



# *ICS-75*

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## **Integrated Combiner Shelf Installation and Operation Manual**

Part Number MN/ICS75.IOM

Revision 5

August 14, 2007

**IMPORTANT NOTE:** The information contained in this document supersedes all previously published information regarding this product. Product specifications are subject to change without prior notice.

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# Preface

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## Customer Support

### Contact the Comtech EF Data Customer Support Department for:

- Product support or training
- Reporting comments or suggestions concerning manuals
- Information on upgrading or returning a product

### A Customer Support representative may be reached at:

Comtech EF Data  
Attention: Customer Support Department  
2114 West 7th Street  
Tempe, Arizona 85281 USA  
  
480.333.2200 (Main Comtech EF Data number)  
480.333.4357 (Customer Support Desk)  
480.333.2161 FAX

### To return a Comtech EF Data product (in-warranty and out-of-warranty) for repair or replacement:

- **Contact** the Comtech EF Data Customer Support Department. Be prepared to supply the Customer Support representative with the model number, serial number, and a description of the problem.
- **Request** a Return Material Authorization (RMA) number from the Comtech EF Data Customer Support representative.
- **Pack** the product in its original shipping carton/packaging to ensure that the product is not damaged during shipping.
- **Ship** the product back to Comtech EF Data. (Shipping charges should be prepaid.)

### For Online Customer Support:

An RMA number request can be requested electronically by contacting the Customer Support Department through the online support page at [www.comtechefdata.com/support.asp](http://www.comtechefdata.com/support.asp):

- **Click** on “Return Material Authorization” for detailed instructions on our return procedures.
- **Click** on the “RMA Request Form” hyperlink, then fill out the form completely before sending.
- **Send e-mail** to the Customer Support Department at [service@comtechefdata.com](mailto:service@comtechefdata.com).

For information regarding this product’s warranty policy, refer to the Warranty Policy, p. viii.

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## About this Manual

This manual provides installation and operation information for the Comtech EF Data ICS-75 Integrated Combiner Shelf. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the ICS-75.

## Reporting Comments or Suggestions Concerning this Manual

Comments and suggestions regarding the content and design of this manual are appreciated. To submit comments, please contact the Comtech EF Data Technical Publications department: [TechnicalPublications@comtechefdata.com](mailto:TechnicalPublications@comtechefdata.com)

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## Conventions and References

### Cautions and Warnings



**IMPORTANT** or **NOTE** indicates a statement that is associated with the task being performed or information critical for proper equipment function.



**CAUTION** indicates a hazardous situation that, if not avoided, may result in minor or moderate injury. **CAUTION** may also be used to indicate other unsafe practices or risks of property damage.



**WARNING** indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

### Metric Conversion

Metric conversion information is located on the inside back cover of this manual. This information is provided to assist the operator in cross-referencing non-Metric to Metric conversions.

### Recommended Standard Designations

Recommended Standard (RS) Designations are interchangeable with the designations of the Electronic Industries Association (EIA).

### Trademarks

Windows is a trademark of the Microsoft Corporation. Other product names mentioned in this manual may be trademarks or registered trademarks of their respective companies and are hereby acknowledged.

## European Electromagnetic Compatibility (EMC) Directive



*In order to meet the European Electromagnetic Compatibility (EMC) Directive (EN55022, EN50082-1), properly shielded cables for DATA I/O shall be used. More specifically, these cables shall be double-shielded from end to end, ensuring a continuous shield.*

## EN55022 - 1997 Compliance

This equipment meets the radio disturbance characteristic specifications for information technology equipment as defined in EN55022.


## Safety Compliance

### EN60950


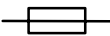
Applicable testing is routinely performed as a condition of manufacturing on all units to ensure compliance with safety requirements of EN60950. This equipment meets the Safety of Information Technology Equipment specification as defined in EN60950.



### Low Voltage Directive (LVD)

The following information is applicable for the European Low Voltage Directive (EN60950):

<HAR>	Type of power cord required for use in the European Community.
	<b>CAUTION:</b> Double-pole/Neutral Fusing <b>ACHTUNG:</b> Zweipolige bzw. Neutralleiter-Sicherung

International Symbols:

Symbol	Definition
	Alternating Current
	Fuse

Symbol	Definition
	Protective Earth / Safety Ground
	Chassis Ground



*For additional symbols, refer to the Cautions and Warnings section featured earlier in this Preface.*

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## Warranty Policy

Comtech EF Data products are warranted against defects in material and workmanship for a period of two years from the date of shipment. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective.

