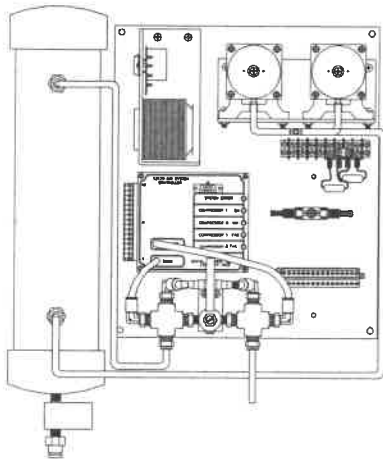




Bubbler Level Transmitter (BLT) Model Number: 12138-2 (U.L. Listed)

Manufacturer of High Performance Instrumentation and Control Systems



Applications:

- Wastewater Pump Station Levels
- Water and Wastewater Plant Tank Levels
- Liquid Level for Tank Monitoring
- Storm Water Levels
- Holding Pond Levels
- Groundwater and River Levels
- Landfill Liquids (Leachate) Levels
- Most Liquid Level Monitoring Applications Where Liquid is Vented to Atmosphere

Features:

- Operates up to 2 AC air compressors. DC air compressors are also available.
- Automatic and timed cycle air tube purging.
- Automatic air tank moisture drain valve control.
- Ranges of up to 115 feet available.
- Level can be adjusted in the field within the ordered range.
- 4-20 mA signal output proportional to level.
- Air compressor and system status indicators on front panel.
- System error relay output to detect errors from remote site.
- Pressure gauge - 0 -150 psig (optional).
- High accuracy pressure transducer - $\pm 0.25\%$ (optional).
- Level digital display (optional).
- System available in an optional enclosure.
- Compact design allows for easy low cost installation.
- RS-232 serial port for SCADA communications support.
- Uses non-volatile memory allowing system to retain program software during power loss.
- Various specific gravities available to accurately measure most liquids.
- Proven software that allows for easy setup and reliability.
- Custom software available from factory.

Description:

The Bubbler Level Transmitter (BLT) model 12138-2 is an automatic bubbler type liquid level measurement system. It operates by forcing compressed air into a bubbler tube at a constant rate with its opening placed near the bottom of the liquid. The BLT measures the pressure required to force air through the tube and generates a 4-20 mA signal which is proportional to the depth of the liquid. The system also detects an air flow reduction through the bubbler tube and initiates a line purge in addition to a timed purge cycle to keep the air line clear from obstructions. The BLT system is designed to control up to two air compressors which are alternated to minimize their use. If one compressor fails, then the other takes over while keeping the system operational. The BLT also includes an RS-232 serial communications interface designed to support SCADA systems using a variety of Modbus based communication devices giving the system remote data acquisition, monitoring, and control capability.

Specifications:

Input Power:

- 115 VAC (with power supply), 2 A min. (varies with air compressor size)

Operating Temperature Range:

- -30°C to $+60^{\circ}\text{C}$ (-22°F to $+140^{\circ}\text{F}$)

Accuracy:

- $\pm 1\%$ of full scale over temp range (higher accuracy available)

Ranges:

- 0 to 20 ft. standard (up to 115 ft. available)

Relay Outputs:

- System Failure - SPDT Form C - 10 A at 125 VAC

Discrete Outputs:

- Purge Freeze - Open Drain FET, Non-isolated

4-20 mA Current Loop Output:

- Non-isolated transmitter
- Total compliance of 9 VDC

Transient Protection:

- Metal Oxide Varistor

Interconnect:

- Pluggable terminal blocks (screw type)
- DE-9 connector for RS-232 Bus

Communications Protocol:

- Modbus ASCII

External Dimensions:

- System Flat Plate - 12.90"H x 10.90"W x 4.00"D
- Air Tank - 17.00"H x 4.00"W/D

UL File Number:

- E201217



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DIGITAL CONTROL COMPANY
BUBBLER LEVEL TRANSMITTER
PRODUCT SPECIFICATION

MODEL SY12138-2

SPECIFICATION NUMBER SY12138-2

ISSUE DATED: 11/14/96

PREPARED BY: WAYNE D. BRITTIAN

LAST REVISION DATE: 02/20/02

1.0 PURPOSE

This document establishes the performance, and design requirements for the Bubbler Level Transmitter, model 12138AC.

2.0 APPLICABLE DOCUMENTS

None

3.0 REQUIREMENTS

3.1 GENERAL DESCRIPTION

The Bubbler Level Transmitter (BLT) is an automatic bubbler type level measurement system. When connected to a bubbler tube in a well or tank of liquid, it measures the depth of liquid. It operates by forcing air into a bubbler tube which is mounted in a tank or well with its opening near the bottom of the well. The air emerges from the bottom of the tube as a stream of bubbles. The pressure required to force air through the tube is proportional to the depth of liquid. The BLT measures this pressure and generates a 4-20 milliamp current loop signal which represents the depth. The system controls two air compressors which are used to charge an air tank. The air tank pressure is monitored so that the pumps only operate when the tank needs charging and so that pump failures can be detected. The air flow rate through the bubbler tube is also monitored so that tube blockages can be detected. To prevent and clear tube blockages an automatic purge feature is included. The purge operation is set to function at five hour intervals, and it will be automatically initiated if a tube blockage is detected. The purge system works by routing high pressure air directly from the air tank to the bubbler tube. This cycle only takes a few seconds and does not affect the output level signal. The system uses a microcomputer to control its operation and can therefore be easily modified for custom requirements. The BLT is designed to be easily adapted to various pump controllers, instruments, and SCADA systems. The BLT also includes an automatic water dump system which vents the bottom of the air tank every 24 hours to prevent water from accumulating in the air tank.

