

# C-6100E

## Digital Conductivity Controller with Virtual Clean Probe™

Installation and Operating Manual



### INTRODUCTION

Beta Technology is pleased to present you with the new C-6100E digital conductivity controller. The controller utilizes Beta Technology's industry renowned BetaSet digital concentration control circuitry. Regardless of whether you use a titration kit, PH meters, litmus paper or conductivity meters to establish your concentration setpoint, the controller will accurately control the detergent solution strength. The controller includes temperature compensation circuitry which enables the system to maintain accurate concentration control regardless of fluctuations in solution temperatures.

Beta's Virtual Clean Probe (VCP™) is a standard feature on the C-6100E. It ensures accurate dosing while minimizing service calls due to probe fouling.

### PREFACE

This manual describes how to use C-6100E Digital Conductivity Controller.

Material in this manual is subject to change without notice. Manual revisions will be made on an as needed basis. Special circumstances involving important design, operation or application information will be released via Technical Service Bulletins.

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*C-6100E has a multiple input voltage power transformer (115, 208 or 230 Volts). Wire appropriately.*

*The 24 Volt AC "load" output on the controller drives a Single Pole Single Throw (SPST) normally open contact closure relay. You can wire one leg of any voltage up to 250 Volts AC through this contact closure from your power source to your "load". The relay contacts can handle 8 amps continuous current with an inrush capability of 16 amps.*

### SPECIFICATIONS

#### Size

Height	Width	Depth	
9.25	9.25	3.75	in
23.5	23.5	9.53	cm

#### Weight

6.5 lbs (2.95 kg)

#### Cabinet

Brushed stainless steel

#### Mounting

Wall mounted via external flanges with two (2) keyhole slots and two (2) bolt holes

#### Power

Multiple input voltage transformer, 24 Volt AC, 40 VA output

115 Volts AC ( $\pm 10\%$ ), 50/60 Hz

208 Volts AC ( $\pm 10\%$ ), 50/60 Hz

230 Volts AC ( $\pm 10\%$ ), 50/60 Hz

#### Feed Relay Specs

##### Output Relay Characteristics

24 Volt AC Coil, Single Pole Single Throw (SPST) Normally Open Contact Closure

##### Output Relay Contact Closure Voltage Characteristics

Maximum 250 Volts AC or DC

##### Output Relay Contact Closure Current Capability

8 amps maximum (continuous duty)

15 amps maximum (inrush current)

#### Fuse

Circuit board is fused with a board mounted 1 amp fuse, type AGC 250 Volt

#### Conductivity Probe Input Measurement Range

60 BU max (See the section on probes)

VCP™ – Virtual Clean Probe

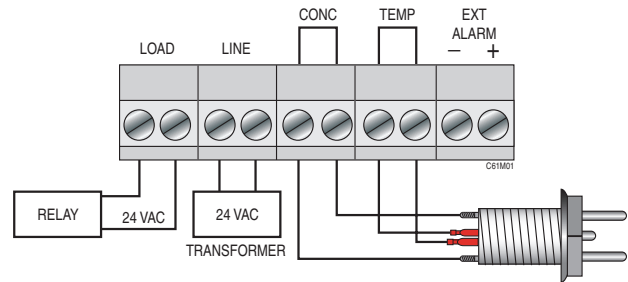
#### External Alarm Output

24 VDC; 1 amp max

### SYSTEM FEATURES

- Beta Set Digital Concentration Control** - The controller is equipped with a sophisticated digital conductivity sensing circuit. No longer is it necessary to turn a potentiometer dial and guess what setting you are at. This feature makes it easy to establish detergent concentration set-points from account to account. If you are using the same detergent product, simply program the menu for same number that you have used before. Slight adjustments may be necessary to compensate for inherent conditions in the account (i.e. water conditions, soil load type, etc.).

- Low Detergent Alarm** - When wash tank concentration fails to reach setpoint during a set period of time, an alarm sounds. This alarm delay time has a range of 0-990 seconds.
- Overfeed Stop** - After the low detergent alarm has sounded, the system will stop feeding detergent if the setpoint is not reached within an additional set period of time. This overfeed stop delay time is programmable from 0-990 seconds.
- Reduced Feed Rate** - Detergent feed rate can be programmed (in 10% steps) to operate from 10% to 100% of full speed when wash tank concentration is within 5 Beta Units of setpoint. This will help prevent setpoint overshoot when using very concentrated chemicals.
- Alarm Volume Control** - A volume control is located on the control circuit board. Adjust the dial so that the alarm volume is satisfactory.
- VCPT™** - Probe fouling is the prime limiting factor in accuracy. As probes progressively foul, the C-6100E “thinks” the conductivity is lower than it actually is. The patented, pulse-powered probe uses a digital signal processing algorithm, enabling typical protein and hard water-fouled probes to perform as if they were clean.
- Temperature Compensation (optional)** - Thermistor equipped probes are available and can be connected to any controller unit. This probe will ensure that the concentration is stable regardless of water temperature fluctuations in the wash tank. For every degree centigrade that the solution temperature drops or rises, the amount of detergent used will increase or decrease (respectively) by about 1.8% (typically). Using temperature compensation probes is highly recommended to ensure optimum concentration control. This probe will control the concentration and also continuously monitor the wash tank water temperature and adjust the injection of detergent accordingly.