For equipment under warranty, the owner is responsible for freight to Comtech EF Data and all related customs, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges only for return of the equipment from the factory to the owner. Comtech EF Data will return the equipment by the same method (i.e., Air, Express, Surface) as the equipment was sent to Comtech EF Data.

All equipment returned for warranty repair must have a valid RMA number issued prior to return and be marked clearly on the return packaging. Comtech EF Data strongly recommends all equipment be returned in its original packaging.

Comtech EF Data Corporation's obligations under this warranty are limited to repair or replacement of failed parts, and the return shipment to the buyer of the repaired or replaced parts.

## Limitations of Warranty

The warranty does not apply to any part of a product that has been installed, altered, repaired, or misused in any way that, in the opinion of Comtech EF Data Corporation, would affect the reliability or detracts from the performance of any part of the product, or is damaged as the result of use in a way or with equipment that had not been previously approved by Comtech EF Data Corporation.

The warranty does not apply to any product or parts thereof where the serial number or the serial number of any of its parts has been altered, defaced, or removed.

The warranty does not cover damage or loss incurred in transportation of the product.

The warranty does not cover replacement or repair necessitated by loss or damage from any cause beyond the control of Comtech EF Data Corporation, such as lightning or other natural and weather related events or wartime environments.

The warranty does not cover any labor involved in the removal and or reinstallation of warranted equipment or parts on site, or any labor required to diagnose the necessity for repair or replacement.

The warranty excludes any responsibility by Comtech EF Data Corporation for incidental or consequential damages arising from the use of the equipment or products, or for any inability to use them either separate from or in combination with any other equipment or products.



A fixed charge established for each product will be imposed for all equipment returned for warranty repair where Comtech EF Data Corporation cannot identify the cause of the reported failure.

## **Exclusive Remedies**

Comtech EF Data Corporation's warranty, as stated is in lieu of all other warranties, expressed, implied, or statutory, including those of merchantability and fitness for a particular purpose. The buyer shall pass on to any purchaser, lessee, or other user of Comtech EF Data Corporation's products, the aforementioned warranty, and shall indemnify and hold harmless Comtech EF Data Corporation from any claims or liability of such purchaser, lessee, or user based upon allegations that the buyer, its agents, or employees have made additional warranties or representations as to product preference or use.

The remedies provided herein are the buyer's sole and exclusive remedies. Comtech EF Data shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.



# Chapter 1. INTRODUCTION

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## 1.1 Overview



**Figure 1-1. ICS-75 Integrated Combiner Shelf**

The ICS-75 Combiner Shelf, shown in Figure 1-1, organizes the mass of cables and individual splitter/combiners usually associated with earth station IF racks into one convenient package.

Housed in a 2RU (3.5") high, 19" rack-mountable chassis, the ICS-75 is composed entirely of passive components, and therefore requires no AC power input.

