Phins Compact C7

Technical Description

Revision History

Edition	Date	Comments
A	07/2019	Creation
B	03/2020	Navigation data & settling time chapters updated
C	12/2022	Settling time, Reference frame center and Web-Based Graphical User Interface chapters updated

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Phins Compact C7 Documentation

The following documents give all the information you need in order to understand and to use your product.

- **Phins Compact C7 Technical Description** *(ref.: MU-PHINC7TD-AN-001*)
  - > Phins Compact C7 and iXblue technology presentation
  - > Technical specifications
  - > Certification and qualification, life cycle
  - > Mechanical, electrical and communication interface description
- **Phins Compact C7 Installation & Setup Guide** *(ref.: MU-PHINC7ISG-AN-001)*
  - > Conventions
  - > Physical and electrical installation
  - > Connecting to the Web-Based Graphical User Interface
  - > Setup the Phins Compact C7
  - > Contacting iXblue support
- **Phins Compact C7 Operation Guide** *(ref.: MU-PHINC7OG-AN-001)*
  - > Introduction to the Inertial Navigation System
  - > Start-up Phases
  - > Web-Based Graphical User Interface description
  - > Configuring the navigation parameters & managing the external information
  - > Viewing the system information
  - > Recording data
- **Phins Compact C7 Interface Library** *(ref.: MU-PHINC7IL-AN-001)*
  - > NMEA frames
  - > Digital input and output protocols
  - > Pulses interfaces specification
  - > Control commands
- **Subsea Inertial Products - Maintenance Manual** (*ref.: MU-SUBSEAMM-AN-001*)
  - > Troubleshooting
  - > Corrective maintenance
- **Subsea Inertial Products - Illustrated Part Catalog (***ref.: MU-SUBSEADP-AN-001)*
  - > Detailed part list
  - > Alphanumerical Index
- **Application Note - INS+DVL Calibration** *(ref.: MU-DVLINS-AN-001)*
  - > Configuring the calibration
  - > Calibrating the DVL+INS
- **Application Note - Installation and Configuration of AHRS and INS for Seabed Mapping Measurements** (*ref.: MU-HEAVAPN-AN-001*)
  - > Using heave compensation on seabed mapping
  - > Effect of vehicle transient movements

Phins Compact C7 Technical Description Overview

This document must be read and understood prior to using the product.
The manufacturer shall in no case be held liable for any application or use that does not comply with the stipulations in this manual.

The Phins Compact C7 Technical Description is divided into several parts:

- **Part 1: Phins Compact C7 Description**
  This part contains the description of the main product parts and the presentation of iXblue technology.
- **Part 2: Technical Specification**
  This part gives details on the technical specifications, the certification, qualifications and the life cycle.
- **Part 3: Mechanical Description**
  This part describes mechanical aspect of Phins Compact C7, except connectors.
- **Part 4: Electrical interface Description**
  This part gives the detail of the electrical interface (connector, pinout description and electrical levels).
- **Part 5: Communication Interface Description**
  This part details the interfaces to communicate with Phins Compact C7.

Abbreviations and Acronyms

ACC	Accelerometer
CTD	Conductivity, Temperature, Depth sensor
DVL	Doppler Velocity Log
EGNOS	European Geo-stationary Navigation Overlay Service
GALILEO	European Satellite Navigation System
GGA	Essential fix data which provide 3D location and accuracy data
GLONASS	Global Navigation Satellite System (operated by the Russian Space Forces)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System (operated by the United States Department of Defense)
GST	GPS Pseudo-range Noise (PRN) statistics (The GST message is used to support Receiver Autonomous Integrity Monitoring)
GUI	Graphical User Interface
HRP	Heading, Roll, Pitch
IMU	Inertial Measurement Unit
INS	Inertial Navigation System
IP	Internet Protocol
LVA	Lever Arms
PPS	Pulse Per Second
SD	Standard Deviation
UTC	International acronym for Coordinated Universal Time (CUT)
UTM	Universal Transverse Mercator
ZUPT	Zero velocity UPdaTe

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1 Phins Compact C7 Description

The Phins Compact C7 is an Inertial Navigation System (INS). It delivers heading and attitude information as well as position and speed, to other systems and displays. It can receive data from other sensors to improve its accuracy.

1.1 iXblue technology

iXblue Phins Compact C7 design is based on fiber-optic gyros (FOG) and quartz accelerometers.
iXblue's fiber-optic gyros are the result of more than 40 years of research and development, and they address the most demanding applications with performance from 0.1 deg/h to 0.001 deg/h. All main components are designed and manufactured by iXblue. This vertical integration is a key to achieve the high performances, higher quality standards and obsolescence management.

iXblue technology is an interferometric closed loop FOG. It is a high end design made to reach the highest spectrum of gyroscope performances. It has demonstrated superior reliability and navigation performance over many years and thousands of units. iXblue navigation systems have been chosen as the primary and secondary gyrocompass and INSs by the world's leading navies.

FOG Definition

FOG is a solid state / strap-down optical gyroscope technology based on the Sagnac effect (one of the physical effects used to create gyroscopes). A FOG is a 2-wave ring interferometer made of a multi-turn fiber coil (see Figure 1). It includes no moving parts or anything that will wear out or require any maintenance.

The Sagnac effect

The Sagnac Effect is a physical phenomenon of relativistic type.
Understanding it requires a good grasp of Special Relativity. However, it is possible to provide a simplified (although representative) physical interpretation of the effect with Newtonian physics.
Let us consider a Multi-Integrated Optical Circuit (MIOC) and a coil of optical fiber (Figure 1). The light entering in the MIOC is separated in two equivalent pulses of light which propagate in opposite direction in the fiber coil.
At rest, the two pulses of light travel at the same velocity (speed of light) along the same path in opposite directions in the coil. As their optical path is equivalent, they return "in phase" at the end of the coil and no signal is measured.
When the FOG is rotating, we can consider that the exit point of light has moved during the travel of light. Thus, the pulse propagating in the opposite direction of the FOG rotation will be late, and a "phase shift" between the two pulses is measured.

FOG Description

Dedicated signal processing allows conversion of the information on optical phase, (carrying information on rotation), into a digital signal useable by a computer.

The difference of transit time is proportional to the product of the rotation rate and the area A enclosed by the coil (calculated as the diameter of the coil multiplied by the number of times the fiber is wound around the coil).

As such the FOG performance improves as FOG diameter increases and the total optical path length increases. For example, increasing the fiber length results in a longer optical path length that will translate into a larger time shift between waves for a given rotation speed.

The fiber optic gyroscope (FOG) is a flexible technology that can meet diverse requirement. It has no moving parts which reduce maintenance and recalibration operations.

It provides a very wide dynamic range and can tolerate extremely demanding mechanical environments without compromise to its performances.

