



# Control Guard FCS Instruction Manual

---

## TABLE OF CONTENTS

Specifications .....	3
Pre-Installation.....	4
Installation .....	4
Operation.....	6
Programming.....	7
Titration Graph.....	11
System Wiring Diagram.....	12
Replacement Parts .....	13
Optional KTM-550/600 .....	14
Optional CT-550/600 .....	16
Optional MT-300/400.....	18
Warranty Information .....	20
Knight Locations .....	20



**CAUTION:** Wear protective clothing and eyewear when dispensing chemicals or other materials. Observe safety handling instructions (MSDS) of chemical mfrs.



**CAUTION:** To avoid severe or fatal shock, always disconnect main power when servicing the unit.



**CAUTION:** When installing any equipment, ensure that all national and local safety, electrical, and plumbing codes are met.

## SPECIFICATIONS

Pumps	Wet End Mat'l	Flow Rate	Voltage	PSI Rating	Suction Lift
KP-5200	EPDM	16 oz/min	24 VDC	30 max	10 ft max
KP-8100	EPDM	34 oz/min	24 VDC	30 max	10 ft max
Clean Guard 1.5	EPDM or Viton	1.5 GPM	115 or 230 VAC	70 max	10 ft max
Clean Guard 3.2	EPDM or Viton	3.2 GPM	115 or 230 VAC	70 max	10 ft max
Probes	Material	Probe Max Temp	Control Range	Cable Length	Mounting
Conductive	Polypropylene	180° F max	80 ms (max)	Order separately	7/8" hole
Inductive	Polypropylene	180° F max	80 ms (max)	25 ft	7/8" hole
Case	Material	Gasket	IP Rating	NEMA Class	Dimensions
	ABS or PC	EPDM	IP-65	1, 4, 4X, 12, 13	W 13.25" x H 10.5" x D 7.5"

- Pollution Degree II
- Installation category I
- Altitude 2000m
- Humidity 5 to 95%
- Electrical supply 115/230VAC, 50/60Hz, 2A
- For Indoor Use Only
- Temperature 5°C to 40°C
- Mains supply voltage fluctuations are not to exceed 10% of the nominal supply voltage
- The unit shall not be positioned so that it is difficult to operate the power disconnecting means
- Protection is impaired if the product is used in a manner not specified by the manufacturer
- Replacement Fuse for 115V model: 2Amp, 250V, 6.3x32mm, Fast-Acting
- Replacement Fuse for 230V model: 2Amp, 250V, 5x20mm, Fast-Acting

## SAFETY SYMBOL EXPLANATIONS

Listed below are explanations of the safety symbols that appear either on the unit, in the instruction manual, or both. Please familiarize yourself with the meaning of each symbol.



**GENERAL CAUTION:** This symbol indicates a general safety caution.



**SHOCK HAZARD:** This symbol indicates that hazardous voltages are inside the enclosure.



**READ MANUAL:** This symbol indicates to read the manual for important instructions and procedures related to safety.

---

## PRE-INSTALLATION

- (1) Check all applicable plumbing and electrical codes before installation. This will help to ensure that the system is installed in safe and suitable manner.
- (2) Get a wiring schematic of the washmachine (provided by the machine mfr or may be on the machine itself).
- (3) Check to make sure that all functions of the washer are operating properly. Including; timer, water solenoids, water level switch, pump motor, and drain valve.
- (4) Check the proposed location for a 115, or 230 VAC power source (based on the model you will be using).
- (5) Check voltage of all washer chemical signals that will be used. Measure voltage between chemical signal and signal common with a voltmeter. Do not check signal voltage between supply signal and case (earth) ground.
- (6) Check mounting location for chemical injection anti-siphon valves. Verify port size with fittings you have for installation.

***Before beginning the installation, make sure you have the following tools and materials ready...***

- Flat and Phillips screwdrivers.
- Drill and drill bits.
- Suitable wire for main power and signals (check local codes).
- Wire cutters, wire strippers, and pliers.
- Wire terminal connectors and a crimping tool.
- Voltmeter (or multi-meter).
- Dry wall inserts and mounting screws.
- Electrical tape and wire nuts.
- Chemical test kit.
- Injection check valves.
- Braided vinyl hose for 3/8" ID.

## INSTALLATION

### ***Mounting***

Mounting feet and screws are provided with the unit. Attach the mounting feet to the back of the unit by putting the screws into the brass inserts in the upper corners. Hang the unit on a wall in a suitable location that is close to the chemical containers and also the chemical injection point(s). Mounting height should be no more than 10' vertically above the chemical containers.

### ***Main Power***

Connect leads to a 115, or 230 VAC power source (based on the model you have) that is "on" when the machine is "on." This will provide power for all pumps, however the system will only pump chemical when electrically signaled. Whenever possible, use the machine's ON/OFF switch as the main power source. Avoid using the machine's pump motor as main power. Check the voltage select switch on the circuit board to ensure its set for the correct main power voltage. Important: If EDP pumps will be used, they must match the main power voltage.

### ***Pump 1 Signal***

A trigger signal is required to activate the probe sensing operation, or to trigger the repeat cycle mode initial charge. For Probe mode, check the washer for a power source that is active during the wash cycle only, for example, the magnetic contactor that controls the wash pump motor. You can also jumper main power to the signal input when a constant power up condition is applicable. Connect leads to the pump 1 signal source. Signal voltage range is 14 - 240 VAC. For repeat cycle mode initial charge, check for a signal that will activate only when the machine is filled with a fresh tank of water.

### ***Pump 2 Signal***

In addition to running pump 2, the pump 2 signal triggers the recharge injection if repeat cycle mode is selected. For probe mode, check the washer for a signal source that is active when you want the pump to run. For repeat cycle mode, check the washer for a signal source that will be used to trigger the recharge injection. Connect leads to the pump 2 signal source. Signal voltage range is 14 - 240 VAC.

---

### ***Conductive Probe Installation (optional)***

- (1) Install the probe in the wash tank below the water level. It should be away from incoming water supplies, near the recirculating pump intake, and 3 to 4 inches from corners, heating elements, or the bottom of the tank. If an existing mounting hole cannot be located, cut or punch a 7/8" hole.
- (2) Use 18 AWG multi-stranded copper wire for the probe connection. Avoid running the wire near high voltage AC lines. Do not route probe wires through the same conduit as power and signals.
- (3) Connect leads to the probe. Ring-type terminals are recommended (be sure to connect them to the probe terminals with "backing" nuts to prevent the probe tips from being pulled out of the probe). The ring terminals should be secured between the inner (backing) nuts and outer nuts.

### ***Inductive Probe Installation (optional)***

- (1) The probe should be mounted in the washer tank with the hole oriented vertically. Start by feeding the wire end through the mounting hole from the inside of the tank. One rubber washer should already be mounted on the threaded mounting stud.
- (2) After the plastic probe body has been firmly secured to the mounting hole with a rubber washer on each side of the tank, feed the wire lead through a strain relief on the bottom of the Control Guard unit.
- (3) With the wire lead routed through the strain relief, attach the four wires to the circuit board per the wiring diagram. The wire colors must match the colors shown on the terminal strip.

### ***Peristaltic Pump Connections***

- (1) Cut a suitable length of braided tubing and connect between the discharge (right) side of the pump's squeeze tube and the injection point. Use barb fittings (supplied) and hose clamps to secure safely.
- (2) Cut a suitable length of braided tubing and connect between the suction (left) side of the pump's squeeze tube and the chemical pickup tube. Use of barb fittings and hose clamps is recommended.
- (3) Insert pickup tube into chemical container.

