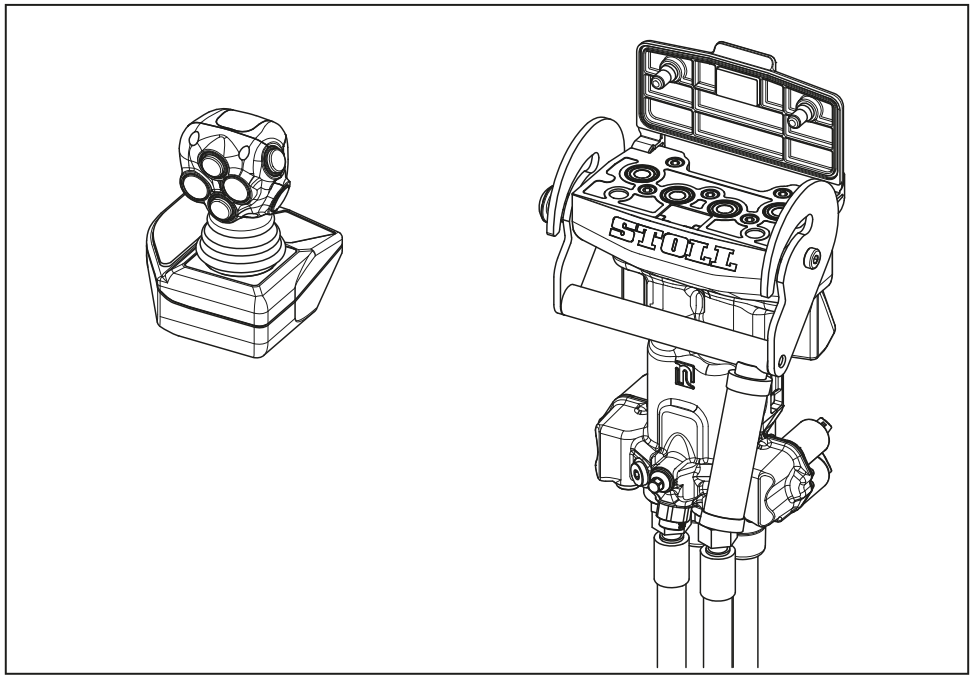
Installation instructions

Single-lever control unit Pro Control



Front loader

ProfiLine

Solid

Status: 10/2022

3601510 M00176 0000000134 EN 002

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The original instructions were written in the German language.

Instructions in other languages were translated from German.

Contents

1 About these installation instructions

1.1 Use and purpose of the installation instructions

These installation instructions are aimed at specialist workshops. Experience in installing hydraulic components and basic knowledge of vehicle electrical systems are required in particular.

More detailed information can be found in the operating instructions of the front loader.

Directions refer to the forward direction of travel, unless otherwise specified.

For better readability, Wilhelm STOLL Maschinenfabrik GmbH will hereinafter be called "STOLL".

1.2 Validity of the installation instructions

The installation instructions are valid for the different versions of the Pro Control single-lever control unit. The equipment may only be used with ProfiLine and Solid front loaders.

Please also note the installation instructions supplied for the hydraulic equipment or front loader mounting kits, which take into account individual connection points and mounting brackets for the respective tractor.

1.3 Other applicable documents

In conjunction with these installation instructions, the following additional documents also apply:

- Installation instructions for the front loader mounting kit,
- Installation instructions for hydraulic equipment,
- Operating instructions of the tractor,
- Operating instructions for the front loader.

For all types of work, please also observe:

- The recognised technical regulations for safe and professional work,
- The legal regulations for accident prevention,
- The legal regulations for health and environmental protection,
- The national regulations that apply in the country of the operator / user of the front loader,
- The specifications that are relevant for the status of the technology.

2 Safety

2.1 Proper use

The versions of the Pro Control single-lever control unit described in these installation instructions are supplied to be mounted solely on agricultural and forestry tractors for operating STOLL front loaders.

The maximum permissible pressure in the hydraulic system is 205 bar.

The information for its correct use and technical data in the operating instructions of the front loader apply in all other respects.

2.2 Basic safety information

2.2.1 Instructions to avoid hazards during the assembly and installation

- Secure the tractor against accidental start-up and rolling away!

Danger when working on the hydraulic system!

- Hydraulic oil can escape under high pressure/at high-speed and people in the immediate vicinity can be seriously injured!
- Hydraulic equipment can move unexpectedly when the pressure drops (e.g. disconnecting a line)!
- Before starting work on the hydraulic system, depressurize the system and secure it against restarting. Please refer to the operating instructions of the tractor.
- For work that must be performed on a pressurised hydraulic system (e.g. bleeding):
  Protect yourself from escaping oil!
  Make sure that no other people are at risk!
- For work on the chassis hydraulics (e.g. detaching and turning the lines of the steering hydraulics):
  Support the axles of the tractor to prevent sagging while working.

2.2.2 Instructions to prevent hazards caused by a defective installation

If the hydraulic lines are routed incorrectly, this may endanger the operator and other people!

- Route the hydraulic lines correctly! Follow the instructions for installing the hydraulic lines (see *4.3 Connecting the hydraulic lines*)!
- Follow the occupational health and safety regulations and technical regulations for hydraulic lines that are applicable for the place of assembly and use.

If the screws are tightened with the incorrect torque or screws are inserted with dirt, they may loosen and cause an accident!

- Make sure that the threads are clean. If necessary, clean them!
- Screws and threads must be free from grease!
- To finish installation, tighten all the screws with a torque wrench at the correct tightening torque (see *7 Tightening torques for screws*)!

3 Overview

The Pro Control single-lever control unit consists of the joystick, a proportional valve, the controller (task controller), and the cable harness.

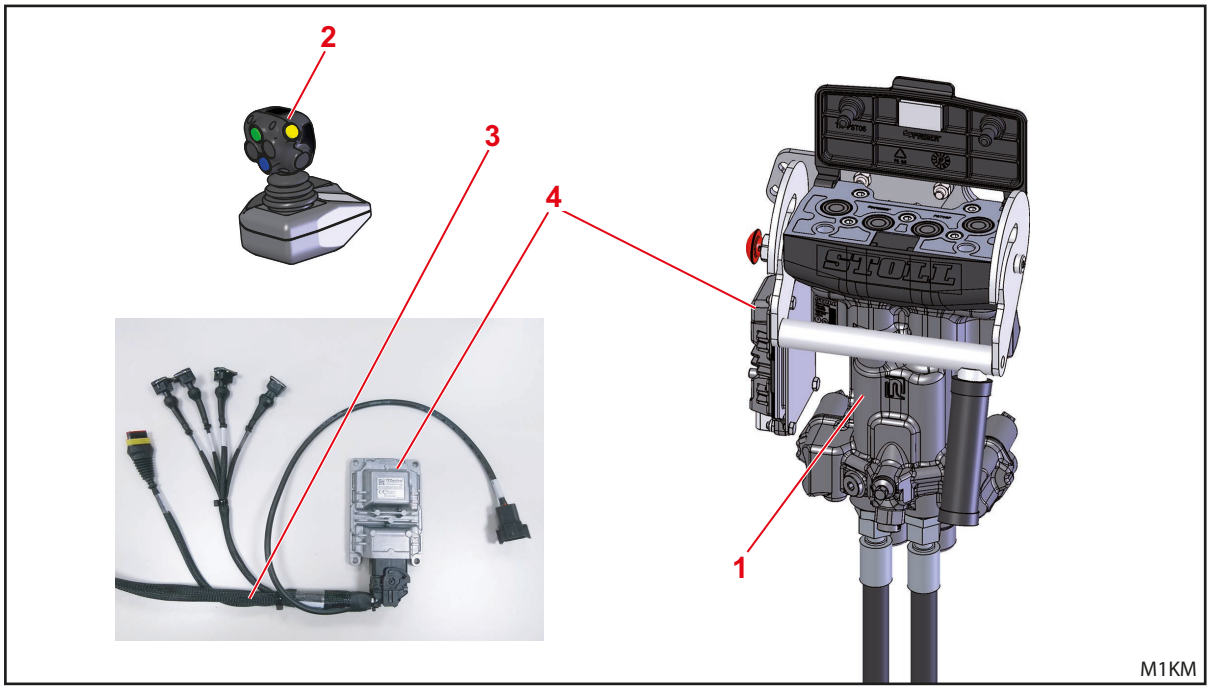

Fig. 1 Pro Control overview

Valve designs

Pos.	Id. no.	Valve configuration	For the tractor hydraulic system
1	3709890	Hydac OC NW12 MK02 56.00-89-10	Open-Centre hydraulic system (OC), connections nominal width 12
1	3709900	Hydac OC NW16 MK02 56.00-90-10	Open-Centre hydraulic system (OC), connections nominal width 16
1	3709960	Hydac OC-LU NW12 MK02 56.00-191-10	Open-Center hydraulic system, final consumer in the hydraulic circuit (OC-LU), Connections nominal width 12
1	3709980	Hydac OC-LU NW16 MK02 56.00-195-10	Open-Center hydraulic system, final consumer in the hydraulic circuit (OC-LU), Connections nominal width 16
1	3709940	Hydac CC NW12 MK02 56.00-179-10	Closed-Center hydraulic system (CC), Connections nominal width 12
1	3709910	Hydac LS NW12 MK02 56.00-91-10	Hydraulic system with load sensing (OCLS or CCLS), connections nominal width 12
1	3709920	Hydac LS NW16 MK02 56.00-92-10	Hydraulic system with load sensing (OCLS or CCLS), connections nominal width 16
1	3710050	Hydac OC MM NW12 MK02 56.00-212-10	Open-Centre hydraulic system (OC), connections nominal width 12, hose connection
1	3710000	Hydac OC MM NW16 MK02 56.00-199-10	Open-Centre hydraulic system (OC), connections nominal width 16, hose connection
1	3710020	Hydac LS MM NW12 MK02 56.00-206-10	Hydraulic system with load sensing (OCLS or CCLS), connections nominal width 16, hose connection
1	3710010	Hydac LS MM NW16 MK02 56.00-201-10	Hydraulic system with load sensing (OCLS or CCLS), connections nominal width 16, hose connection

Equipment

Pos.	Id. no.	Designation	Notes
2	3602300	Joystick complete 58.753-01-04	incl. adapter
2	3627130	Joystick complete (5 buttons) 58.753-01-08	incl. adapter
3+4	3602340	Controller equipment 58.753-01-05	incl. cable harness
	3600340	Basic equipment for Hydac valves 56.00-95-03-02	Contains the bracket and small parts, without illustration
	3656230	Hydac diaphragm accumulator 56.00-95-03-03	No picture

Optional equipment

Id. no.	Designation	Notes
	Hydro-Fix	Multiple coupling for easier mounting and dismounting of the front loader (part of the front loader equipment)
3602360	Relay module (X5, X6, X7)	For additional functions "electrically actuated Comfort Drive" and "Hydraulic implement locking mechanism", 2 relays with one additional function, 3 relays with both additional functions
3602350	Relay module X0	Required with additional functions (see above) and for valves Walvoil LS-LSP, Walvoil OC (connection Y0)
3627330	Relay cable complete 58.753-01-09	Required when using front loaders other than ProfiLine (FS, FZ) or Solid

Only mount the "Pro Control" single-lever control unit on tractors with a driver's cab.

The "Pro Control" single-lever control unit may only be used in combination with front loaders with mechanical parallel motion!

STOLL recommends the following procedure for the mounting and installation work:

(1) Install the proportional valve on the intended support (see *4.1 Mounting the proportional valve on the tractor*).

(2) Option: Install the Hydro-Fix lower part (see *4.2 Mounting the Hydro-Fix lower part (optional)*).

(3) Connect the hydraulic lines (see *4.3 Connecting the hydraulic lines*).

To do so, please also note the installation instructions supplied for the hydraulic equipment or front loader mounting kits, which take into account individual connection points and mounting brackets for the respective tractor.

(4) Fasten the joystick on the intended bracket (see *4.4 Installing the joystick*).

(5) Install the controller (see *4.5.2 Installing the controller*).

(6) Route and connect the cable harness (see *4.5 Installing the controller and the cable harness*).

(7) Program the controller (see *5 Programming*).

(8) Check for proper installation and function (see *6 Completing the mounting and installation*).

4 Assembly and installation

4.1 Mounting the proportional valve on the tractor

The standard bracket on the right mounting part is shown in the installation drawing. Depending on the tractor, special brackets may be required (see installation instructions for the front loader mounting kit).

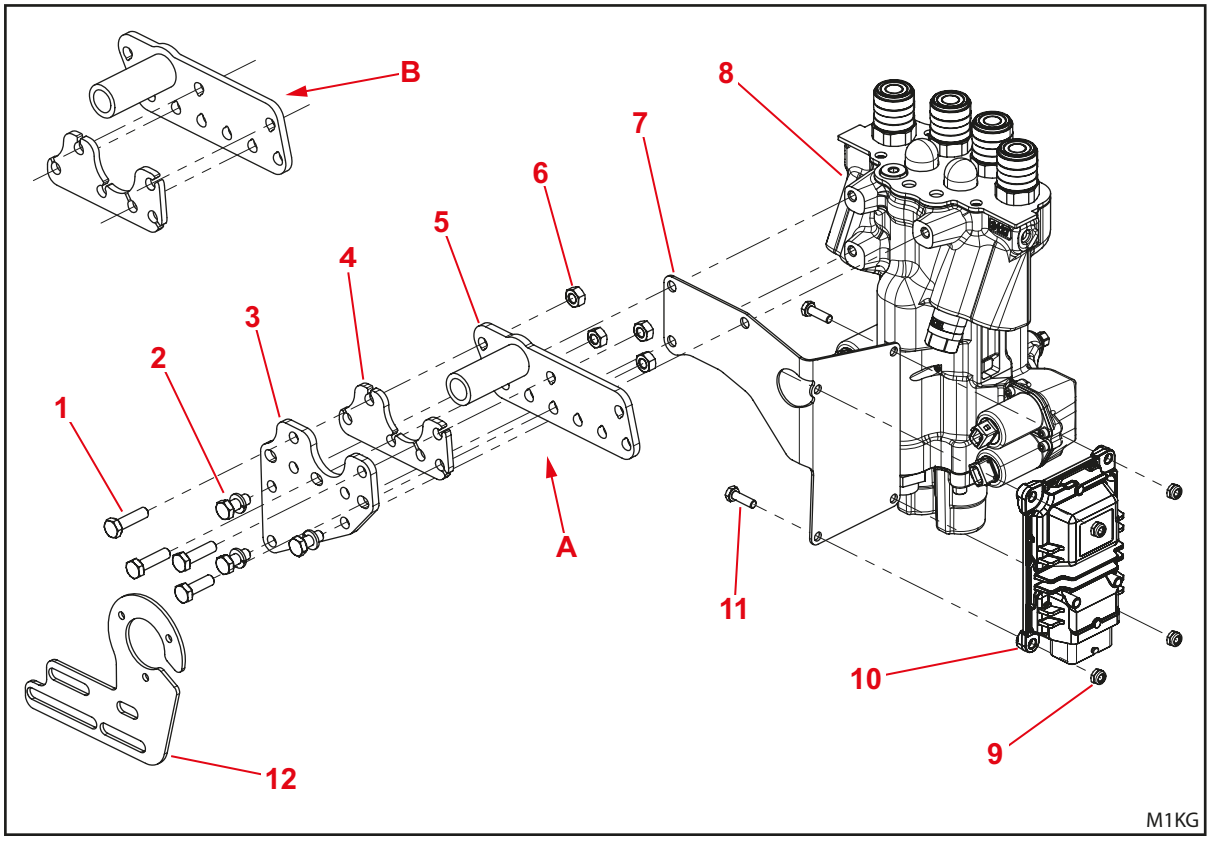

Fig. 2 Installing the proportional valve

Legend

1 4 hexagonal screws M8x30
2 3 hexagonal screws M8x20 with circlips
3 Bracket
4 Intermediate plate
5 Bracket on the right mounting part
6 4 hexagonal nuts M8
7 Angle bracket
8 Proportional valve
9 4 lock nuts M6
10 Controller
11 4 hexagonal screws M6x20
12 Socket bracket

The proportional valve is fastened on the support on the right mounting part.

