QUADRANS

Interface Control Document

Document Revision History

Edition	Date	Comments
A	01/2017	First Edition

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Abbreviations and Acronyms

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

Table of Contents

1 INTRODUCTION

This document is the QUADRANS Interface Control Document. It provides general information on the QUADRANS interface, with a focus on mechanical and electrical interfaces.

2 GENERAL INTERFACE SPECIFICATION

2.1 Communication link

QUADRANS is able to receive and transmit data through 2 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 2 serial links.

QUADRANS is able to receive and transmit data through a 10/100 Mbits/s Ethernet link:

- TCP/IP and UDP protocols are available
- 2 inputs / 5 outputs virtual ports can be opened simultaneously

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

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

- Either through the Ethernet connector (see section 4.4).
- Or through the I/O connector (see section 4.5).

In default configuration, access to the Web-based 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 User Interface (see *Network Set-up Guide (Ref.: MU-INS&AHRS-AN-005)* 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 QUADRANS 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 *INS Interface Library document (Ref.:MU-INSIII-AN-001)* 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)

2.2   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 *INS - Interface Library* document *(Ref.:MU-INSIII-AN-001).*

System configuration and operation can be performed either through the Web-based User Interface (refer to the Inertial Products - Marine Applications, Web-based interface user guide, ref.: *MU-INSIII-AN-021*) or the control command software (refer to INS – Advanced Configuration, ref.: *MU-INSIII-AN-004*).

2.2.1   WEB BASED INTERFACE

The QUADRANS Web-based user interface runs either on a workstation or on a laptop and allows full installation and operation of the system.

The user interface software is qualified with PC running Windows XP operating system with the following minimum requirements:

- Minimum processor frequency   : 2 GHz
- Minimum RAM   : 2 048 Mo
- Minimum storage available   : 10 Go

Necessary software versions are detailed in the web MMI user guide and these versions can be found on the CD delivered with the product.

2.2.2   CONTROL COMMAND

The control command software gives access to the following features:

- Installation
  - ❑ Misalignment configuration
  - ❑ Level arms configuration
  - ❑ Communication link configuration (physical parameter and software parameters)
- Operation
  - ❑ Software reset
  - ❑ Manual latitude or speed input
  - ❑ Data display
- 5 Hz refresh rate
  - ❑ Data logging

3 MECHANICAL SPECIFICATIONS

3.1 QUADRANS General Mechanical Specifications

Characteristics	QUADRANS Unit alone (see Figure 1 - QUADRANS housing dimensions)
Housing footprint (l x w x h) in mm	160 x 160 x 113,5

3.2 QUADRANS Mechanical Alignment

The QUADRANS base plate is designed with two holes for alignment of QUADRANS axis X_1 with a reference direction on the matching adaptation plate fixed onboard.

The description and recommendations for the QUADRANS mechanical alignment are developed in a specific application note (See *Inertial Products-Application Note- Mechanical Integration of Inertial Systems (Ref.: MU-MECHAPN-AN-001)* for details).

3.3 QUADRANS Reference Frame Centre

The QUADRANS reference frame centre P 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)*.

The QUADRANS reference frame centre, P, 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).

It is shown in Figure 1 - QUADRANS housing dimensions and reference frame center P.

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.

