MORRISON BROS. CO.

1018 AST Electronic Gauge System

Installation Manual

Model #1018
Manual #1018--3105 PP

Table of Contents

I. Introduction
- Features 4
- Warranty Conditions and Return/Repair Authorization 4
- Warnings 5
- Specifications and Approvals 5

II. Installation
- Package Contents 7
- Materials Needed 7
- Assembled Panel Installation 7
  - Panel Location 7
  - Panel Mounting 8
- Gauge Head(s) Installation 8
  - Gauge Head Mounting 8
- Wiring 9
  - Console AC Wiring 9
  - Gauge Head(s) Wiring 10
  - Mechanical Clock Gauge Calibration 10
- PC Wiring (Optional) 11
  - Communication to a PC (from a single console) 11
  - Communication to Multiple Consoles 12
  - Warning Tag Installation 14

III. Start-up
- Switch Settings 15
  - Number of Tanks 15
  - Baud Rate 15
  - Local Lockout 15
  - Console Address 15
- System Power-up 16

IV. System Programming
- System Programming (From Console) 17

V. System Operation
  - Battery Back-up Mode 20
  - Manually Activated Fill 20
  - Auto Fill 21
  - Hi-Alarm Activation 21
  - Hi-Alarm Test 21

VI. PC Software Installation and Operation (Optional)
  - Software Installation 21

VII. Maintenance
  - Console Enclosure 22
  - Keypad 22
  - Console Interior 22
  - Battery Back-up 22
  - Gauge 22

VIII. Troubleshooting 23

Appendix

Appendix A Example 4 Tank Block Diagram (B-7356-4) 26
Appendix B Barrier Box Control Drawing (1018B-3109PP).....27
Appendix C Gauge Head Control Drawing (1018G-3151PP) 28
Appendix D Example Tank Configuration 29
Appendix E Replacement Parts and Optional Parts 30

I. Introduction

The Morrison Bros. Co. 1018 system is designed to display and record liquid level measurements made in tanks up to 35 feet tall. The measurements are made with an intrinsically safe Gauge Head. These products must be used in conjunction with a safety Barrier to maintain the intrinsic safety of the Gauge Head.

The 1018 system can measure from 1 to 4 tanks per Panel. Measurements can be taken directly from the Console display on the Panel, or a PC can be connected for on-site measurements. Also, an optional RCA (Remote Communications Adapter) is available to allow remote measurements to be made through a phone line.

It is possible to daisy-chain up to 8 Panels together at one site. This will allow a total of 32 Gauge Heads to be monitored with a single PC or RCA. The 1018 consists of 2 components (see Appendix A):

1. The assembled Panel which contains the Console and electrical safety Barrier. The Panel can be used in non-hazardous locations only.
2. The Gauge Head which has an attached float measures liquid level in hazardous locations

If any items do not function as indicated, contact Morrison Bros. Co. Customer Service Department immediately to resolve the problem.

Features

Corrosion Resistant: The aluminum and fiberglass construction ensures that the Console and Gauge Head(s) will last for years, even when used on tanks containing corrosive liquids. All of the Gauge Head wetted components are stainless steel for excellent chemical compatibility.

Hands Free Operation: During normal operation, all tank levels can be read quickly and accurately without operator input. The liquid levels of up to four tanks automatically cycle on the Console display.

Large Lighted Display: A one-inch backlit LCD display allows for easy viewing from a distance, even at night. Arrows on the display indicate the tank being read and its current status.

PC Compatible: The Console has an electronic interface allowing connection to a personal computer. Tank data can be collected and viewed easily from a comfortable indoor location via direct PC connection or by a Remote Communications Adapter. The Console may also be programmed remotely from the PC.

Network Chaining: Up to eight Consoles may be networked together for constant gauging of up to 32 tanks per site. Remote communications software allows communication with an unlimited number of these sites.

Warranty Conditions and Return/Repair Authorization

Limits of Sale: Morrison products are offered for sale only through authorized distributors. Possession of this manual by any person is not to be construed as an offer to sell this product.

Price Changes: Prices are subject to change without notice.

Product Changes: Product updates, design, and materials are subject to change without notice. It is recommended to verify with Morrison Bros. Co. when the specification is critical.

Warranty: All Morrison products are thoroughly tested before shipment and only material found to be defective in manufacture will be replaced. Claims must be made within one year from the date of invoice. Morrison Bros. Co. will not allow claims for labor or consequential damage resulting from purchase, installation, or misapplication of the product.

Contact Morrison Bros. Co. Customer Service Dept. before attempting any repair or diagnostics on the system

Warnings

- **DO NOT INSTALL ASSEMBLED PANEL IN A HAZARDOUS LOCATION.**
- **The Console is locked with a padlock from our factory. The padlock must be in place when AC power is switched ON to the Console. The padlock may only be removed when AC power at the breaker panel is switched OFF.**
- **The Barrier Box on the assembled panel is an associated apparatus and must be wired in accordance with National Electrical Code 500. This device and its wiring may not share any junction box, conduit, or raceway with any other type circuit or wiring. Do not perform live maintenance.**
- **The Gauge Head is an intrinsically safe device and the Barrier on the Panel is an associated apparatus. These devices must be wired in accordance with National Electric Code 500. This device and its wiring may not share any junction box, conduit, or raceway with any other type circuit wiring. Do not perform live maintenance. Clean gauge head with dampened cloth to prevent ignition hazard from static build-up. Care must be taken to avoid ignition hazard from impact of aluminum enclosure.**
- **MAKE SURE THAT ALL POWER IS TURNED OFF TO THE PANEL BEFORE ANY MAINTENANCE IS DONE TO THE HARDWARE OF THE SYSTEM**
- **SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.**
- **Alteration, modification, or replacement with non-factory components could impair the intrinsic safety of this equipment, void the warranty, and void the UL Listing. FAILURE TO COMPLY MAY RESULT IN PERSONAL INJURY, PROPERTY LOSS, AND EQUIPMENT DAMAGE.**
- **Failure to follow the operator's manual could result in a malfunction of this system, which may lead to property damage, personal injury, or loss of life.**
- **Only one tank per Console should be filled at a time since the Console will monitor the 1st tank being filled and disregard the other tanks until the fill operation is complete.**
- **A maximum of 1000ft of cable should be used to connect each Gauge Head to the Console. A maximum of 4000ft of cable should be used to connect the Console to the PC. Belden cable parts #9842 must be used to connect the Gauge Head(s) to the Console(s) and Belden #9841 must be used to connect the Console(s) to the PC (or Remote Communications Adaptor).**

Specifications & Approvals

Console (1018C-3100 AC)

Specifications:
Nominal Input Voltage: 120/240VAC
Maximum Current Draw: 2A
Maximum Power Consumption: 240W
Line Frequency: 50/60Hz
Operating Temperature Range: -30°C to +60°C
Nominal Output Voltage Rating to Barrier: 6.19VDC
Barrier Protection Fuse Rating: 80mA FA 5x20mm (F1 – F12)
Power Supply Protection Fuse Rating: 2.5A FA 5x20mm (F13)

Approvals:
UL61010 Ed. 2
CSA C22.2 No. 61010-1 Ed. 2

Barrier Box (1018B-3100 AB)

Entity Parameters:

Vt: 6.51 VDC	Ca: 17.3 uF	Po: 500mW
It: 300 mA	La: 1.5 mH	

Associated Equipment
[Ex ia]
Class I, Division 1, Group D, T4
-30°C ≤ Ta ≤ 60°C
Maximum Nonhazardous Location Voltage: 250VRMS or 250VDC

Approvals:
UL913 Edition 7 and UL61010
CSA C22.2 No. 157 and CSA C22.2 No. 14
Nominal Voltage Rating at Input Terminals: 6.19VDC
Barrier Fuse Rating: 100mA FA 5x20mm

Control Drawing: 1018B-3109 PP (See Appendix B)

Gauge Head (1018G-3100 AG)

Entity Parameters:

Vmax: 12.0VDC	Ci: 16.7uF	Pi: 500mW
Imax: 320mA	Li : 0mH	

INTRINSICALLY SAFE
Class I, Division 1, Group D, T4
Ex ia
-30°C ≤ Ta ≤ 60°C

Approvals:
UL913 Edition 7
CSA C22.2 No. 157

Control Drawing: 1018G-3151 PP (See Appendix C)

II. Installation

The 1018 Electronic AST Gauge is installed in the following sequence:

- Assembled Panel
- Gauge Head(s)
- Wiring-AC power and Gauge Head(s)
- Wiring-PC (optional)

Package Contents

The following items should be included with your 1018 system:

