INSTALLATION INSTRUCTION # 42E
ELECTRONIC THERMOSTAT

Model No. NGUTC-2030-(program code #)
and
Model No. NGUTC-2230-(program code #)
(with 2-pole circuit breaker)
and
Contactor version
Model No. NGUTC-VPAA-(program code #)

NGUTC electronic thermostats are designed to control one or more heating cables having a total current draw that does not exceed 30 A for the relay version and up to 60 A for the contactor version. They can be fitted with up to three temperature sensors as required by the application. Because separate temperature sensors are used, they may be installed on the pipe during the initial installation phase while the electronic thermostat itself may only be installed at a later date.

Features include:

- Universal power supply allowing operation at 120 to 240 Vac without wiring modifications (Model No. NGUTC-2030-xx & NGUTC-2230-xx). Contactor version allowing operation at 3 phases at 208 V, 480 V & 600 V (Model No. NGUTC-VPAA-xx).
- Internal ground fault detection circuitry eliminating the need for an external ground fault device. It is for NGUTC equipment protection only & does not replace the GFCI designed for electric shock protection. Alarm only or alarm and trip is activated when ground fault condition is present.
- Internal circuitry for load current monitoring.
- Three temperature sensor inputs (RTD): RTD1 for pipe temperature control, RTD2 (when enabled) for pipe temperature control at another location on the piping system and RTD3 (when enabled) might be used as a 3rd temperature control or serve as a high temperature limit for plastic piping protection. An alarm is activated when an enabled “open” or “shorted” sensor is detected.
- Low temperature alarm on both controlling sensors RTD1 and RTD2. Applicable on RTD3 when used as control. Alarm level is factory set at a dedicated level for each sensor.
- USB port for ease of programming using a USB key with factory program codes.
- Override input (factory programmable): timed between 1-48 hours or non-timed.
- On-off control with a 1°C (1.8 °F) temperature differential for accurate control of piping systems. This close tolerance control can save thousands of kilowatt-hours of power consumption and is ideal for controlling electric tracing systems in locations where power is costly.
- Auto-cycle function (when enabled) momentarily turns on heating cable at 24 hours interval to monitor ground fault condition of the load.
- One three-color LED indicator lamp mounted on the enclosure door and connected to the electronic card operates as follows:
  - **Green:** When illuminated, the power supply to the electronic thermostat is ‘on’ and the pipe temperature at the sensor is above the setpoint. When extinguished, the power supply is ‘off’.
  - **Amber:** When illuminated, the electronic thermostat is calling for heat.
  - **Red:** When illuminated, this indicates that one of the alarms has been triggered. The electronic thermostat is not calling for heat.
  - **Amber and Red (alternating):** This indicates that one of the alarms has been triggered. The electronic thermostat is calling for heat.
- Non-volatile memory retains all programmed parameters in the event of a power outage.

- OLED display module indicating alarms, temperature reading & setting, current reading, serial number & software version.

Conducted and radiated emissions FCC/DOC statement of compliance

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the card and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This Class B digital apparatus complies with Canadian ICES-003.

Installation :

- Be sure that the personnel involved in the installation and servicing is qualified and familiar with electrical equipment, their ratings and applicable codes.
- The wide ambient operating temperature range of the electronic thermostat allows installation in any convenient location. Considerations should include exposure to weather elements and accessibility for maintenance and testing.
- Mounting hole positions are shown on the drawing in annexes A, B and C.
- Backplate should be removed from the enclosure before any holes are drilled or cut to prevent damage due to flying debris.
- Conduit/cable entries should be made on the bottom of the enclosure to reduce the possibility of water entry. Avoid having holes drilled on the sides adjacent to the electronic components.
- The user may choose to drill 3 mm (1/8 in) drain holes on the bottom of the enclosure on both the left and right sides (note that drilling holes in the enclosure compromises the Nema 4 rating).
- Use connector bushings suitable for the enclosure type and install such that the completed installation remains waterproof.

Wiring:

- Always verify wiring connections before applying power to the electronic thermostat. To avoid injury or equipment damage, do not install or remove wiring while the electronic thermostat is powered.
- To minimize chance of loose connections, connector operated spring-loaded terminals are used for signal wiring.
- Use shielded, twisted, three-conductor wire for the extension of the RTD leads.
- Shields on the temperature sensor wiring should be grounded only at the card end using the appropriate terminals provided (# 4, 8 and 15).

  Note: Some sensor constructions may have continuity between the drain wire and the metal housing at the tip; in this case, the drain wire should not be connected to ground. Drain wire continuity should be verified with a digital multi-meter.
- To minimize the risk of damage to the electronic thermostat due to a cable fault, the integrity of the heating cable should be verified by:
  - ❖ Performing a high voltage insulation test.
  - ❖ Measuring the load resistance with an ohmmeter.
  - ❖ In both cases, the results should be within proper ranges and recorded for future reference.

Sensor type:

This electronic thermostat can be factory programmed to operate only with 100 ohms @ 0 °C (32 °F) Platinum RTD sensor(s). The last two digits of the electronic thermostat's catalog number indicate the programming code (from 01 to 99). Ensure that the proper type of temperature sensor is used with the electronic thermostat. Program codes are listed in annex F and are identified by a label on the electronic cards.