P : REFERENCE FRAME CENTER

MASS: 2550 gr +/-150 gr

Moments of inertia: (gr*mm²)
$L_{xx}=9032098.71$ $L_{xy}=-159326.90$ $L_{xz}=140391.07$
$L_{yx}=-159326.90$ $L_{yy}=10185432.96$ $L_{yz}=53827.49$
$L_{zx}=140391.07$ $L_{zy}=53827.49$ $L_{zz}=7009261.26$
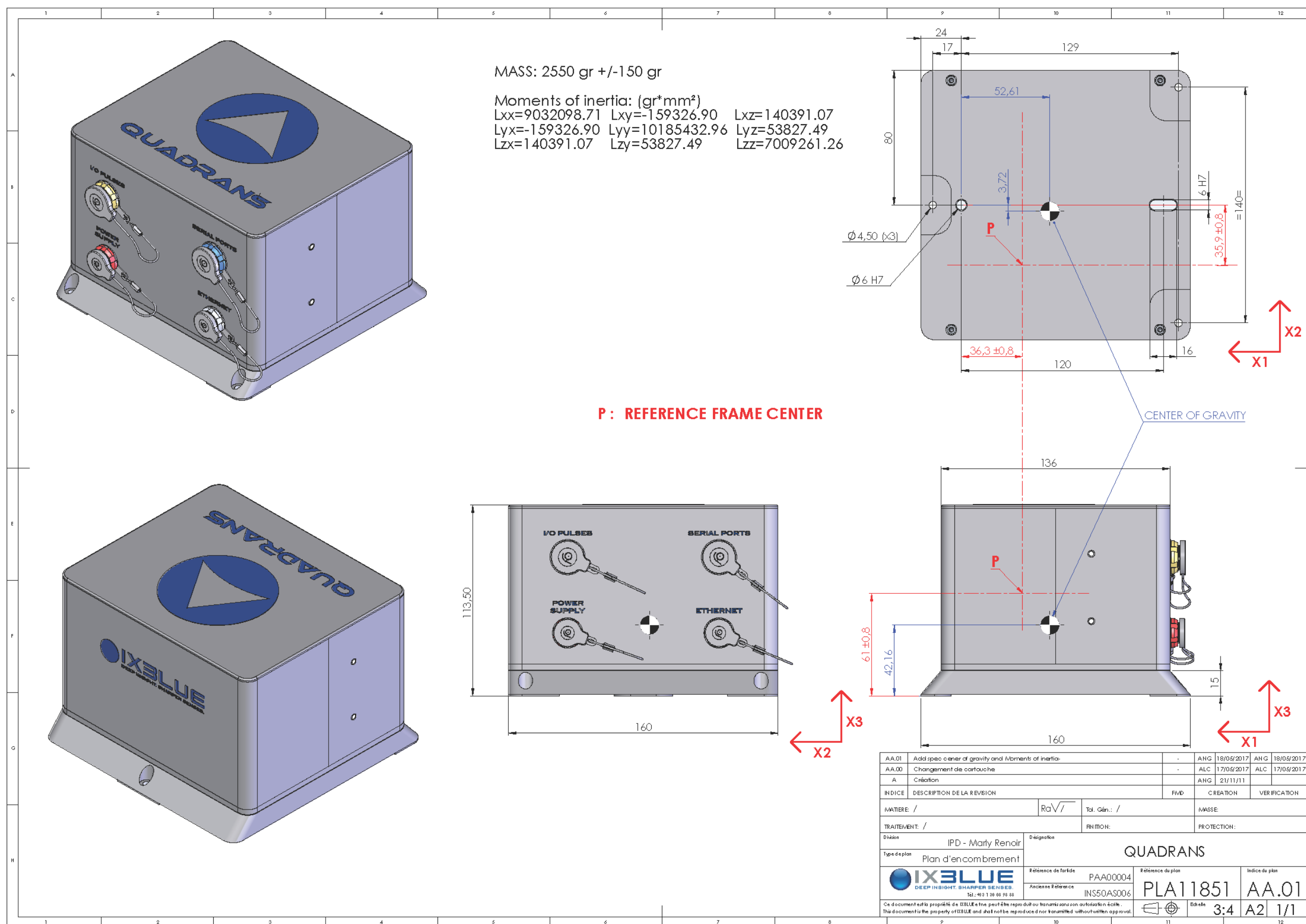
Figure 1 - QUADRANS housing dimensions and reference frame center P

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4 ELECTRICAL INTERFACE SPECIFICATIONS

4.1 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

4.2   Listing of Interfaces

INPUTS   **OUTPUTS**

RS422, RS232   RS422, RS232

or Ethernet inputs   or Ethernet outputs

Pulse inputs   Pulse outputs

PPS input

24 V$_{DC}$ / 15W
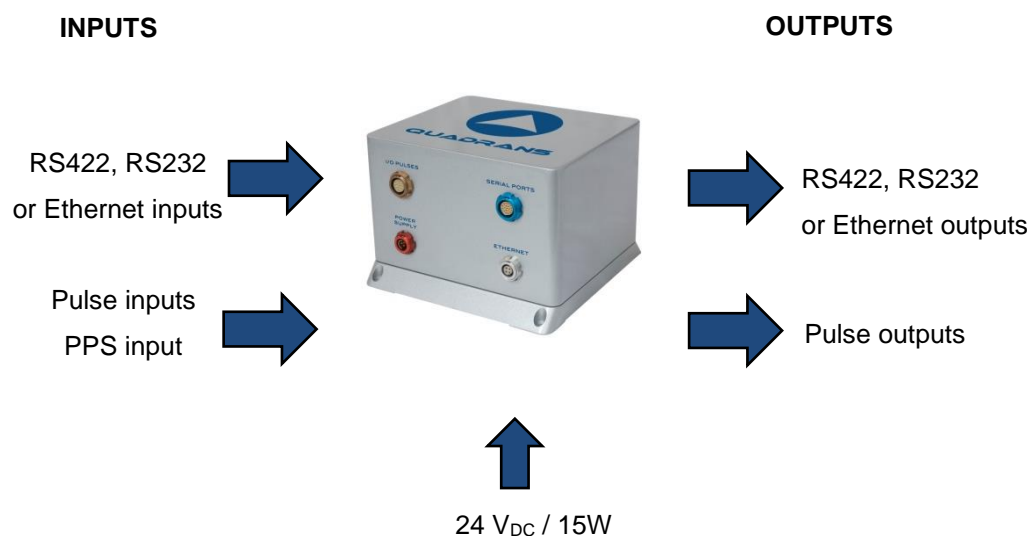
QUADRANS is fitted with 4 connectors configured to provide the following:

	I/O pulses connector	Serial ports connector	Ethernet connector	Power supply connector
Power system supply				1
Repeater and configuration port		1	1	
Ethernet inputs			2	
Ethernet outputs			5	
RS232 or RS422 inputs		2		
RS232 or RS422 outputs		2		
Pulse Inputs (user-configurable)	3			
Pulse Outputs (user-configurable)	2			
PPS input	1			

The I/O port configuration is done with the Web-based User Interface Software installed on a PC connected to QUADRANS. Refer to document *Inertial Products,* Marine applications – Web-based interface user guide *(Ref.: MU-INSIII-AN-021)* for details.

4.3 Power Supply Connector Specifications

4.3.1 DEFINITION

The QUADRANS unit is powered by 24 Volts Direct Current. However, it is possible to power it with any constant voltage in the range 15 V to 36 V. Power consumption is around 15 W. QUADRANS power supply connector is configured as shown in Figure 3.

