Hoffmann&Hoffmann
Water Well Monitoring & Control

Dripmaster EDD-4B/EDD-4BS

U.S. Patent No. 5,996,739 & other countries

User Guide

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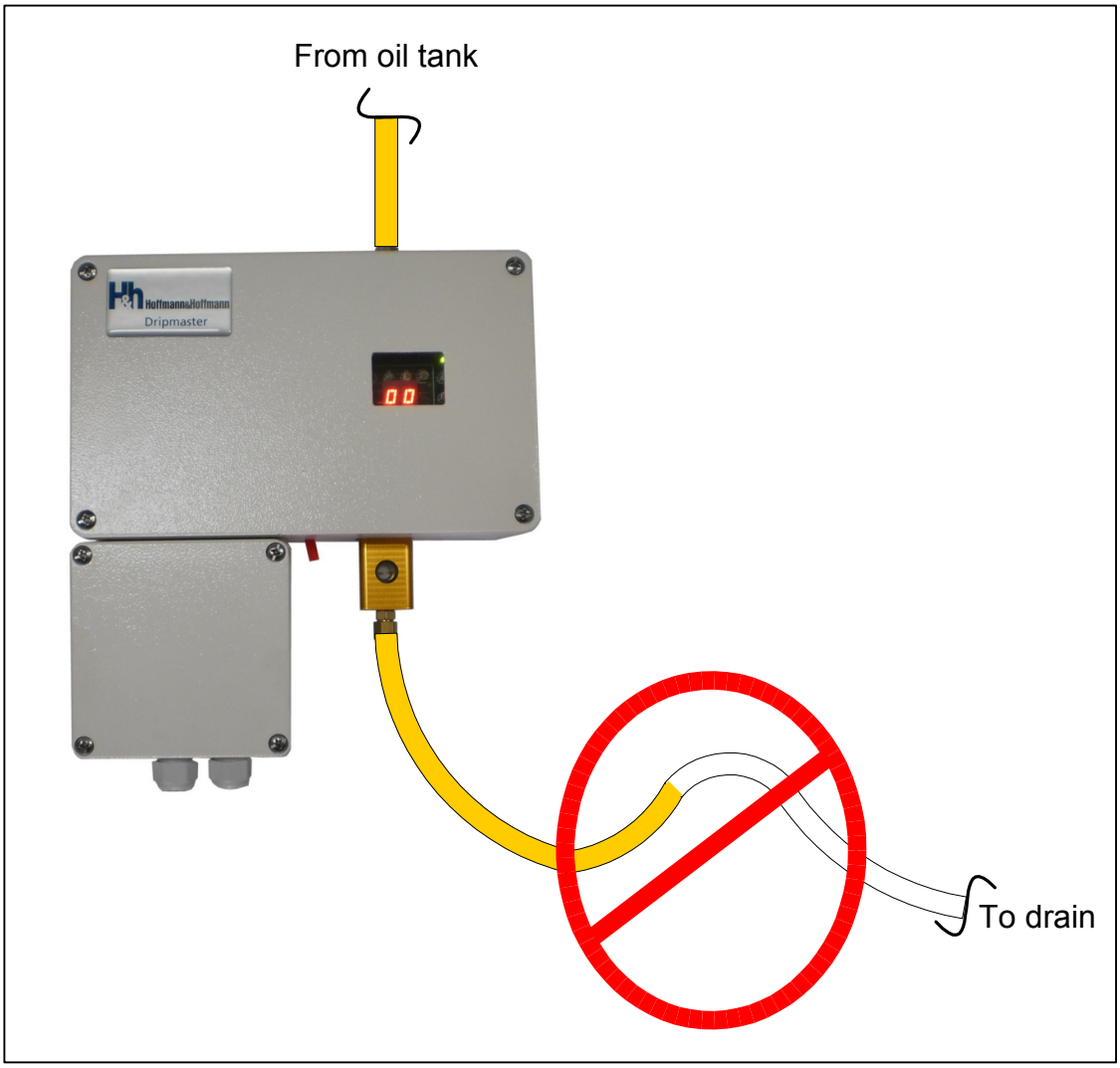
CAUTION!

ENSURE THE FREE FLOW OF OIL



Entire drain tube must face downward to prevent oil backup.

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Section 1: Introduction

Overview

The Dripmaster is an active vertical line-shaft lubrication control and monitoring device. It automatically stabilizes the oil drip rate so as to comply with pump manufacturer's requirements.

Figure 1: Dripmaster EDD-4B/EDD-4BS

Constant drip rate is maintained regardless of ambient temperature or hydrostatic pressure in the feeding oil tank. This is achieved by monitoring and controlling the drip rate 55 times per hour.

There are two modes of operation:

- **Normal Operational mode**—when the well pump is operational
- **Pre-lube Operational** (Stand-by) **mode**—ensures that the line-shaft is lubricated prior to turning on the well pump.

Automatic switching between the Normal Operational and Pre-lube (Stand-by) modes is achieved by remotely sending a control signal to the Dripmaster.

The SCADA interface provides:

- Accurate oil consumption data (drip rate count)
- Total lack of oil warning
- Automatic pump shutdown

A built-in manual mechanism ensures oil flow even in the remote possibility of unit malfunction.

Section 2: Installation

General

The Dripmaster installation procedure is simple and does not require any special tools, but requires site preparation.

Well Site Requirements

- 115 VAC line power (or 24 V DC/AC) must be available at the well pump.
- An eight-wire control cable (containing wires not smaller than 22 AWG) needs to be laid between the well pump and the local PLC enclosure.
- A sturdy, vertical pole with a welded metal plate should be in close proximity to the well pump.

Note: For large oil tanks (35 to 50 gallons), mount the Dripmaster to the oil tank stand.

Important: The relative spacing between the oil tank, the Dripmaster, and the line-shaft inlet should be according to Figure 2. In order to maintain minimal oil pressure on the needle valve (especially when the oil tank is almost empty), the oil inlet should be in the range of 10 to 14 inches below the oil tank.

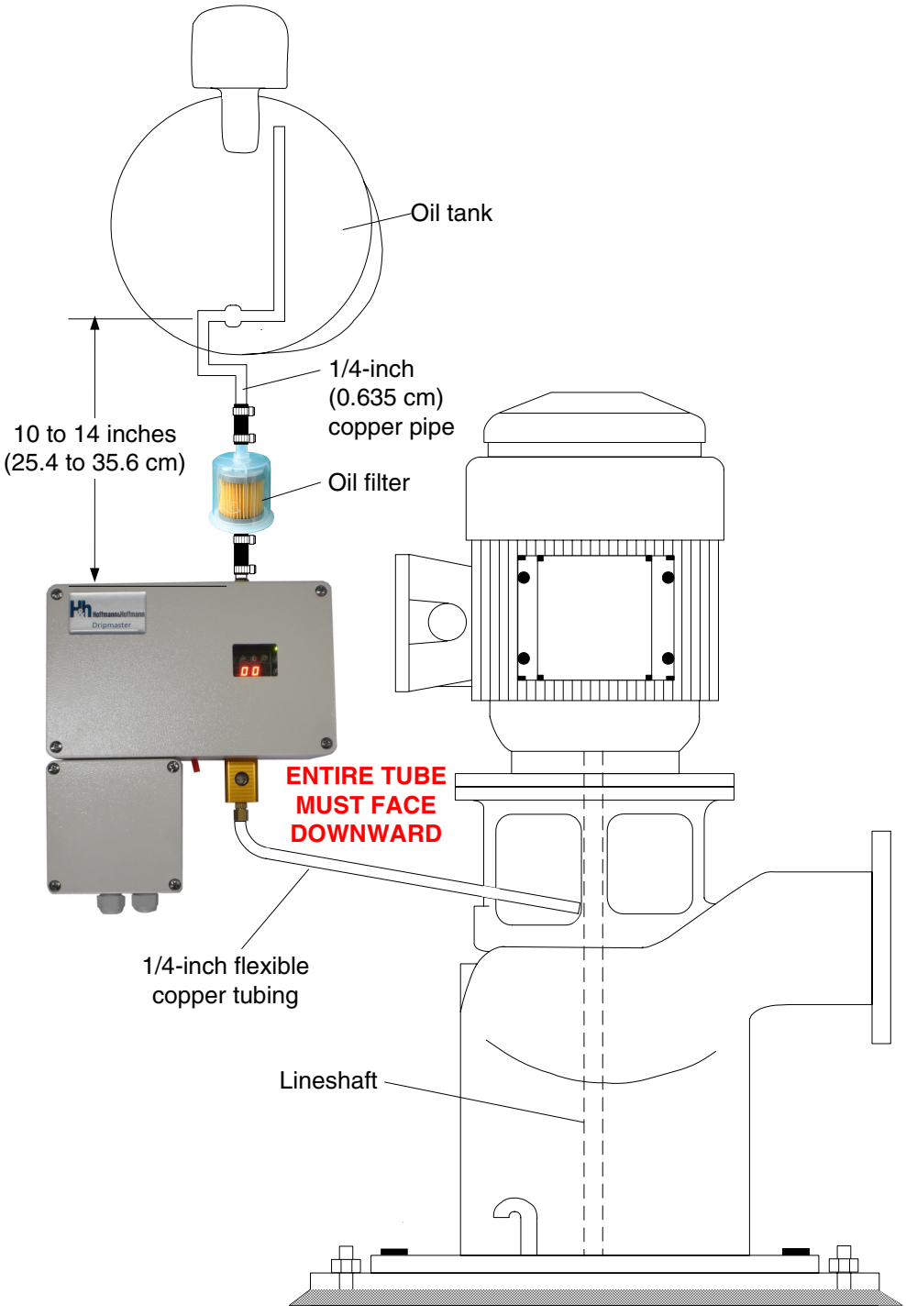

Figure 2: Installation requirements

Installation Kit

The Dripmaster is supplied with the following parts:

