



**MODEL 9050, 9052, 9054 CONTINUOUS LEVEL
TRANSMITTERS
User Manual**

<u>MODEL</u> 9050, 9052, 9054	<u>DOCUMENT TYPE</u> USER MANUAL	<u>DOCUMENT FILE NAME</u> 9057UM13.DOC	<u>REV.</u> 1.3
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1.0 INSTRUMENT OVERVIEW

1.1 FEATURES

- 2 Point automatic calibration
- RF Technology
- Arjay pulse card system for simple, safe, remote control, calibration and maintenance
- Modular design: components interchangeable with other members of the 9000 series family
- Up to 4 Differential Alarm relays (SPDT 10A contacts) (905x series only)
- Direct or Inverse 4-20mA output with offset capability
- RS-485 Network / Hart Protocol / Modbus protocol
- Multiple Calibration software available with menu selection (on one probe or more than one)
- No moving parts
- For use with any Arjay Capacitance probe

1.2 DESCRIPTION

The unit senses level using a RF capacitance measurement technique for very high resolution measurements. A probe mounted in a vessel forms a capacitor with the vessel wall, or with a concentric shield around the probe for non metallic vessels (ground reference). The capacitance of this arrangement is directly proportional to the level of material in the tank and may be measured to provide signals and controls.

The Arjay Level-Ease 9000 Series system uses RF (radio Frequency) methodology to measure the vessel capacitance. This technique minimizes the effects of other electrical properties of the probe, vessel, and vessel contents and focuses only on the vessel capacitance. As a result, measurement error due to coating buildup on the probe is minimized. The controller may be located up to one km away from an Arjay probe via inexpensive 2 wire shielded cable.

A 20 character by 4 line LCD and 16 key membrane keypad offer detailed data displays plus ease of calibration and setup. Level is displayed in percentage fill and in user selectable engineering units. In addition a bar graph gives a quick indication of level.

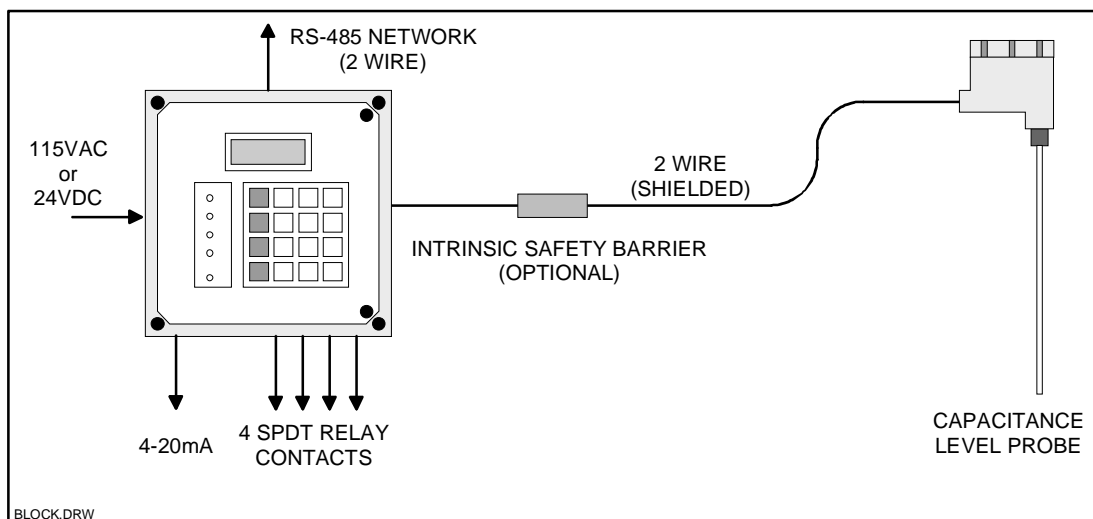


Figure 1.0

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OPERATION

The unit senses level using a RF Capacitance measurement technique for very high resolution measurements. A probe mounted in a vessel forms a capacitor with the vessel wall (or with a concentric shield around the probe for non metallic vessels). The capacitance of this arrangement is directly proportional to the level of material in the tank and may be measured to provide signals and controls.

USER INTERFACE

Display	4 line X 20 Character LCD with optional backlight + bar graph.
Keypad	4x4 Membrane type matrix.
Network	HART RS-485 protocol or Modbus protocol

PERFORMANCE

	The unit measures capacitance in pF. Capacitance to Level translation depends on the tank geometry and the type and temperature variance of the material being measured. The resolution figures for Capacitance are guaranteed. Level Measurement figures are for typical applications.
Range	0-1000pF recommended for the resolution figures listed below. 0-10,000pF may be measured with less resolution and accuracy.
Resolution	Capacitance:0.03% of Full Scale worst case. Typical: 0.01%. Level: 0.02% of Full Scale (6ft concentric shield probe in water)
Accuracy	±0.2% of Full Scale

INPUTS

2 wire plus shield connection to an Arjay PMC-9000 module located in any Arjay Capacitance probe head.

OUTPUTS / RELAYS

4 - 20 mA output	0.05% resolution, sourced into 900 Ohms maximum load.
Relays	up to 4 SPDT 10A/120VAC contacts (applies to the 905x family only). Each relay may be set for differential control (hi and low setpoints) Programmable time delay: 0 - 99 seconds. Hi Fail-safe selectable.

POWER

115VAC @ 12VA or 24VDC @ 0.15A max.

MECHANICAL SPECIFICATIONS

Enclosure	Wall mount Nema4X with hinged clear cover to access keypad.
Dimensions	305mm (12")H x 305mm (12")W x 203mm (8")D
Weight	2.2 kg (5lb) max.

ENVIRONMENTAL SPECIFICATIONS

Operating Temp.	-20 to 60 Deg. C for Controller only. Probe:-40 to 80 Deg. C
Relative Humidity	90% max. with no condensation.

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2.0 INSTALLATION

NOTE: If any damage to the instrument is found, please notify an Arjay Engineering representative as soon as possible prior to installation.

2.1 PROBES

Capacitance probes may be selected from a variety of styles for use with liquids, liquid interfaces, and granular materials. The probe length is customer specified for the height of material desired to be measured. Usually Teflon coated probes are used.

2.2 PROBE INSTALLATION

Standard probe entry in to a tank is via a 3/4" NPT opening (standard probes) or 1" NPT opening (heavy duty probes). Flanges and concentric shields are available as options. The entrance configuration may vary depending on the application requirements.

TO SCREW IN PROBE (THREADED ENTRY) USE WRENCH ON LOWER HEX. The probe fittings are compression type with Teflon ferrules assembled by applying torque between the two hex sections. The fittings are sealed at the factory to provide a compression seal capable of withstanding high pressures. Once opened they cannot be reassembled without new ferrules.