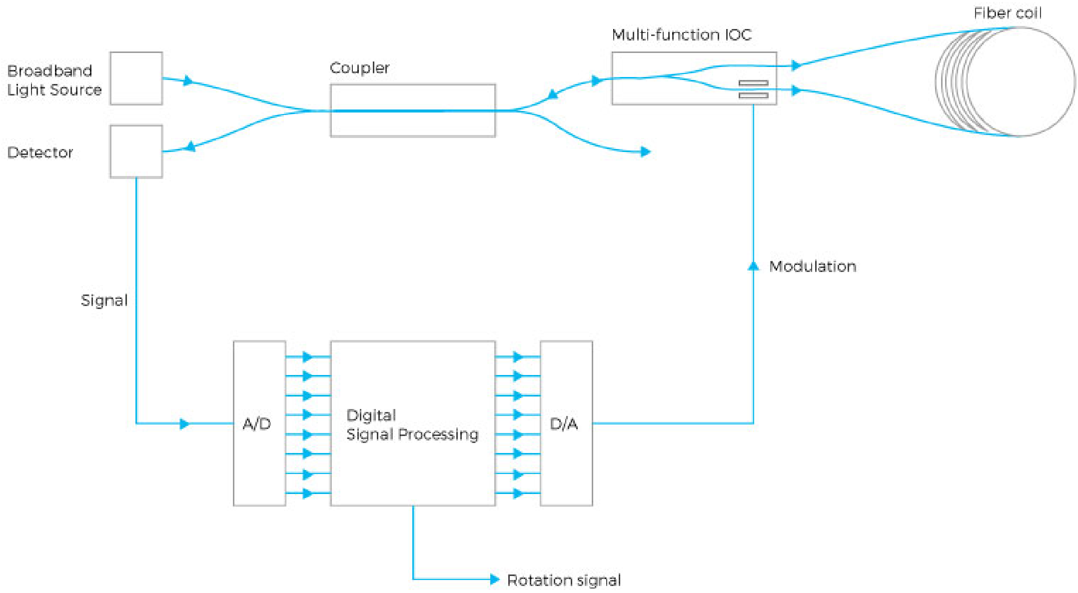


Figure 1 - Optical gyroscope technology

1.2 Phins Compact C7 Design

Phins Compact C7 is an Inertial Navigation System (INS). It delivers heading and attitude information as well as position and speed, to other systems and displays. It can receive data from other sensors to improve its accuracy.

Phins Compact C7 is a state-of-the-art inertial navigation systems, designed to meet the demands of high performance subsea INS in harsh deep water applications in terms of compacity and accuracy.
While preserving the subsea vehicle upload, Phins Compact C7 allows for accurate survey and autonomous navigation for subsea applications, providing very accurate heading, roll, pitch, speed and position in USBL, LBL, Sparse Array positioning as well as DVL only navigation.

Figure 2 - Phins Compact C7

Due to the very high precision of its IMU, Phins Compact C7 is subject to export regulations.

Phins Compact C7 and DVL

One of the most valuable external sensors for Phins Compact C7 is a Doppler Velocity Log (DVL) which provides consistent and reliable speed information (in bottom tracking mode). Since Phins Compact C7 and DVL must be calibrated before use.

To get more information about installing & calibrating the DVL kit option, refer to the Phins Compact C7 flash drive to get:
- Phins Compact C7 and DVL mechanical drawings
- INS+DVL Calibration - Application Note

Phins Compact C7 and USBL Configuration

USBL (Ultra Short Base Line) positioning system is commonly used for quick and efficient tracking tool for subsea vehicle tracking (ROV, AUV, towed body, etc...). Although USBL technology allows good performance it is subject to several native limitations in terms of robustness (tracking range limit, noisy environment, poor acoustic propagation conditions) and position refresh rate.

Phins Compact C7 ideally complements USBL thanks to its capacity to provide a stable position between each acoustic interrogation. It will maintain reliable position output during short acoustic data outages, and smooths out USBL positioning noise by at least a factor 3.
In addition to a better and stable high recurrence position Phins Compact C7 provides full attitude of the subsea vehicle (heading, pitch and roll data).
Combination of USBL + INS (or better USBL + INS + DVL) makes GNSS-like subsea positioning a reality.
Phins Compact C7 naturally interfaces with iXblue acoustic positioning systems (GAPS, RAMSES) but also includes communication protocols compatible with most industry standard subsea positioning systems.

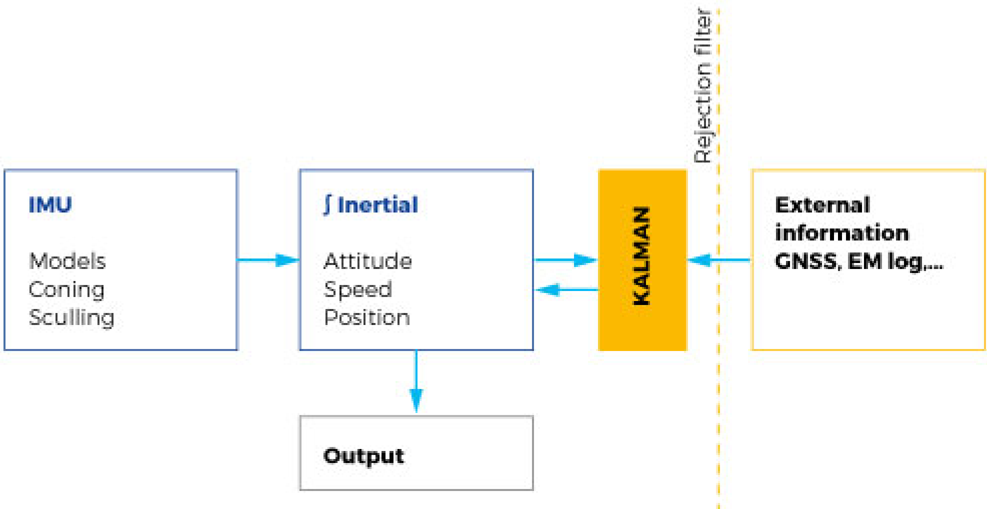
Being a fully strap down system based on gyroscopes without any moving parts, Phins Compact C7 requires no scheduled maintenance to provide the best performance during the full length of its lifetime. Its modern design integrating state of the art technologies (Ethernet, Web-Based Graphical User Interface, high baud rate …) allows easy installation and interfacing to most standard external sensors and vehicle control systems.

To deliver the best during operations, Phins Compact C7 is designed to:

- Align at sea
- Auto-calibrate its internal sensors during navigation
- Integrate data from GNSS, USBL, LBL positioning systems when available and reject inconsistent data
- Navigate using only DVL or EM Log data

Phins Compact C7 is a strap-down all in one INS that contains:

- An IMU with 3 fiber optic gyroscopes (FOGs) and 3 quartz accelerometers
- A rejection filter
- A Kalman filter
- A Built In Test (BIT)
- A real-time digital signal processor (DSP) supporting the navigation software
- An interface board that manages input and output protocol conversion
- An embedded Web-Based Graphical User Interface



Phins Compact C7 navigation algorithm is based on a very advanced Kalman filter that enables the unit to constantly autocalibrate, using any external information that can be provided.

