OPERATING MANUAL

Masterflex® L/S™

LABORATORY STANDARD CONTROLLER/DISPENSER

Type	MODELS System	Pump Drive	Controller
Benchtop (115V)	77300-00	77300-50	77300-60
Benchtop (230V)	77300-05	77300-55	77300-65
NEMA (115V)	77300-10	77300-50	77300-70
NEMA (230V)	77300-15	77300-55	77300-75

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Edition 05

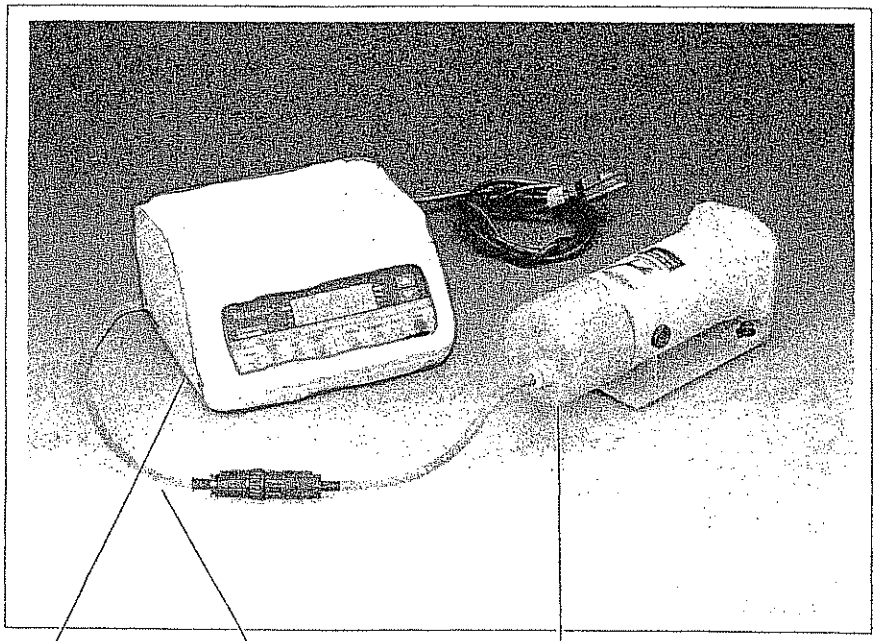
Cole-Parmer®

ISO 9001 VENDOR CERTIFIED

DESCRIPTION

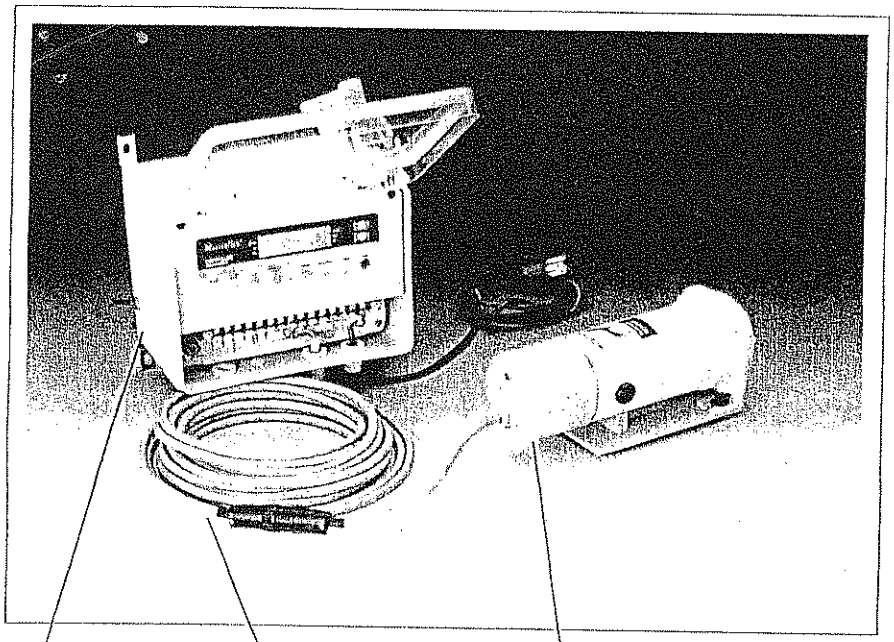
The Series 77300 Laboratory Standard (L/S) CONTROLLER/DISPENSER systems are modularized to allow easy setups and operation. The Controller is connected to the separate Pump Drive via a multi-conductor cable (6-ft. for the Benchtop models; 24-ft. for the NEMA wash-down model).

Benchtop System



Benchtop systems (77300-00 and 77300-05).

NEMA System



NEMA CONTROLLER
77300-70 (115V)
77300-75 (230V)

CONTROLLER CABLE
(24-ft.)