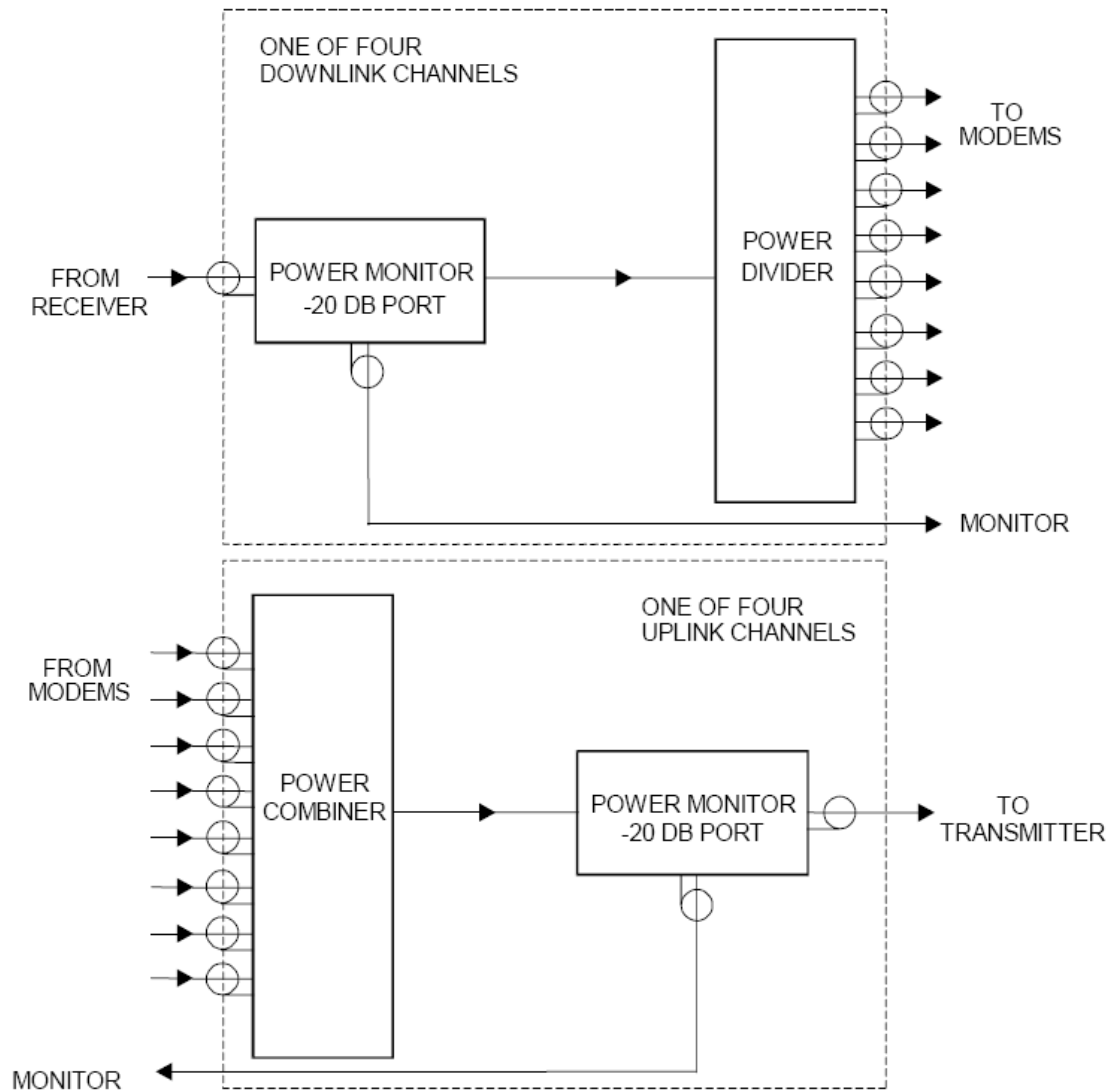
Operating in the IF frequency range of 50 to 180 MHz, the ICS-75 consists of four IF combiners and four IF splitters built into the same chassis:

- Each uplink channel may optionally have four, six, or eight inputs.
- Each downlink channel may optionally have four, six, or eight outputs.

Each channel has a monitor port available to sample the combined port. The monitor ports are location on the front panel, while all inputs and outputs are located on a logically arranged rear panel, eliminating confusion and greatly easing equipment installation and rack configuration.

## 1.2 Theory of Operation

A block diagram for the ICS-75 Integrated Shelf Combiner is shown in Figure 1-2.



**Figure 1-2. ICS-75 Block Diagram**

Each of the eight channels enclosed in the combiner shelf is made up of a power combiner/divider and a directional coupler. The polarity of the directional coupler is dependent on whether the channel is an uplink or downlink.

The combiner/divider circuits in the ICS-75 are capable of holding four, six, or eight input/output connectors.

For more detailed information, refer to the interconnect diagram depicted in Figure 3-2.

