OPERATION MANUAL

MODEL 2100C DISSOLUTION TEST SYSTEM

DISTEK

This Operation Manual is Part No. 3821- 0193 D

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*Revised for 2100**C** and TCS-0200**C***

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Using This Manual: This manual covers the installation, routine operation, maintenance and repair of your Model 2100C Dissolution Test System. It has information regarding the commands, menus, indicators and controls. Chapter 1 provides an overview of the 2100C. Chapter 2 covers unpacking, installation, and qualification of the system. Chapter 3 has operation and programming information. Chapters 4 and 5 cover maintenance and troubleshooting. Please read Chapters 1, 2 and 3 before proceeding.

Comment Page

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❑ Daily ❑ Weekly ❑ Monthly ❑ Seldom ❑ Never

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The manual has the information I need.					
The information is accurate.					
The instructions are easy to understand.					
The manual format and size are about right.					
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Thank you for your consideration. **DISTEK Incorporated**

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1. INTRODUCTION

Model 2100C Dissolution System

The DISTEK Model 2100C Dissolution System utilizes state-of-the-art electronics, solid state components, and advanced materials to provide a cost-effective dissolution testing solution. The 2100C has intelligent programming features that allow automatic control of "Infinity RPM" at end of test, remote programming and control, and comprehensive method reporting, documentation, and validation.

1.1 SPECIFICATIONS

Dissolution Vessels:	7 built-in vessel positions	
Volume:	500mL to 1000mL	
Drive Positions:	6 positions standard (7th & 8th optional)	
RPM Control Range:	25-250 RPM, digitally controlled, closed loop	
Resolution:	0.1 RPM	
Accuracy:	+/- 0.5 RPM	
Display:	0.55 inch (14mm) four-digit LED	
Motor:	High Torque, Permanent Magnet	
Shaft Wobble:	less than 0.010" (0.254mm) TIR (total indicator reading)	
Bath Temperature Control:	TCS-0200C Thermocirculator	
Display Resolution:	0.1° C	
Accuracy:	+/- 0.25° C	
Program Modes:	Manual	
	Automatic	
	External	
Interface Ports:	RS-232, RS-485, Parallel Printer	
Construction Materials:	Aluminum, Stainless Steel, Engineered Plastics	
	2100C Bath *	**TCS-0200C**
Dimensions:	25"W x 39"H x 19¼"D (63.5 x 99 x 49cm Deep)	7"W x 16"H x 7"D (17.8 x 40.6 x 17.8cm D)
Net Weight (approx.):	140 lb. (63.5kg) (water bath full)	16 lb. (7.3kg)
Electrical Power: (Operating voltage pre-set at factory)	115V 50/60Hz 0.5A *or* 220V 50/60Hz 0.5A	115V 50/60Hz 8A *or* 220V 50/60Hz 5A

* Contact Distek for dimensions and weight of 2-Liter bath or Zymark bath.

1.2 OVERVIEW

The DISTEK 2100C dissolution bath system consists of a Motor Control Module, a Temperature Control System (TCS-0200C), and the water bath with six to eight vessel positions. The 2100C dissolution system is a direct replacement for the DISTEK 2100B dissolution bath. All functions and specifications of the 2100B are preserved. New features are provided for simpler height adjustment, and to reduce bench space requirements.

This manual contains important information regarding the safe operation, maintenance and repair of your Model 2100C Dissolution Test System. Please read Chapters 1, 2 and 3 before proceeding.

"**WARNING**" statements are used in this manual to prevent injury to personnel.

"CAUTION" statements are used to prevent damage to equipment.

"NOTES" contain helpful information.

"REQUIRED ACTION" is used where necessary to distinguish the action needed from the Warnings, Cautions and Notes.

WARNING: HIGH VOLTAGE IS EXPOSED WHEN THE MOTOR CONTROL MODULE IS OPENED ON THE 2100C.

WARNING: HIGH VOLTAGE IS EXPOSED WHEN THE CABINET IS OPENED ON THE TCS-0200C.

WARNING: TAKE PROPER PRECAUTIONS WHEN HANDLING DISSOLUTION MEDIA. WEAR SPLASH PROTECTION TO AVOID EXPOSURE TO ACIDIC, CAUSTIC, OR PHARMACEUTICAL HAZARDS. BACTERIA HAVE BEEN SHOWN TO THRIVE IN CERTAIN MEDIA, ESPECIALLY AT TEST TEMPERATURES.

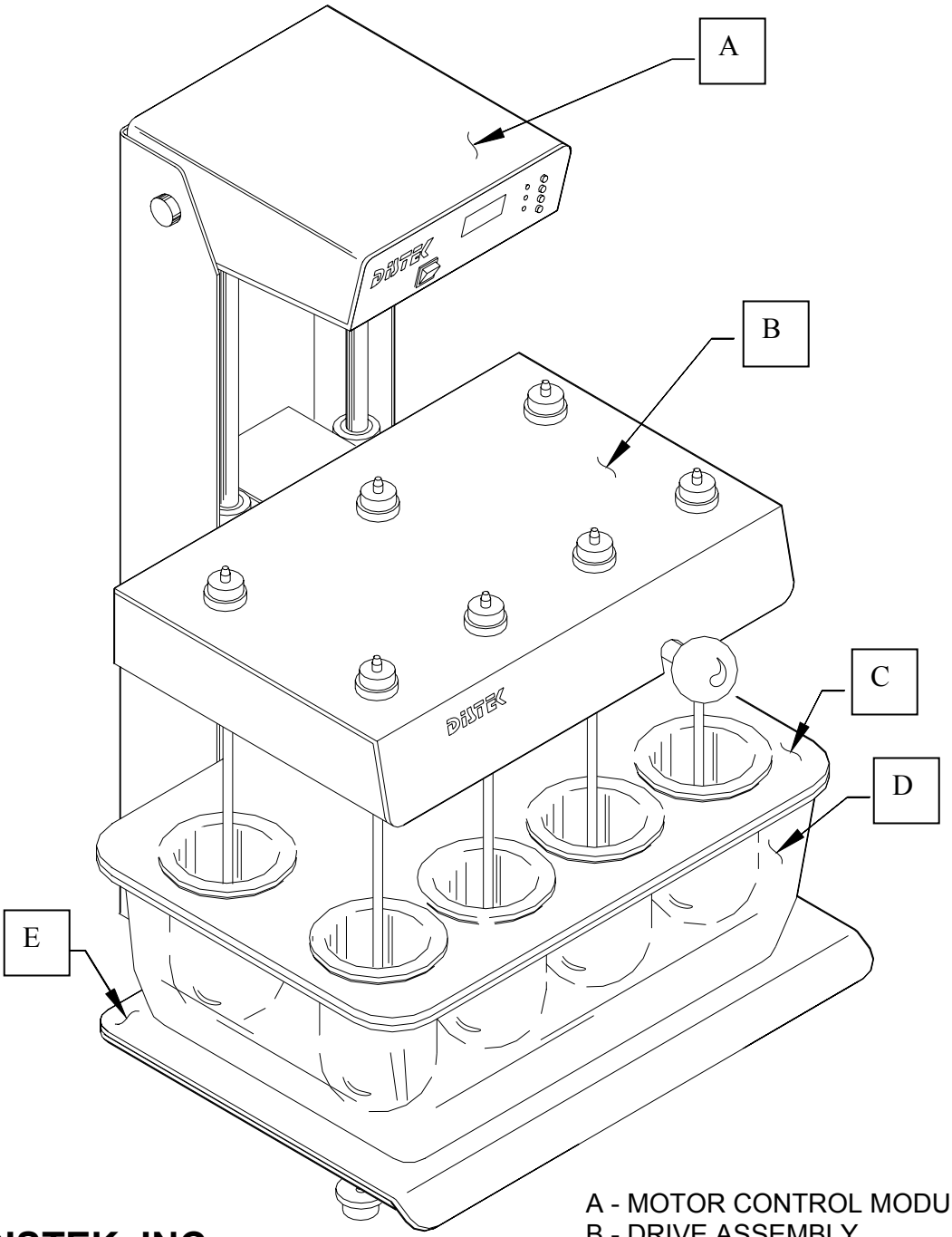


Figure 1-1: MODEL 2100C DISSOLUTION TEST SYSTEM

2. INSTALLATION

2.1 UNPACKING

Please take a few moments when unpacking the unit to check for all items indicated on the packing list. Notify DISTEK or your shipper immediately of any discrepancies or damage to the cartons or contents in transit.

WARNING: ***Team Lift:*** **To avoid injury, two people should remove 2100C from carton.**

1. Open large carton.
2. Carefully remove packing insert.
3. Slide or lift 2100C main unit out of its packing carton.
4. Remove all packing materials.

Note: Keep in mind the reduced bench space requirements for the TCS-0200C. The TCS-0200C fits at the right rear of the 2100C, behind the right side of the water bath (see Figure 2-1). Place the TCS in its approximate location ***before*** *lifting the 2100C onto the bench. This can make installation easier if space is tight.*

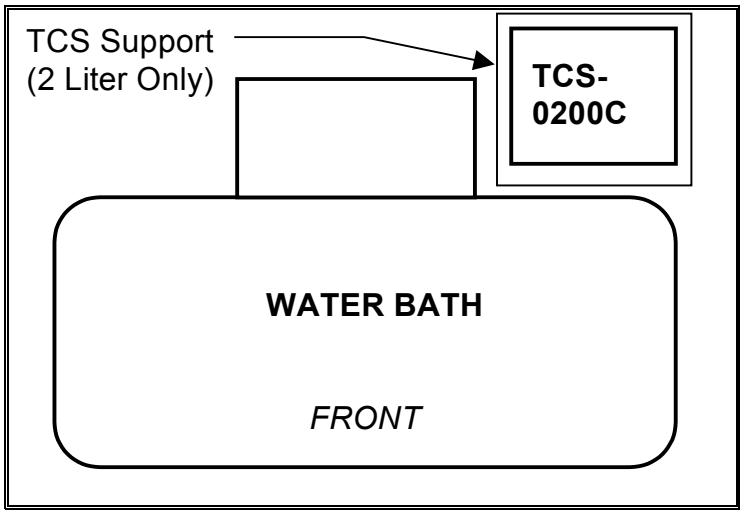


Figure 2-1: Location of TCS-0200C (Top View)

2.2 MOTOR CONTROL MODULE: REAR PANEL CONNECTIONS

The Motor Control Module is located at the top of the instrument. The motor control cable runs from the Drive Assembly to the Motor Control Module. The cable passes through a vertical slot in the back cover of the 2100C. The rear panel of the 2100C Motor Control Module is shown in Figure 2-2:

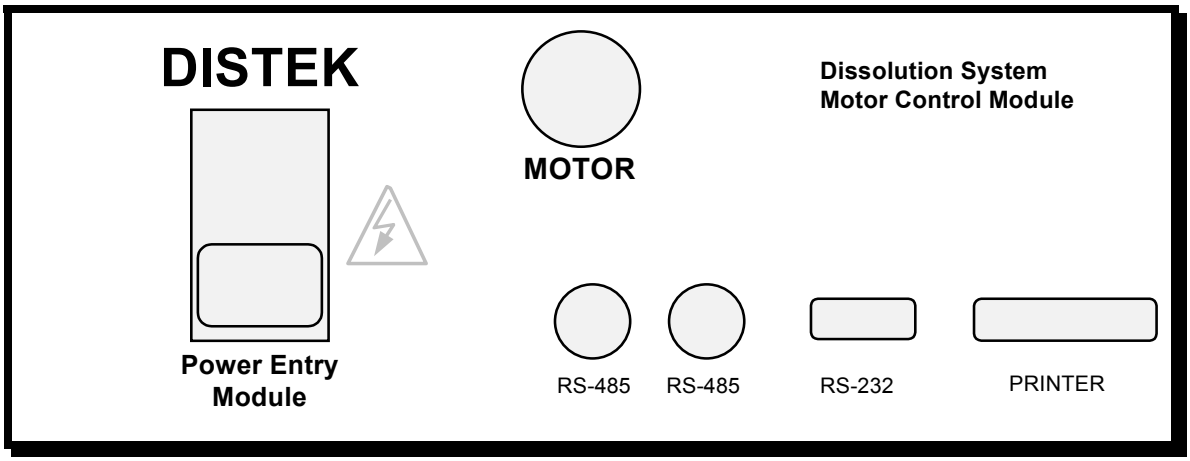


Figure 2-2: Motor Control Module Rear Panel

1. Remove packing materials from the motor control cable at the rear of the unit.
2. Carefully align keyed connectors and connect motor control cable to round "Motor" connector shown above.
3. Connect the power cord to the "Power Entry Module" shown above.
4. Locate proper electrical outlets for 2100C and TCS-0200C.

NOTE: The power cord is shipped in a separate carton from the main unit.

NOTE: The dual RS-485 jacks are identical in function. Two jacks are provided to simplify interconnection of master and slave instruments.

2.3 PRELIMINARY LEVELING: MODEL 2100C

1. Trained personnel should team lift unit onto bench and slide it into position.
2. Place supplied level on vessel support plate as shown in Figure 2-3.
3. Loosen locking nut on each leveling foot, using an open-end wrench.
4. Level unit from side to side by adjusting the four leveling feet.
5. Turn level 90°.
6. Level unit from front to back by adjusting the front two leveling feet.
7. Do not tighten the locking nut on each foot at this time.
8. Plug Model 2100C into proper electrical outlet provided.

NOTE: Always recheck the level with 6-9" carpenter's level (not included) after installing and filling the water bath, or after moving the Model 2100C to a new location.

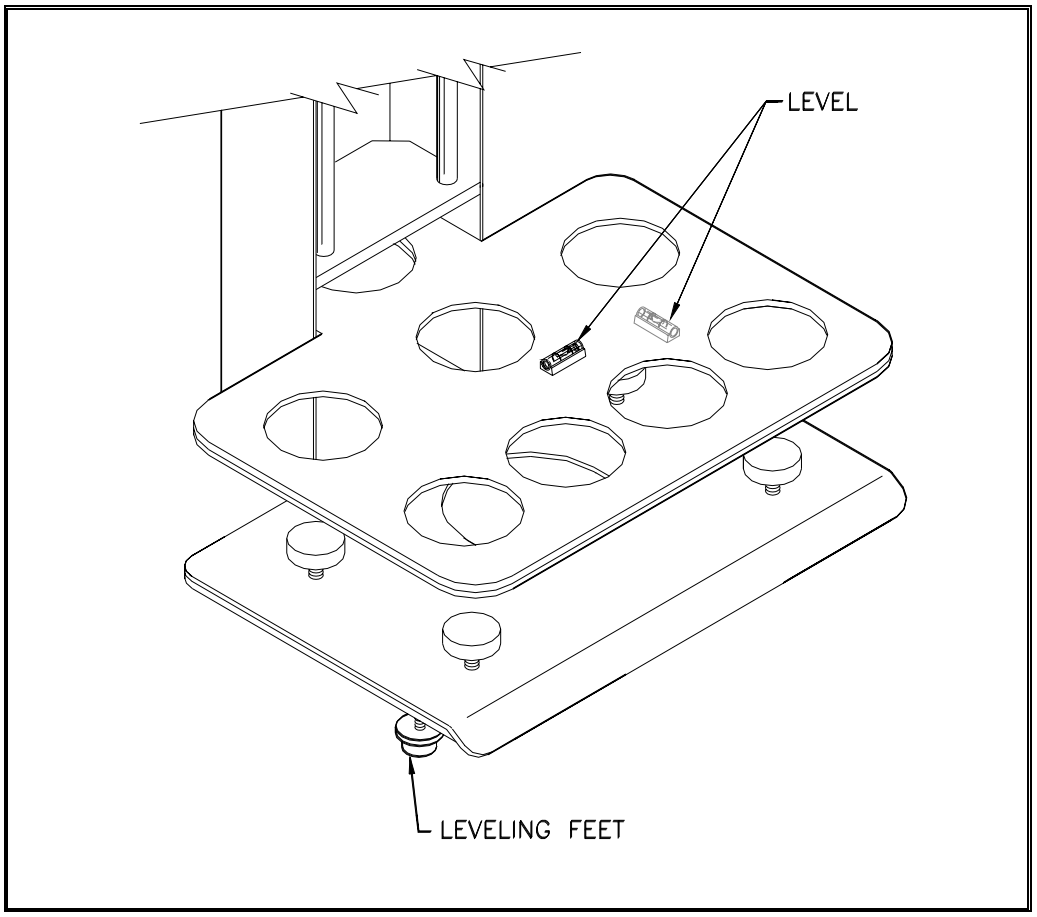
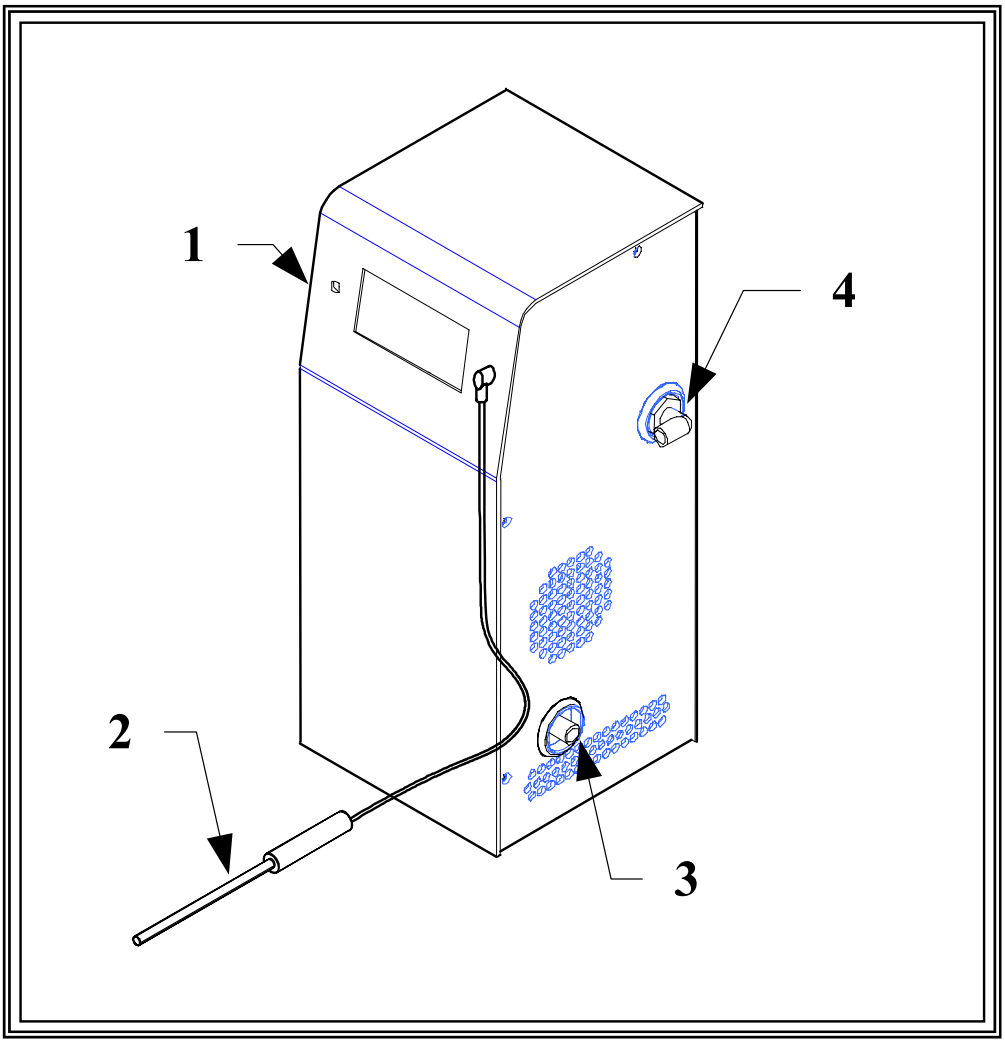


