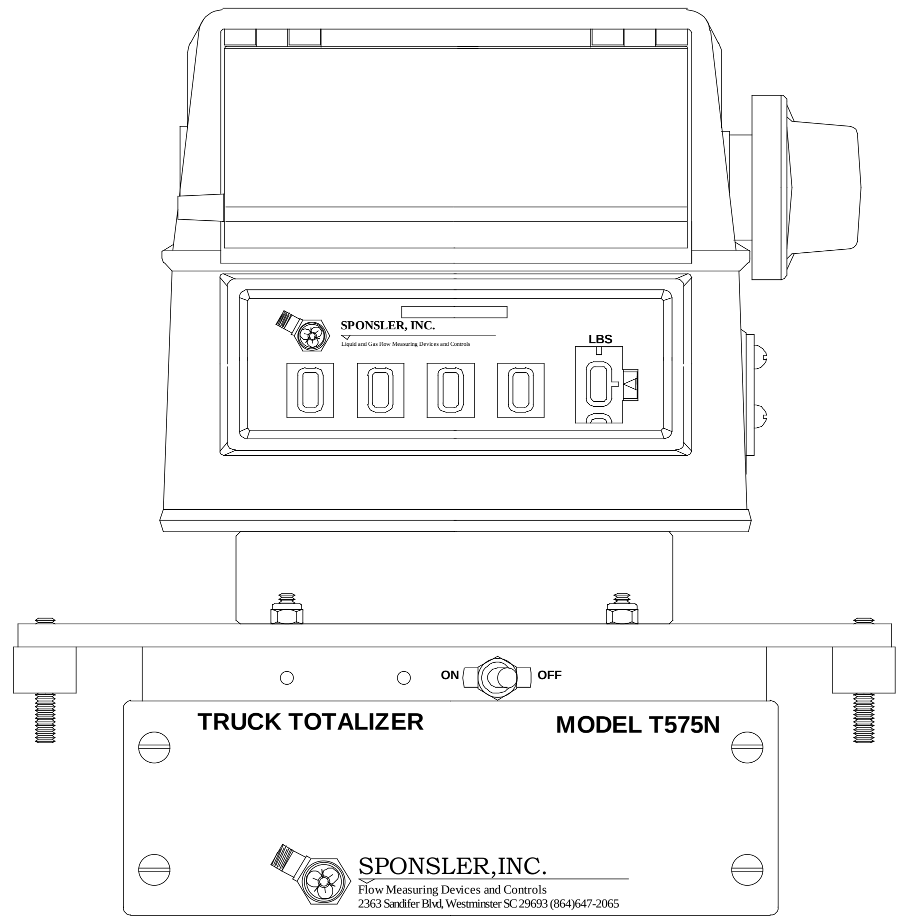
INSTALLATION & OPERATION MANUAL

MODEL T575N

TEMPERATURE COMPENSATED TOTALIZER/PRINTER

DOC#: MN-T575N



LIQUID CONTROLS SPONSLER, INC.

FLOW MEASURING DEVICES AND CONTROLS

A Unit of the IDEX Corporation

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IDEX
LIQUID CONTROLS GROUP

GENERAL

The Model T575N is a highly sophisticated electronic temperature compensated flow totalization system specifically designed to handle the harsh conditions associated with liquid transports. Totalization is displayed via a motor driven Veeder-Root Meter Register. Individual delivery data is displayed on eight 1/8" high figures. A Veeder-Root zero start meter printer mechanically prints the amount of the delivery on a 4 1/8" x 7 3/4" universal meter ticket. Reset and print operations are manually actuated.

The input from a SPONSLER PRECISION TURBINE FLOWMETER or similar device is amplified, factored, divided, temperature compensated, adjusted for the gearplate used and output through a motor driven circuit via a SINGLE electronic circuit board. The Model T575N factoring/temperature compensation electronic module accommodates the temperature compensation curves of up to eight different products; field selectable via a rotary switch. The RTD temperature sensor is linearized automatically. Calibration of the Model T575N to provide totalization in any engineering unit (gallons, liters, lbs., kg, etc.) is accomplished via four BCD factoring switches and one BCD divider switch.

THEORY OF OPERATION

As product flows through a turbine flowmeter, rotor blades inside the flowmeter rotate through the magnetic field of the magnetic pickup coil generating electrical pulses through the pickup coil. The number and frequency of these pulses correspond to the amount of product and the flow rate respectively.

