LINKAGE CONTROL SYSTEM EHR

AMENDMENT
to the Operation Manual of KIROVETS Tractors
K-744R1, K-744R2, K-744R3, K-744R4
(744Р-0000010ИЭ)

Linkage is controlled by the control panel located on the hydraulics board in the tractor cabin and by external buttons on the wings of rear wheels of tractor.

Hydraulic distributor on tractors with EHR system

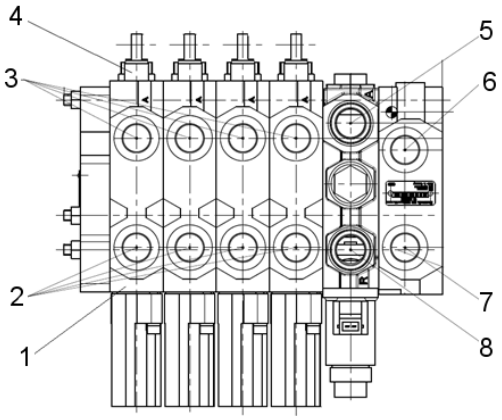
(1) – distributor unit;

(2), (3) – unions of service hydraulic lines;

(4) – valve spool; (5), (8) – unions of EHR section;

(6) – pressure line union;

(7) – drain line union



LINKAGE CONTROL PANEL

(1) – holding lock of the linkage control handle;

(2) – linkage control handle;

(3) – indicator of linkage lifting (red);

(4) – failure diagnostics indicator (red);

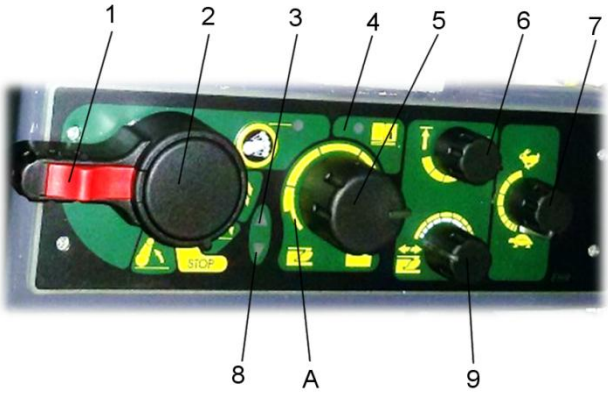
(5) – soil cultivation depth control handle;

(6) – control handle for limitation of linkage lifting height;

(7) – lowering speed control handle;

(8) – linkage lowering indicator (green);

(9) – handle for selection of adjustment method



Linkage control panel

In case of faults in the linkage electronic hydraulic control system, the diagnostic alarm device (4) informs about the fault and, in case of occurrence of complex faults, the linkage control system operation is blocked.

The rear linkage is controlled in the following procedure:

– use handle (9) to set the control method depending on the nature of operation.

Handle clockwise rotation all the way in — positional control mode; counterclockwise rotation all the way in — power control mode; in between — combined control. Preferred is the combined control mode. Since the tractor has only a position sensor (see “EXTERNAL BUTTONS OF LINKAGE CONTROL SYSTEM” section), handle (9) shall be set to “POSITIONAL CONTROL” position (all the way clockwise);

– use handle (6) to set the required allowable lift height of implement in transport position.

Handle clockwise rotation all the way in corresponds to the maximum lift, counterclockwise rotation all the way in corresponds to the minimum lift;

– use handle (5) to set the required operating depth.

Handle clockwise rotation all the way in corresponds to the minimum depth, counterclockwise rotation to position “A” corresponds to the maximum depth; counterclockwise rotation all the way in corresponds to "FLOATING POSITION".

– move handle (2) to the low locked position in order to lower the linkage. Then, during the work, it is required to adjust the best possible operation conditions for the mounted implement:

- - using handle 9, select the combination of control methods (with draft control available);
- - using handle (5), select the operating depth;
- - using handle (7), select linkage lowering and lifting speed. Handle clockwise rotation all the way in corresponds to the maximum lowering (lifting) speed, counterclockwise rotation all the way in corresponds to the minimum lowering (lifting) speed.

