



Magnetrol® STI

Echotel® Model 350/351 Ultrasonic Non-Contact Dual Point Level Controller

(Software Version 1.2)

Instruction Manual and Parts List

MODEL IDENTIFICATION

Each Model 350/351 ultrasonic level controller has a nameplate on which the model number of the unit is shown. Each model number is coded to identify the options in that specific unit. Listed below and to the right are the definitions of each digit of the model number. By referring a model number to these charts, the installer can determine exactly which options the level controller contains.

Controller Part Number

35 - - 0

MOUNTING

- 0 - Integral Mount Electronics
- 1 - Remote Mount Electronics

HOUSING

- 5 - NEMA 4X Poly. Powder Coated
- 6 - NEMA 4X w/Transparent Lexan®
- 8 - NEMA 4X/7/9* Poly. Powder Coated
- 9 - NEMA 4X/7/9** Cenelec Epoxy Coated Alum.

* For use in hazardous environments when used with sensor material codes E, and F.

**Can only be used with sensor code 6 in ninth digit.

HAND HELD INTERFACE

- 0 - No Connection
- 1 - Hand Held Connection*

* Requires hand held calibrator 046-8105-001 (ordered separately) and is not available with output codes 5 or 8.

INPUT VOLTAGE

- 0 - 120 VAC
- 1 - 240 VAC

OUTPUT

- 0 - (2) SPDT Relays
- 8 - RS-485 and 2 SPDT Relays*

* N/A with hand held interface code 1.

SENSOR CODE

- 0 - Remote
- 5 - Standard
- 6 - Cenelec*

* Can only be used with sensor material and length codes E and F in the tenth digit.

SENSOR MATERIAL & LENGTH

- 0 - Remote
- C - Kynar/CPVC, w/6" (152 mm) length
- D - Kynar/CPVC, w/10" (254 mm) length
- E - 316 Stainless Steel w/6" (152 mm) length
- F - 316 Stainless Steel w/10" (254 mm) length
- K - Kynar w/6" (152 mm) length
- L - Kynar w/10" (254 mm) length

MODEL IDENTIFICATION cont.

Sensor (To be used with 351 Controller only)

Part Number

395 - -

SENSOR MATERIAL

- 1C - Kynar/CPVC w/3/4" NPT*
- 5C - Kynar/CPVC w/2" NPT
- 1K - Kynar w/3/4" NPT*
- 5K - Kynar w/2" NPT
- 1E - Stainless Steel w/3/4" NPT*
- 5E - Stainless Steel w/2" NPT
- 2E - Cenelec, SS w/3/4" NPT*
- 6E - Cenelec, SS w/2" NPT

* 3/4" NPT connection can be used for process connection without housing (sensor housing code 0) or sensor housing connection only (sensor housing code 1).

SENSOR HOUSING

- 0 - No sensor housing, w/20 ft. (6 m) of Cable
- 1 - Sensor housing* NEMA 4X/7/9

* If specifying sensor housing, you must include connecting cable length (See below).

SENSOR MOUNTING BRACKET

- 0 - None
- 1 - Wall Mount 3/4" NPT
- 2 - Floor Mount 3/4" NPT
- 3 - Wall Mount 2" NPT
- 4 - Floor Mount 2" NPT

SENSOR LENGTH

- 003 - 3" length (76 mm)
- 006 - 6" length (152 mm)
- 010 - 10" length (254 mm)

CONNECTING CABLE — (To be used with 351 Controller only) Belden type 9265. Consult factory before selecting an alternate.

Part Number

037-3170 -

Cable length in feet

10 ft. (3 m) min., 100 ft. (30 m) max.

DESCRIPTION

Model 350/351 non-contact ultrasonic level controllers detect level in most liquid and some bulk material applications. The non-contact sensor may be mounted integrally or it may be mounted up to 100 feet (3 m) from the micro-processor-based electronics. All parameters are entered by means of an easy to use menu-based keyboard housed within the unit.

INSTALLATION

CAUTION: Please read the entire installation section carefully prior to starting installation.

PRINCIPLE OF OPERATION

Pulses generated by the microprocessor-based electronics are directed via the sensor to the surface level. The returning echo signal is detected by the sensor. The microprocessor amplifies and converts the signal into a digital representation of the distance from the reflecting surface. Two independent relays can be programmed as individual alarm points or used as pump control functions to turn on or off at selected values. All operating parameters are entered via three tactile-feedback push buttons and displayed on a four character LED display located under the NEMA cover.

UNPACKING

Unpack the instrument carefully. Make sure all components have been removed from the packing material. Inspect all components for damage. Report any concealed damage to the carrier within 24 hours. Check the contents of the packing slip and report any discrepancies to the factory. Check the nameplate model number to be sure it agrees with the packing slip and purchase order. Check and record the serial number for future reference when ordering parts.

UNIT MOUNTING LOCATION

The level controller should be securely fastened to an appropriate supporting structure, in a location that permits easy access for maintenance. Avoid locations that are exposed to direct sunlight, flooding, high levels of radiated electromagnetic interference, and excessive vibration or shock.

Model 350/351 sensor units must be mounted directly over the material to be measured. This may be accomplished by the 2" NPT mounting. Refer to Model Identification on page 1.

Proper mounting and wiring of this ultrasonic unit is of utmost importance. Both the accuracy and the reliability of Model 350/351 can be adversely affected if the sensor is mounted off axis or where obstacles protrude into its field of vision.

NOTE: The 350/351 requires a dead band distance between the bottom of the sensor and the maximum level of material to be measured. Minimum dead band = 12 inches (305 mm). Maximum dead band should be limited to about 10 ft (3 meters) as this blanking distance is extended at the expense of the useful span over which the instrument operates satisfactorily. At temperatures greater than 140°F (60°C) the minimum dead band is extended to 18 inches (457 mm).

GENERAL UNIT MOUNTING REQUIREMENTS

(350 Integral and 351 Remote Sensor)

1. Make sure that there are no obstructions between the sensor's radiating surface and the material level. Ultrasonic sound radiates from the sensor face in a cone-shaped beam of approximately 12° width. Any object within the signal's path may produce an echo that can mask the true echo returned by the material surface.
2. Position the sensor so that the radiating surface or sensor face is exactly parallel to the target surface. This will provide the strongest return signals and enhance the reliability of the 350/351.

GENERAL UNIT MOUNTING REQUIREMENTS cont.

3. In applications where the material level can reach the top of the tank, the sensor portion of the unit must be mounted in a short, flanged pipe stub. The diameter of the stub should be at least 8 inches (203 mm) and its length should be limited to 12 inches (305 mm). Refer to Figure 1.

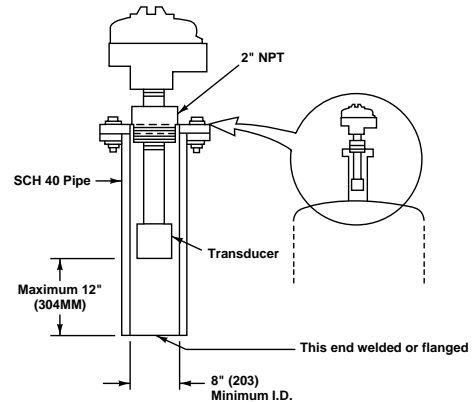


Figure 1
Sensor Mounting for Full Tanks

4. Avoid installing the sensor in tank top openings that exhaust heated air or vapors. The boundaries between the vapors and the outside air often represent acoustic impedance gradients that can cause troublesome sound reflections. In those installations, the sensor should be mounted well away from the opening inside the tank, or in a pipe stub as illustrated here. Refer to Figure 2.

