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*Revolution Not Evolution*

**P7498**

**DIPTRONIC™**

**SUMP TRUCK INSTALLATION**



**Issue C March 2008**

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## **P7403 Electrical equipment service and installation guide for road tankers**

Liquip supplies the following document as a guide for installing and operating electrical equipment on road tankers. It should be used in conjunction with local legislation and standards, owner's requirements and tank manufacturer procedures.

### **INFORMATION PERTAINING TO WORKING ON A TANK VEHICLE**

1. Prior to working on a tank vehicle it must be degassed or certified to work on. Before working in a tank compartment an appropriate device must be used to check for the presence of volatile gases.
2. Any work carried out on a tank vehicle must be done so in a non-hazardous area.
3. Before working on any electrical equipment on a tank vehicle power must be isolated either via the battery isolation switch (BIS), by disconnecting the truck battery or by disconnecting the positive of the electrical equipment.
4. Never weld on a tank vehicle unless all electronic equipment is completely disconnected electrically from both the tanker and other equipment.
5. Hazardous conditions may be present when working with high voltage devices (such as gantry monitors). Qualified technicians only should be servicing these devices.
6. Do not connect a battery charger or other pulsed power supply to the truck battery without first isolating all electrical equipment as permanent damage may result.
7. Long sleeve and pants protective clothing should be worn at all times. Clothing must be non-static generating. Any petroleum contact with skin should be washed off immediately.
8. Always follow manufacturer guidelines when working on electrical equipment. Failure to do so may void warranty or cause damage.

### **INFORMATION PERTAINING TO INSTALLING EQUIPMENT ON A TANK VEHICLE**

1. All electrical equipment and fittings must be suitable for use on a tanker and meet all local regulations for operation.
2. Use high quality waterproof conduit and fittings to IP66 minimum for all wiring and junction boxes.
3. Use waterproof flexible compound such as Silastic in all glands and joints not available as waterproof by design.
4. Mount all equipment away from direct spray areas such as behind the tyres and out of direct sunlight. Always select the most sheltered aspect.
5. Ensure all installations adhere to appropriate guidelines.
6. Coat all terminals, cable end and joints with non-conducting grease or Vaseline after final testing. This will prevent corrosion.
7. Prior to crimping, check wiring connections are electrically correct. When crimping make sure there is good electrical contact between the wire strands and metal section of the crimp terminal. Pull on the crimp to ensure a good connection has been made.

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8. Cable ends may be crimped with ferrules for better connection. Do not solder the cable ends (fatigues and corrodes). Pre-coat with non-conductive grease for corrosion protection.
9. At any point a cable is extended or joined to a standard cable assembly, all cable screens must be connected to the chassis as well as being joined together at a star point. Insulate exposed screen wire using heat shrink, terminate with an eye-terminal and attach to the junction box mounting screw. If the junction box is mounted to a panel not electrically connected to the chassis, the screens must still be joined together.
10. It is recommended the negative terminal of the battery be connected to the chassis.
11. Common grounding of a system is most important. Do not rely on common chassis grounding at various points, run a full-length dedicated ground cable. Max resistance, battery ground to any ground point to be  $1\Omega$ . Refer Liquip Tech Talk #48: Electrical Bonding on Tankers. The electrical resistance between the tank and tanker chassis, prime mover chassis, or trailer undercarriage, and between the tank and the connection of the tanker pipework to the delivery hose, shall not exceed  $10\Omega$ .
12. Always fit as much loose cable length into junction boxes and housings as practicable to allow for future servicing.
13. When pulling multiple cables through conduit always consider using cable with one or two extra conductors to allow for any future requirements.
14. Always completely segregate power and intrinsically safe wires into completely safe conduit and in accordance with I.S wiring rules.
15. Carry out a complete wiring check for accuracy and continuity before connecting power to any device.
16. All equipment must be supplied from a fused power supply.
17. Observe international and local legal requirements. In the event of conflicting instructions seek qualified advice before proceeding.
18. Do not route communication cables past 'noisy' electrical apparatus such as solenoids and alternators.
19. Check instruction manual for recommended cable type and torque settings.
20. Use specialised, genuine tools for all electrical work.
21. Mount equipment to clean, dry, bare surfaces on a metal bracket mounted to the chassis/sub-frame. It is recommended the bracket be welded to the chassis/sub-frame to facilitate good electrical contact.
22. Ensure adequate clearance around equipment being installed. This will provide for ease in future maintenance.
23. When bolting equipment into place, the use of Teflon tape or anti-seize compound on threads is advised.
24. Prior to welding a socket into a tank or pipe it is advised a pipe plug be inserted before welding to prevent heat distortion of the socket. An anti-seize lubricant may be used to help with plug removal.
25. If possible run power wires directly from the equipment being installed to the battery isolation switch. This will avoid the use of intermediary junction boxes ensuring proper voltage and grounding.
26. Fuses located in hazardous areas must be suited to that location.