The Model T575N Totalizer conditions these low amplitude pulses from the pick up coil. The amplified pulses are then factored, divided and, if equipped, temperature compensated. Factoring permits the displayed quantity to be in any engineering unit desired. The flowmeter calibration factor that converts electronic pulses to gallons, pounds, liters, etc., is field adjustable. The overall factored pulses are translated to motor steps that drive the Veeder-Root register. The Veeder-Root register displays a running account, final total, and accumulated total of the product delivery. The meter register drives the zero start Veeder-Root printer which mechanically records and prints digital information. The zero start meter printer begins the count at zero and returns to zero when reset. The printer total is the amount of the delivery. Print and reset operations are manually activated.

Turbine flowmeters are volumetric devices; requiring a means to COMPENSATE for temperature related physical changes of the product. As the product warms and cools, the density, as well as volume, changes while the MASS remains constant. The Model T575N determines the product temperature via an RTD temperature probe located in the delivery line and compensates for the corresponding temperature. As long as the product is within the normal delivery temperature range of the product and there is no sensor failure, the Model T575N will automatically correct for the density of the product. If the product temperature is not within the specified range or a problem exists with the probe, the Model T575N will stop compensating and only factor the product. Whenever the indicated temperature is not within the specified range, whether from a problem with the probe or a problem with on-board circuitry, the COMPENSATED LED located on the front of the unit will flash indicating NO COMPENSATION and the ALARM LED on the circuit board will illuminate. If jumper 'A' is installed the unit will not totalize when an alarm condition exists.

INPUT/OUTPUT MAXIMUM FREQUENCY

This unit is designed to operate with input frequencies up to 2000 Hz. When driving a Veeder-Root register, the maximum output frequency after factoring and temperature compensation is 180 steps per second with 1:2 gearplate installed (maximum count per minute is 1080) and 150 steps per second with 1:3 gearplate installed (maximum count per minute is 1351). Any attempt to output at a faster rate will cause pulses to go into storage. Up to 30,000 pulses can be put into storage. Stored pulses will be output at the maximum rate.

INSPECTION

All units are completely assembled, tested, and inspected at the factory prior to shipment. Upon receipt of the unit a visual inspection should be conducted to detect any damage that may have occurred during shipment.

INSTALLATION

Physical

The T575N should be mounted as practically as possible taking into account display visibility, accessibility, etc. Ideally, the T575N should be mounted on a stand, positioning the unit 12"-18" above the deck, clear of overhead pipes and as remote from the pump motor as possible. The Model T575N MUST be securely mounted using ONLY the SCI supplied shock mounts which have isolating studs.

Electrical

The T575N is designed to operate on the 12 VDC power system of the transport and is "polarity insensitive". Both + and - power inputs should be obtained in the pump control box. To facilitate testing without activating the entire pumping system, + input power should be derived from the unswitched 12 VDC input to the pump control box. Every effort should be made to keep the proximity of the totalizer's input power leads to the pump motor winding leads as isolated as practically possible within the pump control box. In the event a transport does not have a pump control box as is the norm in CO_2, 2 wires should be routed to the trailer power junction box connected to the 12 VDC accessory or light circuit located at the front of the trailer.

DO NOT attempt to obtain power by splicing into the light circuit located near the meter; line drops and fluctuations may affect the unit operation.

DO NOT connect a jumper from the T575N enclosure to the trailer chassis.

DO NOT replace the SCI shock mounts with solid 'Look Alikes' available in hardware stores: 'Look Alikes' have solid mounting studs, not isolating studs as provided by SCI.

Cables

SIGNAL: P/N S-2F-2F-G-2S-20: The T575N standard signal cable is a 20' 2 wire shielded cable with MS3102E Connector termination which is the industry standard interface for 2-pole pickup coils. The shielding is single-ended and should not be altered. Connect the shielded end (metal braided shield extends beyond the end of the connector backshell) to the electronic unit mating connector (CON1).

POWER: P/N P-2M-SP-B-2U-20: The T575N standard power cable is a 2 wire cable with MS3106E12S-3P connector termination for mating to the unit power connector (CON4) and wire spade terminations for connection to the 12 VDC power source. The unit is 'polarity insensitive' so that either wire may be connected to + input.

PROBE: P/N R-3F-2M-G-2S-20: The T575N standard probe cable is a 20' 2 wire shielded cable with MS3106E12S-2PZ connector termination for mating to the unit probe connector (CON2) and a 3 pin connector termination for mating with the RTD.

RTD Temperature Sensor

RTD Temperature Sensor: The standard temperature supplied by SCI is a 2-wire 100Ω RTD with 'rugged' specification for use in transport systems. An aluminum head with MS3106E 3-pin connector termination is assembled to the RTD to facilitate cable connection in the system. The RTD has 1/2-14 NPT threaded nipple for installation in a mating coupling in the flowmeter outlet piping. A 7/8" Hex plane is located at the center of the RTD assembly for tightening the RTD into the coupling. DO NOT APPLY WRENCH ON THE PROBE HEAD ASSEMBLY.