- One oil filter (fuel filter for ¼-inch hose)
- Four mounting bolts
- Eight nuts
- Eight lock washers
- Two cable bushings (glands)

Make sure that all of the kit items are present. You need to obtain ¼-inch fuel hose to complete the installation.

Mounting the Dripmaster

1. In order to mount the Dripmaster, drill four 1/4-inch holes in the metal plate that mounts the Dripmaster according to the drilling template shown in Figure 3.

Note: The mounting centers for the Dripmaster are shown on the back of the unit for convenience. Mounting the unit does not require more than four bolts.

2. Remove the Dripmaster front covers.
3. Place a bolt into a mounting hole, and keep it in place by using a nut.
4. Repeat step 3 for the other bolts.
5. Secure the device to the metal plate using the remaining nuts and lock washers.

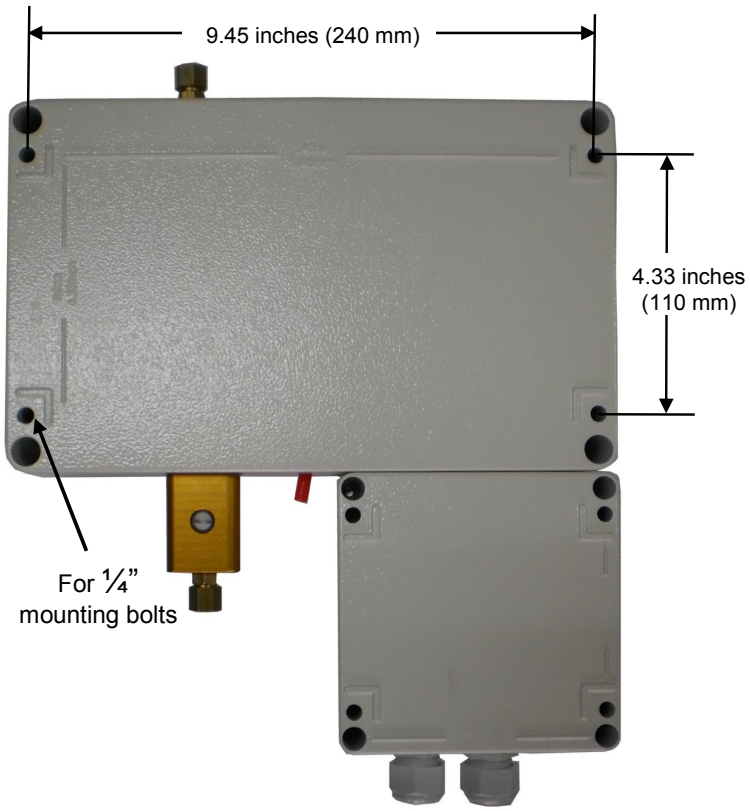

Figure 3: Dripmaster—rear view showing mounting centers

Wiring the Power and Control Cables

Power and control cables are routed through the bottom of the connection box through two strain relief bushings.

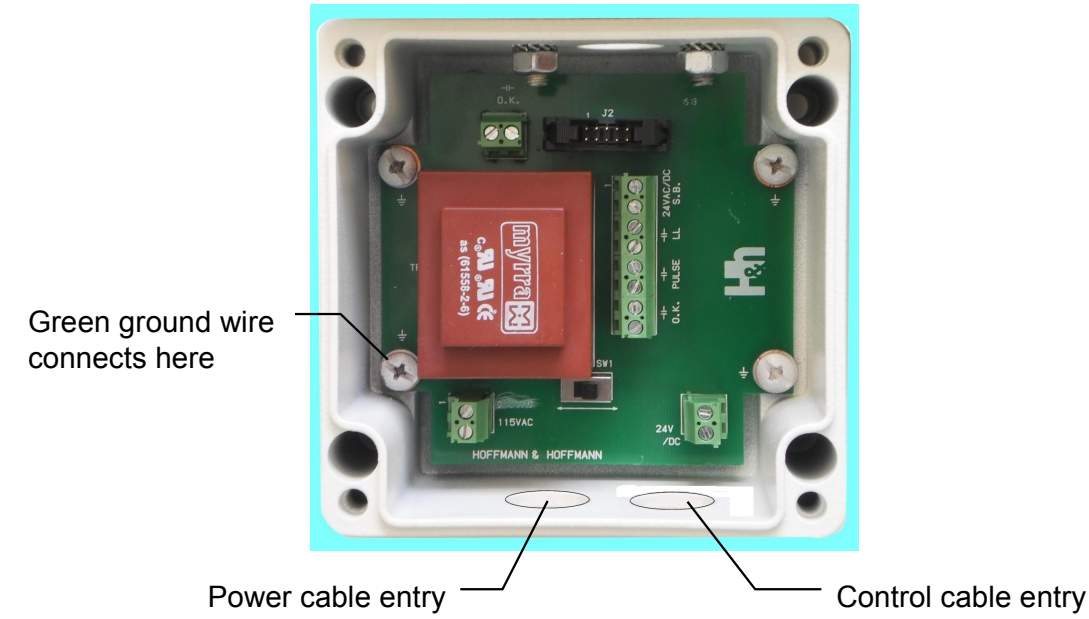

Figure 4: Connection box – cable routing

Wire the connection box according to Figure 5. Connections are described in detail in Table 1 on page 11.