- Installation Manual
- Software Manual
- Tank Number Decals for Multi-Panel Numbering
- Tank Number Labels For Each Gauge Head
- Cable Ties to Secure Barrier Wiring
- Gauge Head Wire Splices
- Assembled Panel (s)
- Gauge Head(s)
- Warning Tag with Cable Tie
- USB to RS485 Converter
- 1/2" Conduit Fittings For Each Gauge Head/Panel Connection
- CD to install the AST Software for a PC (also includes software to install a modem for remote communications)

Materials Needed

The following items will be needed for installation:

- Mounting hardware for Assembled Panel(s).
- Bushing to mount 1" NPT Gauge Head to tank bung opening (minimum 2").
- Fuel compatible, non-hardening thread sealant (pipe dope) for Gauge Head mounting threads.
- Conduit to connect from the AC breaker box to the Assembled Panel(s).
- Wiring from AC breaker box to Assembled Panel(s).
- Intrinsic Safety grounding of Assembled Panel as required by code (see NFPA 70, Article 504).
- Conduit and vapor seals to connect from the Assembled Panel(s) to the Gauge Head(s).
- Belden Cable #9842 wire to go from each Gauge Head to the corresponding Assembled Panel connection (maximum 1000 ft per Gauge Head).
- OPTIONAL: ½" conduit fitting and conduit to go from a site located PC (or Remote Communications Adapter) to an Assembled Panels.
- OPTIONAL: Additional conduit and junction boxes required to connect multiple Assembled Panels together.
- OPTIONAL: Belden Cable #9841 wire to daisy chain from each Assembled Panel back to a PC.

Assembled Panel Installation

NOTE: See Appendix A for an overview of the components mentioned in the installation text.

Panel Location

The panel is only approved for operation outside of all hazardous locations as defined by the National Electrical Code or NFPA 70. The Panel consists of the Console and an intrinsic safety barrier, both pre-attached to an aluminum mounting panel. See Appendix A for an example of a 4 tank system block diagram. The Console mounted on the Panel has connections for AC Power and an optional PC. The Barrier mounted on the Panel has connections for the Gauge Head(s).

Panel Mounting

The Assembled Panel must be mounted by the installer in a secure, upright position. The 16'' on-center holes may be used to mount to a wall or posts, or new holes may be drilled to accommodate another method of mounting. If more than one Panel is mounted, the labels to differentiate tanks 5-32 may be placed on the appropriate Console.

Gauge Head(s) Installation

WARNING: Insure power is disconnected from the interconnecting devices before beginning installation.

NOTE: The yellow label holding the pulley wheel in place during shipping should NOT be removed until indicated below.

NOTE: The Gauge Head and Panel should not be wired until the Gauge Head is properly mounted to the tank.

Gauge Head Mounting

The Gauge Head may be mounted onto any tank opening 2" or larger. The Gauge Head should be mounted at the top of the tank in a level position. The Gauge Head must be mounted directly to the tank via a bushing connected directly to the tank bung. The bushing must adapt the 1" male NPT of the Gauge Head to the desired bung opening. The clock face should be positioned so it is visible from the ground. The Gauge Head must be mounted so it doesn't interfere with the normal operation of the tank.

The standard float will pass through an opening the size of a 2" Schedule 40 pipe. Position gauge head such that the float hangs down in a position that is away from tank fill and discharge pipe penetrations.

1. Remove the six screws from the rear cover (yellow label side) of the Gauge Head. A yellow label has secured the pulley wheel of the gauge for shipping and installation. Do not pull or tug on the cable. Do NOT remove the yellow label yet.
2. Attach the necessary pipe bushing to adapt the 1" pipe at the base of the Gauge Head using a non-hardening fuel resistant paste.
3. Remove the wire cable connector from the end of the float and thread it through the swivel at the end of the cable of the Gauge Head. Reconnect the wire to the float. Using pliers, if necessary, to crimp the top end of the connector. Apply non-hardening fuel resistant paste to the pipe bushing.
4. Hold the pulley wheel with your hand and remove the yellow label from the body housing. SLOWLY lower the float into the tank until it reaches the bottom of the tank (if the tank is empty), or the product level.
5. Thread the Gauge Head to the top of the tank by rotating the body. A pipe wrench should not be needed.
6. Attach a supplied Gauge Head number label to the rear plate. Align the holes of the label, plate and body. Replace the cover and 6 screws. The Gauge Head is now ready to be wired.

Console AC Wiring

1. Remove the padlock and set aside. Put keys in a safe place. Install conduit to attach from the facility power breaker panel to the ½" conduit fitting farthest from the keypad surface at the bottom of the Console mounted on the Panel.

***Above**: This picture shows the conduit fittings used for wiring the console. The vertical arrow on the right shows where the conduit for AC power will run to. The arrow on the left shows where the barrier connects to the console (factory installed), and the right most arrow shows the 1/2" hole seal that should be replaced with a 1/2" conduit fitting if a PC connection will be installed.*

2. Wire AC power from a dedicated circuit breaker (must meet the minimum electrical requirements), to the Console terminal strip (3 right terminals) with the proper wire per the appropriate electrical codes (see Fig. A and B).
3. In addition to facility ground, 2 intrinsic safety grounds connections have been provided (left 2 terminals). Refer to NFPA 70, Article 504 for ground suitability.

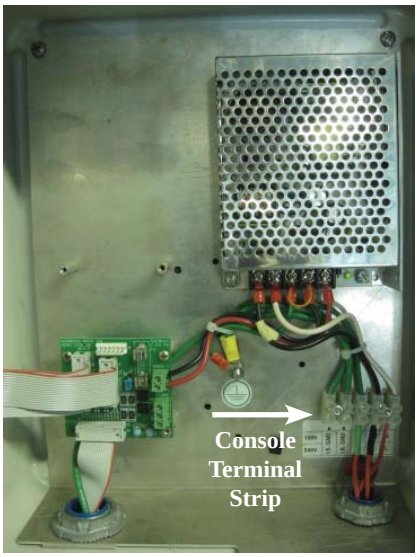


Fig. A

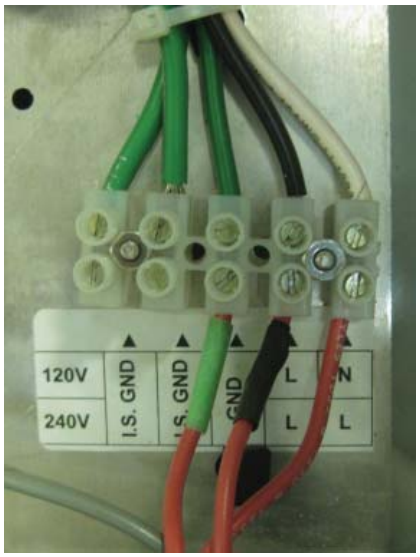


Fig. B

Gauge Head(s) Wiring

NOTE: Exercise caution during installation of Gauge Head. UL requirements will not allow repair of damaged product.

WARNING: Connecting the wires improperly may severely damage or destroy the Gauge Head.

WARNING: The Gauge Head MUST be connected using Belden Cable part #9842, which is a shielded, 4-conductor, low capacitance RS-485 type communications cable. This cable is critical to the proper operation and safety of this device.

WARNING: A maximum distance of 1,000 feet to each Gauge Head is required for proper operation and safety of this device.

1. Remove the 4 screws holding the cover on the Barrier of the Panel. Install ½" rigid conduit from each Gauge Head to the Barrier of the mounted Panel. IMPORTANT: Be sure to use vapor seals (not supplied), as required per appropriate electrical codes, when transitioning from a non-hazardous to hazardous location.
2. Loosen the 2 screws and remove the conduit junction box cover of the Gauge Head and set aside momentarily.
3. Install the Belden #9842 wire from the Barrier of the Panel in the corresponding opening to be wired up through the conduit to the Gauge Head conduit junction box.
4. Connect the wiring to the Gauge Head first. Trim excess cable and then strip 2 to 3 inches of sheathing to expose the braided shield. Push back the braided shield and use electrical tape or heat shrink tubing to insulate the braided shield. Cut away the exposed foil shield, as well as the bare shield wire.
5. Use 4 of the provided splice connectors (part number: 1018G-3136 2C) to connect each wire color pair (ex. blue to blue, etc.). The wires must remain insulated to work properly. Do NOT strip ends. Insert the corresponding wire color pair all the way into the connector. Use pliers to squeeze the button to the body on the connector. This will pierce the insulation and make the electrical connection. There is a jelly that may squeeze out through the connector. This is to prevent corrosion of the connection, and will not harden.
6. After all 4 of the wire pairs are connected, fold the splices and wires into the junction box and replace the junction box cover.
7. It is now time to connect the wiring to the Barrier at the Panel. Trim excess cable 6 inches past the edge of the Barrier Enclosure and then strip the sheathing to expose the braided shield. Push back the braided shield and use electrical tape or heat shrink tubing to insulate the braided shield. Cut away the exposed foil shield, but do not cut the bare shield wire.
8. Strip 3/16 of an inch of insulation off each wire and twist the bare shield wire and blue wire together.
9. Connect the wire colors to the indicated wire color on the Barrier terminal block. The terminal block may be removed for ease of installation.
10. After all of the Gauge Heads are wired, replace the Barrier Cover and tighten the 4 screws.

