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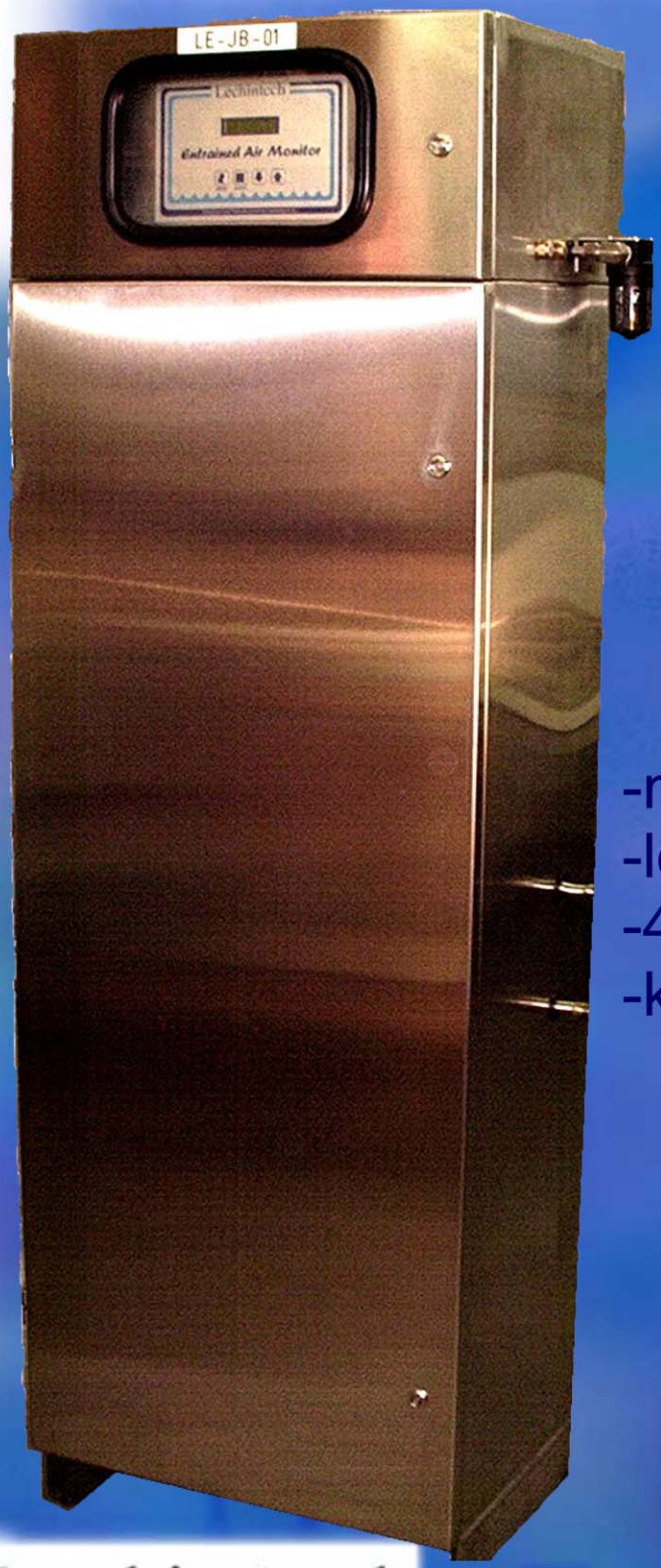

-monitors headbox stock
-local reading of air content
-4-20mA scalable output
-keypad calibration

Entrained Air Monitor

Lechintech
ION CHARGE ANALYSERS
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CONTENTS

LECHINTECH ENTRAINED AIR MONITOR

SYSTEM OVERVIEW

The Lechintech Entrained Air Monitor is a measuring device to determine the amount of air in a headbox sample from a paper machine, or thick stock from the pulp process. The device has a sample inlet, a flush water port and a discharge port. The control of the device is done from the local microprocessor and electronics interface housed in the upper enclosure of the device cabinet. The valves are double acting pneumatically operated ball valves.

A sample is drawn from the stock approach flow line or headbox sample point via the sample inlet valve. At this time, the discharge port is open, allowing the hydraulic cylinder temperature to approach the sample temperature, and also ensuring that the cylinder is completely full of sample prior to shutting the inlet valve. After a short delay, the discharge port valve closes and the sample is compressed. The linear displacement of the pneumatic cylinder ram, which is coupled to the hydraulic cylinder piston, is measured, and hence the entrained air volume can be determined.

Once the test has been completed, the pressure to the pneumatic cylinder is released, as is the hydraulic cylinder pressure. Once the ram is at rest, and the pressure completely relieved, the discharge port valve is opened, as is the flush water valve. The flush water runs for a specified time cleaning out the sample cylinder and discharging the contents to the wire pit or fibre recovery system. When the flush cycle is completed, the valves are closed and the system waits in readiness for the next measuring cycle.

The unit requires an interlock to suspend testing when there are no samples available from the process. Each time a result is registered by the unit, the 4-20mA output is updated and a scaled value can be recorded accordingly. The test result is also displayed locally on the LCD display. Should a fault occur, this will be indicated on the LCD display, and a potential free contact will be activated, which can be connected to the DCS or other warning device to alert the operator.