The probe should be mounted vertically and parallel to a reference ground surface which is typically the vertical wall of the tank or a concentric shield around the probe. The following points are important when installing the probe:

- 1- **Reference ground:** This is VERY IMPORTANT and is typically the metal walls of the tank. For non metallic tanks, a concentrically shielded probe is required in which case the shield provides its own Ground. **IMPORTANT:** For standard threaded entry and flange entry probes (without concentric shields), make sure the fittings are clean to ensure a **GOOD ELECTRICAL CONNECTION BETWEEN THE PROBE HEAD ENCLOSURE AND THE TANK (REFERENCE GND).**
- 2- **The distance between the probe and the ground reference:**
This only applies to probes without concentric shields. The closer the distance to the tank wall, the greater the sensitivity of measurement; too close and bridging problems may occur.
- 3- **The degree of parallelism between the probe and the reference ground:**
The probe must be parallel to the reference ground for a linear output signal. Note: that the concentric shield option is inherently linear due to the concentric shield.
- 4- **The measurement accuracy is affected by the temperature change of the material in the tank.** The amount of measurement error depends on the material. If the temperature change is excessive, temperature correction will be required. Contact the Arjay representative for more information.
- 5- **Agitators or moving objects in the tank:**
Moving objects in the tank close to the probe such as agitator blades, moving baffles etc. appear as moving ground references to a capacitance probe and will cause measurement errors. In applications where these objects are present, a concentrically shielded probe must be used.

CAUTION: INSTALL PROBE WITH CARE: DAMAGE TO TEFLON SHEATH WILL CAUSE MEASUREMENT ERRORS.

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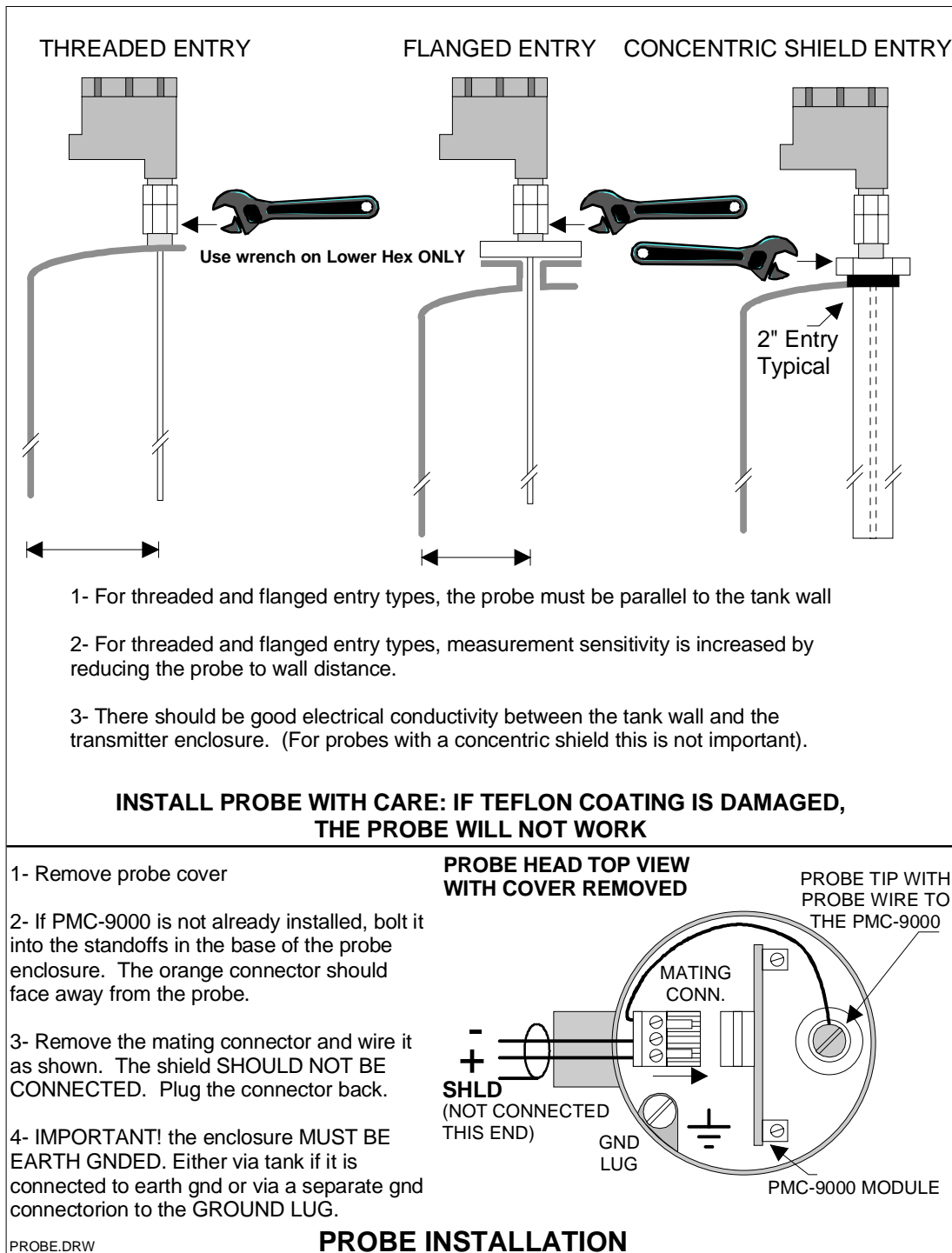
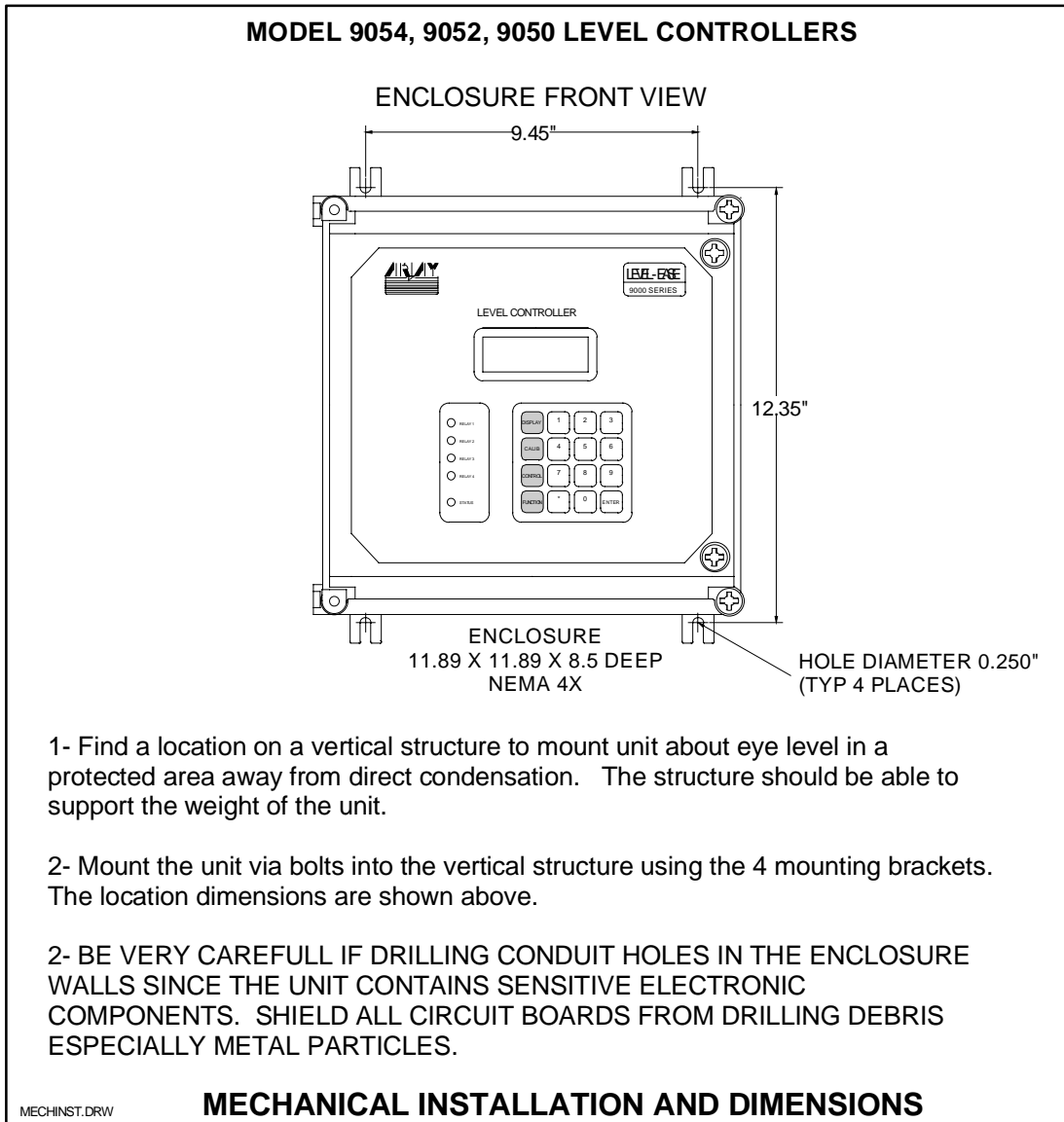