PUMP DRIVE
77300-50 (115V)
77300-55 (230V)

PUMP HEAD
(Order Separately)

NEMA wash-down Systems (77300-10 and 77300-15). Controllers are housed in a durable plastic case suitable for wall mounting. Hinged door with latch provides easy access to Control panel.

Controllers

The foldout sheet summarizes the control and display functions for all Controllers.

The control panel is composed of a membrane keypad and display. The display window has a capacity for 8 large, bright characters to show many values on demand: including *volume* (in milliliters or liters)...*flow rate* (in milliliters per minute or microliters per minute)...*tubing number*...*copy number*.

Alternate line cords are available for the 230 volt Benchtop unit, 77300-05. See the Accessories section for details.

NOTE: Masterflex tubing numbers used throughout the manual and displayed in the Controller refer to the last two digits of the L/S Masterflex tubing catalog number. For example, the 0.31" ID silicone tubing catalog number is 06411-18 so "18" should be selected under tubing size.

Non-Masterflex tubing, such as micro-bore tubing, is referred to by the tubing inside diameter in millimeters, for example, .19, .25, .38 and .51.

The display always tells you what's happening during a pumping operation. Adjacent to the display window on either side are units and direction indicators. One or more "dash" segments automatically align opposite the appropriate indicator in response to your settings. Thus, you can instantly verify motor rotation (clockwise or counter-clockwise) and whether the value displayed represents a flow rate in milliliters per minute or microliters per minute.

A microprocessor adds great flexibility to the overall pump system performance. Its memory stores built-in calibration factors so you can completely bypass the normal calibration chores. For optimum precision, the microprocessor also allows you to calibrate a pump head/tubing combination using *empirical* (measured volume) values that **you** enter (described in the CALIBRATION section).

Finally, the microprocessor stores all settings for the current job. This permits instant restart when an operation is resumed after a shutdown. These stored values include pump head selection, tubing selection, flow rate setpoint, motor direction, dispense volume, copy amount, mode and custom calibration.

Safety Features: (1) At startup, all circuits are automatically checked. (2) Special circuitry detects selected fault conditions, and automatically shuts down the system if appropriate. (3) Software and circuitry prevents an uncontrolled high speed (runaway) condition.

Pump Drive (All Systems)

The drive furnished with all Series 77300 systems has a 1/10 H.P. 600 RPM precision permanent magnet DC motor with a husky gearhead capable of delivering 180 oz.-in torque. Superb speed regulation is achieved through a digital optical encoder feedback signal. The motor is rated for continuous duty operation and is permanently lubricated. It also meets NEMA 4 requirements to withstand wash-downs.

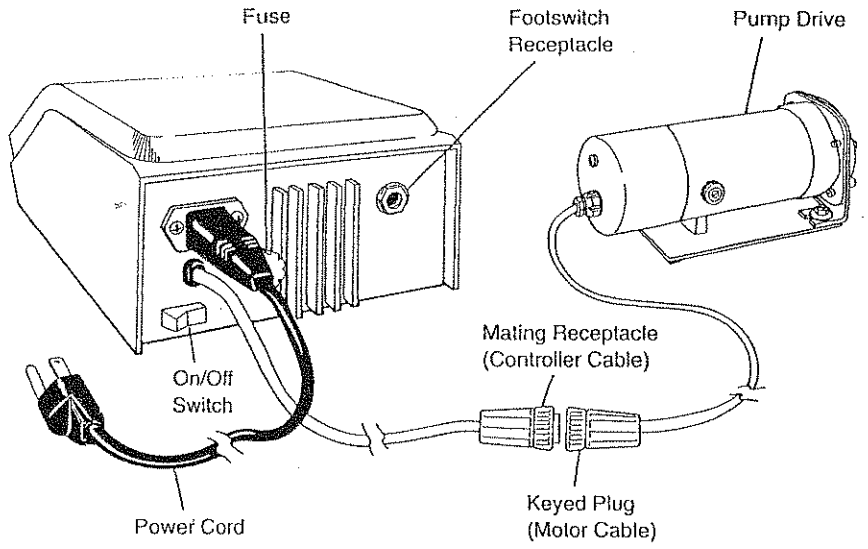
Pump Heads (All Systems)

One or two L/S Pump Heads can be controlled, depending upon the selected tubing number and material, plus backpressure conditions (see SETUP section).

INSTALLATION

The installation procedures for the Benchtop and NEMA systems are quite different:

Benchtop System



Rear Panel of Benchtop System.

(1) Connect Pump Drive

The CONTROLLER CABLE is factory-wired to the Benchtop Controller.

☐ Connect the keyed plug on the MOTOR CABLE to the mating receptacle on the CONTROLLER CABLE.

☐ Connect power cord to Controller.

