GP-4 Yo-Yo®
Inventory Management System

INSTALLATION,
OPERATION &
MAINTENANCE MANUAL
Safety Information

Before installing the GP-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 GP-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 864-574-8960.
# TABLE OF CONTENTS

## 1.0 PRODUCT DESCRIPTION

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Function</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>Applications</td>
<td>1</td>
</tr>
<tr>
<td>1.3</td>
<td>Features</td>
<td>1</td>
</tr>
<tr>
<td>1.4</td>
<td>Model Code Identification</td>
<td>3</td>
</tr>
<tr>
<td>1.5</td>
<td>Technical Specifications / Approvals</td>
<td>4</td>
</tr>
<tr>
<td>1.6</td>
<td>Dimensions</td>
<td>5</td>
</tr>
</tbody>
</table>

## 2.0 HANDLING & STORAGE

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Inspection and Handling</td>
<td>6</td>
</tr>
<tr>
<td>2.2</td>
<td>Storage</td>
<td>6</td>
</tr>
</tbody>
</table>

## 3.0 MECHANICAL INSTALLATION

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Guidelines</td>
<td>6</td>
</tr>
<tr>
<td>3.2</td>
<td>Mounting</td>
<td>6</td>
</tr>
</tbody>
</table>

## 4.0 ELECTRICAL WIRING

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Guidelines</td>
<td>6</td>
</tr>
<tr>
<td>4.2</td>
<td>Connection Information / Wiring Diagram</td>
<td>7</td>
</tr>
<tr>
<td>4.3</td>
<td>System Configurations</td>
<td>7</td>
</tr>
</tbody>
</table>

## 5.0 SET-UP & PROGRAMMING

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Operation</td>
<td>8</td>
</tr>
<tr>
<td>5.2</td>
<td>Set-up / Programming</td>
<td>9</td>
</tr>
<tr>
<td>5.3</td>
<td>Programming Mode</td>
<td>10</td>
</tr>
</tbody>
</table>

## 6.0 MAINTENANCE / PARTS LIST

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Preventative Maintenance</td>
<td>13</td>
</tr>
<tr>
<td>6.2</td>
<td>Spare / Replacement Parts</td>
<td>14</td>
</tr>
</tbody>
</table>

## 7.0 TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

## 8.0 APPENDIX

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>
1.0 PRODUCT DESCRIPTION

1.1 Function
The Bindicator general purpose GP-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 GP-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 GP-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 GP-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 GP-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 GP-4 Yo-Yo sensors and the Remote Display are connected to the network via RS-485 MODBUS protocol.

Automatic Cycle Timer: The GP-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 GP-4 Yo-Yo sensor board that allow 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 5VDC. Do not provide external power to the "inhibit" and "measure" terminals. Provide a dry contact only.

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 either in the Remote Display or inside a Yo-Yo sensor. A direct dial, analog telephone line is required.
1.4 Model Code Identification

GP-4 Yo-Yo Sensor

<table>
<thead>
<tr>
<th>LBY</th>
<th>4</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>-</th>
</tr>
</thead>
</table>

**Cable**
1 = Polyester  
2 = Monofilament (See Note 2)

**Sensing Weights**
P = Plastic Weight - standard  
D = Stainless Steel Bob  
F = Stainless Steel Float  
S = Plastic Spike Weight  
LP = Low Density Plastic Weight  
LS = Low Density Stainless Steel  
PB = PVC Jacketed Bob (See Note 1)

**Output**
1 = MODBUS, 4-20mA

**Modem (See Note 5)**
M = Modem  
N = No Modem

**Voltage**
1 = 120 VAC  
2 = 240 VAC

**Heater (See Note 3)**
N = Without Motor Heater  
Y = With Motor Heater

**Enclosure**
4 = NEMA 4

Remote Display

<table>
<thead>
<tr>
<th>LBY-4</th>
<th>-</th>
<th>-</th>
<th>-</th>
</tr>
</thead>
</table>

**Modem (See Note 5)**
M = Modem  
N = No Modem

**Heater (See Note 4)**
N = Without Heater  
Y = With Heater

**Communications**
M = MODBUS

**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

**GP-4 SENSOR**

**Power Requirements**

120 VAC or 240 VAC

**Power Consumption**

Quiescent: 120 VAC, ± 10%, 50/60 Hz, 4 Watts (with power to remote display)

