

Sadelco[®] Signal Level Meters

DisplayMax[®] Jr.
Operator's Manual

Models: 3000, 2500, 2000, 1500 & 1000

Introduction

The DisplayMax Jr. packs all the features you need into one instrument. A large LCD readout, automated test functions, and intuitive keypad make using the DisplayMax Jr. fast and easy, even for beginners. A rugged mechanical design combined with automatic self-calibration will insure years of accurate readings under the most severe field conditions.

In modern two-way systems, cable defects at the drop and in the home can allow ingress into the system. Ingress can wreak havoc on digital signals and can shut down the return path for the entire node. Installers are now being required to not only check levels, but also check for ingress and leakage (the same cable defect that allows ingress into the system also allows signals to leak out of the system). The automated features built into the Displaymax Jr. will make these complicated tests routine.

- **Favorite Channel:** Up to 30 channels or frequencies can be programmed as favorite channels. Once channels are programmed, the installer simply scrolls through the desired channels by pressing one key.
- **Level Check:** By pressing one key, the installer can quickly check all favorite channels against internal pass / fail limits. If all channels are within tolerance, the meter will display “Pass”. If any channel is out of tolerance, the meter will display “Fail” along with the failed channel number and actual level.
- **Ingress Check:** By pressing one key, the installer can check for ingress on the return path. The meter quickly scans the return path looking for ingress and displays a pass / fail message along with the highest reading. If ingress is present, the installer can make ingress readings at different locations to determine which cable is defective.
- **Leakage Check:** By attaching an antenna and pressing one key, the installer can check for leakage. If leakage is present, the installer uses the antenna to locate the defective cable or component and make a repair.
- **Auto-Digital:** Channels can be programmed as digital with a quick press of the digital key. If the digital key is held for 2 seconds, the meter takes several measurements and determines automatically if the channel is analog or digital. Channel status is stored in memory.

To determine the features of your meter, see Specifications on page 6.

Thank you for purchasing a Sadelco meter.

Table of Contents

INTRODUCTION	0
FRONT PANEL CONTROLS	4
SPECIFICATIONS.....	6
GETTING STARTED	7
Battery & Charging.....	7
Battery	7
Charger	7
Charge Time.....	7
Run Time	7
Battery Test.....	7
Automatic Shutoff	7
Power On / Off.....	8
Channel Plan.....	8
CHANNEL MEASUREMENTS	9
Level Units	9
Analog Channels.....	9
Analog Basics.....	9
Tuning Analog Channels.....	9
Target Analog Levels.....	10
Digital Channels.....	10
Digital Basics	10
Manual Digital Programming.....	10
Automatic Digital Programming.....	10
Tuning Digital Channels	11
Measuring Non-Standard Digital.....	11
Forward Vs Return	11
Target Digital Levels	12
Measuring Off-Air HDTV (VHF / UHF).....	12
Favorite Channels	12
Favorite Channel Basics.....	12
Programming Channels.....	12
Programming Frequencies.....	13
Tuning to a Favorite Channel.....	13
Tuning by Frequency.....	13

DROP QUALIFICATION..... 14

- Level Check..... 15
 - Level Check Basics 15
 - Level Check Operation 15
 - Level Check Setup..... 15
 - Level Check Troubleshooting..... 16
- Ingress Check..... 16
 - Ingress Basics..... 16
 - Ingress Operation..... 17
 - Ingress Setup..... 17
 - Ingress Troubleshooting..... 17
- Leakage Check..... 18
 - Leakage Basics 18
 - Leakage Operation..... 20
 - Leakage Setup 20
 - Leakage Measurement Techniques 21
 - Leakage Troubleshooting..... 22

USER SETUP 22

- General 22
- User Setup Table 23
- Description of Setup Items 24

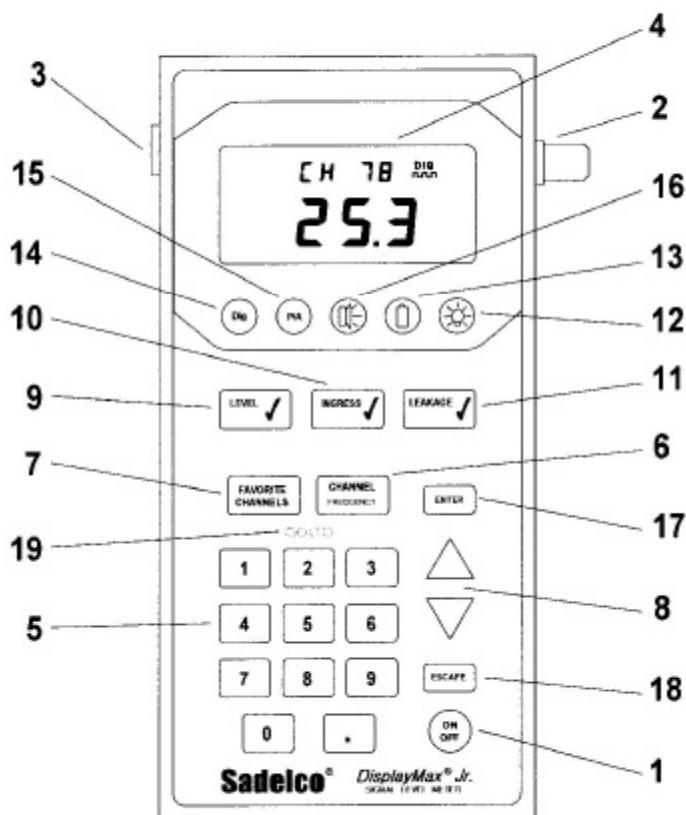
AUTO-CALIBRATION 26

WARRANTY / SERVICE 27

TROUBLESHOOTING GUIDE 28

CONTACTING SADELCO 28

Front Panel Controls



- 1. ON/OFF – Power**
- 2. Input F-Connector**
Connect to coax or antenna.
User replaceable when worn.
- 3. Charge Jack**
Use Sadelco T70 only.
- 4. LCD Display**
Channel number displayed on top, level (dBmV) on bottom.
- 5. Main Keypad**
Used for entering channel or frequency.
- 6. Channel / Frequency Key**
Used to enter channel or frequency. When entering frequency, use decimal point. Can also be used to toggle between channel and frequency.
- 7. Favorite Channel Key**
Used to program or tune favorite channels.
- 8. Up / Down Arrows**
Scroll to next channel in plan or next favorite channel.
- 9. Level Check**
Automatically check all favorite channels against pass / fail limits.
- 10. Ingress Check**
Automatic ingress check with pass / fail message.
- 11. Leakage Check**
Activates leakage detector.
- 12. Light**
Turn lights on and off.
- 13. Battery**
Displays battery voltage and accumulated on-timer.
- 14. Digital**
Toggles channel between analog and digital.
- 15. Picture / Audio**
Toggles between picture and audio carriers on analog channels.
- 16. Speaker**
Adjust volume level of speaker.
- 17. Enter**
Used for channel & data entry.
- 18. Escape**
Terminates any keypad entry.
- 19. Speaker Holes**

