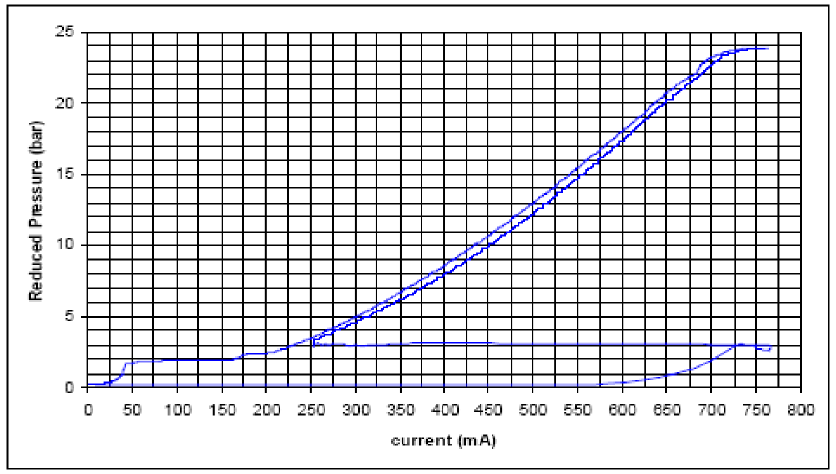
Mod. IP-PRZ-T059 "Zero Off-Set" Proportional Pressure Reducing Valve

Pressure Reducing Valves

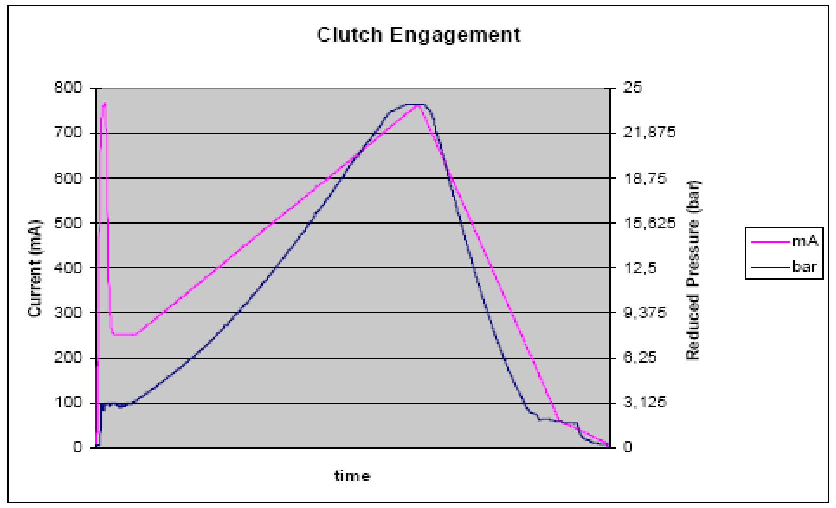
IP-PRZ (Slip-in version) and EG-TRZ (Threaded version) are pilot-operated pressurereducing valves used to generate a variable pressure in response to a PWM (Pulse width Modulated)current signal .

APPLICATIONS

- Micro-processor controlled power shift transmissions for off-higway equipment, agricultural tractors and marine inverters
- Electro-hydraulic proportional control of directional valves amd variable displacement pumps servo-valves
- Electro-hydraulic proportional strokers for Engine Speed Governors



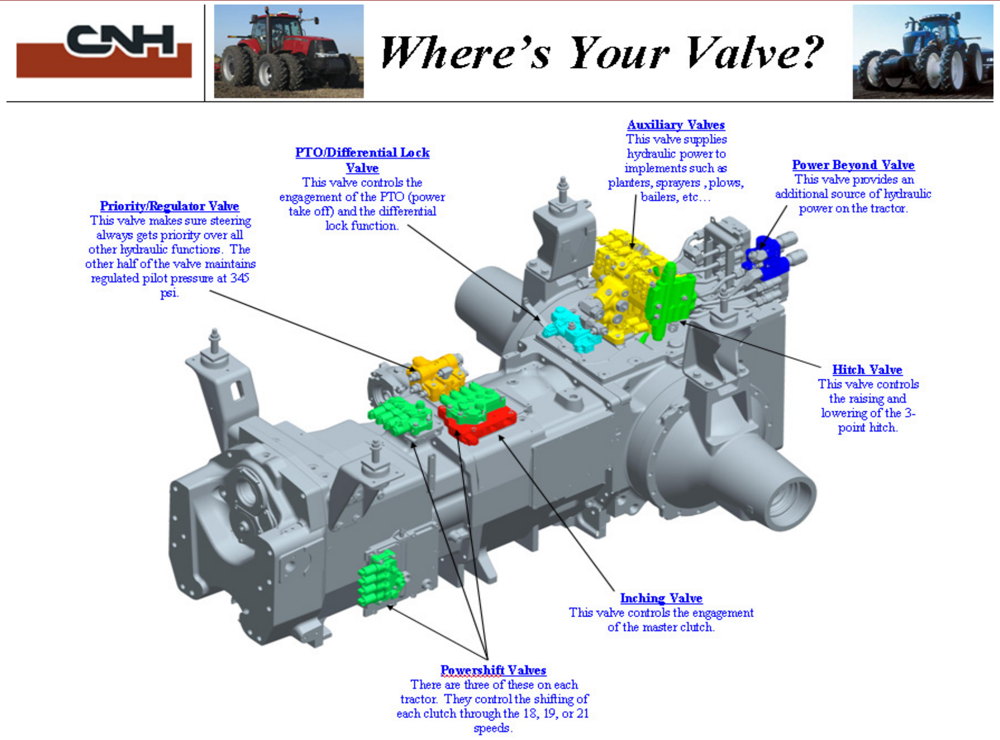
1. Press (bar) vs. Current (mA) Curve with quick fill-up phase followed by a modulation ramp



2. Typical Clutch Cycle:

- Preliminary "quick fill-up" phase at top current until pressure begins to raise within the cluctch piston chamber

- Modulated Current ramp to generate a "soft engagement" of clucth discs

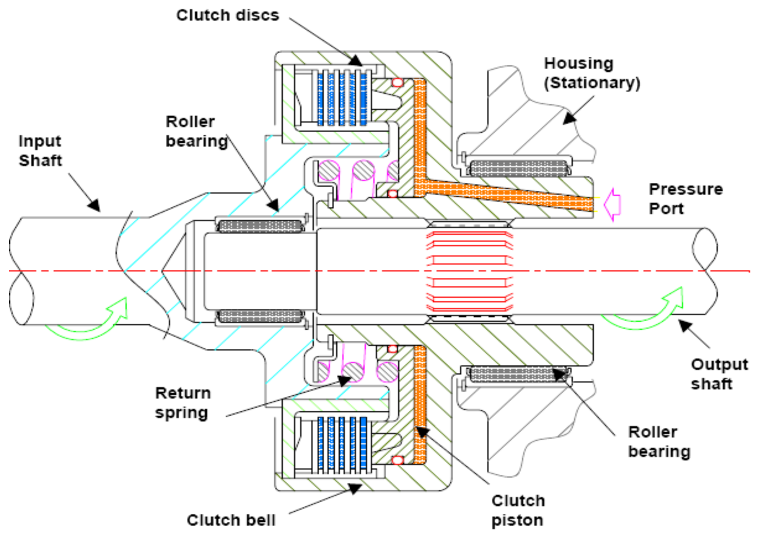


APPLICATION EXAMPLE : soft engagement of a wet-disc clutch

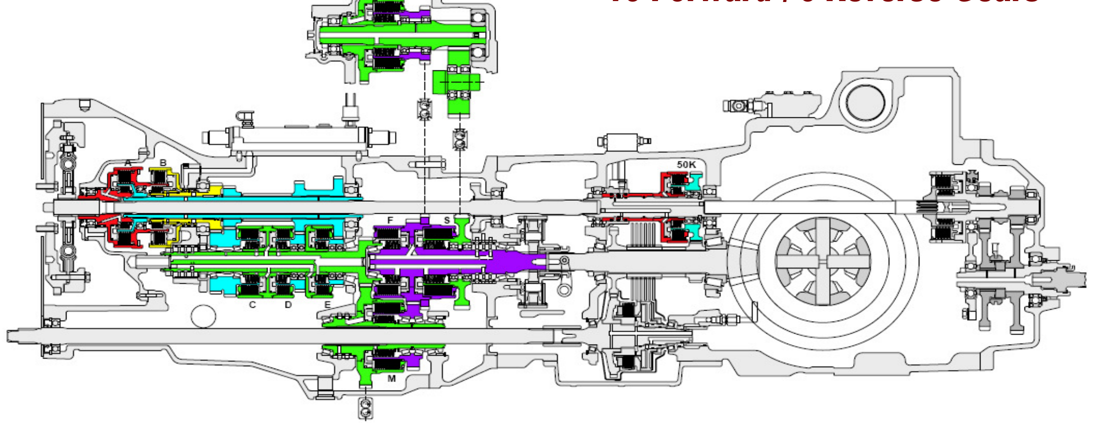
PRINCIPLE OF OPERATION

QUICK FILL-UP: a high current peak fed to the propotional solenoid of the IP-PRZ-59, generates a quick shifting of the valve spool and to fill up the interstices between clutch disc in the shortest possible time. Clutch discs enter in touch with each other to begin to transfer torque and speed (= power) from the INPUT to the OUTPUT shaft

SOFT ENGAGEMENT: thePWM current signal is quickly reduced to a minimum value in order to ler the pressure start from a "low end" (2 bar) and then ramped up smoothly to a "high end" (16-18 bar) during which the torque is gradually transmitted to the friven shaft.



175-190 CNH Full Powershift Transmission
19 Forward / 6 Reverse Gears



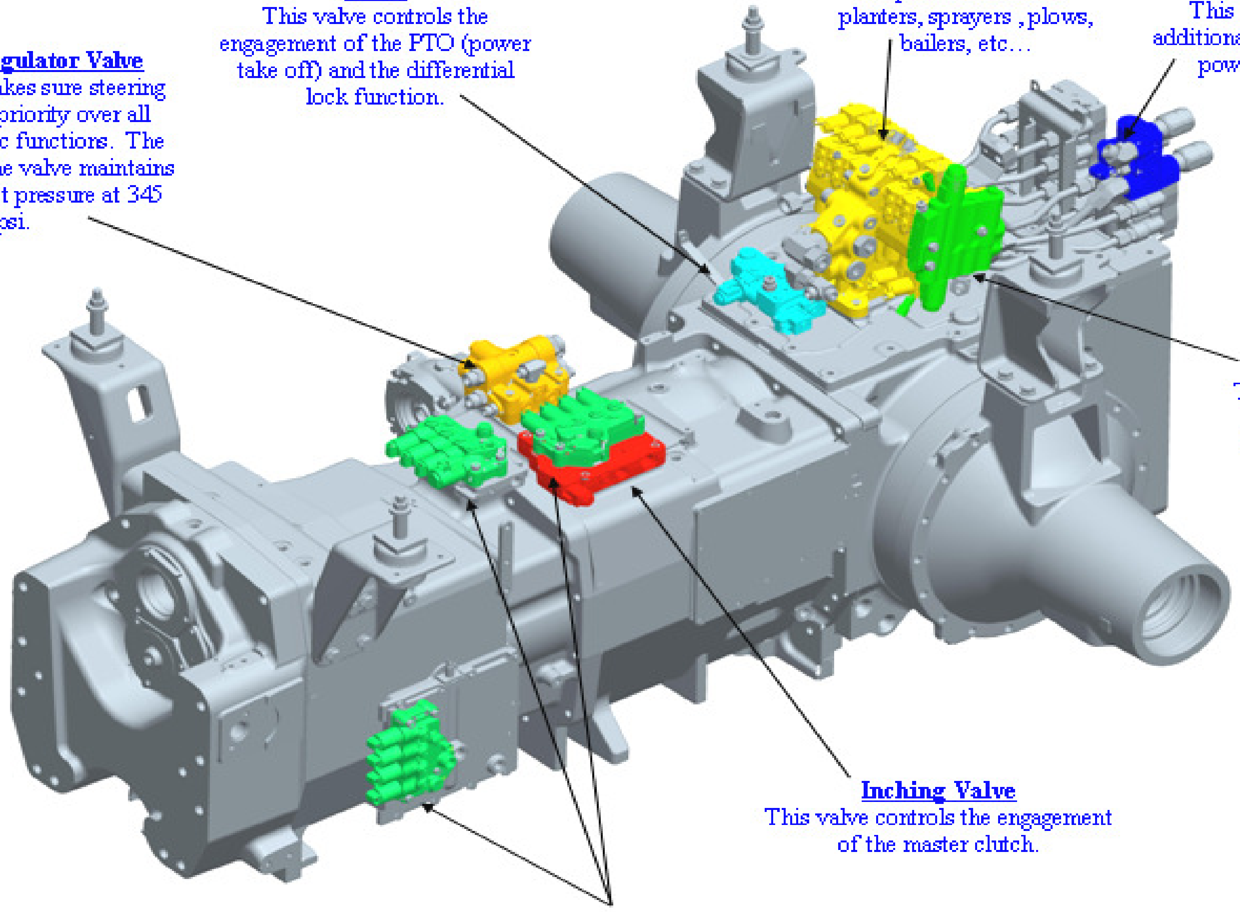
Where's Your Valve?

Auxiliary Valves
This valve supplies hydraulic power to implements such as planters, sprayers, plows, bailers, etc…

PTO/Differential Lock Valve
This valve controls the engagement of the PTO (power take off) and the differential lock function.

Power Beyond Valve
This valve provides an additional source of hydraulic power on the tractor.