Figure 2.0

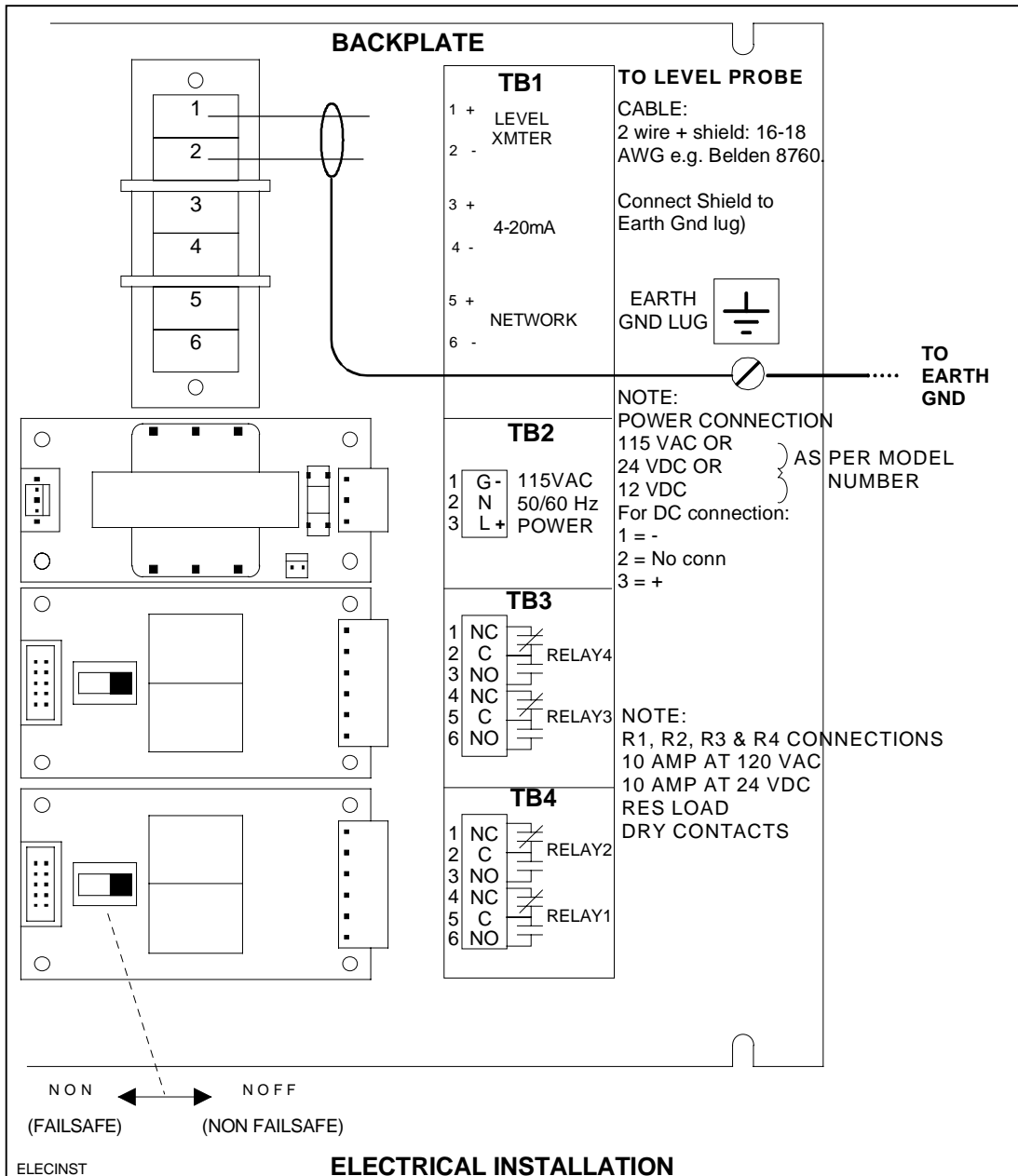
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2.1 MECHANICAL INSTALLATION

Figure 2.1

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2.2 ELECTRICAL INSTALLATION

Figure 2.2

NOTE:

Please make sure that the connections have the polarity as indicated or the controller may be damaged.