Specifications

The Displaymax Jr. has five model types: 3000, 2500, 2000, 1500 and 1000. The model number is printed on a label located on the meter's housing, is displayed momentarily during power up, and can also be viewed on the LCD by pressing .85 + Enter, while the meter is on, *Hold Enter for 2 seconds*

If your model does not include the features required by your application, contact Sadelco at 201-569-3323 for information on upgrades.

	3000	2500	2000	1500	1000
Leakage Check	●				
Ingress Check	●	●			
Level Check	●	●	●	●	●
Battery Fast Charge	●	●	●	●	●
Audio	●	●	●	●	●
Auto-Calibration	●	●	●		
Enhanced Digital	●	●	●	●	●
Frequency Range	5 – 872 MHz			47-872	47-600
Power Range	-30 to +60dBmV			-20 to +30dBmV	
Battery Life	4 hours continuous				
Fast Charge	2 hrs for 80%, 4hrs for 100% charge				

For complete specifications, contact Sadelco at 201-569-3323

Getting Started

Battery & Charging

Battery

The DisplayMax Jr. is powered by 4 A-Size Nickel Metal-Hydride cells. The Sadelco part number is BAT08.

Charger

AC Charger: T70 for 110V
T70E for 220V

Car Charger: CH04

Charge Time

The DisplayMax Jr. has a fast charge circuit that provides 90% charge in 2 hours, and 100% charge in 4 hours. Use either the AC “wall” charger, or the optional car charger. Fast charge will automatically discontinue when the battery reaches full charge.

Run Time

The DisplayMax will operate 4 hours continuously on a full charge and with the backlights turned off.

Battery Test

To test the battery, press the battery key. The LCD will display the battery voltage and an accumulated on-timer. The nominal battery voltage is 4.8V and the normal operating range is 4.0 to 5.5 volts. Since the battery voltage does not drop linearly with use, it is not a good indicator as to the remaining life of the battery. The accumulated on-timer tracks the total amount of time the meter has been operated since the timer was last reset. To reset the timer, press the decimal point, then the battery key. Use the timer in conjunction with the battery voltage to determine when the battery needs to be recharged. Remember to reset the timer each time the battery is charged.

The meter will beep and display a warning when the battery voltage is getting low. The meter will turn off automatically when the battery reaches 4.0V. The DisplayMax Jr. WILL NOT give incorrect readings due to low battery.

Automatic Shutoff

To conserve battery power, the meter is programmed to turn off after 5 minutes of non-use (no keypad entry). The timer can be set to 10 minutes by pressing .10 ENT (decimal, 1, 0, ENT) or disabled by pressing .00 ENT (decimal, 0, 0, ENT). To set back to 5 minutes, press .05 ENT (decimal, 0, 5, ENT)

Power On / Off

To power the meter on, **press and hold** the ON/OFF key until the model number is displayed on the LCD. If the meter does not power on, the battery may require charging. The Displaymax Jr. will automatically power itself down if the battery voltage is too low, or after 5 minutes of no keypad entry (see automatic shutoff).

Channel Plan

The DisplayMax Jr. comes programmed with all major plans. The most common plan, EIA (NCTA) is the default plan. To check which plan is currently selected, press .50 ENT (decimal + 5 + 0 + ENT, *Hold Enter key for 2 seconds*) To change plans, press the up or down arrow to scroll to a new plan, then press ENT. The standard plans are as follows:

- | | |
|-------------------------|-----------------------------|
| 1. EIA (Standard Cable) | 5. HRC (Non-Standard Cable) |
| 2. EIA (Standard Cable) | 6. IRC (Non-Standard Cable) |
| 3. EIA (Standard Cable) | 7. AIR (Off-Air Broadcast) |
| 4. EIA (Standard Cable) | 8. PAL BG (Europe) |

Plans can be edited in the following ways: 1. Mark digital channels. 2. Assign favorite channels.

Three copies of the most common plan (EIA) allow users to program different favorites and / or digital channels for different systems.

Make sure the correct plan is selected for your application. Contact Sadelco for custom channel plan requirements.

Channel Measurements

Level Units

Television signals are measured in decibels relative to 1 millivolt, commonly expressed as dBmV. The decibel expresses the ratio between two voltages. A positive dBmV indicates the signal is greater than 1mV, a negative dBmV indicates the signal is lower than 1mV, and a 0 dBmV signal = 1mV.

Displaymax Jr has been preset to measure in dBmV units. However, the measurement units can be changed to the European standard of decibels relative to 1 microvolt, or dBuV. To change the units, press .99 ENT (decimal + 9 + 9 + ENT, *Hold ENT for 2 seconds*). The display will momentarily flash “dB EUR”. To change back to dBmV, press .99 ENT again; the display will momentarily flash “dB USA”. Note: If your meter is set to dBuV, it will read 60 dB higher than if set to dBmV.

Analog Channels

Analog Basics

Analog channels have two separate carriers, Picture and Audio. The Displaymax Jr. can only measure one carrier at a time. Since the picture carrier is of primary interest, the meter automatically tunes to the picture carrier whenever a channel entry is made. To toggle the measurement between picture and audio carrier, press the “P/A” key. When measuring the picture carrier, the letter “P” will appear after the channel number. When measuring the audio carrier, the letter “A” will appear after the channel number. If the volume is adjusted while tuned to the audio carrier, you can monitor the audio on the speaker.

Tuning Analog Channels

- Direct Tuning: Enter desired channel number, then press the “Channel / Frequency” key or the “Enter” key.
- Sequential Tuning: Press the up / down arrows to tune to the next channel in the plan; In this mode, the channels are tuned in frequency order. Since the channel numbers are not always in frequency order, the channel numbers may jump (e.g. CH 4, 5, 6, 95, 96, 97).
- Favorite Channels: Up to 30 channels can be programmed as “Favorite Channels”. To tune to a favorite channel, enter the favorite slot, then press the “Favorite Channel” key. Once in the favorite channel mode, the up / down arrows tune to the next favorite channel. For more information, see the “Favorite Channel” section in this manual.

