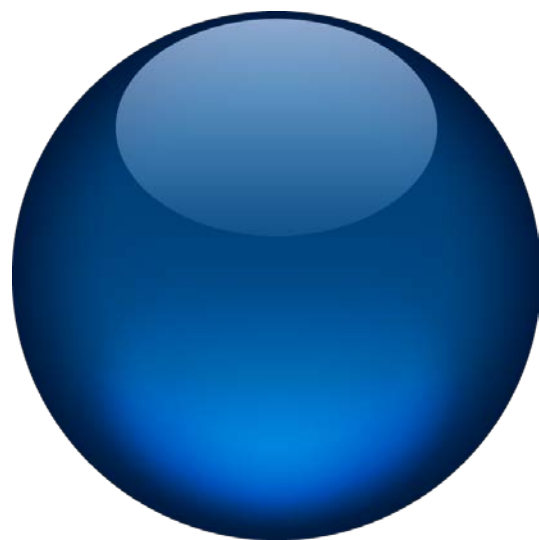




QUADRANS

USER MANUAL

Document Revision History

Edition	Date	Comments	Modified page(s)
A	10/2011	First Edition	-
B	02/2012	Electrical interface updated	9
C	03/2012	Operational consideration chapter added	19
D	06/2012	Power supply and pigtails updated	10
E	10/2012	Electrical interface updated	9
F	09/2013	Pigtail specifications added	11->17
G	10/2014	Mechanical drawings & recommended wirings updated	7-19

Copyright

All rights reserved. No part of this guide may be reproduced or transmitted, in any form or by any means, whether electronic, printed guide or otherwise, including but not limited to photocopying, recording or information storage and retrieval systems, for any purpose without prior written permission of iXBlue.

Disclaimer

iXBlue specifically disclaims all warranties, either express or implied, included but not limited to implied warranties of merchantability and fitness for a particular purpose with respect to this product and documentation. iXBlue reserves the right to revise or make changes or improvements to this product or documentation at any time without notify any person of such revision or improvements.

In no event shall iXBlue be liable for any consequential or incidental damages, including but not limited to loss of business profits or any commercial damages, arising out of the use of this product.

Trademarks

Microsoft, MS-DOS and Windows are registered trademarks of Microsoft Corporation. Intel and Pentium are registered trademarks and Celeron is a trademark of Intel Corporation.

Text Usage

bold	Bold text is used for items you must select or click in the software. It is also used for the field names used into the dialog box.
Courier	Text in this font denotes text or characters that you should enter from the keyboard, the proper names of disk Drives, paths, directories, programs, functions, filenames and extensions.
<i>italic</i>	Italic text is the result of an action in the procedures.

Icons



The **Note** icon indicates that the following information is of interest to the operator and should be read.

Important



THE **IMPORTANT NOTE** ICON INDICATES THAT THE FOLLOWING INFORMATION SHOULD BE READ TO FORBID OR PREVENT A PRODUCT DYSFUNCTION OR A FAULTY OPERATION OF THE EQUIPMENT



THE **CAUTION** ICON INDICATES THAT THE FOLLOWING INFORMATION SHOULD BE READ TO FORBID OR PREVENT PRODUCT DAMAGE.



THE **WARNING** ICON INDICATES THAT POSSIBLE PERSONAL INJURY OR DEATH COULD RESULT FROM FAILURE TO FOLLOW THE PROVIDED RECOMMENDATION.

Abbreviations and Acronyms

Abbreviations and acronyms are described in the document Inertial Products - Principle & Conventions (Ref.: MU-INS&AHRS-AN-003).

Table of Contents

I	INTRODUCTION.....	1
II	PRODUCT DOCUMENTATION	3
III	VERIFICATION OF PACK CONTENTS.....	4
IV	CERTIFICATION	5
V	MECHANICAL SPECIFICATIONS.....	6
V.1	QUADRANS Mechanical Alignment	6
V.2	QUADRANS Center of Measurements	6
VI	ELECTRICAL INTERFACE SPECIFICATIONS	9
VI.1	Overview of QUADRANS Electrical Interface.....	9
VI.2	Listing of Interfaces	10
VI.3	Power Supply Connector Specifications.....	11
VI.4	Ethernet Connector Specifications	13
VI.5	Serial Inputs/Outputs Connector Specifications	15
VI.6	I/O Pulses Connector Specifications	17
VI.7	QUADRANS Recommended Wirings	19
VI.8	Electrical Schematics for RS232 and RS422 Interfaces	21
VI.9	Specifications for Communication between QUADRANS & PC	25

I INTRODUCTION

This document is the QUADRANS User Manual. It provides information on QUADRANS specifications, mechanical and electrical interfaces.

The QUADRANS system is an AHRS. It delivers heading and attitude information to other systems or to displays. It can receive data from other sensors to improve its accuracy.

The current edition of this document is applicable to QUADRANS units using firmware versions higher than 2.74 (DSP) and 5.62 (CINT).

The core of QUADRANS is an inertial measurement unit (IMU). The IMU is the assembly of three high class (0.1 deg/h) fiber optic gyroscopes (FOG) manufactured by the Inertial Products Division of iXBlue (formerly iXSea) and three high precision accelerometers (see document *Inertial Products - Principle & Conventions* (Ref.: MU-INS&AHRS-AN-003) for an overview of the INS and AHRS technologies).

Kalman filter

Even if it is an AHRS, QUADRANS contains a self-consistent navigation algorithm based on Kalman Filtering. This structure enables QUADRANS to work either as a black box or to be connected to external sensor systems (GPS or EM log) to correct heading from latitude and speed influence and to be able to output filtered speed information (see document *Inertial Products - Principle & Conventions* (Ref.: MU-INS&AHRS-AN-003) for an overview of the INS and AHRS technologies). Furthermore the association of the Kalman filter plus the coupling with the external sensors improves the heading and stability performances.

System Design

Much attention has been put on the mechanical design of QUADRANS. The system is a compact 16 cm x 16 cm x 11.3 cm box. The box contains a high performance inertial measurement unit (IMU) and a digital signal processor (DSP) supporting the navigation software. Connectors enable the connections of external sensors.

Developed marine applications, it can be interfaced easily with other industry standard navigation sensors (GPS, EM log) and systems.

