FALCOM

PROMOTION-KIT

Getting started

FOR BOLERO40 SERIES

Table of contents

Version history:

This table provides a summary of the document revisions.

Version	Author	Changes	Created
1.0.1	F. Beqiri	-Added chapter 5, A detailed explanation of the sample configuration	16/01/2018
1.0.0	F. Beqiri	- Initial version	22/12/2017

Cautions

The information furnished herein by FALCOM is believed to be accurate and reliable. However, no responsibility is assumed for its use. Please, read carefully the safety precautions.

If you have any technical questions regarding this document or the product described in it, please contact your vendor.

General information about FALCOM and its range of products are available at the following Internet address: http://www.falcom.de/

Trademarks

Some mentioned products are registered trademarks of their respective companies.

Copyright

This document is copyrighted by FALCOM GmbH with all rights reserved. No part of this documentation may be reproduced in any form without the prior written permission of FALCOM GmbH.

FALCOM GmbH

No liability (incl. patent liability) is assumed with respect to the use of the information contained herein.

Note

Because our products are being continuously improved, specifications and information given in this document are subject to change by FALCOM without notice.

This confidential document is a property of FALCOM GmbH and may not be copied or circulated without previous permission.

Page 3 of 21

1. ABOUT THIS DOCUMENT

This document provides information about the BOLERO40 series PROMOTION-KIT giving customers the possibility to easily and quickly evaluate the product and all its functionality.

This document was written assuming the user has basic computer knowledge, and is familiar with the Windows operating environment.

1.1 Audience

This document is intended for system integrator and application developers.

1.2 How this document is organized

This guide consists of following chapters:

1. Chapter 2, "Overview" gives an overview of the BOLERO40 series PROMOTION-KIT and describes its contents.

2. Chapter 3, "Getting started" provides installation instructions of the PROMOTION-KIT and testing its functionality.

3. Chapter 4, "Control-Box - hardware description" provides an overview of the control-box and describes how to use it.

4. Chapter 5, "Sample configuration explanation" provides information how the factory preloaded configuration works and the explanation of alarms within the promotion kit configuration.

5. Chapter 6, "Appendix" provides information how the firmware operates and information about the included installation cables. Here is also explained how to operate with your own SIM card and how to login the BOLERO45/41 device to your own remote server.

2. OVERVIEW

This PROMOTION-KIT provides all the necessary hardware, software, and documentation to easily and quickly evaluate the performance of your BOLERO40 series device. The BOLERO40 series device in the promotion kit is shipped pre-configured allowing system integrators and developers to test the factory-preloaded configuration and see how the BOLERO40 series device works. Once the device is powered up, it connects automatically to the FALCOM *D2Sphere* server which supports two-way communication interface between server and device and lets you track all activities of the device, pull and change the factory-preloaded device configuration. You don't need anything else to get started with PROMOTION-KIT. Only an internet enabled computer (PC client) with a pre-installed standard web browser is required. After you log in to the *D2Sphere* server, the exact location and other information transmitted from the device will be displayed on the map.

Please note that, FALCOM's vehicle telematics devices are shipped generally un-configured by default, so, before the device is deployed in the field, the user must write its own PFAL script to configure the functionality of the device and load it into the device with the help of the Workbench configuration tool. How the PFAL script looks like can be read out from the device in the promotion kit using the Workbench configuration tool.

2.1 Scope of delivery

PROMOTION-KIT consists of 1 outer box with 3 small boxes inside. Before you start up the PROMOTION-KIT, make sure that your package includes the following items listed in table 1 below. If any item is missing or damaged, please contact your vendor immediately.

Figure 1: PROMOTION-KIT delivery package.

Nr	Article name	Quantity	Description
BOLERO40 (BOX)			
1	BOLERO45 or BOLERO41	1	1 x BOLERO41 or BOLERO45 device (depending on customer request) pre-configured and all supported Premium-features are activated. At the end of the cable there is an 8pin (2x4) connector that allows connection of the device to the Control-box.
	Battery	1	700 mAh rechargeable battery (already inserted and connected to the BOLERO45)
	PREMIUM-FEATURES	-	All PREMIUM-FEATURES supported by the BOLERO45/41 device are activated by the factory. For details how to use them refer to the corresponding Application Notes listed in chapter 2.2
	Support	-	8 hours free technical support via skype, phone etc. for starting up your project.
5	SIM-Card	1	Prepaid SIM card. Service fee includes 10MB of data transfer and 3 months access to the FALCOM *D2Sphere* server for evaluation purposes.
6	Instruction sheet	1	Mounting instruction contains important information to assist personnel in the installation of the unit.
7	Quick Setup Guide	1	Quick Setup Guide, containing the necessary information how to open/close the case of the device, insert the SIM card(s) and (re)place the internal battery.
8	Info-Sheet	1	Contains log-in data to access the online documentation on the FALCOM website and FALCOM *D2Sphere* frontend server for evaluation purposes.
BOLERO40-CONTROL-BOX			
2	Control-Box	1	Control-Box with a 50 cm long cable and an 8pin (2x4) connector at the end. It has a RS-232 connector that allows USB connection to a PC using the USB-to-Serial converter. This box looks the same as the BOLERO45' Control-Box, with the one difference that it has only one 50 cm long cable instead of 2 cables like the BOLERO45' Control-Box.
3	USB to SERIAL adapter	1	USB-to-Serial converter with extension cable for connection of the control-box to the PC/Laptop.
POWER-SUPPLY-BOX			
4	Power Supply	1	Type **FW7238/12** incl. UK/US/AU/EU adaptor

Table 1: The list of items included in the PROMOTION-KIT.

2.2 Related documents

In addition to this document, the following files comprise the full set of BOLERO40 series product manuals and can be downloaded from the FALCOM web site (protected area). Downloading documents from the FALCOM website:

1. Open your installed browser and enter "https://www.falcom.de/distributor-login/?origin=4"

2. Log-in using the logging data (Username & Password) available in the Info Sheet delivered with the PROMOTION-KIT

3. Go to "Support" and select "AVL (FOX3, STEPPIII,.....)" from the "Documentation" selection box

4. This will list the supporting documents for all FALCOM's vehicle telematics devices. Please, download just the documents listed in the table below.