Sensor location:

- Install the temperature sensor(s) with aluminium foil tape to enhance heat transfer.
- The controlling sensor is to be taped directly to the pipe wall, 180º away from the heating cable (or as far as possible).

- The controlling sensor(s) RTD1, RTD2 & RTD3 (when feature enabled) should be located at the coldest expected point(s) on the piping system.
- If controlling a pipe entering a heated building, the sensor(s) must be located at least 3 m (10 ft) away from the outside wall to avoid inaccurate temperature sensing.
- The high cable temperature sensor RTD3 (when feature enabled) is to be taped to an active heating zone of the heating cable (not to the cold lead), within the heat trace channel.

Note: The accurate identification and positioning of the sensor(s) are essential for efficient and safe operation of the system.

Troubleshooting:

Temperature sensor failure:

This alarm will indicate that one of the sensors is not operating properly. The temperature sensor may fail due to an “open” or “shorted” condition. Ensure that you are using the correct type of sensor i.e.: 3-wire RTD (refer to program code table in annex F), and that it is wired correctly.

Probable causes of alarm:

- Incorrect or damaged field wiring, “open” leads or excess resistance due to broken or damaged wires or loose connections.
- Damaged or inoperative temperature sensor.
- Wrong type of sensor used.

Notes:

- Ensure that the RTD is a 3-wire 100 ohms @ 0 °C (32 °F) Platinum type.
- Disconnect the RTD wiring from the input terminals.
- Measure the resistance between the source (white) and sense (black) leads at the electronic thermostat. It should not exceed 40 ohms. Excessive lead resistance will cause a sensor failure alarm and must be corrected. Look for loose terminals, excessive lead length or insufficient wire gauge and correct as necessary.
- Measure the resistance between the source (white) or sense (black) lead and the common (red) lead of the RTD at the electronic thermostat. It should be between 84 and 178 ohms depending on the probe temperature and lead resistance. To evaluate the temperature at an RTD, measure the resistance from source or sense lead wire to the common lead wire and subtract the resistance measured between source and sense lead wires. The resulting value can be cross-referenced to the table in annex F.
- Verify that the RTD is wired correctly. Refer to the wiring diagram in annex D.
- Ensure that the RTD extension wire (when used) is grounded at one end only, normally on the electronic board.

Low temperature alarm (when enabled):

This alarm will appear when the temperature at the sensor decreases below the low temperature setpoint.

Probable causes of alarm:

- Alarm setpoint too close to maintain temperature setpoint.
- Flow of cold liquid.
- Empty pipe venting to atmosphere.
- Damaged or missing thermal insulation.
- Heating cable not sized properly for the application.
- Damaged heating cable.
- Recent power outage allowing pipe to cool under setpoint.

Seemingly incorrect temperature:

Disconnect the temperature sensor from the input terminals at the electronic thermostat and evaluate the temperature reading.

Notes:

To evaluate the temperature at an RTD, measure the resistance from source or sense lead wire to the common lead wire and subtract the resistance measured between source and sense lead wires. The resulting value can be cross-referenced to the table in annex G.

You can usually determine if the temperature obtained from the list is representative of the conditions on the pipe. If you have more than one sensor installed, you can compare the readings. Note that when comparing values of a sensor on the pipe with a sensor on the heating cable, you should ensure that the heating cable has been de-energized for a substantial period of time to allow for both sensors to be in similar temperature environments.

GFI alarm:

This alarm is caused by a ground fault leakage current in excess of the setting.

Probable causes of alarm:

- Alarm level set too close to normal leakage current.
- Damaged cable insulation or moisture presence.
- Poor cable splice or termination.
- Moisture in enclosure that provides a conductive ground path sufficient to trigger the alarm.

NGUTC-2030 SPECIFICATIONS:

Approvals: CSA "C" - "US" for ordinary locations.

Terminal blocks:

Power terminals for #20 to #6 AWG

Power in: L/L1, N/L2.
Heater out: H1, H2/N.

Signal terminals for #28 to #12 AWG

Sensors:	RTD1 # 1-2-3-4
	RTD2 # 5-6-7-8
	RTD3 # 12-13-14-15*
Alarm relay:	# 9-10-11
Door:	# 16-17
Override input:	# 18-19

*RTD3 can be used as a 3rd temperature control sensor or serve as a high temperature limit for plastic piping protection.

Indicator light: Multi-function three color LED.

Valid temperature range: -5 to +100℃ *(23 to 212 °F)*.

Alarm/Electronic thermostat reset: Push button.

Input voltage range: 120-240 Vac, 50/60 Hz.

Alarm output: 1 A max, 240 Vac max., 50/60 Hz, SPDT (form C) relay output configured for "fail-safe" operation.

Enclosure: Nema 4, gray painted steel with ¼ turn latch.

Power output: 2 pole relay output rated 30 A - 240 Vac.

Monitoring and alarming: The electronics monitor low temperature (when enabled), ground fault current, connected load current, open / shorted temperature sensor(s), high temperature (when enabled) & functional MCU (Heartbeat).

