͏ͪtellabs
technical manual
76-81291R
rev A

P/o

291R Conference/Alerting System

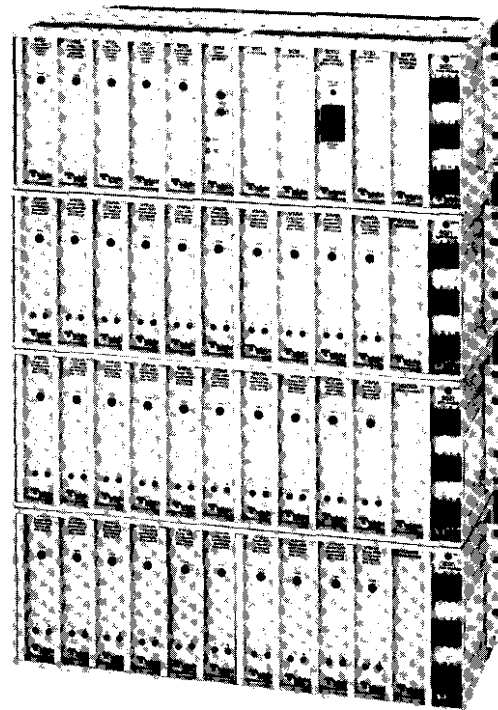## FCC Registration No. BPX826-68172-KF-N

contents

figure 1. 291R Conference/Alerting System

1. general description

1.01 The Tellabs 291R Conference/Alerting System (figure 1) is a multistation ringdown telephone conference circuit designed primarily for use in local emergency reporting and alerting applications and in business conferencing applications. The 291R System provides simultaneous access to up to 30 PBX stations either from a dedicated telephone (i.e., a "master" station) or via two PBX extension numbers. Conferees are provided with emergency conference capability at their everyday business telephones with no disruption of normal telephone service except during a conference call. All PBX stations assigned to the conference network are signaled via a distinctive ringing format on conference calls. The 291R System may be used with any FCC Registered PBX system. Services provided by the 291R System are typically used by airport emergency crews, banks, stores, and factories with multiple PBX stations.

1.02 The 291R System affords a choice of three methods of originating a conference: automatic origination, manual origination, or a combination of the two. The method chosen will, of course, depend upon local requirements.

1.03 With **automatic conference origination,** a call to one of the two PBX conference originate extension numbers causes all stations assigned to the conference network to ring distinctively. These stations are usually the PBX stations of key executives and/or emergency personnel. Anyone in the conference network may answer the call and hold up the conference for the purpose of relaying information. The conference can either be maintained until the last conference station goes onhook, or the conference can be forced idle after a predetermined timeout interval (adjustable between 1.5 and 5 minutes). This latter feature clears the conference in the event that a conference station is accidentally left off-hook.

1.04 With **manual conference origination,** up to two conference-originating (master) stations can initiate a conference call simply by going off-hook, causing all stations assigned to the conference network to ring distinctively. The conference is held up as long as the master station remains off-hook unless the 291R System is optioned otherwise.

1.05 The 291R System may also be arranged (via module selection) for **both automatic and manual conference origination.** This arrangement

permits a conference to be initiated either by a master station going off-hook, or by a call to the PBX conference extension number. The conference call can be terminated in any one of the several methods described in paragraphs 1.03 and 1.04.

1.06   When an emergency conference is **not** in effect, all stations assigned to the conference network are provided with normal PBX telephone service. When a conference **is** in effect, anyone involved in the conference need only depress his/her hookswitch momentarily to be disconnected from the conference and restored to normal service unless the system is optioned otherwise.

1.07   In addition to the operational capabilities previously mentioned (distinctive ringing on conference calls, automatic and/or manual conference origination, and compatibility with any conventional FCC Registered PBX system), the 291R System provides the following additional features related to its installation and operation:

★ a maximum of 4dB of bridging loss, regardless of the number of stations accessing the conference.

★ selection of either 20Hz or 30Hz ringing frequencies.

★ ringing timeout to terminate ringing at stations where conference calls are not answered.

★ remote access capability, whereby a station not assigned to the conference network can call in via one of the PBX conference extension numbers and be connected to a conference in progress.

★ an integral tone oscillator that eliminates the need to connect to PBX tone sources.

★ individual fusing for all modules in the System.

★ compact size: when arranged for the maximum number of lines (30), the complete System occupies only 24.5 inches of vertical space in a standard relay rack.

★ ease of installation, facilitated by a standardized wiring scheme and prewired, connectorized backplanes on the System's equipment shelves.

★ ease of alignment and testing, facilitated by a Tellabs 9802 Card Extender.

★ ease of optioning: most options are switch-selectable.

1.08   Designed primarily for PBX room installation, the 291R System mounts in either a 19 or 23 inch relay rack. All cabling between the System's equipment shelves, as well as cabling from the shelves to the terminal blocks (network interface connections), is simplified through the use of 25 foot connectorized cable adapters that plug into connectors on the backplanes of the System's equipment shelves. These cable adapters conform to USOC (Universal Service Ordering Code) RJ21X for connections from the 291R's manual, automatic and remote access ports to the PBX, and USOC RJ71C for connections from the 291R's Line Circuit modules to their associated PBX conference stations.

1.09   The 291R System is powered by a −48Vdc, 10 ampere power supply (part number 81-8007). A

fully equipped 30 conference-station system draws a maximum current of 8.5 amperes (excluding ring generator current). Ringing for the same fully equipped system is provided by three 8102, 20Hz, 5 watt, Ring Generators.

2.   system components

2.01   A 291R Conference/Alerting System equipped for the maximum number of lines (30) plus remote access, power and ringing consists of the following:

★ one 291R Emergency Reporting System (mounting) Assembly configured for a maximum of 30 lines. In this configuration, the 291R Assembly consists of 4 prewired Type 10 Mounting Shelves with connectorized backplanes, three connectorized cables for interconnecting the Shelves and four cable adapters for connecting the 291R to the PBX. A 9802 Card Extender and auxiliary bypass connector are also provided with these Shelves.

★ four 9021 Fuse modules.

★ one 9003 Ringing Interrupter Relay module.

★ one 9132 Ringing Timer module.

★ one 9121 Tone Supply module.

★ thirty 9191 2Wire Automatic Ringdown (ARD) Conference Terminate Line Circuit modules.

★ one 9196 2Wire ARD Loop Start Access Trunk Circuit module (automatic conferencing only).

★ one 9193 2Wire ARD Conference Originate Line Circuit module (manual conferencing only).

★ one 9194 2Wire Conference Amplifier module.

★ three 9196 2Wire ARD Loop Start Access Trunk Circuit modules (remote access).

★ one 81-8007 48Vdc, 10 ampere Power Supply, 19-inch rack mounted (requires two 14-9009 rack adapters for 23 inch rack).

★ three 8102 Ringing Generators, 5 watt, 20Hz (see note 2).

Note 1: *For combined automatic and manual conferencing, one 9196 module and one 9193 module are used in the System.*

Note 2: *The 8102 Ringing Generator requires two 14-9002 Mounting Bars when installed in a 19-inch rack, and two 14-9003 Mounting Bars when installed in a 23-inch rack.*

2.02   Following is a brief description of each of the components of the 291R System. Detailed information on these items can be found in the Tellabs Practice or Catalog Sheet on each.

291R Emergency Reporting System Assembly

2.03   The 291R Emergency Reporting System Assembly provides the necessary hardware to mount and interconnect the modules in the System. The 291R Assembly is available in configurations for 19-and 23-inch rack installation and for maximums of 10, 20, and 30 conference stations. One Assembly consists of the following items:

★ one 80-5033 Type 10 Mounting Shelf with a connectorized backplane wired for 291R System's common equipment.

★ one, two or three 80-5034 Type 10 Mounting Shelves with a connectorized backplane wired for PBX conference circuits (one shelf for each 10 conference circuits).

★ one, two, or three connectorized cables for interconnecting the Shelves.

★ two, three or four cable adapters for network interface connections to the PBX.

★ one auxiliary bypass connector (equipped with a bypass plug for circuit continuity).

★ one 9802 Card Extender. The 9802 provides a convenient means of testing and aligning a 291R System module while that module is functioning in its designated application. The 9802 plugs into the module's shelf position and the module then plugs into the 9802. The module now projects from the shelf to allow access to the connector pins, adjustment of potentiometers and switch-selection of options.

system modules
2.04 The modules in the 291R System may be functionally grouped into three classifications: common control modules, PBX access interface modules, and conference station interface modules (the 9191 Line Circuit modules).

2.05 The common control modules perform all necessary amplification, ringing, timing, tone supply, and fusing functions for the System. These modules include the 9194 Conference Amplifier, the 9121 Tone Supply module, the 9132 Ringing Timer, the 9003 Ringing Interrupter Relay module, and the 9021 Fuse Module.

2.06 The PBX access interface modules provide the necessary switching functions to originate a conference and to allow remote access to the conference. These modules include the 9193 Conference Originate Line Circuit, and the 9196 Loop Start Trunk Circuit.

2.07 Each of the System modules is described individually in the following paragraphs.

9194 2Wire Conference Amplifier
2.08 The 9194 2Wire Conference Amplifier module provides controlled gain for 2wire conference applications of up to 30 participating stations. The 9194 maintains satisfactory transmission levels by automatically increasing gain as successive stations bridge the conference circuit. Maximum bridging loss is only 4dB, regardless of the number of stations (up to 30) accessing the conference.

9121 Tone Supply
2.09 The 9121 Tone Supply module, when used in the 291R System, supplies both ringback tone (440 + 480Hz interrupted at 30ipm) and alerting tone (440 + 620Hz interrupted at 120ipm). The System extends ringback tone to the originating station until the first conference station is answered. The alerting tone is applied to busy conference lines to provide notification that a conference call is waiting. By supplying these tones, the 9121 module eliminates the need for connection to the PBX tone supply. Ringback and alerting tone levels are factory preset at −14dBm.

9132 Ringing Timer
2.10 The 9132 Ringing Timer module provides control timing for the 9003 Ringing Interrupter Relay Module in the form of 1-second signals. The 9132 module also provides an adjustable timeout circuit to control the length of time the conference stations will ring if not answered. This timeout circuit can also be optioned to force the conference idle after a predetermined timeout interval has expired. This option clears the conference in the event that a conference station is accidentally left off-hook. The timeout circuit activates whenever the master station goes off-hook (manual mode), or in response to an incoming call (automatic mode). The timer is automatically reset after the first conference station answers.

9003 Ringing Interrupter Relay Module
2.11 The 9003 Ringing Interrupter Relay module divides the ringing load into two groups. When one group is connected to the ringing source the other group is connected to either battery or ground. This configuration is reversed once every second in response to control signals supplied by the 9132 module. Each of the three ring generators inputs is individually fused with a GMT-type fuse and provided with an alarm detection circuit. This alarm detection circuit provides an external alarm indication in the event that an overload condition (caused by a shorted cable) or loss of ring generator voltage is sensed by the 9003 module. The 9003 module can be optioned for either battery bias or ground during the silent interval and for either the normal 1-second-on, 1-second-off ringing, or continuous ringing to one group of stations.

9021 Fuse Module
2.12 The 9021 Fuse Module provides 12 distribution fuses functionally arranged in 2 groups of 6 fuses each. In the 291R System, the 9021 is used to separately fuse the circuits of each of the other modules in the same Type 10 Shelf, thus preventing a single module malfunction from affecting power to the rest of the System. An alarm lamp and relay contact provide both a local visible indication and leads for a remote indication of a blown fuse in any of the circuits served by the 9021 module. Fuses in the 9021 are Buss GMT-type fuses rated at 0.25 ampere. Located on the front panel of the module, these fuses may be replaced without removing the module from service.

9193 2W ARD Conference Originate Line Circuit
2.13 The 9193 2Wire ARD Conference Originate Line Circuit is used to initiate a conference call manually from a dedicated conference-origination telephone (master station). The 9193 module supplies talk battery to the master station and supplies all necessary switching functions to originate a conference when the master station goes off-hook.

These functions include outputting a start pulse to all 9191 modules, providing system-locking ground to hold up the conference under control of the master station, and supplying ringback tone to the master station until the first party on the conference answers.

9196 2W ARD Loop Start Access Trunk Circuit
2.14   The 9196 module may be used either as an automatic conference originate module or as a remote access module. In the automatic conference originate arrangement, the 9196 seizes the conference circuit in response to incoming ringing and rings all conference stations until they answer, or until the ringing timeout interval has elapsed. The 9196 will disconnect from the conference either upon an opening of the loop greater than 50ms, when the calling party goes on-hook, or upon return of dial tone from the PBX. However, please note that the conference will still be maintained until the last conference station goes on-hook, or until forced-idle after a predetermined timeout interval. In the remote access arrangement, the 9196 seizes the remote access line in response to incoming ringing and connects the caller to the on-going conference. Circuit disconnect is the same as previously described for in the automatic access mode.

9191 2W ARD Conference Terminate Line Circuit
2.15   As stated previously, up to 30 conference stations may be signaled simultaneously upon activation of the 291R System. This is accomplished by routing each station's PBX line circuit through a 9191 2Wire ARD Conference Terminate Line Circuit. When the System is activated, the 9191 module transfers each conference station from its standard PBX service to the conference circuit. (Distinctive ringing is provided by the 9132 Ringing Timer module to distinguish a conference call from a normal call.) If a conference station is busy with a normal call at the time the conference is activated, the 9191, depending upon optioning, either disconnects the call in progress and connects the station to the conference or applies an alerting tone to notify the station user that a conference call is waiting. The station user need only depress the hookswitch momentarily to be connected to the conference. The 9191 marks the conference lines busy to normal traffic during a conference by applying interrupted alerting tone (supplied by the 9121 module) as a busy indication. The 9191 can also be optioned either to ignore the incoming call, or trip ringing voltage on incoming calls, the 9191 then applies "busy" (interrupted alerting) tone, and finally, after a preset time interval, drops the call.

3.   application
3.01   The 291R Conference/Alerting System is used primarily in local emergency reporting and alerting applications. In these applications, it provides a means of receiving emergency calls, and informing emergency personnel of details concern-ing an emergency via a ringdown conference network. The 291R System may also be used by business for multiparty conference calls involving key personnel within a company (i.e., "command" conferencing). Typical business users of the 291R System include downtown banks and stores with several suburban branches and manufacturing firms with their main offices at one location and their factories at several different locations.

types of conferencing
3.02   Depending upon local requirements, the 291R System may be arranged for automatic conference origination, manual conference origination, or a combination of the two. More detailed information on automatic, manual and combined conference arrangements can be found in paragraphs 3.03, 3.06 and 3.08, respectively.

automatic conferencing (9196 module)
3.03   In an automatic conferencing arrangement, the 291R System is activated directly from a call to one of the two PBX automatic conference originate extension numbers. The 291R will then ring all idle conference stations with a distinctive 1-second-on, 1-second-off ringing interval. Any conference station can answer the call, and the conference can either be maintained until the last conference station goes on-hook, or the conference can be forced idle after a predetermined timeout interval (adjustable between 1.5 and 5 minutes). When a station wishes to disconnect from the conference, the conferee need only go on-hook momentarily to restore normal PBX service (unless optioned otherwise). The System provides adjustable ringing timeout on conference lines to stop the ringing of unanswered telephones after a predetermined interval.

3.04   For stations that are busy at the time a conference call is made, the System either applies an alerting tone to indicate that a conference call is waiting or immediately cuts off the existing calls on the busy lines and transfers these lines into the conference. The choice of alerting tone or immediate cutoff for busy lines is an individual station option. If alerting tone is selected, a station user need only depress the hookswitch momentarily to be connected into the conference.

3.05   The 291R System can accommodate a maximum of two automatic access lines (two 9196 modules). This two module arrangement allows a second conference call to be initiated while a conference call is in progress. The second conference caller will rering any conference stations that are on-hook and the caller will automatically be connected into the on-going conference. These two automatic access lines can have individual extension numbers, or can be arranged in a line hunting group. The two 9196 modules are located in positions 1 and 2 of the 291R's common equipment shelf (80-5033).

manual conferencing (9193 module)
3.06   In a manual conferencing arrangement, one or two dedicated (master) telephones (typically

dialless) can initiate a conference call simply by going off-hook. This causes the 291R System to ring all conference stations that are not busy (using the distinctive ringing interval previously mentioned) and to either apply alerting tone to all busy conference lines or immediately cut off the existing calls on busy lines and automatically transfer these lines into the conference.

