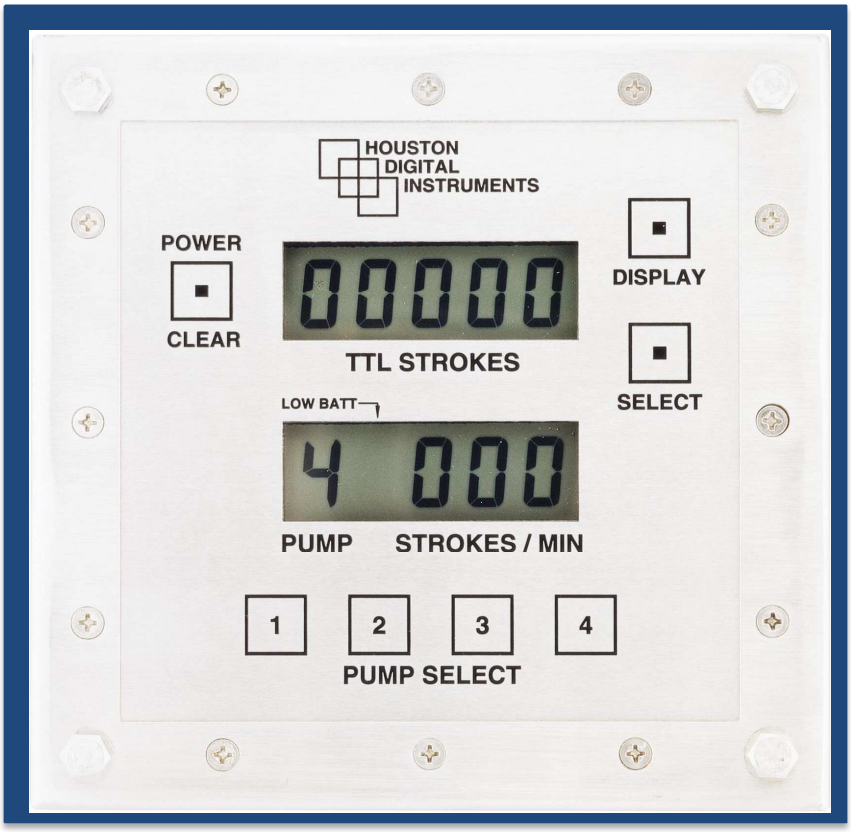
HDI 2100 Pump Stroke Counter

USER'S MANUAL
Revision D



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Section 1 – Introduction

1.A General Information

This manual describes the installation, operation, and maintenance of the HDI 2100 Pump Stroke Counter (PSC) System. This manual provides the user with all the necessary information to properly operate the Pump Stroke Counter and perform troubleshooting and repair.

The HDI 2100 PSC, like all of HDI's core products, have three (3) key elements: the Control Head, a Sensor Assembly specified by the end client, and the Cable Assembly connecting the Control Head to the Sensor Assembly. These items will be discussed at greater detail in Section 2.

1.B Unpacking and Inspection

Upon receipt of the equipment, it is critical to confirm all the necessary items are accounted as some items can settle to the bottom of the box or be thrown out/misplaced if previously inspected by a freight forwarder or third party (Customs) during transit. If any items are missing, contact the freight forwarder or third party. If there are still missing items, please contact HDI.

1.C Cautionary Information

Power

This system is typically configured with an internal power pack and dry contact sensors that will be damaged if tested or connected to a 24VDC system without proper modifications from HDI.

Exposed Electronics

Caution: Do not leave the equipment out and unconnected (open cables or display) as this may expose the connector leads to moisture and outside elements damaging the electronics.

Returns

Proper protection of the equipment should be a top priority when returning the equipment back to HDI or an authorized agent for repair. Additionally, the shipper must ensure all equipment clears all Customs duties and inspection as different agencies may hold equipment without notifying HDI.

1.D Personnel Qualifications

Caution: Anyone testing the equipment should have basic Electronic Technician understanding and knowledge of electronic circuitry and use of voltage meters. Read the entire manual prior to opening the display, testing or making any modifications as work performed by personnel without the proper qualifications may null the warranty.

Section 2 – HDI 2100 Pump Stroke Counter System Overview

The HDI 2100 System is comprised of a Control Head with a Power Pack, a Cable Assembly, and one or multiple Sensors (Microswitch or Proximity).

2.A Control Head

The Control Head has two (2) LCD windows that display combined total strokes overall, an individual total count per pump, and strokes per minute (SPM) on each pump.

The upper LCD window displays total strokes for all active pumps as well as total strokes for each individual pump.

There is a maximum digit display limitation of 65,535 for the total stroke count window. This will require periodic reset.

The lower LCD window displays each individual pump stroke rate and can toggle between each active pump. The HDI 2100 is able to monitor up to 4 active pumps.

The Control Head does not have any applicable output options.

UPPER DISPLAY	Displays the Total Accumulative Stroke count under normal conditions and total count for each individual active pump.
LOWER DISPLAY	Displays the RATE of the currently selected active pump (in SPM).

To **Power On**:

1. Press Power/Clear Button once.

To **Power Off**:

1. Press the Select Button once and within four seconds -
2. Press the Power/Clear Button.

There are seven buttons and two LCD displays on the front panel of the gauge.

