

REPAIR REFERENCE GUIDE





REPAIR REFERENCE GUIDE

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TROUBLESHOOTING (71201, 71500, 71601, 71700)

LEAKS: When looking at the outside of the pump there may be certain areas where you can see oil. Locating the area of the leak will help in determining the appropriate replacement or repair.

	ISSUE	SOLUTION
1.	Oil on or around the piston	Backup and o-rings with snap ring need to be replaced
2.	Oil under the pump handle indicates handle shaft assembly is leaking	Either replace o-rings on the shaft assembly or replace entire shaft assembly
3.	Handle not pumping	This could indicate air or not enough oil in the pump
4.	Handle not coming back up	 Check that the handle shaft is straight Shaft assembly may need to be replaced Check valve (71201-001A-20) may need to be cleaned or replaced
5.	Air in the pump	Bleed air from pump by opening bottom of handle. Then open the side valve and squeeze reservoir. Pump about ten times. Close the side valve, lie on table and lightly push down on the reservoir while pumping. Air should be out and oil should be pushing piston up. (May need to repeat this procedure more than once).

RECOMMENDED REPAIR KITS FOR HYDRAULIC PUMPS

71201	-001A-REPK	7150	00-REPAIRKT	71600-PARTS	
PART #	DESCRIPTION	Part #	DESCRIPTION	PART #	DESCRIPTION
71201-18-SR	Snap Ring	71500-001A-1	Handle Shaft Assembly	71600-17-R	Piston Shaft & Allen Set Screw
71201-18-B0	Backup O-Ring	71500-33-0	0-Ring	71201-18-0	0-Ring
71201-001A-49	Back Check Valve	71500-37A	Back Pin & Ring for 71500	71600-CONE	Cone
71201-18-0	0-Ring for Shaft	71500-40K-NEW	New Valve Assembly Kit	71600-16	Spring
71500-40K-NEW	New Valve Assembly Kit	71201-001A-49	Back Check Valve	71600-15	Piston Cap
71500-001A-1	Handle Shaft Assembly	71500-18-0	O-Ring for Hydra-Krimp		
		71500-18-BO	Backup O-Ring for Hydra Krimp		



71201-001A-REPK

TOTAL REPAIR KIT FOR 71475, 71480, 71300, 71400, 71450

71201-18-SR Snap Ring "C-Clip" (FIG. A) 71201-18-0 O-Ring for Shaft (FIG. K) 71201-18-B0 Back Up O-Ring for Shaft (FIG. J) 71500-40K-NEW New Valve Assembly Kit (FIG. H1) 71201-001A-49 Back Check Valve (FIG. S) 71500-001A-1 Handle Shaft Assembly (FIG. N) 71201-RE-KIT PISTON SHAFT SEAL REPAIR KIT 11. Close OPEN/CLOSE valve. (Fig. H) Lightly press on oil **OPEN/CLOSE VALVE REPLACEMENT** (71500-40K-NEW) 71201-18-0 **O-Ring for Shaft (FIG. K)** reservoir and pump handle until maximum pressure is built. 1. Remove open/close valve and silver ball. (Fig. H1) Back Up O-Ring for Shaft (FIG. J) (This step will bleed oil past the newly installed check valve.) 71201-18-B0 2. Install silver ball. 12. Open valve to release pressure. 71201-18-SR Snap Ring "C-Clip" (FIG. A) 3. Install open/close valve. 13. Open oil reservoir cap and check oil level. Add oil if necessary. REPLACEMENT SHAFT HANDLE ASSEMBLY (71500-001A-1) (Fig P) 1. Remove snap ring "c-clip" (Fig. A) 1. Remove front pin c-clip and front pin. (Fig. 01) 14. Reinstall reservoir cover. (Fig. L) 2. Remove adapter holder. (Fig. B) 2. Slide handle forward and remove from handle shaft assembly. 3. Unscrew yolk assembly. (Fig. C) 3. Remove handle shaft assembly. (Fig. N) 4. Remove allen set screw using a 2.5mm allen wrench. (Fig. D) 4. Install handle shaft assembly. 5. Secure tool upright with yoke assembly facing upward. 5. Reinstall handle on handle shaft assembly. 6. Unscrew piston cap. (Fig. E) Reinstall front pin and c-clip. (Fig. 01) 7. Remove spring. (Fig. G) CHECK VALVE REPLACEMENT (71201-001A-49) 8. With OPEN/CLOSED (Fig. H) valve closed, remove piston shaft. 1. Open OPEN/CLOSE valve. (Fig. H) (Fig. I) 2. Unscrew reservoir cover. (Fig. L) 02.71500-37A 9. Remove top and bottom o-rings from piston shaft. (Fig. J & K) BACK PIN 3. Remove cap on oil reservoir and drain oil. (Fig. P) REASSEMBLY 4. Remove oil reservoir o-ring. (Fig. Q) N. 71500-001A-1 1. Install new o-rings on piston shaft. (Fig I) With shaft pointing 5. Remove oil reservoir. (Fig. R) HANDLE SHAFT ASSEMBLY upward (small diameter facing upward), first install backup 6. Remove check valve. (Fig. S) 01.71500-37B seal (square seal Fig. J) with bevel facing down. Second, 7. Install new check valve. (Fig. S) FRONT PIN L. RESERVOIR COVER install round o-ring (Fig. K). The round o-ring should be facing 8. Reinstall oil reservoir. (Fig. R) the bottom of the piston shaft. 9. Reinstall oil reservoir o-ring. (Fig Q) P. CAP 2. Open OPEN/CLOSE valve. (Fig. H) 10. Fill oil reservoir with a quality grade anti-ware Q. 71500-52 **OIL RESERVOIR O-RING** 3. Carefully push in piston shaft. (Fig. I) hydraulic oil and reinstall oil reservoir cap. (Fig P) R. 71200-51 4. Reinstall spring. (Fig. G) 0 **OIL RESERVOIR** 5. Reinstall piston cap (Fig. E) - screw in until tight. K. 71201-18-0 6. Reinstall allen set screw. (Fig. D) S. 71201-001A-49 0-RING CHECK VALVE (BACK) ¹ 7. Reinstall yolk assembly. (Fig. C) J. 71201-18-B0 BACKUP O-RING 8. Reinstall adapter holder. (Fig. B) SILVER BALL 9. Reinstall snap ring "c-clip." (compress w/ pliers if needed) (Fig. A) 10. Remove tool from vice, and hold with the volk portion facing H1. 71500-40K-NEW downward. NEW VALVE ASSEMBLY KIT WITH .187" SILVER BALL T. 71201-001A-20 11. Close OPEN/CLOSE (Fig. H) valve and pump handle to build D. ALLEN SET SCREW **CHECK VALVE (FRONT)** H2. 71500-40K-0LD hydraulic pressure. OLD VALVE ASSEMBLY KIT WITH .250" SILVER BALL 12. Open OPEN/CLOSE (Fig. H) valve and release pressure. I. 71201-17-R 13. REPEAT 11 and 12 two times (This will bleed excess air from PISTON SHAFT I. PISTON hydraulics.) A. SNAP RING SHAFT "C-CLIP" A. 71201-18-SR H. VALVE G. 71201-16 C. YOKE CHECK OIL LEVEL SNAP RING ASSEMBLY E. PISTON SPRING **B. ADAPTER** 0 "C-CLIP" KIT 1. Secure tool upright with the handle facing upward. CAP HOLDER 2. Unscrew reservoir cover portion of tool. (Fig. L) F. 71201-15 3. Remove cap on oil reservoir. PISTON CAP 4. Add oil if oil level is low. Oil level should be even with the top of the oil reservoir. 5. Reinstall cap. L. RESERVOIR COVER 6. Reinstall reservoir cover. D. ALLEN SET SCREW U. 71201-Y-T Yoke "T" Handle for 71201 7. Check for proper operation.



