EMH500 Series
Electronic Register

Hardware Reference Manual

Version 2.0 (Draft1.0)

Date: 1 July 1999

Other Manuals in the Series:

Installation Manual
Software Settings Reference Manual
Developer Interface Manual
General User Guide
Revision History (Internal Use Only)

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1. Introduction

Thank you for supporting this product and taking the time to read this manual.

The Liquip Group has been manufacturing Electronic Meter Heads (Electronic Registers) for over 15 years. The EMH500 being the 5th and latest series has undergone a complete transformation with many new technologies being employed to greatly enhance the overall functionality.

The EMH500 has been specifically designed to meet the many different Weights & Measures standards for metered delivery systems found around the world. Especially, where the use of mobile computing, point of sale invoicing and other electronic administration automation is being used.

The EMH500 is a significant departure from traditional Electronic Meter Heads. While the device remains self-contained and easy to install, the large number of set-up parameters and functional options suggests a good understanding of this manual will greatly reduce potential configuration errors.

1.1 Use of this Manual

This manual is designed as a guide for experienced installation technicians familiar with all local codes and standards associated with this type of work. It is supplied with the intent of providing a broad view on installing and configuring the EMH500 only.

It should be used as a reference for both basic (Stand-alone) and more complicated (Interfaced with Computer) installations. However, separate manuals provide the necessary details for associated equipment.

We recommend you become familiar with the contents of this manual before attempting to install the product. We also assume you have detailed local knowledge on and certified where required in,

- Electrical Safety Standards.
- Weights & Measures certification and verification.
- Electronic systems installation.
- Hazardous Environment Installation (where applicable)

Ensuring compliance with the highest safety and regulatory standards is of critical importance.

1.2 Document Revision History

Version 1.0 – Initial Release

2. EMH500 Overview

The EMH500 is an Electronic Meter Head (Register or Totaliser) designed to replace traditional mechanical devices fitted to mechanical meters such as positive displacement rotary vane etc. The EMH500 is also well suited for direct electronic interfaces such as turbine meters.

A remote pulse transmitter option allows total flexibility with dispenser design and mechanical meter interface.

However, the essence of the EMH500 design has to do with interacting with on-board vehicle computers and the need to maintain compliance with Weights & Measures Authorities.

The EMH500 register and printer as approved measuring instruments can fully interact with other on-board computers and associated commercial administration software without creating data paths that necessitates including this additional equipment or software in the certifying process.

2.1 Basic Features

- Preset Function (batching)
- Temperature Compensation
- Curve Flattening for non-linearity
- Two comms ports, RS232, configurable
- Electronically non-reversible
- Ticket print by demand or automatic after time delay
- Display for batching - counting down.
- On-demand displays of, rate of flow, temperature, time date.
- Mechanically sealed calibration data access.
- Programmable resolution, tenths, whole or deca.
- Slow start and slow stop functions (ramp up, ramp down)
- Limited configuration on Ticket Printer outputs.

Note: The front cover label peels off to reveal various display markings on the front cover.

2.2 EMH500 Electronic Register Specifications

Microprocessor:	32 bit μP running at 16.7MHz
Program Memory:	256K × 16 bits of EPROM
Operating Temperature:	-40 to +70°C
Size:	200 x 200 x 150mm
Weight:	1.8kg
Displays:	2 x 8 digits, 15mm high
Power:	9Vdc @ 400mA polarity protected (EMH501: 9Vdc @ 650mA)
Temperature Compensation:	-15 - +55°C for LPG, -20 - +60°C for other products (EMH501: -40ºC to +60ºC for all products)
Temperature Probe:	PT100 100Ω@0°C
Product Density:	0.500 - 0.600 for LPG, 0.653 - 1.075 for other products
Communication:	2 x RS232C Ports, can be used to communicate with a PC or other serial devices such as a modem or printer.
PC or TouchPC:	Software is written for Touch-PC on-line communication. Commands that can be interrogated include: resetting the meter, pre-setting the batch quantity and requesting the current delivery quantity. See software section for detail.
Printer:	Epson CTM-290 or TM-295, Liquip Blaster.
Pulse Input:	Will accept 3-channel pulses of 60° (Electrical) separation from ERP100 pulser or single pulse from foreign pulser.
Pulse Output:	This is an Open Drain, active-low output, signal calibrated to 10 pulses/litre, where the pulse width can be set up to either 2 ms or 0.2 ms.
Two Stage Solenoid Outputs:	These outputs are Open Drain, providing slow start and slow stop. (UK version has three solenoid outputs).
External Reset:	This is an input/output signal.
NOTE:	**EMH501 is a cold climate version with heaters fitted to LCD displays.**

2.3 Register housing

The greatest mechanical enemies of a register mounted on a tanker (and probably out in the weather) are water entry and vibration.

Water entry has been addressed primarily by eliminating the normal viewing window. Construction is a shallow nylon body which contains all buttons and the main connection plug. A clear high impact polycarbonate top hat then forms the viewing windows. Therefore the whole cover of the register has no potential leak points of any sort, nor any connections, so in the case of impact damage replacement is cheap and simple.

All control buttons are of the sealed type with no through-spindle to allow leakage and the 26-pin connecting plug and socket are a military specification water-proof type. The latter is also vibration resistant and all connectors employed in the electronics are of the locking type to prevent loosening. All screw fasteners are fitted with locking washers.

Pulser vibration can cause false readings if not controlled. Mechanically the pulse-wheel is dampened by an internal wave spring but the primary control is electronic, employing three precisely-spaced sensors and the software then analyses and rejects any spurious counts.

All control buttons and sealed access ports for calibration purposes are mounted on the front face for ease of use by the operator. Buttons are click-type to provide feedback to the user.

A 26-pin connector is rear-mounted and clearance is maximised by recessing the male into the nylon housing and supplying a 90° female for the EJB101 connector.

As previously mentioned the register bolts directly onto the mounting of a Veeder Root mechanical counter - simply fit the drive fork to suit the particular meter.

In the case of a Neptune meter, LIQUIP supply an adaptor EMH200-5 for equally simple bolt-on conversion.

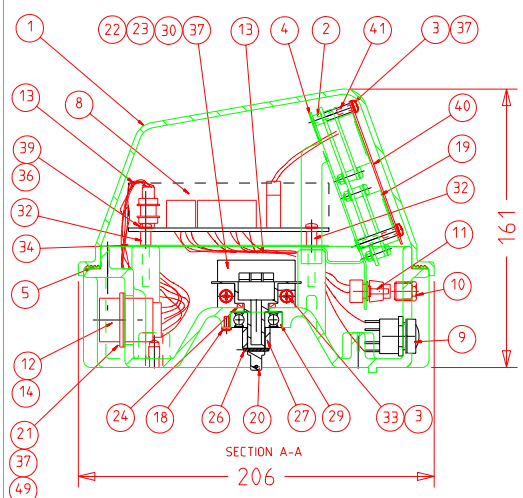
For housing diagram and specifications, refer to page 18.

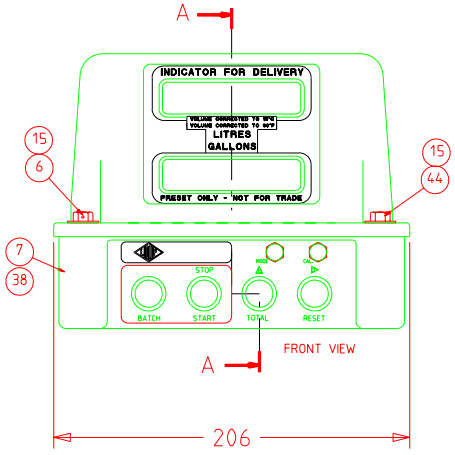
(Note: EMH501 denotes a variant for cold climates such as Canada where a display heater is required).

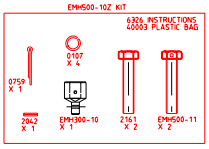
2.4 EMH500 Technical Drawing

LIQUIP

EMH500







ITEM	PART NO	DESCRIPTION	QTY	MATERIAL	ITEM	PART NO	DESCRIPTION	QTY	MATERIAL
1	EMH500-1	TOP COVER	1	POLYCARBONATE	26	0759	COTTER PIN 1/16" X 3/4"	2	S/S
2	5058	STAND OFF 3.4 ID X 5 LG	4	NYLON	27	EMH500-12	SPACER TUBE	1	DELRIN
3	4937	SCREW M3 X 10LG PAN/HD PH/HD	6	Z/P M/S	28	EMH300-10	ADAPTOR DRIVE	1	AL
4	EMH500-2	BRACKET FOR DISPLAY PCB	1	Z/P M/S	29	4543	BEARING DEEP GROOVE BALL 10 X 30 X 9 (NTN 6200-LLU)	1	STEEL
5	4581	SEAL BETWEEN HOUSING & BASE	1	BUNA	30	4963	SCREW SELF TAPPING #004 X 9.5LG PAN/HD PH/HD	2	Z/P M/S
6	EMH500-4	SCREW #010 X 20LG HX WITH HOLE	2	Z/P M/S	31				
7	EMH500-3P	BASE	1	NYLON	32	5062	STAND OFF 4.3 ID X 8 LG	4	NYLON
8	5554	PCB EMH & PRESET	1	ELEC	33	4925	NUT HEX NYLOC M3	2	Z/P M/S
9	5550	PUSHBUTTON GREEN WITH HARNESS	1	ELEC	34	EMH500-13	SHIELDING PLATE	1	AL
10	EMH200-15	PLUG 1/8" BSP	2	BRASS	35	2042	SELOX PIN 1.5 X 8LG	1	
11	5566	SWITCH CONNECTOR WITH HARNESS	1	ELEC	36	5277	WASHER 4mm SHAKEPROOF INT.	4	Z/P M/S
12	5551	PLUG 26 PIN WITH HARNESS	1	AL ALLOY	37	5268	WASHER 3mm SHAKEPROOF INT.	10	Z/P M/S
13	5617	TIE CABLE	6	NYLON	38	5743	LABEL - SIDE	1	AL
14	4285	GASKET FOR REAR PLUG	1	NEO CORK	39	6451	SCREW #008 X 25.4LG PAN/HD PH/HD	4	Z/P M/S
15	4938	WASHER FLAT M6 X 18 OD	4	NYLON	40	6327	LABEL DISPLAYS	1	POLYCARB
16					41	5078	STANDOFF M3 X 16 (FARNELL 517574)	4	N/P BRASS
17					42	EMH500-11	SCREW 1/4"UNF X 1 1/4" LG HX C/W HOLE	2	Z/P M/S
18	4936	SCREW #004 X 6.4 PAN/HD PH/HD	1	Z/P M/S	43	2161	SCREW 1/4" UNF X 1 1/4" LG HX	2	Z/P M/S
19	5555	DISPLAYS PCB SUB-ASSEMBLY (2 DISPLAYS ON ONE BOARD)	1	ELEC	44	4998	SCREW #010 X 20LG HX	2	Z/P M/S
20	ERP100-10	SHAFT OPTICAL	1	DELRIN	45	0107	WASHER 1/4" SPRING	4	Z/P M/S
21	5000	SCREW SELF TAP #004 X 12LG PAN/HD PH/HD	4	Z/P M/S	46	6326	INSTRUCTIONS	1	PAPER
22	ERP100-6	BRACKET CIRCUIT BOARD FOR PULSER	1	Z/P M/S	47	40003	PLASTIC BAG	1	PLASTIC
23	5546	PCB PULSER (OPTO BOARD)	1	ELECT	48		CARTON	1	CARD BOARD
24	6103	SMALLEY WAVE SPRING	1		49	5585	TERMINAL LUG	2	BRASS
25					50				

DRAWING No: X400097
ISSUE: H

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2.4.1 EMH501 (Canadian Approval)

- Extended Cold climate temperature range
- Heaters fitted to LCD screen
- Blow down functionality

EMH501 board specifications

Processor:	32 bit μP running at 16.7MHz
Data Memory:	32K bytes of RAM
Program Memory:	4Mbit (256k x 16) EPROM
Operating Temperature:	-40 to +70°C
OMIL approved temp range:	-25 to +55°C
Size:	115 x 150mm
Power:	9Vdc @ 650mA polarity protected;
Temperature Compensation:	-40 to +60°C for all products.
Temperature Probe:	PT100 100Ω@0°C
Product Density:	0.500 – 0.600 for LPG, 0.653 – 1.075 for other products.
Communication:	2 X RS232C serial Ports (1200 to 9600 baud), Query/Setup Command protocol.
Printer:	Supports Epson ESC P format, Liquip Blaster format.
Pulse Input:	3-channel Liquip ERP100 pulser; Single pulse input
Pulse Output:	Open Drain, active-low output, calibrated to 10 pulses/litre, Pulse width either 2 mSec or 0.2 mSec
Solenoid Outputs:	2 stage Open Drain, Slow start and Slow stop
External Reset:	Input/output signal for reset

2.4.2 EMH500IS (Intrinsically Safe)

- Approved for intrinsically safe areas.

