USER MANUAL

MODEL 2100 DLS PRODUCT LINE

REDILEVEL 2100 DLS

Rev. D

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Description

The RediLevel™ 2100 DLS measures and reports fluid levels and temperatures in a variety of tanks and vessels. The sensor has a thin-profile, sturdy design to fit into tanks with two-inch ports. It is a digital sensor as it reports the information in a serial bit stream. The sensor uses a float(s) embedded with magnets to sense the top fluid level(s). A sensor may have one or two floats. A two-float sensor can measure multiple fluids in a tank. There is a temperature sensor mounted inside the tube fourteen inches from the bottom. When the sensor is polled for data, a series of microprocessors read and determine the position of the float(s) along the sensor tube. The main microprocessor then calculates the level and temperature and returns the data in a serial stream.

Communications

The serial communication protocol is RS485 2-wire or 4-wire, field selectable via jumpers on the fuse board. The baud rate is set to 9600, N, 8, 1. In 4-wire mode, one pair of wires is used strictly for transmitting and another pair is for receiving. For 2-wire mode, only one pair of wires is needed for both transmit and receive. Two wires are needed for the power supply, therefore 4-wire communications require a 3-pair cable while 2-wire communications require a 2-pair cable.

Wiring Connections

The sensor requires a power supply of 5.6 to 13 volts DC. To connect the sensor communication lines to the telemetry equipment, connect the sensor data receive to the RTU data transmit and the sensor data transmit to the RTU data receive. The voltage supply can be connected to a switched output so power is applied only during sensor polling.

Installation

To install the sensor, follow the simple steps below while referring to the assembly diagram in Figure 2 at the end of this manual:

1. Install the sensor-grip and a reducer for the tank port size that is to be used. Slide this assembly onto the bottom of the tube.
2. Install the float/floats onto the tube (product float first then water interface).
3. Install the float stop at the bottom of the sensor tube.
4. Carefully insert the bottom end of the sensor into the tank port and lower the sensor slowly into the tank. Be careful with the float so it does not hang up on the port edge.

CAUTION: DO NOT drop the sensor into the tank. The sensor contains glass switches and a sharp impact will break them, making the sensor inoperable.

5. With the sensor resting on the tank bottom, slide the reducer/sensor-mount assembly down to the tank port and tighten it onto the port. Tighten the sensor mount tight enough so the sensor cannot rotate by hand.
6. Unscrew the round side cover from the sensor top housing and feed the signal cable through the cord grip on the side of the sensor top. Unplug the gray, 6-position connector from the internal fuse board.
7. Make sure power is off before proceeding.

8. Using the white depressor tool, install the six wires (4-wire communication) or four wires (2- wire communication) as directed in the connection (hook-up) diagram in Figure 3.
9. Plug in the connector and replace the side cover.

Sensor Calibration Procedure - Setting the Initial Offset

The RediLevel™ 2100 DLS is designed to provide an accurate and dependable level measurement for oil and water levels in production tanks. The only calibration required is to set the offset value for the sensor. This can be done in the sensor or at the EFM, RTU, or PLC by determining the difference of the level between the electronic reading and the actual fluid level in the tank, measured with an approved gauge line. Once the level offset is entered in either the sensor or SCADA system, the level offset will be added to the raw value of the sensor to provide an accurate fluid level.

The level offset is determined by reading the sensor with the HHC-1000 Hand-Held Communicator while simultaneously gauging the level in the tank. For best results, the tank should *not* be in active production so that the fluid is not agitated at the time of reading. If it is not possible to isolate the tank, then it is recommended to take several readings of both the sensor and gauge line to make sure the readings are consistent.

Note: If there is no fluid in the tank, the level offset cannot be determined.

Note: The level offset is always added to the raw value. If a mistake is made when entering the level offset, reset the offset value to zero before proceeding to avoid large swings in readings. If there is an offset programmed in the sensor and the actual level is not correctly displayed, simply changing the offset value will ***not*** include the previous offset value.

Example: If a 1.50” offset is entered and the sensor is still reading ¼” below actual level, the true offset should be 1.75.” If you add a ¼” offset, the level reading will be 1.50” below actual level. Resetting the level offset to zero will make it easier to determine the correct offset value.

Procedure:

1. Using the Hand-Held Communicator (HHC-1000), connect to the sensor and take initial readings of level and temperature. Refer to the *HHC -1000 User Manual* for instructions.
2. If readings are providing multiple fluid levels, then verify that the two readings are more than 3” apart. If the difference is less than 3”, the two floats will be touching and a valid offset cannot be determined.
3. Verify that the first level is more than 3”. If less than 3”, then the bottom float is sitting on the bottom of the tank and level offset cannot be determined.
4. Using a gauge line, measure the actual level in the tank and note the level. Subtract the electronic reading from the gauged level to determine the level offset value.

   For example, if the actual level is 156.25” and the DLS reading is 155.50,” then the offset value will be 0.75” (156.25-155.50=0.75).

5. To program the level offset in the sensor using the HHC-1000, go to the “Set Points” menu and then to the “Level” menu. Press F2 in the “Level” menu to bring up the level offset screen.

6. To set the total fluid level offset, enter a value of *1* for the top float and then enter the offset value. If the value is less than one, enter the decimal value, then press "Enter."
7. To set the level offset for the bottom float, enter a value of *2* for the bottom float, then enter the offset value, and press "Enter."
8. To verify that the offset is correct, return to the main screen and then read level and temperature values to verify the DLS is reading correctly.
9. Once the level offsets are entered, there is no further calibration required unless the DLS is removed and reinstalled in another tank.