Figure 2-3: Location of Leveling Feet

2.4 INSTALLING THERMOCIRCULATOR



1. THERMOCIRCULATOR HOUSING
2. TEMPERATURE SENSOR
3. PUMP INLET
4. PUMP OUTLET

Figure 2-4: Model TCS-0200C Thermocirculator

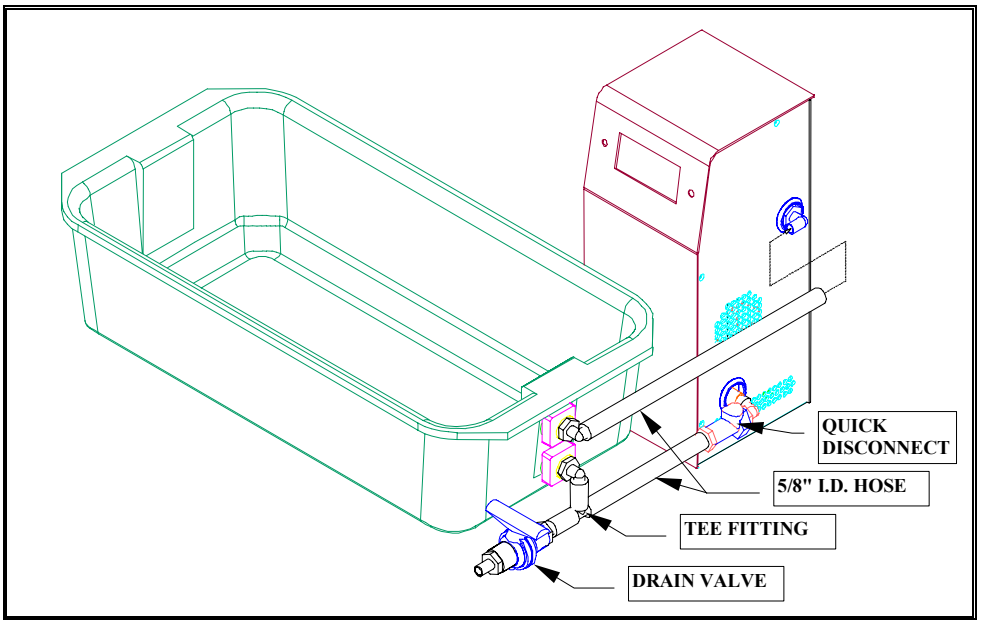


Figure 2-5: Thermocirculator Connections

2.4.1 PLACEMENT AND CONNECTIONS

1. Install TCS-0200C behind the right side of the 2100C bath. (Contact DISTEK for information on left-side installation if necessary.)
2. Place TCS-0200C thermocirculator on bench at same level as 2100C or below. *
3. Make sure ventilation holes on both sides of TCS-0200C are not obstructed.
4. Connect power cord to back of TCS unit.
5. Plug temperature probe (supplied with unit) firmly into front panel jack.
6. Place a hose clamp loosely on inlet and outlet hoses.
7. Connect water bath inlet hose (5/8" I.D.) to pump outlet as shown in Figure 2-5.
8. Connect water bath outlet hose (5/8" I.D.) to pump inlet using quick disconnect coupling. Push coupling together until it clicks.
9. Make sure all hoses are installed fully onto fittings.
10. Place hose clamps over fittings, with locking portion on right side of fitting.
11. Tighten hose clamps snugly with pliers. Adjust position of unit so TCS does not touch 2100C, to avoid transmitting vibration.

** NOTE: Thermocirculator TCS-0200C is normally placed on same level as Model 2100C, or below, in order for pump to be primed properly. Contact DISTEK for special instructions if pump needs to be installed higher than bath. Failure to install and prime thermocirculator as specified may result in damage to heater and/or pump, and void the warranty. The 2-liter (tall) bath is an exception: Distek supplies a support piece which goes under the TCS. This raises the TCS a few inches to make the temperature display visible over the taller bath.*

2.4.2 PRIMING PUMP AND FILLING WATER BATH

1. Wipe inside of water bath with damp cloth to remove any debris that might lodge inside and damage pump.
2. Make sure power switch on upper rear panel of TCS-0200C is off (press "0"). Plug TCS into proper outlet.
3. Place temperature probe from TCS-0200C in bath location next to center rear vessel.
4. **Make sure bath drain valve is closed** (handle should be perpendicular to drain hose as shown in Figure 2-5).
5. **Fill bath** to midway between the top bath inlet fitting and the lower outlet fitting (see Figure 2-7).

TO PRIME PUMP:

1. Attach a **3 ft.** (1m) long x 5/8" (~16mm) ID **drain tubing** to drain valve.
2. RAISE DRAIN TUBING: Raise the drain tubing to **vertical position** as shown below. Drain valve should be tilted up.
3. **Open drain valve.** Allow pump inlet tubing to fill with water (5-10 sec.).

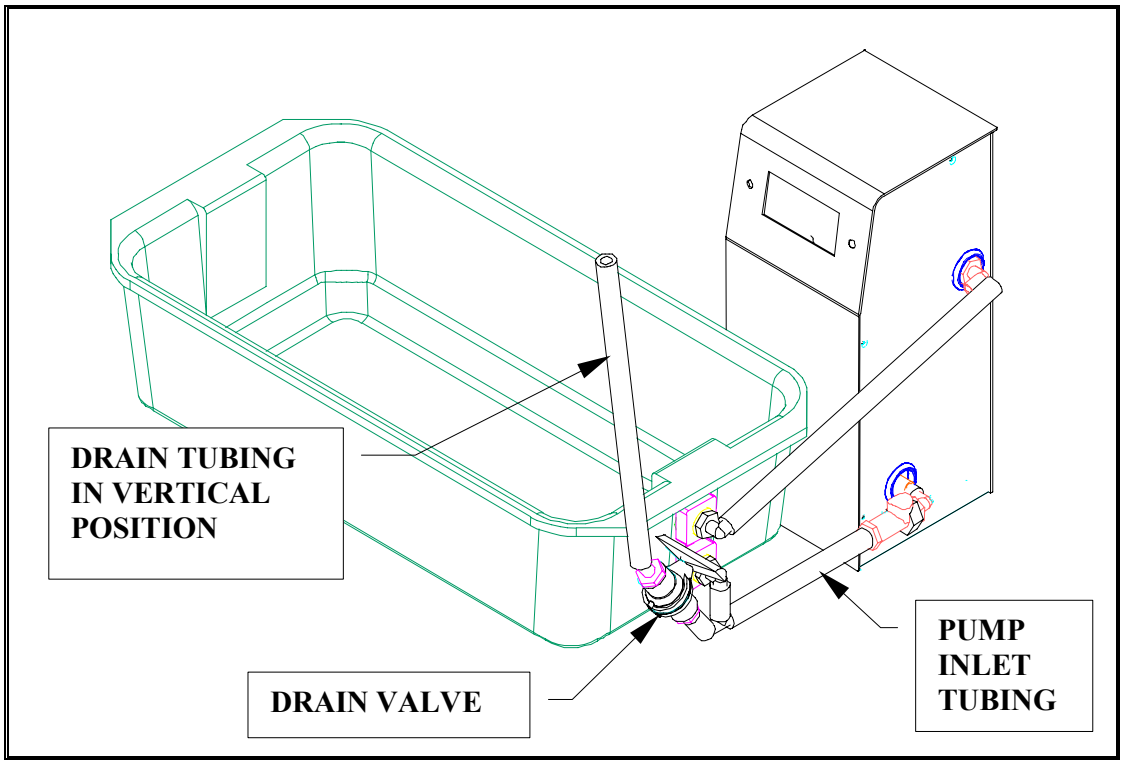


Figure 2-6: Drain Tubing in Vertical Position

4. See Figure 2-7 below. While trying not to spill, **SLOWLY lower drain tubing to allow tubing to fill with water** as shown. Fill as much as possible.

5. Close drain valve.

6. Again lift drain tubing to **vertical** position (see Figure 2-6 above).

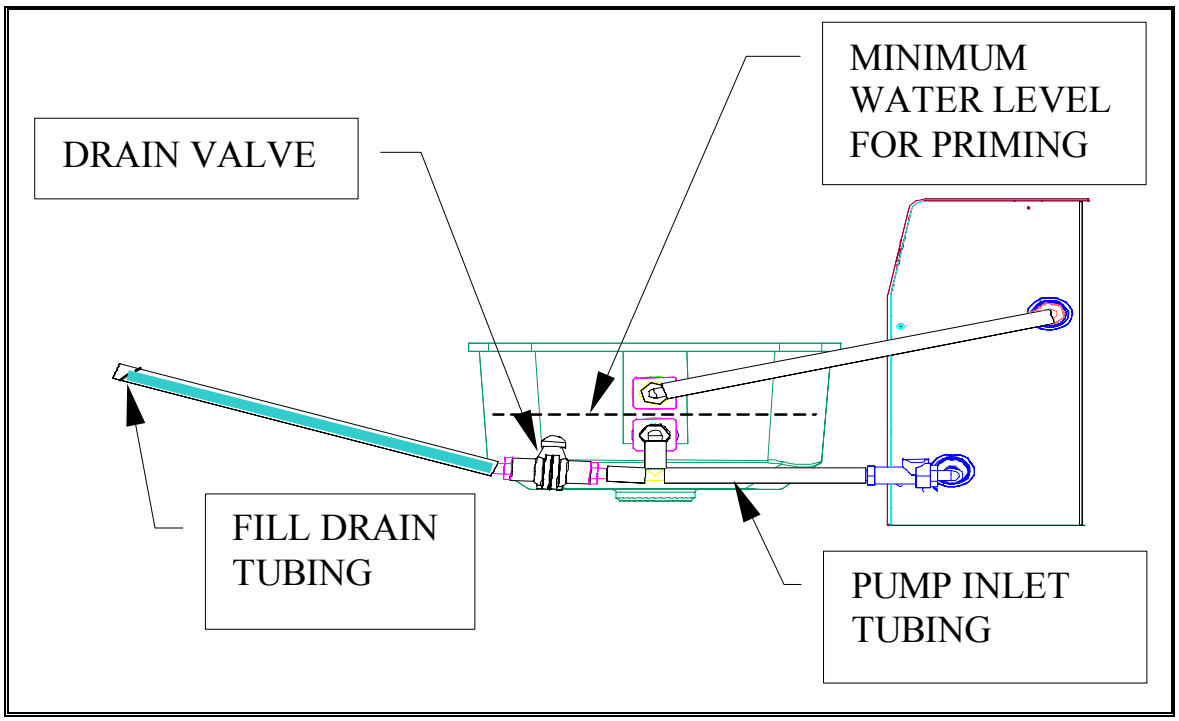


Figure 2-7: Drain Tubing Filled with Water

7. While holding drain tubing vertical, open drain valve for 5 seconds.

8. **Repeat above steps #4 (SLOWLY lower drain tubing …) through #7.**

9. **Close drain valve.**

10. With valve closed, dump drain tubing into bucket.

11. **Turn on TCS power and run TCS for 15 seconds.** (Power switch is on upper rear panel of TCS.) If priming is successful, water should flow rapidly from bath inlet within 15 seconds. If not, turn off TCS immediately and go back to step #7, "Raise Drain Tubing".

12. Re-check the instrument level again (see Figure 2-3) with water in bath. Adjust leveling feet if necessary.
13. Tighten the locking nuts on each leveling foot.
14. Check all fittings for leaks for next five minutes.
15. Momentarily turn pump on to verify that pump is primed and flow is steady.
CAUTION: DO NOT RUN PUMP WHEN DRY. If pump is not primed properly, internal thermal safety switch will trip. See Figure 3-7 to reset switch.
11. If water in bath is not circulating, stop the pump. Go back to "Raise Drain Tubing".
12. When flow is steady, turn on TCS-0200C and set temperature (see Sec. 3.4.2: TCS-0200C FRONT PANEL CONTROLS).

2.5 POSITIONING THE VESSELS

1. Position Acculign centering ring in each hole on vessel plate (see Figure 2-8).
2. Install six vessels in outer positions: Slide vessel through Acculign ring until it can go no farther. Top of Acculign ring flange should contact bottom of vessel flange.
NOTE: DISTEK ships vessels with Acculign ring already installed on vessel -- in this case, slide vessel and centering ring together into hole in vessel support plate.
3. Use hold-down clips to secure vessels in position.
4. Remove plug (if any) from seventh vessel position.
5. Add water to bath until level is 1.0 cm below top of bath.
6. If seventh vessel is used, install it now with Acculign ring.
7. If seventh vessel is not used, add water to bath until level is 0.5 cm below top of bath, and replace plug in vessel plate.

NOTE: The DISTEK Acculign ring is a precise, flexible plastic ring, which accurately centers vessel in its mounting location. This feature provides consistent shaft centering in vessel.

REQUIRED ACTION: Mark location of leveling feet on bench. This will facilitate re-location of instrument, if necessary, without loss of level position.

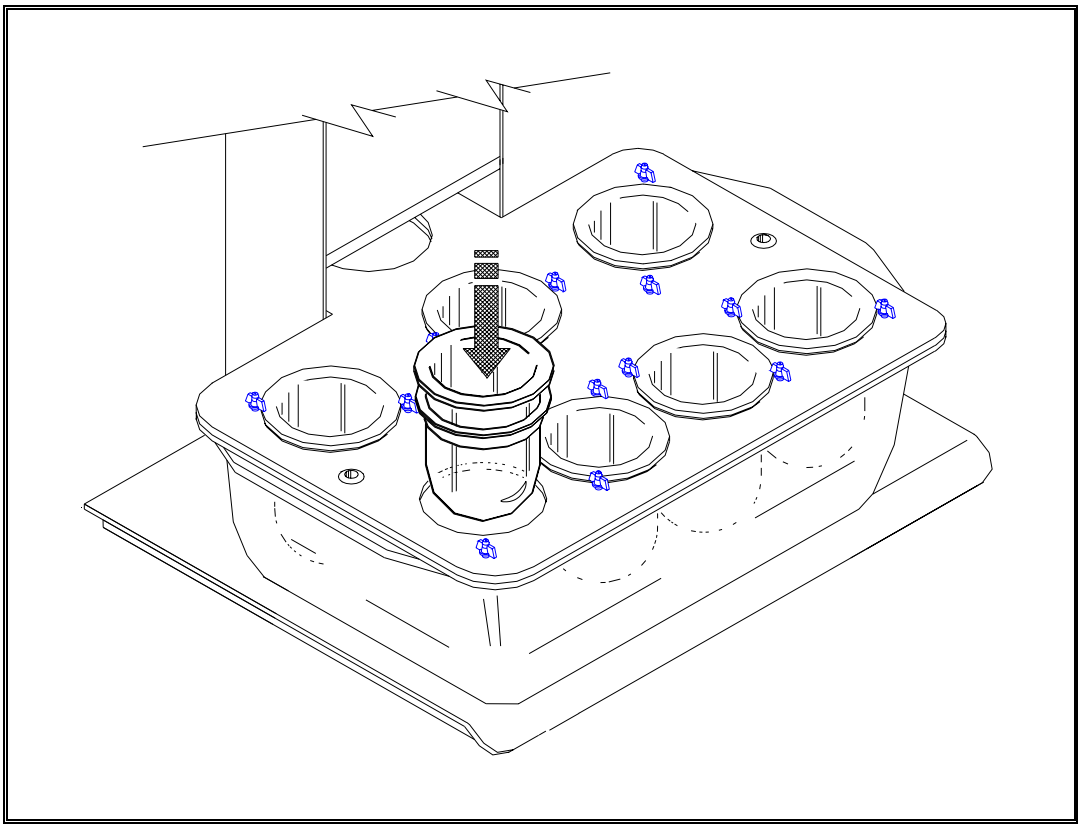


Figure 2-8: Placement of Vessels and Centering Rings

2.6 PADDLES AND BASKETS

2.6.1 HANDLING AND STORAGE

CAUTION: DO NOT GRASP BASKET BY MESH SCREEN WHEN INSTALLING OR REMOVING. ALWAYS GRASP BASKETS BY UPPER RIM. PROPER HANDLING WILL PREVENT BASKET DISTORTION AND RESULTING WOBBLE.

Handle baskets, paddles and shafts carefully to avoid bending or damage. Store carefully in original container to prevent damage.

2.6.2 CHECKING PADDLES, BASKETS AND SHAFTS FOR STRAIGHTNESS

Use instruments such as DISTEK's Wobble Meter, Shaft-CHEK™, or other means to verify straightness of stirring shafts, blades, and baskets. Check shaft wobble near bottom end of shaft. Check basket wobble at bottom rim of basket. Record values at 25 and 250RPM.

2.6.3 ASSEMBLING BASKET AND SHAFT

1. Always place tablet or capsule into a dry, empty basket before the test.
2. Place basket, open end up, in palm with thumb and fingers grasping upper rim.

CAUTION: DO NOT GRASP BASKET BY MESH SCREEN WHEN INSTALLING OR REMOVING. ALWAYS GRASP BASKETS BY UPPER RIM. PROPER HANDLING WILL PREVENT BASKET DISTORTION AND WOBBLE.

3. Raise basket until inside of upper rim just contacts the O-ring shown in Fig. 2-6.
4. Twist and push basket onto shaft.
5. When removing basket, grasp only on the upper rim of the basket. Pull down and twist.

NOTE: Upon completion of each test, rinse baskets and shafts thoroughly with distilled water. DO NOT ALLOW ACIDS OR BUFFERS TO DRY ON THE METAL SURFACES.

