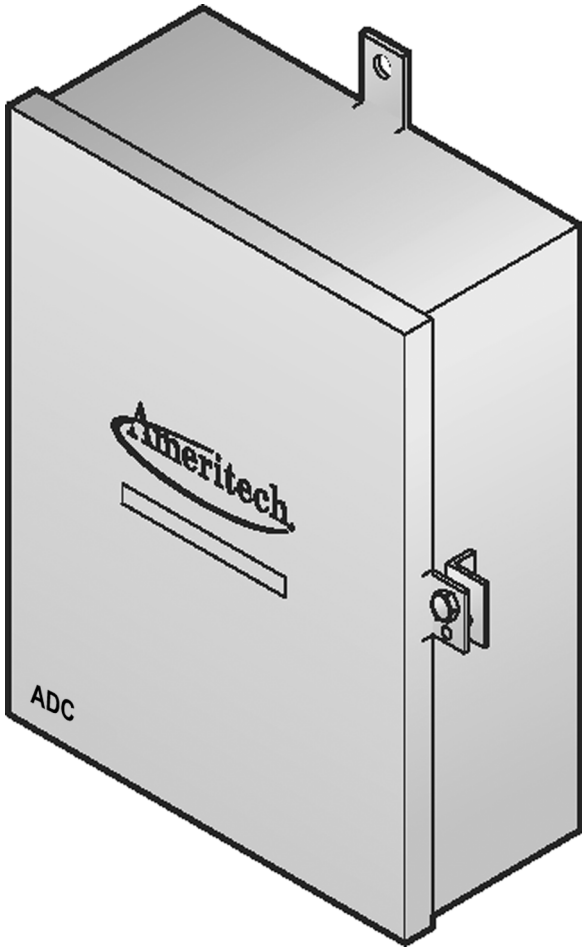
PG-FLEX

TECHNICAL PRACTICE



CHANNEL REMOTE TERMINAL ENCLOSURE

Model	List	CLEI Code
FRE-765	4J	VAMRFR0A~~

Revision History of This Practice

Revision	Release Date	Revisions Made
01	June 18, 1998	Initial Release (363-765-400-01)
02	October 22, 1998	Update (363-765-400-02)
03	October 11, 2002	Release to rebrand document to comply with ADC standards. Replaces 363-765-400-02.

©Copyright 2002 ADC DSL Systems, Inc. All Rights Reserved.

ADC is a registered trademark of ADC Telecommunications, Inc. PG-Flex is a registered trademark of ADC DSL Systems, Inc. No right, license, or interest to such trademarks is granted hereunder, and you agree that you shall assert no such right, license, or interest with respect to such trademarks. Other product names mentioned in this document are used for identification purposes only and may be trademarks or registered trademarks of their respective companies.

Information contained in this document is company private to ADC DSL Systems, Inc., and shall not be modified, used, copied, reproduced or disclosed in whole or in part without the written consent of ADC.

Contents herein are current as of the date of publication. ADC reserves the right to change specifications at any time without notice. Information furnished by ADC is believed to be accurate and reliable. In no event shall ADC be liable for any damages resulting from the loss of data, loss of use, or loss of profits and ADC further disclaims any and all liability for indirect, incidental, special, consequential or other similar damages. This disclaimer of liability applies to all products, publications and services during and after the warranty period.

USING THIS TECHNICAL PRACTICE

Two types of messages, identified by icons, appear in the text:

Notes contain information about special circumstances.

Cautions indicate the possibility of equipment damage or the possibility of personal injury.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PRODUCT OVERVIEW

This section describes the product and defines the features and specifications for the ADC® PG-Flex® FRE-765 List 4J Remote Terminal (RT) enclosure.

Description and Features

The FRE-765 RT enclosure (see Figure 1 on page 2) provides convenient mounting for one PG-Flex system, which includes one RT line unit and up to three channel units, supporting up to 24 channels. The RT enclosure does not include subscriber drop protection and is intended for inside installations. Terminations with internal gas tube protectors are provided on the backplane for High-bit-rate Digital Subscriber Line (HDSL), bypass connections, and for auxiliary power pairs when the system is used with a doubler. The RT enclosure can be pole- or wall-mounted and is environmentally sealed for outside plant installations.

