KONGSBERG

KONGSBERG EM 2040

Processing Unit

Installation

391932/D

Copyright

Disclaimer

Kongsberg Maritime AS endeavours to ensure that all information in this document is correct and fairly stated, but does not accept liability for any errors or omissions.

Warning

The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment and/or injury to personnel. All users must be familiar with the contents of the appropriate manuals before attempting to install, operate, maintain or in any other way work on the equipment.

Kongsberg Maritime AS disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.

Support information

If you require maintenance or repair, contact your local dealer. You can also contact us using the following address: km.hydrographic.support@kongsberg.com. If you need information about our other products, visit http: //www.km.kongsberg.com.

Table of contents

About this manual

The purpose of this manual is to provide the descriptions, procedures and detailed parameter explanations required to allow for safe and efficient use of the EM 2040. The manual also provides you with a thorough understanding of the EM 2040 parameters and adjustments.

Target audience

This manual is intended for all users of the EM 2040. Due to the nature of the descriptions and the level of detail provided by this manual, it is well suited for those who are - or wish to be - expert users.

A good understanding of system functions and controls is essential to fully take advantage of the functionality provided. Sea conditions vary, sometimes drastically. The acoustic conditions are also changing. Temperature and salinity layers differ from one day to the next, and from one position to another. It is not possible to identify settings that will provide the best data at all times. A careful study of the information in this manual is highly recommended, preferably while exploring the EM 2040 functionality.

Online information

For information about the EM 2040 and other products from Kongsberg Maritime, visit our website.

https://www.kongsberg.com/maritime

Software version

This EM 2040 Installation complies with software version .

Registered trademarks

Observe the registered trademarks that apply.

Windows® is a registered trademark of Microsoft Corporation in the United States and other countries.

KONGSBERG EM 2040

Topics

System description

The EM 2040 is a true wide band high resolution shallow water multibeam echo sounder. It is an ideal tool for any high resolution mapping and inspection application.

Key features

- Frequency range from 200 to 400 kHz
- High resolution
- Dual swath option, allowing sufficient sound density alongtrack at reasonable survey speed
- FM chirp allowing much longer range capability (depth and coverage) compared to CW pulses
- Complete roll, pitch and yaw stabilization
- Nearfield focusing on both transmit and receive
- Short pulse lengths, large bandwidth. Shortest pulse is 14 µs
- IHO-S44 special order compliant
- Seabed image
- Displaying and logging of water column data is an option
- Swath coverage:
  - Single system: 140 degrees
  - Dual RX: 200 degrees
- Beam width:
  - EM 2040-04 : 0.4x0.7 degrees at 400 kHz
  - EM 2040-07: 0.7x0.7 degrees at 400 kHz
- Transducer depth rating: 6000 metres

System diagram, single system

The system diagram identifies the main components of a basic EM 2040 system. Only the main connections between the units are shown. Detailed interface capabilities and power cables are not shown.

A *Hydrographic Work Station*

B *Interfaces:*

- *Sound speed sensor*
- *Tide*
- *Centre depth output*

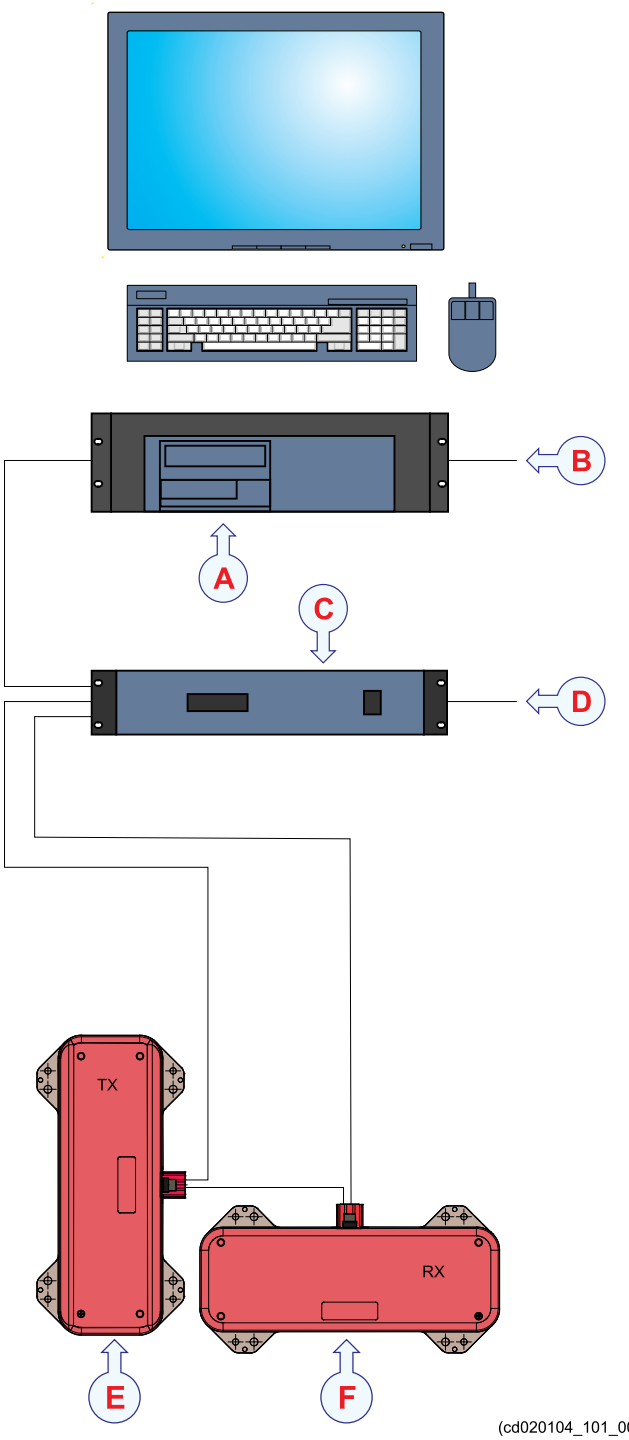
C *Processing Unit*

D *Interfaces:*

- *Positioning systems*
- *Attitude (roll, pitch and heave)*
- *Sound speed sensor*
- *Velocity*
- *Heading*
- *Clock*
- *Trigger input/output*
- *Clock synchronisation (1PPS)*

E *Transmit transducer (TX)*

F *Receive transducer (RX)*



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System diagram, dual RX

The system diagram identifies the main components of a dual RX EM 2040 system. Only the main connections between the units are shown. Detailed interface capabilities and power cables are not shown.

A *Hydrographic Work Station*

B *Interfaces:*

- *Sound speed sensor*
- *Tide*
- *Centre depth output*

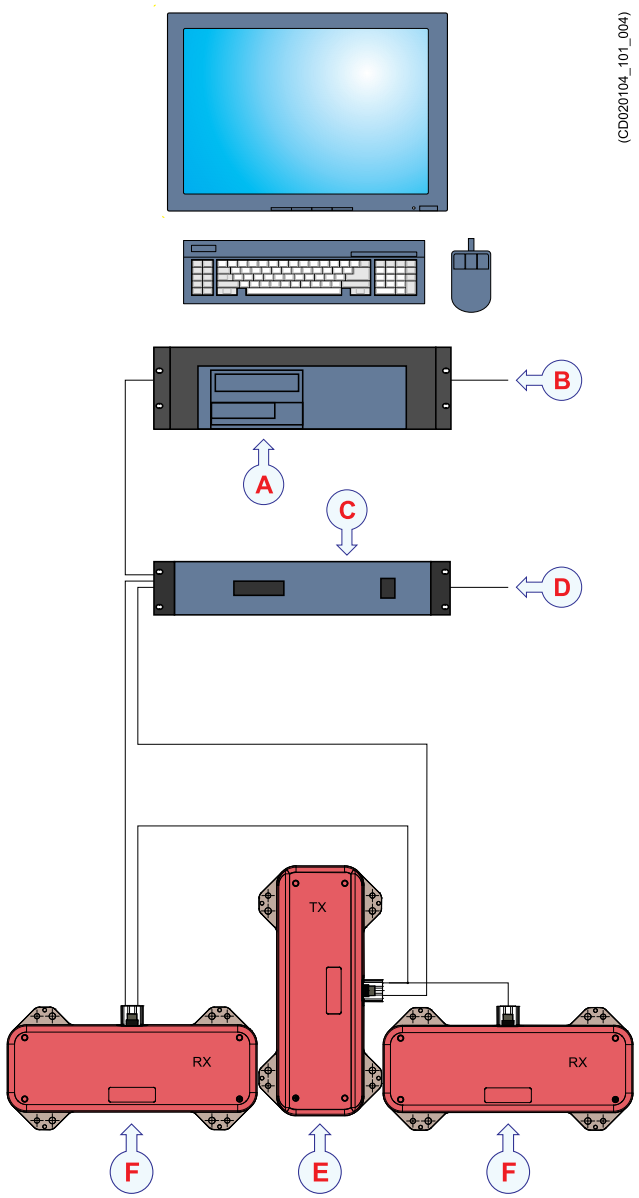
C *Processing Unit*

D *Interfaces:*

- *Positioning systems*
- *Attitude (roll, pitch and heave)*
- *Sound speed sensor*
- *Velocity*
- *Heading*
- *Clock*
- *Trigger input/output*
- *Clock synchronisation (1PPS)*

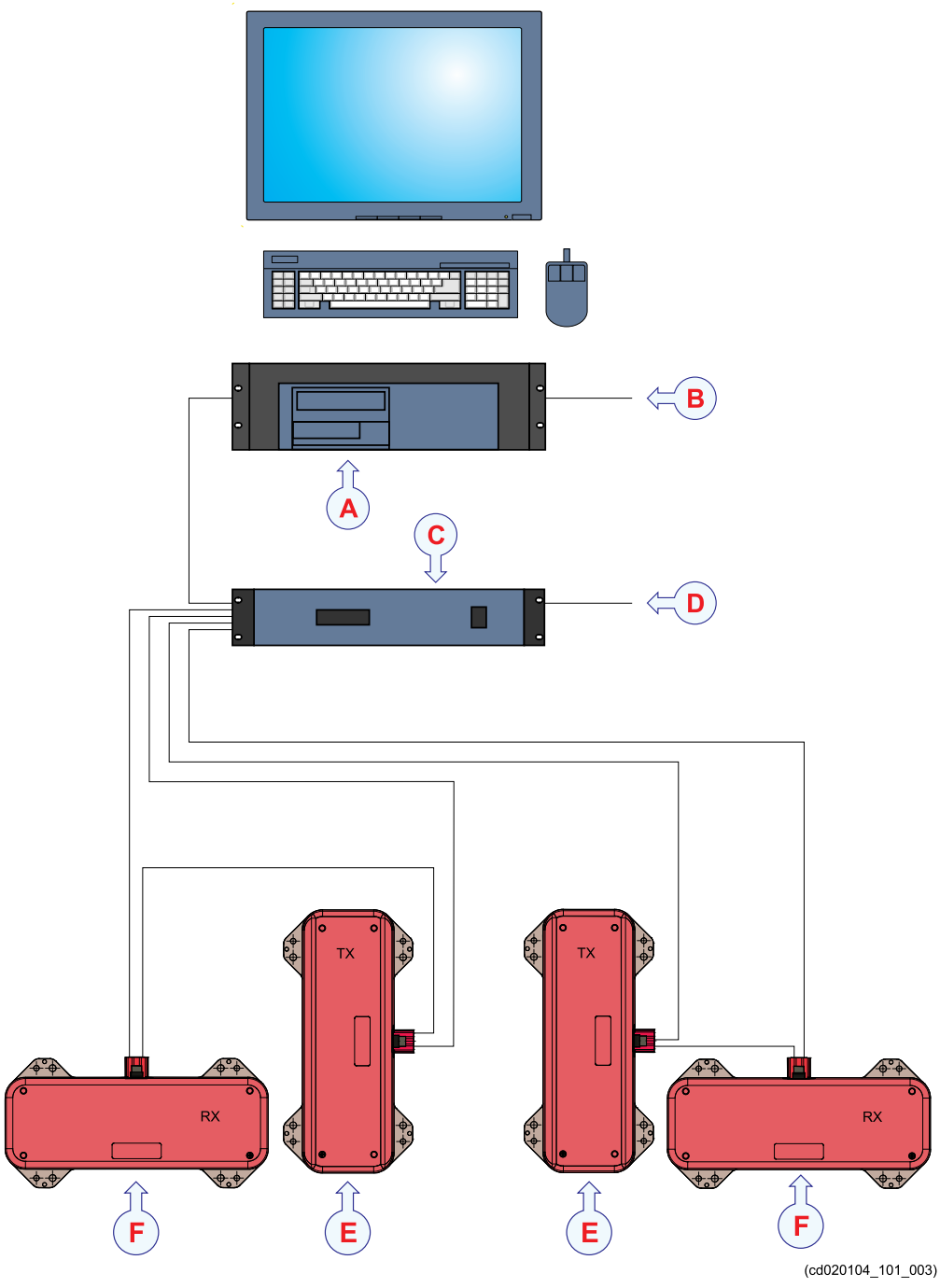
E *Transmit transducer (TX)*

F *Receive transducer (RX)*



System diagram, dual TX

The system diagram identifies the main components of a dual TX EM 2040 system. Only the main connections between the units are shown. Detailed interface capabilities and power cables are not shown.



A *Hydrographic Work Station*

B *Interfaces:*

- *Sound speed sensor*
- *Tide*
- *Centre depth output*

C *Processing Unit*

D *Interfaces:*

- *Positioning systems*
- *Attitude (roll, pitch and heave)*
- *Sound speed sensor*
- *Velocity*
- *Heading*
- *Clock*
- *Trigger input/output*
- *Clock synchronisation (1PPS)*

E *Transmit transducer (TX)*

F *Receive transducer (RX)*

Main system units

Topics

Transducer description

A transducer is a device that converts one form of energy to another. In an echo sounder system the transducer converts between electric energy and sound. The EM 2040 uses separate transducer arrays for transmitting and receiving sound pulses.

The EM 2040 system may be delivered in different versions with different transmission beam width.

- EM 2040-04 (0.4 degrees at 400 kHz)
- EM 2040-07 (0.7 degrees at 400 kHz)

The EM 2040 has separate transducers for transmit and receive, mounted in a Mills cross configuration. The transmit transducer consists of three separate line arrays, one looking straight down and the two others pointing 55 degrees to each side. The transducer contains all analog electronics and digital control units with Ethernet interface to the Processing Unit. The transmitter is electronically steerable alongtrack while the receiver is steerable athwartship.

The transducers are made from composite ceramics which enables a wide bandwidth. The material in the transducer housing is Titanium.

Processing Unit description

The Processing Unit is the central controlling device in the EM multibeam system. It is provided to process the signals to and from the transducer(s).

It is an industrial computer which is designed and tested for rugged use.

The Processing Unit also supplies 48 Vdc power to the transducer(s).

One or two Processing Units may be required, depending on the system configuration.

Portable Processing Unit description

The EM 2040 Processing Unit is available in a portable splash proof IP67 rated version.

The portable version has the same functionality as the standard EM Processing Unit in a splash proof enclosure, with the following exceptions:

- No external trigger available
- No Remote on/off available
- Not possible to interconnect two PU's to manage dual head and dual swath systems. Systems will either have to be dual head or dual swath.

Hydrographic Work Station description

The Hydrographic Work Station is the operator station of the EM 2040.

A dedicated maritime computer is provided with the EM 2040 Processing Unit. It is set up with all necessary software.

The Hydrographic Work Station is based on the Microsoft® Windows operating system.

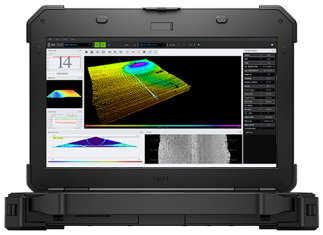
The Hydrographic Work Station is normally mounted near the operator work space.

Portable Hydrographic Work Station description

The Hydrographic Work Station is the operator station of the EM 2040.

A dedicated maritime computer is provided with the EM 2040 Processing Unit. It is set up with all necessary software.

The Hydrographic Work Station is available in a semi rugged or fully rugged version for portable use.



Ethernet switch description

A high capacity Ethernet switch may be required.

If you use more than one Processing Unit, a high capacity Ethernet switch is required. The Ethernet switch is used to connect each Processing Unit to the Hydrographic Work Station. A high capacity Ethernet switch is included in the EM 2040 delivery.

Note

It is very important that a high-quality Ethernet cable is used. You must use CAT-5E quality or better. If you use cables with lower bandwidth capacity you will reduce the EM 2040 performance.

1000BASE-T (also known as IEEE 802.3ab) is a standard for gigabit Ethernet over copper wiring. Each 1000BASE-T network segment can be a maximum length of 100 meters (330 feet), and must use Category 5 cable or better (including Cat 5e and Cat 6).

https://en.wikipedia.org/wiki/Gigabit_Ethernet (January 2016)

Remote Control Unit (K-Rem) description

A dedicated junction box has been designed to provide remote on/off switches with light indication and interface to a remote synchronizing system. The junction box contains a terminal block and four switches with lamps mounted in the front.

Note

The Remote Control Unit is not a standard part of the EM 2040 delivery.

The Remote Control Unit is called K-Rem. It is prepared for remote control and interface to an external synchronization system for four KONGSBERG echo sounders.

- One Sub-bottom profiler (SBP 27 or SBP 29)
- Two EM multibeam echo sounders
- One EA single beam echo sounder

The Remote Control Unit is designed to be mounted in a 19 inch rack, but it is also possible to mount it on a flat surface or in a bulkhead. It is also prepared for mounting on telescopic rails.