Operating ambient temperature: -40 to +50 °C (-40 to 122 °F).

Current monitoring: Up to 30A.

Display: OLED display module (2 lines x 16 characters) that will indicate alarms, temperatures, load current, GFI, serial number & software version. ON/OFF switch installed inside enclosure.

Programming: USB port to download standard or custom program codes in the electronic card.

FACTORY PROGRAMMABLE:

Low temperature alarm: Feature can be enabled to provide low temperature alarm on RTD1, RTD2 and/or RTD3.

Low temperature setpoint range: -10 to 90°C (*14 to 194 °F*).

Remote override: The user may force the unit on/off via a remote dry contact. Factory adjustable to operate in timed (1-48 hours) or non-timed mode.

Temperature control: Three 3-wire 100 Ω @ 0 °C (32 °F) Platinum RTD (alpha=0,00385 Ω/Ω/°C) lead compensated to 20 Ω per lead.

Control temperature setpoint range: -5 to +100 ℃ *(23 to 212 °F)*.

Deadband: 1 to 5 ℃ *(1.8 to 9 °F)*.

Auto-cycle: The electronic thermostat performs an auto-cycle test (if enabled) by turning on the load to measure the ground fault leakage current when the electronic thermostat is energized and then at 24 hours intervals. If the measured ground fault current is above the set level, the ground fault current alarm is activated.

Ground fault detection: Factory adjustable to trip or alarm only. Setting @ 30 or 100 ma.

High cable temperature: The third temperature sensor (referred to as RTD3) can be used as a high cable temperature limit for plastic piping system protection. When RTD3 is enabled (as high limit option), the high limit feature will override demand for heat and shut off the load when a high cable temperature condition is reached.

High temperature setpoint range: 10 to +100 °C *(50 to 212 °F).*

NGUTC-2230 SPECIFICATIONS:

Same specifications as the NGUTC-2030 with the addition of:

Circuit breaker: 2-pole, 30 A, 240 Vac, pre-wired to the temperature control board.

Terminal blocks: Incoming power lugs at the circuit breaker for: # 14 to # 4 AWG.

CONTACTOR VERSION SPECIFICATIONS:

Same specifications as the NGUTC-2030, except for the following:

Sequence of numbers is: NGUTC-VPAA-xx

'V' in the catalog number denotes the operating voltage, i.e.: 2 for 208, 4 for 480 or 6 for 600.

'P' in the catalog number denotes the number of poles on the circuit breaker, i.e.: 2 or 3.

'AA' in the catalog number denotes the amperage of the circuit breaker, i.e.: 15, 20, 25, 30, 35, 40, 45, 50 or 60.

'xx' in the catalog number denotes the control program code (see ANNEX F).

Input voltage: 208, 480 or 600 Vac, 50/60 Hz, 3-phase / 4-wire.

Power output: 3-pole contactor output rated 60 A – 600 Vac.

Terminal blocks:	Power in terminals;	L1, L2 and L3:	# 14 to # 4 AWG
	Heater terminals;	H1, H2 and H3:	# 14 to # 3 AWG
	Neutral terminals;		# 14 to # 6 AWG

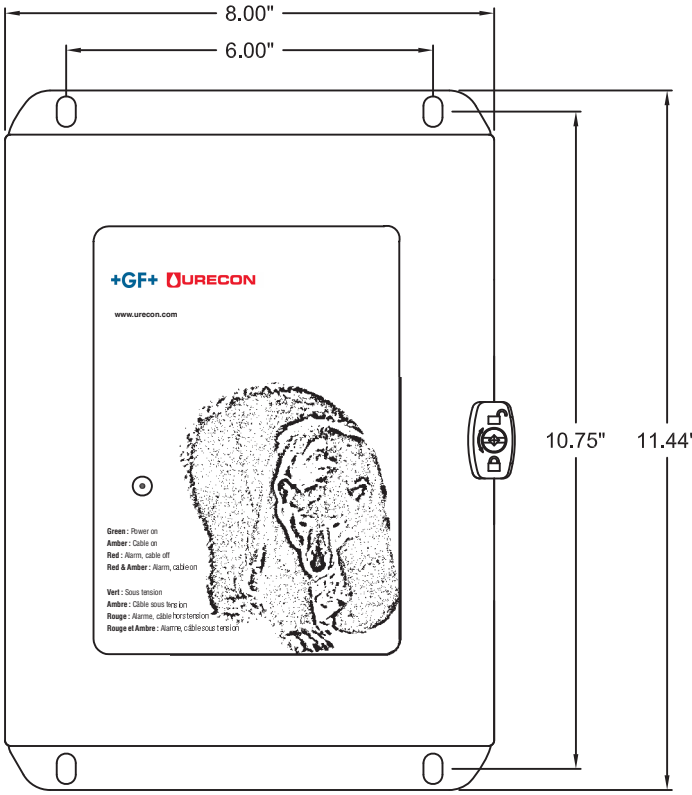
Current monitoring: Up to 60A.

Circuit breaker: 3-pole of the selected amperage, pre-wired to the temperature control board.