4.3.2 CONNECTOR & PIN OUT

The QUADRANS unit can be powered on by two methods:

- A mains power supply module to plug directly to QUADRANS power supply connector provided as a standard with the QUADRANS unit. This module enables conversion of 100/240 V_{AC} to 24 V_{DC} using the standard power cable for connection to the mains supply of the country of delivery.

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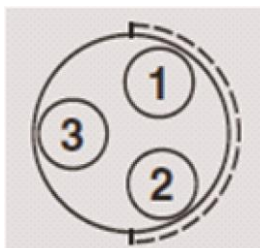
Figure 3 - Diagram of the power supply plug (soldering side)

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 QUADRANS 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

Pin number	Usage
1	15 - 36 V_{DC}
2	Electrical GND
3	Mechanical GND

FISCHER	COLOUR
1	White
2	Blue
3	Braid
Body	Braid (360°)

4.4 Ethernet Connector Specifications

4.4.1 DEFINITION

The Ethernet connector provides the following inputs and outputs:

- 2 inputs, which can be user-configured either with UDP or TCP.
- 5 outputs, which can be user-configured either with UDP or TCP.

These interfaces are user configurable through the Web-based User Interface. For details, refer to the documents:

- INS – Marine applications, Web-based Interface User Guide (Ref.: MU-INSIII-AN-021)
- INS – Advanced configuration (Ref.: MU-INSIII-AN-004)

Important

Do not use both the Ethernet link and the serial one to configure QUADRANS at the same time.

4.4.2 CONNECTOR & PIN OUT

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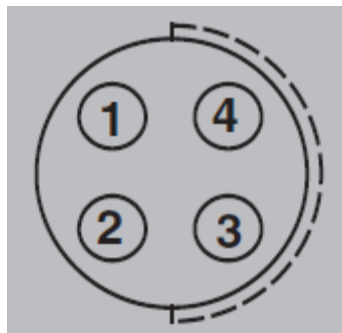
Figure 5 – Diagram of the Ethernet plug (soldering side)

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.