Available external sensors

QUADRANS uses external sensor data to improve its own estimates of attitude and heading. The following external sensor can be connected to QUADRANS:

- GPS
- EM Log

When a GPS is connected, QUADRANS will output filtered position and speed. When the position is no more given by the GPS, QUADRANS displays the last known position or the entered manual position. The speed output by QUADRANS is systematically filtered by the Kalman filter whatever the coupling mode is (GPS, EM Log or manual speed). There is no additional activation of the external sensors on QUADRANS as for the other INS. Once configured, the external sensor is activated (i.e. taken into account by the Kalman filter).

**UTC/Time
synchro**

Your QUADRANS internal clock can be synchronized with data coming from an external reference clock (i.e., GPS clock). In this case, time is synchronized with input coming from the selected interface with appropriate protocol. For more details see *INS – Marine Applications*, Web-based interface user guide (*Ref.: MU-INSIII-AN-021*).

Alignment

QUADRANS is ready and meets its specifications within 30 minutes:

- First 5 minutes for the coarse alignment phase (static or at drift)
- Then 25 minutes moving

II PRODUCT DOCUMENTATION

Your QUADRANS belongs to the family of the iXBlue inertial products. The following documents are useful to use the best way your product:

- This **QUADRANS User Manual** gives information about:
 - ❑ Mechanical specifications
 - ❑ Electrical Interface Specifications (included : recommended wiring)
- **QUADRANS Technical Specifications** (REF.: G_ST_TSH_029) gives all specifications about your product
- **General Information** (Ref.: MU-INS&AHRS-AN-007) gives information about
 - ❑ Export Regulation
 - ❑ Warranty
 - ❑ Customer Support
 - ❑ Contacts
- **Principle & Conventions** (Ref.: MU-INS&AHRS-AN-003) gives information about
 - ❑ Abbreviations
 - ❑ Terminology
 - ❑ Behavior and operation principles
 - ❑ Geometrical conventions
- **Installation Form** (Ref.: MU-INS&AHRS-AN-004): this document is a link between the installation process and the configuration process. It contains empty tables to fill in.
- **Network Set-up Guide** (Ref.: MU-INS&AHRS-AN-005) gives information about
 - ❑ default network configuration
 - ❑ network configuration
- **INS - Marine applications - Web-based interface user guide** (ref.: MU-INSIII-AN-021) gives information about
 - ❑ how to perform the software configuration of the product (which sensor is connected, on which port, ...)
 - ❑ operation : how to use the product
- **INS Interface Library** (Ref.: MU-INSIII-AN-001) gives information about all the protocols that your product can use
- **INS Advanced Configuration** (Ref.: MU-INSIII-AN-004): this document gives all the configuration and monitoring commands which can be used during operation. These commands are sent directly through the repeater port
- **Depending of the use of the product, the following application notes can be useful:**
 - ❑ Inertial Products – Application Note – Mechanical Integration of Inertial Systems (ref.: MU-MECHAPN-AN-001)

III VERIFICATION OF PACK CONTENTS

You will find in the shipping case a Packing List detailing all the items delivered. This Packing List has been completed and checked by iXBlue before shipment, and should match the contents of the pack you have received.

However, **we recommend checking the contents of the pack and the equipment immediately after reception.** Specifically, you should check that all the items referred to above are present on delivery and that none has sustained damage.

If you observe any non-conformity or damage, please inform the carrier and iXBlue without delay by certified mail, describing in detail the problem encountered.

IV CERTIFICATION

QUADRANS is certified in accordance with the IMO, SOLAS 74 convention as amended for marine equipment with the EC Type Examination Certificate, as per Module B and MED 96/98/EC Quality System Module D Certificate of European Union Council Directive 96/98/EC on marine equipment as amended.

In this context, the certificates concerning the QUADRANS are:

- For item designation “Gyro compass”:
 - ❑ Module B certificate number is: 28465,
- For item designation “Gyro compass for high- speed craft”:
 - ❑ Module B certificate number is: 28466,
- For “Quality System”:
 - ❑ Module D certificate number is SMS.MED.D/24647.

Please, refer to www.iXBlue.com to find the current certificate.

V MECHANICAL SPECIFICATIONS

V.1 QUADRANS Mechanical Alignment

Alignment is carried out by means of two centering pins, located on the bottom plate of the QUADRANS (accuracy of mechanical positioning with the centering pins is ± 0.01 degree). These pins are located on the QUADRANS centerline, as shown by grooves on the front and rear of the gyrocompass.

The mechanical tolerance in the design of QUADRANS bottom plate allows 0.01° accuracy on the centerline of the unit.

V.2 QUADRANS Center of Measurements

The QUADRANS center of measurement (see Figure 1) is the intersection of the three QUADRANS reference axis X1, X2 and X3 defined in *Inertial Products - Principle & Conventions* (Ref.: MU-INS&AHRS-AN-003). It lies inside QUADRANS, and its exact position is reported in Figure 1).

The QUADRANS center of measurements is the reference point for the determination of QUADRANS and external sensor lever arms (Refer to the document *Inertial Products - Principle & Conventions* (Ref.: MU-INS&AHRS-AN-003) for details).

