HIAB

Service Manual

System description

SPACE 4000

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Overview

General

SPACE 4000 is one of the electronic control systems for HIAB loader cranes. SPACE 4000 contains a number of control boxes, sensors and indicators which sends signals to the microprocessor regarding the crane's load, position and movements. This then decides how the crane can be operated. It stops or reduces unpermitted movements and speeds.

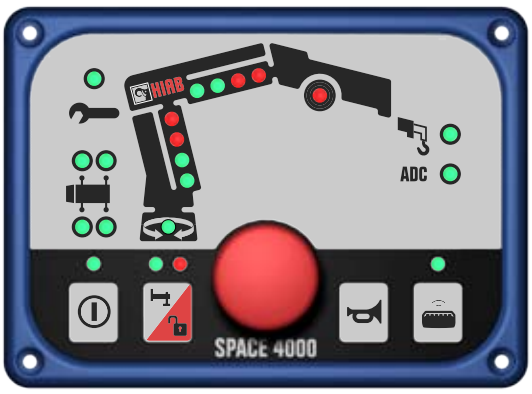


Fig. 1

CAN network

The control boxes communicate via the CAN bus. The communication is controlled by the SPACE ST (1)

Boxes connected to the CAN bus:

(2) SPACE UI -the user interface
(3) XSDrive -the remote control system on the crane
(4) SPACE RE -relay box
(5) Leg Box -Indicating device. Handles signals from sensors
(6) MUX box
(7) TWI -transport warning interface
(8) CAN Connection box.

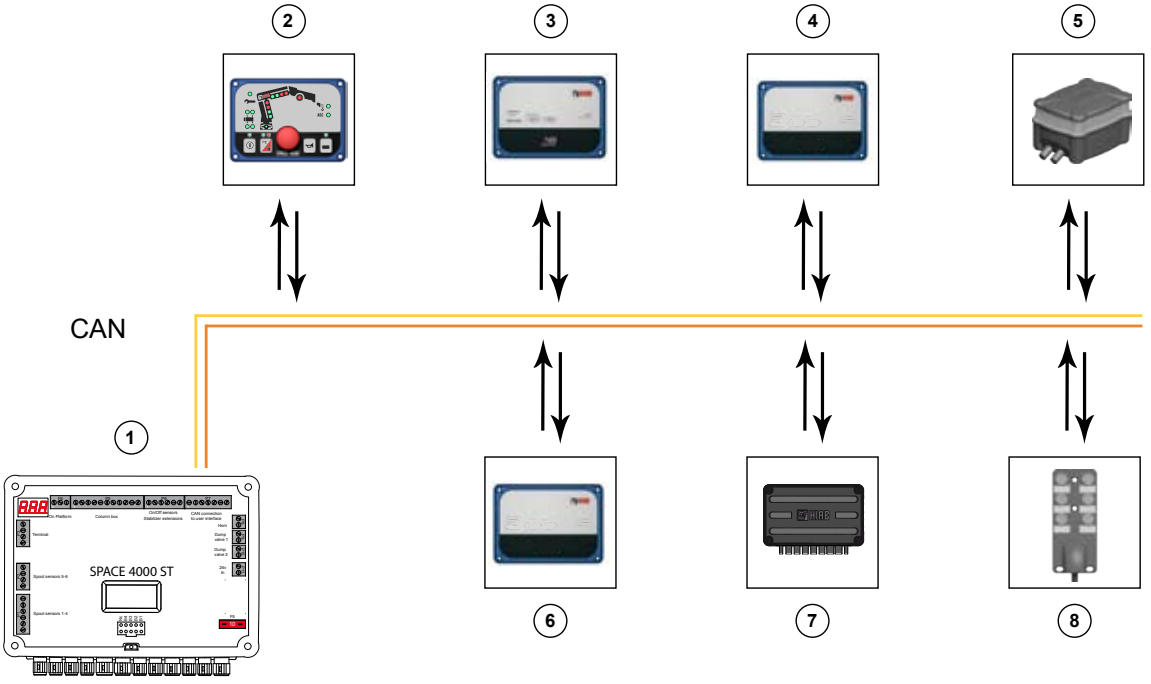


Fig. 2

Diagnostic

There is a diagnostic function in the system that can tell if there is a problem with a component.
This information can be displayed by qualified field service personnel either by reading out the error code on the three digit display in the standard box, or in the terminal program. This can be a good help when doing trouble shooting and fault finding on the various components.
There are also a number of counters in the system for operating hours, number of lifts, number of overloads etc.

Components

SPACE 4000 ST

This is the brain in the system. It has a display for viewing errors. All sensor signals are taken care of in this box. There can only be one 4000 ST connected to the system.

SPACE 4000 UI

This is the user interface for SPACE 4000. Here is where the operator turns on and off the system and activating stabilizer legs and OLP release. Activating the remote control and the horn. There is also an emergency stop button on the UI.
The LED's on the UI shows crane status and load.
There can be up to 4 UI:s connected to the system.

SPACE RE

The relay box supplies the SPACE 4000 system with power. There is also an output that can be used for e.g an oil cooler.
It has 8 relay output's that can be used for e.g extra work light, start/stop of engine.
It can be up to 4 relayboxes connected to the system.

SPACE 4000 EX

Ex stands for "extended" You can connect an additional numbers of sensors and outputs to the EX box. MSC, ADS,Dump2 and spool position sensors for 7-8 functions can be connected. There can be only one EX box connected to the system.

SPACE 4000 MUX

A MUX box collects signals (24 V) from a maximum of eight indicators and transmits the signals via CAN bus to the SPACE box. There can be up to 3 MUX boxes connected to one SPACE box.

XSDrive

This is the remote control unit for the system. The XSDrive unit comprises of one transmitter/receiver and a hand controller.

Leg Box

The Leg Box indicates usage and status of the crane. The stabilizer leg pressure sensors are connected to the Leg Box.

Column box

Pressure sensors, indicators etc that are assembled on the boom system are connected to the column box. A multi wire cable connects this box with the SPACE ST

CAN connection Box

The CAN connection box is a connection box where to connect the analogue position sensors, LegBox.

TWI

The transport warning interface TWI is used to indicate if the crane is in high position and if the stabilizer extensions are out.
A push button with indicator lamp and buzzer (CWI) mounted in the cabin is used to warn the operator. The buzzer can be silenced by either pushing the button, or by activating the vehicle parking brake

SPACE MUX

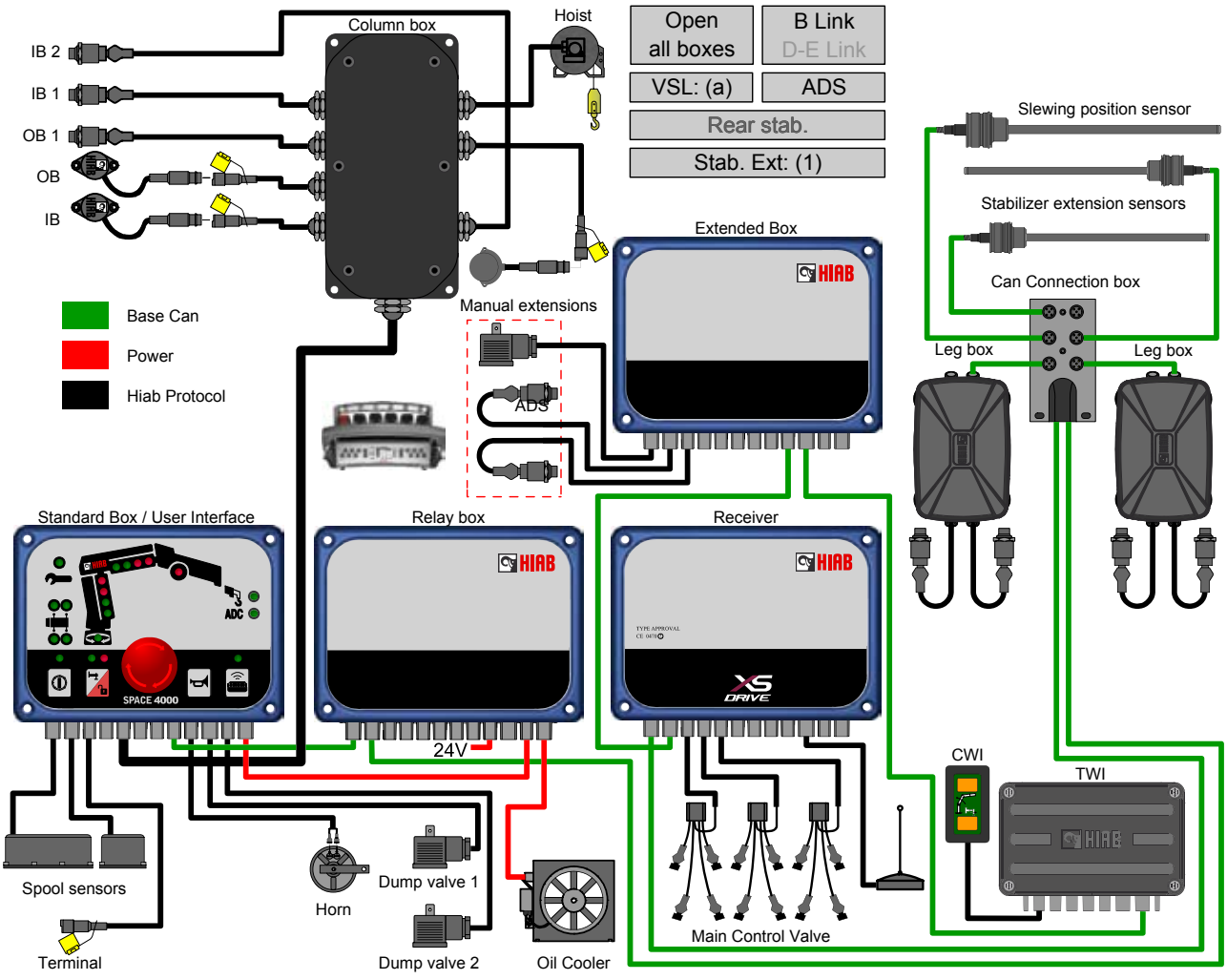
A MUX box collects signals (24 V) from a maximum of eight indicators and transmits the signals via CAN bus to the ST box. There can be up to 3 MUX boxes connected to SPACE 4000.

Sensors

There are different types of sensors used on the system.

- Pressure sensors, senses hydraulic cylinder pressures.
- Length sensors (LEN), which gives the position of slewing and stabilizer extensions. The LEN sensors are connected to the CAN connection box.
- On/Off sensors which gives position of the stabilizer extensions (if LEN sensor not present). They are connected to the standard box.
- Angle sensors which senses the boom angle.
- Spool position sensors

Wiring diagram complete system



Terminal blocks and inputs

Terminal blocks with screws is named: NNNNN PX.Y

NNNNN: is the name of the box i. e SPACE 4000 ST
X: is the number of the terminal block i.e P**6**
Y: is the connection slot number on the plinth.

Example: SPACE 4000 ST P6.2

The wires are marked with color and numbers.

Our standard is to have:

Slot	Color	Type
1.	Brown	0 V
2.	Red	24 V
3.	Orange	signal
4.	Yellow	signal
5.	Green	signal
6.	Blue	signal
7.	Purple	signal
8.	Grey	signal
9.	White	signal
10.	Transparent	signal

NOTE
Terminal blocks that are used for sensors have two slots where to connect the wires, one for 24 V and one for signal.
Always see the terminal block description for the current box before connecting anything to it.

If there in an two slot terminal block, we start with 24 V on slot 1.

Slot	**Color**	**Type**
1.	Brown	24 V
2.	Red	Signal 4-20 mA

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FUNCTIONS

This section contains functions that SPACE 4000 is equipped with as a standard for the majority of cranes. This section also describes a number of functions that can be obtained with the accessories supplied by HIAB and options that are only program possibilities in SPACE 4000. HIAB has no standard solutions how to apply sensors e.g. Please contact HIAB for information of supply sources of these components.