Handle (2) has four positions:

– middle position – OFF;

– upper position – LIFTING;

– lower position – LOWERING (in operation – AUTOMATIC CONTROL);

– lower position NON-FIXED – upon final pressing of handle in lower position, deepening of implement takes place by its weight without assessment of the state of position sensor. This position of handle is used in case of raising an agricultural implement in case of heavy soil treatment.

Indicator (8) lights up during linkage lowering, indicator (3) lights up during its lifting.

In case of agricultural implement raising when it penetrates tight soil or pot holes, land the implement by pressing handle (2) further downwards. After handle (2) is released, it will return into fixed position “LOWERING”. At the same time, agricultural implement reaches the depth that was set earlier with handle (5).

Agricultural implement shall raise with handle (2) moving to the upper position.

In the course of operation, indicators (3) or (8) will light up upon linkage position correction.

ATTENTION! When indicator (3) does not go out after the implement is lifted up, operation of the tractor is *PROHIBITED* to prevent GNS pump against failure!

ATTENTION! When the tractor is stopped for emergency reasons, to prevent further landing of agricultural implement you must set control handle (2) to position “OFF”.

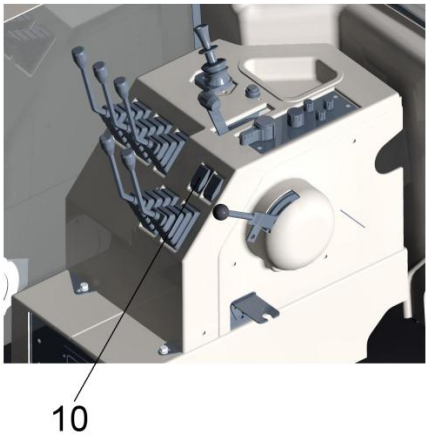
When the tractor starts moving, set the handle to position “LOWERING” and the implement will land for the depth set earlier!

You have to learn the following details of how to operate the linkage:

– after the engine is started, diagnostics indicator (4) lights up to signal about serviceability and locking of control system;

– to activate and unlock the control system you have to set the switch 10 on the hydraulics board to ON position (press the symbol), and put handle (2) into operation position once (LIFTING or LOWERING).

At the same time, diagnostics indicator (4) goes out;



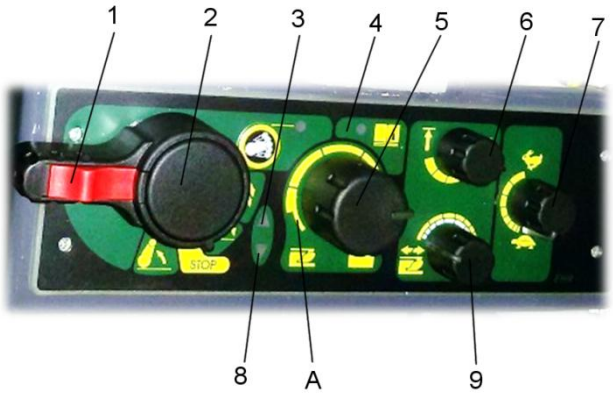
– after the system is unlocked at switching for the first time, due to safety reasons, linkage lowering and lifting speed is automatically limited.

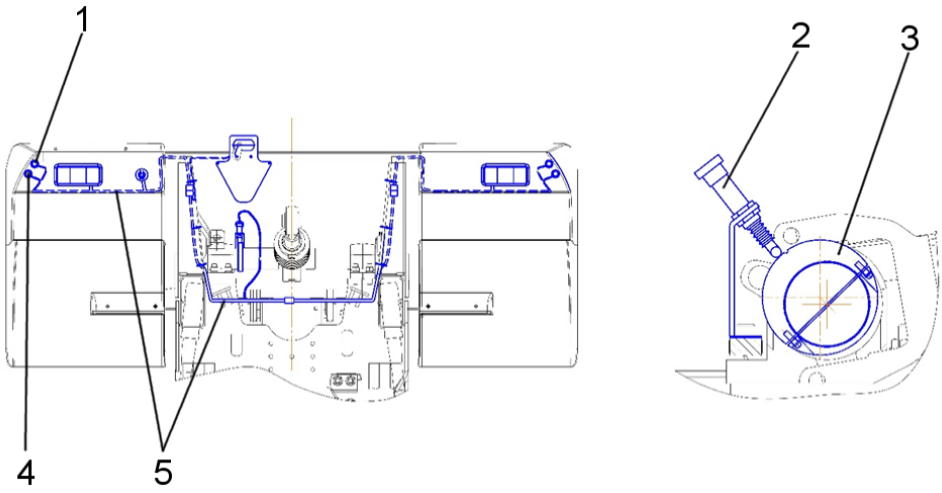
To remove the lifting or lowering speed limitation, set handle (2) to position OFF and then to position LIFTING or LOWERING.

