



*Manitowoc Boom Trucks*

# **Radio Remote - Tecnord Actuators**

*For C-Series Cranes*

- **Installation**
- **Service**

## ***Manitowoc Boom Trucks, Inc.***

3000 S. Austin Ave  
Georgetown, TX 78627-1609

---

Sales:	(512) 942-3000
Sales Fax:	(512) 863-3776
Service:	(512) 942-3000
Service Fax:	(512) 942-3094

---

*Web Site: [www.manitowocbt.com](http://www.manitowocbt.com)*

**MULTIDROM MLT/CEY-FBK Multi-function, electro-hydraulic proportional control system.**

Special configuration for installation on the trasmission rods of truck-mounted cranes

22.0 mm / 0.86'' – Long stroke version



**Installation and Service Manual**  
*MANITOWOC "C" series*

**TECNORD**

Via Decorati al Valor Militare, 3 – 41040 Baggiovara (Modena) Italy  
Tel: +39 – 059 – 51 00 01 Fax: +39 – 059 – 51 13 57  
E-mail: [tecnord@tecnord.com](mailto:tecnord@tecnord.com)

	<b>INDEX</b>	<b>Page</b>
1.	Introduction	2
2.	Parts description	3
3.	System layout	Tab. I
	Principle of operation	4
4.	Installation	5
5.	System start-up procedures	8
6.	Inspection and maintenance procedures	9

## **1. INTRODUCTION**

This Manual has been compiled by TECNORD to provide the basic information on how to use Mod. MLT/CEY-FBK Electro Hydraulic remote Control System and how to proceed with its maintenance.

Before using this equipment, carefully read this Manual with particular reference to Paragraph 5 (SYSTEM START-UP PROCEDURES).

- The User of the Remote Control must be properly trained on how to use the equipment.
- The Manufacturer warrants that at the time of delivery, the REMOTE CONTROL is free of defects in material and manufacture and will conform substantially to the Manufacturer's specifications.
- It is the Purchaser's responsibility to determine the suitability of the REMOTE CONTROL for an specific application and to insure that it is installed and guarded in accordance with all State, Local, Private Safety and Health Regulations, Codes and Standards.
- If the Remote Control will be used in a safety critical applications, the Customer must undertake appropriate testing and evaluation to prevent injury of the Final user.
- Changes or modifications not expressly approved by the Manufacturer, could void the User's authority to operate the equipment.
- The Manufacturer is constantly aiming at the improvement of the System for what concerns its efficiency, performances and durability. Therefore, it is possible that some parts or components are changed without notice.

## **2. PARTS DESCRIPTION**

Mod. MLT/CEY has been designed to remotely control the functions of Truck-Mounted Cranes and other types of Machines equipped with directional, hydraulic control valves.

Mod. MLT/CEY can be attached to the transmission rods of the Crane manual control linkage without inhibiting the manual controllability of the equipment.

The system consists of ELECTRO-HYDRAULIC PARTS to install on the original hydraulic equipment suitable to be controlled with cable and radio systems.

### **ELECTRO-HYDRAULIC PARTS**

These parts are common to both CABLE and RADIO versions (see Tab.I)

- A - Inlet section with pressure maintenance valve VCP, solenoid-operated dump valve EV49, pressure reducing valve VRP and solenoid-operated pilot pressure cut-off valve EV49.
- B - Electro-hydraulic proportional actuator with closed-loop control of the servo piston stroke and built-in electronic circuit board and mounting flange
- C - Connecting adaptor between ACTUATOR and TRANSMISSION ROD.

### **ELECTICAL JUNCTION BOX**

- D - Base-connector with pre-wired output harness to valves, battery and accessories.

### **3. PRINCIPLE OF OPERATION (Tab. I)**

#### **PRESSURE MAINTENANCE VALVE (A) AND PILOT PRESSURE SPECIFICATIONS**

TECNORD Mod. MLT/CE Electro-hydraulic Remote control requires a pilot pressure of 18 bar (250 psi). In most cases, where used with fixed displacement pumps and open center valves, this pilot pressure is attained by directing oil through a spring-loaded pressure maintenance valve VCP lodged in manifold (A) to insure 18 bar (250 psi) at all times. Manifold (A) also carries a 2-WAY, NORMALLY OPEN VENTING VALVE EV49 whose function is to dump oil to tank when no machine function is activated, either for safety purposes and for eliminating any flow restriction through the VCP valve when all the electro-hydraulic remote control actuators are disengaged.

