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CHAPTER 1 CONCEPTS OF THE MICROMASTER® 4000

Introduction

For the sake of brevity, description and program examples will be for Program A only. However, operation of program B, C, and D are identical in every respect to program A.

Features of the Micromaster® 4000 Series controller.

1. Programs.
 - 4 unique programs A, B, C, D
 - 16 or 32 stations
 - Runtimes of either 0 - 99 hrs 99 minutes (count in 1 minute increments) or 0 - 99 mins 99 seconds (count in 1 second increments) .
2. Each program can be set to water with up to 99 repeats for each start time. The cycle repeats can be varied for each day of a 14 day watering cycle.
3. User defined program delay between each cycle repeat, for Cycle and Soak operation. The cycle delay can be varied for each individual program.
4. User defined program inter-station delay for valves with a slow turn off characteristic.
5. Displays the accumulative run time of each program scaled to the water budget during programming .
6. Multiple starts. Program A ,B, C, D can have up to 30 starts each.
7. Screen displays the next Program to start, the Start time and the day it is to operate.
8. Automatic sorting of Start Times in Chronological order.
Totalizer to continuously total the irrigation run time for each station up to 999 hours (hours/mins mode) or 999 mins (mins/sec mode). The totals can be set to zero at any time.
9. Water budgeting. Adjustment range from 0% to 250% for each individual program.
10. Global rain ON/OFF switch for all programs.
11. Password protection protects against unauthorized program changes.
12. All programs are held in permanent memory. A back up battery is installed only to retain the clock function during power failure.
13. A two row by 24 character screen to give a clear concise status of controller function.
14. Two programmable Auto-Skip delay times between 2-250 secs to monitor the Auto-Skip input when a pressure or flow fault occurs.
15. Fault Reporting.
 - Monitors flow or pump pressure using the two preset auto-skip times. In the case of a malfunction, the controller will log the faulty station, and then step to the next station. The faulty stations can be recalled at any time. An Alarm output is switched on to indicate a fault has occurred.

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- Skip to the next station if a valve draws excessive current in the field. The faulty station is stored in the fault Data Base.
16. User defined Program Overlap mode to allow only 1 program at a time to operate, or all programs.
 17. Emergency Program B. Program B can be set to interrupt program A, C or D when the external Bstart input is activated. i.e. program B can be a heat stress, frost , or PD input from a filter. Program B will continue cycling until the input is removed from the Program B start input. The original program will then recommence from the point of interruption.
 18. Any station or program can be manually started with or without a run time. Pump start is also actuated.
 19. Program advance during irrigation.
 20. A pump start or master valve circuit is provided.
 21. When an external pulse flow meter is installed a flow rate data base can be set up for each station. In the stand alone mode, an upper and lower percent variation of the flow for each station can be entered. If the flow during irrigation exceeds this operating window, then a report on the faulty stations will be made and if required skip to the next programmed station.
 22. When not irrigating, check for burst pipes, broken valves or leaks in irrigation pipes and set alarm if a fault is found.
 23. Large plug in terminal block. Field wiring does not need to be disconnected during servicing.
 24. Sensor inputs for precise control. Require normally open input switches. External sensor inputs - Reset, Hold, Auto-Skip, Program A Start input, Program B start input, door open status input and Alarm out for fault reporting.
 25. When directly connected to an IBM PC or Modem, two thresholds can be set to report flow variation or report and skip to the next station.
 26. Can be directly connected to an IBM PC through the com1 or com2 port for easy menu driven programming and fault reporting.
 27. With an optional modem the Micromaster[®] 4000 can be networked to a central PC with control of up to 9999 controllers.
 28. When connected through a modem, all programming and fault reporting, can be controlled by one central IBM PC. All data and controller phone numbers are programmed by a user friendly Menu driven operating system.
 29. The controller is contained in a weatherproof lockable cabinet.
 30. Extensive mains surge and field surge protection. Relay outputs to field valves ensure reliable operation in the most rugged field conditions.

CHAPTER 2 **FAMILIARIZATION WITH THE CONTROLLER****Keyboard Basics**

The numbered keys 0 - 9 are used to enter numerical data when programming the controller. When the controller is ready to accept numerical program data, the portion of the display which is to acknowledge and accept the data, will have a flashing cursor. Whilst in this condition the controller will reject non numeric key strokes, except for the ← →, and **END** keys, which will advance to the next program entry or return the controller to the "rest mode". If an incorrect key is pressed, the controller will issue a prolonged "beep", and wait for further correct input. If an unacceptable large number is entered, the display will register the large number until the ← →, or **END** key is used, then it will reject, (prolonged "beep"), and return the display to the previous entry before modification began, and wait for correct input. When an acceptable keystroke is made, the controller confirms acceptance by a short "beep" and waits for the next key entry.

When numerical data is being entered, the display will continually "roll" from right to left, until the correct entry is made.

Example:

*If a 00:12 was mistakenly entered instead of 00:32, by pressing **0 0 3 2**, 00:12 would "roll" out of the display and be replaced by 00:32.*

When entering the time of day, the controller uses 24 hour military time. Run times may be entered in hours and minutes or just minutes. i.e. 82 minutes can be programmed in place of 1:22 (1hr 22 mins.).

Basic Operation Keys

Among the most important, and by far the most frequently used keys are ← →, and **END** keys, that allow the user to move from one program location to another (in single steps) while "inside" any of the particular program functions. Once you have entered a value, pressing ← →, or **END** will store this entry in **permanent memory** and move onto the next location awaiting a data entry or another program step. When all program data has been entered, a rapid check of the entered data may be made by depressing the ← or → keys and maintaining the pressure on the key pad. This will cause the data value to "roll" through, quickly enabling visual confirmation of program data.

Home Screen

The controller will display:

1. The time of day and day (SUN Week 1 to SAT Week 2).
2. The program to start next, the time to Start, and the Day of the week.
3. If no valid programs, (NO IRRIGATION PROGRAMMED) will be displayed.
4. If the Global Rain Switch has been set, (ALL IRRIGATION DISABLED).
4. If a power failure (POWER FAIL) will be displayed.

5. If a fault has occurred in the field (SEE REPORTS) will be displayed in the screen.

NOTE: The Home Screen is the only mode from which programming changes can be made to the controller.

During Irrigation

As the primary directive of the Micromaster® controller, is the irrigation cycle, once started, it can only be interrupted by →, or **END** keys or by an external A-skip, Hold or Reset input.

NOTE: If connected to an IBM PC, all irrigation programs can be accessed and changed during irrigation.

Therefore in order to edit or view a program when an irrigation cycle is in operation, the controller must be stopped and returned to the rest mode before editing or viewing procedures can be employed.

Audio Feedback Keys (Beeps)

The short "beep" which accompanies all key-strokes and controller actuation's is an important programming tool. Micromaster® controllers are designed so that erroneous and potentially corrupt data cannot be entered into the program.

CHAPTER 3 CONTROLLER PROGRAMMING

3.1 Setting Time and Day

The first step in programming the Micromaster® controller is to set the current time and day of the fortnight. On initial “power up” the controller will display the default time of 4:00 on Sunday of week one. The controller will also sort through all the start times and day table entries in order to display the program which is to start next. If no programs are entered the controller will display, “NO IRRIGATION PROGRAMMED”.

i.e.

```
MM4000 32    SUN W1  4:00
NO IRRIGATION PROGRAMMED
```

Press the **SET TIME** key, enter the current time of day (in 24 hour mode).

Example:

*If the current time is 20 minutes to 4 (pm), then enter, **1 5 4 0** (15:40 hours).*

```
NEW TIME OF DAY    15:40
Enter time then → key
```

After pressing the → key enter the current day. The Micromaster® is a 14 day cycle controller and identifies the day and the week. To change the day number from the default SUN W1 use the ← → keys and then press the **END** key..

Example:

To change the day number to Thursday of week one press the → key until THU W1 is showing.

```
TODAY IS SET AT THU W1
PRESS ←→ CHANGE END-Exit
```

3.2 Required Data for an Irrigation Program

To initiate a watering sequence, the Micromaster® **MUST** have some valid entries in each of the following 4 tables.

1. **CYCLES PER DAY** - *What day irrigation is to take place and **number of Irrigation Cycles**.*
2. **START TIMES** - *What time of day to start watering.*
3. **RUN TIMES** - *How long each valve is switched on for.*

4. WATER BUDGET - A percent override of greater than 0%.

These may be carried out in any order, depending on preference, without adverse effects.

3.2.1 Cycles Per Day - (What day irrigation is to take place and the number of cycles.)

The Micromaster® has a separate CYCLES PER DAY Table for each of the Programs A, B, C, and D. The table allows the controller to be programmed for up to a 14 day period. The table can set which day irrigation is to take place and whether that irrigation will take place in 1 to 99 irrigation repeats - see table below.

<i>Enter:</i>	<i>0 - No Irrigation</i>
	<i>1 - Irrigate Program Once</i>
	<i>2 - Irrigate Program Twice</i>
	<i>up to</i>
	<i>99 - Irrigate Program 99 Times</i>

i.e. If a run time is set to 10 minutes and 2 cycles is programmed then the actual irrigation time will be 20 minutes in two 10 minute applications.

Example:
 To select the day table for Program A, press **CYCLES PER DAY** and then press **PROG A RUNTIME**.

PROG A SUN W1 = 01 CYCLES
 Enter 0-99 then ←→ or END

*Enter the number of irrigation cycles for Program A on Sunday Week 1. See table above. Press the → key to program Monday Week 1. Repeat until all 14 days have been programmed. Press the **END** key to exit the program.*

The above programming example is identical for Program B, C, and D by pressing The **CYCLES PER DAY** key and then the **PROG. B,C, or D RUNTIME** keys.

3.2.2. Start Times (What time of day to start watering.)

Up to 30 separate start times can be entered for each of the four programs (A, B, C, and D). It is therefore possible to obtain 2970 cycles (30 x 99) of irrigation **per day per program** by using the 99 repeats for cycle.

Entering Start Times

The following example sets two start times for Program A to 2:35 and 6:30. This will result in irrigation starting at 2:35 and 6:30 each day if an entry other than 0 is entered in the CYCLES PER DAY Table for that day for Program A.

Example:

Press **PROG. A STARTS**. Using the numeric keys, enter the first start time for this program. Press **2 3 5**. To enter more starts press **→** and enter the second start time **6 3 0**. This procedure is repeated until all required start times are entered for Program A. Press the **END** key to exit the program.

```
START 2 FOR PRG A = 6:30
Enter time then ←→ or END
```

To set the start times for Program B, press **PROG. B STARTS**, for Program C press **PROG. C STARTS**, and for Program D press **PROG. D STARTS**.

NOTE: When exiting from the program, the start times will be restored in chronological order. i.e. if the start times were entered as

Start 1	16:30		Start 1	04:30
Start 2	22:30		Start 2	08:30
Start 3	Blank	these will be restored as	Start 3	16:30
Start 4	04:30		Start 4	22:30
Start 5	08:30			

NOTE: If consecutive start times are set, which do not allow sufficient time for the completion of the entire irrigation program, those start times will be ignored. Start times will only be recognized when the Micromaster® is in the home screen.

NOTE: A start time of "00:00" cannot be set. The controller will read this as a non-start. If midnight is to be set, a start time of 23:59 or 00:01 can be set.

3.2.3. Run Times (How long each valve is to be switched on for.)

The Micromaster® supports cyclic watering. Enter the run time for each station before water run-off occurs. The total precipitation for each station is selected by the number of repeats multiplied by the program run time. A delay between repeats can be entered to allow for water infiltration to occur before the next application.