Entrained Air Monitor

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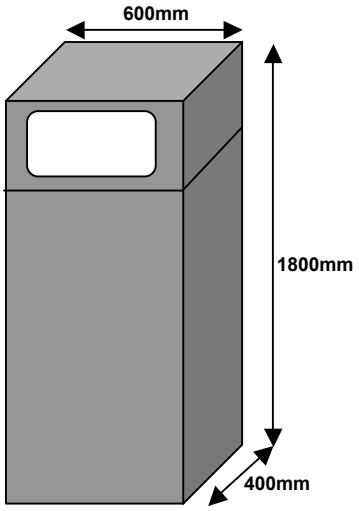


Technical data — Entrained Air Monitor

operating modes	Run, Hold, Stop and Fault
measuring sensors	0-10bar analogue pressure sensor
	55mm displacement linear pot - IP65
sample volume	approximatly 1000 ml
	Actual volume measured and set for each unit
standard flow ratings	Sample - headbox pressure @ 20 l/min
	Flush Water- 20 l/min @ 2bar < press < 5bar
	Drain - accommodates sample and flush, with the
	discharge to the wire pit or recovery system
reading frequency	Cycle times selectable for operational conditions
	with average cycle time being three minutes
	Delay between subsequent samples adjustable between
	zero and 256 minutes (default = 5min)
instrument alarms	LCD local display FAULT
	digital output - potential free contact (250 VAC 1 A)
Output	linear scaled 4-20mA output set to selected range
	Range adjustable from 1% to 10%
Output load	500 ohms max
Output resolution	12 bit (0 to 4095 counts)
Input	Digital input for hold function - sensor powered
calibration	Sensor cylinder volume set at workshop
	Linear pot calibrated for counts/micron
	Pressure sensor zero and mA set on deadweight tester
accuracy	Of full scale range: +-1%
repeatability	+- 1% or less
temperature limits	5 °C min 80 °C max
sample consistency	not greater than 4%
pH range for operation	3 - 12 pH
Mains supply (specify at time of order)	220 VAC **OR** 110 VAC 50Hz - 60Hz -12 VA
air supply	> 5 bar instrument quality air
test sign	pending
housing	Stainless Steel cabinet - IP 55
wetted parts	stainless steel, PVDF, PVC,Viton
dimensions of housing	W600 x H1800 x D400 mm
control box	W600x H300 x D450 mm
inlet/outlet	All connections 3/4" BSP
weight	< 100 Kg
guarantee period	1 year

Installation comments:

1. The device should be located as close to the sample point as possible.
2. If the device is located above or below the sample point,allow a time for the sample to flow of > 30 seconds before commencing test
3. Ensure adequate access area at the front and back of the panel to conduct maintenance.
4. The device base has M10 holes for securing the panel to the floor.
5. Multiple samples can be accommodated with certain modifications.

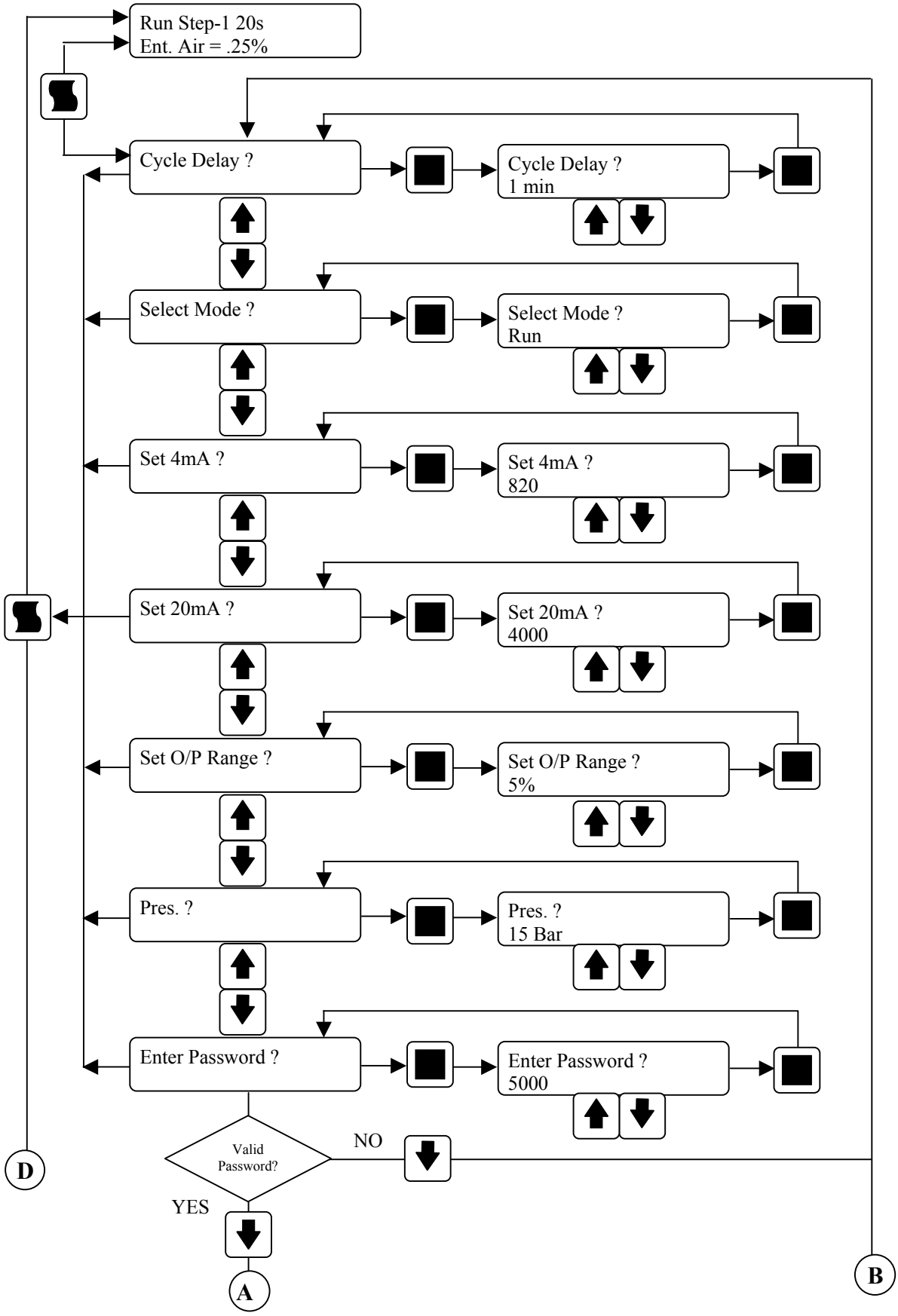
SYSTEM OPERATION

During the commissioning phase, all of the necessary parameters are set into the controller for the system operation. The menu structure, commissioning values, and system default settings are noted later in this manual for reference and assistance with adjustment. The operator needs only to check that the unit power is healthy, that there is sample available to the unit, flush water availability, that the instrument air pressure is greater than 5 bar, and that the drain flow is unrestricted. Fault conditions are displayed on the local LCD display, and must be remedied as per the instructions in the Trouble Shooting Guide in this manual. The unit has a fault output contact, which can be utilised for remote alarming or connection to the DCS.