Cable layout and interconnections

Topics

Read this first

Detailed information about cable specifications, termination and connectors is provided. Unless otherwise specified, all cables are supplied by Kongsberg Maritime as a part of the EM 2040 delivery.

Detailed drawings are provided for relevant cables. Each drawing provides additional information, and may, when applicable, include minimum specifications, connector terminations and the required number of cores. Drawings are generally not provided for standard commercial cables. Cables fall into three categories.

1 **System cables**: These cables are provided by Kongsberg Maritime as a part of the EM 2040 delivery.

2 **Shipyard cables**: These cables must be provided by the shipyard performing the installation, or the shipowner. It is very important that the cables used meet the minimum specifications provided in this manual.

3 **Commercial cables**: These cables may be provided by Kongsberg Maritime as a part of the EM 2040 delivery. They may also be included with third party items that are used with the EM 2040.

All electronic installations and corresponding wiring must be in accordance with the vessel's national registry and corresponding maritime authority and/or classification society.

Note

It is very important that all cables are properly installed and correctly terminated. Observe the relevant regulations and work standards. Always leave enough cable slack close to system units and cabinets to allow for maintenance.

Only skilled and authorized personnel can install the EM 2040 cables.

Kongsberg Maritime accepts no responsibility for damage to the system, or reduced operational performance, when this is caused by improper wiring.

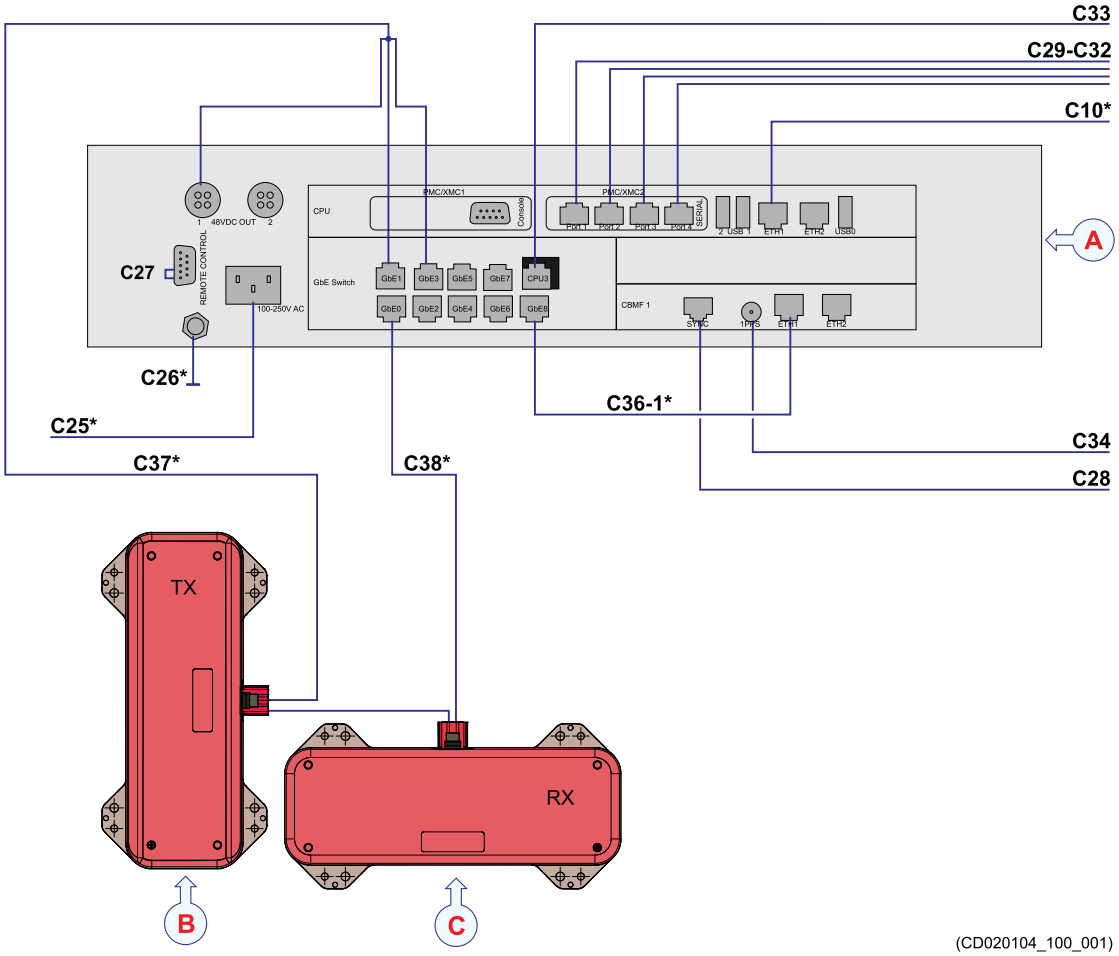
Before you install or maintain the EM 2040 cables, make sure that the AC mains circuit breaker for the system is switched off.

Cable plans

Topics

Processing Unit, single system, cable plan

The Processing Unit cables include those used to connect the EM 2040 Processing Unit to AC mains power, and to the transducer. One Ethernet cable is used to connect the Processing Unit to the Hydrographic Work Station.



A *Processing Unit (PU)*

B *Transmit Transducer (TX)*

C *Receive Transducer (RX)*

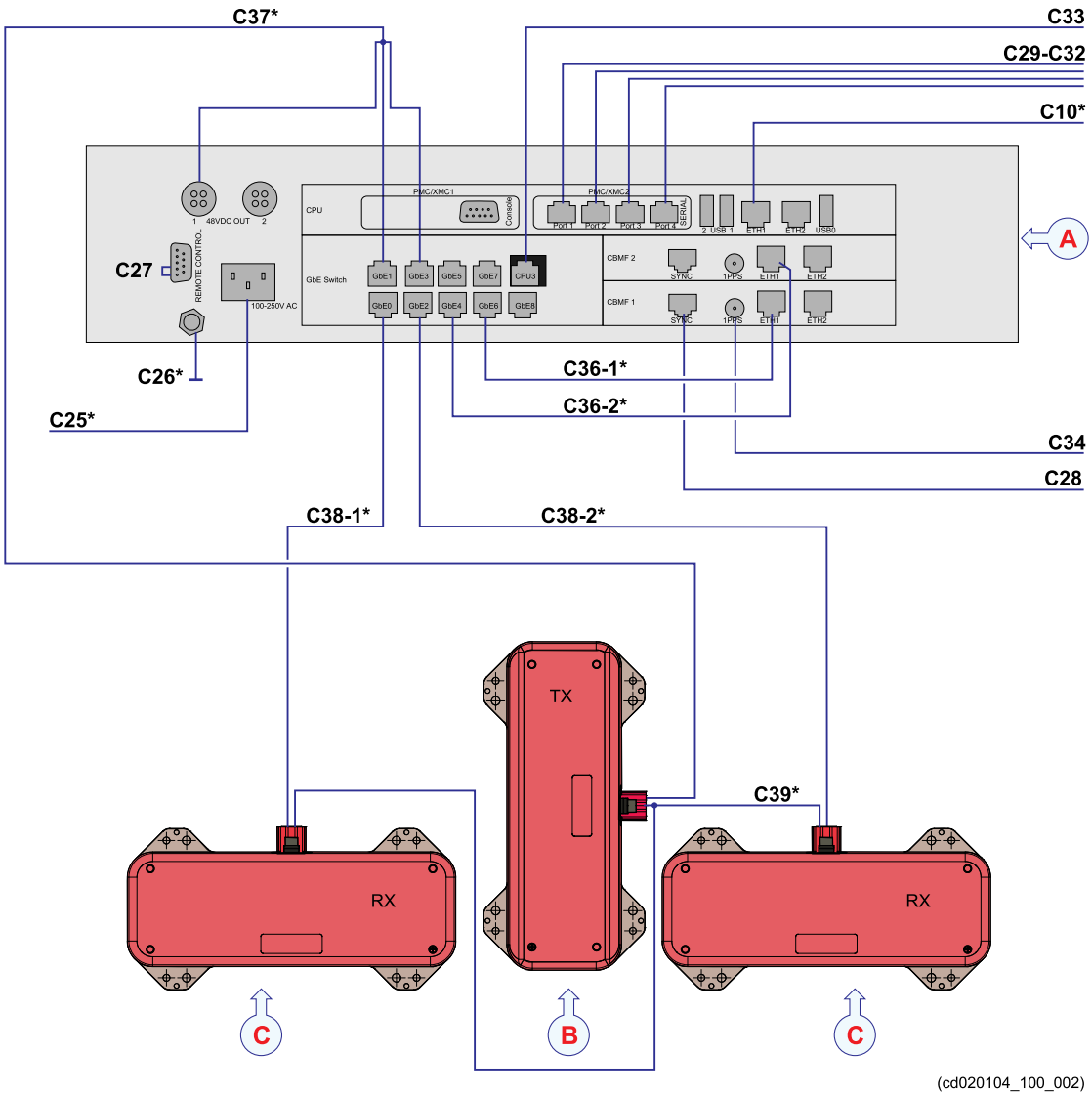
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 delivery.

Related topics

List of EM 2040 cables, page 27

Processing Unit, dual RX - single swath, cable plan

The Processing Unit cables include those used to connect the EM 2040 Processing Unit to AC mains power, and to the transducer. One Ethernet cable is used to connect the Processing Unit to the Hydrographic Work Station.



A *Processing Unit (PU)*

B *Transmit Transducer (TX)*

C *Receive Transducer (RX)*

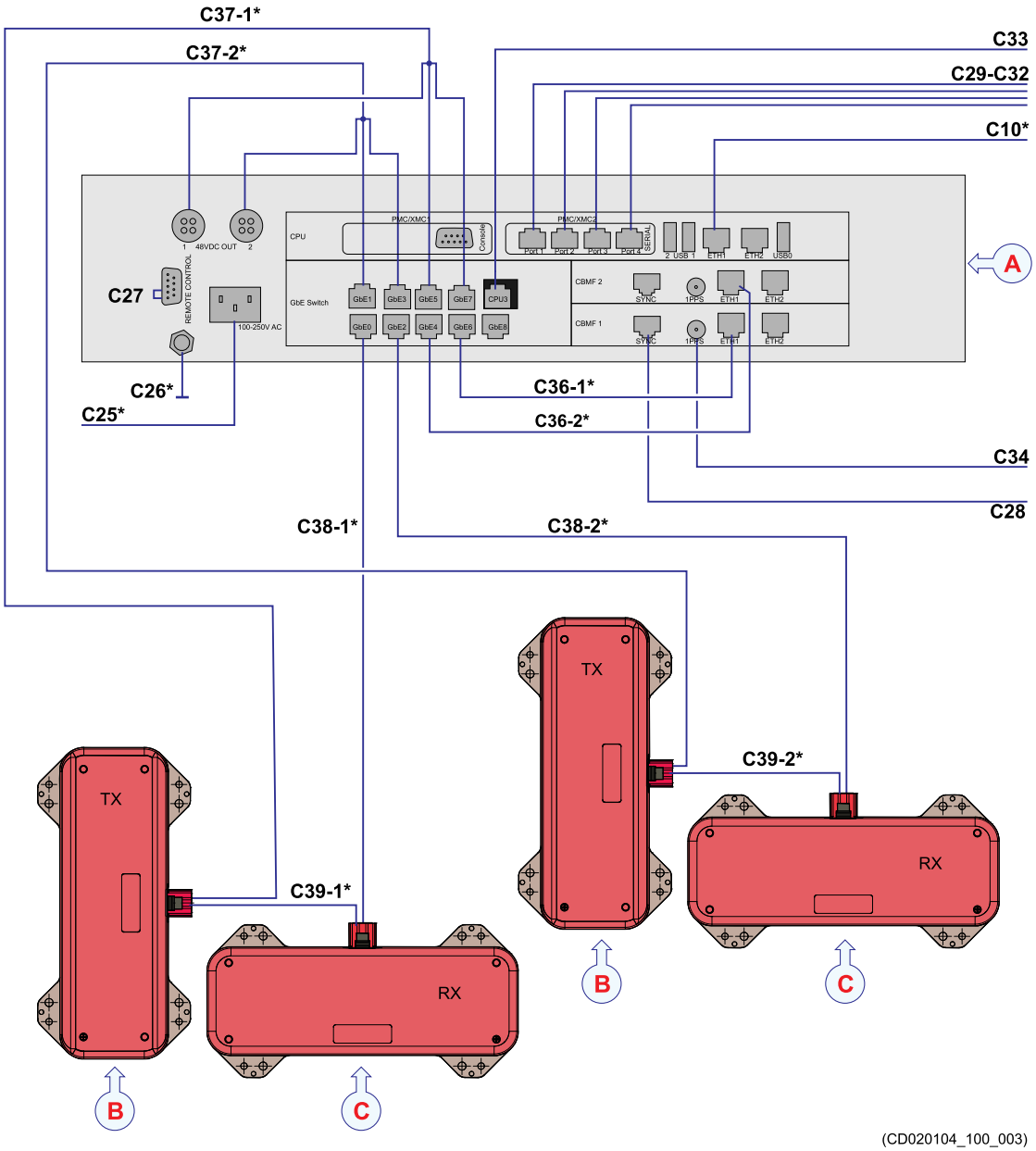
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 delivery.

Related topics

List of EM 2040 cables, page 27

Processing Unit, dual TX- single swath, cable plan

The Processing Unit cables include those used to connect the EM 2040 Processing Unit to AC mains power, and to the transducer. One Ethernet cable is used to connect the Processing Unit to the Hydrographic Work Station.



A *Processing Unit (PU)*

B *Transmit Transducer (TX)*

C *Receive Transducer (RX)*

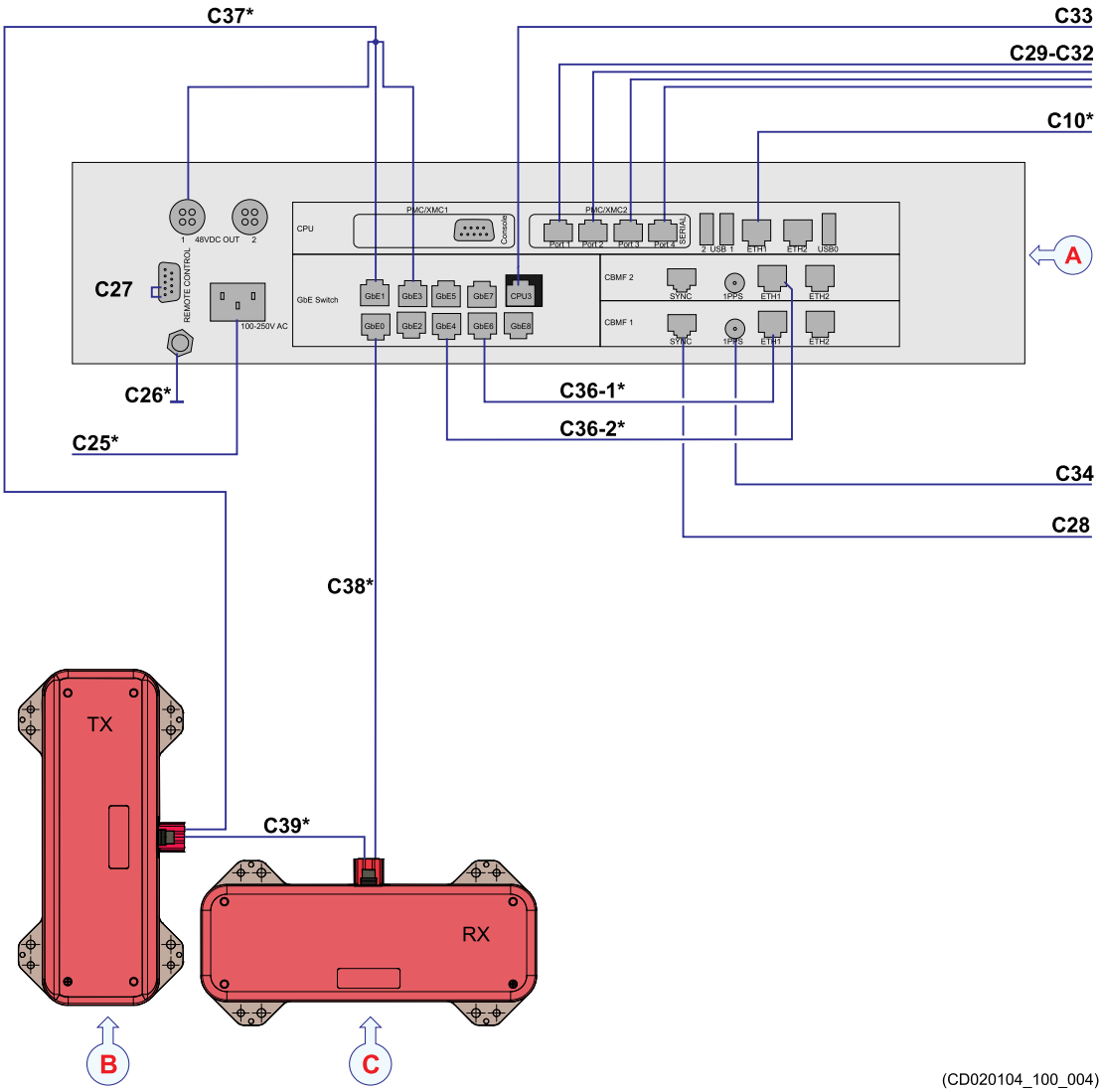
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 delivery.