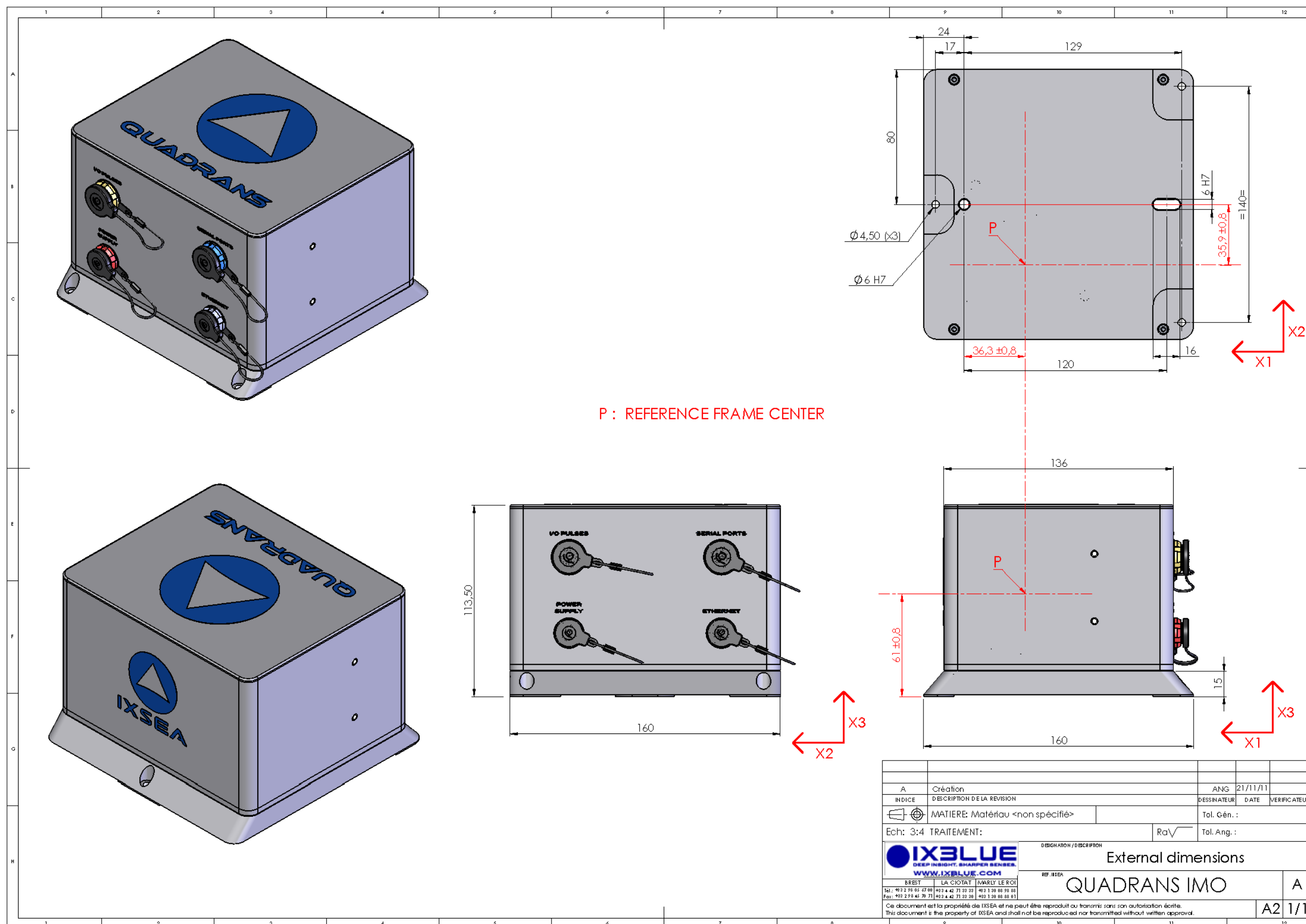


Figure 1 – Position of the center of measurement

PAGE INTENTIONALLY LEFT BLANK

VI ELECTRICAL INTERFACE SPECIFICATIONS

VI.1 Overview of QUADRANS Electrical Interface

Connectors are available on the rear panel of QUADRANS. These connectors are referenced and identified by markings on the unit. They are all different and fool-proofed to avoid any misconnection.

Figure 2 shows the details of the QUADRANS connector panel.



Figure 2 - QUADRANS connector panel

The connector references are as follows:

I/O PULSES	
Socket	FISCHER DBPU104A086
Plug	FISCHER S104A086

SERIAL PORTS	
Socket	FISCHER DBPU104A092
Plug	FISCHER S104A092

POWER SUPPLY	
Socket	FISCHER DBPU103Z052
Plug	FISCHER S103Z052

ETHERNET	
Socket	FISCHER DBPU103A053
Plug	FISCHER S103A053

VI.2 Listing of Interfaces

QUADRANS is fitted with four connectors:

- **Power supply**, described in section VI.3
- **Ethernet**, described in section VI.4,
- **Serial ports**, described in section VI.5
- **I/O pulses**, described in section VI.6

The connectors can be configured to provide the following interfaces:

- 2 inputs, serial or Ethernet, exclusive
- 2 outputs serial and/or Ethernet
- 3 additional outputs for Ethernet only
- 3 inputs pulses
- 2 outputs pulses

The I/O port configuration is done with the QUADRANS Web-based User Interface. Refer to *INS – Marine Applications, Web-based interface user guide (Ref.: MU-INSIII-AN-021)* for details.

VI.3 Power Supply Connector Specifications

The QUADRANS unit is powered by 24 V_{DC}. However, it is possible to power it with any constant voltage in the range 15 V to 36 V. Power consumption is around 10 W.

QUADRANS power supply plug is configured as shown in Figure 3.

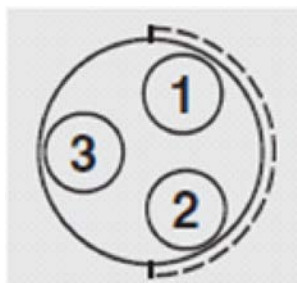


Figure 3 - Diagram of the power supply plug (soldering side)

A mains power supply module to plug directly to QUADRANS power supply connector is provided as a standard with the QUADRANS unit.

An optional 5-meter long power supply pigtail can be ordered from iXBlue to connect QUADRANS to an existing 24 V_{DC} power supply (see Figure 4).

Alternatively, the bare plug, ref. Fischer S103Z052 can be ordered directly from Fischer.

The reference of the recommended cable clamp set is FISCHER E31 103,2/5,7+B.

The assignment of the wires on the power supply connector on the QUADRANS unit is defined in Table 1.

Table 1 - QUADRANS power supply plug pin definition

Wire	Signal
1	24 V _{DC} (15 V to 36 V)
2	Electrical ground (0 V)
3	Mechanical ground



IT IS STRONGLY ADVISED AGAINST CONNECTING ATLANS-C DIRECTLY TO THE VEHICLE BATTERY.

IT IS RECOMMENDED TO USE A DEDICATED POWER SUPPLY FOR INSTRUMENTATION, STABLE AND FILTERED OUT FROM NOISE.