SELF REPAIRING FOR HYDRA-KRIMP ASSEMBLY (71500)

Please reference 71500-PARTS

LEAKING ON TWO COMMON PLACES ON SECTION 'A'

- 1. Around shaft assembly under handle.
- 2. Around piston shaft under yoke.

FOR REPLACING HAND SHAFT ASSEMBLY UNDER HANDLE

- 1. Remove snap-ring on the pin No. 37A.
- 2. Remove the handle No. 56.
- 3. Unscrew nut No. 35.
- 4. Remove the complete shaft.
- 5. Replace it with the new shaft assembly.

FOR REPLACING THE DOUBLE LAYER O-RING AROUND THE PISTON SHAFT UNDER YOKE

- 1. Remove screw No. 20.
- 2. Unscrew piston cap No. 15.
- 3. Remove piston cap, piston shaft, piston spring, No : 15, 16, 17.
- 4. Replace double layer o-ring No. 18.

Part #	Description	FIG.	Part #	Description	FIG.		
71500	HYDRA-KRIMP HOSE KRIMPER		71500-001A-6	2 OZ. HYDRAULIC OIL		~ 0	
71500-001A	Complete Hydraulic Assembly	А					\frown
71500-001B	Yoke Assembly	В	71500-18-KIT				
71500-001C	Die Set Assembly	С	71500-18-B0	Backup O-Ring	12		
71500-PB	Plastic Molded Box for 71500		71500-18-0	0-Ring	13		
71500-INST	Operating Instructions		71500-17-R	Piston Shaft	14		
			71500-15	Piston Cap	15		
71500-001	HYDRA-KRIMP ASSEMBLY			· · · · · · · · · · · ·		×0 0	
71500-001A	Complete Hydraulic Assembly	Δ					
71500-001R	Yoke Assembly	B					
11000 0010	Toke Assembly	D					
71500-001A-1	HANDLE SHAFT ASSEMBLY FOR 71500	1					
					9. 71500-001C		
71500-001A-2	HANDLE				DIE SET ASSEMBLY		
71500-56	Handle only for 71500	56			7 71500 0010 1		
71500-37A	Back Pin & Ring for Handle	37A		5. 71500-5			
71500-37B	Front Pin & Ring for Handle	37B		YOKE HINGE PIN			1
					HULDER ASSEMBLY		
71500-001A-3	OIL RESERVOIR ASSEMBLY			\mathbf{R}			
71500-51	Rubber Oil Reservoir	51					
71500-52	Oil Reservoir O-ring	52					
	5		9 71500 2				
71500-40K-NEW	NEW VALVE ASSEMBLY KIT	10	2. 71500-2 VOKE PIN	/			
71500-38	.187" Silver Ball		IONETIN	< . /		UW	
						\checkmark	
71500-40K-0LD	OLD VALVE ASSEMBLY KIT	11					56, 71500-56
71500-38	250" Silver Ball	••		2 ad			HANDLE
					6. / 1500-06 SNA	AP RING FOR HINGE PIN	
71500-001B-1	YOKE PIN & CHAIN ASSEMBLY		24 71500-24				
71500-24	Pin Chain for 71500	24	PIN CHAIN			0014-1	37B. 71500-37A
71500-2	Voke Pin for 71500	2	111 017 11	3. 71500-3	HANDI F	SHAFT @	BACK PIN
71500-2	Voke Pin $\Omega_{\rm ring}$ for 71500	2		YOKE PIN	2A 71500 2A ASSEMB		
71500-5		0		0-RING			
71500-001B-2	VOKE & HINGE PIN ASSEMBLY						
71500-5	Voke Hinge Pin	5				37A. 71500-37B	
71500-5	Din Chain for 71500	24			Y g		- RESERVOIR COVER
71500-2A 71500-2	Volco Din for 71500	24			S. /	ʻ 陆 🦯	CAP
71500-2	Yoke Pin Oring for 71500	2			- (9 6)		$\mathcal{W} = 52$ 71500-52
71500-5	foke Fill 0-filly for 71500	о С					
71500-06	Shap King for Hinge Pill 7 1500-5	0					51 71500-51
71500 0010					12 71500 10 0		
					0 PINC		
71500-0	Die Sel #0 (3/10)	0					
71600 0	ruipie (#ö Neuuceu Barrier)	9		12. 715			71201-0014-49
71500-8	Die Set #8 (13/32") Red	9		BAG		71500-38	
71500-10		9				SILVER BALL	
/1500-12	Die Set #12 (5/8") Green	9					10 71500-40K-NEW
71500-6SRB	Die Set #6 Black (5/16" Reduced Barrier)	9					NEW VALVE ASSEMBLY KIT WITH 187" SILVER BALL
71500-10SRB	Die Set #10 Orange (1/2" Reduced Barrier)	9		/			
71500-12SRB	Die Set #12 Blue (5/8" Reduced Barrier)	9				N 71201-001A-20	11 . 71500-40K-0LD
						CHECK VALVE	OLD VALVE ASSEMBLY KIT WITH .250" SILVER BALL
71500-001C-1	PLASTIC DIE HOLDER ASSEMBLY				\sim	(FRONT)	
/1500-6-PURPLE	Plastic Die Holder #6 (5/16")	_			14. 71500-17-R		
	(13/32" #8 Reduced Barrier) Purple	7			PISTON SHAFT		
71500-8-RED	Plastic Die Holder #8 (13/32") Red	7					
71500-10-YELLOW	Plastic Die Holder #10 (1/2") Yellow	7					
71500-12-GREEN	Plastic Die Holder #12 (5/8") Green	7		71500-	16	71500 DAI	
71500-6RB-BLACK	Plastic Die Holder #6 (5/16" Reduced Barrier) Black	7		PISTON	I SPRING	<u>1 I JUU FAI</u>	
71500-10RB-ORANGE	Plastic Die Holder #10 (1/2" Reduced Barrier) Orang	e 7		15 71500-15			
71500-12RB-BLUE	Plastic Die Holder #12 (5/8" Reduced Barrier) Blue	7		PISTON CAP			
			1 Aspen Drive • Bandolph.	NJ 07869 • phone (973) 252-	-9119 • fax (973) 252-2455 • www.ma	stercool.com	71500-PARTS-0420