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3.0 STARTUP AND CALIBRATION

This section is provided for minimum setup. For a more detailed description of features please refer to Section 4.0.

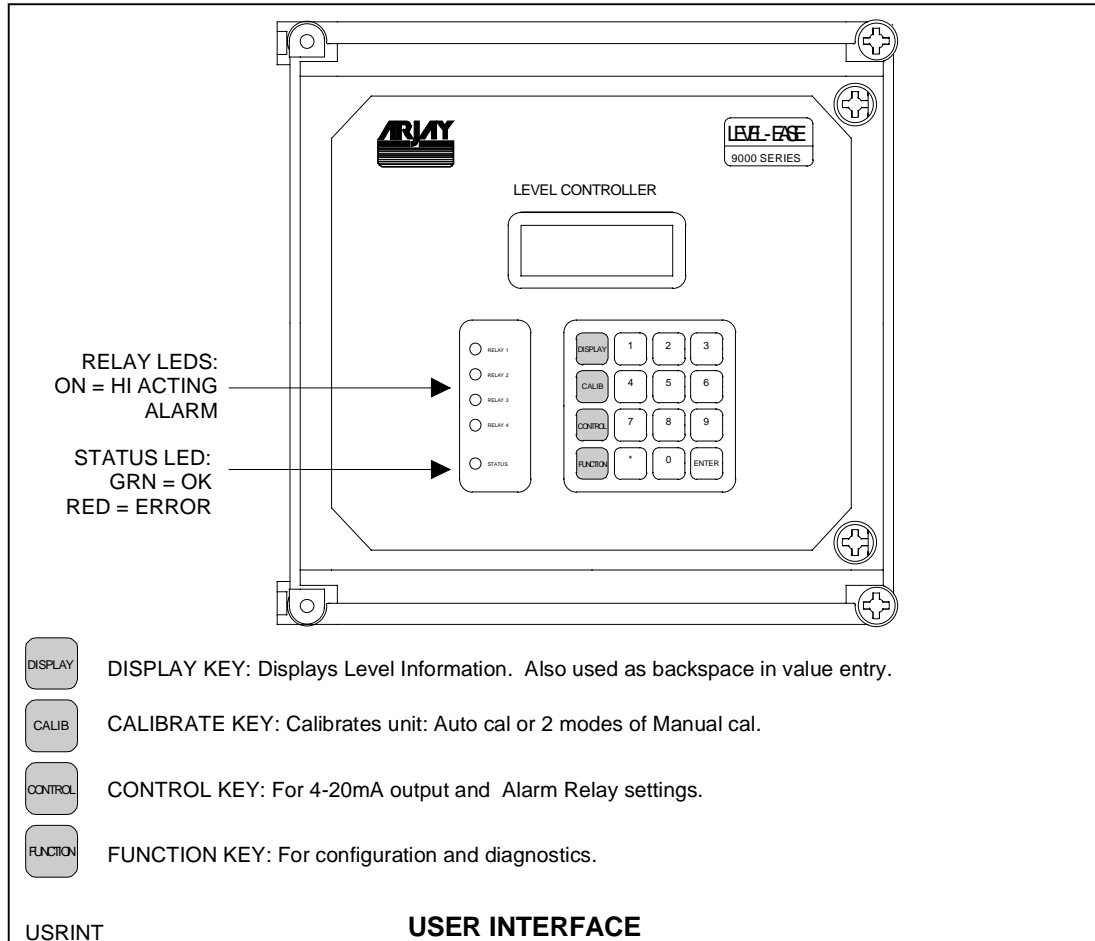


Figure 3.0

3.1 NOTES ON VALUE ENTRY

When entering in numeric values, the cursor can be backspaced to correct mistakes by pressing the DISPLAY key. This is only true if the cursor is not at the beginning of the displayed value, in which case the DISPLAY menu is entered.

The decimal point is the asterisk (*) key.

Values may be entered with any number of places of decimal.


If the entered value is out of the allowed limits, the system displays the limiting value for 2 seconds. For example if the 4-20mA Span value is entered as 5000.0% then **MAX. 100** is displayed for 2 seconds then entry is allowed again. The current value is not changed unless the entered value is within limits.

During value entry, the capacitance and level are still being constantly updated in the background. Apart from the CALIBRATION menu and the DIAGNOSTICS menu, in all other menus, the Alarm relays and the 4-20mA output are also updated.

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3.2 POWERUP DISPLAY

After mechanical and electrical installations of the probe and the controller have been successfully completed, power up the unit. The LCD should show a similar screen to:

CAPACITY
10.00 in
13.88 %


NOTE: The shown values are for example only.

The 2nd line shows the vessel capacity in engineering units. One of 8 engineering units may be selected in the configuration menu as described in the next sub-section.

The 3rd line shows the vessel capacity in percent. This value is independent of the engineering units.

The 4th line displays a bargraph of the percent capacity. The resolution is 5%.

The Status Indicator (see figure 3.0) should be green. If this is red then the LCD displays the kind of System Error. See the troubleshooting guide for details.

3.3 MINIMUM SETUP

3.3.1 XMTR VALUES

- Press the FUNCTION key, then 1 for Xmtr Set, then 2 for Manual. This menu enters the PMC-9000 level transmitter module's calibration parameters. These parameters are printed on a label attached to the PMC-9000 transmitter connector. These values should also be noted down in the SETTINGS table located at the end of this manual. On pressing 2 for Manual:

******XMTR CONFIG******
Enter xmtr A value:
0.03316

- Enter the PMC-9000 module A value then press Enter. The unit will prompt for the K and C values. Enter these followed by pressing the Enter key in each case.

3.3.2 DATA FILTER (SMOOTHING)

- Press the FUNCTION KEY if not already in the Function menu), then press 3 for Settings, then 2 for Filter.

*******SETTINGS*******
Enter filter time
in seconds:
0.0

- Enter the data response time in seconds for the unit to respond to a sudden change followed by the Enter key. For example a 5 second setting means the calculated value of the vessel capacitance and resulting values of level in % and engineering units will take 5 seconds to respond to an actual sudden change in vessel level.

3.3.3 ENGINEERING UNITS

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- One of 8 units may be selected. These units do NOT cause any change in internal calculations, but are only used for clarity. For example, if the vessel is cylindrical with a vertical axis then the volume is proportional to the depth. In this case, volume (or mass) units may be selected such as Liters or gallons. However, switching between liters to gallons does NOT change the displayed value:

***** SETTINGS *****
1-in 2-ft 3-m 4-cm
5-lb 6-kg 7-L 8-gal

- Press the number of the desired units.