## 1.3 Summary of Specifications

<b>Equipment Type</b>	Integrated Combiner Shelf
<b>Manufacturer</b>	Comtech EF Data, Tempe, Arizona
<b>Frequency Range</b>	50 to 180 MHz
<b>Uplinks</b>	Configurable for 1 to 4 uplinks, with options for the uplinks to have 4, 6, or 8 inputs
<b>Downlinks</b>	Configurable for 1 to 4 downlinks, with options for the downlinks to have 4, 6, or 8 outputs.
<b>IF Impedance</b>	All Ports — 75Ω (50Ω optional)
<b>Return Loss (Inputs and Outputs)</b>	20 dB minimum
<b>IF Loss by Number of Channel Ports</b>	<b>4 Ports</b> <7.2 dB
	<b>6 Ports*</b> <10.5 dB
	<b>8 Ports</b> <10.5 dB
<b>Flatness</b>	± 0.25 over 20 MHz
<b>Monitor Coupling Loss</b>	20 dB ± 0.5 dB
<b>Return Loss Monitor Ports</b>	20 dB Minimum (both 50Ω and 75Ω)
<b>IF Connectors</b>	BNC Female
<b>Physical Size</b>	3.5 H x 19 W x 22 D inches (88.9 H x 482.6 W x 558.8 D mm [excluding connectors]) 19-inch rack mounting compatibility
<b>Weight</b>	10 lbs. (4.54 kg) max.

**\* Note – Based on 8 ports. The IF loss based on 6 ports for older units is typically <9.2 dB. These units are no longer available.**

**Notes:**

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# Chapter 2. INSTALLATION

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## 2.1 Unpacking

The ICS-75 Integrated Combiner Shelf and its Installation and Operation Manual are shipped in a preformed reusable foam enclosure inside a cardboard carton. Unpack and inspect the ICS-75 as follows:

Step	Procedure
1	Inspect shipping containers for damage.
2	If shipping containers are damaged, keep them until the contents of the shipment have been carefully inspected and checked for normal operation.
3	Remove the packing list from the outside of the shipping carton.
4	Open the carton by cutting the tape at the top of the carton (indicated by OPEN THIS END) and remove the contents.
5	Check the contents against the packing list to verify completeness of the shipment.
6	If damage is evident, contact the carrier and Comtech EF Data immediately and submit a damage report.
7	If the unit needs to be returned to Comtech EF Data, use the original shipping container.



***Do not use any cutting tool that will extend more than 1" into the container and cause damage to the unit.***



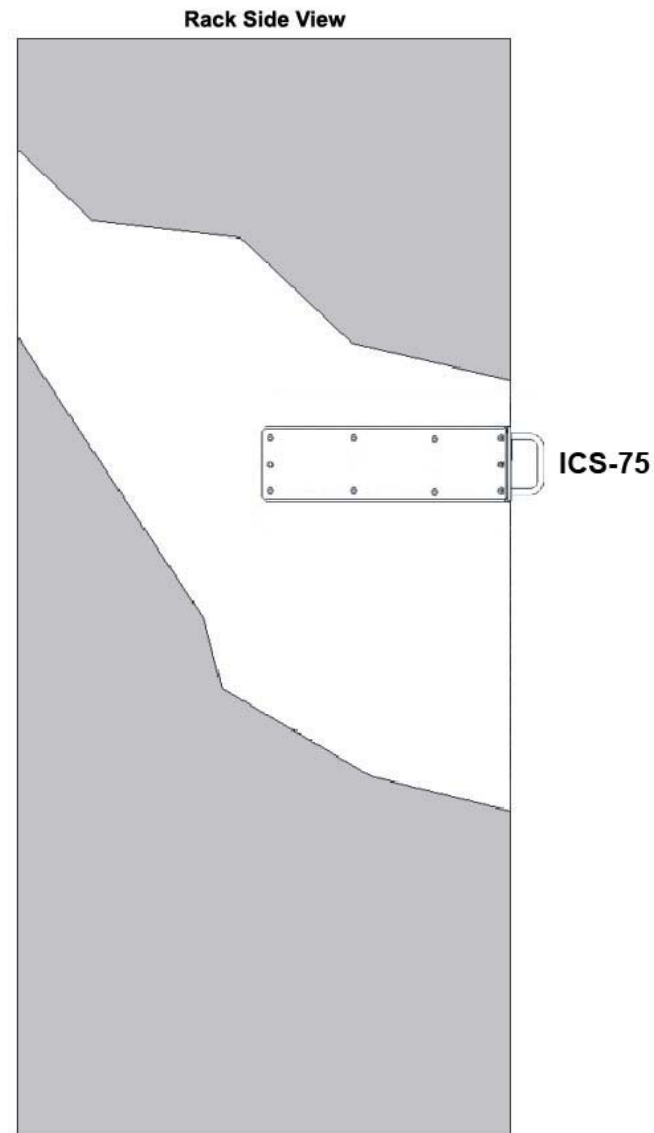
***Be sure to keep all shipping materials for the carrier's inspection.***

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## 2.2 Mounting

The ICS-75 is constructed as a 2U-high, rack-mounting chassis. As shown in Figure 2-1, rack handles are provided to facilitate removal and placement into an equipment rack.