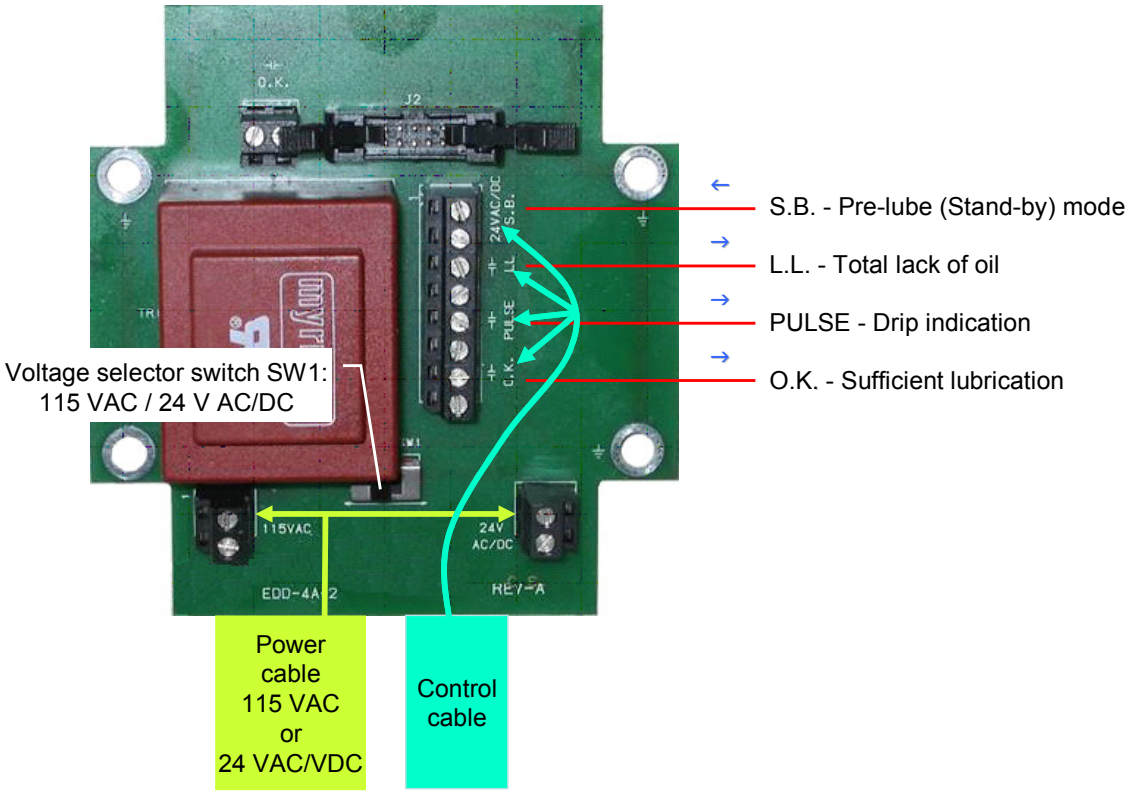

Figure 5: Connection box – electrical terminals

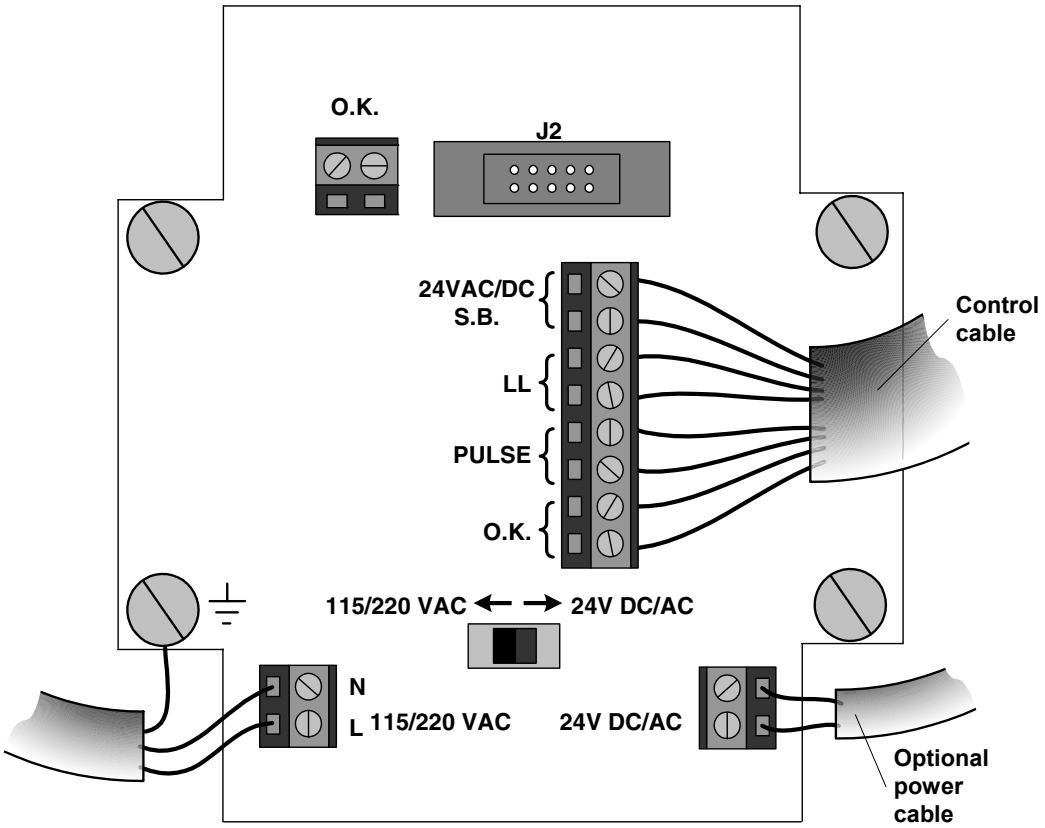

Figure 6: Connection box PCB – wiring diagram

Note: Line voltage is either 115 VAC, 60 Hz or 220 VAC, 50 Hz. The unit can be powered by line voltage or optionally by 24 V (DC or AC).

Note: Each of the signals associated with the control signal terminal block are **not** polarity dependent (24VAC/DC S.B., LL, PULSE, and O.K.).

Note: Avoid daisy-chain connections of the control signal returns – if the ground potentials of each return differ.

1. Set the power switch SW1 located just below the transformer, for either 115 VAC or 24 V DC/AC according to your requirements. See Figure 5.

2. Route the power cable through a cable strain relief on the left side of the connection box (Figure 4).
3. Connect the green ground wire to a chassis screw or bolt, preferably using a ring terminal. See Figure 4.
4. Route the control cable through the right cable strain relief (Figure 4).
5. Connect control cable according to Table 1.

   The connection box power and control line descriptions are shown below.

Table 1: Connection box—power and control lines

Cable or dry contact name (Figure 5)	Function
Power Cable (contains 3, 18 AWG wires)	This cable provides power to the Dripmaster. Using the selector switch and appropriate terminal block, either 115 VAC or 24 V DC/AC can be supplied.
Control Cable (contains 8, 22 AWG wires)	Input and output control or status signals are routed through this cable.
S.B. – Pre-lube (Stand-by) mode	A 24 V DC/AC **input** causes the Dripmaster to function in the Pre-lube (Stand-by) mode. The +SB LED (item 6 in Figure 7 also lights. See page 12. In this mode, the oil shut off setting is possible if pre-lube is not required. **For the EDD-4BS model, the shut off setting is not necessary since the oil shut off is performed by the internal solenoid.**
LL – Total lack of oil	A dry contact that closes when a total lack of oil condition occurs. The **LL** LED (item 9 in Figure 7) also lights. See page 12.
PULSE – Drip indication	A dry contact that transmits the drip rate. The contact closes for every drop fed to the line-shaft.
O.K. – Sufficient lubrication[1]	A dry contact that closes when sufficient oil is present. This contact closes when the **OK** LED (item 13) in Figure 7 lights. See page 12.

[1] In the Pre-lube (pump off) mode, the OK contacts are always closed.

During the transition period from the Stand-by (Pre-lube or Oil shut-off) mode to the preset Normal (pump on) mode settting, the OK relay is not energized (contacts open and OK LED is off) since the 15 dpm threshold has not yet been reached. In order to signal to the SCADA room that the Dripmaster is functioning normally during this transition period, the OK contacts of the external time delay relay should remain closed for approximately five minutes. If the external time delay relay has not been installed to control pump startup, the Dripmaster should be turned on approximately five minutes before starting the pump.

In case of a total lack of oil (e.g., empty oil tank) the LL contacts close, and the OIL LED turns on.

6. Connect an external time-delay relay of approximately five minutes to the O.K. output. This is necessary to extend the time needed for an OK indication during the transition from the pump-off state to the pump-on state.
7. Connect the oil filter (supplied) to the oil tank (Figure 2).

Important: The oil filter is essential as it prevents blockage in the needle valve.

8. Connect the Dripmaster oil outlet (Figure 13 on page 23, and Figure 2) to the well shaft inlet by means of flexible ¼-inch copper tubing.

Setting the Drip Rate

1. Set the dip switch settings for both the Normal Operational and Pre-lube (Stand-by) modes using the dip switches (see Figure 8 on page 14).

Note: There are 50 drops per 1 cc, and there are 3785.4 cc per gallon.

2. Replace both covers and tighten the eight cover screws so that the unit is watertight.

Section 3: Operation

Controls and Indicators

Button and indicator locations on the Dripmaster control panel are shown below.

