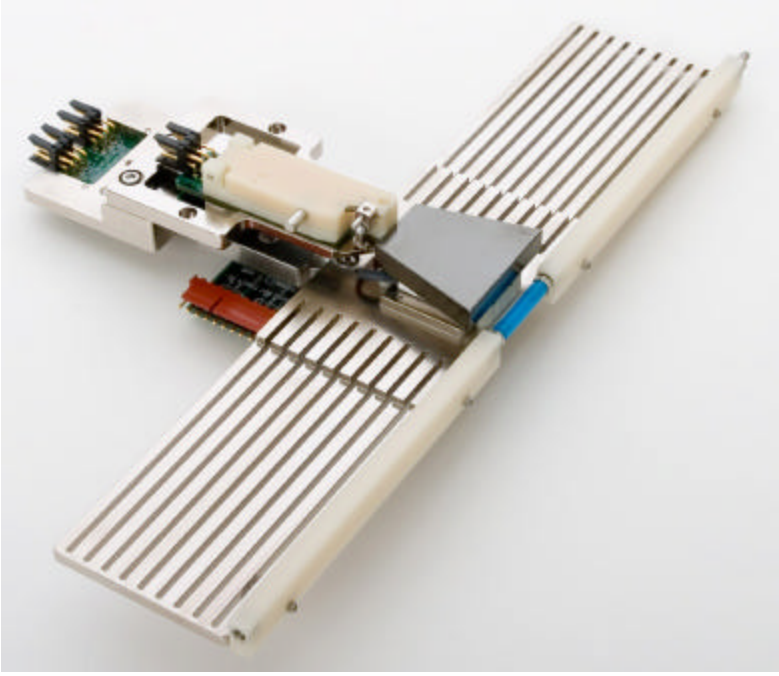

Hot/Cold System Manual

Integral Solutions Int'l

– QPS-1050 H/C –

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Contents

Caution: Hot/Cold surface can get very cold or very hot; take care not to come into close contact with it.

1. Installation

1.1.Overview

Hot/Cold system is used to vary temperature of MR heads. Hot/Cold system is usually used together with QST-2002 so that quasi-static tests can be performed while a head is subjected to different temperatures.

Hot/Cold system consists of 3 modules: QPS-1050 H/C, Watlow96 temperature controller and hot/cold finger base assembly. Watlow96 temperature controller is mounted on the front plate of QPS-1050H/C (Fig 5). Hot/Cold finger base assembly is connected to QPS-1050 H/C via a Hot/Cold custom cable (Fig 1). System uses air to cool down the heat sinks that are located on the Hot/Cold finger base assembly. Pressure line which can provide at least 20 PSI must be connected to the in-inlet in the back of QPS-1050 H/C. Pneumatics cable from the Hot/Cold finger base assembly must be connected in the out-outlet in the back of QPS-1050 H/C. Communications between controller and computer are done through DB-9 pin cable (Fig 2) which plugs in the back of QPS-1050 H/C.

