to describe how to connect and configure the current generation of the Interface Box (the K-INT 4) when a ComNav Vector G2/G2B GPS Compass is used for the Heading source of certain ComNav & SI-TEX Autopilot Systems.

However, it also includes some historical wiring information, for the two previous generations of the Interface Box (Types K-INT 3 & K-INT 2), and for the KVH GyroTrac Sensor (PN 21010003).

Overview

The ComNav Sine-Cosine Interface Box allows an NMEA 0183 compass to be used with an autopilot that can only accept a traditional analog-signal type of compass input (usually referred to as “Sine-Cosine” signals). It can also be used to interface other NMEA “heading” devices to analog-compass-input autopilots & other navigation equipment.

In particular, it allows a ComNav Vector G2 (or G2B) GPS Compass to be used as the compass source for a ComNav 1000, 2000 or 14xx Series Autopilot, or a SI-TEX SP-70/80 Autopilot. Those autopilots can not accept NMEA 0183 heading data; they were designed to be used with a Fluxgate Compass or Magnetic Compass Sensor. The Interface Box does the conversion of the Vector’s serial digital NMEA heading data output into the analog Sine-Cosine compass signals required by those autopilots.

The Interface Box contains a small microcontroller, a NMEA 0183 Listener circuit, and some analog amplifier circuitry. The microcontroller receives NMEA 0183 heading sentences (either HDT, HDG or HDM) from the Vector – which is an NMEA 0183 Talker – via the box’s Listener circuit, converts the heading data in those sentences to analog Sine & Cosine “compass” signals, and then drives those signals out to the autopilot that it is connected to, via the amplifiers.

The Interface Box has two Jumpers which control how the microcontroller handles the checksums on the NMEA sentences, and set the polarity of the Sine & Cosine signals. It has four DIP Switches which set the Reference Voltage for the Sine & Cosine output signals. It has an on-board voltage regulator circuit, which allows it to accept two different ranges of power supply, and two LEDs which indicate how it is operating.

The Interface Box requires a special ComNav cable, when it is used with ComNav 1000/2000 Series Autopilots; this cable, PN 31110023, is shown on the cover page[1]. When used with ComNav 14xx or SI-TEX SP-70/80 Autopilots, a similar special cable, PN 31110051, is required.

> ⓘ ***CAUTION****: these special cables are NOT the standard Compass Cable that is supplied with those autopilots.*
>
> *The special cables have internal resistors to limit the swing of the compass signals. The resistors are required for the autopilots’ compass input circuit to work properly when connected to the Interface Box.*

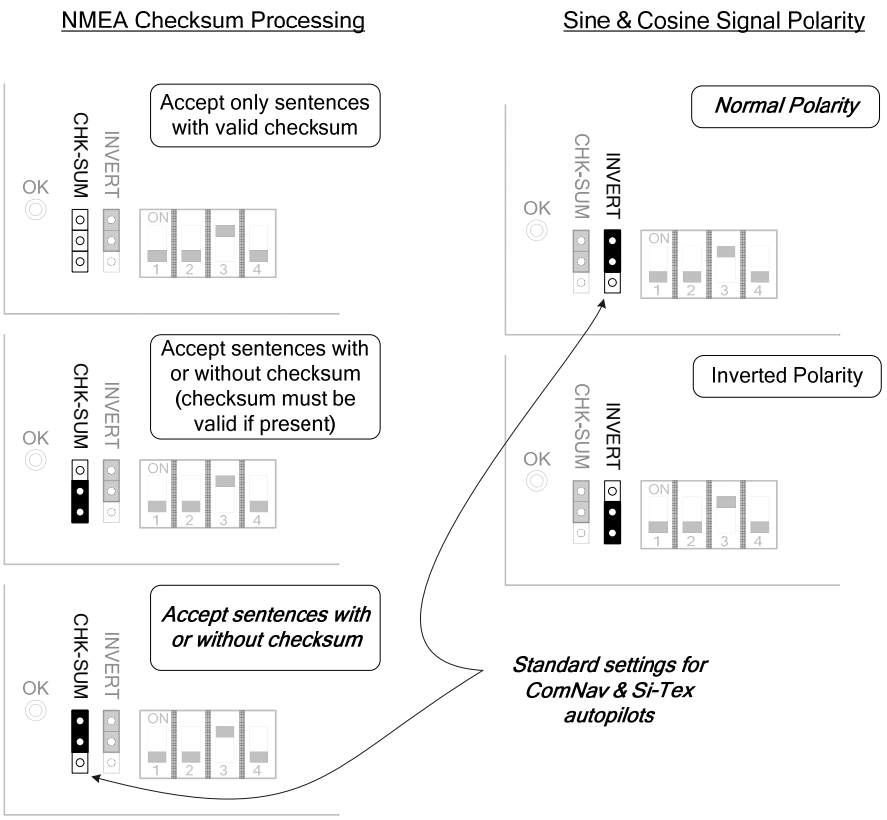
Do not attempt to use the standard Compass Cable with the Sine-Cosine Interface Box! If you do so, the autopilot may operate incorrectly.