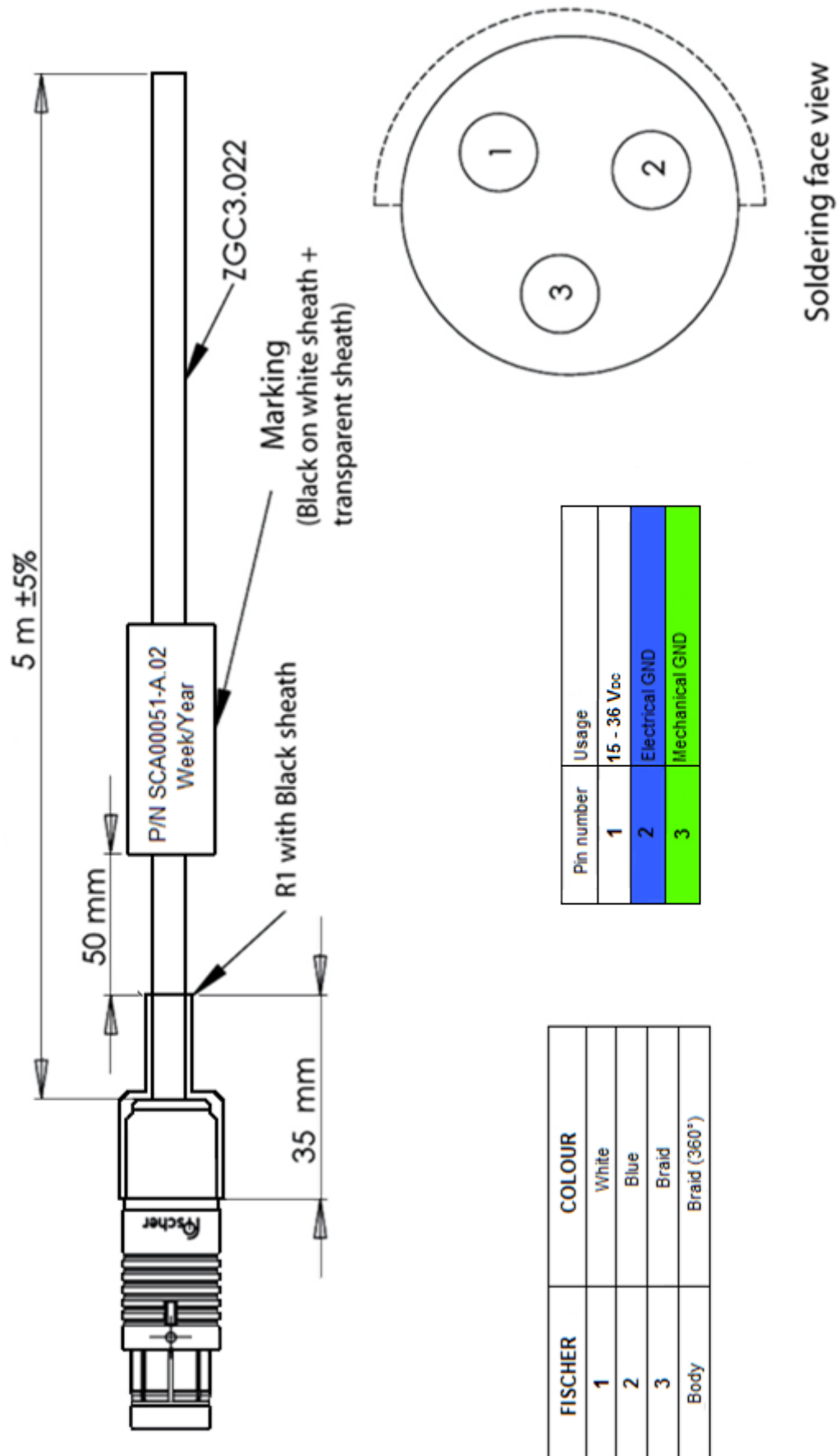


Figure 4 - QUADRANS power supply pigtail presentation

VI.4 Ethernet Connector Specifications

An Ethernet input/output is available on QUADRANS: it is a female connector the reference of which being FISCHER DBPU103A053. It offers an Ethernet Class D/Cat 5e connection for 10 Base T or 100 Base TX networks. Refer to Figure 5 for the corresponding wiring on the Ethernet plug.

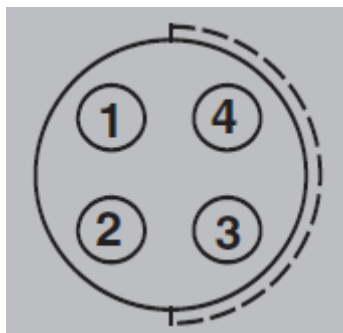


Figure 5 – Diagram of the Ethernet plug (soldering side)

Table 2 - Ethernet plug pin definition

Pin	Signal
1	TX +
2	TX -
3	RX +
4	RX -
Body	Shield

A 5-meter long Fisher to RJ45 straight cable is supplied as a standard with the QUADRANS (see Figure 6).

Alternatively, the bare plug, ref. Fischer S103A052 can be ordered directly from Fischer. The reference of the recommended cable clamp set is FISCHER E31 103,2/5,7+B.

The assignment of the wires at the output is defined for each in Table 2

The Ethernet output can be user configured. Refer to *INS – Marine Applications, Web-based interface user guide (Ref.: MU-INSIII-AN-021)* for details about the configuration.

- 2 inputs and 5 outputs, which can be user-configured either with UDP or TCP.
Configuration is made through the Web-based User interface.

These electrical interfaces are user configurable.

They are used:

- For input/output of QUADRANS data to/from external systems
- For configuration and display purposes