3.1.1 SYSTEM OPERATION

The system operates in the following manner:

1. Air Pump Control. The system has two solid state relays which are used to drive the two air pumps. The system measures pressure in the air tank using pressure transducer 2. If the pressure in the tank is less than the lead pump setpoint then the lead air pump is turned on. If the pressure is less than the lag pump setpoint then the lag air pump is turned on. These setpoints are continually generated by the microcomputer in such a way that they minimize the duty cycle of the air pumps. Because of this the pressure in the air tank is maintained at a level sufficient for bubbler operation but low enough to insure long air pump life. If either pump is called and fails to increase the pressure then an error is set for that pump and the

other pump called. An alternator is provide the automatically alternate the lead channel between the two compressors.

2. Flow Control. High pressure air from the air tank is routed through a flow control valve. This limits the air flow so that all of the air charge in the tank does not immediately vent out through the bubbler tube. This permits the air pumps to be required only periodically and therefore each pump is only on for a small percent of the time. The advantage of this is that heat does not build up in the pumps and degrade pump life. This type of system will have very long pump life. After the flow control valve the air is routed to the bubbler tube and the bubbler pressure transducer. The computer monitors airflow using the change in air tank pressure so that it can detect bubbler tube blockages. If the bubbler tube starts to clog up then the air flow will fall off. The computer detects this and initiates a purge cycle to clear the blockage. The setpoint at which this occurs is set at the factory. Air from the flow control valve is routed to pressure transducer 1. This transducer is monitored by the computer to sense level in the wet well.
3. Purge Control. A purge cycle can be initiated in three ways. If a blockage is detected, on power up, or periodically called by a timer built into the controller. The time between periodic purge cycles is factory set to 5 hours. The BLT continually measures the pressure decay rate in the air tank and uses this to calculate the air flow. If the air flow falls to 50% of nominal then a purge cycle is initiated. When a purge cycle is initiated the purge solenoid opens. This causes high pressure air from the air tank to go directly to the bubbler tube. This cause a rapid discharge of the air in the tank through the bubbler tube clearing any blockages. During the time a purge cycle is in progress the BLT cannot measure liquid level so it outputs the last valid level measurement. The purge cycle requires approximately 10 seconds.
4. Electrical Interface. The main output of the Bubbler Level Transmitter is a 4-20 milliamp current loop which is proportional to liquid level in the wet well. It can be field calibrated but should be ordered for the maximum depth required. The system has a relay for a system failure which will activate if the system cannot maintain an accurate output signal.

3.2 REQUIREMENTS

3.2.1 CONTROL MODULE

The control module is an assembly which contains all of the electronics required by the Bubbler Level Transmitter. This circuit card includes the following functions:

1. A pressure transducer for measuring tank pressure.
2. A pressure transducer for measuring bubbler tube pressure.
3. Two solid state relays for driving the two air pumps.

These circuits are designed to drive one or two air compressors which can be either 115 VAC or 12 VDC.

4. A system alarm relay.
5. Two solenoid drivers for the Purge Solenoid and the Water Dump solenoid.
6. A 4-20 ma. current transmitter for wet well level out.
7. A 12 Volt D.C. power supply for system power.
8. Five lamps for Compressor on 1 and 2, Compressor Fail 1 and 2, and System Alarm.

9. A MC68HC11 microcomputer.
10. An RS-232 serial interface for program loading.

3.2.1.1 AIR TANK PRESSURE TRANSDUCER

The air tank pressure transducer is a 0-15 psi solid state gage pressure transducer. It has a maximum overpressure of 45 psi. It has an accuracy of +/- 1%.

3.2.1.2 BUBBLER TUBE PRESSURE TRANSDUCER

The bubbler tube pressure transducer is a 0-5 psi solid state gage pressure transducer. It has a maximum overpressure of 20 psi. It has onboard adjustments for span (gain) which can be field adjusted. Other pressure ranges are available for deeper wet wells. It has an accuracy of +/- 1%.

3.2.1.3 The Bubbler Level Transmitter has two solid state relays which have the following functions:

3.2.1.4

1. air pump 1 control
2. air pump 2 control

Each relay has the following specifications:

Continuous output voltage	12 to 280 volts A.C. 50 to 60 Hz.
Continuous output current	.02 to 5 amps
Isolation	4,000 volts rms optically isolated
Peak blocking voltage	+/- 600 volts
zero voltage switching	

Each of the relay circuit has an output for a 12 VDC air compressor which has the following specifications:

Output Voltage	12 Volts D.C.
Output Current	3 amps max.

3.2.1.5 The Bubbler Level Transmitter has one form C relay which activates if the system has a failure which results in an unreliable level output. It has the following specifications:

Contact rating - 10 amps at 125 vac

Breakdown voltage - 1,000 volts RMS

Life - 1,000,000 minimum cycles

This relay will close if all available air compressors fail or if there is a bubbler tube blockage which can not be cleared by a purge.