Connection is available both through serial and Ethernet connections.

Phins Compact C7 can be connected to any GNSS receiver (GPS, Glonass, Galileo or other) or any other external sensor (Doppler Velocity Log, Depth sensor, USBL, LBL) providing position, speed or time or to work in a pure inertial mode.

1.3 Phins Compact C7 Data availability

Phins Compact C7 provides the subsea vehicle survey package and/or subsea vehicle control system with full navigation data:

- Position (Latitude and Longitude)
- Speed (North, East, Vertical Speed and ship speeds)
- Depth and Altitude
- Roll/Pitch and Heading
- Polar Heading, Latitude, Longitude, Speed
- Rate of turn and Accelerations (all three axis)
- Heave, Surge, Sway
- True course
- Current speed and direction
- Standard deviation of data
- Built In Test Status data

The exhaustive list of output data is detailed in the Phins Compact C7 Interface Library.

Heave measurement/ Center of Gravity of the vehicle (COG)

Phins Compact C7 can output two distinct heave measurements:

- Specific Heave which provides heave in real-time.
- Smart Heave™ which provides a measurement of heave with a fixed 100 s delay. In this case heave is compensated for error due to high pass filtering distortions and is more accurate.

To avoid the effect of transient subsea vehicle movement on the heave measurement, you can define the position of the center of gravity (COG) of the subsea vehicle. When this is done, Phins Compact C7 will compute heave at the COG and add the heave induced by lever arms from the COG to external monitoring points. For more details refer to Phins Compact C7 Installation & Setup Guide .

UTC/Time synchro

All data is accurately time stamped with respect to internal reference time, GNSS time or any autonomous external clock.

Phins Compact C7 internal clock can be synchronized with data coming from an external reference clock (i.e., GNSS clock or autonomous external clock). In this case, internal reference time is synchronized with the input coming from the selected interface with the appropriate protocol.

Phins Compact C7 clock can also be synchronized with NTP (network time protocol) servers.

For more details on time synchronization setting, refer to Phins Compact C7 Installation & Setup Guide.

Availability of full quality check data

Phins Compact C7 provides a numeric quality checks indicator (RMS/CEP50/CEP95) for all main navigation data:

- Position standard deviation estimation Latitude and Longitude
- Depth standard deviation estimation
- Speed standard deviation estimation (North, East and Vertical Speed)
- Roll/Pitch and Heading standard deviation estimation
- Altitude or Depth standard deviation estimation

1.4 External sensors

Phins Compact C7 uses external sensor data to improve its own estimates of position, speed, attitude and heading. The following external sensors can be connected to Phins Compact C7:

- GNSS
- LBL
- USBL
- EM Log
- DVL
- CTD/SVP
- Depth Sensor.

Phins Compact C7 can simultaneously use all the sensors described above and its Kalman Filter will manage them without any manual intervention.

The system constantly and automatically uses the information form the external sensors when it is available and runs in full free inertial mode when no external information is available. As soon as external information is back, the system will use it. Phins Compact C7 also integrates a rejection filter that will prevent inconsistent data to be sent to the Kalman Filter.

Phins Compact C7 also allows the user to provide a manual input position either at the start or during the navigation sequence.

Phins Compact C7 can be operated over serial or Ethernet through its embedded Web-Based Graphical User Interface or through a third-party system interface via a control command link.

For more details on:

- Electrical connection of the external sensors: refer to section 4
- The configuration of the external sensors: refer to the Phins Compact C7 Installation & Setup Guide.
- The available input protocols for external sensors: refer to Phins Compact C7 Interface Library.

2 Technical Specification

2.1 Performance prerequisites

The performances listed hereafter are achieved at sea under the following conditions (which complements the environmental conditions stated in section 1).

- **subsea vehicle's motion does not exceed:**

	Amplitude	**Period (sinusoidal)**
Heading	± 10°	10 s
Roll	± 40°	9 s
Pitch	± 15°	6 s

As some external sensors do not provide any quality indicator with the provided data, some hypothesis of performance have been made in the system for those sensors. This can be manually modified using the advanced filtering page, refer to Phins Compact C7 Installation & Setup Guide.

- **EM Log sensor**
  Log speed accuracy: 0.5 m/s RMS (with respect to water)
  Ocean current stability: 1 knot (One sigma) 3 hours correlation time
  To ensure EM Log performance, it must be calibrated after installation.
  Log sensor must only be used outside of harbors. During harbor maneuvers erroneous EM Log data could be sent to Phins Compact C7, e.g., while working tug boats produce strong local currents over the EM Log sensor, and these erroneous inputs would adversely affect Phins Compact C7 performance.

- **Doppler Velocity Log (DVL) sensor**:
  Performance using any other technology (i.e.: Correlation Velocity Log [CVL]) should be submitted to qualification testing to evaluate their impact on navigation performance.
  For example CVL technology does not have the same performance as DVL. Navigation performance would be degraded.
  EM Log can be used by selecting an extra DVL input and choosing the corresponding protocol (e.g. EM Log VBW)

2.2 Equipment Data Dynamic Range

Heading	0° to 360°
Roll	-180° to +180°
Pitch	-90° to +90°
Roll / Pitch / Heading Rate	± 750°/ s
Geodetic Latitude	90° S to 90° N
Geodetic Longitude	180° E to 180° W
Altitude (above sea level)*	**up to 4000 m**
Speed	up to 80 knots
Linear Acceleration	± 15 g

* No limitation for negative altitude.

2.3 External Sensors

	External Sensors
GNSS	up to 2
DVL	up to 2
EM Log	1
CDT/ SVP	1
Depth Sensor	1
USBL	Up to 3 beacons
LBL (range meter) Sparse Array	Up to 10 simultaneous beacons
UTC	Up to 2
NTP	Up to 3

2.4 Navigation Data

GPS or USBL or LBL & DVL	DVL (Bottom Track mode)	EM Log	No aiding
Position (Latitude and Longitude) accuracy			
2 to 3 times better than aiding sensor	0.05 % (CEP50) of distance travelled	2 Nm/8 h (TRMS)	0.06 m after 1min (CEP50) 2 m after 5 min (CEP50) 0.21Nm/h after 1 hour (CEP50)
Speed (North and East) accuracy			
0.01 knot (RMS)		0.1 knot (RMS)	0.6 knot (RMS)
Heading accuracy			
0.01° seclat (RMS)	0.025° seclat (RMS)		
Attitude (Roll and Pitch) accuracy			
0.01° (RMS)			

With or without aiding:

Dynamic stability[1]	
Heading rate accuracy	0,001°/ s RMS
Roll rate accuracy	0.001°/ s RMS
Pitch rate accuracy	0.001°/ s RMS
Heave Surge Sway	
Heave[2]	5 cm or 5% of movement full amplitude
Smart Heave™[3]	2.5 cm or 2.5% of movement full amplitude
Surge and Sway[4]	5 cm or 5% of movement full amplitude

[1] According to the dynamics stated in the prerequisites in section 2.1.
[2] Whichever is higher for wave periods up to 25 s.
[3] Whichever is higher for wave periods up to 30 s.
[4] Whichever is higher for wave periods up to 15 s.

