MAGUIRE PRODUCTS INC.

PUMPS

Series MPA-6®

Six Roller Liquid Color Metering Pump

with Automatic Speed Control

INSTRUCTION MANUAL

Maguire Products Inc.

Model MPA-6
LIQUID COLOR METERING PUMP
With AUTOMATIC SPEED CONTROL

Table of Contents

Copyright

To every person concerned with use and maintenance of the Model MPA-6 Liquid Color Metering Pump with Automatic Speed Control it is recommended to read thoroughly these operating instructions. Maguire Products Inc. accepts no responsibility or liability for damage or malfunction of the equipment arising from non-observance of these operating instructions.

To avoid errors and to ensure trouble-free operation, it is essential that these operating instructions are read and understood by all personnel who are to use the equipment.

Should you have problems or difficulties with the equipment, please contact Maguire Products Inc. or your local Maguire distributor.

These operating instructions only apply to the equipment described within this manual.

For the latest revision of this manual, visit www.maguire.com

Manufacturer's Contact Information

Maguire Products Inc.
11 Crozerville Road
Aston, PA. 19014

Phone: 610.459.4300
Fax: 610.459.2700

Website: http://www.maguire.com

Email: info@maguire.com

START-UP PROCEDURE

1. Place color drum next to process machine.

2. Install pickup lance into liquid container for suction pickup of liquid, or attach tubing assembly in accordance with color manufacturer's recommendations.

3. There should be provision for attaching the poly-tubing to the process machine so as to allow color to be metered in directly over the feed section of the screw, or into a premixer if one is installed. Assuming provisions have been made, attach or install the poly-tubing to the process machine as required. (The best color mixing without color contamination of the feed throat of your machine is obtained when the color delivery tube is positioned approximately 1/2-inch over the screw at the forward edge of the feed throat toward the side of the screw that is turning downward.)

   NOTE: Adaptor Plates are available from MAGUIRE PRODUCTS that mount between the hopper and feed throat. This will allow easy insertion and removal of the color delivery tube into the feed throat of the process machine.

4. Connect the power cords as follows:

   Plug the "CONTINUOUS POWER" cord into a standard 110 volt continuous power source. Plug "SIGNAL" cord into outlet that is energized only when the screw is turning. The signal can be as low as 24 volts, as high as 240 volts, either AC or DC.

   The "screw return" time and associated "SIGNAL ON" time must be at least one (1) second. If you are not sure that this is always the case, then it is advisable to select another source of power for the signal. INJECTION time would be an excellent choice for a signal. For very short overall cycle times, the CLAMP CLOSE time is usually the longest signal time available. When screw return times are shorter than 1 second, use the INJECTION circuit or CLAMP CLOSE circuit to provide power to the SIGNAL cord.

5. Set Counter to 20 and switch pump to 'CONTINUOUS'. Rollers should now be turning slowly.

   Lay the pump tube into the slot across the top of the pump head running front to back in a straight path across the top of the dowel pin rollers, positioning the brass tube-inlet fitting against the machined recess of the pump head. Draw the tube into position under the overhanging portion of the pump body and maintain tension while the turning of the rollers draws the tube into place.

   The tube, properly installed, will be in contact with only the uppermost two rollers. The inlet end of the tube will be resting against the small recess that is machined into the side of the pump head that faces front. The tube will pass through the pump body in a nearly straight line and reappear out the other side of the pump head.

6. Assuming pump is not already primed, set counter to 60 and run pump in the 'CONTINUOUS' mode until color line is primed.

7. Using the formula provided in this manual, set the counter to the proper setting for the particular part you are molding.

8. The main switch should now be set on "CYCLE". Your pump will now cycle on and off each time the process machine screw is cycled.

   Pump speed will automatically adjust to match screw return time.

   REMEMBER: Experience may show that a somewhat higher or lower counter setting is required to produce the exact depth of color desired. Once the proper setting is determined, it should be recorded for future reference.

PRINCIPLE OF CONTROLLER OPERATION

The MAGUIRE Digital Controller provides the precise speed regulation and metering control necessary to assure absolute accuracy over color usage. The Controller signal cord is plugged into an outlet that is energized only when the process machine screw runs. During each screw return cycle, the motor runs and color is metered into the throat of the process machine.

Since metering rate is directly related to motor output shaft rotation, accuracy is obtained by controlling the exact degree of rotation of the drive motor. The unique Maguire Products Digital Controller is designed to do this with precision. Our standard Model divides each full motor rotation into 159 increments; each increment representing a small fraction of a gram of color being carefully measured out.

The digital counter located on the face of the controller provides the means for predetermining the exact degree of rotation and, therefore, the precise amount of color that will be added during each cycle. When the pre-set count is reached, the motor will automatically shut off, ensuring that no excess color is metered. To determine the proper setting for the counter, a simple formula is used based on percent of color required and total shot weight in grams (or pounds per hour for extrusion applications).

