



LHY280400 Rev. C

Mark-4 Yo-Yo[®]

Inventory Management System



INSTALLATION, OPERATION & MAINTENANCE MANUAL

SAFETY INFORMATION

Before installing the Mark-4 Yo-Yo® Inventory Management System, please read these instructions and familiarize yourself fully with the requirements and functions of the sensor and Remote Display (if included).

The Mark-4 Yo-Yo® sensor is an electromechanical device. It contains high voltage circuits and moving parts. Always remove power before servicing.

Yo-Yo® sensors are on-demand, continuous measurement devices. Therefore, they should not be used for process level control. If high or low-level alarm set points are required in addition to continuous measurement, point level switches should be added to the vessel.

If any questions or problems arise during installation of this equipment, please contact the Bindicator Applications Department at 800-778-9242 or 864-574-8060.

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1.0 PRODUCT DESCRIPTION

1.1 Function

The Bindicator general purpose Mark-4 Yo-Yo® is a sensor that is mounted to the top of a vessel and measures the distance to the product in the tank. This is done by lowering a weight to the surface of the product, while measuring the amount of cable used. When the weight contacts the material, the unit senses the loss of weight. The motor reverses and automatically returns the weight to its home position, sealing the weight against a bellows assembly in the bottom of the sensor housing. The cable is measured while traveling in both directions and the readings are compared. If each of these measured distances do not agree, the sensor automatically takes another measurement. A microprocessor located on board has the ability to convert this measured distance to "level of product" or "volume/weight of product" in the vessel. This value is communicated via RS-485 MODBUS to the Remote Display, or transmitted via 4-20mA to other equipment.

1.2 Applications

Bindicator Mark-4 Yo-Yo® sensors provide level measurement in most dry bulk solid materials, liquid/solid interfaces, and liquids at atmospheric pressure. They can be used for measurement of materials with temperatures of up to 200° F (93° C). Consult Bindicator Applications Department if you are using the Mark-4 Yo-Yo® sensor in material temperatures above 200° F (93° C).

Locating the proper mounting location on the top of your tank is important. When filling bulk materials into a vessel, a positive angle of repose (mound up) is created. When emptying, the angle of repose may go negative. In a round, center fill and discharge vessel, the point that best averages this angle of repose is located at 1/6 the diameter of the tank (or 1/3 radius) from the outside wall.

The Mark-4 Yo-Yo® sensor, like any other plumb bob device, drops a weight into the vessel. If the material in the vessel buries this weight, the sensor will become inoperative. Therefore, it is not recommended that readings be taken when there is a chance the weight will be buried. This could occur when the vessel is being filled or discharged.

If material is sticky and will eventually build up on the weight, this will cause the weight to become stuck at its home position inside the standpipe. In order to avoid this, a tare stop is available. The tare stop will still seal against the bellows when in the "home" position, but the weight is left suspended below the standpipe. If build-up does occur on the weight, it will not become stuck because it never enters the standpipe.

Consideration should be given to airflow characteristics in the vessel when there is no product movement. The internal dynamics of bulk solids storage vessels can vary drastically. If your vessel includes air movement equipment that continuously filters or moves air, this could cause problems with the weight when it is dropped into the vessel. Air currents can cause the weight to swing or spin as it is being lowered or raised inside the vessel. If the weight spins, it can create knots in the cable. Knots in the cable could hinder the movement of the weight as it is being retracted, or on the next measurement, when it is lowered. A swinging weight can be the cause of inaccurate readings or can abrade and eventually cut the cable as a result of rubbing on the edge of the standpipe at the top of the vessel.

1.3 Features

The Mark-4 Yo-Yo® is Bindicator's most application and interconnection flexible sensor to date. This sensor provides both RS-485 MODBUS communications and an isolated, reversible 4-20mA output. It can be cycled using a momentary contact closure such as a spring-loaded push button; or from the remote display by selecting 1 of up to 99 sensors and requesting a measurement; or by requesting the measurement via computer, either on-site or off-site.

Resolution: Resolution of the sensor is 1 cm (0.39 in).

Isolated 4-20mA Output: The 4-20mA output is optically isolated, and reversible. Setting "Tank Empty Distance" and "Tank Full Distance" values sets the parameters for the 4-20mA output. Selecting the "Set 4-20mA Mode" in the Program Menu allows the user to reverse the 4-20mA signal. The user is asked to choose whether 20mA represents a full tank or an empty tank. An external power supply is required to drive the 4-20mA signal.

RS-485 (MODBUS) Communications: All Mark-4 Yo-Yo® sensors and the Remote Display are connected to the network via RS-485 MODBUS protocol.

Automatic Cycle Timer: The Mark-4 Yo-Yo® sensor also has an on-board timer that can be set to take automatic readings from once every 2 minutes to 9999 minutes (approximately 1 week). Please use caution when using this feature. Sending the sensing weight to the material surface should not be done while the vessel is filling. For this reason, the sensor is also equipped with connections for an external switch that can be used to inhibit the initiation of a measurement (see Figure 1). Shorting these terminals inhibits the sensor from taking a reading, regardless of how the reading is requested. Examples of ways to ensure the weight does not get buried by material filling the vessel include connecting these pins to a limit switch on a diverter valve that swings fill into a vessel, truck loading switch, or PLC digital output (see Note 1).

Remote Measurement Request

Separate from the sensor measurement request from the display, are terminals on the Mark-4 Yo-Yo® sensor board that allows connection of a spring loaded push button, or a PLC digital output to request a reading of each sensor (see Figure 1). This is a momentary contact closure. Recommended "start pulse" is 500 milliseconds (see Note 1).

Note 1: Voltage across these terminals, supplied from the sensor board, is 5 VDC. Do not provide external power to the "inhibit" and "measure" terminals. Provide a **dry contact only**.

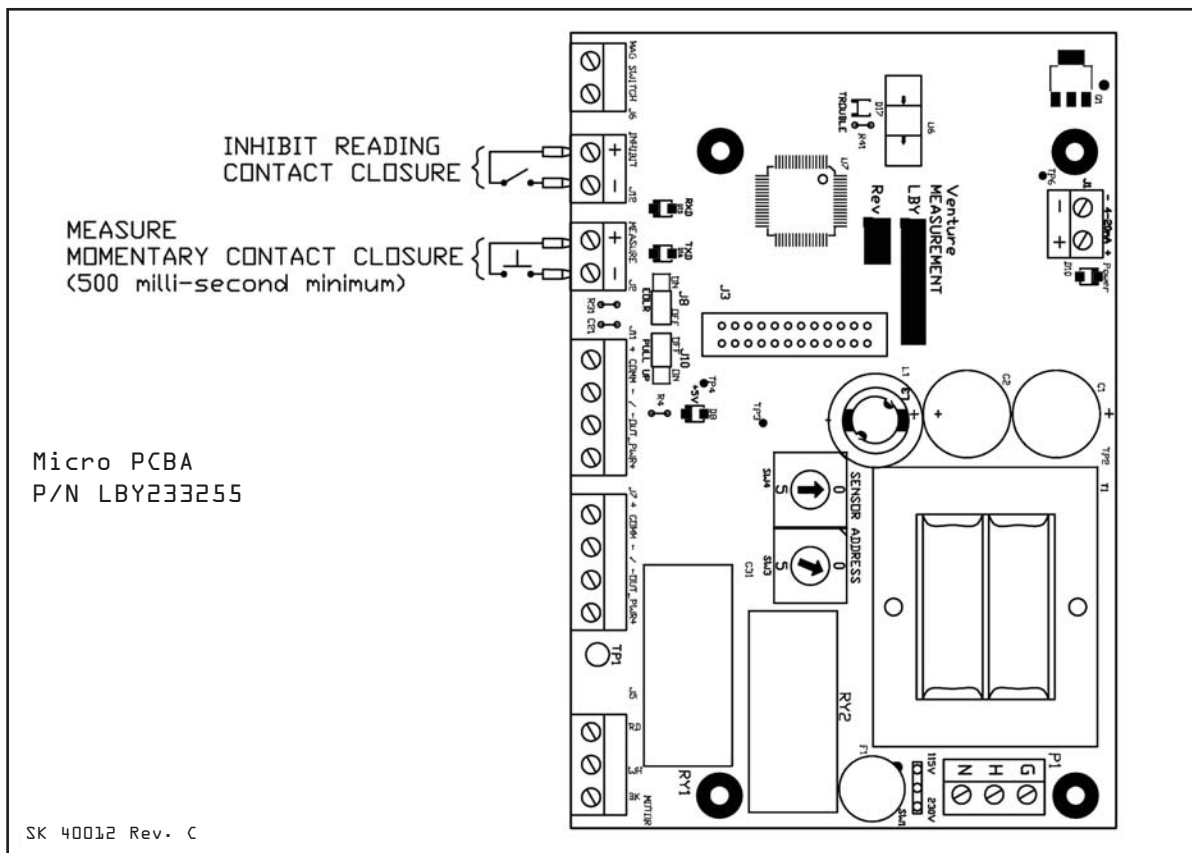


Figure 1. Inhibit and Measure Contact Closures

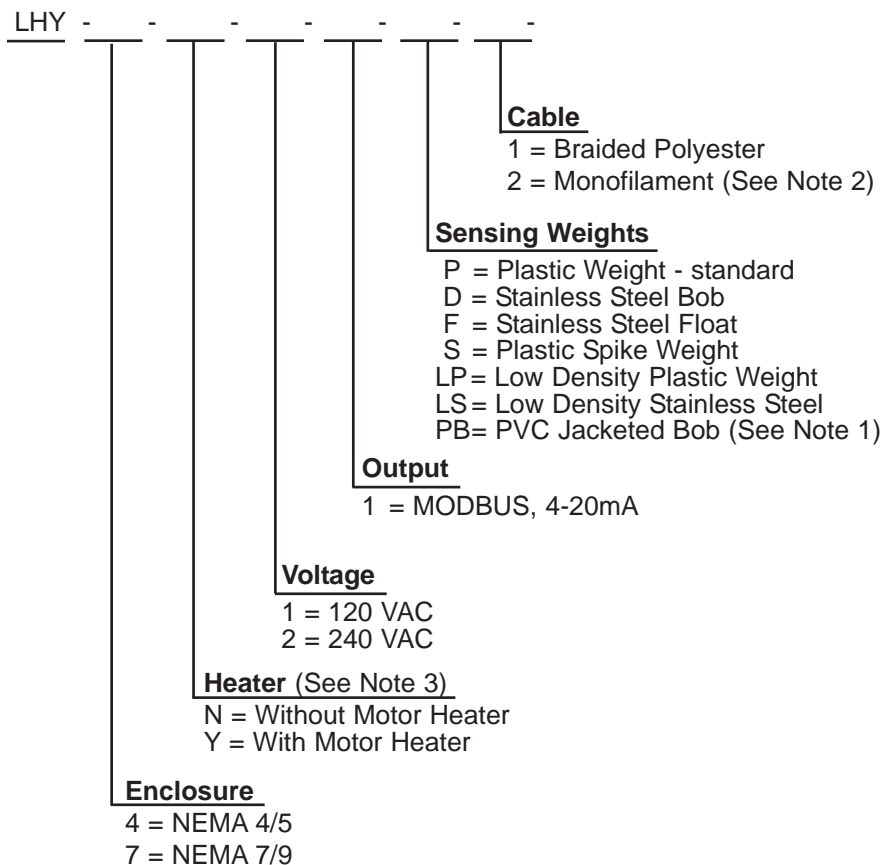
Remote Display: The Remote Display is capable of monitoring up to 99 sensors. It has a 4-line x 20-character LCD backlit display. The Remote Display is connected to the sensors via the RS-485 MODBUS network. All sensor programming and measurement requests are performed using the display. However, set-up and configuration settings are stored in each sensor.