Table 2 - Ethernet plug pin definition
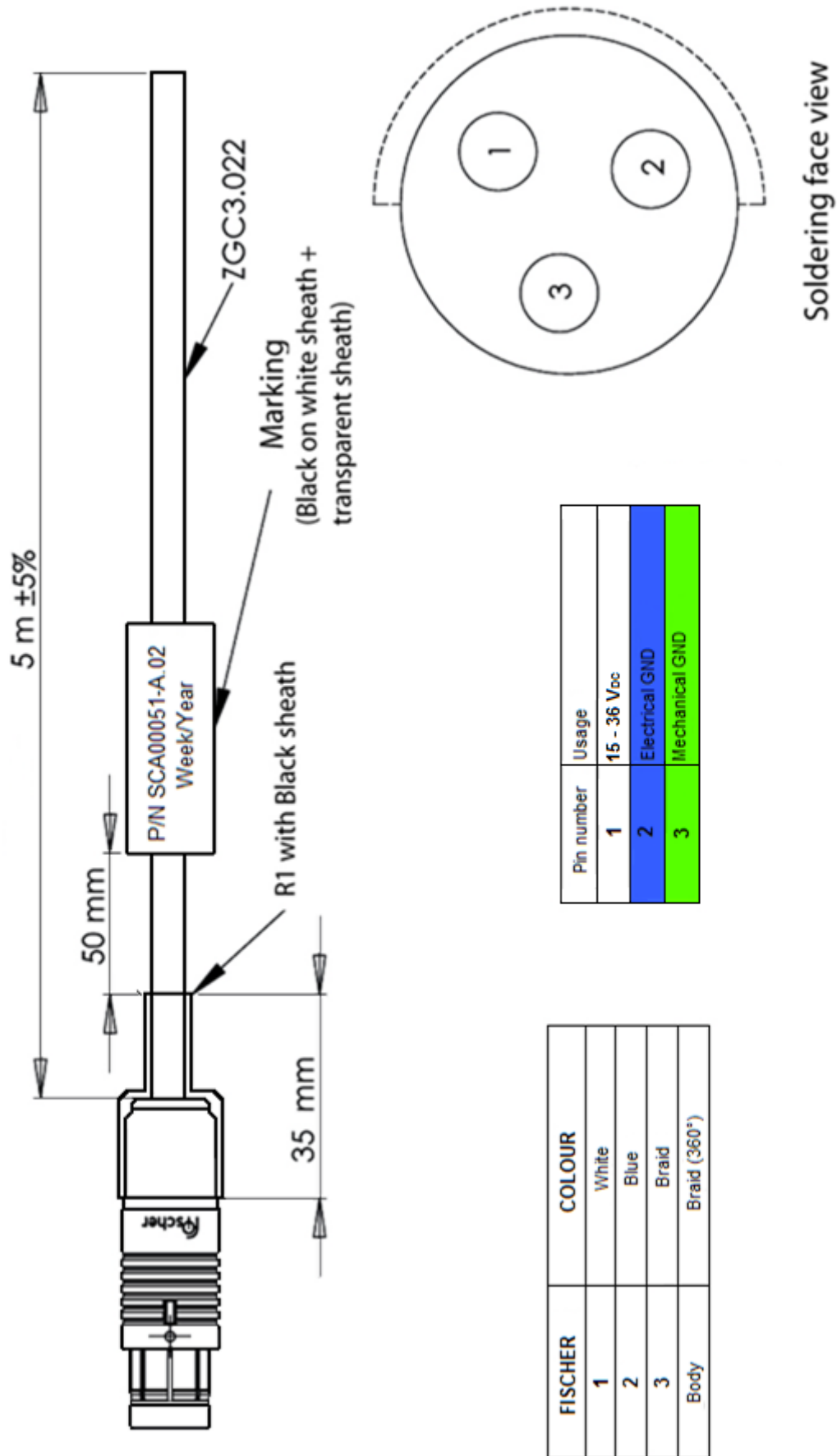
Pin	Signal
1	TX +
2	TX -
3	RX +
4	RX -
Body	Shield
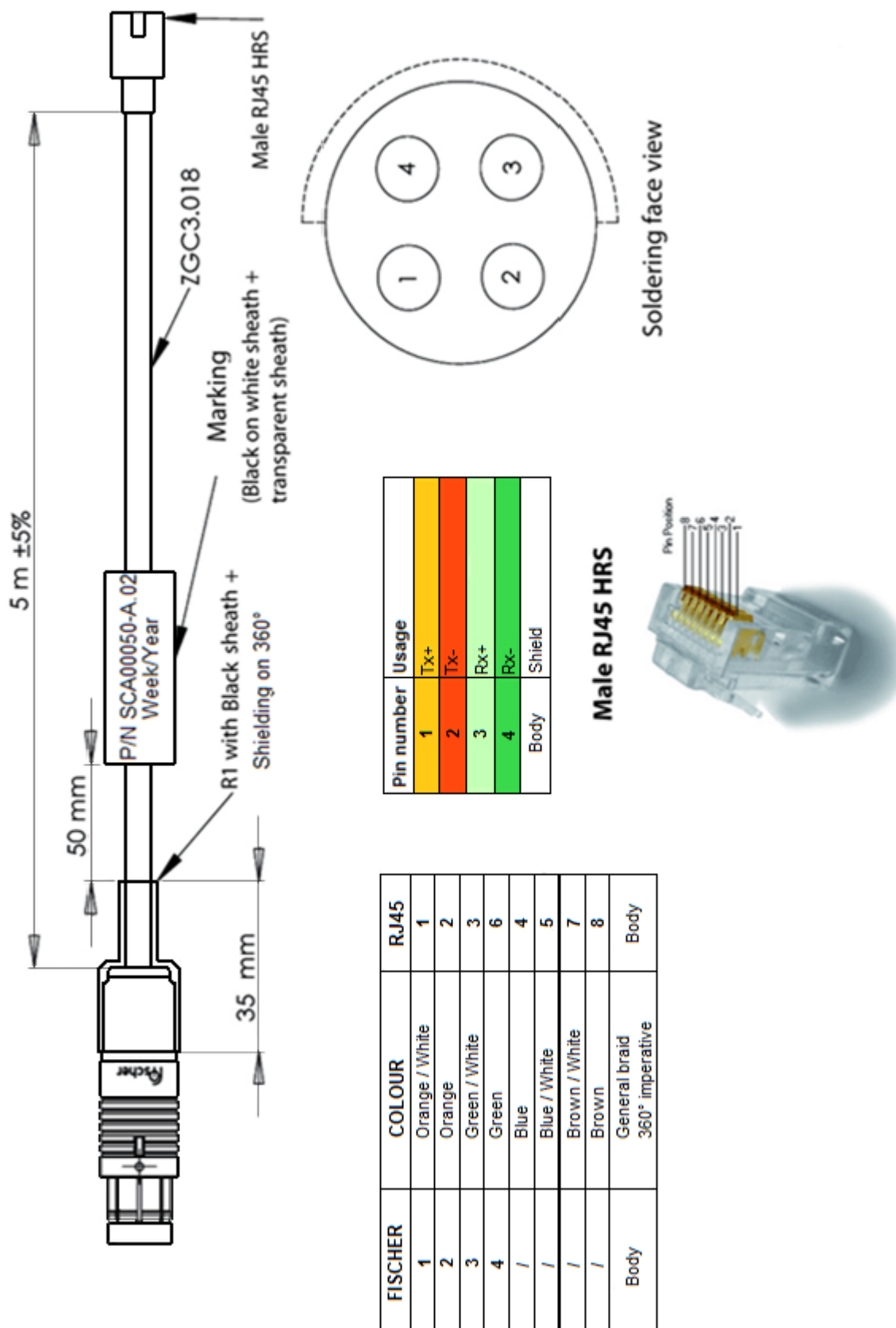
Figure 6 - QUADRANS Ethernet pigtail presentation

Pin number	Usage
1	Tx+
2	Tx-
3	Rx+
4	Rx-
Body	Shield

Male RJ45 HRS

FISCHER	COLOUR	RJ45
1	Orange / White	1
2	Orange	2
3	Green / White	3
4	Green	6
/	Blue	4
/	Blue / White	5
/	Brown / White	7
/	Brown	8
Body	General braid 360° imperative	Body

4.5   Serial Inputs/Outputs Connector Specifications

4.5.1   DEFINITION

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

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

4.5.2   CONNECTOR & PIN OUT

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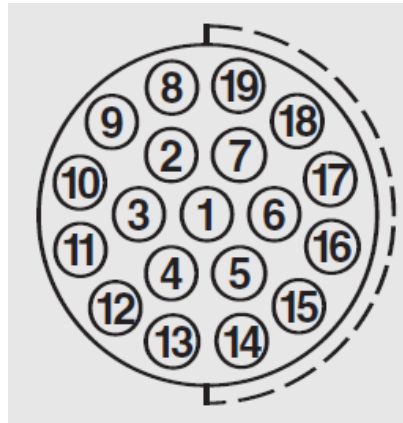
Figure 7 - Diagram of the serial I/O plug (soldering side)

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

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

RS232/RS422 ports have to be wired with twisted shielded pairs. Refer to section 4.7 for shielding recommendations.