### ***Air Pump Installation (optional)***

- (1) Attach air input fitting to the air inlet port on the pump.
- (2) Attach inlet and outlet barb fittings.
- (3) Mount the pump as close as possible to the chemical supply and no more than 6 ft above chemical containers.
- (4) Connect pickup line to input side of pump.
- (5) Connect discharge line between output side of pump and point of injection.
- (6) Cut 3/8" poly tubing to length needed and connect between air input fitting on pump and the outlet fitting on the air solenoid at the control box.
- (7) Cut 3/8" poly tubing to length needed and connect between the inlet fitting on the air solenoid at the control box and the available air supply. Be sure to use a clean, dry, source of compressed air for optimal performance.
- (8) Insert pickup line into chemical container.

### ***EDP Pump Installation (optional)***

- (1) Mount the pumps as close as possible to the chemical supply and no more than 10 ft above chemical containers.
- (2) Install braided tubing between the discharge (right) tube side of the pump and the injection point. Use stainless steel hose clamps and barb fittings to secure braided tubing to pump.
- (3) Install braided tubing between the suction (left) tube side and the barb fitting on the PVC pickup tube. Use stainless steel hose clamps and barb fittings to secure braided tubing to squeeze tube.
- (4) Insert pickup line into appropriate chemical container.
- (5) Connect each pump to corresponding terminals on the circuit board (see wiring diagram).

---

## OPERATION

### **Probe Mode**

When the pump 1 signal is “on”, the probe senses chemical concentration. When concentration drops below the setpoint, the control automatically turns on chemical feed. As the chemical feeds, the control senses the rate at which the concentration is approaching the setpoint. The control then begins to pulse feed (intermittent on/off) to prevent over-use of chemical. The pulse feed rate will depend on how fast the setpoint is being approached.

The low product alarm will sound if the setpoint is not reached within the alarm delay time period. The alarm can be temporarily muted if desired (see button functions). A “feed limit” feature allows you to set the unit to automatically shut off the chemical feed when the alarm has been activated.

### **Repeat Cycle Mode**

This type of operation controls chemical concentration without a probe, based on timed feed modes. The initial charge feeds chemical to bring the machine to working concentration when initially filled with fresh water. The initial charge feed is activated by a trigger signal, which also increments the initial charge counter for each activation.

Recharge time feeds chemical to maintain concentration strength as fresh water dilutes the machine. The recharge is triggered after a specified number of washes.

## BUTTON FUNCTIONS

- ENTER: Holding the enter button for 3 seconds (approx.) switches between run and program modes. Enter also advances through programming menus.
- SCROLL: The scroll button moves the position of the cursor in menus where text or number changes are done. The scroll button will “wrap around” at the end of a line of characters, meaning that the cursor will advance to the beginning of the line automatically. The scroll button toggles between choices in menus that have selectable settings. The scroll button also shows the wash count and initial charge count during normal operation.
- UP (↑): Increases numeric values or advances upward through available characters. Hold the button down to rapidly advance. The UP button also acts as pump 2 prime during normal operation.
- DOWN (↓): Decreases numeric values or advances downward through available characters. Hold the button down to rapidly advance. The DOWN button also acts as satellite pump 1 prime during normal operation.

### **Alarm Mute**

During operation, the low chemical alarm (probe mode) can be silenced by pressing the SCROLL and UP buttons simultaneously for 1 full second. The display will show “Alarm Muted” and the audio alarm will turn off for 5 minutes.

## OPERATING PARAMETERS

Parameter	Default Value	Range
Pass Code	0000	0 – 9, A – Z
Language	English	English, Spanish, French, German, Dutch, Italian
Pump 2 Speed	50%	0%-100% (of full speed)
Wash Time	10 sec	10 – 255 sec
Chemical Mode	Probe	Probe/Repeat Cycle
Chemical Type	Liquid	Liquid / Dry / Small Tank
Chemical Concentration	25 Knight Units 0 % 0 mS	0 – 999 Knight units 0 – 99.99 % 0 – 80 Millisiemens
Alarm Delay	180 sec	1 – 512 sec
Initial Charge	1 sec	1 – 128 sec
Recharge Time	1 sec	0 – 255 sec
Wash Count	0	0 – 65536
Repeat Cycle Interval	10	10 – 255 Washes
Feed Limit	On	On/Off
Detergent Run Time	0	9999 Minutes