The display does not require separate power unless equipped with a heater. Only when the display will be subjected to temperatures lower than -4° F (-20° C) is a heater required. The heater requires 120 VAC or 240 VAC depending on the specified display model.

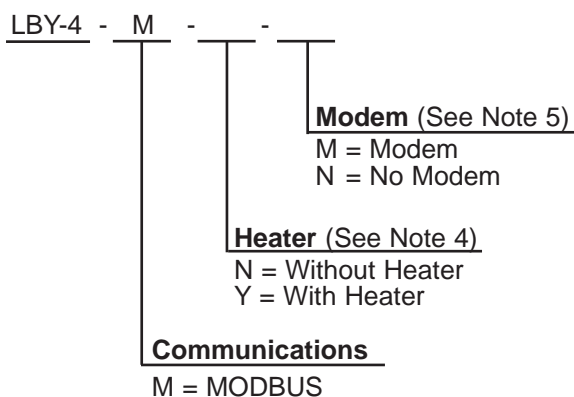
Optional Telephone Modem: If remote site monitoring is required, a telephone modem is available. The modem connects directly to the RS-485 MODBUS network and can be installed in the Remote Display. A direct dial, analog telephone line is required.

1.4 Model Code Identification

Mark-4 Yo-Yo® Sensor



Remote Display



- Note 1:** Specify monofilament cable
- Note 2:** Maximum length 50 ft (15.24 m)
- Note 3:** For operation below 32° F (0° C)
- Note 4:** For operation below -4° F (-20° C)
- Note 5:** Maximum one modem allowed per system

1.5 Technical Specifications

Mark-4 SENSOR

Power Requirements	120 VAC or 240 VAC
Power Consumption	Quiescent: 120 VAC, \pm 10%, 50/60 Hz, 4 Watts (with power to remote display) Operating: 120 VAC, \pm 10%, 50/60 Hz, 32 Watts (with heater, add 10 Watts to above)
Operating Temperature	32° F to 120° F (0° C to 49° C); with heater: -31° F to 120° F (-35° C to 49° C)
Measurement Span	Up to 100 ft standard
Repeatability	2 cm (0.8 in)
Resolution	1 cm (0.39 in or 0.033 ft)
Analog Outputs	Optically isolated 4-20mA (user sourced) into 600 ohms maximum Resolution: 12 bit (0.004mA)
Communications	RS-485 MODBUS Optional integral modem
Enclosure Material	Polyester powder coated/380 cast aluminum
Enclosure Rating	General Purpose, NEMA 4/5 and NEMA 7/9
Mounting	3" NPT
Conduit Entry	(1) 3/4" conduit opening for power, (3) 3/4" conduit opening for signal
Weight	26 lbs
Air Purge Connection	1/4" NPT
Cable	Braided Polyester or Monofilament (liquid/solid interface)
Automatic Timer	From 2 minutes to 9999 minutes (approx. 1 week)
Hazardous Location Approvals	FM, CSA, CE, ATEX-Dust

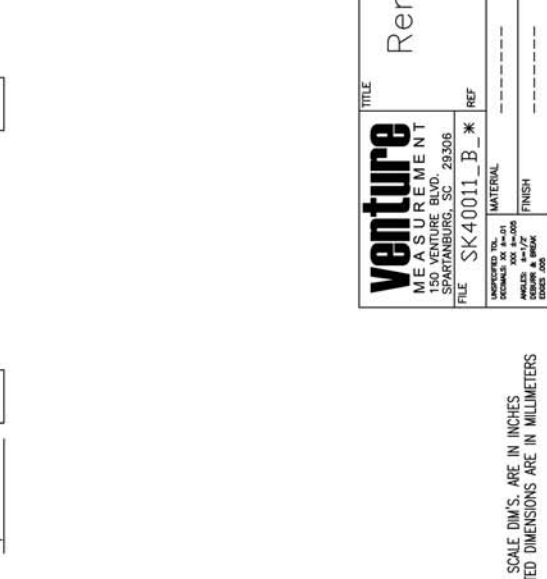
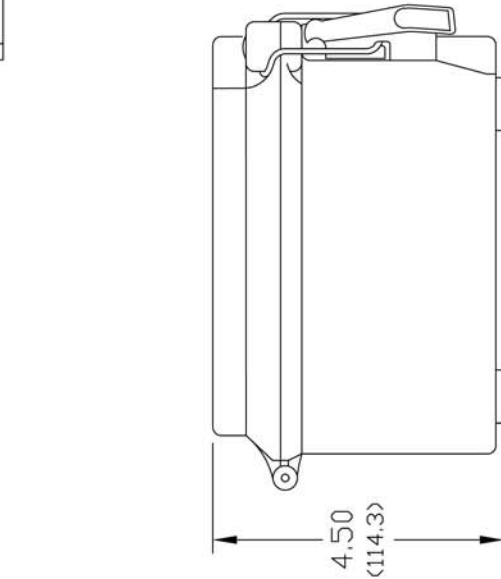
REMOTE DISPLAY

Power Requirements	9-24 VDC powered from Yo-Yo® sensor; with optional heater: additional 120/240 VAC
Operating Temperature	-4° F to 158° F (-20° C to +70° C); with heater: -40°F to 158°F (-40°C to 70°C)
Communication	RS-485 MODBUS Optional integral modem
Sensors	Up to 99
Display	4 lines by 20 characters backlit LCD display
Keypad	NEMA 4X soft-touch
Enclosure	NEMA 4X molded fiberglass polyester
Internal Modem	Optional 56K Modem

COMMUNICATIONS NETWORK

Wiring Requirements	Belden 9842, 4-wire, shielded cable recommended
Wiring Distance	4000 ft maximum
Speed	115 Kbps
Protocol	MODBUS
Interface	RS-485

REVISIONS		ECN	DRAWN BY	APPROD BY
A	INIT. RELEASE	03-127	SE	JD
B	Revised TitleBlock For (p=4 or Non-p=4 usage)	05-327	SE	NBC



venture MEASUREMENT	TITLE	Remote Enclosure for YO-YO	SCALE	NONE
	FILE	SK40011_B_*	SIZE	B
150 VENTURE BLVD. SPARTANBURG, SC 29306	MATERIAL		SHEET	---
UNAPPROVED FOR ISSUE 000 4-005	FINISH		PART	SK40011
00000 & 00000				

DO NOT SCALE DIM'S. ARE IN INCHES
BRACKETED DIMENSIONS ARE IN MILLIMETERS

Figure 3. Remote Display Dimensions

in (mm)

2.0 HANDLING & STORAGE

2.1 Inspection and Handling

The Mark-4 Yo-Yo® sensor and Remote Display are packaged separately to provide adequate protection of each instrument during shipment. Each sensor has been tested at the factory for 24 hours prior to shipment. When received, each package should be inspected for damage that may have occurred due to mishandling during shipping. If damage is discovered, notify the shipping carrier immediately. Do not dispose of the carton or packing materials. If you have any problems or questions, consult Bindicator Customer Care at 1-800-778-9242 or 864-574-8060.

2.2 Storage

If the Mark-4 Yo-Yo® sensor is not scheduled for immediate installation following delivery, the following steps should be taken:

1. Following inspection, repackage the unit into its original packaging.
2. Select a clean dry site, free of vibration, shock, and impact hazards.
3. If storage will be extended longer than 30 days, the unit must be stored in a non-condensing atmosphere less than 100% humidity.

Do not store a non-powered unit outdoors for a prolonged period.

3.0 MECHANICAL INSTALLATION

3.1 Guidelines

The sensor housing is rated NEMA 4/5 or NEMA 7/9 for use in hazardous and non-hazardous areas. When all screws are inserted and securing the cover, the sensor will remain weather tight. With the weight in the stored position, a bellows seal prevents any intrusion of vessel contents into the enclosure. However, when a measurement is being taken, product can blow up into the housing. To prevent this from happening, an air purge fitting is provided. A low pressure, low volume air supply to the enclosure will serve to create a positive airflow out of the enclosure and into the vessel, preventing product in the vessel from blowing up into the enclosure.

3.2 Mounting

Section 1.2 Applications, outlines the proper sensor location on the tank top. The Mark-4 Yo-Yo® sensor's mounting connection is 3" NPT. The sensor can connect directly to a 3" NPT nozzle or pipe nipple extending vertically from the tank top. If the standard "Digestible Bottle Weight" is used, the recommended nozzle length is 12 in (30.48 cm). If the "Stainless Steel Bob Weight" will be used, the recommended nozzle length is 3 in (7.62 cm). In either case the bottom of the weight will be slightly above the tank top when the weight is retracted.

All sensing weights should weigh between 20 & 25 ounces. The Standard Plastic Weight, and Plastic Spike Weight require additional weight to reach the desired total weight. Both weights have removable tops, and are made to accept additional material; usually the same material as is in the vessel, until the total weight is 20 - 25 ounces (see drawing number SK40009 on page 21 for weight options).