[1] The special cables are not supplied with the Sine-Cosine Interface Box. They must be ordered separately.

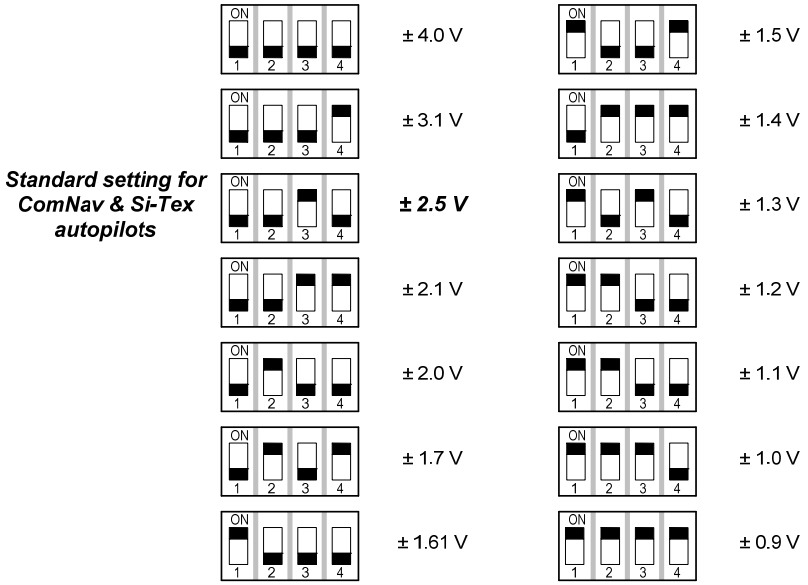
Installation

Jumper & DIP Switch Settings

The Jumpers control the processing of NMEA 0183 data checksums, and define the polarity of the Sine & Cosine signals:



The DIP switches set the peak-to-peak voltage amplitude of the Sine & Cosine signals:



Connections

The terminal strip in the Interface Box contains 4 groups of signals:

1) SIN/COS (output):

Pin	Signal
S	Sine
C	Cosine

The peak-to-peak voltage of the Sine & Cosine output signals is set by the DIP Switches (see page 3).

2) REF (input, output):

Pin	Signal
V	Reference Voltage input
R	Reference Voltage output
U	Ground

Pins R & U are only used when the Sine-Cosine Interface Box is being used with equipment other that a ComNav autopilot, and only if there is no “Reference Voltage” output provided by the equipment.

- Connect a wire jumper between pins V & R
- Connect pin R to the Reference Input of the equipment
- Connect a ¼ or ⅛ W resistor between pins R & U, as follows:

Reference Voltage required at equipment	Resistor Value
1.0 V	1K2 Ω
1.6 V	2K2 Ω
2.5 V	4K7 Ω
3.4 V	10K Ω
4.0 V	18K Ω

3) SUPPLY (input):

Pin	Signal
U	Ground
T	+8 VDC ⓘ
J	+12 to +24 VDC ⓘ

ⓘ ***Note**: only one of pins T & J can be used for the Interface Box’s power input; the choice depends on the external supply.*

4) NMEA (input):

Pin	Signal
+	A (or “+ve”)
–	B (or “–ve”)

NMEA Configuration

NMEA Data Source

The NMEA data source must be configured to transmit sentences at the NMEA 0183 standard settings: 4800 Baud, 8 bits, no parity, one stop bit. It must transmit the data with at least 100 milliseconds between successive sentences.

The data source should be set to transmit only one of the three possible Heading sentences:

1) HDT, if you wish to have the autopilot steer the vessel on Headings in Degrees True
2) HDG, if you wish to have the autopilot steer the vessel on Headings in Degrees Magnetic
3) HDM, if you wish to have the autopilot steer the vessel on Headings in Degrees Magnetic

The source's setting for NMEA checksums must match the setting of the CHK-SUM jumper on the Sine-Cosine Interface Box (see the figure on page 3).

For best operation with ComNav or SI-TEX autopilots mentioned earlier, the NMEA data source must output Heading data sentences at no less than a 5 Hz update rate (10 Hz or more is preferable).

Status LEDs

The Interface Box has two status LEDs.

- The **NMEA** LED indicates that data signals are being received on the NMEA + and NMEA – pins.

  ⓘ *It does not indicate that those signals are properly formatted, or even that the signal wires are correctly polarized (i.e., as NMEA "A" & "B" signals); it only indicates that there is "signal activity" – i.e., transitions between logical '1' & '0' bit states – on the pair of signal wires.*

- The **OK** LED indicates that the NMEA data signals being received on the NMEA input (+, –) pins are valid: that is, the sentences are correctly formatted, & have checksums according to the CHK-SUM jumper. It also indicates that valid Sine & Cosine signals, corresponding to the heading data values in the received NMEA sentences (HDT, HDG or HDM, as noted above), should be appearing on the box's Sin & Cosine output pins.

