

## INSTALLATION, OPERATION AND INSTRUCTION MANUAL

### **Level-Trac Model LT-420 Control Unit**

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Note: This document should be reviewed in its entirety prior to installation of equipment.

## 1.0 Operating Principle

The Level-Trac LT-420 is a control unit designed specifically to power and provide a visual display of water level in a steam drum. However, it can be used for any 4-20 mA transmitter in liquid device to provide 4 DPDT relay set points for alarm/trip use and/or provide a visual display.

By design the LT-420 can provide an independent, local 24 VDC power supply for loop powered equipment as an alternative to powering with a Distributed Control System.

The visual display is controlled by a processor that assigns a programmed quantity of LEDs to show green at a specific 4-20 mA output.

The same processor controls 4 relays to change state at a programmed 4-20 mA output.

## 2.0 System Configuration

Control Unit:

The standard unit is housed in a NEMA 4X Fiberglas Reinforced Polyester enclosure (Reference 320-80-420), and includes a 28 Channel visual display mounted on the door. The unit may be supplied "blind" without the local display. There is an option for a 304 SS enclosure (Reference 320-80-421.) The control unit is designed and recommended to be installed in close proximity to the transmitter.

Power Supply:

Line power required is 84-264 VDC, 50-60Hz. This is converted to 24 VDC by a Meanwell Model RS-35-24 Switching Power Supply (Reference RS-35-SPEC). This is a very stable power source capable of handling up to 1.5 A Load. The power supply has a green LED to indicate that it is powered and working. There is a "hiccup" circuit that will pause the power supply if shorted, and will self-clear when the short is corrected.

Relays:

Four relays are available to be used as alarms, trips or other tasks. Relay action is controlled by factory installed programming customized for the specific application. Standard functions are:

<i>Relay</i>	<i>Normal State</i>	<i>Assignment</i>
RL1	Energized when below indicated liquid level	Low Low Level Alarm
RL2	Energized when below indicated liquid level	Low Level Alarm
RL3	Energized when above indicated liquid level	High Level Alarm
RL4	Energized when above indicated liquid level	High High Level Alarm

Relays may also be programmed with a hysteresis to provide on/off pump logic or valve actuation. Consult the factory for additional information about this programming option.

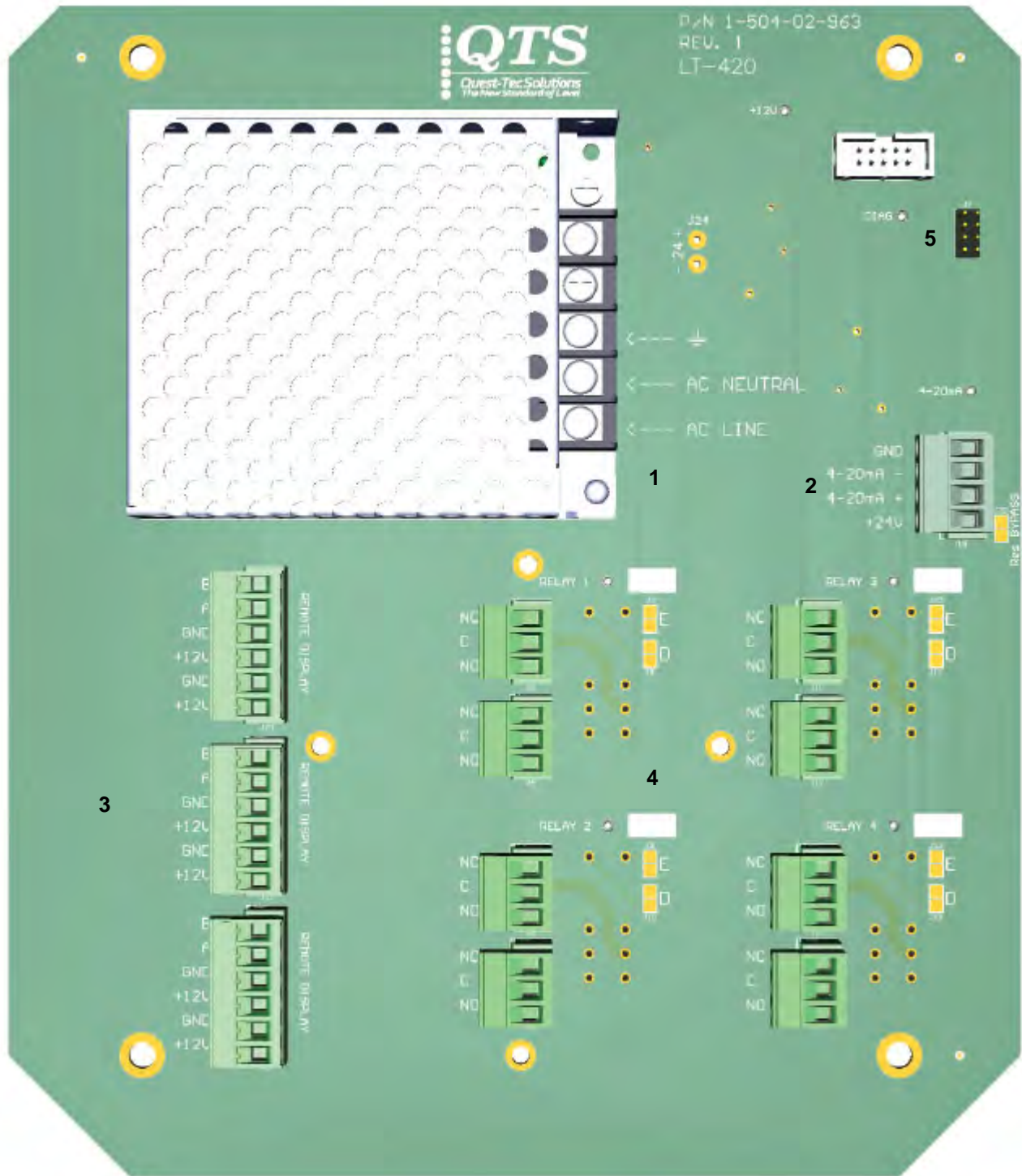
Programming:

Indicator and relay programs are factory installed. The unit was designed to specifically to handle Heat Recovery Steam Generation Systems with four field selectable programs. Standard programming:

<i>Jump</i>	<i>Assignment</i>
Position 1 (1 to 2)	HP Drum
Position 2 (3 to 4)	IP Drum
Position 3 (5 to 6)	LP Drum
Position 4 (7 to 8)	HP Drum with Static calculation for Water Density Compensation (Reference: Calculated Water Density Compensation)

By design, these programs are to be installed by factory authorized personnel. Program alterations are normally performed at no charge. Quest-Tec Solutions serializes and archives all programs and therefore, can provide fully programmed spare units or motherboards when provided with the original serial number. Having a program for each drum in a unit allows the user to stock a single PCB as a spare.

