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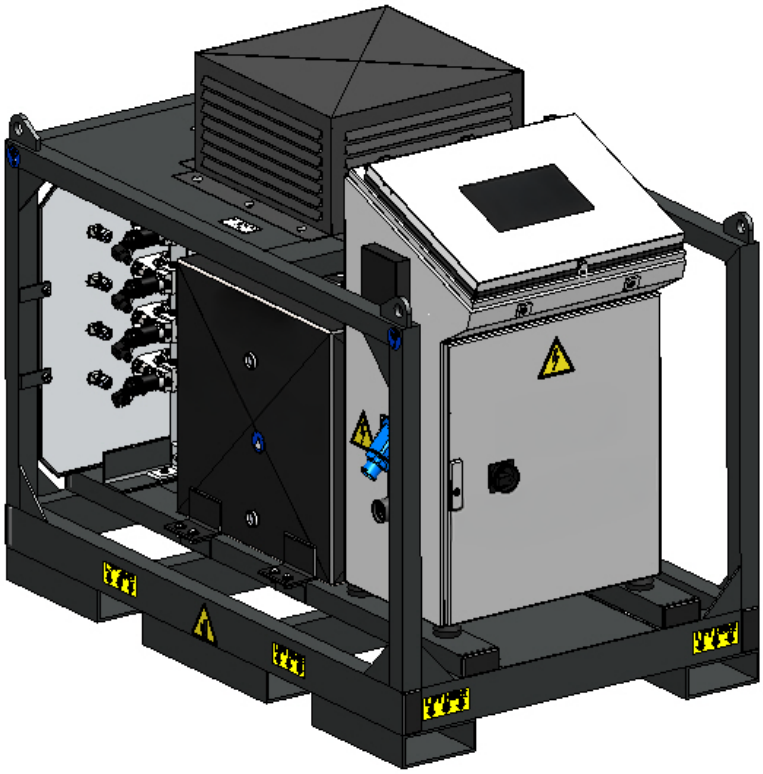
Operating Instructions for:
MCS Series

MOTION CONTROL SYSTEM

⚠WARNING

These operating instructions must be read and thoroughly understood for the safe commissioning, operation, and maintenance of the Motion control system. The following procedures must be performed by qualified, trained personnel who are familiar with this equipment. While every attempt has been made to ensure clarity, the intent of this document is to provide basic guidance and it is the responsibility of the end user to review each application thoroughly for suitable usage. Users should utilize sound engineering judgment prior to, and during, product operation. This unit is not suitable for use in explosive environments. Failure to comply may result in damage, injury, or death.



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GLOSSARY

In the context of this Instruction sheet, the following words have the meaning as described:

Accuracy	Difference in measurement unit (usually mm or inch) between the load movement of the leading vs the lagging lifting point.
Actuation time	Time period during which the spool of the directional valve as well as the spool of a 2-position-2-way valve to at least one hydraulic circuit is energized.
Displacement mode	Operational mode in which the PLC unit determines the actuation time of each 2-position-2-way valve and thus keep the movement of the load within the preset accuracy.
Displacement sensor	Device to measure the movement of the load as a result of the application of forces generated by hydraulic cylinders
Forced zero	Starting point of the controlled load movement achieved by pressing the "Reset" button. For Displacement mode only
Hydraulic circuit	Hydraulic Cylinder connected to a 2-way-2-position valve and the return line of the pump unit via a hydraulic hose
Lifting point	The location on the load where force generated by hydraulic cylinders is applied
Manual mode	The operator is solely responsible and in control of the movement of each cylinder while using manual mode!
⚠WARNING	Operational mode in which the PLC unit does NOT have any automated control function.
Measuring system	Set of analog displacement sensor, sensor cable and analog pressure sensor, one each per hydraulic circuit
Motion Control	Any type of movement or translocation of a heavy load by means of forces generated by hydraulic cylinders operated by and under the control of a PLC-based control system

PLC unit — Programmable Logic Controller composed of analog input channels, digital output channels and computing capabilities to control the advance and retract operation of hydraulic cylinders within specific parameters of accuracy and repeatability.

Pressure mode — Operational mode in which the PLC unit controls the pressure applied to each hydraulic circuit against a maximum pressure value.

⚠WARNING — In the pressure mode there is NO control of the actual movement of the load in this mode.

Pressure sensor — Device to measure the oil-pressure within the hydraulic circuit, one per hydraulic circuit (motion point).

Pump unit — Assembly of a hydraulic pump mounted on a reservoir with valves and pressure sensors.

Sensor cable — Shielded cable between the Displacement sensor and the PLC unit as carrier for the analog signal generated by the Displacement sensor.

Target — Total movement of the load that shall be achieved simultaneously at all lifting points under the control of the PLC unit.

USB flash drive — USB flash drive often used for storage of data and transfer of computer files. Device used to store the datalog of lifting project.

DESCRIPTION

Motion control is all about precision and control of a mass in motion; precision in the measurement of movements and control over the energies involved.

Whether it is a bridge, a building or any other kind of heavy load; lifting, lowering, tilting or positioning of such a load can be carried out completely automatically with a high degree of accuracy when using the Hydraulic Technologies Motion Control System.

The PLC-controlled system includes a combination of digital actuation and digital control that provides significant advantages including time savings, repeatability, and extremely low internal stress in the object being moved.

In the standard configuration, a state-of-the-art A/D measurement system captures the displacement of the load during the movement process, in increments of less than a millimeter. Those digital signals are then processed by the PLC, utilizing powerful algorithms, to generate the digital output used by the hydraulic system.

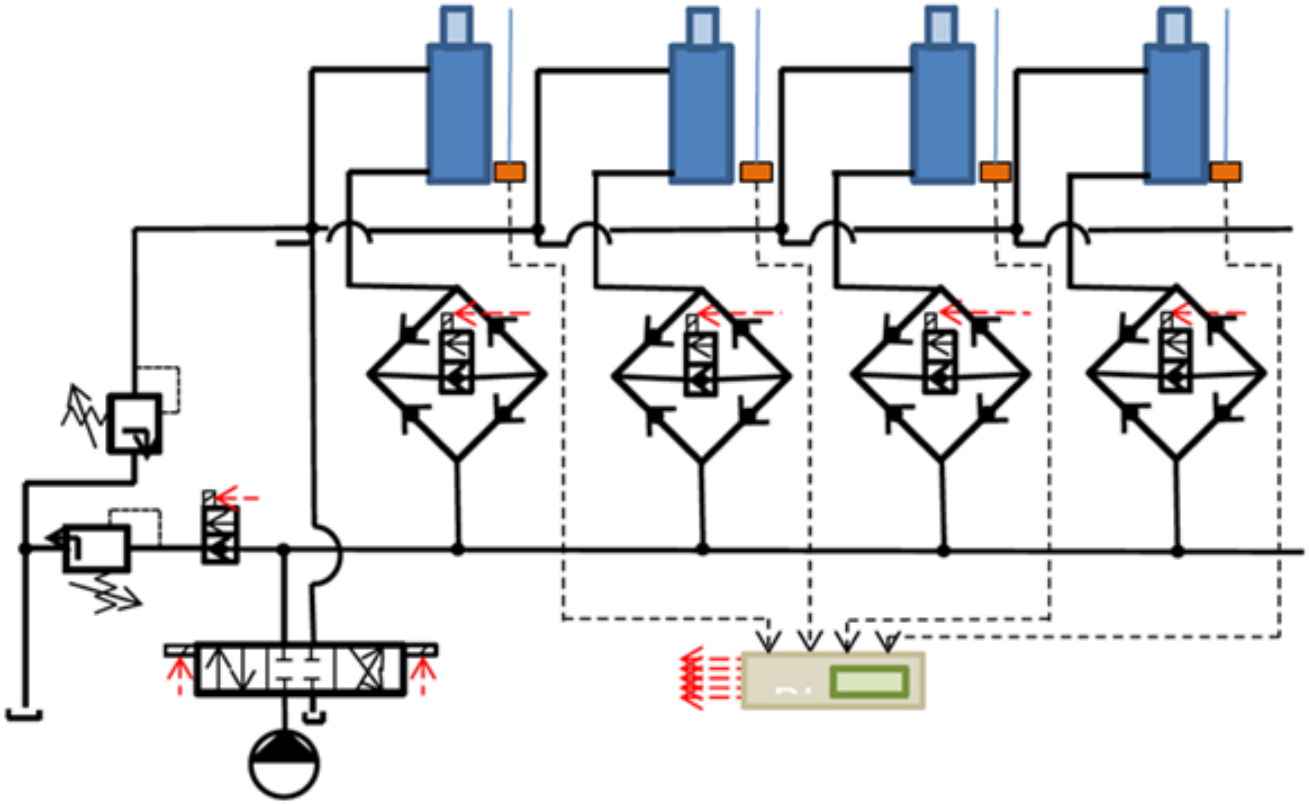
With system performance being driven by extremely short duration actuation times for specifically selected valves, only small units of oil are directed to the selected hydraulic cylinders at any given moment. With this "partitioning" of the hydraulic oil, the hydraulic system becomes a virtual digital hydraulic system with all advantages of checkability and control over the movement of the load.

Subsequently, with all movement points being synchronized and under full control, no additional stresses are induced into the object being moved due to bending, torsion or shifting loads.

Measurements are taken and calculations are made utilizing a Best Developed Available Technology (BDAT) PLC. Using the BDAT-PLC allows the operator to focus on monitoring the movement without having to interfere or even take long-lasting manual interventions. This creates the basis for significant time savings compared to traditional methods of moving heavy loads.

Improved control in applications that involve the same movement repeatedly, such as self-climbing formworks, strand-lift or stage-lift operations, is due to the functionality of the PLC software and the operational features provided by the HMI (Human Machine Interface).

The same factors also allow for an automated documentation of the movement including pressure (force) on the various cylinders, a time signal and all operator actions taken via the HMI (Human Machine Interface).



The motion control system is a PLC-based eight lift point (expandable) motion control system which allows for accurate and reliable control of multiple hydraulic cylinders to accomplish the lifting / lowering / pushing / etc. of almost any size load. The PLC software controls valves feeding each hydraulic cylinder in a way that will keep the load-movement synchronized within the preset tolerance range, regardless of the actual load distribution within the hydraulic circuit.

One hydraulic setup suits both single and double-acting cylinders under different pressure - different load – in each circuit

NOTE: When using single - acting cylinders, an over center, or other appropriate valve should be used as safety in the event of hose break.

Controlled cylinder movement in both directions: advance and retract

Complete Motion Control System package consists of the following modules

- Controller
- Measuring System
- Pump Unit
- Valve System
- Electrics/Electronics

SAFETY SYMBOLS AND DEFINITIONS

The safety signal word designates the degree or level of hazard seriousness.

[**IMPORTANT:** This guide cannot cover every hazard or situation so always do the job with **SAFETY FIRST** in mind.]

⚠ DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
⚠WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
CAUTION:	Used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.
IMPORTANT:	Important is used when action or lack of action can cause equipment failure, either immediate or over a long period of time.

SAFETY PRECAUTIONS

⚠ DANGER This unit is **NOT** suitable for use in explosive environments.

In order to take the necessary actions to avoid an accident with or any damage to the MCS motion control system, or the load being positioned, note:

This unit is not suitable for use in explosive environments.
It is the responsibility of the user of this equipment to create a lifting plan in accordance with their company's policies. That plan should include at least the following items:

- Who is involved and what their responsibilities are.
- What the lift objectives are and what are actions and their sequence in order to achieve the lift.
- When the lift will take place, over what time frame.
- Where the lift takes place and where critical lift or reaction points are located.
- A comprehensive safety plan.
- Local special conditions (legal, environmental, geographical, etc.)

Before putting the motion control system into operation, the operator shall analyze the lift application for all foreseeable risks, their likelihood to occur, and the potential consequences of the identified risks as per ISO 31000 and ISO/IEC 31010 in their actual current version.

- Read and understand the Operating Manual before operating this equipment. For the latest version of the instruction please visit the “Resources” page on our Website (www.PowerTeam.com)
- **IMPORTANT:** For instructions specific to the various system components refer to the related individual manufacturer’s instructions that have been included with the MCS.
- **IMPORTANT:** The following procedures must be performed by qualified, trained personnel who are familiar with this equipment. Operators must read and understand all safety precautions and operating instructions included with the MCS Motion Control System. If the operator cannot read these instructions, operating instructions and safety precautions must be read and discussed in the operator's native language.

- The Motion Control System is designed for general use in normal environments. These products are not designed for lifting and moving in special work environments such as: explosive, flammable, or corrosive. Only the user can decide the suitability of this system for use in these conditions or extreme environments. Power Team will supply information necessary to help make these decisions. Consult your nearest Power Team facility.
- Safety glasses and hearing protection must be worn at all time by the operator and anyone within sight of the unit. Additional personal protection equipment may include: face shield, goggles, gloves, apron, hard hat, and safety shoes.
- The owner of this motion control system must ensure that safety-related decals are installed, maintained, and replaced if they become difficult to read or understand.
- Disconnect electrical power prior to opening electrical cabinet.

⚠CAUTION To prevent operator error, perform all of the following steps to develop a lift plan for the requirements including and especially concentrating on the controlled movement with an assistant operator whose sole task it is to double-check and verify any input and operational action taken by the main operator.

IMPORTANT: All movements to be performed by the Motion Control System must be ordered and approved by the person responsible at the job site. If on a job site, Hydraulic Technologies employees may answer questions about the function or operation of the Motion Control System, but cannot be responsible for static or strength calculations of the structure or load to be moved, or the actual operation of the Motion Control System during the lift.

⚠WARNING After setting up the MCS, the system needs to be tested for correct mapping of circuit number on the screen versus displacement sensors and correlation with the 2-way valves. Extend each displacement sensor individually for approximately 100 mm and verify the displacement indication on the screen to show the same change of values. Set the system into “Manual” mode and activate each circuit one by one. Verify the function of the related 2-way valve by checking the movement of the spool-core.

PUMP

⚠WARNING

- Do not exceed the hydraulic pressure rating noted on the pump nameplate or tamper with the pump's internal high pressure relief valve. Creating pressure beyond rated capacities can result in personal injury.
- Retract all cylinders in the system before adding fluid to prevent overfilling the pump reservoir. An over-fill can cause personal injury due to excess reservoir pressure created when cylinders are retracted.

ELECTRIC-DRIVEN MOTOR

⚠ DANGER This unit is **NOT** suitable for use in explosive environments.

⚠WARNING

Electrical work must be performed and tested by a qualified electrician per local directives and standards.

- Disconnect the pump from the power supply and relieve pressure before removing the motor case cover, or performing maintenance or repair.
- Check the total amperage draw for the electrical circuit you will be using. For example: Do not connect a pump that may draw 25 amps to a 20 amp fused electrical circuit.
- Never use an ungrounded power supply with this unit.
- Changing the voltage is an involved and, if incorrectly performed, hazardous procedure. Consult the manufacturer for specific information before attempting rewiring.
- Wire pump motors for counterclockwise rotation when viewed from the shaft end of the motor.
- Do not attempt to increase the power line capacity by replacing a fuse with another fuse of higher value. Overheating the power line may result in fire.
- Exposing electric pumps to rain or water could result in an electrical hazard.
- Avoid conditions that can cause damage to the power cord, such as abrasion, crushing, sharp cutting edges, or corrosive environment. Damage to the power cord can cause an electrical hazard.

HOSES

⚠WARNING

- Before operating the pump, tighten all hose connections using the correct tools. Do not over-tighten. Connections should be only secure and leak-free. Over-tightening can cause premature thread failure or high pressure fittings to split at pressures lower than their rated maximum operating pressure.

- Should a hydraulic hose rupture, burst, or need to be disconnected, immediately depress the **RED** emergency E-Stop Button to shut off the pump. Never attempt to grasp a leaking hose under pressure with your hands. The force of escaping hydraulic fluid could cause serious injury.
- Do not subject the hose to potential hazard, such as fire, sharp surfaces, heavy impact, or extreme heat or cold. Do not allow the hose to kink, twist, curl, or bend so tightly that the fluid flow within the hose is blocked or reduced. Periodically inspect the hose for wear, because any of these conditions can damage the hose and possibly result in personal injury.
- Do not leave a hydraulic hose in a position where it could shift under a raised load in order to prevent the hose from being crushed or ruptured when the load is lowered.
- Do not use the hose to move attached equipment. Stress can damage the hose and possibly cause personal injury.
- Hose material and coupler seals must be compatible with the hydraulic fluid used. Hoses also must not come in contact with corrosive material such as creosote-impregnated objects and some paints. Consult the manufacturer before painting a hose. Never paint the couplers. Hose deterioration due to corrosive materials may result in personal injury.

CYLINDER

⚠ DANGER

- Do not exceed rated capacities of the cylinders. Excess pressure may result in personal injury.
- Cylinders should be arranged, as much as practical, to evenly distribute the load to each cylinder.
- Avoid off-center loads that could damage the cylinder and/or cause loss of the load.
- Read and understand all safety and warning decals and instructions for devices attached.
- Inspect each cylinder and coupler before each shift or usage to prevent unsafe conditions from developing.
- Do not use cylinders if they are damaged, altered or in poor condition.
- Do not use cylinders with bent or damaged couplers or damaged port threads.
- With the MCS, the use of an extension with a hydraulic cylinder is prohibited.
- Avoid pinch points or crush points that can be created by the load or parts of the cylinder.
- To help prevent material fatigue if the cylinder is to be used in a continuous application, the load should not exceed 80% of the rated capacity or stroke.
- Cylinder must be on a stable base which is able to support the load while pushing or lifting.
- To help prevent personal injury, use shims, friction material or constraints to prevent slippage of the base or load.
- Do not set poorly-balanced or off-center loads on a cylinder. The load can tip or the cylinder can “kick out” and cause personal injury.