3.07 As in the automatic conferencing mode, the 291R System provides adjustable ringing timeout on the conference lines to stop the ringing of unanswered stations after a predetermined interval. When a station wishes to disconnect from the conference, the conferee need only go on-hook momentarily to restore normal PBX service (unless optioned otherwise). The conference circuit, however, does not release until the master station goes on-hook, unless the System is arranged so that the conference is held up until the *last* station in the conference goes on-hook.

3.08 The 291R System can accommodate a maximum of two manual access lines (two 9193 modules). Additional stations can be bridged to each manual-access line, however, only one station should be off-hook at any given time in order to avoid bridging losses and subsequent degradation in transmission quality. The two 9193 modules are located in positions 1 and 2 of the 291R's common equipment shelf (80-5033).

combined manual and automatic conferencing (9193 and 9196 modules)
3.09 In a combined manual and automatic conference arrangement, a conference call can be initiated either by a master station going off-hook, or by a call placed to the PBX conference originate extension number. Detailed information on each type of conferencing arrangement can be found in paragraphs 3.03 (automatic) and 3.06 (manual).

3.10 The 291R System can accommodate one manual (9193) and one automatic (9196) access line. The 9193 and 9196 modules are located in positions 1 and 2 of the 291R's common equipment shelf (80-5033). The first 2 positions of this shelf are nondedicated, i.e., either module can be used in either position.

remote access (9196 module)
3.11 The 291R System can be optionally arranged to provide up to three remote access lines (three 9196 modules). This remote access capability allows up to three PBX stations, which are not directly connected to the conference network, to gain access to an ongoing conference by dialing a remote-access extension number. Outside central-office (CO) lines can also access an ongoing conference. Depending upon the type of PBX system in use, an outside line can enter a conference via the PBX attendant console, or by dialing direct to the remote-access extension number.

3.12 When a call is placed to one of the remote-access extension numbers, the associated 9196 module trips incoming ringing and connects the station into the conference. If a call is placed to a remote-access extension number while the conference network is idle, the associated 9196 module will **not** trip ringing and the calling station will receive ringback tone from the PBX indicating an idle conference network. To disconnect from the conference, the calling party need only go on-hook momentarily to restore normal PBX service.

3.13 In order to provide remote access capability, the 291R System must be equipped with at least one 9196 module. The 291R System may also be equipped with 2 additional 9196 modules (total maximum of 3) to accommodate 3 simultaneous remote access conference calls. When more than one 9196 module is used, these modules should be assigned to a line-hunting group. The three 9196 modules are located in positions 3, 4 and 5 of the 291R's common equipment shelf (80-5033).

power
3.14 The 291R System can operate on any filtered input voltage from −42.75 to −56Vdc. Power connections to each shelf are made to screw terminals located at the rear of the shelf. Power is supplied to each shelf's modules via a 9021 Fuse module, which individually fuses each module, thus preventing a single module malfunction from affecting other modules in that shelf. Fuses on the 9021 are Buss GMT-type fuses rated at 0.25 amperes. Alarm relay contacts are also provided on the 9021 for remote alarm indication of a blown fuse.

3.15 A fully equipped common equipment shelf composed of either two 9193 manual access modules, or two 9196 automatic access modules (or one of each in a combined conference arrangement), three 9196 remote access modules, one 9003 ringing interrupter module, one 9132 ringing timer module and one 9121 tone supply module draws 1 ampere of current. Each of the line equipment shelves (3 maximum for 30 stations) when fully equipped with ten 9191 line terminate modules draws 2.5 amperes of current. Total current requirement for a fully equipped 30 station 291R System (excluding the three 8102 Ringing Generators which require 0.25 ampere apiece) is 8.5 amperes.

3.16 The 291R System is equipped with a Tellabs' 81-8007 −48Vdc, 10 ampere Power Supply. This power supply occupies 5.25 inches of vertical rack space and mounts across a 19-inch relay rack. Relay rack adapters (Part No. 14-9009) are also available to mount the 81-8007 Power Supply in a 23-inch rack.

ringing
3.17 The 291R System can accommodate ringing frequencies of 20Hz, 30Hz, or both depending upon local requirements. Five separate ringing inputs are available in the 291R, but only the first 3 inputs are used in PBX applications. (The other 2 inputs are used in CO environments where harmonic or decimonic ringing may be required.) Ring generator connections are made to screw terminals lo-

cated at the rear of the common equipment shelf. Factory wiring then connects these ring generator inputs to the 9003 Ringing Interrupter Relay module. The 9003 individually fuses and alarms the three ring generator inputs. Three GMT-type fuses (labeled A, B and C) on the modules front panel protects the three ring generators from possible short circuits. Once a fuse opens, the module's ringing detector will activate the alarm circuitry providing a relay contact closure to activate an external audible or visible alarm, and a local visible alarm via a front panel *ring gen alarm* (red) LED. The alarm circuit is also activated when the ringing generator's input to the 9003 module drops below approximately 50Vac. When any one of the three ring generator inputs is not used the corresponding detector circuit **must** be disabled.

3.18   Each of the 9003's three ring generator inputs terminates in two outputs. In response to 1-second control pulses generated by its associated 9132 Ringing Timer module, the 9003 connects the ringing source to one half of the outputs. Battery or ground is connected to the other group of outputs to provide the bias required to trip ringing during the silent period. This configuration is reversed once every second. Because the 9003 *splits* the ringing load into two groups, the ringing source can accommodate twice the rated number of ringers. By using this type of ringing format a fully equipped 30 conference station system requires only a 15 watt ring generator.

3.19   The 291R System can be optionally equipped with Tellabs' 8102, 20Hz, 5 watt Ringing Generator. One 8102 Generator is required for every 10 conference stations (or for every 10 ringers). Therefore, a fully equipped 30 station system requires three 8102 Generators. In addition, mounting bars (part number 14-9002 for 19 inch racks and 14-9003 for 23 inch racks) are required for relay rack installation of these Generators. If a customer supplied ringing generator is used, the generator must provide continuous ringing. Either battery or ground connected ring generator is used, all the ring generators **must** be either battery or ground connected to provide for proper ring trip.

4.   installation
inspection
4.01   The 291R Conference/Alerting System and its component modules should be inspected upon arrival to find possible damage incurred during shipment. If damage is noted, a claim should immediately be filed with the carrier. If stored, the equipment should be inspected again prior to installation.

4.02   All 291R Systems consist of a common equipment shelf (80-5033) and one to three line equipment shelves (80-5034), depending upon the number of conference stations required. The common equipment shelf houses the Systems' common control modules, PBX access interface modules and fuse module. The line equipment shelf houses the Systems' conference station interface modules and

fuse module. A 9802 Card Extender is also provided with every 291R System. The following checklist will assist in verifying that all the necessary equipment for your particular installation has been provided, and to familiarize you with the various mounting assemblies, modules and hardware.

common equipment shelf
   A.   Carton labeled **80-5033** contains the following equipment:
   □ one 80-5033 Common Equipment Shelf with attached bag of mounting hardware
   □ one 50-4001 Auxiliary Bypass Plug (Verify plug is inserted in connector J5 on the rear of the 80-5033 shelf.
   □ one 50-4011 Cable Adapter (converts 291R cabling to USOC RJ21X cabling)

line equipment shelf
   B.   Carton(s) labeled **80-5034** contains the following equipment:
   Note: *One, two, or three 80-5034 cartons may have been provided, depending upon the number of conference stations required. One 80-5034 Shelf is required for every 10 conference stations.*
   □ one 80-5034 Common Equipment Shelf with attached bag of mounting hardware.
   □ one 50-5302 Interconnect cable.
   □ one 50-4010 Cable Adapter (converts 291R cabling to USOC RJ71C cabling).

Both the 80-5033 and 80-5034 are Type 10, 12-position shelves designed for 19-inch relay rack installation. If these shelves are to be mounted into a 23-inch rack, one pair of 14-9009 rack adapters are required for every shelf. Locate and verify:
   □ two, three or four pair of 14-9009 Rack Adapters.

power and ringing equipment
   C.   The 291R System is equipped with power and ringing, locate and verify:
   □ one **81-8007** Power Supply.
   □ one, two, or three **8102** Ringing Generator(s) (one 8102 is required for every 10 conference stations).
   □ one pair 14-9002 (19-inch), or one pair 14-9003 (23-inch) Mounting bars for ringing generators.

The 81-8007 Power Supply is designed for 19-inch relay-rack installation. If the Supply is to be mounted into a 23-inch rack, one pair 14-9009 Rack Adapters are required. Locate and verify:
   □ one pair 14-9009 Rack Adapters.

   Note: *If power and ringing are supplied by the customer, a UL Listed power supply and ringing generator capable of meeting System specifications are required. Power and ringing specifications for the 291R System are listed in paragraphs 3.14 and 3.17, respectively.*

common control modules
   D.   Five common control modules are required in every 291R System. Locate and verify the following modules:

☐ one **9194** 2Wire Conference Amplifier module.

☐ one **9121** Tone Supply module.

☐ one **9132** Ringing Timer module.

☐ one **9003** Ringing Interrupter relay module.

☐ one **9021** Fuse module.

station interface modules

E.   From one to thirty **9191** 2W ARD Conference Terminate Line Circuit modules (depending upon conference requirements) are required in every 291R System. Locate and verify the proper number of modules for your application.

☐ one to thirty **9191** 2Wire ARD Conference Terminate Line Circuit modules.

☐ one to three (one for every ten 9191 modules) **9021** Fuse module(s)

PBX access interface modules

F.   The following modules are required to either provide manual (9193) conference origination, or automatic (9196) conference origination. If combined automatic and manual conference origination is required, one 9193 and one 9196 module must be provided. Locate and verify the following modules:

☐ one or two **9193** 2Wire ARD Conference Originate Line Circuit module(s) (manual conference origination), or

☐ one or two **9196** 2Wire Loop Start Access Trunk Circuit module(s) (automatic conference origination), or

☐ one **9193** and one **9196** module (combined automatic and manual conference origination.

remote access interface modules

G.   If remote access capability is required, one, two, or three 9196 2Wire Loop Start Access Trunk Circuit module(s) must be provided. Locate and verify the following modules:

☐ one to three **9196** 2Wire Loop Start Access Trunk Circuit modules.

card extender

H.   To facilitate optioning and testing, every 291R System comes equipped with a 9802 Card Extender. Locate and verify:

☐ one **9802** Card Extender.

mounting

4.03   The 291R System is designed for PBX equipment room location and, by virtue of the prewired Type 10 Shelves that are supplied as part of its mounting Assembly, mounts in either a 19-inch or 23-inch rack. In its maximum configuration (i.e., 30 stations and 4 shelves), the System occupies only 24.5 inches of vertical rack space.

4.04   The most common 291R System arrangement is shown in figure 2. The uppermost shelf is the 80-5033 common equipment shelf followed immediately below by one, two, or three (depending upon the number of conference stations re-

quired) 80-5034 line equipment shelves. If a power supply and ringing generator(s) are supplied, they should be located below the last line equipment shelf (80-5034). Install the 291R System in accordance with the following checklist.

☐ Mount the 80-5033 Common Equipment Shelf with the hardware provided (a pair of 14-9009 Relay Rack Adapters are required for 23-inch relay rack mounting.)

☐ Mount the one, two, or three 80-5034 line equipment shelves with the hardware provided. (A pair of 14-9009 Relay Rack Adapters are required for each shelf when mounted in a 23-inch rack.)

☐ Connect the 50-5302 interconnect cable between connector *J1* of the first line equipment (80-5034) shelf and connector *J1A* on the common equipment shelf (80-5033).

☐ If a second line equipment (80-5034) shelf is supplied, connect the second 50-5302 interconnect cable between connector *J1* on the second line equipment shelf to connector *J1B* on the common equipment shelf (80-5033).

☐ If a third line equipment (80-5034) shelf is supplied, connect the third 50-5302 interconnect cable between connector *J1* on the third line equipment shelf to connector *J1C* on the common equipment shelf (80-5033).

☐ Connect the 50-4011 Cable Adapter (end labeled *J4 MDF*) to connector *J4 Main Distributing Frame* on the common equipment shelf (80-5033).

☐ Connect the 2 to 1 50-4010 Cable Adapter (end labeled *J2 SWG EQ* to connector *J2 Switching Equipment* on the first line equipment shelf (80-5034). Connect the second end of the double ended connector labeled *J3 SUB LINES* to connector *J3 SUBSCRIBER LINES* on the same shelf.

☐ If a second and third line equipment shelf is supplied, connect the remaining two 2 to 1 50-4010 Cable Adapters to these shelves as described in the previous step.

☐ Secure all cable connectors to the shelves with the brackets provided on the rear of each shelf.

☐ If the optional ringing generator(s) (one, two or three, depending upon System requirements) are supplied. Mount these generators on the appropriate mounting bars (14-9002 for 19-inch rack, 14-9003 for 23-inch racks) with the hardware provided.

☐ Mount this ringing generator assembly on the relay rack with the hardware provided.

☐ Mount the optional 81-8007 Power Supply (if provided) on the relay rack directly below the ring generators. (A pair of 14-9009 Relay Rack Adapters are required for 23-inch relay rack mounting.)
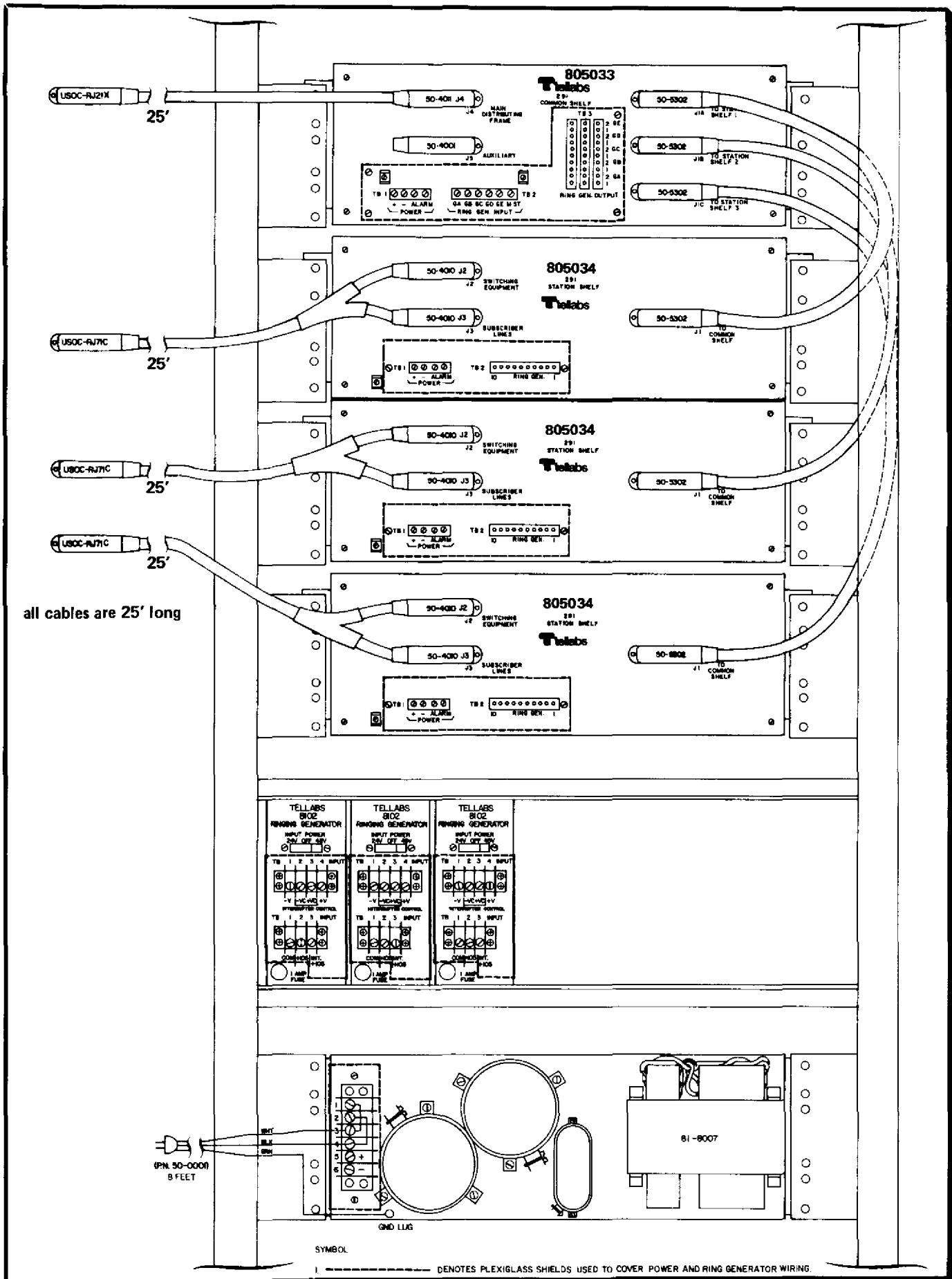
figure 2. 291R System, rear view, showing equipment arrangement

installer connections
power
4.05   Before starting the power wiring procedure, ensure that input power is **not** applied to the power supply and/or ringing generators. Power is only applied after all wiring has been completed and all modules have been properly optioned. Reference to figure 3 will aid in completing this wiring procedure.

