

# Installation Instructions

## Model 481BA D-20 6-Channel Intracom System 78-9236-2877-6

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**To the Installer:**  
Be sure to review the page 3 and 5 wiring and cable requirements before you begin.

## A. Contents

Item	Part Number	Description	Qty.
1	78-8028-9163-6	Installation Instructions	1
2	See Parts List	D-20 6-Channel Intracom	1
3	78-8028-8990-3	Bracket, Mounting	1
4	78-8028-9029-9	Guide, Mounting	4
5	26-1000-4190-9	Screw, 6-20 x 1/4 inch	12
6	78-8050-8524-4	Cable Assy., 8 Foot 9-Pair	2
7	78-8028-9182-6	Label, Cable "A"	1
8	78-8028-9181-8	Label, Cable "B"	1
9	78-8028-9180-0	Decal, Terminal Strip	1
10	26-1004-0752-2	9 Terminal Strip	4
11	78-8028-9283-2	Transformer, Plug-In 14 VAC, 15 VA	1
12	78-8028-9188-3	Cable Clamp	1
13	78-8002-2563-9	Screw, Machine, 8-32 x 1 inch	1
14	78-8028-9075-2	Screwdriver/Switch Tool	1
15	44-0005-0302-7	Operating Instructions	1
16	78-8028-9194-1	Warranty Card	1
17	34-4305-5040-1	Dealer Receiving Card	1

**Note:** Check for shipping damage. If you find damage, notify the shipping company and 3M Sound Products Order Dept. immediately. 3M processes any claims against the shipping company on items 3M has shipped. If someone else has reshipped components, they must make the claim. If making a claim, retain all packaging and components for inspection by the shipping company.

## B. Introduction

The Model 481 "D-20" six-channel Intracom has a wide range of applications which include self-serve gas stations, convenience stores and truck stops for communication between store and pump islands. Multiple-lane drive-thru's are another application. You can connect up to six 8-ohm speakers to the D-20 for selectable talk/listen capability. An all-call feature allows you to talk or listen to all six speakers simultaneously. The D-20 also provides a music input connection for feeding background music and/or messages over the speakers. Music or messages continue on all unused Intracom channels.

Each channel has a connection for a momentary-contact call switch. Switch closure triggers an internal alert tone in the D-20 and turns on a flashing indicator over that channel's call button until answered. Selection of a "repeat tone" mode provides repeat tones while in STANDBY mode and single tones while in LISTEN mode. Once a channel has called, additional call switch closures do not retrigger a tone while in the LISTEN mode. 3M offers a wide selection of speaker and call button options for various applications. Each channel also has a talk and a listen LED indicator. A hold switch allows you to "hold" a channel call indicator on while you answer a call from another channel. A built-in electret microphone and three-inch speaker provide "true voice" quality. Quick-disconnect via two 18-pin plug-in connectors provides easy service access or replacement.

Follow these instructions carefully to help assure proper installation and reliable operation. The D-20 contains several internal factory-set jumpers which require change for some applications. See Section F. For quickest and most reliable installation, we recommend contacting one of our nationwide network of authorized 3M Sound Products dealers. Call (612) 733-4912/4913 for the name of your nearest dealer.

We recommend that you use one of the following 3M speakers with the D-20 for best voice quality. The application determines your choice of speaker. See the Intracom Speaker Application Guide for more details. The 3M Security Speaker/Mic (SSM) provides best security for ground-level applications, but with some reduction in voice quality. While the D-20 "works" with any 8-ohm speaker, these 3M speakers work best with the shaped frequency response of the D-20 amplifier to provide best voice quality and reduced noise pickup.

Part Number	Description	Normal Application/Location
78-8028-9195-9 Note 1	Speaker/mic and switch with stainless faceplate	Pump-island post to signal and talk inside. Has a weather-proof call switch.
78-8028-9196-6 Note 1	Speaker/mic assembly with stainless faceplate	High on pump island post with a separate callswitch to signal inside.
78-8028-9174-3 Note 2	Call switch assembly with stainless faceplate	On pump island post to signal D-20 alert inside. Use with a high-mounted speaker.
78-8016-9810-7	Outside speaker/mic horn-type speaker with mounting base	In the menu sign, as a monitor and on a pump island post.
78-8028-9047-1	Security speaker/mic horn-type speaker with surface backbox	Security surface-mount on a pass-through window mullion or on a pump island post.

Note 1 - Requires stainless backbox (78-8028-9192-5) for surface or recessed mounting.

Note 2 - Requires backbox (26-1004-3627-3) for surface mounting or use a standard single-gang electrical box for recessed mounting or conduit rough-in.

### C. Mounting Methods

The D-20 has four rubber feet for countertop placement, but permanent surface attachment prevents movement which could break connections. The mounting guides and an "A" mounting bracket enclosed with each unit provide various wall-mounting methods. Using the optional pedestal-mount as shown in figures 3-D, 3-E and 3-F places the D-20 closer to the operator for better voice clarity, easier control access and reduced listening volume.

## D. Mounting and Connecting Speakers, Call Switches and Handsets

Various applications involve connecting up to six speakers and call switches, handsets or vehicle detection systems to the D-20. We offer a variety of products for connection to the D-20, but speakers connected to the six D-20 channels should be of the same type to provide equal volume levels.

All speaker wiring must consist of individual, 18 to 20 gauge, shielded, twisted-pairs — grounded at the inside end only. (i.e. Belden #9402, two twisted pair, 20-gauge, individually shielded or, Belden #8762, 20-gauge, single twisted-pair, individually shielded.) Use of individually shielded twisted-pairs is absolutely essential if music is to be played at the speakers.

### WARNING:

All speaker and switch cables must route through a conduit that is **SEPARATE** from those containing 120 VAC power wiring. Do not under any circumstances route audio or low voltage cables in the same conduit with 120 VAC wiring. This violates the national electrical code and presents a hazard.