When selected to RUN mode from the local keypad, the system will automatically continue to evaluate samples and display the results of the tests on the local display and relay this information to the DCS. Should the paper machine stop, or stock is removed from the wire, the system will automatically go into HOLD mode, once the interlock is made. In HOLD mode, the unit will complete the last test and then flush itself. It will wait in this state until the sample interlock is reset. In order for this HOLD feature to function, an interlock must be supplied from the DCS or directly from the machine chest pump contactor , and connected to the required terminals in the electronics enclosure (see wiring diagrams in the Drawings section of this manual). In addition to the local display value of entrained air, the unit has a scalable 4-20 mA output, which can be connected to the DCS or other recording device.

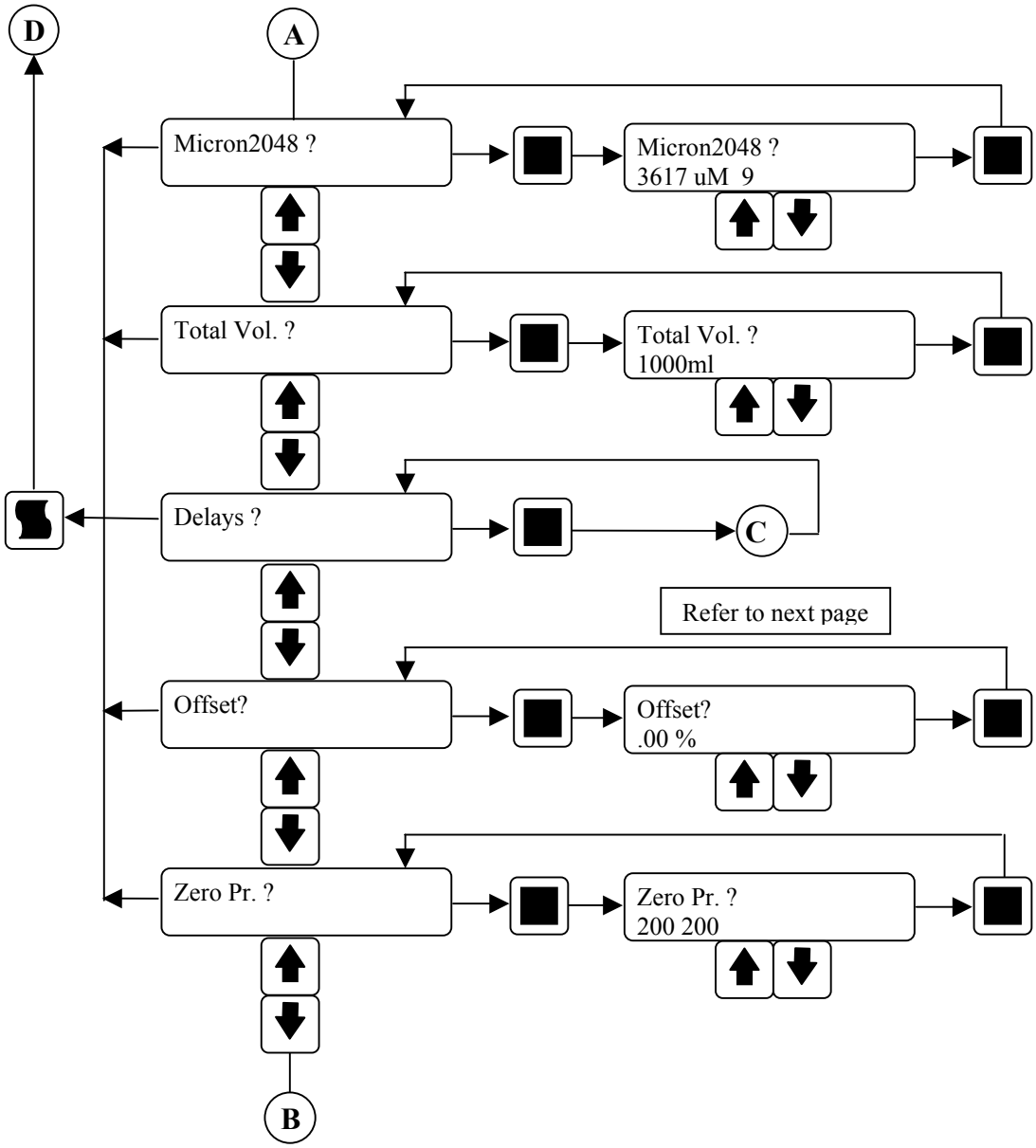
If multiple samples are to be considered, programming can be done in the DCS to accommodate this. At the time of order, a limit switch can be mounted on the sample inlet valve actuator, and will be wired to the terminal rail. When the valve opens, a signal will be relayed to the DCS to actuate the sample valve of the selected sample. When the EAM sample valve closes, the selected sample valve will then simultaneously close. The DCS programming can be structured to do consecutive samples in a fixed order, or selective sampling during trouble shooting sessions.