2.5 Input / Output

Baud rate	600 bauds to 921 kbauds
Data output rate	0.1 Hz to 200 Hz
Data input rate	Up to 5 Hz (1 Hz recommended)
Time stamping accuracy	< 100 µs

(1) 200 Hz update rate for attitude data (Heading, roll, pitch, surge, sway).
Update rate for position is performed at 100 Hz.

	Serial (All)	Ethernet 1	Ethernet 2	Ethernet 3	Ethernet 4	Ethernet 5
Jitter	< 200 µs	< 400 µs	< 800 µs			
Fixed Latency	2.35 ms	2.95 ms	3.45 ms	3.95 ms	4.45 ms	4.95 ms
	Input	**Output**	**Configuration & Repeater**			
Serial RS232	2	2	1			
Ethernet(2)	4	5	1			
Max (Serial & Ethernet)	4	5	1			
Pulse Port	1	1	-			

Ethernet(2)	UDP (Unicast, multicast and broadcast)/ TCP client / TCP server (10 / 100 Mbits)
Pulse port	5 V (TTL level)
Input / output formats	Industry standards: NMEA 0183, ASCII, BINARY

(2) All inputs and outputs are available on the Ethernet link. Output can be duplicated both on serial and Ethernet port.

2.6 Power Supply

Power supply / consumption	24 V_{DC} (20 to 32 V) / < 20 W(1)

(1) Typical value @ 24 V and ambient temperature.

2.7 Export Limitations

Phins Compact C7 is a dual use product and is thus submitted to export limitations on the provided data, and to export restrictions to some countries.

	Limitations
Rotation rate resolution(1)	3.6°/ h
Acceleration resolution	1 mg
Heading, Roll, Pitch resolution	0.001°
Speed saturation	80 knots
Altitude saturation	4,000 m
Acceleration saturation	15 g
Rotation rate saturation	750°/ s
Post-processing data output	Available

(1) Additional export restrictions may apply regarding the availability of raw IMU data (set to 0 in output telegrams).

2.8 Settling Time

Important

To achieve the highest performance, during the alignment procedure, it is recommended that the systems generating stationary magnetic fields be put into operation before starting the Phins Compact C7 and left running as long as it is operational. High magnetic fields can temporarily disturb the Phins Compact C7. The Kalman filter used in the Phins Compact C7 constantly estimates the bias of the sensors produced by this magnetic field. If this interference is stationary, the unit can compensate for the presence of this field.

Power Up

Power up is automatic, as soon as power is applied to the system.

Restart or Power Down

Equipment can be restarted either through the embedded Web-Based Graphical User Interface, in the maintenance menu or by sending a start command.
To power down the equipment, you need to disconnect it from its power source.

Initialization:

The system must be initialized before it will provide fully accurate information. This initialization is performed using external sensor data, during several phases.

Alignment Phases

- **Coarse Alignment**
  The data are computed by the Phins Compact C7 but are not yet valid.
  Coarse alignment will finish when heading standard deviation gets lower than1° seclat.
- **Heave initialization**

During the heave filter initialization phase, the heave, surge and sway outputs have not reached full accuracy. Once the heave filter completes its initialization, it will accurately measure any variations of Phins Compact C7 positions in the three directions (heave, surge and sway).

- **Fine Alignment**
  After the coarse alignment phase, Phins Compact C7 is ready for navigation. The performance of the system has not been reached, but all the data are valid.
  'Fine alignment phase completes when heading standard deviation gets below 0.03° seclat.
- **Optimal alignment**
  Optimal alignment means that the system is reaching the specified heading performance.
  Optimal Alignment completes when heading standard deviation is below 0.02° seclat RMS.
  When optimal alignment is completed, the system is ready and gives all the data with full performance.

	Static (GNSS, USBL, LBL, ZUPT)	**At sea (USBL or LBL & EM Log or DVL)**
Data availability	5 min	5 min
Roll/ Pitch 0.01° RMS	5 min	5 min
Heading 0.1° RMS	20 min	10 min
Heading 0,02° seclat RMS	N/ A	45 min*

(*) At a speed of 3 kt and including a heading change of at least 90° and linear acceleration.

- **System ready**
  The legacy System ready flag is raised when heading standard deviation gets below 0.02° seclat. The system is ready to operate with full performance.

For more information about the alignment phases, refer to Phins Compact C7 Operation Guide.

2.9 Life Cycle

2.9.1 Packaging, Handling, Storage, Transportation requirements

During storage and transportation, Phins Compact C7 should be kept locked in its transportation case, it shall have its protective caps installed on its connectors.

2.9.2 Auto-calibration

At each start up, and continuously while aided, Phins Compact C7 is calibrating its internal gyrometer and accelerometer sensors using external sensors information and its advanced Kalman Filter. Therefore there is no need to recalibrate the system periodically.

2.9.3 Built-in-test

Phins Compact C7 includes a Continuous Built-In Test (CBIT) that covers internal sensor status verification, system status and algorithm status The Interface Library document details the complete list of parameters that are monitored. Refer to Phins Compact C7 Interface Library for further detail.

2.9.4 Reliability & maintainability

Due to the technology used in its design, Phins Compact C7 is a fully strap-down / solid-state equipment. It does not use any gas filled cavity that could leak nor any moving mechanical part that would wear out. As a consequence, Phins Compact C7 requires no scheduled maintenance.

Phins Compact C7 does not have any life limited parts and as such, it has no predicted life limitation.

The entire Phins Compact C7 is a Line Replacement Unit (LRU).

MTBF

- 100,000 hours (System observed)
- 500,000 hours (FOG + Accelerometers)

End-of-life product management

When the product reaches the end of its life, it must be returned to iXblue where it will be sent to a treatment facility meeting the requirements of the directive on waste electrical and electronic equipment (WEEE).

3 Mechanical Description

3.1 Presentation and overall dimensions

The Phins Compact C7 overall dimensions are the following:

- Dimensions (Ø x h): Ø 200 mm x h 161.5 mm
- Weight: 3,8 kg +/-0.2 kg

3.2 Mechanical Alignment

The Phins Compact C7 base plate is designed with two holes for alignment of Phins Compact C7 axis X1 with a reference direction on the matching adaptation plate fixed onboard.

The accuracy of this mechanical alignment is ± 0.01 degree. The adaptation plate should be designed with two pins ϕ6 g6 maximum height is 6 mm and with a flatness better than 0.05 mm on the fixing area.

The Phins Compact C7 base plate is designed with two holes for alignment of Phins Compact C7 axis X2 with a reference direction on the matching adaptation plate fixed onboard.

For mechanical and installation recommendations, refer to Phins Compact C7 Installation & Setup Guide.