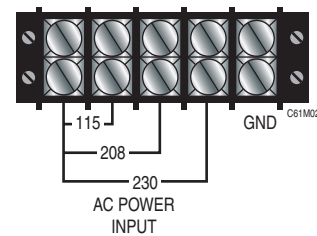


- Power Wiring** - Provide appropriate AC line power to the controller only when you want the unit to actually be in operation. If power is ON to the controller and the probe electrodes are not covered with water, the output will be ON until turned off by the overfeed stop feature.

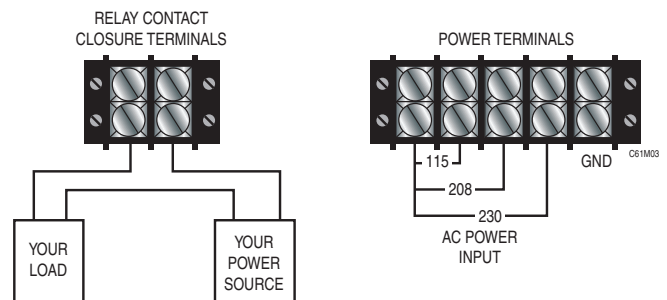


*Always comply with all pertinent electrical codes when wiring any Beta Technology, Inc. equipment.*

- Ground Wiring** - Always ground the unit to a verified earth/chassis ground.



- Relay Wiring** - The diagram below shows how to wire your power source through the relay to provide power or a signal to your injection device. See the Specifications section for voltage and current parameters.



## INSTALLATION



*No installation kit or probe kit is supplied with the controller unit. These must be ordered separately. The information and the diagram are in regards to probe installation and refer to the CPT-1104 probe. See Conductivity and Temperature Probe Information section for probe information.*

- Mounting the controller Unit** - Mount the unit on a vertical surface (usually a wall) using the keyhole slots and bolt holes. Mount the unit at a serviceable level away from excessive heat, moisture or steam.
- Wiring the Conductivity/Temperature Probe** - Wire the probe as shown in the following graphic.

## CONDUCTIVITY & TEMPERATURE PROBE INFORMATION

The following information describes the various probe kits Beta Technology has available for use with the controller unit. Each description includes the part number for ordering as well as information on the general application the probe is designed for. Also included is the probe “cell constant” (K factor) information and the approximate measuring capability of the probe when used with the controller. In the back of the manual, there are diagrams providing additional information on many of the probes listed below.

1. CTP-3150 This probe is designed for medium to high concentration industrial use as a “dip in” or bulkhead mounted sensor. It includes the temperature compensation thermistor encapsulated in the probe assembly.
  - A. Cell Constant = 5.0
  - B. Measuring Range - 00 Beta Units = approximately 8363 micro mhos (umhos), 60 Beta Units = approximately 162,184 umhos.
  - C. Element Material = Carbon

**Accessory Part Note** - An optional bulkhead ball valve is available to simplify removal of the CTP-3150 probe for maintenance purposes. The ball valve drawing number is 13-07793-00.

2. CPT-3250 This probe is designed for medium to high concentration industrial use as a “dip in” or bulkhead mounted sensor. It includes the temperature compensation thermistor encapsulated in the probe assembly.
  - A. Cell Constant = 5.0
  - B. Measuring Range - 00 Beta Units = approximately 8363 micro mhos (umhos), 60 Beta Units = approximately 162,184 umhos.
  - C. Element Material = Hastelloy “C”

**Accessory Part Note** - An optional bulkhead ball valve is available to simplify removal of the CTP-3250 probe for maintenance purposes. The ball valve drawing number is 13-07793-00.

3. CPT-2150 This probe is designed for medium concentration industrial use in bulkhead mounting applications (1/4" NPTM) and includes the temperature compensation thermistor.

- A. Cell Constant = 5.0
  - B. Measuring Range - 00 Beta Units = approximately 8363 micro mhos (umhos), 60 Beta Units = approximately 162,184 umhos.
  - C. Element Material = Hastelloy “C”
4. CTP-1104 This probe is designed for use in light industrial applications where light concentrations are utilized. This probe is a bulkhead mounting (7/8" hole) type and includes the temperature compensation thermistor.
    - A. Cell Constant = 0.4
    - B. Measuring Range - 00 Beta Units = approximately 669 micro mhos (umhos), 60 Beta Units = approximately 12,975 umhos.
    - C. Element Material = 303 stainless steel
  5. CP-3408 Bayonet Probe (conductivity only) - This probe is designed for light industrial use with light to low medium concentrations. This probe does not include a temperature thermistor, a separate thermistor probe can be utilized.
  6. TP-1100 Temperature Probe (only) - Drop in type, 30 inches long, CPVC construction with a 304 stainless steel thermistor element.
  7. TP-2100 Temperature Probe (only) - Bulkhead mount type, 1/8" NPTM threads, 316 stainless steel body, 304 stainless steel thermistor element.