That's it. The Benchtop system is ready for setup (unless you wish to plug in a FOOTSWITCH – see step number 2).

☐ Skip ahead to the SETUP section.

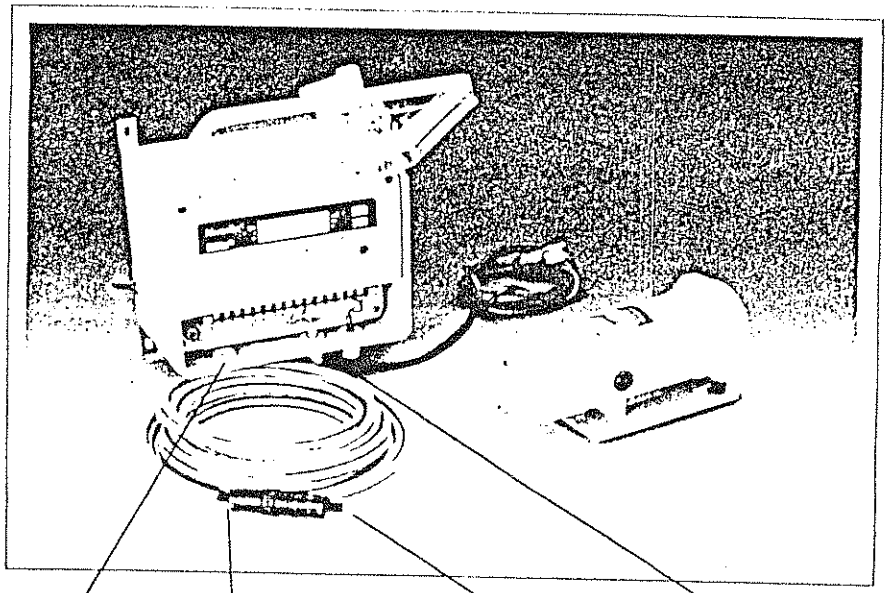
NOTES: (1) The front panel START/STOP keys will always *override* the FOOTSWITCH control.
(2) Air vents are provided at the bottom of the cabinet; don't place Controller on a surface that will obstruct air flow when the system is operating.

(2) Optional: Connect FOOTSWITCH

Instead of using the START/STOP keys on the front control panel, the rear panel of the Benchtop system has a receptacle for connecting a FOOTSWITCH (described in the ACCESSORIES section) or similar momentary contact closure.

☐ Plug the FOOTSWITCH cable into the receptacle shown in the preceding illustration.

NEMA (Wash-down) System



*FITTING with plastic cap for optional REMOTE CONTROL CABLE

MATING RECEPTACLE (Controller Cable)

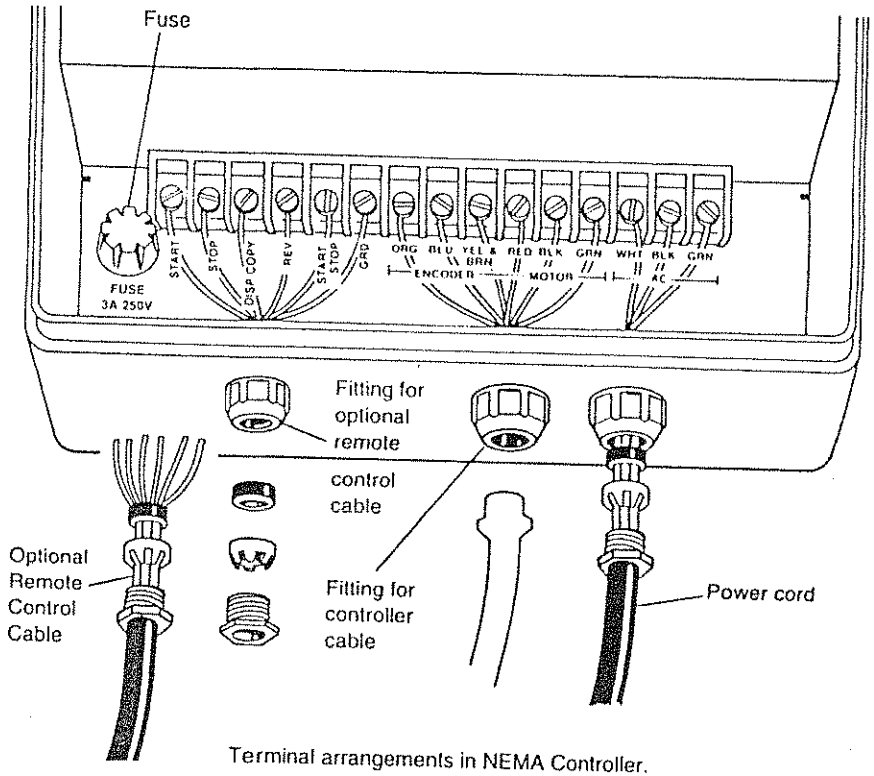
KEYED PLUG (Motor Cable)

*FITTING with plastic cap for CONTROLLER CABLE

*NOTE: In order to make enclosure wash-down proof, without installing remote control cables, remove outer part of fitting, plastic grip and rubber washer and replace with plastic cap.