3.3 Reference Frame Center

All data is calculated at the Phins Compact C7 reference frame center 'P point'. This is the reference point from which all of the external sensor lever arms must be measured. This point is also the reference frame center for the intersection of the three reference axis X1, X2 and X3. The Phins Compact C7 reference frame center is:

- the sensing point of all product measurements
- to be used as a reference point to the determination of Phins Compact C7 and external sensor lever arms

The reference frame center is shown as the IMU measurement centre point in figure next page, the measures are in mm.

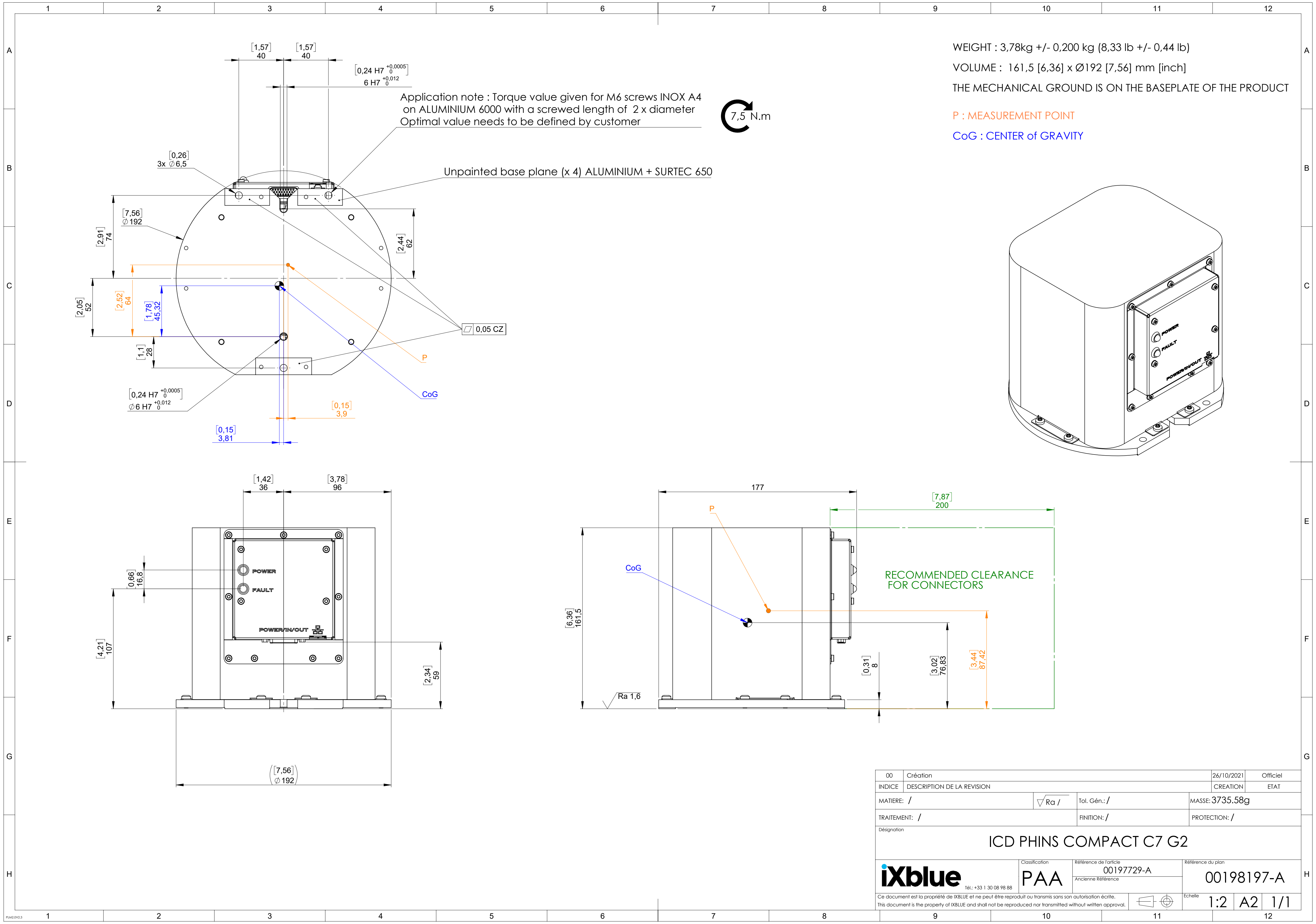


Figure 3 - Phins Compact C7 housing dimensions and centre point P

4 Electrical Interface Description

4.1 Overview of electrical interface

Two connectors and two LEDS (one power indicator and one fault indicator) are available on the face of Phins Compact C7 . They are all different and fool- proof to avoid any misconnection.

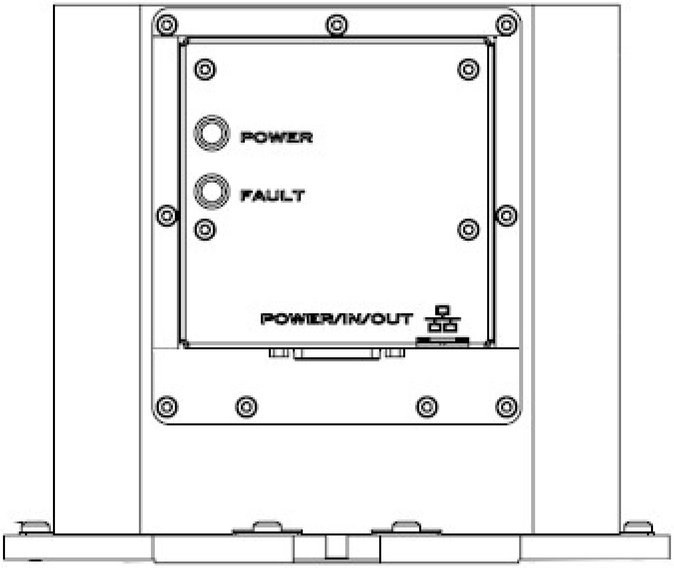


Figure 4 - Details of the Phins Compact C7 connector and indicator panel

4.2 Fault indicators

Two indicators are integrated on the front of Phins Compact C7:

- Green LED:
  - > Illuminated: indicates power-on on the 24 power supply.
  - > Not illuminated: Phins Compact C7 is not powered on.
- Red LED:
  - > Illuminated: Phins Compact C7 output data are not reliable. After initial alignment, if this LED is still on, it means that a system fault was detected.
  - > Not illuminated indicates that Phins Compact C7 is in normal operation

The main possible causes for the Red LED fault indicator to be switched on are:

- Communication problem on an electronic board leading to a wrong data transmission.
- Problem with a gyroscope or accelerometer sensor.
- Exceeding in angular dynamics.
- Speed saturation.

4.3 Listing of Interfaces

Phins Compact C7 is fitted with 2 connectors configured to provide the following:

	Ethernet connector	Main connector
Power system supply		1
Ethernet inputs	4	
Ethernet outputs	5	
RS232 inputs		2
RS232 outputs		2
RS232 serial control input		1
RS232 serial control output		1
Pulse Inputs (user-configurable)		1
Failure signal output (TTL)		1
Failure relay output		1

The I/O port configuration is done through embedded Phins Compact C7 Web-Based Graphical User Interface accessible via PC web browser or through a third party system interface via a control command link.