As soon as one of the directional control valves is partially shifted to move the applied load, pressure builds up in the system: in order to limit the maximum working pressure of the actuators to 250 psi, a PRESSURE REDUCING VALVE VRP is provided.

**Safety first of all:** the INLET SECTION (a) incorporates a SOLENOID-OPERATED 3-WAY VALVE EV49 to cut off the pilot pressure any time the remote control joysticks are disengaged.

#### **PROPORTIONAL ACTUATOR (B) CONTROL FUNCTIONS**

The pilot pressure  $P_p$  coming from the INLET SECTION (A) feeds the PROPORTIONAL VALVES VPA and VPB. The function of these valves is to generate a variable pressure in response to a pulse-width modulated (PWM) current signal alternatively fed to the coils via the electronic circuit board (ECB). This variable pressure is active on the ends of the servo piston (SP) connected to the spool of each sectional valve: as the servo piston moves, the position transducer (TP) generates a feed-back signal to provide the desired control characteristic in response to a given deflection angle of the remote control joystick.

#### **4. INSTALLATION (Tab. I)**

##### **A. INSTALLATION OF ELECTRO-HYDRAULIC PARTS**

- Fix manifold (A) on the chassis, leaving room around it for hoses connection
- Fix the actuators block (B) in the crane arranged point (see Tab.I )
- Connect the forks at the end of the servo-piston rods.
- If co-axial mechanical connections between servo-pistons and transmission rods can be adopted, these must be done leaving enough clearance for self-alignment of matching parts.
- After that, move the Crane's manual levers back and forth, and check for their free return to neutral, as a result of a good alignment between matching parts. Correct every deficiency that may cause mechanical drag.

**WARNING:** do not attempt to connect the actuators block directly to the Crane's manual levers, as this would limit the stroke of the directional valve spool and cause problems of slow return to neutral.

**TECNORD****B. HYDRAULIC CONNECTIONS (Tab. I)****Connections at block (A):**

REF.	DESIGNATION	SIZE	REMARKS
E:	Pump line inlet port	1/2" - BSP	High pressure hose
S:	Return line to tank	1/2" - BSP	Low pressure hose
DIS:	To the P port of directional control valve	1/2" - BSP	High pressure hose
Pp:	To the P port of inlet section B	1/4" - BSP	High pressure hose
ML	Pump pressure gauge port	1/4" - BSP	High pressure gauge (300 bar - 4500 psi)
MP	Pilot pressure gauge port	1/4" - BSP	Low pressure gauge (60 bar - 1000psi)

**Connections at manifold (B):**

Pp	Pilot pressure inlet line	1/4" - BSp	High pressure hose Max. 2 mt (6 ft) long
Sp	pilot pressure return line	1/4" - BSP	The line must be driven to tank separately in order to avoid back-pressure effects on the servo-pistons
MPR	Pilot pressure (reduced) gauge port	1/4" - BSP	Low pressure gauge (0-60 bar / 0 - 1000psi)

**TECNORD**

Via Decorati al Valor Militare 3 - 41040 Baggiovara (Modena) - Italy

**C. ELECTRICAL CONNECTIONS (Tab. I)**

- Install the JUNCTION BOX (D) max. 1.5 mt (5 ft) away from the actuators block.
- make sure that the open end of the black sheath grouping all the output cables is placed upside down to prevent water from entering the junction box.
- Make sure that the output DIN connectors are properly tightened with rubber seals installed between the plug and the socket.
- Do not leave DIN plugs hanging disconnected, to prevent water and moisture from oxidating contacts and wires.

REF.	COLOUR	DESIGNATION	REMARKS
(+)	Blue	Positive (12 VDC)	
(-)	Brown	Negative	This wire must be connected to the negative pole of the battery. DO NOT USE THE VEHICLE FRAME AS (-)
49	DIN Plug	Dump valve EV49 at block (A)	
9	DIN Plug	Pilot pressure cut-off valve at block	
1...4		Proportional actuators	

**Radio Remote Control**

- The RECEIVER UNT will be connected to the junction box (D) through a multi-core cable with MALE/FEMALE plugs.
- The wiring schematic of the junction box (D) corresponds to the flying MALE connector of the RECEIVER INTERCONNECTING CABLE.

