



B R O A D B A N D E Q U I P M E N T

Operating Manual

for the

P389 Digital Agile
Processor

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Important Notices

Shipping Loss or Damage

Before signing the Common Carrier's delivery receipt, count the number of cartons and inspect each for visible damage. If the number of cartons does not agree with the receipt or there is damage, make note of these discrepancies on all copies of the receipt before signing.

Immediately unpack the equipment and inspect for concealed damage. If damage is found, notify the carrier immediately. We suggest you keep the shipping carton and packaging material should the equipment ever need to be returned.

After filing your claim, notify CADCO for assistance on repair or replacement disposition.

CAUTION - Unauthorized Repair

Unauthorized repair, modification or disassembly during the warranty period may cancel the warranty. Should field repairs or modifications be desired, CADCO technicians may be able to provide helpful suggestions, saving you both time and money.

Notice of Proprietary Data and Changes

Data, drawings, designs represented and all other material contained herein are the proprietary property of CADCO Systems, Inc., and may not be reproduced or duplicated in any form without written authorization by CADCO Systems, Inc. All material is subject to change without notice or obligation.

Equipment Return

Should you desire to return the equipment for service, please call CADCO prior to shipping. Enclosing as much information as possible on the reason for return and the work desired will expedite service and help to insure your satisfaction. If possible, pack the equipment in the original carton and materials. If the original packaging material is no longer available, pack the equipment in cushioning material sufficient to provide a minimum of 1.5 inches separation between the carton and the equipment. No Return Authorization number is required. Include your return address, telephone number and method of return shipment. Ship the equipment prepaid to the address in this manual.

Reasons for using CADCO Factory Service:

- **CADCO** services exclusively **CADCO** equipment
- Designed and manufactured your **CADCO** equipment
- Knows **CADCO** equipment better than any other service provider
- Technicians are trained on all CURRENT and PAST technical product information
- Technicians use specialized testing and alignment tools designed for **CADCO** equipment
- Technicians may often help with a specialized application
- Toll-free factory sales and service hotline
- Factory service rates are very competitive and in many cases less expensive than non-factory service stations
- Guarantees factory service for two years
- Is known for fast, friendly customer service

Suggestions for Headend Racking and Maintenance

For prolonged equipment life and operating stability, *CADCO* makes the following recommendations:

- All headends should be installed in an environmentally controlled dust-free room having a nominal temperature of 80°F (26°C) and 60% humidity. The room should be protected from rodents and insect pests.
- All equipment should be mounted in standard equipment racks or cabinets
- All equipment should be rack spaced at one panel height, 1.75 inches (4.44cm). There should be nothing between the equipment preventing air circulation.
- Please make certain headend wiring and current capacity has adequate safety margins. Never cascade AC powering strips. Use separate outlets. If AC power is subject to fluctuation we recommend a constant voltage transformer be used. Beware of ground loops and be certain all wiring is bonded and properly grounded. Consult a codebook as needed.
- All equipment racks should be electrically bonded together and earth grounded
- All equipment interconnecting RF cables should be a minimum of double shielded and quad shielded is recommended. Poorly shielded cable causes cross-modulation picture degradation between equipment.
- Always use the coax connector intended for the coaxial cable used. Be certain it is installed as recommended by the manufacturer. Connectors should be RFI shielded.
- RF Input and RF Output cables should be on opposite sides of the equipment rack. Never bundle input and output RF cables together.
- Operate each up-converter at the RF output level recommended. If it is necessary to reduce the RF Output level, always operate the equipment as recommended and reduce the RF
- Equipment RF test points are only relative indicators of the actual RF output level. All RF operating level measurements should be made at the RF Output of each unit.
- When the headend is initially placed in service, create a record of all operating parameters for each channel's equipment. Referring to these records during routine maintenance provides a helpful record of operating changes.

FORWARD

INTRODUCTION

CADCO Systems thanks you for purchasing the Model P389 Digital Heterodyne Low-Noise processor. The P389D contains the latest in CATV electronics, including synthesized crystal-referenced phase-locked-loop oscillators, microprocessor control, saw-filtered if and hybrid amplifiers. In addition to these features, the P389D has Frequency Input and Output with 25 KHz frequency tuning allow for more accurate tuning then channel-by-channel tuning. This gives better flexibility and will work with all Cable standard and HRC systems.