- Do not use the locking collar on a threaded piston as a stop. The threads may shear resulting in loss of the load, Damage to equipment and personal injury.
- Because this system is used to lift or lower loads, be certain that the load is under operator control at all times and that others are clear of the load.
- Never Rapidly drop the load in an uncontrolled manner.
- As the load is lifted, use mechanical blocking and cribbing to guard against a falling load.
- To help prevent personal injury, do not allow personnel to go under or work on a load before it is properly cribbed or blocked. All personnel must be clear of the load before and during lowering.
- Never use extreme heat to disassemble a hydraulic cylinder or ram. Metal fatigue and/or seal damage will result and can lead to unsafe operating conditions.

IMPORTANT

- Keep the cylinders clean at all times.
- While at a job site, when the cylinder is not in use, keep it fully retracted and upside down.
- Use an approved, high-grade pipe thread sealant to seal all hydraulic connections. PTFE tape can be used if only one layer of tape is used and it is applied carefully (two threads back) to prevent the tape from being pinched by the coupler and broken off inside the pipe end. Any loose pieces of tape could travel through the system and obstruct the flow of fluid or cause jamming of precision-fit parts.
- Always use protective covers on disconnected quick couplers.
- Limiting the stroke on spring return cylinders will prolong spring life.
- Limiting the stroke and pressure on all cylinders will prolong their life.

ELECTRICAL CONTROL UNIT

⚠WARNING

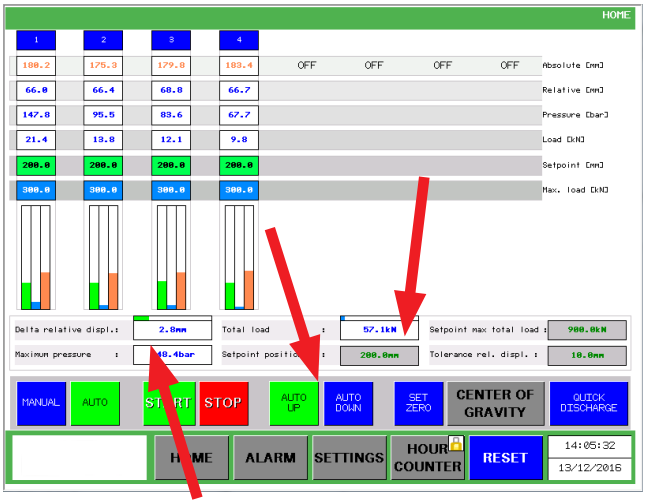
If the HMI (Human machine interface) touch screen becomes unreadable at any time during operation of the MCS system, depress the **RED** emergency stop button **IMMEDIATELY** to stop system operation until trouble shooting of malfunction can be performed.

- To prevent personal injury, electrical work must be performed by a qualified electrician per local directives and standards.
- Disconnect the electrical control cabinet control unit from the power supply before opening or removing the cover of the control unit or performing maintenance or repair on electrical components.
- Some electronic components inside the electrical control unit are sensitive to static charges. Always use an anti-static wrist band connected to the ground-earth bar inside the electrical Control unit before performing any maintenance or repair work on those electronic components.

GENERAL OVERVIEW

(Detailed setup, start up and Operating Instructions begin on page 19)

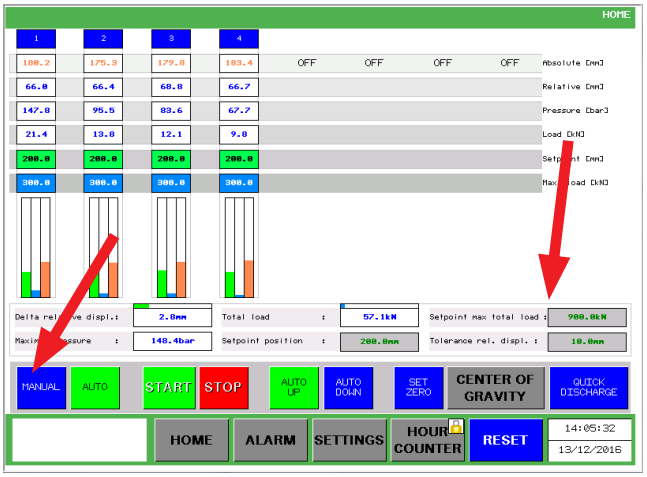
- On the HMI touch screen, push the “Set Zero” button to set the readings of all displacement sensors to “Forced Zero” This defines the starting point of the synchronized movement.



- Enter the allowed maximum difference between the leading and the lagging lift point (Tolerance Rel. Displ.). Make sure you observe the unit-setting you have chosen earlier. Enter the target stroke all lift points shall reach simultaneously under "Setpoint Position".

- **IMPORTANT:** As a background safety-check, the system will continuously monitor the pressure in each cylinder and compare it to a pre-set maximum pressure value. Enter this max pressure value per cylinder. This value shall be calculated based on the cylinder capacity and the expected / predicted load at the referring Lifting point.

  As an additional check-point, the system also monitors the overall total load. Please enter the estimated total load, (which may theoretically be less than the sum of the individual max. load per circuit that you have entered in the previous step).



- On the HMI, set the operation mode to “Auto”.

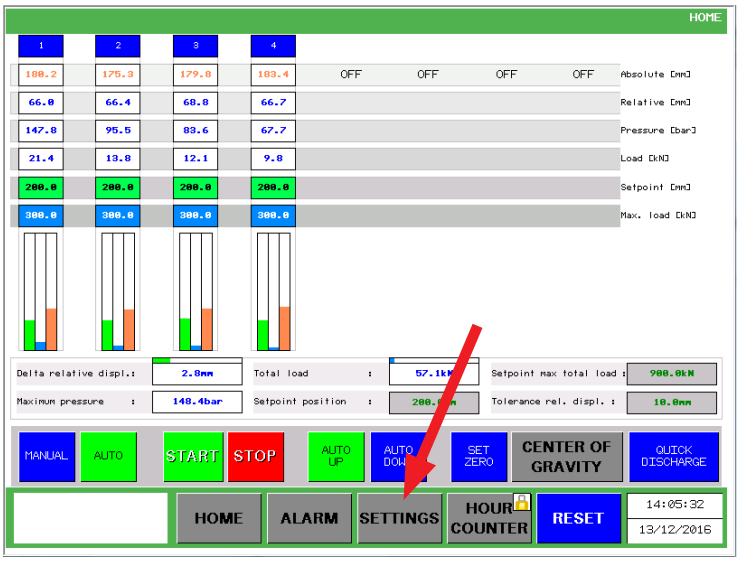
NOTE: It is suggested that for the first run, the duration **"ON"** be set at 40 ms, the duration **"OFF"** be set at 20 to 30 ms, and the release quick discharge pressure be set at 50 bar.

- As you select each cylinder, you will be required to input data for each of the cylinder’s relative to pressure at 4 and 20 mAmps, and maximum load and maximum pressure.

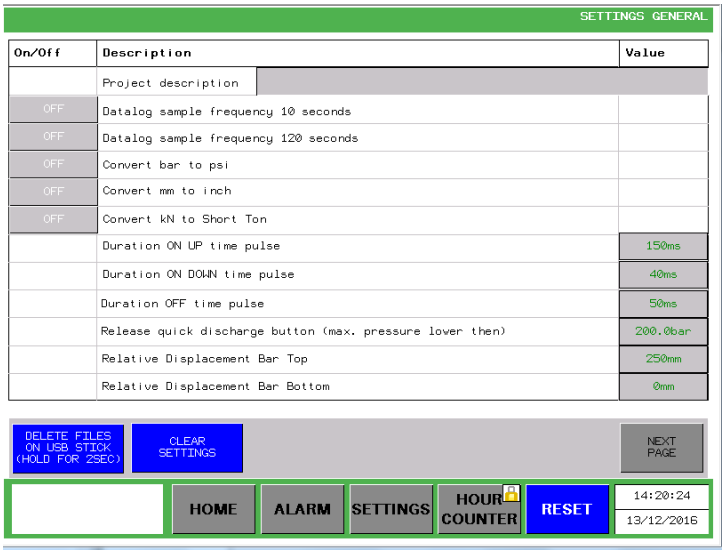
- Back on the home screen, you must set the parameters of set point position, set point maximum load, and tolerance for relative displacement. The set point position target has to be greater than the relative position of the cylinder’s in order to move the load up or down.

  NOTE: For the first test of lifting the platform, set the set point target at 25 mm. Before performing lift, manually measure the platform height at each active cylinder. Record the data for each cylinder.

- Enter the time increment value that the 2-way valves shall be operated within. Start with a short time value (e.g. 50 ms). Depending on the size and capacity of the cylinders, the length of the hoses and the pressure level needed for lifting, this time can be too short to allow for a reasonable lifting speed. Gradually increase the time during the operation and monitor the resulting overall accuracy. Too long of an actuation time will cause the cylinders to advance or retract in too large of steps, subsequently exceeding the preset tolerance. In this case the PLC software will stop the operation, close all valves, and display an alarm on the screen of the HMI.



- Check all data and settings. Take notes of your settings in a Log-file as shown in Annex 1 of this instruction sheet.



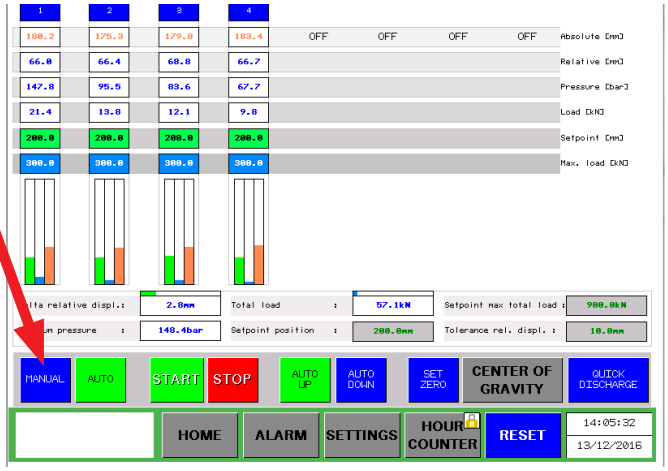
- The PLC will perform a system integrity check to avoid using settings that are contradictory or might lead to a dangerous situation.

- On the home screen, confirm the cylinder selection that you will be using in the auto operation mode. They should be the same cylinder's that were originally set up in the Manual mode.The cylinders should be moved to a position that is not in contact with load to be lifted.

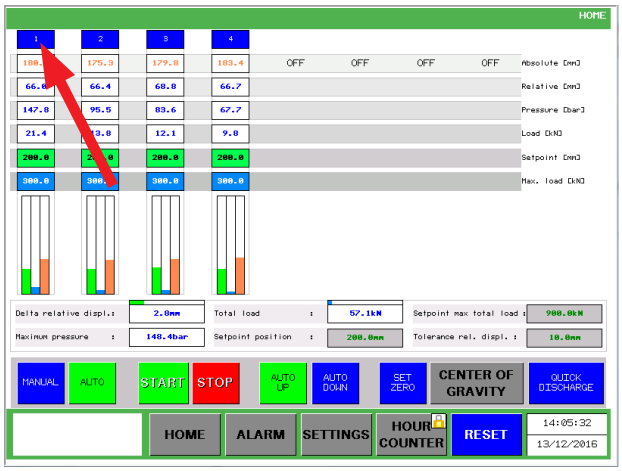
- On the first screen you'll need to establish the duration **"ON"** and the duration **"OFF"** times, as well as the release quick discharge pressure. You will establish these through drop down menus as described before.

- Touch the auto button on the home screen. The pump will turn on.

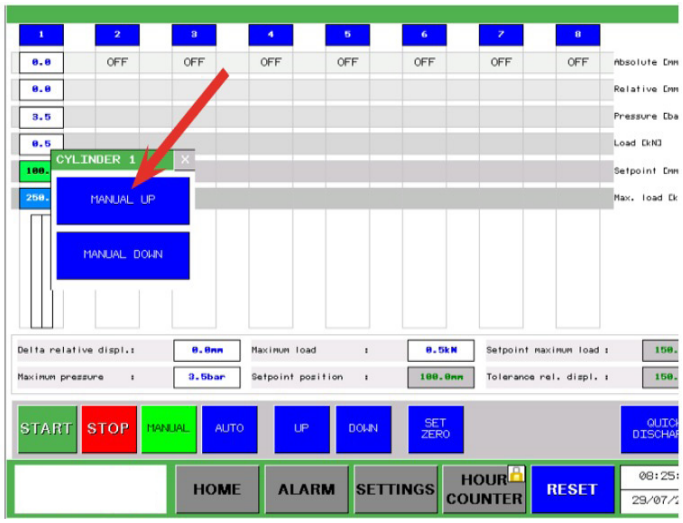
- **ON THE HOME SCREEN** select Manual mode of operation by pressing the Manual button on the screen. At this point the hydraulic pump turns on. No pressure is building in the system as the pump flows back to tank.



- To select a specific cylinder to raise, touch the numbered blue box at the top of the screen that corresponds to the cylinder you wish to move.



- Using the up and down buttons on the touchscreen that appear once a cylinder is selected will independently manually raise and lower each active cylinder. This movement should be performed intermittently raising the cylinder piston rod 1 or 2 inches at a time until it gently touches the load to be lifted.



(SEE NOTES ON NEXT PAGE)

CYLINDER APPROACH TO LOAD

(Set the system into Manual mode)

⚠WARNING

There is NO control of the actual movement of the load in the manual mode! Set the maximum pressure to a setting that allows the plunger of each cylinder to move. However, this pressure setting must be low enough such that the cylinder cannot move the load, but only make firm contact with the load to be lifted.

⚠WARNING

During this operation the plunger of each cylinder will come into contact with the lifting point of the load. This can cause a pinch point. Make sure all personnel stand clear from moving plungers.
IMPORTANT: Too high of a pressure setting can cause a cylinder to start moving the load and cause unduly stress or even damage to the structure to be moved. Activate each circuit one by one until the plunger is in full contact with the load and the pre-set max pressure has been reached.

- **NOTES:** While in Manual operation mode only one cylinder may be operated at a time. System pressure should be low enough, there will be cylinder movement, but not high enough to allow the load to be lifted.

- Depending upon the length of hoses and the size of the cylinder's used as well as the length of the initial stroke it may be necessary to add additional oil to the tank.

- In any circumstance it is recommended to use pre filled hydraulic hoses with the same oil as the rest of the system before any lift is performed.

- While manually raising a cylinder, disconnect the connector wire from the position sensor at that cylinder and confirm that an alarm response is received and the system stops operating.

- Reattach the cable and touch re-set button on home page to continue testing.

TRANSPORTATION

Before transporting the MCS, make sure the system is switched off and all hydraulic pressure has been bled from the system. Remove all oil from the reservoir. Always disconnect all hydraulic and electric connections before attempting to move the MCS unit. After disconnecting hydraulic hoses re-install the dust covers on quick disconnects as well as hose fittings to prevent contamination from entering the hydraulic system.

For short on-site distances, always transport the control unit in a cradle or lifting device rated for the weight of the unit. Secure the unit against tipping over. Move the MCS unit by means of the lifting eyes attached to the frame or a forklift type vehicle using the side or end fork locations. Always move the MCS in an upright position.

For long distance transport, use an appropriately rated forklift and slowly place the MCS into the shipping container in which the MCS was delivered to the job site. Make certain all additional hardware and accessory items are securely stored within the shipping container prior to shipment.

UNPACKING

When unpacking, make sure the MCS is located on a stable, flat, leveled surface that will support the weight of the MCS. Carefully open the shipping container and arrange for its storage. Save the shipping container as it is re-useable. With a forklift that is rated to safely move the MCS, slowly remove the MCS from its shipping container. Save the shipping container as it is re-useable.

Once the MCS is removed from the shipping container, locate the MCS on a flat, stable surface that is sufficient to withstand the weight of the MCS system without deforming the surface upon which it is resting.