  ⓘ ***Note**: if the Heading sentences being received have Null data (for example, a $GPHDT,,T*xx sentence), the Sine/Cosine output signals will typically remain at the voltages that existed when the Heading sentences last had non-Null data. This condition can occur, for example, in Vector G2/G2B GPS Compasses, during start-up, or during extended periods of loss of GPS satellite signals (see the Vector G2/G2B manual for more information).*

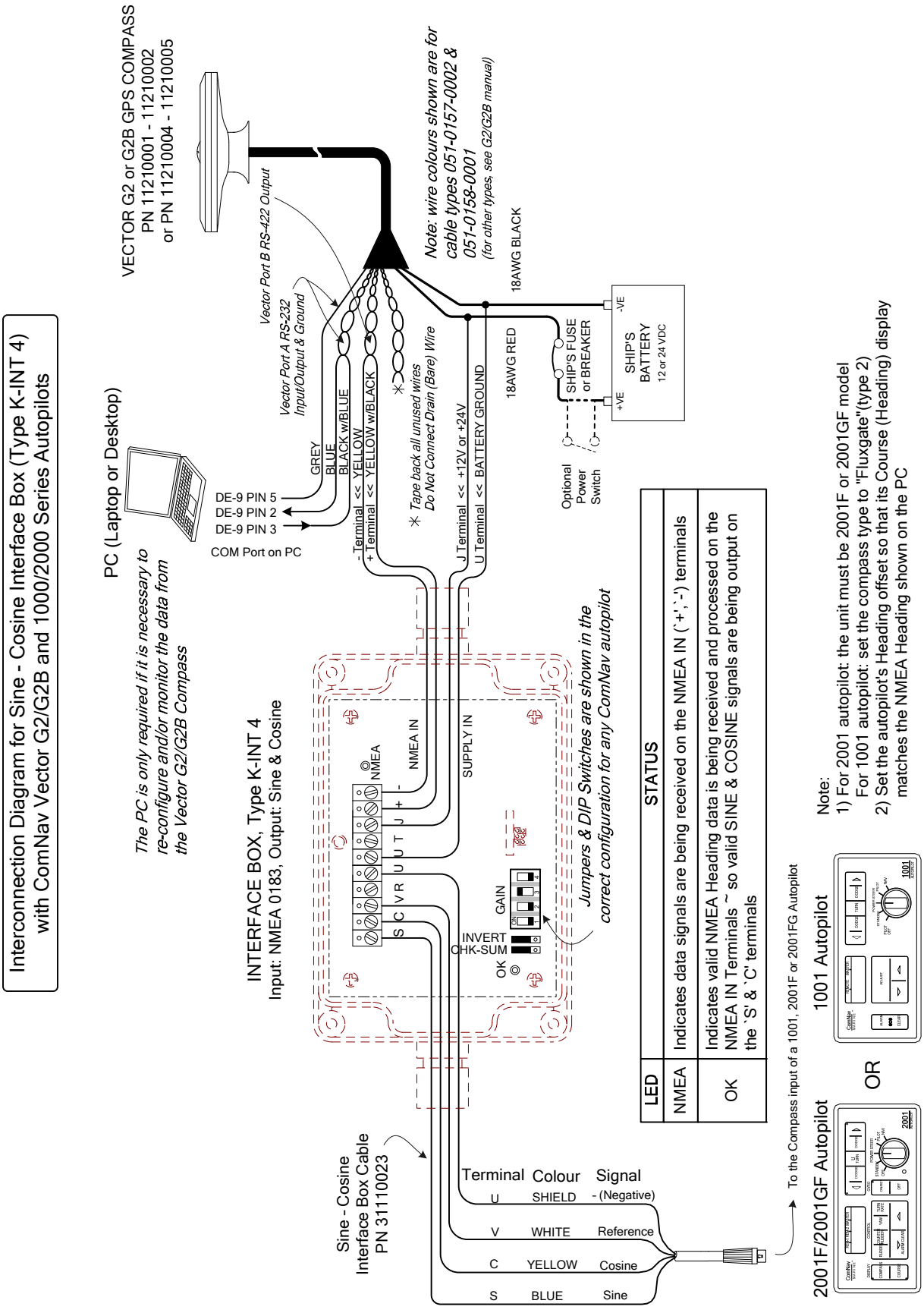
Wiring Diagrams

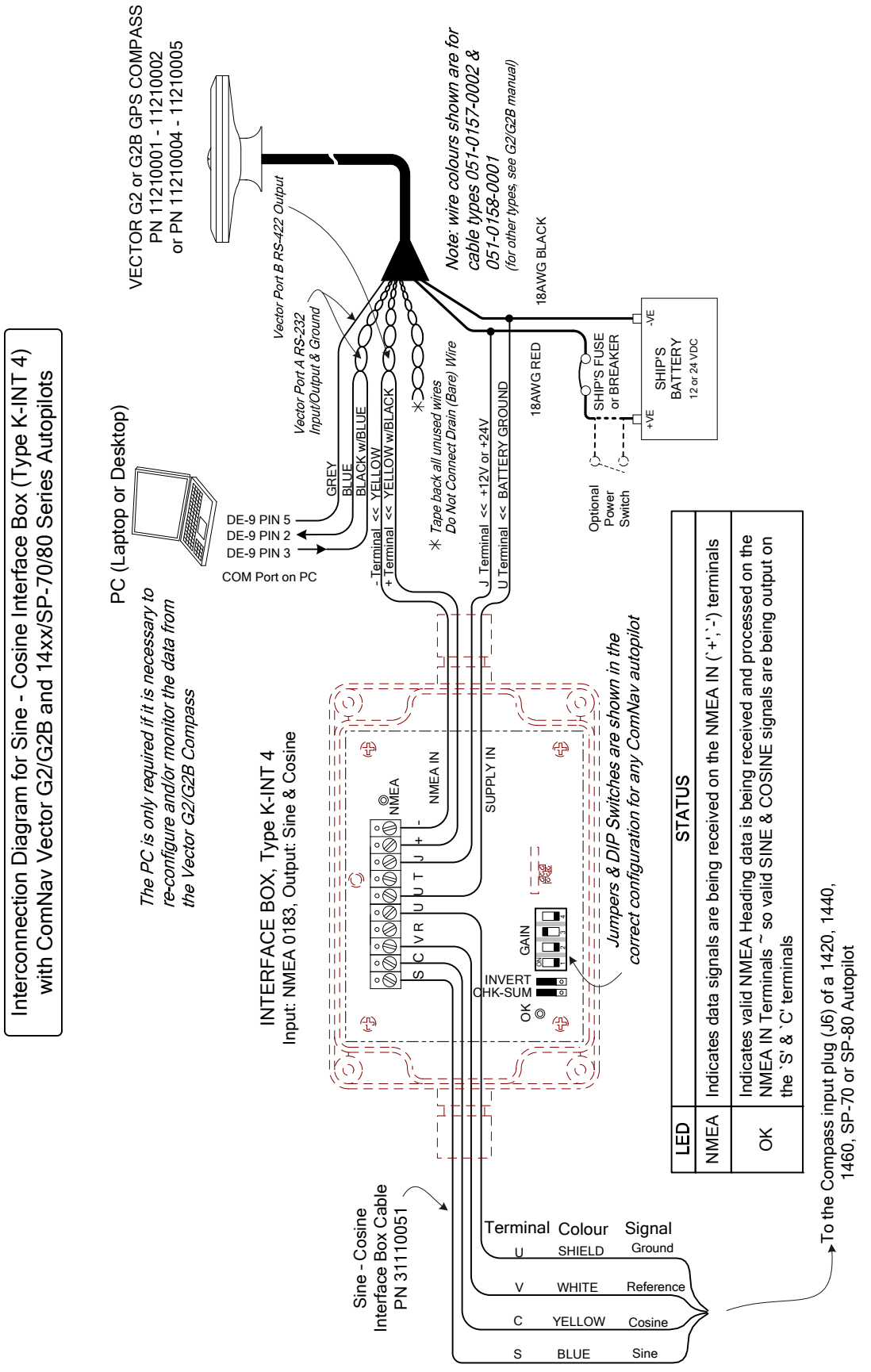
The following pages contain typical wiring diagrams for the Interface Box.