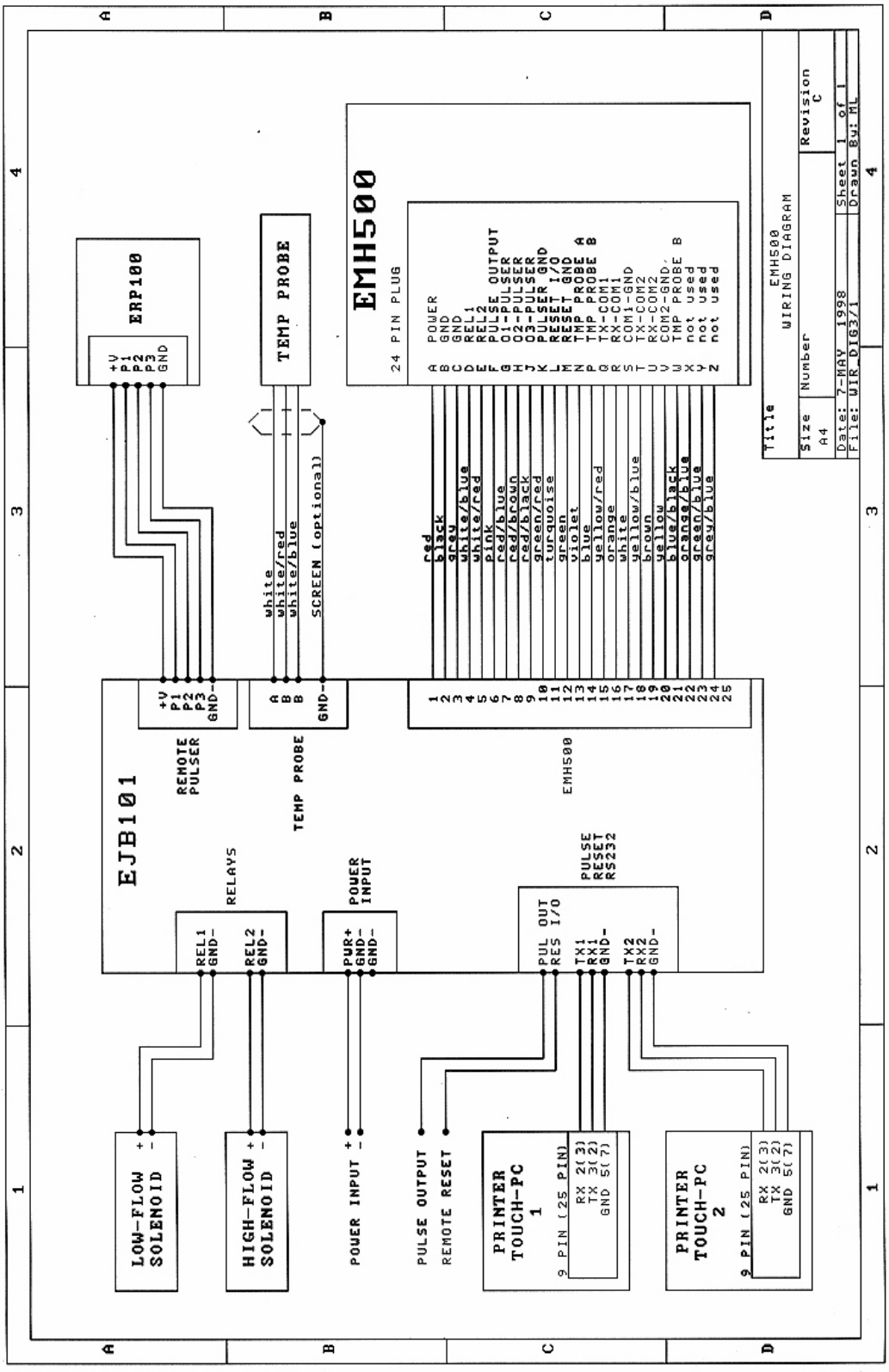
EMH501IS board specifications

Processor:	32 bit μP running at 16.7MHz
Data Memory:	32K bytes of RAM
Program Memory:	4Mbit (256k x 16) EPROM
Operating Temperature for IS applications:	-20 to +50°C
OIML approved temp range:	-25 to +55°C
Size:	110 x 150mm (two boards, bottom one encapsulated)
Power:	9Vdc @ 300mA polarity protected
Temperature Compensation:	-15 to +55°C for LPG, -20 to +60°C for other products
Temperature Probe:	PT100 100Ω@0°C
Product Density:	0.500 – 0.600 for LPG, 0.653 – 1.075 for other products.
Communication:	2 X RS232C serial Ports (1200 to 9600 baud), Query/Setup Command protocol.
Printer:	Supports Epson ESC P format, Liquip Blaster format.
Pulse Input:	3-channel Liquip ERP100 pulser; Single pulse input
Pulse Output:	Open Drain, active-low output, calibrated to 10 pulses/litre, Pulse width either 2 mSec or 0.2 mSec
Solenoid Outputs:	2 stage Open Drain, Slow start and Slow stop
External Reset:	Input/output signal for reset

3. EJB101 Electronic Junction Box

EJB101 Specifications

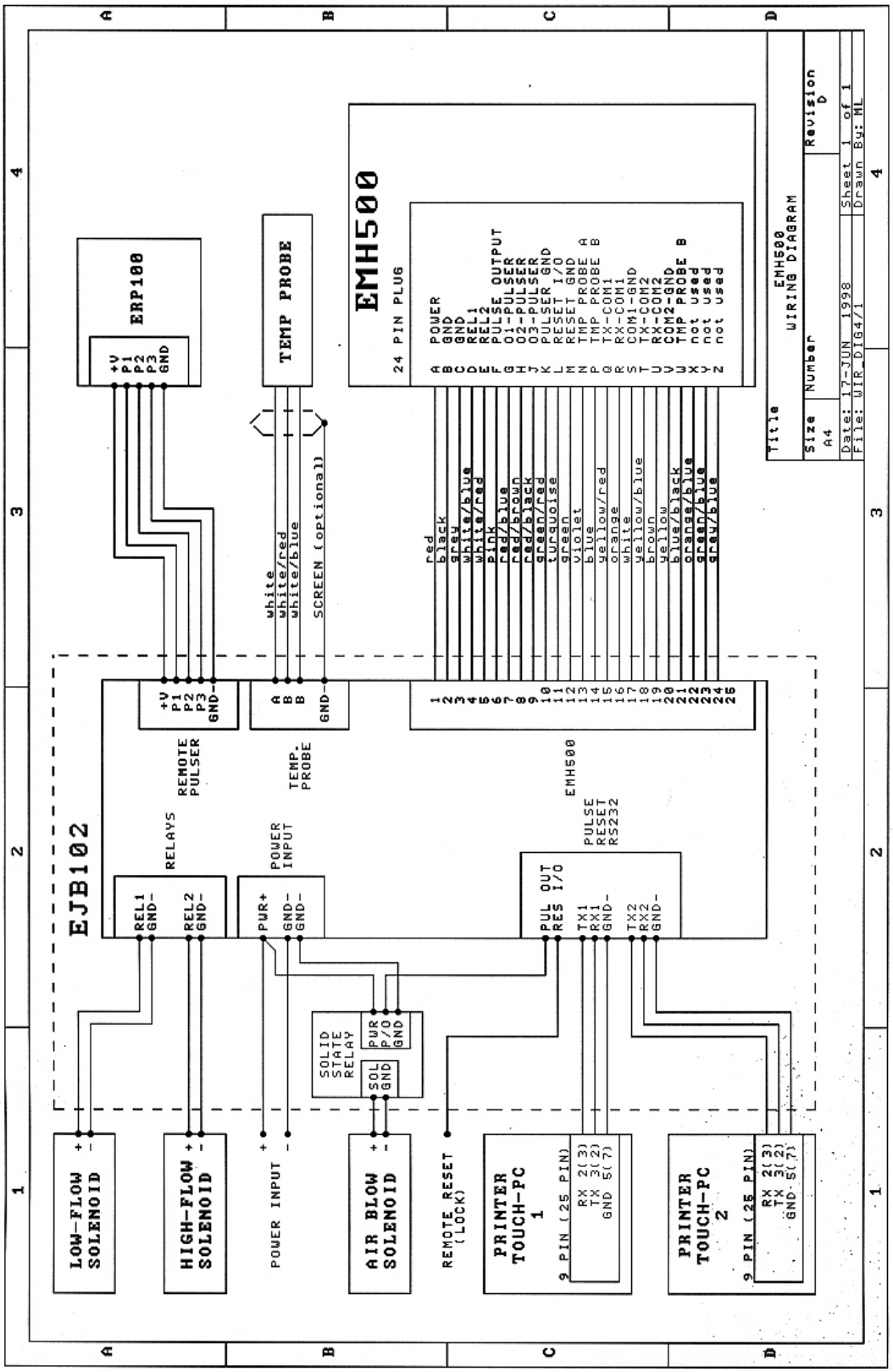
Input Power:	11 - 30Vdc
Operating Temperature:	-40 to +70°C
OIML approved temp range:	25 to +55°C
Size:	334 x 223 x 100mm
Weight:	4.3kg
Output Power:	9Vdc@800mA
Solenoid Outputs:	Two relay outputs 30Vdc@2A All RS232C are buffered to eliminate noise interference to and from the Register.
Communication:	2 x RS232C buffers
Housing:	Cast aluminium, Ex e rated to IP65
Cable:	25 core screened. ∅10.4 with polyurethane sheath. Inner sheath and separate insulated wires. Bend radius is 150mm.


