

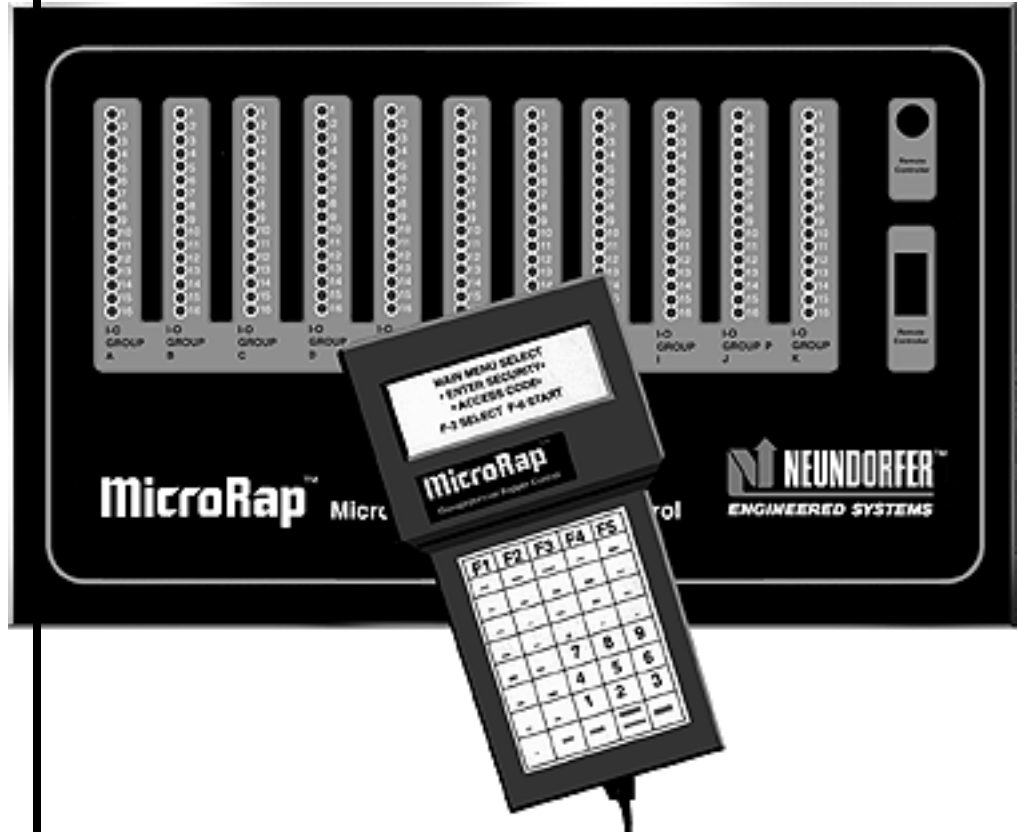


USER MANUAL

MicroRap™

MICROPROCESSOR RAPPER CONTROL USER MANUAL

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ADDENDUM

MICRORAP FIRMWARE UPGRADE TO VERSION 4.0

Upgrading MicroRap firmware to version 4.0 or later from version 3.x or lower may require changes to the user's rapping programs, because starting with version 4.0 there have been changes in the way all rapper types are energized. Version 4.0 also contains extensive revisions to enhance usefulness with tumbling hammer rappers.

All user program configuration settings and rapping programs should transfer correctly, with the exception of the rapper *on times*. MicroRap firmware version 4.0 or later requires POS version 5.513 or later for proper operator display and programming. Using MicroRap firmware to version 4.0 with POS versions preceding 5.513 will result in incorrect display of rapper *on times*. *On times* will be longer than displayed. If in doubt, use the MicroRap hand held programmers terminal to verify rapping programs.

If your rapping programs do not use *phase firing (intensity)* setting for impact rappers **and** do not use *on times* greater than 1.2 seconds for any non-impact rappers (Vibrators, NAVCO's, motor starters), then installing firmware version 4.0 or later will not require any changes to your rapping programs.

Starting with version 4.0 firmware, impact rapper energization only provides phase firing on the last half cycle of *on time* rather than for every half cycle. This means that if your old rapping programs use *phase firing* for impact rappers, and you do not revise those programs for version 4.0 firmware, **the lift heights will increase.**

With version 4.0 firmware, the *on times* for all non-impact rappers has been revised. This means that if your old rapping programs use *on times* greater than 1.2 seconds for any type of non-impact rappers, and you do not revise those programs for version 4.0 firmware, **the on times will increase, in some cases dramatically.** Table 1 below shows the effect of changing to version 4.0 firmware without revising the rapper *on times*.

Highlights of MicroRap firmware 4.0:

General Revisions

- Revised Impact rapper *on time* settings to provide fractional half cycle settings.
- Eliminated *phase firing (intensity)* setting for impact and NAVCO rappers.
- Revised *on times* for all non-impact rappers
- Ability to accept and run a transient, time-limited program form POS known as Specialized Rapping.
- Ability to perform on-the-fly program switching without restarting at the beginning of each field.
- Ability to automatically detect and adjust to POS baud rate.
- Corrected cause of lockup that sometimes occurred on brief power losses.
- Provide program continuation rather than restart on brief AC power losses.
- Revised program for hand held programmer's terminal to accommodate new v 4.0 features.

For Tumbling Hammer Rapper Motor Starters

- Provide long *on times* for all non-impact rappers up to 8 hours, with a final selection that is always on.
- Provide a *disabled AG* setting that will allow all fields with *disabled AG* to run simultaneously. Outputs sequentially turn on at 1/2 second intervals to minimize starter inrush current loading.
- Increase the maximum number of *simultaneous non-impact rappers* from 12 to 16.
- Dynamically adjust allowed *simultaneously non-impact rappers* based on number of active Impact rappers.
- Using AUX outputs, the MicroRap can now directly control up to 32 motor starters and run them simultaneously, if desired, using as few as 8 program fields.



Details of new and changed features

- **Revised Impact rapper *on time* settings.**

Replaced integral half cycle *on time and intensity (phase firing)* setting with an energization scheme providing full power half cycles of *on time* with a final half cycle of reduced power to achieve *on time* settings between integral half cycles. The operator's interface for impact rapper *on times* is revised to remove the *intensity* setting and provide *on times* adjustable in 0.2 HCY increments from 0.2 HCY through 50.0 HCY.

- **Eliminated phase firing (intensity) setting for impact and NAVCO rappers.**

Intensity setting has always been ignored by the MicroRap for NAVCO rappers and has now been removed from the user interface display. **Intensity** is no longer a defined setting for impact rappers.

- **Revised *on times* for non-impact rappers.**

The non-impact rapper *on time* lookup table has been completely revised to provide significantly longer *on times*. Following table 1 provides some examples of old and new settings

Old <i>On Time</i>	New <i>On Time</i>
1.2 sec	1.2 sec
2.0 sec	2.8 sec
5.0 sec	11 sec
10 sec	60 sec
21 sec	4 min
50 sec	22 min
100 sec	90 min
3 min	4.5 hr
3.8 min	8 hr
3.9 min	Always on

Table 1: Revised Non-Impact Rapper ON TIMES

- **Provide a disabled AG setting.**
- Disables anticoincidence for selected fields so they may run independent of all other field rapping activities. This is useful for tumbling hammer rappers where it may be necessary to operate multiple field motor starters simultaneously.
- A new anticoincidence selection is added to the operator interface, which is displayed as 'DIS' or 'Disabled'.
- **Increased the maximum number of simultaneous non-impact rappers from 12 to 16. Scope - All**
- Provides an increase in the number of non-impact rappers that may be active at the same time. This is particularly useful for tumbling hammer rappers where it may be necessary to operate many motor starters simultaneously.
- The operator interface for setting this configuration item has been revised to allow settings of 1 through 16 rather than the previous range of 1 - 12.
- **MicroRap Specialized Rapping (Program Number 10).**
- Program \$0A is considered an operating override with a defined lifetime from POS, and as such is implemented in a fail safe way that will assure timely resumption of the normal rapping program if POS fails.
- When program 10 is started, and the departing program is number 1-6, the departing program will be suspended so that when program 10 is abandoned, the previous program (1-6) will resume where it was when program 10 first started. POS can start or restart program 10 indefinitely without defeating the resume feature. Transition from program 10 to any other program number will be treated as a seamless transition from the last non-program 10 running before program 10 started to the newly selected program.



- **MicroRap “On The Fly” Seamless Program Switching.**
- Starting with version 4.0a MicroRap firmware data link ordered **Restart** and **Program Selection Change** commands will be handled differently than those ordered via the front panel switch.
- Program **Restart** and **Program Selection Change** commands requested by the front panel switch will function as it always has. That is, the newly selected program will always start at its beginning.
- **Restart** and **Program Selection Change** commands requested over the data link will analyze the departing program and the new program for similarity and make as seamless a transition as possible between the two following the rules below. In the case of a transition from program 10 to program 1-6, the analysis and transition will be made between the suspended non-program 10 and the newly selected program. POS will no longer have the ability to force a restart of a rapping program from its beginning.

Replacing the MicroRap EPROM Chip

1. Turn OFF the system power.
2. Remove the MicroRap card cage front panel.
3. Disconnect the ribbon cable from the CPU card in the right most card slot.
4. Remove CPU card from the card cage.
5. Locate existing firmware chip in socket U18, and carefully remove it.
6. Insert the new firmware chip in socket U18. (Align the notch with notch end of the socket.)
7. Replace the CPU card in the cage and reassemble the MicroRap system.



1.0 IMPORTANT OPERATIONAL NOTES

1.1 Remote Program Selector Switch Jumpers

! CAUTION !

For CPU boards with silk screen designation "PCB NO. 801340-021 REV A" on the component side of the board above connector J4, placing JMPR4 in position 1-2 can cause severe board damage. If the CPU board is being configured for a remote program selector switch operating on 120V, DO NOT insert jumper JMPR4 into position 1-2. Instead, remove and discard the jumper. IF IN DOUBT, discard JMPR4 when configuring for 120 Volt operation. Inserting JMPR4 into position 1-2 and applying power to the remote selector switch, will cause damage to the circuit board. CPU boards shipped after May 20, 1992, have been modified to eliminate the possibility of damage.

1.2 Terminating Resistor Networks

The ribbon cable connecting the system PC boards together is terminated at its physical ends by resistor networks for maximum reliability in high electrical noise environments. The CPU card in the right most card slot has these terminating resistors soldered into the board. All other cards have socket provisions adjacent to the ribbon cable connector for the terminating resistor networks. The two resistor networks must be installed in the card occupying the left most card cage slot, and only in that card. Notice that the resistor networks have an identification on the pin 1 end of the pack, which must be installed into the designated pin 1 of the socket. Pin 1 of both resistor networks should face up towards the top of the board when installed in the card cage.

MicroRap systems are shipped with the terminating resistors in the proper card slot. Changing the card in the left most slot will require removing the two terminating resistors and placing them into the card being put into the left slot. Make sure that the two resistor networks are removed from any card not in the end slot.

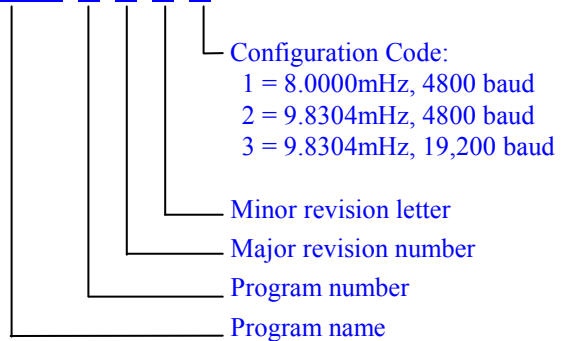
1.3 Changing CPU Boards

When changing CPU boards, the EEPROM integrated circuit in socket U16 containing the site specific rapping programs must be removed from the old CPU board and placed into the new CPU board. When powering up the new CPU board, the System configuration information, excluding the rapper data, must be reentered, since this information is stored in the microcomputer chip.

1.4 Firmware Identification

Firmware chip labels are identified as follows:

NMRAP 3 . 3 A 1



When the programmer's terminal is connected, a copyright message including software identification message following the above format will be displayed as the opening screen. There is a three second delay between the terminal self test and the appearance of the software identification screen to accommodate variations in terminal interface design.



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1.5 Program Selection on Power Up

When the MicroRap is powered up it will attempt to locate and execute a valid rapping program using the following logic:

If the program indicated by the front panel selector switch exists, the MicroRap will execute the indicated program.

If the program indicated by the selector switch does not exist or if the program selector switch is set to 0, 7, 8, or 9, the MicroRap will begin executing the program it was using when power went down. If the program in use when power went down is no longer a valid program, the MicroRap will sequentially examine programs 1 through 4 and will execute the lowest numbered valid program from that group. If no valid program can be found the MicroRap will not resume rapping. The alarm output will remain activated until cleared by an external acknowledgment.

1.6 Configuring Terminal Interface

The front panel programmer's terminal interface can be configured to operate the standard hand held programmer's terminal or it can communicate with a local computer running the Rapper Control Programming Module of POS.