3.2.1.6 The BLT has two solenoid drivers. Each one has the following specifications:

output voltage	12 volts D.C.
max output current	2 amp

3.2.1.7 The System has one discrete output which will activate whenever a purge or water dump is in progress. This Freeze output can be used to signal a display that the output is frozen while a purge is in progress. It is an open drain FET outputs with the following specifications:

Output Voltage 12 volts D.C. max
Sink current 1 amp max.

This output is active low. When activated the output goes to 0 volts.

3.2.1.8 The System has a 4-20 milliamp current loop output for transmitting wet well level. It is a self powered , non-isolated transmitter with a total compliance of 9 volts D.C.

3.2.1.9 Input Power The BLT is designed to operate on 115 VAC 60 Hz. The power input has the following requirements:

Voltage 120 VAC +10% -13% at 47-63 Hz.
Current 1 amp Max.

3.2.1.10 The system has one RS-232 serial interface for program modification and loading.

3.2.1.11 The BLT is controlled by a Motorola MC68HC811E2 microcontroller. It has 256 bytes of random access memory and 2K bytes of electrically erasable memory for program storage.

3.3 CONNECTOR PIN DEFINITIONS

The circuit board of the Bubbler Level Transmitter has two connectors. The first is a 16 pin detachable terminal strip which includes all of the connections to operate the system. The second on is a 9 pin serial interface connector which is only used to update the systems internal software.

3.3.1 MAIN TERMINAL STRIP

PIN NO.	FUNCTION
1	INPUT POWER 115 VAC HOT
2	INPUT POWER 115 VAC NEUTRAL
3	GROUND
4	WATER DUMP SOLENOID -
5	WATER DUMP SOLENOID + (+12VDC)
6	N/A
7	N/A
8	LEVEL OUTPUT + 4-20 Ma.
9	GROUND (4-20 Ma. return)
10	FREEZE
11	N/A
12	N/A
13	N/A

14	SYSTEM FAIL RELAY normally closed contact
15	SYSTEM FAIL RELAY common contact
16	SYSTEM FAIL RELAY normally open contact

3.3.2 CONNECTOR J2

PIN NO.	FUNCTION
2	RECEIVE LINE
3	TRANSMIT LINE
5	GROUND
7	REQUEST TO SEND
8	CLEAR TO SEND

4.0 OPTION SWITCHES

The BLT has four option switches on the controller circuit card which are used to select its configuration and to facilitate calibration. They are as follows:

SWITCH 1	NO PURGE	This switch is used to disable purging. This can be used if the liquid being measured is sensitive to large amounts of air.
SWITCH 2	NO LEVEL	The ASC can be ordered without the level pressure transducer. In this case the system functions only to manage the air tank and supply bubbler air where an existing pressure transducer is used for level information.
SWITCH 3	NO FLOW	This option disables the automatic flow calculations and the purge triggered by low air flow. This is useful where the chances of a tube blockage is low and a very low airflow rate is used.
SWITCH 4	CALMODE	This switch is used to command the system into Calibrate Mode.

5.0 CALIBRATION

The BLT has two adjustment potentiometers which are used to set the air tank pressure and to set the full scale level.

TANK PRESSURE ADJUSTMENT To adjust tank pressure a pressure gauge must be attached to the air tank. While the BLT is operating in normal mode (CAL switch off) adjust the tank pressure adjustment to set the maximum tank pressure. The pressure in the tank will fall as the air is used by the bubbler until it reaches the lead compressor turn on point. At this point one of the compressors will turn on and charge the air tank back up and turn off. The point at which the compressor turns off is the maximum tank pressure. This pressure should be set to 10 PSI for every 10 feet of level in the well or fluid tank. For example, if the well has a maximum measured depth of 15 feet then the maximum tank pressure should be at least 15 PSI.

LEVEL ADJUST The level adjustment can be done in two ways. The first way is preferred.

Method 1.

1. With the BLT operating in normal mode connect the bubbler tube to the BLT. The bubbler tube should be at the maximum depth which is to be measured (depth at which the output is to be 20 Ma.). Connect a Voltmeter between the ASC chassis and Test Point B. Adjust the Full Scale Level Adjust for a reading of 5.00 Volts.
2. Power the BLT down and disconnect the bubbler tube from the BLT and one of the tubes to the air tank. Switch the CAL MODE switch (SW4) to the CAL Mode and power up the BLT. Wait 10 seconds and switch back to normal mode using switch 4. Reconnect the bubbler and tank tubes and the BLT should return to normal operation.

Method 2.

1. With the BLT operating in normal mode connect the bubbler tube to the BLT. The bubbler tube should be in a known depth of liquid as near as possible to maximum depth. Wait for the level to settle and adjust the level adjust to make the 4-20 Ma. level output correct. If the depth is at max then the 4-20 output should be at 20 Ma. This adjusts the level full scale reading.
2. Power the BLT down and disconnect the bubbler tube from the BLT and one of the tubes to the air tank. Switch the CAL MODE switch (SW4) to the Cal Mode and power up the BLT. Wait 10 seconds and switch the BLT back to normal mode using switch 4. Reconnect the bubbler and tank tubes. This step allows the BLT to automatically do the zero adjustment for level.
3. Check for proper reading. Repeat steps 1 and 2 if the reading is not correct. This may be required if the new calibration is very different from the old.