### 3.0 LT-420 Motherboard Connection Map



#### Field Connections:

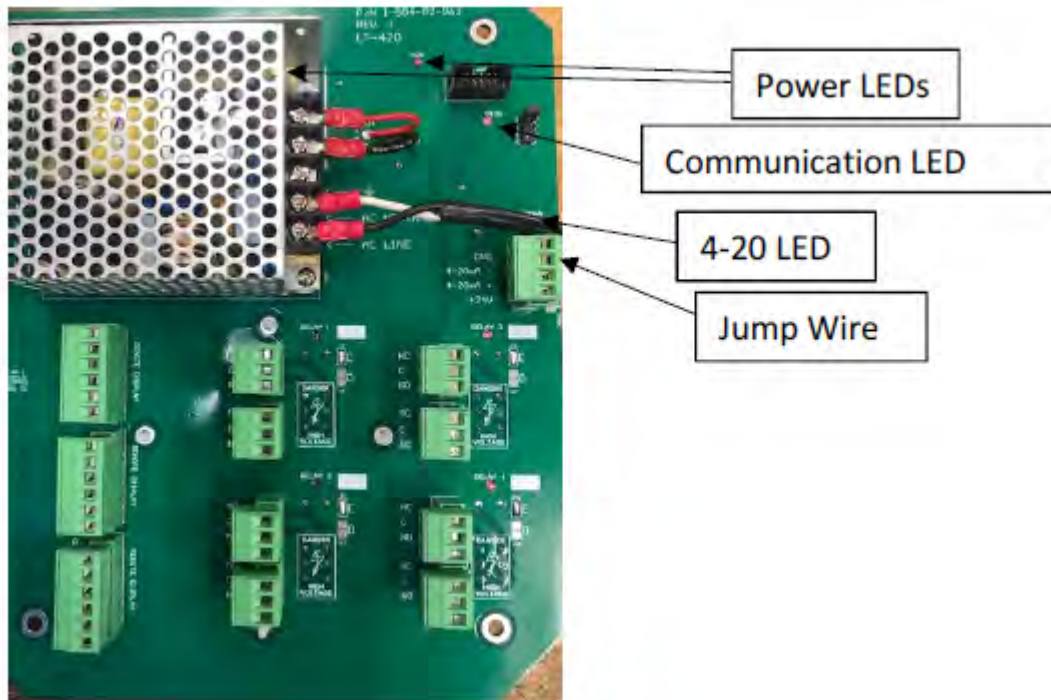
- 1) Line Power Supply, 84-264 VAC, 50/60 Hz. Maximum Current Draw:
- 2) Power to Transmitter (+24V), Return (4-20 mA +), Loop Connection to DCS or other participant (4-20 mA -), Loop Return (GND). This circuit includes a 250  $\Omega$  Resistor, which may be bypassed by making a solder jump.
- 3) Remote Display Connectors, A, B, +12 VDC, GND, +12 VDC (Redundant), GND (Redundant). One of these plugs will normally be used for the door mounted display.
- 4) Four DPDT 8 Amp Relays, normally supplied in an Energized Normal State (Failsafe).
- 5) Program Selection jump.

## 4.0 Commissioning

### Pre-Commissioning Electronics Check List GWR/LT-420/LTI-420

Following is a quick pre-commissioning check list to enable confirmation of electronics func-

No.	Item	Observation	Pass	Fail
1	LT-420	Green LED in Switching power supply, 12 V Red LED on PCB (indicates power to unit is correct)		
2	LT-420	4-20 LED is lit (indicates there is a complete loop) Note: There should be jump wire between GND and 4-20 mA		
4	LT-420	Red Communication LED blinking approx. 2 times per second Indicates RS485 signal is being transmitted		
5	LTI-420	Green LED on back blinking approx. 1 time per second Indicates that RS485 signal is being received. It will blink once every 3-5 seconds if it is not receiving the signal.		
6	GWR Head	Display, should read 0.00 (This takes about 30 seconds for it to boot up.)		
7	LT-420 LTI-420	Display should be all Red (or one green, definitely not all Green)		



## 5.0 LT-420 Control Unit Specifications

### Enclosure:

Wall mounted glass-fiber reinforced polyester, IP65/NEMA4X protection for location in harsh environments.

*Dimensions:* 9.39" H X 9.76" W X 4.31" D (239 mm H X 248 mm W X 110 mm D)

Mounting Legs: (4) 0.50" X 0.31" (13 mm X 8 mm) Slots on 10.21" H X 6" W Centers (250 mm H X 152 mm W)

### Inputs:

Power Supply: 84-264 VAC, 48-63 Hz. Maximum Output 1.5 A

### Power Consumption:

Voltage	28 Channel Indicator, Amps		
	LT-420	1 Remote	2 Remotes
115	0.129	0.175	0.221
120	0.125	0.171	0.217
230	0.105	0.129	0.153
240	0.104	0.128	0.152

Voltage	36 Channel Indicator, Amps		
	LT-420	1 Remote	2 Remotes
115	0.143	0.203	0.263
120	0.138	0.198	0.258
230	0.113	0.143	0.173
240	0.111	0.141	0.171

### Temperature Rating:

Operating: -13° F (-25° C) to 158° F (70° C), Storage: -58° F (-50° C) to 212° F (100° C)

### Relay Ratings:

DPDT, Max. Current: 8 Amps @ 250VAC

### Power Tie-Ins:

*Line Power:* Direct hookup to Meanwell Power Suply, Line, Neutral Earth Ground

*Relays, Transmitter, Loop and Remote Displays:* Phoenix MSTB 2,5 Plugs, 0.20" (5 mm) Pitch, 24-12 AWG

### Remote Display (optional configurations):

The standard configuration includes one door mounted display with the facility for two additional remote displays. Remote displays are normally powered by the control unit. Additional remote display option configurations include:

Configuration	Conductors	Power Required
Standard	6 Wires, 20 AWG min.	Self Powered
Local Power	2 Wires, 20 AWG Min.	84-264 VAC, 50/60 Hz, or 24 VDC, or 12 VDC
Fiber Optic (Local Power)	Multimode	84-264 VAC, 50/60 Hz, or 24 VDC, or 12 VDC
Multiplexer, transmitting multiple signals from field to Control Room with a single Fiber Optic Cable		84-264 VAC, 50/60 Hz, or 24 VDC, or 12 VDC

### Installing and Removing Covers

#### To remove cover:

- 1) Open the enclosure completely and provide adequate support to keep the cover from being damaged during disassembly.
- 2) Using a hammer and screwdriver, gently tap on the end of the hinge pin nearest the middle of the enclosure (closed end) so that the pin becomes unseated at the other end (approx. 1/4")
- 3) Using pliers, grasp the opposite end (flattened) of the hinge pin and pull completely out. Repeat steps 1 and 2 to remove the second hinge pin.