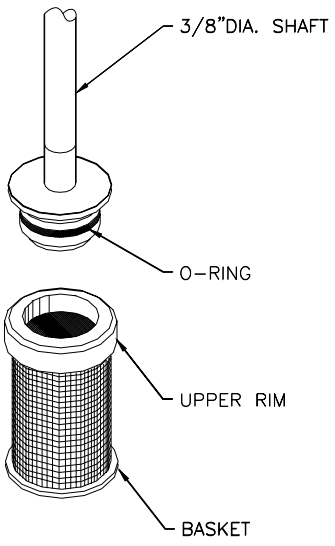


Figure 2-9: Basket and Shaft

2.6.4 INSTALLING PADDLES OR BASKETS

1. Rotate control knob left (counterclockwise) about 1/2 turn to loosen drive assembly. See Figure 3-1: Drive Assembly.
2. Raise drive assembly and turn control knob right to lock.
3. Remove basket from shaft before inserting shaft in spindle.
4. Slide the paddle or basket shafts up through each spindle (Fig. 2-7). **There are no chucks to loosen.**
5. Raise each shaft so at least 2" (5 cm) extends above top of spindle.
*Note: If shafts do not slide up smoothly, a **very thin** film of lubricant may be applied to the top half of each shaft. Wipe off any excess grease. If necessary, DISTEK recommends Dow Corning High Vacuum Grease. Do not use a lubricant which may affect your test results.*

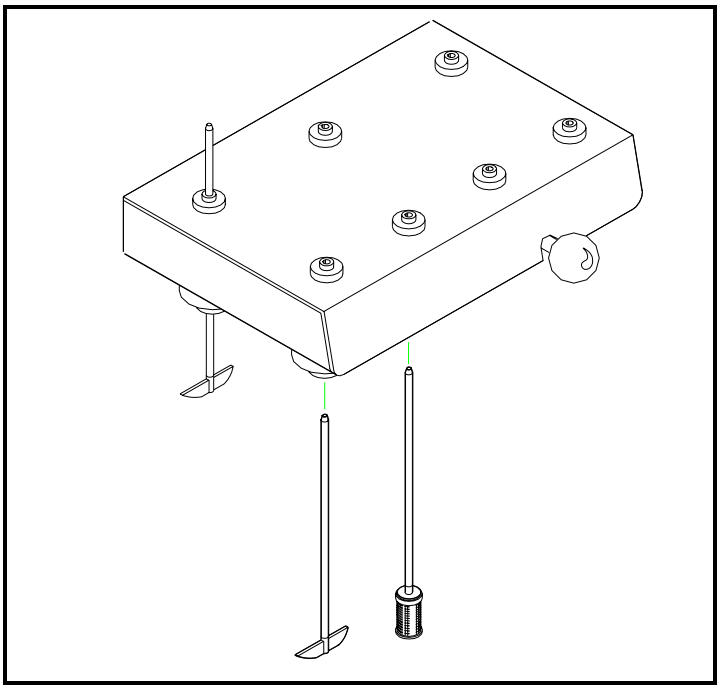


Figure 2-10: Paddle or Basket Shaft Inserted into Spindle

2.6.5 CHECKING SHAFT CENTERING

Use DISTEK Center-CHEK™ or other means to verify shaft centering with respect to vessels. Follow instructions included with Center-CHEK for accurate results.

2.7 HEIGHT ADJUSTMENT

2.7.1 INSTALLING SHAFT COLLARS IN PREPARATION FOR HEIGHT ADJUSTMENT

1. Install paddle or basket shafts in spindles. Top of shaft should be at least 2" (5cm) above top of spindle.
2. Carefully place basket (or paddle blade if needed) on each shaft.
3. Make sure height adjustment knob is in horizontal position (Figure 2-12 shows vertical position).
4. Slowly lower drive assembly fully to lowest position, and lock in place.
5. Lower shafts gently until they just touch bottom of each vessel.
6. Place collar on each shaft and lock securely (see Figure 2-11).

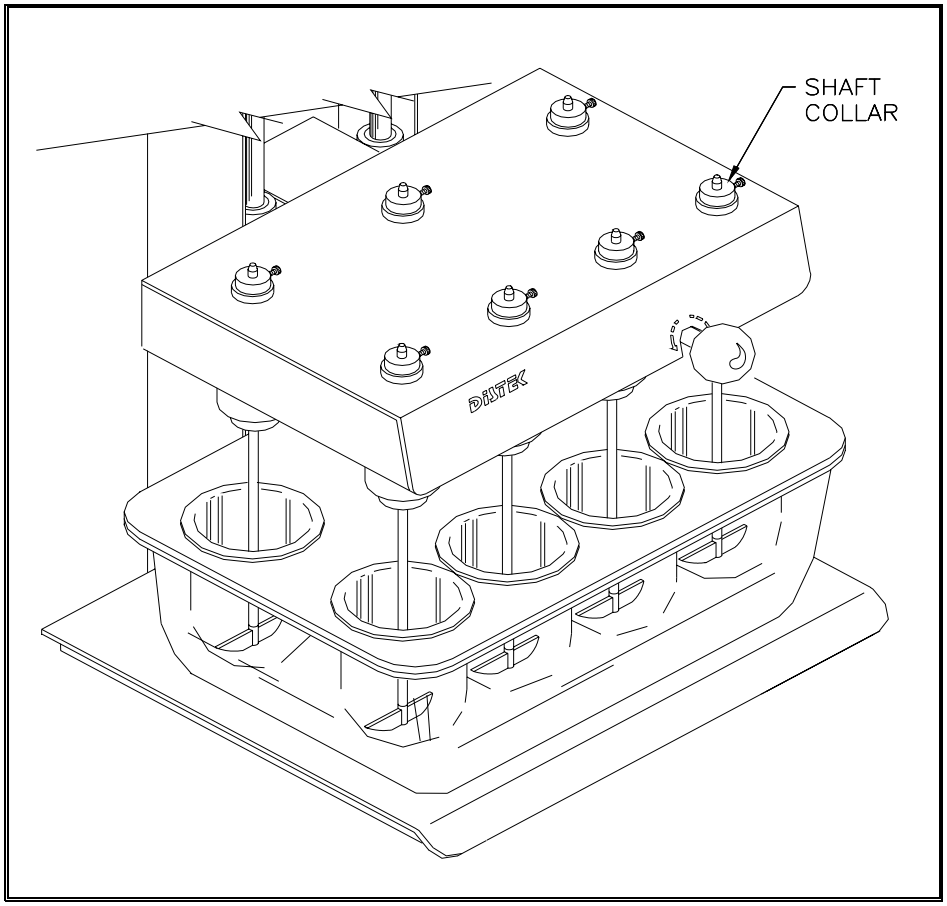


Figure 2-11: Location of Shaft Collars

2.7.2 ADJUSTING THE PADDLE OR BASKET HEIGHT

1. Raise the drive assembly to its highest position.
2. Turn height adjustment knob to vertical position for PADDLES or BASKETS as seen from front of unit. (see Figure 2-12).
3. Lower drive assembly until drive plate extension rests on height knob and lock in place.
4. Check paddle or basket height using DISTEK Height-CHEK™ or other means. Verify and record distance from bottom of each paddle or basket to bottom of vessel.

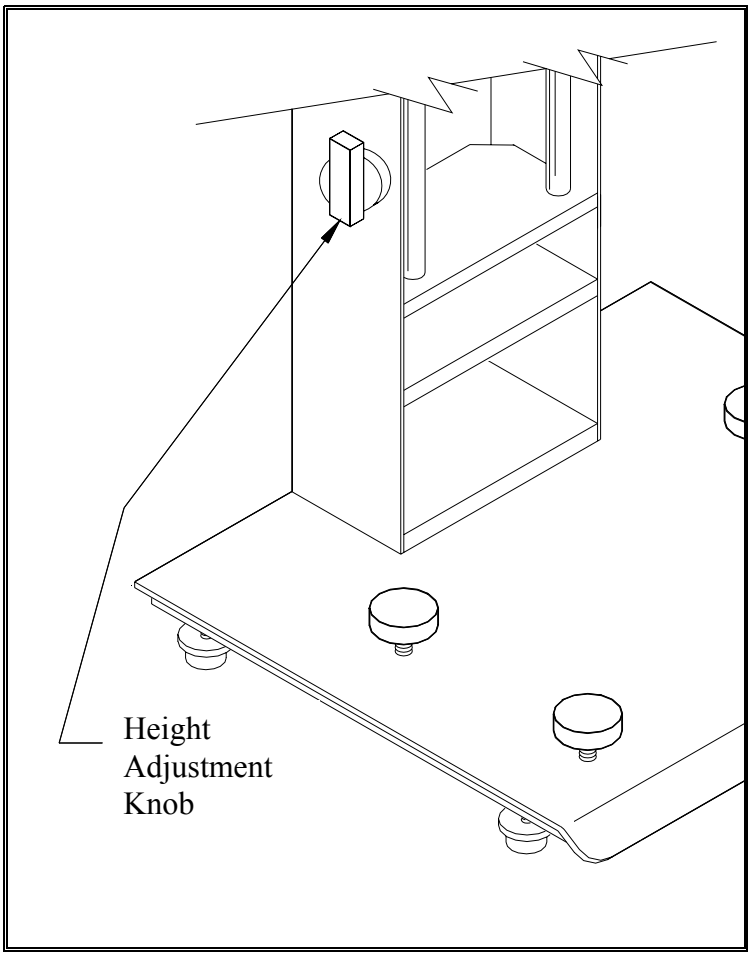


Figure 2-12: Height Adjustment Knob

2.8 SETTING THE INSTRUMENT INTO OPERATING POSITION

1. Rotate control knob left (counterclockwise) about 1/2 turn to loosen drive assembly. See Figure 3-1: Drive Assembly.
2. Lower drive assembly gently until it comes to rest on desired height adjustment block.
3. Turn control knob right (clockwise) to lock drive assembly.
4. Turn on instrument power.
5. Set RPM (see Figure 3-5: Front Panel, Motor Control Module).
6. Check and record RPM display accuracy at 50, 100, 150 and 250 RPM using a calibrated tachometer such as DISTEK RPM-CHEK™.

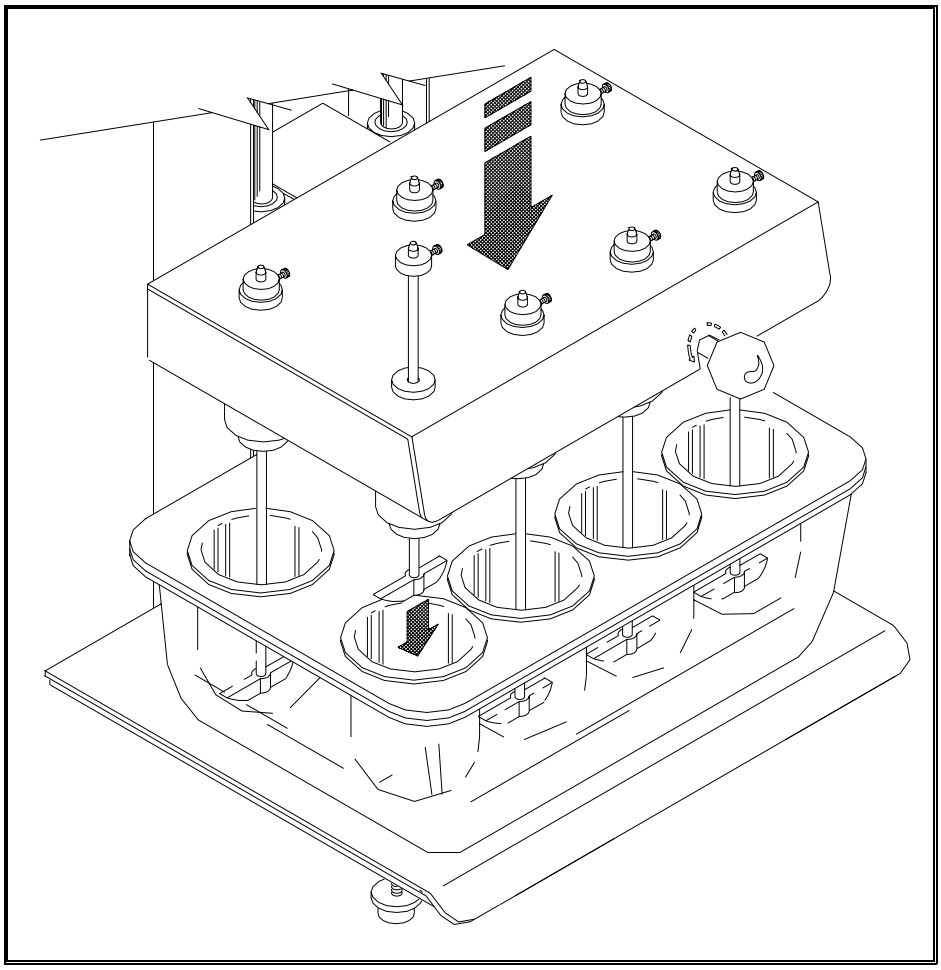


Figure 2-13: Model 2100C Placed into Operating Position

2.9 INITIAL TEMPERATURE STUDY

1. Install paddle shafts.
2. Set shaft collars in place.
3. Raise drive assembly.
4. Fill each vessel with 900ml of DI water.
5. Set proper height of paddles.
6. Lower drive assembly and paddles fully, and lock in place.
7. Set rotation to 250RPM.
8. Cover all vessels with vessel covers provided.
9. Place a calibrated reference temperature probe, such as DISTEK Temp-CHEK™, in one of front center vessels.
10. Record vessel temperature and time.
11. Turn on TCS-0200C.
12. Monitor temperature and time until vessel temperature stabilizes.
13. Adjust TCS-0200C temperature set-point so that vessel temperature stabilizes at required vessel temperature (such as 37.0°C).
14. Record set-point required to achieve required vessel temperature.

2.10 PARALLEL PRINTER PORT, 2100C

The 2100C printer port sends output in standard ASCII line printer format. Virtually any printer that is set to this format (Epson LQ emulation mode) can be used. The rear of the 2100C Motor Control Module has a DB-25 female connector, which is similar to a standard PC printer port. A standard IBM PC-compatible parallel printer cable can be used to connect to a printer with a 36-pin Centronics parallel interface. DISTEK offers an optional printer and cable for this purpose.

2.11 2100C INTERNAL DIP SWITCH SETTINGS

The 2100C has an eight-position DIP switch (see Figure 2-14). Seven of the eight switches are for serial communications configuration. One of the switches (position seven) is for the time format. The first five switches determine the unit's RS-485 address. (For example, if switches 1, 3, and 5 are on then the address = 1 + 4 + 16 = 21 .) For customers in North and South America, factory default 2100C settings are: Address=16, Master mode, 12-hr. (AM/PM) format as shown in Figure 2-14. European units have switch 7 in the ON position for 24-hour time format. See Table 1: DIP Switch Functions, 2100C.

Note: To set instrument in Zymark mode, ensure that switch 6 is in Slave position (OFF), and switch 8 is in Zymark position (ON).

Table 1: DIP Switch Functions, 2100C

	1	2	3	4	5	6	7	8
ON	+1	+2	+4	+8	+16 *	MASTER *	24 Hr Time	ZYMARK
OFF	ADDRESS					SLAVE	AM/PM *	

* = Default Settings

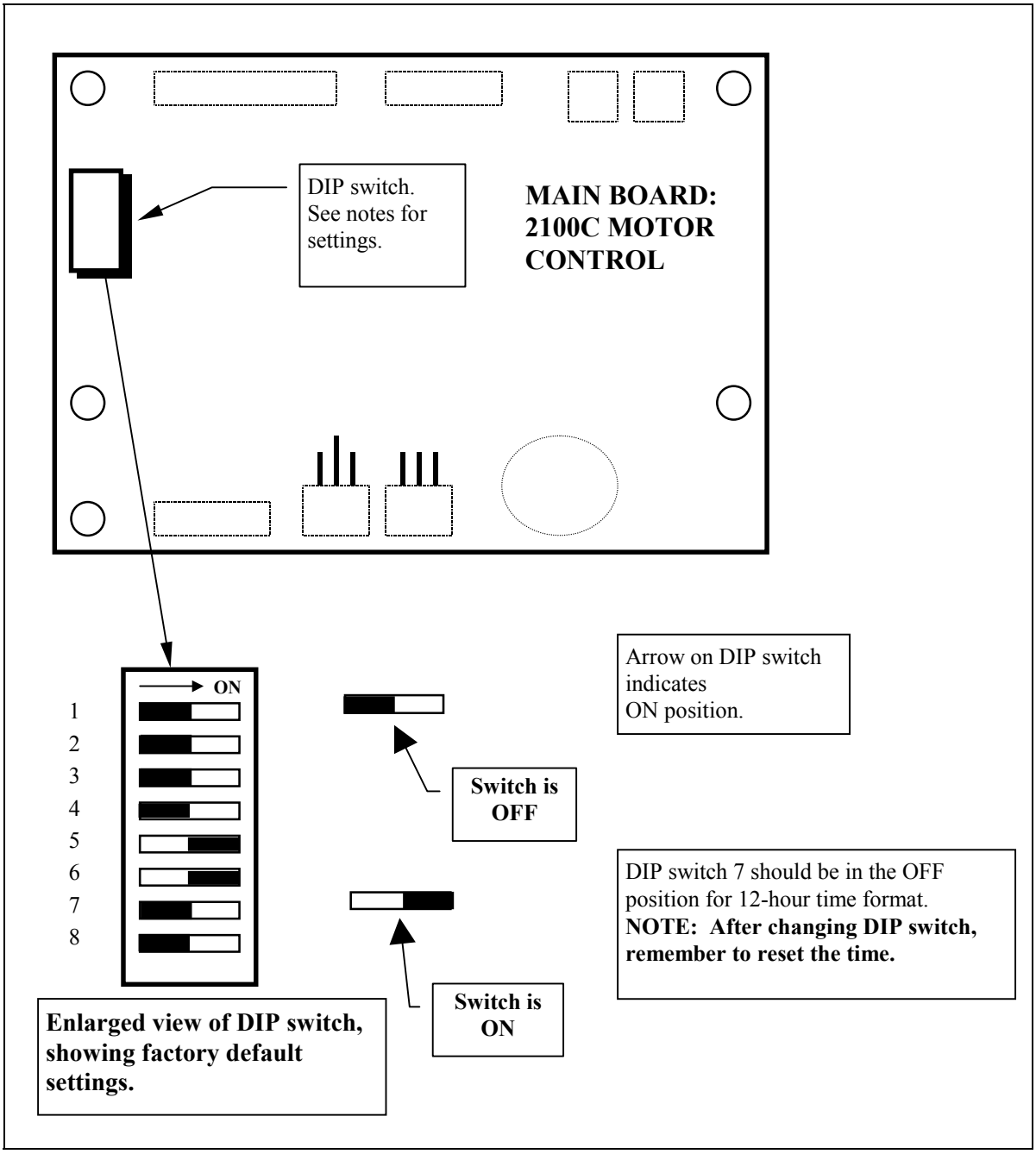


Figure 2-14: Location of DIP Switch, 2100C

2.11.1 CHANGING DIP SWITCH SETTINGS ON 2100C MOTOR CONTROL MODULE MAIN BOARD:

1. Disconnect power cord and all other cords from rear of Motor Control Module (MCM).
2. Carefully support and remove the MCM by unscrewing two knobs and two Phillips flat head screws that hold it to the 2100C frame (see Figure 5-1).
3. Remove four screws from bottom panel of MCM.
4. Remove four more screws at rear of MCM (at four corners of back panel).
5. Remove top cover to expose main PC board.
6. Check DIP switch settings and ensure they are set up for proper operation. Refer to Table 1 above. For double bath configuration with single printer, refer to Figure 2-16.
7. Put top cover back on and replace four screws on rear panel.
8. Replace four screws at bottom of MCM.
9. Re-install MCM on frame. (See step 2 above.)
10. Connect all external cables to connectors on rear of unit. Ensure all cables are firmly in place (including black four-pin DIN cable for RS-485).
11. Connect power cord to unit.
12. Turn the unit on and check for proper functioning.