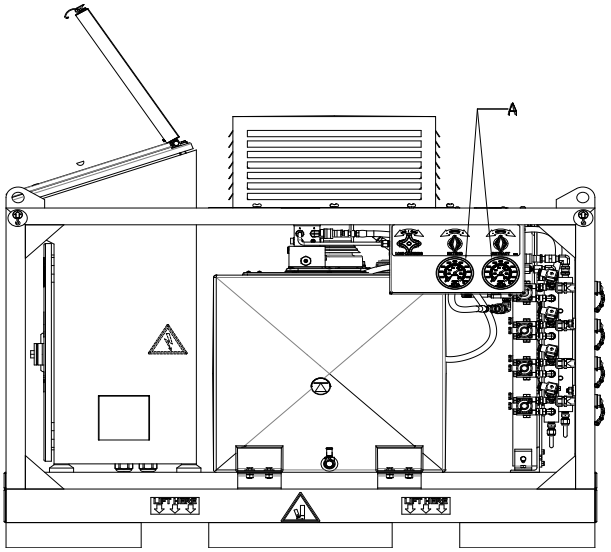
Check the completeness of the Motion Control System:

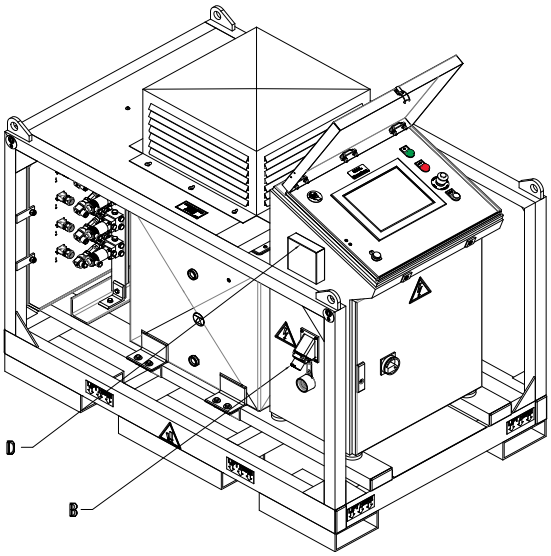
- Pump unit
- Control unit
- Displacement sensors (contained in two small cases – NOTE: The electrical control unit cabinet door key is included in one of these cases)
- Sensor cables (contained in one large case)
- Hoses (may not be included as part of the MCS control and may be packaged separately)
- Cylinders (may not be included as part of the MCS control and may be packaged separately)

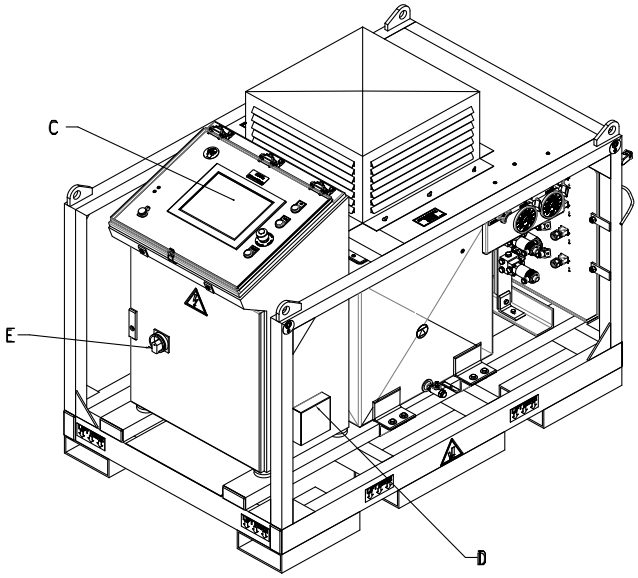
Check that all components are clean and without visible damage. Cable and hose connection points should be protected from environmental humidity and dust by protective covers installed on the unit. Confirm that the covers are in place and should remain in place until unit is ready to use.

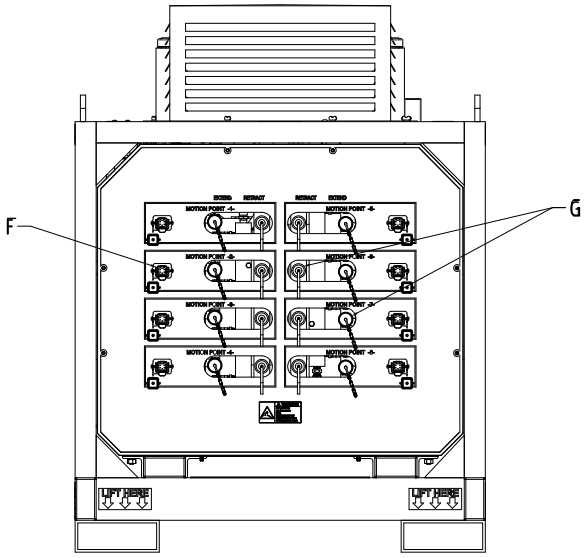
Check and confirm that the following items are undamaged and in good condition:

A. Pressure Gauges
B. Electrical Plug Outlet
C. HMI (Tough Screen)
D. External Cabinet Vents
E. Door Switch
F. Displacement Sensor Connectors
G. Hose Connection Quick Couplers









OPERATING INSTRUCTIONS

1. SET UP

Begin by visually checking the MCS unit, cables, sensors, cylinders and connectors (electrical with cables and hydraulic hoses) to confirm the integrity of all components and that there is no visible signs of damage.

2. COMPONENTS

⚠WARNING

Make sure that all components such as hoses, couplers, and cylinders are rated for the maximum operating pressure provided by the pump unit (700 bar).

3. DOCUMENTATION

IMPORTANT: To avoid operator error and to document the performance of each operational step it is recommended that the operator fills in a checklist as shown in Annex 1 of this instruction sheet during the Motion Control System operation.

4. INSTALLATION

Mechanical set up

- Fill Reservoir with 40 Gallons (150L) of Power team hydraulic oil (Part Nos. 9616, 9636, 9637, or 9638)

- Once the MCS has been moved into place, with no power cord attached, begin to physically connect the cylinders to the MCS with the appropriate hoses. Position the magnetic bases of the position sensors by the appropriate cylinders and attach the appropriate cable to each position sensor and its respective connector on the MCS face plate.

5. CYLINDERS

- **IMPORTANT:** When placing the cylinders under the load to be lifted, the cylinders should be placed on a surface that is capable of supporting a minimum of 1.5 times the rated cylinder capacity without surface deformation. For example, use properly sized load-distributing steel plates in order to remain below maximum local surface loading conditions. Failure to do so may result in surface deformation that may lead to an unsuccessful lift, personal injury and/or damage to the structure being lifted.

- In addition to ground level surface support, make sure that the support point on the load to be lifted is capable of withstanding and distributing the lifting forces without deformation to the lift point itself.

- A review of each lift point's estimated load should be performed, so that when selecting and sizing cylinders for the lift, it is recommended that the load on the cylinder at each lifting point should not exceed 80% of the rated cylinder capacity.

6. LINEAR DISPLACEMENT SENSORS

Mounting position

- The displacement sensor must be firmly mounted as close as practical to the lift cylinder in a position which allows free cable movement and where damage to the sensor or cable from foreign objects is unlikely. The sensor will operate in any orientation. Where string cable contamination by oil, water or particulate matter is possible, the sensor should be mounted in the vertical plane with the cable pointing down. Where necessary a sensor shield should be incorporated in the mounting assembly to protect the sensor from falling solids or liquid media. It is also good practice to mount the sensor onto or close by a rigid part of the machine or system.

- When mounting the position sensor make sure the linear travel of the cable is at 90 degrees to the sensor body surface.

- **IMPORTANT:** Any deviation from the 90 degree angle will reduce the life of the cable and cable outlet, and may affect the linear position readout which could result in an unsuccessful lift.

- **CAUTION:** Never let the sensor cables snap back into the sensor. It may damage the sensor.

- **CAUTION:** As a regular occurrence, moving heavy loads is typically performed during night time with limited visibility. Make sure that each lifting point and especially the location of the electrical control unit and pump unit has sufficient lighting. As a general rule always protect the electrical control unit from environmental influences such as rain, dust, vibration, heat, physical damage, etc.

7. HYDRAULIC CONNECTIONS (See Photos under SETUP AND STARTUP)

- Connect the cylinders to the pump unit with the appropriate length and pressure rated hoses.
- Clean the areas around the fluid ports of the pump and cylinders.
- Clean all hose ends, couplers or union ends.
- Remove the protective covers from the hydraulic quick connects.
- Connect the hose assembly to the lift point hydraulic outlet, and connect the opposite end of the hose to the cylinder.
- Throughout the entire lift operation, periodically check each connection for loose couplings, leaks, or problems.

8. ELECTRIC CONNECTIONS (See Photos under SETUP AND STARTUP)

- Connect the individual displacement sensor cables to the each sensor. Run the cable back to the MCS and connect the cable to the appropriate lift point connector.
- Double check the reference between the displacement sensor and lifting point.
- Clean the areas around the electrical connections on the displacement sensors.
- Remove protective covers and clean all connectors with a dry cloth.
- Affix the screw connections to the displacement sensors.
- A power cord connector is provided with the MCS unit. Attach the connector to an approprite sized electrical cable in conformance with all local and national electrical codes. All work must be performed by a qualified electrican.
- Connect the control box power cord to an appropriate power source.

9. IMPORTANT: Never run the pump on long, light gauge extension cords.

- To prevent equipment damage and a potentially hazardous condition, the correct voltage is required for the pump to operate. Verify the voltage rating on the pump name plate matches the outlet or power source you are using. Low voltage may cause: an overheated motor; a motor that fails to start under load; motor surging when trying to start; or a stalled motor before maximum pressure is reached. The motor nameplate can be accessed by removing the motor shroud on top of the MCS unit.

NOTE: After installing cylinders, hoses, sensors, and cables; have a second individual verify each hose and sensor cable connection for - 1) correct lift point and - 2) confirm connections are tight.

10. USB MEMORY STICK: Must be formatted to FAT32

- Minimum stick size 8GB

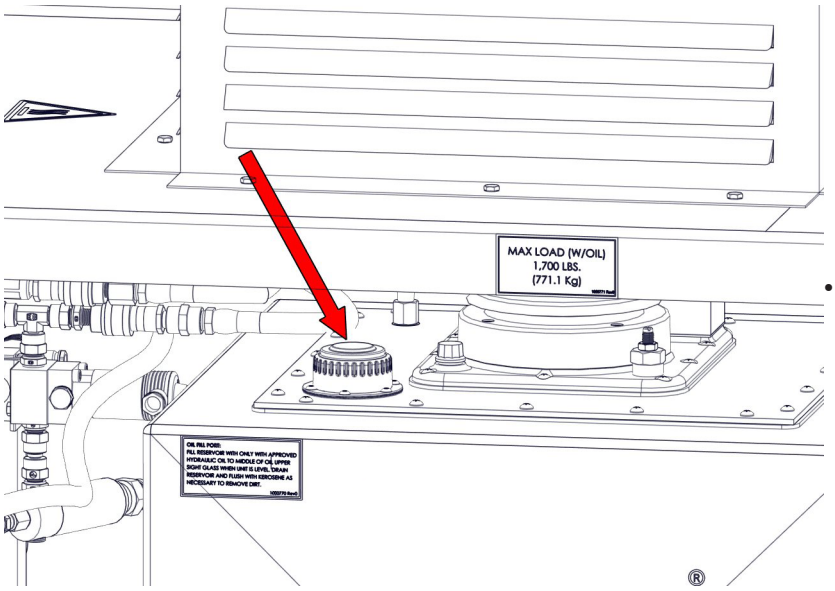
11. DATA LOGGING (SEE PHOTOS UNDER SETUP AND STARTUP):

- Place USB memory stick in USB port after the system has finished the power process.

SET UP AND START UP

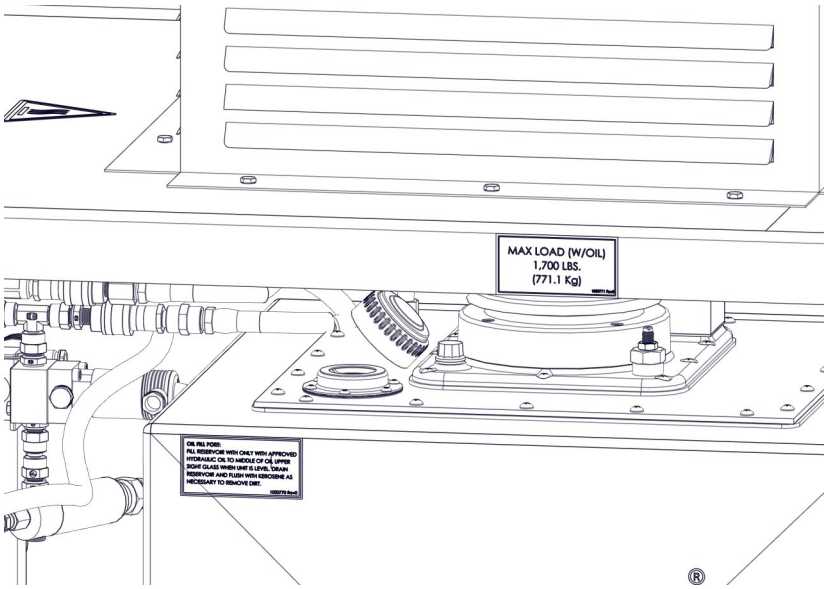
Note : Prior to setting up and starting the MCS perform a multiperson safety walk around to :

- Ensure cables and hoses will not be crushed, pinched, cut, during a lift or lowering cycle.
- Ensure that all lift participants have knowledge of the safety plan.
- Confirm that there are no obstructions (i.e. overhead power cables, trees, other structures, etc.) that may interfere with the lift or lower cycle.

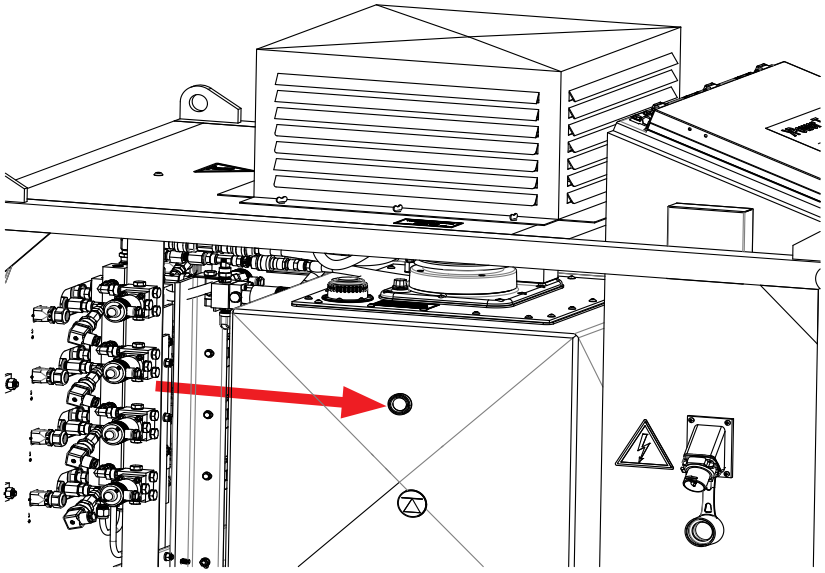


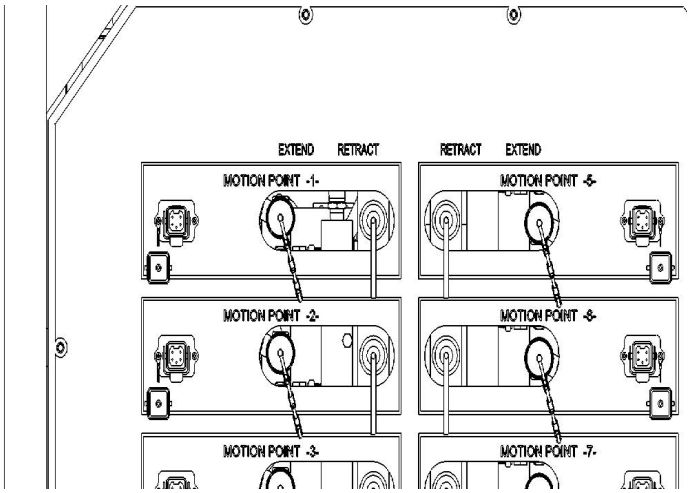
- **FILL WITH OIL:** Begin by locating the reservoir oil filler tube, located next to hydraulic pump.