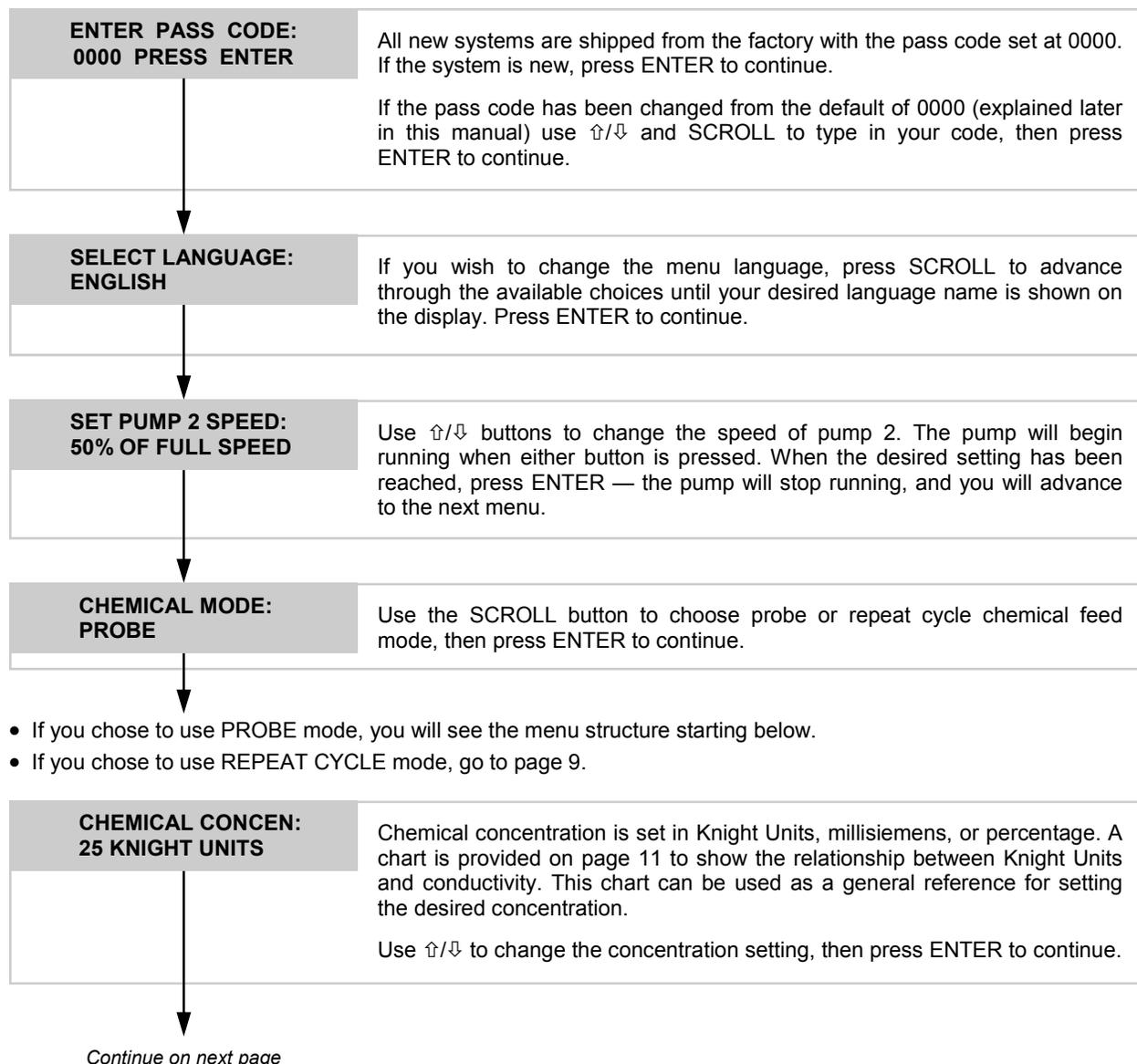
---

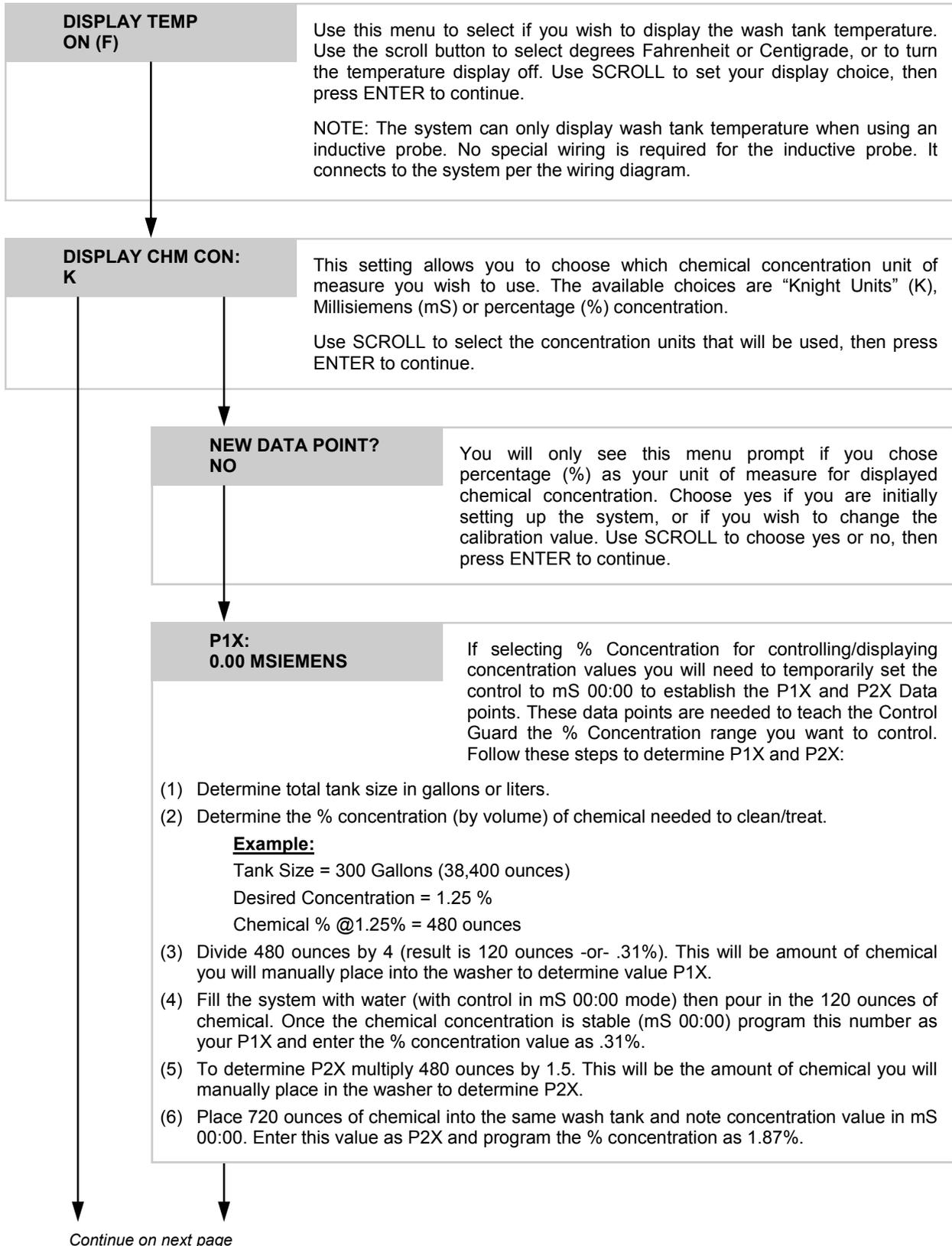
## PROGRAMMING

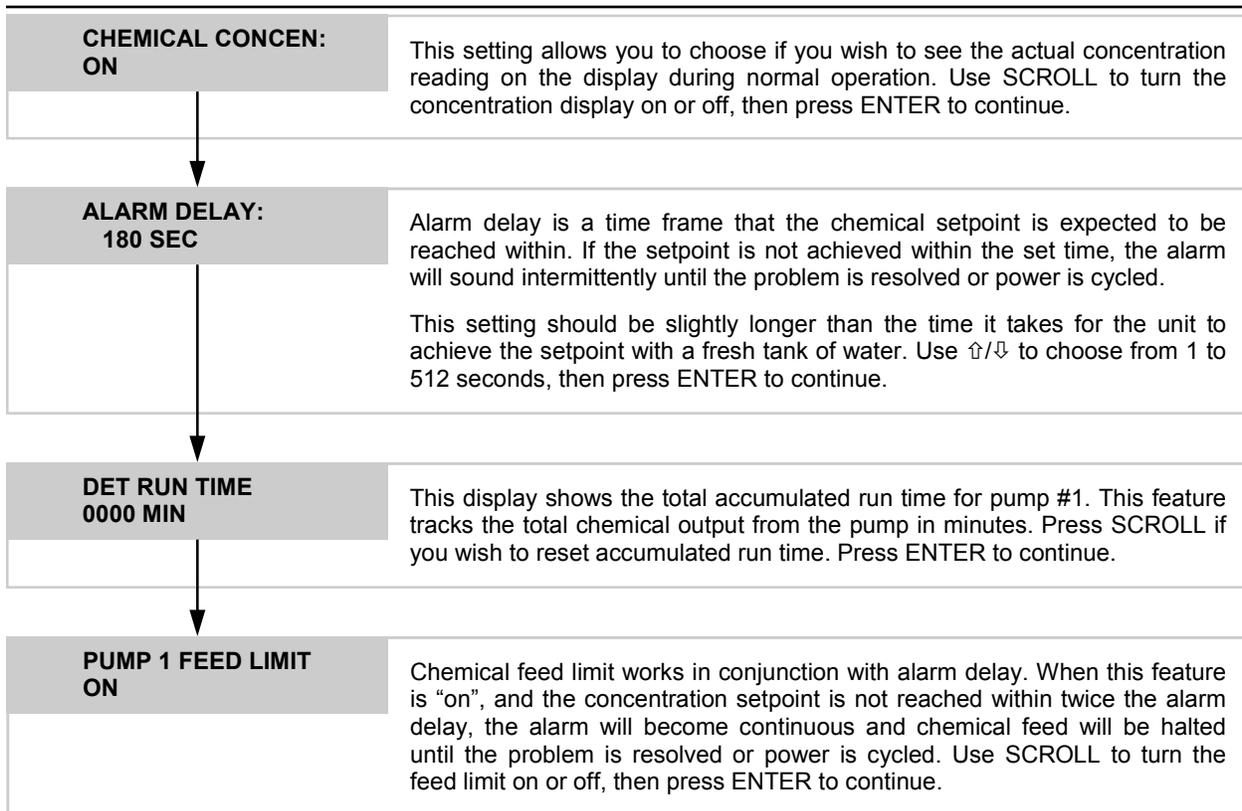
You may find it helpful to read through the programming instructions before getting started. This will better familiarize you with the operation of the Control Guard FCS, and will make the actual programming go much quicker. Be aware of the following notes.