EMH500
24 PIN PLUG
A POWER
B GND
C GND
D REL1
E REL2
F PULSE OUTPUT
G O1-PULSER
H O2-PULSER
J O3-PULSER
K PULSER GND
L RESET I/O
M RESET GND
N TMP PROBE A
P TMP PROBE B
Q TX-COM1
R RX-COM1
S COM1-GND
T TX-COM2
U RX-COM2
V COM2-GND/
W TMP PROBE B
X not used
Y not used
Z not used
red
black
grey
white/blue
white/red
pink
red/blue
red/brown
red/black
green/red
turquoise
green
violet
blue
yellow/red
orange
white
yellow/blue
brown
yellow
blue/black
orange/blue
green/blue
grey/blue
ERP100
+V
P1
P2
P3
GND
TEMP PROBE
white
white/red
white/blue
SCREEN (optional)
EJB101
REMOTE PULSER
TEMP PROBE
EMH500
RELAYS
POWER INPUT
PULSE RESET RS232
REL1 GND-
REL2 GND-
PWR+ GND- GND-
PUL OUT RES I/O
TX1 RX1 GND-
TX2 RX2 GND-
LOW-FLOW SOLENOID
HIGH-FLOW SOLENOID
POWER INPUT
PULSE OUTPUT
REMOTE RESET
PRINTER TOUCH-PC 1
9 PIN (25 PIN)
RX 2(3)
TX 3(2)
GND 5(7)
PRINTER TOUCH-PC 2
EMH500 WIRING DIAGRAM
Title
Size A4
Number
Revision C
Date: 7-MAY 1998
File: WIR_DIG3/1
Sheet 1 of 1
Drawn By: ML

3.1 EJB102 Specifications (with Air blow down function)

Input Power:	11 - 30Vdc
Operating Temperature:	-40 to +70°C
OMIL approved temp range:	-25 to +55°C
Size:	80 x 160mm
Output Power:	9Vdc@800mA
Solenoid Outputs:	Three relay outputs 30Vdc@2A
Communication:	2 x RS232C buffers
Housing:	Cast aluminium, Ex e rated to IP65

3.2 EJB102 Wiring Diagram



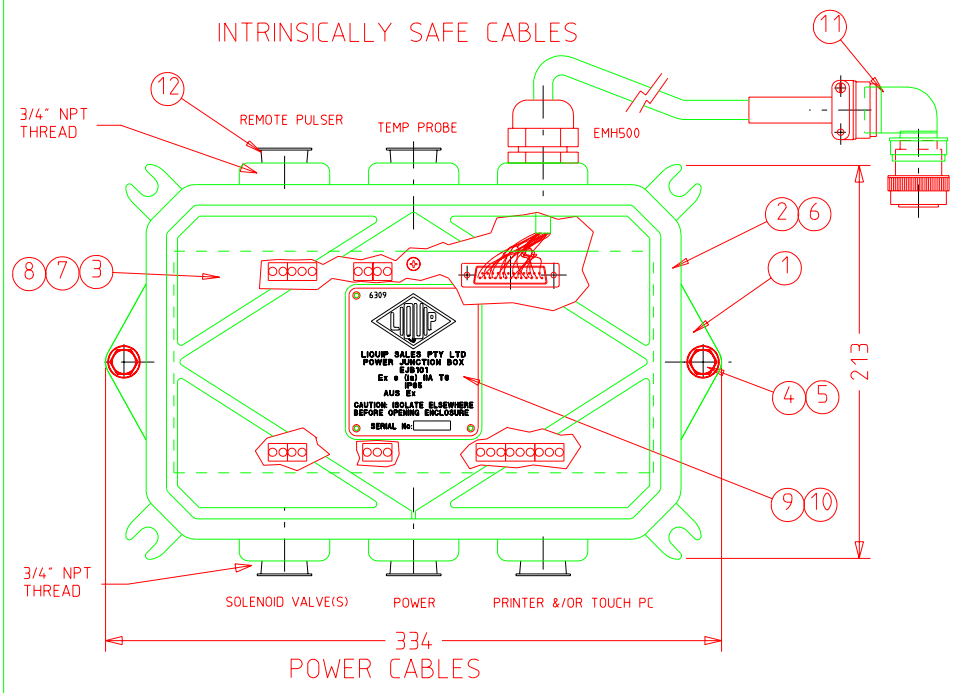
3.3 EJB200 Power board specifications (encapsulated board)

Input Power:	11 - 30Vdc (Isolation from ground)
Operating Temperature for IS applications:	-20 to +50°C
OIML approved temp range:	-25 to +55°C
Size:	203 x 256mm (encapsulated)
Output Power:	9Vdc@500mA
Solenoid Outputs:	Three relay outputs 30Vdc@2A
Communication:	2 x RS232C buffers
Housing:	Cast aluminium, Ex e rated to IP65

3.4 EJB101 Technical Drawing

LIQUIP

EJB101



ITEM	PART NO	DESCRIPTION	QTY/ASS	MATERIAL
1	EJB101-1	BASE	1	ALUMINIUM
2	EJB101-2	LID	1	ALUMINIUM
3	5553	CIRCUIT BOARD	1	ELECTRICAL
4	EJB101-3	SETSCREW HX	2	Z/P M/S
5	4943	WASHER SPRING	2	Z/P M/S
6	4598	SEAL	1	BUNA
7	3234	SCREW SELF TAPPING	6	S/S
8	0098	WASHER SHAKE PROOF	6	Z/P M/S
9	6309	LABEL	1	ALUMINIUM
10	4885	SCREW HAMMER DRIVE #002 X 6.4LG	4	M/S
11	5552	SOCKET HARNESS 26 PIN & GLAND (1m LONG)	1	ELEC
12	5737	CAP / PLUG	NOTE 1	PVC
13				
14				

NOTES:
1. PROTECTION FOR TRAVELLING ONLY. QUANTITY DEPENDS ON APPLICATION (TYPICALLY QTY = 5).

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ISSUE: E

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4. Preset Valve and Solenoid Connection

Primarily used for controlling the flow of the delivery, such as the BATCH commands in the EMH 500.

Two power output ports are provided in the Junction Box. One is used for the slow start / slow stop the other for the valve full open. Maximum rating for each circuit is 2 Amp 30 Volt.

The LOW FLOW solenoid must be connected to the terminals “REL1” and “GND”, the HIGH FLOW solenoid to “REL2” and “GND”. Both outputs are current sources, protected with fuses (F201,F202), with output voltage the same as the input power to the junction box.

5. ERP100 Electronic Remote Pulser

It is sometimes preferred to have the register mounted away from the meter. In this case the register internal opto connection to the main board must be disconnected. Remove cable tie from connector labeled CON801 (This is located in rear right hand corner). Disconnect plug and cable tie out of harms way. The ERP100 is wired into the power box then via the standard main harness without further modification.

ERP100 is a self-contained pulser which can operate from the EJB101 or directly from the vehicle power at 9v to 30v.

Body mounting is the same pattern as Veeder Root pulsers for interchangeability. It can therefore be driven off a Veeder-Root mechanical register off the existing post-calibration gear drive train by mounting on an adaptor plate, or by driving directly off the meter chamber main shaft.

Construction of body, cover and toothed wheel and shaft is in Delrin, supported by a sealed-for-life ball bearing. Friction damping is by an internal wave spring. The cover is screw-on for ease of access with calibration-seal lug provided and o-ring water-sealing. A maximum speed of 1,000 rpm is sufficient for all current applications when driving directly off the meter main shaft. There is no minimum speed, each tooth is counted.

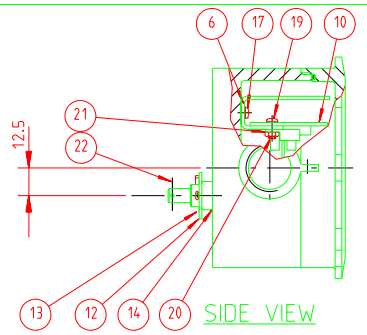
NOTE: EMH500 can also work with third party remote pulsers as long as they produce output signal of amplitude from 0V to at least +4Vsquare or sine. Such a pulser must be connected to the input terminal marked “P1” on “REMOTE PULSER” inside the EJB101 and the register must have enabled reading of the single pulse input (in the management calibration menu “SInput=Y”).

5.1 ERP100 Specifications

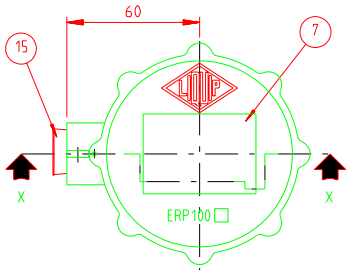
Power Consumption:	+9 to +30Vdc; 100mA
Output Voltage	Internally pull up to +5V through 4.7kΩ. However, it can be pulled up to 30Vdc, maximum load current 100mA.
Rotation	Bi-directional.
Input Shaft Speed:	1000 rpm maximum.
Torque:	120 g-cm maximum.
Output Pulse:	Three channels lagging each other by 60 electrical degrees, with a 50% duty cycle and 25 evenly spaced slots allowing 150 change of electrical states per revolution or single pulse output.
Operating Temperature:	-40°C to +80°C.
Weight:	300g for assembly less terminator.
Materials:	Housing & drive “delrin”, Buna seals Brackets and screws Zinc Plated or 304 Stainless steel.

LIQUIP

ELECTRONIC REMOTE PULSER ERP100

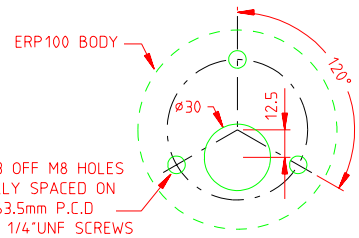


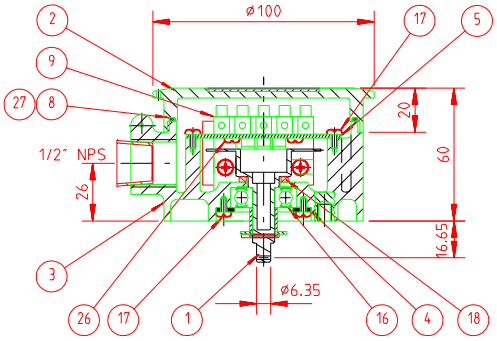
SIDE VIEW



TOP VIEW

MOUNTING HOLE POSITION





SECTION X-X

PART LIST

ITEM	PART NO	DESCRIPTION	QTY	MATERIAL	DRAWING
1	ERP100-10	OPTICAL SHAFT	1	DELRIN	E105098
2	ERP100-2	LID	1	DELRIN	E402
3	ERP100-11	BODY	1	DELRIN	E105198
4	ERP100-4	RETAINING RING	1	DELRIN	E404
5	ERP100-5	CONNECTOR BOARD PLATE	1	304 S/S	E405
6	ERP100-6	CIRCUIT BOARD BRACKET	1	Z/P M/S	E406
7	4784	LABEL	1	FUJICAL	P4784
8	4590	'O' RING	1	BUNA	---
9	1460	CONNECTOR BLOCK	1	ELECTRICAL	---
10	5546	PRINTED CIRCUIT BOARD (PCB)	1	ELECTRONIC	P5546
11	---	---	-	---	---
12	0813	WASHER	1	304 S/S	---
13	0759	COTTER PIN	1	304 S/S	---
14	EMH302-8	SPACER TUBE	1	ALUM 5005	E868
15	5746	CAP	1	PVC	---
16	4543	BEARING DEEP GROOVE BALL	1	STEEL	---
17	4936	SCREW SELF TAPPING PAN/HD PH/HD	6	Z/P M/S	---
18	6103	WAVE SPRING	1	S/S	---
19	4937	SCREW M3 x 10 LONG PAN/HD PH/HD	2	Z/P M/S	---
20	4925	NUT HEX M3 NYLOC	2	304 S/S	---
21	5254	WASHER FLAT	2	304 S/S	---
22	---	---	-	---	---
* 23	2094	CRIMP SEAL	1	LEAD	---
* 24	2190	SEAL WIRE COPPER WRAP	1	---	---
* 25	4785	INSTALLATION INSTRUCTIONS	1	---	P4785
26	3234	SCREW SELF TAPPING PAN/HD PH/HD	2	304 S/S	---
27	3395	GREASE SHELL SOLVENT RESISTANT	1	---	---