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## 1.0 Overview

This manual details the steps involved in installing, calibrating and commissioning Diptronic in a single compartment sump truck.

It applies to software rev 04.00.03.

For further technical support please use the following contact information:

Primary contact: Miroslaw Lapinski (Senior Electronic Engineer)  
Email: [miroslawl@liquip-nsw.com.au](mailto:miroslawl@liquip-nsw.com.au)  
Phone: +612 9725 9045

Please note time zone differences between Sydney and Orlando. Suitable contact times would be 7am Orlando time which is equivalent to 9pm Sydney time. Alternatively, 5pm Orlando time is equivalent to 7am Sydney time.

## 2.0 Getting started

In a clean, dry area, carefully unpack all shipping boxes and lay out the Diptronic parts.

Identify the following parts:

- \* DIP2XX series CPU (figure 1).
- \* DIP1XX series sensor (figure 2).
- \* P4130 Epson ticket printer.
- \* P4188 power cable for ticket printer.
- \* P6868 printer communication harness.
- \* P6865 printer communication cable.
- \* P6865 PC communication cable.
- \* P4138 voltage doubler.
- \* DIP400 automatic calibration rig (figure 3).



*Fig 1 - Diptronic DIP2XX CPU*



*Fig 2 - Diptronic DIP1XX*



*Fig 3 - Diptronic DIP400 automatic calibration rig*

Remove the 3-pin plug from the power cable. Replace with suitable plug for connecting to your power supply.

This automatic calibration rig has been modified to operate at 220V 60Hz.





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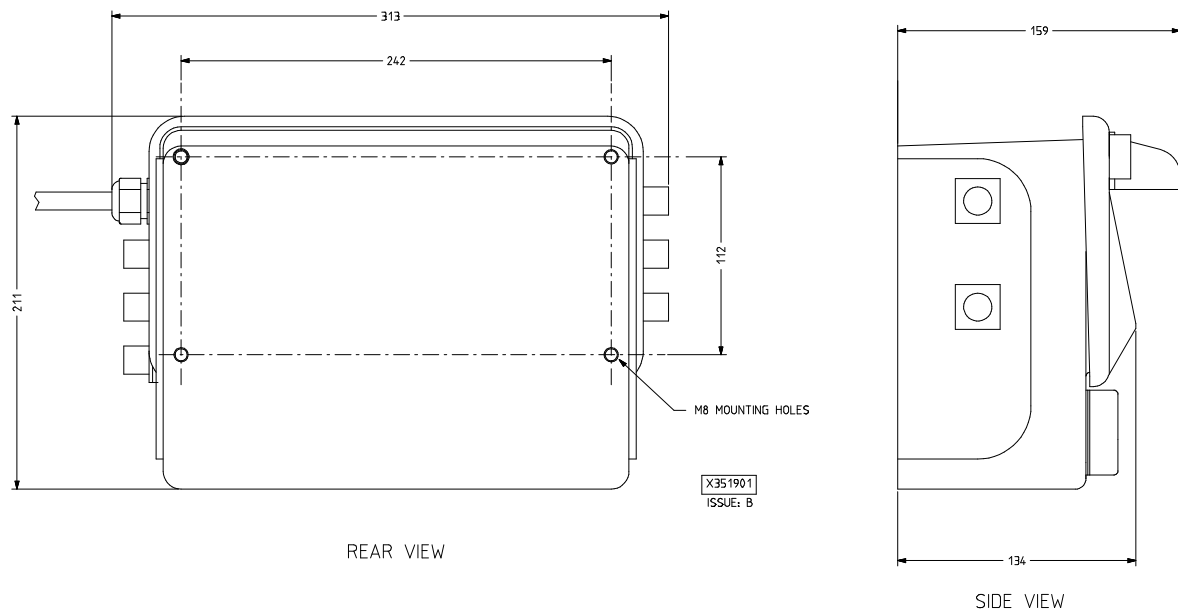
### 3.0 Hardware installation

Move all the parts to a clean, dry area near the truck.

#### 3.1 Central Processing Unit (CPU) – DIP2XX installation

The CPU has up to six military specification connectors that connect to the sensors, printer and peripheral devices (where applicable).

The CPU is mounted using 4 M8 bolts tapped into the rear of the body. It may be mounted direct to a plate or via brackets.



The CPU is sealed at the factory before delivery and access inside the CPU is not required at anytime. All wiring is done externally by military spec connectors or junction boxes. The front calibration buttons are sealed once the CPU has been calibrated.

Refer appendix 3 for details on CPU wiring.





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### **3.2 Sensor – DIP1XX series installation**

The Diptronic sensor will be mounted on the manhole cover as illustrated in figure 4.