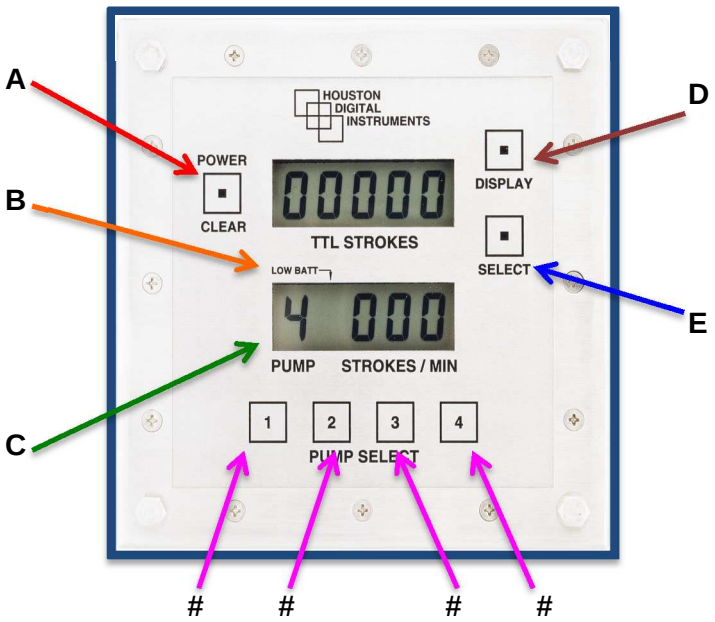
1. **Power / Clear Button (A)** – multifunction button to power on or off the gauge. Also clears the displayed total strokes and/or individual pump stroke count seen on the top screen.
2. **Battery Indicator (B)** – battery symbol is displayed when the power voltage drops below 3.x VDC so the user is able to secure a spare / replacement. The symbol appears when the battery has roughly 30-45 remaining days of use.
3. **Pump Monitored (C)** – displays the active pump being monitored. This format is also used in the upper window if an individual pump is being displayed to show an individual pump's stroke total.
4. **Display (D)** – toggles the top screen between Total System Strokes and Individual Pump Strokes. If the unit only has 3 active pumps, the user will see Zero (0) when toggling the upper display to Pump 4.
5. **Select (E)** – toggles in between pump functions.
6. **Pumps (#s)** – Used to toggle lower screen between different pumps.

"**1**" – represents Pump 1

"**2**" – represents Pump 2

"**3**" – represents Pump 3

"**4**" – represents Pump 4



2.B Power Pack

The unit has an internal Power Pack with a 3.6 VDC source.

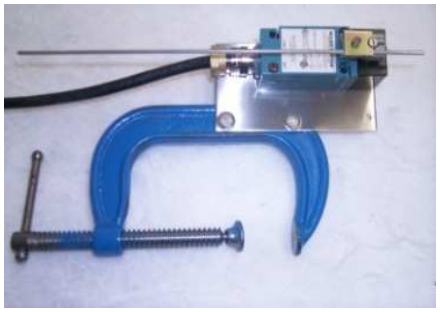
2.C Pump Stroke Sensors

The signal generated by the sensors is a simple contact closure. As the pump cycles across the magnet or the contact switch, the contact closure is sensed by the Control Head allowing both total strokes and strokes per minute to be displayed. The HDI 2100 Pump Stroke Counters are capable of detecting and monitoring a minimum stroke per minute (SPM) rate of 11 SPM and a maximum of 300 SPM.

There are two different sensor configurations show below. Further detail is found in Section 7.

2.C.1 Microswitch Sensor

The Microswitch is a standard limit switch with a contact lever box, wand, and a 5" C Clamp. The contact lever box comes with a ½" NPT gland entry.



2.C.2 Proximity Sensor

The Proximity Sensor is comprised of a magnet assembly, an all thread pick up sensor stem, and a mounting bracket.

2.D Certification

The HDI 2100 Pump Stroke Counter is certified by CSA as Intrinsically Safe for Class I Div 1 Groups A – D and ATEX Certification is available upon request.

Section 3 – Installation

3.A Control Head

The Control Head can be mounted from either the front or back of a control panel console. The Control Head comes with four (4) ¼-20 Bolts and Lock Nuts used for mounting.

If the LCD is mounted from the front of the panel, the user will remove the Lock Nuts, drop the Control Head into the panel/bracket, and secure it by threading the Lock Nuts back onto the ¼-20 Bolts.

If the LCD is mounted from the back of the panel, the user will remove the ¼-20 Bolts from the Control Head. Then, place the Control Head in line with the holes on the panel or bracket and place the ¼-20 Bolts back through the console to the Control Head. The Lock Nuts will not be needed as the Control Head has threaded holes.

Caution: Take care to not over tighten the Bolts as cracking the Front Lens is possible.

3.B Cable Assembly

The Cable Assembly, by default, is arranged differently depending on the type of Sensor ordered. Cable lengths are ordered in increments of five (5) feet.

3.B.1 Microswitch Cable

The Cable Assembly is configured into a "Y" configuration with each pump leg being the shorter sections of the "Y" with the main stem of the "Y" representing the main cable from the Control Head to the "Y" split. By default, the pump legs are identical lengths; however, based on final wiring, adjustments can be made locally to shorten each pump leg to the proper length. The Microswitch pump legs are combined into a permanent 3M epoxy splice kit at the "Y" split combining the legs together before being routed to the Control Head.

