NAVICO®

JB 5000

JUNCTION BOX
JB5000

FOR USE WITH THE NAVICO TILLERPILOT® TP5000 AND TP5500.

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The Junction box **JB5000** is used to expand the Tillerpilot **TP5000** system, allowing connection of a handprogrammer **HP5000**, a wind vane **WV3** or masthead unit **WD200**, plus interfacing to a Navico log **DL200** and to a Radio Navigation Receiver.

It is supplied pre-wired with a 6-metre cable to connect to the remote socket on the Tillerpilot. It is also supplied with two 6-metre extension cables with panel mounted sockets to allow connection of both a handprogrammer, and a **WV3**.

If the Radio Navigation interface is to be used a handprogrammer **HP5000** is also required.

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CAUTION

The **TP5000/5500**, interfaced via a **JB5000** to a radio navigation receiver, gives sophisticated control to relatively small vessels.

It is therefore **vital** to understand the full implications of steering a vessel using such equipment when interfaced with radio navigation receivers (ie: Decca, Loran, GPS).

It is the responsibility of the owner to ensure the suitability and compatibility of interfacing with such navigational receivers and to periodically check the reliability and accuracy of the signals being received.

There is no substitute for good seamanship and it is the **full responsibility of the owner, and/or master** of the vessel using such devices to maintain a proper watch system at all times.

1 INSTALLATION

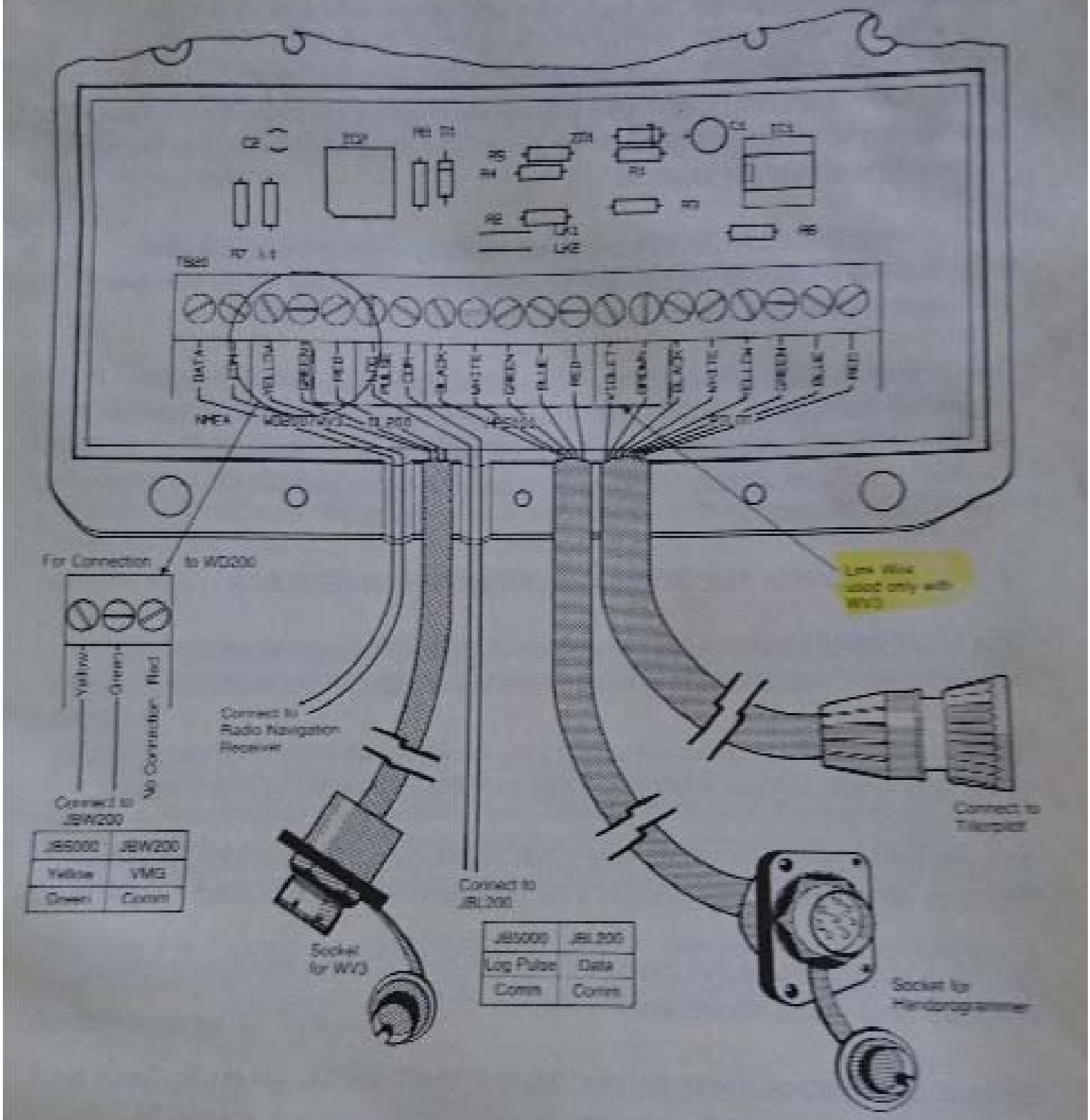
The **JB5000** should be installed in a position that is protected from moisture. The two sockets provided can be mounted into the cockpit at a suitable position for use of the appropriate accessory. Always fit the weatherproof cap to the sockets when not in use!

