



closing the loop on thermal solutions

ISO 9001: 2008 REGISTERED COMPANY

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HALO® 7000 Temperature Controller and Sentinel® Heaters

Guideline for Designing and Installing Master/Slave Thermal System

Durex Industries HALO 7000 temperature controller and SENTINEL silicone rubber heaters can be applied independently or together as part of a thermal system. This document provides technical guidance for designing and installing a master/slave thermal system using HALO and SENTINEL. Master/Slave is a model of communication where one device or process has unidirectional control over one or more other devices.

A HALO and SENTINEL master/slave thermal system is an electrical circuit including:

- 1 Durex Industries HALO 7000 Temperature Controller
- 1 Durex Industries master SENTINEL Gas or Pump Line Heater with integral process temperature sensor and temperature limit sensor
- 1 or more slave heaters
- Any wire harness with specified connectors, terminal pins, and strain reliefs
- 1 GFCI power cord assembly

Master/Slave Best Practice Guidelines:

1. Correctly manufactured wire harnesses are critical for thermal system operation and safety. Our recommendation is that wire harnesses be purchased directly from Durex. However, if a company or individual decides to manufacture their own wire harness, ALWAYS:
 - a. Use the connector housings and terminal pins identified in this guideline. Use of any substitute connector housing and or terminal pin will result in failure.
 - b. Use wire crimper Molex 63819-0900 and follow the crimper manufacturer's instructions. Incorrectly crimped terminals may result in temperature rise and possible failure of the heaters and/or the HALO temperature controller.



(continued on page 2)

HALO and SENTINEL Installation Instructions

HALO Model and Component Part Numbers

HALO Temperature Controller: HA7000

Cable/Connector Part Numbers: *(Cable assemblies are normally supplied directly from Durex or users can build their own cable assemblies using the following components.)*

■ 6 Pin Power/Alarm Connector

- Mating Connector Housing: Molex 30-01-2060
- Terminal Pin: Molex 45750-1112 (18 AWG)
Molex 45750-3112 (16 AWG)
- Strain Relief: Amp Duac 1375618-1

■ 8 Pin Thermocouple and Heater Connector

- Mating Connector Housing: Molex 30-01-2080
- Terminal Pin: Molex 45750-1112 (18 AWG)
Molex 45750-3112 (16 AWG)
- Strain Relief: Molex 15-04-0343

■ 6 Pin Modbus R/S 485 Communications Connector

- Mating Connector Housing: Molex 794617-6
- Terminal Pin: Molex 1-794606-1

■ 4 Pin Digital Input/Output Connector

- Mating Connector Housing: Molex 794618-4
- Terminal Pin: Molex 1-794606-1



HALO Installations

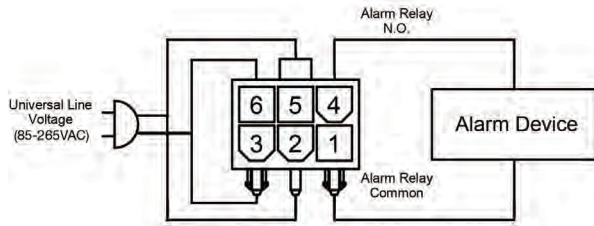
For Use In Semiconductor Manufacturing Equipment / Facilities in accordance with SEMI S2-310C and/or SEMI S22-1110b. HALO temperature controller may also be used as an internal control / component part in non-Semiconductor Manufacturing Equipment or the equivalent.

2. Balanced thermal design is critical for uniform heating. The thermal mass and conductivity of stainless steel piping varies with component type. For example, valves have a different thermal mass than straight heaters. Never mix master/slave heaters on stainless steel components with different thermal mass. Different lengths of straight piping can be used, so long as they have the same wall thickness. SENTINEL heaters are designed and manufactured with a nominal watt density, so straight heaters will ramp to temperature at approximately the same rate in a thermal system.
3. Always, locate the master SENTINEL heater at the environmental location where the fastest temperature rise will occur. Environmental variables such as air flow and vertical or horizontal orientation, although minor may result in different heating rates than the master and slave SENTINEL heater on the location.
4. Never integrate heated, non-heated and/or non-insulated stainless steel components within a master/slave thermal system. Like thermal masses should be contiguous for master/slave thermal systems. For example, do not separate the master SENTINEL heater from a slave SENTINEL heater with a non-heated or non-insulated ball or isolation valve nor any other different thermal mass assembly. The exception is use of SENTINEL insulators on flanges. A master or slave SENTINEL heater can be separated by an insulated non-heated or heated flange. A flange heater should not be a master heater.
5. Never include a valve in a master slave system. The large thermal mass of the valve bodies require independent HALO temperature controllers.
6. SENTINEL heaters are wired in a master/slave configuration using the Durex wiring diagram below. The master/slave heaters are wired in parallel for a total current of up to 10 amps. Always, use a SENTINEL master heater with two temperature sensors. One temperature sensor is for control in process temperature and the second temperature sensor is for high temperature alarm.
7. Monitor the functional operation of master/slave SENTINEL heaters by using the current (I) monitoring function in the HALO temperature controller. Current monitoring validates that the master/slave SENTINEL heaters are energizing and de-energizing in response to the master SENTINEL heater process demand. If one or more of the slave SENTINEL heaters are not functioning, the HALO temperature controller can signal an alarm condition. See User Manual for set-up of the current monitoring function.
8. HALO temperature controller dimensions and mounting.