☐   Remove and store the protective plexiglass shields from the rear of the following units: 81-8007 Power Supply, 8102 Ring Generator(s), 80-5033 Common Equipment Shelf and 80-5034 Line Equipment Shelves.

☐   Connect a 14AWG stranded red wire equipped with spade lug connectors (Tellabs 60-0048, or Panduit P18-8F-C) from the negative (—) terminal of the 81-8007 Power Supply to the negative (—) terminal of terminal block *TB-1* on the 80-5033 Common Equipment Shelf.

☐   Connect a second 14AWG stranded red wire equipped with spade lug connectors from the same negative (—) terminal of *TB1* on the 80-5033 Shelf to the negative (—) terminal of *TB1* on the first 80-5034 Line Equipment Shelf.

☐   In a similar fashion, connect a 14AWG stranded red wire equipped with spade lug connectors from the negative (—) terminal of *TB1* on the first 80-5034 Shelf, and to the negative (—) terminal of *TB1* on the second 80-5034 Shelf and from the negative (—) terminal of *TB1* on the second 80-5034 Shelf to the negative (—) terminal of *TB1* on the third 80-5034 Shelf (if provided).

☐   Connect a 14AWG stranded black wire equipped with spade lug connectors from the positive (+) terminal of the 81-8007 Power Supply to the positive (+) terminal of *TB1* on the 80-5033 Shelf.

☐   Connect a second 14AWG stranded black wire equipped with spade lug connectors from the same positive (+) terminal of *TB1* on the 80-5033 Shelf to the positive (+) terminal of *TB1* in the first 80-5034 Line Equipment Shelf.

☐   In a similar fashion, connect a 14AWG stranded black wire equipped with spade lug connectors from the positive (+) terminal of *TB1* on the first 80-5034 Shelf to the positive (+) terminal of *TB1* on the second 80-5034, and from the positive (+) terminal of *TB1* on the second 80-5034 to the positive (+) terminal of *TB1* on the third 80-5034 Shelf (if supplied).

4.06   If Tellabs' 8102 Ringing Generators are supplied, the following input connections must be made from the 81-8007 Power Supply to the 8102 Units.

☐   Connect a 20AWG solid red wire equipped with spade lug connectors from the negative (—) terminal on the 81-8007 Power Supply to the negative (—) *V* terminal of terminal block *TB1* on the first 8102 Generator.

☐   Connect a strap (20AWG solid red wire equipped with spade lug connectors) from the negative (—) *V* terminal of *TB1* on the first 8102 to the negative (—) *V* terminal of *TB1* on the second 8102 and, from the negative (—) *V* terminal of *TB1* on the second 8102 to the negative (—) *V* terminal of *TB1* on the third 8102 (if supplied).

☐   Connect a 20AWG solid black wire equipped with spade lug connectors from the positive (+) terminal of the 81-8007 Power Supply to the positive (+) *V* terminal of *TB1* on the first 8102 Generator.

☐   Connect a strap (20AWG solid black wire equipped with spade lug connectors) from the positive (+) *V* terminal of *TB1* on the first 8102 to the positive (+) *V* terminal of *TB1* on the second 8102, and from the positive (+) *V* terminal of *TB1* on the second 8102 to the positive (+) *V* terminal of *TB1* on the third 8102 (if supplied).

☐   Connect a strap (20AWG solid red wire equipped with spade lug connectors) from the *com* terminal of *TB2* on the first 8102 to the *com* terminal of *TB2* on the second 8102, and from the *com* terminal of TB2 on the second 8102 to the *com* terminal of *TB2* on the third 8102.

☐   On the last 8102, connect a 20AWG solid red wire equipped with spade lug connectors between the negative (—) *V* terminal of *TB1* and the *com* terminal of *TB2*. This strap and the three straps installed in the previous step provides each 8102 with the required —48Vdc ring trip bias voltage.

ringing
4.07   The following connections must be made between the 8102 Ring Generators and the 80-5033 Common Equipment Shelf. Reference to figure 3 will aid in completing this wiring procedure.

☐   Connect a 20AWG solid white wire equipped with spade lug connectors from the ±*105* terminal of *TB2* on the first 8102 to terminal *GA* of *TB2* on the 80-5033 Common Equipment Shelf.

☐   Connect a second 20AWG solid white wire equipped with spade lug connectors from the ±*105* terminal of *TB2* on the second 8102 to terminal *GB* of *TB2* on the 80-5033 Shelf.

☐   Connect a third 20AWG solid white wire equipped with spade lug connectors from the ±*105* terminal of *TB2* on the third 8102 to terminal *GC* of *TB2* on the 80-5033 Shelf.

Note: *Terminals* GD, GE, *and* MST *of* TB2 *on the 80-5033 Shelf are not used in PBX applications.*
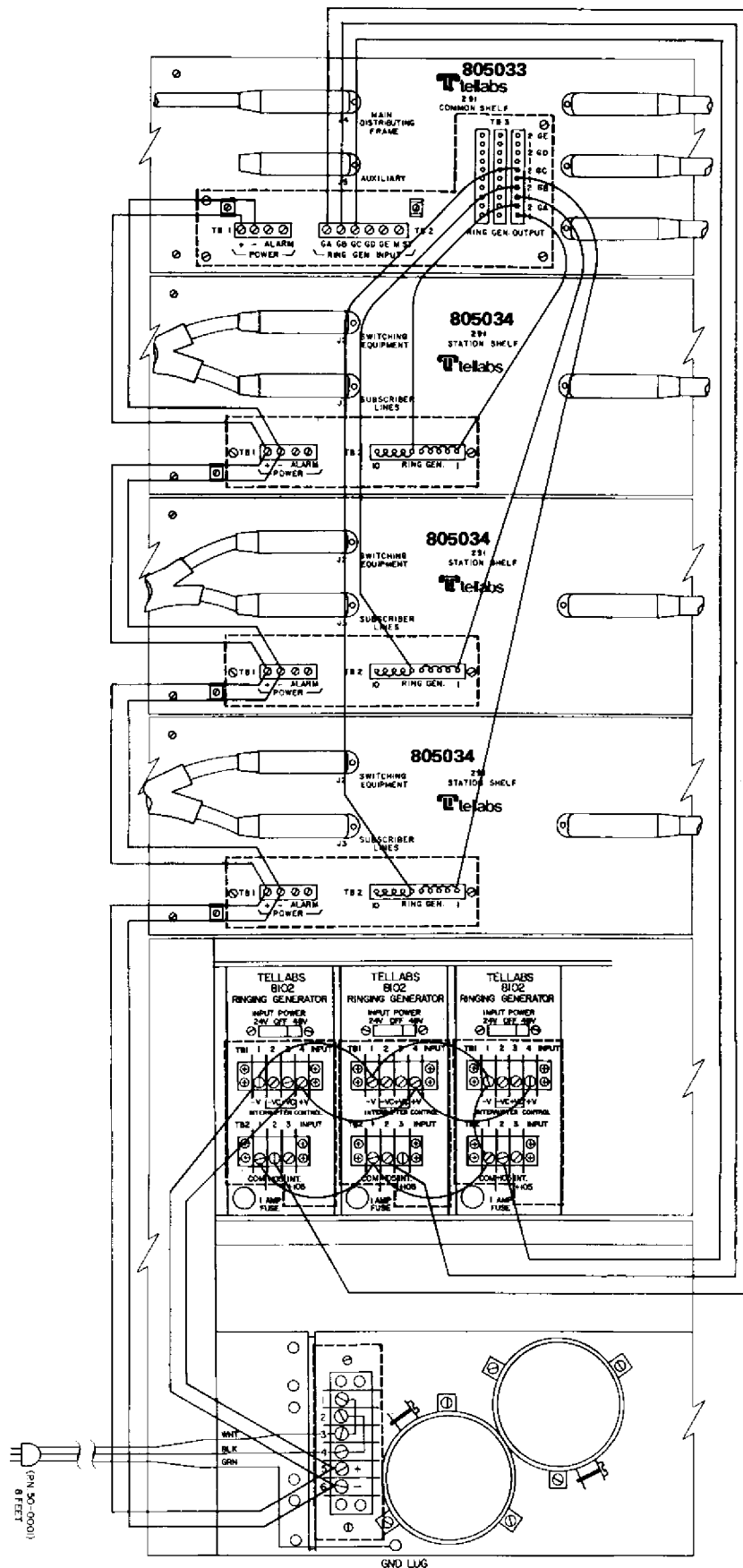
NOTE: DIAGRAM DOES NOT ILLUSTRATE ACTUAL WIRE ROUTING. IT REPRESENTS POINT TO POINT CONNECTIONS FOR REFERENCE ONLY.

figure 3. Required power and ringing connections for the 291R System

☐ If a single 15-watt continuous ringing generator is used in place of the three 8102's, connect a single 20AWG solid white wire equipped with spade lug connectors from the output of the generator to terminal *GA* of terminal block *TB2* on the 80-5033 Shelf. Then connect a 20AWG wire strap to terminals *GB* and *GC* of *TB2*.

4.08 Terminal block *TB2* is factory-wired to the input of the 9003 module, which provides the 1-second-on, 1-second-off ring format. Output of the 9003 is factory-wired to terminal block *TB3*. The 9003 provides alternate ringing between the pairs of rows on *TB3*, i.e., while terminals *GA1* through *GC1* are ringing, terminals *GA2* through *GC2* are silent (and vice versa). The following connections must be made between terminal block *TB3* and each of the line equipment shelves (80-5034) to provide the conference stations with ringing voltage. Please note that although terminal block *TB3* consists of three 10-position terminals, only the righthand terminal is used in PBX applications.

☐ Wire wrap a 22AWG tinned, solid white wire from terminal *GA1* of terminal block *TB3* on the 80-5033 Shelf to terminal 1 of terminal block *TB2* on the first 80-5034 Shelf.

☐ Connect a 22AWG tinned solid white wire strap between the first 5 terminals of terminal block *TB2* on the 80-5034 Shelf.

☐ Wire wrap a 22AWG tinned, solid white wire from terminal *GA2* of terminal block *TB3* to terminal 6 of terminal block *TB2* on the first 80-5034 Shelf.

☐ Connect a 22AWG tinned, solid white wire strap between terminals 6, 7, 8, 9, and 10 of terminal block *TB2* on the 80-5034 Shelf.

☐ In a similar fashion, wire-wrap 22AWG tinned, solid white wires from terminals *GB1* and *GB2* of terminal block *TB3* to terminals 1 through 5 and 6 through 10 respectively, of terminal block *TB2* on the second 80-5034 Shelf.

☐ If a third 80-5034 Shelf is supplied, wire-wrap 22AWG tinned, solid white wires from terminals *GC1* and *GC2* of terminal block *TB3* to terminals 1 through 5 and 6 through 10, respectively, of terminal block *TB2* on the third 80-5034 Shelf.

☐ Bind all wiring together using ty-wraps and replace all of the plexiglass shields.

☐ Connect 20AWG solid white wires equipped with spade lug connectors from the *alarm* terminals of *TB1* on each shelf to the PBX room alarm monitoring system.

☐ Set the input power slide switches on all 8102 Ringing Generators to the *48V* position.

cabling
4.09 The PBX access interface modules, located in the 80-5033 Common Equipment Shelf are ter-

minated into the 50-4011 Cable Adapter in accordance with USOC RJ21X. The conference station interface modules, located in each of the up to three 80-5034 Line Equipment Shelves, are terminated into the 50-4011 Cable Adapter in accordance with USOC RJ71C. Make the connections at the main distributing frame (MDF) in accordance with figure 4 and the following checklist.

☐ Locate the common equipment shelf connector labeled RJ21X and make the required installer connections in accordance with table 1.

☐ Locate the first line equipment shelf connector labeled RJ71C and make the required installer connections in accordance with table 2.
Note: *Disconnect all cross-connects between the PBX station numbers prior to connecting the RJ71C cable.*

☐ In a similar fashion, locate the second and third line equipment shelf connectors labeled RJ71C and make the required installer connection in accordance with table 2.

RJ21X connector pin no.	color	lead designation	80-5033 position no.	module
26	W-BL	T	1	9196 Automatic Access or
1	BL-W	R		9193 Manual Access
27	W-O	T	2	9196 Automatic Access or
2	O-W	R		9193 Manual Access
28	W-GR	T	3	9196 Remote Access
3	GR-W	R		
29	W-BR	T	4	9196 Remote Access
4	BR-W	R		
30	W-SL	T	5	9196 Remote Access
5	SL-W	R		

table 1. Connections from 80-5033 Common Equipment Shelf's connector (RJ21X) to MDF

option switch selection
4.10 Nearly all optioning of the modules in the 291R System is done via switches on the printed circuit board of each module. Once optioned and installed, no alignment or adjustment of the modules is necessary, with the possible exception of a level adjustment on the 9194 2Wire Conference Amplifier module. Locations of these switches on the modules' printed circuit boards are shown in figure 5. Once optioned, insert each module into its appropriate position in the 80-5033 Common Equipment Shelf or 80-5034 Line Equipment Shelves as shown in figure 6. The 80-5034 Shelves are equipped with cut-through connectors for each conference station to maintain regular PBX service whenever the associated 9191 module is removed from its shelf position. Option the modules in accordance with the following checklist.

line	RJ71C connector pin no.	color	lead designation	80-5034 sta shelf position no.	module
1 in	26	W-BL	T PBX	1	9191 in pos. 1
	27	W-O	R EXT. NO.		of sta. shelf 1, 2, or 3
1 out	1	BL-W	T PBX	1	
	2	O-W	R STA.		
2 in	28	W-GR	T PBX	2	9191 in pos. 2
	29	W-BR	R EXT. NO.		of sta. shelf 1, 2, or 3
2 out	3	GR-W	T PBX	2	
	4	BR-W	R STA.		
3 in	30	W-SL	T PBX	3	9191 in pos. 3
	31	R-BL	R EXT. NO.		of sta. shelf 1, 2, or 3
3 out	5	SL-W	T PBX	3	
	6	BL-R	R STA.		
4 in	32	R-O	T PBX	4	9191 in pos. 4
	33	R-GR	R EXT. NO.		of sta. shelf 1, 2, 3
4 out	7	O-R	T PBX	4	
	8	GR-R	R STA.		
5 in	34	R-BR	T PBX	5	9191 in pos. 5
	35	R-SL	R EXT. NO.		of sta. shelf 1, 2, or 3
5 out	9	BR-R	T PBX	5	
	10	SL-R	R STA		
6 in	36	BK-BL	T PBX	6	9191 in pos. 6
	37	BK-O	R EXT. NO.		of sta. shelf 1, 2, or 3
6 out	11	BL-BK	T PBX	6	
	12	O-BK	R STA		
7 in	38	BK-GR	T PBX	7	9191 in pos. 7
	39	BK-BR	R EXT. NO.		of sta. shelf 1, 2, or 3
7 out	13	GR-BK	T PBX	7	
	14	BR-BK	R STA		
8 in	40	BK-SL	T PBX	8	9191 in pos. 8
	41	Y-BL	R EXT. NO.		of sta. shelf 1, 2, or 3
8 out	15	SL-BK	T PBX	8	
	16	BL-Y	R STA		
9 in	42	Y-O	T PBX	9	9191 in pos. 9
	43	Y-GR	R EXT. NO.		of sta. shelf 1, 2, or 3
9 out	17	O-Y	T PBX	9	
	18	GR-Y	R STA		
10 in	44	Y-BR	T PBX	10	9191 in pos. 10
	45	Y-SL	R EXT. NO.		of sta. shelf 1, 2, or 3
10 out	19	BR-Y	T PBX	10	
	20	SL-Y	R STA		

Note: *Existing frame cross-connects between the PBX numbers and the stations must be removed prior to interface into the RJ71C connector.*

table 2. Connections from each 80-5034 Line Equipment Shelf's connector (RJ71C) to MDF

A. 9196 2Wire ARD Loop Start Trunk Circuit module (automatic conference origination, positions 1 and 2 of 80-5033 Shelf).