Applying power with the Program Selector switch set to position 7 configures the RS-232 port to communicate with the hand held programmer's terminal. Applying power with the Program Selector switch set to position 8 configures the RS-232 port to communicate with a POS computer. Applying power with the switch in any positions other than 7 or 8 retains the previous configuration.

If the control will not talk to the programmer's terminal, first power up the system with the Program Selector switch set to position 7. If that does not resolve the problem, see [section 2.7](#) to set the proper terminal setup parameters.



2.0 HARDWARE

The MicroRap hardware typically includes electrical components mounted on a back panel, usually mounted in an enclosure. Figure 1 shows a typical layout of a MicroRap back panel with major components identified. The electrical components include fuses, contactor, rectifiers, current limiting resistors, terminal strips, control chassis with circuit cards, and a hand held programmer's terminal. The following sections describe these components.

2.1 Fuses

There are two to four fuses mounted on the MicroRap back panel. First is a one amp fuse for the logic power supply and the zero cross signal to the CPU board. The second is a 5 amp fuse for the contactor, power indicator, and optional auxiliary outputs. The third and fourth fuses are 30 amp fuses for rapper outputs. The 30 amp fuses and the contactor are not used if all outputs are low current. In that case, the rapper outputs are powered by the 5 amp fuse.

2.2 Contactor

The contactor is used to connect or disconnect the power from the MicroRap control. The contactor has a 120V coil and two sets of contacts. It is operated by the front panel On-Off switch. There are no auxiliary contacts on the contactor.

2.3 Current Limiting Resistors

Resistors are included on the MicroRap back panel to prevent short circuit conditions from clearing the main fuses and to limit surge currents on shorted outputs to safe values. These resistors allow the control to sense over current conditions and disable the outputs immediately.

2.4 Rectifiers

Rectifiers are only included on rapper controls with DC outputs. Rectifiers are rated at 90 amps.

2.5 Terminal strips

Terminal strips are provided for making field connections to the rappers. All customer connections are made on the terminal strips.

2.6 Front Panel

The chassis includes a front panel for protecting the electronic components in the chassis. It also provides indication for all of the outputs on the output cards. The outputs are labeled 1 through 16. These numbers correlate to the addresses used in programming the rappers and auxiliary outputs.

2.7 Hand Held Terminal

The MicroRap usually includes a hand held programmer's terminal for creating and editing user rapping programs. It has an RS-232 serial interface to the MicroRap CPU card. Proper operation requires that the hand held terminal be set up properly. Enter the set up mode on the hand held terminal by pressing the CONTROL, SHIFT and F1 keys simultaneously. Then follow the screen prompts. The settings for the hand held terminal are as follows:

```
BAUD = 4800
BITS = 7
PARITY = IGNORE
DISPLAY PE ENABLED
REPEAT = FAST
ECHO DISABLED
HANDSHAKE DISABLED
SELF TEST ENABLE
```



2.8 Control Chassis

The control chassis consists of a power supply, a CPU board and output cards. The chassis also includes interconnection cables consisting of data and logic signals through a ribbon cable on the front and power connections on the back of each output card.

2.8.1 Power Supply

The power supply is powered from 120V AC. It has a single 5V output with a nominal rating of 4 amps at 80°C.

2.8.2 CPU Board

The CPU board includes a micro-controller and logic circuits to operate the output cards. It also includes nonvolatile memory for program storage, which allows permanent memory of all program settings and the ability for the control to automatically power up when it receives power. The CPU board has a program select switch, an RS-232 receptacle for the hand held terminal or POS computer connection, and a ribbon cable interface connector to the output cards. Auxiliary I/O devices provide alarm relays and opto coupled inputs.

2.8.3 Output Cards

Output cards have indicators on the front that are illuminated when an output is active. If an indicator remains illuminated, it signals an over current or undercurrent condition. Normally, indicators are only illuminated during the actual operation of the output.

There are a variety of output cards for different types of applications as shown in Table 1. Outputs can be either AC or DC for 120V or 240V operation. A wide range of current ratings is available for each type of output. The output card power connections have a keying system that prevents the wrong type of output card from being inadvertently plugged into a slot. Output cards are also individually fused at the point of power entry with one fuse on AC cards and two fuses on DC cards.

Each output card has an address selection switch and jumpers. The rotary address selection switch is a sixteen position switch labeled with digits 0 through 9 and letters A through F. This address should correspond with the address used in programming the rapper control. Typically, output card 0 will be installed in the left most slot and the output addresses will increase going towards the right.

Jumpers JMPR1 and JMPR2 must be installed on rapper output cards and removed if a card is to be used for auxiliary or power off rapping outputs.

Each card also has a 5 position switch labeled 0 through 4 for selecting the current output level as shown in Table 1. The switch setting selects the level at which an over current condition will be detected.

The left most output card in the chassis at the end of the ribbon cable should include termination resistors that should be plugged into the sockets near the ribbon cable connector. These resistors are not required in all cases and may not exist in your particular system.

Some MicroRap controls have an expansion card cage with additional output cards. In this case, install the termination resistors in the card at the physical end of the ribbon cable.

2.9 Alarm Relays

The MicroRap can be built with up to two alarm relays. The System Fail alarm relay is energized when the MicroRap is running a valid rapping program and de energized at all other times.

The Rapper Fail alarm relay is energized when a user specified number of rappers has failed. See as built system drawings and section 4.2.4.



2.10 Auxiliary Digital Inputs

The CPU card has a total of eight opto coupled inputs that can accept 24 volt or 120 volt AC or DC signals. Four of the inputs are committed for the external program select switch described in [section 3.4.4.5](#). The other four inputs are described in the following paragraphs. Refer to sheet 6 of the CPU card schematic drawing 6-6010 for connection points. The as built drawings may indicate that some of these inputs are wired to the customer terminal strips.

Each input may be configured for 24 volts or 120 volts by proper placement of jumpers JMPR1 through JMPR8. Placing the jumper in the 2 to 3 position configures the input for 24 volts, while placing the jumper in the 1 to 2 position or removing it configures the input for 120 volt operation. The inputs have a full wave bridge rectifier and will operate on AC or DC.

! CAUTION !

For CPU boards with silk screen designation "PCB NO. 801340-021 REV A" on the component side of the board above connector J4, placing JMPR4 in position 1-2 can cause severe board damage. If the CPU board is being configured for a remote program selector switch operating on 120V, DO NOT insert jumper JMPR4 into position 1-2. Instead, remove and discard the jumper. IF IN DOUBT, discard JMPR4 when configuring for 120 Volt operation.

2.10.1 Reset Rapper Fail Alarm

Applying a signal to this input cancels the Rapper Fail Alarm. See [section 2.9](#).

2.10.2 Global AG input

The Global AG input receives the permissive for the global AG from the preceding control in the global loop. See [section 4.2.3](#) for complete information on the operation and wiring of the global feature.

2.10.3 DAUX1 Input

The DAUX1 input is assigned to clear the internal memory of the failed rappers. This action will clear the LED's on the output cards and will reset all rappers to the non failed condition on the data link status message to POS or a host computer. This input has never been used and may be reassigned to a different feature in the future.

2.10.4 Suspend Rapping Input

When AUX2 input is powered, the MicroRap will conclude the rap cycle for the rappers in progress and then suspend operation until the AUX2 input is deenergized.

2.11 Data Link

The MicroRap can communicate with a host computer or a Neundorfer POS computer to provide rapper status information and upload / download rapping programs. The front panel RS-232 connector can be reconfigured to communicate with a local computer running RCPM, the Rapper Control Programming Module of POS. See [section 1.6](#) for information on configuring the front panel RS-232 port. The normal data link is via RS-485 connections on the customer terminal strips.

Presently 4800 and 19,200 baud rates are available. The baud rate is determined by the firmware chip in the CPU card. See [section 1.4](#) for baud rate identification. The Neundorfer communications protocol document, available upon request to MicroRap owners, details all message protocols.

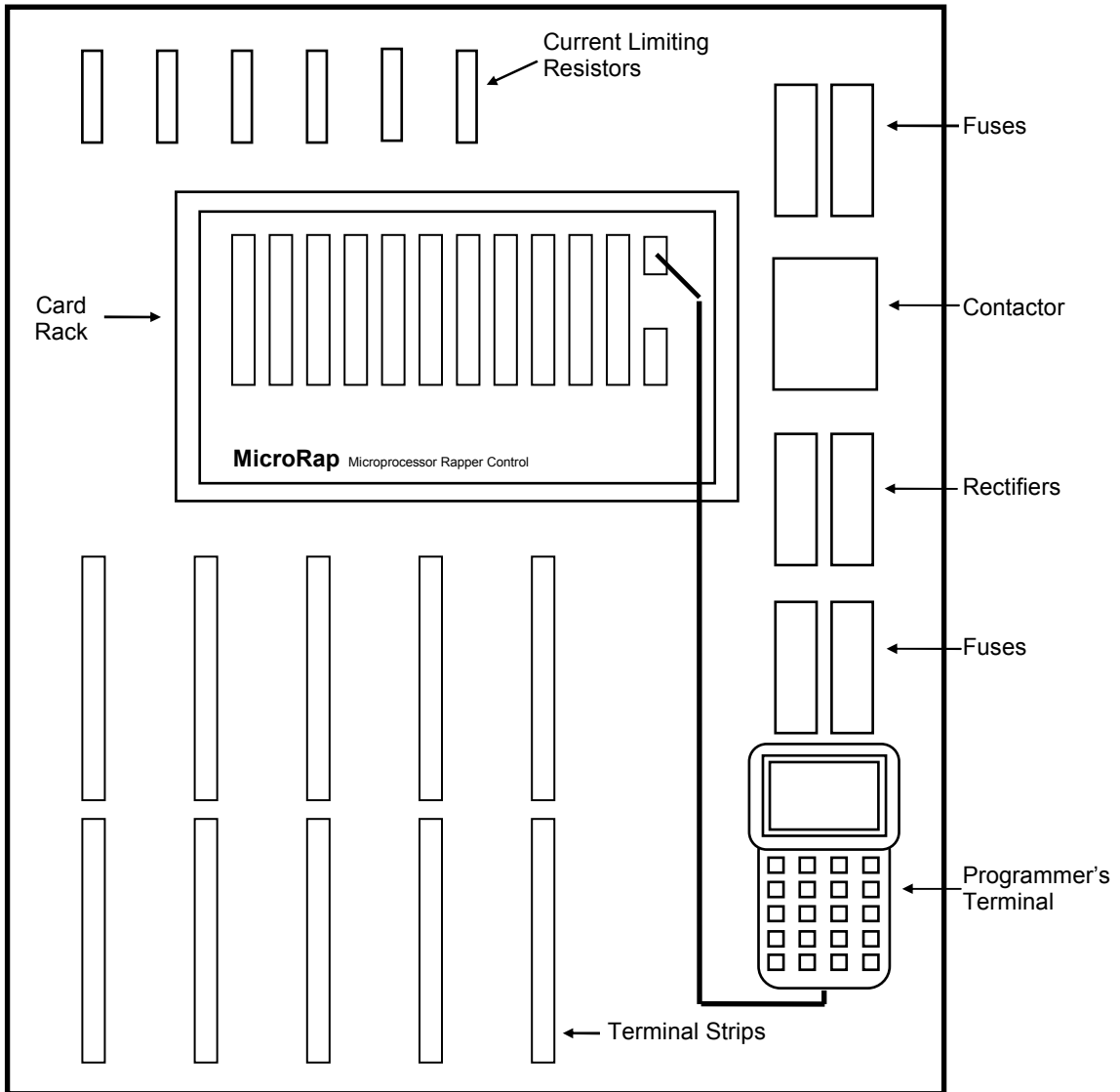


Figure 1 - MicroRap Panel Layout



Output Card Type	Application	Voltage	Assembly Number	Current Rating	Current Limit Settings	Key Position	Current Limit Resistor	Fuse Rating
AC very low Current	Auxiliary and POR outputs NAVCO Rappers Small Solenoid Valves or Relays	120	MR-C02	400 MA continuous	2.8 A 4.0 A 5.6 A 8.0 A 11.2 A	7	5.0 Ohm	3 A 250 V ABC-3
		240		400 MA continuous	1.4 A 2.0 A 2.8 A 4.0 A 5.6 A	7	10 Ohm	3 A 250 V ABC-3
AC Low Current	Motor Starters Contactors	120		3.75 Amp 2 seconds	2.8 A 4.0 A 5.6 A 8.0 A 11.2 A	7	5.0 Ohm	3 A 250 V ABC-3
		240		3.75 Amp 2 seconds	1.4 A 2.0 A 2.8 A 4.0 A 5.6 A	7	10 Ohm	3 A 250 V ABC-3
AC Standard Current	Electric Vibrators	120	MR-C01	25 Amp 2 seconds	28 A 40 A 56 A 80 A 112 A	3	0.5 Ohm	15 A 250 V MDA-15
		240	MR-C04	25 Amp 2 seconds	14 A 20 A 28 A 40 A 56 A	4	1.0 Ohm	15 A 250 V MDA-15
AC High Current	High Current Electric Vibrators	120	MR-C03	40 Amp 0.5 second	35 A 50 A 70 A 100 A 140 A	5	0.4 Ohm	15 A 250 V MDA-15
		240	MR-C05	40 Amp 0.5 second	17.5 A 25 A 35 A 50 A 70 A	6	0.8 Ohm	15 A 250 V MDA-15
DC Standard Current	Electric Impact Rappers	120	MR-C70	25 Amp 1 seconds	28 A 40 A 56 A 80 A 112 A	1	0.5 Ohm	15 A 250 V MDA-15
		240	MR-C70	25 Amp 1 seconds	14 A 20 A 28 A 40 A 56 A	1	1.0 Ohm	15 A 250 V MDA-15
DC High Current	High Current Electric Impact Rappers	120	MR-C71	50 Amp 0.25 second	35 A 50 A 70 A 100 A 140 A	2	0.4 Ohm	15 A 250 V MDA-15
		240	MR-C71	50 Amp 0.25 second	17.5 A 25 A 35 A 50 A 70 A	2	0.8 Ohm	15 A 250 V MDA-15

Table 1 - MicroRap Output Card Specifications



3.0 PROGRAMMABLE FUNCTIONS AND FEATURES

The MicroRap allows 6 different rapping programs to be set up in the control. Only one program, however, can be run at a time. Before programming a MicroRap there are a number of things to take into consideration. The following sections describe the factors involved with programming the MicroRap control.