Overload protection (OLP)

The OLP function is a safety function in SPACE that prevents overloading of the crane, which could result in damage of the crane or in worst case, injury or death of a person. To control the load, pressure sensors in the hydraulic cylinders are used.
For the hoist, there is a type of tension sensor which senses the torque on the hoist.

OLP Basic crane

Depending on the different pressure levels in the first and second boom cylinders, the LED's are illuminated.

- With 50% of maximum permitted load the first LED are illuminated in green.
- With 70% of maximum permitted load the first and second LED’s are illuminated in green.
- With 90% of maximum permitted load 1st, 2nd, 3rd LED’s are flashing in red.
- When reaching 100% of maximum permitted pressure, the OLP cuts in and stops moment increasing movements. All four LED´s are illuminated in red until the overload situation is over.

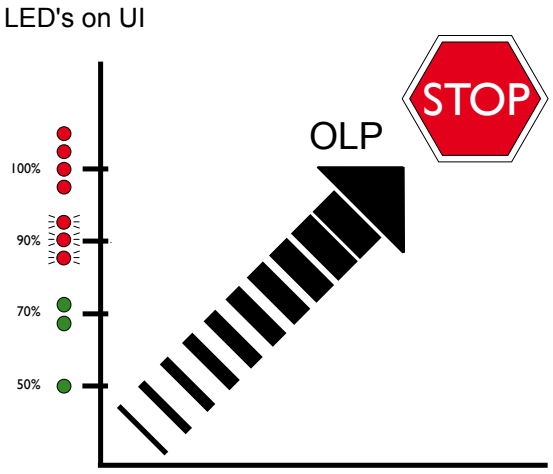


Fig.1

When the second boom is directed upwards (Fig. 2):

- first boom downwards
- second boom downwards
- extension outwards
- first boom upwards (if OLP-pressure in the first boom cylinder).

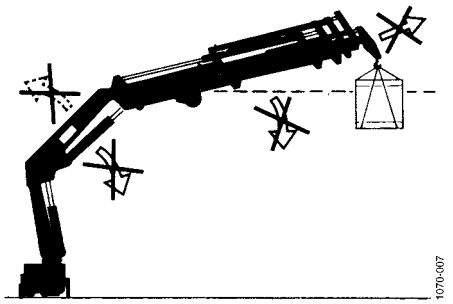


Fig. 2

When the second boom is directed downwards (Fig. 3):

- first boom upwards
- second boom upwards
- extension outwards
- first boom downwards. Applies only if:

- crane has mechanical link
- OLP-pressure in first boom cylinder
- first boom angle more than 25°.

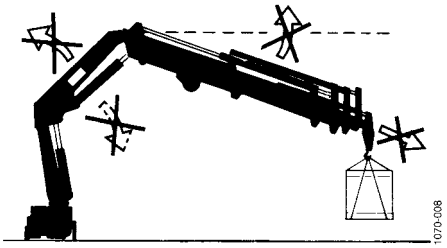


Fig. 3

OLP Hoist

When hoist reaches 90% of permitted load the hoist LED on the User interface starts flashing. At 100% load OLP cuts in, stopping load increasing movements. The LED has a steady red light until the overload situation is over. When the wire is almost completely unwound (three turns left on drum) hoist lowering is stopped. Operator has to hoist in to reverse situation.

OLP release

In certain OLP situations, the first and second booms can be locked. It is then possible to release the OLP for 5 seconds.
Press the "OLP release" button (Fig. 4), while moving one lever (time starts to count when you move the lever)

The red LED will flash. During this period it is possible to operate a suitable crane function to correct the overload situation. Only one unallowed function at a time can be operated. Extension out can't be operated. There is a waiting time of 30 seconds before the release operation can be activated again.

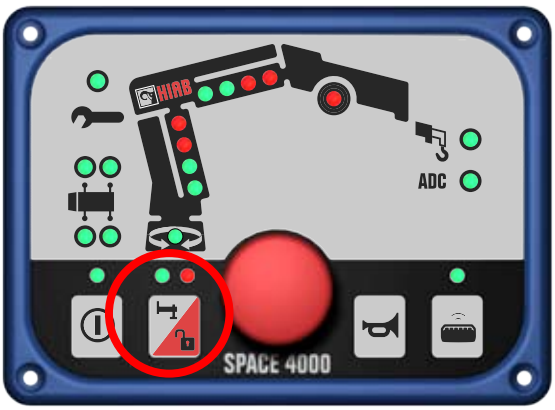


Fig. 4

NOTE!

From software version v3.06 the OLP release has been changed. The wait time is getting longer, in 3 steps, every time release is used during in OLP. The steps will be 30, 60 and maximum 90 seconds.

Automatic Duty Control (ADC)

ADC is a patent pending function in SPACE 4000. The purpose of the ADC function is to increase the lifting capacity with approximately 10 %.

The first boom pressure sensors indicates if there is a positive or negative pressure on the first boom. If the first boom is pressed down during digging or similar operation, the sensor indicates a negative pressure and lifting capacity is 100% during the complete lifting cycle.
If the sensor indicates a positive pressure on the first boom, the lifting capacity is increased to the next lifting cycle. The LED (Fig 5) on the user interface indicates increased capacity due to ADC.

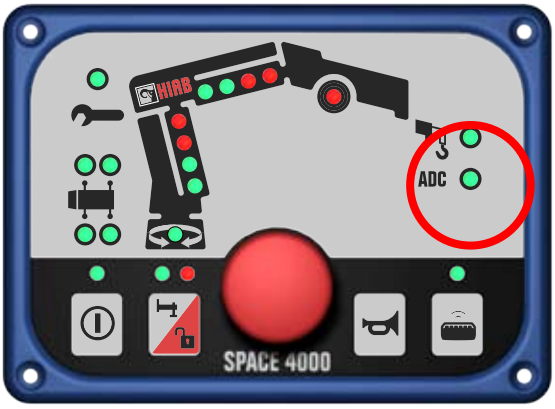


Fig. 5

Automatic Speed Control (ASC)

Automatic Speed Control (ASC) is a function in SPACE 4000, which is protected by patent. When the capacity of the crane is calculated the speed of the crane is an essential factor.
If the speed is reduced, the capacity can be increased without any risk of overloading the crane construction. SPACE continuously receives signals from pressure sensors on first boom, second boom and jib cylinders.

When the load is above approx. 75 % of the maximum allowed load, ASC is activated. SPACE change the signals to the DA2/XSDrive/SDA modules resulting in reduced spool stroke and speed. The speed is continuously reduced. At approx. 95 % of load the speed will be reduced to 25 %. The speed will automatically increase when the load in the cylinder decreases. ASC increases the lifting capacity depending on type of crane.

Automatic damping of slewing (ADS)

On cranes with extended box it is possible to connect ADS to the system. ADS is a system that automatically reduces the oscillations in the slewing function of cranes with many extensions. ADS consists of two pressure sensors and one valve which make it possible to move oil between piston side and piston rod side of slewing cylinder.

Automatic Dumping of Oil (ADO)

To prevent high pressure and thereby unnecessary heating of the oil there is an automatic dumping function. When no lever movement has been made for 3 seconds SPACE system opens the dump valve and the oil is returned directly to the hydraulic tank. As soon as the operator moves a lever the valve closes.

Disconnect ADO

In case that you have a crane with extra valve without spool sensors, you need to disconnect ADO to be able to use the extra valve. If you are not in a OLP situation press the release button to disconnect ADO, then you will have the posibility to work with the second control valve. To reconnect ADO press release button again.

Supervision of spools

If a valve spool's movement is greater than the equivalent lever movement on the controller a safety function is activated (Fig. 6). All pump oil is dumped to the tank, the crane stops. This occurs for example if a control lever on the valve is moved while remote control is engaged.

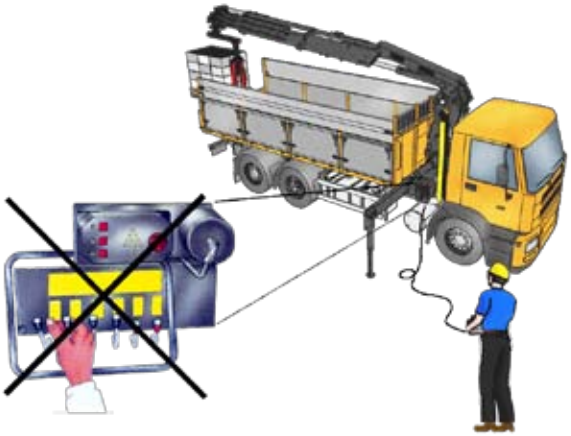


Fig. 6

Stability

VSL

Variable Stability Limit

General description

The VSL function senses the outreach and attachment of the stabilizer legs to the ground which related to that, automatically sets the level of OLP limit. This means that the crane always is working with the highest possible lifting capacity related to stability.

This is controlled by:

- Analogue length sensors or on/off sensors on the stabilizer extensions.
- Analogue slewing sensor.
- Pressure sensors in the stabilizer legs.
- Pressure sensors in boom cylinders.

VSL ASC

The VSL ASC function is used to reduce the slewing speed when the pressure is close to the current VSL OLP value. The VSL ASC function does not consider the crane OLP limit.
The ADS function is temporarily disabled during the state of VSL OLP.

NOTE!
For information how to set the VSL function, see *terminal program manual*.

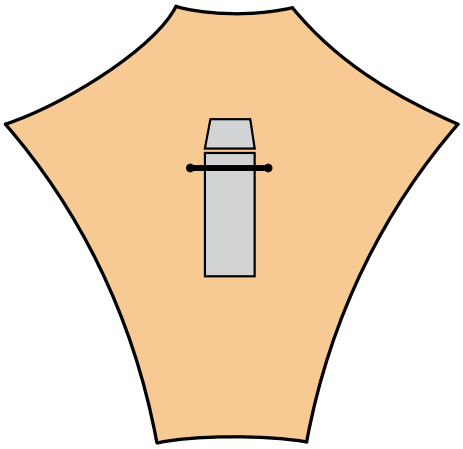


Fig. 7

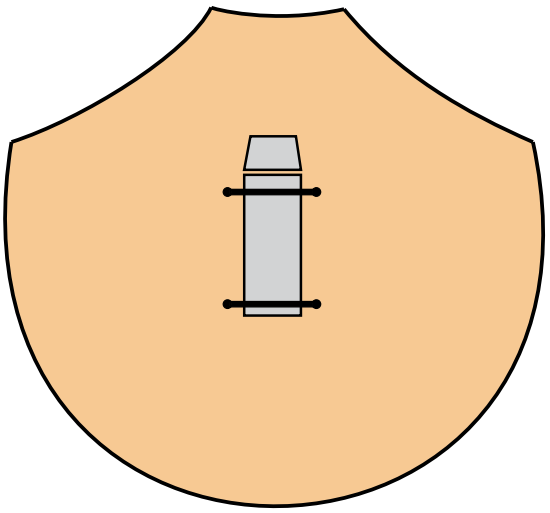


Fig. 8

High boom logic

When working in high position, the crane is very close to its capacity limit. If there should be an unintended movement of the crane it could be a risk that the hydraulic shock valve opens and the crane "falls" down.
To prevent accidents because of unintended movements, there is a function called High boom logic. To control this, SPACE are reading information from the angle sensor and through pressure sensors in the hydraulic cylinders.

> ⚠ WARNING
>
> Care must be taken when handling loads in high lifting area, that load/ tool does not come into contact with the boom system.

The limitations are:

- The maximum second boom angle is limited in relation to the horizontal plane (default is 80º) .
- The maximum jib boom angle is limited in relation to the horizontal plane (default is 80º).
- The OLP algorithm becomes gradually more sensitive using pressure derivatives, at second boom angles >40º
- The down speed is limited at second boom angles (Fig. 10) >40º (default is 50% of the max speeds)
- Still, especially with the load attached to a hoisting cable or using long slings, the use of the crane close to its limits in high boom positions will require a very careful operation of the crane
- To control the speed, the spool movement is controlled by space. This is made by calculations regarding boom angle and load (Fig. 11).