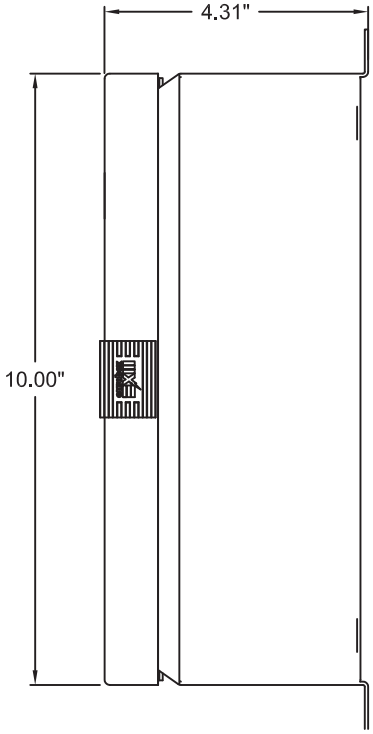
ANNEX **A**

NGUTC-2030

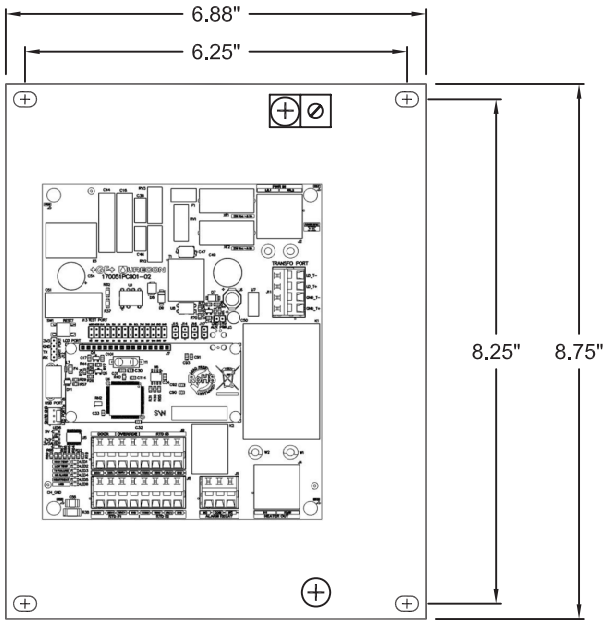
Electronic thermostat



FRONT VIEW



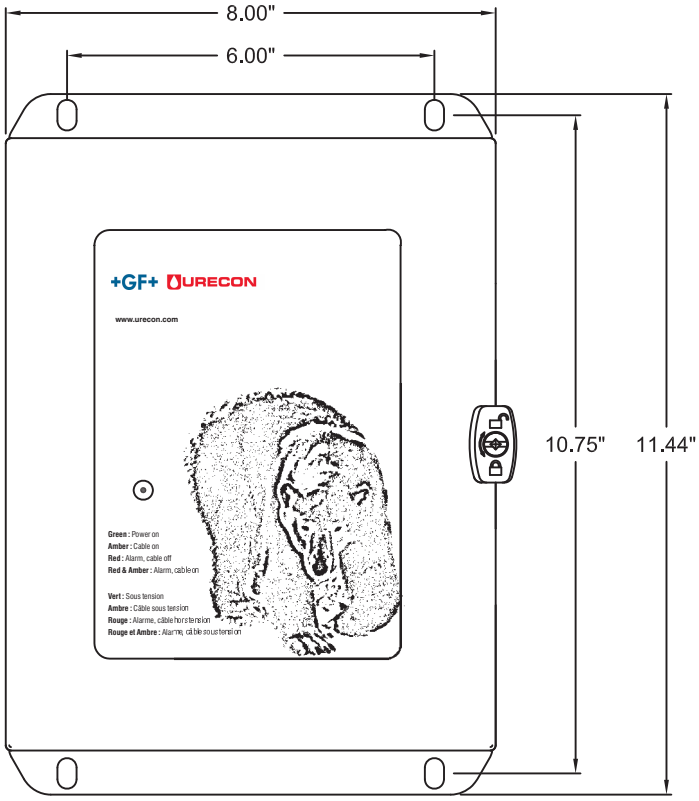
LEFT SIDE VIEW



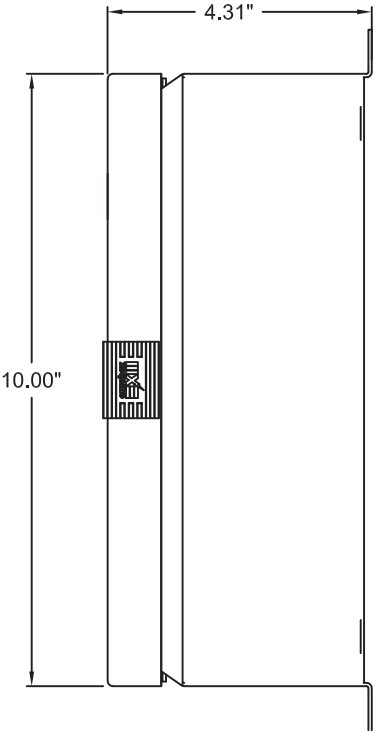
BACKPLATE

ANNEX **B**

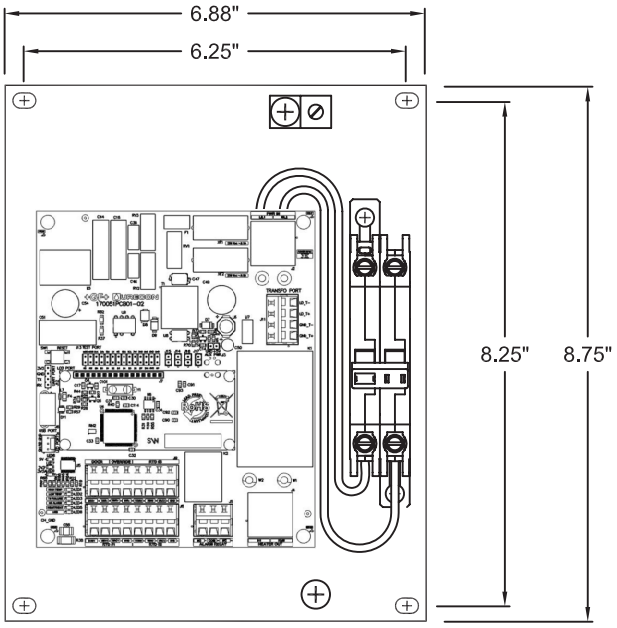
NGUTC-2230
Electronic thermostat



FRONT VIEW



LEFT SIDE VIEW

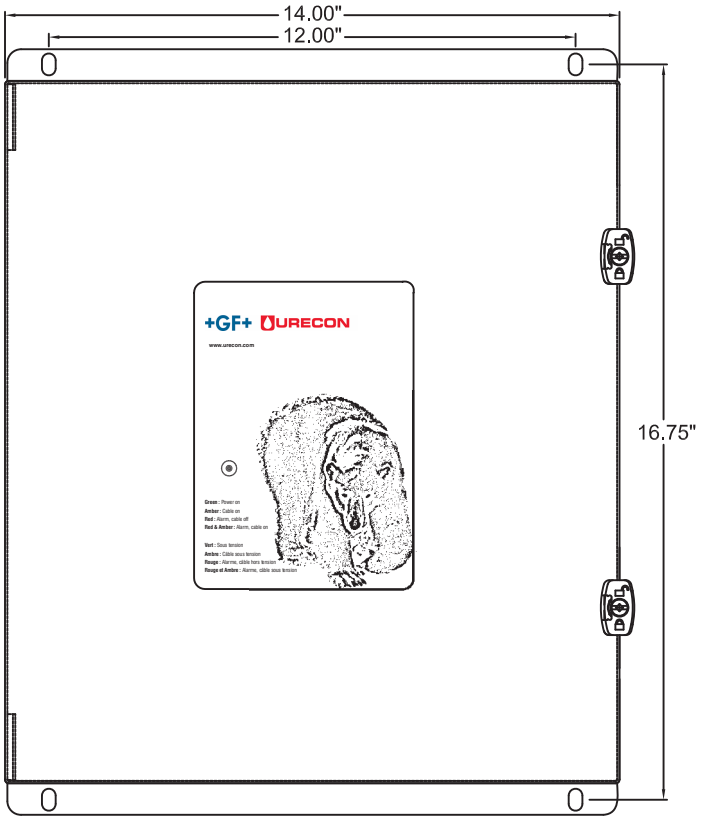


BACKPLATE

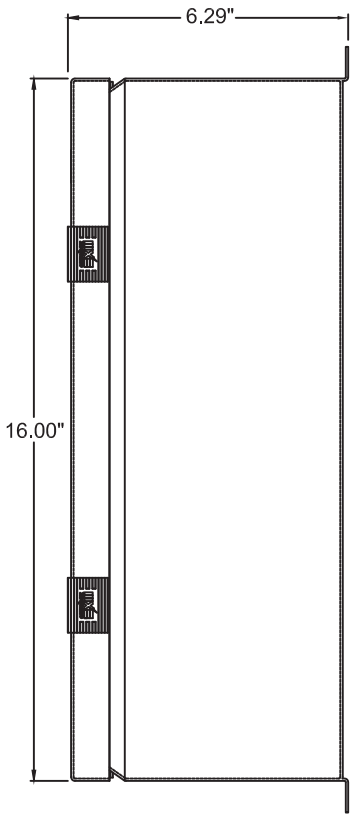
ANNEX **C**

NGUTC-VPAA

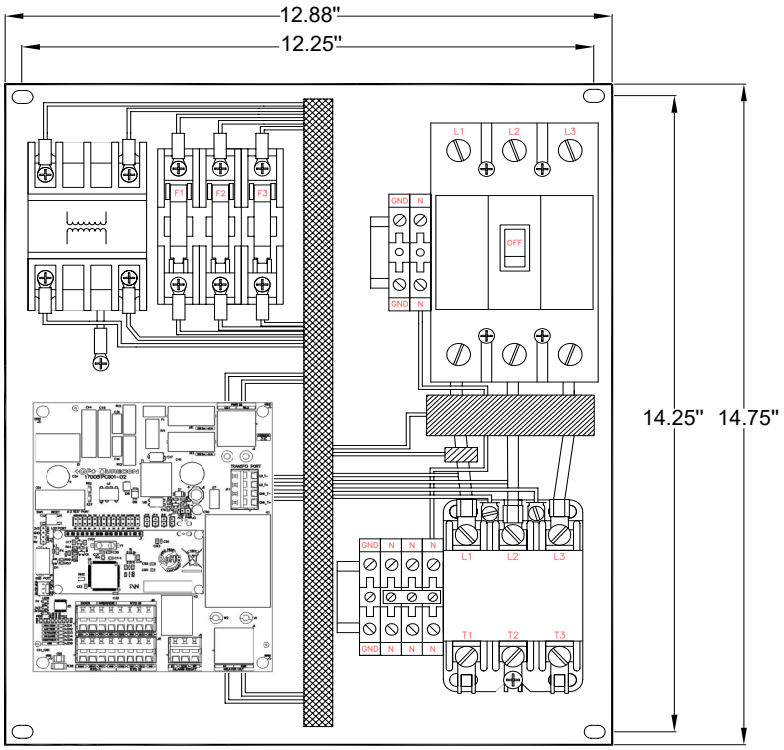
Contactor version electronic thermostat



FRONT VIEW



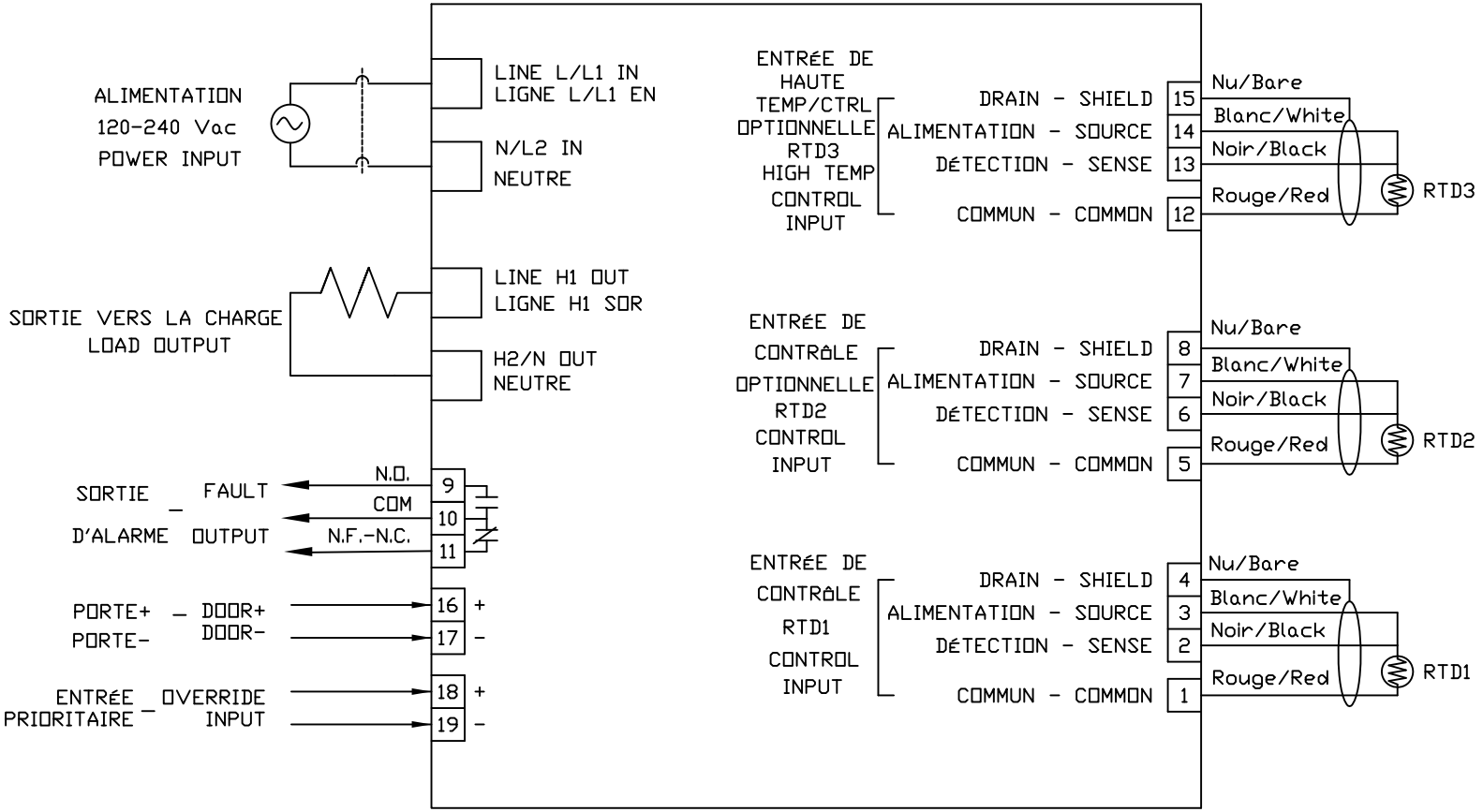
LEFT SIDE VIEW



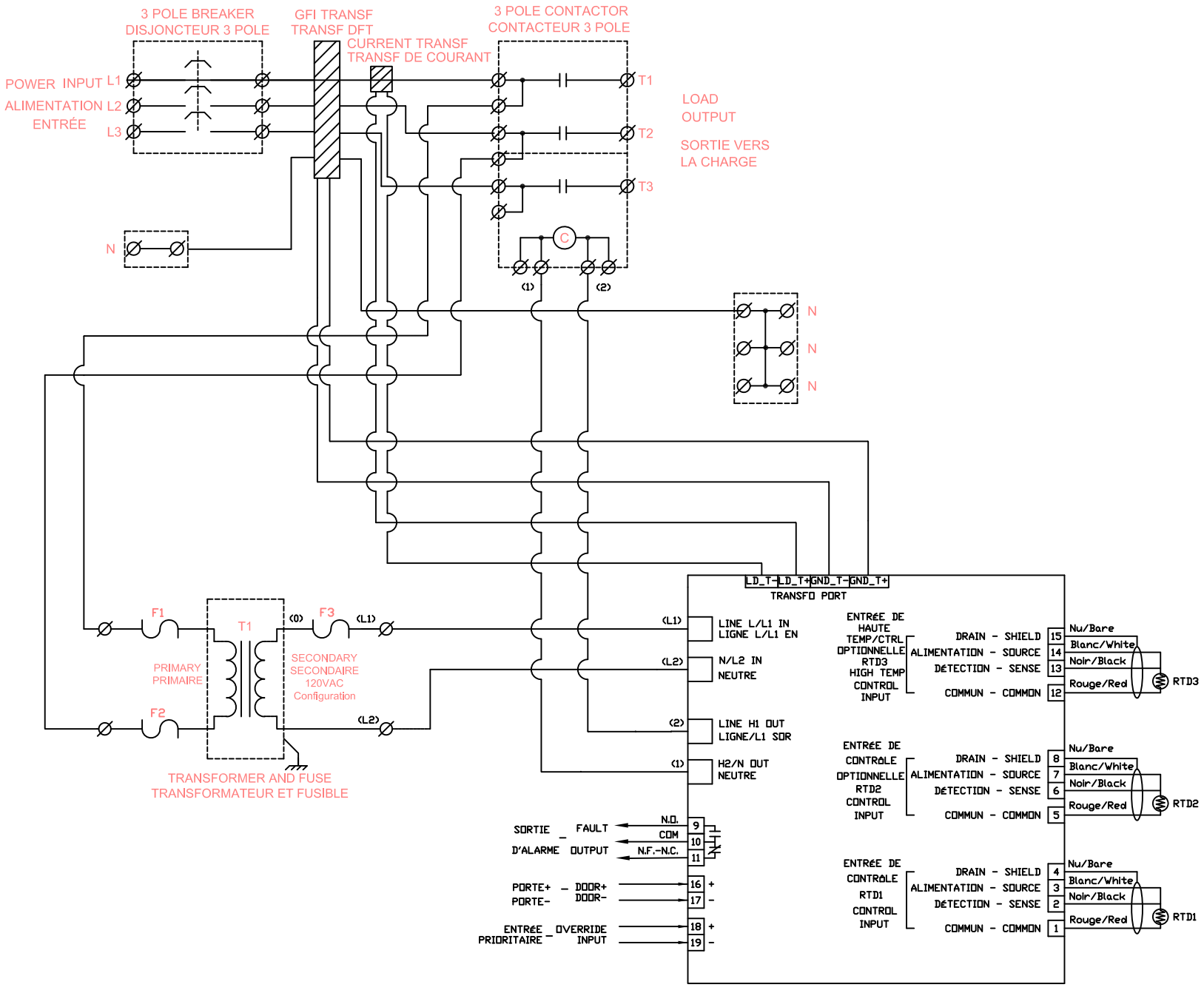
BACKPLATE

ANNEX **D**

Wiring Diagram for NGUTC-2030 & NGUTC-2230



ANNEX **E**
Wiring diagram for NGUTC-VPAA
Contactor version