4.0 ELECTRICAL WIRING

4.1 Guidelines

The Mark-4 Yo-Yo® sensor is a line powered level transmitter that provides both an isolated 4-20mA output and RS-485 MODBUS communications. Wiring will consist of properly grounded input supply power (120 VAC or 240 VAC), RS-485 MODBUS communications and possibly 4-20mA output. It is very important that the supplied power to the sensors be clean and free of interference. Should clean power not be available, the isolation transformer (Bindicator part number LUC035683 (plug in) or LUC036139 (hard wire)) should be used to provide power to the system. Note: These isolation transformers provide a maximum power output of 150 VAC (see Sensor Specifications on page 4). An over current protection device, in the form of an external switch or circuit breaker is required for building installations. The communications and/or 4-20mA wiring should not be run in the same conduit as the AC supply wiring. Two ¾" conduit openings are provided for this reason. All wiring should conform to local and/or national electrical codes.

4.2 Connection Information / Wiring Diagrams

Consult drawings SK40005 on page 17 and SK40019 on page 20 for connection locations on the Mark-4 Yo-Yo® sensor and the Remote Display.

Communications: The recommended communication cable is Belden #9842 (2-pair, AWG 24) or equivalent (see Spare/Replacement Parts on page 15). Using this cable will allow a total network cable length of up to 4000 ft (1219.2 m). See Figure 4 below and drawings SK40005 on page 17 and SK40019 on page 20 for proper wiring. The communications wiring, which consists of communication and power pairs, is polarity sensitive.

Warning: Wiring power into the communication terminals will result in permanent damage to the electronics. Double-check all communications wiring before powering any sensor! Damage caused by incorrect wiring will void the warranty!

End of line resistors (EOLR) are required in the communication system in order to match the characteristic impedance of the communication cable. The EOLRs will avoid undesired reflections in the communication line. Each system (network) must have two EOLRs, one on each end of the communication cable.

In a four-sensor system with one remote display, if the communication wiring runs from Sensor #1 to Sensor #2 to Sensor #3 to Sensor #4, and then to the remote display, EOLRs would be required at the display and on Sensor #1. If the system is expanded to include an additional sensor (Sensor #5), which is wired only to Sensor #1, the EOLR would be removed from Sensor #1 and placed into Sensor #5. If a modem were installed in the display, it would become the end of line device, therefore the EOLR would be removed in the display and placed into the modem. See drawing SK40019 on page 20 for EOLR jumper settings.

Note: Device addressing has no bearing on end of line resistor settings. Only the physical ends of the network require the EOLR. Do not set this jumper in any device in the middle of the network.

A pull-up resistor is used for very long communication lines, usually greater than 1000 ft (304.8 m). The pull-up resistor actually compensates for the voltage drop on the communication line due to wire resistance. The longer the communications network cable becomes, the more likely the pull-up resistor will be required.

There is no rule of thumb to set the pull-up resistor as there is with the EOLR. If communication problems are experienced in a system using the recommended cable, EOLR settings, and addressing, it may be necessary to set a pull-up resistor in the middle of the network. In this location it will up both sides of the communication cable.

For very long communication lines, two or even three pull-up resistors could be used at different points. When using two pull-up resistors, place them $\frac{1}{4}$ of the cable length away from each end of the network, so each pull up-resistor takes care of half the length of the cable from its middle.

A Settings and Parameters Log is located on page 24 of this manual for recording the location of the jumper settings and your Mark-4 Yo-Yo® sensor settings.

4.3 System Configurations

See drawing number SK40031 on page 19 for possible Mark-4 Yo-Yo® System Configurations.

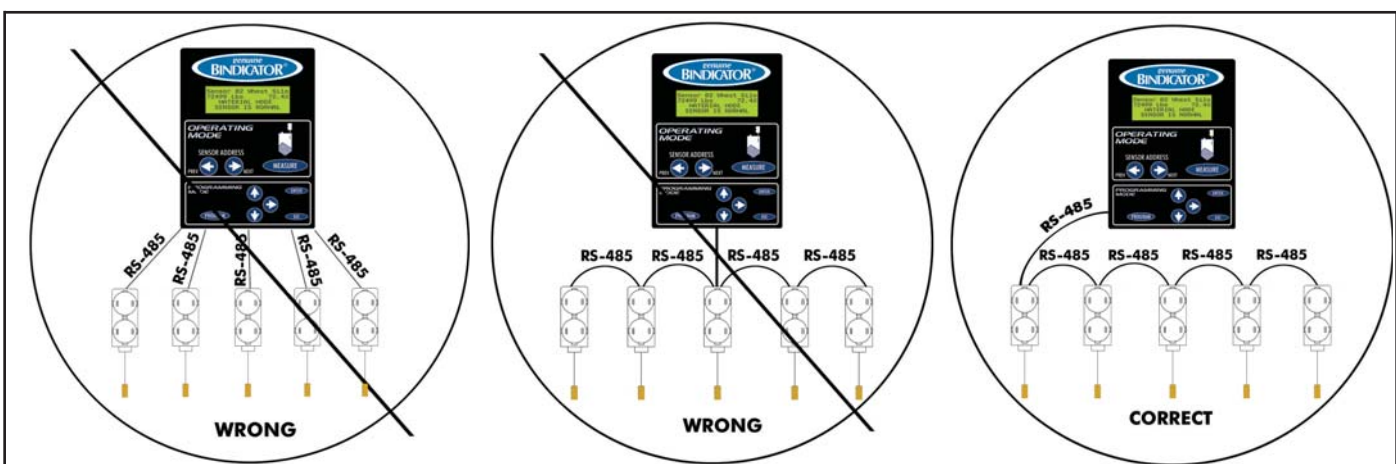


Figure 4. Proper Wiring Configuration

The Remote Display can be located anywhere in series with the network. Only two (2) EOLRs can be used; one EOLR at each end of the network.

5.2 Set-up / Programming

The Mark-4 Yo-Yo® sensors and remote display communicate via RS-485 MODBUS protocol. Each sensor has a couple of rotary switches located near the center of the electronics board. Sensors are addressed using these switches. All sensors are shipped from the factory with address #01. If you have purchased more than one sensor, or are adding to an existing systems, the sensors will need to be individually addresses. Each sensor **MUST** have a unique address between 1 and 99 inclusive. **Once address switches have been set, sensor must be re-initialized by pressing the reset button on board or by turning off and back on the power sensor.** See Figure #6.

When the Mark-4 Yo-Yo® sensor is installed on the tank top, properly addressed, and connected, it will begin communicating with the display. The display automatically looks for sensor address #01 or the first enabled sensor. From this address the user can enable all other sensor addresses using the "Programming Mode". The access code for this menu is "1936". Use the "up", "down" and "right" arrows to program each sensor. Pressing "ENTER" stores a change in the readout. When all changes are complete for a given sensor, go to "SAVE & QUIT" and press "ENTER". This sends all changes from the display to the sensor.

Note: While in the Programming Mode, no information is transferred between the Remote Display and other Mark-4 Yo-Yo® sensors. For this reason, there is an automatic timeout period. If no keys are pressed for one (1) minute, the Remote Display will exit the Programming Mode **without** saving changes and return to the Operating Mode.

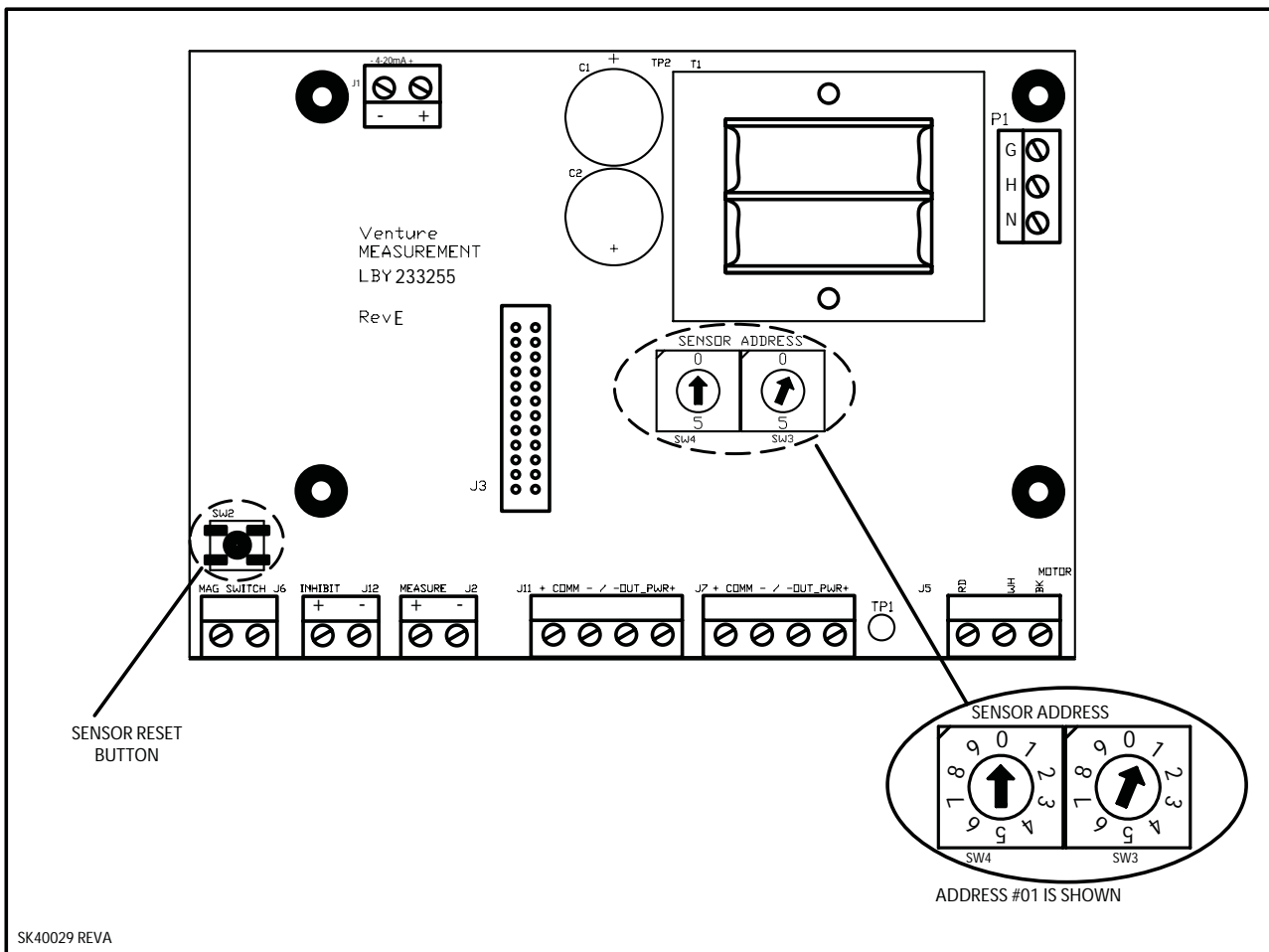


Figure 6. Sensor Addressing Rotary Switches

5.3 Programming Mode

The Programming Mode allows the user to configure a single sensor or multiple sensors. To enter the menu system a 4-digit numerical password is required. This password is "1936". The system does not allow changes to the password at this time.