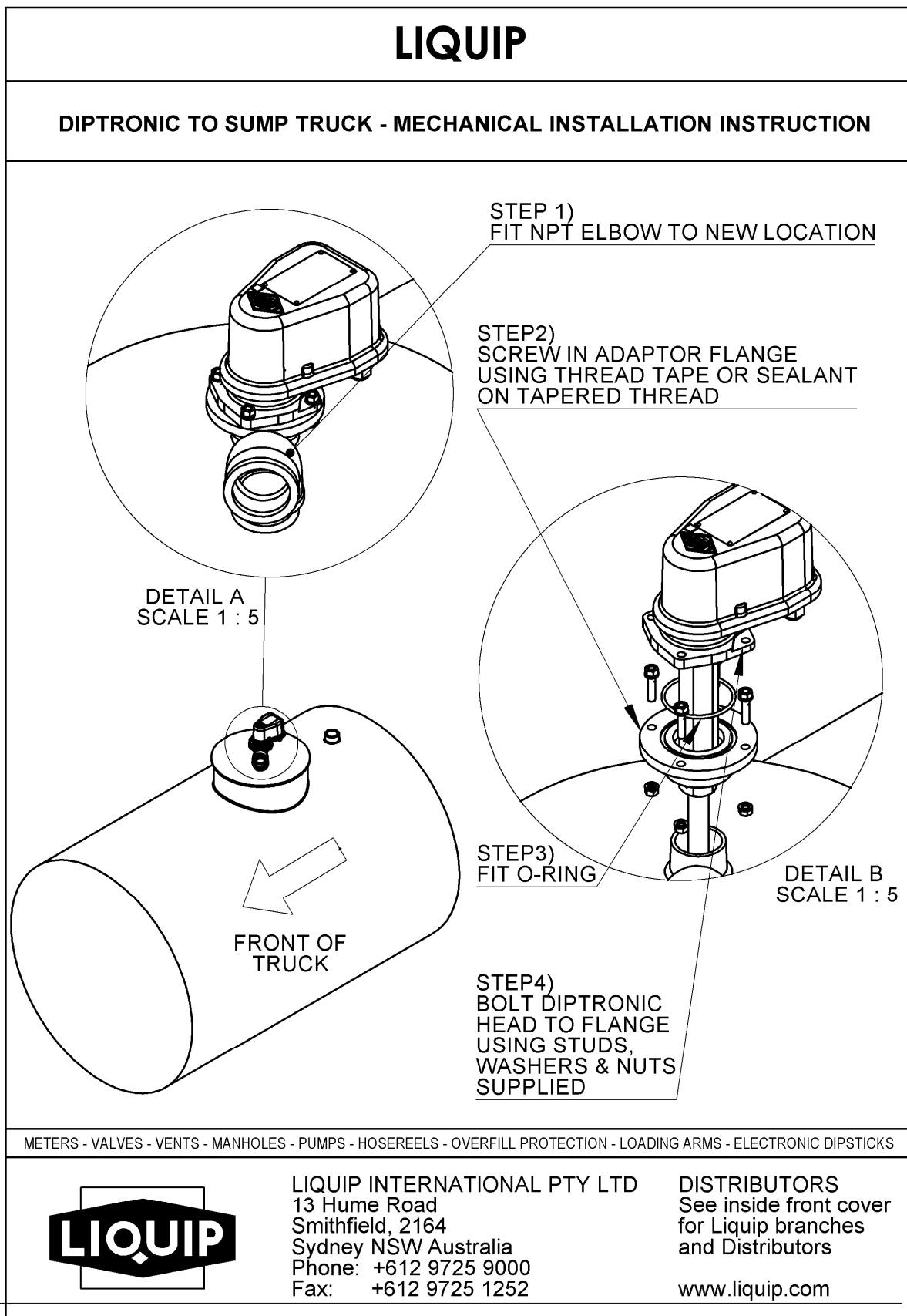
Follow the steps in figure 4. With the adaptor flange in place use a rule to measure the vertical distance from the top of the flange to the bottom of the tank. Check this measurement against the DIP1XX sensor length (base of flange to tip of sensor) to determine clearance between the tip of the sensor and tank floor.

Ensure anti-seize is used on the adaptor to prevent the threads binding.



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Fig 4 - Diptronic DIP1XX installation diagram





### **3.3 Sensor to CPU wiring**

All electrical cabling must be protected from external environmental influences. This can be achieved by using appropriate conduit, sealed to IP68. In the case of the supplied cable, it is protected by a polyurethane coating and sealed using military specification connector and water proof gland.

The cable connected to the DIP1XX sensor should run longitudinally along the walkway, down one end of the barrel then to the CPU. Ensure the cable is secured using cable ties.

The mil spec connector at the end of the cable connects to the SENSORS 1,2,3 port on the CPU. Refer appendix 3.

### **3.4 Printer mounting**

The printer should be mounted in a weather protected enclosure.