ZGC3.089

5 m ±5%

Marking
(Black on white sheath +
transparent sheath)

P/N SCA000048-A.02
Week/Year

50 mm

R3 with black sheath

40 mm

Fischer

Soldering face view

Pin number	Usage
1	Port A Tx RS232 / RS422 (-)
2	Port A Tx RS422 (+)
3	Port A Tx GND
4	Port B Tx RS232 / RS422 (-)
5	Port B Tx RS422 (+)
6	Port B Tx GND
7	Port A Rx RS232 / RS422 (+)
8	Port A Rx RS422 (-)
9	Port A Rx GND
10	Port B Rx RS232 / RS422 (+)
11	Port B Rx RS422 (-)
12	Port B Rx GND
13	Reserved
14	Reserved
15	Reserved
16	Repeater Tx RS232
17	Repeater Rx RS232
18	Reserved
19	Repeater Rx / Tx

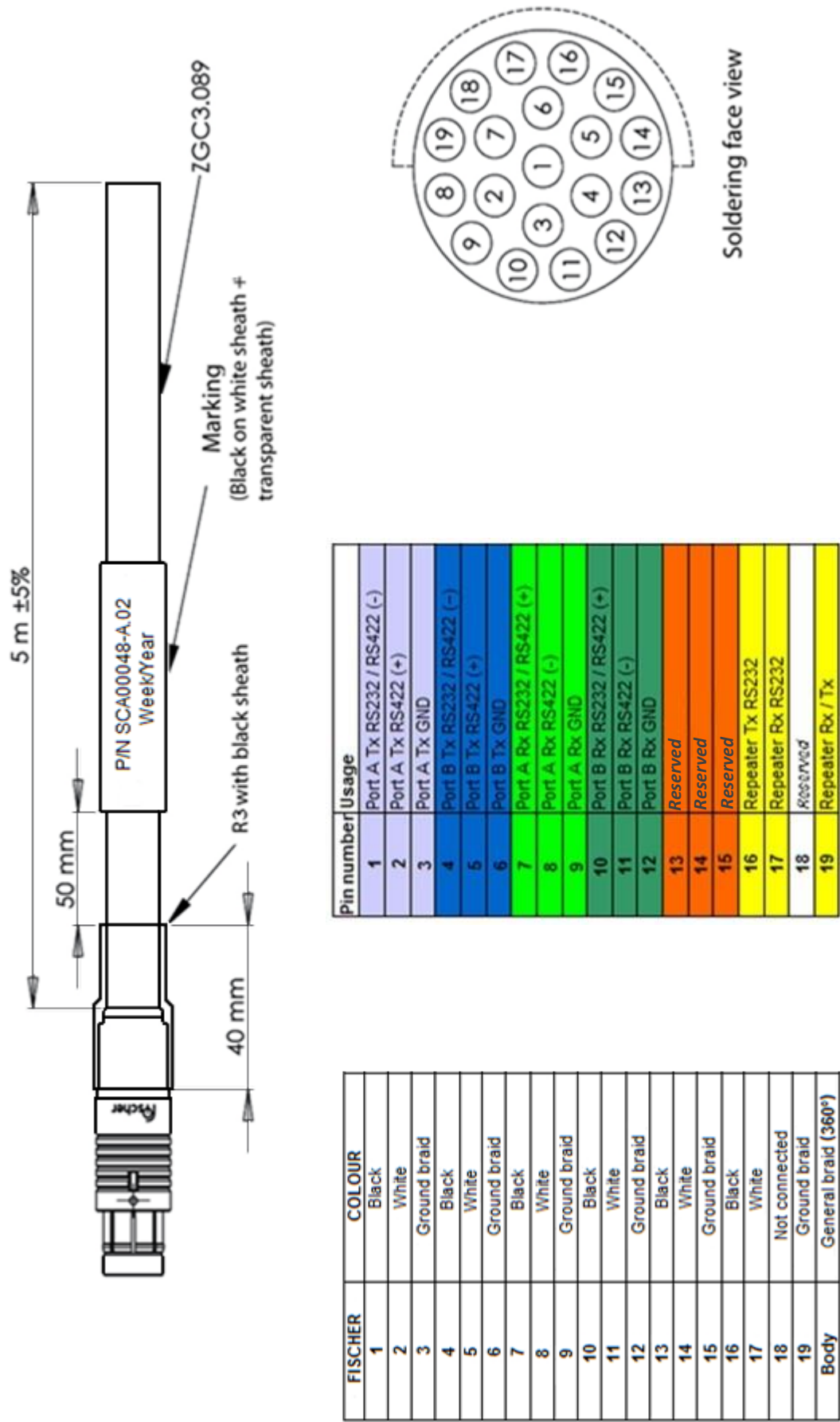| FISCHER	COLOUR
1	Black
2	White
3	Ground braid
4	Black
5	White
6	Ground braid
7	Black
8	White
9	Ground braid
10	Black
11	White
12	Ground braid
13	Black
14	White
15	Ground braid
16	Black
17	White
18	Not connected
19	Ground braid
Body	General braid (360°)