- If you wish to return to normal operating mode at any point during programming, hold down the ENTER button for 3 seconds to exit the programming mode.
- While programming, if no buttons are pressed for approximately 2 minutes, the system will automatically return to normal operating mode.
- Programming changes can be made while the unit is operating — changes will take effect immediately. This allows you to make minor adjustments “on-the-fly” and fine tune the performance of your system.

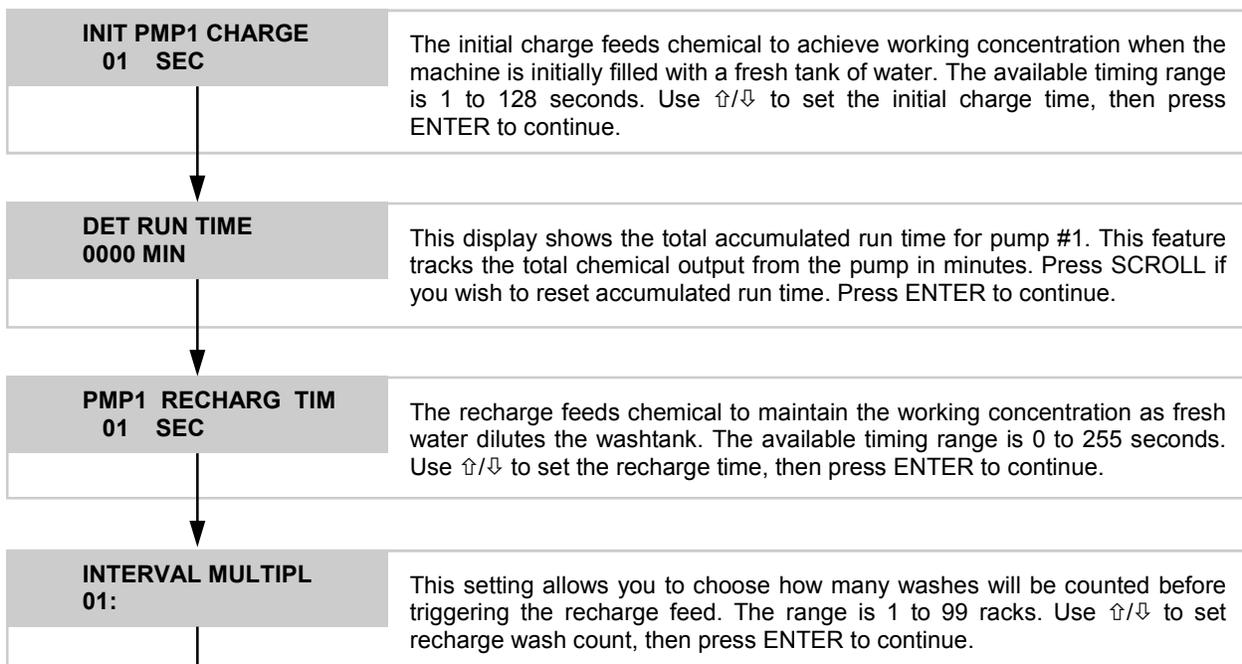
When you're ready to get started, hold down the ENTER button for about 3 seconds to go into the programming mode. Release the button when you see the following display...