Mechanical Clock Gauge Calibration

The Acrylic cover on the Gauge Head is protected by a removable paper. Do not remove the coating at this time. It is recommended that the tank level be measured by tape or stick before calibrating the mechanical gauge. This will provide an accurate reading for future use.

To calibrate the gauge:

1. Remove the retaining ring holding the acrylic cover in place. This can be done with a flat blade screw driver.

2. Remove the acrylic cover. The cover may be tight. Leave the protective coating on the cover to aid in the initial removal of the acrylic cover.
3. Grasp the dial hand by the center shaft and gently pull outward. You should feel the gears on the mechanism disengage.
4. With the dial hand pulled out, rotate the dial to the measured fluid level of the tank. If tank is empty, set to 0.
5. Release the dial hand. It should snap back into place.
6. Check the dial hand by grasping the center shaft of the dial hand and attempting to rotate it. If the dial hand has engaged with the gears, there should be a small amount of play, but the dial hand will not move.
7. If the dial hand does move, gently rock it back and forth until you feel the gears engage.
8. Remove the protective coating from the acrylic cover.
9. Replace the acrylic cover over the o-ring and replace the retaining ring.

PC Wiring (Optional)

Communication to a PC (from a single Console):

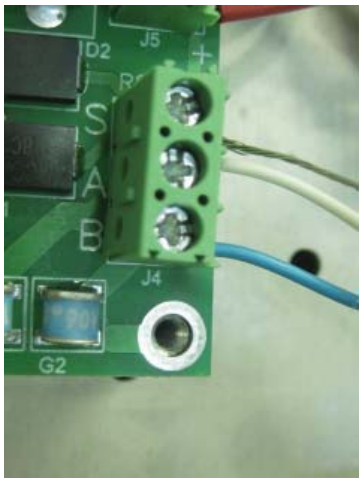
NOTE: Do not connect more than 4,000 feet of cable from the Panel mounted Console to a PC.

NOTE: Use Belden Cable #9841 to make the connection from the Panel mounted Console to a PC.

NOTE: A PC with a USB port is required.

NOTE: Do NOT plug the USB to RS485 converter into the PC until instructed to in the Software Manual.

To connect to a PC, use Belden Cable #9841 wires to connect the RS485 terminals. The cable should enter the Console through the opening that the 1/2 inch hole seal is in. This hole should be replaced with a 1/2" conduit fitting. The RS485 connection point is inside the Console at J4 of PCB Assembly 1018C-3136 2B.



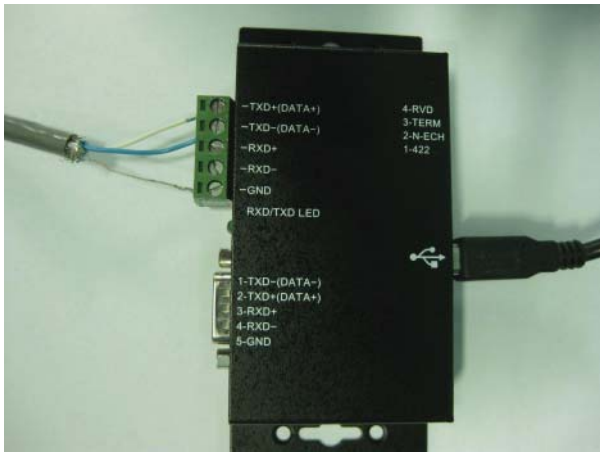
1) Once the cable is in the fixture, strip the sheathing two to three inches to expose the braided shield. Push back the braided shield and use electrical tape or heat shrink tubing to insulate the braided shield. Cut away the exposed foil shield, **but do not cut the bare shield wire.**
2) Plug the bare shield wire into the "Shield" terminal of the J4 terminal block and tighten the screw by turning it clockwise to secure the shield wire.
3) Strip 3/16 of an inch of insulation off each wire.

4) Take the termination resistor provided and wrap the end of one of the leads of the resistor to the end of one of the exposed wires. Then wrap the end of the other lead to the end of the other exposed wire. It does not matter which wire gets twisted to which end of the resistor.

5) Plug one wire into the "A" terminal and the other wire into the "B" terminal of the J4 terminal block. Any wire color may be selected for the "A" or "B" line. Tighten the two screws for the "A" and "B" terminals so the wires are held firmly in place. Give the wires a slight tug (not too hard) and ensure they stay in the terminals.

6) Take the other end of the cable and strip the sheathing two to three inches to expose the braided shield. Push back the braided shield and use electrical tape or heat shrink tubing to insulate the braided shield. Cut away the exposed foil shield, **but do not cut the bare shield wire.**

7) Strip 3/16 of an inch of insulation off each wire and plug the wire into their respective terminals of the USB to RS485 Converter. **The wire that is connected to the "A" terminal of the J4 terminal block inside the Console gets inserted into the "TXD+ (DATA+)" terminal of the converter, and the wire from the "B" terminal gets inserted in the "TXD- (DATA-)" terminal.** Also the bare shield wire needs to be inserted into the "GND" terminal of the USB to RS485 Converter.



8) Once the wires are plugged into their respective terminals, tighten the screws (by turning them clock wise) to secure the wires.

9) Set the dip switches on the USB to RS485 converter so that switches 1 and 4 are in the "UP" or "OFF" position and switches 2 and 3 are in the "DOWN" or "ON" position.

Do NOT plug the USB to RS485 converter into the PC until instructed too in the Software Manual.

Communication to Multiple Consoles:

NOTE: Do not connect more than 4,000 feet of wire total between all Consoles and the PC.

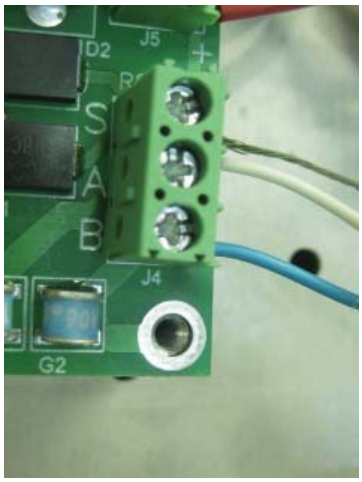
NOTE: Use a quality shielded, twisted pair wire such as Belden Cable #9841 to make the connections between the Console(s) and to the PC.

NOTE: A PC with a USB port is required.

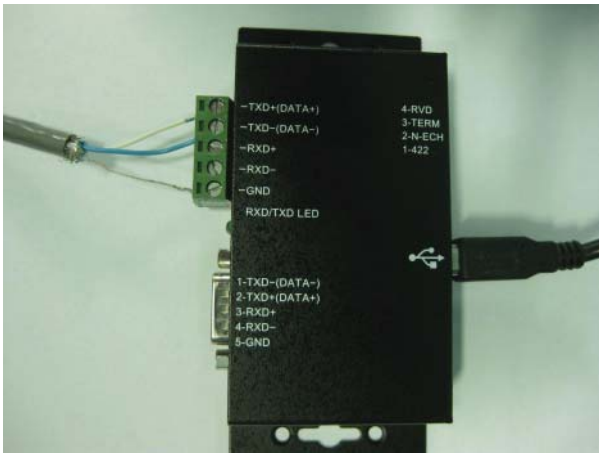
NOTE: Do NOT plug the USB to RS485 converter into the PC until instructed to in the Software Manual.

NOTE: A junction box may be necessary to connect multiple Consoles since there is only 1 additional opening in each Console for RS485 wiring.

NOTE: The order in which Consoles are interchanged, as well as the Console connected to the PC, is not required to be any particular Console number.



To connect multiple Consoles to a single PC, use Belden Cable #9841 wires to connect all of the RS485 terminals. Cables should enter the Consoles through the openings the 1/2" hole seals were in. These holes should be replaced with 1/2" conduit fittings. The RS485 connection points are inside the Consoles at J4 of the PCB Assembly 1018C-3136 2B. All "A" terminals from each Console must be connected to only other "A" terminals, and all "B" terminals from each Console must be only connected to other "B" terminals. This makes it important to use the same colored wire for each respective "A" and "B" terminal to avoid accidentally crossing over the lines, which would result in the loss of functionality.