Figures 4 - 6 show typical speaker, handset and call switch connections. Figure 7 shows typical multiple lane drive-thru speaker and multiple vehicle detection connections to the D-20.

1. **SPEAKERS AND CALL SWITCHES** - Mount each speaker and call switch per the 3M application guide and included instructions. Be sure to fill the attaching screw slots with epoxy after mounting to reduce the theft potential. Call switches must be spring-return type and weatherproof for outdoor use if not using 3M switches.
2. **INSTALLING A SECURITY SPEAKER/MIC:**
  - a. Remove two screws attaching speaker to enclosure.
  - b. Drill three 1/4-inch holes through the enclosure per figure 1.
  - c. If no hole or electrical box exists at the mounting point, drill a 1/4-inch cable hole as shown in figure 2.
  - d. Center the enclosure over the cable hole, mark and then drill two 1/4-inch mounting holes.
  - e. Attach the enclosure using 10-32 x 3/4-inch screws and nuts. **DO NOT USE THE EXTERNAL MOUNTING TABS.**
  - f. Route a twisted pair cable containing #20 or heavier wires through the cable hole to the D-20 terminal strips.
  - g. Connect the cable to the speaker leads using wire nuts.
  - h. Reattach the speaker to the enclosure.
  - i. Fill the screw slots with epoxy to inhibit theft.

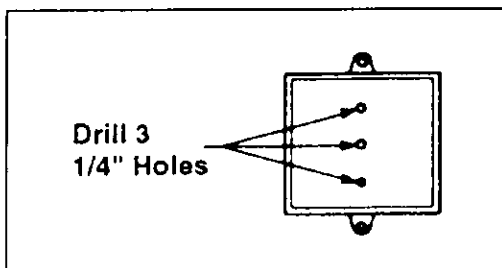


Figure 1. Drilling Enclosure Holes

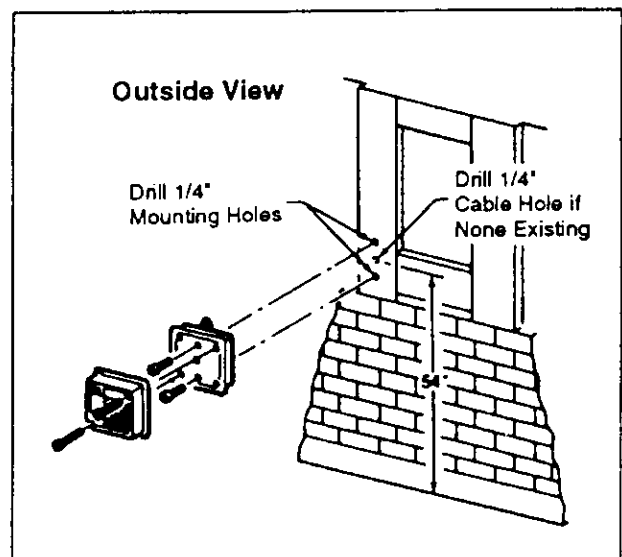


Figure 2. Mounting SSM Speaker

3. **OUTSIDE HANDSETS** - You can use handsets instead of speakers on each D-20 channel. Connect handset as shown in figure 6.

4. **SODAR CABLE** - If installing Sodar, also pull the RG-58A/U shielded coaxial cable specified in the SODAR instructions at the same time as the speaker/detection cable. You only need a single 18-gauge, twisted-pair, shielded speaker cable when using SODAR.
5. **VEHICLE DETECTION COMPONENTS (DRIVE THRU-APPLICATIONS)** - Install chosen vehicle detection components as follows:
  - a. **Magnetic Loop System** - Install a Prefab Loop kit (lay-in) or a Magnetic Loop Kit (cut-in) and route the loop lead-in into the menu sign per instructions enclosed with the kit. Solder the lead-in to the white/black pair of the speaker/detection cable. Be sure to set the internal mode switch to PULSE for use with the D-20.
  - b. **Sodar System** - Attach the SODAR transducer and shield to the menu sign and connect it to the coaxial transducer cable per SODAR instructions. SODAR requires the optional relay to trigger the D-20 alert. Set the relay mode select switch to PULSE mode for use with the D-20. You need one complete SODAR system for each menu sign. Mount each detector out of the way under a counter and label each to designate the channel/menu sign.
  - c. **Air Hose System** - Drill a 5/8-inch hole for the air switch nozzle in the sign and two holes appropriate for #8 machine or sheet metal mounting screws. Mount the air switch with the nozzle down and connect the wires to the white/black pair. Attach approximately 16 feet of air hose to the air switch nozzle, route the hose down the curb and clamp it so that it crosses the driveway behind a stopped vehicle. Use a hose anchor or a hose plug to close the open end of the hose.

### E. Changing D-20 Jumper Options

Three D-20 options may require you to change internal jumpers. To change a jumper:

1. Turn the D-20 upside down and remove the four cabinet screws (outside corner screws).
2. Separate the cabinet and chassis.
3. Open or close the appropriate switch or cut the jumpers on the lower circuit board per the checklist below.
4. Rejoin the cabinet and chassis.
5. Reinstall the four screws.