* NOTE - ITEM 23,24 & 25 ARE NOT SHOWN AND ARE SUPPLIED LOOSE FOR COMMISSIONING

X1369

SH 1 OF 2

Issue: F

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5.2 ERP100 Connection Diagram

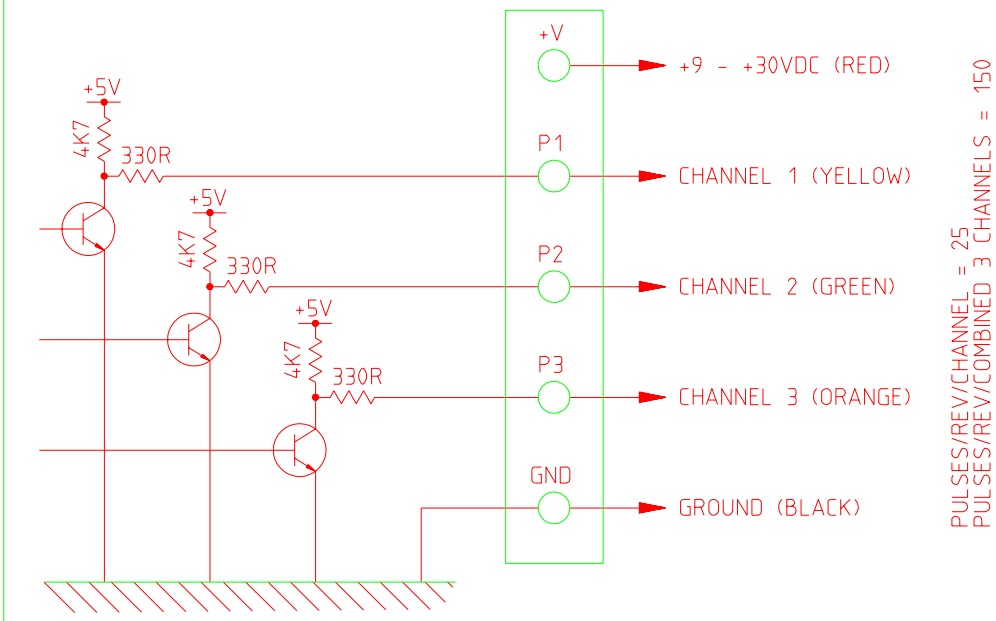
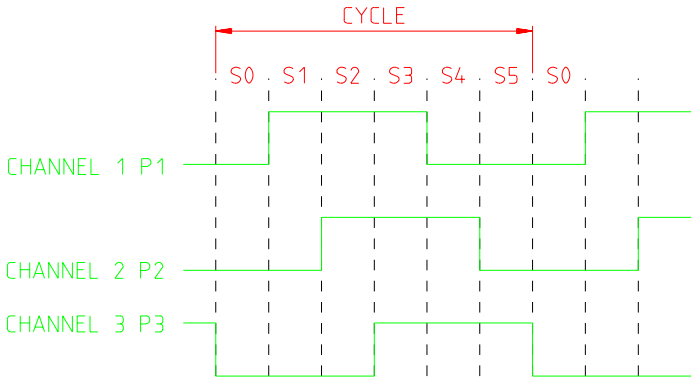


FIGURE 1



1 CYCLE = 360 ELEC DEG = 14.4 ANGULAR DEG

POSSIBLE STATE	P3	P2	PI	ALLOWED STATE
0	0	0	0	S0
1	0	0	1	S1
2	0	1	0	-
3	0	1	1	S2
4	1	0	0	S5
5	1	0	1	-
6	1	1	0	S4
7	1	1	1	S3

FIGURE 2

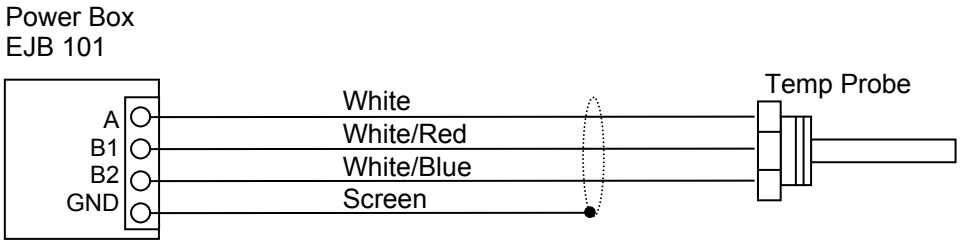
X1369
SH 2 OF 2
Issue: A

6. Temperature Probe Connection

The EMH500 is designed to work with a Temperature Probe the increase the sensitivity of the meter at different product temperatures. If the cable's length is shortened or lengthened ensure the EMH500 register is powered OFF and ON to automatically calibrate the Temperature Probe's leads.

At 15 °C, Probe resistance = 105.775Ω
At 45 °C, Probe resistance = 117.325Ω

- The probe has a ¼" NPT thread and can be mounted directly in the fluid line or in a temperature well filled with oil (for thermal conduction).
- The probe is a 3-wire device and is connected into the junction box. The temperature probe cable should not be cut, as it is a calibrated length.
- The screen should be connected to the ground wire of the power box.



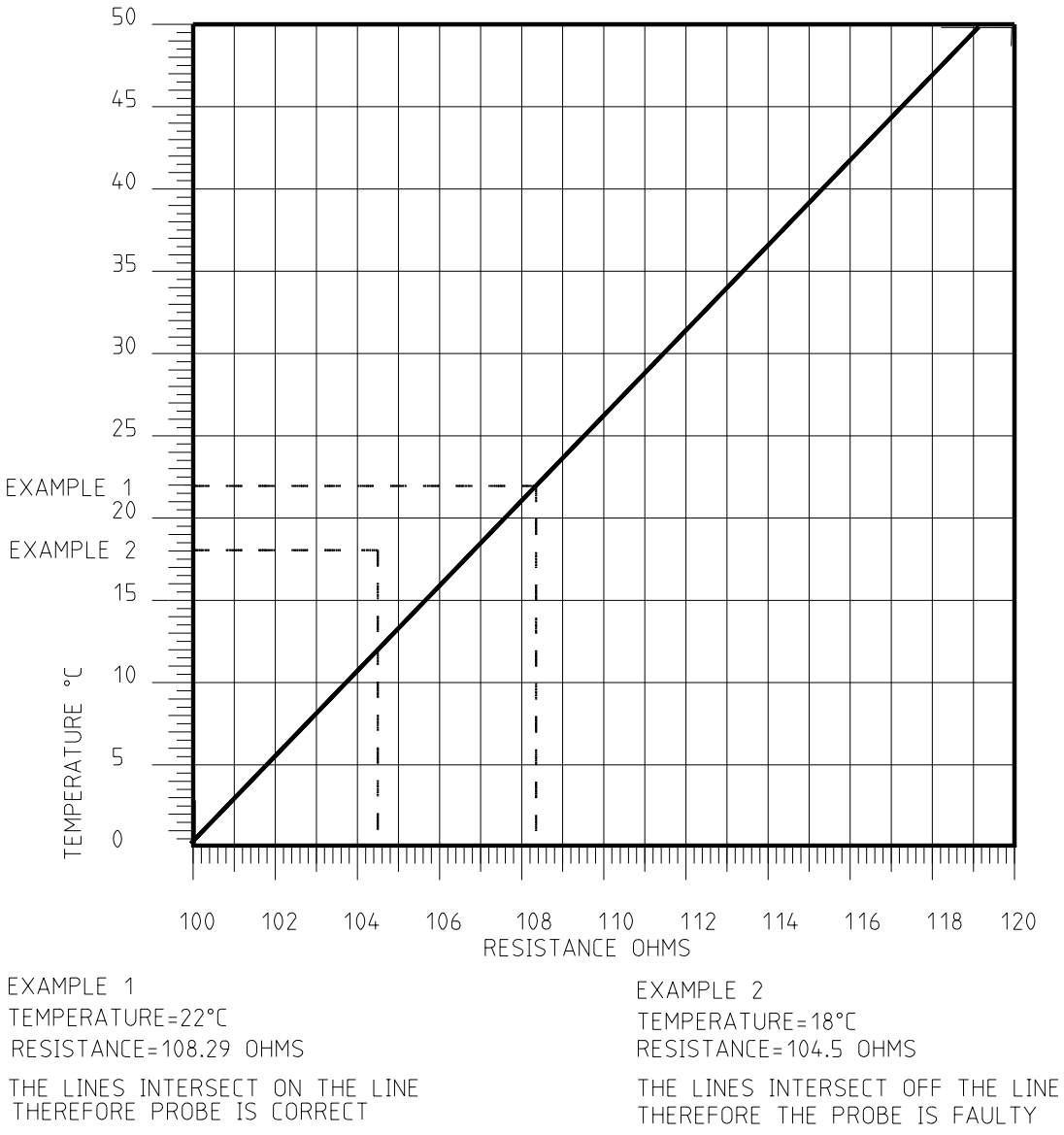
6.1 Testing the accuracy and functionality of any given probe.

1. Remove the plug from the rear of the EMH500.
2. With a resistance meter (multimeter set to ohms and properly zeroed), measure the resistance between pins N and P on the plug. *(Do not put the meter across any pins in the socket of the register nor any wires while the plug is connected as this could damage the register!).*
3. Record this measurement.
4. Determine the temperature of the probe by using a thermometer to measure the probes environment, i.e. if the probe is immersed in a liquid, measure the temperature of the liquid.
5. Record this result.
6. Using the graph on the following page (5.4), draw a vertical line from the horizontal axis using the value from step 3.
7. Draw a horizontal line from the vertical axis using the value from step 5.
8. If the two lines intersect on the line, the probe is reading correctly and its accuracy can be derived from its deviation from the nominal value. If the lines do not intersect on the line, repeat the test and check your calculations. If the reading is confirmed to be off the line, the probe or its writing are faulty.

Note:

- If voltage of power supply to EJB101 is low, the first effect (before register shutdown) is on the temperature reading accuracy.
- It is essential that supply voltage to the EJB101 is 11 volt minimum.
- It is also essential that the voltage supply to the EMH500 register (normally 9.0V) never reduces below 8.7 volt.
- If either of these voltages reads low, do not attempt to calibrate the temperature probe as it will be subject to drift. Ensure the battery is charged and the power supply point to register system is not itself subject to a prior voltage drop.
- All EMH500 temperature circuits are pre-calibrated and tested during assembly and should not require any further adjustment.

6.2 Temperature Accuracy Graph



Temperature Vs Probe Resistance Graph

6.3 Temperature Reading Calibration

The EMH500 assembly has been pre-calibrated in the factory to measure temperature correctly. However, when used in different wiring configurations with obscure lengths of cable (different to those supplied), the temperature reading may need to be re-calibrated. The following procedure is used to re-calibrate the temperature reading.