2 mounting positions are possible:
A: right position (see *Fig. 2*)
B: left position (see *Fig. 3*)

(1) Fasten the controller on the angle bracket with 4 hexagonal screws M6x20 and 4 lock nuts.

(2) Secure the support and angle bracket on the proportional valve with 3 hexagonal screws M8x20 with circlips.

Pay attention to the length of the screws! The fixing holes on the valves are only 12 mm deep.
Use washers and circlips if the screws are too long.

(3) Fasten the support and intermediate plate with 4 hexagonal screws M8x30 and hexagonal nuts on the bracket on the right mounting part.

On front loader models with 7-pin plug/socket:

(4) Fasten the socket bracket together with the bracket using hexagonal screws M8x30.

✓ The proportional valve is installed.

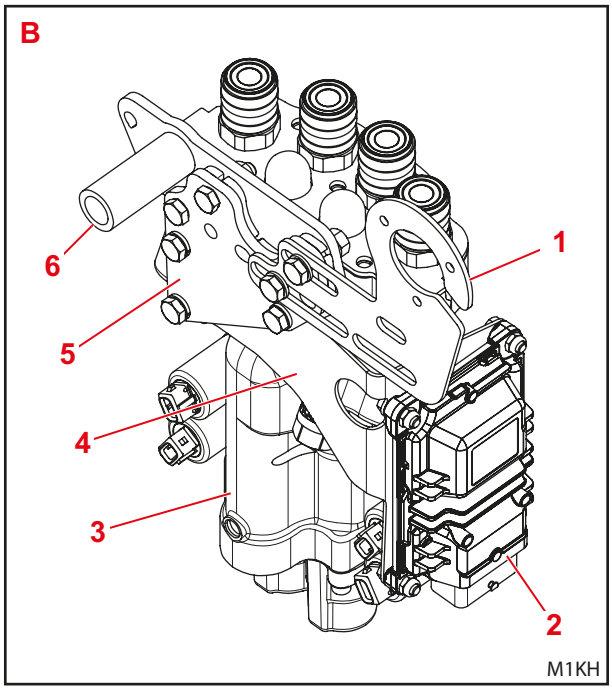

Fig. 3 Installing the proportional valve (installation position B)

Legend

1 Socket bracket
2 Controller
3 Proportional valve
4 Angle bracket
5 Bracket
6 Bracket on the right mounting part

Alternative fastening options

The valve can be fastened differently depending on the space available on the tractor:

- At both mounting positions (A, B), the support can also be fastened from the front on the bracket on the right mounting part (with or without an intermediate plate).
- The proportional valve can also be installed further up on the bracket on the right mounting part (see *Fig. 4*).

Pay attention to the length of the screws! The fixing holes on the valves are only 12 mm deep.
Use washers and circlips if the screws are too long.

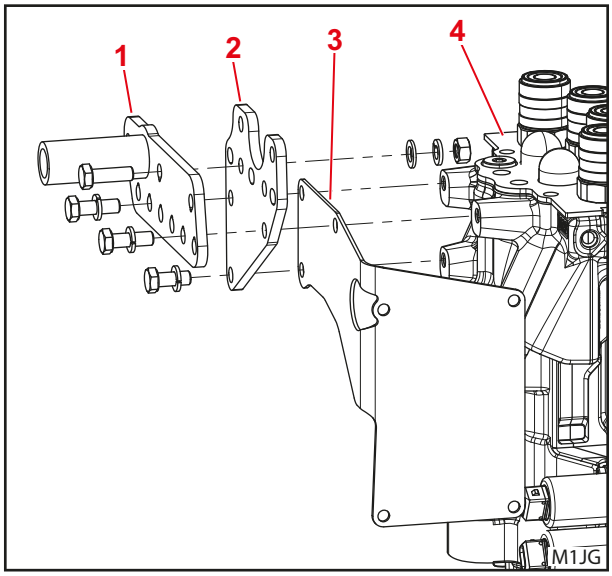

Fig. 4 Alternative fastening options

Legend

1 Bracket on the right mounting part
2 Bracket
3 Angle bracket
4 Proportional valve

4.1.1 Installing the diaphragm accumulator

⚠ WARNING

Risk of injury due to system under high pressure!

If the valve has already been in operation, the system is under pressure and there is a risk of injury.

- ▸ Depressurize the valve or use a valve that has not been in operation yet.

Install the diaphragm accumulator:

🛠 Open-ended spanner WAF 17 mm, 19 mm, 22 mm, 27 mm

(1) Unscrew the lock screw on the valve.

(2) Screw in the screw-in connector.

(3) Screw on the adjustable elbow connector.

ⓘ The alignment of the elbow connector depends on the space available on the tractor.

(4) Install the diaphragm accumulator with screw-in connector on the elbow union.

✓ The diaphragm accumulator is installed.

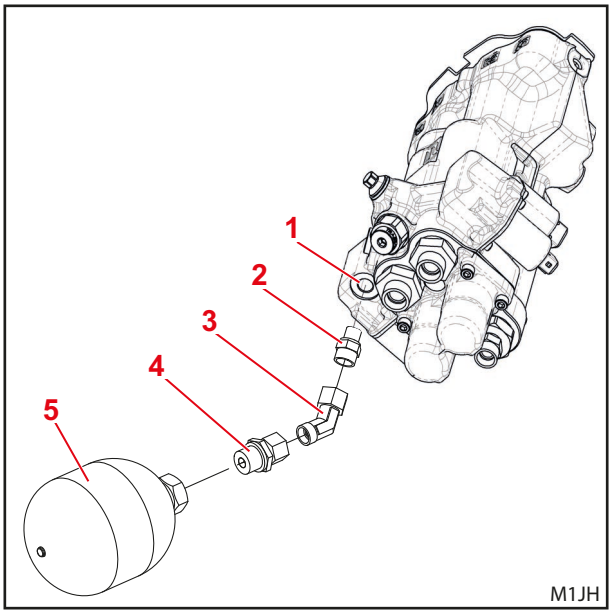

Fig. 5 Installing the diaphragm accumulator

Legend

1 Lock screw
2 Screw-in connector WA GES 12LR 1/4-WD
3 Adjustable elbow connector WA EWSD 12L B45
4 Screw-in connector WA EGESD 12LR1/2WD
5 Diaphragm accumulator

4.2 Mounting the Hydro-Fix lower part (optional)

Required tools:

- Allen key WAF 6
- Screwdriver

4.2.1 Mounting without electrics

(1) Unscrew the 5 screws on the valve.

(2) Remove the lug on the cover.

(3) Slide the cover on the valve until it is about 5 mm from the edge of the sheet.

(4) Slide the Hydro-Fix lower part on the valve (not all the way down).

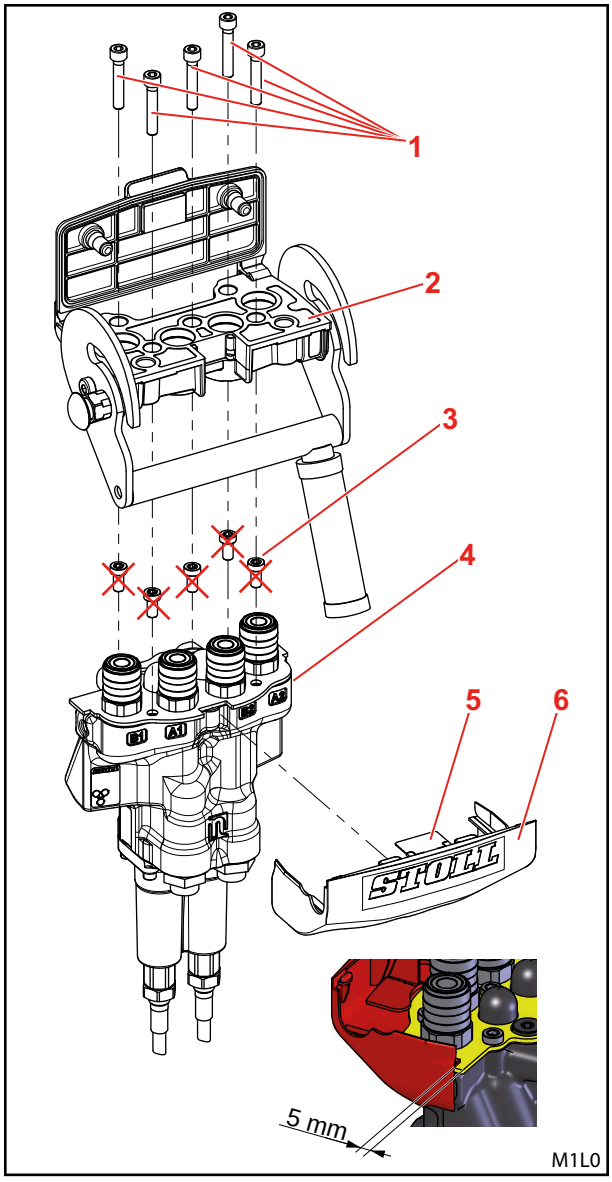

Fig. 6 Installing the Hydro-Fix lower part on Hydac valves (without electrical system)

Legend

1 Screws M8x45
2 Hydro-Fix lower part
3 Screws
4 Valve
5 Lug
6 Cover

(5) Carefully lift the lug with a screwdriver and slide the cover in all the way so that the lug rests on both supports.

(6) Slide the Hydro-Fix lower part all the way on.

(7) Secure the Hydro-Fix lower part with the 5 screws M8x45.

Observe the tightening torque: 27 Nm.

Tighten the middle screw first. Tighten the screws evenly.

✓ The Hydro-Fix lower part is installed.

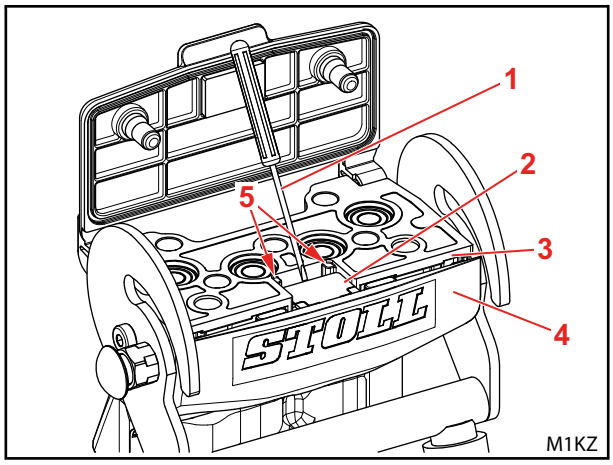

Fig. 7 Installed Hydro-Fix lower part (without electrical system)

Legend

1 Screwdriver
2 Lug
3 Hydro-Fix lower part
4 Cover
5 Supports

4.2.2 Mounting with integrated electrical interface

(1) Unscrew the 5 screws on the valve.

(2) Remove the lug on the cover.

(3) Slide the cover on the valve until it is about 5 mm from the edge of the sheet.

(4) Insert electrical plug connectors on the cover.

The groove of the electric plug connector points to the Hydro-Fix lower part, and the spring to the cover.

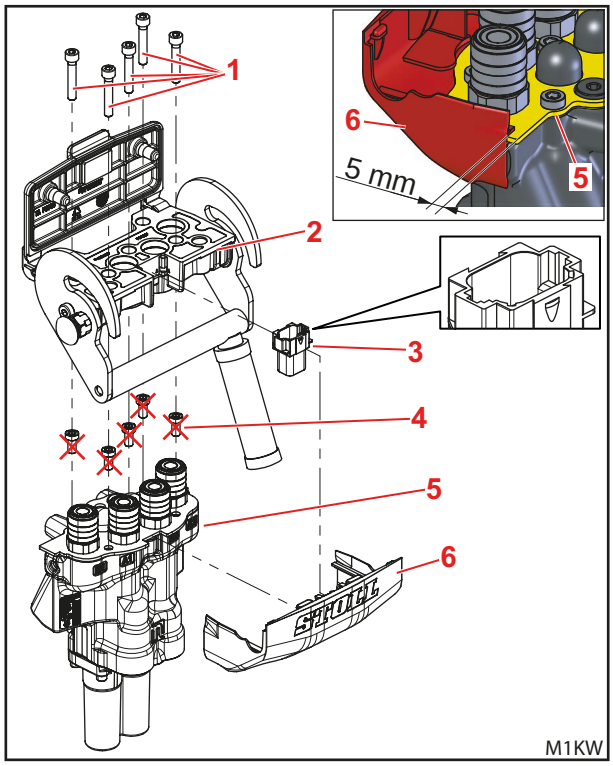

Fig. 8 Installing the Hydro-Fix lower part on Hydac valves (with integrated electrical interface)

Legend

1 Screws M8x45
2 Hydro-Fix lower part
3 Electrical plug connector
4 Screws
5 Valve
6 Cover

(5) Route the electric cable and ground cable along the side.

