RINGING, TONES, AND RECORDED ANNOUNCEMENT MAINTENANCE SOFTWARE SUBSYSTEM DESCRIPTION (SSD) 2-WIRE NO. 1 AND NO. 1A ELECTRONIC SWITCHING SYSTEMS

CONTENTS PAGE

1. GENERAL

INTRODUCTION

1.01 The ringing, tones, and recorded announcement maintenance software performs the control functions necessary to provide for automatic monitoring and maintenance of the ringing, tone, and recorded announcement machines operating in a No. 1 or No. 1A Electronic Switching System (ESS) central office.

1.02 When this section is reissued, the reason for reissue will be given in this paragraph.

1.03 Part 6 of this document provides a defined list of the abbreviations and acronyms as used herein.

PURPOSE OF THE RINGING, TONES, AND RECORDED ANNOUNCEMENT MAINTENANCE SOFTWARE

1.04 This software subsystem provides for automatic monitoring and maintenance of the ringing and tone plant and recorded announcement equipment monitoring facilities. The capabilities provided include provision for teletypewriter (TTY) interface with the central office maintenance personnel.

SCOPE OF SECTION

1.05 This section provides an introduction to the ringing, tone, and recorded announcement maintenance software operating in a No. 1 or No. 1A ESS. Information unique to No. 1A ESS is so noted. Information unique to No. 1 ESS is not provided.

1.06 This section is based on the 1E5 (No. 1 ESS) and No. 1AE5 (No. 1A ESS) versions of the generic program.

2. PIDENTS DESCRIBED IN SECTION

2.01 Table A provides a PIDENT to PR number cross-reference listing for the programs described in this document.

2.02 The ringing and tone plant monitor and exercise program, ***PIDENT TOMK***, provides for program control of the monitoring equipment which insures that ringing current and various tones are constantly provided to the ESS. PIDENT TOMK also provides for ringing and tone plant status lamp indications at the master control center (MCC) and for TTY output messages (OMs).

2.03 The ringing and tone plant diagnostic program, ***PIDENT TODA***, provides for periodic testing of the trouble detecting capability of the monitors in the ringing and tone plant and the ground cross-detection circuit. TODA functions may also be TTY requested.

2.04 The recorded announcement machine program, ***PIDENT RAMP***, monitors the scan points associated with the recorded announcement machine. These scan points provide status information such as power, fuse, voice alarm, channel requests, and etc.

3. RINGING, TONES, AND RECORDED ANNOUNCEMENT MAINTENANCE FUNCTIONAL DESCRIPTION (Fig. 1)

Ringing and Tones

3.01 Normal operation of the ESS requires that a collection of tones and announcements be available for connection to both called and calling lines. Additionally, a ringing current is available as a power source to operate the bell in a station set. A No. 1/1A ESS central office requires four fundamental tones:

(a) Dial tone (350 Hz + 440 Hz)

(b) Audible ringing (440 Hz + 480 Hz)

(c) High tone (480 Hz)

(d) Low tone (480 Hz + 620 Hz)

The tones mentioned above plus the output of ringing generators (ie, ringing current) are amplified, interrupted, and distributed as required from the ringing and tone plant equipment. Solid state or mechanical interrupters are used to break the continuous tones (or currents) into the desired patterns. For example, both audible ring and ringing current are provided as a 2-second burst followed by 4 seconds of interruption. Ringing current is provided in three phases, each being 120° apart, thus providing a new ringing cycle start every 2 seconds to fulfill immediate ring requirements.

3.02 Three types of ringing and tone plants—806H, 808A, and 812A—may provide ringing and

TABLE A

RINGING, TONES, AND RECORDED ANNOUNCEMENT MAINTENANCE PIDENTS

PIDENT	TITLE	NO. 1 PD/PR—	NO. 1A PR—
TOMK	Ringing and Tone Plant Monitor and Exercise	1A050	6A050
TODA	Ringing and Tone Plant Diagnostic	1A050	6A050
RAMP	Recorded Announcement Machine Program	1A172	6A172