The NEMA controller has the same front panel keypad functions as the Benchtop units – accessible through a hinged door. In addition to being wash-down and having a longer CONTROLLER CABLE (24 ft.), it has more remote functions.

Warning: Turn off the AC power before connecting cables.



Terminal arrangements in NEMA Controller.

NOTE: The WHT, BLK, GRN AC Input wires are labeled BLU, BRN, YEL/GRN for the 77300-75, 230 volt unit.

(1) Wire Controller Cable to Terminals

The cables are furnished factory wired. However, if they need to be re-connected for any reason, follow these instructions.

☐ Remove the plastic cap from the middle fitting and feed the leads of the CONTROLLER CABLE through to the terminal strip.

☐ Connect the color-coded leads to the designated terminals.

☐ Be sure to tighten the plastic fitting to maintain the wash-down seal.

(2) Connect the CONTROLLER/MOTOR CABLES

☐ Connect the keyed connector on the CONTROLLER CABLE to the mating receptacle on the MOTOR CABLE.

(3) Optional: Connect REMOTE CONTROL

Five remote functions are available. The start, stop, reverse and dispense/copy remote controls operate the same as the corresponding front panel keys. Refer to the Operation section. A customer supplied momentary low level contact closure to ground will activate the function. The start/stop remote control works differently depending on operating mode. When in the dispense mode, a customer supplied momentary low level contact closure to ground initiates a dispense. When not in the dispense mode, the motor will run as long as the input is grounded. The customer must furnish the necessary cable, 0.196" to 0.315" diameter (50 mm to 80 mm).

☐ Remove the plastic cap from the first fitting and feed the accessory or user supplied cable leads through to the terminal strip.

☐ Connect the leads to the appropriate designated terminals.

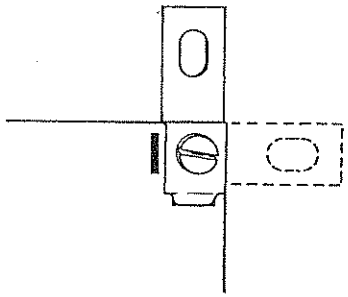
☐ Be sure to tighten the plastic fitting to maintain a wash-down seal.

NOTE: An optional hand held remote control unit (7592-80) is available which is connected via a 10 ft. cable. (Refer to instructions furnished with unit.)

Caps must be installed on unused cable feed-throughs to maintain wash-down feature.

(4) Optional: NEMA Controller Wall-Mount

The 24-ft . long CONTROLLER CABLE furnished with the NEMA system permits convenient wall mounting away from the pumping operation:



Optional wall mounting for NEMA Controller.
(Broken lines denote horizontal bracket arrangement.)

☐ Select a mounting location. The 4 brackets furnished can be installed vertically or horizontally, as shown, to help overcome any obstructions or space limitations.

☐ Fasten the accompanying bolts to secure the brackets in each corner of the Controller enclosure.

(5) Plug the Power Cord into a Grounded Outlet.

SETUP

Fast, easy setups will become routine because the microprocessor stores nominal flow rates for different pump heads and tubing numbers. Also, your last setpoints are automatically stored, even when the power is off. This enables you to eliminate repetitive setup chores when you resume the same operation after a shutdown.

Before proceeding, it will be helpful to review the control and display functions summarized in the foldout sheet at the front of this manual.

Automatic prompts are displayed to help you enter settings for each new job. Whenever you see a flashing field in the display, you can either

change the digital values (via the ▲ and ▼ keys) or simply exit to another function by pressing some other button.

NOTE: *Underscores* in the following example displays represent flashing fields.

Following is the basic setup sequence:

(1) Select Pump Head(s) & Tubing

All L/S Easy-Load®, Quick Load®, Cartridge and standard Masterflex L/S peristaltic pump heads can be used with the Controller/Dispenser drives. Teflon® Diaphragm Pumps (7090-42 and 7090-62) can also be used. The pump head selected depends on the application and flow rate requirements.

The number of pump heads that can be used in tandem depends on the application requirements such as fluid density, viscosity, temperature, backpressure and tubing size and material. Silicone and C-FLEX® tubing materials create a smaller load than do Tygon®, Norprene®, PharMed® and Viton®.

As a rule of thumb, the Pump Drives can pump water in one size 18 Masterflex tube at pressures up to 30 psi and two size 18 Masterflex tubes at 0 psi.