## OPERATION

### COMMUNICATIONS PORT

A phone type communications port (phone jack) is located on the board. This is reserved for future development.

### PROGRAMMING PROCEDURES

#### General

Controls for the C-6100E are on the PCB located inside the enclosure lid.

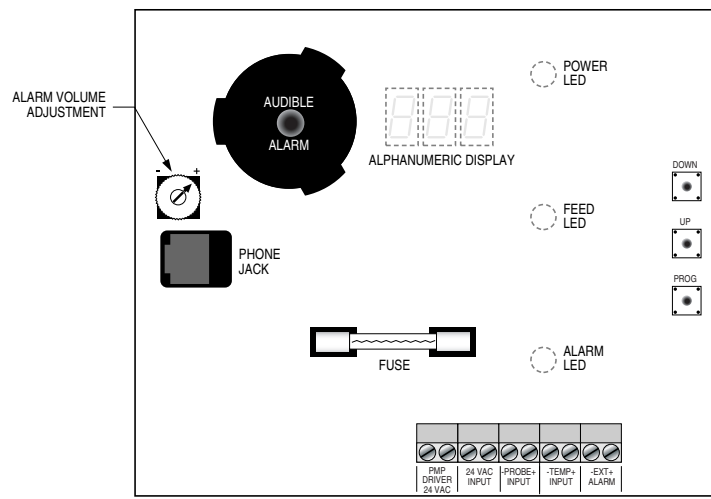
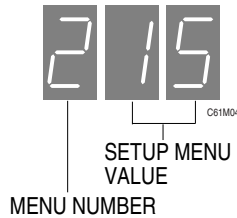


Figure 1. PCB Controls and Probe Connections

The Program/Run button is used to change from the run mode to the programming mode, to scroll through the programming steps and to change the operating information on the display LEDs.



To place the controller in the programming mode, open the top door of the controller and hold down the Program/Run button for 5 seconds. The setup information is displayed on the PCB alphanumeric display (see **Figure 1**). The left digit is the setup menu number and the two right digits are the setup menu value. See the table on the next page for specific menu numbers and values.

If you don't do any programming for 60 seconds, the controller will automatically return to the run mode. Use the Program/Run button to change to the next menu and the prime buttons to change the menu values. The detergent prime button increases the value and the rinse prime button decreases the value. Unused menu items are automatically skipped. Each time you press a button while programming, the alarm beeps.

To change the readout value between temperature and concentration, press the program button for 1-2 seconds.

## PROGRAMMING

All menu steps are summarized inside the C-6100E. To quickly change from programming to run mode, turn the power switch OFF then ON.

Menu Number	Probe Values
2	Low Detergent Alarm Delay Time 0-990 seconds in 10-second steps
4	Detergent Concentration Setpoint 0-70 Beta units
5	Detergent Overfeed Stop Delay Time 0-990 seconds in 10-second steps after alarm condition
d	Reduced Detergent Feed Rate 01 = 1 second ON/9 seconds OFF to 09 = 9 seconds ON/1 second OFF 10 = ON continuously



*Alarm conditions will reset and alarm will turn off; 1) By turning power switch ON/OFF or 2) when conductivity reaches setpoint.*

## MAINTENANCE

1. **Cleaning the Probe** – While VCP™ minimizes the problems associated with probe fouling, we recommend that you clean them on a regular basis to ensure optimum performance. The inherent water conditions (i.e. water hardness) and the type of soil load will be the primary factors in determining how often the electrodes need to be cleaned. To clean, simply wipe off any scale or grease/soil build up. A de-liming product may be necessary in some cases.
2. **Cleaning the Cabinet** - Keep the cabinet wiped clean of any residual chemical buildup and other soil that might lead to corrosion of the stainless steel.

## TROUBLESHOOTING

### Display Shows tLE at Any Time

1. Replace the circuit board.

### No Power Yet Circuit Board Fuse is Good

1. Check the fuse on the circuit board.
2. Verify correct primary line power to correct transformer terminals in the controller.
3. If not, check main circuit breaker and/or user supplied power source.
4. If yes, disconnect the transformer secondary wires from the circuit board and verify 24 volts AC across the transformer secondary wires.
5. If not, replace the transformer.
6. If yes, replace the circuit board.