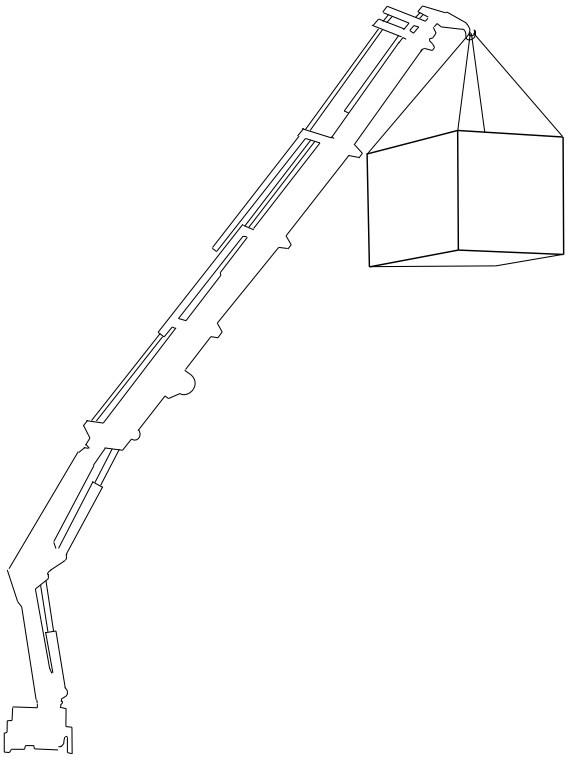


Fig. 9

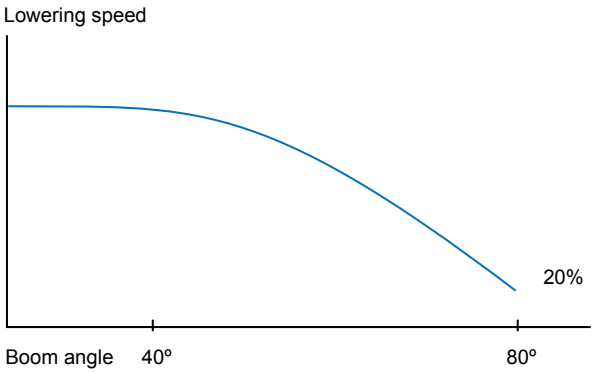


Fig. 10

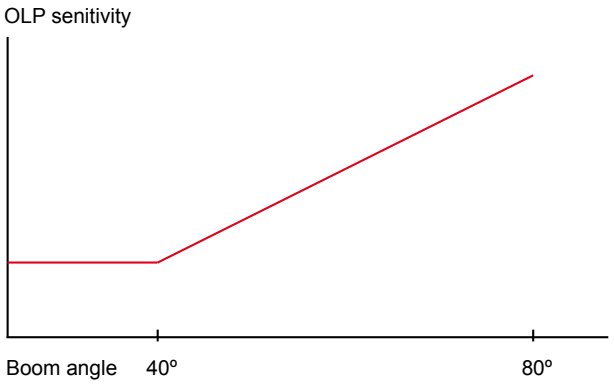


Fig. 11

Stabilizer leg supervision

To prevent unintended movements of the stabilizer legs when there is heavy load on the crane, the stabilizer leg up function is disabled when used crane capacity is > 40% of the maximum lifting capacity.

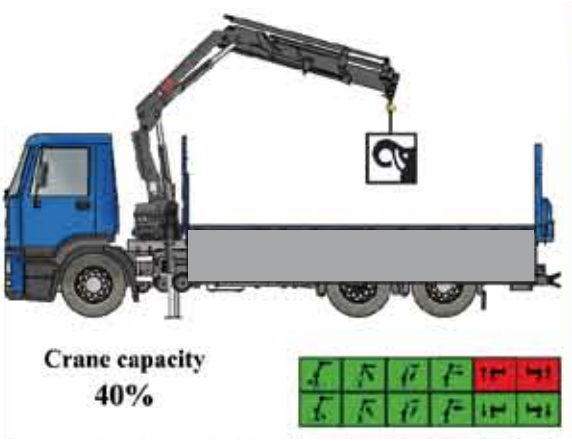


Fig. 12

Transport warning interface TWI

The transport warning interface TWI is used to warn if the crane is in high position or if the stabilizer legs are in locked/unlocked position.
A lamp with buzzer is mounted in the cabin to warn the operator. The buzzer can be silenced by either pressing the acknowledgement button or by activating the parking brake

Fig. 13

LEG box

The leg box is used to warn the surrounding about ongoing activity, by amber light indication. The Leg box also gives information to the operator about the different statuses of the crane.

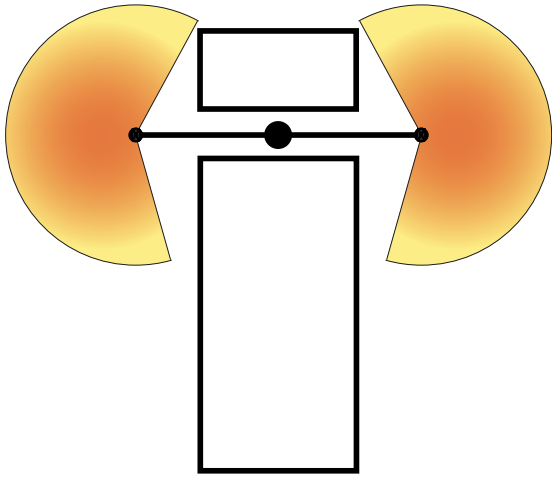


Fig.14

Automatic power off (APO)

In case the operator forgets to switch off the SPACE system, it will switch off itself after 30 minutes.

SPACE 4000 UI

The User Interface is the communication centre of the SPACE 4000. It gives information about the system and also were it is switched on and off.

The User Interface is mounted as a front cover on the Standard Box, but it can also be mounted on an Empty Box. A maximum of four User Interfaces can be fitted on a crane.

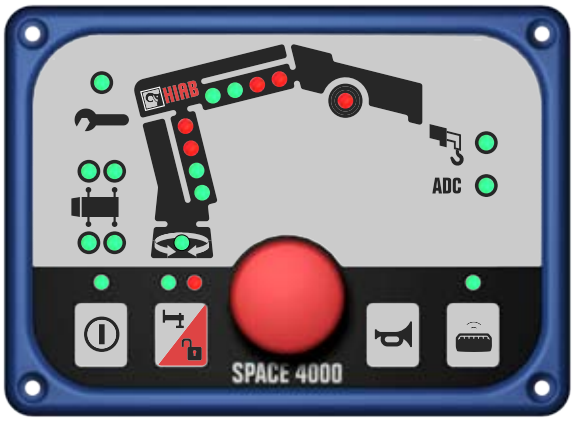


Fig. 1

Control functions on the UI

Buttons

There are a total of 5 buttons on the UI:
Power On/Off, Stabilizer activation/OLP Release, Stop Button, Horn and Remote Control (Fig.2).

1. Power On/Off

Enables power to SPACE.

Lamp test

With this button it is also possible to do a lamp test
To do the test:

1. Press the ON/OFF button for at least 2 sec. The test is activated and all the red LED's are illuminated.
2. Release the button. After 3 sec, all the green LED's are illuminated. The test is finished when all LED's are extinguished.

2. Stabilizer extension activation/ OLP Release

Enables power to:
- Activate stabilizer extension.
- OLP release if crane has OLP

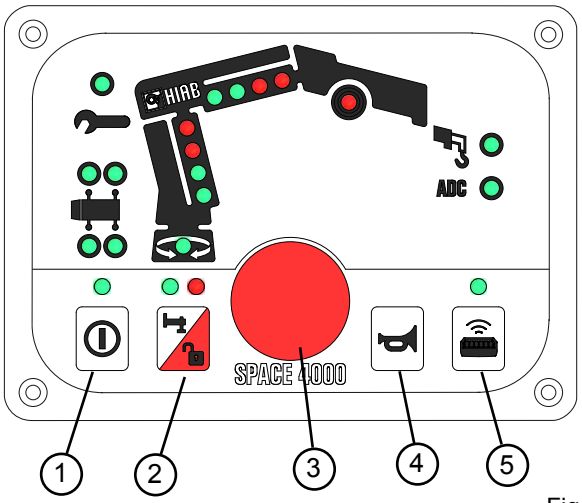


Fig. 2

Fig. 2. Control panel buttons

1. Power on/off.
2. Stabilizer activation/OLP Release.
3. Stop button.
4. Horn.
5. Remote control

3. Stop Button

In an emergency situation the Stop Button is pressed. Power to the dump valve is cut and the crane stops. Turn the stop button clockwise to reset.

4. Horn

Enables power to the horn if present.

5. Remote Control

Button to activate remote rontrol. Press and release to activate, repeat to de-activate.

Indicator LED´s

The display contains LED`s which indicates button positions, errors, stability, hoist etc.
For detailed information, see table below (Fig. 3).

1. Power On, green

On: System is on
Blinking: Dump power to SPACE is interrupted due to a stop button is pressed or remote is selected but not active

2. VSL:Variable Stability Limit

Green	Full capacity
Light off:	Reduced capacity due to stability.
Red light on:	VSL OLP. Vehicle has reached a stability limit. (Also all first boom diodes will light red).

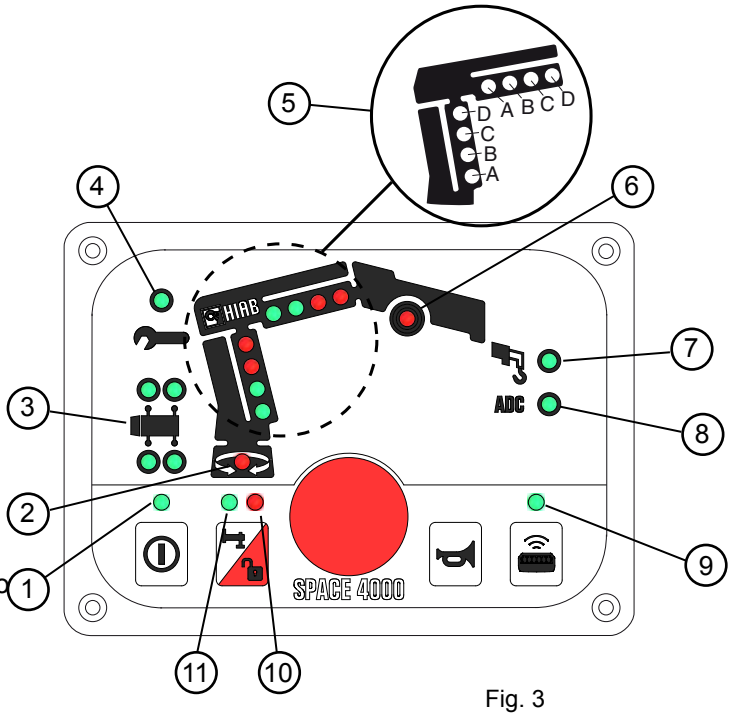


Fig. 3

Fig. 16. Control panel, Indicator LED´s:

1. Power On
2. VSL indication
3. Stabilizer leg/extension
4. Service/error
5. Cylinder pressure LED's
6. Hoist
7. Manual extension
8. ADC
9. Remote Control
10. OLP Release/Dump 2
11. Dump1

3.  Stabilizer leg/extension

Green light on: Stabilizer extension fully out and leg fully set.

Lamp blinking: Stabilizer leg set.

but stabilizer extension is not fully out.

Red light on: Stabilizer leg overload.

4. Service indicator.

Green light on: Time to service the crane.

Red light on: A non critical error detected in the system. Does not stop crane movements.