This completes the calibration.

Notes: Header and plugs use copper conductors only. Torque requirement: Plugs – 1.47 Ft. Lbs.

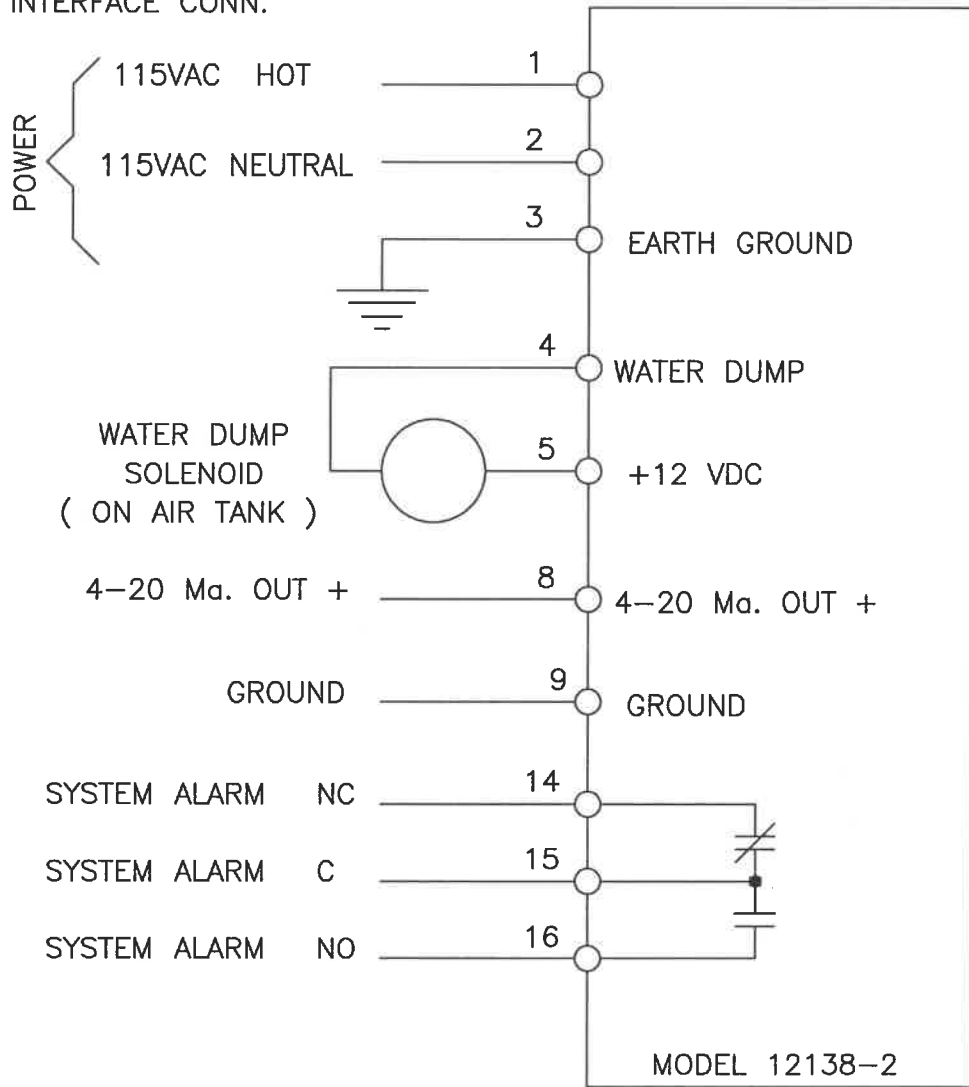
Unit operates at "Pollution Degree 2".

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FIGURE 1
16PIN INTERFACE CONN.