For example if Program A, station 1 needs a total watering time of 35 minutes and run-off occurs after approximately 7 minutes. Enter 7 minutes for Program A and a CYCLES PER DAY table entry of 5. As weather conditions change it is only necessary to change the CYCLES PER DAY. i.e. during hot dry weather the irrigation to station 1

could be increased to 56 minutes simply by changing the day table entry to 8 without the penalty of run-off.

Setting Run Times

NOTE: If Program A has been setup in Hours and Minutes a **m** will be displayed in the extreme right of the top line indicating time has been setup in Hours and Minutes. If Program A has been setup in Minutes and Seconds, then a **s** will be displayed.

Example:

To set run times, press **PROG A RUNTIME** and enter the required run time in Hours and Minutes or Minutes and Seconds. Press the → key to advance to station 2, Program A. Repeat this sequence until the run times have been set on all required stations.

```
PRG A RUN TIME 1 = 0:45m
Enter time then ←→ or END
```

After the 16/32 run times have been entered, enter the delay between repeat cycles. Then press **END**.

```
PRG A CYCLE DELAY = 1:00
Enter time then ←→ or END
```

The Repeat Cycle Delay will only be used if the day table entry is greater than one. i.e. if a repeat cycle is required the pump will be switched off and will wait for this delay to count to zero before restarting the irrigation. It is not modified by the percent entry nor is it included in the accumulative run times.

3.2.4 Accumulative Run Times

The total Run Time for Program A is displayed after the Repeat Cycle Delay and represents the sum of all run times set on Program A. The current Water Budget percent entry is taken into account when calculating the cumulative irrigation run time. Program B, C, and D run times are set in exactly the same manner as above, except the **PROG B RUNTIME**, **PROG C RUNTIME** or **PROG D RUNTIME** key is pressed instead of **PROG A RUNTIME** key. Press **END** to return to the home screen.

i.e.

```
RUNTIME FOR PRG A 005:45
PRESS ←→ or END to EXIT
```

NOTE: Run time settings for controllers initialized in minutes and seconds mode are the same as above, except that all settings are read in total seconds.

NOTE: Zero all station run times if a station is not required to operate.

3.2.5. Water Budget

The irrigation run times can be globally changed for each program using the Water Budget function. The variation is from 0% (program off) to 250%.

This procedure can isolate any of the programs to disable irrigation for an indefinite period until re-enabled. i.e. *to disable irrigation enter 0 percent.*

Example:- if a run time is 20 mins and a Water Budget of 150% is entered for Program A, the irrigation time will be 20 mins x 150% = 30 mins.

Example:

To set the Water Budget for Program A to 150%.

*Press **WATER BUDGET** and select Program A by pressing the **PROG A RUNTIME** key. Press 1 5 0 enter a Water Budget of 150%.*

```
PERCENT PROGRAM A = 150%
% OVER-RIDE      END=EXIT
```

*Press the **END** key to exit the program.*

To enter the Water Budget for Programs B, C and D, press **PROG B RUNTIME**, **PROG C RUNTIME** or **PROG D RUNTIME**.

3.2.6 Rain Switch – Stand alone operation

To disable irrigation (Rain Switch), the **WATER BUDGET** key can be used to disable all irrigation on **ALL** Programs for an indefinite period until re-enabled.

Example:

*To disable all irrigation, press **WATER BUDGET** twice.*

```
ALL PROGRAMS ENABLED
→ = CHANGE      END=EXIT
```

Press the ← → keys to enable or disable all irrigation. Select disable irrigation. The screen will display Irrigation Disabled.

```
MM 4000 32 SAT W2 4:24
IRRIGATION DISABLED
```

. The controller will remain disabled until the rain switch is changed from the keyboard.

3.2.7 Rain Switch and Rain Bucket – Optional Communication chip installed.

Enable the rain switch is the same as for stand-alone operation or can be downloaded from the central. The controller will remain disabled until the rain switch is removed either from the keyboard or commanded from the central.

```
MM 4000 32 SAT W2 4:24
DISABLED BY RAINSWITCH
```

If a rain bucket is installed at this controller and the rainfall Exceeds RAINFALL CANCEL, then the following screen will be displayed indicating the actual rainfall and the limit that was set to disable irrigation.

```
MM 4000 32 SAT W2 4:24
RAIN 8 /RAIN CANCEL 5
```

The irrigation will be disabled Until the rainfall in the logging period drops below the RAIN CANCEL value or the log is cleared from the central or at the keyboard by pressing the REPORTS key.

If both the RAINSWITCH and the RAIN CANCEL are active, the following screen is

```
MM 4000 32 SAT W2 4:24
RAIN= 8/CANCEL= 5+SWITCH
```

displayed. The controller will remain disabled until both the RAINSWITCH Is removed and the rainfall in the logging period drops below the RAIN CANCEL value or the log is cleared from the central or at the keyboard by pressing the REPORTS key

CHAPTER 4 CONTROLLER OPERATION

4.1 Semi-Automatic Operation

To manually start Program A press **MANUAL** .The display will then request which program to start .

i.e.

```
START A, START B, START C
START D TO START PROGRAM
```

Then press **PROG. A STARTS.**

NOTE: A check of the Cycles/Day Table is made by the Micromaster® during Semi-Automatic operation. If a 0 (no irrigation) is entered for that current day, the irrigation will default to 1 cycle of irrigation for the selected program. If an entry other than 0 was entered for the current day, irrigation will take place normally. i.e. if the Cycles/Day Table of 3 was entered for the current day, 3 cycles of irrigation will take place.

4.2 Manual Operation

The **MANUAL STATION** function bypasses **ALL** programmed information and simply activates the pump and one valve output.

The **MANUAL STATION** key is used when simple 'on - off' station operation is required.

Example:

*To manually switch on Station 3, press **MANUAL STATION.***

```
MANUAL TURN OF VALVE 1
SET TIME → OR WAIT 2 SEC
```

There is a 2 second delay before the valve is switched on to prevent valves being actuated when pressing the → key. Press the → key until the required station is displayed. Wait 2 seconds and the valve will switch on. The screen will now display:

```
STN 3 ON UNTIL STOPPED
PRESS END TO CANCEL
```

A MANUALLY ACTUATED VALVE WILL REMAIN ACTIVE UNTIL ADVANCED USING THE → key, OR CANCELED USING THE **END** KEY.

4.2.1 Manual Switch on station 3 for 25 minutes.

Example:

Press **MANUAL STATION** then press → until Station 3 is displayed. Press **SET TIME** within 2 seconds.

```
VALVE 3 RUNTIME = :25  
ENTER RUN TIME THEN END
```

Press **2** then press **5** to enter 25 minutes. Press **END**.

```
IRRIGATE VALVE 3 :25  
PRESS END TO CANCEL
```

The Run Time will now count down to 0 and then return to the home screen.

3. Display during Normal Irrigation

Example:

Screen displays Program A is operating the first cycle of 25 cycles. The current station irrigating is station 7 with time remaining of 1 hour 25 minutes.

```
PROGRAM A CYCLE 1 OF 25  
TIME LEFT STN 7 = 01:25m
```

If the controller is operating in program overlap mode, and more than 1 program is operating, then the above screen will change every 2 seconds to display other programs operating. This information will be displayed in the same format.

CHAPTER 5 **CONTROLLER SET UP FUNCTIONS**

The **SET UP** key allows for the following tests and set up functions of the controller. The Set Up is stored in permanent memory and is not lost in the event of a power failure and no standby battery.

1. Clear all Programs and set all values to default Mode.
2. Diagnostics. Serial Port : Test serial port communications.
 Controller : Memory, output and keyboard test.
3. Program Time base set to count in Minutes or in Seconds.
4. Communications mode set to telephone or direct link.
5. Enable/disable emergency program B.
6. Enable/disable program overlap mode.
7. Set Controller identity code and Phone numbers to ring when fault report is reported.
8. Flow Meter Setup.
 - Enter number of pulses / 100 litres.
 - Generate Flow rate data base for each station for comparison during irrigation.
 - Upper and lower percent of normal flow for reporting and skip to the next station.

5.1. Clear All Programs and Set Controller to Default Mode.

Press **SETUP**. Then press **1** to select clear programs. A warning will be given that all program locations will be cleared. Press → to continue.

i.e.

CLEAR PROGRAMS PRESS 1
DIAGNOSTICS 2 MORE=SETUP

All Programs will now be cleared and the following defaults set.

Day	Set to Sunday week 1
Time	Set to 4:00 am
Programs A, B, C, and D Cycles / Day	Set to 0 (No Irrigation)
Program A, B, C, and D RunTimes	All stations set to 0 minutes
Program A, B, C, & D Start Times	Set to 00.00 i.e. no starts
Auto Skip 1 Time	Set to 20 seconds
Auto Skip 2 Time	Set to 20 seconds
Water Budget Program A, B, C, & D	Set to 100 percent
Global Program ON / OFF	Set to ON
Modem / Serial Link PC	Set to Serial Link PC
Pass word	Set to Off
Emergency Program B	Set to Off
Program Over Lap Mode	Set to Off
All Flow Setup	All set to 0
Identity Code & Phone Numbers	All set to 0.

5.2 Self-Test Diagnostic Procedures

5.2.1 Serial Port Test (optional communications chip only)

A loop back 9 pin plug is supplied with the MicroMaster 4000 Central Software. To test the Serial Port, select Serial Port. The following screen is displayed.

```
SHORT PINS 2-3 & 8-4 OF  
SERIAL → = GO END = EXIT
```

Connect the loop back plug to the serial connector. Press the → to continue the test. Four short beeps will indicate a good port. Long beeps indicate a bad port. If there is a Bad port contact a Irritrol dealer.

5.2.2 Controller Test

The following checks are made during the Controller Self Test Diagnostics.

Program Memory Check

Initially the controller checks the program memory. i.e. the EPROM memory that runs the Micromaster® program and the RAM that holds the user programs. If the memory is faulty, the screen will display the following,

```
PROGRAM MEMORY ERROR  
CONTACT DEALER
```

Key Pad Check

When each key is pressed, a short "beep" will sound, and the key name will be displayed. If a key does not work, return for service.

```
KEY TEST = WATER BUDGET  
PRESS END KEY LAST
```


Output Relay Check

After the above sequence is completed and the **END** key has been pressed, all output relays are activated in sequence as the output number is displayed on the screen. The relays can be heard to click on and off twice as the controller cycles through each station. After all valve outputs (1-16) or (1-32), the Pump Start will be activated. The controller then switches on the Alarm output relay. If any relay fails, return for service.

CHECK VALVE OUTPUT No.23
RELAYS WILL CLICK TWICE

Input Check

This requires a length of insulated wire approximately 150mm long with the wire stripped bare for 5mm at each end. One end is to be connected to the GND connector at either end of the input connector strip.

The screen will display,

ASTRT - PROGRAM A START
SHORT INPUT TO GND

Touch the free end of the GND wire to the ASTRT input. - PROGRAM A START. There will be a short confirmation beep and the screen will now display BSTRT - Program B START.

Repeat operation as above.

Repeat for	RESET -	RESET Input
	HOLD -	HOLD Input
	ASKIP -	AutoSkip Input
	PD -	Door Alarm Input
	FLOW1	Pulse Flow Input

The controller will then give 4 short beeps to indicate clock operating and return to the home screen.

If a controller fault is suspected, this test procedure should be performed first with the system circuits connected, and again (if the fault persists) with the system circuits disconnected. Control system malfunctions are often attributable to operator or external system error.

5.3 Setting Program Time Base to Minutes or Seconds

Press **SETUP** key until SECS or MINS is displayed. Press **1**.

PRESS PRG A, PRG B, PRG C
PRG D TO SELECT END=EXIT

To set Program A to Minutes and Seconds press **PROG A RUNTIMES**.