Refer to Phins Compact C7 Installation & Setup Guide (Ref.: MU-PHINC7ISG-AN-001) for details.

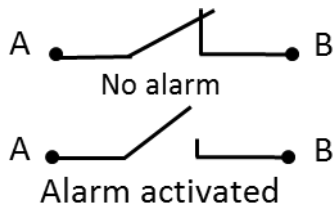
4.4 Main Connector Specifications

4.4.1 Main Connector Definition

The main connector provides power and connection of the Phins Compact C7 to a PC for installation, for configuration and display/monitoring purposes through the Web-Based Graphical User Interface which is embedded in the unit.
In this configuration, the Web server connection will be accessed using the PC Ethernet port or alternatively if serial port is used you will need to be configured in PPP (TCP/IP over serial port). Refer to Phins Compact C7 Installation & Setup Guide.

Phins Compact C7 is fitted with one main connector configured to provide the following:

- Power supply for PHINS COMPACT C7
- 2 user-configurable digital serial inputs (RX). RS232 input signal should provide a voltage min ± 5 V to ± 20 V when loaded.
- 2 user-configurable digital serial outputs (TX). RS232 output signal level is ± 5 V min when load is 3 kΩ.
- 1 pulse input (IN) that can be used for PPS input in typical configurations.
- 1 RS232 digital serial input (designated as RxRep) and 1 RS232 digital serial output (designated as TxRep) dedicated to configuration and installation through connection to a computer.
- A TTL logic output (logic low signal) can be used as fault indicator.
- An open circuit on the voltage free contacts (relay characteristic: 1 A / 24 VDC) indicates a fault condition:



4.4.2 Main Connector Pinout

The main connector is a 26-way High density D-type female connector fitted with screw lock nut kit of type AMPHENOL reference 17HTHAS4F1C.

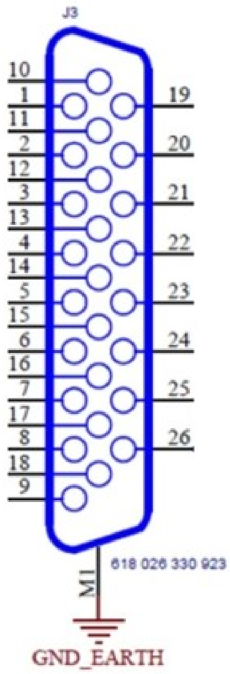


Figure 5 - Diagram of the main connector

The assignment of the wires is defined in the following table.

Table 1 - The Phins Compact C7 main connector pin definition

Pin Number	Signal
1	Repeater: RS232 Tx+
2	Port A: RS232 Tx+
3	Port B: RS232 Tx+
7	Pulse A : IN TTL
8	0 VDC**
9	0 VDC**
10	Repeater: GND_R*
11	Port A: GND_A*
12	Pulse A: GND_A*
16	Port B: GND_B*
17	Port B: RS232 Rx+
18	+24 VDC**

Pin Number	Signal
19	Repeater RS232 Rx+
20	Port A: RS232 Rx+
21	Fault: Output TTL
22	Fault: GND*
23	Fault: Relay A
24	Fault: Relay B
26	+24 VDC**

*: Power supplies GND (0 VDC) and mechanical ground (housing) are insulated from each other and from serial GND X.

**: Pin 8 and 9 and pin 18 and 26 should be used as pairs to share the current over the two pins.

4.5 Ethernet Connector Specification

4.5.1 Definition

The Ethernet connector provides the following inputs and outputs:

- 4 inputs, which can be user-configured either with UDP or TCP. Configuration is made through the embedded Web-Based Graphical User Interface.
- 5 outputs, which can be user-configured either with UDP or TCP. Configuration is made through the embedded Web-Based Graphical User Interface.
- 1 input and 1 output dedicated to configuration and installation through connection to a computer, only on TCP port 8110 (the Phins Compact C7 is on the server side).

These interfaces are user configurable (except for the dedicated configuration I/O) through the Web-based Graphical User Interface or through a third party system interface via a control command link. For details, refer to the documents:

- Installation & Setup Guide (Ref.:MU-PHINC7ISG-AN-001)
- Interface Library (Ref.: MU-PHINC7IL-AN-001)

Important

Do not use both Ethernet and serial link to configure Phins Compact C7 at the same time.

4.5.2 Connector & Pin out

The Ethernet connector is a RJ45 connector. It offers an Ethernet Class D/Cat 5e connection for 10 Base T or 100 Base TX networks.

Refer to the figure below for the corresponding wiring.

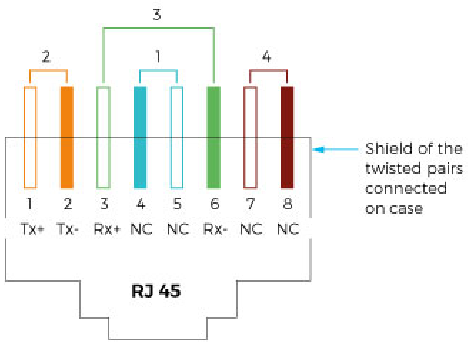


Figure 6 - Ethernet connector pin definition

4.6 Recommended Wiring

Important

If you do not use shielded multi-twisted pairs, you may encounter cross-talk problems between input and output, and this may give error or dysfunction. Shield link should be done at one end only to avoid ground loops unless shield is used as an electrical ground. It is recommended to link external cable shielding to mechanical ground. It is recommended to link the wires not used to the mechanical ground of the related port.

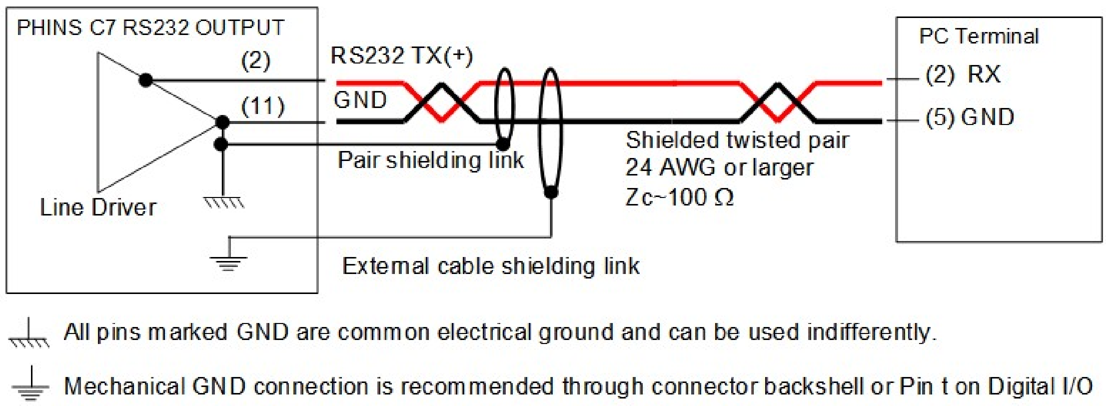


Figure 7 - Description of mono-directional RS232 Output wiring (Port A example)

