BROADCAST tools inc.

Installation and Operations Manual

For the

MC-16

Mega-Coupler 16

All Specifications and features are subject to change without notice.

Software Version 1.27 or above

Manual update 02/23/2004

INTRODUCTION.

Thank you for your purchase of a *Broadcast Tools, Inc.*, MC-16, MEGA-COUPLER 16. We will refer to this unit as the MC-16 thought out this manual. We're confident that this product will give you many years of dependable service. This manual is intended to give you all the information needed to install and operate the unit.

♫ **NOTE:** This manual should be read thoroughly before installation and operation.

SAFETY INFORMATION

Only qualified personnel should install broadcast Tools products. Incorrect or inappropriate use and/or installation could result in a hazardous condition.

CAUTION: Broadcast Tools products, as with any electronic device, can fail without warning. Do not use this product in applications where a life threatening condition could result due to failure.

WHO TO CONTACT FOR HELP

If you have any questions regarding this product, or you need assistance, please contact your distributor from whom you purchased this equipment or contact us directly.
If you would like more information about *Broadcast Tools, Inc.*, products, you may reach us at:

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Thank you for choosing Broadcast Tools!

WARRANTY.

LIMITED WARRANTY

The term "Buyer" as used in this document refers to and includes both (but only) (a) any person or entity who acquires such an item for the purpose of resale to others (i.e., a dealer or distributor of an item), and (b) the first person or entity who acquires such an item for such person's or entity's own use. Broadcast Tools warrants to each Buyer of any item manufactured by Broadcast Tools that the item will be free from defects in materials and workmanship at the time its is shipped by Broadcast Tools if the item is properly installed, used and maintained.

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NOTICE TO THE USERS.

- This device may not be used on telco-operated coin phone lines. Party lines and privately owned coin-phones, which are subject to local State regulatory policies, and possible additional State special requirements.

- The telephone utility company has the right to make changes to their network, which may affect the operation of your equipment, provided you are given adequate advance written notice to permit correct operation.

- In case of operational problems, disconnect your unit by removing the modular plug from the telco jack. If your regular phone (or other device or system) still works properly, your MC-16 has a problem and must remain disconnected and officially serviced or returned for repairs. If upon the above disconnection your regular service still has problems, notify your telephone utility company that they may have a problem. Request prompt service, at not cost to you the user. If a problem is found in premises wiring not telco-installed, you are subject to a service charge. If a fault is in telco installed wiring, you may not be subject to a service charge.

- Unless otherwise noted in the User's Manual (e.g.: fuses, etc.), user may not under any circumstances (in or out of warranty) attempt any service, adjustments or repairs on this unit (NO USER SERVICEABLE PARTS). It must be returned to Broadcast Tools, Inc. for all such work. Broadcast Tools, Inc. address and phone information is listed in this manual.

- Special rules apply to equipment connected behind a PBX or KTS.

AUDIO SPECIFICATIONS.
Table 1

Input Levels:	Adjustable, Max + 24dbu, balanced bridging (Send to telephone line and (Aux to DTMF receiver).
Output Levels:	Adjustable, Off to + 4 dbu, @ 100 Ω, balanced output (Receive audio from telephone line).
Logic:	Microprocessor, EEprom user programming memory and high performance DTMF transceiver.
Relays/OC:	Sealed relays, utilizing 2 – form C on relays 1 & 2, 1 – form C on relays 3 through 16 and access. Contacts 30 vdc @ 500 ma. Open collector, @ 24 vdc @ 60 ma.

NOTE: For safety, do NOT connect 120 Volt circuits to the relays.

Busy:	Compatible with 5 volt CMOS/TTL, open collector or contact closures. Max logic voltage 5 vdc.
Connectors:	I/O - Removable screw terminals, mates supplied Phone - Modular, RJ-11C phone line, cable supplied. Serial - Female DB-9, D-Sub, cable supplied
Ringer equivalence:	0.2A (AC) / 3.0 (DC).
Power Requirements:	16 to 18 Vac, @ 600 ma. 120 Vac wall transformer. Supplied
Size:	19" X 1.75" X 4.50" (WHD)
Weight:	3.0 lb.
Shipping weight:	4.0 lb.

Resource Specifications.
Table 2

RESOURCE SPECIFICATIONS	
SPDT Relays, except K1 & 2 which are 2PDT	17
Programs	32
Maximum Commands per Program	30
Macros	64
Maximum Commands per Macro	64
Number of Strings	64
Maximum Characters per String	32
Maximum Characters per Program Access Code	4
Maximum Macro Depth (Macro calling Macro calling, Macro…)	5

PRODUCT DESCRIPTION .

Front Panel

The MC-16 is a 1-rack unit device (19″w x 1.75″h x 4.5″d). The front panel supports two selection switches, 4 LED indicators, Telco send and receive level controls, Auxiliary input level control and telephone line hybrid null control.

Rear Panel

Installation is simplified with pluggable screw terminal connectors. The MC-16 may be pre-wired and installed in minutes. The rear panel consists of one 9-pin D-Sub RS-232 connector, Telephone line modular connector, 2.1mm coaxial power connector and the removable screw connectors.