☐ Switch *S1* Conference release. *ON* (conference held up by any station remaining off-hook) or *OFF* (conference held up by conference originator).

☐ Switch *S2*. Must be set to *A* position.

B. 9193 2Wire ARD Conference Originate Line Circuit module (manual conference origination, positions 1 and 2 of 80-5033 Shelf).

☐ Switch *S1* — Conference release. *ON* (con-

ference held up by any station remaining off-hook) or *OFF* (conference held up by master station only).

C. 9196 2Wire ARD Loop Start Trunk Circuit module (Remote access capability, positions 3, 4 and 5 of 80-5033 Shelf).

☐ Switch *S1*. Setting irrelevant.

☐ Switch *S2*. Must be set to *A* position.

D. 9121 Tone Supply module (position 7 of 80-5033 Shelf).

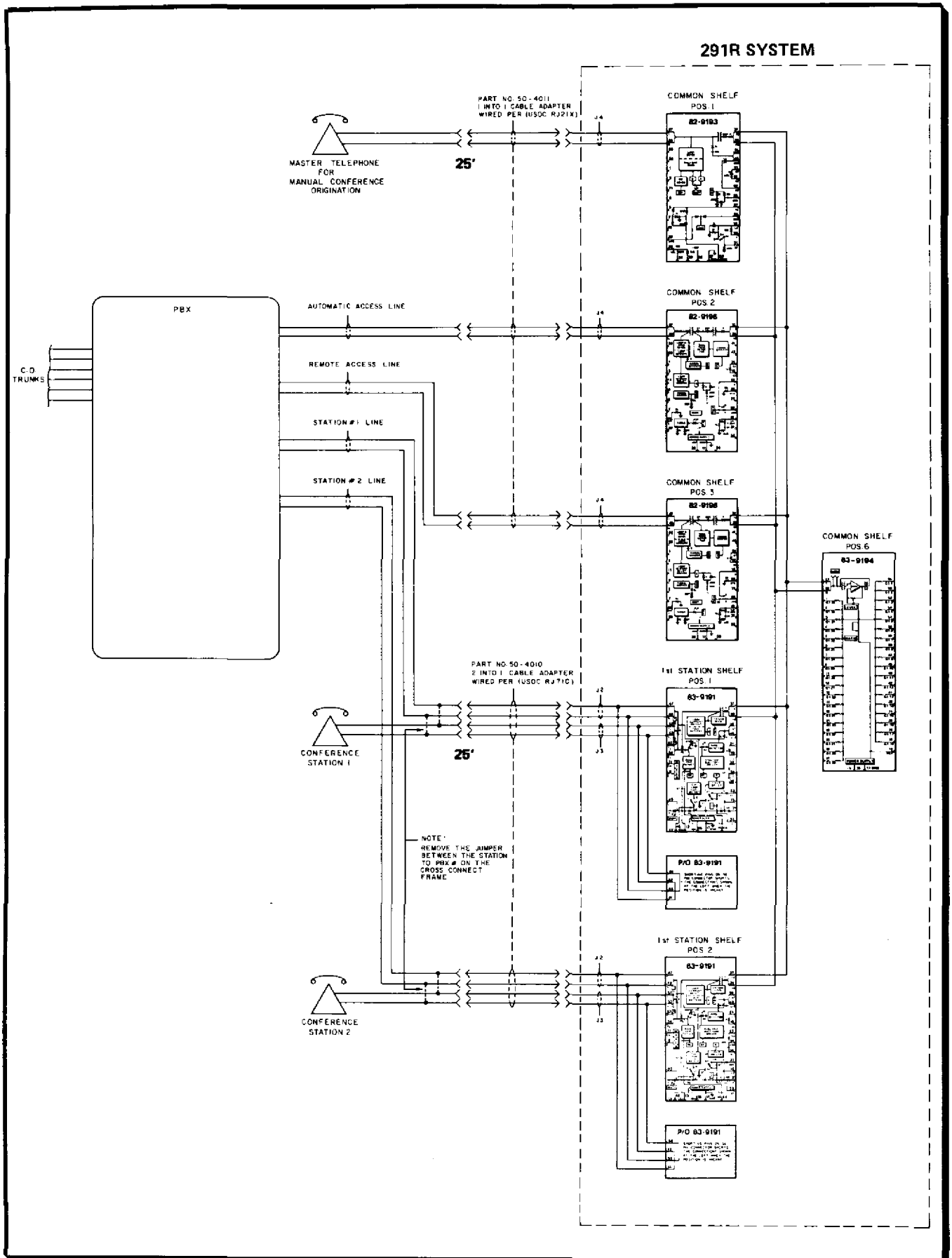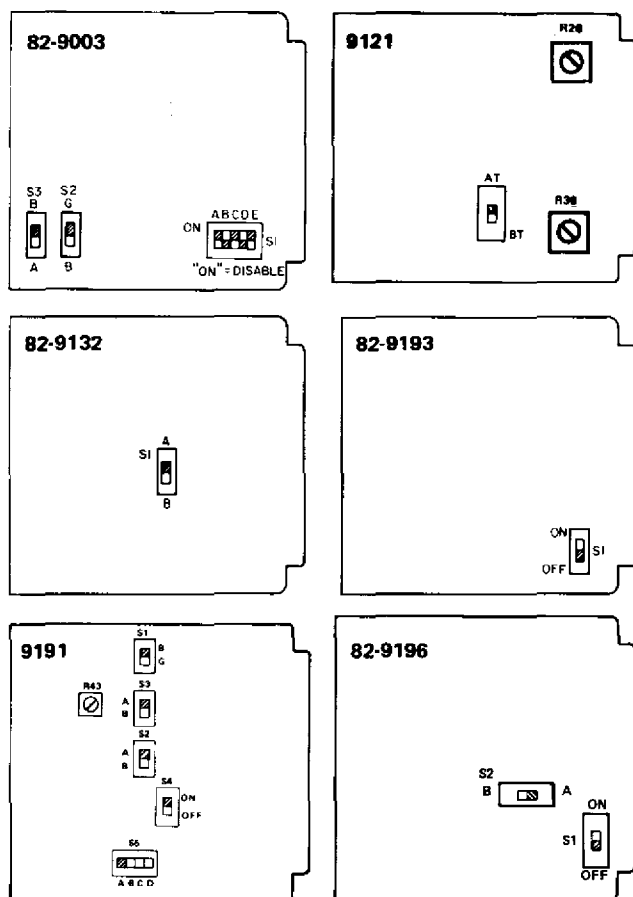☐ Switch *AT/BT*. Must be set to *AT* (alerting tone) position.

291R SYSTEM

PART NO. 50 - 4011
1 INTO 1 CABLE ADAPTER
WIRED PER (USOC RJ21X)

COMMON SHELF
POS.1
82-9193

MASTER TELEPHONE
FOR
MANUAL CONFERENCE
ORIGINATION

25'

PBX

C.O
TRUNKS

AUTOMATIC ACCESS LINE

COMMON SHELF
POS.2
82-9196

REMOTE ACCESS LINE

STATION #1 LINE

STATION # 2 LINE

COMMON SHELF
POS.3
82-9196

COMMON SHELF
POS.6
83-9194

PART NO. 50 - 4010
2 INTO 1 CABLE ADAPTER
WIRED PER (USOC RJ71C)

1st STATION SHELF
POS.1
83-9191

CONFERENCE
STATION 1

25'

P/O 83-9191

NOTE:
REMOVE THE JUMPER
BETWEEN THE STATION
TO PBX # ON THE
CROSS CONNECT
FRAME

1st STATION SHELF
POS.2
83-9191

CONFERENCE
STATION 2

P/O 83-9191

figure 4. System cabling diagram
page 13

figure 5. Option switch locations

E. 9132 Ringing Timer module (position 8 of 80-5033 Shelf).

- ☐ Switch *S1* — Method of conference termination. *A* (conference forced idle, 1.5 to 5 minutes after first station answers) or *B* (conference held up until last station or master station returns on-hook).
- ☐ Potentiometer *R1*. Not used in PBX applications.
- ☐ Potentiometer *R2*. Ringing timer is adjusted after system test is completed (see alignment paragraph 4.13).

F. 9003 Ringing Interrupter Relay module (position 9 of 80-5033 Shelf).

- ☐ Switch *S1* — Ringing generator alarm detectors *OFF* (activates ringing alarm detectors) or *ON* (deactivates ringing alarm detectors).
- ☐ Switch position *S1A*. Must be set to *OFF* position.
- ☐ Switch position *S1B*. *ON* (10 or less conference stations supplied) or *OFF* (10 to 20 conference stations supplied.
- ☐ Switch position *S1C*. *ON* (20 or less conference stations supplied) or *OFF* (20 to 30 conference stations supplied
- ☐ Switch positions *S1D* and *S1E*. Must be set to *ON* position.

- ☐ Switch *S2* — Ringing generator bias. *B* (battery connected ring generator) or *G* (ground connected ring generator. Set to *B* position if Tellabs' 8102 Ringing Generators are supplied.
- ☐ Switch *S3* — Ringing mode. *A* (continuous 1-sec-on/1-sec-off ringing) or *B* (continuous 1-sec-on/1-sec-off ringing) on G2X ring generator outputs and interrupted ringing on G1X ring generator outputs.

G. 9021 Fuse module (position 12 of the 80-5033 and 80-5034 Shelves).

H. 9191 2Wire ARD Conference Terminated Line Circuit (positions 1 through 10 of 80-5034 Shelves).

- ☐ Switch *S1* — Ring generator return. *G* (ground connected to tip side of line during ringing) or *B* (battery connected to tip side of line during ringing). Set switch *S1* to *G* position if the ring generator is battery connected, or to the *B* position if the ring generator is ground connected.
  Note: *This instruction may seem incorrect. It is* **not** *incorrect. On the module B=ground connected and G=battery connected ring generator.*
- ☐ Switch *S2* — Automatic ring trip disable. *A* (calls to the station involved in a conference are automatically answered and busy tone applied) or *B* (the call is not answered). This switch is used in PBX applications to mark individual line appearance busy while a conference call is in progress. Set switch *S2* to the *A* position to option the 9191 to automatically trip incoming ringing and to return interrupted alerting tone as a busy indication, or to the *B* position to ignore an incoming call.
- ☐ Switch *S3* — Conference entry supervision control. *A* (applies alerting tone to indicated conference) or *B* (automatically transfer station into conference). Switch *S3* determines the manner in which the station, if busy with a normal call at the time a conference is originated, will enter the conference. Set *S3* to the *B* position to condition the 9191 to apply alerting tone to the call in progress (after which the station user may enter the conference via a hookswitch flash), or to the *A* position to condition the 9191 to cut off the call in progress and force the busy station into the conference.
- ☐ Switch *S4* — Station disconnect *ON* (conference station remains connected to conference until entire conference is terminated), or *OFF* (conference station can disconnect from conference in progress via hookswitch flash).

  Switch *S4* conditions the manner in which the station disconnects from a conference.
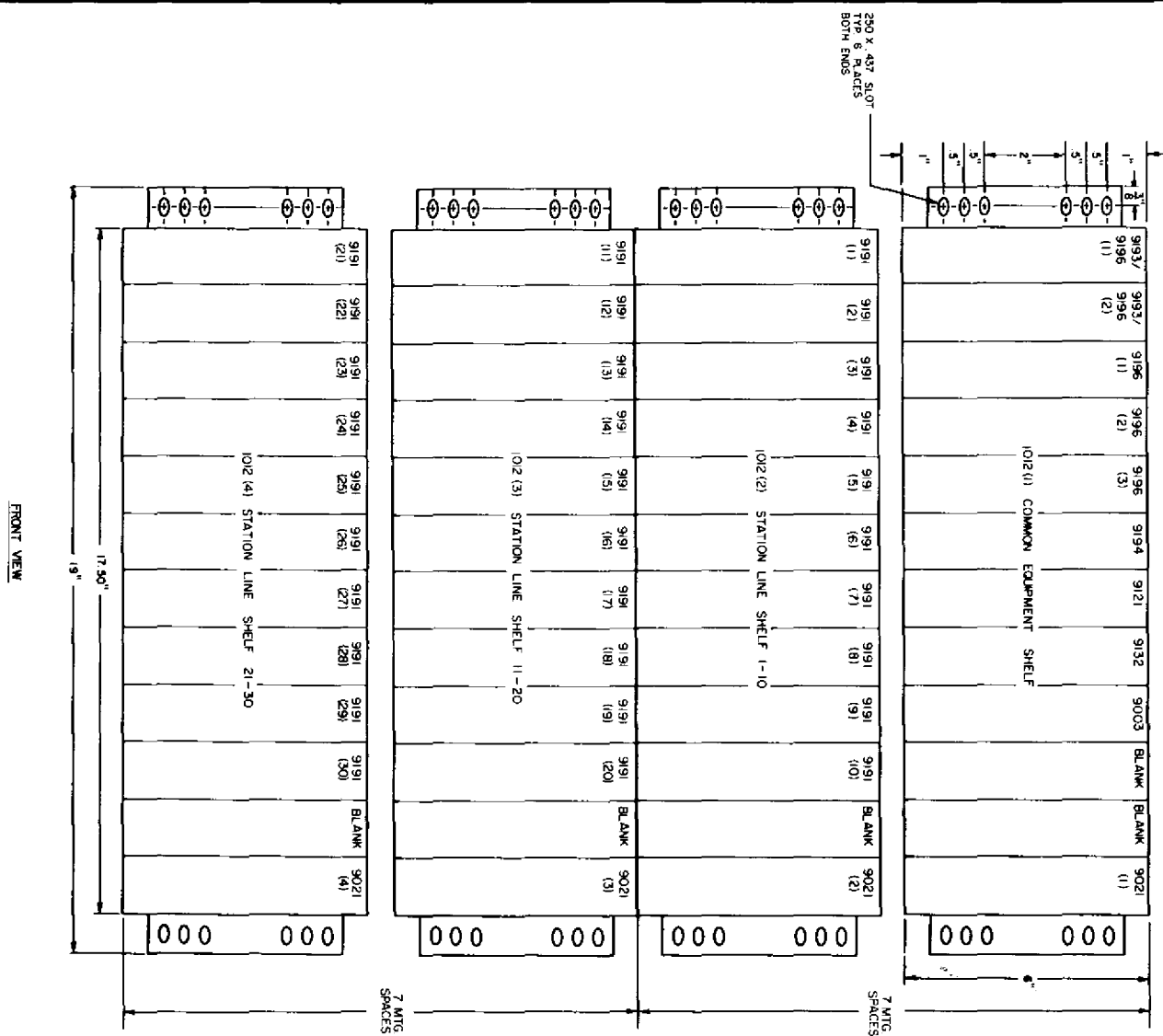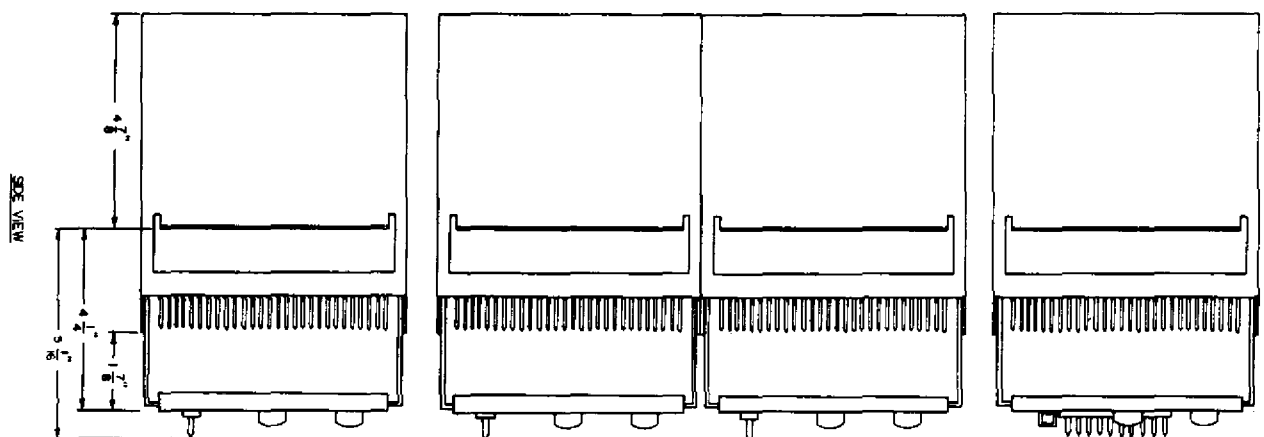
figure 6. 291R System, front view, showing module configuration

In 291R System applications, set *S4* to the *OFF* position to allow the station to disconnect from a conference in progress via hookswitch flash. The *ON* position of *S4*, which is not normally used in the 291R System, restricts the station from leaving a conference in progress by causing the station to re-enter into the conference if it goes back off-hook.