### Properly Rated Fuse Blows Repeatedly

1. Verify that the current draw of any device connected to the 24 volt DC external alarm output terminals on the circuit board is less than 1 ampere.
2. Verify correct power as detailed in the above section.
3. Disconnect the two wires from the Pump driver terminals on the circuit board (two far right terminals on the green connector).
4. Install another fuse and power up the unit.
5. If the fuse blows, replace the circuit board.
6. If the fuse does not blow, replace the output relay after confirming 24 volts AC is present across the Pump Driver terminals when the circuit board is in a feed condition.

### Display Shows “Lo” When Indicating Beta Units

1. Verify Beta Unit set point is correct.
2. Verify that the K factor of the probe being used is appropriate to measure the solution conductance.
3. Verify the probe is located where a good representative sampling of the solution is assured.

4. Verify no process system problems such as too much makeup water diluting the solution or open drains causing water loss.
5. Check for loose, disconnected, or broken probe wires.
6. Disconnect temperature sensor (if being used). If this corrects the problem, see the section on testing the PCB temperature circuit to determine whether the problem is with the temperature sensor or the circuit board. If not, see the section below on testing the PCB conductivity circuit.
7. Verify that the chemical pump is operating properly. The pump should be feeding if the display shows "Lo". If the pump is not operating, check for 24 volts AC across the two Pump Driver terminals on the circuit board (the two screws on the far right). If not, replace the PCB. If yes, confirm that there is continuity across the two relay OUTPUT screws. If yes, the problem is with the pump or the signal to the pump. If not, replace the output relay.



- Bad temperature sensor (thermistor) or shorted wiring. Check connections or replace temperature sensor.



- Failed PCB. Replace the PCB.



### Display Shows "Hi" When Indicating Beta Units

1. Verify Beta Unit set point is correct.
2. Verify that the K factor of the probe being used is appropriate to measure the solution conductance.
3. Disconnect temperature sensor (if being used). If this corrects the problem, see the section on testing the PCB temperature circuit to determine whether the problem is with the temperature sensor or the circuit board. If not, see the section below on testing the PCB conductivity circuit.
4. Verify that the chemical pump is operating properly. The pump should not be feeding if the display shows "Hi". If the pump is feeding, check for 24 volts AC across the two Pump Driver terminals on the circuit board (the two screws on the far right). If yes, replace the PCB. If not, confirm that there is continuity across the two relay OUTPUT screws. If yes, replace the output relay. If not, the problem is with the pump or the signal to the pump.

### Display Shows "tLo" or "tHi" When Indicating Temperature

1. Check for loose, disconnected or broken sensor wires if "tLo" shows
2. Check for shorted sensor wires if "tHi" shows.
3. Disconnect the temperature sensor wires at the circuit board and connect a 6.8K ohm 1/4 watt resistor across the two temperature sensor screw terminals. A 64 should appear in the display. If not, replace the circuit board. If yes, replace the temperature sensor.

### Display Diagnostics

During operation, the display on the PCB may indicate one of the following error conditions.

- Bad temperature sensor (thermistor) or open wiring. Check connections or replace temperature sensor.

### Testing the PCB Conductivity Probe Circuit

A simple resistor test across the probe terminals on the circuit board will tell you if the circuit is responding correctly. Performing the same tests at the end of the probe wire run will tell you if there open or shorted probe wires. The chart below indicates what Beta Unit number should appear on the PCB display when the resistor value listed is used. 1/4 watt resistors are fine for the test. Actual solution conductance in micromhos ( $\mu\text{mhos}$ ) is also shown for reference purposes. Note that when resistors are used for testing, the circuit responds as if a 1.0 cell constant (K factor) probe is connected. It is only necessary to test the input with one resistor value to ensure that the circuit is okay.

R Value	B/U	Probe K Factor 0.1 in Micro mhos	Probe K Factor 0.4 (in Micro mhos)	Probe K Factor 1 (in Micro mhos)	Probe K Factor 5 (in Micro mhos)
598 $\Omega$		1672	3344	1672	8360
358 $\Omega$	13	2793	5586	2793	13965
277 $\Omega$	11	361	7220	3610	18050
217 $\Omega$	28	4608	9216	4608	23040
170 $\Omega$	28	588	11760	5880	29400
133 $\Omega$	35	7505	15010	7505	37525
100 $\Omega$	39	9579	19158	9579	47895
82 $\Omega$	45	12225	24450	12225	61125
64 $\Omega$	42	15502	31004	15502	77510
56 $\Omega$	53	19113	39826	19913	99565
39 $\Omega$	55	25415	50830	25415	127075
47 $\Omega$	67	32437	64874	32437	162185