Switches

The front panel of the MC-16 contains a "SETUP" push-push switch used to put the MC-16 into (Set-up) configuration mode. The second push-push switch is used to seize the telephone line when the MC-16 is used to initialize a phone call.

LED Indicators

The MC-16's front panel LED indicators provide operational display of the following information:

The **"RING"** LED indicator will flash each time a ring is received.
The **"TONE"** LED indicator will illuminate each time a valid DTMF tone is decoded.
The **"HOOK"** LED indicator will light when the MC-16 picks up a call.
The **"POWER"** LED indicator will light when power is applied to the MC-16

Audio Inputs

Each of the 2 monaural inputs are balanced bridging (20KΩ) at a nominal line level of +4dBu. Single turn level controls are provided for each input.

Audio Outputs

The MC-16 provides a single balanced monaural output. The output is set at +4dBu @ 100 Ω and may be adjusted from off to + 4 dBu. Note: With –9dbm at the receive end of the telephone line.

Relay Outputs

The MC-16 contains 15 spdt and 2 dpst relays. Sixteen of the relays may be latched on, latched off or momentarily. The default pulse length is one hundred milliseconds. Note: Relay 17 will close when a valid access is entered.

User Programming

The MC-16 programming is stored in non-volatile memory. Configurations are programmed with selection dipswitches and computer commands.

INSTALLATION.

Supplied Items

Please examine your MC-16 carefully for any damage that may have been sustained during shipping. If any is noted, please notify the shipper immediately. Retain the packaging for inspection by the shipper. The package contains the MC-16, 16.5 vac @ 600 ma power transformer, Installation manual, modular telephone cable and serial cable.

Mounting

The MC-16 is designed to be rack mounted in a standard 19" rack. It should be mounted in an area that is accessible from the rear and preferably away from sources of heat. We recommend before permanently installing the MC-16, you bench test and become familiar with the operation of the unit.

Power supply connection

The MC-16 requires 16 - 18 VAC @ 600 ma power. Plug the supplied wall transformer into a convenient 120 VAC power outlet. Plug the 2.1 mm coaxial power connector into the socket at the rear of the MC-16 labeled "Power".

Connecting the Audio Inputs, Outputs, Status inputs and OC/Relays

The MC-16 interfaces to your equipment through depluggable rear panel screw terminals. Follow the legends for the desired audio, relay and control connections, which appear on the rear side of the printed circuit board. Remove each screw terminal, strip each conductor, and insert the conductor into the terminal and screw down the capture screw. The terminals accommodate wire sizes from 16 - 28 AWG solid or stranded wire. Connections may be made to the + and – audio inputs for balanced operation, or to the + input while grounding the - side for unbalanced input operation. Connections can be made to the + and – audio outputs for balanced operation, or to the + output and ground for unbalanced output operation.

CAUTION: In no case should either the + or - outputs be connected to ground.

CAUTION: Installation of the MC-16 in high RF environments should be performed with care. Shielded cable is suggested for all control, audio inputs and outputs. All shields should be tied to the "CH GND" terminal on each channel. The station ground should be connected to the chassis ground screw (CH1) located next to J1 as viewed from the rear. It is recommended that all cables connected to the MC-16 be looped through ferrite cores to suppress RF. Surge protection with RF filtering such as the Tripp Lite "ISOTEL 4 Ultra" or equivalent is also suggested for the power transformer and telephone line. The purchase of an inexpensive uninterruptible power supply (UPS) will provide back up in case of power outages.

Serial Interface

The Serial Interface is RS-232 with a female DB-9 connector. Only use the supplied serial cable to connect the MC-16 to your computer.

Serial Control

The MC-16 may operate at baud rates of 2400, 9600, 19200 and 38400 baud. **The unit is shipped set for 9600 baud, with 8 data bits, no parity and one stop bit.**

2400
9600 **Default**
19,200
38,400

MC-16 Operation.

Explanation of Setup Items

Programs

The MC-16 supports 32 "programs." Each program provides up to 30 commands, which may be activated by a remote user over the telephone interface.

For example, a command might be "*pulse relay 2* and *send serial string 3*." The user would issue this command by pushing a key(s) on the telephone.

Each command is issued by pressing a key(s) on the telephone. Keys 0-9, A-D, #, and "*" may be used, although few telephones have the "A-D" keys.

Program Startup

A user activates a program by dialing the MC-16's phone number, waiting for the acknowledgement signal, then entering an asterisk (*), the program number (01 - 32), and then the access code (if any) for that program.

If a mistake is made in entering the program number or access code, a single asterisk key (*) entry should be made, and the entire sequence restarted. At that time the program will generate another acknowledgement signal. At this time any program digit(s) may be entered to cause the appropriate action.