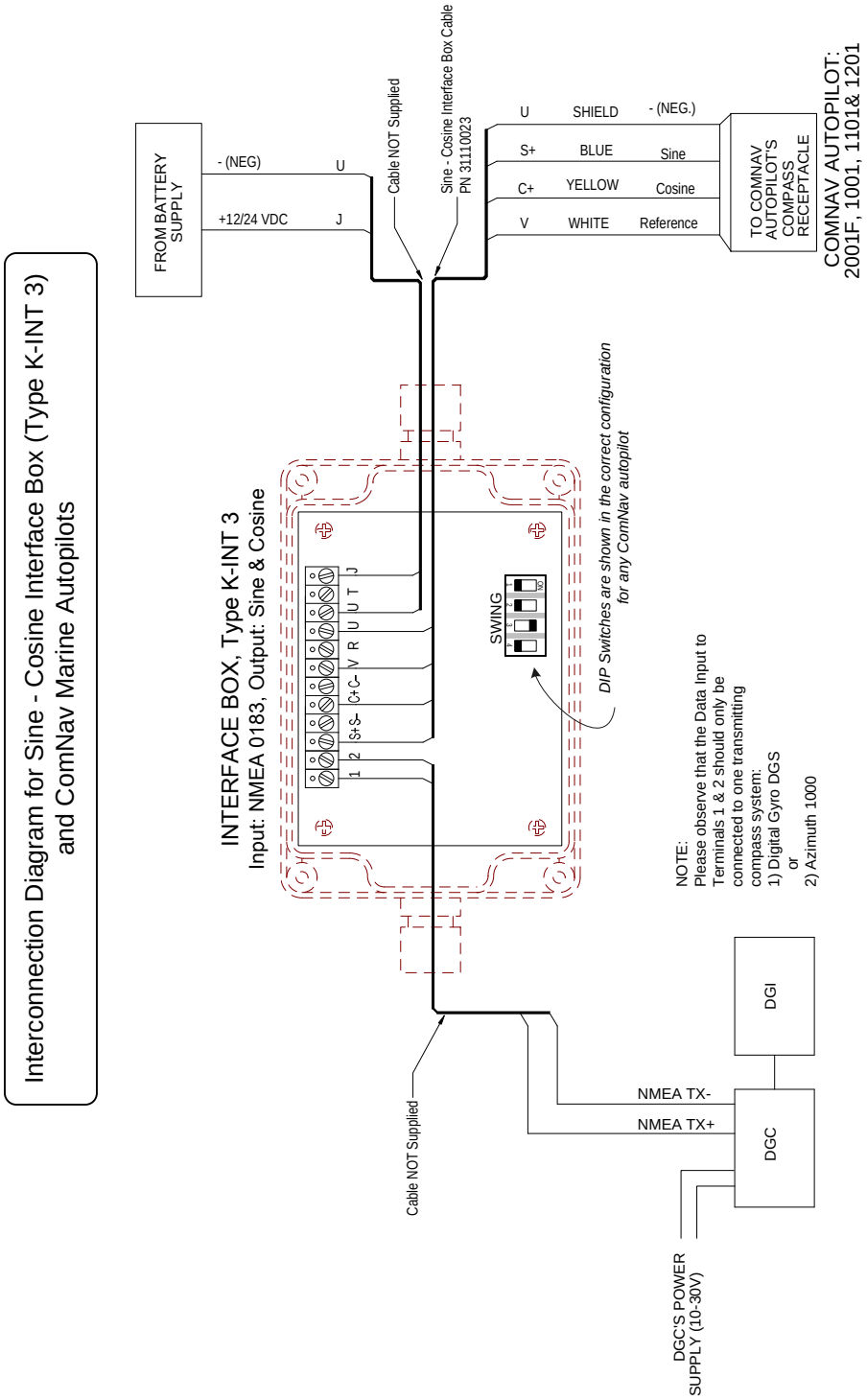
The first diagram is for the Type K-INT 4 Interface Box, with a Vector G2/G2B GPS Compass, when used with a ComNav 1000 or 2000 Series Autopilot.

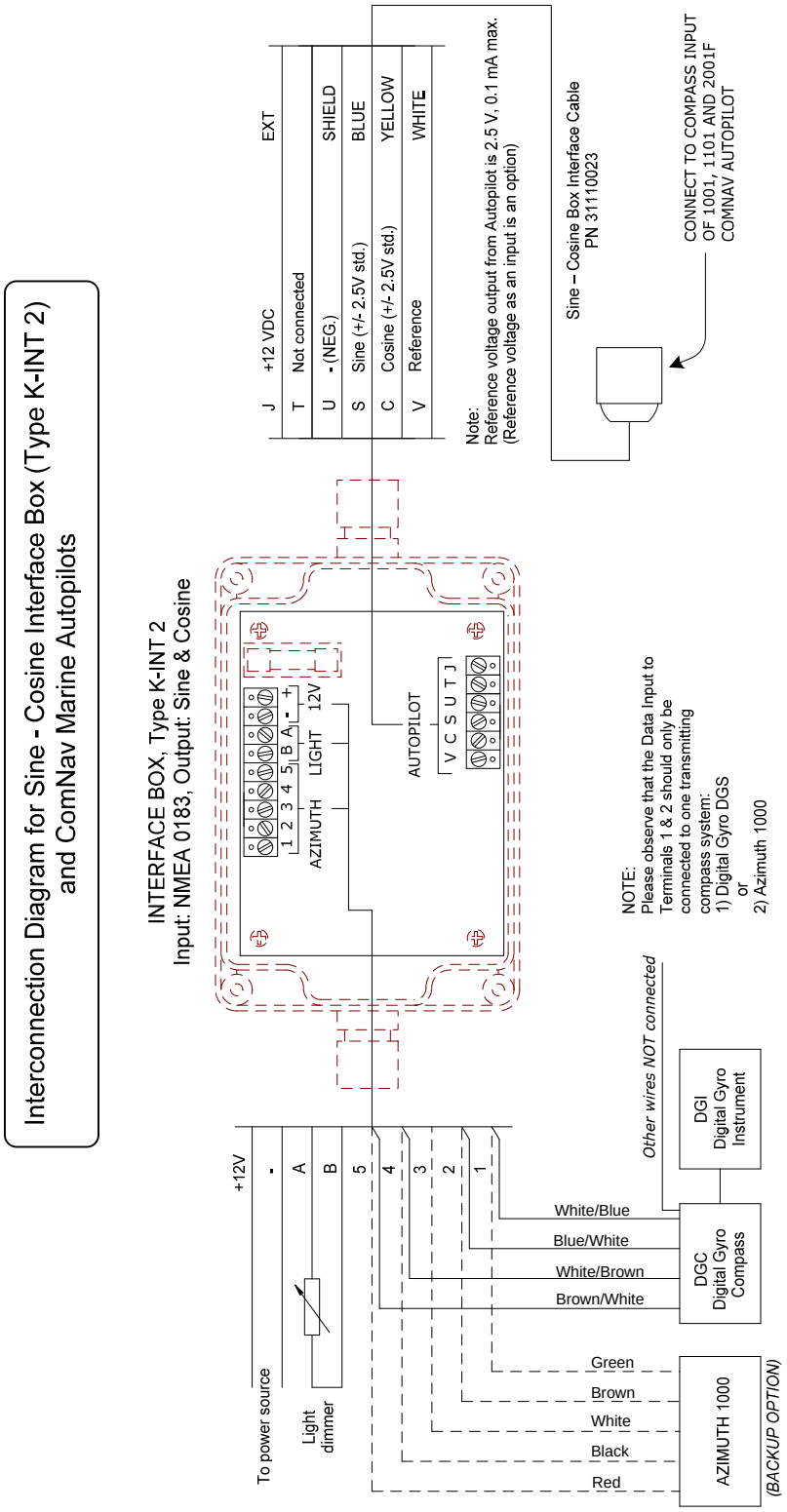
The second diagram is similar, but for a ComNav 1440 or SI-TEX SP-70/80 Autopilot.