3.1 Configuration

Configuration pertains mainly to the physical layout of the rappers in a precipitator or a portion of the precipitator.

3.1.1 Anti-coincidence

Anti-coincidence refers to the capability of the control to prevent two rappers in a designated portion of the precipitator from operating simultaneously. Anti-coincidence may be necessary to prevent opacity spikes due to rapping reentrainment. Global Anti-coincidence provides similar capabilities between multiple MicroRap controllers.

3.1.2 Fields

The term "field" applies to a set of rappers in the same physical field of a precipitator or some logical group. From the control point of view, a field represents a common set of timing and sequencing patterns for a group of rappers. Usually the control will be set up with one rapping field for each physical field of the precipitator plus one or more "fields" for the discharge electrodes.

3.1.3 Lanes

Lane assignments describe the position of rappers in the direction of gas flow. Lane anti-coincidence, when enabled, prevents simultaneous operation of rappers that are in the same gas passage or lane of the precipitator. Using lane anti-coincidence can reduce opacity spiking.

3.2 Rapper Data

Each output in the MicroRap control requires several setup parameters as listed below:

3.2.1 Output address

The output address is a code that identifies each output on the MicroRap control. The address is a three digit code with the first digit representing the address of the output card as selected on the card's rotary address switch. The second two digits refer to the output number as designated on the front panel of the rapper control. For example, the address 001 refers to the first output on output card 0. The address 016 represents the last output on that same output card. The next output in the system at the top of the next card would be represented as 101.

Auxiliary and POR output cards use the same address structure, but are located in a separate address bank by software and jumper JMPR1. The MicroRap can distinguish between rapper output cards and auxiliary/POR output cards by JMPR1. As a result there can be two cards in the system with the address switch set to 0, one being a rapper output card and the other being an auxiliary card. The control will operate both cards separately even though they appear to have the same address.

3.2.2 Rapper Name

The name of a rapper is a 5 character alpha numeric code. This can include any combinations of letters, numbers and other symbols. A name must be provided for each active output in the system.



3.2.3 Rapper Type

There are four rapper type choices:

MIGI selects phase fired DC outputs for electric impact rappers .

FWVIB selects phase fired AC outputs for full wave AC vibrators.

HWVIB selects phase fired AC outputs for half wave AC vibrators.

NAVCO is used for non-phase fired low current AC outputs.

3.2.4 Power Off Rapping

The POR output on a MicroRap is used to momentarily reduce or turn off the high voltage in a bus section being rapped. The power off rapping output informs the voltage control that rapping is occurring or about to occur in that section of the precipitator. The use of power off rapping requires an auxiliary output card. Several rappers in the system can be associated with the same POR output port. In this situation the voltage control will receive a signal whenever any one of these rappers is active. There is a timing parameter called POR lead which is used to cause the POR output to become active before the rapper actually operates. This allows time for the T-R voltage to drop before rapping occurs.

3.2.5 Auxiliary

Auxiliary outputs are similar in nature to POR outputs except that there is no lead time parameter for auxiliary outputs. In other words, an auxiliary output is active only during the interval in which the rapper is active. The auxiliary outputs are useful for operating a secondary air valve supplying a group of NAVCO rappers. The secondary air valve prevents a rapper from continuously operating if its valve fails open.

3.2.6 Lane

Lane number is used to establish the position of a rapper in a particular gas passage. All rappers in the gas passage from inlet to outlet field should share the same lane number. This allows lane anti-coincidence to be used.

3.3 Field Setup Data

Each program in the MicroRap control consists of the field setup data and rapping sequence data. The field setup data includes timing parameters for all of the rappers in a particular field. The sequence data describes the actual order in which rappers will be activated along with rapping duration and intensity. These features are described below:

3.3.1 Repeat Time

The repeat time refers to the amount of time from the start of rapping in the field until the time when that field will start rapping again. Repeat time can be specified as either a minimum or an average interval. If the field repeat time is set to average, the MicroRap will attempt to catch up if it falls behind in the rapping sequence by using the minimum rap interval instead of nominal and by shortening the dead time between the last and the first rapper in the field.

If the repeat time is set to minimum, the control may recover lost time during the same cycle through the field by using the minimum rap interval, but it will ensure that the elapsed time between successive activations of any particular rapper in the field will not be less than the field repeat time.

Anti-coincidence considerations can cause rapping to fall behind schedule.

3.3.2 Rap Interval

Rap interval is the amount of time from the start of a particular rapper in a field until the next rapper in that field begins to operate. For example, if the rapping duration is set to three seconds, and the rap interval is set to 15 seconds, there will be a 12 second period between when one rapper shuts off and the next one turns on in a particular field.

There are two values for the rap interval – nominal and minimum. The nominal rap interval will be used as long as the control does not fall behind in the rapping schedule. If the control does fall behind, it will use the minimum rap interval in an attempt to make up lost time.



3.3.3 Interleaved Anti-coincidence

This feature allows two or more fields in the same Anti-coincidence group to be rapped concurrently, while preventing simultaneous rapper operations. When the interleave function is disabled, each field in a group will be rapped to completion before the next field in the same group is started. For example, if fields 1, 2, & 3 were all in the same group and the interleave is disabled, field 1 will rap all the way through followed by field 2 and finally by field 3. If the interleave function is enabled with a particular interleave interval, the rappers in fields 1, 2 & 3 will alternate operation as dictated by each field's timing parameters. The control will ensure that the amount of time specified as the interleave interval elapses between the operation of any two rappers in different fields assigned to the same anti-coincidence group.

If interleaved anti-coincidence is used for some, but not all fields in a particular anti-coincidence group, the field(s) set for interleaved relinquish the anti-coincidence group after each rapping event. Another field that is not set for interleaved may obtain the AG and rap to completion before allowing the interrupted interleaved field to resume rapping. Careful use of this feature can be beneficial, while inadvertent use can cause seemingly mysterious rapping patterns.

3.3.4 Lane AG

The Lane AG interval is the minimum amount of time that will elapse between the operation of any two rappers in the same lane. If lane AG is disabled, the lane number will be ignored.

If lane anti-coincidence is used, it is sometimes advantageous to program adjacent fields to rap in opposite directions across the precipitator. This allows fields to pass each other rather than a faster field becoming caught behind a slower field due to the lane wait time restriction.

3.3.5 Multiple Impact

In some cases electric impact rappers are operated such that each operation is actually several impacts in a row. The number of impacts and the frequency of impacts when they occur can be selected for

each field. If the rappers in this field are not of the impact type, the setting for impacts and frequency will be ignored.

3.4 Rapping Sequence

For each field, the rapping sequence contains a list of the rappers to be operated along with the rapping duration, the intensity and other parameters.

3.4.1 Leading & Trailing Edge Rapping

In some cases it may be desirable to operate two rappers at the exact same time in order to rap a collecting plate assembly on its leading and trailing edge. This function is enabled by selecting the dual output setting in the rapping sequence. When dual rapping is enabled, two rapping sequence steps are executed simultaneously.

3.4.2 Power Off Rapping

Each step in the rapping sequence allows power off rapping output associated with the rapper to be enabled or disabled. Power off rapping is described in detail in previous sections.

3.4.3 Rapping Intensity

For electric rappers the rapping energy is adjusted by a combination of output duration and the intensity setting. The intensity setting adjusts the conduction angle of the phase-fired output. 100% intensity specifies full conduction during each half cycle of operation. For impact rappers, the duration is the number of half cycles the output will be on. For vibrators, the duration is set in seconds.

For magnetic impact rappers the intensity setting provides fine lift adjustment between discreet half cycles of on time. For example, if 9 half cycles of conduction at 100% intensity is not enough lift height, but 10 half cycles is too much, set the duration to 10 half cycles then reduce the intensity.



3.4.4 Running a Rapping Program

There are a variety of factors that affect the actual operation of the rapping program. These factors are described below:

3.4.4.1 Program Selector Switch

The MicroRap control can store 6 programs in nonvolatile memory. The selector switch on the CPU card is a means of selecting a program to be executed. Note that the switch allows position 0 through 9 although positions 1 through 6 are the only valid rapping program select positions. If the switch is used to change programs while a program is running in the control, there will be a delay of about 5 seconds before the new program begins. If the switch is not set to 1 through 6, or if the selected program is invalid, the control will continue to execute the current program.

Selecting position 7 will reset the failed rapper alarm relay. Code 8 will clear all of the failed rapper LED indicators. The same 5 second delay is required for these functions. After the selected function has taken place, return the program select switch to indicate the rapping program in use.

3.4.4.2 Power up Program Selection

When the MicroRap is powered up it will attempt to locate and execute a valid rapping program using the following logic:

If the program indicated by the front panel selector switch exists, the MicroRap will execute it.

If the program indicated by the selector switch does not exist or if the program selector switch is set to 0, 7, 8, or 9, the MicroRap will begin executing the program it was using when power went down. If that program is no longer a valid program, the MicroRap will sequentially examine programs 1 through 4 and will execute the lowest numbered valid program from that group. If no valid program can be found the MicroRap will not resume rapping.

3.4.4.3 Editing the System Configuration

Editing the system configuration can only be done with rapping halted. After editing the system configuration, save the changes and return to the main menu on the hand held terminal to resume rapping. The MicroRap will restart at the beginning of the currently selected program.

3.4.4.4 Program Editing

Rapping programs can be edited while the control is operating without disrupting the program that is running. If you edit the program that is currently running, the changes made during the editing session will not take effect until external events cause the MicroRap to restart that program.

If, for example, program 1 is running and you choose to make changes to it, even when you save the changes the old timing and sequence parameters will continue to be active. The changes that you make to the program will not become active until you restart the program by moving the selector switch to another valid program selection for more than five seconds, cycling power to the control, or by editing the system configuration. These actions cause the control to restart the program, which will then use the recent changes to the program.

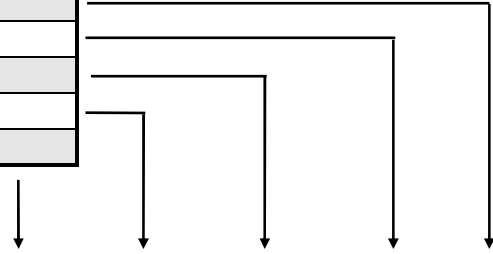
3.4.4.5 Program Select Inputs

The Microprocessor board has a set of four inputs that can be used to remotely select a rapping program. These four inputs can be coded as shown in [Table 2](#) to select the operating program in the MicroRap and perform the functions described in [section 3.4.4.1](#) for codes above 6. The inputs can be jumper selected to operate on 120V or 24V, AC or DC.

The MicroRap will only recognize the program select inputs when the front panel switch is in position "0". If both the front panel and external program switches (if connected) are set to 0, the MicroRap will respond to program select commands from the data link.



Signal Name	CPU Board Conn-Pin	TB-12 Term Up to 3/21/05 production date	TB-12 Term After 3/21/05 production date
Select Common	J4-A6, J4-C6	12	15
Select - 1	J4-A2	13	16
Select - 2	J4-C2	14	17
Select - 4	J4-A4	15	18
Select - 8	J4-C4	16	19



Function	BCD Code	Connected To				
		Open	Open	Open	Open	
Enable Program Select from Data link	0	Open	Open	Open	Open	
Select Program 1	1	Open	Open	Open	V+	V
Select Program 2	2	Open	Open	V+	Open	
Select Program 3	3	Open	Open	V+	V+	C
Select Program 4	4	Open	V+	Open	Open	O
Select Program 5	5	Open	V+	Open	V+	M
Select Program 6	6	Open	V+	V+	Open	M
Reset Rapper Fail Alarm	7	Open	V+	V+	V+	O
Clear Failed Rapper Status	8	V+	Open	Open	Open	N
Undefined	9	V+	Open	Open	V+	

Table 2 - Remote Program Select Connections

Notes:

- 1) V+ is the source voltage for the remote program select switch. It can be 24 Volts or 120 Volts, AC or DC.
- 2) V Common is the return or common side of V+.
- 3) Jumpers JMPR4 through JMPR11 on the MicroRap CPU card must be installed in position 2-3 for 24 Volt operation and must be placed in position 1-2 or removed for 120 Volt operation.