ANNEX **F**

NGUTC-2030-xx, NGUTC-2230-xx & NGUTC-VPAA-xx

xx is to be replaced by the appropriate program code number

RTD program code		Controlling sensor RTD1 (alarm in subscript)	Controlling sensor RTD2 (alarm in subscript)	High temperature sensor RTD3	Controlling sensor RTD3 (alarm in subscript)
FOR PLASTIC PIPE	01	3 °C (37.4 °F)	-	65 °C (149 °F)	-
	02	3_{1} °C ($37.4_{33.8}$ °F)	-	65 °C (149 °F)	-
	03	5 °C (41 °F)	-	65 °C (149 °F)	-
	04	5_{3} °C ($41_{37.4}$ °F)	-	65 °C (149 °F)	-
	05	10 °C (50 °F)	-	65 °C (149 °F)	-
	06	10_{5} °C (50_{41} °F)	-	65 °C (149 °F)	-
	07	15 °C (59 °F)	-	65 °C (149 °F)	-
	08	15_{10} °C (59_{50} °F)	-	65 °C (149 °F)	-
	09*	40.5 °C (105°F)		85 °C (185 °F)	-
	11	3 °C (37.4 °F)	3 °C (37.4 °F)	65 °C (149 °F)	-
	12	3_{1} °C ($37.4_{33.8}$ °F)	3_{1} °C ($37.4_{33.8}$ °F)	65 °C (149 °F)	-