HDSL, Auxiliary Power, and Bypass Pair circuits must be protected with 3-mil carbon blocks or equivalent. Subscriber circuits must also be protected with 3-mil carbon blocks or equivalent when these circuits are exposed to the outside plant.

Use the RT enclosure only with List 2 or higher COT shelves.

Features of the FRE-765 RT enclosure includes (Table 1 on page 2):

- pole or wall mounting
- line power from Central Office Terminal (COT)
- terminations with internal protectors for HDSL inputs, auxiliary power pairs, and a metallic bypass pair
- hinged cover for electronics inside the RT enclosure

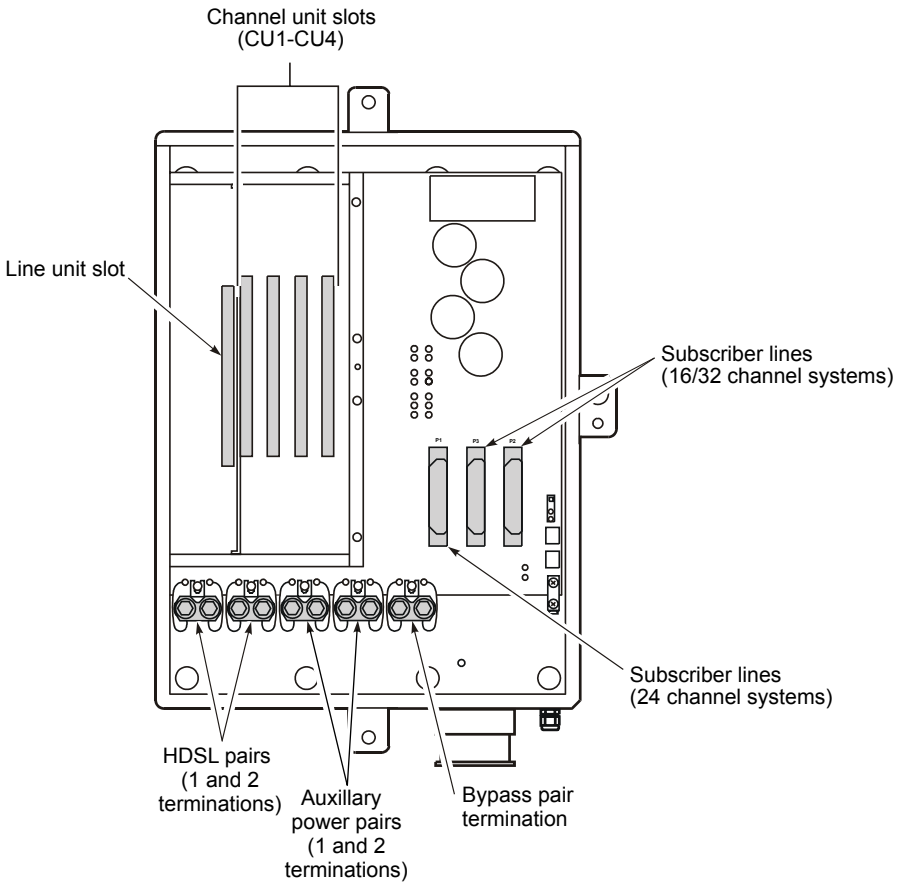


Figure 1. *FRE-765 RT Enclosure (Inside View)*

Table 1. *Features of FRE-765 RT Enclosure*

Feature	
Application	Inside/Outside
HDSL, Aux Power, and Bypass Terminations	AMP Insulation Displacement
Subscriber Terminations	25-pair Amphenol (male)
HDSL, Aux Power, and Bypass Protection	AMP (Quiet Front)
Subscriber Protection	None

SPECIFICATIONS

Environmental

Operating Temperature .....-40° F to +150° F (-40° C to +65° C)

Operating Humidity .....5% to 95% (non-condensing)

Operating Elevation .....-200 feet to 13,000 feet (-60 m to 4,000 m)

Physical

Dimensions

Height: .....19.25 in. (48.9 cm.)

Width: .....14.25 in. (36.2 cm.)