#### D-20 SELECT OPTION CHECKLIST

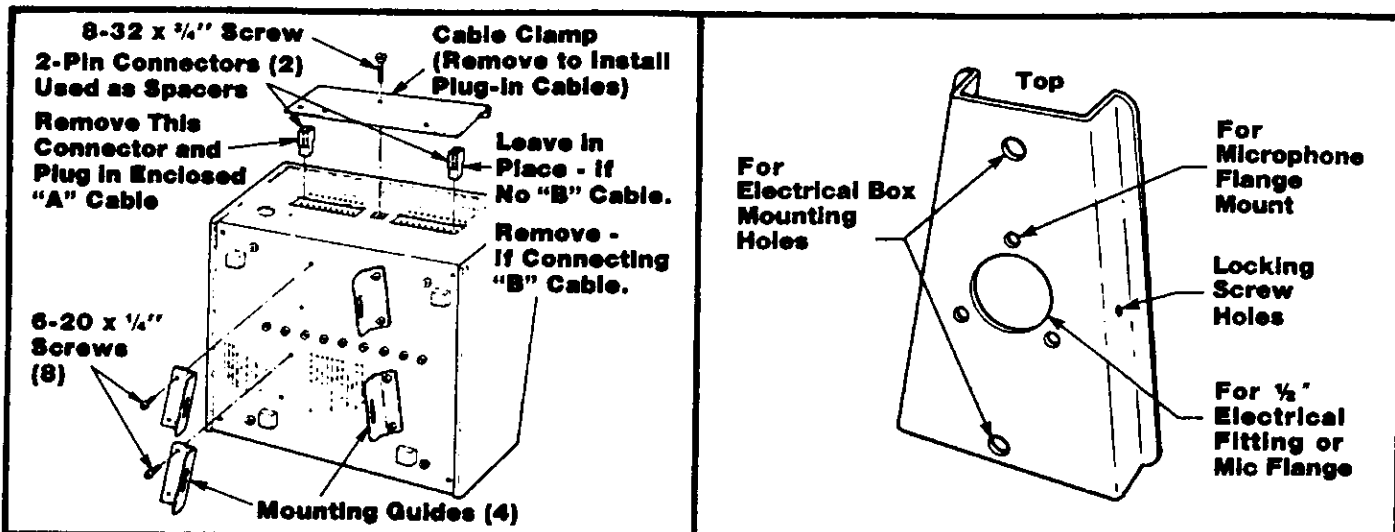
- |  |  |
|--|--|
| <p><b>1. Single or repeat alert tone in standby (always single tones in listen)</b><br/>         Slowly repeated call alert tone in standby.<br/>         Single call alert tone in standby.</p>   | <p>*SW203 OPEN<br/>         SW203 CLOSED</p>                       |
| <p><b>2. Type of talk microphone (talk preamp gain select)</b><br/>         Built-in electret mic or inside handset (low gain).<br/>         Using external flex mic (high gain).</p>  | <p>*SW202 CLOSED<br/>         SW202 OPEN</p>                       |
| <p><b>3. Outside speaker/mic or separate speaker &amp; mic</b><br/>         Speaker/mic or handset connected to each channel.<br/>         Separate outside mic's with push-to-talk switches<br/>         wired in parallel to a single input.</p> | <p>*WJ201 &amp; WJ202 UNCUT<br/>         WJ201 &amp; WJ202 CUT</p> |
| <p>Listen preamp input is a speaker or handset (low gain).<br/>         Listen preamp input is a mic (high gain).</p>  | <p>*SW204 CLOSED<br/>         SW204 OPEN</p>                       |

\* Factory setting of this option.

Jumper wires WJ201 and WJ22 normally allow the speaker on each channel to act both as a speaker, and through the jumpers, as a microphone. If you wish to connect a separate outside microphone(s), cut both jumper wires, and connect the microphone(s) to the "A" terminals 1 and 2 and open SW204. Use of outside handsets in place of speaker/mic's does not require the above changes if you connect the receiver and mic in parallel per figure 6.

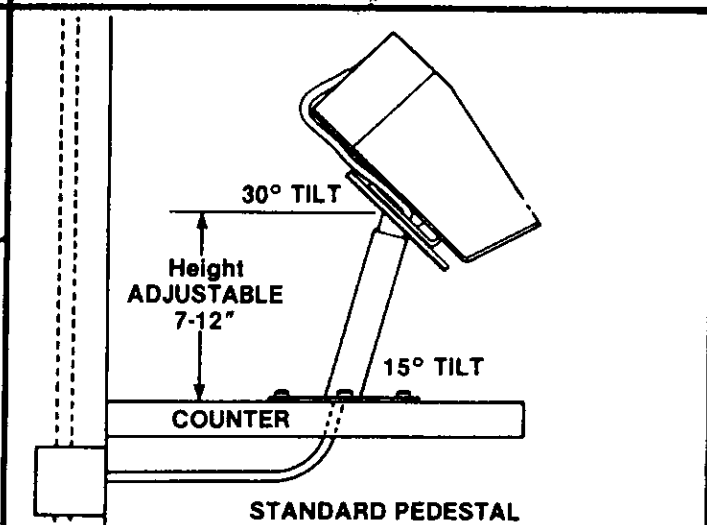
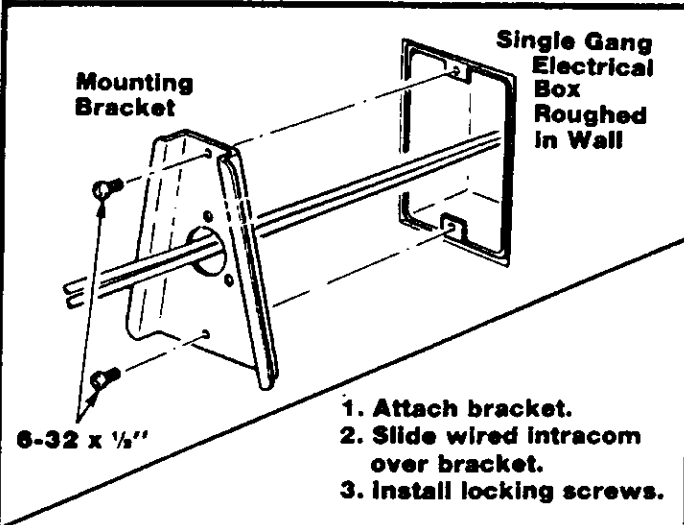
## **F. Installing D-20 and Optional Components**

