Conjet pump connection

We connect a pump to control the loading and unloading of high pressure. We also hook into the emergency stop circuit of the connected pump so the robot can “kill” the connected pump in case of emergency.

The emergency stop circuit communicated in the opposite direction as well so that the pump can “kill” the robot as well.

In some cases, we are unable to hook into the emergency stop circuit why we have to make do with only controlling the loading/unloading of high pressure.

That means that we can use the connection to:

1. Load / unload high pressure.
    a. Close the appropriate vale calling high pressure.
    b. With a signal from the pump verifying that the system *is* in high pressure.
2. Do the above and also verify status of emergency stops.
    a. E-stop from robot to pump (robot “kills” the pump **and** robot).
    b. E-stop from pump (pump “kills” the pump **and** robot).

We would prefer the latter, option 2.

Our solution works on relays, why the systems are electrically separated reducing the issue of potential difference.

Set-up

Pump skid connection kit (3312 2559 71)

The communication between a Conjet robot and a high-pressure pump is done through a Pump skid connection kit (3312 2559 71). This box is installed in the high-pressure pump and the cable W1 (see Figure 3) connects into the existing electrical system of the high-pressure pump.

All communication to and from the high-pressure pump goes through this box.

This box is placed inside the pump at a suitable location. If the 16-pole connector (XS2.1) is not accessible from the outside, a feeder cable can be connected to the XS2.1 leading the signals to a surface mounted connector outside the high-pressure pump.

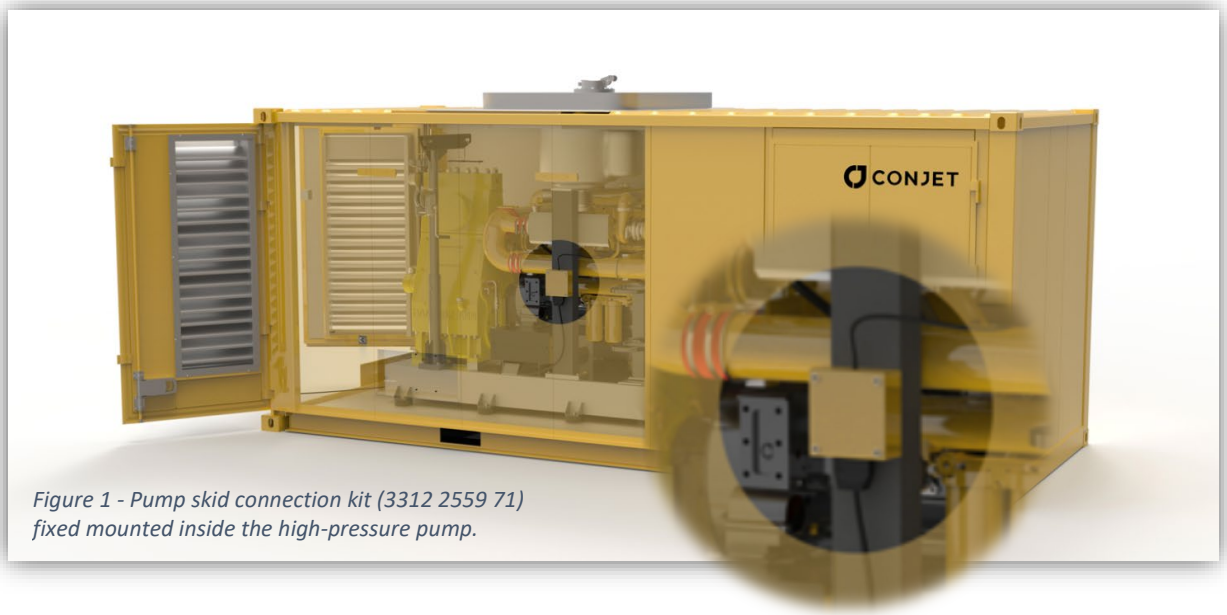


Figure 1 - Pump skid connection kit (3312 2559 71) fixed mounted inside the high-pressure pump.