Depth: .....5.93 in. (15.1 cm.)

Weight:.....21.2 lb. (9.6 kg.)

FUNCTIONAL DESCRIPTION

This section outlines the operational capabilities, defines the channel unit circuit assignments, and specifies the channel unit configurations for the service provided.

OPERATIONAL CAPABILITIES

The FRE-765 RT Enclosure requires the following plug-in units:

- one RT Line Unit which is line powered via the HDSL pairs that connect the RT to the System COT line unit installed in a COT Shelf.
- one Channel Unit, minimum, with a maximum installation of three Channel Units, supporting up to 24 channels.

Table 2 shows how circuit assignments are configured in the FRE-765 with the following deployment rules:

- For channel units providing four (4) circuits, Ckt 1 through Ckt 4 are used for Tip and Ring terminations.
- For channel units providing eight (8) circuits, Ckt 1 through Ckt 8 are used for Tip and Ring terminations.
- For a 24-channel system, you can provision a maximum of 24 circuits.

Table 2. *FRE-765 Circuit Assignments*

Channel Unit 1	Channel Unit 2	Channel Unit 3	Channel Unit 4
Ckt 1	Ckt 1	Ckt 1	Not Used
Ckt 2	Ckt 2	Ckt 2	
Ckt 3	Ckt 3	Ckt 3	
Ckt 4	Ckt 4	Ckt 4	
Ckt 5	Ckt 5	Ckt 5	
Ckt 6	Ckt 6	Ckt 6	
Ckt 7	Ckt 7	Ckt 7	
Ckt 8	Ckt 8	Ckt 8	

CHANNEL UNIT SERVICE CONFIGURATIONS

Each system channel unit provides four (4) or eight (8) circuits. Table 3 shows how the channels are assigned, depending on the type of service provided, such as:

- Plain Old Telephone Service (POTS)
- Integrated Services Digital Network (ISDN)
- Digital Data System (DDS)

Table 3. *Channel Unit Circuit Utilization*

Channel Unit Service Configurations			
Channel Unit	**8-Channel POTS**	**4-Channel ISDN**	**4-Channel DDS**
T/R 1	Ckt 1	Ckt 1	Ckt 1 TX
T/R 2	Ckt 2	Ckt 2	Ckt 1 RX
T/R 3	Ckt 3	Ckt 3	Ckt 2 TX
T/R 4	Ckt 4	Ckt 4	Ckt 2 RX
T/R 5	Ckt 5	—	Ckt 3 TX
T/R 6	Ckt 6	—	Ckt 3 RX
T/R 7	Ckt 7	—	Ckt 4 TX
T/R 8	Ckt 8	—	Ckt 4 RX

BACKPLANE CONNECTIONS

Table 4 lists the FRE-765 backplane connectors and where each connector is described in this practice.

Table 4. *FRE-765 Backplane Connectors*

Connector or Fuse	Go to Table(s) and Page(s)
P1 Connector	Table 5 on page 6
Subscriber Terminations	Table 12 on page 14
P3 Connectors (not used, for reference only)	Table 6 on page 7
P2 Connectors (not used, for reference only)	Table 7 on page 8
Test and Configuration Line Unit Terminations	Table 8 on page 9
Power and Ground Line Unit Terminations	Table 9 on page 9

Table 5. *P1 Connector Pinouts*[(a)]

Channel Unit	Circuit	Backplane Connector P1		Protector Block Cable Stub	
		Tip	Ring	Tip	Ring
1	1	26	1	WH/BL	BL/WH
	2	27	2	WH/OR	OR/WH
	3	28	3	WH/GN	GN/WH
	4	29	4	WH/BN	BN/WH
	5	30	5	WH/SL	SL/WH
	6	31	6	RD/BL	BL/RD
	7	32	7	RD/OR	OR/RD
	8	33	8	RD/GN	GN/RD
2	1	34	9	RD/BN	BN/RD
	2	35	10	RD/SL	SL/RD
	3	36	11	BK/BL	BL/BK
	4	37	12	BK/OR	OR/BK
	5	38	13	BK/GN	GN/BK
	6	39	14	BK/BN	BN/BK
	7	40	15	BK/SL	SL/BK
	8	41	16	YL/BL	BL/YL
3	1	42	17	YL/OR	OR/YL
	2	43	18	YL/GN	GN/YL
	3	44	19	YL/BN	BN/YL
	4	45	20	YL/SL	SL/YL
	5	46	21	VI/BL	BL/VI
	6	47	22	VI/OR	OR/VI
	7	48	23	VI/GN	GN/VI
	8	49	24	VI/BN	BN/VI

[(a)] Shaded terminations used only with the 8-channel POTS or 4-channel DDS units.