PRINTING/RESET

In printing operation, a ticket is inserted into the slot of the ticket tray until it bottoms on the internal stop.

1. Turn the print knob one complete clockwise revolution until a positive stop is reached. As the ticket tray moves into position, the seal pin pierces the ticket, holding it in place. This initial printing is made with print wheels at zero. During this initial printing, a shutter moves into place covering the meter register display wheels and the individual wheels are set to a zero position. At completion of initial print/reset, the display wheels will read all zeros, the shutter will rise to the normal operating position, and the ticket will be imprinted with all zeros and locked in place.
2. At the completion of the delivery, turn the knob in a clockwise direction one complete turn until the positive stop is reached. During this cycle, the ticket tray returns to its original position and the seal pin releases the ticket.

NOTE: The meter register does not reset to zero at this time.

SWITCH, ADJUSTMENT, INDICATOR DESCRIPTIONS

Refer to DRAWING pg. 8

S1-POWER SWITCH: 3 amp SPST Toggle; Switches fused input power to the logic circuits of the factoring/ compensation module.
D1-POWER INDICATOR: L.E.D. Illuminates indicating power is applied to circuitry.
D2-TEMPERATURE COMPENSATION INDICATOR: L.E.D.
‘OFF’ indicates COMPENSATION
‘FLASHING’ indicates NO COMPENSATION
INTERNAL BOX AND MODULE: Refer to DRAWINGS pg. 8 & 9
F1: INPUT POWER FUSE: 5 amp 3AG
R15: SENSITIVITY ADJUSTMENT: Single turn potentiometer; establishes input signal amplitude required to initiate the count sequence. Nominal position is with the arrow indicator in the 11:00 o’clock position.
SW1-SW4: FACTORING SWITCHES: 10 position (0-9) BCD; digitally inserts the desired calibration factor with SW1 as the MSD and SW4 the LSD.
SW5: PRODUCT SELECTOR SWITCH: 10 position (0-9) BCD; selects the product temperature compensation curve. (See ‘Model T575N option “IC EPROM TABLE, Pg.)
SW6: DIVIDER SWITCH: 10 position (0-9) BCD; digitally sets a divisor (1-10000) to allow entering a calibration factor with maximum accuracy. (See CALIBRATION)
TP1: GEARPLATE JUMPER: 3 position jumper terminal; Jumper installed for the gearplate used so that the unit internally adjust the required motor steps.
A (TP5): 2-position jumper terminal; INSTALLED unit will not totalize if temperature is not within compensation range for the selected product.
B (TP4): 2 position jumper terminal; NOT USED
C (TP3): 2 position jumper terminal; NOT USED
V (TP2): 2 position jumper terminal; momentarily SHORT to simulate 1000 pulse input signal.
+L.E.D.: Illuminated indicates temperature out of range high.
- L.E.D.: Illuminated indicates temperature out of range low.
A L.E.D.: ALARM INDICATOR: Illuminated when temperature goes out of range for the selected product.
I L.E.D.: INPUT INDICATOR: Flashes at the input signal frequency (at high frequencies, the L.E.D. will appear constantly illuminated)
O L.E.D.: OUTPUT INDICATOR: Flashes at the output signal frequency (at low frequencies, the L.E.D. will be very dim)

SENSITIVITY

If electrical noise is generated near the turbine or signal cable, it can overwhelm the real signal and cause erratic performance resulting in large errors. To prevent this condition, the sensitivity must be reduced. The sensitivity adjustment should be made at the lowest expected flowrate. Turn R15 completely counter-clockwise. With the low flow through the turbine, slowly adjust R15 clockwise until the totalizer increments, then increase R15 slightly clockwise again. In the nominal R15 position, the arrow indicator will be in the 11:00 o’clock position

CALIBRATION

At the factory, Model T575N units are set for the gearplate used and calibrated for the engineering units and product as specified by the customer. This initial calibration is based on a calibration factor (CF) derived from the reciprocal of the flowmeter "K" factor (sensing element constant) multiplied by 10 (electronics meter factor).

CF = (1/K) x10 = 10/K

Factoring Switches SW1-SW4 allow entry of a four digit Calibration Factor.

The Divider Switch (SW6) allows proper decimal point placement by dividing by 1, 10, 100, 1000 or 10000 so that zero is not entered into the MSD factor switch (SW1).