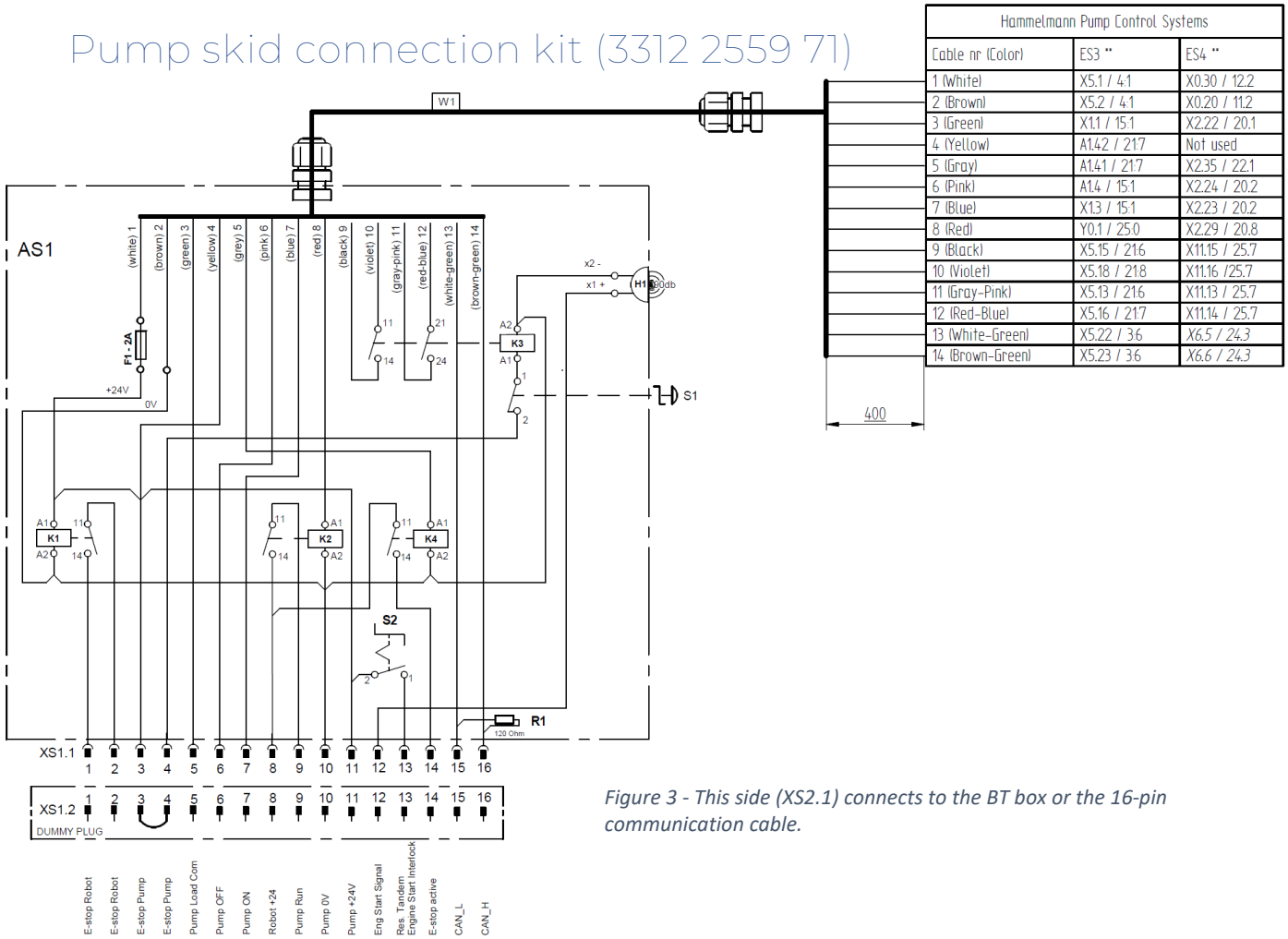
Wireless Pump Com (3312 2560 95)

The Wireless Pump Com-box is connected to the XS2.1 connector to enable wireless communication over Bluetooth to the robot. This device replaces the need for a 16-pole cable.