EXTERNAL BUTTONS OF LINKAGE CONTROL SYSTEM

Linkage is normally controlled by external buttons with the purpose of attachment of agricultural machines and implements to linkage.

Rear unit can be lifted and lowered with external buttons installed on wings of the rear wheels in any control modes: handles (2), (5), (6), (7), (9) can stay in free position as the cabin control system is blocked in this case.





External buttons for linkage control and installation of position sensor

(1) – button LIFTING; (2) – position sensor; (3) – eccentric;
(4) - button LOWERING; (5) - connection wire harnesses.

To lift the linkage, press and hold any of the buttons (1) on the right or left wing. To lower the linkage, press and hold any of the buttons (4) on the right or left wing.

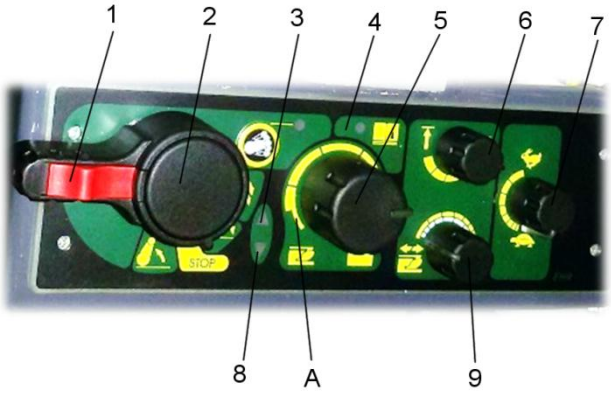
Due to safety reasons, the external buttons operate with interruptions. When you press and hold the lifting button (1)/lowering button (3), linkage will lift/lower with smooth reaching the extreme positions (reduced speed of lifting/lowering).

When working with remote buttons of the linkage control system, never stay between the tractor and the implement being attached!

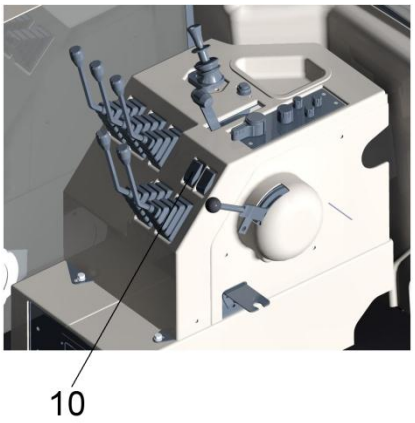
To prevent accidents, *IT'S PROHIBITED* to use buttons for mechanical movement of EHR section solenoid-operated valves.

DIAGNOSTICS OF FAILURES IN LINKAGE ELECTRONIC CONTROL SYSTEM

Electronic control system by BOSCH installed at your tractor has the self-diagnostic function, and in case of finding failure, it provides code information to the operator using diagnostic failure indicator (4) on the linkage control panel. After the engine is started, as it was stated earlier, and when the linkage control system operates without failure, indicator (4) lights continuously. After handle (2) is operated upward or downward, indicator (4) goes out.



After the engine is started and the system is activated using switch (10), when an error is found in the system, diagnostic indicator (4) starts producing code information related to such error and blocks the system, if required.



The error code is produced as a two-digit number; first digit equals to the number of flashes of indicator (4) after the first long pause, and the second digit equals to the number of flashes after second long pause.

For example, indicator (4) operates with the following algorithm:

- engine start-up;
- system is activated;
- lighting is continuous;
- after the system is unblocked, the indicator goes out;
- indicator flashes 3 times;

– long pause (indicator does not light);

– indicator flashes 6 times;

– long pause (indicator does not light).

