



OVERBUILT LOADER

!! WARNING !!

MAXIMUM HYDRAULIC PRESSURE FOR THIS MACHINE IS 3250 PSI. SETTINGS HIGHER THAN THIS MAY RESULT IN HARM TO PERSONS OR PROPERTY.

IN MANY INSTANCES, WE HAVE LEARNED THAT THE RELIEF VALVES ON OVERBUILT LOADERS HAVE BEEN RESET, INCREASING THE MAXIMUM SYSTEM PRESSURE, IN TURN, INCREASING THE LOAD THE UNIT WILL LIFT BEFORE THE RELIEF VALVE OPENS. THE FUNCTION OF THE RELIEF VALVE IS TO PROVIDE A FUSE ACTION TO PROTECT THE MACHINE AND OPERATOR FROM OVERLOADING. WHEN OVERLOADED THE MACHINE CAN BECOME STRESSED TO A LEVEL WHERE PARTS FRACTURE AND SERIOUS PHYSICAL DAMAGE TO THE EQUIPMENT AND PERSONNEL CAN RESULT. THIS IS AN EXTREMELY DANGEROUS PRACTICE.

ACCORDINGLY, YOU ARE ADVISED THAT THE SETTINGS OF THIS VALVE IS LIMITED TO A MAXIMUM OF 3250 PSI. PRESSURE SETTINGS IN EXCESS OF THIS LEVEL RENDER EACH AND ALL OVERBUILT WARRANTIES NULL AND VOID AND CONSTITUTE AN OBVIOUS MISUSE AND ABUSE OF OUR PRODUCTS.

SAFETY CONSIDERATIONS

AS WITH ALL TYPES OF HEAVY EQUIPMENT, ORIENTATION FOR PROPER OPERATION IS ALWAYS RECOMMENDED. THE OPERATOR SHOULD FAMILIARIZE HIMSELF WITH ALL THE SAFETY EQUIPMENT CONTROL FUNCTIONS AND MAINTENANCE. THE SAFETY OF THE OPERATOR AND THOSE AROUND HIM LARGELY DEPENDS ON THAT APPLY TO ALL EQUIPMENT:

- > KNOW AND UNDERSTAND WHAT PERSONAL SAFETY EQUIPMENT IS REQUIRED ON THIS MACHINE SUCH AS EAR PLUGS, SAFETY GLASSES, HARD HAT, ECT.
- > AVOID LOOSE CLOTHING, CUMBERSOME FOOTWEAR, OR ANYTHING THAT WOULD INTERFERE WITH MOVEMENT OR SIGHT WHILE OPERATING.
- > LEARN TO PROPERLY MOUNT AND DISMOUNT FROM THE OPERATORS STATION. MOST ACCIDENTS OCCUR FROM JUMPING, SLIPPING, OR FALLING OFF THE MACHINE.
- > BECOME FAMILIAR WITH THE WORKING AREA, ROADS, DIRECTION OF TRAFFIC, AND LOCATION OF OTHERS.
- > REPAIR OR REPORT ANY EQUIPMENT DAMAGE IMMEDIATELY.
- > MOST ACCIDENTS ARE AVOIDABLE. BECOMING AN EFFICIENT OPERATOR DEVELOPS FROM YEARS OF EXPERIENCE NOT JUST HOURS. SLOW DOWN. SAFETY FIRST!!

REMEMBER - CLIMATE, TERRAIN, AND OPERATING TECHNIQUE MUST ALL BE CONSIDERED BEFOREHAND TO PROVIDE A SAFE WORKING ENVIRONMENT.

INITIAL START-UP

WARNING!!! - UNDERSTANDING THE EQUIPMENT AND ITS LIMITATIONS LOAD, CAPACITY, SPEED, AND BREAKING CONTROLS, ECT. IS ESSENTIAL BEFORE INITIAL START-UP. THE OWNER-OPERATORS MANUAL SHOULD PROVIDE MOST OF THE PERTINENT INFORMATION. IF A MANUAL IS NOT AVAILABLE, OVERBUILT SHOULD BE CONTACTED.

OPERATION

IN GENERAL, LOADER OPERATING TECHNIQUES ARE BASICALLY THE SAME. PARTICULAR REFERENCE IS MADE TO "INCHING", OR "FEATHERING" CONTROLS. THE TECHNIQUE WITH PRACTICE, WILL GIVE A SMOOTH WORKING CYCLE WITH POSITIVE, WELL BLENDED AND

TO ACTUATE A MOTION OF THE LOADER, MOVE THE CONTROL SLOWLY FROM ITS NEUTRAL POSITION. THIS TRANSMITS POWER AT A PROPORTIONAL RATE. FOR FULL POWER, THE CONTROL IS MOVED TO ITS LIMIT. STOPPING OR CHANGING DIRECTION REACTS THE SAME.

THE FOLLOWING RECOMMENDATIONS SHOULD BE PRACTICED:

- > BE SURE THE OPERATING AREA IS CLEAR OF STANDING TREES, BUILDINGS, ETC.
- > APPLY TRUCK BRAKES AND BLOCK TIRES WHEN OPERATING LOADER.
- > ALWAYS USE BOTH LOADER STABILIZERS.
- > CLEAR THE OPERATING PLATFORM OF ALL MAINTENANCE AND PERSONAL ITEMS.
- > NEVER ALLOW RIDERS ON THE MACHINE.
- > OBSERVE GAUGES AND INSTRUMENTS CLOSELY.
- > AVOID PULLING HARD OR JERKING ON THE CONTROLLERS.
- > NEVER WORK UNDER OVERHANGS OR ON UNSTABLE TERRAIN.
- > ALWAYS LIFT AND CARRY YOUR LOADS SO THAT YOU HAVE MAXIMUM STABILITY BY KNUCKLING IN AS WELL AS LIFTING UP.
- > ALWAYS LOWER THE GRAPPLE TO THE GROUND OR TRUCK BED BEFORE LEAVING THE OPERATORS PLATFORM DURING AND AFTER LOADING OPERATORS.
- > NEVER MOVE THE TRUCK OR TRAILER WHILE THE OPERATOR IS ON THE LOADER UNLESS ORDERED TO DO SO BY THE OPERATOR FOR PURPOSE OF SPOTTING OR RELOCATING. WHEN SPOTTING THE TRUCK AND LOADER FOR THE OPERATOR. ALWAYS PROTECT THE OPERATOR FROM OVERHEAD OBSTRUCTIONS, WIRES, ECT.
- > ALWAYS CHECK THAT THE STABILIZERS ARE FULLY RETRACTED BEFORE MOVING.
- > NEVER ALLOW PEOPLE TO BE UNDER THE LOAD OR NEAR THE LOAD AND RAISED BOOM.

- > NEVER LEAVE A LIVE LOADER UNATTENDED. ALWAYS DISENGAGE THE P.T.O.
- > WHEN LIFTING A SINGLE LOG WITH A BUTT TYPE GRAPPLE. THE LOG SHOULD BE PINCHED BETWEEN THE GRAPPLE JAWS, NEVER CRADLED.
- > NEVER PICK UP MORE WOOD OR LESS WOOD THAN THE GRAPPLE CAN HOLD FIRMLY.
- > LOOK OUT FOR OVERHEAD POWER LINES.

BEHIND ALL THE STRUCTURAL STEEL OF YOUR LOADER IS A SOPHISTICATED HYDRAULIC OIL SYSTEM THAT HAS BEEN PRESET AND TESTED BY YOUR DEALER. CERTAIN FUNCTIONS MAY BE ADJUSTED TO YOUR NEEDS. IT IS CRUCIAL THAT THE DEALER BE CONTACTED TO ASSIST AND ADVISE SHOULD SUCH ADJUSTMENTS BECOME DESIRABLE.

CAUTIONS TO OBSERVE ON THE ROAD

- > ALWAYS RAISE STABILIZERS BEFORE MOVING THE LOADER.
- > BE SURE THE BOOM AND GRAPPLE ARE SECURELY POSITIONED.
- > WHEN MOVING BETWEEN JOBS, ALWAYS BE SURE THE P.T.O. IS DISENGAGED.
- > ALWAYS CHECK TRANSPORTING REGULATIONS WHEN PUBLIC HIGHWAYS ARE TO BE USED.
- > CHECK ALL MARKER AND TRAILER LIGHTS TO ENSURE THEY ARE WORKING PROPERLY.
- > KNOW THE OVERALL HEIGHT AND WIDTH OF YOUR RIG. CHECK THE LOCAL REGULATIONS.

INSTRUCTIONS

IT IS ALWAYS ADVISABLE TO LOCATE AND OPERATE YOUR LOADER ON LEVEL AND STABLE GROUND.

CHECK THE ENTIRE MOUNTING OF THE LOADER TO THE FRAME FOR COMPLETENESS AND SECURITY.

ALL PIVOT POINTS MUST BE LUBRICATED.

CHECK THE HYDRAULIC RESERVOIR. FILL IF NEEDED WITH THE RECOMMENDED OIL. REFER TO THE LUBRICATION CHART.

CHECK THE PUMP AND P.T.O. SHAFT FOR PROPER ALIGNMENT.

KNOW YOUR CONTROLS ! REFER TO THE DIAGRAM.

SET AND ADJUST THE ENGINE RPM AND ENGINE P.T.O.

ACTUATE ALL CYLINDERS TO THEIR LIMIT OF TRAVEL SO THAT AIR WILL BE EXPELLED FROM THE HYDRAULIC SYSTEM.

AGAIN, CHECK AND REFILL THE OIL RESERVOIR TO THE RECOMMENDED LEVEL.

OPERATING NEAR ELECTRIC POWER LINES

CURRENT IN A HIGH VOLTAGE LINE MAY ARC SOME DISTANCE TO JUMP FROM WIRE TO NEARBY GROUND, SO MERELY NOT TOUCHING POWER LINE IS NOT ENOUGH EXCEPT WHERE THE ELECTRICAL DISTRIBUTION AND TRANSMISSION LINE HAVE BEEN DE-ENERGIZED AND VISIBLY GROUNDED AT A POINT OF WORK AND WHERE INSULATING BARRIERS NOT A PART OF OR AN ATTACHMENT TO THE LOADER HAVE BEEN ERECTED TO PREVENT PHYSICAL CONTACT WITH THE LINES. LOADERS SHALL BE OPERATED PROXIMATE TO, UNDER, OVER, BY, OR NEAR POWER LINES IN ACCORDANCE WITH THE FOLLOWING.

- > FOR LINES RATED 50 KV OR BELOW, MINIMUM CLEARANCE BETWEEN THE LINES, AND ANY PART OF THE CRANE OR LOAD SHALL BE 10 FEET.
- > FOR LINES RATE 50 KV MINIMUM, CLEARANCE BETWEEN THE LINE AND ANY PART OF THE CRANE OR LOAD SHALL BE 10 FEET PLUS 0.4 INCH FOR EACH 1 KV OVER 50 KV, OR TWICE THE LENGTH OF THE LINE INSULATOR BUT NEVER LESS THAN 10 FEET. SOME STATES REQUIRE MORE CLEARANCE THAN SHOWN HERE. CHECK THE LAW.
- > IN TRANSIT WITH NO LOAD AND BOOM LOWERED THE CLEARANCE SHALL BE A MINIMUM OF 4 FEET.
- > IT IS RECOMMENDED THAT A PERSON BE DESIGNATED TO OBSERVE THE CLEARANCE AND GIVE TIMELY WARNING FOR ALL OPERATIONS WHERE IT IS DIFFICULT FOR THE OPERATOR TO MAINTAIN THE DESIRED CLEARANCE BY VISUAL MEANS.
- > ANY OVERHEAD WIRE SHALL BE CONSIDERED TO BE ENERGIZED LINE UNLESS AND UNTIL THE PERSON OWNING SUCH LINE OR THE UTILITY COMPANY INDICATE THAT IT IS NOT AN ENERGIZED LINE.
- > IF YOU KNOW THE BOOM HAS CONTACTED A HIGH WIRE, TRY TO SWING THE BOOM AWAY WITHOUT DOWNING WIRES. IF THIS IS NOT SUCCESSFUL, WARN OTHERS NOT TO TOUCH THE TRUCK OR LOADER AND KEEP CLEAR OF THE AREA IF THE WIRES ARE DOWNED. IF YOU MUST LEAVE THE LOADER DO NOT TOUCH THE MACHINE AND GROUND AT THE SAME TIME, JUMP CLEAR AVOIDING ANY DOWNED LINES. GET IN TOUCH WITH THE POWER COMPANY, GIVING THE NUMBER OF THE NEAREST NUMBERED POLE. IF YOU SUSPECT THAT THE LOADER IS STILL GROUNDING CURRENT, DON'T ALLOW ANYONE TO TOUCH IT OR THE CARRIER UNTIL QUALIFIED HELP ARRIVES.

RECOMMENDED CLEARANCE

ASSUME ALL LINES TO BE UNINSULATED. YOU WILL BE SAFER.

LOCAL TRANSMISSION LINE
750 VOLTS OR LESS: 8"

HIGH TENSION LINES 750-
7500 VOLTS: 10"

LONG DISTANCE TRANSMISSION LINES
7500 VOLTS AND UP: 10" +1/10 FOOT FOR EACH 1000 VOLTS OVER 7500

PREVENTIVE MAINTENANCE

WARNING!! NEGLECT OF REGULAR MAINTENANCE AS SPECIFIED DURING THE WARRANTY PERIOD WILL VOID THE WARRANTY.

YOUR LOADER WAS SPECIFICALLY DESIGNED TO BE REGULARLY MAINTAINED IN ORDER FOR IT TO PROVIDE PROPER OPERATION AND DEPENDABLE SERVICE. CAREFUL PERFORMANCE OF THESE MAINTENANCE SERVICES WILL ASSURE LONGER MACHINE LIFE.

PARTICULAR ATTENTION MUST BE GIVEN TO MAINTENANCE TIME INTERVALS. ADJUSTMENTS SHOULD BE REGULATED BY ACTUAL OPERATING TIME, CLIMATE, AND TERRAIN CONDITIONS AND OVERALL OPERATING PERFORMANCE. OVERBUILT WILL ADVISE YOU ACCORDINGLY ON ALL ABOVE.

MACHINE LUBRICATION, AS DIRECTED BY THE LUBRICATION AND MAINTENANCE CHART, IS VITAL IN KEEPING YOUR MACHINE IN A SAFE OPERATING CONDITION.

HYDRAULIC RESERVOIR

IT IS VERY IMPORTANT TO CHECK DAILY THE LEVEL OF THE HYDRAULIC RESERVOIR. ADD OIL WHEN NEEDED. THE RECOMMENDED LEVEL IS THREE INCHES FROM THE TOP OF THE TANK (USE SIGHT GAUGE). THREE INCHES ALLOWS SUFFICIENT SPACE WITHIN THE RESERVOIR FOR LIQUID EXPANSION.

IT IS ADVISABLE TO CHANGE THE HYDRAULIC OIL FILTER AFTER THE FIRST 100 HOURS OF OPERATION. THE HYDRAULIC OIL AND HYDRAULIC OIL FILTER SHOULD BE CHANGED EVERY 2500 OPERATING HOURS OR EVERY 6 MONTHS THEREAFTER. DUE TO SEASONAL WEATHER CHANGES IN WHICH CONDENSATION MAY OCCUR, CHECK WITH OVERBUILT, CONDITIONS MAY EXIST WHERE AN EARLIER CHANGE MAY BE RECOMMENDED.

MAINTENANCE TIPS

PURCHASE BEFOREHAND THE PROPER HYDRAULIC OIL FOR THE CLIMATE CONDITIONS THAT MAY BE ENCOUNTERED THROUGH THE NEXT OIL CHANGE.

****SEE THE FOLLOWING PAGE ON HYDRAULIC OIL SPECIFICATIONS****

ALL FILTERS, FILTER ELEMENTS AND STRAINERS SHOULD BE CLEANED OR REPLACED AT EACH OIL CHANGE.

THE HYDRAULIC OIL SHOULD BE DRAINED WHILE IT IS WARM AND COLLECTED IN AN APPROPRIATE CATCH BASIN.

AFTER DRAINING THE RESERVOIR, EXAMINE THE INSIDE FOR RUST, SCALE, METALLIC PARTICLES, AND OTHER RESIDUE THAT HAVE ACCUMULATED.

IF NECESSARY, CLEAN THOROUGHLY AND REASSEMBLE THE RESERVOIR. DO NOT ALLOW DIRT OR DEBRIS TO FALL IN.

BEFORE REFILLING, CLEAN THE AREA AROUND THE FILLER. MAKE SURE THAT THE FILLER STRAINER IS IN PLACE AND PROPERLY CLEANED. IF SUCH A FILTER DOES NOT EXIST A FUNNEL WITH A FINE WIRE SCREEN APPROX. 200 MESH MUST BE USED.

CLEAN UP ANY SPILL OR OVERFLOW.

DO NOT STEAM CLEAN OR HIGH PRESSURE WASH AROUND TURNABLE BEARING. REASON: SOAPY WATER PENETRATES GREASE AND CAUSES PREMATURE BEARING FAILURE.

HYDRAULIC OIL SPECIFICATIONS

QUESTION:

WHEN DO I NEED TO CHANGE RANDO HDZ HYDRAULIC OIL IN AN OVERBUILT

ANSWER:

THE MAIN CAUSE OF OIL DETERIORATION REQUIRING RANDO HDZ 32 TO BE REPLACED ARE OIL OXIDATION AND CONTAMINATION. THE RATE OF OIL OXIDATION DOUBLES FOR EACH 18°F (10°C) INCREASE IN TEMPERATURE ABOVE 140°F (60°C). THE RATE OF OXIDATION IS ALSO INCREASED BY THE PRESENCE OF METALS (ESPECIALLY COPPER), RUST PARTICLES, WATER AND OTHER CONTAMINANTS. THE INDICATIONS THAT AN OIL IS OXIDIZED ARE DARKENING IN COLOR, INCREASE IN VISCOSITY, AND/OR ACIDITY (TOTAL ACID NUMBER). LUBRICANTS CAN BE CONTAMINATED BY WATER, MILL SCALE, DIRT, ATMOSPHERE, LEAKAGE FROM OTHER SYSTEM, ADDITIONS OF WRONG OIL, OR IMPROPER VENTILATION. TEXACO RECOMMENDS A QUARTERLY OIL ANALYSIS PROGRAM TO MONITOR THE CONDITION OF THE HYDRAULIC FLUID. UNDER THE CONDITIONS SPECIFIED (165°F, 2500 PSIG, FILTRATION SYSTEM) THE OIL SERVICE LIFE COULD REACH 1 YEAR OR 2500 OPERATING HOURS, HOWEVER, IT IS BEST TO MONITOR THE CONDITION OF THE FLUID IN TYPICAL OPERATING CONDITIONS BEFORE SETTING DEFINED CHANGE INTERVALS.

MODERN LUBRICATING OILS ARE FORMULATED TO PROVIDE MAXIMUM SERVICE LIFE CONSISTENT WITH GOOD LUBRICATION PRACTICES. DESPITE THE BEST EFFORTS TO FORMULATE PREMIUM PRODUCTS, KEEP SYSTEMS CLEAN AND DRY AND EXTEND OIL LIFE, IT WILL EVENTUALLY BECOME NECESSARY TO DRAIN THE OIL CHANGE. TO ASSIST IN THE DECISION TO DRAIN AN OIL CHANGE, CONDEMNING LIMITS ARE DEVELOPED FOR THE VARIOUS LUBRICANTS AND/OR LUBRICANT APPLICATIONS. CONDEMNING LIMITS FOR TEXACO'S RANDO HDZ PRODUCTS ARE SUMMARIZED BELOW. IT SHOULD BE NOTED THAT THESE ARE GUIDELINES, AND THE CONDITION OF THE LUBRICATED EQUIPMENT SHOULD BE CONSIDERED WHEN DRAIN INTERVALS ARE ESTABLISHED.

CONDEMNING LIMIT GUIDELINES FOR USED RANDO HDZ PRODUCTS:

VISCOSITY:	AN INCREASE OF 10% OVER THE VISCOSITY OF THE UNUSED OIL GENERALLY INDICATES MODERATE OXIDATION; HOWEVER, ADDITION OF A HIGHER VIS OIL WILL ALSO CAUSE THE VISCOSITY TO INCREASE.
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NEUTRALIZATION NO.: AN INCREASE OF 0.2 UNITS OVER UNUSED OIL BASELINE NEUTRALIZATION NO. IS CAUSE FOR CONCERN. AN INCREASE OF 0.5 UNITS OVER BASELINE DEFINITELY INDICATES A PROBLEM.

WATER CONTENT: A CONCENTRATION OF WATER SUFFICIENT TO CAUSE A CLOUDY APPEARANCE INDICATES CORRECTIVE ACTION IS NEEDED. A CONCENTRATION OF 0.1% IS THE MAXIMUM ALLOWABLE.

FLASH POINT COC: GENERALLY 375°F IS CONSIDERED AS THE MINIMUM. THE FLASH POINT OF A USED SAMPLE IS NOT DETERMINED UNLESS CONTAMINATION WITH A LOWER FLASH PRODUCT IS SUSPECTED.

PARTICLE COUNT: THE PARTICLE COUNT IS GENERALLY BASED ON EQUIPMENT MANUFACTURER'S REQUIREMENTS.

SEDIMENT CONTROL: THE USED SAMPLE CONTAIN NO VISIBLE SEDIMENT.

TRACE METALS: THE CONCENTRATION OF WEAR METALS, SUCH AS IRON, COPPER, LEAD, CHROMIUM, ETC, SHOULD NOT EXCEED 50 PPM. EVEN LOWER LEVELS SHOULD BE CONSIDERED SUSPECT, DEPENDING UPON THE HISTORY OF THE EQUIPMENT AND USED OIL TEST RESULTS. ANY SUDDEN INCREASE IN WEAR METAL CONCENTRATION SHOULD BE CONSIDERED SUSPECT. ADDITIVE ELEMENTS SUCH AS CALCIUM, PHOSPHORUS, AND ZINC MUST NOT BE CONFUSED WITH WEAR METALS.

CARE OF ROTATION BEARING

A.

BOLTS SHOULD BE CHECKED PERIODICALLY AND RETIGHTENED TO PROPER TORQUE. THE POSSIBILITY EXISTS THAT DUE TO THE STRESSES APPLIED TO THE ROTATION SYSTEM, THE BOLTS COULD WORK LOOSE.

B. REGULAR PERIODIC LUBRICATION IS THE MOST EFFECTIVE WAY TO INCREASE THE LIFE AND SERVICEABILITY OF ROTATION BEARINGS. MOST LARGE DIAMETER BEARINGS ARE USED OUT OF DOORS AND UNDER CONDITIONS LIKELY TO PRODUCE INTERNAL CONDENSATION. ALSO, WHEN BEARINGS ARE HEAVILY LOADED, EXTREME PRESSURE LUBRICATION IS HELPFUL. BELOW ARE SEVERAL LUBRICANTS WHICH ARE ACCEPTABLE FOR BOTH RUST INHABITING AND EXTREME PRESSURE CHARACTERISTICS.

USE ONLY HIGH PRESSURE LUBE (NO SUBSTITUTIONS)

TURNTABLE USE ONLY HIGH PRESSURE LUBE

BEARING WITH A (EP #2) SPECIFICATION

GEAR MOBILCOTE-S CRATER 407 POCO SOHITAC

TEETH COMPOUND COMPOUND B GEARSHIELD #1

MAINTENANCE

1. LUBRICATE THE BEARING DAILY IF THE LOADER IS USED DAILY.
2. ROTATE THE BEARING THROUGH TWO OR MORE ROTATIONS DURING THE LUBRICATION PROCESS
3. DO NOT STEAM CLEAN OR HIGH PRESSURE WASH AROUND TURNTABLE BEARING. REASON: SOAPY WATER PENETRATES GREASE AND CAUSES PREMATURE BEARING FAILURE.
4. CHECK BOLT TIGHTNESS IN CROSS PATTERN. 3/4"-10 BOLTS SHOULD BE STANDARD DRY TORQUED TO 376 FT LBS.

!!WARNING!!

**DO NOT USE
MOLYBDENUM
(MOLY) GREASE**

WEEKLY MAINTENANCE

1. INSPECT ALL HOSES AND CONNECTIONS FOR CRACKS OR LEAKS. TIGHTEN OR REPLACE IF NECESSARY.
2. INSPECT FRAME AND BOOM FOR STRESS CRACKS. REPAIR OR REPLACE IF NECESSARY.
3. CHECK ALL NUTS AND BOLTS. TIGHTEN OR REPLACE IF NECESSARY.
4. LUBRICATE WHERE NECESSARY. SEE LUBRICATION CHART.

LOCATION	LUBRICATE	INTERVAL	NOTE
GEAR BOX	OIL	8 HOURS	1
MAIN AND JIB BOOM PIVOTS	GREASE	8 HOURS	2
MAIN AND JIB CYLINDER PINS SWING PEDAL AND	GREASE	8 HOURS	2
LINKAGES	GREASE	8 HOURS	2
CONTROL LEVERS	GREASE	8 HOURS	2
GRAPPLE LEVERS	GREASE	8 HOURS	2
GRAPPLE HANGER	GREASE	8 HOURS	2
GRAPPLE HEAD	GREASE	8 HOURS	2
GRAPPLE CYLINDER PINS	GREASE	8 HOURS	2
GRAPPLE ARM PINS	GREASE	8 HOURS	2
HYDRAULIC TANK	HYDRAULIC OIL	2500 HOURS	2
FILTERS	REPLACE WITH ORIGINAL BRAND: PARKER	DURING AND IN BETWEEN EACH OIL CHANGE	3

NOTE: GREASE INTERVALS INCLUDE LOADER RUNNING TIME AND DRIVE TIME

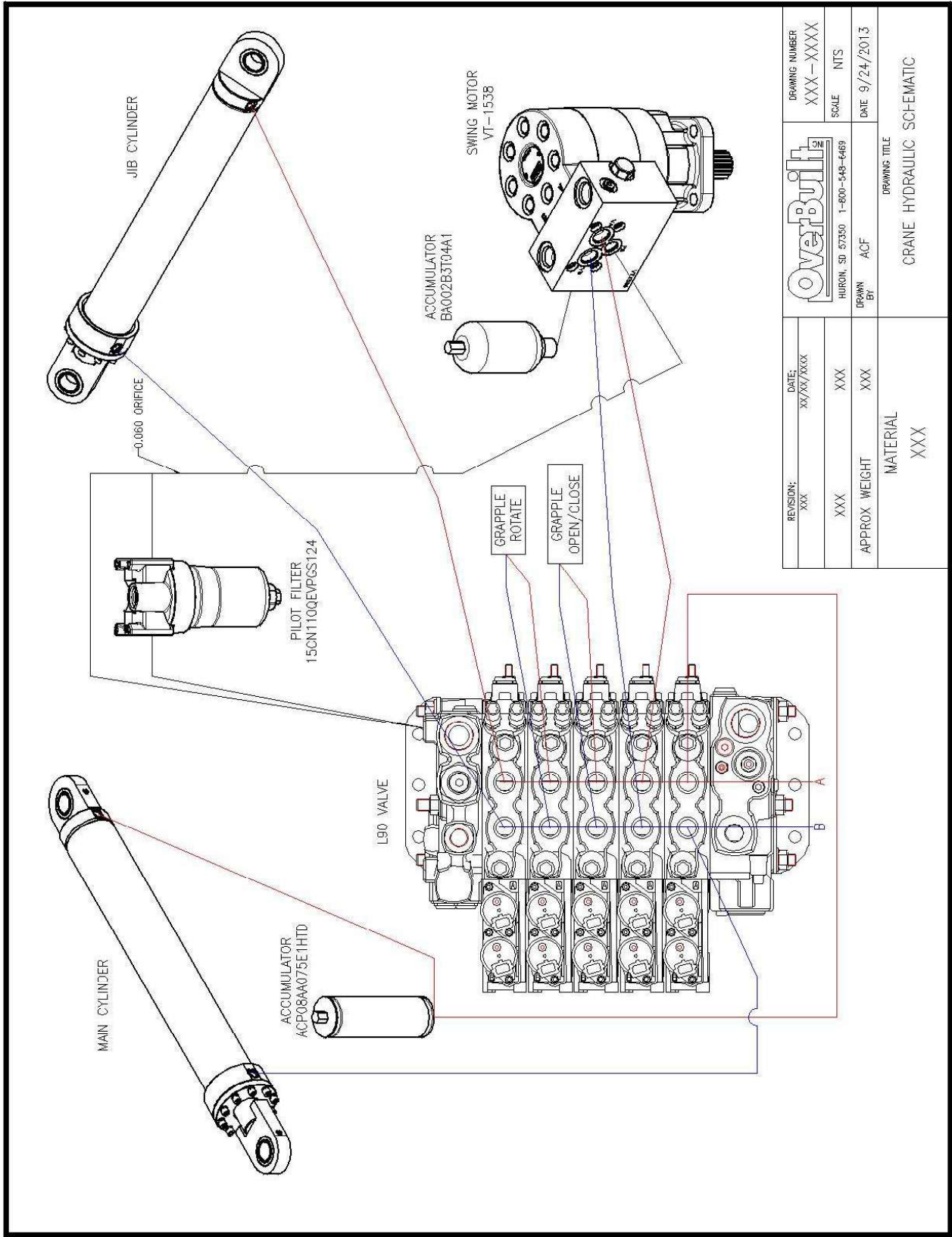
!!CAUTION!!

MAKE SURE BOOM IS LOWERED AND SECURED DURING LUBRICATION PROCESS

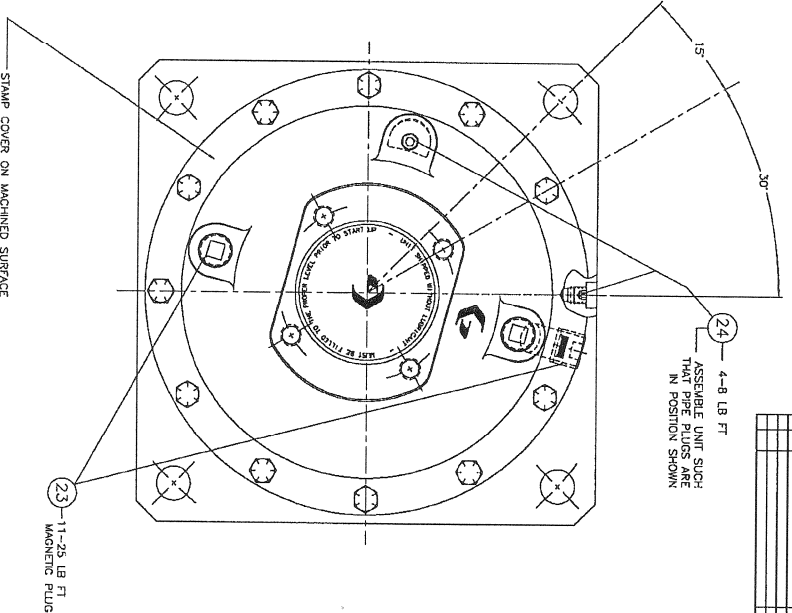
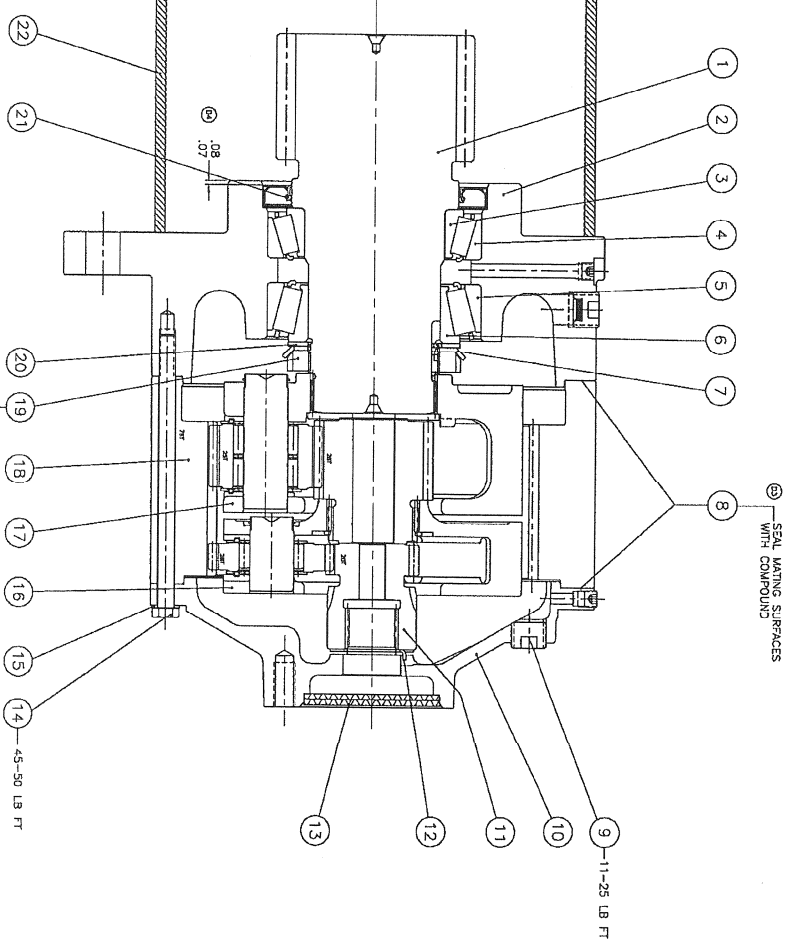
NOTE 1: LUBRICANT GRADE: MIL-L-2105 OR API-GL-5 BELOW -10 F USE 80-90 WT
ABOVE 10 F USE 80-90 WT

NOTE 2: THE LIST OF GREASES FOR THE BEARING RACE ON THE FOLLOWING PAGE ARE ALSO
RECOMMENDED FOR THE ABOVE APPLICATIONS.

NOTE 3: HYDRAULIC OIL SHOULD HAVE A ISO RATING OF 32-36 SUCH AS TEXACO Z-36, HD-32, OR
MOBIL DT-13



NO.	DESCRIPTION	QTY.	UNIT	PRICE
1	1.000000 1.000000 1.000000	1	EA	1.00
2	2.000000 2.000000 2.000000	2	EA	2.00
3	3.000000 3.000000 3.000000	3	EA	3.00
4	4.000000 4.000000 4.000000	4	EA	4.00
5	5.000000 5.000000 5.000000	5	EA	5.00
6	6.000000 6.000000 6.000000	6	EA	6.00
7	7.000000 7.000000 7.000000	7	EA	7.00
8	8.000000 8.000000 8.000000	8	EA	8.00
9	9.000000 9.000000 9.000000	9	EA	9.00
10	10.000000 10.000000 10.000000	10	EA	10.00
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23	23.000000 23.000000 23.000000	23	EA	23.00
24	24.000000 24.000000 24.000000	24	EA	24.00



SETTING RANGE - .0015 TO -.0005 PRELOAD.
 PRESS BEARING CONE ON SPINDLE/SHAFT UNTIL ROLLER JUST TOUCHES THE CUP. INSTALL THRUST WASHER AND LOCKNUT DO NOT INSTALL LOCKWASHER AT THIS TIME) AND TORQUE NUT UNTIL A ROLLING TORQUE OF 44-52 IN LBS WITH BEAT SEAL OR 40-48 IN LBS WITHOUT A BEAT SEAL TO 55-75 FT LBS. SECURE LOCKNUT BY BEARINGS AND RE-TORQUE NUT TAG INTO ONE OF FOUR LOCKNUT SLOTS. IF NO TAG ALIGNS WITH A SLOT, THE NUT MAY BE TIGHTENED UNTIL ONE OF THE SLOTS ALIGNS WITH A LOCKWASHER TAB.

ITEM	PART NO.	DESCRIPTION	QTY
24	613-04-101-09	PLUG-PIPE	3
23	14-00-082-002	RING-PISTON	2
22	14-00-044-011	SEAL-OL	1
21	619320	WASHER-THRUST	1
20	614912	NUT-LOCK	1
19	6659222	BEARING-CLIP	1
18	6659222	ASSY-FRI CARBIDE	1
17	14-00-047-002	WASHER-FLAT	12
16	618319	BOLT-HEX HEAD	12
15	14-00-191-006	PLUG-SHIPING	1
14	14-00-181-006	PLUG-SHIPING	1
13	14-00-181-006	PLUG-SHIPING	1
12	6165103	GEAR-SUN	1
11	603999	COVER-SUN	1
10	603999	COVER-SUN	1
9	03-04-101-01	PLUG-PIPE	2
8	10-00-041-002	COMPOUND-SEALING	1
7	613313	WASHER-LOCK	1
6	613313	WASHER-LOCK	1
5	613314	BEARING-CLIP	1
4	14-00-133-006	BEARING-CUP	1
3	14-00-133-007	BEARING-CONE	1
2	6179189	HUB	1
1	617113	SHAFT-OUTPUT	1

NOTES:
 PRESSURE TEST PER LEW TEST SPECIFICATION 00-00-000-01
 SPIN TEST TO BE POWER OPERATED
 OUTPUT SHAFT MUST TURN FREE BY HAND AFTER ASSEMBLY
 USE PACKING SPECIFICATION PP-260
 X = MODEL 9 GEARING

ORDER CODE: BSW2A214183X
 INSTALLATION DRAWING- N/A
 SAE A MOUNT - 4 BOLT
 RATIO- 18.85 : 1.00

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50 Results Per Page ▾

Component #	Description	Qty	Pack
14-00-044-011	SEAL-OIL ~ #8	1	1
613352SH	BEARING-CUP~#8(JLM716610)SERVI	1	--
613353SH	BEARING-CONE~#8(JM716649)SERVI	1	--
613328SH	BEARING-CUP~9"(JM515610)SERVIC	1	--
613329SH	BEARING-CONE~9"(JM515649)SERVI	1	--
14-00-191-006	PLUG-SHIPPING, SAE A, 3.31" O.	1	1
605003	WASHER-LOCK ~ 9"	1	1
665995	ASSY-PRI CARRIER ~ 9"	1	1
6659222	ASSY-SEC CARRIER ~ 8B	1	--
603999	COVER ~ #8B	1	--
6165103	GEAR-PRI SUN ~ #9	1	1
6171173	SHAFT-OUTPUT ~ #8B	1	--
6179188	HUB ~ 8B	1	--
616237	GEAR-RING ~ 8B	1	1
14-00-193-003	WASHER-THRUST (SVC = 5/PKG)	1	5
618319	BOLT-HEX HEAD ~ 9"	12	1
03-04-101-09	PLUG-PIPE ~ 1/8-27	3	1
14-00-052-002	PLUG-PIPE ~ 1/2-14 MAGNET (SV	2	2
614912	NUT-LOCK ~ 9"	1	1
619320	WASHER-THRUST ~ 9"	1	1
MH612	RING-PACKING	1	--
14-00-047-002	WASHER-FLAT (SVC = 10/PKG)	12	10
03-04-101-01	PLUG-PIPE ~ 1/2-14 (SVC = 10/P	1	14
10-00-041-002	COMPOUND-SEALING - 10.2 OZ. CA		1

Parts Found: 24 - Page: 1 of 1

[1]

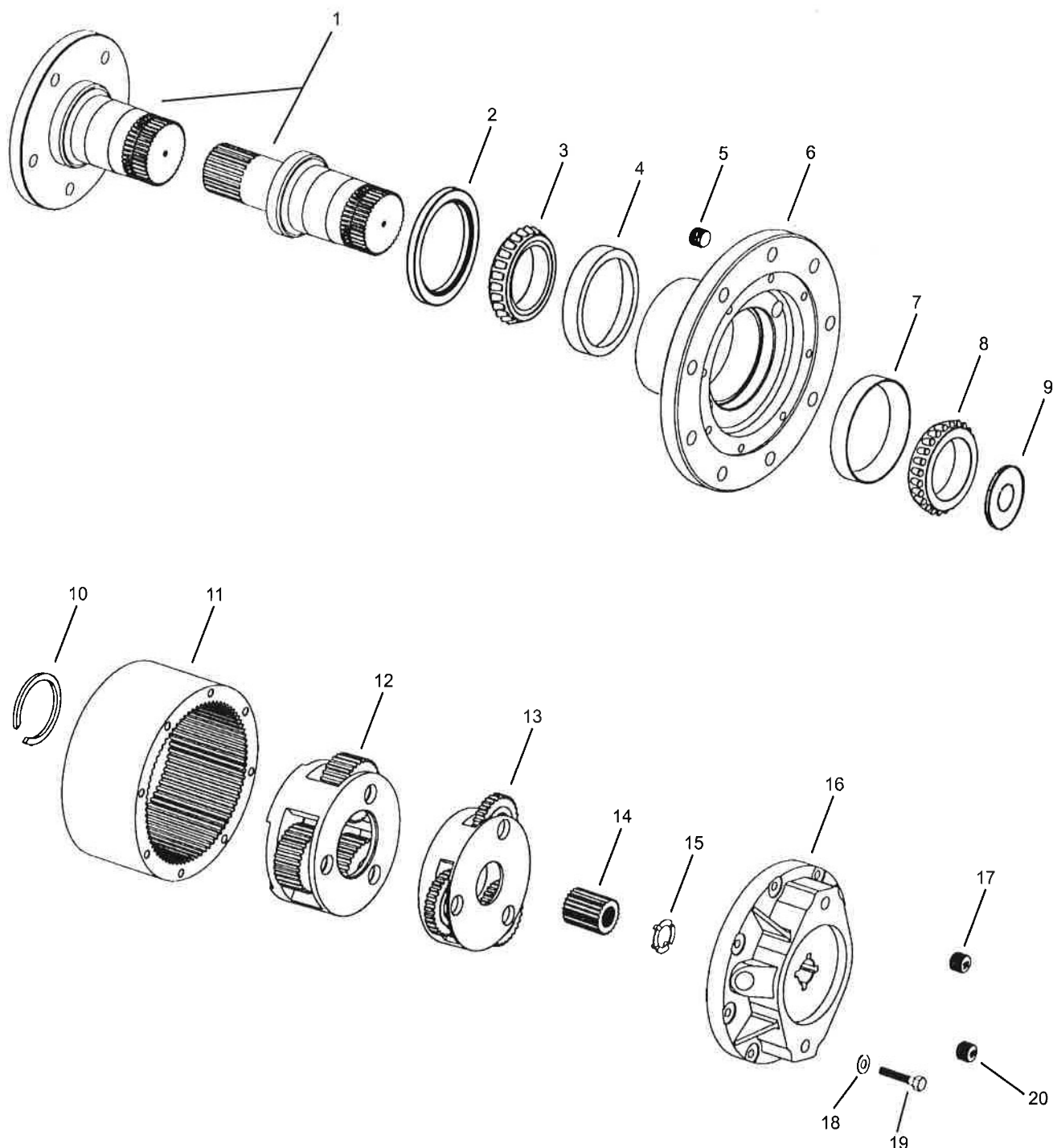
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Power Wheel® Service Manual
Model 8 Double Reduction
Shaft and Spindle Output Drives



PHONE: (219) 925-3200

FAX: (219) 925-4725



IDENTIFICATION

IMPORTANT: All Power Wheel units and kits are shipped with a nameplate that includes the Auburn Gear part number and order code as shown.

Example:



In addition to the nameplate, Power Wheel drives are stamped with an identification number which appears on the cover or hub flange as shown.

Example: **6000236-A-4-9**

When ordering parts, the information included on the nameplate or the stamped identification number is necessary to accurately identify the drive and obtain the correct replacement parts. Once this information has been obtained, contact Auburn Gear for the appropriate parts list.

DISASSEMBLY OF POWER WHEEL

STEP 1

Remove twelve hex head bolts (19) and washers (18) cover (16). Lift cover (16) from assembly. Thrust washer (15) usually remains with cover (16).

STEP 2

Lift primary sun gear (14) from primary carrier assembly (13).

STEP 3

Remove primary (13) and secondary (12) carrier assemblies from ring gear (11).

STEP 4

Pull ring gear (11) from remaining assembly. It may be necessary to strike ring gear (11) with rubber mallet to loosen from hub (6).

STEP 5

Remove retaining ring (10) from groove in output shaft (1). NOTE: To remove retaining ring, use retaining ring expander tool. Remove thrustwasher (9). Pull output shaft (1) from hub (6).

STEP 6

Remove oil seal (2) and bearing cones (3 & 8) from hub (6). Inspect bearing cups (4 & 7) in hub (6) and remove only if replacement is required.

ASSEMBLY OF POWER WHEEL

STEP 1

Press new bearing cups (4 & 7) into each side of hub (6). It is recommended that bearing cups (4 & 7) and cones (3 & 8) be replaced in sets.

STEP 2

Assemble bearing cone (3) into cup (4) at seal end of hub (6) and press a new seal (2) into hub (6).

STEP 3

Lubricate lips of oil seal (2) and lower hub (6) onto output shaft (1). Keep hub (6) centered to prevent damage to oil seal (2).

STEP 4

Assemble bearing cone (8) over output shaft (1) and into bearing cup (7). Add thrustwasher (9). Select the thickest retaining ring (10) that can be assembled in ring groove on output shaft (1) above bearing. Bearing should have from .000 – .006 inch (.00 – .15 mm) end play when proper retaining ring (10) is installed.

STEP 5

Clean mating surfaces and apply a bead of silicone sealant to face of hub (6) that mates with ring gear (11). See instructions on sealant package.

STEP 6

Assemble ring gear (11) to hub (6) being careful to align all the bolt holes.

STEP 7

Place secondary carrier assembly (12) into ring gear (11) aligning the gear teeth. Carrier splines mesh with splines on output shaft (1).

STEP 8

Lower primary carrier assembly (13) into assembly. Align sun gear teeth with secondary carrier planetary gears and primary planet gears with ring gear (11).

STEP 9

Install primary sun gear (14) into primary carrier assembly. Primary sun gear (14) should turn freely by hand when assembled.

STEP 10

Apply a bead of silicone sealant to cover face of ring gear (11). Secure thrust washer (15) with tangs engaged in cover (16). **NOTE:** Washer (15) can be secured to cover (16) with a small amount of grease or silicone sealant. Assemble cover (16) to ring gear (11). Align cover (16) with hub (6) such that pipe plug holes on cover (16) align with mounting holes in hub (6).

STEP 11

Install twelve washers (18) and grade 8 hex head bolts (19) and torque to 40 – 45 lb.-ft. (54 – 61 Nm) with dry threads. Lubed threads torque to 20 – 25 lb.-ft. (27 – 34 Nm).

STEP 12

Position filler opening horizontally and fill unit to oil level hole in hub (6). Install pipe plugs (5), (17) and (20).

NOTE: When installing a hydraulic motor to the Power Wheel drive it is necessary to place an "O" ring or gasket (not supplied by Auburn Gear) between the motor and the planetary drive. "O" ring sizes: SAE A 2-042, SAE B 2-155, SAE C 2-159, SAE D 2-163. Apply sealant to motor mounting bolt threads when holes in cover are thru holes.

CARRIER ASSEMBLIES

It is recommended that the carrier assemblies (12 & 13) be serviced in their entirety to protect the integrity of the Power Wheel drive.

LUBRICATION RECOMMENDATIONS

IMPORTANT: POWER WHEEL PLANETARY DRIVES ARE SHIPPED WITHOUT LUBRICANT AND MUST BE FILLED TO THE PROPER LEVEL PRIOR TO START UP.

Observe lubrication recommendations given by the original equipment manufacturer. When specific recommendations are not available, use mild extreme pressure lubricant API-GL-5, No. 80 or 90 when filling the Power Wheel under normal temperature ranges between 0 - 120°F (-18 to 49°C). Power Wheel is to be half full of oil when unit is mounted level and horizontal. Use drain and fill plugs located in cover and ring gear. Oil is to be changed after first 50 hours of operation with subsequent changes every 1000 hours or yearly, whichever comes first. If unit is to be operated vertically, if ambient conditions are outside the specified range, or if the oil temperature exceeds 200°F (93°C) contact Auburn Gear for oil and level recommendations.

STORAGE

A protective film is applied to the Power Wheel at the factory to prevent rust during shipment. Additional protection may be required if the Power Wheel is to be stored for an extended period of time.

SEALING COMPOUND

Silastic RTV732 sealer and General Electric Silimate RTV No. 1473 or RTV No. 1503 are currently recommended for sealing gasket surfaces. Sealant should be applied in a continuous bead, which should be centered on the surface to be sealed but should move to the inside of the hole at each bolt hole location. For service requirements order Auburn Gear part number 604101.

SPECIFICATIONS

Maximum intermittent output torque	100,000 lb. in. (11,300Nm)
Maximum input speed	5,000 RPM
Oil capacity	42 oz (1,242 ml)

ITEM NO.	DESCRIPTION*	NO. USED IN ASS'Y.	ITEM NO.	DESCRIPTION*	NO. USED IN ASS'Y.
1	Output Shaft or Spindle	1	11	Ring Gear	1
2	Oil Seal 14-00-044-011	1	12	Secondary Carrier Assembly	1
3	Bearing Cone 14-00-133-007	1	13	Primary Carrier Assembly	1
4	Bearing Cup 14-00-133-006	1	14	Primary Sun Gear	1
5	Pipe Plug 03-04-101-09	1-2	15	Thrust Washer	1
6	Hub	1	16	Cover	1
7	Bearing Cup 14-00-133-008	1	17	Magnetic Plug 14-00-052-002	1
8	Bearing Cone 14-00-133-009	1	18	Flat Washer	12
9	Thrust Washer 14-05-193-003	1	19	Hex Head Bolt (Grade 8)	12
10	Retaining Ring Kit 14-05-410-001	1	20	Pipe Plug 03-04-101-01	1

* Contact Auburn Gear with part number and order code of drive to obtain the appropriate parts list. Refer to parts list for the specific part numbers and quantities.

Model 8 Power Wheel® Service Kits

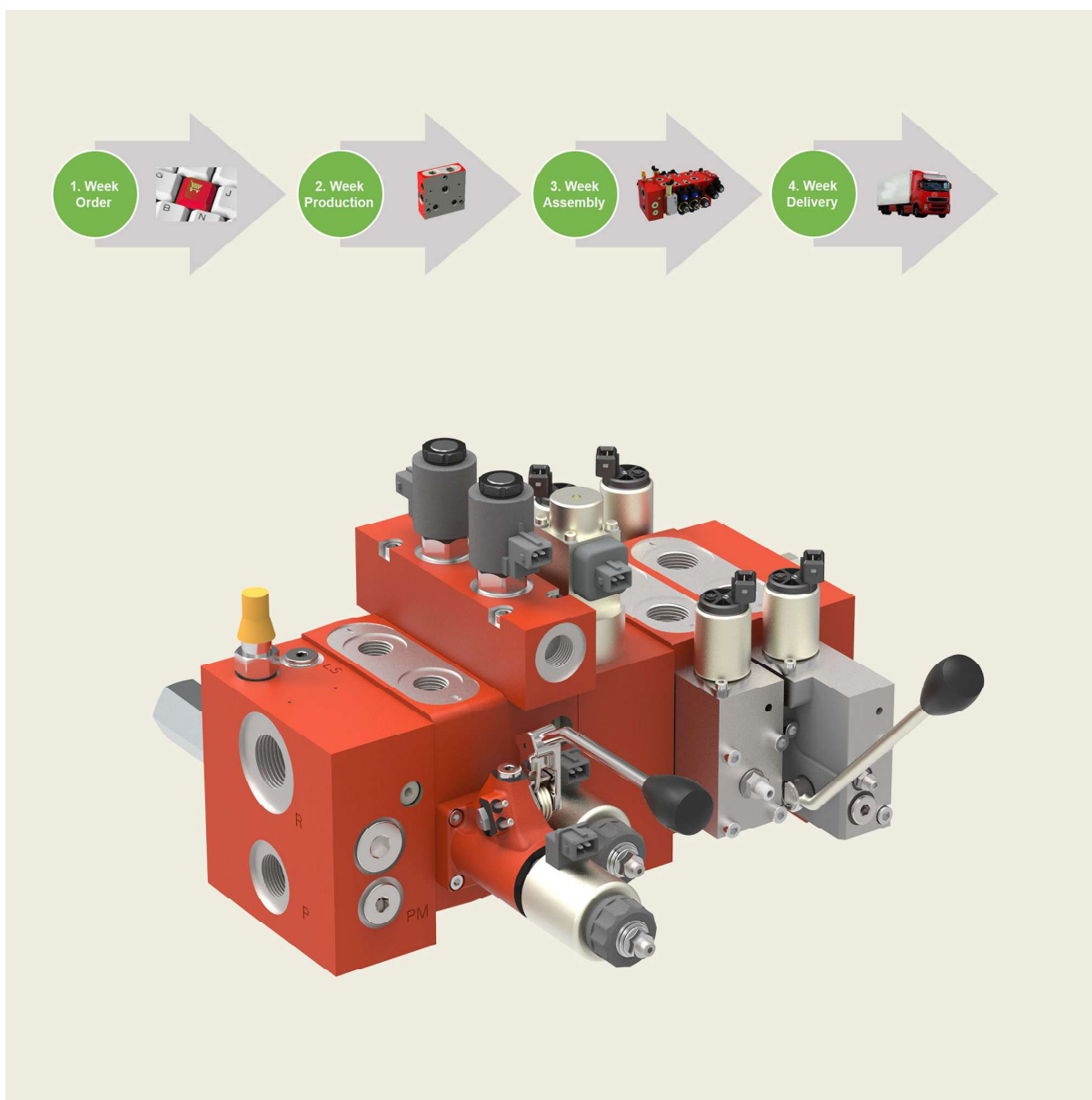
Part No.	Description	Included Items
14-05-410-001	Retaining Ring Kit	10 (6 Retaining Rings)
641011**	Bearing and Seal Kit	2, 3, 4, 7, 8 and 10
641018**	Seal Kit	2 and 10

** Indicates kit also includes a tube of sealant, part number 604101.

ITEM	QTY	PART NO.	DESCRIPTION	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	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Proportional Directional Valves

Series LVS08 and LVS12 – Preference program



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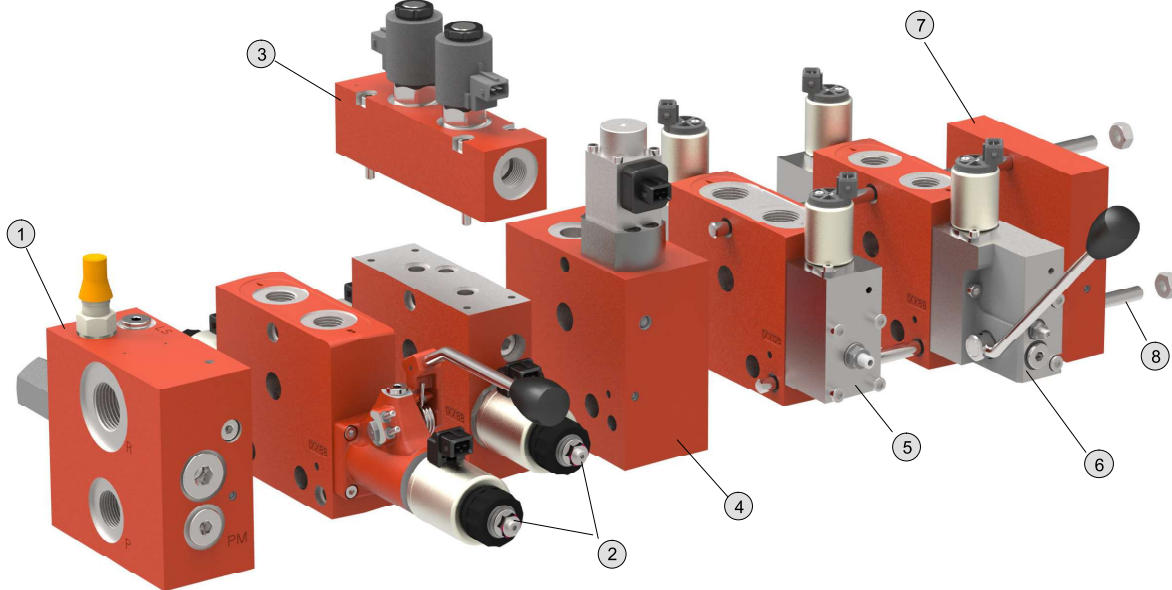
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1 General description

Manufacturers of machinery and equipment depend on fast response times and the reliable supply of machine components. By using the preference programme shown in this

publication, you benefit from the straightforward ordering and on-time delivery of the fast-moving products from the LVS proportional directional valve modules.



Item	Description
1	Inlet section
2	Direct acting, solenoid-operated directional valve, on/off or proportional solenoid
3	Bolt-on section
4	Intermediate section
5	2-stage, proportional, electrohydraulically operated directional valve
6	2-stage, proportional, electrohydraulically operated directional valve with additional manual handle
7	End section
8	Threaded tie rods

1.1 Advantages

- Short and reliable lead times (we maintain an inventory of preferred products)
- Reduced customer inventories
- Rapid reaction time to changes in customer- and market-requirements
- Adaptable valve-block configuration

1.2 Application examples

- Agricultural equipment
- Forestry machines
- Construction equipment
- Transportation and materials handling
- Municipal vehicles and equipment

1.3 Pump systems

1.3.1 System with fixed-displacement pump

The valve block includes a 3-way pressure compensator, directional sections and block termination components. In the neutral position, the 3-way pressure compensator is unloaded to tank and the entire flow being supplied to the valve passes through the 3-way compensator to tank with minimal off-load pressure drop.

When a directional section is operated, the actuator pressure is signalled to the 3-way pressure compensator. The 3-way compensator maintains the Δp at a constant level. So the flow rate is independent of the load and proportional to the open flow area of the metering orifice in the directional valve.

1.4 General technical data

General characteristics	Unit	Description, value
Recommended mounting orientation		With spool axis horizontal
Fluid temperature	°C	-20 ... +80
Viscosity range	mm ² /s	For reliable operation 380 ... 10 For rated performance 80 ... 20
Minimum fluid cleanliness level		ISO 4406 code 20/18/15
Pressure	bar	LVS08 pump port max. 250 actuator port max. 280 tank port max. 200 static LVS12 pump port max. 300 ¹⁾ actuator port max. 320 ¹⁾ tank port max. 50 static
Flow rate	l/min	Maximum flow rate at the P inlet = 260 ¹⁾ Maximum flow rate at the actuator ports = 180 with control Δp of 12 bar
Hydraulic fluid		Recommendation: high-quality fluids with a mineral-oil base, such as HLP oils to DIN 51524 part 2. Biodegradable oils in groups HEES and HEPG can be used if the manufacturer's instructions are followed. For other fluids please contact Bucher Hydraulics.
Valve block size		Max. 10 directional sections per valve block

1) For higher pressures and flow rates, please enquire.

2 Inlet sections



2.1 General technical data

General characteristics	Unit	Description, value
Inlet pressure	bar	max. 300 ¹⁾
Nominal flow rate Open-Center systems	l/min	max. 200
Nominal flow rate Closed-Center systems	l/min	max. 260
Nominal flow rate, A and B to T	l/min	max. 300

1) For higher pressures, please enquire.