Table 2. Resistor Test Chart

## SPARES LIST- ORDERING INFO

Seq#	Description	Item#
	C-6100E with VCP™	050560
	PCB Assy, C-6100E with VCP™	087694
	Fuse, 3 Amp	042883
1	LBL,TB,5P,115-230,PWR GND	040787
2	LBL,TB,2P,250V,5A,OUTPUT	040827
4	LBL,SS, C-6100E, BETA	098389
5	LBL,INSTR,OPER,UNIT,C61	040833
6	ENCL,SST,C61	050578
7	DR,SST,C61	036303
8	TERM BLK,CVR,5 POS,SNAP	040965
9	TERM BLK,CVR,2 POS,SNAP	040966
10	NUT,KEP,6-32	041088
12	SPCR,#6 X 1/8	041197
13	SPRT,PCB LKG,L-SHAPED	041182
14	SPCR,#6 X 3/8	041173
15	GSKT, 0.12 X 0.50 X 7.50	041276
16	BSHG,SHTR,7/800 X 9/16 ID,NYL	031618
17	WSHR,FL,#6,0.267 X 0.143 X 0.016,SST	041113
18	LCH,SCR,STL	041326
19	PCB ASSY,C6100 w/VCP 24VAC	087694
20	SW,SPST,TGL,ON/OFF,PNL	042566
21	SW ACCY,ON-OFF SW PL	042555
22	RLY,24VAC,SPST/NO	097613
23	TERM BLK,SCR/JMP,2	042844
26	XFMR,PWR,120/208/240,40VA	050562
27	HL PLG,PLSTC,7/8",BLK	041235
28	TIWRP,0.10 X 4L,NYL,NAT	041318
29	STDF,F-F,1/4 HEX,6-32 X 1-1/2	039745
30	WSHR,FL,#8,0.380 X 0.174 X 0.30,SST	041122
32	LBL,HZR, WARN,DSCNT PWR,TB,2 X 0.6	040791
33	TIWRP,AHR,ADH,RB,3/4", NYL,NAT	041323
34	WIRE,18 GA,9,BLU,QDC	055765
35	WIRE,18 GA,13,YEL,QDC	055766
36	WIRE,1,18 GA,20,ORN,QDC	050320
37	WIRE,1,18 GA,9,VIO/BLK,QDC	035998
38	WIRE,1,18 GA,20.5,WHT/ ORN,QDC	050321

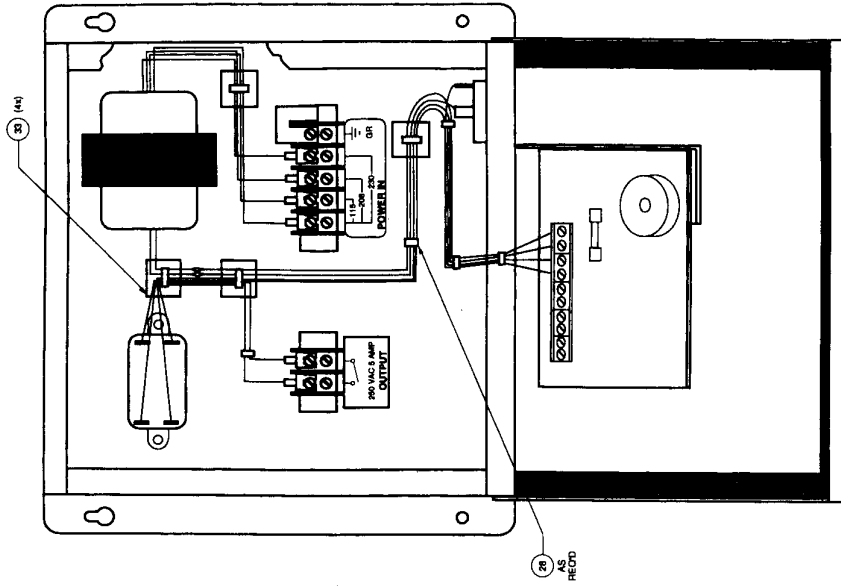
39	WIRE,1,18 GA,10,VIO,QDC	038742
40	WIRE,1,18 GA,10,RED/ WHT,QDC	050323
41	TERM,CRP,18-22,QDC, 1/4F,INSUL	050537
42	TERM,CRP,18-22,SPADE, #8,T&B	041720



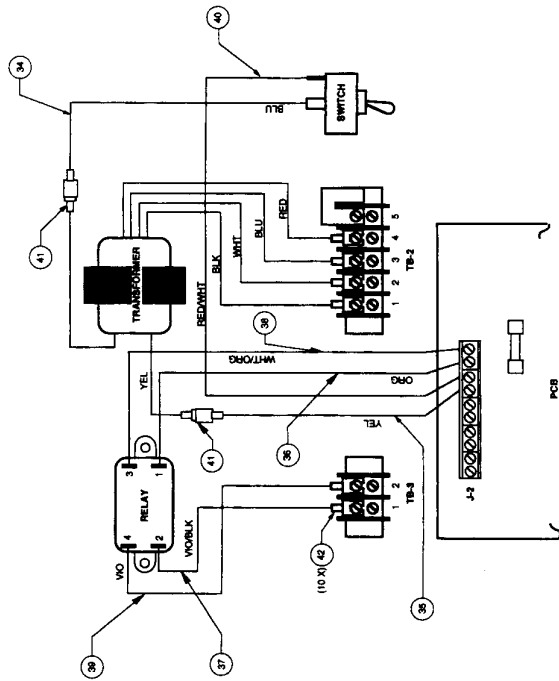
*Part numbers are listed for reference only and may be unavailable for individual sale or may change without notice.*



IMPORTANT NOTE:  
PRIMARY AND SECONDARY WIRES MUST  
BE TIE BUNDLED SEPERATELY.