Make sure that the cables are not crushed.

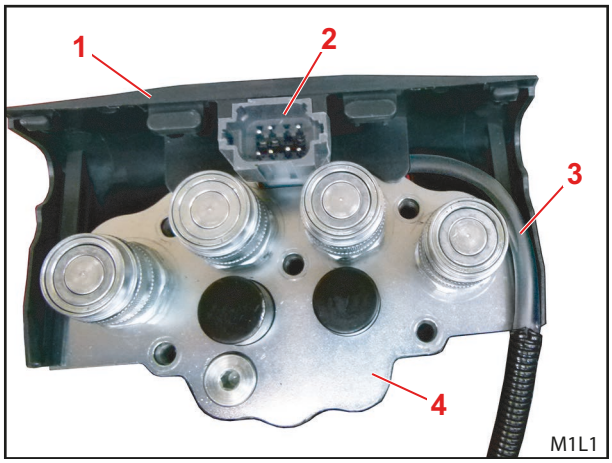

Fig. 9 Inserted electrical plug connector

Legend

1 Cover
2 Electrical plug connector
3 Electric cable
4 Valve

(6) Slide the Hydro-Fix lower part on the valve (not all the way down).

(7) Set the electric plug connector at a slight angle so that it slides into the guides and support plates (see arrows in *Fig. 10*) when you put the cover and the Hydro-Fix upper part together.

(8) Slide the cover on completely, and at the same time, gently press down on the Hydro-Fix lower part.

(9) Secure the Hydro-Fix lower part with the 5 screws M8x45.

Observe the tightening torque: 27 Nm.

Tighten the middle screw first. Tighten the screws evenly.

(10) Fasten the ground connection of the ground cable with one of the screws of the proportional valve.

✓ The Hydro-Fix lower part is installed.

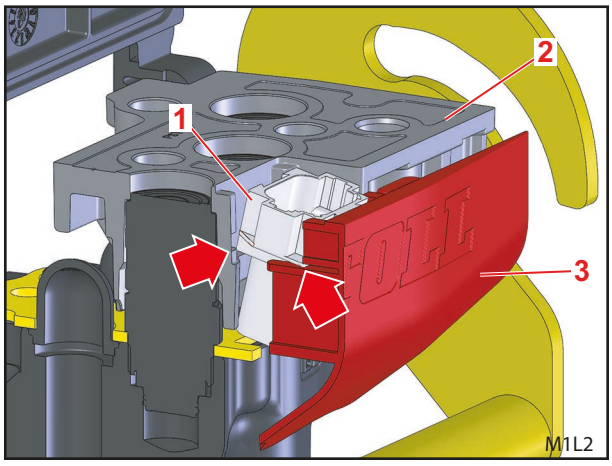

Fig. 10 Installing the Hydro-Fix lower part – Electric plug connector and cover

Legend

1 Electrical plug connector
2 Hydro-Fix lower part
3 Cover

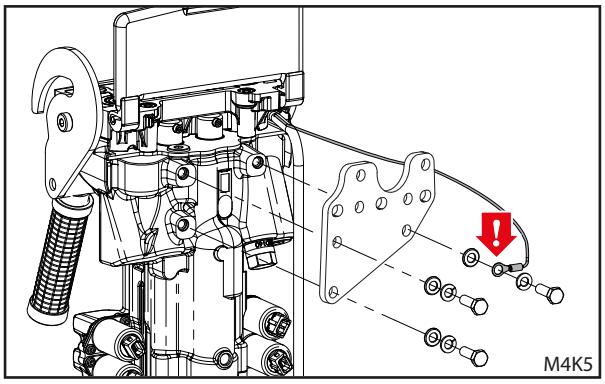

Fig. 11 Fastening the earth cable

4.3 Connecting the hydraulic lines

For the hydraulic installation, the following instructions must be observed

- Before starting work on the hydraulic system, depressurize the system and secure it against restarting. To do so, refer to the operating instructions of the tractor.
- Set up the drip trays ready to catch any residual oil that leaks.
- Only use the supplied hose lines and fittings. These are designed to bear the load.
- Avoid torsion. Hydraulic hoses must not be twisted in their routing.
- First connect hydraulic lines "N RKA90" or "A RKN90" with the 90° end, then remove all possible torsion (twisting) of the hose lines. You can only connect the straight end after you have done this.
- Avoid tensile and compressive loads on the hoses.
- Route the hoses in such a way that there are no points where they bend or rub. Be especially mindful that the hoses are routed straight from the connecting points. A bend in the hose right by the connecting point may tear the hose.
- Hydraulic hoses must be routed in such a manner that if a line breaks, nobody is endangered by the spraying hydraulic fluid. As such, do not route the hydraulic hoses through the driver's cab.
- If the driver is not protected by the cab or other components, a minimum distance of one metre must be kept between the driver's body and the hydraulic lines. Install splash guard hoses if this distance cannot be provided. Also make sure it is still possible to open the front or rear widows! The safety of the driver must be guaranteed even if the pane is open!
- Hydraulic hoses can be easily laid under the cab usually after removing the right-side rear wheel. Take account of the travel of the cab's suspension. Be especially careful that the hydraulic lines do not rub on the electrical lines that move through the cab's suspension!
- The hydraulic lines are partially pre-assembled. The fittings are not tightened to avoid any unnecessary torsions as they are being installed. After routing the lines, retighten all of the screws!

4.3.1 Assignment of the lines of the front loader to the connection points

The hose lines on the front loader are A1, B1, A2 and B2 (see *Fig. 12*). The designations A1, B1, A2, B2 can also be found on the proportional valves (see *Fig. 13*).

Functions and identification colours:

A1 Lifting, yellow

B1 Lowering, green or black

A2 Scooping, blue

B2 Dumping, red

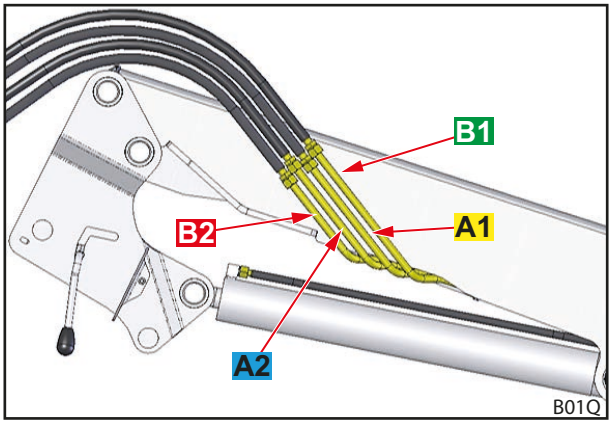

Fig. 12 Hose lines on the front loader

The embossed lettering on the cast bodies of the proportional valves can vary. The connection sequence from left to right is always B1-A1-A2-B2.

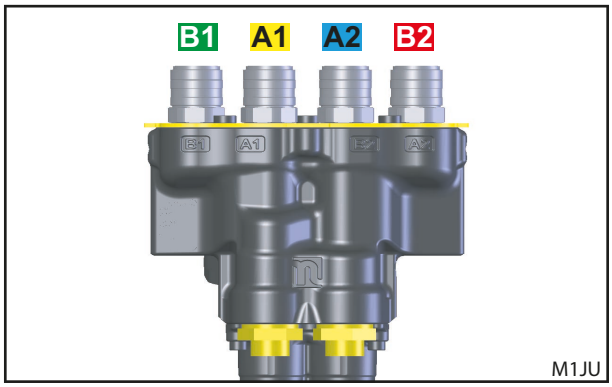

Fig. 13 Proportional valve

4.3.2 Pro Control ST for tractors with open-centre hydraulic system (OC) or closed-centre hydraulic system (CC)

4.3.2.1 Operating principle

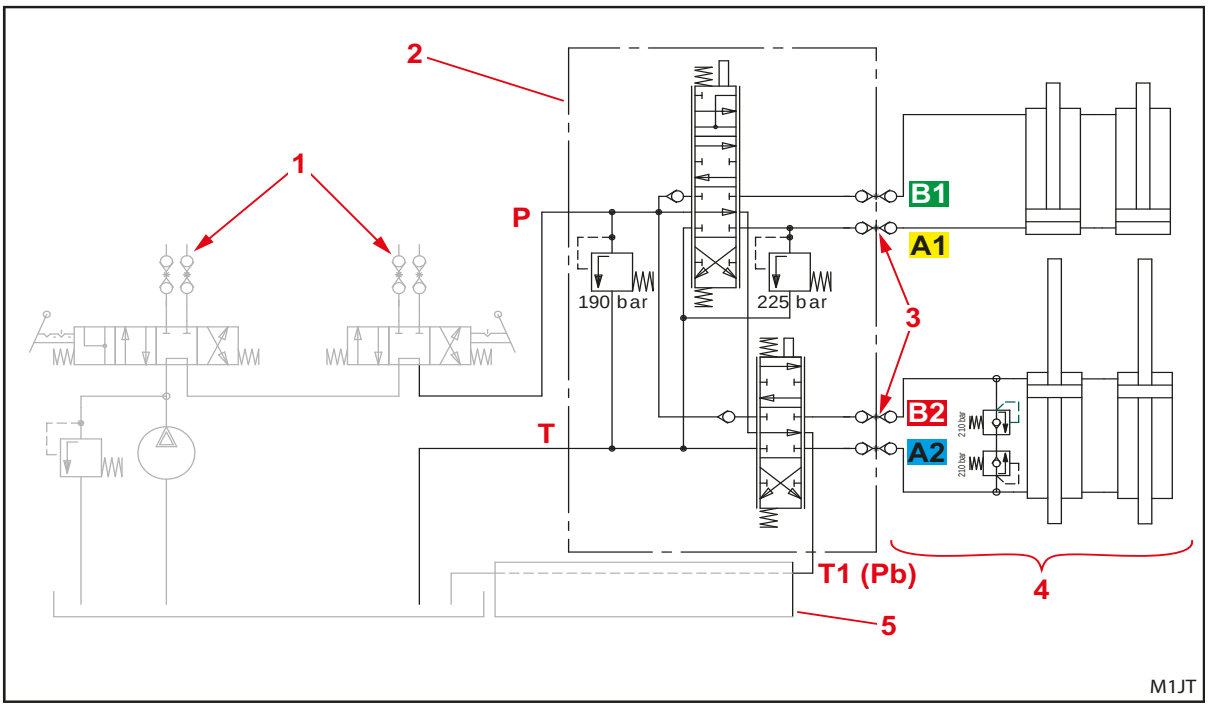

Fig. 14 Working principle of the open-centre hydraulic system (OC)

Legend

1 Existing valves on the tractor (e.g. for coupling points at the rear) can be used for other devices
2 Proportional valve on the right mounting part
3 Interface to the front loader (see *4.1 Mounting the proportional valve on the tractor*)
4 Front loader
5 Unload pressure point to lower priority users
P Pressure line
T1 Unload pressure point (Pb)
T Return line (tank connection line)

The three hydraulic lines P, T1, and T connect the OC proportional valve to the tractor's hydraulic system.

Open Centre, last consumer (OC-LU)

If the proportional valve is the last consumer in the chain (open-centre load user, OC-LU), the connections T and T1 are connected to the valve. Only lines P and T are then connected.

Closed-centre (CC)

In closed-centre hydraulic systems, all the consumers are connected in parallel with the lines P and T. Connection T1 (Pb) is closed on the valve. The "190 bar" pressure relief valve is closed.

4.3.2.2 Connecting the hydraulic lines to the tractor

With open-centre hydraulic systems (OC), all the hydraulic consumers of the tractor are connected in series between the pump and tank, so that when a valve is closed, the hydraulic pressure is passed from one consumer to the next.

The proportional valve of the front loader is integrated in this hydraulic circuit: A hydraulic line of the tractor is interrupted and the proportional valve is interposed with its connections P and T1.

The proportional valve should be placed downstream of the pressure relief valve of the tractor, so that the pump cannot be overloaded by the front loader. Since this pressure relief valve is often integrated into the valve assembly of the first consumer of the tractor, the proportional valve should not be connected upstream of the first consumer of the tractor.

Furthermore, the proportional valve requires a tank connection T.

Basic procedure for open-centre hydraulic systems (OC):

(1) Look for a pressure line of the tractor that can be interrupted.

(2) Interrupt this pressure line, usually by removing a tubular piece, a hose or a screw connection.

(3) Connect line P to the supply side (from the direction of the pump).

(4) Connect line T1 to the unload pressure side (in the direction of the tank).

(5) Connect line T to a free tank connection or to a T-piece on a tank line.

✓ The hydraulic lines are connected to the tractor.

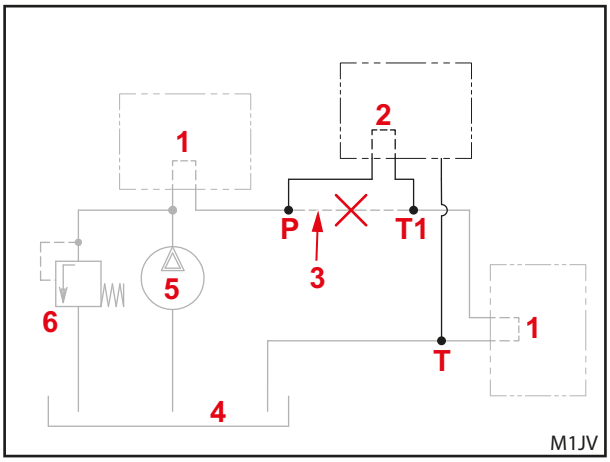

Fig. 15 Connection of the hydraulic lines to tractors with open-centre hydraulic system (OC)

Legend

1 Hydraulic consumer
2 Proportional valve
3 Hydraulic line
4 Tank
5 Pump
6 Pressure relief valve
P Pressure line
T1 Unload pressure point
T Return line (tank connection line)

4.3.2.3 Connection points on the proportional valve

Hydac proportional valve – Pro Control, OC configuration

Connect the hydraulic lines to the proportional valve:

(1) Screw 3 screw-in connectors ¾" into the proportional valve.

(2) Connect lines P, T1 and T on the screw-in connectors.

✓ The hydraulic lines are connected to the proportional valve.