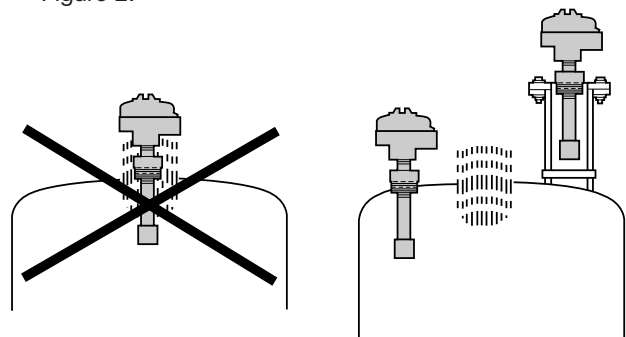


Figure 2
Sensor Mounting for Tanks With Exhaust

CONTROLLER MOUNTING PROCEDURE

The controller enclosure should be securely fastened to an appropriate supporting structure, in a location that permits easy access for maintenance. Avoid locations that are exposed to direct sunlight, flooding, high levels of radiated electromagnetic interference, and excessive vibration or shock.

INSTALLATION cont.

CONTROLLER MOUNTING PROCEDURE cont.

1. Mount the enclosure to a wall or flat surface using the appropriate screws or bolts. A remote mounting bracket is available from the factory, if required. Refer to mounting hole pattern as shown in the dimensional drawings on page 13.
2. Provide watertight seals for all wiring entrances in the enclosure.
3. Install conduits for power and control wiring. Be sure all connections to the enclosure maintain the proper NEMA rating.
4. Be sure to replace housing cover before proceeding to sensor mounting.

SENSOR MOUNTING PROCEDURE

NOTE: Be sure the sensor location meets the requirements discussed under GENERAL SENSOR MOUNTING REQUIREMENTS.

SENSOR MOUNTING PROCEDURE cont.

1. Position sensor over the tank port. Install the 3/4" NPT or 2" NPT sensor on the tank port, flange, or mount with an optional mounting bracket.
2. Hand tighten sensor mounting threads through the sensor mounting hole in the flange. For a gas tight process seal, pipe thread compound is recommended on stainless steel sensors.

For Remote Sensor Only

3. Install 3/4" watertight flexible conduit from the sensor to the transmitter enclosure.
4. Carefully pull the coaxial cable and temperature cable attached to the sensor through the conduit to the controller.

CAUTION: Avoid excessive twisting of both the sensor and temperature cables.

5. Proceed to the WIRING section of this manual.

WIRING

POWER WIRING

NOTE: Before connecting the power line to the controller, be sure that the voltage identification on the nameplate matches the power supply. **DO NOT** attempt to operate this unit at voltages other than as identified as it will damage the unit. Refer to Figure 3.

NOTE: Ensure power is off before proceeding.

1. Remove housing cover and terminal strip cover.
2. No. 14 AWG wire size is the recommended maximum size for power and control circuit wiring. The power and control circuit terminal strips are marked for proper identification.
3. Bring wires into housing.
4. Attach earth ground to housing base using the green head screw.
5. Run power leads to power terminal strip on PC board.
6. Dress wiring to ensure no interference or contact with cover or circuit board components.

OBSERVE ALL APPLICABLE ELECTRICAL CODES AND PROPER WIRING PROCEDURES.

7. Prevent moisture seepage into the enclosure by installing approved seal-drain fittings in the conduit run leading to the unit.
8. Replace terminal strip cover.
9. Replace housing cover.

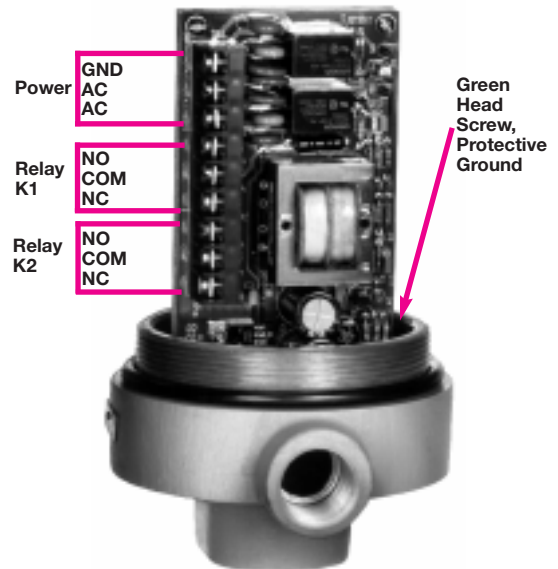


Figure 3
Power/Relay Wiring

WIRING cont.

SENSOR WIRING (351 Remote Only)

The sensor contains two cables which must be connected to the controller. The sensor cable is the round coaxial cable which consists of a center coaxial conductor and a shield wrapped around it. The temperature cable is a twisted pair.

1. Connect center conductor of sensor cable to X1 position on TB2 on the amplifier PC board in the controller.
2. Connect shield of sensor cable to GND of TB2.
3. Connect black wire of temperature cable, (twisted pair), to negative (-) TEMP terminal of TB2. Refer to Figure 4.
4. The other wire from twisted pair, (red or white), is connected to positive (+) TEMP terminal of TB2. Refer to Figure 4.

NOTE: If sensor housing is provided, use connecting cable ordered with remote sensor housing. Connect sensor cable and temperature cable per above instructions between the terminal block in the sensor housing to TB2 on the amplifier PC board in the controller. Be sure to connect wires to appropriate terminals.

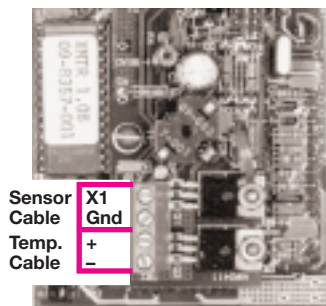


Figure 4
Sensor Wiring

OUTPUT SIGNAL WIRING (Relays & RS-485)

Relay output connections are made by loosening the screws at the relay output connections terminal strip, inserting the wires with spade lugs and tightening the screws. Refer to Figure 3 on page 3.

1. Bring wires into housing.
2. Connect output wires to appropriate terminals.
3. Replace terminal strip cover.
4. Replace housing cover.

RS-485 connections are made by means of a 2-wire twisted pair connected to the terminal block. Refer to Figure 5.

1. Connect the transmitting wire to terminal (A) on the terminal block.
2. Connect the receiving wire to terminal (B) on the terminal block.

NOTE: Transmitting and receiving wire connections must remain consistent throughout the RS-485 wiring scheme. (i.e. A to A, B to B)

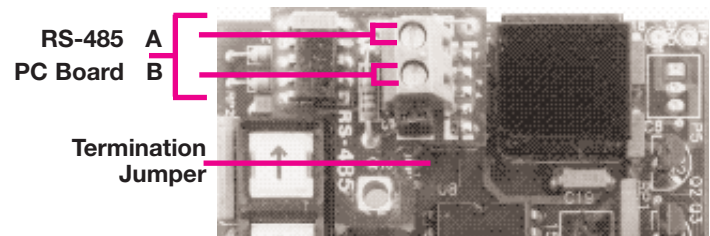


Figure 5

MODE OF OPERATION

HEIGHT OR DISTANCE SELECTION

The model 350/351 allows the user to choose the MODE of Operation, HEIGHT, (HGT) or DISTANCE (DIST). This choice is made in a special SET-UP menu which is accessed by pressing the UP button three times from the normal run condition. The Model 350/351 responds by displaying MODE. Press ENT to display either HGT for Height mode or DIST for Distance mode. The UP and DOWN buttons allow the user to change the Mode. Press ENT to accept the displayed mode and return to UNIT.