MINS & SECS PRESS 1
HRS & MINS 2 END=EXIT

Press Key **1** to select Minutes and Seconds mode for program A. The controller will confirm the change and exit back to the home screen.

5.4.1 Master Slave Operation - Option 1

For this operation a spare station is required. *e.g. station 25.*

Program this station for 1 minute (2 seconds minimum.) in a group or in sequential mode.

Operation.

An Omron LY2 or equivalent relay (coil 24 Vac at 50 ma and 2 DPDT contacts) is ideal for this purpose as the contacts can switch 240 volt AC with a very low coil current . Most of the transformer current is then available for the field valves.

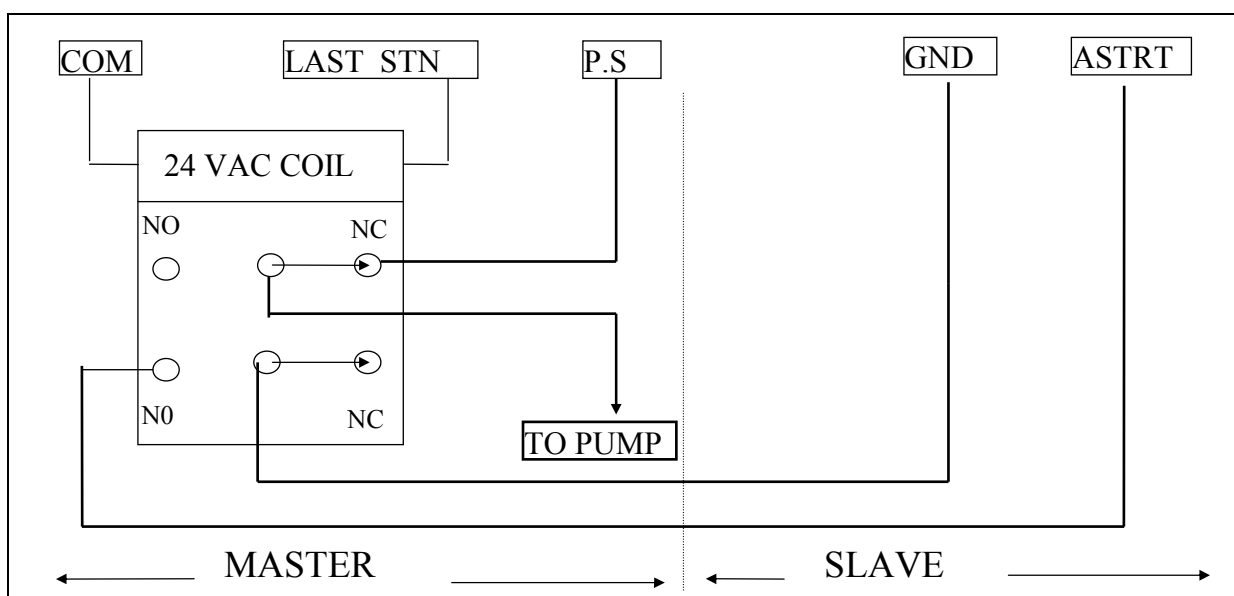
The pump start output is connected through the first set of normally closed contacts.

When station 25 operates, the pump will be switched OFF.

The second set of contacts will close, and activate the ASTRT input of the slave controller.

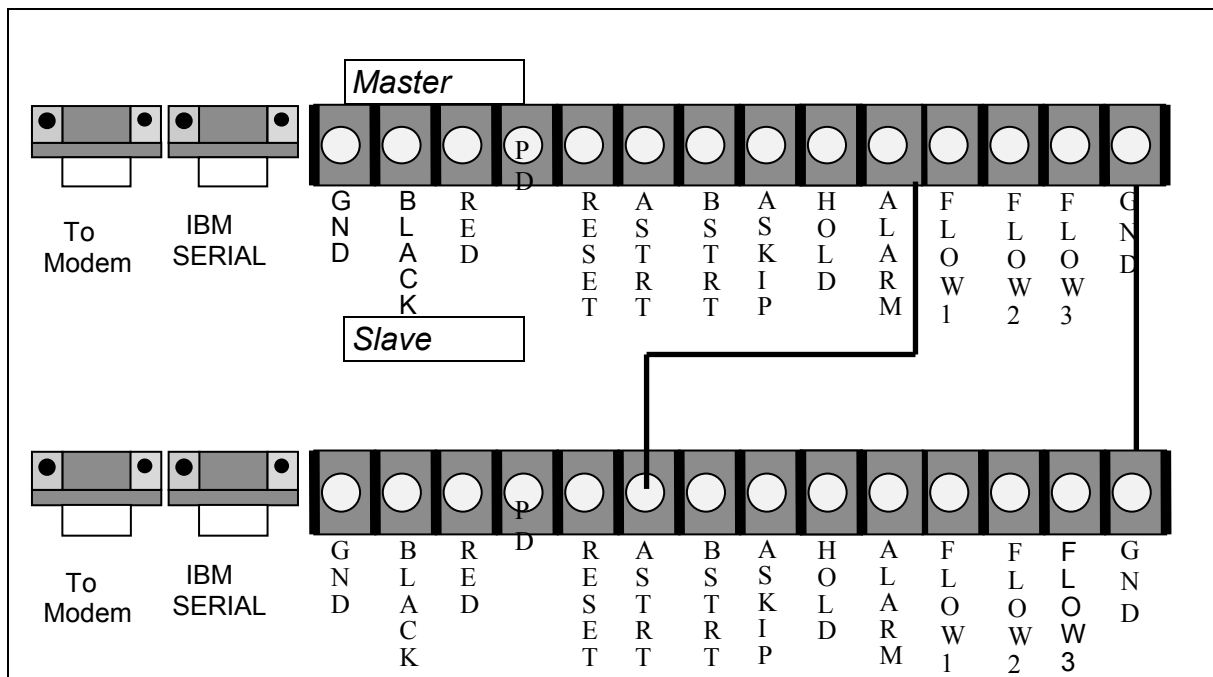
Note: The *Cycles / day table* must be set on the Slave for Program A to operate.

Program B operation can be activated in the same way.



5.4.2 Master Slave Operation Using Alarm Terminal Output - Option 2

The 4500 can be setup to Master Slave Program A in the following way if only one program is required to be (ie program A **OR** Program B.)



Press Setup until **ALARM O/P 2** is displayed. Press key 2 to select the alarm setup function. The following screen is displayed.

```

INVERTER KEY 1      ALARM 2
MASTER/SLAVE 3     END=EXIT
    
```

When key 3 is pressed, the alarm output will be setup as the **Master** slave trigger. It is a normally open contact that will close 2 seconds before the completion of Program A. The **ALARM** output of the Master can now be directly connected to the **ASTRT** or **BSTRT** of the slave controller as in the diagram above.

Note: The Cycles /Day and Runtimes on the slave controller must be programmed (no Start Time is necessary) for the Slave to operate. The Cycles / day entry allows the Slave program to operate only on those days required by the user. To indicate that

```

MM25 id =003  MON W1  12:35
CHEM PRG A TUE W1   06:35
    
```

1 controller is the master the **ID** is changed to lower case **id** to indicate that is the Master.

Each controller will operate as per the programming and Setup installations of each individual controller. e.g. The master (the controller with the programmed *Start Time*) can be Volumetric grouping and the slave can be Time base sequential operation.

5.4.3 Inverter Control / Solar Operation

The Solar power option for a Micro-Master 4500 generates 24 VAC to operate standard 24 VAC solenoid valves. The Benefits of this are as follows.

1. Wiring for 12 volt DC valves require expensive double insulated wire to prevent electrolysis break down of cable.
2. 24 VAC valves require half the wiring diameter than that used by 12 VDC valves. Calculate wire size as for standard solenoid valves.
3. Latching solenoid valves must be installed close to the controller because they require a very large initial current to latch (approx. 2 amps). The wire must also be double insulated for the same reasons as (1) above.
4. Latching solenoid valves are expensive.
5. Hydraulic valves cannot be used in undulating terrain.
6. Earth Stake must be fitted for DC operation to prevent damage from Field Surges.

The Solar power option consists of

- 60 Watt Solar Panel.
- MSX1 frame for roof or wall mount.
- 12 Volt DC to 24 Volt 2.5 Amp AC Converter. (IP66 weatherproof enclosure).
- SR4 Solar Regulator.
- 6 metres twin sheath cable 3.2mm²
- Micro-Master Solar adapter cable.

NOTE: Battery to be supplied by the user.

Recommend standard 12 volt 90 Amp hour motor vehicle battery.

For the sake of simplicity, the following table gives an indication for Winter and Summer operation. Following is the number of valve hours that the system can operate in a continuous 24-hour day.

E.g.

40 valve hours = 4 valves operating for 10 hours OR
2 valves operating for 20 hours.

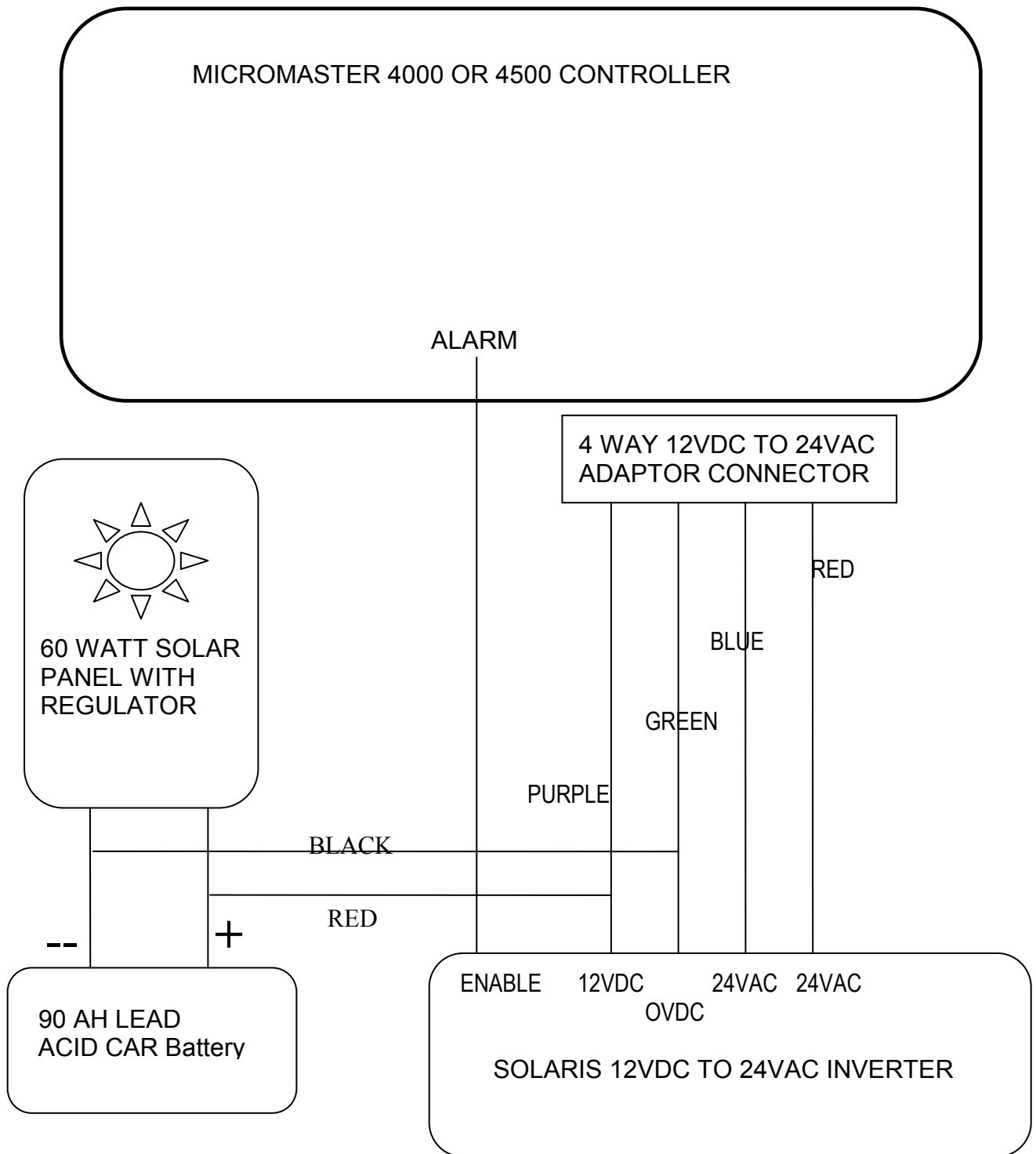
Location	Winter Valve Hours	Summer Valve Hours
South of Melbourne and Tasmania	17.5 Valve Hours	42 Valve Hours
Rest of Australia	22.5 Valve Hours	45 Valve Hours

To prevent the inverter using current when not in use, the Alarm output of the controller can be programmed to switch on the inverter only when irrigation is required. For this purpose the controller loses its alarm output capability.