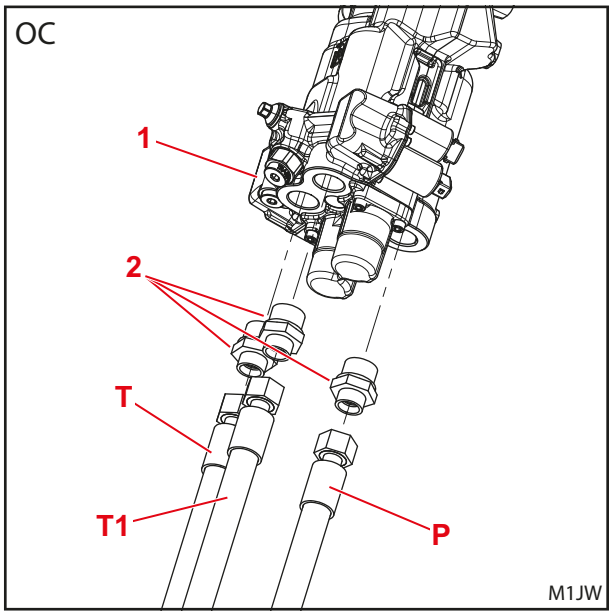

Fig. 16 Hydac valve (OC)

Legend

1 Proportional valve
2 Screw-in connector ¾"
P Pressure line
T1 Unload pressure point
T Return line (tank connection line)

Proportional valve Hydac – Pro Control, Configuration OC-LU

Connect the hydraulic lines to the proportional valve:

(1) Screw the three ¾“ screw-in connectors into the proportional valve.

(2) Screw in the plug on the connecting piece.

(3) Screw 2 screw-in connectors into the connecting piece.

(4) Install the connecting piece with screw-in connector on the proportional valve.

(5) Connect line T with the screw-in connector to the connecting piece.

(6) Connect line P to the ¾“ screw-in connector in the proportional valve.

✓ The hydraulic lines are connected to the proportional valve.

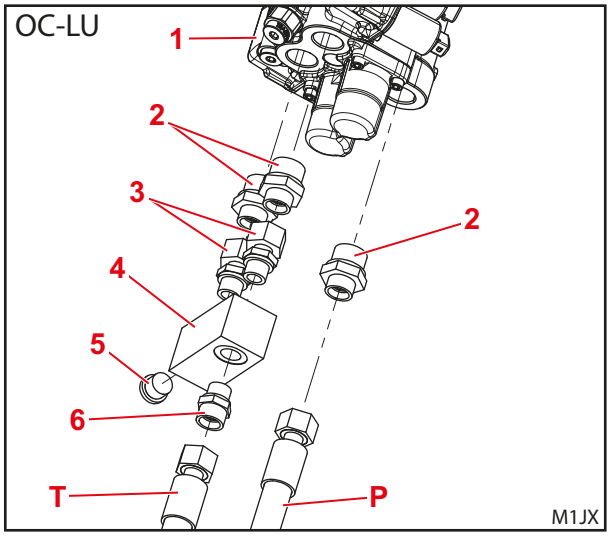

Fig. 17 Hydac proportional valve (OC-LU)

Legend

1 Proportional valve
2 Screw-in connector ¾"
3 Screw-in connector
4 Connecting piece
5 Sealing plug
6 Screw-in connector
P Pressure line
T Return line (tank connection line)

Hydac proportional valve – Pro Control, CC configuration

> In closed-centre hydraulic systems, the "190 bar" pressure relief valve must be closed.

Connect the hydraulic lines to the proportional valve:

(1) Pierce the plastic plugs labelled "190" in the hole below on the proportional valve with a small screwdriver and remove them.

(2) With an Allen key (6 mm), turn the screw of the pressure relief valve to the right in the hole up to the stop.

(3) Screw in the plug on the proportional valve in connection Pb.

(4) Screw the two ¾“ screw-in connectors into the proportional valve.

(5) Connect lines P and T with the screw-in connectors.

✓ The hydraulic lines are connected to the proportional valve.

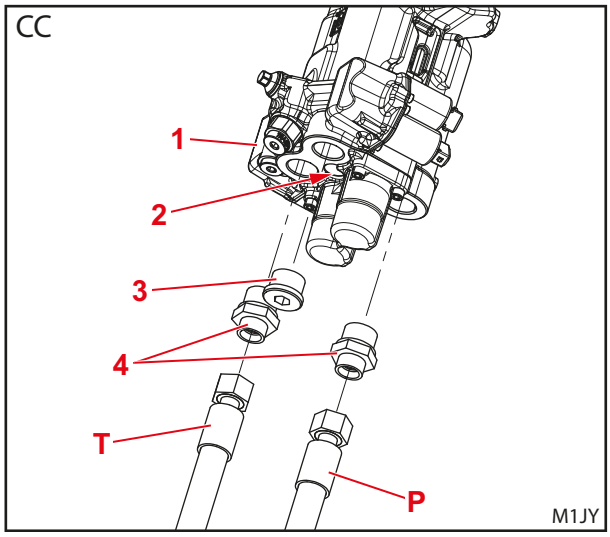

Fig. 18 Hydac proportional valve (CC)

Legend

1 Proportional valve
2 Hole
3 Sealing plug
4 Screw-in connector ¾"
P Pressure line
T Return line (tank connection line)

4.3.3 Pro Control OCLS for tractors with open-centre hydraulic system with load sensing (OCLS)

4.3.3.1 Operating principle

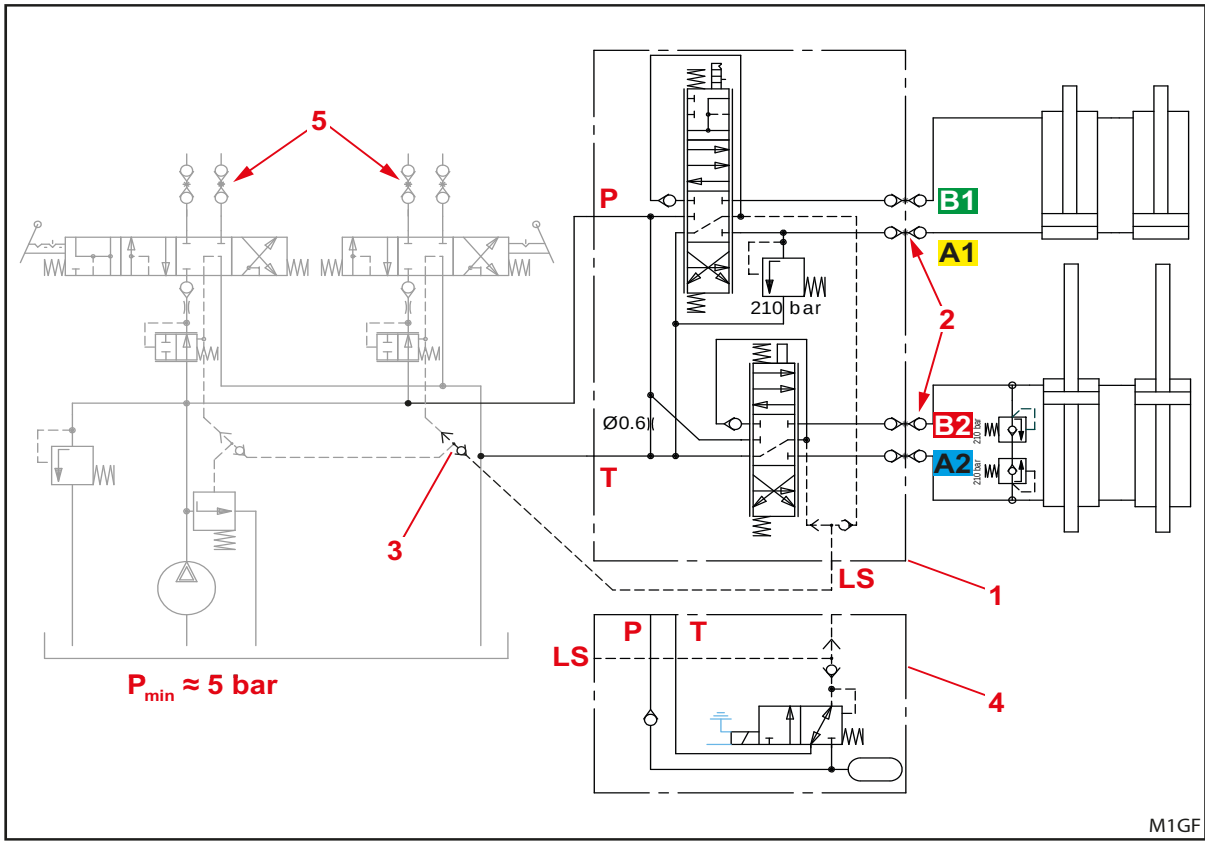

Fig. 19 Working principle of the open-centre hydraulic system and load sensing (OCLS)

Legend

1 Control unit on the right mounting part (pilot-operated electric proportional valves)

2 Interface to the front loader (see *4.1 Mounting the proportional valve on the tractor*)

3 Additional shuttle valve for load sensing

4 Additional module "start function": When the standby pressure is too low, the system pressure is raised by a pressure pulse from the reservoir when it is deflected out of the neutral position.

5 Existing valves on the tractor (e.g. for coupling points at the rear) can be used for other devices.

LS Load sensing (line P1)

P Pressure line

Pmin Standby pressure of the system

T Return line (tank)

4.3.3.2 Connecting the hydraulic lines to the tractor

For open-centre hydraulic systems with load sensing (OCLS), all the hydraulic consumers of the tractor are connected in parallel to the pump with a pressure line and to the hydraulic tank with a tank line. In addition, all the consumers are connected to the pressure compensator of the tractor control units via a load-sensing line. The individual load-sensing lines are connected to shuttle valves, so that consumers with the highest load always determine the pressure on the LS line and therefore the pump capacity.

The proportional valve of the front loader is connected as follows:

(1) Insert an additional shuttle valve on an LS line of the tractor.

(2) Connect line P1 to the shuttle valve.

(3) Connect lines P and T to the existing pressure and tank lines.

The pressure line of the proportional valve should be positioned after the pressure relief valve of the tractor so that the pump cannot be overloaded by the front loader.

✓ The proportional valve is connected.

Basic procedure:

(1) Connect the line P to a free pressure connection or with a T-piece to a pressure line.

(2) Connect line T to a free tank connection or to a T-piece on a tank line.

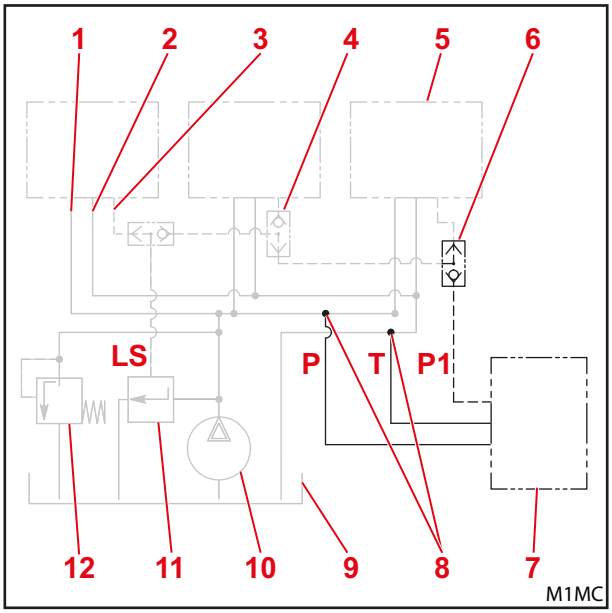

Fig. 20 Connecting the hydraulic lines to tractors with OCLS

Legend

1 Pressure line
2 Tank line
3 Load sensing line
4 Shuttle valve
5 Hydraulic consumer
6 Additional shuttle valve
7 Proportional valve
8 T-pieces
9 Hydraulic tank
10 Pump
11 Pressure compensator of the tractor control units
12 Pressure relief valve
LS Load sensing
P Pressure line
P1 Pressure line (load sensing)
T Return line (tank connection line)

(3) Interrupt an LS line of the tractor, usually at a connection point.

(4) Install the shuttle valve.

> The T-shaped shuttle valve must be inserted in the correct installation direction: The ends of the "crossbar" of the T pointing towards the hydraulic consumers. The "foot" of the T points towards the pressure compensator of the tractor control units.

(5) Connect line P1 to the shuttle valve.

✓ The hydraulic lines are connected to the tractor.

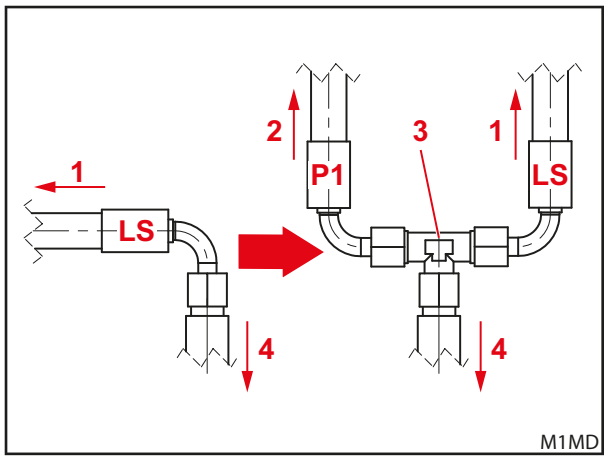

Fig. 21 Installing the shuttle valve

Legend

1 Hydraulic consumer
2 Hydraulic consumer
3 Shuttle valve
4 Pressure compensator of the tractor control units
LS Load sensing
P1 Pressure line (load sensing)

4.3.3.3 Connection points on the proportional valve

Hydac proportional valve – Pro Control, LS configuration

Connect the hydraulic lines to the proportional valve:

(1) Screw the two ¾“ screw-in connectors into the proportional valve.

(2) Screw one ¼“ screw-in connector into the shuttle valve.

(3) Connect lines P, P1 and T to the screw-in connectors.

✓ The hydraulic lines are connected to the proportional valve.