1 Aspen Drive • Randolph, NJ 07869 • phone (973) 252-9119 • fax (973) 2



71601 PUMP ASSEMBLY REPAIR PARTS REPAIR PARTS FOR 71600, 71650







TROUBLESHOOTING (98210-B1-SCALE)



	ISSUE	SOLUTION
1.	When the scale locks up and will only display one weight	Change the chip (part # 98210-chip)
2.	When the scale displays everything but a zero value	Follow the recalibration procedure
3.	Cannot recalibrate	Replace the PC board (part # 98210-PC)
4.	No weight readings display when weight is on the scale	Replace the load cell (part # 98210-L-Cell)
5.	Losing calibration	The battery is low, may need replacing
6.	Blank screen could mean a loose wire	Check the PC board and behind the LCD screen

Note: After changing the PC board, load cell or chip, always recalibrate.

REPLACEMENT PARTS			
DESCRIPTION	PART #		
PC BOARD	98210-PC		
LOAD CELL	98210-L-CELL		
CHIP	98210-CHIP		



98210 – B1 CALIBRATION PROCEDURE

- 1. Press **ON/OFF** then immediately press **CLEAR** + **TARE/ENTER** simultaneously
- 2. You will then see **SET-1** on the LCD
- 3. Press **TARE/ENTER** again You will then see **SET-11**
- 4. Press **TARE/ENTER** again You will see **CAL** followed by a **5 digit number**
- 5. Press ↓ (down arrow) You will see "ZERO" appear on the bottom left side of the LCD momentarily
- 6. Place a known calibrated weight on the platform The number on the LCD will change to a new 5 digit number
- 7. After the new five digits become stabilized, Press ↑ (UP arrow)
- 8. You will see the word "TARE" appear in the middle of the LCD for a moment
- 9. Press TARE/ENTER again and you will see GOOD
- 10. Press **UNIT/SHIFT** and in combination with the ↑ and ↓ (UP/DOWN arrow keys) set the proper display that corresponds to the exact weight that is placed on the platform
- 11. When you have completed setting the display in agreement with the actual weight press TARE/ENTER again and you will see GOOD followed by HELLO and the actual weight amount will appear on the LCD again
- 12. Calibration is completed. Remove the weight from the platform and the scale should read 0.000



TROUBLESHOOTING (90060)

	ISSUE	SOLUTION
1.	Pump is locking up	 Change cartridge (part # 90160-R) Possible motor replacement Motor (50/60 Hz 1/6HP) (part # 90060-001-220V)
2.	Pump is leaking	 Change seals Shaft seal (part # 90060-06) Smaller O-ring on housing (part # 90052-23) Pump cover gasket with lip (part # 90060-13)
3.	Motor spins with no vacuum	Replace coupler (part # 90062-02)

REPLACEMENT PARTS

REF #	DESCRIPTION	PART #	REF #	DESCRIPTION	PART #
1.	MOTOR 110-220V 50/60Hz 1/6 HP	90060-001	11	SHAFT SEAL	90060-06
2.	SHAFT COUPLER ASSEMBLY	90060-02	12.	SMALLER O-RING ON HOUSING	90052-23
3.	ON/OFF SWITCH (1/0)	98300-006	13.	CARTRIDGE KIT (1.5 CFM or 42 LIT/MIN)	90160-R
4.	CAPACITOR (1 pc.) - 2 REQ. FOR EA. PUMP	90050-003	14.	OIL FILL PLUG W/O-RING	90052-30
5.	INTAKE TEE	90052-31	15.	PUMP COVER	90060-12
6.	GAS BALLAST FITTING WITH O-RING	90052-29	16.	SIGHT GLASS ASSEMBLY	90052-14
7.	PUMP HANDLE WITH GRIP AND PLUG	90060-40	17.	DRAIN VALVE	90052-28
8.	PUMP HOUSING	90060-11	18.	COVER CAP SCREW (1 pc.)	90052-33
9.	PUMP COVER 0-RING	90060-13	19.	THERMISTOR	90050-002
10.	SUCTION O-RING	90060-22	(TO SPEC	CIFY 220V MOTORS, ADD -220 TO PART#)	