HEIGHT MODE

In the HEIGHT mode, the values of span and relay set points are programmed as heights measured from the bottom of the vessel (Range Point).

NOTE: This is the preferred mode of operation.

DISTANCE MODE

The DISTANCE mode allows all parameters (Range, Span and relay set points) to be programmed as the values measured from the face of the sensor).

NOTE: All Set Up Procedures are written in the HEIGHT mode.

ALARM MODES

NOTE: The Model 350/351 is equipped with two 10 amp SPDT independent field adjustable relays for a variety of alarm functions or complex control applications.

GENERAL INFORMATION

The Model 350/351 is equipped with two 10 amp SPDT independent field adjustable relays. A unique relay calibration mode allows the user to select the programmable set points in either the distance or the height mode for each of the two relays. The relays can be used in combination with each other, programmed independently, or used for failsafe conditions. The unit allows the user to preset the relay position ON (energized) or OFF (de-energized) as a fail-safe; should the ultrasonic signal be lost to the unit. The following are examples of different relay functions for a variety of process requirements.

- A. High Alarms
- B. Low Alarms
- C. Automatic Empty Pump Control
- D. Automatic Fill Pump Control
- E. Lead/Lag Pump Control

A. High Alarm Mode

In this application, a relay is dedicated to a set point value for a high alarm. When the level is below this set point value, the relay is activated. When the level exceeds this value, the relay is deactivated. Refer to Figure 6.

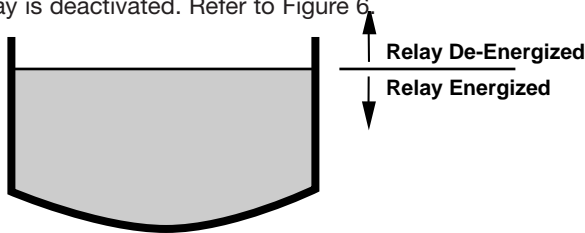


Figure 6

B. Low Alarm Mode

In this application, a relay is dedicated to a set point value for a low alarm. When the level is above this set point value, the relay is activated. When the level drops below this value, the relay is de-activated. Refer to Figure 7.

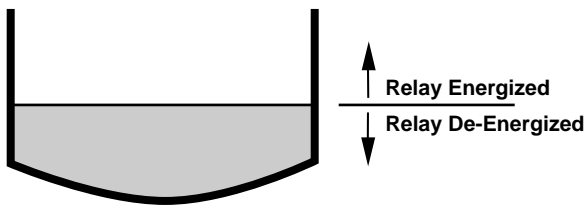


Figure 7

GENERAL INFORMATION cont.

C. Auto Empty Mode

This pump control mode is for use with valves, pumps, or other automatic control devices. Each of the two relays has independently settable ON and OFF set points so that two individual devices may be controlled with the 350/351. When the level is below the OFF set point value, the relay is de-energized. When the level increases to the ON set point value, the relay is energized. Refer to Figure 8.

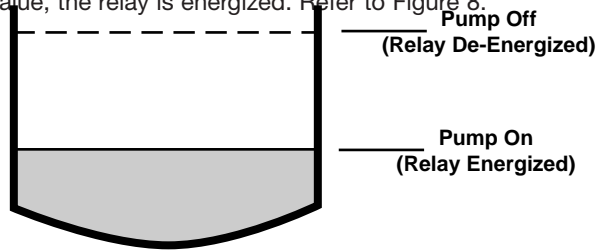


Figure 8

D. Auto Fill Mode

This pump control mode is for use with valves, pumps, or other automatic control devices. Each of the two relays has independently settable ON (energized) and OFF (de-energized) set points so that two individual devices may be controlled with the 350/351. When the level is above the OFF set point value, the relay is de-energized. When the level decreases to the ON set point value, the relay is energized. Refer to Figure 9.

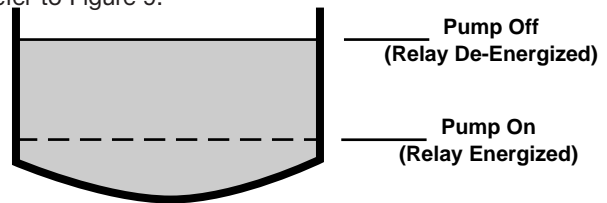


Figure 9

E. Lead/Lag Pump Control

Lead/Lag pump control provides for an exchange of the role or function of the two pumps in order to provide for even wear on both pumps, therefore increasing pump life. The relay action is identical to the Auto Empty Mode or the Auto Fill Mode, however, following each pump shutdown, the lead/lag role of each pump is exchanged. When using Lead/Lag Pump Control, set points cannot be identical; they must operate in the same direction. Refer to Figure 10.

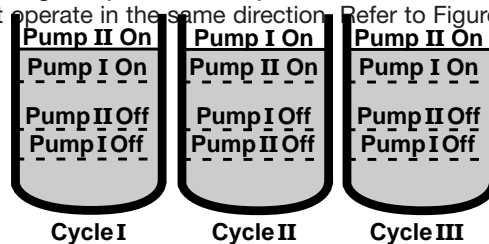


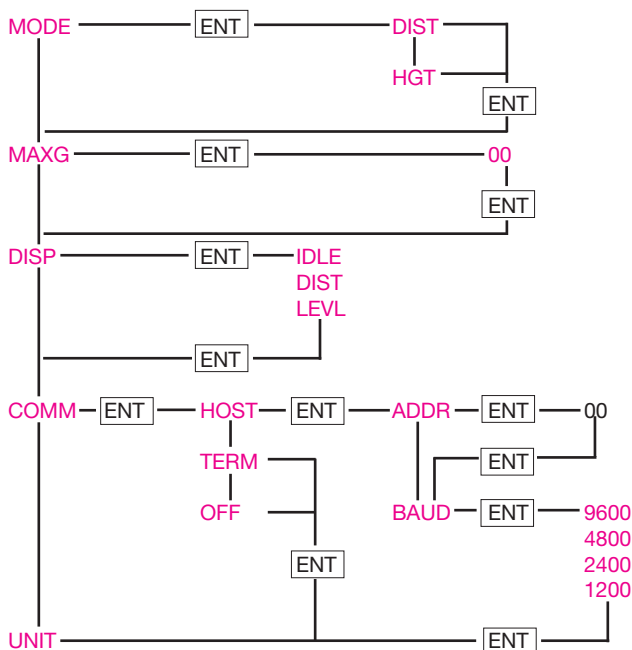
Figure 10

SPECIAL MENUS

INITIALIZATION MENU

The initialization Menu selection is accessed by pressing the UP arrow three times from the normal display mode or run.

The Mode selection is accessed by pressing the UP button three times from the normal display present mode or RUN. The unit will display **MODE**. Press ENT to display present mode (**HGT** or **DIST**). Use UP or DOWN to choose desired mode. Refer to Mode of Operation on page 4 for additional information.



NOTE: In the Distance Mode, all values of range and span are measured from the sensor face instead of the reference point or range point. Although distance selection is measured from the sensor face, the output can only be set between the span and range.

NOTE: Span cannot be set within the first 12" (305 mm) from the sensor face (dead zone).

Changing MODE will reset range and span. All set-up procedures must be repeated if MODE is changed.