- With a lint free cloth, clean around the reservoir oil filler tube. Open fill tube cover by turning counter-clockwise and fill reservoir with 40 Gallons filtered Power Team oil (part numbers 9616, 9636, 9637, or 9638)

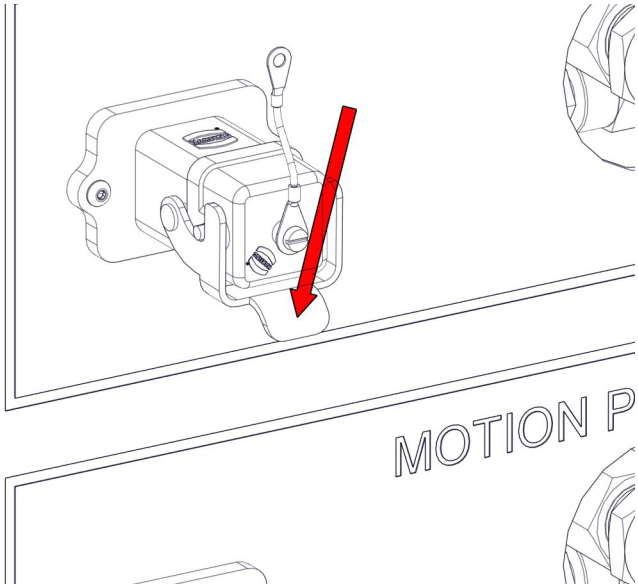


- When the reservoir is filled with 40 gallons, the oil level should be visible at mid-level in the sight gauge



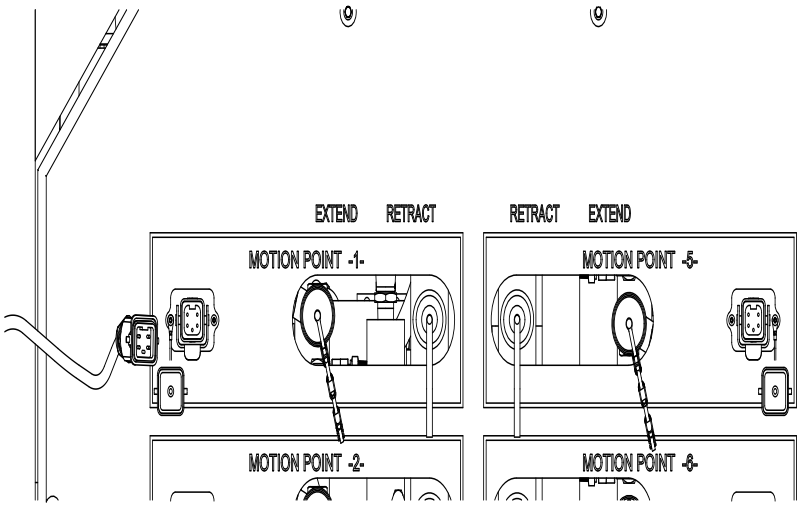


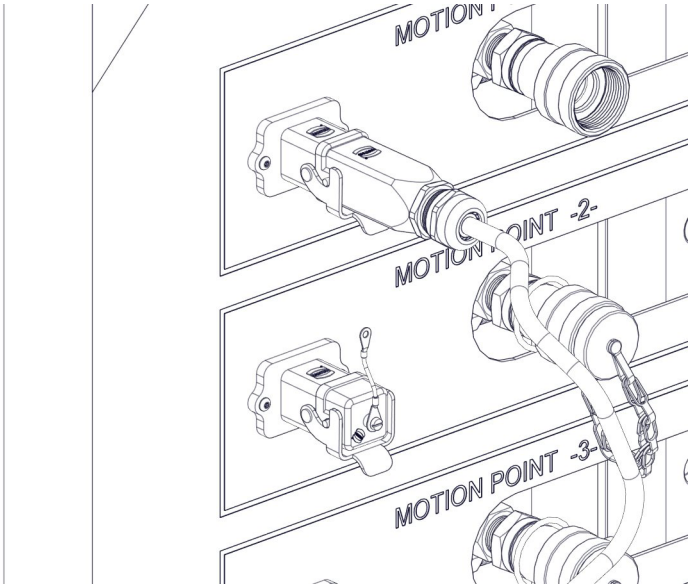
- There is one 25599 male quick disconnect coupler and one 25600-1 female quick disconnect coupler for each “Motion Point”. (Lift point)
- **(Left Side)** - Displacement sensor cable connector.
- **(Center)** - 25600-1 female quick disconnect coupler.
- **(Right Side)** - 25599 male quick disconnect coupler.



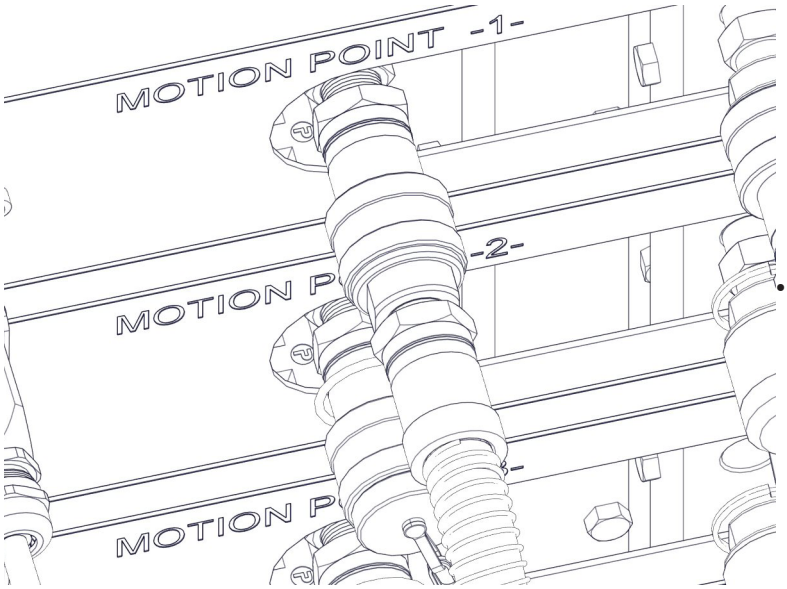
- To install the position sensor electrical cables, press down on the connector cover retaining bracket to remove the connector cover. This will allow you to connect the sensor cable to the connector.

- The connector is a five pin connector with a slotted groove that will help assure installation of the mating connector in the correct position. Do NOT force the connectors together. Although a snug fit, the connectors should be easy to assemble. If not, check for bent pins in the connector on the cable end.
- Installation groove mates with tab in mating connector
- Attach the five pin connector on the sensor cable to the mating connector on the MCS faceplate.



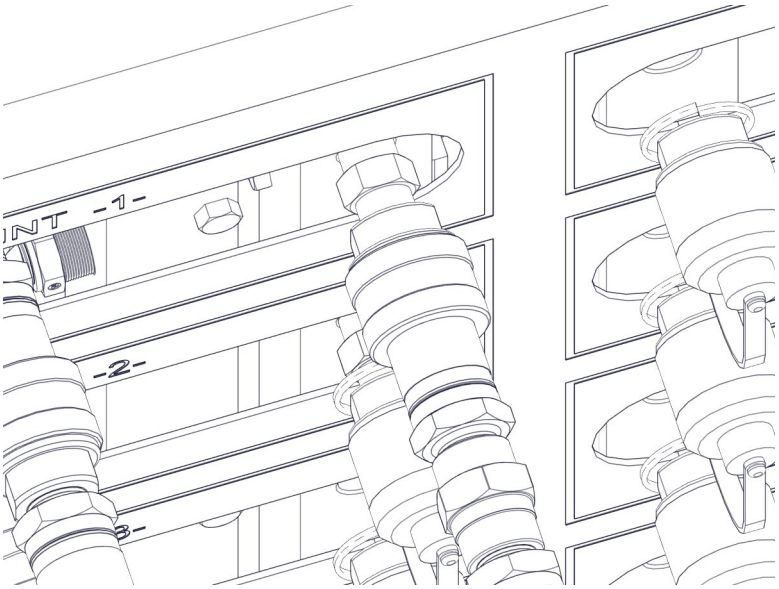


- Once the connector is installed, flip up the retaining bracket to securely hold the connector in place. This helps protect the connector assembly from becoming disengaged by vibration, or pulls on the cable during MCS operation.



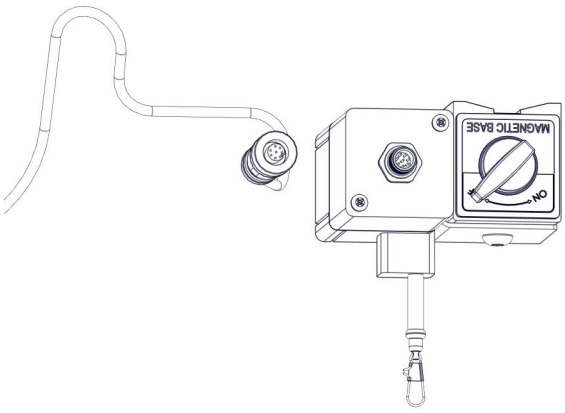
- Install the extend hoses from the base of the cylinder to the female quick disconnect - 25600-1 at each lift motion point to be tested.

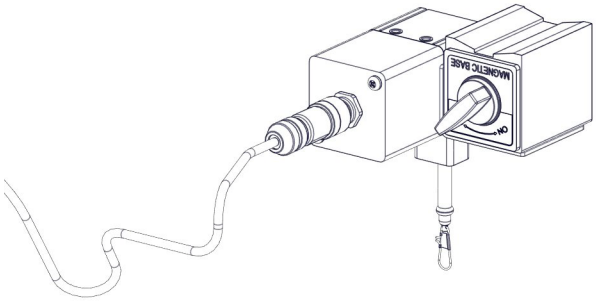
- Install the retract hoses from the rod end of cylinder to the male quick disconnect - 25599 at each lift motion point to be tested.



The linear displacement sensors included with the MCS are used to determine the relative position of each sensor with respect to all other linear sensors, with the MCS providing incremental adjustments to keep all cylinders within a predetermined range. The sensors are assembled to magnetic bases that allow each sensor to be attached to the load being lifted close to the cylinder that sensor represents. The sensors should be mounted as close as practical to each lift cylinder used in the lifting process.

Attach the displacement sensors close to each lifting point. Preferably hang the displacement sensors upside down underneath the load for additional protection of the displacement sensors against mechanical impact and water intrusion. Attach a small chain or similar means to the displacement sensor's cord and affix it to the cylinder foundation. Make sure that the displacement sensor's cord is pulled out several mm with the chain under slight tension in order to set an accurate "zero" point for the relative displacement measurements.



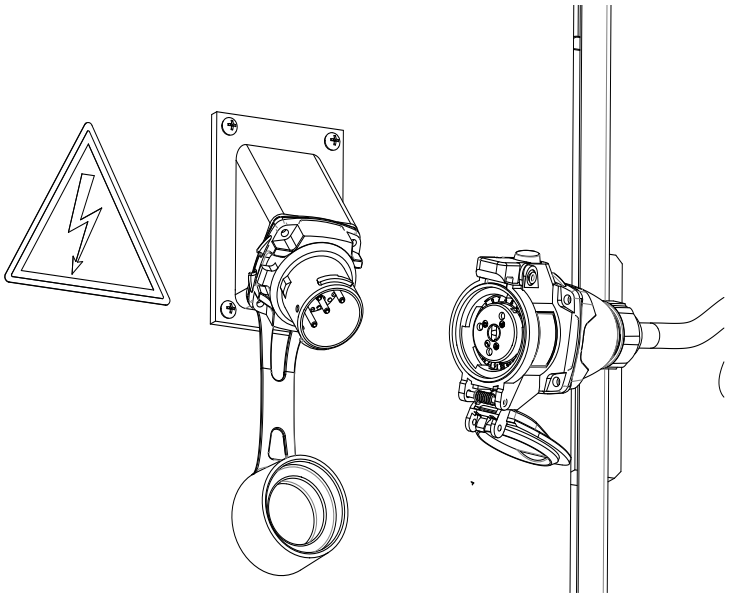


- If not already attached, attach the opposite end of the sensor cable (with the "8" pin screw-on connector) to the displacement sensor at each lift point. Make sure that the cable is connected to the sensor on the cylinder that MATCHES the hose connections for the lift motion point to be tested. Gently screw the connector onto the displacement sensor and hand tighten only in order to prevent damage to the sensor.

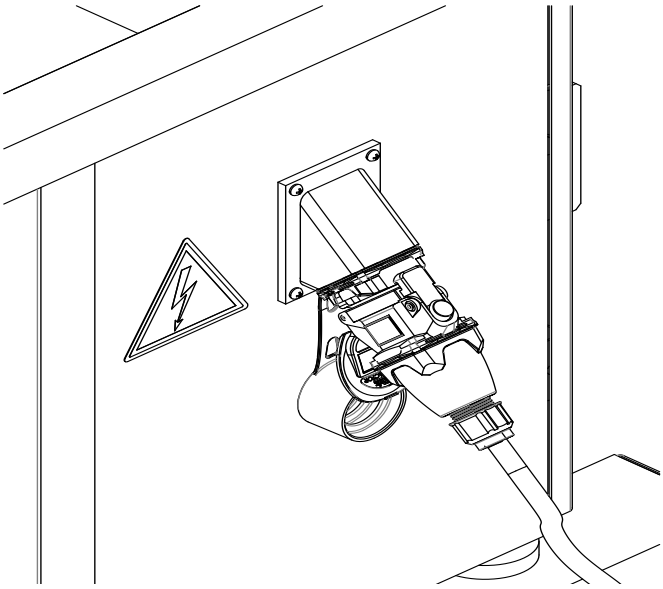
- **NOTE:** Prefered orientation is with sensor wire vertically down (as shown on left).

- Once all of the hydraulic hoses and sensor cables are attached, power can be supplied to the electronic control cabinet.

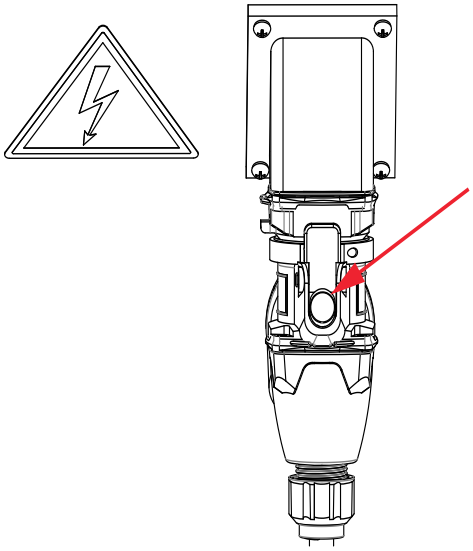
- **CAUTION:** Avoid releasing the the sensor retractable wire and letting it freely snap back to his neutral position. this can cause dammage to the calibration and functionality of the displacement sensor.



- Orient the pins in the plug with the pins in the receptacle. While installing, it will take a small “clockwise” turn to get the plug oriented correctly

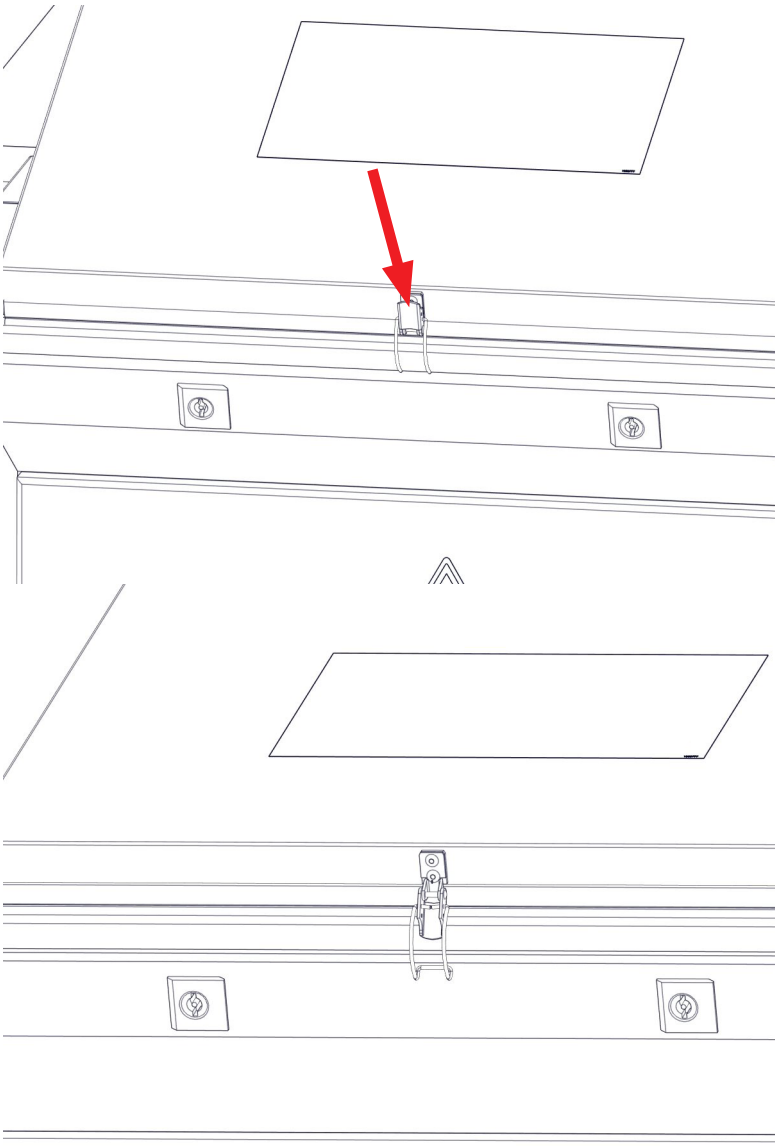


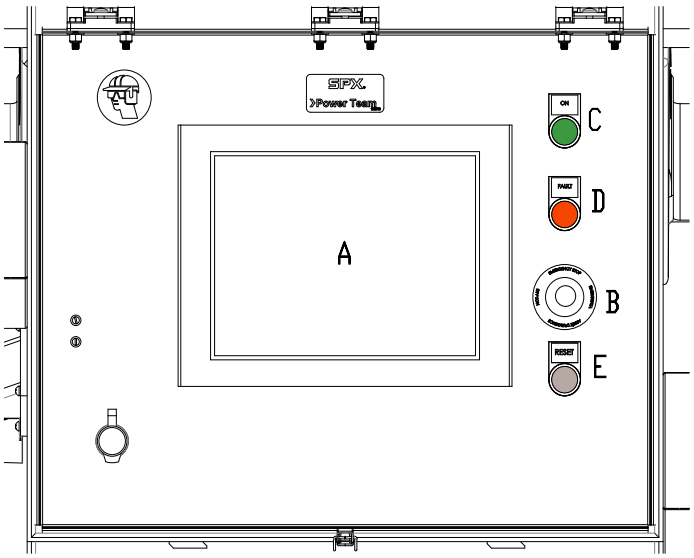
- After slight clockwise turn and pins start to enter, push firmly on the plug to get it to latch with the black lever.