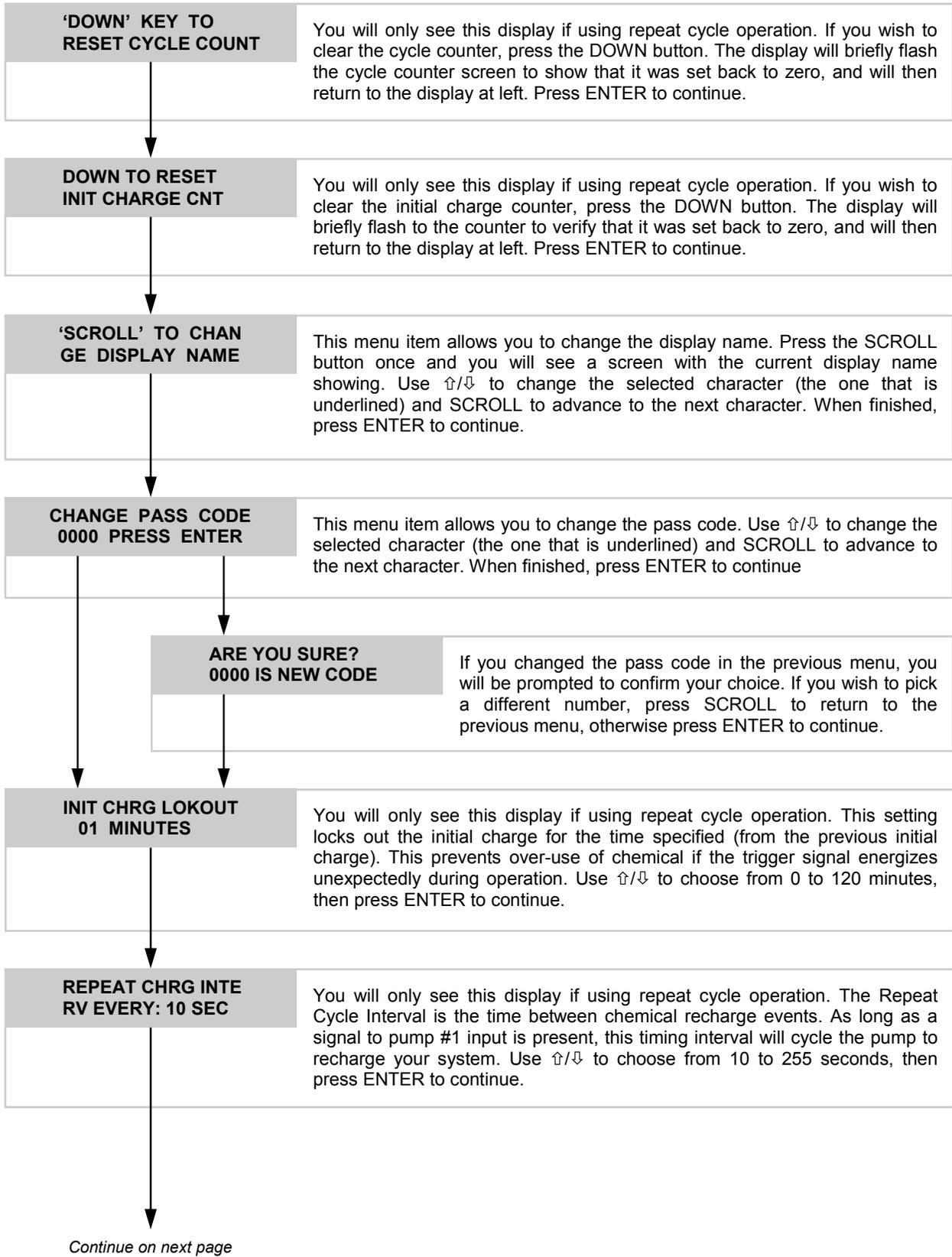


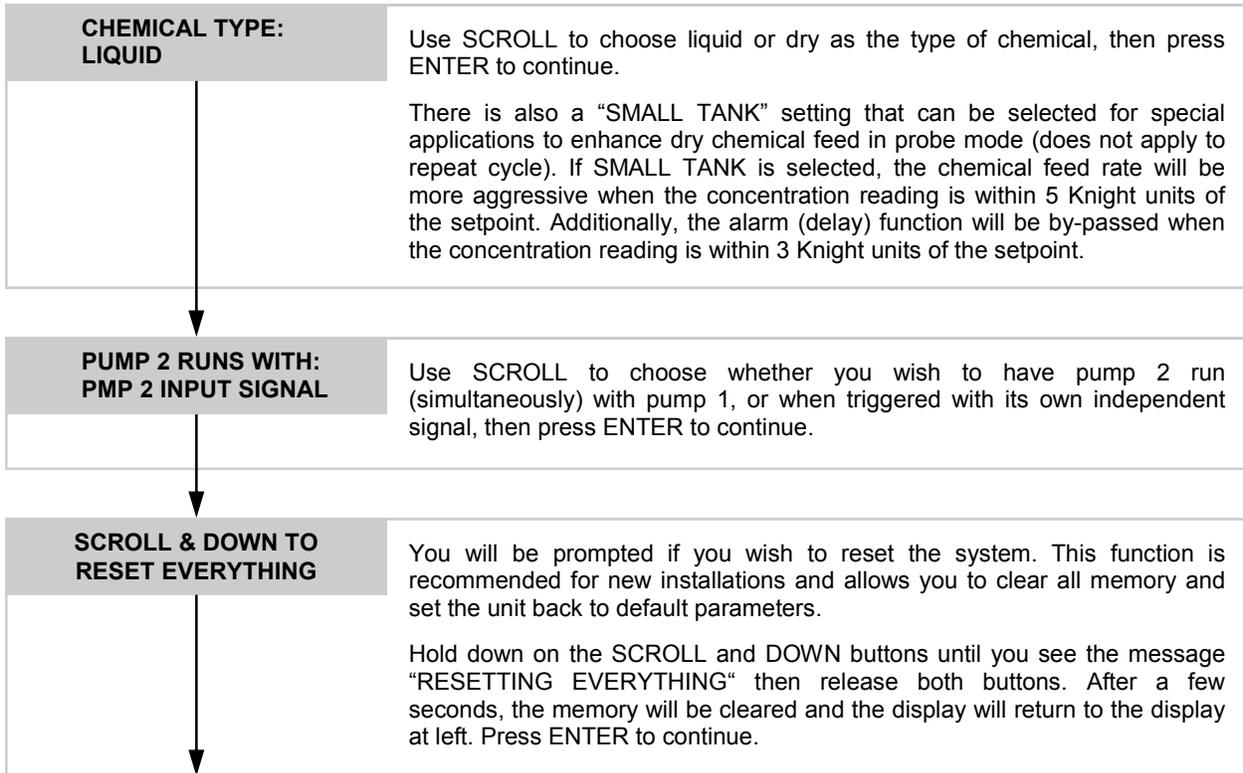


- If you are done programming PROBE mode, go to page 10.
- If you chose to use REPEAT CYCLE mode instead of PROBE mode, you will see the following menu structure...