1. **ROUTING CABLES** - Route all speaker/detection cables and cables from any optional components to the chosen D-20 location. If the plug-in transformer cable will route through conduit or wall to the D-20 location, do so now.
2. **ATTACHING MOUNTING GUIDES AND "A" BRACKET** -
  - a. Attach the mounting "A" Bracket to the wall, electrical box or pedestal where you will mount the D-20.
  - b. Attach the four mounting guides using eight of the screws provided (figure 3-A).
  - c. Temporarily slide the D-20 onto the "A" bracket.
3. **PLUG-IN CABLES AND TERMINAL STRIP CONNECTIONS** -
  - a. Locate the two eight-foot plug-in cable assemblies and apply the "A" Cable Label to both ends of one cable and the "B" Cable Label to both ends of the other cable per figures 4 - 7.
  - b. Plug the "A" cable connector onto the CONNECTOR A socket and the "B" cable connector onto the CONNECTOR B socket on the back of the D-20.
  - c. Route the two cables through conduit, pedestal post or hole to below the counter above the ceiling or wherever you can mount the four terminal strips.
  - d. Apply the terminal strip decal to the wall or other surface within reach of the two plug-in cables.
  - e. Attach the four nine-terminal strips over the decal in the areas shown using the appropriate #4 or #6 hardware (not included).
  - f. Remove about 7 inches of the grey outer jacket from each cable.
  - g. **ATTACH PLUG-IN CABLE WIRES TO TERMINALS** - Attach one pair of wires at a time from each cable to the terminals shown on the decal as follows:
    - Strip 1/8-inch of insulation from each wire of the first (red & black/red) pair and twist the strands of each wire together.
    - Insert the red wire in the indicated terminal and tighten the screw firmly. Then insert the other paired wire and tighten its screw firmly.
    - Repeat these two steps for the remaining eight pairs in the cable and the nine pairs in the other cable.
4. **OPTIONAL FOOTSWITCH** - You can use a footswitch to talk to any channel after selecting the channel. Connect to "A" terminals 9 and 10.



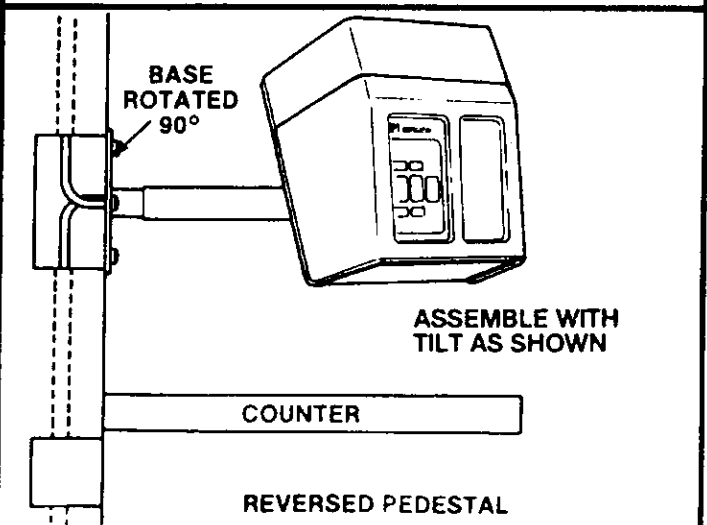
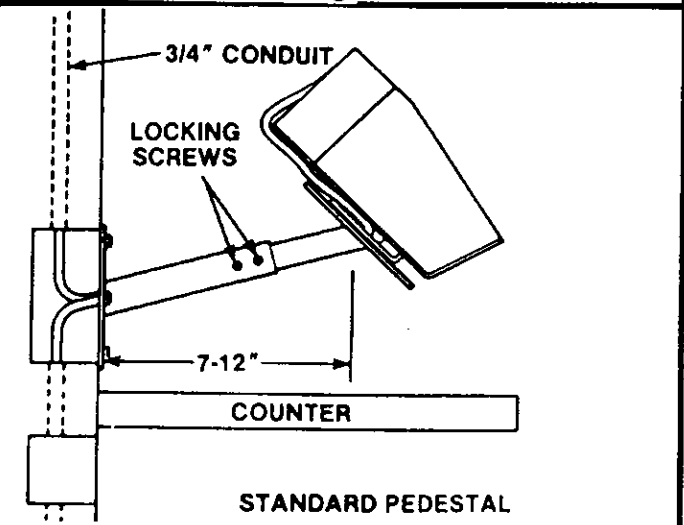
**A. Attaching Mounting Guides**

**B. Mounting Bracket Features**



**C. Wall Mounting**

**D. Countertop Pedestal**



**E. Wall Pedestal**

**F. Wall Pedestal - Side Angle**

Figure 3. Intracom Mounting Methods

5. **OPTIONAL FLEX MICROPHONE** - You can connect an external microphone to the D-20 instead of the internal electret microphone. For best results, use one of the following 3M microphones depending on customer requirements:
  - Flex mic without switch (78-8010-4847-7) for hands-free talk activation via any channel talk switch or a footswitch.
  - N.O. flex mic (78-8010-4873-3) with the switch contacts for the mic jumpered and the relay switching (blue and black) wires connected to the footswitch terminals for optional grip-to-talk T/L activation in addition to the channel talk buttons, or a footswitch.

When using a flex mic, connect per figure 4. You also must open the D-20 and:

- a. Open SW202.
  - b. Unplug the internal mic at P103.
6. **OPTIONAL MONITOR SPEAKER** - You can connect any 8-ohm speaker to "A" terminals 5 and 6 to monitor the incoming audio only. Install a volume control on or near the monitor speaker to provide separate monitor volume adjustment. **Note** - The D-20 listen volume control also controls the monitor volume.
  7. **OPTIONAL PHONE JACK ASSEMBLY FOR PLUG-IN CONNECTION OF AN EARPHONE, HEADSET OR EXTERNAL SPEAKER** - Install the phone jack assembly 78-8028-9153-7 and attach 1/4-inch, 3-conductor phone plug to the device you will plug in per the phone jack assembly instructions.
  8. **OPTIONAL MUSIC AND/OR MESSAGE CONNECTIONS** - Connect the 8-ohm output of a 3M music player or any amplifier to "B" terminals 1 and 2 per figures 4-7 to provide music and/or commercial messages over all the speakers connected to the D-20. Calling any channel on the D-20 will mute the music/messages for just that channel.