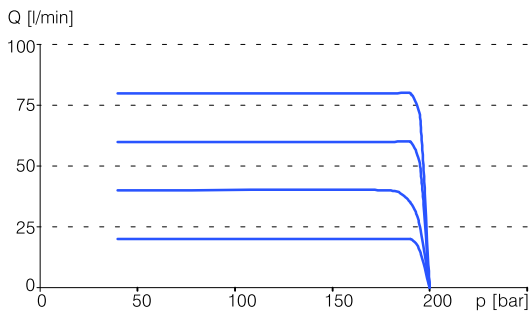
2.2 Characteristic curves

2.2.1 Priority valve

With no flow to downstream actuators

Q [l/min] = priority flow

p [bar] = load pressure at priority actuator

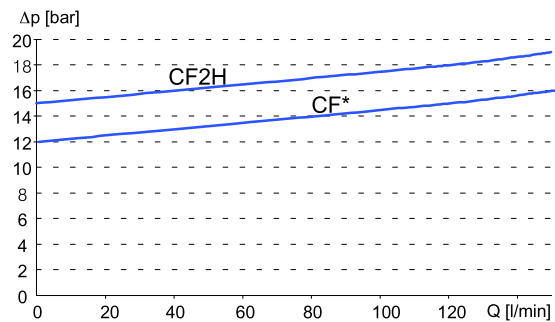


This characteristic curve is valid in conjunction with inlet sections that have an additional priority function.

2.2.2 Bypass pressure with 3-way pressure compensator in neutral position

Q [l/min] = flow rate through the block

Δp [bar] = pressure drop from P to T



Definition of the inlet sections see section 2.4.2.

2.3 Functions

2.3.1 LS Unloading

The most highly loaded directional valve signals its load pressure to the LS gallery when it is in a working position. In the neutral position, no load is signalled. In the proportional flow-sharing system, all control valves are connected to the same load-sensing pressure. This means that pressure unloading in the neutral position is ensured by a controlled connection to tank (Q_{LS} approx. 0.7 l/min).

2.3.2 LS_{max} pressure relief

The LS_{max} pressure relief setting at the valve block have to set below the pressure cut-off setting of the pump. Without this pressure-relief function, all activated actuators stop

when any actuator reaches its end-position. If this is not a disadvantage in a system, the LS_{max} pressure-relief function in the valve block is not required.

IMPORTANT: the pressure setting at the LS pump have to be higher than the LS_{max} pressure relief by at least the $LS-\Delta p$ of the pump (see also section 4.4.4)

2.3.3 3-way pressure compensator

The 3-way pressure compensator keeps the pressure difference between the pressure and control galleries inside the block at a constant level. The rest flow passes to tank or to the rest-flow port.

2.3.4 2-way pressure compensator

In the inlet section, the 2-way pressure compensator is needed to convert a higher inlet pressure into a lower, controlled working pressure.

This circuit is needed when several control blocks, each with a different working pressure, are incorporated in the overall system and one of these hydraulic circuits has to be regulated to a lower pressure level.

If the pressure in the control line reaches the setting of a pressure relief valve, the pressure compensator shuts off the supply to the hydraulic circuit. In this way, a constant pressure level is achieved in the respective hydraulic circuit.

2.3.5 Pressure control in P line

Direct-acting pressure-relief function in the inlet flow in P line.

2.3.6 2-stage pressure relief (only in conjunction with 3-way pressure compensator)

If the pressure in the control line reaches the setting of an upstream pressure-relief valve, the 3-way compensator opens to tank, thus limiting the pressure in the pressure gallery inside the block.

2.3.7 External priority function, with "Dynamic Flow" in the LS line

An external actuator always has priority when flow is supplied by pump. Only when the external priority is completely supplied, rest flow will feed the block functions. A defined oil flow runs through the LS line to the priority actuator. This has the effect of shortening the priority function's reaction time.

2.3.8 LS pressure relief in the priority flow

If the pressure in the control line reaches the LS pressure-relief setting, the flow to the priority actuator is reduced until the pressure in the LS line equals the setting of the pressure-relief valve. The flow that is no longer required is now available to other actuators.

2.3.9 LS shut-off

In the type LVS-E-CCL... inlet sections for closed-center operation (LS pump), an additional LS shut-off is implemented using a seat-type directional cartridge valve.

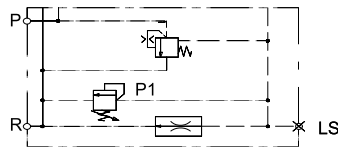
This safety shut-off is used to interrupt the LS signal from the control block to the pump (by connecting the LS signal inside the block directly to tank).

2.4 Overview inlet sections

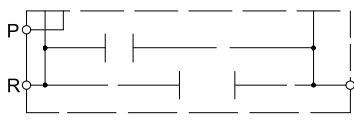
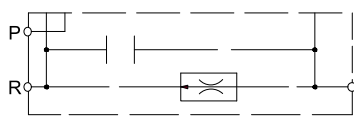
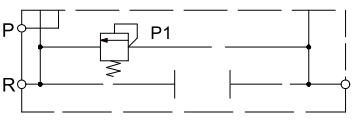
2.4.1 Overview of items, with part number

Model code	Part number	Model code	Part number
LVS-E-CF*-G110A00/P1=	100030365	LVS-E-CCL-G110J24A53/P1=	100033188
LVS-E-CAP-G110A00	100027317	LVS-E-CCL-G110J12A48/P=/P1=	100036604
LVS-E-CB*-G110A00	100030496	LVS-E-CCL-G110J24A48/P=/P1=	100033704
LVS-E-CE*-G110A01/P1=	100029646	LVS-E-CF2-G110A00/P1=	100031115
LVS-E-CE*-G110A48/P=P1=	100032849	LVS-E-CF2H-G110A00/P1=	100036559
LVS-E-CE*-B110A42/P=P1=	100032566	LVS-E-CME-G101A54/P2=	100032775
LVS-E-CCL-G110J12A53/P1=	100036603	LVS-E-CGE-G100A00/P2=/P3	100027273

2.4.2 Inlet sections for systems with fixed-displacement pump (Open Center)

Symbol	Description	Part number
	LVS-E-CF*-G110A00/P1=	100030365
	• 3-way compensator • LS_{max} pressure relief adjustable, $P1 =$ • Two-stage pressure relief, $P1 =$ • Control $\Delta p = 12 \text{ bar}$ • Q_{in} up to 200 l/min • Port threads: P and R = G1" ⇒ Give the pressure setting P1 in bar with the ordering information This results in $P = P1 (LS_{max}) + \Delta p$	

2.4.3 Inlet sections for systems with load-sensing pump (Closed Center)

Symbol	Description	Part number
	LVS-E-CAP-G110A00 • Q_{In} = up to 260 l/min • Port threads: P and R = G 1", LS = G 1/4"	100027317
	LVS-E-CB*-G110A00 • LS-unloading • Q_{In} = up to 260 l/min • Port threads: P and R = G 1", LS = G 1/4"	100030496
	LVS-E-CC*-G110A00/P1= • LS_{max} pressure relief, fixed setting, P1 = e.g. 210 bar • Choice of LS_{max} pressures P1 [bar]: 100, 125, 140, 160, 175, 190, 210, 230, 250, 280, 300 • Q_{In} = up to 260 l/min • Port threads: P and R = G 1", LS = G 1/4" ⇒ Give the pressure setting P1 in bar with the ordering information This results in $P = P1 (LS_{max}) + \Delta p$	see ordering code

L V S - E - C C * - G 1 1 0 A 0 0 / P 1 =

Inlet section

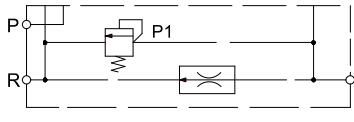
Function: without LS unloading
with LS_{max} pressure relief = CC*

Port threads to DIN 3852 - Part 2

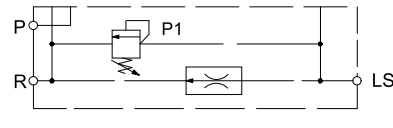
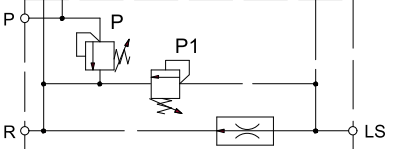
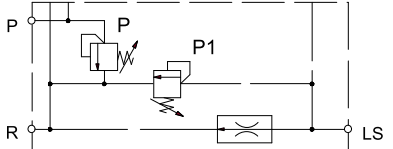
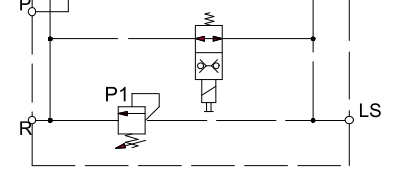
Design stage

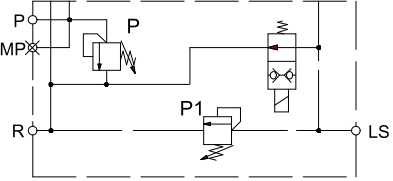
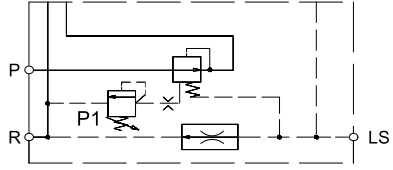
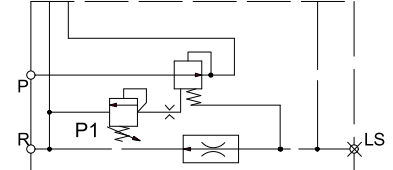
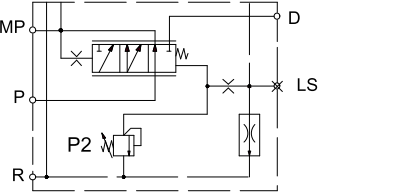
Option

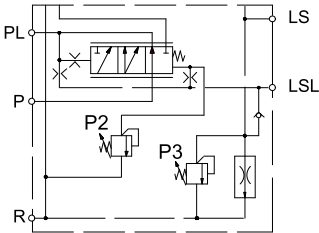
LS_{max} pressure setting P1 [bar]: 100, 125, 140, 160, 175, 190, 210, 230, 250, 280, 300

	LVS-E-CE*-G110A00/P1= • LS-unloading • LS_{max} pressure relief, fixed setting, P1 = e.g. 210 bar • Selection of LS_{max} pressures P1 [bar]: 100, 125, 140, 160, 175, 190, 210, 230, 250, 280, 300 • Q_{In} = up to 260 l/min • Port threads: P and R = G 1", LS = G 1/4" ⇒ Give the pressure setting P1 in bar with the ordering information This results in $P = P1 (LS_{max}) + \Delta p$	see ordering code
---	--	-------------------

	L	V	S	-	E	-	C	E	*	-	G	1	1	0	A	0	0	/	P	1	=	
Inlet section																						
Function: with LS unloading with LS _{max} pressure relief																						
Port threads to DIN 3852 - Part 2																						
Design stage																						
Option																						
LS _{max} pressure setting P1 [bar]:																						

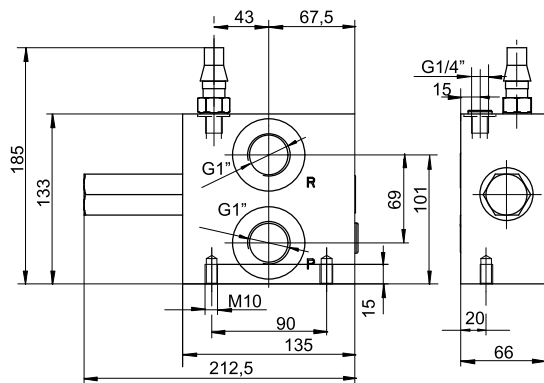
	LVS-E-CE*-G110A01/P1=	100029646
	• LS-unloading • LS_{max} pressure relief adjustable, P1 = • Q_{In} = up to 260 l/min • Port threads: P and R = G1", LS = G1/4" ⇒ Give the pressure setting P1 in bar with the ordering information This results in $P = P1 (LS_{max}) + \Delta p$	
	LVS-E-CE*-G110A48/P=/P1=	100032849
	• LS-unloading • LS_{max} pressure relief adjustable, P1= • Pressure relief can be set in the P inlet, Q = 140 l/min, P = • Q_{In} = up to 260 l/min • Port threads: P and R = G1", LS = G1/4" ⇒ Give the pressure setting P and P1 in bar with the ordering information This results in $P = P1 (LS_{max}) + \Delta p$	
	LVS-E-CE*-G110A42/P=/P1=	100032566
	• LS-unloading • LS_{max} pressure relief adjustable, P1= • Pressure relief can be set in the P inlet, Q = 60 l/min, P = • Q_{In} = up to 260 l/min • Port threads: P and R = G1", LS = G1/4" ⇒ Give the pressure setting P and P1 in bar with the ordering information This results in $P = P1 (LS_{max}) + \Delta p$	
	LVS-E-CCL-G110J12A53/P1= (12 V DC) LVS-E-CCL-G110J24A53/P1= (24 V DC)	100036603 100033188
	• Electrical LS-disable via 2/2 seat valve, de-energised open • LS_{max} pressure relief adjustable, P1= • Q_{In} up to 260 l/min • Port threads: P and R = G1", LS = G1/4" ⇒ Give the pressure setting P1 in bar with the ordering information This results in $P = P1 (LS_{max}) + \Delta p$	

 Note: • Test port for P inlet	<table border="1"> <tr> <td>LVS-E-CCL-G110J12A48/P=/P1= (12 V DC)</td><td>100036604</td></tr> <tr> <td>LVS-E-CCL-G110J24A48/P=/P1= (24 V DC)</td><td>100033704</td></tr> </table> • Electrical LS-disable via 2/2 seat valve, de-energised open • LS_{max} pressure relief adjustable, P1= • Q_{In} up to 260 l/min • Pressure relief can be set in the P inlet, $Q = 140$ l/min • Port threads: P and R = G1", LS = G1/4" ⇒ Give the pressure setting P and P1 in bar with the ordering information This results in $P = P1 (LS_{max}) + \Delta p$	LVS-E-CCL-G110J12A48/P=/P1= (12 V DC)	100036604	LVS-E-CCL-G110J24A48/P=/P1= (24 V DC)	100033704
LVS-E-CCL-G110J12A48/P=/P1= (12 V DC)	100036604				
LVS-E-CCL-G110J24A48/P=/P1= (24 V DC)	100033704				
	<table border="1"> <tr> <td>LVS-E-CF2-G110A00/P1=</td><td>100031115</td></tr> </table> • 2-way compensator • LS-unloading • Flow cut-off, adjustable P1 = • Control $\Delta p = 12$ bar • Q_{In} up to 150 l/min • Port threads: P and R = G1", LS = G1/4" ⇒ Give the pressure setting P1 in bar with the ordering information This results in $P = P1 (LS_{max}) + \Delta p$	LVS-E-CF2-G110A00/P1=	100031115		
LVS-E-CF2-G110A00/P1=	100031115				
	<table border="1"> <tr> <td>LVS-E-CF2H-G110A00/P1=</td><td>100036559</td></tr> </table> • 2-way compensator • LS-unloading • Flow cut-off, adjustable P1 = • Control $\Delta p = 15$ bar • Q_{In} up to 180 l/min • Port threads: P and R = G1", LS = G1/4" ⇒ Give the pressure setting P1 in bar with the ordering information This results in $P = P1 (LS_{max}) + \Delta p$	LVS-E-CF2H-G110A00/P1=	100036559		
LVS-E-CF2H-G110A00/P1=	100036559				
 Note: • Test port for P inlet	<table border="1"> <tr> <td>LVS-E-CME-G101A54/P2=</td><td>100032775</td></tr> </table> • Internal priority function • Control $\Delta p = 9$ bar • LS-unloading • LS_{max} pressure relief, priority flow, adjustable P2= • Q_{In} up to 200 l/min • Rest flow at port D = 200 l/min • Port threads: P and R = G1", MP and LS = G1/4" ⇒ Give the pressure setting P2 in bar with the ordering information This results in $P = P2 (LS_{max}) + \Delta p$ Description: The LVS valve sections mounted after the inlet section are given priority supply. The maximum pressure for priority- and surplus-flow is set using P2. The rest flow is available at port D.	LVS-E-CME-G101A54/P2=	100032775		
LVS-E-CME-G101A54/P2=	100032775				

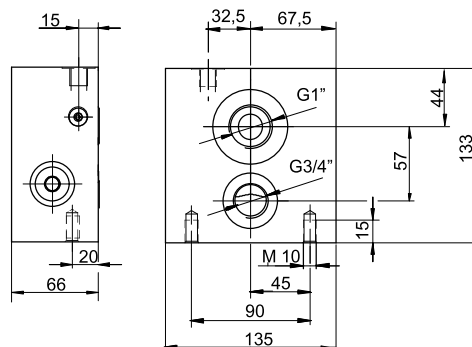
	LVS-E-CGE-G100A00/P2=/P3=	100027273
	• LS-unloading • LS_{max} pressure relief, priority flow, adjustable $P2 = / P3 =$ • Control $\Delta p = 9 \text{ bar}$ • Q_{In} up to 200 l/min • Q_D up to 80 l/min • Priority flow at port PL • Port threads: P and R = G1", PL = G1/2", LS and LSL = G1/4" ⇒ Give the pressure settings P2 and P3 in bar with the ordering information This results in $P = P2/3 (LS_{max}) + \Delta p$ Description: The priority function is routed via port PL to a prioritised external actuator and is load-independent, thanks to the pressure compensator. The maximum pressure of the prioritised flow can be limited with the P2 pressure relief function. The rest flow is available to the LVS directional valves downstream of the inlet section. The maximum pressure can be set with P3 (must be higher than the priority pressure P2). Dynamic LS: - Application with Orbitrol At port LSL there is a permanent flow of control oil of about 0.8 l/min. This is mostly used in systems with a steering function. If another valve block is connected to PL, there must be no dynamic LS (please discuss with Bucher Hydraulics).	

2.5 Dimensions

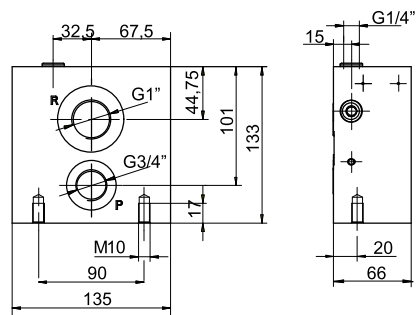
2.5.1 LVS-E-CF*-G110A00 (100030365)



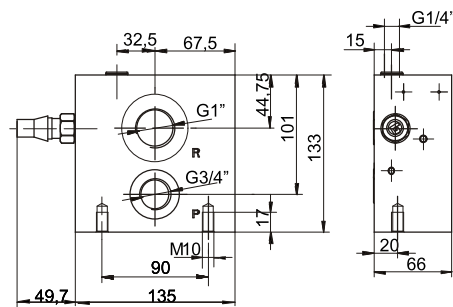
2.5.2 LVS-E-CAP-G110A00 (100027317)



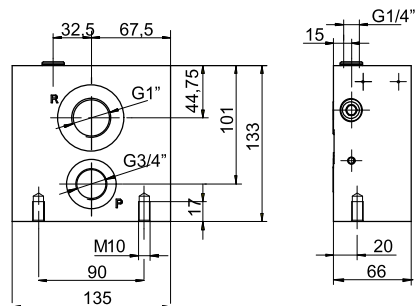
2.5.3 LVS-E-CB*-G110A00 (100030496)



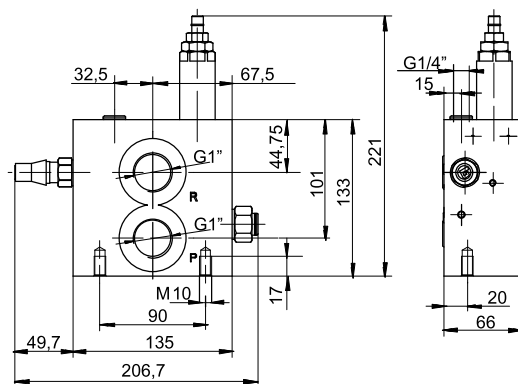
2.5.6 LVS-E-CE*-G110A01 (100029646)



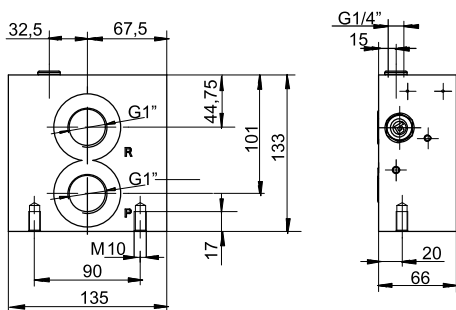
2.5.4 LVS-E-CC*-G110A00/P1=



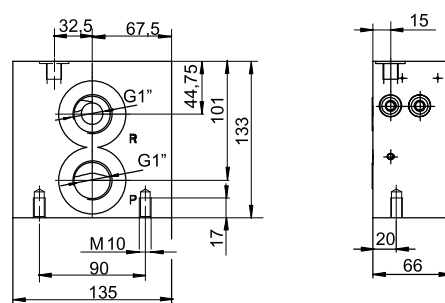
2.5.7 LVS-E-CE*-G110A48 (100032849)



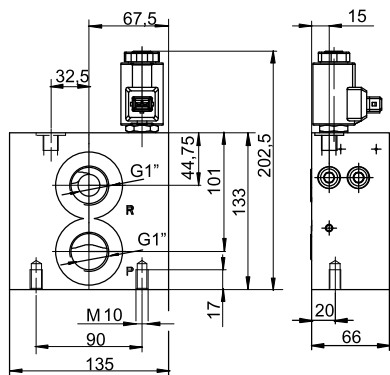
2.5.5 LVS-E-CE*-G110A00/P1=



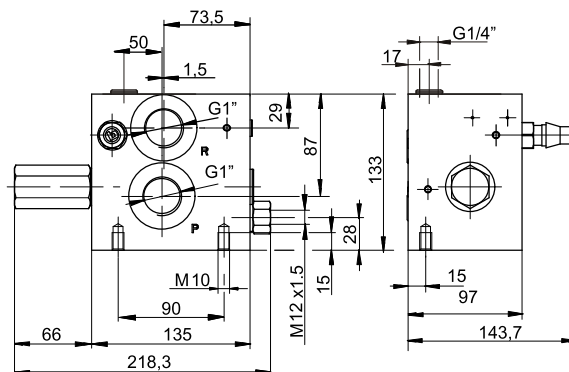
2.5.8 LVS-E-CE*-G110A42 (100032566)



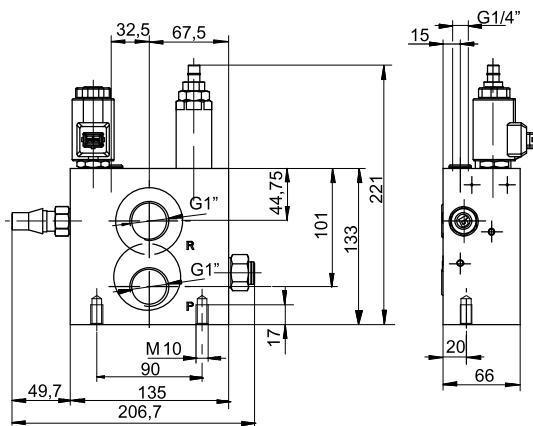
2.5.9 LVS-E-CCL-G110J12A53 (100036603)
LVS-E-CCL-G110J24A53 (100033188)



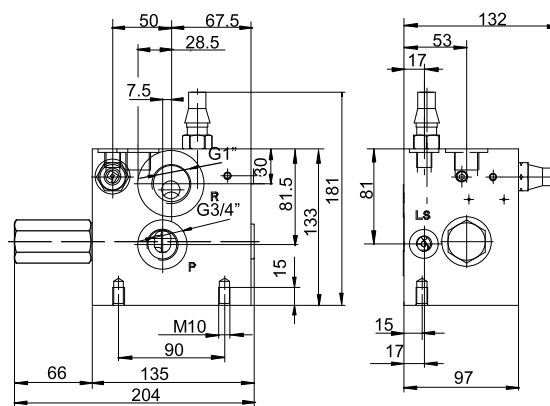
2.5.12 LVS-E-CME-G101A54 (100032775)



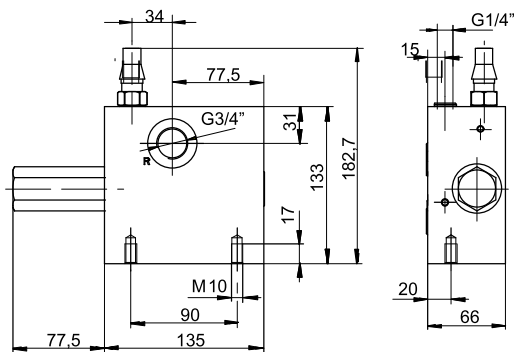
2.5.10 LVS-E-CCL-G110J12A48 (100036604)
LVS-E-CCL-G110J24A48 (100033704)



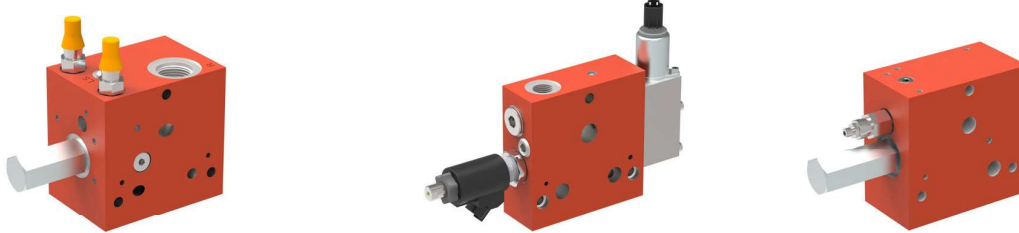
2.5.13 LVS-E-CGE-G100A00 (100027273)



2.5.11 LVS-E-CF2-G110A00 (100031115)
LVS-E-CF2H-G110A00 (100036559)



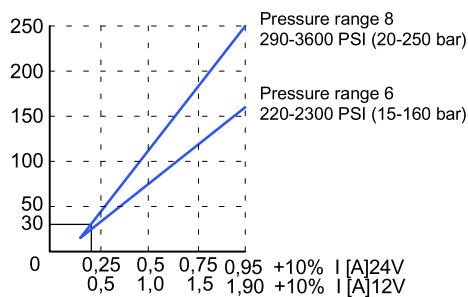
3 Intermediate sections



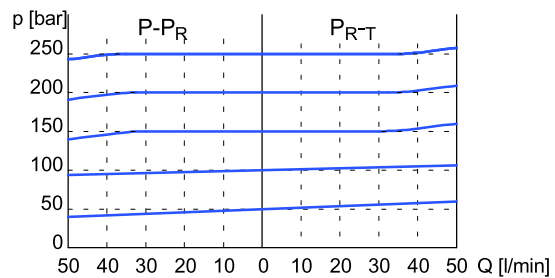
3.1 Characteristic curves

3.1.1 Adjustment range of 3-way proportional pressure-control valve

I [A] = solenoid current



3.1.2 Control characteristic as a function of flow rate

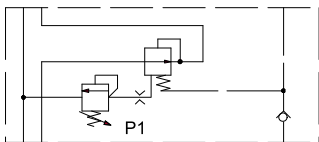


This characteristic curve is valid in conjunction with intermediate sections that have a 3-way pressure control (LVS-Z-PDR...).

3.2 Overview of items, with part number

Model code	Part number	Model code	Part number
LVS-Z-CF2-****A00/P1=	100031656	LVS-Z-PDRC6FJ-G1/2A00	100031117
LVS-Z-CME-G3/4A10/P2=/P3=	100035201	LVS-Z-PDRA8FJ-G1/2A00	100029118

3.3 Overview of intermediate sections

Symbol	Description	Part number
	LVS-Z-CF2-****A00/P1= 2-way compensator for a lower p_{max} in the downstream part of the block, pressure is adjustable • LS-unloading • Control Δp 12 bar • Flow cut-off adjustable P1= • Q_{Nom} up to 180 l/min ⇒ Give the pressure setting P1 in bar with the ordering information This results in $P = P1 + 12$ bar	100031656

	LVS-Z-CME-G3/4A10/P2=/P3=	100035201
	LVS-Z-BHR...-G1/2...B1000/P=...	see ordering code

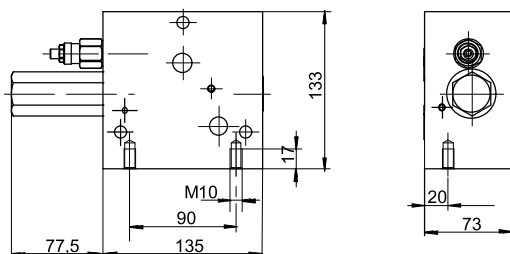
LVS - Z	- BHR	- G1/2	-	B	1000	/ PB =
Intermediate section						
Function						
Actuator flow rate [l/min]: 16, 25, 32, 40, 50, 63, 80, 100	= 016 - 100					
Port threads to DIN 3852 - Part 2 B	= G½"					
Plug type AMP Junior Timer = J	Deutsch plug DT04-2P-EP04 = T					
Supply voltage 12V DC = 12	24V DC = 24					
Design stage						
Option						
Pressure range PB [bar]:	50, 63, 80, 100, 125, 140, 160, 175, 190, 210, 230, 250, 280, 300					

	LVS-Z-PDRC6FJ-G1/2A00 (12 V DC)	100031117
	3-way proportional pressure control of actuators; preferred in applications that require a supporting or counterbalancing pressure. E.g. ground-guided equipment such as snow ploughs, mowers, harvesting systems,	
	• 3-way pressure reducing valve • Controllable pressure range 15-160 bar • $Q_{\text{Actuator}} = 40 \text{ l/min}$	
		Port thread B = G½"

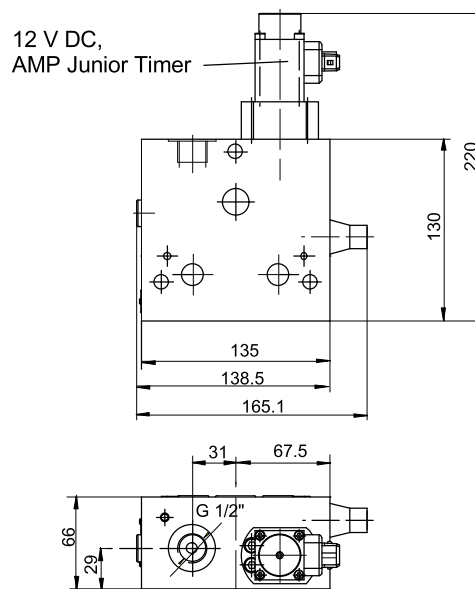
	LVS-Z-PDRA8FJ-G1/2A00 (12 V DC)	100029118
	3-way proportional pressure control of actuators; preferred in applications that require a supporting or counterbalancing pressure. E.g. ground-guided equipment such as snow ploughs, mowers, harvesting systems,	
	• 3-way pressure reducing valve • Controllable pressure range 20-250 bar • $Q_{\text{Actuator}} = 40 \text{ l/min}$	
		Port thread B = G $\frac{1}{2}$

3.4 Dimensions

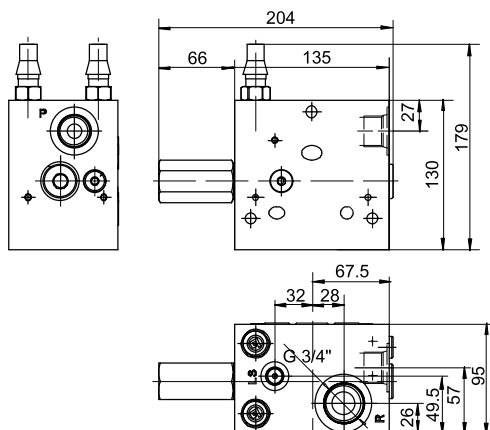
3.4.1 LVS-Z-CF2-****A00 (100031656)



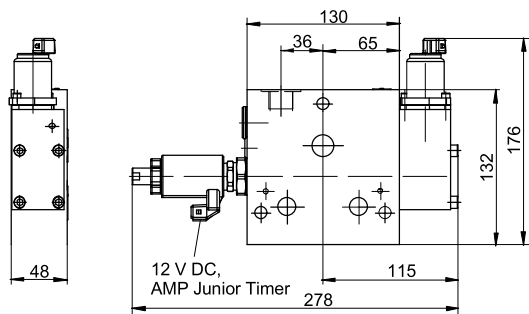
3.4.4 LVS-Z-PDRC6FJ-G1/2A00 (100031117 / 100029118)



3.4.2 LVS-Z-CME-G3/4A10 (100035201)



3.4.3 LVS-Z-BHR100-G1/2J12A..



4 Directional valve sections

Directional valve series LVS08 and LVS12 can be freely combined. Ideally, the LVS12 sections are the first ones after the inlet section, followed by the LVS08 sections.

4.1 General technical data

Description	LVS08	LVS12
Control types:		
- direct acting ON/OFF solenoid	X	-
- direct acting proportional solenoid	X	-
- two-stage, proportional, electrohydraulically operated	-	X
Nominal flow rate [l/min]	50	180
Maximum inlet pressure [bar]	250	300 ¹⁾
Maximum pressure at the actuator ports A and B [bar]	280	320 ¹⁾
Possible additional functions:		
- separate, proportional flow rates for A and B per valve section		X
- pressure relief and make-up function		X
- electrically operated seat valves (integral)	X	-
- manual override by pin	X	X
- manual override by hand lever	X	X
- spool-stroke limiter	-	X
- bolt-on plate with seat valves	X	-
- bolt-on plate with load-control valves	X	-

1) For higher pressures and flow rates, please enquire.

4.2 Technical data for pressure relief / make-up valve

General characteristics	Unit	Description, value
Nominal flow rate	l/min	60 permissible tolerance = +/- 10% at $Q_{in} = 3$ l/min

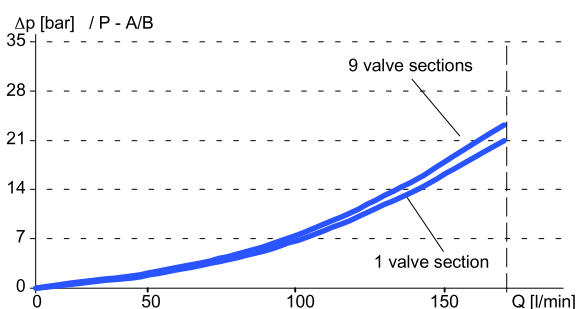
4.3 Characteristic curves

4.3.1 Spool in maximum operating position

Measured with spool type O = 180 l/min

Q [l/min] = flow rate $P \rightarrow A/B$ and $A/B \rightarrow T$

Δp [bar] = pressure drop $P \rightarrow A/B$ and $A/B \rightarrow T$

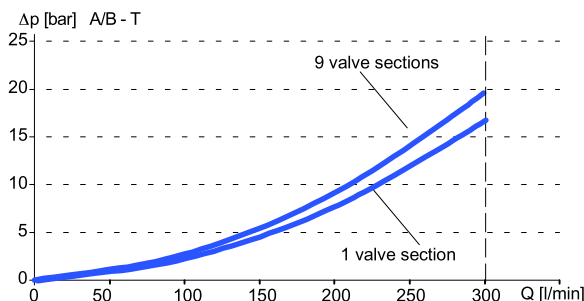


4.3.2 Pressure drop with individual operation

Measured with spool type O = 180 l/min

Q [l/min] = flow rate $A/B \rightarrow T$

Δp [bar] = pressure drop $A/B \rightarrow T$



4.4 Functions

4.4.1 Directional function

3-way valves have only one actuator port. 4-way valves are designed for double-acting actuators.

4.4.2 Two independent 3/2 prop. directional valves

Spool types 6A and 6D are designed to supply 2 motor drives.

By dividing the control spool 6A, 2 motor drives can be implemented in parallel, and independently of one another, in one valve body.

4.4.3 Load-independent operation

When several valves are operated simultaneously, the highest actuator pressure is signalled to the 3-way pressure compensator or to the pump control. The control pressure-difference of the system pressure control (3-way pressure compensator, variable-delivery pump) acts directly on the most highly loaded actuator and ensures load-independent control. The lower loaded actuators can be made load-independent by using individual section compensators.

4.4.4 LS-max pressure relief

If no oil flows out from an actuator port although the valve is in an operated position (e.g. cylinder at end-stop), the P pressure is signalled in the LS ring circuit behind all compensators. The compensators in the individual functions would now also close due to their spring forces, and all actuators would remain stationary.

To prevent this from happening, the LS_{max} pressure is limited by a pressure-relief function. The discharge of LS flow reduces the pressure before the LS ring circuit, which results in the planned Δp being kept constant. The actuators in the system now operate without any malfunction.

4.4.5 Pressure compensator function

With the LVS08 valve series, there are two versions of the pressure compensator. The standard pressure compensator can be used in all applications and functions.

There is also a pressure compensator that can be configured for improved fine control. To increase the functional stability, this variant is the preferred choice for oscillation-critical functions (usually motor functions).

4.4.6 Pressure relief and make-up function

The pressure relief valves protect actuators from unacceptably large pressure peaks when the actuator is operated or when external forces act on the actuator. The make-up (anti-cavitation) function supplies oil to the actuator when the tank pressure is higher than the actuator pressure.

4.4.7 Load sensing

By means of the load sensing system, the highest prevailing actuator pressure is signalled to all proportional flow-sharing valves.

4.4.8 Conversion factors

Without changing the spool position, the flow rate at the actuator ports can be changed by altering the LS Δp setting at the compensator or pump controller. The corresponding conversion factors are shown in the following table.

Actuator flow rate for each spool is defined at 12 bar.

LS p	Conversion factor
6 bar	0.7
8 bar	0.8
9 bar	0.86
12 bar (standard)	1.0
15 bar	1.12
16 bar	1.15
18 bar	1.25
20 bar	1.30

4.4.8.1 Example

$LS \Delta p$ 18 bar
 spool 120 l/min
 $120 \times 1,25 = 150 \text{ l/min}$
 = max. flow rate achieved at 18 bar control Δp

4.4.9 Spool types for the directional valve sections

A spool	Actuator flow closed to tank in middle position.
D + J spools	Actuator connected to tank in the middle position
4A + 4D spools	For double-acting actuators
3A + 3J spools	For single-acting actuators
6A + 6D spools	Split spool, for two single-acting actuators in one section.

5 Directional sections LVS08 – with ON/OFF or proportional solenoids



5.1 General technical data

Description	Unit	ON/OFF solenoid	Proportional solenoid
Maximum flow rate	l/min	50	
Maximum inlet pressure	bar	250	
Maximum inlet pressure with manual operation	bar	250	
Maximum pressure at the actuator ports	bar	280	
Maximum pressure at the actuator ports with manual operation	bar	280	
Spool increments by actuator flow rates at 12 bar Δp	l/min	6 (A), 10 (B), 16 (C), 25 (D), 32 (E), 40 (F), 50 (P)	
Power consumption and voltage tolerance $\pm 10\%$	W	30	max. 30 at 2.5 A / 12 V max. 30 at 1.25 A / 24 V
Energising current	A		0.8 - 2.5 for 12 V 0.4 - 1.25 for 24 V
Duty cycle	%	100% (2.5 A / 12 V or 1.25 A / 24 V)	
Protection class		AMP Junior Timer: Deutsch plug DT04:	IP65 IP67 (DIN EN 60529)
Override pin Φ		6	2

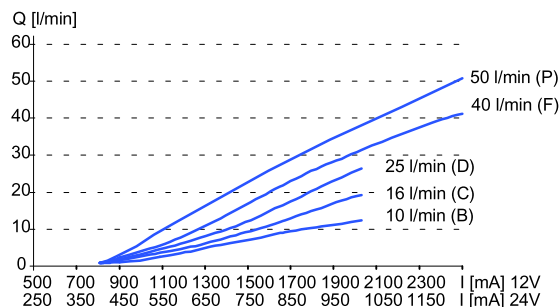
Main characteristics of the seat valves	Unit	Description, Value
Maximum flow rate	l/min	50
Power consumption	W	20
Voltage tolerance	%	+/- 10
Coil resistance	Ω	7.4 for 12 V 28.4 for 24 V
Switching time: opening closing	msec	50 100

5.2 Characteristic curve

5.2.1 Control characteristic

Valve with proportional solenoid and 12 bar pressure drop at the orifice.

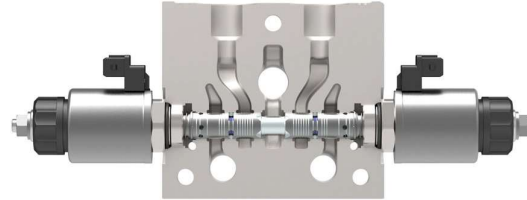
Q [l/min] = flow rate at the actuator outlet port
I [mA] = current at the proportional solenoids



5.3 LVS08 Standard

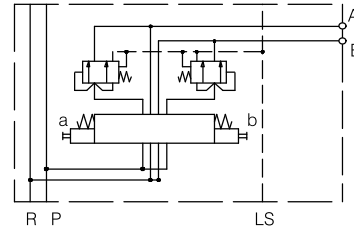
5.3.1 Standard version

- Port threads for actuator A + B = G $\frac{1}{2}$ "
- Pressure compensator in A and B
- Override pin



5.3.2 Freely configurable functions

- Flow rate
- Spool type in mid-position
- Compensator function
- Control type (proportional solenoid or ON/OFF)
- Plug type



5.3.3 Options menu

Spool type	3A	3J	4A	4D
06 l/min at B (A closed)	=	*A3J	06 l/min at A and B =	AA4A
10 l/min at B (A closed)	=	*B3J	10 l/min at A and B =	BB4A
16 l/min at B (A closed)	=	*C3A	16 l/min at A and B =	CC4A
25 l/min at B (A closed)	=	*D3A	25 l/min at A and B =	DD4A
32 l/min at B (A closed)	=	*E3J	32 l/min at A and B =	EE4A
40 l/min at B (A closed)	=	*F3J	40 l/min at A and B =	FF4A
50 l/min at B (A closed)	=	*P3A	50 l/min at A and B =	PP4A

Pressure compensator function	standard	fine control ¹⁾
for actuator B	= 4	B
for actuator A	= 8	A
for actuator A + B	= 5	C

Control type	
ON/OFF solenoid 12 V	= A
ON/OFF solenoid 24 V	= B
Proportional solenoid 12V	= C
Proportional solenoid 24V	= D

Plug type	
AMP Junior Timer	= J
Deutsch plug DT04-2P-EP04	= T

1) Fine controlled compensator function for increased stability in the hydraulics systems (see section 4.4.5).

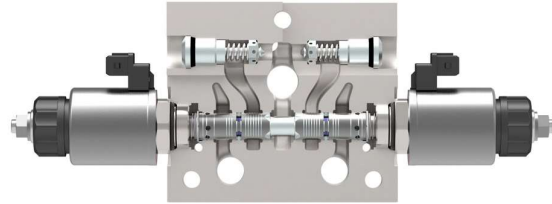
5.3.4 Plug type

AMP Junior Timer -J..-	Deutsch plug DT04-2P-EP04 -T..-

5.4 LVS08 Standard with pressure relief / make-up valve

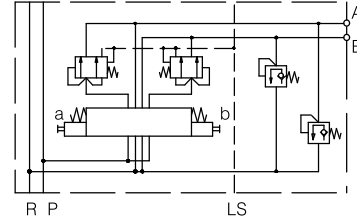
5.4.1 Standard version

- Port threads for actuator A + B = G $\frac{1}{2}$ "
- Pressure compensator in actuator A + B
- Override pin
- Pressure relief and make-up function (pressure setting selectable)



5.4.2 Freely configurable functions

- Flow rate
- Spool type in mid-position
- Pressure compensator function
- Control type (proportional solenoid or ON/OFF)
- Plug type



5.4.3 Options menu

Spool type	3A	3J	4A	4D
06 l/min at B (A closed) =		*A3J	06 l/min at A and B =	AA4A AA4D
10 l/min at B (A closed) =		*B3J	10 l/min at A and B =	BB4A BB4D
16 l/min at B (A closed) =	*C3A	*C3J	16 l/min at A and B =	CC4A CC4D
25 l/min at B (A closed) =	*D3A	*D3J	25 l/min at A and B =	DD4A DD4D
32 l/min at B (A closed) =		*E3J	32 l/min at A and B =	EE4A EE4D
40 l/min at B (A closed) =		*F3J	40 l/min at A and B =	FF4A FF4D
50 l/min at B (A closed) =	*P3A	*P3J	50 l/min at A and B =	PP4A PP4D

Pressure compensator function	standard	fine control ¹⁾
for actuator B =	4	B
for actuator A =	8	A
for actuator A + B =	5	C

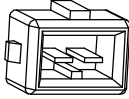
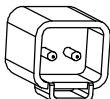
Control type	
ON/OFF solenoid 12 V	= A
ON/OFF solenoid 24 V	= B
Proportional solenoid 12V	= C
Proportional solenoid 24V	= D

Plug type	
AMP Junior Timer	= J
Deutsch plug DT04-2P-EP04	= T

Pressure relief and make-up function	
adjustable 70 - 230 bar	= A
adjustable 150 - 380 bar	= B
fixed setting (values in bar):	
25 = D, 32 = E, 40 = F, 63 = H, 80 = I, 100 = K, 125 = L, 140 = M,	
160 = N, 175 = O, 190 = P, 210 = Q, 230 = R, 250 = S, 280 = T	
Cavity prepared (closed, no function, prepared for retrofitting anti-shock valves, with plug) = #	

¹⁾ = Fine controlled compensator function for increased stability in the hydraulics systems (see section 4.4.5).

5.4.4 Plug type

AMP Junior Timer -J..-	Deutsch plug DT04-2P-EP04 -T..-
	

5.4.5 Control type

A / B



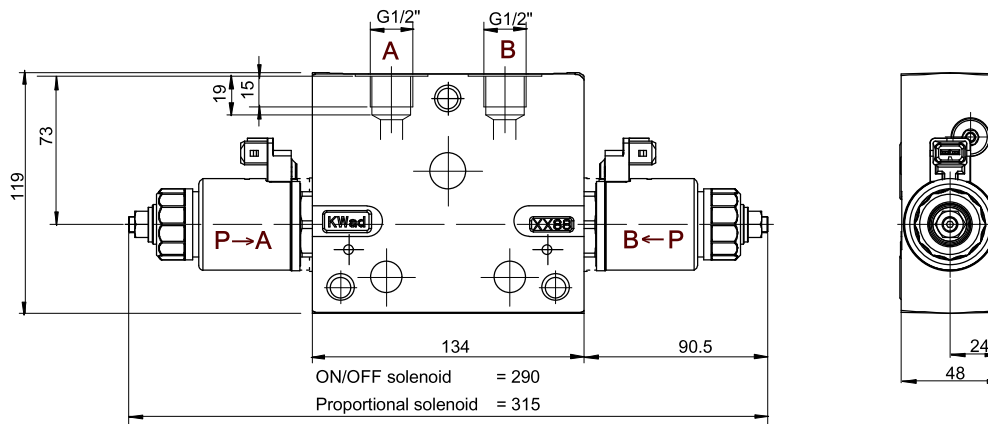
ON/OFF solenoid
with override pin

C / D



Proportional solenoid
with override pin and
starting point adjustment
(starting point is set by the
factory)

5.4.6 Dimensions



5.4.7 Ordering code

- ☐ White fields = data specified by Bucher Hydraulics
- ☐ Grey fields = data from the overview of sections 5.4.3

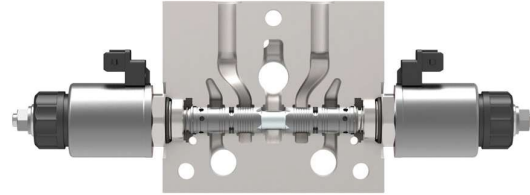
L	V	S	0	8					2	1	A	0	0	0	0	C	-															
Directional valve section size 08			Spool type			Pressure compensator function for actuator port A + B			Control type			Plug type			Port threads to DIN 3852 Part 2, actuator A and B = G1/2"			Override pin			Options			Design stage			Pressure relief/ make-up valve Actuator A cavity prepared = #			Actuator B cavity prepared = #		

For adjustable valves
Pressure setting
P_A = ... bar
P_B = ... bar

5.5 LVS08 Standard, surface for bolt-on valve

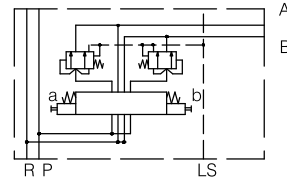
5.5.1 Standard version

- Prepared for bolt-on plate
- Pressure compensator in actuator A + B
- Override pin



5.5.2 Freely configurable functions

- Flow rate
- Spool type in mid-position
- Pressure compensator function
- Control type (proportional solenoid or ON/OFF)
- Plug type



5.5.3 Options menu

Spool type	3A	3J	4A	4D
06 l/min at B (A closed) =		*A3J	06 l/min at A and B =	AA4A AA4D
10 l/min at B (A closed) =		*B3J	10 l/min at A and B =	BB4A BB4D
16 l/min at B (A closed) =	*C3A	*C3J	16 l/min at A and B =	CC4A CC4D
25 l/min at B (A closed) =	*D3A	*D3J	25 l/min at A and B =	DD4A DD4D
32 l/min at B (A closed) =		*E3J	32 l/min at A and B =	EE4A EE4D
40 l/min at B (A closed) =		*F3J	40 l/min at A and B =	FF4A FF4D
50 l/min at B (A closed) =	*P3A	*P3J	50 l/min at A and B =	PP4A PP4D

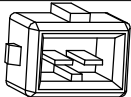
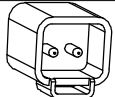
Pressure compensator function	standard	fine control ¹⁾
for actuator B =	4	B
for actuator A =	8	A
for actuator A + B =	5	C

Control type	
ON/OFF solenoid 12 V	= A
ON/OFF solenoid 24 V	= B
Proportional solenoid 12V	= C
Proportional solenoid 24V	= D

Plug type	
AMP Junior Timer	= J
Deutsch plug DT04-2P-EP04	= T

1) Fine controlled compensator function for increased stability in the hydraulics systems (see section 4.4.5).

5.5.4 Plug type

AMP Junior Timer -J..-	Deutsch plug DT04-2P-EP04 -T..-
	

5.5.5 Control types

A / B



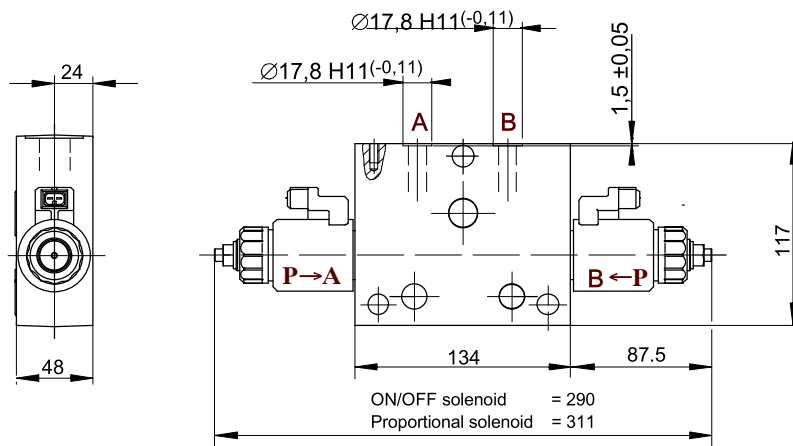
ON/OFF solenoid
with override pin

C / D



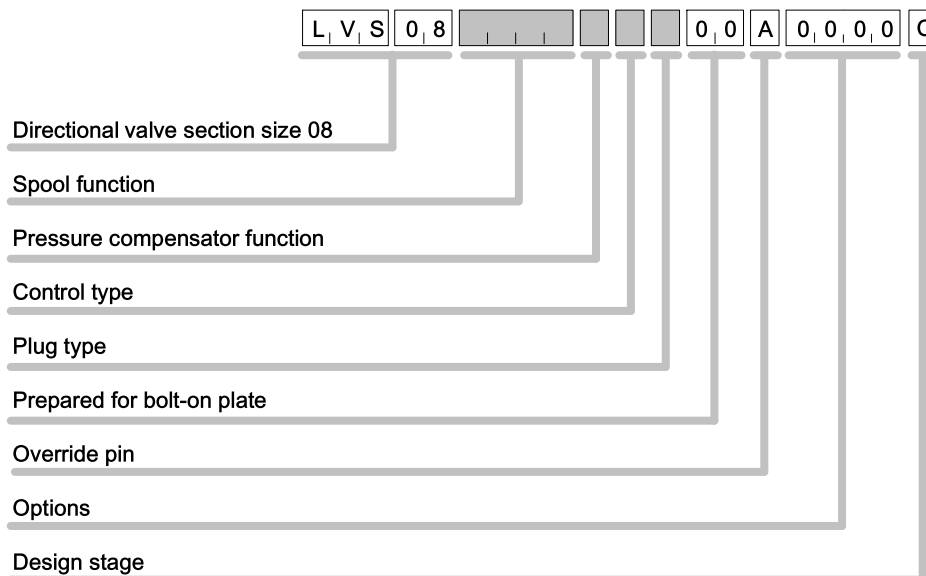
Proportional solenoid
with override pin and
starting point adjustment
(starting point is set by the
factory)

5.5.6 Dimensions



5.5.7 Ordering code

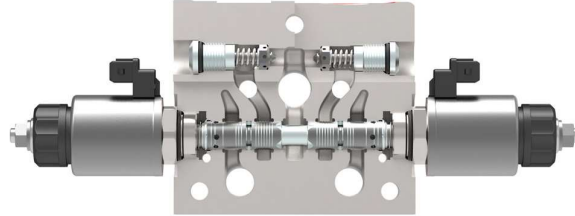
- ☐ White fields = data specified by Bucher Hydraulics
- ☒ Grey fields = data from the overview of sections 5.5.3



5.6 LVS Standard, surface for bolt-on valves, with pressure relief / make up valve

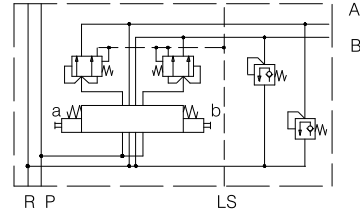
5.6.1 Standard version

- Prepared for bolt-on section
- Pressure compensator in actuator A and B
- Override pin
- Pressure relief and make-up function (pressure setting selectable)



5.6.2 Freely configurable functions

- Flow rate
- Spool type in mid-position
- Pressure compensator function
- Control type (proportional solenoid or ON/OFF)
- Plug type



5.6.3 Selection menu

Spool type	3A	3J	4A	4D
06 l/min at B (A closed)	=	*A3J	06 l/min at A and B =	AA4A
10 l/min at B (A closed)	=	*B3J	10 l/min at A and B =	BB4A
16 l/min at B (A closed)	=	*C3A	16 l/min at A and B =	CC4A
25 l/min at B (A closed)	=	*D3A	25 l/min at A and B =	DD4A
32 l/min at B (A closed)	=	*E3J	32 l/min at A and B =	EE4A
40 l/min at B (A closed)	=	*F3J	40 l/min at A and B =	FF4A
50 l/min at B (A closed)	=	*P3A	50 l/min at A and B =	PP4A

Pressure compensator function	standard	fine control ¹⁾
for actuator B	=	4 B
for actuator A	=	8 A
for actuator A + B	=	5 C

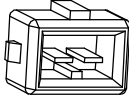
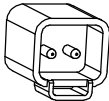
Control type	
ON/OFF solenoid 12 V	= A
ON/OFF solenoid 24 V	= B
Proportional solenoid 12V	= C
Proportional solenoid 24V	= D

Plug type	
AMP Junior Timer	= J
Deutsch plug DT04-2P-EP04	= T

Pressure relief and make-up function	
adjustable	70 - 230 bar = A
adjustable	150 - 380 bar = B
fixed setting (values in bar):	
25 = D,	32 = E, 40 = F, 63 = H, 80 = I, 100 = K, 125 = L, 140 = M,
160 = N,	175 = O, 190 = P, 210 = Q, 230 = R, 250 = S, 280 = T
Cavity prepared (closed, no function, prepared for retrofitting anti-shock valves, with plug) = #	

1) Fine controlled compensator function for increased stability in the hydraulics systems (see section 4.4.5).

5.6.4 Plug type

AMP Junior Timer -J..-	Deutsch plug DT04-2P-EP04 -T..-
	

5.6.5 Control type

A / B



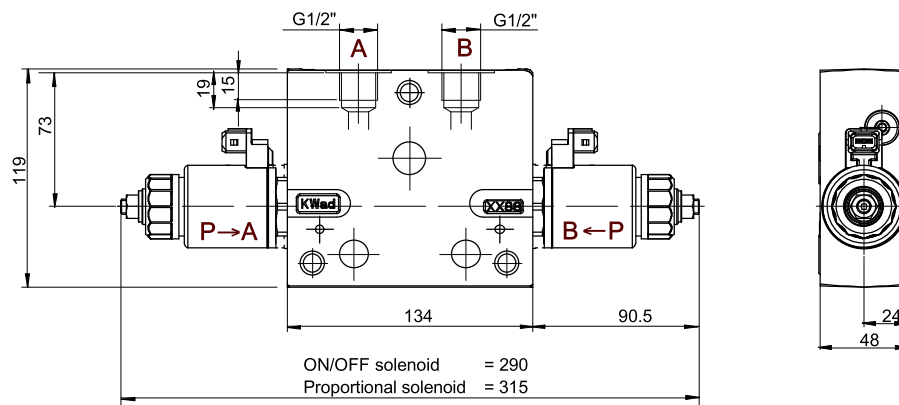
ON/OFF solenoid
with override pin

C / D



Proportional solenoid
with override pin and
starting point adjustment
(starting point is set by the
factory)

5.6.6 Dimensions



5.6.7 Ordering code

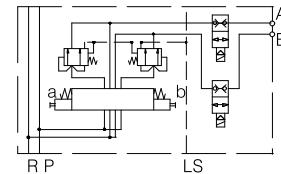
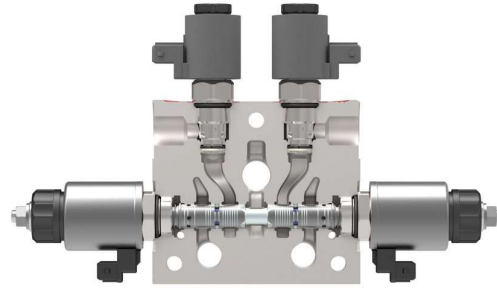
- ☐ White fields = data specified by Bucher Hydraulics
- ☐ Grey fields = data from the overview of sections 5.6.3

L	V	S	0	8					0	0	A	0	0	0	0	C																															
Directional valve section size 08				Pool type				Pressure compensator function for actuator A and B				Control type				Plug type				Prepared for bolt-on plate				Override pin				Options				Design stage				Pressure relief / make-up valve Actuator A Cavity prepared = #				Actuator B Cavity prepared = #				For adjustable valves Pressure settings P _A = ... bar P _B = ... bar			

5.7 LVS08 with integrated double seat valve

5.7.1 Standard version

- Port thread for actuator A + B = G $\frac{1}{2}$ "
- Pressure compensator in actuator A + B
- Double seat valve, solenoid operated



5.7.2 Freely configurable functions

- Flow rate
- Spool type in mid-position
- Pressure compensator function
- Control type (proportional solenoid or ON/OFF)
- Plug type

5.7.3 Selection menu

Spool type	3A	3J	4A	4D
06 l/min at B (A closed)	=	*A3J	06 l/min at A and B =	AA4A
10 l/min at B (A closed)	=	*B3J	10 l/min at A and B =	BB4A
16 l/min at B (A closed)	=	*C3A	16 l/min at A and B =	CC4A
25 l/min at B (A closed)	=	*D3A	25 l/min at A and B =	DD4A
32 l/min at B (A closed)	=	*E3J	32 l/min at A and B =	EE4A
40 l/min at B (A closed)	=	*F3J	40 l/min at A and B =	FF4A
50 l/min at B (A closed)	=	*P3A	50 l/min at A and B =	PP4A

Pressure compensator function	standard	fine control ¹⁾
for actuator B	= 4	B
for actuator A	= 8	A
for actuator A + B	= 5	C

Control type	
ON/OFF solenoid 12 V	= A
ON/OFF solenoid 24 V	= B
Proportional solenoid 12V	= C
Proportional solenoid 24V	= D

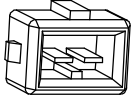
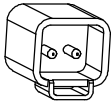
Plug type	
AMP Junior Timer	= J
Deutsch plug DT04-2P-EP04	= T

Seat valves, solenoid operated, Q _{max} 70 l/min, de-energised closed	
Double seat valve, solenoid operated, in A + B	= J8
Double seat valve, solenoid operated, in A + B with manual override, 'Knob-Style', push-and-turn	= J8D
Double seat valve, solenoid operated, in B	= J7 ²⁾
Double seat valve, solenoid operated, in B with manual override, 'Knob-Style', push-and-turn	= J7D ²⁾

1) Fine controlled compensator function for increased stability in the hydraulics systems (see section 4.4.5).