The Microswitch assemblies are pre-connected to the "Y" cable assembly and may require the cable to be disconnected from the contact lever box ½" NPT gland so the cable assembly can be routed into the cable trays.

3.B.2 Proximity Cable

The Cable Assembly is routed through a local J-Box in the Pump Room. There will be one cable from the Control Head to the J-Box, and from the J-Box to the Sensor, there will be a cable for each pump being monitored, these cables are referred to as the pump legs.

3.C Sensor Assembly

3.C.1 Microswitch

The switch assembly has the contact lever box, wand, and C clamp. The C Clamp mounts to the adapter plate for easy installation.

3.C.2 Proximity

In order to install the proximity sensor onto the pump shaft properly, the user will need to know the specific pump model and manufacturer being monitored so that HDI can review its list of existing fabricated brackets. See current available bracket list provided by HDI in Section 7.E of this manual.

Note: The proximity sensors require careful measurements to ensure proper installation. The Sensors can double stroke on the out and return stroke. The all thread pick up sensor stem is assembled with a 2' pigtail and a connector. The mating cable assembly has an open lead for local junction box termination. Please review the appendix for an example step-by-step guideline on how to properly install the proximity sensors based on the Wirth 2200 Series pumps.

The all thread stem and magnet should be adjusted so the components are no more than 1.25" apart. Typical installation would leave a ½" – ¾" gap when properly installed.

Prior to closing up the inspection plate, review the details to ensure no potential damage will be caused by having the all thread stem and magnet positioned too close together.

Special attention should be observed when replacing a proximity sensor assembly to ensure the sensor is properly adjusted to pick up the pulses as the pump strokes.

Section 4 – Maintenance

The HDI 2100 Pump Stroke Counter System will require the following periodical maintenance.

4.A Power Pack

The System is powered by an internal 3.6VDC power pack that is warranted for 12 months from the date of shipment. On average, the power pack will last 18 months based on 24 / 7 operation; however, if the user is able to turn off the unit when not in use, the battery life can be greatly extended.

4.B Processor Boards

The LCD has two (2) internal processor boards: the HDI 012 and the HDI 02 debounce processor board, both of which can be replaced in the field if either component has failed. In the event there is an issue with a specific pump's SPM rate, the user may be able to simulate signals to help isolate which PCB has failed. Section 5 provides some basic troubleshooting tips. Additionally, please contact HDI Technical Support for additional suggestions.

4.C Sensors

Depending on the pump configuration, either sensor type can be replaced as a full assembly kit or partial components based on what components have been damaged or have been found faulty. See related Section 7 BOM illustrations.

4.D Increasing Existing PSC Pump Capacity

To increase the number of pumps on an existing PSC, a pump sensor kit will need to be purchased. The kit includes a spare sensor (Proximity or Microswitch) with specified cable. The bulkhead connector on the back of the Control Head and the mating connector for the cable assembly must be replaced; the replacement connectors are shipped with the pump sensor kit. In addition, if the pump legs are joined together with a 3M-splice kit, the user will have to cut the legs, remove the splice and replace it with a J-Box. The J-Box is also included in the pump sensor kit.

Section 5 – Troubleshooting

5.A Battery Voltage

The System effectiveness and accuracy is impacted when voltage of the power pack drops below xxx VDC. Once the voltage drops below xxx. VDC, the battery indicator symbol will accent on the display providing the user a warning / notification to source a replacement. This will provide the user with a 30-45 day advance notice to obtain a replacement. See Section 2.A for the battery symbol location.

5.B Simulate Signals

In the event a faulty sensor assembly or main PCB board assembly is failing, the user is able to simulate signals to isolate the failed component. Be sure to clear out both Total Strokes and all individual Pump Strokes prior to testing to verify results.

5.B.1 Microswitch

Using a flat head screwdriver to twist the rod to simulate a stroke, the installation can be tested to see if the pump's contact point is properly striking the Microswitch sensor. If simulating the stroke displays properly on the Control Head, the pump's contact point is not making contact with the rod. Adjust rod/sensor location to allow the rod to be properly struck during each pump stroke.

Opening the contact level box on the Microswitch Sensor is another way to test the Microswitch Sensor. By tapping the White and Black wire leads, found inside the contact level box, the user can simulate a stroke. If the Control Head registers a stroke, the Microswitch Sensor will need to be replaced.

5.B.2 Proximity

Troubleshooting the Proximity Sensor will require the user to open up the local J-Box in the pump room. At the local J-Box, the user can tap the Black and White wire leads to simulate a stroke back to the Control Head. If a stroke is seen on the Control Head, the Proximity Sensor will need to be replaced.

5.C Main PCB / Debounce:

The user can also conduct a similar test to the Sensor tests above; directly on the PCB or Debounce Board found within the Control Head. Using the pin details listed below, the user can simulate strokes. The test will allow the user to determine whether a new PCB or Debounce Board is needed. If the system being tested has an available spare connection on the PCB, the user can move the signal over to test on the input another pump. For example, if the System is a 3 pump unit and pump 2 isn't displaying correctly, move the white wire to pump 4 to test.