Target Analog Levels

- **Picture Carrier:** According to the FCC, the minimum picture carrier level going to the TV is 0 dBmV, and the maximum level is one that will not cause distortion in the TV tuner. Industry standards are 0 to 15 dBmV, with 10 dBmV as a good target. As you move upstream from the TV, signal level must increase to compensate for signal losses in the cable, splitters, taps, etc.
- **Audio Carrier:** According to the FCC, the audio carrier should be 10 dB to 17 dB lower than the picture carrier. The only way to adjust this parameter is in the headend; this is why the audio carrier is typically not measured in the field.

Digital Channels

Digital Basics

Digital channels have their power spread across the full bandwidth of the channel they occupy. “Standard” digital channels (video and forward modem) occupy a 6MHz bandwidth (same as analog channels) and therefore fit neatly into the existing channel plan. Tuning to a standard digital channel is the same as tuning to an analog channel. **Before making a measurement, the tuned channel must be programmed as digital.** Non-standard digital channels (telephony and data) typically occupy a narrower bandwidth and do not correspond to the existing channel plan. To accurately measure these types of channels, see “Measuring Non-Standard Digital” later in this section.

Manual Digital Programming

Quickly pressing and releasing the “Dig” key will toggle the selected channel’s status between analog and digital. When in the digital mode, “Dig” will appear to the right of the channel number, and the “P” or “A” associated with analog channels will not appear.

To prevent accidental programming, see “Lockout” in the User Setup section.

Automatic Digital Programming

If you are not sure whether the channel you are measuring is analog or digital, press and hold the “Dig” key for two seconds. You can release the key once the word “Auto” appears on the display. The Displaymax Jr. will automatically determine if the channel is analog or digital and program its status accordingly. When programming is complete, the “auto programming” mode is exited.

Note: You must be connected to an active cable system in order to utilize the automatic programming feature.

Caution: If you release the “Dig” key before the word “Auto” appears, the status of the channel will simply toggle from analog to digital, or from digital to analog.

Tuning Digital Channels

Tuning to a digital channel is the same as tuning to an analog channel. Enter the channel number on the keypad followed by “Channel / Frequency” or “Enter”. When tuning to a new channel, the Displaymax Jr will check its memory to determine whether the channel has been programmed as analog or digital.

Since several programs may be combined into a single digital channel, the set-top box may display a channel number that is not part of the Displaymax Jr’s channel plan (e.g. HBO – Channel 905). In this case, you need to determine the channel number of the modulator.

Digital channels are sometimes referred to by their center frequency. For example, the center of channel 125 (EIA Plan) is 801 MHz. Simply tuning to the center frequency of the digital channel will lead to large measurement errors. To accurately measure a digital channel, you must tune by channel number, then program the channel as digital.

Measuring Non-Standard Digital

Non-standard digital channels do not conform to the standard channel plans, therefore, the channel must be tuned by frequency. In addition, a custom correction factor may be required based on the channels bandwidth and modulation format. To simplify the measurement, the Favorite Channels can be programmed with a specific frequency and correction factor that match the digital channel. Once programmed, simply tune to the Favorite Channel and read the level displayed on the LCD. See “Programming and Recalling Favorite Channels”.

An example of a non-standard digital channel is a 1.8 MHz. telephony carrier using QPSK modulation. To program this as a Favorite Channel, you would first tune to the center of the channel (tuning by frequency), program as a Favorite, then add an offset of +2.2 dB.

To determine the proper offset of a given digital channel, you can first make a measurement with an instrument that is properly calibrated for the digital channel in question, then add an offset to make the Displaymax Jr. match. If you are unable to determine the proper digital offset, contact Sadelco for assistance.

Forward Vs Return

Forward digital channels (signals that transmit from the headend to the field) are easy to measure since they transmit continuously and do not change frequency, level or modulation format. Return signals (signals that transmit from the field to the headend – typically from a modem) are sometimes difficult to measure since they do not always transmit continuously (bursty), and can change frequency, modulation format and level based on instructions from the headend computers.

Target Digital Levels

On cable systems, standard digital channels are typically set 6 to 10 dB lower than what an analog channel would have been. For non-standard digital channels, ask your supervisor for guidelines.

Measuring Off-Air HDTV (VHF / UHF)

To measure an off-air HDTV signal, you must first change the channel plan to “Air” (See “Channel Plans”). Next, select the desired channel and program as digital (See “Manual Programming” and “Automatic Programming” of Digital Channels).

When working with off-air HDTV signals, channel flatness is equally important as signal level. When reflected signals are received by the antenna slightly out of phase with the “line of sight” signal (a condition know as “Multi-Path”), the channel may have large response variations and the digital receiver may be unable to “lock-on”. By storing several frequencies across the channel’s bandwidth (avoid band edges and carrier frequency), the flatness of the channel can be determined. (See “Favorite Channel Programming” – use offset of 6.8 dB). Adjust the antenna for the best combination of level and flatness.

Favorite Channels

Favorite Channel Basics

The Displaymax Jr. can be programmed with a maximum of 30 Favorite Channels (per channel plan). The user can program the meter to measure specific analog channels, standard digital channels, non-standard digital channels, test pilots and other signals. Once programmed, the stored channels can be easily scrolled through by entering the Favorite Channel mode, then pressing the up / down arrows.

Standard analog and digital channels (6 MHz channels that are included in the channel plan) are stored as channels. Non-standard digital channels (channels that are not included in the channel plan) and other non-standard signals are stored as frequencies. When storing a frequency, a level offset can be applied to account for bandwidth and other correction factors associated with digital channels.

To exit the Favorite Channel mode, enter a channel using the Channel / Frequency key, or press ESC. Cycling power WILL NOT exit Favorite Channel mode.

Programming Channels

To program a channel as a Favorite Channel, first tune to the desired channel. Next, press the Favorite Channel key, then select a Favorite Channel number, (1 to 30), and press Enter.

Note: The only way to store a channel's audio carrier as a Favorite Channel is by programming the audio carrier frequency. When programming a channel as a Favorite Channel, the picture carrier is automatically stored.