Table 6. *P3 Connector Pinouts (not used, for reference only)*[a]

Channel Unit	Circuit	Backplane Connector P3	
		Tip	Ring
1	1	26	1
	2	27	2
	3	28	3
	4	29	4
	5	30	5
	6	31	6
	7	32	7
	8	33	8
2	1	34	9
	2	35	10
	3	36	11
	4	37	12
	5	38	13
	6	39	14
	7	40	15
	8	41	16

[a] Shaded terminations used only with the 8-channel POTS or 4-channel DDS units.

Table 7. *P2 Connector Pinouts (not used, for reference only)*[a]

Channel Unit	Circuit	Backplane Connector P2	
		Tip	Ring
3	1	26	1
	2	27	2
	3	28	3
	4	29	4
	5	30	5
	6	31	6
	7	32	7
	8	33	8
4	1	34	9
	2	35	10
	3	36	11
	4	37	12
	5	38	13
	6	39	14
	7	40	15
	8	41	16

[a] Shaded terminations used only with the 8-channel POTS or 4-channel DDS units.

Table 8. *Test and Configuration Line Unit Terminations*

Connector	Type	Function
ID_0 GND	.045 in. Wire-wrap	(No Connection - Future)
ID_1 GND	.045 in. Wire-wrap	(No Connection - Future)
ID_2 GND	.045 in. Wire-wrap	(No Connection - Future)
TEST_IN_TIP TEST_IN_RING	.045 in. Wire-wrap	(No Connection - Future)
TEST_OUT_TIP TEST_OUT_RING	.045 in. Wire-wrap	(No Connection - Future)
SSC1_A SSC1_B	.045 in. Wire-wrap	(No Connection - Future)
SSC2_A SSC2_B	.045 in. Wire-wrap	(No Connection - Future)

Table 9. *Power and Ground Terminations*

Connector	Type	Function
BATT -48V (TB2)	Screw	(No Connection - Future)
BATT RTN (TB1)	Screw	(No Connection - Future)
CHASSIS GND*	Screw termination on ground	Chassis Ground

***** Where the FRE-765 is shipped with the “CHASSIS GND” wire-wrap post connected to the adjacent “GND” wire-wrap post on the RT Backplane.

INSTALLATION AND TEST

UNPACKING

Upon receipt of the equipment:

1 Unpack each container and visually inspect it for signs of damage. If the equipment has been damaged in transit, immediately report the extent of damage to the transportation company and to ADC. Order replacement equipment if necessary.

2 Check the contents against the packing list to ensure complete and accurate shipment. If the shipment is short or irregular, contact ADC as described in the "Product Support" on page 16. If you must store the equipment for a prolonged period, store the equipment in its original container.

INSTALLATION Requirements

Prior to installing the FRE-765 RT enclosure, be aware of these installation requirements or conditions shown in Table 10.