Red light flashing: Critical error stopping crane. Diagnostic required. Press release to be able to use the crane

5. Cylinder pressure LED's

Green light A on: 50% of OLP pressure.

Green light A - B on: 70% of OLP pressure.

Red light A - C flashes: 90% of OLP pressure.

Red light A - D on: 100% of OLP pressure.

Blinking from A to D: OLP Release.

6. Hoist.

Green On: Hoist mode
Red Flashing: 90 % of OLP pressure
Red On: 100 % of OLP pressure
Red Flashing fast: The outer boom is over a given angle when the system is switched off.

7. ADC, green.

LED to show if crane is working in ADC mode.
If the system type ADC is not selected,
LED is always off.
On: Crane is working with ADC (added) capacity.
Off: Crane is working with normal capacity

8.  Manual extension, green

On: Manual extension logic on.
Off: Manual extension logic off

9.  Remote Control

Steady Green: Remote control on.
Blinking Green: Stop button pressed.
Blinking Red: Radio Interference.

10.  Stabilizer leg activation/ OLP Release, red

On: OLP
Blinking red: Release button pushed and allowed to run crane (OLP case)
Steady green: Dump valve 2 on (if dump valve 2 present)

11.  Stabilizer leg activation/ OLP Release, green

On: Dump 1 active.

Jumpers

The jumpers are located in the back of the User Interface. There is one row with five jumpers (Fig. 4).

Jumper settings SPACE 4000 UI:

-The four jumpers (B1-4), tells the standard box which address the current UI has.
The first UI is strapped at jumper slot UI 1
The second at UI 2 and so on.
-The fifth jumper (nc) is not used, strapping has no effect.

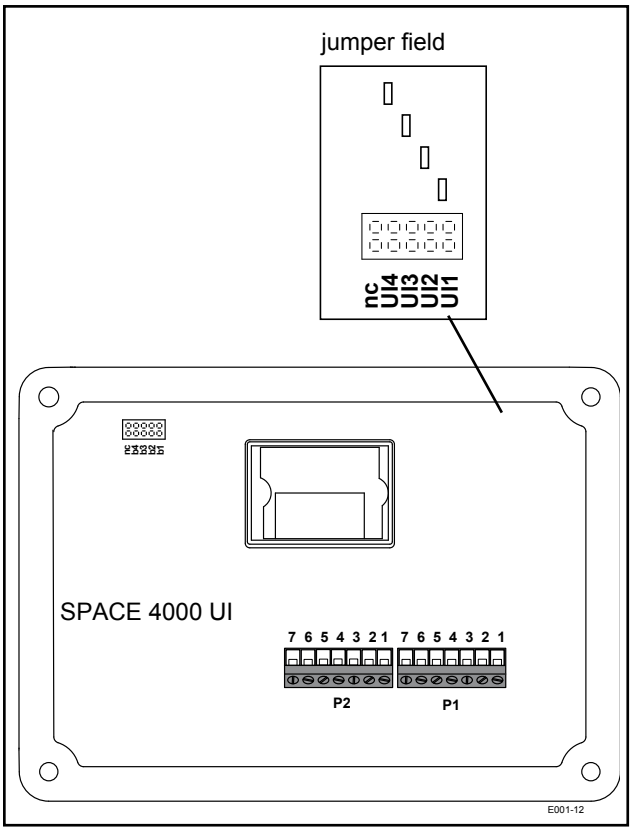


Fig. 4

Terminal blocks on SPACE 4000 UI

Plinth	Description
P1	**CAN IN**
P1.1	0V
P1.2	24V
P1.3	CAN H
P1.4	CAN L
P1.5	Stop Button from ST box
P1.6	Stop Button in to ST box
P1.7	On/Off of the system
P2	**CAN OUT**
P2.1	0V
P2.2	24V
P2.3	CAN H
P2.4	CAN L
P2.5	Stop Button from ST box
P2.6	Stop Button in to ST box
P2.7	On/Off of the system

NOTE: If no connections are made to the CAN out plinth (P2) a bridge wire must be fitted between P2.5 & P2.6. If no bridge wire is fitted, error code E3 being displayed.

SPACE 4000 ST

The standard box is the central unit of the system. It consists of three parts, a micro processor, a connection terminal board and a display.
The standard box distributes power to all the other modules of the system. Nominal supply is 24 V DC, but the system will fully operational between 16 V - 32 V DC.

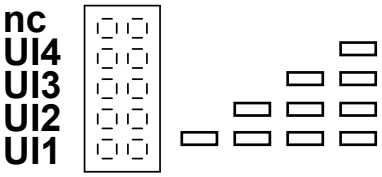
There is a three digit indicator (1) in the box which displays a number if an error code should occur in the system. It also indicates the number of errors that is present in the system.
Example: Digit 2. followed by 003 and 110 indicates that there are two error codes, 003 and 110 present in the system.

The ST box is equipped with a 10 A main fuse for the power supply.

There is also a jumper field (2) (Fig. 1) which shows the number of UI's connected to the system.

Jumper settings SPACE 4000 ST:

Fit the number of jumpers according to the numbers of User Interface connected to the system.



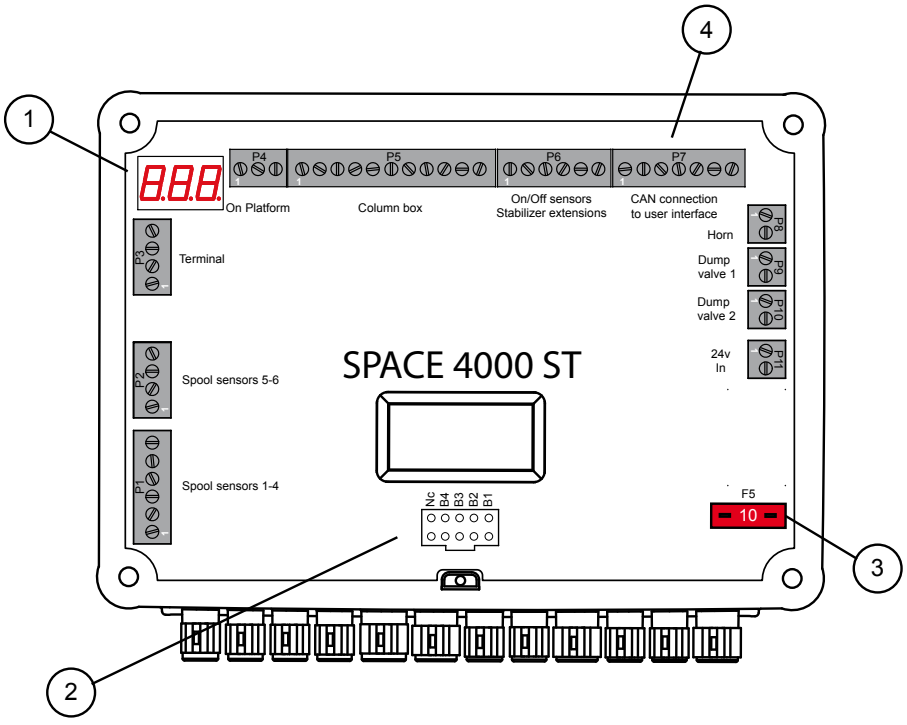


Fig. 1.

1. Status display
2. Jumper field
3. 10A Fuse
4. Terminal blocks

Parts connected to SPACE ST

1. Spool sensors
2. Diagnostic connector
3. On platform indicator (OPS)
4. Column box
5. On/Off sensors stabilizer extensions
6. Output to next unit CAN
7. Horn
8. Dump valve 1&2
9. 24 v input

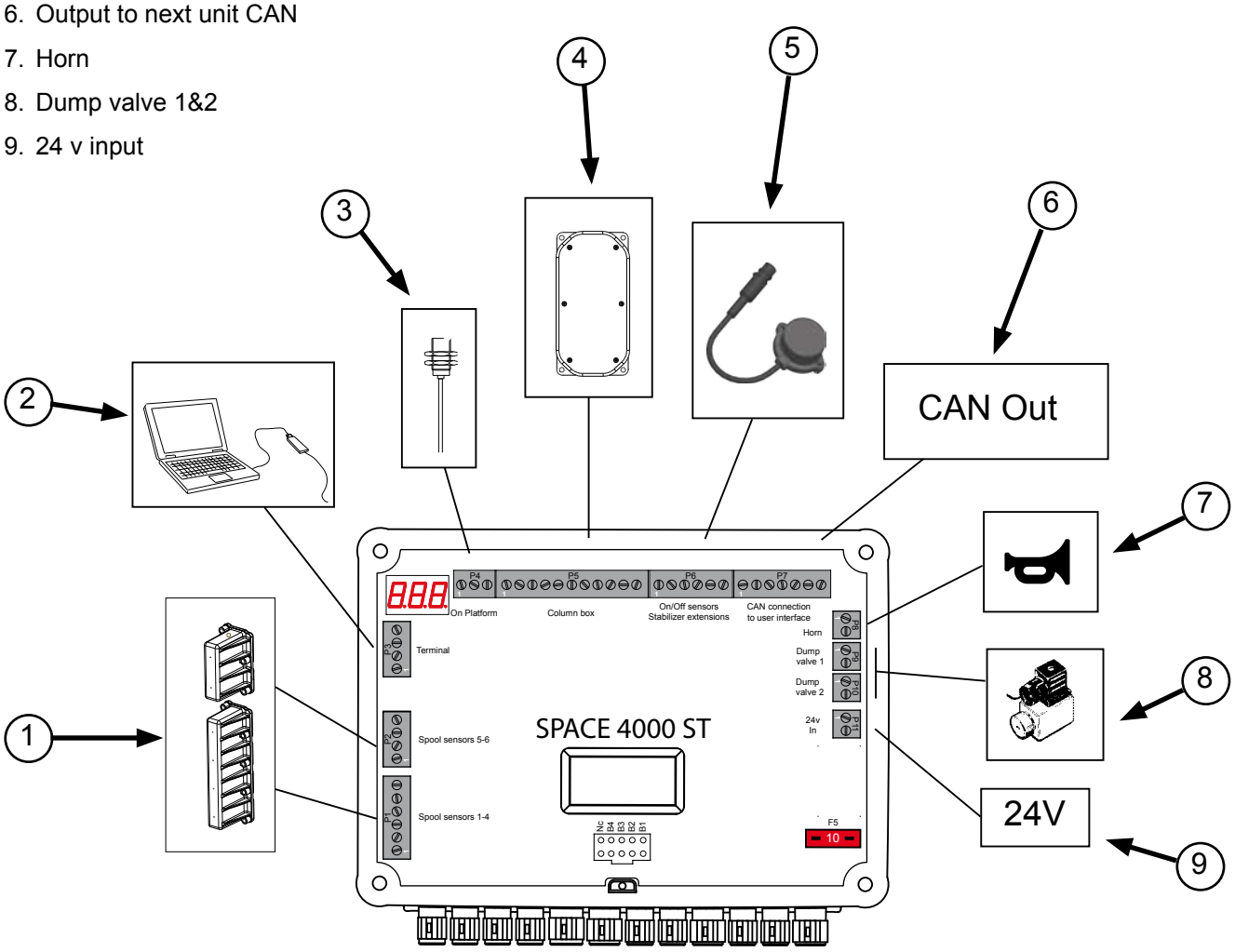


Fig. 2.