Priority/Regulator Valve
This valve makes sure steering always gets priority over all other hydraulic functions. The other half of the valve maintains regulated pilot pressure at 345 psi.



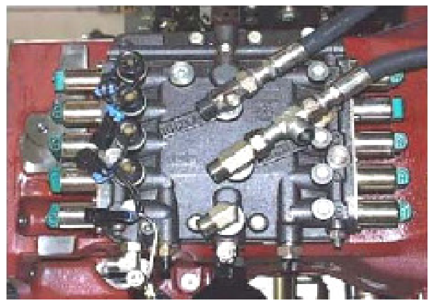
Hitch Valve
This valve controls the raising and lowering of the 3-point hitch.

Inching Valve
This valve controls the engagement of the master clutch.

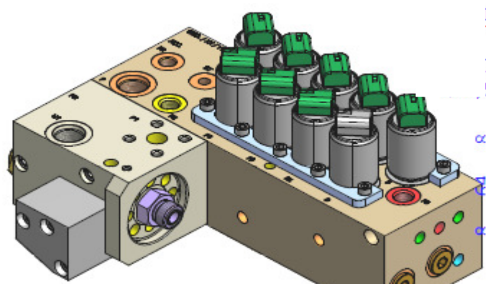
Powershift Valves
There are three of these on each tractor. They control the shifting of each clutch through the 18, 19, or 21 speeds.

Fuji-Univance Gearbox

VALVE SYSTEM for 175-190 CNH FULL POWERSHIFT

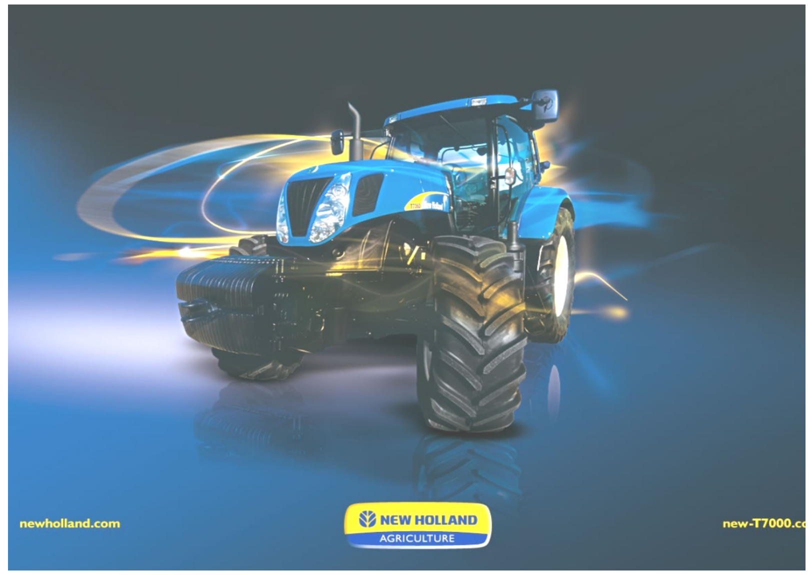


VALVE BANK FOR CVT (Continuously Variable Transmission)



Rear Auxiliary Valves with 3-Point Hitch Valve

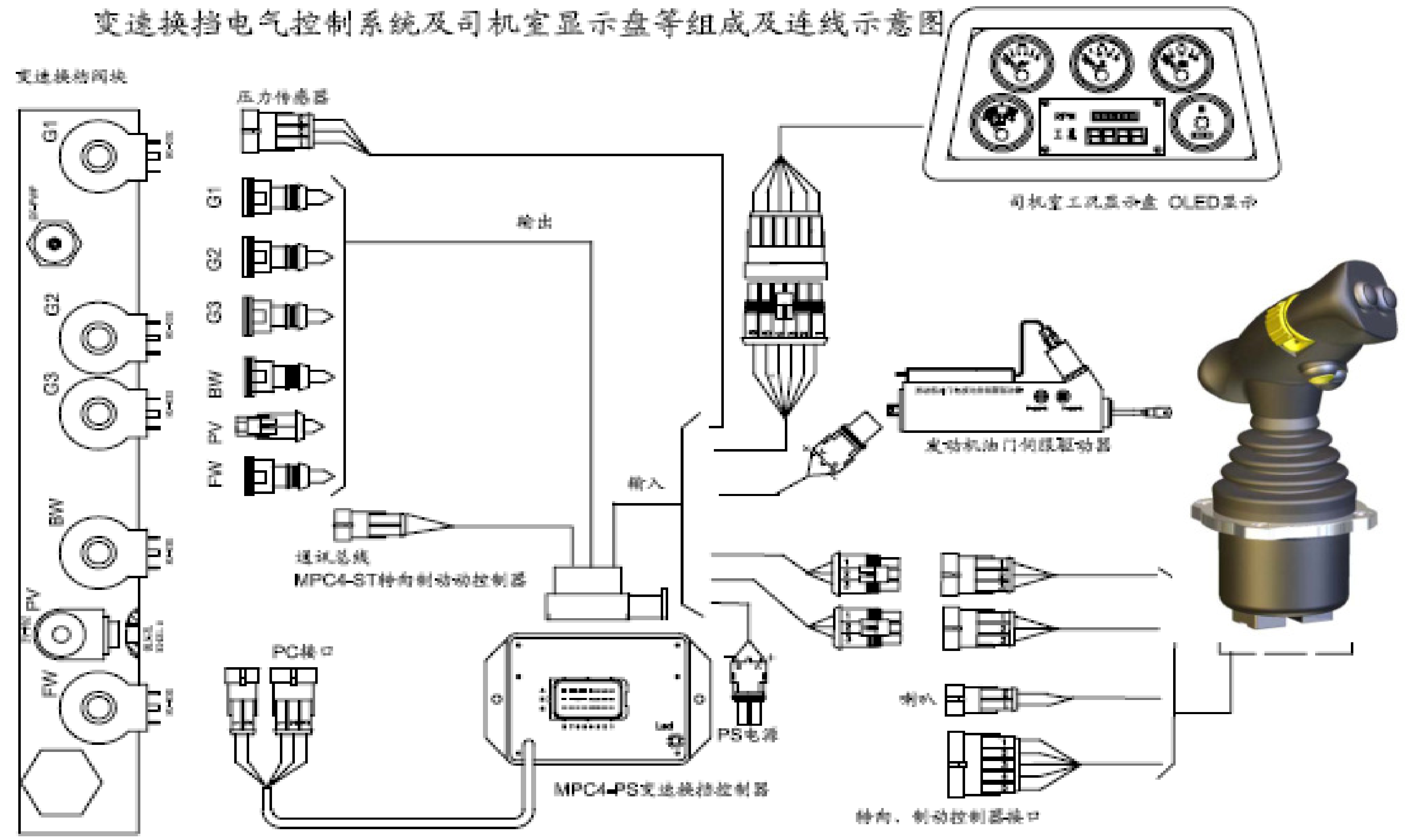
NEW HOLLAND T7000 Series



MAGNUM Series

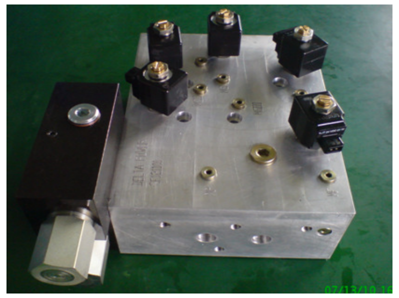
STEIGER & QUADTRACK Series

Powershift / Steer & Brake Control System

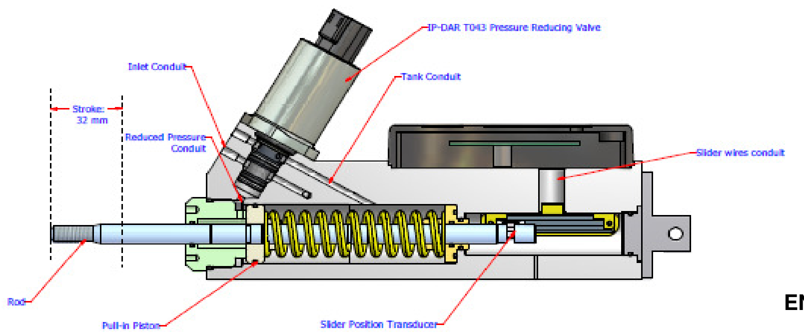


BRAKE & STEERING MANIFOLD VALVE

POWERSHIFT VALVE SYSTEM



IN-CABIN CONTROLS



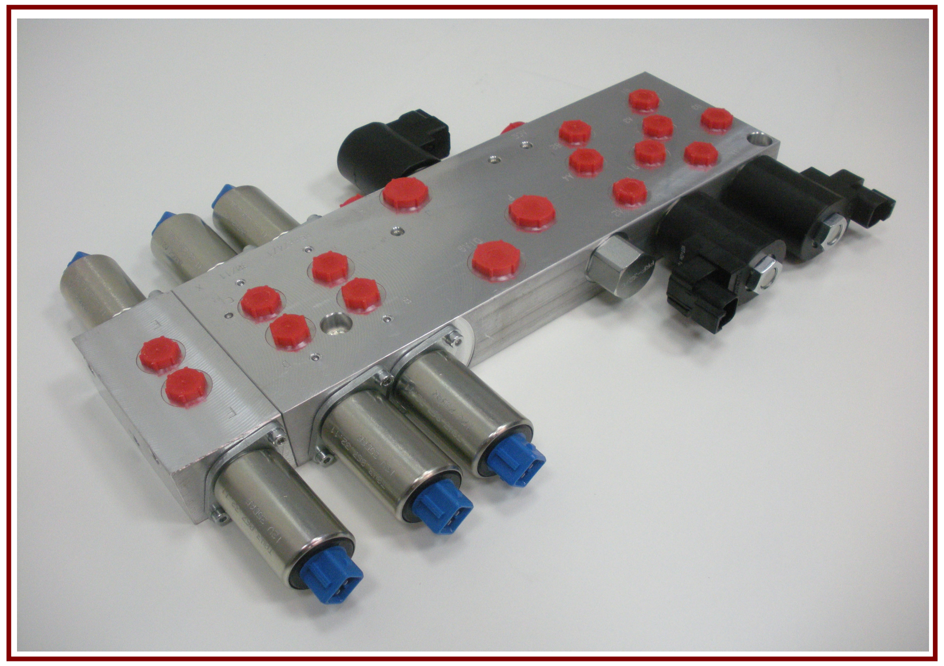
ENGINE RPM PROPORTIONAL STROKER

SHANTUI CRAWLER DOZER

XUANGONG DOZER Mod. SD7

XUANGONG DOZER Mod. SD7 in action

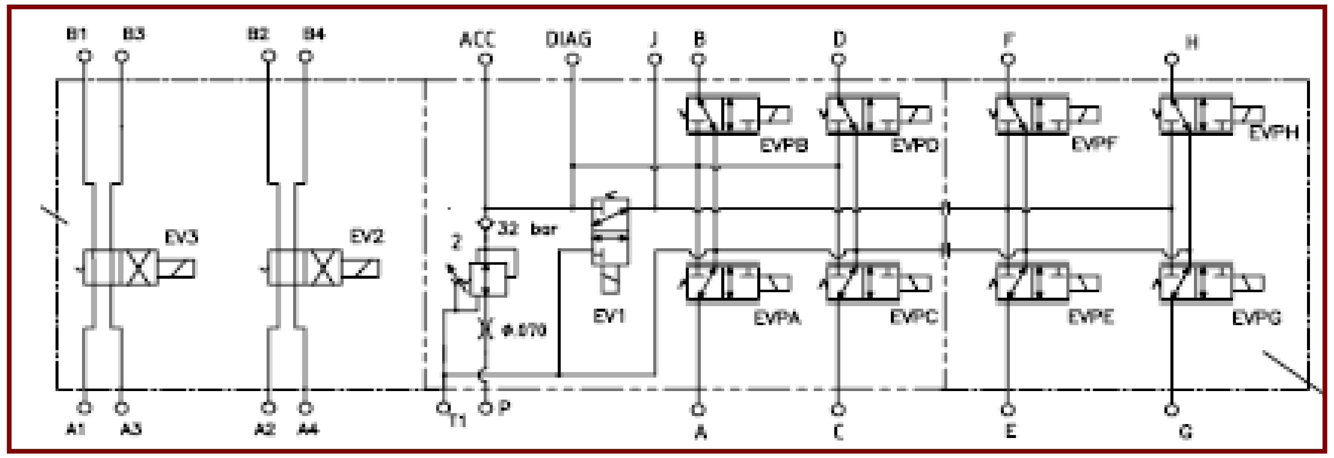
P/N 15.1503.017



TLB Application
(Tractor / Loader / Bucket)

5- Auxiliary Functions
Proportional Pilot Pressure Control Manifold
. Extend-a-Hoe
. Left & Rigth Stabilizer
. Accessory implement
. 2x Reverse Criss-Cross Flow Pattern Control