LIMITED WARRANTY INFORMATION

Vacuum Pumps are warrantied against defects in material and workmanship for a period of one year. This warranty does not cover failure due to abuse, improper usage, or progressive wear and tear. Warranty becomes valid to the original owner and is effective on the purchase date. WARRANTY SERVICE IS PROVIDED THROUGH THE FACTORY ONLY. Please contact the service department toll free for parts, service concerns, or to obtain a return authorization number for warranty repair.





	ISSUE	SOLUTION
1.	Pump is locking up	 Change cartridge for 5 CFM pump (part # 90165-R) Change cartridge for 7.5 CFM pump (part # 90167-R) Possible motor replacement (5 CFM pump part # 90052-010R1-220V) (7.5 CFM pump part # 90057-01-R1-220V)
2.	Pump is leaking	Change seals Shaft seal (part # 90052-06) Smaller 0-ring on housing (part # 90052-23) Pump cover gasket with lip (part # 90052-13R)
3.	Motor spins with no vacuum	Replace coupler (part # 90062-02R)

REPLACEMENT PARTS

REF #	DESCRIPTION	PART #	REF #	DESCRIPTION	PART #
1.	PUMP COVER 5 CFM	90062-12	10.	FLOAT BALL	90052-20
	PUMP COVER 7.5 CFM	90067-12	11.	GAS BALLAST FITTING W/O-RING	90052-29
2.	SIGHT GLASS ASSEMBLY	90052-14	12.	RUBBER FOOT WITH BOLT	90052-38
3.	COVER SOCKET CAP (1 pc.)	90052-33	13.	SHAFT SEAL	90052-06
4.	DRAIN VALVE	90052-28	14.	SMALLER O-RING ON HOUSING	90052-23
5.	OIL FILL PLUG W/O-RING	90052-30	15.	PUMP COVER GASKET WITH LIP	90052-13R
6.	CARTRIDGE KIT 5 CFM / 142 LIT/MIN	90165-R	16.	PUMP HANDLE WITH GRIP	90062-40
	CARTRIDGE KIT 7.5 CFM / 213 LIT/MIN	90167-R	17.	SHAFT COUPLER ASSEMBLY	90062-02-R
7.	PUMP HOUSING WITH GUIDE	90062-11-R	18.	MOTOR-115V (5 CFM PUMPS) 1/3HP	90052-01-R1
8.	INTAKE VALVE ASSEMBLY (2 STAGE)	90056-01		MOTOR-115V (7.5 CFM PUMP) 1/2HP	90057-01-R1
9.	INTAKE TEE (SINGLE STAGE)	90052-31	(TO SPEC	HFY 220V MOTORS, ADD -220 TO PART #)	

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TROUBLESHOOTING (55100)



Battery Check: Always check the batteries before any kind of repair. Weak batteries can create false readings.

	ISSUE	SOLUTION
1.	No keypad reaction	Replace the keypad (55100-KEY)
2.	No leak readings	 The sensor may need to be replaced (55100-SEN) (Sensors usually last around 20 hours) The probe may need to be replaced (55100-PR)
3.	When the unit is not responding to any function	 Look for loose or broken wires on the PC board May need to change the PC board (55100-PC)
4.	LED lights do not show any readings	Replace the LED light (55100-LED)

REPLACEMENT PARTS				
DESCRIPTION	PART #			
SENSOR	55100-SEN			
PROBE	55100-PR			
PC BOARD	55100-PC			
KEY PAD	55100-KEY			
LED LIGHT	55100-LED			



TROUBLESHOOTING (55200)

Battery Check: Always check the batteries before any kind of repair. Weak batteries can create false readings.

	ISSUE	SOLUTION
1.	No keypad reaction	Replace the keypad (55200-KEY)
2.	No leak readings	 The sensor may need to be replaced (55100-SEN) (Sensors usually last around 20 hours) The probe may need to be replaced (55200-PR)
3.	When the unit is not responding to any function	 Look for loose or broken wires on the PC board May need to change the PC board (55200-PC)
4.	LED lights do not show any readings	Replace the LED light (55100-LED)

PLACEMENT PARTS	
DESCRIPTION	PART #
SENSOR	55100-SEN
PROBE	55200-PR
PC BOARD	55200-PC
KEY PAD	55200-KEY
LED LIGHT	55100-LED



TROUBLESHOOTING (55500)

Battery Check: Always check the batteries before any kind of repair. Weak batteries can create false readings.

	ISSUE	SOLUTION
1.	No keypad reaction	Replace the keypad (55200-KEY)
2.	No leak readings	 The sensor may need to be replaced (55500-SEN) (Sensors usually last around 20 hours) The probe may need to be replaced (55500-PR)
3.	When the unit is not responding to any function	 Look for loose or broken wires on the PC board May need to change the PC board (55500-PC)
4.	LED lights do not show any readings	Replace the LED light (55100-LED)
5.	Broken wire on PC board connecting to battery	Change the battery wire (55500-WIRE)

REPLACEMENT PARTS		
DESCRIPTION	PART #	
SENSOR	55500-SEN	
PROBE	55500-PR	
PC BOARD	55500-PC	
KEY PAD	55200-KEY	
LED LIGHT	55100-LED	
BATTERY WIRE	55500-WIRE	



COMBUSTIBLE GAS LEAK DETECTOR

TROUBLESHOOTING (55750)

Battery Check: Always check the batteries before any kind of repair. Weak batteries can create false readings.