Press ENT and unit will display normal run condition if mode was changed. If the mode of operation is not changed, the display will show the next selection **MAXG** (Maximum Gain Limit).

Press ENT to display current maximum gain limit. Use the UP and DOWN arrow to change limit. Press ENT to save maximum gain value and exit **MAXG**.

DISP will now be displayed. This parameter is the normal operating display. The choices are as follows:

- IDLE- **MAGNETROL INT'L...**
- DIST- Displays distance in run condition
- LEVEL- Displays tank level in run condition

Use the UP or DOWN arrow to select and press ENT and then DOWN arrow to exit Initialization Menu and return to the normal operating mode.

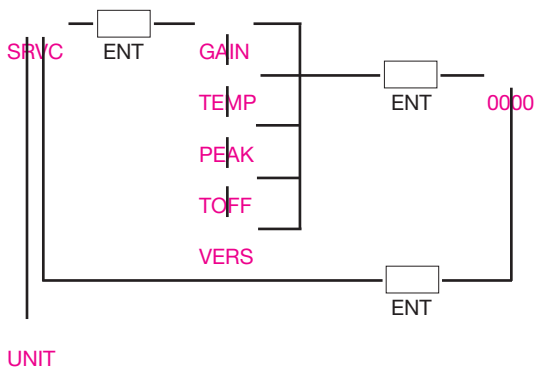
SERVICE MENU

If in the event of a problem with the Model 350/351, it may be necessary to access the Service Menu located within the unit. To access this menu, the UP keypad must be pressed two times while the unit is in the normal operating mode and displaying the **MAGNETROL INT'L...** message, or other chosen display.

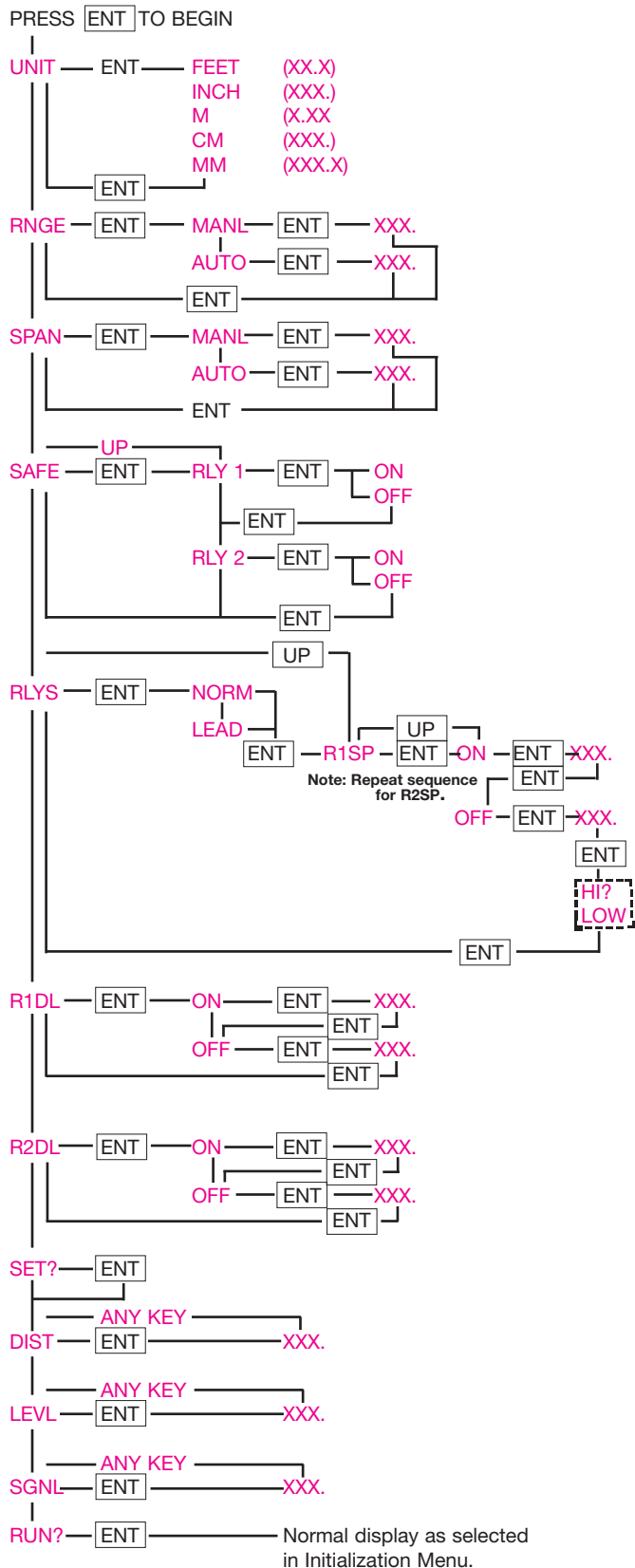
When the UP button is depressed twice, **SRVC** will be displayed. Press ENT to display either **GAIN**, **TEMP**, **PEAK**, **TOFF** or **VERS**.

ENT will display the value for each of the selections. Use the UP or DOWN key to scroll to the next parameter.

These values are read only parameters and cannot be changed by the operator. They are for reference use only, however, in the event of a question or problem with the 350/351, an authorized representative or service technician will request the values displayed in this menu. Become familiar with this Service Menu and the corresponding instructions in the event of the need to access this special menu.



MAIN MENUS



OPERATOR SET UP

The Model 350/351 Ultrasonic Level Controller contains a microprocessor-based user interface which provides the operator unmatched flexibility and programmability for a variety of level control applications. These features are built into the controller and are entered via three tactile-feedback push button located on the circuit board under the NEMA enclosure. The push button and their functions are shown below.

Upon power up, the LED will display the following message: **MAGNETROL INT'L** followed by a series of walking dots as follows:, or one of the chosen displays.

NOTE: The 350/351 is able to display a choice of three display modes. This display may be changed by accessing the Initialization Menu described on page 6.

IDLE- **MAGNETROL INT'L... Preferred Mode**

DIST- Displays distance in run condition

LEVL- Displays tank level in run condition



UP/RAISE - Used to scroll up through menu selections or raise numeric values. Holding down for a few seconds will increase the rate of change.



DOWN/LOWER - Used to scroll down through menu selections or lower numeric values. Holding down for a few seconds will increase the rate of change.

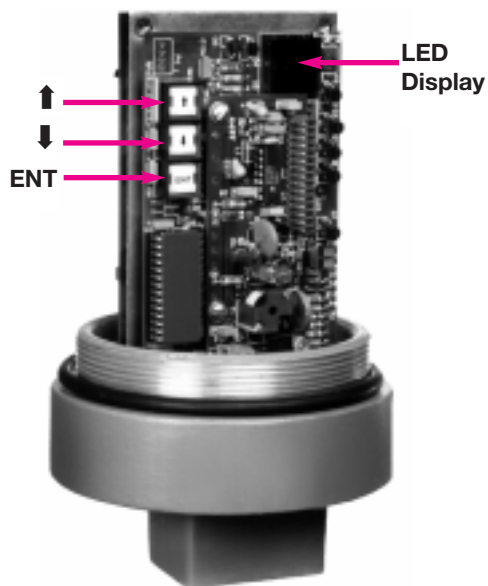


ENTER - Used to select displayed value and to continue to next menu selection.

A complete menu layout is provided to show the user-selectable parameters.