1. Remove the EMH500 cover.
2. Power up the unit.
3. Immerse both the temperature probe and a reference thermometer probe into a single large container of water at room temperature. Allow these to site for at least 5 minutes, so that temperature equilibrium can be reached. Note: We recommend using a digital thermometer with a resolution of $0.1^{o}C$ or better.
4. On the EMH500, press CAL.
5. Press MODE once to reach MANAG?N with the cursor flashing on the N which indicates that this option can be changed by the user.
6. Toggle this to Y (for yes) by pressing TOTAL once.
7. Press STOP/START to accept this option.
8. Press MODE twice to display the current temperature reading.
9. Compare this reading with the reading on your reference thermometer.
10. The displayed temperature can be adjusted using a small flat screwdriver to **slowly** turn the potentiometer P301, located on the left hand edge of the main board.
11. When the displayed temperature matches that of your reference thermometer to at least one decimal place, secure the potentiometer screw by covering it with a small amount of paint, adhesive, silicone, etc.
12. Press CAL to return to delivery mode
13. Turn the power off.
14. Replace the EMH500 cover.

Note: Max turn of potentiometer is 25 turns representing approximately a temperature range of $16^{o}C$.

7. Output Pulse and Remote Displays

- The single output pulse used to drive an external counter is an open drain, active low signal, calibrated to 10 pulses/Litre, with the pulse width set to either 2 mSec or 0.2 mSec.

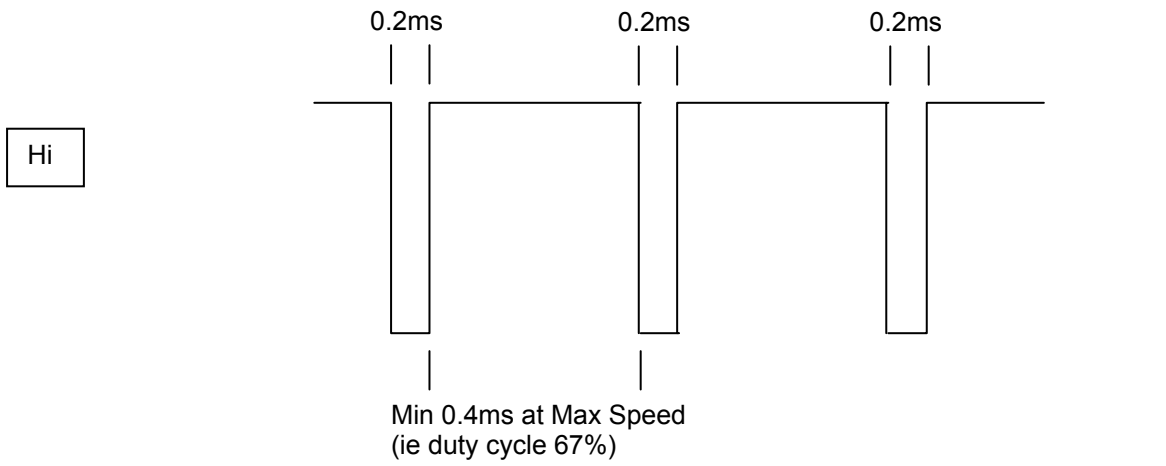
7.1 Remote Displays and other counting devices

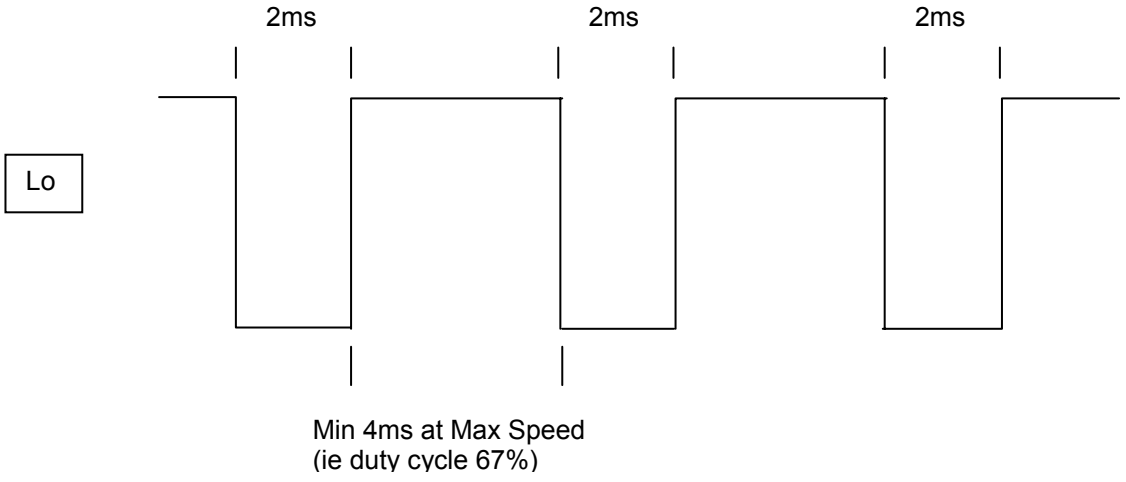
- Remote Displays allow the quantity of liquid dispensed, to be viewed at a location other than where the meter head is mounted. ie in the vehicles cabin or, in a highly visible external location.
- A pull up resistor (typically $10k\Omega$) is required, as the output pulse is an open drain, active low signal.
- The external reset can also be connected to the remote display or counting device so it is reset by the register

7.2 Pulse Output

This is an Open Drain, active-low output, signal calibrated to 10 pulses/litre, where the pulse width can be set up to either 2 ms or 0.2 ms.

EMH500 Setting - MANAG?N – P/O LO





Active Low Pulse

Low pulse fixed at 0. 2ms when setting low

High oulse fixed at 2ms when setting high

8. LC Meters & Speeds

Meter characteristics are as follows;

	US Gallons		Litres	
	M5	**M7**	**M5**	**M7**
Max flow rate	60	100	228 l/m	380 l/m
Max RPM of main output shaft.	245	555	245	555
Revolutions per gallon	4.079	5.555	-	-
Revolutions per litre	-	-	1.0775	1.4674
Pulses per rev of pulser wheel.	150	150	150	150
K Factors (nominal)	612	833	162	220
If vertical drive used with 1:2 bevel gears then:-				
RPM of vertical shaft	122	278	122	278
K Factors (nominal)	306	416	81	110

The first eighty production units contained software version 01.01.10 with a K factor limit of 500. Therefore these required the mandatory fit of the LC bevel gear for a 1:2 speed reduction (small gear on meter main output shaft).

However as the reduction in accuracy by going to a K factor limit of 999.9999 is insignificant, software versions starting from 01.01.11 will have the higher K limit and will not require any change to any gearing.

8.1 Oilmeter/Avery Hardoll/Satam meters

	Litres	
	SBM75	**SBM150**
Max flow rate l/min	500	1500
Max RPM of main output shaft.	300	430
Revolutions per litre	0.6	0.287
Pulses per rev of pulser wheel.	150	150
K factor (nominal) (from 150 pulses X (revs/min / litres/min)	90	43

8.2 Neptune Meters.

These meters do not have calibrators in the drive line and the EMH500 simply replaces the Neptune register.

8.3 Turbine Meters

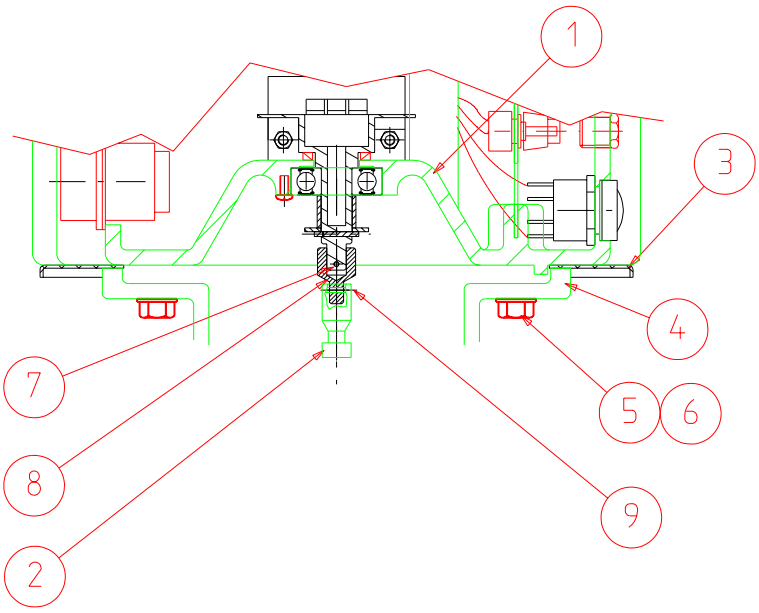
Electrical compatibility of EMH500 with the turbine meter depends on the type of proximity sensor used in it. If it sends out electrical signal of amplitude from 0V to at least +4V with square or sine shape, no interface is necessary and the user must only remember about selecting the “single pulse input” in the calibration menu of the register.
If the signal from the proximity switch is not amplified, a special interface (amplifier) is required for the register. Using standard turbine meter (with k-factor 224.30 P/L) at the maximum flow rate of 250LPM we get frequency of pulses: 250x224.3/60 = 934.6Hz. This is well below the limit for the EMH500 register, which can work up to 2500Hz.

9. EMH500 and Pulsar Mounting Kit Diagrams

LIQUIP

TOP MOUNT TO LC METER WITH CALIBRATOR

PART No: 6310



ITEM	PART NO	DESCRIPTION	QTY	MATERIAL
1	EMH500	REGISTER		-
2	2169	DRIVE - LC METER	1	Z/P M/S
3	EPM200-2	WEATHER PLATE	1	AL
4	-	METER		-
5	4992	SETSCREW		Z/P M/S
6	0107	WASHER SPRING		Z/P M/S
7	0759	COTTER PIN		Z/P M/S
8	EMH300-10	ADAPTOR DRIVE		AL
9	2042	SELOX PIN		Z/P M/S
10				AL
11				

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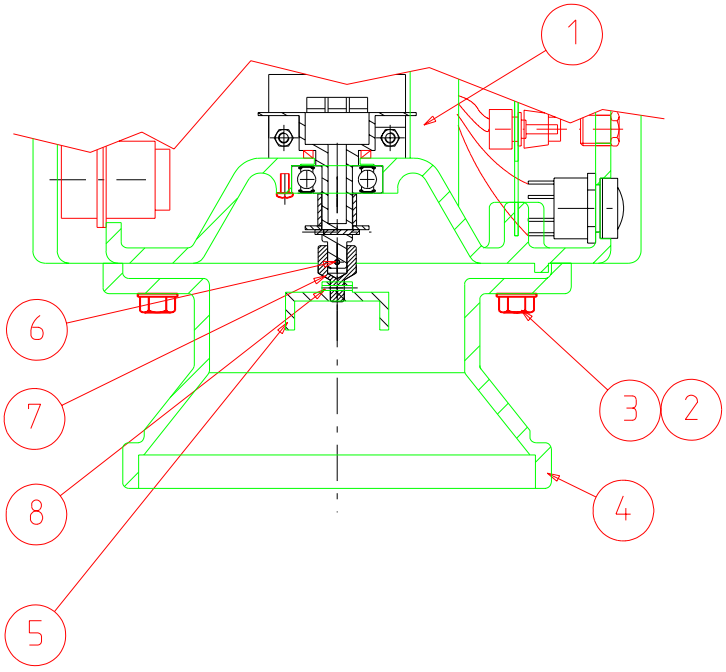
LIQUIP

TOP MOUNT TO NEPTUNE METER

PART No: 6311



ITEM	PART NO	DESCRIPTION	EMH500	MATERIAL
1	EMH500	REGISTER		-
2	0107	WASHER SPRING		Z/P M/S
3	4992	SETSCREW		Z/P M/S
4	EMH200-5	ADAPTOR BRACKET - NEPTUNE	1	AL
5	1696	DRIVE - NEPTUNE	1	AL
6	0759	COTTER PIN		Z/P M/S
7	EMH300-10	ADPTOR DRIVE		AL
8	2042	SELOX PIN		Z/P M/S
9				
10				