Table 10. *Installation Requirements*

Requirement	Description
Environmental	The FRE-765 can operate in an outside plant environment. It can operate in a temperature range of -40°F to +150°F (-40°C to +65°C) and a humidity range of 5% to 95% (non-condensing).
Mounting	The FRE-765 has external mounting flanges with a clearance hole for a 3/8-inch bolt for pole or wall mounting. The customer must provide the appropriate mounting hardware. When mounting to a pole using the Pole Mounting Kit, ensure that the pole mounting bracket and FRE-765 are fully installed before installing cabling.
Power	The FRE-765 gets power from the HDSL lines connected to the COT shelf in the Central Office (CO). When a doubler is installed between the system COT Shelf and RT enclosure, two additional power pairs are required from the COT shelf and RT enclosure.
HDSL Lines	Two HDSL pairs are terminated in the FRE-765 to AMP Quiet Front Protectors.
Subscriber Lines	25-pair Amphenol connection (male)
Metallic Bypass Pair	The metallic bypass pair for subscriber line testing is terminated in the FRE-765. Do not connect the bypass pairs between PG-Flex systems or to other DLC systems.
Doubler	When using a doubler, add two AMP Quiet Front terminals to the FRE-765 to terminate the auxiliary power pairs from the COT. Order the Quiet Front kit which contains two Quiet Front terminations, four jumpers, and a tool for inserting the jumpers into the insulation displacement barrels. Use AMP Quiet Front connections identified PWR_1_T, PWR_1_R, PWR_2_T, PWR_2_R.
Cable Entry	Knockouts are located on the bottom of the FRE-765 and accept ¾-, 1-, 1½-, and 2-inch fittings. Install grommet (provided with FRE-765) conduit or cable strain relief fittings prior to wiring the FRE-765.
Protectors	No subscriber protectors are provided.

Mounting

The FRE-765 RT enclosure mounts on a pole or a wall. Follow local practices to ensure a secure mounting. Mount the FRE-765 for easy access to the cable entry points on the bottom of the enclosure. Provide ample room to open the door completely.

If desired for the FRE-765, install the grommet into the base of the enclosure (Figure 2) prior to performing any wiring (Table 11 shows the wire gauges that you can install through the holes in the grommet):

1 Remove the largest knockout so that the entire hole is open.

2 Install the grommet from the outside of the FRE-765. (Hold it at an angle to the hole and roll it into position.)

3 Ensure that the lip of the grommet rests on the bottom of the FRE-765 around the knockout hole.

4 Use an appropriate tool to open the required hole(s) in the bottom of the grommet.

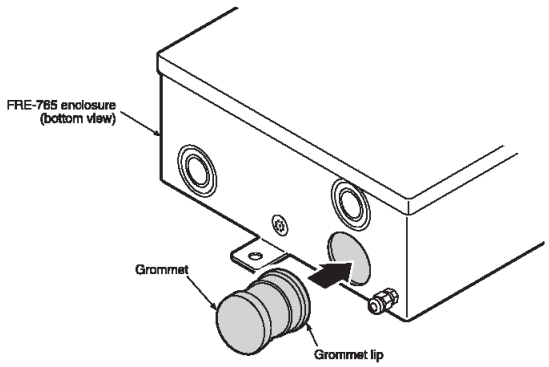


Figure 2. *Installing the Grommet*

Table 11 shows the wire gauges that can be installed through the holes in the grommet.

Table 11. *Grommet Hole Diameters*

For this grommet hole size	Use this cable
.410 to .765 in. diameter (two)[a]	24 or 26 AWG, 25- or 50-pair Primary Interexchange Carrier (PIC) (filled or non-filled) 22 AWG, 25-pair PIC (filled or non-filled) 22, 24, or 26 AWG , 6- or 11-pair PIC (filled or non-filled)
.240 to .275 in. diameter (one)	ground wire[b]
.155 to .240 in. diameter (one)	ground wire[b]

[a] Recommend using one hole for both the HDSL and the bypass pairs (i.e., 6-pair cable) and the second hole for POTS (subscriber) lines.
[b] Dependent upon gauge of wire used.

WIRING

The sections below describe how to connect the FRE-765 RT enclosure cables. Refer to "Cabling Verification" on page 15 to verify the installation.

Chassis Ground Wiring

Install the chassis ground (Figure 3).

Use 6 AWG or larger wire to ensure a good ground connection to the FRE-765.

1. Route the chassis ground wire through the small hole in the strain relief on the bottom of the enclosure (Figure 3).
2. Connect one end of the chassis ground wire to grounding lug (Figure 3).
3. Connect the other end of the chassis ground wire to a suitable ground termination point (ground rod or cold water pipe).
4. Tighten the strain relief around the wire.