#### To install new cover

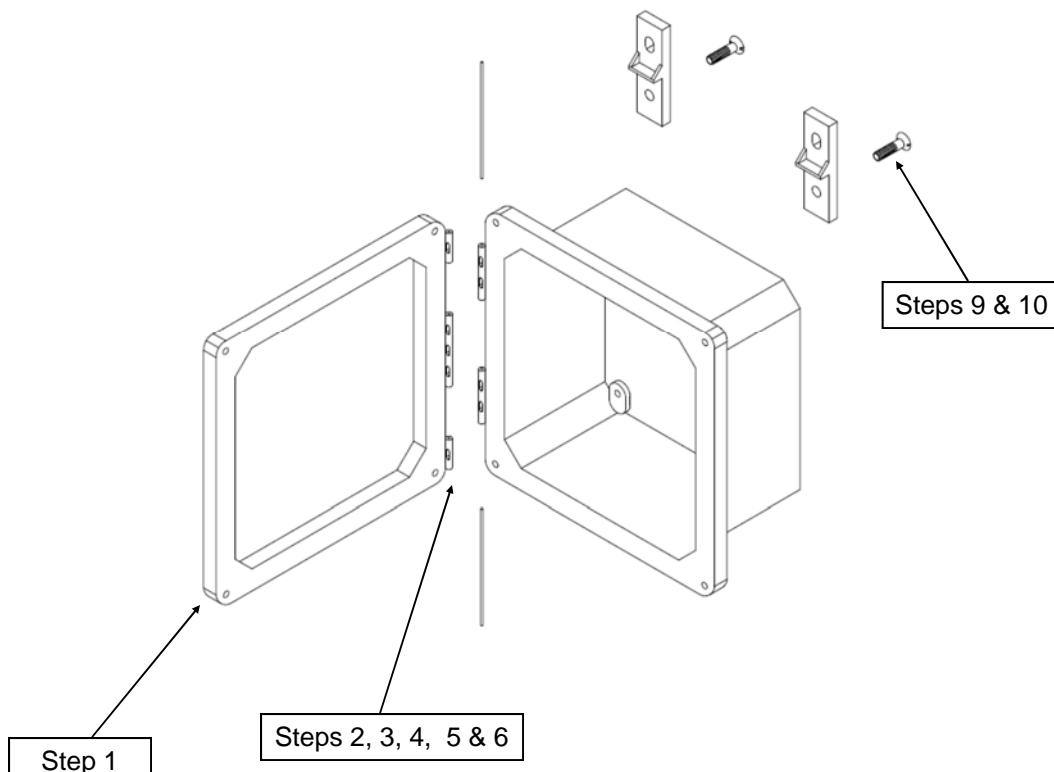
- 4) Assemble hinge pins to the cover by inserting the round end of the pin into the hinge core in the cover. You may need to use a hammer to gently tap the pin into place. Repeat this for the second pin.
- 5) Align the cover with the base in the open position.
- 6) Using a small hammer, gently tap the hinge pin into the corresponding hole in the base until the end of the pin is fully seated and flush with the cover surface. Repeat this step for the second hinge pin.

#### Changing out the latches

- 7) Remove existing latch by gently tapping the latch off the dovetail on the side of the enclosure.
- 8) Assemble the new latch by sliding the latch base onto the corresponding dovetail on the enclosure base **UNTIL COMPLETELY SEATED**. Repeat steps 7 & 8 for the other latches.

#### Adding Mounting Feet

- 9) Place mounting foot on the back side of enclosure so that the countersink hole is directly over the brass insert.
- 10) Using a screw driver and the #10-32 x 7/16" flat head screw, tighten the mounting foot to the enclosure. Torque to approximately 25 in-lbs. Repeat steps 9 and 10 for the remaining mounting feet.



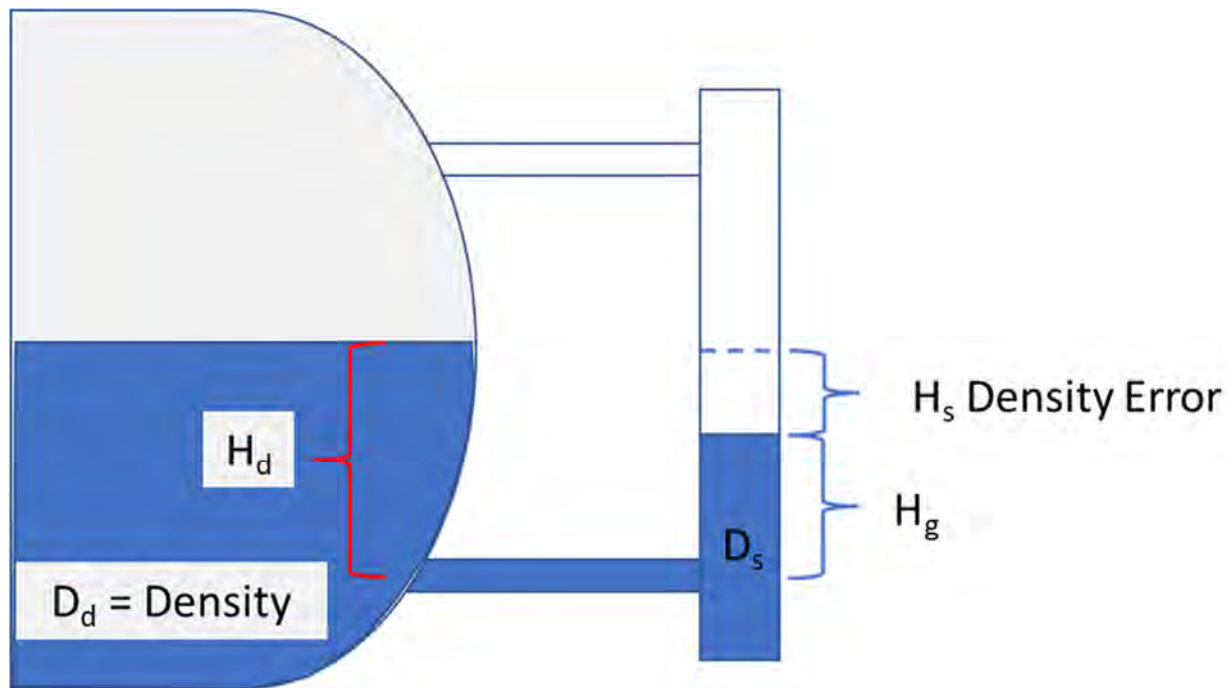
## Water Density Compensation

Water Density Error is a well documented phenomenon that occurs due to the sub-cooling of the water in a bypass chamber/water column. Whereas steam and water in a saturated steam drum have equal temperatures, the water in the bypass chamber will be somewhat lower than the water in the steam generating drum. (Note that this is a separate issue than guided wave radar vapor density error, which is resolved by the electronics of the guided wave radar device.)