	ISSUE	SOLUTION
1.	No keypad reaction	Replace the keypad (55750-KEY)
2.	No leak readings	 The sensor may need to be replaced (55750-SEN) (Sensors usually last around 20 hours) The probe may need to be replaced (55750-PR)
3.	When the unit is not responding to any function	 Look for loose or broken wires on the PC board May need to change the PC board (55750-PC)
4.	LED lights do not show any readings	Replace the LED light (55100-LED)
5.	Broken wire on PC board connecting to battery	Change the battery wire (55750-WIRE)

REPLACEMENT PARTS

DESCRIPTION	PART #
SENSOR	55750-SEN
PROBE	55750-PR
PC BOARD	55750-PC
KEY PAD	55750-KEY
LED LIGHT	55100-LED
BATTERY WIRE	55750-WIRE

PREAMBLE

HOW TO RE-CALIBRATE THE 99103-A & 99903 MANIFOLD

Our calibration process involves 16 steps and each step was designed to perform a specific task within that process.

Before I provide you with the details, I need to summarize for you what each step is for:

- Step #1 Identifies the software revision level of the unit.
- Step #2 Is always 500 (DO NOT CHANGE).
- Step #3 Calibrates the High Side Pressure at 0 PSI (Input pressure must be 0 PSI when calibrating this step).
- Step #4 Calibrates the High Side Pressure (we use a calibrated 300 PSI source, but you can use another known pressure to calibrate).
- Step #5 Calibrates the Low Side Pressure at 0 PSI (Input pressure must be 0 PSI when calibrating this step).
- Step #6 Calibrates the Low Side Pressure (we use a calibrated 300 PSI source, but you can use another known pressure to calibrate).
- Step #7 Calibrates the Vacuum Gauge at ATM (we use a calibrated ATM Vacuum Tube to calibrate this point).
- Step #8 Calibrates the vacuum at 96 microns (we use a calibrated 96 micron Vacuum Tube to calibrate this deep vacuum point).
- Step #9 Calibrates the High Side Temperature Thermocouple (a known low temperature reference is required).
- Step #10 Is always 423 (this corresponds to the boiling point of water (100°C or 212°F) DO NOT CHANGE, for K type thermocouple.
- Step #11 Calibrates the Low Side Temperature Thermocouple (a known low temperature reference is required).
- Step #12 Is always 423 (this corresponds to the boiling point of water (100°C or 212°F) DO NOT CHANGE, for K type thermocouple.
- Step #13 DO NOT CHANGE, this is a number that is specific to the unit.
- Step #14 DO NOT CHANGE, this is a number that is specific to the unit.
- Step #15 MUST BE 200, DO NOT CHANGE, this number is a temperature correction factor for the pressure sensors in the unit (High Side).
- Step #16 MUST BE 200, DO NOT CHANGE, this number is a temperature Correction factor for the pressure sensor in the unit (LOW SIDE).

The Keypad is used for entering and exiting the Calibration Process. I will call the keypad buttons by numbers instead of their function, starting with the left most key, which will be 1 (Vacuum) followed by 2 (Select), 3 (Power), 4 (Enter) and 5 (B/LT).

(A) To Enter the Calibration Mode turn the Unit ON then: Press 5 (and hold) **then** Press 1 and **hold both down** until the LCD screen goes blank.

Now (momentarily one button at a time) press the following button sequence 2, 1, 2. At this point you will see the following on the LCD screen:

Lower right screen will display the number 1 - This means you are in Calibration step #1 (the top center of the LCD displays the CALIBRATION VALUE of that particular step.

MY RECOMMENDATION IS THAT YOU RECORD ALL THE CALIBRATION VALUES IN YOUR MANIFOLD **BEFORE** ANY CHANGES ARE MADE, JUST IN CASE AN ERROR IS MADE. You record the numerical value that appears in the TOP CENTER of the LCD screen in each step.

Press ENTER to move to step #2 etc. until you reach step #16. Record every value in each step. Pressing ENTER one more time (after step #16) will EXIT the Calibration Mode.

A NOTE OF PRECAUTION:

When you are in the Calibration Mode, you can not go backwards and you will be <u>unable to shut the unit OFF</u>. You must first exit the calibration mode if you pass a step or if you wish to shut the unit OFF.

You are now ready to re-calibrate your manifold.

Follow instruction in (A) above and re-enter the Calibration Mode.

VACUUM SENSOR FIELD CALIBRATION PROCEDURE

- 1. Turn unit ON with ATM sensor plugged in.
- 2. Hold down UNIT key until CAL is displayed.
- 3. Within 3 seconds, press ENTER key.....AU CAL will show on the display.
- 4. Press ENTER key......ENDCAL will show on the display.
- 5. Power unit OFF.....calibration is completed.

How to Re-Calibrate a K-Type Temperature Sensor on a Digital Manifold in the Field (99103-A & 99903)

PRE-REQUISITE:

The PREAMBLE, which describes, "HOW TO RE-CALIBRATE THE MANIFOLD" has been read and understood. This preamble describes the meaning and purpose of every step and the requirement of recording the existing digital parameters for each of the 16 steps <u>before proceeding with the re-calibration process</u>.

REQUIREMENTS:

- 1. A stable temperature reference.
- 2. A calibrated digital or analog temperature instrument.
- 3. In the event such temperature sources or instruments are not available, a suitable alternative can be a mixture of ice and water. In that event, the temperature reference WILL NOT BE EXACT. Stirring the ice-water combination can generate a "reference temperature" in the 33 to 34 degrees Fahrenheit region for a short period of time.