MENU NAVIGATION

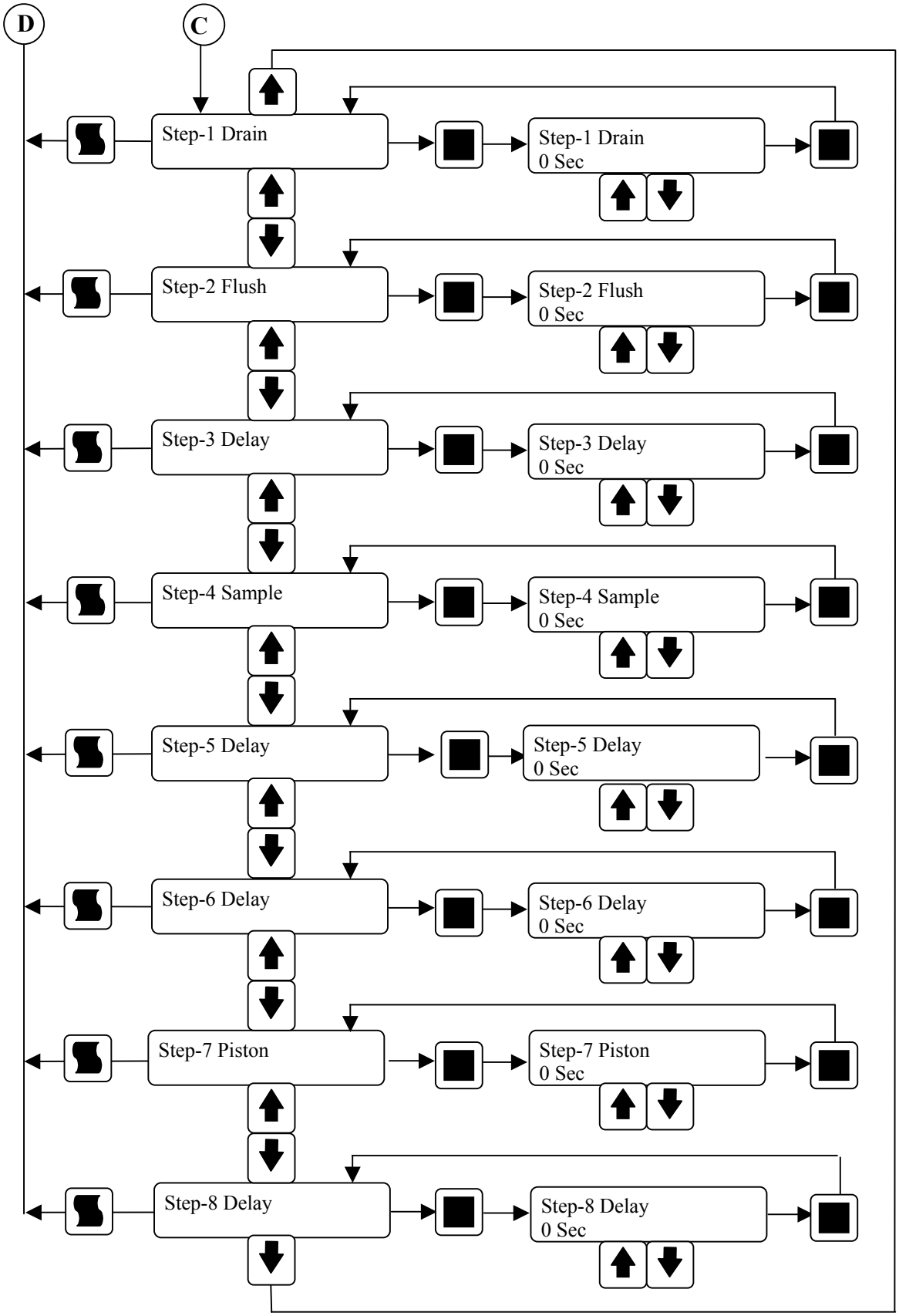


Password Protected Menu

Note that this part of the menu is only available if the correct password is entered into the required field. **The Default Password set at the factory is 5000**. Once the adjustments have been completed in this part of the menu, scroll through the menu until the "Enter Password" sub menu is reached. Enter an incorrect password value and then the enter key to activate the lockout feature for this menu, or else the menu will remain open for access. In the event that the password is changed and forgotten, contact Lechintech for the procedure to reinstate the default setting.



Delay Menu Navigation



Menu Table

Sub Menu Title	Description	Range/Options	Default	Units
Cycle Delay	Delay time between individual samples	0 to 250	5	Min.
Select Mode	Allows user to stop and start the unit.	Run Stop	Stop	N/A
Set 4mA	Used to calibrate the mA output. When entered the count on the display must be adjusted until the current reads 4 mA at the mA output.	200 to 1600	794	counts
Set 20mA	Used to calibrate the mA output. When entered the count on the display must be adjusted until the current reads 20 mA at the mA output.	3000 to 4095	3962	counts
Set O/P Range	Selects the range of the mA output.	1 to 10	5	%
Pres.	This value sets the pressure to which the EAM will compress the sample.	0 to 10	9	Bar
Enter Password	Allows user to enter a password. If the password is correct the display will read “Valid”, else “Invalid”.	0000 to 9999	5000	N/A

Password Protected Menu

Sub Menu Title	Description	Range/Options	Default	Units
Micron2048	Linear Pot. Calibration factor.	14 to 5000	3617	Micron
Total Vol.	Volume of sample chamber is entered here.	500 to 1500	1000	ml
Delays	This sub-menu controls the delays within each measurement cycle and is detailed on the following table.	N/A	N/A	N/A
Offset	Value entered here will be subtracted from the absolute measured value.	0 to 10	0	%
Zero Pr.	This value zeroes the pressure transmitter.	0 to 1023	200	counts

Delay Menu Table

Sub Menu Title	Description	Range/Options	Default	Units
Step-1 Drain	Delay after the Drain valve opens.	1 to 250	5	Sec
Step-2 Flush	Delay after the Flush valve opens.	1 to 250	20	Sec
Step-3 Delay	Delay after the Flush valve closes.	1 to 250	3	Sec
Step-4 Sample	Delay after the Sample valve opens.	1 to 250	30	Sec
Step-5 Delay	Delay after the Sample valve closes.	1 to 250	2	Sec
Step-6 Delay	Delay after the Drain valve closes.	1 to 250	1	Sec
Step-7 Piston	Time-out after Piston is activated.	1 to 250	120	Sec
Step-8 Delay	No-flow time-out.	1 to 250	30	Sec