Operating: 120 VAC, ± 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**

Frame: Minlon

Cover: Low density polyethylene

**Enclosure Rating**

NEMA 4

**Mounting**

3” FNPT

**Conduit Entry**

Dual opening for 3/4” conduit

**Weight**

13 lbs

**Air Purge Connection**

1/4” NPT

**Cable**

Polyester or Monofilament (liquid/solid interface)

**Automatic Timer**

From 2 minutes to 9999 minutes (approx. 1 week)

**Approvals**

FM, CSA, CE for Ordinary Locations/Measurement Category 2 and Pollution Category 2

**REMOTE DISPLAY**

**Power Requirements**

9-24VDC 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

**COMMUNICATIONS NETWORK**

**Wiring Requirements**

Belden 9842, 4-wire, shielded cable recommended

**Wiring Distance**

4000 ft maximum

**Speed**

115 Kbps

**Protocol**

MODBUS

**Interface**

RS-485

**Internal Modem**

Optional 56K Modem
1.6 Dimensions

Figure 2. GP-4 Yo-Yo Sensor Dimensions

Figure 3. Remote Display Dimensions
2.0 HANDLING & STORAGE

2.1 Inspection and Handling
The GP-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.

2.2 Storage
If the GP-4 Yo-Yo sensor is not scheduled for immediate installation following delivery, the following steps should be observed:

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 for use in 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 GP-4 Yo-Yo sensor's mounting connection is 3" FNPT. 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 "SS 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 GP-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 VA (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 16 and SK40008 on page 19 for connection locations on the GP-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 14). 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 20 and SK40008 on page 19 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 SK40008 on page 19 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 ¼ 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 26 of this manual for recording the location of the jumper settings and your GP-4 Yo-Yo sensor settings.

4.3 System Configurations
See drawing number SK40006 on page 17 for possible GP-4 Yo-Yo System Configurations.
5.0 SET-UP & PROGRAMMING

5.1 Operation
Operating mode screen (see Figure 5):
This screen displays the following information: The top line contains the sensor address and name. The second line displays the measurement in the units selected and the percentage full (material mode) or percentage empty (air mode). The third line indicates the display mode (Material or Air) and the fourth line indicates the status of the displayed sensor.

To select a sensor press the left (PREV) or right (NEXT) arrow keys. Holding a key down will scroll through the sensors very quickly. Once selected, press "MEASURE" to request a measurement. The initial indication should read "Starting Measure", followed by "Sensor is Measuring". When the measurement is complete, the reading will be updated and the status should read "Sensor is Normal".

Other status readings are possible. The following list illustrates the status messages that could be displayed:

<table>
<thead>
<tr>
<th>Status Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SENSOR IS NORMAL</td>
<td>Sensor is normal</td>
</tr>
<tr>
<td>STARTING MEASURE</td>
<td>Sensor is starting measurement (A command has been sent to the sensor to start a measurement and the sensor is ensuring that the weight is in the home position.)</td>
</tr>
<tr>
<td>SENSOR IS MEASURING</td>
<td>Sensor is taking a measurement</td>
</tr>
<tr>
<td>PERFORMING TEST</td>
<td>Sensor is performing a 4-20mA test</td>
</tr>
<tr>
<td>INHIBITED TO MEASURE</td>
<td>Sensor measurement is inhibited</td>
</tr>
<tr>
<td>MAXMOVE DIST REACHED</td>
<td>Sensor has reached the &quot;max move distance&quot; without contacting material in the tank</td>
</tr>
<tr>
<td>UP/DOWN DO NOT MATCH</td>
<td>&quot;Up&quot; counts and &quot;Down&quot; counts do not agree</td>
</tr>
<tr>
<td>LOST WEIGHT</td>
<td>Weight is missing/no weight on cable</td>
</tr>
<tr>
<td>STUCK WEIGHT</td>
<td>Weight is stuck</td>
</tr>
<tr>
<td>INVALID REPLY</td>
<td>Communication trouble, invalid reply</td>
</tr>
<tr>
<td>4-20mA CONFIG ERROR</td>
<td>Error in configuration of 4-20mA</td>
</tr>
<tr>
<td>INVALID ERROR CODE</td>
<td>The error code received by the display is wrong</td>
</tr>
<tr>
<td>OvrFlow</td>
<td>If measurement is greater than 9,999,999 in engineering units (or 100 m if set in meters or 200 ft if set in feet) <strong>this message will be shown instead of level, weight or volume.</strong></td>
</tr>
<tr>
<td>Unit Error</td>
<td>If the unit of measurement received by the display is wrong, <strong>this message will be shown instead of level and units.</strong></td>
</tr>
<tr>
<td>%Error</td>
<td>If the percentage received by the display is wrong, <strong>this message will be shown instead of the percentage.</strong></td>
</tr>
<tr>
<td>ERROR IN MAT/AIR MOD</td>
<td>If the display mode received by the display is wrong, <strong>this message will be shown instead of the display mode.</strong></td>
</tr>
</tbody>
</table>