! CAUTION !

For CPU boards with silk screen designation "PCB NO. 801340-021 REV A" on the component side of the board above connector J4, placing JMPR4 in position 1-2 can cause severe board damage. If the CPU board is being configured for a remote program selector switch operating on 120V, DO NOT insert jumper JMPR4 into position 1-2. Instead, remove and discard the jumper. IF IN DOUBT, discard JMPR4 when configuring for 120 Volt operation.



4.0 CONTROL SETTINGS & PARAMETERS

4.1 Security Access Code

The Security Access Code is a combination of six (6) letters, numbers or special characters that are used to control access to the settings of the MicroRap Control. When the Security Access Code is not used, the Terminal will show the values of settings, but will not allow any of them to be changed. Any changes to settings require that the six digit Security Access Code be entered. Once the Security Access Code is entered, menus are provided to cancel or change it.

4.2 System Configuration

System Configuration is a group of system wide settings and definitions that control the overall operation of the system.

4.2.1 Line Frequency

Selections are available for 50 or 60 Hertz.

4.2.2 Data Link

The Data Link address is used by a Neundorfer POS computer or other host computer to access a specific MicroRap on the network. Each MicroRap is assigned a unique address. The address can be set from 1 to 254.

4.2.3 Global AG

MicroRap firmware version NMRAP3.3 and later provides the Global Anti-coincidence Group function. Global anti-coincidence establishes an anti-coincidence network between two or more MicroRap controllers.

The Global AG configuration can be set to MASTER or SLAVE. One controller in the global network is set to MASTER and all others are set to SLAVE.

Fields assigned to the Global AG in each controller will be interlocked with all other controllers in the global network so that only one Global AG assigned field can be active at a time. This is particularly useful in installations where more than

one MicroRap controller is operating outlet field rappers served by a common stack.

Global rapping permission is managed by the designated master and is granted in a circular direction around the network starting with the controller electrically following the one that has just finished rapping. The interleaved rapping choice on the field setup menu is ignored for fields assigned to the Global AG. Global AG fields will always run non interleaved.

If the Global AG link is broken, or a control is shut down, all other controls will sense the loss of the Global AG link and will rap as if the global permissive is always true

Lane anti-coincidence is a non global function. Fields assigned to the Global AG will obey lane anti-coincidence programming within that controller, but there is no lane anti-coincidence between MicroRap controllers.

Fields assigned to the Global AG operate in AG number 1. Other fields in the controller may be assigned, if desired, to AG number 1 without being assigned to the global group. This allows the Global AG fields to also maintain anti-coincidence with other fields in the same controller that are not in the global group.

Global AG OUT is powered by wiring 120 VAC to J4-C22 or C24 of the MicroRap CPU card. A pair of wires connects Global AG OUT at J4-A26 and controller AC neutral to the Global AG IN terminals J4-A12 and J4-C10 of the next control in the loop. The Global AG OUT of the last control is wired back to the Global AG IN of the first control (usually the global master).

MicroRap CPU boards with serial numbers lower than 167 may require a minor modification to the Global AG input circuit.



4.2.4 Alarm Failures

This setting is used to control the number of failed rappers that will trigger an alarm signal. This can be set from any value 1 through 255. Setting a value of zero will cause continuous alarms.

4.2.5 Failed Rappers

This selection can be designated as Retry or Skip. The Skip selection causes a shorted rapper to be eliminated from the rapping sequence. The Retry selection attempts to operate the shorted rapper each time its turn comes in the rapping sequence. The system will always retry open circuit rappers each time they occur in the rapping sequence.

4.2.6 Maximum MIGI/Vibration On

This selection is used to determine the maximum number of phase-fired output devices that can be on at one time. This selection can be any number from 1 through 6. This setting should be made so as not to overload the power supply transformer.

4.2.7 Maximum NAVCO

This selection is used to determine the number of low current non phase fired output devices that can be on at the same time. This value can be set from 1 through 12. The limiting factor will usually be the available air supply.

4.2.8 Number of Fields

This number determines the number of individual fields in the rapping program. This can be selected from 1 through 16. This setting determines the number of fields available for editing on the programmer's terminal. It does not limit the number of active rapping fields. If a field is made active and then this setting is reduced below the number of the last active field, the inaccessible field will continue to operate. This can cause unexplained rapping patterns.

4.2.9 Field Names

Each field has a name that is up to six alphanumeric characters long. It is not necessary to set the name, but it can be used as a convenient reference.

4.2.10 Rapper Data

Rapper Data include the following items:

- The **name** of the rapper, which is a five character alphanumeric name.
- The **address** of the rapper, which is from 001 through F15.
- **POR** designates the Power Off Rapping Output Address. This can be set from 001 through F15.
- **AUX** indicates the auxiliary output, which has an address from 001 through F15.
- **LANE** is used to designate the lane number for anti-coincidence. This value can be set from 1 through 48.
- The **TYPE** of the rapper can be one of the following four types:

Half Wave Vibrator
Full Wave Vibrator
Impact
NAVCO



4.3 Rapping Programs

Six different Rapping Programs can be stored in the Rapper Control. The active program is selected by the digital switch on the front panel, an optional external selector switch, or from the optional POS computer. Every rapping program may have unique Field Setup parameters and Rapping Sequence for each field. Therefore, each of the settings described in sections 4.3.1 and 4.3.2 will be duplicated for each field of each program in the Rapper Control.

4.3.1 FIELD SETUP

4.3.1.1 Anti-coincidence

Each field is assigned to an anti-coincidence group (AG) which can be selected from 1 through 6 or global anti-coincidence which also is in AG-1.

4.3.1.2 Interleave

The Interleave parameter can be set from 0.5 through 63.5 seconds in 1/2 second increments. It sets a minimum time interval between rapping two rappers in different fields that are in the same interleaved AG. This function can be disabled.

4.3.1.3 Lane Wait

Lane Wait parameter, like the Interleave, can be set from 0.5 through 63.5 seconds. It sets a minimum time interval between rapping two rappers in the same precipitator lane. A disabled setting is provided.

4.3.1.4 POR Lead

POR Lead can be set from 0.5 to 63.5 seconds or can be disabled. The POR output will activate in advance of rapping by the POR Lead time.

4.3.1.5 Start Delay

Start Delay parameter can be selected from 128 settings in a range of 1 second through 4 hours and 30 minutes. The start delay can also be set equal to the field repeat time.

4.3.1.6 Field Repeat

This parameter can be set as either Minimum Field Repeat Time or Average Field Repeat Time. The

Field Repeat Time can be set from 0 through 99 hours, 59 minutes and 59 seconds.

4.3.1.7 Nominal Rap Interval

The Nominal Rap Interval can be selected in 1 second increments from 0 through 4 hours, 33 minutes and 3 seconds.

4.3.1.8 Minimal Rap Interval

Minimal Rap Interval can be selected from 255 settings from 1 second through 1 hour and 15 minutes, or it can be disabled.

4.3.1.9 Impact Frequency

This parameter, used for Impact Rappers, can be set from 1 through 31 impacts at 1 through 8 Hertz.

4.3.2. RAPPING SEQUENCE

4.3.2.1 Single or Dual Output

This selection determines whether Leading and Trailing Edge Rapping will be used. When Dual Output is selected, this rapper and the next rapper in the sequence will be activated at the same time.

4.3.2.2 Address

The Address of the Rapper is selected from a range of 001 through F15.

4.3.2.3 On-Time

On-Time for Impact Rappers is measured in 1/2 cycles (HCY). Values can be set from 0 through 99 half cycles. For Non-Impact Rappers, On-Time can be selected from 128 settings over a range of 0.1 second through 234 seconds. The controller adds two half cycles at low power to the start of each on period for soft short circuit detection.

4.3.2.4 Intensity

The Intensity parameter corresponds to the phase firing of the output. This value can be set from 7% for minimum intensity to 100% for full conduction. This value can be set in increments of 3%.

4.3.2.5 Power Off Rapping

Power Off Rapping for each step in the Rapping Sequence can be set to Enable or Disable.



5.0 PROGRAMMING INSTRUCTIONS

Throughout this section, the circled numbers refer to the numbers on the programming guide, Figure 9. Bold capitalized text indicates screen messages. Items in parenthesis may be edited.

5.1 Viewing Configuration

5.1.1 Power Up

- 5.1.1.1 Turn on the power if it is not already on.
- 5.1.1.2 Plug in the hand-held terminal in the port marked Terminal Connector on the front panel of the MicroRap.
- 5.1.1.3 The terminal should beep, perform the self test and after a three second delay, display the MicroRap software version message on the screen.
- 5.1.1.4 Press any key. Then Press F3.

**VIEW
CONFIGURATION**

- 5.1.1.5 Press F5.
- 5.1.1.6 To view configuration go to 5.1.2. To view rapper data go to 5.1.3.

5.1.2 View Configuration

- 5.1.2.1 Press F3.
**LINE FREQUENCY 60 HZ
DATA LINK UNIT 1**
- 5.1.2.2 Press F3.
GLOBAL AG MASTER
- 5.1.2.3 Press F3.
**ALARM __ FAILURES
RETRY FAILED RAPPERS**
- 5.1.2.4 Press F3.
**MAX MIGI/VIBR ON __
MAX NAVCO ON __**
- 5.1.2.5 Press F3.
FIELD NAMES

- 5.1.2.6 Press F5.
**FIELD 1 Name
FIELD 2 Name**

- 5.1.2.7 To view field 3 and higher, press F3.

Note: Pressing F4 at anytime will return to step 5.1.1.4.

5.1.3 View Rapper Data

- 5.1.3.1 Press F5.
**Name OUTPUT 001
POR __ AUX __
LANE __ TYPE NAVCO**
- 5.1.3.2 To view more rappers, OUTPUT 002 and higher, Press F3.

Note: Pressing F4 anytime will return to step 5.1.3 (Rapper Data). Pressing F4 again will return to step 5.1.1.4.

5.2 Viewing Programs

5.2.1 Power Up

- 5.2.1.1 Turn on the power if it is not already on.
- 5.2.1.2 Plug in the hand-held terminal in the port marked Terminal Connector on the front panel of the MicroRap.
- 5.2.1.3 The terminal should beep, perform the self test and after a three second delay, display the MicroRap software version message on the screen.
- 5.2.1.4 Press any key. Then press F3 twice.
VIEW RAPPING PROGRAM.
- 5.2.1.5 Press F5.
FIELD SETUP DATA
- 5.2.1.6 Select program you would like to view by using the F1 UP key. To view field setup data go to 5.2.2. To view rapping sequence go to 5.2.3.



5.2.2 View Field Setup Data

- 5.2.2.1 Press F5.
FIELD 1
- 5.2.2.2 Select the field you would like to view by using F1 up key.
- 5.2.2.3 Press F3.
ANTI-COINCIDENCE __
INTERLEAVE __
- 5.2.2.4 Press F3.
LANE WAIT __
POR LEAD __
- 5.2.2.5 Press F3.
START DELAY ____
- 5.2.2.6 Press F3.
FIELD REPEAT _:__:__ (time)
- 5.2.2.7 Press F3.
NOM RAP INTV __
MIN RAP INTV __
- 5.2.2.8 Press F3.
IMPACTS __ HZ __
- 5.2.2.9 Press F3. Returns to [step 5.2.2.2](#) to view other fields.

Note: Pressing F4 at anytime will return to [step 5.2.1.6](#) to select another program. Pressing F4 again will return to [step 5.2.1.4](#).

5.2.3 View Rapping Sequence

- 5.2.3.1 Press F3.
RAPPING SEQUENCE
- 5.2.3.2 Press F5.
FIELD
- 5.2.3.3 Select the field you would like to view by using the F1 UP key.
- 5.2.3.4 Press F3.
SEQ 0 S 101
0.0 S 100% POR DIS

- 5.2.3.5 To view more rappers, press F3 to access SEQ 1 and higher.

Note: Pressing F4 at anytime will return to [step 5.2.3.3](#). Pressing F4 again will return to [step 5.2.1.4](#).

5.3 Changing Security Access Code

5.3.1 Power Up

- 5.3.1.1 Turn on the power if it is not already on.
- 5.3.1.2 Plug in the hand-held terminal in the port marked Terminal Connector on the front panel of the MicroRap.
- 5.3.1.3 The terminal should beep, perform the self test and after a three second delay, display the MicroRap software version message on the screen. ①
- 5.3.1.4 Press any key. Then press F5.
ENTER ACCESS CODE ③

5.3.2 Enter Old Security Code

- 5.3.2.1 Enter security code or hold “SHIFT” and press “?” six times.
XXXXXX
 - 5.3.2.2 Press F5.
ACCESS GRANTED ④
- If “ACCESS DENIED” message is displayed, press F4 and repeat 5.3.2.1.