While in this mode the display will indicate which sensor address is currently being edited. To select a menu item use the arrow keys to place the * beside the desired selection and press "ENTER". To move back, press "ESC". A Settings and Parameters Log is located on page 24 of this manual for recording your Mark-4 Yo-Yo® sensor settings.

Note: While in the Programming Mode, no information is transferred between the Remote Display and other Mark-4 Yo-Yo® sensors. For this reason, there is an automatic timeout period. If no keys are pressed for one (1) minute, the Remote Display will exit the Programming Mode **without** saving changes, and return to the Operating Mode. If programming is interrupted before completion, "Save and Quit" to avoid losing your settings.

Following, is a description of each menu item in the Programming Mode:

Units

Determines if the sensor will display linear distance units in feet or meters, or engineering (volume/weight) units. If English engineering units are selected on this menu, all tank definition distances will be edited using "feet". If metric engineering units are selected, all distances will be edited using "meters".

When Engineering Units are selected in conjunction with a cone height greater than "0", the displayed value and the 4-20mA output are linearized. This linearization assumes a center discharge cone below a round, straight sidewall silo.

Note: When selecting any engineering unit, the "full scale value" (amount of material that corresponds to the "tank full distance" must also be specified. See "full scale value" in Tank Parameters on page 12.

Distance Units

Feet (Default - One decimal place)

Meters (Two decimal places)

Engineering Units (no decimal places)

Cubic Feet

Cubic Meters

Lbs

Kgs

Gallons

Liters

Tank Parameters

This menu defines the tank dimensions (see Figure 7). All distances except "cone height" are taken from the sensor's "Home" position. The firmware allows the user to enter only the following possibilities:

Tank Height >= Maximum Move Distance >= Tank Empty Distance

Tank Empty Distance > Tank Full Distance >=0

Tank Height > Cone Height >= 0

Maximum Move Distance >= $\frac{\text{Tank Height}}{2}$

Tank Height:

This parameter is the distance from the Yo-Yo® sensor's home position to the bottom of the tank. The default value is 75 ft (22.86 m) and the range is from 3.3 ft to 199.9 ft (1 m to 60.93 m).

Note: Standard cable length is 100 ft (30.48 m). Do not program a value greater than this length unless a special storage wheel with an extended length of cable has been provided with the sensor.

The tank height value must be greater than or equal to "maximum move distance" and "tank empty distance." Therefore, setting this value to less than 75 ft (22.86 m) will automatically reduce the value of the "tank empty distance" and "maximum move distance" to the same value.

Tank Parameters (continued)

Tank Full Distance:

This parameter is the distance from the Yo-Yo® sensor's home position to the level of material where the tank is considered full. This parameter also determines the 20mA output point when 20mA represents a "full" vessel. If 20mA represents an empty vessel, the "tank full distance" is also setting the 4mA point. The default value for "tank full distance" is 0, and the range is from 0 ft to 1999.9 ft (0 m to 60.93 m). Also, see "4-20mA mode" on page 13.

Tank Empty Distance:

This parameter is the distance from the Yo-Yo® sensor's home position to the point where the tank is considered empty. This parameter normally determines the 4mA output. The default value is: 75 ft (22.86 m) (same as "tank height") and the range is from ½ of the tank height parameter to 199.9 ft (60.93 m).

Maximum Move Distance:

This parameter is the maximum travel distance from the Yo-Yo® sensor's home position. This parameter is used to limit the sensor from traveling through the discharge of the tank, or into discharge equipment such as screw conveyors. When the Yo-Yo sensor reaches this travel distance, it will stop the measurement, retract the weight, and display 'MAXMOVE DIST REACHED'. It will also display the distance traveled. The default value of this parameter is 75 ft (22.86 m) and the range is from "tank empty distance" to 199.9 ft (60.93 m). The "maximum move distance" value must be less than or equal to the "tank height" value.

Cone Height:

This parameter is only used when "engineering units" have been selected and is used to calculate the volume of material in the cone of a center fill, center discharge, round vessel. It is the distance from the bottom of the tank to the top of the cone. The default value is 0 ft (0 m) and the range is from 0 ft to 199.9 ft (0 m to 60.93 m).

Full Scale Value:

This entry is shown only if "engineering units" have been selected. It is the maximum (full) tank weight or volume capacity of the tank from the bottom of the tank to the level where the tank is considered full (see "tank full distance" in Figure 7). The default value is 1 and the range is from 1 to 9,999,999.

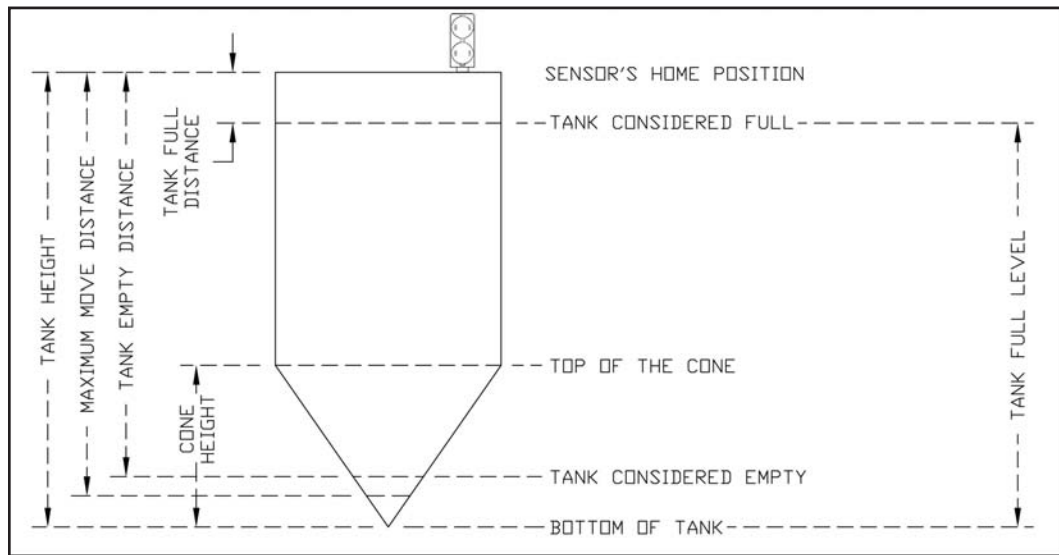


Figure 7. Tank Parameters

Display Mode

Material Mode:

If feet or meters have been selected in the "Units" menu, the display shows the level of material in the tank. This is the distance from the bottom of the tank to the top of the material. When engineering units are selected, the display shows the weight or volume of material in the vessel. When using the 4-20mA output, the range is defined as the points between "tank empty distance" and "tank full distance". Material mode is the default setting.

Mathematically: Level Material Mode = Tank Height - Measured Level (see Figure 8)

Air Mode:

If feet or meters have been selected in the "Units" menu, the display will show the distance to the material minus the "tank full distance" value (see Figure 8). For example, if the material in the tank is 10 ft from the sensor's home position and the tank full distance is "0", the display will show 10 ft. In the same scenario, with the "tank full distance" set to 3 ft, the display will now show 8 ft.

The same rules apply when using engineering or distance units; when volumetric or mass units have been selected, the display will indicate the volume or weight available (outage) in the vessel from the Tank Full Distance point. Only the unit of measurement changes.

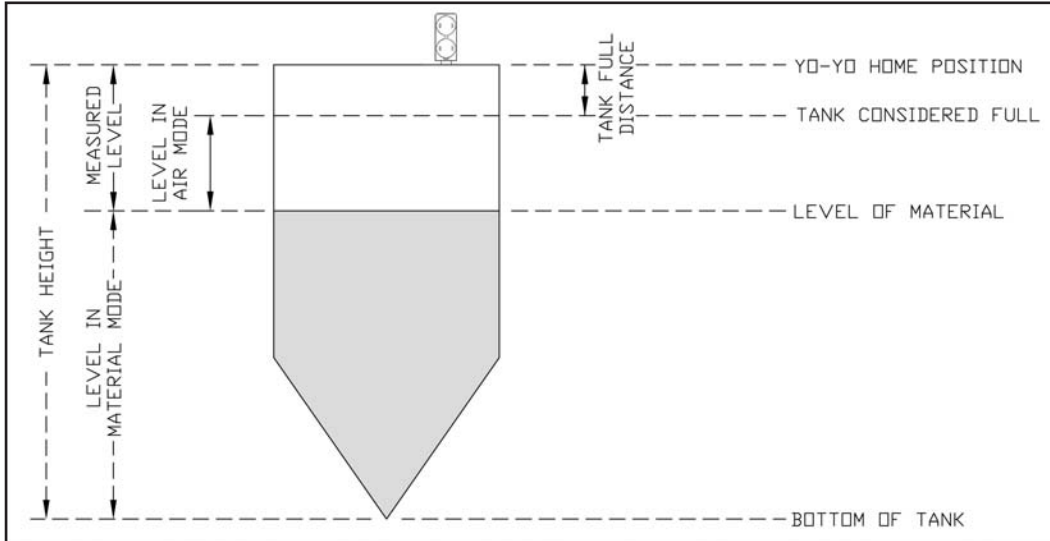


Figure 8. Display in Air / Material Mode

4-20mA Mode

This parameter is selected independent of the air and material modes. Typically, when the display is programmed for material mode, 20mA will also represent a full tank. Inversely, when displaying in air mode, 20mA will be set to represent an empty tank. However, both functions can be independently reversed if desired.

Note: If engineering units have been selected and a cone height greater than "0" specified, the 4-20mA output will be linearized for the cone section (see "Units" on page 11).

If power has been lost and restored, or on initial power-up, the 4-20mA output will indicate greater than or equal to a full tank. The actual output could be greater than or equal to 20mA or less than or equal to 4mA depending on the selected mode. When a new reading is requested and the cycle is completed within the set tank parameters, a new value, typically between 4 and 20mA, will be produced. Once updated, the Mark-4 Yo-Yo® sensor will hold the 4-20mA value until cycled again.