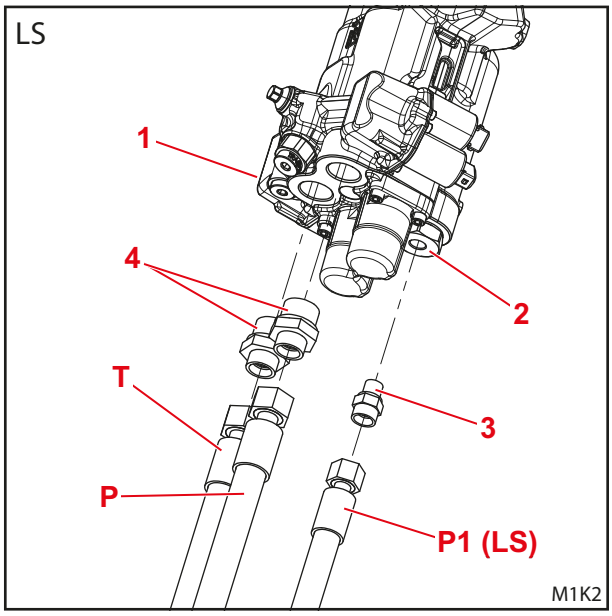

Fig. 22 Hydac proportional valve (LS)

Legend

1 Proportional valve
2 Shuttle valve
3 Screw-in connector ¼"
4 Screw-in connector ¾"
P Pressure line
P1 Load sensing line
T Return line (tank connection line)

4.3.4 Pro Control CCLS for tractors with closed-centre hydraulic system with load sensing (CCLS)

4.3.4.1 Operating principle

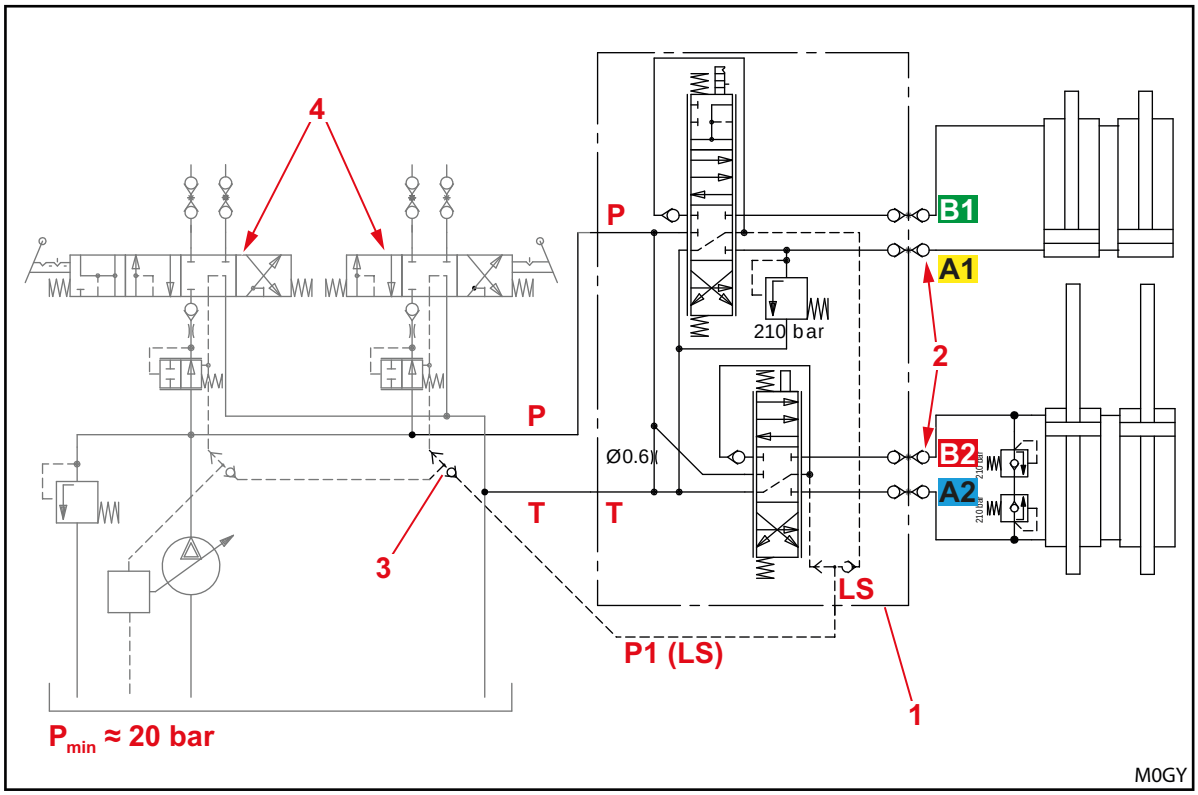

Fig. 23 Working principle of the closed-centre hydraulic system with load sensing (CCLS)

Legend

1 Control unit on the right mounting part (pilot-operated electric proportional valves)

2 Interface to the front loader (see *4.1 Mounting the proportional valve on the tractor*)

3 Additional shuttle valve for load sensing

4 Existing valves on the tractor (e.g. for coupling points at the rear) can be used for other devices.

LS Load sensing (line P1)

P Pressure line

Pmin Standby pressure of the system

T Return line (tank)

4.3.4.2 Connecting the hydraulic lines to the tractor

For closed-centre hydraulic systems with load sensing (CCLS), all the hydraulic consumers of the tractor are connected in parallel with a pressure line to the pump and a tank line to the hydraulic tank. In addition, all the consumers are connected with a load-sensing line to the pump controller. The individual load-sensing lines are connected to shuttle valves, so that consumers with the highest load always determine the pressure on the LS line and therefore the pump capacity.

The proportional valve of the front loader is connected as follows:

(1) Insert an additional shuttle valve on an LS line of the tractor.

(2) Connect line P1 to the shuttle valve.

(3) Connect lines P and T to the existing pressure and tank lines.

The pressure line of the proportional valve should be positioned after the pressure relief valve of the tractor so that the pump cannot be overloaded by the front loader.

✓ The proportional valve is connected.

Basic procedure:

(1) Connect the line P to a free pressure connection or with a T-piece to a pressure line.

(2) Connect line T to a free tank connection or to a T-piece on a tank line.

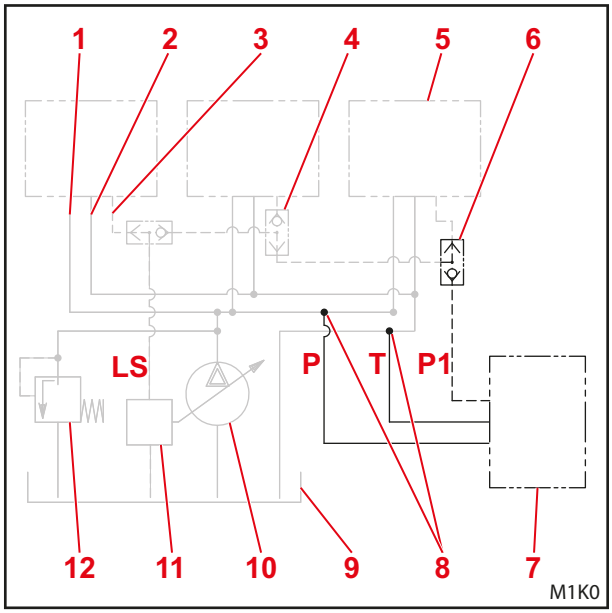

Fig. 24 Connecting the hydraulic lines to tractors with CCLS

Legend

1 Pressure line
2 Tank line
3 Load sensing line
4 Shuttle valve
5 Hydraulic consumer
6 Additional shuttle valve
7 Proportional valve
8 T-pieces
9 Hydraulic tank
10 Pump
11 Pump control
12 Pressure relief valve
LS Load sensing
P Pressure line
P1 Pressure line (load sensing)
T Return line (tank connection line)

(3) Interrupt an LS line of the tractor, usually at a connection point.

(4) Install the shuttle valve.

> The T-shaped shuttle valve must be inserted in the correct installation direction: The ends of the "crossbar" of the T pointing towards the hydraulic consumers. The "foot" of the T pointing towards the pump control.

(5) Connect line P1 to the shuttle valve.

✓ The hydraulic lines are connected to the tractor.

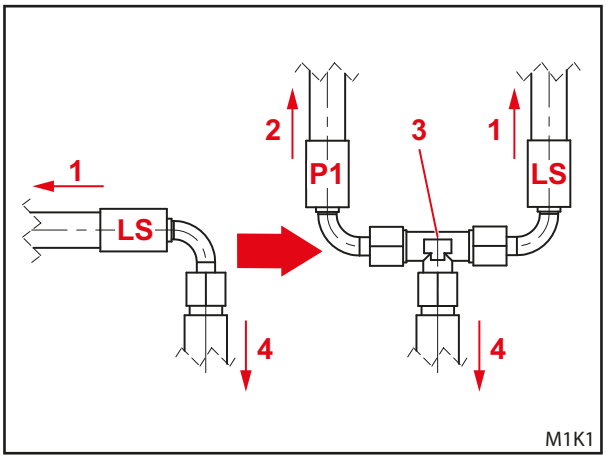

Fig. 25 Installing the shuttle valve

Legend

1 Hydraulic consumer
2 Hydraulic consumer
3 Shuttle valve
4 Pump control
LS Load sensing
P1 Pressure line (load sensing)

4.3.4.3 Connection points on the proportional valve

➢ see *4.3.3.3 Connection points on the proportional valve*

4.4 Installing the joystick

4.4.1 Preparing the joystick

The joystick is supplied with 2 adapters. Select the adapter to which the joystick handle can be attached in a convenient position.

(1) Push the adapter into the round socket on the joystick using the lug.

(2) Fasten the adapter with screws.

✓ The joystick is prepared.

> There are special joystick brackets available for many tractors (see installation instructions for the front loader mounting kit).

Fig. 26 Preparing the joystick

Legend

1 Lug
2 Bolt
3 Adapter

4.4.2 Installing the joystick on tractors with standard armrest

The joystick bracket is attached to the driver's seat on the mounting for the seat belt.

Install the joystick:

(1) Remove the screw on the seat belt buckle.

> This screw is no longer required.

(2) Remove the seat belt buckle and spacer.

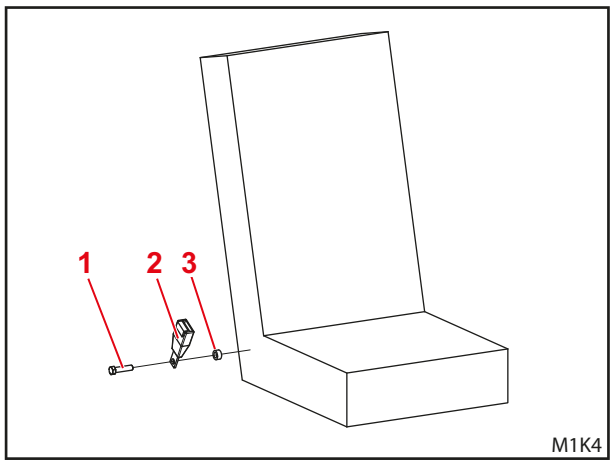

Fig. 27 Removing the mounting for the seat belt

Legend

1 Screw
2 Seat belt buckle
3 Spacer

(3) Put on the support base and initially only fasten loosely with 1 hexagonal screw M6x35 as well as a hexagonal nut with circlip and washer.

(4) Fasten the spacer and seat belt buckle with a new hexagonal screw 7/16"–20UNFx1.75".

(5) Fasten the joystick bracket with 1 hexagonal screw M8x35 with a washer on the slotted hole and 1 hexagonal screw M8x35 without washer as well as the corresponding hexagonal nuts with circlips.

> Do not fully tighten the screws yet.

(6) Fasten the adapter on the bracket with 1 hexagonal screw M8x25 with washer on the slotted hole and 1 hexagonal screw M8x25 without washer as well as the corresponding hexagonal nuts with a circlip and washer.

> Do not fully tighten the screws yet.

(7) Adjust the bracket in the slots so that the joystick is in a position that can be easily reached.

(8) Tighten the screws with a torque wrench.

> Observe the tightening torques for the screws in *7 Tightening torques for screws*!

✓ The joystick is installed.

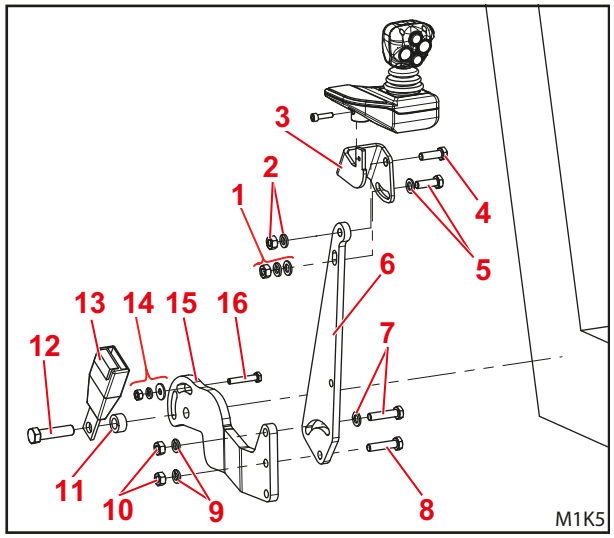

Fig. 28 Installing the joystick and mounting for the seat belt buckle

Legend

1 Hexagonal nut M8 with detent edged ring and washer
2 Hexagonal screw M8 with detent edged ring
3 Adapter
4 Hexagonal screw M8x25
5 Hexagonal screw M8x25 with washer
6 Joystick bracket
7 Hexagonal screw M8x35 with washer
8 Hexagonal screw M8x35
9 Detent edged rings VSK 8
10 Hexagonal nuts M8
11 Spacer
12 Hexagonal screw 7/16“–20UNFx1.75“
13 Seat belt buckle
14 Hexagonal nut M6 with detent edged ring and washer
15 Support base
16 Hexagonal screw M6x35

4.5 Installing the controller and the cable harness

4.5.1 Overview

⚠ WARNING

Risk of injury due to electrical voltage!

Electrical voltage can cause severe injuries.

- Only connect the power supply when all the other work has been completed.

NOTICE

Functional impairment of the front loader!

Changes to the cable harness can lead to malfunctions.

- Do not shorten the cable of the cable harness.
- Do not make any changes to the cable harness.
- Look for suitable installation routes.
- Do not damage any of the supporting cab parts when preparing the cable grommets.
  The required diameter of the grommets for the individual cables is 15 mm for the joystick connector and 35 mm for the fuses and the relay plug.