	13	5 °C (41 °F)	5 °C (41 °F)	65 °C (149 °F)	-
	14	5_{3} °C ($41_{37.4}$ °F)	5_{3} °C ($41_{37.4}$ °F)	65 °C (149 °F)	-
	15	10 °C (50 °F)	10 °C (50 °F)	65 °C (149 °F)	-
	16	10_{5} °C (50_{41} °F)	10_{5} °C (50_{41} °F)	65 °C (149 °F)	-
	17	15 °C (59 °F)	15 °C (59 °F)	65 °C (149 °F)	-
	18	15_{10} °C (59_{50} °F)	15_{10} °C (59_{50} °F)	65 °C (149 °F)	-
	19*	41 °C (105.8°F)	41 °C (105.8°F)	85 °C (185 °F)	-
FOR METAL PIPE	21	3 °C (37.4 °F)	-	-	-
	22	3_{1} °C ($37.4_{33.8}$ °F)	-	-	-
	23	5 °C (41 °F)	-	-	-
	24	5_{3} °C ($41_{37.4}$ °F)	-	-	-
	25	10 °C (50 °F)	-	-	-
	26	10_{5} °C (50_{41} °F)	-	-	-
	27	15 °C (59 °F)	-	-	-
	28	15_{10} °C (59_{50} °F)	-	-	-
	31	3 °C (37.4 °F)	3 °C (37.4 °F)	-	-
	32	3_{1} °C ($37.4_{33.8}$ °F)	3_{1} °C ($37.4_{33.8}$ °F)	-	-
	33	5 °C (41 °F)	5 °C (41 °F)	-	-
	34	5_{3} °C ($41_{37.4}$ °F)	5_{3} °C ($41_{37.4}$ °F)	-	-