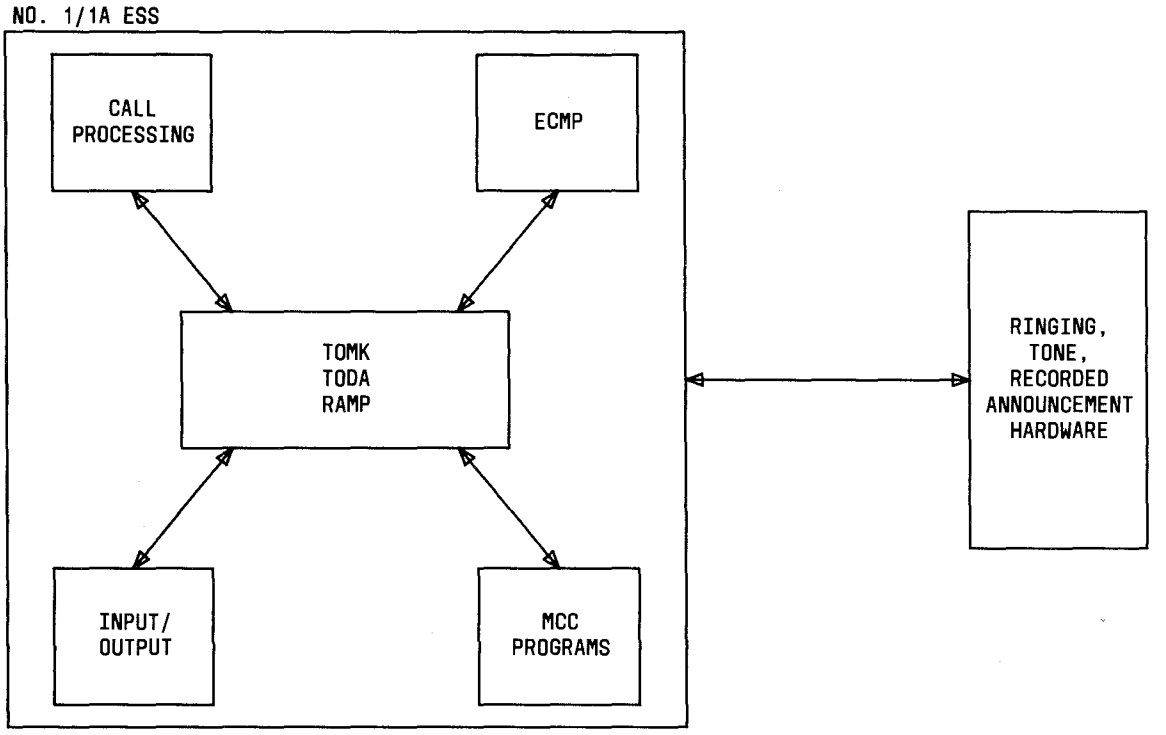

Fig. 1—System Interface

tone service for the ESS central office. The equipment is duplicated as necessary to insure continuous service. It is the function of the ringing and tone plant ***monitor and exercise*** and ***diagnostic*** programs to provide for automatic equipment monitoring, testing, and administration.

Recorded Announcement

3.03 The recorded announcement frame (RAF) provides fixed message length announcements to subscribers whenever the calling conditions encountered require some explanation. Additional capabilities such as variable message length announcements can be provided by the common systems recorded announcement frame (CSRAF). An ESS office may be equipped with frames of either type, or a combination of both.

3.04 A central office may be equipped with up to 16 RAFs, with each RAF providing up to six announcement channels. These six channels, each with a maximum message length of 11.2 seconds, provide recorded announcements as necessary via distribution and service circuits.

4. PIDENT DESCRIPTIONS

PIDENT TOMK

4.01 Program control of the ringing and tone plant is provided by TOMK. Status input to TOMK is via the ferrods associated with the ringing and tone plant monitors. When a scan result detects trouble for the first time, the following actions are initiated:

(a) The load may be transferred to the other circuit.

(b) A TTY message is printed.

(c) A major alarm is sounded.

(d) A status lamp at the MCC is lighted.

4.02 Table B provides a list of the major global entries found in TOMK. A brief discription of these globals follows. For more detailed information refer to the program listing.

TABLE B

TOMK GLOBALS

GLOBAL	FUNCTION	ENTERED FROM
MCKICK	Entry for Audit 56	TODA SADT MIRV
TOMESS	Receiver off-hook and ground detection	CHGD
TOMP01	Bypass test and monitor action	ECMP
TOMSA	Obtain MTDN translation	TODA
TOMS00	Transfer of circuits	TODA
TOPOW	Manual power action	MCLM
TOSUB1	Signal distributor action.	TODA

4.03 ***TOPOW:*** This routine is entered from the MCC programs upon restoral of power to the ringing and tone plant. A check is made of the stop test (STPT) flag. If STPT is not set, the trouble flags for the idle circuit are zeroed and a bypass counter is set up. The STPT flag inhibits the scheduled 1-second entry from ECMP. If an 806H or 808A plant is involved, an initializing routine will zero the interrupter control word. If power is removed at the frame, the appropriate status records are updated. When power is restored, the status records are erased so that any newly detected trouble in the circuit will generate an alarm.