Terminal blocks on SPACE 4000 ST

Block Description

P1 From spool sensors 1-4

P1.1 0V
P1.2 24V
P1.3 Analog input: Spool sensor 1 (0-5V)
P1.4 Analog input: Spool sensor 2 (0-5V)
P1.5 Analog input: Spool sensor 3 (0-5V)
P1.6 Analog input: Spool sensor 4 (0-5V)

P2 From spool sensors 5-6

P2.1 0V
P2.2 24V
P2.3 Analog input: Spool sensor 5 (0-5V)
P2.4 Analog input: Spool sensor 6 (0-5V)

P3 Communication with terminal

P3.1 0V
P3.2 24V
P3.3 Data out
P3.4 Data in

P4 From on platform indicator/manual extension in indicator

P4.1 0V
P4.2 24V
P4.3 Digital input:
on platform indicator

P5 From column box

P5.1 0V
P5.2 24V
P5.3 Analog input: Inner boom pressure sensor (4-20 mA)
P5.4 Analog input: Outer boom pressure sensor (4-20 mA)
P5.5 Analog input: Outer boom tilt indicator (4-20 mA)
P5.6 Analog input: Inner boom tilt indicator (4-20 mA)
P5.7 Analog input: Hoist indicator (4-20 mA)
P5.8 Analog input: Second inner boom tilt indicator (for platform logic) (24V)
P5.9 Digital input: Extensions out indicator /
P5.10 Analog input: Inner boom rod side pressure sensor (4-20 mA)
P5.11 Analog input: Outer boom rod side pressure sensor (4-20 mA)

P6 Stabilizer extension sensors

P6.1 0V
P6.2 24V
P6.3 Digital input: Stabilizer extension fully out
P6.4 Digital input: Stabilizer extension fully out
P6.5 Digital input: Stabilizer extension 2/3 out
P6.6 Digital input: Stabilizer extension 2/3 out

P7 CAN (From/to Cover 1)

P7.1 0V
P7.2 24V
P7.3 CAN H
P7.4 CAN L
P7.5 Emergency stop out
P7.6 Emergency stop in
P7.7 on/off

P8 Horn

P8.1 0V
P8.2 HORN (24V, 2A)

P9 Dump valve 1

P9.1 0V
P9.2 24V

P10 Dump valve 2

P10.1 0V
P10.2 24V

P11 POWER IN

P11.1 0V truck
P11.2 24V truck (15-35V, 10A)

Note: P11 0V and 24V on this plinth don't have the same potential as the other plinths in the system because there is a filtering unit between them.

One x 5 position jumper field, used to tell the 4000 standard box the number of the user interfaces (UI) in the system. It is possible to use up to 4 user interfaces in the SPACE 4000 system.

SPACE RELAY BOX

The Relay Box can activate eight 24 V outputs. This can be used for work lamps or start/stop of the engine. 24 V power supply from vehicle is connected into this box. There can be a maximum of 4 boxes in the system. The relay box communicates via the CAN network.

Fig. 1

Functions

CAN LED

The CAN LED is placed in the lower left corner inside the box. (Fig. 1,2)

1. Flashing Red	CAN protocol missing or strapping error
2. Flickering Green	SPACE system switched On, Stop button Out.
3. Flashing Green	SPACE system switched On, Stop button In.

Status LED

The Status LED is placed in the lower right corner inside the box.

1. Steady Green	Relays Ok, external and CAN supplies present.
2. Flashing Red	Relay malfunction. All relay outputs are disabled.

Relay output LED´s

There is additional LED´s connected to the relay outputs P3 - P10. The LED for each output turns green when a relay function is activated (Fig. 2).

Jumpers

The jumpers are located in the lower middle of the relay box (Fig. 2)
There is one row with five jumpers.

Jumper settings relay box:

-The four jumpers (B1-4), tells the standard box which address the current relay box has.
The first relay box is strapped at jumper slot b1
The second at b2 and so on.
-The fifth jumper (nc) is not used, strapping has no effect.

Fuses

There is a automatic fuse for each relay output and one common15 A main fuse for all outputs.

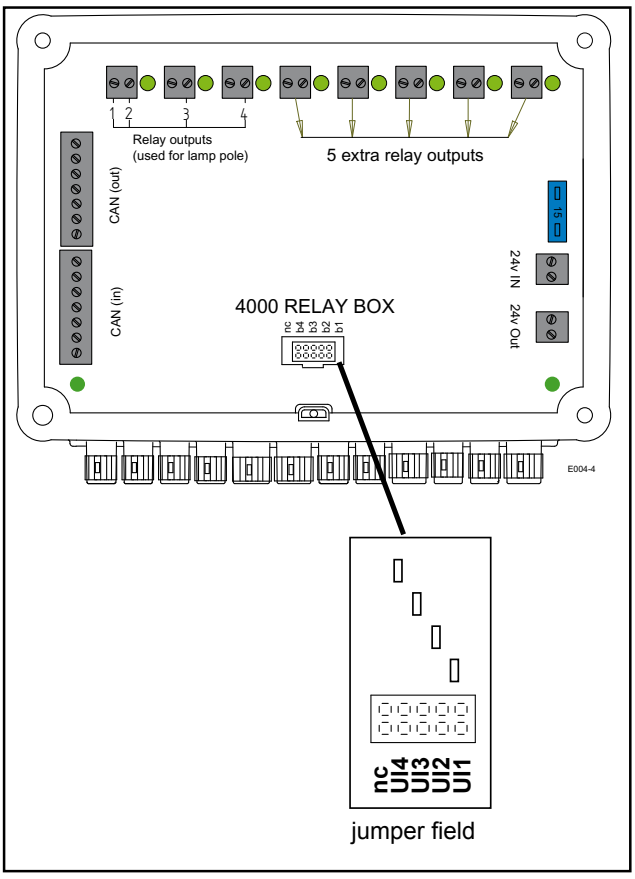


Fig. 2

Relay box up to box serial number 15013

Parts connected to relay box

1. Relay outputs (used for lamp pole)
2. 5 extra relay outputs
3. 24 V input from vehicle
4. 24 V output to SPACE ST
5. Inputs (from prev control box)
6. Outputs (to next control box)v

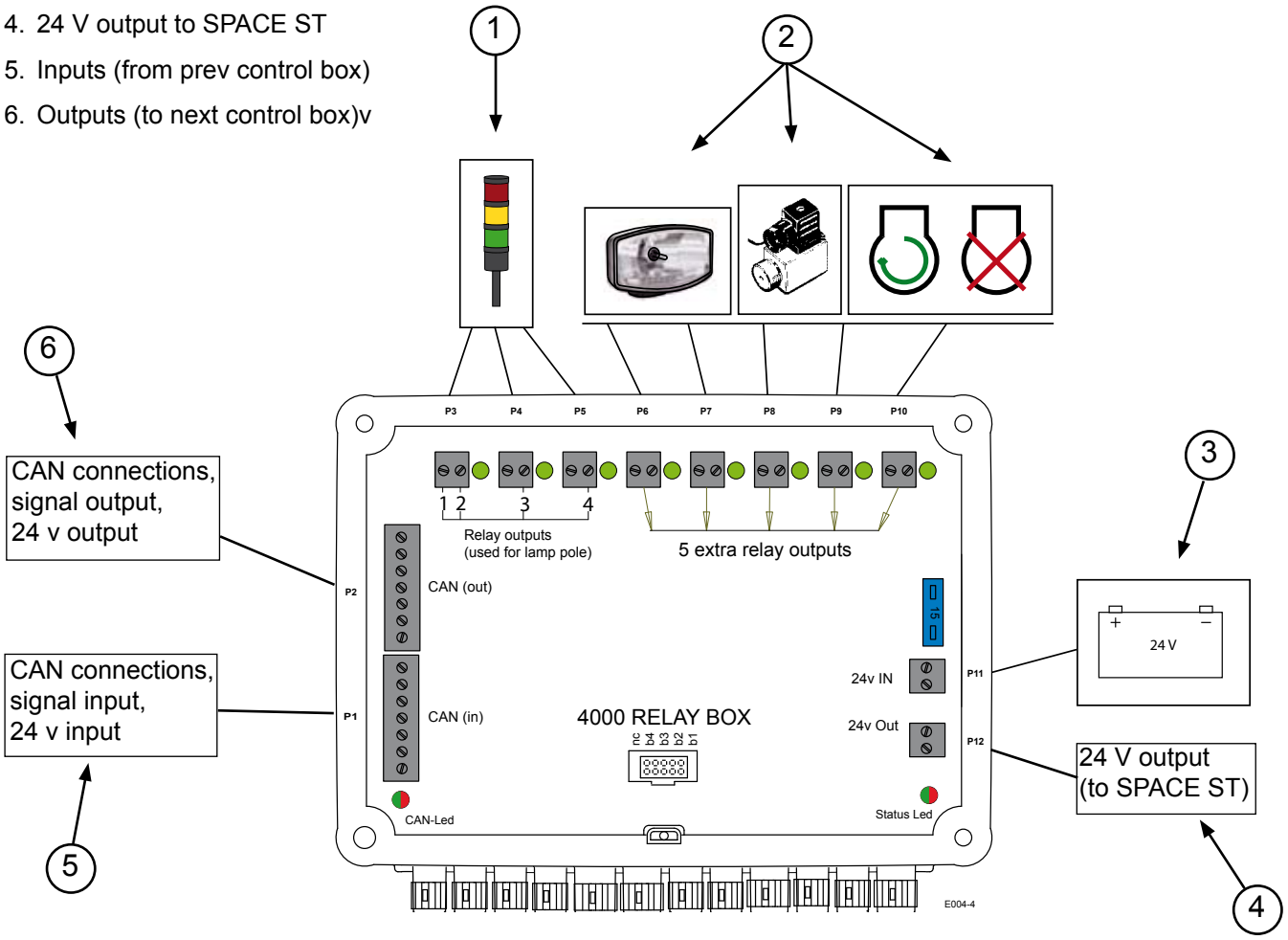


Fig. 3

Terminal blocks on SPACE relay box up to serial number 15013

Block	Description
P1	**CAN in**
P1.1	0V
P1.2	24V
P1.3	CAN H
P1.4	CAN L
P1.5	Emergency stop out
P1.6	Emergency stop in
P1.7	On/off
P2	**CAN out**
P2.1	0V
P2.2	24V
P2.3	CAN H
P2.4	CAN L
P2.5	Emergency stop out
P2.6	Emergency stop in
P2.7	On/off
P3	**Relay 1**
P3.1	0V Truck
P3.2	Relay 1 out, 24V 2A
P4	**Relay 2**
P4.1	0V Truck
P4.2	Relay 2 out, 24V 2A
P5	**Relay 3**
P5.1	0V Truck
P5.2	Relay 3 out, 24V 2A
P6	**Relay 4**
P6.1	0V Truck
P6.2	Relay 4 out, 24V 2A
P7	**Relay 5**
P7.1	0V Truck
P7.2	Relay 5 out, 24V 2A
P8	**Relay 6**
P8.1	0V Truck
P8.2	Relay 6 out, 24V 2A
P9	**Relay 7**
P9.1	0V Truck
P9.2	Relay 7 out, 24V 2A
P10	**Relay 8**
P10.1	0V Truck
P10.2	Relay 8 out, 24V 2A
P11	**24V In**
P11.1	0V Truck
P11.2	24V Truck
P12	**24V Out**
P12.1	0V Truck
P12.2	24V Truck

Relay box from box serial number 15013

Parts connected to relay box

1. Relay outputs
2. 24 V output to SPACE ST
3. 24 V output to oil cooler
4. 24 V input from vehicle
5. Inputs (from prev control box)
6. Outputs (to next control box)