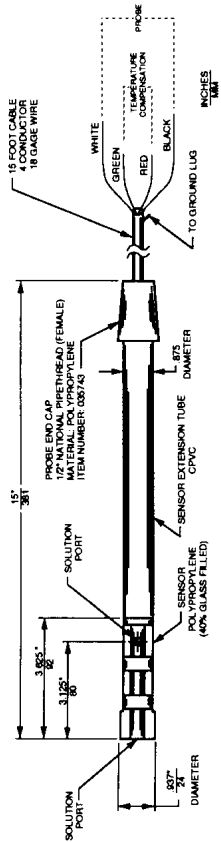


WIRE ROUTING



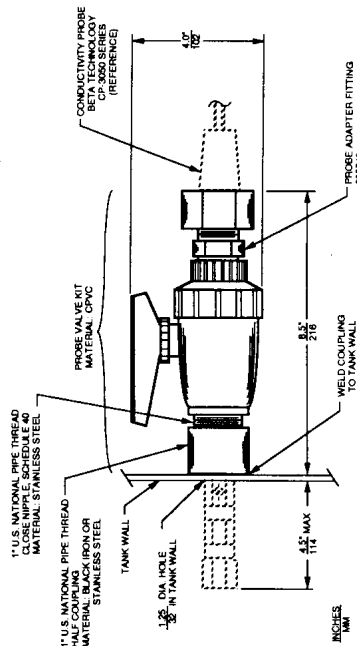
WIRING DIAGRAM

	ELEMENT MATERIAL
	NICKEL CARBON
MODEL NUMBER	CP-3250
ITEM NUMBER	056573

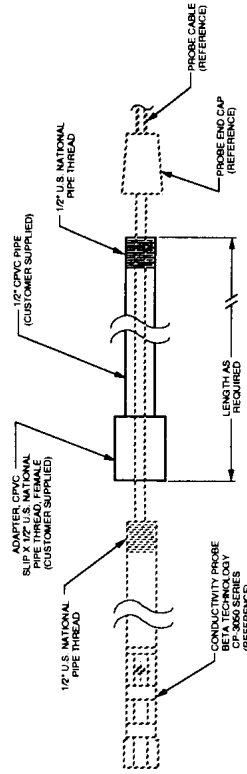


### Accessory Kits and Applications

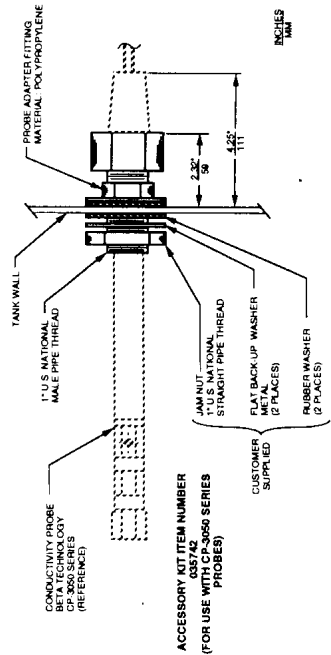
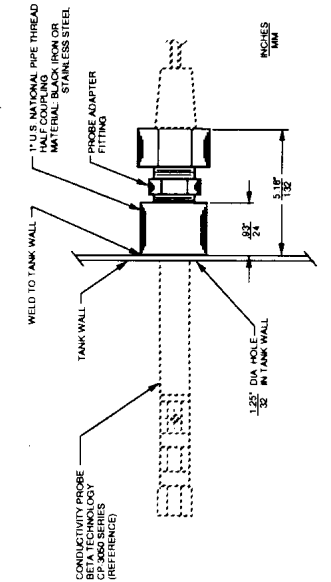
ACCESSORY KIT ITEM NO. 035714 WITH BLACK IRON HALF COUPLING  
035715 WITH STAINLESS STEEL HALF COUPLING  
(FOR USE WITH CP-3060 SERIES PROBES)