Refer appendix 3 for printer wiring.

Note: Dip switch settings are factory set to:

1. Dip switches #1 & #3 to ON position. Remaining switches to be in the OFF position.

**DO NOT CHANGE THE FACTORY PRESET SETTINGS.**

### **3.5 Voltage doubler**

The printer is powered from +24Vdc via the P4138 voltage doubler.

Mount the voltage doubler in a weather protected enclosure. Refer appendix 3.

The CPU is powered via +12Vdc from the truck battery.



### 3.6 Final power on check

Switch on the battery isolation switch. The CPU screen may flicker followed by a small bootup routine where the software version is displayed.

The main display (top) will display MIN-. The bottom display should have the following message, "TOTAL VOL [G]: MIN-" in the top left hand corner and "BELOW MEAS. LIMIT" in the bottom right hand corner.

Power on the printer. Insert some plain paper. Press and hold the NEXT & PRINT buttons on the CPU. A calibration report of sensor 1 should be printed. Refer section 3.7 for details on using the printer.

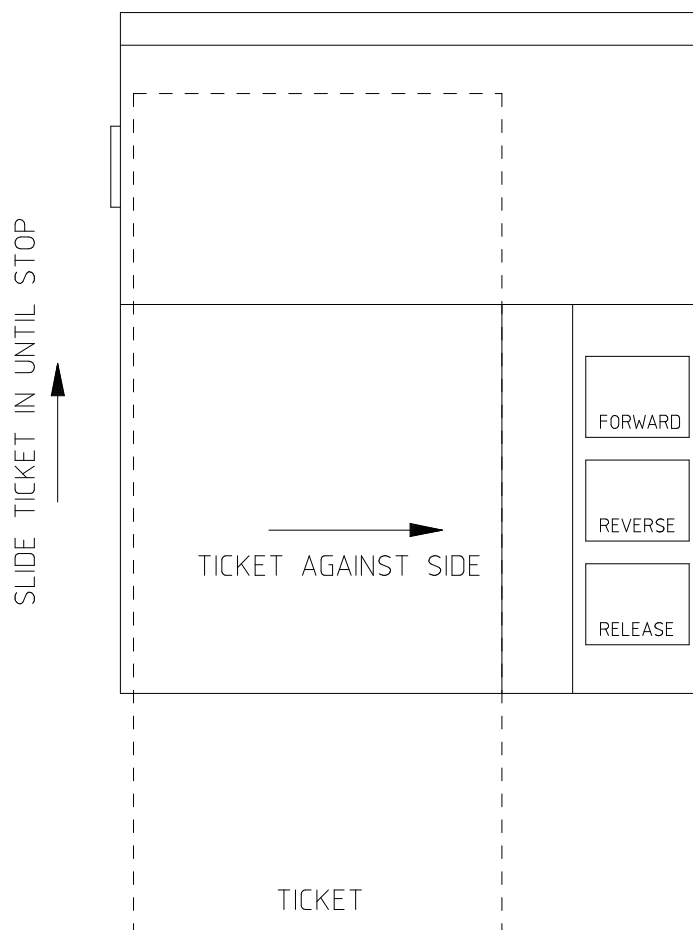
Power on the automatic calibration rig by turning the power switch clockwise. The power switch should illuminate and register power on. Refer figure 3.

### 3.7 Using the printer

A printer is used to print out the volume of product in the compartment and sensor setup details.

The paper is slid into the printer as shown. Press the forward button for the printer to hold onto the paper.

The release button on the printer may have to be pressed if the *paper out* light is on.







## 4.0 Calibration

Following installation the sensor must be calibrated. This is achieved in an automatic process via the automatic calibration rig. Note, the meter in the rig has been pre-calibrated. Follow all normal calibration practices such as pre-wetting the walls of the tank.

This process will require pumping jet fuel via the rig from a storage reservoir into the sump truck barrel. There must be a sufficient volume of jet fuel in the storage reservoir to completely fill the sump truck.

1. Check that the vehicle is on a level surface.
2. Ensure the vehicle tank is empty.
3. Connect appropriate 2" hoses to the inlet and outlet adaptors on the automatic calibration rig.
4. Connect the free end of the inlet hose to the storage reservoir.
5. Connect the free end of the outlet hose to another temporary vessel or the storage reservoir tank.
6. Circulate jet fuel to eliminate any air in the calibration pump system (30 gallons will be sufficient). This can be achieved by powering on the automatic calibration rig & manually using the EMH500 electronic register (refer appendix 4). Note, it may be necessary to open the smaller ball valve leading to the catch tank and return pipe to assist in air elimination. This should be closed once air is eliminated. Refer figure 3.
7. Remove the outlet hose from the circulation system and connect to the vehicle tank. The outlet hose can be connected to either a top fill or bottom fill point, however, bottom filling is preferred.
8. Setup the automatic calibration rig close to the tanker and connect the rig mil spec cable (P6865) to the bottom left hand side mil spec port of the CPU (AUX RS232 SPDS). Refer drawing X352302 & appendix 2.
9. Follow the steps indicated on the next page to start automatic calibration:

STEP	OPERATION	DISPLAY
1	Hold CAL & press OK	CALIBRATION? NO
2	Press INC then OK	SENSOR SETUP? NO
3	Press MENU until get	COMPART.CALIBRATION? NO
4	Press INC then OK	SELECT COMP.NO.: 1
5	Press OK	MANUAL CALIBRATION? NO
6	Press MENU until get	AUTOMATIC CALIBRATION? NO
7	Press INC then OK	
8	Use the NEXT and INC buttons to enter the max capacity of the compartment	COMP: # MAX.CAPACITY: ##### (VEHICLE TANK MAX CAPACITY TO TANK TOP)
9	Press OK to select	
10.1	For compartments bigger than 2337G: In this case the steps are calculated as GALLONS / 195. The number of steps will be 195 with 5 left at the end for manual batching.  Use NEXT & INC buttons to change recommended number of steps if desired	COMP: 1 MAX.CAP.:#####G STEP:####.#G NO.OF STEPS: 195 (MIN=010, MAX=195)
10.2	For compartments smaller or equal 2337G: In this case the steps are 12G. The number of steps will be GALLONS / 13 with an option left at the end for manual batching up to 200 steps.  Use NEXT & INC buttons to change recommended number of steps if desired	COMP: 1 MAX.CAP.:#####G STEP:0012.0G NO.OF STEPS: ### (MIN=010, MAX=###)
11	Press OK to select	COMP: 1 MAX.CAP.:#####G STEP:####.#G NO.OF STEPS: ### (MIN=010, MAX=###)
12	Hold CAL & press NEXT to start	'COMMUNICATING WITH EMH500'



**Note:** In step 8 enter a vehicle tank maximum capacity 30 gallons less than the known capacity to prevent possible spill.

When product is within approximately 30 gallons or more of the compartment maximum capacity, climb onto the tanker & visually monitor the product to ensure there is no overfill. If overfill seems likely, stop the automatic calibration sequence by pressing the START/STOP button on the EMH500 while pump is running or simply close the inlet or outlet valve on the rig.

The inlet or outlet valve may also be used to restrict the flow nearing completion of calibration to prevent possible spill.

When climbing on the tanker, do so carefully so as not to disturb the calibration. Also, do not stand directly on the walkway of the compartment being calibrated to prevent possible deflection of the sensor.

At the end of automatic calibration or if the calibration is stopped for any reason, a message will appear asking if the user wants to input any more steps (ADD ANOTHER STEP).

Select N using the INC button and press OK if calibration is complete or select Y and press OK if more steps need to be added. Steps will be added up to 200 maximum.

Following calibration, empty the newly calibrated tank and eliminate any air in the automatic calibration rig system as was done prior to calibration. Verify using the chart in appendix 1. First pump in 50 gallons, record the register & Diptronic levels and determine the error. Continue until the table is complete. Return table to Liquip along with the calibration report ticket.

Use the EMH500 register as per appendix 4 to batch in the required volume each step.

If a consistent offset is found refer section 5.



## 5.0 Adding an offset in gallons

Following verification there may be a small consistent error. In this case an offset in gallons can be entered. This is only necessary for consistent offset greater than approximately 5 gallons.

STEP	OPERATION	DISPLAY
1	Hold CAL & press OK	CALIBRATION? NO
2	Press INC then OK	SENSOR SETUP? NO
3	Press MENU until get	COMPART.CALIBRATION? NO
4	Press INC then OK	SELECT COMP.NO.: 1
5	Press OK	MANUAL CALIBRATION? NO
6	Press MENU until get	ADD OFFSET IN GALLONS? NO
7	Press INC then OK	COMP#    OFFSET: ###G
8	Repeatably press INC then NEXT for offset, then press OK to save	COMP#    OFFSET: ###G
9	Hold CAL & press OK to exit	EXIT CALIBRATION? YES
10	Press OK	

Note, following the addition of an offset re-verify the compartment.





## 6.0 Setting up time interval for volumes recording.

Following the calibration it may be required to setup time interval for automatic capture of all volumes into the non-volatile memory buffer. The time interval can be entered in minutes, minimum is 1 min, maximum is 999 min. The default value is 10.

STEP	OPERATION	DISPLAY
1	Hold CAL & press OK	CALIBRATION? NO
2	Press INC then OK	SENSOR SETUP? NO
3	Press MNU once	SYSTEM SETUP? NO
4	Press INC then OK	NO.OF COMPARTMENTS: 1
5	Press MENU until get	TIME INTERVAL: ###
6	Repeatably press INC and NXT to modify the , value then press OK to save	
7	Hold CAL & press OK to exit	EXIT CALIBRATION? YES
8	Press OK	



## **7.0 Compartment level messages**

The level messages L1 to L6 described below are automatically set by the CPU following completion of the automatic or manual calibration. Level messages are set simply as indicators on the LCD display.