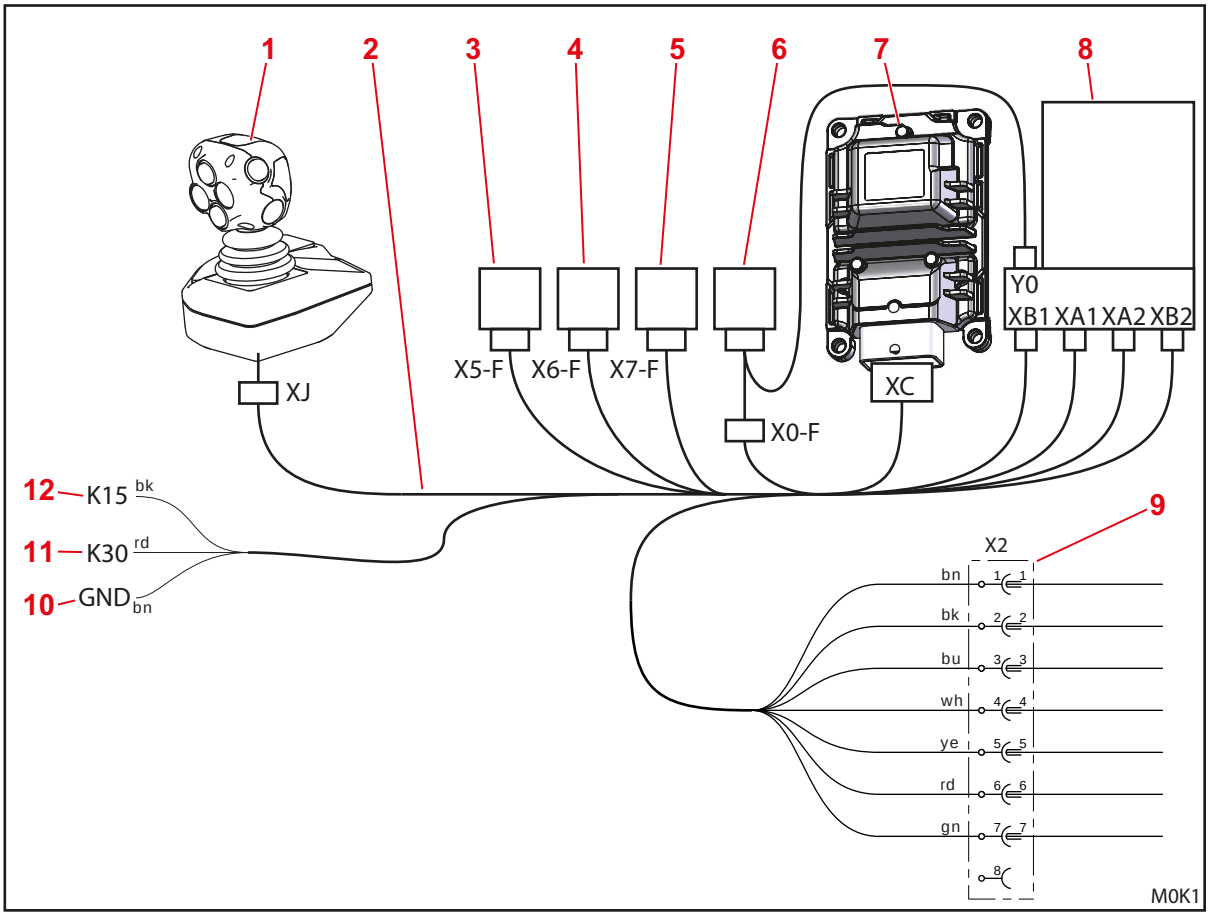

Fig. 29 Pro Control – Overview for the installation of the joystick

Legend

1 Joystick
2 Wiring harness
3 Relay for Comfort Drive (optional)
4 Relay for implement locking mechanism (optional)
5 Relay for additional functions (optional)
6 Adapter cable with relay for connection "Y0" on the Walvoil OC and LSP proportional valves
7 Controller
8 Proportional valve
9 8-pin plug X2: Electrical interface for front loader
10 Brown wire "GND": Ground line
11 Red wire "K30": Power supply 12 V+ (battery)
12 Black wire "K15": Power supply 12 V+, switched via the ignition

4.5.2 Installing the controller

Install the controller:

(1) Fasten the controller on the angle bracket with 4 hexagonal screws M6x20 and lock nuts.

✓ The controller is installed.

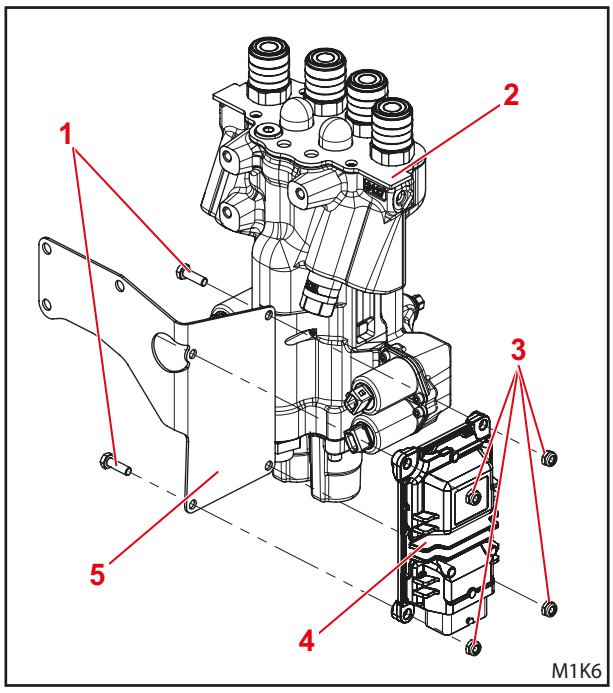

Fig. 30 Installing the controller

Legend

1 Hexagonal screws M6x20
2 Proportional valve
3 Lock nuts M6
4 Controller
5 Angle bracket

4.5.3 Connecting the cable harness to Hydac valves

Connect the cable harness:

(1) Insert plug XC of the cable harness in the controller.

(2) Insert plugs XA1, XB1 XA2, XB2 on the rear of the proportional valve.

(3) Protect plug X0-F from moisture with a blind plug.

Do not cut off the cable.

✓ The cable harness is connected.

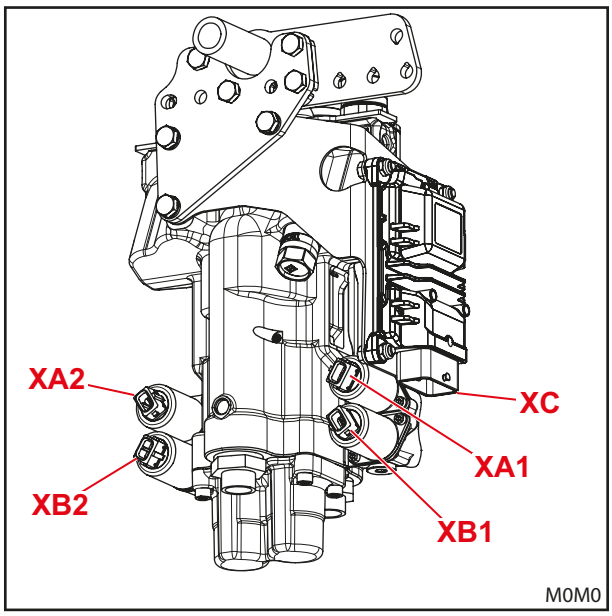

Fig. 31 Pro Control – Overview of the connectors on the Hydac valve

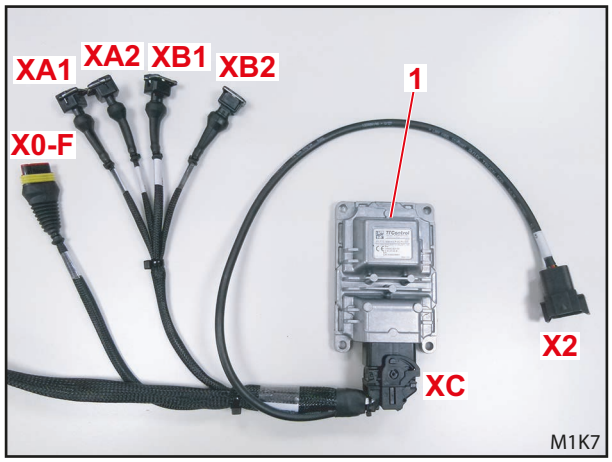

Fig. 32 Pro Control – Overview of the connectors on the controller or wiring harness

Legend

1 Controller

4.5.4 Connections to additional functions

Additional functions that require a special connection:

- Proportional valve additional function,
- Plug X0-F for Hydac valves without function,
- Electrically operated Comfort Drive,
- Hydraulic implement locking mechanism.

A relay must be connected in parallel to the plug X7-F for all additional functions (including "Y0")!

Connect additional functions:

(1) Insert plug X7-F on the relay.

(2) On front loaders with an electrically actuated Comfort Drive: Connect, plug X5-F to the relay.

(3) On front loaders with hydraulic implement locking mechanism: Connect plug X6-F to the relay.

(4) Secure all the relay in a suitable location.

Use blind plugs to protect unneeded plugs from moisture!
Do not cut off the cable!

✓ The additional functions are connected.

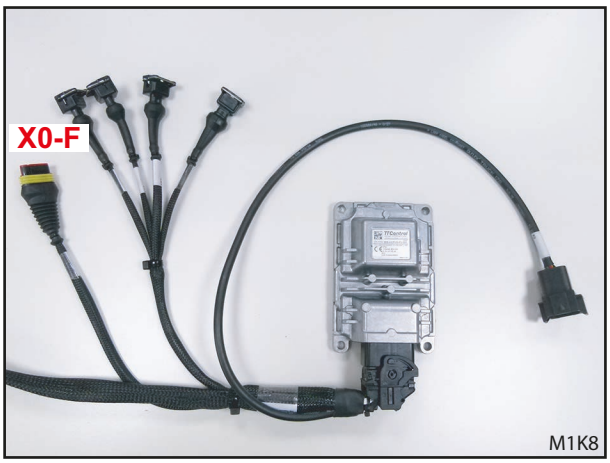

Fig. 33 Pro Control – Relay for additional functions

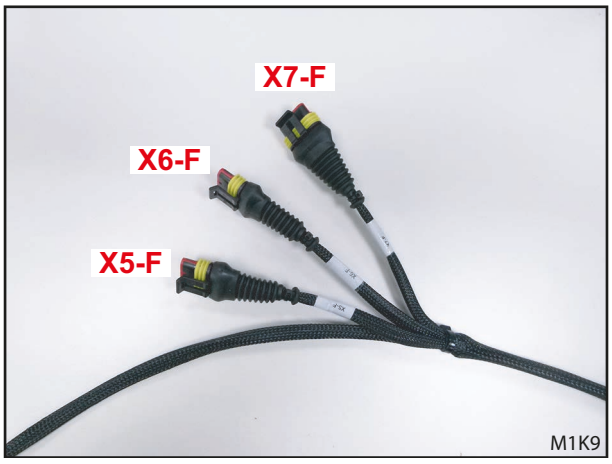

Fig. 34 Pro Control – Overview of the connectors on the controller

4.5.5 Connecting the joystick

Connect the joystick:

(1) Route the cable with the plug XJ to the joystick and connect it there.

✓ The joystick is connected.

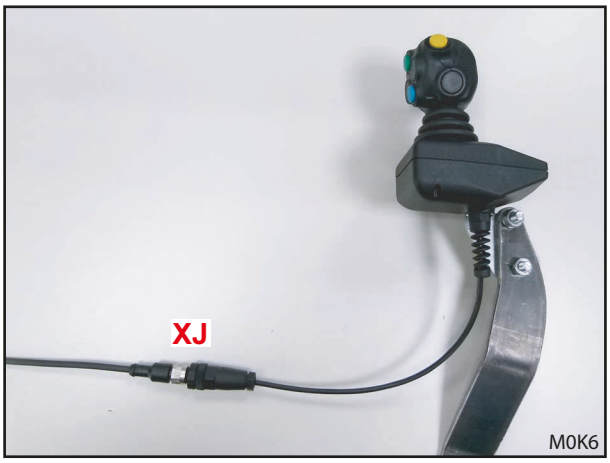

Fig. 35 Cable on the joystick

4.5.6 Connecting the sockets to cable end X2

The required contact pins are mounted at the factory on the individual wires.

Depending on the configuration of the front loader and the proportional valve, there are 2 different connection options:

- 8-pin plug connector without "lug" for installation in a Hydro-Fix lower part,

> The gasket on the pin housing is no longer required.

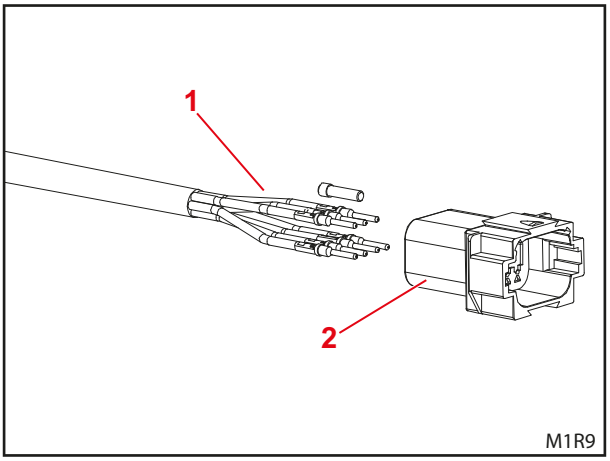

Fig. 36 8-pin plug connector without "lug" for installation in a Hydro-Fix lower part

Legend

1 Peripheral cable of the Hydro-Fix
2 8-pin plug connector without "lug"

- 8-pin plug connector with "lug" (red arrow in *Fig. 37*) to connect an adapter cable with a 7-pin socket.

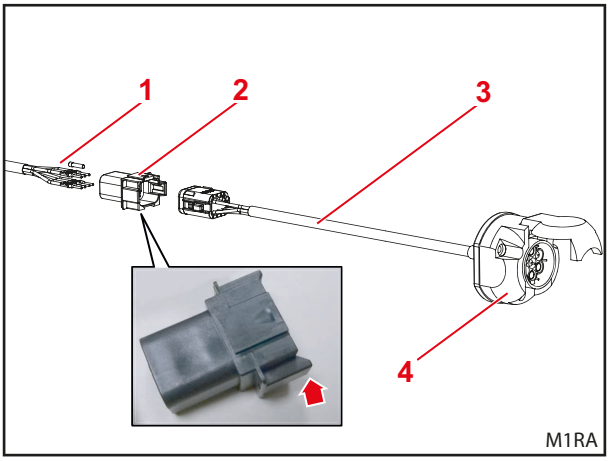

Fig. 37 8-pin plug connector with "lug" to connect an adapter cable with a 7-pin socket

Legend

1 Peripheral cable
2 8-pin plug connector with "lug"
3 Adapter cable
4 7-pin socket

Procedure for installing both plug connector versions:

(1) Slide in the individual wires with contacts on the rear side (for plug connectors with "lugs", through the gasket), until the individual wires click into place.