NR	PDF file name	Description
[1]	AVL_PFAL_Command_Set.pdf	Contains the description of the internal firmware and the supported Configuration Command Set for the FALCOM's vehicle telematics devices.
[2]	BOLERO-40_Series_HardwareManual.pdf	Contains information about the hardware of the BOLERO45/41 device.

Table 2:   Documents for download from the FALCOM website (protected area)

Downloading documents from the FALCOM website:

1. Open your browser and enter "https://www.falcom.de/support/documentation/application-notes/"

2. This will list the application notes for all FALCOM vehicle telematics devices. Please, download just the application notes listed in the table below.

NR	PDF file name	Description
[3]	AppNotes_ECO-DRIVE-GPS.pdf	Contains information about the using of ECO-DRIVE-GPS on FALCOM's vehicle telematics devices.
[4]	AppNotes_INDEXED_HISTORY.pdf	Contains information about the indexed history on FALCOM's vehicle telematics devices.
[5]	AppNotes_Transform_history_data.pdf	Contains information about the conversation of the history data stored in a FALCOM's vehicle telematics device.
[6]	AppNote_Remote_update.pdf	Contains information of how to upgrade FALCOM vehicle telematics devices to a new firmware revision remotely via TCP.
[7]	AppNotes_AVL_Installation_Guide.pdf	This document provides all the necessary information to allow your FALCOM product to be properly and safely installed.
[8]	AppNotes_1-Wire-Guide.pdf	This document provides all the necessary information how to connect 1-Wire sensors to your FALCOM product and work with them.
FALCOM D2Sphere-fleet documents		
[9]	t4y_fleet_UsersGuide.pdf	This document provides all the necessary information how to get started and work with FALCOM *D2Sphere*-fleet server application/frontend.

Table 3:   Documents for free download from the FALCOM website

These PDF files are viewable and printable from Adobe Reader. If you do not have the Adobe Reader installed, you can download it from http://www.adobe.com.

This confidential document is a property of FALCOM GmbH and may not be copied or circulated without previous permission.

Page 7 of 21

3. GETTING STARTED

3.1 PROMOTION-KIT hardware set up

This chapter explains how to connect and set-up this PROMOTION-KIT.

Installing the PROMOTION-KIT in five steps:

1. Unpack the PROMOTION-KIT.
2. Connect the BOLERO45/41 unit to the control-box and PC and apply power.
3. Power up the control-box and charge the internal backup battery of the device.
4. Install the FALCOM Workbench software and start the evaluation of the BOLERO45/41 device
5. Access the online documentation from the FALCOM website using the login data available in the info sheet supplied with PROMOTION-KIT.

3.2 Unpacking the PROMOTION-KIT

Unpack the contents as shown in the figure below. There is no external antenna included in the PROMOTION-KIT, as the BOLERO45/41 has also internal GSM/GGNSS antennas.

Figure 2: Boxes inside the PROMOTION-KIT and the contents of the kit.

3.2.1 Connecting BOLERO45/41 to the control-box

1. Before starting initial operation, switch all switches on the Control-Box to "OFF" (factory default setting) and make sure the device has a clear view of the sky so that the satellite signals can be received.

2. Plug in the 8pin double row connector of cable of the device to the cable with 8pin double row connector of the control-box. To unplug, press the "lever" on the back of this connector and pull it out.
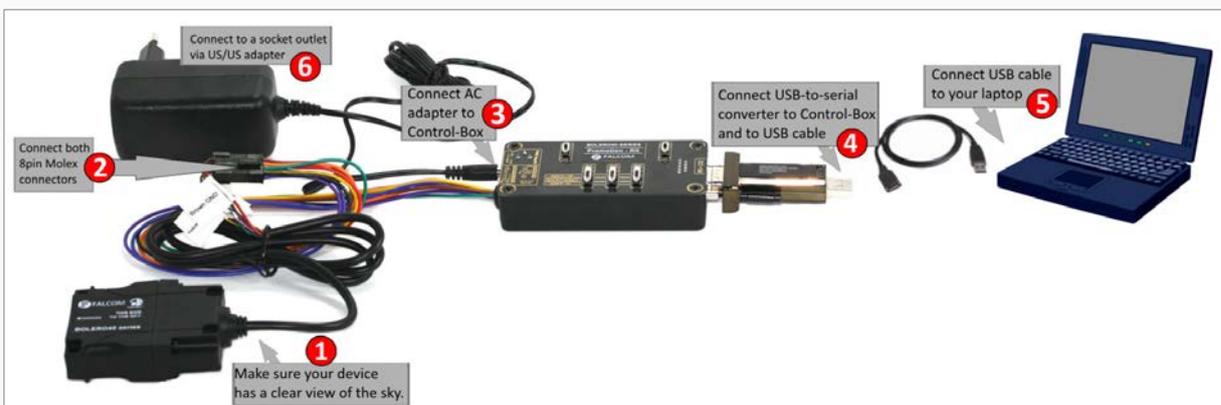

Figure 4: Connecting PROMOTION-KIT to BOLERO45/41 and PC

3. Now, unpack the power supply from the box and plug it into the left input socket on the control-box marked "INPUT 12.0V … 32.0V". Then plug the AC adapter into the wall socket of your 220V electric mains (to access British/American wall socket use the included UK/US adaptor accordingly).

4. The internal battery in the device may be shipped with a minimal charge and will need to be fully charged before use. To charge the internal battery, follow the steps below:

   a) After connecting the AC adapter to the Control-Box and into the wall socket, apply power to the control box and BOLERO45/41 device by turning just the "**+IN**" switch to "**ON**" position.

Figure 5:   Overview of the control-box top panel (+IN = ON)

   b) Depending on the battery charge state, the charging time may by different but usually it takes 2-3 hours to fully charge the internal battery.

5. After the battery is fully charged, unpack the USB to serial converter and the USB extension cable. Remove the USB cover on the converter and connect the USB cable to the converter (1), see figure below. Plug the serial port of the converter to the COM port of the control box (2). Finally, plug the other end of the cable into a free USB port on your PC (3). This cable is used for communication between the BOLERO45/41 and Workbench software for sending and receiving data as well as to change the configuration stored in the BOLERO45/41 device.