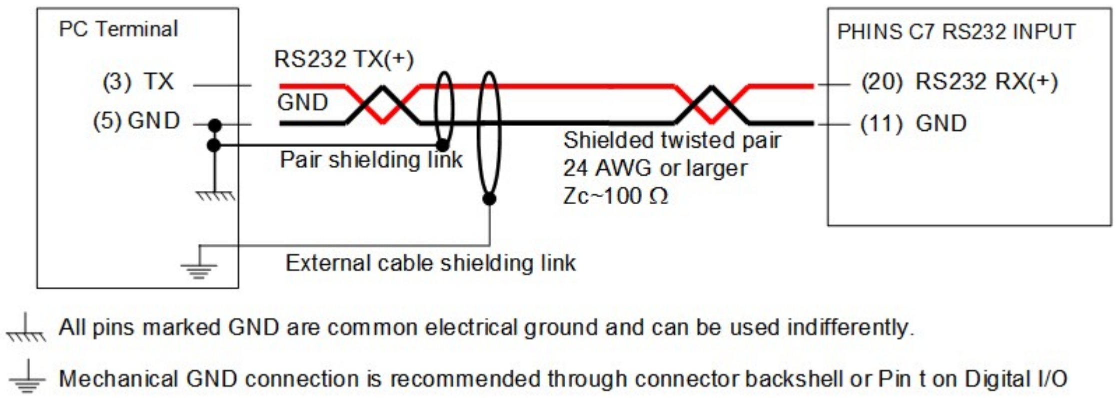
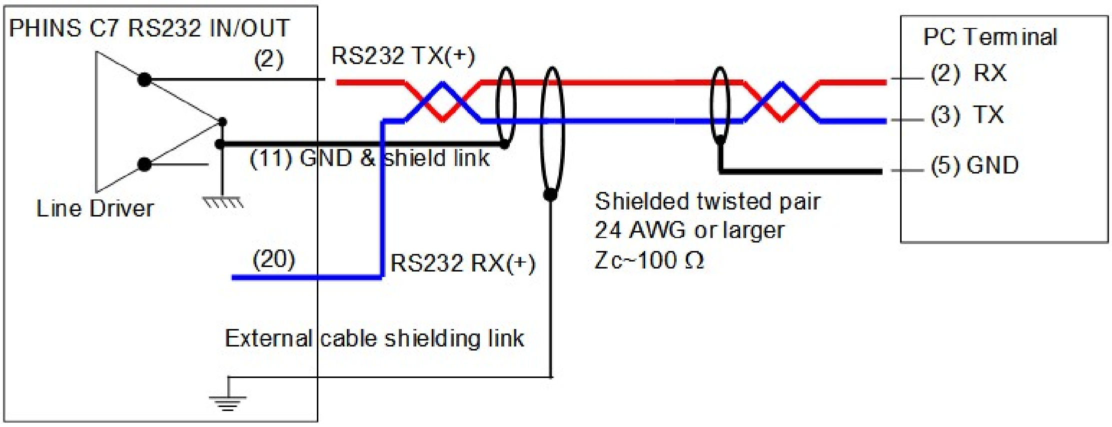


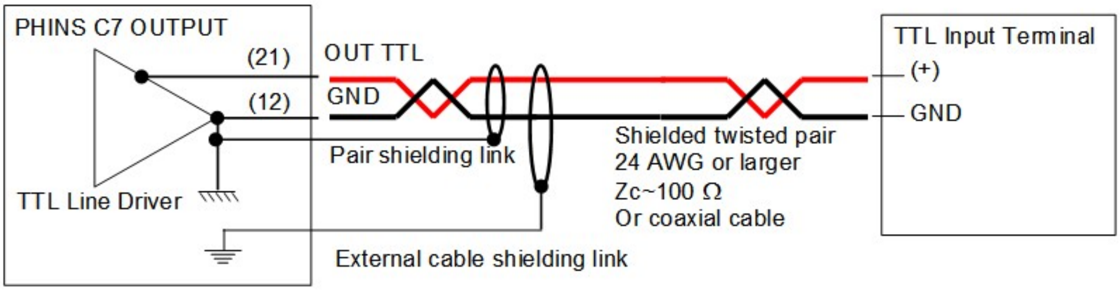
Figure 8 - Description of mono-directional RS232 Input wiring (Port A example)



All pins marked GND are common electrical ground and can be used indifferently.

Mechanical GND connection is recommended through connector backshell or Pin t on Digital I/O

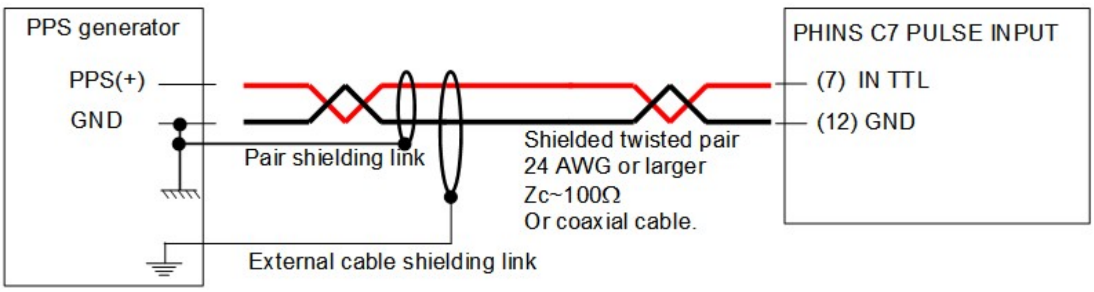
Figure 9 - Description of bi-directional RS232 Output wiring (Port A example)



All pins marked GND are common electrical ground and can be used indifferently.

Mechanical GND connection is recommended through connector backshell or Pin t on Digital I/O

Figure 10 - Description of the Pulse Output wiring with a Shielded Twisted Pair (Pulse A example)



All pins marked GND are common electrical ground and can be used indifferently.

