SeeLevel ACCESS™

Data Portal & Remote Display

with 4-20 mA Output and Serial Interface

MODEL T-DP0301-A

RS-232 Version

IMPORTANT OPERATOR INFORMATION

DATE INSTALLED:_____

UNIT NUMBER:_____

COMPARTMENT: _____

DISPLAY CALIBRATION UNITS (e.g. inches, gallons): _____

MINIMUM TANK READOUT: _____

MAXIMUM TANK READOUT:_____

FULL SCALE ANALOG CALIBRATION VALUE: _____

SERIAL NUMBER : _____

NOTES: _____

_____

_____

_____

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CHAPTER 1 - INTRODUCTION

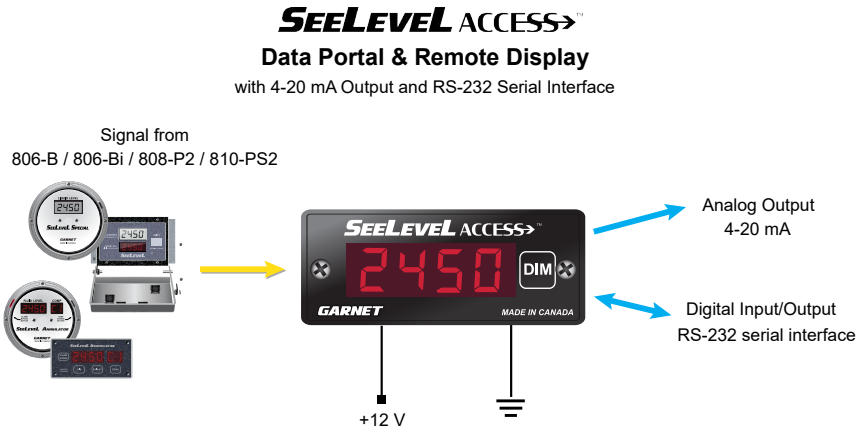
Congratulations on purchasing the Garnet Instruments **SeeLevel Access™ Data Portal**. The SeeLevel Access™ compliments the SeeLevel Annihilator™ 806-B, 806-Bi, or SeeLevel Special™ 808-P2 and SeeLevel ProSeries II 810-PS2 gauges by providing an additional volume readout in the cab of your truck.

In addition to providing readout of the tank level, the SeeLevel Access™ provides a 4-20 mA analog output proportional to the fluid volume displayed. This analog output can be used to communicate the tank level to other pieces of equipment such as fleet management systems or Electronic Logging Devices (ELD).

The full scale value of the analog output can be set using the buttons on the back of the display, no additional equipment is required for calibration.

The SeeLevel Access™ also contains a serial RS-232 interface which allows fleet management or ELD systems to gather fluid volume data from the gauge. The interface is full duplex and contains security features to prevent unauthorized access.

The SeeLevel Access™ display has been designed to withstand the vibration and shock encountered in mobile applications. While the 808-P2 and 810-PS2 operate on internal batteries, (12 volt truck power is used to operate the back light and external alarms), the SeeLevel Access display operates on 12V truck power.



CHAPTER 2 - FEATURES

The SEELEVEL Access™ has been uniquely designed for specific applications and with specific features:

Standard SEELEVEL Access Features

1. The signal between the 806-B, 806-Bi, 808-P2 or 810-PS2 display and the SEELEVEL Access™ is digitally encoded so the signal line can be connected using a standard 7 pin trailer plug.
2. The display operates on 12 volt truck power, and draws less than 150 mA.
3. All-digital design (except the 4-20 mA output) eliminates reading drift or degradation, ensuring long-term accuracy under all operating conditions.
4. Operation from -40 °C to +60 °C (-40 °F to +140 °F) ambient temperature.
5. Easy installation and servicing with a one-year limited warranty.