2) Can only be used with spool types 3A and 3J.

5.7.4 Plug type

AMP Junior Timer -J..-	Deutsch plug DT04-2P-EP04 -T..-
	

5.7.5 Control type

A / B



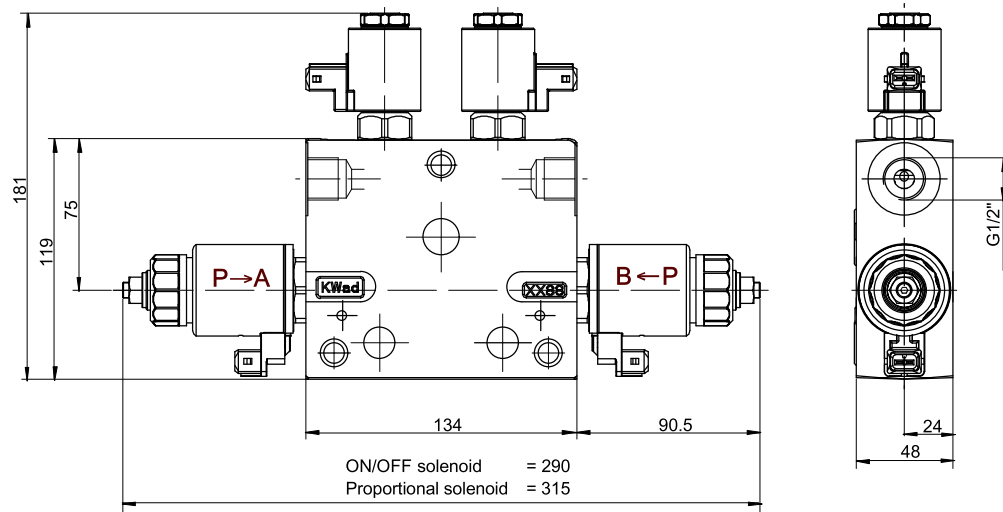
ON/OFF solenoid
with override pin

C / D



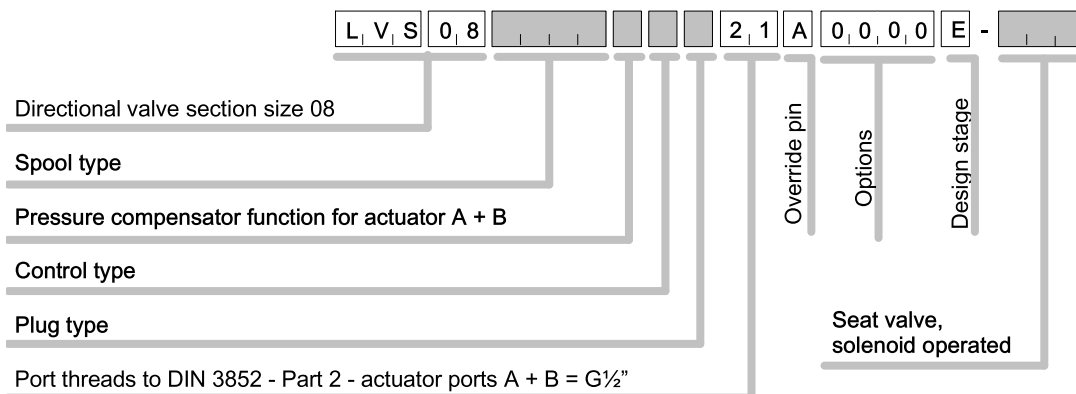
Proportional solenoid
with override pin and
starting point adjustment
(starting point is set by the
factory)

5.7.6 Dimensions



5.7.7 Ordering code

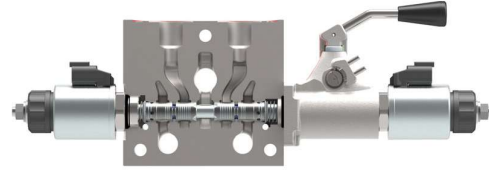
- ☐ White fields = data specified by Bucher Hydraulics
- ☒ Grey fields = data from the overview of sections 5.7 3



5.8 LVS08 with additional manual handlever

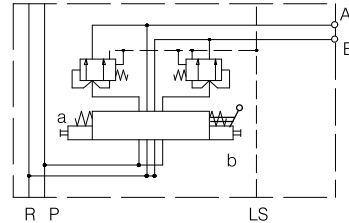
5.8.1 Standard version

- Port threads for actuator A + B = G $\frac{1}{2}$ "
- Pressure compensator in actuator A + B
- Additional manual handlever with override pin P_{max} 250 bar. With electrical operation, the hand lever remains in the 0 position (hand lever does not move with the spool).



5.8.2 Freely configurable functions

- Flow rate
- Spool type in mid-position
- Pressure compensator function
- Control type (proportional solenoid or ON/OFF)
- Plug type



5.8.3 Options menu

Spool type	3A	3J	4A	4D
06 l/min at B (A closed) =		*A3J	06 l/min at A and B =	AA4A
10 l/min at B (A closed) =		*B3J	10 l/min at A and B =	BB4A
16 l/min at B (A closed) =	*C3A	*C3J	16 l/min at A and B =	CC4A
25 l/min at B (A closed) =	*D3A	*D3J	25 l/min at A and B =	DD4A
32 l/min at B (A closed) =		*E3J	32 l/min at A and B =	EE4A
40 l/min at B (A closed) =		*F3J	40 l/min at A and B =	FF4A
50 l/min at B (A closed) =	*P3A	*P3J	50 l/min at A and B =	PP4A

Pressure compensator function	standard	fine control ¹⁾
for actuator B =	4	B
for actuator A =	8	A
for actuator A + B =	5	C

Control type	
ON/OFF solenoid 12 V =	A
ON/OFF solenoid 24 V =	B
Proportional solenoid 12V =	C
Proportional solenoid 24V =	D

Plug type	
AMP Junior Timer =	J
Deutsch plug DT04-2P-EP04 =	T

1) Fine controlled compensator function for increased stability in the hydraulics systems (see section 4.4.5).

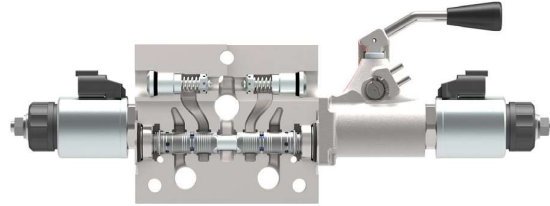
5.8.4 Plug type

AMP Junior Timer -J..-	Deutsch plug DT04-2P-EP04 -T..-

5.9 LVS08 with additional manual handlever and pressure relief / make-up valve

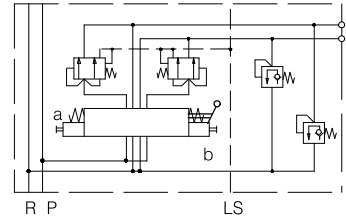
5.9.1 Standard version

- Pressure compensator in actuator A + B
- Override pin with manual handlever P_{max} 250 bar
With electrical operation, the hand lever remains in the 0 position (the hand lever does not move with the spool).
- Pressure relief – make-up valve / choice of pressure settings



5.9.2 Freely configurable functions

- Flow rate
- Spool type in mid-position
- Pressure compensator function
- Control type (proportional solenoid or ON/OFF)
- Plug type



5.9.3 Selection menu

Spool type	3A	3J	4A	4D
06 l/min at B (A closed)	=	*A3J	06 l/min at A and B =	AA4A AA4D
10 l/min at B (A closed)	=	*B3J	10 l/min at A and B =	BB4A BB4D
16 l/min at B (A closed)	=	*C3A	16 l/min at A and B =	CC4A CC4D
25 l/min at B (A closed)	=	*D3A	25 l/min at A and B =	DD4A DD4D
32 l/min at B (A closed)	=	*E3J	32 l/min at A and B =	EE4A EE4D
40 l/min at B (A closed)	=	*F3J	40 l/min at A and B =	FF4A FF4D
50 l/min at B (A closed)	=	*P3A	50 l/min at A and B =	PP4A PP4D

Pressure compensator function	standard	fine control ¹⁾
for actuator B	= 4	B
for actuator A	= 8	A
for actuator A + B	= 5	C

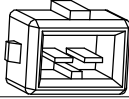
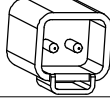
Control type	
ON/OFF solenoid 12 V	= A
ON/OFF solenoid 24 V	= B
Proportional solenoid 12V	= C
Proportional solenoid 24V	= D

Plug type	
AMP Junior Timer	= J
Deutsch plug DT04-2P-EP04	= T

Pressure relief and make-up function	
adjustable 70 - 230 bar	= A
adjustable 150 - 380 bar	= B
fixed setting (values in bar):	
25 = D, 32 = E, 40 = F, 63 = H, 80 = I, 100 = K, 125 = L, 140 = M,	
160 = N, 175 = O, 190 = P, 210 = Q, 230 = R, 250 = S, 280 = T	
Cavity prepared (closed, no function, prepared for retrofitting anti-shock valves, with plug) = #	

1) Fine controlled compensator function for increased stability in the hydraulics systems (see section 4.4.5).

5.9.4 Plug type

AMP Junior Timer -J..-	Deutsch plug DT04-2P-EP04 -T..-
	

5.9.5 Control type

A / B



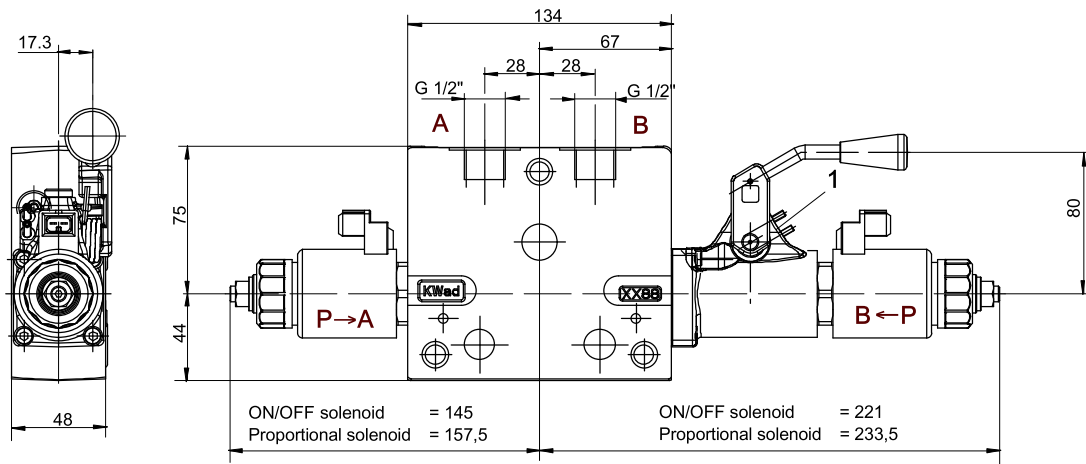
ON/OFF solenoid
with override pin

C / D



Proportional solenoid
with override pin and
starting point adjustment
(starting point is set by the
factory)

5.9.6 Dimensions



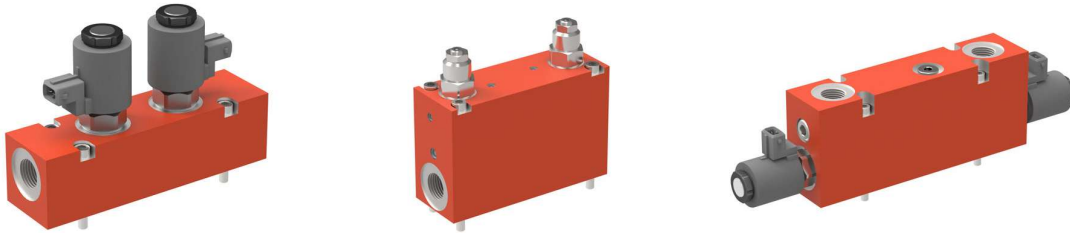
1 Set screws for spool stroke limiting (flow limiting only works with manual operation)

5.9.7 Ordering code

- ☐ White fields = data specified by Bucher Hydraulics
- ☐ Grey fields = data from the overview of sections 5.9.3

L	V	S	0	8					2	1	N	0	0	0	0	D	-																														
Directional valve section, size 08				Spool type				Compensator function for actuator A and B				Control type				Plug type				Port threads to DIN 3852 Part 2, actuator ports A + B = G 1/2"				Override pin with additional manual handlever				Options				Design stage				Pressure relief / make-up valve Actuator A Cavity prepared = #				Actuator B Cavity prepared = #				For adjustable valves: Pressure setting P _A = ... bar P _B = ... bar			

6 Bolt-on sections LVS08



6.1 Function

6.1.1 Load-control valve

These bolt-on load control valves, with integrated anti-shock function, ensure load-independent lowering motion at speeds determined by the inlet flow, with leak-free shut-off when the directional valve is in its neutral position. The anti-shock valve setting should preferably be set higher than 1,5 times the highest load pressure. Turning the adjusting screw in the clockwise direction reduces the setting, and this can also be used for emergency lowering of the load.

6.1.2 Seat valves

These seat valves, which can be opened by solenoid or by hydraulic pressure, shut off the actuator lines with zero leakage.

6.1.3 Seat valves with pressure relief and make-up valve

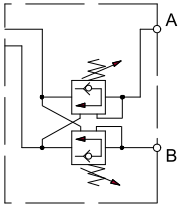
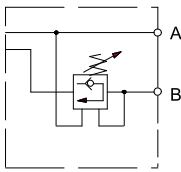
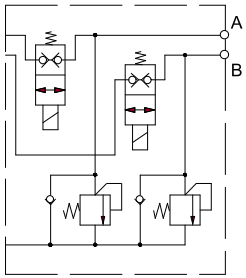
These solenoid-opened seat valves with service line pressure relief and make-up valves shut off the actuator lines with zero leakage and protect the actuator from unacceptable large pressure peaks.

6.2 Overview of items, with part number

Model code	Part number	Model code	Part number
LVSPRE-ZVAZVB-21-J12-C2000	100040196	LVSPBH-***-S30-21-A00/P=	100029653
LVSPRE-ZVAZVB-21-J24-C2000	100040200	LVSPRH-DVADVB-21-***-A00	100037249
LVSPBH-S30-S30-21-A00/P=	100031107	LVSPRH-DVA***-21-***-A00	100037896

6.3 Overview bolt-on sections

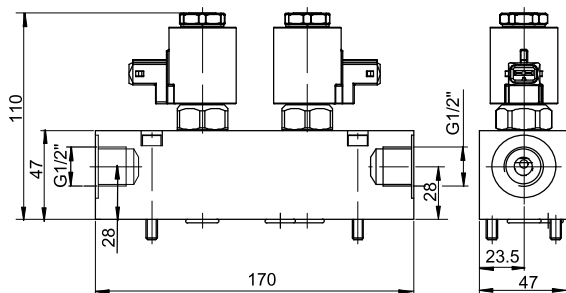
Symbol	Description	Part number
	LVSPRE-ZVAZVB-21-J12-C2000	100040196
	LVSPRE-ZVAZVB-21-J24-C2000	100040200
	LVSPRH-DVADVB-21-***-A00	100037249
	Bolt-on section with double seat valve. These solenoid-opened seat valves shut off the actuator lines with zero leakage. • $Q_{max} = 50 \text{ l/min}$ • Port threads $G\frac{1}{2}$"	
	LVSPRH-DVA***-21-***-A00	100037896
	Bolt-on section with double seat valve. These solenoid-opened seat valves shut off the actuator lines with zero leakage. • $Q_{max} = 50 \text{ l/min}$ • Port threads $G\frac{1}{2}$"	

	LVSPBH-S30-S30-21-A00/P=	100031107
	LVSPBH-***-S30-21-A00/P=	100029653
	LVSPEC-230-230-21-J24-C02	see ordering code

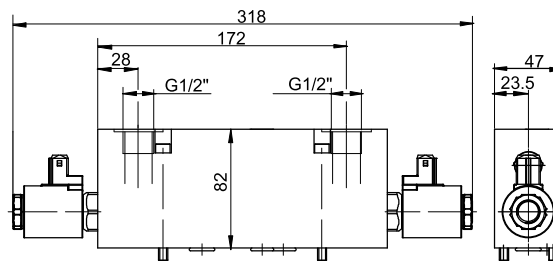
L	V	S	P	E	C	-		-		-	2	1	-	J	2	4	-	C	0	2
Bolt-on valve with pressure-relief Actuator port A: Pressure-relief - pressure setting [bar] 100, 125, 140, 160, 175, 190, 210, 230, 250, 280, 300 Actuator port B: Pressure-relief - pressure setting [bar] 100, 125, 140, 160, 175, 190, 210, 230, 250, 280, 300 Port threads to DIN 3852 - Part 2 / actuator A+B = G$\frac{1}{2}$" Plug type and nominal voltage: AMP Junior Timer 24 V DC = J24 Design stage Seat valves, solenoid opened: Double seat valves in actuator ports A + B																				

6.4 Dimensions

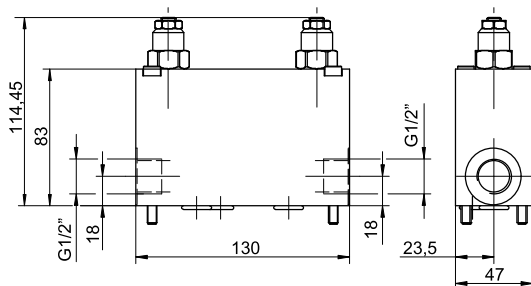
6.4.1 LVSPRE-ZVAZVB-21-J12-C00 (100040196) LVSPRE-ZVAZVB-21-J24-C00 (100040200)



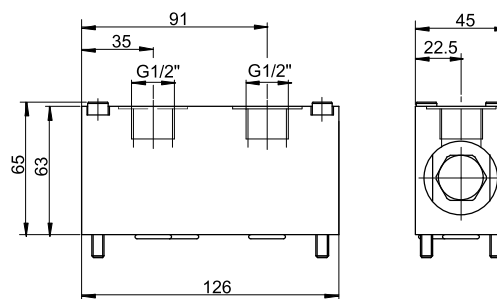
6.4.4 LVSPEC-230-230-21-J24-C02



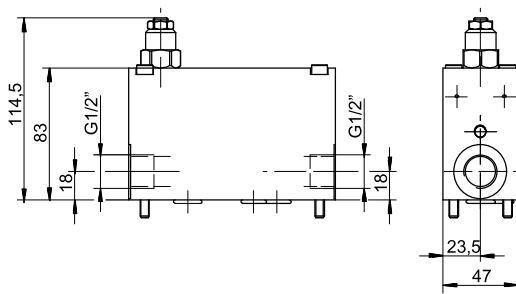
6.4.2 LVSPBH-S30-S30-21-A00 (100031107)



6.4.5 LVSPRH-DVADVB-21-***-A00 (100037249) LVSPRH-DVA***-21-***-A00 (100037896)



6.4.3 LVSPBH-***-S30-21-A00 (100029653)



7 Directional valve sections LVS12 – electrohydraulic, two-stage



7.1 General technical data

General characteristics	Unit	Value
Maximum flow rate	l/min	180
Maximum inlet pressure	bar	300 ¹⁾
Maximum pressure at the actuator ports	bar	320 ¹⁾
Spool increments by actuator flow rates at 12 bar Δp	l/min	16(C), 25(D), 40(F), 50(P), 63(G), 80(H), 100(K), 125(L), 150(M), 180(O)
Nominal voltage	V DC	12 or 24
Power consumption	W	max. 18 (at 1.5 A + 12 V or 0.75 A + 24 V)
Energising current	A	0.6 ... 1.5 with 12 V 0.3 ... 0.75 with 24 V
Duty cycle	%	100
Protection class		AMP: IP65 Deutsch plug DT04-2P-EP04: IP67 (DIN EN 60529)

1) For higher pressures and flow rates, please enquire.

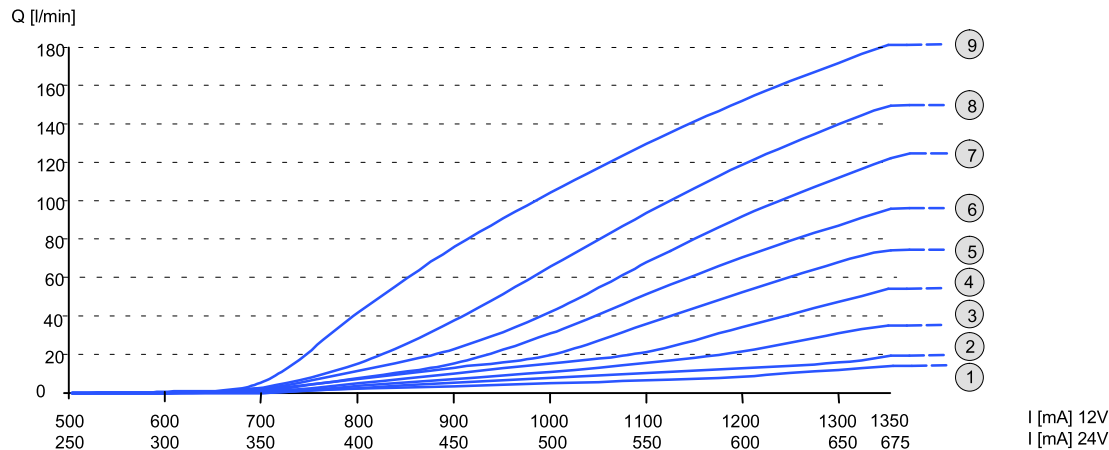
Technical data pressure relief valve	Unit	Value
Limit current	A	1.6 with 12 V 0.8 with 24 V
Coil resistance	Ω	5.3 with 12 V 21.2 with 24 V
PWM frequency (dither)	Hz	100

7.2 Characteristic curve

Proportional, electrohydraulically operated valve with 12 bar pressure drop at the orifice

Q [l/min] = flow rate at the actuator outlet port

I [mA] = current at the solenoids



1	Spool type C	(16 l/min)
2	Spool type D	(25 l/min)
3	Spool type F	(40 l/min)
4	Spool type G	(63 l/min)
5	Spool type H	(80 l/min)

6	Spool type K	(100 l/min)
7	Spool type L	(125 l/min)
8	Spool type M	(150 l/min)
9	Spool type O	(180 l/min)

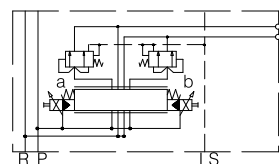
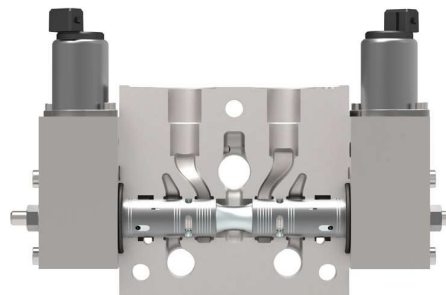
7.3 LVS12 Standard

7.3.1 Standard version

- Port threads for actuator A + B = G $\frac{3}{4}$ "
- Pressure compensator in A + B

7.3.2 Freely configurable functions

- Flow rate
- Spool type in mid-position
- Plug type
- Manual override
- Spool stroke-limiter feature (can be factory-setted)
Only with spool types 3A, 4A and 4D



7.3.3 Selection menu

Spool type

Spool type	3A	3J	4A	4D	6A	6D
Compensator function for actuator	A B closed	B. A closed	A+B	A+B	A+B	A+B
16 l/min	= *C3JB	= CC4AC	= CC4DC			
25 l/min	= *D3JB	= DD4AC	= DD4DC	= DD6AC	= DD6DC	
32 l/min	= *E3JB	= EE4AC	= EE4DC	= EE6AC	= EE6DC	
40 l/min	= *F3JB	= FF4AC	= FF4DC	= FF6AC	= FF6DC	
50 l/min	= *P3JB	= PP4AC	= PP4DC	= PP6AC	= PP6DC	
63 l/min	= *G3JB	= GG4AC	= GG4DC	= GG6AC	= GG6DC	
80 l/min	= *H3JB	= HH4AC	= HH4DC	= HH6AC	= HH6DC	
100 l/min	= *K3JB	= KK4AC	= KK4DC	= KK6AC	= KK6DC	
125 l/min	= *L3JB	= LL4AC	= LL4DC		= LL6DC	
150 l/min	= *M3JB	= MM4AC	= MM4DC		= MM6DC	
180 l/min	= O*3AA	= *O3JB	= OO4AC	= OO4DC		= OO6DC

Control type

- Electrohydraulic, two stage, 12 V = F
- Electrohydraulic, two stage, 24 V = G

Plug type

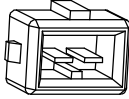
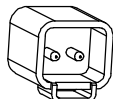
- AMP Junior Timer = J
- Deutsch plug DT04-2P-EP04 = T

Manual override by pin / spool-stroke limiter

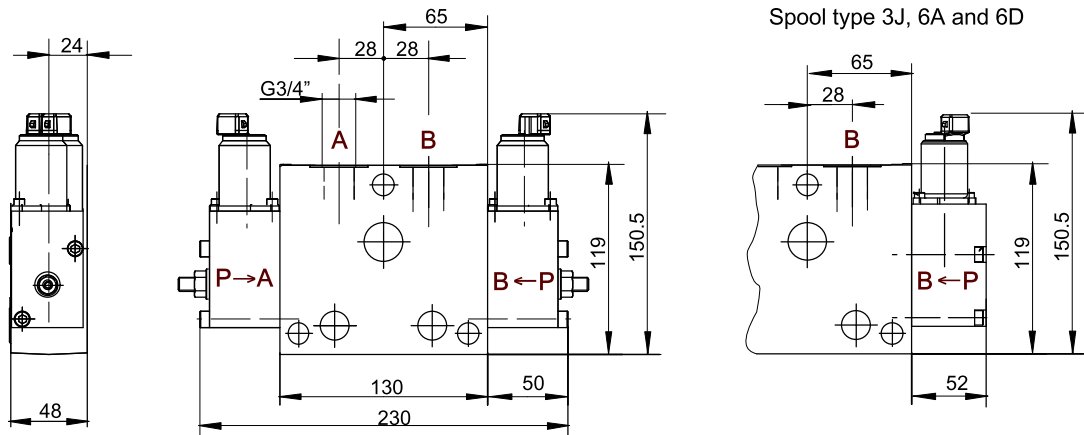
- Manual override = A
- Manual override and spool-stroke limiter = C ¹⁾

1) Spool stroke limiting is not possible with split spools (spool selection 3J, 6A, 6D).

7.3.4 Plug type

AMP Junior Timer -J..-	Deutsch plug DT04-2P-EP04 -T..-
	

7.3.5 Dimensions



7.3.6 Ordering code

- ☐ White fields = data specified by Bucher Hydraulics
- ☒ Grey fields = data from the overview of sections 7.3.3

L	V	S	1	2				2	2		1	0	0	0	D		
Directional valve section, size 12			Spool type and pressure compensator			Control type			Plug type			Port threads for actuators A + B = G $\frac{3}{4}$ "			Override pin and spool-stroke limiter		
Options																	
Design stage:																	
for spool type 3A, 4A, 4D = B																	
for spool type 3J, 6A, 6D = D																	

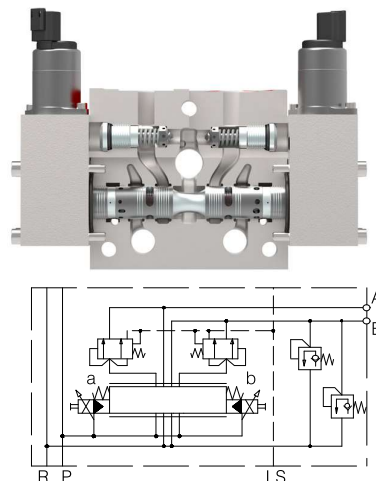
7.4 LVS12 with pressure relief /make-up valves

7.4.1 Standard functions

- Port thread for actuator A + B = G $\frac{3}{4}$ "
- Pressure compensator in A + B
- Pressure relief/make-up valve (selectable pressure setting)

7.4.2 Free configurable functions

- Flow rate
- Spool type in mid-position
- Plug type
- Manual override
- Spool stroke-limiter feature (can be factory-setted)
Only with spool types 3A, 4A and 4D



7.4.3 Selection menu

Spool type					
3A	3J	4A	4D	6A	6D
Compensator function for actuator:					
A B closed	B A closed	A+B	A+B	A+B	A+B
16 l/min	= *C3JB	= CC4AC	= CC4DC		= CC6DC
25 l/min	= *D3JB	= DD4AC	= DD4DC	= DD6AC	= DD6DC
32 l/min	= *E3JB	= EE4AC	= EE4DC	= EE6AC	= EE6DC
40 l/min	= *F3JB	= FF4AC	= FF4DC	= FF6AC	= FF6DC
50 l/min	= *P3JB	= PP4AC	= PP4DC	= PP6AC	= PP6DC
63 l/min	= *G3JB	= GG4AC	= GG4DC	= GG6AC	= GG6DC
80 l/min	= *H3JB	= HH4AC	= HH4DC	= HH6AC	= HH6DC
100 l/min	= *K3JB	= KK4AC	= KK4DC	= KK6AC	= KK6DC
125 l/min	= *L3JB	= LL4AC	= LL4DC		= LL6DC
150 l/min	= *M3JB	= MM4AC	= MM4DC		= MM6DC
180 l/min	= O*3AA	= O*3JB	= OO4AC		= OO6DC

Control type

Electrohydraulic, two stage 12 V = F

Electrohydraulic, two stage 24 V = G

Plug type

AMP Junior Timer = J

Deutsch plug DT04-2P-EP04 = T

Manual override by pin / spool-stroke limiter

Manual override = A

Manual override and spool-stroke limiter = C

Cavity prepared = #

Pressure relief and make-up function

adjustable 70 - 230 bar = A

adjustable 150 - 380 bar = B

fixed setting (values in bar):

25 = D, 32 = E, 40 = F, 63 = H, 80 = I, 100 = K, 125 = L, 140 = M, 160 = N, 175 = O, 190 = P, 210 = Q, 230 = R, 250 = S, 280 = T, 300 = U, 330 = V

Cavity prepared (closed, no function, prepared for retrofitting anti-shock valves, with plug) = #

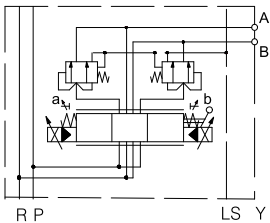
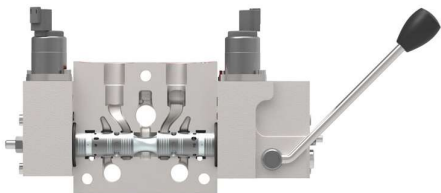
7.5 LVS12 with additional manual handlever

7.5.1 Standard version

- Pressure compensator in A + B
- Port thread actuator A and B = G $\frac{3}{4}$ "
- Additional manual handlever
- Spool-stroke limiter

7.5.2 Freely configurable functions

- Flow rate
- Spool function
- Plug type
- Spool stroke-limiter feature (can be factory-setted)



7.5.3 Selection menu



Spool type		
	4A	4D
Pressure compensator function for actuator:		
	A+B	A+B
16 l/min	= CC4AC	= CC4DC
25 l/min	= DD4AC	= DD4DC
40 l/min	= FF4AC	= FF4DC
50 l/min	= PP4AC	= PP4DC
63 l/min	= GG4AC	= GG4DC
80 l/min	= HH4AC	= HH4DC
100 l/min	= KK4AC	= KK4DC
125 l/min	= LL4AC	= LL4DC
150 l/min	= MM4AC	= MM4DC
180 l/min	= OO4AC	= OO4DC

Control type	
Electrohydraulic, two stage 12 V	= F
Electrohydraulic, two stage 24 V	= G

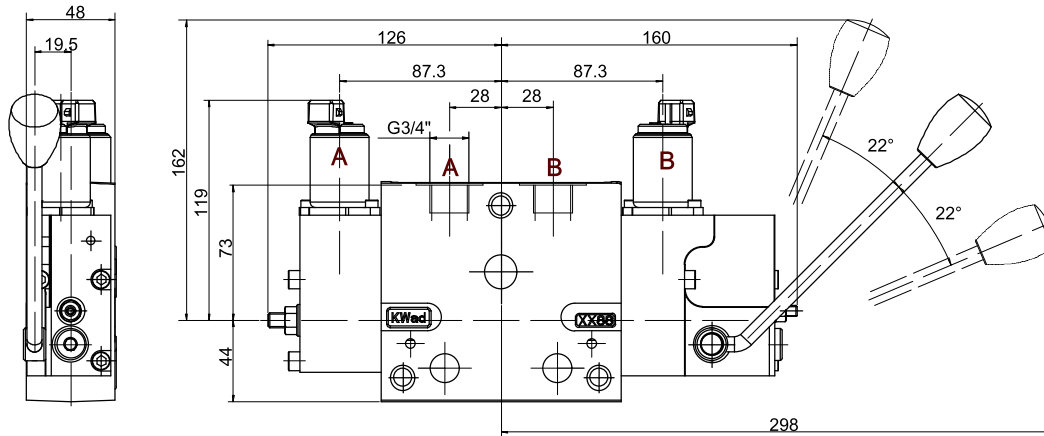
Additional function	
Additional manual handlever, Spool stroke limiter	= H

Plug type	
AMP Junior Timer	= J
Deutsch plug DT04-2P-EP04	= T

7.5.4 Plug type

AMP Junior Timer -J..-	Deutsch plug DT04-2P-EP04 -T..-

7.5.5 Dimensions



7.5.6 Ordering code

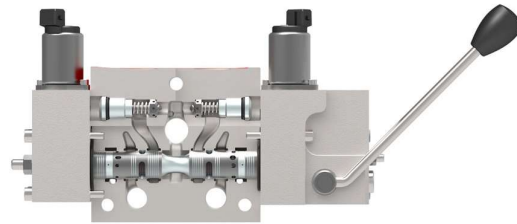
- ☐ White fields = data specified by Bucher Hydraulics
- ☐ Grey fields = data from the overview of sections 7.5.3

	L	V	S	1	2					2	2	H	1	0	0	0	B
Directional valve section size 12																	
Spool type and pressure compensator																	
Control type																	
Plug type																	
Port thread for actuator A + B = G3/4"																	
Additional manual operation, override pin, spool-stroke limiter																	
Options																	
Design stage																	

7.6 LVS12 with additional manual operation, pressure relief / make-up valve

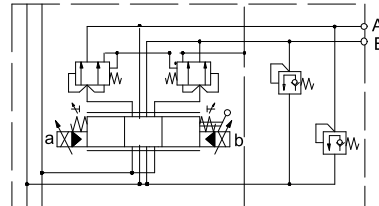
7.6.1 Standard functions

- Port threads G $\frac{3}{4}$ "
- Pressure compensator in A +B
- Pressure relief / make-up function (pressure settings are selectable)
- Additional manual handlever and spool-stroke limiter



7.6.2 Freely configurable functions

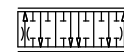
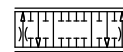
- Flow rate
- Spool type in mid-position
- Plug type



7.6.3 Selection menu



Spool type

4A
4D


Pressure compensator function
for actuator:

A+B
A+B

16 l/min	= CC4AC	= CC4DC
25 l/min	= DD4AC	= DD4DC
40 l/min	= FF4AC	= FF4DC
50 l/min	= PP4AC	= PP4DC
63 l/min	= GG4AC	= GG4DC
80 l/min	= HH4AC	= HH4DC
100 l/min	= KK4AC	= KK4DC
125 l/min	= LL4AC	= LL4DC
150 l/min	= MM4AC	= MM4DC
180 l/min	= OO4AC	= OO4DC

Control type

Electrohydraulic, two stage 12 V	= F
Electrohydraulic, two stage 24 V	= G

Plug type

AMP Junior Timer	= J
Deutsch plug DT04-2P-EP04	= T

Additional function

Additional manual handlever, Spool stroke limiter	= H
--	-----

Pressure relief / make-up function

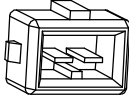
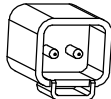
adjustable 70-230 bar	= A
adjustable, 150 - 380 bar	= B

fixed setting (values in bar):

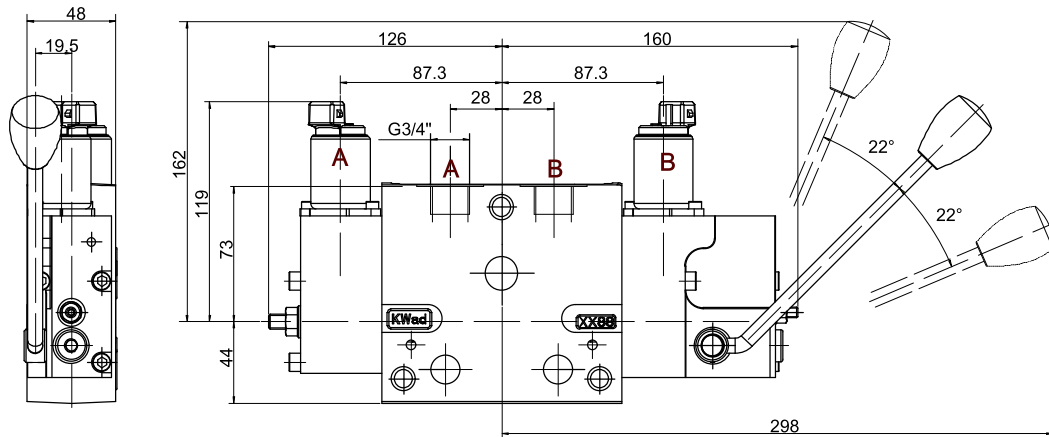
25 = D,	32 = E,	40 = F,	63 = H,	80 = I,	100 = K,	125 = L,	140 = M,
160 = N,	175 = O,	190 = P,	210 = Q,	230 = R,	250 = S,	280 = T,	300 = U

Cavity prepared (closed, no function, prepared for retrofitting anti-shock valves, with plug) = #

7.6.4 Plug type

AMP Junior Timer -J..-	Deutsch plug DT04-2P-EP04 -T..-
	

7.6.5 Dimensions



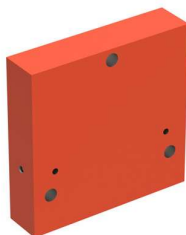
7.6.6 Ordering code

- ☐ White fields = data specified by Bucher Hydraulics
☐ Grey fields = data from the overview of sections 7.6.3

L	V	S	1	2					2	2	H	1	0	0	0	B													
Directional valve section size 12			Spool type with pressure compensator function			Control type			Plug type			Port thread for actuator A + B = G $\frac{3}{4}$ "			Additional manual operation, manual override by pin, spool-stroke limiter			Options			Design stage			Pressure relief / make-up function: Actuator A Cavity prepared = #			Actuator B Cavity prepared = #		

For adjustable valves:
 Pressure setting
 P_A = ... bar
 P_B = ... bar

8 End sections



8.1 Overview of items, with part number

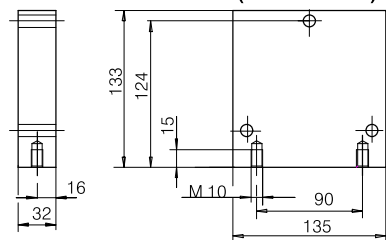
Model code	Part number	Model code	Part number
LVS-A-CA*-****A00	100027983	LVS-A-CA*-G1/2A07	100026845
LVS-A-CA*-G110A10	100030024		

8.2 Overview of end sections

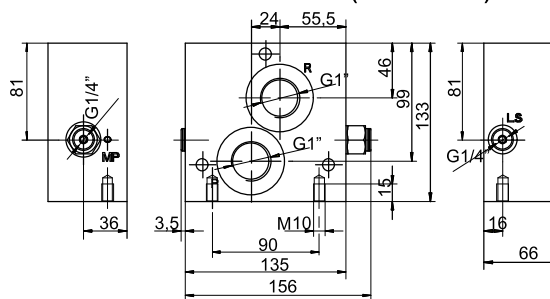
Symbol	Description	Part number
	LVS-A-CA*-****A00	100027983
	• No function	
	LVS-A-CA*-G110A10	100030024
	• No function	
	• Ports: P, R = G1" LS, MP = G1/4"	
	LVS-A-CA*-G1/2A07	100026845
	• No function	
	• Test ports; MP, MLS = G1/4" MR = G1/2"	

8.3 Dimensions

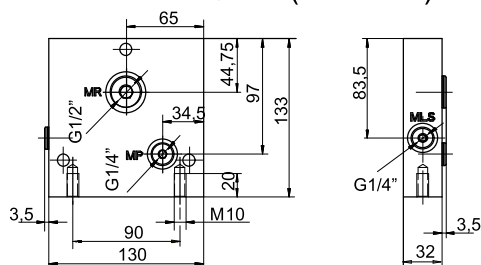
8.3.1 LVS-A-CA*-****A00 (100027983)



8.3.3 LVS-A-CA*-G110A10 (100030024)



8.3.2 LVS-A-CA*-G1/2A07 (100026845)



9 Configuration of control blocks

9.1 Ordering example

Criteria	Ordering code and data	Part number
General: Power supply = 24 V DC Plug type = AMP Junior Timer		
Inlet section: Pump type = fixed-displacement pump Inlet flow = 140 l/min P_{max} = 230 bar 3-way pressure compensator function	LVS-E-CF*-G110A00/P1 = 230 bar Port threads: A + B = $\frac{3}{4}$ " Q_{In} up to 200 l/min, Δp = 12 bar, LS_{max} setting = 218 bar ($P_{max} - \Delta p$)	100030365
1st. Directional valve section: Actuator = 1 motor drive, reversible Inlet flow = 100 l/min	LVS12KK4DCGJ22A1000B Port threads: P + R = 1" Q_{In} up to 200 l/min, Δp = 12 bar, LS_{max} setting = 218 bar ($P_{max} - \Delta p$)	Defined by factory
2nd. Directional valve section: Actuators: 2 motor drives, non-reversible Q motor 1 = 100 l/min, Q motor 2 = 40 l/min P_{max} at actuator B = 100 bar	LVS12KK4DCGJ22A1000B-#K	Defined by factory
3rd. Directional valve section: Actuator = double-acting cylinder Q at A and B = 25 l/min P_{max} at A = 100 bar, at B = 160 bar ON/OFF operation	LVS08DD4A5BJ21A1000C-KN	Defined by factory
End section No control function	LVS-A-CA*-****A00	100027983
Tie rods Screw-in depth 15 mm, plus 3 directional sections = 3 x 48 mm, plus thickness of end section 32 mm, plus projection of 15 mm = 206 mm, rounded up to the next 10 mm size = 210 mm	3x tie rods 212 mm	

9.2 Assembly kit

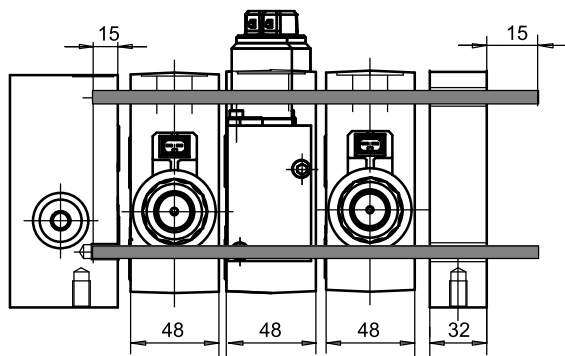
To assemble the individual valve sections with assured functional reliability, 3 tie rods and hex. nuts are necessary.

Maximum tightening torque 30 Nm
Tighten in steps of 6, 16 and 30 Nm.

9.2.1 Ordering code

3x tie rod M10 x (required length in mm)

3x hex. nut M10, Part No.: 100243580



Calculating the tie rod length:

15 mm + (48 mm x no. of directional valve sections) + width of the end section + 15 mm

Example:

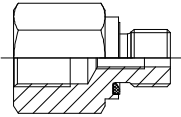
15 + (48 x 3) + 32 + 15 = 206 mm

For ordering purposes, always round up the calculated tie rod length to the next 10 mm.

In our example, we therefore need to order 3x tie rod M10 x 210 mm.

IMPORTANT: maximum 10 directional sections in one valve block

9.2.2 Pipe fitting and orifices

Model code	Description
Part number: 100116329 	- Pipe fitting G1/4" with thread for inserting up to 2x M5 orifices (TN3001, Form B) Application note: for fitting in the LS-line to improve system stability - Orifice : Ø 0.5 = 100219282 Ø 0.6 = 100209791 Ø 0.8 = 100216052 Ø 1.0 = 100225419

10 Fluid

The control blocks require fluid with a minimum cleanliness level of ISO 4406 code 20/18/15.

We recommend the use of fluids that contains anti-wear additives for mixed-friction operating conditions. Fluids without appropriate additives can reduce the service life of valves.

The user is responsible for maintaining and regularly checking the fluid quality.

11 Liability

In the design and operation of hydraulic systems, all aspects of the potential failure modes and all planned operational conditions and uses of the equipment have to take into consideration.

Concerning risk assessment, please refer to the relevant Standards. The use of components that are not Original Bucher Replacement Parts and Accessories nullifies all warranty.

12 Note

This catalogue is intended for users with specialist knowledge. The user must check the suitability of the equipment described here in order to ensure that all of the conditions necessary for the safety and proper functioning of the system are fulfilled. If you have any doubts or questions concerning the use of these pumps, please consult Bucher Hydraulics.

info.kl@bucherhydraulics.com

www.bucherhydraulics.com

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Data is provided for the purpose of product description only, and must not be construed as warranted characteristics in the legal sense. The information does not relieve users from the duty of conducting their own evaluations and tests. Because the products are subject to continual improvement, we reserve the right to amend the product specifications contained in this catalogue.

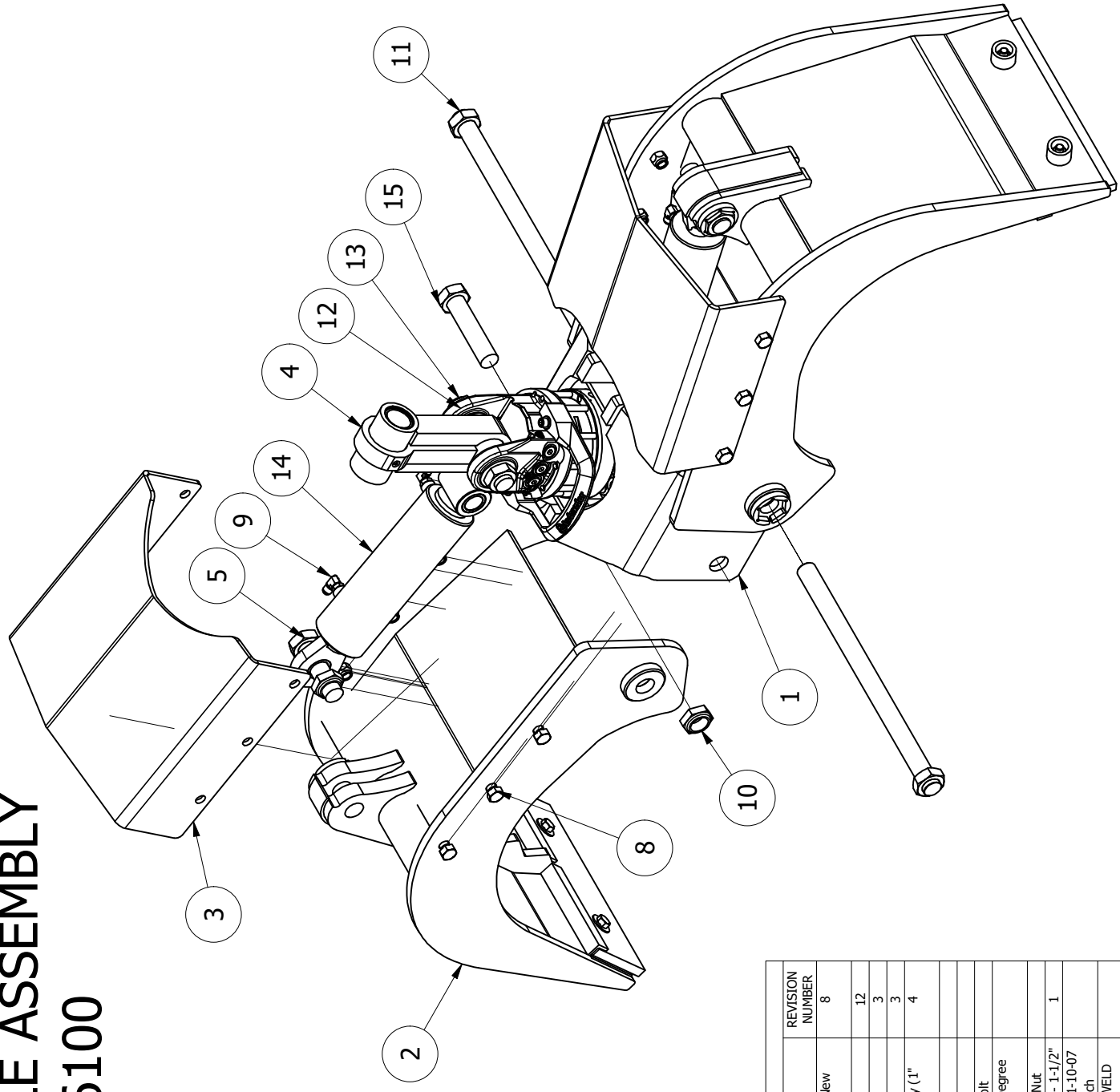
Classification: 430.300.330.

CRANE GREASE BANK



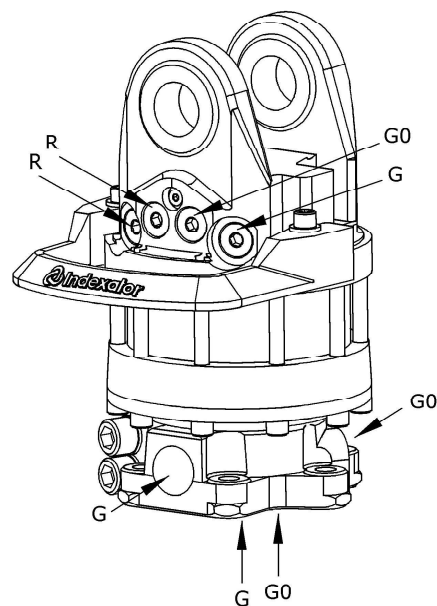
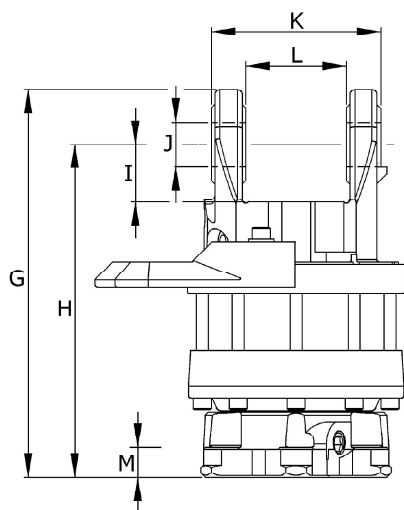
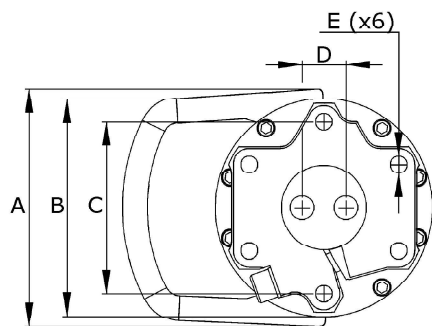
CLAM GRAPPLE ASSEMBLY

906-6100



PARTS LIST				REVISION NUMBER
ITEM	QTY	PART NUMBER	DESCRIPTION	
1	1	904-6101	Grapple Center Assembly (New Style)	8
2	2	904-6100	Grapple Claw Assembly	12
3	2	902-6103	GRAPPLE COVER PLATE	3
4	1	904-6102	Pivot Tackle Assembly	3
5	2	904-6105EX	Clam Cylinder Bolt Assembly (1" Longer)	4
6	2	900-6215	CYLINDER ROD	
7	12	205-8412	3/4"-10 Nylon Lock Nut	
8	12	205-1211	3/4"-10 x 1-3/4" Grade 5 Bolt	
9	4	336-6801-8-8	#8 MJIC to #8 O-Ring 90 Degree Swivel	
10	6	205-8428J	1-1/2"-12 Jam Nylock Lock Nut	
11	2	904-6118	Grapple Pivot Welded Bolts - 1-1/2"	1
12	1	902-6175	5212208_GV 125_A_E_2011-10-07	
			Grapple Rotator from Vantech	
13	1	904-6119	GRAPPLE ROTATOR BOLT WELD ASSEMBLY	
14	2	900-6222RS	Cylinder Tube Assembly w/ Tube	
15	2	904-6122	CLAM CYLINDER BOLT WELDMENT (TUBE END)	3

ROTATOR | ROTATOR - GV 12S A E



Technical data

Part no	5212 208
Dimensional drawing	2001 816
Hydraulic circuit	
Rotation	unlimited
Weight	58,9 kg
Max axial load, static	100 kN
Max axial load dynamic	50 kN
Torque at 25 MPa	2 200 Nm

Function

□

Function	Max working pressure	Rec oilflow
R = Rotation	25 MPa	25 l/min
GO = Grapple open ⇄	25 MPa	*
G = Grapple close ⇄	25 MPa	*

Connections¹

Upper	7/8"-14 UNF
Lower	7/8"-14 UNF

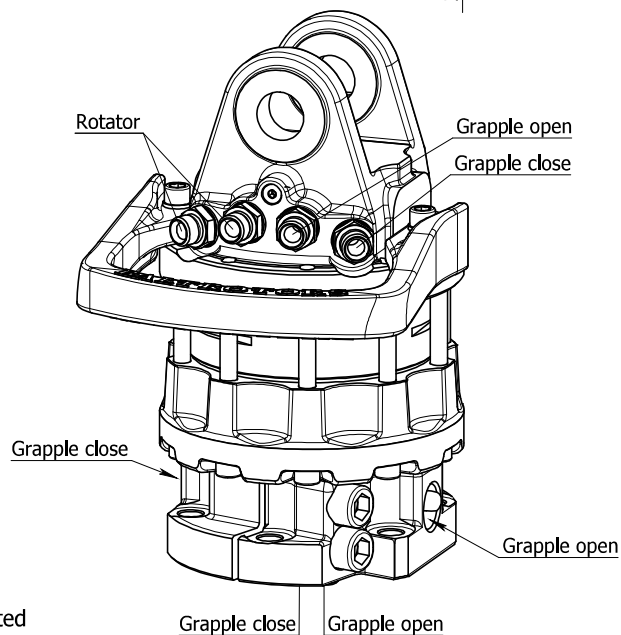
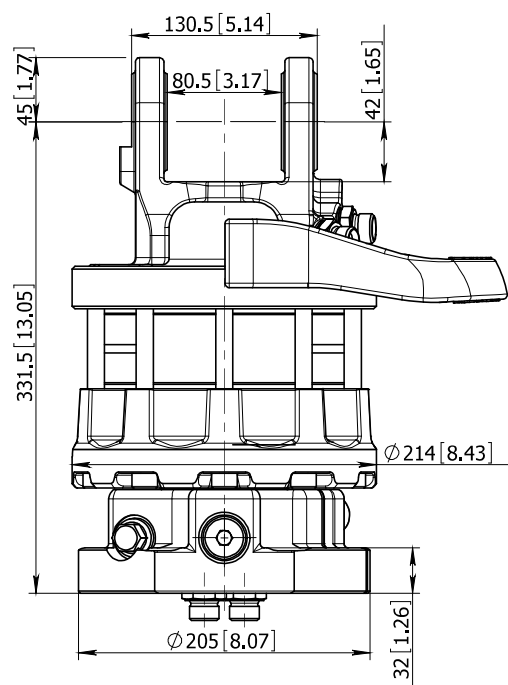
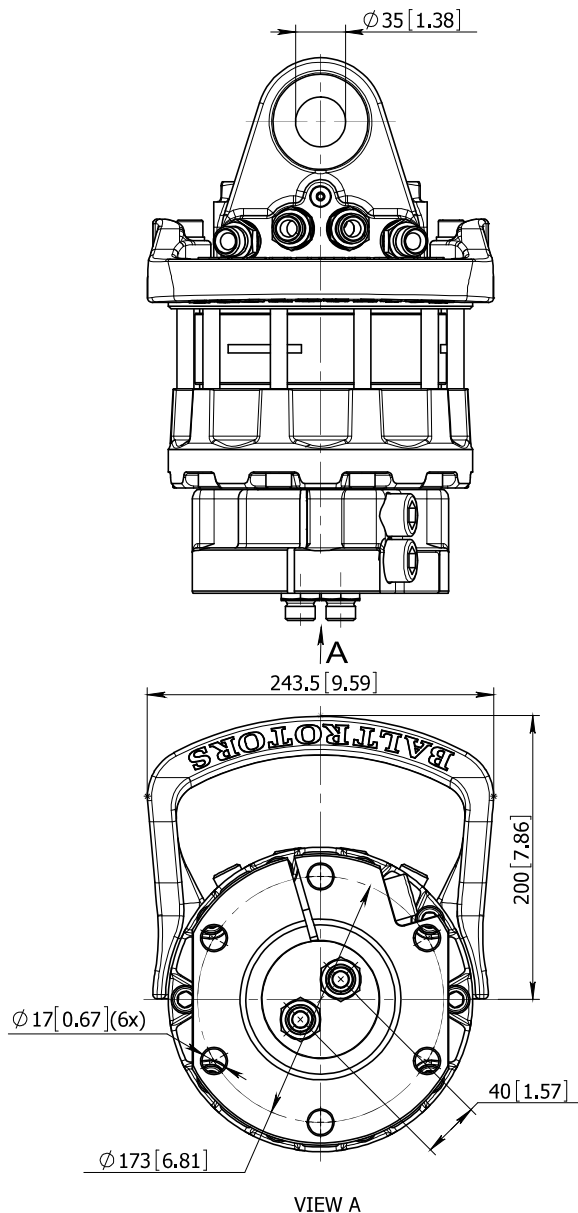
ØVe supply adapter sets for alternative connections

* For more technical information about installation and hydraulic connections, we refer to dimensional drawing and hydraulic circuit as specified above.