This drop in temperature will lead to an increase in density of the water in the bypass chamber which will be manifested by a lower water level in the bypass chamber than that in the steam drum.

The standard formula is:  $H_d D_d = H_g D_g + H_s D_s$

To solve for Drum Water Level:  $H_d = \frac{H_g(D_g - D_s)}{D_d - D_s}$



Lacking a means of providing a precise temperature drop for the sub-cooled water in the bypass chamber ( $D_s$ ), this must be estimated. The standard estimate Quest-Tec uses for this static calculation is 30° F.

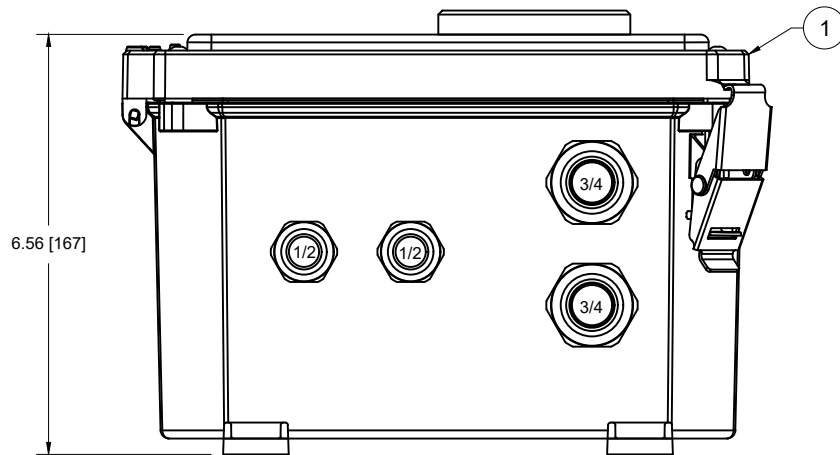
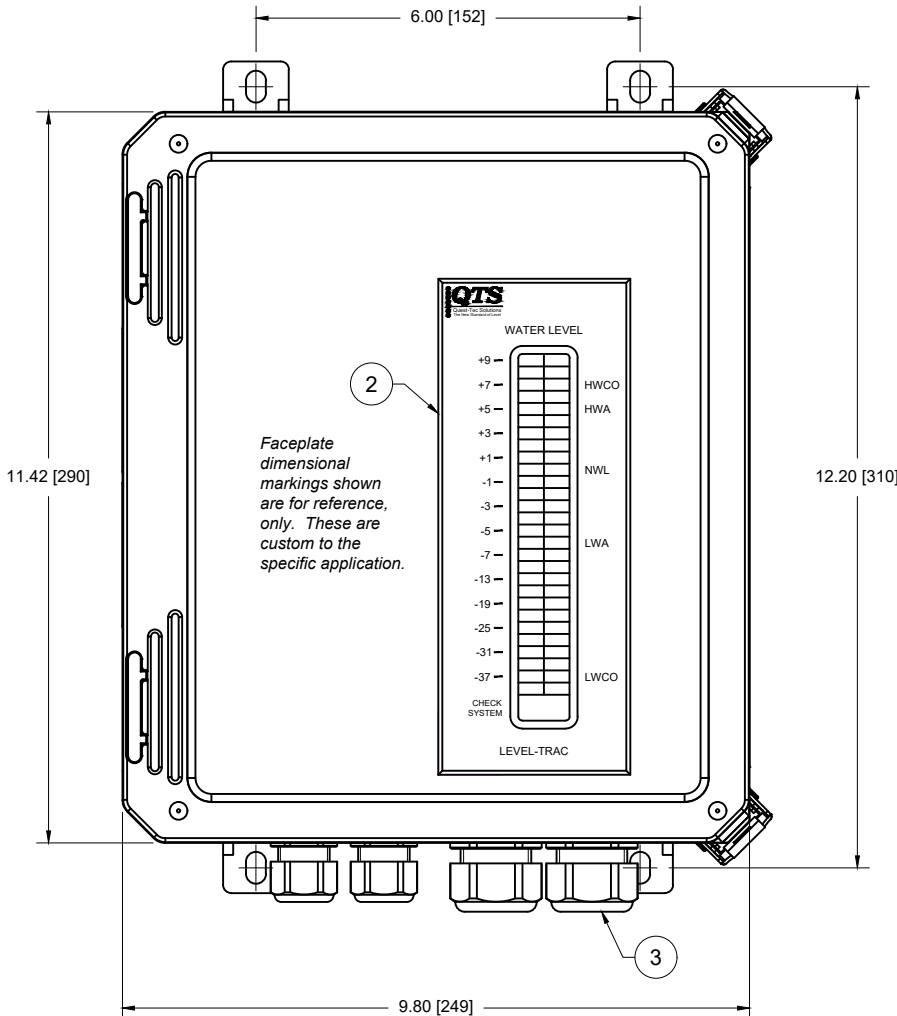
To eliminate this estimate, please see the LT-430, which uses thermocouple input to more accurately provide temperature data.

BILL OF MATERIALS

ITEM#	DESCRIPTION	MATERIAL
1	NEMA 4X ENCLOSURE	FIBERGLASS REINFORCED POLYESTER
2	FACEPLATE	ANODIZED ALUMINUM
3	CORD GRIP	NYLON

PROGRAMMING

NORMALLY WET	
HIGH LEVEL TRIP	
HIGH LEVEL ALARM	
LOW LEVEL ALARM	
LOW LEVEL TRIP	
NORMAL RELAY STATE	ENERGIZED
RELAY TIME DELAY	5 SECONDS



CUSTOMER:
CUST. PO#:
FACT. REF.:
END USER:
TAG#:
SERIAL:

APPROVAL DRAWING:
<input type="checkbox"/> APPROVED AS IS TO MFG. <input type="checkbox"/> APPROVED AS NOTED TO MFG. <input type="checkbox"/> NOT APPROVED-RESUBMIT BEFORE MFG.
SIGNED BY: _____
DATE: _____

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SI METRIC  
THIRD ANGLE PROJECTION