This means that the error code in the system is “36”. When several errors are present, the system indicates error codes one after another and separates them with a long pause.

The system defines three groups of errors: complex, medium and simple errors.

In case of complex errors, the adjustment procedure stops and the system goes off. The system cannot be operated from the panel or remote buttons. Diagnostics indicator generates an error code. When the error is corrected and the engine is started, the system operation restores.

In case of medium errors, the adjustment is stopped and the system is blocked. The system can be operated only from remote buttons and it is not operated from the main panel. Diagnostics indicator generates an error code. When the fault is corrected and the engine is started, the system operation restores.

In case of simple errors, the diagnostics indicator generates a fault code, but the system can be operated without blocking. With simple faults, linkage control system doesn’t operate properly and gives wrong measurements for soil. After the fault is corrected, the diagnostics indicator goes out.

When the system detects an error of any complexity, the following must be done:

– determine the code;

– stop the engine;

– according to instructions provided in fault code table “Possible errors of electronic linkage control systems and troubleshooting” (see below), correct the error;

– start the engine and start working, if no errors are present.

POSSIBLE ERRORS OF ELECTRONIC LINKAGE CONTROL SYSTEMS AND TROUBLESHOOTING

ATTENTION! Linkage control system connectors shall be disconnected only when the engine is shut down!

ATTENTION! Indicated voltage values shall be measured with engine in operation, taking proper safety measures for live electric equipment!

ATTENTION! Numbering of pins in the cable connectors is provided at connector’s body!

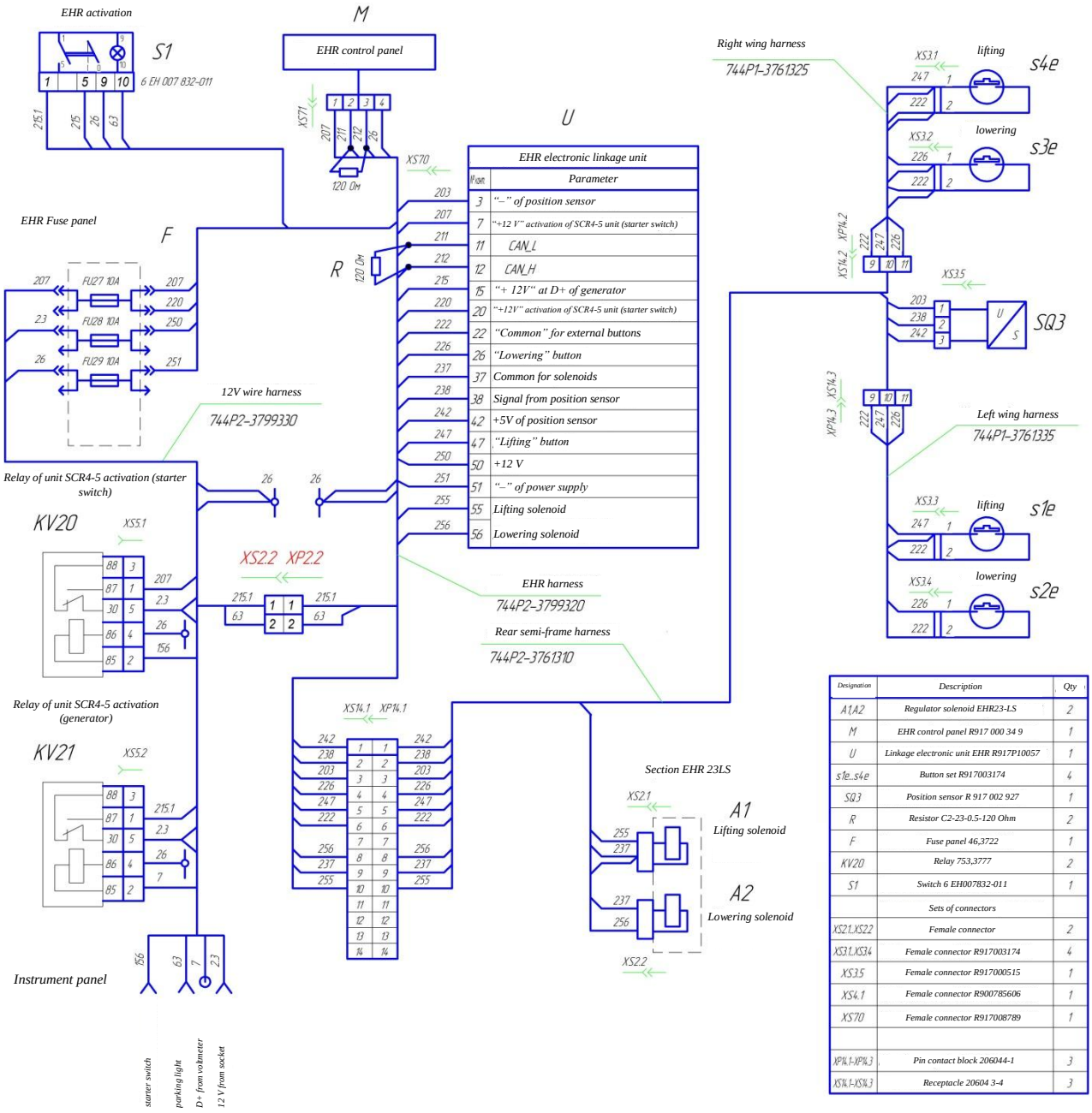
ATTENTION! Only authorized dealers shall repair electronic linkage control systems. Otherwise, the guarantee for electronic linkage control systems becomes void!