- 5.3.2.3 Press F4.
CHANGE SECURITY ⑤
ACCESS CODE

5.3.3 Entering New Code

- 5.3.3.1 Press F5.
CHANGE ACCESS CODE ⑥
NEW CODE ()
- 5.3.3.2 Enter new 6 character security code.
- 5.3.3.3 Press F5. The new security code is saved replacing the old one.



5.4 Configuration Editing

! CAUTION !

Configuration changes affect all of the programs and have the potential to cause rapper damage. System configuration is not usually edited except when the MicroRap is originally put into service by a factory trained technician.

If, however, you must change a parameter or have modified the precipitator in some way, such as changing the types or number of rappers, please follow the instructions carefully. Rapping will be suspended during configuration editing.

5.4.1 Power Up

- 5.4.1.1 Turn on the power if it is not already on.
- 5.4.1.2 Plug in the hand-held terminal in the port marked Terminal Connector on the front panel of the MicroRap.
- 5.4.1.3 The terminal should beep, perform the self test and after a three second delay, display the MicroRap software version message on the screen. ①
- 5.4.1.4 Press any key. Then press F5.
ENTER ACCESS CODE ③
- 5.4.1.5 Enter security code or hold "SHIFT" and press "?" six times.
XXXXXX
- 5.4.1.6 Press F5.
ACCESS GRANTED ④
If "ACCESS DENIED" message is displayed, press F4 and repeat 5.4.1.5.
- 5.4.1.7 Press F4. Then press F3.
EDIT SYSTEM ⑥
CONFIGURATION
- 5.4.1.8 Press F5.
RAPPING STOPPED ⑩

- 5.4.1.9 Press F5.

RAPPER DATA 11

To edit the configuration go to 5.4.2.
To edit the rapper data go to 5.4.3.

5.4.2 Edit Configuration

Note: Press F5 after each edit to save the new value.

- 5.4.2.1 Press F3.
LINE FREQUENCY () HZ ⑮
Select 50 or 60 HZ using F1 key.
- 5.4.2.2 Press F3.
DATA LINK UNIT () ⑯
Select unit number for POS computer software using F1 up or F2 down keys.
- 5.4.2.3 Press F3.
GLOBAL AG () ⑰
Select Master or Slave using F1 key.
- 5.4.2.4 Press F3.
ALARM () FAILURES ⑱
Select number of rappers that can fail before the alarm will be activated.
- 5.4.2.5 Press F3.
() FAILED RAPPERS ⑲
Select Skip or Retry using F1 key.
- 5.4.2.6 Press F3.
MAX MIGI/VIBR ON () ⑳
Select the number of rappers allowed to operate at one time.
- 5.4.2.7 Press F3.
MAX NAVCO ON () ㉑
Select the number of rappers allowed to operate at one time.
- 5.4.2.8 Press F3.
NUMBER OF FIELDS () ㉒
Use F1 or F2 to select the number of fields.
- 5.4.2.9 Press F3 then F5.
FIELD 1 () ㉔
Press F1 Only if you want to change the field name.



5.4.2.10 Press F3.

FIELD 2 ()

Repeatedly Pressing F3 sequences through the Field Names.

5.4.2.11 Press F4. To exit.

5.4.3 Edit Rapper Data

5.4.3.1 Press F5.

RAPPER (name) (0 01) 12

[Card number 0, Output number 01 of 16]
Select the card number of the rapper to edit by pressing F2. Then press F3. Use F2 to select the output number.

5.4.3.2 Press F5.

(name) (card #) (output #) 14

POR XXX AUX XXX
LANE 64 TYPE NAVCO

5.4.3.3 Press F3 to move the cursor past any field on the screen you don't want to edit.

To Edit POR address (if POR is used) use F1 or F2 to edit POR card number. Press F3 then use F1 or F2 to edit output number.

5.4.3.4 Press F3 to access AUX.

To Edit AUX address (if AUX is used) use F1 or F2 to edit AUX card number. Press F3 then use F1 or F2 to edit output number.

5.4.3.5 Press F3 to access LANE

Use F1 or F2 to select the lane number.

5.4.3.6 Press F5 then F4.

The edits will be saved and you will be returned to the display for **step 5.4.3.2** with the next rapper on the screen. To Edit this or other rappers repeat the sequence beginning at **step 5.4.3.3**.



5.5 Quick Program Editing

5.5.1 Collecting Information

- 5.5.1.1 Which program are to be edited.
- 5.5.1.1 Which field(s) are to be edited.
- 5.5.1.1 What rapper(s) are to be edited.
- 5.5.1.1 What are the new value(s) to be entered. (Field Repeat, Rap Interval, Number of Impacts, Lift Height (On time), Intensity or POR (Enable/Disable).

5.5.2 Power Up

- 5.5.2.1 Turn on the power if it is not already on.
- 5.5.2.2 Plug in the hand-held terminal in the port marked Terminal Connector on the front panel of the MicroRap.
- 5.5.2.3 The terminal should beep, perform the self test and after a three second delay, display the MicroRap software version message on the screen. ①
- 5.5.2.4 Press any key. Then press F5.
ENTER ACCESS CODE ③
- 5.5.2.5 Enter security code or hold "SHIFT" and press "?" six times.
XXXXXX
- 5.5.2.6 Press F5.
ACCESS GRANTED ④
If "ACCESS DENIED" message is displayed, Press F4 and repeat 5.5.2.5.
- 5.5.2.7 Press F3 twice.
MAIN MENU SELECT ⑦
CREATE OR EDIT RAPPING PROGRAM
- 5.5.2.8 Press F5.
EDIT RAP PROGRAM () ②⑤
Select which program you want to edit using the F1 up or F2 down keys.

- 5.5.2.9 Press F5.

FIELD SETUP DATA ②⑥

To edit field setup data go to 5.5.3. To edit rapping sequence go to 5.5.4.

5.5.3 Edit Field Setup Data

- 5.5.3.1 Press F5.

RAPPING PROGRAM ②⑦

Select which field you want to edit by using the F1 up key.

- 5.5.3.2 Press F3 7 times.

FIELD RPT ③④

Edit Field Repeat time by typing in the new time in hours-minutes-seconds format. The new time will type over the old one.

- 5.5.3.3 Press F3.

NOM RAP INTV ③⑤

Edit Nominal Rap Interval by typing in the new time in hours-minutes-seconds format. The new time will type over the old one. (This time is generally the field repeat time divided by the number of rappers in the field.)

- 5.5.3.4 Press F3.

MIN RAP INTV ③⑥

Edit Minimum Rap Interval by using the F1 up and F2 down Keys. (This value is generally same or slightly shorter then the Nominal Rap Time above.)

- 5.5.3.5 Press F3.

IMPACTS ③⑦

Edit the number of Impacts by using the F1 up key, this will change the number of impacts on all of the impact rappers in this field but won't affect other type rappers or other fields.

- 5.5.3.6 Press F5.

"Beep"

The revised field data has been saved and you will go back to the screen shown at step 5.5.2.7.



5.5.4 Edit Rapping Sequence

- 5.5.4.1 Press F3 then F5.
FIELD (39)
Select which field to be edited by using the F1 up key.
- 5.5.4.2 Press F3.
SEQ 0 (40)
If you are not editing the first rapper, press F3, repeatedly until you view the rapper you want to edit.
- 5.5.4.3 Press E (Edit) and the cursor will be flashing at the top of the screen. To edit the bottom line of information (**ON TIME**, **INTENSITY** and **POR**) move the cursor by pressing F3 key until it is flashing on what you want to edit. Use F1 up and F2 down keys to edit.
- 5.5.4.4 Press F5 when all of the changes have been made for this rapper. The next rapper in sequence will appear in the window.
- 5.5.4.5 Press C (Copy) if you want to copy the **ON TIME**, **INTENSITY** and **POR** from the previous rapper to this rapper. Pressing C will automatically change that line of information.

To edit the next rapper Press F3 then press C. Alternatly Pressing F3 then C until all of the rappers that you want to edit in this field have been edited.
(Always make sure the rapper you want to edit is being displayed in the window before Pressing C).
- 5.5.4.6 When all editing in this field is complete, press F5. The terminal beeps to indicate the new program has been saved, and you will go back to the screen shown at **step 5.5.2.7**. Always save the program after each field has been edited.

5.6 Running New Program

- 5.6.1 Review new program by using **section 5.2**, Viewing Rapping Programs. It is always best to carefully inspect a new program before running it.
- 5.6.2 Select the new program by using the Program Select switch on the front panel of the MicroRap. Then cycle the power using the power switch on the front of the cabinet.



5.7 Making Similar Programs

This is a method to create a new program from an existing program without destroying the original program.

Note: The new program will be saved as a NEW program number PERMANENTLY ERASING any program that may already exist with that program number.

5.7.1 Collecting Information

- 5.7.1.1 Review Rapper Sequence Data Forms to see what program most closely resembles the new program you would like to write. This is the most difficult information to edit.
- 5.7.1.2 Review Field Data List Form to see what editing will be required.
- 5.7.1. Review Forms to determine what program you would like to copy over.

5.7.2 Power Up

- 5.7.2.1 Turn on the power if it is not already on.
 - 5.7.2.2 Plug in the hand-held terminal in the port marked Terminal Connector on the front panel of the MicroRap.
 - 5.7.2.3 The terminal should beep, perform the self test and after a three second delay, display the MicroRap software version message on the screen. ①
 - 5.7.2.4 Press any key. Then press F5.
ENTER ACCESS CODE ③
 - 5.7.2.5 Enter security code or hold "SHIFT" and press "?" six times.
XXXXXX
 - 5.7.2.6 Press F5.
ACCESS GRANTED ④
- If "ACCESS DENIED" message is displayed, press F4 and repeat 5.7.2.5.

- 5.7.2.7 Press F3 twice.
MAIN MENU SELECT ⑦
CREATE OR EDIT RAPPING PROGRAM

5.7.3 Copying Program

- 5.7.3.1 Press F5.
EDIT RAP PROGRAM () ②⑤
FROM RAP PROGRAM
On the top line, select which program you want to copy OVER using the F1 up or F2 down keys.
- 5.7.3.2 Press F3.
EDIT RAP PROGRAM ②⑤
FROM RAP PROGRAM ()
On the second line, select which program you want to copy FROM using the F1 up or F2 down keys.
- 5.7.3.3 Press F5.
EDIT RAP PROGRAM () ②⑥
FIELD SET UP DATA
- 5.7.3.4 To edit the new program see [section 5.5](#), Quick Program Editing or [section 5.8](#), Complete Program Editing.



5.8 Complete Program Editing

5.8.1 Collecting Information

- 5.8.1.1 Review Field Data List and Rapper Sequence Data Forms.
- 5.8.1.2 Which program you would like to edit?
- 5.8.1.3 Which field(s) are to be edited?
- 5.8.1.4 What rapper(s) are to be edited?
- 5.8.1.5 What are the new values to be entered?

5.8.2 Power up

- 5.8.2.1 Turn on the power if it is not already on.
- 5.8.2.2 Plug in the hand-held terminal in the port marked Terminal Connector on the front panel of the MicroRap.
- 5.8.2.3 The terminal should beep, perform the self test and after a three second delay, display the MicroRap software version message on the screen. ①
- 5.8.2.4 Press any key. Then press F5.
ENTER ACCESS CODE ③
- 5.8.2.5 Enter security code or hold "SHIFT" and press "?" six times.
XXXXXX
- 5.8.2.6 Press F5.
ACCESS GRANTED ④
If "ACCESS DENIED" message is displayed, press F4 and repeat 5.8.2.5.
- 5.8.2.7 Press F3 twice.
MAIN MENU SELECT ⑦
CREATE OR EDIT RAPPING PROGRAM
- 5.8.2.8 Press F5.
EDIT RAP PROGRAM () ②⑤
Select which program you want to edit using the F1 up or F2 down keys.
- 5.8.2.9 Press F5.
FIELD SETUP DATA ②⑥
To edit field setup data go to 5.8.3. To edit rapping sequence go to 5.8.4.

5.8.3 Edit Field Setup Data

- ANTI-COINCIDENCE
- INTERLEAVE
- LANE WAIT
- POR LEAD
- START DELAY
- FIELD REPEAT
- RAP INTERVAL
- NUMBER of IMPACTS

To create a new field or new program - First start with section 5.8.4 to create a Rapper Sequence for each field. Field data cannot be programmed until a Rapper Sequence exists for that field.

Undoing errors: Pressing F4 any time before the information has been saved will return the program to its original state.