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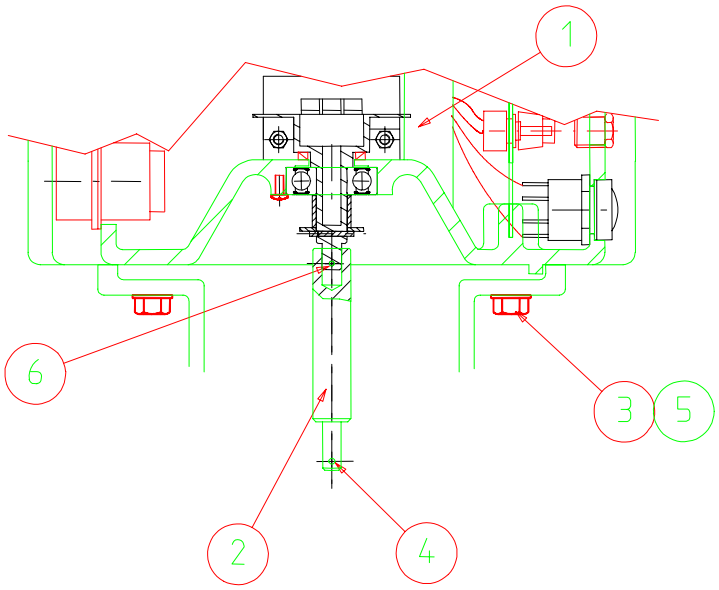
LIQUIP

TOP MOUNT TO SBM METER

PART No: 6312



ITEM	PART NO	DESCRIPTION	EMH500	MATERIAL
1	EMH500	ELECTRONIC REGISTER		-
2	5243	DRIVE - SBM	1	S/S
3	4992	SETSCREW		Z/P M/S
4	2610	SELOX PIN	1	Z/P M/S
5	0107	WASHER SPRING		Z/P M/S
6	0759	COTTER PIN		Z/P M/S

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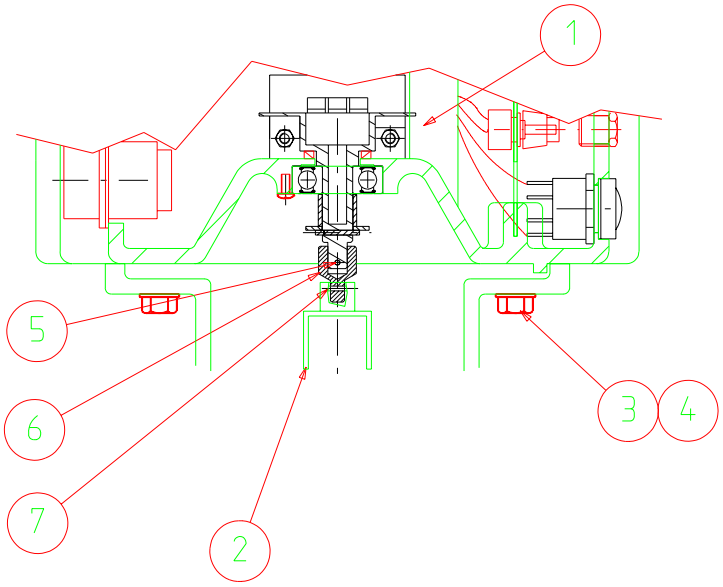
LIQUIP

TOP MOUNT TO SMITH METERS

PART No: 6313



ITEM	PART NO	DESCRIPTION	EMH500	MATERIAL
1	EMH500	ELECTRONIC REGISTER		-
2	-	DRIVE - SMITH (VEEDER ROOT 68845-005)	1	Z/P M/S
3	4992	SETSCREW		Z/P M/S
4	0107	WASHER SPRING		Z/P M/S
5	0759	COTTER PIN		Z/P M/S
6	EMH300-10	ADAPTOR DRIVE		AL
7	2042	SELOX PIN		Z/P M/S
8				
9				
10				

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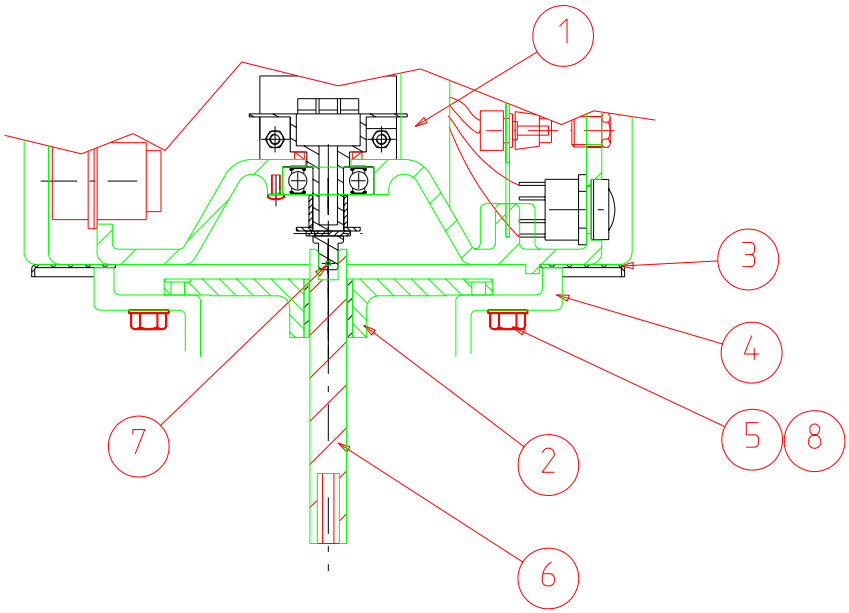
LIQUIP

EMH500-6 METER KIT
TOP MOUNT TO LC METER - NO CALIBRATOR

PART No: 6314



TO SUIT LC METER WITH HEXAGON DRIVE

ITEM	PART NO	DESCRIPTION	EMH500-6	MATERIAL
1	EMH500	ELECTRONIC REGISTER		-
2	EMH500-5	ADAPTOR BRACKET WITH BUSH EMH500-6	1	AL
3	EPM200-2	WEATHER PLATE	1	AL
4	-	METER		-
5	4992	SETSCREW 1/4" UNF X 1" LG		Z/P M/S
6	EMH500-7	SHAFT DRIVE	1	NYLON
7	0759	COTTER PIN	1	Z/P M/S
8	0107	WASHER SPRING 1/4"		Z/P M/S
9				
10				

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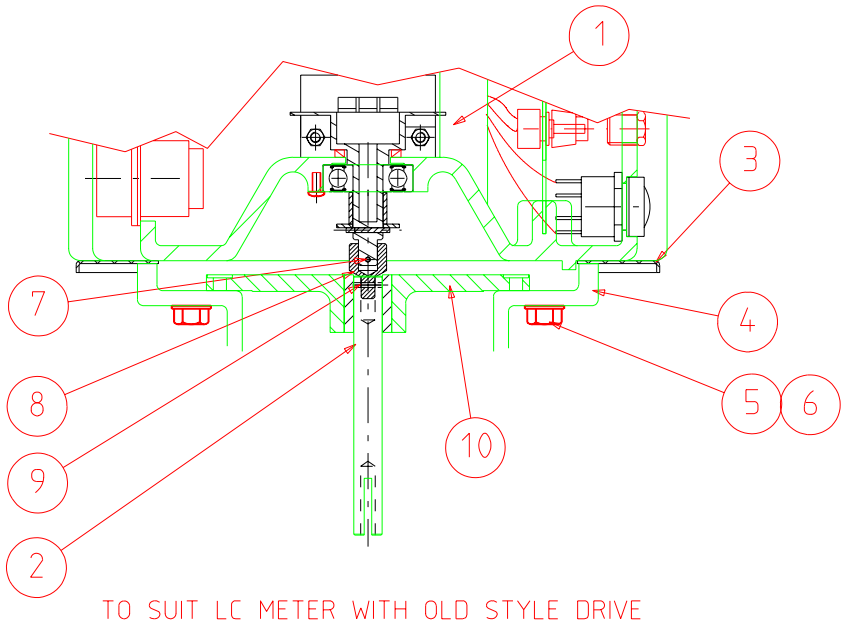
LIQUIP

EMH400-21 METER KIT
TOP MOUNT TO LC METER - NO CALIBRATOR

PART No: 6315



TO SUIT LC METER WITH OLD STYLE DRIVE

ITEM	PART NO	DESCRIPTION	EMH400-21	MATERIAL
1	EMH500	ELECTRONIC REGISTER		-
2	EMH400-23	SHAFT	1	S/S
3	EPM200-2	WEATHER PLATE	1	AL
4	-	METER		-
5	4992	SETSCREW		Z/P M/S
6	0107	WASHER SPRING		Z/P M/S
7	0759	COTTER PIN	1	Z/P M/S
8	EMH300-10	ADAPTOR DRIVE		AL
9	2042	SELOX PIN		Z/P M/S
10	EMH400-22	ADAPTOR INCLUDING 2281 BUSH	1	AL
11				
12				

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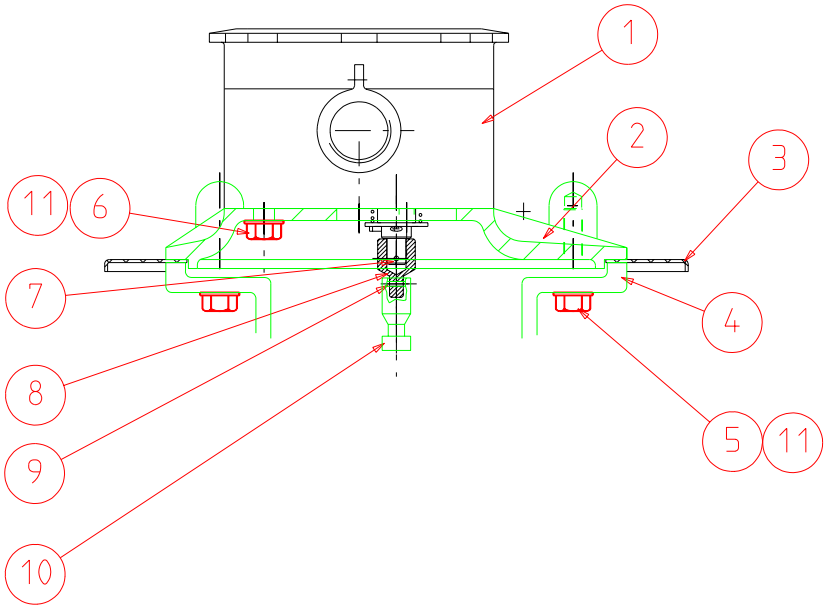
LIQUIP

EPM200-4 METER KIT
FOR ELECTRONIC REMOTE PULSER
TO TOP MOUNT TO LC METER WITH CALIBRATOR

PART No: 6316



ITEM	PART NO	DESCRIPTION	EPM200-4	MATERIAL
1	ERP100	ELECTRONIC REMOTE PULSER	-	-
2	EPM200-1	ADAPTOR BRACKET TOP MOUNT	1	AL
3	EPM200-2	WEATHER PLATE	1	AL
4	-	METER	-	-
5	4992	SETSCREW	4	Z/P M/S
6	4984	SETSCREW	3	Z/P M/S
7	0759	COTTER PIN	1	Z/P M/S
8	EMH300-10	ADAPTOR DRIVE	1	AL
9	2042	SELOX PIN	1	Z/P M/S
10	2169	DRIVE - LC METER	1	AL
11	0107	WASHER SPRING	7	Z/P M/S