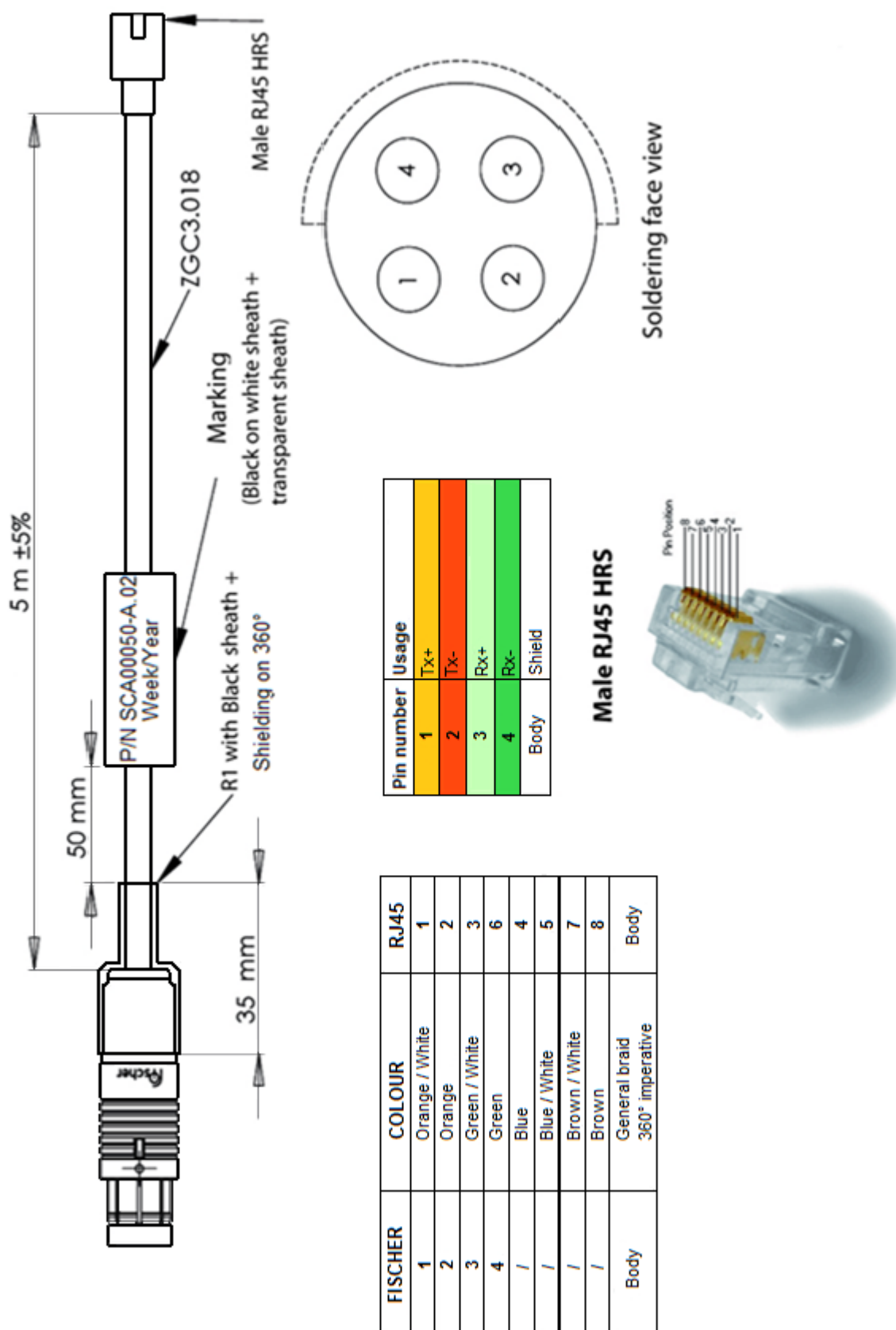


Figure 6 - QUADRANS Ethernet pigtail presentation

VI.5 Serial Inputs/Outputs Connector Specifications

All serial inputs and outputs are available through one Fischer DBPU104A092 fixed connector.

The serial plug is illustrated in Figure 7. The pins are designated from 1 to 19.

A serial plug pigtail is provided in the QUADRANS standard package (see Figure 8).

Alternatively, the “bare” plug, reference Fischer S104A092, can be ordered from FISCHER. Recommended reference of the cable clamp set is FISCHER E3 104,2/8,7+B.

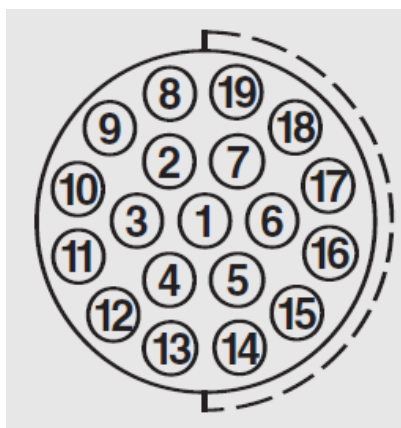


Figure 7 - Diagram of the serial I/O plug (soldering side)

The serial I/O connector provides the following inputs and outputs:

- ❑ 2 RS232/422 user-configurable serial outputs (TX)
- ❑ 2 RS232/422 user-configurable serial inputs (RX)
- ❑ 1 RS232 repeater link that can be used to monitor the unit

Refer to Table 3 for the corresponding wiring on the I/O serial plug.

Table 3 – Serial I/O plug pin definitions

Pin	Signal	Pin	Signal
1	Port A TX RS232 / TX RS422 (A)	11	Port B RX RS422 (A)
2	Port A TX RS422 (B)	12	Port B RX GND(*)
3	Port A TX GND(*)	13	Reserved
4	Port B TX RS232 / TX RS422 (A)	14	Reserved
5	Port B TX RS422 (B)	15	Reserved
6	Port B TX GND(*)	16	Repeater TX RS232
7	Port A RX RS232 / RX RS422 (B)	17	Repeater RX RS232
8	Port A RX RS422 (A)	18	Reserved
9	Port A RX GND(*)	19	Repeater RX/TX GND
10	Port B RX RS232 / RX RS422 (B)		

(*) all RX/TX GND are insulated from each other



RS232/RS422 ports have to be wired with twisted shielded pairs. Refer to section VI.7 for shielding recommendations.