FEATURES

- Digital Tuner for Digital and Analog Input Signals
- Totally Microprocessor Controlled with Self-Diagnostic Monitoring
- Selectable Input Frequency
 - Frequency: 7MHz through 756 MHz
- Selectable Output Frequency
 - Frequency: 7MHz through 756MHz
- Automatic Input Offset Control
 - Detects and Corrects Input Signal Offset Frequency for Heterodyne Processing *before* the IF
- SAW-filtered IF Centered on 44MHz - Designed for Adjacent Channel Operation
- Defeatable Automatic Gain Control (AGC) for Manual Gain Control (MGC)
- +60dBmV Digital Signal / +60dBmV Analog Signal Output Using Low-Distortion Hybrid Amplifiers
- Non-volatile Channel Memory
- Synthesized Oscillators
 - Crystal Referenced
 - Phase Locked
- Digital LED Readout
- Surface Mount Technology (SMT) Construction
- RF Muted During Tuning
-

AVAILABLE OPTIONS

- Dual RS232 Control for Daisy Chain Capability

General Setup and Operating Instructions CADCO P389D Digital Agile Processors

***NOTE:** Power measurements for digital signals referenced throughout this manual refer to **envelope power**, and are better measured with a power meter than with a spectrum analyzer.*

Position the CADCO P389D Agile Modulator in its installation mount or rack

Locate the antenna lead or cable drop that will provide the input signal for the P389D Agile Processor.

Ensure that the input signal provides an adequate signal. The recommended input level for best performance from the CADCO P389D Agile Modulator is from **0dBmV to +10dBmV**.

Connect the input-source cable drop or antenna lead to the F-connector on the rear panel of the P389D marked “RF INPUT”.

Connect the output of the P389D to a 75Ω load, normally a channel combiner, via an RF cable connected to the F-connector marked “RF OUTPUT” on the rear panel of the P389D

***NOTE:** A hybrid combiner - such as the CADCO 24-1000 - is strongly recommended for this purpose because of its flat response and maximum isolation between frequency.*

Connect the CADCO P389D to a proper AC electrical source. The correct electrical input type for the unit is marked on the rear panel, directly under the entrance of the power cord into the unit.

***NOTE:** CADCO power supplies are designed so that, under certain power line or heat buildup conditions, the unit shuts off. An indication is no RF output, although the POWER LED on the front panel remains illuminated. If this occurs, unplug the power cord and wait at least two (2) minutes before reapplying power. Upon reapplying power, you should again have RF output. If the unit fails to provide RF output again, or should the unit return to shutdown mode, telephone your distributor for assistance or call CADCO Systems direct at 800-877-2288. Remember: CADCO recommends a 1.75” air circulation space between each piece of rack-mounted equipment.*

Input Channel Selection

Select the desired input source type and channel using the front panel controls. Because the built-in input offset feature automatically removes any input offset, no calculations or adjustments are required.

*NOTE: The CADCO P389D Agile Processor has a **built-in delay** in the input- and output-channel or frequency tuning circuits. In order to change channels, hold the channel select switch in the up- or down-position for at least three seconds*

When the circuit is defeated, channel or frequency selection will proceed normally. Channels or frequency can be changed one at a time by raising/lowering the channel select switch one channel at a time; or channels can be scanned rapidly by raising/lowering the channel select switch and holding it while the unit rapidly moves through the channels. However, once the channel or frequency select switch is released for more than one second, the delay-tuning circuit reactivates.

***NOTE:** The FREQUENCY LOCK LED on the front panel display may also blink during input-frequency tuning. This is because, when the unit is being tuned, an RF-OUTPUT MUTING circuit is enabled to ensure that moving RF carriers do not interfere with any existing frequency on the cable system.*

NOTE: For HRC output frequency, see the section in this manual entitled HRC Output Frequency Set.

NOTE: During output-frequency tuning, the FREQUENCY LOCK LED on the front panel display may also blink during input-frequency tuning. This is because, when the unit is being tuned, an RF-OUTPUT MUTING circuit is enabled to ensure that moving RF carriers do not interfere with any existing frequency on the cable system.