The USB to RS485 Converter also must have its "TXD+ (DATA+)" terminal connected to the "A" terminals and its "TXD- (DATA-)" terminal to the "B" terminals. The bare shield wire(s) also should be connected to the "Shield" terminals in the Consoles and the "GND" terminal of the USB to RS485 Converter. When wires are daisy chained from one Console to another, it is important to wrap the ends of the wires together

1) Start by connecting the Belden Cable #9481 wires into the USB to RS485 Converter.
2) Loosen the screws of the "TXD+ (DATA+)," "TXD- (DATA-)," and "GND" terminals (by turning them counterclockwise) until there is enough room to fit the wires into.
3) Strip the sheathing two to three inches from the cable to expose the braided shield. Push back the braided shield and use electrical tape or heat shrink tubing to insulate the braided shield. Cut away the exposed foil shield, **but do not cut the bare shield wire**. Then strip 3/16 of an inch of insulation off of each wire and connect one into the "TXD+ (DATA+)" terminal and the other into the "TXD- (DATA-)" terminal. Which wire is connected into which terminal does not matter, as long as it stays consistent when connecting up all the Consoles. Also, insert the bare shield wire into the "GND" terminal.
4) Tighten the screws (by turning them clockwise) to secure the wires.
5) Set the switches on the side of the USB to RS485 converter so that switches 1 and 4 are in the "UP" or "OFF" position and switches 2 and 3 are in the "DOWN" or "ON" position. **Do NOT plug the USB cable from the converter into the computer until instructed to.**

6) Feed the other end of the wire into the next Console to be connected.
7) Take another end of a different Belden Cable #9481 and feed it into the same conduit as the other cable that is already connected.
8) Once both cables are in the fixture, strip the sheathing two to three inches off both cables to expose the braided shield, push back the braided shield, and use electrical tape or heat shrink tubing to insulate the braided shield on both cables.
9) Cut away the exposed foil shield, **but do not cut the bare shield wire on both cables.**
10) Strip 3/16 of an inch of insulation off the ends of the two wires of both cables.
11) Wrap/twist the ends of the two bare shield wires and plug them both into the "Shield" terminal of the J4 terminal block and tighten the screw (by turning it clockwise) to secure them.
12) Wrap/twist the wire that is already connected to the "TXD+ (DATA+)" terminal of the USB converter (or "A" terminal) to the same colored wire from the other cable and plug them both into the "A" terminal of the J4 terminal block and tighten the screw (by turning it clockwise) to secure them.
13) Wrap/twist the wire that is already connected to the "TXD- (DATA-)" terminal of the USB converter (or the "B" terminal) to the same colored wire from the other cable and plug them both into the "B" terminal of the J4 terminal block and tighten the screw (by turning it clockwise) to secure them.
14) Verify that all wires are properly connected by giving them a slight tug (not very hard) and ensure that no wires come out of the terminal blocks.

Now keep repeating steps 6 through 14 in the procedure described above to connect up to eight Consoles (except for the last Console to be connected).

15) For the last Console being connected, once the cable is in the fixture, strip the sheathing two to three inches to expose the braided shield. Push back the braided shield and use electrical tape or heat shrink tubing to insulate the braided shield. Cut away the exposed foil shield, **but do not cut the bare shield wire.**
16) Strip 3/16 of an inch of insulation off the "A" and "B" wires.
17) Take the termination resistor provided and wrap the end of one of the leads of the resistor to the end of one of the exposed wires. Then wrap the end of the other lead to the end of the other exposed wire. It does not matter which wire gets twisted to which end of the resistor.
18) Plug the correctly colored wires wrapped with the resistor into the proper "A" or "B" terminal of the J4 terminal block and tighten the screws (by turning clockwise) to secure the wires.
19) Plug the bare shield wire into the "Shield" terminal of the J4 terminal block and tighten the screw by turning it clockwise to secure the wire.
20) Verify that all wires are properly connected by giving them a slight tug (not very hard) and ensure that no wires come out of the terminal block.

Warning Tag Installation

After all wiring is installed, the Warning Tag(s) included must be placed near the fill point for each tank being measured. If additional Warning Tags are required, contact Morrison Bros. Co. The Warning Tags may be attached with the provided cable tie.

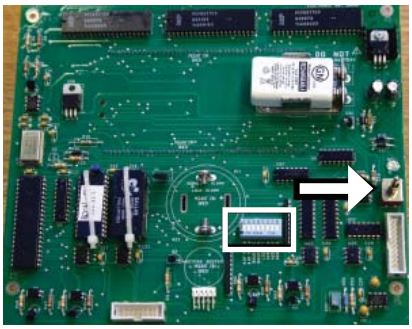
III. Startup

NOTE: Before the 1018 is powered on, the DIP switches will need to be set on the control board. After changing any switch setting, the system must be reset (by turning power switch S3 of the display PCB inside the Console off for a few seconds and then back on) in order for the changes to take effect.

Switch Settings

Number of Tanks – Switches 1 and 2

Adjust switch S2 of PCB Assembly 1018C-3109 2B to set the number of Gauge Heads connected to the Barrier. Use the table below (Position 1 is on the far left, and Position 2 is just to the right of Position 1):



This picture shows the control PC board. The white rectangle denotes the location of S2 (the DIP switches). The large arrow on the right points to S3, the main power switch.

Position 1	Position 2	Number of Tanks
Down	Down	1
Up	Down	2
Down	Up	3
Up	Up	4

Baud Rate – Positions 3 and 4

The baud rate is the speed at which the system communicates with the PC. It should never be necessary to change these settings. Position 3 and 4 should always be in the down position. This represents 9600 baud.

Local Lockout – Position 5

Local lockout prevents unwanted system changes. When enabled, it does not allow changes to the system programming to be made from the Console itself. Changes must be made through a PC connection. Local lockout is controlled by position 5 of S2 on PCB assembly 1018C-3109 2B.

Position 5	Local Lockout	System Programming Location
Down	Off	PC or Console
Up	On	PC Only

Console Address – Positions 6, 7 and 8

When multiple Consoles share the same PC connection, each one must have a unique identifier. This is known as the Console address, and its set using positions 6, 7 and 8. Also, changing the Console's address changes the number of the tanks being monitored. Only one Console can monitor tanks number 1 through 4. A second Console would monitor tanks number 5 through 8, and so on. Although the software can accommodate illogical tank numbering schemes, the Console should be set with logical numerical values. Console addresses and tank numbers correspond to these switch settings:

Switch 6	Switch 7	Switch 8	Console Address	Tank Numbers
Down	Down	Down	1	1-4
Up	Down	Down	2	5-8
Down	Up	Down	3	9-12
Up	Up	Down	4	13-16
Down	Down	Up	5	17-20
Up	Down	Up	6	21-24
Down	Up	Up	7	25-28
Up	Up	Up	8	29-32

WARNING: The Console is locked with a padlock from our factory. The padlock must remain in place when AC power is switched ON to the Console. The padlock may only be removed when AC power is switched OFF.

System Power-up

When all of the wiring and the configuration is complete, the power may be switched on inside of the Console and then at the circuit breaker. The Console will run through a screen check, display a time and date (will be displayed as zero's until the system is programmed), and then display numerical data for all configured tanks. The high level alarm may sound for each tank as the tanks have not yet been configured. Press any key on the keypad to silence the alarm. Following a successful power up, the installer may proceed with system programming and calibration procedures. If there are any problems refer to the troubleshooting section of this manual.

IV. System Programming (from Console)

If the Console will be programmed from the PC, skip this section and proceed to Section VI (PC Software Installation and Operation). Insure Console is not set to Local Lockout, see Section III.

NOTE: The time, date and year must be set for the Fill Mode to work properly.

NOTE: Words shown in square brackets [ ] indicate prompts and spellings as shown on the Console display. Some spelling may appear distorted due to the constraints of the seven-segment numeric display.

All system programming is done through the Select menu. This menu is found by holding the SELECT key down continuously (this may take several seconds) until the Console makes two quick beeps and the display reads [SELEct] (this may take several seconds). All options can now be accessed by using the UP or DOWN arrow keys until the desired setting is displayed, and pressing SELECT to edit that setting. Menus are only accessible in one direction. The DOWN arrow will not go back to the previous menu. The headings below each represent a menu item within the Select menu and are given in the order in which they should be set, where applicable.