Related topics

List of EM 2040 cables, page 27

Processing Unit, dual swath, cable plan

The Processing Unit cables include those used to connect the EM 2040 Processing Unit to AC mains power, and to the transducer. One Ethernet cable is used to connect the Processing Unit to the Hydrographic Work Station.



A *Processing Unit (PU)*

B *Transmit Transducer (TX)*

C *Receive Transducer (RX)*

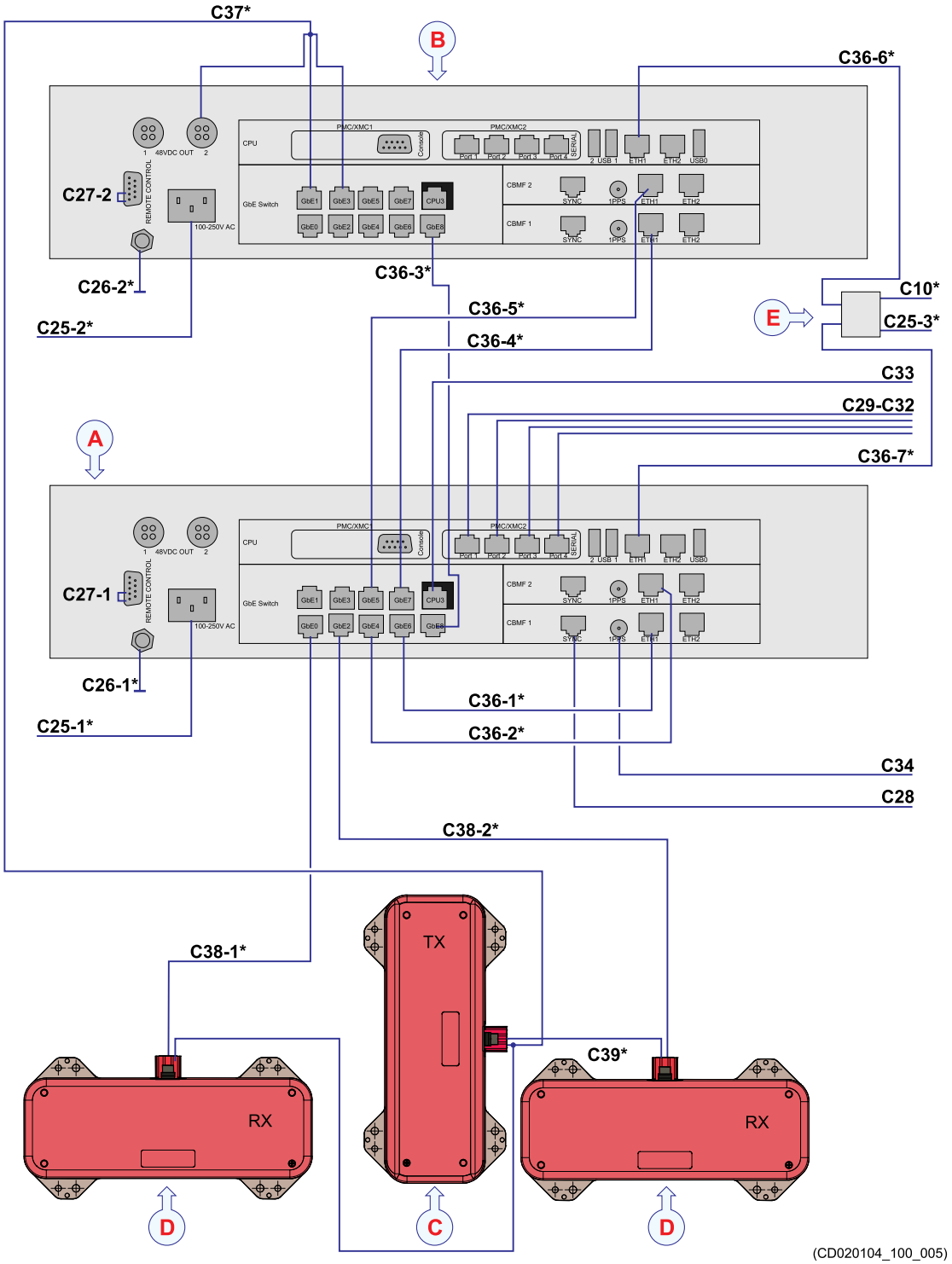
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 delivery.

Related topics

List of EM 2040 cables, page 27

Processing Unit, dual RX - dual swath, cable plan

The Processing Unit cables include those used to connect the EM 2040 Processing Units to AC mains power, and to the transducer. Ethernet cables are used to connect the Processing Units to the Hydrographic Work Station.



A *Processing Unit (PU), master*

B *Processing Unit (PU), slave*

C *Transmit Transducer (TX)*

D *Receive Transducer (RX)*

E *Ethernet switch*

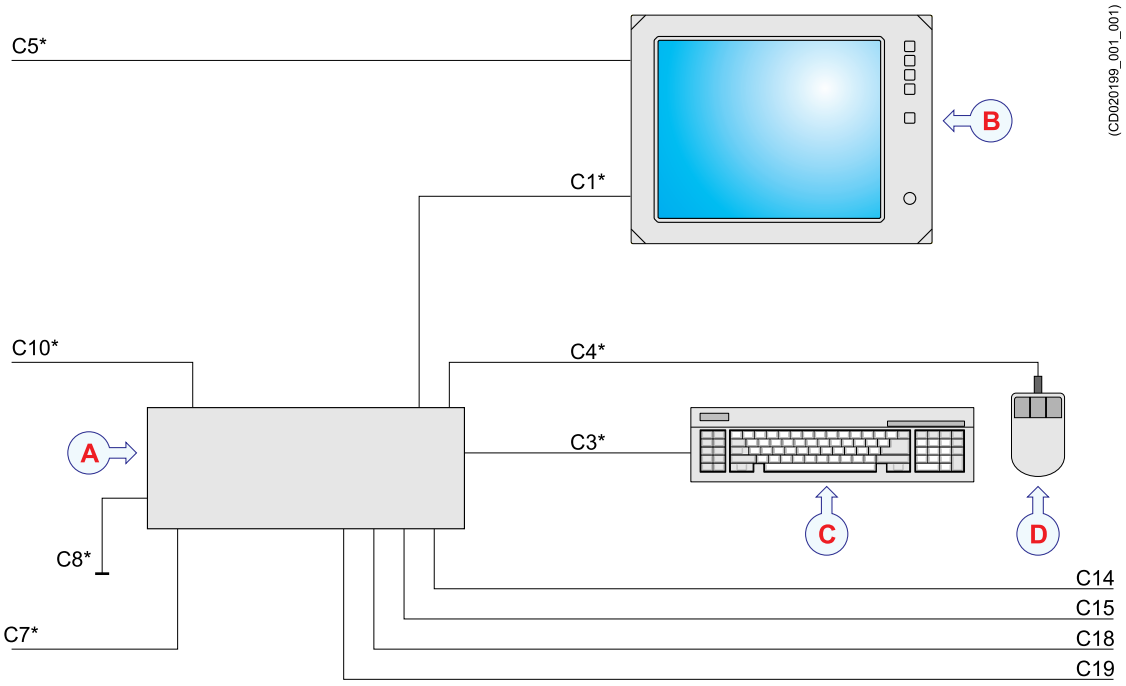
Cables identified with an asterisk (*) are system cables. These cables are supplied with the EM 2040 delivery.

Related topics

List of EM 2040 cables, page 27

Cable plan, Hydrographic Work Station

The topside/bridge cables include those used to connect the EM 2040 Hydrographic Work Station and the display to each other, to AC mains power, and to external devices.



A *Hydrographic Work Station*

B *Display*

The Hydrographic Work Station supports up to three displays.

C *Computer keyboard*

D *Computer mouse or trackball*

Cables identified with an asterisk (*) are system or commercial cables. These cables are supplied with the EM 2040 delivery.

Related topics

List of EM 2040 cables, page 27

List of EM 2040 cables

A set of cables is required to connect the EM 2040 units to each other, and to the relevant power source(s).

Cable	Signal	From/To	Minimum requirements
C1	Video cable	From Hydrographic Work Station to display	
	This is a commercial cable. The display cable is often physically attached to the display, and terminated in the “computer end” with a male connector. If the cable is not attached, it is normally provided with the display.		
C3	Computer cable	From Hydrographic Work Station to keyboard	
C4	Computer cable	From Hydrographic Work Station to mouse (or another similar device).	
C5	AC power cable	From display to uninterruptible power supply (UPS)	2 x 1.5 mm^2 + 1.5 mm^2 Ground
C7	AC power cable	From Hydrographic Work Station to uninterruptible power supply (UPS)	2 x 1.5 mm^2 + 1.5 mm^2 Ground
C8	Ground cable	From Hydrographic Work Station to vessel ground	1 x 6 mm^2
C10	Ethernet cable	From Processing Unit to Hydrographic Work Station	CAT5-E STP (Shielded Twisted Pair)
	A 4.5 meter long Ethernet cable is provided with the Processing Unit. If a longer cable is required, this must be provided by the installation shipyard.		
C14	Serial cable	From Hydrographic Work Station to external device(s)	
C15	Serial cable	From Hydrographic Work Station to external device(s)	
C18	Ethernet cable	From Hydrographic Work Station to local area network (LAN)	CAT5-E STP (Shielded Twisted Pair)
C19	Ethernet cable	From Hydrographic Work Station to local area network (LAN)	CAT5-E STP (Shielded Twisted Pair)
C25	AC power cable	From Processing Unit to uninterruptible power supply (UPS)	2 x 1.5 mm^2 + 1.5 mm^2 Ground
C26	Ground cable	From Processing Unit to vessel ground	1 x 6 mm^2
C27	Control cable	From Processing Unit to remote control unit	3 x 0.5 mm^2
	The Processing Unit can be switched on/off with a remote switch. This switch is connected to a 9–pin D-connector on the Processing Unit.		

Cable	Signal	From/To	Minimum requirements
C28	Control cable	From Processing Unit to external synchronisation	2 x 5 x 0.5 mm²
	The Processing Unit is equipped with a connection for interface to an external synchronisation system.		
C29-C32	Serial cable	From Processing Unit to external devices	
C33	Ethernet cable	From Processing Unit to global positioning system (GPS) (Attitude velocity)	CAT5-E STP (Shielded Twisted Pair)
	The Processing Unit must be connected to the global positioning system (GPS) to receive the Attitude velocity datagram. The connection is made using an Ethernet cable. On the Processing Unit, this Ethernet cable is connected to the upper right socket (**A-CPU 3-L**) on the Ethernet switch.		
C34	Coax cable	From Processing Unit to the global positioning system (GPS) (1PPS (Pulse per second))	Coax cable
	The software clock can be synchronized to an external 1PPS (Pulse per second) signal. This signal is normally available from a global positioning system (GPS), and this is the preferred method to synchronise the echo sounder to an external clock.		
C36	Ethernet cable	Internal Ethernet connections on the Processing Unit	CAT5-E STP (Shielded Twisted Pair)
	Some of the circuit boards in the Processing Unit must be connected via Ethernet cables. The number of internal Ethernet connections depends on the chosen configuration. All the internal Ethernet connections are shown on the cable plans. The Ethernet cables for internal connections are delivered with the system.		
C37	Transducer cable	From Processing Unit to TX transducer	
C38	Transducer cable	From Processing Unit to RX transducer	
C39	Transducer cable	From TX transducer to RX transducer(s)	

Comments

Note

It is very important that high-quality Ethernet cables are used. You must use CAT-5E STP (Shielded Twisted Pair) quality or better. If you use cables with lower bandwidth capacity you will reduce the EM 2040 performance.

The EM 2040 is often a part of a project delivery. For such deliveries, specific project cable drawings are established to show all the main cables, and how the various products are connected. In such project cable drawings, the EM 2040 cables may be identified as **EM 2040/Cx**.

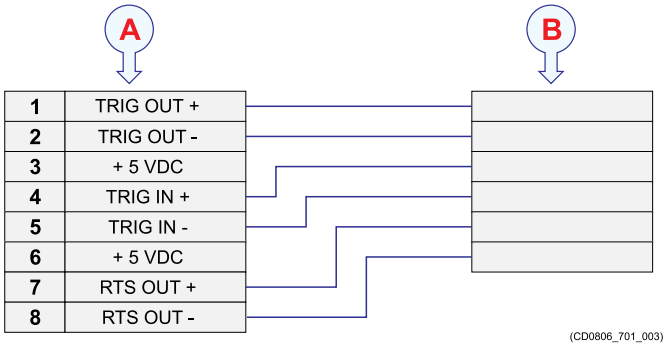
Installing the EM 2040 cables

Topics

External synchronisation

The Processing Unit (PU) is equipped with a connection for interface to an external synchronisation system.

This connection is used for interface to an external synchronisation system (for example K-Sync) used when multiple echo sounders are employed on the same vessel. The external synchronisation connector is located on the CBMF board of the processing unit. The connector is RJ45 type.



A *Local connection The connector is RJ45 type.*

Note

Pin 3 and 6 is used by Kongsberg Maritime only.

B *Connection on remote device*

Unless otherwise specified, this cable must be provided by the installation shipyard.

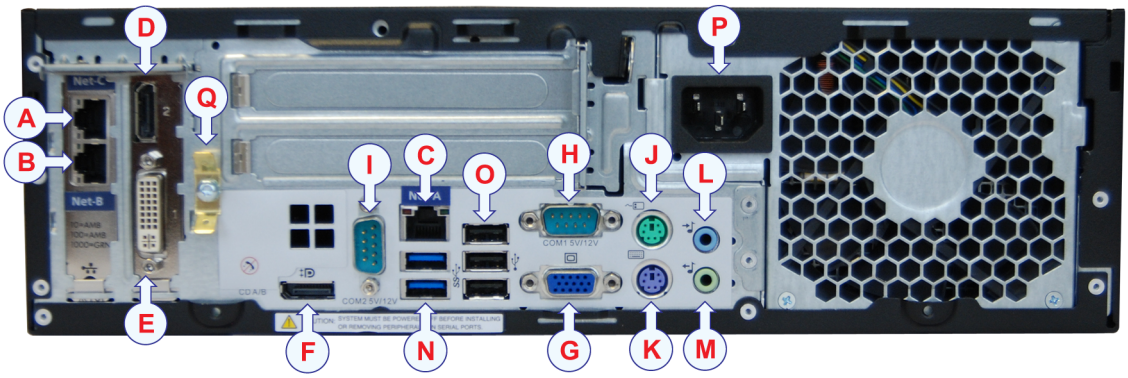
Minimum cable requirements

- **Conductors**: 2 x 3 x 0.2 mm²
- **Screen**: Overall braided
- **Voltage**: 30 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

We recommend using a shielded CAT-6A quality or better cable.

Hydrographic Work Station rear connectors

The rear panel on the Hydrographic Work Station holds connectors for the various EM 2040 cables.



The image shows the MP5810 Fishery SIS5 model. Part number: 438803

If another model is used, the connections can be different.

A *Ethernet cable: From Hydrographic Work Station to local area network (LAN) (C18)*

B *Ethernet cable: From Hydrographic Work Station to local area network (LAN) (C19)*

C *Ethernet cable: From Hydrographic Work Station to Processing Unit (C10)*

It is very important that high-quality Ethernet cables are used. You must use CAT-5E STP (Shielded Twisted Pair) quality or better. If you use cables with lower bandwidth capacity you will reduce the EM 2040 performance.

D *Display port*

Display cable: From Hydrographic Work Station to display (C1)

This is a commercial cable. The display cable is often physically attached to the display, and terminated in the "computer end" with a male connector. If the cable is not attached, it is normally provided with the display.

E *Video port: DVI*

F *Display port*

G *Video port: VGA*

H *Serial cables: From Hydrographic Work Station to external device(s) (C14)*

I *Serial cables: From Hydrographic Work Station to external device(s) (C15)*

J *Computer cable: From Hydrographic Work Station to mouse (or another similar device) (C4)*

The cable is often physically attached to the mouse, and terminated in the "computer end" with a male PS/2 or USB connector. Depending on the type of connector you must connect the mouse to the PS/2 connector or an USB connector on the computer.

K *Computer cable: From Hydrographic Work Station to keyboard (C3)*

The cable is often physically attached to the keyboard, and terminated in the "computer end" with a male PS/2 or USB connector. Depending on the type of connector you must connect the keyboard to the PS/2 connector or an USB connector on the computer.

L *Audio cable: Not used*

M *Audio cable: Not used*

N *USB (Universal Serial Bus) sockets: USB 3.0 From Hydrographic Work Station to external device(s)*

O *USB (Universal Serial Bus) sockets: USB 2.0 From Hydrographic Work Station to external device(s)*

P *AC power cable: From Hydrographic Work Station to uninterruptible power supply (UPS) (C7)*

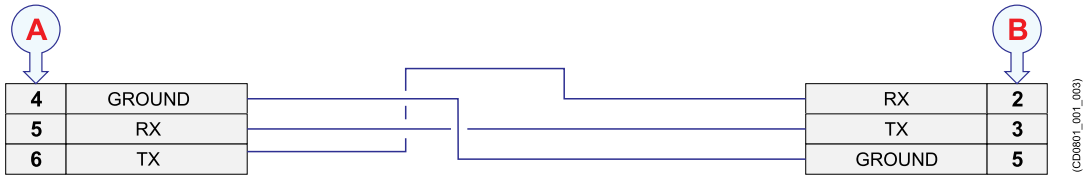
Q *Ground cable: From Hydrographic Work Station to vessel ground (C8)*

Cable drawings and specifications

Topics

RS-232 serial line using three wires and RJ45 connector

An RS-232 serial line connection using three (3) wires is a common way to connect the EM 2040 to external devices.