Note: Digital / analog status is not stored as part of the Favorite Channel. The channel's status can be programmed in or out of Favorite Channel mode by pressing the "Dig" key.

Programming Frequencies

Frequencies can be stored as Favorite Channels in order to measure non-standard digital channels, test pilots and other signals. When programming a frequency, the meter will allow a level offset (used for digital channel measurement) and pass / fail parameters that will be used during Level Check mode.

To program a frequency as a Favorite Channel, first tune to the desired frequency (see "Tuning by Frequency" later in this section). Next, select a Favorite Channel number (1 to 30), then press Enter. An offset of 0.0 dB will now appear on the LCD display. Use the up / down arrows to select an offset value, then press Enter. Next, a default value of 15 dBmV will appear as the Pass / Fail High value. Use the up / down arrows to select a new High Pass value, then press Enter. Next, a default value of 0 dBmV will appear as the Pass / Fail Low value. Use the up / down arrows to select a new Low Pass value, then press Enter.

Tuning to a Favorite Channel

To tune a Favorite Channel, first enter the Favorite Channel number (1 to 30), then press the Favorite Channel key. The LCD will display the stored channel or frequency and its level. Once in the Favorite Channel mode, the up / down arrows will tune to the next / previous Favorite Channel.

Tuning by Frequency

To tune a specific frequency, enter the frequency on the keypad using a decimal point, then press the Channel / Frequency key. Once in the frequency mode, the up / down arrows will tune to the next / previous frequency in 125 KHz. increments.

It is important to use the decimal point when entering a frequency. If the decimal point is not entered, the entry will be assumed to be a channel. It is also not required to add trailing zeros after the decimal point.

Keypad Entry	Action
100.000 + CH/FRQ	Tune to 100.000 MHz.
100. + CH/FRQ	Tune to 100.000 MHz.
100 + CH/FRQ	Tune to Channel 100

Drop Qualification

To understand “Drop Qualification” you need to understand exactly what the coax cable does. First, the center conductor transports the desired signals from one point in the system to another with minimal loss. For example, the coax transports the signals from the tap to the ground block. Second, the shielding prevents signals on the cable from radiating or “escaping” from the cable into the air (Leakage), and also prevents signals that are in the air from getting into the cable (Ingress). A defect in the shielding will normally produce both Ingress and Leakage.

If there is a problem with the coax (or other component) that introduces excessive loss, analog pictures will get snowy, digital pictures will tile or drop out all together and modems will disconnect. Checking for proper levels is the first step in Drop Qualification. If levels are unacceptable, you must troubleshoot to determine which cable or component is defective and fix it.

Problems with shielding introduce Ingress and Leakage. Shielding problems are caused by torn or punctured shielding and also by loose connections. Since the shielding requires a good ground connection, and ground connection is reduced when a cable connection is loose, a loose connector can turn a drop cable into a transmit / receive antenna. Bad shielding also causes an impedance mismatch that can affect levels.

Ingress signals that are in the return path bandwidth (5 to 40 MHz) can interfere with digital upstream signals, making them unreadable by computers in the headend. If the ingress signals are large enough, they may saturate the return laser, disrupting service for the entire node. Because of this susceptibility, testing for ingress has become a standard practice for two-way systems.

Leakage signals that escape from defective drop / home wiring cause interference with aircraft communications. Many small leaks throughout a system add up to create a large leakage signal above the cable system where aircraft may pass through. The FCC requires that cable operators routinely monitor their leakage levels and provide data that insures that total leakage values are acceptable. By checking for leakage at each home, you are helping to keep the total leakage value for the system to a minimum. In addition, by fixing the source of leakage, you are also fixing a source for ingress.

Although a defect in a cable’s shielding causes both ingress and leakage, it is important to run both tests. Based on the type of shielding defect, the forward levels, the nature of the ingress signal (if present at all), you may find the problem only by performing an Ingress Check or only by performing a Leakage Check. For example, if you only perform an Ingress Check and it passes, it is possible that there is still a defect in the shielding but there were no interfering signals at the exact moment you performed the Ingress Scan. If you only

perform a Leakage Check, it is possible that the radiation pattern of the leak produced a dead zone where the leakage measurement was made. The bottom line is that neither Ingress Check nor Leakage Check is 100% error free. By performing both tests, you improve your odds on finding a problem.

Once a problem in the shielding is discovered, use standard troubleshooting techniques to isolate the problem to the exact cable or component, then fix it.

If all three tests pass, then the drop and home wiring is qualified for digital services.

Level Check

Level Check Basics

It is important to verify that drop levels are within normal range. The Level Check mode allows a quick pass / fail test of all Favorite Channels. The acceptable range for analog channels is from 0 dBmV to 15 dBmV at the input of the television, with standard digital channels being from 6 to 10 dB lower than analog channels.

Check with your supervisor to determine appropriate pass / fail parameters for your system.

Level Check Operation

The Level Check mode compares all Favorite Channels against stored pass / fail parameters. If all Favorite channels are within pass / fail parameters, the LCD will display a Pass message. If an individual channel is not within pass / fail parameters, the LCD will display a Fail message along with the failed channel and level.

If a channel fails, press the Up Arrow key to continue testing. When all Favorite Channels have been tested, the LCD will display Scan End. To enter a new mode, first press the Escape key.

During Level Check, all other modes are locked out. To enter a new mode, first press the Escape key.

If all channels pass, the LCD will display a Pass message until the Escape key is pressed.

Level Check Setup

Analog and digital pass / fail parameters can be viewed and edited by pressing $.70 + ENT$, *Hold ENT for 2 seconds*. First, the LCD will display the Analog Channel High Pass Limit. Use the Up / Down arrow to change the value, press Enter to accept the displayed value and advance to the next parameter. Continue for Analog Low, Digital High and Digital Low.

Single frequency pass / fail parameters are entered while storing the Favorite Channel. Unlike analog and digital channels, each Favorite frequency can have its own pass / fail parameter.

Level Check Troubleshooting

Low levels can be the result of an incorrect tap value, over splitting of the signal, or a problem with the cable or any component. If the levels behind the TV are too low, then take measurements at the ground block. If the levels at the ground block are acceptable, then the problem is somewhere in the house. If the levels at the ground block are also too low, then measure at the tap. By measuring at different points, the problem can be localized to an individual cable or component. The basic approach is simple, each time you take a measurement further “upstream”, the levels should increase by the amount of loss expected in the cable or component that is being bypassed. For example, if a two-way splitter is measuring 3 dBmV at its output, you would expect the input to measure about 6.5 dBmV since most two-way splitters drop about 3.5 dB.