Testing and Troubleshooting

If the sensor fails to respond or does not report an accurate level, several things could be at fault. See the list of common issues below for help in diagnosing the problem.

Sensor does not respond:

Sensor is new and recently installed:

1. The sensor wiring is incorrect: check the sensor connection (hook-up) diagram.
2. Wrong baud rate: (Factory default is 9600)
3. Wrong protocol: (Factory default is N81)
4. There is insufficient voltage: The sensor needs at least 5.6 VDC.

Sensor has been in service for some time but is not working:

1. There are corroded connections or damaged cables.
2. Blown fuse or shorted suppressor on the barrier board (if equipped). Check the fuses with a continuity tester.
3. There is possible damage to sensor electronics.

Sensor sends inaccurate level or temperature:

1. An incorrect level or temperature offset is programmed into sensor, RTU, or host.
2. An incorrect number of floats are programmed. Check the sensor protocol list to reprogram the sensor with the correct information.

Sensor sends temperature but no valid level:

1. If the sensor reports error code 1, the float is not on the sensor in the correct orientation. The white mark on the float must be on top of the strip on the side of the sensor.
2. An incorrect number of floats are programmed. Check the sensor protocol command list to reprogram the sensor with the correct information.

Digital Level Sensor Protocol

Command syntax

1. Uppercase characters denote literals in the command and response streams.
2. Lowercase characters represent data fields in the command and response streams. Further explanation of data field structure is provided as necessary with each command.
3. All commands are terminated with carriage return **<cr>**.

4. All responses are terminated with **Ccccc** (cccc=16 bit CRC field in hexadecimal) followed by a carriage return linefeed pair **<cr><lf>**. All alpha hexadecimal characters are lower case.
5. The prefix to all commands and responses is **Uuu** where *uu* is the unit number (00-31). The unit number is the identity of the level sensor to which a command is addressed or which generates the response. '*' may be used as a wild card character for either digit in the unit number field 'uu'. The responding level sensor will always convert wildcard characters to the actual unit number.
6. Commands, which modify a level sensor configuration, always return the command string and 'OK' if successful. 'EEerr' replaces 'OK' if there is a problem storing the configuration data in the level sensor EEPROM.

Data Request Commands

Report Level and Temperature

Uuu?
where *uu* is a two-digit unit number from 00 to 31("*" may be used as a wildcard for either digit)

Note: *Do Not use the wildcard "**" if connected to more than one level sensor, as all sensors will respond simultaneously.*

Response: **UuuDlll.llFtttEeeeeWwwww**
where uu = unit number
lll.ll = level in inches (repeated for sensors with 2 floats)
ttt = temperature in degrees F
eeee = error number
0 = No errors
1= No float detected
2 = One float is out of range on a two-float sensor
3 = Too many groups
4 = (reserved)
5 = Transmit to slave processor for level failed
6 = Transmit to slave processor for temperature failed
7 = Receive from slave processor of level failed
8 = Receive from slave processor of temperature failed
9 = No slave processors responding

Note*: If errors 5 through 9 occur and persist after power cycling, the sensor should be returned for repair.*

wwww = warning number
0 = No warnings
1 = Possible level degradation

Under normal circumstances the warning field is 0. It will display *1* if the sensor is configured for two floats and only one group of switches is detected (i.e., only one float is present or both floats are abutted).

> ***Note****: The number of decimal places in a data field implies nothing about the accuracy of the data, i.e., levels are not accurate to 0.01 inches.*

Report Level and Temperature Continuously (factory diagnostics)

Uuu??
Response: **Same as above**, except continuously with internal module configuration and reported individual switch activation and groups of activated switches.

***Note**: The unit must be powered down before it will respond to other commands.*

Report 4-20mA Output Level (version 3.09 and higher)

Uuu?M
Response: UuuMhhhhEeeeeWwwww
Where uu = unit number
hhhh = hex value 0x0000-0xFFFF
eeee = error number
0 = No errors
1= No float detected
2 = One float is out of range on a two-float sensor
3 = Too many groups
4 = (reserved)
5 = Transmit to slave processor for level failed
6 = Transmit to slave processor for temperature failed
7 = Receive from slave processor of level failed
8 = Receive from slave processor of temperature failed
9 = No slave processors responding

***Note**: If errors 5 through 9 occur and persist after power cycling, the sensor should be returned for repair.*

wwww = warning number (0 means “No warnings”)
0 = No warnings
1 = Possible level degradation

Report Temperature Only

Uuu?T
Response: UuuFxxEeeeeWwwww
Where
xx= temperature

Configuration Commands

Assign Unit Number

UuuNnn
Where
uu = unit number (from 00 to 31)
nn = new unit number

***Note:** Unit number 00 is not valid in Modbus RTU mode*

Response: **UuuNOK**
Where
uu = newly assigned unit number

Assign Unit Number to Sensor With the Corresponding Serial Number (version 3.15 and higher)

UsssssssNnn
sssssss = seven-digit serial number
nn = two-digit unit number

Response:
UuuNOK uu = new unit number
UuuEEerr Write to EEPROM failed

Set Baud Rate

UuuBbbbb[b][pds]
Where
bbbb[b] = 1200, 9600, 14400, 19200, 38400, or 57600 (9600 is default) (v3.15 and higher)
pds = parity, data length, stop bit (pds options)
N81 (default)
E71
O71
For example**,** to program Unit 00 to 9600 E 7 1 would be U00B9600E71

Note: It is not necessary to power down the Model 2100 before this command takes effect. The Model 1000 must have power cycled for this command to take effect.