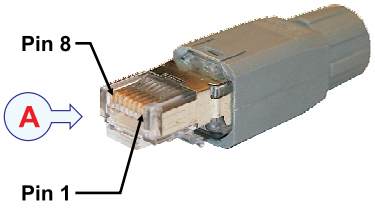
A *Local connection*

RJ45 connector

B *Connection on remote device*

C *Female 9-pin D-Subminiature connector*

D *Male 9-pin D-Subminiature connector*



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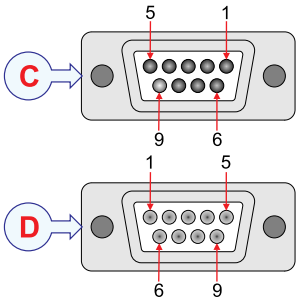
Unless otherwise specified, this cable must be provided by the installation shipyard. Note that this cable does not support all the signals in the standard RS-232 specification.



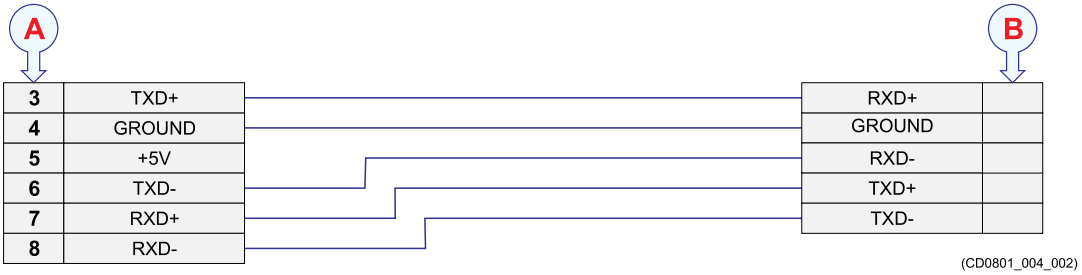
Minimum cable requirements

- **Conductors**: 2 x 2 x 0.2 mm²
- **Screen**: Overall braided
- **Voltage**: 30 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

We recommend using a shielded CAT-6A quality or better cable.

RS-422 serial line using five wires and RJ45 connector

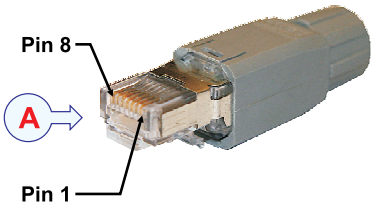
An RS-422 serial line connection is a common way to connect the EM 2040 to external devices. An RS-422 serial line connection can transmit data at rates as high as 10 million bits per second, and may be sent on cables as long as 1500 meters.



A *Local connection*

RJ45 connector

B *Connection on remote device*



Unless otherwise specified, this cable must be provided by the installation shipyard.

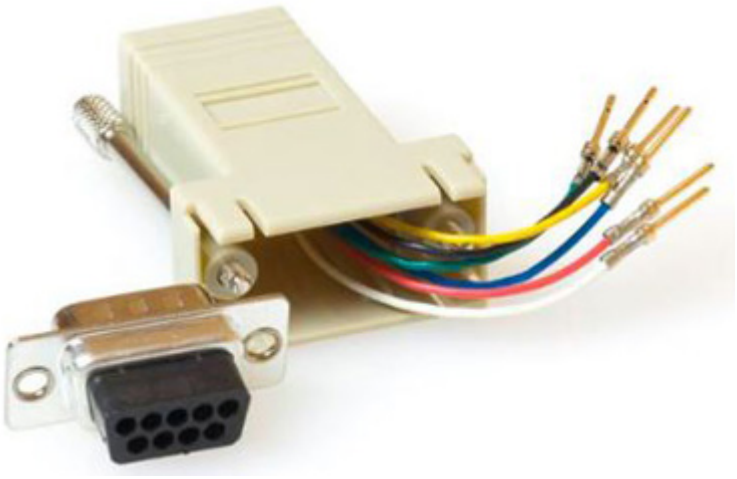
Minimum cable requirements

- **Conductors**: 2 x 3 x 0.2 mm²
- **Screen**: Overall braided
- **Voltage**: 30 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

We recommend using a shielded CAT-6A quality or better cable.

Adapter for D-connector to RJ45 connector for RS-422

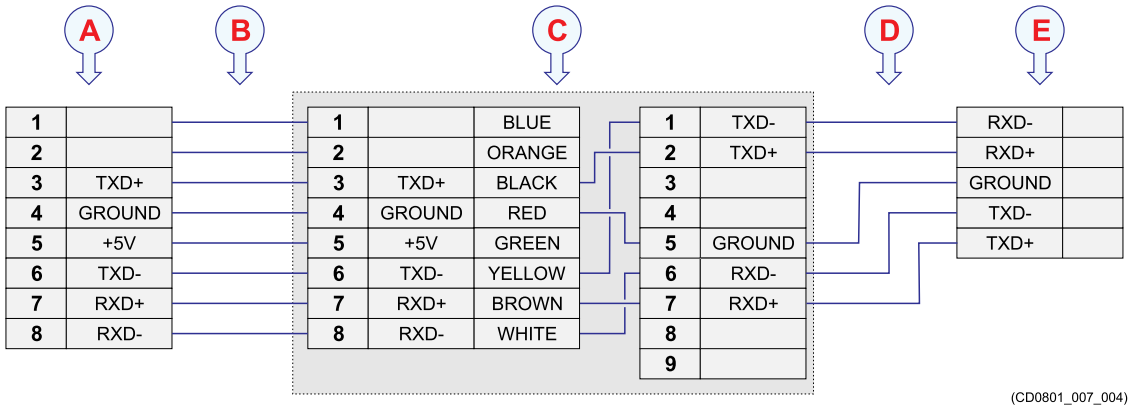
You can use an adapter if you need to connect a serial cable with a D-connector to the Processing Unit.



The Processing Unit has four serial ports with RJ45 connectors. The ports can be configured to be RS-232 or RS-422.

You can use an adapter if you need to connect a serial cable with a D-connector to the Processing Unit. Two adapters and two standard Cat6 patch cables are provided with a standard delivery.

The adapter has RJ45 female connector at one end and 9-pin male D-connector at the other end. The wiring at the RJ45 side is fixed, and the wire ends have crimp contacts to be placed in the desired position of the D-connector without any tools.



A Local connection (Processing Unit)

RJ45 connector

B Standard patch cable

C Adapter Part number 357235

Wired for RS-422

D Standard RS-422 cable

E Connection on remote device

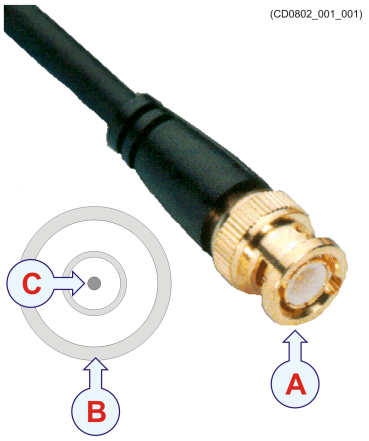
Clock synchronisation (1PPS) using a coax cable

The Processing Unit is equipped with a 1PPS signal input for clock synchronisation.

A *Male BNC connector*

B *Ground*

C *1PPS signal*



This cable must be provided by the installation shipyard.

The 1PPS (one pulse per second) signal is normally provided by a positioning system.

Remote control

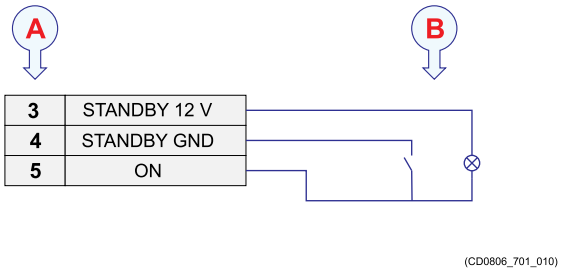
The Processing Unit can be switched on/off with a remote switch. This switch is connected to a 9–pin D-connector on the Processing Unit.

A *Local connection, male 9–pin D-connector*

B *Connection to remote lamp and on/off switch*

C *Female 9–pin D-connector*

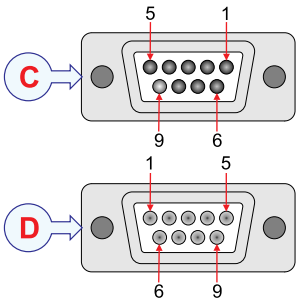
D *Male 9–pin D-connector*



Minimum cable requirements

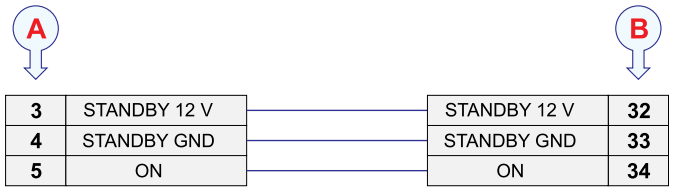
- **Conductors**: 3 x 0.5 mm²
- **Screen**: Overall braided
- **Voltage**: 60 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

This cable must be provided by the installation shipyard.



Remote Control using K-Rem

The Processing Unit can be switched on/off with a remote switch. This switch is connected to a 9–pin D-connector on the Processing Unit. A dedicated junction box with on/off switches and light indication has been designed for this purpose (K-Rem).

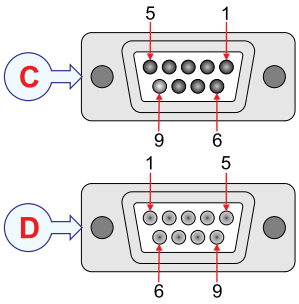


A *Local connection, male 9–pin D-connector*

B *Connection at the terminal strip in Remote Control Unit (K-Rem)*

C *Female 9–pin D-connector*

D *Male 9–pin D-connector*



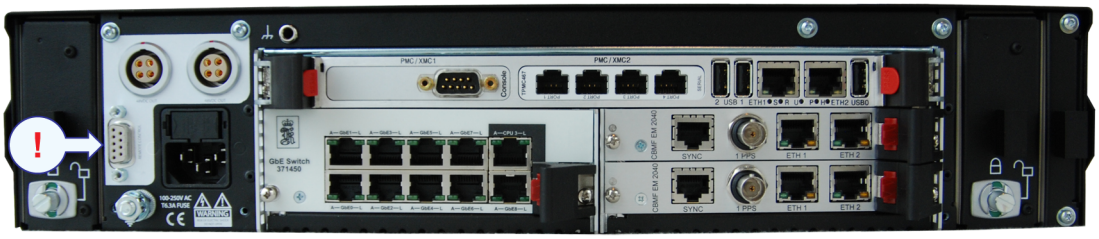
Minimum cable requirements

- **Conductors**: 3 x 0.5 mm²
- **Screen**: Overall braided
- **Voltage**: 60 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

This cable must be provided by the installation shipyard.

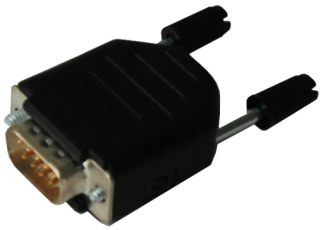
Dummy plug for not using remote control

The Processing Unit can be switched on/off with a remote switch. If remote control is not used, the enclosed remote control dummy plug has to be inserted in the **Remote Control** connector in the Processing Unit.



Note

*If remote control is not used, the enclosed remote control dummy plug has to be inserted in the **Remote Control** connector in the Processing Unit. The Processing Unit will not work without this dummy plug.*



K-Sync interface to EM 2040 Processing Unit

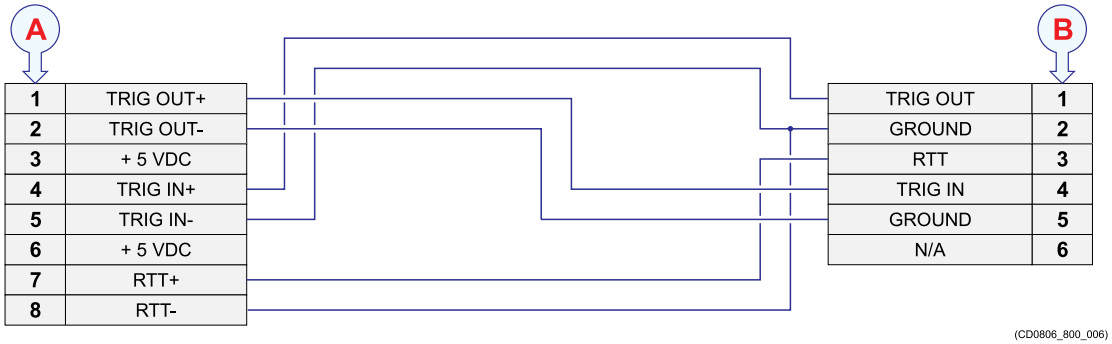
The Processing Unit (PU) is equipped with a connection for interface to an external synchronisation system.

This connection is used for interface to an external synchronisation system (for example K-Sync) used when multiple echo sounders are employed on the same vessel. The external synchronisation connector is located on the CBMF board of the processing unit.

This is an optically isolated connection that requires ~10mA current. Input power and resistor value must be adjusted accordingly.

The connector is RJ45 type.

This cable must be provided by the installation shipyard.



A *Connections on the EM 2040 Processing Unit. RJ45 connector*

Note

Pin 3 and 6 is used by Kongsberg Maritime only.

B *Connections on the K-Sync IO Module*

The pin configuration on the K-Sync IO Module follows:

Pin no.	Signal	Description
1	TRIG OUT	Trigger out – Signal to external device enabling it to transmit
2	GROUND	Mandatory – connected to pin 5 inside the module
3	RTT	Ready to transmit – Input from external device when it is ready for the next trigger pulse
4	TRIG IN	Trigger in – Input from external device, active while the device is transmitting
5	GROUND	Mandatory – connected to pin 2 inside the module
6	Not used	

Each IO Module in the K-Sync Synchronizing Unit provides six connectors and a configuration board for physical adjustments of the communication parameters.

Connectors 1 through 6 as indicated by the arrows.

Note that each of the two connector elements can be pulled out of the IO Module for easy access.

Configuration board

Unless otherwise specified, this cable must be provided by the installation shipyard.

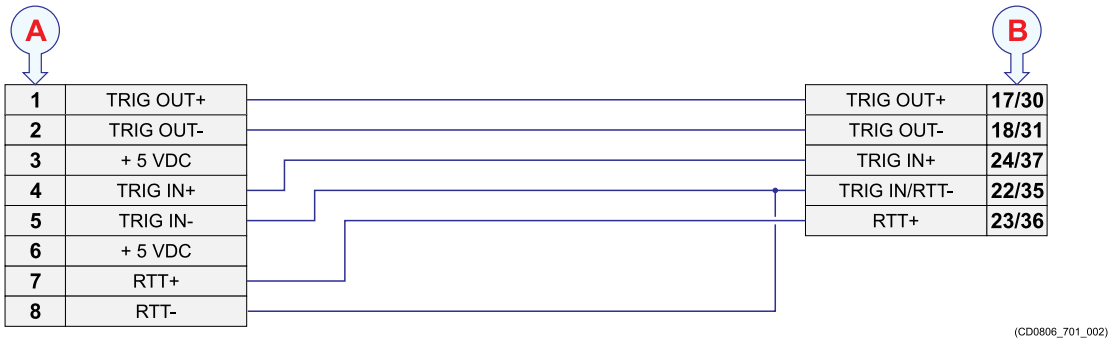
Minimum cable requirements

- **Conductors**: 2 x 5 x 0.5 mm^2
- **Screen**: Overall braided
- **Voltage**: 60 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

Interface to Remote Control Unit for external synchronisation

A dedicated junction box has been designed to provide remote on/off switches with light indication and interface to a remote synchronizing system. The junction box contains a terminal block and four switches with lamps mounted in the front.

The Remote Control Unit is called K-Rem. It is prepared for remote control and interface to an external synchronization system for four KONGSBERG echo sounders.



A *Connections on the EM 2040 Processing Unit. The connector is RJ45 type.*

Note

Pin 3 and 6 is used by Kongsberg Maritime only.

B *Connections in the Remote Control Unit (K-Rem)*

Unless otherwise specified, this cable must be provided by the installation shipyard.

The Remote Control Unit is not a standard part of the EM 2040 delivery.

Minimum cable requirements

- **Conductors**: 2 x 5 x 0.5 mm^2
- **Screen**: Overall braided
- **Voltage**: 60 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

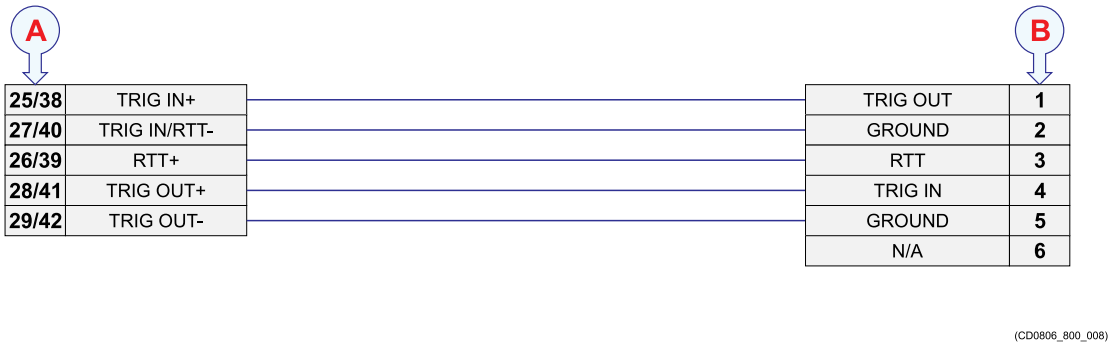
Related topics

Remote Control Unit (K-Rem) description, page 14
External synchronisation, page 29
373962 Remote Control Unit (K-REM) wiring diagram, page 60

K-Sync interface to Remote Control Unit

A dedicated junction box has been designed to provide remote on/off switches with light indication and interface to a remote synchronizing system. The junction box contains a terminal block and four switches with lamps mounted in the front.