Mechanical GND connection is recommended through connector backshell or Pin t on Digital I/O

Figure 11 - Description of the Pulse Input wiring with a Shielded Twisted Pair (Port A example)

4.7 Input Pulses Electrical Characteristics

Following table details input pulse characteristics:

Table 2 - Input Pulse Electrical Characteristics

	Symbol	Min	Max	Unit
Input pulse width	TW	1	-	µs
Low to High transition voltage	VLH	2	-	V
High to Low transition voltage	VHL	-	0.8	V
Input voltage	VIN	- 0.5	5.5	V
Input current	IIN	- 10	10	µA
Pulse internal latency	TL	-	10	µs

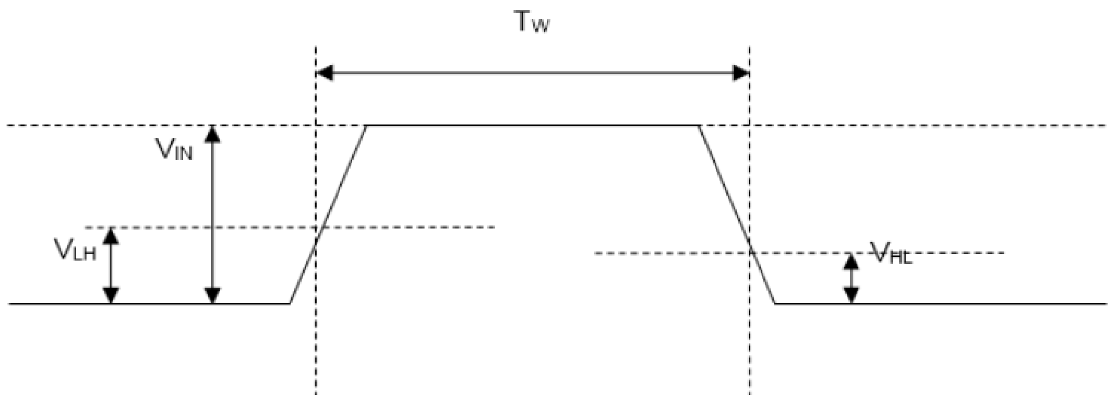


Figure 12 - Input Pulse Diagram

4.8 Output Pulses Electrical Characteristics

Following table details output pulse characteristics:

Table 3 - Output Pulse Electrical Characteristics

	Symbol	Min	Max	Unit
Output voltage at logic low	VL	0	0.4	V
Output voltage at logic high	VH	4.8	5	V
Output current	IOUT	-	4	mA

5 Communication Interface Description

5.1 Communication Link

Phins Compact C7 is able to receive and transmit data through 2 configurable (port A and port B), and 1 repeater port configurable asynchronous serial communication lines (digital I/O):

- Baud rates, parity and number of stop bits can be configured independently for each of the 2 serial links
- Electrical level (RS-232 or RS-422) can be configured independently for each of the 3 serial links
- 4 input / 5 output virtual ports can be opened simultaneously

The output frequency can be selected as presented in the Interface Library document.

In default configuration, access to the Web-Based Graphical User Interface is only possible through the Ethernet connector.

On RSXX2 serial link, the Installation and Repeater output has to be configured in PPP mode to have access to the Web-Based Graphical User Interface (refer to Phins Compact C7 Installation & Setup Guide for more details).

For the Ethernet link, the following parameters are defined by default:

- IP Address: 192.168.36.1xx, xx being the last two numbers of the Phins Compact C7 serial number
- Connection through http web server (port 80)
- Repeater flow available in TCP (port 8110)

By default, serial repeater link is configured as follows:

- Protocol used : PHINS Standard, refer to Phins Compact C7 Interface Library for a description of PHINS Standard data frame output
- Baudrate : 57.6 kBauds
- Flow Control : Odd, 2 stop bits
- Refresh rate : 5 Hz (200 ms)

5.2 Software Interfaces and Library

Input and output digital interfaces are user-configurable with a comprehensive set of protocols (or formats) to be selected from the digital interface library.
Digital protocols in binary format and NMEA compliant ASCII format are available for input and output data.
To get details on protocols, please refer to Phins Compact C7 Interface Library.
System configuration and operation can be performed either through the Web-Based Graphical User Interface (refer to Phins Compact C7 Installation & Setup Guide) or with text control command (refer to Phins Compact C7 Interface Library).

5.3 Web-Based Graphical User Interface

Phins Compact C7 is delivered with iXblue established Web-Based Graphical User Interface. It runs either on a workstation or on a laptop and allows system configuration.
The embedded Web-Based Graphical User Interface has been optimized and qualified with PC running Windows 10 and Windows 11 operating systems.

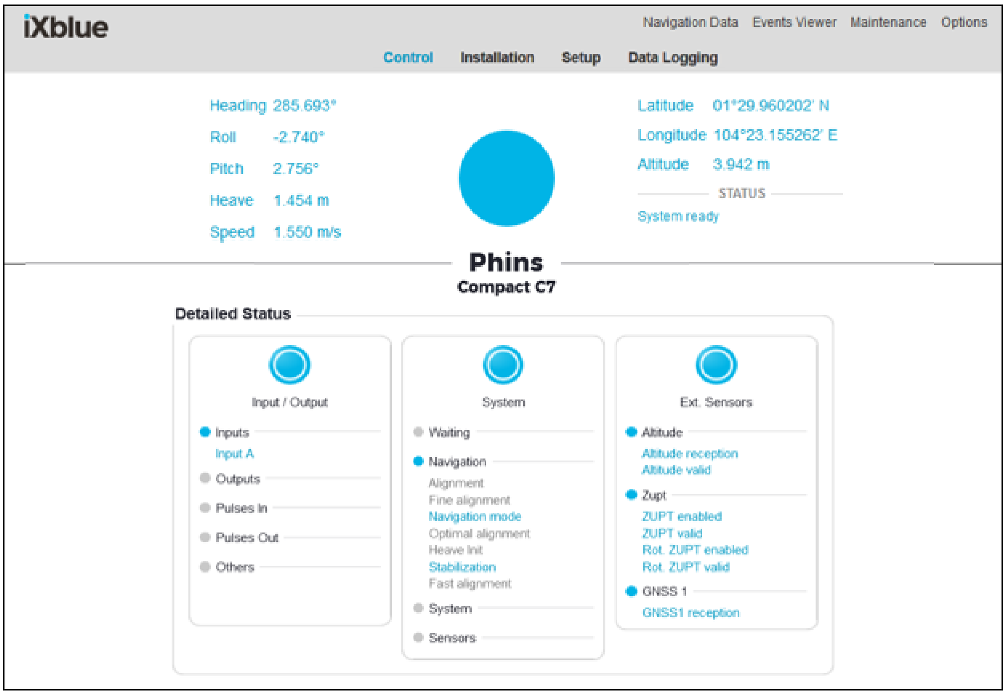


Figure 13 - Phins Compact C7 Web-based Graphical User Interface

An USB flash drive is provided with the Phins Compact C7, it contains web brower software, Phins Compact C7 user manuals and mechanical drawings.

5.4 Control Command

The control commands give access to the following features:

- Installation
  - Misalignment configuration
  - Level arms configuration
  - Communication link configuration (physical parameter and software parameters)
  - External sensor configuration
- Operation
  - Software reset
  - User position fix
  - Software activation / deactivation of external sensor
  - Data display (including all navigation and quality check data)
  - Data logging

Refer to Phins Compact C7 Interface Library to get details on the control commands.

iXblue CONTACT - SUPPORT

For non-URGENT support:

- by email: support@ixblue.com
- using the form on the iXblue web site www.ixblue.com

For 24/7 URGENT SUPPORT:

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  +65 6747 7027