Additional SEELEVEL Access T-DP0301-A Features

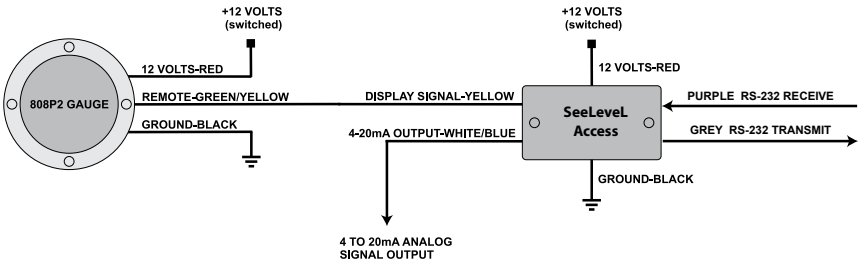
6. An analog 4-20 mA output, with 4 mA corresponding as zero displayed volume, and 20 mA corresponding to the full scale displayed volume programmed into the remote display.
7. An RS-232 serial interface available to connect to a a variety of ELD or fleet management systems.
8. The SEELEVEL Access™ provides an easy-to-read LED display inside a compact, edge-view enclosure, optimized for top-of-dash or overhead console mounting. The display is housed in an aluminum enclosure 2.7" wide x 1.1" high x 3.4" deep (68 mm wide x 29 mm high x 87 mm. deep).
9. A dimmer button switch enables the operator to control brightness.
10. Simple 6 wire electrical installation - 12V power (red), ground (black), gauge signal (yellow), analog output (white/blue), serial receive (purple) and serial transmit (grey).

CHAPTER 3 - WIRING DIAGRAMS

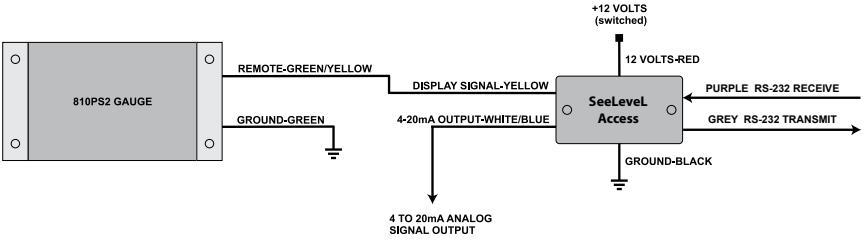
THE SEELEVEL Access™ has been designed for easy installation with your 806-B, 806-Bi, 808-P2 or 810-PS2 series SEELEVEL™ gauge. Installation instructions are available online at www.garnetinstruments.com.

The SEELEVEL Access™ Remote Display is easy to install:

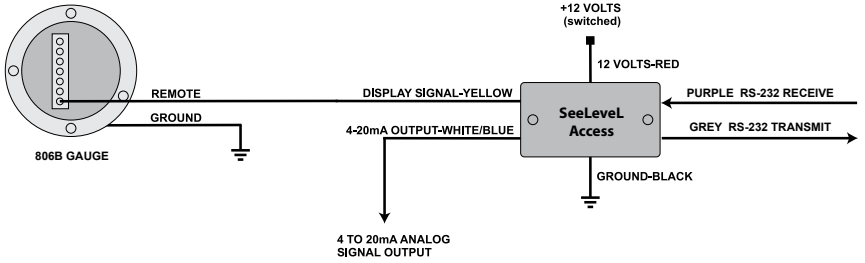
808-P2 Wiring Diagram



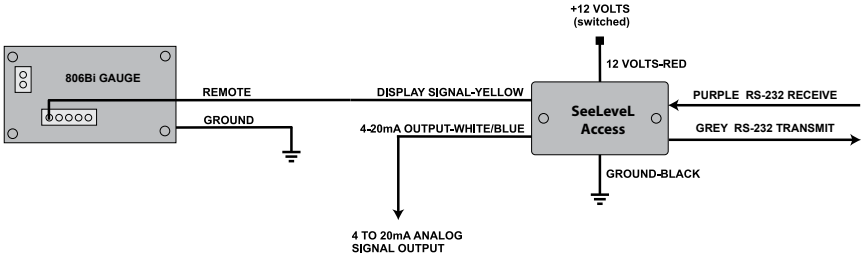
810-PS2 Wiring Diagram



806-B Wiring Diagram



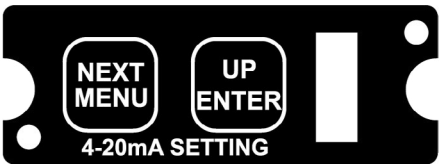
806-Bi Wiring Diagram



CHAPTER 4 - DISPLAY PROGRAMMING

The SEELEVEL Access™ display shows the tank level by repeating the information shown on the 806-B, 806-Bi, 808-P2 or 810-PS2 gauge. The 4-20 mA analog output is calculated from the display level with a 4 mA output corresponding to a display level of zero, and a 20 mA output corresponding to the full scale level programmed into the SEELEVEL Access™ display.