The following example sequence accesses the program (including an error and its recovery)

EEXAMPLE:

Program: 02
Access Code: 1234

- User dials the MC-16 phone number.
- MC-16 answers and then gives an acknowledgement signal
- User enters *02124
- User realizes he has made a mistake, so press the asterisk key (*) to restart, and then start the sequence again: *021234
- MC-16 responds with an acknowledgement signal
- User enters first command, in this case command 2 – by pressing key 2. The MC-16 does the commanded function and sends the acknowledgement tone is enabled. (see below for commands).
- User continues to press command keys as required for various functions.
- Program Termination

The program is terminated and the telephone disconnected when:

- The user enters two "pound" (#) keys in sequence.
- Or, if the unit is operating in CPC mode, when the CPC disconnect pulse is received by the MC-16 from your local telephone company.
- Or, if the unit is not operating in CPC mode, when a specified time (see below) has elapsed with no commands being given.

Program Operations

As long as the program is operating, the user may activate any command by pressing the appropriate key(s) on the telephone.

Macros

It is often desirable to have more than one action occur when a single program command is given. A "macro" facility is provided to enable this. A macro is simply a list of commands. When the macro is invoked (started), either by a program command or by another macro, it executes the commands in the list one at a time until it has finished the list.

EEXAMPLE:

For example, we might want one command to *pulse relay 4 and send serial string 6.* The following illustrates an example macro to achieve this:

Macro 3	
Macro Step	MC-16 Action
1	Pulse relay 4
2	Send string 6

NOTE: Notice that a macro can also call another macro if needed. That macro can call yet another. The maximum depth of these calls is 5 including the call from the program. There may be a maximum of 64 macros defined.

Program and Macro Operations

Programs can directly, or indirectly through macros, perform a number of operations on command. This following table defines those operations.

Operation	Action in Program	Action in Macro (if different than in Program)
Relay Close	Closes or pulses the specified relay. Specific action of relay is configured in the Relay Configuration menu.	
Operation	Action in Program	Action in Macro (if different than in Program)
Relay Open	Opens or pulses the specified relay as determined by the relay configuration	
Send String	Sends the specified string out the serial port	
Set Phone Audio On	Sends audio from the TELCO Send input to the telephone Line.	
Set Phone Audio Off	Stops sending audio to the telephone line.	
Hang Up	Hangs up the telephone line.	
Do Nothing	Disables associated command key	Not Allowed in Macro
Invoke Macro	Executes the specified macro	Executes the specified macro. When that macro completes, continues to the next operation in this macro.

Operation	Action in Program	Action in Macro (if different than in Program)
Delay	Not Allowed in Program	Delay macro execution for a specified number of tenths of seconds
End of Macro	Not Allowed in Program	Completes macro execution. If the macro was invoked by a program, the macro ends the program. If macro was invoked by a macro, the macro returns to the invoking macro and continues execution.

CONFIGURATION SETUP

This section describes how to configure the MC-16, including programs, macros, strings, relays and miscellaneous parameters. While the MC-16 is in setup mode, it will not answer any calls.

Accessing Setup Menus

The following instructions are for use with Windows 95/98/ME/NT/2000 HyperTerminal.

You can start HyperTerminal by clicking **Start**, pointing to **Programs**, pointing to **Accessories**, pointing to **Communications**, clicking **HyperTerminal**, and then double-clicking on the icon labeled **Hypertrm** or **Hypertrm.exe**.

- A new window will open labeled **CONNECTION DESCRIPTION.**
- In this window, Type a name that describes the connection (We suggest **BTI96**), click the appropriate icon, if desired this is not required, and then click OK.
- A new window will open labeled **CONNECT TO.**
- At the **CONNECT TO** screen,

1. Move your cursor to the **CONNECT USING** box
2. Press the down arrow on the right of the box to select the available com port ("Direct to com x"),
3. Then click the **OK** button.

- The **PORT SETTING** window will appear.
- At the **PORT SETTING** window,

Accessing Setup Menus (cont)

1. Change the **baud rate** to **9600**,
2. **Flow control** to **NONE**
3. Then click **OK** button.

- You will have a new window open labeled with the Connection Description you typed in earlier (in our example, BTI96).
- At this window
    1. Click on the word **FILE** at the upper left portion of the menu bar and click on **Properties**.
        i) Click the **Settings** tab, and then change the
            (1) **EMULATION** to **ANSI,**
            (2) Then click the **OK** button.
    2. Click on **FILE**, click **Save.**
    3. Click on **FILE**, click **Exit.**
- Click **Yes**, when asked to disconnect. This will place you back at the HyperTerminal screen

At the HyperTerminal screen, find the Icon and/or file you named and double click on it.

SERIAL PORT TROUBLESHOOTING

A Build a loop-back "TESTER" by purchasing a "FEMALE" 9 pin D-sub solder cup connector (Radio Shack, CompUSA, Local Electronic Store, etc).

B Solder a jumper between pins 2 & 3.

C Try typing on the keyboard with nothing connected to the computer's com port. You shouldn't see any characters. If you do, the "ECHO typed characters locally" is checked (ON)" in the ASCII settings in HyperTerminal. Turn this OFF (Uncheck) and retest.

D Plug the "TESTER" into the com port under test

E Try typing on the keyboard, if you're using the correct com port, each character typed will be displayed.