Response: **UnnBOK**

Set Number of Floats

UuuFn
Where
uu = unit number
n = float number (1 or 2 – Standard; 11 or 12 – 1/8" Resolution; 11 – Single Float; 12 – Dual Float)

Response: **UuuFOK**

Set Level Offset

UuuLOslll Sets the offset for the level sensor
Where
uu = unit number
sIIII = sign and offset with two implied decimal places
Note: If two floats, assigns the same offset to both

Response: **UuuOLOK**

Set Level Offsets for Individual Floats

UuuL[1|T]Oslll.ll Sets the top float offset.
Example of setting top level offset for Unit 00 to 2.25 inches - U00L1O2.25

UuuL[2|B]Oslll.ll Sets the bottom float offset. (*Dual Float Sensor only)*
Example of setting bottom level offset for water interface to 1.75 inches - U00L2O1.75
Where
uu = unit number

slll.ll = sign and offset with two implied decimal places.
The Plus (+) sign is assumed.
The Minus (-) must precede the offset value if required.
If no decimal places are required, then you do not need to add to value
Note: "O" in the command is the letter *O* and not the number zero

Response: **UuuLOOK**

Set Temperature Offset

UuuOFsoo
Where
uu = unit number
soo = -99 to 99 (optional sign)

Response: **UuuOFOK**

Set Multiple Temperature Sensor Offsets

UuuTnOso.o
Where
uu = unit number
n = temperature sensor identifier (1-8, 1 is at top)
so.o = -9.9 to 9.9 degrees (optional sign)

Response: **UuuTnOOK**

Set Receive to Transmit Delay

UuuRmmm
Where
uu = unit number
mmm = milliseconds (50 to 250). The default is 127ms

Response: **UuuROK**

Set 4-20mA Poll Period

UuuMPpppp
Where
uu = unit number
pppp = seconds (Default is 30 seconds)

Response: **UuuMPOK**

Note**:** Poll Periods less than 20 seconds may shorten the life expectancy of the 4/20mA converter board. The relay (which power cycles the sensor to reduce power consumption) is rated for 10,000,000 cycles.

Set 4-20mA Minimum (4mA) Range

UuuMINmm.mm
Where
uu = unit number
mm.mm = level for 4mA output (Default is 00.00)

Response: **UuuMINOK**

Set 4-20mA Maximum (20mA) Range

UuuMAXmmm.mm
Where
uu = unit number
mmm.mm = level for 20mA output in inches (Default is 240.00")
Example: For 20-foot long sensors = 240.00

Response: **UuuMAXOK**

Set the Level Error setting (version 3.09 and higher)

UuuSETERRx
Where
uu = unit number
x = 0 will set the level error report to be 999.99. This is the default setting.
x = 1 will set the level error report to be 000.00.

Response: UuuSETERROK

Set the Modbus 16 bit Unsigned Integer, 32 bit or 2 x 16 bit floating point mode

UuuIFxxxx
Where
uu = unit number
xxxx = 1007 will set the 16 bit Unsigned integer mode. This is the default setting.
xxxx = 1008 will set the 32 bit floating point mode.
xxxx = 1009 will set the 2x16 bit floating point mode (**v3.14 and higher**).

Response: UuuIFOK

Force sensor to enter Boot Load mode (version 3.15 and higher, (future use)

UUUFB
uu = two-digit unit number

Response: **none**

Enter High Level Electronic Shut Down (ESD mode) (version 3.15 and higher)

UuuESDONn
uu = unit number
n = one-digit number from 1 to 3 which represent the number of level request commands that will respond with the maximum level without cycling power. After this number, the sensor reverts to normal operation (Note: If power is cycled the count reverts back to programmed number of polls).

Response: **UuuESDONOK** ESD mode was successfully activated

Exit High Level Electronic Shut Down (ESD mode) (version 3.15 and higher)

UuuESDOFF

Response: **UuuESDOFFOK** ESD mode exit successfully

Note: UuuESDON0 also turns off ESD mode

Configuration Request Commands

Report Number of Floats

UuuF?
Response: **UuuFn**
Where
uu = unit number
n = number of floats (1 or 2 – Standard; 11 or 12 – 1/8" Resolution; 11 – Single Float; 12 – Dual Float)

Report Level Offsets

UuuLO?
Response: UuuL1Osnn.nnL2Osnn.nn
Where
uu = unit number
snn.nn = sign and offset with two implied decimal places

Report Temperature Offset

UuuOF?
Response: **UuuOFsff**
Where
uu = unit number
s = sign
ff = temperature offset (degrees F)

Report Multiple Temperature Offsets

UuuTO?
Response: **UuuTnOso.o…..TnOsn.n** repeated for additional temperature sensors
Where
uu = unit number
n = temperature sensor (1-8, 1 is top sensor)
s = sign
o.o = temperature offset

Report Switch Distance

UuuD?
Response: **UuuDd**
Where
uu = unit number
d = distance between switches as integral tenths of an inch (e.g., 5 = 0.5 inches, 10 = 1 inches)

Report Total Switches

UuuS?
Response: **UuuSssss**
Where
uu = unit number
ssss = total number of switches in the sensor

Report Receive to Transmit delay

UuuR?
Response: **UuuRmmm**

Where
uu = unit number
mmm = delay in milliseconds

Report 4-20mA Configuration

UuuMC?
Response: UuuPppppL1_4MAll.ll_20MAhhh.hh
Where
uu = unit number
Ppppp = Polling period in seconds
L1 = Data source is top float
_4MAll.ll = Level to output 4 mA
_20MAhhh.hh = Level to output 20 mA

Report Serial Number

UuuSN?
Response: UuuSNxxxxxxx
Where
uu = unit number
xxxxxxxx = serial number.