2.11.2 DIP SWITCH SETTINGS FOR DOUBLE BATH SYSTEM USING SINGLE PRINTER:

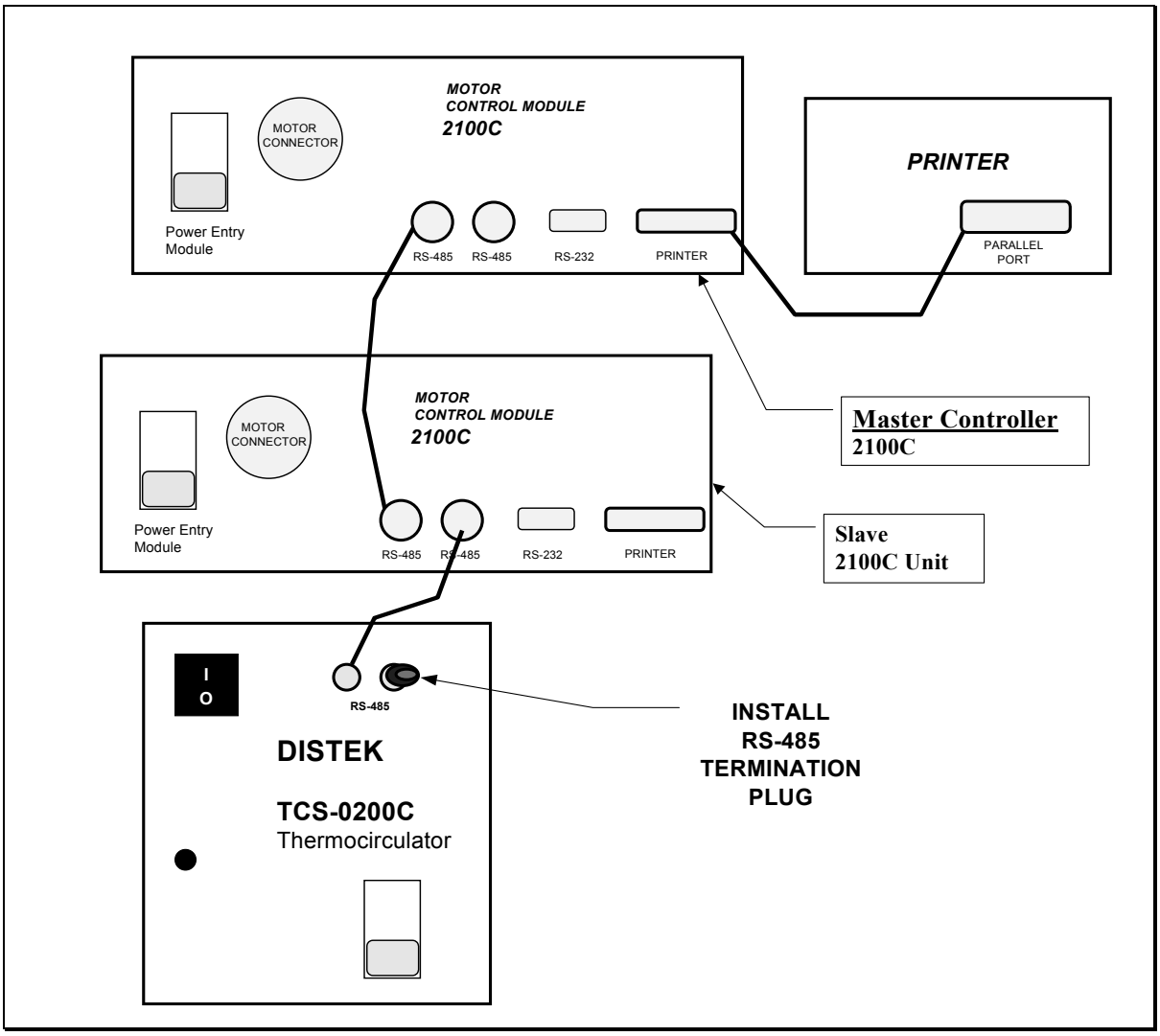


Figure 2-15: Double Bath RS-485 Cables (Optional Printer Shown)

Figure 2-15 shows double bath cable connections. In this configuration one 2100C should be set as a Master, and the other as a Slave. Refer to Figure 2-16 for DIP switch settings.

Note: When a single printer is used with multiple instruments as shown in Figure 2-15, the printer must be connected to the Master unit's printer port.

TO CONNECT DOUBLE BATH SYSTEM USING SINGLE PRINTER:

1. Set Master 2100C address to 16 and set Slave 2100C address to 8 as shown in Figure 2-16.
2. Complete hook-up using RS-485 cables and printer cable as shown in Figure 2-15.
3. Install termination plug as shown in Figure 2-15.
4. Turn on Slave units first, then the **Master unit last.**
5. Perform the ***SCAn*** function on Master unit (See Section 3.3.2.5.)
6. Generate the System Report printout from the Master unit, and make sure printout has list of instruments which include both 2100C's and the TCS-0200C (check their addresses).

Note: Switch number 7 is used for time format setting, and is not indicated on Figure 2-16. See Table 1 for time format settings.

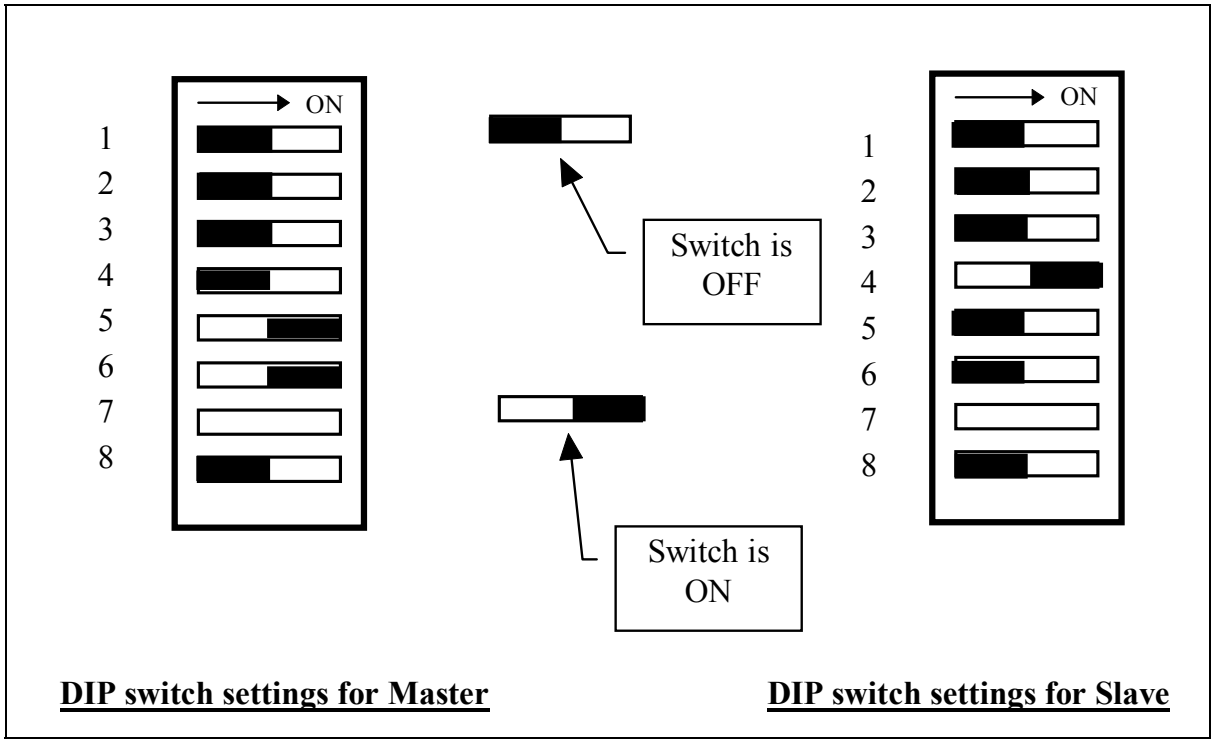


Figure 2-16: DIP Settings for Double Bath Configuration

2.12 TCS-0200C ADDRESS SETTING

The TCS-0200C address can be reset if necessary, in preparation for connecting multiple TCS units on the same RS-485 bus. The factory default address is ten (10) , which enables the use of a PC to set new device address for the TCS-0200C. See procedure below to reset address.

TO RESET TCS ADDRESS:

1. Set the 2100C Motor Control Module to Slave mode.
2. Connect the RS-485 port of the 2100C to the TCS-0200C using the RS-485 cable.
3. Hook up a PC which has a terminal program (such as HyperTerminal™ or ProComm™) to the RS-232 port of the 2100C.
4. Turn on the PC, then the 2100C, then the TCS-0200C.
5. Open the PC's terminal program.
6. The factory default address of the TCS-0200C is 10.
7. Type the following command, including brackets and spaces: [10 Z aa] where aa is the new address of the TCS-0200C. You should get an exclamation point [!] response from the TCS-0200C.
8. Save the new address in the TCS-0200C memory by typing [aa M] where aa=new address. You should get an exclamation point [!] response from the TCS.
9. Wait five to ten minutes and then obtain a System Report printout from the Master Controller. (See Section 3.3.2.7.)
10. Make sure System Report printout has list of instruments which include any 2100C's and the TCS-0200C (check their addresses).

Note: RS-485 addresses can be any values from 01 through 31. Address 00 is reserved for use with older TCS-0200B units.

TO SET UP MULTIPLE TCS-0200C'S ON RS-485 NETWORK:

1. Set the 2100C Motor Control Module to Slave mode.
2. Connect all TCS-0200C's to the slave 2100C using the RS-485 cables.
3. Connect the 2100C to a PC which has a terminal program (such as Hyperterminal™ or ProComm™) using RS-232 cable.
4. Turn on the PC, then the 2100C, then the **first** TCS.
5. Open the PC's terminal program.
6. The factory default address of the TCS is 10.
7. Type the following command, including brackets and spaces: [10 Z aa] where aa is the new address of the TCS. You should get an exclamation point [!] response from the TCS.
8. Save the new address in the TCS memory by typing [aa M] where aa=new address. You should get an exclamation point [!] response from the TCS.
9. Turn on the next TCS-0200C and repeat steps 6 and 7, but make sure to use a different new address for each TCS connected on the RS-485 network. Keep a record of each TCS serial number and its assigned address.
10. Repeat step 8 until all TCS-0200C addresses have been set.
11. Wait five to ten minutes and then obtain a System Report printout from the Master Controller. (See Section 3.3.2.7.)
12. Make sure System Report printout has list of instruments which include any 2100C's and TCS-0200C's (check their addresses).

3. OPERATION

3.1 GENERAL

3.1.1 RAISING AND LOWERING DRIVE ASSEMBLY

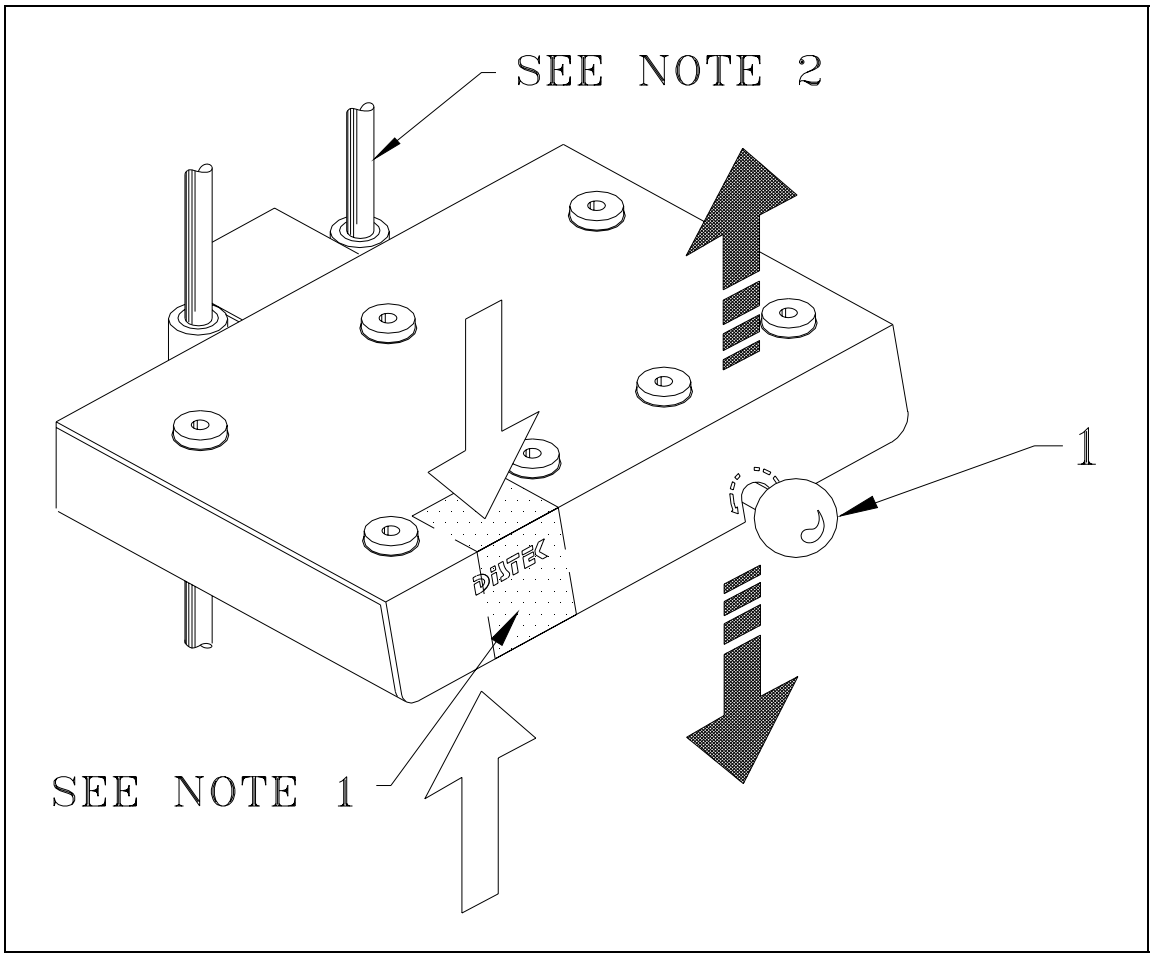


Figure 3-1: Drive Assembly

(1) - Control knob: Used to raise or lower drive assembly. Rotate left (counterclockwise) about 1/2 turn to loosen, right to lock drive assembly.

NOTE 1: When raising or lowering drive assembly, place your left hand on location shown for smooth vertical motion.

NOTE 2: For maintenance, apply a thin film of light oil lubricant, such as 3-in-1, to guide shafts.

3.1.2 VESSEL SUPPORT PLATE

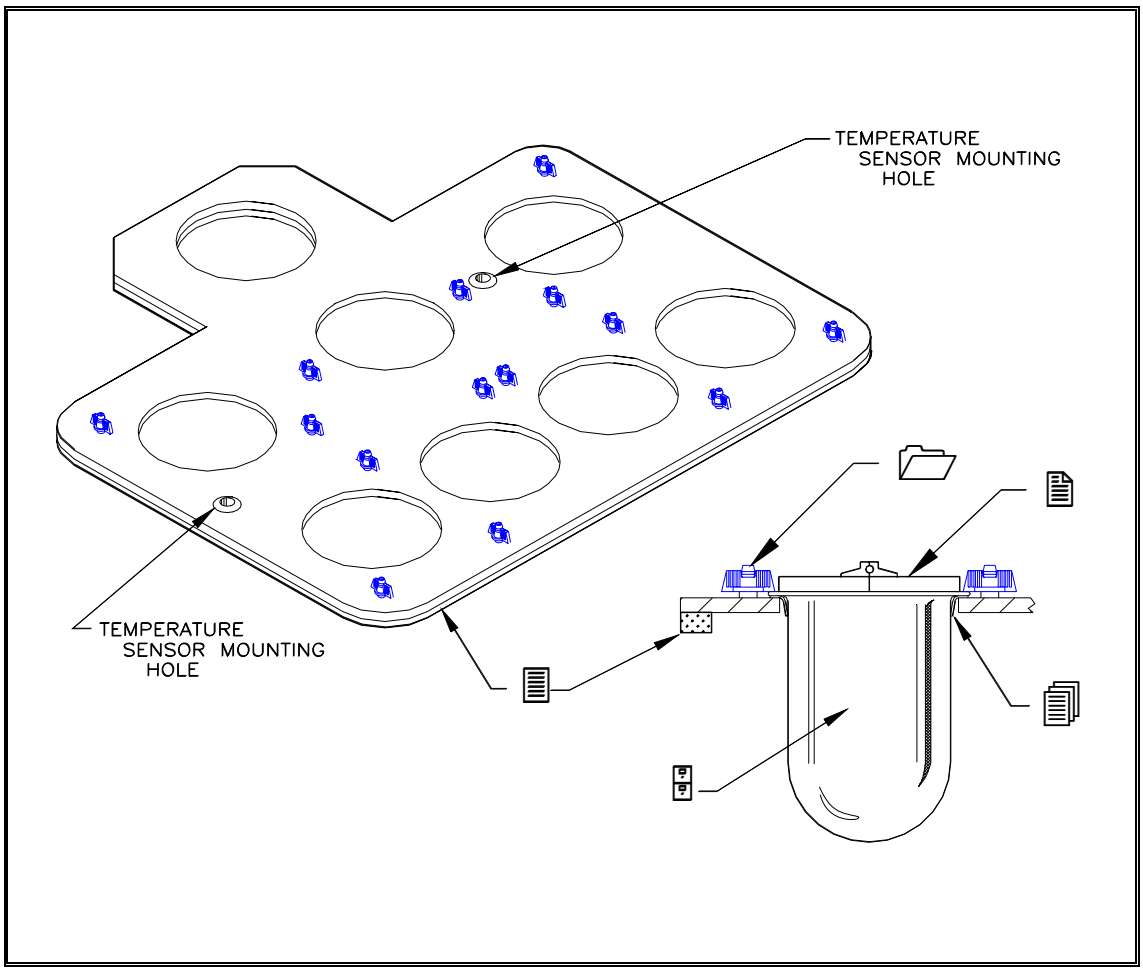


Figure 3-2: Vessel Support Plate

(1) - Hold Down Clip: * Used to hold down vessel in water bath.

(2) - Vessel Cover: Used to cover vessel, reduce heat loss, and reduce evaporation.

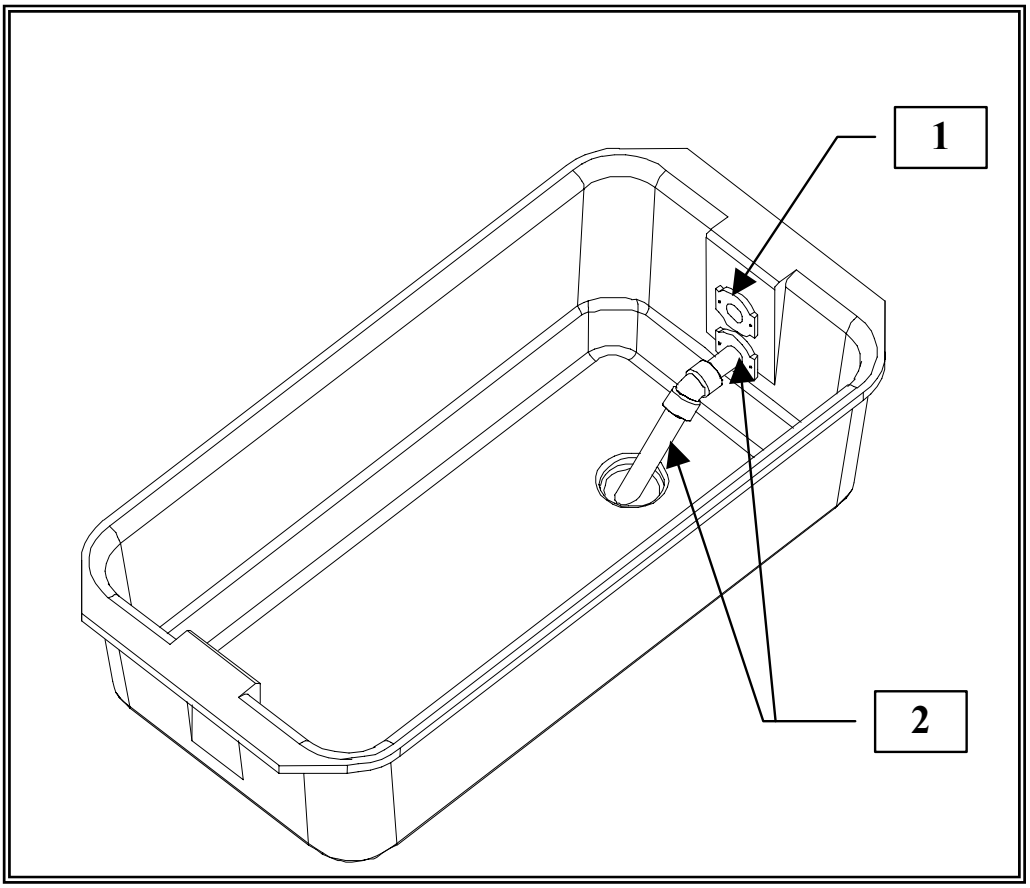
(3) - Rubber Sponge: Seals edge of water bath to retard evaporation.