Note: Defects that affect level may also allow ingress and leakage to occur. You should take level problems seriously and try to find the cause and fix the problem.

If levels are too high, you can simply add an inline attenuator to bring the levels down.

Ingress Check

Ingress Basics

The cable’s shielding is designed to prevent signals that are “in the air” from getting to the center conductor of the cable. If there is a defect in the shielding, unwanted signals will be picked up by the center conductor, a condition referred to as Ingress. Ingress signals that are picked up in the home wiring, or at the drop, will continue upstream to the local node and then on to the headend computers. If the ingress signal is large enough, it can disrupt data flow from the individual home, and possibly for the entire node.

Since ingress signals travel upstream, the best way to check for them is to disconnect at the ground block and measure what is coming out of the house. To test the drop cable, disconnect at the tap and measure what is coming back from the drop. It is important to fully tighten the cable to the meter before pressing the Ingress Check key.

The Ingress Check performs a fast scan across a user defined bandwidth (default values are 5 to 40 MHz). At the end of the scan, the LCD will display a pass /

fail message depending on the results and will also display the highest reading and the frequency at which it occurred.

Ingress signals can come from many sources. As such, ingress signals are very unpredictable. They can occur for a period of time, then go away. They can be at a single frequency or across the full return bandwidth at the same time. They can also vary in level. If you made 10 ingress reading on a defective drop cable, you may get a different reading each time. Take any failed reading seriously; a border line reading may give a much worse reading at a later time.

Ingress Operation

The Ingress Check mode compares readings at each frequency between user defined start / stop frequencies (default 5 to 40 MHz) against a user defined pass / fail parameter (default -35 dBmV). If all frequencies pass, the LCD will display a Pass message in addition to the highest reading and the frequency at which it occurred. If one or more frequencies are above the pass / fail parameter, the LCD will display a Fail message in addition to the highest reading and the frequency at which it occurred.

During Ingress Check, all other modes are locked out. To enter a new mode, first press the Escape key.

Ingress Setup

To enter a new start frequency, first tune to the desired frequency (See Tuning by Frequency), then enter the following keys: `.72 + Enter` (decimal, 7, 2, Enter), *Hold the enter key for 2 seconds*. After holding the Enter key for 2 seconds, the LCD will display the original start frequency value. Press Enter again (quick press) to continue. If you do not want to change to a new start frequency, press Escape. If you press Enter, the LCD will flash the new start frequency value. Press Enter one more time to program the new start frequency.

To enter a new stop frequency, follow the same procedure as entering a start frequency, except use input code `.73 + Enter`.

To enter a new pass / fail value, enter the following keys: `.74 + Enter` (decimal, 7, 4, Enter). **HOLD THE ENTER KEY FOR 2 SECONDS**. After holding the enter key for 2 seconds, the current pass / fail value will display. If you do not want to enter a new value, press Escape. To change the current value, use the up / down arrows to select a new value, then press Enter (quick press).

Ingress Troubleshooting

To measure ingress, you must disconnect the cable you are testing from the active plant. If you are testing for ingress in the home wiring, the best place to measure is at the ground block. To avoid false ingress readings, turn off modems and set top boxes inside of the home, or avoid scanning the bandwidth used by those devices. Disconnect the drop from the ground block, then measure what is

coming out of the house. If Ingress Check fails at the ground block, then find the first splitter, disconnect its outputs and run the test on each leg separately. Use this technique to isolate the problem to an individual cable or component.

The level of ingress depends on the nature of the defect and also the nature of the interfering signal. Some types of ingress may be fairly stable while others may be quite intermittent. If you measure ingress at point A, then measure no ingress at point B, go back to point A and see if the ingress is still present.

MAKE SURE ALL CONNECTIONS ARE TIGHT! A loose connection will cause the cable to act as an antenna, creating both ingress and leakage. If you measure ingress at point A, then measure no ingress at point B, then measure no ingress back at point A, you may have unknowingly fixed the problem by tightening a loose connection, or you may be dealing with an intermittent ingress source.

The Leakage Check can also be used to determine the location of a shielding problem (See Leakage Check). Use the duck antenna to find where leakage signals are radiating from. Most likely this is where ingress is getting into the system. Leakage Check is very helpful, especially when dealing with intermittent types of ingress that are not always present.

Leakage Check

Leakage Basics

The cable's shielding is designed to prevent signals that are carried on the center conductor of the coax from radiating into the air. Signals that escape from the cable are known as leakage signals. The FCC requires that cable operators regularly monitor their systems for leakage. This is because channels in the 110 to 140 MHz range will interfere with aircraft communications. As such, cable operators normally have special crews that deal specifically with leakage issues. A secondary problem associated with leakage is ingress. The same defect that causes leakage will also allow unwanted off-air signals to enter the coax, a condition referred to as ingress (See Ingress Check). Since ingress causes major problems in modern two-way cable systems, finding and fixing leaks is a good way to reduce ingress in the system.

Leakage signals are measured using an antenna that is connected directly to the meter or through a short length of coax cable (several feet). It is recommended to use a short length of coax so the antenna can be moved about while the tech views the meter's LCD display. Leakage signals are strongest at the location of the cable fault. As you move away from the leakage source, the signal level will drop as a function of distance. From a distance of 10 feet from the leak, the signal level is reduced one half each time the distance is doubled. For example, if you were measuring 50 uV/m at 10 feet, you would measure 25 uV/m at

20 feet, and 12.5 uV/m at 40 feet. Consequently, leakage readings are only meaningful if made at a specific distance. The FCC requires leakage readings be made 10 feet from the source of the leak.

In the leakage menu, the distance can be set to 3, 10 or 20 feet. Measurements are always normalized to 10 feet. Therefore, the meter will always display what the leakage value is at a distance of 10 feet from the leak, even though the measurement was made at a different distance. For accurate leakage measurements, it is necessary for the antenna to be 3, 10 or 20 feet from the leakage source, as per the menu setting. The default distance is 3 feet. To change the distance in the menu, see the section on Leakage Setup. If you are only interested finding and fixing leaks and measurement accuracy is not important, then you do not have to worry about the distance setting.