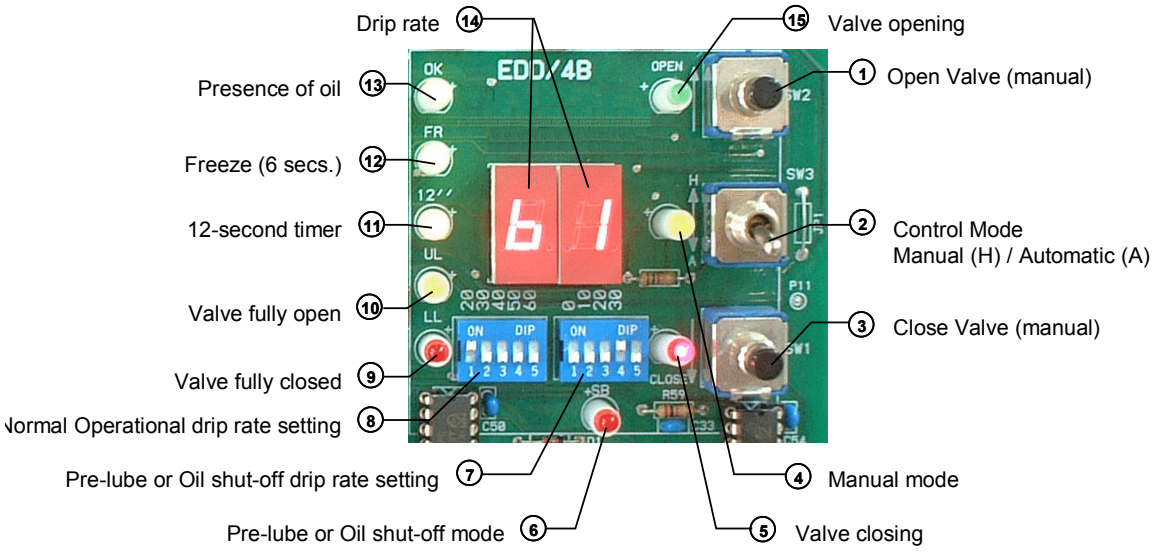

Figure 7: Dripmaster control panel

Table 2: Control panel—controls and indicators

Item number (Figure 7)	Name	Control or Indicator	Function
1	**SW2** (Open Valve)	Push button	Press to manually **open** the valve—for troubleshooting, and can be used to shorten the time to reach the preset drip rate.
2	**SW3** (Control Mode)	Toggle switch	Select between automatic and manual operation: • Manual (H) • Automatic (A)
3	**SW1** (Close Valve)	Push button	Press to manually **close** the valve—for troubleshooting, and can be used to shorten the time to reach the preset drip rate.
4	Manual Mode	Yellow LED	Lights in the manual mode—when the mode switch (item 2) is in the up position
5	**CLOSE** (Valve closing)	Red LED	Lights when the motor is closing the valve
6	**+SB** (Pre-lube or Oil shut-off mode)	Red LED	Lights in the Pre-lube or Oil shut-off mode when 24 V DC/AC is applied to the S.B. (Stand-by) input in the connection box
7	Pre-lube or Oil shut-off drip rate setting	DIP switch	Set the drip rate that occurs when the well pump is off. Choose only one switch in the DIP switch, and push it up to the desired dpm value.

Item number (Figure 7)	Name	Control or Indicator	Function
8	Normal Operational drip rate setting	DIP switch	Set the drip rate that occurs when the well pump is on. Choose only one switch in the DIP switch, and push it up to the desired dpm value
9	**LL** (Valve fully closed)	Red LED	Lights if the valve is completely closed, indicating a complete absence of oil. A corresponding relay contact closes when this LED is on. The terminal for this contact is called **LL – Lower Limit signal** and appears in Figure 5 on page 9.
10	**UL** (Valve fully open)	Yellow LED	Lights when the valve is completely open
11	**12 ' '** (12-second timer)	Yellow LED	Flashes every 12 seconds for timing purposes. You can count the number of drips seen during this 12-second interval and multiply them by five to arrive at the dpm rate. This LED is useful in the Manual control mode when you want to quickly stabilize the drip rate.
12	**FR** (Freeze – 6 secs.)	Green LED	Lights to indicate the six-second freeze interval. During this interval, which occurs once per minute, the needle valve may be opened or closed in order to adjust the drip rate.
13	**OK** (Presence of oil)	Green LED	Indicates that sufficient oil is delivered whether the well pump is on or off. In the Normal Operational mode, this corresponds to oil drip rates in excess of 15 dpm. In the Pre-lube/Oil shut-off (Stand-by) mode, the LED lights when the rate is between 1 and 15 dpm. The LED is off when a total lack of oil condition occurs, and the LL LED lights. A corresponding relay contact closes when this LED is on. The terminal for this contact is called **O.K.** and appears in Figure 5 on page 9. This terminal can be used to directly turn off the well pump in the Normal Operational mode, when drip rates are less than 15 dpm.
14	Drip rate	Display	A two-digit display shows the drip rate count
15	**OPEN** (Valve opening)	Green LED	Lights when the motor is opening the valve

Automatic Control

When the Control Mode toggle switch SW3 is in the lower **A** position (Figure 8), the Dripmaster automatically stabilizes the drip rate. At the end of each 60 second interval, a short correction command is given only if there is a deviation from the desired preset drip rate.

Normal Operational Mode

During normal operation (when the well pump is operating), the drip rate is selectable for drip rates of 20, 30, 40, 50, or 60 drips/minute.

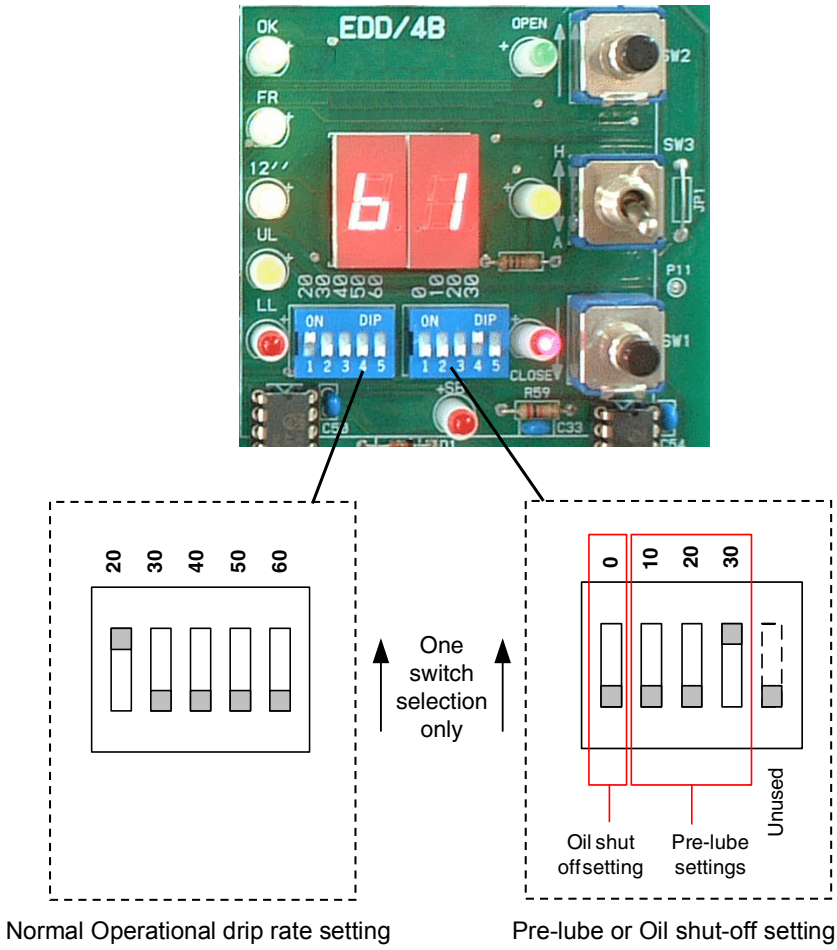

Figure 8: Drip rate settings

During the compensation time interval (Freeze state) that occurs once each minute, the needle valve is opened or closed according to the actual drip rate, as compared to the drip rate set point:

- The valve closes if the actual drip rate is 4 drips/minute or more than the preset value.
- The valve opens if the actual drip rate is 1 drip/minute or less than the preset value.

The **CLOSE** and **OPEN** LEDs indicate whether the valve is opening or closing. See items 5 and 15 in Figure 7 on page 12.

In Figure 8, it can be seen that the Normal Operational drip rate is set for 20 dpm.

Pre-Lube or Oil Shut Off Mode (Stand-by)

When the well pump is not operating, a different set of DIP switches are used in order to define the Pre-lube drip rate or to select Oil shut-off. See item 7 in Figure 7 on page 12. In the Stand-by operational mode, the following drip rates can be set:

- For pre-lube applications, select 10, 20, or 30 drips/minute
- To gradually shut off the oil flow, select 0 drips/minute (the Oil shut-off process takes approximately five minutes). In the Oil shut-off mode, the EDD-4B does not provide pre-lube capabilities; because only one switch setting is permitted (you cannot select 0 and another drip rate simultaneously).

The **EDD-4BS** provides the option for complete oil flow shut off, yet offers pre-lube capabilities (refer to "EDD-4BS" on page 19).

Note: There are 50 drops per 1 cc, and there are 3785.4 cc per gallon.

To select the Stand-by mode, 24 V DC/AC must be applied to the S.B. input in the connection box.

In Figure 8, it can be seen that the Pre-lube/Oil shut-off (Stand-by) drip rate is set for 30 dpm.

Manual Control

This mode permits emergency operation in the rare case when there is a suspected failure of the main circuitry.