Each System's pump configuration is different. Please review the table below which identifies each System's wiring configuration for testing. Test either board by tapping the faulty pump's wires with the common. For example, to test Pump 2 on a 2 Pump System, tap the pins B and C.

	1 Pump	1 Pump	2 Pump	2 Pump	3 Pump	3 Pump	4 Pump	4 Pump
Pin A	Black	P1 A - B	Black	P1 A - C	Black	P1 A – D	Black	P1 A – E
Pin B	White		White	P2 B - C	White	P2 B – D	White	P2 B – E
Pin C			Green		Red	P3 C – D	Red	P3 C – E
Pin D					Green		Common	P4 D – E
Pin E							Green	

Section 6 – Options

Backlight and External Power

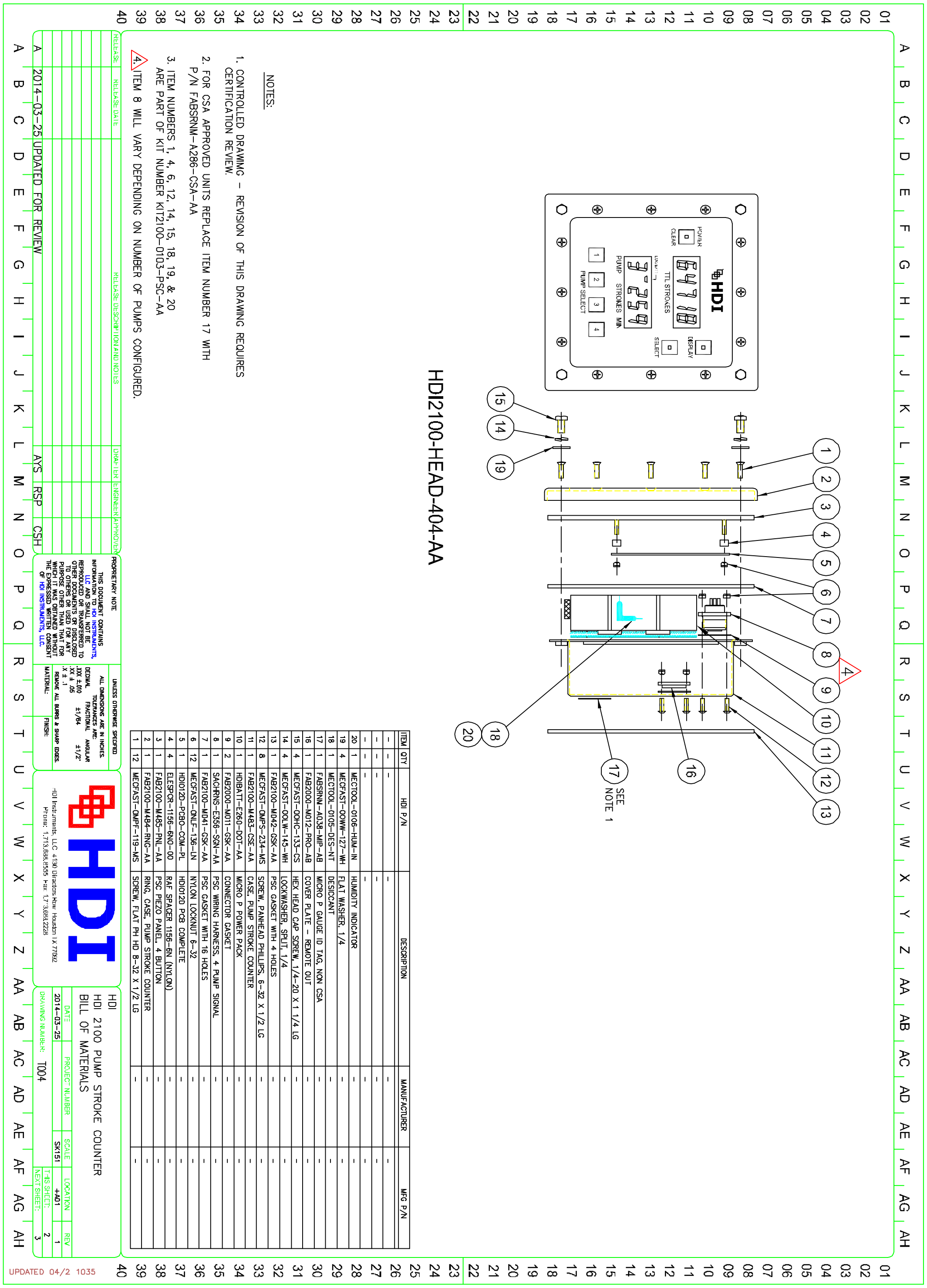
The System can be modified to add backlighting and the unit can be powered by an external 12 or 24VDC power source provided basic precautions and barriers are used. Please note, these two options can be carried out in the field after the fact but are costly to do so as the internal components would be replaced.

Output

HDI offers dual proximity sensors in one all thread stem allowing the signals to be split to the Control Head and an HMI or secondary remote display.