Perform a visual check on the front side.

(2) Insert the retaining key at the front in the plug.

(3) Only for plug connectors with "lugs": Insert blind plugs in the gasket on the rear side.

✓ The plug connectors are installed.

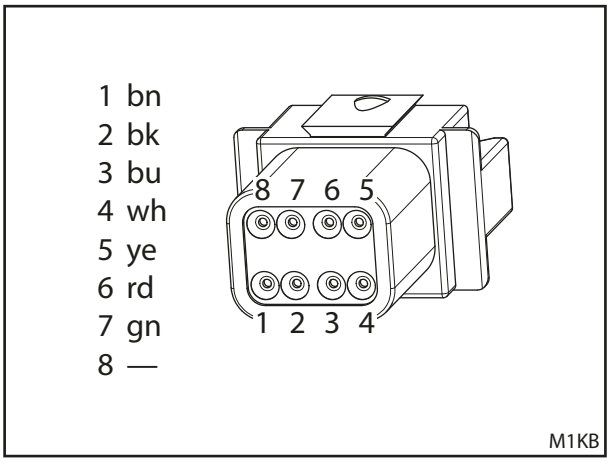

Fig. 38 X2 – Plug connector assignment

Assignment of the wire colours to the contact numbers:

Front loader additional functions	Wire colour	Plug connector, 8-pin Contact no.	Socket, 7-pin Contact no.
4th control circuit	Brown (bn)	1	1
3rd control circuit	Black (bk)	2	2
Quick emptying (FZ-L)	Blue (bu)	3	3
Return To Level (FZ-L)	White (wh)	4	4
Comfort Drive	Yellow (ye)	5	5
Hydro-Lock (hydraulic implement locking mechanism)	Red (rd)	6	6
Ground	Green (gn)	7	7
	Blind plugs	8	

Mounting the socket 7-pin socket (option)

The 7-pin socket is supplied with an adapter cable to connect to plug connector X2.

(1) Fasten the socket on the bracket with 3 screws M5, washers and nuts.

(2) Insert the adapter cable in plug connector X2.

✓ The 7-pin socket is installed.

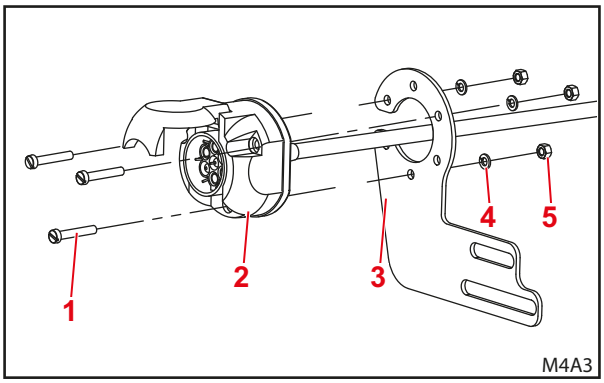

Fig. 39 Installing the 7-pin socket

Legend

1 Screws M5
2 Socket
3 Socket bracket
4 Discs
5 Nuts

Installing the 8-pin plug connector (optional)

For a description of the installation, see *4.2.2 Mounting with integrated electrical interface*.

4.5.7 Connection to the power supply

Additional functions that require a special connection:

- K30 red, +12 V, battery + (terminal 30);
  Continuous voltage for:
  - Fuse F1 – CPU
  - Fuse F4 – Controller
- K15 black, +12 V, switched via the ignition (terminal 15);
  Power supply for:
  - Fuse F2 – Relay
  - Fuse F3 – Joystick
  - Valves
- GND brown, vehicle mass, battery -.

Route the cable harness so that the fuses are accessible.
Place the fuses protected from moisture in the cab or battery box.

Maintain a secure earth connection.

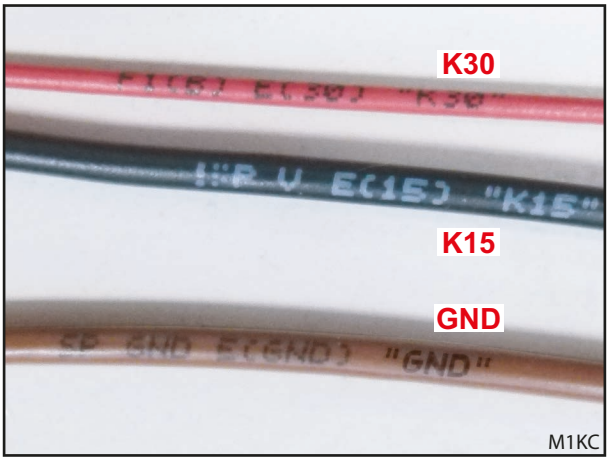

Fig. 40 Labelling of the cable for the power supply

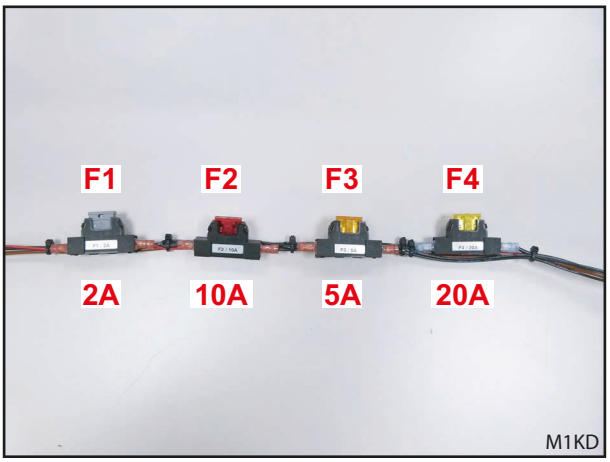

Fig. 41 Overview of the fuses

4.6 Bleeding the valves

⚠ WARNING

There is a risk of injury due to hydraulic fluids escaping at high speed!

Hydraulic oil may leak out at high speed and people in the immediate vicinity of the valve can get seriously hurt.

- Protect yourself from escaping oil.
- Make sure that nobody else is put at risk.

After the hydraulic system, electrical system and all the mounting parts have been completely installed, the valve is then bled. The hydraulic system must be closed!

Vent only with electro-hydraulic controlled valves (STOLL numbers 1439450, 1439460, 1440540 and 1440550)!

Check that the controller is properly set before venting the valve. To that end, please observer the following chapters!

On Hydac valves, the screws are on the top side (see *Fig. 42*).

Vent the valves:

(1) Only loosen the two screws on the top of the caps.

Under no circumstances unscrew them completely!

(2) Steer the joystick in all directions with the engine running until hydraulic oil is continuously leaking from the two screws.

(3) Tighten both screws again.

✓ The valves are vented.

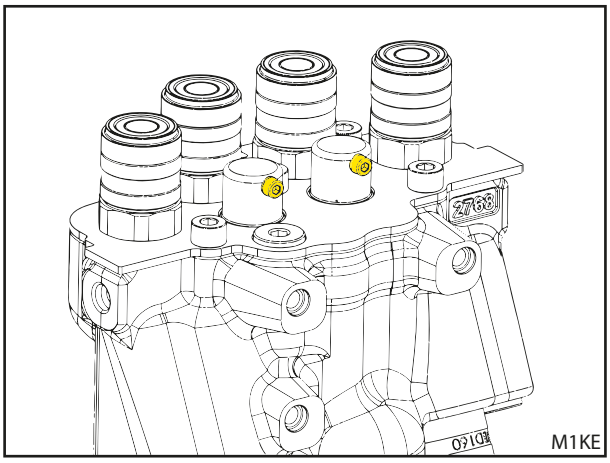

Fig. 42 Position of the hydraulic screws on a Hydac valve

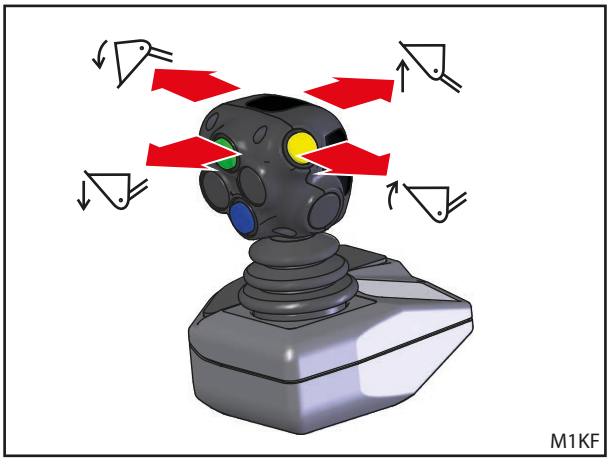

Fig. 43 Overview of the joystick

5 Programming

The programming must be suitable for the mounted front loader equipment.
Check all the functions of the front loader after changes have been made to the programming.

Take note of all the programming you have done. You can then restore the settings more quickly in case of an error or accidental change.

Programming procedure:

(1) Select the basic programme (see *5.1 Setting the basic programme*).

(2) Only for Walvoil LS valve: Disable the additional function Y0 (see *5.2.2 Enabling / disabling options*).

(3) Only for front loaders with a 3rd control circuit and/or quick emptying: Set the function of switch S2 (see *5.2.5 Membrane key functions*).

(4) Only for front loaders with Comfort Drive "closed without power" special equipment: Set function of switch S4 (see *5.2.5 Membrane key functions*).

Other settings in the software are only required if the front loader is equipped with special optional equipment or is to be optimised for specific requirements.

5.1 Setting the basic programme

There is a total of 6 different basic programmes with which the controller is set to the respective valve type. Enable the programme that is appropriate for the valve during start-up. The program will then automatically be used for each new start.

Program	Button(s)	Valves	Remark
1	yellow	Walvoil OC Walvoil LS	With Walvoil LS: Disable Y0 (see *5.2 Adjustments in the programming mode*).
2	green	Walvoil LSP	
3	blue	Hydac LS	
4	yellow + blue	Walvoil LS Walvoil OC	Alternatives to programs 1 and 2 for tractors with hydraulic pumps with high power output per litre.
5	green + blue	Walvoil LSP	
6	blue + green	Hydac OC (OC, OC-LU, CC)	

Programme 3 is factory-set.

Identifying the valves

Pay attention to the rating plate.

The valves can be distinguished by the layout of the electrical and hydraulic connections (see *Fig. 44* and *Fig. 45*):

- **Hydac LS:** 4 electrical connections at the rear, LS connection at the rear
- **Hydac OC:**4 electrical connections at the rear, connection P at the rear

The configurations for Hydac OC, Hydac OC-LU and Hydac CC are all based on the same valve in different configurations.
Use programme 6 for all 3 configurations!

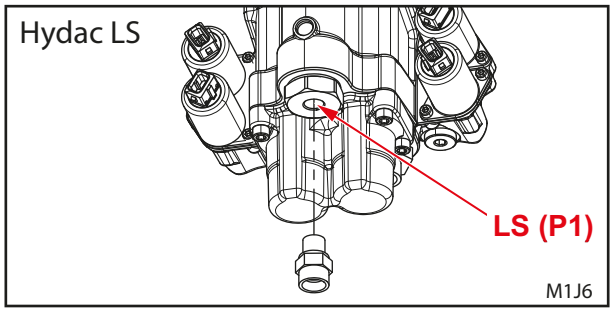

Fig. 44 Hydac LS

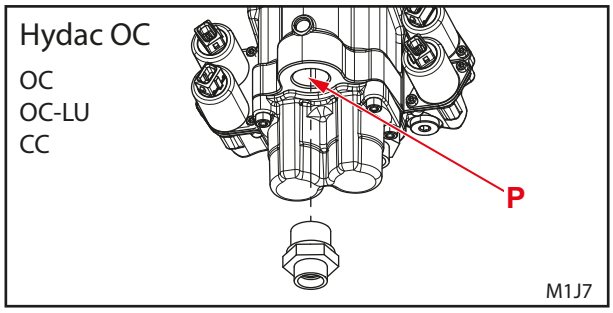

Fig. 45 Hydac OC

Activating the programme

Do not move the joystick!

(1) Press button 1 or 2.

(2) Switch on the ignition.

(3) Wait until the LED L1 stops flashing.

(4) Release the button.

✓ The programme is activated.

If you want to use another programme later on (e.g. programme 5 instead of programme 2), proceed in exactly the same way. Afterwards, check all the changes made in the programming mode (see *5.2 Adjustments in the programming mode*).

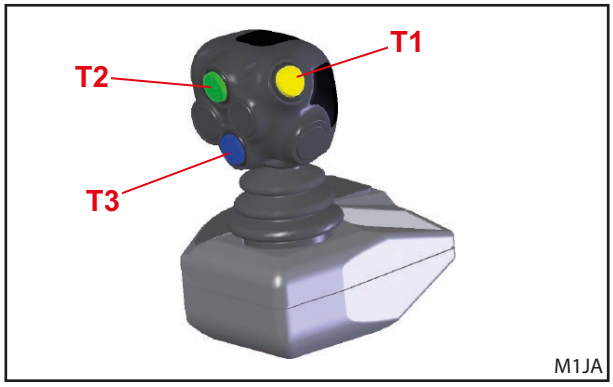

Fig. 46 Pro Control – Buttons

5.2 Adjustments in the programming mode

5.2.1 Starting and exiting the programming mode

Start programming mode:

(1) Press and hold down button T3 (blue).

(2) Move the joystick backwards and keep it there.

(3) Switch on the ignition.

(4) Wait until L1 flashes quickly.

(5) Release the joystick and button T3.

✓ The programming mode is now enabled. LED L1 flashes quickly, all the other LEDs on the membrane keyboard are off.

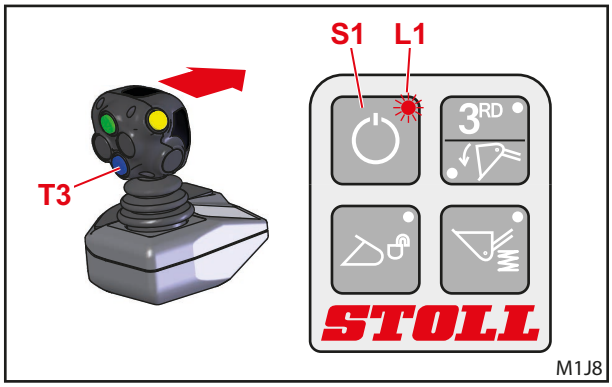

Fig. 47 Starting the programming mode

Exit programming mode:

(1) Switch off the ignition.

✓ The programming mode is terminated.

5.2.2 Enabling / disabling options

(1) Start programming mode (see *5.2.1 Starting and exiting the programming mode*).