7 K H V H □ G R F X P H Q W V □ F D Q □ E H □ R U G H U H G □ D W □ U R W D W R U # L Q G H □ D W R U □ F R P □

Measure specification

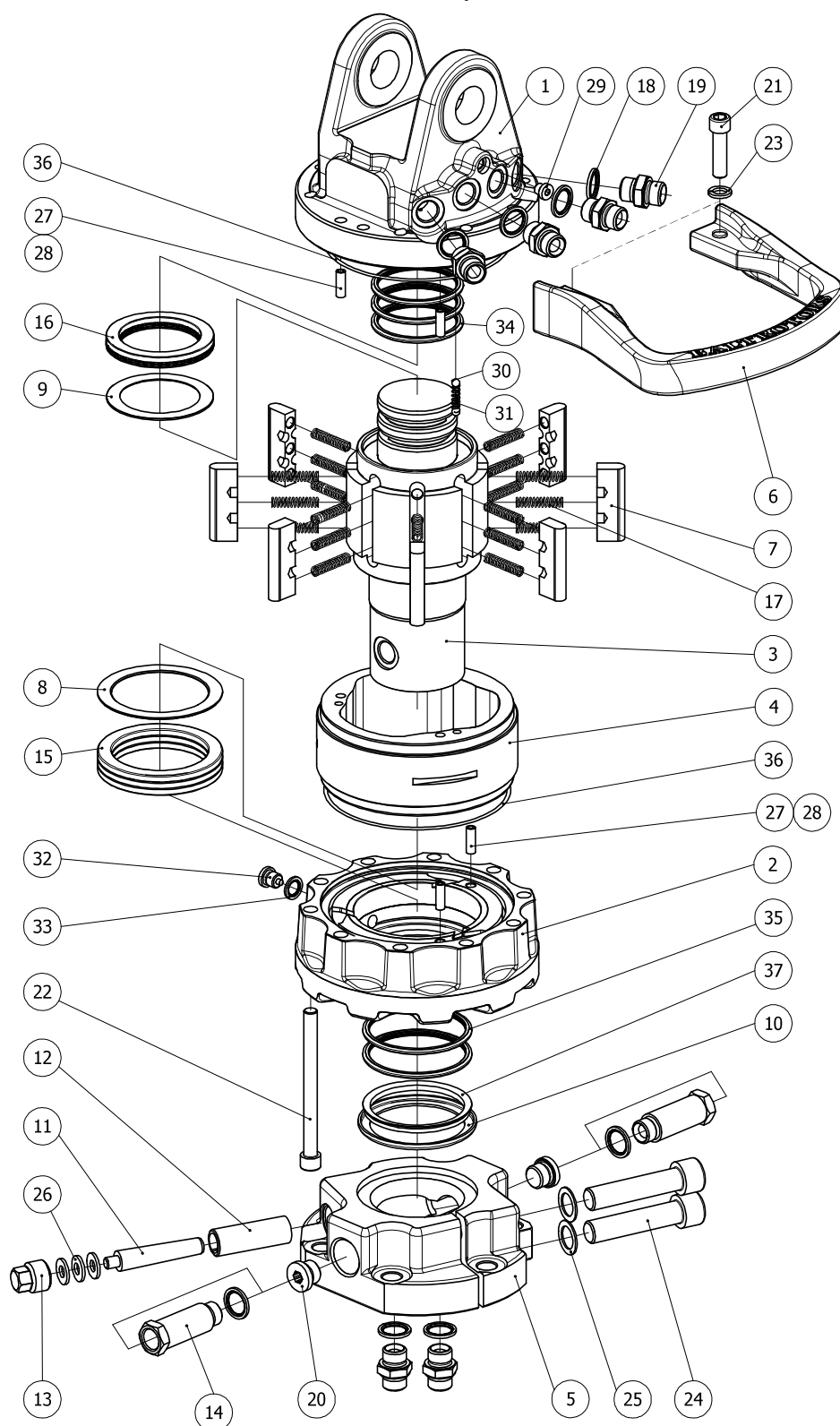
	mm
A	235
B	ø□□
C	ø□□
D	38,5
E	ø□
G	389
H	333
I	58
J	ø□
K	169
L	101*
M	30



Rotation	Unlimited
Max axial load static, KN (lbf)	+100 (22485)
	- 80 (17985)
Max axial load dynamic, KN (lbf)	+50 (11242)
	- 40 (8992)
Torque at 25Mpa (3625psi), Nm (lb ft)	2500 (1844)
Rec oilflow, l/min (US gallon)	30 (7.9)
Weight, kg (lb)	59 (130)

Rotator	↔	Max 25 MPa (3625 psi)	G 1/2"
Grapple / Tool open	↔	Max 30 MPa (4350 psi)	G 1/2"
Grapple / Tool close	→	Max 30 MPa (4350 psi)	G 1/2"

List of parts

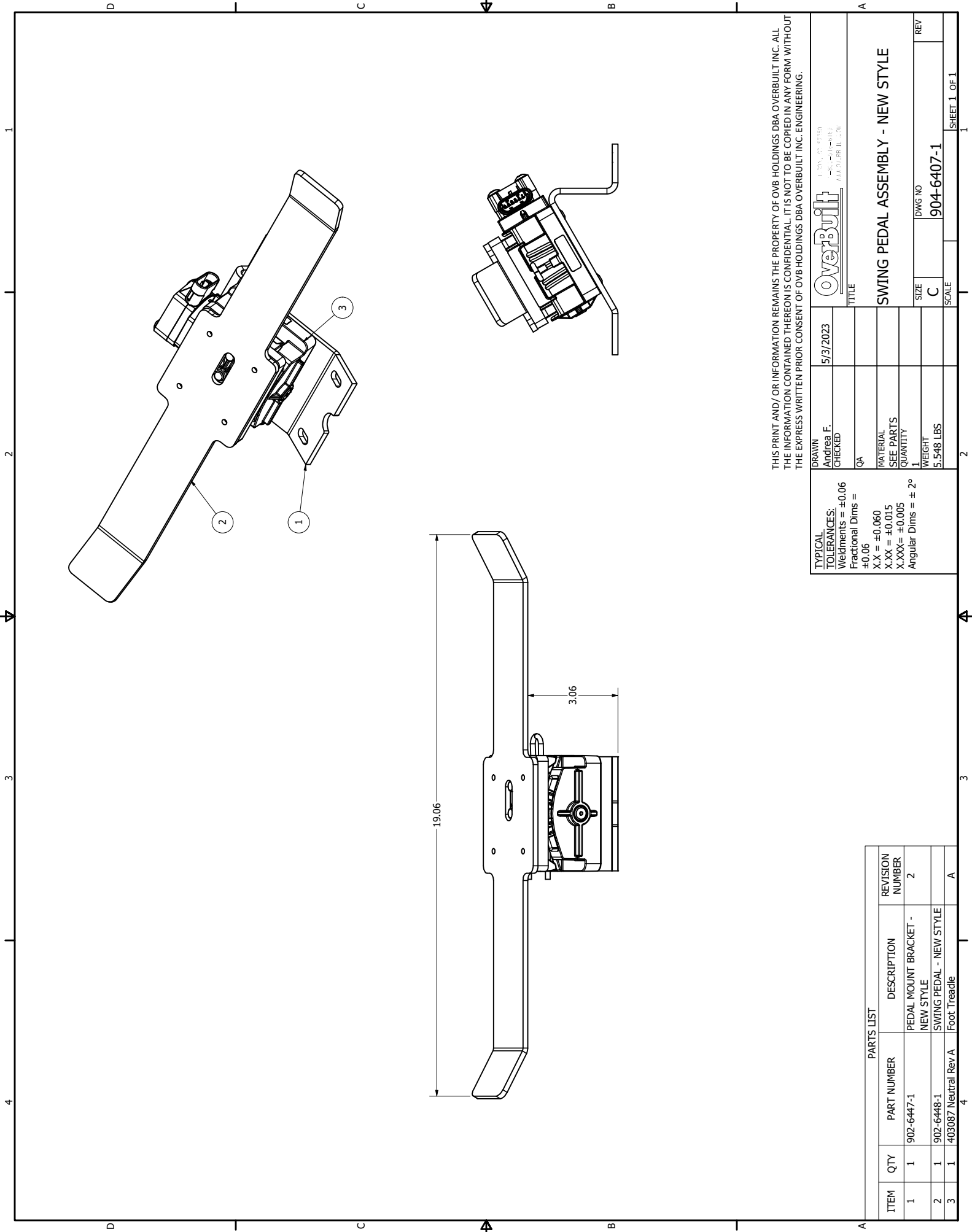


2011.07.15. Sheet 2 of 3

List of parts

.....				
1	GR 104 DB.01	Stator plate, upper	1	
2	GR 104.02-01	Stator plate, lower	1	
3	GR 104 DB.006	Rotator shaft	1	
4	GR 104.007	Stator frame	1	
5	GR 104.010-05	Link, lower	1	
6	GR 104.03	Hose guard	1	
7	MTR 104.008	Vane	8	
8	HR 10 S.020	Shim	1	
9	MTR 45.011-01	Shim	1	
10	HR 10 S.021	Washer	1	
11	GR 16.011	Wedge	1	
12	GR 16.012	Bung	1	
13	MTR 100.013-01	Locking screw	1	
14	MT 0219	Nipple	2	
15	G213.12009	Axial bearing	1	
16	G213.12020	Axial needle bearing	1	
17	MTR 100.009	Spring	24	
18	G104.112	Bonded seal	8	
19	G117.1311	Nipple	6	
20	G104.135	Plug	2	
21	G111.1415	Screw	2	
22	G111.1417	Screw	10	
23	G111.143	Spring washer	2	
24	G111.1420	Screw	2	
25	G111.147	Washer	2	
26	G111.145	Cup spring	3	
27	G111.1421	Pin	4	
28	G111.1422	Pin	4	
29	G104.133	Plug	1	
30	G213.12027	Ball	2	
31	G209.11004	Spring	1	
32	G104.139	Magnetic plug	1	
33	G104.113	Bonded seal	1	
.....				
34	G102.1113	Glide ring	3	
35	G102.1115	Glide ring	2	
36	G102.1110	O-ring	2	
37	G102.1124	V - seal	1	

2011.07.15. Sheet 3 of 3



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TYPICAL TOLERANCES: Weldments = ± 0.06 Fractional Dims = ± 0.06 X.X = ± 0.060 X.XX = ± 0.015 X.XXX = ± 0.005 Angular Dims = $\pm 2^\circ$		DRAWN Andrea F. CHECKED	5/3/2023	OverBuilt 1/201, 12" x 15" 1/2 1/1/2018 1/2 x 1/2	
		QA		TITLE	
		MATERIAL SEE PARTS		SWING PEDAL ASSEMBLY - NEW STYLE	
		QUANTITY 1		REV	
		WEIGHT 5.548 LBS		SIZE C	DWG NO 904-6407-1
				SCALE	SHEET 1 OF 1

PARTS LIST				REVISION NUMBER
ITEM	QTY	PART NUMBER	DESCRIPTION	
1	1	902-6447-1	PEDAL MOUNT BRACKET - NEW STYLE	2
2	1	902-6448-1	SWING PEDAL - NEW STYLE	
3	1	403087 Neutral Rev A	Foot Treadle	A



V5 System

User Manual

Updated: Jan 4th, 2023

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Warranty

Cranesmart Systems warrants to the purchaser of each new Cranesmart System that any part thereof which proves to be defective in material or workmanship within two (2) years from date of delivery will be repaired or replaced at no charge if the system is returned to us in Edmonton, Alberta with all freight charges prepaid. If a performance problem should occur, contact our office/manufacturing facility in Edmonton, Alberta at (888) 562-3222 or (780) 437-2986 (Address: 4908 97 St NW, Edmonton, AB T6E 5S1).

This warranty does not cover defects resulting from accident, alteration, improper use, or failure of the purchaser to follow normal operating procedures as outlined in this instruction manual.

PLEASE NOTE:

- Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- This device complies with part 15 of FCC rules, and Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
- The display panel is a category 2 item as per IC and FCC radio certification
- This warranty is in lieu of any warranty or merchantability and of all other warranties, expressed or implied, all of which are hereby excluded.
- The display panel operates at an input range of 12-24 VDC at 1 A.
- The wireless transducers operate at 3.6 VDC at 30mA (battery).
- All Cranesmart devices are FCC compliant and are labeled clearly as such.
- All Cranesmart devices have an IP rating: 68, and an operable temperature range of: -40°C to +60°C (-40°F to 140°F).



- **WARNING:** OPENING THE DISPLAY PANEL VOIDS THE WARRANTY.



- **WARNING:** NO COMPONENTS OF THE SYSTEM ARE TO BE SUBMERGED IN WATER.



- **WARNING:** DO NOT PRESSURE-WASH CRANESMART COMPONENTS. DIRECT APPLICATION OF HIGH-PRESSURE WATER CAN BREAK SEALS AND LEAD TO MOISTURE DAMAGE.



- **WARNING:** POTENTIAL ELECTROSTATIC CHARGING HAZARD: USE A DAMP CLOTH ONLY TO WIPE CLEAN THE EXTERIORS OF COMPONENTS.

Cranesmart Systems shall in no event be liable for any special, indirect, or consequential damages whatsoever and neither assumes nor authorises any person to assume for it any other obligation or liability.

Important Safety Information

All of Cranesmart Systems' load cells and support hardware have been designed and tested to have a minimum 5 to 1 safety factor and to meet or exceed the guidelines, standards and certification requirements set forth by more than 30 legislative bodies worldwide including API, ABS, DNV, ASME and OSHA.

All Cranesmart load cells and support hardware are to be considered 'Critical Path' components. Loads imposed on these components should never exceed the maximum rated capacity shown on the load cell. The rated capacity applies only to uniform direct tension loading (straight-line pull). Off-axis loading, bending, side loading, two-blocking and shock loads should be avoided. Damages caused by such situations are not covered by the Cranesmart Systems warranty.

Inspection for damage, deterioration, cracks and corrosion on all load bearing components should be conducted pre-use, weekly, monthly, quarterly or annually, depending upon crane usage. Load bearing components showing damage, deterioration, cracks or corrosion should be removed from service. If the crane is two-blocked or side loaded, the load cell and links should be visually inspected immediately. Continued use of damaged components may result in catastrophic failure and personal injury.

Unless authorized by the factory in writing, modifications such as cutting, welding or permanently attaching other material to any load cell, pin, link or part thereof will void the warranty. Do not repair, alter, rework, or reshape any load bearing component by welding, heating, grinding or bending. Do not engrave or stamp marking into the steel body of the load cell as this may affect the integrity of the load cell, will void the warranty, and may result in a costly replacement of the steel body.

Regular Inspections

We recommend that all load components regularly undergo routine visual inspection as noted above. We also recommend that a qualified inspector, using industry standard techniques such as Ultrasonic Testing and/or Dye Penetrate Testing, annually inspect the load components. These tests are to be performed in conjunction with the inspection frequencies and guidelines as mandated by the applicable regulatory bodies.

NOTE: Do not disassemble the load cell by removing the plastic covers during testing. Disassembly will require the cell to be returned to the factory for calibration and testing.

If any issues arise, contact the Cranesmart Systems main office @ 780-437-2986 and ask for the service department. Please have the component serial number(s) readily available.

NOTE: The Cranesmart System is designed for and intended to be used as an operator safety aid for cranes, pipelayers and similar load lifting machinery. Operational parameters such as: load weight, boom angle, anti-2-block status, level indication, (and others) are monitored by the system and displayed clearly for the operator in order to make working conditions safer, and operations more accurate and efficient. This manual has been written in the effort to explain the most pertinent details of this system and its use.

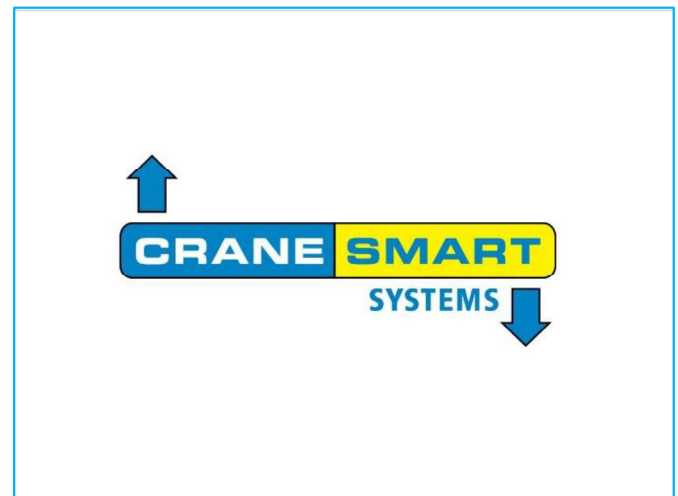
1. The User Interface

The new Cranesmart System utilizes a large full color touchscreen display panel, which is described generally, in this section. All information, parameters, menus and alarms are displayed and accessible directly via the touchscreen.

NOTE: The touchscreen does not respond to increasing pressure on its surface - to make a selection, use only light contact directly overtop the desired button to avoid potentially damaging the screen.

1.1. The Startup Screens

Illustrated below are the Startup Screens, which are displayed immediately upon powering the system. First is a picture of the components, followed by a certification screen, then a quick system diagnostics checklist. Once the system is fully initialized, the main user interface will appear.



1.2 Understanding the user interface

The **menu bar** allows for navigation by tapping the respective Icons.

In order from left to right they are the: Home, configurations, settings, information, permission, brightness, language and date and time selection. Date and time will only be accessible in supervisor mode (see page 34 for info on how to access the supervisor levels)



The **bypass button**

Pressing this button will shut off any audible alarm and dismiss any warning message for a period of 30 seconds. The display will show this time interval counting down, until the timer runs out completely and the alarm is reactivated. A more detailed description of the alarms and their displays can be found in the Troubleshooting section of this manual.



Typical **Primary parameter tile**



Typical **secondary parameter tile**

The **Back Button**

Use this button to return to the previous screen



Cancel accept buttons

Use these buttons to confirm or cancel a selection



Page selection arrows

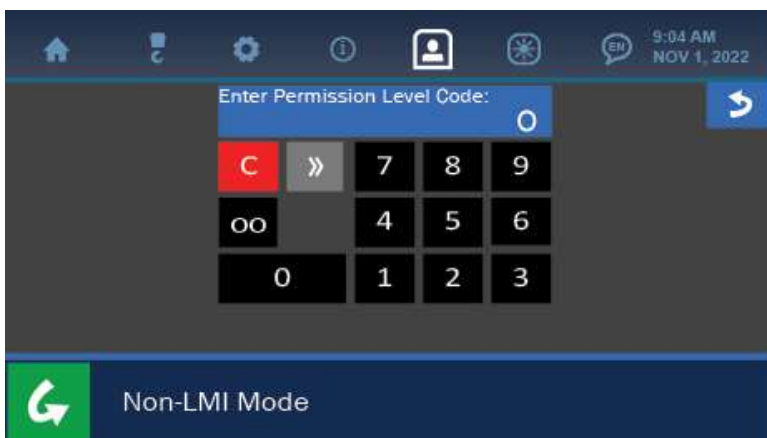
Alarm notification bar

The lower section of the screen shows the Alarm and Notification Bar. As shown in the screenshot, the system pictured is experiencing no alarms and shows the default notification, 'Non-LMI Mode'. In case of an alarm, an associated message would be displayed in this area, with color changes to indicate the problem visually. Touching the notification bar will change between alarm, warning and notifications. Further description of the alarms and their displays can be found in the Troubleshooting section of this manual.

Banner Buttons

Every listed item on a menu screen is shown overtop a blue Banner Button. If the item is changeable or linked to a further submenu, pressing anywhere on the banner button will advance the display to show more associated options.

The **value entry screen** is only accessible in supervisor mode. This is the main entry screen for changing values. To clear the value press the red C Icon and to delete the last digit entered press the grey double arrow icon. To enter the value select the green checkmark or X to cancel



1.3 The Home Screen

Shown below is the Home Screen, which is the main display for normal operation. The system updates in real time, all the most important parameters of the system and displays them here for the operator. The elements of the display are labeled and explained on the following page.

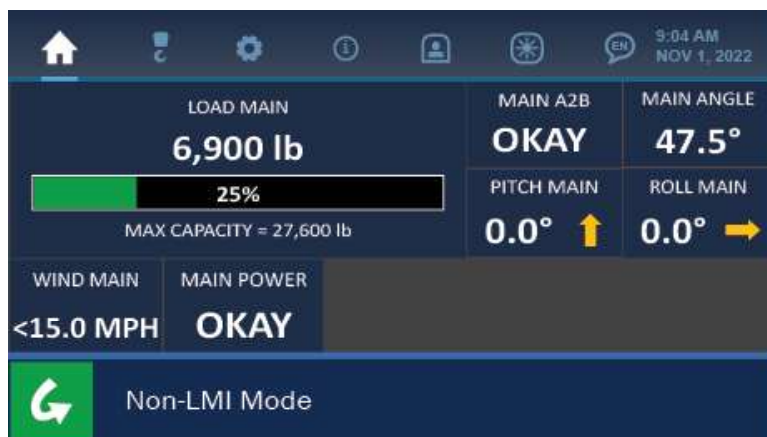
2. Normal Operation

The Cranesmart 5 interface was designed to present the user with all the most important, real-time information regarding the machine in use, for the safest and easiest possible operation. This section of the manual explains each parameter on the Home Screen and other screens used during normal operation, how to view and change important settings, and the ways the system indicates potential danger.

NOTE: See 'Understanding The User Interface' section for explanations of the screen formats and common functions used throughout the system.

2.1. Load Indication

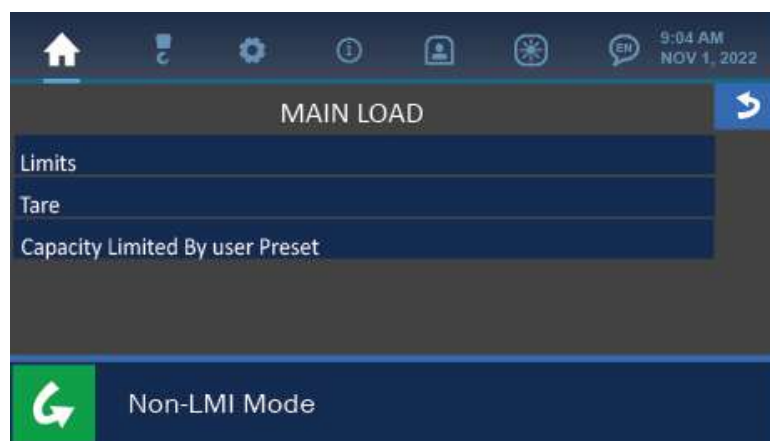
Shown below is the Home Screen, with the Load Indication Tile emphasized.



As shown in the previous screenshot, and the detail image below, the load is indicated. The current load on the hook is shown, as well as a bar graph and percentage indicating how close the current load is to the maximum capacity. This max load limit is set by a supervisor, and is shown below the bar graph as 'MAX CAPACITY'.



Pressing anywhere directly overtop the Load Indication Tile will open the Load Menu, as shown below. This menu offers the following options for the load: Limits, and Tare. These options are described on the following pages.



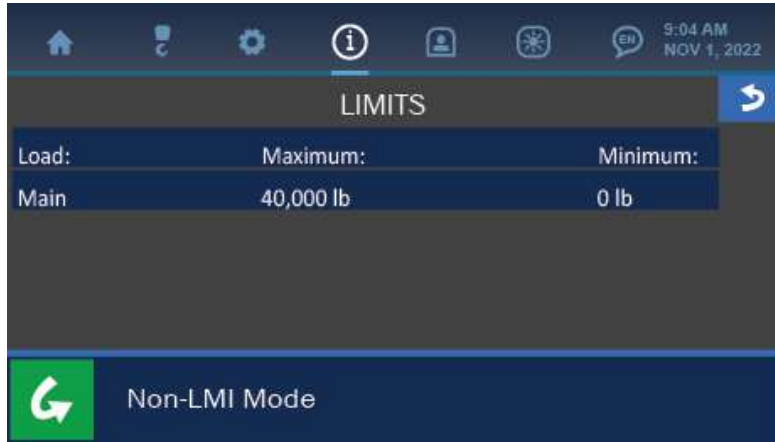
Secondary parameter tile

Beneath the load display are other important parameters being monitored by the system: A2B status, boom angle and machine pitch / roll. Pressing the area of the screen overtop each parameter shown will open an associated menu for that parameter, where certain values can be changed or displayed.

the Primary Parameter Tile

The primary parameter tile is the large tile that takes up the majority of the screen. Typically the parameter displayed will be load but can be other depending on your system design.

Load Limits



The Load Limits Menu displays the current settings for the following parameters:

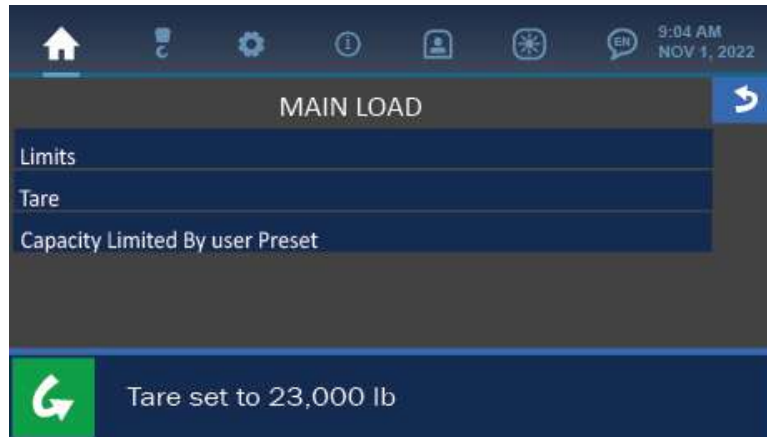
Maximum: the current maximum load allowed before the system displays a load alarm condition

Minimum: the current minimum load value recognized by the system for proper display

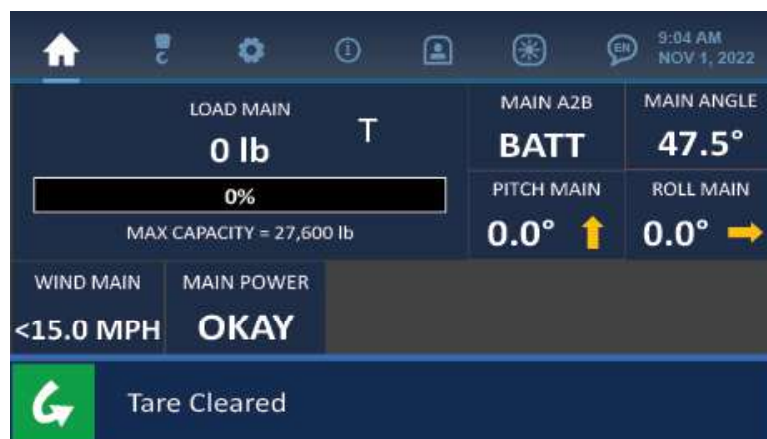
Derate: this value indicates the capacity of the load chart that the system is set to recognize. If for example, the Derate value is set to 100%, the entire load chart is used at full capacity. If the Derate value were to be set at 50%, the machine would be enabled to function at only half of its actual capacity before the system shows an alarm state.

NOTE: See ' Understanding The User Interface' section of this manual for more information on the Value Entry Screen.

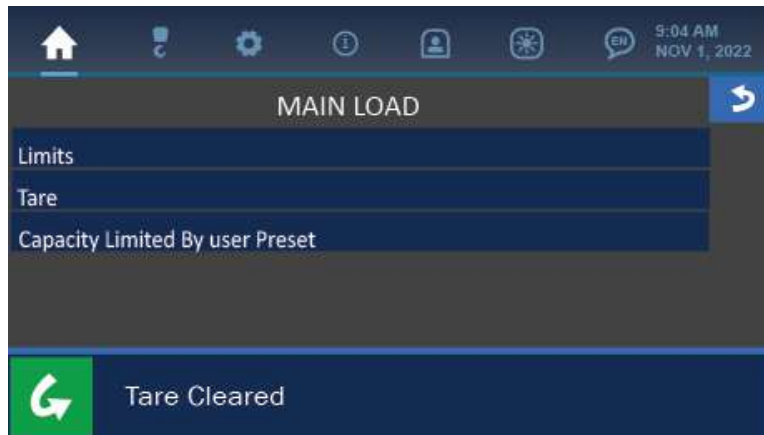
Load Tare



The Load Tare option enables an operator to set the current weight on the hook to zero. To do this, simply press the Tare Banner Button in the Load Menu. For the example of this screenshot, the system shown is displaying in the Notification Bar (along the bottom of the screen) that the current load of 23,000 lb has been set to zero. This is further indicated by the following screenshot of the modified Home Screen – the current load shows 0 lb and the 'T' symbol indicates that this zero-load is the result of the tare operation.



To clear the tare set point, simply re-enter the Load Menu, and press the Tare Banner Button again. The Notification Bar will indicate that the tare has been cleared, as shown in the screenshot below.



2.2. Anti-2-Block Indication

Shown below is the Home Screen, with the Anti-2-Block Indication Tile emphasized.



As illustrated above, the A2B status reads simply 'OKAY', indicating the transducer is sensing the load of the counterweight and is operating normally. In case of a 2-block situation, the A2B status will display this state as shown below. An associated alarm message will also display in the Alarm and Notification Bar along the bottom of the screen.

A2B MAIN
2BLK

NOTE: See the 'Troubleshooting' section of this manual for more information on various alarm states and displays.

2.3. Angle Indication

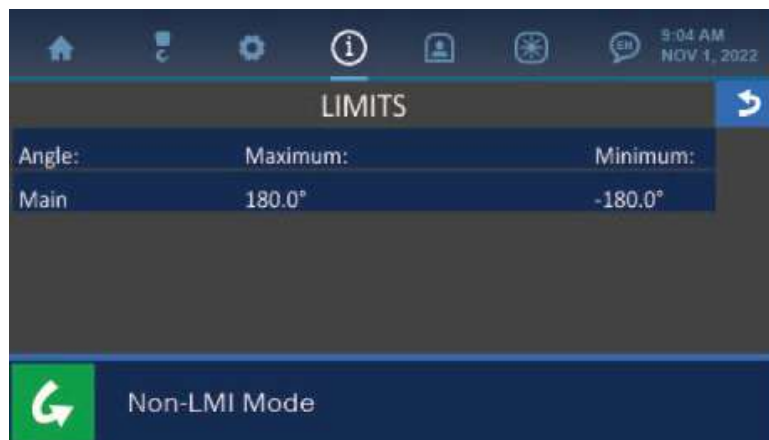
Shown below is the Home Screen, with the Angle Indication Tile emphasized.



As illustrated above, the current boom angle is shown in degrees, to the resolution of 0.1°. Pressing anywhere directly overtop the Angle Indication Tile will open the Angle Menu, where angle limits can be adjusted.

Angle Limits

The angle limits are defined as max and min values for machine boom angle. This simply ensures that the angle transducer is given its full potential range of operation, values are factory set but can be changed in the field as required.



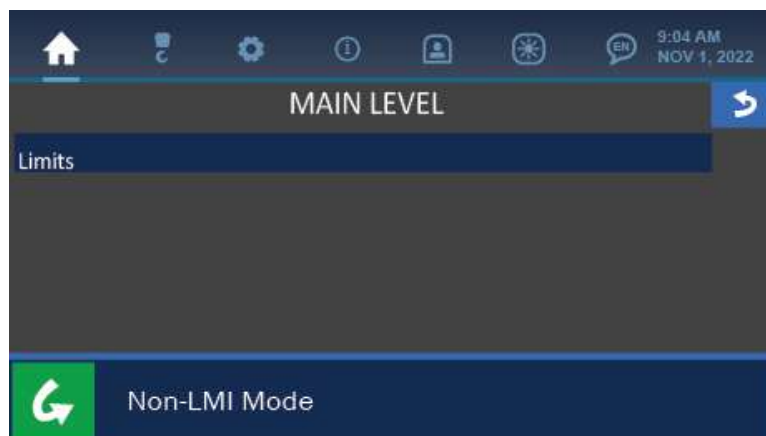
NOTE: See 'Understanding The User Interface' section of this manual for more information on the Value Entry Screen.

2.4. Level Indication

Shown below is the Home Screen, with the Level Indication Tiles (Pitch and Roll) emphasized.



As illustrated above, the current machine pitch and roll values are shown in degrees, to the resolution of 0.1°. Pressing anywhere directly overtop either parameter will open the Level Menu, as shown below.



Level Limits



LIMITS				
Level:	Pitch Max:	Pitch Min:	Roll Max:	Roll Min:
Main	40.0°	-40.0°	-40°	-40.0°

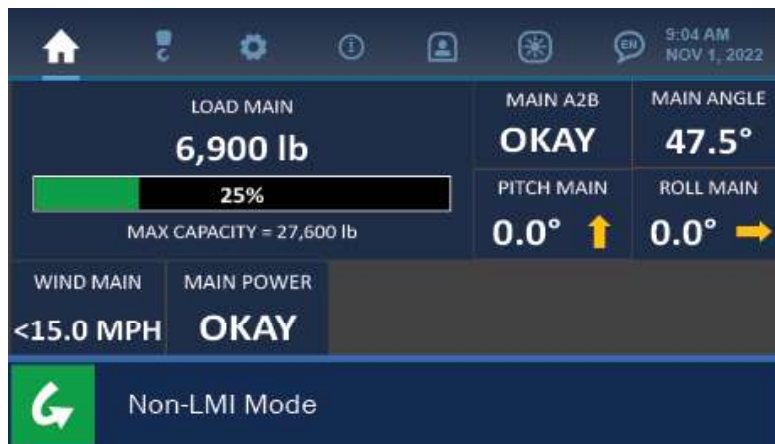
Non-LMI Mode

The level limits are defined as a maximum and minimum values for machine pitch and roll. These values are factory-set but can be changed in the field as necessary,

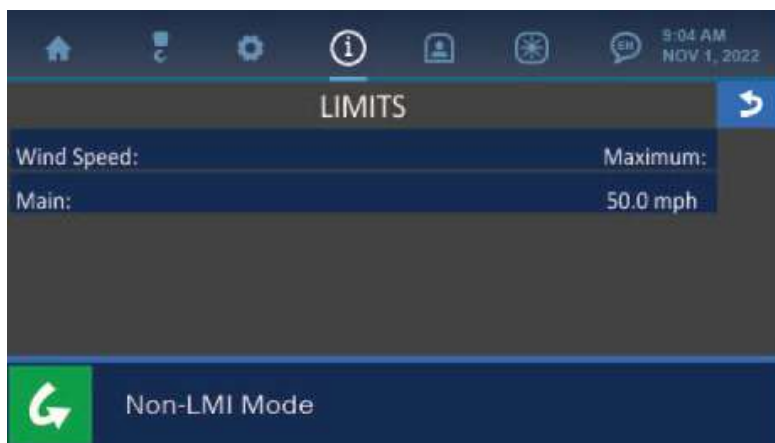
NOTE: See 'Understanding The User Interface' section of this manual for more information on the Value Entry Screen.

2.5. Wind Speed Indication

Shown below is the Home Screen, with the Wind Speed Indication Tiles emphasized. In addition to indicating wind speed, this component will also sense and display temperature on the Home Screen.



As illustrated above, the current wind speed is shown in miles per hour, to the resolution of 0.1mph. Pressing anywhere directly overtop either parameter will open the Windspeed Limit Menu, as shown below. These values are factory-set but can be changed in the field as necessary,



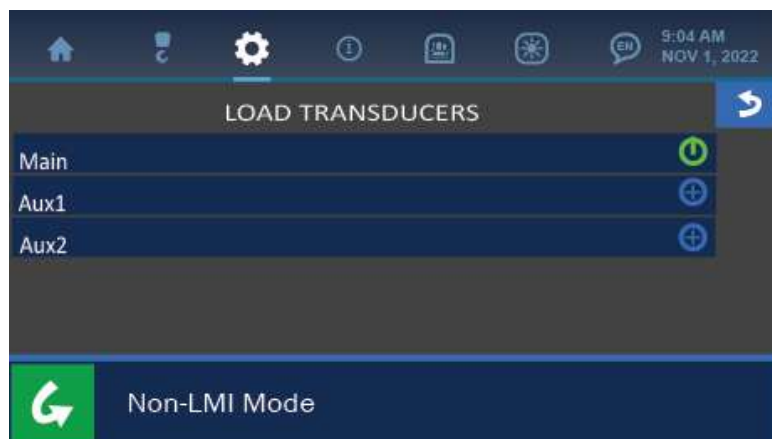
NOTE: See "Understanding The User Interface" section of this manual for more information on the Value Entry Screen.

2.6. Adding a Spare Transducer

The display panel allows for spare components to be added to the system quickly and easily. First, enter the user permission code to gain access to the required menus for this operation (see the section: *Entering the Permission Level Code* of this manual).



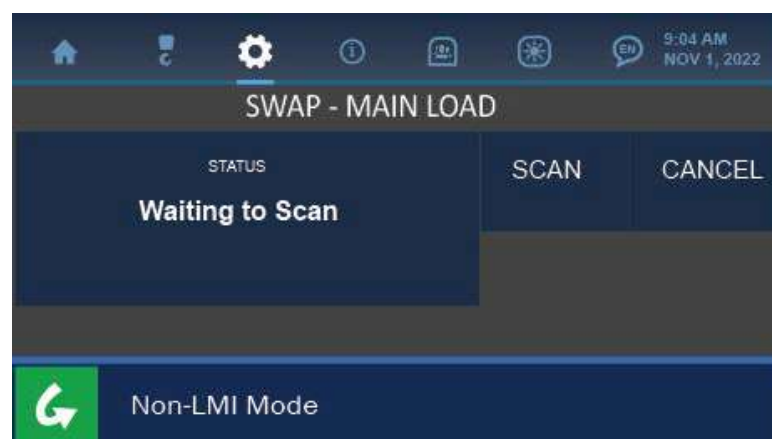
Select the transducer type to open further options for the component. From the transducer menu, an inactive component can be added to the system, or an already active component can be disabled, swapped or removed.

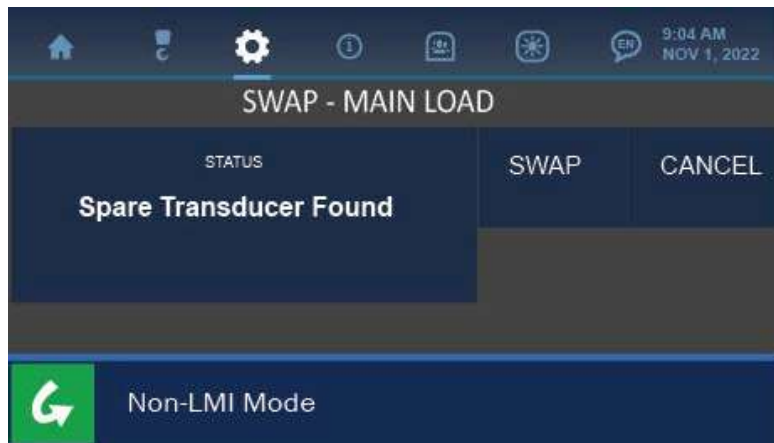




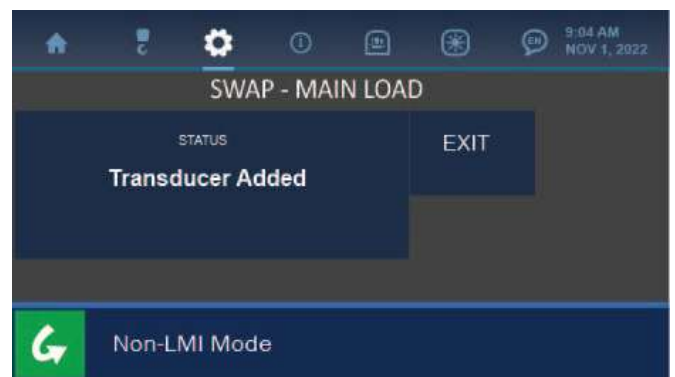
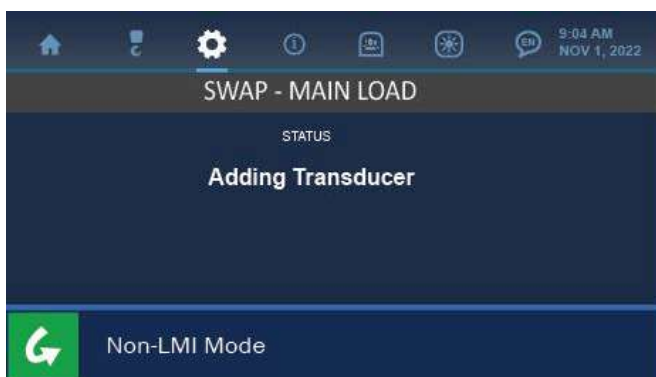
The **disable** function will keep a component's ID number registered in the system and assigned to that particular transducer but will not accept communications from it. A disabled transducer will not trigger system alarms as it is unable to send signals to the display panel. The **swap** function will disable one component and enable another in its place. The **remove** function will completely ignore communication from a component and reassign its ID number to another component when necessary.

Once a new component is selected to be added or swapped for another, the system will prompt the user to initiate a scan for a new transducer. Press the 'Scan' button to start the scan.





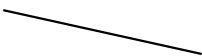
Once found, the message: 'Spare Transducer Found' will be displayed. Press the 'Swap' button to complete the operation. The system will then perform the replacement, while displaying accompanying messages on the screen. All calibration and identification assignment will also be handled automatically within the system.



After the new transducer has been added to the system, press the 'Exit' button to return to normal operation.

2.7. Using the USB Functions (Alarm Event Logging and Upgrading the System Firmware)

The system introduces new functions available via a built-in USB port, located on the back of the display panel as shown in the illustration below. The USB port can be used to pull alarm event logs as well as upgrade the system firmware. Both of these functions are described in the following sections.

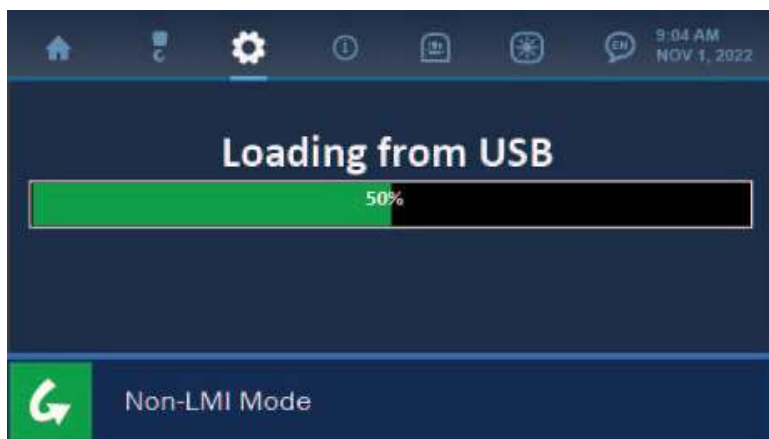
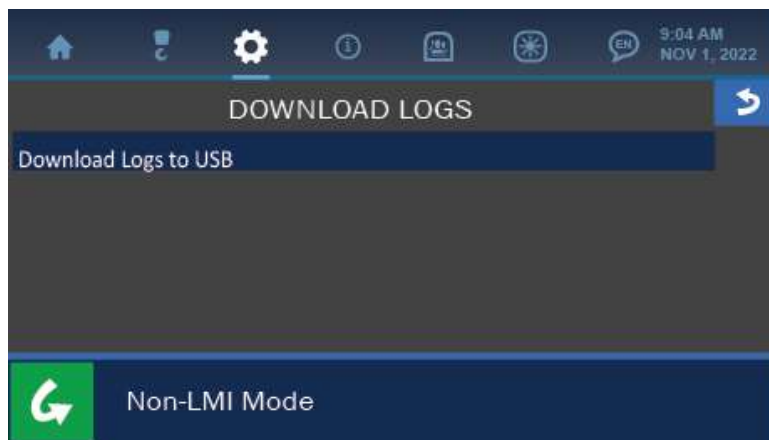
USB port 

Data Logging

To begin downloading data from the system display panel, first insert a FAT formatted USB drive into the panel's USB port. Next, enter the Supervisor Permission Code to access the data logging option in the Settings Menu (see the section: *Entering the Permission Level Code* of this manual).

Next, navigate to the Logs Menu (screenshot shown below) by entering: Settings / Panel / Logs. Select the option 'Download to USB' to begin downloading logs to the USB drive. This may take several minutes, depending on how many logs are being downloaded.

NOTE: While logs are being downloaded to the USB drive, the display panel's functionality is limited and will not operate as an LMI or system component.



Once finished, the system will indicate that the download is complete and the USB drive can be safely removed from the display panel.

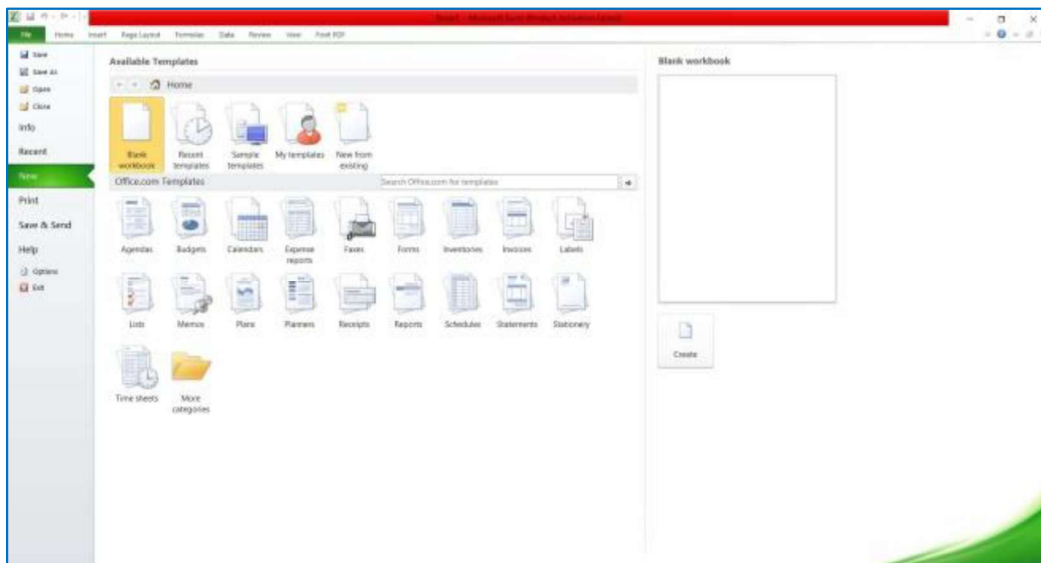
Viewing the Data Logs

The downloaded logs will be saved to the USB drive with a title indicating the date and time saved. The naming format is described below:

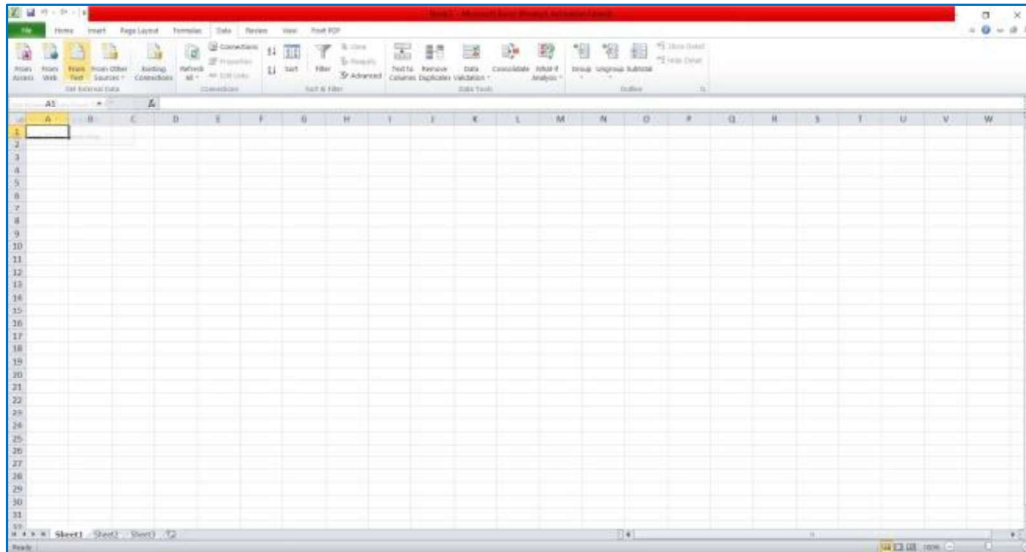
CS.20000-2017-10-24_10h10m37s.csv

System Serial Number *Year* *Month* *Day* *Hour* *Minute* *Second* *File Type*

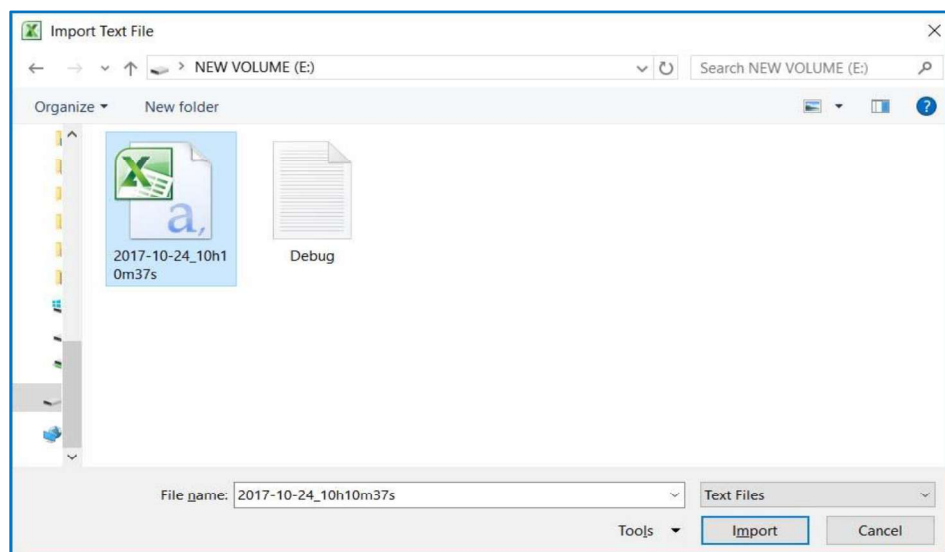
Once the USB drive is inserted into a computer, open Microsoft Excel and create a new workbook, as shown in the screenshot below.



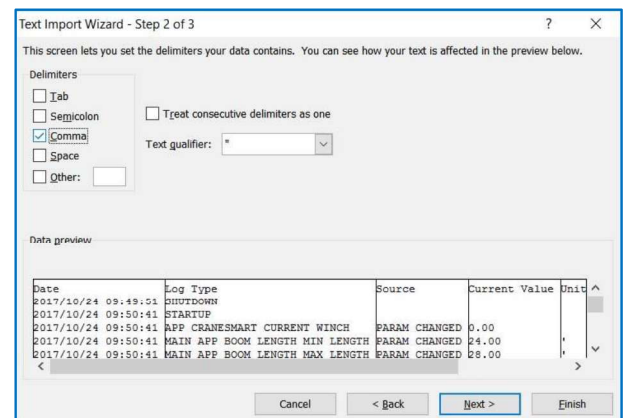
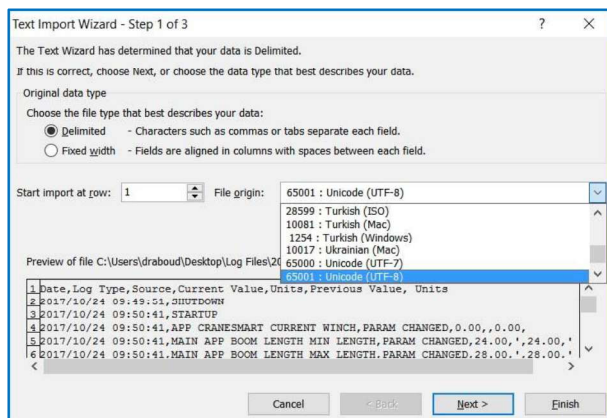
From the new workbook interface, click to open the 'Data' tab located along the top of the menu bar. Then, from the 'Get External Data' section of the 'Data' tab, click the option *From Text*.



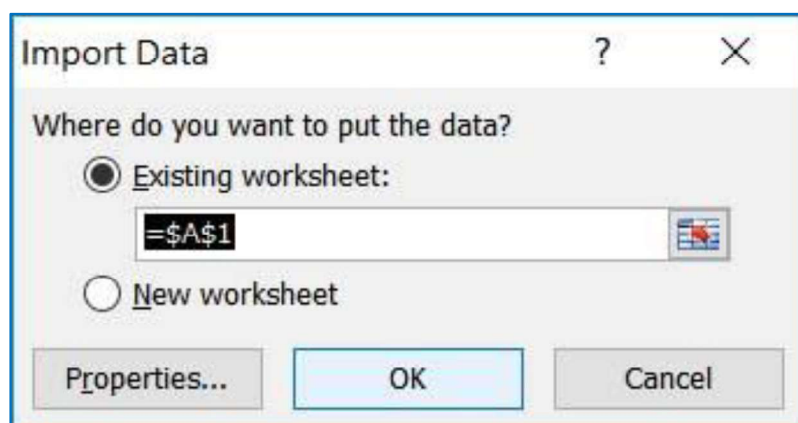
Upon selection, an 'Import Text File' window will open, allowing the user to navigate to the log files on the USB drive. Select the appropriate csv file and click 'Import'.



At this point, a 'Text Import Wizard' will be displayed, allowing for various options and customization of the data. From the 'File origin' dropdown box, select the option '65001: Unicode (UTF-8)' and click the 'Next' button. Then, deselect the 'Tab' option in the 'Delimiters' section and select the 'Comma' option. Click 'Finish' to close the wizard.



The program will open one final dialogue box, asking where the data should be placed. The default setting of 'Existing worksheet: =\$A\$1' is appropriate – simply click 'OK' to close the dialogue box and view a spreadsheet of the saved logs.

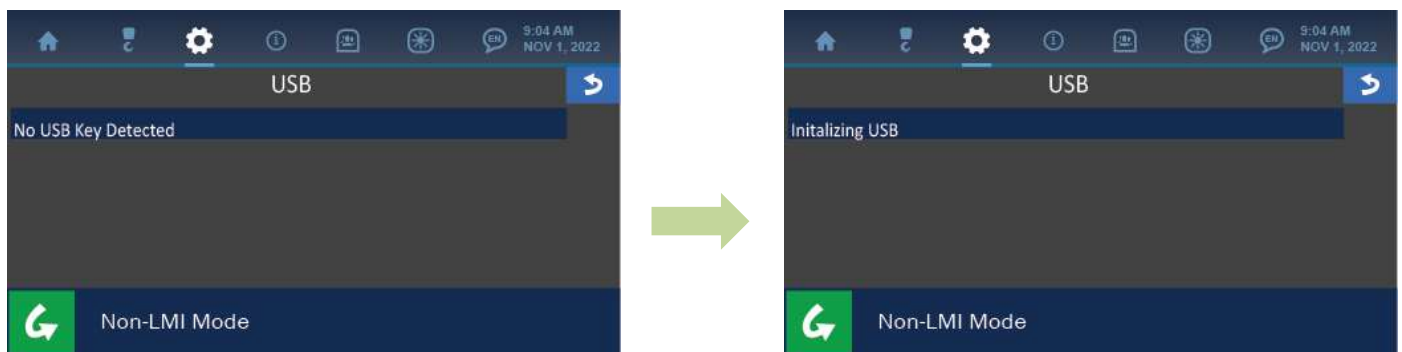


The logs will now be displayed as a detailed and columned list, marked by a timestamp (left column) and describing qualities such as: parameter changes, transducer output values, alarms and limits breached, bypass button presses and start-up / shutdown points.