Connect a Spectrum Analyzer (recommended) or a Field Strength Meter to the F-connector marked “RF OUTPUT” on the rear panel of the P389D Agile Processor. If the unit is already connected to another device, disconnect that device from the unit.

To use the P389D in AGC (Automatic Gain Control) configuration, ensure that the rear panel AGC/MGC switch is in the **AGC** position. To use the P389D in MGC (Manual Gain Control) configuration, ensure that the rear panel AGC/MGC switch is in the **MGC** position.

MGC Operation

Using the front panel control marked “OUTPUT LEVEL,” adjust the RF output of the unit. The recommended output level is between **+55dBmV and +60dBmV**.

NOTE: Setting the RF output level below the recommended level may adversely affect the parameters of the modulating signal; setting RF output level above +60dBmV will adversely affect the quality of performance of the P389D. Ensure that the RF output level is checked each time an output frequency is selected or when the frequency selected is in a different band from the previous frequency.

MGC Setup And Operation

If you are using the P389D for DOCSIS (cable modem). Return path operation uses it should be operated in Manual Gain Control (MGC) only. Manual Gain Control is needed to keep the DOCSIS (cable modem) from chasing the Automatic Gain Control (AGC).

If you are using the P389D for off-air or other antenna receive applications the MGC may cause you to experience fluctuations in the output levels due to wind on the receive antenna etc... Off-air using should be in AGC **not MGC**.

To use the P389D for Manual Gain Control determine.

Determine the signal input level from the off-air antenna or cable signal source to the P389D. Keep in mind that the output level of the P389D will be reduced approximately by the difference from 0dBmV and the level of your input signal. That is, if you have in input level of -10dBmV, the maximum output level from the P389D will be approximately **+50dBmV**.

Switch the MGC switch on the back panel of the P389D to "ON."

With a spectrum analyzer, look at the input source and notice the typical Input Signal. *See Figure 0.0 (A minimum of 40dBmV from the top of the haystack to the noise floor should be present for acceptable.)*

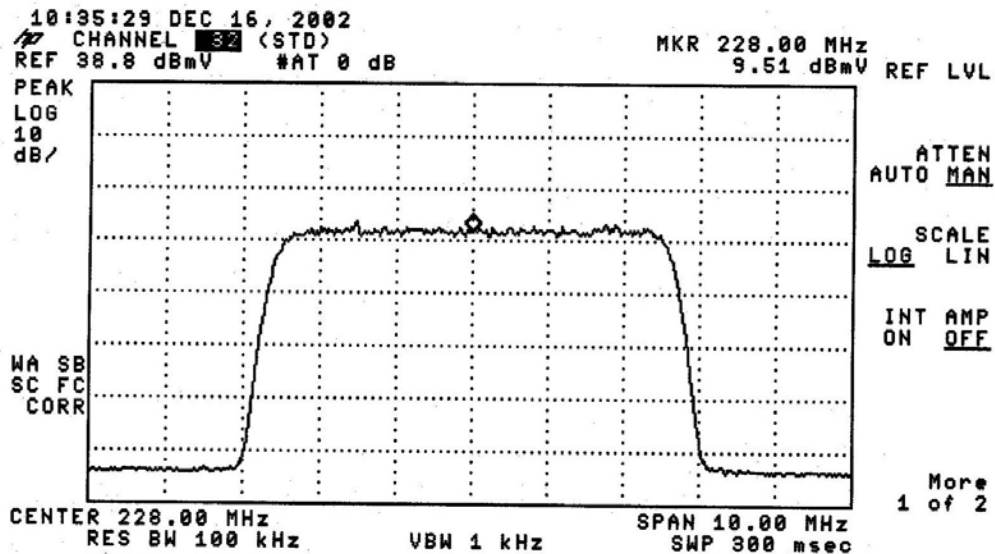


Figure 0.0

Connect the input source to the RF input of the P389D.