F If this test fails, try changing com ports on the communication program until you find the correct port. When a working com port is found, follow the instructions below.

> 🛠 **Tool Tip:** With some communication programs, any change made to the program settings requires you to save the changes, exit the program and restart the program.

Press and hold the *SETUP* button on the front panel, press the space bar on your keyboard, and then release the *SETUP* button. The initial setup menu will appear on the screen. (See next page for sample screen).

Master Setup Menu

Menu **Master Setup Menu**

MC-16 - 01.27 Copyright 1999,Broadcast Tools, Inc

1 - Programs
2 - Macros
3 - Relays
4 - Strings
5 - Access Codes

A - CPC Mode
B - Call Timeout for Non-CPC Mode
C - Baud Rate
D - Rings Before Answer
E - Response Mode
F – Dump EEPROM
R - Reinitialize EEPROM

T - Enable Hybrid Balance

Q - Exit Setup Mode

Cmd:

This menu provides access to all configuration information. To select an individual item, enter the number or letter to the left of the menu line. To exit from setup mode, enter the letter q or Q. The case of letters does not matter except in strings.

	Initial Setup Menu Details *Table 5* Description of Item Selected
1	Programs (01 to 32) – the programs define the telephone key (DTMF) commands. Each program contains one operation or macro invocation per DTMF key(s).
2	Macros – each macro contains a series of operations to be performed by the MC-16. Maximum 64.
3	Relays – each relay can operate in one of four modes. This selection selects the modes.
4	Strings – each string is a group of ASCII and/or 7-bit binary characters, which may be sent out the serial port as a program or macro operation. Maximum 32
5	Access Codes – each program has an access code required to access it. (Maximum 4 digits)
A	CPC Mode – in CPC mode the MC-16 automatically hangs up when it detects a disconnect pulse from your local telephone company. This occurs (if the telephone company provides the service) when an incoming call is disconnected. If CPC mode is off, the MC-16 hangs up after a set period of time without any commands being issues. This selection allows CPC mode to be turned on or off.
B	Call Timeout for non-CPC mode. This allows the hang-up timer to be set to a specified number of minutes. Maximum 20 minutes.
C	Baud Rate – the serial interface may operate at any of four serial speeds. This entry selects the speed. This speed applies both to the sending of serial strings, and future setup sessions.
D	Rings Before Answer – the MC-16 will wait a set number of rings before answering the telephone. This entry sets that number. Maximum 20 rings.
E	Response mode – Enable or disable the acknowledgment (beep) tone per program
F	Dump EEPROM – The MC-16 downloads all configuration information in the Electrical Erasable PROM to a connected PC.
R	Reinitialize EEPROM – The MC-16 stores all configuration information in an Electrical Erasable PROM. This entry resets the configuration to factory defaults or allows a configuration upload from a connected PC.
T	Hybrid Balance Tone – the MC-16 can generate a single or multiple tones to be used while balancing the telephone interface hybrid. This entry activates and allows control of that tone.
Q	Exit Setup Mode – entering Q or q will erase the screen and terminate setup mode. If the serial speed was changed during this setup session, the new speed will now be activated.

Program Setup Menus

After the Program is selected, the following menu is displayed:

Example Program Setup Menu **Table (**

```
MC-16 - 01.27     Copyright 1999,Broadcast Tools, Inc


      Pgm Setup

---01---   ---02---   ---03---   ---04---   ---05---   ---06---   ---07---
 0-AUD ON   0-C01       0-         0-         0-         0-         0-
 1-C01      1-O01       1-         1-         1-         1-         1-
 2-C02      2-C02       2-         2-         2-         2-         2-
 3-C03      3-M02       3-         3-         3-         3-         3-
 4-C04      4-          4-         4-         4-         4-         4-
 5-O01      5-          5-         5-         5-         5-         5-
 6-O02      6-          6-         6-         6-         6-         6-
 7-O03      7-          7-         7-         7-         7-         7-
 8-O04      8-          8-         8-         8-         8-         8-
 9-O04      9-          9-         9-         9-         9-         9-
 A-C05      A-          A-         A-         A-         A-         A-
 B-S11      B-M01       B-         B-         B-         B-         B-
 C-S12      C-          C-         C-         C-         C-         C-
 D-C01      D-          D-         D-         D-         D-         D-
 *-         *-C01       *-         *-         *-         *-         *-
#0-        #0-         #0-        #0-        #0-        #0-        #0-

Enter: + for next page, - for prev page, Item Num:
```

This menu displays the first 7 programs. To display other programs, press the Plus (+) or Minus (-) key. Each program is shown in a separate column. The key corresponding to the command is on the left, then a "-", then the operation code itself. See the Operations Decode Table For Macros and Programs to see how to decode the operation codes.

Examples from the menu displayed above:

Example Program Operation Entries **Table 7**

Program Number	Command Key	Displayed	Meaning
01	*	*-S01	Send string 01 when the asterisk (*) key is pressed on the telephone.
02	3	3-M02	Execute Macro 02.

To modify or create a specific program, enter it's number (such as "**02**"). To go back to the previous menu, press the Enter key.