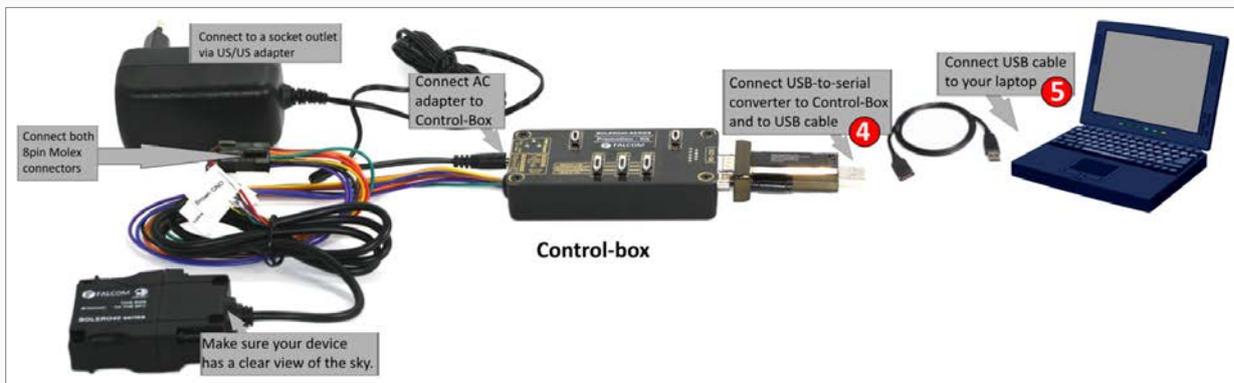**Figure 6:**   Connecting the converter with the USB cable

6. Finally, power up the BOLERO45/41 device by turning the "**IGN**"-switch to "**ON**" position.

     "+IN"   It supplies power to the control box and the connected BOLERO45/41 device.

     "IGN"   It wakes up the BOLERO45/41 from IGN-Sleep mode.

Figure 7:   Overview of the control-box top panel (IGN = ON)

3.2.2 Installing the FALCOM Workbench software and start evaluation

The following list shows the hardware requirements for Workbench software:

(a) PC with 700 megahertz or higher processor Intel Pentium II or compatible processor recommended
(b) 512 MB of RAM or higher recommended (512MB min. supported; may limit performance and some features)
(c) 90 megabytes (MB) of available hard disk space (recommended 2 gigabytes)
(d) Keyboard and Mouse.

To be able to test your device with factory preloaded configuration or to change this configuration and load your configuration into the BOLERO40, you need to install the *Workbench* evaluation software. Go to the link below and download it: http://www.falcom.de/support/software-tools/falcom-workbench/. An install shield will guide you through the installation. An integrated online help can be found after the installation completes.
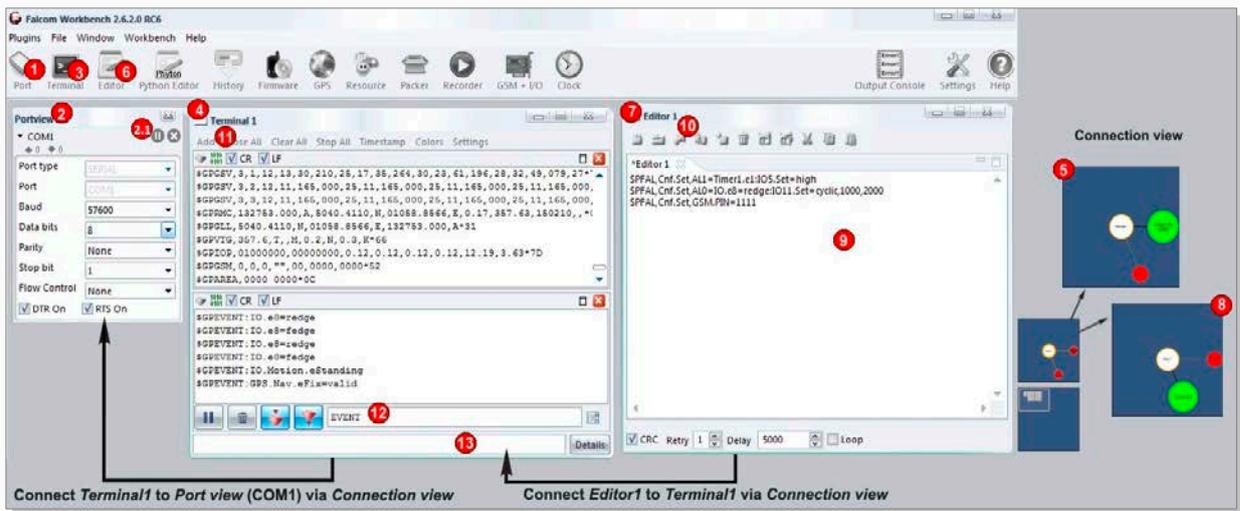

Figure 9: FALCOM Workbench software.

1. After completing the installation, start the **Workbench.exe** by double-clicking on it. Open a new **COM Port** from the Toolbar **(1)**, on the **COM Port view (2)** choose the Port where BOLERO45/41 is connected (go to Device Manager > Ports > USB Serial Port (COMxx), where **xx** is the COM port to use), define the port settings (**115200** bps, **8** Data bits, **No** Parity bit, **1** Stop bit, **None** Flow control) and finally, click the connect (play) icon **(2.1)** to open that COM Port. You can also get an online help in HTML format if you click "**Help**" button on the upper-right corner.
2. Open a new **Console** from the Toolbar **(3)**, click on the **Console1 (4)**, then go to **Connection view** and click on **COMPort (5).**
3. Open a new **Editor** from the Toolbar **(6)**, click on the **Editor1 (7)**, then go to **Connection view** and click on **Console1 (8).**
4. To send commands to the BOLERO45/41 device, type them on the **Editor (9)** and then click on **Start sending configuration (10)** or double click with left mouse each configuration line on the **Editor (9)** individually.
5. To see all events generated by the BOLERO45/41 device, either open a new console "Console2" or on the Console1 **(4)**, click "Add" **(11)**, type the text "GPEVENT" on input field **(12)**, finally click the button **(13)**"Filter incoming". A description how to operate with the Control-Box is given in chapter 4.
6. You have to load/save your configuration into your device before installing the device in the vehicle. How to send data to a TCP-Server or SMS messages to a phone number/SMS server and how to reconfigure the loaded configuration on the device, refer to the Related Documents [1]. A description how the firmware on the BOLERO45/41 works is given in chapter 5.1.