- Once connected, attach the opposite end of the power cable to the power source. In the event you need to disconnect the plug and cable assembly, simply press the RED button. The connector latch is spring loaded and will quickly release the plug.

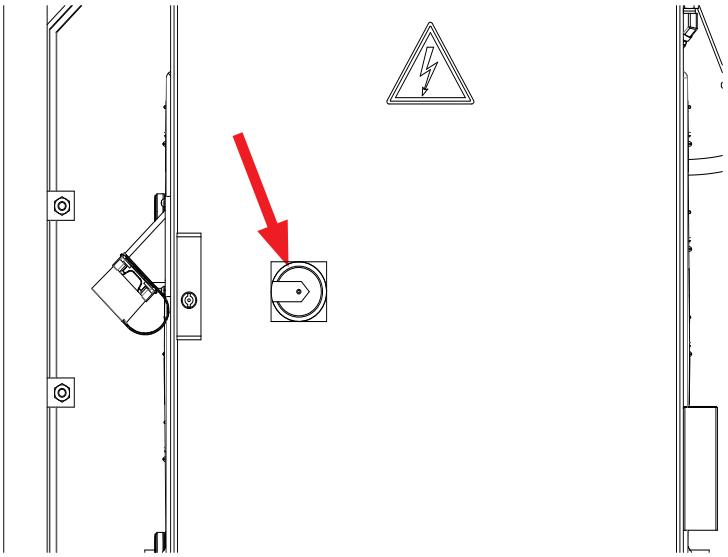
- Open the top cover to the MCS by gently pressing down on the cover latch. Pull the wire clasp forward and out from under the latch point. You will now be able to lift the cover. Slowly raise the cover to its full open position.

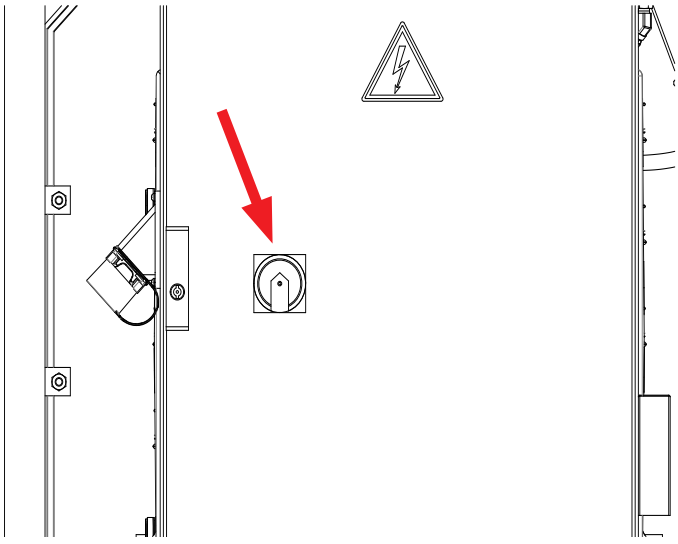




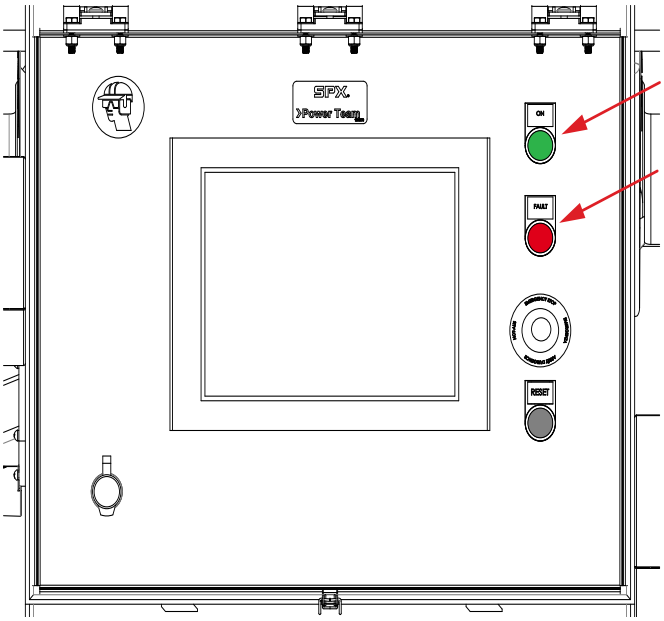
- A = HMI (human-machine interface) touch activated screen
- B = Emergency E-Stop button that shuts off pump **BUT DOES NOT SHUT OFF POWER** to the electrical control unit.
- C = GREEN power “ON” light
- D = RED light indicating E-stop is activated
- E = BLACK button for re-setting system after E-stop button disengaged

- The Power Switch is in the front door of the electrical cabinet – shown to the right in the horizontal OFF position.



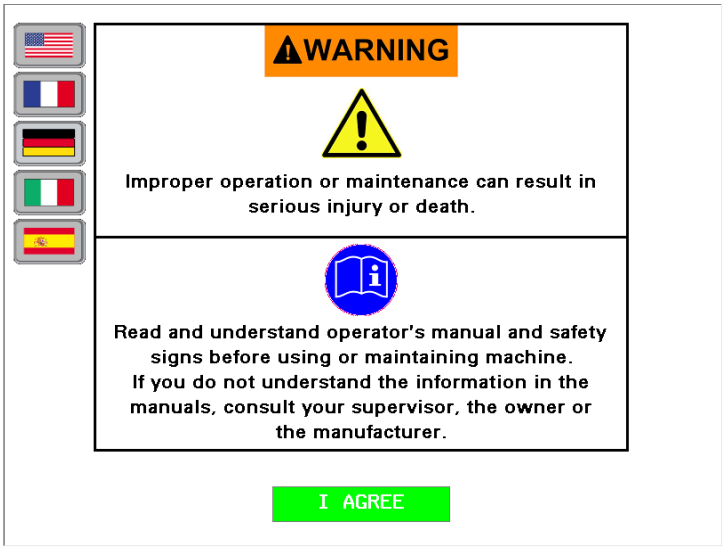


- Turn Power Switch 1/4 turn clockwise to turn on electrical console the electrical switch will now be in the vertical position.

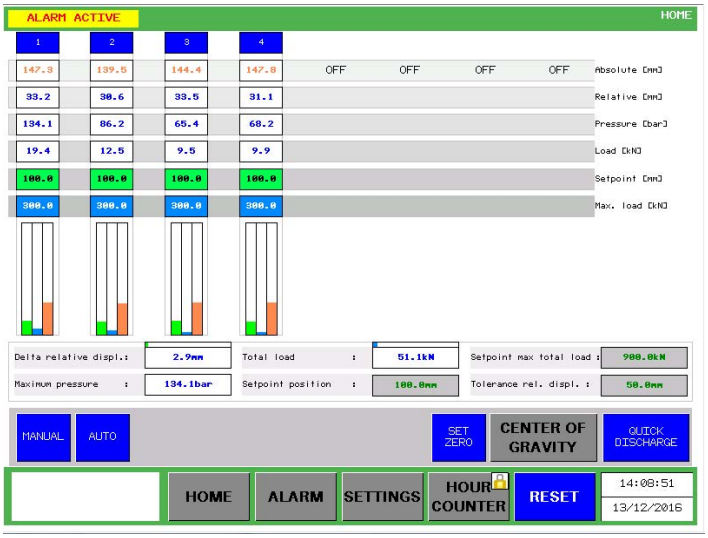


- At this point, the HMI (Human-Machine-Interface) screen starts to power on, the **GREEN** power light and the **RED** Emergency E-stop light are activated.
- During the opening sequence, you will see a blank BLUE screen which is normal. This will change and the HMI will soon switch over to the Hydraulic Technologies page.

- At this point, the MCS controller is running through its diagnostics. This may take up to a minute or more. Once completed, the program will switch to the next page – the WARNING screen.

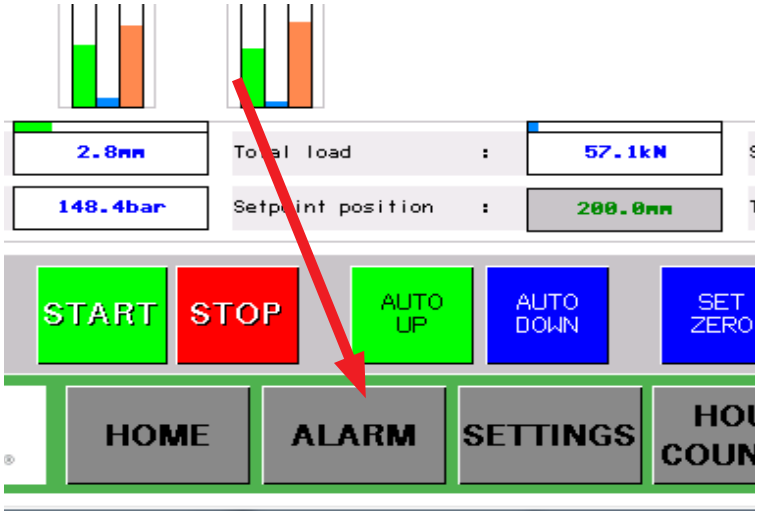


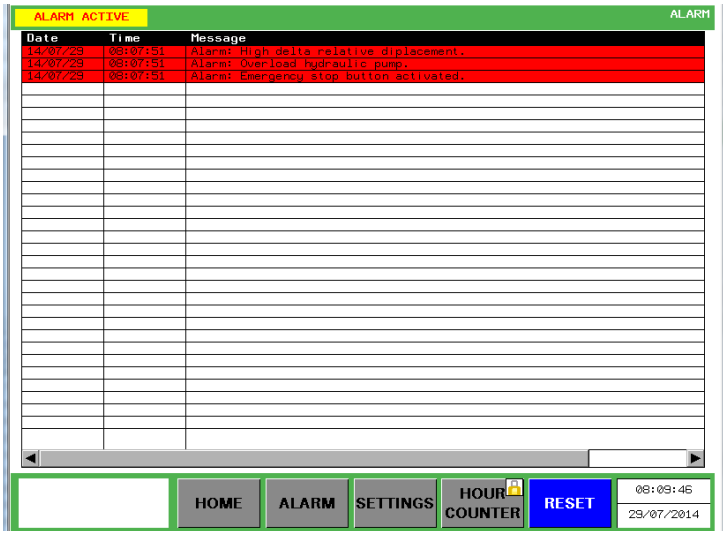
- This page requires you, the operator, to read and understand the operator's manual before proceeding.
- The HMI is a touch screen. When you have read and understand the operating instructions, simply place your finger on the screen and press the "**I AGREE**" icon, you will then transition to the home screen.



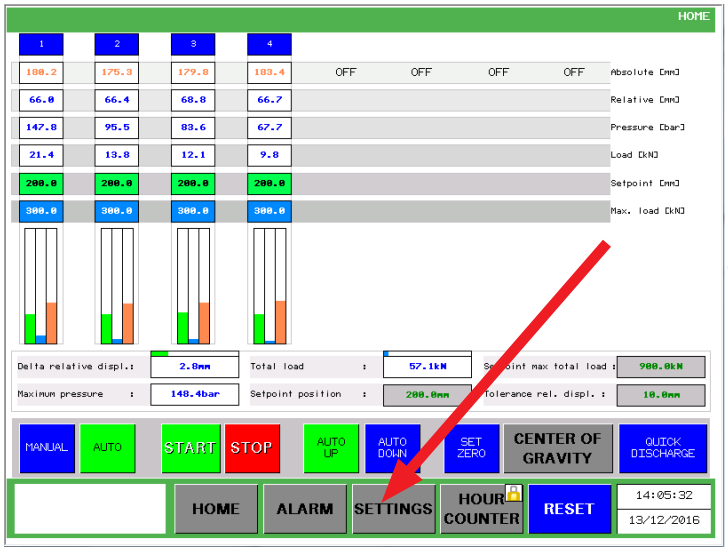
- **HOME PAGE**: This page highlights all activities during the use of the MCS. For each cylinder in use, the cylinder's performance is captured and shown on this screen.
- **NOTE**: the yellow and red **ALARM ACTIVE** message in the upper left of the screen.

- To diagnose and eliminate the active alarms, press the **ALARM** icon at the middle bottom of the **HOME** page. This will take you directly to the alarm message page.



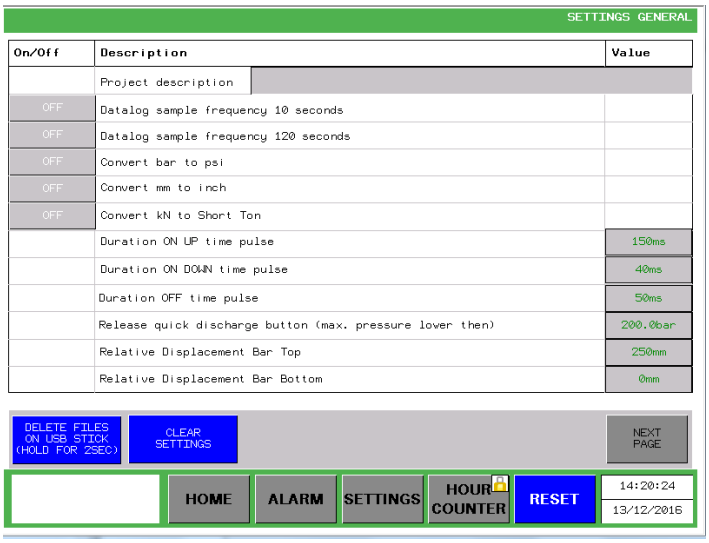


- The alarm message page will list all of the alarms present since starting the MCS unit. The following diagnostics page will help you to identify and remove all of these alarms.
- The MCS is equipped with a SIL-level 3 safety relay. Thus, after the initial startup of the system, at least the following two Alarm messages will show :
- **Overload hydraulic pump**
- **Emergency stop button activated**
- Push the black Reset button on the right hand side of the console followed by the Reset button on the touchscreen to cancel both alarms out.



- Once all of the alarms have been re-set you can proceed to setting up the cylinder parameters. This will be accomplished by pressing the **SETTINGS** button in the middle bottom of the touch screen.

- **NOTE**: this step can also be performed before all of the alarms are re-set. On the first **SETTINGS** page, you enter project name,the solenoid “ON UP time", solenoid “ON DOWN time”, the Release Quick Discharge pressure, (the Quick Discharge can be activated at all system pressures below this point),data log frequency, select conversion.

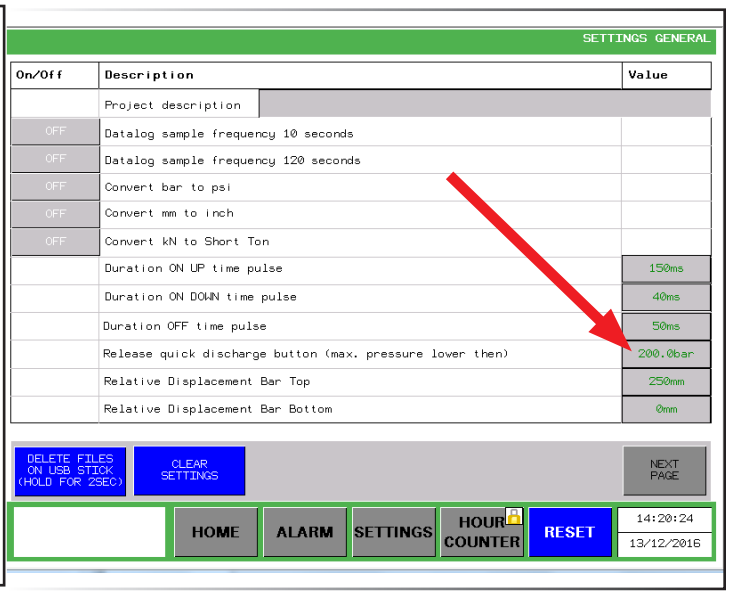


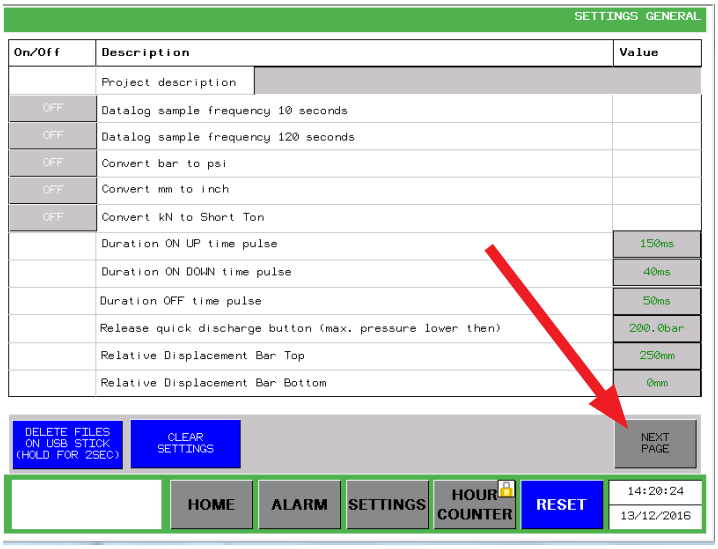
- By pressing the box for the ON time value, a keypad will come up on the screen which will allow you to enter the ON time. In the example above it shows 110 msec. Press enter and the value is placed in the program.