20mA = Full (Default)

20mA = Empty

Autotimer Mode

When the autotimer mode is set to ON, the Mark-4 Yo-Yo® sensor is able to take a reading automatically at an interval defined in menu "Autotimer Time". When the autotimer mode is set OFF, the Mark-4 Yo-Yo® sensor will only begin a measurement when manually requested. We strongly recommend the use of the "inhibit" feature when using the autotimer mode. See "Automatic Cycle Timer" on page 2 for a more detailed description of this inhibit feature.

On

Off (Default)

Autotimer Time

This entry is shown only if autotimer mode is set to ON. This parameter selects the amount of time between automatic cycle requests. The default setting is 1440 minutes (24 hours). Select a value 2 minutes to 9999 minutes (approximately 1 week).

Note: The motor has a 50% duty cycle. Do not run the Mark-4 Yo-Yo® sensor continuously.

Set Sensor Name (10 characters)

This entry defines a 10-character name for the selected sensor. The set of possible characters follows:

A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, [, \,], ^, _, a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z, {, |, }, Space, !, ", #, \$, %, &, ', (,), *, +, Comma, -, ., /, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, :, <, =, >, ?, @.

These characters represent ASCII codes from 32 to 126.

Enable/Disable Sensors

All disabled sensors can be enabled or disabled from any active (enabled) sensor address. In a new system the readout will look for sensor address #1. Addressing is done via an 8-position DIP switch on each sensor. See section 5.2. Other sensors can be enabled from that address. Sensor enable/disable status is stored in EEPROM at the display. Sensors do not have to be sequentially addressed.

Sensor 01 Ena (currently enabled)

Enable
Disable

Sensor 02 Ena (currently enabled)

Enable
Disable

Sensor 99 Dis (currently disabled)

Enable
Disable

Save and Quit

This entry downloads all parameter additions or changes from the display to the selected sensor. All sensor configuration information is stored in EEPROM on-board each sensor. Enabled/disabled sensor information is stored in the display.

Press ENTER to save changes.

Note: While in the Programming Mode, no information is transferred between the Remote Display and other Mark-4 Yo-Yo® sensors. For this reason, there is an automatic timeout period. If no keys are pressed for one (1) minute, the Remote Display will exit the Programming Mode **without** saving changes and return to the Operating Mode. If programming is interrupted before completion, "Save and Quit" to avoid losing your settings.

6.0 MAINTENANCE / PARTS LIST

6.1 Preventative Maintenance

Bindicator does not provide a preventative maintenance schedule for the Mark-4 Yo-Yo® Inventory Management System. The interval for preventative maintenance depends on the sensor's application and how often it is cycled. Following are recommended checks:

1. Inspect inside of sensor enclosure. Check the mechanical side for excessive coating on cable or in the enclosure. Clean if necessary. If the problem continues, or if dirt and debris are present on the electrical side of the sensor, install a low-pressure air purge on the sensor. A ¼" NPT fitting is provided.
2. Inspect the weight and cable. Is there excessive wear on the cable? If so, the cable may be rubbing on a sharp edge of the nozzle or the entry into the tank.
3. Be sure the weight is securely attached to the cable. If a bottle style weight is used, ensure that there are no leaks and that the overall weight is between 20 and 25 ounces.
4. Check that all wheels and arms move freely, particularly the count wheel.

6.2 Spare / Replacement Parts

<u>Product Code</u>	<u>Description</u>
LBY211182	Plastic (bottle) Weight
LBY211188	Stainless Steel Bob Weight
LBY211384	PVC Jacketed Bob Weight (Includes 50' of monofilament cable)
LBY211269	Plastic Spike Weight
LBY211427	Stainless Steel Float
LHY211397	Low Density Stainless Weight
LBY211305	Low Density Plastic Weight
LBY231290	Braided Polyester Cable
LBY231293	Monofilament Cable
LBY233255	Replacement Sensor E/U - 120 VAC
LBY211453	Replacement Sensor E/U - 240 VAC
LUC042827	Fuse, Sensor PCBA 80 mA TR5 Case
60119P009	Fuse, Display/Driver Bd., 1 Amp
LBY211454	Modem Board Assembly for Display
LBY233256	Replacement Modem PCBA
RAD230007	Replacement Display CPU Bd.
LBY233258	Replacement Display/Driver Bd.
LHY211581	Motor Assembly - 120 VAC
LHY211582	Motor Assembly - 240 VAC
LBY-C-1-length in ft.	Kit, RS-485/232 Converter, DB-9 Connector, Cable
LBY208007	i-LEVEL™ Software
LBY233271	RS-485/232 Converter
LUC035683	Isolation Transformer - plug in
LUC036139	Isolation Transformer - hard wired
Recommended Communication Cable - Belden #9842 (2-pair, AWG 24)	
LUC039209	Per foot Belden #9842 (2-pair, AWG 24)
LUC039210	500' Roll Belden #9842 (2-pair, AWG 24)
LUC039211	1000' Roll Belden #9842 (2-pair, AWG 24)
LUC039212	Per foot Belden #9841 (1-pair, AWG 24)

7.0 TROUBLESHOOTING

When troubleshooting the Mark-4 Yo-Yo® Inventory Management System, confirm that all power and communications wiring between the sensor and Remote Display, or PC is correct. If troubleshooting the sensor outdoors, shield the opto-reader from direct sunlight whenever the cover is removed. Always check the display status message on the Remote Display (see section 5.1 for status messages).

Problem: Reading always indicates a full vessel when a measurement is requested.

Solution: The sensor is short-cycling. Inspect the sensor for the following possible problems.
Verify the sensor weight is 20 - 25 ounces.
Check that the weight is not stuck in the home position, possibly due to material build-up.
Check that the count wheel is free to move through the opto-reader.
If ambient temperature is below 32° F (0° C), check that motor heater is operational.

Problem: Remote Display is blank.

Solution: Power to the display is fed from the sensor(s).
Check that power is supplied to the sensor(s).
Check the fuse on the display driver board (1 amp).
If this is a single sensor system, and power is present at the sensor also check the sensor fuse (5 amp).

Problem: Sensor cycles normally, but displayed value reads "0" or "1".

Solution: Sensor may be set to Engineering Units, but "Full Scale Value" has not been changed from its default value of "1". Set Full Scale Value to a valid number.

Problem: Reading requested once, but sensor travels down to the surface multiple times.

Solution: If the sensor is programmed to take automatic readings, the sensor may be taking a timed reading following the manual request. If the number of counts up and down does not agree, the sensor automatically takes another reading. The sensor will send the weight to the material surface three (3) times before displaying "UP/DOWN DO NOT MATCH". Check that the count wheel is moving freely and that the cable is not slipping. Check that the "max move distance" is not greater than the length of cable available on the sensor. The cable could be running off of the storage wheel and rewinding backwards.

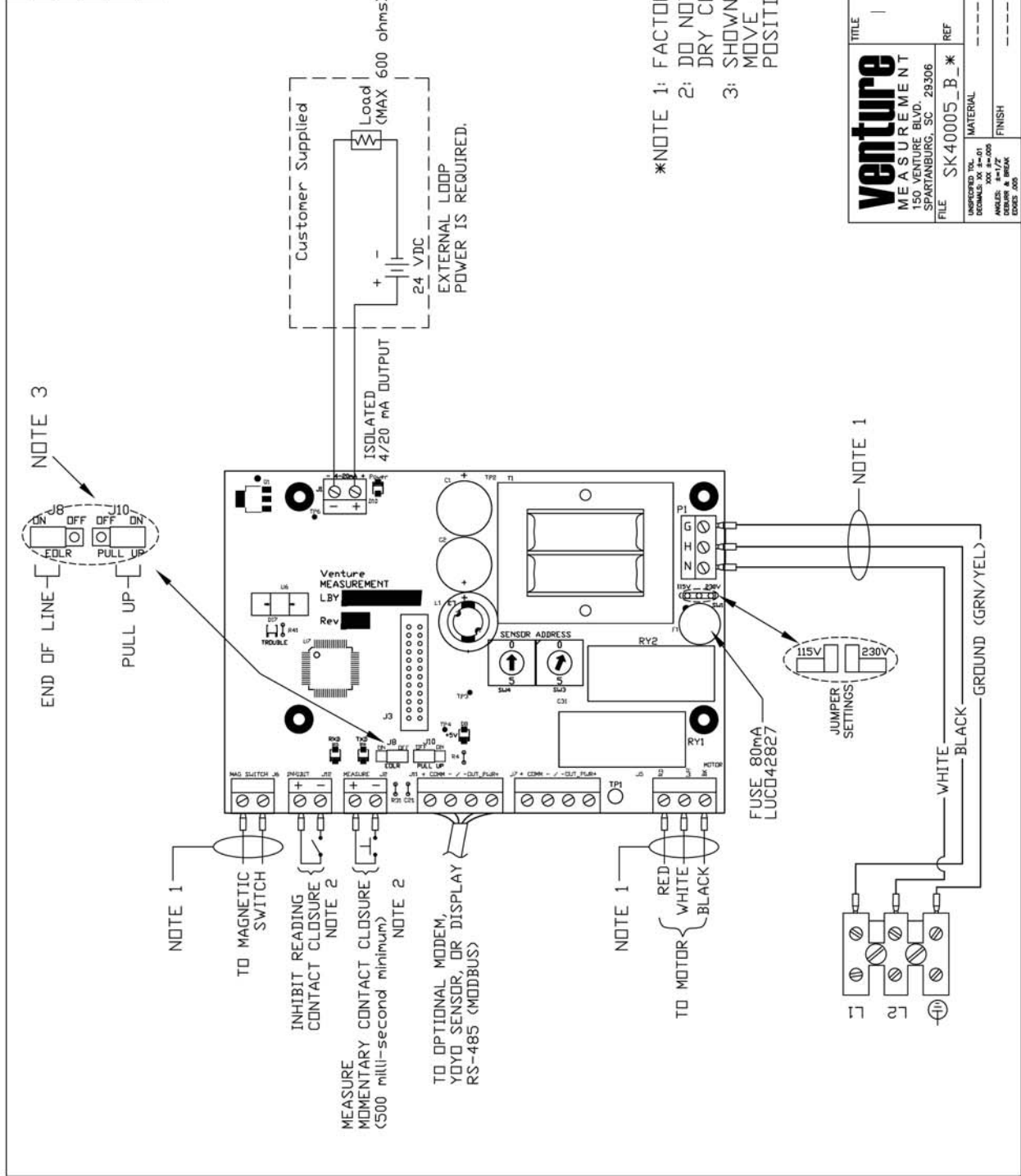
Problem: Sensor does not respond when measurement requested.