STARTING THE TEMPERATURE SENSOR RE-CALIBRATION PROCESS:

This procedure is for re-calibrating the HIGH side of a new K-type thermocouple temperature sensor.

- 1. Connect the temperature sensor to the HIGH side of the manifold.
- 2. Press the POWER button to turn the unit ON.
- 3. Enter the CALIBRATION MODE, as described in the Pre-Requisite section above.
- 4. Press the ENTER button until you reach step #9 (lower right hand quadrant on the LCD display shall display a number 9).
- 5. Using one of the temperature sources, or another external temperature measuring instrument as mentioned in the REQUIREMENTS section above, clamp the new thermocouple sensor to the known temperature source. If the water-ice mixture is used, insert the thermocouple into the slurry and stir or agitate the mixture to keep the temperature stable and uniform. While doing this, use the UP or DOWN arrows on the keypad until the temperature displayed in the lower left hand quadrant is in the 33 to 34 degrees Fahrenheit range. Record the 3-digit number in the top center of the LCD.
- If a known temperature source is used or an external calibrated temperature measurement source is used, adjust the UP and DOWN arrows until the lower left quadrant of the LCD matches these external references.

- 7. Press ENTER one more time to get into step #10 of the calibration process. The number in the top center of the display should be 423. <u>Do not change that number</u>.
- 8. Press ENTER repeatedly <u>until you go past step #16</u>.
- 9. You have completed the re-calibration of the temperature sensor for the HIGH side of the digital manifold.

This procedure is for re-calibrating the LOW side of a new K-Type thermocouple temperature sensor.

- 1. Connect the temperature sensor to the LOW side of the manifold.
- 2. Press the POWER button and turn the unit ON.
- 3. Enter the CALIBRATION MODE, as described in the Pre-Requisite section above.
- 4. Press the ENTER button until you reach step #11 (lower right hand quadrant on the LCD shall display a number 11).
- 5. Using one of the temperature sources or another external temperature measuring instrument as mentioned in the REQUIREMENTS section above; clamp the new thermocouple sensor to the known temperature source. If the water-ice mixture is used, insert the thermocouple into the slurry and stir or agitate the mixture to keep the temperature stable and uniform. While doing this, use the UP or DOWN arrows on the keypad until the temperature displayed in the lower left hand quadrant is in the 33 to 34 degrees Fahrenheit range. Record the 3-digit number in the top center of the LCD.
- 6. If a known temperature source is used or an external calibrated temperature measurement source is used, adjust the UP and DOWN arrows until the lower left quadrant of the LCD matches these external references.
- 7. Press ENTER one more time to get into step #12 of the calibration process. The number in the top center of the display should be 423. <u>Do not change that number</u>.
- 8. Press ENTER repeatedly <u>until you go past step #16</u>.
- 9. You have completed the re-calibration of the temperature sensor for the LOW side of the digital manifold.

HOW TO RE-CALIBRATE A NEW PRESSURE SENSOR ON A DIGITAL MANIFOLD IN THE FIELD (99103-A & 99903)

GENERAL:

Whenever a manifold experiences a pressure sensor replacement, the manifold requires re-calibration. **Two (2)** known pressures will be required to re-establish the accuracy of the manifold.

Determining which steps in the calibration are required to be modified will depend on whether the low side or high side sensor was replaced.

If the pressure sensor on the **low side** was replaced: step #5 and step #6 need to be changed.

If the pressure sensor on the **high side** was replaced: step #3 and step #4 need to be changed.

The calibration parameters in all other steps must remain un-changed.

PRE-REQUISITE:

It is presumed that the following events have taken place.

- The directions describing "How to Replace a Pressure Sensor in the Digital Manifold" have been read and the defective pressure sensor has been replaced.
- The **Preamble**, which describes, "**How to Re-Calibrate the Manifold**" has been read and understood. This preamble describes the meaning and the purpose of every step.
- The pre-requisite of recording the existing parameters for all 16 steps has been met before proceeding with the re-calibration process.

REQUIREMENTS:

- Any stable source of air pressure in the 0 PSI to 300 PSI range.
- One side (low side) or the other side (high side) is still calibrated and will be used as a reference to re-calibrate the side with the new pressure sensor.
- Zero PSI will be one of the pressures used for calibration. The second pressure should be in the 200 to 250 PSI range. The exact value of the high pressure is not important.

STARTING THE RE-CALIBRATION PROCESS – HIGH SIDE:

This procedure is for re-calibrating the <u>HIGH SIDE</u> with the new pressure sensor

- 1. Press the **POWER** button to turn the unit **ON**.
- To enter the calibration process: Press the B/LT button (and hold) then press VACUUM (hold both until the LCD screen goes blank). Next, press the following sequence (momentarily one button at a time), SELECT-VACUUM-SELECT. When the number 1 appears in the lower right quadrant, you are in Step #1 of the calibration process.
- **3.** Calibrating the zero PSI point for the high side is done in Step #3. Press **ENTER** two more times until the lower right hand quadrant display shows the number 3. At this point use the UP arrow (select button) or the DOWN arrow (vacuum button) until the upper right hand quadrant displays 0 PSI.
- Record the calibration parameter that appears in the top center of the LCD. This information should be entered with the calibration data for Step #3 that was initially recorded for future use.
- **5.** A second pressure calibration point is required for the high side to complete the re-calibration.
 - Turn the high side, low side and vacuum knobs fully counterclockwise (open position).
 - Install the black plastic caps on the low side and high side ports and tighten them <u>by hand</u>, **making certain that they are tight**. The refrigerant (yellow) knob should be in the horizontal (fully clockwise) position.
 - Wear safety glasses and connect a pressure source of 150 PSI (minimum) but not greater than 300 PSI to the vacuum port.
 - Turn the compressor on until a maximum PSI is attained. Turn the vacuum knob fully clockwise to the closed position. This keeps the pressure constant inside the manifold.
- **6.** Now press the **ENTER** button to advance the calibration to Step #4. You should see a 4 in the lower ride quadrant of the LCD.
- 7. You will observe a PSI reading on the **high side**. You need to exit the calibration mode to see what the PSI reading is on the **low side** of the LCD display. <u>The presumption is that the low side is calibrated.</u>
- 8. Press ENTER 13 more times until the manifold exits the CAL. MODE. You will now record (on a piece of paper) the PSI reading on the low side. This is an accurate PSI pressure valve that you will also want the LCD to display on the high side. You will accomplish this by following the instructions in the next step.