Figure 8 - QUADRANS serial inputs/outputs pigtail presentation

4.6 I/O Pulses Connector Specifications

4.6.1 DIGITAL CONNECTOR DEFINITION

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

4.6.2 GENERAL DIGITAL CONNECTOR & PIN OUT

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.
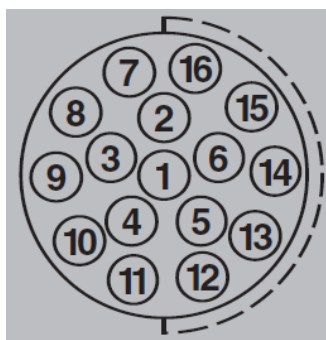

Figure 9 - Diagram of the I/O Pulses plug (soldering side)

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	*Reserved*
4	*Reserved*
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 (*)

Pin	Signal
11	Pulse out A signal
12	Pulse out A GND (*)
13	Pulse out B signal
14	Pulse out B GND (*)
15	*Reserved*
16	*Reserved*

(*) all pulse GND signal are common
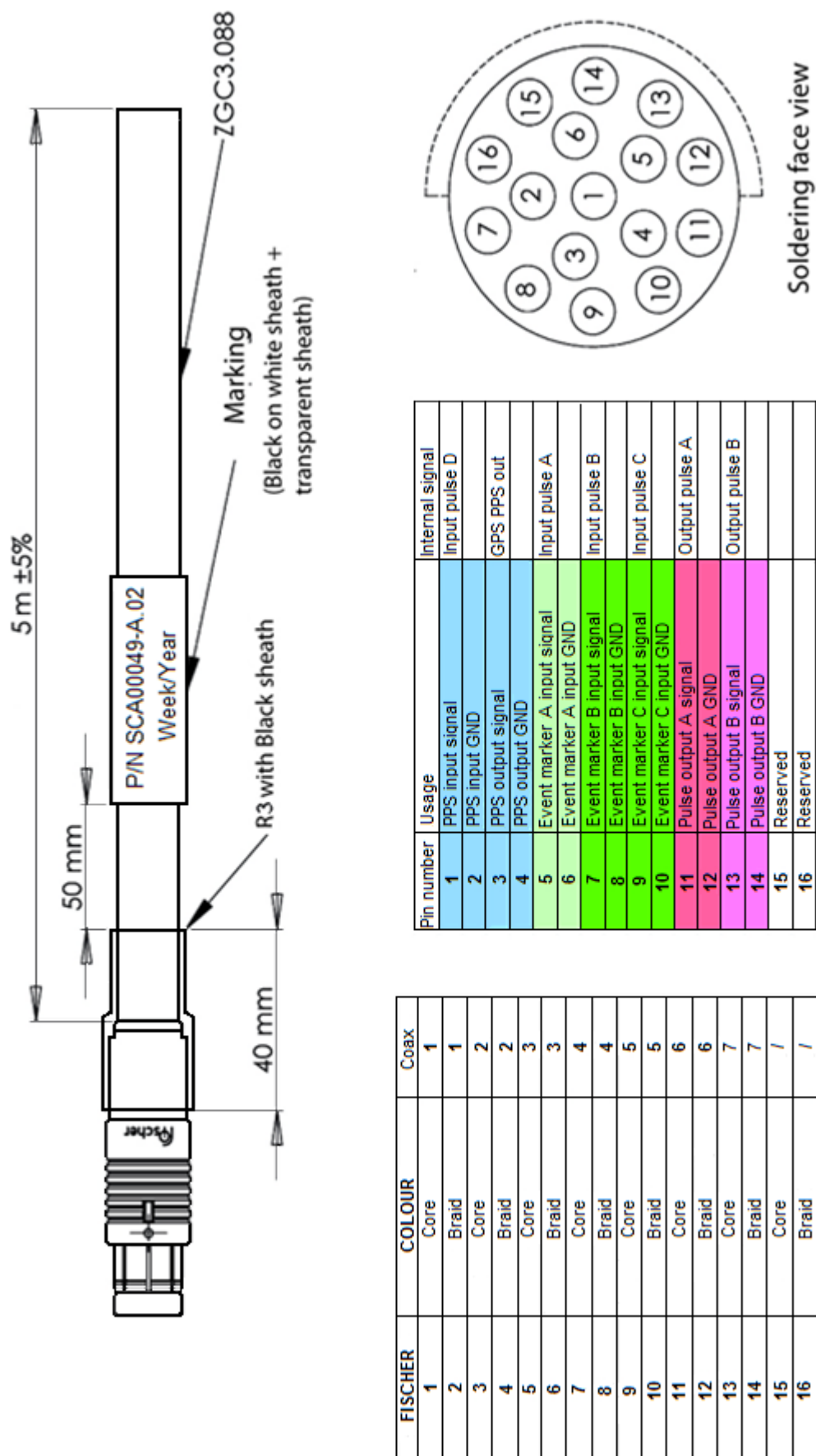
Figure 10 - QUADRANS I/O pulses pigtail presentation