This list is split into 2 parts: The first 3 are not errors; they report sensor status only. The remaining are actual errors. For obvious reasons, some errors overlay other errors; for example: A sensor without communications cannot report its status.
5.2 Set-up / Programming
The Gp-4 Yo-To sensors and remote display communicate via RS-485 MODBUS protocol. Each sensor has a couple of rotary switches located near to 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 addressed. Each sensor MUST have a unique address between 1 and 99 inclusive. Once address switches have been set, sensor must be reinitialized by pressing the reset button on board or by turning off and back on the power sensor. See Figure #6.

When the GP-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 GP-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](image-url)
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 GP-4 Yo-Yo sensor settings.

Note: While in the Programming Mode, no information is transferred between the Remote Display and other GP-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 11.

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 >= (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 12.

**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](image)

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 10).

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 GP-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 GP-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 GP-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 5 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 GP-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 and Table 1. 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 GP-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 GP-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

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LBY211182</td>
<td>Plastic (bottle) Weight</td>
</tr>
<tr>
<td>LBY211188</td>
<td>Stainless Steel Bob Weight</td>
</tr>
<tr>
<td>LBY211384</td>
<td>PVC Jacketed Bob Weight (Includes 50' of monofilament cable)</td>
</tr>
<tr>
<td>LBY211269</td>
<td>Plastic Spike Weight</td>
</tr>
<tr>
<td>LBY214427</td>
<td>Stainless Steel Float</td>
</tr>
<tr>
<td>LHY211397</td>
<td>Low Density Stainless Weight</td>
</tr>
<tr>
<td>LBY211305</td>
<td>Low Density Plastic Weight</td>
</tr>
<tr>
<td>LBY231290</td>
<td>Polyester Cable</td>
</tr>
<tr>
<td>LBY231293</td>
<td>Monofilament Cable</td>
</tr>
<tr>
<td>LBY233255</td>
<td>Replacement Sensor E/U - 120 VAC</td>
</tr>
<tr>
<td>LBY211453</td>
<td>Replacement Sensor E/U - 240 VAC</td>
</tr>
<tr>
<td>LUC042827</td>
<td>Fuse, Sensor PCBA 80 mA TR5 Case</td>
</tr>
<tr>
<td>60119P009</td>
<td>Fuse, Display/Driver Bd., 1 Amp</td>
</tr>
<tr>
<td>LBY211454</td>
<td>Modem Board Assembly for Display</td>
</tr>
<tr>
<td>LBY211455</td>
<td>Modem Board Assembly for Sensor</td>
</tr>
<tr>
<td>LBY233256</td>
<td>Replacement Modem PCBA</td>
</tr>
<tr>
<td>RAD230007</td>
<td>Replacement Display CPU Bd.</td>
</tr>
<tr>
<td>LBY233258</td>
<td>Replacement Display/Driver Bd.</td>
</tr>
<tr>
<td>LBY211448</td>
<td>Motor Assembly - 120 VAC</td>
</tr>
<tr>
<td>LBY211452</td>
<td>Motor Assembly - 240 VAC</td>
</tr>
<tr>
<td>LBY-C-1-length in ft.</td>
<td>Kit, RS-485/232 Converter, DB-9 Connector, Cable</td>
</tr>
<tr>
<td>LBY208007</td>
<td>i-Level Software</td>
</tr>
<tr>
<td>LBY233271</td>
<td>RS-485/232 Converter</td>
</tr>
<tr>
<td>LUC035683</td>
<td>Isolation Transformer - plug in</td>
</tr>
<tr>
<td>LUC036139</td>
<td>Isolation Transformer - hard wired</td>
</tr>
</tbody>
</table>

Recommended Communication Cable - Belden #9842 (2-pair, AWG 24)

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUC039209</td>
<td>per foot Belden #9842 (2-pair, AWG 24)</td>
</tr>
<tr>
<td>LUC039210</td>
<td>500' Roll Belden #9842 (2-pair, AWG 24)</td>
</tr>
<tr>
<td>LUC039211</td>
<td>1000' Roll Belden #9842 (2-pair, AWG 24)</td>
</tr>
<tr>
<td>*LUC039212</td>
<td>per foot Belden #9841 (1-pair, AWG 24)</td>
</tr>
</tbody>
</table>

### 7.0 TROUBLESHOOTING

When troubleshooting the GP-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).
- First check that power is supplied to the sensor(s).
- Next, 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 9 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 11 for possible cause.