The cable used to connect to the Tillerpilot should be connected into the handprogrammer socket when not in use. This is to prevent water ingress into the plug. If this is not practical due to distance of the socket from the flying cable, then a dummy socket can be purchased as an accessory - Part No. E01160.

No user access is needed to the **JB5000** as all operation is controlled by either the Tillerpilot or the handprogrammer. Instructions for use of all accessories are covered in the appropriate manual with the exception of radio navigation interfacing which is covered in this Manual.

1.1 CONNECTION OF CABLES TO THE JB5000

Cables to connect to the **TP5000**, the **WV3**, and to **HP5000** are colour coded for connection to the appropriate terminal block. The cables may be trimmed to length, but ensure that the outer sheath does not terminate outside the point of entry to the box.



JB5000	JBW200
Yellow	VMG
Green	Comm

JB5000	JBL200
Log Pulse	Data
Comm	Comm

2 N.M.E.A.

NMEA stands for National Marine Electronics Association. It is an American Association which has defined a number of standards for the output of data from marine instruments so that they can be made compatible with others.

The Tillerpilot 5000 system is designed to be compatible with standards NMEA 0180, NMEA 0182 and NMEA 0183, using information available for off-track error and bearing to waypoint (NMEA 0182 and NMEA 0183 only). Refer to Section 5 for definition of formats required.

This information is used to trim the boats heading to bring it onto the track between two waypoints which have been user defined in the Radio Navigation Receiver (hereinafter referred to as navigator).

The algorithm used to process the information also requires information regarding the speed of the vessel. This information can be entered manually on the handprogrammer **HP5000** (refer to **HP5000** Owner's Manual Section 4) but for best results information of speed can be obtained automatically by interfacing to a Navico **DL200** log.

3 USING THE RADIO NAVIGATION INTERFACE

It is essential to fully understand how to use your navigator. Normally a sailplan has to be entered before data is sent from the navigator and alarms enabled.

Navico are unable to assist on use of your navigator as there are many models available - refer to your navigator Instruction Manual or to the manufacturer.

It is essential to enable the correct mode of interface in the handprogrammer. Refer to **HP5000** manual Section 5 for programming of the correct NMEA format.

It is also essential to enter the speed of your boat into the handprogrammer **HP5000** (this is not necessary if a Navico **DL200** is interfaced).

Before use please refer to the IMPORTANT NOTE given in Section 7 of this Manual.

3.1 HOW TO ENGAGE OPERATION

Control of the autopilot NMEA mode is enabled from the handprogrammer **HP5000** as follows.

- Select the approximate bearing to the required waypoint using the bearing to waypoint facility, waypoint 0. (Note: with NMEA 0182 and NMEA 0183 information may be available automatically as waypoint 0). Press the Enter Key to lock onto this heading as the autopilot course.

- Engage the NMEA mode - press the Mode Key to give a flashing NMEA Legend on the display. Press the Enter Key to lock this mode of operation.

The Tillerpilot will now steer to a heading that is modified occasionally to ensure that the destination waypoint is reached, correcting for tidal and wind drift. The course displayed on the **HP5000** will be updated when each change occurs.