- 5.8.3.1 Press F5.
RAPPING PROGRAM ②⑦
Select which field you want to edit by using the F1 up key.
If the message "THIS FIELD DISABLED" appears for the selected field, press F2 to enable the field.
If Pressing F2 does not erase "THIS FIELD DISABLED", there are no rappers in the field. Press F4 and go to section 5.8.4, Edit Rapper Sequence.
- 5.8.3.2 Press F3.
ANTI-COINCIDENCE ②⑧
Select AG group number using F1 up key or use F2 to ENABLE or DISABLE the field.
If you select DISABLED this field will not run in this program. Go to step 5.8.3.13 to save.
- 5.8.3.3 Press F3.
INTERLEAVE ②⑨
Edit time or disable using F1 or F2.
- 5.8.3.4 Press F3.
LANE WAIT ③⑩
Edit time or disable using F1 or F2.



- 5.8.3.5 Press F3.
POR LEAD (31)
Edit time or disable using F1 or F2.
- 5.8.3.6 Press F3.
START DELAY (32)
Edit time or set to REPEAT. REPEAT uses the same time as FIELD RPT time.
- 5.8.3.7 Press F3.
FIELD REPEAT (33)
Select AVERAGE or MINIMUM using the F1 (generally set at minimum).
- 5.8.3.8 Press F3.
FIELD RPT (34)
Edit Field Repeat Time by typing in the new time in hours-minutes-seconds format overtyping the old one)
- 5.8.3.9 Press F3.
NOM RAP INTV (35)
Edit Nominal Rap Interval by typing in the new time in hours-minutes-seconds format, typing over the old one. (The time is usually field repeat time divided by the number of rappers in the field.)
- 5.8.3.10 Press F3.
MIN RAP INTV (36)
Edit Minimum Rap Interval by using the F1 up and F2 down Keys. (This value must be the same or shorter than the Nominal Rap Time above.)
- 5.8.3.11 Press F3.
IMPACTS (37)
Edit the number of Impacts by using the F1 up key, this will change the number of impacts for all impact rappers in this field but won't affect other type rappers.
- 5.8.3.12 Press F3.
HZ (37)
Edit the Speed of multiple impacts using the F1 up key.
- 5.8.3.13 Press F5.
"Beep"
The new program has been saved and you will go back to [section 5.8.2.](#)

5.8.4 Edit Rapping Sequence

- SEQUENCE
- ADDRESS
- ON-TIME
- INTENSITY
- POR

- 5.8.4.1 Press F3.
RAPPING SEQUENCE (38)
- 5.8.4.2 Press F5.
FIELD() (39)
Select which field you want to edit by using the F1 up key.
- 5.8.4.3 Press F3.
SEQ () 0 S 001 (name) (40)
0 HCY 100% POR DIS
Insert Copy Edit Del
If you are not editing the first rapper Press F3 repeatedly until you see the rapper you want to edit or the message,
NO SEQUENCE IN THIS FIELD
If this message appears, Press "I" (INSERT) the first rapper listed will appear on the screen similar to the sample in 5.8.4.3 then go to 5.8.4.4 to EDIT this sequence if required.
Pressing "I" (INSERT) will always add the next rapper in sequence. Example:
SEQ 0 001
Pressing "I" (INSERT) gives:
SEQ 1 002



- 5.8.4.4 Press "E" (EDIT) and the cursor will flash at the top of the screen over **S** or **D** to EDIT use F1 key. Selecting **D** will make this rapper and the next rapper in sequence operate simultaneously, selecting **S** will not.
- 5.8.4.5 Press F3 and the cursor will flash on the ADDRESS (output card number). To change this sequence to another card use F1 up or F2 down keys.
- 5.8.4.6 Press F3 and the cursor will flash on the ADDRESS (output number). To change this sequence to another output use F1 up or F2 down keys.
- 5.8.4.7 Press F3 and the cursor will flash on the ON TIME (half cycles for DC impact rappers, seconds for all other types of outputs). To change on time use F1 up or F2 down keys.
- 5.8.4.8 Press F3 and the cursor will flash on the INTENSITY. To change intensity use F1 up or F2 down keys.
- 5.8.4.9 Press F3 and the cursor will flash on POR ENABLE or DISABLE. Select enable or disable by using F1 key.

Undoing errors: If you make a mistake on this sequence continue pressing F3 until the cursor is flashing on what you would like to change then follow the directions above.

- 5.8.4.10 Press F5 ONLY when all of the changes have been made for this rapper sequence. The next rapper in sequence will appear in the window. To EDIT this sequence, go to 5.8.4.4.

If you are only editing the information on the previous rapper, go to step 5.8.4.12 to save.

- 5.8.4.11 Press C to COPY the ON TIME, INTENSITY and POR from the previous sequence. Alternately Press F3 then C until all of the rappers that you want to edit in this field have been edited. (Always make sure the rapper you want to edit is being displayed in the window before Pressing C.

- 5.8.4.12 Press F5
"Beep"

The new program has been saved and you will go back to section 5.8.3.

Always save the program after each field has been edited and enter the new values on Rapper Sequence or Field Data form.)

5.8.5 Running New Program

- 5.8.5.1 Review new program by using section 5.2, Viewing Rapping Programs. It is always best to carefully inspect a new program before running it.
- 5.8.5.2 Select the new program by using the Program Select switch on the front panel of the MicroRap. Then cycle the power using the power switch on the front of the cabinet.



5.9 Program Samples

5.9.1 Rapper Layout Print (Figure 2)

Mark the following information on a rapper layout print for the precipitator:

- 5.9.1.1 Write rapper Address (output) numbers on the print next to its name.
- 5.9.1.2 Write Field names on the print next to fields.
- 5.9.1.3 Write POR output number next to T/R or field names.
- 5.9.1.4 Write Lane numbers next to inlet and outlet rappers. Make copies of layout for each program.
- 5.9.1.5 Write Field Repeat and Rap Interval times next to fields for each program.

5.9.2 System Configuration Form (Figure 3)

Enter the following information on a copy of the system configuration form provided in appendix 3:

- 5.9.2.1 Enter line frequency
- 5.9.2.2 Enter Data Link Unit number for POS or host computer interface.
- 5.9.2.3 Enter Global AG Master or Slave as needed. If a global network is implemented select only one controller in the network to be the Master. If a global network is not implemented, select Slave for all controllers.
- 5.9.2.4 Enter number of failed rappers required to cause an alarm. Each time the alarm is reset a new quantity of rappers equal to this setting must fail for the alarm to be generated again.
- 5.9.2.5 Enter Retry or Skip Failed (shorted only) rappers.
- 5.9.2.6 Enter Max Migi/Vibrator On, the number of phase fired high current outputs that can be on simultaneously.

- 5.9.2.7 Enter Max Navco On, the number of non phase fired outputs that can be on simultaneously.
- 5.9.2.8 Enter Number of Fields.
- 5.9.2.9 Enter Field Names.

5.9.3 Rapper Setup Data Form (Figure 4)

Enter the following information on a copy of the rapper setup data form provided in appendix 3:

- 5.9.3.1 Enter Rapper name next to address numbers.
- 5.9.3.2 Enter POR if you have a POR card.
- 5.9.3.3 Enter Aux output if have an Aux card.
- 5.9.3.4 Enter Lane number.
- 5.9.3.5 Enter Type of rapper.

5.9.4 Rapper Sequence Data Form (Figure 5, single rapping; Figure 6, single rap maintenance program; Figure 7, dual rapping)

Enter the following information on a copy of the rapper sequence data form provided in appendix 3:

- 5.9.4.1 Enter Field Number.
- 5.9.4.1 Enter sequence number starting with 0.
- 5.9.4.1 Enter S (Single) D (Dual). Make this entry on the form for the first rapper only.
- 5.9.4.1 Enter Address. (Card and Output number).
- 5.9.4.1 Enter On Time. (half cycles for DC impact rappers, seconds for all other types of rappers).
- 5.9.4.1 Enter Intensity in %.
- 5.9.4.1 Enter POR E (Enable) D (Disabled).



5.9.5 Field Data List (Figure 8)

Enter the following information on a copy of the field data list form provided in appendix 3:

- 5.9.5.1 Enter Field Number.
- 5.9.5.2 Enter Anti-coincidence Number.
- 5.9.5.3 Enter Interleave time or disabled.
- 5.9.5.4 Enter Lane Wait time or disabled.
- 5.9.5.5 Enter POR Lead or disabled.
- 5.9.5.6 Enter Start Delay or set to field repeat time.
- 5.9.5.7 Select Min or Avg Field Repeat.
- 5.9.5.8 Enter Field Repeat Time.
- 5.9.5.9 Enter Nominal Rap Interval.
- 5.9.5.10 Select Minimum Rap Interval.
- 5.9.5.11 Select Impacts and Frequency (Impact rappers only).

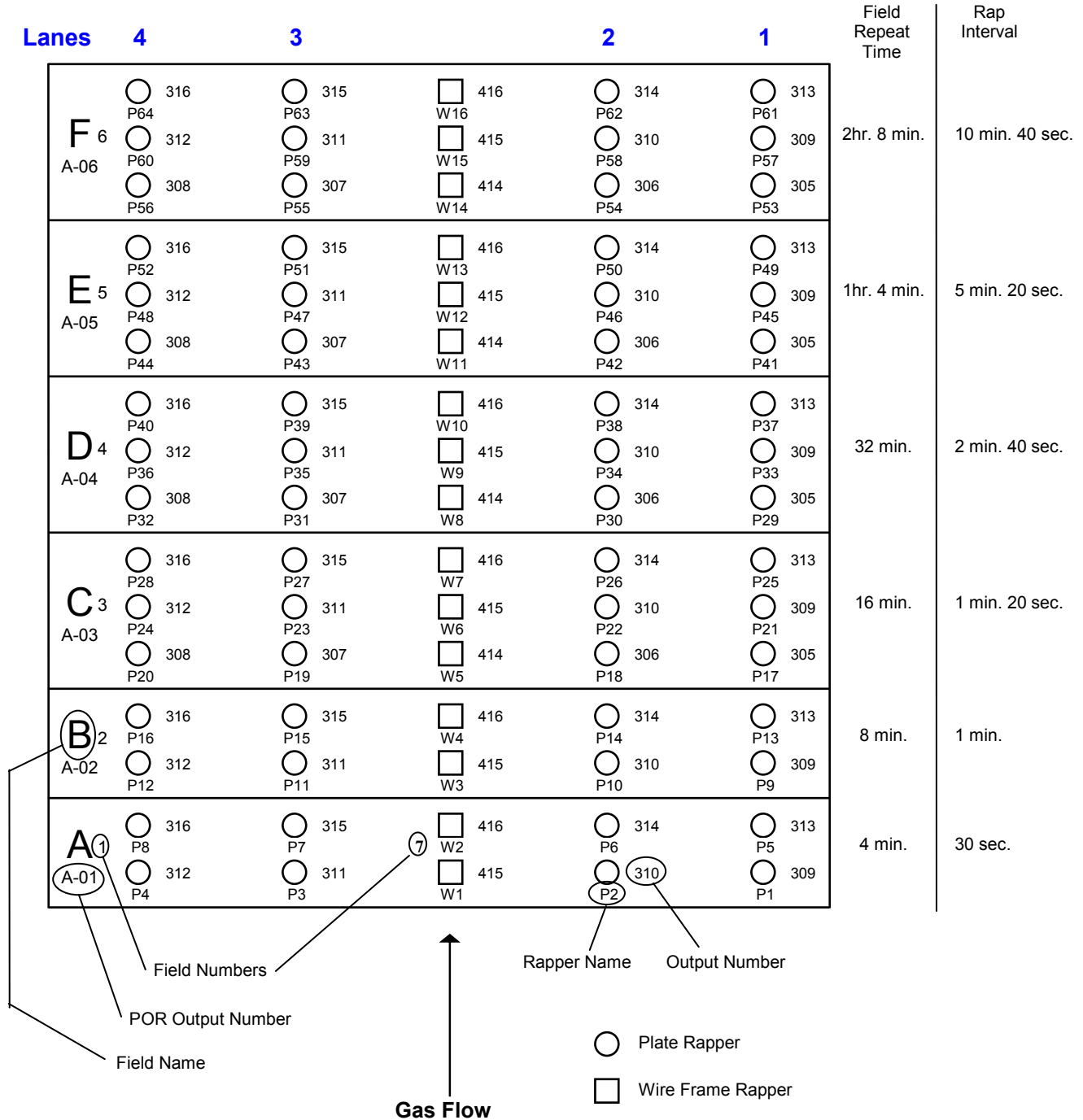


Figure 2 - Sample Rapper Layout



SYSTEM CONFIGURATION DATA

Customer Name Sample Program

Order No. _____

System Setup

HZ. (Line frequency)	60
Unit number	1
Global Slave or Master	Slave
Number of failed rappers to alarm	3
Skip or Retry shorted rappers	Retry
Max MIGI or Vibrators on	2
Max NAVCO on	3
Number of fields	7

Field Names

Field	Name
1	A, Inlet
2	B
3	C
4	D
5	E
6	F, Outlet
7	Wires
8	
9	
10	
11	
12	
13	
14	
15	
16	