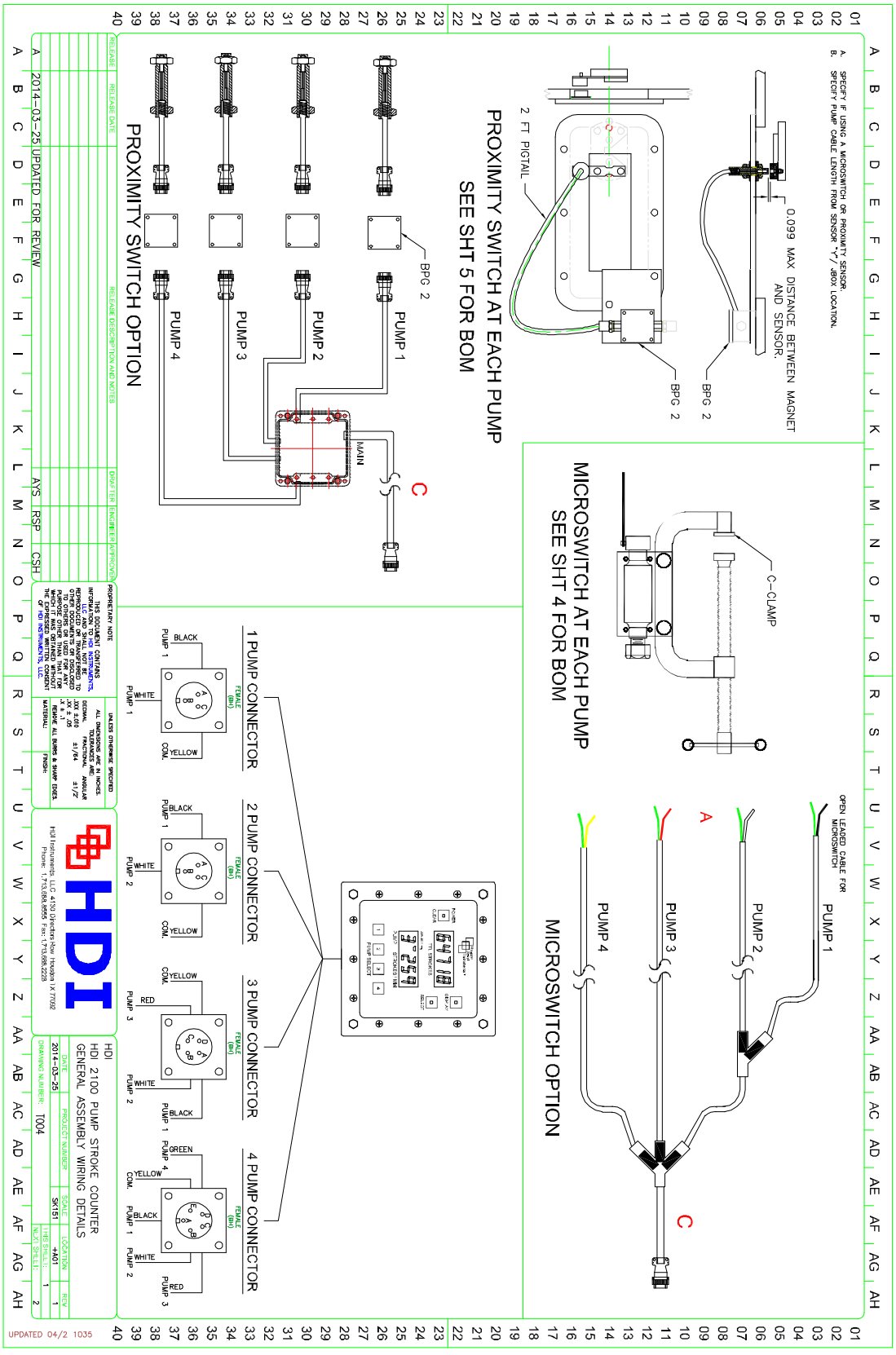
Section 7 – Technical Overview

7.A General Layout Overview



ITEM	QTY	HDI P/N	DESCRIPTION	MANUFACTURER	MFG P/N
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
20	1	MECTOOL-0106-HUM-IN	HUMIDITY INDICATOR	-	-
19	4	MECFAST-00WW-127-WH	FLAT WASHER, 1/4	-	-
18	1	MECTOOL-0105-DES-NT	DESICCANT	-	-
17	1	FABSRNN-A038-MIP-AB	MICRO P GAUGE ID TAG, NON CSA	-	-
16	1	FAB2000-M012-PRO-AB	COVER PLATE – REMOTE OUT	-	-
15	4	MECFAST-00HC-133-CS	HEX HEAD CAP SCREW, 1/4-20 X 1 1/4 LG	-	-
14	4	MECFAST-00LW-145-WH	LOCKWASHER, SPLIT, 1/4	-	-
13	1	FAB2100-MD42-GSK-AA	PSC GASKET WITH 4 HOLES	-	-
12	8	MECFAST-0MPS-234-MS	SCREW, PANHEAD PHILLIPS, 6-32 X 1/2 LG	-	-
11	1	FAB2100-M483-CSE-AA	CASE, PUMP STROKE COUNTER	-	-
10	1	HDIBATT-E260-DOT-AA	MICRO P POWER PACK	-	-
9	2	FAB2000-M011-GSK-AA	CONNECTOR GASKET	-	-
8	1	SACHRNS-E356-SGN-AA	PSC WIRING HARNESS, 4 PUMP SIGNAL	-	-
7	1	FAB2100-MD41-GSK-AA	PSC GASKET WITH 16 HOLES	-	-
6	12	MECFAST-0NLF-136-LN	NYLON LOCKNUT 6-32	-	-
5	1	HDIO12D-PCBO-COM-PL	HDIO12D PCB COMPLETE	-	-
4	4	ELESPCR-1156-6N0-00	RAF SPACER 1156-6N (NYLON)	-	-
3	1	FAB2100-M485-PNL-AA	PSC PIEZO PANEL, 4 BUTTON	-	-
2	1	FAB2100-M484-RNG-AA	RING, CASE, PUMP STROKE COUNTER	-	-
1	12	MECFAST-0MPF-119-MS	SCREW, FLAT PH HD 8-32 X 1/2 LG	-	-