The NMEA mode can be entered when the boat is off-track, but will NOT function correctly if the boat is greater than 0.3Nm off-track for NMEA format 0180, or greater than 1.27Nm off-track for NMEA formats 0182 and 0183.

On reaching the destination waypoint an alarm may sound on the **HP5000**. This depends on the content of information sent to the Tillerpilot system by your navigator.

Provided the alarm has sounded, no further corrections to the course will occur unless a new waypoint is selected. If information on a new bearing to waypoint has been received by the Tillerpilot system (from your navigator) then this bearing will automatically be displayed on the centre row of the **HP5000** display.

To utilize this bearing simply press the Enter Key. Immediately the vessel will steer to this bearing and further small corrections thereafter applied to compensate for off-track error.

Note:

- Should a waypoint be reached and no further waypoint engaged then the vessel will continue to steer the last course.
- The NMEA mode can only be used when operating under compass operation.

3.2 ALARMS

If communication between your navigator and the Tillerpilot system is lost, the NMEA Legend will flash and an intermittent alarm sound.

When a waypoint is reached the NMEA Legend will flash and an intermittent alarm sound. Provided information of the next bearing to waypoint has been received this will then be indicated on the centre row of the HP5000 display (Note: This information is definitely NOT available on the NMEA 0180 format).

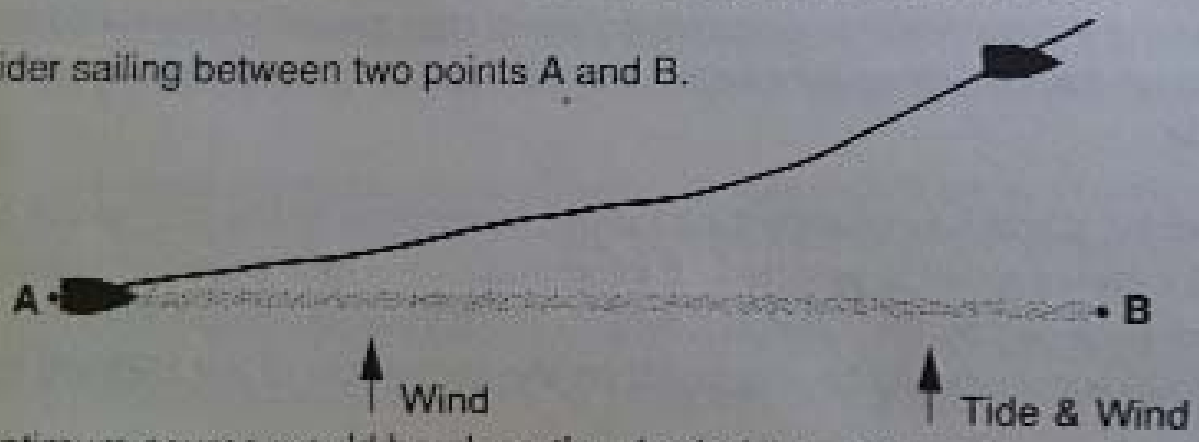
3.3 JITTER

Information from Radio Navigation Systems can be subject to jitter. ie: random jumps of position, possibly of 50/200 metres hence giving rise to false information of off-track error. This jittor is commonly caused by electrical interference and careful installation of your navigator is required to eliminate this, refer to your Radio Navigator Handbook or the manufacturer.

It is important to note that the NMEA interface with the Tillerpilot is designed to use the off-track error information and should this be subject to jitter then the boat will slowly oscillate by a few degrees around the desired course. Refer to Section 4 for a diagrammatical example.

4 WHY USE THE RADIO NAVIGATION INTERFACE

Consider sailing between two points A and B.



The optimum course would be along the shaded line, referred to as the desired track.

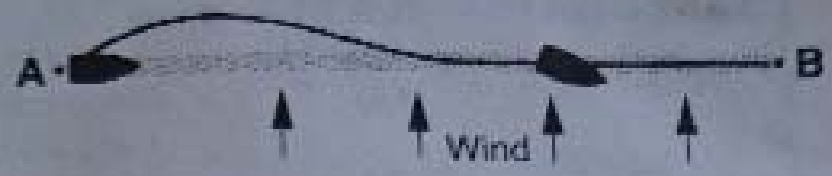
The autopilot will maintain a good heading, but cannot compensate for wind and tidal drift. To arrive at B you would need to continually monitor your position and make adjustments to the heading to bring the boat back onto the desired track.