Solution: Is sensor properly addressed? See Section 5.2 Set-Up / Programming on page 10 of this manual. Check display; status line should read "starting measure" followed by "sensor is measuring". If status does not change, check sensor fuse. If a different status message appears, see section 5.1 on page 9 for possible cause.

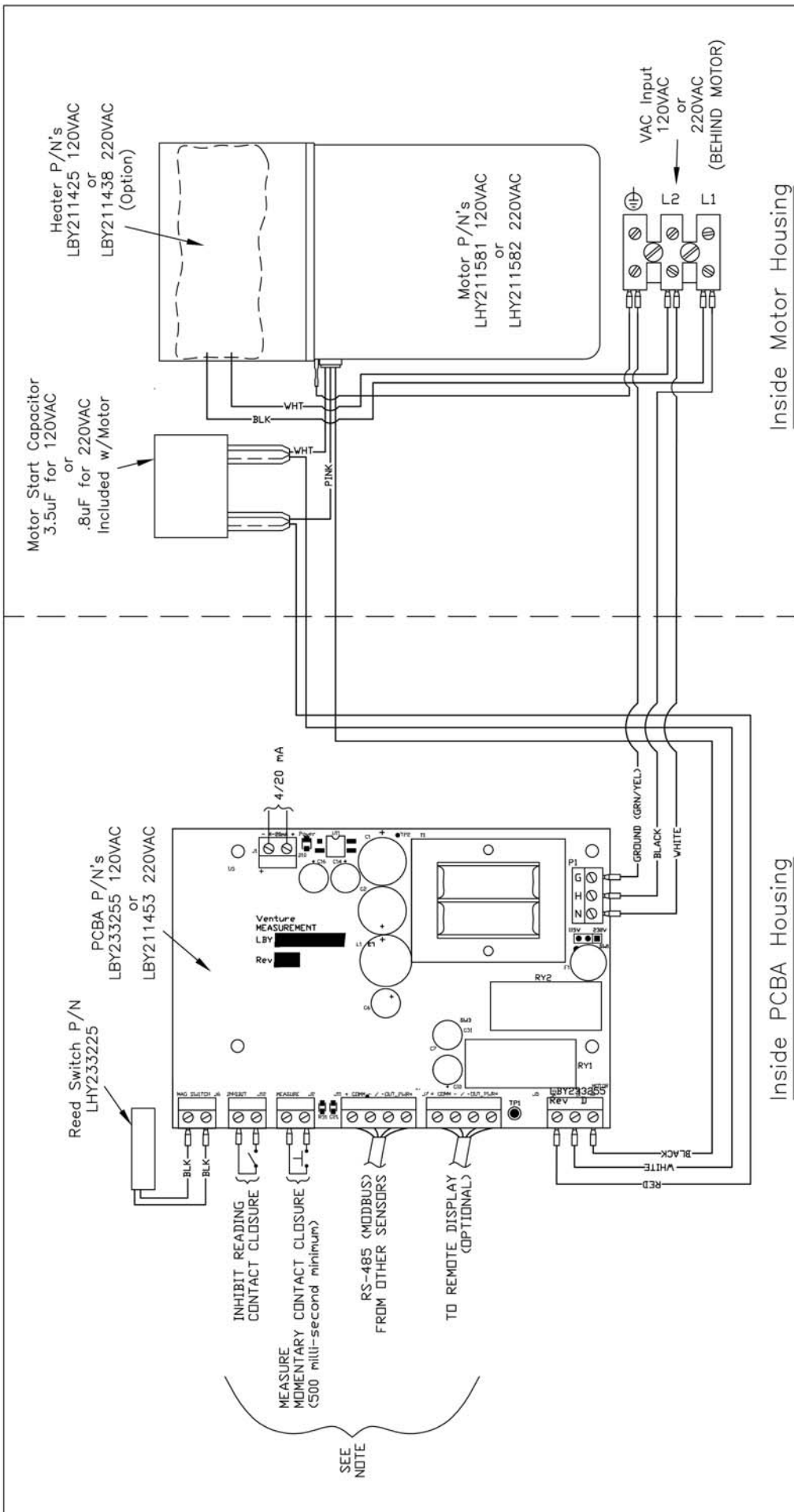
8.0 APPENDIX

<u>Drawing Description</u>	<u>Drawing Number</u>	<u>Rev.</u>	<u>Page Number</u>
Mark-4 Sensor Board Inhibit and Measure Contact Closures	SK40012	C	2
Mark-4 Yo-Yo® Outline	SK40023	B	5
Yo-Yo® Remote Enclosure	SK40011	B	6
Mark-4 Sensor Addressing Rotary Switches	SK40029	A	10
Mark-4 Sensor Board Wiring Diagram	SK40005	C	17
Mark-4 System Wiring Diagram	SK40026	B	18
Mark-4 Yo-Yo® Wiring Configurations	SK40031	B	19
Mark-4 Wiring Sensor to Remote Display with board RAD230007 Rev C	SK40019	B	20
Yo-Yo® Weight Options	SK40009	B	21
Mark-4 Cable Wrap Guide	SK40032	A	22
Mark-4 RS 485/232 Converter Wiring	SK40020	A	23
Mark-4 Yo-Yo® Sensor Settings/Parameters Log	SK40028	B	24

REVISIONS		ECN #	DRAWN BY	APPRO. BY
A	INIT. RELEASE	03-127	SE	JD
B	BOARD REVISED TO LATEST REV	05-252	SE	DE



SCALE	NONE
SIZE	C
SHEET	---
TITLE	SENSOR BOARD WIRING DIAGRAM (Customer Drawing)
FILE	SK40005_B_*
REF	
MATERIAL	
FINISH	
PART	SK40005

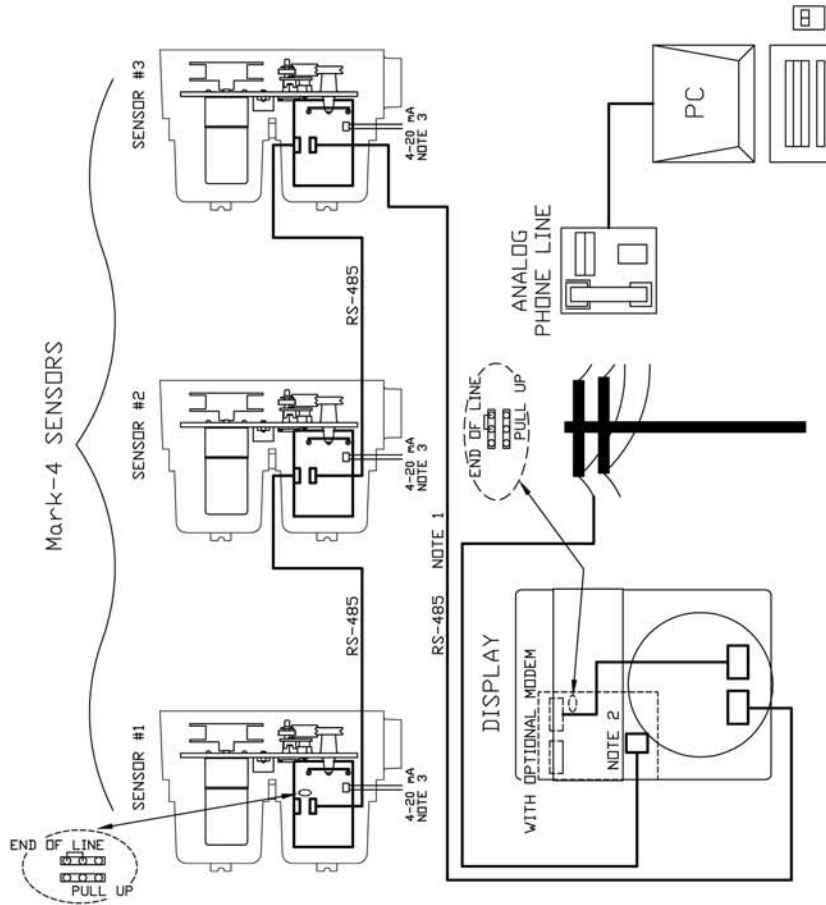


SCALE	NONE
SIZE	B
SHEET	---
TITLE	MARK-4 System Wiring Diagram
FILE	SK40026_B_*
MANUFACTURED BY	VENTURE MEASUREMENT SPARTANBURG, SC 29306
MATERIAL	---
FINISH	---
PART	---
REF	---
SK40026	---

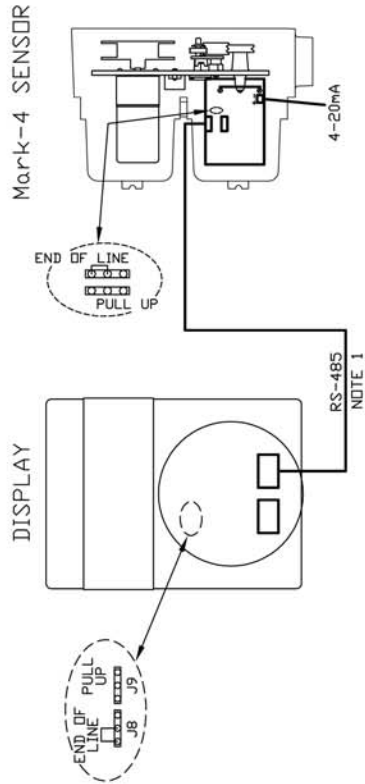
REVISED FOR CORRECT ORIENTATION	05-327	SE	9-20-05	NBC	9-19-05
INIT. RELEASE	05-121	SE	3-30-05	NBC	3-30-05
REVISIONS	EON	DATE	DATE	DATE	DATE

NOTE:
FOR GREATER DETAIL, REFER TO DRAWING SK40019

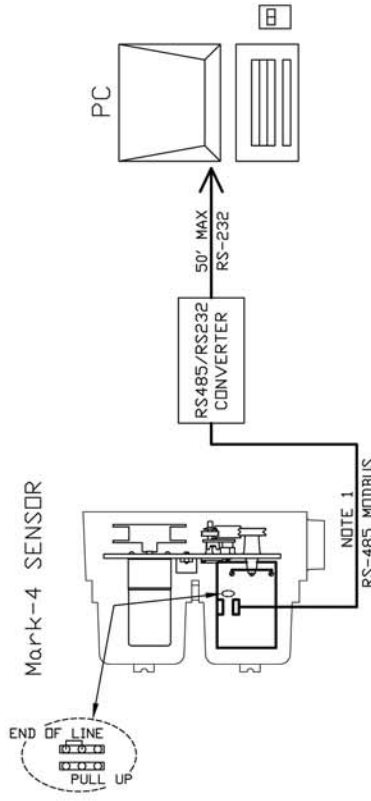
REMOTE MONITORING WITH LOCAL DISPLAY



STANDARD CONFIGURATION



LOCAL PC WITHOUT DISPLAY



- NOTE 1:
MAXIMUM NETWORK CABLE LENGTH IS 4000'
MODBUS PROTOCOL
- NOTE 2:
MODEM CONNECTOR IS RJ-12. USE RJ-11
OR RJ-12 TO MAKE CONNECTION.
- NOTE 3:
SEE DRAWING SK40005 FOR 4-20mA DETAIL