When a program has been selected, a screen like the following is displayed. It shows only the program selected, and allows commands in that program to be edited.

Example Program Edit Screen **Table 8**

```
MC-16 - 01.27    Copyright 1999,Broadcast Tools, Inc

     Pgm 01 - Edit Screen

0-AUD ON  #1-
1-C01    #2-
2-C02    #3-
3-C03    #4-
4-C04    #5-
5-O01    #6-
6-O02    #7-
7-O03    #8-
8-O04    #9-
9-O04    #A-
A-C05    #B-
B-S11    #C-
C-S12    #D-
D-C01    #*-S01
*-
#0-
Enter Key (0-9A-D* or #+key), or X to erase:
```

- To erase all commands in the program, press X.
- To return to the previous menu, press Q or Enter.
- To edit or enter a command, enter the command key(s) (0-9,A-D, #, ∗**)** to display the Command Edit Dialog (See next page).

Example Command Edit Dialog **Table 9**

```
Enter Key (0-9A-D * or # + key), or X to erase:

Edit Cell  8 =>  8-O04

 D - Do Nothing
 H - Hang Up
 M - Invoke Macro
 P - Set Phone Audio
 R - Set Relay
 S - Send String

 Q - Quit Edit

Cmd?
```

The above screen allows modification of a command. In this instance, it allows the command (cell) 8 to be modified. Some of the selections will result in additional dialogues being displayed. When a cell modification is complete, this dialog is displayed for the next cell.

Actions allowed:

- Set command to do nothing at all – press D. This will prevent the associated key from doing anything.
- Set command to hang up the phone – press H.
- Set command to invoke a macro – press M. You will be prompted to enter the macro number.
- Set command to control audio-to-telephone link – press P. You will be prompted to enter Y if the command is to turn on the audio link, or N to turn it off.
- Set command to control a relay – press R. You will be prompted as follows:
- Relay Num (01-16): (enter the relay number – two digits)
- Relay Close (C) or Relay Open(O) (C/O)? (Enter the appropriate letter)
- Set command to send a string – press S. You will be prompted for the string number.
- Return to previous menu – press Q or ESC.

Macro Setup Menus

The Macro Setup Menus provide the capability to examine and set up Macros. A macro is a list of commands which, when invoked by a command, executes until it is complete. Macros allow all program commands, and also the additional Delay command, which causes the macro to pause for a specific period of time.

Example Macro Setup Menu **Table 1(**

```
MC-16 - 01.27    Copyright 1999,Broadcast Tools, Inc

    Macro Setup  - Only First 16 Commands Shown

---01---  ---02---  ---03---  ---04---  ---05---  ---06---  ---07---
01-S10    01-S12    01-       01-DLY:1.2 01-       01-       01-
02-S01    02-DLY:2.0 02-      02-M01    02-       02-       02-
03-M02    03-S13    03-       03-AUD ON  03-      03-       03-
04-C03    04-       04-       04-AUD OFF 04-      04-       04-
05-DLY:1.0 05-      05-       05-C01    05-       05-       05-
06-S11    06-       06-       06-O01    06-       06-       06-
07-       07-       07-       07-S01    07-       07-       07-
08-       08-       08-       08-HANG UP 08-      08-       08-
09-       09-       09-       09-       09-       09-       09-
10-       10-       10-       10-       10-       10-       10-
11-       11-       11-       11-       11-       11-       11-
12-       12-       12-       12-       12-       12-       12-
13-       13-       13-       13-       13-       13-       13-
14-       14-       14-       14-       14-       14-       14-
15-       15-       15-       15-       15-       15-       15-
16-       16-       16-       16-       16-       16-       16-

Enter: + for next page, - for prev page, Item Num:
```

The Macro Setup Menu shows the first group of macros and the first commands in that macro. You can:

- To move to the next page of macros – press the plus (+) key.
- To move to the previous page of macros – press the minus (-) key.
- To display all commands in a macro, and enable editing of that macro - enter its two digit macro number.
- To return to the previous menu -press Q or ESC.

Once a macro has been selected by entering it's two-digit macro number, a page is displayed to edit that macro. It displays all commands in the macro, and enables editing or erasing any cell (command) in the macro.

Example Menu to Set Up One Macro **Table 11**

```
MC-16 - 01.27    Copyright 1999,Broadcast Tools, Inc

     MACRO - Edit Screen

01-S10    17-S17    33-       49-
02-S01    18-S18    34-       50-
03-M02    19-S19    35-       51-
04-C03    20-       36-       52-
05-DLY:1.0 21-      37-       53-
06-S11    22-       38-       54-
07-       23-       39-       55-
08-       24-       40-       56-
09-       25-       41-       57-
10-       26-       42-       58-
11-       27-       43-       59-
12-       28-       44-       60-
13-       29-       45-       61-
14-       30-       46-       62-
15-       31-       47-       63-
16-       32-       48-       64-

Enter Cell Num(01-64), or X to erase:
```

- To erase the entire macro – press X.
- To redisplay the macro – press S.
- To return to the previous menu – press Q or ESC.
- To edit one cell of the macro – enter the *two-digit* cell number. The Edit Macro Cell dialog will be displayed.