TROUBLE SHOOTING GUIDE

1. When a fault occurs on the Entrained Air Monitor, the system will terminate the current step and initiate the flush sequence. When the flush sequence is complete, all of the valves will be closed, the pneumatic cylinder will be at rest position and the hydraulic cylinder will be full of flush water. The local display will indicate as follows:

> STOP STEP-1 DRAIN 0s
>
> System Failed! (flashing)

Before setting the system to RUN mode, check the following:

- Ensure that the sample point isolation valves are open, and that there is sample available at the unit.
- Ensure that the instrument air supply has not been isolated and that the operating pressure is greater than 5 bar.
- Ensure that the drain line is unrestricted.
- A loss of power would be indicated by no characters on the LCD display. If this is the case, call an electrician to confirm that the supply is healthy. If the supply is healthy, then further investigation is required by trained personnel.

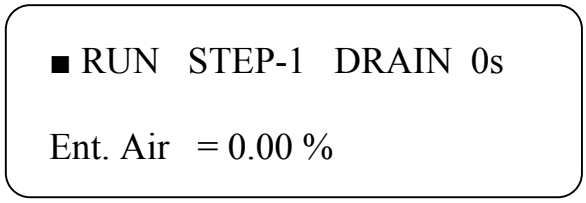
Once the above checks have been carried out and all services are confirmed to be functioning correctly, press the increment▼ and decrement▲ keys simultaneously to clear the fault condition. The unit will revert to its operational state prior to the fault condition. If the sample interlocks have been made in the interim, the system will go into HOLD mode.

The system fault is activated if the required switching pressure is not achieved in the hydraulic cylinder within the allocated time for that sequence step. Possible causes of the system fault:

a. Loss of air supply to the unit. Reinstate the air supply.
b. Burned out coil on the pilot actuation valve. Replace coil.
c. Fault with the pilot actuation valve. Repair or replace valve.
d. No sample, or insufficient sample in the hydraulic cylinder. Investigate the reason for the loss of sample to the unit and rectify.
e. Failure of one or more of the isolation valve seals. Investigate which valve is leaking and repair/replace as necessary.
f. Isolation valve actuation fault. Check the valve operation manually from the pilot valve and confirm that the valves are operating freely. Repair/replace the faulty pneumatic valve actuator if necessary.
g. Faulty or out of calibration pressure transmitter. Repair/replace as necessary.

Standard fault finding procedures will indicate the possible cause of the system failure, but qualified personnel should be utilised to rectify any faulty components and conditions.

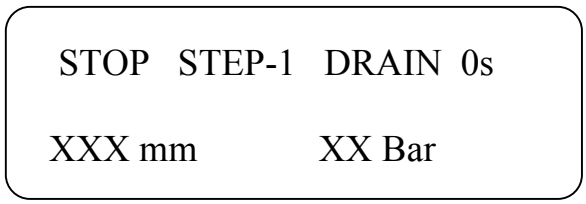
a. If the device is returning a zero result from the tests, the operator needs to make a local check of the LCD display to confirm if a DOT is being displayed in the top right hand corner of the display, as shown below:



If this is the case, check the OFFSET value in the password-protected portion of the menu, and return it to zero in order that the actual value can be displayed. If the value returned from the test is still zero, then the failure of the linear potentiometer could be the cause. Call the Lechintech service agent to investigate and repair the unit.

2. If the device is returning erratic readings, two possible reasons should be investigated:
   a. The restriction devices on the pneumatic cylinder my have been adjusted to allow for to rapid a movement of the piston. This must be rectified by restricting the airflow to and from the cylinder to allow for a movement of about 1mm per second.
   b. Leaking valve seals can cause erratic readings, depending on the extent of the damage to the seals, and the amount of fibre that gets jammed in the seal when the valve closes.

In order to test for the leaking of the seals, select the operating mode to STOP. Depress the enter ▐ and decrement ▼ keys simultaneously and the bottom line of the display will indicate the linear displacement of the pneumatic cylinder and the pressure in the hydraulic cylinder, as shown below:

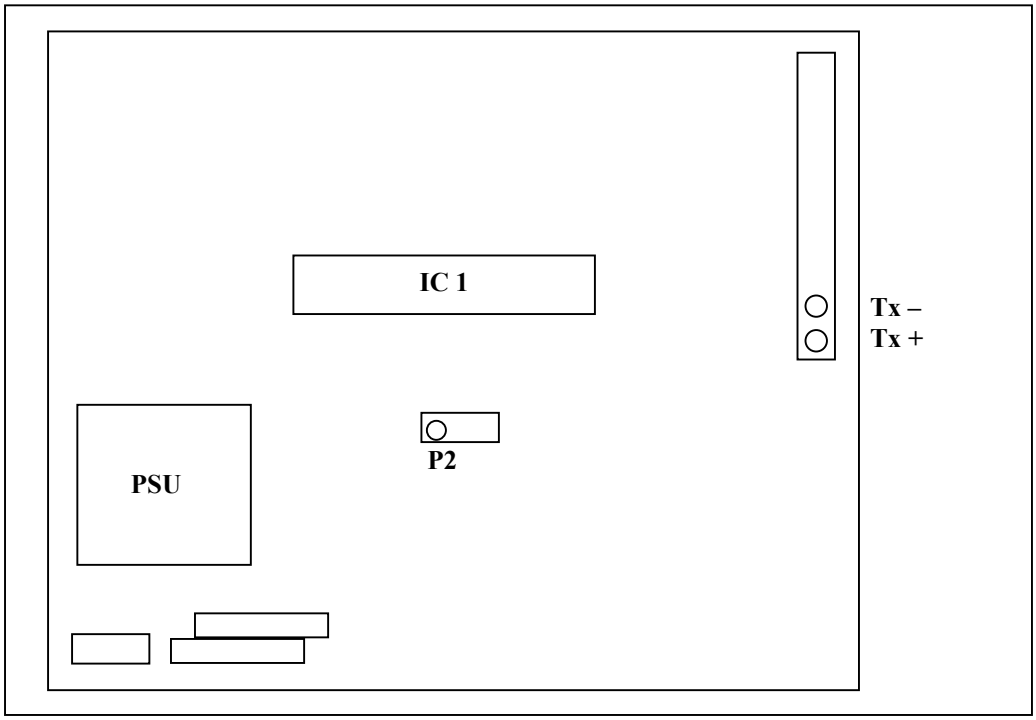


Now activate the pneumatic cylinder manual override screw on the pilot valve and then close the airflow adjustment screw on the pneumatic cylinder inlet port prior to the test cylinder reaching the 10bar upper limit. Note the values for the displacement and pressure. Leave the system in this condition for two minutes and then compare the readings at the start of the test and after the lapsed time. If there is little or no change then the condition of the seals is OK. Return the cylinder to the rest position by switching off the manual override. Adjust the air inlet screw on the pneumatic cylinder to ensure a smooth travel of about 1mm/sec. Return the unit to RUN mode.

Calibration of the Pressure Transmitter and Input

1. The pressure transmitter mA output needs to be calibrated using a dead weight tester. The electrical plug can be removed from the transmitter and then the adaptor ring removed to expose the zero and span adjusting screws.
   - 1.1 Attach the transmitter to the test device
   - 1.2 Connect the electrical plug to the transmitter connections and connect a mA meter in series with the voltage source and plug.
   - 1.3 Adjust the 4mA using the zero adjustment screw
   - 1.4 Adjust the test ring pressure to 10bar.
   - 1.5 Adjust the 20mA using the span adjustment screw

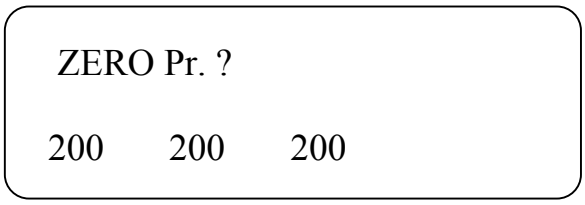
2. To set up the input to the electronics, connect a mA source to terminals 9(Tx+) and 10(Tx-) of the Entrained Air Monitor electronics board.
   - 2.1 Using the password-protected menu go to the sub menu Zero Pr. Adjust the mA source to read 20mA.
   - 2.2 In the centre of the electronics board is located the potentiometer P2. Adjust this pot until 1000 counts are displayed on the center set of figures on the unit LCD display. The third set of figures may be slightly variable.



ZERO Pr. ?

200 1000 1000

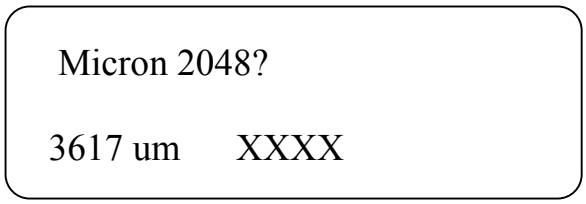
2.3 Adjust the mA source to a 4mA value. This value should give a reading of 200 counts on the second and third set of figures (the counts will be slightly variable). If there is a significant difference between the setting in the first set of figures and the second set of figures, using the keypad, adjust the value in the first set of figures to the actual counts displayed in the second set of figures (default value 200 counts).



The pressure transmitter and input are now calibrated.

Calibration of Linear Potentiometer

1. Set the gain of input amp such that the Linear Pot gives full-scale voltage at maximum travel. This voltage can be measured on the input of the A/D converter (pin 2 with reference to ground).
2. Extend the pot to approximately 25% of full stroke and record the value of the counts produced by the A/D converter and the distance in Micron. This is done by switching on the manual override on the pneumatic pilot valve and closing the airflow adjustment screw on the pneumatic drive cylinder inlet port when the shaft has extended from its rest position to 25% travel. Switch off the override on the pilot valve. Note that the A/D count can be viewed in the "Micron 2048" sub menu and that 1 Micron is taken to be a 100^{th} of a millimeter.
3. Now extend the pot to approximately 75% of its maximum stroke and record the counts from the LCD display and measure the distance traveled by the piston with a vernier caliper. This can be achieved by switching on the override of the pilot valve and allowing air to enter the pneumatic cylinder slowly by manipulating the airflow adjustment. When the correct distance is reached, close the airflow regulator and switch off the manual override.
4. Determine the difference in the two recorded values for both the counts and distance, and using these two figures calculate the ratio Microns per count. Now multiply this value by 2048 and enter the result into the "Micron 2048" sub menu using the keypad. The default value will be 3617 and the XXXX values will display the actual counts for the present potentiometer position.



DCS DETAIL

The Lechintech EAM is designed to accommodate a single sample stream, with all the necessary electronics and controls being local. The device has the following standard I/O:

- Analogue Output – Active 4-20mA scaled output with variable range selection from the menu. It is our recommendation that a loop isolator is installed between the EAM and the DCS input to prevent any current loop disturbances.
- Digital Input – HOLD function activation. A potential free contact must be supplied from the DCS to activate the input.
- Digital Output – Device fault output. The output is potential free contact rated at 220VAC 1Amp.