See Wiring Diagram on page 47.

Cleaning of Solar panel.

See manufacturers instructions for Solar panel cleaning.



Wiring Diagram for connecting Micro-Master 4000 and 4500 to a Solaris 12VDC to 24VAC inverter. Disconnect the 4 way connector between the mains transformer and the relay board. Connect the 4 way connector of the 12VDC to 24VAC adaptor connector to the 4 way connector of the relay board. Connect the wire labeled Enable to the alarm output. Connect the Red wire to the + terminal of the battery. Connect the Black wire to the - terminal of the battery. Connect solar panel as above ie + to + and - to -. Program Output see page 50. Setup is now complete.

To convert the controller from 240 volt to solar power operation, the following setup is required.

1. Remove the front panel of the controller.
2. Disconnect the 4 way power cable to the controller relay board.
3. Connect the 4 way solar connector to the power cable connector of the relay board.
4. Connect a wire between the EARTH STAKE terminal (last terminal on the right of the valve output connector see diagram on page 39 and the GND terminal on the top processor board last terminal on the right see diagram on page 36.

Program Setup for Inverter Control

Press **SETUP** until **ALARM O/P 2** is displayed. Press **2**

```
INVERTER KEY 1   ALARM KEY 2
MASTER/SLAVE 3   END=EXIT
```

Press **1** key to enable the Alarm Output to control the 24vAC inverter. The controller will now display.

```
ALARM = SOLAR CONTROL
```

Note: To Setup Alarm output for standard Alarm ,Press Key 2. The alarm output will now operate as the default setup for the Alarm. See 7.5.7

5.4 Setting Communications (optional communications chip only)

The Telephone modem or the GSM modem must be connected to the 9 pin Male D connector labeled TO MODEM. If connection is Direct RS232, then connect to IBM Serial 9 pin female D connector. If communications is Radio-Master or RS485, then connect to the Red and Black RS485 connections of the controller.

Eg. Setting Communications to Telephone Mode.

Press **SETUP** until screen displays;

```
PHONE 1   GSM 2   RADIO 3
DIRECT 4   SETUP=MORE
```

Press **1**. The following screen will be displayed while the MicroMaster® passes the setup data to the modem;

```
WILL TAKE APPROX. 3 SECS
HAVE MODEM SWITCHED ON
```

The controller will then exit back to the home screen

5.5 Enable/Disable Emergency Program B

Emergency Program B can be set up to be a heat stress, or frost control input sensor and can be set up to interrupt Program A, C or D. When the normally open contacts of External Bstart input are activated, Program B will interrupt Program A, C or D and will continue cycling until the input is removed from the Program B start input. Program B will then continue until the end of its program cycle and the original irrigation will then continue from the point of interruption.

To enable emergency program B, press **SETUP** until *EMERGENCY PROGRAM B Press 1* is displayed. Press **1**. The following screen is displayed;

```
EMERGENCY PRG ON PRESS 1
EMERGENCY OFF 2 END=EXIT
```

Press **1** to enable or press **2** to Disable.

The controller will then confirm setup in Emergency Program B mode and then return to the home screen.

5.6 Enable/Disable Program Overlap Mode

During irrigation in overlap mode, more than one program can operate at the same time. Any program can be stopped or advanced by the → and the **END** keys.

To enable Overlap Mode press **SETUP** until “*OVERLAP MODE Press 2*” is displayed. Press **2**. The following screen is then displayed;

```
OVERLAP MODE ON PRESS 1
OVERLAP OFF 2 END=EXIT
```

Press **1** to enable or press **2** to Disable.

The controller will then setup the overlap mode and then return to the home screen.

END and → Key Functions in Program Overlap Mode

Example:

Programs A and B are operating at the same time. To stop Program B, press END. The screen will display;

```
PRESS PRG A, PRG B, PRG C
OR PRG D TO STOP PROGRAM
```

*When the **PROG B RUNTIME** key is pressed, Program B will be canceled.*

The same procedure is used for the → function.

5.7 ID. Code & Phone Numbers (optional communication chip only)

When the optional communication chip is installed, the controller can be centrally controlled through a telephone modem, GSM modem, direct link RS232 or RS485 or Radio-Master spread spectrum radio transceivers. and when communications is Telephone or GSM, the telephone number must be installed.

1. In all cases the ID code of the controller must be installed. Start from controller number 1 and increase the numbers sequentially for each controller.
2. Ring up to 3 telephone numbers to report a malfunction. It will identify itself (4 Digit ID. number) and report the faulty Valve Station at the end of the irrigation period.

The Micromaster® needs to be programmed with an ID. code and telephone numbers. Press **SETUP** until *Phone Numbers Press 1* is displayed. Press **1**

```
CONTROLLER ID CODE 0001
PRESS → = NEXT END=EXIT
```

Enter a 4 digit code. Start at 1 for the first controller and as new controllers are added, set the ID codes sequentially.

Press → , to enter the Phone numbers.

```
PHONE No.1 4513127478
NEXT = → END SETUP=CLEAR
```


Enter the required telephone number e.g. 4513127478. If an error is made when entering the telephone number, simply press **SETUP** to clear the screen and allow the number to be re-entered.

Press → to enter the additional telephone numbers. The same number can be rung up to three times by entering the number in all 3 locations of the telephone table or 3 separate phone numbers can be entered for the controller to search for an attended PC to download the fault report to.

5.8. Enter Flow Calibration (Communication chip only)

Press **Setup** until .

ID & PHONE NO.	PRESS 1
PULSES/CMETRE	PRESS 2

Press **2**.

PULSES / C.METRE	= 010
ENTER PULSES	

Enter Flow meter calibration. Note: with central control, flow control limits and expected flow rates for each station are set at the Central.

5.9 Flow Meter Set Up (Stand-Alone Chip only)

The flow monitoring set up consists of

1. Entering the number of pulses / 100 litres for the flow sensor.
2. Setting the upper and lower percent of normal flow for reporting and skipping to the next station.
3. Generating a Flow Rate data base for each station for comparison during irrigation.

NOTE: When the optional communication chip is installed, set up from a Central computer can set the upper and lower percent of normal flow for reporting back to central without. Auto-Skip can also be set up.

1. Enter Flow Sensor Calibration (Pulses/100 litres - Stand-Alone Chip only)

For optimal flow measuring, the pulse rate should be selected to be in the range of 1 pulse every 0.5 sec to 2 seconds. This may require a change of units. (e.g. Pulses/10 litres etc.)

Press **SETUP** until *FLOW SETUP 2* is displayed. Press **2**.

```
PULSES/100 LITRES PRESS 1  
LOW% 2 HIGH% 3 OR SETUP
```

Press **1**.

```
PULSES/100 LITRES = 10  
ENTER PULSES     END=FLOW
```

Enter the number of pulses/100 litres or user specified units. Press **END** to return to flow setup menu.

2. Upper & lower percent of flow for reporting & Skip. - Stand-Alone Chip only

Press **2** to enter the lower Percent of normal flow for Auto-Skip and report fault. This can be set between 20-80 percent of Normal flow rate.

```
FLOW FOR LOW SKIP = 75%  
ENTER 20-80%     END=FLOW
```

For example enter 75% and press **END** to Return to Flow menu.

Press key **3** to enter percent of normal flow, above which the controller will Auto-Skip to the next active station. Normally between 120-200%

During irrigation, if the flow rate exceeds (e.g. 130%) or is less than 75% of normal flow, the controller will automatically skip to the next station and store the faulty station in fault reports. If a PC is connected, the fault will be sent to the Central to be stored on disk.

5.10. Generate a Flow Rate Data Base for Each Station (Stand- alone chip only)

This enables the user to set the station to start the flow rate measurement (usually Station 1) and the last active station of the controller. i.e. the last station with valves connected. After this has been set, a run time in seconds is set to allow the flowrate to stabilize before the flow rate measurement is calculated. At the end of this test the flow rate can be viewed by pressing the **REPORTS** key.

Flow Setup menu.

```
PULSES/100 LITRES PRESS 1  
LOW% 2 HIGH% 3 OR SETUP
```

Press **SETUP**.

```
SET UP STN FLOW DATABASE  
PRESS → CONTINUE END=EXIT
```

Press →, The screen then displays *CALC. FLOW FOR EACH STATION*
Press →.

```
START AT STATION 01  
PRESS → CONTINUE OR END
```

Enter the station to start the flow rate data base. This is generally Station 1. Press →
to enter the last active station for the flow rate data base. Press →.

```
060 SECS FLOW STABILIZE  
PRESS → CONTINUE OR END
```

Enter the number of seconds before the flow rate to stabilize. This is a function of the
size of the system and a time of 1-999 seconds can be entered. Generally 60-120
seconds is adequate.

Enter 060 seconds and press → to continue.

The first station will now be switched on and the count down started

```
055 SECS LEFT FOR STN 6  
PRESS END TO CANCEL
```

NOTE: If no flow meter is connected, this program can be used as a very easy to
program walk through program. i.e. set start station, stop station, and a common
runtime.

5.11 Rain Fall Cancel (Optional Communication Chip is installed)

The controller can also be setup to cancel irrigation if the accumulative rainfall in a defined period (between 1 to 7 days) exceeds a predefined precipitation.

This function requires a rain bucket sensor connected to the input to one or more field controllers. If the system is under Central control, a controller with a Rain-bucket sensor can Rain-Switch controllers within a group or all controllers in the system. The Central would then report the action to a mobile phone with SMS.

The Controller counts the number of precipitation pulses and logs the total every hour. The log period can be set for a period of 1 to 7 days.

If a period of 1 day is selected, rainfall will stay in the log for a period of 24 hours before being “over written” 24 hours later by a new sample. If the rainfall was greater than the precipitation defined in Cancel Irrigation threshold, then the controller will disable all irrigation, and set the Rain Switch on.

No irrigation will take place until the total precipitation within this 24 hour Window falls below the Cancel Irrigation Threshold, (i.e. if no more rain occurs). The rain switch will then be switched OFF and irrigation will continue when programmed.

Each event of the Rain Switch being turned ON or OFF by the Rainfall can be programmed to be transmitted to the Central. If the log period was set to 7 days, then irrigation could be disabled for up to a period of 1 week.

Rainfall Cancel can be entered from the Central or from the controller.