7.B Sensor Illustrations

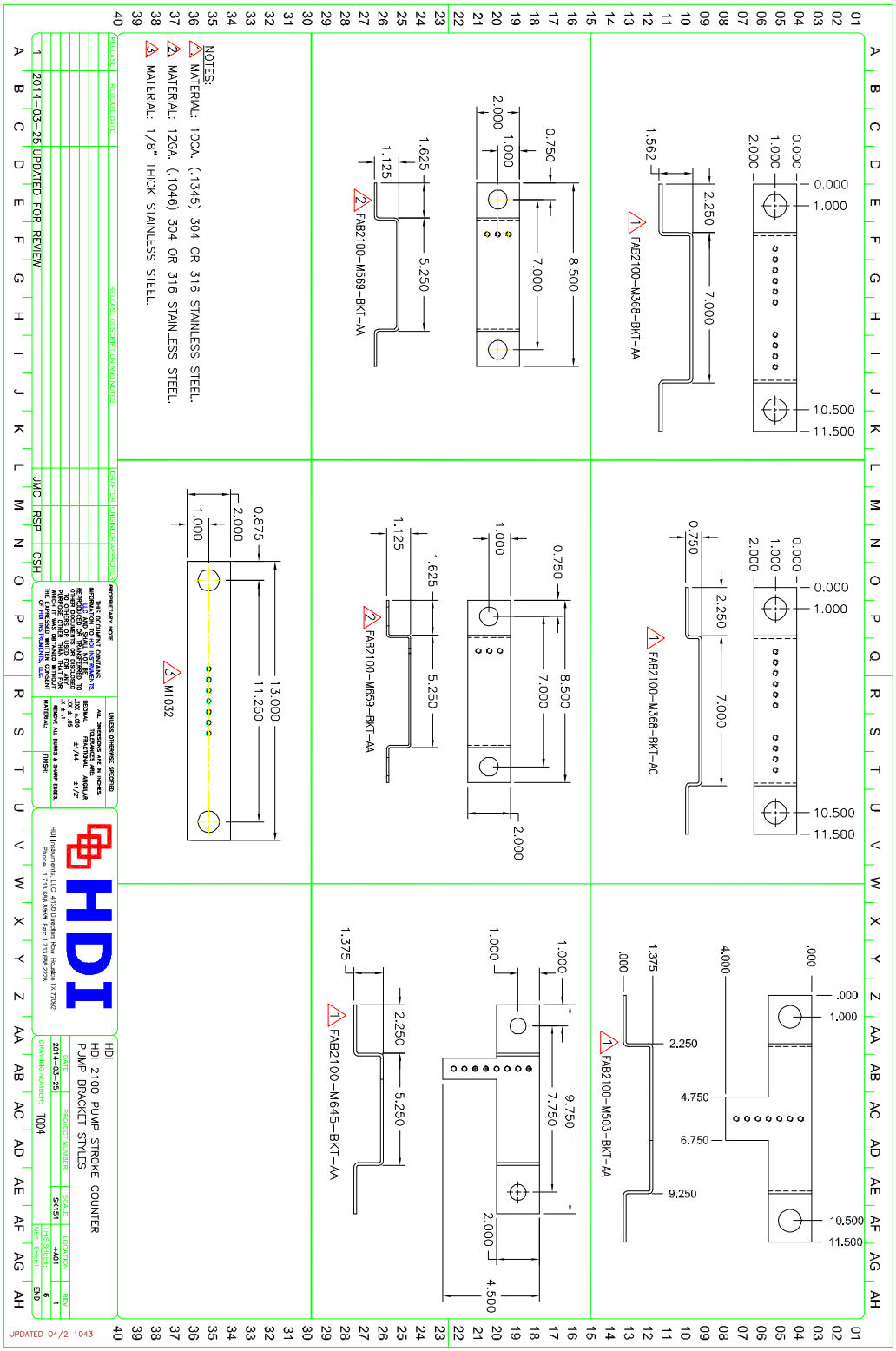


7.C Exploded BOM

7.D Common Operational Spare Parts

Item	HDI Part #	Description
1	HDIBATTE260DOTAA	MICRO P POWER PACK, INCLUDE MSDS CLASS IX UN 3090
2	FAB2100M485PNLAA	PSC PIEZO PANEL 4BTN
3	FAB2100M041GSKAA	PSC GASKET W/ 16 HOLES INNER GASKET BETWEEN CASE AND PIEZO
4	KIT21000103HRW	PSC HARDWARE KIT: DESI PACK, COROSION INHIBITOR, HUMIDITY INDICATOR, AND SCREWS
5	HDI012D-PUMP-PCB-KT	HDI 012 PSC PROCESSOR BOARD ASSY W/ DEBOUNCE BOARD
6	HDI012DPSC0COMPL	HDI 012 PSC PROCESSOR BOARD ASSY
7	HDI-002STUFBRDAA	HDI 002 PSC DEBOUNCE BOARD ASSY
8	HDI2100MICROKITAA	MICROSWITCH SENSOR PUMP REPLACEMENT KIT W/ CLAMPS AND MOUNTING HARDWARE
9	ELESWTH0101CNTPS	CONTACT SWITCH – PUMP STROKES
10	ELESWTH0102LVRCN	CONTACT SWITCH LEVER (WAND)
11	HDI2100PROXKITAD	PROXIMITY SENSOR KIT W/ 2' PIGTAIL CABLE W/ CONNECTOR FOR CLIENT TO INSTALL ON EXISTING CABLE AND PICK UP MAGNET ASSY (REPLACEMENT KIT ONLY)
12	FAB7103M513MGTAA	PSC PROXIMITY MAGNET ASSY
13	HDI2100PROXKIT50	PROXIMITY SENSOR KIT W/ PICK UP MAGNET W/ 2' PIGTAIL AND 50' OPEN LEAD CABLE FOR JBOX TERMINATION (REPLACEMENT KIT NO JBOX -)
14	ELECONN01133PNTR	CONNECTOR 3 PIN TERMINATOR
15	ELECONN01564PNTR	CONNECTOR 4 PIN TERMINATOR
16	ELECONN01055PNTR	CONNECTOR 5 PIN TERMINATOR
17	21141000000000AA	1 PSC CONTROL HEAD (LCD)
18	21142000000000AA	2 PSC CONTROL HEAD (LCD)
19	21143000000000AA	3 PSC CONTROL HEAD (LCD)
20	21144000000000AA	4 PSC CONTROL HEAD (LCD)

7.E Proximity Mounting Brackets



7.F Proximity Sample Installation Details

SUBJECT: Modify Inspection Plate

DATE: May 4, 2011

This memo is to cover the basic step by step instructions on modifying the Wirth 2200 Series Mud Pumps to install the HDI Proximity Sensors for proper installation whether interfacing directly with the HDI 2100 Pump Stroke Counter or our HDI V9000 Virtual Control System.

Per the supplied drawing from the Aker manufacturing plant in Germany, marked Appendix A, you will need a two (2) man team to complete the basic work. Please review both Appendix A and B so you can become familiar to the additional reference documents.

You will need to have the following supplies with you to avoid any unexpected delays:

1. Plastic (approx. 2mm thick) to cover the inspection plate while the inspection is removed and modifications are being completed to prevent debris from entering the Mud Pump. See attached picture showing the inspection plate removed.