4.04 ***TOMP01:*** This is the 1-second main program entry whose purpose is to check the speed off the interrupter. On each entry, the interrupter ferrods are scanned and the ringing phase is determined. A pointer to the expected ringing phase (updated on the previous entry) is examined to verify that the actual ringing phase agrees with the expected ringing phase. A match results in the pointer being updated. The interrupter is considered to be in trouble after three consecutive mismatches, a failure to resynchronize, followed by three more consecutive mismatches. A failure of this sort will normally prompt a load transfer to the spare interrupter.

4.05 The matching of ringing phases consists of comparing a scan result of the interrupter ferrods and a stored expected result. A ferrod is associated with each of the three ringing phases. Normally in the 806H and 808A plants, one of the three ferrods is unsaturated and the other two are saturated. When a scan result indicates a match between the actual and expected results, the expected result pointer is advanced to the next expected result for the next ringing phase. One second later the program is reentered and the ringing phase is again determined. If a match occurs, the pointer is advanced as before. If a mismatch is found, a counter is incremented and actions are taken as described above.

4.06 It is possible for a mechanical interrupter to be stopped such that one of the ringing current contacts is neither making nor breaking contact (ie, in the "middle"). This causes no problem in the 806H plant, but is detected in the 808A plant by an interrupter monitor. To clear this problem, power is momentarily removed from the interrupter and then the monitor is scanned. This procedure is repeated twice in hopes that the contacts will reach either a make or break condition. Failing this, the interrupter is marked in trouble.

4.07 A status record is maintained for each unit type to indicate the idle, active, and trouble

status of each unit. The status record is used to determine the program actions to be taken. The unit types are also assigned a priority that determines the action to be taken should trouble develop simultaneously in more than one unit. In the 806H and 808A plants, the ringing generators are assigned the highest priority, the solid state interrupters are next, followed by the tone sources and then the mechanical interrupters. In the 812A plant, the ringing generators are assigned the highest priority, followed by the interrupters, the common DC sensors, the tone sources, and then the converters.

4.08 When trouble is detected for the first time, program control is given to various subroutines which take actions to provide TTY messages, light the MCC status lamps, and generate a major alarm. The status record for the unit in trouble is updated. If the trouble is in an active unit, depending on the status of the duplicate unit and high priority units, the load may be transferred to the spare unit via TOMS00. Status records are checked before alarms are generated so that redundant alarms and printouts are not generated by subsequent program entries.

4.09 ***TOMSA:*** This entry is used to set the STPT flag (inhibits scheduled ECMP entry) and zero the bypass counter. Control is then given to a maintenance control program routine to obtain the necessary translation information for signal distributor actions.

4.10 ***TOSUB1:*** This entry is provided for loading T-scratch with the appropriate MTDN for multiple signal distributor actions. After loading an end code and general buffer table (GBT) code, a maintenance control (MAC) routine is called to get a peripheral order buffer (POB). Should POB loading fail (no POBs available), the request for signal distributor action is aborted and the MCC status lamps are updated as necessary.

4.11 ***TOMS00:*** This is the load transfer entry. To perform load transfer, TOMK performs the following actions:

(a) Sets STPT to inhibit 1-second entries from ECMP

(b) Loads T-scratch with the MTDNs of the relays to be activated

(c) Via MAC, attempts POB loading and activation.

Blocked requests are queued and the STPT flag is reset so that a retry is attempted 1 second later. Load transferral may be requested automatically or manually.

4.12 ***TOMESS:*** This routine is responsible for setting up the pool phrase for a TTY message indicating:

(a) Loss of output from the receiver off-hook (ROH) tone generator

(b) A ground cross in distribution network of the milliwatt tone source, loop checker generator, or tone sources in the ringing and tone plant

(c) Loss of 105-volt ringing for the emergency manual line circuit.

Actions are also taken to generate a major alarm. The TTY message will also identify the failing unit.

4.13 ***MCKICK:*** This entry is provided for the ringing and tone plant audit (audit 56). During an emergency action (EA) phase 4 or higher, some time after all relays in the ringing and tone plant have been released, the audit segment of this program is entered. The relays used for fault simulation are released and the power relays are operated. Load transfer control relay T0 is operated so that plant 0 will be active. The necessary T2 bits for plant 1 are set to ignore and those for plant 0 are set to accept.

PIDENT TODA

4.14 The ringing and tone plant provides facilities for testing the trouble detecting capability of the monitors and the ground cross-detection circuit. Program control of these testing facilities is provided by PIDENT TODA. Although the primary purpose is to test the monitors and ground cross-detection circuit, TODA also is used to transfer the load from one ringing and tone plant to the other. Load transfer is done daily to distribute wear on plants with mechanical interrupters.