Press the SETUP key until **RAIN CANCEL 2** is displayed. Press key **2** and the following screen is displayed.

```
RAINCANCEL 1      PULSE/MM 2
DAYS FOR LOG 3      END= MORE
```

Press key **1** to enter the accumulative rainfall that the controller Rain-switch will activate to cancel further irrigation. The following screen is displayed.

```
RAINFALL CANCEL MM      = 8
0-99MM      END - RAINBUCKET
```

Press **END** to return to enter other Rain-bucket parameters.

Press key **2** to enter the calibration pulses per mm of rainfall for the Rain-Bucket. The following screen is displayed.

```
NUMBER OF PULSES MM = 10
0-99MM      END - RAINBUCKET
```

Press **END** to return to enter other Rain-bucket parameters

Press key **3** to enter the logging period to accumulate rainfall. The following screen is displayed.

```
AVERAGE RAIN DAYS      = 5
1-7 DAYS  END - RAINBUCKET
```

Enter the logging period between 1 to 7 days. The rainfall cancel has now been setup. Press **END** to return to enter other Rain-bucket parameters

5.12 Communications Protocol (Optional Communication Chip is installed)

If a Central computer is used, the only data to be entered is **Enable Central Radio Mode** . All other information can then be down loaded from the central.

From the setup Menu press

Setup 5 times and the following screen will be displayed.

```
PHONE 1      GSM 2      RADIO 3
DIRECT 4          SETUP=MORE
```

5.12.1 Telephone Communications

When Key **1** is pressed, the setup code to setup the telephone modem is dumped to the modem. (Note: the Modem must be connected and switched on during this operation). To enter phone numbers go to **Enter Phone Numbers**.

5.12.2 GSM Communications

When Key **2** is pressed, the setup code to setup the GSM modem is dumped to the modem. (Note: the Modem must be connected and switched on during this operation). To enter phone numbers go to **Enter Phone Numbers**.

5.12.3 Direct Communications

When key **4** is pressed, the communication is setup for direct communications by RS232 (IBM serial 9 pin female D connector) or RS485 2 wire multi-drop communications, using the RED – Black terminals. Note: The processor panel is factory set up for RS232 communications. To change the communications to RS485, the configuration links will need to be changed. See diagram on rear of panel and diagram supplied with option chip.

5.13 Entering Radio-Master Data. (Optional Communication Chip is installed)

Over-View.

There are 3 specific RadioMaster Spread Spectrum 15 channel radio modules. They have been specially designed to suit the formatting of the Micro-Master and feed back to the controller the status of the valve actuation. The information sent back and displayed and written to the log are Status of communication , valve operation, Node battery voltage, temperature and signal strength. (4.3 _Manual Operation with Radio-Master)

Rm100 – Central Radio. This is connected to the Central P.C computer.

Rm200 – Slave radio. This is connected to 1 or more Micro-Master 4500 controllers and used to connect to the Central Radio or communicate to field Nodes (RM400)

RM400 – Field Nodes. This is installed in the field and is used to actuate up to 4 irrigation valves.

The above 3 Radio-Master types of radio can act as a repeater for any other radio in the system. The maximum number of repeaters is 1.

When a Central system is ordered, communication chips for each controller must be ordered (part No. CMM4000301). This software version has added benefits that will be described below. Radio-Master can be easily Installed or changed from the keyboard of the Micro-Master controller

To setup Radio-Master communications key **3** must be pressed.

```
CENTRAL RADIO          PRESS 1
RADIO VALVES  2      END=EXIT
```

Press key **1** and the following screen is displayed.

```
CENTRAL RADIO CODE          1
ENABLE RADIO  2      END=EXIT
```

Press key **1** to enter the radio IDCode printed on the bottom of the radio. The following IDCode entry screen is displayed as below.

```
CENTRAL RADIO ID    = 12345
ENTER 5 DIGITS      END=EXIT
```

Press **END** to exit from this screen. The Central IDCode has now been setup.

Press Key **2** to enable Radio-Master mode.

The following screen is displayed during the installation of the Radio-Master protocol into the controller.

```
SET RADIO COMMUNICATIONS
```

Press the **END** key to return to enter Radio-Master valves if required.

Press Key **2** to enter radio valves. The following screen is displayed.

```
VALVES ON/OFF 1      VALVES 2
REPEATERS  3          END=EXIT
```

After all radio valve data has been entered, radio valve operation can be turned off by pressing key **1** from this screen. Press key **1** to enable radio valves.

```
SET RADIO VALVE MODE ON
```

The next time key **1** is pressed the screen would display **Mode Off**.
Press key **2** to enter the radio valve IDCode and the node output number (1-4) defined for this station.

```
STN 1 TO O/P 3 OF 13247
END <PREV NXT> SETUP=CLR
```

In the above example station 1 of this controller is connected to output 3 of Radio-Master node that has a radio address of 13247.

Press **>** to go to the next station.

Press **<** to back to the previous station.

Press **SETUP** to clear data for this station

Press **END** to exit from this function.

If any of these stations require a repeater press key **3** to enter this data.

The following screen is displayed when entering a radio repeater for station 1.

```
STN 1 REPEATER = 47763
END <PREV NXT> SETUP = CLR
```

Press **>** to go to the next station.

Press **<** to back to the previous station.

Press **SETUP** to clear data for this station

Press **END** to exit from this function.

5.14 Multiple Pump Set-Up

The Micromaster 4000 can be programmed to operate up to 2 pumps.

The setup can be done at the Central computer or at the controller keyboard.

Press **Setup** until

```
TIMEBASE 1 ALARM O/P 2
RAIN 3 PUMPS 4 SETUP=MORE
```

Press key **4** to Setup the pump configuration.

The following screen will be displayed.

```
PROGRAM A=PUMP1 (PS O/P)
SETUP=CHANGE <->=PROGRAM
```

Press **SETUP** to change the pump configuration.

The options for each of the 4 programs is

1. **No Pump.**
2. **Pump 1** This is labeled (**PS**) pump start output.
3. **Pump 2.** This is labeled (Station 32). In this mode station 32 will be lost as an irrigation station.
4. **Pump 1 and Pump 2.** Pump 1 labeled (**PS**) and Pump 2 labeled (Station 32). In this mode station 32 will be lost as an irrigation station.

The pump configuration can be changed for each program.

Press the arrow keys to select the required program to change.

Press Setup to select the desired pump configuration.

CHAPTER 6 REPORTS

6.1 Irrigation Totalizer Report (Stand-alone Chip Installed)

The Micromaster® keeps precise internal records of all irrigation activity during a season or specific period. To access the Totalizer press **REPORTS**. The following screen is then displayed when the Stand-alone chip is installed.

```
TOTALIZER = 1 FLOWRATE = 2
FAULTS PRESS 3 END = EXIT
```

Then press **1**. to select the Totalizer. The accumulated time in Hours and Minutes is displayed for Station 1. Total runtimes are then displayed.

```
TOTAL RUN TIME 1 = 999:35
0 = RESET ←→ END TO EXIT
```

The maximum run time that can be displayed is 999 hours 99 minutes. The total may be reset when required by Pressing the **0** key. When the **→** key is pressed, the accumulated irrigation for station 2 is shown. To view/set all stations press the **←** or **→** key. Press the **END** key to return to the rest mode.

NOTE: When a program is in the mins/secs mode, a time of 1min 35 secs will be rounded up to 2 minutes, i.e. any seconds equal or greater than 30 sec will be rounded up. Any seconds less than 30 will be rounded down.

6.2 Flow Rate Report

When the Stand-alone Chip Installed, the Flow Rate data base is generated during the flow set up (see 5.9 *Generate a Flow Data Base For each station*) and can be viewed via the **REPORTS** key. When a (Communication chip) is installed, The flowrate is downloaded from the central data base.

Press **REPORTS** key, and then press **2**. The Flow Rate for Station 1 is displayed.

```
FLOW RATE STN 1 123 l/m
PRESS ←→ or END To EXIT
```

Press **← →** to scroll through the Flow Rates for each station. Press **END** to exit.

6.3 Faulty Station Report

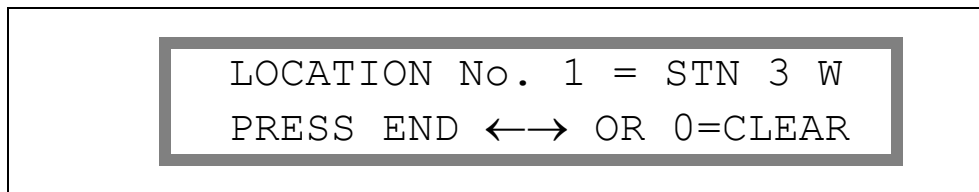
An entry into the Fault Table can be caused by

1. *The Auto-Skip input.*
2. If the *current load on the internal transformer exceeds 2.5 Amps*, then that station will be skipped and reported.

To view the fault table, and cancel the alarm output, the faulty station(s) must be cleared. Clearing each station is achieved by pressing the Key **0** for each fault report.

Press the **REPORTS** key.

There are 2 types of reports that can be viewed for the standard chip. An additional error message is displayed if Radio-Master valves are used. The station number is displayed followed by a **C** for communication error. (**Communication chip option required**). Press **2** to access the Fault report table.



The first faulty station number to be recorded, will be shown in the right display. i.e. station 3. **W** indicating a watering fault occurred at the auto-skip input for station 3. If the display is **STN 3 E** this would indicate an electrical fault i.e. a current > 2.5 amps occurred on *station 3*.

When RadioMaster valves are installed (note requires Communications Chip) the following fault can be displayed. **STN 3C** indicating a communication fault to this valve. After noting this number (if required), press the **0** key to cancel the station number. **No fault** will now be displayed. Press the **→** to check for subsequent fault reports. All locations should be checked and cleared by pressing the **0** key. If all faults have been cleared, the alarm output will be switched off when the **END** key is pressed.

The Normally open contact of the Alarm output is also compatible with most auto-dialers e.g. ParaVox or equivalent. It has 4 inputs to report the status of other functions such as Chemical level, pump failure etc.. It can be programmed over the phone and the messages sent to a phone or pager.

NOTE: Even if the fault table has not been cleared, the controller will attempt to irrigate again on the next irrigation cycle for all stations including those where a fault was detected and reported.

6.4 Reports (Communication chip is installed).

```
TOTALS 1  FAULTS 2  RAIN 3  
FLOWRATE 4          END = EXIT
```

Totals – See 6.1 Irrigation Totalizer Report above.

Faults – See 6.3 Faulty Station Report above.

FlowRate – See 6.2 Flow Rate Report above.

An additional feature of the controller when a communication chip is installed, is the rainfall log.

6.5 Rain-Fall Log

Press **3** to access the Rainfall log. The following screen is displayed

```
5 DAY TOTAL RAIN = 12MM  
0=CLEAR LOG      END=EXIT
```

The length of the logging period is displayed with the accumulative rainfall for this period. The log can be cleared by pressing the **0** key. This will clear the log and set the accumulative Rainfall to 0 and turn the automatic rain switch off to allow irrigation to take place.

CHAPTER 7 AUXILIARY FUNCTIONS

7.1 Password

The Micromaster® 4000 has the password switched off on delivery. The password program is a hidden function described only in the user guide for protection. To initialize the password program press the **1**, **5**, and **9** keys simultaneously.

```
ENTER 4 DIG PASSWORD 0000
SEE USER GUIDE PAGE 25
```

Enter the 4 digit password code of your choice i.e. **1 0 4 4** and then press the **END** key. **PASSWORD 0000 IS USED TO INDICATE NO PASSWORD.** All keyboard functions except password will display the warning

```
WARNING PASSWORD IS SET
SEE USER GUIDE
```

To gain access to the programs press **PASSWORD** and enter **1 0 4 4** and then the **END** key. The Micromaster® keyboard is again enabled. All keyboard functions will remain enabled until:

1. The key sequence **PASSWORD** then the **END** key.
2. After the end of an irrigation sequence, the controller will look for a valid password code and if so switch on the **Password protection**. This allows the user to manually start an irrigation cycle. The controller will automatically switch on the **Password Protection** at the end of the irrigation cycle.