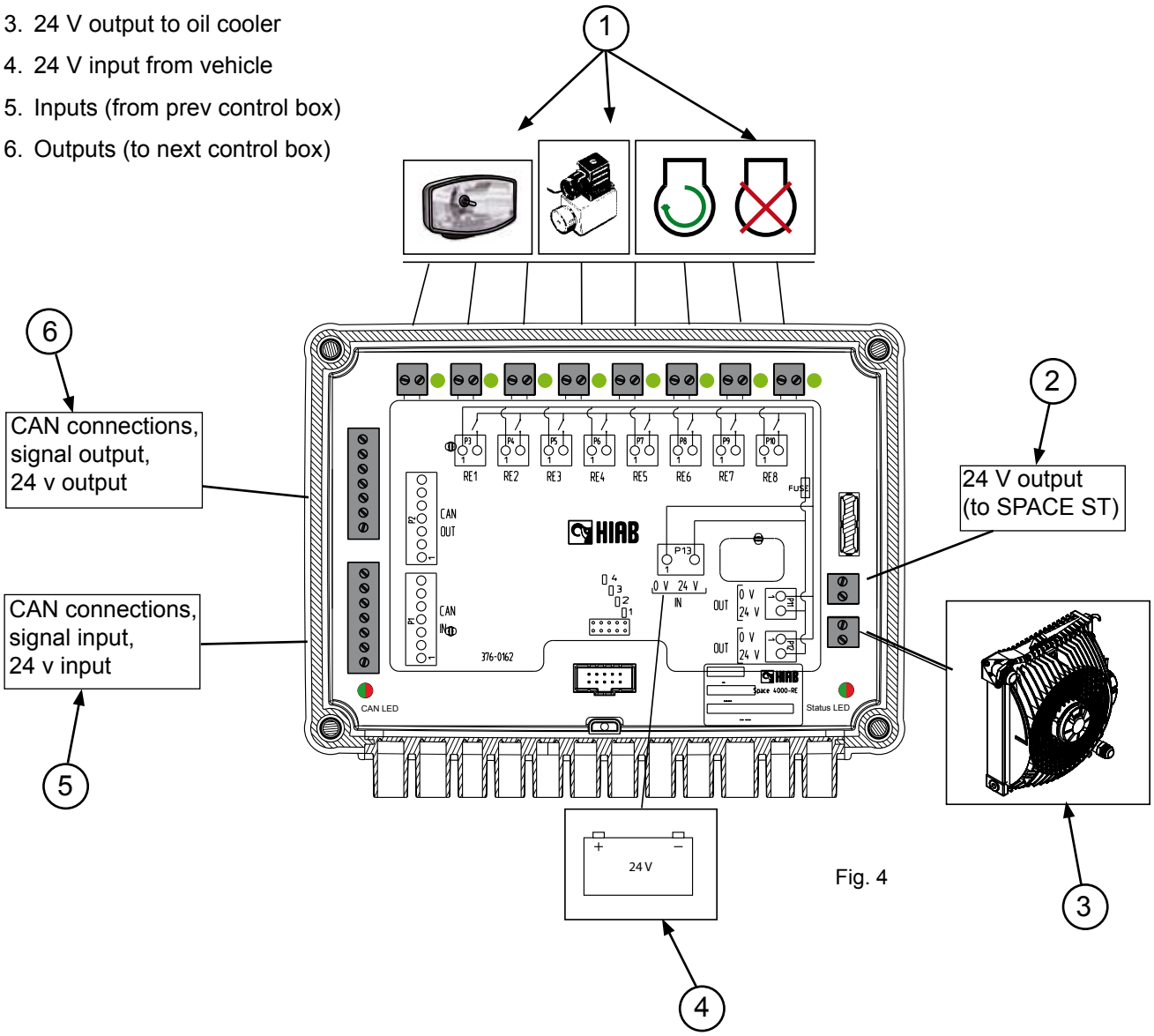


Fig. 4

Description of LED's

CAN status LED´s

The CAN LED is placed in the lower left corner inside the box.
Depending of status it will illuminate in three ways:

1. Flickering Green	SPACE system switched On, Stop button Out.
2. Flashing Green	SPACE system switched On, Stop button In.
3. Flashing Red	CAN protocol missing or strapping error

Status LED´s

The Status LED is placed in the lower right corner inside the box.
Depending of status it will illuminate in two ways:

1. Steady Green	Relays Ok, external and CAN supplies present.
2. Flashing Red	Relay malfunction. All relay outputs are disabled.

Relay output LED´s

There are additional LED´s connected to the relay outputs P3 - P10.
The LED for each output turns green when a relay function is activated.

Jumpers

There is one row with five jumpers

Jumper settings relay box:

Jumpers B1-4 tells the standard box which the current relay box have.
Up to 4 relay boxes can be used in the system.

Fuses

The box are equipped with automatic fuses for the relay outputs and one one common15 A main fuse for all outputs.

Terminal blocks on SPACE relay box

Block	Description
P1	**CAN in**
P1.1	0V
P1.2	24V
P1.3	CAN H
P1.4	CAN L
P1.5	Emergency stop out
P1.6	Emergency stop in
P1.7	On/off
P2	**CAN out**
P2.1	0V
P2.2	24V
P2.3	CAN H
P2.4	CAN L
P2.5	Emergency stop out
P2.6	Emergency stop in
P2.7	On/off
P3	**Relay 1**
P3.1	0V Truck
P3.2	Relay 1 out, 24V 2A
P4	**Relay 2**
P4.1	0V Truck
P4.2	Relay 2 out, 24V 2A
P5	**Relay 3**
P5.1	0V Truck
P5.2	Relay 3 out, 24V 2A
P6	**Relay 4**
P6.1	0V Truck
P6.2	Relay 4 out, 24V 2A
P7	**Relay 5**
P7.1	0V Truck
P7.2	Relay 5 out, 24V 2A
P8	**Relay 6**
P8.1	0V Truck
P8.2	Relay 6 out, 24V 2A
P9	**Relay 7**
P9.1	0V Truck
P9.2	Relay 7 out, 24V 2A
P10	**Relay 8**
P10.1	0V Truck
P10.2	Relay 8 out, 24V 2A
P11	**24V Out**
P11.1	0V Truck
P11.2	24V Truck
P12	**24V Out**
P12.1	0V Truck
P12.2	24V Truck
P13	**24 V In**
P13.1	0V Truck
P13.2	24V Truck

XSDrive

Fig. 1

The Receiver Box (Fig. 1).is used with XSDrive hand controller. It is both a receiver and output box. It consists of a combined radio receiver and 12 outputs for servo valves. The inboard receiver in the box is communicating with the transmitter fitted in the XSDrive hand controller. Each transmitter is programmed to communicate with its own receiver only.
The unit has no internal antenna, a separate antenna is mounted on the equipment and connected to the reciever by a cable.
One Receiver Box supports 12 proportional functions. The controller has 4 menus which gives the possibility of using up to 24 proportional functions by using 2 receiver boxes. Up to 3 receiver boxes can be used in one system.

Indicator LEDS´s

Inside the box is four indicator LED´s (Fig. 2), which is visible first after the lock is removed.

1. Red Error = Error, radio signal corrupted
2. Green Data = Radio data is ok
3. Yellow Squelch = Carrier detected
4. Green Power = Power to the system

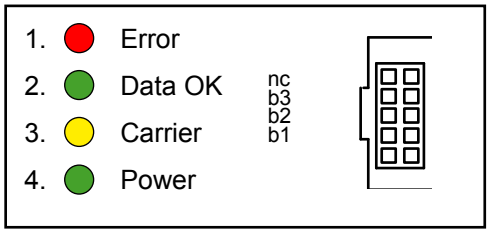


Fig. 2

Jumper settings XSDrive:

Inside the box there is a jumper field.
Slot 1 – 3 is used to set the address in the system. The one programmed as number 1 will be the receiver, the others will just be extra distribution boxes for extra functions.
The fields "nc" and ext_ant are not used.

Fuses

The Receiver Box is equipped with automatic fuses.

Radio

The inboard receiver in the box is communicating with the transmitter fitted in the XSDrive hand controller.
Each transmitter is programmed to communicate with its own receiver only. When transmission is disturbed, it is possible to change the channel. There are a maximum of 12 channels available.

Antenna

The unit has no internal antenna (compare to the receiver for HiDrive). An external antenna (Fig. 3) is connected inside the box (Fig. 4).

Remote Control Cable.

It is possible to connect a remote cable between the Hand Controller and the Receiver Box. The cable is connected to terminal block No. P9 (Fig. 4). When the cable is connected the radio communication is automatically disabled.

Fig. 3

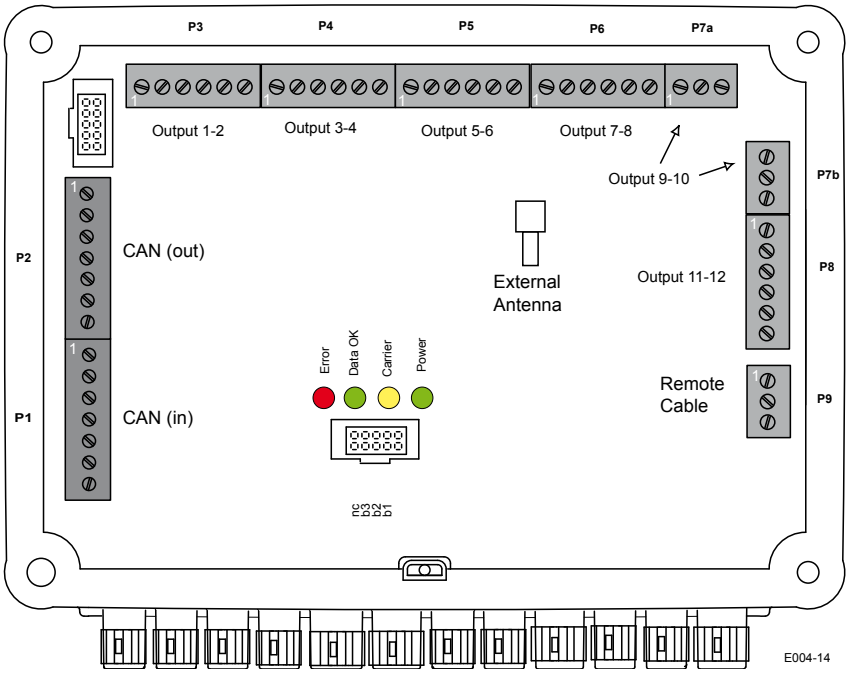


Fig. 4

Terminal blocks on XSDrive radio reciever

Plinth	Description
P1	**CAN in**
P1.1	0V
P1.2	24V
P1.3	CAN H
P1.4	CAN L
P1.5	Emergency stop out
P1.6	Emergency stop in
P1.7	On/off
P2	**CAN out**
P2.1	0V
P2.2	24V
P2.3	CAN H
P2.4	CAN L
P2.5	Emergency stop out
P2.6	Emergency stop in
P2.7	On/off
P3	**Output 1-2**
P3.1	0V
P3.2	Output Valve 1-1
P3.3	Output Valve 2-1
P3.4	Output Valve 2-2
P3.5	Output Valve 1-2
P3.6	0V
P4	**Output 3-4**
P4.1	0V
P4.2	Output Valve 3-1
P4.3	Output Valve 4-1
P4.4	Output Valve 4-2
P4.5	Output Valve 3-2
P4.6	0V
P5	**Output 5-6**
P5.1	0V
P5.2	Output Valve 5-1
P5.3	Output Valve 6-1
P5.4	Output Valve 6-2
P5.5	Output Valve 5-2
P5.6	0V
P6	**Output 7-8**
P6.1	0V
P6.2	Output Valve 7-1
P6.3	Output Valve 8-1
P6.4	Output Valve 8-2
P6.5	Output Valve 7-2
P6.6	0V
P7A	**Output 9-10**
P7A.1	0V
P7A.2	Output Valve 9-1
P7A.3	Output Valve 10-1
P7B.	**Output 9-10**
P7B.1	Output Valve 10-2
P7B.2	Output Valve 9-2
P7B.3	0V
P8	**Output 11-12**
P8.1	0V
P8.2	Output Valve 11-1
P8.3	Output Valve 12-1
P8.4	Output Valve 12-2
P8.5	Output Valve 11-2
P8.6	0V
P9	**Remote cable**
P9.1	24V
P9.2	Data
P9.3	0V

Contents

XSDrive hand controller

The XSDrive hand controller is used to remote control the crane. The communications are made with radio signals from an built-in transmitter or by cable.
The hand controller has six proportional levers for up to 24 functions divided in four menus.