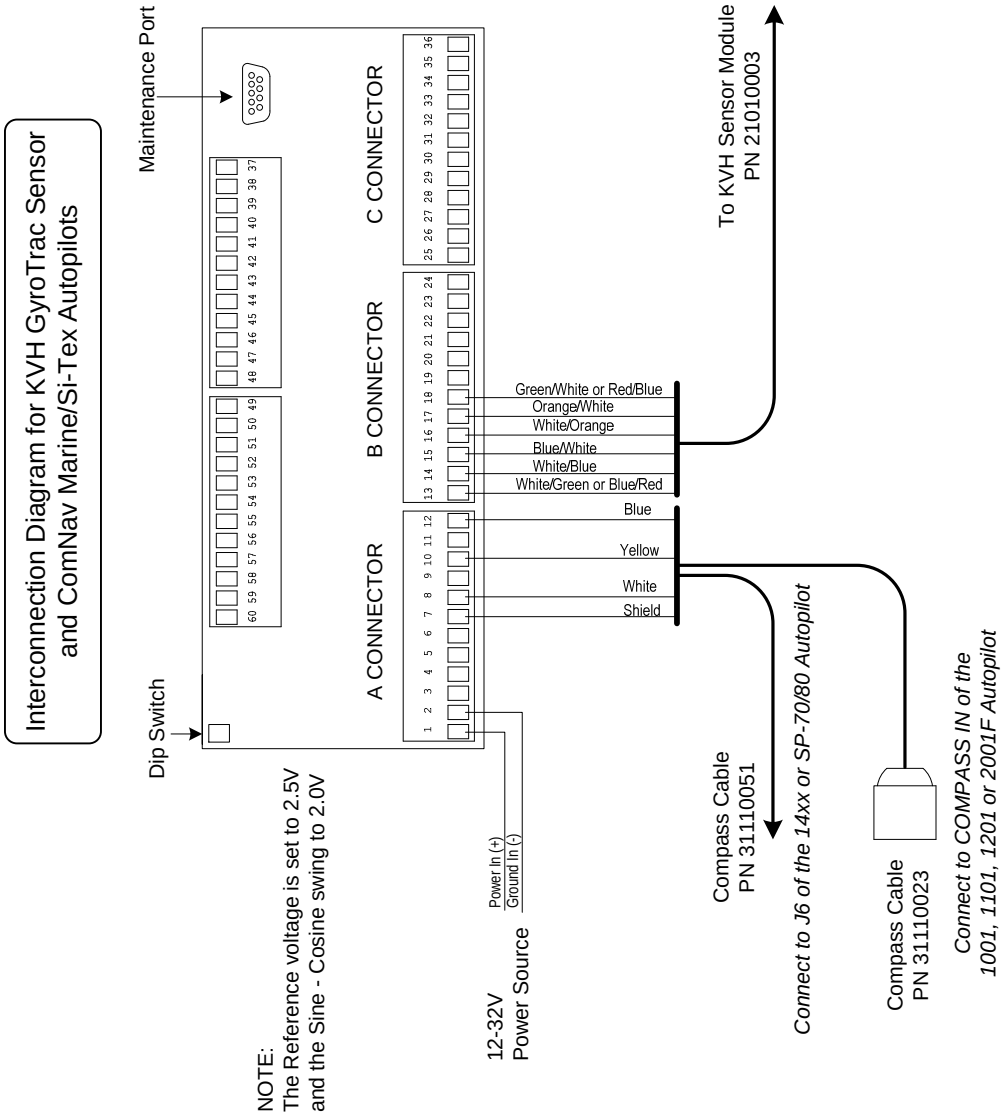
The other drawings are for the previous versions of the Interface Box; they are provided for the convenience of anyone who is using those previous versions with this new Installation Instructions document.