PLEASE STUDY THE MENU LAYOUT AND FOLLOW THE SET UP INSTRUCTIONS WHEN PLACING THE UNIT IN SERVICE OR WHEN CHANGING VALUES.

NOTE: MENU LAYOUT IS PROVIDED IN INCHES FORMAT. IF OTHER UNIT OF MEASUREMENT IS SELECTED, ALL DISPLAY VALUES WILL CHANGE ACCORDINGLY.



SET UP PROCEDURES

GENERAL SET UP

After completing the Unit Installation/Wiring section and studying the Menu Layout for the 350/351, power up the unit.

CAUTION: Power the Model 350/351 and perform all calibration in a non-hazardous area.

There are twelve steps in the initial SET UP of the Model 350/351.

All twelve steps must be accessed in order to provide optimum control for your application. After the initial SET UP, any of the twelve programmable functions can be accessed. **All Set Up Procedures are written based on the HEIGHT Mode selection. Refer to page 4 - Height or Distance Selection. If using the Distance Mode, all measurements are taken from the sensor face.**

NOTE: It is recommended that the user determine the values to be programmed into the unit prior to entering values using the keypad. This is due to a unique security feature which places a 30 second time limitation in various stages of the menu. If a time out occurs during parameter selection, the unit assumes the previous value for that parameter, continues to control under those values and will initially display **MAGNETROL INT'L** followed by a series of walking dots, or the display mode selected from the Initialization Menu. Refer to page 6. If a time out occurs during span selection, the range as well as span will revert to the previous setting. **All set up procedures are written based on the IDLE display mode as the unit shipped from the factory. The DIST or LEVL display modes may be chosen at any time. Refer to Initialization Menu on page 6.**

Upon power up, the unit will display the normal operating message followed by the walking dots as follows:

MAGNETROL INT'L.....

STEP 1 - To enter into the menu, press the ENT key. The display will read **UNIT**. UNIT is the unit of measurement used for all calculations and display within the 350/351. Press ENT a second time to display the current units selected. To change UNITS, use the UP or DOWN arrow key to scroll through the UNIT selections. Press ENT to select the displayed **UNIT** desired. The display will now read **UNIT** once again. Press the DOWN push button to proceed to **STEP 2 - RANGE (RNGE)**.

GENERAL SET UP cont.

STEP 2 - RANGE (RNGE) - Range is the distance from the face or the bottom of the transducer to the farthest point to be measured. The maximum range for the Model 350/351 is approximately 25 feet. With **RNGE** displayed, press ENT to continue. The display will read **MANL** for manual entry of the range value. Use either the UP or DOWN key to toggle between **MANL** and **AUTO**. If **MANL** is selected, press ENT to display the current operating value. Use the Up or DOWN keys to raise or lower the numeric value. Holding down the keys for several seconds will increase the rate at which the values are changed. When the desired value is displayed, press the ENT key to accept this value and to exit **RANGE**.

Selecting **AUTO** will allow for the 350/351 to actually measure the distance between the face of the transducer and the current material level. This selection can be used as a convenience when the level of the material being measured is at a desired minimum level. Press ENT to display the current range. There is no time limitation in this selection. Press ENT once again to accept the value and to exit **RANGE**. Press the DOWN key to proceed to **STEP 3 - SPAN**.

NOTE: When using the AUTO mode, in range or span. the 350/351 must first be manually programmed with values for range and span which are larger than the expected values. This allows the 350/351 to automatically measure the correct values within the programmed window of accepted signals.

STEP 3 - SPAN (SPAN) - Span is the difference between the range (low level) and the desired maximum level. Maximum span is the range value, less the 12" dead band in which measurement cannot take place. With **SPAN** displayed on the LED, press ENT to display **MANL** for manual entry of the span value. Use either the UP or DOWN key to toggle between **MANL** and **AUTO**.

If **MANL** is selected, press ENT to display the current operating value. Use the UP or DOWN key to raise or lower the numeric value. When the desired value is displayed, press the ENT key to accept this value and to exit span.

Selecting **AUTO** will allow the 350/351 to actually measure the distance between the face of the transducer and the current material level, and calculates the span based on that measurement. This selection is used in applications when the level of the material being measured is at a desired maximum level. Press ENT to display **SPAN VALUE**.

NOTE: There is no time limitation in this selection. If **OVER** or **UNDR** flashes, an illegal parameter has been selected. Review range values and re-enter the correct value. Press ENT once again to accept this value and to exit **SPAN**. Press the DOWN key to proceed to **STEP 4 - SAFE**.

SET UP PROCEDURES cont.

GENERAL SET UP cont.

STEP 4 - FAIL-SAFE (SAFE) - SAFE is designated as the fail-safe condition of both internal relays, used as alarms or pump control, and the desired condition of these relays in the event of a loss of echo for 30 seconds or more. Press ENT to display **RLY1** and **RLY2** for ease of programming. Each relay is independent and must be configured separately. When **RLY1** or **RLY2** is displayed, press ENT to display the current FAIL-SAFE condition. Use the UP or DOWN keys to set the desired condition - ON/OFF. Press ENT to choose either ON (energized) or OFF (de-energized) condition.

Repeat the above procedure for **RLY2**. Press ENT to exit and to accept that condition and display **SAFE**. Press the DOWN key to proceed to STEP 5 - **RELAYS**.

NOTE: An optional method of providing LOSS OF ECHO alarm is to program both the ON and OFF set points for a relay at 000, with FAIL-SAFE ON.

CAUTION: If the actual level drops beyond the maximum range of the unit, the display will show **LOSS**, and the relays will assume the programmed fail-safe position.

WARNING: If level exceeds the programmed span, false display or control errors will occur. Sensor should be installed and unit programmed to assure that this level cannot occur.

STEP 5 - RELAYS (RLYS) - Two 10 Amp SPDT independent relays are standard in the Model 350/351 and can provide simple high/low alarm functions or complex pump control functions. It is of utmost importance to correctly configure Relay 1 and Relay 2 on the 350/351 for optimum control.

NOTE: If desired, relays can be disabled by configuring both the ON and OF values to zero.

Both Normal (**NORM**) or Lead/Lag Pump Sequencing (**LEAD**) can be selected from the menu-driven keypad. Normal configuration treats each of the two relays as independent, each having adjustable ON/OFF values. Lead/Lag Pump Sequencing allows for a reversal of the role of two pumps to allow for even wear on both pumps. Figure 10 on page 5 shows a typical application of the Lead/Lag Pump Sequencing.

NOTE: If illegal values are entered for Lead/Lag settings, the LED will display **GOOF**. Check all settings for alarm conditions and continue with the Set Up Procedures.

To set **NORM** relay values, each relay has independent values. Instructions will be for the initial SET UP of the Relay 1 Set Point. Relay 2 Set Point values are entered in the same manner as Relay 1, therefore follow the same procedure in the description.

GENERAL SET UP cont.

Please follow the menu layout along with the following description for proper relay configuration.

With **RLYS** displayed on the LED, press ENT to display **NORM**. This is the independent relay conditions previously described. If **NORM** is desired, press ENT to display **R1SP**; or if **LEAD** is desired, press the UP or DOWN key to display **LEAD**. For **LEAD/LAG**, the following conditions MUST exist. Both relays must be in the same direction - i.e. Fill or Empty and both must have valid setpoints with different values. (Not single points).