SW6 POSITION		DIVIDER	FUNCTION
0	=	1	does not move decimal
1	=	10	moves decimal place to right
2	=	100	moves decimal 2 places to right
3	=	1000	moves decimal 3 places to right
4	=	10000	moves decimal 4 places to right
5-9	=	NOT USED	for decimal placement

Calibration Procedure:

Step 1: Calculate CF using formula: CF = 10/K
Step 2: Determine Divider required to move decimal point so that zero is not entered into MSD factoring switch (SW1)
Step 3: Round CF to four digits (there are four factoring switches)
Step 4: Dial in SW1-SW4 and divider in SW6
Step 5: Dial Product Selector switch (SW5) for product being measured.

EXAMPLE 1:

NOTE: The K-Factor used in this example is for illustration ONLY. Be sure to use the K-Factor for the turbine flowmeter being used with the unit.

Model T575N is used with a Sponsler model SP1 1/2-CB-NL-B-4 precision turbine flowmeter

K-Factor = 230 pulses per gallon

STEP 1: CF = (1/K) x 10
CF = 10/230
CF = .043478
STEP 2: DIVIDER 10 needed to move decimal point right one place.
STEP 3: CF = .43478 (ROUND UP to four digits)
CF = .4348
STEP 4: Dial CALIBRATION factor in SW1-SW4 and DIVIDER in SW6
SW6 @ 1
SW1 @ 4 SW2 @ 3 SW3 @ 4 SW4 @ 8
STEP 5: SW5 @ 3 (LCO_2) for correct temperature compensation curve.

FIELD CORRECTION

Sometimes, the actual response of the turbine flowmeter to the operating conditions will cause a small CONSISTENT error (same percentage of error in several runs). To correct this condition, the calibration factor can be adjusted by using the following formula:

$$\text{New Calibration factor} = \frac{\text{Actual total}}{\text{Meter total}} \times \text{Present CF}$$

EXAMPLE 2:

NOTE: TOTALS & CF used here are for illustration only.
Be sure to use the CF as dialed on SW1-SW4 of the unit being used.

Actual total: 500
Meter total : 520
CF = .4348 (Numbers dialed on SW1-SW4)

$$\text{New Calibration factor} = \frac{\text{Actual total}}{\text{Meter total}} \times \text{Present CF}$$

New CF = (500/520) x .4348
New CF = (.96154) x .4348
New CF = .41807
New CF = .4181

Insert 4181 into SW1-SW4 respectively.
In the above example .96154 denotes that the meter is operating 3.85% fast and multiplying the present calibration factor (.4348) by the ratio of Actual total: Meter total (.9615) reduces the calibration factor 3.85%

Calibration Factor - Change of Engineering Units
The Model T575N can be calibrated to read in most engineering units. A new K-Factor for the desired engineering unit must be derived from the flowmeter K-Factor (pulses per gallon) and the conversion factor (liters per gallon, cubic meters per gallon, kilograms per gallon, etc.)

EXAMPLE 3: K-Factor = 230 pulses per gallon
Desired readout = liters
Conversion factor = 3.78541 liters per gallon

$$\text{New K-Factor} = \frac{\text{K-Factor}}{\text{Conversion factor}}$$

$$\text{New K-Factor} = \frac{.230}{3.78541}$$

Using the New K-Factor, determine the calibration factor following the 4 steps in the calibration procedure.

EXAMPLE 4:

STEP 1: CF = 10/K
CF = .16458
STEP 2: DIVIDER = 1 (does not move the decimal)
STEP 3: Round CF to four digits
CF = .1646
STEP 4: Insert CF & DIVIDER
SW6 @ 0
SW1 @ 1 SW2 @ 6 SW3 @ 4 SW4 @ 6
STEP 5: No change of product, but verify SW5 is set for correct product.

Whenever a new factor is entered, a check should be made to ensure that the maximum count speed would not be exceeded. The maximum count per minute with a 1:3 gearplate is 1351. The maximum count per minute with a 1:2 gearplate is 1080.

$$\text{Maximum Count} = \frac{\text{Full-scale flowrate frequency X 60}}{\text{K-Factor}}$$

EXAMPLE 5: From the flowmeter calibration sheet the full-scale flowrate is 898 cycles per second.

K-Factor (EXAMPLE 3) = 60.759

$$\text{Maximum Count} = \frac{\text{Full-scale flowrate frequency X 60}}{\text{K-Factor}}$$

$$\text{Maximum Count} = \frac{898 \times 60}{60.759}$$

$$\text{Maximum Count} = \frac{53880}{60.759}$$

$$\text{Maximum Count} = 886.78$$

Maximum Count is not exceeded; no pulses will go into storage.