Motor speed is automatically controlled by the internal microprocessor to allow color metering to occur uniformly over the entire screw return cycle. The operator need not concern himself with motor speed adjustment. Changing cycle times or fluctuations in plant voltage are automatically detected and compensated for and, therefore, will have no effect on metering accuracy.

The controller contains a 1/27 HP D.C. Permanent Magnet motor with variable speed control of from approximately 50 to 3000 RPMs. In the standard configuration, the motor is close coupled to a heavy duty gearbox with a reduction ratio of 53:1. Final output speed of the motor is, therefore, approximately 1 to 56 RPMs. As the motor turns, a "hall effect" pickup device on the motor sends 3 pulses per revolution to the microprocessor controlling it. The gearbox ratio of 53:1 means that 159 pulses (3x53) are received for every single revolution of the motor output shaft.

The purpose of the thumbwheel switch is to pre-set the exact number of pulses that the motor is going to run before stopping. The microprocessor in the controller automatically multiplies the counter setting by a factor of 10. A setting of 16 on the counter will allow the controller to receive 160 pulses or run approximately 1 revolution before stopping. Regardless of how fast or how slow the motor runs, color metering will stop after 1 turn.

In addition to this precise control of color quantity being metered, the microprocessor also controls motor speed using the same pulses for digital tachometer feedback. This ensures that motor speed is precisely regulated regardless of changing torque requirements or variations in plant voltage.

CONTROLLER OPERATION IN CONJUNCTION WITH OUR REGRIND FEEDER

All MAGUIRE Color Feeders are designed to work in conjunction with our REGRIND Feeder which may be purchased separately at some later date if the handling of REGRIND at-the-throat becomes a concern.

This Regrind Feeder is installed on the process machine at the base of the material hopper just above the throat. Liquid Color is introduced directly into the regrind flow chamber. The regrind enters the flow of virgin resin at the same height above the process feed screw as the color feed. When REGRIND metering starts, COLOR metering is reduced accordingly. For this reason, both components must enter the material flow near each other.

REGRIND Controllers are equipped with 2 standard grounded 110V outlets in the rear that provide both a continuous 110V power source and a "signal" power source to operate a color feeder. Your Maguire Products COLOR Controller, when plugged into these outlets, receives messages from the REGRIND Controller telling it when to reduce coloring and by what %. In this way, the regrind that is added is not "colored twice".

Instructions provided with our REGRIND Controllers explain proper operation of both units when they are working together.

PRINCIPLE OF PUMP OPERATION

The MAGUIRE six roller peristaltic pumps are designed for years of rugged industrial service with little or no maintenance. Only the inexpensive pumping tube needs to be replaced from time to time to keep these units performing like new.

Metering is accomplished by the compression and release of a flexible pumping tube. These peristaltic pumps are true positive displacement pumps. Unlike other positive displacement pumps such as piston, gear, diaphragm, and rotary screw pumps, a peristaltic pump has no seals, check valves or clearances to allow even the slightest internal leakage. Liquid is retained within a flexible tube at all times and never comes into contact with any surfaces of the pumping mechanism. There are no check valves used at all.

Where tubing passes through the pump head, rollers alternately close off a portion of the tube and squeeze the liquid inside the tube forward by rolling over the tube in the forward direction. As the tube behind the roller springs back to its original round shape, the expanding inside cavity creates a vacuum that draws liquid into the tube. At least one roller is always in the position of closing off the tube completely, thereby assuring that no liquid can "leak" backwards.

Pumping is so complete that this type of pump can pump air as effectively as liquid and can develop a near full vacuum of 30 inches of mercury. These pumps are self-priming and will pass any entrapped air bubbles in the liquid through the pump without loss of prime.

Six hardened dowel pins retained by a plastic cage are held firmly out against the inside surface of the pump head housing by a flexible polyurethane center drive roller. A tube compression slot is machined into the pump head housing and tube compression tolerances will not change over time. In this design there are no bearings and the dowel pins will not wear out.

The rollers are driven by a variable speed motor and, as they move over the tube, they cause the liquid inside the tube to be squeezed forward in small uniform increments. The accuracy of these pumps for metering small amounts of viscous liquids is unmatched.

PUMP TUBING

The pump tube that is continually compressed by the rotating rollers is the heart of the pump. Many materials are available for this tube; resiliency and chemical compatibility being the primary considerations in selection of this material. Virtually all liquid color applications use polyurethane tubing.

Conditions that affect tube life are resiliency of the tube material selected--urethane being the best, chemical compatibility, and tubing diameter--smaller diameters having a longer life than larger diameters.

Three different diameter pump tubes are available for use in the Maguire Six Roller Pump; 1/8", 3/16", and 1/4" I.D. tubes. Theoretical maximum pumping rates of the pump are as follows:

Using 1/8" I.D. pump tube -- 37 CCs/minute @ 56 RPMs.
Using 3/16" I.D. pump tube -- 74 CCs/minute @ 56 RPMs.
Using 1/4" I.D. pump tube -- 123 CCs/minute @ 56 RPMs.