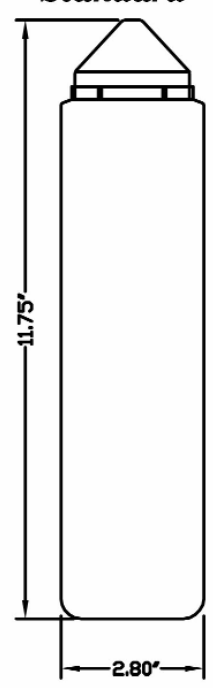
SCALE	NONE
SIZE	B
SHEET	---
TITLE	Mark-4 YOYO WIRING CONFIGURATIONS (Customer Drawing)
FILE	SK40031_B_*
REF	---
MATERIAL	---
FINISH	---
PART	SK40031

REV	DATE	BY	CHKD	DATE
1	05-327	SE	NBC	02-18-08
INIT. RELEASE				

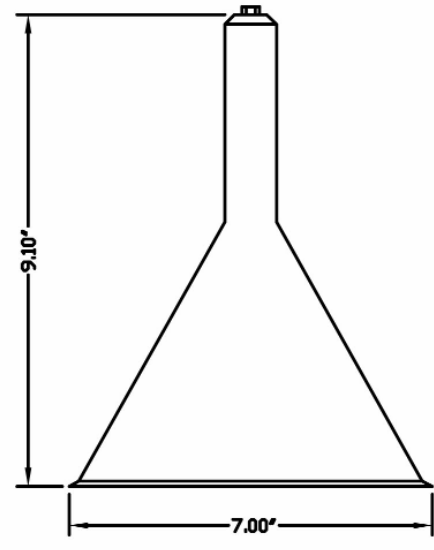
REVISIONS	
#	DATE

SK40009

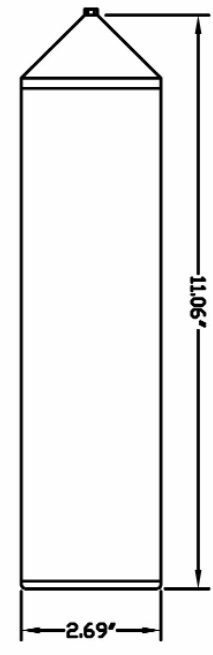
LBY211182
Plastic Weight
Standard



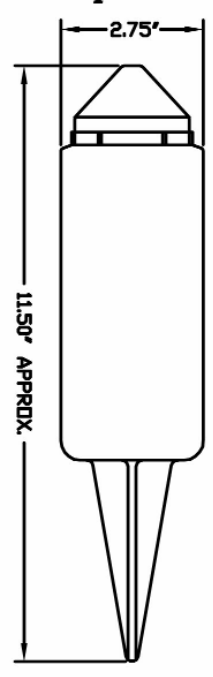
LHY211397
Low Density Stainless Steel



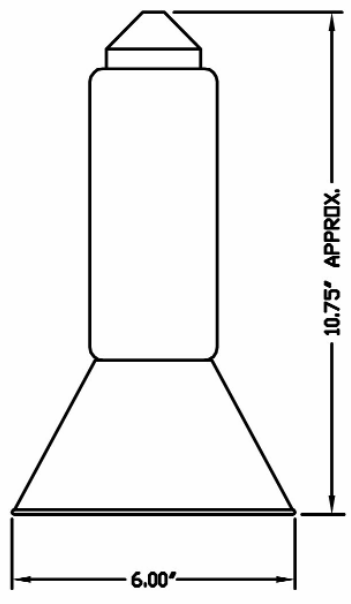
LBY211427
Stainless Steel Float



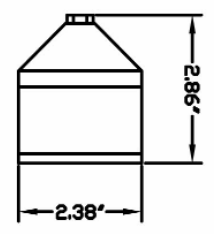
LBY211269
Plastic Spike Weight



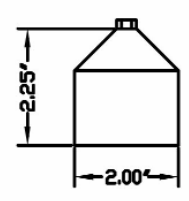
LBY211305
Low Density Plastic Weight



LBY211384
PVC Jacketed Bob



LBY211188
Stainless Steel Bob



SK40009

DO NOT SCALE DIM'S. ARE IN INCHES
BRACKETED DIMENSIONS ARE IN MILLIMETERS

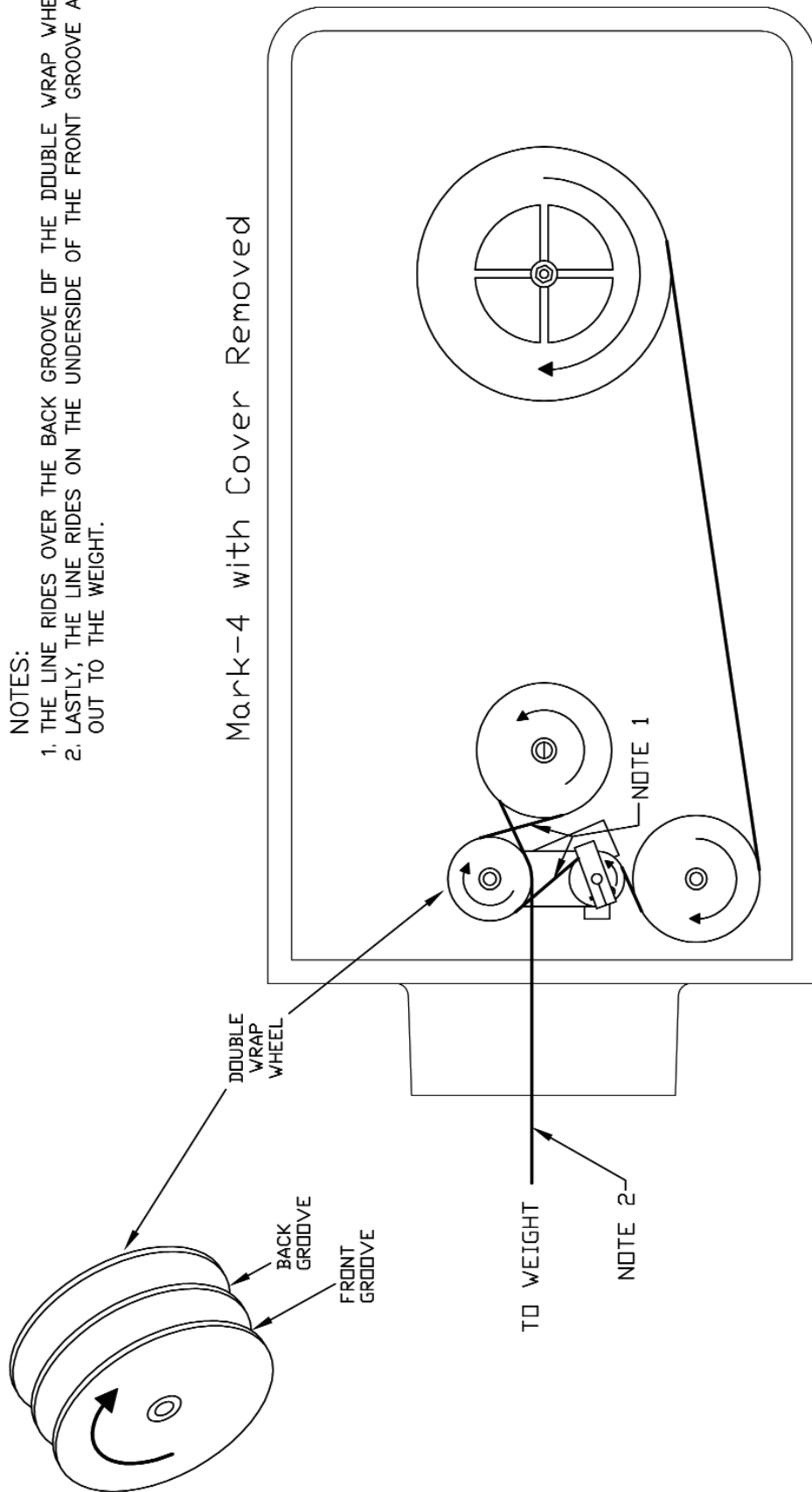
REV.	DATE	BY	CHKD.	APP'D.
A	03-127	SE	JD	6-11-03
REVISIONS				

venture MEASUREMENT 150 VENTURE BLVD. SPARTANBURG, SC 29306 FILE SK40009_B_#	TITLE	YoYo Series Weight Options (Outline Drawing)	SCALE	NONE
	MATERIAL	---	SIZE	B
FINISH	---	PART	SK40009	
SHEET			---	

NOTES:

1. THE LINE RIDES OVER THE BACK GROOVE OF THE DOUBLE WRAP WHEEL.
2. LASTLY, THE LINE RIDES ON THE UNDERSIDE OF THE FRONT GROOVE AND OUT TO THE WEIGHT.