SET TIME

1. Hold SELECT until the select menu appears. Press the down arrow key once, the display should now read [SEt CLoC], press the SELECT key.
2. The display should now show [CLoC] and the current time in 24 hour (military) format, ex. [CLoC 13:39].
3. Use the arrows to change the clock to the desired time. The arrows can be held down continuously to change the indicated time rapidly.
4. Once the desired time is displayed press SELECT. The display should read [donE] and the system will return to normal operation automatically.

SET DATE

1. Hold SELECT to access the select menu, arrow down to the [SEt dAtE] option and press SELECT.
2. The display will show [dAtE] and the current system date in month:day format, ex. [dAtE 6:20].
3. Use the arrow keys to change the date displayed, again the keys can be held down to change the date rapidly.
4. Once the desired date is displayed press SELECT. The display should read [donE] and the system will return to normal operation automatically.

SET YEAR

1. Choose the [SEt yEAr] option in the Select menu, and press the SELECT key.
2. The display will show [yEAr] and the current system year, ex. [yEAr 08].
3. Use the arrows to change the year displayed until the desired year is shown.
4. Once the desired year is displayed press the SELECT key, the display will show [donE] and the system will return to normal operation.

WARNING: When the tank parameters are entered, it is critical they are entered in the same units that the system is operating in. If it is in metric, centimeters must be used. If it is in English, the values must be entered in inches.

SET UNIT (Set Display Units)

1. To set the units which are displayed by the system, choose [SEt UnIt] from the select menu.

2. The display will show [UnIt] and the currently selected units will be indicated by an arrow. Use the arrow keys to change the selected units.
3. Once the desired units are indicated press the SELECT key. The display will read [donE] and the system will return to normal operation.

SET SHAPE:

For additional information, please reference Appendix D Example Tank Configuration.

1. To set the shape of a tank, choose [SEt SHAPE] from the Select menu.
2. [tAnC] will now be displayed, as well as an indicator arrow in the top left of the display showing which tank is currently selected, use the arrow keys to select the appropriate tank. Once the desired tank is found press the SELECT key.
3. The tank shape must now be selected, there are three choices; rectangular ([rECtAng]), round horizontal ([rnd Hor]), and round upright ([rnd UP]). Use the arrow keys to change the displayed shape, when the desired shape is shown press the SELECT key.
4. The system will now prompt for tank dimensions, which will vary as follows depending on the shape of the tank:
    A. Rectangular Tanks—length [LEn], and width [LEn2] must be entered.
    B. Round Horizontal Tank—diameter [dIA] and length [Len] are needed.
    C. Round Upright (vertical) tank—diameter [dIA] is needed.
5. Use the arrow keys to change the tank dimension values, an indicator arrow on the right side of the display will show what units the values should be entered in, press SELECT after the desired value is displayed.
6. If another value is needed (Tanks type A and B from step four) repeat step 5. After all the needed values have been entered the display will read [donE] and the system will return to normal operation.

SET TOP

For additional information, please reference Appendix D Example Tank Configuration.

This setting represents the maximum level of fluid that can be in the tank. This will NOT be the height of the tank. The high and low alarm set-points are calculated as percentages of this value.

WARNING: If this value is set improperly, the tank may be overfilled causing product loss, personal injury, or property damage. The top level of the tank MUST be set exactly to the tank manufacturer's recommendations.

1. To set the top of a given tank, choose [SEt toP] from the Select menu.
2. [tAnC] will now be displayed, as well as an indicator arrow in the top left of the display showing which tank is currently selected, use the arrow keys to select the appropriate tank. Once the desired tank is chosen press the SELECT key.
3. The display will show [toP] and the current top level for that tank, ex. [toP 265.0]. Also indicator arrows on the right side of the display will tell what units the height is being measured in. Use the arrow keys to change the top value for the given tank.
4. Once the desired value is displayed press the SELECT key, the display will read [donE] and the system will return to normal operation.

SET CALIBRATION (Set Current Fluid Height)

For additional information, please reference Appendix D Example Tank Configuration.

For new installations, this should only be performed after the Gauge Head(s) have been properly installed and wired. Calibration will fail if the Gauge Head is not installed properly.

Calibration sets the actual product level in the tank. To measure the actual product level for the initial calibration, a manual 'tank stick' is necessary to determine the level to be entered. Make the measurement to the

nearest 0.1 of an inch. The accuracy of all new measurements taken on this tank will depend upon the accuracy of its calibration. CALIBRATION SHOULD ONLY BE PERFORMED ON A TANK WITH A STABLE LEVEL. Calibrating a tank during a fill will yield incorrect results.

NOTE: Calibration of an empty tank may be performed, but will not have 0.1" accuracy due to partial submersion of the float. It is recommended to re-calibrate after fluid has been put into the tank.

1. To calibrate the product level, choose [SEt CAL] from the Select menu.
2. [tAnC] will now be displayed, as well as an indicator arrow in the top left of the display showing which tank is currently selected, use the arrow keys to select the appropriate tank. Once the desired tank is chosen press the SELECT key.
3. The display will show [CAL] and a level reading in the current system units (inches or centimeters). Use the arrow keys to change the calibration value so that it matches the manually obtained ('tank stick') value.
4. Once the desired value is displayed press the SELECT key. The display will read [donE] and the system will return to normal operation.

SET HIGH (Set High Alarm Set-point)

For additional information, please reference Appendix D Example Tank Configuration.

1. To set the high alarm set-point for a given tank, choose the [SEt HI] option in the Select menu, and press the SELECT key.
2. [tAnC] will now be displayed, as well as an indicator arrow in the top left of the display indicating which tank is currently selected, use the arrow keys to select the appropriate tank. Once the desired tank is found press the SELECT key.
3. [PCt] and the current high alarm set-point will now be displayed ex. [PCt 90]. [PCt] indicates that the setting will be made as a percentage of the tank volume. Use the arrows to adjust the set-point up or down.
4. Once the desired percentage is displayed press the SELECT key, the display will read [donE] and the system will return to normal operation.

SET LOW (Set Low Alarm Set-point)

For additional information, please reference Appendix D Example Tank Configuration.

1. To set the low alarm set-point for a given tank, find [SEt Lo] in the Select menu, and press the SELECT key.
2. [tAnC] will now be displayed, as well as an indicator arrow in the top left of the display showing which tank is currently selected, use the arrow keys to select the appropriate tank. Once the desired tank is found press the SELECT key.
3. [PCt] and the current low alarm set-point will now be displayed ex. [Pct 10]. [PCt] indicates that the setting will be made as a percentage of the tank volume. Use the arrows to adjust the set-point up or down.
4. Once the desired percentage is displayed press the SELECT key, the display will read [donE] and the system will return to normal operation.

RESET

This function found in the Select menu will reboot the system without needing to cycle the power switch or circuit breaker. This function does not modify any settings made above.

END

Although the system will resume cycle mode after a few seconds of inactivity, this menu command may be used to exit the command menu and resume normal activity.

V. System Operation

Battery Back-up Mode/Power Switch

WARNING: When adjustments inside of the Console are required, the circuit breaker for the 1018 must be turned off before removing the padlock. The padlock must be reinstalled before switching power to the 1018 back on.

Power switch S3 on the display PCB inside of the Console is used to turn power on and set the desired backup mode. The Console is equipped with NiCAD battery back-up. The user can leave the unit on, with battery-back up mode enabled (power switch S3 in the down position). The unit will operate normally, and continue to charge the battery under normal conditions. In the event of a power failure the unit will automatically switch to battery power and continue to run, without the display backlight. However, if left on continuously in back-up mode during a power failure the unit will have enough battery power to run for approximately 30 minutes. Or switch S3 can be left in the normal mode (up) and switched to battery mode (down) when a reading is desired. Either mode will still charge the battery so it is ready when needed. The middle position of S3 is the OFF position.

NOTE: Words shown in square brackets [ ] indicate prompts, and spellings, as shown on the Con sole display. Some spelling may appear distorted due to the constraints of the seven-segment numeric display.

Manually Activated Fill

A FILL operation should only be performed on a tank which is not full (current level below the HI alarm set-point). To perform a FILL operation using the manual method, follow these steps (For the automatic method, see the AUTO-FILL section below):

1. Hold down the FILL key until the system makes two quick beeps and the display reads [FILL] (this may take several seconds). Then release the FILL key.
2. Use the UP or DOWN arrow keys to select the tank [tAnC] to be filled.
3. When the proper tank number is indicated, press the SELECT key once.
4. The display will show [LoggIng] as it logs the initial level of the tank, and then [AutoFILL] will be displayed.
5. The Console will begin displaying the level of the tank being filled only. This level will be updated about once each second. The number of the tank being filled will be indicated, and an arrow will indicate that the system is in standard fill mode (STD indicated with arrow on Console display).
6. The FILL mode will end automatically if the tank level has not risen more than 0.4” in 5 minutes. If the HI alarm set-point is reached on any system, the internal audible alarm will sound.
7. The FILL mode may be terminated manually at any time by pressing any key on the keypad.
8. The system will show [LoggIng] as it logs the new tank level.