CAUTION: Do not leave blank in-between cells before the last one. The macro will stop executing at the first blank cell. In the example above, cells 17, 18 and 19 will never be executed. The macro will stop at cell 06.

The edit macro cell dialog allows you to edit one cell of a macro. It displays the contents of that cell

Example Edit Macro Cell Dialog **Table 12**

```
Edit MacroCell 06 => 06-S11

 D - Delay
 E - End of Macro
 B - Emit Beep
 H - Hang Up
 M - Invoke Macro
 P - Set Phone Audio
 R - Set Relay
 S - Send String

 Q - Quit Edit

Cmd?
```

The cell can be set to:

- Delay execution of the rest of the macro – press D. You will be prompted for the two digit number of tenths of seconds of that delay. Example: 10 = 1 second.
- End execution of the macro – press E. Note that this is not necessary if there is no room to add it. Otherwise the cell immediately following this entry must be set to End execution. It will display as blank.
- Set command to emit a confirmation "Beep" tone. Press B
- Set command to hang up the phone – Press H.
- Set command to invoke a macro – Press M. You will be prompted to enter the two digit macro number of another macro to be invoked. When it ends execution, the current macro will continue where it left off.
- Set command to control the send audio-to-telephone line – press P. You will be prompted to enter Y if the command is to turn on the audio link, or N to turn it off.
- Set command to control a relay – press R. You will be prompted as follows:
  - *Relay Num (01-16)* (enter the relay number – two digits)
  - Relay Close(C)or Relay Open(O) (C/O) (enter the appropriate letter)
- Set command to send a string – Press S. You will be prompted for the string number.
- To return to the previous menu – Press Q or ESC.

Relay Setup Menu

Relays on the MC-16 can be set to one of the following modes:

MC-16 Relay Modes **Table 13**

Mode	Meaning
Hold (Latch)	Close command: close relay and keep it closed. Open command: open relay and keep it opened.
Interlock	Relays operate in even-odd pairs. Thus, for an example, if relay 2 is set to interlock, relay 3 will also be interlocked with it. ***In an interlocked pair:*** Close command: close the specified relay and keep it closed. Open the other relay of the pair and keep it opened. If one receives the open command, it opens and stays open. The other relay will then close and stay closed.
Momentary On Tone	When the close command is issued, the relay pulses for 100 milliseconds as soon as the DTMF tone is detected.
Momentary After Tone	When the close command is issued, the relay pulses for 100 milliseconds as soon as the DTMF tone has ceased.

The relay setup menu is displayed when option 3 is selected from the Master Setup Menu. The menu shows the current state (whether the relay is opened or closed) and current mode for each relay. Interlocked pairs consist of a relay in the left column and the relay on the same line in the right column.

An example is:

Example Relay Setup Menu **Table 14**

```
MC-16 - 01.27    Copyright 1999,Broadcast Tools, Inc

    Relays

01 - C -  Interlock          02 - O -  Interlock Secondary
03 - O -  Mom On Tone        04 - O -  Mom After Tone
05 - O -  Hold Mode          06 - O -  Hold Mode
07 - O -  Hold Mode          08 - O -  Hold Mode
09 - O -  Hold Mode          10 - O -  Hold Mode
11 - O -  Hold Mode          12 - O -  Hold Mode
13 - O -  Hold Mode          14 - O -  Hold Mode
15 - O -  Hold Mode          16 - O -  Hold Mode

Relay Num(01-16)?
```

To set the mode of a relay, enter its two-digit number. If the mode will be Interlock, its paired relay will also be configured as Interlock. This will display the Relay Setup Dialog (see example below).

To return to the previous menu, enter Q or ESC.

Example Relay Setup Dialog **Table 15**

Relay 05 Setup

A - Set Relay to Close When Last Character of Command Starts

B - Set Relay to Close After Last Character of Command Done

C - Set Relay to Hold State

D - Set Relay to Interlock with Neighbor

This example sets up relay number 05.

- To set relay to close when last character of command starts – Press A.
- To set relay to close when last character of command ends – Press B.
- To set relay to hold mode – Press D.
- To set relay to interlock mode – Press D. This will also set the paired relay to interlock mode.

String Setup Menu

The MC-16 can send ASCII strings from its serial port at the configured bit rate. The String Setup Menu is used to define those strings. The strings can contain both printable characters, and hexadecimal encoded binary characters. It is common to end a string with a "carriage return". This is encoded in hexadecimal (per the ASCII standard) as 0D (note: this starts with the number *zero* rather than the letter *oh*). See Appendix II - ASCII to HexaDecimal Conversion Table.

Example String Setup Menu

```
MC-16 - 01.27     Copyright 1999,Broadcast Tools, Inc

    String Setup

01:SP C,S,2\0D@AM C,0\0D
02:
03:SETAUDIO 1 S SR1 0\0D
04:
05:LOAD FILE,3456\0D
06:
07:
08:
09:
10:
11:
12:
13:
14:
15:
16:
+ for Next page, - for Prev page, String Num:
```

The String Setup Menu shows the first group of macros and the first commands in that macro. You can:

- To move to the next page of macros – press the plus (+) key.
- To move to the previous page of macros – press the minus (-) key.
- To display all commands in a macro, and enable editing of that macro - enter its two digit macro number.
- To return to the previous menu -press Q or ESC..