Select the manual mode by switching the Mode toggle switch to the upper **H** position (Figure 8). This mode bypasses the electronic control circuitry, and allows the operator to modify the drip rate by using the Open and Close push buttons.

Use the Drip verification peephole to check the drip rate. The 12 ' ' LED, which flashes every 12 seconds, can be used as a timer. Count the number of drips during consecutive flashes of the 12 ' ' LED, and multiply by five to obtain the drips/minute (dpm) rate.

In this mode, power is removed from the circuitry, except for the push buttons, motor, and Manual mode LED.

Resetting the Dripmaster

There are two ways to accomplish reset:

1. By disconnecting the power source to the Dripmaster for 10 seconds, and then reconnecting it.

2. By removing the Dripmaster cover, and raising the Mode toggle switch to the **H** position, and then back to the **A** position.

In both cases, the circuit voltage is interrupted and then restored. After restoration, the counter displays 00, and the drip search function causes the motor to open the needle valve until drops are detected, after which normal stabilization occurs.

Note: In case (2) above, a random drip rate is displayed initially which can be ignored.

Section 4: Theory of Operation

General

The Dripmaster is a gravity-based oil lubrication system.

The common needle valve fed from an oil tank does not provide any regulation of the drip rate—the rate varies in response to variations in temperature (day versus night and time of year) and changes in the tank oil level (hydrostatic pressure). Another cause of rate fluctuation is temporary valve blockage.

The Dripmaster performs as an automatic needle valve that regulates oil flow (Figure 9).

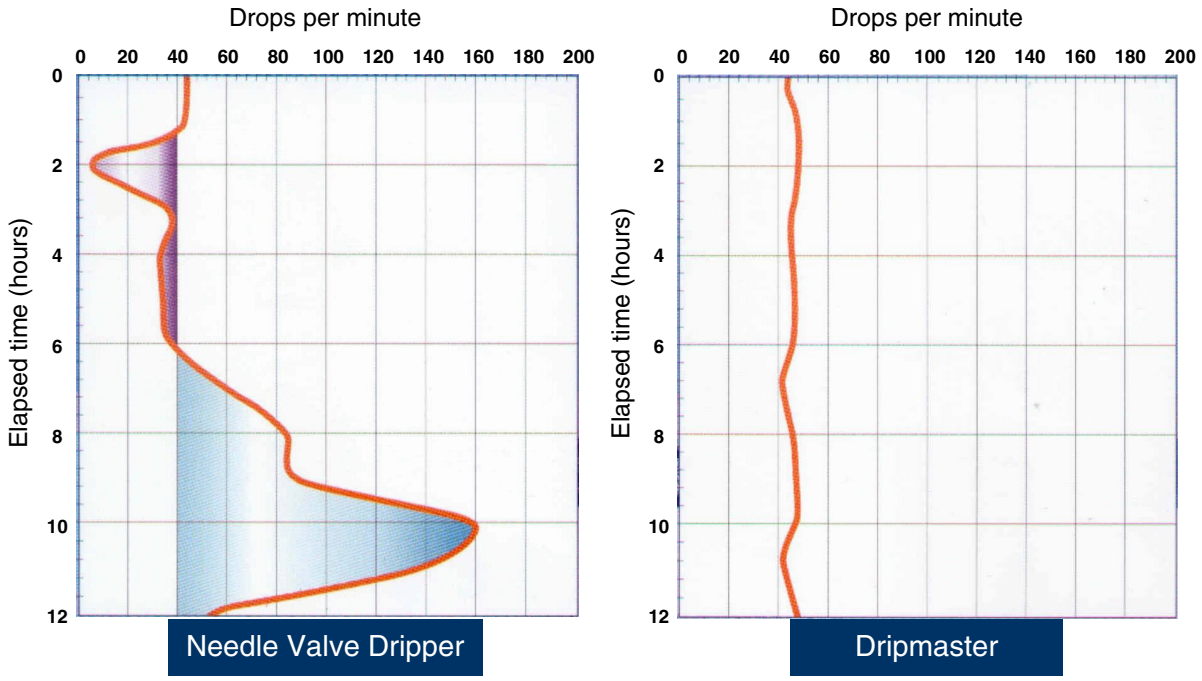

Figure 9: Common Needle Valve compared to Dripmaster

The components that make this possible are described below.

The servo motor regulates the needle valve aperture according to the preset drip rate value. A photoelectric sensor detects the drips and reports the drip count to the control circuitry. The control circuitry sets the mode of operation and generates the alarms and drip count information to the SCADA interface.

The Dripmaster EDD-4B/EDD-4BS incorporates a specially-designed needle valve connected to a servo motor which automatically compensates for rate fluctuations. The compensation magnitude is defined by the control circuitry. For example, if the drip rate set point is 40 drips/minute, and the drip rate drops below that level for any reason, the servo motor that attaches to the needle valve opens it to increase the drip rate to maintain 40 drips/minute. Conversely, if the drip rate exceeds the set point, the servo motor closes the needle valve to maintain the set point value (Figure 10).

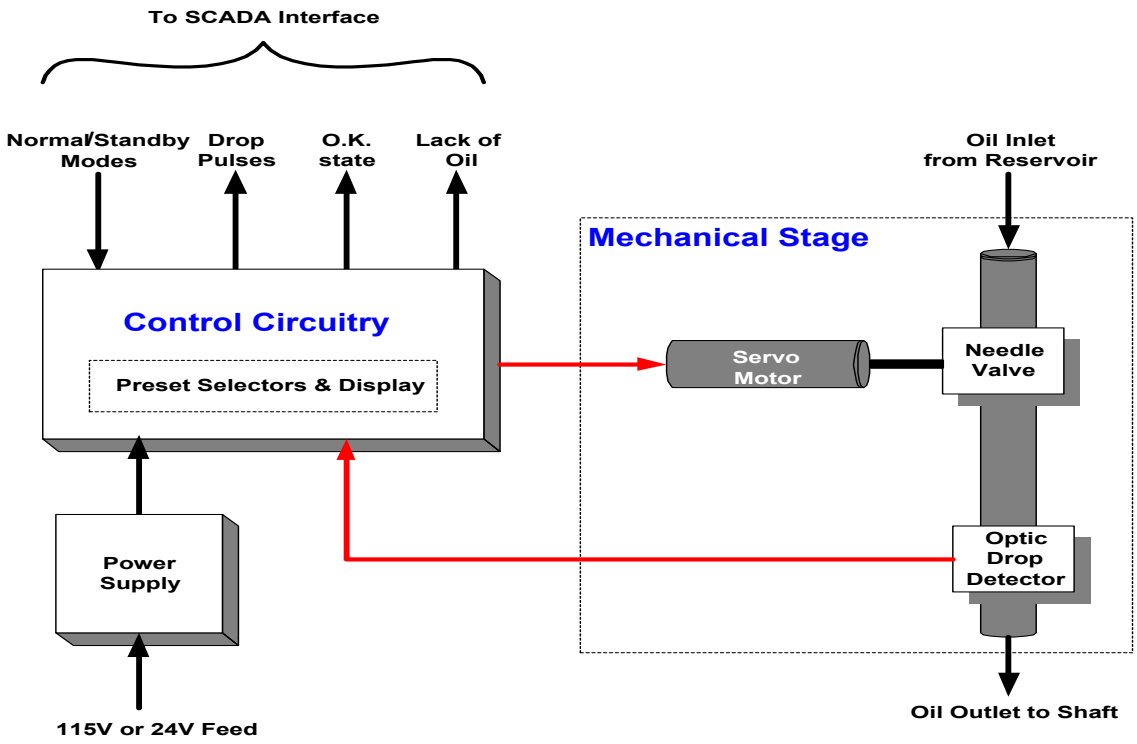

Figure 10: Dripmaster functional diagram

A two-digit display is visible in the Dripmaster display window (see Figure 7 on page 12)—this is a drip counter that stops at one minute intervals and indicates the number of drips applied during the previous minute (Freeze mode). A green Freeze LED turns on for six seconds during the Freeze period, after which it turns off, the counter returns to zero, and the count restarts. See Figure 7 on page 12.

During the freeze period, the servo motor is actuated to compensate for drip rate deviations.

A built-in fail-safe relay (O.K. relay) in the system activates when the drip rate exceeds fifteen drips per minute in the Normal Operational mode. External dry relay contacts permit direct control, such as pump shut-off. Other dry contacts in the Dripmaster are available to transmit the drip rate, and for warning of a total lack of oil condition.