Report Unit Number corresponding to Serial Number (version 3.15 and higher)

UsssssssN?
sssssss seven digit serial number
Response: UsssssssNuu
uu = unit number

Report sensor Health Status (version 3.15 and higher)

UuuH?
uu = two digit unit number

Response:
grp0=ttt-bbb--grp1=ttt-bbb
grp3=ttt-bbb--grp4=ttt-bbb
UuuDlll.ll[Dlll.ll]Fttt[Fttt……]EeeeeWwwww
BATTERY-VOLTAGE:vv.vV

If sensor works in normal operation parameters the message will be
UuuSENSOR-OK

Error, one or more of the following Error messages

NO-SWITCH-CLOSED
ONLY-ONE-GROUP-FOUND-ON-A-TWO-FLOAT-SYSTEM
TOO-MANY-GROUPS-TO-RESOLVE-THE-LEVEL
NO-FLOAT-CONFIGURED
TRANSMIT-TO-PIC-PROCESSOR-FOR-LEVEL-FAILED
RECEIVE-FROM-PIC-PROCESSOR-FOR-LEVEL-FAILED
TRANSMIT-TO-PIC-PROCESSOR-FOR-TEMP-FAILED
RECEIVE-FROM-PIC-PROCESSOR-FOR-TEMP-FAILED

Warning, one or both of the following Warning messages:

WARNING!-POSSIBLE-LEVEL-DEGRADATION
WARNING!-POSSIBLE-LEVEL-DEGRADATION-DUE-TO-OFFSET

Report the Level Error Setting (version 3.09 and higher)

UuuSETERR?
Response: UuuSETERR=x
Where
uu = unit number
x = 0 is set for level error report to be 999.99 (default)
x = 1 is set for level error report to be 000.00

Report the Modbus 16 bit Unsigned Integer, 32 bit or 2 x 16 bit floating point mode

UuuIF?
Response: UuuIF=x
Where
uu = unit number
x = 0 is set for 16 bit Unsigned integer mode. This is the default setting.
x = 1 is set for 32 bit floating point mode.
x = 2 is set for 2x16 bit floating point mode (**v3.14 and higher**)

Report Battery Voltage

UuuBV?
Response: UuuBVvv.vV
Where
uu = unit number
vv.v = battery voltage in volts

Modbus Registry Map

Read/Write functions are given in Table 1. The read only functions in the holding registry are referenced in Table 2 & Table 3. The sensor warnings codes are provided in Table 4. Error codes are given in Table 5.

Table 1. Read/Write Registers

Configuration Registers	Register Read/Write	Address	No. Reg.	Notes	Integer Type
ESD ON: 0 = ESD off 1 to 3 ESD ON, 1 to 3 times	40106	105	1	**R/W** Factory setting: 0	16 bit Unsigned (v3.15 and higher)
Assign Sensor unit number	40107	106	1	Default value is 1	16 bit Unsigned
Select 16 bit unsigned integer (0) or 32 bit floating point (1) for registers that hold top float, bottom float, and temperature or 2x 16 bit floating point (2)	40108	107	1	Factory setting: 16 bit unassigned integer **(see Note for advanced users)**	16 bit Unsigned
Set baud rate (1200, 9600, 14400, 19200, 38400) (57600 V3.15 and higher)	40109	108	1	Factory setting: 9600	16 bit Unsigned
Set parity: 78 (N) = No parity 79 (O) = Odd parity 69 (E) = Even parity	40110	109	1	Factory setting: 78 (N)	16 bit Unsigned
Set data bit: 8	40111	110	1	Factory setting: 8	16 bit Unsigned
Set stop bit: 1	40112	111	1	Factory setting: 1	16 bit Unsigned
Rx to Tx delay [ms]: 50 to 250	40113	112	1	Factory setting: 127	16 bit Unsigned
Set number of floats: 1, 2, 11 or 12	40114	113	1	Factory setting: 1	16 bit Unsigned
Level error report: 0 or 1	40115	114	1	Factory setting: 0	16 bit Unsigned
K factor x 100: 10 to 1000 bbls/in	40116	115	1	Factory setting: 167	16 bit Unsigned
Top level offset x 100: -9999 to 9999	40117	116	1	Factory setting: 0	16 bit Signed
Bottom level offset x 100: -9999 to 9999	40118	117	1	Factory setting: 0	16 bit Signed

Temperature offset1 x 10: -99 to 99	40119	118	1	Factory setting: 0	16 bit Signed
Temperature offset2 x 10: -99 to 99	40120	119	1	Factory setting: 0	16 bit Signed
Temperature offset2 x 10: -99 to 99	40121	120	1	Factory setting: 0	16 bit Signed
Temperature offset4 x 10: -99 to 99	40122	121	1	Factory setting: 0	16 bit Signed
Temperature offset5 x 10: -99 to 99	40123	122	1	Factory setting: 0	16 bit Signed
Temperature offset6 x 10: -99 to 99	40124	123	1	Factory setting: 0	16 bit Signed
Temperature offset7 x 10: -99 to 99	40125	124	1	Factory setting: 0	16 bit Signed
Temperature offset8 x 10: -99 to 99	40126	125	1	Factory setting: 0	16 bit Signed
Sensor Description Registers					
Serial number high	40127	126	1	**Read only**	16 bit Unsigned
Serial number medium high	40128	127	1	**Read only**	16 bit Unsigned
Serial number medium low	40129	128	1	**Read only**	16 bit Unsigned
Serial number low	40130	129	1	**Read only**	16 bit Unsigned
Version number	40131	130	1	**Read only**	16 bit Unsigned
Number of modules: 1 to 8	40132	131	1	**Read only**	16 bit Unsigned
Number of switches	40133	132	1	**Read only**	16 bit Unsigned
Switch distance x 10: 5 or 10	40134	133	1	**Read only**	16 bit Unsigned
Number of temperature sensors: 1 to 8	40135	134	1	**Read only**	16 bit Unsigned
Sensor status: 0 or 1, 0= Good 1= Sensor errors or low battery	40136	135	1	**Read only**	16 bit Unsigned (v3.15 and higher)
Group 0 top	40137	136	1	**Read only**	16 bit Unsigned (v3.15 and higher)
Group 0 bottom	40138	137	1	**Read only**	16 bit Unsigned (v3.15 and higher)