Hydraulic Diagram



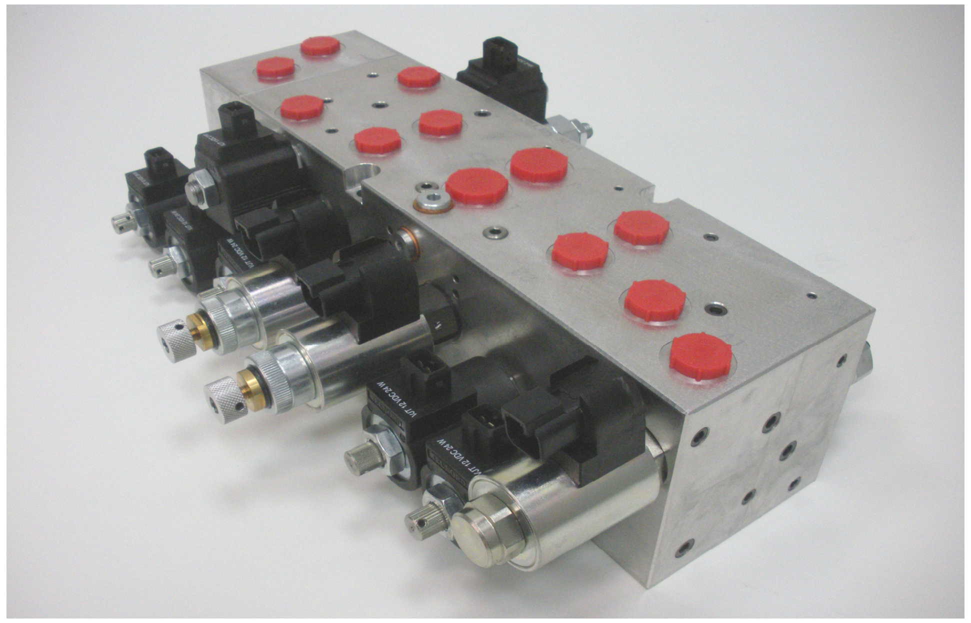
Electronic Controls

Multi-Function
Joystick Controller
with FRP Proportional Rollers

Finger-tip
proportional control levers
and microprocessor-based
MMS (Machine Management System)

TLB's (Tractor / Loader / Bucket) in action:

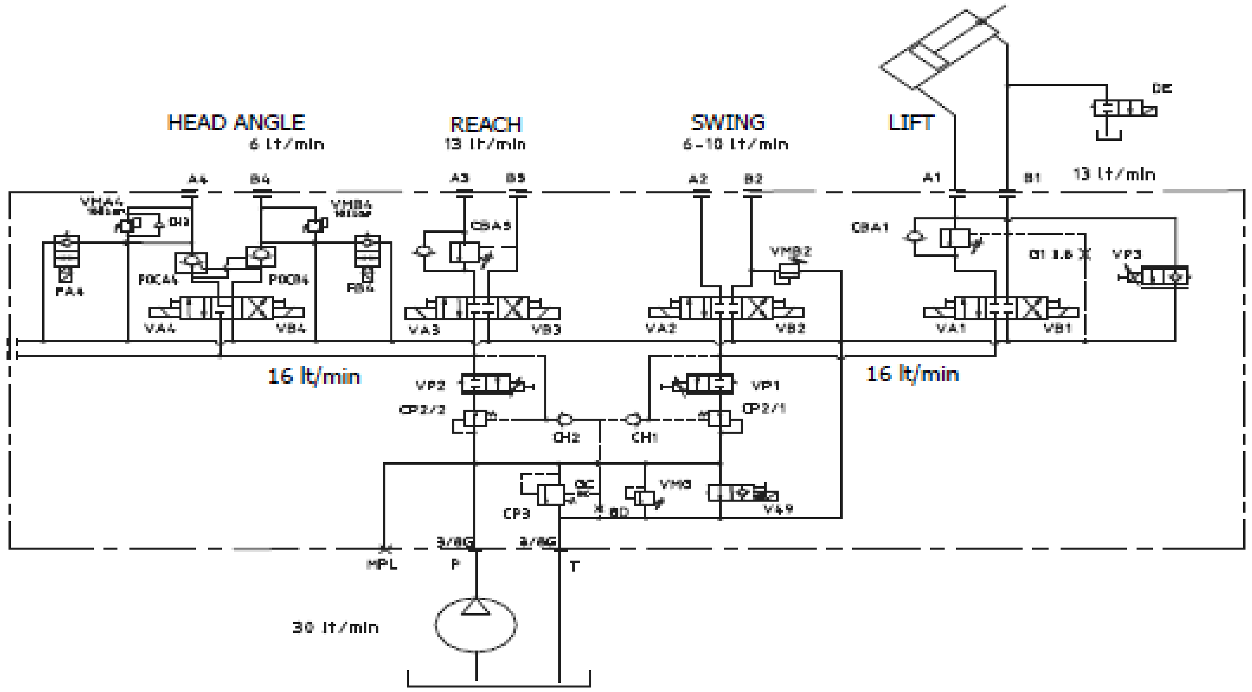
In-cabin Controls



Dual Path / 4-function Proportional Valve System Mod. 15.1304.106

- *Typical Input Flow: 50 lt/min*
- *Max. Work Pressure: 250 bar*
- *Load-holding valves on REACH and LIFT*
- *FLOAT on HEAD ANGLE*

Hydraulic Diagram



Tractor-mounted Edge Cutters in action ......

Electronic Controls

In-cab Joystick Controller

MMS Machine Management System

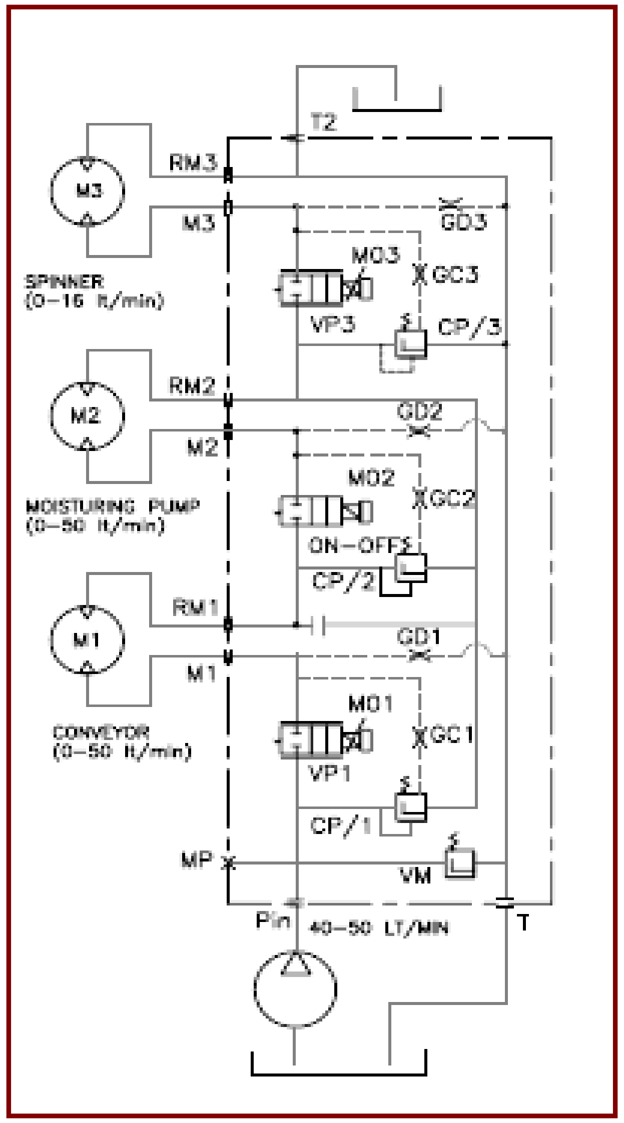
2-axes Proportional Inclinometer

Armrest Multi-function Control Panel

P/N 15.2104.016

3- Proportional Functions Electro-Hydraulic Control Block

- Conveyor (Auger)
- Spinner
- Water moisturing



Hydraulic Diagram

Truck-mounted Salt Spreader Systems and Snow Plows in action:

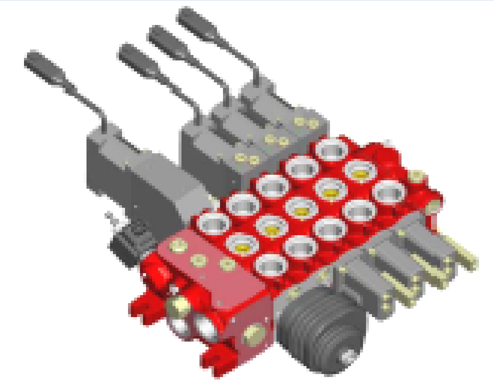
Electronic Controls

IN-CABIN CONTROL BOX
.Microprocessor-based unit
with Multi-Programmable functions
.Input / Output connections
to valves and accessories

GPS / GPRS
GSM Unit

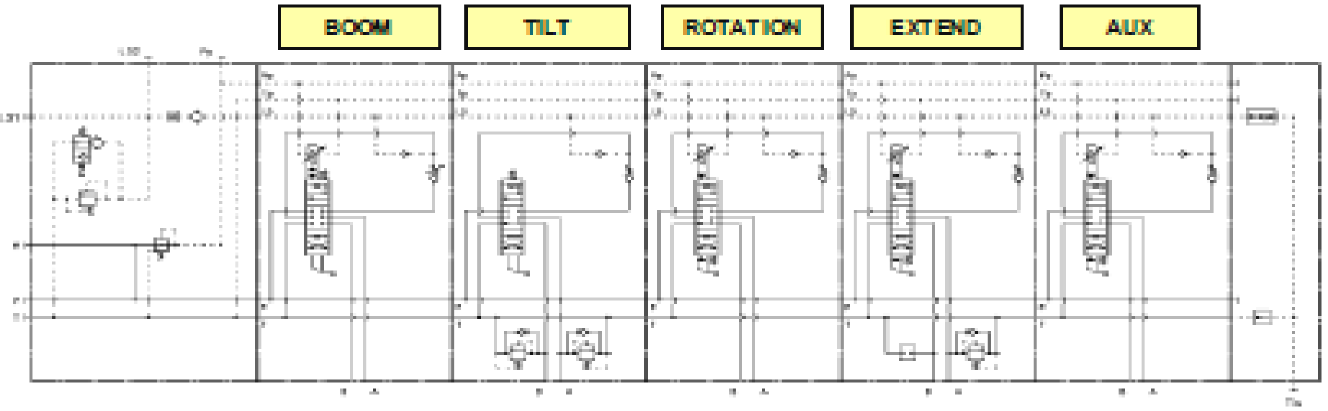
Conveyor / Auger
RPM sensor

Mod. HDS34 Flow Sharing Valves with MLT/FD5 Closed Loop Proportional Controls

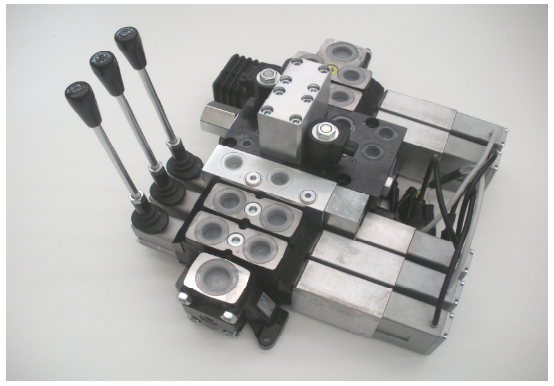


- Assembling position: Cabine side
- BOOM + TILT: Direct acting manual joystick
- EXTEND + ROTATION + AUX: Manual levers
- BOOM + EXTEND + ROTATION + AUX: Closed loop proportional control (to control functions from platform or via radio remote control)
- Option: joystick handle 5 - in - 1
- Solenoid LS unloading valve with manual override
- Pressure reducing valve for pilot oil supply

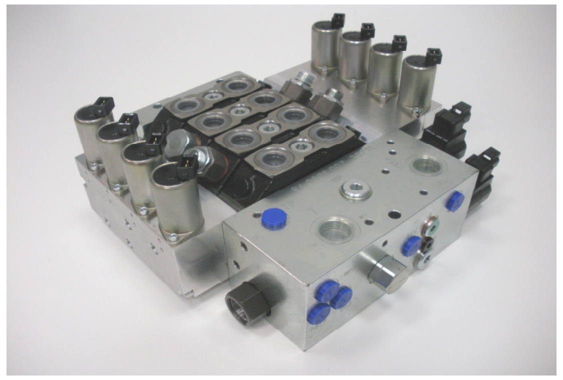
HDS34 - Hydraulic Diagram



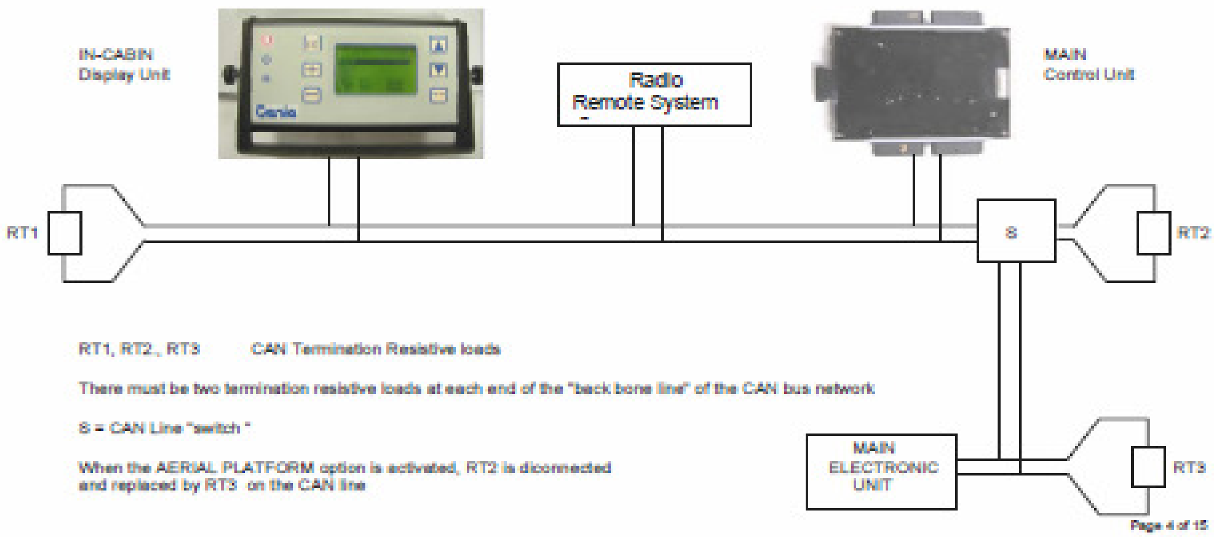
Mod. HDS30 Load Sensing Valve with MLT/FD5 Closed Loop Proportional Actuators