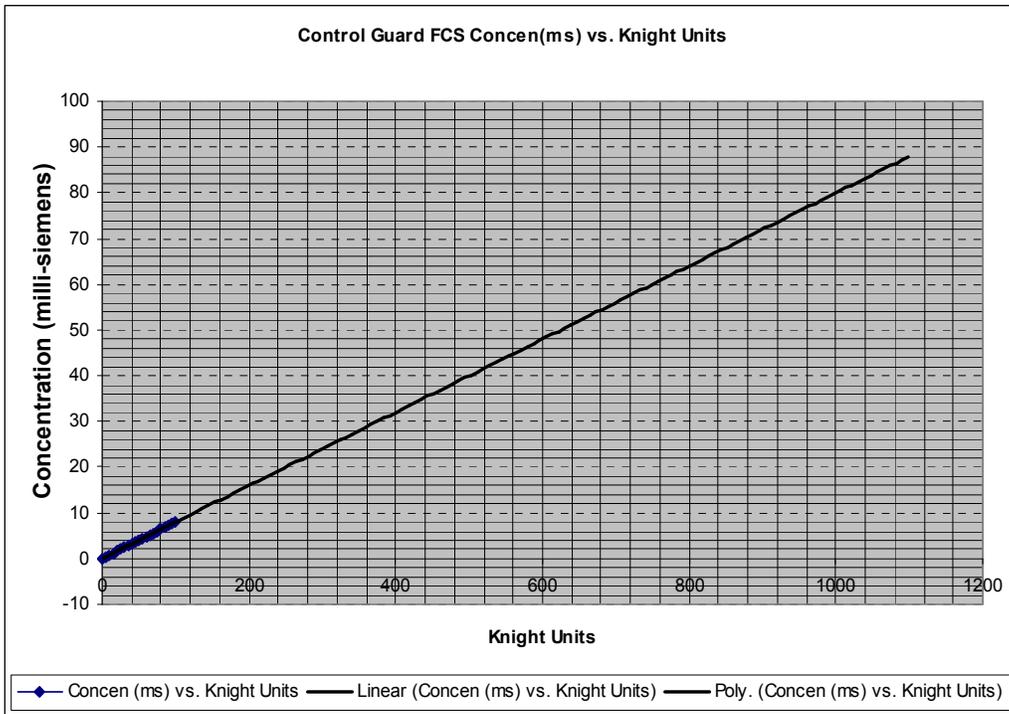


Continue on next page



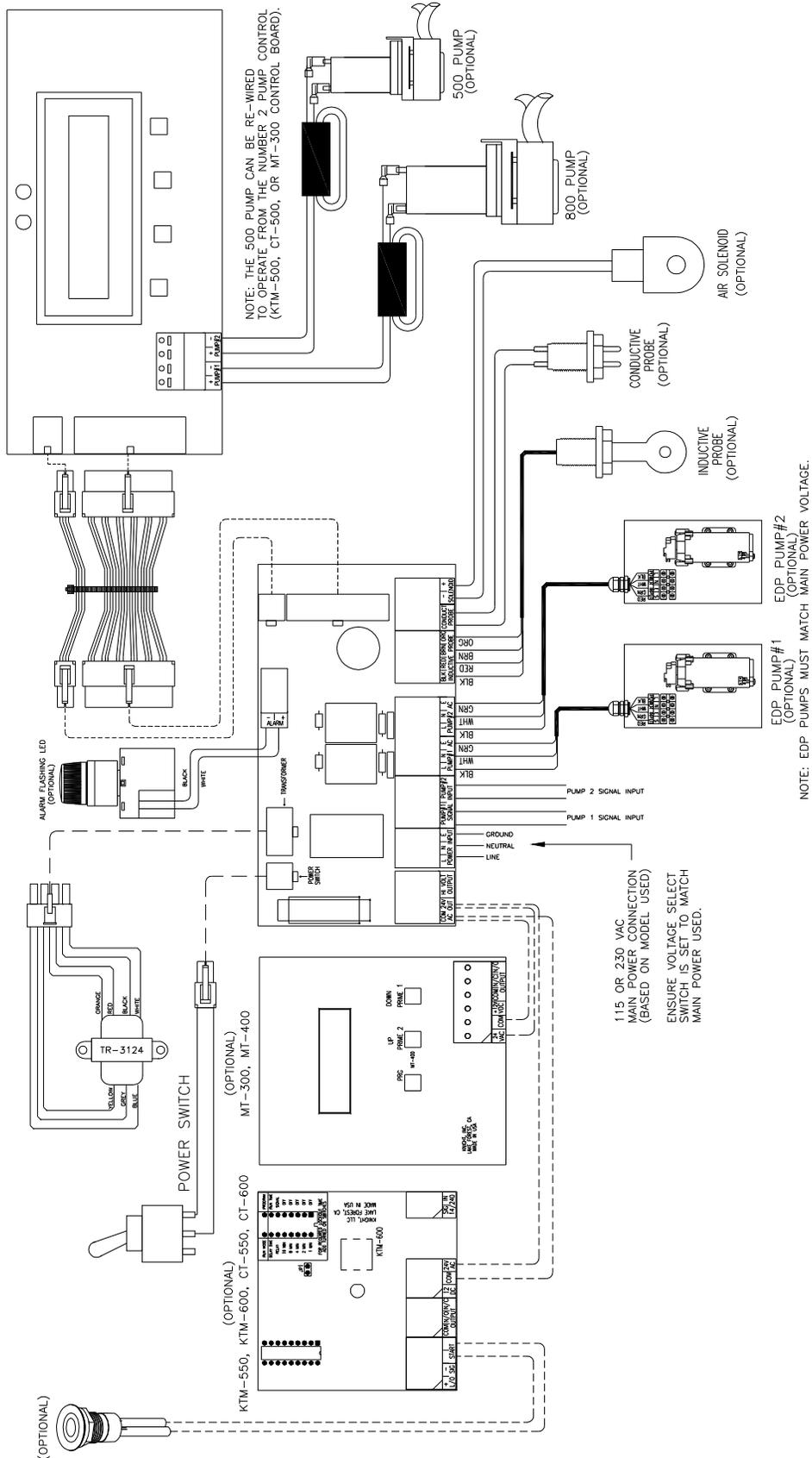


*Wrap around to first menu item*



Note: The chart shown above is based on data that was derived using the inductive probe, and, should be used as a guide only. Actual titration testing of your chemical concentration is recommended to achieve the desired setpoint.

# SYSTEM WIRING DIAGRAM



---

## REPLACEMENT PARTS

Part Number	Description
7140566	Main Control Circuit Board
7140567-01	Pump Circuit Board
7140567-02	Pump Circuit Board (for Europe applications)
7164257-1	Transformer With Plug
1201701	Control Guard FCS Label
7010261	Gearmotor (for 500 series pump)
7018051	T-50-E Squeeze Tube (for 500 series pump)
7020148	Hose Clamp (for 500 series pump)
7501311-BK	500 Series Pump Body (black)
7502312	500 Series Pump Face Plate
7503450	500 Series Pump Roller Block Assy
1600747	1/4" Barb x 1/4" Barb Fitting
7010116	Gearmotor (for 800 series pump)
7018068	T-66-E Squeeze Tube (for 800 series pump)
7020144	Hose Clamp (for 800 series pump)
7630330	800 Series Pump Face Plate
7631331	800 Series Pump Body (black)
7633330	800 Series Pump Roller Block Assy
1600713	3/8" Barb x 3/8" Barb Fitting
7641069-D4	Air Solenoid Valve
7005190	Conductive Probe
1600698	Inductive Probe
0200503	Strobe Alarm
7140583	KTM-550 Circuit Board Assy
7142326	KTM-600 Circuit Board Assy
7140586	CT-550 Circuit Board Assy
7141600	CT-600 Circuit Board Assy
7142218	MT-300 Circuit Board Assy
7142228-2	MT-400 Circuit Board Assy

---

## OPTIONAL KTM 550/600 CONTROL

### **Priming**

- (1) Locate the dip-switch pack on the circuit board and set switch #6 to RELAY.
- (2) Press and hold the Start button until the chemical line is fully primed, then release the button.
- (3) Set switch #6 to SIGNAL (unless you intend to use relay mode).

### **Programming Run Time**

- Max run time: 12 min and 42 sec
- (1) Locate the dip-switch pack on the circuit board. Set switch #6 to SIGNAL, set switch #7 to RUN TIME and set switch #8 to PROGRAM MODE.
  - (2) Using a measuring cup or flask, press Start switch and release when pump starts. Let the pump run until desired amount of chemical is dispensed then press Start switch again to stop. The run time is now programmed.
  - (3) Set mode switch #8 to RUN MODE.

### **Programming Delay Time (optional)**

- Max delay time: 12 min and 42 sec
- (1) Locate the dip-switch pack on the circuit board. Set switch #6 to SIGNAL, set switch #7 to DELAY TIME and set switch #8 to PROGRAM MODE.
  - (2) Press Start switch and release when the LED begins flashing. When the desired delay time has passed, press the Start switch again. The delay time is now programmed. Repeat step if new delay time is required.
  - (3) Set mode switch #8 to RUN MODE.

### **Setting Lock-Out Time (optional)**

This feature defeats consecutive dispensing of product for a pre-determined interval. Select a combination of switches 1 – 5 to program total lock-out time.

Example: For 10 minute lock-out, set switches #2 and #4 to ON with all other switches OFF.

- For maximum lock-out (31 min) set all switches ON.
- For no lock-out, set all switches OFF.

**Manual activation:** Press the Start button for 1 full second. The control will begin counting down the delay time (if used) and will then run the pump for the amount of time programmed. Once the lock-out time expires the pump will be ready to restart.

**Signal activation:** When the signal input on the circuit board (see wiring diagram) receives a 14-240 VAC trigger signal for at least 5 full seconds, the delay time (if used) will begin counting down. Then the pump will run for the amount of time programmed. Once the lock-out time expires the pump will be ready to restart.

**Relay Mode:** Set switch #6 to RELAY. The pump will activate for as long as an external trigger signal is present, or for as long as the manual button is depressed. All other board functions (such as delay time and lock-out time) are by-passed in relay mode.



---

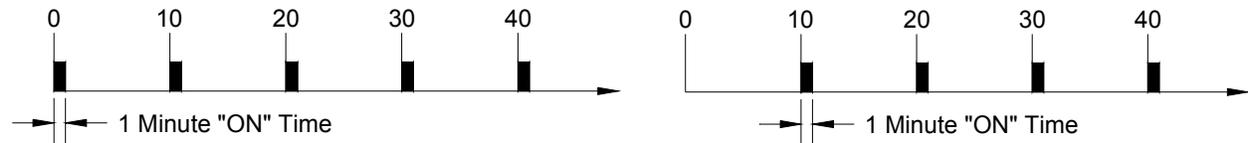
## OPTIONAL CT 550/600 CONTROL

The CT-550/600 circuit board is a cycle timer that controls a pump by repeatedly cycling the “on” time at the end of every “off” time (interval time). The CT-550 version has a 24 VDC pump output, whereas the CT-600 version has a relay that switches power to a 115 or 230 volt motor (or other device). The board has the option to have the pump operate as soon as power is applied (“on” first) or after the “off” interval has expired (“off” first). See details below.

### ***On-First / Off-First***

DIP switch #7 is used to select on-first/off-first operation. Which setting you choose will be based on your application requirements and how you wish for the pump to operate. In the examples shown below, if the interval time is 10 minutes and the on time is 1 minute, then the pump will run every 10 minutes when the interval time expires. The first activation of the pump is based on DIP switch #7 setting.

- When set to “ON FIRST”, the pump will begin running for the on-time immediately when powered up.
- When set to “OFF FIRST”, the pump will start counting down the interval time when powered up (before running the pump).