On the control panel there are push buttons for relay on/ off-functions, buttons for function control and indicator LED´s.
The bottom part contains Stop button, battery and cable remote connector.
The battery is a 1500 mAh NiMH.
Indicator light on the controller lights steady red when the battery becomes weak and the horn will sound two times.

NOTE!
Make sure that the stop button is pushed in before changing the battery.

Fig. 1

Fig. 2

Functions

Stop Button

A red Stop Botton is placed on the right hand side of the hand controller. When pressed in, all crane movements are immediatelly stopped. The stop button should be pressed in when you are not using the controller. To release, turn clockwise.

NOTE!
Because of possible electromagnetic interference, the hand controller should not be used closer than 1,0 metre to the receiver.

Levers

The Hand Controller has six proportional function levers (Fig. 3), one red lever and five black levers. Up to 24 functions in 4 menus can be programmed (se Menu Control). The symbols on the Lower Protection bow can be changed (se Symbol Sheet). Levers can also be used for controlling relay functions.

Fig. 3

Buttons

There are a total of 14 buttons on the controller (Fig. 4).
Seven relay buttons, four function buttons, one toggle menu button and and non active buttons. The on/off relay buttons can be set to operate various functions controlled by the SPACE Relay Box. No function labels are fitted as the function can becustomized and shall be set during installation (see Menu Control).

1. Relay On/Off button No. 1

2. Relay On/Off button No. 2

3. Relay On/Off button No. 3

4. Not active

5. ▲ Menu toggle button

The group toggle button allows the operator to select the menu, 1-4, of functions to be controlled by the proportional levers. The menus LED (10) (Fig. 5) indicates in
what menu you are at the moment.

6. OLP Release button.

Has the same function as the OLP release button on the SPACE user interface. Warning Led's will display in sweeping sequence on user interface during release operation.

7. Horn button.

Once the hand controller is activated the horn button can be used to sound the crane horn.

8. Speed selector button

There is a memory function for crane operating speed which means that it will start in the mode it was when hand controller was swithed off. The speed is selected by pushing the button, a LED (7) lights up when you are in low speed mode. Leopard symbol = normal operation, snail symbol = reduced speed.

9. Relay On/Off button No. 4

10. Relay On/Off button No. 5

11. Relay On/Off button No. 6

12. Relay On/Off button No. 7

13. Channel switch button

One push and the hand controller changes the radio frequency channel in case of radio interference. One push one channel, two pushes two channels. Total there are 12 channels.

14. Not active

Can be used as relay button 8.

15. Manual Extension

Manual Extension is activated by simultaniously pressing OLP Release (6) and Horn (7) buttons.

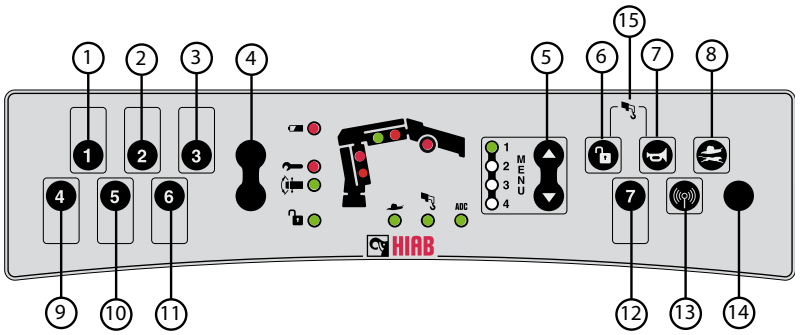


Fig. 4

Fig. 4. Control panel; Buttons

1. Relay On/Off button No. 1
2. Relay On/Off button No. 2
3. Relay On/Off button No. 3
4. Not active
5. Menu buttom
6. OLP Release button
7. Horn button
8. Low Speed button
9. Relay On/Off button No. 4
10. Relay On/Off button No. 5
11. Relay On/Off button No. 6
12. Relay On/Off button No. 7
13. Channel Switch button
14. Not active
15. Manual Extension

Indicator LED´s

The control panel has indicator LED`s which indicates button positions, errors, stability sector, hoist etc. For detailed information, see table below (Fig. 5).
There are also two groups of LED`s in the first boom and second boom. Each group contain two LED`s. Two are two-coloured, green/red, and two are red. The purpose of the LED`s is to show the pressure in the cylinders. For detailed information, see table below.

1. Battery indicator
- Lights constant red when the power is low.

2. Service indicator
- Lights constant red when SPACE gives an error code.

3. Stability sector
- Indicates when the crane is in a stability sector.

4. OLP Release
- Lights constant red when you are in OLP. Blinking when OLP Release.

5.Cylinder LED's (both cylinders)
- 70% lower constant green
- 90% lower blinking red
- 100% Lower + upper constant red

6. Hoist
- 90% blinking red
- 100% constant red

7. Low speed
- Lights constant green in low speed mode.

8. Manual extension
- Lights constant green in man ext mode .

9. ADC ADC
- Lights constant green in ADC mode.

10. Menu LED's
- Indicates by constant green light the active menu. Menu LED 1 is flashing, the hand controller is waiting for radio contact.
Menu LED's 1, 2, 3, 4, are flashing simultaneously when the hand controller is locked. To unlock the hand controller read the *General operations* in this chapter.
If LED 1 & 2 is flashing simultaneously the radio link is disabled and the hand controller can only be used together with cable.
How to enable or disable the radio is described in: *S3000 Win terminal progam manual.*

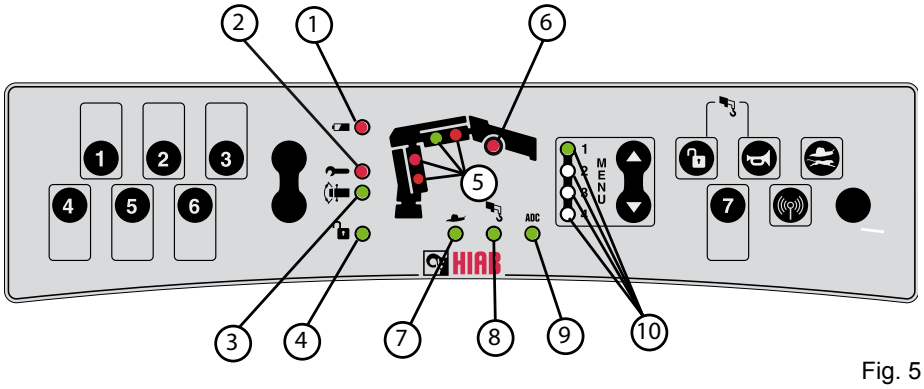


Fig. 5

Control panel Indicator LED´s:

1. Battery Indicator.
2. Service Indicator.
3. Stab Indicator.
4. OLP Release.
5. Cylinder LED´s.
6. Winch.
7. Low Speed.
8. Manual Extension.
9. ADC.
10. Menu LED´s.

Menu Control

There are four lever menus available for controlling the levers. It is possible to set the number of active menus in the SPACE program (see **Terminal Program Settings**). It is also possible to set the behavior of the Menu button. it can be “rolling”: 1, 2, 3, 4, 1… or the other way 1, 4, 3, 2, 1… It can also stop at the ends: 1, 2, 3, 4 and back 4, 3, 2, 1. Default setting is stop at the ends.
The radio always starts up in menu one.

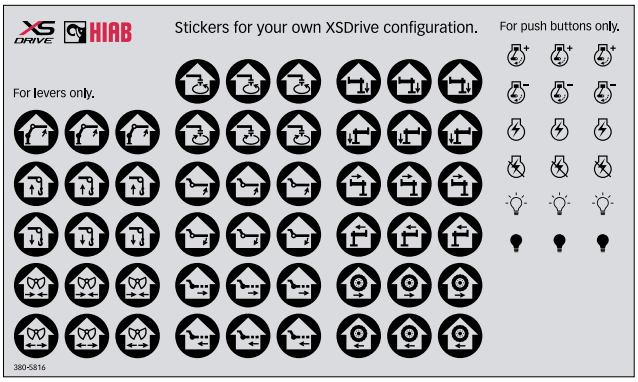
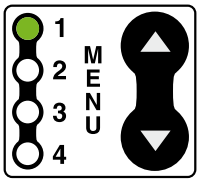
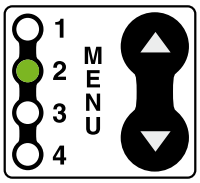
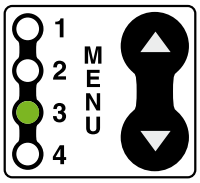
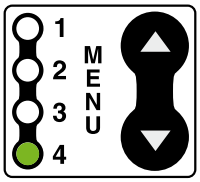
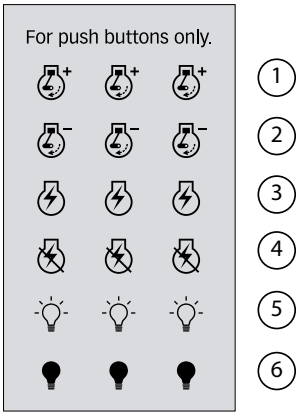


Fig. 6

Exemple of menu:

Menu 1
Slewing, first boom, second boom, extension boom, tools, jib, winch, etc. 
Menu 2
[option] (If crane is equipped with remote controlled stabilizers) 
Menu 3
[option] (If crane is equipped with extra remote controlled stabilizer) 
Menu 4
[option] 



Stickers for buttons:
1. Engine speed up.
2. Engine speed down.
3. Start engine.
4. Stop engine.
5. Light on.
6. Light off.

Fig. 7

Symbol Sheet for Levers and Buttons

The Hand Controller is delivered with a sheet of stickers with symbols (Fig. 6). The big stickers can be placed on the Lower Protective bow to make new signs for the levers. The small stickers can be placed over or under the relay buttons to signal different functions (Fig. 7).

General Operations

Start Up

1. Pull out the Stop Button.
2. The menu 1 LED starts blinking. When the communication is established, the menu 1 LED illuminates constant and the hand controller is ready for use.

Locking Controller

1. Ensure that the Stop Button is pressed in.
2. Press the two Menu Toggle buttons (5) at the same time while releasing stop button. All menu LED's are now flashing simultaneously about 5 sec, and the hand controller can not be operated.
3. Press the Stop Button.

Unlocking Controller

1. Ensure that the Stop Button is pressed in.
2. Press the two Menu Toggle buttons (5) at the same time while releasing Stop Button. All menu LED's are now flashing fast simultaneously 5 times, Menu LED 1 lights up.

The controller can now be operated.

Fig. 8

Connections

Radio

The primary communication is done by radio. It is possible to disconnect the radio communication in the software (se ***Terminal Program Settings***).
The radio consists of:
• Transmitter, fitted in the controller
• Receiver Box, fitted on the crane.
Each transmitter is programmed to communicate with its own receiver only. When transmission is disturbed, it is possible to change the channel with **Channel Switch button**. There are 12 channels available.

Fig. 9

Remote Control Cable.

It is possible to connect a remote cable between the hand controller and the Reciever Box. There is an 4 pin connector mounted on the left lower side (Fig. 9), where to connect the cable. The radio communication will automatically be disabled when a cable is connected.

Battery Charger

Function

The battery charger (Fig. 10) is to be fitted in a protected environment, preferably in the cab. The charger is connected to the general power system of the truck. The cable has markings for + and -.
No harm will come to the battery if it is left in the charger beyond the required charging time.
Lamp (1) is continuously illuminated when the battery charger is ready for use.
Lamp (2) is blinking during precharging. When the lamp is continuously illuminsted, the charging process is finished.

Fig. 10

Charging time

A fully charged battery is approximately 8,4V. It takes 3h to charge.
A fully charged battery lasts for about 5-8 hours working time. Note that the battery voltage stays between 7,6V and 7,5V for a long time. Therefore the battery voltage can not be used to estimate the working time.