☐ Switch *S5*. This switch setting is irrelevant.

I. 9194 2Wire Conference Amplifier (alignment performed after system test, position 6 of 80-5033 Shelf).

system test

4.11 When all wiring is completed and all modules are installed, power can be applied to the System by plugging the line cord of the 81-8007 Power Supply into a conventional 117Vac, grounded power receptacle. To verify proper operation of the 291R System, complete the following checklist. If any difficulties are encountered, refer to the Troubleshooting Guide Checklist in section 9.

☐ Verify that all conference stations receive dial tone from the PBX.

☐ Automatic Access. Have one of the conference stations dial the PBX conference originate extension number. Station receives alerting tone from 291R and ringback tone from PBX. After first conference station answers, ringback tone ceases. Station then momentarily goes on-hook to remove alerting tone.

☐ Manual Access. Have the master conference station go off-hook. Master station receives ringback tone from 291R until first conference station answers.

☐ Verify that all conference stations that are on-hook ring at the 1-second-on, 1-second-off ringing format.

☐ Verify that any conference station off-hook when a conference call is originated either receives alerting tone, or is disconnected from the call and connected to the conference.

☐ Verify that all conference stations engaged in a conference call can communicate with each other. If voice levels are either excessively high or low, proceed to the 9194 alignment procedure in paragraph 4.12.

☐ Remote Access. Have a non-conference station dial the remote access PBX extension number. Verify that the station enters an on-going conference. Check each remote access line if more than one is provided.

☐ Verify that all conference stations can disconnect from an on-going conference by momentarily going on-hook.

☐ Verify all other System options and features.

9194 Conference Amplifier Level Adjustment

4.12 The *level* and *gain ratio* potentiometers on the 9194 are factory-set and should not require any adjustment. However, if transmission levels are too high or too low the *level* and *gain ratio* controls may have to be balanced in order to provide the exact amount of gain necessary to overcome the bridging loss as stations enter the conference. To perform this level adjustment, proceed as follows:

A. Arrange the transmit portion of a transmission measuring set (TMS) terminated into 600 ohms, to output 1000Hz tone at −30dBm.

B. Initiate a conference. Request all conference subscribers to leave their station instrument off-hook for about 15 minutes while the circuit is being aligned. Inform subscribers that tone will be present during level measurements.

C. Disconnect the 25-pair J2 connectors (to the switching equipment) from the rear of all 291R System station equipment shelves. This will allow you to maintain control of the conference stations during alignment.

D. Place the TMS in the bridging mode and, using test cords equipped with type 310 plugs, connect the transmit and receive portions of the TMS to the parallel *monitor* jacks on the 9194.

E. Observe the receive level in TMS. If this level is a steady −34 ±4dBm, proceed to step G. Otherwise, adjust *level* control and *gain ratio* controls fully counterclockwise.

F. TMS should indicate −50dBm. Adjust *level* control until a −45dBm level is reached. Adjust *gain ratio* control until a −42dBm (3dB higher) level is reached.

G. Using the TMS's frequency-selection control, sweep the 300-to-3000Hz frequency range and observe the level-reading portion of the TMS for the highest level (peak amplitude) within this frequency range. Do not adjust the output level of the TMS. Leave the frequency-selection control of the TMS set for the frequency at which the peak amplitude was observed.

H. Observe the receive level on the TMS and adjust the *level* control until a −33 ±0.5dBm level is reached.

I. Momentarily depress the front-panel *test* pushbutton and observe receive level. If this level decreases when pushbutton is depressed, adjust *gain ratio* control ½ turn clockwise. If this level increases when the pushbutton is depressed, adjust *gain ratio* control ½ turn counterclockwise.

J. Repeat steps H and I until the receive level remains at −33 ±0.5dBm before and while the *test* pushbutton is depressed.

K. When alignment is completed, reconnect J2 connectors to the station equipment shelves, and inform conference subscribers that alignment is completed.

9132 Ring Timer Adjustment

4.13   The 9132 module provides an adjustable ringing timeout to control the length of time a station will ring if not answered. An option switch is also provided on the 9132 to control the method in which a conference call is terminated. The conference can either be maintained until the last conference station goes on hook, or the conference can be forced idle after the 1.5 to 5-minute ringing timeout interval has expired (refer to paragraph 4.10, step E). To adjust this ringing timeout interval, proceed as follows:

Note: *To perform the following procedure, the Tellabs' 9802 Card Extender* **must** *be used to provide access to the ringing time adjustment (potentiometer R2).*

A. Unplug the 9132 module from shelf position 8 of the 80-5033 Shelf.

B. Plug the 9802 Card Extender into the mounting space just vacated by the 9132 (position 8). Plug the 9132 into the card extender and proceed to step C.

C. Request all conference subscribers to leave their telsets on-hook for about 15 minutes while the ringing timeout circuit is being adjusted.

D. Initiate a conference call and time how long it takes for the 9132 to timeout and stop the ringing.

Note: *If any of the conference stations answers the call, the timer will automatically reset the timing cycle.*

E. If the timeout circuit needs adjustment, turn potentiometer *R2* clockwise to increase the ringing timeout interval or counterclockwise to decrease the ringing timeout interval.

F. Initiate another conference call and again time how long it takes for ringing to stop. Readjust *R2* as required.

G. Remove the 9132 module from the 9802 Card Extender, and remove the 9802 from the shelf. Reinsert the 9132 into its Shelf position.

4.14   After the 9194 and 9132 modules are aligned, installation of the 291R System is completed. Included in this Practice Section are system wiring diagrams (section 5) individual module block diagrams (section 6), individual module specifications (section 7), a system flow chart (section 8) and a troubleshooting guide checklist (section 9) to assist you in understanding the operation of the 291R System and its associated modules.

TABLE 1 — J3 ASSIGNMENT CHART FOR #1 STATION SHELF

POSITION	PIN	DESIG	PIN	COLOR
1	51	T1	26	W-BL
	53	R1	1	BL-W
2	51	T1	27	W-O
	53	R1	2	O-W
3	51	T1	28	W-G
	53	R1	3	G-W
4	51	T1	29	W-BR
	53	R1	4	BR-W
5	51	T1	30	W-S
	53	R1	5	S-W
6	51	T1	31	R-BL
	53	R1	6	BL-R
7	51	T1	32	R-O
	53	R1	7	O-R
8	51	T1	33	R-G
	53	R1	8	G-R
9	51	T1	34	R-BR
	53	R1	9	BR-R
10	51	T1	35	R-S
	53	R1	10	S-R
2	45	L1	36	BK-BL
3	45	L3	11	BL-BK
	45	L3	37	BK-O
4	45	L4	12	O-BK
5	45	L5	38	BK-G
6	45	L6	13	G-BK
7	45	L7	39	BK-BR
8	45	L8	14	BR-BK
9	45	L9	40	BK-S
10	45	L10	15	S-BK
12	22	TL1	41	Y-BL
12	24	TL2	16	BL-Y
12	14	RL1	42	Y-O
12	16	RL2	17	O-Y
12	18	RL2	43	Y-G
12	52	T	18	G-Y
12	54	TKR	44	Y-BR
12	20	HVR	19	BR-Y
12	50	T	45	Y-S
12	48	R	20	S-Y
12	46	K1C	46	V-BL
12	44	K2C	21	BL-V
12	42	K30	47	V-O
12	40	K40	22	O-V
12	38	T	48	V-G
12	36	R	23	G-V
12	34	K1C	49	V-BR
12	30	K2C	24	BR-V
12	28	K30	50	V-S
12	26	K40	25	S-V

TABLE 2 — J3 ASSIGNMENT CHART FOR #2 & #3 STATION SHELVES

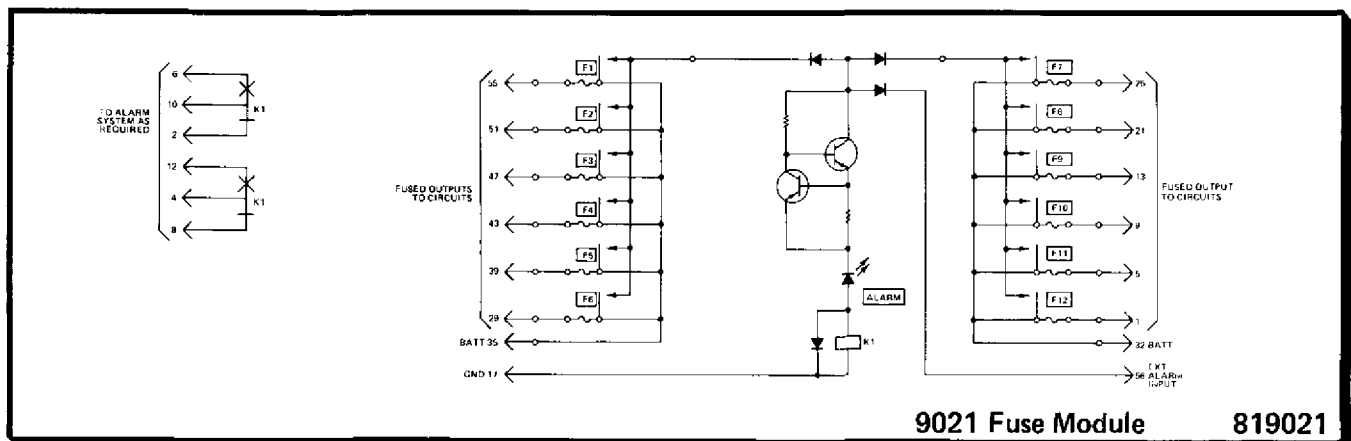| POSITION	PIN	DESIG	PIN	COLOR
1	51	T1	26	W-BL
	53	R1	27	G-W
2	51	T1	2	O-W
	53	R1	28	W-G
3	51	T1	3	G-W
	53	R1	29	W-BR
4	51	T1	4	BR-W
	53	R1	30	W-S
5	51	T1	5	S-W
	53	R1	31	R-BL
6	53	R1	6	BL-R
	51	T1	32	R-O
7	53	R1	7	O-R
	51	T1	33	R-G
8	53	R1	8	G-R
	51	T1	34	R-BR
9	53	R1	9	BR-R
	51	T1	35	R-S
10	53	R1	10	S-R
2	45	L1	36	BK-BL
3	45	L3	11	BL-BK
	45	L3	37	BK-O
4	45	L4	12	O-BK
5	45	L5	38	BK-G
6	45	L6	13	G-BK
7	45	L7	39	BK-BR
8	45	L8	14	BR-BK
9	45	L9	40	BK-S
10	45	L10	15	S-BK

TABLE 3 — J2 ASSIGNMENT CHART FOR ALL STATION SHELVES

POSITION	PIN	DESIG	PIN	COLOR
1	47	T	26	W-BL
	49	R	1	BL-W
1	11	CN	27	W-O
2	9	C	2	O-W
	47	T	28	W-G
2	49	R	3	G-W
2	11	CN	29	W-BR
2	9	C	4	BR-W
3	47	T	30	W-S
	49	R	5	S-W
3	11	CN	31	R-BL
3	9	C	6	BL-R
4	47	T	32	R-O
	49	R	7	O-R
4	11	CN	33	R-G
4	9	C	8	G-R
5	47	T	34	R-BR
	49	R	9	BR-R
5	11	CN	35	R-S
	9	C	10	S-R
6	47	T	36	BK-BL
	49	R	11	BL-BK
6	11	CN	37	BK-O
	9	C	12	O-BK
7	47	T	38	BK-G
	49	R	13	G-BK
7	11	CN	39	BK-BR
	9	C	14	BR-BK
8	47	T	40	BK-S
	11	CN	15	S-BK
8	9	C	41	Y-BL
9	47	T	16	BL-Y
	49	R	42	Y-O
9	11	CN	17	O-Y
	9	C	43	Y-G
10	47	T	18	G-Y
	49	R	44	Y-BR
10	11	CN	19	BR-Y
	9	C	45	Y-S
			20	S-Y