L2 is used to indicate tank full with a 'MAX+' message. L2 is set to the last calibration step in gallons rounded down to the nearest 10 gallons.

L3 is set between SFL and L2. L3 is set 50 gallons under the internal roof level.

SFL (Safe Fill Level) is the maximum operating volume. The safe fill level should be set to allow for thermal expansion of the liquid in the tank without spillage.

L4 and L5 are internal messages that are not normally used. They should both be left at the default value of 1.

L6 indicates the lowest measurable level. Below this level the CPU will display 'MIN-'. The MIN- region is a volume undetectable by the radar system. It will be set to approximately 30 gallons, however, this may vary depending on the distance between the sensor end and tank floor.



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## **8.0 Calibration report ticket**

To get a printout of all calibration and setup data for a particular sensor press the NEXT and PRINT buttons (NEXT+PRINT) at the same time while in the main display.

If there is insufficient paper inserted in the ticket printer to print all the data, a warning message will be displayed prompting for more paper. If no paper is inserted within a 10sec period after the warning message is displayed the screen will revert back to the main display.

Return each calibration report ticket to Liquip following a tanker calibration.



## 9.0 Printing transaction docket

In order to print a transaction docket the operator must log the start of transaction BEFORE movement of the product.

This is done by pressing OK + PRINT buttons and is confirmed with message "start of transaction".

After filling the vehicle tank with a jet/fuel mix allow a short time for the mix to settle and Diptronic to display a valid reading. This will be indicated by the display changing from 'PLEASE WAIT' to 'READY'. At this point it is possible to print a transaction docket.

Printing is activated by pressing PRINT button.

A typical transaction docket will show truck number, transaction number and date and time of transaction. Also shown will be the total volume (jet fuel plus water volume), water volume and jet fuel volume if present. Refer sample dockets.

Notes:

It is not mandatory to use the ticket printer to make a transaction.

Transaction history is saved in the CPU and can be accessed via a PC or other communication device.

Simultaneously to printing the CPU sends out the similar data packets via communication port COM2 to allow for capture of the docket by the remote equipment if required.





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## **10.0 Printing history of transactions**

Printing is activated by pressing INC+PRINT buttons.

The printout consists of header block followed by summary of transactions in chronological order, the most recent first.

Printing can be terminated at any time by INC+PRINT buttons.



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## APPENDIX 1 - Verification Table

Tanker No.:  
Sensor Serial No.:  
Calibrator:

Date:  
Company:  
License No.:

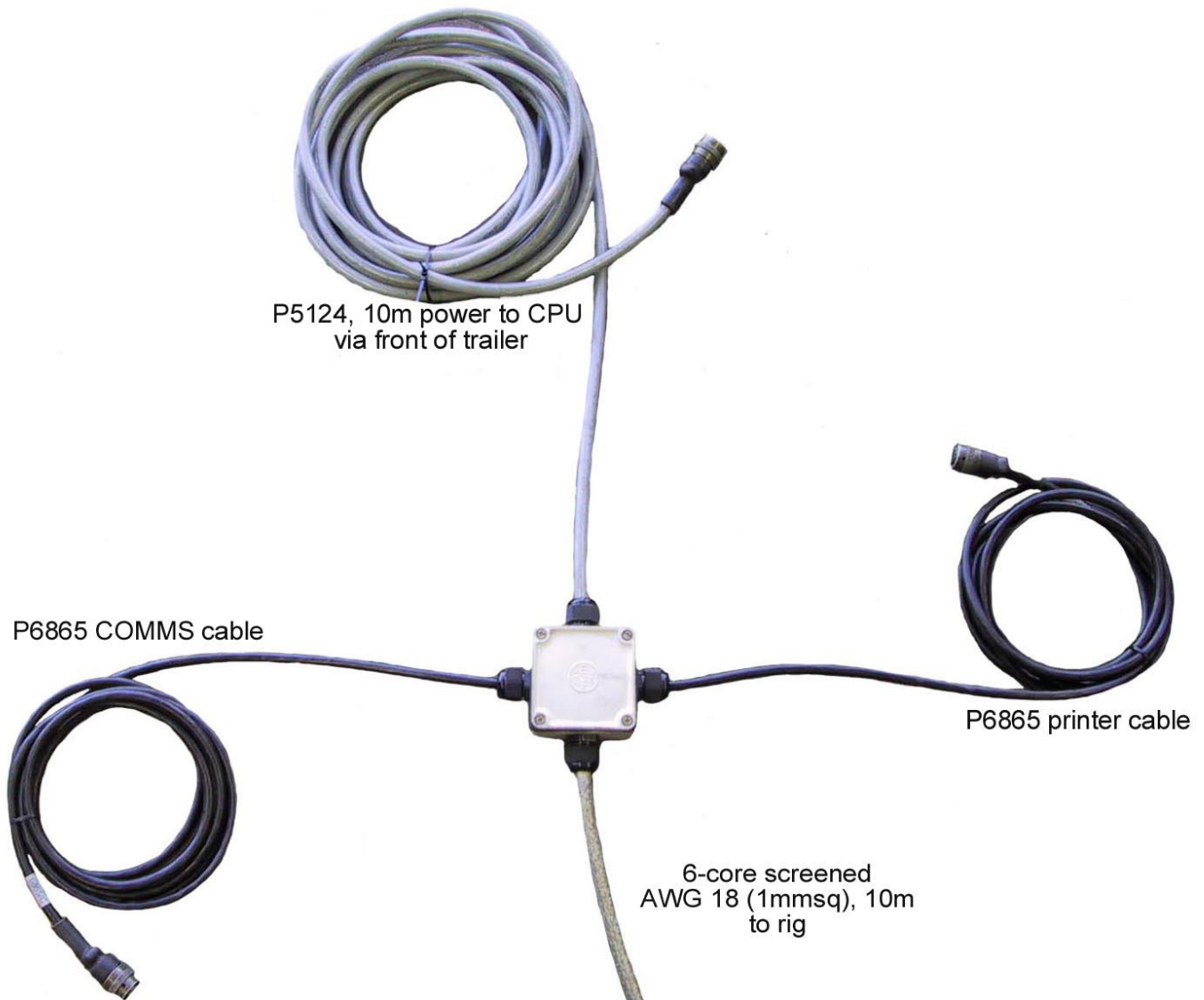
Level (gallons)	Compartment: 1			
	Meter	Diptronic	Error (G)	Error (%)
EMPTY	0			
50 gallons				
100 gallons				
200 gallons				
300 gallons				
400 gallons				
500 gallons				
600 gallons				
700 gallons				
800 gallons				
900 gallons				
970 gallons				

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Fax: +612 9725 1252  
Email: miroslawl@liquip-  
nsw.com.au

Make a copy of this page & fax  
back to Liquip along with a Calibra-  
tion Report Ticket (section 7).

## APPENDIX 2 - Automatic calibration rig cables

Note, only P6865 communication cable will be used as part of the calibration process via the 10m cable connected to the rig.