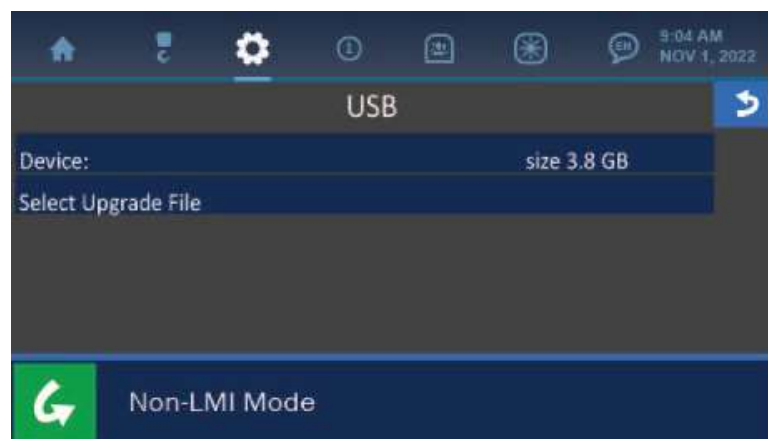
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
Date	Log Type	Source	Current Value	Units	Previous Value	Units										
10/24/2017 9:49	SHUTDOWN															
10/24/2017 9:50	STARTUP															
10/24/2017 9:50	APP CRANESMART CURRENT WINCH	PARAM CHANGED	0		0											
10/24/2017 9:50	MAIN APP BOOM LENGTH MIN LENGTH	PARAM CHANGED	24	'	24	'										
10/24/2017 9:50	MAIN APP BOOM LENGTH MAX LENGTH	PARAM CHANGED	28	'	28	'										
10/24/2017 9:50	APP LOGGER SHUTDOWN PERIOD	PARAM CHANGED	60		60											
10/24/2017 9:50	APP CRANESMART CURRENT WINCH	PARAM CHANGED	0		0											
10/24/2017 9:50	PARAM LIST	MAIN A2B STATE	2													
10/24/2017 9:50	PARAM LIST	MAIN ANGLE STATE	2													
10/24/2017 9:50	PARAM LIST	MAIN ANGLE USER MAX ANGLE	180	°												
10/24/2017 9:50	PARAM LIST	MAIN ANGLE USER MIN ANGLE	-180	°												
10/24/2017 9:50	PARAM LIST	MAIN ANGLE ZERO VALUE	89.5	°												
10/24/2017 9:50	PARAM LIST	MAIN LEVEL STATE	2													
10/24/2017 9:50	PARAM LIST	MAIN LEVEL USER PITCH MAX	49	°												
10/24/2017 9:50	PARAM LIST	MAIN LEVEL USER PITCH MIN	-49	°												
10/24/2017 9:50	PARAM LIST	MAIN LEVEL USER PITCH ZERO	0	°												
10/24/2017 9:50	PARAM LIST	MAIN LEVEL USER ROLL MAX	49	°												
10/24/2017 9:50	PARAM LIST	MAIN LEVEL USER ROLL MIN	-49	°												
10/24/2017 9:50	PARAM LIST	MAIN LEVEL USER ROLL ZERO	0	°												
10/24/2017 9:50	PARAM LIST	MAIN LOAD STATE	2													
10/24/2017 9:50	PARAM LIST	MAIN LOAD USER MAX	1000000	lb												
10/24/2017 9:50	PARAM LIST	MAIN LOAD USER MIN	0	lb												
10/24/2017 9:50	PARAM LIST	MAIN LOAD USER ZERO	0	lb												
10/24/2017 9:50	PARAM LIST	MAIN LOAD VALUE	0	lb												
10/24/2017 9:50	SNAPSHOT	LOAD CHART MAX LOAD	216000	lb												
10/24/2017 9:50	SNAPSHOT	MAIN ANGLE CURRENT VALUE	-89.5	°												
10/24/2017 9:50	SNAPSHOT	LOAD CHART OVERHANG	1.71	'												
10/24/2017 9:50	SNAPSHOT	LOAD CHART TIP HEIGHT	-22	'												
10/24/2017 9:50	SNAPSHOT	MAIN LEVEL PITCH VALUE	0	°												
10/24/2017 9:50	SNAPSHOT	MAIN LEVEL ROLL VALUE	0	°												
10/24/2017 9:50	SNAPSHOT	MAIN A7R VAL LIF	0													

Upgrading the System Firmware

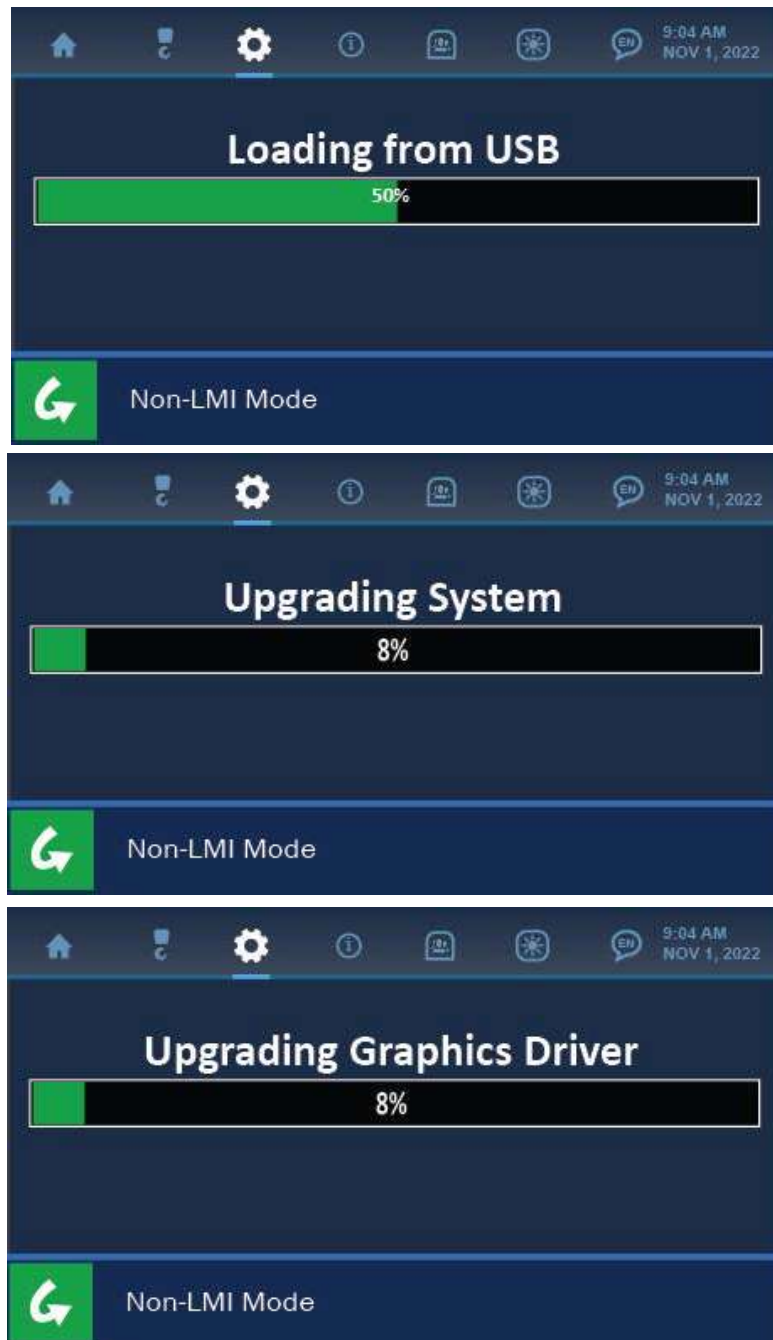
To upgrade the system firmware, first ensure that the USB drive to be used is FAT formatted, and that the appropriate *Upgrade.bin* file is located in its root directory. Then, enter the Supervisor Permission Code to gain access to the USB Menu in the system (see the section: *Entering the Permission Level Code* of this manual).



Next, enter the USB Menu, by entering: Settings / Panel / USB. Before a USB drive is inserted into the display panel, the USB Screen will indicate that there is no device detected. Once a USB drive is inserted, the status will change to 'initializing', and will display various parameters once the contents of the drive have been read by the system. As shown in the following screenshot, these include: the device name, disk size, and the version of the available upgrade.



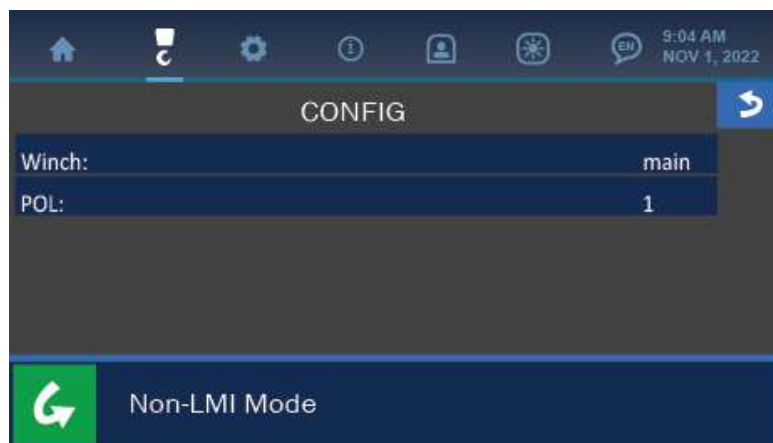
To upgrade the system firmware, simply press the screen directly overtop the upgrade version number. The system will prompt the user to confirm the upgrade, then will display the following progress screens:



Depending on what kind of upgrade is being installed, the update may take up to 15 minutes. Once the upgrade is complete, the system will restart, run a diagnostic routine and return to normal functioning. At this point, the system will be upgraded and the USB drive can be safely removed from the display panel.

3. The Configuration Menu

The Configuration Menu is symbolized by the boom hook icon at the top of the display and can be accessed by pressing the screen directly overtop this icon. This menu shows the major parameters that can vary with each install and are crucial to ensuring that the system's logic, displays and calculations will be accurate. This section describes these major parameters: Winch and POL (parts of line).



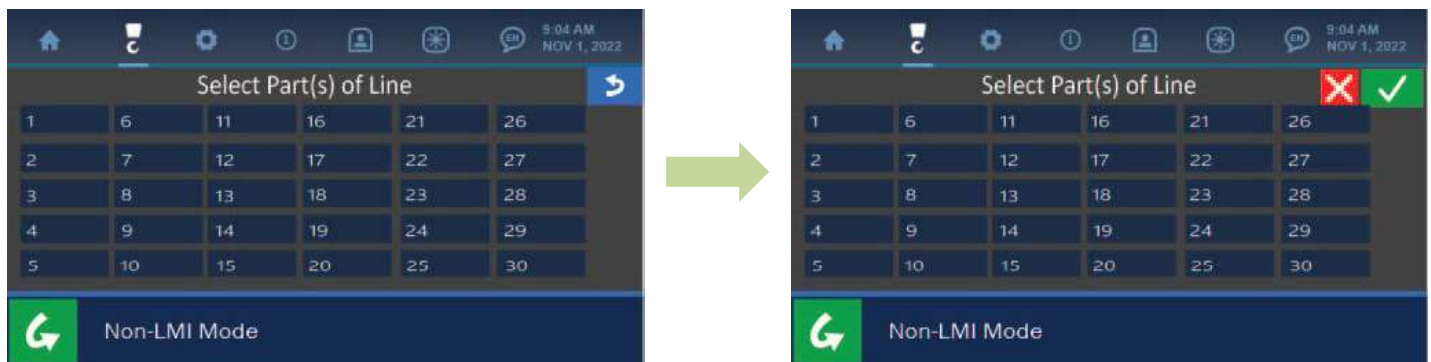
NOTE: Typically, the winch parameter is factory-set and cannot be changed without the assistance of a Cranesmart Service Technician. The POL can be changed as needed, though this operation requires a Supervisor Permission Code (see the 'Supervisor Access Screens' section of this manual for an explanation of how to gain access. Alternatively the locks need to be disabled.

3.1. Winch

The winch parameter indicates that the system is using the 'main' winch line.

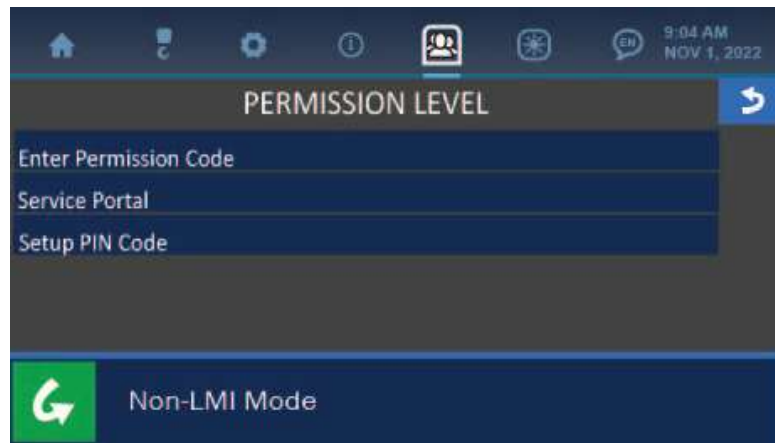
3.2. POL (Parts of Line)

The POL (Parts of Line) can be changed by simply selecting a new value from the POL menu. Once selected, the system will prompt for confirmation that the parameter should be changed. Press the green 'Check' button to accept the change.



4. The Permission Menu

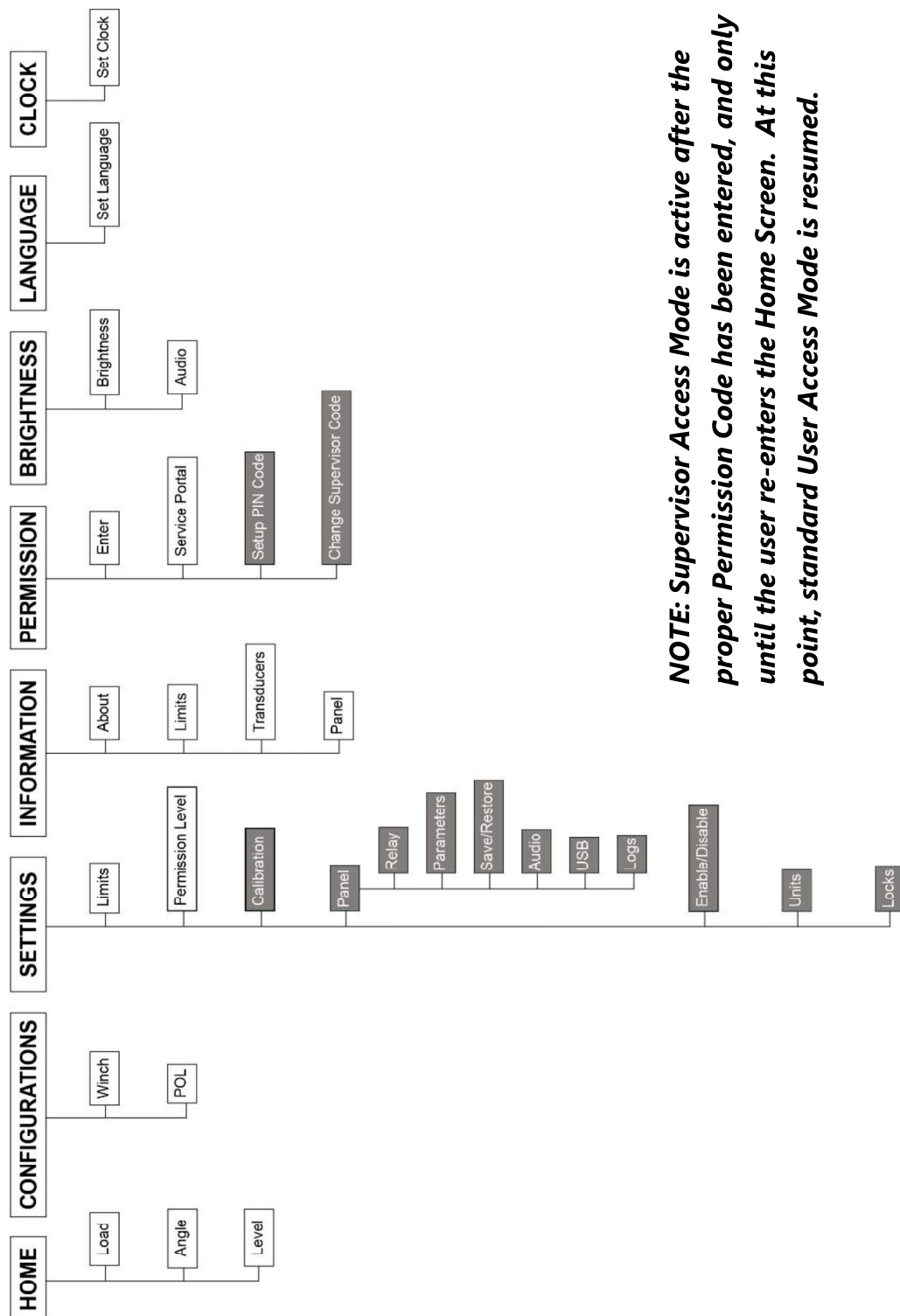
The Permission Menu is symbolized by the figure icon at the top of the display and can be accessed by pressing the screen directly overtop this icon. This menu is used to enter restricted areas of the system. A Supervisor Permission Code entered on the Permission Code Screen opens restricted areas to supervisors for safety control. A Service Code via the Service Portal Screen is used for technical maintenance and adjustment. The default Supervisor Permission Code from the factory is: 111, but can be customized to each system and changed at any time. **NOTE: For the sake of this manual, the supervisor access level of this menu is shown. Normal user access will have less options available than those shown for this description.**



Once a permission code is entered into the system, a Supervisor Mode is enabled and new options become available in many of the system's menus. Refer to the following page for a visual layout of which screens are available in each mode. The Supervisor Access Mode will be active until the user navigates back to the Home Screen, at which time normal access resumes. (Refer to the *Supervisor Access Screens* section of this manual for a description of the supervisor options).

6.1. System Screen Flowchart

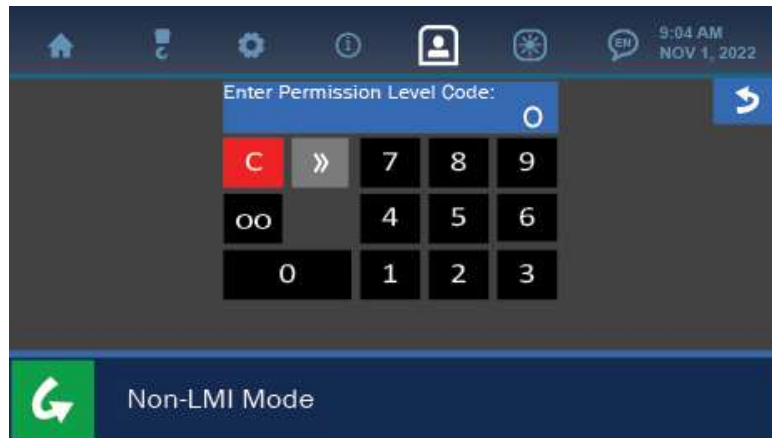
This illustration shows the basic layout of the system's main menus and screens. The screens shaded in grey are the areas that are only available in Supervisor Access Mode, once the code has been entered. All other screens are available in standard Operator Access Mode.



4.2. Entering the Permission Level Code

To gain supervisor access to the system, press the 'Enter Permission Code' Button from the Permission Menu (symbolized by the figure icon at the top of the display). Then, enter the code via the keypad and press the (green) Accept Button to save the change to the system. To cancel this operation, simply press the (red) Cancel Button to return to the previous screen.

NOTE: The default Supervisor Permission Code from the factory is: 111, however this code can be customized to each system and changed at any time.



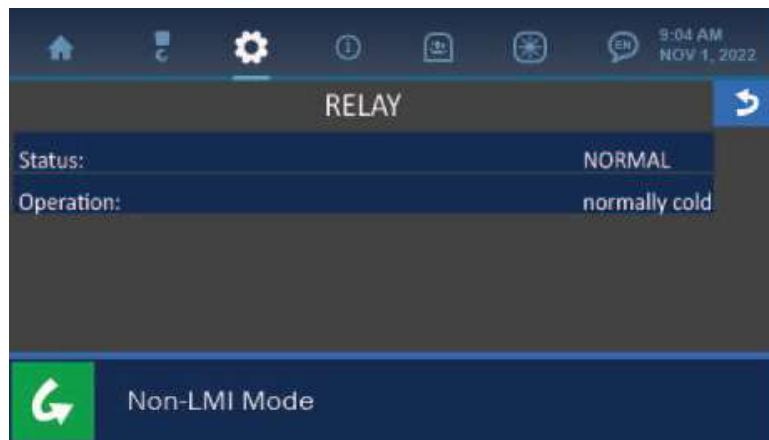
NOTE: See "Understanding The User Interface" section of this manual for more information on The Value Entry Screen.

4.3. Supervisor Access Screens

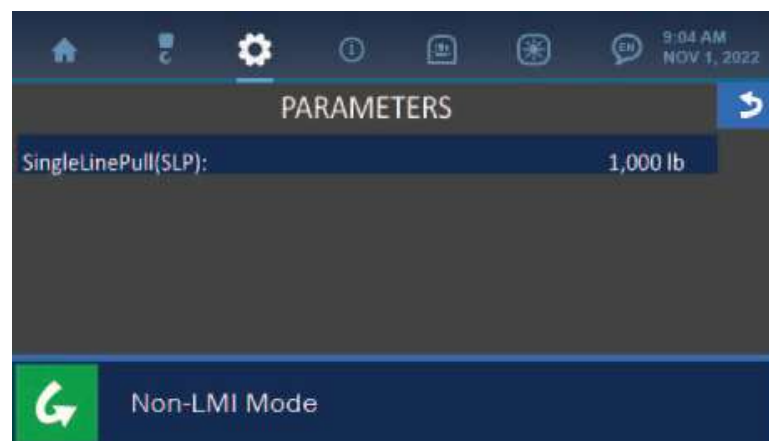
Once the supervisor access level is gained (by entering the correct Permission Code) the Permission Menu symbol will be changed to reflect the new setting, and the following listed screens will now be made available. **NOTE: As noted earlier, these screens will no longer be available once the user cancels the Supervisor Access Mode by re-entering the Home Screen.**

Settings / Panel Menu:

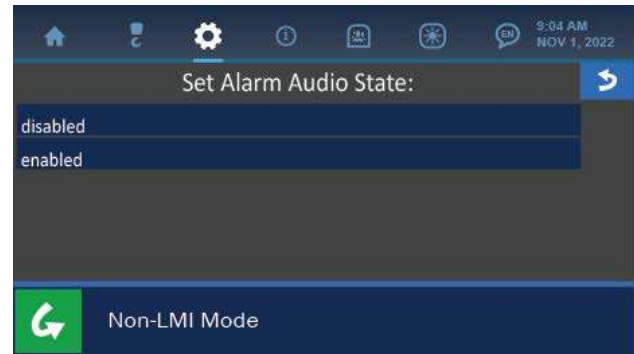
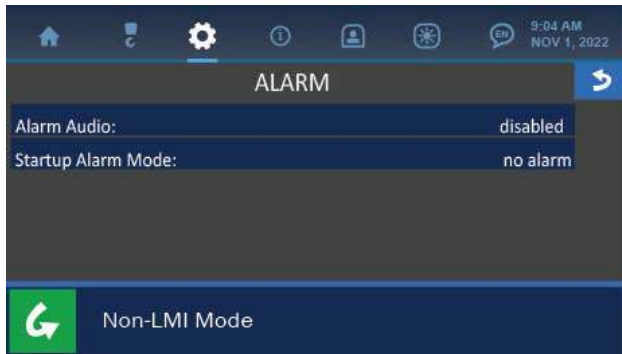
- **Relay:** The Relay Screen offers options for adjusting how the relay function (shutoff option) operates, including whether the shut off is normally hot or cold, and which components it will affect. For example, the panel can be configured to interrupt the winch up function to prevent the operator from damaging the machine. Overload, A2B, Angle and Level can also be used to shut down the machine in unsafe conditions.



- **Parameters:** The Parameters Menu is used to set the single line load cell pull so that the logic calculations are correct and able to display accurately. These values are pre-set in the factory but can be changed in the field as necessary.



- **Audio:** The Audio Screen is used to either enable or disable the alarm sound. Pressing the Banner Button will open the Audio State Submenu, where either state can be selected and saved into the system.



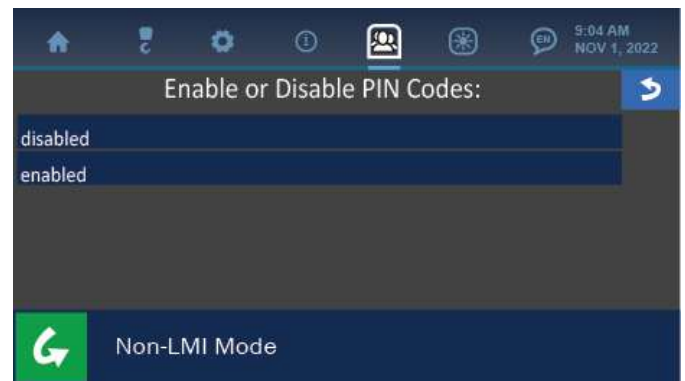
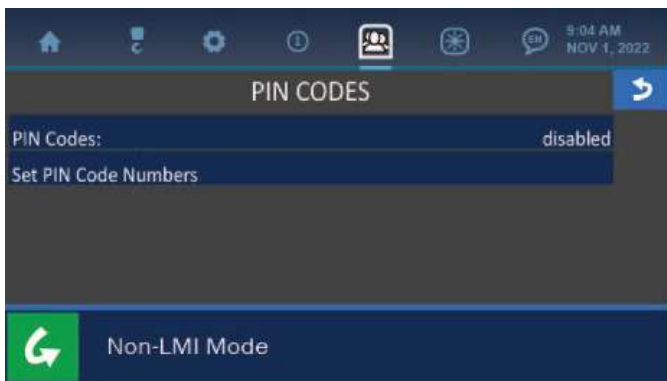
Settings Menu:

- **Locks:** The Locks Menu offers options for restricting operators from accessing various parts of the system.



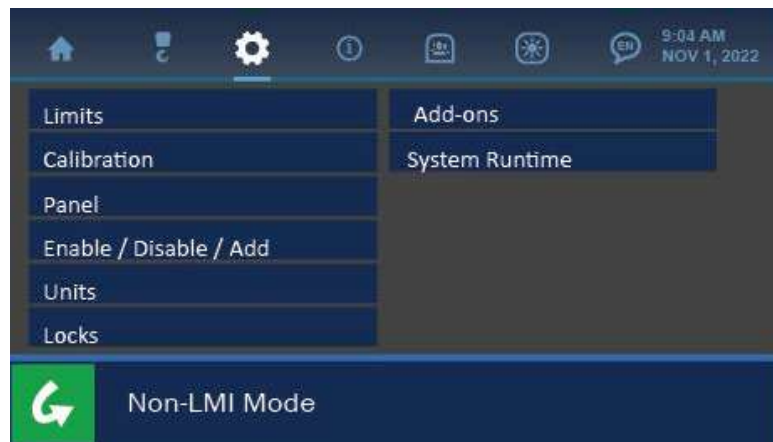
Permission Menu:

- **Setup PIN Code:** This screen is used to set optional user access codes, in order to customize and track each operator's access to the system. First, enable the feature by pressing the Enable Banner Button, then press the 'Set PIN Code Numbers' button to enter the codes themselves.



5. The Settings Menu

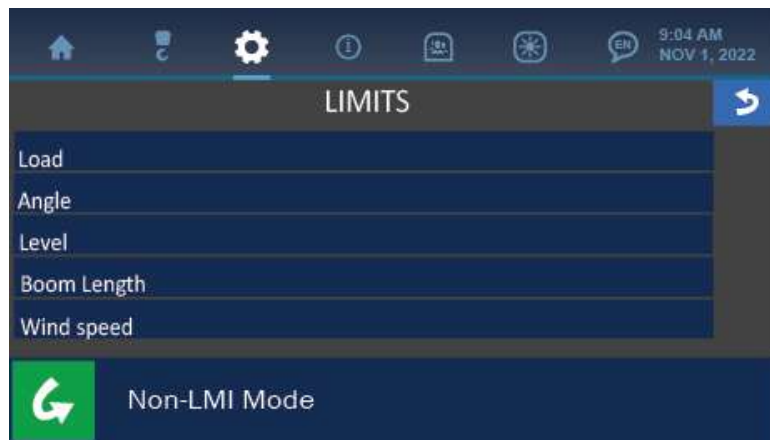
The Settings Menu is symbolized by the gear icon at the top of the display and can be accessed by pressing the screen directly overtop this icon. This menu offers many important options to the operator for how the system functions and displays information. The Settings Menu is shown below, and explanations of its various components follow. **NOTE: For the sake of this manual, the supervisor access level of this menu is shown. Normal user access will have less options available than those shown for this description.(see supervisor access)**



5.1. Limits

The Limits Menu presents all the various parameters that can be adjusted to define what the machine's safe zones of operation are. As listed and shown on the following screenshot,

these limit categories are: Load, Angle and Level. For more information on each of the listed limits see *The Normal Operation* section of this manual. To change the limit, select the settings. Then select clear data, input new data and save the changes.

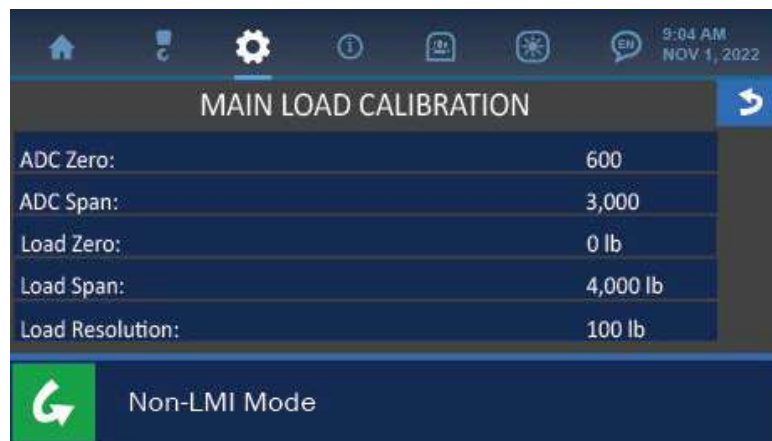


5.2. Calibration

The Calibration Menu lists the system indicators that require proper adjustment for accurate operation. As listed and shown on the following screenshot, these indicators are: Load, Angle and Level. Each of these calibrations is described in its respective section of this manual.



Load Calibration



The Load Calibration Menu is accessible only after the Supervisor Permission Code has been entered (see the section *Entering the Permission Level Code* of this manual). Once made accessible, this menu displays the current settings for the following parameters:

ADC Zero: indicates the system's analog to digital conversion value when there is no load on the hook. **(NOTE: This value cannot be directly changed).**

ADC Span: indicates the system's analog to digital conversion value when the maximum possible load is on the hook (before the system shows a load alarm). **(NOTE: This value cannot be directly changed).**

Load Zero: indicates the displayed load value when there is no load on the hook

Load Span: indicates the displayed load value when there is a maximum load on the hook (before the system shows a load alarm)

To change the 'Load Zero' or 'Load Span' values, simply press the screen directly overtop the target option to enter the Value Entry screen for this parameter.

Values are factory set and can be adjusted in the field as necessary

NOTE: See "Understanding The User Interface" section of this manual for more information on the Value Entry Screen.

Angle Calibration

The Angle Calibration Menu allows the operator to set a target angle and orientation for the angle transducer.

Concerning the Target Angle, set this value to what the system should be reading at a known boom angle. If the machine boom is currently at 0° but the system is displaying a different value, using the Target Angle Option will compensate for this discrepancy, by introducing an offset value in order to make the display more accurate.

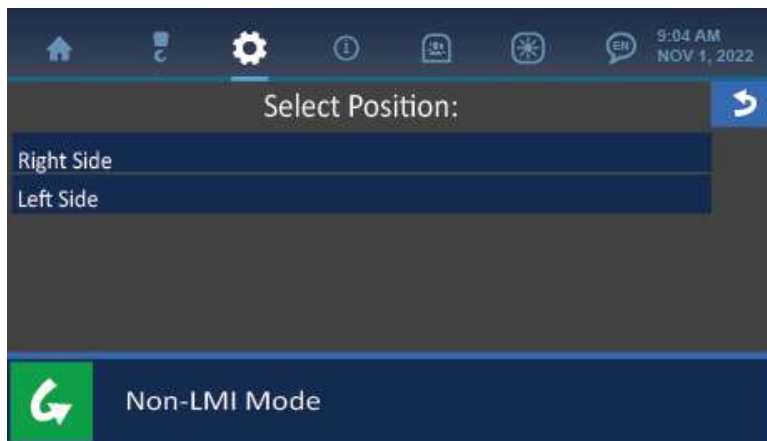
NOTE: The boom can be set to any angle, as long as that angle is known to be accurate by some other means (for example a level, applied to the boom horizontally or vertically). The resolution of the angle indicator is 1.0°.



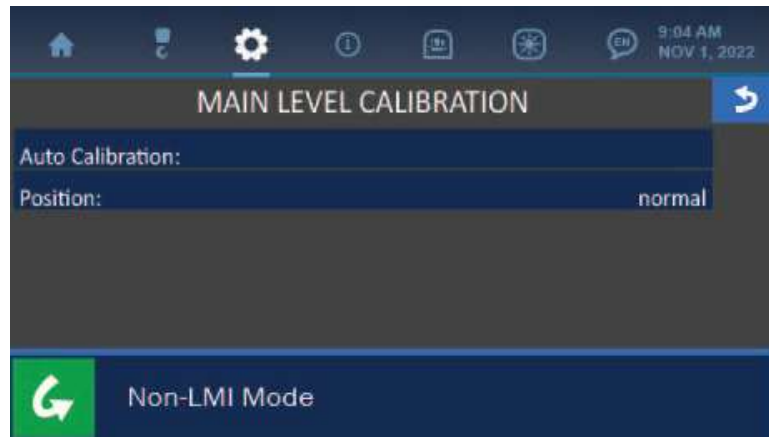
To change the target angle value, simply press the screen directly overtop the target angle option to enter the Value Entry screen for this parameter.

NOTE: See "Understanding The User Interface" section of this manual for more information on the Value Entry Screen.

The Position option simply ensures that the system displays the boom angle correctly by indicating which side of the boom the transducer is mounted on (in relation to the operator's viewpoint). As shown in the following screenshot, selecting this option will open a submenu, allowing the choice of either the left or right side of the boom. Selecting either option for the orientation will automatically enter that selection into the system and return the user to the Angle Calibration Screen.



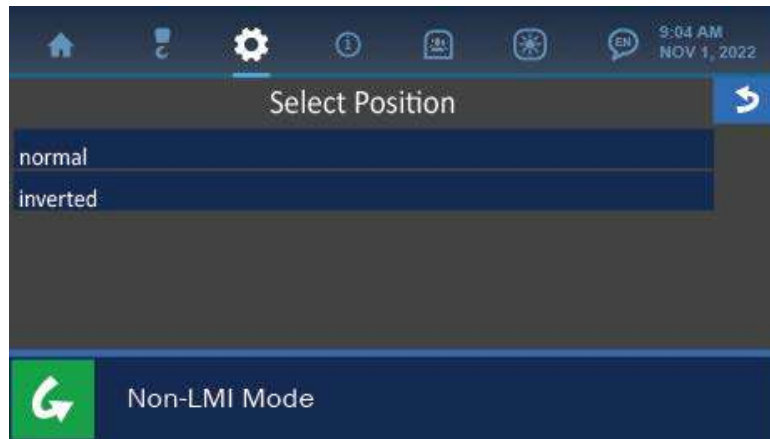
Level Calibration



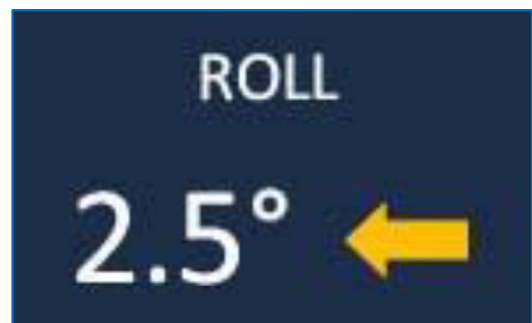
The first option listed the Level Calibration Menu is 'Auto Calibration'. To use the automatic calibration method, position the machine so it is level (within 0.5°) and press the Auto Calibration Button. If calibration is successful, the message: 'Roll Offset set Successfully' will be displayed in the Notification Bar at the bottom of the screen, and the values for Pitch and Roll should display as 0.0° on the Home Screen. If calibration has failed, or if the level transducer has been disabled, the message: 'Level Transducer is Disabled' will be shown instead to indicate the problem.

NOTE: If at any point, the machine is positioned more than 5.0° out of level (either pitch or roll) the system will enter an alarm state, and the load indication will only show the weight on the line alone, without accounting for angle limits. (Pipelayer only)

The 'Position' button on the Level Calibration Menu offers the option to either normalize or invert the roll orientation.



For example, if the *normal* option is selected, a machine roll to the right side of 2.5° (relative to the operator's viewpoint) would display as a roll value of 2.5° and an arrow pointing to the right. The *inverted* option would show the arrow pointing left, to indicate how much and in which direction the machine should move in order to re-establish a level position.



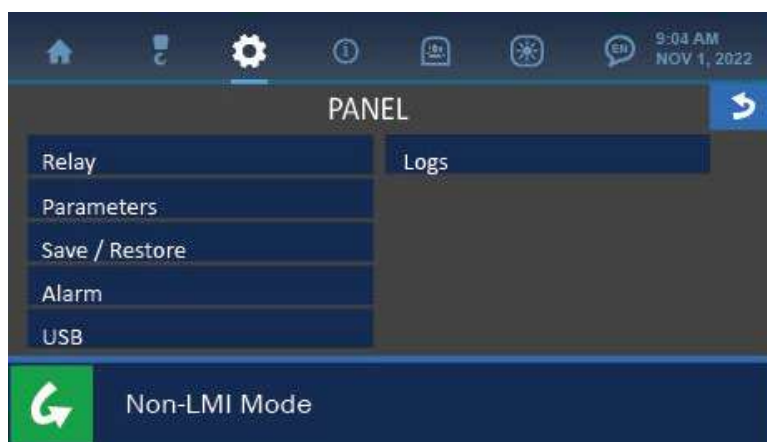
Boom Length Calibration



To calibrate the boom length of the machine, first ensure that the boom is fully retracted. Once retracted, press the 'Set Fully Retracted' button. Then, fully extend the boom and press the 'Set Fully Extended' button. Use the arrow keys to page down from retracted to extended. The system is now calibrated for the specific boom length of the machine.

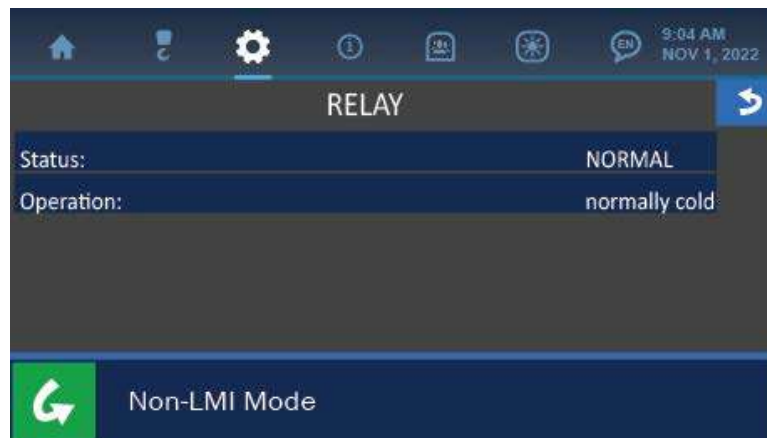
5.3. Panel

The Panel Menu offers the options to: adjust the relay settings, machine type parameters, save or restore the panel and system settings, adjust the alarm startup mode, and enter the USB and logging options.



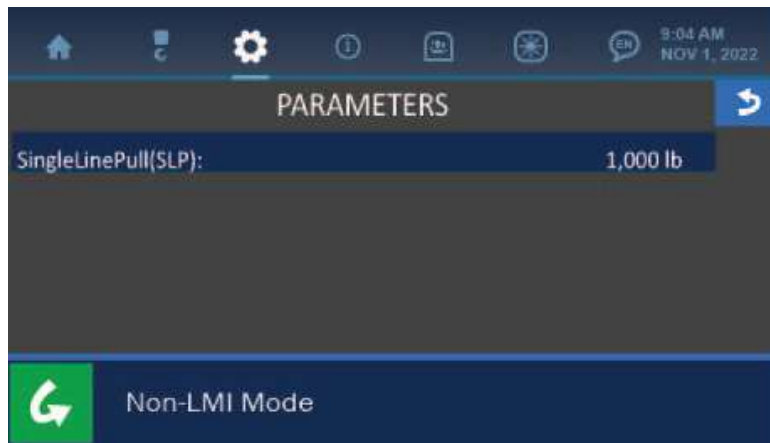
Relay

The Relay Menu allows a supervisor to check on the relay status, adjust the operation mode (normally cold or normally hot) and select which components are controlled by the relay function.



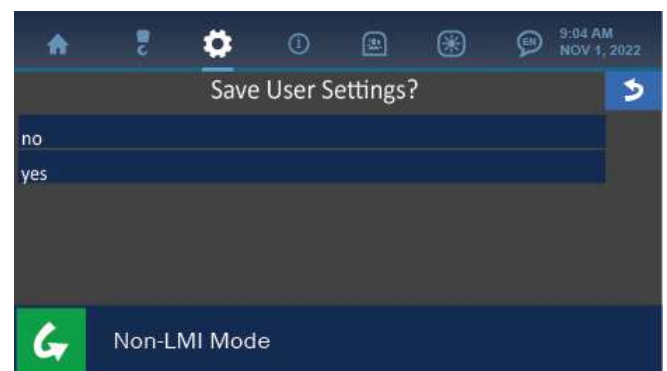
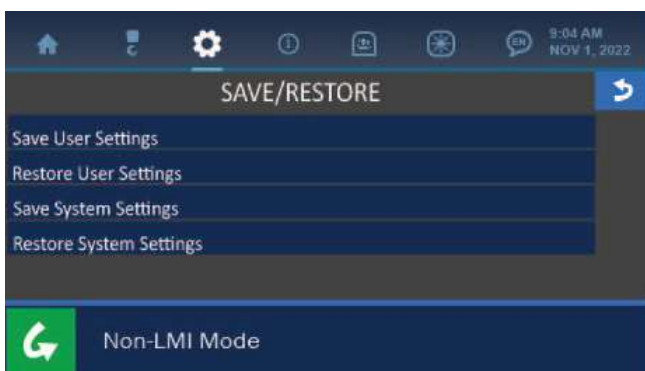
Parameters

The Parameters Menu allows a supervisor to adjust the single line pull parameter of the machine in use.



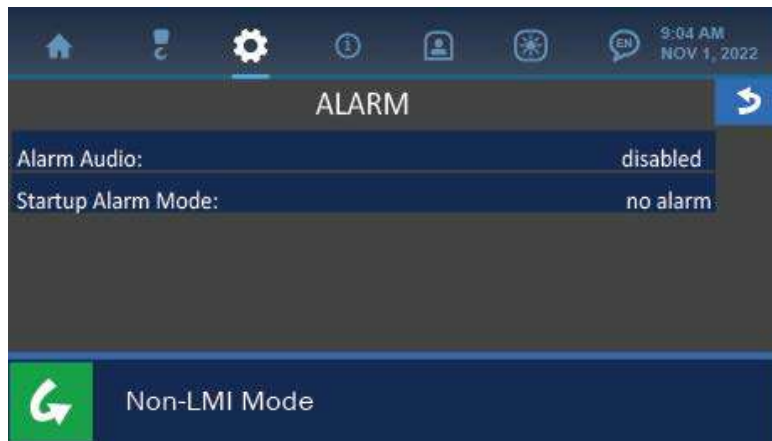
Save / Restore

From the Save/Restore Menu, the operator can choose to save the current system settings, or restore previous ones. Pressing either button will prompt a confirmation screen to ensure the right selection has been made.



Audio

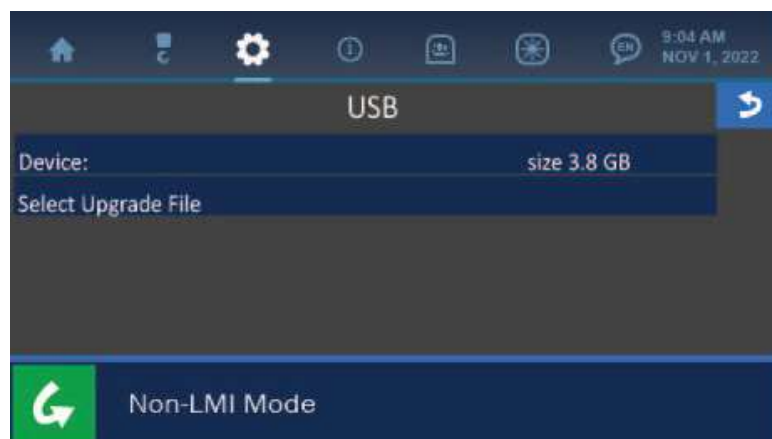
The Audio Menu allows the supervisor to enable or disable the alarm audio.



USB

The USB Menu allows the supervisor to update the system firmware, via a USB drive.

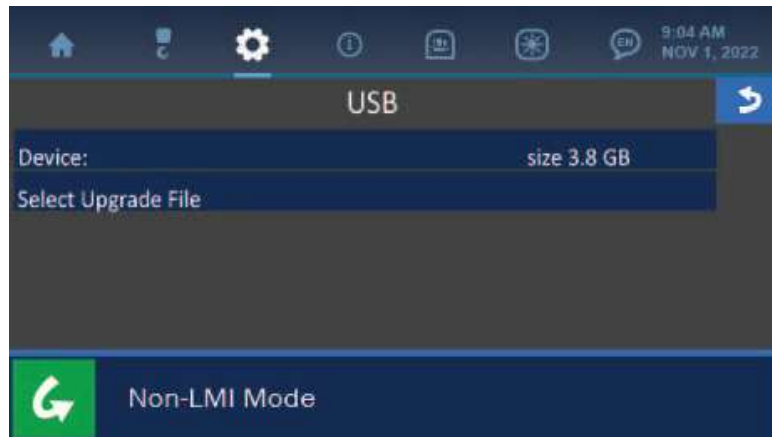
NOTE: See the section: 'Upgrading the System Firmware' of this manual for more information on using this function.



Logs

The Logs Menu allows the supervisor to download the systems logged data to a USB drive. The screenshot below shows the default display when no USB drive is detected.

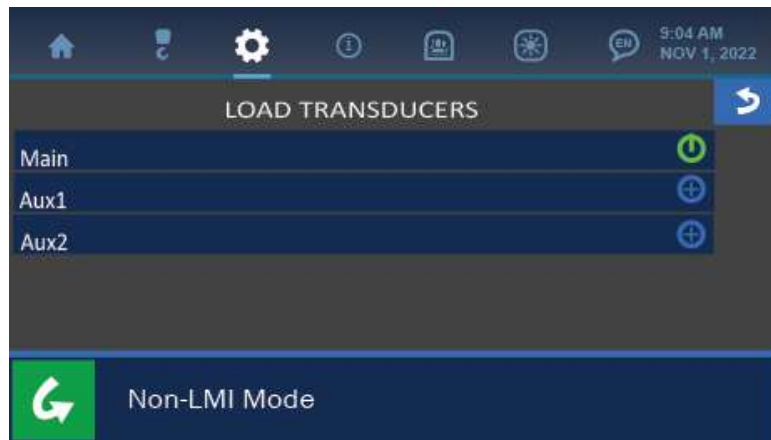
NOTE: See the section: 'Using the USB Functions' of this manual for more information.



5.4. Enable / Disable / Add

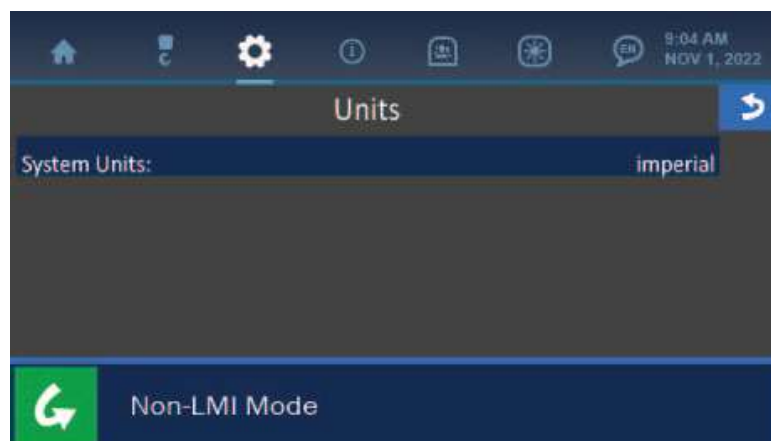
This menu is used to add or remove components from the system and active display. Simply select which transducer to affect, and either activate or deactivate it.





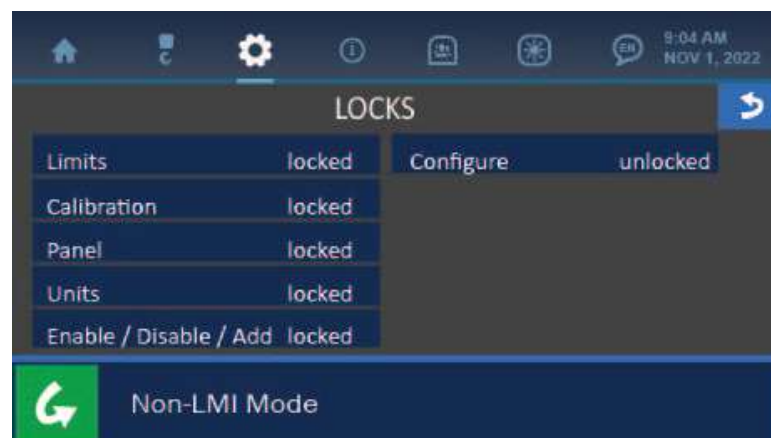
5.5. Units

This menu is used to toggle between metric and imperial units for the parameter display.



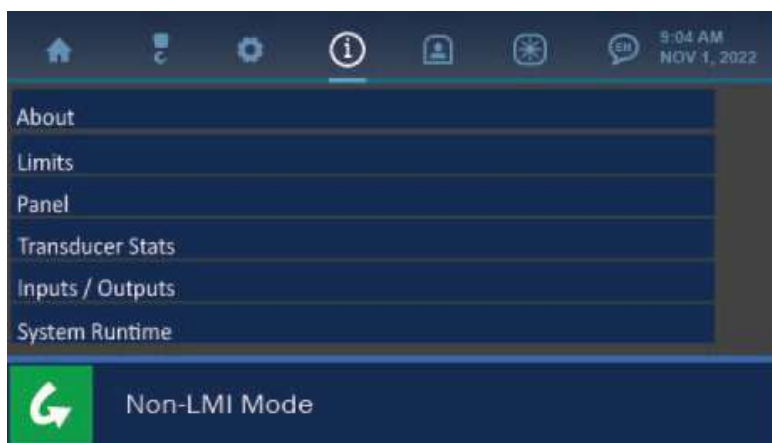
5.6. Locks

The locks are used to restrict user access to certain features. When a feature is locked it restricts accessibility. When a feature is unlocked it grants additional accessibility.



6. The Information Menu

The Information Menu is symbolized by the encircled 'i' icon at the top of the display, and can be accessed by pressing the screen directly overtop this icon. This menu offers options for displaying important information about the system such as: serial number, machine number, firmware version, system limits, transducer communication status and more. The Information Menu is shown below, and explanations of its various components follow.



NOTE: The displays in the Information menu are for display purposes only. Other menus must be accessed to edit the settings and information found here.

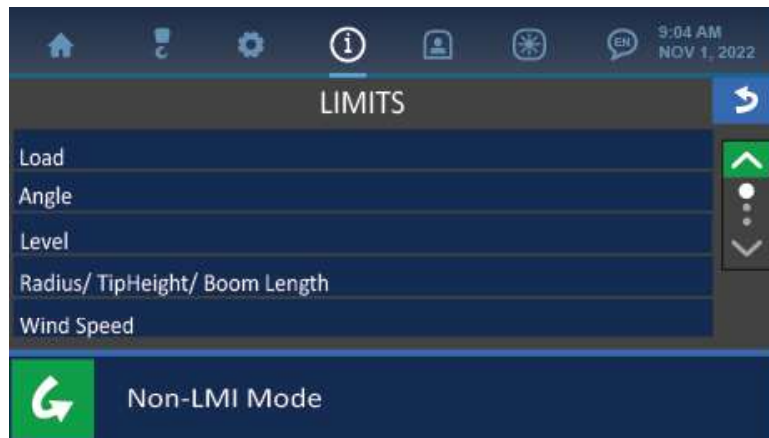
6.1. About

The About option shows information related to the initial setup of the system. The system serial number, machine serial number, machine model, firmware version, and compiler timestamp can all be found in this menu.

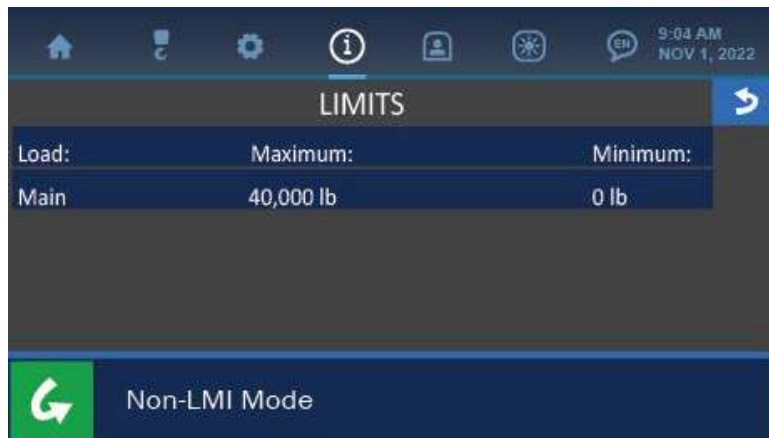


6.2. Limits

The Limits option offers displays of the set limits for all the major components, which are: load, angle, level and overhang/tip height.

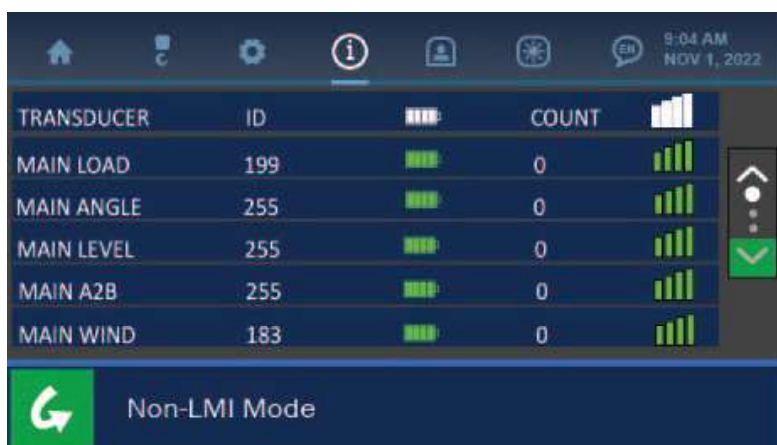


Press the screen overtop any of the options to reveal the set limits of that parameter.



6.3. Transducer Stats – Radio

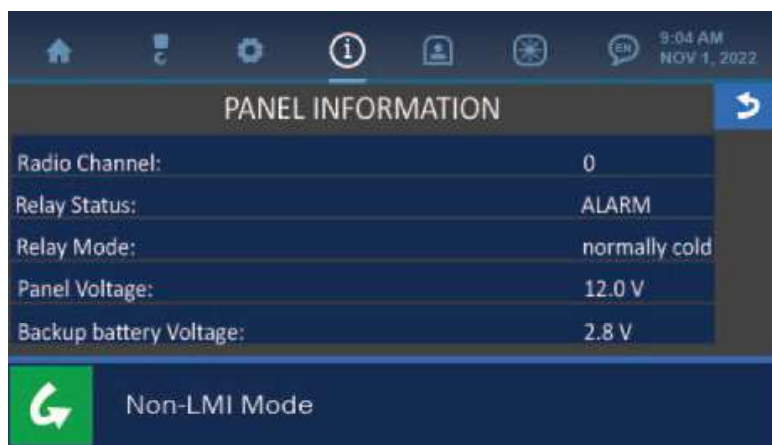
This screen will show you the status of each transducer active in the system



This screen can be used to troubleshoot radio signal.
See the troubleshooting section of this manual for more details.

6.4. Panel

The Panel option shows information related to the display panel's relay function, relay mode and power settings, as shown in the screenshot below. The relay function is used (optionally) to limit or disable the machine in the case of an alarm. See the *Supervisor Access Screens* section of this manual for more information on configuring the panel's relay function.



7. The LCD Brightness and Audio Menu

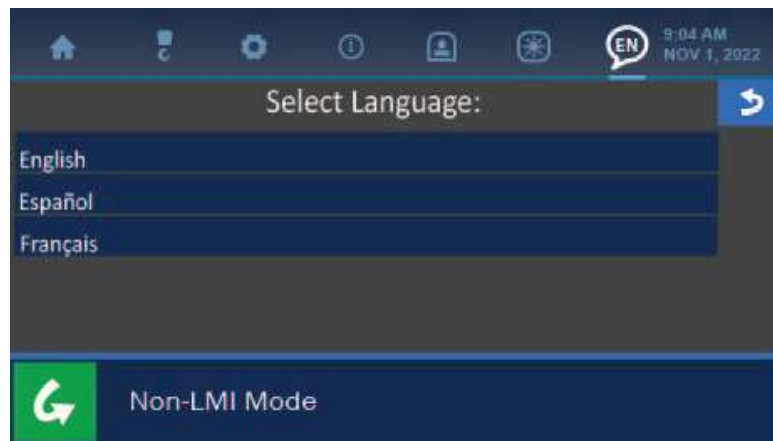
The LCD Brightness and Audio Screen is symbolized by the 'sun' icon at the top of the display, and can be accessed by pressing the screen directly overtop this icon. Use this menu to adjust the screen's brightness and the system sound for optimal display and performance. Press directly overtop the percentage bars in the center of the screen, or press the increment / decrement buttons on either side of the bars to fine tune the adjustment of either parameter.



8. The Language Menu

The Language Menu is symbolized by the figure icon at the top of the display.

This allows the operator to select a language. Currently it can be toggled between English and Spanish. Additional languages may be available in the LMI version of the system or upon request. Please contact us for more information.



9. The Time and Date Menu

Setting the correct time and date for the system is important for the accuracy of data logs, in case certain job information must be recalled or a machine needs to be serviced. The clock is backed up by a separate battery contained within the panel, eliminating the need to set this parameter each time the panel is powered off. The Time and Date Screen is shown and described below.



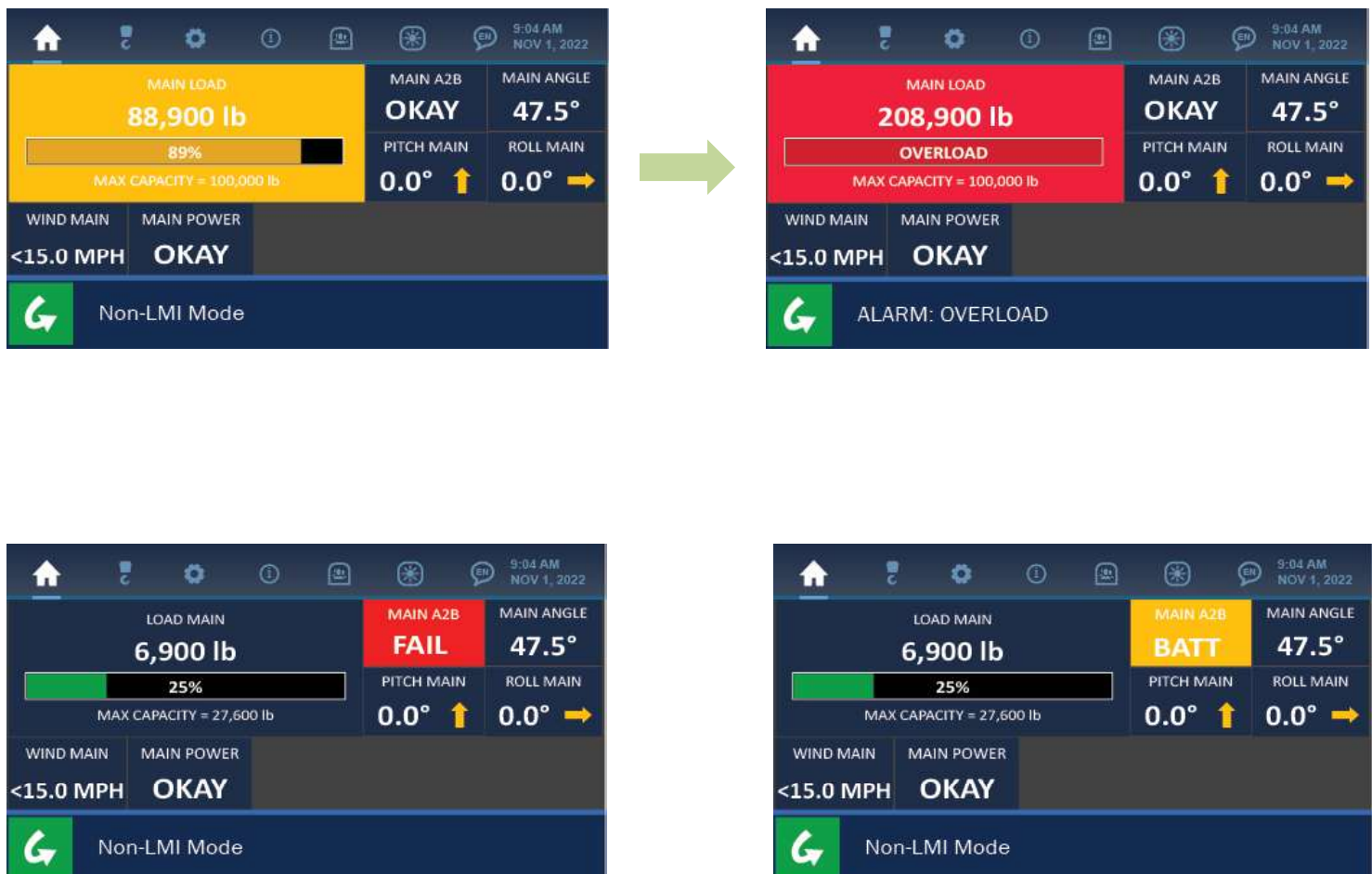
To change the date and time currently displayed, use the up/down arrows beside the year – month – day – hour - minute. Once the display is correct, press the (green) 'Accept' button to save the change and return to the previous screen. **NOTE: See "Understanding The User Interface" section of this manual for more information on the Value Entry Screen.**

10. Troubleshooting

The Cranesmart System performs self-checks for system errors, exceeded limits and any equipment malfunctions. This section illustrates and briefly describes some examples of this.