For example, if the full scale is programmed to be 500.0, then a display value of 400.0 will result in an analog output of 16.80 mA. The display will recognize the decimal location and adjust the output accordingly, so in this example a display value of 400 will also result in an analog output of 16.80 mA.



To set the full scale level:

1. Determine the maximum volume that can be displayed and pick a full scale amount that is equal to or greater than this volume.

2. Press both the **NEXT MENU** and **UP/ENTER** buttons on the back panel, the display will show SCAL. Release both buttons.

3. The display will show the existing calibration with the left digit bright. Press the **UP/ENTER** button to change the bright digit. Press the **NEXT MENU** button to go to the next digit.

4. Set all 4 digits, then press **NEXT MENU** again to set the decimal point, it will be bright to indicate that it is selected. Press the **UP/ENTER** button to select either x.xxx, xx.xx, xxx.x or no decimal. For best accuracy of the analog output, try to use all 4 digits such as 500.0 instead of just 500.

5. After the decimal as been set, press **NEXT MENU** again, the display will show Stor. Press **UP/ENTER** to store the calibration and exit the setting menu. The display will continue to show Stor for a moment and then will show donE for a second. Then normal operation resumes.

6. If you do not want to store the calibration, press **NEXT MENU** again and the display will show Abrt. Press **UP/ENTER** to abort which exits the calibration menu without saving.

7. If you press **NEXT MENU** again from the AbrE display, the menu will return to the beginning with the left digit selected by being bright.

8. If the full scale calibration is below 103, the display will be unable to calculate a valid calibration, and will show cErr (calibration error) after a few seconds. The existing calibration will be retained, and the display will return to normal operation.

To view the existing calibration:

1. Press either the **NEXT MENU** or **UP/ENTER** button (but not both) on the back panel, the display will show the existing full scale analog calibration while the button is held down. Release the button to return to normal operation.

To test the analog output:

1. While either the **NEXT MENU** or **UP/ENTER** button on the back panel is pressed, the display will show the full scale calibration and the analog output will go to full scale (20 mA). This can be used to test or calibrate the equipment connected to the analog output.

2. While the display is in the calibration mode (entered by pressing both the **NEXT MENU** and **UP/ENTER** buttons) the analog output will be at 4mA.

SeeLevel ELD Portal Format and Signal Format

- The supported signal format is bidirectional serial (separate TX and RX lines), RS232 voltage levels, 9600 baud, 8 bit, no parity, 1 stop bit.
- All messages obey the following format: [start sequence] [total number of bytes in message] [message ID] [payload - optional] [CRC] [stop sequence]
- All multi-byte parameters are transferred big-endian (MSB first)
- Start sequence: [0xFE][0xFE][0x24]
- Total number of bytes in message (1 byte)
- Message ID (1 byte)
- Payload (optional depending on the message)
- CRC (1 byte) = direct sum of all preceding bytes, truncated to 1 byte
- Stop sequence: [0xFF][0xFF][0x2A]

SeeLevel Query Message (ELD -> SeeLevel)

- Value: 0x00
- Allows the ELD to query the SeeLevel device
- [0xFE][0xFE][0x24][0x09][0x00][0x29][0xFF][0xFF][0x2A]

SeeLevel Query Response (SeeLevel -> ELD)