** NOTE: To switch off the password function, initialize the password to 0000.

7.2 Setting the Auto-Skip

The Auto-Skip function allows the controller to monitor specific conditions e.g. Pressure or Flow and if either fall outside the required parameters during irrigation then the current valve station can be canceled, the faulty station recorded, and irrigation switched to the next station before this condition becomes potentially dangerous or unstable.

The most common application of the Auto-Skip function is to monitor the condition of a normally open, high/low pressure switch (or flow switch) installed in the system mainline. In the event of a valve not opening (high pressure and no flow) or a pipeline rupture (low pressure and high flow) the controller will permit the condition to persist for

a pre-set time, then advance to the next programmed station. When this occurs the faulty station is recorded (in the Fault table for later reference), the alarm output is actuated, and the fault is reported if connected to an IBM PC either direct link or via a telephone modem at the end of the irrigation cycle.

To permit the system to stabilize after initial start-up, mainline filling, air evacuation etc., two separate Auto-Skip times can be programmed into the controller; "AS 1" which operates only at initial start-up and hold, and "AS 2" which is the operational scanning time.

To set these Auto-Skip times, Press **AUTO-SKIP**.

```
AUTO-SKIP 1 (0-250)=20
TIME SECS → OR END=EXIT
```

Use the numerical keys to set the first Auto-Skip time (Range - 0-250 secs).

Now press the → key to enter the scan time for the Auto-Skip 2 time. (Auto-Skip 2 time will generally be a lower value than Auto-Skip 1 time.)

Press → To enter Inter-station Delays or **END** to exit.

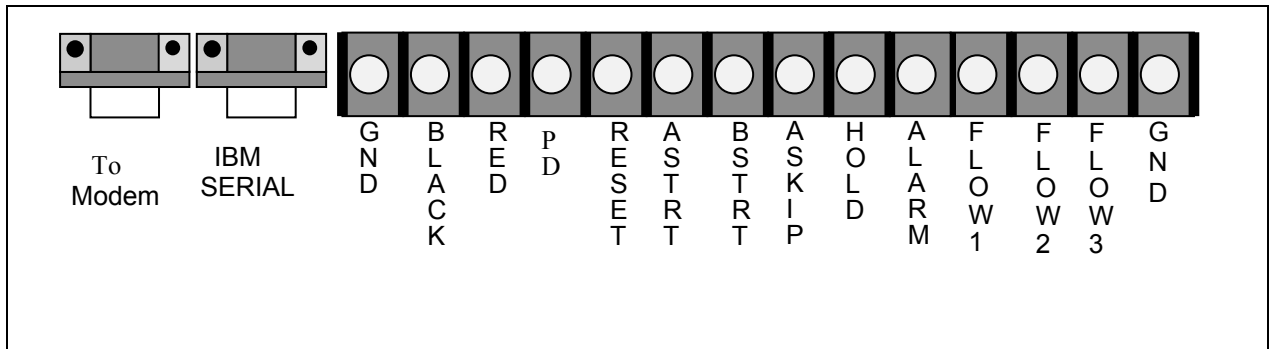
7.3 Setting the Inter-Station Delay

For some valves to switch off, full water pressure must be applied to the valve. To ensure this, a delay must be inserted between one valve switching off and the next valve switching on.

```
INTER-STATION DELAY A=10
TIME SECS → OR END=EXIT
```

There are individual Inter-Station delays (0-250 seconds) for each of the 4 Programs. For example if a delay is entered for 10 seconds for Program A, a 10 second delay will be inserted between each station change for Program A. Similarly a different delay can be entered for Program B, C, and D.

7.4 External Connections and Functions



All Micromaster® inputs react to the closing of a normally open switch or circuit. Many devices are available which close or open a switch in response to some external stimulus and can be connected directly to the controller.

1. GND

Common Terminal for Inputs, i.e. ASTRT input sensors connected between ASTRT and GND.

2. BLACK RS485 terminal Black.

3. RED RS485 terminal Red.

4. P.D to GND

Door status input. When contact between PD and GND is closed, Central control status is Door closed. When Contacts open, status is Door open.

5. RESET To GND

When this circuit is closed the controller will terminate current program operation, return to the home screen and wait until the next program to start. This function operates on all programs and could be used in conjunction with a normally open moisture switch, such as a tensiometer or more commonly a rain switch. An irrigation cycle **will not be attempted** while the contacts are closed across the RESET Input and GND.

6. ASTRT To GND (*External Program A start*)

When the normally open contacts close across ASTRT and GND, the controller will start Program A.

NOTE: An entry greater than 0 must be entered in the Cycles/Day Table for the current day.

The sensor most commonly used to start an irrigation program is a moisture sensor, i.e. a tensiometer or equivalent to indicate that the soil is dried out.

For example, if the sensor was placed in the influence of the valve on Station 1, and the run time of each station is set to 5 minutes, and the number of cycles of irrigation is set to 1, when the contacts close, Program A would start and irrigate all programmed

stations. If the moisture sensor contacts are still closed, program A will irrigate again. This will be repeated until the moisture sensor contacts open. The controller would then wait for the moisture sensor switch to close again for the next irrigation.

7. BSTRT To GND (*External Program B start*)

When the circuit B-STRT TO GND is closed, the controller will switch on program B. NOTE: An entry greater than 0 must be entered in the Cycles/Day Table for the current day.

This circuit is most commonly used to activate an emergency program to counteract potentially damaging factors such as frost or extreme heat, dust or sand. It may of course be used as a second primary irrigation cycle. In the Emergency Program B configuration, Program B would be set to cycle rapidly through its watering sequence (i.e. short station Run times). A normally open temperature switch would be connected between the BSTRT and GND terminals. Program B would then repeat until the temperature switch opened and then operate to the end of program B and finish .

Emergency Program B

NOTE: If Program A, C or D are operating when Program B is started, they will be suspended until Program B finishes. Irrigation will then recommence from the point of the interruption.

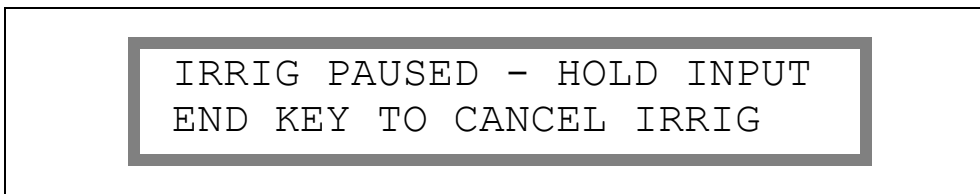
8. A.SKIP To GND (*Auto-Skip Input*)

A.SKIP stands for Automatic Station Skip. When this circuit is closed, the controller will scan the A.SKIP for a pre-selected interval, terminate the current station, skip to the next programmed station, and close a relay contact (Alarm output). The faulty station will be stored in the Fault Table for viewing at the end of irrigation. If a Central is connected, this will be reported and stored on disk.

The most common device used to activate this function is a pressure switch. This switch is set to remain open while pressures remain within a pre-set acceptable range. If the pressure in the line being sensed exceeds or falls below the pre-set range, the A-SKIP function will be activated. (e.g. if a pipe bursts or a valve fails to operate the pressure switch will be activated.) To avoid unnecessary "skips", two Auto-Skip times can be programmed into the controller. These delay times allow sufficient stabilization to occur after system start-up or hold before the A.SKIP function begins sensing input status.

9. HOLD To GND

The hold input circuit, when closed, instructs the controller to temporarily suspend all operations (except time of day) and resume at the same point in the program when the hold input is released. (i.e. when the Hold input circuit opens.) While a controller "Hold" is in action The screen will display



A common application of the Hold input is a normally open level switch, sensing the storage level in a tank or dam. If outflow and inflow are in periodic imbalance, the intermittent nature of supply can be overcome as the Hold input will suspend the irrigation when the level switch senses a low water level. The irrigation will be put on HOLD and irrigation will not be permitted until the sensed level is sufficiently high to allow further pumping.

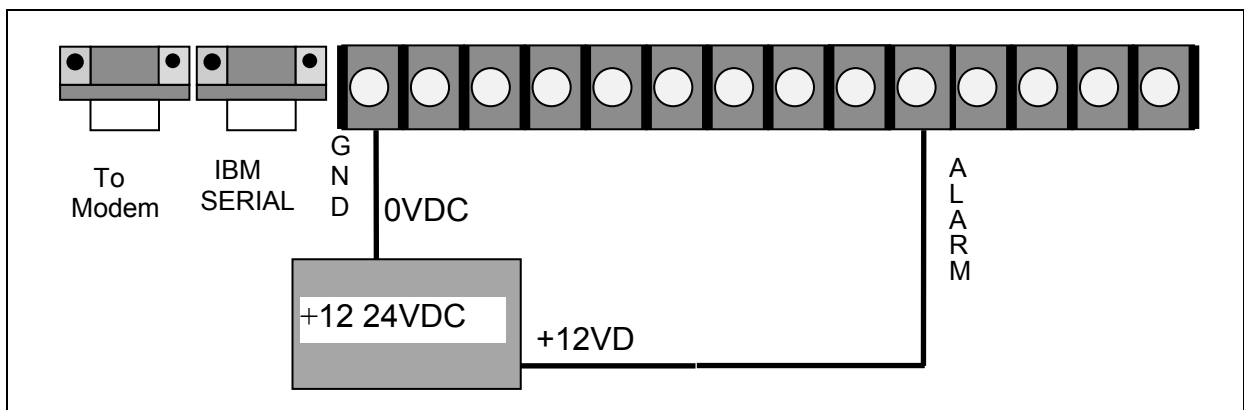
A power failure will result in the same controller reaction to the HOLD Input except the screen will display



All irrigation is suspended until the power is re-instated. The program will continue from where it was when the power failure occurred (provided a back-up battery is installed).

10. Alarm Output

When the Auto-Skip function is actuated due to a fault or sensed conditions, the alarm output terminal is switched to GND. In order to actuate an alarm device, an external power source not exceeding 30 VAC or (30 VDC) at 1.5 Amp Max must be used. This is done to reduce the current draw requirement of the controller so that more power is available for valve actuation.



11. FLOW1 to GND

The input for the pulse flow sensor. Select Number of pulses to operate between 1 pulse every 1 second to 4 pulses a second.

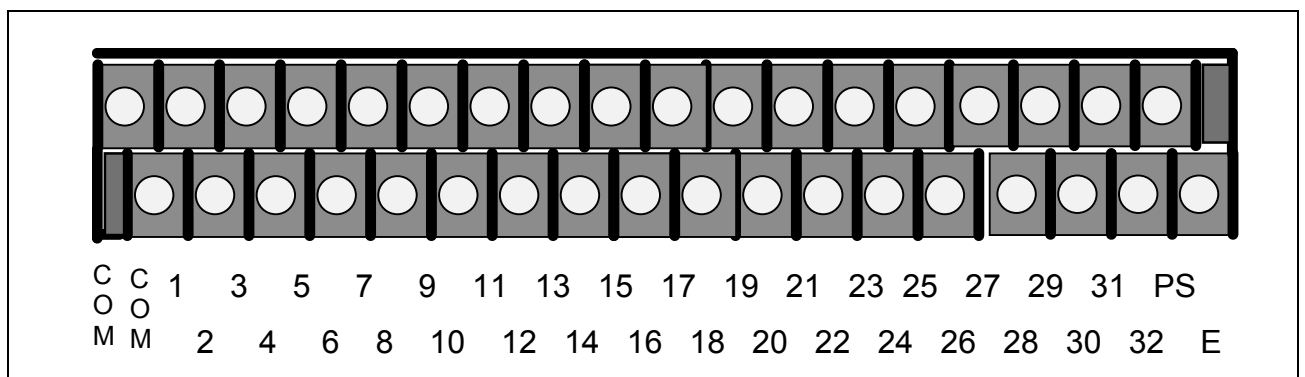
12. FLOW2 to GND (Not Used. Model 4500 only.)