10.1. Alarm and Warning Screens

The system will notify the operator of any unsafe condition via the built in audible and visual alarms. A loud beep will sound from the display panel speaker, and an associate screen will show what error or unsafe condition has arisen. The alarms may be bypassed using the Bypass Button, located in the lower left corner of the display, which will silence the speaker for 30 seconds. However, the alarm state will persist until the error causing the alarm is corrected.



NOTE: Alarms will normally sound while the system components are being installed, and until there is a clear line of sight between the transducers and display panel. If alarms still sound after the components are properly installed, check the Transducer Stats Screen via the Information Menu to ensure a clear signal is being received from all components. If an alarm still persists, please contact the Cranesmart service department at: (780) 437-2986.

10.2. Replacing a Transducer Battery

Before replacing the batteries, call the Cranesmart Systems service department at (780) 437-2986, with the system serial number ready. The serial number can be found on the display panel or any transducer. Once it has been verified that a faulty battery is causing the error, follow the steps below.

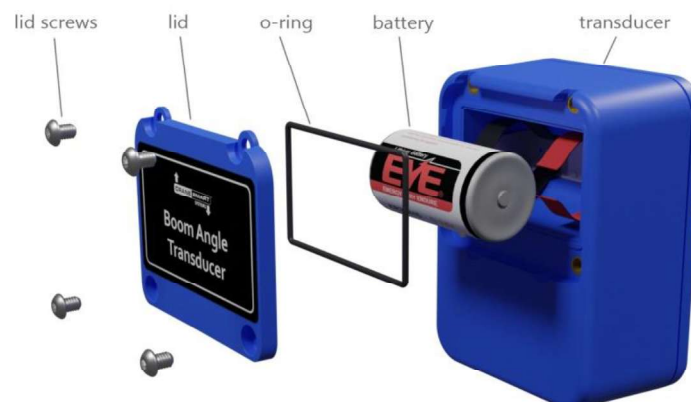
Tools and Equipment needed for battery replacement:

- (1) battery replacement kit (obtain a free battery replacement kit from Cranesmart Systems).
The kit contains:
 - (1) 3.6 volt Lithium Ion D-cell battery
 - (1) 1/8" Allen key(Alternatively, a 3.6V lithium battery may be purchased from a battery supplier.)

NOTE: If it is humid, raining or snowing – DO NOT OPEN THE TRANSMITTER. Remove the transmitter and perform the battery replacement indoor or undercover.

To Replace the Battery:

1. Remove the cap screws from the battery compartment lid and remove the lid.
2. Remove the battery from the holder.
3. Insert the new battery according to the battery picture on the base of the battery clip.
4. Secure the lid.



10.3. Replacing a Load Cell Battery

The display panel will indicate a low battery for approximately 3 weeks before the battery fails.

Before replacing batteries, please call the service department at (888) 562-3222 or (780) 437-2986 and have the serial number of the system being serviced readily available. The serial number can be found on the display panel or the load cell itself.

Tools and equipment for battery replacement:

- (1) 3.6 volt lithium ion D-cell battery
- (2) O-rings (one for a 7.5/15/25K load cell, one for a 40K and larger load cell)
- (1) 6g packet of silicone grease (Dow Corning 111 or similar)
- (1) 5/32" Allen key
- (2) battery cover gaskets (one for a 7.5/15/25K load cell, one for a 40K and larger load cell)
- (1) tube of RTV silicone sealant (Dow Corning 734 or similar)

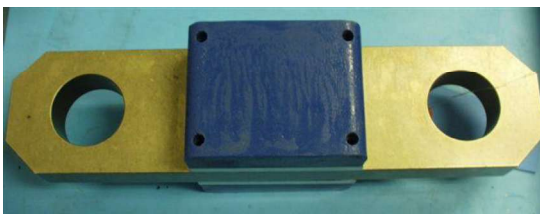
These parts are designed for use with the older gasket sealed load cells and **are not to be used** with o-ring sealed load cells.

NOTES:

- ***A 3.6V Lithium battery can be purchased from a local battery store for use with the load cell. Use the existing system battery for size matching.***
- ***If purchasing a new battery, the o-ring will need to be reused. Use grease as per the instructions below, when installing the o-ring.***

Locate the four exposed hex bolts on the battery compartment side of the load cell. The holes that are filled with silicone indicate the transmitter side of the load cell. Do not open this side – it has no user serviceable parts, and ***the warranty will be void if the transmitter electronics section has been opened.***

1. Remove the load cell from the crane.
2. Use the Allen key to remove the four hex bolts.
3. Remove the battery from clip (be careful not to break the red polarisation tab).
4. Install the new battery, (positive to red polarisation tab).
5. Remove and discard the old o-ring from the aluminum plate.
6. Grease the proper replacement o-ring, using a portion of the silicone grease supplied with the kit.
7. Install the new, greased o-ring into the groove on the aluminum plate. Apply the remaining grease liberally, covering the o-ring and groove. **As mentioned above, Do Not use the RTV silicone sealant – it is for the older gasket style load cell.**
8. Carefully place the plastic cover over the battery pack, so as not to pinch the battery wires.
9. Replace the screws and fully tighten the hex bolts. Some grease may squeeze out depending on the amount that was applied.
10. Clean off any excess grease.
11. Reinstall the load cell and test its operation.



11. Appendix

11.1. Installation Instructions

Guidelines

Read these instructions before beginning installation.

If the power available is not 12 - 24 (28VDC Maximum) Cranesmart Systems can supply the necessary converters. Please call our sales department at (888) 562-3222 or (780) 437-2986.

- Have the necessary tools available.
- Mount the transducers - load cell, angle transducer, A2B switch, etc.
- Mount the panel, alarm hub and antenna.
- Test the system.

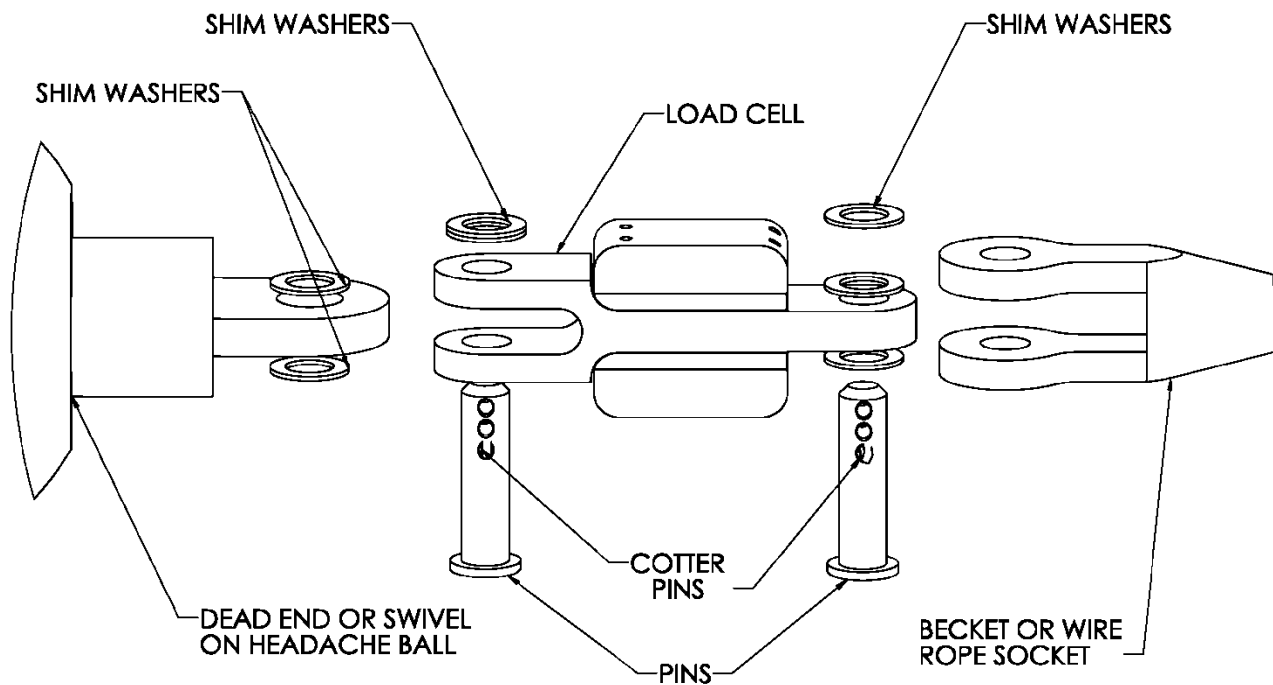
Tools Required

- Man basket (if the boom cannot be lowered) – to reach the boom, rooster sheave and/or jib.
- Pliers – for removing and bending cotter pins.
- Electric drill with drill bits.
- Welder – for attaching weld plate to boom/jib tips, if installing A2B or angle systems (not required for load cell installation).
- Wire crimping tools – for the display panel power and ground connections.
- Screwdrivers and/or socket set.
- Anti-seize compound for bolts and threaded pins to ensure the components can be disassembled and/or removed if necessary.

11.2. Load Cell Link Installation A

(Male/Female Load Cell Installation – 7.5K/15K/25K)

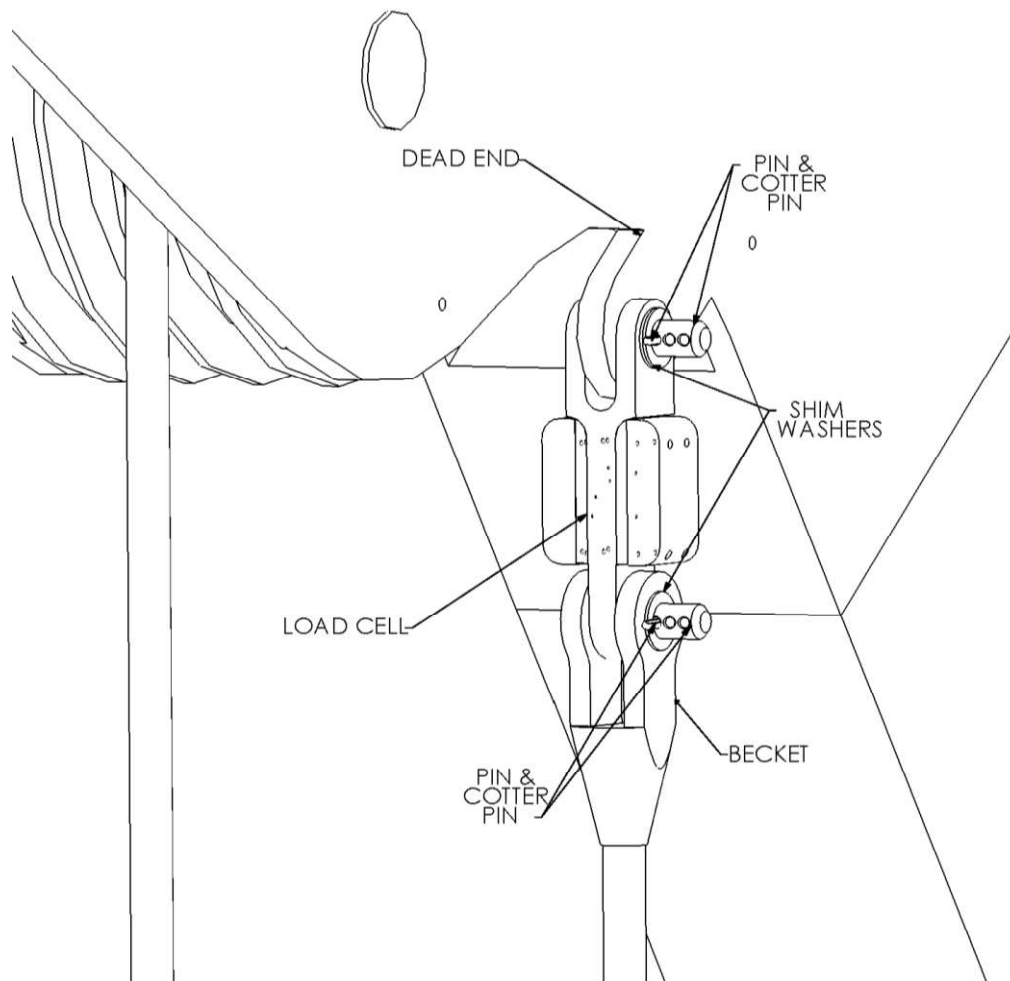
1. Pin the blue (main) load cell between the wire rope socket (becket) and the dead end on the main boom of the crane.
2. Pin the yellow load cell (Aux 1) between the wire rope socket (becket) and the headache ball or the auxiliary sheave (rooster) on the crane's boom tip. (Orange is for the Aux. 2 winch, if applicable.)



11.3. Load Cell Link Installation B

(Male/Female 7.5K/15K/25K Load Cell Link Placement Dead-End for Multiple Parts-Of-Line)

NOTE: Ensure the load cell does not contact the boom or rigging at any angle when pinned in place.



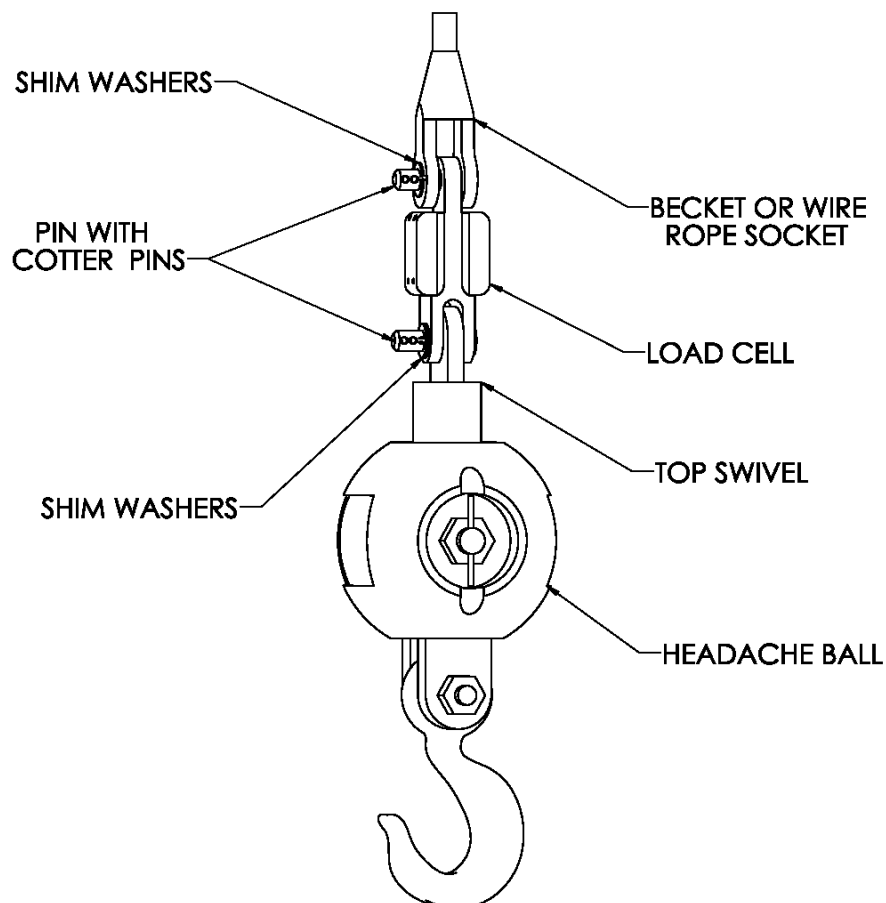
11.4. Load Cell Link Installation C

(Male/Female 7.5K/15K/25K Load Cell Link Placement on Headache Ball for Single Part-Of-Line)

Pin the load cell link between the wire rope (wedge) socket and the 'headache ball' or hook block as illustrated below.

The system is factory calibrated. To address any questions, please call the Cranesmart Systems sales department at (780) 437-2986.

NOTE: Custom links are available to help fit the load cell on the ball, if necessary.



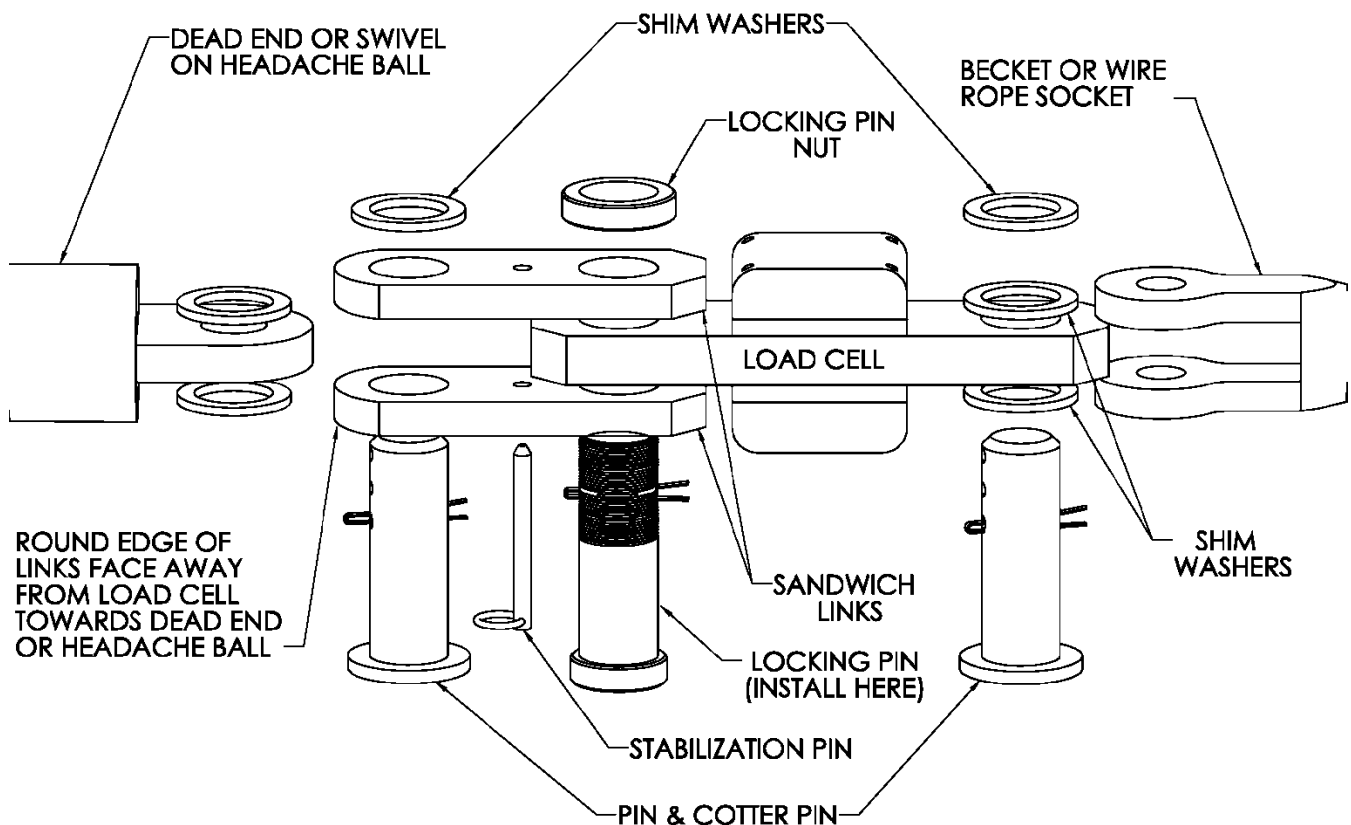
11.5. Load Cell Link Installation D

(Male/Male 40K/50K/80K Flat Link Load Cell Link Installation)

Sandwich Link Stabilization Pin – Male/Male flat link load cells only

The sandwich link stabilization pin prevents the sandwich link from folding against, and damaging the load cell when the headache ball or hook block is laid on the ground or during a two-blocking. Ensure that this pin is securely in place. Also ensure that the locking threaded centre pin and the stabilization pins are located in place as illustrated below.

NOTE: Ensure the load cell does not contact the boom or rigging at any angle when pinned in place.

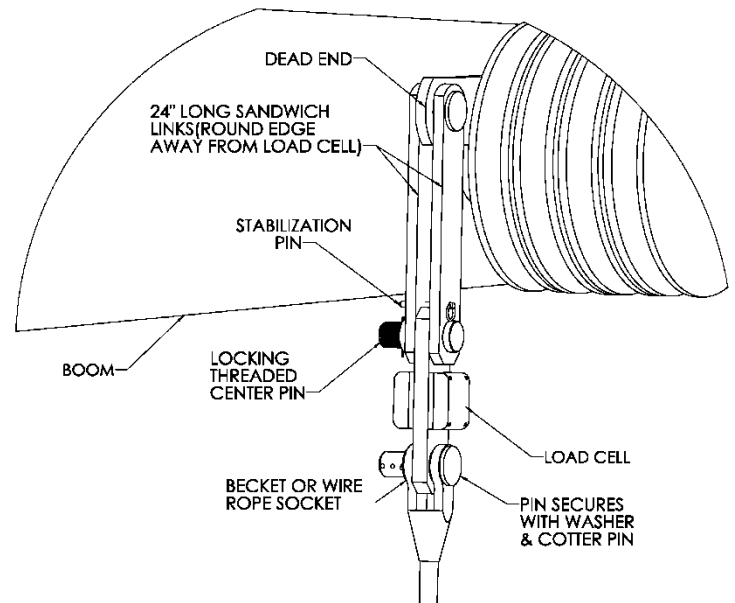
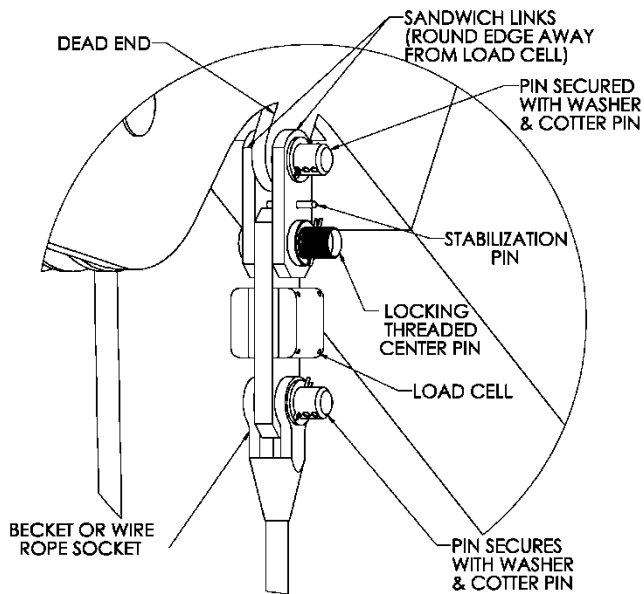


11.6. Load Cell Link Installation E

(Male/Male 40K/50K/80K Load Cell Link Placement on Boom Tip Dead-End for Multiple Parts-Of-Line)

The drawings below show the standard sandwich link installation and the optional 24" long sandwich link installation. Use the sandwich links to pin the load cell link between the wire rope socket (becket) and the dead-end boom tip as illustrated below. Place the locking threaded centre pin (important) and the stabilization pin as illustrated below.

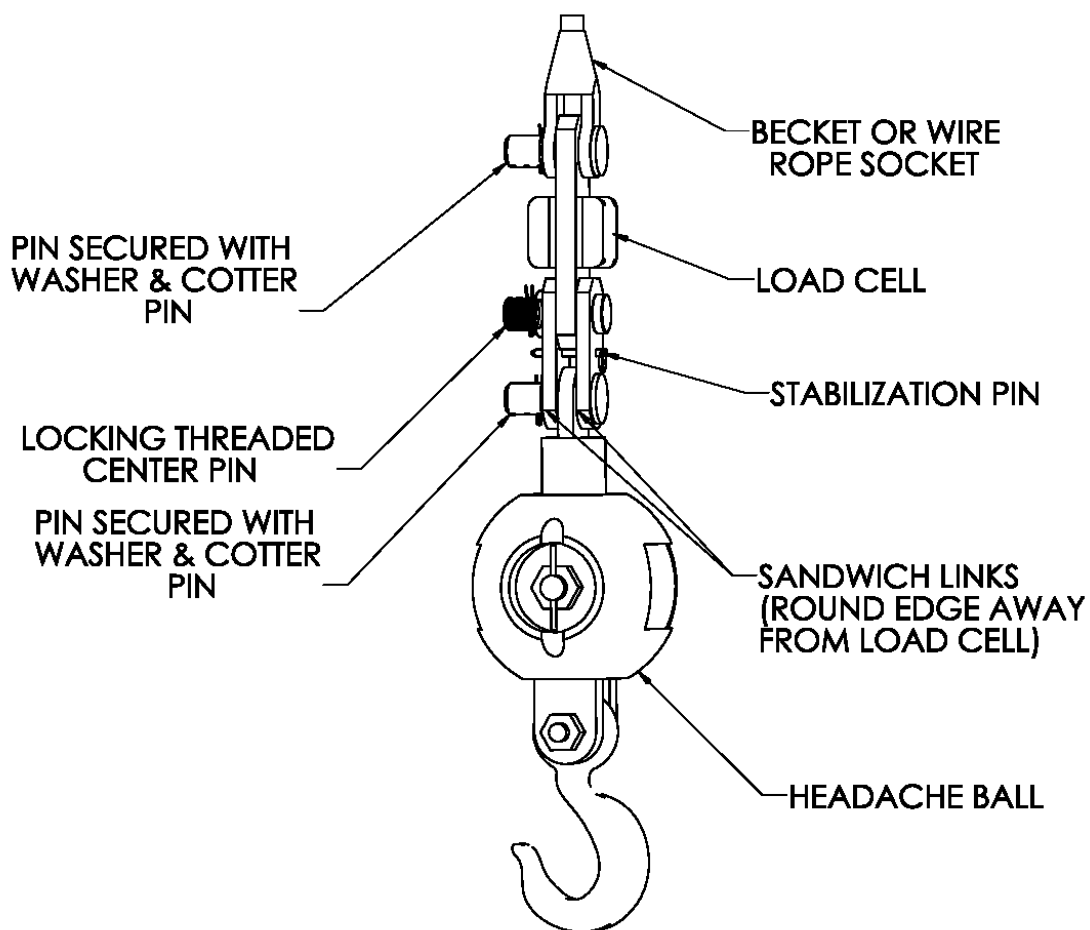
NOTE: Each system is factory calibrated. Please call the Cranesmart Systems sales department at (780) 437-2986 for assistance and/or further information.



11.7. Load Cell Link Installation F

(Male/Male 40K/50K/80K Load Cell Link Placement on Headache Ball for Single Part-Of-Line)

Pin the load cell link between the wire rope (wedge) socket and the 'headache ball' or hook block as illustrated below. Place the locking threaded centre pin and the stabilization pin as illustrated below.

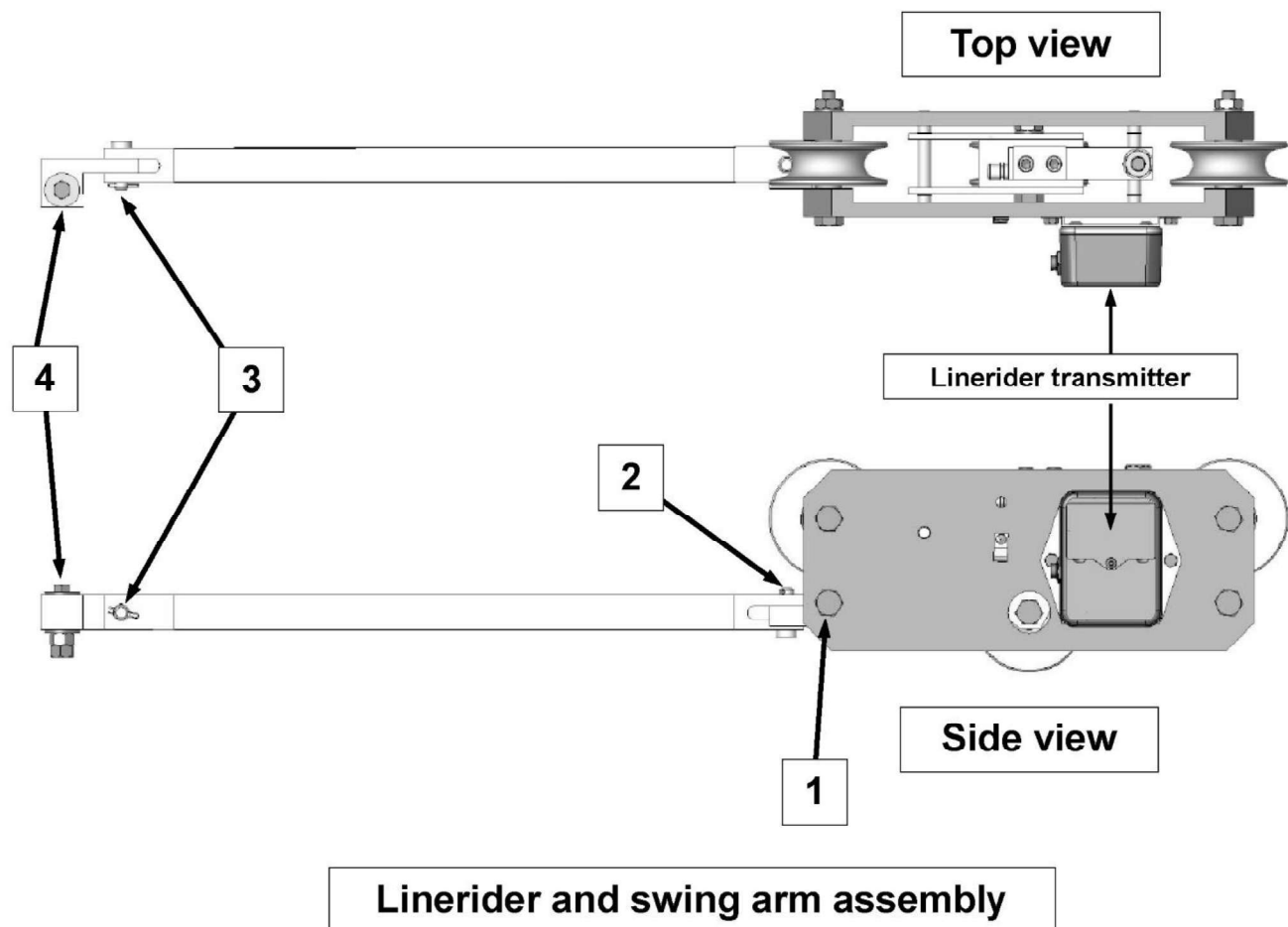


11.8. Radio Linerider Installation

The linerider installation will vary, depending on the type of crane boom it's being installed on. Follow the instructions below for hydraulic or lattice style boom installation.

The linerider is attached to a swing arm mounting bracket (included with kit) as shown in the illustration. The swing arm assembly has four joints:

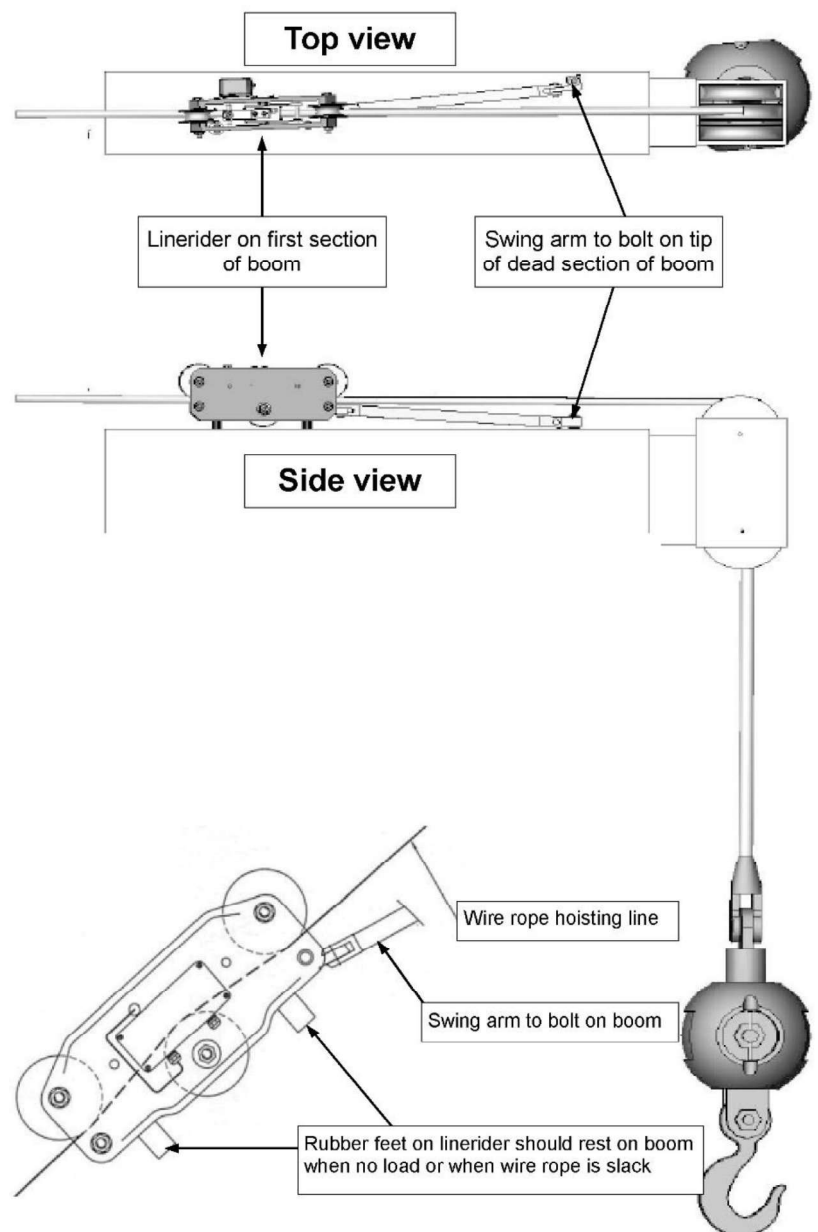
1. Vertical movement at the attachment point to the linerider
2. Horizontal movement of the swing arm
3. Vertical movement of the swing arm
4. Swivels horizontally around the mounting bolt



11.9. Hydraulic Boom Linerider Installation

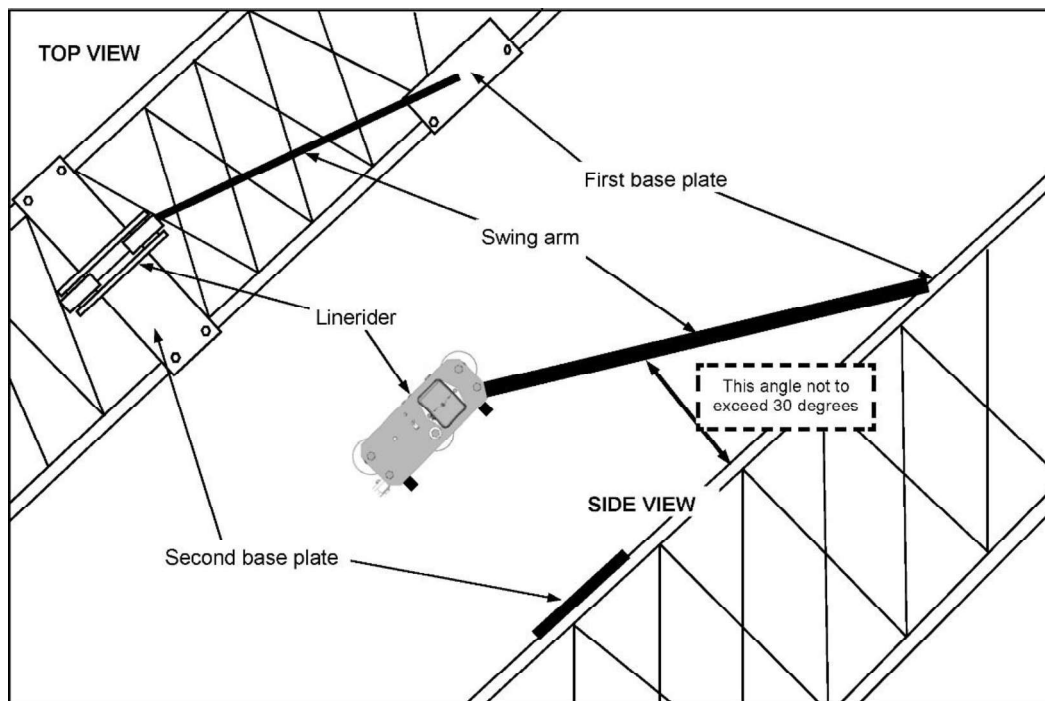
NOTE: The linerider should be located on the top of the boom and as close to the dead-end section of the boom tip as possible (see the illustration below).

1. Affix the bolt at the tip of the base section (dead section) of the hydraulic boom as illustrated to the right. Select a location so that the swing arm angle with respect to the boom will not exceed 30° during normal operation of the crane. The linerider should be located on the top of the boom and as close to the tip of the base (or non-moving) section as possible.
2. Attach the swing arm to the bolt.
3. Run the hoist line through the linerider (see the section *Installing the Wire Rope Through the Linerider* of this manual).
4. Check to ensure that the linerider has freedom of movement from side to side.



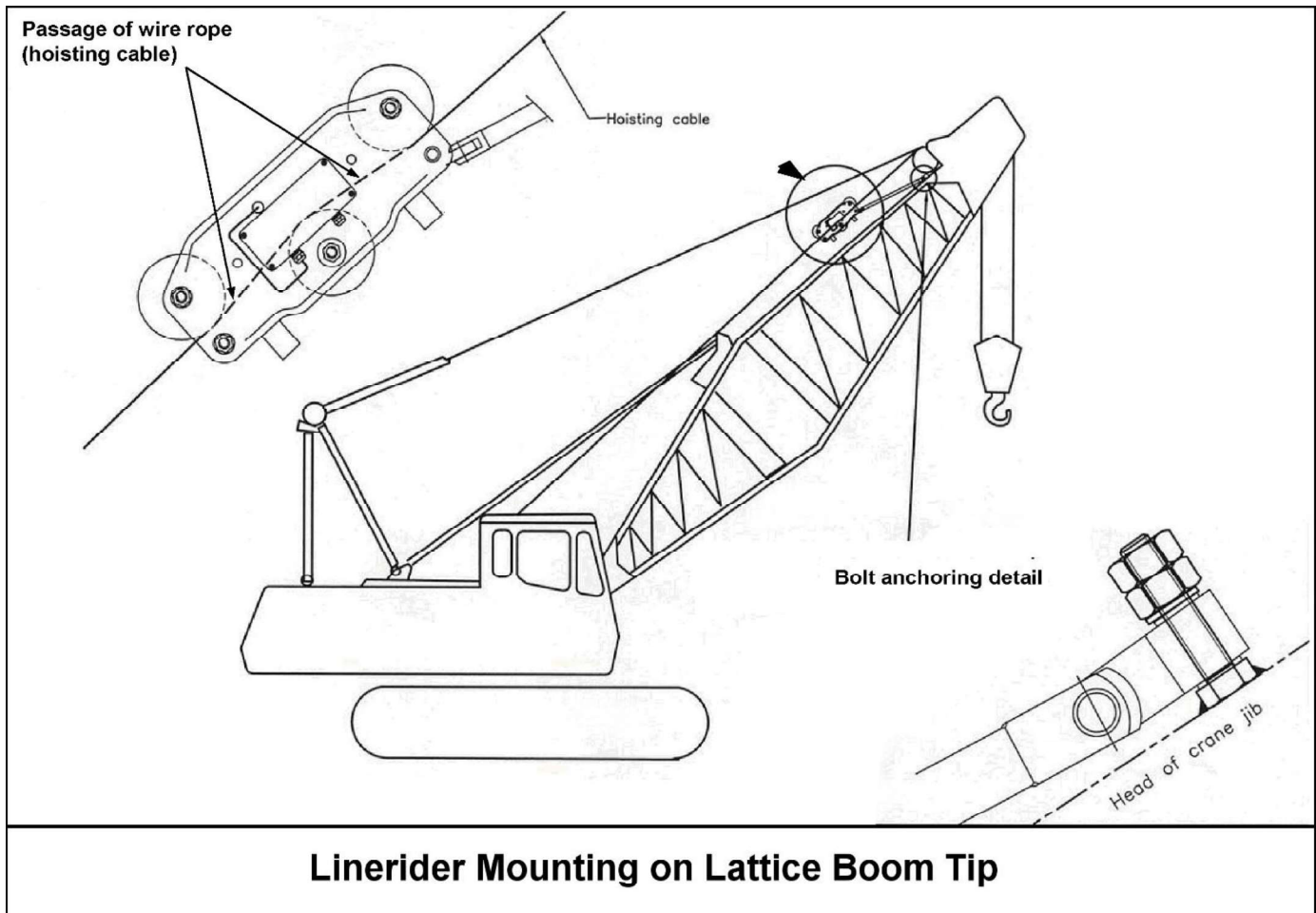
11.10. Lattice Boom Linerider Installation

NOTE: The linerider should be located on the top of the boom and as close to the boom tip as possible.



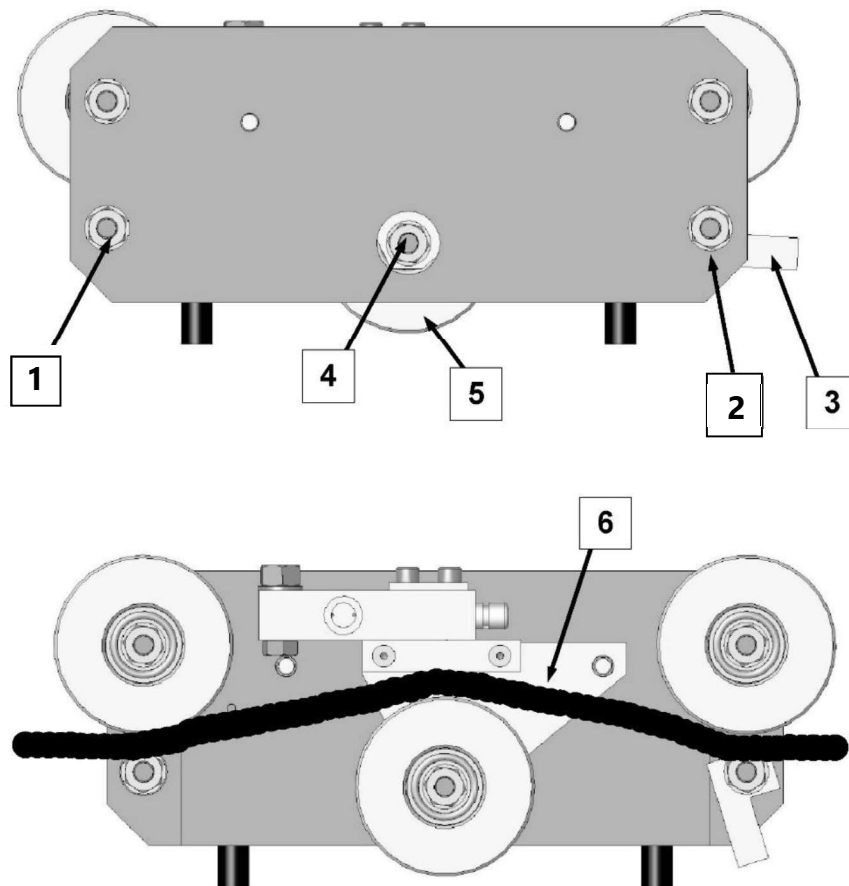
1. Select a location that the swing arm angle with respect to the boom will not exceed 30°. The linerider should be mounted as close to the lattice boom tip as possible.
2. Construct two base plates. The size of the base plates will be specific to the lattice structure and the plate location.
3. The first base plate will be attached to the boom with the swing arm bolt affixed to the center of the base plate.
4. The second base plate will be attached to the boom so that it supports the linerider when not in use.
5. Affix the swing arm bolt to the center of the first base plate.

6. Affix the first base plate to the selected location on the lattice boom.
7. Attach the swing arm to the bolt.
8. Run the wire rope (hoisting line) through the linerider (see the section *Installing the Wire Rope Through the Linerider* of this manual).
9. Ensure freedom of movement from side to side.
10. Attach the second base plate to the boom so the linerider's rubber feet will touch the plate when there is no load (wire rope is slack).



11.11. Installing the Wire Rope Through the Linerider

1. With the linerider positioned as illustrated, remove the free axle (at bottom left of the linerider).
2. Remove the anchoring axle (at bottom right of the linerider).
3. Remove the anchor component with sleeve.
4. Remove the measurement pulley axle (at the left center of the linerider).
5. Remove the pulley with its sleeve.
6. Pass and position the wire rope (hoisting cable) as illustrated.
7. Reassemble the linerider in reverse order to the above disassembly steps.

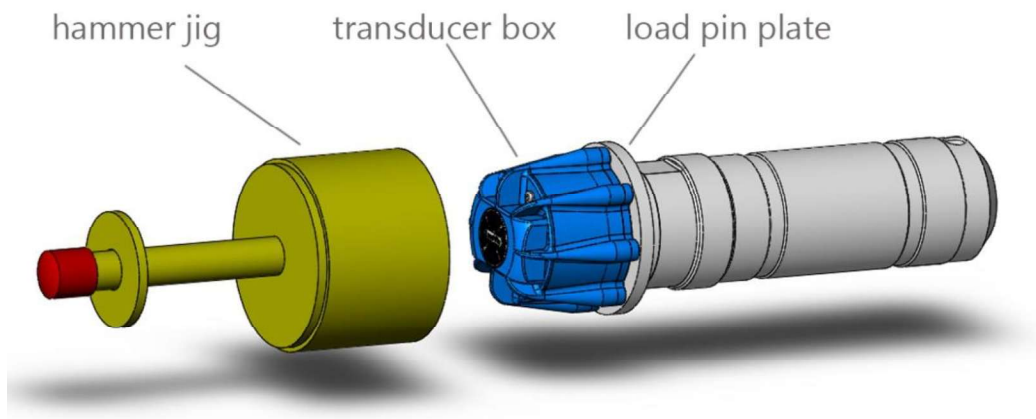


11.12. Load Pin Installation

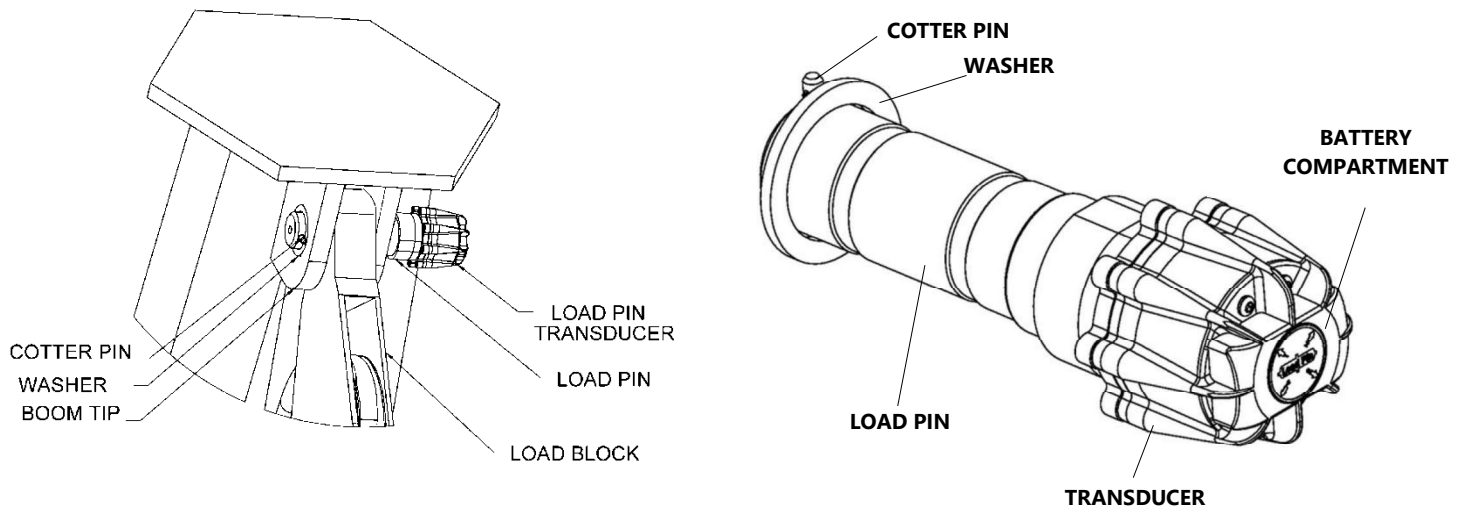
To Install the Load Pin:

1. **Remove the existing pin**
2. **Install the Cranesmart System load pin**

The transducer box contains sensitive electronics. Do not use a hammer or any other object to strike the load pin directly.



3. **Align the hammer jig against the load pin plate**
Place the jig to fit around the transducer box and against the load pin plate, then hammer the red end of the jig until the pin is in place.
4. **Secure the load pin**
Secure the load pin by installing the cotter pin through the hole in the end of the pin. Use washers to secure the pin and keep it from moving from side to side as this would affect calibration.



5. Check for free rotation of the load pin

Once the pin is installed properly, check that it can move freely by rotating it 360°.

6. Check for good signal strength on the display panel

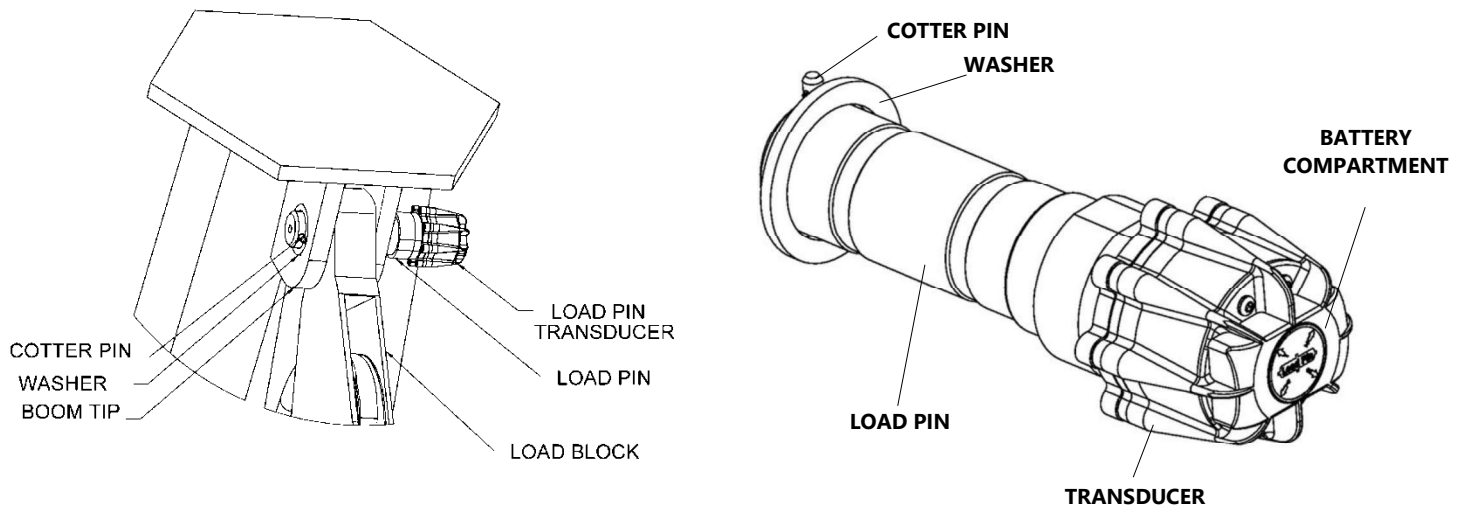
See the Information Menu section of this manual for instructions on checking the component signal strengths.

7. Verify the load pin calibration

Load pins are factory calibrated, but due to small differences in pipelayer boom ends, the calibration of each machine may require slight adjustment. Verify the calibration of the load pin by lifting a certified weight. If it is necessary to refine the load pin's calibration, refer to the Load Indication section of this manual.

8. Secure the load pin

Secure the load pin by installing the cotter pin through the hole in the end of the pin. Use washers to secure the pin and keep it from moving from side to side as this would affect calibration.



9. **Check for free rotation of the load pin**

Once the pin is installed properly, check that it can move freely by rotating it 360°.

10. **Check for good signal strength on the display panel**

See the Information Menu section of this manual for instructions on checking the component signal strengths.

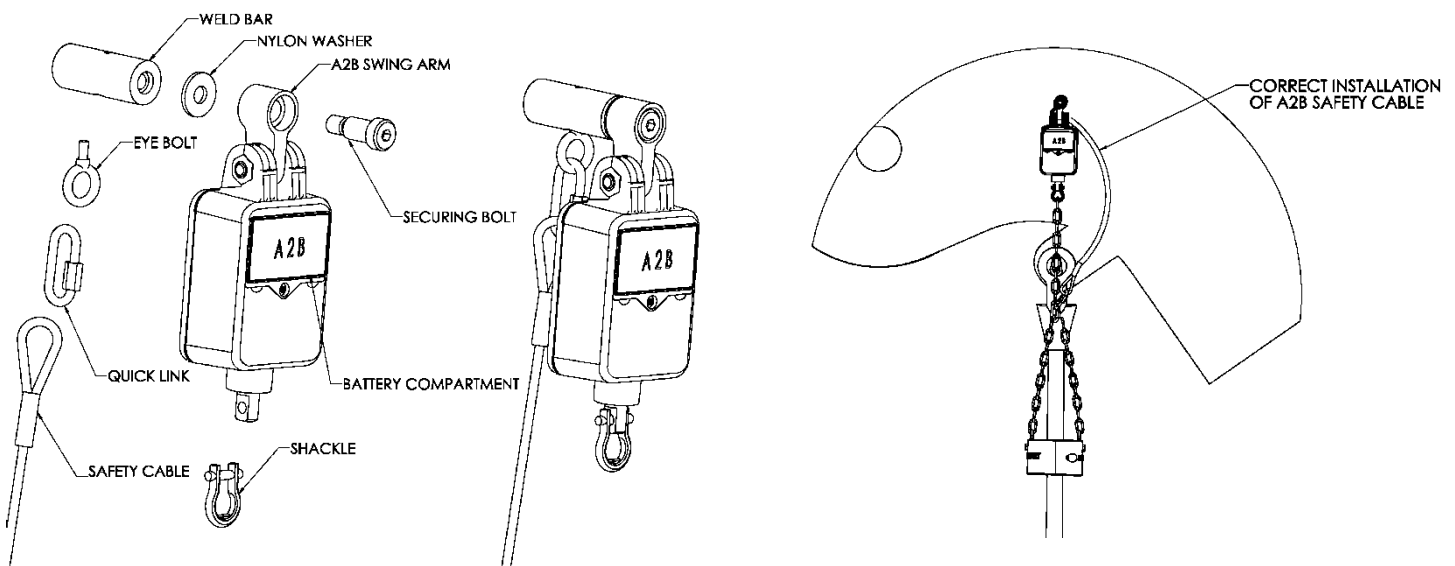
11. **Verify the load pin calibration**

Load pins are factory calibrated, but due to small differences in pipelayer boom ends, the calibration of each machine may require slight adjustment. Verify the calibration of the load pin by lifting a certified weight. If it is necessary to refine the load pin's calibration, refer to the Load Indication section of this manual.

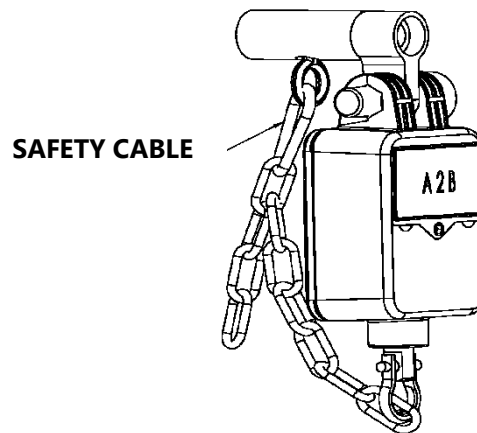
11.13. Anti-2-Block Installation

The switch is designed to swivel and pivot to track with the wire rope in relation to the boom angle.

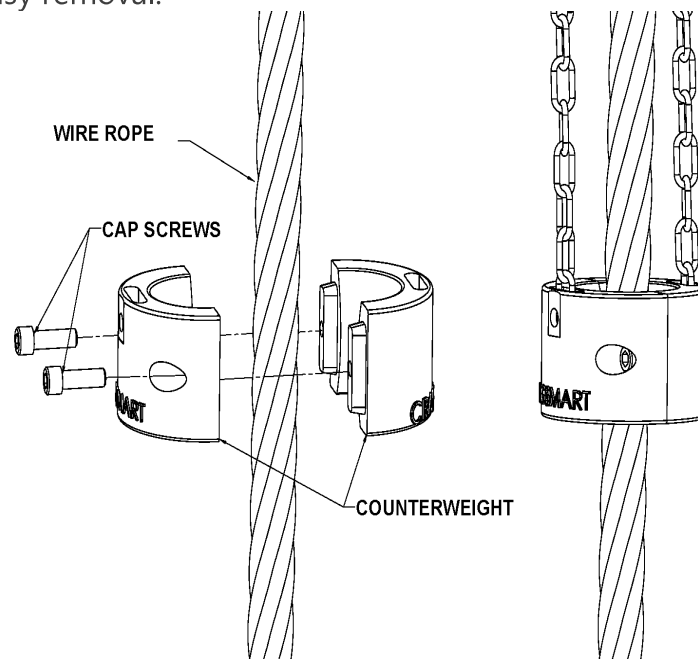
1. Weld the weld bar to the crane. Ensure the switch is mounted directly above the dead-end or the slowest speed line. The weld bar can be welded directly to the crane or to an existing Cranesmart weld plate. (Both ends of the weld bar are identical).
2. Ensure that the mounted A2B switch will have an unobstructed line-of-sight to the receiver panel antenna. Install the large shoulder bolt into the A2B swing arm.
3. Attach the A2B switch to the bar. (Install the nylon bushing between the bar and the swing arm).
4. Attach the two-piece counterweight to the dead-end line or the slowest speed line.
5. Use the shackle (bottom of A2B switch) to install the chain to the A2B switch.
6. Counterweight Safety Cable: This Safety Cable is used to secure the counterweight so that it will not fall down the wire rope in the case of severe damage to the A2B. See drawing for proper installation.



NOTE: Ensure the A2B switch can move freely without contacting the boom, the sheaves, bracing struts or any other equipment such as a swing away jib extension. The Eyebolt on the weld bar is used with the red clip for storage and transportation on mobile cranes. When transporting the crane, it is advised that the weight is hung using this method, in order to remove tension from the counterweight chain.