3.2.3 Accessing online documentation

References to the online documentation are listed in chapter 2.2, related documents.

3.3 Customer Support

Users of the PROMOTION-KITS can receive assistance up to 8 hours through technical support team. Contact our technical support through our web site at: http://www.falcom.de/support/support-form/

3.4 FALCOM D2Sphere server-frontend

The D2Sphere-fleet is a web-based tracking application that provides users with an easy-to-use interface from where you can remotely monitor and view the location of the FALCOM AVL devices in real-time. The D2Sphere online tracking software allows you to view the device history and device-generated event, view reports, manage geofences as well as pull and change the factory-preloaded device configuration. After the BOLERO45/41 is successfully powered up, open a web browser (IE or Firefox) and follow the registration process as given on the enclosed slip of paper called „Info-Sheet".

3.5 How does the sample configuration work ?

Once the BOLERO45/41 device is powered up, it tries automatically to register to the GSM network, attach to the GPRS network and finally connect to the FALCOM *trace4yor* server using the factory-preloaded configuration. The connection state of the GPRS and TCP services will be shown by the generated events *GSM.GPRS.eConnected* and *TCP.Client.eConnected* telling you that the device is connected to the GPRS/TCP server. These events are displayed on the Terminal in the Workbench. The device GPS location is shown on the *trac4you* frontend server after log-in. Fore more details about the sample configuration, refer to the chapter 5, A detailed explanation of the sample configuration. For more details about the *D2Sphere* server refer to the Related Documents [14].

4. CONTROL-BOX - HARDWARE DESCRIPTION

This chapter gives you some information about the operation of the control box. It allows you to exercise the function of all inputs and outputs on the BOLERO45/41 device without the need to add any other external component to them. The components on the control-box can be identified from the figures below showing the front, top, and the rear panels. Inside the control-box there is a 1-wire temperature sensor, therefore you are able with corresponding PFAL commands to test also the 1-Wire interface on BOLERO40 series device.
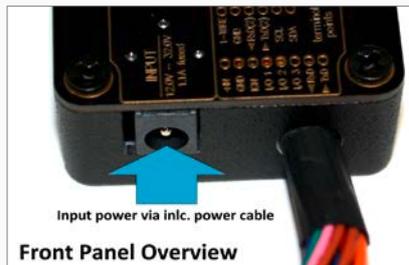
4.1   Front panel overview

Figure 10:   Front panel of the control-box.

A description of each of the items on the front panel is provided in Table 4.

Item	Description
INPUT (12V – 32V)	Input power supply for control-box and BOLERO45/41 device with 1.1 A fuse protected.

Table 4:   Front panel overview.

4.2   Top panel overview

Figure 11:   Top panel of the control-box.

A description of each of the items on the top panel is provided in Table 5.

Item	Description
LED (+IN)	Lights when the +IN-switch is turned to ON.
LED (IGN)	Lights when the IGN-switch is turned to ON.
+IN - switch	This two-way-switch enables or disables power to the connected BOLERO45/41 unit. (To enable power to the device, the **Current**- switch must be set to "**ON**")
IGN - switch	This two-way-switch wakes up the BOLERO45/41 device from **IGN-sleep** mode and sets the **IGN-pin** of the BOLERO45/41 to **High** or **Low signal level** for using the rising edge and falling edge events.
IO - switches	These pins have dual functions. All are controlled by the internal firmware of BOLERO40. Therefore, the user must define whether to use them as analog or digital pins. The configured digital pins can be inputs or outputs while the analog pins can only be inputs. Their function is controlled with commands with **$PFAL,IO1[2].Config=DI,1,10** *or* **$PFAL,IO1[2].Config=AI,1,10** by changing the electrical behaviour of the reference pin to digital or analogue input (**DI** = Digital input; **AI** = Analogue input). These three-way switches (from IO/2 to IO/3, while the IO/1 does not have any function – as IO1 is not available for BOLERO40 series.) allow operation of the IOs either as digital/analogue inputs or digital outputs. More details how to test these IOs, are given below.
	Testing IOs as digital inputs:	When the reference IO (e.g: IO/2) is configured as digital input with "**$PFAL,IO1.Config=DI,2,10**", the BOLERO45/41 device will generate a rising edge event "IO.e1=redge" and set the state of the IO/2 to high "IO.s1=high", if: • the position of the IO/2-Switch changes from "**Digital IN - Low"** to "**Digital IN - High".**

Item	Description
	and will generate a falling edge event "IO.e1=fedge" and sets its state to low "IO.s1=low", if: • the position of the IO/2-Switch changes from "**Digital IN - High**" to "**Digital IN -Low**."
Testing IOs as analogue inputs:	When the reference IO (e.g: IO/2) is configured as analogue input with "**$PFAL,IO1.Config=AI,2,10**, you have to calibrate first this IO the low and high voltages. To do it, perform the following steps (e.g. IO/1): 1. Switch the IO/2-Switch (IO/2) to "**Digital IN - Low**" position**.** 2. Send the command "**$PFAL,IO0.Calibrate,offset=0**" from the Workbench **Editor** ❾ (see Fig. 8) to BOLERO40. 3. Switch the IO/2-Switch (IO/2) to "**Digital IN - High**" position**.** 4. Send the command "**$PFAL,IO1.Calibrate,gain=15**" from the Workbench **Editor** ❾ (see Fig. 8) to BOLERO40. 5. Switch the IO/2-Switch (IO/2) to "**Digital OUT / analogue IN**" position. This position has a fixed voltage of approx. 6V. Now, you can configure an alarm (e.g. *$PFAL,CNF.Set,AL31=Sys.Timer.e1&IO.s1>6.0:IO6.Set=high*) to switch on an LED (e.g. IO/3) when the voltage on the IO/3 is higher than e.g. 5.0 V. To test it, perform the steps below: 6. Send the configuration "**$PFAL,CNF.Set,AL31=Sys.Timer.e0&IO.s2>5.0:IO13.Set=hpulse,5000**" from the Workbench **Editor** ❾ (see Fig. 8) to BOLERO40. 7. Switch the IO/1-Switch (IO/2) to "**Digital OUT / analogue IN**" position**.** 8. Send the command "**$PFAL,Sys.Timer0.Start=single,1000**" from the Workbench **Editor** ❾ (see Fig. 8) to BOLERO40. After the timer expires (1 second has passed), the red LED of the BOLERO45/41 (front side, next to the 6pin accessory port) goes ON for 5 seconds and then turns OFF. For more details about the LED of the BOLERO40 device, refer to the Related Documents [2]**.**
Testing IOs as digital outputs:	When the reference IO (e.g: IO/2) is supposed to be used as digital output, there is no configuration to be done in the firmware. To test it, perform the steps below: 1. Remove the available configuration for the IO/2 with "**$PFAL,IO0.Config=**" 2. Switch the IO/2-Switch to the *"Digital OUT / analogue IN"* position 3. Send the command "**$PFAL,IO5.Set=high**" to set it to High 4. Send the command "**$PFAL,IO6.Set=low**" to set it to Low.