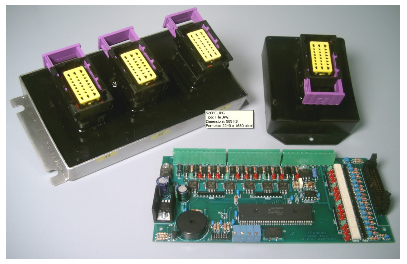
Mod. HDS20 Open Center Valve with MPP/T043 Open Loop Proportional Actuators



MMS Machine Management System with CAN-bus Communications Network



In-cab Joystick



Machine Management System Units

Boom Extension and Angle Sensor

Aerial Basket Radio Remote Control

CASE-New Holland

GENIE by Terex

Kramer - Allrad

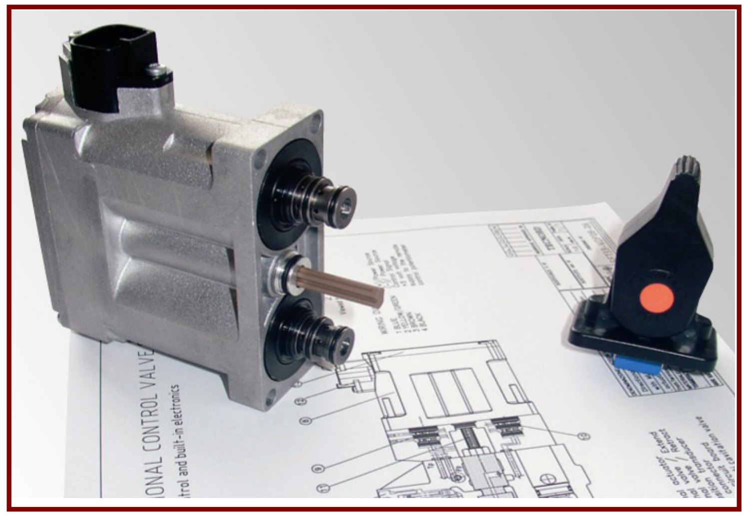
Manitou

Merlo

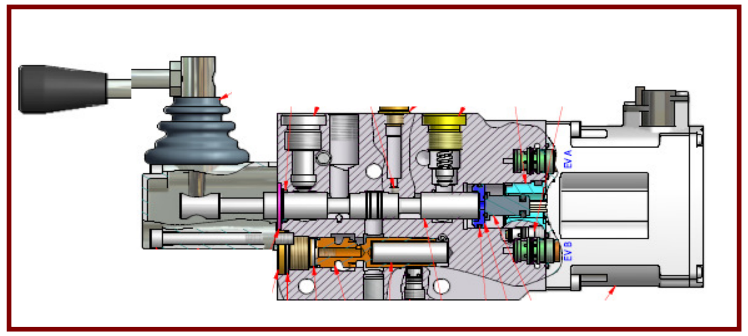
Bobcat-Doosan

Dieci

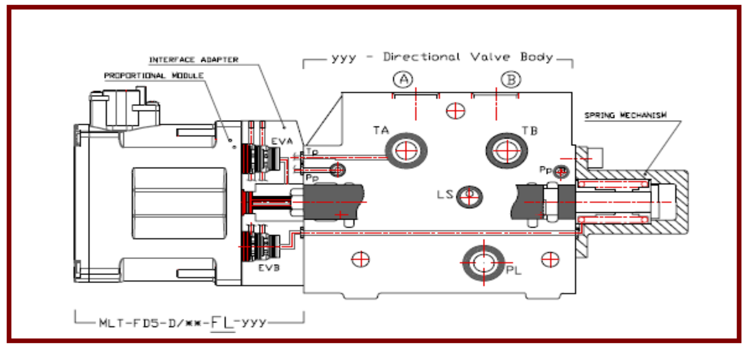
FARESIN Industries



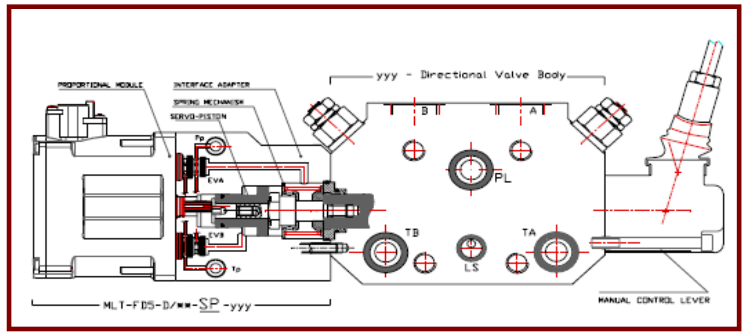
Mounting Style "A": Direct Flange Mounting



Mounting Style "B": Adapter Flange Mounting



Mounting Style "C": Double-Acting Servo-Piston



Functions :

The *MLT-FD5 / D* electro-hydraulic proportional actuator has been designed to shift a directional control valve spool either directly *(FL version)* or by means of a servo-piston mechanically connected to it *(SP version)*
The internal closed loop position control configuration of *Mod. MLT-FD5-D* makes the valve spool achieve the desired position with accuracy levels approaching the performance of a servo-valve, by continuously comparing the set-point of a remote control device *(Potentiometer, Joystick, Machine Management System)* with the feed-back signal generated by a high-precision *Hall effect* position transducer.

Features :

. Two independent proportional valves

- Control configuration: bidirectional with MOTOR SPOOL center position for fail-safe return to neutral in case of power loss
- Flow rate: 0.2 to 0.5 lt/min max. flow requirement under normal control conditions
- Work pressure: 12 to 35 bar

. Hall effect / Contactless spool position sensor

- Excellent linear control on 100% of spool travel
- 8.5 mm standard control stroke from each side of NEUTRAL / 13.5 mm for FLOAT position in one direction only
- No "cross talking" between adjacent work sections

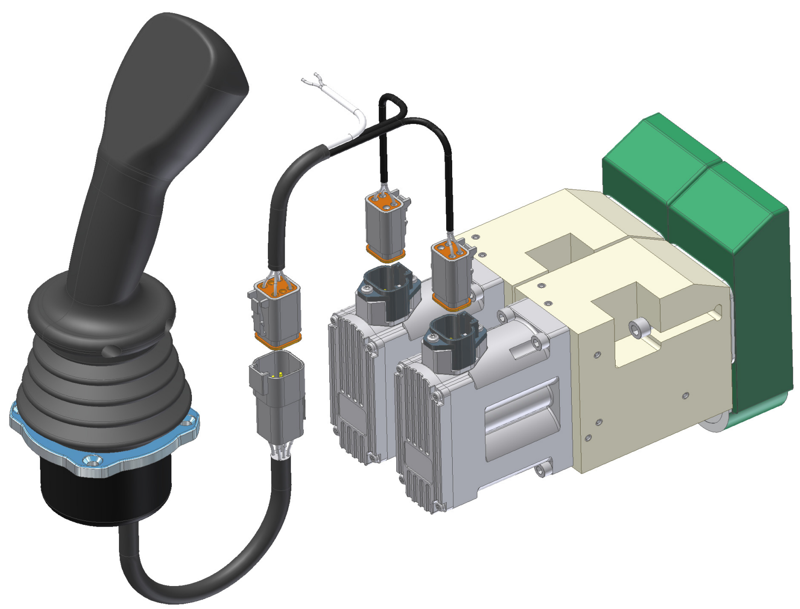
. Built-in Electronics

- ANALOG OPERATING MODE: +5Volts supply to external potentiometers or joystick controllers
- CAN BUS OPERATING MODE: the remote control set point is processed via CAN bus according to ISO 11898 at 250 Kbit/s by means of address-based (SAE J1939) or message-based (CAN2.0B) protocols

APPLICATIONS

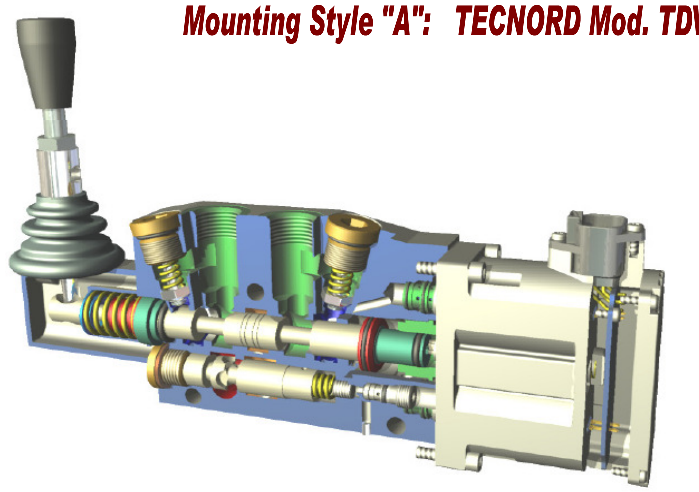
- High performance proportional control of stackable or monoblock directional control valves
- Proportional control of varaible displacement pumps and motors
- Engine governor RPM controls

Typical Control Configuration of a 2-Sections Proportional Valve by means of a Dual-Axes Joystick Controller



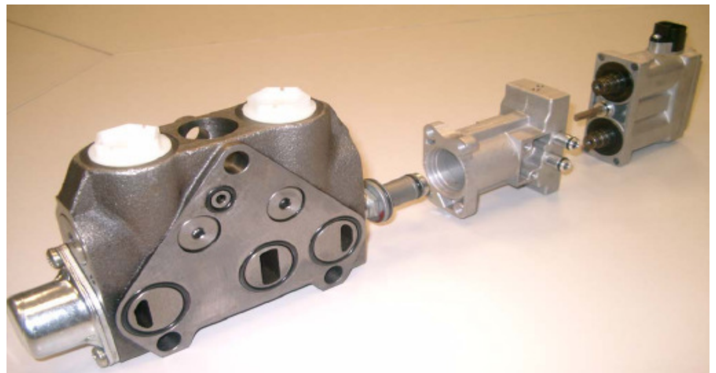
Application Examples:

Mounting Style "A": TECNORD Mod. TDV100



Mounting Style "B": Bucher HDS34

Mounting Style "C": BOSCH-REXROTH Mod. SX14



.... because Power is nothing without Control

Mod. TDV - 30

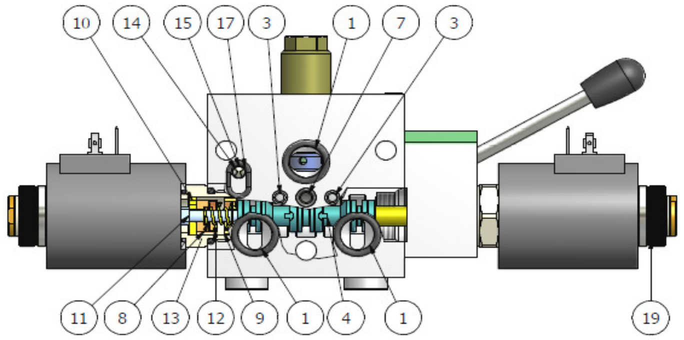
Hydraulic Specifications:

Typical Input Flow Rate:	*45 lt/min*
Max. Flow /section:	*27 lt/min*
Max. Work Pressure:	*280 bar*

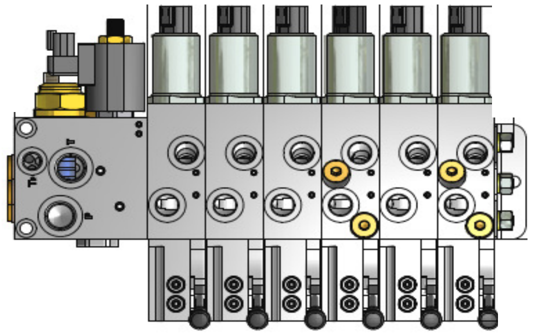
Controls :

ON-OFF: Direct Acting
PROPORTIONAL: Open-Loop / Direct Action
(with Standard PUSH-type Manual Overrides)

Optional: Bidirectional Manual Levers



Mod. TDV - 40



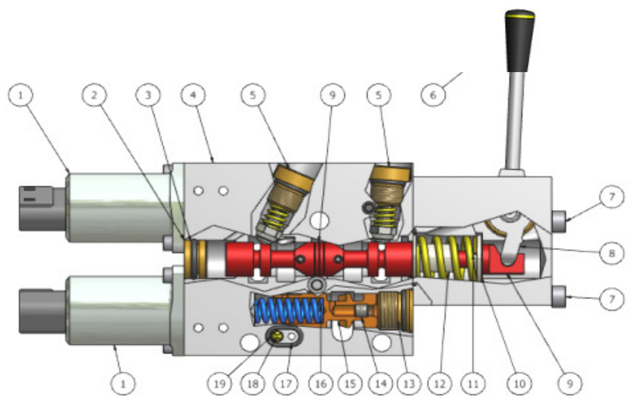
Hydraulic Specifications:

Typical Inlet Flow Rate:	*60 lt/min*
Max. Flow /section:	*45 lt/nin*
Max. Work Pressure:	*280 bar*