Factory set calibration constants are programmed into the drive memory for all compatible pumps and tubing sizes. Maximum flow rates for each pump and tubing size combination are also stored in the unit and are displayed for use in pump head/tubing selection.

(2) Install Pump Head(s)

Refer to instructions furnished with the pump heads.

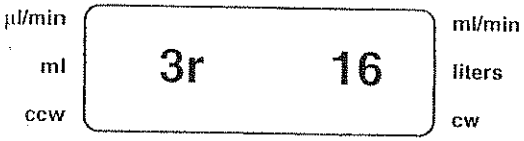
(3) Set Pump Head and Tubing

☐ Place the power switch to the ON position (at the rear panel of the Benchtop Controller; at the side of the NEMA enclosure).

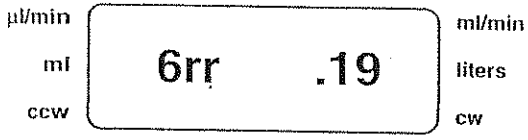
A non-volatile memory stores the last setpoints and operating conditions, after a shutdown. When power is applied, the last setting will appear. (If the pump was running when power was disconnected, it will re-start when power is applied.) For example:

☐ Press SETUP key; two displays will alternate. The first shows the tubing size and pump head while the second shows the *maximum* associated flow rate. Units are as indicated and are not selectable. Press the ▲ or ▼ keys until the desired setup configuration is obtained. A second press of the SETUP key advances to the next pump type. Press any key other than ▲, ▼ or SETUP to exit the setup mode.

"3r", "6r", or "8r" indicate the number of rollers in the selected pump head. "3r" should be selected for all Masterflex pump heads except for the Low Flow Cartridge Pumps which can be either "6r" or "8r". The last two digits of the first display indicate the tubing size. For example, the following setup selection is used for an Easy-Load pump head with 6411-16 Masterflex tubing:



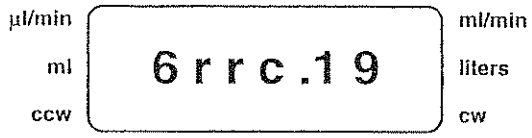
A second "r" in the display indicates that the Low Flow Cartridge Pump with a speed reducer is selected. For example, the following setup selection is used for the 7519-15, Low Flow Cartridge Pump with 0.19 millimeter ID tubing:



Since the Low Flow Cartridge Pumps can be configured in a low pulsation mode that results in a doubling of the flow rate, an "L" is included for selecting this setup configuration. See the Low Flow Cartridge Pump Operator's Manual for further details.

Finally, a "c" is included in the display indicating which setup configuration has been **field** calibrated. For example, if the above

setup configuration was field calibrated, the field calibrated setup is utilized by selecting:



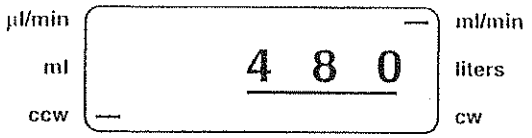
NOTE: Non-Masterflex tubes can be accommodated by selecting a similar tube size and using the field calibrate feature.

See Table 1 for a summary of cartridge pump head and Teflon Diaphragm Pump selection options.

TABLE 1

PUMP HEAD MODEL NUMBER	PUMP HEAD DESIGNATION	PUMP HEAD DESIGNATION FOR LOW PULSATION
7519-00	3r	not applicable
7519-10	6r	6r L
7519-15	6rr	6rr L
7519-20	8r	8r L
7519-25	8rr	8rr L
7090-42	P8 800	not applicable
7090-62	P1 100	not applicable

☐ To read the stored Flow Rate previously set, press the FLOW RATE key. For example:



Note that the "dash" segment is aligned with the ml/min mode indicator. Thus, the Flow Rate shown (480) represents milliliters per minute. Incidentally, 480 is the maximum flow rate for Tubing Size 16 – it could be any smaller value you previously set.

If you wish to resume a job with the **same** settings, no further setup steps are required. You can prime the pump and start operating the system.

(4) Select CW or CCW operation

(5) Prime The Pump

☐ Press and **hold** the PRIME key. The motor will run at full speed (600 RPM).

OPERATION

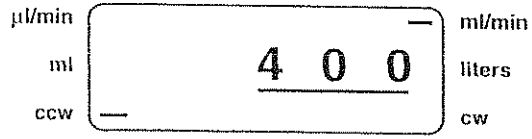
This section describes how to put the system to work. For most accurate operation, a new pump should be run for approximately 30 minutes.