## **G. System Checkout and Volume Backing**

1. **CONNECT POWER TRANSFORMER TO D-20** - Insert the plug-in transformer cable plug into J201, the power jack on the back of the D-20.
2. **PLUG-IN TRANSFORMER** - Plug the power transformer into a 120 VAC, 60Hz outlet.
3. **VOLUME ADJUSTMENTS AND FUNCTION CHECKS** - The D-20 has a listen volume control for the operator, and two internal volume controls. The internal TALK and ALERT volumes require installer adjustment through the bottom of the D-20 PRIOR TO mounting. **Note** - Use care and the special plastic screwdriver tool enclosed with the D-20 for these two volume adjustments. Excessive force will break the controls.



## D-20 OPERATION CHECK AND VOLUME ADJUSTMENT PROCEDURE

- a. Turn on the D-20 (green "POWER" LED lights and a single tone [or slowly repeating tone if SW203 is open] will be heard over the speaker). **Note** - Random combinations of the three LED's for each of the six channel switches will light upon power-up. Rub a finger across each row of numbered channel switches and then the standby switch to clear these lights before use.
  - b. Set the listen volume (operator's knob) to its mid-position.
  - c. Press and hold any TALK switch (red LED above that switch illuminates). Adjust the "TALK VOLUME" control for the desired volume heard over that channel's speaker using the special tool. Release the talk switch (the green LED illuminates).
  - d. Press the STANDBY switch to silence the D-20 (green LED goes out and the yellow LED above the standby switch lights).
  - e. TEST ALERT - Activate the call switch or vehicle detection (if used) for channel 1. Closure should cause the yellow LED above the channel 1 switch to flash and produce a single tone (SW103 closed) or slowly repeating tone (SW103 open) heard over the speaker. Adjust the "ALERT VOLUME" control using the special tool.
  - f. Check each channel for audio level and alert activation. Adjust the talk volume to a compromise position if you find volume differences between channels.
  - g. TEST HOLD SWITCH - Press any channel switch. Then press the HOLD switch (yellow LED above that channel switch should light steadily).
  - h. TEST ALL CALL SWITCH - Press the ALL CALL switch (all six red TALK LED's should light). Release the ALL CALL switch (all six LISTEN LED's should light). Press STANDBY to clear.
  - i. If using a footswitch, flex mic, or handset, check talk switching.
  - j. Instruct the operator and present the operating instructions (item 10).
  - k. Keep these instructions for reference.
4. FINAL D-20 MOUNTING - Lock the D-20 to the "A" bracket by installing the remaining two small screws at each side of the "A" bracket per figure 3-B. Either install the cable clamp or rear wire cover as follows:
- Cable Clamp (Item 7) - Attach to D-20 with screw (item 8) per figure 3-A.
  - Optional Rear Wire Cover - Install the optional rear wire cover (78-8028-9062-0) instead of the cable clamp (item 7) per included instructions.

**Special Note:** Music or messaging "crosstalk" (music or messages are heard in the base station speaker) can occur if: separate, twisted pair wiring is not used for OSM connections or, if an extremely high level of music/message is used. If crosstalk occurs, cut the red and red/blk pair about two inches from the B connector and then connect the music/message source directly to the D-20, bypassing the 8-foot cable.

## H. Service Information

Most new installation problems result from wiring errors or from missed instructions so recheck everything if you have a problem. Be sure you have properly set the internal jumper switches for the options used and adjusted the two internal volume controls. Refer to the D-20 service manual for schematics, troubleshooting and parts information.

Users should contact their local authorized 3M Sound Products dealer for service on these products. For the name of your local dealer, repair or installation assistance, contact 3M Sound Products Technical Service at (612) 733-4912/4913.