UNLESS OTHERWISE NOTED ALL DIMENSIONS IN INCHES [mm]					
<b>QTS</b>		13960 SOUTH WAYSIDE DR. HOUSTON, TEXAS 77048 OFFICE (281)240-0440 FAX (281)240-2440 WWW.QTSLevel.com			
TITLE					
LT-420 CONTROL UNIT					
DRN	PCD	DATE	7/19/23	SIZE	DRAWING #
CHKD	MB	DATE	8/2/23	A	320-80-420
APPD	MB	DATE	8/2/23	SCALE	N.T.S.
				SHEET	1 OF 1
					REV 0

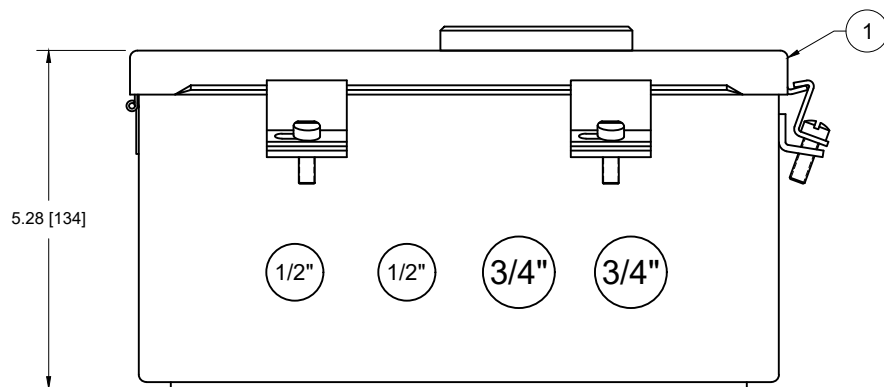
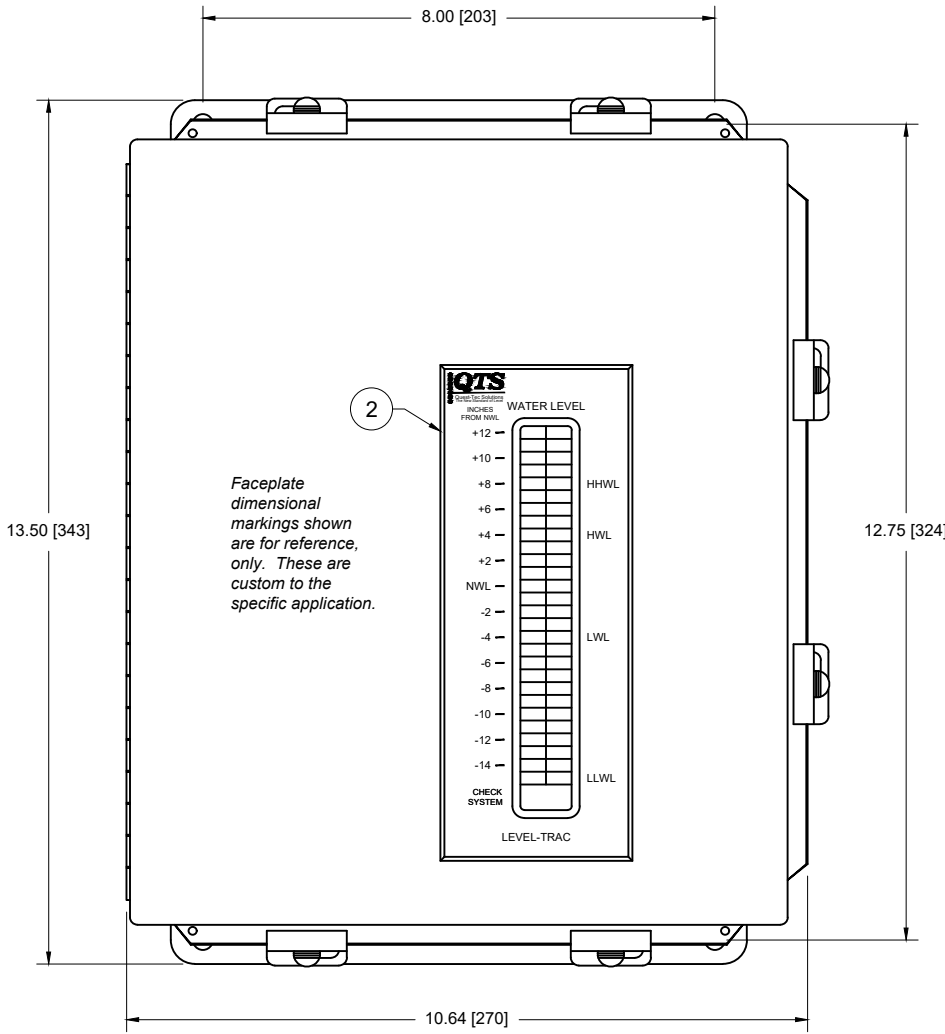


BILL OF MATERIALS

ITEM#	DESCRIPTION	MATERIAL
1	NEMA 4X ENCLOSURE	304 SS
2	FACEPLATE	ANODIZED ALUMINUM

PROGRAMMING

NORMALLY WET	
HIGH LEVEL TRIP	
HIGH LEVEL ALARM	
LOW LEVEL ALARM	
LOW LEVEL TRIP	
NORMAL RELAY STATE	ENERGIZED
RELAY TIME DELAY	5 SECONDS



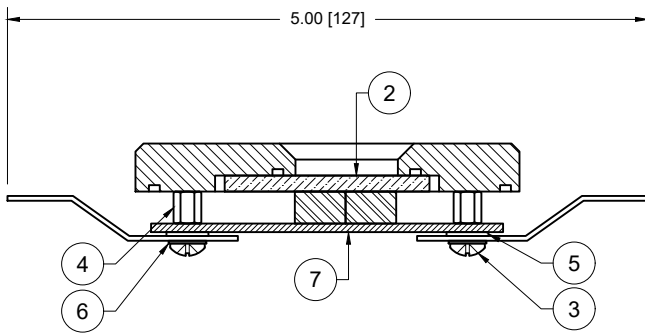
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<b>CUST. PO#:</b>
<b>FACT.REF.:</b>
<b>END USER:</b>
<b>END USER PO#:</b>
<b>TAG#:</b>
<b>SERIAL:</b>

<b>APPROVAL DRAWING:</b>	
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<input type="checkbox"/>	APPROVED AS NOTED TO MFG.
<input type="checkbox"/>	NOT APPROVED-RESUBMIT BEFORE MFG.
SIGNED BY: _____	
DATE: _____	