Table 5:   Components on the top panel of the control-box and their functionality

4.3   Rear panel overview

Figure 12: Rear panel of the control-box.

A description of each of the items on the rear panel is provided in Table 6.

Item	Description
Serial port 0	With the serial-toUSB adapter supplied with promotion kit you are able to connect the control-box to a PC and evaluate the connected BOLERO45/41 device.

Table 6: Item description on the rear panel of the control-box.

5. A DETAILED EXPLANATION OF THE SAMPLE CONFIGURATION

In the table below you find a detailed description of the configuration preloaded in the device shipped with promotion kit. To call this configuration use either the command *$PFAL,Cnf.Show* or use the button "*Read current device configuration*" from the **Editor** of the Workbench software. See chapter 3.1.4, Fig. 9.

Functions	Configuration alarms and their descriptions.
Tracking	$PFAL,CNF.Set,AL0=SYS.Device.eStart:SYS.TIMER1.start=cyclic,20000&SYS.TIMER0.start=cyclic,5000&SYS.TIMER2.start=cyclic,2000
	AL0: Every time the BOLERO45 turns on or wakes up, it starts three cyclic Timers: Timer0, Timer1 and Timer2 with repeat timer events that occur every time a 20000, 5000 and 2000 of milliseconds elapses. These timer events will be used later in other alarms to start or stop actions (PFAL commands). E.g. Timer0 event (Sys.Timer.e0) is used in **AL9** to save GPS position data every 20 sec. in the history if other set conditions (*like: displaced distance is > 50m and GPS fix is valid*) are true.
	$PFAL,CNF.Set,AL1=SYS.Device.eStart:GPS.Nav.Position0=load0&GPS.Nav.Position1=load0&Sys.Timer3.Start=single,10000
	AL1: Every time the BOLERO45 turns on or wakes up, it loads the saved Position from memory slot zero to GPS.Nav.Position0 and starts a Timer3 with a single timer event that occurs once, after 100000 of milliseconds (10 sec.).
	$PFAL,CNF.Set,AL2=SYS.Device.eShutdown:GPS.Nav.Position0=save0&GPS.Nav.SaveLastValid
	AL2: Before the device goes in sleep mode, it saves both its position from GPS.Nav.Position0 to memory slot zero and the last valid position in the corresponding configuration parameter.
	$PFAL,CNF.Set,AL3=SYS.Device.eShutdown:TCP.Client.Send,8,"<sfal.event text='shutdown'>"
	AL3: Before the device goes in sleep mode, it sends a TCP packet to the server including the RMC GPS protocol and the user text <sfal.event text='shutdown'>, telling the server D2Sphere its current location with the text event 'shutdown'.
	$PFAL,CNF.Set,AL9=SYS.TIMER.e0&GPS.Nav.Position.s1>50&GPS.Nav.sFix=correct&GPS.Nav.sSpeed>2:GPS.Nav.Position1=current&GPS.History.Write,0,""
	AL9: Each time the cyclic Timer0 runs out, the displaced distance from the position 1 is greater than 50 meters, the GPS is corrected and the speed is > 2m/s, then the device sets the new position to current position and saves the position in the history (Data logging) inside the device.
	$PFAL,CNF.Set,AL10=SYS.TIMER.e1&GPS.Nav.Position.s0>200&GPS.Nav.sSpeed>2:GPS.Nav.Position0=current&TCP.Client.Send,8,"<sfal.pos>"
	AL10: Each time the cyclic Timer1 runs out, the displaced distance is greater than 200 meters, the GPS is corrected and the speed is > 2m/s, then the device sets the new position to current position and sends a TCP packet to the server including the GPRMC protocol and the user text <sfal.pos>.
	$PFAL,CNF.Set,AL11=GPS.Nav.eChangeHeading&GPS.Nav.sSpeed>2:GPS.Nav.Position1=current&GPS.Nav.Position0=current&GPS.History.Write,0,"HEAD"
	AL11: Each time the predefined angle (course) is exceeded and the speed is > 2m/s, then the device sets the new position to current position AND it saves the position in the History (Data logging) with the user text "HEAD"
	$PFAL,CNF.Set,AL12=GPS.Nav.eChangeHeading&GPS.Nav.sSpeed>2:TCP.Client.Send,8,"<sfal.pos>"
	AL12: Each time the predefined angle (course) is exceeded and the speed is > 2m/s, then the device sends a TCP packet to the server including the GPRMC protocol AND the user text 'HEAD'.
	$PFAL,CNF.Set,AL13=IO.e8=redge:Sys.Timer3.Start=single,2000&Sys.Timer4.Stop
	AL13: Each time the Ignition is turned ON (IO.e8=redge), the device starts Timer3 with a single timer event that occurs once, after 2000 of milliseconds (2 sec.) and stops running the Timer4.
	$PFAL,CNF.Set,AL14=Sys.Timer.e3&IO.s8=high:TCP.Client.Send,8,"<sfal.trip.start>"&GPS.History.Write,20,"<sfal.trip.start>"&GPS.Nav.Distance=0
	AL14: When the single Timer3 runs out and the status of the Ignition is still high, then the device sends a TCP packet to the server including the GPRMC protocol, the user text <sfal.trip.start> and also it saves

This confidential document is a property of FALCOM GmbH and may not be copied or circulated without previous permission.