	35	10 °C (50 °F)	10 °C (50 °F)	-	-
	36	10_{5} °C (50_{41} °F)	10_{5} °C (50_{41} °F)	-	-
	37	15 °C (59 °F)	15 °C (59 °F)	-	-
	38	15_{10} °C (59_{50} °F)	15_{10} °C (59_{50} °F)	-	-

***Usually for grease lines**

Note: Other program codes available, contact GF Urecon for more details.

FOR METAL PIPE	41	3 °C (37.4 °F)	3 °C (37.4 °F)	-	3 °C (37.4 °F)
	42	3_{1} °C ($37.4_{33.8}$ °F)	3_{1} °C ($37.4_{33.8}$ °F)	-	3_{1} °C ($37.4_{33.8}$ °F)
	43	5 °C (41 °F)	5 °C (41 °F)	-	5 °C (41 °F)
	44	5_{3} °C ($41_{37.4}$ °F)	5_{3} °C ($41_{37.4}$ °F)	-	5_{3} °C ($41_{37.4}$ °F)
	45	10 °C (50 °F)	10 °C (50 °F)	-	10 °C (50 °F)
	46	10_{5} °C (50_{41} °F)	10_{5} °C (50_{41} °F)	-	10_{5} °C (50_{41} °F)
	47	15 °C (59 °F)	15 °C (59 °F)	-	15 °C (59 °F)
	48	15_{10} °C (59_{50} °F)	15_{10} °C (59_{50} °F)	-	15_{10} °C (59_{50} °F)