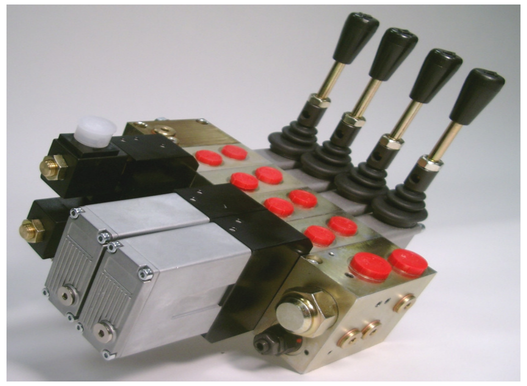
Controls :

ON-OFF: Pilot Operated
PROPORTIONAL: Open-Loop /Pilot Operated
(with Standard PUSH-type Manual Overrides)

Optional: Bidirectional Manual Levers



Mod. TDV - 50

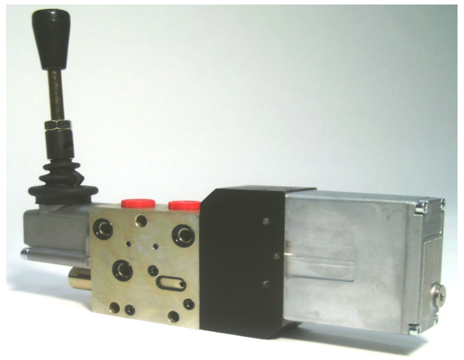


Hydraulic Specifications:

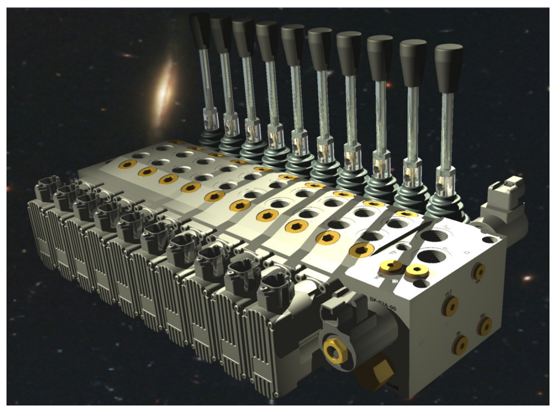
Typical Inlet Flow Rate:	*50 lt/min*
Max. Flow /section:	*27 lt/min*
Max. Work Pressure:	*250 bar*

Controls :

ON-OFF: Direct Acting
PROPORTIONAL: Closed loop /Pilot Operated
(with Standard Bidirectional Manual Lever)



Mod. TDV - 100

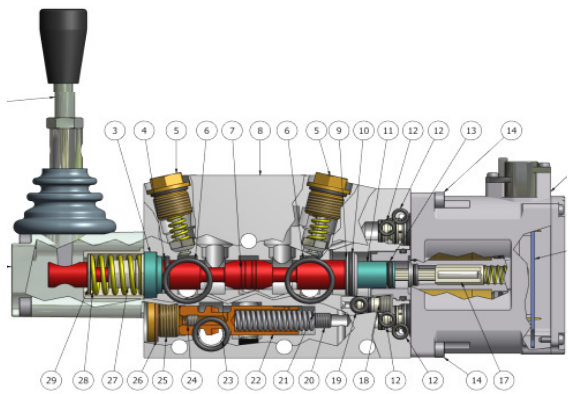


Hydraulic Specifications:

Typical Inlet Flow Rate:	*90 lt/min*
Max. Flow /section:	*70 lt/nin*
Max. Work Pressure:	*280 bar*

Controls :

ON-OFF: Pilot Operated
PROPORTIONAL: Open-Loop / Pilot Operated
(with Standard PUSH-type Manual Overrides)
PROPORTIONAL: Closed loop /Pilot Operated
(with Standard Bidirectional Manual Lever)

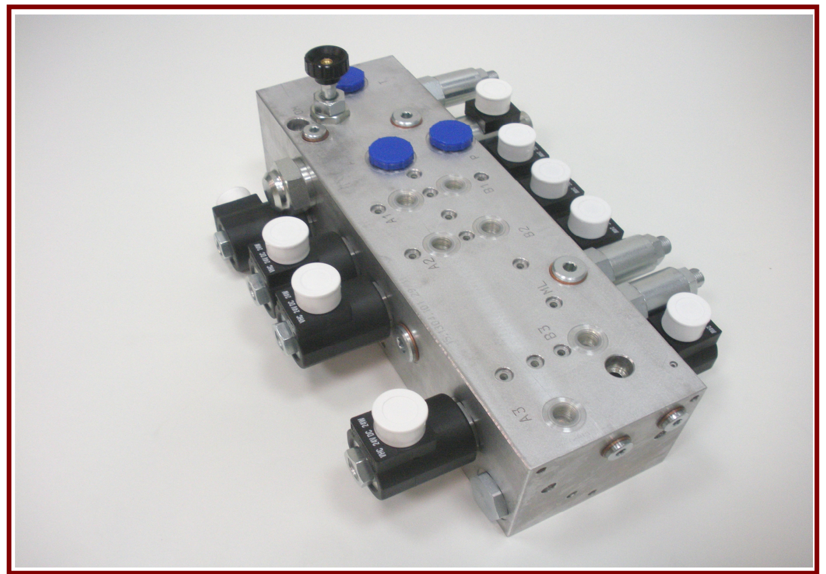


Service Cranes

Aerial Platforms

Hedge Cutters

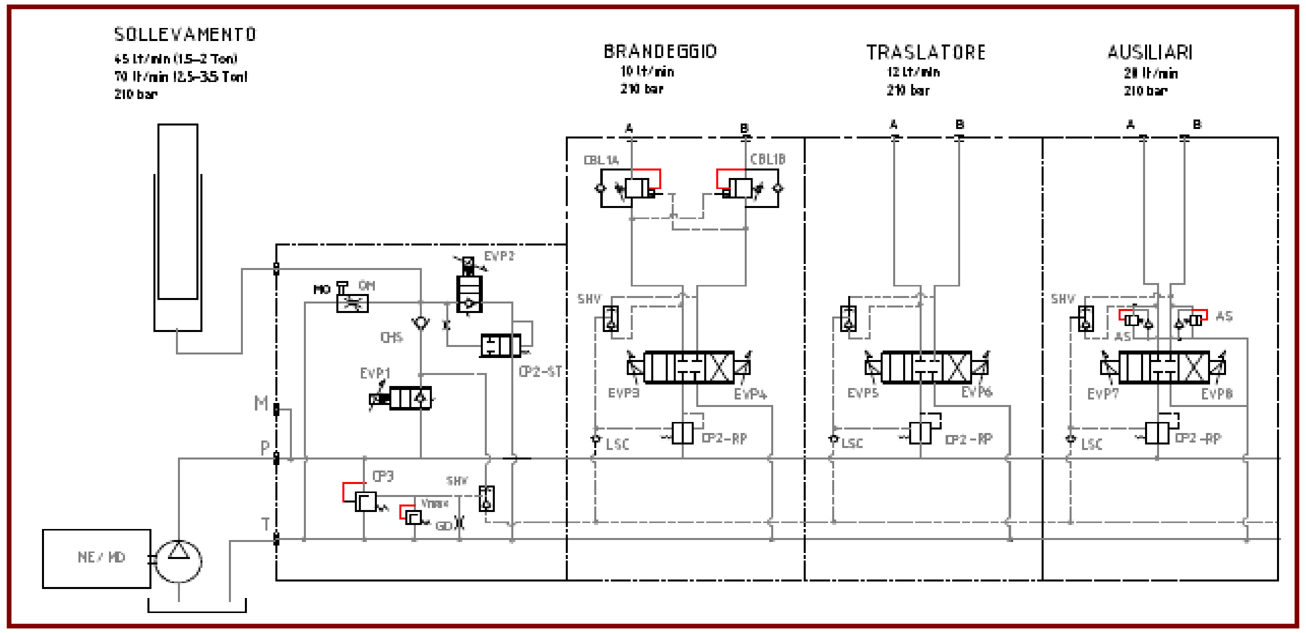
Loader Cranes



Multi-function Proportional Valve System Mod. SF1202-CSB for 2-Ton Electrical Fork Lift Truck

- ***Typical Input Flow:*** ***80 lt/min***
- ***Max. Work Pressure:*** ***280 bar***
- ***Load-holding valves on TILT and AUX. functions***

Hydraulic Diagram



Electric Side-Shifter

Stand-up Drive Electric Fork Lift

Diesel Fork Lift

Commissioner

Staker

Electronic Controls

Multi-function Joystick Controller

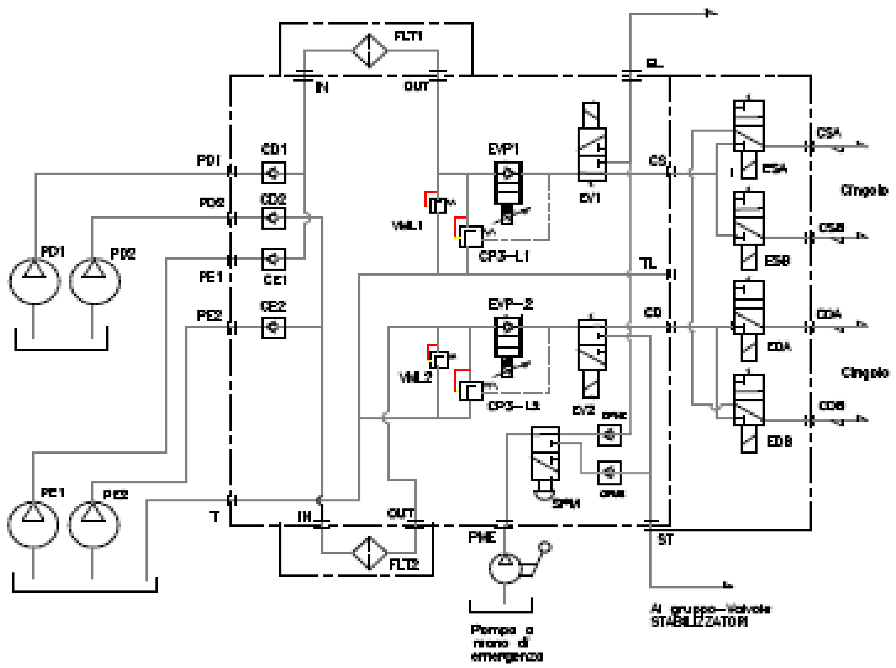
Finger-tip proportional control levers and microprocessor-based MMS (Machine Management System)

Proportional Roller for LIFT & LOWER control for STAKERS

In-cabin Control Panels

P/N 15.1302.193

Electro-Hydraulic Control System for Self-Propelled / Crawler-type Aerial Platform



Typical Input Flow :	30 lt/min
Max. Work Pressure:	250 bar
Control Configuration:	dual-path proportional control circuit