The system will automatically return to normal operation and will return to monitoring all of the configured tanks when the fill operation terminates. This occurs if any button on the keypad is pressed during the fill, or if a tank has not risen more than 0.4” within 5 minutes.

NOTE: The FILL feature will only operate properly for filling a tank. This feature can’t be used to measure product being removed from the tank.

NOTE: For additional safety before fill monitoring begins, the tank ullage will be displayed (UL xxxx, where the x’s represent volume) in either gallons or Liters depending on the Units set for display. This ullage number is calculated from the current level of the tank to the set high point on the tank. This value will be dependent on the values that have been programmed by the user.

WARNING: Each console can only monitor one tank at a time, do not attempt to fill multiple manifolded tanks at the same time.

Auto-Fill

The system is equipped with an auto-fill feature that will automatically record the fill in the same manner as a manually activated fill if the level of the tank rises 0.4” in two minutes or less. The fill will record the initial and ending fluid levels. The auto-fill will exit fill mode if there is no activity for 6 minutes once a fill has been initiated.

High Alarm Activation

A high alarm is triggered when the level in the tank is at or above the high alarm set-point configured by the user. In addition to the alarm beeper on the Console activating, the Console will alternately flash on the display the current level of the tank and the warning message ‘HI’. This will continue until the high alarm is acknowledged (by pressing any key) or after 15 minutes has expired.

High Alarm Test

The alarm beeper mounted on the Console may be tested without opening the Console. The alarm may be tested by pressing and holding the “Up Arrow” key on the front keypad until the alarm activates. The alarm will continue to operate for 5 seconds once the button on the keypad has been released. This feature will work even if the local lockout switch has been activated.

VI. PC Software Installation & Operation (Optional)

A separate manual has been provided with your system that explains how to successfully install and use the AST Gauge software on a PC. Please refer to that for further instructions.

VII. Maintenance

Routine maintenance will increase the life of the system. These steps should be performed on a routine basis, taking environmental and safety factors into consideration.

NOTE: Where applicable, follow all OSHA Lockout/Tagout procedures when replacing the bat tery or performing maintenance on the Console unit. This may include shutting off the power at the main circuit box or power source.

Console Enclosure

Since the Console unit enclosure is constructed from fiberglass, very little maintenance is required. Cleaning the exterior of the enclosure and front panel with a mild detergent will remove dirt and contaminants. Do not use solvents to clean the front panel of the unit. Some solvents will damage keypad and front panel material. Normal fuels will not hurt the front panel or keypad. Chemicals such as MEK and Methaline Chloride will damage the front panel and keypad. Use care when cleaning the display window so that you do not scratch it. (Window cleaners containing ammonia should not be used, because they may streak and cause a haze over the window.)

Keypad

The keypad should be inspected frequently for punctures, tears, or other damage. Should one of the keypads seem to function improperly, run a diagnostic routine on the keypad. If the keypad fails the diagnostic test, contact Morrison Bros. Co.

Console Interior

The console circuit boards are sealed from external elements and coated with an environmental coating to prevent contamination. Should contaminants build up on the internal circuit boards, dry compressed air may be used to blow off the boards.

Battery Back-up

The battery back-up is an 8.4 volt (9V style) Nickel Cadmium battery designed to last for many years. Replacement batteries are available from your Morrison Bros. Co. distributor or may be purchased at local electronic stores.

WARNING: Do not replace the back-up battery with anything but an 8.4 volt NiCAD battery. A standard 9 volt battery may explode or cause damage to the Console, since it would not be designed for recharging.

Gauge

The gauge is a critical component of the system and should be checked periodically. Begin by removing the cover plate located on the same side as the inlet pipe. The mechanical clock face side should not be opened. Removing the cover from the gauge will expose the pulley mechanism. Inspect the mechanism for signs of corrosion. The brass components in the gauge could have tarnish or slight corrosion, which is acceptable as long as it does not impair the operation of the gauge. Check to see that the cable is wound around the pulley and that there is tension on the cable by gently tugging on it. Do not pull the cable out or turn the pulley wheel, this may cause the pulley to backlash or unwind. If excessive corrosion has built up on the pulley mechanism to a degree that the gauge does not function properly or the mechanism appears to be damaged, consult Morrison Bros. Co. Customer Service Department for instructions.

VIII. Troubleshooting

This section is intended as a basic guide to trouble shoot the system. If further assistance is required, contact Morrison Bros. Co. Customer Service Department toll free at **800-553-4840**.

PROBLEM

The display shows 'Error' for one or more tanks

SOLUTION

'Error' indicates that the Gauge Head for the indicated tank is not responding to the Console.

For a new installation:
Check that the wires are all attached to the appropriate terminal block for their tank numbers. Also, check that the Gauge Head wires are connected to the proper terminals at the Panel and at the Gauge Head junction box. Also make sure the number of tanks is set correctly (See Switch Settings in Section III).

For an existing installation:
Check the Gauge Head electronics for standing water or corrosion build-up which may cause the electronics to fail. Look for points in the wiring where the cable may be subject to wear over an extended period of time. If conduit or exposed cables are in a position to flex repeatedly, the conductors may fail by shorting together, short to ground, or disconnecting.

PROBLEM

I recently changed the units being displayed from metric to standard (or standard to metric) and now the volume readings are all incorrect.

SOLUTION

The volume calculations rely on the accuracy of the tank dimensions that were programmed into the system (usually at time of installation). When programming tank dimensions, measurements are entered in centimeters if the current display is liters or centimeters, and inches if the current display is inches, feet-inches, or gallons. If the measuring system is changed after tank dimensions have been programmed, the tank dimensions must be re-entered in the new measuring units.

PROBLEM

When attempting to fill the tank, the fill display exits "Fill Mode" immediately after it starts.

SOLUTION

This is usually caused by attempting to fill a full tank. Filling is only allowed on a tank which has a level below its HI level alarm set-point. If the tank in question is not full (or nearly full), check that the tank dimensions, TOP level, and HI alarm set-point are programmed properly. If all other possibilities check out, listen for the number of Console beeps: it is possible the 'SELECT' button is being pressed twice, causing the unit to release from fill mode.

PROBLEM

The tank volume shown on the display is jumping around erratically when in fill mode.

SOLUTION

Fill mode locks the Console processor on one tank for a continuous real-time readout. Since the maximum precision of the gauge is 0.1", the level of the tank may fluctuate, jumping plus or minus 0.1". This is normal. Large tanks that are set to display in gallons may look like larger jumps. If the jump seems abnormal set the display unit to inches and observe the deviation in fill mode.

PROBLEM

The tank level is not moving.

SOLUTION

The float could be hung on an obstruction inside the tank or a malfunction in the gauge head may have occurred. Remove the backside cover plate and check the pulley wheel and spring to make sure the cable is still on the wheel and the spring is still attached at both ends. Gently turn the pulley wheel counterclockwise to check for movement. Do not remove the mechanical face side of the gauge.

PROBLEM

The console is set in gallons and keeps reverting back to inches and losing tank information.

SOLUTION

There is most likely a grounding problem. Check to make sure all items are grounded properly according to the instruction manual. If no grounding faults are found, check the ribbon cables for nicks or cuts caused from the door during closing. Replace if necessary.

PROBLEM

High Alarms randomly activate.

SOLUTION

Check sensor gauge head grounds and wire connections. A loose wire or short conditions may cause a high alarm to activate alternatively to an Error message.

PROBLEM

The Console memory is corrupted and needs to be completely reset, including all transactions, calibration and setup.

WARNING: The High and Low Level alarms, all tank dimensions, calibration, transactions, and unit's settings will be cleared. System configuration should be recorded before resetting the system so they can be easily re-entered. It may be possible to use configuring Site-Print to record settings before clearing memory.

SOLUTION

This is a last resort option only, the memory will be completely reset to factory default settings (date and time will be retained). Hold the FILL key and the DOWN arrow at the same time, and turn the Console power switch S3 from the OFF (middle) position to the ON (up) position, to perform a reconfiguration to factory defaults. [dEFAULT] will be displayed as the system reboots.