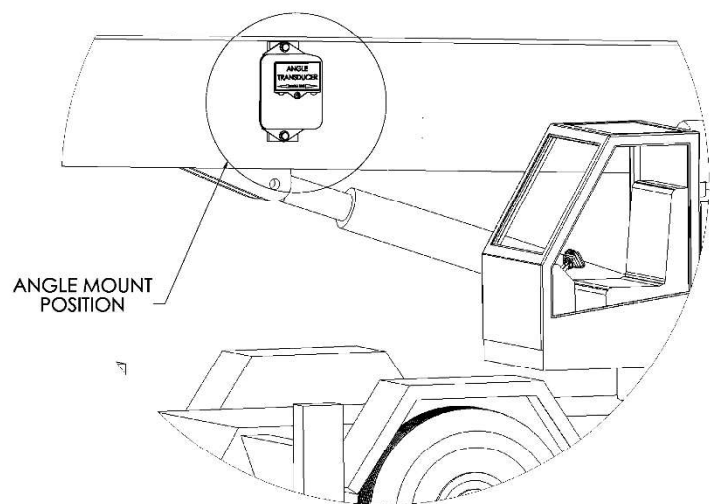
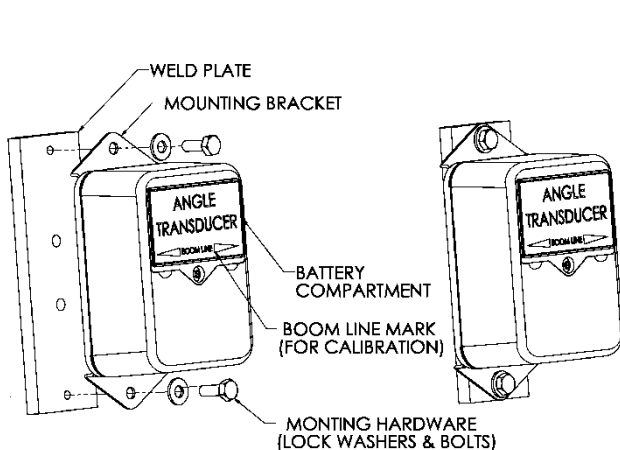
1. Attach the counterweight chain to the bottom of the A2B transmitter using the shackle supplied.
2. Assemble the counterweight around the cable, as shown in the illustration.
3. Bolt the two counterweight halves together using the cap screws. The cap screws are coated with oil but it is suggested that anti-seize compound be used on the bolts to allow for easy removal.



11.14. Boom Angle Transducer Installation

The boom angle transducer can be mounted on either side of the boom. The transducer cannot be installed on the top or bottom of the boom and must be installed in the orientation shown in the diagram below. Do not weld permanently before testing in case adjustments are needed.

1. Remove the weld plate from the angle transducer.
2. Align and mark the installation position. Position the transducer to be parallel (level) with the boom line.
3. Tack weld the weld plate before testing the system.
4. Mount the transducer to the weld plate.
5. Verify operation
6. Raise the boom to a minimum angle of 45° and return it to level. (This will set the transducer for the proper side of the boom before calibration).
7. Remove the transducer to finalize the welding
8. Repeat steps 4-6



11.15. Windspeed Transducer Installation

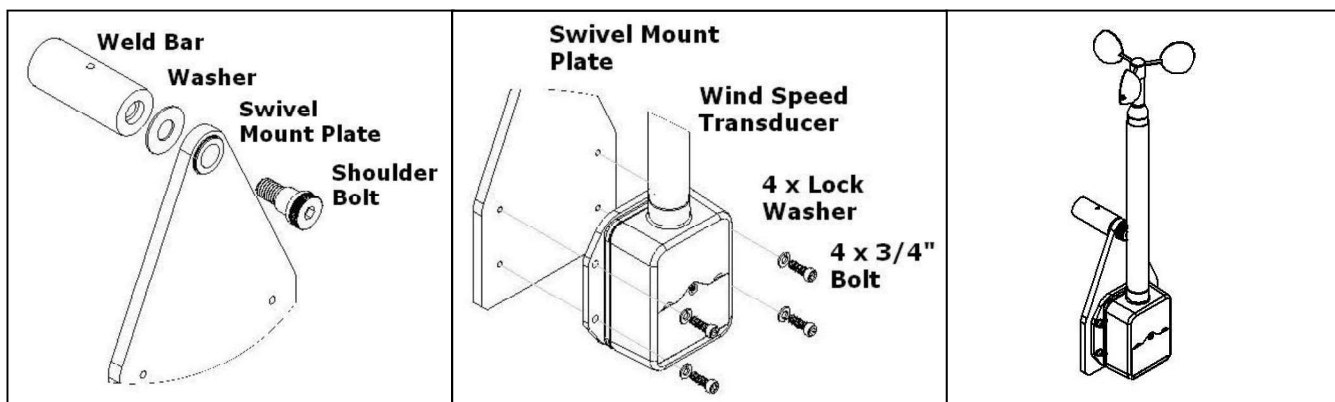
The wind speed transducer is designed to swivel so that it is always in an upright, vertical position, regardless of the boom angle.

Tools Required

- 5/16" hex key (included)
- 3/16" hex key (included)
- Welder

Wind Speed Installation Procedure

1. Remove the shoulder bolt from the weld bar and swivel mount plate.
2. Tack weld the weld bar to the crane. The weld bar can be welded directly to the crane or to an existing Cranesmart weld plate. (Both ends of the weld bar are identical).
3. Attach the wind speed swivel mount plate to the weld bar using the shoulder bolt and washer. Use a 5/16" hex key to tighten the bolt.
4. Attach the wind speed transducer to the swivel mount plate using the provided hex key bolts and lock washers. Use a 3/16" hex key to tighten all bolts.
5. Ensure that there is enough clearance for the wind speed transducer to swing freely. Finish welding the weld bar to the crane.

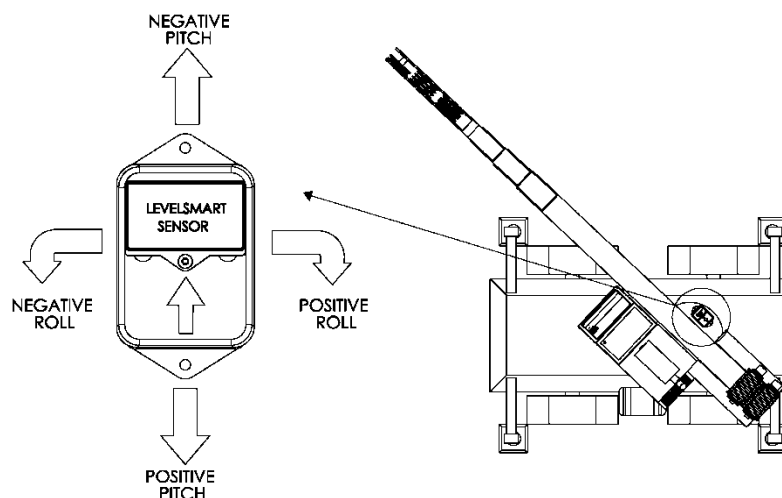


11.16. Level Transducer Installation Type A

(Measuring Machine Tilt (Roll))

This installation is typically used in marine applications where the crane is on a ship or a barge and it allows the user to observe actual tilt based on the direction of the boom.

1. The level transducer should have a clear line of sight to the Cranesmart system's antenna and be kept free of all obstructions.
2. The level transducer must be mounted onto a part of the crane that rotates along with the boom, but does not change with the boom angle. The label must be facing up and the directional arrow should point along the boom towards the tip.
3. Make sure that the transducer is not mounted in a position where it might be stepped on or in a position where it may suffer impact damage. Possible mounting locations are on top of the turret or on the operator's cab if it rotates with the boom.
4. The mounting position needs to be stable during operation as vibration may cause the unit to jitter.
5. The transducer should be made as level as possible but it is **NOT** critical that it be perfectly level, as the unit can be calibrated after installation. (See the *Level Calibration* section of this manual).
6. Verify communication with the receiver panel before permanently mounting the transducer (see the *Transducers* section of this manual).
7. The crane **MUST** be level during the calibration process.
8. **DO NOT** weld the weld plate with the level transducer attached.

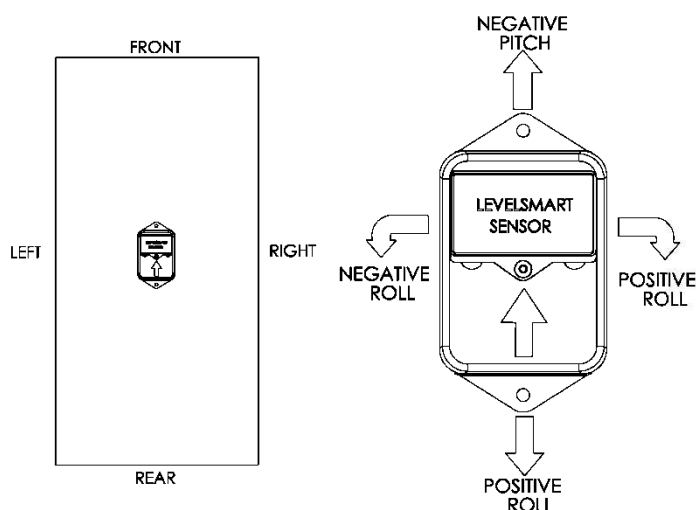


11.17. Level Transducer Installation Type B

(Measuring Grade and Super Elevation / Ship List (Roll) and Trip (Pitch))

This installation should be used for locomotive cranes (grade and super elevation) or ship and barge applications where the user wants the Cranesmart system to indicate if the **ship** is listing (rolling) or trimming (pitching)

1. The level transducer should have a clear line of sight to the Cranesmart system's antenna and be kept free of all obstructions.
2. The transducer can be mounted to the deck (label facing up) or onto a post. The higher the level transducer is from the deck, the better the radio transmission will be.
3. The correct mounting position of the level transducer is critical. The label must be facing up and the directional arrow should point towards the front of the car or ship. Refer to the diagram below.
4. The mounting position needs to be stable during operation as vibration may cause the unit to jitter.
5. The level transducer should be made as level as possible but it is **NOT** critical that it be perfectly level as the unit can be calibrated after installation. (See the *Level Calibration* section of this manual).
6. Verify communication with receiver panel before permanently mounting the transducer (see the *Transducers* section of this manual).
7. The barge deck **MUST** be level during the calibration process.
8. **DO NOT** weld the weld plate with the level transducer attached.



Refer to this table for application terminology

Default	Roll	Pitch
Locomotive Crane	Super Elevation	Grade
Ship/Barge	Listing	Trimming

11.18. Powerline Proximity Sensor Installation

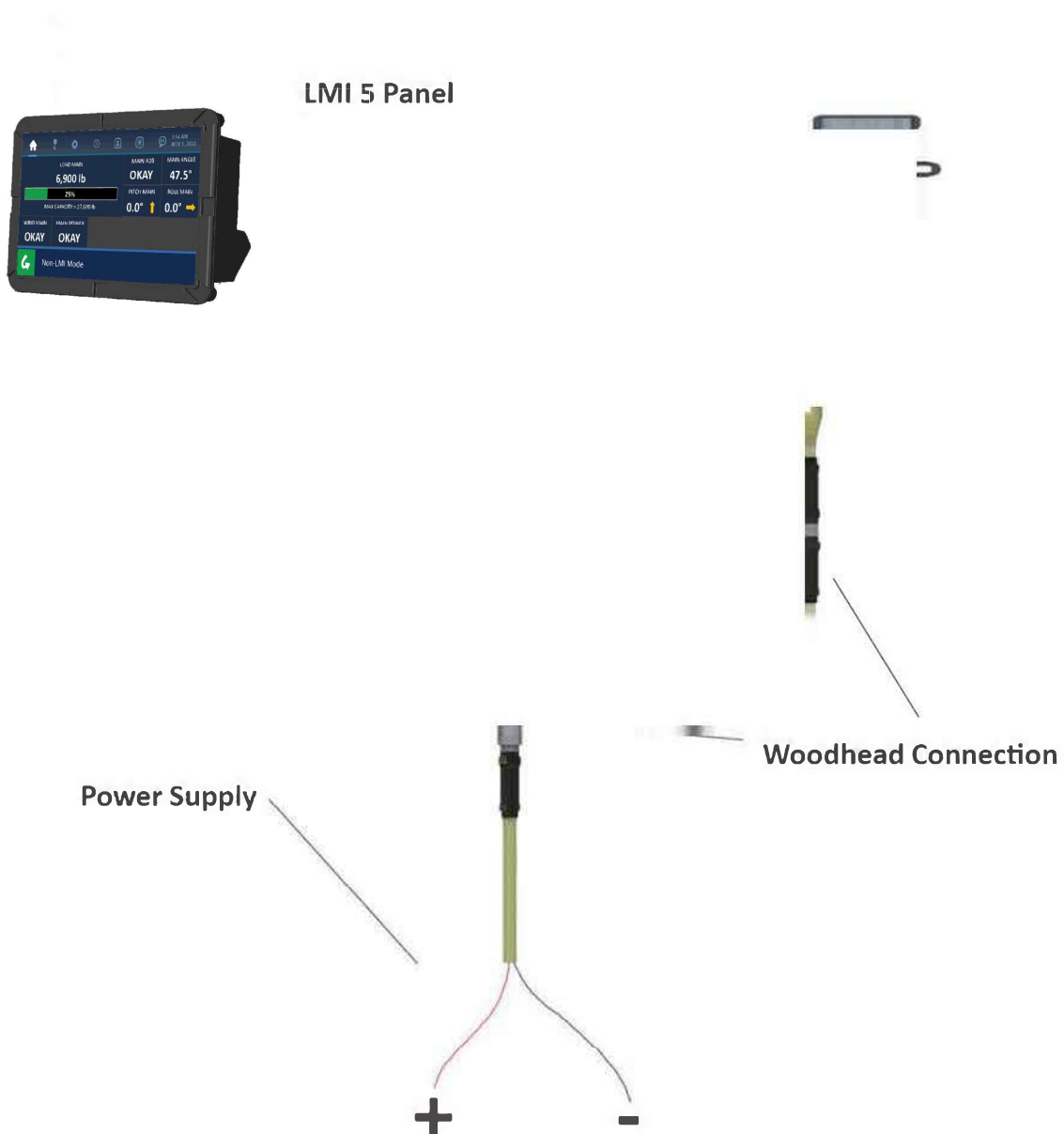
The powerline proximity sensor must be mounted to the highest point and leading edge of the machine, (boom tip for example). The leading side may not be the same as the angle indicator, depending on where the powerlines are located in relation to the boom. For strongest communication, maintain the best line of site between the transducer and the display panel as possible.

1. Align and mark the installation position of the weld bar.
2. Tack weld the weld plate before testing the system. **NOTE: Ensure that transducer is not attached to the weld bar during welding.**
3. Mount the transducer to the weld plate.
4. Adjust the setpoint of the transducer (see the Powerline Calibration section of this manual).
NOTE: This setpoint is field adjustable and must be configured properly for every powerline affecting work.
5. Remove the transducer from the weld bar.
6. Complete the weld and remount the transducer.



Display Panel, Horn Assembly and Power Configuration

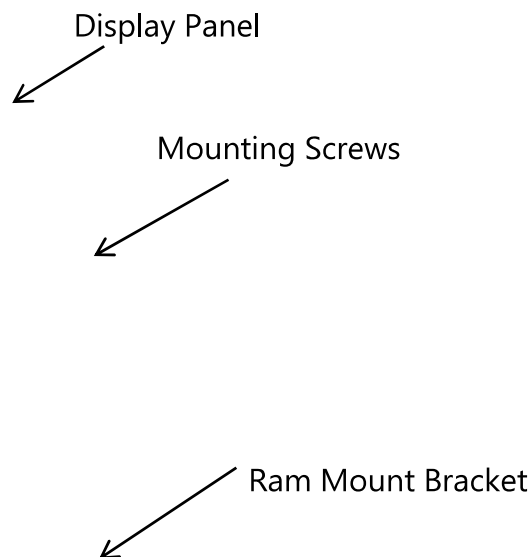
The diagram below shows the proper configuration for the display panel, horn and power source for the system. The power source should be 12-24VDC (28VDC Max).



11.19. Display Panel Installation

Mounting the Display Panel

1. Mount the display panel to ensure the operator has an unobstructed view.
2. Align the ram mount bracket; mark and drill mounting holes using the mounting bracket as a guide.
3. Attach the bracket using the hardware provided.
4. Install the display panel to the bracket.
5. Mount the ram mount bracket to an appropriate place within the cab, using the 3/8" bolts provided.



NOTE:

- ***The display panel can pivot horizontally or vertically by changing the position of the mounting bracket.***
- ***The panel should be mounted in the operator's field of view but not obstruct sight during a lift.***
- ***DO NOT PRESSURE WASH THE DISPLAY PANEL OR SUBMERGE IT IN WATER.***

Wiring the Display Panel

Power to the display panel is supplied through the cable included in the kit, which plugs into the back of the panel. Refer to the wiring diagram on the following page.

1. Connect the red wire to a positive 12-24VDC (28VDC Max) terminal.
2. Connect the black wire to a good ground connection on the machine.
3. *(Optional):* Connect the white wire to an optional 'shut off' solenoid or to sound external horns. (Maximum output is 7.5 amps).

NOTES:

- ***Ensure that a continuous 12-24VDC (28VDC max) is available to the panel at all times while the machine is in operation. If the voltage drops below 10.5 VDC the panel will not function.***
- ***When attaching the power cable to the panel, align the plug and gently push it into the receptacle, then slide the plug neck back towards the panel and turn it clockwise half a turn to tighten. The plug is keyed and will require alignment of the housing as well as the pins.***
- ***If the power cable is cut to shorten it for installation, it will be noticed that two extra wires are contained inside the insulation. The purple and blue wires are only used in other applications (for RS485 communication).***
Secondary Output

Systems are supplied with a second output (green wire). It provides either a 12VDC or 24VDC in normal condition, 0VDC in alarm condition and has a current limitation of 1.5amps.

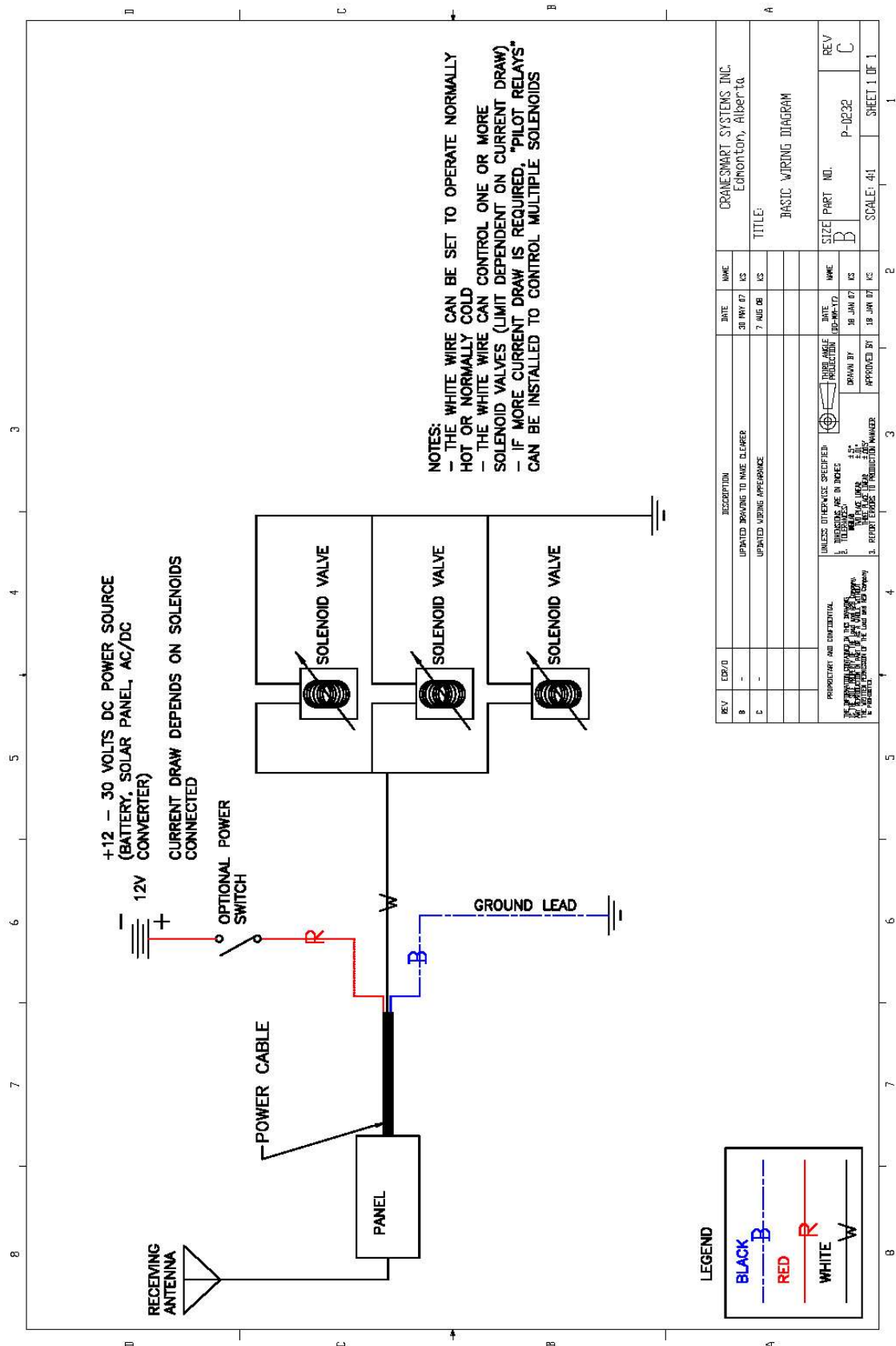
By default the second output is not tied to any alarms in the panel but can be programmed to do so. Please contact Cranesmart Systems for assistance.

11.20. Alarm Shutoffs (White Wire)

The Cranesmart system will be shipped with a three-conductor wiring harness which consists of a black, a red, and a white wire. The white wire may be used in conjunction with external alarm horns, lights, or shut-offs (if installed).

- When supplying power to the Cranesmart System with +12 VDC, the white wire is normally hot (energized) with a +12 VDC in a non-alarm condition. If the white wire is not to be used for any of the purposes listed above, ensure that its exposed end remains sealed to prevent grounding and damage to the display panel.
- When supplying power to the Cranesmart System with +24 VDC, the white wire is normally hot (energized) with a +24 VDC in a non-alarm condition. If the white wire is not to be used for any of the purposes listed above, ensure that its exposed end remains sealed to prevent grounding and damage to the display panel.

11.20. Display Panel Wiring Diagram



11.21. Power Converters

A power converter is needed to convert AC voltage to DC for the display panel. Cranesmart power converters change 110/220V AC to 12/24VDC, depending on the application. If a power converter is needed it will be discussed at the time of purchase.

11.22. Hazardous Area Options

In Class 1 Division 2 (C1D2) applications the Cranesmart system will wire identically to the basic wiring diagram – the only difference being that the panel has a pigtail with a red C1D2 connector on the end. The connector will mate with the corresponding C1D2 on a power cable or on the cable coming from the IMD. Use a set of tongue-in-groove pliers to fully tighten the connection, to ensure that the power cannot be accidentally loosened or disconnected by hand.

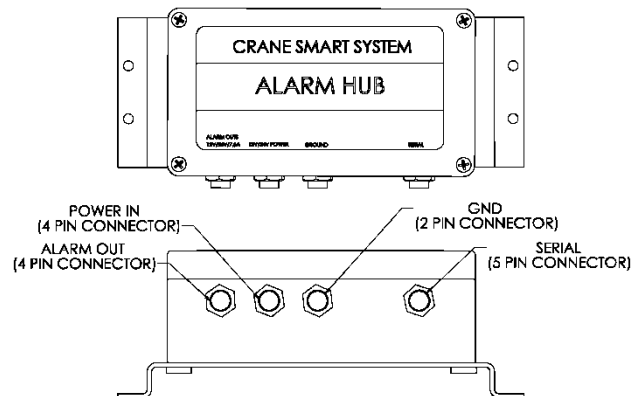
11.23. Alarm Hub Installation

When used with the alarm hub, the panel has the ability to control 4 separate outputs. These outputs can be set normally hot or normally cold. The alarms that control the outputs of the alarm hub are specified at the time of purchase.

The standard alarm hub comes supplied with the following cables:

- 4-pin alarm output cable
- 4-pin power cable, the ends of the cable are twisted together
- 2-pin ground
- 5-pin serial cable to connect the panel to the alarm hub.

1. Locate a position to mount the alarm hub where the operator can reach the wiring, if necessary.
2. Align the position mark and drill holes using the alarm hub mounting bracket holes as a guide.
3. Bolt the alarm hub in place.



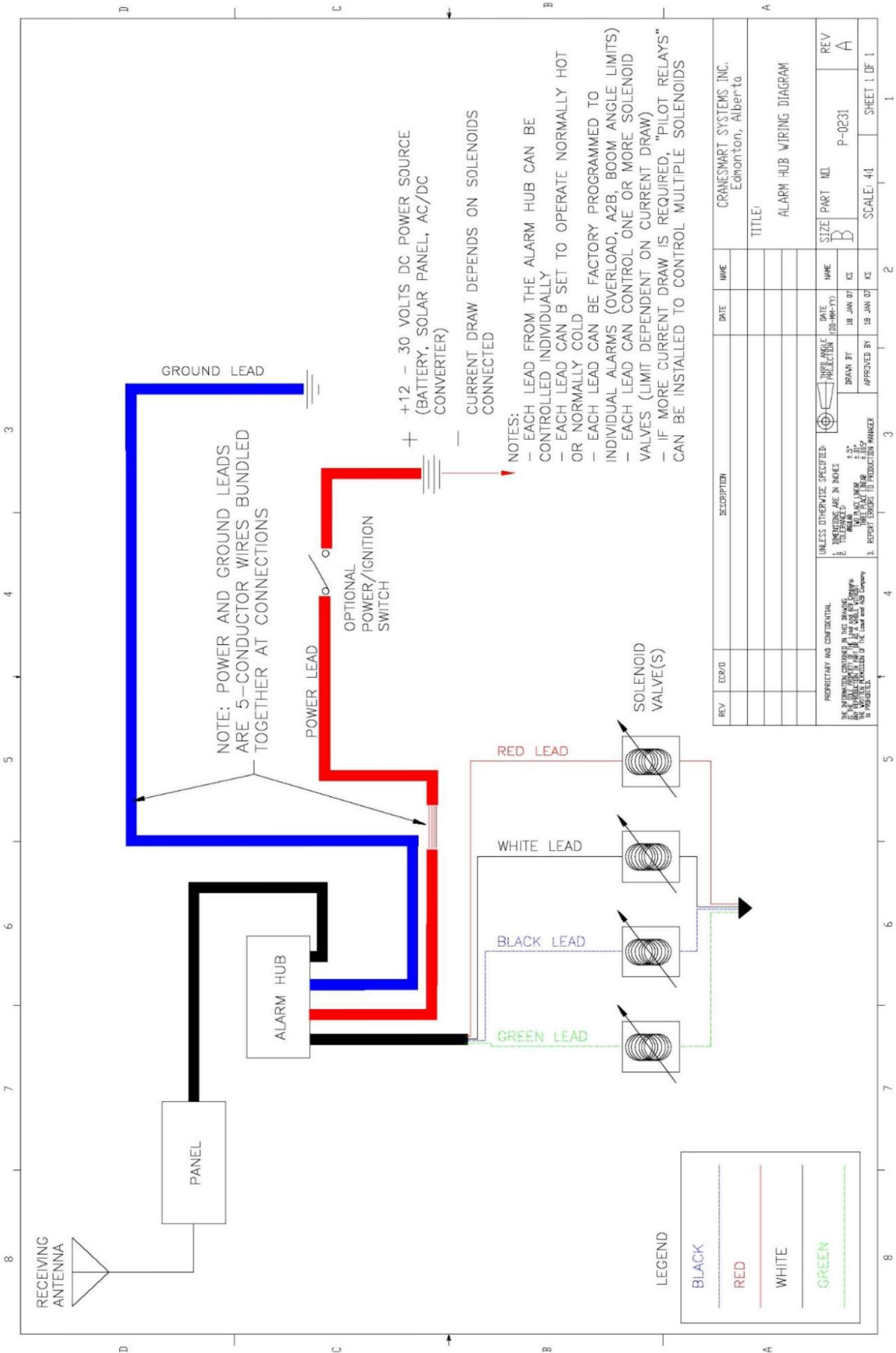
Wiring the Alarm Hub

1. Attach the black wire to electrical ground.
2. Attach the red wire to power 12-24Vdc.
3. Attach the serial cable from the alarm hub to the panel.
4. Use the custom insert as a guide to wire the alarm outputs.
5. Test to ensure that the outputs control the proper alarms.

NOTES:

- **The length of cable and the position of the panel will limit the mounting location of the alarm hub.**
- **The plug is keyed to ensure a proper connection.**
- **When a Cranesmart system is programmed for use with an alarm hub, the alarm hub must be present and working or the display will indicate an error. The alarm hub is crucial in this case, as power to the display panel is routed through it.**

11.24. Display Panel Wiring Diagram



11.25. Antenna Installation

There are currently two types of antennas; installation and placement depend on the length and type of crane boom.

1. External Mount – for cranes with cabs.
2. Marine – for marine cranes with cabs.

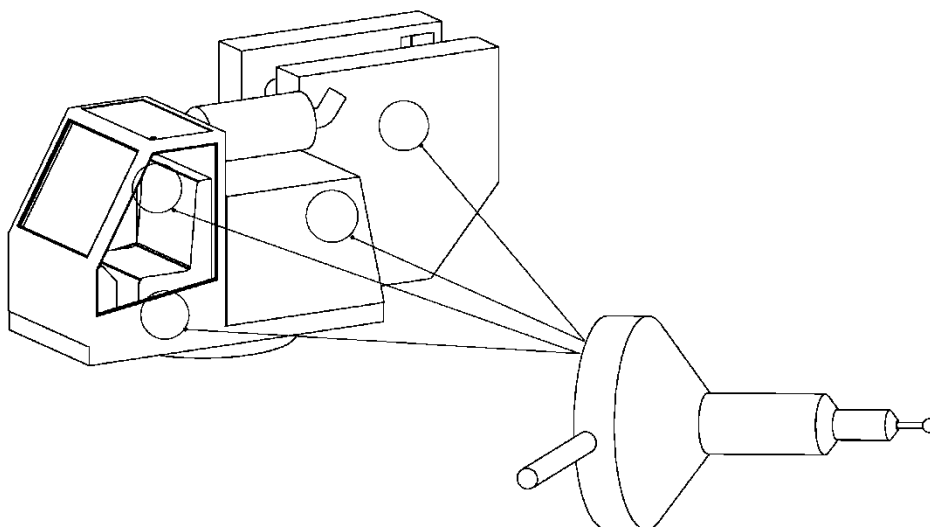
NOTES:

- ***Ensure that the lines of sight between the load cells, anti-2-block, switches, angle transducers and the antenna are not obstructed.***
- ***Do not let the antenna touch glass or metal.***

Antenna Installation Type A (Inside Operator Cab)

When the display panel is mounted inside the cab of the crane, use the external magnetic mount antenna. This antenna will be included in the system packaging. Installation varies between cranes, but the following can be used as a guideline.

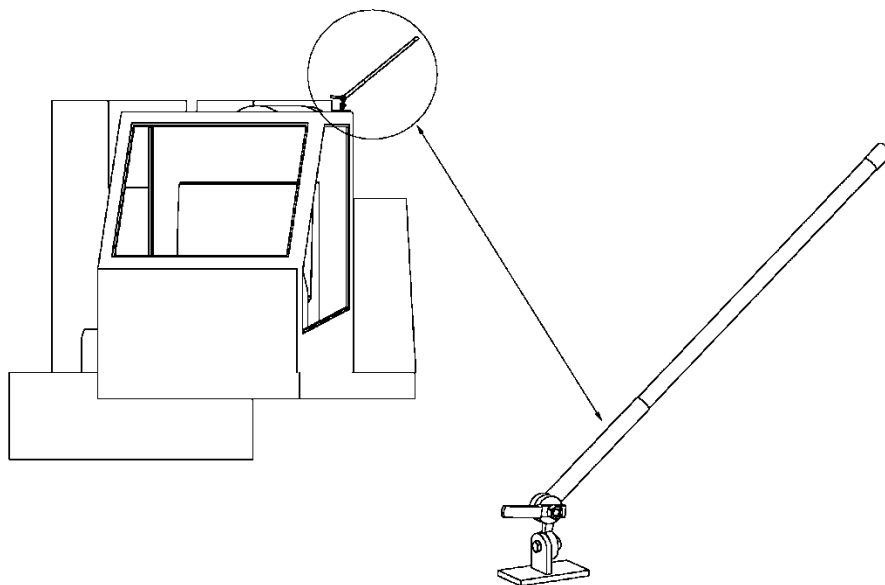
For optimum performance, the antenna should be installed horizontally as shown below but it will work in a vertical orientation also. To confirm the best position for the antenna, check the signal quality while moving it around (see the *Transducers* section of this manual).



Antenna Installation Type B (Marine Installation)

When the Cranesmart system is used on a crane with a cab in a marine environment, use the external marine antenna included in the kit. Installation varies between cranes, but use the following can be used as a guideline.

For optimum performance, the antenna should be installed at a 45° angle as shown below. Determine the best position for the antenna by checking the signal quality on the signal display screen (see the *Transducers* section of this manual) while changing the angle, etc.



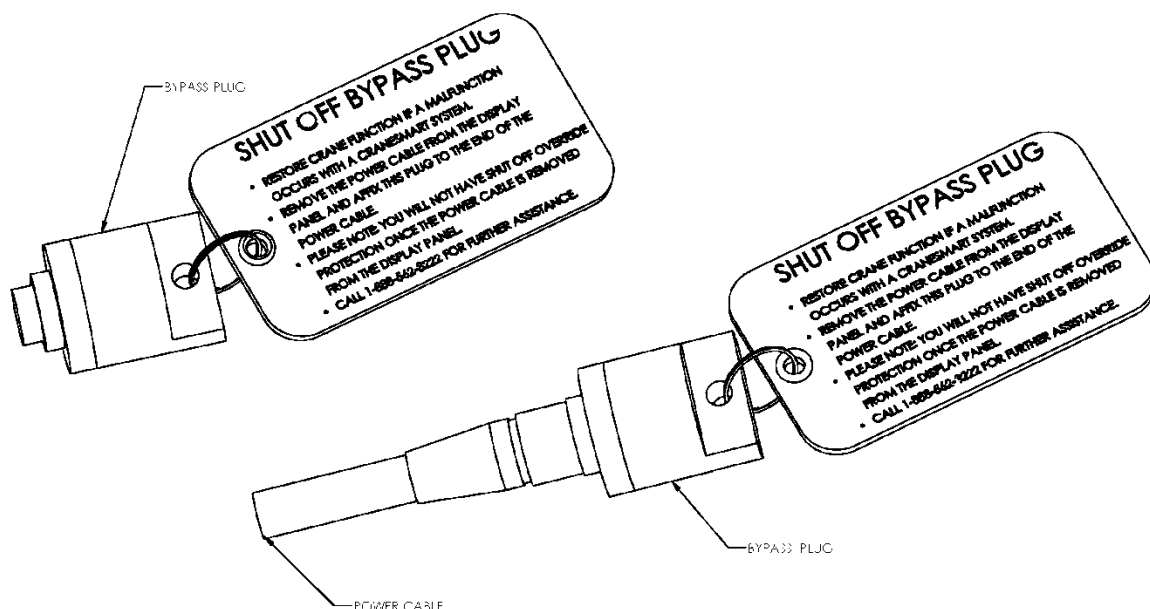
11.26. Shut-Off Bypass Plug

Not all systems require a shut-off bypass plug. The bypass plug is only required with systems that are using shut-off functions and only if those solenoids are normally hot (energized).

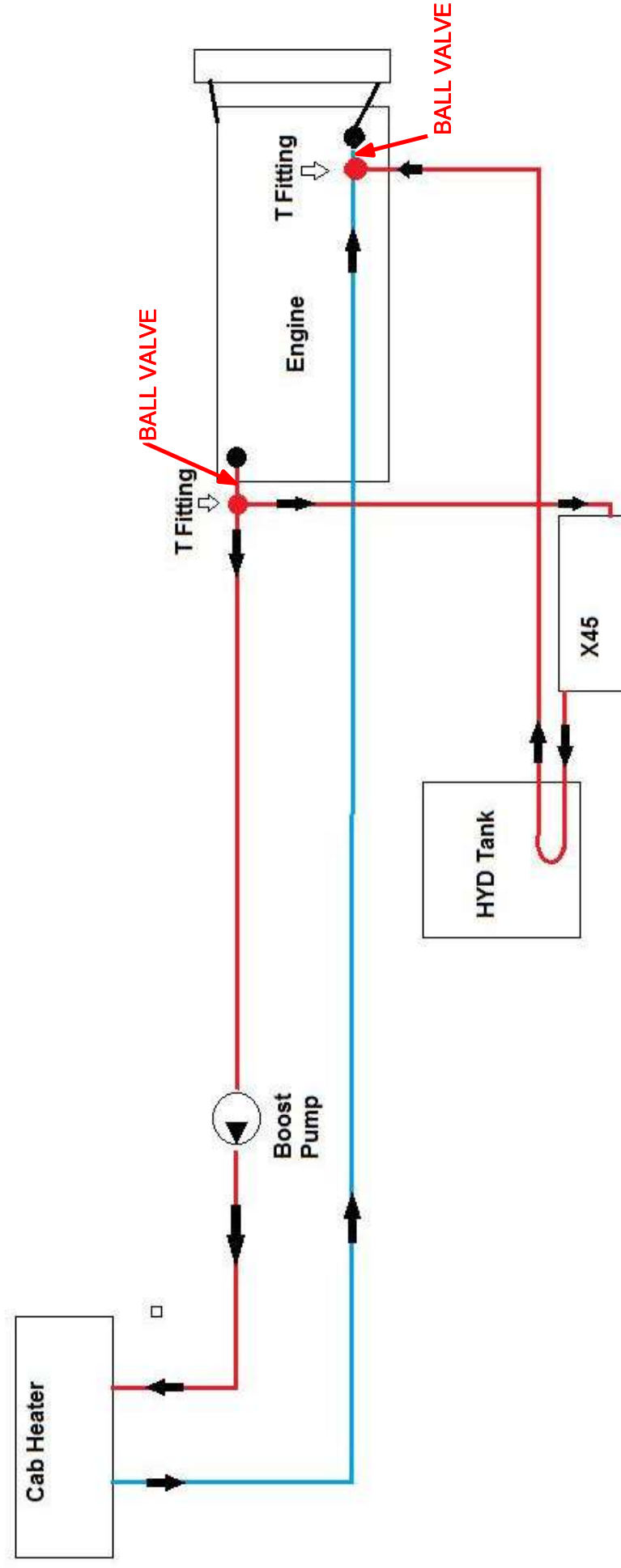
If the Cranesmart system was installed using the white output wire to control crane shut-offs (kick outs) and is overcome by damage or system malfunction, this wire can be bypassed using a bypass plug included with the kit. When this plug is installed as follows, it will allow the function kick outs to be re-energised.

1. Remove the power cable from the back of the display panel by twisting the coupling a half turn clockwise and pull it away from the panel.
2. Insert the bypass plug into the end of the power cable (lower illustration) – not the panel – and turn the plug a half turn clockwise.

NOTE: While this will restore crane functions, the Cranesmart system will no longer be monitoring crane functions.



PRO HEAT FLOW DIAGRAM



FHP series

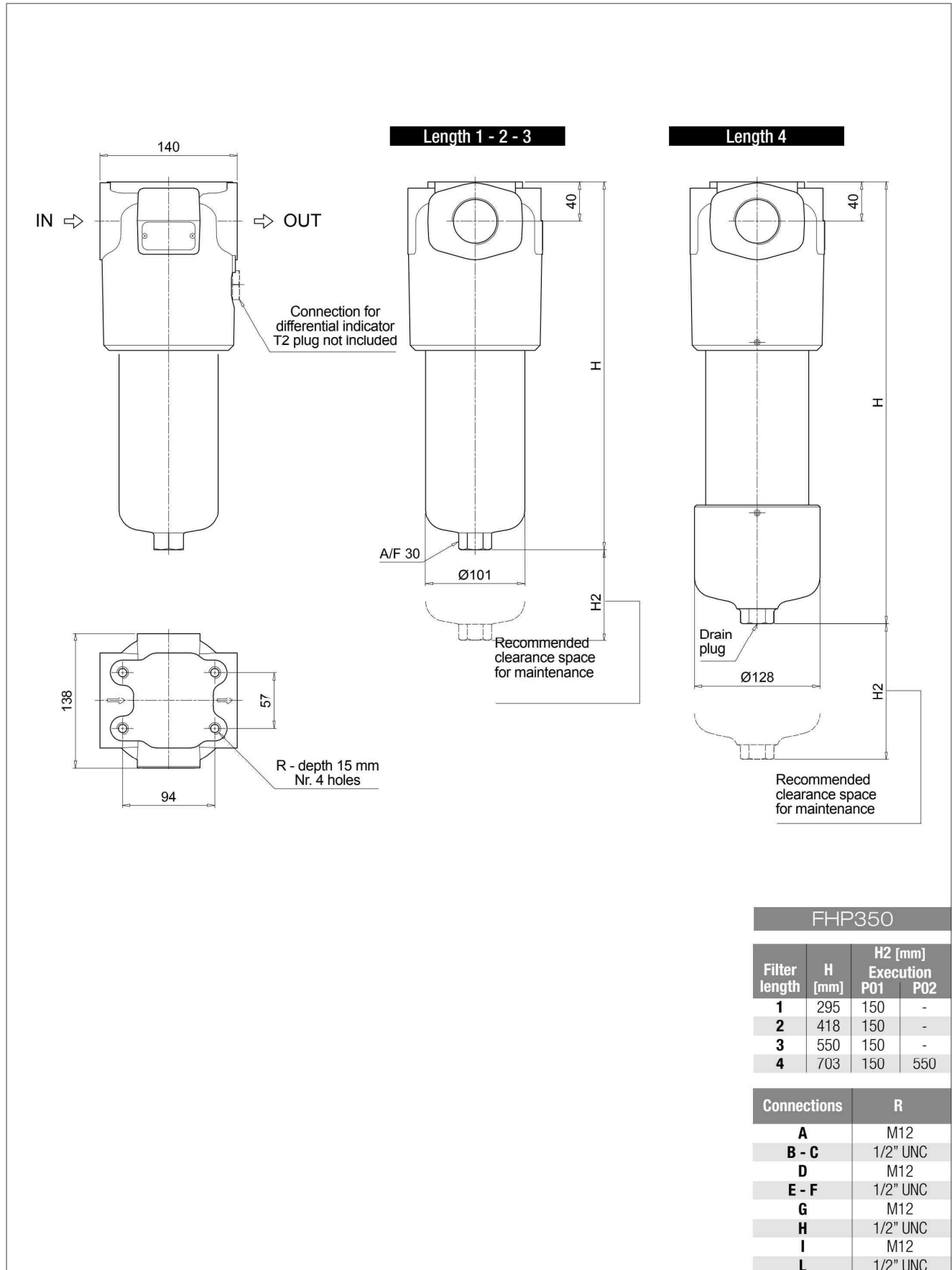
Maximum working pressure up to 42 MPa (420 bar) - Flow rate up to 630 l/min



COMPLETE FILTER																																																																
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ACCESSORIES			
Differential indicators		page	
DEA	Electrical differential indicator	577	
DEH	Hazardous area electronic differential indicator	577-578	
DEM	Electrical differential indicator	578-579	
DLA	Electrical / visual differential indicator	579-580	
Additional features		page	
T2	Plug	582	
			page
DLE	Electrical / visual differential indicator		580
DTA	Electronic differential indicator		581
DVA	Visual differential indicator		581
DVM	Visual differential indicator		581



FHP 350

FHP 500

The diagrams show the exploded view of the FHP 350 and FHP 500 filter assemblies. The FHP 350 assembly includes a filter element (2), a seal kit (3) with NBR and FPM options, and an indicator connection plug (4). The FHP 500 assembly includes a filter element (2), a seal kit (3) with NBR and FPM options, and an indicator connection plug (4). The diagrams are labeled with callouts 3d, 3e, 4, 3g, 3a, 3b, 3c, 2, 3f, and 3g.

Q.ty: 1 pc.		Q.ty: 1 pc. (3a ÷ 3g for FHP 350) (3a ÷ 3f for FHP 500)		Q.ty: 1 pc.	
Item:	2	3		4	
Filter series	Filter element	Seal Kit code number		Indicator connection plug	
		NBR	FPM	NBR	FPM
FHP 350	See order table	02050272	02050283	T2H	T2V
FHP 500		02050330	02050331		

Clogging Indicators



Clogging indicators are devices that check the life time of the filter elements. They measure the pressure drop through the filter element directly connected to the filter housing.

These devices trip when the clogging of the filter element causes a pressure drop increasing across the filter element.

Filter elements are efficient only if their Dirt Holding Capacity is fully exploited. This is achieved by using filter housings equipped with clogging indicators. The indicator is set to alarm before the element becomes fully clogged.

MP Filtri can supply indicators of the following designs:

- Vacuum switches and gauges
- Pressure switches and gauges
- Differential pressure indicators

These type of devices can be provided with a visual, electrical or both signals.

The electronic differential pressure clogging indicator is also available.

It provides both analogical 4-20 mA output and digital warning (75% of clogging) and alarm (clogging) outputs.

Clogging indicators



Suitable indicator types

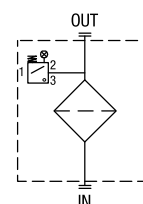
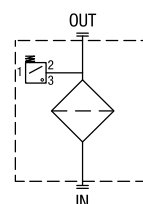
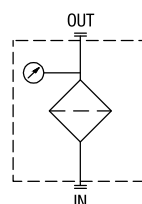
VACUUM INDICATORS

Vacuum indicators are used on the Suction line to check the efficiency of the filter element.

They measure the pressure downstream of the filter element.

Standard items are produced with R 1/4" EN 10226 connection.

Available products with R 1/8" EN 10226 to be fitted on MPS series.

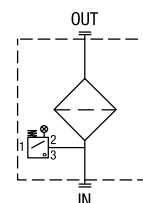
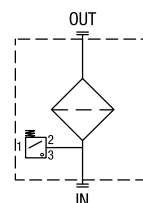
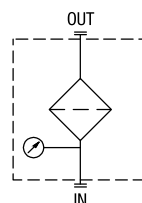


BAROMETRIC INDICATORS

Pressure indicators are used on the Return line to check the efficiency of the filter element.

They measure the pressure upstream of the filter element.

Standard items are produced with R 1/8" EN 10226 connection.



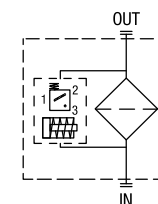
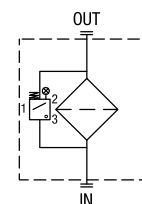
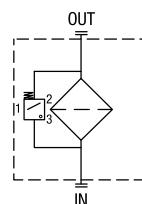
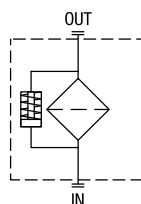
DIFFERENTIAL INDICATORS

Differential indicators are used on the Pressure line to check the efficiency of the filter element.

They measure the pressure upstream and downstream of the filter element (differential pressure).

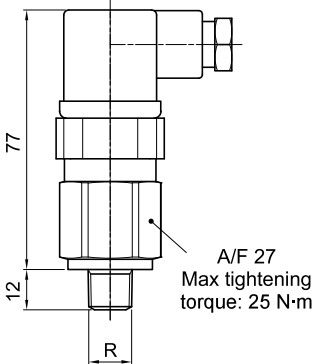
Standard items are produced with special connection G 1/2" size.

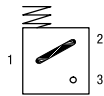
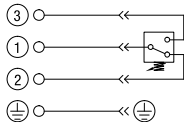
Also available in Stainless Steel models.



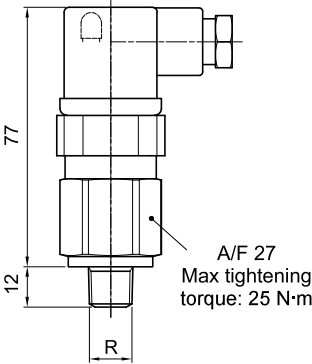
VACUUM INDICATORS

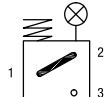
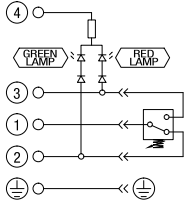
Dimensions

VE*50	
Electrical Vacuum Indicator	
R	Ordering code
EN 10226 - R1/4"	VE A 21 A A 50 P01
EN 10226 - R1/8"	VE B 21 A A 50 P01
	

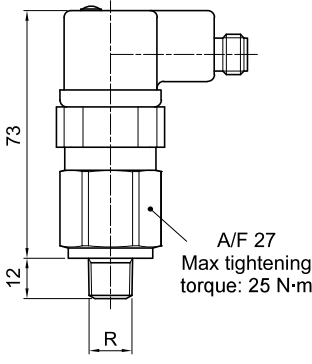
Hydraulic symbol	
	
Electrical symbol	
	

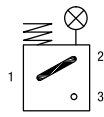
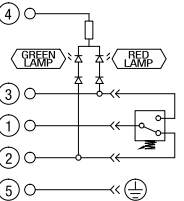
Materials	
- Body:	Brass
- Base:	Black Nylon
- Contacts:	Silver
- Seal:	NBR
Technical data	
- Vacuum setting:	-0.21 bar ±10%
- Max working pressure:	10 bar
- Proof pressure:	15 bar
- Working temperature:	From -25 °C to +80 °C
- Compatibility with fluids:	Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943
- Degree of protection:	IP65 according to EN 60529
Electrical data	
- Electrical connection:	EN 175301-803
- Resistive load:	5 A / 14 Vdc 4 A / 30 Vdc 5 A / 125 Vac 4 A / 250 Vac
- Available Atex product:	II 1GD Ex ia IIC Tx Ex ia IIIC Tx °C X 
- CE certification	

VL*51 - VL*52 - VL*53	
Electrical/Visual Vacuum Indicator	
R	Ordering code
EN 10226 - R1/4"	VL A 21 A A xx P01
EN 10226 - R1/8"	VL B 21 A A xx P01
	

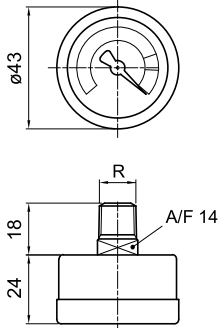
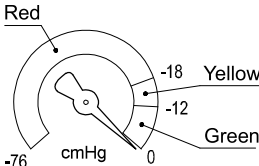
Hydraulic symbol	
	
Electrical symbol	
	

Materials	
- Body:	Brass
- Base:	Transparent Nylon
- Contacts:	Brass - Nylon
- Seal:	NBR
Technical data	
- Vacuum setting:	-0.21 bar ±10%
- Max working pressure:	10 bar
- Proof pressure:	15 bar
- Working temperature:	From -25 °C to +80 °C
- Compatibility with fluids:	Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943
- Degree of protection:	IP65 according to EN 60529
Electrical data	
- Electrical connection:	EN 175301-803
- Type	51 52 53
- Lamps	24 Vdc 110 Vdc 230 Vac
- Resistive load:	1 A / 24 Vdc 1 A / 110 Vdc 1 A / 230 Vac

VL*71	
Electrical/Visual Vacuum Indicator	
Connections	Indicator code
EN 10226 - R1/4"	VL A 21 A A 71 P01
EN 10226 - R1/8"	VL B 21 A A 71 P01
	

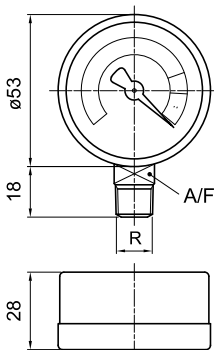
Hydraulic symbol	
	
Electrical symbol	
	

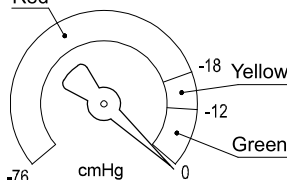
Materials	
- Body:	Brass
- Base:	Black Nylon
- Contacts:	Silver
- Seal:	NBR
Technical data	
- Vacuum setting:	-0.21 bar ±10%
- Max working pressure:	10 bar
- Proof pressure:	15 bar
- Working temperature:	From -25 °C to +80 °C
- Compatibility with fluids:	Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943
- Degree of protection:	IP65 according to EN 60529
Electrical data	
- Electrical connection:	IEC 61076-2-101 D (M12)
- Lamps	24 Vdc
- Resistive load:	0.4 A / 24 Vdc

WA - VVB	
Axial Vacuum Gauge	
R	Ordering code
EN 10226 - R1/4"	VVA 16 P01
EN 10226 - R1/8"	VVB 16 P01
	
	
Dial scale	
	
Conversion to SI units	
[cmHg]	[bar]
-12	-0.16
-18	-0.24
-76	-1.01

Materials	
- Case:	Painted Steel
- Window:	Transparent plastic
- Dial:	Painted Steel
- Pointer:	Painted Aluminium
- Pressure connection:	Brass
- Pressure element:	Bourdon tube Cu-alloy soft soldered

Technical data	
- Max working pressure:	Static: 7 bar Fluctuating: 6 bar Short time: 10 bar
- Working temperature:	From -40 °C to +60 °C
- Compatibility with fluids:	Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943
- Accuracy:	Class 2.5 according to EN 13190
- Degree of protection:	IP31 according to EN 60529

VVR - WS		
Radial Vacuum Gauge		
R	A/F	Ordering code
EN 10226 - R1/4"	14	VV R 16 P01
EN 10226 - R1/8"	11	VV S 16 P01
		

Hydraulic symbol	
	
Dial scale	
	
Conversion to SI units	
[cmHg]	[bar]
-12	-0.16
-18	-0.24
-76	-1.01

Materials	
- Case:	Painted Steel
- Window:	Transparent plastic
- Dial:	Painted Steel
- Pointer:	Painted Aluminium
- Pressure connection:	Brass
- Pressure element:	Bourdon tube Cu-alloy soft soldered
Technical data	
- Max working pressure:	Static: 7 bar Fluctuating: 6 bar Short time: 10 bar
- Working temperature:	From -40 °C to +60 °C
- Compatibility with fluids:	Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943
- Accuracy:	Class 2.5 according to EN 13190
- Degree of protection:	IP31 according to EN 60529

DESIGNATION & ORDERING CODE									
Series									
VE				Configuration example 1:					
VL				Configuration example 2:					
VV				Configuration example 3:					
Type VE - VL				Type VV					
A Connection EN 10226 - R1/4"				A Axial connection EN 10226 - R1/4"					
B Connection EN 10226 - R1/8"				B Axial connection EN 10226 - R1/8"					
				R Radial connection EN 10226 - R1/4"					
				S Radial connection EN 10226 - R1/8"					
Vacuum setting									
16 0.16 bar				VE VL VV					
21 0.21 bar				• • •					
Seals				VE VL VV					
A NBR				• • •					
Thermostat				VE VL VV					
A Without				• • •					
Electrical connections				VE VL VV					
50 Connection EN 175301-803				• • •					
51 Connection EN 175301-803, transparent base with lamps 24 Vdc				• • •					
52 Connection EN 175301-803, transparent base with lamps 110 Vdc				• • •					
53 Connection EN 175301-803, transparent base with lamps 230 Vdc				• • •					
71 Connection IEC 61076-2-101 D (M12), black base with lamps 24 Vdc				• • •					
				Option					
				P01 MP Filtri standard					
				Pxx Customized					

BAROMETRIC INDICATORS

Dimensions

BEA*50	
Electrical Pressure Indicator	
Settings	Ordering code
1.5 bar ±10%	BE A 15 H A 50 P01
2 bar ±10%	BE A 20 H A 50 P01
Hydraulic symbol	
Electrical symbol	
Materials - Body: Brass - Base: Black Nylon - Contacts: Silver - Seal: HNBR Technical data - Max working pressure: 40 bar - Proof pressure: 60 bar - Working temperature: From -25 °C to +80 °C - Compatibility with fluids: Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 - Degree of protection: IP65 according to EN 60529 Electrical data - Electrical connection: EN 175301-803 - Resistive load: 5 A / 14 Vdc 4 A / 30 Vdc 5 A / 125 Vac 4 A / 250 Vac - Available Atex product: II 1GD Ex ia IIC Tx Ex ia IIIC Tx °C X - CE certification	
BEM*41	
Electrical Pressure Indicator	
Settings	Ordering code
1.5 bar ±10%	BE M 15 H A 41 P01
2 bar ±10%	BE M 20 H A 41 P01
Hydraulic symbol	
Electrical symbol	
Materials - Body: Brass - Base: Black Nylon - Contacts: Silver - Seal: HNBR Technical data - Max working pressure: 40 bar - Proof pressure: 60 bar - Working temperature: From -25 °C to +80 °C - Compatibility with fluids: Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 - Degree of protection: IP67 according to EN 60529 Electrical data - Electrical connection: Four-core cable - Resistive load: 5 A / 14 Vdc 4 A / 30 Vdc 5 A / 125 Vac 4 A / 250 Vac - CE certification On request this indicator can be provided with main connectors in use for wirings.	
BET*10	
Electrical Pressure Indicator	
Settings	Ordering code
2 bar ±10%	BET 20 H F 10 P01
2.5 bar ±10%	BET 25 H F 10 P01
Hydraulic symbol	
Electrical symbol	
Materials - Body: Brass - Base: Black Nylon - Contacts: Silver - Seal: HNBR Technical data - Max working pressure: 10 bar - Proof pressure: 15 bar - Working temperature: From -25 °C to +100 °C - Compatibility with fluids: Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 - Degree of protection: IP65 according to EN 60529 Electrical data - Electrical connection: AMP Superseal series 1.5 - Resistive load: 0.5 A / 48 Vdc - Thermostat condition: Open up to 30 °C - CE certification	

BET*30		Hydraulic symbol	Materials	
Electrical Pressure Indicator			- Body: Brass	
Settings	Ordering code	Electrical symbol	- Base: Black Nylon	
2 bar ±10%	BET 20 H F 30 P01		- Contacts: Silver	
2.5 bar ±10%	BET 25 H F 30 P01		- Seal: HNBR	
BET*50		Hydraulic symbol	Materials	
Electrical Pressure Indicator			- Body: Brass	
Settings	Ordering code	Electrical symbol	- Base: Black Nylon	
2 bar ±10%	BET 20 H F 50 P01		- Contacts: Silver	
2.5 bar ±10%	BE T 25 H F 50 P01		- Seal: HNBR	
BL*51 - BL*52 - BL*53		Hydraulic symbol	Materials	
Electrical/Visual Pressure Indicator			- Body: Brass	
Settings	Ordering code	Electrical symbol	- Base: Transparent Nylon	
1.5 bar ±10%	BL A 15 H A xx P01		- Contacts: Silver	
2 bar ±10%	BL A 20 H A xx P01		- Seal: HNBR	