HALO® and SENTINEL® Wiring Diagrams

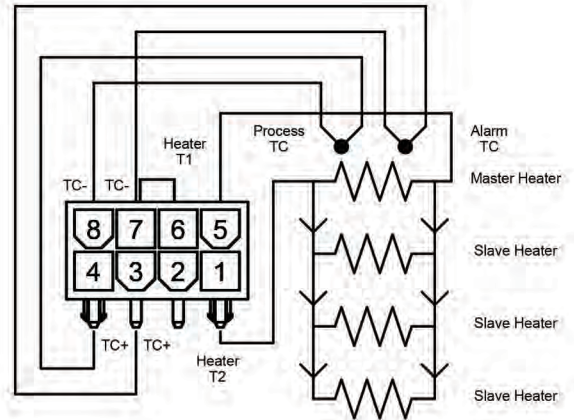
All diagram views looking into the HALO Temperature Controller

HALO Power Connector



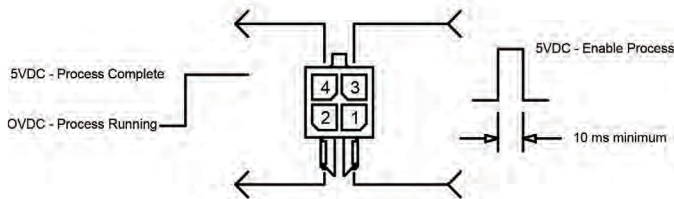
1. Alarm Relay Common
2. L1 (Black)
3. L2
4. Alarm Relay N. O.
5. L1 (Black)
6. L2

HALO Heater and Sensor Connector



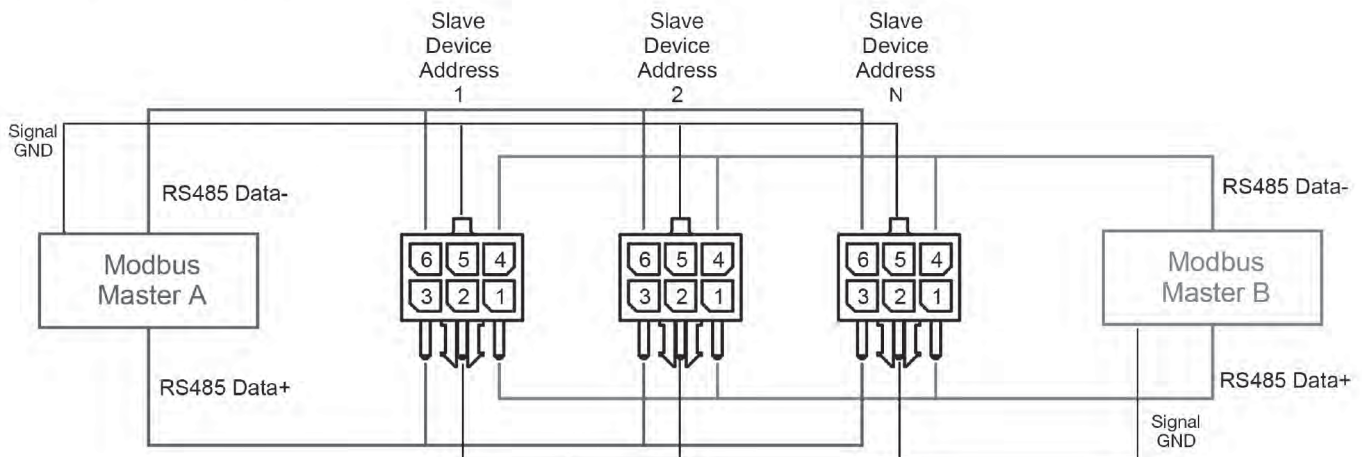
1. Heater T2
2. NC
3. Alarm TC + (Yellow)
4. Process TC + (Yellow)
5. Heater T1
6. NC
7. Alarm TC - (Red)
8. process TC - (Yellow)