PROBLEM

Tank levels don't match when reading in gallons.

SOLUTION

When reading the console in gallons, the size of the tank must be taken into consideration. The variance in inches may be only 1/10 of an inch. However, on some tanks, 0.1" may be equal to 200 gallons or more. Temperature fluctuations may also cause variations in the product level.

PROBLEM

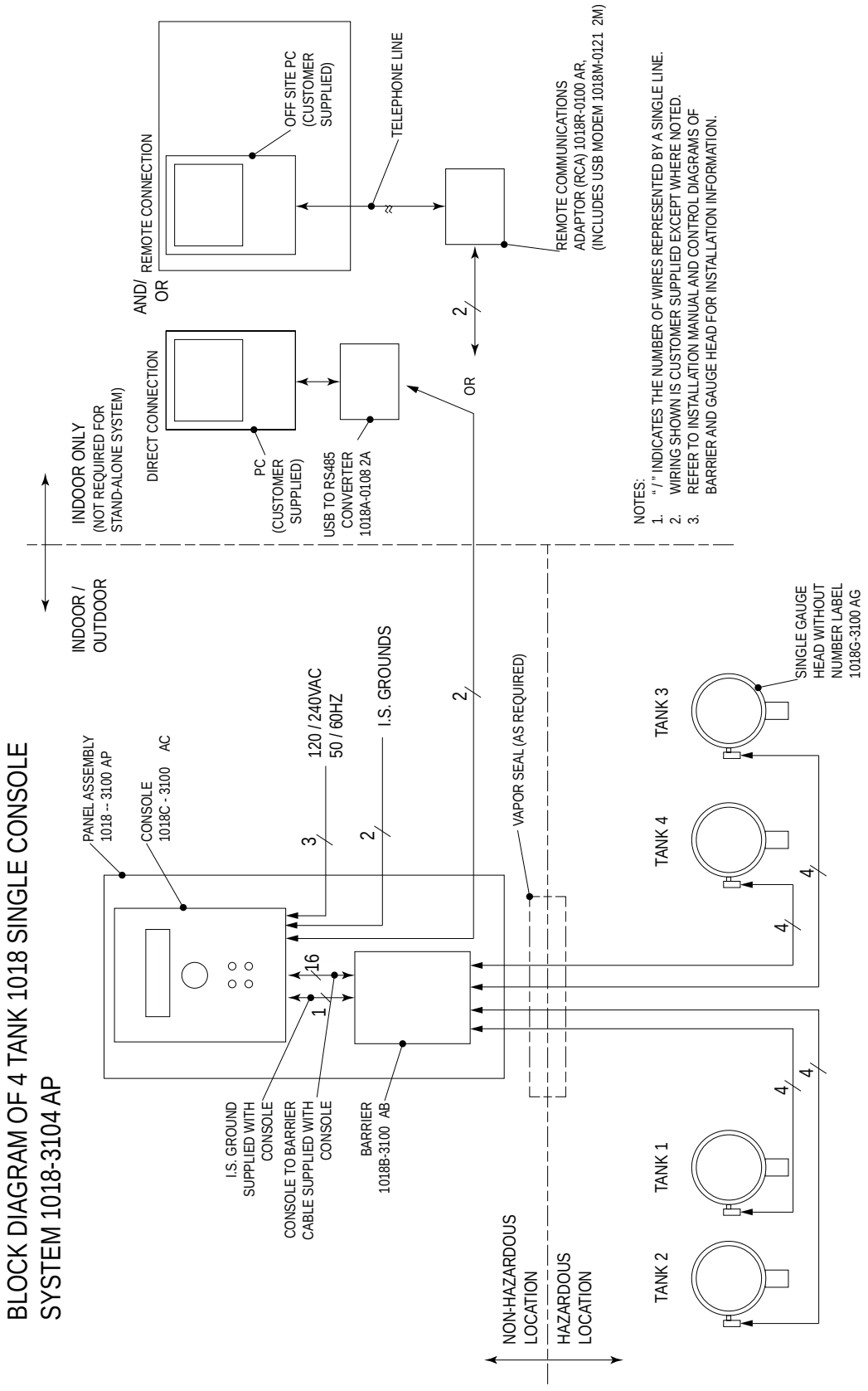
Fill mode not working in manual or automatic mode.

SOLUTION

Make sure that date and time have been configured on the Console. The fill mode relies on this information to operate properly.

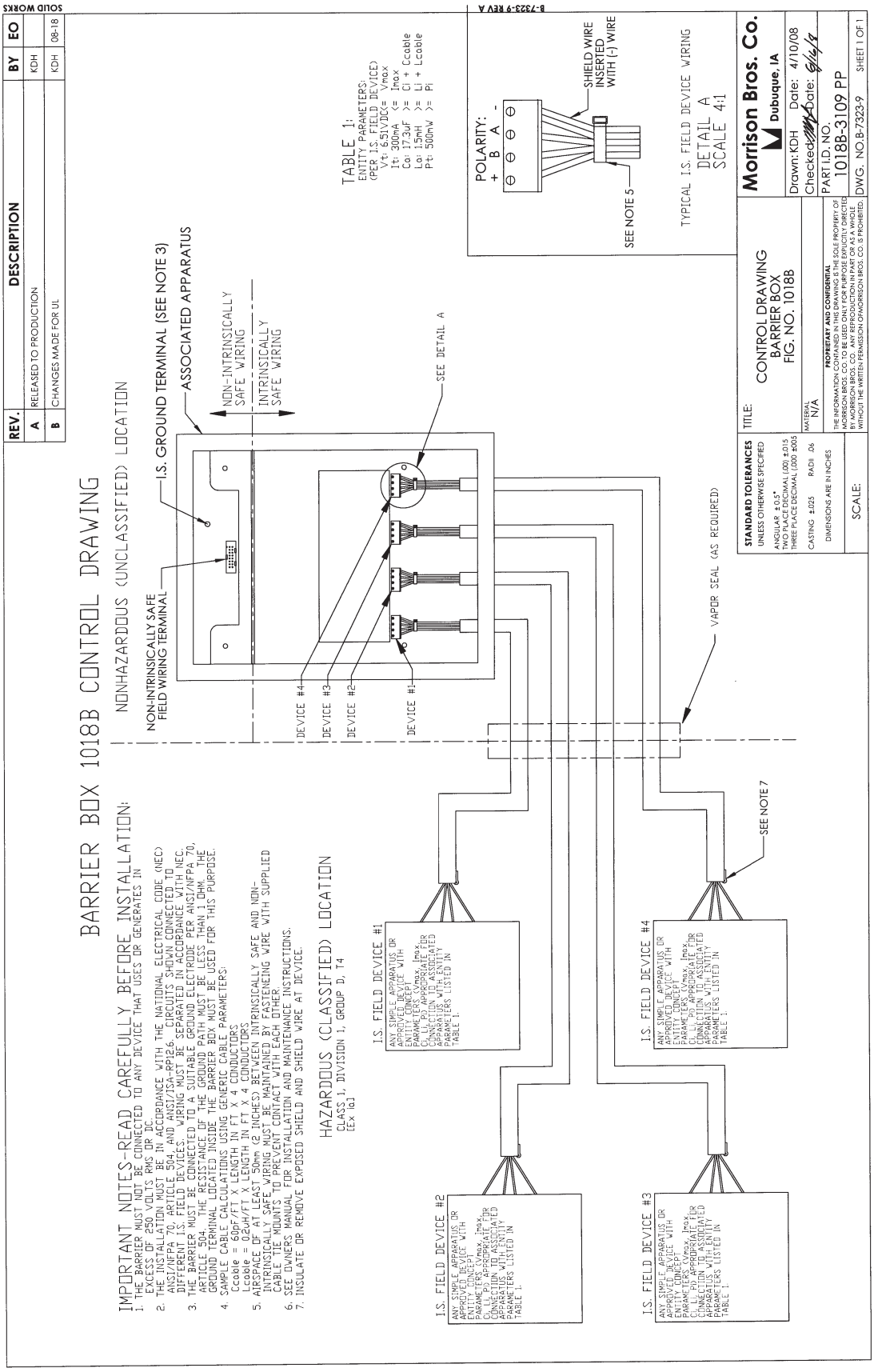
Appendix A

Block Diagram (B-7356-4)