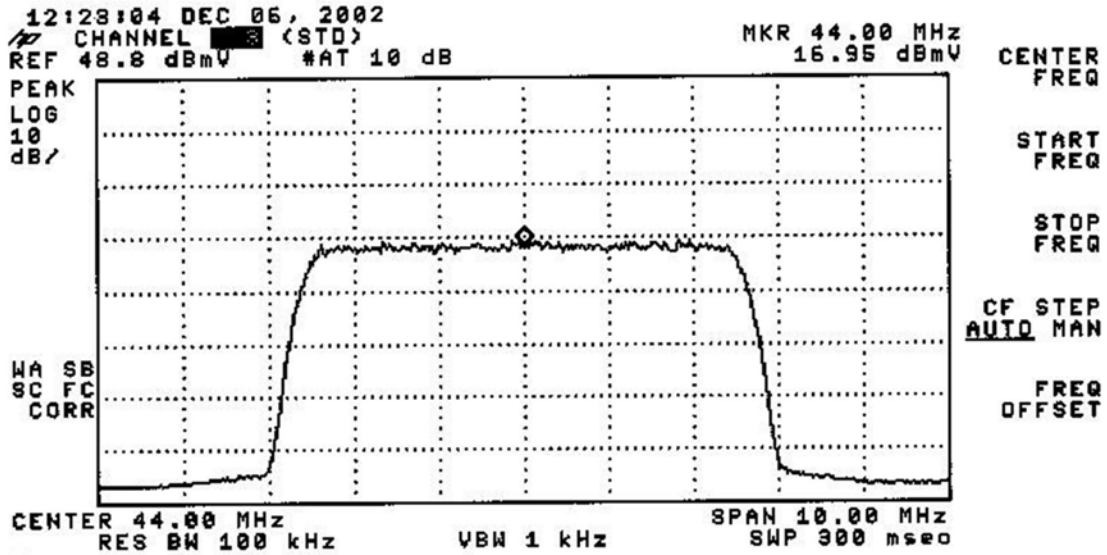


Figure 0.1

Disconnect the rear panel IF loop cable.

Connect a Spectrum Analyzer (recommended) or a Field Strength Meter to the F-connector marked "IF OUTPUT" on the rear panel of the P389D Agile Processor. This Output has a center frequency of 44 MHz.

Using the front panel control marked "MGC LEVEL," adjust the RF output of the unit until a carrier-to-noise level is achieved which is close to the carrier-to-noise level of the input signal. Again, by using the same measurement technique as described in Step c., above, the level between the pilot carrier and the noise measured at 1MHz should be very close to the same. *See Figure 0.1*

If the level is set for too much gain, an improper condition will occur. *See Figure 0.2* In no instance should this IF level exceed **+42dBmV**.

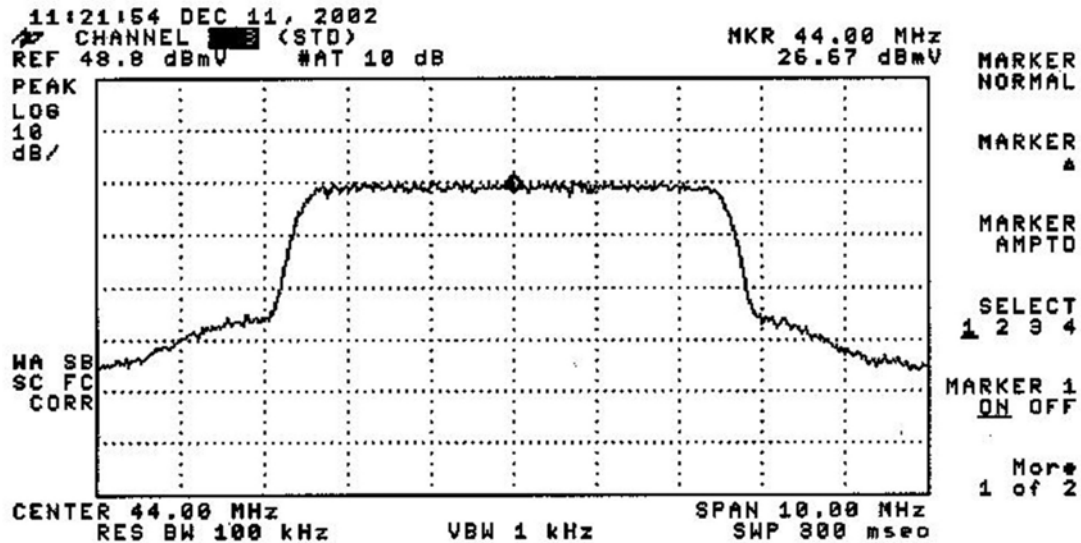


Figure 0.2

NOTE: The recommended IF output level is between **+38dBmV** and **+42dBmV**.