- 9. Follow the instructions in Step #1 above and re-enter the calibration mode. Press ENTER 3 times. You should now be in Step #4. Now use the UP arrow (select button) or DOWN arrow (vacuum button) until the pressure reading on the high side matches the number that you recorded on the piece of paper in Step #8 above.
- 10. To exit, continue pressing ENTER until you pass Step #16. Check that the high and low PSI readings on the LCD display are the same or within +/-0.5% error. When this is accomplished, the re-calibration process is completed.

STARTING THE RE-CALIBRATION PROCESS - LOW SIDE:

This procedure is for re-calibrating the <u>LOW SIDE</u> with the new pressure sensor.

- 11. Press the **POWER** button to turn the unit **ON**.
- 12. To enter the calibration process: Press the B/LT button (and hold) then press VACUUM (hold both until the LCD screen goes blank). Next, press the following sequence (momentarily one button at a time), SELECT-VACUUM-SELECT. When the number 1 appears in the lower right quadrant, you are in Step #1 of the calibration process.
- **13.** Calibrating the zero PSI point for the low side is done in Step #5. Press **ENTER** four more times until the lower right hand quadrant display shows the number 5. At this point use the UP arrow (select button) or the DOWN arrow (vacuum button) until the upper left hand quadrant displays 0 PSI.
- 14. Record the calibration parameter that appears in the top center of the LCD. This information should be entered with the calibration data for Step #5 that was initially recorded for future use.
- **15.** A second pressure calibration point is required for the low side to complete the re-calibration.
 - Turn the high side, low side and vacuum knobs fully counterclockwise (open position).
 - Install the black plastic caps on the low side and high side ports and tighten them <u>by hand</u>, **making certain that they are tight**. The refrigerant (yellow) knob should be in the horizontal (fully clockwise) position.
 - Wear safety glasses and connect a pressure source of 150 PSI (minimum) but not greater than 300 PSI to the vacuum port.
 - Turn the compressor on until a maximum PSI is attained.
 - Turn the vacuum knob fully clockwise to the closed position. This keeps the pressure constant inside the manifold.

- 16. Now press the ENTER button to advance the calibration to Step #6. You should see a 6 in the lower ride quadrant of the LCD. You will observe some PSI reading on the LOW SIDE. You need to exit the calibration mode to see what the PSI reading is on the HIGH SIDE of the LCD display. The presumption is that the high side is calibrated.
- 17. Press ENTER 13 more times until the manifold exits the CAL. MODE. You will now record (on a piece of paper) the PSI reading on the high side. This is the PSI number that you want the LCD to display on the low side. You will accomplish this by following the instructions in the next step.
- 18. Follow the instructions in Step #1 above and re-enter the calibration mode. Press ENTER 5 times. You should now be in Step #6. Now use the UP arrow (select button) or DOWN arrow (vacuum button) until the pressure reading on the low side matches the PSI reading that you recorded on the piece of paper in Step #17 above.
- **19.** To exit, continue pressing **ENTER** until you pass Step #16. Check that the low and high side PSI readings on the LCD display are the same or within +/- 0.5% error. When this is accomplished, the re-calibration process is completed.

HOW TO REPLACE A PRESSURE SENSOR ON A 2-WAY DIGITAL MANIFOLD IN THE FIELD

STEP #1

Remove both knobs using a large flat screwdriver. Rest the screwdriver on the rubber cover to prevent damage to the cover or case as shown in the photograph below.



STEP #2

Remove all plastic caps from the ports to facilitate the removal of the flexible blue rubber cover. Start the removal on the rear of the unit, by prying OFF the cover, where the rectangular slots are located (see photograph below). Continue removing the cover from all sides until the cover is completely separated from the housing.



Remove all Phillips head screws from the rear of the housing. While the rear of the unit is facing up and the input ports are nearest to you, use a flat screwdriver and gently separate the two halves of the housing. Be careful in lifting the back cover (top) away from the bottom cover since a wire will still be secured between the two halves. If you lift the back cover from a 6:00 to 12:00 position, you can lay both cover sections down without disconnecting the battery connection from the main PCB.





STEP #4

Since the unit is lying on its face, the LOW-pressure sensor will be on the <u>right</u> side of the manifold block and the HIGH-pressure sensor will be on the <u>left</u> side.

Remove both pressure sensor connectors WITH EXTREME CARE. The recommended tool is a miniature side cutter. If used improperly or with excessive force, this tool can sever the cable, therefore, be very careful. Carefully place the jaws of the side-cutter between the plug and the socket interface, gently apply a minimal amount of force and carefully rock the side cutters in a lateral motion until the plug lifts out of the PCB socket. Repeat this process and remove the other pressure sensor. TAG THE SENSOR THAT IS TO BE REMOVED at this time. The photo below will detail the recommended removal process.



STEP #6

Having marked the pressure sensor that is to be removed and replaced, NOW proceed to remove the manifold block out of the housing cavity.

Secure the block in a vice; proceed to remove the marked sensor using a 7/16-inch wrench.

Apply blue Lock-Tite around the threads of the new sensor and re-install in the manifold block, applying sufficient force until tight (approximately 10 inch-lbs). Be careful not to cross-thread the new sensor in the process. Clean off excess Lock-Tite.