LEAD GLOSSARY

ANS	ANSWER LEAD - INDICATION OF AN ANSWERED STATION (i.e. GROUND W/STA OFF HOOK)
AT	ALERT TONE FROM 9121 TO ALL 9191's
ATR	ALERT TONE RETURN
C1	C-LEAD FOR 1ST REMOTE ACCESS PORT (9195/9196)
C2	C-LEAD FOR 2ND REMOTE ACCESS PORT (9195/9196)
C3	C-LEAD FOR 3RD REMOTE ACCESS PORT (9195/9196)
C2I	C-LEAD FOR 1ST 9195/9996 MODULE TO 9133
C2I	C-LEAD FOR 2ND 9195/9996 MODULE TO 9133
C3I	C-LEAD FOR 3RD 9195/9996 MODULE TO 9133
C	C-LEAD BIAS WHEN REQUIRED
CN	C-LEAD INPUT (SLEEVE LEAD INPUT WHEN USING 9192)
E	NORMALLY OPEN CONTACT (PRIMARY USE -N.T. DMS-10)
SG	NORMALLY OPEN CONTACT (PRIMARY USE -N.T. DMS-10)
GA-GE	RING GENERATOR INPUTS (MAY USE 5 DIFFERENT RING FREQ)
GIA-GIE	RING GENERATOR OUTPUTS (OPPOSITE RING SCHEME OF G2A-G2E)
G2A-G2E	RING GENERATOR OUTPUTS (OPPOSITE RING SCHEME OF GIA-GIE)
GI-1 TO GI-35	GAIN CONTROL LEADS FOR 9194 CONFERENCE AMP
G2	GAIN CONTROL LEADS REFERENCE
H	CONTROL LEADS FOR NO. 2 EAX REMOTE ACCESS PORT #1 (9195)
H2	CONTROL LEADS FOR NO. 2 EAX REMOTE ACCESS PORT #2 (9195)
H3	CONTROL LEADS FOR NO. 2 EAX REMOTE ACCESS PORT #3 (9195)
HVR	GND OUTPUT TO CONTROL HIGH VOLTAGE SIREN RELAY
K1C	TRANSFER KEY (NORMALLY CLOSED)
K2C	TRANSFER KEY (NORMALLY CLOSED)
K30	TRANSFER KEY (NORMALLY OPEN)
K40	TRANSFER KEY (NORMALLY OPEN)
L1-L30	LAMP LEADS FOR STATIONS 1-30
LG	LOCKING GROUND
LGC	LOCKING GROUND OFF NORMALLY CLOSED CONTACTS OF 9132
MRST	MASTER RESET
MST	MACHINE START
N.C.	NORMALLY CLOSED CONTACTS
N.O.	NORMALLY OPEN CONTACT
COM	COMMON CONTACT
P	SIREN START LEAD
RBR	RING BACK TONE, RING
RBT	RING BACK TONE, TIP
RL1	REMOTE LINE (9195/6 #1) LAMP LEAD GND
RL2	REMOTE LINE (9195/6 #2 LAMP LEAD GND
RL3	REMOTE LINE (9195/6 #3 LAMP LEAD GND
RO	RING CONTROL FROM 9132 TO 9003 TO TIME-OUT RINGING
RC	RING CONTROL FROM 9132 TO 9003 TO DISTINCTIVE RING RATE
r	RING LEAD TO CO
t	TIP LEAD TO CO
Ri	RING LEAD TO STATION
Ti	TIP LEAD TO STATION
RB	RING LEAD BUSS TIED TO CONFERENCE AMPLIFIER (9194)
TB	TIP LEAD BUSS TIED TO CONFERENCE AMPLIFIER (9194)
STR	START LEAD FROM 2 CONFERENCE ACCESS LINES
ST-A & ST-B	START LEAD DERIVED FROM N.O. CONTACT OF THE 9003
ST-1 TO ST-30	START LEADS TO STATIONS 1-30
TL1	LAMP LEAD GND FOR CONFERENCE ACCESS LINE #1
TL2	LAMP LEAD GND FOR CONFERENCE ACCESS LINE #2
#,*,0-9 OUT	GND OUTPUTS FROM 6072
TK	TIMER KEY (STRAP TK TO TKR FOR 0-2 MINUTE RING TIME - 9132)
TKR	TIMER KEY RETURN
TDD & TDD2	TIME DISCONNECT DISABLE FOR USE W/AE EAX SWITCHES

SYMBOLS:

1. o — DENOTES WIRE WRAP TERMINAL ON 56 PIN CONNECTOR MOUNTED ON REAR OF ENCLOSURE.
2. — — — DENOTES CUSTOMER WIRING.
3. →x — DENOTES PIN NO. FOR 50 PIN MALE AMPHENOL CONNECTOR.
4. x→ — DENOTES PIN NO. FOR 50 PIN FEMALE AMPHENOL CONNECTOR.
5. () — DENOTES TWISTED PAIR.
6. x>—o — DENOTES FEMALE AMPHENOL CONNECTOR WITH WIRE WRAP TERMINALS AND THE ASSOCIATED PIN NUMBER.
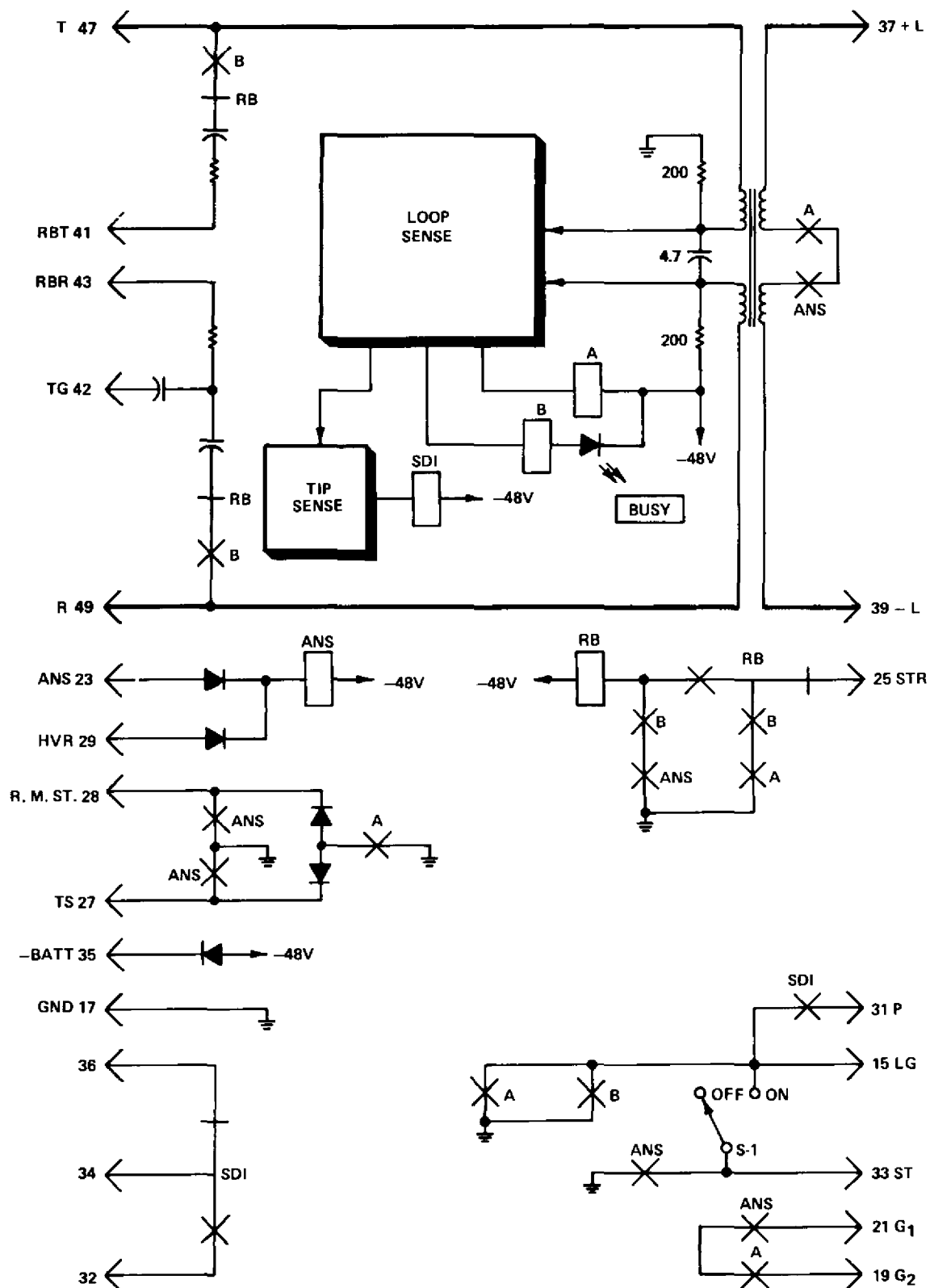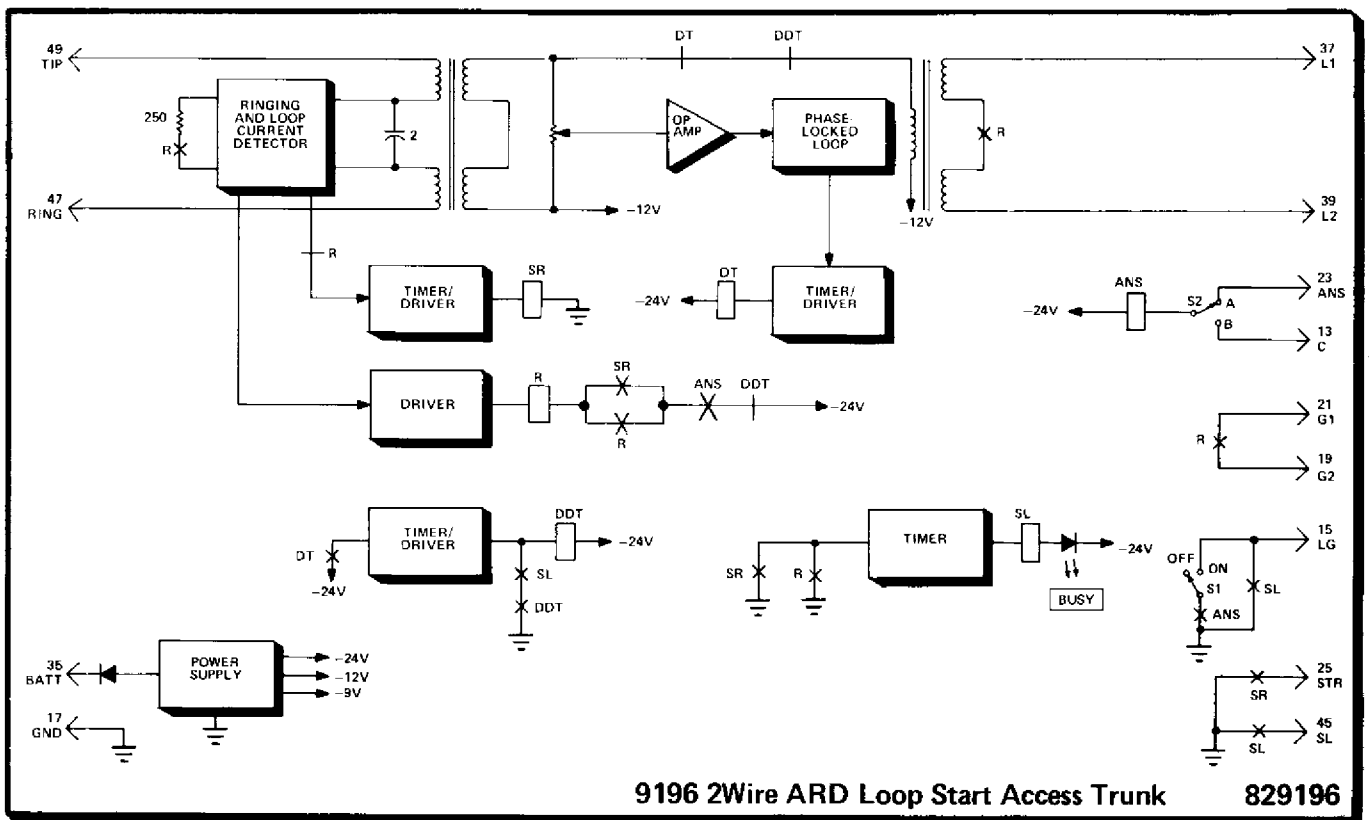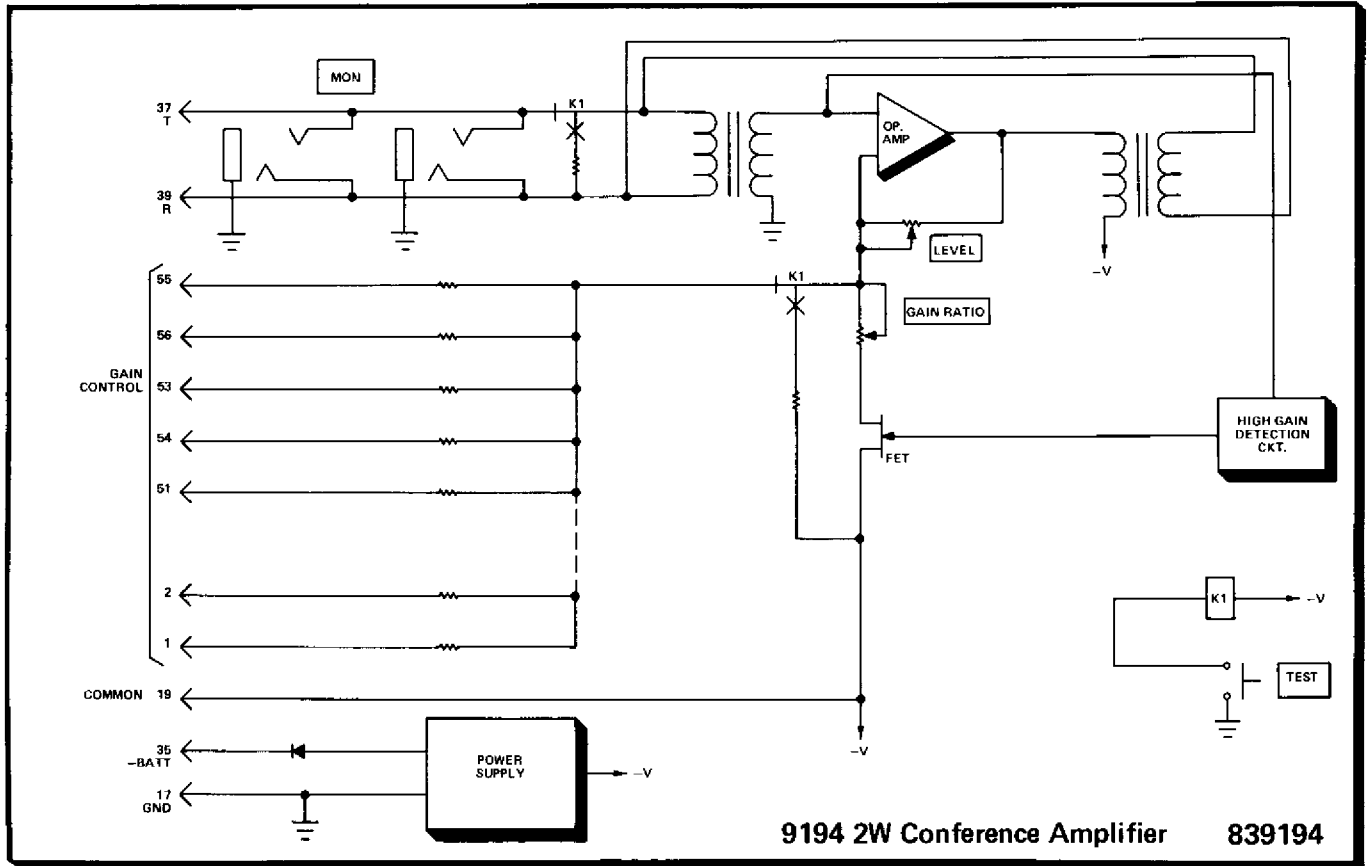7. ⊘ — DENOTES SCREW TERMINAL.