Group 1 top	40139	138	1	**Read only**	16 bit Unsigned (v3.15 and higher)
Group 1 bottom	40140	139	1	**Read only**	16 bit Unsigned (v3.15 and higher)
Group 2 top	40141	140	1	**Read only**	16 bit Unsigned (v3.15 and higher)
Group 2 bottom	40142	141	1	**Read only**	16 bit Unsigned (v3.15 and higher)
Group 3 top	40143	142	1	**Read only**	16 bit Unsigned (v3.15 and higher)
Group 3 bottom	40144	143	1	**Read only**	16 bit Unsigned (v3.15 and higher)

Table 2. Holding Registers

Sensor Data	Register	Address	No. Reg.	Values	Type
Float 1 (Top Float)	43991	3990	1	**Read Only**	Total Fluid Level in Tank 16 bit Unsigned integer or 32 bit floating point
Float 2 (Bottom Float)	43992	3991	1	**Read Only**	Water Interface Level in Tank 16 bit Unsigned integer or 32 bit floating point
Oil Level in Tank (top to bottom)	43993	3992	1	**Read Only**	Oil Level in Tank (top-bottom) 16 bit Unsigned integer or 32 bit floating point
Total Volume (top level x K_factor)	43994	3993	1	**Read Only**	Total Volume (top level x K factor) 16 bit Unsigned integer or 32 bit floating point
Oil Volume (top level – bottom level) x K_factor	43995	3994	1	**Read Only**	Oil Volume 16 bit Unsigned integer or 32 bit floating point
Water Volume (bottom level x K_factor)	43996	3995	1	**Read Only**	Water Volume 16 bit Unsigned integer or 32 bit floating point
Temperature1	43997	3996	1	**Read Only**	Temperature1 16 bit Unsigned integer or 32 bit floating point
Temperature2	43998	3997	1	**Read Only**	Temperature2 16 bit Unsigned integer or 32 bit floating point
Temperature3	43999	3998	1	**Read Only**	Temperature3 16 bit Unsigned integer or 32 bit floating point
Temperature4	44000	3999	1	**Read Only**	Temperature4 16 bit Unsigned integer or 32 bit floating point
Temperature5	44001	4000	1	**Read Only**	Temperature5 16 bit Unsigned integer or 32 bit floating point
Temperature6	44002	4001	1	**Read Only**	Temperature6 16 bit Unsigned integer or 32 bit floating point
Temperature7	44003	4002	1	**Read Only**	Temperature7 16 bit Unsigned integer or 32 bit floating point
Temperature8	44004	4003	1	**Read Only**	Temperature8 16 bit Unsigned integer or 32 bit floating point
Battery Voltage	44005	4004	1	**Read Only**	Battery Voltage (*100 for 16 bit)

					16 bit Unsigned integer or 32 bit floating point
Error Register:	44006	4005	1	**Read Only**	16 bit Unsigned integer (See Notes)
Warnings Register:	44007	4006	1	**Read Only**	16 bit Unsigned integer (See Notes)

Table 3. Holding Registers (2 x 16 bit)

Sensor Data	Register	Address	No. Reg.	Values	Type
Float 1 (Top Float)	45001	5000	2	**Read Only**	Total Fluid Level in Tank Floating point upper two bytes (v3.14 and higher)
	45002	5001		**Read Only**	Total Fluid Level in Tank Floating point lower two bytes (v3.14 and higher)
Float 2 (Bottom Float)	45003	5002	2	**Read Only**	Water Interface Level in Tank Floating point upper two bytes (v3.14 and higher)
	45004	5003		**Read Only**	Water Interface Level in Tank Floating point lower two bytes (v3.14 and higher)
Oil Level in Tank (top to bottom)	45005	5004	2	**Read Only**	Oil Level in Tank(top-bottom) Floating point upper two bytes (v3.14 and higher)
	45006	5005		**Read Only**	Oil Level in Tank(top-bottom) Floating point lower two bytes (v3.14 and higher)
Total Volume (top level x K factor)	45007	5006	2	**Read Only**	Total Volume(top level x K factor) Floating point upper two bytes (v3.14 and higher)
	45008	5007		**Read Only**	Total Volume(top level x K factor) Floating point lower two bytes (v3.14 and higher)
Oil Volume (top level – bottom level) x K factor	45009	5008	2	**Read Only**	Oil Volume (v3.14 and higher) Floating point upper two bytes
	45010	5009		**Read Only**	Oil Volume (v3.14 and higher) Floating point lower two bytes
Water Volume (bottom level x K factor)	45011	5010	2	**Read Only**	Water Volume(bottom level x K factor) Floating point upper two bytes (v3.14 and higher)
	45012	5011		**Read Only**	Water Volume(bottom level x K factor) Floating point lower two bytes (v3.14 and higher)
Temperature1	45013	5012	2	**Read Only**	Temperature1 (v3.14 and higher) Floating point upper two bytes