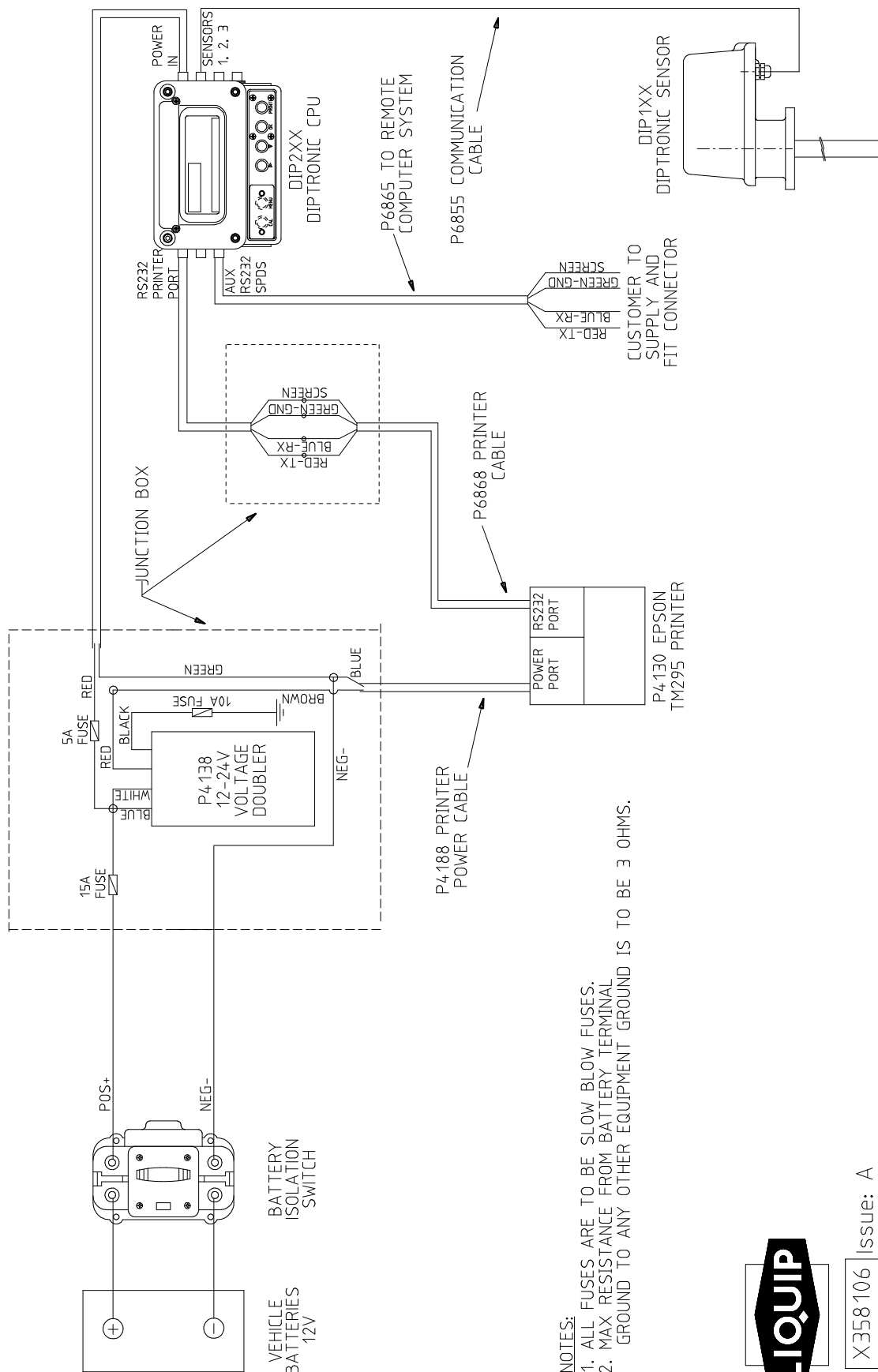




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## APPENDIX 3 - Sump truck wiring diagram

### DIPTRONIC SUMP TRUCK WIRING



NOTES:  
1. ALL FUSES ARE TO BE SLOW BLOW FUSES.  
2. MAX RESISTANCE FROM BATTERY TERMINAL  
GROUND TO ANY OTHER EQUIPMENT GROUND IS TO BE 3 OHMS.



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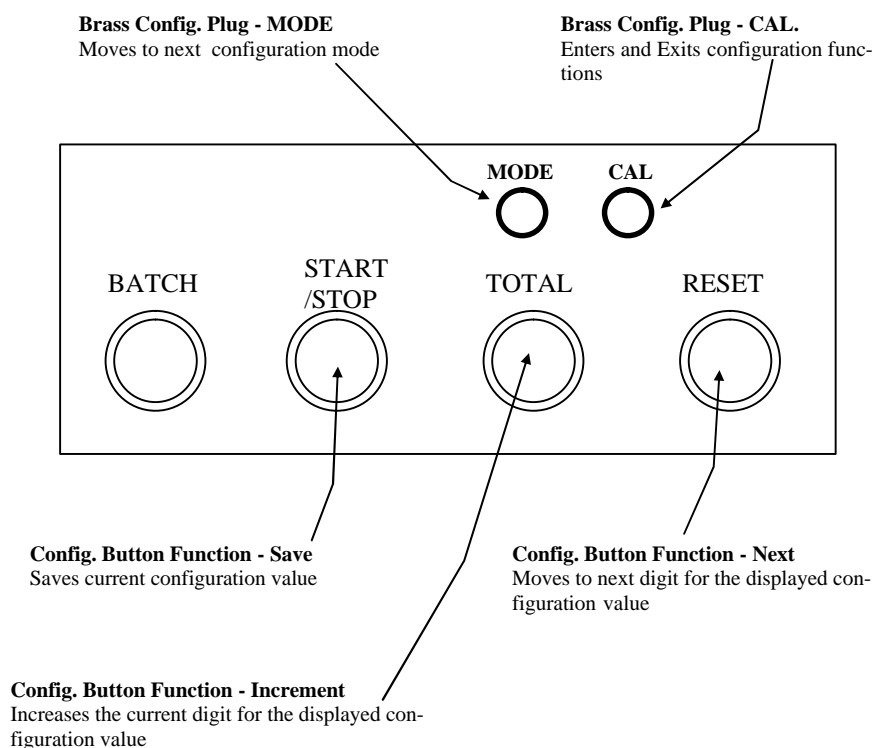
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## APPENDIX 4 - Quick guide to using the EMH500 register

Navigate the buttons on the front panel of the register to batch a known volume to a tank.

Press the BATCH button to enter batch mode. Use the TOTAL and RESET buttons to enter the volume required to dispense. Press the BATCH button again to save.

Press the START/STOP button to begin a delivery.



During a delivery, the top display will show the volume delivered so far, while the bottom display will show the volume left to dispense according to the preset batch size. If no batch size has been entered, then the bottom display will show the company name.

Press the RESET button will reset the register to zero.

Note, the CPU automatically sets a volume to dispense when the automatic calibration process is started.



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