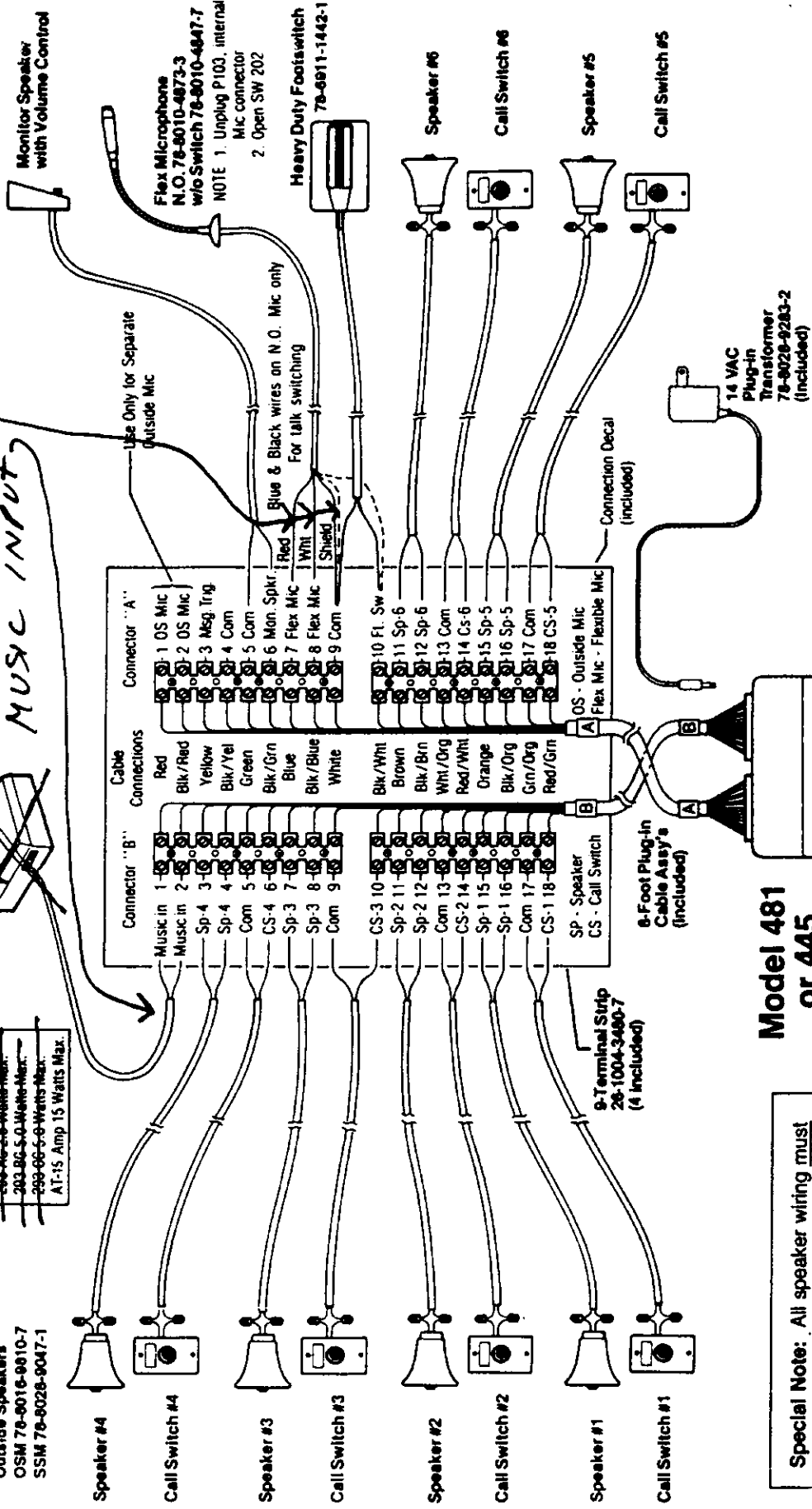
SEP. MIC. CONNECTIONS

MUSIC INPUT

Optional "CANTARA" Music Player

- Model 200 Terminals 1 & 2
- 8-wire output to D-20
- 200 AC-2.5-Watts Max.
- 200 BC-5.0-Watts Max.
- 200 CC-6.0-Watts Max.
- AT-15 Amp 15 Watts Max.

Outside Speakers  
OSM 78-0016-0010-7  
SSM 78-0028-0047-1



Model 481  
or 445  
D-20  
6-Channel  
Intracom

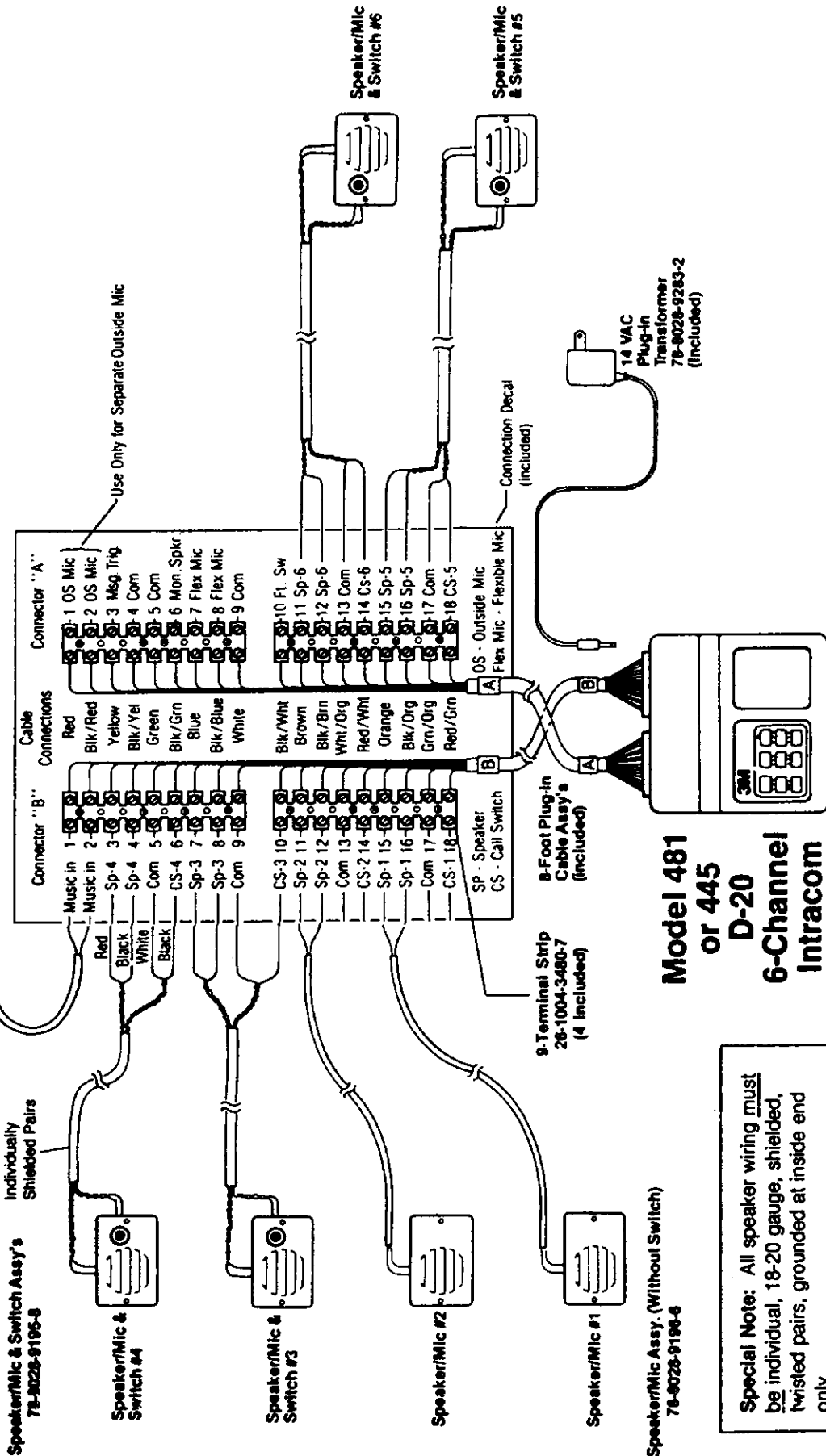
Special Note: All speaker wiring must be individual, 18-20 gauge, shielded, twisted pairs, grounded at inside end only.