These maximum pumping rates are achievable only for liquids having viscosities similar to, or lower than, latex paint or easy pouring syrup. Viscosities so high that they do not readily pour can also be pumped, but at considerably reduced maximum rates.

While the pump is a positive displacement pump and can produce a full vacuum, the liquid flowing to the pump is pushed only by atmospheric pressure, about 15 PSI. Since high viscosity liquids flow poorly through small diameter tubes, these two conditions should be observed:

1. Always use as large a diameter supply tube to the inlet side of the pump as is practical and do not reduce this diameter except upon entering the pump head.

2. Keep the distance to the liquid supply as short as possible.

In selecting tube sizes, keep these factors in mind:

Larger diameter tubes offer higher pumping rates and are generally recommended when coloring very large parts. They are also better suited for pumping thicker materials.

Smaller diameter tubes always last longer and also pump more accurately for a longer period of time.

Generally, presses with less than a 500-ton capacity use 1/8" I.D. green tube. Nearly all larger presses use 3/16" I.D. red tube. Only large extrusion applications use 1/4" I.D. tube.

DESCRIPTION OF CONTROLS

1. CYCLE-OFF-CONTINUOUS SWITCH

CYCLE: The controller will meter a given quantity of color and will shut off for the remainder of the cycle. Quantity metered is controlled by the setting of the thumbwheel switch. In this mode, motor speed is automatically adjusted by the internal microprocessor based on the time length of the previous cycle and the setting of the counter. A speed is selected that will allow the feeder to stop approximately 1/2 second before the cycle ends.

OFF: Will prevent the controller from running and will remove power to the computer controls.

CONTINUOUS: The controller will run continuously as long as 110 volt power is present at the controller power cord. Speed is controlled by and directly follows the setting of the thumbwheel switch. Energizing the "cycle" cord has no effect -with one exception; if the RANGE switch is in the LOW resolution position (turned to the right) the motor will ONLY run when the SIGNAL cord is energized.

2. MOTOR FORWARD/REVERSE SWITCH

This switch should be in the FORWARD position for all normal operation. Holding the switch down in the REVERSE position will cause the controller motor to run backwards.

In LIQUID COLOR pumps, this will cause the liquid color in the tubing to be returned to its source.

3. THUMBWHEEL SWITCHES

In the CYCLE mode, the thumbwheel switch setting controls the amount of color metered per cycle. In the CONTINUOUS mode, the setting determines the RPMs of the motor output shaft.

4. MODE SWITCH

The Mode Switch allows several SPECIAL functions. Located in the upper right corner of the control panel, it can be turned with a small screwdriver.

NORMAL (mid position)

All functions work as described elsewhere. Approximately 1/16 turn of the motor can be expected for every count on the counter or 63 turns of the motor for the maximum setting of 999. (This relationship may vary with non-standard models).

FRACTIONAL (left position)

CYCLE MODE:

If very small metered amounts are required and calculated settings are 10 or less, these settings may not give you the fine resolution of control that you desire. Turning the Range Switch to the FRACTIONAL position will shift the display left one dig it with a decimal point appearing between the middle and last digit.

Display format will be (##.#) so that fractional numbers can be set on the counter. A maximum of about 6 turns will result from the maximum setting of 99.9. Thus, to accomplish the same output as before, you would use a setting such as 030 instead of 003, resulting in a display of "03.0" instead of "003".

CONTINUOUS MODE: no effect

CALIBRATION (right position)

CYCLE MODE:

This position will force ONE cycle to run for 100 counts at a speed of about 20 RPMs. The SIGNAL cord need not be energized. When calculating METERING RATES for each color you run, this switch will force the controller to run a proper CALIBRATED output. This output in grams is used in the SETTING formula.

CONTINUOUS MODE:

The motor will ONLY run when the SIGNAL cord is energized. In the other positions, NORMAL and FRACTIONAL, CONTINUOUS mode will run the motor WITHOUT the SIGNAL cord being energized.

5. DISPLAY WINDOW

In the CYCLE mode, the window will display a numerical countdown beginning with the three digit counter setting and proceeding to zero. In the CONTINUOUS mode, the window will display motor RPMs. Flashing of this display at half second intervals indicates that the motor is not running at the speed necessary to deliver all the color in the time allotted (See TROUBLESHOOTING section for more information). The presence of a decimal point in the display means the range switch is turned to the FRACTIONAL position.

6. SIGNAL LIGHT

The Signal Light indicates power is present at the signal cord; in other words, the process machine screw is turning.

7. MOTOR LIGHT

The Motor Light indicates the computer processor is outputting a D.C. voltage to the controller motor; in other words, the motor is turning.