2. Tape – to secure the plastic to the mud pump
3. Torque Wrench suitable to the specified tolerances for the mud pump
4. Socket / Wrench Set to remove the inspection plate bolts approx. ¾", see Aker team or manual for actual sizes.
5. HDI Sensor kits – specific bracket for pump model and manufacturer (2200 is the M368)
6. Tape Measure
7. Drill / Tap for ¾-10

Step 1

First is to loosen all the bolts on the inspection plate after ensuring you have the correct materials.

Step 2

Remove the inspection plate and put to the side for measuring for modification using Appendix A. Give to the appropriate personnel to make the necessary modifications ensuring that you noted top and bottom references.

Step 3

Depending on the location of the piston when the pump was stopped you may be able to install the M368 bracket without any additional work. Remove the (2) bolts in order to install the bracket as shown in Appendix B. Install Magnet as noted in the hole placement on Appendix B and secure the bracket to the piston. Using the manufacturing specifications, please follow their procedure to Torque the bolts and suggest that they oversee this process.

Note: If the piston can not be accessed, you may have to remove the secondary cover to manually move the piston forward so you can complete the bracket installation.

Step 4

Prior to installing the HDI Proximity All thread stem (stainless threaded rod) into the inspection plate, you will need to measure the internal clearance from the magnet to the outer edge of the pump frame. You will then proceed to thread the stem into the inspection plate and ensure that you have a maximum ¾" gap between the magnet and all thread. This measurement needs to be verified to ensure they do not collide inside once the pump is re-assembled. Once you are certain the measurements are correct, install the washers and nuts on the stem so the pump vibration does not cause the stem to become loose and create potential damage.

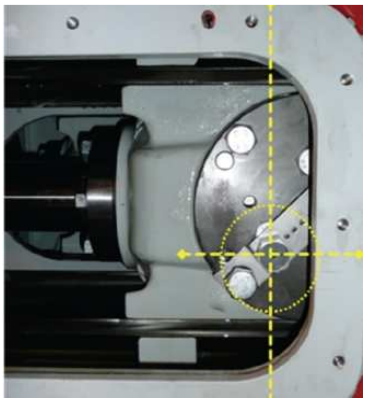
Step 5

Install the Inspection plate back on to the pump and route the cable lead that is attached to the stem to the appropriate designated jbox location for termination. The configuration provided for this project is a Dual pick up sensor with a set on Black / White, the secondary signals on Red / Green.