Proceed with the identical instructions for either **NORM** or **LEAD** relay set up values from this point on. Press ENT to display **R1SP**. Press ENT once again to display ON. This will be the value for Relay 1 to turn ON. Pressing ENT will display the current operating value. Use the UP or DOWN keys to scroll to the desired value. When the correct value is displayed, press ENT to accept this value and proceed to the OFF setting. With **OFF** displayed, press ENT to view the current value. Use the UP or DOWN keys to raise or lower the numeric value until the desired value is displayed. Press ENT to accept and proceed to the values for Relay 2.

NOTE: If the ON and OFF setpoints are equal and the mode is **NORM**, before proceeding to Relay 2, either a HI? or LOW? condition must be selected. (This portion of the menu is shown in box in the Menu Layout). HI? is normally selected for a high level alarm at the selected setpoint. LOW? on the other hand, is normally selected as a low level alarm. In addition, when the alarm condition is displayed (ON/OFF) and the value does not need to be verified, pressing the UP key will display the Relay 1 or Relay 2 prompt. Pressing the UP key once again will exit the relay level of the menu.

If all of the Relay 1 values are complete, press ENT to proceed to **R2SP**. Follow the menu layout and the instructions for Relay 1 for the values desired for Relay 2. When the Relay 2 values are entered, press ENT to exit **RLYS**. Press the DOWN key to display **R1DL** and proceed to STEP 6.

SET UP PROCEDURES cont.

GENERAL SET UP cont

STEP 6 - RELAY 1 DELAY (R1DL) - Relay 1 delay is the number of seconds before activating or deactivating the relay.

NOTE: The signal must be in a continuous ON condition for the delay time before activating the relay. This delay is adjustable between 1 and 120 seconds. Press ENT to display ON. Press ENT once again to display the current value in seconds. Use the UP or DOWN keys to raise and lower the numeric value until the desired delay is displayed. Press ENT to accept the value and proceed to OFF delay. Press ENT to display the current operating value and use the UP or DOWN keys to scroll to the new value. Once the correct value is displayed, press ENT to exit R1DL and to proceed to STEP 7 - **R2DL**.

STEP 7 - RELAY 2 DELAY (R2DL) - Relay 2 delay (**R2DL**) is configured identical to STEP 6 - Relay 1 Delay. Follow the menu layout on page 6 and the STEP 6 instructions. When the Relay 2 Delay values are entered, press ENT to exit **R2DL**. Press the DOWN key to display **SET** and proceed to STEP 8 - (**SET?**).

STEP 8 - SET? - This selection appears only if a change was made to **RANGE, SPAN, R1SP** or **R2SP**. These four values depend on each other, therefore in the previous SET UP procedures, the values chosen were stored in memory as temporary values until this step. If a change has been made to one or more of these parameters ENT will return to the parameter which has not been changed but which could be affected by these changes.

A review of the previous settings can be accomplished by using the UP and Down keys to scroll through the menu.

When all values are verified, press ENT to accept these settings and to exit SET? and proceed to STEP 9 - (**DIST**).

GENERAL SET UP cont

STEP 9 - DISTANCE (DIST) - Distance is the measurement from the face or the bottom of the transducer to the level of the material being measured. This step is a read only display, meaning a continuous display of distance in the units selected in STEP 1. There is no time limitation in this step. When **DIST** is displayed, press ENT to display the distance. Press any key to exit **DIST** and press the DOWN key to continue to STEP 10 - (**LEVL**).

STEP 10 - LEVEL (LEVL) - Level is the measurement from the range point to the actual level of the material being measured. This is read only display, continuously displaying the level within the tank or vessel in the units of measurement selected in STEP 1. There is no time limitation in this step. When **LEVL** is displayed, press ENT to display the level. Press any key to exit **LEVL** and press the DOWN key to continue to STEP 11 - (**SGNL**).

STEP 11 - SIGNAL (SGNL) - Signal refers to the strength of the returning signal being received from the surface level of the material being measured. With **SGNL** displayed, press ENT to display the signal strength. There is no time limitation in this step. The representation of the signal strength is displayed in a value from 0 - 100% in 5 % steps. Ideally the reading should be between 40 - 90%. If the readings are less than 25%, improper alignment or poor installation procedures may be the cause. Press the DOWN key to continue to **RUN?** STEP 12 - (**RUN?**).

STEP 12 - RUN (RUN?) - This is the end of the SET UP PROCEDURES and provides the operator the opportunity to check previous settings before leaving the main menu. Returning to the normal operating mode is accomplished by pressing ENT.

MAGNETROL INT'L will then be displayed, or the previously chosen display as described in the Initialization

TROUBLESHOOTING

LOSS DISPLAYED

- Level falls below range selected. Signal maintains fail-safe selection and will return to normal output when level returns to within selected range. Increase range if this is not desirable.
- Echo lost. Check for surface foam, vapors or non-verti-

cal mounting of sensor.

OUTPUT NOT TRACKING LEVEL

- Check for obstruction in tank causing false echo.
- Incorrect calibration mode. (Height/Distance). Refer to page 4 for Height/Distance Selection.

SPECIFICATIONS

ELECTRICAL SPECIFICATIONS

Description	Specification
Supply Voltage	120 VAC, 50-60 Hz 240 VAC, 50-60 Hz
Power Consumption	5 watts maximum
Range	25 ft. (7 m) from sensor face Consult factory for range greater than 25 ft. (7 m).
Span	2 in. (51 mm) minimum 24 ft. (7 m) maximum
Frequency	50 kHz
Dead Zone	12 in., -20°F to 140°F (305 mm, -30°C to +60°C) 18 in., +140°F to +160°F (457 mm, +60°C to +71°C)
Output	2 - SPDT 120/240 VAC relays, adjustable differential, 10 A resistive, or (2) relays with RS-485
Fail-safe	User selectable; on, off, or hold
Time Delay	1-120 seconds in 1 second intervals, independent for each set point
Response Time	1 second minimum
Repeatability	±0.125" (±3 mm)
Accuracy	±0.25% of full scale
Ambient Temperature (Electronics)	-40°F to +160°F (-40°C to +71°C)
Ambient Temperature (Sensor)*	-20°F to +160°F (-30°C to +71°C)
Temperature Compensation	Automatic over range of sensor operating temperature
Operating Pressure	-10 to +50 PSIG (-0.689 to +3.45 Bar)
Beam Angle	Conical 12° (typical)
Humidity	95% Non-condensing (electronics)

* Kynar and 316 SS sensors temperature rating -20°F to +200°F (non-operational to +250°F).

MODEL 350 AGENCY APPROVALS

Agency	Model No.	Approval
CSA	350-5XXX-05X 350-8XXX-05X	Non-hazardous TYPE 4X environments except Lexan® cover
	350-8XXX-05E 350-80XX-05F	Hazardous locations TYPE 4X: Class I, Groups C & D Class II Groups E, F, & G Class III
FM	350-XXXX-05X	Non-hazardous NEMA 4X environments
	350-8XXX-05E 350-8XXX-05F	Hazardous locations NEMA 4X: Class I, Div. 1, Groups C & D Class II, Div. 1, Groups E, F, & G Class III

MODEL 351 AGENCY APPROVALS

Agency	Model No.	Approval
CSA	351-5XXX-000 351-8XXX-000 and 395-XCXX-0XX 395-XKXX-0XX 395-XEXX-0XX	Non-hazardous environments w/ TYPE 4X except Lexan® cover
	351-8XXX-000 w/ 395-XEXX-0XX	Hazardous locations TYPE 4X: Class I, Groups C & D Class II Groups E, F, & G Class III
FM	351-XXXX-000 and 395-XCXX-0XX 395-XKXX-0XX 395-XEXX-0XX	Non-hazardous NEMA 4X environments
	351-8XXX-000 ^① with 395-XEXX-0XX	Hazardous locations NEMA 4X: Class I, Div. 1, Groups C & D Class II, Div. 1, Groups E, F, & G Class III

① Transducers may be approved for Class I, Groups A & B. Consult factory.