The Dripmaster EDD-4B/EDD-4BS contains two drip rate settings, depending on the mode of operation:

- **Normal Operational mode**—the following values are selectable:
  - 20, 30, 40, 50, or 60 drips/minute
- **Pre-lube** (Stand-by) **mode**—the following values are selectable:
  - 0, 10, 20, or 30 drips/minute, where "0" signifies a completely closed valve (Oil shut-off)

A built-in, SCADA-compatible report-back mechanism provides the status and alarm information. This information is sent to the local PLC on site. The following signals are reported:

- **OK state** – signals that the oil drip rate exceeds a factory-set threshold. Whenever the oil drip rate falls below this threshold, the OK state is disabled and a relay contact can turn off the well pump directly or signal the SCADA room, which in turn can shut down the pump.
- **Drip rate count**– transmits the oil drip rate to the SCADA room, thereby providing the data to calculate oil consumption.
- **Lack of oil alarm** – the Dripmaster detects and warns of a lack of lubrication, as a result of an empty oil tank or blockage in the oil inlet or outlet.

Manual operation is possible using the OPEN and CLOSE push buttons on the control panel. The built-in peephole allows the operator to count the drips per minute.

Switching between the Normal Operational mode and Pre-lube or Oil shut-off (Stand-by) mode is accomplished by applying or removing a 24 V DC/AC voltage to the S.B. terminal in the connection box. Applying a 24 V DC/AC voltage sets the Dripmaster to the Stand-by mode of operation (for Pre-lube or Oil shut-off applications). Removing the 24 V DC/AC voltage causes the Dripmaster to switch to the Normal Operational mode.

Search Feature

In exceptional cases, where only a few drops are counted, or none at all, the drip search function is activated. This situation occurs if there is needle valve blockage or when there is a continuous flow of oil. In the continuous flow case, there are no individual drops and consequently no counter readings. Continuous oil flow may occur when filling an almost empty oil tank, for example. In case of partial blockage, the drip search function scans until drops appear (the needle valve opens continuously until drops are detected). If no drops are detected during the drip search (if the oil blockage or continuous oil flow persists), then the needle valve eventually reaches its upper limit, the UL LED illuminates briefly, and the motor changes its direction of rotation and starts to close the needle valve (Figure 11).

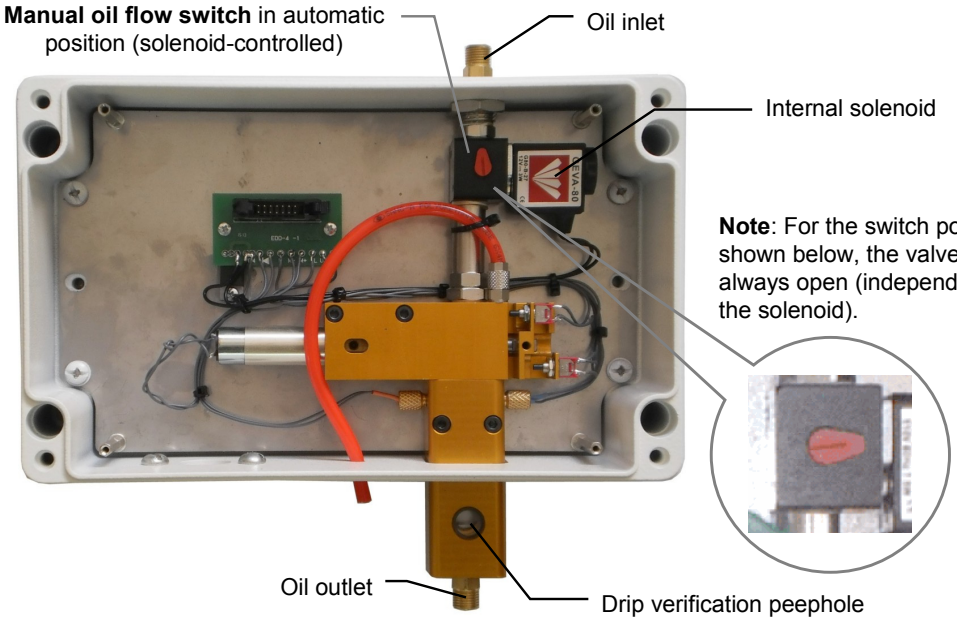

Figure 11: Dripmaster Needle Valve Assembly – EDD-4B

When and if oil drops are detected, the search function stops, and normal stabilization resumes. If no drops are detected while the needle valve is closing, then the needle valve eventually reaches its

lower limit and the LL LED lights continuously. The LL relay outlet contact closes, transmitting a total lack of oil condition. At this stage, there is no vertical line-shaft lubrication which means that either the oil tank is empty or there is an oil flow blockage between the oil tank outlet and the Dripmaster inlet.

In the case of oil flow blockage in the Dripmaster outlet pipe, excess oil briefly flows from a built-in overflow hose (see Figure 12 on page 19). Also, the LL LED turns on, and oil flow is cut off by the closure of the needle valve. After taking corrective measures, you must reset the system. See "Resetting the Dripmaster" on page 15.

Push-Down and Push-up Features

In order to enhance the response time of the system whenever the drip rate exceeds 80 dpm, an automatic push-down mechanism is engaged. This is achieved by continuously closing the valve for a number of seconds. Excessive drip rates may occur when filling an empty oil tank, or when the Dripmaster has finished scanning.

Similarly, an automatic push-up mechanism accelerates the stabilization of the system whenever the Dripmaster is transferred from the Stand-by (Pre-lube or Oil shut-off) mode to the Normal Operational mode. This mode change occurs when the 24 V DC/AC is removed from the S.B. terminal in the connection box.

EDD-4BS versus EDD-4B

The EDD-4BS is identical to the EDD-4B except for the addition of an internal solenoid. This internal solenoid provides instantaneous on/off control of oil flow, as opposed to the EDD-4B, where oil flow is gradually turned on and off over a period of minutes. The EDD-4BS allows you to use the pre-lube settings **in addition to** having on/off oil flow control. With the EDD-4B, you can **either** select pre-lube settings **or** on/off oil flow control (see Figure 8 on page 14).

Whenever the system power is on, the energized solenoid allows oil flow. Oil flow stops when the system power ceases. The oil flow can be manually opened or closed via the manual oil flow switch (Figure 12).

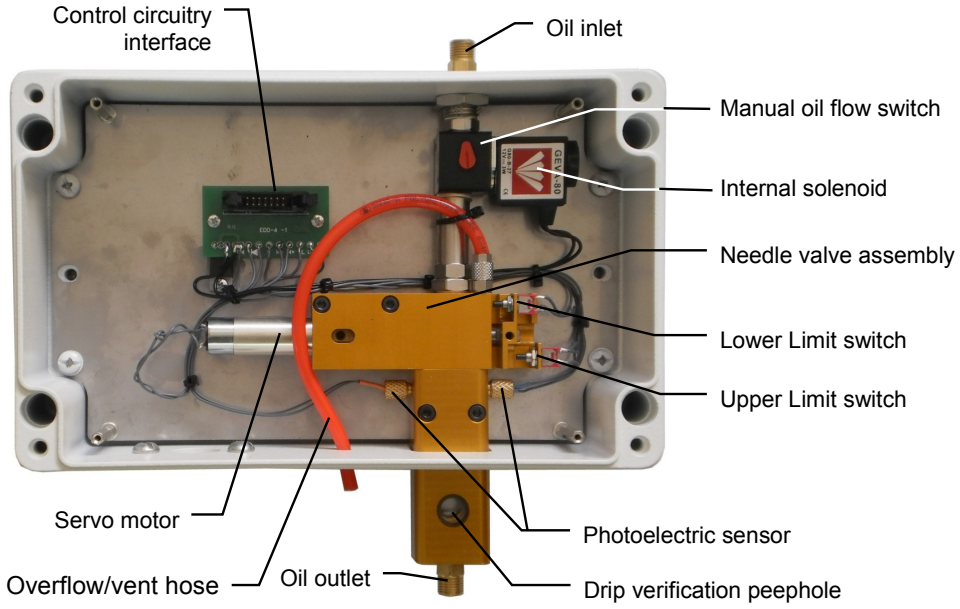

Figure 12: Dripmaster Needle Valve Assembly with Solenoid – EDD-4BS

Section 5: Maintenance and Troubleshooting

Table 3: Routine Maintenance

Task	Frequency
Check for oil leaks	Monthly
Oil filter change (the oil filter used can be an automotive fuel filter with ¼" fittings)	Every six months
Check for normal operation • The displayed drip rate is equal to the Normal Operational mode drip rate setting, within a -1, +3 digit tolerance	Weekly

Table 4: Troubleshooting

Problem	Possible Cause	Solution
The display and LEDs are not lit.	• The unit is not powered.	• Check power in the connection box.
An unusual result appears on the display	• Changing the mode toggle switch (item 2 in Figure 7 on page 12).	• Ignore.
You want to quickly stabilize the Dripmaster for a new drip rate	• You just refilled the oil tank.	• With the **Mode** toggle switch (item 2 in Figure 7 on page 12) in automatic (**A**), hold down the **Close** push button momentarily to slow down the drip rate.
	• You just increased the drip rate setting in the Normal Operational mode.	• With the **Mode** toggle switch in position **A**, hold down the **Open** push button momentarily to speed up the drip rate.
A suspected fault has occurred in the system; the drip rate is much higher or lower than expected.	• Circuit failure	• Set the **Mode** switch to **H**, and set the drip rate manually using the **Open** and **Close** push buttons. See Figure 7.