FORMULAS FOR SETTING THE COUNTER - MPA LIQUID COLOR PUMP

INJECTION MOLDING (Cycle Mode):

1. Determine the WEIGHT of the entire shot IN GRAMS.
2. Determine the LBS. of COLOR per 100 LBS. of natural required, or KILOS of COLOR per 100 KILOS of natural.
3. Determine the METERING RATE for each color in grams/100 counts.
4. Set the digital counter using the following formula:

   (Shot wt) x (lbs/100) / (grams/100ct) = Setting

   Example: Shot weight = 400 grams
   4 lbs color per 100 lbs of product
   Metering rate = 52 grams/100ct
   400 x 4 / 52 = 30.76 Set Counter on 31

EXTRUSION (Continuous Mode):

1. Determine the extruder output in pounds per hour.
2. Determine the LBS. of COLOR per 100 LBS. of natural required. or KILOS of COLOR per 100 KILOS of natural.
3. Determine the METERING RATE in grams/100 counts.
4. Set the digital counter using the following formula:

   (lbs/hr) x (lbs/100) / (grams/100ct) x .71 = Setting

   Example: Extruder Output = 900 pounds per hour
   lbs/100 required = 5.5
   Metering Rate = 42 grams/100ct
   900 x 5.5 / 42 x .71 = 83.68 -- Set Counter on 84.

DETERMINING METERING RATE

To insure ACCURACY a METERING RATE must be determined for EACH COLOR.

1. Switch to CYCLE.

2. Turn CALIBRATION knob (upper right corner) to "CALIBRATE". This will force one cycle of 100 counts to be dispensed.

   OR: Set counter to 100 and switch from OFF to CYCLE.
   Plug in SIGNAL cord to force cycle of 100 counts.

3. Run several cycles and record GRAM WEIGHT metered each cycle.
   The average of these weights is the METERING RATE in grams/100ct.

   Example: Each CALIBRATION cycle produces 55 grams output.
   Your METERING RATE is 55 grams/100ct.

ALTERNATE FORMULA METHOD

This method does not require calibration, but instead relies on an accurate knowledge of the weight of the liquid (lbs/gal) and accurate tube sizes.

INJECTION MOLDING (Cycle Mode):

1. Determine the WEIGHT of the entire shot in GRAMS.
2. Determine the PERCENT color let-down desired.
3. Determine the weight of the liquid color in POUNDS per GALLON.
   or GRAMS per LITER (G/L).
4. Set the digital counter using the following formula:

   (Shot Weight) x (% let-down) x ('C' factor) / (lbs/gal) = Setting
   or (Shot Wt) x (% let-down) x ('C' factor) x 120 / (G/L) = Setting

   Example: Shot Weight = 400 grams
   % color = 1.2%
   Weight of liquid color = 12 lbs. per gallon
   Green tube; 'C' factor = 1.3
   400 x 1.2 x 1.3 / 12 = 52 -- Set Counter on 52

EXTRUSION (Continuous Mode):

1. Determine the extruder output in pounds per hour.
2. Determine the percent color let-down desired.
3. Determine the weight of the liquid color in pounds per gallon.
   or GRAMS per LITER (G/L).
4. Set the digital counter using the following formula:

   (lbs/hr) x (% let-down) x ('E' factor) / (lbs/gal) = Setting
   (lbs/hr) x (% let-down) x ('E' factor) x 120 / (G/L) = Setting

   Example: Extruder output = 900 pounds per hour
   % color = 2%
   Weight of liquid color = 16 lbs. per gallon
   Red tube; 'E' factor = .47
   900 x 2 x .47 / 16 = 52.875 -- Set Counter on 53

CHART OF 'C' and 'E' FACTORS:

Tube Size	'C' factor	'E' factor
1/8" I.D. (green)	1.3	.93
3/16" I.D. (red)	.66	.47
1/4" I.D. (clear)	.39	.28

NOTE: If you have Model MPA-6-18 (which uses an 18 RPM motor) then multiply these factors by six, i.e. (6 x C factor).

CHANGING COLORS

1. Run the pump in REVERSE to empty the tube of color.

2. Remove pump tube from pump head.

3. Remove poly-tubing from process machine and coil entire tube onto top of drum. Do not disconnect any other fittings. Tape up the open end of the poly-tubing to prevent dripping of color.

4. Bring in next color drum and repeat Steps 5 through 8 of "Start Up Procedure".

PICKUP ASSEMBLY

An inexpensive pickup assembly is fitted to the drum of color to be used. If one pump is going to run more than one color, each color drum should be equipped with its own pickup assembly. Each pickup assembly consists of several components. All are connected together and should never be disassembled except in the case of a tube blockage caused by contaminants in the liquid color. The lance and threaded adaptor are installed directly into the lid of the drum. The other end of the tubing assembly is connected to the feed throat of the process machine.

A common source of problems comes from contaminants, such as plastic pellets entering the liquid. When opening a new drum or replacing an empty one, be certain that no openings are left uncovered where contaminants could accidentally enter the liquid.