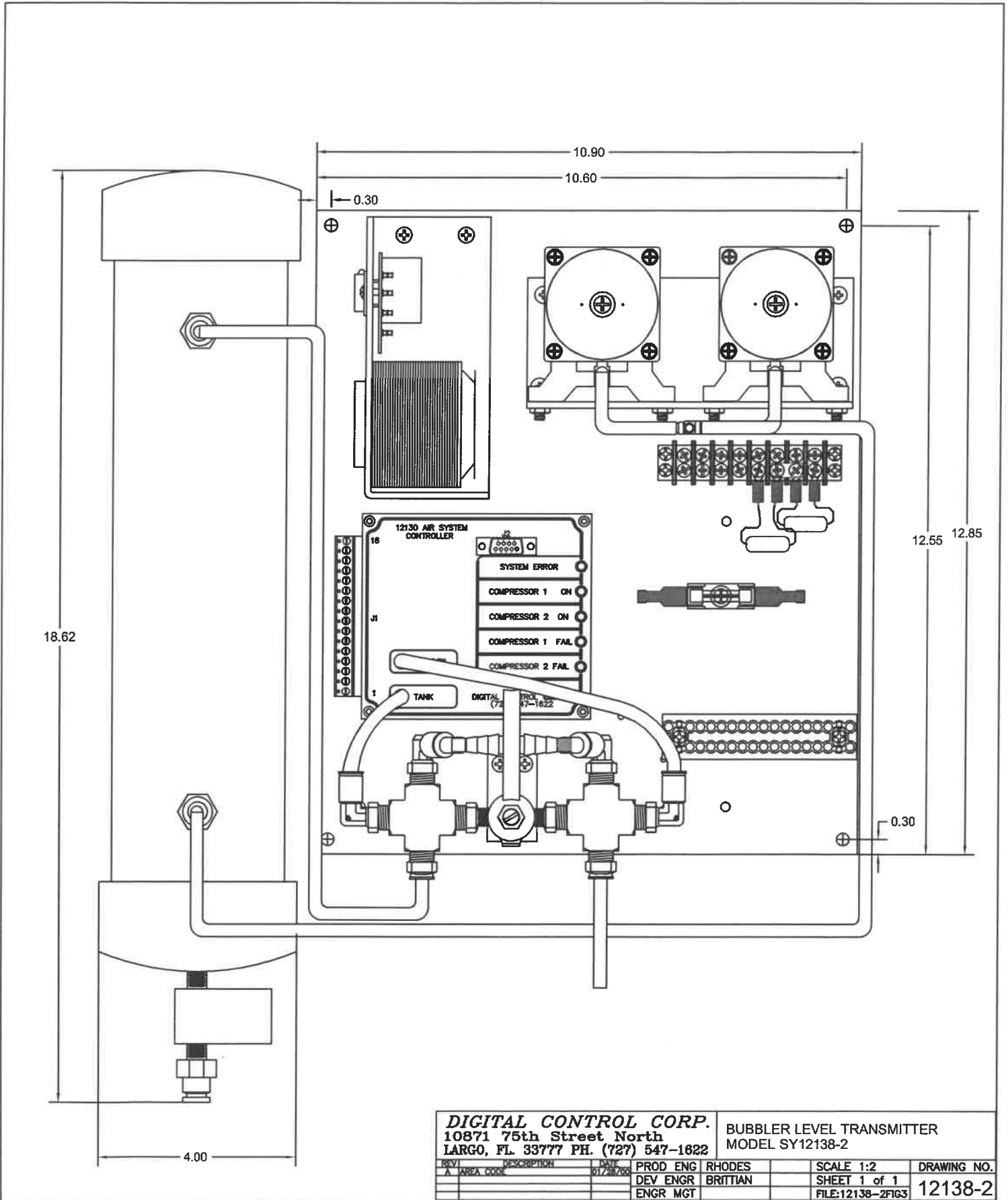
CAUTION: DO NOT GROUND SECONDARY OF TRANSFORMER



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4260 114TH TERR.NO.
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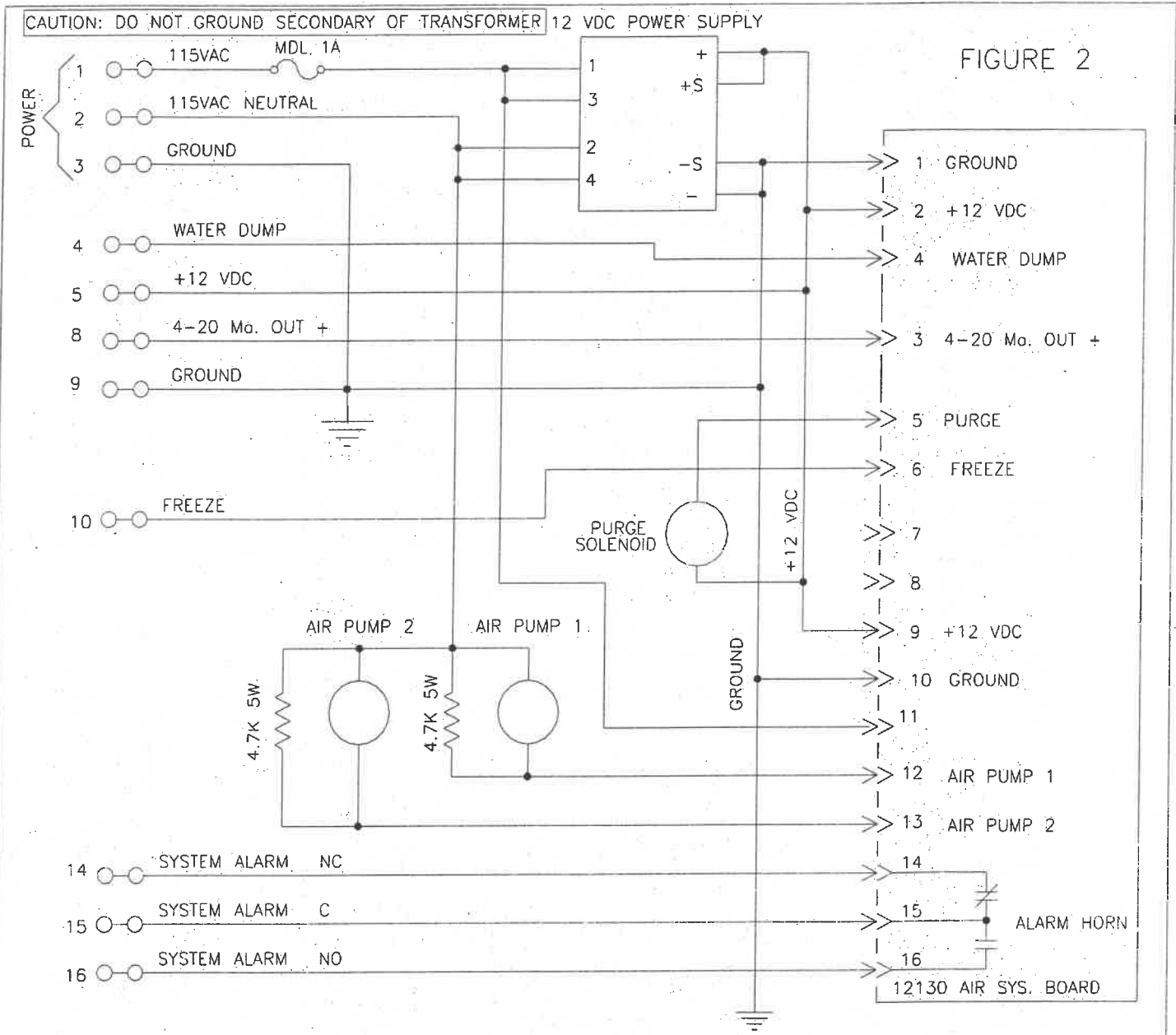
BUBBLER LEVEL TRANSMITTER
MODEL 12138-2
INTERFACE DIAGRAM