1.2.Step by Step Installation Procedure

Parts

Figure 1 - Hot/Cold Custom Cable

Figure 2 - DB-9 Pin cable

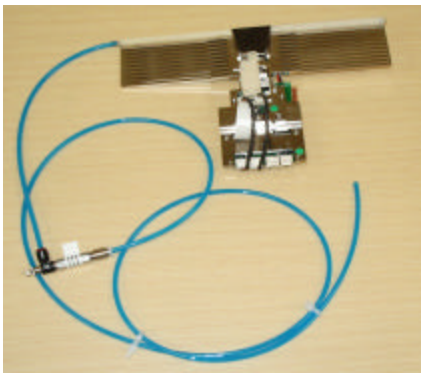

Figure 3 - Pneumatics Cable from Hot/Cold Finger Base Assembly

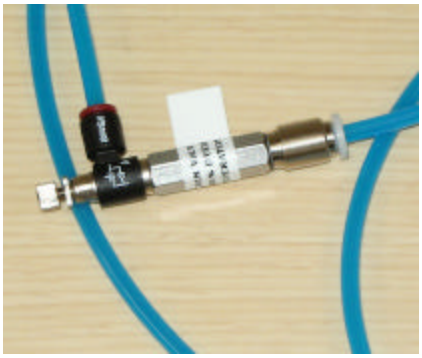

Figure 4 - Flow Control Valve

Figure 5 - QPS-1050 H/C and Watlow96

a. Connect Blue pneumatics cable from Hot/Cold finger base assembly to the "Air Out" outlet in the back of the QPS-1050 H/C (Fig 6).
b. Connect pressure from outside cable to "Air In" inlet in the back of the QPS-1050 H/C. (There is a pressure regulator inside QPS box; it is set to 15 PSI.)
c. Open Flow Control Valve (Fig 4), one attached to the tooling all the way to allow maximum air flow.
d. Connect a Hot/Cold custom cable (Fig 1) from the tooling to QPS-1050H/C.
e. Connect the female end of DB-9 cable (Fig 2) to computer's I/O port and connect the other end to connector on the back of QPS-1050H/C.
f. Power up QPS-1050 H/C from the standard 115V AC outlet.
g. Hot/Cold finger base assembly can then be mounted on a QST-2002.

Figure 6 – QPS 1050 H/C Connections

2. ***Maintenance***

a. Do not operate the system with air line disconnected or Flow Control valve closed; this will cause system to overheat.
b. If too much condensation develops on the Hot/Cold surface, wipe it off periodically.
c. Check temperature of the Hot/Cold surface once every 2 weeks, if difference is too large, system may need to be recalibrated. (See section 4 for calibration procedure.)
d. Avoid touching the Hot/Cold black coated surface with fingers, at high temperatures fingerprints can become permanent.

3. ***Software***

Software that controls Watlow96 can be started through Quasi 97 software or by double clicking on Watlow96.exe.
Executable is located in C:\Program Files\Integral Solutions Int'l\LS340.

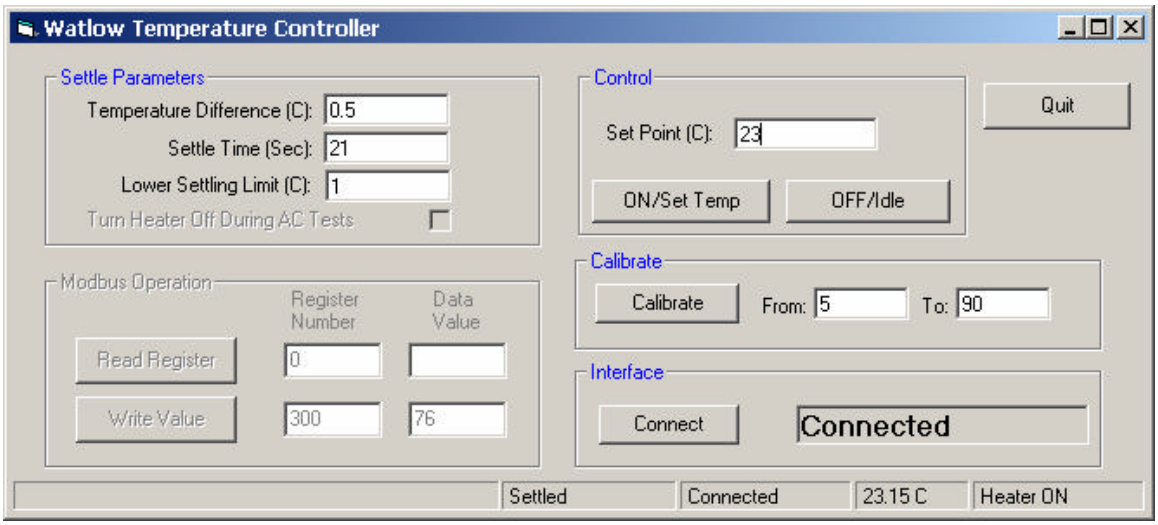

Figure 7 - Main Screen

To start through Quasi97:

1. Start Quasi97
2. Once Quasi97 main window opens, select Add-ins→Selected Modules; select TempApp.Application, by putting a check in the enable column. Close menu.
3. From the menu that opens up next, select Watlow96 from the list of controllers and click OK.