Using the NMEA mode, the boat is brought back to the desired track and adjustments made automatically to keep it on track.

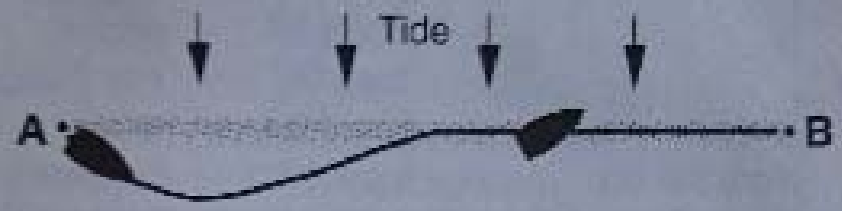
4.1 EXAMPLES OF WHAT TO EXPECT

Operation commenced with boat off-track, heading parallel to track, no tidal or wind drift.

Operation commenced with boat on-track, heading to waypoint, with wind drift.

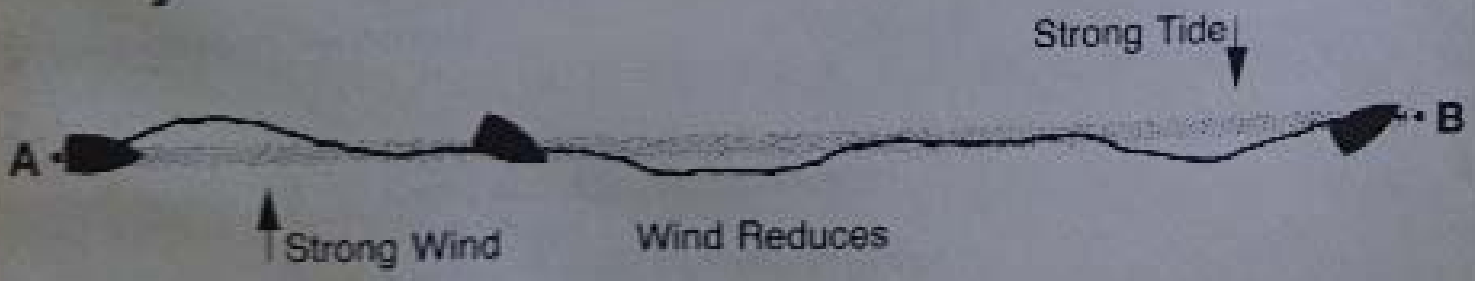


Operation commenced with boat on-track, heading away from waypoint, but with constant tidal drift at 90° to track



Operation commenced with boat on-track, heading to waypoint, but with signals (from the radio navigator) subject to jitter.

These examples represent only a few of the many possible conditions, however the likely result is a composite picture of all of these.



5 NMEA FORMATS REQUIRED

The output of data from your navigator must be in one of the following formats.

5.1 NMEA 0180 SIMPLE FORMAT

Baud Rate	1200		
Parity	odd		
Date repetition rate	0.8-5.0 seconds		
Data	1 start bit	-	Logical 0
	D0-D5	-	Cross track error in offset binary, 1 unit = 0.01Nm, D0 = LSB
	D6	-	Logical 1 if data valid
	D7	-	Logical 0 to identify simple format.
	Parity bit	-	odd
	Stop bit	-	1 or 2 stop bits.
Note D0-D5	1 1 1 1 1 1	-	Full scale left error
	0 0 0 0 0 0	-	Full scale right error

5.2 NMEA 0182 FORMAT

Baud rate	1200
Parity	odd
Data repetition rate	2-8 seconds
Data block	37 bytes, bytes 1-9 XTE (cross track error)
	bytes 10-13 bearing to next waypoint
	bytes 14-23 latitude (not used)
	bytes 24-34 longitude (not used)
	byte 35 status
	byte 36 null
	byte 37 ETX (end ofblock signal).

Details of required data.

Description	Byte	ASCII Character
XTE (cross track error	1 2 3 4 5 6 7 8 9	$ wild card (ie: anything) wild card (ie: anything) unit K = kilometres, N = nautical miles MSD 0-9 or " . " 0-9 or " . " 0-9 or " . " LSD 0-9 or " . " L=off track to left, R = off track to right
Bearing to next waypoint	10 11 12 13	M = magnetic MSD 0-3 0-9 LSD 0-9
Latitude	14-23	Not used by Tillerpilot system
Longitude	24-34	Not used by Tillerpilot system
Status byte	35	Bit 4 - goes high for 4 data updates to indicate arrival at waypoint.
Null	36	Null.
End of Block	37	03 (Hex) End of data block.