(4) - Centering Ring: Used to center vessel accurately in hole and maintain alignment with paddle or basket shafts. Place ring in hole before installing vessel in support plate. (See Fig. 2-5.) Centering rings should not be removed from vessels between tests.

(5) - Vessel: One liter glass or plastic; contains dissolution test medium.

* = *NOTE: Hold down clips are not required for general operation. They can be used for setting the height adjustment in empty vessels, or when the test calls for only 500ml of media.*

3.1.3 WATER BATH



(1) - Water bath inlet bulkhead fitting.

(2) - Drain pipe assembly (includes outlet bulkhead fitting)

Figure 3-3: Water Bath Fittings

Note: Drain pipe spacing above inside bottom of bath recess is .05-.07" (1.3-1.8mm).

- *ADJUSTING PADDLE OR BASKET HEIGHT*
- *SEALING WATER BATH*

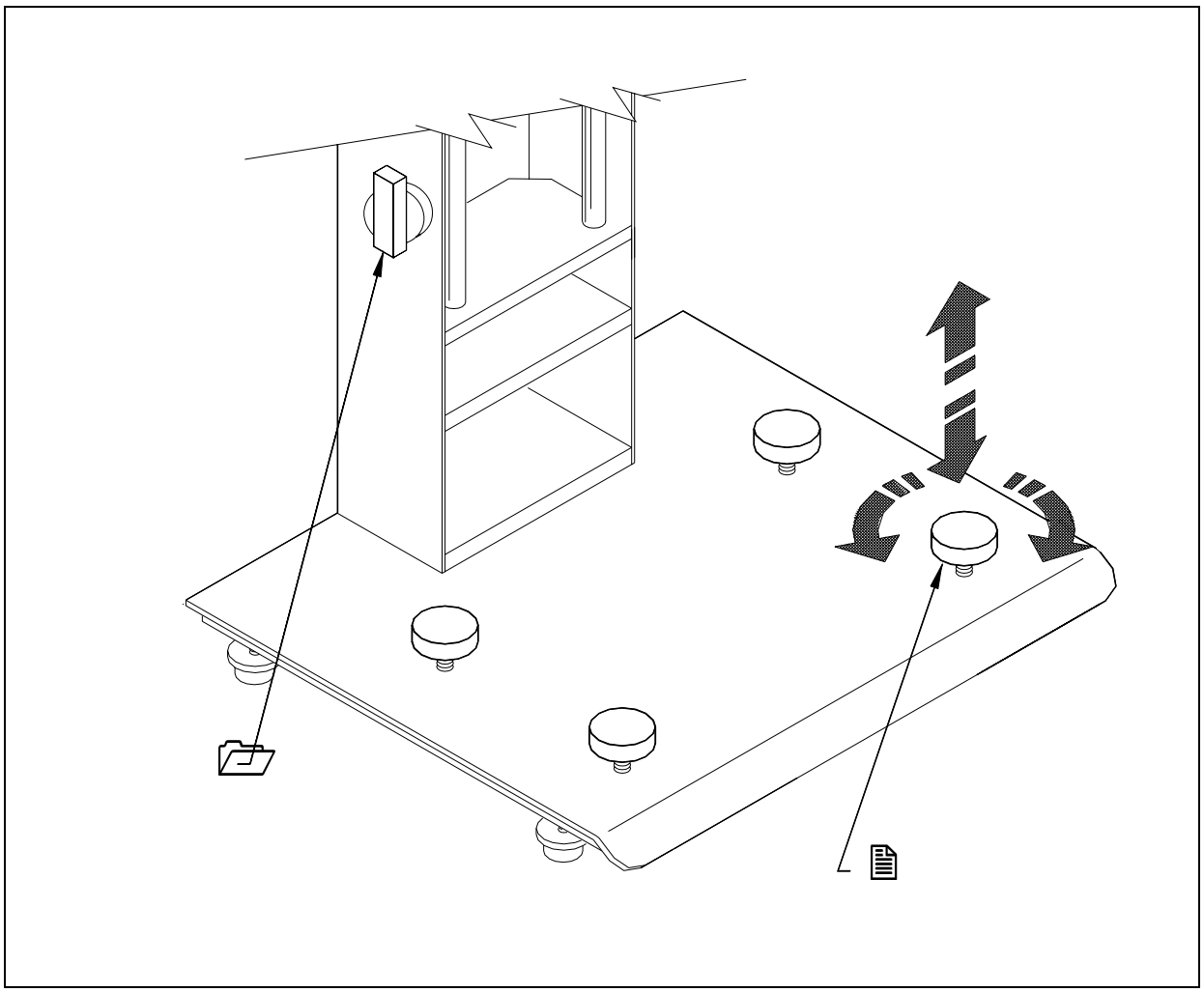


Figure 3-4: Base and Frame Assembly

(1) - Height Adjustment Knob: Used to set 2.5cm distance from bottom of vessel to paddle or basket.

(2) - Water Bath Support: Raise supports to seal water bath. Lower to remove water bath.

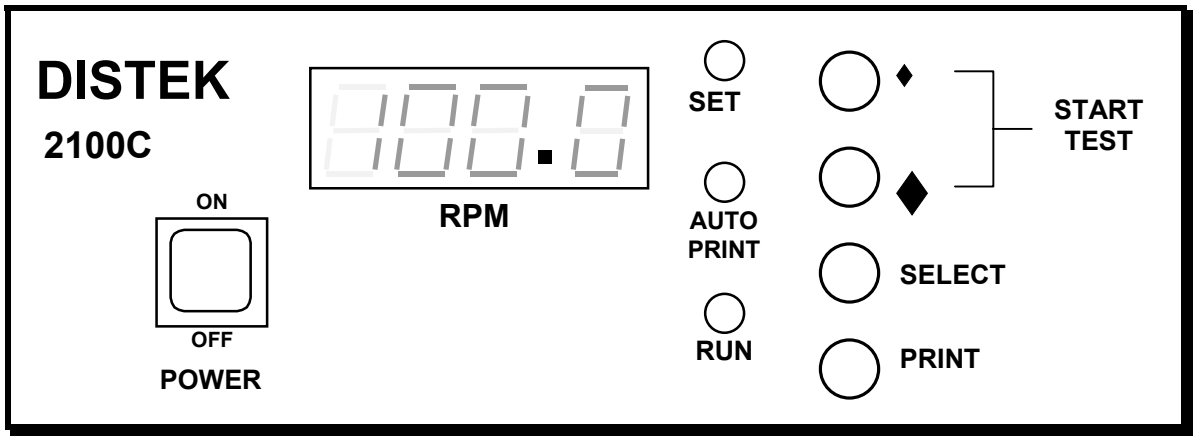
Note: Take extra care when removing or installing the 2 liter (tall) water bath. The corners at top of bath can damage the foam seal under the vessel plate.

3.2 MOTOR CONTROL MODULE: SETTING INSTRUMENT RPM

1. Turn on instrument power (Figure 3-5). The unit displays the *EPROM* version, followed by the unit's *Mode* and *Address*. Each is displayed for a few seconds. The current RPM is then displayed. Spindles will begin rotating at RPM set for the previous test.
2. To change RPM, press Select button once briefly to access the setup menu, and display will show "**SPd**" for RPM (speed) setting.
3. Press Select again to allow a change in RPM setting. RPM display will flash and "SET" LED will light.
4. Use Up and Down arrow buttons to set RPM to desired value.
5. Press and hold Select button to return to normal RPM display mode. After a brief pause, shaft rotation will change to new set speed.

NOTE: There may be a momentary upset in the RPM display. This is normal. Accurate control of RPM will begin immediately.

NOTE: For fuse information, see rear panel of motor control module.



(1) -ON/OFF Switch: Turns main instrument power on or off.

(2) -RPM Display: Provides continuous indication of paddle or basket RPM.

Figure 3-5: Front Panel, Motor Control Module

3.3 PROGRAM MODE OPERATION

The front panel of the 2100C Motor Control Module is shown above. The functions of the controls and indicators are explained below.

3.3.1 INDICATORS

3.3.1.1 RPM Display

The RPM display is a four-digit, red, light emitting diode (LED) type. When setting system parameters, the SET LED is lit, and the display flashes the current parameter to be changed. See section 3.3.2.5 for information on system parameter settings.

Indication At Power On:

- Turn on instrument power.

*Note: The unit displays the EPROM version, (for example **E 2.10**) followed by the unit's Mode and Address. * Each is displayed for a few seconds. The current RPM is then displayed. Spindles will begin rotating at RPM set for the previous test.*

** Note: For a 2100C in Zymark mode, an additional display will show the TCS address that the MCM will use for logging temperatures: it will appear as "tcXX" where XX is the TCS address.*

Mode and Address Display

The following examples show how the 2100C displays its mode and address at power on. The second letter in m**A**ster, s**L**ave, or z**Y**mark mode is used on the display as follows:

Display		*Mode*	*Address*
A 16	=	m**A**ster	16
L 08	=	s**L**ave	08
Y 08	=	z**Y**mark	08

Setting RPM:

1. To change RPM, press Select button once briefly to access the setup menu, and display will show "**SPd**" for RPM (speed) setting.
2. Press Select again to allow change in RPM setting. RPM display will flash and "SET" LED will light.
3. Use Up and Down arrow buttons to set RPM to desired value.
4. Press and hold Select button to return to normal RPM display mode. After brief pause, shaft rotation will change to new set speed.

3.3.1.2 SET LED

When the SET LED is lit, the 2100C is in set system parameters mode (see Section 3.3.2.5: Setting System Parameters). In this mode, the arrow keys are activated to select a new parameter value. The display flashes the value being changed.

3.3.1.3 Auto Print LED

When the auto print interval LED is lit the auto print function is activated. The 2100C will print the standard report at every print interval during a pre-programmed test. The current RPM is shown on the RPM display. To set the print interval, see section 3.3.2.5.

3.3.1.4 Power Switch.

When the RPM display is illuminated, the 2100C is in the power on state.

3.3.2 CONTROLS

3.3.2.1 Power Switch

The power switch is used to apply power to the unit and to abort a test or parameter entry. When power is removed, all settings are retained in internal non-volatile memory.

3.3.2.2 Arrow Keys

The arrow keys are used to increment (up arrow) and decrement (down arrow) the various system parameters. Once a parameter has been changed to the desired value, holding down the Select key stores the new value and returns the 2100C to the RPM display mode.

- To start a pre-programmed test, press both arrow keys simultaneously.

When starting a test, the RPM and temperature max. and min. are reset, the RPM duration is counted, and the IRPM is set after the RPM duration is elapsed. To confirm that the start test function has been activated, an approximately 2 second audible tone will be heard. The RUN LED will be illuminated for the duration of the test. (See Section 3.3.2.6: Running a Test.)

When a test is started on the master 2100C, the unit will contact all other 2100C slave units connected via the RS-485 interface and perform the start test function to each. The master 2100C will only start the previously set RPM and IRPM duration's on each slave unit. All slave test parameters (RPM, IRPM, and test duration's) must be entered on each slave unit individually.

On both master and slave units, when a test is running and the RUN LED is illuminated, no test parameters can be changed. The Select key is locked out for the duration of the test. To abort a test, power can be cycled or the HALT command can be used (see Section 3.3.2.3).

3.3.2.3 HALT Command

The **HALT** command allows user to stop motor at any time, without switching off 2100C power. If **HALT** command is given during a test, the test will be aborted. If a printer is connected to 2100C Printer port, the printout will report an aborted test.

1. To stop motor, press and hold UP arrow key for at least 3 seconds.
Note: The RPM display will flash  *message.*
2. To re-start motor, press SELECT key.

3.3.2.4 Select Key

Press the Select key to access the main setup menu. Press the Select key a second time to select the system parameter shown. The SET LED will light and the RPM display will flash. The arrow keys are used to set the desired value. The Select key is then pressed and held to store the displayed value into memory.

3.3.2.5 Setting System Parameters

1. From RPM display mode (display not flashing), press Select key once to enter into main setup menu. The unit will display the menu item that it was last set to. Normally this will be the RPM setting, in which case "SPd" will be displayed.
2. Press Select key again to allow a change in parameter setting using the arrow keys.
3. Once the value is set, press Select to return to the main setup menu.

Note: To return to normal RPM display mode, press and hold Select key at any time.

5. From the main setup menu, use the up or down arrow key to navigate to any desired parameter as shown below in Table 2: System Parameters.

*Note: When setting the RPM duration, IRPM duration and print interval (**Sdur**, **idur**, **Pint**), minutes and hours are each cycled separately. The parameter (hour or minute) blinks to indicate it is the one being changed.*

5. When setting date and time, use arrow keys to choose "**tod**" (Time of Day) and press Select key to access sub-menu items 1-5.
6. Use arrow keys to set parameter value, and press Select again to choose next item.
7. After cycling through items 1-5, press Select to return to "**tod**" in main menu.
8. SCANNING: Use arrow keys to choose "**SCAn**" in main menu, and press Select again to enter scanning display. (Scanning only works in Master mode: see Section 2.11 .) The display shows "S 00". Press and hold both Up and Down arrow keys together to begin scanning RS-485 addresses. The display cycles from "S 01" to "S 31". After scanning is completed, press and hold Select to return to RPM display mode. The Master unit keeps list of active addresses found in non-volatile memory. Scan again whenever RS-485 network is changed.

*Note: The unit remembers the last menu item selected for about 2 minutes, after which it reverts back to the normal "**SPd**" selection.*

3.3.2.6 Running a Test

1. Press the Up and Down arrow keys together to begin a test.

*Note: The paddle rotation will stop to allow dropping in of dosage forms, indicated by a flashing "**droP**" on display and periodic beep.*

2. After dosage forms are dropped, start test by pressing Select. Paddles begin turning at set RPM and unit starts timing test.

*Note: At the end of a test, the paddles stop and a flashing "**End**" indicates test is finished.*

*Note: Press any key while "**End**" is flashing to re-start paddles at set RPM.*

Table 2: System Parameters

System Parameter	*Menu Item*	*Display Format*	*Range*
RPM	**SPd**	150	0 - 350 RPM
RPM Duration *(hr:min)*	**Sdur**	02.30	00.00 - 99.59 *(hr:min)*
Print Interval *(hr:min)*	**Pint**	02.00	00.00 - 99.59 *(hr:min)*
IRPM (Infinity RPM)	**iSPd**	i 250	0 - 350 RPM
IRPM Duration *(hr:min)*	**idur**	01.30	00.00 - 99.59 *(hr:min)*
Time of Day	**tod**	(sub-menu)	items 1-5 below
Time of Day: Minute	**1**	1 30	0-59
Time of Day: Hour	**2**	2 03	0-23
Date: Day	**3**	3 13	1-31
Date: Month	**4**	4 11	1-12
Date: Year	**5**	5 96	00-99
Scan RS-485 Network	**SCAn**	*S 01*	00-31

3.3.2.7 Print Key

Press the Print Key to enable the auto print mode. The Auto Print LED illuminates to indicate that this function is enabled. During a pre-programmed test, the standard test report is printed every preset interval until the Print key is pressed again to disable the auto print mode.

When the Print key is pressed and held (approx. four sec), the standard test report is printed immediately.

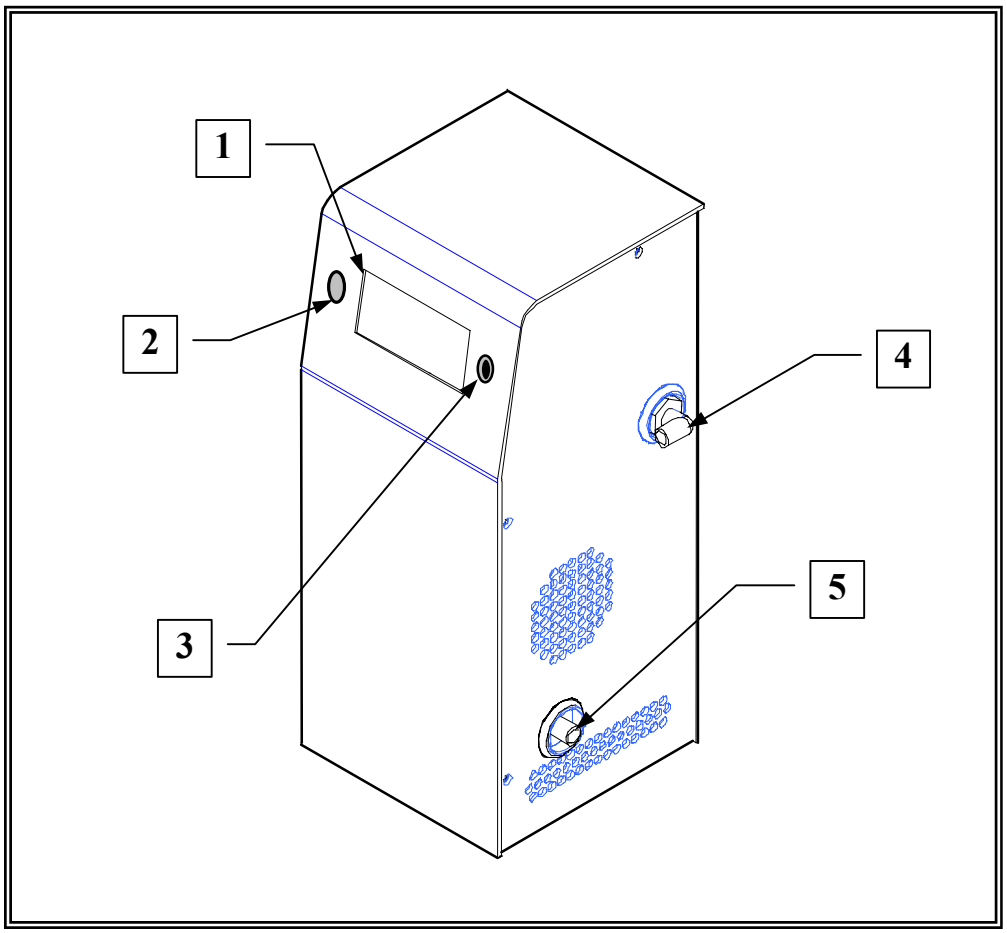
A standard print report is available in this way at any time even while a test is in progress. If the print interval is selected, press and hold the Print key to generate a printout if a test is running or not. (Make sure the Auto Print LED is still illuminated afterwards if desired.) If a test is running, the Select key is not active, therefore the actual print interval cannot be changed.

To generate a SYSTEM REPORT printout, press Select key once ("Spd" is displayed), then hold down the Print key. This report includes system parameter settings and can be used to check against desired values.