Interconnection Diagram for Sine - Cosine Interface Box (Type K-INT 4)
with ComNav Vector G2/G2B and 1000/2000 Series Autopilots
VECTOR G2 or G2B GPS COMPASS
PN 11210001 - 11210002
or PN 11210004 - 11210005
Vector Port B RS-422 Output
Vector Port A RS-232
Input/Output & Ground
GREY
BLUE
BLACK w/BLUE
YELLOW
YELLOW w/BLACK
Note: wire colours shown are for
cable types 051-0157-0002 &
051-0158-0001
(for other types, see G2/G2B manual)
18AWG BLACK
PC (Laptop or Desktop)
DE-9 PIN 5
DE-9 PIN 2
DE-9 PIN 3
COM Port on PC
- Terminal << YELLOW
+ Terminal << YELLOW w/BLACK
Tape back all unused wires
Do Not Connect Drain (Bare) Wire
J Terminal << +12V or +24V
U Terminal << BATTERY GROUND
18AWG RED
SHIP'S FUSE
or BREAKER
Optional
Power
Switch
-VE
+VE
SHIP'S
BATTERY
12 or 24 VDC
The PC is only required if it is necessary to
re-configure and/or monitor the data from
the Vector G2/G2B Compass
INTERFACE BOX, Type K-INT 4
Input: NMEA 0183, Output: Sine & Cosine
NMEA
NMEA IN
SUPPLY IN
S C V R U U T J + -
GAIN
INVERT
CHK-SUM
OK
Jumpers & DIP Switches are shown in the
correct configuration for any ComNav autopilot
STATUS
LED
NMEA
Indicates data signals are being received on the NMEA IN (`+`, `-`) terminals
OK
Indicates valid NMEA Heading data is being received and processed on the
NMEA IN Terminals ~ so valid SINE & COSINE signals are being output on
the `S` & `C` terminals
Sine - Cosine
Interface Box Cable
PN 31110023
Terminal Colour Signal
U SHIELD - (Negative)
V WHITE Reference
C YELLOW Cosine
S BLUE Sine
To the Compass input of a 1001, 2001F or 2001FG Autopilot
2001F/2001GF Autopilot
OR
1001 Autopilot
Note:
1) For 2001 autopilot: the unit must be 2001F or 2001GF model
For 1001 autopilot: set the compass type to "Fluxgate"(type 2)
2) Set the autopilot's Heading offset so that its Course (Heading) display
matches the NMEA Heading shown on the PC


Interconnection Diagram for Sine - Cosine Interface Box (Type K-INT 4)
with ComNav Vector G2/G2B and 14xx/SP-70/80 Series Autopilots
VECTOR G2 or G2B GPS COMPASS
PN 11210001 - 11210002
or PN 11210004 - 11210005
Vector Port B RS-422 Output
Vector Port A RS-232
Input/Output & Ground
GREY
BLUE
BLACK w/BLUE
YELLOW
YELLOW w/BLACK
Note: wire colours shown are for
cable types 051-0157-0002 &
051-0158-0001
(for other types, see G2/G2B manual)
18AWG BLACK
18AWG RED
BATTERY GROUND
SHIP'S FUSE
or BREAKER
SHIP'S
BATTERY
12 or 24 VDC
-VE
+VE
Optional
Power
Switch
PC (Laptop or Desktop)
DE-9 PIN 5
DE-9 PIN 2
DE-9 PIN 3
COM Port on PC
- Terminal << YELLOW
+ Terminal << YELLOW w/BLACK
Tape back all unused wires
Do Not Connect Drain (Bare) Wire
J Terminal << +12V or +24V
U Terminal << BATTERY GROUND
The PC is only required if it is necessary to
re-configure and/or monitor the data from
the Vector G2/G2B Compass
INTERFACE BOX, Type K-INT 4
Input: NMEA 0183, Output: Sine & Cosine
NMEA
NMEA IN
SUPPLY IN
S C V R U U T J + -
GAIN
INVERT
CHK-SUM
OK
Jumpers & DIP Switches are shown in the
correct configuration for any ComNav autopilot
STATUS
LED
NMEA
Indicates data signals are being received on the NMEA IN (`+`, `-`) terminals
OK
Indicates valid NMEA Heading data is being received and processed on the
NMEA IN Terminals ~ so valid SINE & COSINE signals are being output on
the `S` & `C` terminals
Sine - Cosine
Interface Box Cable
PN 31110051
Terminal
Colour
Signal
U
SHIELD
Ground
V
WHITE
Reference
C
YELLOW
Cosine
S
BLUE
Sine
To the Compass input plug (J6) of a 1420, 1440,
1460, SP-70 or SP-80 Autopilot