The Remote Control Unit is called K-Rem. It is prepared for remote control and interface to an external synchronization system for four KONGSBERG echo sounders.



A *Connections in the Remote Control Unit (K-Rem)*

B *Connections on the K-Sync IO Module*

The pin configuration on the K-Sync IO Module follows:

Pin no.	Signal	Description
1	TRIG OUT	Trigger out – Signal to external device enabling it to transmit
2	GROUND	Mandatory – connected to pin 5 inside the module
3	RTT	Ready to transmit – Input from external device when it is ready for the next trigger pulse
4	TRIG IN	Trigger in – Input from external device, active while the device is transmitting
5	GROUND	Mandatory – connected to pin 2 inside the module
6	Not used	

Each IO Module in the K-Sync Synchronizing Unit provides six connectors and a configuration board for physical adjustments of the communication parameters.

Connectors 1 through 6 as indicated by the arrows.

Note that each of the two connector elements can be pulled out of the IO Module for easy access.

Configuration board

Unless otherwise specified, this cable must be provided by the installation shipyard.

The Remote Control Unit is not a standard part of the EM 2040 delivery.

Minimum cable requirements

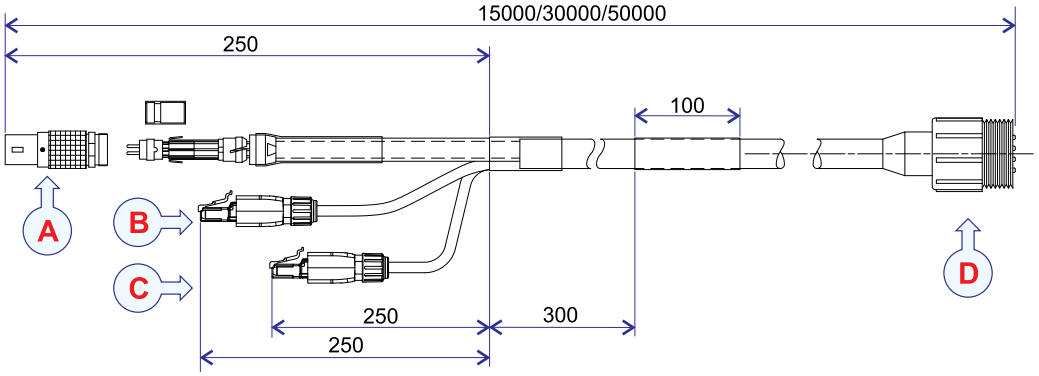
- **Conductors**: 2 x 5 x 0.5 mm^2
- **Screen**: Overall braided
- **Voltage**: 60 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

Related topics

Remote Control Unit (K-Rem) description, page 14
External synchronisation, page 29
373962 Remote Control Unit (K-REM) wiring diagram, page 60

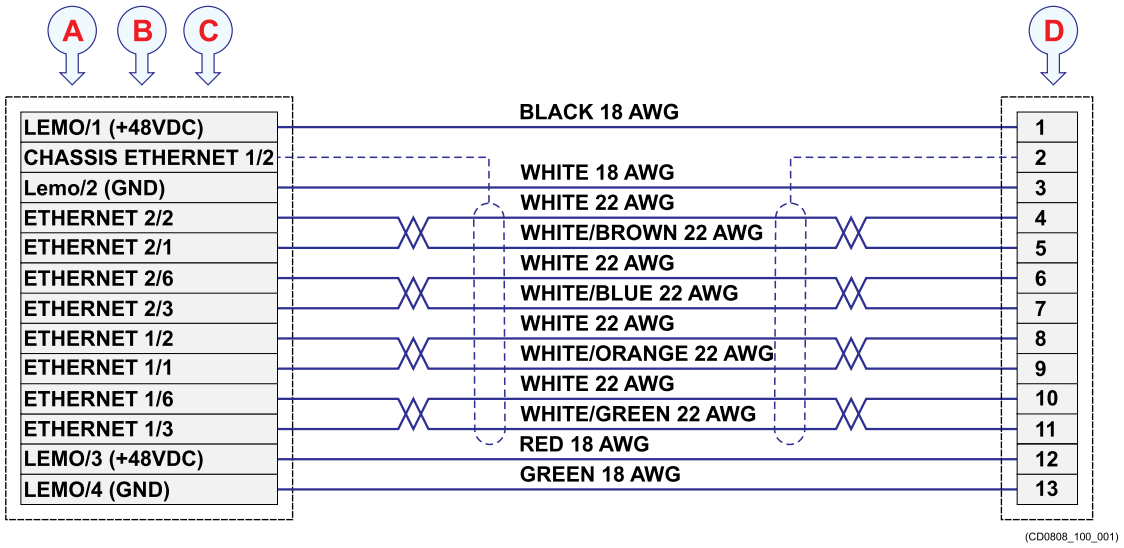
Transmit transducer cable

The TX transducer must be connected to the Processing Unit.



All measurements in mm.
The drawing is not in scale.

(CD0808_100_002)



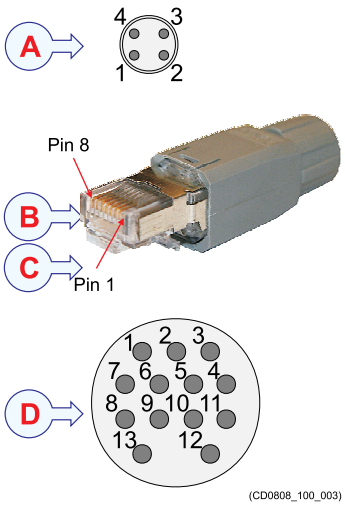
(CD0808_100_001)

A *LEMO Connector for power in Processing Unit end. Solder side view.*

B *RJ45 connector for signal in Processing Unit end.*

C *RJ45 connector for signal in Processing Unit end.*

D *Underwater connector type DIL13M in transducer end. Face view.*



Cable specifications

- SubConn® Power/Ethernet Cable, Type D/P-P4TP24#/4C18#
- 13 pin with 4 Ethernet TPs, 4 power conductors and 1 screen
- Cable length: 15, 30 and 50 meters
- Cable diameter: 13.97 mm nom.
- Diameter DSLA locking sleeve: 36 mm
- Weight in air: 246 kg/km nom.
- Weight in sea water: 90 kg/km nom.
- Min. bending radius: 130 mm
- Depth rating: 6000 metres
- Screen: Overall braided
- Voltage:
  - Power conductor: 600V, max. 4 A
  - Twisted pairs: 250V, max. 1 A

Important

Sacrificial anodes must be mounted near the transducer to protect the connectors. Inspect the anodes regularly, and replace them if needed.

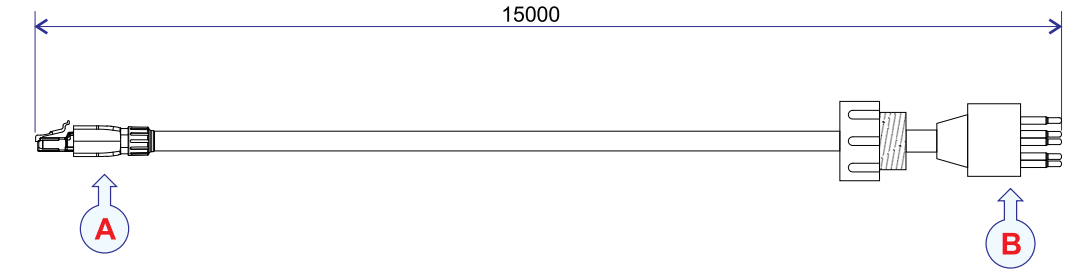
Correct handling of the underwater connectors is very important to avoid any leakage and corrosion problems to the EM 2040 transducers.

Related topics

Handling of underwater connectors, page 53

Receive transducer cable

The RX transducer must be connected to the Processing Unit.



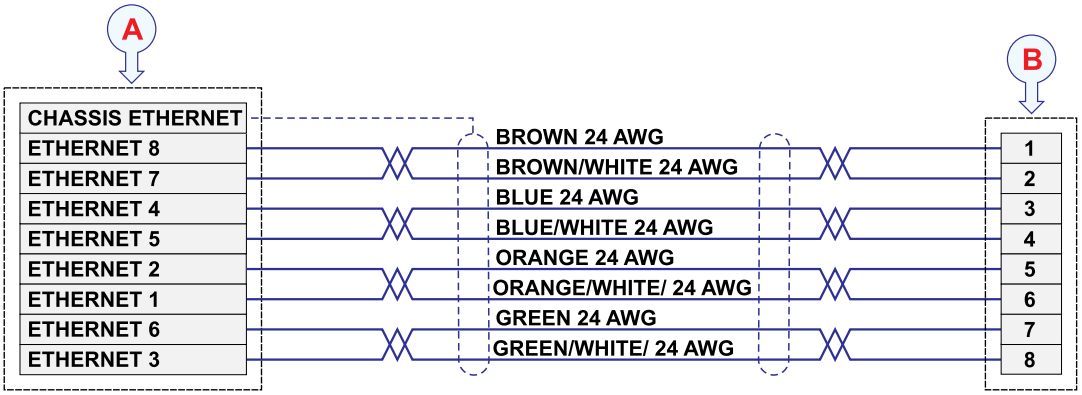
All measurements in mm.
The drawing is not in scale.

(CD0808_101_002)

Note

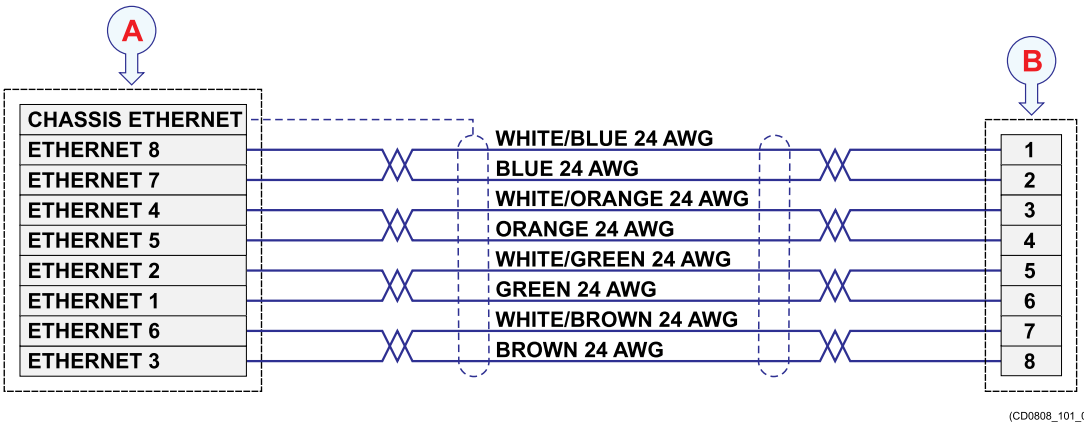
A change in the cable wiring was effectuated without KONGSBERG being made aware. As a consequence there are currently two versions of the cable delivered that have the same part number. This change was introduced to the cable in Q2 2011. Please make sure to check the connections in your RJ45 connector against the drawings below before replacing it.

For deliveries after Q2 2011 the cable is connected according to this diagram, this is also according to EIA 568B:



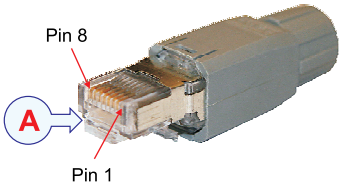
(CD0808_101_001)

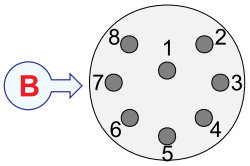
For deliveries before Q2 2011 the cable may be connected according to this diagram:



A *RJ45 connector for signal in Processing Unit end.*

B *Underwater connector type DIL8M in transducer end. Face view.*





Cable specifications

- SubConn® Ethernet Cable, Type D-P4TP24#
- 8 pin with 4 Ethernet wisted pairs
- Cable length: 15, 30 and 50 meters
- Cable diameter: 10.4 mm nom.
- Diameter DSLA locking sleeve: 36 mm
- Weight in air: 140 kg/km nom.
- Weight in sea water: 53 kg/km nom.
- Min. bending radius: 100 mm
- Depth rating: 6000 metres
- Screen: Overall braided
- Voltage:
  - Twisted pairs: 250V, max. 1 A

Important

Sacrificial anodes must be mounted near the transducer to protect the connectors. Inspect the anodes regularly, and replace them if needed.

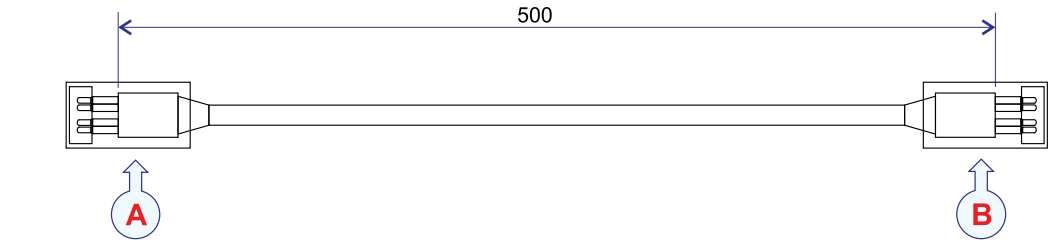
Correct handling of the underwater connectors is very important to avoid any leakage and corrosion problems to the EM 2040 transducers.

Related topics

Handling of underwater connectors, page 53

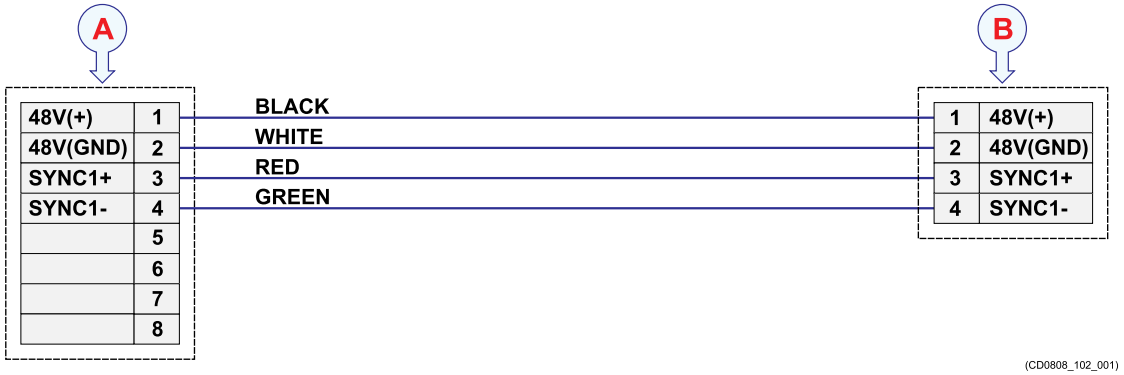
TX to RX transducer cable

The transmit transducer must be connected to the receive transducer for synchronization and power.

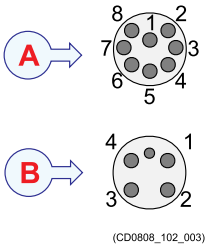


All measurements in mm.
The drawing is not in scale.

(CD0808_102_002)



(CD0808_102_001)



(CD0808_102_003)

A *Connector in TX end. Face view.*

B *Connector in RX end. Face view.*

Cable specifications

- Power/Sync Cable, Type SOOW 20/5
- Manufactured by MacArtney Underwter Technology
- MCIL8M, MCDLSF connector in TX end
- MCIL4M, MCDLSF connector in TX end
- Cable length: 0.5 or 1.5 meters
- Depth rating: 6000 metres
- Screen: Overall braided
- Voltage: 250V, max. 1 A

Important

Sacrificial anodes must be mounted near the transducer to protect the connectors. Inspect the anodes regularly, and replace them if needed.

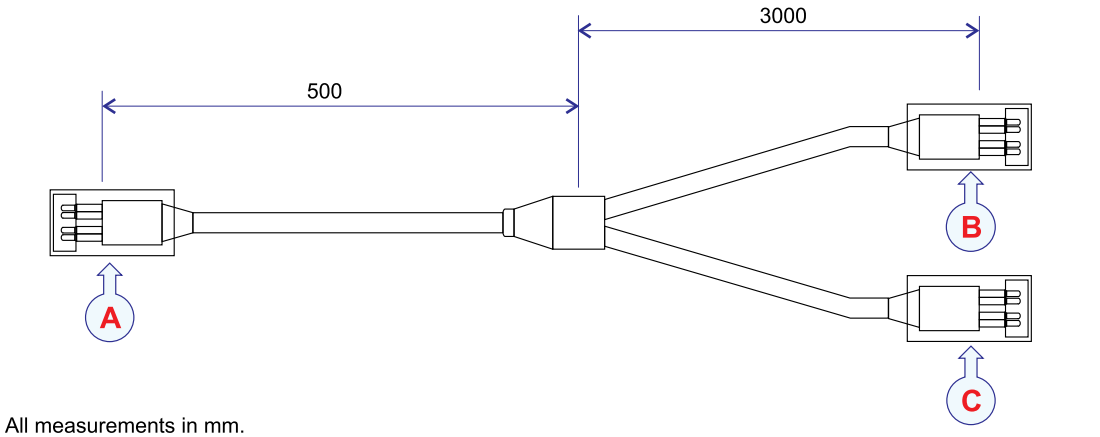
Correct handling of the underwater connectors is very important to avoid any leakage and corrosion problems to the EM 2040 transducers.