Tubing assemblies for 30 and 55 gallon drums are fitted with a High Capacity Filter that reduces the possibility of plastic pellets clogging the pump tube. It is easily cleaned by back flushing with water.

If a pickup assembly is available for every color, operators should never need to come in contact with the liquid color except when replacing an empty drum. The REVERSE switch allows the operator to momentarily run the pump in reverse to drain liquid from the tube assembly back into the liquid container. Since there is no cleanup required for a color change and no color is discarded or lost, a considerable amount of coloring is saved over a period of time.

DISASSEMBLY AND CLEANING

CLEANING THE PICK-UP ASSEMBLY

If a pickup tube assembly must be used for a different color or if, for some other reason, it becomes necessary to clean the coloring from the inside of a pickup assembly, the following steps will make this potentially messy job easier.

1. Disconnect tubing from the process machine.

2. With the pump tube still installed in the pump head, run the pump in reverse until no more color flows from the tubing assembly.

3. Once this is done and you are assured of a continuous air passage through the tubing, the tubing assembly should be removed from the pump head and color container and placed in a large utility sink. Place one end of the tubing assembly into the spigot opening and turn on the hot water SLOWLY. Once you can see water flowing from the other end of the tubing assembly, leave the water running for about 10 minutes. This should be sufficient time to clean all remaining traces of liquid color from the tube. BE PATIENT. HOT WATER AND TIME WILL DO THE JOB FOR YOU.

4. A copper pickup lance can be cleaned in the same manner.

SIX (6) ROLLER PUMP HEAD

1. Remove the clear cover disk.

2. Using an Allen wrench, remove the two recessed screws holding the pump head to the control housing. The pump head may now be removed by simply pulling it away from the motor shaft.

3. To remove the roller set, simply push it out of the outer pump head housing.

4. Once disassembled, clean all parts if necessary with soap and water. Reassemble and re-install in reverse order.

   NOTE: DO NOT LUBRICATE ANY PUMP HEAD PARTS. The pump works best when totally DRY with NO lubrication. Since the center drive roller relies on friction to drive the 6 tube compression rollers, any lubrication such as Liquid Color contamination will interfere with proper operation.

TROUBLESHOOTING CONTROLLER PROBLEMS

IF YOUR MAGUIRE PRODUCTS CONTROLLER DOES NOT WORK PROPERLY:

1. READ below about NORMAL OPERATION and compare to your problem.
2. The QUESTIONS that follow may assist you in solving your problem.
3. If you are unable to remedy the problem:

   a. ANSWER in writing as many of the QUESTIONS that apply.

   b. DESCRIBE the PROBLEM in your own words as carefully as you can.

   c. RETURN this information with the unit for repair.

NORMAL OPERATION

With MAIN POWER cord plugged in, NO power to the SIGNAL cord, Switch on CYCLE:

The display should read zero (0)
The motor light and signal lights are OFF
The motor is NOT running.

IN CYCLE:

Nothing will run until the SIGNAL cord gets power. The first time the signal cord gets power, the unit will start running at about 10 RPMs and will count down from whatever number is set on the counter.

When the count reaches zero (0), the motor will stop.

On all successive cycles, the motor will run at whatever speed is required to finish counting in the time period of the PREVIOUS cycle. If a cycle is SHORTER than the PREVIOUS cycle, the motor will stop before it has counted down to zero (0). The lowest number reached during the countdown will be displayed.

AT NO TIME will the display be COMPLETELY BLANK.

If you try to simulate machine cycles by turning the CYCLE switch on and off, the controller will consider every cycle as a FIRST cycle and will always run at 10 RPMs.

To simulate machine cycles, plug the signal cord in and out of a wall outlet. Shortening of the 'on time' will result in the motor running faster. Lengthening of the 'on time' will result in a slow down of the motor speed.

BLINKING of the display is a WARNING that the actual motor speed is not up to "target" speed.

If the motor FORWARD - REVERSE switch is switched to OFF, the motor will stop and the display will hold at whatever number it reached in its countdown.

Switching to OFF and then to FORWARD again during a countdown will cause a momentary increase in motor speed as the unit tries to 'catch up'.

CYCLE TIME:

The motor will start to run about 1/3 (.3) second after a signal is received.

If the Signal is less than about 2/3 (.6) seconds long, then the motor will stop and the processor will not consider this as a valid cycle. No recalculation of motor speed will occur.

If the signal is over 2/3 (.6) seconds long, then the motor will run for at least 2 seconds even if the signal goes away. This allows time for speed adjustments to occur.

On longer cycles, over 2 seconds, the counter should count down to zero and the motor should stop within the 1/2 second before the end of the signal.

If you are simulating cycles by plugging and unplugging the signal cord, it will be difficult to produce uniform motor speed and count down rates unless you carefully use a watch to produce uniform cycle times.