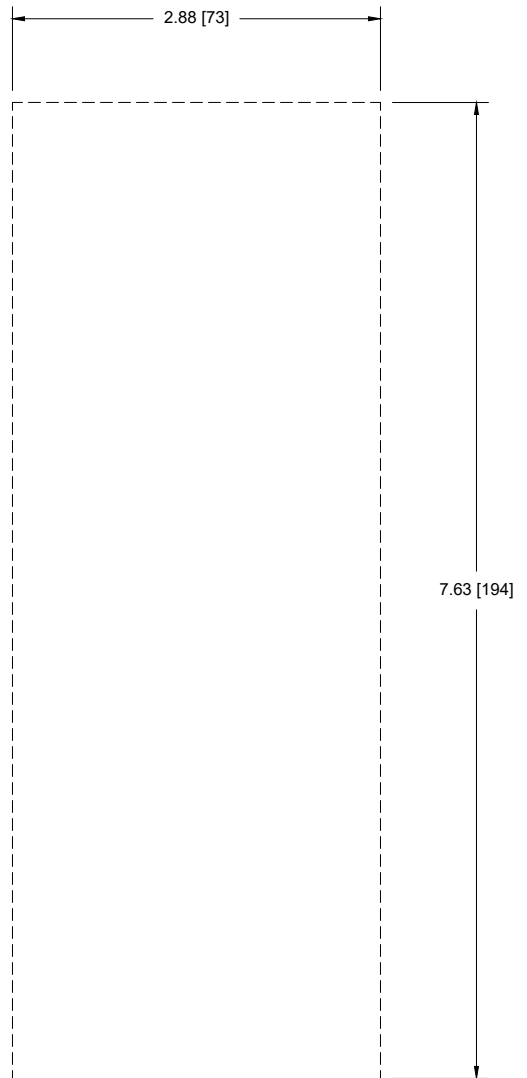
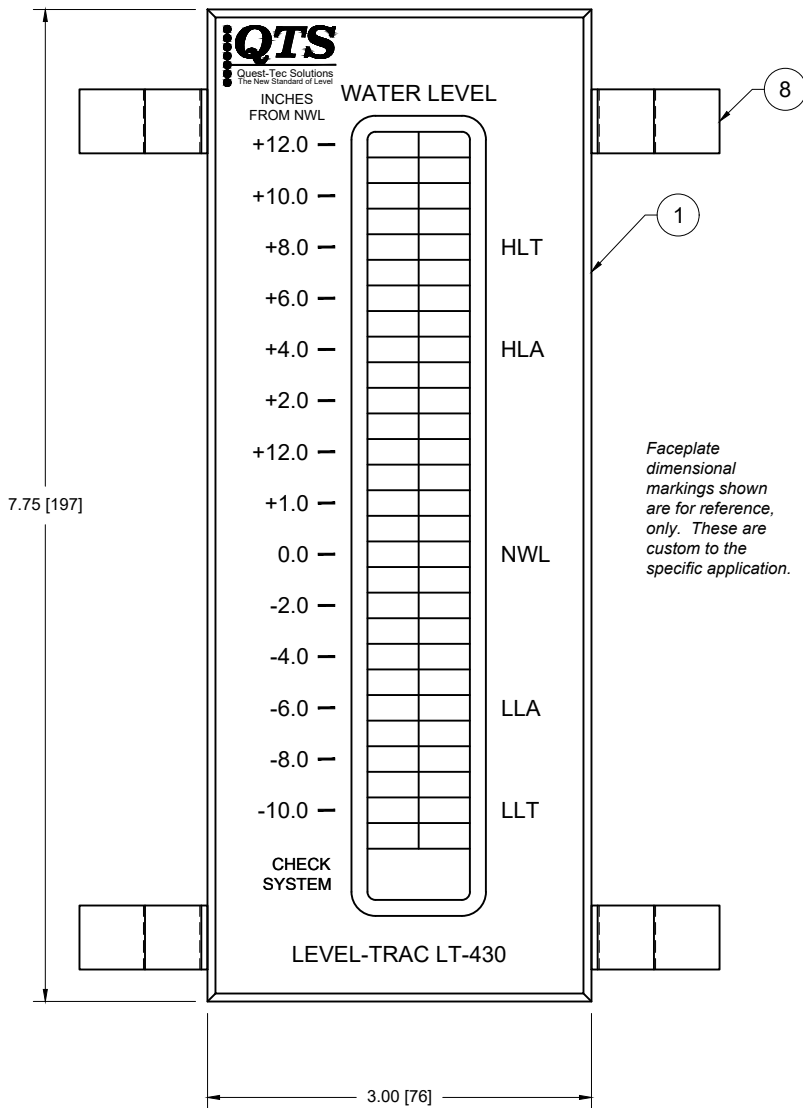
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TITLE: 320-80-421					
DRN	PCD	DATE	5/19/22	SIZE	DRAWING #
CHKD	MRB	DATE	6/8/22	A	LT-420 CONTROL UNIT
APPD	MRB	DATE	6/8/22	SCALE	N.T.S.
				SHEET	1 OF 1
					REV 0



BILL OF MATERIALS		
ITEM#	DESCRIPTION	MATERIAL
1	FACEPLATE	ANODIZED ALUMINUM
2	LENS	GLASS
3	PAN HEAD SCREW	18-8 SS
4	MALE x FEMALE STANDOFF	ALUMINUM
5	WASHER	NYLON
6	INTERNAL TOOTH WASHER	18-8 SS
7	LED PCB	MFG / STD
8	PANEL BRACKET	20 GAUGE STAINLESS SPRING STEEL



PANEL CUT OUT

CUSTOMER:

CUST. PO#:

FACT. REF.:

END USER:

END USER PO#:

TAG#:

SERIAL:

APPROVAL DRAWING:

APPROVED AS IS TO MFG.

APPROVED AS NOTED TO MFG.

NOT APPROVED-RESUBMIT BEFORE MFG.