- Do the same for the ON UP time, ON DOWN time, and OFF time by Pressing the corresponding box and entering the desired time by using the keypad popup. Press enter to have the time placed in the program.

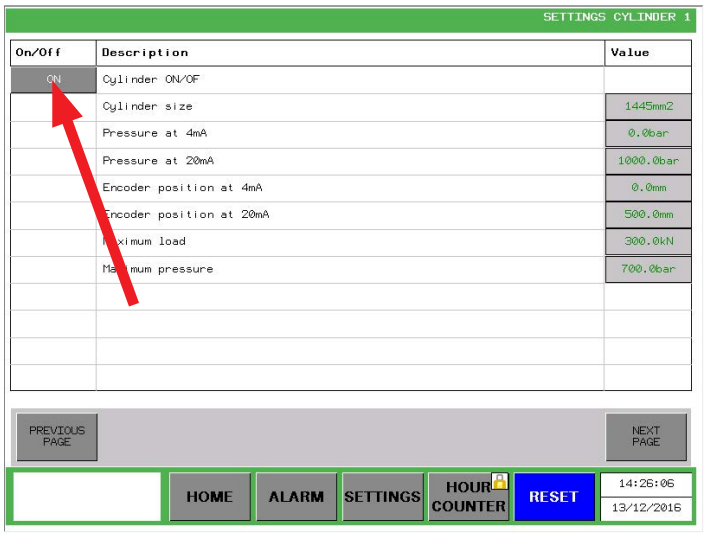
- Set the quick discharge by touching the pressure box on the screen, you will get the keypad popup that will allow you to enter the quick discharge pressure. Press **ENTER** to have the value placed into the program.

- Set the Relative Displacement Bar to the height of the list to be made by pressing the box and entering the lift height once the keypad pops up. Press **ENTER** to have the value placed into the program.



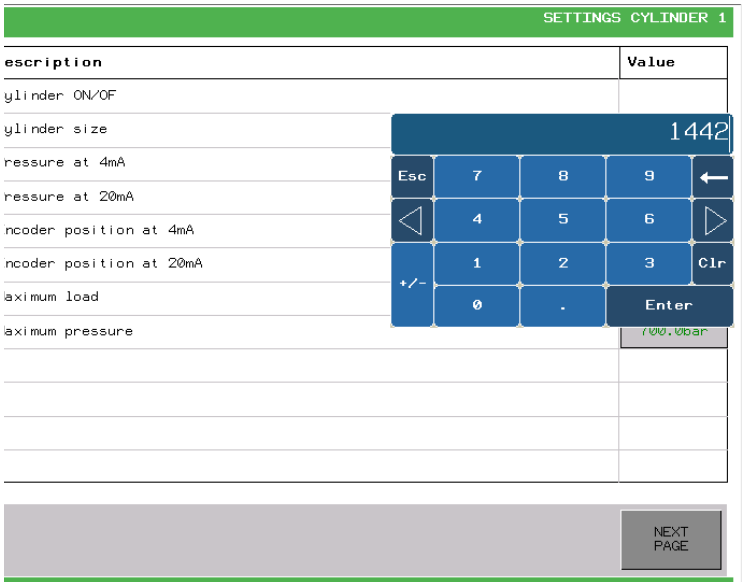


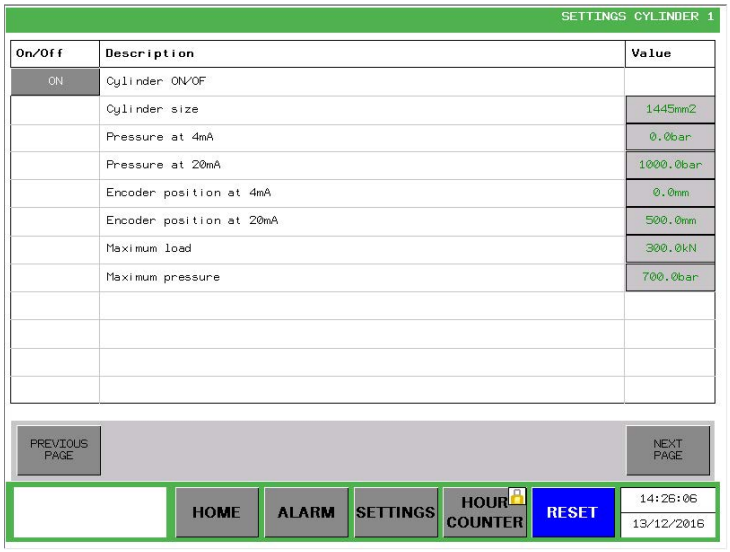
- Once the initial parameters are entered, you will begin to set up each cylinder. To do this, press **NEXT PAGE** as shown in the picture. This will take you to Cylinder #1 data entry page. By continuing to press next you will be able to turn on or off each of the individual cylinder's or lift points. This will enable you to select 4 points, 5 points, 6 points etc., up to 8 points of lift/lowering.



- In the upper left hand corner of the screen you will see on / off. This enables you to select that particular cylinder and place it on or off. The first parameter that is established is the cylinder's size and this is the cross sectional area (also known as "effective aera") of the cylinder (mm² or in²) By touching the screen for the cylinder's size, the keypad will come up. Using the keypad enter the area for the cylinder. Be sure to press the ENTER key when complete in order to store this data in the program.

- In this example you will see 1442 mm² for cylinder size. Once the data has been entered on the screen press the enter key on the keypad.





- Continuing down the screen enter the pressure at four milliamps. This would be 0 bar (0 psi). Enter the pressure at 20 milliamps and this would be 1000 bar (14504 psi). The encoders used are the string pot sensors and the encoder position at four mAmps is equal to 0 mm (0 in.). The encoder position at 20 mAmps is 500 mm (19.7 in.). The maximum load that is permissible would be entered in kiloNewtons or Tons and the maximum pressure the system should see would be 700 bar (10152 psi.).

- **IMPORTANT:** In this example, the pressure sensor is rated for 0-1000 bar and the displacement sensor is rated for 0-500 mm. Be sure to enter values appropriate for the pressure and displacement sensor included with your system.

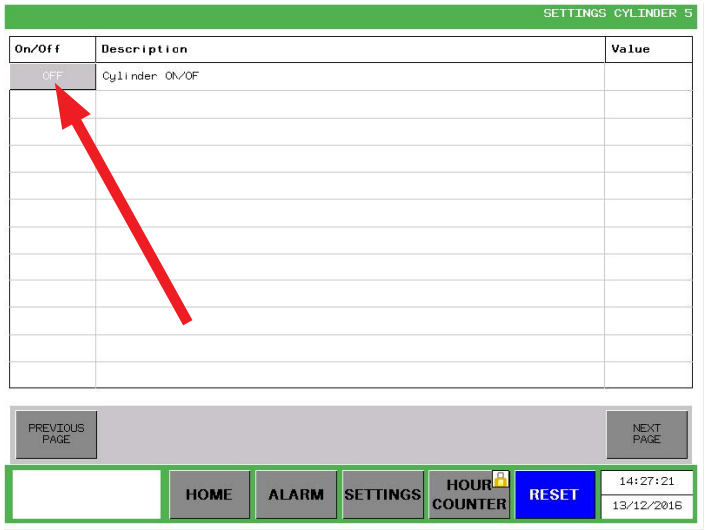
  NOTE: You can replace the pressure and position sensors with any type that provides 4-20 mAmp output. If replaced, be sure to enter the correct numbers for the particular sensor.

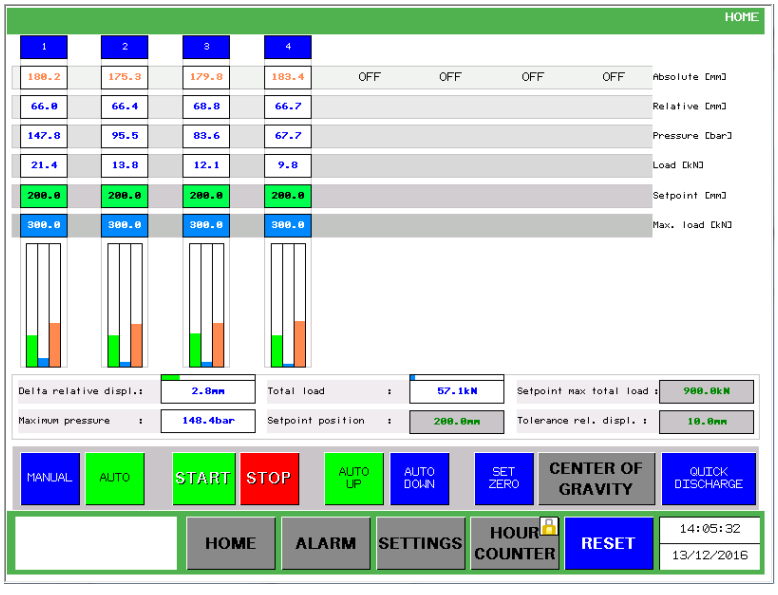
- To ensure the best accuracy of the displacement sensors, check to see if they came along with a calibration certificate, and be sure to record and enter the actual positions from the calibration certificate at 4 mAmps and at 20mAmps. (see displacement sensor log in ANNEX)

- After each entry, be sure to press the **ENTER** key so the data is stored in the program. You can modify this data at any time. However, once the data is entered and the lift has commenced, you should not attempt to change the data in the program.

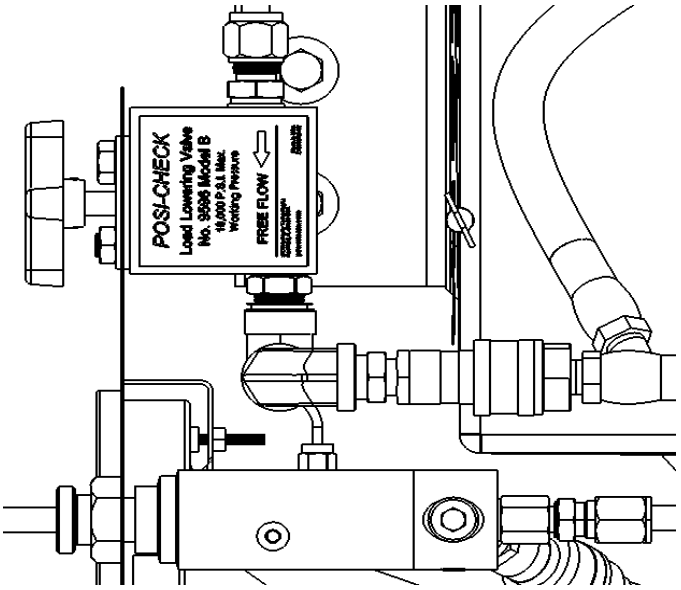
- For the initial setup, it will be necessary to enter all of the data for each of the cylinders you will be using for the lift. You can advance page by page by touching the screen in the bottom right hand corner where it says **NEXT PAGE**

- If you go to the next cylinder and it is off, just press the **OFF** button in the upper left hand portion of the screen to turn the cylinder **ON**. On the **HOME** page, you can readily see which cylinders (LIFT POINTS) are **ON** and which cylinders (LIFT POINTS) have been turned **OFF**.





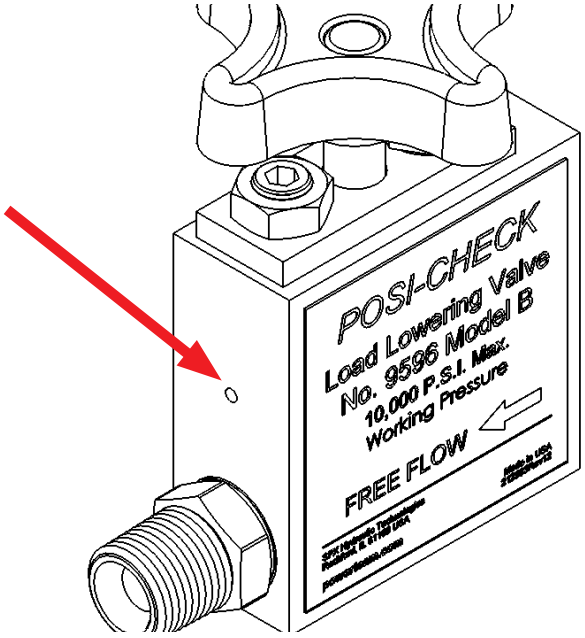
- Here you can see that Cylinders 1, 2, 3 and 4 are **ON**, while Cylinders 5, 6, 7, and 8 are **OFF**.



- The load lowering valve (a restrictive style control that has free-flow in one direction and controlled flow in the other) is located by the Electric Motor valves stacked on top of the reservoir. It is used to control the rate of descent in lowering the load.
- Close the valve completely then reopen one 16th to one 8th turn, this should be used as a baseline from which to observe lowering performance.
- If lowering speed is too slow, open the adjustments by turning the handle counter-clockwise in one 16th turn increments.

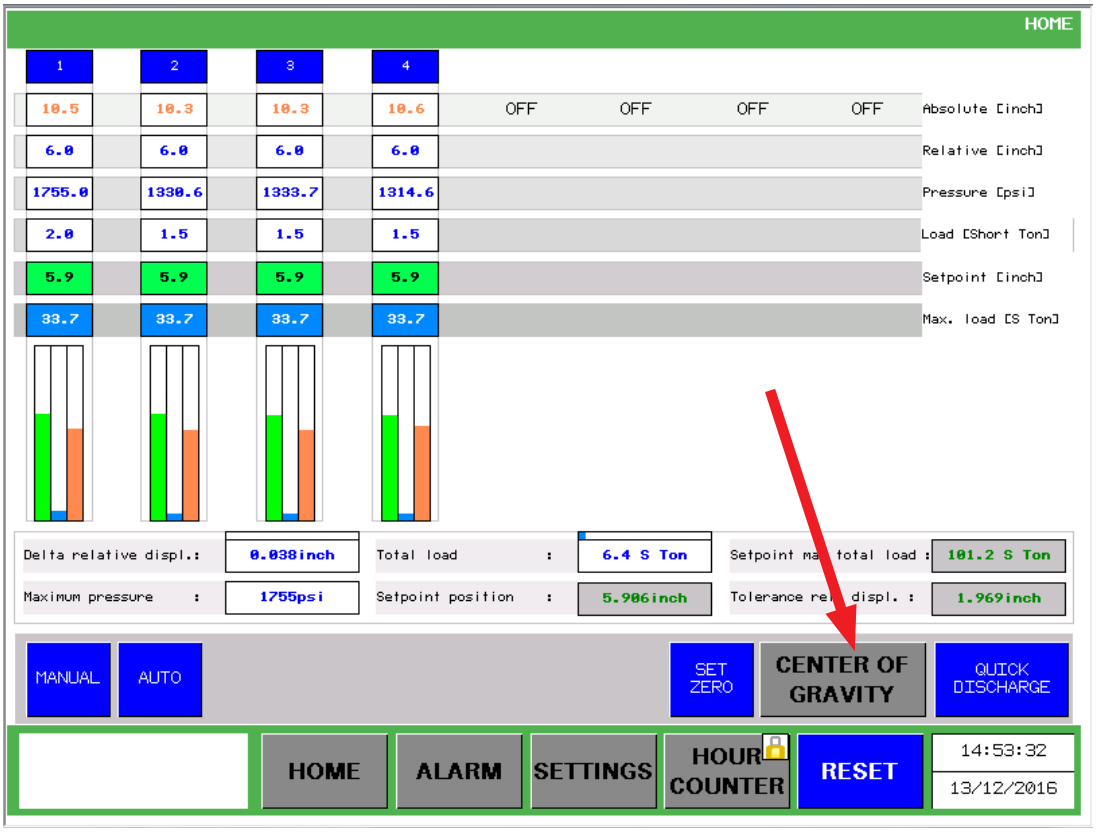
- **WARNING:** Failing to close the load lowering valve can cause the load to move much faster than expected. An unstable condition could occur which may lead to loss of the load or even personal injury.

- **NOTE:** The load lowering valve has a built in internal relief valve. If the relief valve pressure is ever reached, hydraulic oil will spill out of a weep hole that is located on the side of the lowering valve body.