Figure 4. D-20 Connections - Separate Speaker/Call Switch

Optional "CANTATA"  
Music Player

Model 293 Terminals 1 & 2
8-ohm output to D-20
293 AG 2.5 Watts Max.
293 BG 5.0 Watts Max.
293 CG 5.0 Watts Max.
AT-15 Amp 15 Watts Max.

Individually  
Shielded Pairs

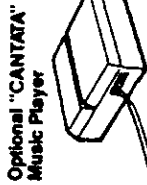


Model 481  
or 445  
D-20  
6-Channel  
Intracom

**Special Note:** All speaker wiring must be individual, 18-20 gauge, shielded, twisted pairs, grounded at inside end only.

Figure 5. D-20 Connections - Combined Speaker/Call Switch

**Special Note:** All speaker wiring must be individual, 18-20 gauge, shielded, twisted pairs, grounded at inside end only.



Model 293 Terminals 1 & 2	8-ohm output to D-20
293 AG	2.5 Watts Max.
293 BG	5.0 Watts Max.
293 CG	5.0 Watts Max.
AT-15 Amp	15 Watts Max.

Protect All Outside Handset and Cradle Switches From Weather with an Enclosure

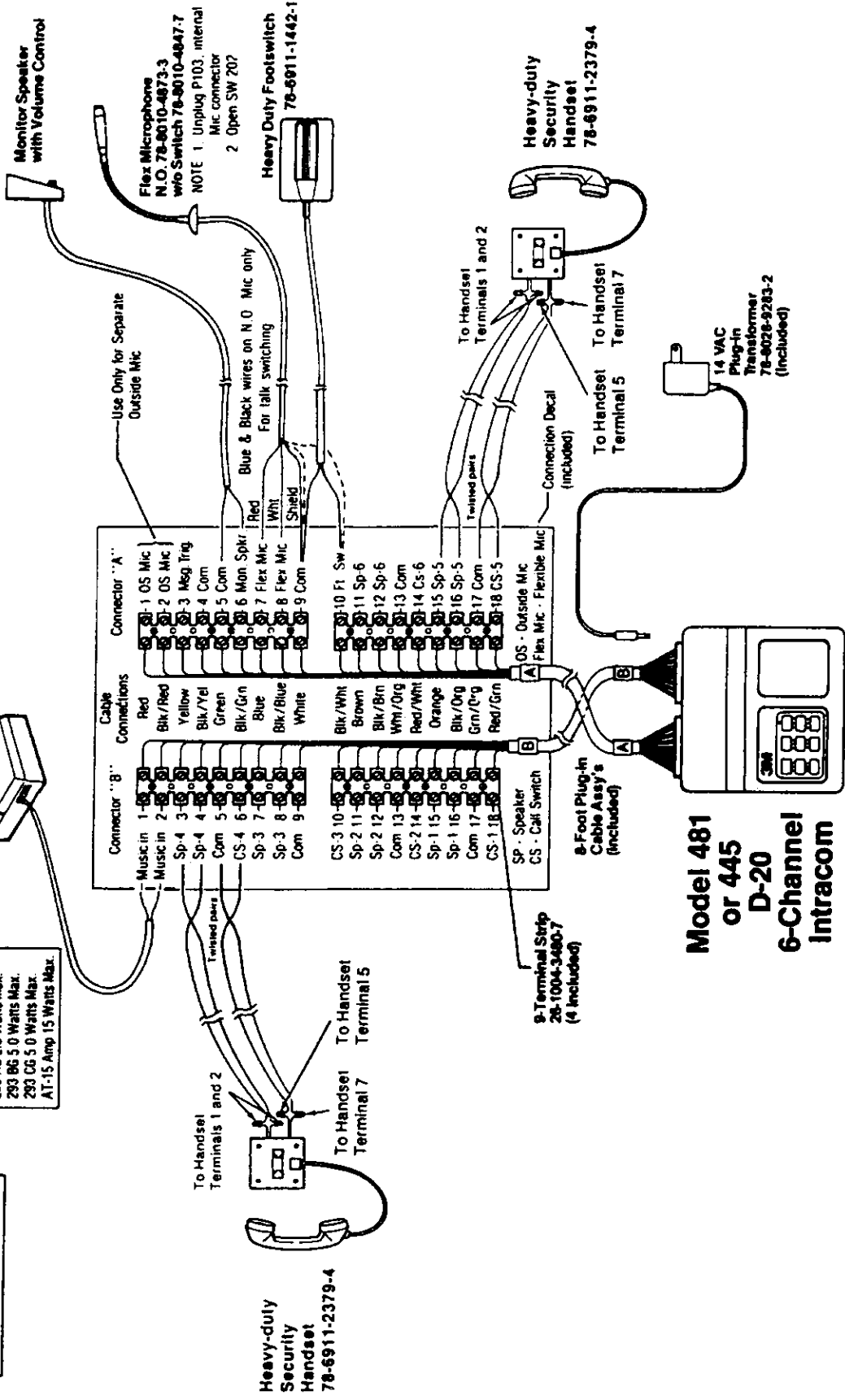


Figure 6. D-20 Connections - With Outside Handsets

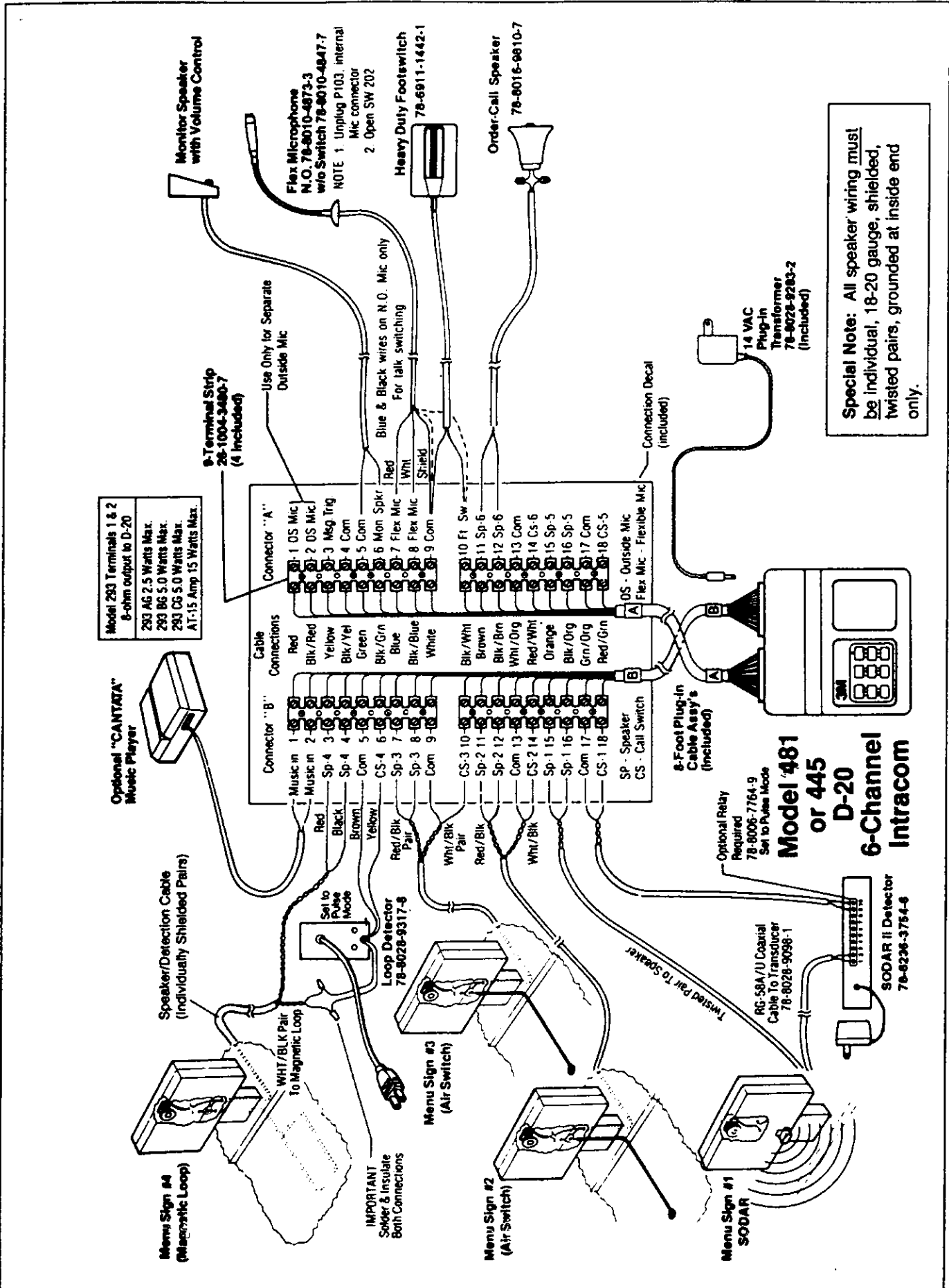


Figure 7. D-20 Connections - Multiple-Lane Drive thru

# Installation Instructions

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## Model 445AA D-20V 6-Channel VOX Intracom System 78-9236-2879-2

### A. INTRODUCTION

These instructions supplement the enclosed standard D-20 Installation Instructions to explain the added requirements of the VOX (Voice Operated Switching) versions of the D-20 Intracom. VOX units require a special gooseneck microphone attached to the rear of the upper cabinet. Read these instructions completely before proceeding to install and use the D-20V.