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°)	/

4.7   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

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.
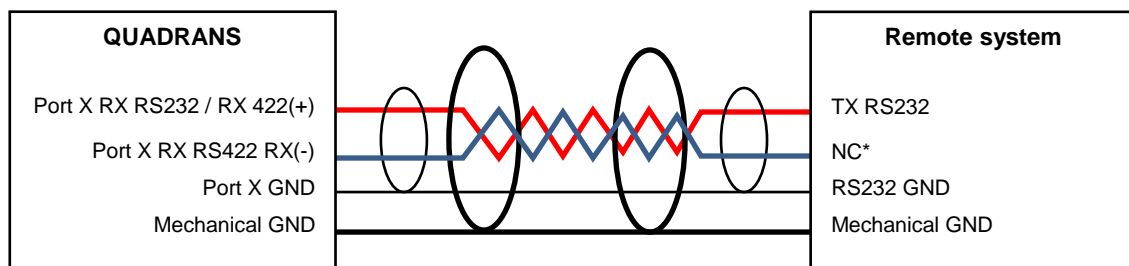
Figure 11 - RS232 reception wiring description
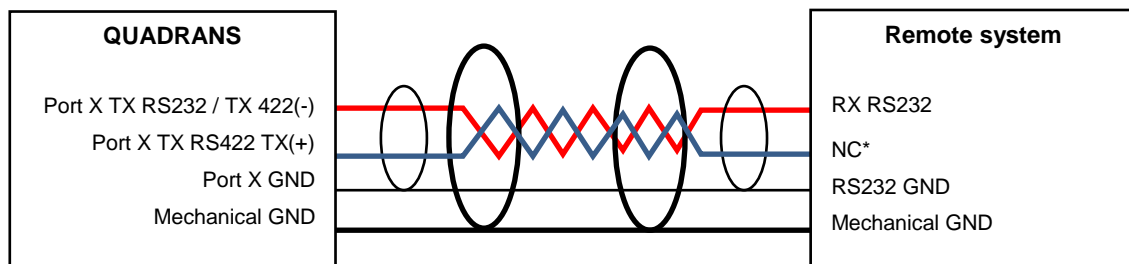
Figure 12 - RS232 transmission wiring description
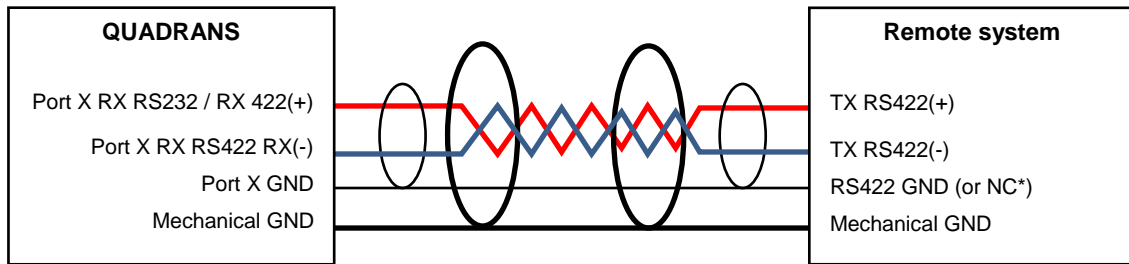
* NC = Not connected
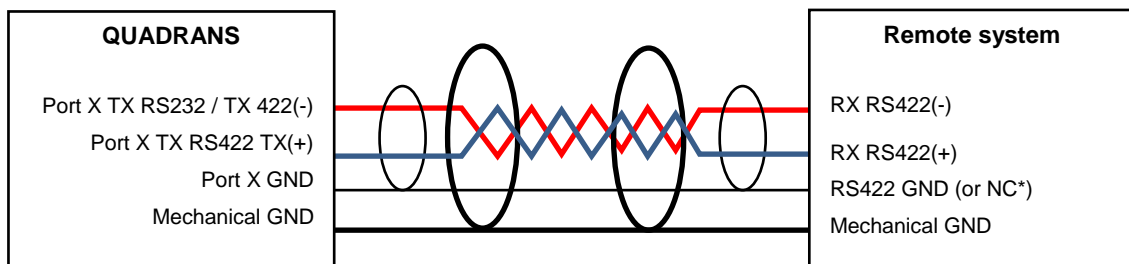
Figure 13 – RS422 reception wiring description

Figure 14 – RS422 transmission wiring description

* NC = Not connected

4.8   Electrical Schematics for RS232 and RS422 Interfaces

Each 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 13 and 14 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 kΩ	48kΩ
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