Figure 2 - Wireless Pump Com (3312 2560 95) mounted on container door with magnetic feet.

No additional components are needed in the high-pressure pump.

Pump skid connection kit (3312 2559 71)



Hammelmann Pump Control Systems		
Cable nr (Color)	ES3 **	ES4 **
1 (White)	X5.1 / 4.1	X0.30 / 12.2
2 (Brown)	X5.2 / 4.1	X0.20 / 11.2
3 (Green)	X1.1 / 15.1	X2.22 / 20.1
4 (Yellow)	A1.42 / 21.7	Not used
5 (Gray)	A1.41 / 21.7	X2.35 / 22.1
6 (Pink)	A1.4 / 15.1	X2.24 / 20.2
7 (Blue)	X1.3 / 15.1	X2.23 / 20.2
8 (Red)	Y0.1 / 25.0	X2.29 / 20.8
9 (Black)	X5.15 / 21.6	X11.15 / 25.7
10 (Violet)	X5.18 / 21.8	X11.16 /25.7
11 (Gray-Pink)	X5.13 / 21.6	X11.13 / 25.7
12 (Red-Blue)	X5.16 / 21.7	X11.14 / 25.7
13 (White-Green)	X5.22 / 3.6	*X6.5 / 24.3*
14 (Brown-Green)	X5.23 / 3.6	*X6.6 / 24.3*

Figure 3 - This side (XS2.1) connects to the BT box or the 16-pin communication cable.

E-STOP pump -> robot (K1 – XS2.1:1/2)

The “Pump connection box” takes power (24VDC) on cable 1 (W1) and feeds the relay K1:86. That is the signal that E-stop in pump is not activated (pump system up).

E-STOP robot -> pump (K3 – XS2.1:3/4)

We feed that signal into pin 3 on XS2.1 that goes into the Bluetooth Box (BT box). In the BT box, a relay closes if the robot’s E-stop is not activated. That relay feeds it back to XS2.1 pin 4. Pin 4 operates relays K3A and K3B. When those relays are active (E-stop on robot is NOT pushed), contacts close completing the circuit between wires 9 and 10 as well as wires 11 and 12 in cable W1.

LOAD HP (XS2.1:5/6/7)

Cable 3 (W1) is connected to pin 5 (on XS2.1) that feeds yet another relay in the BT box or robot. If not activated, that power comes back on pin 6 (XS2.1) feeding wire 6 in W1. When HP activates, the relays switch the power from 6 to 7. That means pin 7 becomes energized on the XS2.1 feeding wire 7 on W1.

HP loaded (K2 – XS2.1:8/9)

When the pump signals HP ON, the relay K2:85 gets powered on wire 8. That relay closes the circuit between pins 9 and 8 on XS2.1, indicating that the system is in HP mode.

Data communication

The next step is to tap into the communication of the high pressure pump.

For this to work, the pump must communicate over CANopen at a speed of either 250 mbps or 500 mbps.

With an EDS-fil describing the communication, we can then map the variables and incorporate them into the communication to the robot.

Data objects

The following data objects can be transported over the CANopen bus:

TX_PDO1 (sent from the pump)

Current RPM	INT
Current pressure	INT
Pump oil pressure	BYTE
Pump oil temperature	BYTE
Pump feed water pressure	BYTE
Pump feed water temperature	BYTE

TX_PDO2

Current volume	INT
Air pressure	BYTE
Filter pressure	BYTE
Engine oil temperature	BYTE
Engine temperature	BYTE
Status	BYTE

TX_PDO3

Error	DINT
Warning	DINT

RX_PDO1 (sent to the pump)

Set state	BYTE
Set RPM value	INT
Set pressure value	INT
Set gear	INT