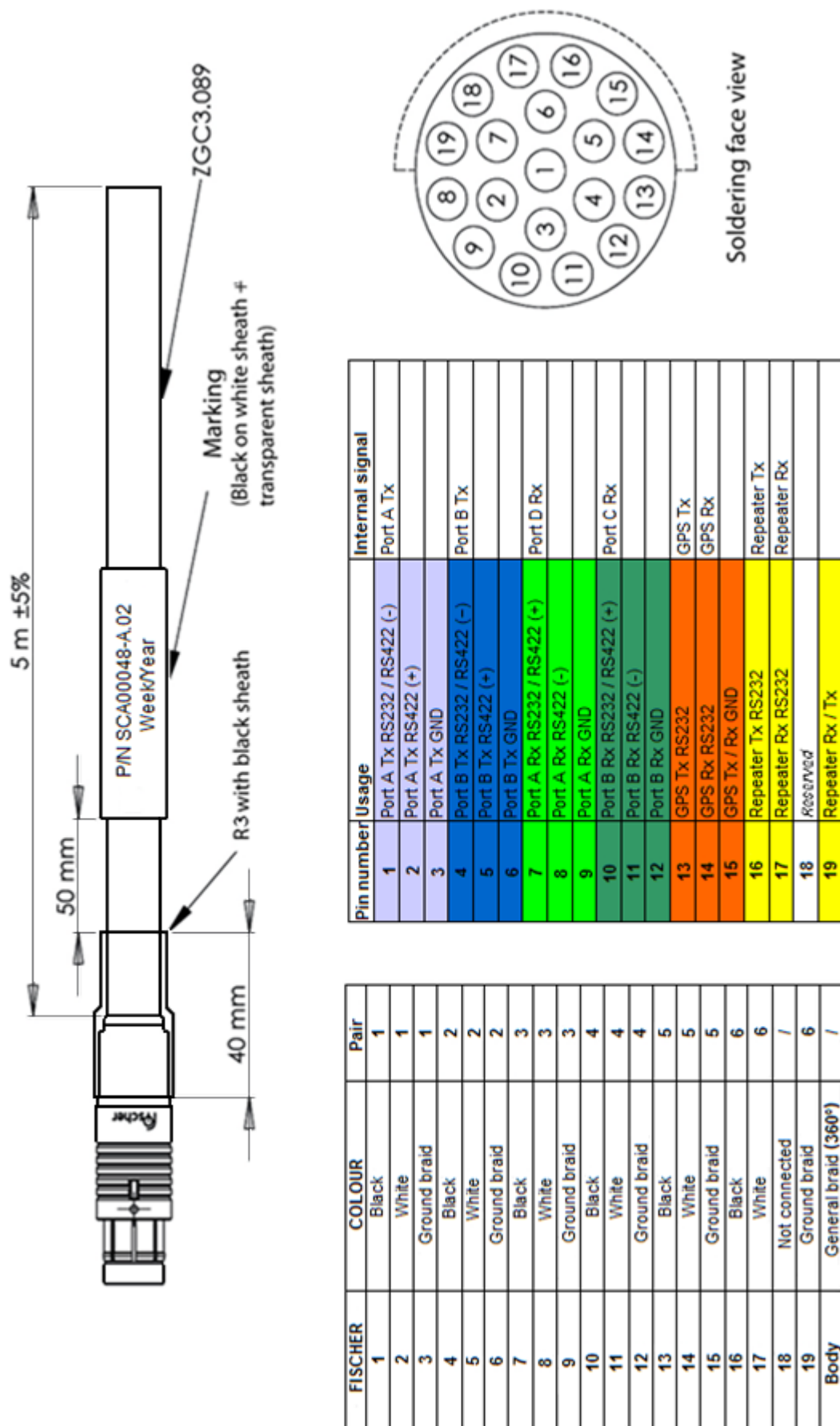


Figure 8 - QUADRANS serial inputs/outputs pigtail presentation

VI.6 I/O Pulses Connector Specifications

The I/O Pulses are available through a Fischer (ref.: DBPU104A086) fixed connector. A Fischer plug pigtail (5 m) is provided in QUADRANS standard package (see Figure 10). Alternatively, the “bare” plug, reference Fischer S104A086, can be ordered directly from Fischer. The reference of the recommended cable clamp set is FISCHER E3 104.2/8.7+B. This plug is illustrated in Figure 9. The pins are designated from 1 to 16.

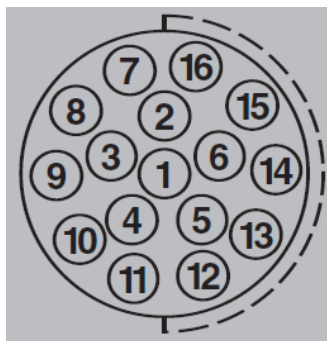


Figure 9 - Diagram of the I/O Pulses plug (soldering side)

The I/O Pulses connector provides the following inputs and outputs:

- 3 inputs for protocol output synchronization
- 1 PPS input for precise time synchronization
- 2 outputs

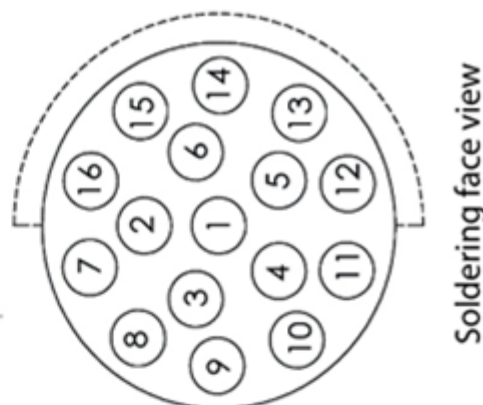
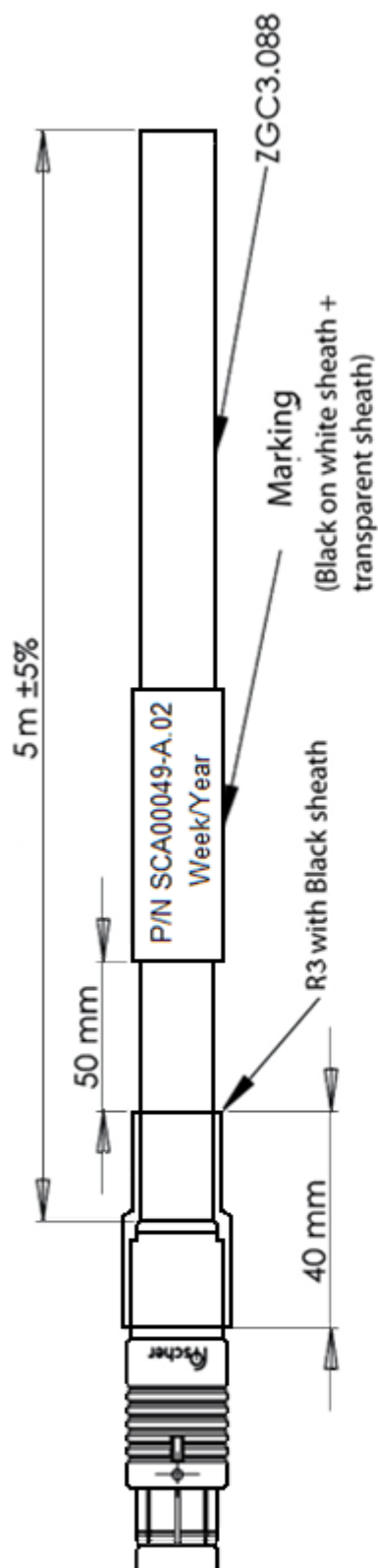
Refer to Table 4 for the corresponding wiring on the I/O serial plug.