If power to the signal cord ends before countdown is complete, the motor stops immediately and the number of counts remaining is held on the display.

IN CONTINUOUS:

The signal cord has no effect. The motor runs at a speed equal to the counter setting. If the setting is above the maximum speed possible, then the motor just runs at full speed and the display BLINKS.

Full speed will display about '65' for 2 magnet models (most 3 and 6 roller pumps) and about '90' for all other models (Extrusion Following models display about 180 at full speed).
BLINKING of the display is NOT NORMAL except during speed changes.

If the FORWARD - REVERSE switch is turned OFF, a display of one [1] will result and the motor will not run.

ALL UNITS:

If, at any time, the processor becomes confused and fails to run the motor properly or display the proper numbers, the unit will 'restart' itself after a delay of about 4 seconds.

BLINKING of the display means that actual motor speed is not up to "target" speed. This occurs normally when the motor is "ramping up" to speed or when you set too high a number on the counter, resulting in a demand for a speed that the motor cannot achieve.

ANSWER QUESTIONS as they apply

YOUR COMPANY NAME:_____ DATE:_____

NAME of PERSON who saw or knows the problem:_____

CONTROLLER SERIAL NUMBER: _____
Time in service: (new, 1 hour, 1 week, years, etc.) _____

IF PROBLEM IS WITH OUTPUT

SPECIFICATIONS as they apply:
Injection molding, Shot weight: _____
Extrusion, lbs/hour: _____
Liquid color lbs/gal: _____
Desired output (%): _____
Viscosity of liquid color (thin, thick, etc.): _____
Supply and delivery tube sizes and lengths, if not standard: _____

IF PROBLEM IS ELECTRONIC FAILURE

CIRCUMSTANCES of failure:
During storm: _____
On Monday morning start up: _____
Same time as another malfunction in plant such as a fuse blowing on a nearby piece of equipment: _____
Possibility of incorrect voltage (220): _____
Possibility of low voltage condition (below 100): _____
On power-up: _____
OR after running for how many hours: _____
Is problem intermittent: _____
How often: _____

TESTING results:
Do other controllers fail under same circumstances: _____
Does controller work when tested in another location: _____
Does problem come and go: _____
After how much time: _____

IF PROBLEM IS ERRATIC OR INCORRECT OPERATION

If running in CYCLE:
What is the COUNTER SETTING: _____
SCREW RETURN (signal) TIME in seconds: _____
Are screw return times consistent from cycle to cycle: _____
If not, list some consecutive screw return times:
_____
Is the problem only at certain settings: _____
Does display start at the full counter setting at the start of each cycle (it should): _____
Does the display BLINK during count down: _____
Does it reach zero (0) before end of cycle: _____
How long before: _____
Does display ever go completely blank (it shouldn't): _____
(it should always show a number or a zero except when blinking)
Is the SIGNAL light lit during screw return time: _____
Is the MOTOR light lit during this period of time: _____

```
        Is it counting down smoothly at a steady speed: _____
 If running too slow: what is actual motor output RPMs: _____
                 What count is displayed when it stops: _____
 If running too fast:
   How many seconds does it take to count down to zero: _____

If running in CONTINUOUS:
                           What is the COUNTER SETTING: _____
                                        EXTRUSION RATE: _____
        Does the display show the full counter setting: _____
                  Does the display BLINK while running: _____
                               Does the display drift: _____
                                      Over what range: _____
                             Is the SIGNAL light lit: _____
                              Is the MOTOR light lit: _____
                              Is motor speed erratic: _____
```

DESCRIBE the PROBLEM

Most problems are apparent and easy to fix. However, the more information we have about what caused the problem, the more we can do to improve our product so that these problems do not occur in the future.

In some cases we may NOT be able to duplicate YOUR particular problem in OUR testing facility. Describing the problem as CAREFULLY and as completely as possible will help us locate and correct any design weakness that might be responsible for the problems you are having.

IN HOUSE REPAIRS

1. If a controller fails to respond properly to counter settings, cycle input signal, or on/off signals properly, you may make an inspection of the internal electronics.

   Work only in a relatively clean environment. Inspect all cable connections to be sure each is tight and that proper connection is being made by each individual wire and clip within each connector; individual wire clips can sometimes pull loose from the connector. Inspect all solder connections for broken wires or improper solder connections.

   Inspect the magnet holding cup on the rear of the motor. If this assembly should loosen, this will adversely affect motor control. Take care not to disturb or damage the electronic hall effect device that is attached to the rear of the motor. Repairs to printed circuit boards should not be attempted. Generally, if a component fails it indicates a condition that may have caused other components to fail as well. Boards should be returned to the factory for repair. A blown fuse on a circuit board usually indicates that other problems are present. A new fuse of similar size and rating may be substituted but if it blows again, the board should be returned to our factory for service. DO NOT EXCEED 5 AMPS on the board.