(1) Start/Stop Operation

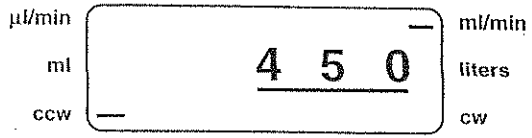
☐ Select the direction of motor rotation. A dash segment will align opposite the CW or CCW mode indicator to indicate the existing flow direction. To change the direction, press the REVERSE key. If the motor is running when the reverse function is activated, it will stop for about one second, then operate in the opposite direction.

☐ Units are as indicated and are not selectable.

☐ Select the Flow Rate. Press the FLOW RATE key to display the last setpoint value. For example:



☐ To change the displayed set Flow Rate Value, press the ▲ or ▼ keys. For example, increase the flow to 450. Use the ▲ key:



Since the drive speeds can exceed recommended Teflon Diaphragm Pump and non-geared Low Flow Cartridge Pump extremes, the flow rate display will flash under these conditions.

The system is now ready to operate.

☐ Press the START button. The system will deliver the fluid until you:

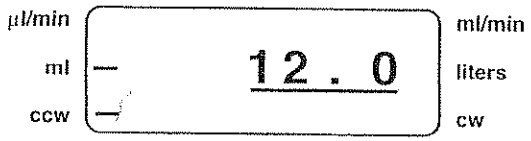
☐ Press the STOP button.

NOTE: Start/stop control can also be done **remotely** by activation of a FOOTSWITCH or other contact closure. (See INSTALLATION section.) The Pump Drive will run as long as the footswitch is pushed.

(2) Dispense Operation

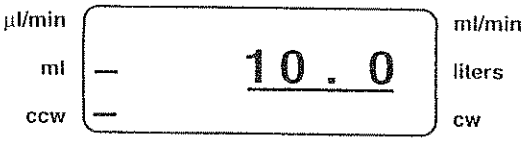
Here's the simple procedure for delivering a precise volume of liquid:

☐ Press the DISPENSE/COPY key. The last-entered volume will be displayed. The dash aligned with milliliters indicates **volume** in milliliters. For example, 12 milliliters:



Note that a dash segment is automatically aligned opposite the milliliter indicator.

☐ Use the ▲ or ▼ keys to change the displayed volume value (12.0) to a new value – for example, 10.0:



NOTE: A controlled Pump Drive coast minimizes potential errors due to motor over-shoot.

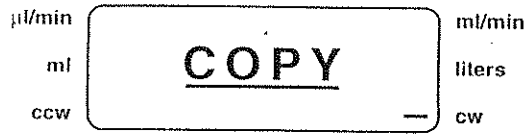
☐ Press the START button. The preset volume will be delivered, and the pump will stop automatically.

☐ To exit from the Dispense function, press any key other than START.

(3) Copy Operation

Any number of precise duplicate volumes can be quickly dispensed. Here's the procedure:

☐ Press the DISPENSE/COPY key twice. This display will flash:



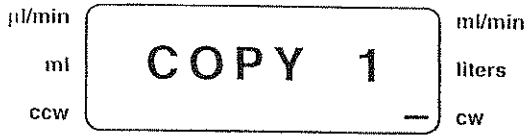
☐ Press the START key.

☐ When the desired COPY volume has been delivered, press the STOP key. The microprocessor will store this information so that precise duplicate volumes can be delivered.

If you wish to refine the copy volume, use the START and STOP keys until you are satisfied. For best accuracy, minimize the number of interim start/stop cycles.

☐ Press the DISPENSE/COPY key again. The COPY message will stop flashing, and you are ready to deliver identical volumes into a series of containers.

☐ Press the START key. The first copy volume will be delivered and the pump will stop automatically. The display will show:



☐ Press the START key for as many duplicate volumes as you desire. The display will show a count of how many copies you make. After 99 copies, the count will start over at 1.

☐ A dispense can be interrupted using the STOP key. To continue with the same dispense, press the START key. To cancel the incomplete dispense and start over, press the DISPENSE/COPY key three times to cycle back to the start of a new dispense.

☐ To exit from the COPY function, press any key, except START or STOP.

(4) Remote Dispensing

Two optional remote control devices (see ACCESSORIES section) are available to pump precise calibrated volumes. Instead of using the front panel controls, a FOOTSWITCH, can be plugged into the rear panel of the Benchtop Controller or easily wired to the NEMA Controller. (See INSTALLATION section.) The operator simply steps on the switch to start each dispense; the pump will stop automatically.