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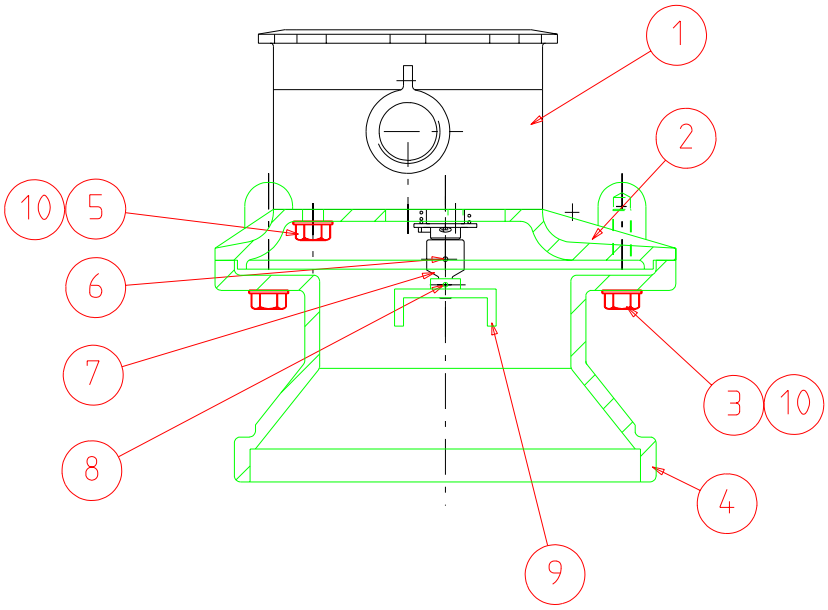
LIQUIP

EPM200-3 METER KIT
FOR ELECTRONIC REMOTE PULSER
TO TOP MOUNT TO NEPTUNE METER

PART No: 6317



ITEM	PART NO	DESCRIPTION	EPM200-3	MATERIAL
1	ERP100	ELECTRONIC REMOTE PULSER	-	-
2	EPM200-1	BRACKET - TOP MOUNT	1	AL
3	4992	SETSCREW	4	Z/P M/S
4	EMH200-5	ADAPTOR BRACKET - NEPTUNE	1	AL
5	4984	SETSCREW	3	Z/P M/S
6	0759	COTTER PIN	1	Z/P M/S
7	EMH300-10	ADPTOR DRIVE	1	AL
8	2042	SELOX PIN	1	Z/P M/S
9	1696	DRIVE - NEPTUNE	1	AL
10	0107	WAHER SPRING	7	Z/P M/S

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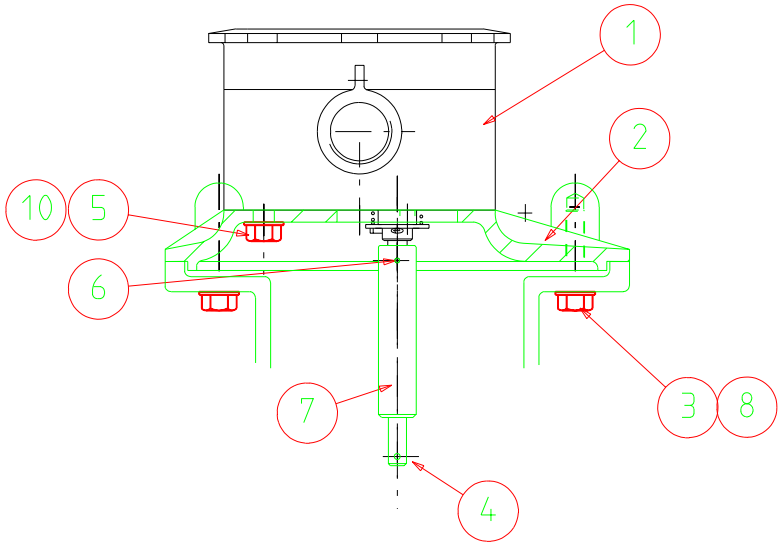
LIQUIP

EPM200-5 METER KIT
FOR ELECTRONIC REMOTE PULSER
TO TOP MOUNT TO SBM METERS

PART No: 6318



ITEM	PART NO	DESCRIPTION	EPM200-5	MATERIAL
1	ERP100	ELECTRONIC REMOTE PULSER	1	-
2	EPM200-1	ADAPTOR BRACKET - TOP MOUNT	1	AL
3	4992	SETSCREW	4	Z/P M/S
4	2610	SELOX PIN	1	Z/P M/S
5	4984	SETSCREW	3	Z/P M/S
6	0759	COTTER PIN	1	Z/P M/S
7	5243	DRIVE - SBM	1	S/S
8	0107	WASHER SPRING	7	Z/P M/S

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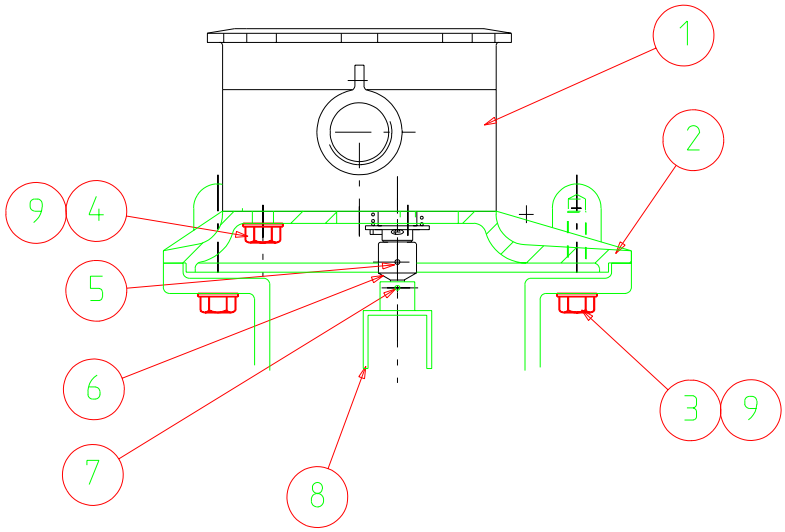
LIQUIP

EPM200-6 METER KIT
FOR ELECTRONIC REMOTE PULSER
TO TOP MOUNT TO SMITH METERS

PART No: 6319



ITEM	PART NO	DESCRIPTION	EPM200-6	MATERIAL
1	ERP100	ELECTRONIC REMOTE PULSER	-	-
2	EPM200-1	ADAPTOR BRACKET TOP MOUNT	1	AL
3	4992	SETSCREW	4	Z/P M/S
4	4984	SETSCREW	3	Z/P M/S
5	0759	COTTER PIN	1	Z/P M/S
6	EMH300-10	ADAPTOR DRIVE	1	AL
7	2042	SELOX PIN	1	Z/P M/S
8	-	DRIVE - SMITH (VEEDER ROOT 68845-005)	1	Z/P M/S
9	0107	WASHER SPRING	7	Z/P M/S
10				

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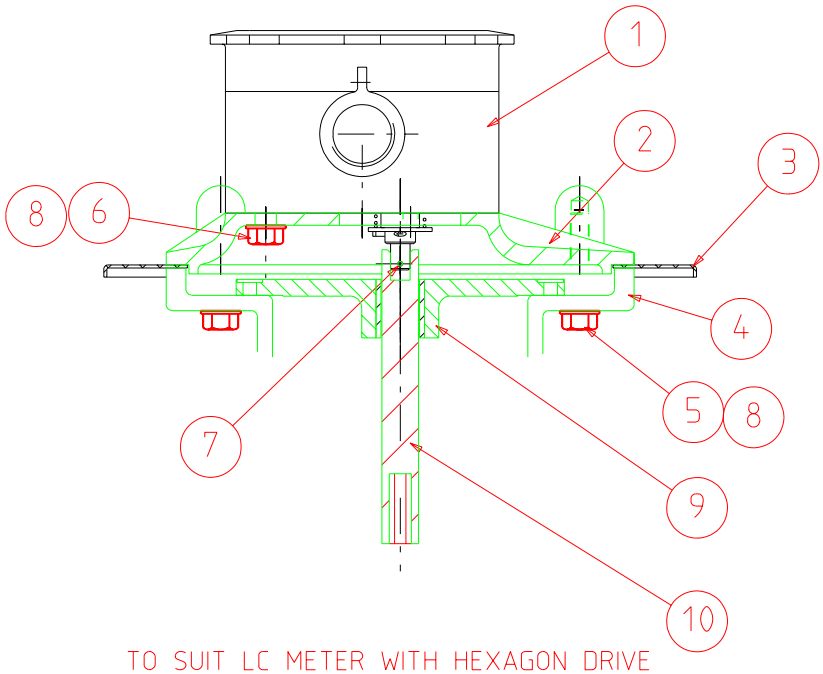
LIQUIP

EPM200-9 METER KIT
FOR ELECTRONIC REMOTE PULSER
TO TOP MOUNT TO LC METERS WITH NO CALIBRATOR

PART No: 6320



TO SUIT LC METER WITH HEXAGON DRIVE

ITEM	PART NO	DESCRIPTION	EPM200-9	MATERIAL
1	ERP100	ELECTRONIC REMOTE PULSER		-
2	EPM200-1	ADAPTOR BRACKET TOP MOUNT	1	AL
3	EPM200-2	WEATHER PLATE	1	AL
4	-	METER		-
5	4992	SETSCREW	4	Z/P M/S
6	4984	SETSCREW	3	Z/P M/S
7	0759	COTTER PIN	1	Z/P M/S
8	0107	WASHER SPRING	7	Z/P M/S
9	EMH500-5	ADAPTOR BRACKET	1	AL
10	EMH500-7	SHAFT DRIVE	1	NYLON

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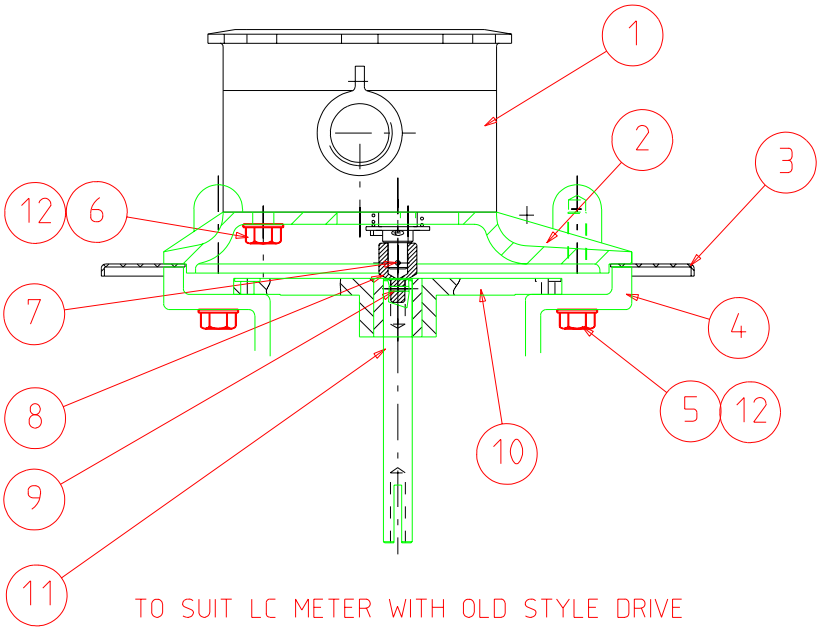
LIQUIP