Procedure for diagnostics of electronic linkage control system faults

Code	Fault description, possible cause	Fault check method
COMPLEX FAULTS		
11	Failure in the control circuit of **lifting** solenoid valve. Break in solenoid coil or control harness.	Disconnect the harness from the solenoid coil and check the coil for break using a multimeter. Coil resistance shall not exceed 2–4 Ohm. If the coil is in good condition, check solenoid control harnesses for mechanical damage and, using a multimeter, check wire 255 for disconnection from solenoid terminal to terminal 55 of 56-pin connector of the electronic unit.
12	Failure in the control circuit of **lowering** solenoid valve. Break in solenoid coil or control harness.	Disconnect the harness from the solenoid coil and check the coil for break using a multimeter. Coil resistance shall not exceed 2–4 Ohm. If the coil is in good condition, check solenoid control harnesses for mechanical damage and, using a multimeter, check wire 256 for disconnection from solenoid terminal to terminal 56 of 56-pin connector of the electronic unit.
13	Failure in the control circuit of **lowering** or **lifting** solenoid valve. Short circuit in one of the solenoid valves or short circuit of solenoid control wires in harness	Disconnect harnesses from the solenoid and check the solenoids for short circuit using a multimeter Coil resistance shall not exceed 2–4 Ohm. Or measure the solenoid valve current consumption by supplying 6 V. The current shall not exceed 3.2 A. Disconnect the connector from the electronic unit and check wires 255 and 256 for short circuit in comparison with wire 237 (solenoid valves shall be disconnected).
14	Failure of the external buttons for **lifting** control. Short circuit of wires or sticking of one of the external buttons for **lifting** control.	Check harnesses coming from the external buttons for linkage lifting control for mechanical damage. By turn, disconnect each lifting button until the fault disappears. During this procedure the engine shall be shut down. If the buttons are disconnected and the fault is still present, disconnect the connector from the electronic unit and, using a multimeter, check terminals 247 and 222 for short circuit.
15	Failure of the remote buttons for **lowering** control. Short circuit of wires or sticking of one of the remote buttons for **lowering** control.	Check harnesses coming from the remote buttons for linkage lowering control for mechanical damage. By turn, disconnect each button until the fault disappears. During this procedure the engine shall be shut down. If the buttons are disconnected and the fault is still present, disconnect the connector from the electronic unit and, using a multimeter, check terminals 222 and 226 for short circuit.
16	Electronic unit failed. Constant supply voltage feeding the control panel is below the required level. Maybe connectors of the sensors for linkage force and position were short-circuited due to water getting into the connectors.	Disconnect EHR harness from the main control panel. Measure constant supply voltage at pins 203 (negative) and 242 (positive) of the panel connector; it shall be of 5 V (the engine shall be in operation). If the supply voltage is low or absent, check the electronic unit connector for reliability of connection. By turn, disconnect the sensors for linkage force and position.