### ***Priming***

The pump can be primed manually while the interval time is counting down (LED flashing). Ensure that the power is on, then press and hold the START button to prime the pump. The pump will run for as long as the button is pressed.

A remote prime switch can be connected to the START terminals on the circuit board if desired. This may be helpful in applications where the pump is not easily accessible.

### ***Setting “On” Time***

The maximum ON time is 12 minutes and 42 seconds. The on time must always be shorter than the interval time for the system to “cycle” properly. If the on time is inadvertently set longer than the off time, then the pump will run continuously and will not cycle off.

- (1) Locate the DIP-switch pack on the circuit board — set switch #8 to PROGRAM.
- (2) Using a measuring cup or beaker, press Start switch and release when pump starts. Let the pump run until desired amount of chemical is dispensed then press Start switch again to stop. The on time is now programmed.
- (3) Set mode switch #8 to RUN MODE.

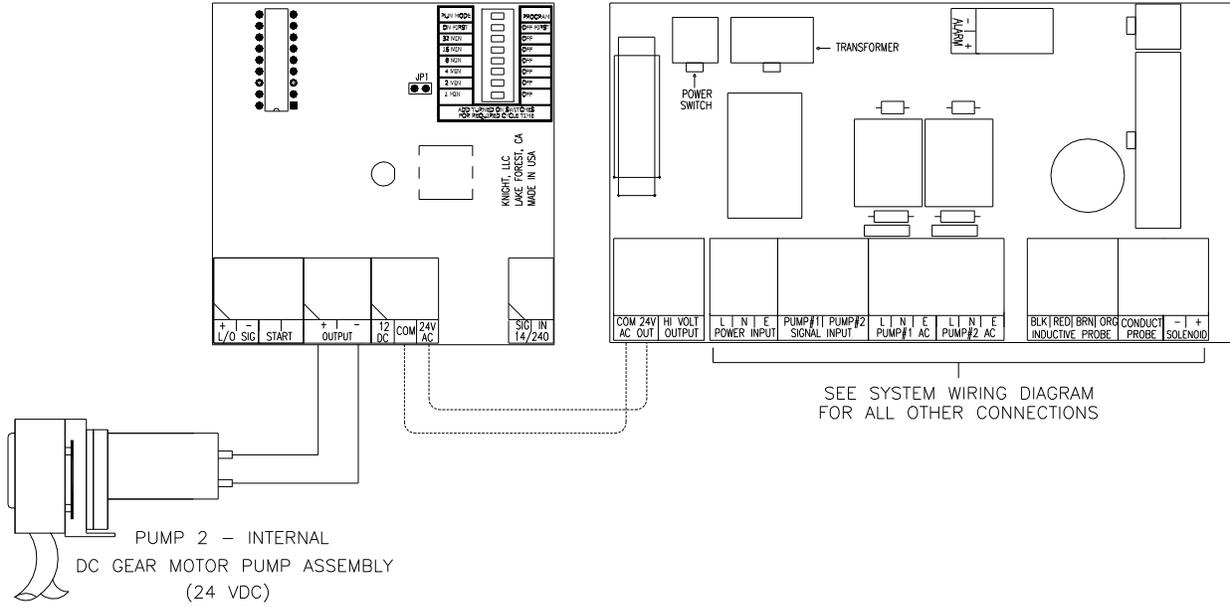
### ***Setting “Off” (Interval) Time***

The maximum OFF time (interval time) is 63 minutes. The interval time is set by selecting a combination of DIP switches 1 – 6. All switches that are turned ON will be added up to determine the total interval time. For example, if you wish to set a 20 minute interval time, set switches #3 and #5 to ON with all other switches OFF.

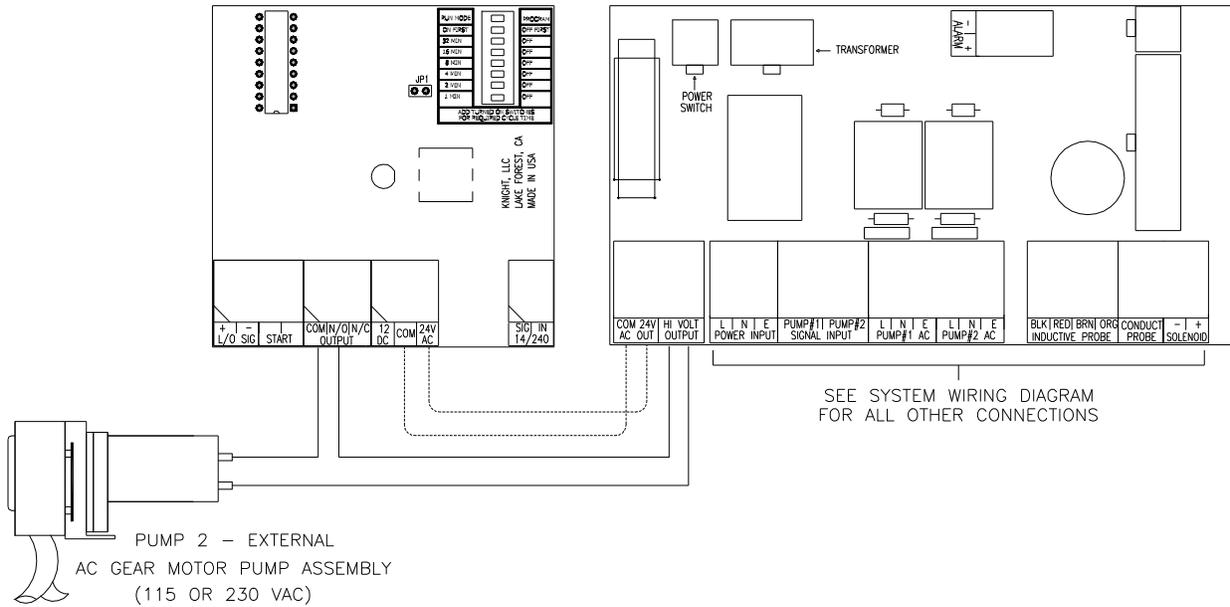
- For maximum off time (63 min) set all switches ON.
- When the interval time expires, it resets and begins counting down again. The pump runs for the duration of the on time each time the interval time resets.

# CT 550/600 WIRING DIAGRAM

CT-550 CIRCUIT BOARD



CT-600 CIRCUIT BOARD



---

## OPTIONAL MT 300/400 CONTROL

### **Button Functions**

- PRGM: Steps you through the setup program.
- PRIME 1 (↓): Manually activates the pump and shows clock when not programming.  
Advances numbers downward when programming.
- PRIME 2 (↑): Advances numbers upward when programming.

### **Security Feature — Remove Jumper JP1 To Program**

To prevent unauthorized tampering, the programmed settings can be “secured” by placing a jumper on the JP1 pins on the circuit board. The jumper acts like a lock and key...when the board is secured (jumper on) the display will show “SECU” if the PRGM button is pressed. The PRIME buttons are not affected and will still function in their normal manner. Removing the jumper allows the board to be programmed or to change the time of day clock. Replace jumper when done programming if you wish to secure the system.