5.3 NMEA 0183 FORMAT

Baud rate 4800 Sentences required:

XTE	cross track error
BWC or BWR	bearing to waypoint
or ARA	minimum autopilot sentence

Structure of Sentences

```
                    (1) (2) (3)      (4) (5) (6)
XTE:   $II XTE, X,  X, X . XX,  L,  N,*XX(CR)(LF)
```

Field
1 Status of data A = OK, V = invalid
2 Cycle lock A = OK, V = invalid
3 Cross track error
4 L = left, R = right (direction to steer)
5 N = nautical miles
6 Checksum (optional)

BWC:

```
  (BWR)     (1)       (2)    (3)    (4)      (5) (6) (7) (8) (9) (10) (11) (12) (13)
$II BWC,XXXXXX,XXXX,XX,N,XXXXX,XX,W,XXX,T,XXX,M,XXX,X,N,XXX,*XX(CR)(LF)
```

Field 1	Time	(this information not used by interface)
2	Latitude of waypoint	(this information not used by interface)
3	N = north, S = south	(this information not used by interface)
4	Longitude of waypoint	(this information not used by interface)
5	E = east, W = west	(this information not used by interface)
6	Bearing to waypoint	(this information not used by interface)
7	T = True	(this information not used by interface)
8	Bearing to waypoint	
9	M = magnetic	
10	Range to waypoint	(this information not used by interface)
11	N = nautical miles	(this information not used by interface)
12	Waypoint number	
13	Checksum (optional)	

```
                  (1) (2)  (3)   (4)(5)(6)(7) (8)  (9) (10)  (11)
APA:        $11 APA,X, X,  X,XX, L,  N, X, X, XXX,M,XXX,*XX(CR)(LF)
```

Field	1	Data A = valid, V = invalid
	2	Cycle lock, A = valid, V = invalid
	3	XTE (9.99 max)
	4	L = left, R = right (direction to steer)
	5	N = nautical miles, K = kilometres
	6	A = valid, V = invalid (arrival alarm)
	7	A = valid, V = invalid (perpendicular crossing alarm)
	8	Bearing to waypoint
	9	M = magnetic, T = time (use M only)
	10	Destination waypoint number (2 or 3 digits)
	11	Checksum (optional).

6 DIAGNOSTIC CHECKS

Symptom	Probable Cause	Remedy
Unable to select NMEA mode.	No data being received.	Check connections to radio navigation receiver. Switch on radio navigation receiver.
Alarm sounds a few seconds after selecting NMEA (NMEA display flashes).	Incorrect data format selected	Re-select the correct data format on the handprogrammer.
Autopilot course updated continuously, oscillating around a mean average heading.	Signals from navigator subject to jitter.	Check installation of navigator.

7 IMPORTANT NOTE RE INTERFACING TO A RADIO NAVIGATOR.

All **TP5000** prior to Serial number FF1727 and all **TP5500** prior to FF0653 require a software update to facilitate correct operation of the NMEA interface. If you have one of these Tillerpilots and require use of this function then return your Tillerpilot to the agent in the country of purchase, who will carry out the update free of charge.

If the update has already been carried out then a suffix "M" will follow the serial number (units of higher serial number to those indicated above do <u>not</u> need a software update and are <u>not</u> suffixed by "M").

SERVICE AND WARRANTY

There are no user serviceable parts in your junction box, and the Warranty is void if the unit is serviced by unauthorized personnel.

The instrument is guaranteed for 12 months from date of retail sale. If it is necessary to have the unit repaired, return it, carriage prepaid to the agent in the country of purchase with a copy of the receipted invoice showing date of purchase. If the original packing is not available, cushion well; the shock loading of freight handling can be very different from the marine environment for which the instrument is designed.

If a fault occurs outside the country of purchase, return the unit to the official NAVICO agent in the country of use. The appointed agent will rectify the fault and make a charge for labour, return carriage and packing. Any component that has failed under the terms of the warranty may be replaced free of charge.

A list of official NAVICO distributors and service centres is available upon request.

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