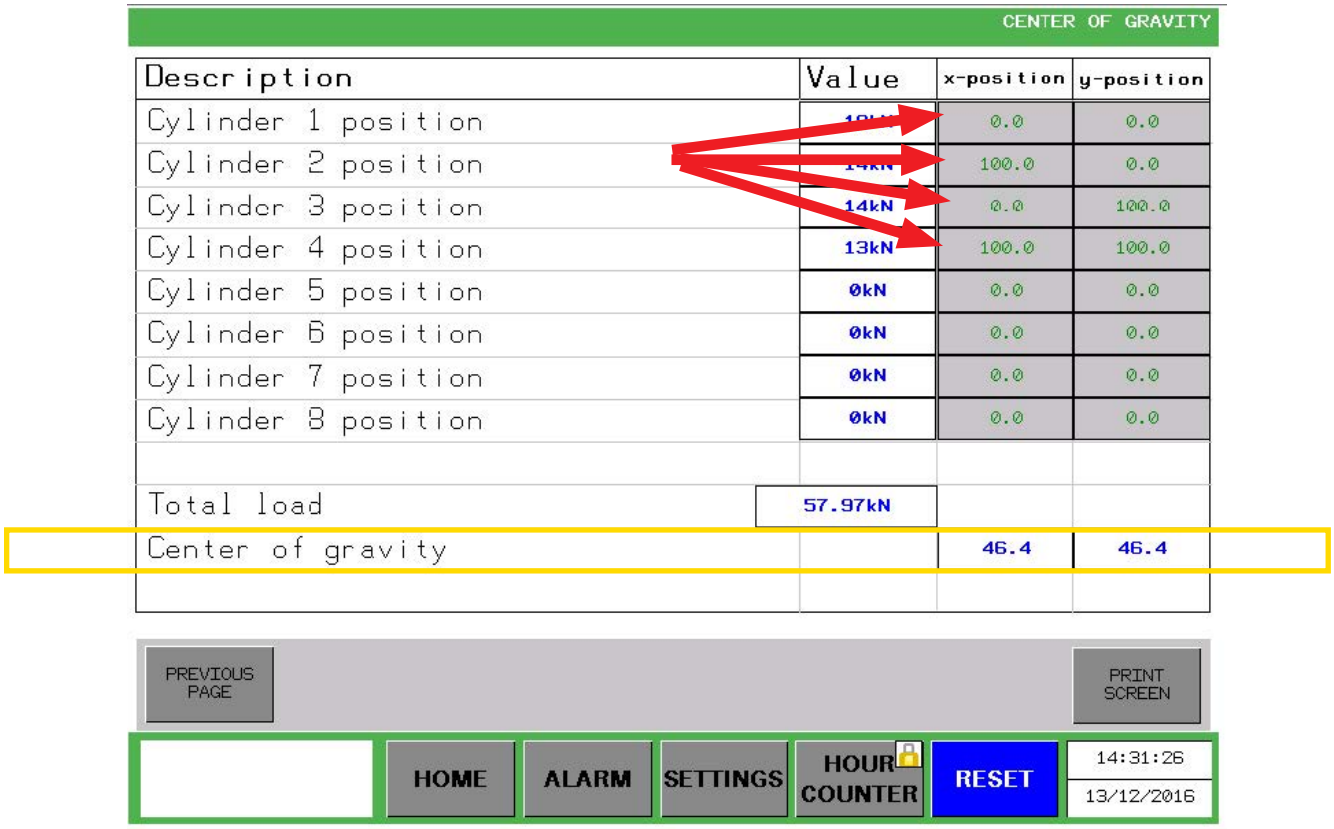
- It is normal to have some seepage of oil from the weep hole due to a shifting load and/or thermal expansion, however, if there appears to be a steady flow of oil seeping from the weep hole, shut down the Motion Control System and contact Power Team Technical Support at 800-477-8326.

FINDING CENTER OF GRAVITY



If your Motion Control System has the center of gravity calculation function enabled, you will see an icon on the HMI home screen labeled "CENTER OF GRAVITY".

Once the icon is selected you will be able to enter information specific to your lifting situation, (see next page for details).



After the center of gravity icon is selected you will need to enter the lifting point locations based on an (X,Y) coordinate system.

IMPORTANT: When entering the (X,Y) locations of the lifting points it does not matter what unit of measure is used as long as all points are consistent, and measured with that same unit of measure, for example you cannot measure one location in millimeters, and then the next location in inches, and ask the MCS to calculate the center of gravity.

In the example above of the HMI screen, the object being lifted is an unevenly distributed load on a perfect square base and cylinder 1 is used as the (0,0) location.

cylinder 2 is placed 100 units to the right on the X axis and 0 units in the Y axis.

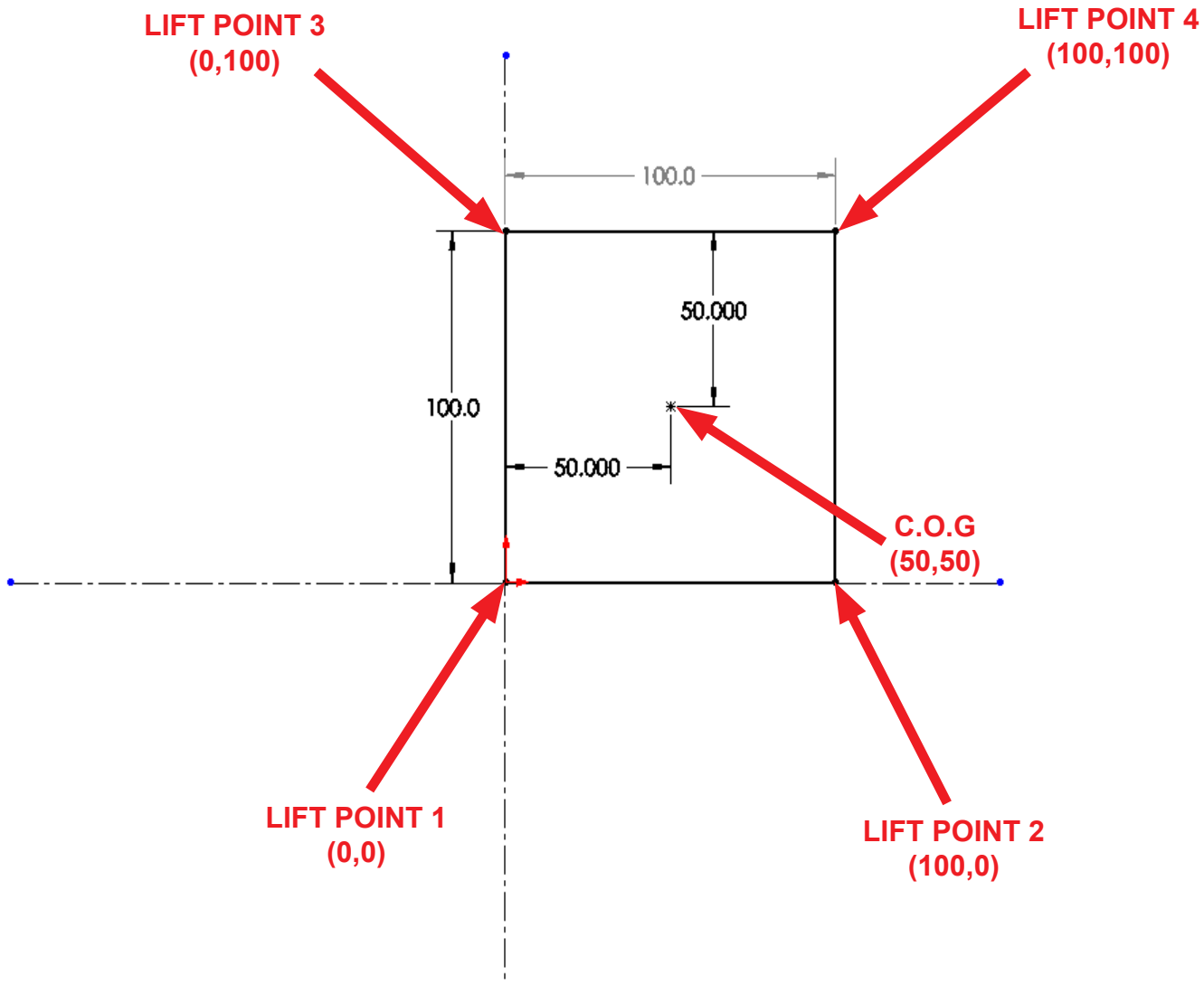
Cylinder 3 is placed 100 units forward on the Y axis and 0 units in the X axis.

Cylinder 4 is placed to the right 100 units on the X axis and forward 100 units in the Y axis completeing the 4 corners of the square base.

With these inputs the MCS is able to calculate the center of gravity of the structure and shows it on the screen, based on the same (X,Y) coordinate System.

The next page further illustrates this lifting example with an illustration using a uniformly distributed load.

EXAMPLE STRUCTURE (TOP VIEW)



ALARMS AND HOW TO RESET

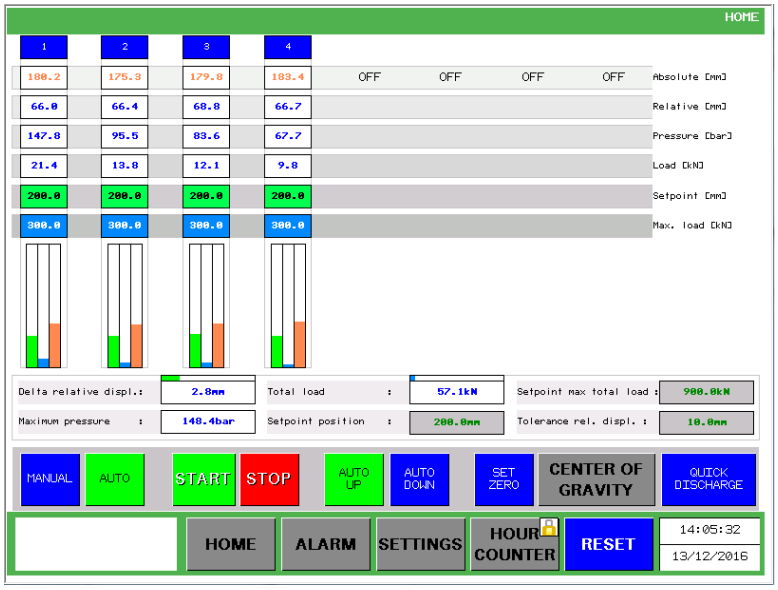
- **Emergency E-stop button Alarm** - pull up on E-Stop Button to ensure it is not engaged, and then press the **BLACK** reset button right below the E-stop button.Also press the Blue reset button on bottom right of home page.

- **Wire Break Encoder Alarm** - review the alarm to determine which cylinder exhibits this alarm. Check to ensure that the wire is attached to the sensor and the face plate attachment point for the appropriate cylinder number. If okay, press the blue **RESET** button on bottom right of home page. If alarm still exists, replace the cable.

- **Wire Break Pressure Sensor Alarm** - review the alarm to determine which cylinder exhibits this alarm. Check to ensure that the wire is attached to the pressure transducer for the appropriate cylinder number. If okay, press the blue **RESET** button on bottom right of home page. If alarm still exists, contact Power Team Tech Service, as this may be an issue in Electrical Control Cabinet.

- **Pump Overpressure Alarm** - review the alarm to determine which cylinder and check the load shown on the screen is not higher than the maximum load input as a variable. Press the blue **RESET** button to erase the alarm. If the alarm still exists, review maximum load
- **Hose Break Alarm** - review the alarm to determine which cylinder has alarmed out, and check that the hoses are connected to the appropriate cylinder and quick disconnect on the face plate, and that the quick disconnects are tightened correctly. Confirm that there is no visible leakage. If leaking, replace the hose. If not leaking, press the blue **RESET** button on the **HOME** page. If alarm still exists, contact Hydraulic Technologies for assis-tance.
- **Overload Hydraulic Pump Alarm (cont.)** - the overload relay/breaker inside the Electrical Control unit may have “tripped”, Which need to be reset on HMI.

- With each action to resolve an alarm, press the blue **RESET** button.



- This is an example of the screen showing that there are no alarms. (no yellow box in upper left corner). All alarms have been reset.

GENERAL MAINTENANCE

⚠WARNING

To prevent personal injury:

- Disconnect the unit from the power source before performing maintenance or repair procedures.
- Repairs and maintenance are to be performed in a dust-free area by a qualified technician.

1. SYSTEM EVALUATION

The components of your hydraulic system — pump, hoses, and couplings - all must be:

- Rated for the same maximum operating pressure.
- Correctly connected.
- Compatible with the hydraulic fluid used.

IMPORTANT: A system that does not meet these requirements can fail, possibly resulting in serious injury. If you are in doubt about the components of your hydraulic system, contact Power Team Technical Support at 800-477-8326

2. INSPECTION

Keep a dated and signed inspection record of the equipment. Before each use, the operator or other designated personnel should visually inspect for the following conditions:

- Excessive wear, bending, damage, or insufficient thread engagement.
- Leaking hydraulic fluid.
- Loose bolts, cap screws, or pipe plugs.
- Bent or damaged couplers or port threads.

3. PERIODIC CLEANING

⚠WARNING

- Contamination of the hydraulic fluid could cause the valve to malfunction establish a routine to keep the hydraulic system as free from dirt as possible.
- Seal unused couplers with dust covers.
- Keep hose connections free of dirt and grime.
- Use only Power Team hydraulic fluid. Replace the hydraulic fluid as recommended, or sooner if the fluid becomes contaminated. Never exceed 300 hours of use between fluid changes.

4. HYDRAULIC FLUID LEVEL

- Check the fluid level in the reservoir after each 10 hours of use. The fluid level should be level with the bottom of the fill hole when all cylinders are retracted and the unit is in the upright (vertical) position.

- Drain, flush, and refill the reservoir with an approved Power Team hydraulic fluid after 100 hours of use. The frequency of fluid changes depends upon general working conditions, severity of use, the overall cleanliness, and care given to the pump. Fluid should be changed more frequently when the system is not operated regularly.

5. HOSE CONNECTIONS

⚠CAUTION

- To prevent personal injury from leaking hydraulic fluid, seal all hydraulic connections with a high-quality, non-hardening, pipe thread sealant.

- Pipe thread sealant tape can be used to seal hydraulic connections if only one layer of tape is used. Apply tape carefully, two threads back, to prevent it from being pinched by the coupler and broken off inside the system. Loose pieces of tape could travel through the system and obstruct the flow of fluid or cause interference of precision-fit parts.

6. STORAGE

- The original shipping crate is a convenient storage container for the MCS. Prior to placing the MCS back into the shipping crate, replace all dust covers on each lift point quick disconnect. Place each of the position sensors in one of the two plastic cases. Place each sensor cable in one of the cloth bags provided, and pack each of the bags into the large storage case. Remove oil from the pump reservoir.

- Using an appropriately rated forklift truck, slowly slide the MCS back into its shipping container. Once the MCS has been secured within the container, place the sensor and cable cases in the shipping crate. At this point the shipping crate can be closed up for storage.

- Cylinder and hoses should be stored/maintained separately.

- Store the MCS unit in a dry, well-protected area where it will not be exposed to corrosive vapors, dust, or other harmful elements. If the MCS unit has been stored for an extended period of time, it must be thoroughly inspected before it is used.

TROUBLESHOOTING GUIDE

⚠WARNING To prevent personal injury, repair work or troubleshooting must be performed by qualified personnel who are familiar with this equipment.

Disconnect the power supply before removing the electrical cover. Electrical work should be performed by a qualified electrician.

- Plug the outlet ports of the pump when checking for leakage to determine if the leakage is in the pump, in the cylinder, or in the tool/hose.

- Check for system leaks by using a hand pump to apply pressure to the suspect area. Watch for leaking fluid and follow it back to its source. Never use your hand or other body parts to check for a possible leak.

NOTES:

- For a detailed parts list or to locate a Power Team Authorized Hydraulic Service Center, contact your nearest Power Team facility.

PROBLEM	CAUSE	SOLUTION
PLC unit does not power up	1. Control system not Powered	1. Turn key-lock into "ON" position.
	2. Unit is not plugged in.	2. Plug in unit.
	3. No voltage supply.	3. Check line voltage.
	4. Circuit breaker tripped because total amperage draw too high for existing circuit.	4. Use an alternate circuit with sufficient power supply
Electric motor will not shut off.	1. Defective motor controls.	1. Disconnect unit from power supply; contact a Power Team Service Center.
Electric motor stalls, surges, overheats, or will not start under load.	1. Low voltage	1. Refer to electric pump instruction sheet
Electrical overload protector keeps tripping.	1. Wired incorrectly.	1. Disconnect unit from power source; have qualified electrician review motor and circuit wiring.

PROBLEM	CAUSE	SOLUTION
Pump is not delivering fluid, or delivers only enough fluid to advance connected components partially or erratically or operation to slow	1. Fluid level too low.	1. Add fluid; refer to filling the pump reservoir in Initial Setup section.
	2. Loose-fitting coupler to component.	2. Verify quick-disconnect couplings are completely coupled. Couplers may need to be replaced because ball check does not stay open due to wear.
	3. Air in system.	3. Refer to Initial Setup in this manual to bleed air from system.
	4. Air leak in suction line.	4. Check and tighten suction line.
	5. Dirt in pump or filter plugged.	5. Clean pump filter. If problem persists, disconnect from power supply contact authorized Power Team service center.
	6. Cold fluid or fluid too heavy. (Hydraulic fluid is of a higher viscosity than necessary)	6. Drain, flush, and refill reservoir using a lighter weight fluid. Refer to General Maintenance section.
	7. Vacuum in reservoir.	7. Clean plugged vent in filler plug.
Pump builds pressure but cannot maintain pressure.	1. Fluid leakage.	1. Look for external leaks. If no fluid leakage is visible, the problem is internal. Seal leaking pipe fittings with PTFE..
	2. Leaking pressure switch seal.	2. Replace pressure switch.
Pump does not build to full pressure.	1. Faulty pressure gauge.	1. Replace pressure gauge.
	2. Check for external leakage.	2. Seal faulty pipe fittings with pipe sealant.
	3. Check external pressure regulator. Check relief valve setting.	3. Refer to Adjusting the Pressure Regulating Valve.
	4.Check for oil leaks.	4. Look for oil leak and repair or tighten loose fittings.