## 5. SYSTEM START-UP

- Place a low pressure gauge (60 bar / 1000psi) on the MP port at the inlet section (A) of the actuator block.
- Start the engine and engage the PTO
- Fold out the crane by means of its manual control levers in order to prevent hazardous movements in case of erratic start-up operation of the remote control.
- Turn on the remote control system:
  - . **Radio configuration:** - turn the key-switch on the command switch to REMOTE
    - turn on the power switch of the transmitter unit ( see original radio instr.)
- Turn one of the remote control levers slightly off the centre (approx. 10°): the pressure reading on the Pressure Gauge at Port MPR must fall between 16 and 20 bar (230 to 285 psi).
- Turn the control lever to its maximum rotation angle: the manual lever of the directional valve must proportionally reach the end of its stroke. Make sure that the pressure reading on the Pressure Gauge at Port MPR does not exceed 21 bar (300 psi).

**WARNING:** before moving away to operate the machine from a remote post, stand in front of the manual control levers of the directional control valve and check if the commands exerted on the levers of the remote control box are correctly executed by the electr-hydraulic proportional actuators with respect to the following working conditions:

- the position control characteristics of the actuators must be smooth, stable and repeatable
- when one function at a time is engaged, only the corresponding manual control lever must respond, while all the other levers must steadily remain at rest
- when two or more functions are engaged at the same time, no mutual interaction must result in the position control characteristics of the corresponding manual control levers
- **EMERGENCY PUSH-BUTTON:** push the red palm button on the control box in order to stop the electrical power to the circuit

**6. INSPECTION AND MAINTENANCE PROCEDURES**

**A - Inspection of pressure maintenance valve A (see dwrg. 15.0202.056)**

**VCP PRESSURE MAINTENANCE CARTRIDGE VALVE**

Remove the hex. cap (34 mm / 1.5/16" hex) and remove the 2 co-axial springs.  
Make sure that at least one shim is placed underneath the springs.

In order to INCREASE / DECREASE the pilot pressure by 2 bar (30 psi) at a time, ADD / ELIMINATE one shim at a time.

Check for free movement of the valves spool in its cage.

**EV49 NORMALLY OPEN, SOLENOID OPERATED VENTING VALVE**

Remove the nut and the coil (19 mm / 3/4" hex).

Remove the cartridge valve from its cavity (26 mm / 1" hex)

Check the correct perpendicularity of the cylindrical tube ass.y: deflections or distortions of the tube prevent the internal plunger from sliding free in response to electrical signals.

Install the coil on the tube ass.y again and insert the DIN connector marked 49 on the coil terminal. Energize the coil by activating any lever of the control box:

- the internal poppet must shift with an audible "click"

- blowing air from the lower bottom, there must be no free passage through the side holes of the cage

**VRP PRESSURE REDUCING VALVE**

Remove the cartridge from its cavity (26 mm / 1" hex).

Push the internal spool upwards with the tip of a plastic stick to override the internal spring force and check if it slides free along the cage.

Inspect the O-RINGS and the BK-UPS.

**A - Inspection of pressure maintenance valve A (see dwrg. 15.0202.056)**

**EV49 SOLENOID-OPERATED PILOT PRESSURE CUT-OFF VALVE**

- Remove the nut and the coil (19 mm / 3/4" hex).
- Remove the cartridge valve from its cavity (26 mm / 1" hex).
- Check for correct perpendicularity of the cylindrical tube ass.y: deflections or distortions of the tube prevent the internal plunger from sliding free in response to electrical signals.
- Install the coil on the tube ass.y again and insert the DIN connector marked 9 on the coil terminal. Energize the coil by activating any lever of the control box: the internal spool must shift with an audible "click".

**C - Disassembly procedure of the Electro-hydraulic proportional Actuator (see dwrg. 15.1002.013/B)**

- Loosen the 2 screws (32) to remove the plastic cover (28).
- Remove the 2 locking nuts (29) (6 mm / 1/4" hex).
- Lift up the electronic circuit board (33) and free the flying connector of the position transducer
- Loosen the 2 nuts (26).
- Lift up the plastic casing, holding the 2 coils (25) and the electronic circuit board (33) in place.
- Remove the 2 proportional cartridge valve (22) from their cavities (29 mm / 1.1/8" hex).
- Remove the plug (42) and the spring (43) to inspect the by-pass valve (21).