Access Codes Setup Menu

The Program Access Code Setup Menu provides the way to view, set or delete program access codes. NOTE: Programs do not require access codes.

Example Program Access Code Setup Menu **Table 16**

```
MC-16 - 01.27    Copyright 1999,Broadcast Tools, Inc

     Pgm Access Code Setup

  01 [0123]   17 [   ]
  02 [   ]    18 [   ]
  03 [   ]    19 [   ]
  04 [   ]    20 [   ]
  05 [   ]    21 [   ]
  06 [   ]    22 [   ]
  07 [   ]    23 [   ]
  08 [   ]    24 [   ]
  09 [   ]    25 [   ]
  10 [   ]    26 [   ]
  11 [   ]    27 [   ]
  12 [   ]    28 [   ]
  13 [   ]    29 [   ]
  14 [   ]    30 [   ]
  15 [   ]    31 [   ]
  16 [   ]    32 [   ]

Pgm Num?
```

This example shows a system where only program 01 has an access code. The other programs do not require an access code. The program one access code is 0123. To run program 01, call the unit on the phone, wait for the acknowledgement tone, and then enter "*010123". To run program 02, call the unit on the phone, wait for the acknowledgement tone, and then enter "*02".

To set or delete an access code, enter the two-digit program number. You will be prompted with:
Enter Access Code. Press ENTER when done:

To set the access code, type the string (use only those keys on the telephone pad – 0-9, * and, if a 16 button phone is to be used, A-D. If you type fewer than four characters, you will need to press ENTER to complete the access code entry.

To delete the access code, press ENTER at the prompt.To return to the previous menu, press Q or ESC.

Setting CPC Mode

The "CPC" mode determines whether the unit will automatically hang-up after a caller disconnects (CPC Mode On), or will require a manual hang-up command or timeout CPC Mode Off). To change the CPC mode, enter A from the main menu. You will be prompted with:

CPC Mode is Now ON

CPC Mode On (Y/N)?

Notice that the current status of the CPC mode is displayed.

Enter Y to turn the mode on, or N to turn it off.

Setting Call Timeout for Non-CPC Mode

In non-CPC mode, if a caller disconnects without entering the hang-up command (##), the unit will remain off hook. In this case, the call timeout is needed to cause it to automatically hang up. The call time-out is the number of minutes after the last command before the unit will hang up automatically.

To set the call timeout value, enter B on the main menu. You will be prompted with:

- Current Timeout is 20 Minutes
- Num of minutes for call timer (00-20)?

Notice that the current value of the timer is displayed. Enter the two-digit number of minutes desired. Entering 00 will disable the time-out function. **NOTE: Maximum time-out is 20 minutes**.

Setting Baud Rate

The baud rate for the setup menu can be set to any of four speeds. The default is 9600 baud.

To change the baud rate, enter C on the main menu. You will be prompted with:
Baud Rate is 9600

1 - 2400
2 - 9600 ***Default***
3 - 19200
4 - 38400
Speed (1-4)?

Notice that the current baud rate is displayed. To change the baud rate, enter the corresponding number.

Setting Number of Rings Before Answer

To set the Number of Rings before answer, select D from on the main menu. You will be prompted with:

Rings before Answer now:01

Rings (01-20)?

Notice the current value is shown – in this case 01, which means answer on the first ring. To change this value, enter two digits 01 through 20. **NOTE: Maximum number of rings is 20.**

Setting the Program Response Mode

Each program may be programmed to give audible responses to commands, or not.

To set the response mode, enter E on the main menu. You will be prompted with:

Program Numbers (01-32)?

Enter the two-digit program number. You will then be prompted with:

Responses are on - Disable (Y/N)?

Notice that the current response state of the program is shown. Enter Y to change the mode, N to leave it the same.

Re-Initializing the MC-16 Configuration (EEPROM)

All configuration information is stored in the MC-16's non-volatile electrically erasable memory (EEPROM). To restore configuration to factory defaults, enter R on the main menu. You will be prompted with: Factory Reset - Code?

You must exactly enter in **capital letters (upper case) the following BTI**. This code is required to prevent inadvertent re-initialization. Once the I has been typed in, the unit will begin re-initializing with the output: Reset EEPROM:.....

As it is initializing, it will output dots to show it is still working. When it is complete, it will display the main menu.

To Download an MC-16 Configuration to a connected PC

1) Connect the MC-16 to your PC and start HyperTerminal at 9600 baud
2) Hold down the SETUP button and press the PC's space bar
   This will bring up the setup menu
3) Enter F (for Dump EEPROM)
   Unit will respond with "Prepare Capture" press the ENTER key.
4) At the Hyper terminal screen,
   1-Click Transfer->Capture Text
   2-Type in a file name (example: mc16.txt).
   3-Click "Start"
   4-Hit the ENTER key
   Unit will respond with a long stream of text. When it is done,
   it will display "End Capture, hit ENTER"
5) On Hyper terminal
   1-Click Transfer->Capture Text->Stop
   2-Hit the ENTER key

At this point, the file (mc16.txt for example) will hold the configuration.