EPM200-7 METER KIT
FOR ELECTRONIC REMOTE PULSER
TO TOP MOUNT TO LC METERS WITH NO CALIBRATOR

PART No: 6321



TO SUIT LC METER WITH OLD STYLE DRIVE

ITEM	PART NO	DESCRIPTION	EPM200-7	MATERIAL
1	ERP100	ELECTRONIC REMOTE PULSER	-	-
2	EPM200-1	ADAPTOR BRACKET TOP MOUNT	1	AL
3	EPM200-2	WEATHER PLATE	1	AL
4	-	METER		-
5	4992	SETSCREW	4	Z/P M/S
6	4984	SETSCREW	3	Z/P M/S
7	0759	COTTER PIN	1	Z/P M/S
8	EMH300-10	ADAPTOR DRIVE	1	AL
9	2042	SELOX PIN	1	Z/P M/S
10	EMH400-22	ADAPTOR BRACKET	1	AL
11	EMH400-23	SHAFT	1	S/S
12	0107	WASHER SPRING	7	Z/P M/S

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METERS VALVES VENTS MANHOLES PUMPS HOSEREELS OVERFILL PROTECTION

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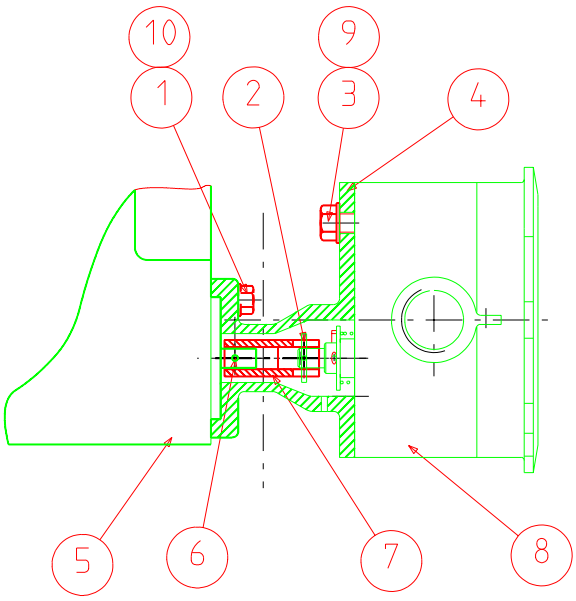
LIQUIP

EPM100-3 METER KIT TO DIRECT MOUNT TO LC METER

PART No: 6322



ITEM	PART NO	DESCRIPTION	EPM100-3	MATERIAL
1	0755	SETSCREW	2	Z/P M/S
2	4850	SELOX PIN	1	Z/P M/S
3	4984	SETSCREW	3	Z/P M/S
4	EPM100-1	ADAPTOR BRACKET - DIRECT MOUNT	1	AL
5	-	METER	-	-
6	2610	SELOX PIN	1	Z/P M/S
7	EPM100-2	DRIVE DOG	1	AL
8	ERP100	ELECTRONIC REMOTE PULSER	-	-
9	0107	WASHER SPRING	3	Z/P M/S
10	0326	WASHER SPRING	2	Z/P M/S

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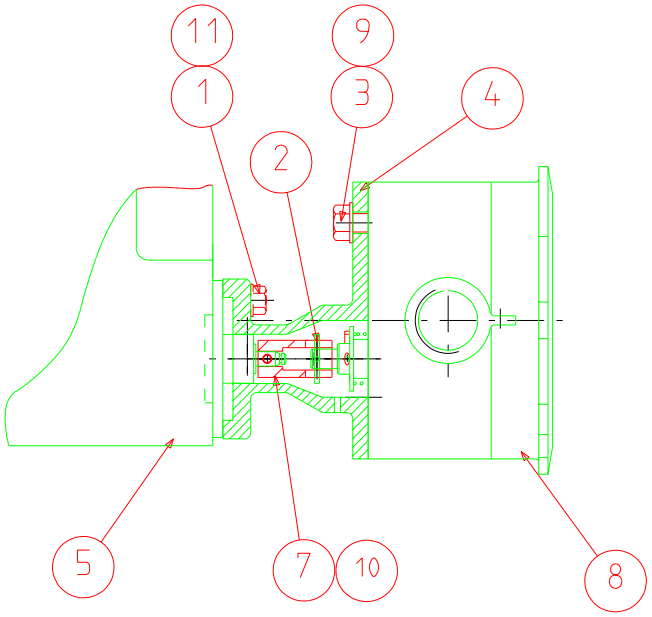
LIQUIP

EPM100-6 METER KIT TO DIRECT MOUNT TO LC METER

PART No: 6355



ITEM	PART NO	DESCRIPTION	EPM100-6	MATERIAL
1	0755	SETSCREW	2	Z/P M/S
2	4850	SELOX PIN	1	Z/P M/S
3	4984	SETSCREW	3	Z/P M/S
4	EPM100-1	ADAPTOR BRACKET - DIRECT MOUNT	1	AL
5	-	METER	-	-
6	2610	SELOX PIN	1	Z/P M/S
7	EPM100-5	DRIVE DOG - NEW LC METERS	1	AL
8	ERP100	ELECTRONIC REMOTE PULSER	-	-
9	0107	WASHER SPRING	3	Z/P M/S
10	6472	GRUB SCREW M3 X 5LG	1	M/S
11	0326	WASHER SPRING	2	Z/P M/S

NOTE:
THIS KIT IS FOR THE NEW STYLE LC METERS. REFER TO KIT EPM100-3 FOE OLD STYLE METERS.

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METERS VALVES VENTS MANHOLES PUMPS HOSEREELS OVERFILL PROTECTION

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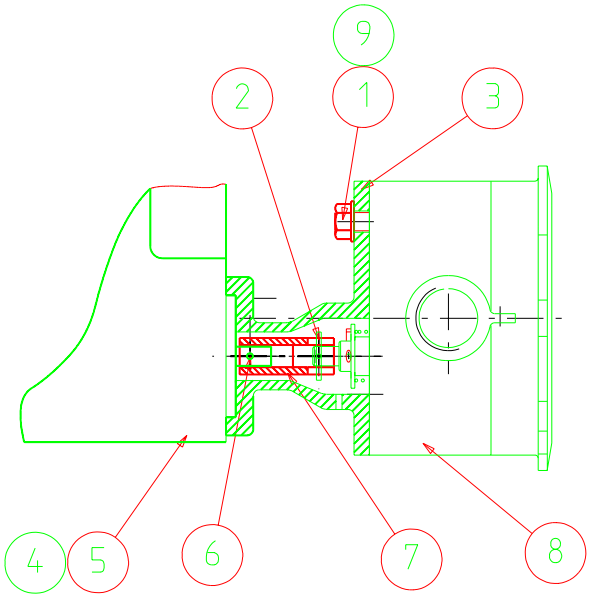
LIQUIP

EPM100-4 METER KIT FOR DIRECT MOUNT TO SBM METERS

PART No: 6323



ITEM	PART NO	DESCRIPTION	EPM100-4	MATERIAL
1	4984	SETSCREW	3	Z/P M/S
2	4850	SELOX PIN	1	Z/P M/S
3	EPM100-1	ADAPTOR BRACKET - DIRECT MOUNT	1	AL
4	-	SETSCREW	2	Z/P M/S
5	-	METER	-	-
6	2610	SELOX PIN	1	Z/P M/S
7	EPM100-2	DRIVE DOG	1	AL
8	ERP100	ELECTRONIC REMOTE PULSER	-	-
9	0107	WASHER SPRING	3	Z/P M/S
10				

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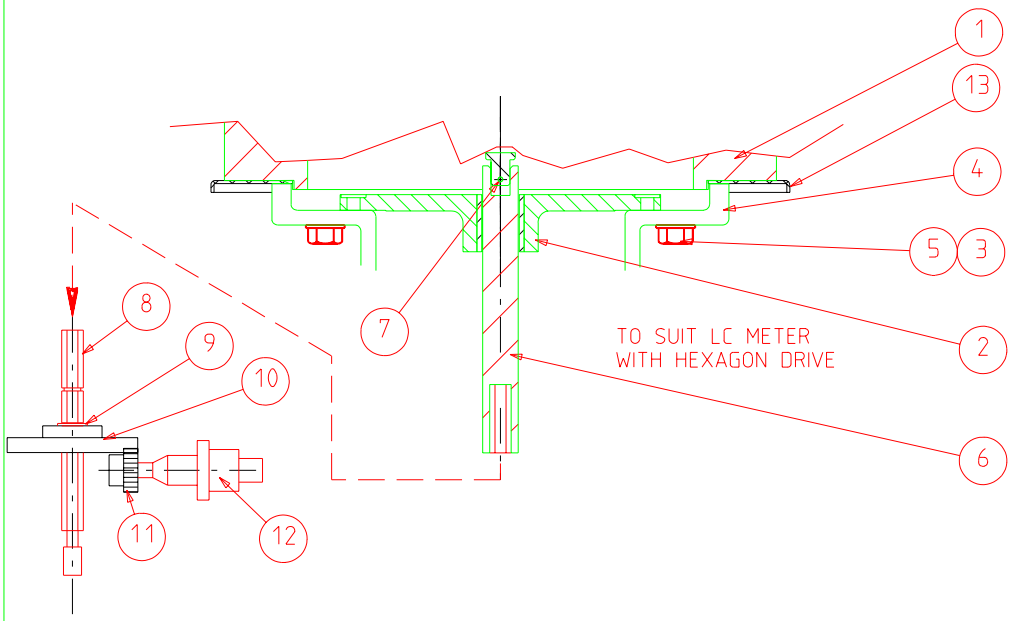
LIQUIP

TOP MOUNT TO LC METER - NO CALIBRATOR



THE EMH400 SERIES 2 CAN ONLY BE MOUNTED TO M5, M30, M60, MS30, MS75 AND MS120 METERS. WHEN MOUNTING TO THE ABOVE METERS, THE EMH400 SERIES 2 REQUIRES A 2:1 RATIO TO REDUCE THE SPEED GOING INTO THE REGISTER.

LC M5 METERS COME STANDARD WITH A 2:1 RATIO, USING THE 12 TOOTH PINION. (NO CHANGE REQUIRED).

HOWEVER, MANY OF THE OTHER UNITS HAVE A 1:1 RATIO. THERFORE THE 24 TOOTH PINION WILL HAVE TO BE REPLACED WITH A 12 TOOTH PINION.

WHEN CHANGING FROM A 24 TOOTH PINION, THE ADJUSTER DRIVE SHAFT GEAR AND E-CLIP IS REQUIRED TO BE MOVED FROM THE UPPER GROOVE TO THE LOWER GROOVE ON THE ADJUSTER DRIVE SHAFT.

ITEM	PART NO	DESCRIPTION	QTY	MATERIAL
1	EMH500	ELECTRONIC REGISTER		-
2	EMH500-5	ADAPTOR BRACKET WITH BUSH EMH500-6	1	AL
3	0107	WASHER SPRING		Z/P M/S
4	-	METER		-
5	4992	SETSCREW		Z/P M/S
6	EMH500-7	SHAFT DRIVE	1	NYLON
7	0759	COTTER PIN	1	Z/P M/S
8	2559	ADJUSTER DRIVE SHAFT		
9		E-CLIP		
10	2562	ADJUSTER DRIVE SHAFT GEAR (24 TOOTH)		
11	2566	PINION (12 TOOTH)		
12	2560	PACKING GLAND ASSEMBLY		
13	EPM200-2	WEATHER PLATE	1	AL

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