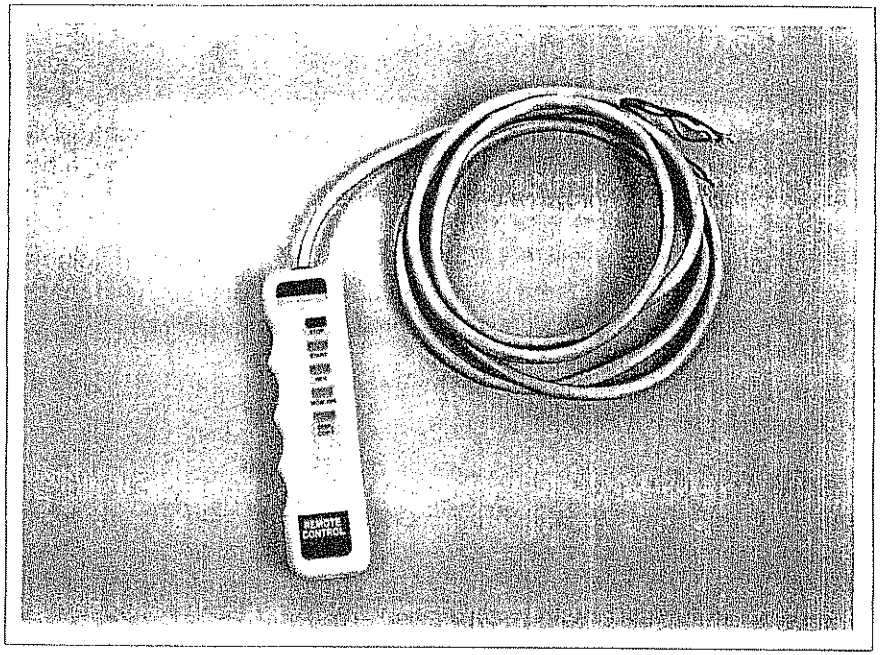
Also, a hand-held REMOTE CONTROL device or external controller can be wired to the NEMA Controller. (See INSTALLATION section.)

ACCESSORIES

Footswitch

The FOOTSWITCH is ideal for applications where frequent start/stop operations are required. It is furnished with a 6-ft. plug-in cable for Benchtop Controllers, and it can be wired to a NEMA Controller. (Part No. 07595-35.)

Remote Control



The REMOTE CONTROL is for the NEMA Controller only. It requires wiring to terminals (see INSTALLATION section). (Part No. 07592-80.)

Line Cords

Alternate Line Cords for Model 77300-05:

50001-70 European (standard)
50001-72 British
50001-74 Swiss
50001-76 Italian
50001-78 NEMA Type 6-15P (USA)

CALIBRATION

Automatic Calibration

Calibration factors for all standard tubing sizes are **stored** in a permanent system memory. If this is satisfactory for your applications, you can skip this calibration section. If more refined system calibration is necessary, use the following method.

Measured Volume Calibration

You have the option of calibrating the system empirically via measured volume (in milliliters or microliters), and achieving improved flow accuracies. This capability is useful if you wish to compensate for minor deviations due to tubing wear or unusual fluid characteristics. Also, empirical calibration is essential if you use non-Masterflex tubing in the Cartridge Pump Head (Models 7519). For most accurate operation, a new pump should be run approximately 30 minutes.

For container size selection, refer to the approximate calibration volumes displayed for each pump head and tubing number. Calibration time ranges from 10 seconds for high flow rates to 10 minutes for low flow rates.

Empirical calibration is performed by pumping a measured volume of the application liquid at a desired flow rate.

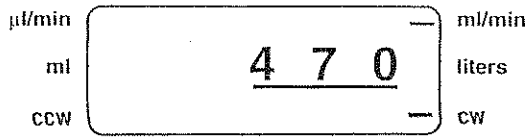
IMPORTANT: Only **one** field calibration can be stored for later instant startup of the same job. Each new calibration factor set for any tubing number automatically **cancels** the previous user calibration factor. Thus, if you calibrate for a new application, it will be necessary to re-calibrate when you resume the previous application.

Here's the calibration procedure using an Easy-Load pump head and tubing number 16.

The maximum Flow Rate for Tubing No. 16 is 480 milliliters per minute.

☐ If you wish to reduce the Flow Rate value shown, press the FLOW RATE key. This field will flash.

☐ Press the ▼ key to display a lower Flow Rate value, for example, 470.



☐ Press the CAL key.

The display will show a calibration message (CAL). Also, the calibration **volume** for the selected Tubing Number will be displayed. For Tubing No. 16, this volume is 60.0 milliliters.

The flashing CAL message prompts you to proceed.

NOTE: At any time, if you wish to **cancel** your entries and start over, simply press the CAL key and repeat the sequence. A "NoCAL" message will appear, indicating that no changes in calibration were made to memory.

☐ For delivery, select a graduate or container that will accommodate the displayed volume (60.0 milliliters), plus a small overshoot.

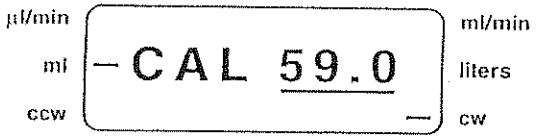
☐ Press the START key to deliver the liquid. The drive will stop automatically, and the volume field will flash:

Note that a second "dash" segment is aligned opposite the CW motor direction indicator. You can also calibrate with the pump running counter-clockwise (explained in the OPERATION section).