13. FLOW3 to GND (Not Used. Model 4500 only.)

14. GND Common Terminal for input sensors.

15 Output Connector

The output connector is a 36 way connector that can be unplugged when servicing ,so that field wiring does not have to be disconnected



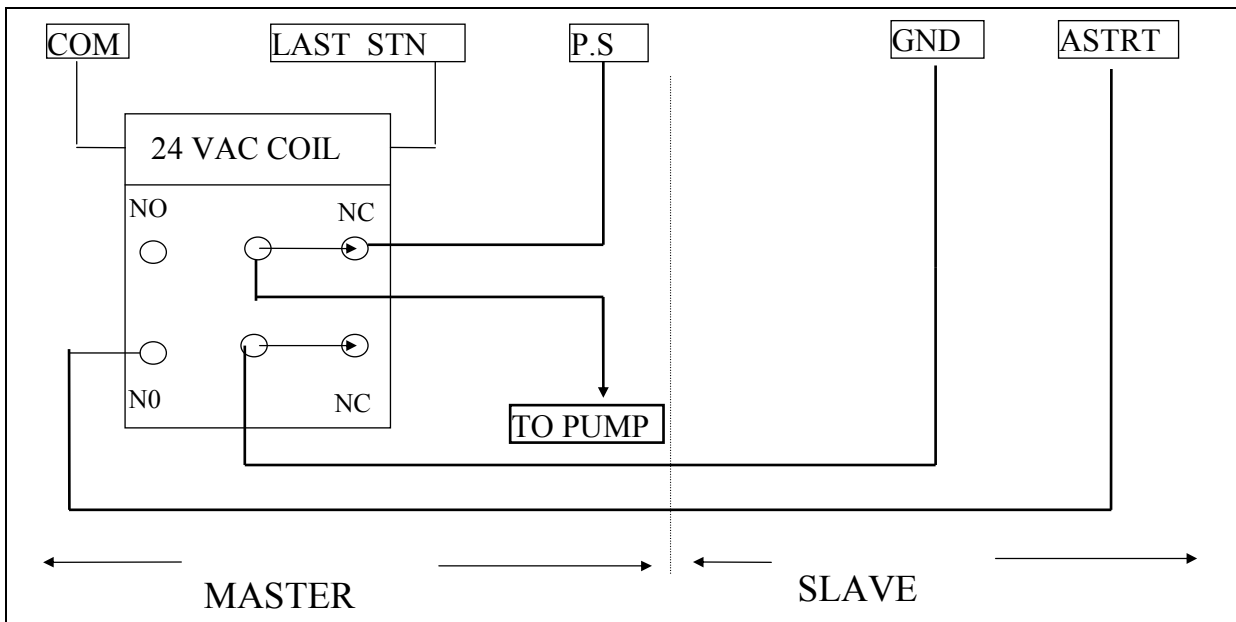
COM Two terminals. Connect to the common of all field valve and pump Start wires.

Terminals 1 to 32 - Connect to each of the field valves.

PS Connect to the Pump start relay or Master Valve. When any field valve is active, the PS terminal will be active.

16. EARTH STAKE (12 Volt DC Operation only) Do not connect Earth when 240VAC

The MicroMaster 4000 Series controllers have a high level of field surge protection. (6500 amp 20usec). For this to work, effectively, a good low resistance earth path must be provided to shunt the surges. In severe lightning areas a *2 metre earth stake* connected to the *E (Earth Stake)* terminal on the right of the terminal block can be used.. (Use multi-strand 4-6mm wire.) Ensure soil around the earth stake is kept moist to create a good earth.



Master Slave operation

For this operation a spare station is required. e.g. station 25.
 Program this station for 1 minute (2 seconds minimum.) in a group or in sequential mode.

Operation.

An Omron LY2 or equivalent relay (coil 24 Vac at 50 ma and 2 DPDT contacts) is ideal for this purpose as the contacts can switch 240 volt AC with a very low coil current . Most of the transformer current is then available for the field valves.

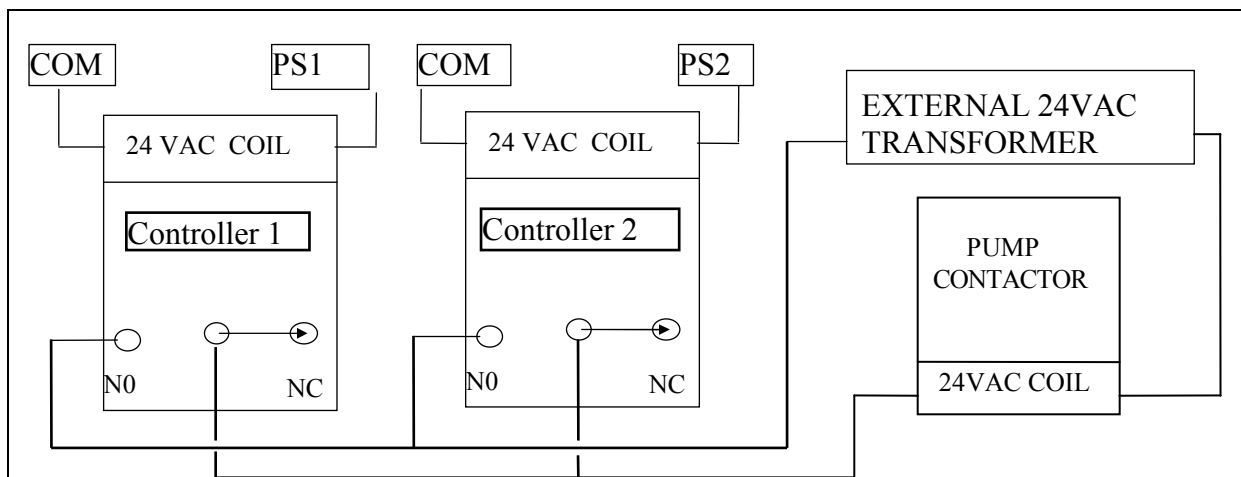
The pump start output is connected through the first set of normally closed contacts.

When station 25 operates, the pump will be switched OFF.

The second set of contacts will close, and activate the ASTRT input of the slave controller.

Note: The *Cycles / day table* must be set on the Slave for Program A to operate.

Program B operation can be activated in the same way.



Connecting 2 or more Pump Starts Together

Outputs from different controllers cannot be connected together because of the phasing between the transformers. The above method can be implemented using a common transformer (ie 24 VAC plug pack.). When any pump start operates, one or the other or both of the relays will operate activating the pump contactor.

APPENDIX 1 **INSTALLATION INSTRUCTIONS**

1.1 Hardware Installation

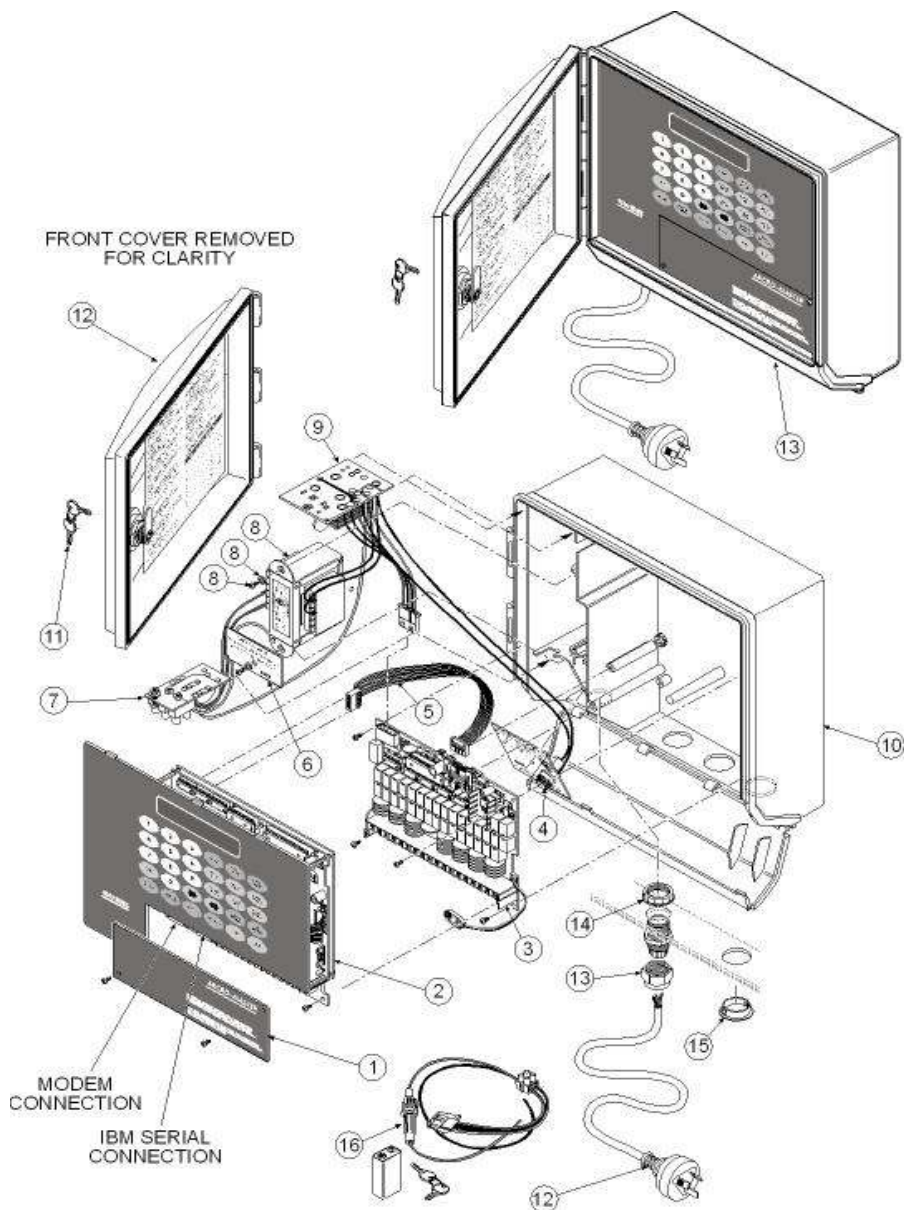
On the back of the controller is a “keyhole” shaped mounting slot as well as 3 mounting holes along the bottom edge. Access to the 3 mounting holes is from the front behind the bottom cover plate.



When attaching to wall studs use a No. 10 self tapping screw and leave approx. 6mm of the head exposed to slip into the “keyhole slot. To secure and stabilize the controller, drive additional screws through the bottom mounting holes.

NOTE: When mounting the controller to a sheet metal wall, it is essential to mount timber mounts to the wall first and then mount the controller to the timber. This prevents high temperatures being conducted to the controller.

3. CONNECTING VALVE WIRING



1. Open cabinet door.
2. Remove bottom right hand panel(labeled as 1) by unscrewing the two Phillips head screws.
3. Lower the bottom flap-door (13) of the controller.
4. Remove one (or more if necessary) of the hole plugs in the base of the cabinet.
5. Route the cables for each valve through the hole in bottom of the controller cabinet. Insert each lead under the appropriate screw on the terminal block. If there are multiple common wires, they should be connected into one common wire and attach to either of the terminals marked "COM".