Model T575N Option ‘IC’ EPROM				
POSITION	**PRODUCT**	**LOW TEMP**	**REF. TEMP**	**HI TEMP**
0	Oxygen	-186.046	-183.11	-167.790
1	Nitrogen	-198.255	-195.930	-181.952
2	Argon	-187.209	-186.046	-167.790
3	CO2	-40.050	-16.388	-6.929
4	N20	-51.087	-34.679	15.384
5	CACO2	-40.051	-25.8333	-6.969
6	MAPP	-17.871	15.384	50.921
7	LPG	-40.050	15.384	49.935
8	Calibrate & switch test			
9	Self test			

Temp = °C

FIGURE 1:

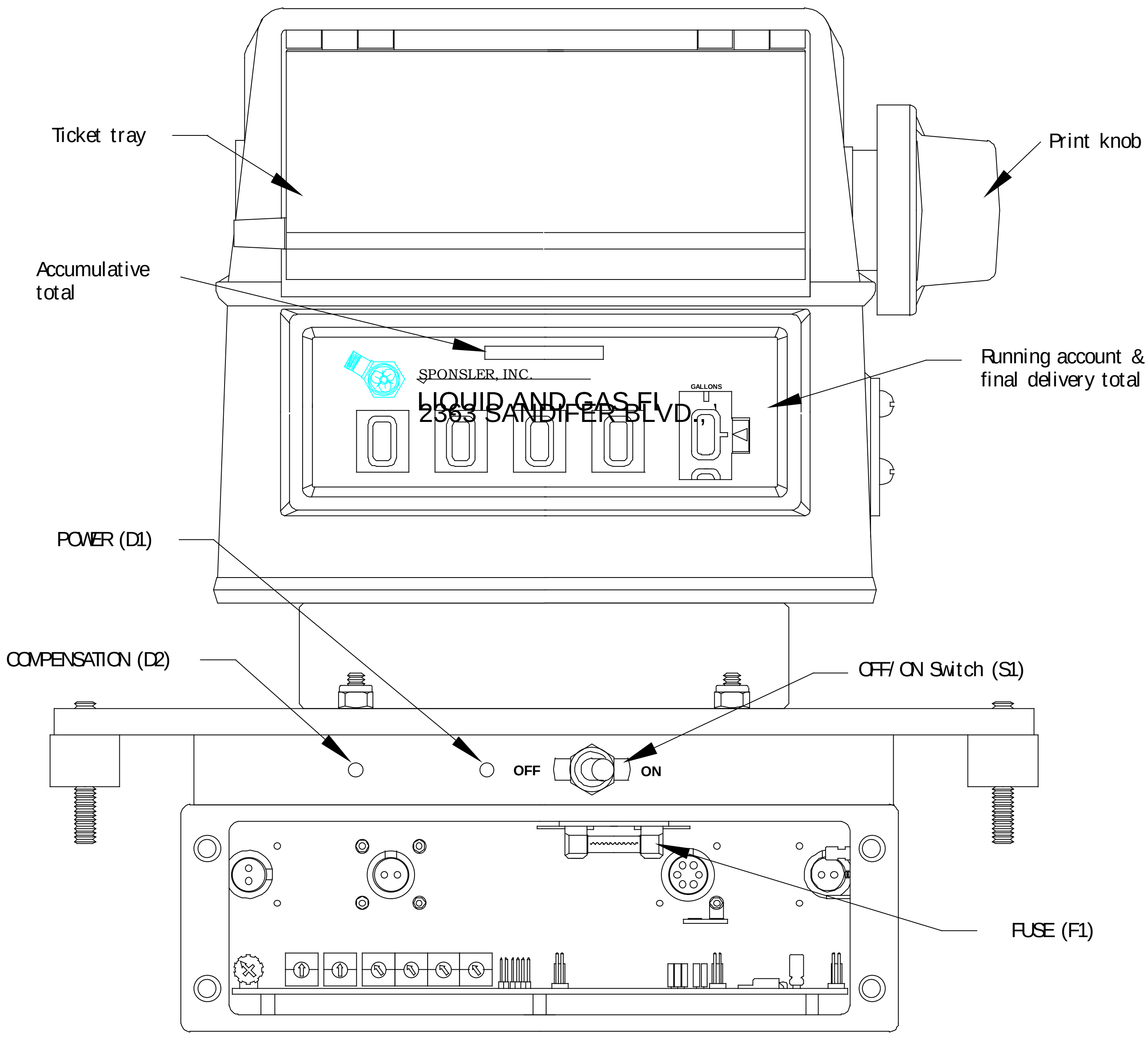

Ticket tray
Print knob
Accumulative total
Running account & final delivery total
SPONSLER, INC.
GALLONS
POWER (D1)
COMPENSATION (D2)
OFF/ON Switch (S1)
OFF
ON
FUSE (F1)