NOTE: Setting the IF output level below the recommended level may adversely affect the parameters of the modulating signal; setting the IF output level above the recommended level will adversely affect the quality of performance of the P389D.

Disconnect the test equipment.

Reconnect the IF loop and connect a spectrum analyzer to the RF output of the P389D. From this point on no further adjustment the MGC is needed.

Using the RF Output control on the front panel, adjust the RF output for maximum carrier-to-noise, as previously outlined. *See Figure 0.3* In no instance should this level exceed **+60dBmV** for a digital or an HDTV signal.

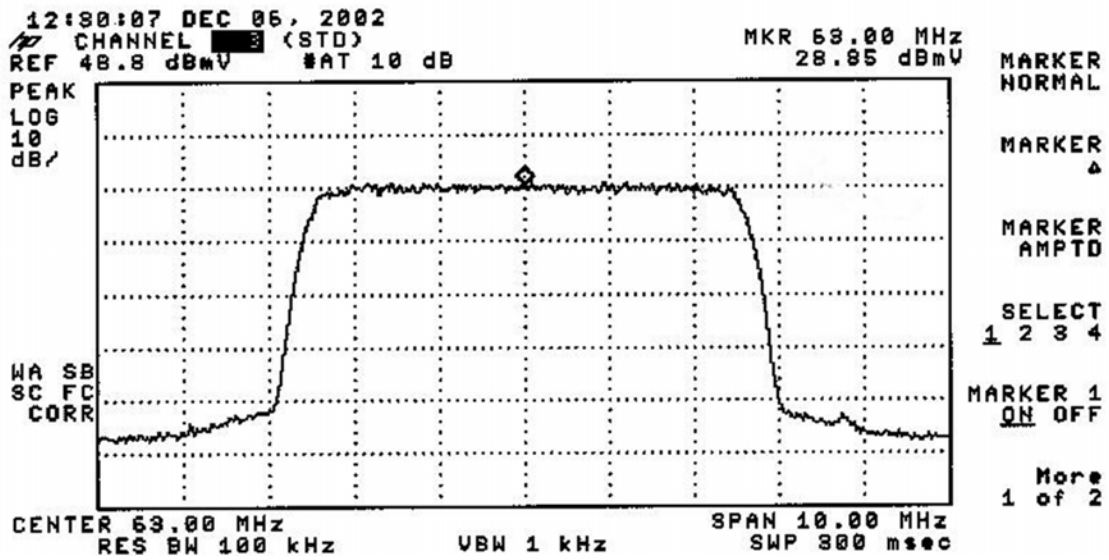


Figure 0.3

Setup is complete.

Remove all test equipment.

Reconnect all cables.

Reposition the unit in its rack location and secure it.

Connect all input and output sources to the unit.

Instructions complete.

GENERAL SETUP AND OPERATION - DUAL RS-232 REMOTE CONTROL OPTION

INTRODUCTION

If you have chosen the DUAL RS-232 Remote Control option for your agile unit, CADCO thanks you for your choice. We think you will agree that this option adds many useful capabilities to the product.

All of the CADCO frequency-agile products are equipped with a microprocessor that controls many functions within the unit. The RS-232 option gives the user remote access to all of the monitoring and control functions *via* a standard RS-232 communications link. To facilitate use of the DUAL RS-232 option, each unit is assigned an individual identification code at the factory. That code is displayed during the unit's initial POST (Power On Self Test) and can be changed at any time through the RS-232 link.

CONNECTION

Connection to the unit and between units is *via* RJ-11-6 jacks on the rear panel. The unit communication jack is marked J1 and is the outermost jack on the rear panel (the one nearest the RF OUTPUT connector). The interface cable, readily constructed by the customer, should have an RJ-11-6 modular connector on one end and the appropriate connector on the other end for the terminal or modem to which the unit will connect. See *Figure 2-1a* below.