Page 14 of 21

Functions	Configuration alarms and their descriptions.
	the user text in the history (data logging) with the user text <sfal.trip.start>.
	$PFAL,CNF.Set,AL15=IO.e8=fedge:Sys.Timer4.Start=Single,2000&Sys.Timer3.Stop
	AL15: When the Ignition is turned OFF (IO.e8=fedge), the device starts Timer4 with a single timer event that occurs once, after 2000 of milliseconds (2 sec.) and stops running the Timer3.
	$PFAL,CNF.Set,AL16=Sys.Timer.e4&IO.s8=low:TCP.Client.Send,8,"<sfal.trip.stop dist='&(NavDist)'>"&GPS.History.Write,20,"<sfal.trip.stop dist='&(NavDist)'>"&Sys.Timer5.Start=single,60000
	AL16: When the Timer4 runs out and the Ignition pin is still OFF, then the device sends a TCP packet to the server including the GPRMC protocol, the user text <sfal.trip.stop> and the driven distance in meters &(NavDist). It also saves the user text in the history (data logging) with the user text <sfal.trip.stop>, the driven distance in meters and starts Timer5 with a single timer event that occurs once, after 60000 of milliseconds (60 sec.) //If another unit of the driven distance is needed, then replace &(NavDist) with the corresponding dynamic variable: &(NavDist.km) or &(NavDist.miles)
	$PFAL,CNF.Set,AL17=Sys.Timer.e5&IO.s8=low:Sys.Device.Sleep=IGN
	AL17: When the Timer5 runs out and the status of the Ignition pin is still low, then the device goes in sleep mode with the wakeup parameter IGN. The wakeup parameter 'IGN' means, the device will wake up whenever the Ignition pin is switched to high.
LED status	$PFAL,CNF.Set,AL4=SYS.Power.eDropped:IO13.Set=cyclic,200,200
	AL4: When the external/main power drops and the BOLERO45 runs on its internal backup battery, the red LED (IO13) starts flashing 200msON/200ms OFF.
	$PFAL,CNF.Set,AL5=SYS.Power.eDetected:IO13.Set=high
	AL5: When the external/main power is applied and the BOLERO45 runs on its internal backup battery, the red LED (IO13) gets solid.
	$PFAL,CNF.Set,AL6=Sys.Device.eStart&Sys.Power.sVoltage>=9:IO13.Set=high
	AL6: When the BOLERO45 turns on or wakes up from Sleep and external/main power is applied, the red LED (IO13) gets solid.
	$PFAL,CNF.Set,AL7=Sys.Device.eStart&Sys.Power.sVoltage<9:IO13.Set=cyclic,200,200
	AL7: When the BOLERO45 turns on or wakes up on its internal backup battery and the external power is below 9VDC, the red LED (IO13) starts flashing 200msON/200msOFF.
	$PFAL,CNF.Set,AL8=TCP.Client.ePacketSent:IO12.Set=lpulse,200
	AL8: Each time the BOLERO45 sends a TCP message to the server, the green LED (IO12) initiates a low pulse of 200ms.
	$PFAL,CNF.Set,AL18=Sys.device.eStart&GPS.Nav.sFix=invalid:IO13.Set=cyclic,200,200
	$PFAL,CNF.Set,AL19=GPS.Nav.eFix=valid:IO13.Set=high
	$PFAL,CNF.Set,AL20=GPS.Nav.eFix=invalid:IO13.Set=cyclic,200,200
	$PFAL,CNF.Set,AL27=Sys.device.eStart&GPS.Nav.sFix=valid:IO13.Set=high
	AL18, 19, 20, 27: Every time the BOLERO45 turns on or wakes up, it checks all the time for GPS fix and sets the orange LED (IO13) either blinking (AL19, AL27) or turns it ON (AL18, AL27) depending if the device has a GPS fix (AL19, AL27) or not (AL18, AL20).
	$PFAL,CNF.Set,AL21=GSM.eOpfound:IO12.Set=cyclic,200,200
	$PFAL,CNF.Set,AL26=GSM.eOplost:IO12.Set=low
	AL21, 26: Once the device has found a GSM operator, the green LED (IO12) will blink and when it has lost a GSM operator, the LED will turn OFF.
	$PFAL,CNF.Set,AL22=GSM.GPRS.eConnected:IO12.Set=cyclic,400,400
	$PFAL,CNF.Set,AL25=GSM.GPRS.eDisconnected&GSM.sOpValid:IO12.Set=cyclic,200,200

Functions	Configuration alarms and their descriptions.
	AL22, 25: Once the device is attached to GPRS services, the green LED (IO12) will blink and when it is detached from that services but it still has a valid GSM operator, the green LED (IO12) will blink fast.
	$PFAL,CNF.Set,AL23=TCP.Client.eConnected:IO12.Set=high
	$PFAL,CNF.Set,AL24=TCP.Client.eDisconnected&GSM.sOpValid:IO12.Set=cyclic,400,400
	AL23, 24: Once the device is connected to TCP server, the green LED (IO12) goes ON and when it is disconnects from that server but it still has a valid GSM operator, the green LED (IO12) will blink slower than when it detaches from GPRS services.
Configuration parameters	$PFAL,CNF.Set,DEVICE.BAT.CHARGEMODE=eco
	Starts charging if the voltage of the internal battery drops to less than 3.9V and terminates charging when the battery is full-charged.
	$PFAL,CNF.Set,DEVICE.BAT.MODE=auto
	Automatically switching between external power and internal battery power source depending on the power source currently available. External DC power supply has priority, if it is higher than 8 V.
	$PFAL,GPS.NAV.GNSS=GPS,GLONASS,Beidou
	Acquires and tracks 3 GNSS systems concurrently: GPS,GLONASS,Beidou
	$PFAL,CNF.Set,DEVICE.COMM.SERIAL0=cmd,7F
	The serial port 0 is set into the command operation mode with protocols and events output enabled.
	$PFAL,CNF.Set,DEVICE.COMM.TCP.CLIENT=cmd,60
	The serial port 0 is set into the command operation mode without protocols and events output enabled
	$PFAL,CNF.Set,DEVICE.GPS.AUTOCORRECT=on,5.0,58,50,10,50
	Enables filtering of GPS auto correction to calculate a valid GPS fix using maximal allowed PDO of 5.0, maximal speed limit of 58 m/s, maximal allowed distance error of 50, drop count incorrect position of 10 and maximal acceleration of 50 m/s.
	$PFAL,CNF.Set,DEVICE.GPS.CFG=4
	At least 4 satellites must be in use to consider a GPS fix as valid.
	$PFAL,CNF.Set,DEVICE.GPS.HEADING=25
	Heading tolerance is set to 25 degrees. Each time this angle is exceeded, the event *GPS.Nav.eChangeHeading* occurs, and the driving direction resets to zero.
	$PFAL,CNF.Set,DEVICE.GPS.TIMEOUT=1,30
	Restarts the GPS receiver to do a new search for visible GPS satellites, if within this time no valid fix is available.
	$PFAL,CNF.Set,DEVICE.NAME=BOLERO45
	Device name is defined to BOLERO45. To use another name replace 'BOLERO45' to your string and send it to the device.
	$PFAL,CNF.Set,DEVICE.PFAL.SEND.FORMAT="$",CKSUM,"","$<end>"
	The syntax of the PFAL messages is defined to start each line with the character '$', followed by the user text and terminated by a NMEA compatible checksum and <CRLF>. The complete message(s) end(s) with $<end>. These settings can be changed based on your server requirements.
	$PFAL,CNF.Set,PPP.PASSWORD=blau
	Required string (password) for the Chap and Pap authentication methods over PPPP to attach the device into the GPRS network. This setting is provider-dependant.
	$PFAL,CNF.Set,PPP.USERNAME=blau
	Required string (username) for the Chap and Pap authentication methods over PPPP to attach the device