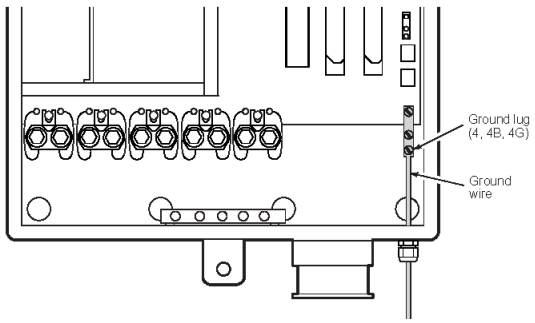


Figure 3. *Installing the Ground Wire*

HDSL Lines

Install the HDSL lines (Figure 4).

1. Route the HDSL pairs through the strain relief on the bottom of the enclosure.
2. Terminate HDSL Pair #1 on the Quiet-Front terminals HDSL_1_T (Tip) and HDSL_1_R (Ring).
3. Terminate HDSL Pair #2 on the Quiet-Front terminals HDSL_2_T (Tip) and HDSL_2_R (Ring).
4. Use a cable tie to secure to the bracket near the cable entrance.

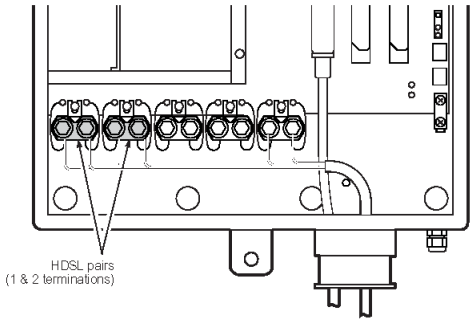


Figure 4. *Installing HDSL Lines and Bypass Pair*

Bypass Pair

Do not connect metallic bypass pairs between PG-Flex systems or to other DLC systems.

Install the Bypass Pair (Figure 5).

1. Route the bypass pair through the strain relief on the bottom of the enclosure.
2. Terminate the bypass pair on the Quiet Front terminals BYPASS_T and BYPASS_R.
3. Use a cable tie to secure to the bracket near the cable entrance.

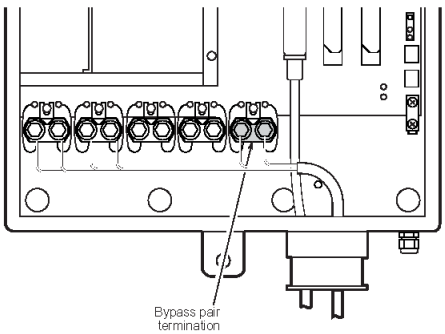


Figure 5. *Installing the Bypass Pair*

Subscriber Lines

Install the Subscriber Lines (Table 12).

1 Route the subscriber line cable through the bottom of the enclosure.

2 Plug the Amphenol connection into P1. Table 12 shows the wiring for the backplane connector P1.

3 Use a cable tie to secure to the bracket near the cable entrance.

Table 12. *Subscriber Terminations*

Channel Unit	Circuit	Backplane Connector P1		Subscriber Cable Stub	
		Tip	Ring	Tip	Ring
1	1	26	1	WH/BL	BL/WH
	2	27	2	WH/OR	OR/WH
	3	28	3	WH/GN	GN/WH
	4	29	4	WH/BN	BN/WH
	5	30	5	WH/SL	SL/WH
	6	31	6	RD/BL	BL/RD
	7	32	7	RD/OR	OR/RD
	8	33	8	RD/GN	GN/RD
2	1	34	9	RD/BN	BN/RD
	2	35	10	RD/SL	SL/RD
	3	36	11	BK/BL	BL/BK
	4	37	12	BK/OR	OR/BK
	5	38	13	BK/GN	GN/BK
	6	39	14	BK/BN	BN/BK
	7	40	15	BK/SL	SL/BK
	8	41	16	YL/BL	BL/YL
3	1	42	17	YL/OR	OR/YL
	2	43	18	YL/GN	GN/YL
	3	44	19	YL/BN	BN/YL
	4	45	20	YL/SL	SL/YL
	5	46	21	VI/BL	BL/VI
	6	47	22	VI/OR	OR/VI
	7	48	23	VI/GN	GN/VI
	8	49	24	VI/BN	BN/VI

Cabling Verification

Perform the following verifications before inserting any cards in the COT shelf.