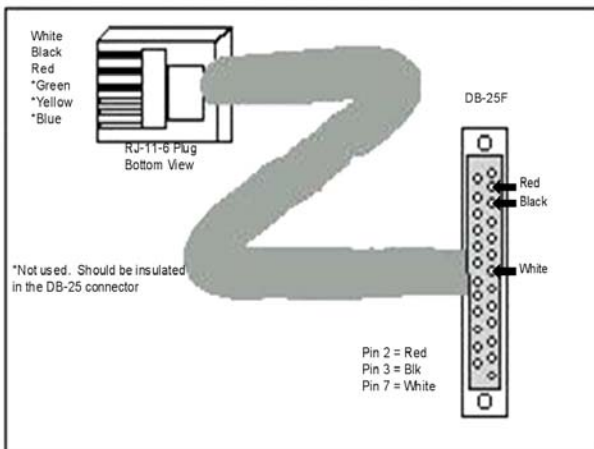


Figure 2-1a

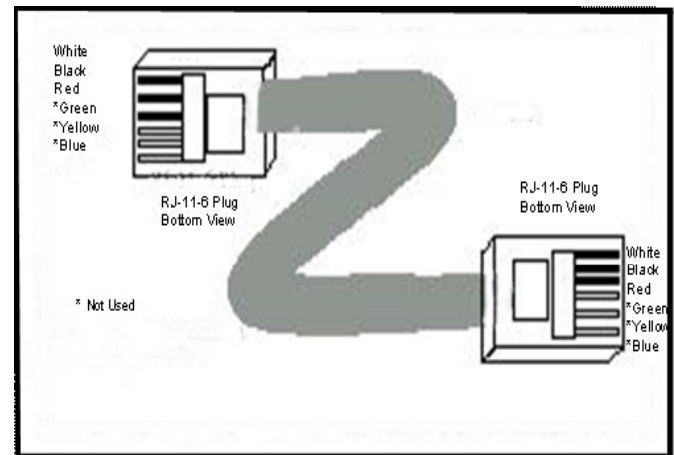


Figure 2-1b

Connection between units is also *via* an interface cable, but with an RJ-11-6 connector on each end and wired in “straight-through” configuration. See *Figure 2-1b*, above. J2 is the throughput jack and connects to J1 on another unit, allowing units to be linked together. Up to 255 units can be daisy-chained in this fashion.

COMMUNICATION

The RS-232 option communicates with the CADCO unit by “dumb” terminals, by computers running terminal emulation software or by high level computers with custom software. The CADCO unit automatically recognized the source type. Any leading ASCII character that lies between HEX 00 and HEX 7F will identify the source to be a ‘dumb’ terminal. Any leading ASCII character from HEX 80 to HEX FF will identify the source as high level.

SETUP AND OPERATION - DUAL RS232 OPTION

After completing SETUP AND OPERATION for the CADCO units in the appropriate Operation Manual, install and setup the CADCO units, which have the RS-232 option.

Connect together, in “daisy-chain” fashion, all units (up to 255) which will be communicating *via* the RS-232 option. Link these units with RJ-11-6 interface cables wired in straight-through fashion as shown below in *Figure 2-2*. Connections should go from J2 on one unit to J1 on the next. Unit ID, at this point, is not relevant. When all units are linked together, the first unit in the chain will have an open J1; the last unit will have an open J2.

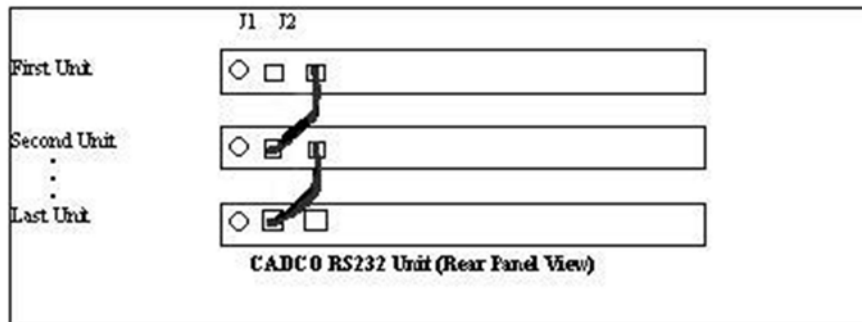


Figure 2-2

Using the customer-made interface cable, which will connect to the interface device (terminal modem port or modem) RS-232 port, connect the first unit to port of the interface device. See *Figure 2-3*