Problem	Possible Cause	Solution
The **LL** LED is on.	• Oil tank is empty • A shut-off valve at the outlet of the oil tank might be closed • Oil flow from the oil tank may be obstructed; the oil filter may be clogged • Oil blockage between the Dripmaster outlet pipe and the line-shaft—excessive oil briefly flows from a built-in overflow hose	• Refill the oil tank • Open the shut-off valve • Change the oil filter, or clean out any obstructions in the pipe between the oil tank and the Dripmaster inlet • Clean out any obstructions in the pipe between the Dripmaster outlet and the line-shaft. **Note**: Reset the system after fixing the problem. See "Resetting the Dripmaster" on page 15.

Section 6: Specifications

Table 5: Dripmaster EDD-4B/EDD-4BS specifications

Power requirements	115 VAC, 60 Hz, 10 VA, or 24 V DC/AC 220 VAC, 50 Hz, 10 VA, or 24 V DC/AC
Normal mode preset drip rates (pump on)	20, 30, 40, 50, 60 dpm
Pre-lube mode drip rate (pump off)	0, 10, 20, 30 dpm
Drip volume	50 drops per 1 cc
PULSE relay contact	35 VDC – 0.5 A
O.K. relay contact	250 VAC – 10 A AC1 110 VAC – 10 A AC1 110 VDC – 0.3 A 30 VDC – 10 A
L.L. relay contact	125 VAC – 0.5 A 110 VDC – 0.2 A 24 VDC – 1 A
S.B. (*Normal/Pre-lube* mode control)	24 V DC/AC
Duty cycle	60 secs count 6 secs freeze
Drip stabilizing tolerance	From x to x+3 dpm (where x is the pre-selected drip rate)
Oil on/off solenoid*	24 VDC 24 VAC (optional)
Oil inlet/outlet	Male thread ¼" BSP
Dimensions (W x H x D)	10.24 x 11.02 x 3.54 inches (260 x 280 x 90 mm)
Weight (approximate)	11 lbs (5 kg)

*For use with the EDD-4BS only.
All specifications are subject to change.

Table 6: Oil volume fed to line shaft

Drip Rate (dpm)	**10**	**20**	**30**	**40**	**50**	**60**
Volume: ml/ hour	12	24	36	48	60	72
Volume: gallons/ day	0.076	0.152	0.228	0.304	0.38	0.45

Volume figures are based on a Dripmaster drop volume of 50 drips = 1 ml.

Overall Dimensions

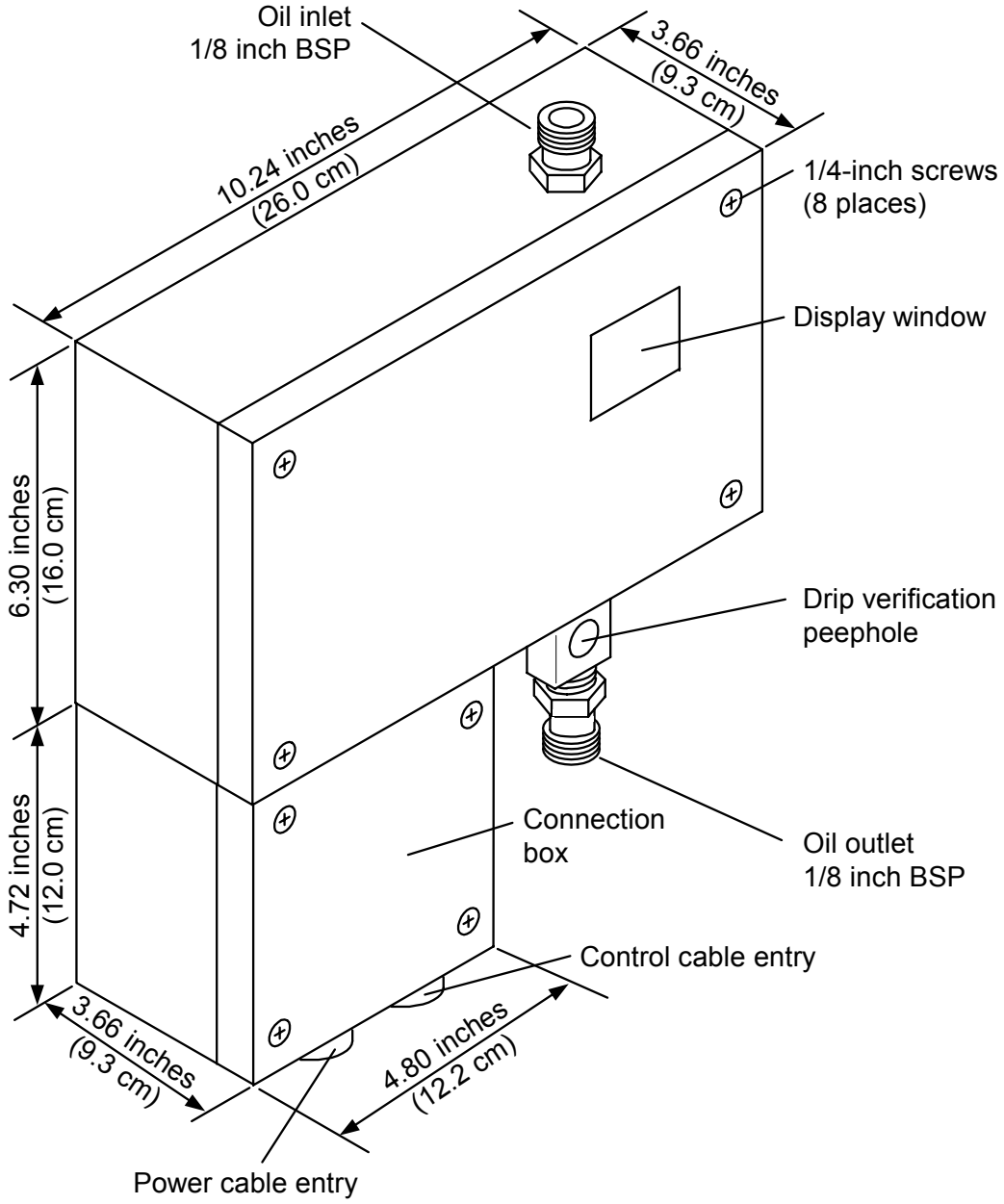

Figure 13: Dripmaster dimensions

The Dripmaster enclosure is made of painted, cast aluminum.

Section 7: Dripmaster Service Policy

This policy has been established to cover the servicing of Hoffmann & Hoffmann products, regardless if it is within or beyond the warranty period.

Installation

1. The installation services required for the Dripmaster includes the following:
    - Infrastructure (trench digging, cable laying)
    - Oil tank stand
    - Dripmaster mount
    - Cabling (4 pairs)
    - 24V (DC or AC) power source
    - Testing
2. Hoffmann & Hoffmann's representative or its authorized subcontractors will perform the installation work required and charge the customer directly.
3. In cases where there is a prior approval by Hoffmann & Hoffmann, the customer may do the installation.
4. The representative will assume full responsibility for the installation work he performs.

Repair procedure

5. In case of a default, the customer can follow the Troubleshooting table (Table 4 on page 20) to try and solve the problem.
6. If the customer does not succeed in solving the problem, he can fax or email Hoffmann & Hoffmann's local representative, describing the problem based on the Troubleshooting table (Table 4 on page 20), and indicating which of the procedures failed ("the notice"). This should be directed to the local representative where he has a service agreement.
7. Hoffmann & Hoffmann's representative will respond within two working days.
8. The problem might be fixed by the representative in one or more of the following ways:
    - **Remotely**: instruct the customer on how to solve the problem by phone.
    - **On Site**: technician arrives at the customer’s site to perform first level support (basic repairs and parts replacements).
    - **In Hoffmann & Hoffmann lab**: ship the unit to Hoffmann & Hoffmann’s Chicago office.
9. The representative should first try to solve the problem remotely.
10. In case the problem is not solved remotely, the representative will send a technician to solve the problem on site, within two working days.
11. If the representative concludes that the problem can only be solved in Hoffmann & Hoffmann's lab, he should disconnect the unit and ship it to Hoffmann & Hoffmann's Chicago office.
12. The representative has the option to replace the faulty unit with one of his spare units.
13. The repaired unit should be shipped back from Hoffmann & Hoffmann to the representative.
14. The representative will send the repaired unit, with the repair invoice and shipment cost, to the customer.