3.3.4 4-20mA SETTINGS

- Press the CONTROL key:

CONTROL SETTINGS
1-Relay Settings
2-4-20mA Settings
Enter selection

- Press 2 to setup the 4-20mA output:

SET 4-20mA OUT
Zero (% Lvl) 0.0
Span (% Lvl) 100.0
mA:DIR

- Enter the level in percent for Zero and Span values followed by the Enter key in each case. After the Enter key is pressed for the Span value, line 3 changes to allow setting the action of the mA output:

SET 4-20mA OUT
Zero (% Lvl) 0.0
Span (% Lvl) 100.0
mA:DIR key 1 for INV ←

- Press key 1 to change the current setting to the alternate setting i.e. from DIRECT action to INVERSE action or vice versa or press the Enter key for no change.

3.3.5 RELAY SETTINGS

- Press the CONTROL key if not already in the Control Settings menu (see 4-20mA Settings display above). The press 1 for Relay Settings:

RELAY SETTINGS
1-Setpoints
2-Enter On delay
3-Enable 4-Off OFF

- Disable the relays (factory default setting): The bottom line can disable Alarm relay alarms even if an Alarm condition exists. The factory default setting is OFF which prevents Alarm relays from being activated until the unit is fully setup and calibrated. If ON is displayed in the bottom corner then press 4 to disable relays. **Relays can be enabled AFTER calibration and setup are complete.**

- Press 1 to enter relay setpoints:

RELAY SETTINGS

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Enter value in %

Relay 1 HI 85.0

Relay 1 LO 80.0

- Enter the High setpoint (level in percent above which an Alarm exists) and Low setpoint (level in percent below which the corresponding Alarm is reset).
- Enter the Hi and Lo setpoints. If Differential control is not desired then set the Hi and Lo setpoints to the same value.
- Enter the Hi and Lo setpoints for the remaining relays: 2-4.
- If no change is required to the setpoints just press the Enter key. When all 4 relays have been setup, the RELAY SETTINGS menu is revisited.
- From the RELAY SETTINGS menu (or if not press the CONTROL key, then 1 for Relay Settings) press 2 for On delay.
- Enter the minimum time in seconds for the level to be GREATER THAN the Hi setpoint for the Alarm condition to be entered. This time is also called the Alarm delay time. Note: The alarms are all High Acting i.e. an alarm is entered when the level is GREATER THAN the Hi setpoint. Note also that the time delay applies to ALL FOUR relays.

3.3.5 CALIBRATION

If this is a new installation and a calibration has not been successfully done before, then the most convenient form of calibration is the Auto Cal feature. This requires that the level in the vessel be changed by at least 10% and the actual two levels in % be entered in the controller. The actual levels in the vessel must be measured or determined independently and as accurately as possible. NOTE: the more the level is changed between the 2 calibration points the better. For example a 1% error in the entered level values for a 25% change translates to a 4% error at Full Scale.

- Press the CALIBRATION key, then press 1 for Auto Cal.
- ACCURATELY MEASURE THE PERCENT LEVEL in the vessel (2 decimal places) and enter it here followed by the Enter key.
- The unit now prompts for the 2nd level. CHANGE THE LEVEL IN THE VESSEL EITHER INCREASE OR DECREASE by a minimum of 10%. Less than 10% is allowed but may reduce accuracy. ACCURATELY MEASURE THE NEW LEVEL IN PERCENT and enter it (again 2 decimal places) followed by the Enter key. If the calibration was not successful, an error message is flashed on the screen for 2 seconds. Common problems are either the level in the tank was not changed or that the 2nd. level value in % was entered identical to the 1st.
- At the end of a calibration, the unit calculates 2 parameters which it uses to determine level: SLOPE and OFFSET. The Slope is the amount of capacitance change per percent level change (sensitivity) and the Offset is the capacitance of the empty silo. These values may be displayed by pressing 4 for Man. 2 option from the CALIBRATION menu. RECORD these values for later reference in SECTION 7 of this manual. These values may be re-entered instead of recalibrating the vessel using Auto Cal.

3.3.6 FULL SCALE VALUE

This is the maximum capacity of the vessel IN THE ENGINEERING UNITS CHOSEN IN SECTION 3.3.3.:

- Press the CALIBRATION key to get to the CALIBRATION menu, then 4 for FS Value.

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- The unit prompts for the maximum capacity of the vessel in the already chosen engineering units. Enter the vessel maximum value then press Enter.

3.3.7 ENABLE ALARM RELAY CONTROL

- If the Alarm Relays are being used, now that calibration has been successfully completed, the Alarm Relay control may be re-enabled.
- Press the CONTROL key to get to the CONTROL menu, then 1 for Relay Settings then 3 to Enable.
- The right, bottom corner of the display should show ON.
- Press the DISPLAY key to go back to the Display menu.

THIS COMPLETES THE SETUP AND CALIBRATION PROCEDURE

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4.0 OPERATION

IN THE FOLLOWING TEXT A MENU WILL BE DISPLAYED AS A PATH. FOR EXAMPLE THE AUTOCAL MENU: [CALIB\ 1]. (CALIB key then 1 for AUTOCAL).
 SETTINGS MENU: [FUNCTION\3] (FUNCTION key then 3 for SETTINGS).

The 9054 Level Transmitter uses a high precision and highly repeatable RF technique to measure capacitance which in turn is used to calculate level. The capacitor formed by the level probe (usually mounted vertically into the vessel) and a ground reference (metallic vessel wall or probe shield for concentrically shielded probes) changes its capacitance in proportion to the level of the material in the vessel. In addition, the capacitance is directly proportional to the dielectric constant of the material in the vessel and inversely proportional to the distance between the probe and the ground reference. In other words, THE GREATER THE DIELECTRIC OR THE SMALLER THE GAP BETWEEN THE PROBE AND THE GROUND REFERENCE, THE HIGHER THE MEASURED CAPACITANCE AND THE GREATER THE CHANGE OF CAPACITANCE AS THE LEVEL CHANGES. The dielectric constant is a physical property of matter and is different for different materials. Water has a dielectric constant of 80 as compared to 3 for most oils. Therefore, water gives a much higher change in capacitance than oils which makes measuring the level of water much more precise as compared to oils. For a linear response, the distance CAPACITANCE LEVEL PROBE MUST BE PARALLEL TO THE GROUND REFERENCE. The closer the distance between the probe and the greater the change in capacitance as the level changes. This may be used to advantage when measuring materials which have a low dielectric and which therefore give a low change of capacitance as the level changes. Arjay's method of measuring capacitance gives better than 0.1pF resolution for typical applications.