STEP #7

Return the manifold block back to its position in the case, making certain that the grounding clip is sitting in its notched position in the case and making contact with the block. It may be advantageous to raise the cover slightly to make the re-insertion process of the manifold block back into the case less difficult (due to the interference of the knob shafts).



Reconnect each pressure sensor to its respective connector on the PCB. The black wire should be on the left side in each connector, when the manifold block is facing you. It is recommended that additional (slight) pressure be exerted on each side of the connector to ascertain that the connectors are inserted all the way.

STEP #9

Carefully join both front and back covers together, making certain that the hinge lock cover (between front & back covers) is properly positioned before securing the covers with the screws. <u>Check to make certain that the unit turns ON before tightening the screws.</u> Tighten all screws that were removed in step # 3, until all surfaces around the perimeter of the case are touching firmly. If the unit does NOT turn ON, open the case and verify that the battery connector is not damaged and the connection with the battery is verified.

STEP #10

IT MAY BE ADVANTAGEOUS TO BEGIN THE INSTALLATION OF THE COVER FROM THE REAR OF THE UNIT, STARTING WITH THE SIDE WHERE THE PORTS ARE LOCATED. Work the cover around the ports, followed by the bottom corners and finally pull the other sides over their corners. Insert the four (4) rubber "feet" back into the rectangular holes in the backside of the case.

STEP #11

You are now ready to re-calibrate the manifold with the newly installed pressure sensor. Follow the instructions entitled "PRESSURE SENSOR RE-CALIBRATION INSTRUCTIONS".

HOW TO REPLACE A PRESSURE SENSOR IN A 4-WAY DIGITAL MANIFOLD IN THE FIELD

STEP #1

Remove all knobs. Each knob is secured with a screw that will be found beneath each label. Remove each label with a thin knife blade (or equivalent) and store labels for re-assembly. Remember the order in which the labels were removed. Disconnect each knob and place nearby in a sequence.

STEP #2

Un-screw and remove all caps from all manifold ports to facilitate removal of the blue rubber cover. Note that there are tiny holes on the rear of the cover. Start the cover removal by prying OFF the area where the holes are. Continue removing the cover from all sides until the cover is completely separated from the housing.

STEP #3

Remove all Phillips head screws from the rear of the housing. While the rear of the unit is facing up and the input ports are nearest to you, use a flat screwdriver and gently separate the two halves of the housing. Be careful in lifting the back cover (top) away from the bottom cover since a wire will still be secured between the two halves. If you lift the back cover from a 6:00 to 12:00 position, you can lay both cover sections down without disconnecting the battery connection from the main PCB.



STEP #4

Since the unit is lying on its face, the LOW-pressure sensor will be on the <u>right</u> side of the manifold block and the HIGH-pressure sensor will be on the <u>left</u> side.

Remove both pressure sensor connectors WITH EXTREME CARE. The recommended tool is a miniature side cutter. If used improperly or with excessive force, this tool can sever the cable, therefore, be very careful. Carefully place the jaws of the side-cutter between the plug and the socket interface, gently apply a minimal amount of force and carefully rock the side cutters in a lateral motion until the plug lifts out of the PCB socket. Repeat this process and remove the other pressure sensor. TAG THE SENSOR THAT IS TO BE REMOVED at this time. The photo below will detail the recommended removal process.



STEP #6

Having marked the pressure sensor that is to be removed and replaced, NOW proceed to remove the manifold block out of the housing cavity.

Secure the block in a vice; proceed to remove the marked sensor using a 7/16-inch wrench.

Apply blue Lock-Tite around the threads of the new sensor and re-install in the manifold block, applying sufficient force until tight (approximately 10 inch-lbs). Be careful not to cross-thread the new sensor in the process. Clean off excess Lock-Tite.

STEP #7

Return the manifold block back to its position in the case, making certain that the grounding clip is sitting in its notched position in the case and making contact with the block. It may be advantageous to raise the cover slightly to make the re-insertion process of the manifold block back into the case less difficult (due to the interference of the knob shafts).

STEP #8

Reconnect each pressure sensor to its respective connector on the PCB. The black wire should be on the left side in each connector, when the manifold block

is facing you. It is recommended that additional (slight) pressure be exerted on each side of the connector to ascertain that the connectors are inserted all the way.

STEP #9

Carefully join both front and back covers together, making certain that the hinge lock cover (between front & back covers) is properly positioned before securing the covers with the screws. <u>Check to make certain that the unit turns ON before tightening the screws</u>. Tighten all screws that were removed in step # 3, until all surfaces around the perimeter of the case are touching firmly. If the unit does NOT turn ON, open the case and verify that the battery connector is not damaged and the connection with the battery is verified.

STEP #10

IT MAY BE ADVANTAGEOUS TO BEGIN THE INSTALLATION OF THE COVER FROM THE REAR OF THE UNIT, STARTING WITH THE SIDE WHERE THE PORTS ARE LOCATED. Work the cover around the ports, followed by the bottom corners and finally pull the other sides over their corners. Insert the rubber material that was designed to protrude into the rectangular holes in the case by pushing the rubber material (using a blunt round object) through the round holes.

STEP #11

After the cover has been installed, turn the four shafts in a fully counter-clockwise position. Observe that there is a black rolled pin adjacent to each shaft. Also observe the white area beneath the knob as depicted in the picture below.



The orientation of each knob must be such that the black rolled pin fits inside the white region of each knob. <u>The white region is only shown in the picture for</u> <u>clarification</u>. After the knobs are positioned as instructed, tighten them with the screws previously removed in Step #1. Check to verify that each now rotates only

90 degrees. If more than 90 degrees, turn the knob fully counter-clockwise remove and flip the knob 180 degree.

Place the respective labels into their knob centers and apply a gentle force to secure them in place.

STEP #12

You are now ready to re-calibrate the manifold with the newly installed pressure sensor. Follow the instructions entitled "PRESSURE SENSOR RECALIBRATION INSTRUCTIONS".





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