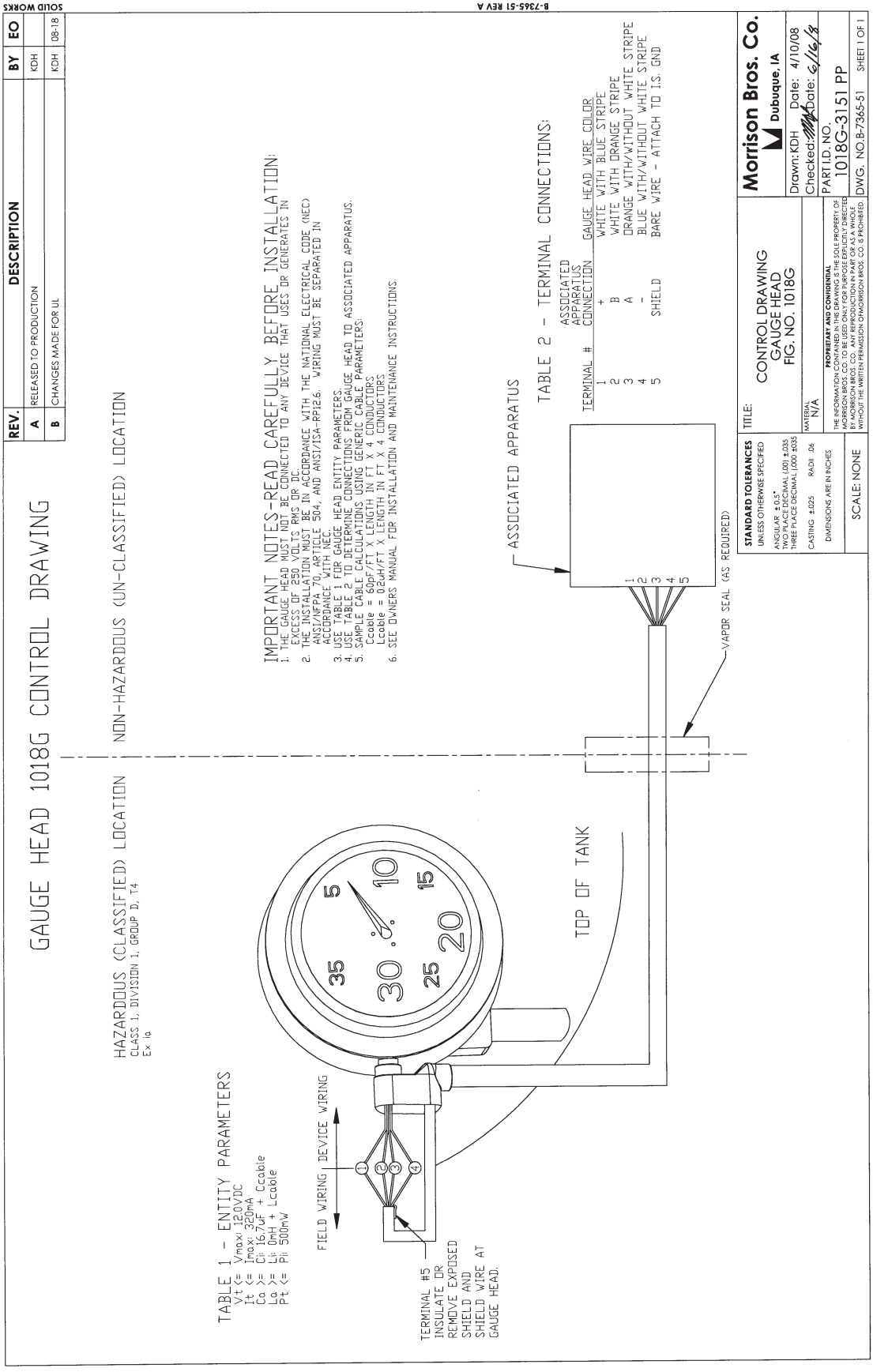
Appendix B

Barrier Box Control Drawing (1018B-3109PP)



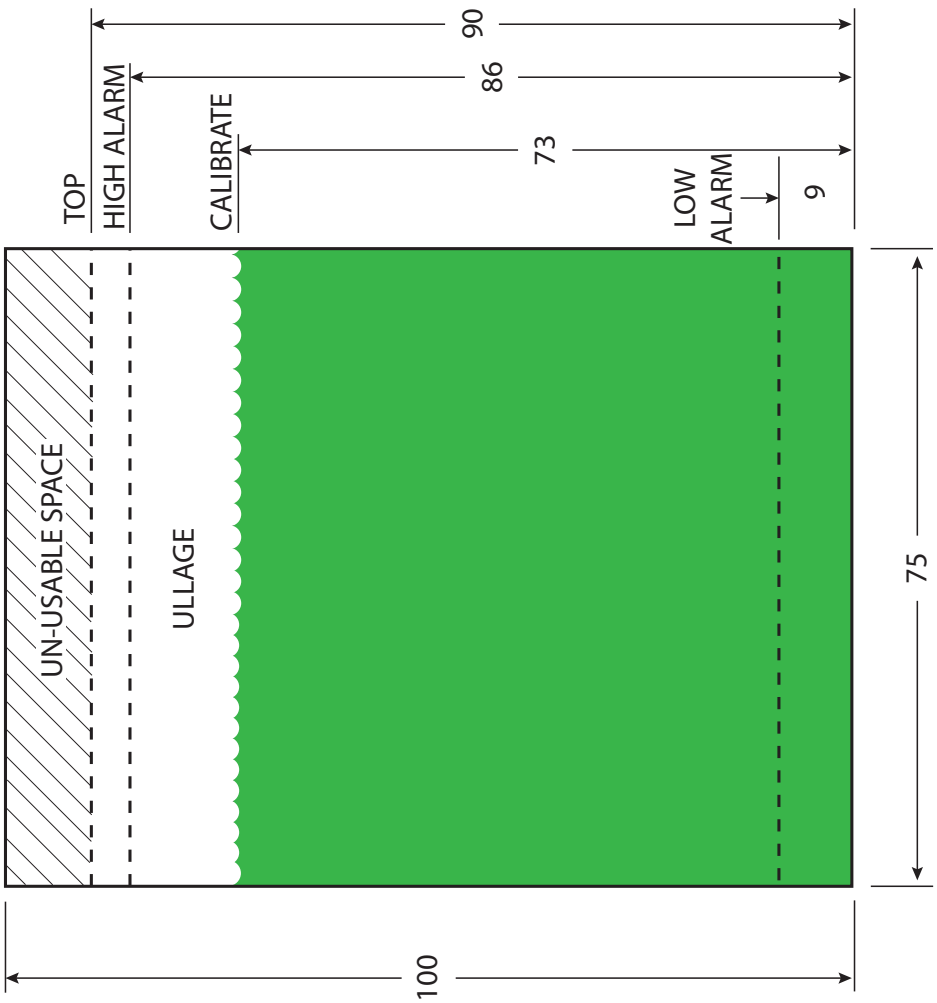
Appendix C

Gauge Head Control Drawing (1018G-3151PP)



Appendix D

Example Tank Configuration



Tank Dependent Variables
Tank Style: Round vertical
Tank Height: 100'
Tank Width: 75'
Top: 90' (Max allowable fluid level based on 90% of tank volume)
Fluid Level: 73'

User Selectable Parameters
High Alarm: 95% of top (equates to 85.5')
Low Alarm: 10% of top (equates to 9')

Appendix E

Replacement Parts

Morrison Part Number	Item Description
1018--3105 PP	Installation Manual
1018-3111 PP	Software Manual
1018--3106 2S	AST Software for PC (includes USB to RS485)
1018A-0108 2A	USB tonRS485 Converter
1018B-3100 AB	Assembled Barrier Box
1018C-3100 AC	Assembled Console
1018C-3103 2O	Membrane Switch
1018C-3109 2B	Console Control PCB
1018C-3112 2P	Console Power Supply
1018C-3136 2B	Console Connector PCB
1018C-3140 2T	Console Terminal Strip
1018C-3170 2F	Fuse (F13) for Connector PCB
1018C-3171 2F	Fuse (F1-F12) for Connector PCB
1018C-3174 2L	Padlock
1018G-3100 AG	Assembled Gauge Head (No Label)
1018G-3136 2C	Gauge Head Wire Splice
1018P-1142 2T	Warning Tags
1018P-1169 AF	Gauge Head Float
1018P-1178 2O	Tank Decals for Console
1018P-1195 2B	8.4 Volt NiCad Battery
1018C-3178 2C	Termination register Control Board IC Chip-RS485

Optional Parts

Morrison Part Number	Item Description
1018R-0100 AR	Remote Communications Adaptor
1018G-31XX AG	Gauge Head for Expansion (Call Customer Service)
1018---3162 2F	1/2” Conduit Fitting
1018M-0121 2M	USB Modem