- Value: 0x01
- SeeLevel responds with model ID (1 byte), H/W Rev (1 byte), S/W Rev (2 bytes), alarm capability (1 byte), and SN support (1 byte). If the SeeLevel device supports a unique serial number, it will follow (8 bytes in length).
- Example: SeeLevel model ID = 0x01, hardware rev = 'E' (0x45), software major rev = 0x05, minor rev = 0x09, no alarm capability = 0x00 (0x01 = alarm capable), serial number supported = 0x01 (serial number not supported = 0x00), and a serial number = 0x0102030405060708:
- [0xFE][0xFE][0x24][0x17][0x01][0x01][0x45][0x05][0x09][0x00][0x01][0x01][0x02][0x03][0x04][0x05][0x06][0x07][0x08][0xB1][0xFF][0xFF][0x2A]

SeeLevel Handshake Demand Message (SeeLevel -> ELD)

- Value: 0x02, 1 byte payload
- ELD must respond with the proper coded response in order to either begin or continue the transfer or broadcast of liquid levels from the SeeLevel device. Handshake demands will be broadcast at random times.
- Example:
- [0xFE][0xFE][0x24][0x0A][0x02][0x3E][0x6A][0xFF][0xFF][0x2A]

ELD Handshake Response (ELD -> SeeLevel)

- Value: 0x03, 1 byte payload
- To calculate the response, the payload from the SeeLevel Handshake Demand Message is used as an address/offset to fetch the contents of the lookup table:
- Response to example above:
- [0xFE][0xFE][0x24][0x0A][0x03][0x85][0xB2][0xFF][0xFF][0x2A]
- Contact Garnet Instruments at 1-800-617-7384 or at info@garnetinstruments.com to set up the appropriate working relationship. Once this is established, the handshake response table will be provided.

Send Liquid Level Message (ELD -> SeeLevel)

- Value: 0x04, no payload
- SeeLevel responds with a single liquid level or a handshake demand message.
- [0xFE][0xFE][0x24][0x09][0x04][0x2D][0xFF][0xFF][0x2A]

Begin Liquid Level Broadcast Message (ELD -> SeeLevel)

- Value: 0x05, no payload
- SeeLevel responds with a liquid level or with a handshake demand message.
- [0xFE][0xFE][0x24][0x09][0x05][0x2E][0xFF][0xFF][0x2A]

Stop Liquid Level Broadcast Message (ELD -> SeeLevel)

- Value: 0x06, no payload
- SeeLevel will cancel any further broadcast of liquid level.
- [0xFE][0xFE][0x24][0x09][0x06][0x2F][0xFF][0xFF][0x2A]

SeeLevel Query Alarm Liquid Level Message (ELD -> SeeLevel)

- Value: 0x07, no payload
- SeeLevel will respond with a liquid alarm level response or an error response if the alarm function is not supported.
- [0xFE][0xFE][0x24][0x09][0x07][0x30][0xFF][0xFF][0x2A]

SeeLevel Liquid Alarm Level Response (SeeLevel -> ELD)

- Value: 0x08, 7 byte payload
- SeeLevel responds with liquid alarm level (4 bytes = unsigned int32), number of digits to the right of the decimal (1 byte), alarm type (1 byte; high = 0x01, low = 0x00), and whether liquid level is currently in alarm (1 byte; alarm active = 0x01, no alarm = 0x00).
- Example: liquid alarm level = 347.56, alarm type = low level, alarm active:
- [0xFE][0xFE][0x24][0x10][0x08][0x00][0x00][0x87][0xC4][0x02][0x00][0x01][0x86][0xFF][0xFF][0x2A]

SeeLevel Query Alarm Status Message (ELD -> SeeLevel)

- Value: 0x09, no payload
- SeeLevel will either respond with current alarm status or an error response if the alarm function is not supported.
- [0xFE][0xFE][0x24][0x09][0x09][0x32][0xFF][0xFF][0x2A]

SeeLevel Query Alarm Status Response (SeeLevel -> ELD)

- Value: 0x0A, 1 byte payload
- SeeLevel responds with current alarm status (1 byte; alarm active = 0x01, no alarm = 0x00).
- Example: alarm active:
- [0xFE][0xFE][0x24][0x0A][0x0A][0x35][0xFF][0xFF][0x2A]

SeeLevel Error Response (SeeLevel -> ELD)

- Value: 0x0F , 1 byte payload
- SeeLevel issues this response if a command/message is not supported. Payload = unsupported message code.