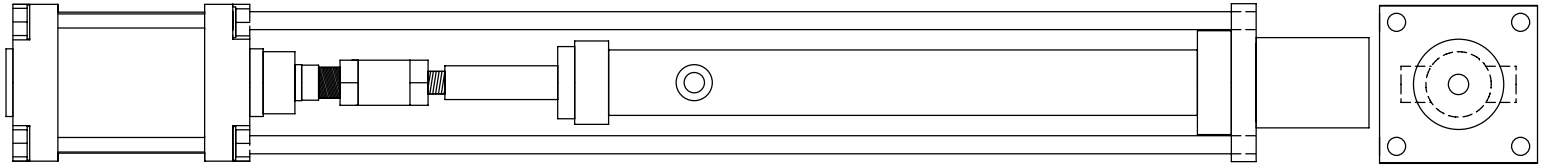
In order to accommodate the additional requirements of a modified system, the following change will have to be made:

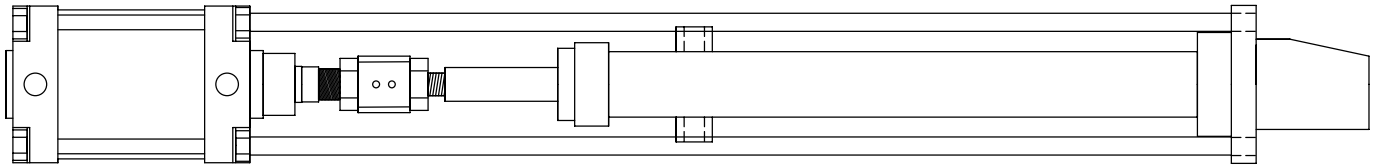
- Digital Output – Device sample valve status signal. The potential free contact on the actuator limit switch is connected to the DCS for open/closed valve status.

DCS programming requirements

- The sample valves need to be arranged in an operating matrix, such that either one or both of the samples will be tested in successive order. The operator changes these options from the DCS control page. When the EAM sample valve opens, the next sample in the sequence must be drawn from the allotted headbox by opening the corresponding valve. Prior to opening the sample valve, the test result of the last test must be allocated to the correct sample log. When the EAM sample valve closes, the external sample valve must close immediately.
- There is only one analogue output from the EAM. The DCS program must be structured such that the result is logged to the correct sample. This will entail the use on the single analogue input and two further analogue tags for the logging of the data for each sample. When the EAM sample valve status indicates the requirement for one of the external sample valves to actuate, the DCS must log the entrained air reading to the previous sample.
- As the paper machine never operates with only one ply, the stock on the wire signal can be derived from the bottom wire system for the HOLD function.
- The device fault output should be linked to the DCS alarming system, and be displayed as a Lechintech EAM general fault condition. The operators need to do local investigation for the cause of the alarm, and to reset the device alarm condition.
- In the event that more samples are required to be tested, the operating matrix for the sample valves will have to be modified accordingly.

SYSTEM DRAWINGS





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Combined Cylinder G.A.

Section

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Schedule No.

File Name

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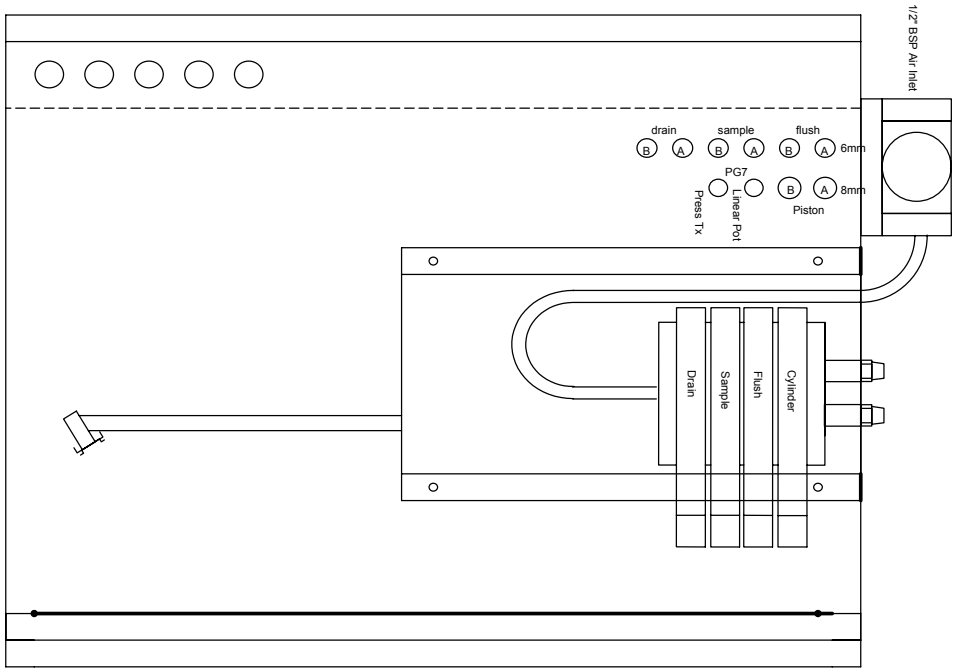
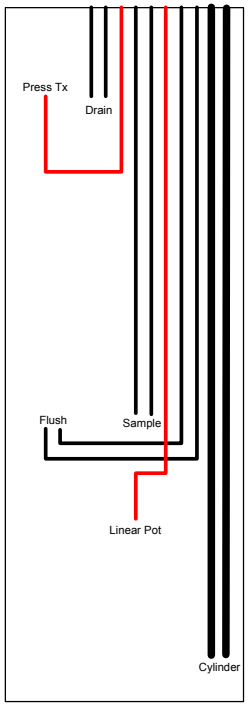


Piping and cable layout



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Entrained Air Monitor Cabinet Pneumatic Layout