REPLACEMENT PARTS

No.	Description		350 Integral	351 Remote	
				Controller	Sensor
1	Base	NEMA 4X	004-9160-002		N/A
		NEMA 4X/7/9	004-9104-001	004-9153-001	004-9104-001
2	Cover	NEMA 4X Lexan®	089-6596-001		N/A
		NEMA 4X Steel	089-6596-003		N/A
		NEMA 4X/7/9	089-6595-001	004-9149-001	089-6597-001
3	O-Ring	NEMA 4X	012-1318-001		N/A
		NEMA 4X/7/9	012-2101-345	012-2101-253	012-2101-345
4	Main PC Board		030-3502-001		N/A
5	Amplifier Board		030-3501-002		N/A
6	Voltage PC Board	120 VAC	030-3503-001		N/A
		240 VAC	030-3503-002		N/A
7	RS-485 PC Board		030-3526-001		N/A
8	Sensor PC Board		N/A		030-3515-001
9	Terminal Block Cover		009-6164-001		N/A
10	Bracket	NEMA 4X	005-6649-001		N/A
		NEMA 4X/7/9	005-6647-001	005-6650-001	005-6634-001

Lexan® is a registered trademark of General Electric

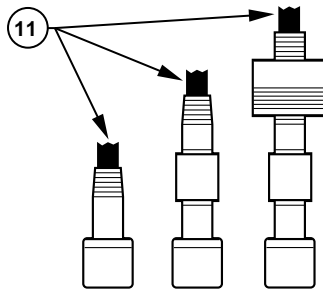
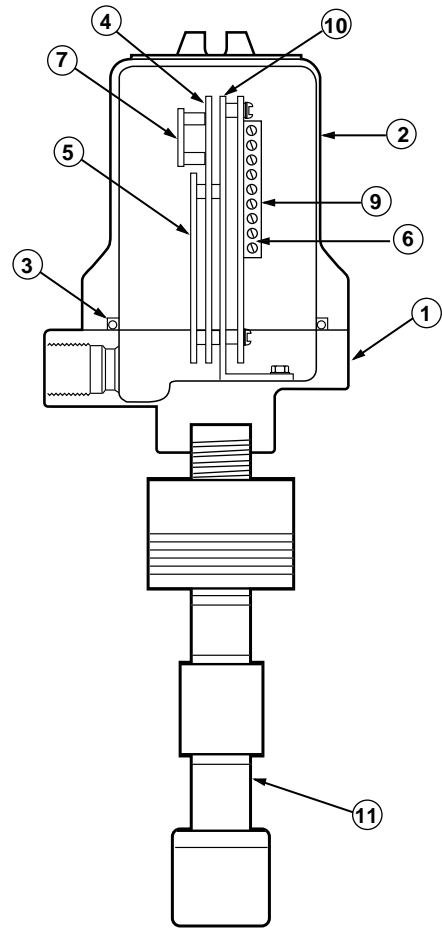
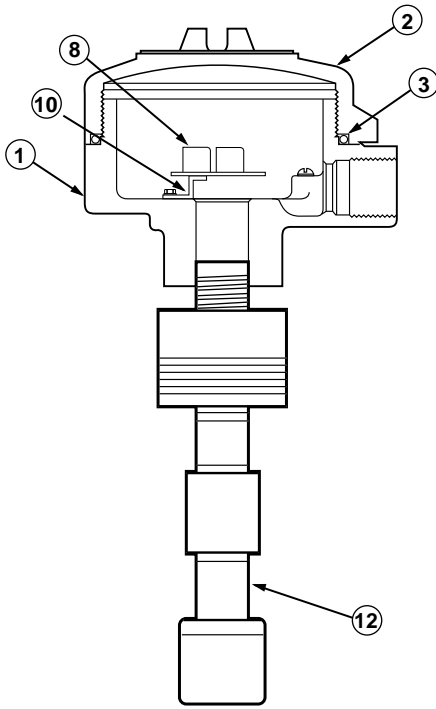
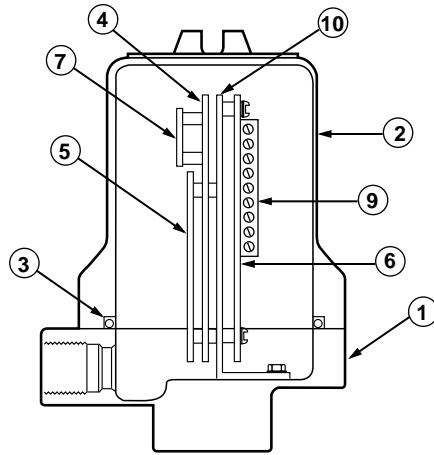
Sensors - 350 Integral

No.	Connection	Sensor Length	Sensor Material		
			Kynar/CPVC	Kynar	Stainless Steel
11	2"	6"	058-1070-023	058-1071-023	058-1061-019
		10"	058-1070-024	058-1071-024	058-1061-020

Sensors - 351 Remote

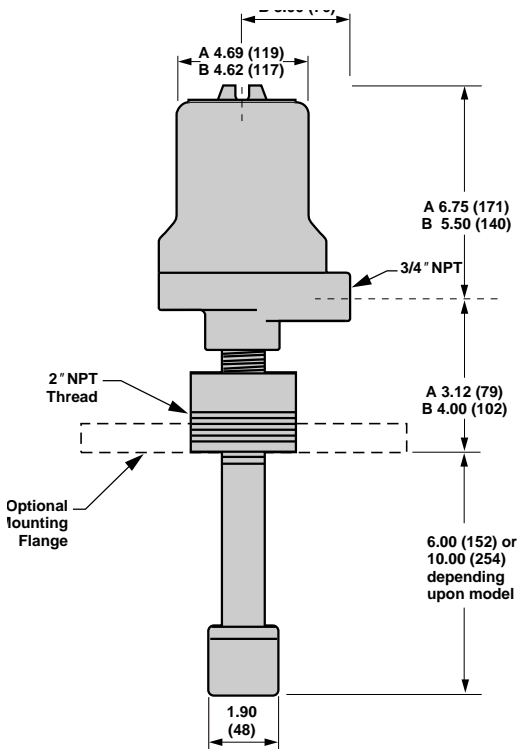
No.	Sensor Housing	Connection	Sensor Length	Sensor Material		
				Kynar/CPVC	Kynar	Stainless Steel
12	w/ Housing (short cables)	3/4" NPT	3"	058-1070-019	058-1071-019	058-1119-004
			6"	058-1070-020	058-1071-020	058-1061-016
			10"	058-1070-021	058-1071-021	058-1061-017
		2" NPT	3"	058-1070-022	058-1071-022	058-1061-018
			6"	058-1070-023	058-1071-023	058-1061-019
			10"	058-1070-024	058-1071-024	058-1061-020
	w/o Housing (20 ft. of cable)	3/4" NPT	3"	058-1070-013	058-1071-013	058-1119-002
			6"	058-1070-014	058-1071-014	058-1061-011
			10"	058-1070-015	058-1071-015	058-1061-012
		2" NPT	3"	058-1070-016	058-1071-016	058-1061-013
			6"	058-1070-017	058-1071-017	058-1061-014
			10"	058-1070-018	058-1071-018	058-1061-015

REPLACEMENT PARTS cont.