NOTE: *If power has not yet been applied to the units, it may be applied now. However, it is recommended that power be applied to each unit in the link sequentially, in order to read and notate the unit ID for each unit and to facilitate changes in the event of duplicate unit ID. Alternatively, each unit can be individually tested and the unit ID set, following the steps below, prior to installation and link with other units.*

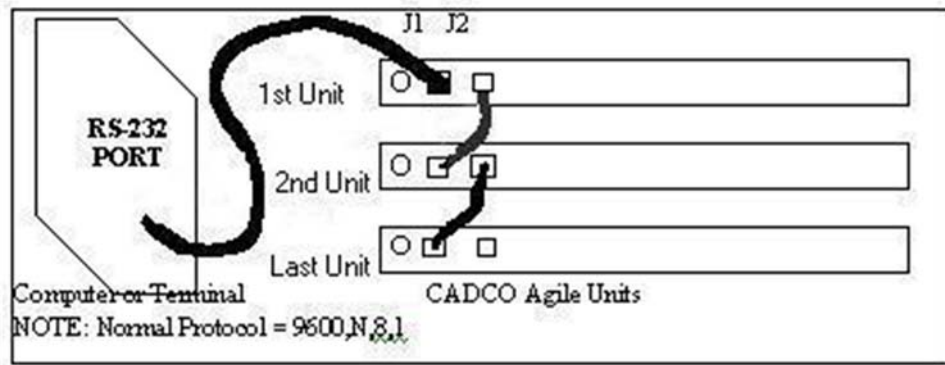


Figure 2-3

To identify the unit ID of a CADCO product, observe the front panel display at the time the unit is connected to a power source. The display will flash in the following sequence, providing the following information:

Seq	Observe	Function
1	All segments flash (“8.8.8”)	Segment test
2	Specific number to two (2) decimal places	Microprocessor version
3	Three- (3-) digit number from 0 to 255 “.”	Unit ID followed by
4	Number from 2-125, possibly preceded by minus sign (“-“)	Last channel selected

To initialize communications with a CADCO product equipped with the DUAL RS-232 option, enter the following keyboard sequence:

^#

where ^ is the symbol obtained by pressing the <SHIFT> and <6> keys, and # is the unit ID number (from 0 to 255, obtained from step four (4), above) of the unit to which a connection is desired.

The menu which appears shows the current configuration of the unit with which communication is established. See *Figure 2-4* On the initial communication, it may be necessary to press <ENTER> to allow the unit to communicate initial information for each parameter command displayed in the “ENTER SELECTION” field until that field is clear. Each time <ENTER> is pressed, new information will appear in the appropriate field in the menu displayed.

CADCO Remote Control Unit Menu v1.94	
CADCO UNIT:	P379 RS-232
CONFIG SWITCH:	11011000
UNIT ID:	255
SWITCH STATUS:	ENABLED
CARRIER STATUS:	CARRIER ON
INPUT CHANNEL:	21 - OFF AIR
OUTPUT CHANNEL:	33 - CABLE STANDARD
U	= Enter new Unit ID text
S	= Enable/Disable Front Panel Switch and Mode
C	= Toggle Carrier ON/OFF
I	= Enter new Input Channel
O	= Enter new Output Channel
^#<CR>	= Enter Unit Comm ID(#=0 to 255)

Figure 2-4

To change parameters in the unit, follow the instructions provided on the menu. Changeable parameters, with their field entry code, are:

Code	Meaning
U	Enter New Unit ID
S	Enable/Disable Front panel Switches and Offsets
T or C	Turn output [RF Carrier] On or Off <i>or</i> Toggle Carrier ON/OFF
I	Enter New Input Channel
O	Enter New Output Channel
^#<CR>	Enter Unit Communication ID (# = 0 to 255)

NOTE: Depending upon whether your CADCO unit is a processor or a modulator, the menu will have slight variations. For example, the menu for the modulator will not display “I” for “Enter New Input Frequency” because a modulator cannot tune an input frequency. Different versions of units with different features may result in similar variations, but all will be understandable from the menu.

To address a new unit in the network, or after a power-up, enter a ^ followed by a valid unit number (0 - 255) and <CR> or <ENTER>. If a unit in the network matches the unit ID number sent, that unit will respond by returning a menu. When a ^ is sent, no further characters will be echoed from any of the units on the network until a valid unit number and carriage return are also sent. This is to avoid collisions on the network.