HALO Digital Input/Output Connector



1. Digital GND
2. Digital GND
3. Digital In - Enable
4. Digital Out - Process Complete

HALO Modbus RS485 Dual Master Connector

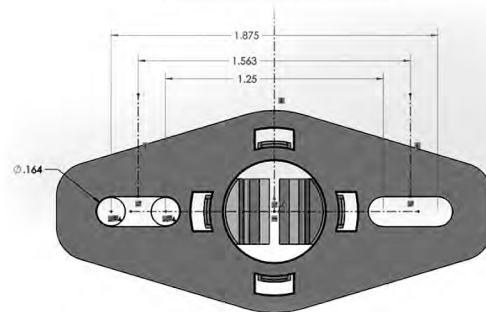
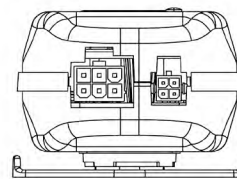
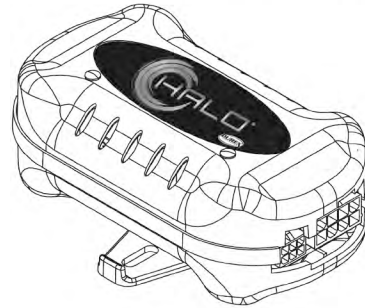
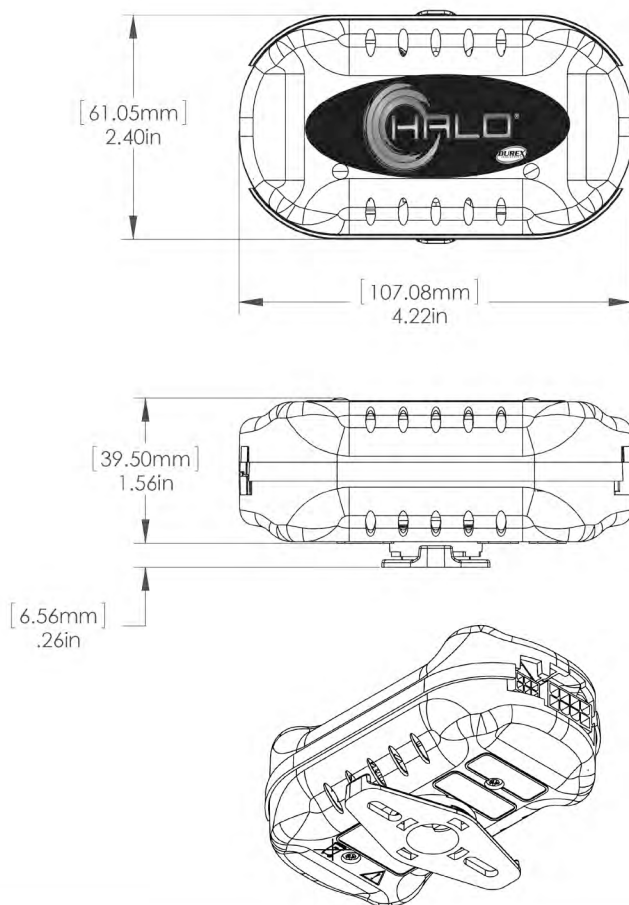


1. RS485 Node 1 Data +
2. Signal GND
3. RS485 Node 2 Data +
4. RS485 Node 1 Data -
5. Signal GND
6. RS485 Node 2 Data -

HALO Dimensions and Universal 1/8 Turn Mounting Bracket

The Universal 1/8 turn Mounting Bracket provides flexible vertical or horizontal mounting directly on the gas line or in a control panel. Mounting flexibility allows use of straps on the gas lines, din rail mounting, or screw fasteners.

HALO Temperature Controller Dimensions



HALO Temperature Controller Mounting Bracket

EN 60519-2:2006 Safety in electroheat installations - Part 2: Particular requirements for resistance heating equipment.

In addition to national and regional safety requirements, Durex Industries always recommends that users follow best safety practice guidelines found in international standard EN 60519-2:2006. At a minimum, the user should:

- Practice generally accepted safe practices when installing and using this product. Installation shall be performed only with non-energized units.
- Follow all local wiring standards when supplying mains power to this product.
- Implement a leakage current detection system such as a GFCI.
- If a temperature limiting safety devices option is not included in the product the user shall implement a method of detecting and preventing an over temperature condition.
- Do not exceed maximum 200°C operating temperature of Durex Industries SENTINEL heaters. SENTINEL heaters maximum operating temperature is base on a 25 °C ambient temperature.
- Disposal of all Durex Industries products must conform to all appropriate local codes.
- Warning! If this product is ignited due to external sources, carbon dioxide, silicon dioxide, formaldehyde, and metal oxides may be emitted .

Warning:

Only use Durex Industries recommended components and design guidelines. Failure to follow Durex Industries components and guidelines may result in a sub-optimal thermal performance and safety hazard.