8.0 APPENDIX

<table>
<thead>
<tr>
<th>Drawing Description</th>
<th>Drawing Number</th>
<th>Rev.</th>
<th>Page Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>GP-4 Sensor Board Inhibit and Measure Contact Closures</td>
<td>SK40012</td>
<td>C</td>
<td>2</td>
</tr>
<tr>
<td>GP-4 Sensor Addressing Rotary Switches</td>
<td>SK40029</td>
<td>B</td>
<td>9</td>
</tr>
<tr>
<td>GP-4 Sensor Board Wiring Diagram</td>
<td>SK40005</td>
<td>C</td>
<td>16</td>
</tr>
<tr>
<td>GP-4 Yo-Yo Wiring Configurations</td>
<td>SK40006</td>
<td>A</td>
<td>17</td>
</tr>
<tr>
<td>GP Series Yo-Yo Outline, Dimensions and Mounting</td>
<td>SK40007</td>
<td>A</td>
<td>18</td>
</tr>
<tr>
<td>GP-4 Wiring Sensor to Remote Display with board RAD230007 Rev B</td>
<td>SK40008</td>
<td>C</td>
<td>19</td>
</tr>
<tr>
<td>GP-4 Wiring Sensor to Remote Display with board RAD230007 Rev C</td>
<td>SK40019</td>
<td>C</td>
<td>20</td>
</tr>
<tr>
<td>GP Series Yo-Yo Weight Options</td>
<td>SK40009</td>
<td>A</td>
<td>21</td>
</tr>
<tr>
<td>GP Series Yo-Yo Cable Guide</td>
<td>SK40010</td>
<td>A</td>
<td>22</td>
</tr>
<tr>
<td>GP-4 RS 485/232 Converter Wiring</td>
<td>SK40020</td>
<td>D</td>
<td>23</td>
</tr>
<tr>
<td>GP-4 Yo-Yo Sensor Settings/Paramaters Log</td>
<td>SK40028</td>
<td>B</td>
<td>24</td>
</tr>
</tbody>
</table>
NOTE 1: FACTORY WIRED
2: DO NOT POWER EXTERNALLY.
   DRY CONTACT ONLY.
3: SHOWN IN ACTIVE POSITIONS.
   MOVE JUMPERS TO THE OPPOSITE
   POSITION TO DEACTIVATE.
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
This drawing applies to all units using board P/N RAD230007 Rev B. and built before October 15th 2003.
RS485/232 Assembly Kit
Model: LBY-C-1

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

LUC039212

Wht/Blue
Blue

DB-9 CONNECTOR

LBY233277 Ferrule Outer

LBY233276 Conn D-SUB plug 9 pos kit

SIDE VIEW

RS232 to RS485

LBY233271 Converter RS485 to RS232

venture
MEASUREMENT
150 VENTURE BLVD.
SPARTANBURG, SC 29306

TITLE
RS 485/232 CONVERTER WIRING

FILE
SK40020_A

REF
LBY211460
GP-4 Yo-Yo Sensor Settings / Parameters Log

The following table is intended to assist you in recording your GP-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.

<table>
<thead>
<tr>
<th>Sensor Address</th>
<th>Sensor Name</th>
<th>Units (check one per sensor)</th>
<th>Distance</th>
<th>Engineering</th>
<th>Tank Parameters</th>
<th>Jumper Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Feet</td>
<td>Tank Height</td>
<td>End of Line Resistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Meters</td>
<td>Full Distance</td>
<td>Pull-Up Resistor</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Empty Distance</td>
<td>Auto Timer On/Off</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Max. Move Distance</td>
<td>Timer Setting in Mins.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cone Height</td>
<td>Air Space or</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Full Scale Value</td>
<td>Material Mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20 mA Full or</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20 mA Empty</td>
</tr>
</tbody>
</table>

SK 40028 Rev. A