All Level-Ease 9000 Series Controllers and Transmitters are intelligent and can perform a number of tasks simultaneously (multitasking software). This means that even while in another menu, the capacitance is always be measured in the background. For example if the Filter value is being set in the SETTINGS submenu (FUNCTION\SETTINGS menu), the level value, relay alarms and 4-20mA outputs are still being updated. This is important since keypad entries are typically slow and sometimes an operator might forget to return the unit to the normal DISPLAY menu: in this case Alarm relays and 4-20mA output are still updated. In some menus however, the 4-20mA output and or the Alarm Relays are not updated on purpose; for example while in the calibration menu, the unit assumes that the unit is being calibrated and so the calculated level may be erroneous. In this case, the 4-20mA and Alarm Relays are set to the inactive states.

Periodically, (every 5-10 seconds) the unit does a self diagnostic. If major errors are found they are displayed on the LCD. These error messages take precedence over the level information in the DISPLAY menu ONLY. All other menus may be entered and parameters viewed or changed. In case of errors, this allows the user to enter the DIAGNOSTICS menu and check the capacitance or frequency etc.

4.1 DISPLAY MENU [DISP]

This is the default or normal operating screen. It shows:

CAPACITY
3454 lbs
50.3%
 ■■■■■■■■

The 2nd line shows the vessel capacity in engineering units. (level % times Full Scale Engineering Units value).

The 3rd line shows the vessel capacity in percent fill.

The 4th line shows a bargraph of the level in percent fill. The resolution is 5%.

4.2 CALIBRATION [CALIB]

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The unit may be calibrated 3 different ways: Automatic Calibration and 2 Manual Calibrations. The CALIBRATION menu is entered by pressing the CALIBRATION key:

****TANK CALIBRATION****
1-Auto 2-Manual
3-Slope/Off 4-FS val

4.2.1 AUTOMATIC CALIBRATION[CALIB1]

This is typically done for a new installation. It involves entering the independently and ACCURATELY MEASURED level in the vessel, changing the level by some amount, then entering the new ACCURATELY MEASURED level. The unit then calculates 2 parameters: SLOPE and OFFSET by correlating the 2 entered percentage levels with the corresponding measured capacitance. The SLOPE is the change in capacitance in pF per percent change in level. The OFFSET is the calculated empty vessel capacitance in pF. The Automatic Calibration procedure is already described in Section 3.3.5.

NOTE: The accuracy of the calibration depends in large part on the accuracy of the 2 measured levels entered during calibration. The resolution of measurement should be 2 decimal places to get the best accuracy. This is also why a minimum of 10% change in level is recommended for the 2 calibration points, since the larger the difference, the less affect the inaccuracies of entered levels has on the calibration. For example, a 1% error in entered values over a 10% change translates to a 10% error at Full Scale (100%).

NOTE: if the SLOPE and OFFSET parameters are already known, they may be entered directly by selecting SLOPE/OFF (item 3 from the Cal menu). This can save a lot of time. Also, FOR CONCENTRICALLY SHIELDED PROBES, THE SLOPE AND OFFSET ARE INDEPENDENT OF THE VESSEL GEOMETRY AND FOR A GIVEN MATERIAL IN THE VESSEL, THE SLOPE AND OFFSET MAY BE FACTORY DETERMINED, THUS SAVING CALIBRATION TIME ONSITE.

4.2.2 MANUAL CALIBRATION [CALIB2]

This option is used to fine tune the SLOPE and OFFSET values after a successful Automatic Calibration or when the capacitance at 2 differing percent levels is known. For example if the capacitance and corresponding levels in % have been recorded over some time then these can be used to recalibrate the unit by using two levels which are furthest apart (and their corresponding capacitance values). The procedure is as follows:

At any time, to view the measured capacitance:

- Press the FUNCTION key then 2 for Diags:
- Read the capacitance in pF on the 3rd line from the top.
- Determine the actual level in percent in the vessel: (2 places of decimal accuracy)
- The above steps must be repeated for one other level which is different from the first by at least 10%.

TO CALIBRATE USING MANUAL CALIBRATION:

- Press the CALIBRATION key to get to the CALIBRATION menu then 2 for Manual.
- Enter the 1st level in percent (2 decimal places) then press the Enter key.
- Enter the 1st (corresponding) capacitance
- The unit then prompts for the 2nd level in percent and the 2nd capacitance. After entering these values the unit will calculate the SLOPE and OFFSET. Use the Slope/Off menu item described below to view and record these values for future reference.

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4.2.3 SLOPE AND OFFSET [CALIB3]

Use this feature to view and or modify the SLOPE and OFFSET calibration values directly.

- Press the CALIBRATION key to enter the CALIBRATION menu then 3 for Slope/Off.
- Enter the desired SLOPE and OFFSET. If no change is desired just press the Enter key in each case or a Menu key to go to another menu such as the DISPLAY menu.

4.2.4 FULL SCALE VALUE [CALIB4]

The 9054 displays the level in both percent and in engineering units. For example if depth in feet is desired or if the material capacity in pounds is desired, the appropriate units are chosen from the Settings submenu of the FUNCTION menu. The unit calculates the level in engineering units by multiplying the level in percent by the full scale engineering units value. This value must be set by the user. For example if the units chosen are feet and the maximum height of the tank (internal) is 15.0 feet then 15.0 is the FULL SCALE VALUE, or if the units chosen are pounds and the maximum tank capacity is 10,000 lbs then 10,000 is the FULL SCALE VALUE. Entry of this value is described in Section 3.3.6. NOTE: This revision of software assumes a linear relationship between level % and tank capacity. If the engineering units chosen are for depth (feet, inches or cm) then this assumption is always true, but if the units are for volume or mass then the relationship may not be true. For example the mass or volume contents of a cylindrical tank on its side are not linearly related to the level in % (linear depth). Arjay can provide custom software based on a customer's tank dimensions to display the volume or mass (or other units).

4.3 CONTROL MENU [CONT]

The CONTROL menu allows the setup of the 4-20mA output and the Control Relays.

NOTE: The Control Relays and the 4-20mA output are set to their OFF states when in the CALIBRATION menu [CALIB]. In the DIAGNOSTICS menu [FUNCTION \ 2], the 4-20mA output may be set manually by the operator to 4mA or 20mA. In this case the 4-20mA output does not reflect the level value.

Setup of the Control Relays, and the 4-20mA output is described in section 3.

The action of the relays may be set to Normally Off (No Fail-safe) or Normal ON (Fail-safe) by setting the switch on the relay modules on the backplate to the Normal On or Normally Off position respectively. With Fail-safe ON, relays are set to their unpowered or non-energized state when the level exceeds the corresponding relay setpoint for at least the delay time. In this case, if the controller fails (no power) then the relays are in the alarm condition. Regardless of the relay action, **ALL relay indicators on the front panel are HI ACTING. i.e. the indicator on the front panel lights when the level is HIGHER the corresponding relay's HI Setpoint for at least the Delay time.**

The 4-20mA output Zero and Span settings may be set anywhere within the measurement range. For example, if the Zero is set to 30% level and the Span is set at 60% level then the mA output is scaled between these two points with the mA output indicating low level at 30% and high level at 60%. NOTE: the Span value (% level) must be at least 1% greater than the Zero value.