Note: System Report not available during pre-programmed test.

3.4 MODEL TCS-0200C THERMOCIRCULATOR

3.4.1 INTRODUCTION



(1) TEMPERATURE DISPLAY/CONTROL: Provides continuous display and control of water bath or vessel temperature, depending on placement of temperature sensor.
(2) HEATER INDICATOR LIGHT: Light is on when heater is on.
(3) SENSOR JACK: Accepts temperature sensor plug.
(4) CIRCULATOR OUTLET: (Connects to bath inlet hose 5/8" I.D.).
(5) CIRCULATOR INLET: (Connects to bath outlet hose 5/8" I.D.).

NOTE: For fuse information see rear panel of thermocirculator.

Figure 3-6: TCS-0200C General Information

- Figure 3-7 shows location of power entry module, power switch, thermal safety reset, and RS-485 ports, on back panel of thermocirculator.

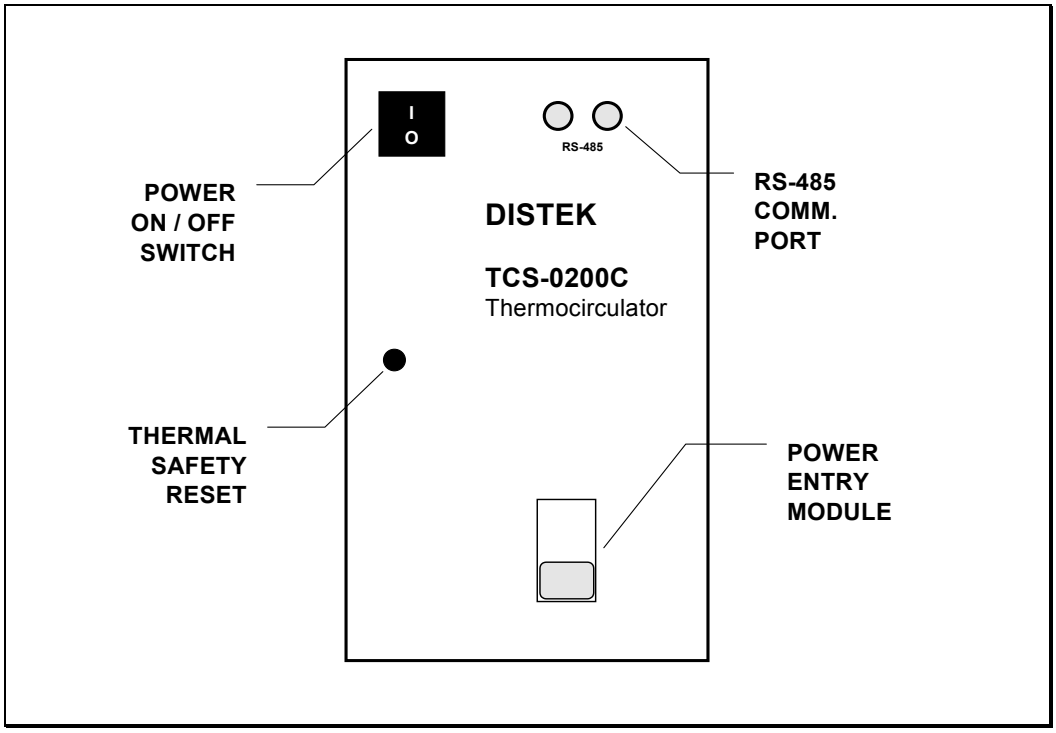


Figure 3-7: TCS-0200C Back View

(1) - POWER ON/OFF SWITCH: Turns power on and off.

- Place temperature sensing probe from TCS in mounting hole on Model 2100C vessel support plate (see Figure 3-2). Remove probe temporarily from bath when measuring vessel temperature.

Note: Do not block ventilation holes on right side panel of thermocirculator.

Note: All DISTEK thermocirculators have thermostatic protection. In the event of a malfunction, the thermocirculator will cut off at approximately 50°C.

CAUTION: MAKE SURE PUMP IS PRIMED (SECTION 2.4.2) BEFORE RESETTING.

NOTE: Wait about 15 minutes for heater to cool before resetting thermostat.

TO RESET:

1. Switch TCS-0200C to the off position.
2. **Unplug** TCS-0200C power cord.
3. WARNING: REMOVE PLUG FROM AC OUTLET. DO NOT USE METAL TOOL TO RESET THERMOSTAT. HIGH VOLTAGE PRESENT.
4. **WARNING: Using an insulated plastic tool**, press the thermal safety reset button through the hole in the TCS back panel. (See Figure 3-7.)
5. Plug in and turn on TCS briefly to check flow.

3.4.2 TCS-0200C Front Panel Controls

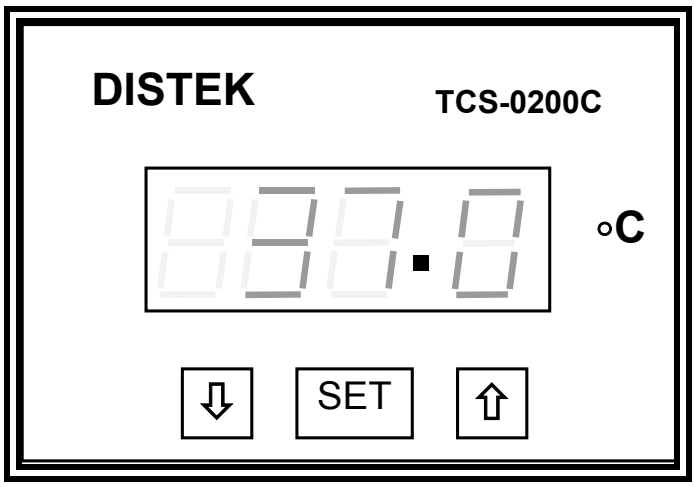


Figure 3-8: TCS-0200C Front Panel

The TCS-0200C Thermocirculator front control panel is shown in Figure 3-8 . When digital display is flashing, the current temperature set-point is displayed. When display is not flashing, the current temperature of the external probe is displayed.

1. To set the temperature set-point, press SET key. The display flashes and the current set-point is displayed.
2. Use UP and DOWN arrow keys to select new set-point.
3. Press and hold SET again to record new set-point into non-volatile memory.
Note: When display is flashing, twenty (20) seconds without a keystroke will return to original set-point value.

3.5 SERIAL PORT CONTROL OF 2100C AND TCS-0200C

3.5.1 INTRODUCTION

DISTEK instruments used in multiple bath configurations can be digitally interconnected using advanced communications capabilities.

The command language and structure are based on the instrument command language defined in "Standard Commands for Programmable Instruments" (SCPI) 1995. Some commands, command syntax, and usage are taken directly from this standard. The SCPI standard was developed mainly as an extension to the IEEE-488.1 parallel interface specification. For implementation on serial networks, additional functions such as device addressing and message packetization have been added by DISTEK.

The protocol uses ASCII characters and text based commands to simplify the testing and development of automated applications. Communications can be monitored and analyzed using any ASCII based terminal connected to the serial interface. The use of English commands that "make sense" allows for quick analysis of the instrument status. The protocol allows for easy testing of single commands, through manual operator entry using any terminal program.

3.5.1.1 Address Setting: Motor Control Module

The 2100C Motor Control Module has an eight-position DIP switch located on the main PC board inside the unit. The first five switch positions (1-5) select the unit's RS-485 address. Switch position 6 selects master or slave mode, and switch 7 selects 12 or 24 hour time formats. The last switch position selects a Zymark control emulation mode for the serial port. Please refer to Section 2.11 for further information.

When two or more 2100C units are connected on the RS-485 bus, it is imperative that each one must have a unique address. Otherwise, faulty communications can occur.

3.5.1.2 Address Setting: TCS-0200C

The TCS-0200C serial address can only be set by using the Set Unit Address command (see Table 8). The 2100C in master mode can be commanded to scan all RS-485 addresses for active slave units.

3.5.2 SPECIFICATIONS

3.5.2.1 RS-232 Port

The 2100C Motor Control Module has a nine-pin DB-9 serial RS-232 port connector, for communications and control using a PC. This port on the 2100C is configured as Data Communications Equipment (DCE) at 9600 baud rate. Settings are: No parity, 8 data bits, and 1 stop bit (N, 8, 1). The RS-232 connector has the following pinout:

Table 3: RS-232 Pin Assignments

Direc-tion	*Circuit Abbreviation*	*Circuit Name and Description*	*Contact Number*
2100C Output	RXD	Received data: The data signals generated by the DCE are transferred on this circuit to the DTE.	2
2100C Input	TXD	Transmitted data: The data signals originated by the DTE are transferred on this circuit to the DCE.	3
2100C Input	RFR	Ready for receiving: This circuit indicates whether the DTE is ready to accept data on RXD.	7
2100C Output	CTS	Ready for sending: this circuit indicates to the DTE whether the DCE is prepared to accept data signals on TXD.	8
--	GND	Signal ground or common return.	5

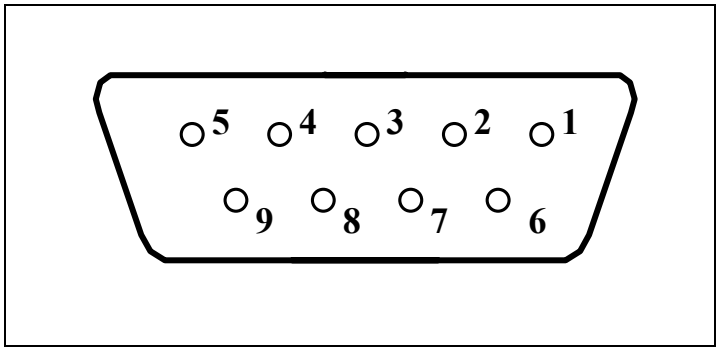


Figure 3-9: RS-232 Pinout Diagram, From Rear View of 2100C

3.5.2.2 RS-485 Port

The 2100C and the TCS-0200C each have two round DIN connectors for RS-485 communications. Both connectors have the same function and pinout. The pinout is as follows:

Table 4: RS-485 Pin Assignments

Circuit Name and Description	*Contact Number*
Circuit A	3
Circuit B	4
GND: Signal ground or common return.	1
GND: Signal ground or common return.	2

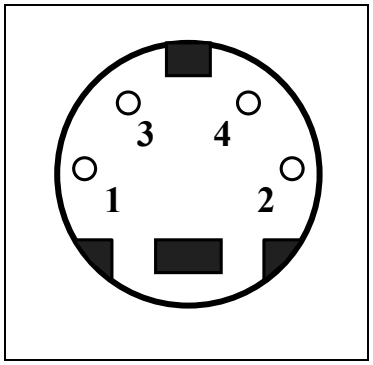


Figure 3-10: RS-485 Pinout Diagram, From Rear View of Unit

Note: When connecting instruments using RS-485 ports, it is very important for error-free communications to use the RS-485 Termination Plug P/N 0500-0006. The termination plug should be installed in the open RS-485 port farthest from the Master Controller. Example below shows single bath configuration:

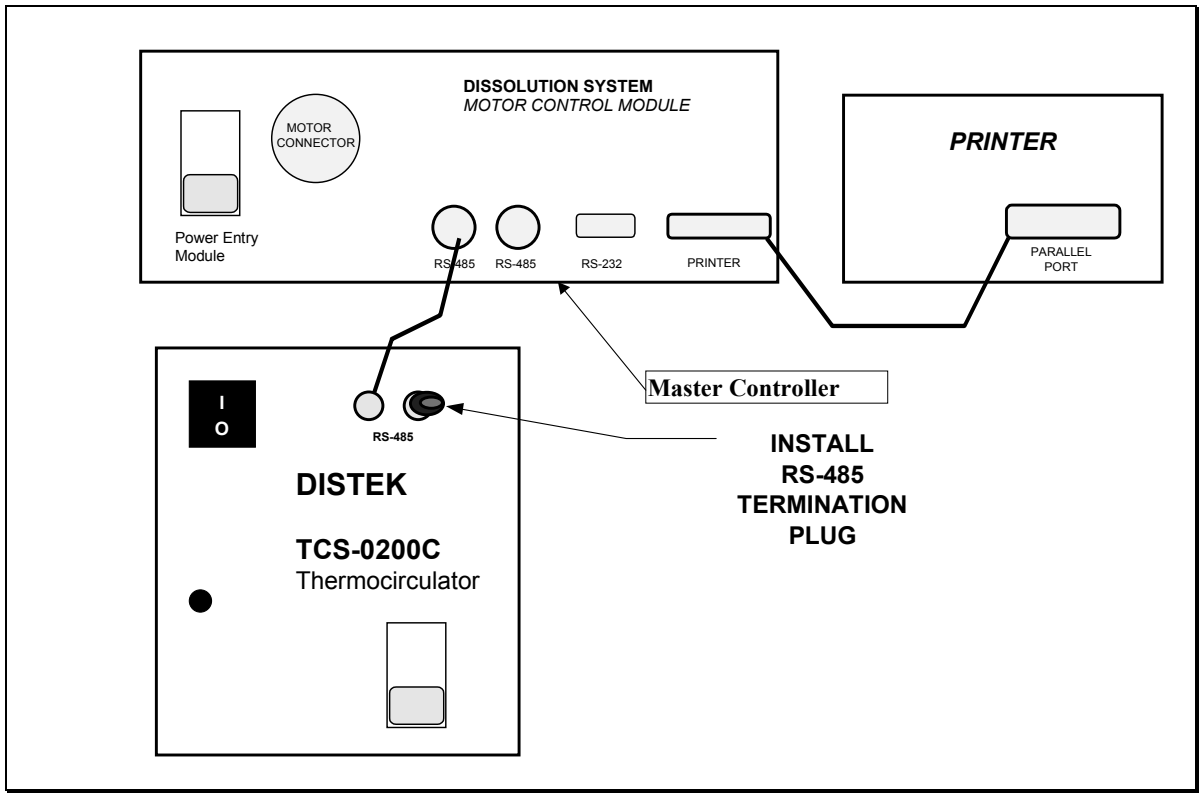


Figure 3-11: RS-485 Termination Plug Installation (Optional Printer Shown)

3.5.3 COMMUNICATIONS PROTOCOL, 2100C

- When a unit receives a command, the unit responds as shown in Table 5.

Table 5: 2100C Serial Command Response

Command Received	*With No Address*	*With Unit Address*	*With Other Address*
RS-232 port	Execute command and respond on RS-232 port	Execute command and respond on RS-232 port	Relay command to RS-485 bus
RS-485 port	Ignore	Execute command and respond on RS-485 bus	Ignore

- If a 2100C is connected to a PC, the PC must set RTS and wait until CTS is true to send a command through the RS-232 port.
- The PC should wait at least 5 seconds for a response to a command (see Table 7), and re-send the command if no response.

3.5.4 MASTER MODE

Functions built into the 2100C Motor Control Module allow this unit to operate as a Master Controller. In Master mode, the 2100C can provide combined test synchronization with multiple bath systems. Through the front panel controls and rear printer port of a single 2100C, test data from other DISTEK dissolution bath systems can be monitored and printed.

The 2100C is normally shipped with Master mode configuration (factory default). The following information will help in use of this feature:

- Master mode is intended for standalone operation of single- or double-bath systems, as shown in Figure 3-11 and Figure 2-15 respectively.
- The maximum number of instruments that should be connected together through the RS-485 ports is two 2100C baths and one TCS-0200C as shown.
- Master mode is not optimized for remote PC control.
- The 2100C in Master mode reads and prints temperatures from a TCS-0200C connected through the RS-485 port.
- The 2100C in Master mode also reads and prints RPM data from a single 2100C Slave unit connected through the RS-485 port.

3.5.5 SLAVE MODE

The serial port of the 2100C can also be configured to connect to a host PC. A single PC connected to only the RS-232 serial port of a single 2100C can control multiple dissolution bath systems connected to the unit's RS-485 port. A complete feature set exists, based upon standard language protocols, to control and monitor all parameters of the DISTEK 2100C system.

DISTEK instruments are designed with the capability to communicate using RS-232 for single point applications and RS-485 for multi-point applications. The support of multi-point networks using the RS-485 standard necessitates that each node connected to the same RS-485 network be programmed with a separate address.

The 2100C can be set to Slave mode using internal DIP switch settings. The information below explains the use of Slave mode:

- Slave mode is used when a host PC is connected to the RS-232 port of a 2100C.
- Slave mode is also used in the second 2100C of a double-bath system (see Figure 3-11).
- The host PC must address and control all Slave mode devices.
- When a PC is connected to the RS-232 port of a 2100C in Slave mode, up to 4 baths can be supported.

3.5.6 DISTEK 2100C MOTOR CONTROL MODULE COMMANDS

- In certain modes the address field is optional or unnecessary. The address field is only shown in Table 6 example as "[aa_".
- The underscore character "_" is used in the command format to indicate the need for a blank space in the command line.

Table 6: Command Example

Command Function	Format	Response Format
Device Identification	"[aa_*IDN?]"	"[DISTEK,2100C,serial#,revision]"

- Table 7 lists 2100C command functions, their formats, and response formats.

Table 7: 2100C Command Reference

Command Function	*Command Format*	*Response Format*
Measure the current RPM	"[aa_MEAS:RPM]" (aa= ASCII encoded address)	[XXXX] (XXXX=RPM)
Measure the current maximum RPM	"[MEAS:RPM:MAX]"	[XXXX] (XXXX=max)
Measure the current minimum RPM	"[MEAS:RPM:MIN]"	[XXXX] (XXXX=min)
Measure the current maximum IRPM	"[MEAS:IRPM:MAX]"	[XXXX] (XXXX=max)
Measure the current minimum IRPM	"[MEAS:IRPM:MIN]"	[XXXX] (XXXX=min)
Start a pre-set test	"[TEST:START]"	"[!]" (success) or "[??]" (failure)
Set the RPM	"[CONT:MOTO:SET_NNN]"	[XXX] (XXX=set RPM)
Set the IRPM	"[CONT:MOTO:SETI_NNN]"	[XXX] (XXX=set IRPM)
Read the set RPM	"[CONT:MOTO:SET?]	[XXX] (XXX=set RPM)
Read the set IRPM	"[CONT:MOTO:SETI?]	[XXX] (XXX=set IRPM)
Set the RPM duration	"[CONT:MOTO:RPMD_NNN]"	[XXX] (XXX=set duration)
Read the set RPM duration	"[CONT:MOTO:RPMD?]	[XXX] (XXX=set duration)
Set the IRPM duration	"[CONT:MOTO:IRPMD_NNN]"	[XXX] (XXX=set duration)
Read the set IRPM duration	"[CONT:MOTO:IRPMD?]	[XXX] (XXX=set duration)
Turn motor on	"[CONT:MOTO:STAT_ON]"	[ON]
Turn motor off	"[CONT:MOTO:STAT_OFF]"	[OFF]
Read the motor status	"[CONT:MOTO:STAT?]"	[ON] or [OFF]
Set Date	"[SYST:DATE_YYYY,MM,DD]"	[YY,MM,DD]
Set Time	"[SYST:TIME_HH,MM,SS]"	[HH,MM,SS]
Read Date	"[SYST:DATE?]"	[YY,MM,DD]
Read Time	"[SYST:TIME?]"	[HH,MM,SS]
Set Print Interval	"[HCOP:INTE XXXX]" (XXXX=print interval in minutes)	"[XXXX]"
Read Print Interval	"[HCOP:INTE?]"	"[XXXX]"
Enable Printer	"[HCOP:STAT_ON]"	"[ON]"
Disable Printer	"[HCOP:STAT_OFF]"	"[OFF]"
Check Printer Status	"[HCOP:STAT?]"	"[ON]" or "[OFF]"
Print Report Now	"[HCOP:IMM]"	"[!]" (success) or "[??]" (failure)

3.5.7 DISTEK TCS-0200C THERMOCIRCULATOR CONTROL

The TCS-0200C is equipped with a dual RS-485 port for standard configurations.