Step 6

Repeat above steps until all the pumps are completed.

Sample Wirth 2200 Installation of Proximity Sensor w/ bracket



Section 8 – Warranty

HDI Instruments, LLC. (HDI) warrants this product for a period of one year from the date of shipment. HDI's manufactured products to the extent that HDI will replace those parts having defects in material or workmanship when used for the purpose or specification HDI recommends for **Normal Oilfield Usage**. For the purpose of this Warranty, **Normal Oilfield Usage** shall be defined as normal, oilfield monitoring applications.

HDI shall not honor the Warranty if any evidence of tampering, misuse or intrusion is indicated except by an HDI authorized technician or agent.

HDI will replace or repair, as it deems necessary, any products covered by this warranty, after HDI's examination discloses to its satisfaction, that in fact the products are defective and an adjustment is required. If an adjustment is required, the amount of the adjustment is the net sales price of the defective product. No allowances shall be made for labor or expenses of repairing defective products or damage resulting from same. All products accepted under the provisions of this warranty shall be shipped prepaid to HDI and returned to the customer prepaid by HDI. This is to include all applicable custom clearance fees, etc. for inbound international shipments. All products not accepted under the provisions of this warranty shall be shipped prepaid to HDI and returned freight collect.

HDI shall not be responsible for repair or replacement of products, resulting from improper handling, storage, installation, misuse, negligence, or use in a manner contrary to the recommendations of HDI.

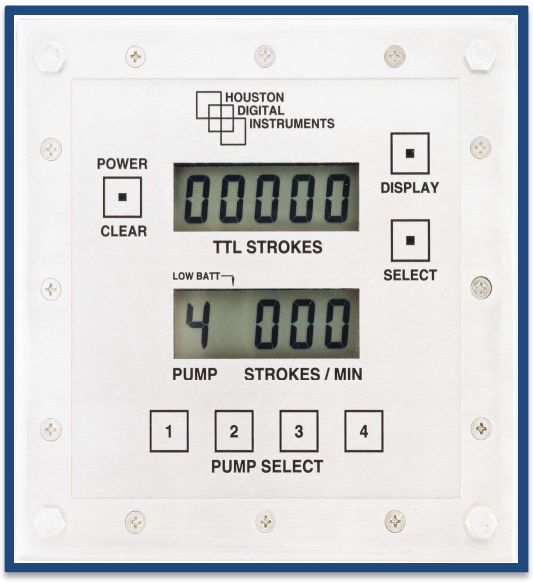
HDI warrants only the products that it sells of Other Manufacturers to the extent of their warranties. All warranty claims shall be made in writing to the nearest HDI office or authorized factory representative. HDI makes no other warranty of any kind, expressed or implied, and all implied warranties of merchantability or fitness for a particular purpose which exceed HDI's afore-stated obligation are hereby disclaimed by HDI and excluded from this warranty.

This Warranty is non transferable and HDI shall not be liable for any damage, injury, loss to property or persons resulting from the use of any HDI's products or equipment whether such damage, injury or loss results from, or is caused by: manner of use, defects in materials or workmanship or otherwise.

Appendix

Drilling Instrumentation:

HDI 2100 Mud Pump Stroke Counter



The **HDI 2100** monitors and displays the total accumulated mud pump strokes and the stroke rate of up to 4 individual mud pumps simultaneously. The stroke rate for each mud pump can be individually selected for display and is updated every second. The HDI Battery Pack is designed to operate continuously 24 / 7 for approximately 18 months. No calibration is required. The quartz crystal oscillator provides high precision counts with no drift. The **Stroke Counter** is designed to be intrinsically safe and is rated by CSA International for use in Class I, Groups A, B, C, and D hazardous locations. The stainless steel case is completely sealed and features stainless steel piezo switches for long life. Labels are engraved permanently on the front panel. The entire package is constructed to operate in harsh environments and high vibration conditions encountered for both land and offshore drilling. ATEX certification is available upon request.

Specifications:

Dimensions:	8"X8"X4" LXWXD (20.3X20.3X10.2 cm)
Weight:	5 Lbs. (2.27 Kgs)
Case Material:	Stainless steel
Front Panel Controls:	Power/Clear, Display, Select, Pump Select 1-4
Stroke Rate Range:	11 to 300 Strokes Per Minute SPM
Total Accumulated Strokes:	65,535 strokes
Battery:	Intrinsically Safe sealed HDI Power Pack
Battery Life:	1.7 years continuous operation
External Power:	Optional + 12 or + 24 vdc
Low Battery Indicator:	LCD bar above selected pump number
Display:	Liquid crystal display of total strokes & selected pump SPM
Time Base:	Quartz crystal oscillator
Pump Switch:	Micro-switch or passive proximity sensor
Maximum Cable Length:	To be confirmed
Operating & Storage Temp:	-40 to 100℃

ISO 9001:2008

Office Phone - 713.688.8555
After Hours Support - 713.819.6103

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Houston, TX 77092

Effective June 2014

Revision D | August 2014