- Example: ELD has previously issued a SeeLevel Query Alarm Liquid Level Message (0x07) to a SeeLevel device which does not support alarms:
- [0xFE][0xFE][0x24][0x0A][0x0F][0x07][0x40][0xFF][0xFF][0x2A]

SeeLevel Liquid Level Report Message (SeeLevel -> ELD)

- Value: 0x10, 6 or 7 byte payload, depending on whether alarms are supported
- SeeLevel transmits liquid level (4 bytes = unsigned int32), number of digits to the right of the decimal (1 byte), optical error status (1 byte), and alarm status (currently active = 0x01, not in alarm state = 0x00). The alarm status field is optional and is not transmitted by a SeeLevel device which does not support alarms. Optical error status: no light = 0x00, low light level = 0x01, sunlight = 0x02, no error = 0x10. In the event that the optical error status is NOT in error, the liquid level/ number of digits to the right of the decimal is ignored.
- Example: liquid level = 1,083.1, no optical error, alarms not supported.
- For the liquid level, the first 4 bytes of the payload represent the hex value of the level, not the BCD value.
- [0xFE][0xFE][0x24][0x0F][0x10][0x00][0x00][0x2A][0x4F][0x01][0x10][0xC9][0xFF][0xFF][0x2A]

Broadcast:

- Done after every data reception (good or bad) or no signal timeout for the 808P2 and 810PS2 gauges. Done after every 8 successful data transmissions for the 806B/806Bi gauges.
- Every 25 broadcasts (approximately 20 seconds) a handshake request is sent to allow continued broadcasts.
- On power up, if broadcasts are enabled, a handshake request is sent to allow broadcasts.
- Does NOT need a handshake to stop broadcasts.
- If a handshake request is not correctly responded to, the broadcasts are stopped.
- The Begin and Stop Broadcast requests are not explicitly responded to, the starting or stopping of the broadcast is the confirmation.

ELD requests needing handshake confirmation:

- Start broadcast and Send liquid level
- The handshake request is done every time one of these requests is received. The handshake must be responded to within 500ms, or else the response is considered invalid and an error message will be sent from the SEELEVEL to the ELD for late responses.

Handshake format:

- Request from ELD is received by SEELEVEL
- SEELEVEL responds with handshake request
- ELD sends handshake response
- SEELEVEL sends reply to original ELD request if handshake response is correct.

The alarms are not currently supported. In the future, if they are:

- The content of Message 0x08 is alarm set point, high or low level alarm, and current alarm status.

SEELEVEL **Query of Handshake Frequency During Broadcast Message (ELD -> SEELEVEL)**

- Value: 0x2D
- This asks for the handshake frequency, response is shown below.
- [0xFE][0xFE][0x24][0x09][0x2D][0x56][0xFF][0xFF][0x2A]

Handshake Frequency During Broadcast Response (SEELEVEL -> ELD)

- Value: 0x2E, 1 byte payload
- The frequency can range from 1 to 126 broadcasts per handshake request. The number is shown in hex from 0x02 to 0x7F (total number of transmissions per handshake, including the handshake).
- Message format, frequency is 20 (0x14):
- [0xFE][0xFE][0x24][0x0A][0x2E][0x14][0x6C][0xFF][0xFF][0x2A]

CHAPTER 6 - TROUBLESHOOTING GUIDE

Error Code	Cause	Solution
no S	The display is not receiving any signal from the 806-B, 806-Bi, 808-P2 or 810-PS2 gauge. The analog output will go to 0 mA. This differentiates the error condition from the zero display condition of 4 mA.	Check the wiring and grounding for errors or bad connections. Also ensure that the 806-B, 806-Bi, 808-P2 or the 810-PS2 is working properly.
Err	The display is receiving corrupted data and the analog output will go to 0 mA.	
EErr	The display cannot communicate with its own memory.	The display will need to be serviced or replaced.
SErr	The display cannot communicate with its own digital to analog convertor.	