As explained in the "Serial Port Control" section above, address fields are required for RS-485 applications. The TCS-0200C has a programmable address that can be set through the RS-485 port. The factory default address is 10. When multiple TCS-0200C units are connected on a single network, they must each be programmed to a unique address.

- The underscore character "_" is used in the command format to indicate the need for a blank space in the command line.

Table 8: TCS-0200C Command Reference

Command Function	Command Format	Response Format
Read the current status	"[aa_A]" (aa= ASCII encoded address)	"[X]" (X = status code)
Read Temperature Probe #1	"[aa_B]"	"[XXX]"
Read Temperature Probe #2	"[aa_C]"	"[XXX]"
Read Device Address	"[aa_N]"	"[XX]"
Read Set-point	"[aa_S]"	"[XXX]"
Read the Scroll Jumper	"[aa_J]"	"[0]" or "[1]"
Set Temperature Setpoint	"[aa_Z:S_NNN]" (NNN=ASCII encoded setpoint)	"[!]" (success) or "[?]" (failure)
Set Unit Address	"[aa_Z:N_NN]" (NN=ASCII encoded new address)	"[!]" (success) or "[?]" (failure)
Save all set parameters	"[aa_M]"	"[!]" (success) or "[?]" (failure)

Notes:
1. All commands following Set Unit Address command must use the new address. After the Save command (M) is executed, the unit retains the new address even after power cycling.
2. Temperature values are in 0.1° Celsius.

3.5.8 EXAMPLES

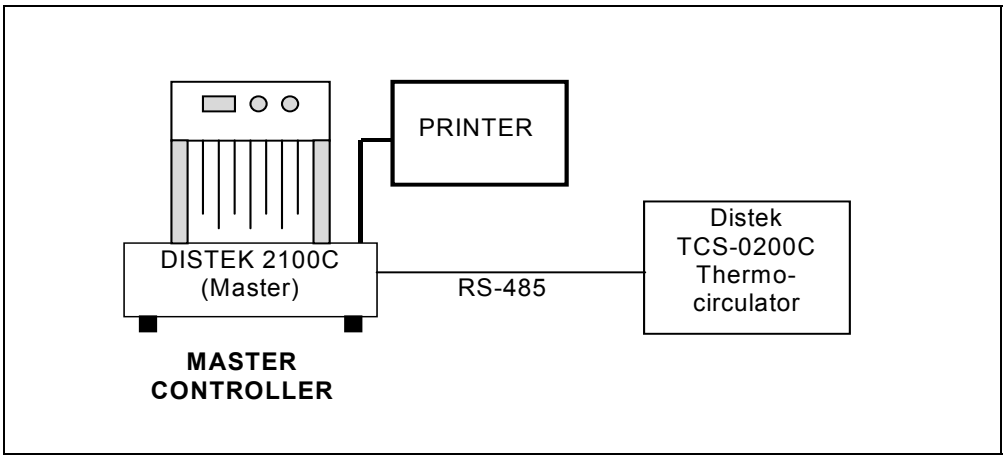


Figure 3-12: Single Bath System With Printer

The single bath system with printer shown in Figure 3-12 can provide test data printouts of temperature, RPM, and test duration.

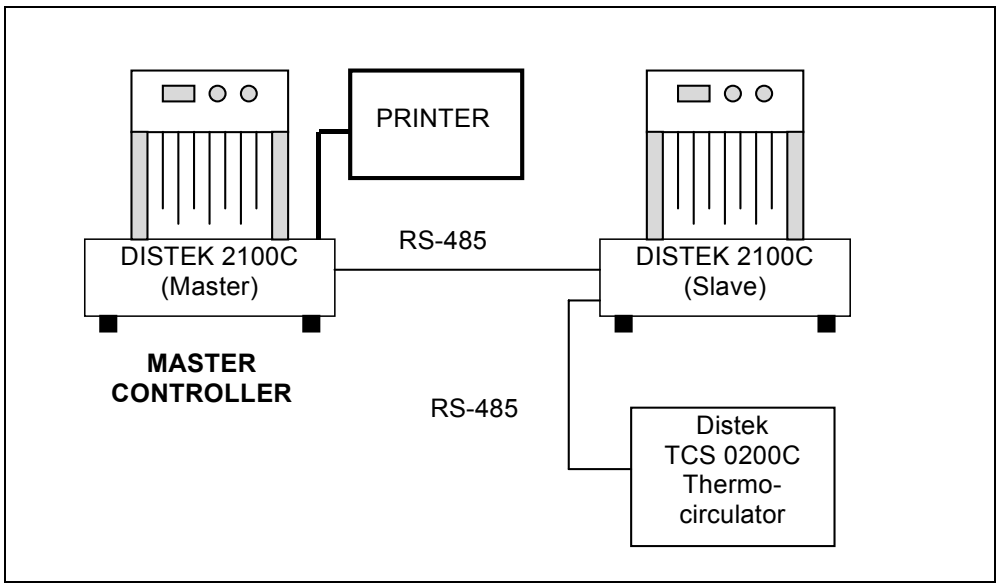


Figure 3-13: Dual Bath System With Master 2100C

A typical dual bath system is shown in Figure 3-13. One DISTEK 2100C and one TCS-0200C are configured as slave devices. Another 2100C is configured as master. A standard parallel printer is connected to the master unit parallel port. All three instruments are connected

together using the dual RS-485 ports on the rear of the units. During scanning, the master unit will find the slave devices at whatever address they are programmed.

The individual 2100C units must be programmed for all test parameters through the front panel interface. Activating the "Start Test " function on the master simultaneously starts the previously programmed test on all slave units. The hard copy printout from the master unit includes all test data from all slave units found during scan mode.

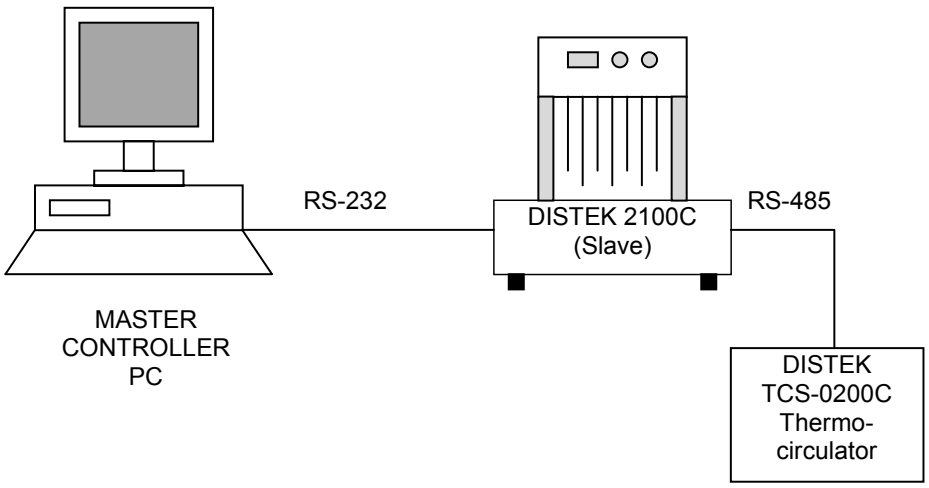


Figure 3-14: Single Bath System With Master Controller PC

A typical single bath system with computer control is shown in Figure 3-14. The DISTEK 2100C and TCS-0200C are configured as slave devices. The master controller can be any type of computer system (or PLC) with an RS-232 port. Initialization of the system consists of first setting the TCS slave address, then setting the test parameters.

Configuring devices in this manner has a number of advantages. Since PC-based controllers do not come standard with RS-485 interface cards, DISTEK intelligent instruments can provide a single RS-232 port to the master controller for up to four slave instruments connected on the RS-485.

In the following example, the TCS is initially set to the default address of 00h, the 2100C is set to address 01h using internal switches. Note that in this configuration the 2100C operates as a "Smart Slave" device where the address on the RS-232 port is optional. This is indicated in Table 9.

Table 9: Single Bath Example Commands

Function	*Command String (from master controller RS-232)*	*Response (from addressed slave)*
Set TCS Unit Address from 10 default to 02	"[10_Z:N_02]"	"[!]" (success)
Write new address into the TCS non-volatile memory	"[02_M]"	"[!]" (success)
Set the RPM on the 2100C to 100	"[01_CONT:MOTO:SET_100]" or "[CONT:MOTO:SET_100]"	[100]
Turn 2100C motor on	"[01_CONT:MOTO:STAT_ON]" or [CONT:MOTO:STAT_ON]"	[ON]
Set TCS Temperature Setpoint to 37.0C	"[02_Z:S_370]"	"[!]" (success)
Read TCS external temperature probe	"[02_C]"	"[XXX]" (XXX=temperature)
Measure the 2100C RPM	"[01_MEAS:RPM]" or "[MEAS:RPM]"	[XXXX] (XXXX = RPM)

4. MAINTENANCE

4.1 GENERAL CARE AND MAINTENANCE OF MODEL 2100C

1. Unit should be cleaned periodically by wiping with a slightly damp cloth. Do not use any harsh chemicals or detergents.
2. Motor control module requires no customer attention. In the event of a malfunction, please call the factory before attempting any repairs.
3. Drive assembly is designed for maintenance-free operation. Drive motor and bearings are permanently lubricated. Belt tension is factory adjusted.
4. ** Rear guide posts require a thin film of lubricant every two to three months. DISTEK recommends light oil such as 3-in-1. (See Figure 3-1.)
5. ** Vessel support plate requires extra care. Do not allow acids or buffers to remain on the plate for extended periods of time. WIPE THE PLATE CLEAN AFTER USE. DO NOT SCRATCH OR SCORE PAINTED SURFACE.
6. Water bath: Clean filter (see Figure 2-5 or Figure 3-3) when needed. This should be done every time the bath water is changed.
7. See Appendix A: Preventive Maintenance Checklist for additional information.

CAUTION: DO NOT CLEAN PLASTIC AND RUBBER PARTS, PARTICULARLY THE WATER BATH, WITH ORGANIC SOLVENTS.

** = *NOTE: These items require periodic attention*.

4.2 REMOVING & RE-INSTALLING WATER BATH

4.2.1 POSITIONING WATER BATH

NOTE: To drain water bath, open drain valve shown in Figure 4-2 *View 'B'.*

TO REMOVE WATER BATH:

1. Drain water bath.
2. Disconnect hose clamps at TCS-0200C.
3. Lower water bath supports (Figure 4-1) to lowest position.
4. Push down four corners of bath to free it from vessel plate.
5. Loosen thumbscrew and turn "bath lock" at front center of vessel plate.
6. Remove bath.

TO RE-INSTALL BATH:

1. Lower water bath supports (Figure 4-1) to lowest position.
2. Slide water bath into position and center it under the vessel support plate.
3. Raise supports until the water bath lip makes good contact with the seal under the vessel support plate.
4. Replace "bath lock" and tighten thumbscrew.
5. Make sure drain valve is closed, and hoses are connected, before filling bath.

NOTE: Do not over-tighten supports; the foam seal strip under the plate should not be compressed any thinner than 3/16" if possible.

NOTE: Always recheck the level again (Fig. 2-1) after installing and filling the water bath.

NOTE: Take extra care when installing or removing the 2 liter (tall) water bath. The corners at top of bath can damage the foam seal under the vessel plate.

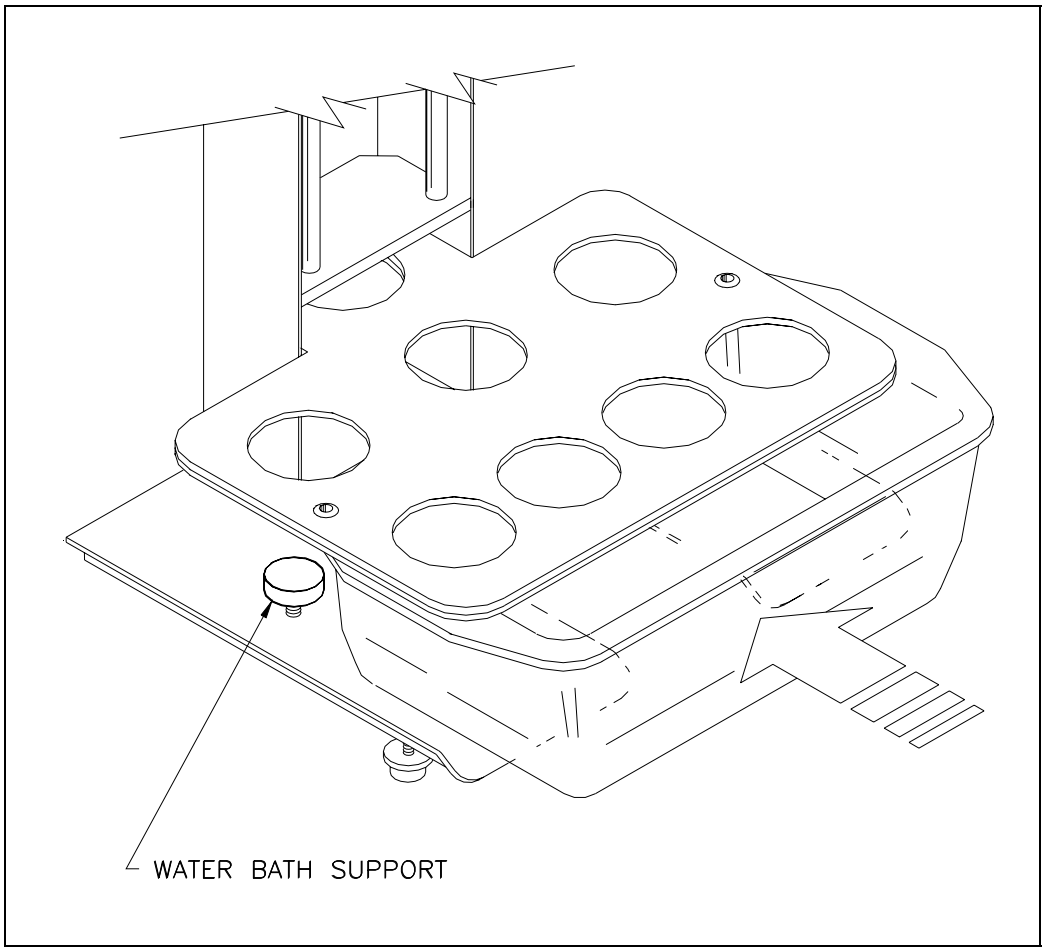


Figure 4-1: Location of Water Bath Supports

4.2.2 CONNECTING HOSES TO THE WATER BATH

Note: Model 2100C is shipped with hoses installed on water bath. These instructions are for use when cleaning bath or replacing hoses.

1. Decide on which side to place thermocirculator (TCS-0200C).
Note: DISTEK recommends right-hand side, when facing unit. If left side placement is required, please call DISTEK for additional installation instructions.
2. Connect bath to TCS as shown in Figure 4-2.
3. Tighten hose clamps.

NOTE: To drain water bath, open drain valve shown below. To open valve, turn handle in line with hose. To close, turn handle perpendicular to hose as shown below.

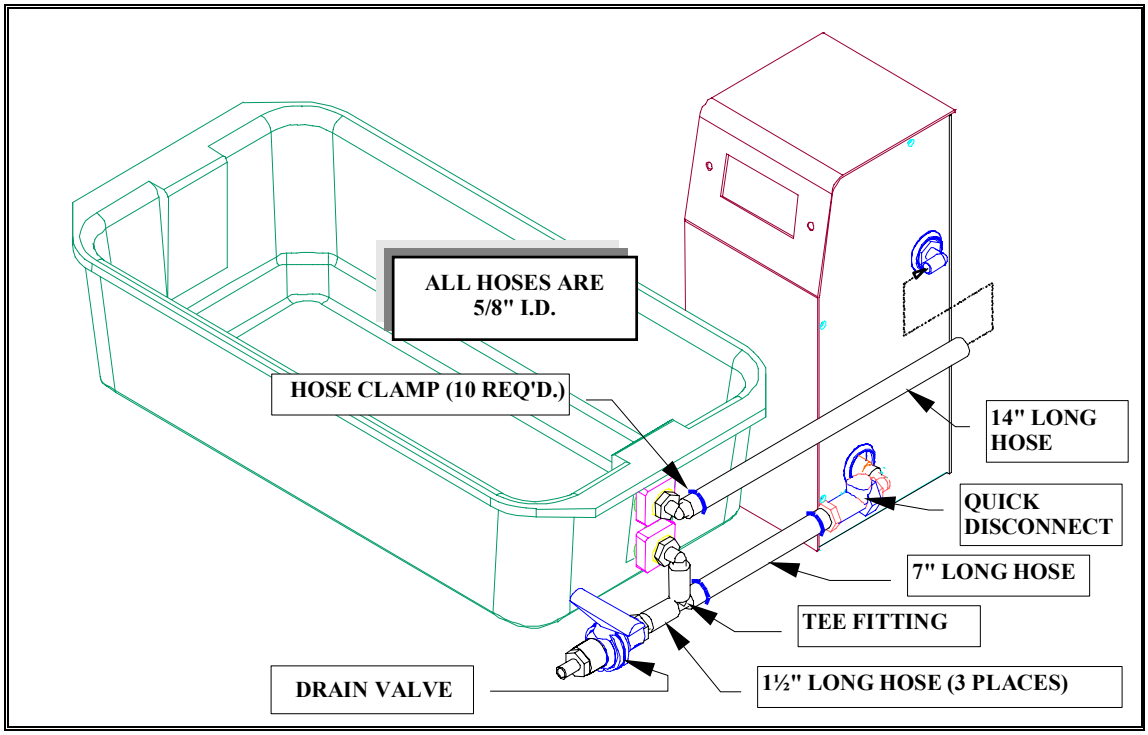


Figure 4-2: Water Bath Hose Connections

4.3 GENERAL CARE AND MAINTENANCE OF TCS-0200C

1. Unit should be periodically cleaned by wiping with a slightly damp cloth.
2. Do not clean plastic or rubber parts with organic solvents.
3. Do not place foreign objects on top of unit.
4. Temperature sensing probe should be placed in mounting hole on Model 2100C vessel support plate (see Figure 3-2). Remove probe temporarily from bath when measuring vessel temperature.
5. Do not block ventilation holes on side panels of thermocirculator.
6. See Appendix B: Preventive Maintenance Checklist.

5. TROUBLESHOOTING

5.1 TROUBLESHOOTING CHART -- MODEL 2100C

SYMPTOM	POSSIBLE CAUSE	SOLUTION
Power switch is on, but no power to unit.	1. Blown fuse in motor control module. 2. Tripped circuit breaker.	1. Change fuse (see power entry module on rear panel, Figure 2-2). 2. Check outlet, reset breaker.
Power switch is on and LED RPM display is flashing.	Select switch not depressed. Display showing *setpoint* instead of actual RPM reading.	Push and hold Select switch to return to normal RPM display mode (no digits flash.)
Unstable temperature reading, variation from vessel to vessel, or temp. control setting does not match LED readout after 45 minutes warm-up.	Drain pipe end too close to bottom of bath.	Check spacing and set to 0.06"
Noise from drive assembly.	Drive belt needs lubrication.	Remove cover, isolate noise location, apply small amount of Dow Corning High Vacuum Grease to top and bottom of belt.
Rotation problems: shaft speed or RPM display problems.	Malfunction in motor control module.	See Section 5-2.