4.15 The operation of certain relays allows trouble conditions to be produced in the ringing and tone plant; these relays are operated under

program control. Table C lists the relays and the trouble conditions produced. After a trouble is introduced, the monitors are scanned and the scan result is compared with an expected result. All tests pass results in a load transfer, an appropriate TTY message, and test of the other circuit. Test failure inhibits the load transfer and again a TTY message is generated. These diagnostics are performed automatically on a daily basis but may also be initiated by a manual TTY request.

4.16 The following paragraphs provide a brief description of the primary entries in PIDENT TODA (Table D). For more detailed information refer to the program listing (Table A).

4.17 ***TOTTY:*** This routine is the TTY request entry used to initiate testing of:

(a) Ringing and tone plant monitors

(b) Ground cross detection

(c) Ringing and tone plant load transfer.

4.18 ***TOGCD:*** The routine is the ground cross-detection diagnostic entry. On entry,

TABLE C

RINGING AND TONE PLANT TROUBLE CONDITIONS

RELAY	TROUBLE
L10	Low voltage output for 350-Hz oscillator of circuit 0 Low voltage output for 480-Hz oscillator of circuit 0 ROH tone trouble Ground cross on audible ring brush 3 (GD0) Ground cross on 60-ipm low tone (GD1) [Ground cross on preempt tone (GD2)]
L20	Low voltage output for 440-Hz oscillator of circuit 0 Low voltage output for 620-Hz oscillator of circuit 0 Ground cross on 120-ipm high tone (GD0) Ground cross on ROH tone (GD1) [Ground cross on miscellaneous tone (GD2)]
L11	Low voltage output for 350-Hz oscillator of circuit 1 Low voltage output for 480-Hz oscillator of circuit 1 ROH tone trouble Ground cross on steady high tone (GD0) Ground cross on 120-ipm low tone (GD1)
L21	Low voltage output for 440-Hz oscillator of circuit 1 Low voltage output for 620-Hz oscillator of circuit 1 Ground cross on 60-ipm high tone (GD0) Ground cross on TOUCH-TONE® (GD1)
H10	High voltage output for all oscillators of circuit 0 Ground cross on audible ring brush 1 (GD0) Ground cross on steady low tone (GD1) Emergency manual ringing (GM02)
H11	High voltage output for all oscillators of circuit 1 Ground cross on audible ring brush 2 (GD0).

TABLE D

TODA GLOBALS

GLOBAL	FUNCTION	ENTERED FROM
TOGCD	Ground cross-detection diagnostic	ECMP
TOREST	Daily diagnostic	ECMP
TOTTY	TTY requests.	TTIA

the program first tests for an existing fault by scanning the ferrods associated with the ground cross-detection circuit. If the scan result indicates a trouble condition and if the diagnostic were requested manually, then the request is aborted. Otherwise, a trouble relay is operated and a scan of the ferrods is done to determine if the trouble was detected. If the trouble is detected, then the trouble relay is released and an appropriate TTY success message is printed.

4.19 ***TOREST:*** This routine is the entry for the daily diagnostic. The ringing and tone plant diagnostic is not normally started if any of the units are marked in trouble. The one exception occurs when a TTY request is made to diagnose the circuit with a unit in trouble.

4.20 A trouble introduced in the tone source is not immediately detectable by the monitor. This is mainly due to the rather slow response of the oscillator to a loss of power. For this reason, it is necessary to delay 1.5 seconds after introducing a trouble before scanning a monitor ferrod. Similarly, a delay of 5 seconds is required after removal of the trouble to allow the circuit to stabilize. Noncall-register timing is used to obtain the required delays. Lack of a timing register will abort the test.

4.21 Troubles are introduced via the relays listed in Table C. After the trouble is established, a scan result from the appropriate monitor is checked against an expected result. Failure to compare results in a failure message on the TTY as described earlier.

PIDENT RAMP

4.22 Program control of the recorded announcement equipment is provided by RAMP. Depending upon the states of the scan points associated with the RAF and its announcement circuits, RAMP is entered to perform control functions.

4.23 Individual RAF channels may be in either a reproduce, record, or maintenance state as indicated by the associated scan points. Based on the scan point changes received, the central control makes busy or idles the trunk group(s) associated with each announcement channel and controls the channel state (in- or out-of-service) via signal distributor points. When the trunk group(s) for a particular channel is busied or idled, an output message indicating the trunk group status is printed.