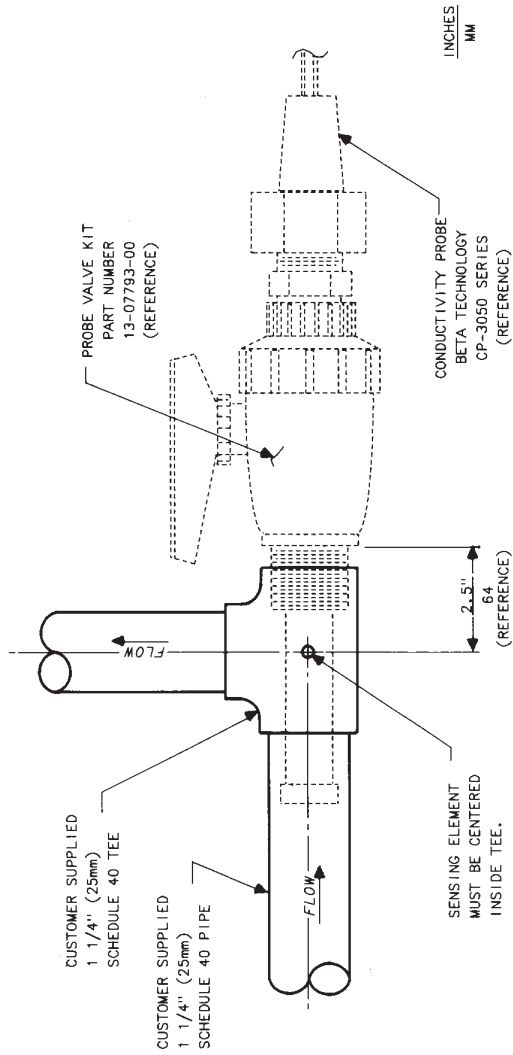
USE UNLESS OTHERWISE SPECIFIED  
(FOR USE WITH CP-3060 SERIES PROBES)



ACCESSORY KIT ITEM NUMBER 035743 WITH STAINLESS STEEL HALF COUPLING  
(FOR USE WITH CP-3060 SERIES PROBES)

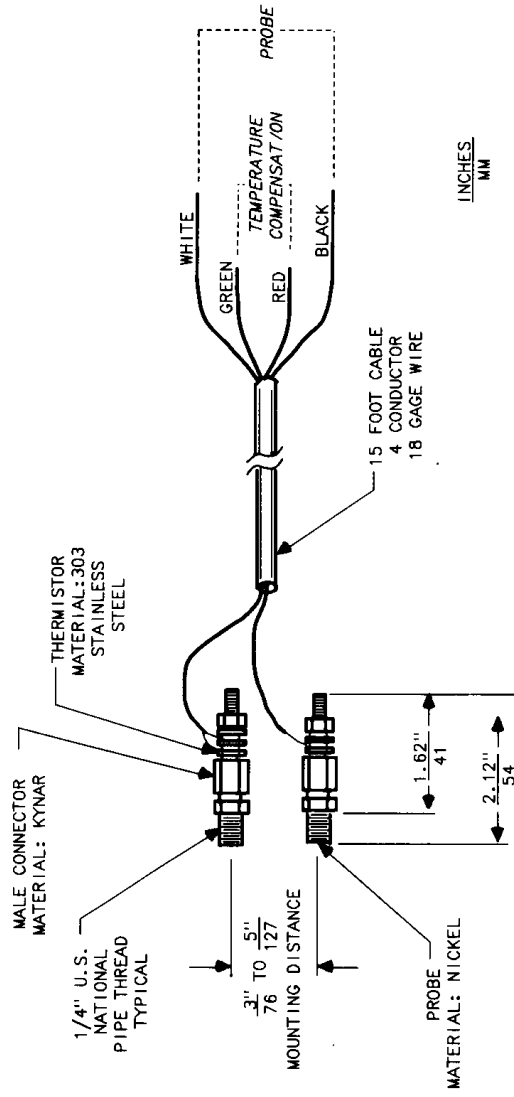


**FLOW-THRU APPLICATION**  
 (FOR USE WITH CP-3050 SERIES PROBES)



CONDUCTIVITY PROBE  
CP-2150

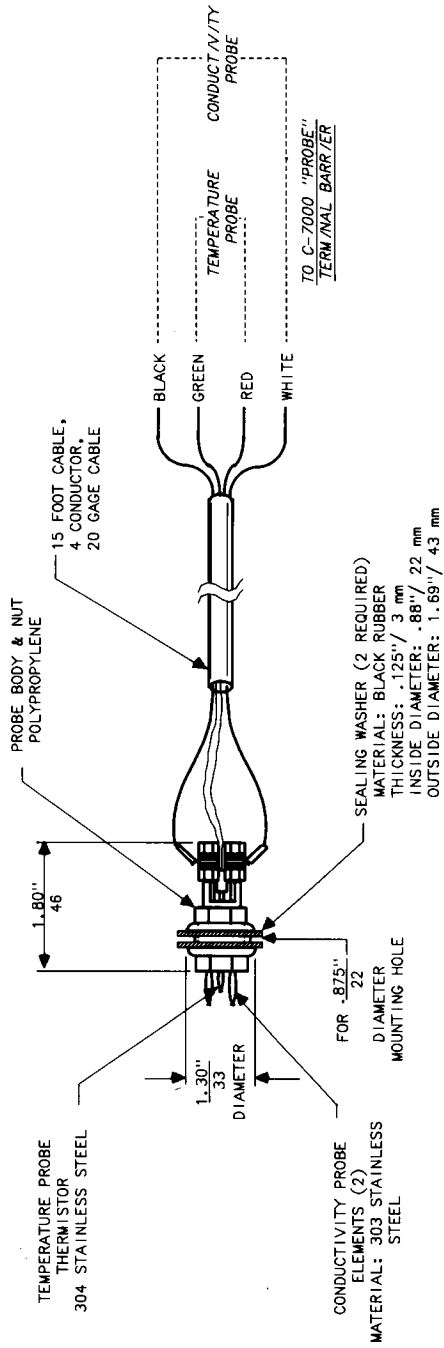
ACCESSORY KIT NUMBER  
 13-07783-00  
 CELL CONSTANT, K= 5.0