Verify the following connections.

1 Visually ensure the ground wire is tightly secured to the grounding lug inside the FRE-765 and at the ground termination point.

2 Visually verify the HDSL lines are terminated properly and with the correct orientation. If the HDSL lines are not connected properly, the COT will not communicate with the FRE-765.

3 Verify that the HDSL lines are "dry."

a Verify 0 Vdc between the Tip and Ring, Tip and ground, and Ring and ground of each of the HDSL pairs terminated at the FRE-765.

b Verify a value greater than 100 kohms resistance between Tip and ground and Ring and ground for each of the HDSL pairs terminated at the FRE-765.

TURN-UP AND TESTING

Refer to the COT Line Unit Technical Practice or RT Line Unit Technical Practice for complete COT and RT turn-up and testing procedures.

Troubleshooting

Refer to the COT Line Unit Technical Practice or RT Line Unit Technical Practice for complete COT and RT troubleshooting procedures

PRODUCT SUPPORT

TECHNICAL SUPPORT

Technical Assistance is available 24 hours a day, 7 days a week by the contacting Customer Service Engineering group at:

Telephone:	800.638.0031 or 714.730.3222
	The 800 telephone support line is toll-free in the U.S. and Canada.
Fax:	714.730.2400
Email:	wsd_support@adc.com

WORLD WIDE WEB

ADC product and company information can be found at http://www.adc.com using any Web browser.

LIMITED WARRANTY

Product warranty is determined by your service agreement. Refer to the ADC Warranty/Software Handbook for additional information, or contact your sales representative or Customer Service for details.

RETURNS

To return equipment to ADC:

1 Locate the number of the purchase order under which the equipment was purchased. To obtain a return authorization number, you need to provide the original purchase order number to ADC's Return Material Authorization (RMA) Department.

2 Call or write ADC's RMA Department to ask for an RMA number and any additional instructions. Use the telephone number, fax number or email address listed below:

- Telephone: 800.370.9670
- Fax: 714.832.9923
- Email Address: rma@ADC.com

3 Include the following information, in writing, along with the equipment you are returning:

- Company name and address.
- Contact name and telephone number.
- The shipping address to which ADC should return the repaired equipment.
- The original purchase order number.
- A description of the equipment that includes the model and part number of each unit being returned, as well as the number of units that you are returning.
- The reason for the return. For example:

- The equipment needs an ECO/ECN upgrade.
- The equipment is defective.

If the equipment is defective, please tell us what you observed just before the equipment malfunctioned. Be as detailed in your description as possible.

If there is another reason for returning the equipment, please let us know so we can determine how best to help you.

4 Pack the equipment in a shipping carton.

5 Write ADC's address and the RMA Number you received from the RMA Department clearly on the outside of the carton and return to:

ADC DSL Systems, Inc.
14352 Franklin Ave.
Tustin, CA 92780-7013

Attention: **RMA (Number)**

All shipments are to be returned prepaid. ADC will not accept any collect shipments.

FCC CLASS B COMPLIANCE

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

* Reorient or relocate the receiving antenna.
* Increase the separation between the equipment and receiver.
* Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
* Consult the dealer or an experienced radio/TV technician for help.

Modifications

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by ADC voids the user's warranty.

All wiring external to the product(s) should follow the provisions of the current edition of the National Electrical Code.

ACRONYMS

AWG	American Wire Gauge
CKT	Circuit
CO	Central Office
COT	Central Office Terminal
DDS	Digital Data System
DLC	Digital Loop Carrier
FCC	Federal Communications Commission
GND	Ground
HDSL	High bit-rate Digital Subscriber Line
ISDN	Integrated Services Digital Network
PIC	Primary Interexchange Carrier
POTS	Plain Old Telephone Service
RT	Remote Terminal
RX	Receive
T/R	Tip/Ring
TX	Transmit

Corporate Office

14402 Franklin Avenue
Tustin, CA 92780

Tel:714.832.9922
Fax:714.832.9924

For Technical Assistance:

800.638.0031
714.730.3222

ISO 9001
DNV
DNV Certification, Inc.
Certificated Firm