Accuracy:

The analog output has an accuracy of ± 0.25% of the full scale value, so any output value should be within 0.05 mA of the "ideal" value. There are no user adjustments that can be made to alter the accuracy.

As with any digital system, there are round off and truncation errors inherent in the mathematical process. However, since the SEELEVEL Access™ utilizes a 10 bit digital to analog convertor, it has sufficient accuracy to allow the full resolution of the truck gauge to be realized. Note that the truck gauge sending the data has a resolution of only 8 bits (⅓" systems).

CHAPTER 7 - SPECIFICATIONS

Analog output accuracy:	"0.25% of full scale value ± 0.05 mA"
Minimum input supply voltage:	+10.0 V
Minimum difference between input supply voltage and voltage on analog 4-20 mA output:	4.0 V
Current drain:	150 mA or less
Temperature range:	-40°C to +60°C (-40°F to +140°F)
Enclosure:	*Material*: Aluminum *Size*: 68 mm wide x 29 mm high x 87 mm deep (2.7" wide x 1.1" high x 3.4" deep)
Display type:	LED 4-digit, 7 segment 10 mm (0.4") high digits
Display power:	Operates on 12 V truck power
Wiring:	6 wire electrical installation: 12 V power (red), ground (black), gauge signal (yellow), analog output (white/blue), RS-232 serial receive (purple), and RS-232 serial transmit (grey)
RS-232 output voltage level:	+/- 4.0 V minimum
RS-232 serial format:	9600 baud Standard mark/space NRZ format Mode is 8 bits Non-interverted tx No parity No break character One start bit One stop bit

CHAPTER 8 - SERVICE & WARRANTY INFORMATION

The warranty will only apply if the warranty has been registered online from the Garnet Instruments registration web page.

Go online to seelevelsupport.com/ and select "Register Warranty".

DISCLAIMER OF WARRANTY ON HARDWARE

Garnet Instruments warrants equipment manufactured by Garnet to be free from defects in material and workmanship under normal use and service for a period of one year from the date of sale from Garnet or an Authorized Dealer. The warranty period will start from the date of purchase or installation as indicated on the warranty card. Under these warranties, Garnet shall be responsible only for actual loss or damage suffered and then only to the extent of Garnet's invoiced price of the product. Garnet shall not be liable in any case for labor charges for indirect, special, or consequential damages. Garnet shall not be liable in any case for the removal and/or reinstallation of defective Garnet equipment. These warranties shall not apply to any defects or other damages to any Garnet equipment that has been altered or tampered with by anyone other than Garnet factory representatives. In all cases, Garnet will warrant only Garnet products which are being used for applications acceptable to Garnet and within the technical specifications of the particular product. In addition, Garnet will warrant only those products which have been installed and maintained according to Garnet factory specifications.

LIMITATION ON WARRANTIES

These warranties are the only warranties, expressed or implied, upon which products are sold by Garnet and Garnet makes no warranty of merchantability or fitness for any particular purpose in respect to the products sold. Garnet products or parts thereof assumed to be defective by the purchaser within the stipulated warranty period should be returned to the seller, local distributor, or directly to Garnet for evaluation and service. Whenever direct factory evaluation, service or replacement is necessary, the customer must first, by either letter or phone, obtain a Returned Material Authorization (RMA) from Garnet Instruments directly. No material may be returned to Garnet without an RMA number assigned to it or without proper factory authorization. Any returns must be returned freight prepaid to: Garnet Instruments, 286 Kaska Road, Sherwood Park, Alberta, T8A 4G7. Returned warranted items will be repaired or replaced at the discretion of Garnet Instruments. Any Garnet items under the Garnet Warranty Policy that are deemed irreparable by Garnet Instruments will be replaced at no charge or a credit will be issued for that item subject to the customer's request.

If you do have a warranty claim or if the equipment needs to be serviced, contact the installation dealer. If you do need to contact Garnet, we can be reached as follows:

CANADA
Garnet Instruments
286 Kaska Road
Sherwood Park, AB T8A 4G7
CANADA
email: info@garnetinstruments.com

UNITED STATES
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Granbury, TX 76049
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email: infous@garnetinstruments.com