CONDUCTIVITY / TEMPERATURE PROBE

CP-1104

ACCESSORY KIT NUMBER  
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CELL CONSTANT, K= 0.4

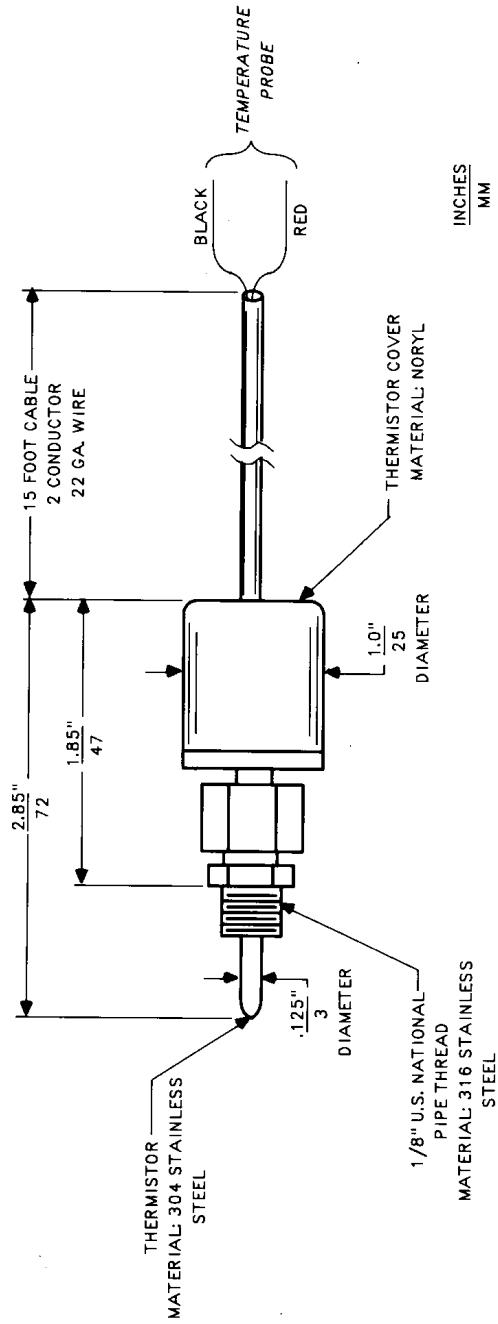


INCHES.  
MM

TEMPERATURE PROBE

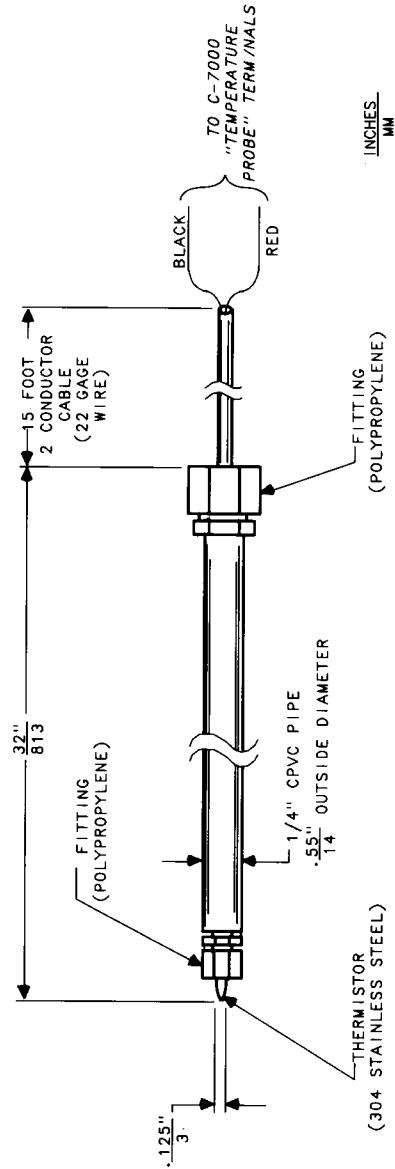
TP-2100

ACCESSORY KIT NUMBER  
13-07782-00



**TEMPERATURE PROBE**  
**TP-1100**

ACCESSORY KIT NUMBER  
13-07781-00



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