Related topics

Handling of underwater connectors, page 53

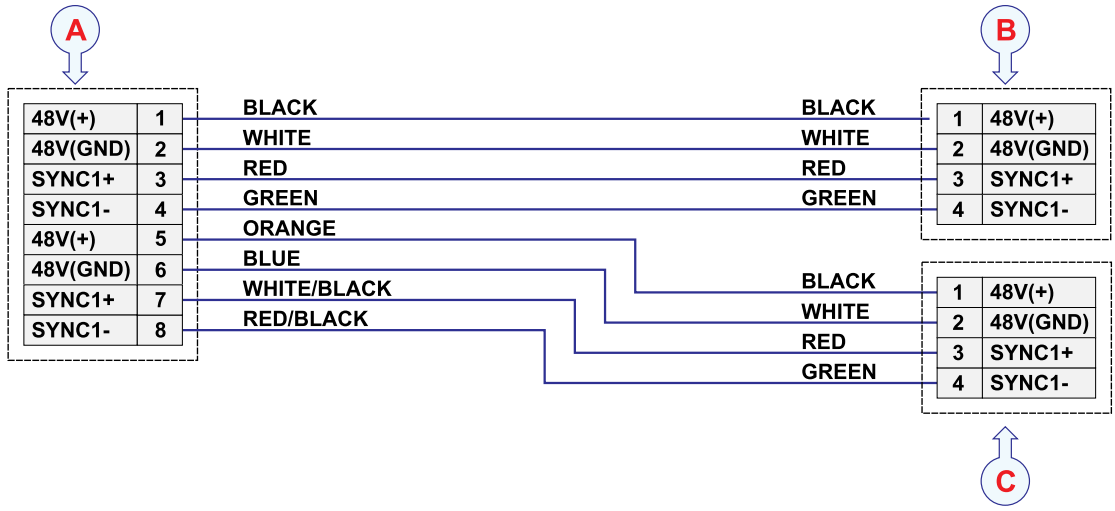
TX to dual RX transducer cable

In a dual RX system, the transmit transducer must be connected to both receive transducers. This connection is for synchronization and power.



All measurements in mm.
The drawing is not in scale.

(CD0808_103_002)

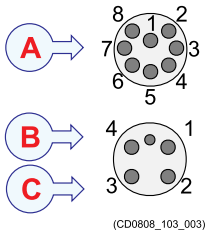


(CD0808_103_001)

A *Connector in TX end. Face view.*

B *Connector in RX end. Face view.*

C *Connector in RX end. Face view.*



Cable specifications

- Power and synchronization cable, type SOOW 20/8 and SOOW 18/4
- Manufactured by MacArtney Underwter Technology
- MCIL8M, MCDLSF connector in TX end
- MCIL4M, MCDLSF connector in RX end
- Cable length: 0.5 + 3.0 meters or 0.5 + 1.0 meters
- Depth rating: 6000 metres
- Screen: Overall braided
- Voltage: 250V, max. 1 A

Important

Sacrificial anodes must be mounted near the transducer to protect the connectors. Inspect the anodes regularly, and replace them if needed.

Correct handling of the underwater connectors is very important to avoid any leakage and corrosion problems to the EM 2040 transducers.

Related topics

Handling of underwater connectors, page 53

Handling of underwater connectors

Correct handling of the underwater connectors is very important to avoid any leakage and corrosion problems to the EM 2040 transducers.

Important

You must follow these instructions carefully to ensure correct use of your SubConn® underwater connectors.

1 Disconnect the connector by pulling it straight out, not at an angle. Do not pull the cable, and avoid sharp cable bends.

2 The connectors must not be exposed to long periods of heat or direct sunlight. If a connector becomes very dry, it should be soaked in fresh water before use.

3 General cleaning and removal of any accumulated sand or mud on a connector should be performed using spray based contact cleaner (isopropyl alcohol). New grease must be applied again prior to mating.

4 Always apply grease before mating.

   Greasing and mating above water (dry mate):

   a Connectors must be greased with Molykote® 44 Medium before every mating.

   b A layer of grease corresponding to minimum 1/10 of socket depth should be applied to the female connector.

   c The inner edge of all sockets should be completely covered, and a thin transparent layer of grease left visible on the face of the connector.

   d After greasing, fully mate the male and female connector in order to secure optimal distribution of grease on pins and in sockets.

   e To confirm that grease has been sufficiently applied, de-mate and check for grease on every male pin. Then re-mate the connector.

   Greasing and mating under water (wet mate):

   a Connectors must be greased with Molykote® 44 Medium before every mating.

   b A layer of grease corresponding to approximately 1/3 of socket depth should be applied to the female connector.

   c All sockets should be completely sealed, and transparent layer of grease left visible on the face of the connector.

   d After greasing, fully mate the male and female connector and remove any excess grease from the connector joint.

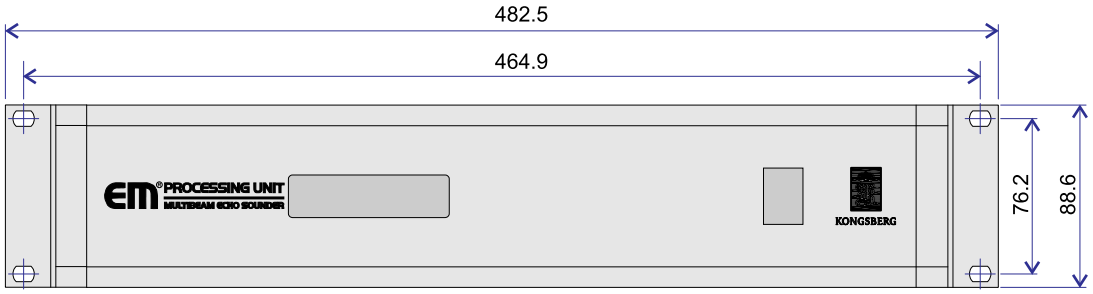
The recommendations from the manufacturer of the underwater connectors may be subject to change without prior notice. Please refer to the manufacturers website for updated information.

- http: //www.macartney.com

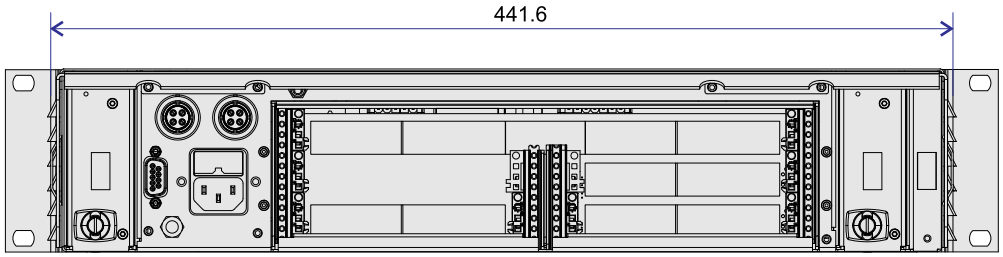
Drawing file

Topics

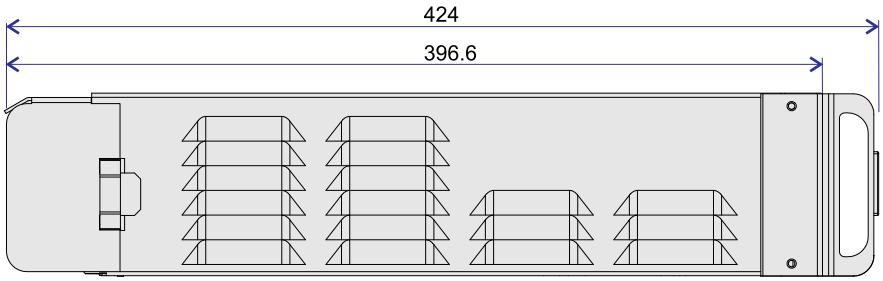
385422 Processing Unit dimensions



Front View



Rear View



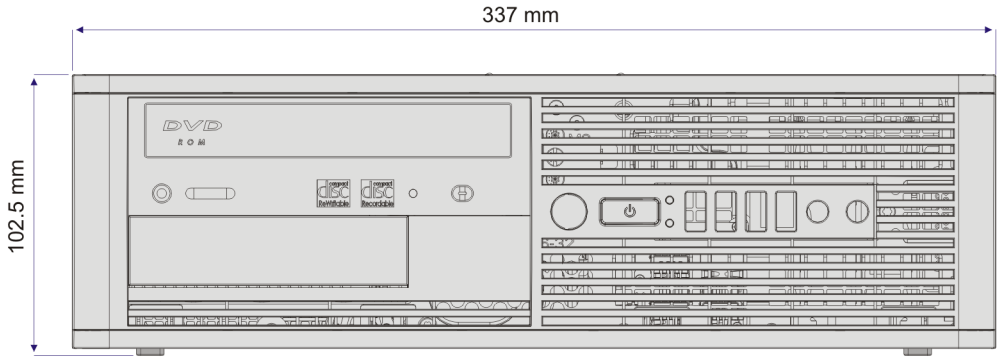
Side View

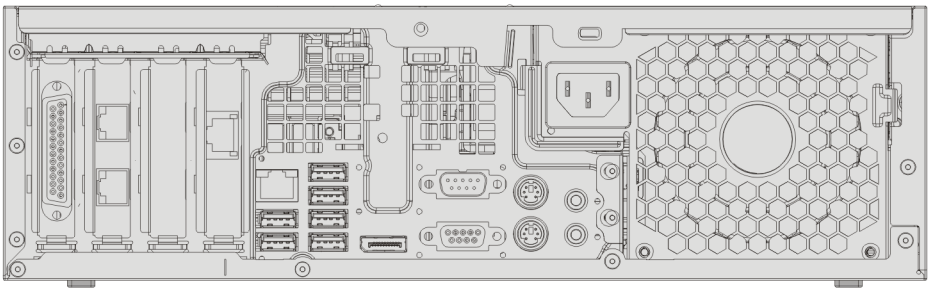
Weight: 10.5 kg

All measurements in mm.
The drawing is not in scale.

[385422] Rev.B
CD12_385422_001_001

378828 Hydrographic Work Station dimensions

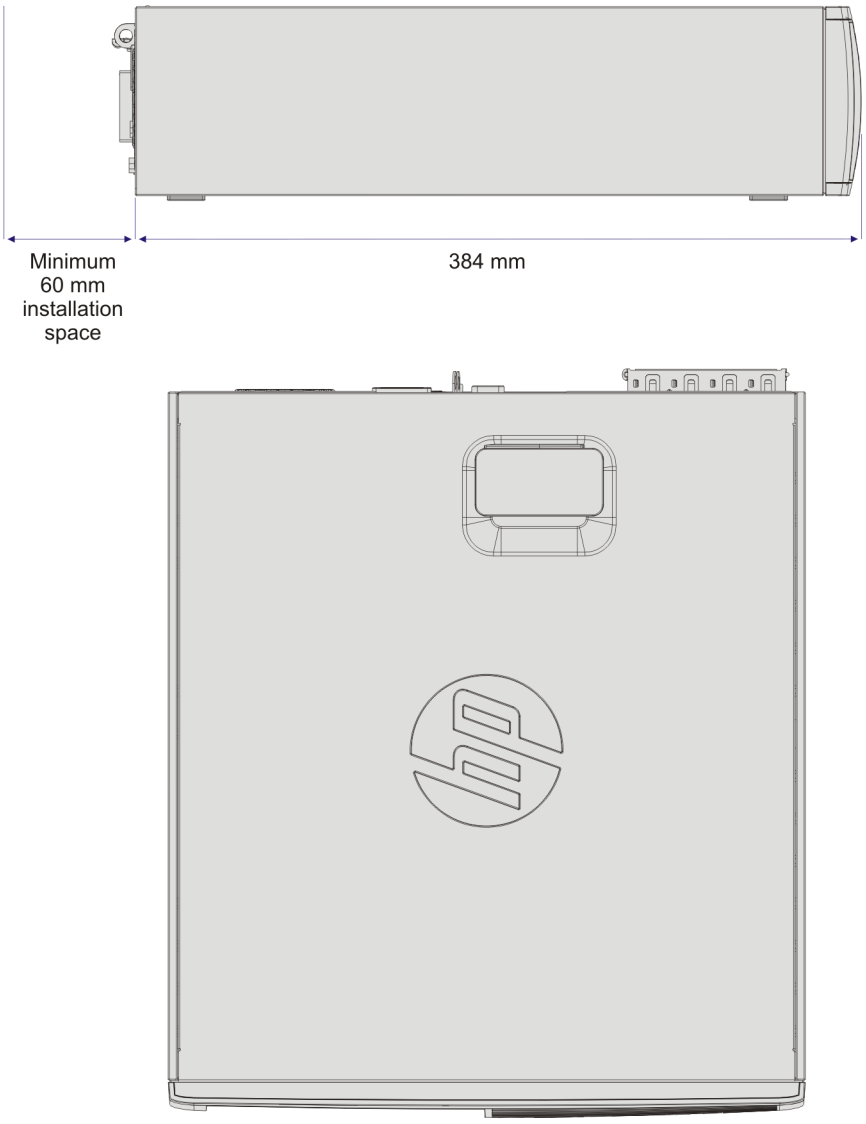




Note that this is a generic drawing. The physical presentation of the computer may not match specific product versions.

All measurements in mm.
The drawing is not in scale.

[378828] Rev.A
CD12_378828_001_001

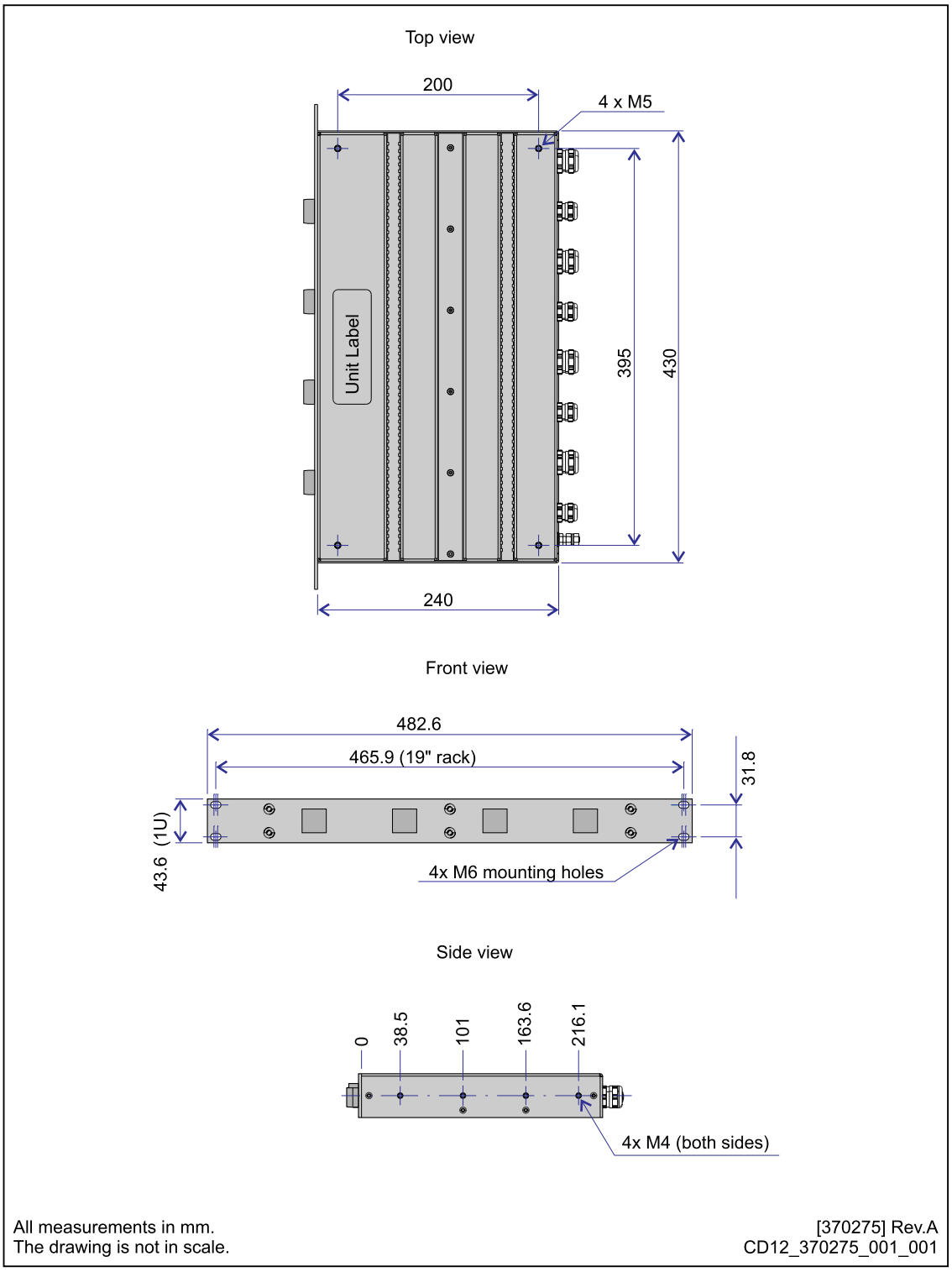


Note that this is a generic drawing. The physical presentation of the computer may not match specific product versions.