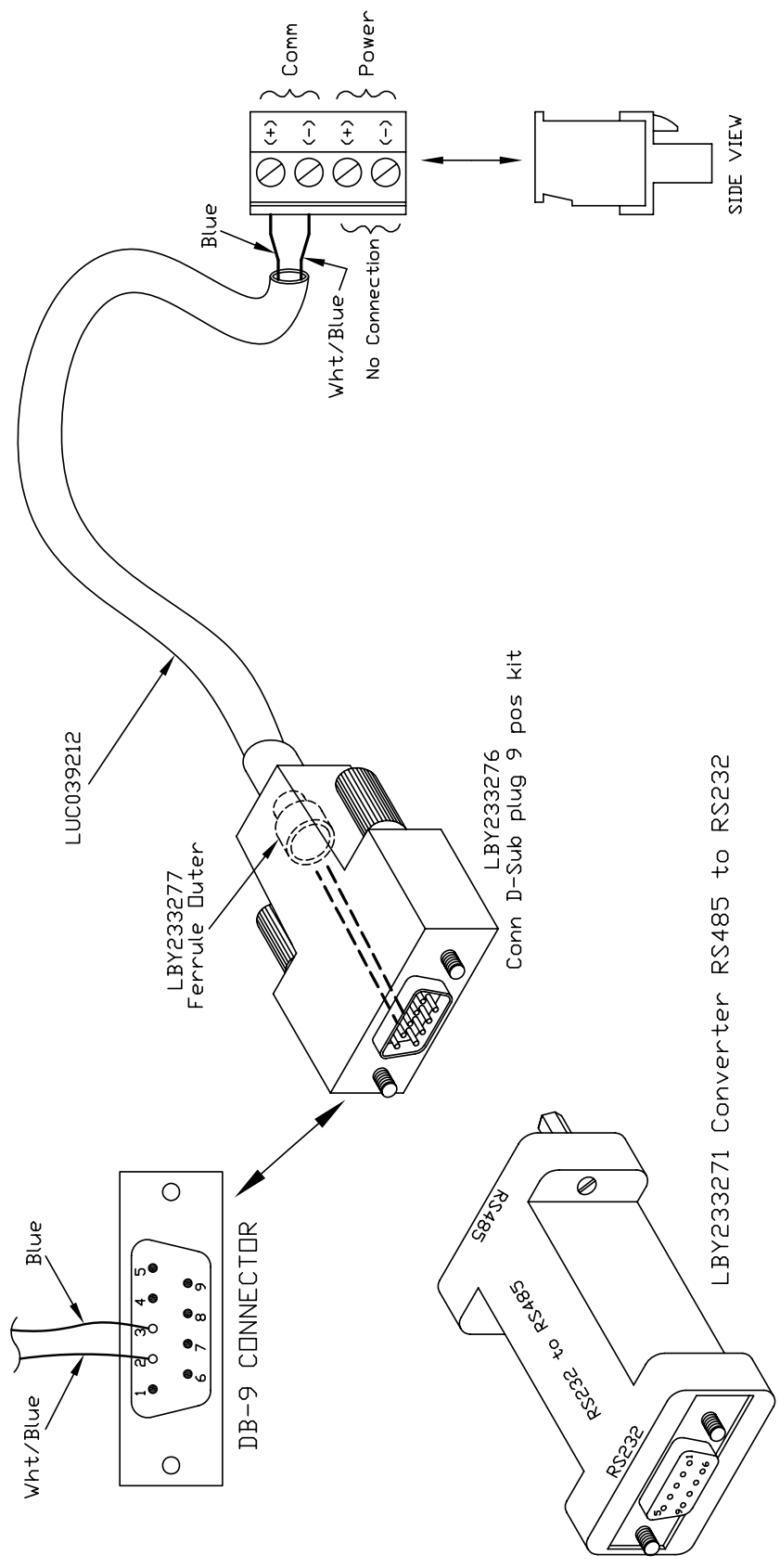
Mark-4 with Cover Removed



SCALE NONE		SHEET ---	
TITLE Mark-4 Cable Wrap Guide		SIZE A	
FILE SK40032		REF	
venture MEASUREMENT 150 VENTURE BLVD. SPARTANBURG, SC 29306		MATERIAL FINISH PART SK40032	
UNSPECIFIED TOLERANCES		PART	
DECIMALS: XX ±.01		---	
ANGLES: XX ±.005		---	
ANGLES: ±1/2		---	
DEBURR & BREAK EDGES .005		---	
① = CHEMICAL DIM. OR NOTE		---	
A INIT. RELEASE		NBC	
05-327		9-15-05	
SE		9-19-05	
DRAWN BY		APP'D BY	
DATE		DATE	
ECN #		DATE	
REVISIONS			

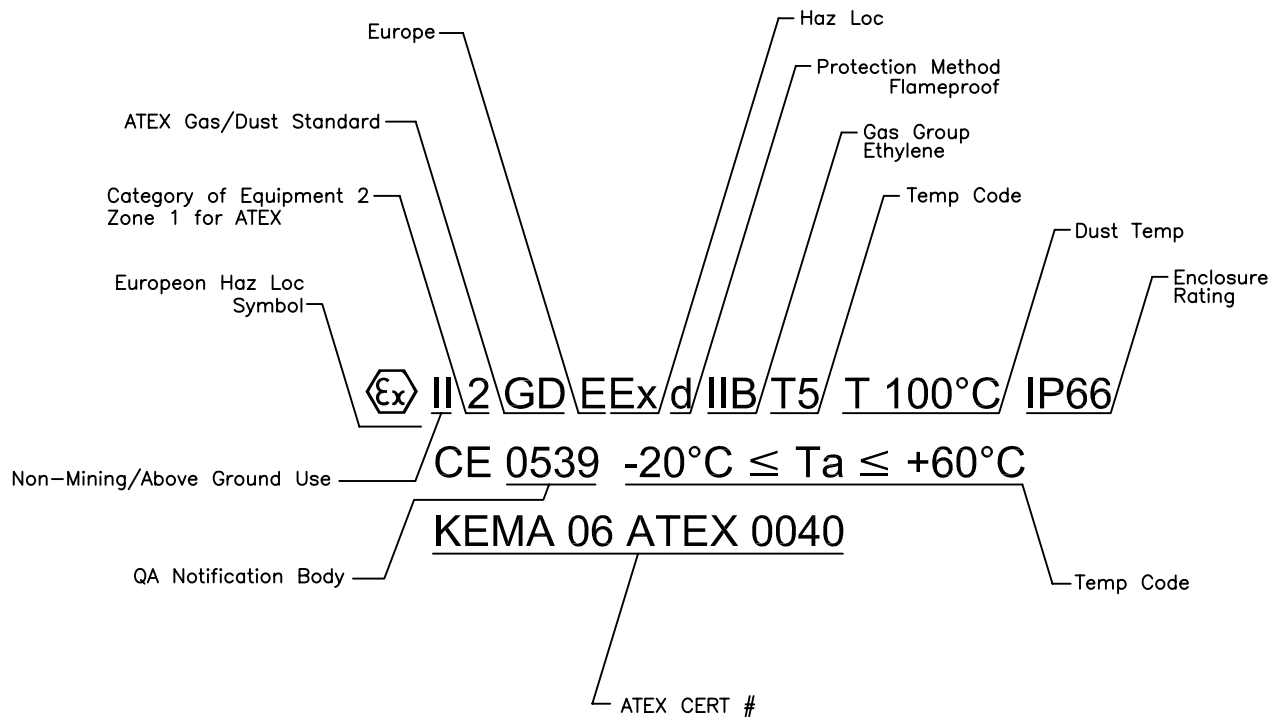
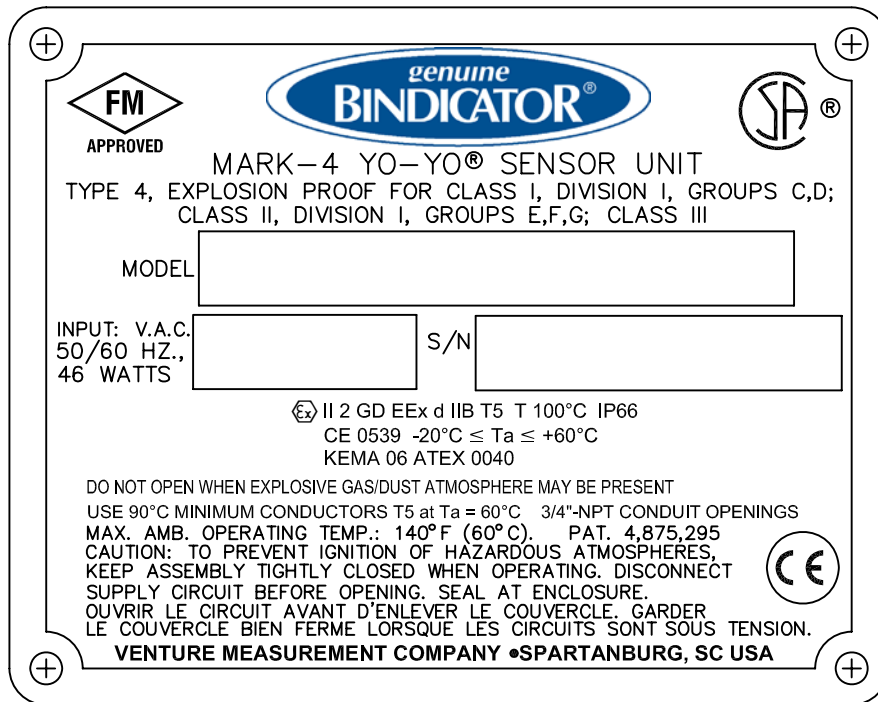
RS485/232 Assembly Kit
Model: LBY-C-1-

LENGTH OF CABLE (IN FT.)
1=STANDARD CABLE
KIT RS-485/232 CONVERTER



SCALE	NONE
	SIZE
TITLE	RS 485/232 CONVERTER WIRING
FILE	SK40020_A_*
REF	LBY211460
MATERIAL	---
FINISH	---
PART	SK40020

D	REVISED PER ECN	04-017	SE	1-14-04	JD	1-14-04
C	REVISED PER ECN	03-452	SE	12-22-03	JD	12-22-03
B	REVISED PER ECN	03-360	SE	10-23-03	DE	10-23-03
A	INIT. RELEASE	03-341	SE	10-8-03	JD	10-8-03
REVISIONS		ECN #	DRAWN BY	DATE	APPD BY	DATE



Mark-4 Yo-Yo® Sensor Settings / Parameters Log

The following table is intended to assist you in recording your Mark-4 Yo-Yo® sensor and jumper settings. Enter the following information for each sensor as it was set via the Remote Display. If necessary, photocopy this page for additional sensors.

Sensor Address										
Sensor Name										
Units (check one per sensor)										
Distance										
Feet										
Meters										
Engineering										
Cubic Feet										
Cubic Meters										
Pounds										
Kilograms										
Gallons										
Liters										
Tank Parameters										
Tank Height										
Full Distance										
Empty Distance										
Max. Move Distance										
Cone Height										
Full Scale Value										
Jumper Settings										
End of Line Resistor										
Pull-Up Resistor										
Auto Timer On/Off										
Timer Setting in Mins.										
Air Space or Material Mode										
20 mA Full or 20 mA Empty										

SK 40028 Rev. B



150 Venture Boulevard
Spartanburg, SC 29306
Phone: (864) 574-8060, Fax: (864) 574-8063
Customer Care: (800) 778-9242
Internet: <http://www.bindicator.com>
email: sales@bindicator.com

venture
MEASUREMENT

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LHY280400 Rev. C 6/06