The 4-20mA output may also be set to Direct or Inverse Acting. In Direct Action, the mA output is 4mA when the level is at the Zero level and 20mA when at the Span level. In Inverse Action, the mA output is 20mA when the level is at the Zero level and 4mA when at the Span level.

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4.3 FUNCTION MENU [FUNC]

The FUNCTION menu is used for one-time setup and for Diagnostics.:

*****FUNCTION*****
1-Xmtr Set 2-Diags
3-Settings

4.3.1 XMTR SETTING [FUNC \ 1 \ 2]

This menu is to calibrate the 9054 for the particular PMC-9000 level transmitter module located at the probe head. There are 3 calibration parameters: A, K, C. These values are used to calculate the capacitance from the frequency signal received from the PMC-9000. The parameters may be calibrated manually or automatically. Automatic Calibration is performed at the factory on each PMC-9000 module. The A,K,C values are then affixed by a label on the connector. AUTOMATIC CALIBRATION IS ONLY TO BE PERFORMED BY AUTHORIZED PERSONNEL AND IS BEYOND THE SCOPE OF THIS MANUAL. IF PROBLEMS ARE ENCOUNTERED OR IF THE A,K,C VALUES ARE NOT KNOWN PLEASE CONTACT AN ARJAY REPRESENTATIVE.

Manual entry of the A,K,C values is described in Section 3.3.1

4.3.2 DIAGNOSTICS [FUNC \ 2]

This menu displays the received frequency signal from the PMC-9000 module at the probe head and the calculated capacitance. Both of these values are useful in determining calibration or performance problems.

****DIAGNOSTICS****
Xmtr freq 4902.25Hz
Cap. 0.00pF
1-4mA 2-20mA

Pressing key 1 forces the mA output to 4mA. Similarly pressing key 2 forces the mA output to 20mA. This is convenient to check the performance of external recorders or PLC's which read the mA output. The mA output reverts back to its actual level when the normal Display Menu is selected.

4.3.3 SETTINGS MENU [FUNC \ 3]

This menu sets the digital filter and the engineering units. In addition the mA output may be trimmed for maximum accuracy. Also the Tag number and Software revision may be viewed:

***** SETTINGS *****
1-mA trim 2-Filter
3-Tag No. 4-Units
Rev: 9057_17

mA TRIM:

This procedure trims the mA output for maximum accuracy by compensating for the mA output circuitry tolerances. THIS PROCEDURE IS PERFORMED ON EVERY TRANSMITTER AT THE FACTORY AND IS TO BE PERFORMED BY AUTHORIZED PERSONNEL ONLY. IF IMPROPERLY DONE, THE ACCURACY OF THE mA OUTPUT IS AFFECTED.

Under certain conditions this procedure may be undertaken in the field with Arjay's permission:

- Press the FUNCTION key, then 3 for Settings and then 1 for mA Trim. The unit should put out what it thinks is 20.0mA.

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- Disconnect any load connected to the mA output of the transmitter.
- With an ACCURATE MULTIMETER MEASURE THE mA OUTPUT. The Multimeter should have at least one place of decimal.
- Enter this value at the prompt and press the Enter key. A maximum tolerance adjustment of 3% is allowed i.e. the entered value must be in the range of 19.4mA to 20.6mA. If a value out of this range is entered an error is flashed on the screen. If this occurs, contact an Arjay representative for assistance.

FILTER & ENGINEERING UNITS:

The Filter and Engineering units settings are described in Section 3.3.2 and 3.3.3 respectively.

TAG NUMBER:

THE TAG NO.s ARE USED ONLY FOR NETWORK APPLICATIONS AND ARE USUALLY FACTORY SET. This menu allows viewing the Tag No. ONLY. To Change the Tag No., the Tag Switch on the Microcontroller card behind the front panel has to be set. Please refer to the Section 5.0 for details.

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5.0 CHANGING THE TAG NUMBER

On an Arjay communication network, each 9000 series transmitter (called a network slave) connected to the network has a unique Tag Number (also called a Node Address) within the range of 1 to 15. The Arjay Central Access Panel (CAP, also called a Network Master) communicates with the slave devices via their Tag Numbers.

Tag Numbers are usually set at the factory as per the customer requirements and are labelled on the outside of each network slave controller. However, the Tag Numbers may also be field set as outlined below.

TAG NUMBERS ON A NETWORK MUST BE UNIQUE with no duplication. Network errors will occur if Tag Numbers are duplicated as the identically numbered slaves all respond to the CAP unit at the same time.

NOTE: the Tag Number switch is ONLY read on powerup.