Functions	Configuration alarms and their descriptions.
	into the GPRS network. This setting is provider-dependant.
	$PFAL,CNF.Set,GPRS.APN=Public4.m2minternet.com
	APN (Access Point Name) name that your network operator has provided to you to connect the device to the GPRS/Internet. This setting is operator or provider dependant.
	$PFAL,CNF.Set,GPRS.AUTOSTART=1
	Enables automatic attachments to the GPRS network. If the GPRS network connection gets lost, it tries to reconnect automatically as soon as the network is available again.
	$PFAL,CNF.Set,GPRS.DIAL=ATD*99***1#
	The V.250 'D' (Dial) command causes the device to enter the V.250 online data state.
	$PFAL,CNF.Set,GPRS.QOS=0,0,0,0,0
	Quality of Service Profile used when the device sends an Activate PDP Context Request message to the GPRS network.
	$PFAL,CNF.Set,GPRS.QOSMIN=0,0,0,0,0
	Minimum acceptable profile checked by the device against the negotiated profile returned in the Activate PDP Context Accept message.
	$PFAL,CNF.Set,GPRS.TIMEOUT=1,600000
	Detaches the device from GPRS network if no TCP communication available within the timeout.
	$PFAL,CNF.Set,GSM.BALANCE.DIAL=*100#
	GSM dial number for retrieving balance information
	$PFAL,CNF.Set,GSM.OPLOST.RESTART=1,1200000,8
	Reinitializes the GSM engine periodically until a GSM operator is found.
	$PFAL,CNF.Set,PROT.3DP=0
	3DP protocol (motion sensor data) is deactivated. To activate this protocol replace 0 to 1 and send it to the device.
	$PFAL,CNF.Set,PROT.AREA=0
	AREA protocol (area states) is deactivated. To activate this protocol replace 0 to 1 and send it to the device.
	$PFAL,CNF.Set,PROT.BIN=0
	BIN protocol (FALCOM) is deactivated. To activate this protocol replace 0 to 1 and send it to the device.
	$PFAL,CNF.Set,PROT.GGA=1
	GGA protocol is activated. To deactivate this protocol replace 1 to 0 and send it to the device.
	$PFAL,CNF.Set,PROT.GLL=1
	GLL protocol is activated. To deactivate this protocol replace 1 to 0 and send it to the device.
	$PFAL,CNF.Set,PROT.GSA=1
	GSA protocol is activated. To deactivate this protocol replace 1 to 0 and send it to the device.
	$PFAL,CNF.Set,PROT.GSM=1
	GSM protocol is activated. To deactivate this protocol replace 1 to 0 and send it to the device.
	$PFAL,CNF.Set,PROT.GSV=1
	GSV protocol is activated. To deactivate this protocol replace 1 to 0 and send it to the device.
	$PFAL,CNF.Set,PROT.IOP=1

Functions	Configuration alarms and their descriptions.
	IOP protocol is activated. To deactivate this protocol replace 1 to 0 and send it to the device.
	$PFAL,CNF.Set,PROT.RMC=1
	RMC protocol is activated. To deactivate this protocol replace 1 to 0 and send it to the device.
	$PFAL,CNF.Set,PROT.START.BIN=$!
	BIN protocol starts with '$!'. To use other charates replace '$!'and send it to the device.
	$PFAL,CNF.Set,PROT.VTG=0
	VTG protocol is deactivated. To activate this protocol replace 0 to 1 and send it to the device.
	$PFAL,CNF.Set,TCP.CLIENT.CONNECT=1,5.35.253.3,4444
	Enables the connection to the remote server and specifies the IP address and the Port number of the TCP server to connect to.
	$PFAL,CNF.Set,TCP.CLIENT.DNS.TIMEOUT=86400
	The length of time (in seconds) to keep the DNS cache valid.
	$PFAL,CNF.Set,TCP.CLIENT.LOGIN=1
	Sends the login data automatically to the remote server after requesting the TCP server for establishing a connection.
	$PFAL,CNF.Set,TCP.CLIENT.PING=1,240000
	Activates sending of pings and specifies the amount of time, in milliseconds, on which a ping will be sent to the remote server.
	$PFAL,CNF.Set,TCP.CLIENT.SENDMODE=2
	Safe and non-volatile transmission mode.
	$PFAL,CNF.Set,TCP.CLIENT.TIMEOUT=300000,30000
	Period of time in milliseconds that the device will wait for a response and between two connection attempts when TCP connection fails.
	$PFAL,CNF.Set,GSM.PIN=1111
	Enters/saves the PIN code of the SIM card inserted into the device..
	$PFAL,GSM.Band=auto
	The GSM band to be used by the device is set to 'auto'. The device registers to that frequency band currently available. Refer to the PFAL command set for the supported settings.
Factory settings	It consists of configuration settings preloaded at the factory during the manufacturing of BOLERO45 series devices. The user has the possibility of personalizing this configuration and with the help of *$PFAL,Sys.Device.FactoryReset* command it is possible to overwrite the **User Settings** with the **Factory Settings**. After reseting the device to factory settings, the device must be configured in order to operate referring to your application (see chapter for more details
AddOns*	The Promotion Kit is shipped with some sample functions. To extend its functionality, you can refer to the setting file „AddOns.conf" and modify it according to your needs. Please contact support (see chapter 3.2) for more details about the file „AddOns.conf".