SAMPLE

Programs

Program number	Description
1	Normal speed rapping
2	Fast rapping program
3	Slow rapping program
4	Plate maintenance walk down program
5	Wire maintenance walk down program
6	Single rapper maintenance program

Figure 3 - Sample System Configuration Data



MicroRap™

MICROPROCESSOR RAPPER CONTROL MANUAL

NEUNDORFER PRECIPITATOR KNOWLEDGE



RAPPER SETUP DATA

Customer Name Sample Programs

Order No. _____

Card Address: 0						Card Address: 1						Card Address: 2						Card Address: 3					
Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type
01	P1	A01	X	1	I	01	P17	A03	X	1	I	01	P33	A04	X	1	I	01	P49	A05	X	1	I
02	P2	A01	X	2	I	02	P18	A03	X	2	I	02	P34	A04	X	2	I	02	P50	A05	X	2	I
03	P3	A01	X	3	I	03	P19	A03	X	3	I	03	P35	A04	X	3	I	03	P51	A05	X	3	I
04	P4	A01	X	4	I	04	P20	A03	X	4	I	04	P36	A04	X	4	I	04	P52	A05	X	4	I
05	P5	A01	X	1	I	05	P21	A03	X	1	I	05	P37	A04	X	1	I	05	P53	A06	X	1	I
06	P6	A01	X	2	I	06	P22	A03	X	2	I	06	P38	A04	X	2	I	06	P54	A06	X	2	I
07	P7	A01	X	3	I	07	P23	A03	X	3	I	07	P39	A04	X	3	I	07	P55	A06	X	3	I
08	P8	A01	X	4	I	08	P24	A03	X	4	I	08	P40	A04	X	4	I	08	P56	A06	X	4	I
09	P9	A02	X	1	I	09	P25	A03	X	1	I	09	P41	A05	X	1	I	09	P57	A06	X	1	I
10	P10	A02	X	2	I	10	P26	A03	X	2	I	10	P42	A05	X	2	I	10	P58	A06	X	2	I
11	P11	A02	X	3	I	11	P27	A03	X	3	I	11	P43	A05	X	3	I	11	P59	A06	X	3	I
12	P12	A02	X	4	I	12	P28	A03	X	4	I	12	P44	A05	X	4	I	12	P60	A06	X	4	I
13	P13	A02	X	1	I	13	P29	A04	X	1	I	13	P45	A05	X	1	I	13	P61	A06	X	1	I
14	P14	A02	X	2	I	14	P30	A04	X	2	I	14	P46	A05	X	2	I	14	P62	A06	X	2	I
15	P15	A02	X	3	I	15	P31	A04	X	3	I	15	P47	A05	X	3	I	15	P63	A06	X	3	I
16	P16	A02	X	4	I	16	P32	A04	X	4	I	16	P48	A05	X	4	I	16	P64	A06	X	4	I

Card Address: 4						Card Address:						Card Address:						Card Address:					
Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type
01	W1	X	X	X	H	01						01						01					
02	W2	X	X	X	H	02						02						02					
03	W3	X	X	X	H	03						03						03					
04	W4	X	X	X	H	04						04						04					
05	W5	X	X	X	H	05						05						05					
06	W6	X	X	X	H	06						06						06					
07	W7	X	X	X	H	07						07						07					
08	W8	X	X	X	H	08						08						08					
09	W9	X	X	X	H	09						09						09					
10	W10	X	X	X	H	10						10						10					
11	W11	X	X	X	H	11						11						11					
12	W12	X	X	X	H	12						12						12					
13	W13	X	X	X	H	13						13						13					
14	W14	X	X	X	H	14						14						14					
15	W15	X	X	X	H	15						15						15					
16	W16	X	X	X	H	16						16						16					

Card Address:						Card Address:						Card Address:						Card Address:					
Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type
01						01						01						01					
02						02						02						02					
03						03						03						03					
04						04						04						04					
05						05						05						05					
06						06						06						06					
07						07						07						07					
08						08						08						08					
09						09						09						09					
10						10						10						10					
11						11						11						11					
12						12						12						12					
13						13						13						13					
14						14						14						14					
15						15						15						15					
16						16						16						16					

SAMPLE

Figure 4 - Sample Rapper Setup Data



RAPPING SEQUENCE DATA

Customer Name Sample Programs **Order No.** _____

Program Number 1, 2, 3 **Description** Single rap, different field timing

Field	Seq	S/D	Output	On	Int %	POR	Field	Seq	S/D	Output	On	Int %	POR	Field	Seq	S/D	Output	On	Int %	POR	Field	Seq	S/D	Output	On	Int %	POR
1	0	S	0-01	8	100	E	5	0	S	2-09	8	100	E														
	1		0-02					1		2-10																	
	2		0-03					2		2-11																	
	3		0-04					3		2-12																	
	4		0-05					4		2-13																	
	5		0-06					5		2-14																	
	6		0-07					6		2-15																	
	7		0-08					7		2-16																	
2	0		0-09					8		3-01																	
	1		0-10					9		3-02																	
	2		0-11					10		3-03																	
	3		0-12					11		3-04																	
	4		0-13				6	0		3-05																	
	5		0-14					1		3-06																	
	6		0-15					2		3-07																	
	7		0-16					3		3-08																	
3	0		1-01					4		3-09																	
	1		1-02					5		3-10																	
	2		1-03					6		3-11																	
	3		1-04					7		3-12																	
	4		1-05					8		3-13																	
	5		1-06					9		3-14																	
	6		1-07					10		3-15																	
	7		1-08					11		3-16																	
	8		1-09				7	0		4-01	5	97	D														
	9		1-10					1		4-02																	
	10		1-11					2		4-03																	
	11		1-12					3		4-04																	
4	0		1-13					4		4-05																	
	1		1-14					5		4-06																	
	2		1-15					6		4-07																	
	3		1-16					7		4-08																	
	4		2-01					8		4-09																	
	5		2-02					9		4-10																	
	6		2-03					10		4-11																	
	7		2-04					11		4-12																	
	8		2-05					12		4-13																	
	9		2-06					13		4-14																	
	10		2-07					14		4-15																	
	11		2-08					15		4-16																	

SAMPLE

Figure 5 - Sample Single Rapping Sequence Data



RAPPING SEQUENCE DATA

Customer Name Sample Maintenance Programs Order No. _____

Program Number 4, 5, 6 Description Maintenance programs

Program 4, Plates

Program 4, Plates (continued)

Program 5, Wires

Program 6, Single rapper

Field	Seq	S/D	Output	On	Int %	POR	Field	Seq	S/D	Output	On	Int %	POR	Field	Seq	S/D	Output	On	Int %	POR	Field	Seq	S/D	Output	On	Int %	POR
1	0	S	0-01	8	100	E	1	40	S	2-09	8	100	E	1	0	S	4-01	4	97	D	1	0	S	0-01	8	100	D
	1		0-02					41		2-10					1		4-02										
	2		0-03					42		2-11					2		4-03										
	3		0-04					43		2-12					3		4-04										
	4		0-05					44		2-13					4		4-05										
	5		0-06					45		2-14					5		4-06										
	6		0-07					46		2-15					6		4-07										
	7		0-08					47		2-16					7		4-08										
	8		0-09					48		3-01					8		4-09										
	9		0-10					49		3-02					9		4-10										
	10		0-11					50		3-03					10		4-11										
	11		0-12					51		3-04					11		4-12										
	12		0-13					52		3-05					12		4-13										
	13		0-14					53		3-06					13		4-14										
	14		0-15					54		3-07					14		4-15										
	15		0-16					55		3-08					15		4-16										
	16		1-01					56		3-09																	
	17		1-02					57		3-10																	
	18		1-03					58		3-11																	
	19		1-04					59		3-12																	
	20		1-05					60		3-13																	
	21		1-06					61		3-14																	
	22		1-07					62		3-15																	
	23		1-08					63		3-16																	
	24		1-09																								
	25		1-10																								
	26		1-11																								
	27		1-12																								
	28		1-13																								
	29		1-14																								
	30		1-15																								
	31		1-16																								
	32		2-01																								
	33		2-02																								
	34		2-03																								
	35		2-04																								
	36		2-05																								
	37		2-06																								
	38		2-07																								
	39		2-08																								

SAMPLE

Figure 6 - Sample Maintenance Sequence Data



6.0 TROUBLESHOOTING GUIDE

6.1 Isolate and Define Problem

When troubleshooting the control, try to isolate and define the problem first. Normally only one component or part has failed, but it may cause similar symptoms on all output cards or groups of

output cards that have a part or component in common. Verify that the controls, micro jumpers and switch settings are set up correctly. Refer to [section 2.8.3](#).

6.2 MOST COMMON HARDWARE PROBLEMS AND SOLUTIONS

ITEM	PROBLEM	CAUSE	SOLUTION
6.2.1	Control is dead. No LED's lit on any output card. No sequential operation of LED's. Power is on. Program selector switch set to a valid program number.	<ol style="list-style-type: none"> 1. Main fuse is blown. 2. Contactor (if applicable) not closed. 3. Defective CPU card. 4. Defective power supply. 	<ol style="list-style-type: none"> 1. Replace fuse, investigate cause of failure. 2a. Test 120VAC to contactor coil. If zero, replace fuse. 2b. If bad coil, replace contactor. 3. Replace card. 4. Replace power supply
6.2.2	Control operates, but rappers do not turn on. All LED's latched on.	<ol style="list-style-type: none"> 1. Main power to output cards interrupted. 	<ol style="list-style-type: none"> 1a. Check all fuses. 1b. Check and repair power connections to output cards at terminal strips, load resistors, and card cage connectors.
6.2.3	Problem: Rappers connected to one output card do not operate. All active LED's on that output card are latched on.	<ol style="list-style-type: none"> 1. Output card fuse blown. 2. Main power to output card interrupted. 3. Current sensing circuit defective. 4. Current limiting resistor open. 	<ol style="list-style-type: none"> 1. Replace fuse(s). Investigate cause of failure. 2. Check power connections to output cards, at terminal strips, load resistors, and card cage connectors. 3. Replace output card. 4. Replace resistor. Investigate cause of failure.
6.2.4	Current limiting resistor failure.	<ol style="list-style-type: none"> 1. Failed (Shorted) SCR's or TRIAC on output card. 	<ol style="list-style-type: none"> 1. Replace output card.
6.2.5	Current limiting resistor failure.	Most common cause of current limiting resistor failure is the simultaneous operation of multiple outputs on the same card, most likely due to a programming error. Check program to make sure there is only one anti-coincidence group assigned to each output card.	

Table 3 - Trouble Shooting Guide



ITEM	PROBLEM	CAUSE	SOLUTION
6.2.6	Output stuck on, current limiting resistor overheating.	1. Failed (Shorted) SCR's or TRIAC on output card.	1. Replace output card.
6.2.7	One or more LED's latched on. Control executes selected program.	Normal operating condition. Latched on LED's indicate defective rappers or field wiring. The output card current sensing circuit monitors the magnitude of output current as well as the presence or absence of current for each output. Either the absence of current or detection of excessive current will cause the LED's to latch on. Disconnect the field wiring before troubleshooting. Look for open or short circuit.	
6.2.8	One or more LED's latched on. Control does not execute selected program.	1. Program lockup.	1. Replace output card causing the lockup.
6.2.9	Program lockup	<p>Program lockup could occur if control is unable to clear an over current condition. This may happen if there is a defective SCR or TRIAC on one of the output cards that will not turn off. If that output draws more current than it is permitted by the detection circuit, control will cease to operate, and corresponding LED will stay lit.</p> <p>If there is more than one LED lit, indicating that the control has found other defective outputs during the execution of the program, to find the output card that caused the lockup, it is necessary to restart the program and observe operation of the control. A fast "maintenance" program would be best suitable for this troubleshooting procedure. The output card with the LED that has turned on last is causing the lockup and needs to be replaced.</p>	

Table 3 - Trouble Shooting Guide (continued)



APPENDIX 1 MICRORAP GLOSSARY

Address

The output circuit for a rapper. The address consists of an output card designation and an output number. The card designation is determined by S1 on the output card. Card designations are hexadecimal from 0 to 9 and A through F. The output numbers are 1 to 16, corresponding to the indication on the front panel. The card designation and the output number are combined to form a three character code. There are 255 valid addresses from 001 to F15.

AG - Anti-coincidence Group

Each field in the rapping program is assigned to an AG. The control guarantees that more than one rapper in an AG will not be active at the same time.

Anti-Coincidence

A mechanism that prevents more than one rapper in a designated group from being active at the same time (except in the case of dual output rapping).

AUX - Auxiliary Output

AUX outputs can be used to generate an output when a specific rapper is active. More than one rapper output can be assigned to the same AUX output. AUX outputs are similar to POR outputs, except that POR outputs allow a timing parameter.

Configuration

A set of parameters that affect the operation of the control. These parameters include rapper data, rapper name, line frequency, data link unit, global anti-coincidence, alarm, failed rapper response and maximum number of active outputs.

Data Link Unit

A number used by a supervisory computer to address a particular rapper control.