Figure 8 - Watlow96 Module Selection

4. From the newly added temperature tests, select Temperature test.
5. On the Temperature test screen, click on Temp Controller Setup button, this will bring up temperature controller screen.

3.1.Control Frame

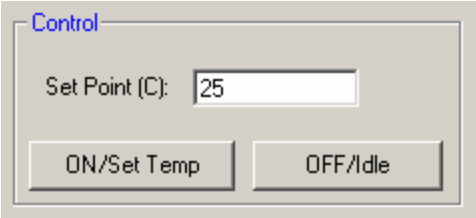

Figure 9 - Control Frame

Set Point (C)	Used to specify what temperature Hot/Cold plate needs to be. (Note: that changing value in the text field does not set the set point, temperature will not be set until ***ON/Set Temp*** button is pressed.) Currently the working temperature range is from 5ºC to 100ºC. Controller will not accept temperatures from outside working range.
ON/Set Temp	***On/Set Temp*** button programs *Set Point 1* register of the controller with value from ***Set Point (C)*** text field and waits until temperature of the Hot/Cold plate reaches the value specified in ***Set Point (C).*** If controller is in idle mode, ***On/Set Temp*** will take controller out of idle mode, program register and wait until Hot\Cold surface reaches programmed temperature.
OFF/Idle	***OFF/Idle*** will put controller into idle mode. Controller will not try to control temperature anymore. If left for a long time in idle state, temperature of Hot/Cold surface will eventually reach room temperature.

3.2.Settle Parameters

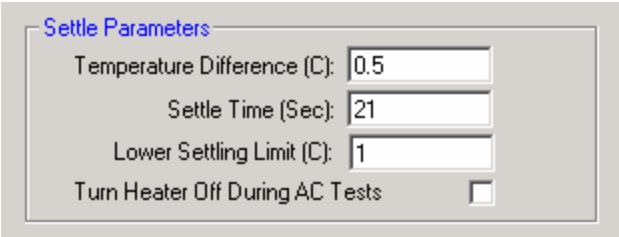

Figure 10 - Settle Parameters Frame

Temperature Difference (C) Settle Time (Sec)	Software uses Temperature Difference to determine if temperature of the H/C surface has settled. Software uses Settle Time to determine if temperature of the H/C surface has settled.
Temperature is considered settled when: Set Point - Temperature Difference < Temperature H/C Surface < Set Point + Temperature Difference; this must be valid for Time = Settle Time	
Lower Settling Limit (C)	Currently not used.
Turn Heater Off During AC Tests	Currently not used.

Whenever value of set point register is changed, controller tries to drive temperature of H/C surface to match value of new set point. Some overshoot usually occurs when set point is changed. Controller uses ramping to minimize the overshoot. However, overshoot can not be eliminated completely; temperature can still overshoot by several degrees.
Controller does not have a settling state, after controller exits ramp mode it tries to drive temperature closer to setpoint, and software is used to simulate a settling state. Settling state is basically a user-controlled delay. Two parameters settle time and temperature difference, can be used to wait (before running tests) until temperature stops fluctuating too much or if time is a concern and temperature accuracy is not an issue time spend in the settling state can be minimized.
Control over settling is left up to the user. Specifying longer settling time and smaller temperature difference will although take longer time to settle, but after software exits settling mode and begins running tests, temperature of H/C surface will be closer to the setpoint and will oscillate less because it stayed in the settling state longer. On the other hand shorter settle time and larger temperature difference will force software to transition from settle state faster, but temperature of H/C surface still may oscillate because time spent in settling stage was not sufficient.