All measurements in mm.
The drawing is not in scale.

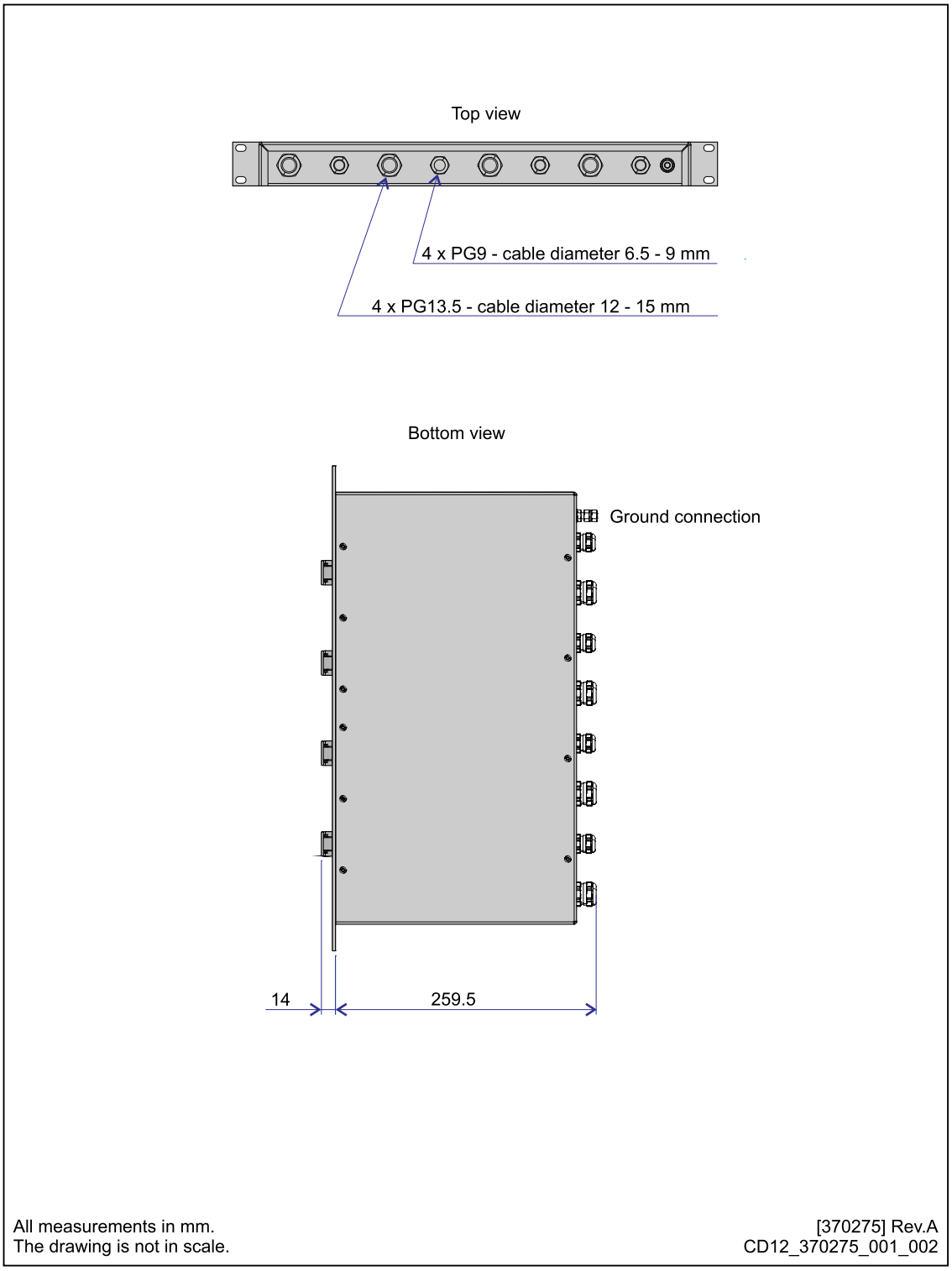
[378828] Rev.A
CD12_378828_001_002

370275 Remote Control Unit (K-REM) dimensions



All measurements in mm.
The drawing is not in scale.

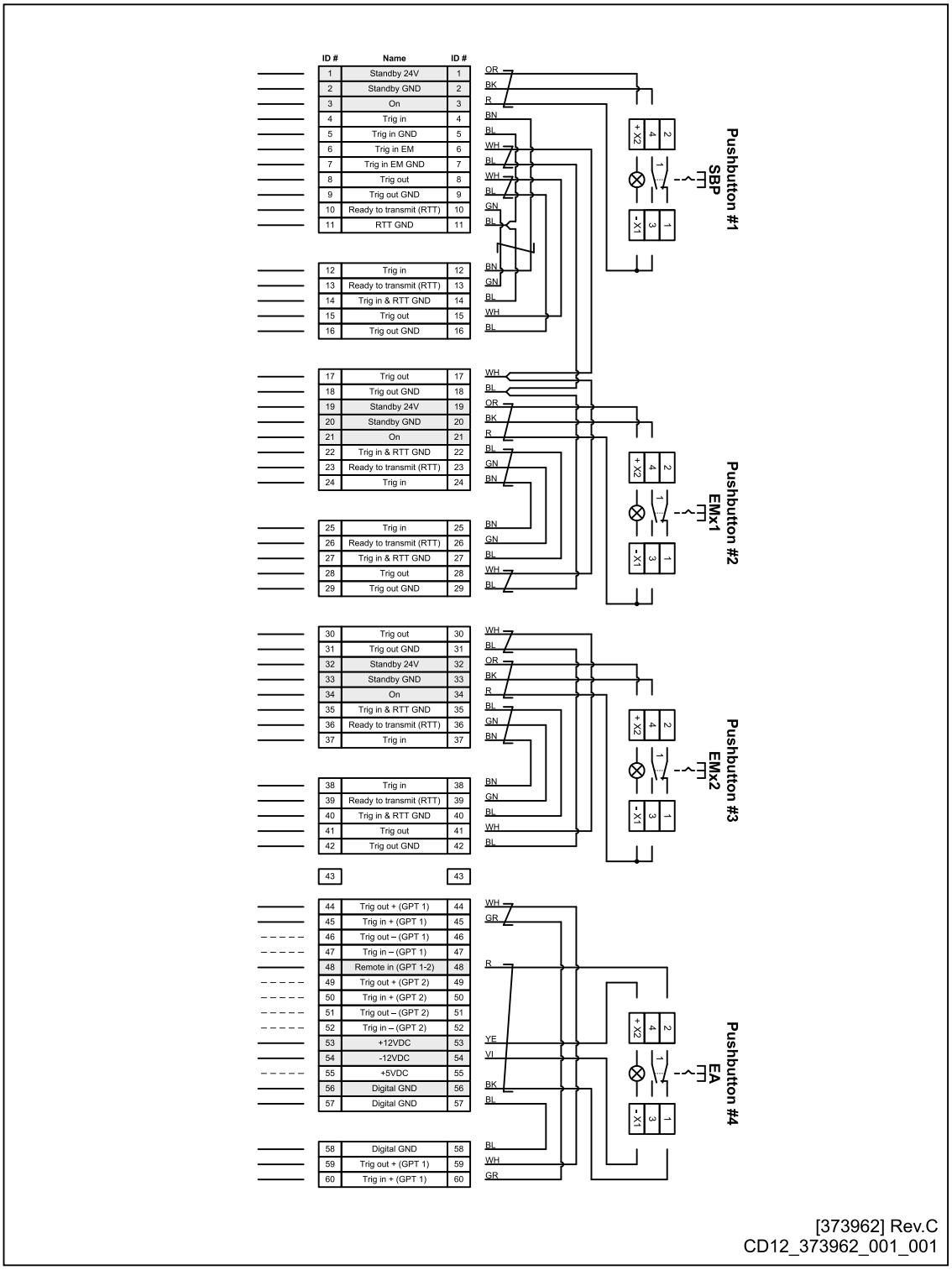
[370275] Rev.A
CD12_370275_001_001



All measurements in mm.
The drawing is not in scale.

[370275] Rev.A
CD12_370275_001_002

373962 Remote Control Unit (K-REM) wiring diagram



[373962] Rev.C
CD12_373962_001_001

Technical specifications

Topics

Performance specifications

These performance specifications summarize the main functional and operational characteristics of the EM 2040 system.

- **Frequency range**: 200 to 400 kHz
- **Selectable frequencies**:
  - **Single system and dual RX**: 200, 300 and 400 kHz operating mode
  - **Dual TX**: 200 to 400 kHz in 10 kHz steps
- **Detected depth (Minimum)**: 0.5 m relative to transducer face, installation dependent
- **Ping rate (Maximum)**: 50 Hz
- **Number of soundings per ping**:
  - **Single RX**: Up to 800 (400 per swath)
  - **Dual RX**: Up to 1600 (400 per swath)
- **Swath coverage sector**:
  - **Single RX**:
    - **200 kHz**: Up to 140 degrees (±70), 5.5 times water depth on a flat bottom
    - **300 kHz**: Up to 140 degrees (±70), 5.5 times water depth on a flat bottom
    - **400 kHz**: Up to 120 degrees(±60), 3.5 times water depth on a flat bottom
  - **Dual RX**:
    - **200 kHz**: Up to 200 degrees (±100), 10 times water depth on a flat bottom
    - **300 kHz**: Up to 200 degrees (±100), 10 times water depth on a flat bottom
    - **400 kHz**: Up to 180 degrees(±90), 10 times water depth on a flat bottom
  - **Dual TX**:
    - **200 kHz**: Up to 200 degrees (±100), 10 times water depth on a flat bottom
    - **300 kHz**: Up to 200 degrees (±100), 10 times water depth on a flat bottom
    - **400 kHz**: Up to 140 degrees (±70), 5.5 times water depth on a flat bottom

- **Depth and coverage (Maximum)**:

  Cold ocean water, bottom type rock (BS = - 10 dB), NL = 45 dB, FM mode

Operating mode	Max depth	Max coverage across	
EM 2040-04		**Single RX**	**Dual RX**
200 kHz	635 m	920 m	980 m
300 kHz	500 m	670 m	760 m
400 kHz	315 m	410 m	430 m
EM 2040-07			
200 kHz	600 m	880 m	930 m
300 kHz	465 m	640 m	725 m
400 kHz	300 m	385 m	410 m

- **Beamwidth (Tx x Rx)**:

  EM 2040-04:

  – **200 kHz**: 0.7 x 1.5 degrees

  – **300 kHz**: 0.5 x 1 degrees

  – **400 kHz**: 0.4 x 0.7 degree

  EM 2040-07:

  – **200 kHz**: 1.5 x 1.5 degrees

  – **300 kHz**: 1 x 1 degrees

  – **400 kHz**: 0.7 x 0.7 degree

- **TX Source level@ 300 kHz**:

  – **EM 2040-04**: Up to 218 dB re 1 µPa at 1 m

  – **EM 2040-07**: Up to 212 dB re 1 µPa at 1 m

- **Receive beam spacing**:

  – Equiangular

  – Equidistant

  – High density equidistant

- **Transmit beam steering, along**: Stabilised for pitch and yaw (±10 degrees)

  The transmit fans may be electronically stabilised for pitch and yaw movements in order to always point vertically. Pitch, yaw, heave and the applied stabilisation are fully taken into account when calculating sounding depths and positions.

- **Receive beam steering, across**: Stabilised for roll (±15 degrees)

  The receive beams are electronically stabilised for roll. In the near field the receive beams are dynamically focused to maintain angular resolution even at very short ranges.

- **Range resolution (defined as $cT_{eff}/2$)**: 10.5 mm at 14 µs pulse

- **Output sampling rate**: Up to 58.8 kHz (12.8 mm)

- **Pulse length, CW**:
  - **Pulse shading**: Hanning
  - **Total pulse length**: 37 to 865 µs
  - **Nominal pulse length**: 25 to 600 µs
  - **Effective pulse length**: 14 to 324 µs (BS footprint)
- **Pulse length, FM**:
  - **Total pulse length**: Up to 12 ms
- **Effective pulse length**:

	200 kHz mode		**300 kHz mode**		**400 kHz mode**	
	CW	FM	CW	FM	CW	FM
Normal mode	38, 108 and 324 µs	3 and 12 ms	38, 108 and 324 µs	2 and 6 ms	27, 54 and 108 µs	N/A
Single sector mode	19, 38 and 81 µs	1.5 ms	19, 38 and 81 µs	1.5 ms	14, 27 and 54 µs	N/A

	200 - 400 kHz in 10 kHz step	
	CW	FM
Dual TX model	14, 27, 54, 135, 324 and 918 µs	3 and 12 ms

Interface specifications

Topics

Different datagram formats

Different EM multibeams will use and log data on different formats.

KMall format

The KMall format is the successor of the all format, and uses the file extension kmall. Water column data can be logged in a separate file with extension kmwcd. The format is a generic format with high resolution data and the structure of the datagram is designed to make updates easier.

EM multibeams using KMall will be controlled and configured using the K-Controller and can acquire and log data using SIS 5 or other third party acquisition software.

Next generation multibeams will only have support for KMall format, and as such will require K-Controller and SIS5. This includes:

- EM 124
- EM 304
- Any future EM multibeams

The KM multibeam output datagram format is described in a Doxygen document, a documentation generator writing software reference documentation, and can be downloaded from the Kongsberg websites.

See this page to download the Doxygen document: https://www.kongsberg.com/maritime/support/document-and-downloads/software-downloads/.

all format

Older generation EM multibeams will not have support for the new datagram format or use the K-Controller and SIS 5. This includes:

- EM 120/122
- EM 300/302
- EM 3000/3002
- EM 710

The all output datagram format is described in a separate document *EM Datagram formats* document number 160692, and can be downloaded from the Kongsberg websites.

See this page and select the relevant product to download the document: Product support A to Z.

Both formats

Support for both all and KMall format and will be available for:

- EM 2040 Series multibeams
- EM 712

For these KONGSBERG will continue to do maintenance and bug fixing for all and SIS4. Any new feature development will only be available for KMall and SIS5. Upgrading to the new format, K-Controller and SIS5 is free, but new features might be licensed.

Contact our customer support line for assistance in upgrading existing systems.

Interface specifications - Processing Unit - all format

The EM 2040 system will interface with peripheral systems and sensors using standard and/or proprietary datagram formats. This is a description of available datagram formats for EM multibeams using the all format.

Supported datagram formats for position information

The EM 2040 supports the following datagram format for position information.

These datagram formats are received using a serial communication line.

- **PTNL GGK**

  This third party datagram format is used to transfer latitude and longitude of vessel position, time of position fix and status from a global positioning system (GPS).

- **NMEA GGA**

  The NMEA GGA datagram transfers time-, position- and fix-related data from a global positioning system (GPS).

- **Simrad 90**

  The Simrad 90 datagram is a proprietary format created by Kongsberg Maritime to interface position sensors.

Supported datagram formats for external clock

The EM 2040 supports the following datagram format from an external clock.

This datagram format is received using a serial communication line.

- **NMEA ZDA**

  The NMEA ZDA datagram contains the universal time code (UTC), day, month, year and local time zone.

Supported datagram formats for heading information

The EM 2040 supports the following datagram formats for vessel heading and/or gyro information.

These datagram formats are received using a serial communication line.

- **NMEA HDT**

  The NMEA HDT datagram provides the true vessel heading. The information is normally provided by a course gyro.

- **SKR82 Heading**

  This is a third-party proprietary datagram format for heading. It was created by Simrad Yachting (https://www.simrad-yachting.com) for use with their Simrad Robertson SKR80(82) gyrocompass.

Supported datagram formats for depth information

The EM 2040 supports the following datagram formats for depth information from an echo sounder:

These datagram formats are received using a serial communication line.

- **NMEA DBS**

  The NMEA DBS datagram provides the current depth from the surface. The datagram is no longer recommended for use in new designs. It is frequently replaced by the NMEA DPT datagram format.

- **NMEA DPT**

  The NMEA DPT datagram provides the water depth relative to the transducer, and the offset of the measuring transducer.

- **Simrad EK500 Depth**

  Simrad EK500 Depth is a proprietary datagram format created by Kongsberg Maritime. It was originally defined for the Simrad EK500 scientific echo sounder. It provides the current depth from three channels, as well as the bottom surface backscattering strength and the athwartships bottom slope. This telegram has been designed for output on either a serial line or a local area network Ethernet connection.

Supported datagram formats for motion information

The EM 2040 system supports the following datagram format from a motion sensor:

These datagram formats are received using a serial communication line.

- **Kongsberg EM Attitude 3000**

  The Kongsberg EM Attitude 3000 is a proprietary datagram format created by Kongsberg Maritime for use with digital motion sensors. It holds roll, pitch, heave and heading information. The datagram contains a 10-byte message.

Supported datagram formats for motion information including velocity

The EM 2040 system supports the following datagram formats from a motion sensor:

These datagram formats are received using a serial communication line.

- **Seapath Binary 11**

  This is a proprietary format created by Kongsberg Maritime (https://www.kongsberg.com/maritime/), former Kongsberg Seatex, for position, attitude and velocity data from the Seapath sensor.

- **Seatex Binary 23**

  The Seatex Binary 23 is a proprietary datagram format created by Kongsberg Maritime (https://www.kongsberg.com/maritime/), former Kongsberg Seatex, to provide position, motion and heading data from a Seapath sensor system.