5.1.1 MOTOR CONTROL MODULE

WARNING: Improper servicing or adjustment practice can cause equipment failure or serious physical injury. This equipment must be adjusted and serviced by qualified electrical maintenance personnel who are familiar with the construction and operation of the equipment and the hazards involved. Take diligent care during adjustment. All exposed points on the control circuit board are electrically hot with respect to earth ground.

Before starting any procedure in this section, perform the following:
- Disconnect AC power from the 2100C.

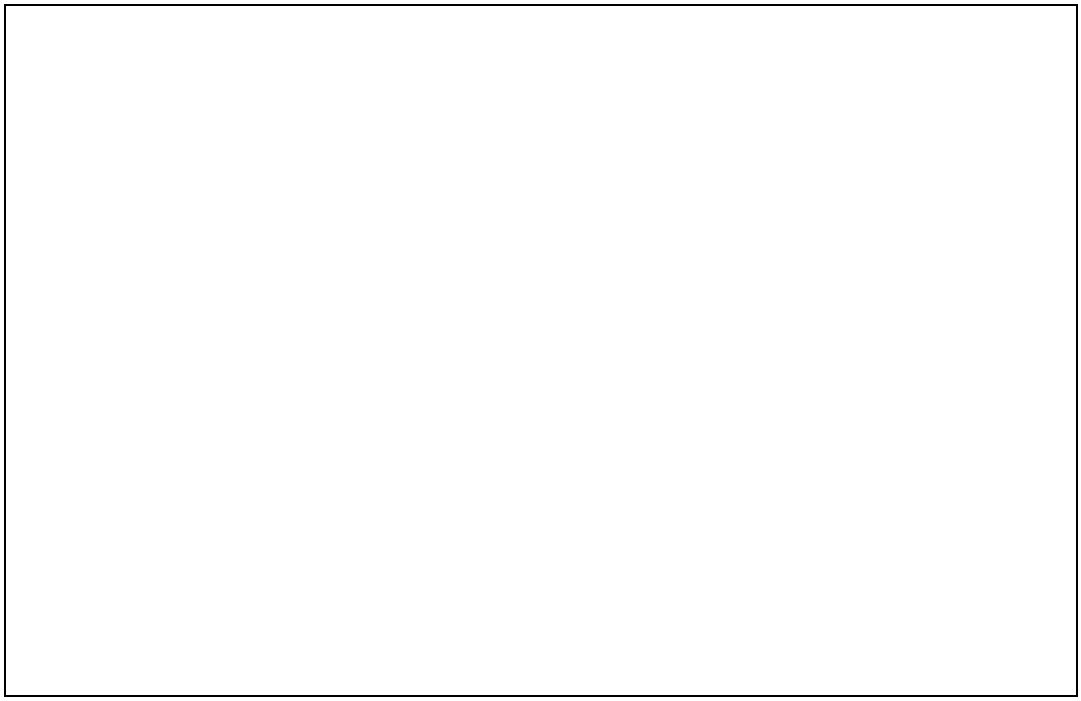
WARNING: Dangerous voltages exist on the motor control boards when powered. Whenever possible, disconnect AC power from the 2100C while troubleshooting. Be alert. High voltage can cause serious or fatal injury.

IF THE MOTOR WILL NOT RUN:

1. Check fuses and circuit breakers.
2. Verify that the LED RPM display is not set to zero (see Section 3.2).
3. If a properly working 2100C is available, you may want to try switching the entire motor control module to isolate an electronic problem from a motor problem. (See Figure 5-1.)

5.1.1.1 REPLACING THE MOTOR CONTROL MODULE

1. Switch off the main power and unplug the 2100C power cord.
2. Disconnect the threaded electrical connector from the back of the module.
3. Remove the flat head Phillips screw and knurled head screw from each side of the module as shown in Figure 5-1. Carefully take the module off the Model 2100C.
4. Reverse this procedure to re-connect the motor control module.



1.) Motor Control Module

2.) Knurled head screw

3.) Flat head Phillips screw

Figure 5-1: Motor Control Module

5.2 TROUBLESHOOTING CHART -- MODEL TCS-0200C

SYMPTOM	POSSIBLE CAUSE	SOLUTION
Switch is on, but no power to unit.	1. Blown fuse. 2. Heater temperature exceeds approx. 50°C causing safety switch to activate. This is usually caused by failure to prime pump. *NOTE: Make sure pump is primed before proceeding - see Section 2.4.2.*	1. Unplug TCS-0200C power cord. Replace fuse in power entry module. (See Figure 3-7.) 2. Unplug power cord. **Use insulated plastic tool.** Push reset button under TCS-0200C rear cover. (See Section 3.4.1). If problem recurs, call factory.
No temperature display, or erratic display.	1. Temperature sensor not plugged in.	1. Plug in sensor. (See Figure 2-4.)
Water is leaking from pump housing.	1. Loose hose fitting. 2. Cracked pipe or leaky joint.	1. Tighten fitting. 2. Shut off pump immediately. Unplug unit. Call manufacturer. (SEE BELOW.)
CAUTION: DO NOT RUN TCS-0200C DRY. CIRCULATOR SHOULD ALWAYS BE PUMPING WATER WHEN POWER IS ON.		

If any other malfunctions occur, please do the following:

1. Turn main power switch to OFF position.
2. Unplug the instrument.
3. Contact DISTEK at (732) 422-7585 or write to: DISTEK, Inc.
   121 North Center Drive
   North Brunswick, NJ 08902-4905

APPENDIX A

SPARE PARTS & ACCESSORIES

Part Number	Description
0500-0193	Operation Manual: Model 2100C
0500-0093	*Dissolution Vessel, 1 Liter, Clear Glass - Includes Acculign Centering Ring*
0505-0023	Dissolution Vessels - Amber (6 per set) SET ONLY - Includes Acculign Centering Rings
0500-0302	Dissolution Vessel - Plastic - Includes Acculign Centering Ring
0500-0099	USP Basket & Shaft - 3/8" dia. - 40 Mesh
0500-0160	USP Basket - 10 Mesh
0500-0159	USP Basket - 20 Mesh
0500-0072	*USP Basket - 40 Mesh*
0500-0303	Basket Shaft - 3/8" dia. (All Stainless) - Basket Not Included
0500-0088	*USP Paddle - 3/8" dia. (All Stainless)*
0500-0098	USP Paddle - 3/8" dia. (Teflon Coated)
0500-0128	USP Paddle - Extended Length (22" - Stainless)
0500-0097	*Acculign Ring - Vessel Centering Ring*
0500-0100	*Vessel Cover - Clear*
0505-0254	Vessel Covers - Black Polypropylene (6 per set) SET ONLY
0500-0103	Seventh Drive Position Spindle (Includes Vessel Cover)
0500-0104	Back Light Kit, 110V
0500-0105	In-Line Filter
0500-0106	*Temperature Sensor*
0500-0109	Seventh Position Hole Plug
0500-0263	Sampling Probe (500 ml special)
0500-0201	*Sampling Probe (900 ml std.)*
0500-0168	Return Probe
0500-0203	*Filter Tips - 10 Micron (1000 per pkg.)*
0500-0275	*Filter Tips - 45 Micron (1000 per pkg.)*
0721-0257	*Vessel Retainer Assembly (Hold Down Clips)*
0721-0094	*Shaft Collar*

Part Number	Description
0707-9010	Hose 5/8" I.D. - 3 ft.
0707-4033	Hose Clamp for 5/8" I.D. Hose
0500-4035	Level
0707-8007	*O-Ring (for Basket/Shaft)*
0707-6065	Adjustable Leveler, 5/16-18 Thread
0707-6066	Adjustable Leveler, **3/8-16** Thread
0707-6011	*Hinge for Flask Cover or Height Adjust Blocks*
0500-9059	Luer Adapter - Female
0500-9060	Luer Adapter - Male
0707-9074	Elbow - Probe (Male to Female)
0752-1009	Coupling 1/4 - 28 Thread
0708-1012	*Thermal Safety Switch TCS-0200C (Internal)*
0708-3000	*On-Off Switch*
0708-3007	*Fuse - 10A Slow Blow*
0708-3008	*Fuse - 2A Slow Blow*
0707-8033	*Drive Belt - Long*
0707-8019	*Drive Belt - Small (Motor to Seventh Position)*
0721-0037	*Pulley, 1/2" I.D. - Mounts on Motor Shaft*
0721-0038	*Pulley, 5/8" I.D. - Mounts on Seventh Spindle*
0721-0039	*Black Pulley - Small*
0721-0290	*Idler Assembly - Includes Bearings & Spacer*
0708-1004	*Magnetic Pickup & Gear*
0700-5123	Temperature Controller/ Display PC Board Assembly for TCS-0200C
0700-2004	Thermocirculator Pump, **115V**
0700-2005	Thermocirculator Pump, 230V
0700-0190	Drive Motor Wiring Assembly with Magnetic Pickup & Gear
0700-0009	*Heater Assembly for TCS-0200C,* **115V**
0700-0010	*Heater Assembly for TCS-0200C, 220V*
0721-0022	Heater Cartridge *Only* for TCS-0200C, **115V**
0721-0153	Heater Cartridge *Only* for TCS-0200C, 220V
0721-2101	Main PC Board Assembly, 2100C Speed Control
0721-2102	RPM Display/ Keypad PC Board Assembly

Part Number	Description
0500-0006	RS-485 Termination Plug
0500-0277	Priming Pump with Hose
0500-0273	Dial Indicator (Wobble Meter)
0500-0281	Center-CHEK™, Model 170
0500-0300	Height-CHEK™, Model 180
0500-0301	Shaft-CHEK™ shaft straightness gauge, Model 190
0500-0298	Temp-CHEK™ Digital Thermometer, Model 200
0500-1044	RPM-CHEK™ Digital Contact Tachometer, Model 210
0500-1045	RPM-CHEK™ Optical Tachometer, Model 220
0500-0299	Vessel-CHEK™, Model 230
0500-1048	Parallel Printer, Inkjet, with Cable
0721-0210	Motor Control Module for 2100C - Complete (Includes RPM Display, Speed Control Board, Etc.)
0021-0005	TCS-0200C: **110V**, Digital Set & Forget Thermocirculator
0021-0006	TCS-0200C: 220V, Digital Set & Forget Thermocirculator

Note: DISTEK maintains a complete stock of all spare parts and accessories for the 2100C. However, some customers may wish to purchase those items shown in italics above, for immediate resolution of most maintenance problems.

APPENDIX B

DISTEK Model 2100C Preventive Maintenance Checklist

Company: _____ **Date:** _____

Location: _____ **2100C Serial #:** _____

Performed By: _____ **TCS-0200C Serial #:** _____

NOTE: DISTEK recommends the following steps after every six (6) months of operation, prior to process calibration.

	1. Check instrument level.
	2. Check water bath clamps, hose connections & bulkhead fittings.
	3. Check all vessel retainer clips & screws.
	4. Check vessel centering rings.
	5. Check alignment of bath in relation to vessel support plate. Check seal.
	6. Clean and lubricate drive posts & bearings.
	7. Verify & record RPM using external tachometer at following speeds: (a) 0 RPM; (b) 10 RPM; (c) 50 RPM; (d) 100 RPM; (e) 150 RPM; (f) 250 RPM.
	8. Measure & record run-out (wobble) for each shaft.

Model TCS-0200C Preventive Maintenance Checklist

	1. Lubricate internal pump bearings with SAE 20 oil.
	2. Check temperature accuracy of thermocirculator with NIST-traceable thermometer.
	3. Check all connections for leaks.

APPENDIX C

SAMPLE PRINTOUTS FROM PARALLEL PRINTER

Note: Actual printouts may vary from samples shown.

```
                DISTEK 2100C DISSOLUTION SYSTEM
                        System Report


Unit Serial Number : 2111604
EPROM Version      : 2.30
Current system date: 06/26/2003
Current system time: 12:15:07P

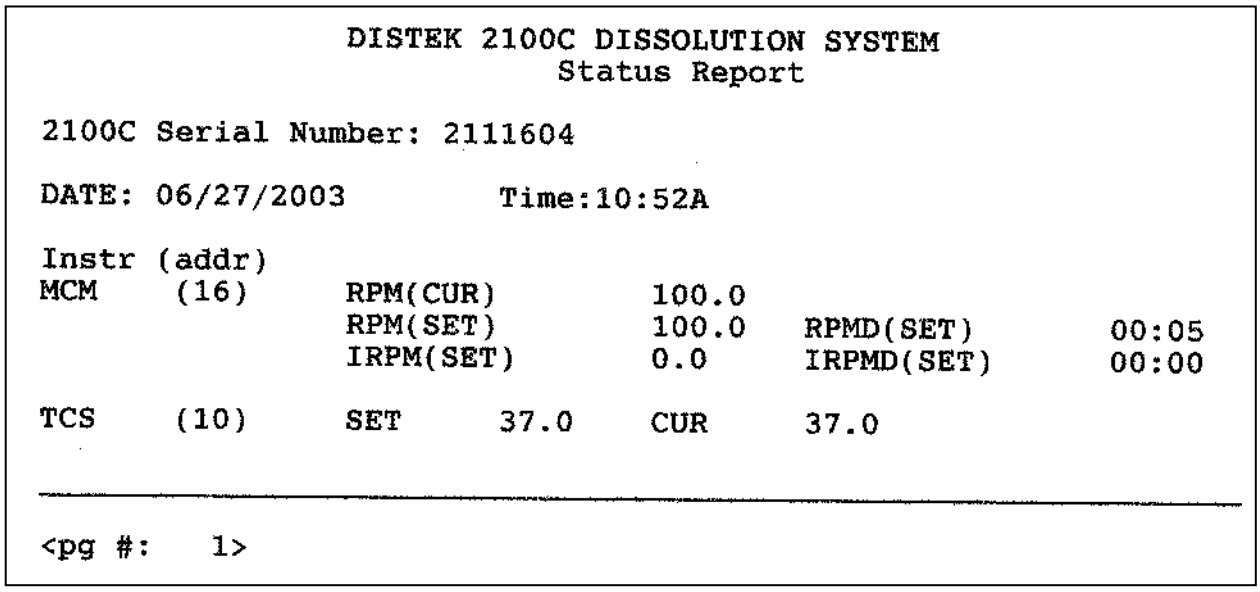
DIP Switch Settings
System Mode  : MASTER
Unit Address : 16
Time Format : AM/PM format

Test Settings
RPM   : 100     Duration  : 01:00
IRPM  : 250     Duration  : 00:01
Print Interval : 00:10

Instrument Database:
Type    Address

TCS     (10)
_____________________________________________________________________

<pg #:   1>
```



```
                DISTEK 2100C DISSOLUTION SYSTEM
                        Status Report

2100C Serial Number: 2111604

DATE: 06/27/2003          Time:10:52A

Instr (addr)
MCM    (16)      RPM(CUR)          100.0
                 RPM(SET)          100.0    RPMD(SET)        00:05
                 IRPM(SET)         0.0      IRPMD(SET)       00:00

TCS    (10)      SET      37.0     CUR      37.0

<pg #:   1>
```

DISTEK 2100C DISSOLUTION SYSTEM
Test Report

2100C Serial Number: 2111604

Product/Lot#:_____ Operator ID:_____
Test Start: 06/26/2003 12:16P

DATE: 06/26/2003 Time:12:16P
Elapsed Time: 00:00

Instr	(addr)	Parm	Set	Last	Max	Min	Dur
MCM	(16)	RPM	100.0	99.9	100.0	99.9	00:00
		RPMD	01:00	active			
		IRPM	250.0				
		IRPMD	00:01				
TCS	(10)	deg C	37.0	37.1	37.1	37.1	

DATE: 06/26/2003 Time:12:26P
Elapsed Time: 00:10

Instr	(addr)	Parm	Set	Last	Max	Min	Dur
MCM	(16)	RPM	100.0	99.9	100.0	99.9	00:10
		RPMD	01:00	active			
		IRPM	250.0				
		IRPMD	00:01				
TCS	(10)	deg C	37.0	37.0	37.1	36.9	

DATE: 06/26/2003 Time:12:36P
Elapsed Time: 00:20

Instr	(addr)	Parm	Set	Last	Max	Min	Dur
MCM	(16)	RPM	100.0	100.0	100.0	99.9	00:20
		RPMD	01:00	active			
		IRPM	250.0				
		IRPMD	00:01				
TCS	(10)	deg C	37.0	37.0	37.1	36.9	

DATE: 06/26/2003 Time:12:46P
Elapsed Time: 00:30

Instr	(addr)	Parm	Set	Last	Max	Min	Dur
MCM	(16)	RPM	100.0	100.0	100.0	99.9	00:30
		RPMD	01:00	active			
		IRPM	250.0				
		IRPMD	00:01				
TCS	(10)	deg C	37.0	37.0	37.1	36.9	

DATE: 06/26/2003 Time:12:56P
Elapsed Time: 00:40

Instr	(addr)	Parm	Set	Last	Max	Min	Dur
MCM	(16)	RPM	100.0	99.9	100.0	99.9	00:40

<pg #: 1>

```
                RPMD    01:00   active
                IRPM    250.0
                IRPMD   00:01

TCS    (10)     deg C   37.0    37.0    37.1    36.9

-------------------------------------------------------------------------------
DATE: 06/26/2003        Time:01:06P
Elapsed Time: 00:50
Instr (addr)    Parm    Set     Last    Max     Min     Dur
MCM    (16)     RPM     100.0   100.0   100.0   99.9    00:50
                RPMD    01:00   active
                IRPM    250.0
                IRPMD   00:01

TCS    (10)     deg C   37.0    37.0    37.1    36.9

-------------------------------------------------------------------------------
DATE: 06/26/2003        Time:01:16P
Elapsed Time: 01:00
Instr (addr)    Parm    Set     Last    Max     Min     Dur
MCM    (16)     RPM     100.0   100.0   100.0   99.9    01:00
                RPMD    01:00   complete
                IRPM    250.0   250.0   250.0   249.9   00:00
                IRPMD   00:01   active


TCS    (10)     deg C   37.0    37.0    37.1    36.9

-------------------------------------------------------------------------------
DATE: 06/26/2003        Time:01:17P
Elapsed Time: 01:01
Instr (addr)    Parm    Set     Last    Max     Min     Dur
MCM    (16)     RPM     100.0   100.0   100.0   99.9    01:00
                RPMD    01:00   complete
                IRPM    250.0   250.0   250.0   249.9   00:01
                IRPMD   00:01   complete


TCS    (10)     deg C   37.0    37.1    37.1    36.9

-------------------------------------------------------------------------------
DATE: 06/26/2003        Time:01:17P
Elapsed Time: 01:01
Instr (addr)    Parm    Set     Last    Max     Min     Dur
MCM    (16)     RPM     100.0   100.0   100.0   99.9    01:00
                RPMD    01:00   complete
                IRPM    250.0   250.0   250.0   249.9   00:01
                IRPMD   00:01   complete


TCS    (10)     deg C   37.0    37.1    37.1    36.9

-------------------------------------------------------------------------------

Test Start:     06/26/2003  12:16P

Test End:       06/26/2003  01:17P
<pg #:   2>
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