CAUTION: You may end the calibration run early, using the STOP key. But if the volume delivered is less than 50% of the displayed volume, the drive will return to the normal Flow Rate operation and terminate the CAL run. (Restart is not allowed in the calibration mode.)

☐ Measure or weigh the delivered volume.

☐ Respond to the flashing volume field by using the ▲ or ▼ keys to make the displayed volume value agree with your measured volume. For example, 59.0:



☐ Press any key (except CAL, ▲ or ▼) to enter this refined calibration factor into memory. When this is done, you will automatically exit the calibration mode.

The system is now calibrated for the measured volume and the selected tubing number (16), replacing the built-in calibration factor. The drive's motor shaft speed will produce the set Flow Rate using the new CAL factor.

A new pump selection is now available with a small "c" to remind you.

MAINTENANCE

Danger: ***High voltages exist and are accessible in the drives. Refer servicing to qualified personnel.***

Service

The Series 77300 systems are not customer serviceable, except for replacement of FUSES and MOTOR BRUSHES (Part No. A-2543-CR). See Table below for fuse part numbers.

MODEL NUMBER	FUSE PART NUMBER
77300-60	B-1115-0006
77300-65	B-1115-0003
77300-70	B-1115-0006
77300-75	B-1115-0042

To replace the brushes, remove the 2 rubber caps and unscrew the brushes using a screwdriver. Inspect for cracks and excessive wear. Brushes should be replaced when less than 3/8" long.

Trouble Shooting

If a problem occurs, turn the unit off, check the fuse, then re-check for the problem.

If an **error message** is displayed, refer to the following list for possible corrective action you can make. If these do not correct the problem, contact your dealer. (See RETURN OF ITEMS at the end of this manual.)

"Error 1" No encoder pulses from motor/
Corrective action: Check all motor connections.

"Error 2" Motor over-speed/
Corrective action: Check all motor connections.

"Error 3" TRIAC firing angle too large/
Corrective action: Check all motor connections. Unit must be turned off to clear error.

"Error 4" Bad EEPROM, operator parameters reset to default values/
Corrective action: Return controller for repair.

"Error 5" Software failure/
Corrective action: Reduce electrical noise around controller.

"Error 6" Software failure/
Corrective Action: Reduce electrical noise around controller.

"Error 7" Bad PROM/
Corrective action: Return controller for repair.

"Error 8" Bad RAM/
Corrective action: Return controller for repair.

"Error 9" Relay inoperable/
Corrective action: Return controller for repair.

Cleaning

Series 77300 Controllers are chemically resistant. Use a mild detergent to clean surfaces.

SPECIFICATIONS

Voltage range:	90 VAC to 130 VAC, 50/60 Hz or 190 VAC to 260 VAC, 50/60 Hz
Current:	115V Units: 1.5 A, nominal 230V Units: 0.8 A, nominal
Microprocessor:	Handles functions for keypad, display, speed monitoring, triac triggering, and relay controlled motor reversing.
Display:	8 character, 7 segment, 9.5mm high vacuum fluorescent
Speed Range:	10 to 600 RPM
Flow Rates:	From 6 ul/min to 2.3 liters per minute
Torque:	180 oz.-in. @ 600 RPM continuous
Speed Regulation:	± 0.3%
Resolution:	Volume: 0.1 ul to 10 ml Flow rate: 1 ul/min to 10 ml/min
Repeatability:	± 1 RPM
Motor Cable Benchtop: NEMA:	 6-ft. multi-conductor 24-ft. multi-conductor
Wash-down-proof:	Controllers 77300-70 & 77300-75, meet NEMA 13 requirements (IP55). Controllers 77300-60 & 77300-65 meet IP22. Pump Drives 77300-50 and 77300-55 meet NEMA 4 & IP56.
Environmental Operating Temperature: Storage Temperature: Humidity:	 0 to 40°C (max.) –25 to 60°C (max.) 20 - 95% (non-condensing)

NEMA Fuses:	 For 115V - 3A #3AG For 230V - 1.6A 5 x 20 mm
Benchtop Fuses:	 For 115V - 3A #3AG For 230V - 1.5A #3AG
Power cord 115V: 230V:	 6-ft., 3-wire, 18 ga., with grounded plug 6-ft., 3-wire, 14 ga., with grounded European type plug (CEE-7-7)
Controller dimensions Benchtop: NEMA:	 9 in W x 9 1/ 4 in L x 5 in H 8 in W x 10 in L x 6 in H
Motor dimensions:	10 11/16 in L x 3 7/8 in W x 4 5/8 in H