SIGNED BY: \_\_\_\_\_

DATE: \_\_\_\_\_

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TITLE

LTI-420-28 PANEL REMOTE DISPLAY

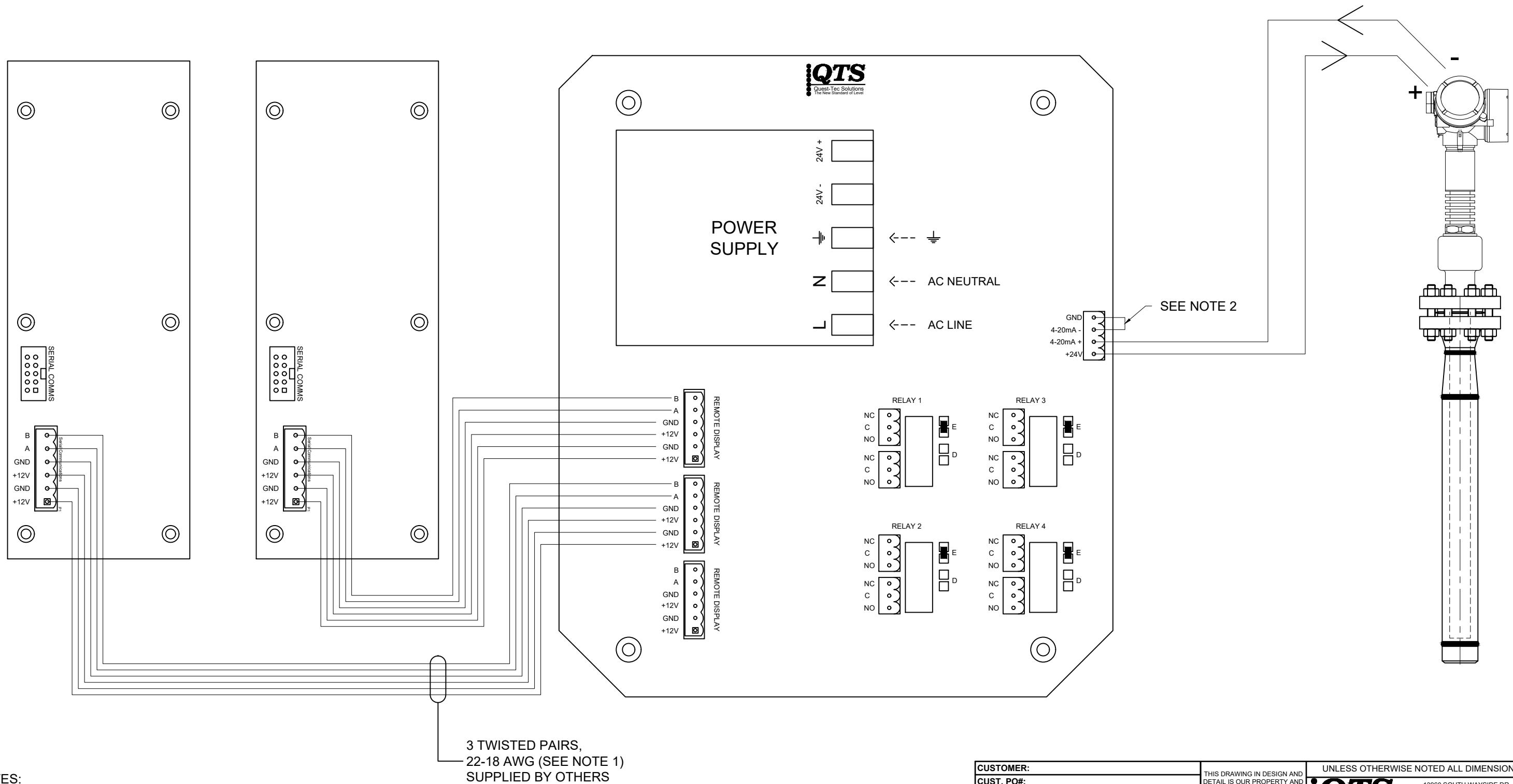
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CHKD	MB	DATE	2/21/22	A	320-80-422	0
APPD	MB	DATE	2/21/22	SCALE	N.T.S.	SHEET 1 OF 1

REMOTE DISPLAY

DOOR MOUNTED DISPLAY (WIRED BY QTS)

LT-420 CONTROL UNIT (POWER SUPPLY PCB)



LEVEL TRANSMITTER



3 TWISTED PAIRS, 22-18 AWG (SEE NOTE 1) SUPPLIED BY OTHERS

NOTES:

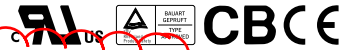
- 1) ONLY A & B ARE REQUIRED TO BE A TWISTED PAIR. (RECOMMENDED CABLE SPEC: BELDEN 9750)
- 2) THE CONTROL UNIT IS SUPPLIED WITH A WIRE JUMP BETWEEN "GND" AND "4-20mA-", IF THIS WIRE JUMP IS REMOVED AN ADDITIONAL 4-20mA LOOP MONITORING DEVICE MUST BE INSERTED TO MAINTAIN LOOP CONTINUITY.

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<b>CUST. PO#:</b>			 13960 SOUTH WAYSIDE DR. HOUSTON, TEXAS 77048 OFFICE (281)240-0440 FAX (281)240-2440 WWW.QTSLevel.com		
<b>FACT.REF.:</b>					
<b>END USER:</b>					
<b>END USER PO#:</b>					
<b>TAG#:</b>		TITLE GWR LEVEL TRANSMITTER TO LT-420 CONTROL UNIT TO REMOTE DISPLAY, WIRING DIAGRAM			
<b>SERIAL:</b>		SI METRIC THIRD ANGLE PROJECTION		DRN PCD DATE 6/29/23 SIZE DRAWING # REV CHKD MB DATE 7/25/23 B W-LT-420 0 APPD MB DATE 7/25/23 SCALE N.T.S. SHEET 1 OF 1	



■ Features :

- Universal AC input / Full range
- Protections: Short circuit/Over load/Over voltage
- Cooling by free air convection
- LED indicator for power on
- 100% full load burn-in test
- All using 105°C long life electrolytic capacitors
- Withstand 300VAC surge input for 5 second
- High operating temperature up to 70°C
- Withstand 5G vibration test
- High efficiency, long life and high reliability
- 3 years warranty