NOTE: If you are sending a ^ followed by a known valid unit ID number and are still not receiving a menu, check to ensure that the unit ID number is not duplicated in another unit. To check this, each unit which has not already been tested and confirmed to have a valid unit ID number will have to be powered down and repowered and the unit ID recorded from the POST sequence on the front panel LED display.

HIGH LEVEL MODE

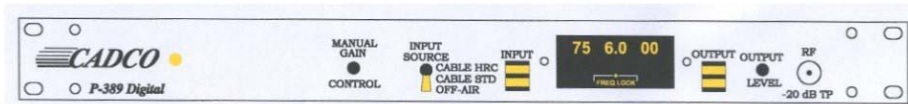
High-level commands are used for faster computer-to-Agile Unit communications. Commands from an external computer take on the form of a command byte, followed by any data bytes required, and ending with a checksum byte used for ensuring message accuracy. Upon receiving a high-level command, data and a checksum, the unit will respond with one or more bytes of data and a checksum.

Available high-level commands consist of:

POLLING	Determines if any unit changes have taken place;
READING	Unit sends current configuration data; and
WRITING	Unit configuration is modified.

Panel Views

- *Front Panel*



- *Rear Panel*



QUESTIONS, PROBLEMS, COMPLAINTS, SUGGESTIONS OR RETURNS

If you purchased your CADCO product through a distributor, please contact that distributor first should you have any questions, problems, complaints, or suggestions concerning your CADCO product. If you need to return the product for any reason, check with your distributor. They may have an exchange or loaner policy in order to minimize any down-time the loss of the unit may cause; or they may prefer that any returns or repairs be processed through them.

If you purchased your product directly from CADCO, or even if you purchased through a distributor, you may contact your CADCO sales representative at 800-877-2288 or 972-271-3651. Simply tell the receptionist the city and state from which you are calling and your call will be directed to the proper representative.

BEFORE RETURNING ANY PRODUCT DIRECTLY TO CADCO FOR CREDIT, REPAIR OR TRADE-IN, PLEASE CONTACT YOUR CADCO REPRESENTATIVE TO OBTAIN A RETURN AUTHORIZATION NUMBER. Failure to do so may delay any credit due your account or may extend repair turnaround time. Our address for returns is:

CADCO Systems
2363 Merritt Drive
Garland, TX 75041

If returning a product for repair, please include the name and telephone number of the contact technician, a fax number, and a brief description of the symptoms. CADCO recommends that, prior to returning a product for repair, an on-site technician review the PROBLEM TROUBLESHOOTING GUIDE in this booklet. However, to preserve your warranty, please contact the CADCO repair department for authorization to break the warranty seal before opening the unit.

THANK YOU FOR CHOOSING CADCO PRODUCTS

PROBLEM TROUBLESHOOTING GUIDE

The guide below covers some typical symptoms; possible associated causes and suggested actions to follow before returning the unit for repair. It is not meant to be all-inclusive.

Symptom	Possible Cause	Suggested Action
No Output Weak output	Unit tuned to output channel different from desired (this occurs particularly on the units which have green LED on the front panel to indicate "T" channels and channels above 99)	Ensure selected output channel is desired channel
	Unit tuned to input channel in a different range than desired	Check INPUT SOURCE SELECT switch for proper source selection
	Input signal is too weak	Ensure input signal strength is within specified range
	IF Loop cable on rear of unit loose/disconnected	Check IF Loop cable is securely attached
	Unit not plugged in or not getting power	Check power cord and power source, fuse
Excessive noise Spurious signals	Output level above rated maximum (most often occurs when changing from high-number channel to low-number channel, especially to the "T" channels)	Measure RF output from rear panel jack and adjust front panel OUTPUT LEVEL control as required
	If level too high (most often occurs when routing IF through scrambler or other external device)	Measure normal IF output level for applied CW/unmodulated input carrier and ensure same level is returned to unit after external processing
	Input signal too strong or no input signal at all	Measure input RF level and pad to within specified input levels; if signal not present, change to active channel
Bad/noisy video	Aural carrier interfering with video carrier	Measure Aural Carrier level and/or adjust AURAL CARRIER LEVEL control on front panel
Channel do not change	Delay feature active	Hold channel change switch in raised/lowered position for at least three seconds