Table 4 – I/O Pulses plug pin definitions

Pin	Signal
1	PPS input signal
2	PPS input GND
3	<i>Reserved</i>
4	<i>Reserved</i>
5	Input pulse A signal (*)
6	Input pulse A GND (*)(**)
7	Input pulse B signal (*)
8	Input pulse B GND(*)(**)
9	Input pulse C signal (*)
10	Input pulse C GND (*)(**)
11	Pulse out A signal
12	Pulse out A GND (**)
13	Pulse out B signal
14	Pulse out B GND (**)
15	<i>Reserved</i>
16	<i>Reserved</i>

(*) can be used as incoming event marker or EM Log input pulse signal

(**) all pulse GND signal are common



Soldering face view

Pin number	Usage	Internal signal
1	PPS input signal	Input pulse D
2	PPS input GND	
3	PPS output signal	GPS PPS out
4	PPS output GND	
5	Event marker A input signal	Input pulse A
6	Event marker A input GND	
7	Event marker B input signal	Input pulse B
8	Event marker B input GND	
9	Event marker C input signal	Input pulse C
10	Event marker C input GND	
11	Pulse output A signal	Output pulse A
12	Pulse output A GND	
13	Pulse output B signal	Output pulse B
14	Pulse output B GND	
15	Reserved	
16	Reserved	

FISCHER	COLOUR	Coax
1	Core	1
2	Braid	1
3	Core	2
4	Braid	2
5	Core	3
6	Braid	3
7	Core	4
8	Braid	4
9	Core	5
10	Braid	5
11	Core	6
12	Braid	6
13	Core	7
14	Braid	7
15	Core	/
16	Braid	/
Body	General braid (360°)	/

Figure 10 - QUADRANS I/O pulses pigtail presentation

VI.7 QUADRANS Recommended Wirings

The recommended wirings with Shielded Twisted Pairs for RS232 (Output and Input), RS422 (Output and Input), and Pulse (Output and Input) cables are described hereafter.

Important

IT IS RECOMMENDED TO USE SHIELDED MULTI-TWISTED PAIRS TO PREVENT 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

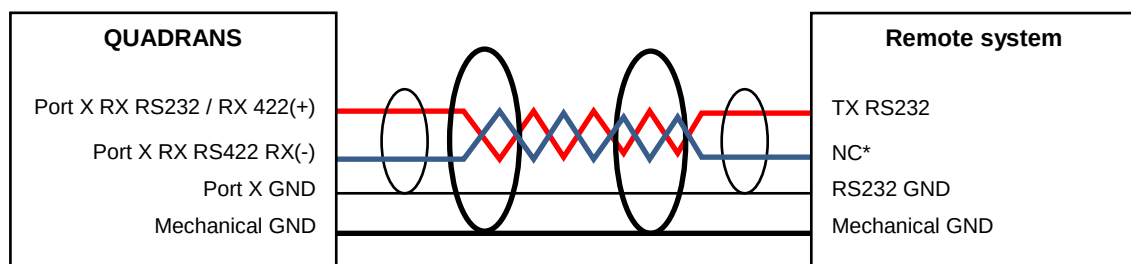


Figure 11 - RS232 reception wiring description

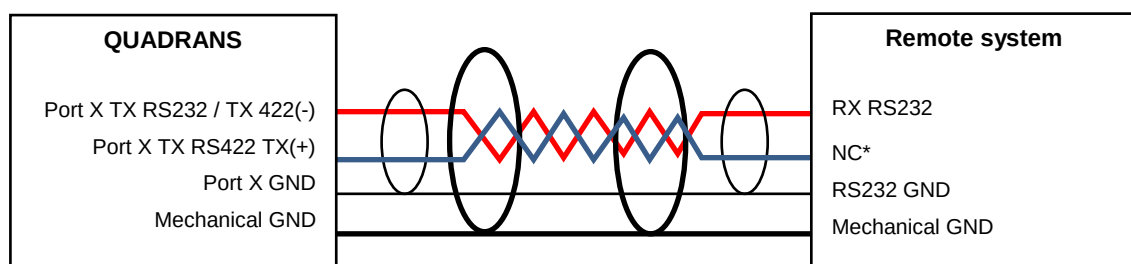


Figure 12 - RS232 transmission wiring description

* NC = Not connected

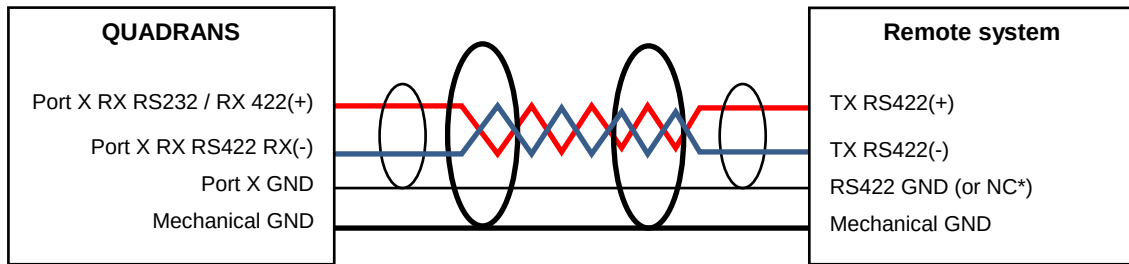


Figure 13 – RS422 reception wiring description

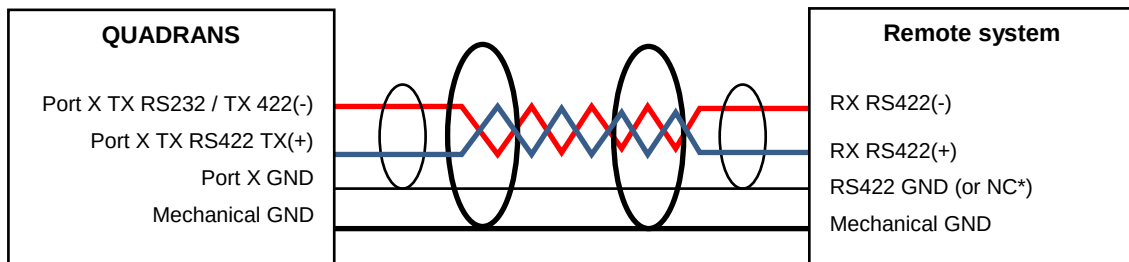


Figure 14 – RS422 transmission wiring description

* NC = Not connected

VI.8 Electrical Schematics for RS232 and RS422 Interfaces

Each QUADRANS RS232 and RS422 input and output is based on a separate MAX3160 driver powered by its own DC/DC converter and isolated from each other and from the internal digital power by an ISO7220AD isolator.