2. Flashing of the number display indicates that the motor is unable to run at the proper calculated speed. One reason for this may be that the counter setting is too high and the cycle time too short for the motor to complete the metering even at full rated speed. The other cause for the flashing display is that an obstruction is slowing the output shaft and the automatic torque limiting feature is slowing the motor intentionally.

3. NO DISPLAY NUMBER at any time is usually a failed power supply. Be sure there is power to the unit. Check the fuse. There is a fuse on the circuit board; however, this fuse usually will not blow unless some other component on the board has failed. Replace only with a fuse of the same amp rating.

4. DISPLAY of ONE (1) in the CONTINUOUS MODE indicates that the processor is attempting to run the motor but is not picking up any RPM feedback from the armature. Check (a),(b),(c) and (d) below if the motor does not run. Check (e) if it does run.

    a. Components may be blown out on the circuit board. A reading of zero (0) VOLTS at the motor FORWARD - REVERSE switch would indicate this.

    b. The FORWARD - REVERSE switch may be turned off or may be faulty.

    c. Brushes on the motor may not be making proper contact with the armature. Sometimes brushes stick in their holders. A DC voltage at the motor leads without corresponding motor rotation would indicate this might be the problem. Removal of the brushes and light sanding of the brush sides will fix this.

    d. The armature may be burned out. This will occur only with continuous overloading and subsequent overheating. Circuit boards are designed to prevent this through a torque-limiting feature. Armatures that burn up leave a distinct odor in the control box.

    e. If the motor is running but the display is still one (1), check the magnet holding disk on the motor armature shaft. It should be secure and there should be about 1/16 inch space between the magnet holder and the electronic "hall effect" device on the back of the motor housing. Also check this electronic device for proper location. It must be positioned under the magnet cup and have no broken wire leads.

    f. If the motor is running but the display is still one (1), check the magnet holding disk on the motor armature shaft. It should be secure and there should be about 1/16" space between the magnet holder and the electronic "hall effect" device on the back of the motor housing. Also check this electronic device for proper location. It must be positioned under the magnet cup and have no broken wire leads.

TROUBLESHOOTING LOSS OF COLOR

1. Check that color supply is adequate by tipping drum of color slightly or observing level of color. Consider that if color level is nearing the bottom of the drum, air may have been sucked in momentarily and a considerable length of time would have passed before the loss of color would be evident at the process machine.

2. Check that the motor is rotating the proper number of revolutions per cycle. 10 counts equals about 1 turn of the motor. Remember that the Range Switch can alter this relationship so that 10 counts will equal 1/10 revolution or 10 revolutions.

   An incorrect relationship between counts and revolutions may indicate an internal electronic problem. See Controller problems.

   In 6-Roller Pumps, contamination of the roller set from liquid color will most probably result in slipping of the drive roller and a corresponding lack of color output. If you suspect slippage is the problem, disassemble and clean the pump head and rollers with soap and water. DO NOT LUBRICATE ANY PUMP HEAD PARTS. Reassemble and recheck for proper pump rotation.

3. Check that pump tube is not permanently flattened. Replace if necessary. Very short tube life may indicate a chemical compatibility problem.

4. Check for vacuum leaks on the inlet side of the pump head. Be sure that TEFLON TAPE was used on all pipe thread connections on the suction side of the pickup assembly. A vacuum leak is indicated if the pump pumps air out of the outlet without sucking liquid into the inlet. Place a moist finger over the outlet end of the pump tube to feel for escaping air. Bubbles in the liquid color output may also indicate an air leak. If an air leak is indicated, re-tape and re-tighten all threaded connections. Check for obstructions at the inlet end of the pump tube. Disconnect brass fittings and check for blockage at this point. Alternating suction and pressure, or pulsating, at the output end indicates a blocked tube. Check for blockage and reprime pump if necessary.

5. Pump speed may exceed the flow characteristics of the liquid being pumped. Pump suction alone is used to draw liquid into the pumping unit and only normal atmospheric pressure of 15 PSI is available to push liquid into the inlet end of the pump tubing assembly. Higher viscosity liquids do not flow as fast as lower viscosity liquids and may not be capable of flowing through pump tubing as rapidly as pumping speed would dictate. To determine if the maximum possible flow rate is being exceeded, reduce counter setting by 50%. If output does not drop proportionally, viscosity is a problem. To solve this, you may:

   1. Locate color closer to the pump head using larger diameter supply lines to reduce flow restrictions where possible.
   2. Use a larger diameter pump tube.
   3. Specify a larger capacity pump.
   4. Reformulate liquid color for lower viscosity.