REV	DESCRIPTION	DATE	CAD OPER	RITCHIE	SCALE	DRAWING NO.
A	ZIPCODE, AREA CODE, UL REQ.	01/28/00	DEV ENGR	BRITTIAN	SHEET 1 of 1	12138-2IFD
			ENGR MGT		FILE: 12138-2FIG1	



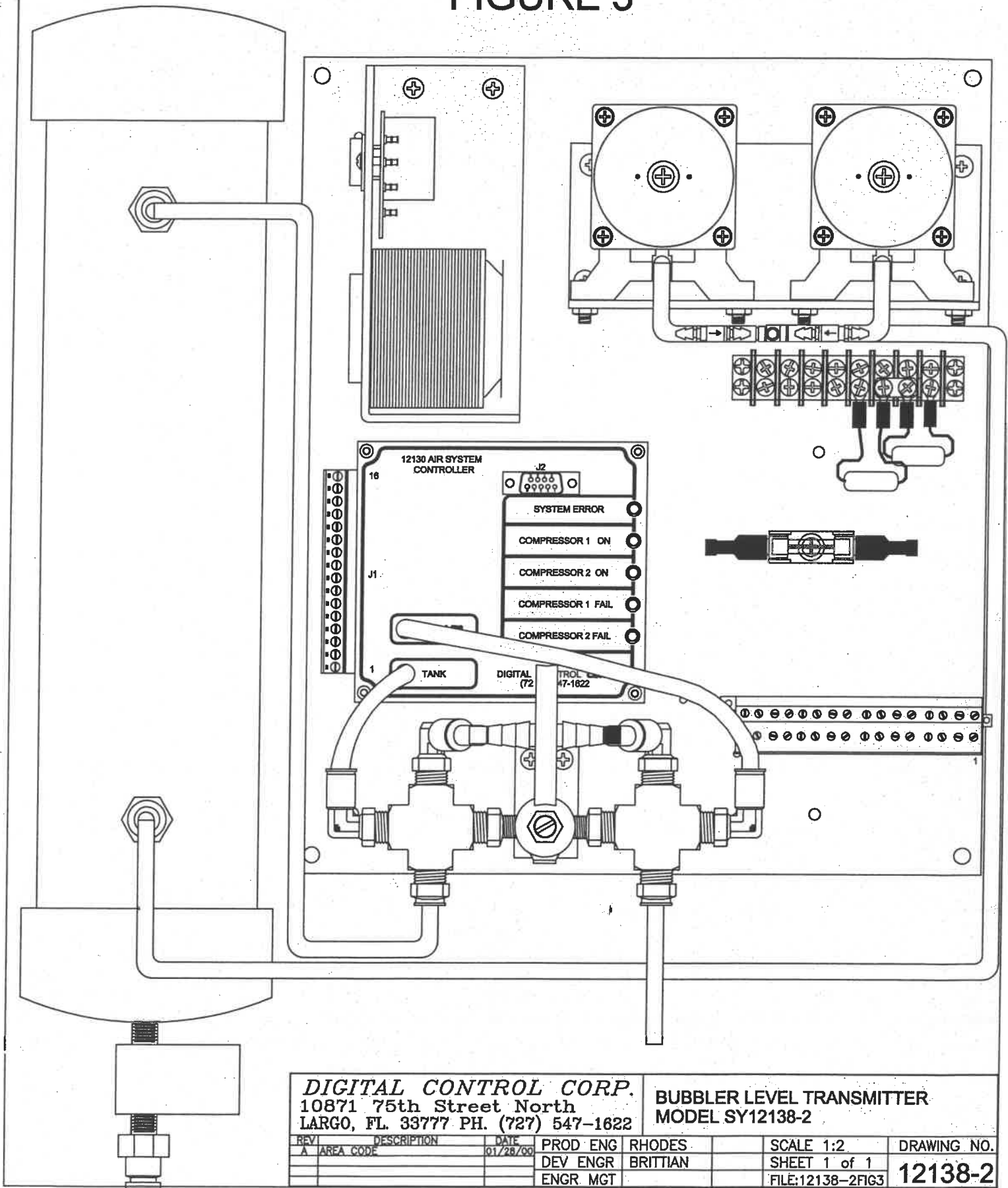
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Figure 2: Wiring Diagram