Mount the ICS-75 in its assigned position in the rack using the mounting holes on the front panel; alternatively, optional rack slides may be installed to the sides of the ICS-75 chassis.



**Figure 2-1. ICS-75 Rack Mounting**



# Chapter 3. CONNECTIONS, PINOUTS, AND OPERATION

## 3.1 Overview

Figure 3-1 shows the front and rear panel connectors for the ICS-75 Integrated Combiner Shelf.



(a) Front Panel – Monitor (Uplink / Downlink)



(b) Rear Panel



(c) Typical Rear Panel Uplink In / Downlink Out



(d) Rear Panel Uplink Out / Downlink In

Figure 3-1. ICS-75 Front and Rear Panel Connectors (8-input configuration shown)

### 3.2 System Connections

Once the ICS-75 has been mounted in its assigned position in the equipment rack as shown in Chapter 2, all cables may be connected to the appropriate locations on the rear panel. Figure 3-2 depicts the interconnect diagram typical for an 8-input installation. See Par. 3.4 for connector pinout information.

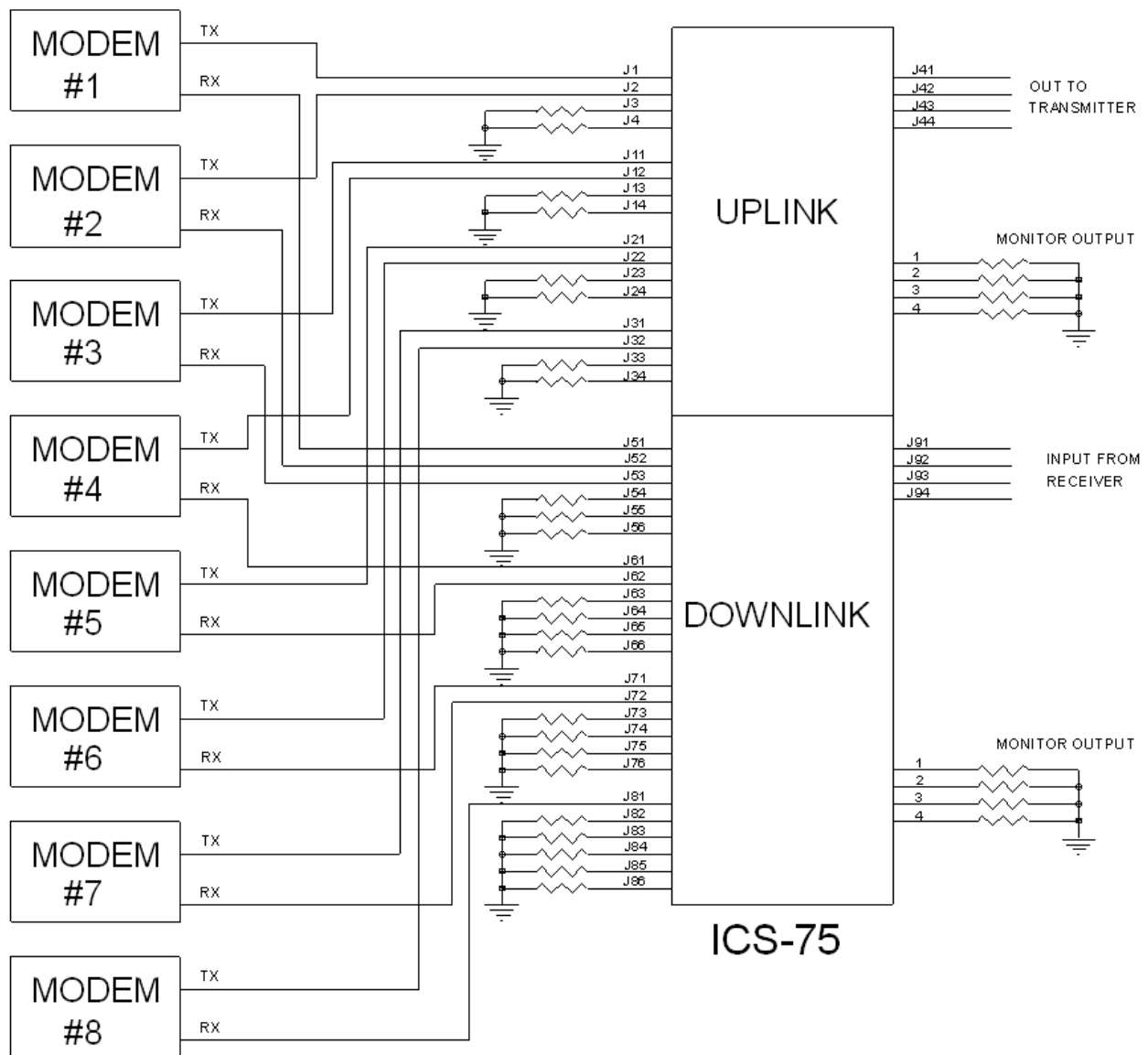


Figure 3-2. Typical Interconnect Diagram

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### 3.3 Connection Description and Function

All connectors used on the ICS-75 are BNC type connectors. Depending on the unit's operational impedance, connector input and output impedance is either 50Ω or 75Ω. See Par. 3.4 for connector pinout information.



***All unused connectors must be terminated with a load matching the operational impedance of the unit (i.e., a 50Ω unit must use 50Ω loads, and a 75Ω unit must use 75Ω loads).***

#### 3.3.1 Uplink Connectors (Rear Panel)

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##### 3.3.1.1 Uplink Inputs