Note: Use a cable sealing gland similar to the one used for the 240VAC power lead, to help seal the field wiring entry hole in the cabinet.

6. When complete, push bottom flap back into place and restore the bottom right hand panel. Always keep the cabinet door closed.

4. EARTH STAKE (12 Volt DC Operation only) Do not connect Earth when 240VAC

The MicroMaster 4500 Series controllers have a high level of field surge protection. (6500 amp 20usec). For this to work, effectively, a good low resistance earth path must be provided to shunt the surges. In severe lightning areas a *2 metre earth stake* connected to the *E (Earth Stake)* terminal on the right of the terminal block can be used.. (Use multi-strand 4-6mm wire.) Ensure soil around the earth stake is kept moist to create a good earth..

5. STANDBY BATTERY

The Standby Battery is a 9v alkaline MN1604 miniature Battery. This will give approx 100 hours of standby time. The alkaline battery is essential in high temperature conditions as they have a shelf life of approx. 5 years at 40 degrees celcius. In the long term, an alkaline battery will be more reliable and cheaper than an equivalent Ni-Cad battery. They are replaced every 1 to 2 years depending on the number of power failures in the area.

NI-CAD (Nickel Cadmium) batteries ***should not be used for 2 reasons.***

1. For a Ni-cad to be efficient, the operating cycle should be fully charged, then fully discharged. This is not the case for a Standby battery in an irrigation controller.
2. Poor operation in a high temperature environment. The capacity is only 20% of an alkaline cell and this is further reduced in high temperature environment.

The 216 standard carbon zinc battery should not be used because of very poor high temperature performance and low capacity.

12 VOLT DC OPERATION

The 4000 series controllers can be easily changed to operate on 12 VDC .

1. Remove the 4 way connector from the transformer
2. Plug in the 12 VDC adaptor plug .(labeled 9 in the above exploded Diagram)
3. Connect the RED lead to + 12 VDC
4. Connect the BLACK lead 0 VDC
5. Connect Earth stake per point 4 above.

APPENDIX 2 TECHNICAL SPECIFICATIONS

Main Input Power

240 volt 50 Hz single phase - Standard
 (110 volt - 60 Hz available on special order)
 12 volt DC (11 volt minimum - 16 volt maximum)
 Quiescent 12 volt input power 15 mA at 12 VDC
 (45 mA with one output relay and pump start relay activated)

Output Power

<i>Station Capacity :</i>	24 volt AC at 2.0 Amp max. 8 (2 watt valves). 12 volt DC at 2.0 Amp max.
<i>Pump Start Capacity</i>	24 volt AC at 1.0 Amp max. 12 volt DC at 1.0 Amp max.
<i>Total Controller Capacity</i>	24 volt AC at 2.0 Amp max. 12 volt DC at 2.0 Amp max.

Inputs

Function	<i>Reset, Hold, Auto Skip, ASTRT</i> (program A Start) , <i>BSTRT</i> (program B Start) , <i>PD</i> (door status)and <i>FLOW1</i> input
Input Impedance	47000 ohm
Operation	Normally Open contacts: Maximum loop resistance 300 ohm.

Alarm

Normally open contacts closing to ground for fault alarm.
 Alarm requires external power source (see ALARM output).
 Maximum voltage for external Alarm 30 VDC / 30 VAC
 Maximum current for external Alarm 1.5 Amps

Power Cable

AC Models supplied with " 2-core-and-E " circular cable and a 7.5 Amp three-pin flat-pin plug complying with Fig. 1a of Australian Standard AS 3112.
 DC Models supplied with 4 way bypass plug to supply external DC power.

Display

Two row by 24 character Liquid Crystal display. 5.5 mm high

Lightning/Surge Protection

<i>Mains</i>	Surge protection 2500 Amps surge for 20 microseconds.
<i>Valve Outputs</i>	Field surge protection 6500 Amps for 20 microseconds.

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inputs - Surge Protection 250 Amps surge 20 microseconds.
50 Hz induced Voltage 10 V RMS. Max.

Ambient Operating Conditions

Temperature -10~C to 65~C
Humidity Maximum 95 % non-condensing

Hardware

Processor CMOS Low Power Integrated circuit technology
Processor protection Varistor 1000 amp 20 usec, and secondary Transorb 1.5KE

Relays

Sealed, high-current (3 Amp) Gold Plated Silver alloy contacts

Fuse

Type 24 volt AC. 3 Amp (in-line housing)
Size 20 x 5mm - 3 AG
Internal over load Protection triggers at approx 2.5 Amp and Auto Skip

Standby Battery

Type Miniature 9 Volt alkaline MN1604B
Life 100 hours standby (nominal)

Cabinet

Lockable, weather proof,

Dimensions 300 x 220 x 130mm

Mass 5.5 kg

Main Components

Transformer Arlec type TFD 62570
Input/Output Connectors Maximum conductor size 2 X 6mm per terminal.
Key-Pad/Front Panel 6 x 5 (30) key totally sealed, poly-carbonate, scratch.
resistant with built in electrostatic shield.
Logic Board (Front) mounted on rear of front key-pad panel.
Output Board (Rear) mounted to base of cabinet. with output connectors.
Logic and output boards interconnect by 14-way flat ribbon polarised connector.

*Reference to specific products, services or companies in this publication does not imply endorsement or specific recommendation of any product, service or company.

APPENDIX 3 FAULT FINDING

Problem	Possible Cause	Correction
Wrong Time of Day	A power failure has occurred and the Battery was flat	Set the time and replace Battery if required
Will Not Start an Irrigation Program	Check cycles/Day Table Check Rain Switch Check the Start Time Check WaterBudget	Refer programming sheet and program.
Irrigation Time is Shorter Than Programmed Irrigation Time is Longer Than Programmed	Check WaterBudget Auto Skip Fault has occurred Check Runtimes Power failure has occurred during irrigation. Check Run Times Check WaterBudget A HOLD occurred during irrigation	Re program Check fault table Re program
Display Indicates Irrigation in Progress but Pump and Valves are not switched ON	Faulty Fuse Faulty wiring or valves	Replace fuse Check wiring & valves.

HINTS

Checking field wiring and valve currents

The fuse is only common to the field wiring, and if it “blows”, it is not caused by the controller logic. To investigate the cause of the fuse “blowing” open the fuse holder and connect in series an AC current meter with a current range of at least 10 Amps. With the meter in place, press **MANUAL VALVE** Note the current and enter the values into the commissioning sheet below together with the wire color. (if a radio control valve then enter the RadioMaster address) . Press → to advance through the stations until the suspect station(s) are found .Then check the wiring and valves to that station. Valve boxes full of water can create high current shorts across valve wiring joints during irrigation.



Suspect Valve outputs

Whenever a valve output is suspected of a malfunction, carry out the **Checking field wiring and valve currents** and compare with the valve current

MICROMASTER 4500 CONTROLLER VALVE OUTPUT COMMISSIONING SHEET				
STATION NUMBER	VALVE LOCATION	VALVE CURRENT	RADIOMASTER ID CODE OR WIRE COLOUR	COMMENTS
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
PUMP START				

readings taken during the initial commissioning. If more than 1 valve comes on at a time, disconnect the wires from the outputs and check the voltage at these outputs. The voltage must be over 24VAC to be a valid voltage. e.g. if the voltage on an output terminal measured 7 - 16VAC, with a valve connected, then the result of this test would indicate that there was an open circuit in the valve solenoid or a broken wire.

For the pump start wiring, a good practice is to operate a small relay (OMRON LY2 or equivalent) which has a 24 VAC at 50 mA coil and 240 VAC at 5 Amp contacts. These contacts can switch a contactor with a 240 VAC coil of almost any size.

Voltage readings on unused Valve outputs

The 24VAC is a floating output. I.e. it does not have any reference to Gnd. The following readings are normal.

When no valves are operating, the voltage between **Com** to **unused stations** is approx. 7VAC

When one or more valves are operating, voltage between **Com** to unused stations is approx. 16VAC.

This is due to the feedback through the surge protection devices.

The surge protection devices have a very high impedance to normal voltages.

Therefore no current can be sourced from these outputs under these conditions.

When a standard solenoid is connected across these inputs the voltage will be **0VAC**.

The varistor surge protection devices will change to a very low impedance only under over-voltage surge conditions in excess of 50VAC.

Sensor Information and Calibration

MicroMaster Sensor Inputs	Calibration or Sensor Function	Comments
Irrigation Flow (Flow 1 input)		
Rain Bucket Input (Flow 3 input)		
External program A Start		
External program B Start		
Hold Input		
Auto-Skip Input		
Reset Input		
Door Status Input		
Alarm Output		
Communications		
RadioMaster OR		
RS232 Direct OR		
RS485 OR		
Telephone Modem OR		
GSM Modem		

APPENDIX 4 **GLOSSARY OR TERMS**

<i>PROGRAM</i>	A combination of entered numbers to determine the time when irrigation will start, the time watering will occur for and the days this irrigation will occur.
<i>RUNTIME</i>	The time a valve is switched on for irrigation to occur.
<i>START TIME</i>	The time of day when irrigation will start.
<i>STATION</i>	A controller output to connect a valve to.
<i>VALVE OUTPUT</i>	Same as station.
<i>AUTOSKIP</i>	A method of sensing a faulty station, switching it off, and skip to the next station.
<i>DIAGNOSTICS</i>	A method of testing controller functions if a fault is suspected.
<i>SENSOR INPUT</i>	An input to the controller to allow external sensors to have some control on the controller operation.
<i>SENSOR</i>	A sensor “senses” external conditions and operates a switch if a predefined condition is reached. Typical sensors are Pressure, Flow, Water Level etc..
<i>WATER BUDGET</i>	A percentage valve that will globally modify the runtime of all station Run times within a program.
<i>CYCLE</i>	A programmed irrigation from stations 1-16 or 1 to 32. Can be repeated using cycle repeats.
<i>CYCLE REPEAT</i>	Allows for cyclic watering. ie irrigate, allow time to infiltrate, and then apply more irrigation. 1 = 1 cycle of irrigation. 2= 2 cycles of irrigation etc.
<i>CYCLE DELAY</i>	If a cycle repeat value is greater than 1, a delay can be inserted between the cycles to allow water to infiltrate into the soil. Some times called “Cycle and Soak”.
<i>DAY OF WEEK</i>	The day of the week in a 14 day schedule.
<i>DEFAULT</i>	The Factory set program values within the controller when the controller is purchased. Can be reset to DEFAULT values using SETUP key and selecting CLEAR PROGRAMS.
<i>MANUAL</i>	Allows a single station to be started at any time.

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<i>WALK THROUGH PROGRAM</i>	Allows a start station , a finish station ,and a common Runtime to be entered, with a Manual start.
<i>SEMI-AUTOMATIC</i>	Allows a program (ie program A, B, C, or D) to be started at any time regardless of the programmed start times.
<i>RAIN SWITCH</i>	Allows the operator to switch off all irrigation without modifying any of the irrigation programs.
<i>PASSWORD</i>	A secret 4 digit code that prevents unauthorised operation of the controller.
<i>HOLD</i>	An input to the controller. When a contact closes across this input the irrigation will be “Paused” or “Suspended “ until the contacts open again.
<i>PAUSE</i>	During a power fail or HOLD input irrigation will be paused until the power fail or hold is removed.
<i>HOME SCREEN</i>	Controller display in normal time of day outside of irrigation cycle or manual operation.

NOTES