PROBLEM	CAUSE	SOLUTION
Erratic action	1. Air in system.	1. Check for leaks. Refer to bleeding procedure.
	2. Internal leakage in attached components.	2. Refer to manufacturer's information for attached component
	3. Attached component sticking or binding.	3. Refer to manufacturer's information for attached component.
	4. Malfunctioning valve.	4. Verify connections. Contact authorized Power Team Service Center.

SCHEMATICS

For questions regarding electrical and/or hydraulic schematics, contact Power Team Technical Support at 1-800-477-8326.

COMPONENT SPECIFIC DATA SHEETS

PRESSURE TRANSDUCERS

PRESSURE RANGE . . . . . .0 BAR TO 1000 BAR

HYDRAULIC CONNECTION. . . . . .G 1/4 A(BSPP), DIN 3852E

ELECTRICAL CONNECTON. . . . . .PLUG CONFORMING TO EN 175 301-803A (1.5mm , EXTERNAL CABLE Ø6-8mm)

OUTPUT CURRENT. . . . . .4 - 20 mAmp

POSITION SENSORS

MEASUREMENT RANGE. . . . . 0mm to 500mm or 0mm to 1000mm

ELECTRICAL CONNECTION. . . . . MALE, 8 PIN SOCKET MI2

OUTPUT CURRENT. . . . . 4 - 20 mAmp

HYDRAULIC PUMP

PE55 VANGUARD. . . . . .230 VAC

OUTPUT. . . . . .0.9 l/min @ 700 bar

Optional use :

PQ120 . . . . . 115VAC, 50/60HZ, 1PH
230VAC, 50/60HZ, 1PH
220/380VAC, 50HZ, 3PH
230/460VAC, 60HZ, 3PH

OUTPUT. . . . . 2 l/min @ 700 bar

ANNEX

1. HYDRAULIC TECHNOLOGIES CYLINDER SIZE AND SQUARE CENTIMETER (AREA) TABLE

Power Team	Tonnage / Size	Effective Area			
Cylinder		(in^2)		(mm^2)	
Series	(short tons)	Push	Pull	Push	Pull
C	5	0.994		641	
C	10	2.236		1,443	
C	15	3.142		2,027	
C	25	5.15		3,323	
C	55	11.04		7,123	
C	75	15.90		10,258	
C	100	20.62		13,303	
RA	20	4.43		2,858	
RA	30	6.49		4,187	
RA	55	11.04		7,123	
RA	100	20.62		13,303	
RLS	5	0.994		641	
RLS	10	2.236		1,443	
RLS	20	4.43		2,858	
RLS	30	6.492		4,188	
RLS	50	9.621		6,207	
RLS	75	15.904		10,261	
RLS	100	19.635		12,668	
RLS	150	30.680		19,794	
RSS	10	2.24		1,445	
RSS	20	4.43		2,858	
RSS	30	6.49		4,187	
RSS	50	9.62		6,206	
RSS	100	19.63		12,664	
RSS	250	50.22		32,400	
RH	10	2.21		1,426	
RH	12	2.76		1,781	
RH	20	4.72		3,045	
RH203	20	3.92		2,529	

Power Team	Tonnage / Size	Effective Area			
Cylinder		(in^2)		(mm^2)	
Series	(short tons)	Push	Pull	Push	Pull
RH	30	6.34		4,090	
RH	50	10.86		7,006	
RH	60	12.31		7,942	
RH	100	20.62		13,303	
RH_D	30/15	5.89	3.38	3,800	2,181
RH_D	30/20	6.54	4.04	4,219	2,606
RH_D	60/25	12.31	5.15	7,942	3,323
RH_D	60/40	13.14	8.59	8,477	5,542
RH_D	100/45	21.39	9.43	13,800	6,084
RH_D	100/50	20.03	10.93	12,923	7,052
RH_D	150/70	30.10	14.70	19,419	9,484
RH_D	150/75	29.95	15.90	19,323	10,258
RH_D	200/75	40.45	15.95	26,097	10,290
RT	17.5	3.53		2,277	
RT	30	6.28		4,052	
RT	50	9.81		6,329	
RT	100	19.24		12,413	
RP	25		0.55		355
RP	55		1.13		729
RD	10	2.23	0.88	1,439	568
RD	25	5.15	1.61	3,323	1,039
RD	55	11.04	5.63	7,123	3,632
RD	80	15.90	8.84	10,258	5,703
RD	100	20.63	8.84	13,310	5,703
RD	150	30.68	14.78	19,794	9,535
RD	200	41.28	22.62	26,632	14,594
RD	300	60.13	29.45	38,793	19,000
RD	400	78.54	37.26	50,671	24,039
RD	500	99.40	49.14	64,129	31,703
R	55	11.04		7,123	
R	100	20.63		13,310	
R	150	30.68		19,794	
R	200	41.28		26,632	
R	280	56.74		36,606	

Power Team	Tonnage / Size	Effective Area			
Cylinder		(in^2)		(mm^2)	
Series	(short tons)	Push	Pull	Push	Pull
R	355	70.88		45,729	
R	430	86.59		55,864	
R	565	113.1		72,968	
RC	740	149.1		96,193	
RC	965	194.8		125,677	
RC	1220	246.5		159,032	
R_D	100	20.6		13,290	
R_D	150	30.7		19,806	
R_D	200	41.3		26,645	
R_D	280	56.7		36,581	
R_D	355	70.9		45,742	
R_D	430	86.6		55,871	
R_D	565	113.1		72,968	
RC_D	740	149.1		96,193	
RC_D	965	194.8		125,677	
RC_D	1220	246.5		159,032	
RA_L	55	11.04		7,123	
RA_L	100	20.62		13,303	
RC_P	55	11.00		7,097	
RC_P	100	20.60		13,290	
RC_P	155	31.14		20,090	
RC_P	240	48.70		31,419	
RC_P	380	76.10		49,097	
RC_P	620	124.60		80,387	
R_L	55	11.04		7,123	
R_L	100	20.63		13,310	
R_L	150	30.68		19,794	
R_L	200	41.28		26,632	
R_L	280	56.74		36,606	
R_L	355	70.88		45,729	
R_L	430	86.59		55,864	
R_L	565	113.1		72,968	
RC_C	740	149.1		96,193	
RC_C	965	194.8		125,677	
RC_C	1220	246.5		159,032	

2. MOTION CONTROL SYSTEM CHECKLIST

While every attempt has been made to ensure clarity, the intent of this checklist is to provide basic guidance and it is the responsibility of the end user to review each application thoroughly for suitable usage. Users should utilize sound engineering judgment prior to, and during, lifting operation. Failure to comply may result in damage, injury, or death.

		check	double check
1. Safety Information:	**A.** Have all operators on the job site read and fully understand the Operating Instructions?		
	B. Have you created a formal lift plan per ISO 31000 and ISO/IEC 31010 or equivalent?		
	C. Have all operators that will be involved in the lift been formally trained?		
	D. Have you confirmed that the load to be lifted will be a static load, not a moving/dynamic load?		
2. Unpacking and Physical Set-up:			
	A. Is there a place to store the reusable shipping crate?		
	B. Electrical		
	1. Is the power cable the proper size and qualified for the MCS unit?		
	2. Is the generator/power supply verified to be sufficient voltage and amperage?		
	C. Hydraulics		
	1. Has Genuine Power Team hydraulic oil been added to the correct level?, (ref. sight gauge on side of tank)		
	2. Are you using properly rated hoses and quick couplers?		
	3. Are the hoses and couplers free from damage and debris?		

		check	double check
2. Unpacking and Physical Set-up (Continued):	**D.** Cables		
	1. Are cables individually bagged?		
	2. Are bags being stored in hard case for reuse after lift?		
	3. Are all fittings securely fastened on cable and free from damage?		
	E. Sensors		
	1. Are protective enclosures free from damage, or cracks that could jepordize performance?		
	2. Are magnets free from contamination, and work as they should to support sensor?		
	3. Is the cable attach point straight and free from damage?		
	4. Are the location of the sensors parallel to the cylinders and clear of moving parts that could cause damage?		
	F. Manual overides		
	1.Are all operators familiar with the location of all manual override locations?		
	G. Pressure controls		
	1. Are all operators familiar with the location of the pressure control.		
	H. Load lowering valve		
	1. Are all operators familiar with the location of the load lowering valve?		
	2. Is it set properly? (Fully closed then opened to desired setting) **DANGER:** Failure to set properly will result in rapid load loss, injury and/or death.		
	I. Cylinders		
	1.Are the foundation plates sufficient to prevent ground deflection?		
	2.Are cylinders and all couplings free from damage and mounted secure?		
	J. Key to electrical enclosure		
	1. Is key in secure location?		

3. Power Up – what to expect	**A.** Did HMI screen power on after 30 seconds?		
	B. Any error signals? (refer to manual)		
	C. Did you select operational parameters?		
	D. How many lift points are required?		
	E. Did you jog the pump to see if function works properly?		
4. Setting the variables:			
	A. Is the Setting Log Sheet from the ANNEX filled out for this lift?		
	B. Are proper inputs being used? **DANGER:** If improper values are used, unexpected, or unsafe results may occur.		
5. Establishing the lift:			
	A. Set "tolerance relative displacement" limit for linear position sensors in "total relative displacement" ?		
	B. Bring the cylinders up to structure in manual mode.		
	C. If a stage lift is required		
	1. Do you have a plan filled out?		
	2. Is there sufficient travel in sensors?		
	3. Is there a cribbing plan in play?		
	D. Are you using mechanical supports? (never use the cylinders themselves to support load once lifted to desired height)		
	E. Is there a designated person to operate the E-Stop ?		
	F. Has data logging been enabled?		
6. Start of lift			
	A. Pay attention to each of the lift points		
	1. Is there a spotter in place for the lift points that are not visible for the HMI control cabinet?		
	B. Is the load moving smoothly?		
	C. Are there any unusual structural sounds?		
	D. Is the load tilting?		
	E. Observe cylinder foundations – make sure they remain stable.		

7. Lowering upon completion of lift	**A.** Has load lowering valve been properly adjusted?		
	B. Have values been entered properly? (time, speed, relative displacement)		
	1. While in auto mode, lower the load until it is 5-10 mm above the ground, then manually lower the load to ground, in case of settling.		
	C. Be sure to bleed pressure from system after lift		
8. Disconnecting and Re-Crating			
	A. Electrical power		
	B. Linear sensors		
	C. Hydraulics		
	D. Reusable crate		
	1. Reference section 2 in reverse		

3. SETTING LOG SHEET

Hydraulic Technologies Synchronized Lift Settings Log Sheet

Date: _____ Job Name: _____

Location: _____ Setpoint Max Load: _____ kN / lb

Motion Point	#	#	#	#	#	#	#
Circuit Used?	on / off	on / off	on / off	on / off	on / off	on / off	on / off
Cylinder size (short tons)	short tons	short tons	short tons	short tons	short tons	short tons	short tons
Cylinder size (effective area)	mm^2 / in^2	mm^2 / in^2	mm^2 / in^2	mm^2 / in^2	mm^2 / in^2	mm^2 / in^2	mm^2 / in^2
Pressure at 4mA	bar / psi	bar / psi	bar / psi	bar / psi	bar / psi	bar / psi	bar / psi
Pressure at 20mA	bar / psi	bar / psi	bar / psi	bar / psi	bar / psi	bar / psi	bar / psi
Encoder at 4mA	mm / in	mm / in	mm / in	mm / in	mm / in	mm / in	mm / in
Encoder at 20mA	mm / in	mm / in	mm / in	mm / in	mm / in	mm / in	mm / in
Max Load	kN / lb	kN / lb	kN / lb	kN / lb	kN / lb	kN / lb	kN / lb
Max Pressure	bar / psi	bar / psi	bar / psi	bar / psi	bar / psi	bar / psi	bar / psi
X - Position	cm / in	cm / in	cm / in	cm / in	cm / in	cm / in	cm / in
Y - Position	cm / in	cm / in	cm / in	cm / in	cm / in	cm / in	cm / in

sheet _____ of _____

4. DISPLACEMENT SENSOR LOG

Make	Model	Serial Number	Position at 4mA	Position at 20mA	Asset Number

5. COMMON REPLACEMENT PARTS

ITEM NUMBER	DESCRIPTION
3000725	CABLE, DISPLACEMENT SENSOR SUB-ASSY
3000713	500MM SENSOR/MAGNET ASSEMBLY
3000875	1000MM SENSOR/MAGNET ASSEMBLY
2008187	VALVE, DIRECTIONAL-SEATED 2P2W
2008185	TRANSDUCER, PRESSURE
2008186	VALVE, DIRECTIONAL-24V 2P2W NC
9795	QUICK COUPLER, COMPLETE
47647	REGULATOR, PRESSURE
9638	HYD OIL 2 1/2 GALLON CONT.
46647	RESTRICTOR VALVE ASSEMBLY
9797	ASSEMBLY, DUST CAM RAM HALF
9799	CAP ASSY, DUST 1-3/16-16 INT. THREAD
2008485	FUSE, 1 AMP 600 VAC KLD-R
2008486	FUSE, 3 AMP 600 VAC KLD-R
2008487	FUSE, 6.25 AMP 600 VAC KLD-R
9072	GAUGE 10,000 PSI, 4" DIA. CAL.
2008150	RELAY, 24 VDC SS

6. DECLARATION OF CONFORMITY

POWER TEAM

English Original

EC DECLARATION OF CONFORMITY

We declare under our sole responsibility that our

Motion Control System MCS - series

to which this declaration relates is in conformity with the following:

EN, EN-ISO, ISO standards	Title
Per the provisions of the Machinery Safety Directive	**2006/42 EC**
EN_ISO 12100:2011	Safety of machinery, basic concepts, general principles for design, risk assessment & risk reduction
EN 4413:2010	Hydraulic Fluid Power – general rules and safety requirements for systems & their components
Per the provisions of the EMC Directive	**2014/30 EU**
EN_61000-4-2:2001	Electromagnetic Discharge Immunity test
EN_61000-4-3:2001	Radiated, Radio Frequency, Electromagnetic Field Immunity test
EN_61000-4-4:2001	Electrical Fast Transient / Burst Immunity test
EN_61000-4-5:2001	Surge immunity test
EN_61000-4-6:2001	Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields
EN_61000-4-11:2001	Voltage Dip and Interrupt test
EN 55011_2007	Industrial, Scientific and Medical (ISM) Radio Frequency Equipment-Electromagnetic Disturbance Characteristics-Limits and Methods of Measurement
Per the provisions of the Low Voltage Directive	**2014/35 EU**
EN_60204-1	Safety of Machinery –Electrical equipment of machines – Part 1 General requirements
Per the provisions of the RoHS Directive	**2015/863 EU**
	Restriction of the use of certain hazardous substances in electrical and electronic equipment

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Hydraulic Technologies
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NL-6471 WX Eygelshoven
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We hereby declare that the equipment specified conforms to the above European Communities Directive(s) and Standard(s).

The Netherlands April 22, 2016

Andreas J. Klemm, Eng. & Ops. Site Leader

6. DECLARATION OF CONFORMITY

POWER TEAM

UKCA DECLARATION OF CONFORMITY

We declare under our sole responsibility that our product :

*** Motion Control System MCS - series**

to which this declaration relates are in conformity with the following:

Legislation & standards	Title
The Supply of Machinery (Safety) Regulations 2008 No. 1597 and amendments	
EN_ISO 12100	Safety of machinery, basic concepts, general principles for design, risk assessment & risk reduction
EN 4413	Hydraulic Fluid Power – general rules and safety requirements for systems & their components
The Electromagnetic Compatibility Regulations 2016 No. 1091	
EN_61000-4-2	Electromagnetic Discharge Immunity test
EN_61000-4-3	Radiated, Radio Frequency, Electromagnetic Field Immunity test
EN_61000-4-4	Electrical Fast Transient / Burst Immunity test
EN_61000-4-5	Surge immunity test
EN_61000-4-6	Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields
EN_61000-4-11	Voltage Dip and Interrupt test
EN 55011	Industrial, Scientific and Medical (ISM) Radio Frequency Equipment-Electromagnetic Disturbance Characteristics-Limits and Methods of Measurement
The Electrical Equipment (Safety) Regulations 2016 No. 1101	
EN_60204-1	Safety of Machinery –Electrical equipment of machines – Part 1 General requirements
The Noise Emissions in the Environment by Equipment for use Outdoors Regulation 2001 No. 1701	
EN_3200L0014	Noise emission in the environment for use outdoors
ISO 3744	Sound Power Level Measurements

measured sound power level on an equipment representative for this type :	82 dB(A)
guaranteed sound power level for this equipment :	86 dB(A) or less

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 No. 3032	
	Restriction of the use of certain hazardous substances in electrical and electronic equipment

We hereby declare that the equipment specified under * conforms to the above quoted UK Legislation and international Standard(s) as per the currently valid revision.
Hydraulic Technologies is certified and registered to ISO 9001: 2015.

The Netherlands February 21st, 2021

Andreas J. Klemm, PhD

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WARNING:

This product can expose you to chemicals including Diisononyl Phthalate, which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.