Dual

A selection that is used to select "leading and trailing edge rapping". The "D" designation in the rapper sequence indicates that the next sequence output will be active at the same time. The opposite selection is "S" for single output.

Field

A group of rappers that are activated in a specific sequence with some common timing parameters.

Field Name

A six character alpha-numeric name for a field. Field names are optional, for convenience only.

Field Repeat Average

This setting causes the control to attempt to maintain an average field repeat time. If the rapping of a field is delayed by anti-coincidence or other factors, the control will shorten the rap interval in the next cycles of operation until rapping is back on schedule.

Field Repeat Minimum

This setting causes the control to use the Field Repeat Time as a minimum value. If a rapping cycle is delayed by anti-coincidence or other factors, the control will NOT attempt to catch up by reducing the rap interval in subsequent cycles.

Field Repeat Time

The amount of time for a complete rapping cycle of a field. It is the elapsed time from the start of the first rapper in the field until the next time that same rapper activates.

FW VIB

Full Wave Vibrator.

GLB

An abbreviation for "global AG".

GLOBAL AG

Anti-coincidence feature that allows selected fields from several rapper controls to function as though they were in a common anti-coincidence group in one control.

HW VIB

Half Wave Vibrator.



HZ

Frequency of impacts for multiply impacted rappers. This setting has no effect on NAVCO rappers or vibrators.

Impacts

The number of impacts for a multiple impact rapper. This setting has no effect on NAVCO rappers or vibrators.

Intensity

The intensity parameter adjusts the conduction angle of a phase-fired output. Intensity settings have no effect on NAVCO type rappers.

Interleave

This allows two or more fields in the same anti-coincidence group to alternate operation. If interleave is disabled, each field in an AG group will complete its sequence before the next field starts. The interleave time parameter is used to offset the time of rapper operation between interleaved fields in the same AG.

Lane

A number that allows rappers to be grouped in the direction of gas flow for the purpose of anti-coincidence.

Lane Wait

The minimum amount of time between operation of two rappers in the same lane.

Line Frequency

The frequency of the power mains to the MicroRap.

Master

This selection determines the Global AG mode for this control.

MIGI

Magnetic Impulse Gravity Impact. This type of rapper is considered a high-current DC output.

MIN RAP INTV

The minimum amount of time between consecutive operation of rappers in a field. Setting must always be less than or equal to the NOM RAP INTV.

NAVCO

This type of rapper is a low-current AC output. This is typically used to activate an air solenoid valve for an air operated rapper. The name originates from the National Air Vibrator Company, a manufacturer of air operated rappers.

NOM RAP INTV

The nominal amount of time between consecutive operation of rappers in a field.

POR

Power-Off Rapping. This feature activates an output for the purpose of reducing the output of a voltage control during rapping.

POR DIS

Power-Off Rapping Disabled.

POR ENA

Power-Off Rapping Enabled.

POR Lead

The amount of time from the activation of the Power-Off Rapping output to the activation of the rapper output.

RAP INTV

An abbreviation for Rapping Interval. This timing parameter specifies the amount of time from the activation of a rapper in a sequence to the activation of the next rapper in the sequence. The rap interval is the sum of the on-time for the rapper plus the idle time between rappers.

Rapper Data

Information that describes the type of rapper connected to a particular output address.

Rapper Name

A five character alpha-numeric name for a rapper. Each rapper must have a name or it will not be activated.

Rapping Program

A combination of field data and sequence data for one or more fields. Up to six rapping programs can be defined in the system.



Rapping Sequence

A list of rappers to be activated in a sequence. Each field has a corresponding rapping sequence. Each sequence element represents the activation of a rapper with a specified on time and intensity along with an enable setting for power-off rapping and a designation for dual or single output rapping.

Retry

A setting that causes the control to attempt to activate a shorted rapper each time it occurs in a rapping sequence. The MicroRap automatically precedes each rapper on period with a two half cycle low power output to detect shorted outputs without over stressing the output devices. Repeated attempts to fire a shorted rapper will not harm the output cards.

Security Access Code

A six character password that prevents unwanted tampering with control settings. If you do not use the password, you can review all of the settings, but you cannot change any of them.

SEQ

An abbreviation for Sequence. Each element in the rapping sequence has a sequence number (starting with 0).

Single

A designation in the rapping sequence indicated by "S". This selection disables the "leading and trailing edge rapping", which is called dual output, indicated by "D".

Skip

A setting that prevents the control from activating a shorted rapper when it occurs in a rapping sequence.

Slave

This selection determines the Global AG mode for this control.

Start Delay

This is the amount of time that the control will wait before starting to rap the field. This setting is only used when the control is first powered on or when a new rapping program is selected.



APPENDIX 2 CIRCUIT BOARD MAJOR COMPONENT LISTS

MR-A02 CPU CARD ASSEMBLY

<u>PART NO.</u>	<u>MFG</u>	<u>MFG P/N</u>	<u>DESCRIPTION</u>	<u>DESIGNATION</u>
82100-117			Micro jumper, male	
83130-004	Siemens	IL420	Optocoupler, TRIAC driver	U36 - U39
83130-144	Maxim	MAX487EEPA	RS-485 line transceiver	U23
83130-084	T.I.	TL7705AIP	Power supply supervisor	U9
83130-090	National	DS3662	Line transceiver	U1, U2, U5, U6
83130-092	Catalyst	28C64	EEPROM, 8K x 8	U16
83130-108	Simtek	STK-15C88-W45I	Static RAM, 32K x 8	U17
83130-094	T.I.	74ALS541	Octal buffer/line driver	U4
83130-095	T.I.	74HC573	Latch, D-Type three state	U3
83130-096	National	74HC125	Buffer, quad gated	U24, U27
83130-097	Maxim	MAX232EPE	Line transceiver	U25
83130-098	National	74HC158	Multiplexer, quad 2-input	U10
83130-099	Motorola	68HC11F1CFN4	8-bit microcomputer	U19
83130-100	T.I.	74ALS00A	Nand gate, quad 2-input	U7
83130-101	T.I.	74ALS1010A	Nand gate, triple 3-input	U8
83130-102	National	74HCT138	Decoder/demultiplexer	U14
83130-103	T.I.	74ALS04B	Hex inverter	U13
83130-104	T.I.	74ALS878	Flip flop, D-type	U11
83130-111	National	27C256	EPROM, 32K x 8	U18
83700-005	Gen. Instr.	MID400	Optocoupler AC to DC	U28 - U35
83700-013	H.P.	HCPL3760	Optocoupler AC to DC	U26
84000-009	National	LM285BXZ	Voltage reference	Q2



MR-CO1 PCB, TESTED 120V AC STANDARD CURRENT OUTPUT CARD

PART NO.	MANUFACTURER	DESCRIPTION	DESIGNATIONS	
81100-006	National	LM258N	Operational amp dual, low power	U16
82100-049			Micro jumper for .025" sq. pin	
83130-003	Micrel*	MIC4807BN	8-bit latched driver	U2, U7, U11, U14
83130-065	T.I.	74ALS804AN	Nand driver, hex 2-input	U6, U15
83130-066	T.I.	74ALS20AN	Nand gate, dual 4-input	U1, U12
83130-087	T.I.	74ALS10AN	Nand gate, triple 3-input	U13
83130-088	T.I.	74ALS175N	Flip flop, D-type	U10
83130-089	T.I.	74ALS518N	Comparator, 8-bit	U9
83130-090	National	DS3662N	Line transceiver	U3, U5
83130-091	National	DS8837N	Line receiver	U4
83700-003	Sharp*	S21MD3V	Photo TRIAC coupler	U17 - U32
83700-011	Motorola	MOC5007	Optocoupler logic output	U8
83700-012	H.P.	HCPL3700	Optocoupler AC to DC	U33
84300-008	Buss	BK/MDA-15	fuse, 15A 250V 750A IR time delay	F1
84800-006	Motorola*	MAC 223-6 or MAC 223-8	TRIAC	Q18 - Q33
85100-010	EECO	230057GB	Switch, yellow PCB rotary 16 pos. 2 pole hex	
85100-031	EECO	350065GS	Switch, blue PCB rotary 10 position, 1 pole	

*= Only Approved Source



MR-CO2 PCB, TESTED 120V AC LOW CURRENT NAVCO OUTPUT CARD

<u>PART NO.</u>	<u>MANUFACTURER</u>	<u>DESCRIPTION</u>	<u>DESIGNATIONS</u>
81100-006	National	LM258N	Operational amp dual, low power
82100-049			Micro jumper for .025" sq. pin
83130-003	Micrel*	MIC4807BN	8-bit latched driver
83130-065	T.I.	74ALS804AN	Nand driver, hex 2-input
83130-066	T.I.	74ALS20AN	Nand gate, dual 4-input
83130-087	T.I.	74ALS10AN	Nand gate, triple 3-input
83130-088	T.I.	74ALS175N	Flip flop, D-type
83130-089	T.I.	74ALS518N	Comparator, 8-bit
83130-090	National	DS3662N	Line transceiver
83130-091	National	DS8837N	Line receiver
83700-003	Sharp*	S21MD3V	Photo TRIAC coupler
83700-011	Motorola	MOC5007	Optocoupler logic output
83700-012	H.P.	HCPL3700	Optocoupler AC to DC
84300-111	Buss	BK/ABC-3	Fuse, 3A 250V 100A IR fast acting
84800-062	Motorola	T2500D or BTB06-400C	TRIAC
85100-010	EECO	230057GB	Switch, yellow PCB rotary 16 pos. 2 pole hex
85100-031	EECO	350065GS	Switch, blue PCB rotary 10 position, 1 pole

*= Only Approved Source



MR-C70 PCB, TESTED 120/240V DC STANDARD CURRENT OUTPUT CARD

PART NO.	MANUFACTURER	DESCRIPTION	DESIGNATIONS	
81100-006	National	LM258N	Operational amp dual, low power	U16
82100-049			Micro jumper for .025" sq. pin	
83130-003	Micrel*	MIC4807BN	8-bit latched driver	U2, U7, U11, U14
83130-065	T.I.	74ALS804AN	Nand driver, hex 2-input	U6
83130-066	T.I.	74ALS20AN	Nand gate, dual 4-input	U1, U12
83130-087	T.I.	74ALS10AN	Nand gate, triple 3-input	U13, U15
83130-088	T.I.	74ALS175N	Flip flop, D-type	U10
83130-089	T.I.	74ALS518N	Comparator, 8-bit	U9
83130-090	National	DS3662N	Line transceiver	U3, U5
83130-091	National	DS8837N	Line receiver	U4
83700-003	Sharp*	S21MD3V	Photo TRIAC coupler	U17 - U32
83700-011	Motorola	MOC5007	Optocoupler logic output	U8
84300-008	Buss	BK/MDA-15	fuse, 15A 250V 750A IR time delay	F1, F2
84800-047	Motorola*	2N6508	SCR	Q2 - Q33
84800-061	Motorola	MR756	6 AMP/600V diode	CR41 - CR56
85100-010	EECO	230057GB	Switch, yellow PCB rotary 16 pos. 2 pole hex	
85100-031	EECO	350065GS	Switch, blue PCB rotary 10 position, 1 pole	

*= Only Approved Source



APPENDIX 3 MASTER PROGRAMMING FORMS

SYSTEM CONFIGURATION DATA

Customer Name _____

Order No. _____

System Setup

HZ. (Line frequency)	
Unit number	
Global Slave or Master	
Number of failed rappers to alarm	
Skip or Retry shorted rappers	
Max MIGI or Vibrators on	
Max NAVCO on	
Number of fields	

Field Names

Field	Name
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	

Programs

Program number	Description
1	
2	
3	
4	
5	
6	



MicroRap™

MICROPROCESSOR RAPPER CONTROL MANUAL

NEUNDORFER PRECIPITATOR KNOWLEDGE



RAPPER SETUP DATA

Customer Name _____

Order No. _____

Card Address:						Card Address:						Card Address:						Card Address:					
Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type
01						01						01						01					
02						02						02						02					
03						03						03						03					
04						04						04						04					
05						05						05						05					
06						06						06						06					
07						07						07						07					
08						08						08						08					
09						09						09						09					
10						10						10						10					
11						11						11						11					
12						12						12						12					
13						13						13						13					
14						14						14						14					
15						15						15						15					
16						16						16						16					

Card Address:						Card Address:						Card Address:						Card Address:					
Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type
01						01						01						01					
02						02						02						02					
03						03						03						03					
04						04						04						04					
05						05						05						05					
06						06						06						06					
07						07						07						07					
08						08						08						08					
09						09						09						09					
10						10						10						10					
11						11						11						11					
12						12						12						12					
13						13						13						13					
14						14						14						14					
15						15						15						15					
16						16						16						16					

Card Address:						Card Address:						Card Address:						Card Address:					
Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type	Out	Name	POR	Aux	Lane	Type
01						01						01						01					
02						02						02						02					
03						03						03						03					
04						04						04						04					
05						05						05						05					
06						06						06						06					
07						07						07						07					
08						08						08						08					
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15						15						15						15					
16						16						16						16					