Code	Fault description, possible cause	Fault check method
17	Excess of the general supply voltage of SRC4-5 unit.	When the general supply voltage of SRC4-5 unit exceeds 19 V. Check output voltage in the vehicle mains. Generator voltage controller failed.
Code	**Fault description, possible cause**	**Fault check method**
MEDIUM FAULTS		
22	**Position sensor** failed Sensor wire is broken, the sensor is not connected or not adjusted.	1. The position sensor is not adjusted. Disconnect the harness connector from the sensor. Screw the sensor out. Lift the linkage to the uppermost position using external buttons or solenoid button “LIFTING”. Screw the sensor all the way in by hand and then screw it out for two turns. Connect the harness connector to the sensor. Using control board, lower down and lift up the linkage into utmost position. Lifting indicator shall go off. If it illuminates, screw the position sensor further in by 1/6 of a turn. Recheck system’s operation. If needed (the lifting indicator doesn’t go out in the upper position of the linkage), turn the sensor further in again and repeat the check. When the linkage is adjusted correctly, then it shall be lifted and lowered in its utmost positions from the control panel. When the linkage after the lifting comes to its uppermost position, the lifting indicator shall go out.
		2. Position sensor failed. Dismantle the position sensor from the tractor to check how it operates. According to wiring diagram for the linkage control system, which is attached to the manual, power shall be supplied to sensor contacts: 5 V to terminal “3”, “frame” (negative) to terminal “1”. Then press by finger on the moving stem of the sensor and, using a multimeter, measure the sensor output voltage between terminals “2” – SIGNAL and “1” – NEGATIVE. When the stem (core) is moved to its full length, the sensor output voltage shall change within 10% to 90% of the supply voltage to sensor (3). Fault (break) of harness is in the sensor circuit. Check the harness according to the electric wiring diagram of EHR system.
23	Control panel failed. Potentiometer 5 (handle (5) on linkage control panel) of operating depth is faulty.	Check connection reliability of control panel and electronic unit connectors; check EHR harness for mechanical damage.
24	Control panel failed. Potentiometer 6 (handle (6) on linkage control panel) of upper end position of linkage is faulty.	Check connection reliability of control panel and electronic unit connectors; check EHR harness for mechanical damage.
28	Control panel failed. Failure of linkage control handle 2.	Check connection reliability of control panel and electronic unit connectors; check EHR harness for mechanical damage.

SIMPLE FAULTS		
33	Low voltage	EHR system supply is below 8 V. Battery is low. Check the generator output voltage.
34	Control panel failed. Potentiometer 7 (handle (7) on linkage control panel) of linkage operating speed is faulty.	Check connection reliability of control panel and electronic unit connectors; check EHR harness for mechanical damage.
36	Control panel failed. Failure of potentiometer 9 (handle (9) on linkage control panel) that combines the plowing modes: draft – position.	Check connection reliability of control panel and electronic unit connectors; check EHR harness for mechanical damage.
Code is not generated	Inadvertent linkage lift after engine starting.	Spool valve LIFTING of EHR section is STUCK in open position. Disconnect harness blocks from LIFTING and LOWERING solenoids. If the fault is still present, correct the error in the hydraulic system.



Designation	Description	Qty
A1A2	Regulator solenoid EHR23-LS	2
M	EHR control panel R917 000 34 9	1
U	Linkage electronic unit EHR R917P10057	1
s1e..s4e	Button set R917003174	4
SQ3	Position sensor R 917 002 927	1
R	Resistor C2-23-0.5-120 Ohm	2
F	Fuse panel 46,3722	1
KV20	Relay 753,3777	2
S1	Switch 6 EH007832-011	1
	Sets of connectors	
XS2.1,XS2.2	Female connector	2
XS3.1,XS3.4	Female connector R917003174	4
XS3.5	Female connector R917000515	1
XS4.1	Female connector R900785606	1
XS70	Female connector R917008789	1
XP14.1-XP14.3	Pin contact block 206044-1	3
XS14.1-XS14.3	Receptacle 20604 3-4	3

EHR system wiring diagram