### B. INSTALLATION

Follow the standard D-20 instructions to mount and connect the D-20V. The externally mounted microphone replaces the internal one (present on other models) and proper VOX operation requires that you use only this microphone.

### C. VOX SENSITIVITY ADJUSTMENT

A VOX sensitivity control located (and marked) on the bottom of the D-20V requires adjustment using the special (plastic) screwdriver tool included with the D-20V. Adjustment of this control determines the voice level required to activate the talk switching. If the control is set too high, background sounds will trigger the switching. If set too low, voice switching can fail to activate or may drop out prematurely. It is best to set this adjustment while the person who will operate the D-20V talks in a normal voice at a specified distance from the microphone, preferably about two inches. Make this adjustment after setting the LISTEN (operator), TALK and ALERT volumes in accordance with the D-20 instructions.

### D. SERVICE INFORMATION

Most new installation problems result from overlooked instructions or from wiring errors, so recheck everything if a problem occurs. Dealer personnel should refer to the related 3M service manual for schematics and parts information on this product.

Customers should contact their local authorized 3M Sound Products dealer for service of this product. To replace the special VOX microphone, order 3M part number 78-8050-8495-7 from your local dealer. For the name of your local dealer, or to obtain installation or repair assistance, contact 3M for technical assistance at 800/328-0033.