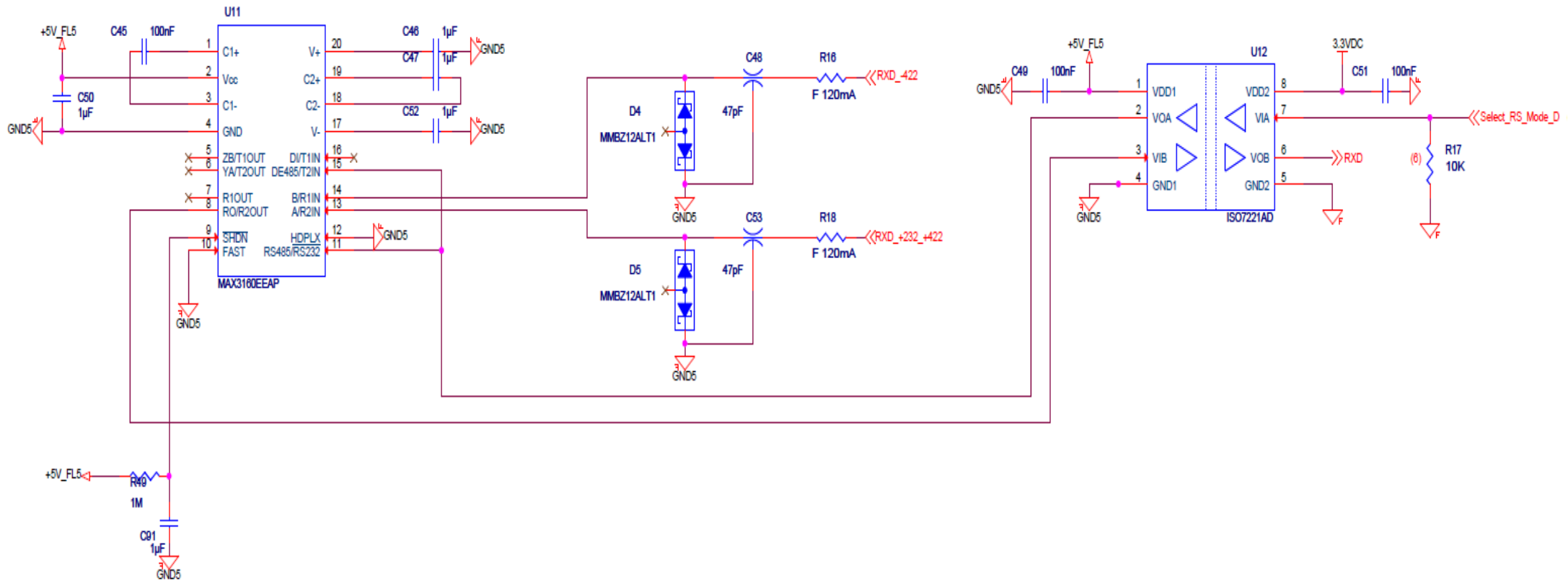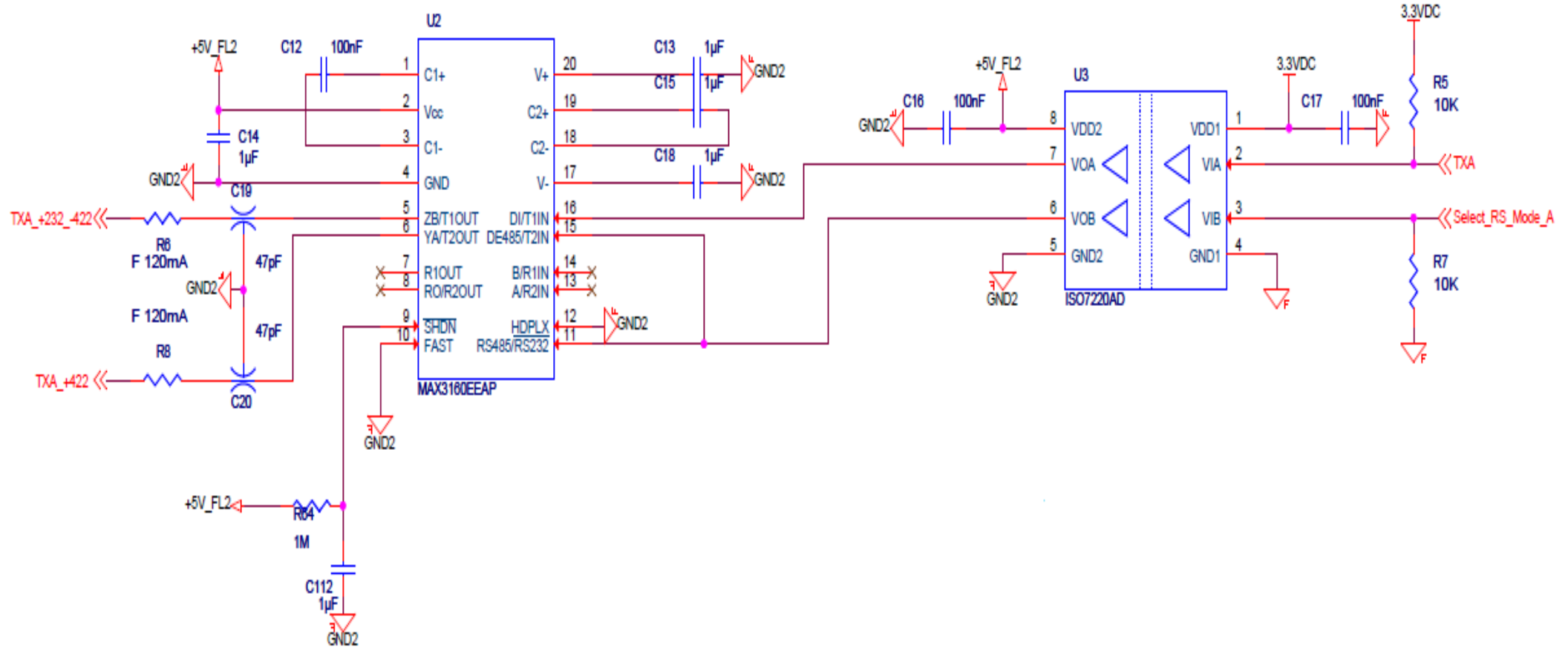|	RS232	RS422
Output impedance	100 Ω	40 Ω
Max. output drive current	110 mA	260 mA
Output voltage (no load)	±11 V	10.4 V differential
Output voltage (loaded)	10.8 V (3 kΩ)	7.5 V differential (100 Ω)

Figure 15 – RS232/422 Input electrical schematic

Figure 16 – RS232/422 Output electrical schematic