BAROMETRIC INDICATORS

Dimensions

BL*71 Electrical/Visual Pressure Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>1.5 bar ±10%</td><td>BL A 15 H A 71 P01</td></tr><tr><td>2 bar ±10%</td><td>BL A 20 H A 71 P01</td></tr></table> 73 10 A/F 27 Max tightening torque: 25 N·m EN 10226 - R1/8"		Settings	Ordering code	1.5 bar ±10%	BL A 15 H A 71 P01	2 bar ±10%	BL A 20 H A 71 P01	Hydraulic symbol Electrical symbol	Materials - Body: - Base: - Contacts: - Seal: Brass Black Nylon Silver HNBR
Settings	Ordering code								
1.5 bar ±10%	BL A 15 H A 71 P01								
2 bar ±10%	BL A 20 H A 71 P01								
BVA Axial Pressure Gauge <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>1.4 bar ±10%</td><td>BV A 14 P01</td></tr><tr><td>2.5 bar ±10%</td><td>BV A 25 P01</td></tr></table> EN 10226 - R1/8" A/F 11 15 25		Settings	Ordering code	1.4 bar ±10%	BV A 14 P01	2.5 bar ±10%	BV A 25 P01	Hydraulic symbol Dial scale BV A 14 P01 BV A 25 P01	Materials - Case: - Window: - Dial: - Pointer: - Pressure connection: - Pressure element: Painted Steel Transparent plastic Painted Steel Painted Aluminium Brass Bourdon tube Cu-alloy soft soldered
Settings	Ordering code								
1.4 bar ±10%	BV A 14 P01								
2.5 bar ±10%	BV A 25 P01								
BVR Radial Pressure Gauge <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>1.4 bar ±10%</td><td>BV R 14 P01</td></tr><tr><td>2.5 bar ±10%</td><td>BV R 25 P01</td></tr></table> EN 10226 - R1/8" A/F 11 16 23		Settings	Ordering code	1.4 bar ±10%	BV R 14 P01	2.5 bar ±10%	BV R 25 P01	Hydraulic symbol Dial scale BV R 14 P01 BV R 25 P01	Materials - Case: - Window: - Dial: - Pointer: - Pressure connection: - Pressure element: Painted Steel Transparent plastic Painted Steel Painted Aluminium Brass Bourdon tube Cu-alloy soft soldered
Settings	Ordering code								
1.4 bar ±10%	BV R 14 P01								
2.5 bar ±10%	BV R 25 P01								

BVP - BVQ	
Visual Pressure Indicator	
Setting	Ordering code
1.5 bar ±10%	BV P 15 H P01
	BV Q 15 H P01
2 bar ±10%	BV P 20 H P01
	BV Q 20 H P01

A/F 27
Max tightening torque: 25 N·m
EN 10226 - R1/8"

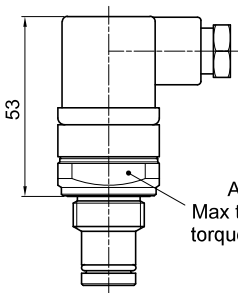
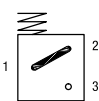
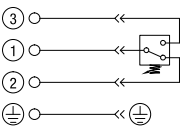
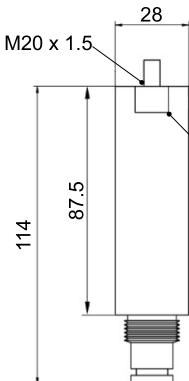
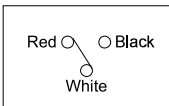
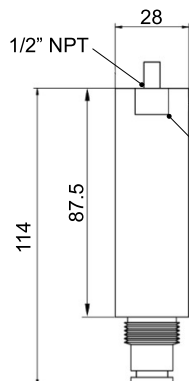
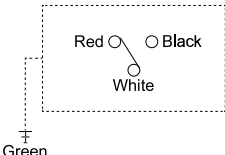
Hydraulic symbol	Materials	Technical data
	- Body: Brass	- Reset: BVP - Automatic reset BVQ - Manual reset
	- Cover / internal parts: Nylon	- Max working pressure: 10 bar
	- Caps: VMQ	- Proof pressure: 15 bar
	- Seal: HNBR	- Working temperature: From -25 °C to +80 °C
		- Compatibility with fluids: Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943
		- Degree of protection: IP45 according to EN 60529

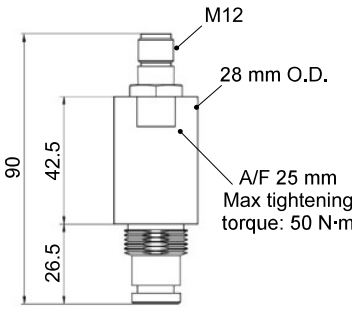
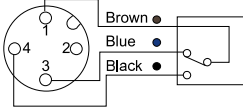
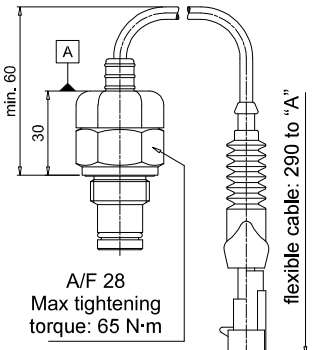
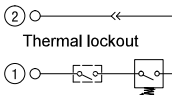
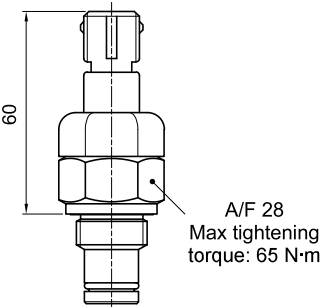
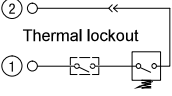
Signals	Absence of pressure (no indicator)	Presence of pressure (green button rises gradually)	Clogged filter element (red button risen)

DESIGNATION & ORDERING CODE									
Series			Configuration example 1:						
BE Electrical pressure indicator			BE	M	15	H	A	41	P01
BL Electrical/Visual pressure indicator			Configuration example 2:						
BV Visual pressure indicator			BL	A	20	H	A	71	P01
			Configuration example 3:						
			BV	R	14				P01
			Configuration example 4:						
			BV	P	20	H			P01
Type	BE	BL	BV						
A Standard type	•	•	A	Axial connection pressure gauge					
M With wired electrical connection	•		R	Radial connection pressure gauge					
T With thermal switch	•		P	Visual indicator with automatic reset					
			Q	Visual indicator with manual reset					
Pressure setting	BEA-BEM	BET	BLA	BVA-BVR	BVP-BVQ				
14 1.4 bar				•					
15 1.5 bar	•		•						
20 2 bar	•	•	•		•				
25 2.5 bar		•		•					
Seals	BE	BLA	BVA-BVR	BVP-BVQ					
H HNBR	•	•		•					
Thermostat	BEA-BEM	BET	BLA	BV					
A Without	•		•						
F With		•							
Electrical connections			BEA	BEM	BET	BL	BV		
10	Connection AMP Superseal series 1.5					•			
30	Connection Deutsch DT-04-2-P					•			
41	Connection via four-core cable				•				
50	Connection EN 175301-803			•		•			
51	Connection EN 175301-803, transparent base with lamps 24 Vdc						•		
52	Connection EN 175301-803, transparent base with lamps 110 Vdc						•		
53	Connection EN 175301-803, transparent base with lamps 230 Vdc						•		
71	Connection IEC 61076-2-101 D (M12), black base with lamps 24 Vdc						•		
Option									
P01			MP Filtri standard						
Pxx			Customized						

DIFFERENTIAL INDICATORS

Dimensions

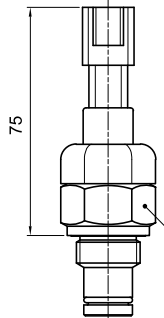
DEA*50 Electrical Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>1.2 bar ±10%</td><td>DE A 12 x A 50 P01</td></tr><tr><td>2 bar ±10%</td><td>DE A 20 x A 50 P01</td></tr><tr><td>5 bar ±10%</td><td>DE A 50 x A 50 P01</td></tr><tr><td>7 bar ±10%</td><td>DE A 70 x A 50 P01</td></tr><tr><td>9.5 bar ±10%</td><td>DE A 95 x A 50 P01</td></tr></table>  A/F 30 Max tightening torque: 65 N·m		Settings	Ordering code	1.2 bar ±10%	DE A 12 x A 50 P01	2 bar ±10%	DE A 20 x A 50 P01	5 bar ±10%	DE A 50 x A 50 P01	7 bar ±10%	DE A 70 x A 50 P01	9.5 bar ±10%	DE A 95 x A 50 P01	Hydraulic symbol  Electrical symbol 	Materials - Body: - Base: - Contacts: - Seal: Brass Black Nylon Silver HNBR - FPM Technical data - Max working pressure: - Proof pressure: - Burst pressure: - Working temperature: - Compatibility with fluids: - Degree protection: 420 bar 630 bar 1260 bar From -25 °C to +110 °C Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 IP66 according to EN 60529 IP69K according to ISO 20653 Electrical data - Electrical connection: - Resistive load: EN 175301-803 0.2 A / 115 Vdc
Settings	Ordering code														
1.2 bar ±10%	DE A 12 x A 50 P01														
2 bar ±10%	DE A 20 x A 50 P01														
5 bar ±10%	DE A 50 x A 50 P01														
7 bar ±10%	DE A 70 x A 50 P01														
9.5 bar ±10%	DE A 95 x A 50 P01														
DEH*48 Hazardous Area Electronic Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>5 bar ±10%</td><td>DE H 50 x A 48 P01</td></tr><tr><td>7 bar ±10%</td><td>DE H 70 x A 48 P01</td></tr></table>  M20 x 1.5 28 114 87.5 A/F 25 mm Max tightening torque: 50 N·m		Settings	Ordering code	5 bar ±10%	DE H 50 x A 48 P01	7 bar ±10%	DE H 70 x A 48 P01	Connection diagram   - Certification / Approvals: ATEX, IECEx, TRCU, INMETRO - Certification included as standard	Materials - Body: - Contacts: - Seal: AISI 316 Stainless steel Rhodium (tungsten optional) MFQ - FPM Protection class Ex ia IIC T4/T6: Intrinsically safe Temperature class T4 (135 °C) and T6 (85 °C) Technical data - Max working pressure: - Working temperature: - Connection type: - Contact type: - Compatibility with fluids: - Degree of protection: 420 bar From -60 °C to +125 °C M20 x 1.5 - 3 core polyrad cable supplied with 5 meters SPCO/SPDT (Hermetically sealed - volt free contacts) Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 IP 66/67/68 according to EN 60529 Electrical data - Current Ratings - Electrical Ratings 24v DC 830mA - 110v AC 180mA Ui 30V - Li 250mA - Pi 1.3W						
Settings	Ordering code														
5 bar ±10%	DE H 50 x A 48 P01														
7 bar ±10%	DE H 70 x A 48 P01														
DEH*49 Hazardous Area Electronic Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>5 bar ±10%</td><td>DE H 50 x A 49 P01</td></tr><tr><td>7 bar ±10%</td><td>DE H 70 x A 49 P01</td></tr></table>  1/2" NPT 28 114 87.5 A/F 25 mm Max tightening torque: 50 N·m		Settings	Ordering code	5 bar ±10%	DE H 50 x A 49 P01	7 bar ±10%	DE H 70 x A 49 P01	Connection diagram   - Certification / Approvals: ATEX, IECEx, TRCU, INMETRO, UL/CSA Class I Division 1 Groups A-D, UL/CSA Class II Division 1 Groups E-G - Certification included as standard	Materials - Body: - Contacts: - Seal: AISI 316 Stainless steel Rhodium (tungsten optional) MFQ - FPM Protection class Ex d IIC T4/T6: Flameproof Temperature class T4 (135 °C) and T6 (85 °C) Technical data - Max working pressure: - Working temperature: - Connection type: - Contact type: - Compatibility with fluids: - Degree of protection: 420 bar From -60 °C to +120 °C : ATEX, IECEx, TRCU, INMETRO From -60 °C to +105 °C : UL/CSA 1/2" NPT - 3 core polyrad cable supplied with 5 meters SPCO/SPDT (Hermetically sealed - volt free contacts) Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 IP 66/67/68 according to EN 60529 Electrical data - Current Ratings - Electrical Ratings 24v DC 830mA - 110v AC 180mA Supply Voltage24 VDC 110 VAC Max switching current830mA 180mA Max voltage150 V AC/DC Power watts20 W VA						
Settings	Ordering code														
5 bar ±10%	DE H 50 x A 49 P01														
7 bar ±10%	DE H 70 x A 49 P01														

DEH*70 Hazardous Area Electronic Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>5 bar ±10%</td><td>DE H 50 x A 70 P01</td></tr><tr><td>7 bar ±10%</td><td>DE H 70 x A 70 P01</td></tr></table> 		Settings	Ordering code	5 bar ±10%	DE H 50 x A 70 P01	7 bar ±10%	DE H 70 x A 70 P01	Connection diagram   - Certification / Approvals: ATEX, IECEx, TRCU, INMETRO - Certification included as standard	Materials - Body: AISI 316 Stainless steel housing with internal engineered resin switch - Contacts: Rhodium - Seal: MFQ - FPM Protection class EX ia IIC T6: Intrinsically safe Temperature class T6 (85 °C) Technical data - Max working pressure: 420 bar - Working temperature: From -20 °C to +80 °C - Connection type: 4 pole male M12 connector - plastic - Contact type: SPCO/SPDT (Hermetically sealed - volt free contacts) - Compatibility with fluids: Mineral oils, Synthetic fluids - Degree of protection: IP 66/67 according to EN 60529 Electrical data - Current Ratings 24v DC 830mA - 110v AC 180mA - Electrical Ratings Ui 30V - Li 250mA - Pi 1.3W						
Settings	Ordering code														
5 bar ±10%	DE H 50 x A 70 P01														
7 bar ±10%	DE H 70 x A 70 P01														
DEM*10 Electrical Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>1.2 bar ±10%</td><td>DE M 12 x x 10 P01</td></tr><tr><td>2 bar ±10%</td><td>DE M 20 x x 10 P01</td></tr><tr><td>5 bar ±10%</td><td>DE M 50 x x 10 P01</td></tr><tr><td>7 bar ±10%</td><td>DE M 70 x x 10 P01</td></tr><tr><td>9.5 bar ±10%</td><td>DE M 95 x x 10 P01</td></tr></table> 		Settings	Ordering code	1.2 bar ±10%	DE M 12 x x 10 P01	2 bar ±10%	DE M 20 x x 10 P01	5 bar ±10%	DE M 50 x x 10 P01	7 bar ±10%	DE M 70 x x 10 P01	9.5 bar ±10%	DE M 95 x x 10 P01	Hydraulic symbol  Electrical symbol 	Materials - Body: Brass - Base: Black Nylon - Contacts: Silver - Seal: HNBR - FPM Technical data - Max working pressure: 420 bar - Proof pressure: 630 bar - Burst pressure: 1260 bar - Working temperature: From -25 °C to +110 °C - Compatibility with fluids: Mineral oils, Synthetic fluids - Degree protection: IP66 according to EN 60529 Electrical data - Electrical connection: AMP Superseal series 1.5 - Resistive load: 0.2 A / 115 Vdc - Switching type: Normally open contacts (NC on request) - Thermal lockout: Normally open up to 30 °C (option "F")
Settings	Ordering code														
1.2 bar ±10%	DE M 12 x x 10 P01														
2 bar ±10%	DE M 20 x x 10 P01														
5 bar ±10%	DE M 50 x x 10 P01														
7 bar ±10%	DE M 70 x x 10 P01														
9.5 bar ±10%	DE M 95 x x 10 P01														
DEM*20 Electrical Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>1.2 bar ±10%</td><td>DE M 12 x x 20 P01</td></tr><tr><td>2 bar ±10%</td><td>DE M 20 x x 20 P01</td></tr><tr><td>5 bar ±10%</td><td>DE M 50 x x 20 P01</td></tr><tr><td>7 bar ±10%</td><td>DE M 70 x x 20 P01</td></tr><tr><td>9.5 bar ±10%</td><td>DE M 95 x x 20 P01</td></tr></table> 		Settings	Ordering code	1.2 bar ±10%	DE M 12 x x 20 P01	2 bar ±10%	DE M 20 x x 20 P01	5 bar ±10%	DE M 50 x x 20 P01	7 bar ±10%	DE M 70 x x 20 P01	9.5 bar ±10%	DE M 95 x x 20 P01	Hydraulic symbol  Electrical symbol 	Materials - Body: Brass - Base: Black Nylon - Contacts: Silver - Seal: HNBR - FPM Technical data - Max working pressure: 420 bar - Proof pressure: 630 bar - Burst pressure: 1260 bar - Working temperature: From -25 °C to +110 °C - Compatibility with fluids: Mineral oils, Synthetic fluids - Degree protection: IP66 according to EN 60529 Electrical data - Electrical connection: AMP Time junior - Resistive load: 0.2 A / 115 Vdc - Switching type: Normally open contacts (NC on request) - Thermal lockout: Normally open up to 30 °C (option "F")
Settings	Ordering code														
1.2 bar ±10%	DE M 12 x x 20 P01														
2 bar ±10%	DE M 20 x x 20 P01														
5 bar ±10%	DE M 50 x x 20 P01														
7 bar ±10%	DE M 70 x x 20 P01														
9.5 bar ±10%	DE M 95 x x 20 P01														

DIFFERENTIAL INDICATORS

Dimensions

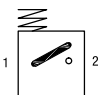
DEM*30	
Electrical Differential Indicator	
Settings	Ordering code
1.2 bar ±10%	DE M 12 x x 30 P01
2 bar ±10%	DE M 20 x x 30 P01
5 bar ±10%	DE M 50 x x 30 P01
7 bar ±10%	DE M 70 x x 30 P01
9.5 bar ±10%	DE M 95 x x 30 P01



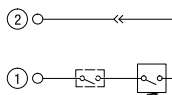
75

A/F 28
Max tightening torque: 65 N·m

Hydraulic symbol



Electrical symbol



Materials

- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR - FPM

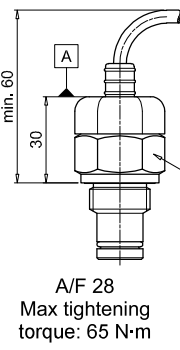
Technical data

- Max working pressure: 420 bar
- Proof pressure: 630 bar
- Burst pressure: 1260 bar
- Working temperature: From -25 °C to +110 °C
- Compatibility with fluids: Mineral oils, Synthetic fluids
HFA, HFB, HFC according to ISO 2943
- Degree protection: IP66 according to EN 60529

Electrical data

- Electrical connection: Deutsch DT-04-2-P
- Resistive load: 0.2 A / 115 Vdc
- Switching type: Normally open contacts (NC on request)
- Thermal lockout: Normally open up to 30 °C (option "F")

DEM*35	
Electrical Differential Indicator	
Settings	**Ordering code**
1.2 bar ±10%	DE M 12 x x 35 P01
2 bar ±10%	DE M 20 x x 35 P01
5 bar ±10%	DE M 50 x x 35 P01
7 bar ±10%	DE M 70 x x 35 P01
9.5 bar ±10%	DE M 95 x x 35 P01



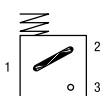
min. 60

30

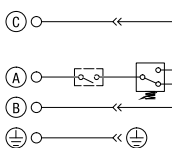
A/F 28
Max tightening torque: 65 N·m

flexible cable: 240 to "A"

Hydraulic symbol



Electrical symbol



Materials

- Body: Brass
- Base: Black Nylon
- Contacts: Silver
- Seal: HNBR - FPM

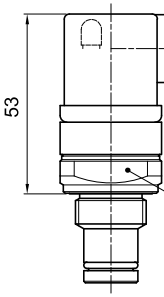
Technical data

- Max working pressure: 420 bar
- Proof pressure: 630 bar
- Burst pressure: 1260 bar
- Working temperature: From -25 °C to +110 °C
- Compatibility with fluids: Mineral oils, Synthetic fluids
HFA, HFB, HFC according to ISO 2943
- Degree protection: IP66 according to EN 60529

Electrical data

- Electrical connection: Deutsch DT-04-3-P
- Resistive load: 0.2 A / 115 Vdc
- Switching type: SPDT contact
- Thermal lockout: Normally open up to 30 °C (option "F")

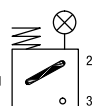
DLA*51 - DLA*52	
Electrical/Visual Differential Indicator	
Settings	**Ordering code**
1.2 bar ±10%	DL A 12 x A xx P01
2 bar ±10%	DL A 20 x A xx P01
5 bar ±10%	DL A 50 x A xx P01
7 bar ±10%	DL A 70 x A xx P01
9.5 bar ±10%	DL A 95 x A xx P01



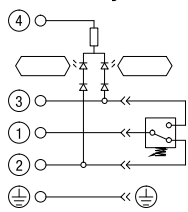
53

A/F 30
Max tightening torque: 65 N·m

Hydraulic symbol



Electrical symbol



Materials

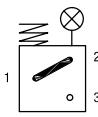
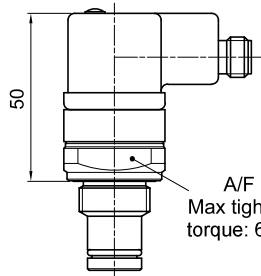
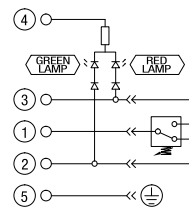
- Body: Brass
- Base: Transparent Nylon
- Contacts: Silver
- Seal: HNBR - FPM

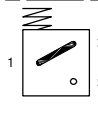
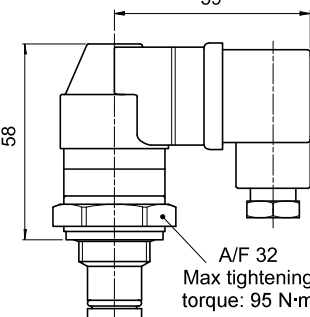
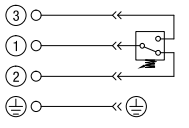
Technical data

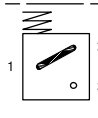
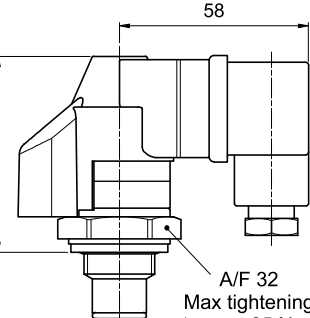
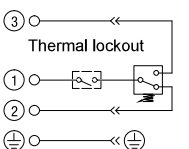
- Max working pressure: 420 bar
- Proof pressure: 630 bar
- Burst pressure: 1260 bar
- Working temperature: From -25 °C to +110 °C
- Compatibility with fluids: Mineral oils, Synthetic fluids
HFA, HFB, HFC according to ISO 2943
- Degree protection: IP66 according to EN 60529
IP69K according to ISO 20653

Electrical data

- Electrical connection: EN 175301-803
- Type: 51 52
- Lamps: 24 Vdc 110 Vdc
- Resistive load: 1 A / 24 Vdc 1 A / 110 Vdc

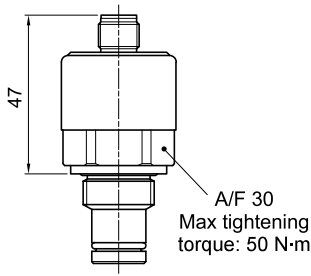
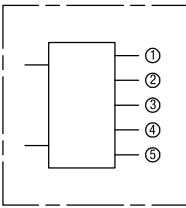
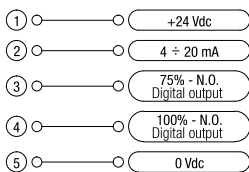
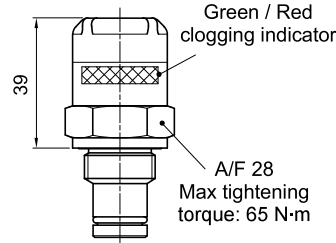
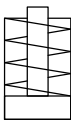
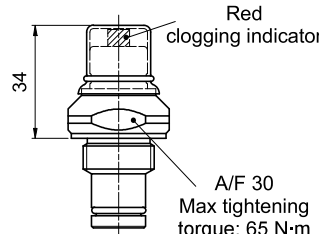
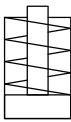
DLA*71		Hydraulic symbol 	Materials - Body: Brass - Base: Black Nylon - Contacts: Silver - Seal: HNBR - FPM										
Electrical/Visual Differential Indicator <table border="1"> <thead> <tr> <th>Settings</th> <th>Ordering code</th> </tr> </thead> <tbody> <tr> <td>1.2 bar $\pm 10\%$</td> <td>DL A 12 x A 71 P01</td> </tr> <tr> <td>2 bar $\pm 10\%$</td> <td>DL A 20 x A 71 P01</td> </tr> <tr> <td>5 bar $\pm 10\%$</td> <td>DL A 50 x A 71 P01</td> </tr> <tr> <td>7 bar $\pm 10\%$</td> <td>DL A 70 x A 71 P01</td> </tr> <tr> <td>9.5 bar $\pm 10\%$</td> <td>DL A 95 x A 71 P01</td> </tr> </tbody> </table>				Settings	Ordering code	1.2 bar $\pm 10\%$	DL A 12 x A 71 P01	2 bar $\pm 10\%$	DL A 20 x A 71 P01	5 bar $\pm 10\%$	DL A 50 x A 71 P01	7 bar $\pm 10\%$	DL A 70 x A 71 P01
Settings	Ordering code												
1.2 bar $\pm 10\%$	DL A 12 x A 71 P01												
2 bar $\pm 10\%$	DL A 20 x A 71 P01												
5 bar $\pm 10\%$	DL A 50 x A 71 P01												
7 bar $\pm 10\%$	DL A 70 x A 71 P01												
9.5 bar $\pm 10\%$	DL A 95 x A 71 P01												
 A/F 30 Max tightening torque: 65 N·m		Technical data - Max working pressure: 420 bar - Proof pressure: 630 bar - Burst pressure: 1260 bar - Working temperature: From -25 °C to +110 °C - Compatibility with fluids: Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 - Degree protection: IP65 according to EN 60529 IP69K according to ISO 20653											
		Electrical data - Electrical connection: IEC 61076-2-101 D (M12) - Lamps: 24 Vdc - Resistive load: 0.4 A / 24 Vdc											

DLE*A50		Hydraulic symbol 	Materials - Body: Brass - Base: Black Nylon - Contacts: Silver - Seal: HNBR - FPM										
Electrical/Visual Differential Indicator <table border="1"> <thead> <tr> <th>Settings</th> <th>Ordering code</th> </tr> </thead> <tbody> <tr> <td>1.2 bar $\pm 10\%$</td> <td>DL E 12 x A 50 P01</td> </tr> <tr> <td>2 bar $\pm 10\%$</td> <td>DL E 20 x A 50 P01</td> </tr> <tr> <td>5 bar $\pm 10\%$</td> <td>DL E 50 x A 50 P01</td> </tr> <tr> <td>7 bar $\pm 10\%$</td> <td>DL E 70 x A 50 P01</td> </tr> <tr> <td>9.5 bar $\pm 10\%$</td> <td>DL E 95 x A 50 P01</td> </tr> </tbody> </table>				Settings	Ordering code	1.2 bar $\pm 10\%$	DL E 12 x A 50 P01	2 bar $\pm 10\%$	DL E 20 x A 50 P01	5 bar $\pm 10\%$	DL E 50 x A 50 P01	7 bar $\pm 10\%$	DL E 70 x A 50 P01
Settings	Ordering code												
1.2 bar $\pm 10\%$	DL E 12 x A 50 P01												
2 bar $\pm 10\%$	DL E 20 x A 50 P01												
5 bar $\pm 10\%$	DL E 50 x A 50 P01												
7 bar $\pm 10\%$	DL E 70 x A 50 P01												
9.5 bar $\pm 10\%$	DL E 95 x A 50 P01												
 A/F 32 Max tightening torque: 95 N·m		Technical data - Max working pressure: 420 bar - Proof pressure: 630 bar - Burst pressure: 1260 bar - Working temperature: From -25 °C to +110 °C - Compatibility with fluids: Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 - Degree protection: IP65 according to EN 60529											
		Electrical data - Electrical connections: EN 175301-803 - Resistive load: 5 A / 250 Vac - Available the connector with lamps											

DLE*F50		Hydraulic symbol 	Materials - Body: Brass - Base: Black Nylon - Contacts: Silver - Seal: HNBR - FPM										
Electrical/Visual Differential Indicator <table border="1"> <thead> <tr> <th>Settings</th> <th>Ordering code</th> </tr> </thead> <tbody> <tr> <td>1.2 bar $\pm 10\%$</td> <td>DL E 12 x F 50 P01</td> </tr> <tr> <td>2 bar $\pm 10\%$</td> <td>DL E 20 x F 50 P01</td> </tr> <tr> <td>5 bar $\pm 10\%$</td> <td>DL E 50 x F 50 P01</td> </tr> <tr> <td>7 bar $\pm 10\%$</td> <td>DL E 70 x F 50 P01</td> </tr> <tr> <td>9.5 bar $\pm 10\%$</td> <td>DL E 95 x F 50 P01</td> </tr> </tbody> </table>				Settings	Ordering code	1.2 bar $\pm 10\%$	DL E 12 x F 50 P01	2 bar $\pm 10\%$	DL E 20 x F 50 P01	5 bar $\pm 10\%$	DL E 50 x F 50 P01	7 bar $\pm 10\%$	DL E 70 x F 50 P01
Settings	Ordering code												
1.2 bar $\pm 10\%$	DL E 12 x F 50 P01												
2 bar $\pm 10\%$	DL E 20 x F 50 P01												
5 bar $\pm 10\%$	DL E 50 x F 50 P01												
7 bar $\pm 10\%$	DL E 70 x F 50 P01												
9.5 bar $\pm 10\%$	DL E 95 x F 50 P01												
 A/F 32 Max tightening torque: 95 N·m		Technical data - Max working pressure: 420 bar - Proof pressure: 630 bar - Burst pressure: 1260 bar - Working temperature: From -25 °C to +110 °C - Compatibility with fluids: Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 - Degree protection: IP65 according to EN 60529											
		Electrical data - Electrical connections: EN 175301-803 - Resistive load: 5 A / 250 Vac - Thermal lockout setting: +30 °C											

DIFFERENTIAL INDICATORS

Dimensions

DTA*70 Electronic Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>1.2 bar ±10%</td><td>DTA 12 x x 70 P01</td></tr><tr><td>2 bar ±10%</td><td>DTA 20 x x 70 P01</td></tr><tr><td>5 bar ±10%</td><td>DTA 50 x x 70 P01</td></tr><tr><td>7 bar ±10%</td><td>DTA 70 x x 70 P01</td></tr><tr><td>9.5 bar ±10%</td><td>DTA 95 x x 70 P01</td></tr></table> 		Settings	Ordering code	1.2 bar ±10%	DTA 12 x x 70 P01	2 bar ±10%	DTA 20 x x 70 P01	5 bar ±10%	DTA 50 x x 70 P01	7 bar ±10%	DTA 70 x x 70 P01	9.5 bar ±10%	DTA 95 x x 70 P01	Hydraulic symbol  Electrical symbol 	Materials - Body: - Internal parts: - Contacts: - Seal: Brass Brass - Nylon Silver HNBR - FPM Technical data - Max working pressure: - Proof pressure: - Burst pressure: - Compatibility with fluids: - Degree protection: 420 bar 630 bar 1260 bar Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 IP67 according to EN 60529 Electrical data - Electrical connection: - Power supply: - Analogue output: - Thermal lockout: IEC 61076-2-101 D (M12) 24 Vdc From 4 to 20 mA 30 °C (all output signals stalled up to 30 °C) 
Settings	Ordering code														
1.2 bar ±10%	DTA 12 x x 70 P01														
2 bar ±10%	DTA 20 x x 70 P01														
5 bar ±10%	DTA 50 x x 70 P01														
7 bar ±10%	DTA 70 x x 70 P01														
9.5 bar ±10%	DTA 95 x x 70 P01														
DVA Visual Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>1.2 bar ±10%</td><td>DV A 12 x P01</td></tr><tr><td>2 bar ±10%</td><td>DV A 20 x P01</td></tr><tr><td>5 bar ±10%</td><td>DV A 50 x P01</td></tr><tr><td>7 bar ±10%</td><td>DV A 70 x P01</td></tr><tr><td>9.5 bar ±10%</td><td>DV A 95 x P01</td></tr></table> 		Settings	Ordering code	1.2 bar ±10%	DV A 12 x P01	2 bar ±10%	DV A 20 x P01	5 bar ±10%	DV A 50 x P01	7 bar ±10%	DV A 70 x P01	9.5 bar ±10%	DV A 95 x P01	Hydraulic symbol 	Materials - Body: - Internal parts: - Contacts: - Seal: Brass Brass - Nylon Silver HNBR - FPM Technical data - Reset: - Max working pressure: - Proof pressure: - Burst pressure: - Working temperature: - Compatibility with fluids: - Degree protection: Automatic reset 420 bar 630 bar 1260 bar From -25 °C to +110 °C Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 IP65 according to EN 60529
Settings	Ordering code														
1.2 bar ±10%	DV A 12 x P01														
2 bar ±10%	DV A 20 x P01														
5 bar ±10%	DV A 50 x P01														
7 bar ±10%	DV A 70 x P01														
9.5 bar ±10%	DV A 95 x P01														
DVM Visual Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>1.2 bar ±10%</td><td>DV M 12 x P01</td></tr><tr><td>2 bar ±10%</td><td>DV M 20 x P01</td></tr><tr><td>5 bar ±10%</td><td>DV M 50 x P01</td></tr><tr><td>7 bar ±10%</td><td>DV M 70 x P01</td></tr><tr><td>9.5 bar ±10%</td><td>DV M 95 x P01</td></tr></table> 		Settings	Ordering code	1.2 bar ±10%	DV M 12 x P01	2 bar ±10%	DV M 20 x P01	5 bar ±10%	DV M 50 x P01	7 bar ±10%	DV M 70 x P01	9.5 bar ±10%	DV M 95 x P01	Hydraulic symbol 	Materials - Body: - Internal parts: - Contacts: - Seal: Brass Brass - Nylon Silver HNBR - FPM Technical data - Reset: - Max working pressure: - Proof pressure: - Burst pressure: - Working temperature: - Compatibility with fluids: - Degree protection: Manual reset 420 bar 630 bar 1260 bar From -25 °C to +110 °C Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 IP65 according to EN 60529
Settings	Ordering code														
1.2 bar ±10%	DV M 12 x P01														
2 bar ±10%	DV M 20 x P01														
5 bar ±10%	DV M 50 x P01														
7 bar ±10%	DV M 70 x P01														
9.5 bar ±10%	DV M 95 x P01														

DESIGNATION & ORDERING CODE - DIFFERENTIAL INDICATORS

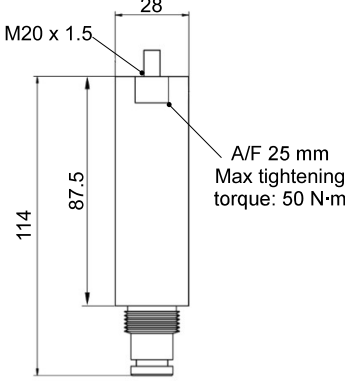
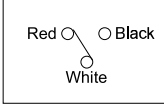
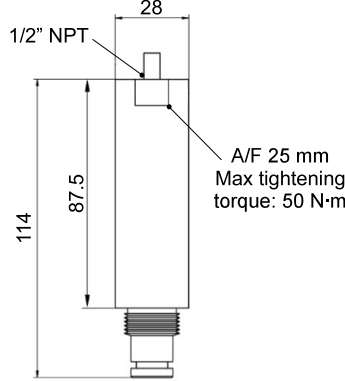
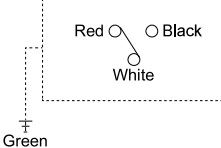
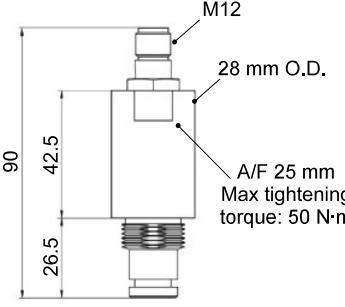
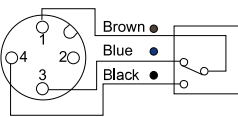
Option
P01 MP Filtri standard
Pxx Customized

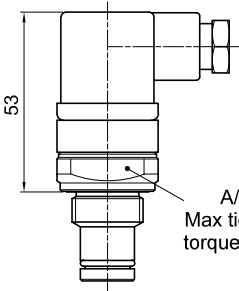
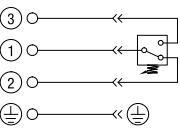
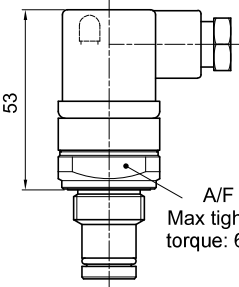
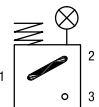
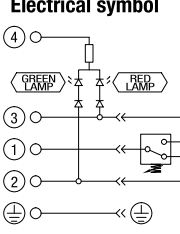
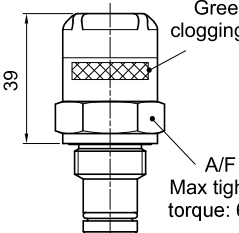
DESIGNATION & ORDERING CODE - DIFFERENTIAL INDICATOR PLUG

13 Clogging Indicators

STAINLESS STEEL DIFFERENTIAL INDICATORS

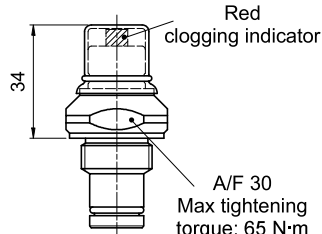
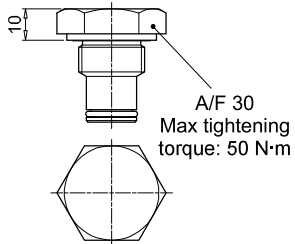
Dimensions

DEH*48 Hazardous Area Electronic Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>5 bar ±10%</td><td>DE H 50 x A 48 P01</td></tr><tr><td>7 bar ±10%</td><td>DE H 70 x A 48 P01</td></tr></table> 		Settings	Ordering code	5 bar ±10%	DE H 50 x A 48 P01	7 bar ±10%	DE H 70 x A 48 P01	Connection diagram   - Certification / Approvals: ATEX, IECEx, TRCU, INMETRO - Certification included as standard	Materials - Body: AISI 316 Stainless steel - Contacts: Rhodium (tungsten optional) - Seal: MFQ - FPM Protection class EX ia IIC T4/T6: Intrinsically safe Temperature class T4 (135 °C) and T6 (85 °C) Technical data - Max working pressure: 420 bar - Working temperature: From -60 °C to +125 °C - Connection type: M20 x 1.5 - 3 core polyrad cable supplied with 5 metres - Contact type: SPCO/SPDT (Hermetically sealed - volt free contacts) - Compatibility with fluids: Mineral oils, Synthetic fluids - Degree of protection: IP 66/67/68 according to EN 60529 Electrical data - Current Ratings 24v DC 830mA - 110v AC 180mA - Electrical Ratings Ui 30V - Li 250mA - Pi 1.3W								
Settings	Ordering code																
5 bar ±10%	DE H 50 x A 48 P01																
7 bar ±10%	DE H 70 x A 48 P01																
DEH*49 Hazardous Area Electronic Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>5 bar ±10%</td><td>DE H 50 x A 49 P01</td></tr><tr><td>7 bar ±10%</td><td>DE H 70 x A 49 P01</td></tr></table> 		Settings	Ordering code	5 bar ±10%	DE H 50 x A 49 P01	7 bar ±10%	DE H 70 x A 49 P01	Connection diagram   - Certification / Approvals: ATEX, IECEx, TRCU, INMETRO, UL/CSA Class I Division 1 Groups A-D, UL/CSA Class II Division 1 Groups E-G - Certification included as standard	Materials - Body: AISI 316 Stainless steel - Contacts: Rhodium (tungsten optional) - Seal: MFQ - FPM Protection class Ex d IIC T4/T6: Flameproof Temperature class T4 (135 °C) and T6 (85 °C) Technical data - Max working pressure: 420 bar - Working temperature: From -60 °C to +120 °C : ATEX, IECEx, TRCU, INMETRO From -60 °C to +105 °C : UL/CSA - Connection type: 1/2" NPT - 3 core polyrad cable supplied with 5 metres - Contact type: SPCO/SPDT (Hermetically sealed - volt free contacts) - Compatibility with fluids: Mineral oils, Synthetic fluids - Degree of protection: IP 66/67/68 according to EN 60529 Electrical data - Current Ratings 24v DC 830mA - 110v AC 180mA - Electrical Ratings<table><tr><td>Supply Voltage</td><td>24 VDC 110 VAC</td></tr><tr><td>Max switching current</td><td>830mA 180mA</td></tr><tr><td>Max voltage</td><td>150 V AC/DC</td></tr><tr><td>Power watts</td><td>20 W VA</td></tr></table>	Supply Voltage	24 VDC 110 VAC	Max switching current	830mA 180mA	Max voltage	150 V AC/DC	Power watts	20 W VA
Settings	Ordering code																
5 bar ±10%	DE H 50 x A 49 P01																
7 bar ±10%	DE H 70 x A 49 P01																
Supply Voltage	24 VDC 110 VAC																
Max switching current	830mA 180mA																
Max voltage	150 V AC/DC																
Power watts	20 W VA																
DEH*70 Hazardous Area Electronic Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>5 bar ±10%</td><td>DE H 50 x A 70 P01</td></tr><tr><td>7 bar ±10%</td><td>DE H 70 x A 70 P01</td></tr></table> 		Settings	Ordering code	5 bar ±10%	DE H 50 x A 70 P01	7 bar ±10%	DE H 70 x A 70 P01	Connection diagram   - Certification / Approvals: ATEX, IECEx, TRCU, INMETRO - Certification included as standard	Materials - Body: AISI 316 Stainless steel housing with internal engineered resin switch - Contacts: Rhodium - Seal: MFQ - FPM Protection class EX ia IIC T6: Intrinsically safe Temperature class T6 (85 °C) Technical data - Max working pressure: 420 bar - Working temperature: From -20 °C to +80 °C - Connection type: 4 pole male M12 connector - plastic - Contact type: SPCO/SPDT (Hermetically sealed - volt free contacts) - Compatibility with fluids: Mineral oils, Synthetic fluids - Degree of protection: IP 66/67 according to EN 60529 Electrical data - Current Ratings 24v DC 830mA - 110v AC 180mA - Electrical Ratings Ui 30V - Li 250mA - Pi 1.3W								
Settings	Ordering code																
5 bar ±10%	DE H 50 x A 70 P01																
7 bar ±10%	DE H 70 x A 70 P01																

DEX*50 Electrical Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>5 bar ±10%</td><td>DE X 50 x A 50 P01</td></tr><tr><td>7 bar ±10%</td><td>DE X 70 x A 50 P01</td></tr><tr><td>9.5 bar ±10%</td><td>DE X 95 x A 50 P01</td></tr></table>  A/F 30 Max tightening torque: 65 N·m		Settings	Ordering code	5 bar ±10%	DE X 50 x A 50 P01	7 bar ±10%	DE X 70 x A 50 P01	9.5 bar ±10%	DE X 95 x A 50 P01	Hydraulic symbol  Electrical symbol 	Materials - Body: - Base: - Contacts: - Seal: AISI 316L Black Nylon Silver HNBR - MFQ Technical data - Max working pressure: - Proof pressure: - Burst pressure: - Working temperature: - Compatibility with fluids: - Degree protection: 420 bar 630 bar 1260 bar From -25 °C to +110 °C Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 IP66 according to EN 60529 IP69K according to ISO 20653 Electrical data - Electrical connection: - Resistive load: EN 175301-803 0.2 A / 115 Vdc
Settings	Ordering code										
5 bar ±10%	DE X 50 x A 50 P01										
7 bar ±10%	DE X 70 x A 50 P01										
9.5 bar ±10%	DE X 95 x A 50 P01										
DLX*51 - DLX*52 Electrical/Visual Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>5 bar ±10%</td><td>DL X 50 x A x x P01</td></tr><tr><td>7 bar ±10%</td><td>DL X 70 x A x x P01</td></tr><tr><td>9.5 bar ±10%</td><td>DL X 95 x A x x P01</td></tr></table>  A/F 30 Max tightening torque: 65 N·m		Settings	Ordering code	5 bar ±10%	DL X 50 x A x x P01	7 bar ±10%	DL X 70 x A x x P01	9.5 bar ±10%	DL X 95 x A x x P01	Hydraulic symbol  Electrical symbol 	Materials - Body: - Base: - Contacts: - Seal: AISI 316L Transparent Nylon Silver HNBR - MFQ Technical data - Max working pressure: - Proof pressure: - Burst pressure: - Working temperature: - Compatibility with fluids: - Degree protection: 420 bar 630 bar 1260 bar From -25 °C to +110 °C Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 IP66 according to EN 60529 IP69K according to ISO 20653 Electrical data - Electrical connection: - Type - Lamps - Resistive load: EN 175301-803 51 52 24 Vdc 110 Vdc 1 A / 24 Vdc 1 A / 110 Vdc
Settings	Ordering code										
5 bar ±10%	DL X 50 x A x x P01										
7 bar ±10%	DL X 70 x A x x P01										
9.5 bar ±10%	DL X 95 x A x x P01										
DVX Visual Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>5 bar ±10%</td><td>DV X 50 x P01</td></tr><tr><td>7 bar ±10%</td><td>DV X 70 x P01</td></tr><tr><td>9.5 bar ±10%</td><td>DV X 95 x P01</td></tr></table>  Green / Red clogging indicator A/F 28 Max tightening torque: 65 N·m		Settings	Ordering code	5 bar ±10%	DV X 50 x P01	7 bar ±10%	DV X 70 x P01	9.5 bar ±10%	DV X 95 x P01	Hydraulic symbol 	Materials - Body: - Internal parts: - Contacts: - Seal: AISI 316L AISI 316L - Nylon Silver HNBR - MFQ Technical data - Reset: - Max working pressure: - Proof pressure: - Burst pressure: - Working temperature: - Compatibility with fluids: - Degree protection: Automatic reset 420 bar 630 bar 1260 bar From -25 °C to +110 °C Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 IP65 according to EN 60529
Settings	Ordering code										
5 bar ±10%	DV X 50 x P01										
7 bar ±10%	DV X 70 x P01										
9.5 bar ±10%	DV X 95 x P01										

STAINLESS STEEL DIFFERENTIAL INDICATORS

Dimensions

DVY		Hydraulic symbol		Materials - Body: AISI 316L - Internal parts: AISI 316L - Nylon - Contacts: Silver - Seal: HNBR - MFQ Technical data - Reset: Manual reset - Max working pressure: 420 bar - Proof pressure: 630 bar - Burst pressure: 1260 bar - Working temperature: From -25 °C to +110 °C - Compatibility with fluids: Mineral oils, Synthetic fluids HFA, HFB, HFC according to ISO 2943 - Degree protection: IP65 according to EN 60529					
Visual Differential Indicator <table><tr><th>Settings</th><th>Ordering code</th></tr><tr><td>5 bar ±10%</td><td>DV Y 50 x P01</td></tr><tr><td>7 bar ±10%</td><td>DV Y 70 x P01</td></tr><tr><td>9.5 bar ±10%</td><td>DV Y 95 x P01</td></tr></table> 					Settings	Ordering code	5 bar ±10%	DV Y 50 x P01	7 bar ±10%
Settings	Ordering code								
5 bar ±10%	DV Y 50 x P01								
7 bar ±10%	DV Y 70 x P01								
9.5 bar ±10%	DV Y 95 x P01								
X2		Indicator plug <table><tr><th>Seal</th><th>Ordering code</th></tr><tr><td>HNBR</td><td>X2 H</td></tr><tr><td>MFQ</td><td>X2 F</td></tr></table> 	Seal	Ordering code	HNBR	X2 H	MFQ	X2 F	Materials - Body: AISI 316L - Seal: HNBR / MFQ
Seal	Ordering code								
HNBR	X2 H								
MFQ	X2 F								

Dimensions

Series	DE	DL	DV
DE Electrical or Electronic differential indicator			
DL Electrical / Visual differential indicator			
DV Visual differential indicator			

Type	DE	DL	DV
H Hazardous area	•		
X Standard type	•	•	•
Y Optional type			•

Pressure setting
50 5 bar
70 7 bar
95 9.5 bar

Seals	DEH	DEX	DLX	DV
F MFQ	•			
H HNBR		•	•	•
V FPM	•	•	•	•

Thermostat
A Without

Electrical connections	DEH	DEX	DLX	DV
48 Connection M20	•			
49 Connection 1/2" NPT	•			
50 Connection EN 175301-803		•		
51 Connection EN 175301-803, transparent base with lamps 24 Vdc			•	
52 Connection EN 175301-803, transparent base with lamps 110 Vdc			•	
70 Connection IEC 61076-2-101 D (M12)	•			

Option
P01 MP Filtri standard
Pxx Customized

Configuration example 1:	DE	H	50	F	A	70	P01
Configuration example 2:	DE	X	50	H	A	50	P01
Configuration example 3:	DL	X	95	V	A	71	P01
Configuration example 4:	DV	Y	70	V			P01

Series	Configuration example	
X2 Indicator plug	X2	H
Seals		
H HNBR		
F MFQ		

Filter family	Filter series	Visual indicator	Electrical indicator	Electrical / Visual indicator	Electronic indicator
SUCTION FILTERS	SF2 250 - 350 SF2 500 - 501 - 503 - 504 - 505 SF2 510 - 535 - 540	VVA16P01 WVR16P01	VEA21AA50P01	VLA21AA51P01 VLA21AA52P01 VLA21AA53P01 VLA21AA71P01	
RETURN FILTERS	MPFX-MPTX-MPF-MPT with bypass 1.75 bar MPH with bypass 1.75 bar	BVA14P01 BVR14P01 BVP20HP01 BVQ20HP01	BEA15HA50P01 BEM15HA41P01	BLA15HA51P01 BLA15HA52P01 BLA15HA53P01 BLA15HA71P01	
	MPFX-MPTX-MPF-MPT with bypass 3 bar MPH with bypass 2.5 bar FRI 255	BVA25P01 BVR25P01 BVP20HP01 BVQ20HP01	BEA20HA50P01 BEM20HA41P01	BLA20HA51P01 BLA20HA52P01 BLA20HA53P01 BLA20HA71P01	
	MPLX FRI 025 - 040 - 100 - 250 - 630 - 850	DVA20xP01 DVM20xP01	DEA20xA50P01 DEM20xAxxP01	DLA20xA51P01 DLA20xA52P01 DLA20xA71P01 DLE20xA50P01 DLE20xF50P01	DTA20xF70P01
RETURN / SUCTION FILTERS	Suction line MRSX 116 - 165 - 166	WVB16P01 VVS16P01	VEB21AA50P01	VLB21AA51P01 VLB21AA52P01 VLB21AA53P01 VLB21AA71P01	
	Return line MRSX 116 - 165 - 166 LMP 124 MULTIPOINT	BVA25P01 BVR25P01 BVP20HP01 BVQ20HP01	BEA25HA50P01 BEM25HA41P01 BET25HF10P01 BET25HF30P01 BET25HF50P01	BLA25HA51P01 BLA25HA52P01 BLA25HA53P01 BLA25HA71P01	
SPIN-ON FILTERS	Suction line MPS 050 - 070 - 100 - 150 MPS 200 - 250 - 300 - 350	WVB16P01 VVS16P01	VEB21AA50P01	VLB21AA51P01 VLB21AA52P01 VLB21AA53P01 VLB21AA71P01	
	Return line MPS 050 - 070 - 100 - 150 MPS 200 - 250 - 300 - 350	BVA14P01 BVR14P01 BVP20HP01 BVQ20HP01	BEA15HA50P01 BEM15HA41P01	BLA15HA51P01 BLA15HA52P01 BLA15HA53P01 BLA15HA71P01	
	In-line MPS 051 - 071 - 101 - 151 MPS 301 - 351 MSH 050 - 070 - 100 - 150	DVA12xP01 DVM12xP01	DEA12xA50P01 DEM12xAxxP01	DLA12xA51P01 DLA12xA52P01 DLA12xA71P01 DLE12xA50P01 DLE12xF50P01	
LOW & MEDIUM PRESSURE FILTERS	With bypass valve LMP 110 - 112 - 116 - 118 - 119 MULTIPOINT LMP 120 - 122 - 123 MULTIPOINT LMP 210 - 211 - LDP LMP 400 - 401 & 430 - 431 LMP 900 - 901 LMP 902 - 903 LMP 950 - 951 LMP 952 - 953 - 954 LMD 211 - 400 - 401 - 431 - 951 - LDD	DVA20xP01 DVM20xP01	DEA20xA50P01 DEM20xAxxP01	DLA20xA51P01 DLA20xA52P01 DLA20xA71P01 DLE20xA50P01 DLE20xF50P01	DTA20xF70P01
	Without bypass valve LMP 110 - 112 - 116 - 118 - 119 MULTIPOINT LMP 120 - 122 - 123 MULTIPOINT LMP 210 - 211 - LDP LMP 400 - 401 & 430 - 431 LMP 900 - 901 LMP 902 - 903 LMP 950 - 951 LMP 952 - 953 - 954 LMD 211 - 400 - 401 - 431 - 951 - LDD	DVA50xP01 DVM50xP01	DEA50xA50P01 DEM50xAxxP01	DLA50xA51P01 DLA50xA52P01 DLA50xA71P01 DLE50xA50P01 DLE50xF50P01	DTA50xF70P01
HIGH PRESSURE FILTERS	With bypass valve FMP 039 - 065 - 135 - 320 FHP 010 - 011 - 065 - 135 - 320 - 500 FMM 050 - 150 FHA 051 FHM 006 - 007 - 010 - 050 - 065 - 135 - 320 - 500 FHB 050 - 135 - 320 FHF 325 FHD 021 - 051 - 326 - 333	DVA50xP01 DVM50xP01	DEA50xA50P01 DEM50xAxxP01	DLA50xA51P01 DLA50xA52P01 DLA50xA71P01 DLE50xA50P01 DLE50xF50P01	DTA50xF70P01 DEH50xA48P01 DEH50xA49P01 DEH50xA70P01 DEH70xA48P01 DEH70xA49P01 DEH70xA70P01
	Without bypass valve FMP 039 - 065 - 135 - 320 FHP 010 - 011 - 065 - 135 - 320 - 500 FMM 050 - 150 FHA 051 FHM 006 - 007 - 010 - 050 - 065 - 135 - 320 - 500 FHB 050 - 135 - 320 FHF 325 FHD 021 - 051 - 326 - 333	DVA70xP01 DVM70xP01	DEA70xA50P01 DEM70xAxxP01	DLA70xA51P01 DLA70xA52P01 DLA70xA71P01 DLE70xA50P01 DLE70xF50P01	DTA70xF70P01 DEH50xA48P01 DEH50xA49P01 DEH50xA70P01 DEH70xA48P01 DEH70xA49P01 DEH70xA70P01
STAINLESS STEEL HIGH PRESSURE FILTERS	With bypass valve FZH 010 - 011 - 039 FZP 039 - 136 FZX 011 FZB 039 FZM 039 FZD 051	DVX50xP01 DVY50xP01	DEX50xA50P01	DLX50xA51P01 DLX50xA52P01	DEH50xA48P01 DEH50xA49P01 DEH50xA70P01 DEH70xA48P01 DEH70xA49P01 DEH70xA70P01
	Without bypass valve FZH 010 - 011 - 039 FZP 039 - 136 FZB 039 FZM 039 FZD 010 - 021 - 051	DVX70xP01 DVY70xP01	DEX70xA50P01	DLX70xA51P01 DLX70xA52P01	DEH50xA48P01 DEH50xA49P01 DEH50xA70P01 DEH70xA48P01 DEH70xA49P01 DEH70xA70P01

Hazardous area electronic indicator

NEW

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Western Hydraulic MV 48

High Performance Hydraulic Oil

Product Description

Western Hydraulic MV 48 hydraulic fluid is an advanced formula, long life, anti-wear hydraulic fluid designed for use in hydraulic systems exposed to wide temperature ranges. This product provides excellent operating and maintenance benefits for increased productivity. Western Hydraulic MV 48 hydraulic fluid takes your equipment to higher levels of wide temperature performance. Western Hydraulic MV 48 hydraulic fluid starts with the A purity process to produce 99.9% pure, crystal clear base oils. By removing the impurities that can hinder the performance of competitive conventional oils, and blending in our specialty additives. Western Hydraulic MV 48 hydraulic fluid retains its 'fresh oil' properties longer providing resistance to oxidative breakdown and superior wear protection in wide temperature ranges.

Features and Benefits

- Seasonal use under wide temperature ranges
- Increased equipment precision and responsiveness
- Better protection from wear in low and high temperatures
- Reduced inventory for greater operational efficiencies and less change of misapplication

How Western Hydraulic MV 48 hydraulic fluid reduces seasonal changeouts and inventory

- Superior anti-wear protection
- Extends equipment life
- Reduces maintenance and mechanical failure
- Protects equipment being driven longer, harder and faster in tougher conditions
- Improves operating reliability over a wide range of pressures

Western Hydraulic MV 48 hydraulic fluid provides better wear protection than the climates with wide temperature extremes, more than on straight AW 22, AW46, AW32 grade hydraulic fluid may AW32, AW68, AW46 have to be used in a season. Replace your straight grade product with Western Hydraulic MV 48 hydraulic fluid product per season.

**Stable refers to locations with minimal seasonal temperature swings.*

† up to operating temperatures of 81°C (178°F)

Improved rust and corrosion prevention

- Iron and other metal components are protected against water damage
- Excellent water separability and hydrolytic stability allows oil to be reused
- Oil separates readily from water without loss of performance additives
- Improve foam and air entrainment performance
- Prevents overflowing of reservoirs
- Eliminates "sponginess" from hydraulic systems and prevents pump cavitation



Typical Properties

Western Hydraulic MV 48 hydraulic fluid

Start-up Temperature 1, °C/°F	-30 / -22
Operating Temperature Range, °C/°F	-11 to 73 / 12 to 164
Viscosity cSt @ 40°C / SUV @ 100°F	46/206
Viscosity cSt @ 100°C / SUV @ 210°F	7.65/51.3
Viscosity Index	140
Flash Point, , °C/°F	220/428
Pour Point, , °C/°F	-45 / -49
Oxidation Stability, hours	7000+
Oxidation Stability, mg sludge	Pass
Rust, procedures A & B, 24 h	Pass
Hydrolytic Stability, Copper Loss, mg/cm2	Pass
FZG Damage Load Stage	11.5
Dielectric breakdown voltage, kV	32
Water Separability at 54°C (129°F)	40-40-0(5)

Health and Safety

Based on available information, this product is not expected to produce adverse effects on health when used for the intended application and the recommendations provided in the Material Safety Data Sheet (MSDS) are followed. MSDS's are available upon request through Stern Oil Company, 800-477-2744. This product should not be used for purposes other than its intended use. If disposing of used product, take care to protect the environment.

TROUBLE SHOOTING

Symptom

5-16-12

Problem

Solution

Engine will turn over but will not start.

Start/Stop relays could be Loose or out.

Check relays

E-Stop engaged

Lift up E-stop

Engine starts but shuts down immediately, or engine shuts off randomly

Hydraulic level sensor stuck or shorted.

Turn sensor, check oil level, check wiring, replace sensor.

Full psi on Doors when oil is warm but losing psi on push block cyl.

Make sure oil cooler is on. Push block cyls. maybe by-passing oil

Extend PBs to middle all the way (out)
Disconnect HP pump.
Disable throttle up.
Remove line on top of rear PB cyl.
Hit out button momentarily to middle
Oil out of cyl.- problem with rear cyl.
Oil out of hose-problem with front cyl.

HP pump stays engaged

would not start. HLG switch is bad.

Disconnect wires to switch & replace

Function in cab calling for pump.

Check Measure group on Iqan for outputs

X or Y axis fault code

Joystick is going bad

Install new joystick.

Engine RPMs go down or dies when rams hit HP

relief is set to close to pump psi. 2nd pump is losing oil through relief.

disconnect low pressure pump to see if it runs normal. turn relief psi up or pump psi down.

Solution

[illegible]