PC Board Replacement in the Field

1. Remove both covers to gain access to the PC boards, and then follow directions shown in Figure 14 below.

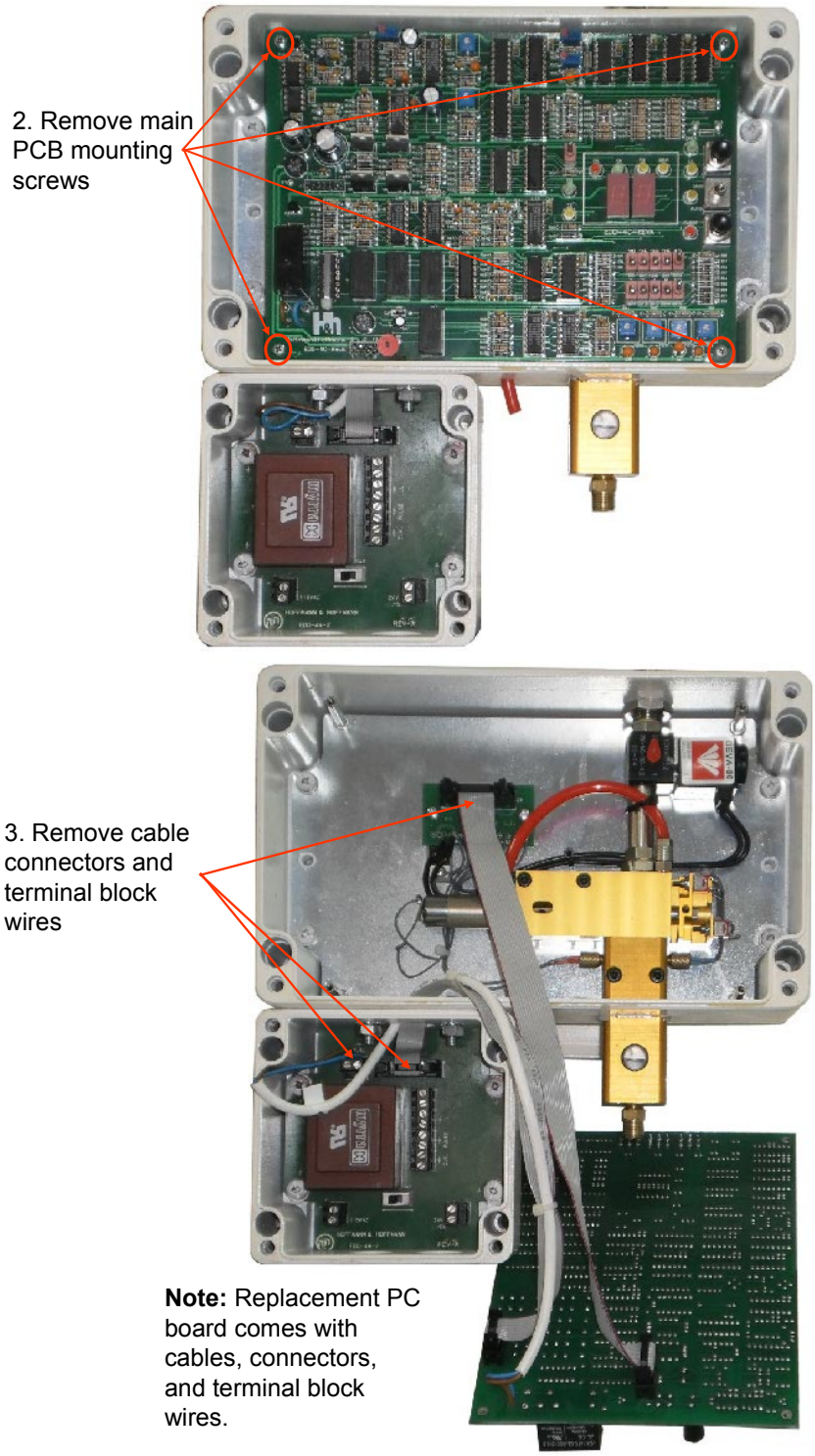

Figure 14: Dripmaster PC board replacement

Reverse procedure above to install the replacement PC board.

Product within the Warranty Period

1. All Hoffmann & Hoffmann products have a one year limited warranty.
2. Hoffmann & Hoffmann Warranty will apply only to units installed by authorized Rep/Distributors or by the customer (if Hoffmann & Hoffmann authorized installation by the customer).
3. Hoffmann & Hoffmann is not responsible for damages caused by extreme environmental factors, i.e. temperature extremes.
4. If the failure occurred during the Warranty Period, Hoffmann & Hoffmann will cover the repair cost. The customer will only pay for the shipment to the nearest Hoffmann & Hoffmann office.

Product Out-of-Warranty Period

1. If product is not under warranty, the customer will be responsible for all of the repair cost as per his agreement with the representative including:
    - Technician labor cost
    - Spare parts cost
    - Other expenses (travel, shipment)
2. **Repairs at Hoffmann & Hoffmann lab**: if the product arriving to the lab is out of the Warranty Period or if failure is deemed by the factory to have been caused by abuse or tampering, the following procedure applies:
    - Diagnosis will be made and repair completed, providing the repair charges are less than 500 USD.
    - We will diagnose (but not repair) a returned unit and notify by email or by fax the estimated charges if any of the following apply:
        i. Repair charges exceed $500.
        ii. You specifically requested an estimate of required repairs and charges.
        iii. When the product is over 7 years old. Hoffmann & Hoffmann takes pride in attempting to repair products of any age. However, due to component availability and product improvements, some older products may no longer be repairable.
    - When you receive an estimate and would like us to proceed, please mail or fax one signed copy (with P.O. number if required) or phone or email your authorization.
    - **Note**: Un-repaired items are discarded unless you wish them to be returned to you. There is currently a $150 charge plus shipping per un-repaired item to cover diagnosis and handling such returns. Items remaining more than 90 days from estimate date will be discarded.
    - Service warranty period is ninety days for all repaired/replaced parts.

Return Instructions

1. When sending your product for repair, please include the following information:
    - Company name and address
    - Contact name
    - Phone, fax and/or email
    - Description of the problem(s)
2. Return properly packaged item to the address of your local Rep/Distributor or to Hoffmann & Hoffmann lab.
3. This warranty is limited to the repair or replacement of the Hoffmann & Hoffmann products only. Hoffmann & Hoffmann assumes no other responsibility or liability.
4. Hoffmann & Hoffmann reserves the right to make changes in policy and pricing without notice.

Terms & Conditions on reverse

The purchaser agrees to the following terms and conditions:

1. **Shipping**:
    - If not specified, goods will be shipped by the most economical carrier of our choice. Domestic orders will be shipped GROUND unless specified. International orders will be shipped AIR unless specified.
    - To obtain warranty service, you must deliver the product in either its original packaging or packaging affording an equal degree of protection.
2. **Insurance**: Insurance costs will be added to all invoices.
3. **F.O.B.**: **F**ree **O**n **B**oard. ALL goods are shipped F.O.B. All shipping and insurance costs, local and/or foreign taxes or exportation / importation duties are the responsibility of the customer.
4. **Claims**: Claims for damage sustained in transit should be made promptly to your carrier.

Force Majeure: Hoffmann & Hoffmann shall not be liable for any delay in or impairment of performance resulting in whole or part from acts of nature, labor disruptions, shortages, inability to procure product, supplies or raw materials, severe weather conditions, or any other circumstances or cause beyond the control of Hoffmann & Hoffmann in the conduct of its business.

Appendix A: Ordering Spare Parts

Table 7: Spare parts list

Description	Remarks
Main printed circuit assembly	Contains display, relays, and LEDs
Power printed circuit assembly	Contains transformer and terminal blocks

Hoffmann&Hoffmann
Water Well Monitoring & Control

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Hoffmann & Hoffmann Ltd., 7 Shoham Str., P.O.Box 7544, Petach Tikva 49170, Israel
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USA office:
Hoffmann & Hoffmann, 2757 W. Jarlath Str., Chicago, Illinois 60645
Tel: 312-277-9191; 312-218-8997; Fax: 866-272-8433; E-mail: info@hw-well.com

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