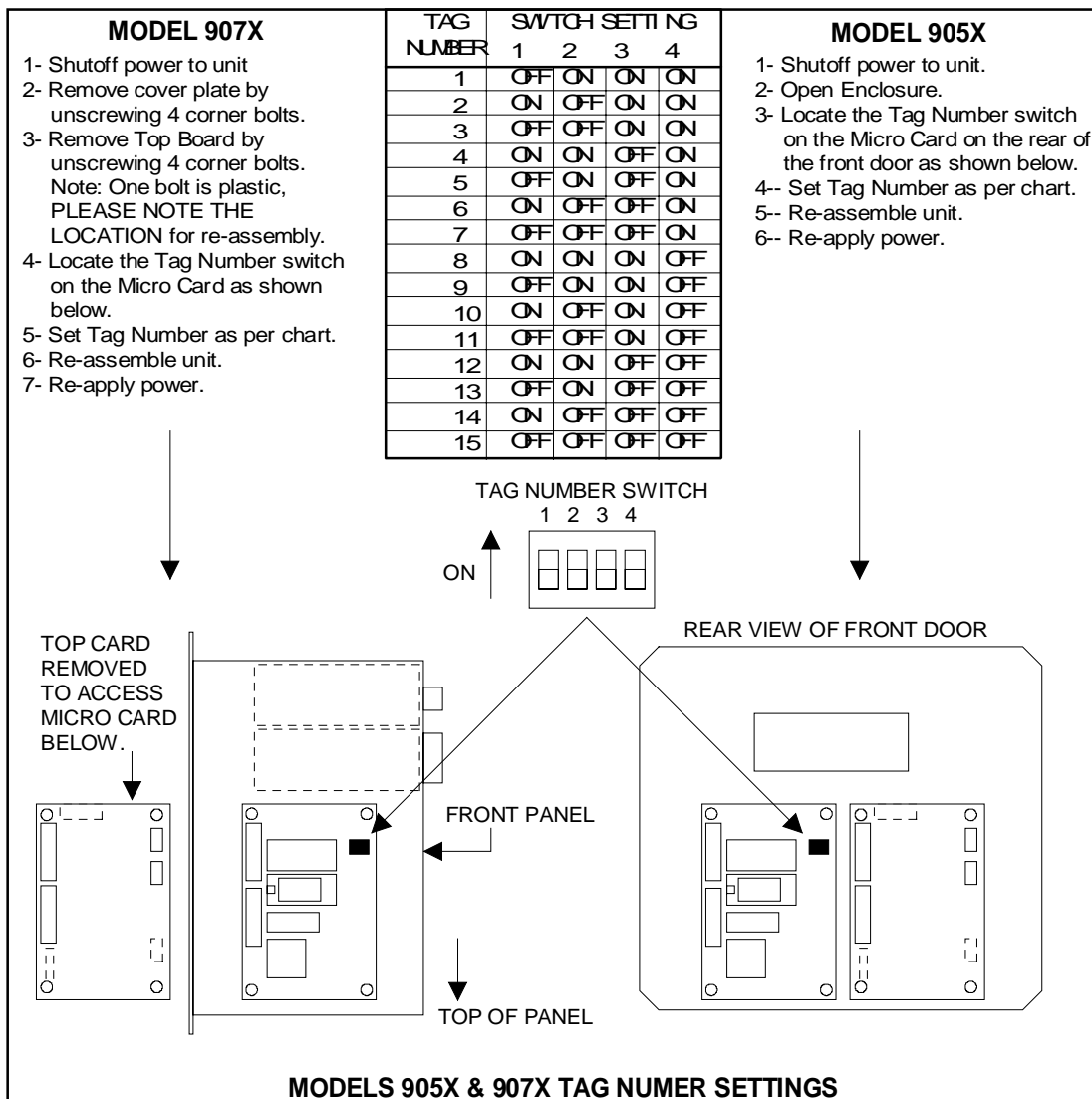


Figure 5.0

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6.0 TROUBLESHOOTING

CONDITION	DO THIS
1. DISPLAY MENU SHOWS: Error: No Xmtr Signal	The unit is not receiving a frequency signal from the remote PMC-9000 level transmitter in the probe head: Check wiring. If wiring checks out: call Arjay Technical Support. An adjustment may be made at the controller.
2. DISPLAY MENU SHOWS: Error: Setup Values Bad	This indicates that one of the calibration or setup parameters has been corrupted. Compare ALL parameters with the table in Section 7.0 to indicate which one. Re-enter it Call Arjay Technical Support
3. DISPLAY MENU SHOWS: Error: pF out of range	The calculated capacitance is out of the legal range: Check if the A,K,C values in the unit correspond to the A,K,C values of the PMC-9000 transmitter. Check the integrity of the Teflon sheath of the probe. If this has been damaged, water could cause an electrical short circuit between the probe within the Teflon sheath and the ground reference. In this case a very high capacitance is usually registered. Check the Xmtr frequency in the Diagnostics menu. If the frequency is much below 19,000Hz then a short should be suspected. To confirm: Open the probe head and disconnect the blue wire from the probe to the PMC-9000. Using a DVM, measure the resistance between the enclosure case and the probe tip. It should read infinite resistance or OL. Make sure that fingers and hands do not touch the metal portion of the probes of the DVM since this could show a lower resistance: 1-10mohms. Contact an Arjay Representative.
4. DISPLAY MENU SHOWS: Error: Low Power	The power to the unit is less than the required minimum. Check the power connection.
5. The level reading is erratic or unstable	Check the Slope value. If this is lower than about 0.5pF per percent then check if the level displayed agrees with the actual level in the vessel at a number of different levels. If so, then check if the probe is being splashed by incoming liquid or if there are moving mixer parts especially metallic close to the probe. If this is true and then try increasing the Filter time setting. If this is not enough and the cause of the disturbance cannot be rectified then a concentrically shielded probe must be used.
6. Display is dim or not enough contrast.	The contrast may be adjusted using a fine screwdriver. The adjustment trimmer is located on one of the 2 cards mounted on the rear of the front plate. Locate the ribbon cable from the Display to a card. The trimmer is blue and the adjustment is on a vertical edge facing the Display. Adjust the trimmer to the desired contrast.

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7.0 CONTROLLER SETTINGS SHEET

PARAMETER	DESCRIPTION	FACTORY SETTING	USER SETTING
Probe A value	Probe PMC-9000 level transmitter calibration value		
Probe K value	Probe PMC-9000 level transmitter calibration value		
Probe C value	Probe PMC-9000 level transmitter calibration value		
Slope	Result of a successful Calibration: Capacitance change per % change. Used by unit to calculate the level in % and Eng. Units from the measure capacitance.		
Offset	Result of a successful Calibration: Calculated capacitance of an empty vessel. Used by unit to calculate the level in % and Eng. Units from the measure capacitance.		
FS Value	Full Scale Engineering Units value: used to calculate Eng. Units value from level %.	100.0	
Zero	Zero Level value for 4-20mA output	0.0%	
Span	Full Scale Level value for 4-20mA output.	100.0%	
mA Action	Direct (20mA when level at Span) or Inverse (4mA when level is at Span)	DIR	
Relay1 Hi Set	Alarm Relay 1 High Setpoint: Alarm condition if level is above this value.	85.0%	
Relay1 Lo Set	Alarm Relay 1 Low Setpoint: Alarm conditions cleared if level is below this value.	80.0%	
Relay2 Hi Set	Alarm Relay 2 High Setpoint: Alarm condition if level is above this value.	65.0%	
Relay2 Lo Set	Alarm Relay 2 Low Setpoint: Alarm conditions cleared if level is below this value.	60.0%	
Relay3 Hi Set	Alarm Relay 3 High Setpoint: Alarm condition if level is above this value.	45.0%	
Relay3 Lo Set	Alarm Relay 3 Low Setpoint: Alarm conditions cleared if level is below this value.	40.0%	
Relay4 Hi Set	Alarm Relay 4 High Setpoint: Alarm condition if level is above this value.	25.0%	
Relay4 Lo Set	Alarm Relay 4 Low Setpoint: Alarm conditions cleared if level is below this value.	20.0%	
Alarm Delay	Amount of time the level must be above the Hi Setpoint for the Alarm condition to be set.	0 sec	
Alarm Enable	Master Alarm Relay Enable: If Off this will prevent relays from being reflecting the Alarm condition. The relay will remain in the non alarm condition base on the Fail-safe switch setting on the relay modules	OFF	
Filter	Digital Filter response time in seconds. Used to smooth out level fluctuations caused by splashing etc.	0 sec	
Engineering Units	Eng. units chosen to display level information in addition to the level in %.	in	
Tag Number	For network applications only. All Arjay 9000 series controllers connected to a network must have a unique Tag Number between 1 and 15	1	