3.3.Calibrate

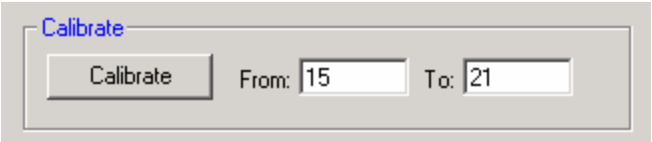

Figure 11 - Calibration Frame

To calibrate the controller, first enter the temperature range that tests are to be performed within. (Temperature values must be within controllers working range 5ºC to 100ºC) Press Calibrate, controller will then ramp to 4 different set points, after settling at each set point, software will prompt for the temperature of test surface. Measure test surface with a temperature sensor (not supplied), enter that temperature into the prompt and press OK. After calibration is complete temperature displayed in the software will be adjusted, please note that the temperature on the screen of the controller may not match the temperature on the computer screen. This is OK; do not use temperature reading on Watlow screen as this temperature is uncalibrated.
Calibration values are saved in the setup file (Watlow96.txt) when software is turned off.

3.4.Interface

Figure 12 - Interface Frame

Interface shows status of the connection between controller and the computer. It will display either connected of not connected. Each time software is started, there are attempts to establish the connection with the controller, if it is unsuccessful, an error message will be displayed and status set to Not Connected. Pressing connect button will try to establish/re-establish a connection with the controller.
If attempts to establish connection are unsuccessful, check if DB-9 cable is connected at both ends. DB-9 cable is used for communication between controller and the computer (step (e) in installation procedure). System will also not be able to establish connection if QPS-1050 H/C is not powered up.

3.5.Modbus Operation

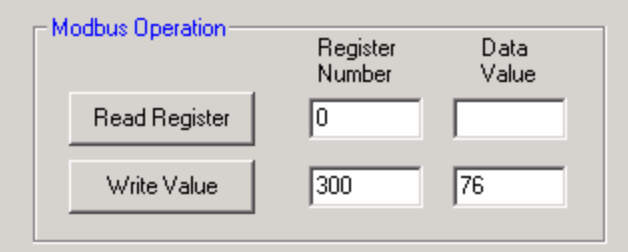

Figure 13 - Modbus Frame

Read/Write Register allows user to access registers of the controller. Buttons in this frame are password protected and are only used for troubleshooting during initial system bring up. It is not recommended that user change values of any register as it may alter operations of the temperature controller. ***In fact changing values in the register will void the ISI warranty.***

To read the value of the register, enter register address in register number field and press Read Register; the value will appear in Data Value field.

To write value to the register, enter register address in register number field, enter value to be written into Data Value field and press Write Register.

For the description of the registers and their values consult "Watlow Series 96 User's Manual" (http://www.watlow.com/products/controllers/co_96.cfm).

3.6.Status Bar

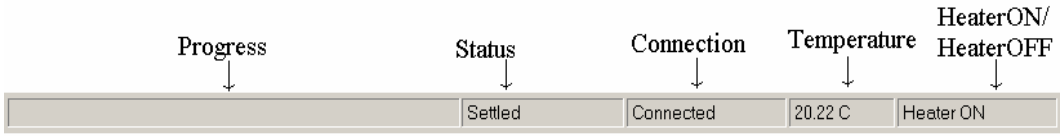

Figure 14 - Status Bar

Status	Displays the status of the controller, can either be (ramping, settling, settled or idle)
Connection	Displays whether there is a connection between computer and the controller.
Temperature	Displays temperature, in degrees Celsius, of the Hot/Cold test surface. Upon calibration, this field will display calibrated temperature.
Power (HeaterON/ HeaterOFF)	Displays whether controller is powered on (using energy to maintain specified set point) or powered off (monitors temperatures of the test surface but does not control it, acts as thermometer).
Progress	Displays progress during ramping and settling.

3.7.Quit

Quit button puts controller into idle mode (temperature sensing, but not controlling) and closes software window.

4. ***Calibration Procedure for Watlow96 Temperature Controller.***

Note: This calibration assumes that software is running through Quasi97 software. If calibration needs to be done in standalone mode, proceed to step 6 of this procedure.

1. Start Quasi97
2. Once Quasi97 main window opens, select Add-ins→Selected Modules; select TempApp.Application, by putting a check in the enable column. Close menu.
3. From the menu that opens up next, select Watlow96 from the list of controllers and click OK. (see figure 7)
4. From the newly added temperature tests, select Temperature test.
5. On the Temperature test screen, click on Temp Controller Setup button, this will bring up temperature controller screen.