(2) Press the membrane key S1.

LED L1 flashes normally (slightly slower than at the start of the programming mode). LEDs L2a, L3 and L4 show the programmed options. When an option is enabled, the corresponding LED lights up; when the function is disabled, the LED flashes. You can enable and disable the options using the T1, T2 and T3 buttons. The table shows the assignment of the buttons and LEDs to the options.

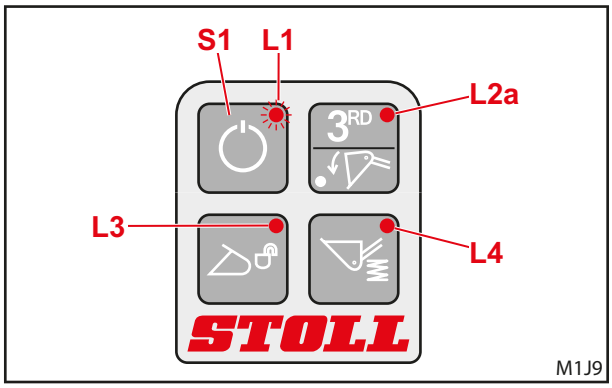

Fig. 48 Pro Control – Membrane keys

Button	LED	Option
T1 Yellow	L2a	Additional function Y0 (adapter cable to cable X0-F)
T2 Green	L4	Implement float position
T3 Blue	L3	Front loader float position

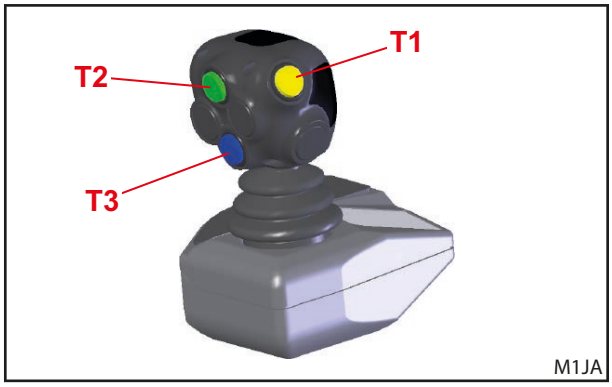

Fig. 49 Pro Control – Buttons

The "Implement float position" option may only be enabled if:

- The front loader is equipped with a mechanical parallel motion (ProfiLine FZ) and
- the valve has a float position in the implement section (only Hydac valves, STOLL numbers 1436140, 1436150, 1439450, 1439460, 1440540 and 1440550).

The following table shows the factory-set options:

Program	Float position		Additional function Y0
	Implement	Lifting arm	
1		Enabled	Enabled
2		Enabled	Enabled
3		Enabled	
4		Enabled	Enabled
5		Enabled	Enabled
6		Enabled	

Exit the programming mode if you have set all the options appropriately for the front loader and the proportional valve.

5.2.3 Adjusting the control behaviour

(1) Start programming mode (see *5.2.1 Starting and exiting the programming mode*).

(2) Press the membrane key S2.

The LED L1 flashes normally (slightly slower than at the start of the programming mode), all of the other LEDs are off.

In this programme level, the settings are saved by pressing membrane key S2. With membrane key S1, it is possible to return to the factory settings (reset).

With buttons T1, T2 and T3, you can reach the subsequent options to make the corresponding settings there.

Button	Option
T1 yellow	Set the ramp (soft, medium, hard)
T2 green	Set the maximum current (per direction)
T3 blue	Set the minimum current (per direction)

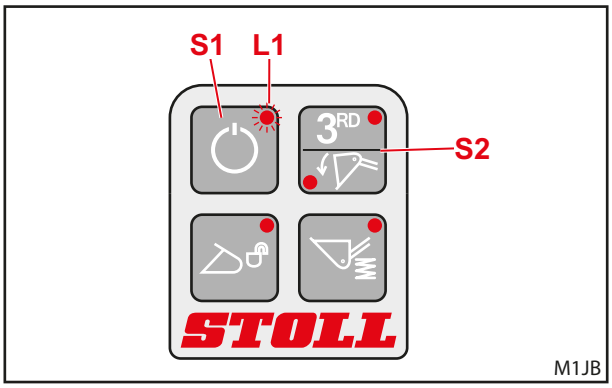

Fig. 50 Pro Control – Membrane keys

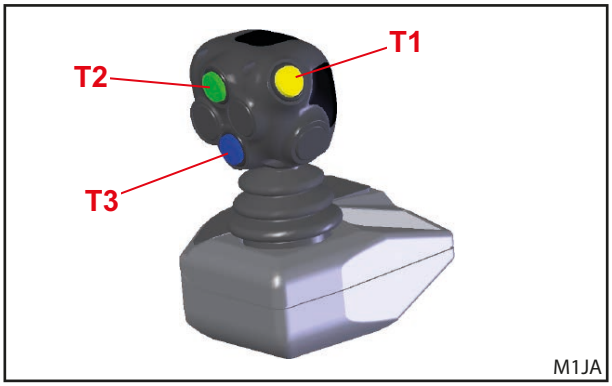

Fig. 51 Pro Control – Buttons

Setting the ramp:

The ramp is set with button T1. The front loader will respond accordingly soft, medium or hard to the control commands of the joystick. The setting is displayed on LEDs L2a, L2b and L4. LED L1 is turned off.

(1) Press button T1 until the required setting is displayed.

(2) Press membrane key S2 to save the settings.

Ramp	LED		
	L2a	L2b	L4
soft	on		
medium		on	
hard			on

✓ The ramp is set.

"Medium" is factory-set.

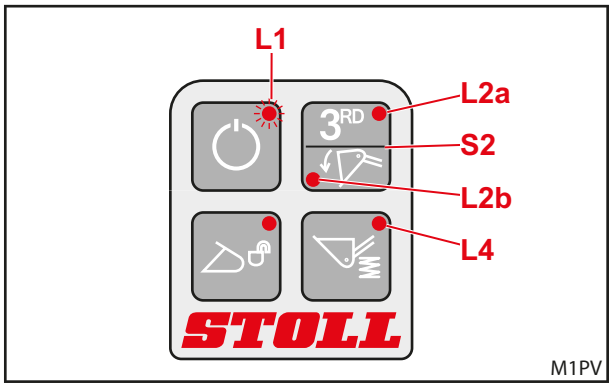

Fig. 52 Pro Control – Membrane keys

Fig. 53 Pro Control – Button T1

Setting the control current:

The minimum and maximum current are factory-set for the utilised valve. Only change the control current when the setting through the programme selection (see *5.1 Setting the basic programme*) or the choice of the ramp is not sufficient.

The setting of the maximum and minimum current is called up by pressing button T2 or T3 while simultaneously moving the joystick. It is set individually for each direction (lifting, lowering, dumping, scooping). Example: If you want to adjust the maximum value for lifting, move the joystick towards lifting and press button T2 at the same time.

The actual current value is displayed on the LEDs L2a and L2b. L2a flashes the hundred digits, L2b for the ten digits. So for the current value of 410 mA, LED L2a flashes four times and the LED L2b once. Next, the current value can be gradually increased by 10 mA increments with button T2 and lowered by 10 mA increments with T3. Shortly after the last setting is made, the actual current value is displayed repeatedly on LEDs L2a and L2b.

Programme	Lifting		Lowering		Scooping		Dumping	
	Imin	Imax	Imin	Imax	Imin	Imax	Imin	Imax
1	410	940	410	800	410	800	410	800
2	410	940	410	800	410	800	410	800
3	450	930	450	950	450	950	450	950
4	320	800	320	800	320	800	320	800
5	320	800	320	800	320	800	320	800
6	550	930	500	950	500	950	500	950

Save the settings with S2 and exit the programming mode when the control behaviour is set.

5.2.4 Joystick button functions

(1) Start programming mode (see *5.2.1 Starting and exiting the programming mode*).

(2) Press the membrane key S3.

LED L1 flashes normally (slightly slower than at the start of the programming mode). LEDs L2a, L2b and L4 indicate the programmed functions. When an function is enabled, the corresponding LED lights up; when the function is disabled, the LED flashes. You can enable and disable the options using the T1, T2, and T3 buttons. The table shows the assignment of the buttons and LEDs to the options.

	LED	Functions	Factory setting
T1 yellow	L2a	Additional control circuit Real³	Disabled
T2 green	L2b	Pressure relief * 3rd control circuit	Disabled
T3 blue	L4	Pressure relief * 4rd control circuit	Disabled

* This function allows the unpressurised switching of the control circuit. The function may only be used with Hydac valves!

The additional control circuit "REAL³" may only be activated when the equipment is installed. In this case, the instructions for "REAL³" must also be observed.

The pressure relief may only be enabled if the corresponding control circuits are available on the front loader and the implement float position is enabled.

Exit the programming mode when the functions are set.

5.2.5 Membrane key functions

(1) Start programming mode (see *5.2.1 Starting and exiting the programming mode*).

(2) Press the membrane key S4.

✓ The functions can be set.

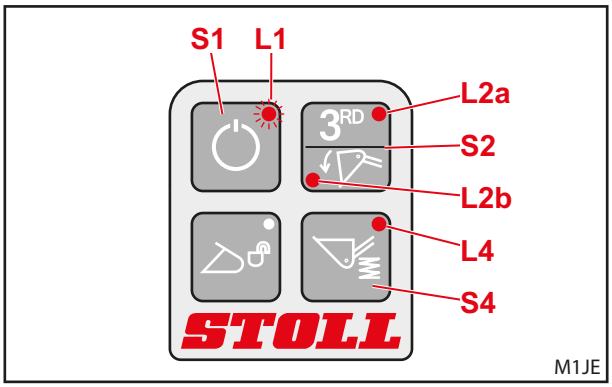

Fig. 54 Pro Control – Membrane keys

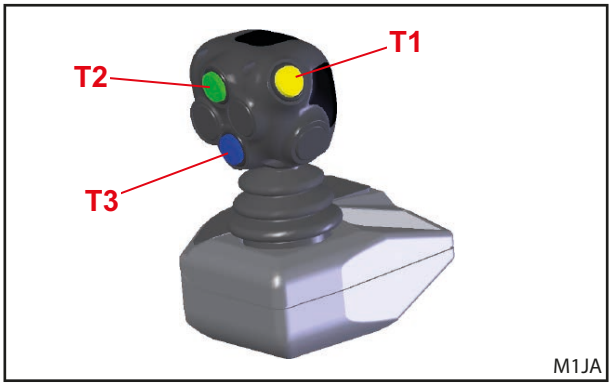

Fig. 55 Pro Control – Buttons

Setting the function of membrane key S2:

If the front loader does not have quick emptying or a 3rd control circuit, this setting can be skipped.

(1) Press button T1 repeatedly until the LEDs indicate the required setting (see table).

Function	LED	
	L2a	L2b
Membrane key S2 without function, 3rd control circuit always available	on	
Membrane key S2 without function, quick emptying always available		on
Membrane key S2 switches between 3rd control circuit and quick emptying	on	on

The last line in the table above is the factory setting.

Setting the function of membrane key S4:

If the front loader does not have an electrically switched Comfort Drive, this setting can be skipped. On ProfiLine FS/FZ 36-20 to 48-42 front loaders, the Standard version of the Comfort Drive is switched on when the valve is energised (closed without power). As special equipment for special applications, the Comfort Drive can be equipped with another valve. The Comfort Drive is then switched on when the valve is not energised (open without power). The function (closed without power or open without power) must be set accordingly.

Please note: on FS/FZ 8 to 100 front loaders, the Standard version of the Comfort Drive is switched on when the valve is not energised (open without power). As special equipment for special applications, the Comfort Drive can also be equipped with another valve (closed without power).

(1) Press button T2 repeatedly until the LED indicates the required setting (see table).

Function	LED
	L4
Open without power (factory setting)	flashes
Closed without power	on

Exit the programming mode when the functions are set accordingly for the front loader.

6 Completing the mounting and installation

Observe the operating instructions!

Operation is explained in detail in the operating instructions.

- Check for proper installation and function:
  - Are all the screws tight?
  - Is the installed hydraulic system airtight?
  - Are all cables routed so that they do not rub or bend?
  - Are all cables routed so that they do not rub or bend?
  - Is a collision possible between newly mounted parts and other components (e.g., mudguards)?

Also check when the steering is turned and front axle is oscillating!

  - Do the operating elements work properly? Does the assignment of operating elements concur with the functions?

- Do all the additional electrical functions work?
- Does the front loader work properly under all operating states?

Upon completion of the installation, pass these installation instructions on to the end user. These installation instructions should be stored in a safe location and given to the new owner if the front loader or the tractor fitted with the front loader changes hands. The information in *3 Overview* is also used for ordering spare parts.

7 Tightening torques for screws

Tightening torque for screws						
Thread	Strength category					
	8.8		10.9		12.9	
	Nm	lb-ft	Nm	lb-ft	Nm	lb-ft
M4	3	2	4.5	3	5	4
M6	11	8	15	11	17	13
M8	27	20	36	27	42	31
M8x1	29	21	38	28	45	33
M10	54	40	71	52	83	61
M10x1.25	57	42	75	55	87	64
M12	93	69	123	91	144	106
M12x1.5	97	72	128	94	150	111
M12x1.25	101	74	133	98	155	114
M14	148	109	195	144	229	169
M14x1.5	159	117	209	154	244	180
M16	230	170	302	223	354	261
M16x1.5	244	180	320	236	374	276
M18	329	243	421	311	492	363
M18x2	348	257	443	327	519	383
M18x1.5	368	271	465	343	544	401
M20	464	342	592	437	692	510
M20x2	488	360	619	457	724	534
M20x1.5	511	377	646	476	756	558
M22	634	468	807	595	945	697
M22x2	663	489	840	620	984	726
M22x1.5	692	510	873	644	1022	754
M24	798	589	1017	750	1190	878
M24x2	865	638	1095	808	1282	946
M27	1176	867	1496	1103	1750	1291
M27x2	1262	931	1594	1176	1866	1376
M30	1597	1178	2033	1499	2380	1755
M30x2	1756	1295	2216	1634	2594	1913
5/8“ UNC (normal)	230	170	302	223		
5/8“ UNF (fine)	244	180	320	236		
3/4" UNC (normal)	464	342	592	437		
3/4" UNF (fine)	511	377	646	476		

Make sure that the threads are clean! The specified tightening torques are valid for screws and threads that are clean, dry and free of grease.

Address of the dealer

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