9003 Ringing Interrupter Relay Module   829003

9021 Fuse Module   819021

section 6. module block diagrams (continued)

9121 Tone Supply   819121

9132 Ringing Timer module   829132

module block diagrams
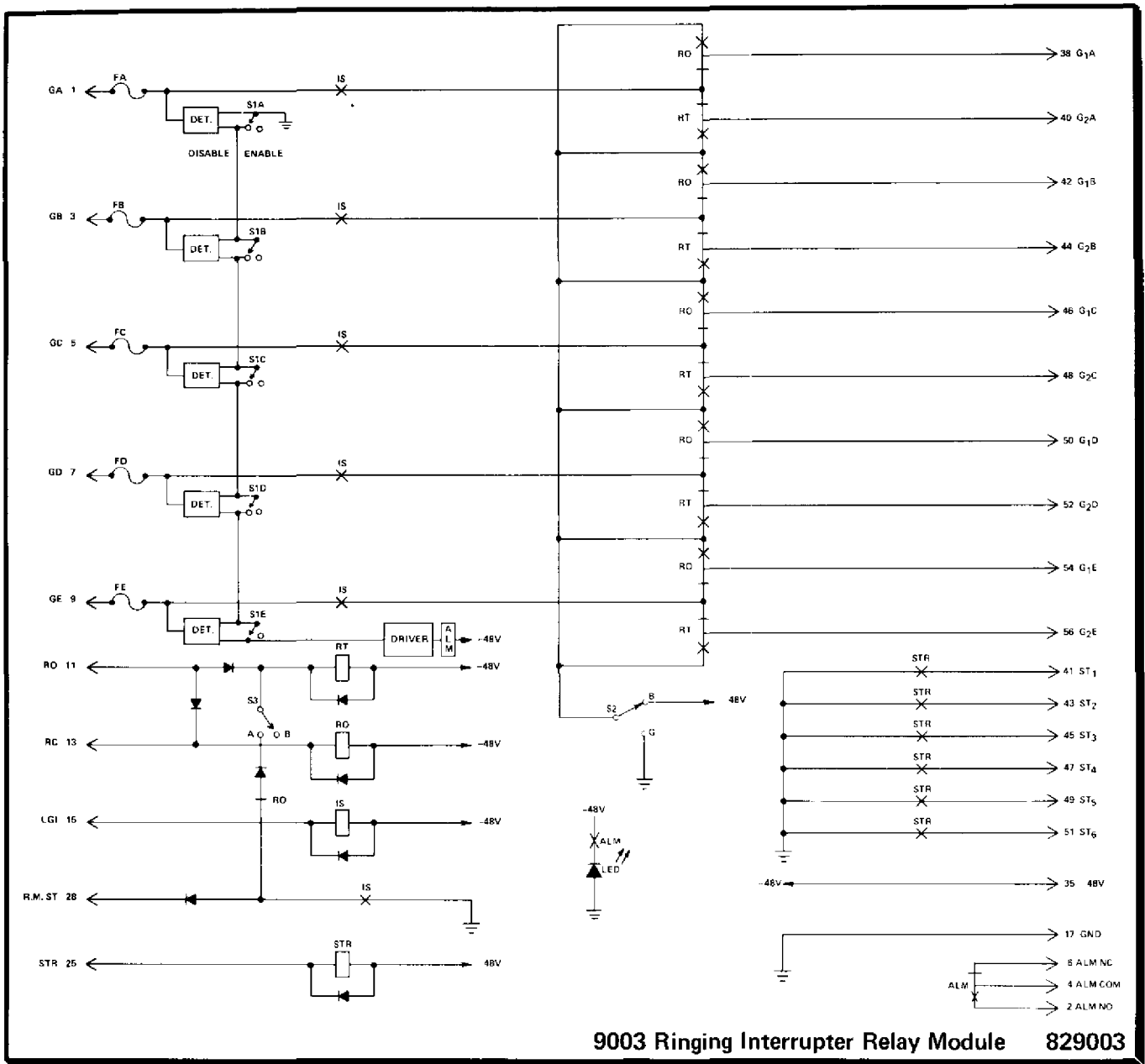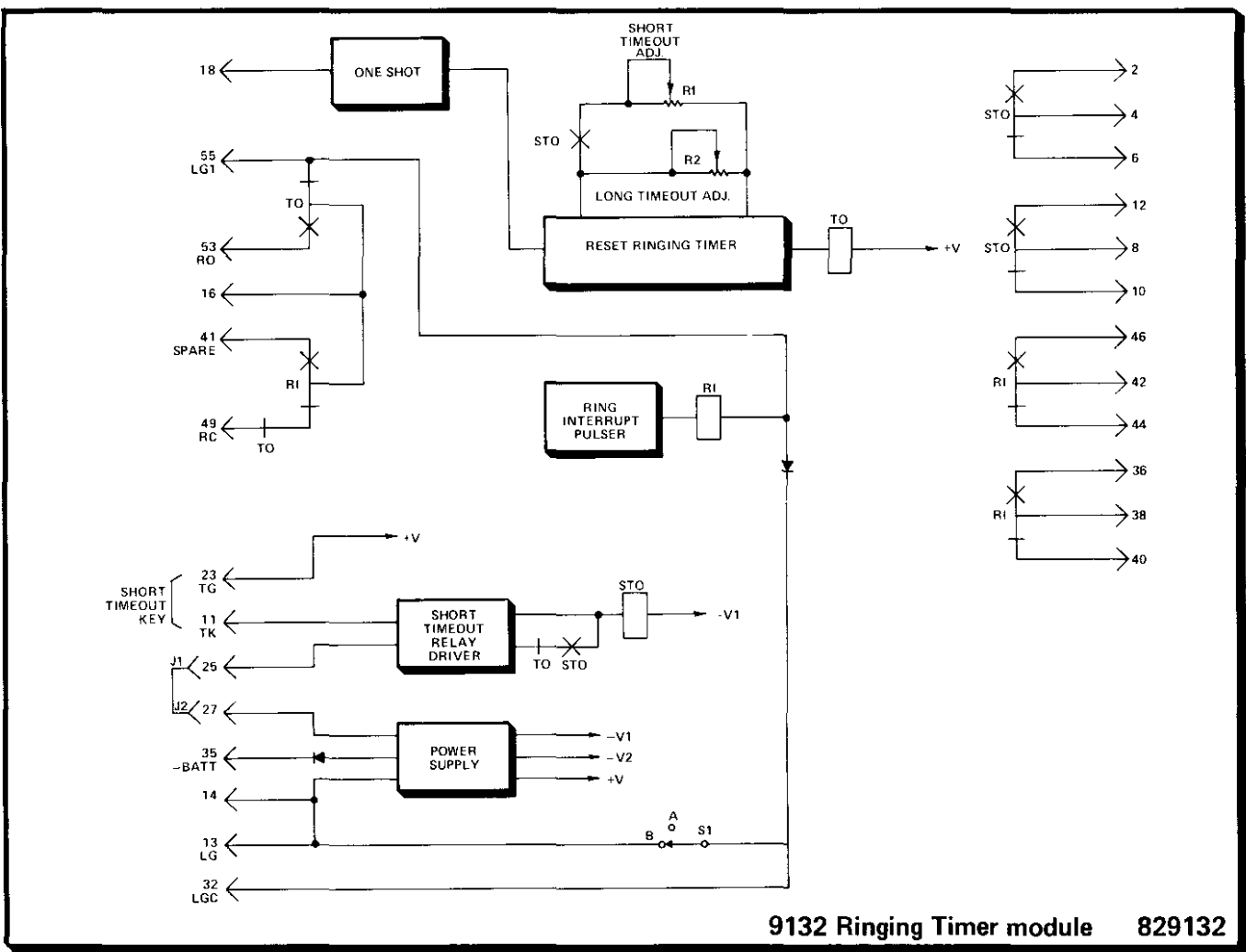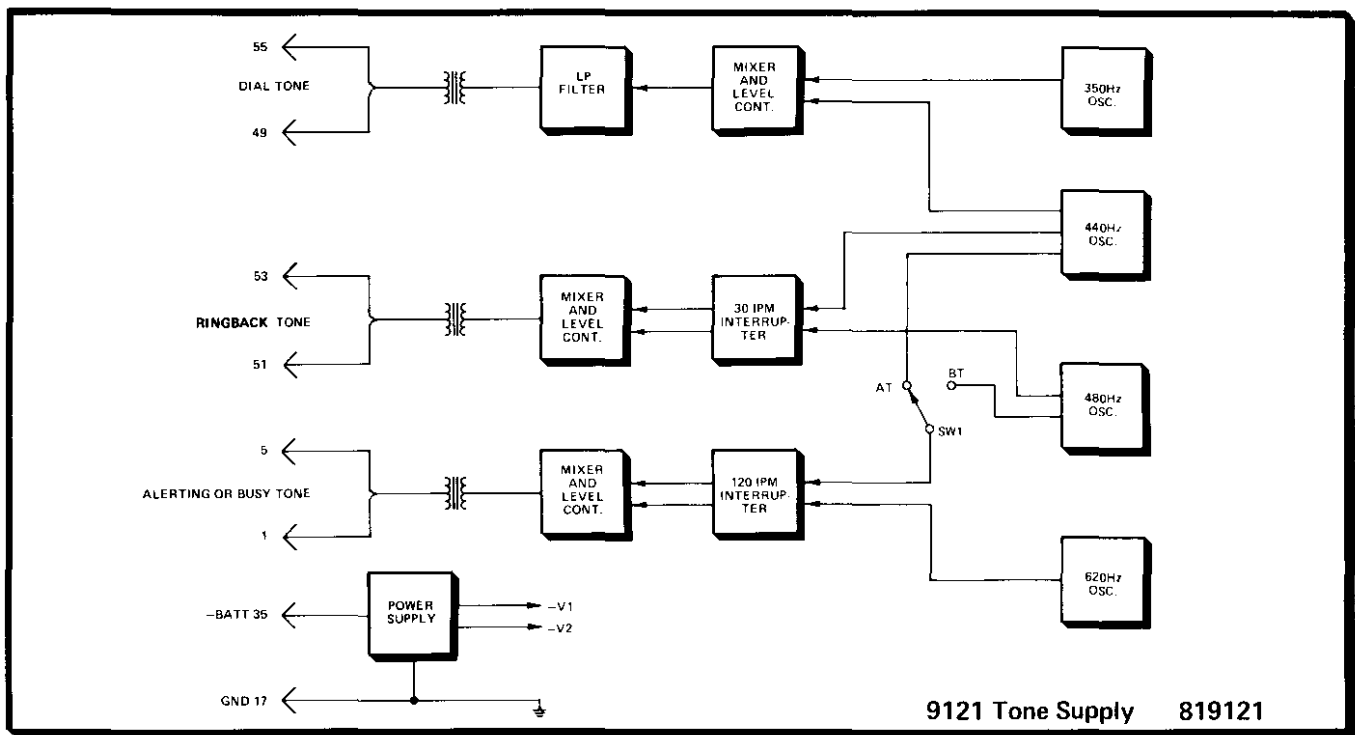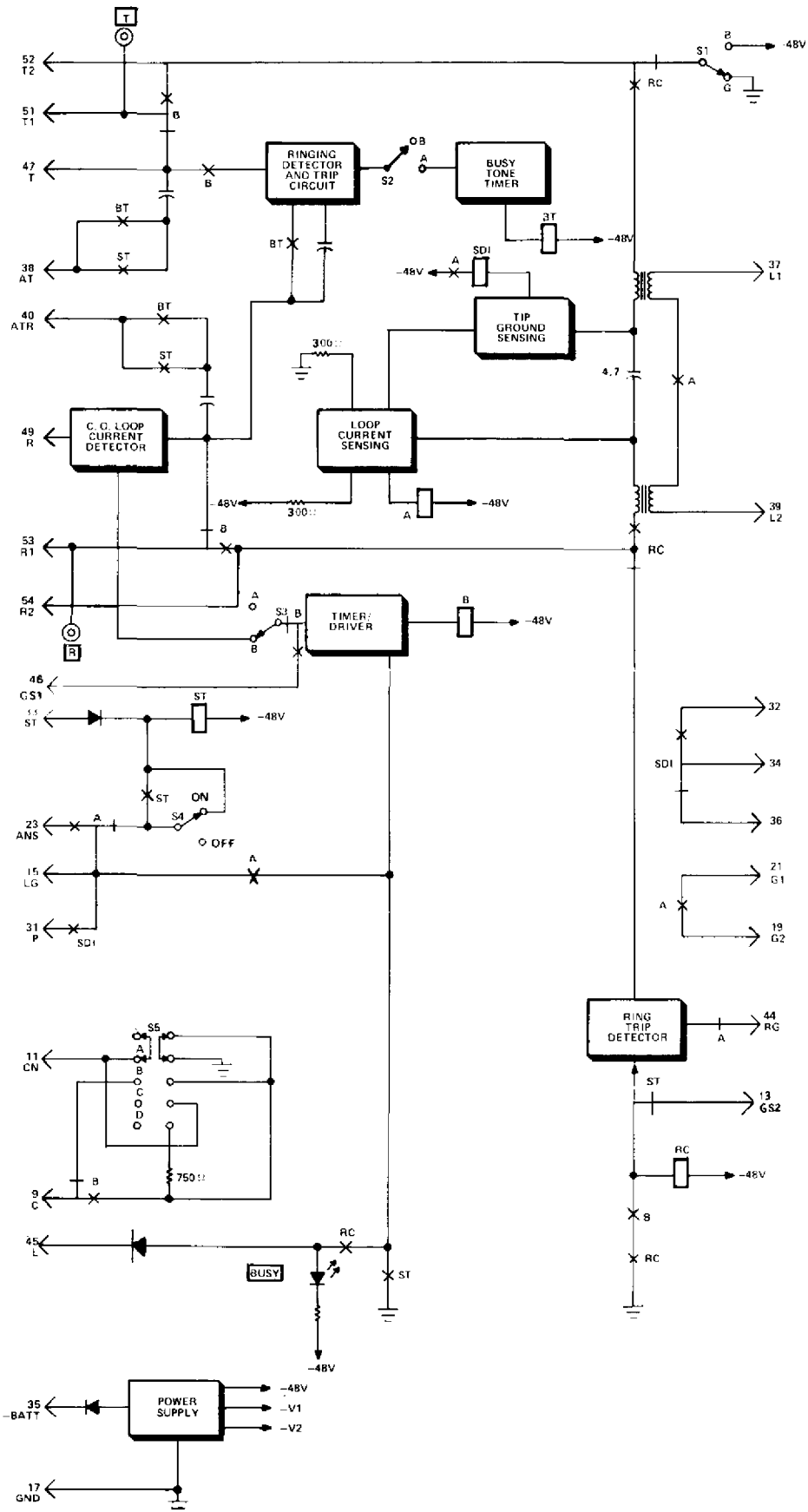
9191 2W ARD Conference Terminate Line Circuit   819191

module block diagrams (continued)

T 47

37 + L

B

RB

LOOP
SENSE

200

A

RBT 41

4.7

RBR 43

ANS

200

A

TG 42

A

B

B

RB

TIP
SENSE

SDI

−48V

−48V

BUSY

R 49

39 − L

ANS

RB

RB

ANS 23

−48V

25 STR

HVR 29

B

B

R. M. ST. 28

ANS

A

ANS

A

ANS

ANS

TS 27

−BATT 35

−48V

GND 17

SDI

36

31 P

15 LG

A

B

OFF   ON

34

SDI

S-1

ANS

33 ST

ANS

21 G₁

32

A

19 G₂

9193 2W ARD Conference Originate Line Circuit   **829193**

module block diagrams

page 22

9194 2W Conference Amplifier 839194

9196 2Wire ARD Loop Start Access Trunk 829196

module block diagrams

page 23

7. specifications

7.01 specifications 9003

interruption frequency
1 second on, 1 second off when pulsed by 9132 Ringing Timer module

capacity
5 frequencies to accommodate harmonic or decimonic ringing

functional arrangement
2 ringing subgroups per frequency (10 subgroups total) arranged as 2 ringing groups of 5 subgroups each (alternate ringing is provided between the 2 ringing groups)

relay contact rating
0.5A (115Vac, 60Hz)

alarm threshold voltage
50Vac rms

power requirements
input voltage: —44 to —56Vdc with positive ground
input current: 80mA maximum

operating environment
—40° to +140°F (—40° to +60°C), humidity to 95%, no condensation

dimensions
5.58 inches (14.17cm) high
1.42 inches (3.61cm) wide
5.96 inches (15.14cm) deep

weight
12 ounces (340 grams)

mounting
position 9 of 291 System's common equipment shelf, or one position of Tellabs Type 10 Mounting Shelf

7.02 specifications 9021

fuse type
Buss GMT, 0.25 ampere, uless otherwise specified

alarm input voltage range
—24 to —72Vdc

input current
10A maximum per circuit (two circuits)

operating environment
20° to 130°F (—7° to 54°C), humidity to 95%, no condensation

dimensions   *weight*
5.58 inches (14.17cm) high   8 ounces (0.227kg)
1.42 inches (3.61cm) wide
5.96 inches (15.14cm) deep

mounting
one position Tellabs Type 10 Shelf

7.03 specifications 9121

alerting tone/busy tone (switch-selectable)
factory-set: —14dBm
alerting tone frequency and interruption rate: 440 + 620Hz ±2Hz at 120ipm
busy tone frequency and interruption rate: 480 + 620Hz ±2Hz at 120ipm
output impedance: 25 ohms, balanced

specifications 9121 (con't)

dial tone
factory-set: —14dBm
frequency: 350 + 440Hz ±2Hz
output impedance: 25 ohms, balanced

ringback tone
factory-set: —14dBm
frequency and interruption rate: 440 + 480Hz ±2Hz at 30ipm
output impedance: 25 ohms, balanced

power requirements
input voltage: —22 to —56Vdc with positive ground
input current: 20mA

operating environment
—40° to +140°F (—40° to +60°C), humidity to 95% (no condensation)

dimensions
5.58 inches (14.17cm) high
1.42 inches (3.61cm) wide
5.96 inches (15.14cm) deep

weight
17 ounces (482 grams)

mounting
one position of Tellabs Type 10 (or Wescom Type 400) Mounting Shelf

7.04 specifications 9132

timing range
normal: 1.5 to 5.0 minutes
short timeout (optional): 0 to 2 minutes

interruption frequency
approximately 25ipm, 50% break

loop limit of optional short timeout key
10 kilohms maximum

power requirements
input voltage: filtered —42.75 to —56Vdc with positive ground
input current: 50mA

operating environment
—40° to +140°F (—40° to +60°C), humidity to 95%, no condensation

dimensions
5.58 inches (14.17cm) high
1.42 inches (3.61cm) wide
5.96 inches (15.14cm) deep

weight
10 ounces (283 grams)

mounting
one position of Tellabs Type 10 Mounting Shelf or position 8 of a 291 System common equipment shelf.