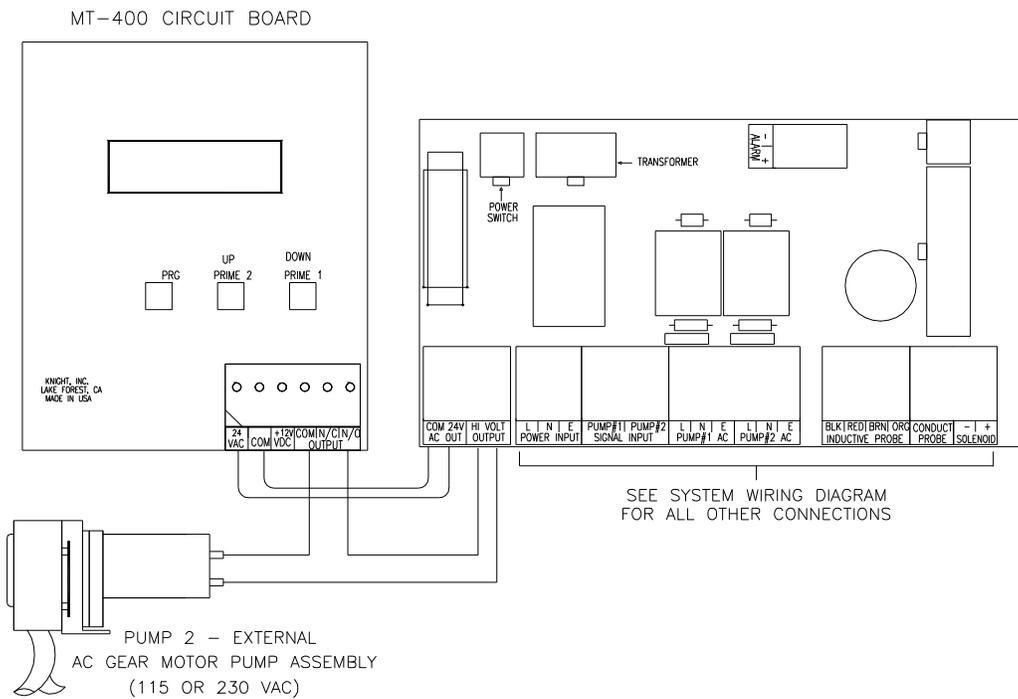
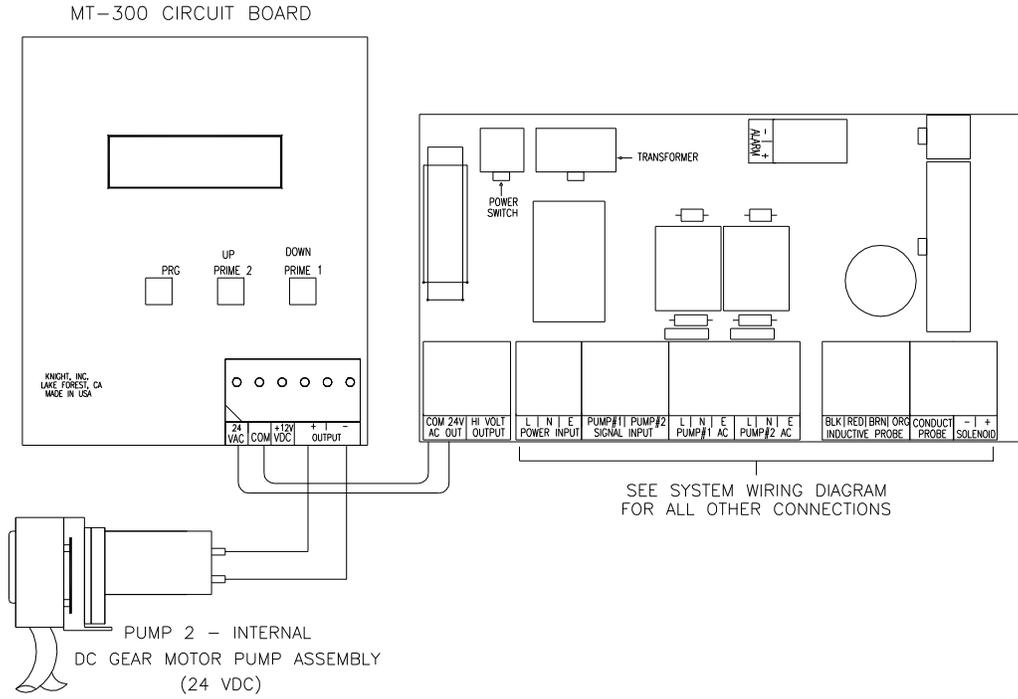
### **Programming**

- (1) Press the **PRGM** button — set the clock to the current time of day. Use ↑/↓ to set the clock (note AM/PM).
- (2) Press **PRGM** button again — PE 1 will be displayed. PE = Pump Events (“on times”) needed per day. Use ↑/↓ to set the number of pump events per day that are required.  
**NOTE:** The system will activate only the number of pump events indicated by the PE #.
- (3) Press **PRGM** button again — E 1 will be displayed indicating that you are going to program the first event.
- (4) Press **PRGM** button again — pump start time will be displayed. Use ↑/↓ to set the pump start time (note AM/PM).
- (5) Press **PRGM** button again — pump run time will be displayed. Use ↑/↓ to set the pump run time (min:sec).
- (6) a: Press **PRGM** button again — E 2 will be displayed if you selected more than 1 pump events (PE) per day. Program all pump events the same as the instruction in steps 4 & 5.  
b: After all pump events are programmed, pressing the **PRGM** button will return you to the blank display.
- (7) To review your pump programming, press the **PRGM** button and slowly step through the program. Make changes as necessary referring to the above instructions.

**Tip:** If you hold down any of the buttons while programming, the numbers will scroll much faster.

**Tip:** If you get lost in the program, press PRGM until you return to blank display. Then repeat instructions above.

# MT 300/400 WIRING DIAGRAM



---

## DISCLAIMER

Knight LLC does not accept responsibility for the mishandling, misuse, or non-performance of the described items when used for purposes other than those specified in the instructions. For hazardous materials information consult label, MSDS, or Knight LLC. Knight products are not for use in potentially explosive environments. Any use of our equipment in such an environment is at the risk of the user, Knight does not accept any liability in such circumstances.

## WARRANTY

All Knight controls and pump systems are warranted against defects in material and workmanship for a period of ONE year. All electronic control boards have a TWO year warranty. Warranty applies only to the replacement or repair of such parts when returned to factory with a Knight Return Authorization (KRA) number, freight prepaid, and found to be defective upon factory authorized inspection. Bearings and pump seals or rubber and synthetic rubber parts such as "O" rings, diaphragms, squeeze tubing, and gaskets are considered expendable and are not covered under warranty. Warranty does not cover liability resulting from performance of this equipment nor the labor to replace this equipment. Product abuse or misuse voids warranty.

## FOOTNOTE

The information and specifications included in this publication were in effect at the time of approval for printing. Knight, LLC reserves the right, however, to discontinue or change specifications or design at any time without notice and without incurring any obligation whatsoever.

---

**KNIGHT LLC, A Unit of IDEX Corporation** ([www.knightequip.com](http://www.knightequip.com))

<b>Knight Headquarters</b> Tel: 949.595.4800 Fax: 949.595.4801	<b>USA Toll Free</b> Tel: 800.854.3764 Fax: 800.752.9518	<b>Knight Canada</b> Tel: 905.542.2333 Fax: 905.542.1536	<b>Knight Europe</b> Tel: 44.1293.615.570 Fax: 44.1293.615.585	<b>Knight Australia</b> Tel: 61.2.9725.2588 Fax: 61.2.9725.2025	<b>Knight N. Asia</b> Tel: 82.2.3481.6683 Fax: 82.2.3482.5742	<b>Knight S. Asia</b> Tel: 65.6763.6633 Fax: 65.6764.4020
--	--	--	--	---	---	---

---