THREE AND SIX ROLLER PUMP - MAXIMUM OUTPUT SPECIFICATIONS

Model	Tubing	Max RPMs	Flow/hour @ 10#/gal		Min Dispense
MPA-	I.D.	Motor Shaft	Min.(grams)	Max.(lbs)	(one cycle)
18-G	1/8" (green)	30	36	2.9	.006 grams
34-G	1/8" (green)	56	36	5.4	.006 grams
34-R	3/16" (red)	56	81	11.6	.013 grams
51-G	1/8" (green)	90	36	8.6	.006 grams
51-R	3/16" (red)	90	81	18.0	.013 grams
51-C	1/4" (clear)	90	138	30.0	.022 grams

(Model 34-G is supplied unless otherwise specified)

To select proper pump size:

1. Determine maximum extrusion rate in pounds per hour. For injection molding, extrusion rate is approximately equal to tons of clamping pressure; i.e., a 500-ton press extrudes material at about 500 lbs/hour. A more accurate estimate may be made using shot weight and screw return time for any molded part:

   (Shot wt in grams) / (Screw return time in seconds) x 8 = (lbs/hr)

2. Determine maximum expected letdown ratio and multiply this times extrusion rate for maximum expected lbs/hour of color required.

3. From the above chart, select the pump with the lowest pumping rate that meets these maximum requirements.

Examples:

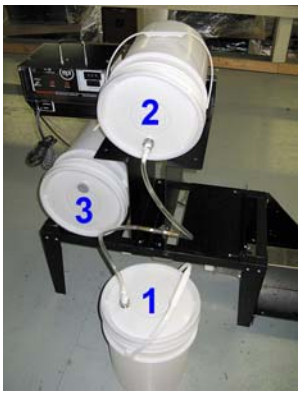
250 lbs/hr x .2% = .5 lbs/hr max. color -- Select Model 18-G
320 lbs/hr x 1.2% = 3.8 lbs/hr max. color -- Select Model 34-G
700 lbs/hr x 2% = 14 lbs/hr max. color -- Select Model 51-R

Three Tiered Stand Instructions

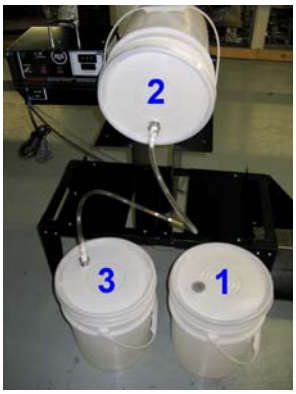
The Three Tiered Stand delivers liquid color using a rotation of three 5-gallon pails. Liquid color is continually supplied by use of a T-fitting and quick disconnects attached to two of the supply pails. The following instructions describe how to rotate the pails to keep a continual supply available.

Step 1 - The main supply pail (1) should be placed at the top of the stand and connected to the supply line. The secondary pail (2) should also be connected to the supply line.

Step 2 - When the main pail is low, tilt upward on the lid to extract as much color as possible. As the main pail depletes (1), color is extracted from the secondary pail (2).



Step 3 - To change out the empty pail, place the empty pail on the floor and remove the quick disconnect fitting.



Step 4 - Place pail #3 on the floor and attach the supply line.

Step 5 - Place pail #3 on the lower tier. When the top pail color is low, repeat the process from step 2.

WARRANTY - Exclusive 5-Year

MAGUIRE PRODUCTS offers one of the MOST COMPREHENSIVE WARRANTIES in the plastics equipment industry. We warrant each instrument and other articles of equipment manufactured by us to be free from defects in material and workmanship under normal use and service; excluding only those items listed below as 'EXCLUDED ITEMS'; our obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within FIVE (5) YEARS after delivery of such instrument or article of equipment to the original purchaser be returned intact to us, transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and MAGUIRE PRODUCTS neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside MAGUIRE PRODUCTS factory, unless such repair or alteration was, in our judgment, not responsible for the failure; nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

Our liability under this warranty will extend only to equipment that is returned to our factory in Aston, Pennsylvania.

It should be noted, however, that we strive to satisfy our customers in whatever manner is deemed most expedient to overcome any problems they may have in connection with our equipment.

EXCLUDED ITEMS

The rotor and stator of the pumping unit are both subject to wear when abrasive pigments are being metered. An example would be TIO2, titanium dioxide, an extremely abrasive white pigment common in many color formulas. For this reason, our warranty on the rotor and stator is for ONE (1) year only. However, in most circumstances, you may reasonably expect these components to last much longer. A life expectancy of over five years is common.

Technical Support and Contact Information

Maguire Products Inc.
11 Crozerville Road
Aston, PA 19014
Tel: 610.459.4300
Fax: 610.459.2700
Email: info@maguire.com
Web: www.maguire.com

Maguire Europe
Tame Park
Tamworth
Staffordshire
B775DY
UK
Tel: + 44 1827 265 850
Fax: + 44 1827 265 855
Email: info@maguire-europe.com

Maguire Products Asia PTE LTD
Main Office
15 Changi North Street 1
#01-15, I-Lofts
Singapore 498765
Tel: 65 6848-7117
Fax: 65 6542-8577
E-mail: magasia@maguire-products.com.sg