NOTE!
A charged battery is a concentrated energy source. Never store a charged battery in a toolbox or similar where it could be short-circuited by metal components.

Battery

The battery is an nickel metal-hydrid (NiMH) sort with a power of 1500 mAh, 200 g.

Used batteries

Used batteries are not to be thrown away without regard to nature and environment. Used batteries should be taken care of according to the local regulations.

Leg Box

The leg box is to used warn the surrounding about ongoing activity, by amber light indication. The Leg box also gives information to the operator about the different statuses of the crane.

There are three states of lightning:

- Constant light — System on
- Swell — Remote activated
- Double blink — Pre warning for OLP

The leg box is also a connection box and comprises the following functions:

- Inputs for two 4-20mA pressure sensors (sensing rod and piston pressure in support leg).
- Input for on off sensor, 0/24V or Safe PWM based sensor.
- Internal output for controlling warning lamp built in same housing.
- CAN interface for communication of internal status, pressures inputs, on/off input and lamp control status with SPACE system, connected at CAN connection point (same as LEN sensors)

During start-up, the Leg box does an internal check of its inputs to sense if there are components connected which sends a signal.

Fig. 1

Mounting

The Leg Box light spreads 270° and lights in the HIAB logo direction, independent of article number. The box is always mounted to lit outwards.

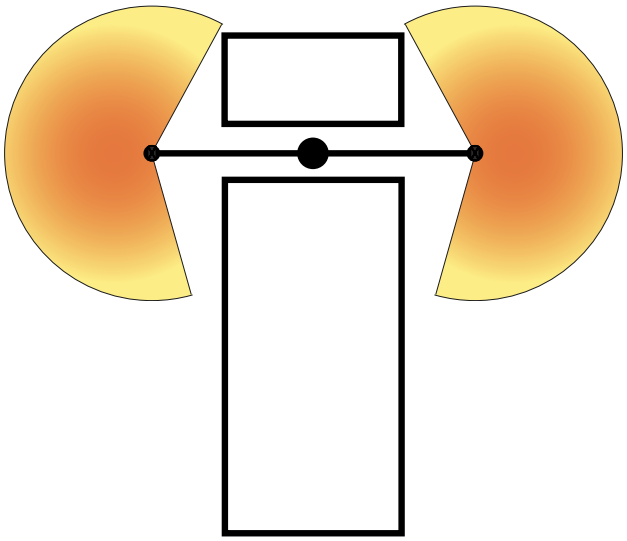


Fig. 2

Terminal Blocks on the Leg Box

Block	Description
P1	**Power/CAN**
1	GND
2	+24V
3	CAN H
4	CAN L
P2	**On/Off input**
1	GND
2	+24V
3	0/24 or PWM signal
P3	**4-20mA (Pressure sensor side xx)**
1	+24V
2	signal
P4	**4-20mA (Pressure sensor side xx)**
1	+24V
2	signal

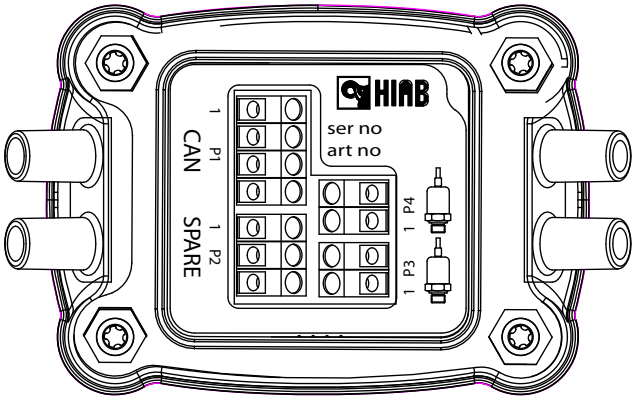


Fig. 3

CAN connection point

The CAN connection point is used to collect CAN bus controlled devices used on the system.

Parts connected to the CAN connection point:

1. LegBox
2. Slewing cylinder sensor
3. Stabilizer extension cylinder sensor
4. Plug with possibility to connect an additional CAN connection point.
5. Stabilizer extension cylnder sensor
6. LegBox

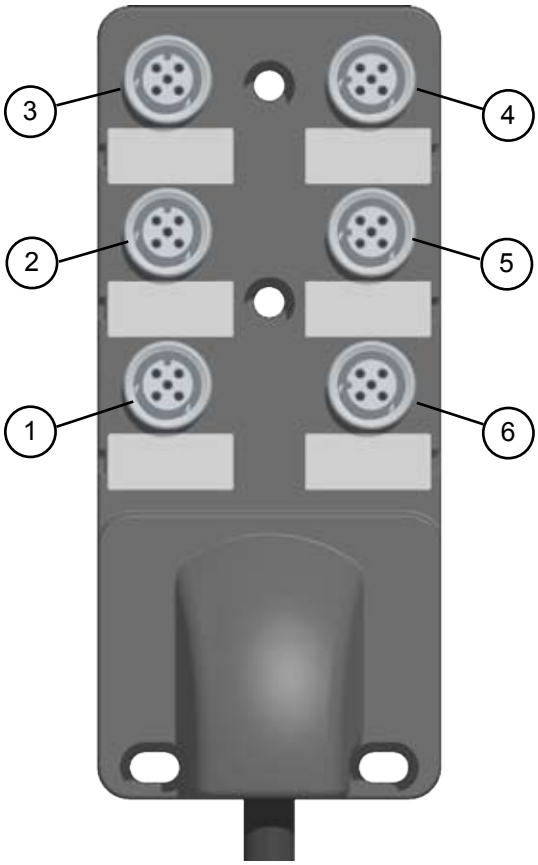


Fig. 1

SPACE MUX box

A MUX = multiplexer can handle several indicators at the same time and send the information via CAN to SPACE. With a MUX box it is possible to expand the number of digital inputs in the system. There can be up to 2 MUX boxes connected to one SPACE box.

Functions

LED indication

The status of the MUX box is indicated by two LED's

CAN LED (1) (Fig. 1)

Flashing red:	Strapping error or CAN-error
Flickering green:	SPACE-system on, emergency stop deactivated.
Flashing green:	System off, emergency stop activated.

STAT-LED (2) (Fig. 1)

Steady green:	Voltage and fuses ok.
Flashing red:	Voltage supply to low (<8V) or sensor fuse blown.

Jumper settings SPACE MUX:

The number of jumpers should correspond to the number of MUX boxes. i. e. 2 MUX boxes, fit jumpers in port 1 and 2.

Fuse

The power supply to the indicators is fused with an common automatic fuse. The status of the inputs and the fuse is sent via the CAN network.

Connections

The MUX has 8 inputs. Connection to the system is done in the Terminal blocks P1 CAN IN and P2 CAN OUT. If the MUX is the last box in the system, it is needed to fit a bridge wire between P2:5 and P2:6 in the emergency stop circuit.

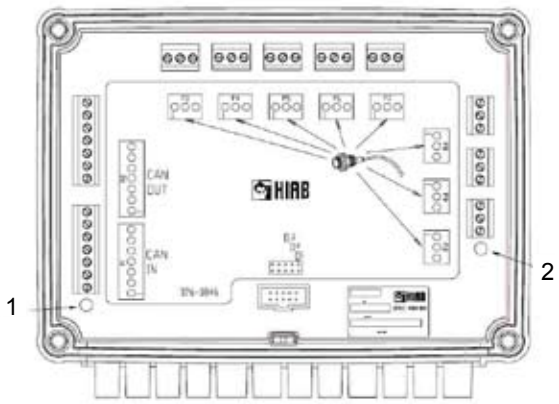


Fig. 1

Terminal blocks on SPACE MUX box

Block	Description
P1	**CAN In**
P1.1	0V
P1.2	24V
P1.3	CAN H
P1.4	CAN L
P1.5	Emergency stop in
P1.6	Emergency stop return
P1.7	ON_OFF
P2	**CAN Out**
P2.1	0V
P2.2	24V
P2.3	CAN H
P2.4	CAN L
P2.5	Emergency stop out
P2.6	Emergency stop return
P2.7	ON_OFF
P3-10	**Sensors**
PX.1	0V
PX.2	24V
PX.3	Digital input (0/24V or PWM signal)

SPACE TWI box

The transport warning interface TWI is used to indicate if the first boom is in high position and if the stabilizer legs are not in locked position when moving the vehicle.
A lamp with an acknowledgement button and a buzzer is mounted in the cabin to warn the operator. The buzzer can be silent by pressing the acknowledgement button or by activating the parking brake.

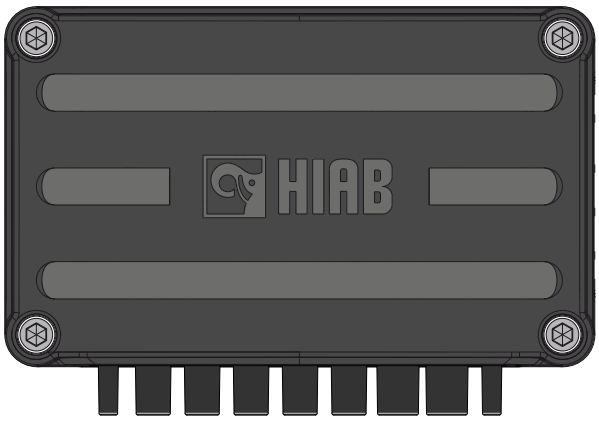


Fig. 1

Stand alone mode

If the TWI is mounted on the crane without a SPACE system, it will be used in “Stand alone mode”. In “Stand alone mode” the TWI can be used as a warning interface for:

- High boom warning
- Stabilizer extension not in and locked warning

Terminal blocks on SPACE TWI box:

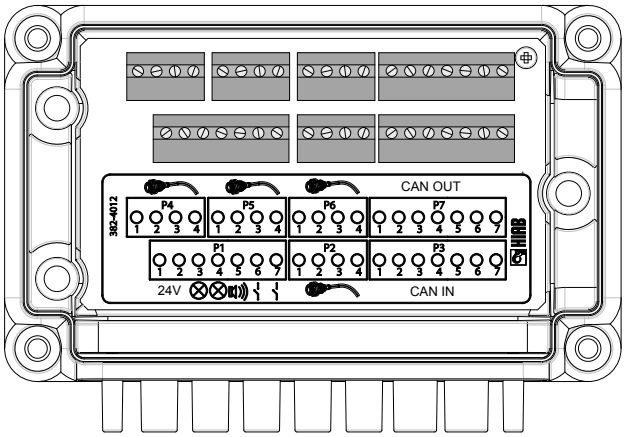


Fig. 2

Block	Description
P1	**Truck interface**
P1.1	Ground Truck
P1.2	+Voltage (10-30V) Truck
P1.3	Lamp1 Output
P1.4	Lamp2 Output
P1.5	Buzzer Output
P1.6	Acknowledge button input
P1.7	Parking brake status input
P2	**Digital input 1 and 2**
P2.1	Ground Truck
P2.2	+Voltage to sensor
P2.3	Digital input 0/24V
P2.4	Digital input 0/24V
P3	**CAN IN**
P3.1	Ground Space
P3.2	+24V Space
P3.3	CAN H
P3.4	CAN L
P3.5	EM_in
P3.6	EM_out
P3.7	On/Off
P4	**Digital input**
P4.1	Ground Truck
P4.2	+Voltage to sensor
P4.3	Digital input 0/24V
P4.4	Digital input 0/24V
P5	**Digital input**
P5.1	Ground Truck
P5.2	+Voltage to sensor
P5.3	Digital input 0/24V
P5.4	Digital input 0/24V
P6	**Digital input**
P6.1	Ground Truck
P6.2	+Voltage to sensor
P6.3	Digital input 0/24V
P6.4	Digital input 0/24V
P7	**CAN OUT**
P7.1	Ground Space
P7.2	+24V Space
P7.3	CAN H
P7.4	CAN L
P7.5	EM_in
P7.6	EM_out
P7.7	On/Off

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