DIGITAL CONTROL CORP.				AIR SYSTEM TRANSMITTER			
10871 75th ST. N.				MODEL 12138-2			
LARGO, FL. 33777 PH. (727) 547-1622				SCHEMATIC			
REV	DESCRIPTION	DATE	CAD OPER	BROWN	SCALE	DRAWING NO.	
A	ZIPCODE AREA CODE, UL REQ	01/28/00	DEV ENGR	BRITTIAN	SHEET 1 of 1	S12138-2	
			ENGR MGT		FILE: 138-2S		

FIGURE 3

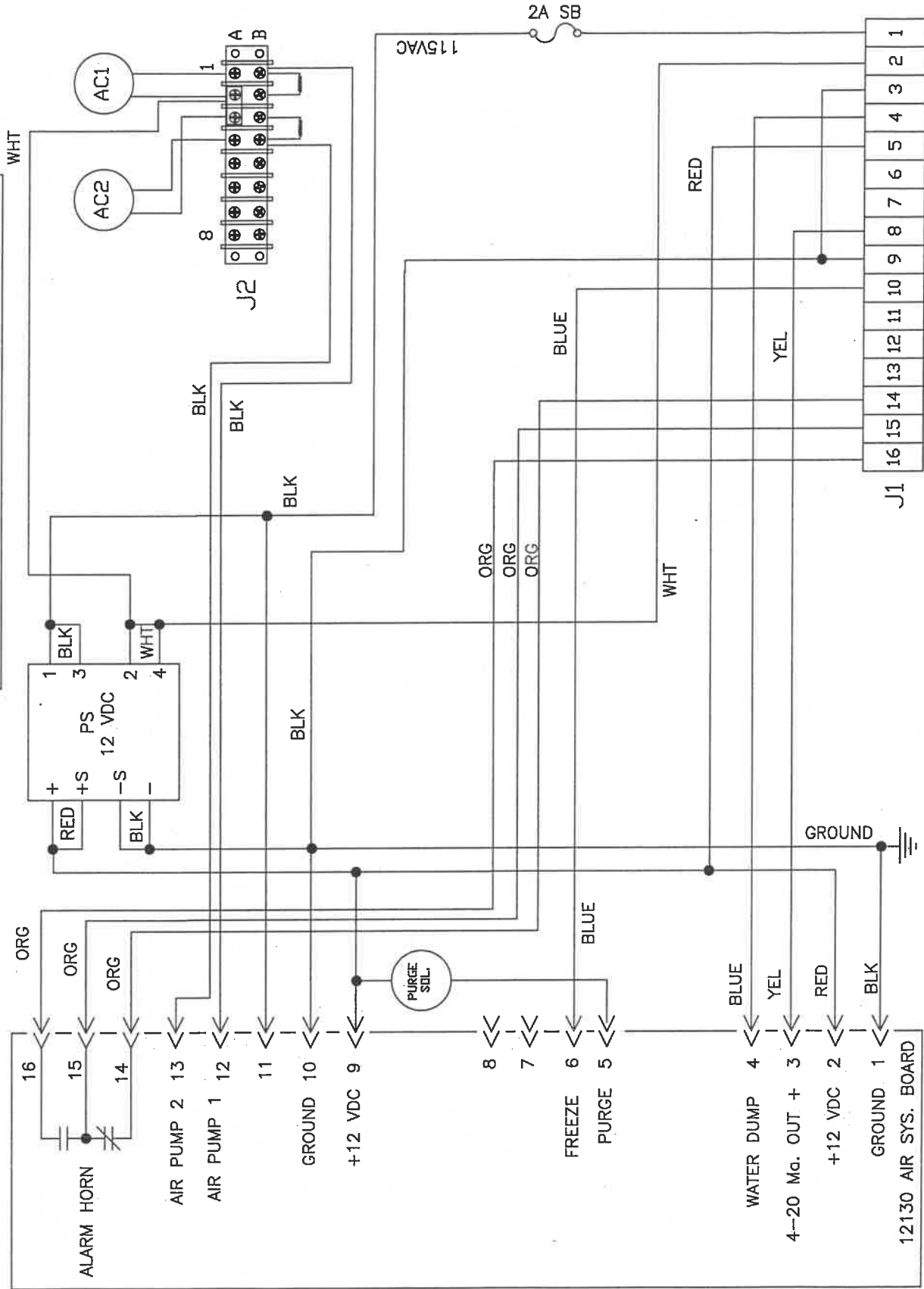


DIGITAL CONTROL CORP.
 10871 75th Street North
 LARGO, FL. 33777 PH. (727) 547-1622

**BUBBLER LEVEL TRANSMITTER
 MODEL SY12138-2**

REV	DESCRIPTION	DATE	PROD. ENG	RHODES	SCALE	DRAWING NO.
A	AREA CODE	01/28/00	ENGR	BRITIAN	1:2	
			ENGR		SHEET 1 of 1	12138-2
			MGT		FILE:12138-2FIG3	