Self-Propelled Craler-type Aerial Platform

Self-Propelled Articulated Aerial Platform

Self-Propelled Scissor Lift

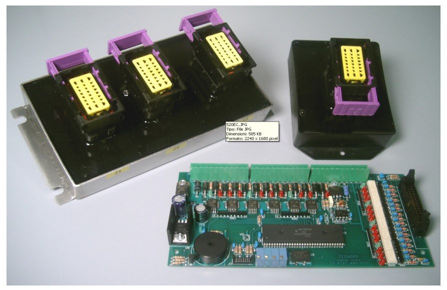
Electronic Controls

Base Control Box for Self-Propelled Aerial Platform

Basket Control Box

Joystick Controllers
Fingertip levers
Multi-function Grips

Aerial Basket Radio Remote Control



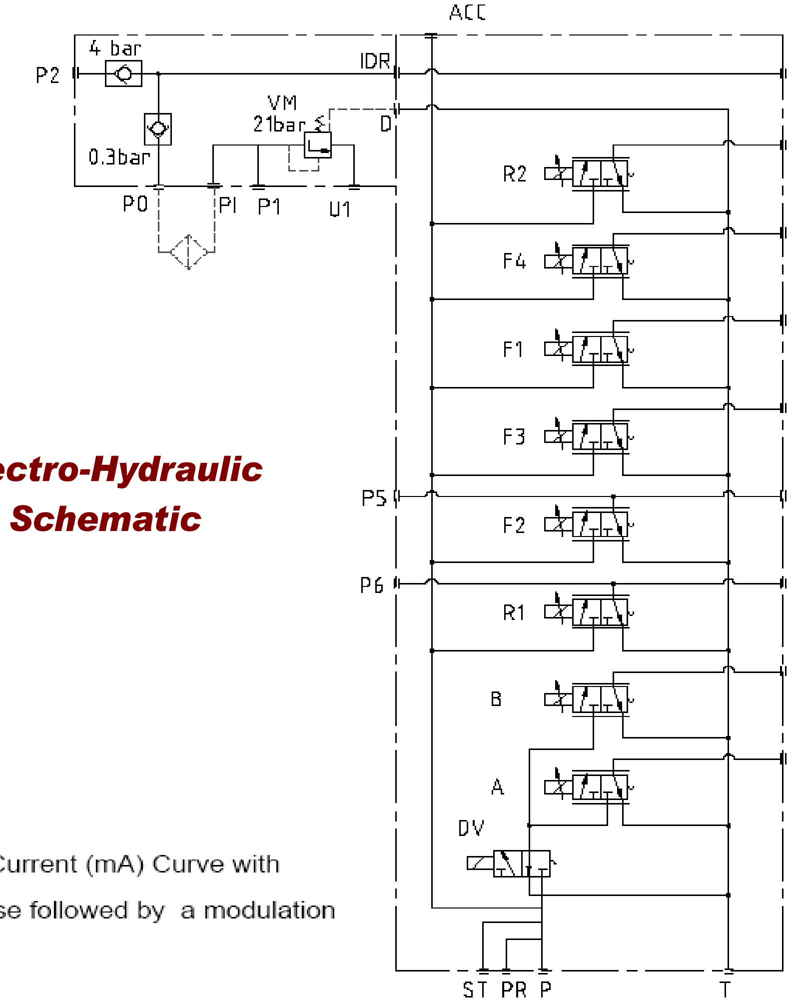
MMS - Machine Management Systems

2-axes Proportional Inclinometer

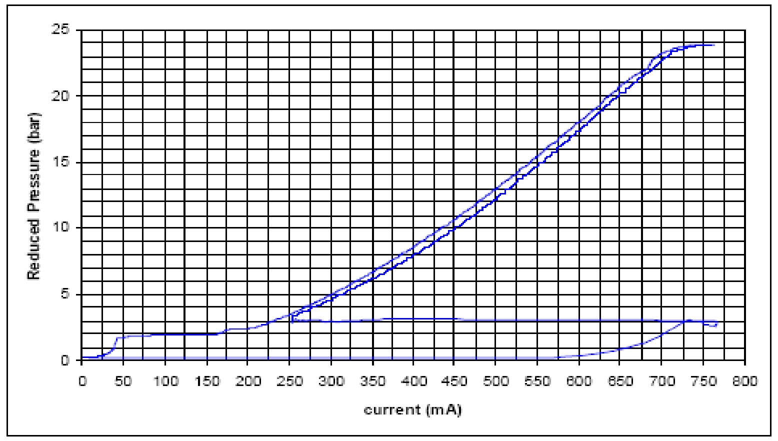
P/N 15.1503.048

8 - Proportional Pressure Reducing Valves Manifold Block for CVT Transmissions

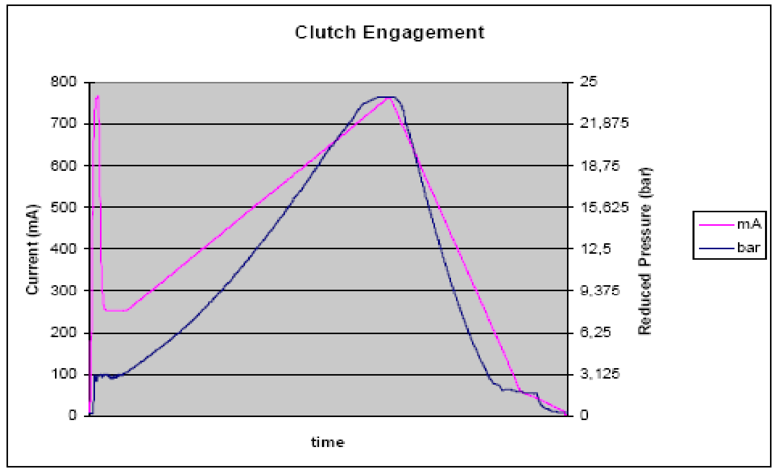
Electro-Hydraulic Schematic



Pressure (bar) vs. PWM Current (mA) diagram for quick fill-up and soft engagement of a wet-disc clutch



1. Press (bar) vs. Current (mA) Curve with quick fill-up phase followed by a modulation ramp



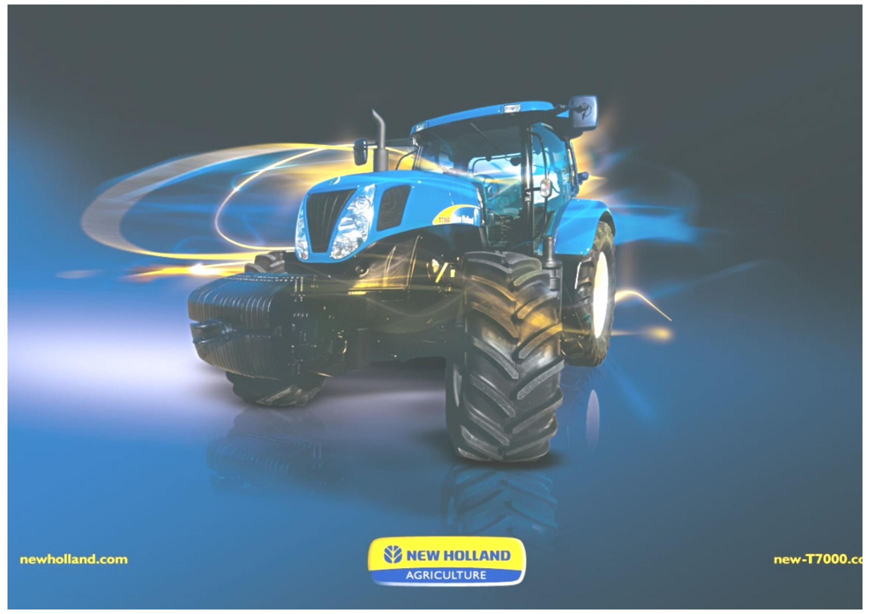
2. Typical Clutch Cycle:

- Preliminary "quick fill-up" phase at top current until pressure begins to raise within the cluctch piston chamber

- Modulated Current ramp to generate a "soft engagement" of clucth discs

Mod. IP-PRZ-T059 Proportional Pressure Reducing Valve

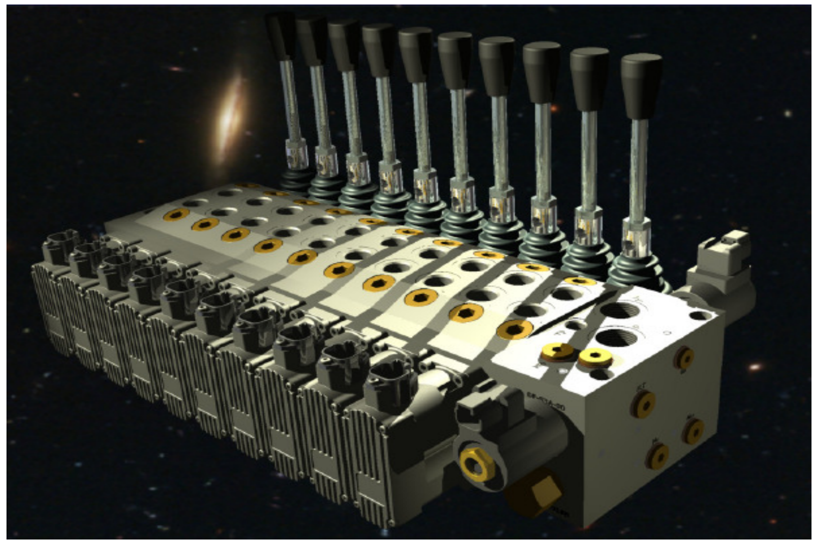
NEW HOLLAND T7000 Series



MAGNUM Series

Steyr Mod. 6255 CVT

Mod. TDV100 Tecnord Directional Control Valve System

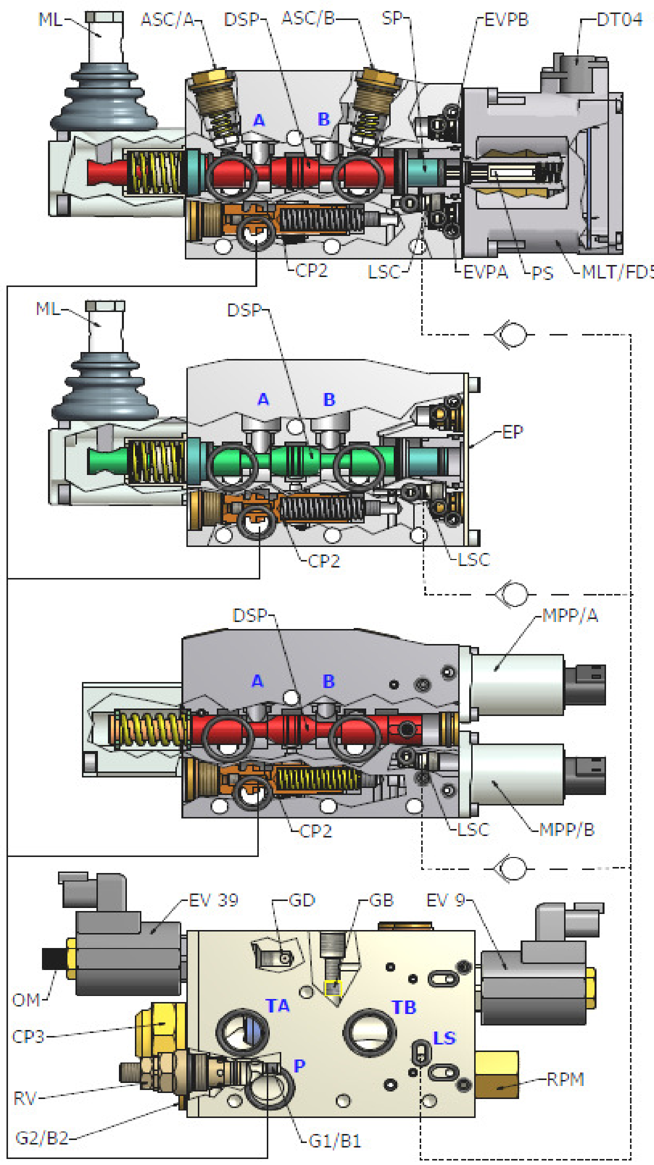


- *90 / 120 lt/min Max. Inlet Flow*
- *70 lt/min Max. Controlled Flow per section*
- *280 bar Max. work Pressure*

- *Stackable Configuration*
- *Load Sensing / Pressure Compensated*
- *Open Center for Fixed Displacement Pumps*
- *Closed Center for Variable Displ. Pumps*

- *Manual control lever*
- *MLT/FD5 Closed Loop Prop. Actuators*
- *RPP/T043 Open Loop Prop. Actuators*

ELECTRO-HYDRAULIC DIAGRAMS



TDV103-LES
Left-hand end section

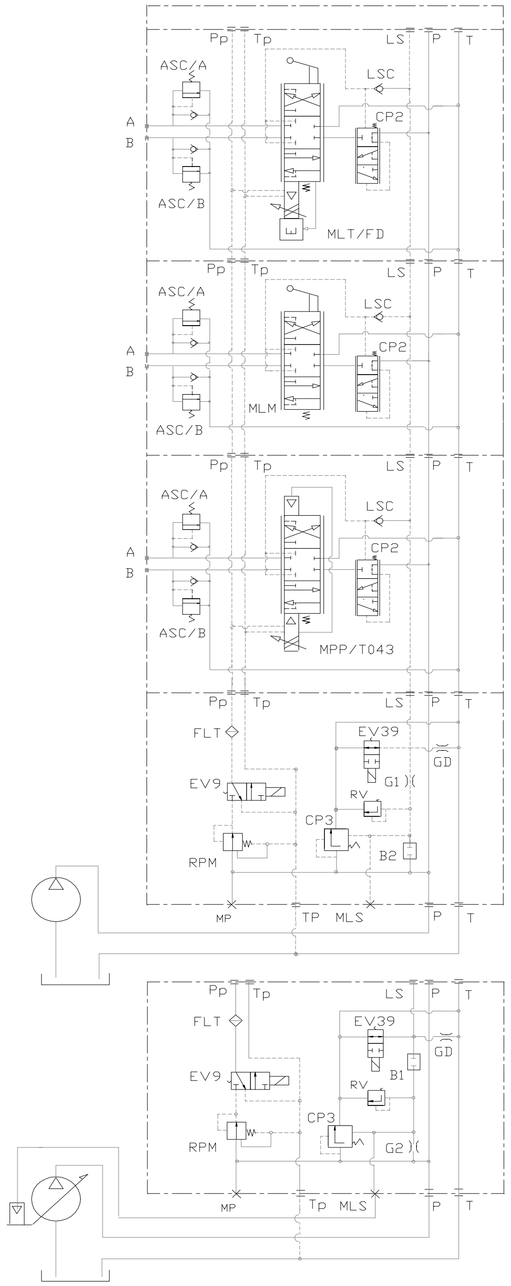
TDV102-MLT
Manual Control Section and Closed Loop Proportional Control Actuator

TDV102-MLM
Manual Control Section

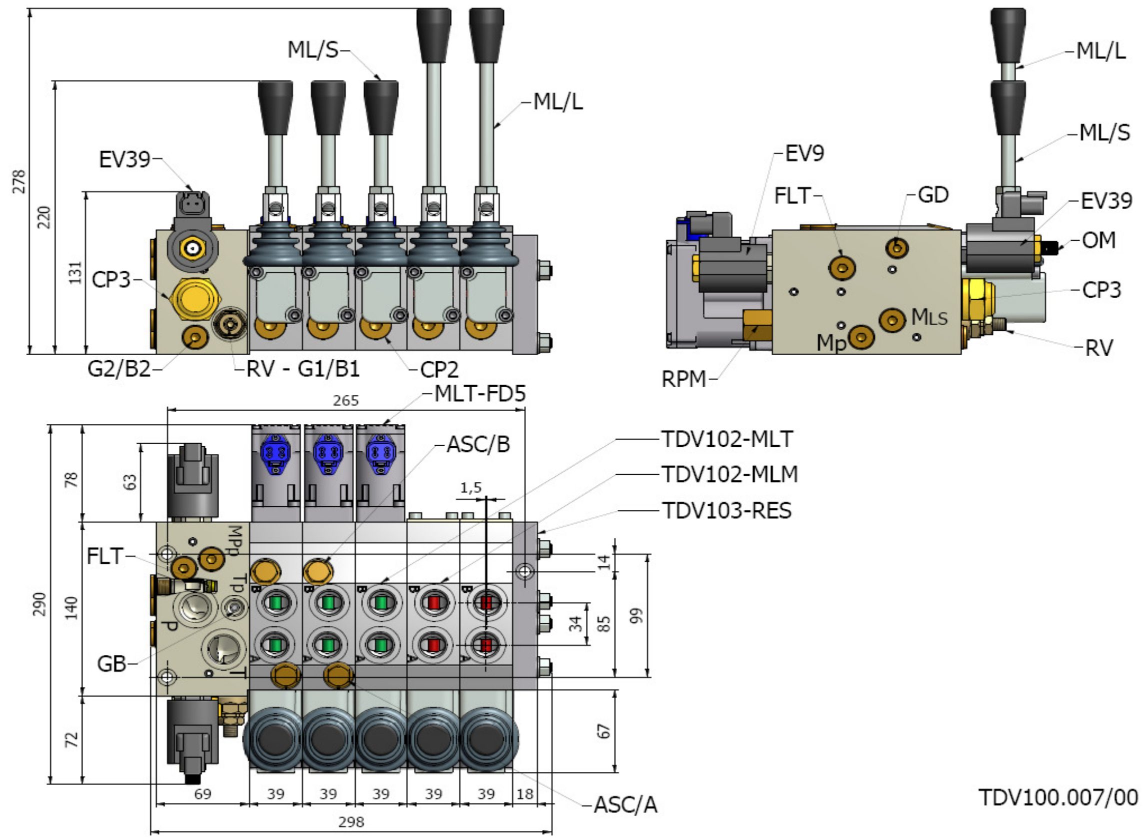
TDV 102- MPP
Electro-hydraulic proportional pilot pressure control