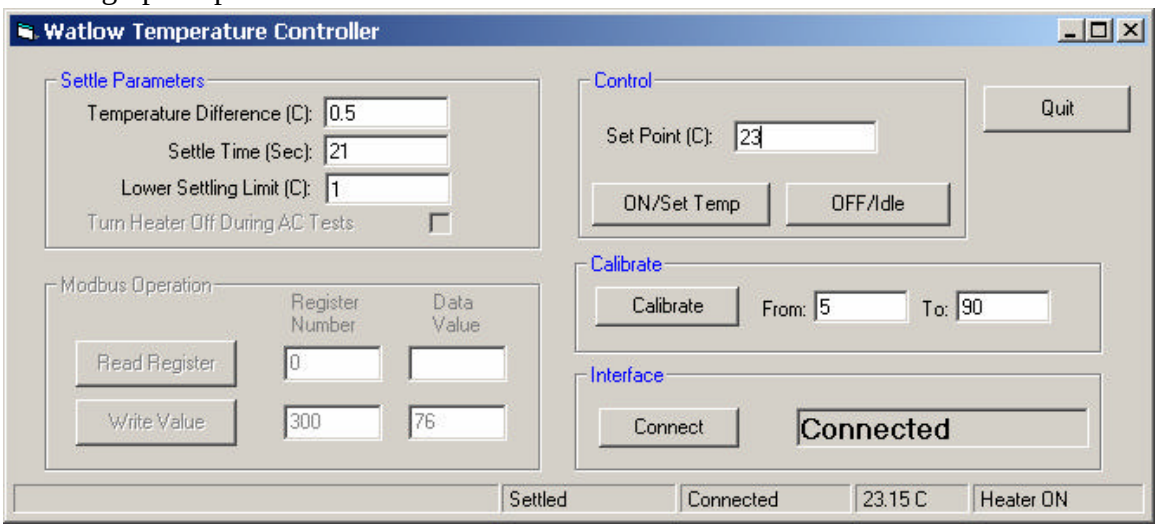

Figure 15 - Main Screen

6. In the "Watlow Temperature Controller" menu, find calibration frame. In the fields *From:* and *To:* specify the calibration range. (Note that calibration range must reflect your working temperature range. i.e. if you plan to sweep from 10C to 60C during your tests, when calibrating put *From: 5*; *To: 65*. Calibration range must also be within controllers working range.)
7. Click on Calibrate.
8. Controller will first set temperature specified in the *To:* field and ramp to that temperature. Once temperature settles, you will be prompted to input the temperature of the test surface. (Test surface is the surface where heads under test will rest. You will need to measure temperature of the test surface using a thermometer.) Enter the temperature you got on external thermometer into the prompt box and press enter.
9. Controller then will set another temperature, this time in the middle of the specified range, (there will be total of 4 test points for calibration, 2 extremes and 2 in-betweens and each time there will be a prompt for temperature as measured by external thermometer.

10. Once temperature is calibrated, temperature displayed on the screen will be adjusted to reflect the calibration.
    NOTE: That temperature on the controller itself will not be adjusted, only temperature on the computer monitor.
11. Calibration factors are saved to the setup file at the time software is turned off. This file is located at:
    C:\Program Files\Integral Solutions Int'l\LS340\Watlow96.txt

5. ***Running through Quasi97 software.***

a. Start Quasi97 software.

b. Once Quasi97 main window opens, if not already done, select Add-ins→Selected Modules; select TempApp.Application, by putting a check in the enable column. Close menu.

c. From the menu that opens up next, select Watlow96 from the list of controllers and click OK. This will add TempApp.Application tests to the list of tests on the left. TempApp contains two tests: Temperature and TempCont Transfer.