7.05 specifications 9191

2wire loop limit
2000 ohms or central office loop limit, whichever is less

ring generator bias
module may be optioned for operation with either grounded or battery-biased ring generator

ringing capability
up to 5 ringers may be run simultaneously

7.05   specifications 9191 (con't)

transformer impedance ratio
1:1

frequency response
±0.5dB, 300 to 3500Hz, re 1000Hz

insertion loss
0.5dB at 1000Hz

longitudinal balance
60dB minimum, 200 to 4000Hz

power requirements
input voltage: −42.75 to −56Vdc with positive ground
input current: 60mA plus loop current

mounting
one position of station line equipment shelves of Tellabs
291 Conference/Alerting System

operating environment
+20° to +130°F (−7° to +54°C), humidity to 95%,
no condensation

weight
19 ounces (590 grams)

dimensions
5.58 inches (14.17cm) high
1.42 inches (3.61cm) wide
5.96 inches (15.14cm) deep

7.06   specifications 9193

loop range
2000 ohms maximum
1486 ohms for 23mA loop current

transformer impedance ratio
1:1

insertion loss
0.5dB at 1000Hz

frequency response
±0.5dB, 300 to 3500Hz, re1000Hz

longitudinal balance
60dB minimum, 200 to 4000Hz

power requirements
input voltage: −42.75 to −56Vdc
input current: 60mA maximum plus loop current

operating environment
−40° to +130°F (−40° to +54°C), humidity to 95%,
no condensation

dimensions
5.58 inches (14.17cm) high
1.42 inches (3.61cm) wide
5.96 inches (15.14cm) deep

weight
18 ounces (560 grams)

mounting
position 1 or 2 of 291R System's common equip-
ment shelf or one position of Tellabs Type 10
Mounting Shelf

7.07   specifications 9194

maximum level
+3dBm at 36 lines

maximum bridging loss
3dB, 2 to 36 lines, 800 to 1000Hz

power requirements
input voltage: −22 to −56Vdc with positive ground
input current: 20mA idle, 45mA at full load

operating environment
+20° to +130°F (−7° to +54°C), humidity to 95%,
(no condensation)

dimensions
5.58 inches (14.17cm) high
1.42 inches (3.61cm) wide
5.96 inches (15.14cm) deep

weight
15 ounces (426 grams)

mounting
position 6 of common equipment shelf of 291R Conference/
Alerting System, or one position of a Tellabs Type 10
Mounting Shelf

7.08   specifications 9196

dial tone frequency
350 + 440Hz (other frequencies may be supplied
upon request)

transformer impedance ratio
1:1

insertion loss
1.0dB at 1000Hz

frequency response
±0.5dB, 300 to 3500Hz, re 1000Hz

longitudinal balance
60dB minimum, 200 to 4000Hz

power requirements
input voltage: −42.75 to −56Vdc with positive ground
input current: 120mA maximum

operating environment
−20° to +130°F (−7° to +54°C), humidity to 95%,
(no condensation)

dimensions
5.58 inches (14.17cm) high
1.42 inches (3.61cm) wide
5.96 inches (15.14cm) deep

weight
20 ounces (567 grams)

mounting
position 1 through 5 of 291R System's common equipment
shelf or relay rack or apparatus case via one position of
Tellabs Type 10 Mounting Shelf

9. troubleshooting

9.01 The following troubleshooting guide checklist identifies the most common types of general trouble conditions with suggestions as to the probable cause. For specific difficulties associated with a particular module and not covered in the *checklist,* consult the separate Tellabs Practice on that module, where detailed testing information is provided. In general, the most expeditious method of isolating trouble is the substitution of a known good module for suspected defective modules while referencing that module's *troubleshooting guide checklist.*

9.02 In compliance with FCC Registration no internal (component level) testing or repairs can be attempted on the modules or shelves in the 291R System. Return malfunctioning modules to Tellabs for repair.

9.03 If a situation arises that is not covered in the *checklist,* contact Tellabs Customer Service at your Tellabs Regional Office or at our Lisle or Mississauga Headquarters. Telephone numbers of the regional offices are as follows:

> central: (312) 969-8800
> northeast: (412) 787-7860
> southeast: (305) 645-5888
> western: (702) 827-3400

9.04 If a 291R System mounting shelf, or module is diagnosed as defective, the situation may be remedied by either *replacement* or *repair and return*. Because it is the more expedient method, the *replacement* procedure should be followed whenever time is a critical factor (e.g., service outages, etc.).

replacement

9.05 If a defective shelf, or module is encountered, notify Tellabs via letter (see below), telephone ((312) 969-8800 in the USA, (416) 624-0052 in Canada), or twx (910-695-3530). Notification should include all relevant information, including the 8XXXXX part number (from which we can determine the issue of the device in question). Upon notification, we shall ship a replacement to you. If the warranty period of the defective item has not elapsed, the replacement will be shipped at no charge. Package the defective device in the replacement carton; sign the packing list included with the replacement and enclose it with the defective device (this is your return authorization); affix the preaddressed label provided with the replacement to the carton being returned; and ship the equipment prepaid to Tellabs.

repair and return

9.06 Return the defective equipment, shipment prepaid, to Tellabs (attn: repair and return).

in the USA: Tellabs Incorporated
4951 Indiana Avenue
Lisle, Illinois 60532

in Canada: Tellabs Communications Canada, Ltd.
1200 Aerowood Drive, Unit 39
Mississauga, Ontario, Canada L4W 2S7

Enclose an explanation of the module's malfunction. Follow your company's standard procedure with regard to administrative paperwork. Tellabs will repair the module and ship it back to you. If the module is in warranty, no invoice will be issued.

troubleshooting guide checklist

Note: *If a fault is isolated to a particular module in the 291R System but cannot be corrected with the information provided in this checklist, refer to the separate Tellabs Practice on that module for detailed testing information.*

trouble condition	possible cause (in order of likelihood)
In automatic mode, System cannot be accessed. Originating party continues to receive ringback tone.	1) Originating line connected incorrectly to 291 System □. 2) Fuse blown in common equipment shelf □. 3) 9196 module incorrectly optioned □. 4) 9196 module in wrong shelf position □. 5) Power connections to 291 System open or improperly connected □. 6) 9196 module defective □.
In automatic mode, System access is incomplete. Ringback tone is removed from originating line, but conference telephones do not ring.	1) Ringing option straps on rear of common equipment shelf improperly installed □. 2) Ring generator(s) incorrectly connected to System □. 3) Power not connected to line equipment shelves □. 4) Fuse associated with 9196 module blown □. 5) 9196 module incorrectly optioned □. 6) 9191 modules incorrectly optioned □. 7) Defective 9196 module □. 8) Defective 9003 module □. 9) Defective 9132 module □.
When accessed, not all conference telephones ring.	1) Ringing option straps on rear of common equipment shelf improperly installed □. 2) Required ringing frequency not wired to System □. 3) Non-ringing telephone lines incorrectly wired to System □. 4) Blown fuses in line equipment shelves □. 5) 9191 associated with non-ringing phones incorrectly optioned □. 6) Defective 9191 module □.

Automatic Conference Origination

Manual Conference Origination

NOTE

CAUTION – WHEN S3 OF THE 9003 IS IN THE A POSITION, ALL RING GENERATOR OUTPUTS ARE INTERRUPTED (ONE SECOND ON, ONE SECOND OFF). WHEN S3 IS IN THE B POSITION, ALL EVEN NUMBER RING GENERATOR OUTPUTS ARE CONTINUOUS WHILE ALL ODD NUMBER OUTPUTS ARE INTERRUPTED.

System flow chart — flowchart boxes (reading order):

- CALLING PARTY DIALS THE CORRESPONDING PBX ACCESS LINE
- PBX APPLIES RING GENERATOR ON THE L LEAD
- RING SENSE CIRCUIT DETECTS RING GENERATOR AND OPERATES THE SR RELAY ON THE 9196
- SR RELAY "MAKE" CONTACT APPLIES A GROUND TO THE STR RELAY ON THE 9196
- SBR RELAY "MAKE" CONTACT APPLIES A GROUND TO THE SR RELAY ON THE 9196
- SR RELAY "MAKE" CONTACT APPLIES A PARTIAL OPERATE PATH FOR THE R RELAY ON THE 9196
- SL RELAY "MAKE" CONTACT APPLIES A GROUND TO THE LAMP LEAD (PIN 45) AND LIGHTS THE BUSY LAMP ON THE 9196
- SLR RELAY "MAKE" CONTACT APPLIES A GROUND TO THE R RELAY ON THE 9196
- SL RELAY "MAKE" CONTACT APPLIES A GROUND TO THE LG LEAD (PIN 15) OF THE 9196
- THE LG GROUND IS APPLIED TO THE LG LEAD (PIN 15) OF THE SR RELAY
- THE LG GROUND IS APPLIED TO THE 9132 TO THE RT RELAY WHICH OPERATES
- IS RELAY "MAKE" CONTACT PROVIDES A GROUND TO OPERATE THE RT RELAY ON THE 9003
- THE RI RELAY PULSES THE RO RELAY ON THE 9003 GROUND TO THE RO RELAY
- THE LG GROUND IS APPLIED TO THE LG LEAD (PIN 13) OF THE 9132 AND ACTIVATES THE RING INTERRUPTER WHICH BEGINS PULSING THE RI RELAY AT 1 SECOND ON, 1 SECOND OFF RATE
- RO RELAY "BREAK" CONTACT BREAKS THE OPERATING PATH OF THE RT RELAY WHEN SWITCH S3 IS IN THE A POSITION (SEE NOTE 2). WHEN RELAY RO OPERATES, RELAY RT DOES NOT AND VICE VERSA.
- RELAY IS AND RO OR RT WHEN OPERATED PROVIDE A COMPLETE PATH FROM THE RING GENERATOR INPUT TO PIN 44 OF EACH 9191
- STR RELAY "MAKE" CONTACTS PROVIDE A GROUND TO THE ST A AND ST B LEADS OF THE 9003 (PINS 49 AND 51) THESE GROUNDS OPERATE THE STR RELAY ON ALL 9191
- STR RELAY "MAKE" CONTACT OPERATES THE B RELAY VIA THE TIMER
- IS THE STATION BUSY WITH A NORMAL CALL? — NO / YES
- OPERATED B RELAY DISCONNECTS THE STATION FROM ITS NORMAL LINE AND APPLIES RINGING FROM PIN 44 THROUGH THE B RELAY "MAKE" CONTACT OUT THE TIP AND RING TO THE STATION
- LOOP SENSE CIRCUIT DETECTS OFF HOOK CONDITION AND OPERATES
- STATION ANSWERS
- RING TRIP CIRCUIT DETECTS OFF HOOK CONDITION AND OPERATES THE RC RELAY ON THE 9191
- RC RELAY "BREAK" CONTACTS IN THE 9191 REMOVES RING GENERATOR FROM THE RING (PINS 51 AND 53)
- A RELAY "MAKE" CONTACT PROVIDES A GROUND TO HOLD UP THE B RELAY AFTER THE STR RELAY RELEASES ON THE 9191
- ANS RELAY ON 9196 OPERATES
- R RELAY OPERATES ON NEXT RINGING CYCLE
- ANS RELAY "MAKE" CONTACT COMPLETES THE OPERATE PATH FOR THE SL RELAY
- SR RELAY "MAKE" CONTACT BRIDGES THE SG RELAY CONTACT AND PROVIDES A LOCKING PATH
- CONTACTS LIGHT LED ON THE 9191
- IS SWITCH S3 OF THE 9191 SET TO — POSITION A / POSITION B
- BUSY STATION IS AUTOMATICALLY CUT OFF FROM ITS CALL AND CONNECTED TO THE CONFERENCE
- A RELAY "MAKE" CONTACTS PLACE CLOSURES ACROSS THE G1 AND G2 LEADS
- A AND B RELAY "MAKE" CONTACTS PROVIDE A GROUND FOR OPERATING
- ANS RELAY ON 9193 OPERATES
- CONFERENCE ACTIVATION COMPLETED. ALL STATIONS ENTER CONFERENCE
- MASTER TELSET GOES OFF HOOK
- LOOP SENSE CIRCUITRY IN THE 9193 OPERATES THE A AND B RELAYS
- A RELAY "MAKE" CONTACTS PROVIDE A PARTIAL CLOSURE BETWEEN T8 AND R8 LEADS
- FRONT PANEL BUSY LED LIGHTS
- A AND B RELAY "MAKE" CONTACTS GROUND ON THE LG LEAD (PIN 15)
- B RELAY "MAKE" CONTACT PROVIDES RINGBACK TONE TO THE MASTER TELSET VIA THE 9121

trouble condition	possible cause (in order of likelihood)
Alerting tone not received by conference telephones off-hook on routine call when conference is activated.	1) 9191 optioned incorrectly ☐. 2) Fuse associated with 9121 module blown ☐. 3) If condition is limited to one specific telephone, defective 9191 ☐. 4) If condition is always associated with same telephones (others work normally), check for incorrect wiring between switching equipment and 291 System on lines with problem ☐. 5) Defective 9121 module ☐. 6) Defective 9191 module ☐.
Conference telephones can answer only during ringing cycle.	1) 9003 optioned incorrectly (check switch S1) ☐. 2) Switch S1 on 9191 modules incorrectly set ☐. 3) Defective 9003 module ☐. 4) Defective 9191 module ☐.
Conference telephones can answer only during ringing cycle.	1) 9003 optioned incorrectly (check switch S1) ☐. 2) Switch S1 on 9191 modules incorrectly set ☐. 3) Defective 9003 module ☐. 4) Defective 9191 module ☐.
Ringing period either too long or too short.	1) Timeout period of 9132 module requires adjustment ☐. 2) Defective 9132 module ☐.
Not all conference telephones ring. Those that do ring, ring without interruption.	1) 9003 optioned incorrectly ☐. 2) Defective 9132 module ☐.
When System operated in manual mode, ringback tone not received to originating station.	1) Station off-hook ☐. 2) Ringback-tone level adjustment set too low on 9121 module ☐. 3) Defective 9121 module ☐. 4) Defective 9193 module ☐.
Remote-access lines inoperated.	1) 9196 module(s) incorrectly optioned ☐. 2) Blown fuse associated with 9196 ☐. 3) Defective 9196 module ☐.
Remote-access lines do not release from switching equipment at end of call.	1) Defective 9196 module ☐.
One particular fuse blows repeatedly.	1) Module associated with blown fuse is defective ☐.
When System is accessed, low level is experienced on all conference telephones.	1) Level adjustment on 9194 Amplifier module incorrect ☐.
Voice level varies widely, depending on number of telephones on line at one time.	1) Adjustment of 9194 Amplifier module is incorrect; balance between *level* and *ratio* controls requires correction ☐. 2) Defective 9194 module ☐.
Voice level cannot be controlled by front-panel adjustment of 9194.	1) 9194 module in wrong position ☐. 2) Fuse associated with 9194 module blown ☐. 3) Defective 9194 module ☐.
Conference activation causes immediate termination of routine calls in progress at conference telephones.	1) 9191 modules incorrectly optioned ☐. 2) Defective 9191 module ☐.