These are the four channels of the four to eight IF inputs from the modems that are combined to form the transmitted signal paths.

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##### 3.3.1.2 Uplink Outputs

These are the four channels of combined IF inputs that are output to the transmitter.

#### 3.3.2 Downlink Connectors (Rear Panel)

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##### 3.3.2.1 Downlink Inputs

These are the four channels that divide the signals from the receiver.

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##### 3.3.2.2 Downlink Outputs

These are the four channels of four to eight IF outputs that are divided to form the received signal paths to the modems.

#### 3.3.3 Monitor Connectors (Front Panel)

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##### 3.3.3.1 Uplink Monitor

These four outputs provide a means to check the summed IF signals. Each sample is taken by a 20 dB directional coupler.

### 3.3.3.2 Downlink Monitor

These four outputs provide a means to check the received IF signals. Each sample is taken by a 20 dB directional coupler.

## 3.4 Connector Pinouts

### 3.4.1 Rear Panel

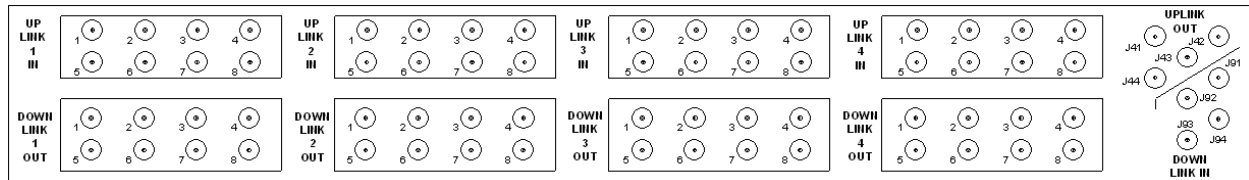


Figure 3-3. Rear Panel Connector Schematic



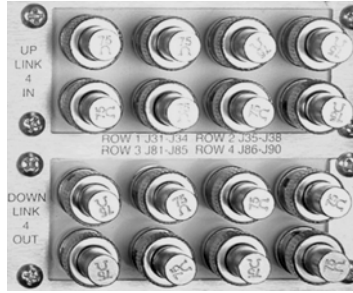
Name	Ref. Des.	Connector Type	Function
UPLINK 1 IN	J1-J8	BNC	Uplink IF input
DOWNLINK 1 OUT	J51-J58		Downlink IF output



Name	Ref. Des.	Connector Type	Function
UPLINK 2 IN	J11-J18	BNC	Uplink IF Input
DOWNLINK 2 OUT	J61-J68		Downlink IF Output