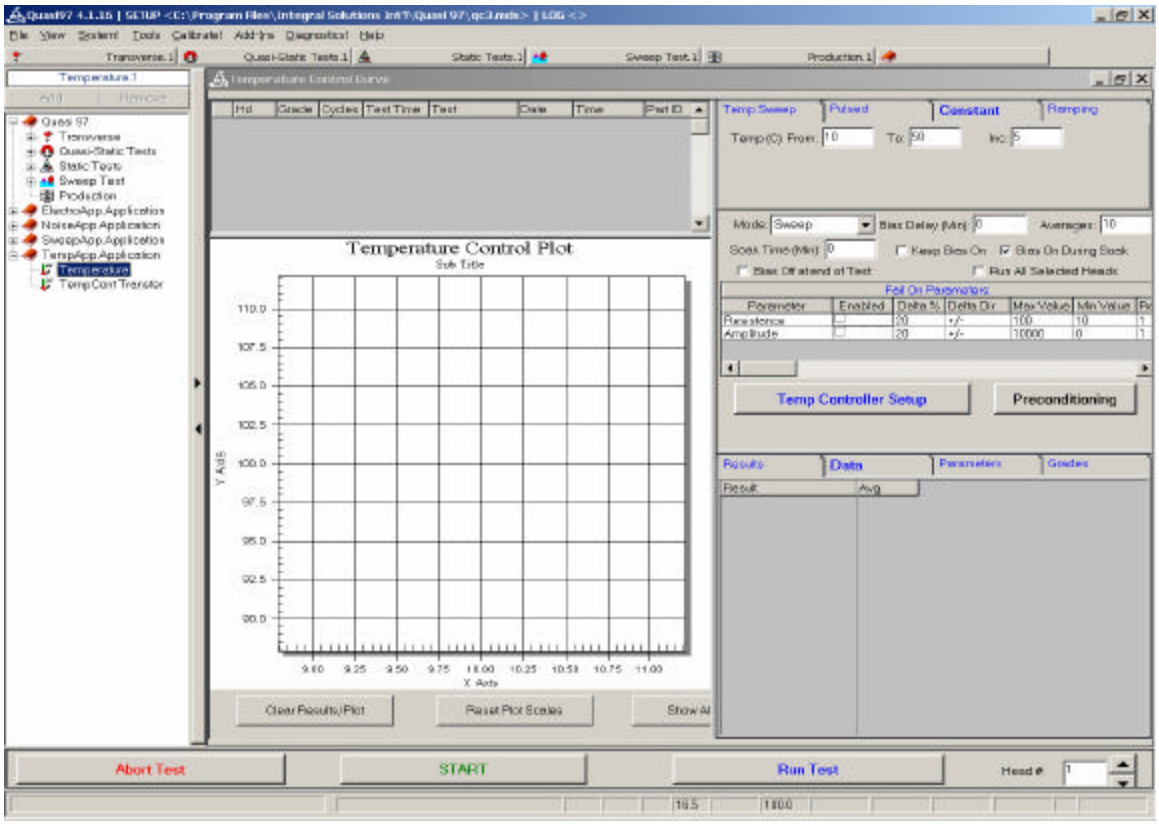

Figure 16 - Quasi97 Temperature Test

d. Click on TempCont Transfer and set it up for testing, this test will be ran by Temperature test.

e. Click on Temperature test. From the Mode drop down box or from the tabs, select what kind of test needs to be run (Temp Sweep, Pulsed, Constant or Ramping). For example in the figure above, sweep test is selected.

f. Next, specify the temperature for your test. For example for Sweep test, specify what range of temperatures need to be swept and the increment with which temperature should be incremented each time.

For example in the figure above, sweep test is set to sweep from 10 to 50 degrees with step of 5 degrees. As soon as Run Test button is pressed, controller will set temperature to 10, wait until this temperature settled,

run transfer curve test. Next it will set temperature to 15 wait until settled and run transfer test again. This cycle will continue until temperature reaches 50 degrees.

g. Select fail parameters if desired. Also it is recommended that Bias off at the end of the Test is selected.
h. Click on Start and Run Test.
i. Software will go through the specified range of temperatures and run transfer curve test (the one that was setup in step d) at each temperature point.