ANNEX **G**

Temperature sensors used with NGUTC electronic thermostats

Platinum RTD (Current model) Of 100 ohms @ 0°C (32 °F)	
Temperature	**Resistance**
-40 °C (-40 °F)	84.27 Ω
-35 °C (-31 °F)	86.25 Ω
-30 °C (-22 °F)	88.22 Ω
-25 °C (-13 °F)	90.19 Ω
-20 °C (-4 °F)	92.16 Ω
-15 °C (5 °F)	94.12 Ω
-10 °C (14 °F)	96.09 Ω
-5 °C (23 °F)	98.04 Ω
0 °C (32 °F)	100.00 Ω
5 °C (41 °F)	101.95 Ω
10 °C (50 °F)	103.90 Ω
15 °C (59 °F)	105.85 Ω
20 °C (68 °F)	107.79 Ω
25 °C (77 °F)	109.73 Ω
30 °C (86 °F)	111.67 Ω
35 °C (95 °F)	113.61 Ω
40 °C (104 °F)	115.54 Ω
45 °C (113 °F)	117.47 Ω
50 °C (122 °F)	119.40 Ω
55 °C (131 °F)	121.32 Ω
60 °C (140 °F)	123.24 Ω
65 °C (149 °F)	125.16 Ω
70 °C (158°F)	127.07 Ω
75 °C (167 °F)	128.98 Ω
80 °C (176 °F)	130.89 Ω
85 °C (185 °F)	132.80 Ω
90 °C (194 °F)	134.70 Ω
95 °C (203 °F)	136.60 Ω
100 °C (212 °F)	138.50 Ω