Name	Ref. Des.	Connector Type	Function
UPLINK 3 IN	J21-J28	BNC	Uplink IF input
DOWNLINK 3 OUT	J71-J78		Downlink IF output

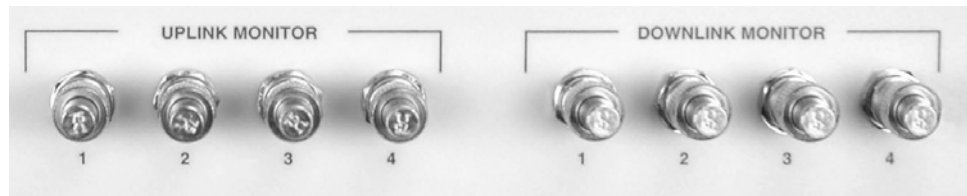


Name	Ref. Des.	Connector Type	Function
UPLINK 4 IN	J31-J38	BNC	Uplink IF input
DOWNLINK 4 OUT	J81-J90		Downlink IF output



Name	Ref. Des.	Connector Type	Function
UPLINK OUT	J41-J44	BNC	Uplink IF output
DOWNLINK IN	J91-J94		Downlink IF input

### 3.4.2 Front Panel



Name	Ref. Des.	Connector Type	Function
UPLINK MONITOR	1-4	BNC	UPLINK sampled output
DOWNLINK MONITOR	1-4		DOWNLINK sampled input

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### 3.5 Troubleshooting System Faults

The ICS-75 Integrated Combiner Shelf is made entirely of passive components – with no user-replaceable modules contained in the unit, it provides extremely reliable service.

To troubleshoot proper operation of the ICS-75, refer to the following table:

Fault	Possible Problem and Action
Excessive Insertion Loss	<ul style="list-style-type: none"><li>• Check to ensure that the <b>allowable insertion loss</b> for the configured unit is within the parameters defined in <b>Chapter 1.3 – Summary of Specifications</b>.</li><li>• Verify all unused connectors have 50Ω or 75Ω terminators, depending on the operational impedance of the unit.</li><li>• Check external cables for broken connections and proper impedance.</li><li>• Verify system configuration for proper input and output connections, as outlined earlier in this chapter.</li><li>• If all external connections are proper, return the unit for repair.</li></ul>

## METRIC CONVERSIONS

### Units of Length

Unit	Centimeter	Inch	Foot	Yard	Mile	Meter	Kilometer	Millimeter
1 centimeter	—	0.3937	0.03281	0.01094	$6.214 \times 10^{-6}$	0.01	—	—
1 inch	2.540	—	0.08333	0.2778	$1.578 \times 10^{-5}$	0.254	—	25.4
1 foot	30.480	12.0	—	0.3333	$1.893 \times 10^{-4}$	0.3048	—	—
1 yard	91.44	36.0	3.0	—	$5.679 \times 10^{-4}$	0.9144	—	—
1 meter	100.0	39.37	3.281	1.094	$6.214 \times 10^{-4}$	—	—	—
1 mile	$1.609 \times 10^5$	$6.336 \times 10^4$	$5.280 \times 10^3$	$1.760 \times 10^3$	—	$1.609 \times 10^3$	1.609	—
1 mm	—	0.03937	—	—	—	—	—	—
1 kilometer	—	—	—	—	0.621	—	—	—

### Temperature Conversions

Unit	° Fahrenheit	° Centigrade
32° Fahrenheit	—	0 (water freezes)
212° Fahrenheit	—	100 (water boils)
-459.6° Fahrenheit	—	273.1 (absolute 0)

Formulas
$C = (F - 32) * 0.555$
$F = (C * 1.8) + 32$

### Units of Weight

Unit	Gram	Ounce Avoirdupois	Ounce Troy	Pound Avoirdupois	Pound Troy	Kilogram
1 gram	—	0.03527	0.03215	0.002205	0.002679	0.001
1 oz. avoird.	28.35	—	0.9115	0.0625	0.07595	0.02835
1 oz. troy	31.10	1.097	—	0.06857	0.08333	0.03110
1 lb. avoird.	453.6	16.0	14.58	—	1.215	0.4536
1 lb. Troy	373.2	13.17	12.0	0.8229	—	0.3732
1 kilogram	$1.0 \times 10^3$	35.27	32.15	2.205	2.679	—



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