	45014	5013		**Read Only**	Temperature1 (v3.14 and higher) Floating point lower two bytes
Temperature2	45015	5014	2	**Read Only**	Temperature2 (v3.14 and higher) Floating point upper two bytes
	45016	5015		**Read Only**	Temperature2 (v3.14 and higher) Floating point lower two bytes
Temperature3	45017	5016	2	**Read Only**	Temperature3 (v3.14 and higher) Floating point upper two bytes
	45018	5017		**Read Only**	Temperature3 (v3.14 and higher) Floating point lower two bytes
Temperature4	45019	5018	2	**Read Only**	Temperature4 (v3.14 and higher) Floating point upper two bytes
	45020	5019		**Read Only**	Temperature4 (v3.14 and higher) Floating point lower two bytes
Temperature5	45021	5020	2	**Read Only**	Temperature5 (v3.14 and higher) Floating point upper two bytes
	45022	5021		**Read Only**	Temperature5 (v3.14 and higher) Floating point lower two bytes
Temperature6	45023	5022	2	**Read Only**	Temperature6 (v3.14 and higher) Floating point upper two bytes
	45024	5023		**Read Only**	Temperature6 (v3.14 and higher) Floating point lower two bytes
Temperature7	45025	5024	2	**Read Only**	Temperature7 (v3.14 and higher) Floating point upper two bytes
	45026	5025		**Read Only**	Temperature7 (v3.14 and higher) Floating point lower two bytes
Temperature8	45027	5026	2	**Read Only**	Temperature8 (v3.14 and higher) Floating point upper two bytes
	45028	5027		**Read Only**	Temperature8 (v3.14 and higher) Floating point lower two bytes
Battery Voltage	45029	5028	2	**Read Only**	Battery Voltage(*100 for 16 bit) Floating point upper two bytes (v3.14 and higher)
	45030	5029		**Read Only**	Battery Voltage(*100 for 16 bit) Floating point lower two bytes (v3.14 and higher)
Error Register **(see Table 4)**	45031	5030	2	**Read Only**	Floating point upper two bytes (See Notes) (v3.14 and higher)
	45032	5031		**Read Only**	Floating point lower two bytes (See Notes) (v3.14 and higher)
Warnings Register **(see Table 3)**	45033	5032	2	**Read Only**	Floating point upper two bytes (See Notes) (v3.14 and higher)
	45034	5033		**Read Only**	Floating point lower two bytes (See Notes) (v3.14 and higher)

Table 4. Warning Codes

Binary Value (for 16 bit Unsigned)	Warning Code	Indication
	0	No warnings
Bit 0	1	Possible level degradation
Bit 1	2	Possible level degradation due to level

Table 5. Error Codes

Binary Value (for 16 bit Unsigned)	Error Code	Indication
	0	No errors
Bit 0	1	Can't resolve level reading or no float is detected
Bit 1	2	One float is out of range on a two float sensor
Bit 2	4	Too many groups
Bit 3	8	Not used
Bit 4	16	Transmit to slave processor for level failed
Bit 5	32	Transmit to slave processor for temperature failed
Bit 6	64	Receive from slave processor for level failed
Bit 7	128	Receive from slave processor for temperature failed
Bit 8	256	No slave processor responding

***Notes for advanced users*:** Writing 1007 at register address 107 will set register 107 to "0'" This will set the device registers that hold top float, bottom float, and temperature to 16 bit Unsigned integer. Writing 1008 at register address 107 will set register 107 to "1" and will set the device hold registers 43991(3990) to 44007(4006) to 32 bit floating point format. Writing 1009 at register address 107 will set register 107 to "2" and will set the device hold registers 45001(5000) to 45034(5033) to 2 x 16 bit floating point format. Reading register 107 will return "0" for 16 bit, "1" for 32 bit floating point, and "2" for 2 x 16 bit floating point format.

RediLevel 2100 DLS Specifications

Measurement Length:
Available from 2 to 16 feet in length

Tubing Material:
18 gauge, 316L stainless steel
Dimensions: .75" x 1.5"

Float:

- One piece Harsh Environment (HE) all nylon float. Ideal for acidic and highly caustic environments
- One float used for single liquid
- Two floats used for multi-fluid measurement
- Designed to fit though a 2” NPT female tank port (2.1995-inch opening)

Level measurement increments and accuracy:
1/4 inch resolution, +/- 1/8 inch accuracy

Operating temperature range:
-40° C to 80° C

Temperature Measurement:
First temperature sensor 12-14 inches from bottom
One temperature sensor standard, up to 8 temperature sensors available with desired spacing: optional
+/- 1.5° C accuracy

Power Requirements:
5.6 VDC to 13 VDC

Power Consumption:
15mA nominal
20mA maximum

Pressure:
40 psi: standard
250 psi: optional

Communication:
RS485
Two- or four-wire communications
Baud rate and parity programmable (up to 57600 baud) (v.3.15 and higher)
4-20mA signal available when connected to digital-to-analog converter board
Wireless capable

Protocol:
Modbus RTU 16 bit unsigned integer*
Modbus RTU 32 bit floating point*
Modbus RTU (2x 16 bit) for alternate 32 bit floating point**
Serial data via ASCII
*Note Modbus RTU available in version 3.13 and higher.
**Available in version 3.14 and higher.