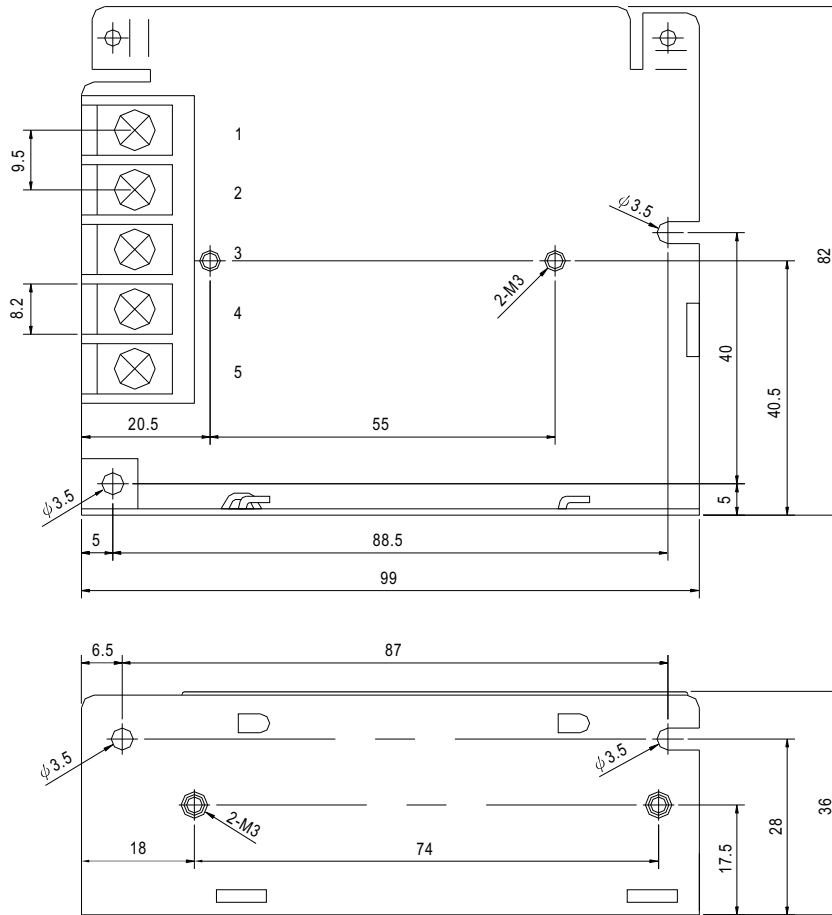


## SPECIFICATION

MODEL		RS-35-3.3	RS-35-5	RS-35-12	RS-35-15	RS-35-24	RS-35-48
OUTPUT	DC VOLTAGE	3.3V	5V	12V	15V	24V	48V
	RATED CURRENT	7A	7A	3A	2.4A	1.5A	0.8A
	CURRENT RANGE	0 ~ 7A	0 ~ 7A	0 ~ 3A	0 ~ 2.4A	0 ~ 1.5A	0 ~ 0.8A
	RATED POWER	23.1W	35W	36W	36W	36W	38.4W
	RIPPLE & NOISE (max.) Note.2	80mVp-p	80mVp-p	120mVp-p	120mVp-p	120mVp-p	200mVp-p
	VOLTAGE ADJ. RANGE	2.9V ~ 3.6V	4.5 ~ 5.5V	10.8 ~ 13.2V	13.5 ~ 16.5V	22 ~ 27.6V	42 ~ 54V
	VOLTAGE TOLERANCE Note.3	±3.0%	±2.0%	±1.0%	±1.0%	±1.0%	±1.0%
	LINE REGULATION Note.4	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
	LOAD REGULATION Note.5	±2.0%	±1.0%	±0.5%	±0.5%	±0.5%	±0.5%
	SETUP, RISE TIME	500ms, 30ms/230VAC      1200ms, 30ms/115VAC at full load					
HOLD TIME (Typ.)	80ms/230VAC      15ms/115VAC at full load						
INPUT	VOLTAGE RANGE	88 ~ 264VAC      125 ~ 373VDC (Withstand 300VAC surge for 5sec. Without damage)					
	FREQUENCY RANGE	47 ~ 63Hz					
	EFFICIENCY(Typ.)	73%	77%	81%	83%	84%	84%
	AC CURRENT (Typ.)	0.8A/115VAC      0.55A/230VAC					
	INRUSH CURRENT (Typ.)	COLD START 36A/230VAC					
LEAKAGE CURRENT	<2mA / 240VAC						
PROTECTION	OVER LOAD	110 ~ 150% rated output power Protection type : Hiccup mode, recovers automatically after fault condition is removed					
	OVER VOLTAGE	3.8 ~ 4.45V	5.75 ~ 6.75V	13.8 ~ 16.2V	17.25 ~ 20.25V	27.6 ~ 32.4V	55.2 ~ 64.8V
ENVIRONMENT	WORKING TEMP.	-25 ~ +70°C (Refer to output load derating curve)					
	WORKING HUMIDITY	20 ~ 90% RH non-condensing					
	STORAGE TEMP., HUMIDITY	-40 ~ +85°C, 10 ~ 95% RH					
	TEMP. COEFFICIENT	±0.03%/°C (0 ~ 50°C)					
	VIBRATION	10 ~ 500Hz, 5G 10min./1cycle, period for 60min. each along X, Y, Z axes					
SAFETY & EMC (Note 6)	SAFETY STANDARDS	UL60950-1, TUV EN60950-1 Approved					
	WITHSTAND VOLTAGE	I/P-O/P:3KVAC    I/P-FG:1.5KVAC    O/P-FG:0.5KVAC					
	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:100M Ohms/500VDC					
	EMI CONDUCTION & RADIATION	Compliance to EN55022 (CISPR22) Class B					
	HARMONIC CURRENT	Compliance to EN61000-3-2,-3					
OTHERS	EMS IMMUNITY	Compliance to EN61000-4-2,3,4,5,6,8,11; ENV50204, EN61000-6-2 (EN50082-2) heavy industry level, criteria A					
	MTBF	249Khrs min.    MIL-HDBK-217F (25°C)					
	DIMENSION	99*82*36mm (L*W*H)					
NOTE	PACKING 0.3Kg; 45pcs/14Kg/0.83CUFT						
NOTE	<ol style="list-style-type: none"> <li>1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25°C of ambient temperature.</li> <li>2. Ripple &amp; noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf &amp; 47uf parallel capacitor.</li> <li>3. Tolerance : includes set up tolerance, line regulation and load regulation.</li> <li>4. Line regulation is measured from low line to high line at rated load.</li> <li>5. Load regulation is measured from 0% to 100% rated load.</li> <li>6. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives.</li> </ol>						

**Mechanical Specification**

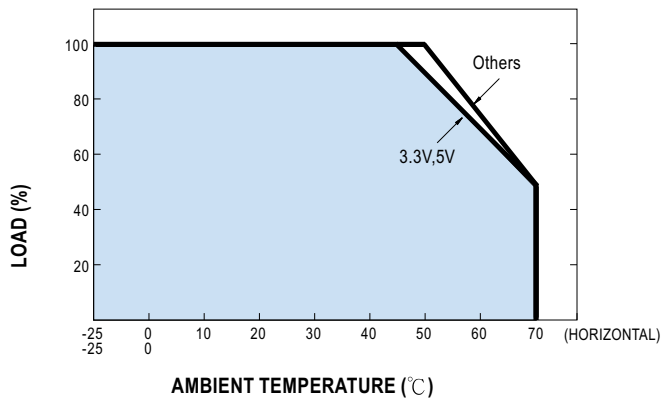
Case No. 932A Unit:mm



Terminal Pin. No Assignment

Pin No.	Assignment	Pin No.	Assignment
1	AC/L	4	DC OUTPUT -V
2	AC/N	5	DC OUTPUT +V
3	FG $\perp$		

**Output Derating**



**Static Characteristics (24V)**