To Set up an MC-16 from a downloaded configuration:

1) Connect to the MC-16 using HyperTerminal at 9600 baud
2) Hold down the SETUP button and press the terminal space bar. This brings up the setup menu
3) Type R to reset EEPROM. Unit will respond with "Factory Reset - Code?"
4) Type **BTI (ALL CAPS)** and then press enter. The MC-16 will response with Init EEPROM and then a string of spaces. When it is complete, it will display the menu again.
5) Type Q to exit the menu
6) Click Transfer->Send Text File
7) Click on the file name with the configuration desired (example:mc16.txt)
8) Click on "Open"
9) The file will be sent. A series of dots will display during transmission.
   When the setup is complete, the unit will respond with a Done message.

CAUTION: If the letter "E" appears on the screen instead of one of the dots, it indicates a transmission error. This entire procedure, starting at step 1 should be repeated. If errors continue, reduce the baud rate.

Balancing the Hybrid

The telephone hybrid in the MC-16 may need to be balanced in order to match your telephone line. The MC-16 can generate a hybrid balance tone for that purpose.

The hybrid balance procedure is:

1. Enter **T** on the main menu. You will be prompted with:

   Next call will be for hybrid setup - press ENTER:

2. Press **ENTER** to continue.

3. You will now see the main menu. Press **Q** to exit setup mode.

4. Dial the unit's telephone number. The unit will answer on the first ring. After it's normal greeting tone, it will start sending the hybrid balance tone (approx 1000 Hz). The unit will stay on line and will continue generating the tone until either:

   - If it is in CPC mode, you hang up; or
   - If it's not in CPC mode, after one minute.

5. Balance the hybrid by connecting an audio voltmeter or headset to the audio output. You will want to slowly adjust the "NULL" control for the lowest possible reading or tone.

6. Hang up the phone when done. On subsequent calls the unit will behave as normal.

Exiting Setup Mode

To exit setup mode, you must return to the main menu if any other menus are showing (except in cases noted, this can be done by pressing the ENTER key until the main menu is displayed. Then press Q and the unit will return to normal operation.

Connecting the MC-16 to external equipment

♬ **NOTE: All connections are labeled on the rear edge of the printed circuit board.**

- Relay connections for relays 1 through 16 and the "ACCESS" relay. Removable screw terminals are provided.

- RS-232 port: A female DB-9 D-Sub connector and straight- through serial cable are provide for connection to a PC. Default: 9600 8 N 1, Flow control = NONE and emulation set to ANSI.

- Telephone line: A modular jack is provided for connection to a telephone line. The line cord is provided.

- Power: A 2.1mm "barrel" connector is provided for 16 to 18 V AC ONLY @ 600ma power. The wall transformer is supplied.

- Open collector transistor outputs are supplied for "RING" and "TONE" status. These outputs go low whenever a ring or tone is detected. Removable screw terminals are provided.

- The remote seize input is labeled "SEIZE". A low on this input causes the MC-16 to seize the telephone line. Removable screw terminals are provided.

- The remote busy input is labeled "BUSY". A low on this input forces an Off-Hook condition. Removable screw terminals are provided.

- The balanced audio input feed to the phone line is labeled "TEL IN". The level is adjustable from the front panel. Removable screw terminals are provided.

- The balanced audio input feed to the DTMF decoder is labeled "AUX". The level is adjustable from the front panel. Removable screw terminals are provided.

- The balanced audio output feed from the telephone line is labeled "TEL OUT". The level is adjustable from the front panel. Removable screw terminals are provided

Appendix I - Operations Decode Table for Macros and Programs

Operations Decode Table For Macros and Programs				
Code	**Allowed in Program**	**Meaning**	**Example**	**Meaning**
DLY:x.x	N	Delay S.S x.x seconds.	DLY:1.2	Delay 1.2 Secs
M:xx	Y	Invoke Macro number xx.	M01	Invoke Macro number 01
AUD ON	Y	Send Audio Input to Telephone Interface		
AUD OFF	Y	Stop Sending Audio Input to Telephone Interface		
Cxx	Y	Close or Pulse Relay xx	C01	Close or Pulse Relay 01
Oxx	Y	Open or Pulse Relay xx	O01	Open or Pulse Relay 01
Sxx	Y	Send String xx	S01	Send String number 01
HANG UP	Y	Hang Up Telephone and End Program Session		

Appendix II - ASCII to HexaDecimal Conversion Table

Hexadecimal Code	Meaning
07	BELL – on an ASCII terminal, make a beep.
08	Backspace – erase the previous character
09	Horizontal Tab – tab key.
0A	Line Feed.
0C	Form Feed – end of a page.
0D	Carriage Return – the *Enter* key.
1B	ESC – The *ESC* key.
7F	DEL – The *DEL* key.