eCodrive	(This feature includes instant and results for driving activities and driver behaviors such as: TripStart / TripStop / Harsh-Brake / Harsh-Acceleration / Harsh-Turn) - refer to the Related documents [6]
Waypoints	(define reference GPS points along a specific route where the vehicle should track. Alerts when exiting/entering that route)
Tilting	(> 45°) and crash detection (1 x Tilt alert every 15 sec.)
1Wire	(iButton + Temp. Sensors) Supported iButton: DS1402D-DR8+ Blue Dot Receptor iButton Reader Cable with DS1982 iButton and DS1921 iButton (MAXIM). Supported 1Wire Temp.Sensor: DS18(B)20 (MAXIM). Refer to the Related documents [13]

HINT: The user text (in quotation marks " ") started with "sfal" indicates an event on our D2Sphere server. This event text is only supported on our server, use other text formats for your own server.

6. APPENDIX

6.1   How does the BOLERO40 Series firmware operate?

BOLERO45/41 device can be easily integrated into a variety of new applications. It contains an independent-customized software that provides even greater performance and flexibility for its users and system integrators to develop high-performance applications. The concept of the device is based on a simple implementation for a wide range of applications with low costs and high flexibility. The software enables you to configure, to track, control and monitor the BOLERO45/41 device via SMS, as well as allows you set and poll the configuration remotely over Internet from the remote server. The software comprises a set of word-like commands termed "PFAL". Each of these causes the system BOLERO45/41 either to take a particular action or to read or set a particular configuration. The software provides the basic configuration settings needed when the system starts up and is used as starting points for the creation of user applications. The development of user applications is based on the advanced event-handling features provided by the operating software. The exact point at which you configure the BOLERO45/41 unit depends on your application you want to develop. Events are triggered automatically at system run-time and manually when the inputs change.

A part of events triggered at system run-time can be:

- Geo-fence violations (in/out)

- Changes to analog inputs (signal exceeds the range)

- Over speed detection (exceeding the speed limits)

- Specific distance reached (distance reached event)

- Towing detection (park events)

- Moving/acceleration detection and many other features.

A part of events triggered manually can be:

- Changes on digital or analog inputs (car' door open/close events, ignition on/off events)

BOLERO45/41 executes actions in response to an event or state(s) or in any combination. BOLERO45/41 can also execute direct actions immediately after the user sends a command (via SMS, TCP, RS-232) to the device. When an event is triggered, the alarms related to that event are automatically sent either over GSM (SMS, Data call) and/or via TCP, or internally used to switch On/Off something in remote e.g. activating a Buzzer.

A part of alarms that can be executed can be:

- Message generation (route verification arrival/departure notification via SMS/TCP)

- Activation of outputs in a number of ways (activate a buzzer)

- Data logging activation (stores the data inside the device

- Handling of incoming messages of any type (Activation on SMS text type)

- Vehicle doors Lock & Unlock

- Vehicle engine starter Disable and Enable

- Handling of Timers, Triggers and Counters, and many others

Above are listed just a few software features and for a full view of the set of events, states, alarms, configurations and their functionalities refer to the Related Documents [1].

6.2   Installing your own SIM card and replacing the internal battery

To insert your own SIM card into the BOLERO40' SIM holder and replace the internal battery by a new one, follow the steps shown in the package insert.

6.3   Conn ecting BOLERO40 series to your server

When using your own SIM card and another TCP server, the following table shows the basic configuration settings that should be done in the BOLERO45 device to register the device in the GSM network and enable internet connection to your TCP-Server. These configuration settings should be done locally via serial port connection. After inserting your SIM card and powering up the device, send the following commands (marked in red) from Workbench **Editor** ❾ (see Fig. 8) to the BOLERO40.

SETUP	**Hint**: Settings required for a GPRS attachment (please enter your mobile operator's data)
	$PFAL,Cnf.Set,GPRS.APN=internet.t-d1.de (enter your operator's APN) $PFAL,Cnf.Set,GPRS.QOS=3,4,3,0,0 $PFAL,Cnf.Set,GPRS.QOSMIN=0,0,0,0,0 $PFAL,Cnf.Set,PPP.USERNAME=t-d1 (if your operator requires) $PFAL,Cnf.Set,PPP.PASSWORD=gprs (if your operator requires)

SETUP	**Hint**: Settings required for a TCP connection (enter your server settings)
	    Where: 2222.222.222.222 - is the IP-address of the TCP server to be connected;
	                     1111 - is the TCP port number of the TCP server to be connected;

	$PFAL,Cnf.Set,TCP.CLIENT.CONNECT=1,2222.222.222.222,1111 (enter your IP and Port)
SETUP	**Hint**: Activate GPRS autostart to reconnect automatically when GPRS network connection gets lost.
	$PFAL,Cnf.Set,GPRS.AUTOSTART=1 (default = 0)
SETUP	**Hint**: Enter the SIM PIN to register the BOLERO45 device into the GSM network: Where: 1111 - is the PIN of the inserted SIM card.
	$PFAL,Cnf.Set,DEVICE.PIN=1111 (enter the PIN of your (used) SIM card)

Table 8: Adapt device configuration settings to your application conditions.

BOLERO45/41 sends login data to your server	**Hint**: After establishing TCP connection with your remote server, the following ServerLogin data is automatically sent to your remote server. For more details refer to the Related Documents [1].
	$<MSG.Info.ServerLogin> $DeviceName=AVL Device $Security=0 $Software=avl_3.0.0 (FBNCT0xFUk80NSByZXY6MDEtTlVhAgEA) $Hardware=BOLERO45 rev:01-NUa $LastValidPosition=$GPRMC,131040.000,A,5040.4089,N,01058.8536,E,0.01,162.02,250917,, $IMEI=357520070404948 $PhoneNumber=+491134501024564 $LocalIP=10.208.151.168 $CmdVersion=2 $SUCCESS $<end>

Table 9:   Login data sent automatically from the BOLERO45/41 to your remote server when the device starts up.