FIGURE 2:

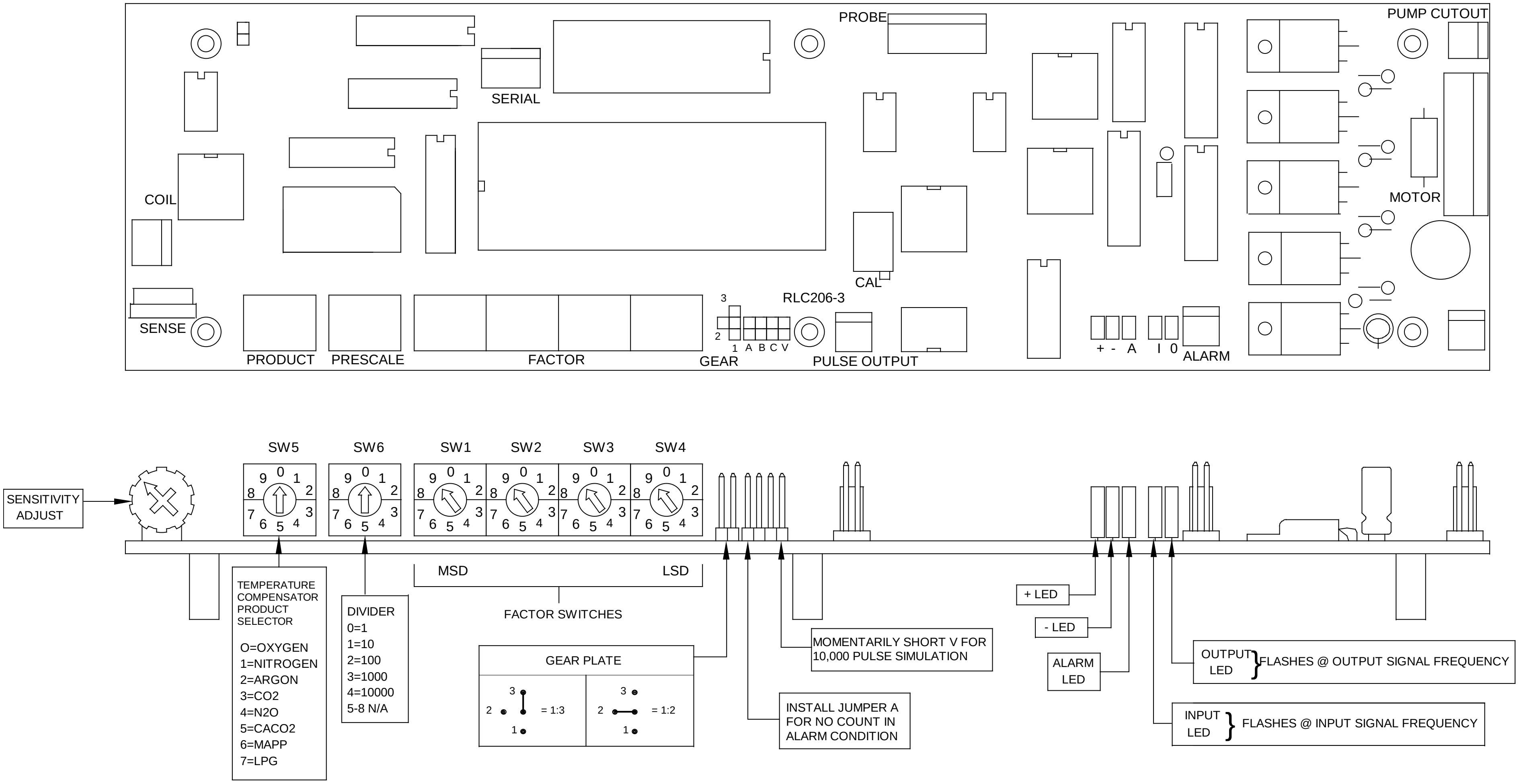