DIMENSIONAL DATA Inches (mm)

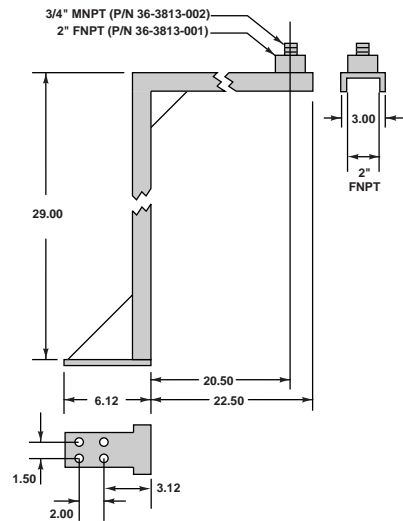
Model 350 Integral Mount



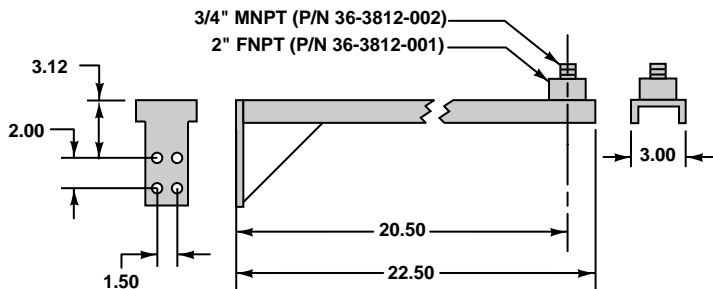
Housing Legend	
A.	NEMA 4X
B.	NEMA 4X/7/9

Notes:

1. Allow 8.00 (203) overhead clearance for removal of cover.
2. Do not attempt to disassemble transducer.

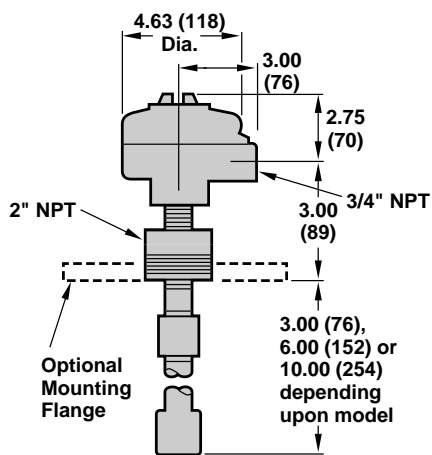


Floor Mount Bracket

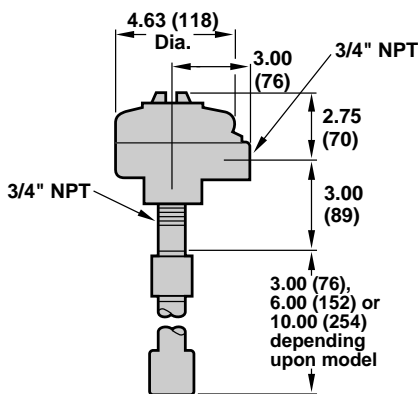


Wall Mount Bracket

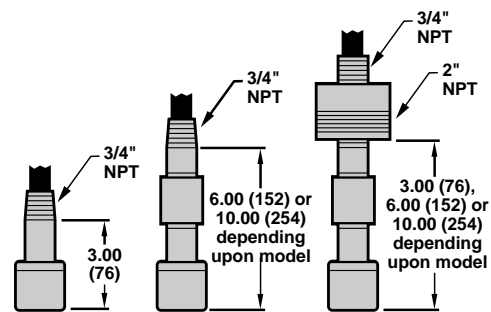
Model 351 Remote Mount



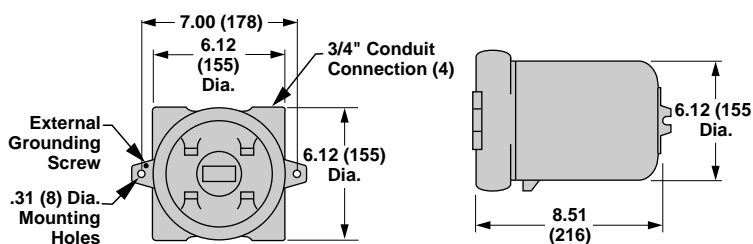
2" NPT Sensor w/ Housing
395-5X10-00X



Sensor w/ Housing
395-1X10-00X



Sensor w/o Housing
395-1X00-00X 395-5X00-00X



NEMA 4X/7/9 Electronics

IMPORTANT

PRODUCT WARRANTY

All Magnetrol/STI electronic and ultrasonic level and flow controls are warranted free of defects in materials or workmanship for one full year from the date of original factory shipment.

If returned within the warranty period; and, upon factory inspection of the control, the cause of the claim is determined to be covered under the warranty; then, Magnetrol/STI will repair or replace the control at no cost to the purchaser (or owner) other than transportation.

Magnetrol/STI shall not be liable for misapplication, labor claims, direct or consequential damage or expense arising from the installation or use of equipment. There are no other warranties expressed or implied, except special written warranties covering some Magnetrol/STI products.

QUALITY ASSURANCE

The quality assurance system in place at Magnetrol/STI guarantees the highest level of quality throughout the company. Magnetrol/STI is committed to providing full customer satisfaction both in quality products and quality service.



Magnetrol's quality assurance system is registered to ISO 9001 affirming its commitment to known international quality standards providing the strongest assurance of product/service quality available.

ASSURED QUALITY & SERVICE COST LESS

SERVICE POLICY

Owners of Magnetrol/STI controls may request the return of a control or any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Controls returned under our service policy must be returned by Prepaid transportation. Magnetrol/STI will repair or replace the control at no cost to the purchaser (or owner) other than transportation if:

- a. Returned within the warranty period; and
- b. The factory inspection finds the cause of the claim to be covered under the warranty.

If the trouble is the result of conditions beyond our control; or, is NOT covered by the warranty, there will be charges for labor and the parts required to rebuild or replace the equipment.

In some cases it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned will be determined on the basis of the applicability of our warranty.

No claims for misapplication, labor, direct or consequential damage will be allowed.

RETURN MATERIAL PROCEDURE

So that we may efficiently process any materials that are returned, it is essential that a "Return Material Authorization" (RMA) number be obtained from the factory, prior to the material's return. This is available through Magnetrol/STI's local representative or by contacting the factory. Please supply the following information:

1. Company Name
2. Description of Material
3. Serial Number
4. Reason for Return
5. Application

Any unit that was used in a process must be properly cleaned in accordance with OSHA standards, before it is returned to the factory.

A Material Safety Data Sheet (MSDS) must accompany material that was used in any media.

All shipments returned to the factory must be by prepaid transportation.

All replacements will be shipped F.O.B. factory.



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5300 Belmont Road • Downers Grove, Illinois 60515-4499 • 708-969-4028 • Fax 708-969-9489



5300 Belmont Road • Downers Grove, Illinois 60515-4499 • 630-969-4000 • Fax 630-969-9489 • www.magnetrol.com
6291 Dorman Road • Mississauga, Ontario L4V-1H2 • 905-678-2720 • Fax 905-678-7407
Heikenstraat 6 • B 9240 Zele, Belgium • 052 45.11.11 • Telex 25944 • Fax 052 45.09.93
Regent Business Ctr., Jubilee Rd. • Burgess Hill, Sussex RH15 9TL U.K. • 01444-871313 • Fax 01444-871317

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