Leakage signals are measured in units called “microvolts per meter”, abbreviated “uV/m”. This represents the voltage, in microvolts, that would be developed across a single length of wire, 1 meter in length, held parallel to the leakage source. In the real world, leakage measurements are made with antennas, not lengths of wire. The Displaymax Jr. comes with a rubber duck type antenna. This is a general-purpose antenna. Optional antennas include a dipole and magnetic mount monopole. The dipole antenna has more gain and is more directional than the rubber duck, which means you can measure lower level leaks and better pinpoint their location. The FCC requires the dipole be used for all leakage reading that are used in the official CLI report (CLI stands for Cumulative Leakage Index and represents the total leakage value for the system.) The magnetic mount monopole antenna is placed on the roof of a vehicle so that the system can be monitored while driving. The monopole antenna can receive signal from all directions which makes it ideal for searching for the presence of a leakage signal while driving, but it is not ideal for precisely locating the source of the leak. If you use either the dipole or monopole, you must select the correct antenna type in the leakage setup menu.

When checking for leakage, the antenna may pickup non-cable signals such as electrical noise and radio transmissions. To prevent false leakage readings, the Displaymax Jr. automatically rejects all non-video signals. This feature can be disabled in the leakage setup menu in order to measure unmodulated test carriers or other CW type signals.

The Displaymax Jr. represents the amplitude of the leakage signal in two ways. First, the level is displayed in uV/m units in numeric form on the LCD display. Second, a tone is generated that increases in pitch as the signal level increases. The volume level can be adjusted by pressing the speaker key under the LCD.

Some systems use a “tagging” method on a channel used for leakage monitoring. Tagging is a special modulation that allows the technician to verify the leakage signal being received is from his cable plant. This is useful in

overbuild situations where two systems can potentially generate a leak. It is also useful in discerning between cable leaks and non-cable signals. Tagging systems can employ either AM or FM modulation although AM systems tend to be more prevalent. Sadelco does not supply a tagging system, however the Displaymax Jr. will detect the AM tagging signal in its audio - the normally flat tone will have a fast warble in it.

The Displaymax Jr. has a tuning range of 110 MHz to 140 MHz in the leakage mode. The default frequency is 133.250 MHz (channel 16). To tune a different frequency, you must enter a new frequency into the leakage setup menu. The Displaymax Jr. uses a wide IF bandwidth for leakage measurement, as such the meter tunes in 125 KHz steps and can accurately measure channels with standard aeronautical frequency offsets. Simply enter the desired frequency and the meter will automatically select the closest 125 KHz tuning increment. There are NO errors due to these frequency offsets.

Leakage Operation

When the Leakage Check key is pressed, the meter activates the leakage circuitry and tunes to the frequency that has been preset into the leakage setup menu. If the video gating is enabled (factory default setting), then only video signals that are present on the antenna will be detected and measured. The LCD display will activate a Leakage Check icon, display the tuned frequency and the uV/m value if a leak is detected. In addition to the numeric value, a tone will be generated on the speaker. The pitch of the tone will increase as the leakage level increases.

During Leakage Check, all other modes are locked out. To enter a new mode, first press the Escape key.

Leakage Setup

To enter a new leakage frequency, first tune to the desired frequency (See Tuning by Frequency), then enter the following keys: *.75 + Enter (decimal, 7, 5, Enter), Hold the Enter key for 2 seconds*. After holding the Enter key for 2 seconds, the LCD will display the original leakage frequency. Press Enter again (quick press) to continue. If you do not want to change to a new leakage frequency, press Escape. If you pressed Enter, the LCD will flash the new leakage frequency. Press Enter again to program the new leakage frequency.

All other parameters are edited by entering a single code, then scrolling through the menu items. To access the main leakage setup menu, enter the following keys: *.76 + Enter (decimal, 7, 6, Enter), Hold the Enter key for 2 seconds*. The menu items are as follows:

- a) Distance: The current distance will initially be displayed. Press the up arrow to scroll through the choices of 3 ft, 10 ft, and 20 ft. Once you select the proper distance, press the Enter key to update the menu and proceed to

the next menu item. Pressing Escape will exit the menu without any changes being made.

- b) Antenna type: After exiting distance, the current antenna type will be displayed. Press the up arrow to scroll through the choices of Ant-1 (rubber duck – supplied with meter), Ant-2 (magnetic mount monopole), and Ant-3 (dipole). Once you select the proper antenna, press Enter to update the menu and proceed to the next menu item. Pressing Escape will exit the menu without changes to the antenna type.
- c) Gate: After exiting antenna type, the current Video Gate status will be displayed. Press the up arrow to toggle between the two choices of EnA (Enable – only video signals will be detected), and diS (Disabled – all signals will be detected). Once you select the desired setting, press the Enter key to update the menu and proceed to the next menu item. Pressing Escape will exit the menu without any changes to the gate status.
- d) Level units: After exiting gate status, the current level units will be displayed. The two choices are uV/m and dBmV. Press the up arrow to toggle between the two. When the display reads “Sho dB diS” (show dB – disabled), the level units will be uV/m which is the standard units for measuring leakage. When the display reads “Sho dB EnA” (show dB – enabled), the level units will be dBmV. Use dBmV only for special test purposes, like checking calibration against a standard signal generator. (Note: If measuring the output of a signal generator, make sure to disable the gate feature.) Once you select the level units, press the Enter key to update the menu and proceed to the next menu item. Pressing Escape will exit the menu without changes to the level units.
- e) Calibration offset: After exiting level units, the current calibration offset will be displayed. To change the calibration offset, use the up / down arrows to scroll to a new offset. The offset is made in dBs and has a max range of +/- 3 dB. Once you select the desired offset value, press the Enter key to update the menu and exit out of the leakage menu. Pressing Escape will exit from the menu without changes to the cal offset.

Note: If you only want to view the menu items, enter the code and continue pressing the Enter key.

Leakage Measurement Techniques

Prior to making leakage measurements, make sure the meter is setup properly for your system. Read the full section on leakage in this manual.

Unlike measuring signal directly from the coax, making leakage measurements require skill and practice. The first step is to try and detect a leakage signal. Do this by pressing the Leakage Check key, attaching the antenna and slowly moving the antenna about.

If a leakage signal is detected, the next step is to determine the location of the leak. The max readings will be obtained when the antenna element is held parallel to the source of the leak (DO NOT HOLD THE ANTENNA

ELEMENT). Keep in mind that the antenna has a donut shape pickup pattern. It is possible that the leak may be coming from several directions. The best way to determine if a suspected cable or component is the source is to move the antenna closer and see if the reading increases. If the reading continues to increase as you move the antenna closer, chances are the cable or component is bad. Making measurements inside of a home is especially difficult since RF signals pass through walls and reflect off of metallic surfaces.