CAUTION: DO NOT GROUND SECONDARY OF TRANSFORMER

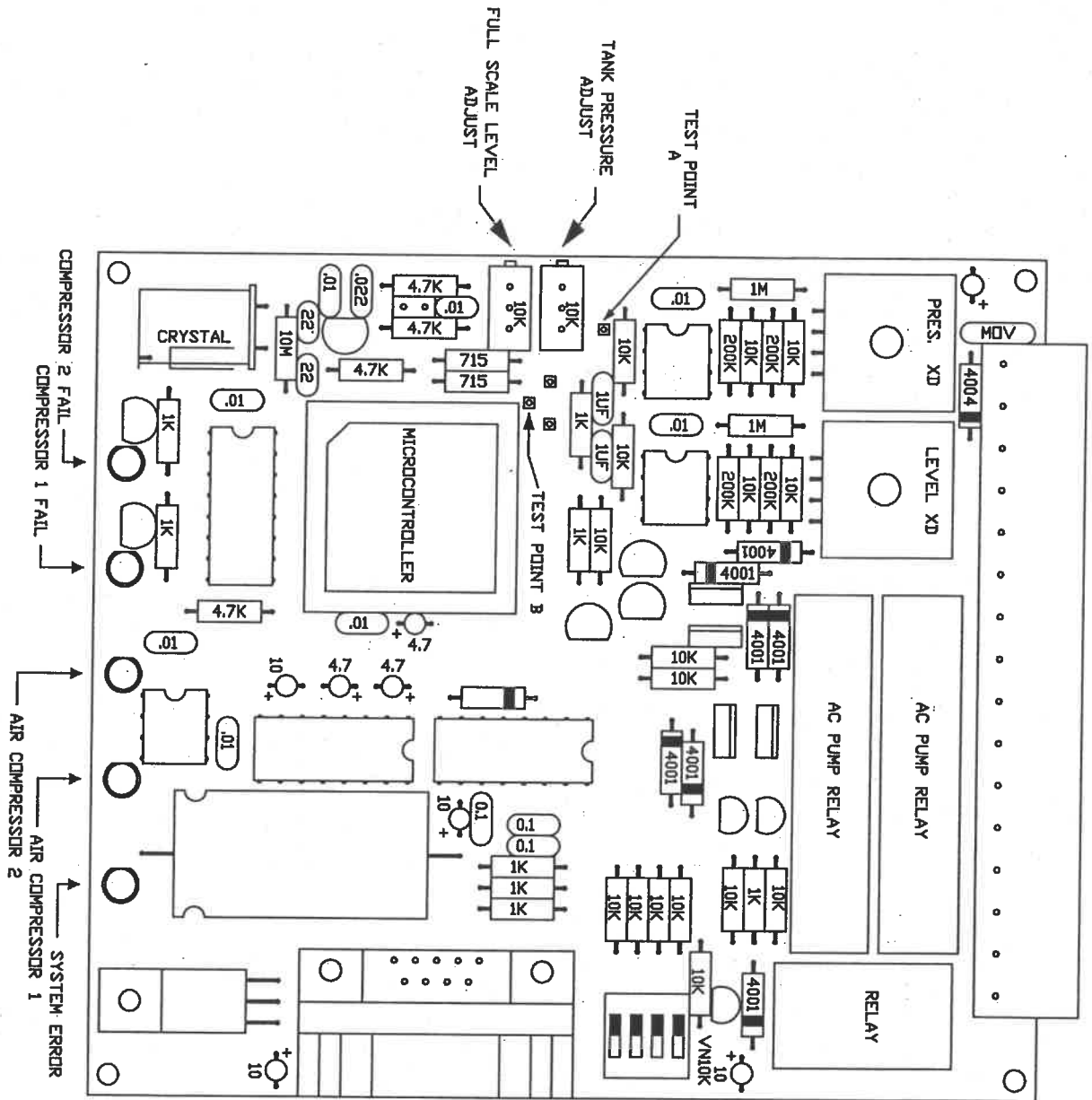


DIGITAL CONTROL CORP. AIR SYSTEM TRANSMITTER
 4260 114TH TERR NO.
 LARGO, FL 33762 PH. (727) 547-1622

REV	DESCRIPTION	DATE	CAD OPER	BROWN	SCALE	DRAWING NO.
A	ZIPCODE AREA CODE U.L. REQ. 01/29/06		DEV ENGR	BRITTIAN	SHEET 0 of 5	138-2 ALL
B	INVERT AIR SYSTEM BD. CONN. 09-05-20		ENGR_MGT		FILE: 138-2S	

MODEL SY12138-2 AC
 Schematic

FIGURE 2
12130 AIR SYSTEM CONTROLLER BOARD



SW1	<input type="checkbox"/> NO PURGE	<input checked="" type="checkbox"/> PURGE
SW2	<input type="checkbox"/> NO LEVEL TRANSDUCER	<input checked="" type="checkbox"/> LEVEL TRANSDUCER
SW3	<input type="checkbox"/> NO FLOW PURGE	<input checked="" type="checkbox"/> FLOW PURGE
SW4	<input type="checkbox"/> CAL MODE	<input checked="" type="checkbox"/> NORMAL MODE

SWITCH LOCATION IS BLACK

DRG#
12138FIG2A