TDV101-IFCL
Inlet Section for Fixed Dsplacement Pump System

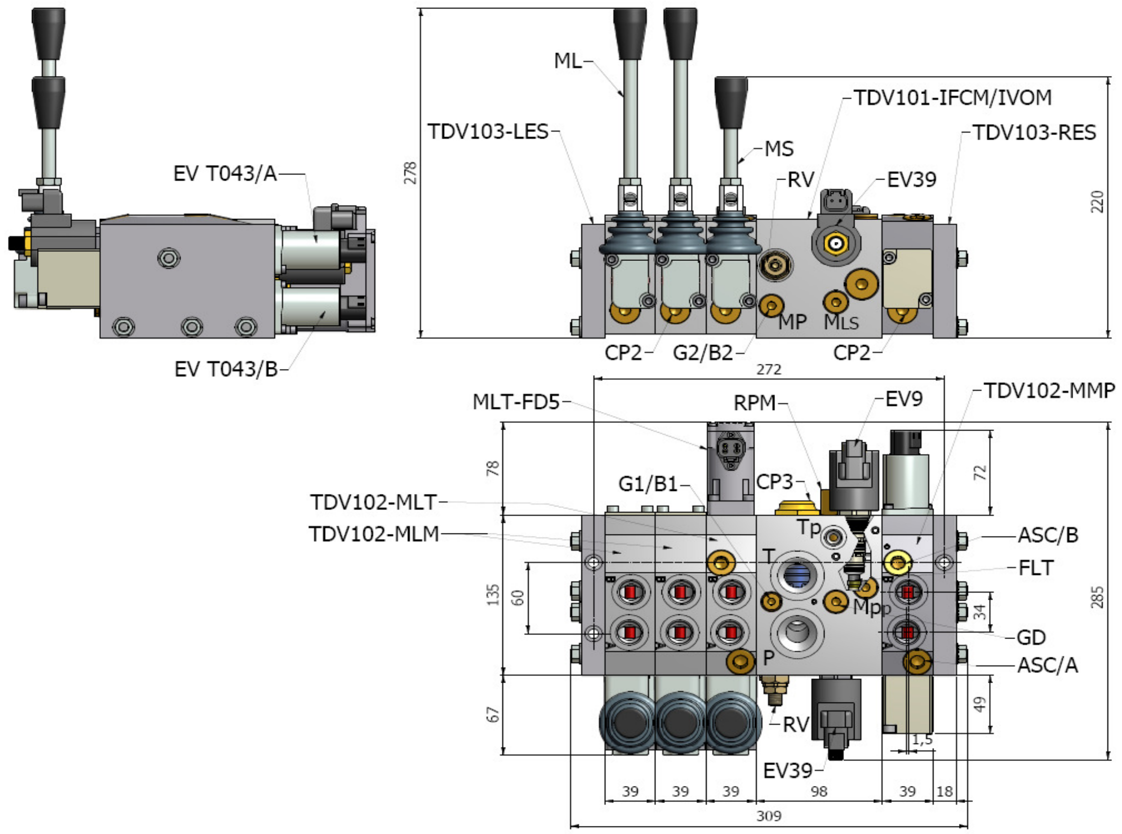
TDV101-IVOL
Inlet Section for Variable Displacement Pump System



TDV100 - IFCLG34 - 3MLT-A/A5 - 2MLM - RES (90 lt/min Max. Inlet Flow)



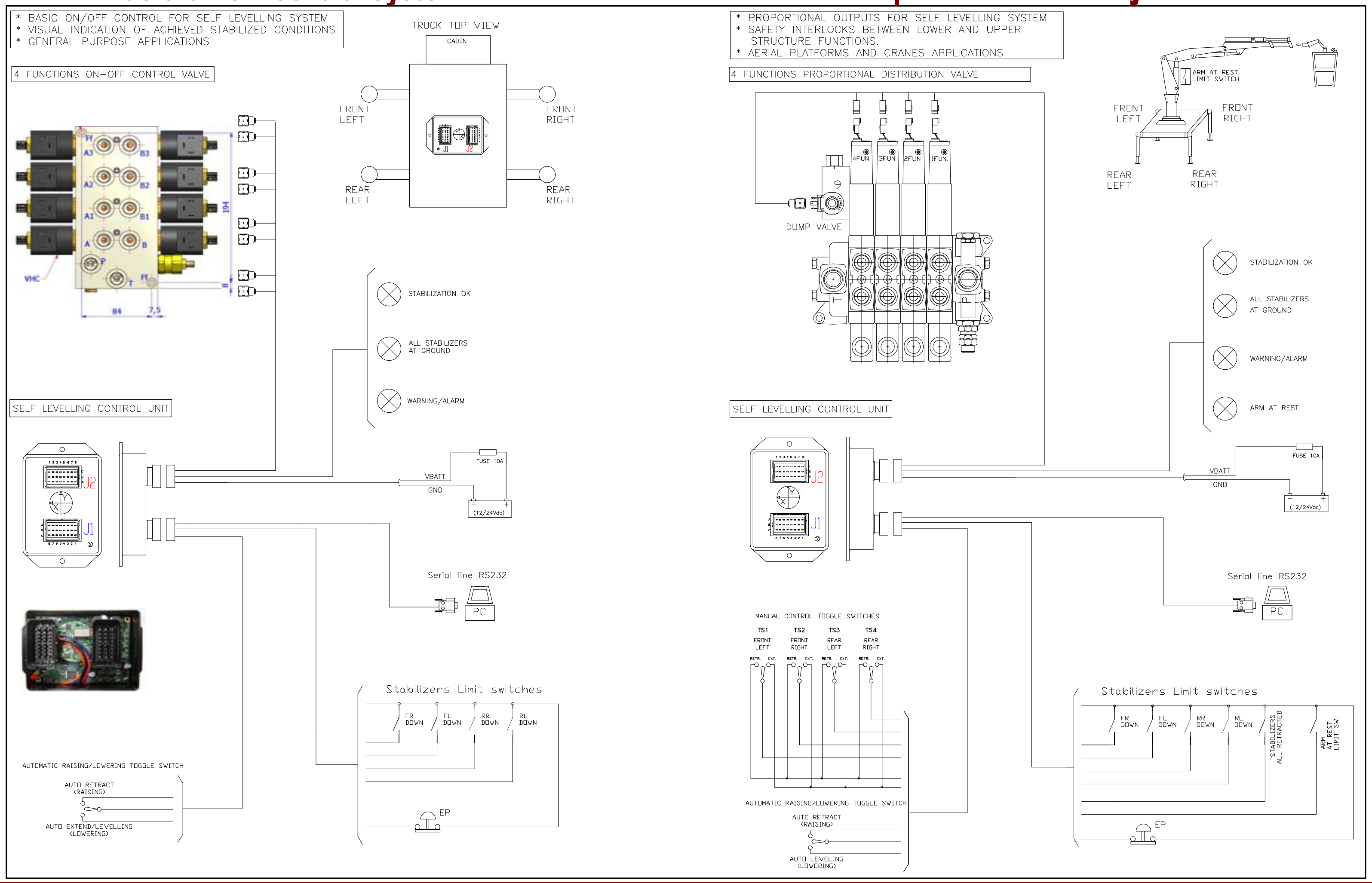
TDV100 - 2MLM-1MLT - IFCMG1" - 1MPP (120 lt/min Max. Inlet Flow)



Self Levelling System

Basic On-Off Control System

Proportional Control System

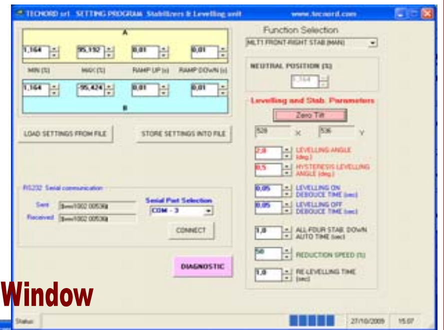


4 Functions On-Off Manifold Valve

TDV100 - 4F Proportional Distribution Valve

MMS2020 - Self Levelling Control Unit

PC Interface - Calibration Window



PC Interface - Diagnostic Window

Cranes

Aerial Platforms

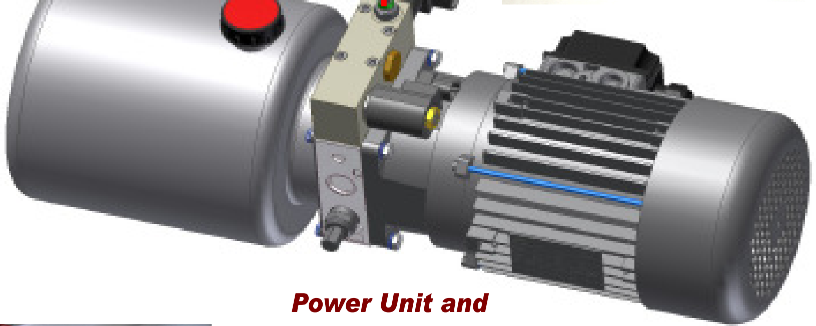
Telehandlers

Utility Vehicles

Single Effect Cylinder Mast

Commissioner type Fork Lift Truck

Lift & Lower Electronic Control and PWM driver



Power Unit and Proportional Control Manifold Block

Proportional Roller Switch for Manual Lift & Lower Control

Applications:

- . Stackers
- . Commissioners
- . Elevators for Commercial and Public Areas

Lift Control sequence

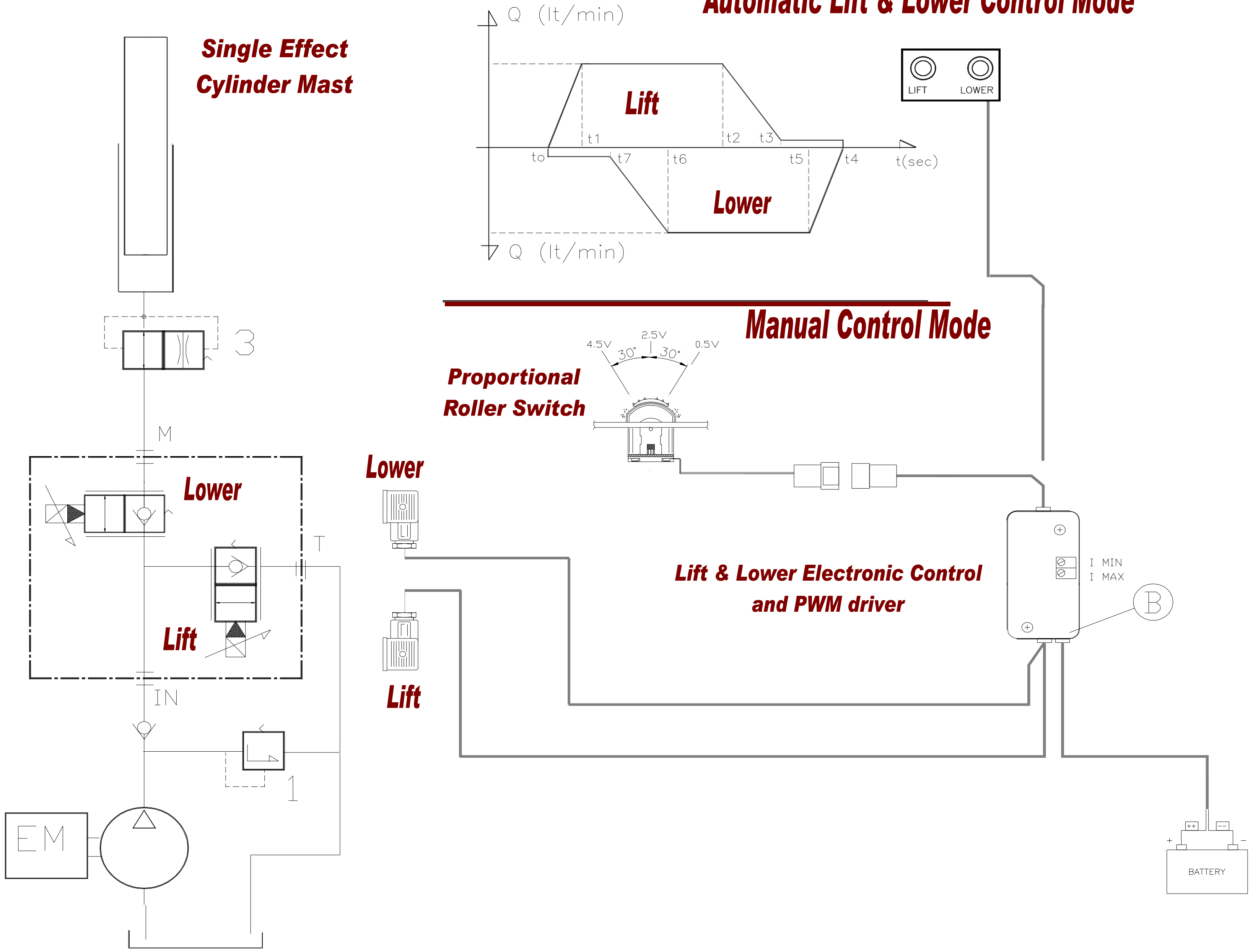
to - t1	Ramp-up from 0 to max. speed
t1 - t2	Riding at max. speed
t2 - t3	Ramp-down from max. speed to creep speed
t3 - t4	Coasting to a stop at creep speed.