Once the source of the leak is found and fixed, it is good practice to again measure for leakage. First, you want to make sure the fix was good and second, there might be smaller leaks coming from other sources. Smaller leaks can't be measured until the larger ones are fixed. If the home wiring is especially bad, finding all of the leaks is like peeling back the layers of an onion.

Leakage Troubleshooting

If you suspect a cable is leaking, check that the connections on either end of the cable are tight. A loose connection can remove the ground connection for the shield, making the cable act as an antenna. Also, check for staples or nails that may have protruded through the cable's jacket and shielding.

If you detect a leakage signal, but can't find the source, it is possible that the signal is coming from outside of the home. To verify, disconnect the cable at the ground block and repeat the measurement inside of the home. To reduce false leaks, make sure the gating feature is enabled in the leakage menu.

User Setup

General

Individual input codes allow the user to view or edit specific menu items. **All input codes are preceded with a decimal point and are terminated by pressing and holding the Enter key for two seconds.** All setup items have been preset by Sadelco to match the needs of the typical user. It is advisable to review all setup items and make sure they make sense for your specific system or application.

Input codes will have one of the following actions: a) View only: Certain items are not editable, such as model type or serial number. b) Set: Sets a specific value. c) Toggle: Toggles between two values each time code is entered. d) Scroll: Once code is entered, the displayed value is changed using the up / down arrows. e) Keypad: Data is entered via numeric keypad. f) Trigger: Triggers a one-time event, such as resetting factory defaults.

To prevent accidental or unauthorized editing, the menu system can be set to view-only. In the view-only mode, input codes allow the user to view the current setting, but will not allow any changes. To set the view-only mode,

enter the following keys: 201.99 + ENT, *Hold enter for two seconds*. The LCD will display “Loc” (lock) on the top row and either “Ena” (enable) or “diS” (disable) on the bottom row. This input code toggles between enable and disable each time it is entered.

User Setup Table

Code	Setup Item	Factory Default Setting
.00	Auto Shutoff disabled	
.05	Auto Shutoff set to 5 min	Default setting
.10	Auto Shutoff set to 10 min	
.50	Select Channel Plan	Plan 1 – EIA (standard)
.70	Level Check P/F Loop	
.70A	Analog High	15 dBmV
.70B	Analog Low	0 dBmV
.70C	Digital High	7dBmV
.70D	Digital Low	-8dBmV
.72	Ingress Start Frequency	5.000 MHz
.73	Ingress Stop Frequency	40.000 MHz
.74	Ingress P/F	-35dBmV
.75	Leakage Frequency	133.250 MHz
.76	Leakage Setup Loop	
.76A	Distance	3ft
.76B	Antenna	1 (rubber duck)
.76C	Gating (rejects false leaks)	Enabled
.76D	Level Units	uV/m
.76E	Leakage Calibration Offset	0dBmV
.77	Auto-Cal during Level Check	Enabled
.80	Display Software Revision	
.81	Display Serial Number	
.82	Display Calibration Date	
.83	Self-Test (software only)	
.84	Display Tuning Range	
.85	Display Model Type	
.92	Keypad Beep	Enabled
.93	Digital Calibration Offset	0dBmV
.94	Display Favorite Offsets	
.95	Reset to Factory Defaults	
.96	Tenths dB Digit On/Off	On
.97	Calibration Offset	0
.99	dB Units (dBmV or dBuV)	dBmV

Description of Setup Items

The following section provides a detailed description of what each menu item does and how the menu system works. To simplify the descriptions, common rules were omitted: a) After selecting a new value or setting, you must press the Enter key to program the value / setting into memory. b) When entering a loop, continue to press Enter to view items without making changes. c) If a value is changed and you decide to not program it into memory, press Escape. d) If you are in the middle of a loop and press Escape, prior loop entries are still saved.

<u>Code</u>	<u>Description</u>
.00	Auto Shutoff Off: Disables automatic shutoff. Meter will only turn off with use of on / off key.
.05	Auto Shutoff 5min: Sets automatic shutoff to 5 minutes. Meter will turn off after 5 minutes without a key being pressed.
.10	Auto Shutoff 10min: Sets automatic shutoff to 10 minutes. Meter will turn off after 10 minutes without a key being pressed.
.50	Select Channel Plan: View current plan or use up / down arrows to select new plan.
.70	Level Check Pass / Fail (Loop): Enters loop allowing viewing and editing of 4 parameters associated with Level Check. The 4 menu items are .70A through .70D.
.70A	Analog High Pass / Fail: View current value for the maximum analog channel level during Level Check mode. Use up / down arrow to select new value.
.70B	Analog Low Pass / Fail: View current value for the minimum analog channel level during Level Check mode. Use up / down arrow to select new value.
.70C	Digital High Pass / Fail: View current value for the maximum digital channel level during Level Check mode. Use up / down arrow to select new value.
.70D	Digital Low Pass / Fail: View current value for the minimum digital channel level during Level Check mode. Use up / down arrow to select new value.
.72	Ingress Start Frequency: To enter a new start frequency for Ingress Check mode, first tune to the desired frequency (see Tuning by Frequency). Next, enter .72 + Enter. The LCD will initially display the current frequency. Pressing Enter will display the new frequency and the LCD will start to flash. Pressing Enter again will program the new frequency into the menu.
.73	Ingress Stop Frequency: To enter a new stop frequency for Ingress Check mode, first tune to the desired frequency (see Tuning by Frequency). Next, enter .73 + Enter. The LCD will initially display the current frequency. Pressing Enter will display the new frequency and the LCD will start to flash. Pressing Enter again will program the new frequency into the menu.