Interconnection Diagram for Sine - Cosine Interface Box (Type K-INT 3) and ComNav Marine Autopilots
FROM BATTERY SUPPLY
- (NEG)
+12/24 VDC
U
J
Cable NOT Supplied
Sine - Cosine Interface Box Cable PN 31110023
U SHIELD - (NEG.)
S+ BLUE Sine
C+ YELLOW Cosine
V WHITE Reference
TO COMNAV AUTOPILOT'S COMPASS RECEPTACLE
COMNAV AUTOPILOT: 2001F, 1001, 1101& 1201
INTERFACE BOX, Type K-INT 3
Input: NMEA 0183, Output: Sine & Cosine
1 2 S+ S- C+ C- V R U T J
SWING
DIP Switches are shown in the correct configuration for any ComNav autopilot
NOTE:
Please observe that the Data Input to Terminals 1 & 2 should only be connected to one transmitting compass system:
1) Digital Gyro DGS
or
2) Azimuth 1000
DGI
DGC
NMEA TX-
NMEA TX+
Cable NOT Supplied
DGC'S POWER SUPPLY (10-30V)


Interconnection Diagram for Sine - Cosine Interface Box (Type K-INT 2)
and ComNav Marine Autopilots
INTERFACE BOX, Type K-INT 2
Input: NMEA 0183, Output: Sine & Cosine
AZIMUTH LIGHT 12V
1 2 3 4 5 B A - +
AUTOPILOT
V C S U T J
J +12 VDC EXT
T Not connected
U - (NEG.) SHIELD
S Sine (+/- 2.5V std.) BLUE
C Cosine (+/- 2.5V std.) YELLOW
V Reference WHITE
Note:
Reference voltage output from Autopilot is 2.5 V, 0.1 mA max.
(Reference voltage as an input is an option)
Sine – Cosine Box Interface Cable
PN 31110023
CONNECT TO COMPASS INPUT
OF 1001, 1101 AND 2001F
COMNAV AUTOPILOT
NOTE:
Please observe that the Data Input to
Terminals 1 & 2 should only be
connected to one transmitting
compass system:
1) Digital Gyro DGS
or
2) Azimuth 1000
Other wires NOT connected
DGI
Digital Gyro
Instrument
DGC
Digital Gyro
Compass
AZIMUTH 1000
(BACKUP OPTION)
+12V
-
A
B
5
4
3
2
1
White/Blue
Blue/White
White/Brown
Brown/White
Green
Brown
White
Black
Red
To power source
Light
dimmer


Interconnection Diagram for KVH GyroTrac Sensor and ComNav Marine/Si-Tex Autopilots
Maintenance Port
Dip Switch
A CONNECTOR
B CONNECTOR
C CONNECTOR
Green/White or Red/Blue
Orange/White
White/Orange
Blue/White
White/Blue
White/Green or Blue/Red
Blue
Yellow
White
Shield
To KVH Sensor Module PN 21010003
Compass Cable PN 31110051
Connect to J6 of the 14xx or SP-70/80 Autopilot
Compass Cable PN 31110023
Connect to COMPASS IN of the 1001, 1101, 1201 or 2001F Autopilot
Power In (+)
Ground In (-)
12-32V Power Source
NOTE:
The Reference voltage is set to 2.5V and the Sine - Cosine swing to 2.0V

Technical Data

Sine-Cosine Interface Box

- Supply Voltage: 8 VDC (Terminal T), or 12 - 24 VDC (Terminal J)
- Supply Current: 15mA (without load, 8 VDC)
- Power rating: 120mW
- Isolation voltage: 5 KV (1 minute, AC)
- NMEA Input:
  - Compliant to NMEA 0183 protocol
  - Interface level: RS-422 (also accepts RS-232)
  - Port settings: 4800 Baud, 8 data bits, no parity,1 stop bit
  - Talker Load Current: 0.8 mA @ ±2 V, 2.3 mA @ ±6 V
  - Min. differential voltage: ±2 V
  - Min. time between sentences: 100 mS

Sine-Cosine Box Interface Cables

PN 31000023

- Length: 3 metres (10')
- Connectors: ComNav-standard 7-pin Compass plug to flying wires
- Internal resistors: 1 K Ω ¼ W in series in Sine & Cosine wires (Blue, Yellow), 10 K Ω ¼ W in series in Reference wire (White)

PN 31000051

- Length: 3 metres (10')
- Connectors: Flying wires both ends
- Internal resistors: 1 K Ω ¼ W in series in Sine & Cosine wires (Blue, Yellow), 10 K Ω ¼ W in series in Reference wire (White)

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