Lower Control sequence

t4 - t5	Ramp-up from 0 to max. speed
t5 - t6	Riding at max. speed
t6 - t7	Ramp-down from max. speed to creep speed
t7 - to	Coasting to a stop at creep speed.

Automatic Lift & Lower Control Mode

Manual Control Mode



Pressure Compensated Flow Regulators

- The addition of individual pressure compensators / pressure reducers COMP.1 and COMP.2 allows to maintain preset flow rates across REG 1 and REG 2 regardless of varying load conditions. ***(Fig. 1)***

- The function of PRESSURE COMPENSATORS CP2.1 AND CP2.2 is to maintain a fixed PRESSURE DIFFERENTIAL across REG 1 and REG 2. If for a given opening degree of REG2, a fixed pressure differential is maintained, the flow going thru it remains constant (Bernoulli's law)

- If the load L1 increases, the LS1 signal will urge the pump to pressurize at a higher pressure without affecting the flow rate across REG 2 ***(Fig. 2)***

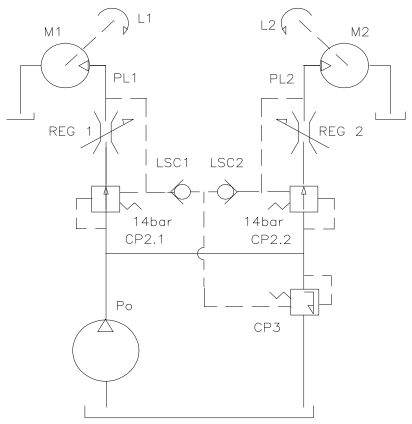


Fig. 1

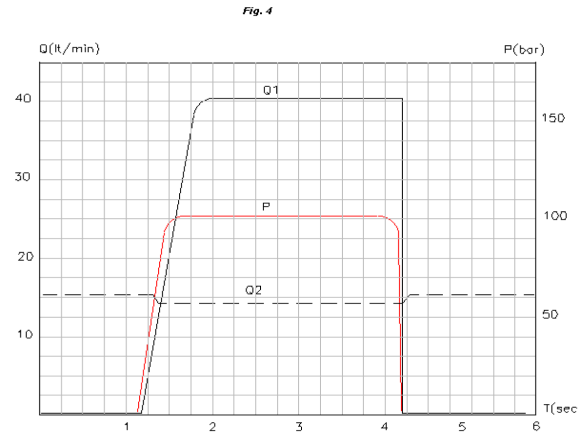


Fig. 2

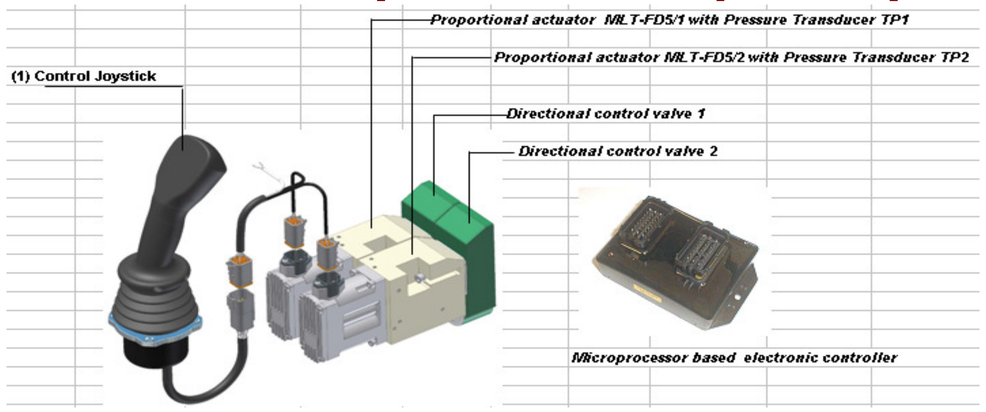
Electronic Compensation's scope:

. To eliminate the PRESSURE COMPENSATOR SPOOL on stackable valves and to provide pressure compensation under variable load conditions by varying the opening of the DIRECTIONAL CONTROL SPOOL in response to the variation of LOAD SENSING SIGNALS sensed by means of pressure transducers and a microprocessor-based control logic.

. The elimination of PRESSURE COMPENSATOR SPOOLS means:
- energy saving (thanks to the limination of the delta-p across the spool itself)
- reduced sized of directional spool valves
- possibility to change the control mode of a given hydraulic function by switching from an electronic configuration to another, such as:

. LOAD SENSING
. FLOW SHARING
. ANTI-SATURATION
. ANTI-STALL
. HORSE-POWER LIMITER

Hardware Description and Principle of Operation



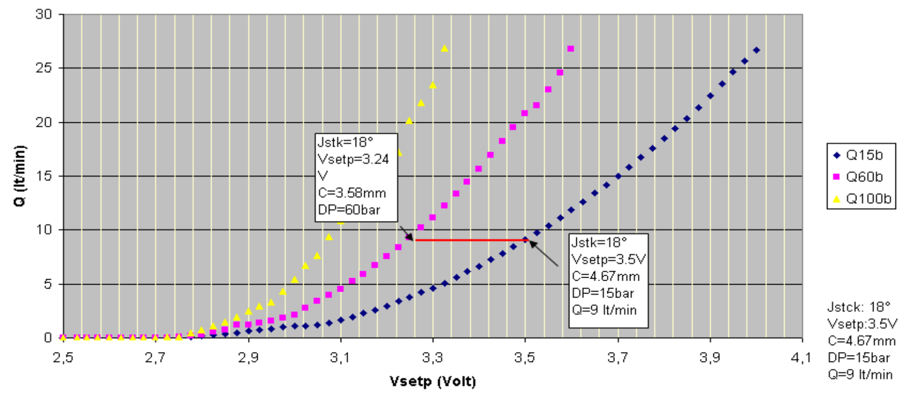


Fig. 4

1. Rotale the JOYSTICK LEVER by 18 ° along the Y-Y axis to generate a 3.5 Volt signal to the PROPORTIONAL ACTUATOR 1

2. In response to a 3.5 V input signal, the PROPORTIONAL ACTUATOR will generate a 4.67 mm STROKE OF THE DIRECTIONAL SPOOL

3. For a given CONTROL SPOOL PROFILE, let us assume that a 4.67 mm stroke generates a 9 lt/min flow under "15 bar pump pressure", whereas 15 bar is the typical "stand-by pressure" of a Closed Center Load Sensing System
This condition is represented by the BLUE dotted line on the graph of Fig. 4
4. Let us assume that the JOYSTICK LEVER is rotated along the X-X to activate the PROPORTIONAL ACTUATOR 2 connected to the DIRECTIONAL VALVE 2 and that in response to this command, a load-induced pressure of 45 bar is created in the circuit. The Load Sensing circuit built into the valve system, will then urge the pump to build up (45+15)=60 bar pressure
5. Being the DIRECTIONAL VALVE SECTION 1 non-pressure compensated, if the SPOOL STROKE is still 4.67 mm, the 9 lt/min flow rate will increase by a significant amount corresponding to the square root of the delta-p variation from 15 to 60 bar (Bernoulli's law)
6. Conversely, if the system were equipped with means of measuring the delta-p variations, then it would be possible to modify the DIRECTIONAL VALVE SPOOL STROKE to maintain the desired 9 lt/min imposed by the "18 ° rotation angle of the joystick", that, in the end is the most intuitive reference point for the Machine Operator.
7. The required control system needed to accomplish the above modification of working parameters, should work as follows:
   - Read the instant pressure surge from 15 to 60 bar
   - Calculate the SPOOL STROKE reduction neeed to maintain 9 lt/min under a 60 bar delta-p according to the Bernoulli's law algorithm
   - Establish the correct correlation between the calculated SPOOL STROKE and the Vin (input signal) needed to produce it by means of the control logic of the MLT-FD5/1 actuator.

8. ***As a result of the ELECTRONIC COMPENSATION, the control characteristic shall shift from the curve Q15 b (Blue) to the curve Q60 (Magenta)***

4 - Data-base acquisition process

Data acquisition process

The flow metering characteristic of a directional spool designed for ELECTRONIC PRESSURE COMPENSATION must be tested to determine the different FLOW (lt/min) vs STROKE (mm) characteristic under varying DELTA- PRESSURE (bar) conditions ***(Fig. 5)***

To attain the graph of ***Fig. 5*** (FLOW vs. STROKE), a data acquisition process has to be carried out to trace a set of (Delta-P vs. FLOW) curves.

A step / linear motor is used to increase the spool stroke by 1/10 mm at a time, while a PROPORTIONAL FLOW REGULATOR creates a variable flow across the orifice and consequently a variable DELTA-P that has to be recorded and then plotted into the set of (Delta P vs. Flow) curves

By plotting the acquired data-base by means of proper mathematical algorithms, it is now

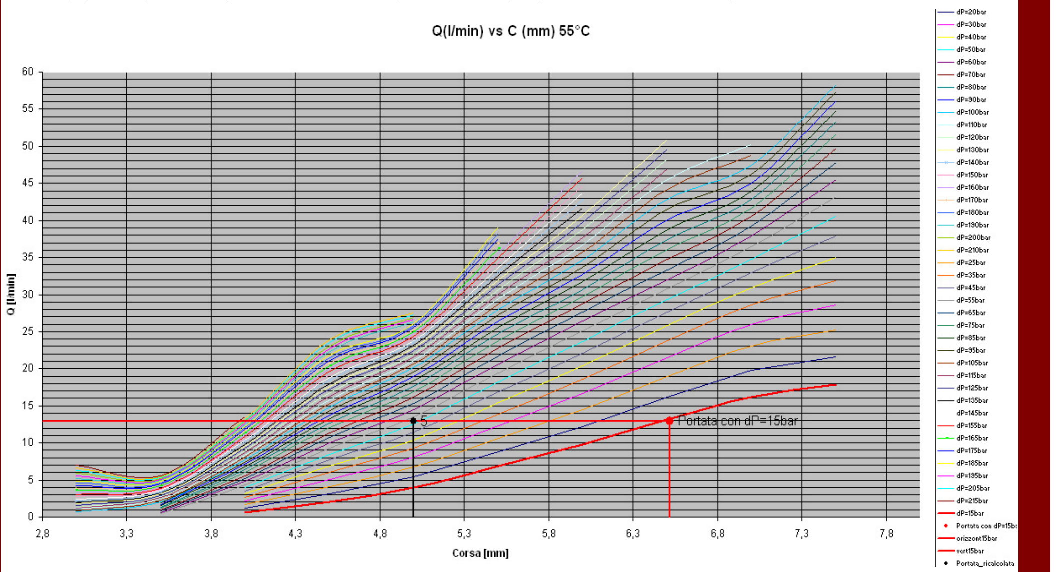
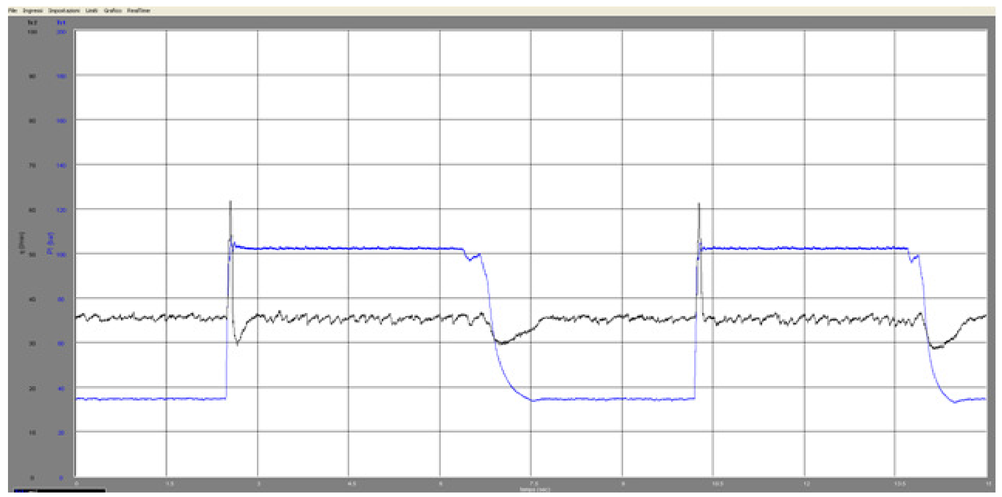


Fig. 5

Performance Level / Example 1

The black / ragged horizontal line on the graph of Fig. 9 is the flow of a directional spool set for 35 lt/min under 40 bar load induced pressure

FLOW (lt/min) and PRESSURE (bar)



Time (sec)

If an instant peak pressure of 100 bar is applied , the transition time between the moment t the pressure peak is sensed and the moment the spool *retracts* to maintain the preset flow rate, is about 100 ms,