<u>Code</u>	<u>Description</u>
.74	Ingress Pass / Fail Threshold: Displays the current pass / fail threshold for the Ingress Check mode. Use the up / down arrow to select a new value.
.75	Leakage Frequency: To enter a new frequency (110 – 140 MHz) for Leakage Check mode, first tune to the desired frequency (See Tuning by Frequency). Next, enter .75 + Enter. The LCD will initially display the current frequency. Pressing Enter again will display the new frequency and the LCD will start to flash. Pressing Enter again will program the new frequency into the menu.
.76	Leakage (Loop): Enters loop allowing viewing and editing of 5 leakage parameters associated with leakage. The 5 menu items are .76A through .76E.
.76A	Distance: View current leakage distance. Use up / down arrows to scroll between 3 possible distances: 3ft., 10ft. and 20ft.
.76B	Antenna Select: View current leakage antenna. Use up / down arrow to scroll between 3 possible antennas: Ant-1 Duck, Ant-2 Monopole and Ant-3 Dipole.
.76C	Gate On / Off: Display current status of leakage gating: Enabled (EnA) rejects false leaks. Disabled (diS) allows meter to respond to any type of signal. Use up / down arrow to select.
.76D	Level Units: View current status of level units. “Sho dB / EnA” enables the showing of dB units. In this setting the displayed units are dBmV. “Sho dB / diS” disables the showing of dB units. In this setting the displayed units are uV/m – the standard units for leakage measurements.
.76E	Cal Offset: View current value for leakage calibration offset. Use up / down arrow to select new value.
.77	Autocal During Level Check: Allow faster Level Check by disabling autocal during Level Check mode. Entering code toggles between Enable (EnA) and Disable (diS). Disabling autocal adds .5 dB to the specs at room temperature and 1 dB over the full temperature range (Level 2000, 2500 and 3000).
.80	Software Rev: View current software revision.
.81	Serial Number: View current serial number.
.82	Cal Date: View calibration date.
.83	Self Test: Initiates a self test of the microprocessor / logic circuits.
.84	Tuning Range: View tuning range of meter.
.85	Model Type: View model type.
.92	Disable Beep: Toggles between beep Enabled (EnA) and beep Disabled (diS). When beep is enabled, the speaker emits a beep everytime a key is pressed.
.93	Digital Cal Offset: View current setting for digital channel calibration offset. Use up / down arrow to select to value. Entered value is applied only to digital channel.

<u>Code</u>	<u>Description</u>
.94	Display Favorite Offsets: Favorite Channels programmed as frequencies have the option of level offsets. Use up / down arrows to scroll through all Favorite Channels and view offsets. Offsets can only be viewed.
.95	Reset User Defaults: Resets all menu items to factory defaults. Also sets all channels to analog and clears all Favorite Channels. When this code is entered, the LCD will display “Erase”. Press Enter again to initiate the reset, or press Escape to abort reset.
.96	Tenths dB Digit On / Off: Enables (EnA) or disables (diS) the digit to the right of the decimal point on the dB readout. Use up / down arrows to select.
.97	User Cal Offset: View current calibration offset. This value is added to all readings (except leakage – see item 19 for leak offset). Use up / down arrows to select new offset. Note: This offset is added to digital channels in addition to the digital channel offset.
.99	dB Select: Selects either dBmV (USA Standard) or dBuV (European Standard). When code is entered, the units will automatically toggle from one unit to the next and will display the new unit on the LCD. When going into dBmV, the LCD will flash “dB USA”. When going into dBuV, the LCD will flash “dB Eur”. Note: dBuV reads 60 dB higher than dBmV.

Auto-Calibration

All Displaymax Jr. models are individually calibrated using a proprietary computer-controlled calibration process. Ultra-precision signal generators are referenced over the entire frequency and power range to produce calibration data for the full measurement window of the instrument. The process is then repeated with the meter in a temperature chamber, guaranteeing accurate readings at any frequency, at any power level, and at any temperature.

Models 3000, 2500, and 2000 include a built-in calibration reference. A precision white-noise source is used to detect errors in the meter’s accuracy resulting from the short-term ‘warm-up’ of components when the instrument is first turned on, as well as the long-term affects of components aging and daily field abuse. “Auto-Calibration” is triggered at turn-on, every time a new channel is selected, and at regular intervals while the meter is in use.

Models with “Auto-Calibration” (3000, 2500, and 2000) have better accuracy, and should remain calibrated for the life of the product. Models without “Auto-Calibration” (1500 and 1000) should be returned to Sadelco annually for a calibration check.

Warranty / Service

Sadelco warrants all instruments against defects in material and workmanship for a period of twelve months after shipment. Sadelco will repair or replace any assembly or component (except batteries) found to be defective under normal use during this period. Sadelco's obligation under this warranty is limited solely to repairing any instrument which, in Sadelco's opinion, proves to be defective within the scope of the warranty when returned to the factory. Transportation to the factory is to be prepaid by the purchaser. Return transportation via UPS surface will be provided by Sadelco. Should the customer request an alternate shipping method, the customer will be solely responsible for any charges in excess of UPS surface rates.

This warranty does not apply to any products repaired or altered by any persons not authorized by Sadelco, or not in accordance with instructions furnished by Sadelco. If the instrument is defective as a result of misuse, improper repair, or abnormal conditions of operation, the warranty will become void. In doubtful cases, we will contact the purchaser for non-warranty repair authorization. Please notify us if an estimate is required.

Sadelco assumes no responsibility for its products being used in a hazardous manner either alone or in conjunction with other equipment. Sadelco assumes no liability for secondary damages and, in any event, Sadelco's liability for breach of warranty under any contract or otherwise shall not exceed the purchase price of the specific product shipped and against which a claim is made.

An RMA number is not required to return either warranty or repair units to Sadelco. However, Sadelco assumes no liability for any product in transit to Sadelco. Please make sure to include a description of the problem or symptom along with your complete company name, address, telephone, fax, email, and contact person.

For Warranty or Repair Service return to:

Sadelco, Inc., 75 West Forest Ave. Englewood, NJ 07631 USA

Tel: 800-569-6299 (USA Only) Tel: 201-569-3323 Fax: 201-569-6285

e-mail: sadelco@aol.com Website: www.sadelco.com

Troubleshooting Guide

Battery won't hold a charge:

- Make sure you are using the correct charger. Sadelco Part No. T70.
- Make sure electrical outlet is active overnight.
- Make sure meter is turned off during charging.
- Charge for a minimum of 4 hours.

Signal level is incorrect:

- Make sure correct channel plan is selected.
- Make sure channel status is correct (analog vs. digital).
- Make sure level units are correct (dBmV vs. dBuV)
- Check F-connector for dirty or open contacts.
- If measuring leakage, make sure correct antenna and distance are entered into the menu.

Contacting Sadelco

Sadelco Inc.
75 West Forest Avenue
Englewood, NJ 07631
Tel: 201-569-3323
Tel: 800-569-6299
Fax: 201-569-6285
Website: www.sadelco.com
Email: sales@sadelco.com

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