4.24 Audits are performed periodically to verify the ground detector and voice alarm scan point states. During an audit these scan points are initialized.

4.25 The response to an IAM-IDLE input message is to:

(a) Put an RAF channel in service

(b) Reinitialize the memory for a single RAF

(c) Reinitialize the entire RAF memory.

Output messages indicating trouble and other conditions are provided by the TTY.

Program Entries

4.26 Table E provides a listing of the RAMP globals, their functions, and the PIDENTs from which they are referenced. The following paragraphs provide a brief description of these globals; for more detailed information refer to the RAMP program listing (Table A).

4.27 ***RAMENT:*** This routine is entered from PIDENTs CRFI or CHGD. Upon checking the state of the frame and CHRN (channel request number) and finding these items invalid, the program stores the state word, frame member number, and an end code. Error actions are taken and a TTY message is generated. If the information is valid and indicates an operator recording or a 1000-Hz tone recording, then the scan point type and state are used to select a path through the program.

4.28 For a voice alarm scan point change, the program sets the out-of-service bit for that channel, updates the RAF state item (STA) in the RAF control block, makes busy the associated announcement trunk group, and prints a TTY message. A minor alarm is sounded.

4.29 Upon detecting a change in the channel request scan point, item CHRN is updated and timing for the requested channel is begun. Before removing a channel from service, 36-second timing is done to insure that all trunks accessing that channel have received at least three cycles of the recording. The RAF control block provides timing words and a counter (CNT) to administer the required timing.

4.30 When a channel request is detected, eg, for message recording, the trunk group(s) associated with that announcement channel is made busy and an appropriate output message is generated. Subsequent calls to that trunk group are given reorder tone. Trunks and lines that were already connected to that channel and have not disconnected after three cycles will receive whatever is being recorded onto the channel.

4.31 ***IARLAC:*** This routine is the entry to RAMP on response to an IAM-IDLE input message. Depending on the selected option, the actions taken are as follows:

(a) Placing an RAF channel in service. The RAF channel is idled and the associated trunk group(s) is returned to service; the channel scan points are initialized.

(b) Reinitializing the memory for one RAF. Memory and scan points for the selected RAF are initialized; each channel and its associated trunk group(s) are individually idled.

(c) Reinitialize the entire RAF memory. The entire block of call store memory used by the RAF program is zeroed and all scan points associated with each RAF are initialized. Following

TABLE E

RAMP GLOBALS

GLOBAL	FUNCTION	ENTERED FROM
RAMENT	Scan point change processing	CRFI CHGD
IARLAC	Channel initialization	TTIA
RAUDIT	Recorded announcement T1-T2 (audit 58)	MAUD RMSG
RATGOS	Notification of trunks inadvertently left out of service	MACR

initialization, each channel plus associated trunk groups are individually idled.

4.32 ***RAUDIT:*** This routine is entered from PIDENT MAUD as part of the audit for RAF scan points. On entry, the state of the RAF is determined. If the RAF is found to be in a transition state (item TRNS) at the time the audit is requested, a check is made to insure that the value of TRNS is valid. If not, TRNS is zeroed. If the RAF is not found to be in transition, the scan points are audited and control is returned to MAUD.

4.33 ***RATGOS:*** This routine is entered hourly to determine if any trunk groups have been inadvertently left out of service. A trunk group may be inadvertently left out of service if the IAM-IDLE message is not used following power restoral or after a voice alarm condition is cleared. This routine checks each RAF to see if any out-of-service bits are set for that frame. An output message provides an indication of the member numbers and channels that have their associated trunk groups marked out of service.

5. GLOSSARY

Announcement	Trunks dedicated to a particular announcement channel. Calling lines or trunks receive a specific announcement when connected to the announcement trunk.
T1 Bit	T1 is the activity bit associated with each ferrod to indicate the ferrod's state, ie, idle if T1 = 1 and busy if T1 = 0.
T2 Bit	T2 is the control bit associated with the T1 bit. If T2 = 0, then T1 changes are to be ignored. If T2 = 1, then T1 changes are to be accepted.

6. ABBREVIATIONS AND ACRONYMS

CSRAF	Common System Recorded Announcement Frame
EA	Emergency Action
ESS	Electronic Switching System
GBT	General Buffer Table
Hz	Hertz (cycles per second)
MAC	Maintenance Control
MCC	Master Control Center
MTDN	Miscellaneous Trunk Distributor Number
OM	Output Message
POB	Peripheral Order Buffer
RAF	Recorded Announcement Frame
ROH	Receiver Off-Hook
SSD	Software Subsystem Description
TTY	Teletypewriter.