**D - Disassembly procedure of Position Transducer (9) (see dwrg. 15.1002.013/B)**

- Loosen the 2 mounting bolts (13) to remove the servo-piston kit.
- Loosen the 4 set screws (6) to remove the cover plate (7) and the gasket (8)
- Remove the press. transducer (9) by sliding the electrical cable along the cavity in the manifold.

**WARNING:** to reassembly, make sure that the driving pin of the transducer matches the circular groove on the free end of shaft.

**E - Inspection and cleaning procedure of Proportional Valves (22) (see dwrg. 15.1002.013/B)**

- Check for correct perpendicularity of the cylindrical tube ass.y: deflections or distortions of the tube ass.y will prevent the internal plunger from sliding free in response to electrical signals.
- The internal POPPET/SEAT arrangement must be free from contamination particles.

**F - Inspection and cleaning procedure of orifices (S) and by-pass valve (21) (see dwrg. 15.1002.013/B)**

- Inspect the orifices (S) ( 0,8 mm - 0,031 dia.) visible on the middle step of prop.valve cavities. Remove contaminants by means of a needle or compressed air.
- Inspect the PILOT OPERATED BY-PASS VALVE ( 21 ) by sliding the poppet in its cavity.

**G - Inspection of electrical connections** (see dwrg. 15.1002.013/B)

- Inspect the soldered terminals on coils (25)
- Inspect the three MALE/FEMALE connectors on the electronic circuit board ( 33 )
- Inspect the three soldered connections on the position transducer ( 9 )

**H - Check the Input signal from the cable or radio joystick control lever**  
( Tab.II -Page#14)

- If available,insert the special test-connector between the DIN flying plug and the fixed socket of the actuator and connect a volt-meter in scale 'DURING VOLTAGE' to test:
  - With the joystick at rest,the reading must be 0,00 Volt.
  - By rotating the corresponding joystick slightly off of center,the reading should change from 0,00 to 6,00Volt (nominal value +/-10%) in one direction and from 0,00 to 2,00Volt in the other direction.

**I - Adjusting the maximum stroke of the servo-piston by means of trimmers T2 and T4**  
( Tab.II -Page#14)

- The optimum calibration of max. stroke is attained when the maximum deflection angle of the joystick control lever corresponds to the maximum stroke of the directional valve spool driven by the servo-piston of the proportional actuator. This condition is monitored by the YELLOW LED called **LG**, which should TURN ON one at a time when the servo-piston reaches the end of its stroke in one direction ( to insure the full flow condition ) ,and then TURN OFF by releasing the joystick lever just a few degrees ( to insure that dead-band around the maximum stroke is limited ).
  - The trimmer **T2** is provided for **EXTEND** direction.
  - The trimmer **T4** is provided for **RETRACT** direction.
  - Turn trimmer T2-T4 clockwise to increase the actuator stroke for a given joystick angle.
  - Turn trimmer T2-T4 counter-clockwise to decrease the actuator stroke.

**L - Adjusting the symmetry of the neutral position dead band by means of trimmer T5  
( Tab.II -Page#14)**

- Because the overall mechanical and electrical tolerances, the dead band across the ' 0 ' position of the control lever might not be symmetrical.  
The symmetry of the dead band can be adjusted by means of trimmer **T5** according to the following logic :
- if the symmetry error causes the actuator to RETRACT as soon as the joystick lever is moved off of center, then trimmer **T5** must be rotated COUNTER-CLOCKWISE
- if the symmetry error causes the actuator to EXTEND as soon as the joystick lever is moved off of center, then trimmer **T5** must be rotated CLOCKWISE
- the optimum calibration is reached when the deflection angles of the joystick lever required to turn on the GREEN LED **LV** are equal on both sides of the NEUTRAL position.

**7. HYDRAULIC SCHEMATIC**

- Tab. IX            - Hydraulic schematic

DESCRIPTION

A	PRESSURE MAINTENANCE MANIFOLD BLOCK
VCP E.V.49	Pressure maintenance valve Sol.Operated By-Pass valve
FLT	Filter screen
VRP	Pressure reducing valve
E.V. 9	Sol.Operated cut-off valve

C	EL-HYDRAULIC PROPORTIONAL ACTUATOR
VPA/B	Proportional pressure control valve
VBP	Pilot operated By-Passs valve
SP	Servo-piston
GC	Coupling
TP	Position transducer
ECB	Electronic circuit board

TAV. IX