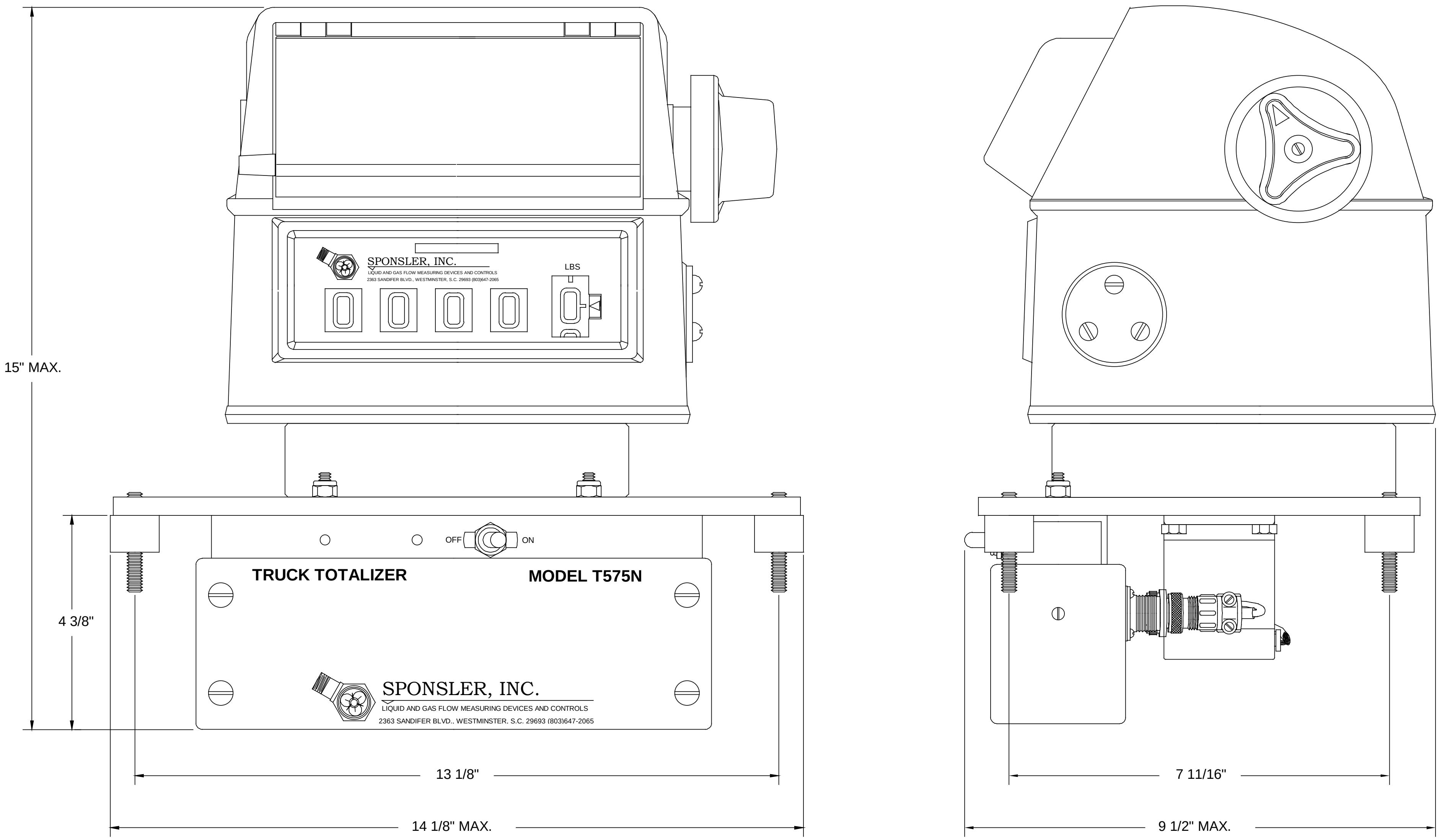