Section

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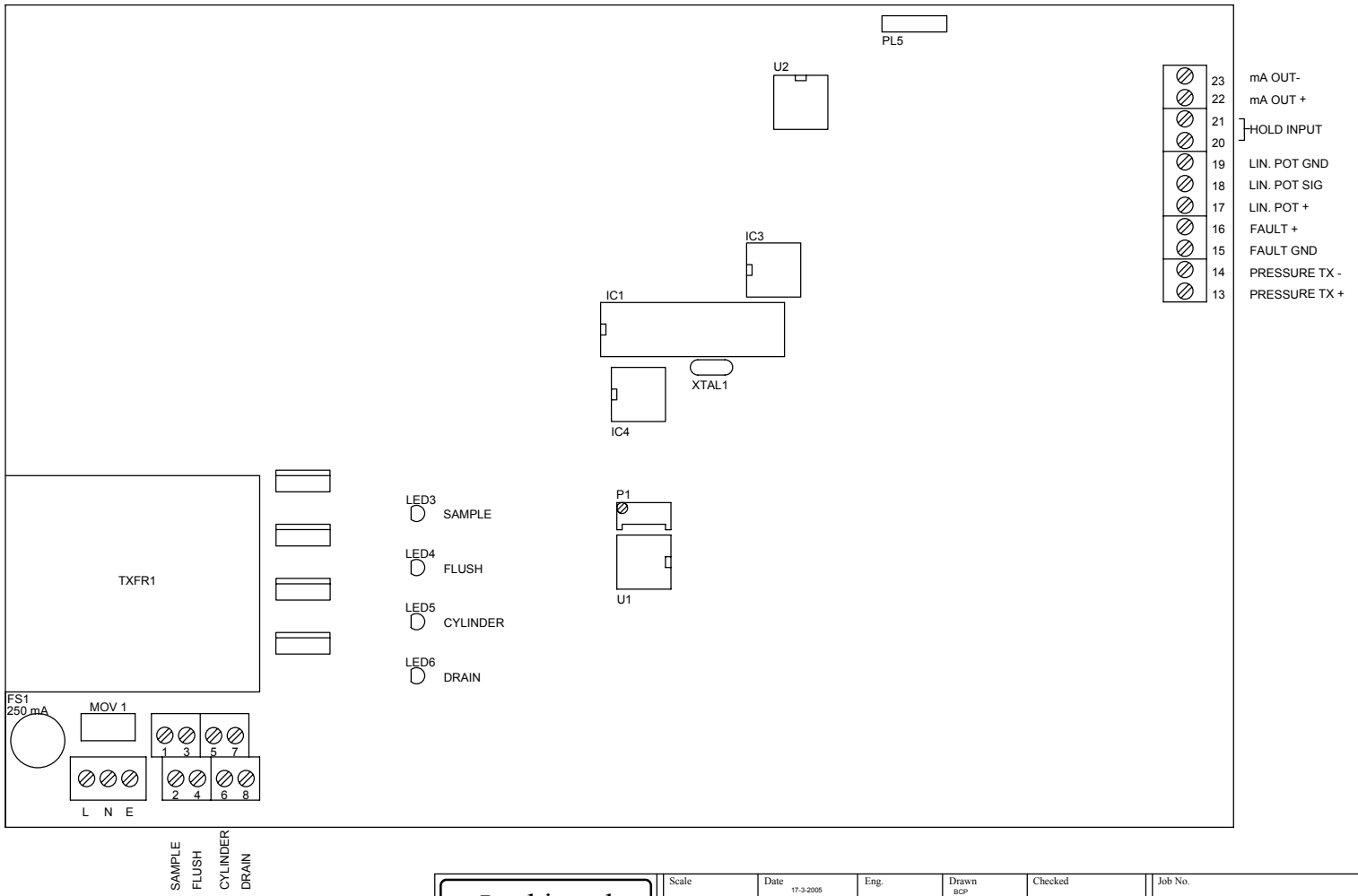

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EAM PCB LAYOUT

Section

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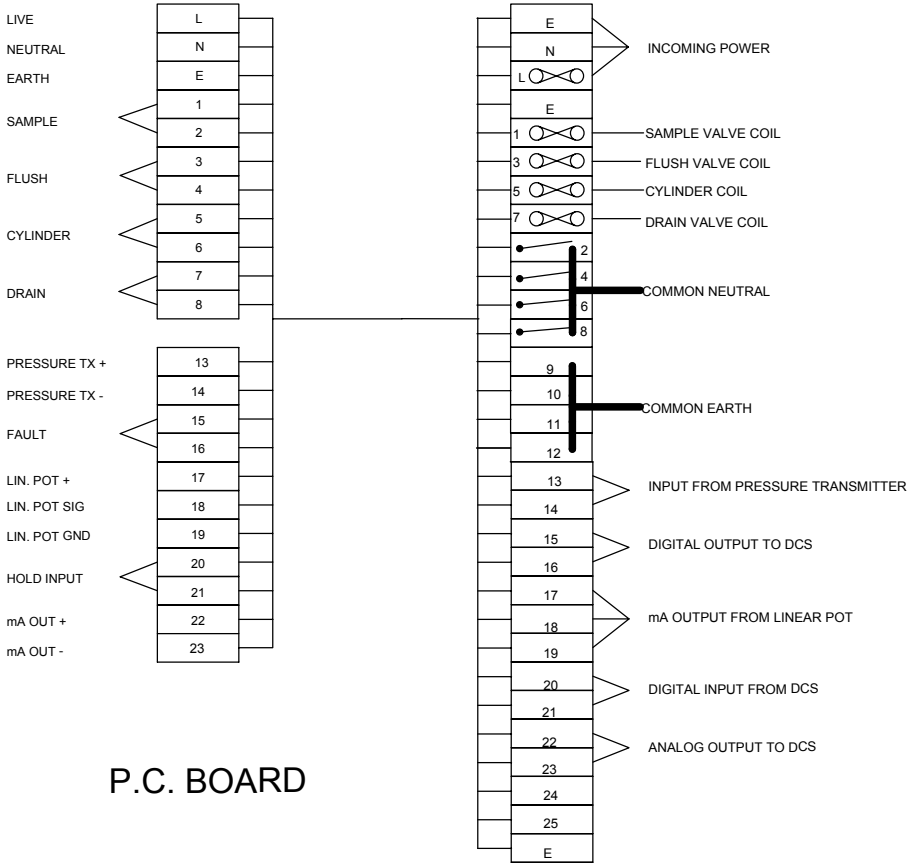
Schedule No.

Rev.



P.C. BOARD

TERMINAL POST

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EAM WIRING DIAGRAM

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Schedule No.

Rev.