Wiring:
Two-wire communication - two twisted pair, (16-18 AWG) recommended
Four-wire communication - three twisted pair, (16-18 AWG) recommended

Classification:
Class I, Div. 1, Group D Hazardous Locations (when connected to an approved intrinsically safe barrier board)

Certification:
ANSI/UL-913
CAN/CSA C22.2, No. 157

Figure 1. RediLevel™ 2100 DLS

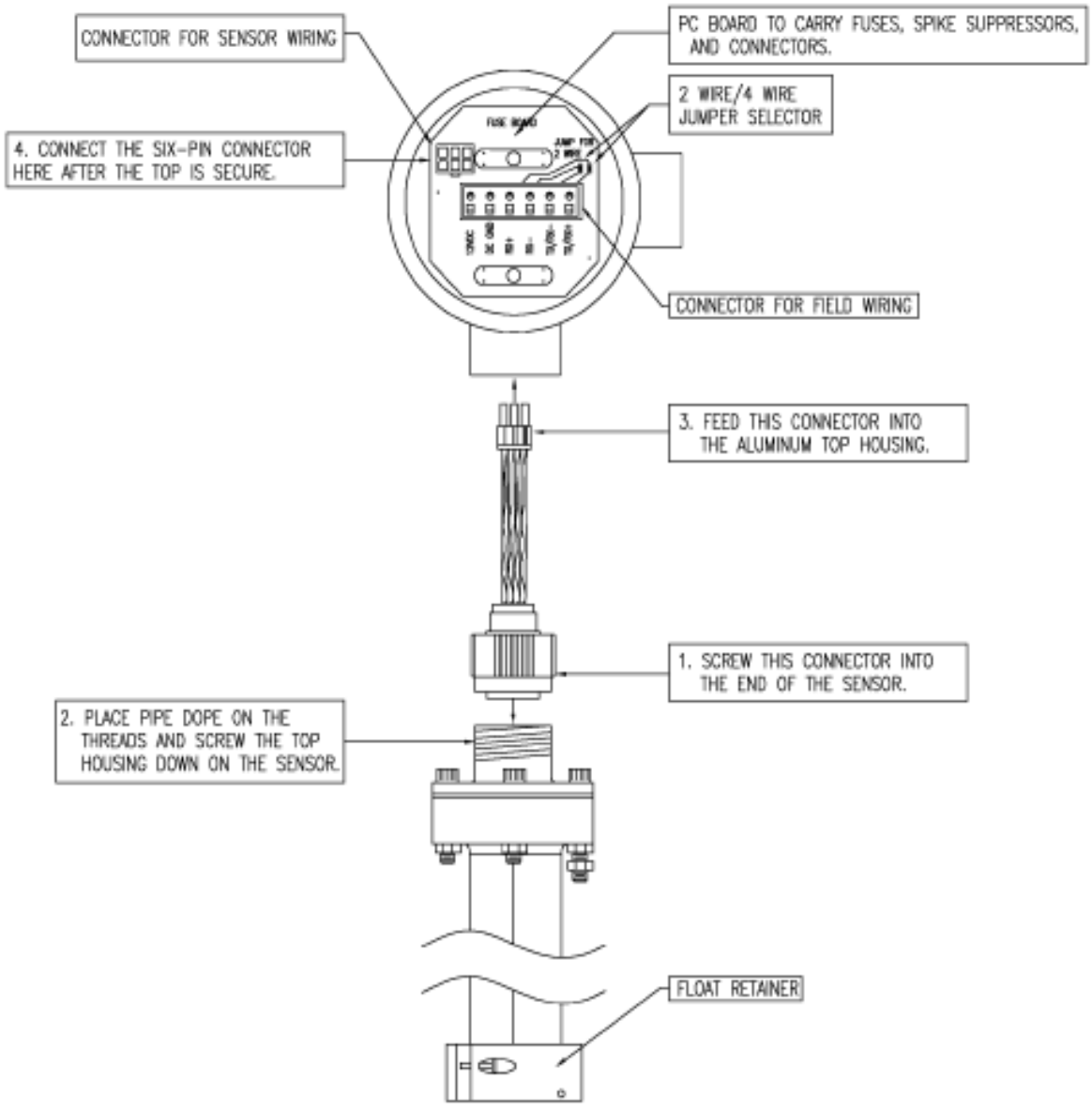

Figure 2. DLS2100 Assembly Diagram

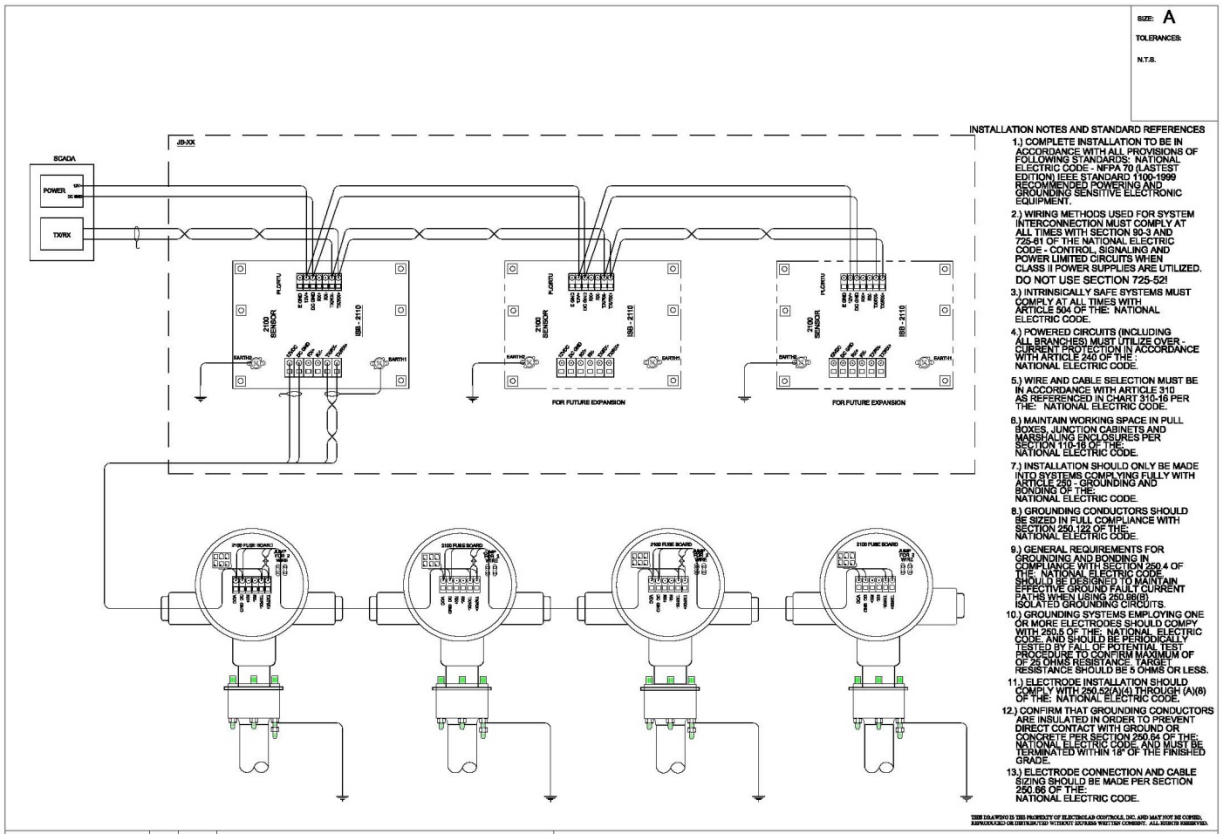

Figure 3. DLS2100 Connection Diagram

Part Numbering System

The sample below is the part number for a 12-foot sensor with ¼ inch resolution, one temperature sensor, and a single float going into a tank with a 2-inch port and being wired up as two-wire RS485.

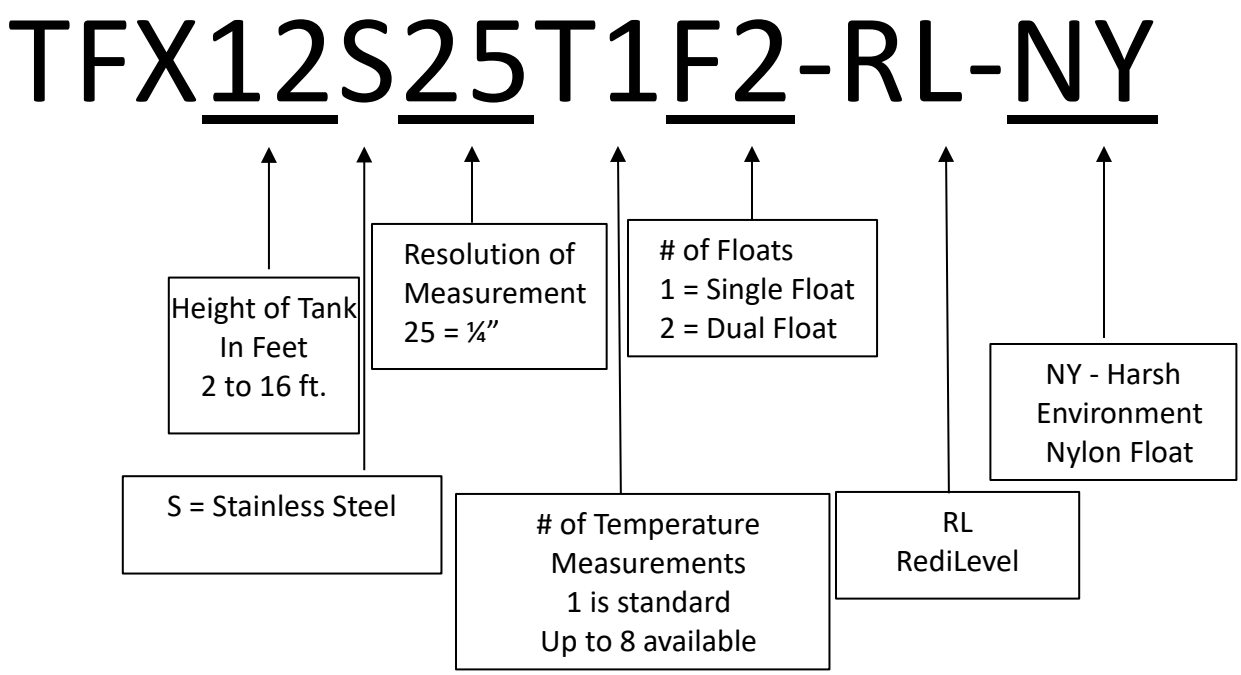

Figure 4. RediLevel 2100 DLS Part Numbering System

In addition to the information provided within the part number, other information is necessary when ordering:

1. **Total Tube Length:** Default is Measurement Length plus 18 inches.
   Note: If installing in a dome-top tank, like a fiberglass tank, you will need to order a sensor that is 1' longer than the tank height to accommodate the extra height the dome adds.
2. **Baud Rate and Parity desired:** Default is 9600, N, 8, 1. If other baud rate and parity are required, please specify.
3. **Unit Numbers Required:** If ordering more than one sensor for a location, then you may have the level sensors pre-addressed with the required unit numbers prior to shipment for the tanks on that location. Example: If there are 3 tanks on one location, then specify that the level sensors be addressed U01, UO2, and U03. Alternate numbering sequences may be chosen. If no unit numbers are specified, then default will be Unit 01.

Contact Information

For further information or for assistance, please contact:

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