PROBE
PUMP CUTOUT
SERIAL
COIL
MOTOR
CAL
RLC206-3
SENSE
PRODUCT
PRESCALE
FACTOR
GEAR
PULSE OUTPUT
ALARM
SW5
SW6
SW1
SW2
SW3
SW4
SENSITIVITY ADJUST
TEMPERATURE COMPENSATOR PRODUCT SELECTOR
O=OXYGEN
1=NITROGEN
2=ARGON
3=CO2
4=N2O
5=CACO2
6=MAPP
7=LPG
DIVIDER
0=1
1=10
2=100
3=1000
4=10000
5-8 N/A
MSD
LSD
FACTOR SWITCHES
GEAR PLATE
= 1:3
= 1:2
MOMENTARILY SHORT V FOR 10,000 PULSE SIMULATION
INSTALL JUMPER A FOR NO COUNT IN ALARM CONDITION
+ LED
- LED
ALARM LED
OUTPUT LED FLASHES @ OUTPUT SIGNAL FREQUENCY
INPUT LED FLASHES @ INPUT SIGNAL FREQUENCY

FIGURE 3: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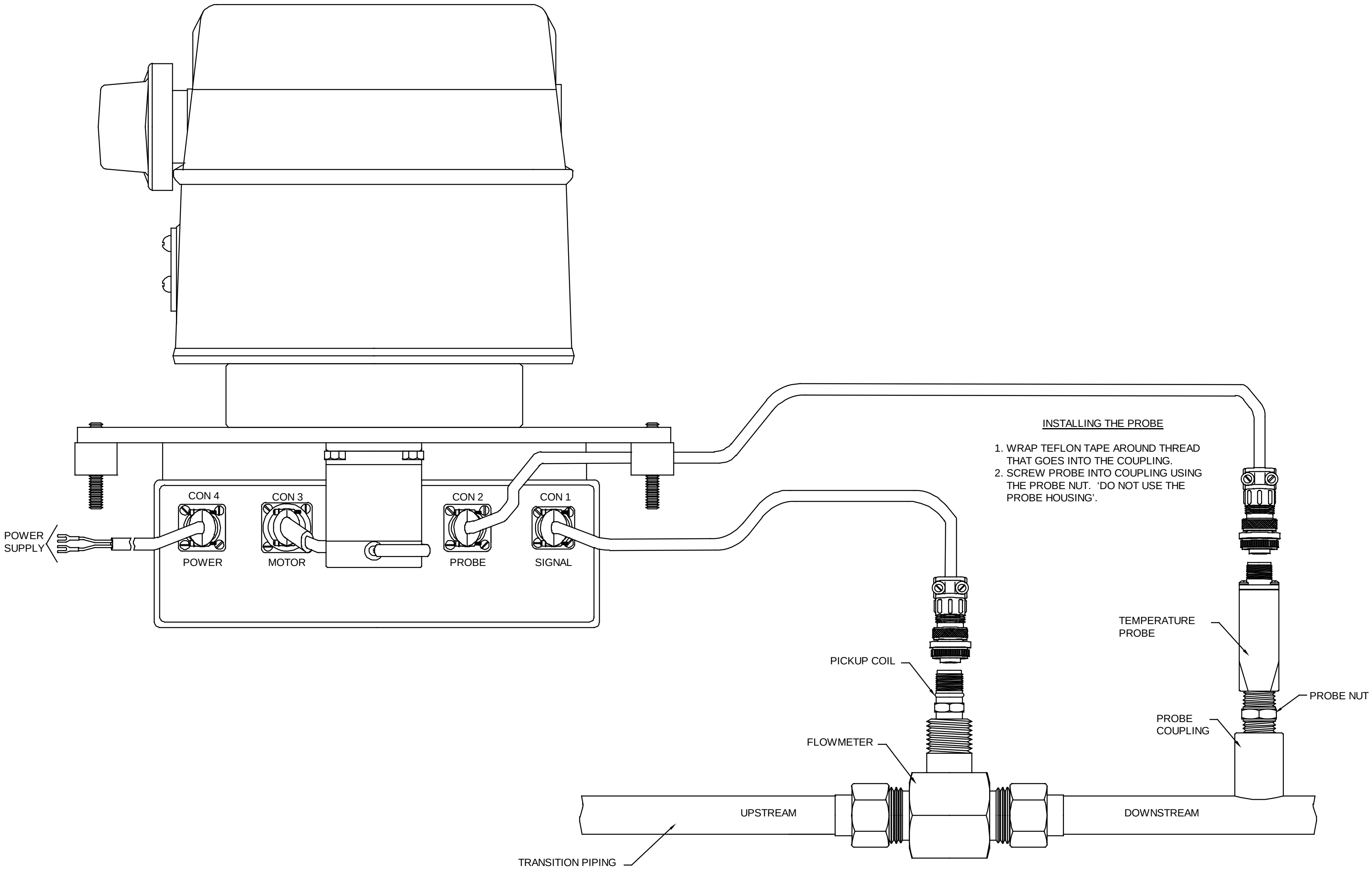
LIQUID AND GAS FLOW MEASURING DEVICES AND CONTROLS
2363 SANDIFER BLVD., WESTMINSTER, S.C. 29693 (803)647-2065
LBS
15" MAX.
OFF
ON
TRUCK TOTALIZER
MODEL T575N
4 3/8"
13 1/8"
14 1/8" MAX.
7 11/16"
9 1/2" MAX.

FIGURE 4:


POWER SUPPLY
CON 4
CON 3
CON 2
CON 1
POWER
MOTOR
PROBE
SIGNAL
INSTALLING THE PROBE
1. WRAP TEFLON TAPE AROUND THREAD THAT GOES INTO THE COUPLING.
2. SCREW PROBE INTO COUPLING USING THE PROBE NUT. 'DO NOT USE THE PROBE HOUSING'.
TEMPERATURE PROBE
PICKUP COIL
PROBE NUT
PROBE COUPLING
FLOWMETER
UPSTREAM
DOWNSTREAM
TRANSITION PIPING

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