- **Seapath Binary 26**

  This is a proprietary format created by Kongsberg Maritime (https://www.kongsberg.com/maritime/), former Kongsberg Seatex, for position, attitude and velocity data from the Seapath sensor.

- **POS-MV GRP 102/103**

  This is a third party proprietary datagram format created by Applanix (http://www.applanix.com) for position, attitude and sound speed data.

- **Coda Octopus MCOM**

  The Coda Octopus MCOM is a third party proprietary datagram format created by Oxford Technical Solutions Limited (http://www.oxts.com) for efficient communication of marine navigation measurements and other data. This format is used by Coda Octopus for transmitting position, attitude and sound speed data.

Special interfaces

- Trigger input/output for synchronization
- 1 pulse per second (1PPS) clock synchronization signal

Interface specifications - Processing Unit - KMall format

The EM 2040 system will interface with peripheral systems and sensors using standard and/or proprietary datagram formats. This is a description of available datagram formats for EM multibeams using the KMall format.

Supported datagram formats for position information

The EM 2040 supports the following datagram format for position information.

- **NMEA GGA**

  The NMEA GGA datagram transfers time-, position- and fix-related data from a global positioning system (GPS).

- **PTNL GGK**

  This third party datagram format is used to transfer latitude and longitude of vessel position, time of position fix and status from a global positioning system (GPS).

Supported datagram formats for external clock

The EM 2040 supports the following datagram format from an external clock.

- **NMEA ZDA**

  The NMEA ZDA datagram contains the universal time code (UTC), day, month, year and local time zone.

Supported datagram formats for motion information

The EM 2040 system supports the following datagram format from a motion sensor:

- **Kongsberg EM Attitude 3000**

  The Kongsberg EM Attitude 3000 is a proprietary datagram format created by Kongsberg Maritime for use with digital motion sensors. It holds roll, pitch, heave and heading information. The datagram contains a 10-byte message.

Supported datagram formats for motion information including velocity

The EM 2040 system supports the following datagram formats from a motion sensor:

- **KM Binary**

  KM Binary is a generic datagram format defined by Kongsberg Maritime. This format has very high resolution on timing and sensor parameters.

- **Seapath Binary 11**

  This is a proprietary format created by Kongsberg Seatex (http://www.km.kongsberg.com/seatex) for position, attitude and velocity data from the Seapath sensor.

  Seapath Binary 11 is an old format with low resolution that KONGSBERG does not recommend.

- **Seapath Binary 23**

  This is a proprietary format created by Kongsberg Seatex (http://www.km.kongsberg.com/seatex) for position, attitude and velocity data from the Seapath sensor.

- **Seapath Binary 26**

This is a proprietary format created by Kongsberg Seatex (http://www.km.kongsberg.com/seatex) for position, attitude and velocity data from the Seapath sensor.

- **POS-MV GRP 102/103**

  This is a third party proprietary datagram format created by Applanix (http://www.applanix.com) for position, attitude and sound speed data.

Supported datagram formats for sound speed probe

Sound speed probe can be interfaced directly to the Processing Unit and configured in K-Controller or interfaced to the Hydrograpic Work Station and configured in SIS 5.

The EM 2040 supports the following datagram format from a sound speed probe.

- **AML Sound speed**

  AML is a third-party proprietary datagram format created by AML Oceanographic (http://www.amloceanographic.com) for use with their sound velocity probes. The file format is ASCII with a five-line header plus a variable number of data lines.

  The supported AML Smart Sensor message formats are

  – **AML NMEA**: NMEA like format
  – **AML SV**: Sound Velocity
  – **AML SVT**: Sound Velocity and Temperature
  – **AML SVP**: Sound Velocity and Pressure
  – **Micro SV**: Sound Velocity
  – **Micro SVT**: Sound Velocity and Temperature
  – **Micro SVP**: Sound Velocity and Pressure

- **Valeport**

  This is a third-party proprietary datagram format created by Valeport Ltd. for use with their sound velocity sensors.

  The supported Valeport message formats are

  – **MiniSVS SV**: Sound velocity

No longer supported

Some external sensors are no longer supported.

- Position sensor format Simrad 90
- Attitude sensor format Sperry MK-39
- Heading sensor format NMEA HDT, SKR 82

Special interfaces

- Trigger input/output for synchronization
- 1 pulse per second (1PPS) clock synchronization signal

Output datagram formats

The KM multibeam output datagram format is described in a Doxygen document, a documentation generator writing software reference documentation, and can be downloaded from the Kongsberg websites.

See this page to download the Doxygen document: https://www.kongsberg.com/maritime/support/document-and-downloads/software-downloads/.

External sensors requirements

The external sensors must fulfil these requirements to achieve the specified performance for the EM 2040 system.

Sensor accuracy

Velocitiy sensor accuracy requirements

- Velocity: 0.03 m/s RMS
- Roll, pitch and yaw rate: 0.03 deg/s RMS
- Latency: Maximum 5 ms
- Update rate: 100 Hz

Motion sensor accuracy requirements

The accuracy of the sensor data, as specified by the sensor manufacturer, must fulfil (preferably surpass) the following requirements.

- **Roll:** 0.02 degrees RMS

  An accuracy of 0.05 degrees RMS can be accepted unless you have very long pulse length and large beam angles.
- **Pitch**: 0.05 degrees RMS
- **Heading**: 0.2 degrees RMS
- **Heading**: 0.2 degrees RMS
- **Heave**: 5 cm or 5% whichever is highest (real-time output)

Doppler shifts

All new generation of multibeam echo sounders from Kongsberg Maritime have an extended range performance by use of a frequency modulated transmitter pulse (FM), also called chirp pulse. In the FM mode, the Doppler shift made by the movements of the survey vessel relative to the bottom, causes a range error. This error must be corrected.

KONGSBERG supports a large range of sensor suppliers in addition to our own Kongsberg Seatex systems.

Check with your sensor supplier if the sensor accuracy requirements are met and the required formats are supported.

Interface specifications - Hydrographic Work Station - all format

The EM 2040 system will interface with peripheral systems and sensors using standard and/or proprietary datagram formats. This is a description of available datagram formats for EM multibeams using the all format.

- Input of sound speed at transducer
- Output to Printer/plotter
- Input of sound speed profile (Ethernet or serial line)
- Input of tide input (Ethernet or serial line)
- Input of single beam echo sounder depths (Ethernet)
- Output of all data normally logged to disk (to Ethernet)
- Output of depth below keel in NMEA DPT format (serial line)
- Output to autopilot in NMEA APB format (serial line)

Interface specifications - Hydrographic Work Station - KMall format

The EM 2040 system will interface with peripheral systems and sensors using standard and/or proprietary datagram formats. This is a description of available datagram formats for EM multibeams using the KMall format.

- Input of sound speed profile (Ethernet or serial line)
- Input of sound speed at transducer (Ethernet or serial line)
- Input of tide input (Ethernet or serial line)
- Input of single beam echo sounder depths (Ethernet)
- Output of all data normally logged to disk (to Ethernet)
- Output of depth below keel in NMEA DPT format (serial line)
- Output to Printer/plotter

Weight and outline dimensions

These weights and outline dimension characteristics summarize the physical properties of the EM 2040 system.

Transmit transducer - 0.4 degrees

- **Outline dimensions**:
  - **Length**: 725 mm
  - **Width**: 200 mm
  - **Height**: 150 mm
- **Weight**:
  - Weight (In air): 45 kg
  - Weight(In water): 30 kg
- **Volume**: 15 litres

Transmit transducer - 0.7 degrees

- **Outline dimensions**:
  - **Length**: 407 mm
  - **Width**: 200 mm
  - **Height**: 150 mm
- **Weight**:
  - Weight (In air): 23 kg
  - Weight(In water): 16 kg
- **Volume**: 8.6 litres

Receive transducer

- **Outline dimensions**:
  - **Length**: 407 mm
  - **Width**: 200 mm
  - **Height**: 136 mm
- **Weight**:
  - Weight (In air): 22 kg
  - Weight(In water): 16 kg
- **Volume**: 7.8 litres

Transducer mounting plate, 0.4 degrees

- **Outline dimensions**:
  - **Length**: 615 mm
  - **Width**: 725 mm
  - **Height**: 139 mm including support pillars
- **Weight**: 23 kg

Transducer mounting plate, 0.7 degrees

- **Outline dimensions**:
  - **Length**: 614 mm
  - **Width**: 407 mm
  - **Height**: 139 mm including support pillars
- **Weight**: 16 kg

Processing Unit

- **Make and model**: Kongsberg Maritime, EM PU
- **Outline dimensions**:
  - **Depth**: 424 mm
  - **Width**: 482.5 mm (19" rack)
  - **Height**: 88.6 mm (2U)
- **Weight**: 10.5 kg

Portable Processing Unit

- **Make and model**: Kongsberg Maritime, EM PPU
- **Outline dimensions**:
  - **Depth**: 391 mm
  - **Width**: 391 mm
  - **Height**: 108 mm
- **Weight**: 10.5 kg

Hydrographic Work Station

The standard commercial computer has been configured to fit the operational requirements of the EM 2040.

- **Make and model**: HP MP5810
- **Outline dimensions**:
  - **Depth**: 379 mm
  - **Width**: 338 mm
  - **Height**: 100 mm
- **Weight**: 7 kg (Approximately)

Portable Hydrographic Work Station

- **Make and model**: Dell Latitude 5424 Rugged
- **Outline dimensions (Excludes bumpers and handle)**:
  - **Depth**: 347.0 mm
  - **Width**: 244.5 mm
  - **Height**: 44.4 mm
- **Weight**: 3 kg (Approximately)

Display

- **Make and model**: Isic MD24 (DuraMON WS 24)

  Manufacturer's website: http://www.isic-systems.com
- **Outline dimensions**:
  - **Depth**: 68 mm
  - **Height**: 408 mm
  - **Width**: 601 mm
- **Weight**: 10 kg (Approximately)

Power requirements

These power characteristics summarize the supply power requirements for the EM 2040 system.

Transducer

The power is normally supplied by the Processing Unit.

- **Voltage requirement**: 48 VDC
- **Maximum voltage deviation**: 10 %
- **Maximum power consumption**:
  - **Receive transducer**: 29 W (0.6 A)
  - **Transmit transducer 0.7 degrees**: 12 W (0.25 A) in CW mode, 24 W (0.5 A) in FM mode
  - **Transmit transducer 0.4 degrees**: 24 W (0.5 A) in CW mode, 48 W (1.0 A) in FM mode

Processing Unit

- **Make and model**: Kongsberg Maritime, EM PU
- **Voltage requirement**: 100 to 250 VAC, 47 to 63 Hz
- **Maximum power consumption**:
  - **With one CBMF board (without transducer)**: 115 W
  - **With two CBMF boards (without transducer)**: 125 W

Portable Processing Unit

- **Make and model**: Kongsberg Maritime, EM PPU
- **Voltage requirement**: 24 VDC Nominal voltage
- **Maximum power consumption**:
  - **With one CBMF board (without transducer)**: 115 W
  - **With two CBMF boards (without transducer)**: 125 W

Processing Unit with Transducer

One CBMF card is required per swath. Consequently:

- Single RX Head systems require one CBMF card
- Dual RX Head systems require two CBMF cards
- Single RX Head Dual Swath systems require two CBMF cards
- Dual RX Head Dual Swath systems require two processing units with two CBMF cards in each processing unit

Dual Head Dual Swath systems are not available for the Portable Processing Unit.

System calculation examples

EM 2040 0.7x0.7 degrees Dual RX - Single Swath System Component	Maximum power consumption
Processing unit with 2xCBMF	125
EM 2040 0.7 degrees Receiver	29
EM 2040 0.7 degrees Receiver	29
EM 2040 0.7 degrees Transmitter	24
Total	207 W

EM 2040 0.4x0.7 degrees Single RX - Dual Swath System Component	Maximum power consumption
Processing unit with 2xCBMF	125
EM 2040 0.7 degrees Receiver	29
EM 2040 0.4 degrees Transmitter	48
Total	202 W

EM 2040 0.4x0.7 degrees Dual TX - Single Swath System Component	Maximum power consumption
Processing unit with 2xCBMF	125
EM 2040 0.7 degrees Receiver	29
EM 2040 0.7 degrees Receiver	29
EM 2040 0.7 degrees Transmitter	48
EM 2040 0.7 degrees Transmitter	48
Total	279 W

EM 2040 0.4x0.7 degrees Dual RX - Dual Swath System Component	Maximum power consumption
Processing unit with 2xCBMF	125
Processing unit with 2xCBMF	125
EM 2040 0.7 degrees Receiver	29
EM 2040 0.7 degrees Receiver	29
EM 2040 0.4 degrees Transmitter	48
Total	356 W

EM 2040 0.4x0.7 degrees Dual RX - Single Swath System Component	Maximum power consumption
Processing unit with 2xCBMF	125
EM 2040 0.7 degrees Receiver	29
EM 2040 0.7 degrees Receiver	29
EM 2040 0.4 degrees Transmitter	48
Total	231 W

Hydrographic Work Station

The standard commercial computer has been configured to fit the operational requirements of the EM 2040.

- **Make and model**: HP MP5810
- **Voltage requirement**: 100/240 VAC, 50 to 60 Hz, autosensing
- **Maximum power consumption**: 240 W (Approximately)

Note

The use of an Uninterruptible Power Supply (UPS) is highly recommended for the Hydrographic Work Station.

Portable Hydrographic Work Station

- **Make and model**: Dell Latitude 5424 Rugged
- **Voltage requirement**: 100/240 VAC or 19.5 VDC
- **Maximum power consumption**: 90 W

Display

- **Make and model**: Isic MD22/24/27 (DuraMON WS 22/24/27)

  Manufacturer's website: http://www.isic-systems.com
- **Voltage requirement**:
  - **Standard**: 90 to 264 VAC, 50 to 60 Hz
  - **Optional**: 18 to 36 VDC
- **Maximum power consumption**: 40 W

Environmental requirements

These specifications summarize the temperature requirements and other environmental standards for the EM 2040 system.

Transducer

- **Operating temperature**: -5 to +40 °C
- **Storage temperature**: -20 to +60 °C
- **Depth rating**: 6000 m

Processing Unit

- **Make and model**: Kongsberg Maritime, EM PU
- **Operating temperature**: 0 to +50 °C
- **Storage temperature**: -30 to +70 °C
- **Relative humidity**: 5 to 95% Non-condensing
- **Ingress protection (IP) rating**: IP22
- **Certificates**:
  - IEC 60945:2002 and CORRIGENDUM 1:2008
  - IACS E10:2006

Portable Processing Unit

- **Make and model**: Kongsberg Maritime, EM PPU
- **Operating temperature**: 0 to +50 °C
- **Storage temperature**: -30 to +70 °C
- **Ingress protection (IP) rating**: IP67
- **Certificates**:

  Designed to meet

  – IEC 60945:2002 and CORRIGENDUM 1:2008

  – IACS E10:2006

Hydrographic Work Station

The standard commercial computer has been configured to fit the operational requirements of the EM 2040.

- **Make and model**: HP MP5810
- **Operating temperature**: 0 to +50 °C
- **Storage temperature**: -20 to +70 °C
- **Relative humidity**: 5 to 95% Non-condensing

  This IP rating is only applicable when the unit is mounted using the optional kit for 19-inch rack.
- **Certificates**:

  – IEC 60945

  – IACS E10

Portable Hydrographic Work Station

- **Make and model**: Dell Latitude 5424 Rugged
- **Operating temperature**: -29 to +60 °C
- **Storage temperature**: -51 to +71 °C
- **Relative humidity**: 10 to 95% Non-condensing
- **Ingress protection (IP) rating**: IP52

  Dust-protected, protected against dripping water when tilted up to 15 degrees

Display

- **Make and model**: Isic MD22/24/27 (DuraMON WS 22/24/27)

  Manufacturer's website: http://www.isic-systems.com
- **Operating temperature**: -15 to +55 °C
- **Storage temperature**: -25 to +70 °C
- **Relative humidity**: 8 to 95% Non-condensing
- **Ingress protection (IP) rating**:
  - **Front**: IP65
  - **Rear**: IP20
- **Certificates**:
  - IEC 60945
  - IACS E10

Alignment specifications

These alignment specifications summarize the alignment accuracy requirements of the EM 2040 system.

Note

The following accuracy requirements are minimum requirements. Higher accuracy will provide better results and should therefore always be aimed at.

Transducer alignment accuracy

- **Position (x)**: ± 0.02 m
- **Position (y)**: ± 0.02 m
- **Position (z)**: ± 0.005 m
- **Pitch**:
  - TX transducer: ± 0.05 degrees
  - RX transducer: ± 0.20 degrees
- **Roll**:
  - TX transducer: ± 0.20 degrees
  - RX transducer: ± 0.02 degrees
- **Heading**: ± 0.05 degrees
- **Relative heading between RX and TX transducer**: ± 0.05 degrees

Note

***Mounting angle between RX and TX transducer**: 90 degrees ± 1 degrees*

Motion sensor alignment accuracy

- **Position (x)**: ± 0.05 m
- **Position (y)**: ± 0.05 m
- **Position (z)**: ± 0.05 m
- **Pitch**: ± 0.05 deg
- **Roll**: ± 0.02 degrees
- **Heading**: ± 0.05 degrees

Heading sensor alignment accuracy

- **Heading**: ± 0.1 degrees

Position sensor alignment accuracy

- **Position (x)**: ± 0.05 m
- **Position (y)**: ± 0.05 m
- **Position (z)**: ± 0.005 m

Waterline determination accuracy

- **Position (z)**: ± 0.005 m

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