Figure 15 and Figure 16 detail input and output RS232 / RS422 electrical schematics.

The following table details input impedance of each port and output current that can be delivered by each port driver:

Table 5 – RS232/RS422 Input characteristics

	RS232	RS422
Input impedance	5 k Ω	48k Ω
Minimum input LOW threshold	0.8 V	N/A
Maximum input HIGH threshold	2.4 V	N/A
Minimum differential threshold	N/A	200 mV

The following table details input impedance of each port and output current that can be delivered by each port driver:

Table 6 – RS232/RS422 Output characteristics

	RS232	RS422
Output impedance	100 Ω	40 Ω
Max. output drive current	110 mA	260 mA
Output voltage (no load)	± 11 V	10.4 V differential
Output voltage (loaded)	10.8 V (3 k Ω)	7.5 V differential (100 Ω)

PAGE INTENTIONALLY LEFT BLANK

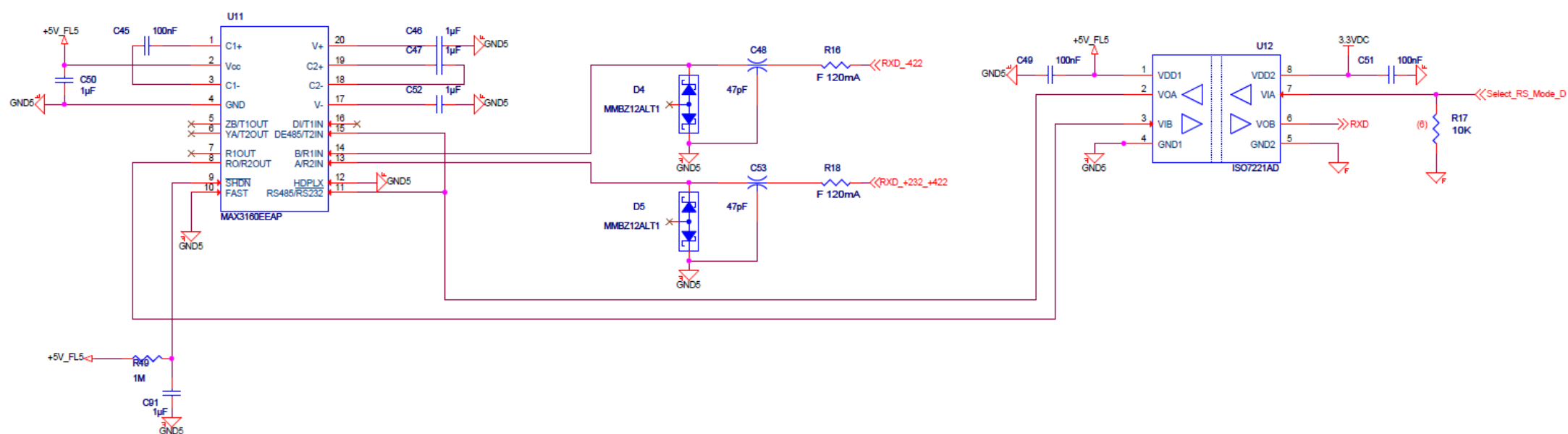


Figure 15 – RS232/422 Input electrical schematic

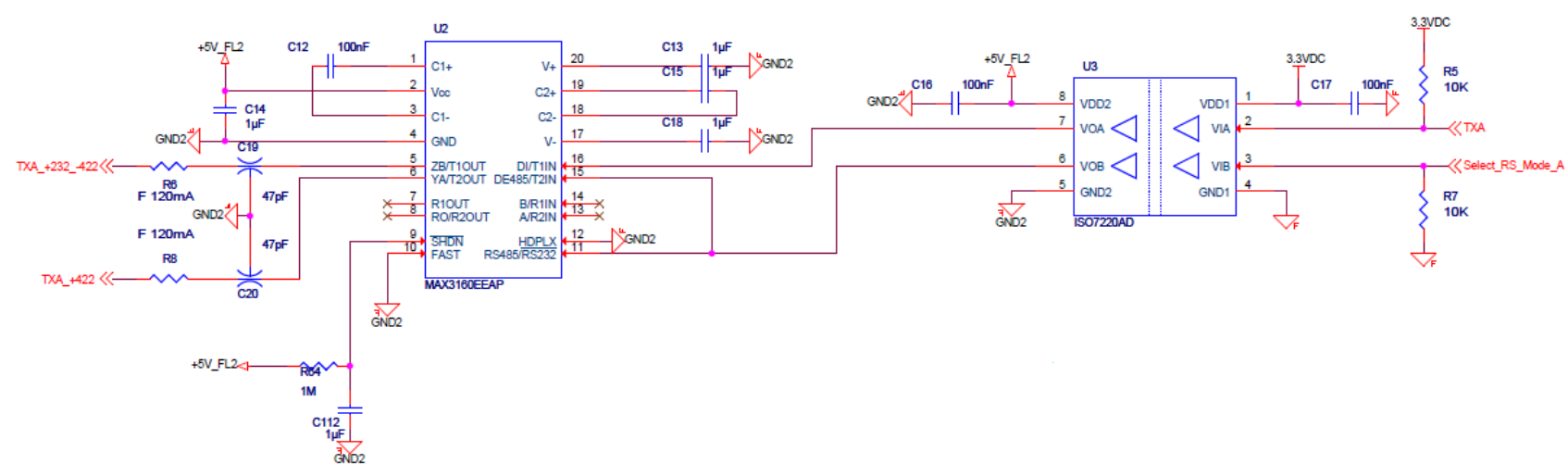


Figure 16 – RS232/422 Output electrical schematic

PAGE INTENTIONALLY LEFT BLANK

VI.9 Specifications for Communication between QUADRANS & PC

QUADRANS can be connected to a PC for configuration, installation and display purposes through the Web-based User Interface. The I/O signal is available

- Either through the repeater link from serial I/O connector (see section VI.5)
- Or through the Ethernet connector (see section VI.4).

By default, serial repeater link is configured as follows:

- Protocol used: PHINS Standard (Refer to *INS Interface Library* (Ref.: MU-INSIII-AN-001) for a description of QUADRANS Standard data frame output)
- Baudrate : 57.6 kBauds
- Flow Control : Odd, 2 stop bits
- Refresh rate : 5 Hz (200 ms)

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

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

PAGE INTENTIONALLY LEFT BLANK